FDR4ALT

FDR4ALT Completeness Report (ALT)

CLS-ENV-NT-23-0294

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Internal/Interne

AUTHORS TABLE

Object	Name
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CHRONOLOGY ISSUES

Issue	Date	Object
1.0	17/05/22	Draft version for Phase 2 PM#1
2.0	02/05/23	Updated version for Final Review
3.0	23/05/23	Consolidated version with some of the RIDs implemented
4.0	05/07/23	Updated version with RIDs implemented

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1 Introduction

This document has been written in the frame of the FDR4ALT project, ESA contract N°4000128220/19/I-BG. It is a deliverable of task 4 of the project and identified as [D-4-01].

1.1 The FDR4ALT Project

In the framework of the European Long Term Data Preservation Programme (LTDP+) which aims at generating innovative Earth system data records named Fundamental Data Records (basically level 1 altimeter and radiometer data) and Thematic Data Records (basically level 2+ geophysical products), ESA/ESRIN has launched a reprocessing activity of ERS-1, ERS-2 and ENVISAT altimeter and radiometer dataset, called the FDR4ALT (Fundamental Data Records for Altimetry) project. A large consortium of thematic experts has been formed to perform these activities which are:

1) To define products including the long, harmonized record of uncertainty-quantified observations.

2) To define the most appropriate level 1 and level 2 processing.

3) To reprocess the whole times series according to the predefined processing.

4) To validate the different products and make them available to large communities of users focused on the observation of the atmosphere, ocean topography, ocean waves, continental hydrology, sea ice, coastal and ice sheet regions.

1.2 Purpose and scope of this document

This document aims at providing a detailed analysis of the completeness of the ALT FDR product.

1.3 Conventions

1.3.1 Terminology

This section aims at defining the terminology used in the FDR4ALT deliverables.

- **Product** refers a specific type of file, defined and described by a dedicated handbook, and designed for a clear purpose (the FDR4ALT project, the REAPER project, …). It is a “container”. One product refers to one file. The use of plural is designed to refer to a group of files, for instance the Thematic Data Products. “FDR4ALT products” will usually refer to all TDPs and FDRs, i.e., the outputs of the whole project. Note that the word “product” does not imply any notion of start date or end date, whereas “dataset” does.
- **File** can be used to refer to one single product or any other file that is not a product.
- **Parameter or variable** refers to a product’s field, i.e., the content of the product. For instance, the sea level anomaly is a parameter of the Ocean & Coastal Thematic Data Products.
- **Dataset** can be used to refer to any group of data, not necessarily products. However, in the context of this project, it will often be used to refer to a sub-ensemble of products, on a specific period of time or a specific geographic area. For instance, the TDS (test dataset) refers to a dataset of 3 years of test products.
- **Track** and **pass** refer to a half-orbit (here pole-to-pole).

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2 Completeness analysis of the FDR4ALT products

2.1 Global summary

This section provides a global completeness rate for the three missions to give an overview indicator of the global data recovery performed in the project to ensure the best data quality and availability for users.

Figure 2-1, Figure 2-2 and Figure 2-3 show that more than **99% of the data** were recovered from the last reprocessing for both ENVISAT and ERS-2 and more than **98% for ERS-1**. These lower completeness rate for ERS-1 and ERS-2 with respect to ENVISAT mainly comes from new corrections brought by the FDR4ALT to edit wrong time tags (jumps or duplicates). These improvements are illustrated in this document through cycle-by-cycle completeness analysis and more details can be found in the reference documents listed in Table 2-15 from Appendix A.

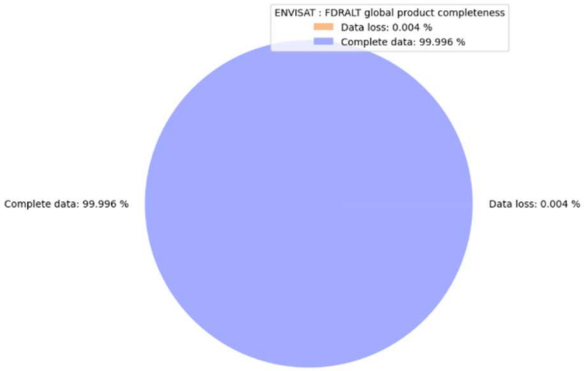

Figure 2-1 : ENVISAT

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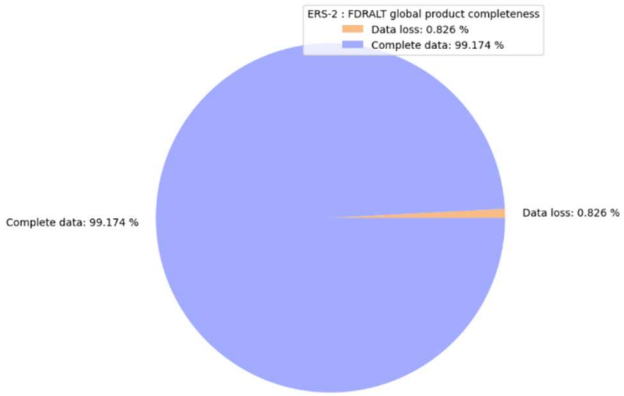

Figure 2-2 : ERS-2

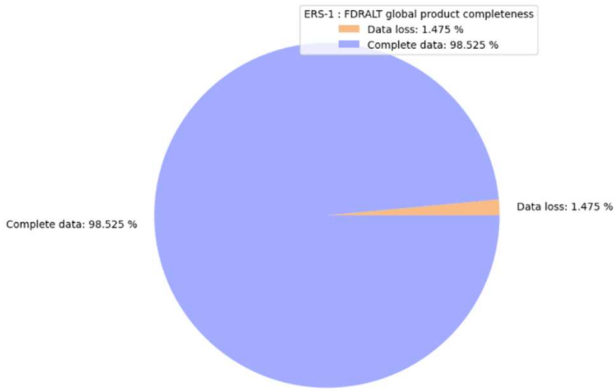

Figure 2-3 : ERS-1

2.2 ENVISAT

For ENVISAT, it is simple to compare the completeness of the ENVISAT V3.0 and the FDR ALT products for two reasons:

- ✓ The ENVISAT V3.0 products are sliced per pass just like the FDR ALT products.
- ✓ As opposed to ERS, editing of "bad" time values was not necessary, i.e., we should expect to have the exact same number of time occurrences between FDR4ALT and ENVISAT V3.0, making it easy to spot any anomaly.

To assess the completeness of the FDR ALT dataset for ENVISAT, two types of diagnoses were performed:

- ✓ **Overview of the year**: for each year of data (given here as subsections of the document), an overview is given by:
  - Listing of all the missing tracks for the corresponding cycles of data in a table
  - A bar plot giving the number of tracks available for ENVISAT V3.0 and FDR4ALT
- **Cycle by cycle**: For each cycle of data, the number of time occurrences is given for each pass and compared to the former baseline V3.0 to ensure that no data have been lost. The number of occurrences of the "burst mode" time_2k (corresponding to the transmission of 2000 Ku-band pulses, described in the Product User Guide [D-5-03]) is also available on the same graph to give an overview of the whole cycle. It also allows to see when this Burst Mode was activated throughout the ENVISAT lifespan. For more information about the mission phases, please refer to [D-5-03].

- For the RA-2 altimeter list of events during nominal operations, please refer to Table 2-16 or download it from ESA website (here).

Name	Start	End	Repeat cycle
Launch	01-Mar-02	-	-
Launch & early orbit phase, or Phase "0"	01-Mar-02	02-Mar-02	-

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Drift phase, or Phase "1"	02-Mar-02	04-Apr-02	-
Nominal phase, or Phase "2"	04-Apr-02	24-Oct-10	35 days
Mission extension phase, or Phase "3"	24-Oct-10	08-Apr-12	30 days
End of mission	08-Apr-12	-	-

Table 2-1 : ENVISAT mission phases

Calibration data: For ENVISAT, only one PTR array and one LPF array are provided per pass. For ERS, one LPF array is provided per pass, but no PTR array as explained in [D-5-03]. For each FDR file, the nearest PTR and LPF array (with respect to the centre of the half-orbit) is selected. That way ensures 100% of the files/pass are filled and with the closest valid instrumental data. This was part of the completeness validation presented next.

2.2.1 2002

2.2.1.1 Overview of the year:

Completeness report of the FDR4ALT data is done for year 2002 and presented in the table and figure below.

In summary:

- cycle 7,11: Data loss due to time jumps issues from V3.0 (backward) rejected by the CLS data processing chain and not recovered (considered as corrupted). See Figure 2-2-6 and Figure 2-2-10. In detail:

    - Cycle 7:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0012	55840	50781
0104	55400	44954
0108	55780	46372

    - Cycle 11:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0260	54180	48923

- All the other cycles are 100% complete.

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ENVISAT year 2002			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
6	678	678	1-25, 53, 54, 101-307, 374-817, 948, 949
7	118	118	192-251, 279-305, 318-321, 326, 402-425, 594, 856, 858, 860, 991
8	81	81	262, 271, 371-395, 462-510, 574-577, 712
9	83	83	213, 316, 356-426, 435-442, 721, 860
10	34	34	41, 250-271, 297, 298, 632, 633, 650, 660-664, 880
11	55	55	150, 151, 152, 382-428, 498, 502, 506, 667, 706
12	10	10	144, 325-333, 428

Table 2-2 : List of missing tracks for year 2002

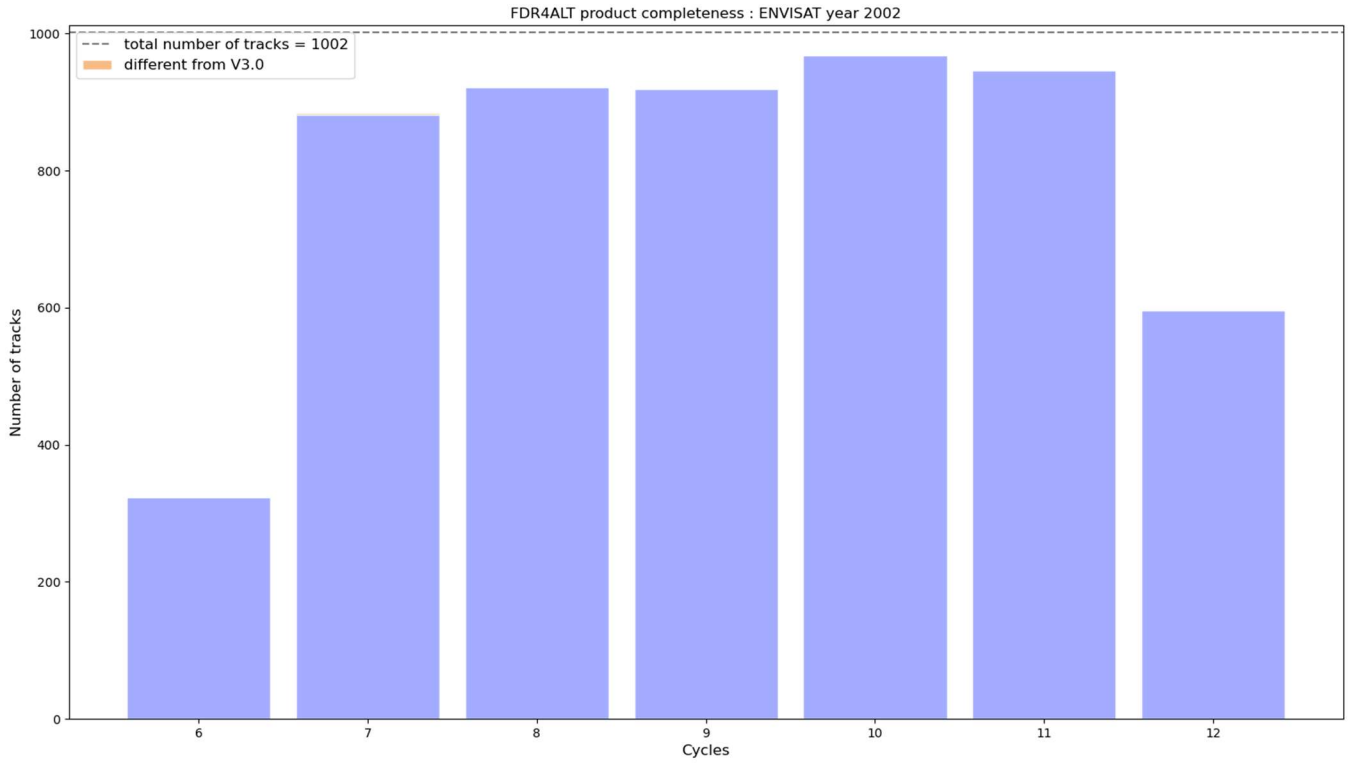

Figure 2-4 : Cyclic monitoring of the number of tracks completeness of year 2002.

2.2.1.2 Cycle by cycle

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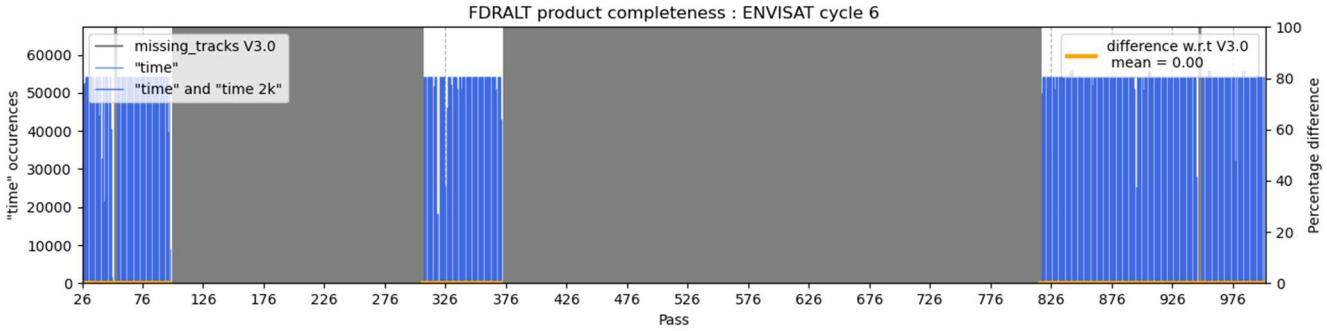

Figure 2-5 : Cycle 6

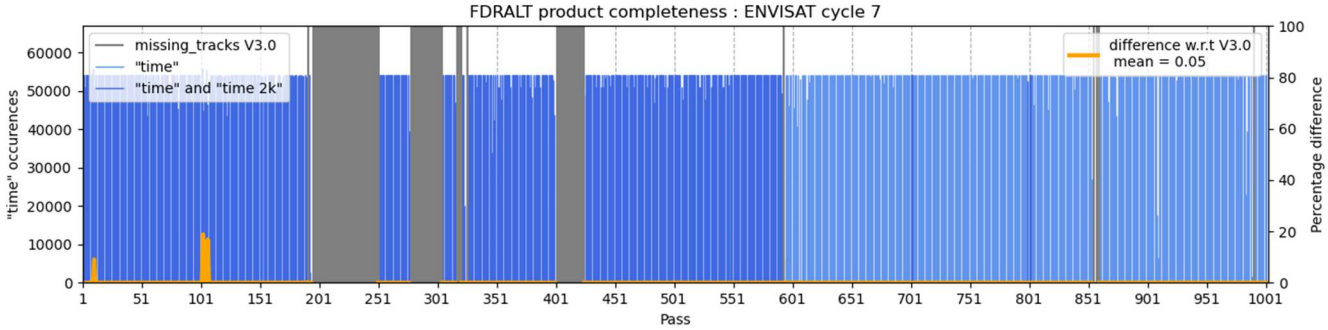

Figure 2-2-6: Cycle 7

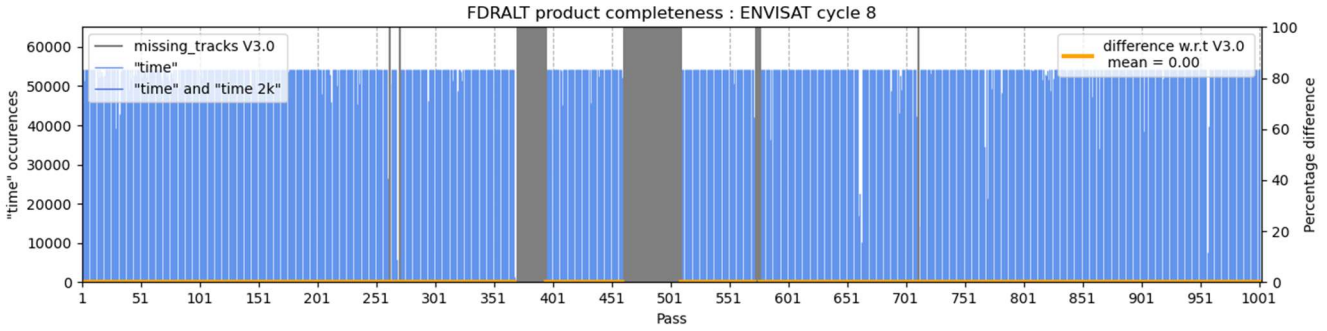

Figure 2-2-7 : Cycle 8

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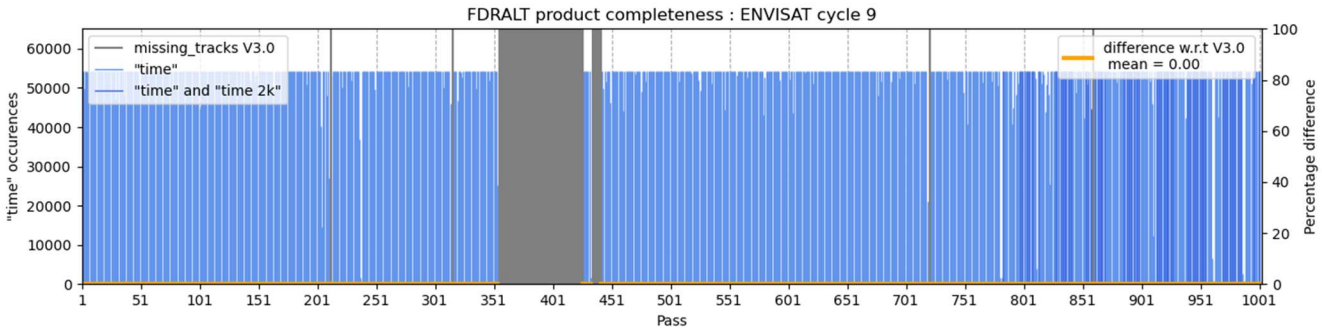

Figure 2-2-8: Cycle 9

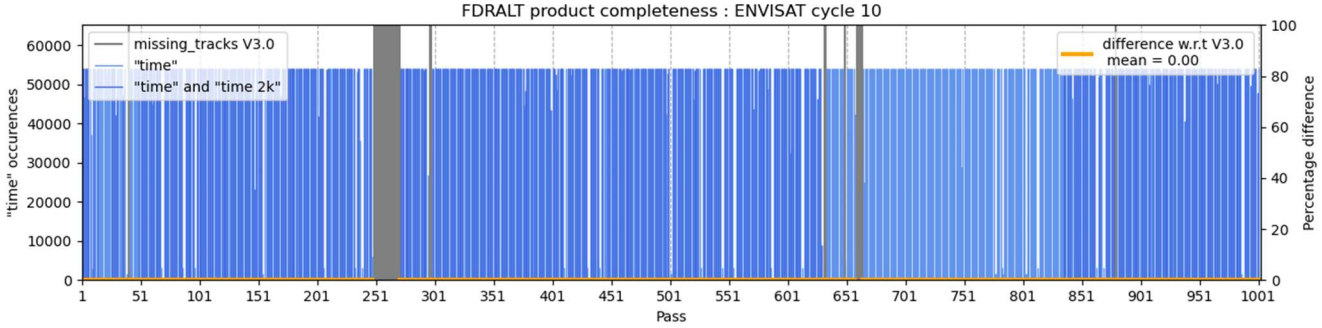

Figure 2-2-9 : Cycle 10

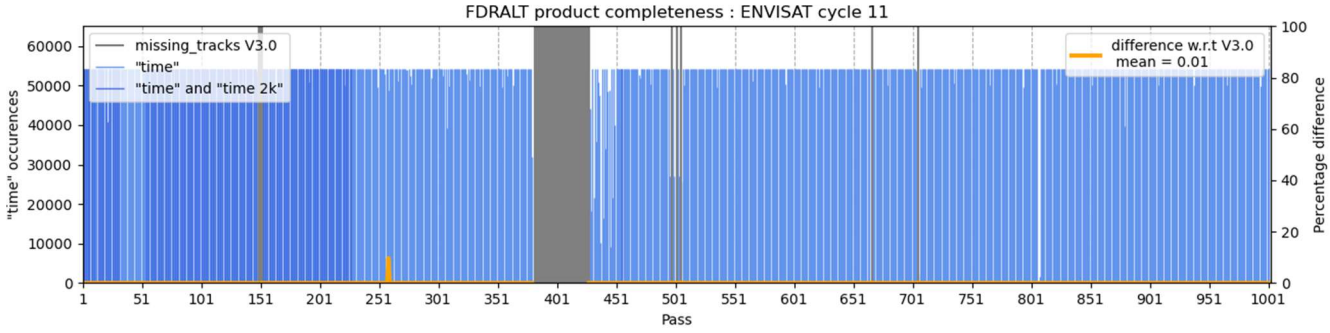

Figure 2-2-10 : Cycle 11

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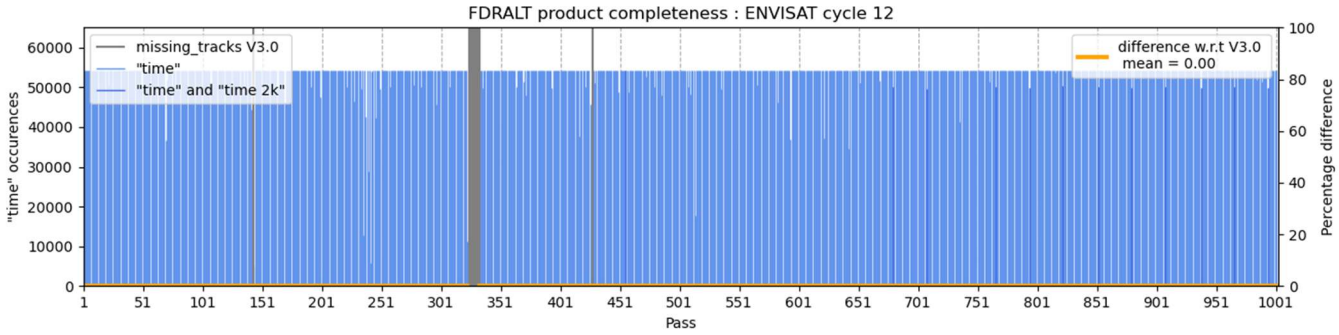

Figure 2-2-11 : Cycle 12

2.2.2 2003

2.2.2.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2003 and presented in the table and figure below.

In summary:

- All cycles are 100% complete.

ENVISAT year 2003			
Cycles	**Number of missing tracks (V3.0)**	**Number of missing tracks (FDR4ALT)**	**Missing tracks**
12	11	11	144, 325-333, 428
13	115	115	64-109, 118, 348-398, 598, 765-772, 826, 845, 856, 869, 923-925, 985
14	201	201	69-134, 363-395, 724-798, 803-826, 875, 983, 984
15	71	71	402, 423-452, 613-324, 697, 718-720, 879-901, 959
16	115	115	191-215, 361-387, 556-594, 766, 862, 967-987, 996
17	5	5	226, 299, 587, 602, 873
18	8	8	99, 202, 215, 538, 641,682, 686, 849
19	63	63	110, 312, 398, 447, 473, 538-543, 600, 688-738
20	17	17	166, 167, 320-333, 445
21	32	32	164, 242-247, 366-389, 499
22	192	192	49-54, 241-308, 338-455
23	3	3	598, 612, 613

Table 2-3 : List of missing tracks for year 2003

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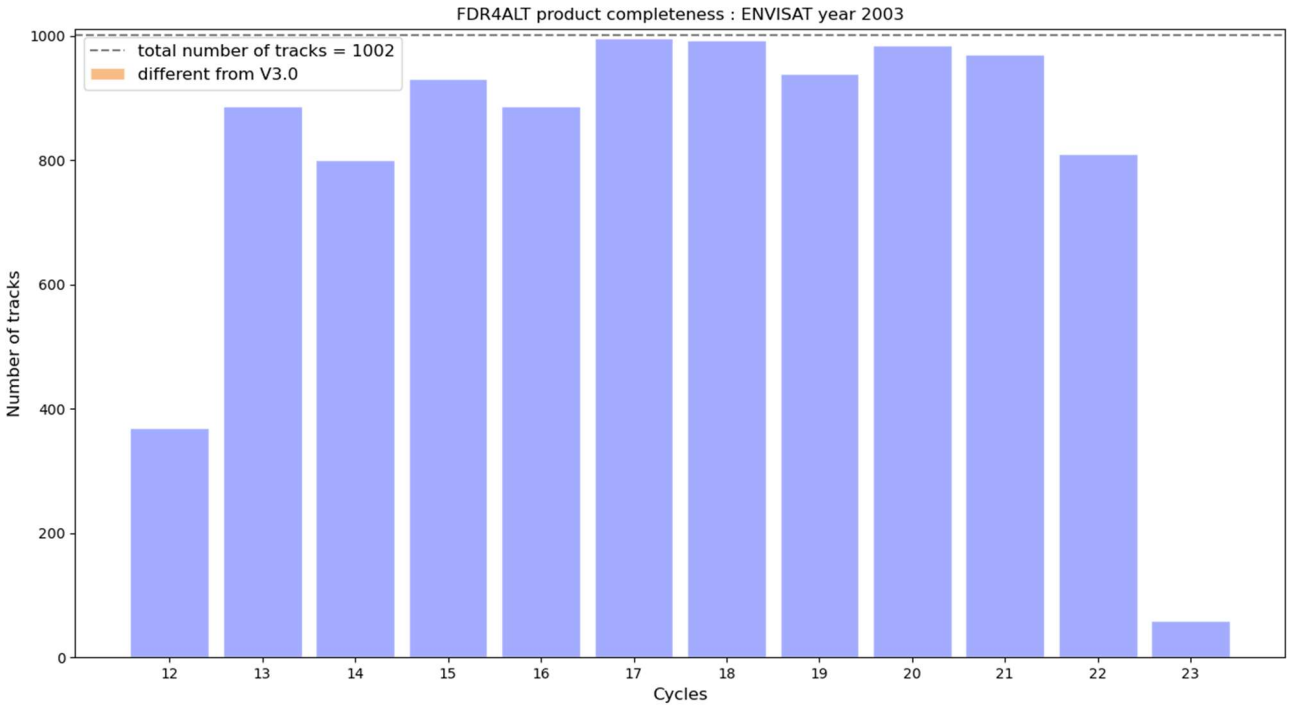

Figure 2-12 : Cyclic monitoring of the number of tracks completeness of year 2003

2.2.2.2 Cycle by cycle

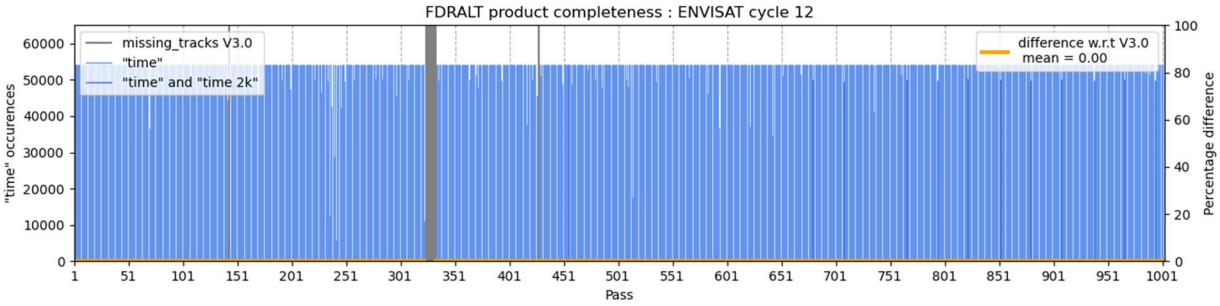

Figure 2-13 : Cycle 12

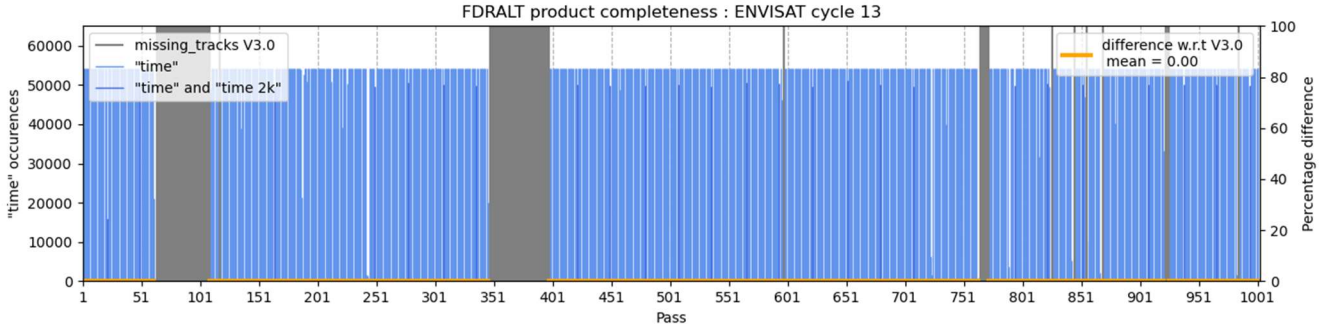

Figure 2-14 : Cycle 13

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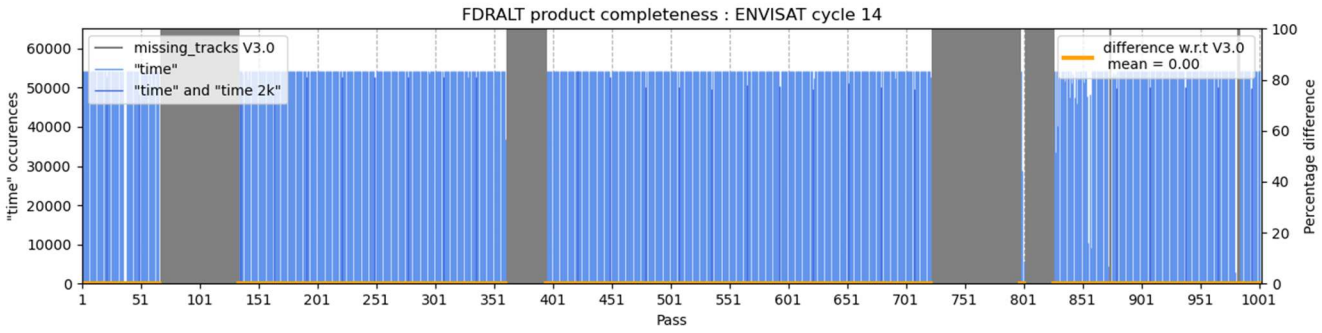

Figure 2-15 : Cycle 14

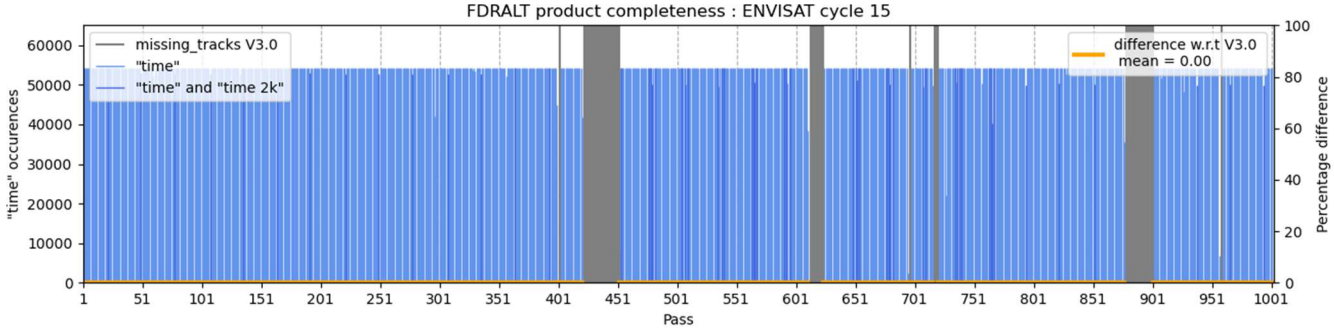

Figure 2-16 : Cycle 15

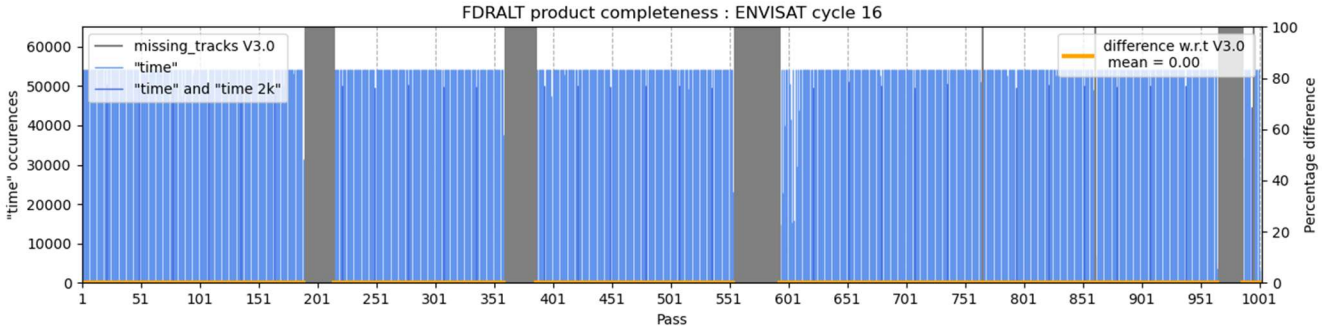

Figure 2-17 : Cycle 16

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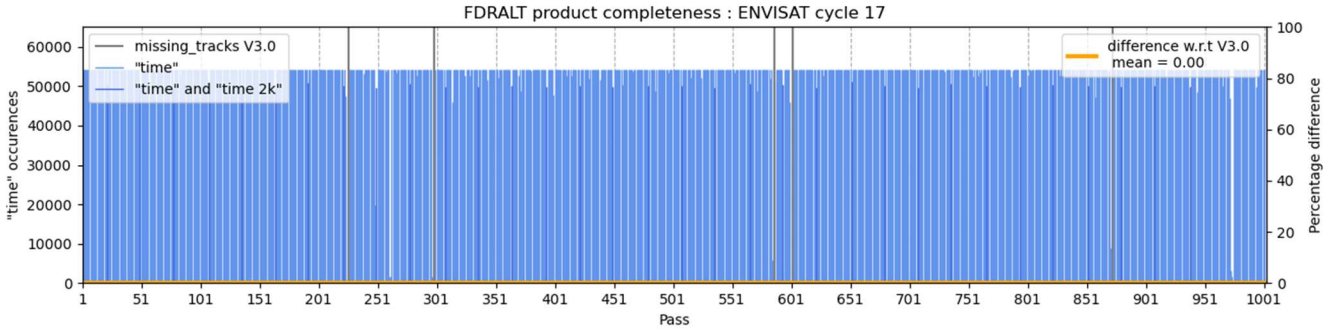

Figure 2-18 : Cycle 17

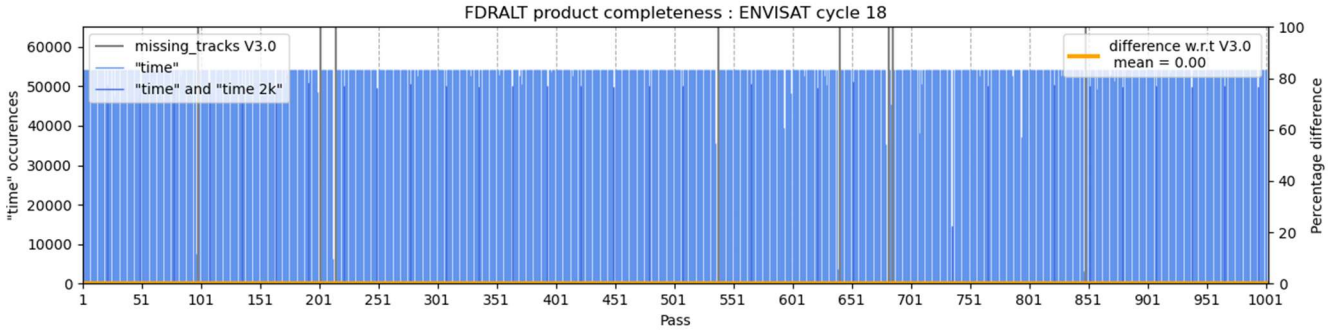

Figure 2-19 : Cycle 18

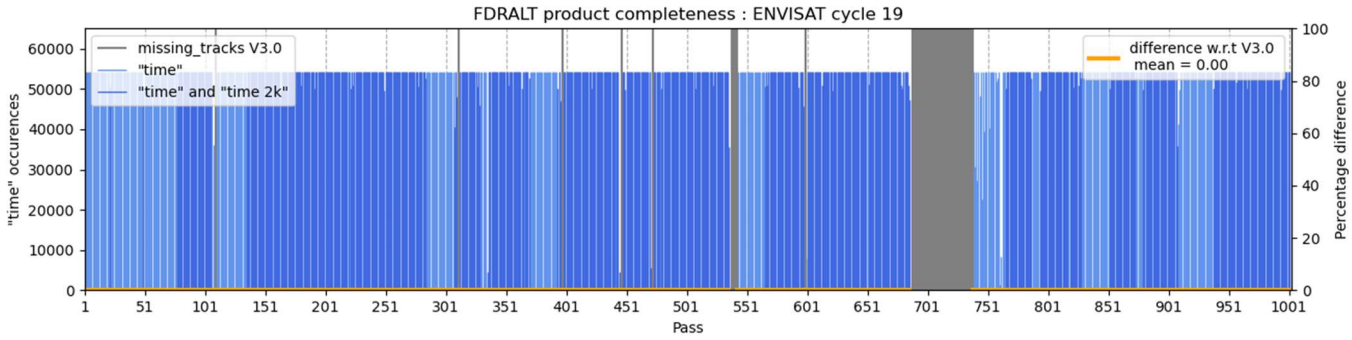

Figure 2-20 : Cycle 19

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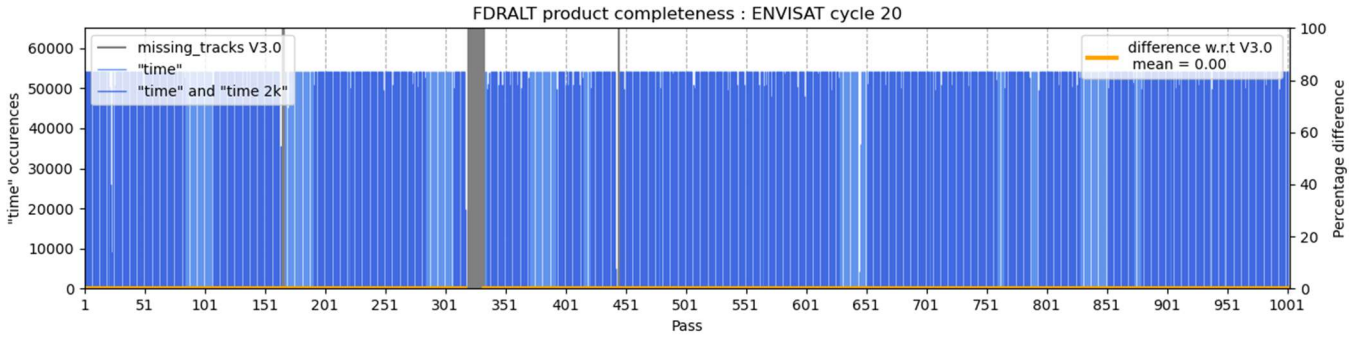

Figure 2-21 : Cycle 20

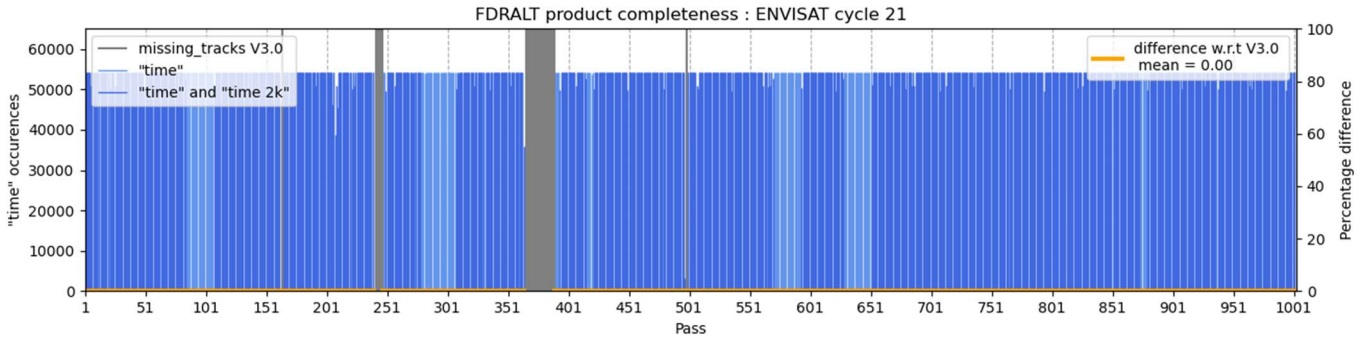

Figure 2-22 : Cycle 21

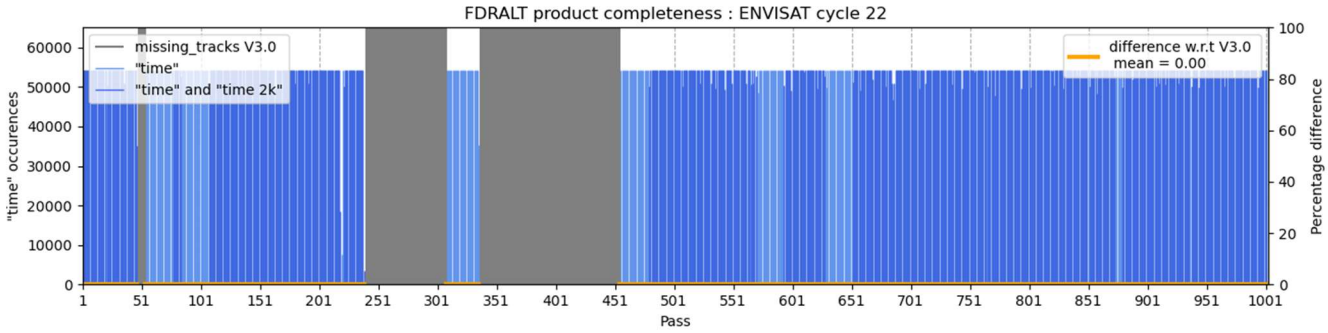

Figure 2-23 : Cycle 22

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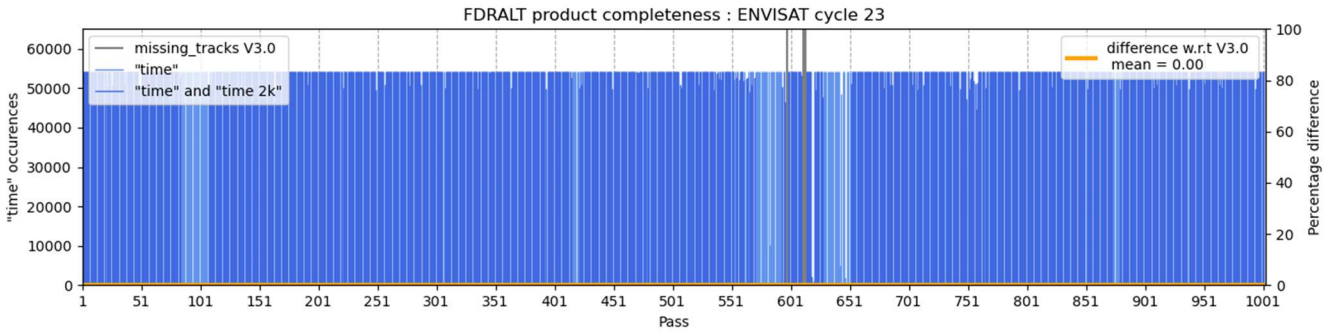

Figure 2-24 : Cycle 23

2.2.3 2004

2.2.3.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2004 and presented in the table and figure below.

In summary:

- All cycles are 100% complete.

ENVISAT year 2004			
Cycles	**Number of missing tracks (V3.0)**	**Number of missing tracks (FDR4ALT)**	**Missing tracks**
23	3	3	598, 612, 613
24	5	5	250, 251, 252, 445, 783
25	0	0	
26	13	13	280, 617, 624, 780-789
27	22	22	380-389, 460, 461, 858, 918, 946, 981, 983, 995-999
28	8	8	361, 765-771
29	33	33	172-179, 361, 411, 423-445
30	32	32	155, 765-795
31	4	4	327, 338, 361, 366
32	54	54	30-39, 122, 206, 361, 421-449, 647-651, 686, 692, 695-697, 744, 819
33	40	40	30, 86-88, 95, 204, 209-211, 228, 234, 267, 295, 297, 325, 380-391, 404-406, 488, 516, 555, 572-574, 578, 632, 647, 819

Table 2-4 : List of missing tracks for year 2004

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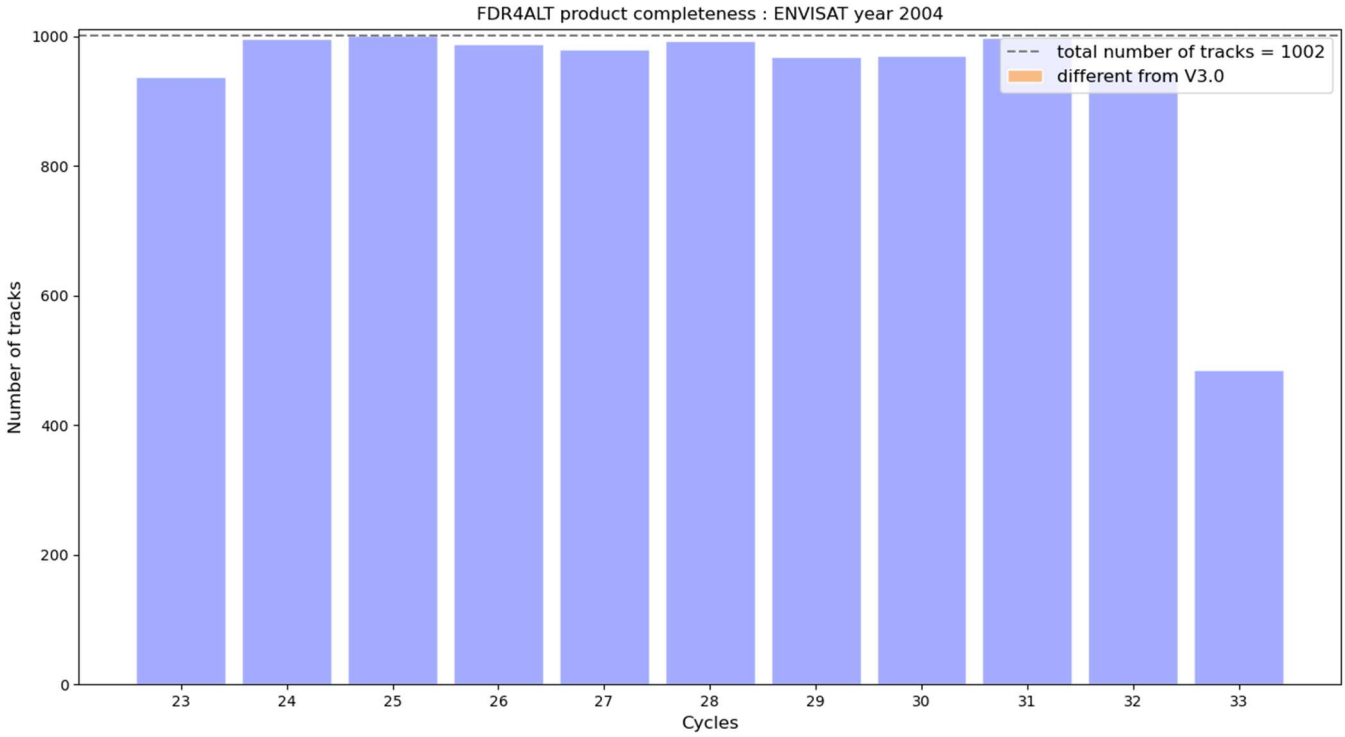

Figure 2-25 : Cyclic monitoring of the number of tracks completeness of year 2004.

2.2.3.2 Cycle by cycle

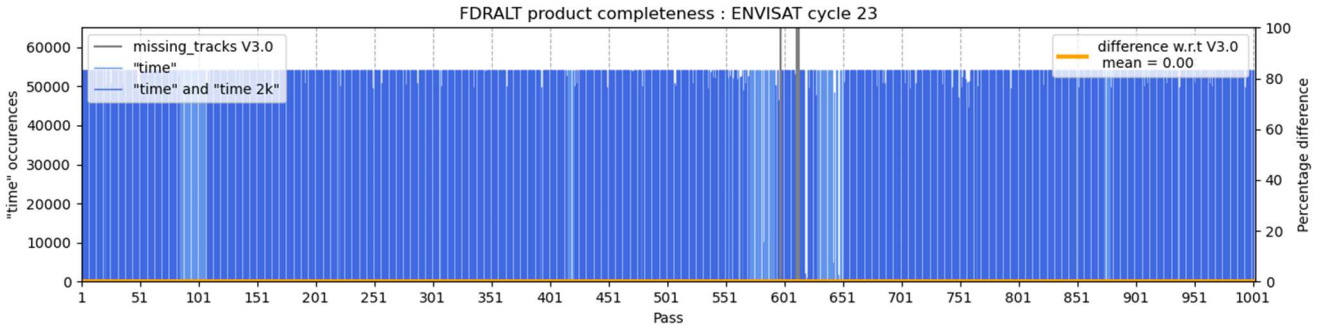

Figure 2-26 : Cycle 23

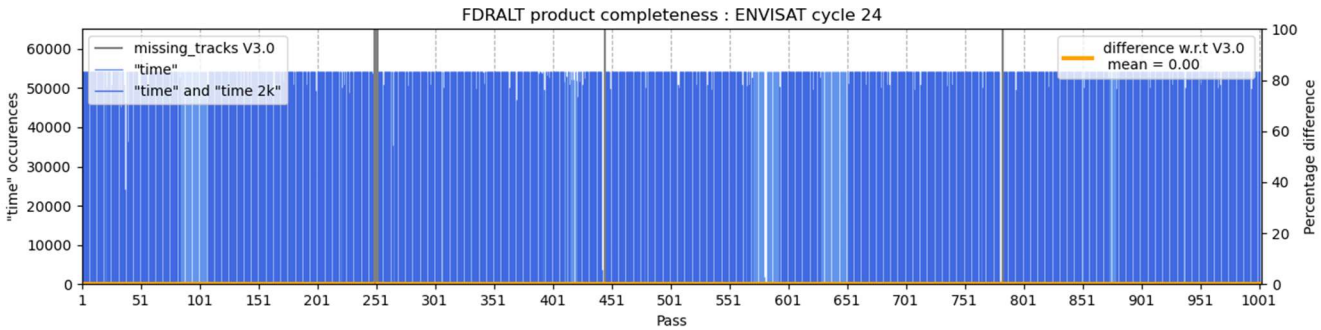

Figure 2-27 : Cycle 24

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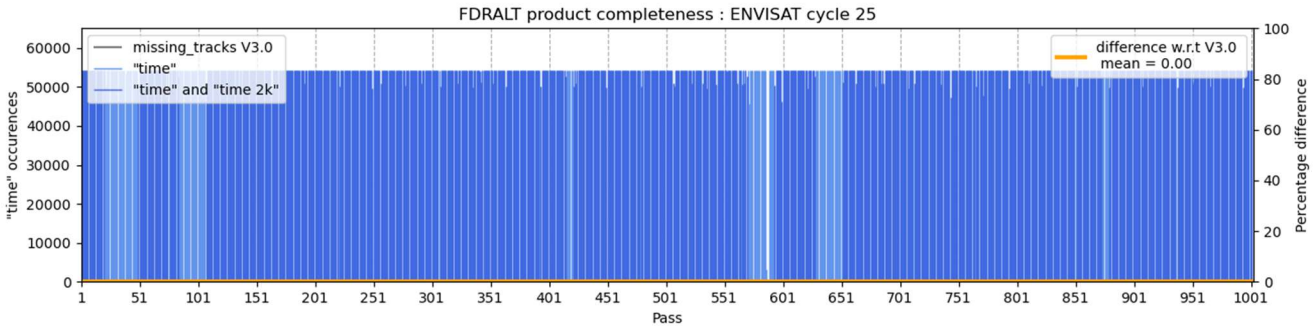

Figure 2-28 : Cycle 25

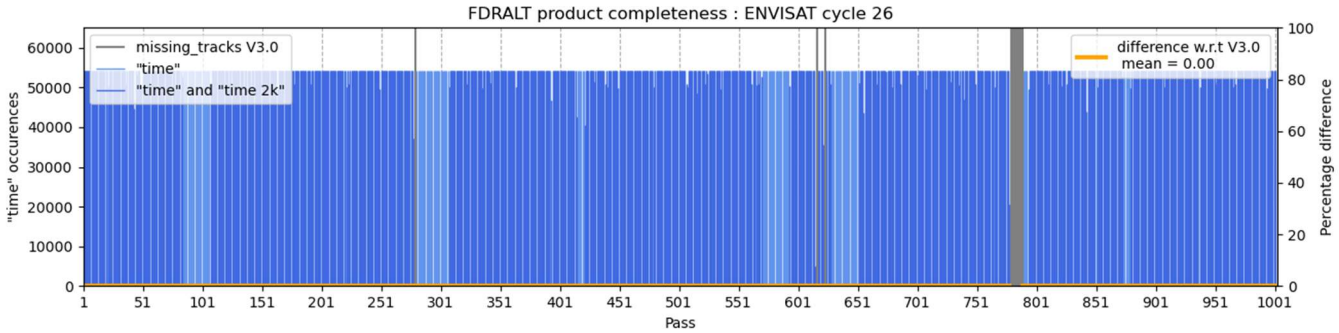

Figure 2-29 : Cycle 26

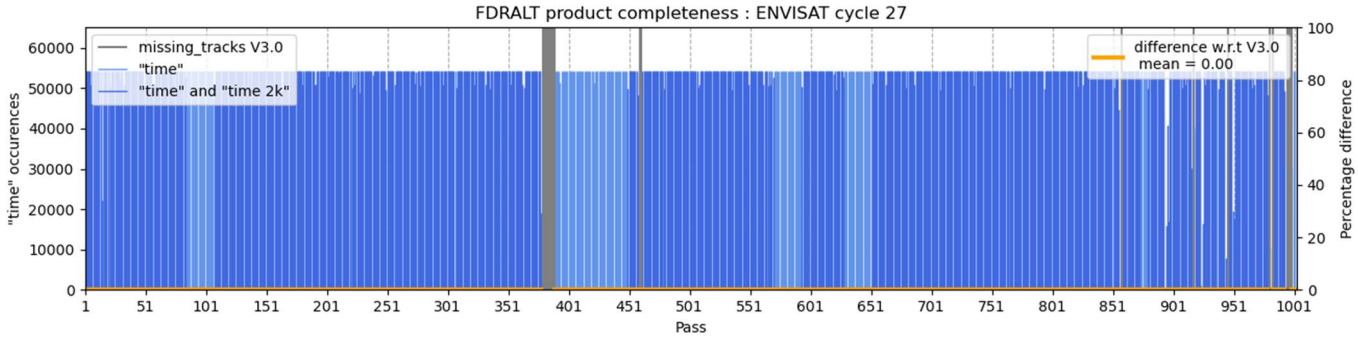

Figure 2-30 : Cycle 27

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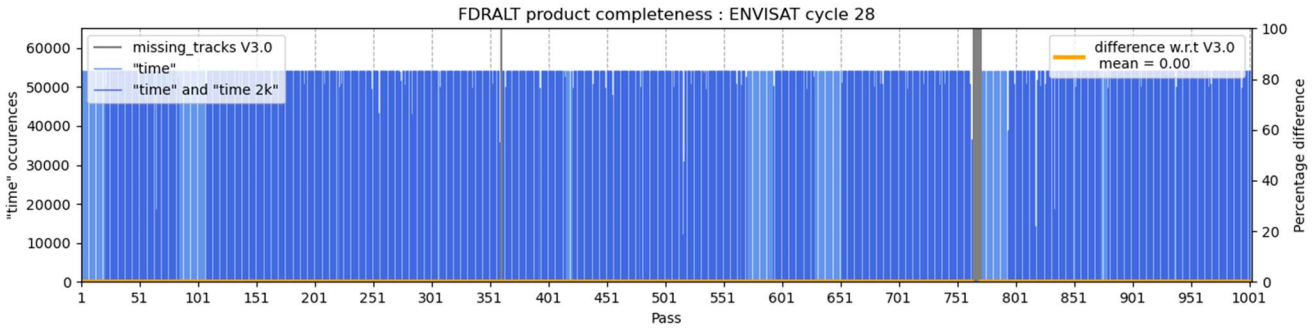

Figure 2-31 : Cycle 28

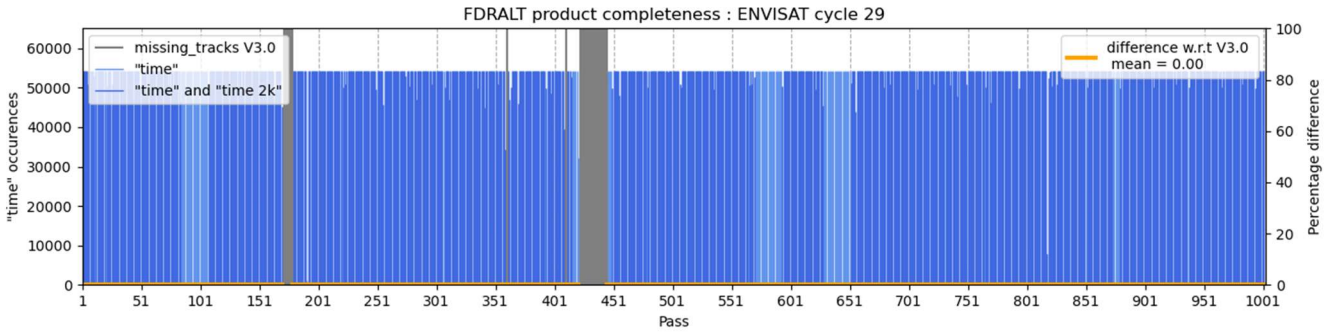

Figure 2-32 : Cycle 29

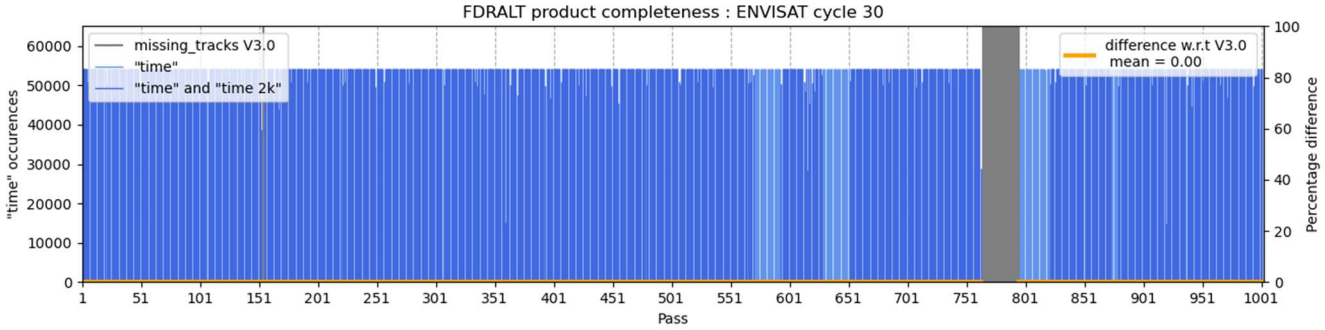

Figure 2-33 : Cycle 30

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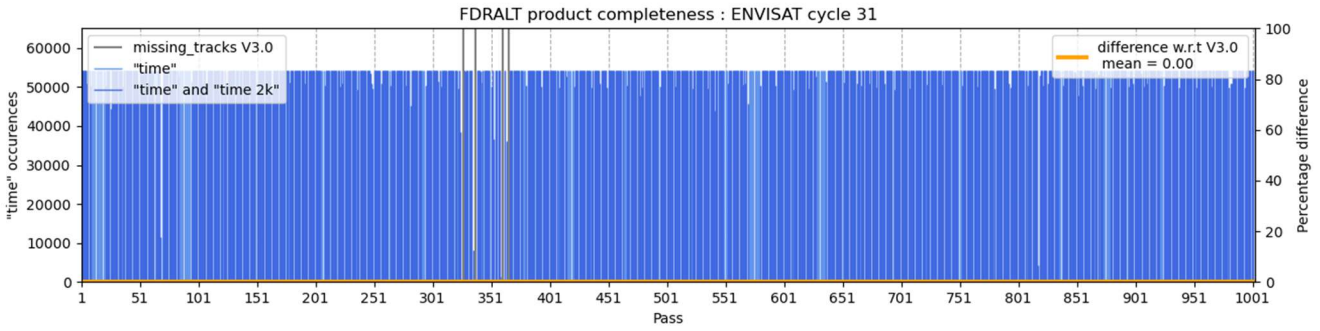

Figure 2-34 : Cycle 31

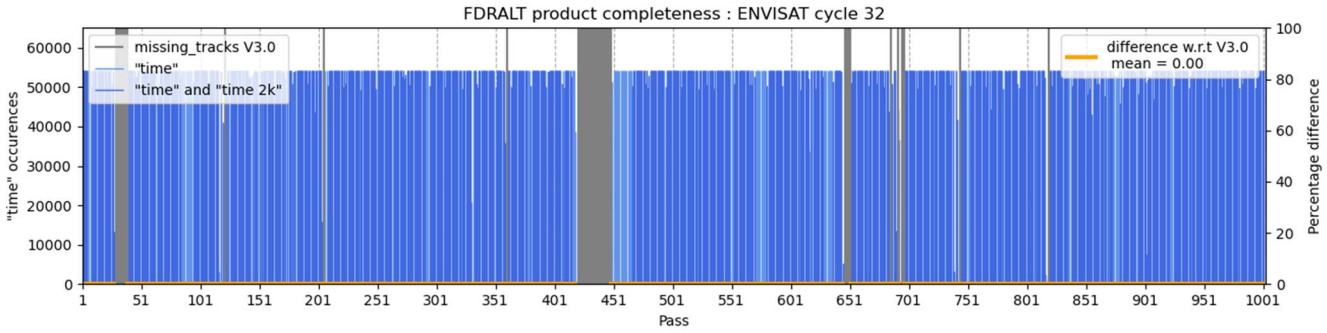

Figure 2-35 : Cycle 32

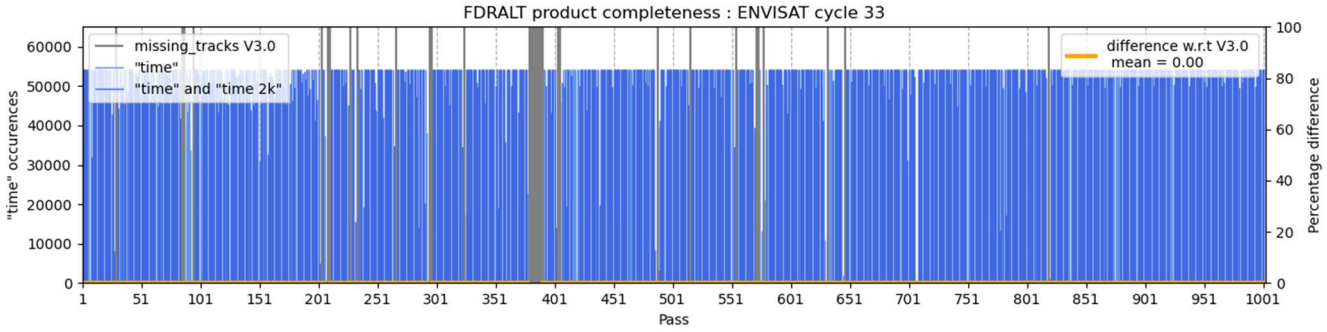

Figure 2-36 : Cycle 33

2.2.4 2005

2.2.4.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2005 and presented in the table and figure below.

In summary:

- Cycle 42, 43: Missing data for passes 287 and 288 for cycle 42 and passes 373 and 374 for cycle 43 due to duplicated time values in V3.0 products (corrupted). Only part of these have been recovered

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without any guarantee of good quality and these data should be used with caution (see Figure 2-47 and Figure 2-50).

- Cycle 42:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0287	85080	25867
0288	57280	20

- Cycle 43:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0373	87000	25867
0374	57280	20

- All the other cycles are 100% complete.

ENVISAT year 2005			
Cycles	**Number of missing tracks (V3.0)**	**Number of missing tracks (FDR4ALT)**	**Missing tracks**
33	40	40	30, 86-88, 95, 204, 209-211, 228, 234, 267, 295, 297, 325, 380-391, 404-406, 488, 516, 555, 572-574, 578, 632, 647, 819
34	82	82	239, 252-257, 288-297, 319, 320, 333, 346, 348-353, 378, 379, 383, 400, 402, 406, 430, 433-439, 460, 518-525, 544-555, 572-583, 608-611, 648, 692, 693, 697
35	11	11	99, 680, 697-705
36	32	32	426, 583-591, 714, 727, 742-761
37	28	28	316, 348-359, 501-503, 520-531
38	11	11	156, 239, 662, 783-789, 942
39	23	23	103, 135-141, 165-169, 492-501
40	18	18	24-27, 155, 383, 424-427, 548, 716, 733, 781, 796-799
41	15	15	19-25, 153, 420-423, 858, 920, 921
42	30	30	97-101, 252, 286, 320, 384, 511, 519, 531, 571, 576-583, 653, 689, 696, 723-726, 945, 946
43	54	54	89, 92, 95, 104, 114, 122, 124, 144, 158, 183, 196, 205, 206, 217, 218, 253, 273, 295, 372, 404, 583, 596, 656, 658, 672, 673, 680, 708, 744-748, 787, 791, 813-820, 830, 844, 925, 926, 950, 993, 994-997

Table 2-5 : List of missing tracks for year 2005

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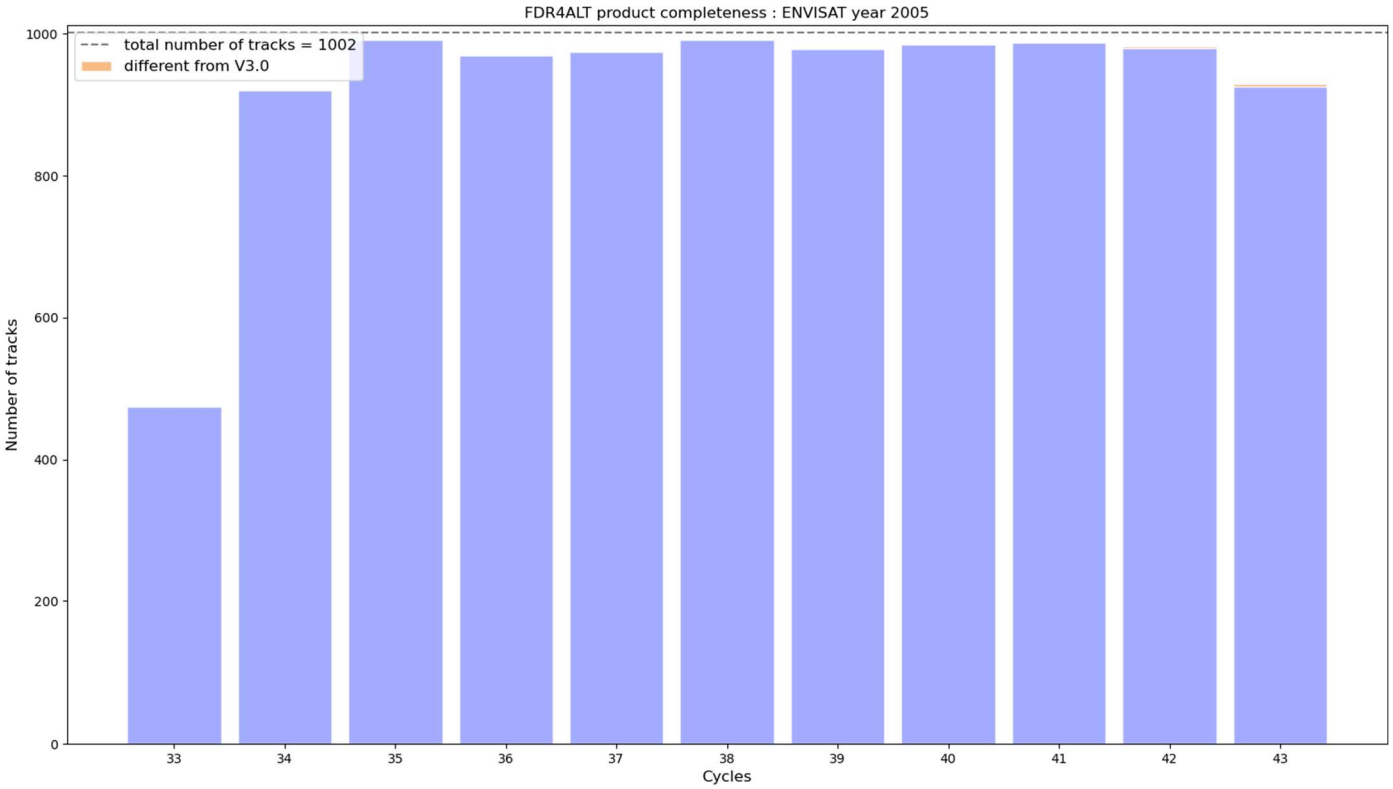

Figure 2-37 : Cyclic monitoring of the number of tracks completeness of year 2005

2.2.4.2 Cycle by cycle

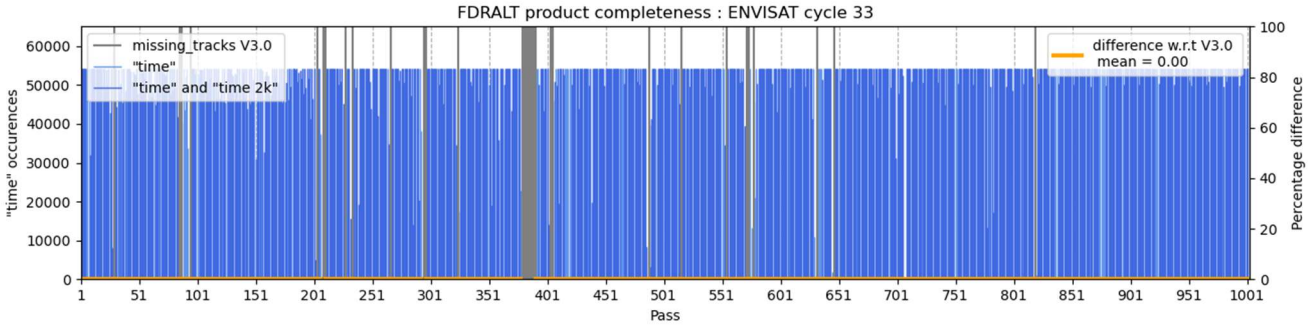

Figure 2-38 : Cycle 33

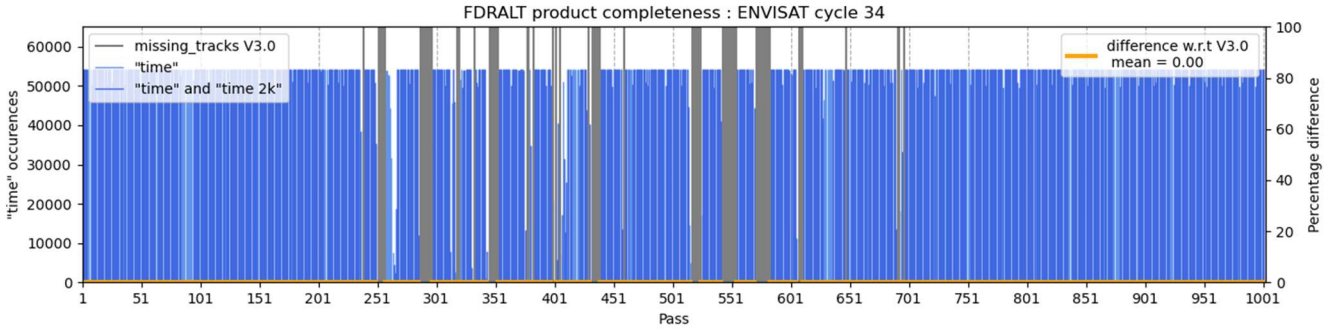

Figure 2-39 : Cycle 34

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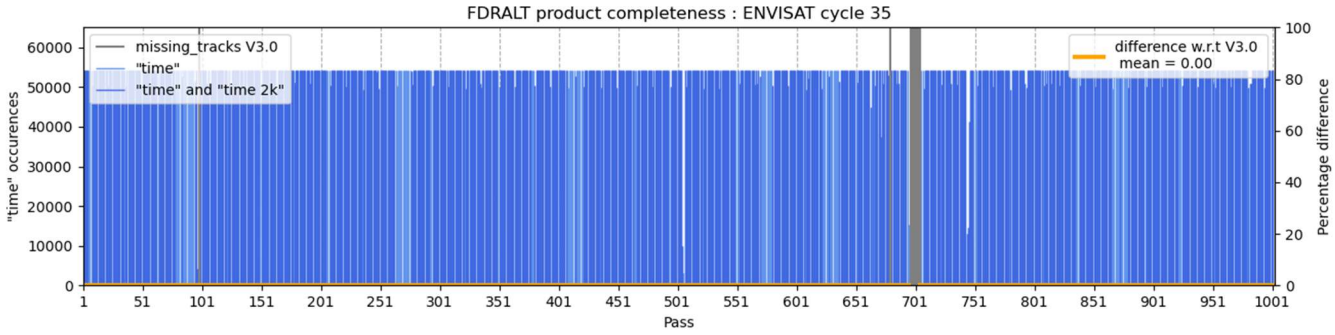

Figure 2-40 : Cycle 35

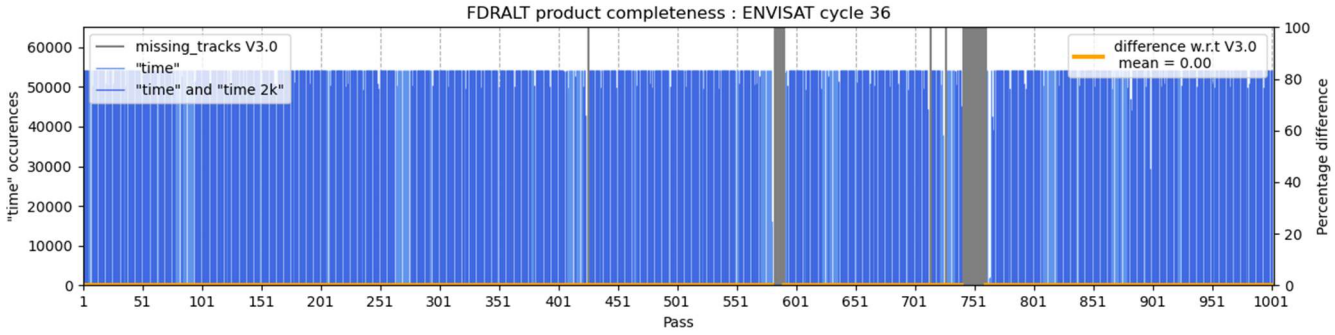

Figure 2-41 : Cycle 36

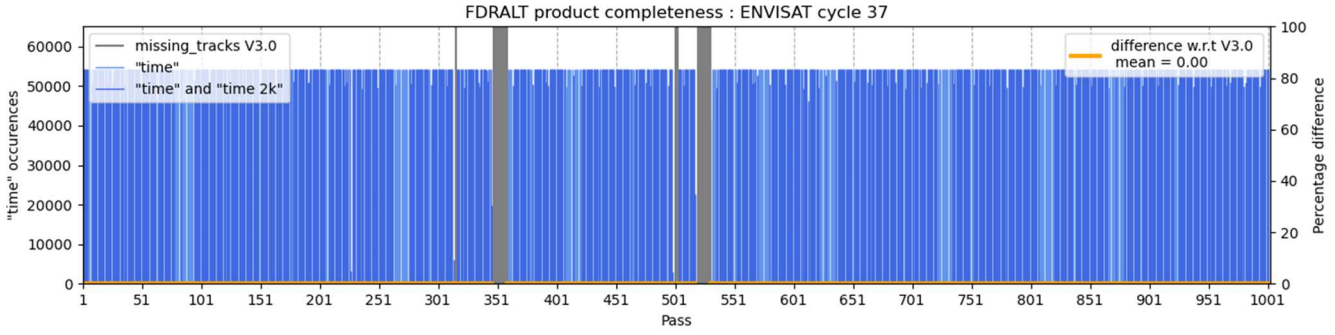

Figure 2-42 : Cycle 37

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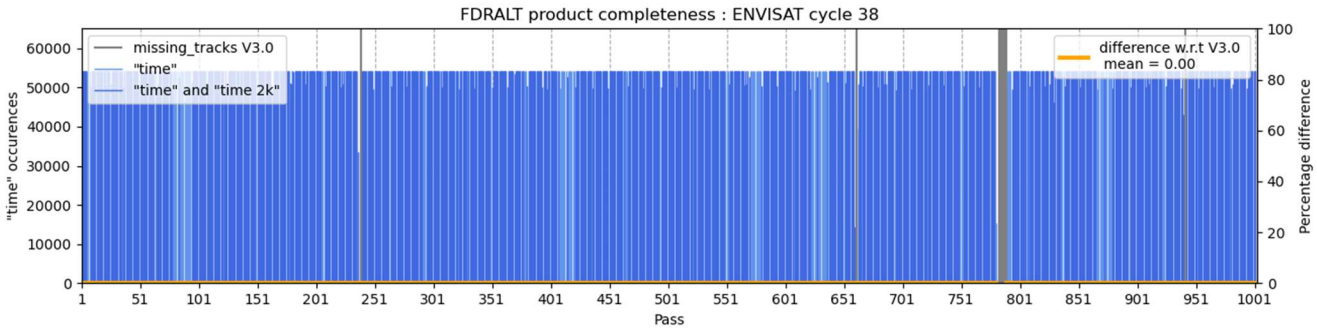

Figure 2-43 : Cycle 38

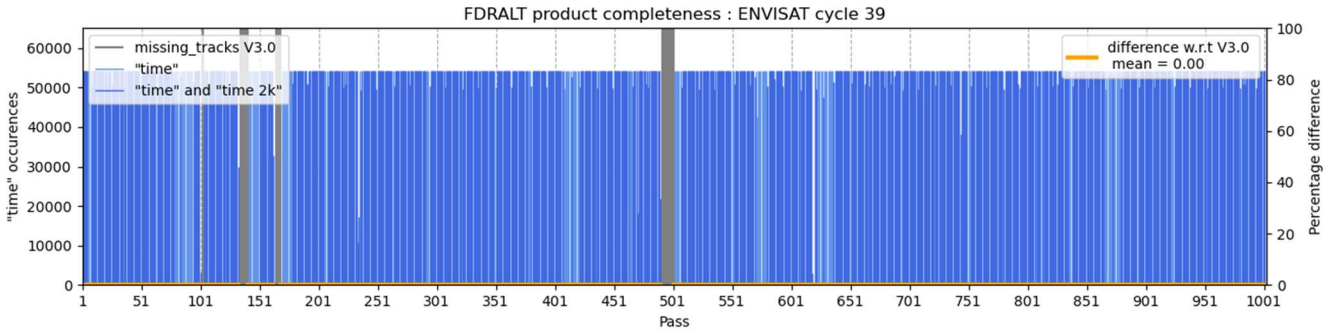

Figure 2-44 : Cycle 39

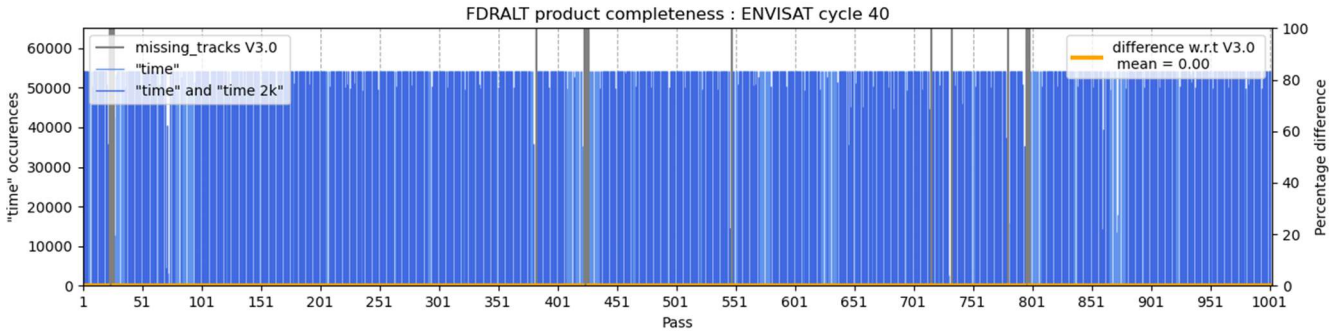

Figure 2-45 : Cycle 40

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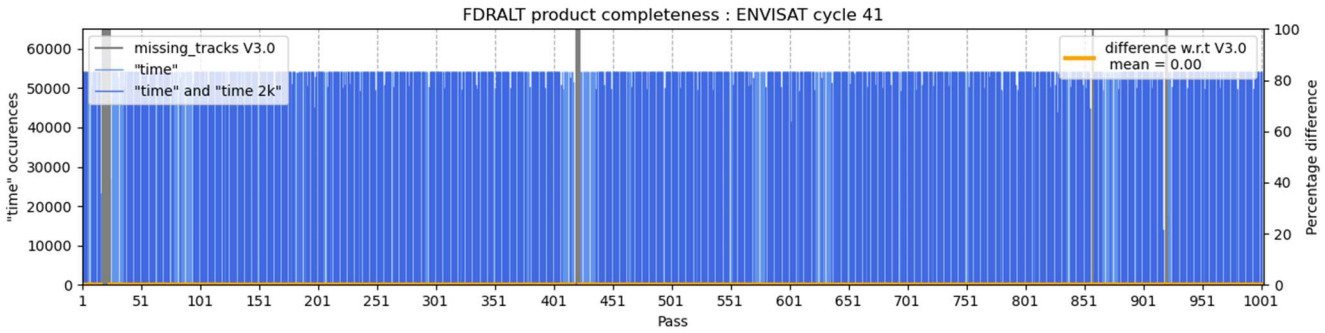

Figure 2-46 : Cycle 41

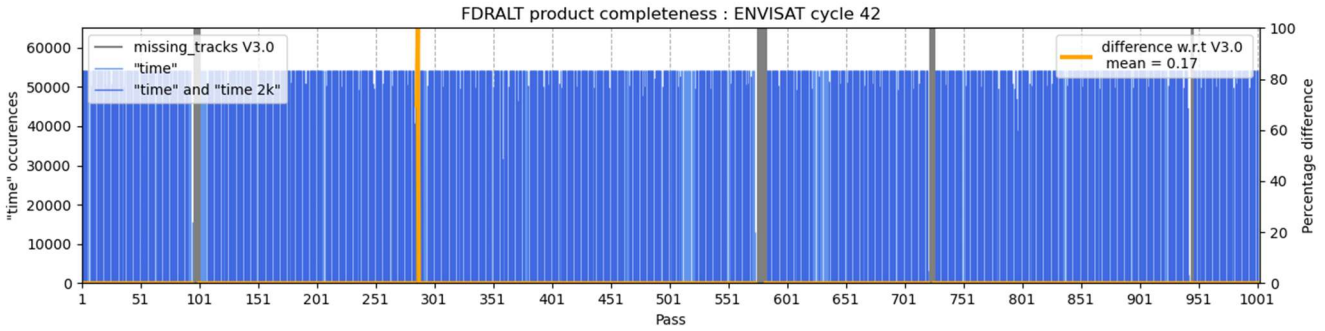

Figure 2-47 : Cycle 42

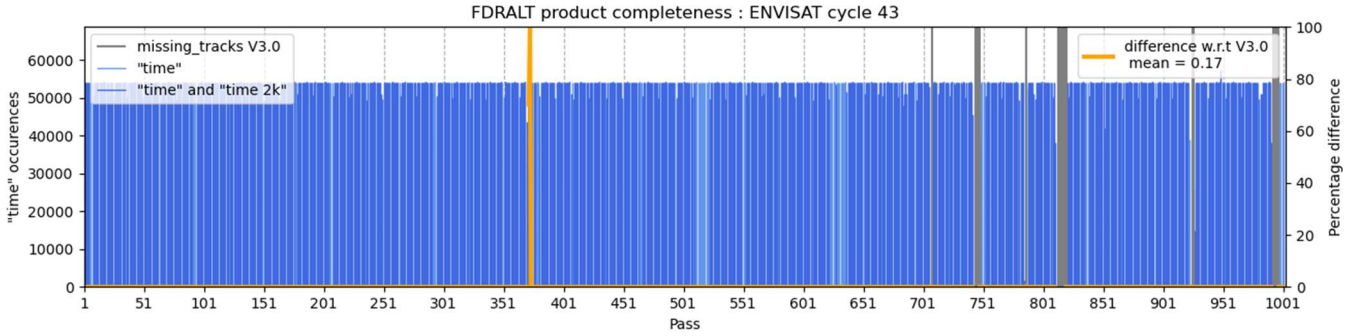

Figure 2-48 : Cycle 43

2.2.5 2006

2.2.5.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2006 and presented in the table and figure below.

In summary:

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- Cycle 43: Missing data for passes 373 and 374 due to duplicated time values in V3.0 products (corrupted). Only part of it have been recovered without any guarantee of good quality and these data should be used with caution.
- All the other cycles are 100% complete.

ENVISAT year 2006			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
43	54	54	89, 92, 95, 104, 114, 122, 124, 144, 158, 183, 196, 205, 206, 217, 218, 253, 273, 295, 372, 404, 583, 596, 656, 658, 672, 673, 680, 708, 744-748, 787, 791, 813-820, 830, 844, 925, 926, 950, 993, 994-997
44	49	49	7, 89, 168, 169, 173, 186, 194 , 208-211, 214, 227, 235, 256, 279-283, 285, 371, 382, 530, 570, 585, 632, 675, 732, 742, 780-789, 841-847, 854, 855
45	35	35	18, 47, 91-93, 101, 138, 160, 168, 174, 179, 192, 208, 223, 224, 236, 274, 530, 545, 632, 648, 683, 717, 797, 802, 812, 989-997
46	110	110	8, 9, 32, 75, 77, 78, 81, 86, 88, 98, 102, 110, 120, 132, 137, 152, 159, 161, 164, 219, 227, 235, 237, 273, 286, 287, 383, 409, 487, 570, 631, 664-736, 767, 795, 804, 858, 913, 928
47	49	49	51, 82, 86, 90, 92, 165, 169, 184, 203, 205, 213, 218, 227, 231, 246, 254, 260, 294, 405, 512, 513, 514, 566, 575, 589, 668, 729, 765, 777, 783, 790-794, 802, 863, 903-913, 983, 984
48	154	154	19, 28, 56, 80-166, 184, 198, 294, 365, 399, 400, 431, 432, 454, 517, 630-641, 658-669, 686-697, 701, 716-725, 740, 744-755, 888, 1000
49	34	34	7, 78, 90, 102, 117, 125, 130, 143, 144, 171, 190, 236, 260, 297, 301, 328, 329, 337, 344, 356, 396, 474, 482, 528, 597, 647, 666, 693, 694, 718, 763, 772, 861, 953
50	23	23	1, 3, 6-13, 67, 93, 210, 215, 225, 320, 438, 540, 541, 544, 620, 740, 953
51	162	162	19, 28, 56, 80-166, 184, 198, 294, 365, 399, 400, 431, 432, 454, 517, 630-641, 658-669, 686-697, 701, 716-725, 740, 744-755, 888, 1000
52	39	39	17, 26, 29, 34, 73, 80, 132, 135, 180, 201, 211, 270, 297, 301, 314, 337, 402, 467-473, 490, 496, 514, 574, 575, 576, 632, 681-685, 776, 803, 913
53	175	175	110, 134, 141, 172, 205, 206, 215, 248, 283, 309, 358-367, 413-469, 599, 659, 826-923, 940, 953
54	24	24	45, 62, 123, 131, 153, 165, 167, 181, 197, 198, 348-353, 491, 511, 556, 557, 572, 720, 738, 953

Table 2-6 : List of missing tracks for year 2006

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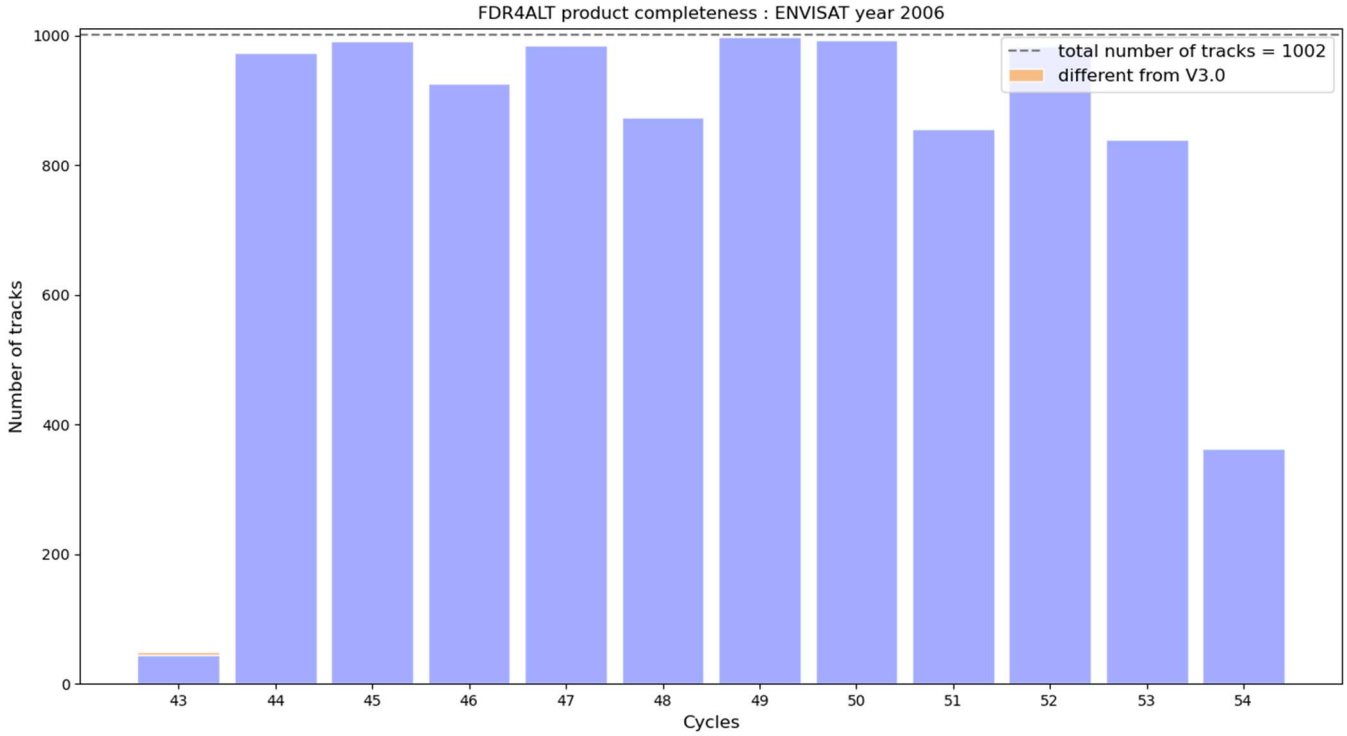

Figure 2-49 : Cyclic monitoring of the number of tracks completeness of year 2006

2.2.5.2 Cycle by cycle

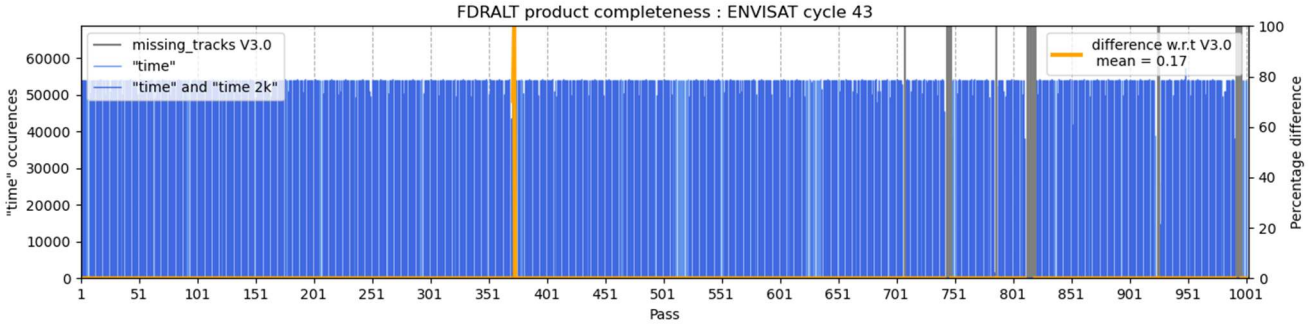

Figure 2-50 : Cycle 43

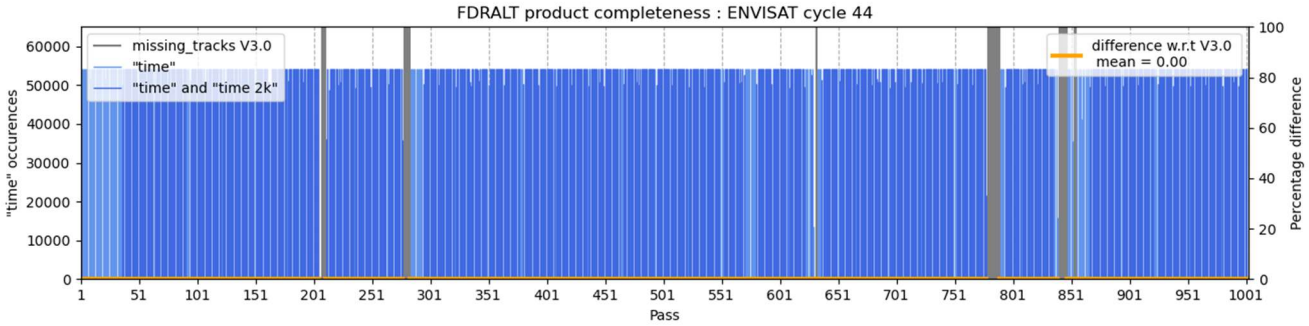

Figure 2-51 : Cycle 44

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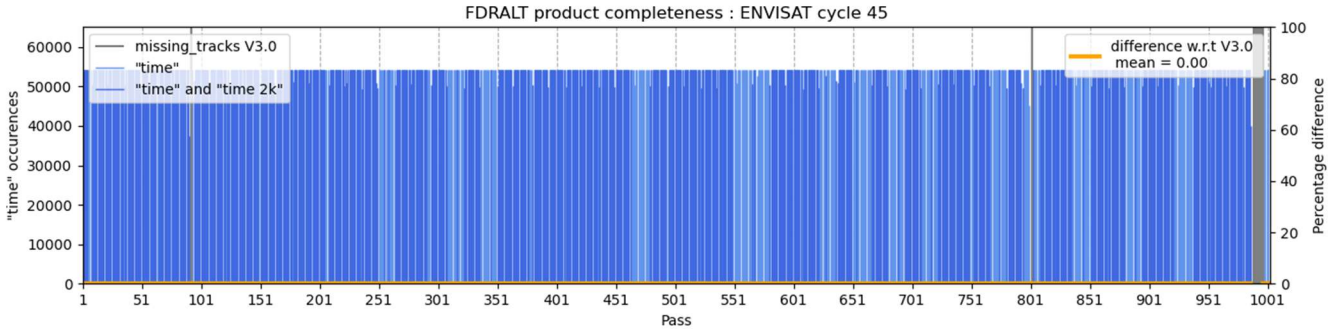

Figure 2-52 : Cycle 45

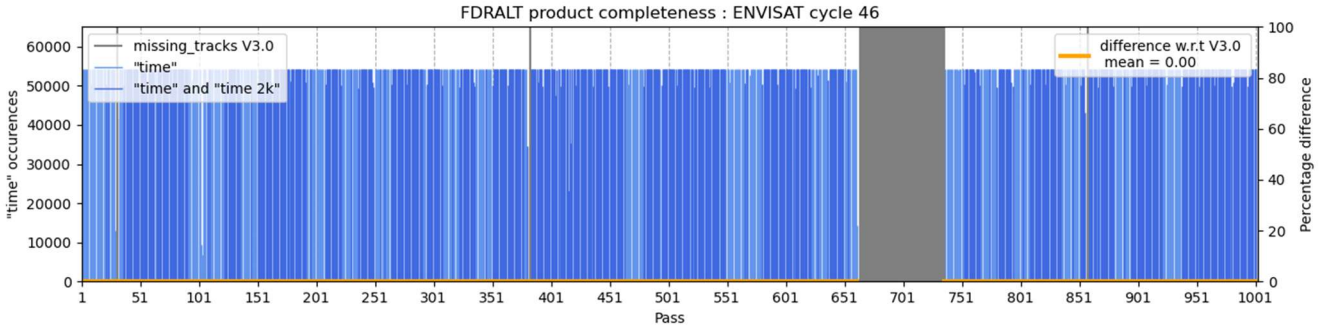

Figure 2-53 : Cycle 46

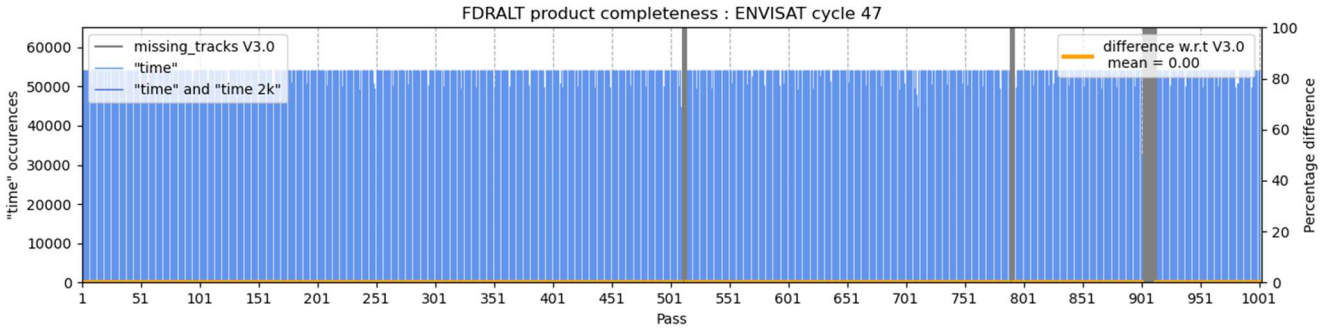

Figure 2-54 : Cycle 47

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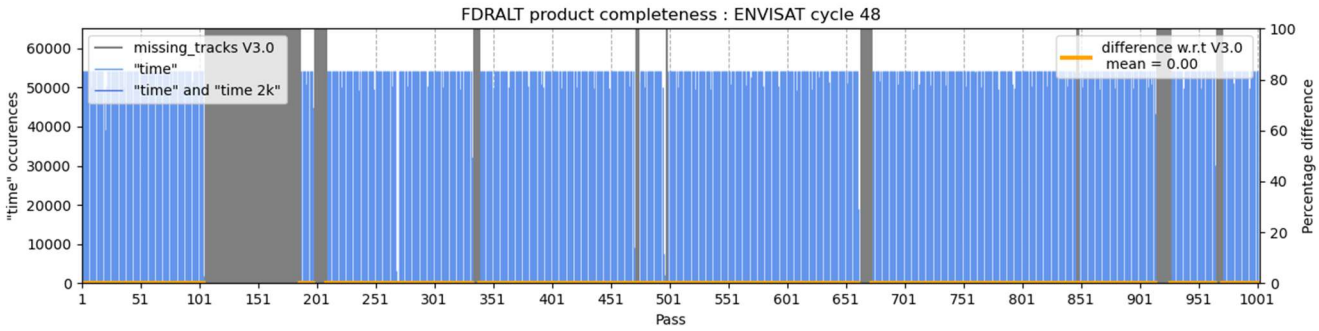

Figure 2-55 : Cycle 48

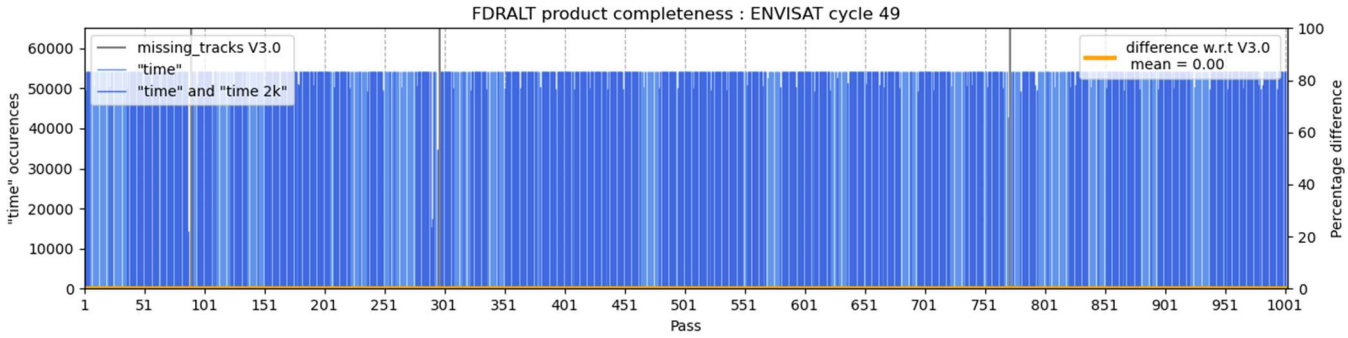

Figure 2-56 : Cycle 49

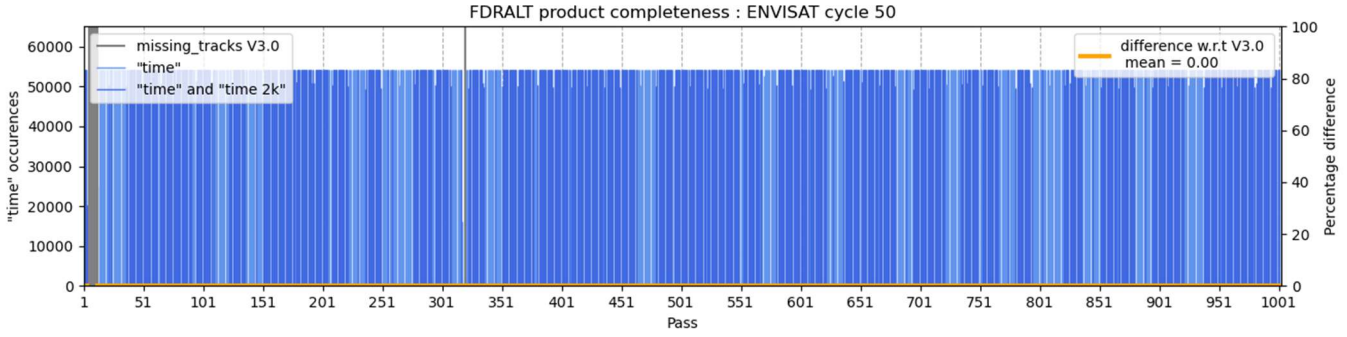

Figure 2-57 : Cycle 50

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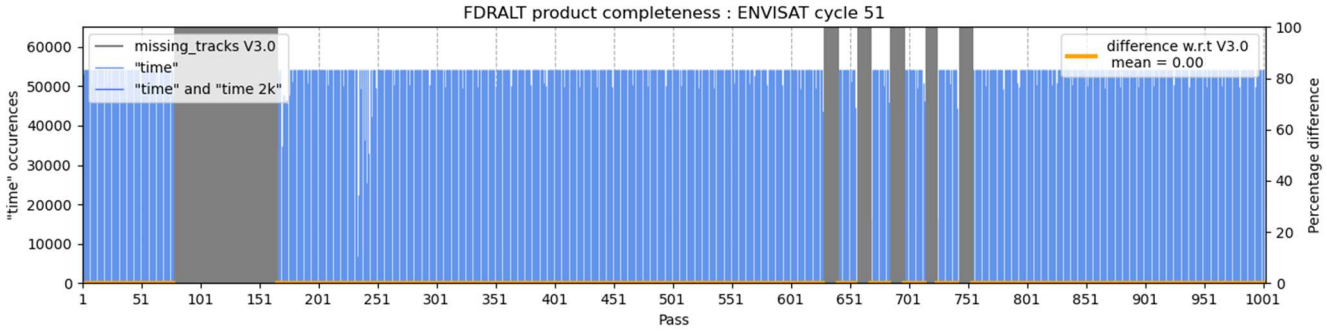

Figure 2-58 : Cycle 51

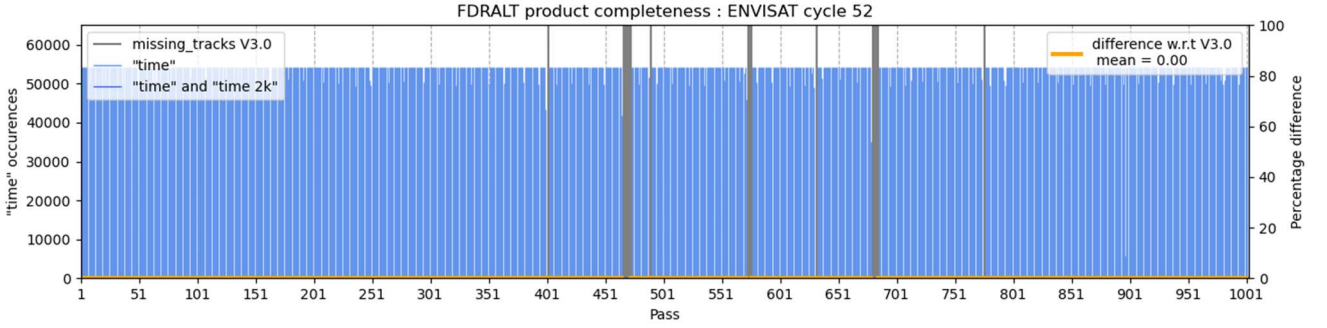

Figure 2-59 : Cycle 52

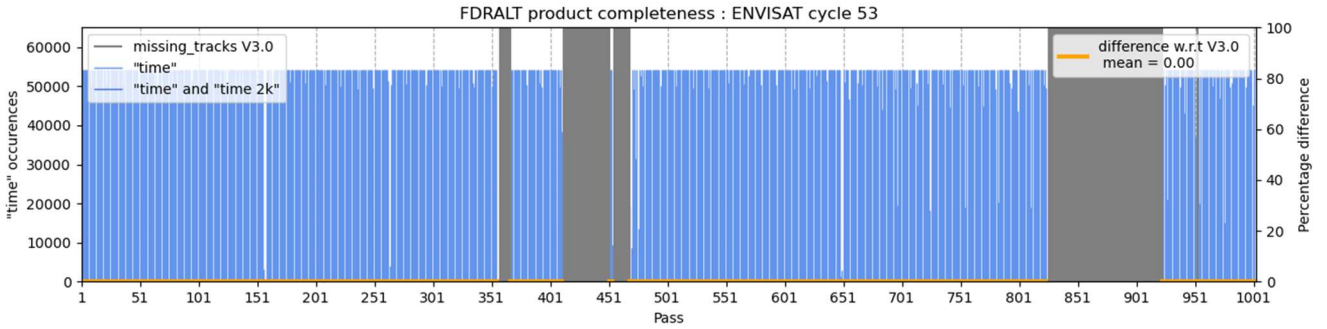

Figure 2-60 : Cycle 53

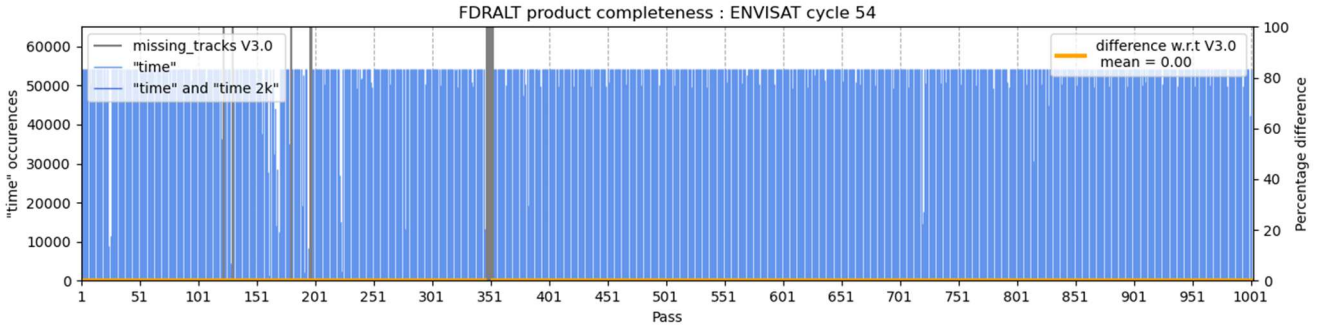

Figure 2-61 : Cycle 54

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2.2.6 2007

2.2.6.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2007 and presented in the table and the figure below.

In summary:

- Cycle 58: Loss of 20 measures (at 20Hz) at end and beginning of tracks on the FDR4ALT "time" array for the following passes:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0161	54180	54160
0171	54180	54160
0204	54180	54160
0207	54180	54160
0272	54180	54160
0308	54180	54160
0309	54200	54180
0403	54180	54160
0414	54200	54180
0449	54200	54180
0802	54180	54160
0841	54180	54160
0860	54200	54180
0922	54180	54160
0999	54180	54160

- Cycle 63: Loss of 20 measures (at 20Hz) at end and beginning of tracks on the FDR4ALT "time" array for the following passes:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0009	50880	50860
0022	54180	54160
0038	54180	54160
0040	54180	54160
0047	54180	54160
0093	50960	50940
0099	54180	54160
0138	54200	54180
0163	54180	54160
0206	54200	54180
0267	50880	50860
0283	54180	54160
0374	54180	54160
0375	54180	54160
0385	54180	54160
0388	54180	54160
0427	54180	54160
0447	54180	54160
0517	54180	54160
0569	54180	54160

- Data loss is very minor and may not been seen in the cycle completeness analysis.
- All the other cycles are 100% complete.

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ENVISAT year 2007			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
54	24	24	45, 62, 123, 131, 153, 165, 167, 181, 197, 198, 348-353, 491, 511, 556, 557, 572, 720, 738, 953
55	117	117	8, 10, 86, 88, 136, 138, 158, 172, 180, 187, 188, 196, 237-239, 280, 281, 285, 290, 413, 514, 554, 599, 663, 667-669, 678, 692-703, 720-789, 830, 837, 842, 865, 925-927
56	132	132	55-71, 84, 97, 130, 139, 147, 161, 170, 258, 268, 297, 311, 314-387, 427, 457, 505-507, 609-615, 702, 710, 809, 846, 864-873, 910, 936, 1001, 1002
57	39	39	2, 5, 19, 45, 115, 182-187, 240, 251, 261, 277, 282, 287, 326, 346, 367, 406, 456, 501, 527, 542, 595, 611, 624, 654-656, 722, 783, 819, 843, 845, 910, 950, 972
58	18	18	161, 171, 204, 207, 272, 308, 385, 389, 403, 414, 434, 435, 449, 802, 841, 860, 922, 999
59	87	87	128, 194, 195, 227, 315, 316, 323, 340, 442, 520-587, 603, 627, 660, 737, 862, 875, 888, 923, 926, 958
60	26	26	63-69, 165, 181, 198, 296, 327, 332, 371, 378, 503, 524, 532, 544, 547, 601, 723, 850, 920, 922, 971
61	37	37	2, 10, 35, 90, 125, 140, 153, 205, 207, 238, 269, 276, 294, 377, 409, 427, 430, 432, 439, 444, 446, 469, 509, 546, 601, 634, 638, 993-1002
62	102	102	1-73, 148, 170, 179, 180, 224-227, 261, 273, 279, 298, 382, 403, 440, 445, 446, 453, 456, 477, 478, 541, 579, 599, 621, 634, 641, 873, 967
63	27	27	4, 9, 22, 38, 40, 47, 93, 99, 138, 163, 206, 267, 278-281, 283, 374, 375, 385, 388, 427, 447, 517, 569, 575, 576
64	83	83	2-19, 25, 122, 138, 142, 143, 149-151, 154, 164, 166, 172-185, 198, 216, 218, 219, 270-275, 296, 349-353, 373, 410, 419, 421, 429, 463, 480, 482, 494, 515, 554, 600, 695, 710, 720-723, 774, 801, 806, 839, 929, 951

Table 2-7 : List of missing tracks for year 2007

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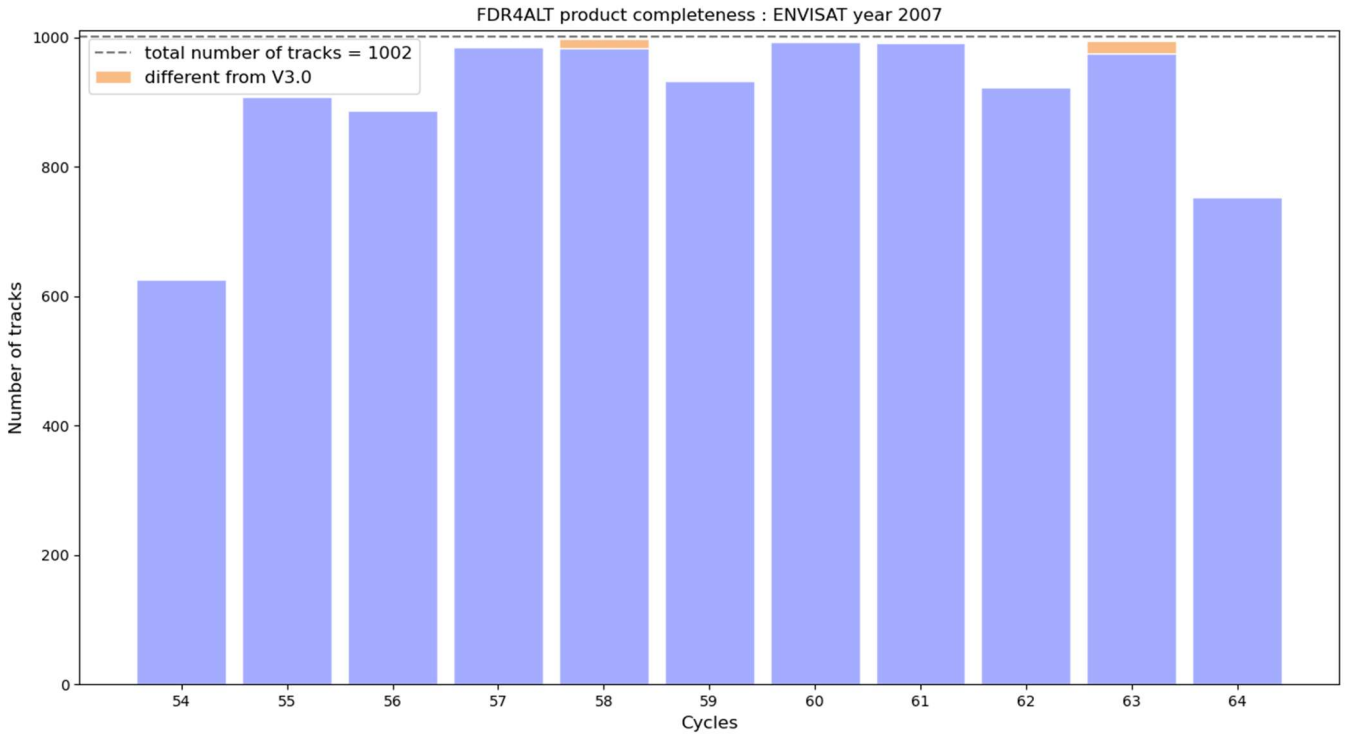

Figure 2-62 : Cyclic monitoring of the number of tracks completeness of year 2007.

2.2.6.2 Cycle by cycle

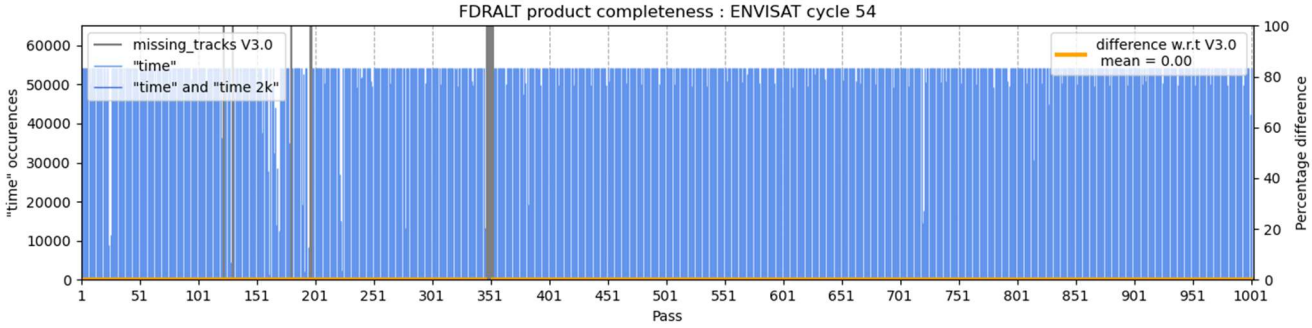

Figure 2-63 : Cycle 54

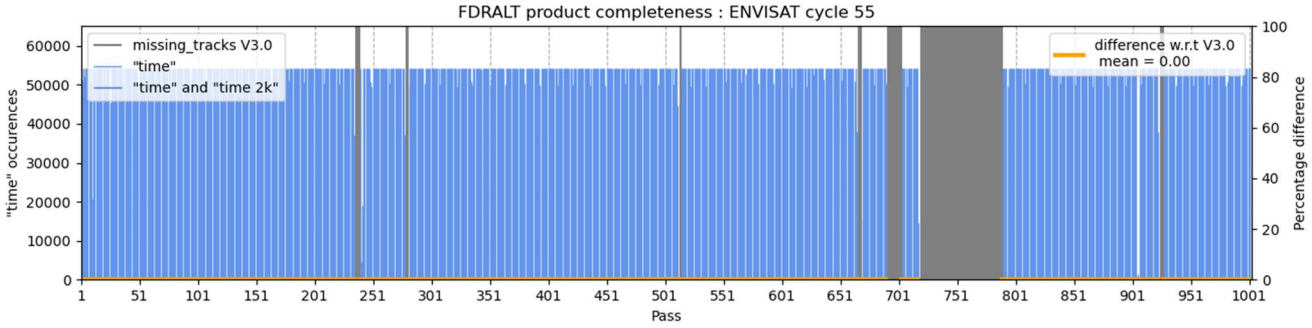

Figure 2-64 : Cycle 55

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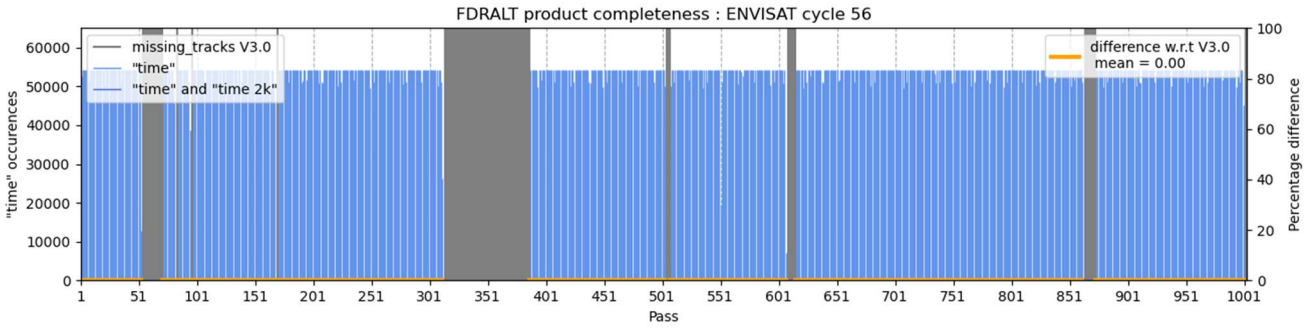

Figure 2-65 : Cycle 56

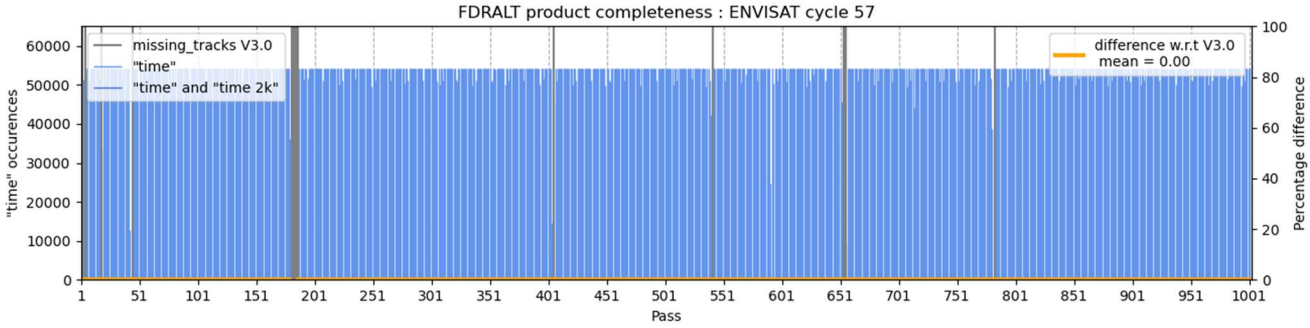

Figure 2-66 : Cycle 57

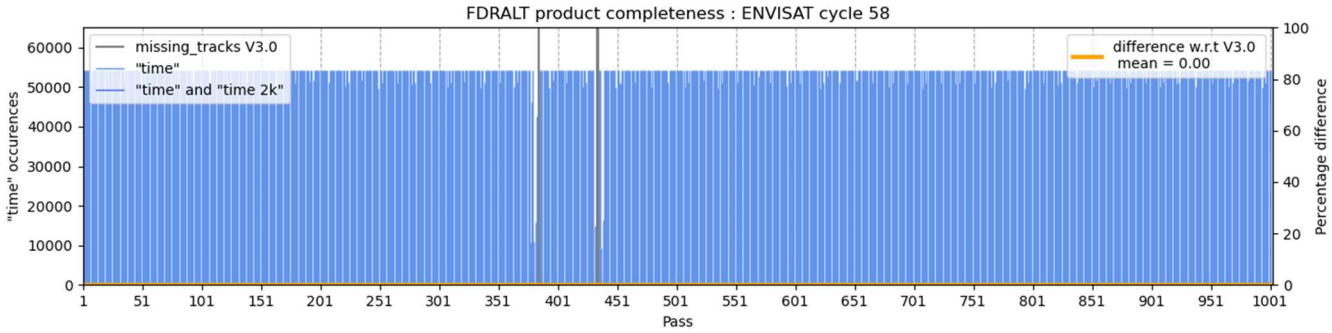

Figure 2-67 : Cycle 58

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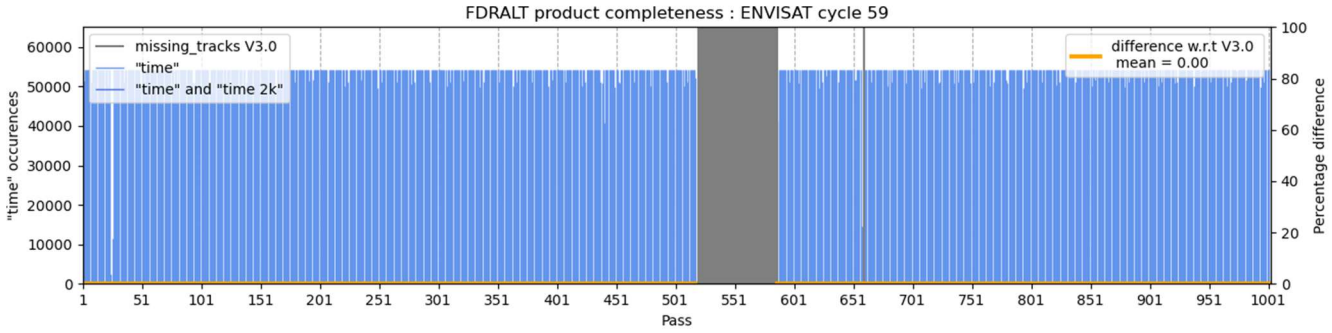

Figure 2-68 : Cycle 59

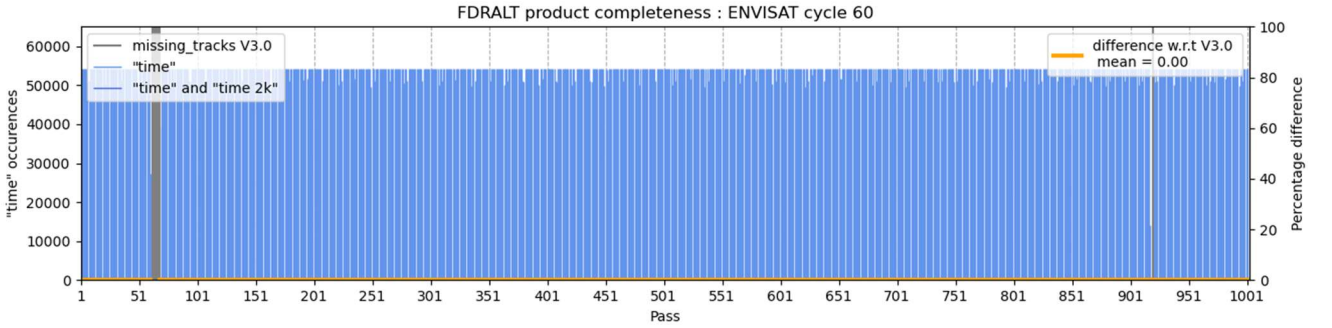

Figure 2-69 : Cycle 60

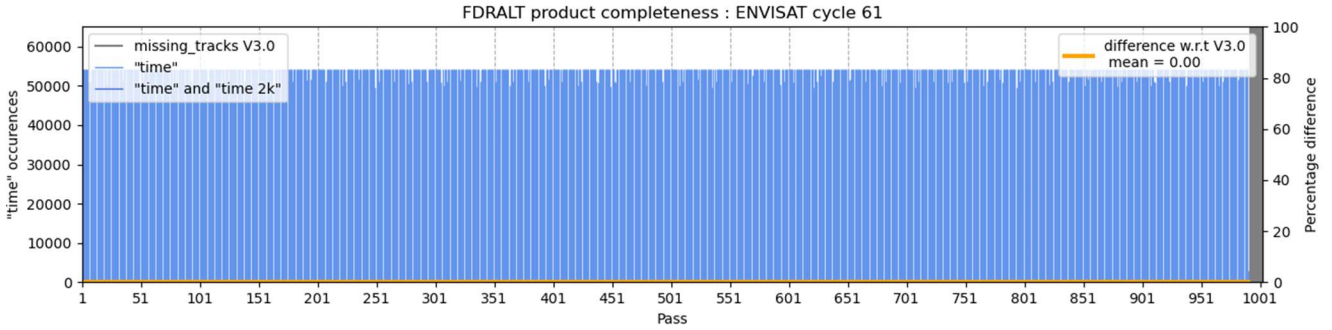

Figure 2-70 : Cycle 61

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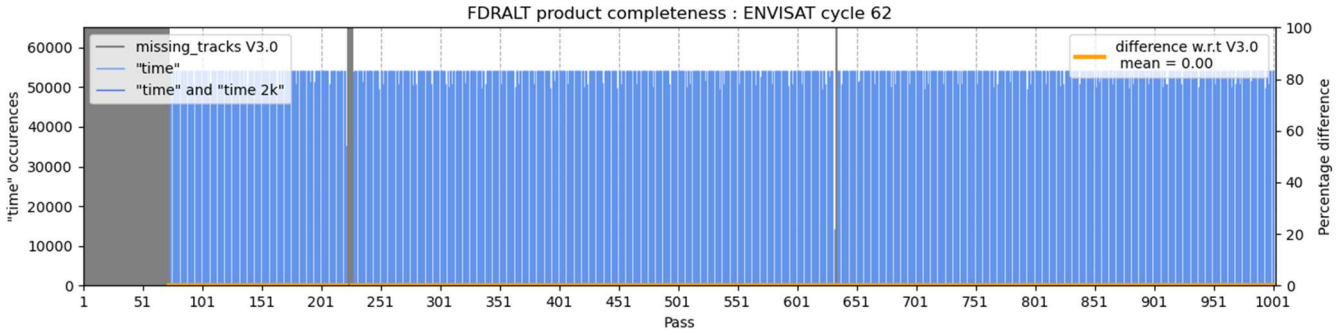

Figure 2-71 : Cycle 62

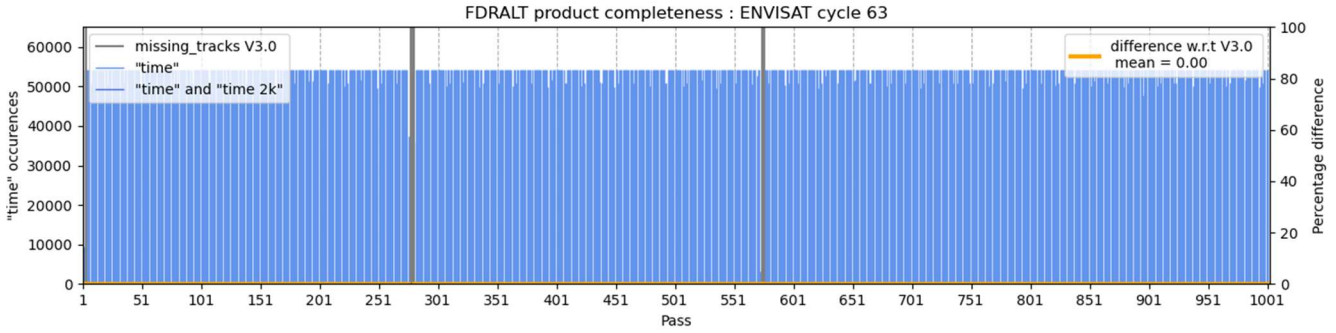

Figure 2-72 : Cycle 63

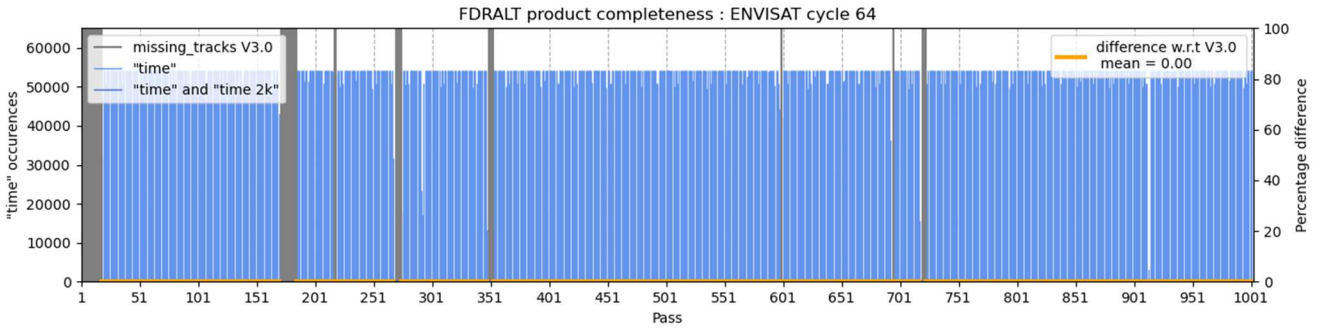

Figure 2-73 : Cycle 64

2.2.7 2008

2.2.7.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2008 and presented in the table and figure below.

In summary:

- Cycle 66: Loss of 20 measures (at 20Hz) at end and beginning of tracks on the FDR4ALT “time” array for the following passes:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0034	54180	54160

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0061	54180	54160
0081	54180	54160
0088	54180	54160
0110	54180	54160
0118	54200	54180
0180	54180	54160
0203	54180	54160
0220	54180	54160
0296	54180	54160
0311	54180	54160
0405	54180	54160
0431	54200	54180
0433	54180	54160
0441	54180	54160
0522	54180	54160
0589	54180	54160
0743	54180	54160

- Cycle 68: Loss of 20 measures (at 20Hz) at end and beginning of tracks on the FDR4ALT “time” array for the following passes:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0151	54180	54160
0176	54200	54180
0187	54180	54160
0203	54180	54160
0226	54180	54160
0365	49980	49960
0383	54180	54160
0397	54180	54160
0411	54180	54160
0430	54180	54160
0433	54180	54160
0440	54180	54160
0521	54200	54180
0548	54200	54180
0622	54180	54160
0626	54180	54160
0720	54180	54160
0742	54180	54160
0720	54180	54160
0742	54180	54160
0763	54180	54160
0874	54180	54160
0896	54180	54160

- All the other cycles are 100% complete.

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ENVISAT year 2008			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
64	83	83	2-19, 25, 122, 138, 142, 143, 149-151, 154, 164, 166, 172-185, 198, 216, 218, 219, 270-275, 296, 349-353, 373, 410, 419, 421, 429, 463, 480, 482, 494, 515, 554, 600, 695, 710, 720-723, 774, 801, 806, 839, 929, 951
65	39	39	31, 35, 65, 96, 135, 138, 173, 203, 253-276, 385, 397, 488, 552, 617, 706, 752
66	20	20	34, 61, 81, 88, 99, 116, 118, 180, 203, 220, 296, 311, 405, 431, 433, 441, 522, 589, 634, 743
67	24	24	1, 17, 23, 118, 119, 125, 150, 178, 221, 150, 178, 221, 297, 316, 402, 411, 416, 485, 523, 597, 636, 637, 727, 754, 862, 898, 975
68	24	24	10, 151, 176, 187, 203, 211, 226, 365, 383, 397, 411, 430, 433, 440, 521, 548, 622, 626, 720, 742, 763, 874, 896, 944
69	20	20	17, 25, 71, 94, 105, 133, 373, 436, 471, 502, 522, 615, 754, 813, 816, 857, 874, 879, 952, 954
70	11	11	76, 88, 90, 172, 178, 419, 721, 733, 740, 832, 974
71	5	5	753, 829, 866, 874, 955
72	13	13	84, 86, 87, 88, 89, 90, 204, 260, 563, 736, 806, 892, 913
73	12	12	40, 183, 232, 353, 416, 427, 745, 751, 756, 778, 797, 98
74	23	23	54, 256, 264, 287, 316, 343, 353, 372-383, 516, 599, 709, 738
75	9	9	82, 232, 262, 299, 314, 334, 425, 747, 994

Table 2-8 : List of missing tracks for year 2008

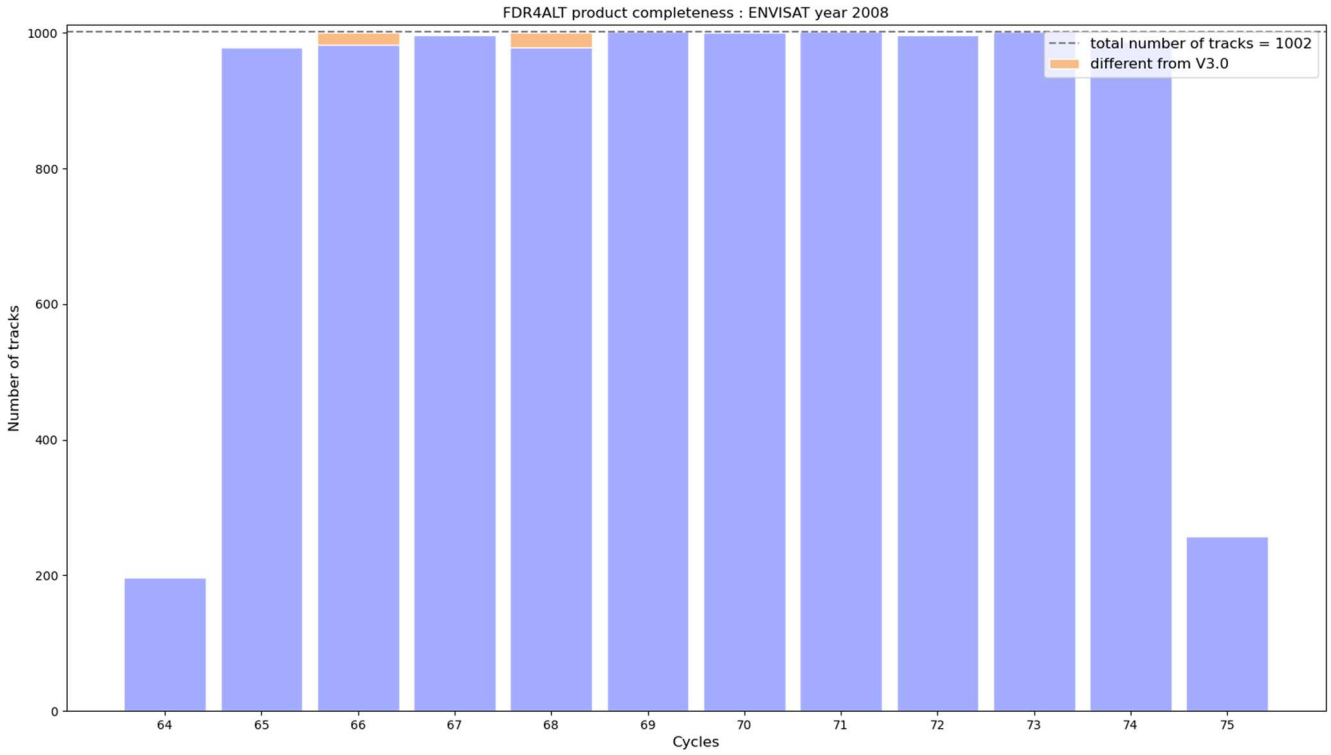

Figure 2-74 : Cyclic monitoring of the number of tracks completeness of year 2008.

2.2.7.2 Cycle by cycle

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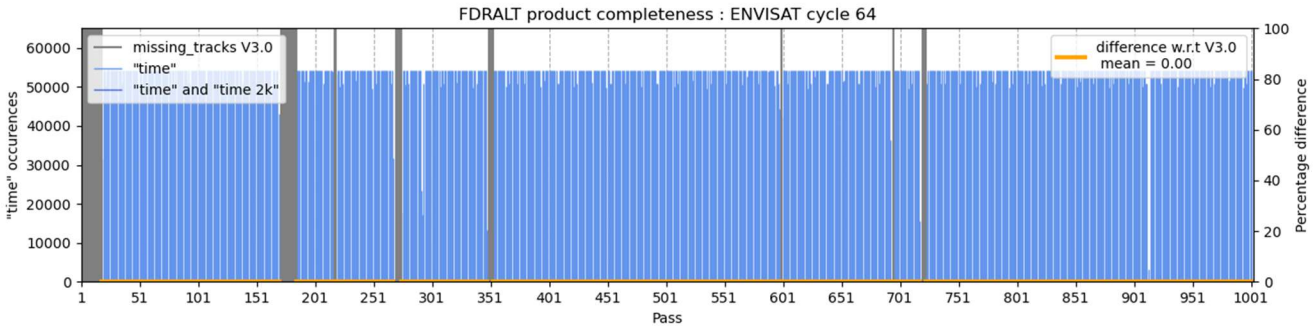

Figure 2-75 : Cycle 64

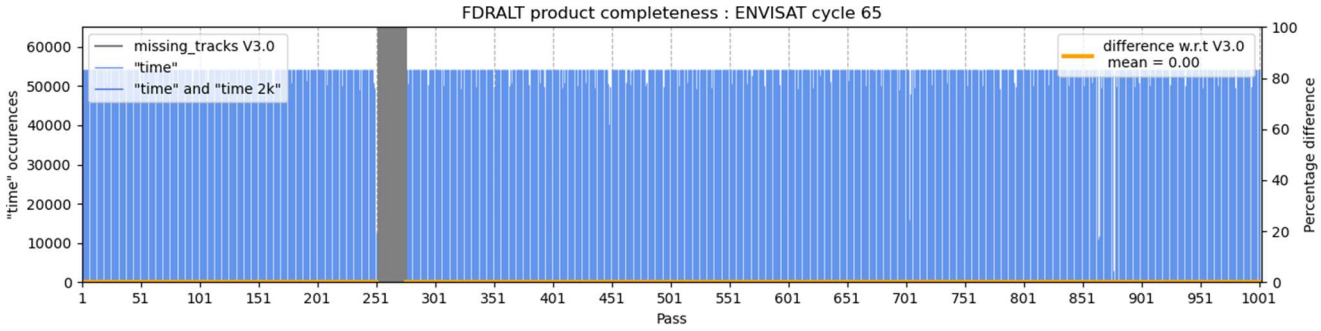

Figure 2-76 : Cycle 65

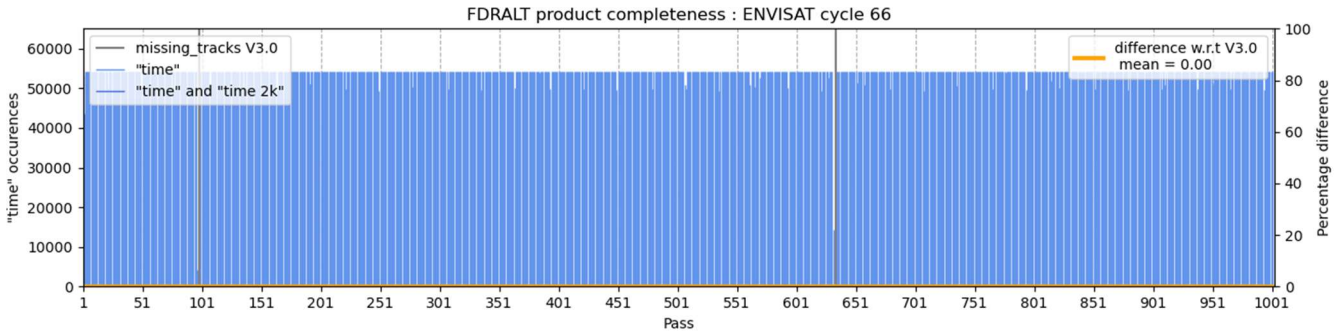

Figure 2-77 : Cycle 66

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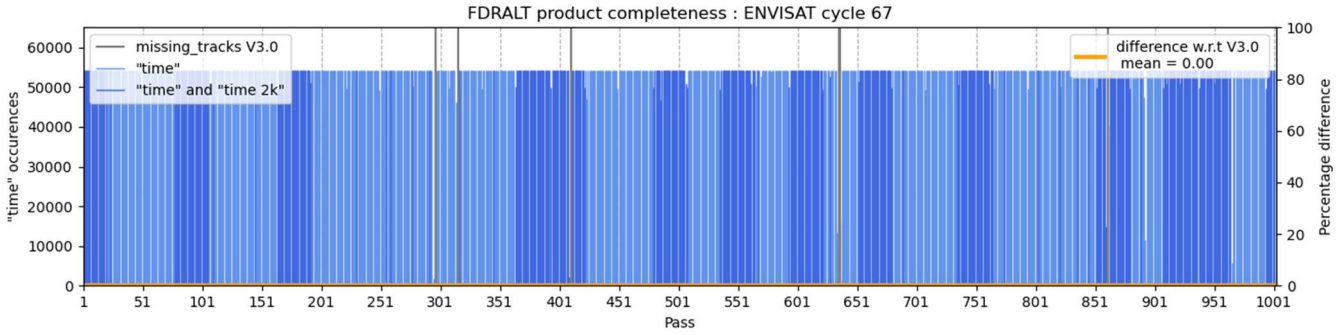

Figure 2-78 : Cycle 67

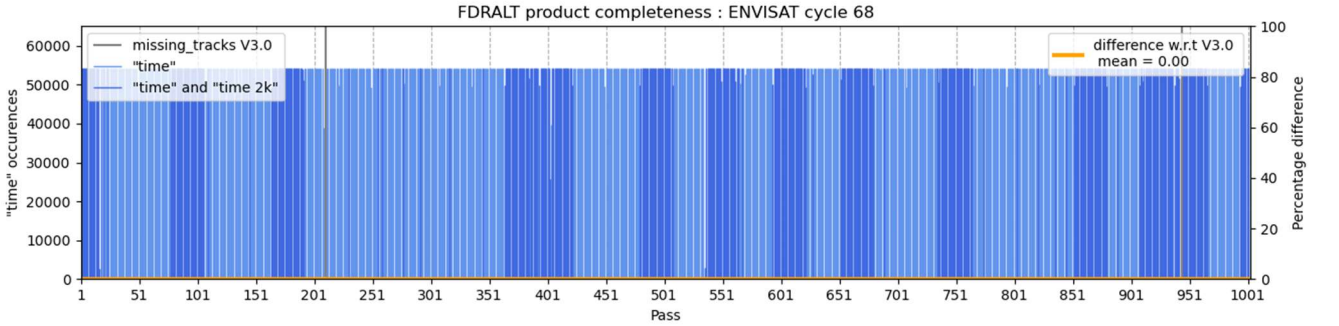

Figure 2-79 : Cycle 68

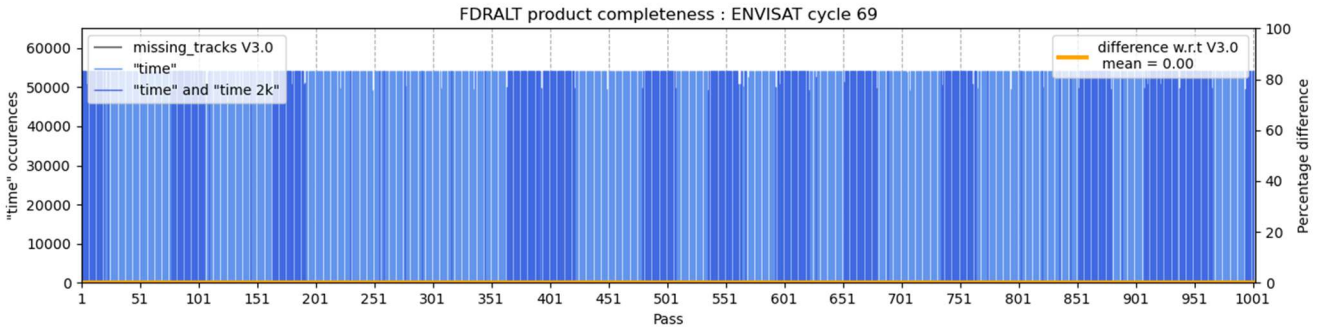

Figure 2-80 : Cycle 69

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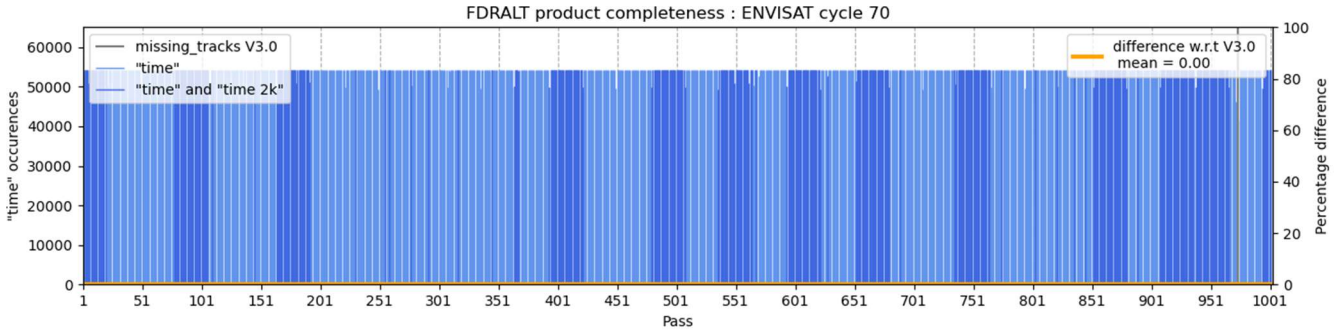

Figure 2-81 : Cycle 70

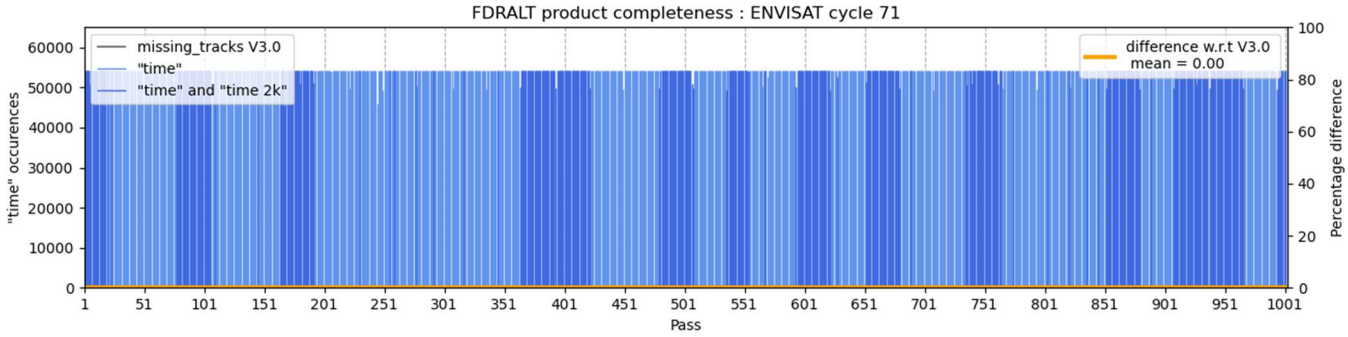

Figure 2-82 : Cycle 71

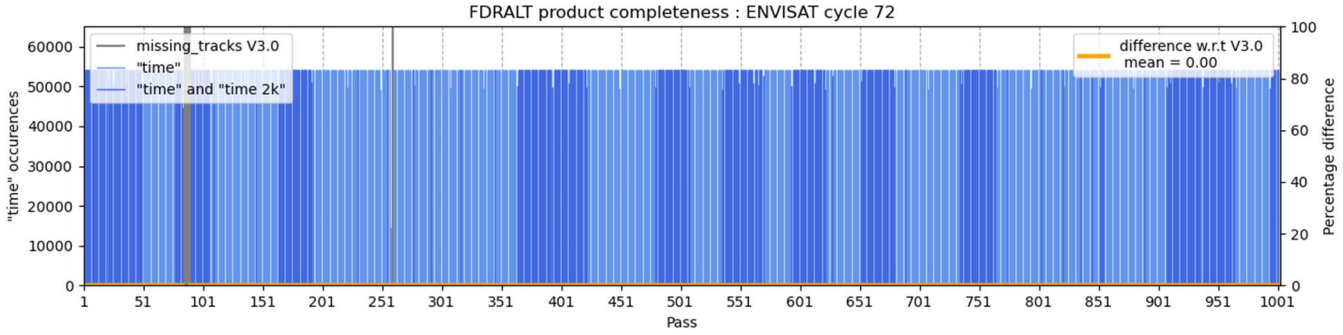

Figure 2-83 : Cycle 72

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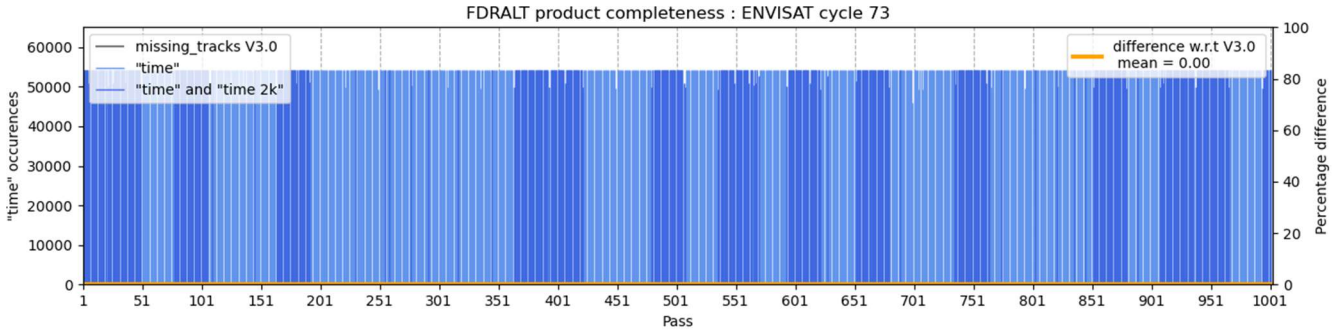

Figure 2-84 : Cycle 73

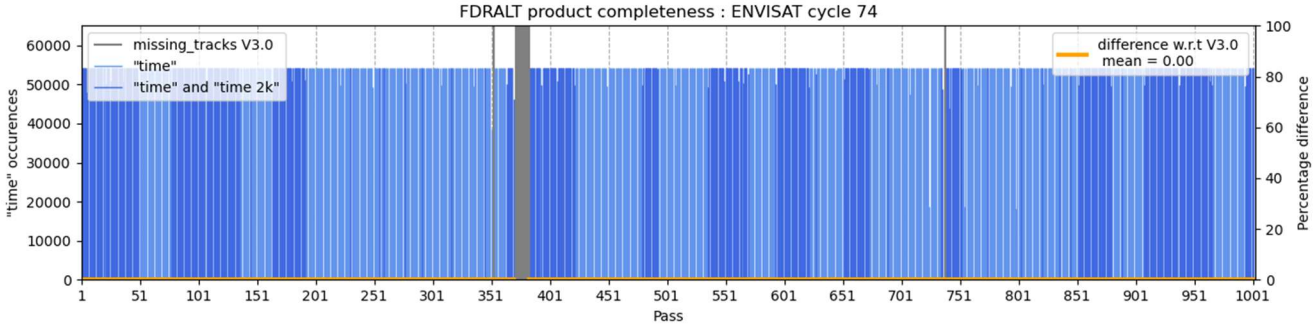

Figure 2-85 : Cycle 74

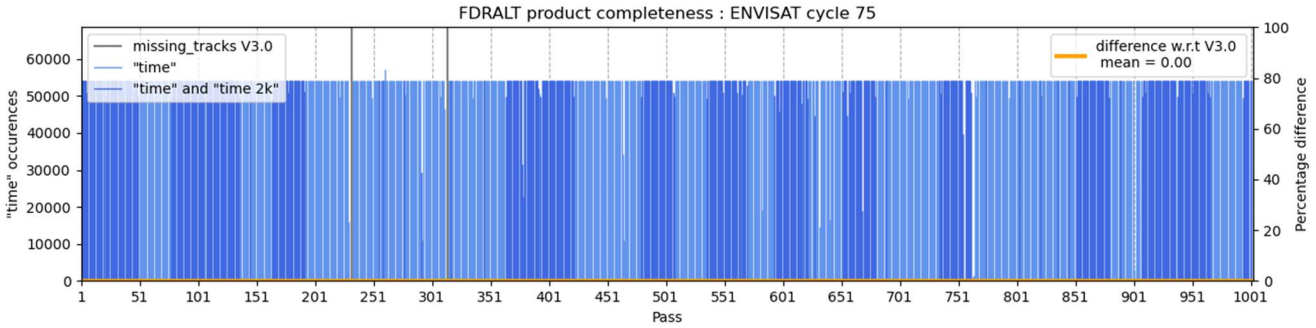

Figure 2-86 : Cycle 75

2.2.8 2009

2.2.8.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2009 and presented in the table and figure below.

In summary:

- Cycle 77: Loss of 20 measures (at 20Hz) at end and beginning of tracks on the FDR4ALT “time” array for the following passes:

Pass (N°)	V3.0 (nb. Meas.)	FDR4ALT (nb. meas.)
0121	54180	54160

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0163	54180	54160
0208	54180	54160
0228	54180	54160
0283	54180	54160

ENVISAT year 2009			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
75	9	9	82, 232, 262, 299, 314, 334, 425, 747, 994
76	15	15	11, 12, 22, 38, 63, 100, 106, 193, 346-348, 351-353, 512
77	7	7	121, 163, 208, 228, 283, 383, 486
78	31	31	621-646, 791, 999-1002
79	25	25	1-15, 23, 27, 73, 141, 147, 153, 161, 193, 231, 239
80	2	2	153, 200
81	8	8	80-85, 864, 983
82	5	5	125, 175, 286, 631, 632
83	14	14	37, 419, 830-841
84	24	24	20, 41, 56, 86, 146, 149, 179, 180, 181, 399, 402, 658-669, 813
85	21	21	15, 67, 101, 196, 652, 676-690, 970

Table 2-9 : List of missing tracks for year 2009

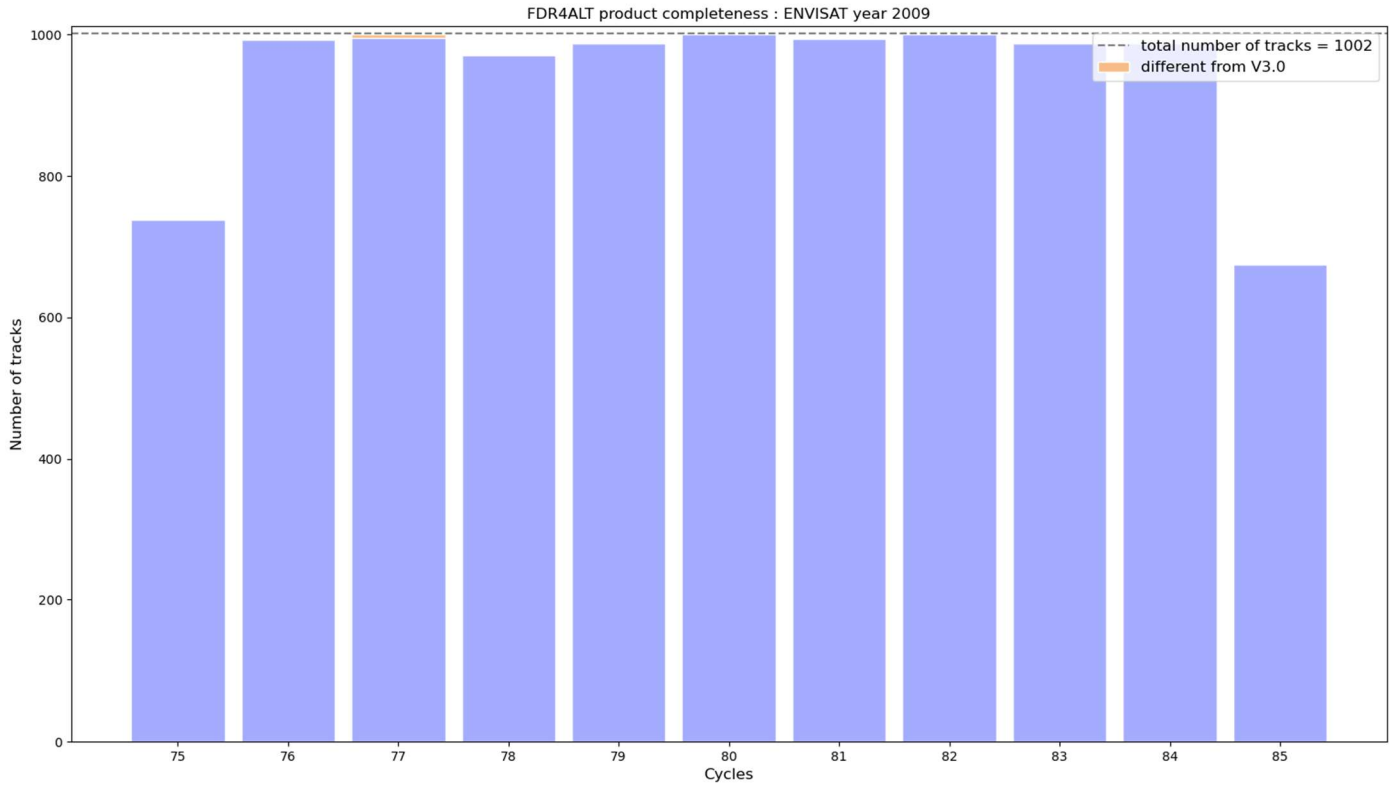

Figure 2-87 : Cyclic monitoring of the number of tracks completeness of year 2009.

2.2.8.2 Cycle by cycle

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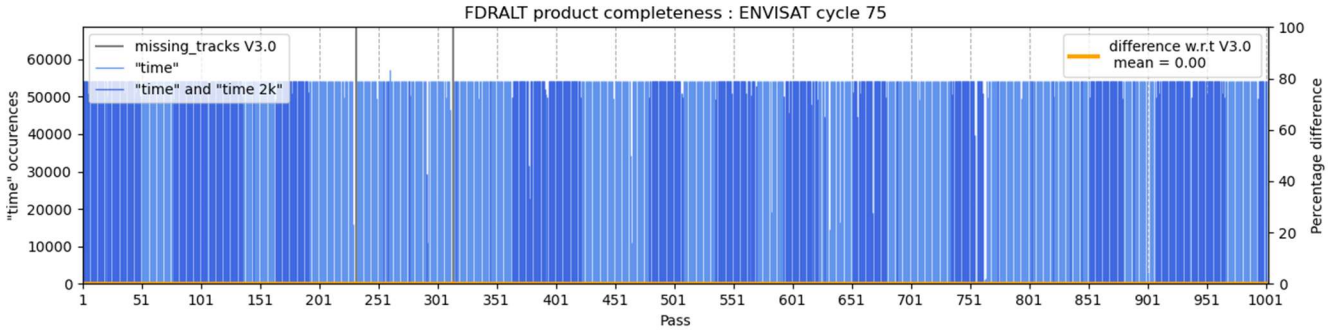

Figure 2-88 : Cycle 75

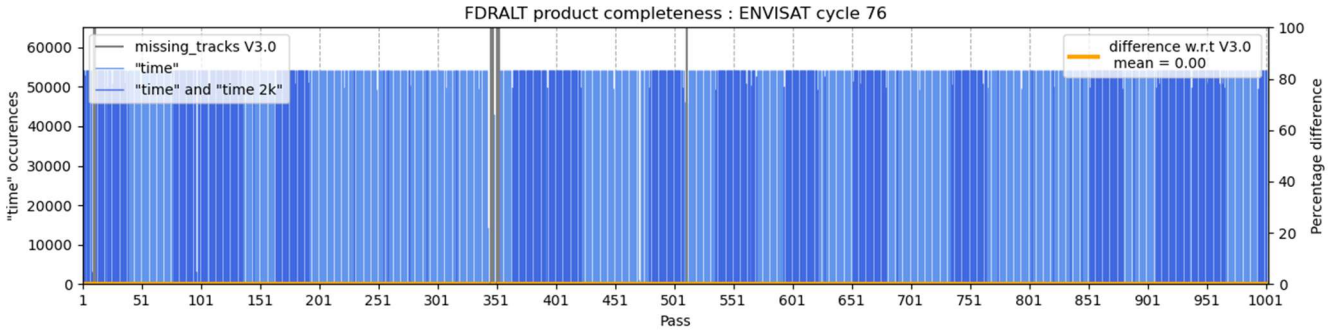

Figure 2-89 : Cycle 76

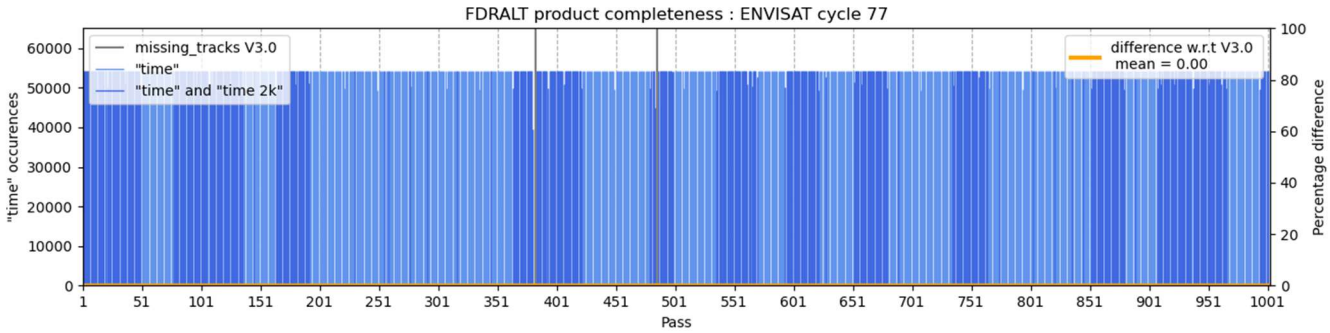

Figure 2-90 : Cycle 77

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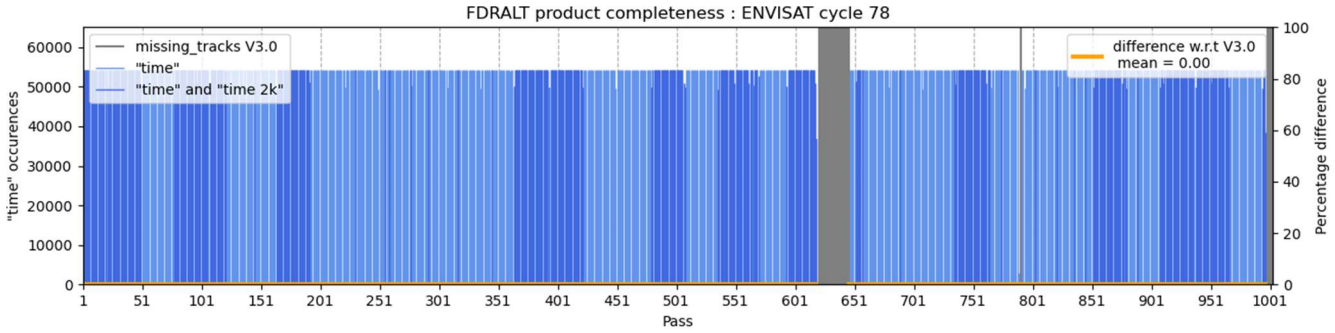

Figure 2-91 : Cycle 78

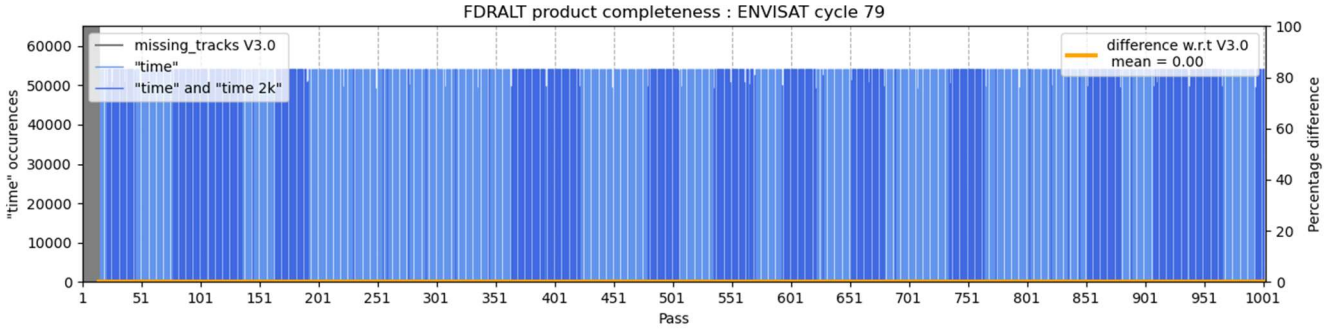

Figure 2-92 : Cycle 79

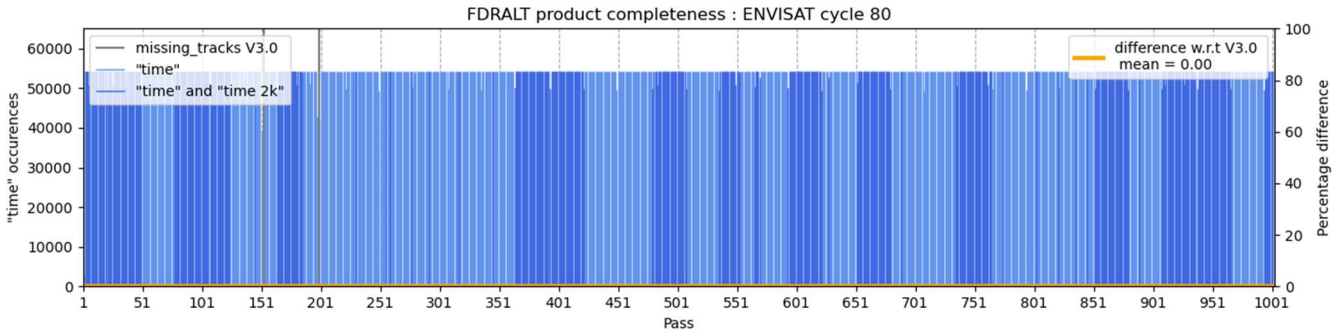

Figure 2-93 : Cycle 80

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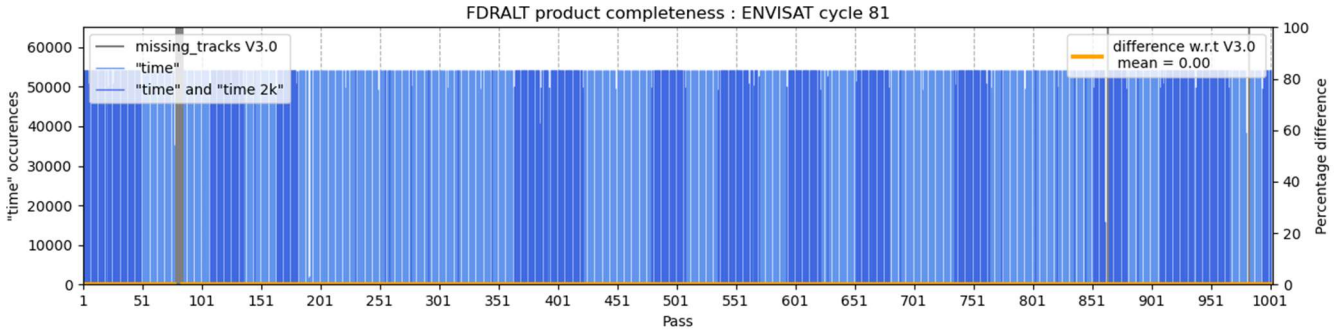

Figure 2-94 : Cycle 81

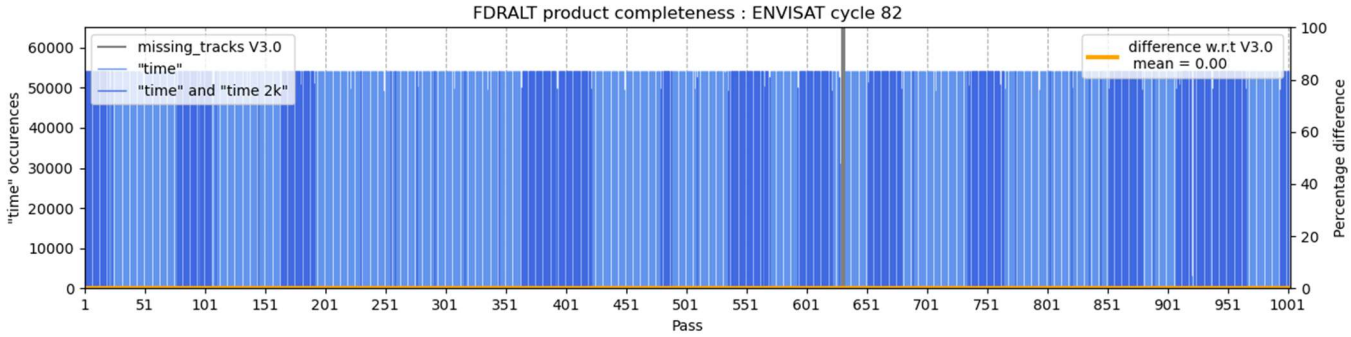

Figure 2-95 : Cycle 82

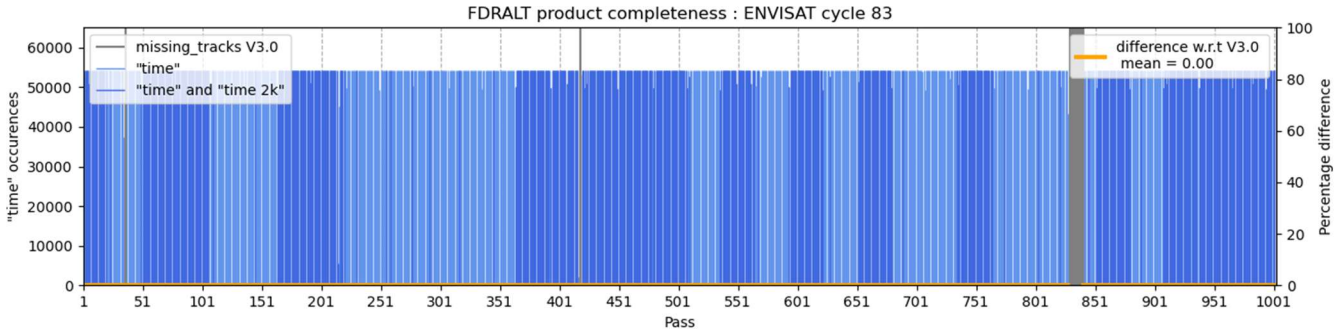

Figure 2-96 : Cycle 83

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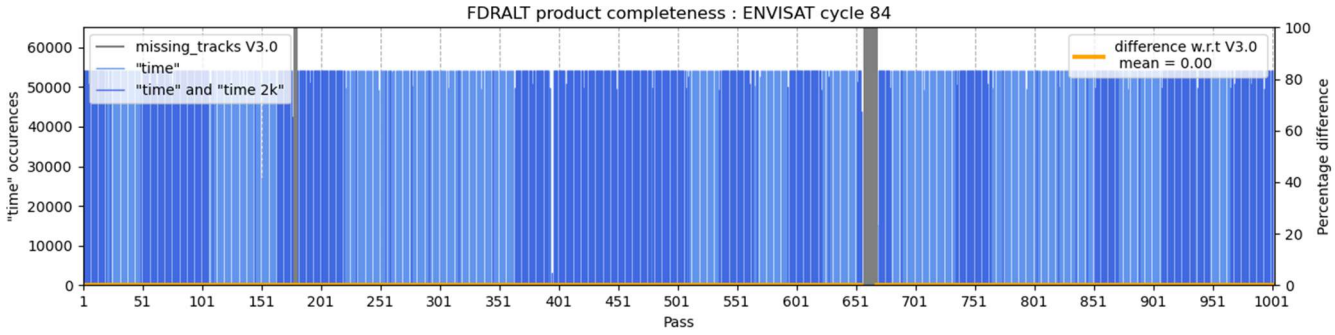

Figure 2-97 : Cycle 84

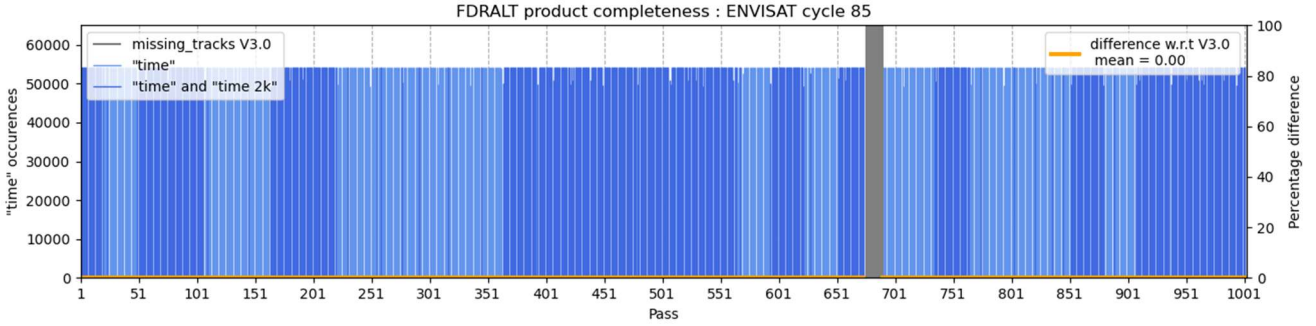

Figure 2-98 : Cycle 85

2.2.9 2010

2.2.9.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2010 and presented in the table and figure below.

In summary:

- All cycles are 100% complete.
- Start of ENVISAT Phase 3 after orbit change on 24/10/2010 7:05, as mentioned in Table 2-1 and illustrated in Figure 2-99 (cycle 95). For more information about the mission, please refer to [D-5-03].

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ENVISAT year 2010			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
85	21	21	15, 67, 101, 196, 652, 676-690, 970
86	15	15	608-611, 716, 746-755
87	3	3	125, 150, 438
88	11	11	141, 550-555, 744, 870, 896, 979
89	5	5	43, 50, 371, 626, 960
90	2	2	475, 675
91	1	1	99
92	0	0	
93	0	0	
94	897	897	62-67, 86-88, 104-107, 114-127, 132-144, 146-1002
95	816	816	1-816
96	1	1	862
97	3	3	92, 93, 174
98	4	4	488, 489, 490, 518

Table 2-10 : List of missing tracks for year 2010

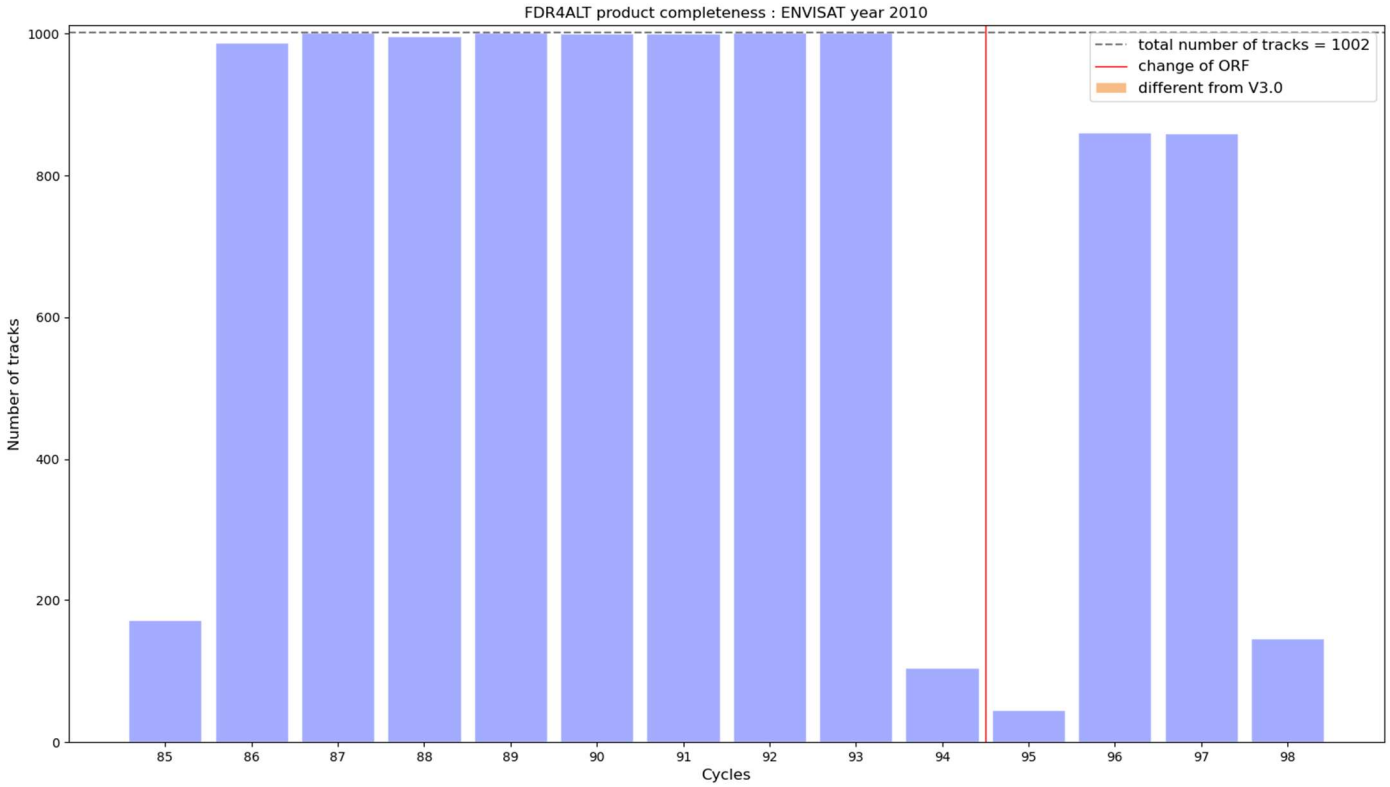

Figure 2-99 : Cyclic monitoring of the number of tracks completeness of year 2010.

2.2.9.2 Cycle by cycle

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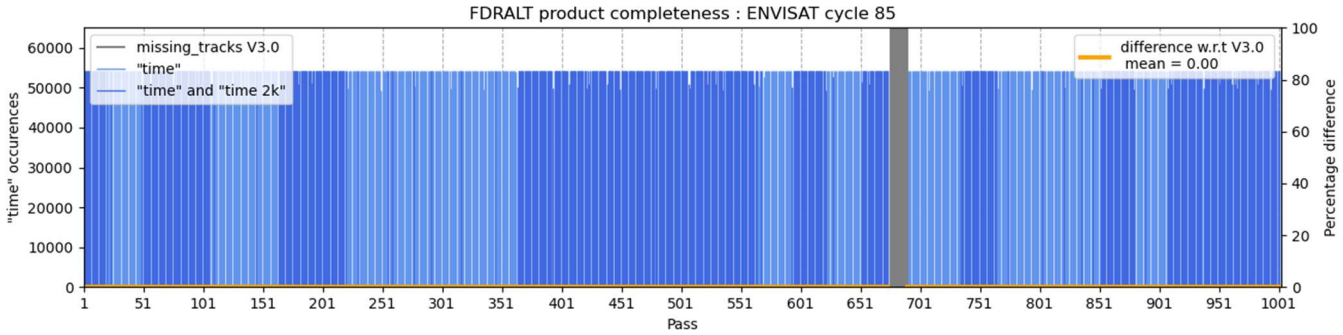

Figure 2-100 : Cycle 85

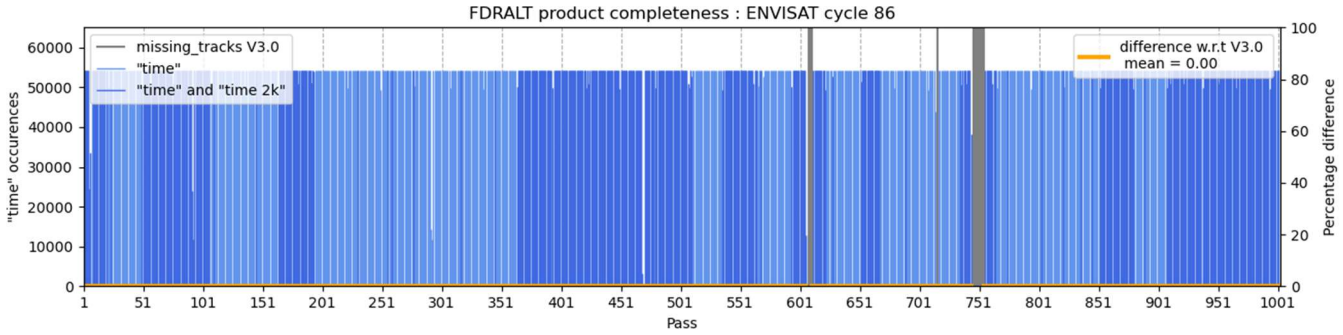

Figure 2-101 : Cycle 86

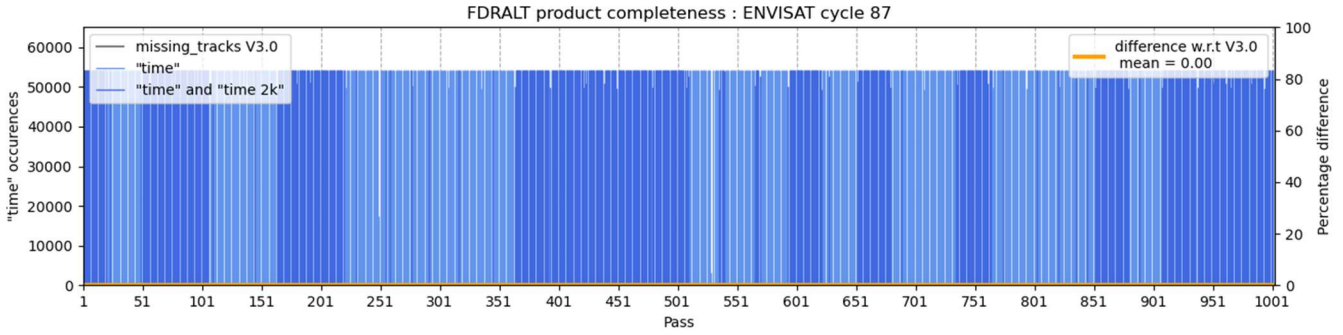

Figure 2-102 : Cycle 87

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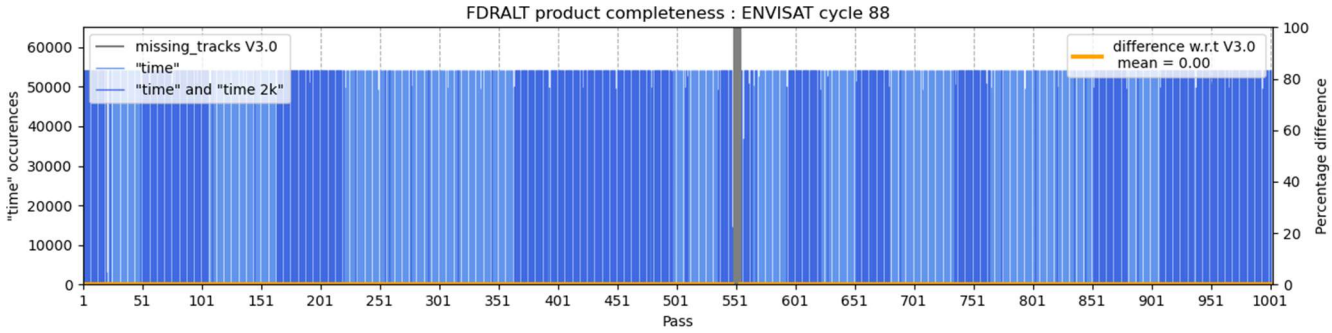

Figure 2-103 : Cycle 88

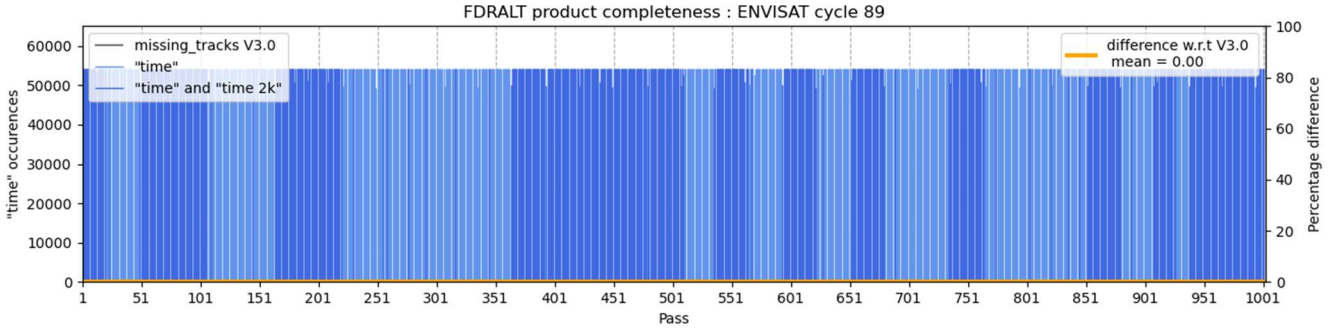

Figure 2-104 : Cycle 89

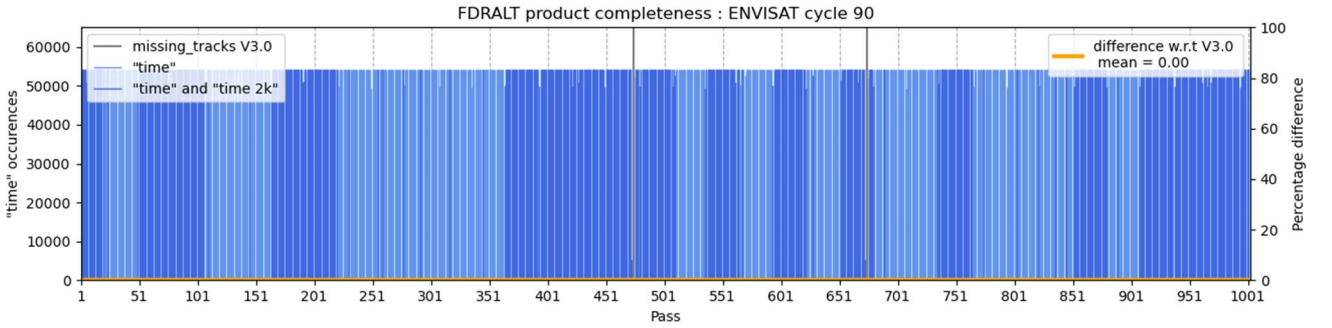

Figure 2-105 : Cycle 90

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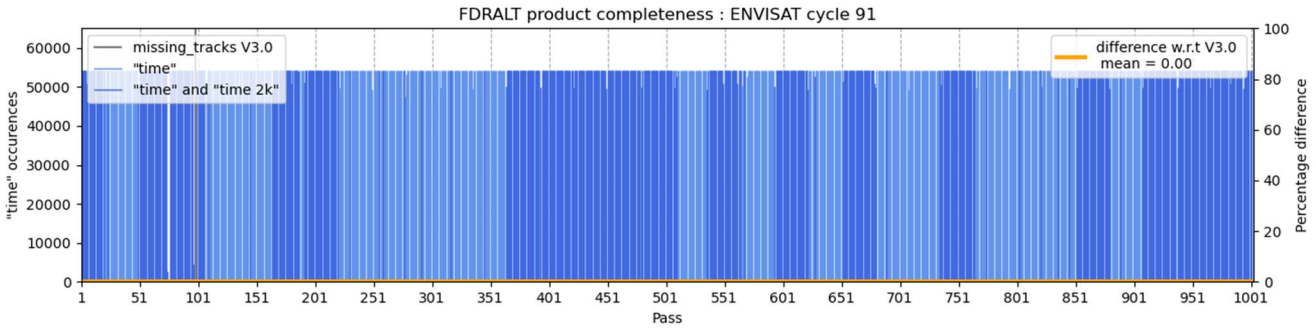

Figure 2-106 : Cycle 91

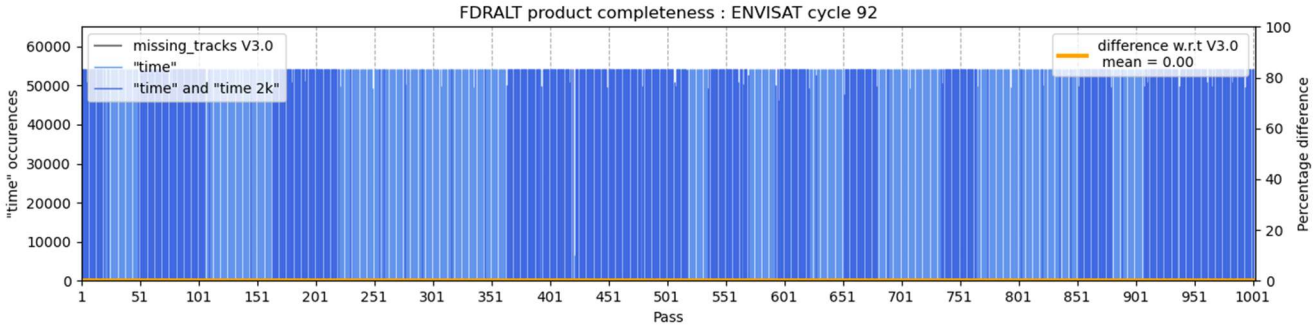

Figure 2-107 : Cycle 92

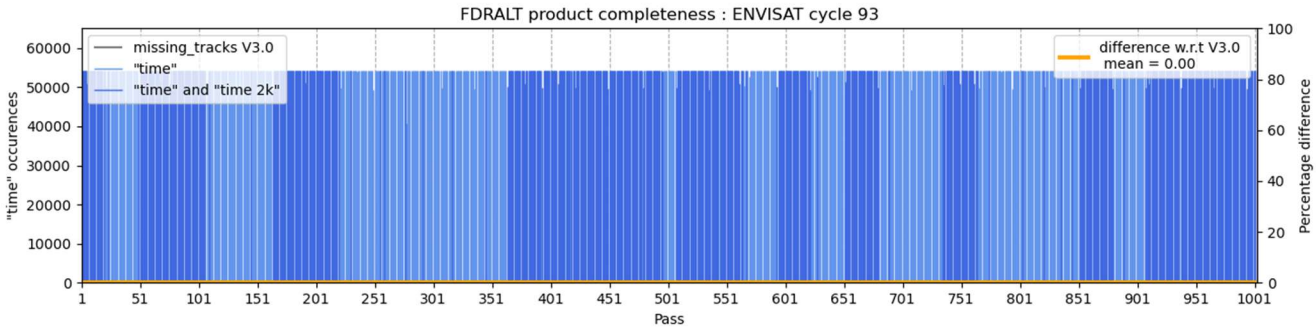

Figure 2-108 : Cycle 93

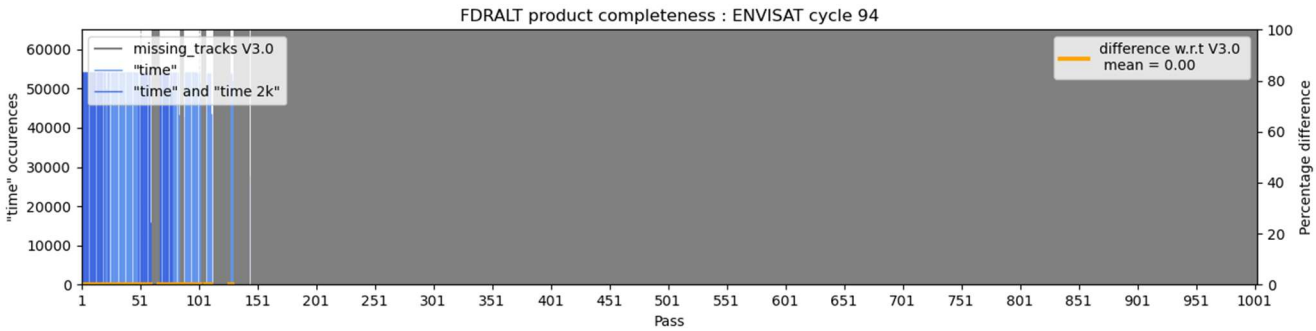

Figure 2-109 : Cycle 94

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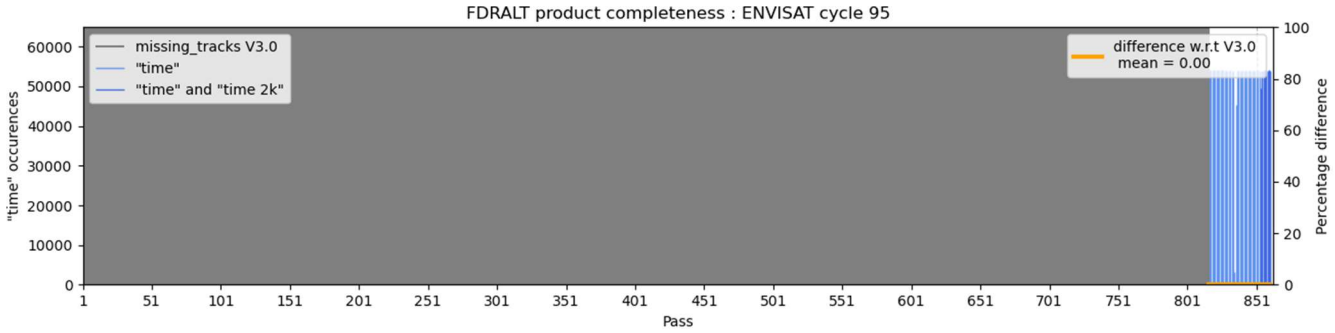

Figure 2-110 : Cycle 95

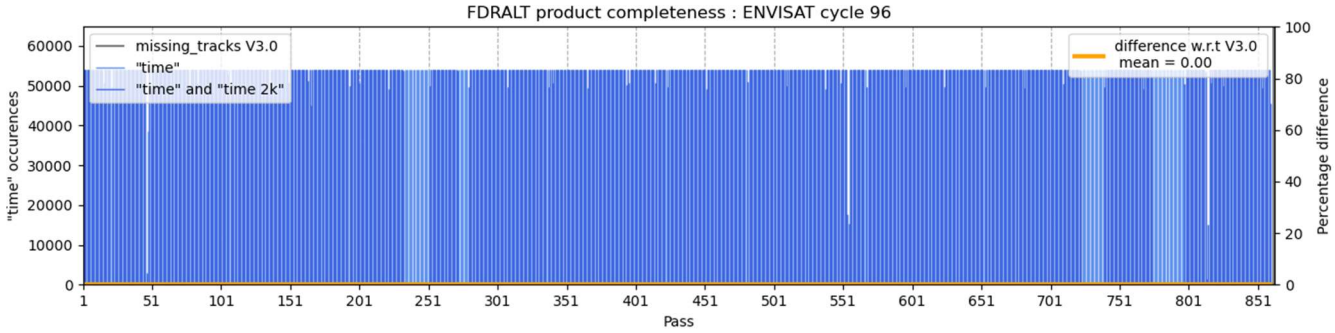

Figure 2-111 : Cycle 96

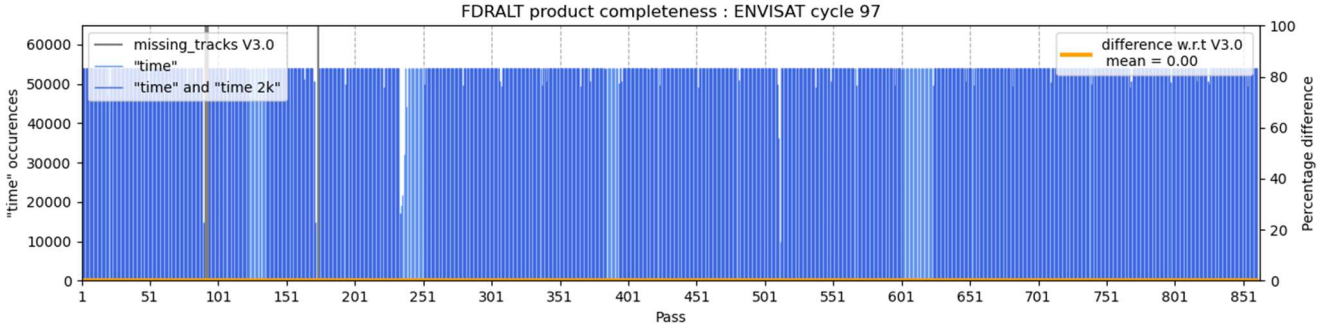

Figure 2-112 : Cycle 97

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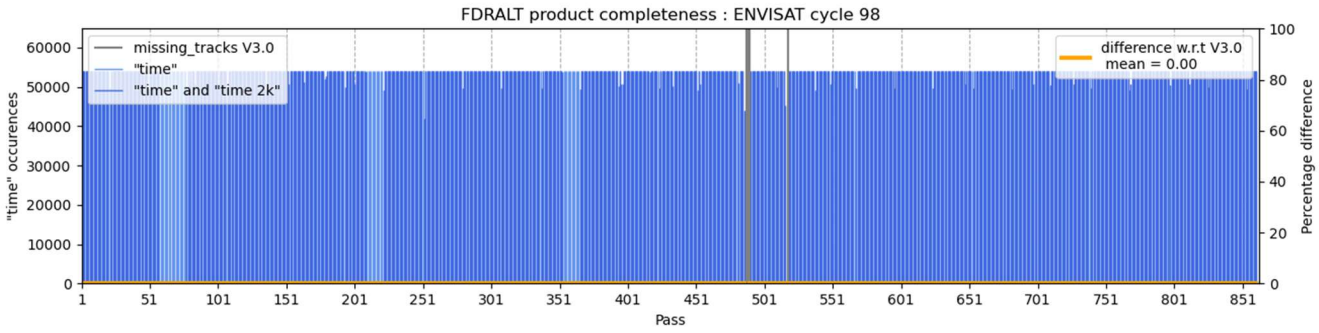

Figure 2-113 : Cycle 98

2.2.10 2011

2.2.10.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2011 and presented in the table and figure below.

In summary:

- All cycles are 100% complete.

ENVISAT year 2011			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
98	4	4	488, 489, 490, 518
99	17	17	634, 750-757, 771-775, 813-815
100	5	5	726-729, 810
101	45	45	4, 43, 86-88, 148-159, 224-251
102	10	10	37-43, 804-806
103	10	10	211, 230-234, 239, 381-383
104	0	0	
105	0	0	
106	13	13	791-794, 819, 821, 845-847, 854, 856, 858, 860
107	6	6	65-68, 591, 821
108	0	0	
109	0	0	
110	6	6	11-15, 154

Table 2-11 : List of missing tracks for year 2011

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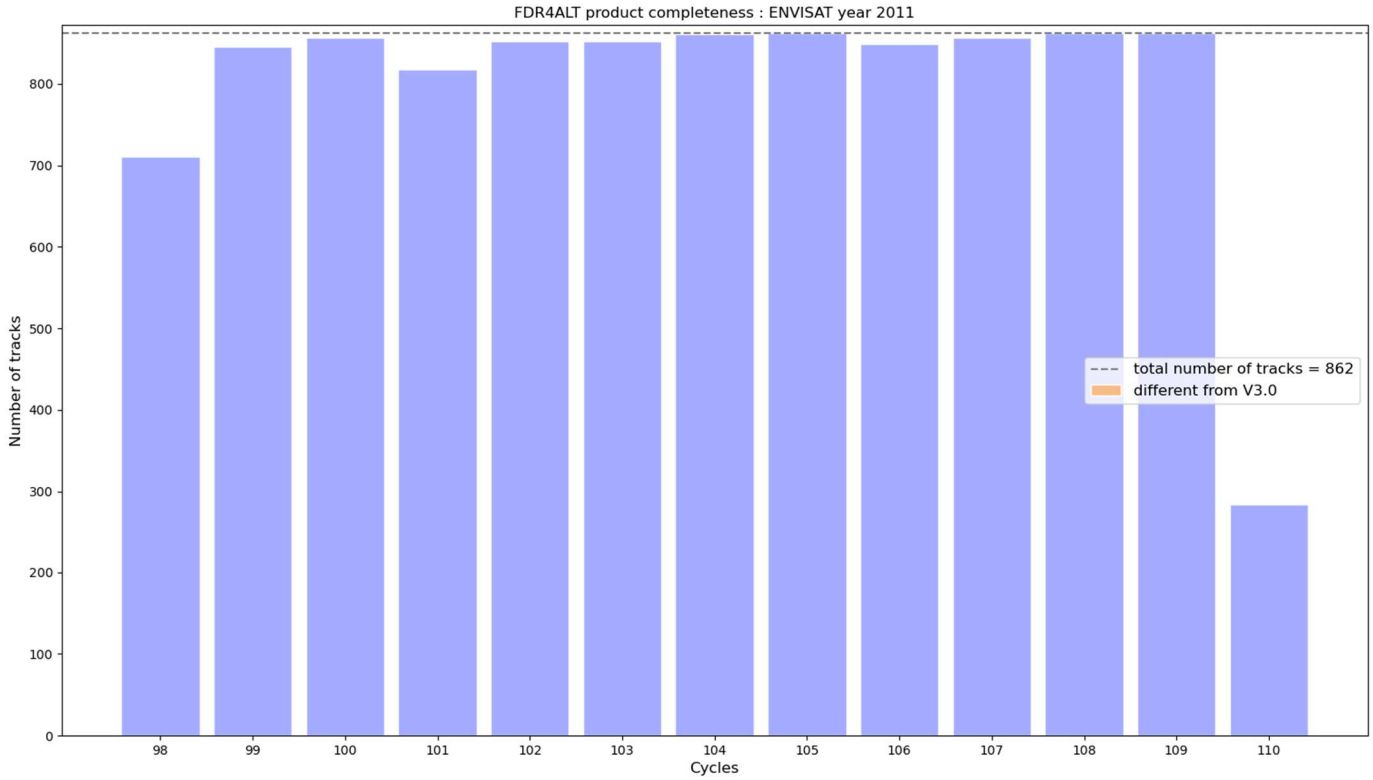

Figure 2-114 : Cyclic monitoring of the number of tracks completeness of year 2011.

2.2.10.2 Cycle by cycle

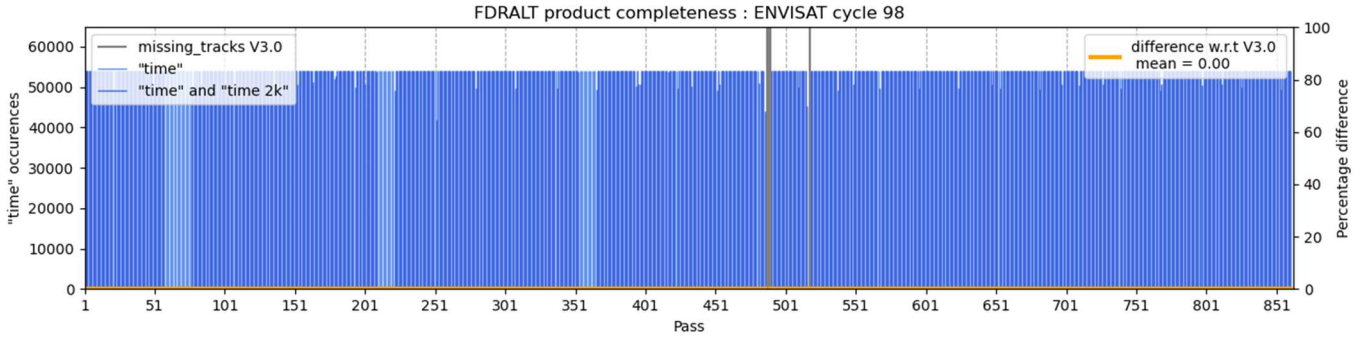

Figure 2-115 : Cycle 98

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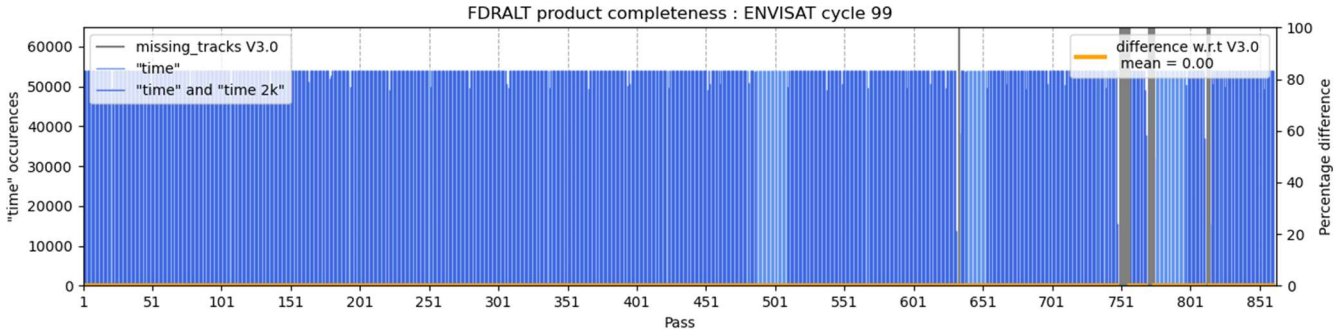

Figure 2-116 : Cycle 99

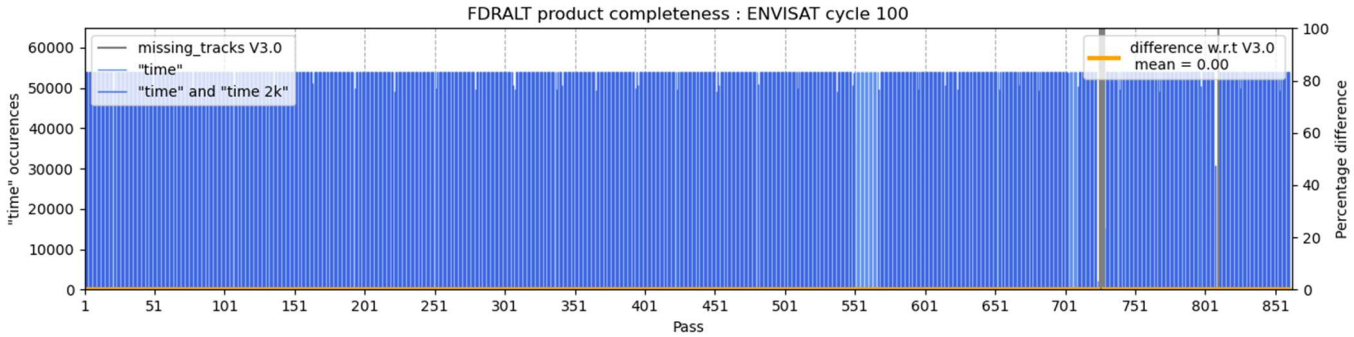

Figure 2-117 : Cycle 100

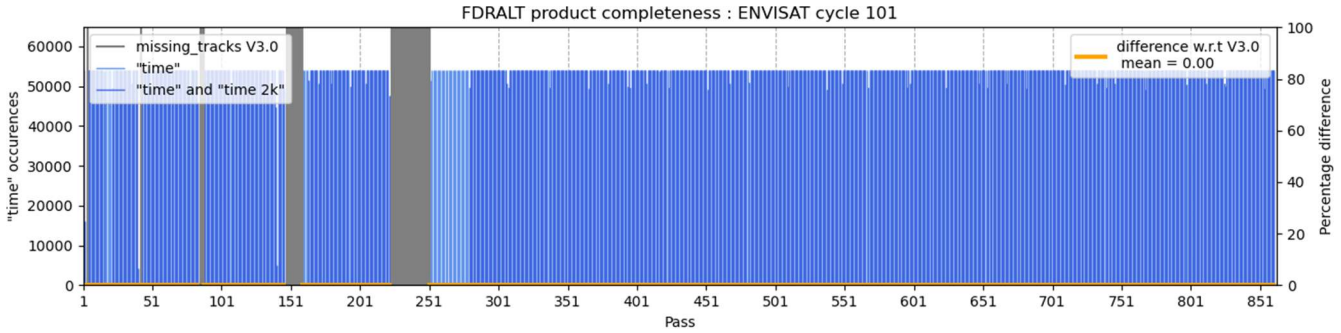

Figure 2-118 : Cycle 101

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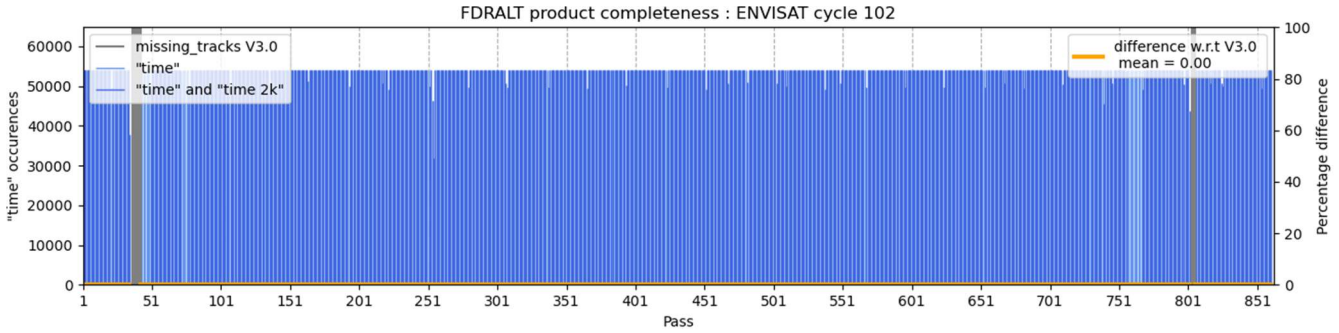

Figure 2-119 : Cycle 102

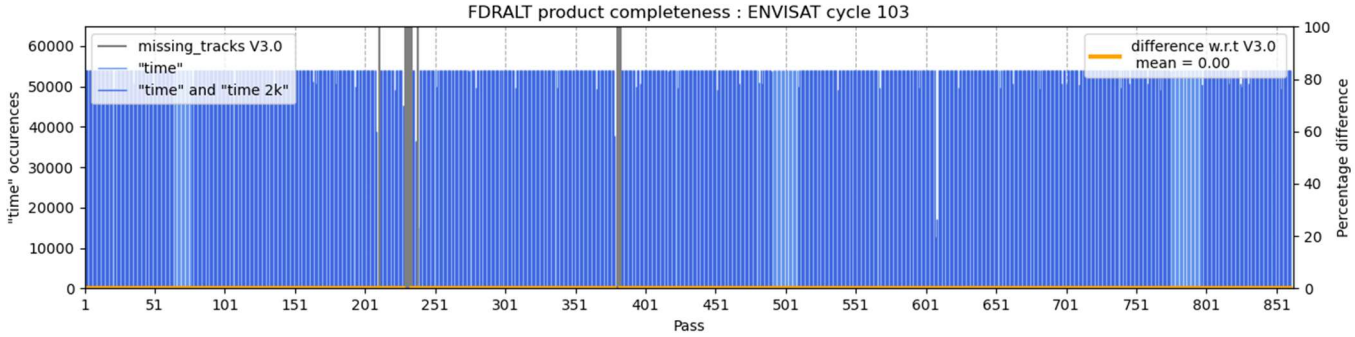

Figure 2-120 : Cycle 103

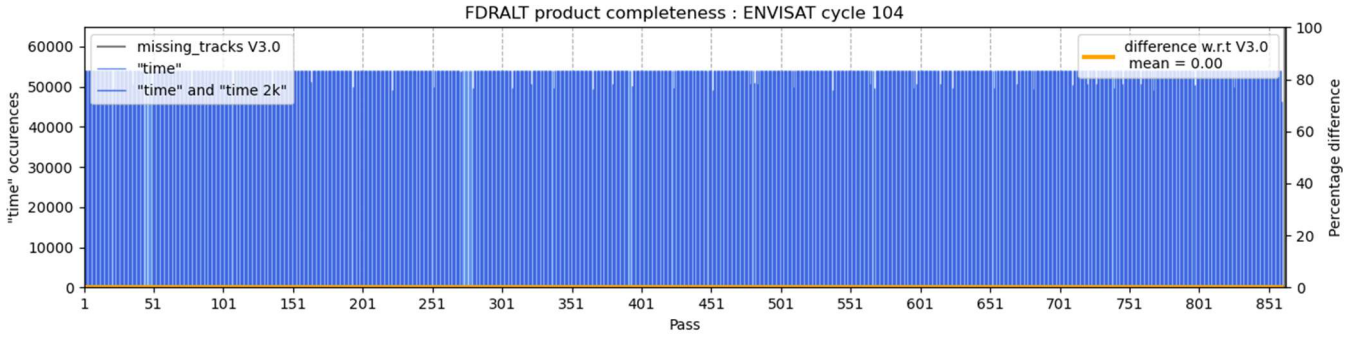

Figure 2-121 : Cycle 104

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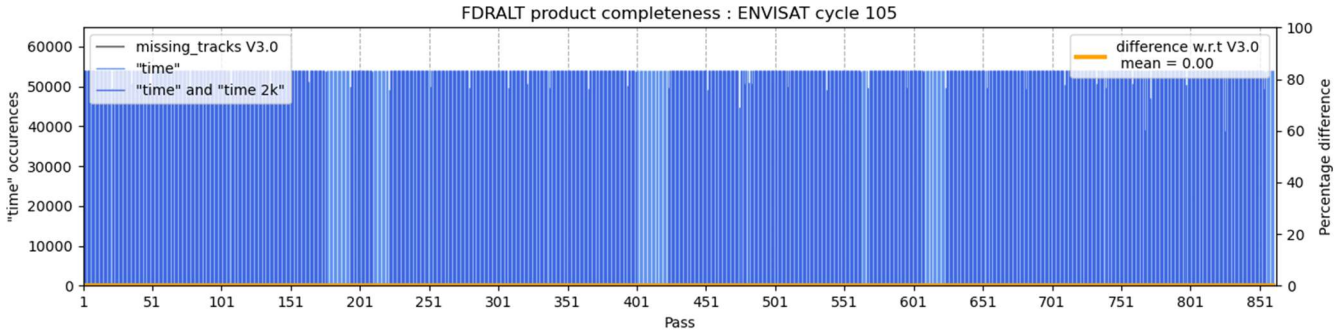

Figure 2-122 : Cycle 105

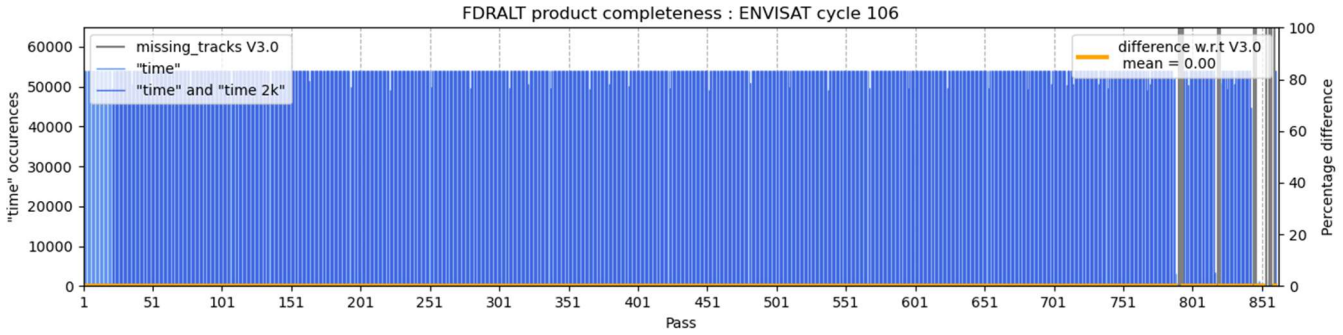

Figure 2-123 : Cycle 106

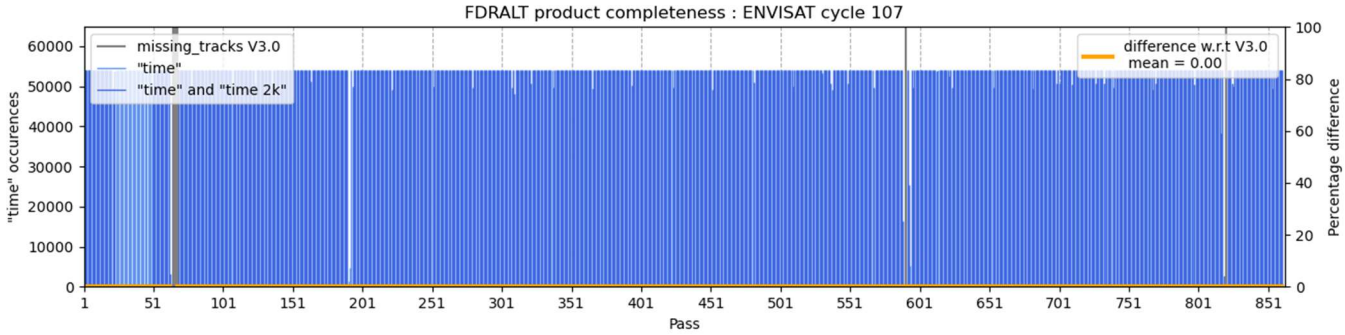

Figure 2-124 : Cycle 107

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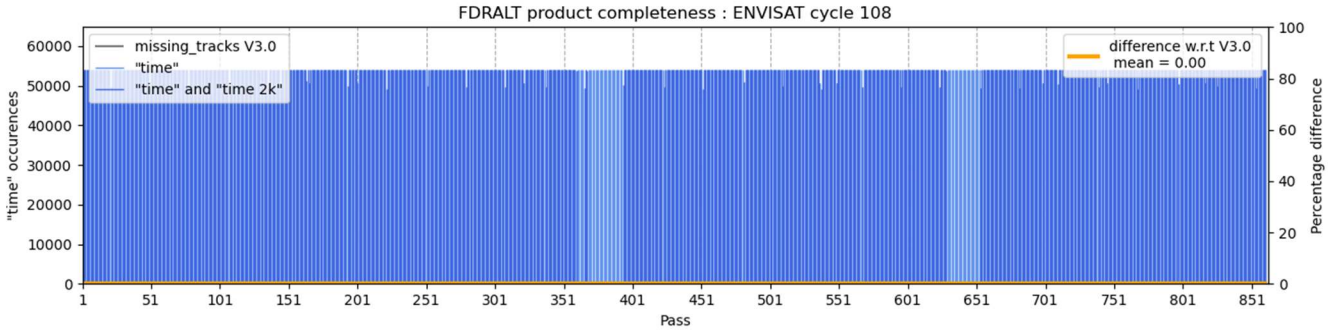

Figure 2-125 : Cycle 108

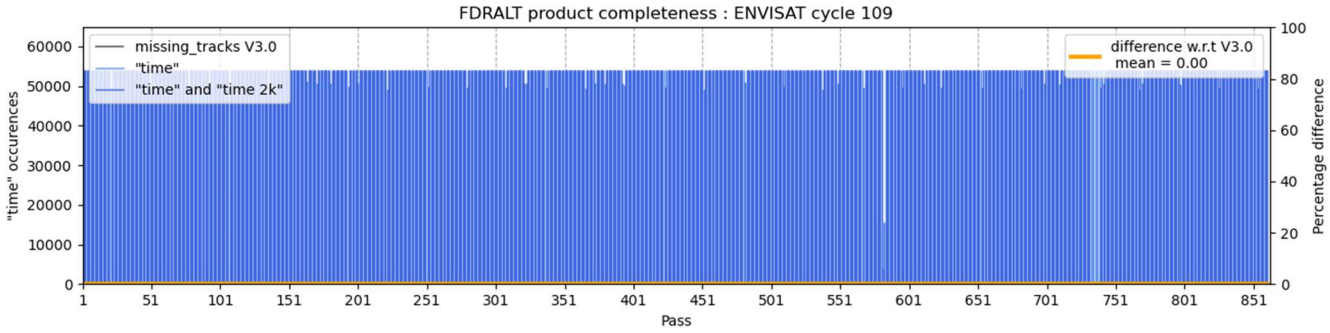

Figure 2-126 : Cycle 109

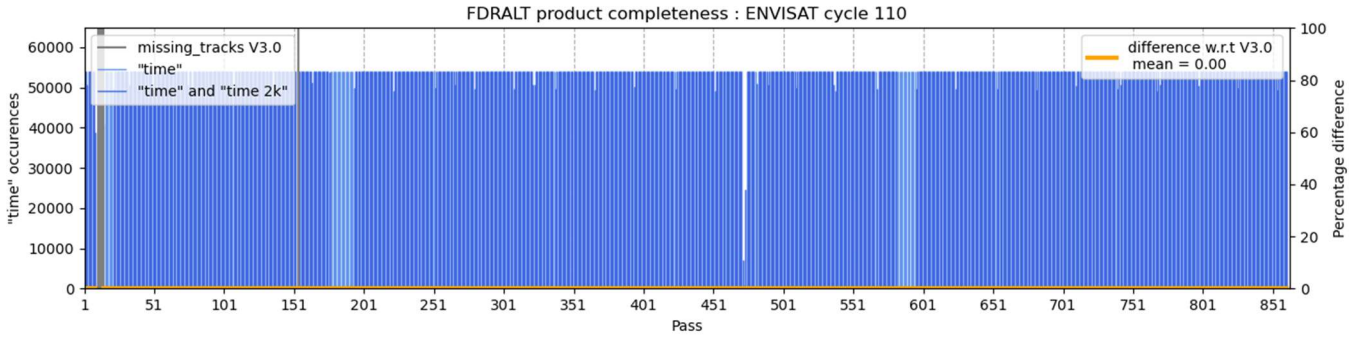

Figure 2-127 : Cycle 110

2.2.11 2012

2.2.11.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2012 and presented in the table and figure below.

In summary:

- All cycles are 100% complete.
- End of the mission occurred during cycle 113.

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ENVISAT year 2012			
Cycles	Number of missing tracks (V3.0)	Number of missing tracks (FDR4ALT)	Missing tracks
110	6	6	11-15, 154
111	15	15	70-79, 380, 381, 411-413
112	1	1	400
113	328	328	535, 862

Table 2-12 : List of missing tracks for year 2012

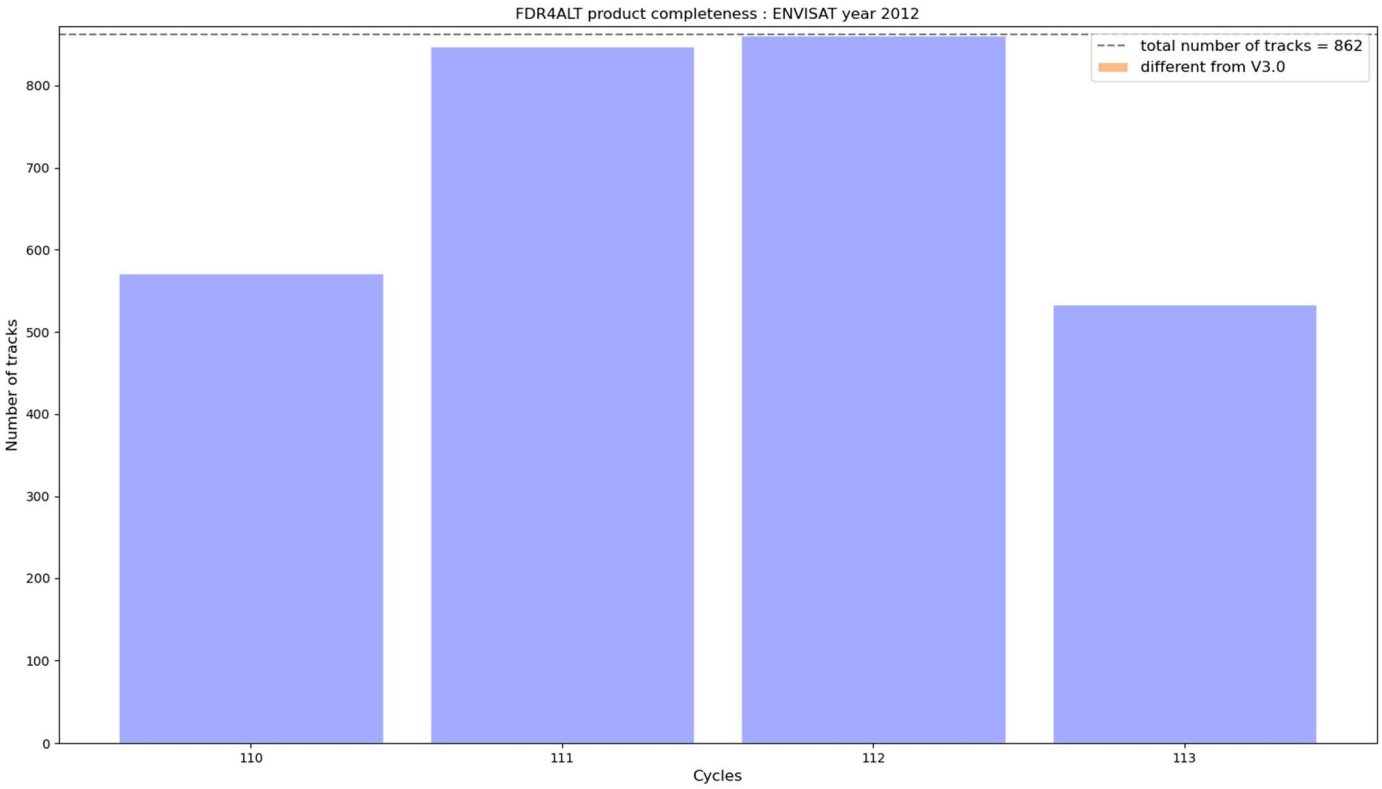

Figure 2-128 : Cyclic monitoring of the number of tracks completeness of year 2012.

2.2.11.2 Cycle by cycle

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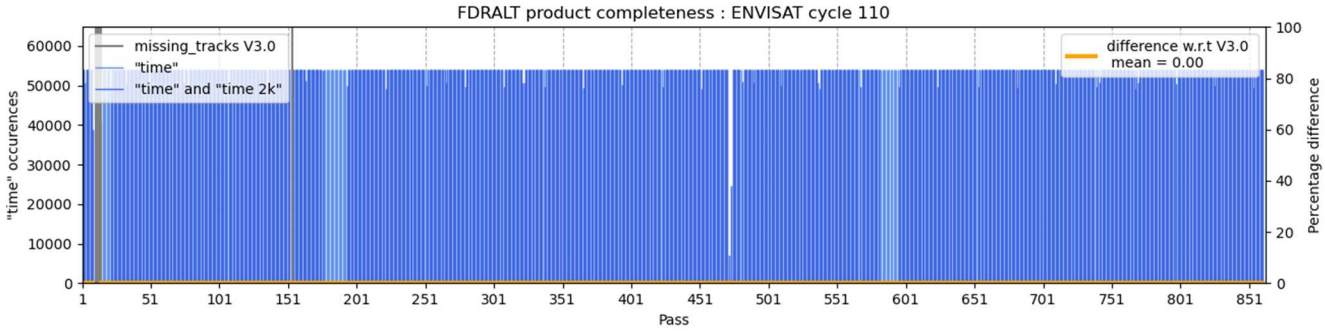

Figure 2-129 : Cycle 110

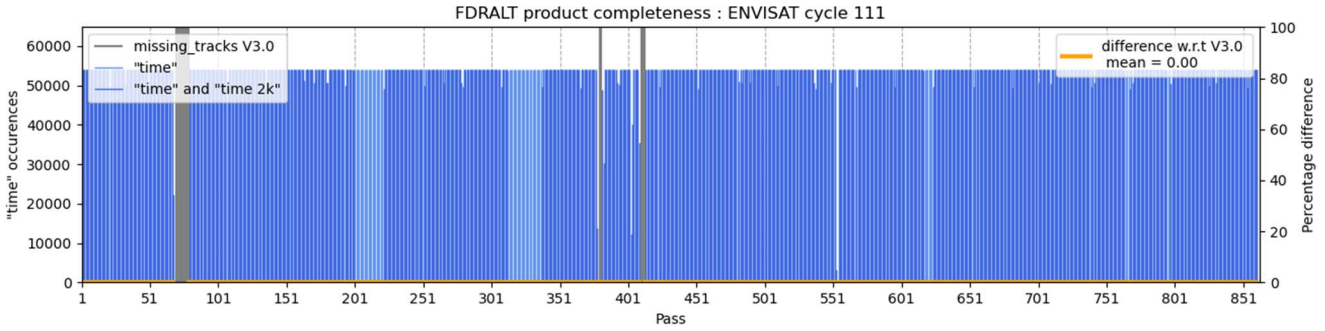

Figure 2-130 : Cycle 111

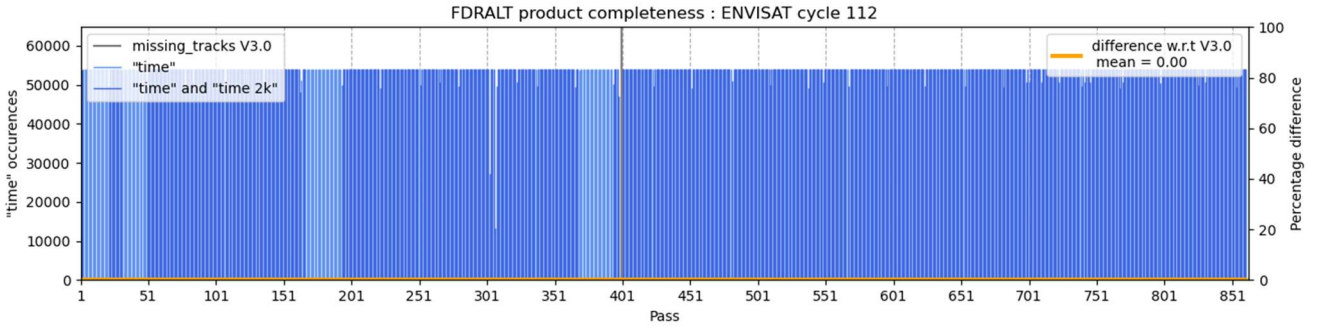

Figure 2-131 : Cycle 112

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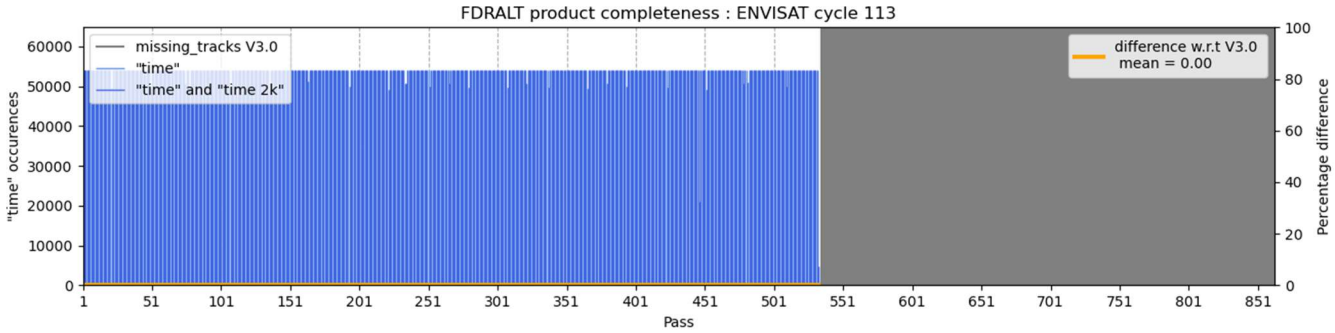

Figure 2-132 : Cycle 113

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2.3 ERS-1

For ERS-1, it is more difficult to assess the completeness of the dataset for two main reasons:

- The ALT FDR corrected the so-called “time jumps” issues of the REAPER dataset. Therefore, the number of time occurrences between FDR4ALT and REAPER is different. Figure 2-133 shows the percentage of time occurrences edited per cycle for the ERS-1 mission. More information about the time jump correction performed in the frame of the FDR4ALT project can be found in the Detailed Processing Model Document [D-2-01] and the Product Validation Report Document [D-4-02]

- The REAPER Level-2 products are sliced per orbit and not per pass (half-orbit). The Table 2-13 illustrates the different mission phases that defined different repeat orbit cycle. For more information, please refer to [D-5-03].

- For the ESA cycle report on the performance of RA altimeter during nominal operations, please see: https://earth.esa.int/eogateway/instruments/ra-ers/quality-control-reports

Name	Start	End	Repeat cycle
Launch	17-Jul-91	-	-
Commissioning Phase, or Phase "A"	25-Jul-91	10-Dec-91	3 days
Roll Tilt Mode validation	12-Dec-91	13-Dec-91	35 days
Ice Phase or Phase "B":	28-Dec-91	01-Apr-92	3 days
Roll Tilt Mode Campaign or Phase “R	4-Apr-92	14-Apr-92	35 days
Multidisciplinary Phase, or Phase "C"	14-Apr-92	21-Dec-93	35 days
Second Ice Phase, or Phase "D"	23-Dec-93	10-Apr-94	3 days
Geodetic Phase, or Phase "E"	10-Apr-94	28-Sep-94	168 days
Geodetic Phase, or Phase "F"	28-Sep-94	21-Mar-95	168 days
Phase G 2nd Multidisciplinary	21-Mar-95	17-Aug-95	35 days
Phase G Tandem	17-Aug-95	2-Jun-96	35 days
Phase G Back-Up	2-Jun-96	10-Mar-00	35 days
End of mission	10-Mar-00	-	-

Table 2-13 : ERS-1 mission phases.

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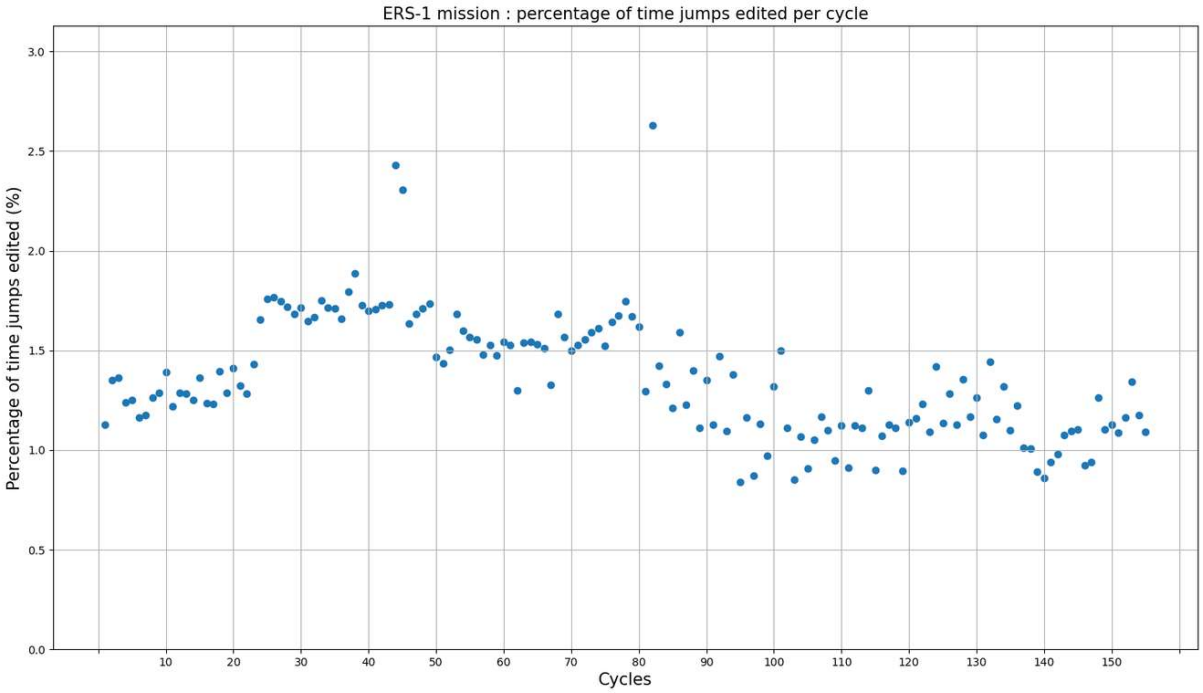

Figure 2-133 : Percentage of time occurrences edited per cycle

Therefore, the completeness analysis consisted in monitoring both the product file size (ESA reference dataset from last reprocessing) and the time occurrence in the CLS core database. This allows to check consistency between the two datasets in addition to the monitoring and analysis of FDR4ALT production tools.

2.3.1 1991

2.3.1.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1991 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.

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ERS-1 year 1991			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
2	23	23	34-56
3	1	1	36
5	0	0	
6	0	0	
7	2	2	8, 66
8	3	3	8, 13, 32
9	0	0	
10	0	0	
11	2	2	10, 11
12	0	0	
13	2	2	38, 66
14	3	3	2, 36, 45
15	7	7	10, 3, 73-77
16	5	5	10-13, 66
17	13	13	24-32, 52-55
18	0	0	
19	1	1	8
20	0	0	
21	2	2	36, 66
22	2	2	57, 58
23	0	0	
24	0	0	
25	0	0	
26	1	1	34
27	0	0	
28	1	1	58
29	0	0	36
30	3	3	
31	0	0	62-64
32	1	1	
33	7	7	36
34	0	0	2, 39-43, 80
35	1	1	
36	20	20	36
37	0	0	4-6, 10-25, 86
38	0	0	
39	0	0	
40	0	0	
41	1	1	36
42	0	0	
43	0	0	
44	1	1	4
45	13	13	2, 22-25, 45, 60-66
46	6	6	2, 22-25, 60
47	2	2	2, 6
48	3	3	2, 59, 60
49	3	3	2, 59, 60
50	4	4	2, 30, 59, 60
51	2	2	2, 30
52	1	1	62

Figure 2-134 : List of missing tracks for year 1991

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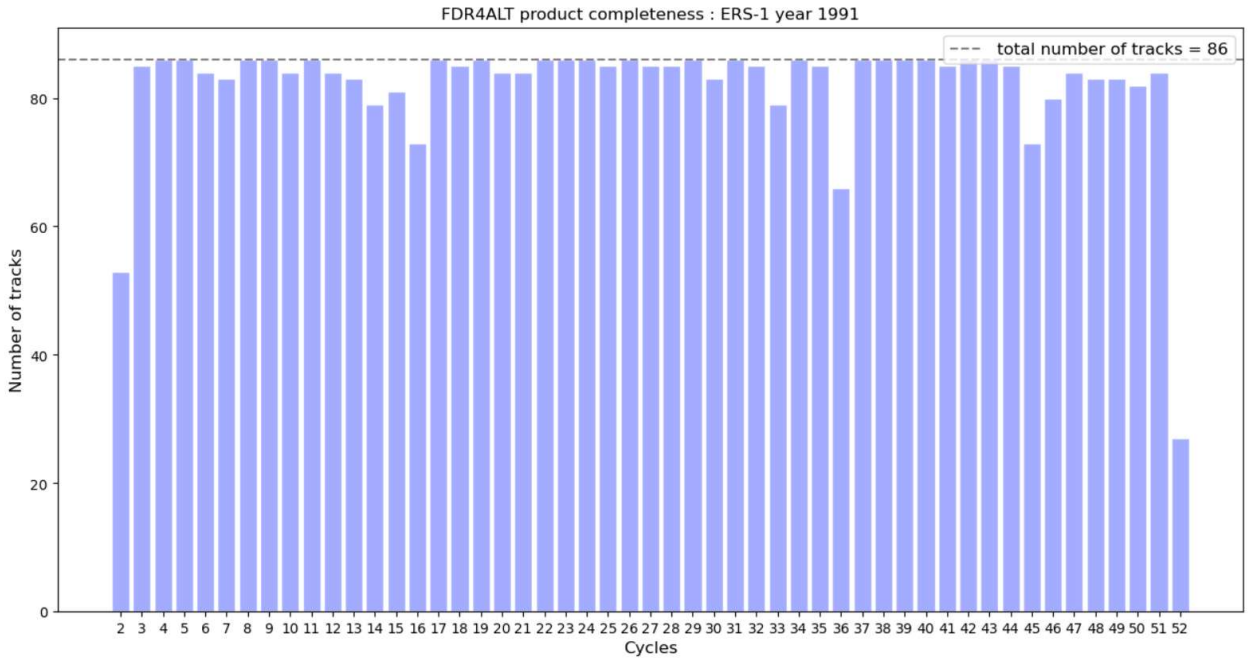

Figure 2-135 : Cyclic monitoring of the number of tracks completeness of year 1991

2.3.1.2 Cycle by cycle

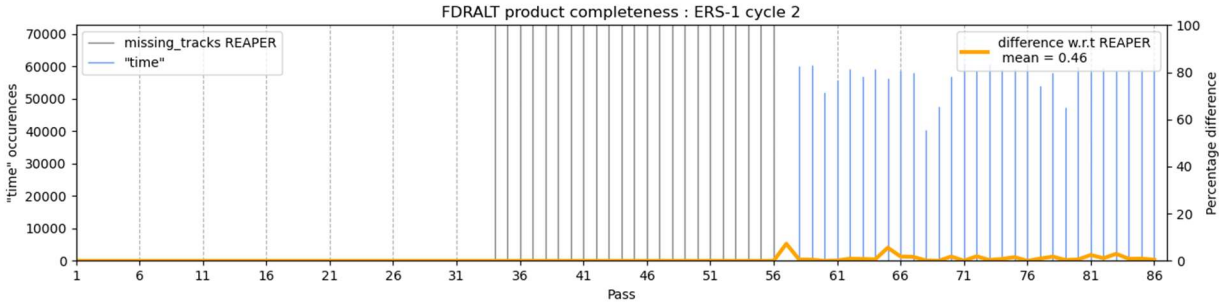

Figure 2-136 : Cycle 2

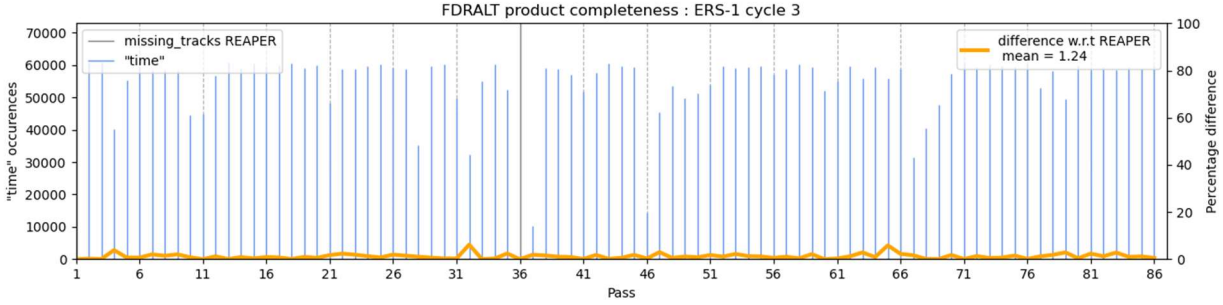

Figure 2-137 : Cycle 3

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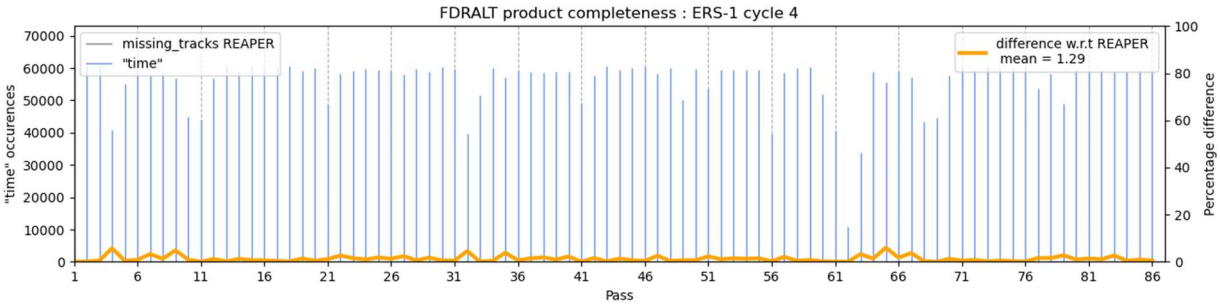

Figure 2-138 : Cycle 4

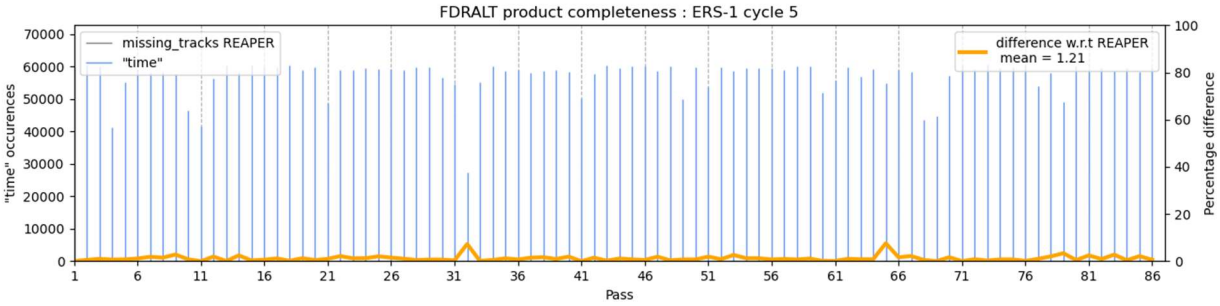

Figure 2-139 : Cycle 5

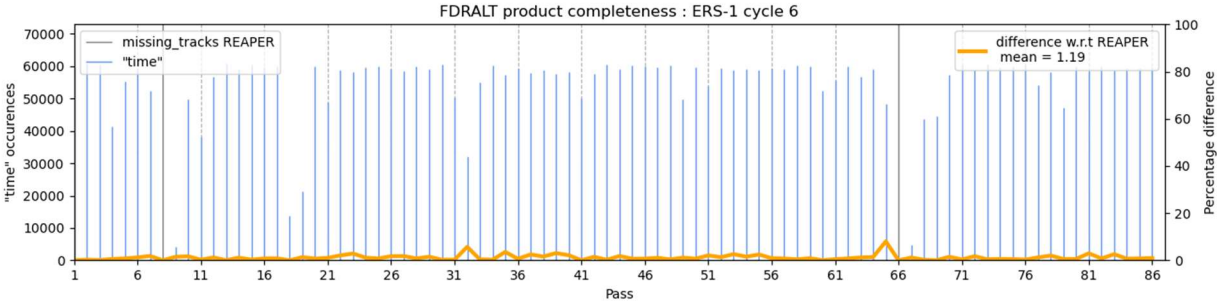

Figure 2-140 : Cycle 6

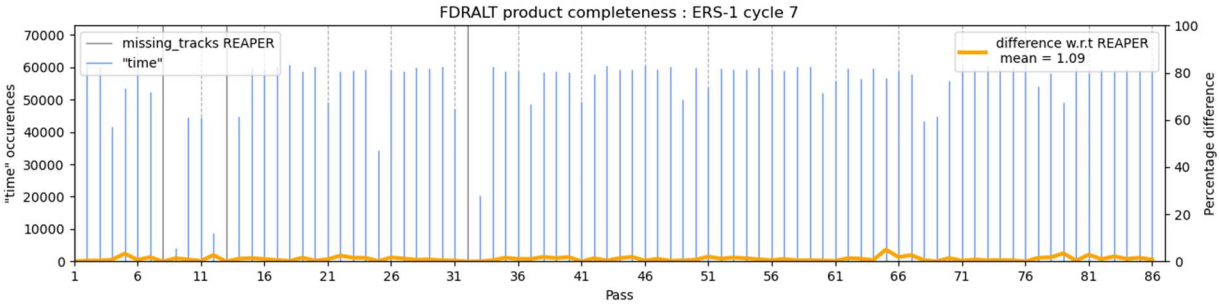

Figure 2-141 : Cycle 7

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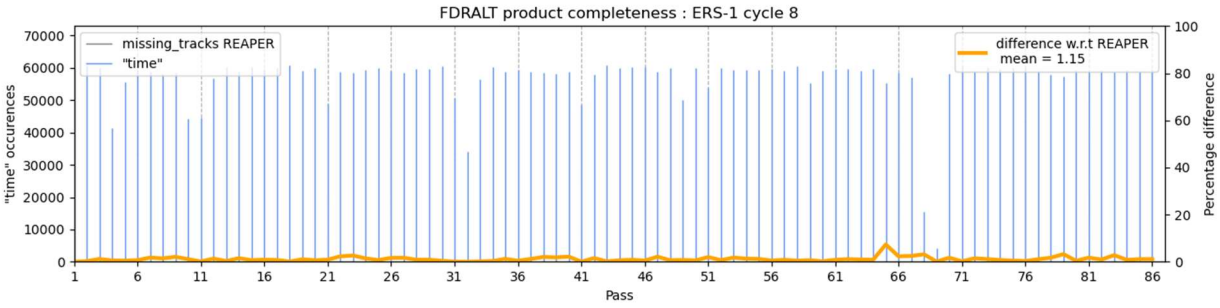

Figure 2-142 : Cycle 8

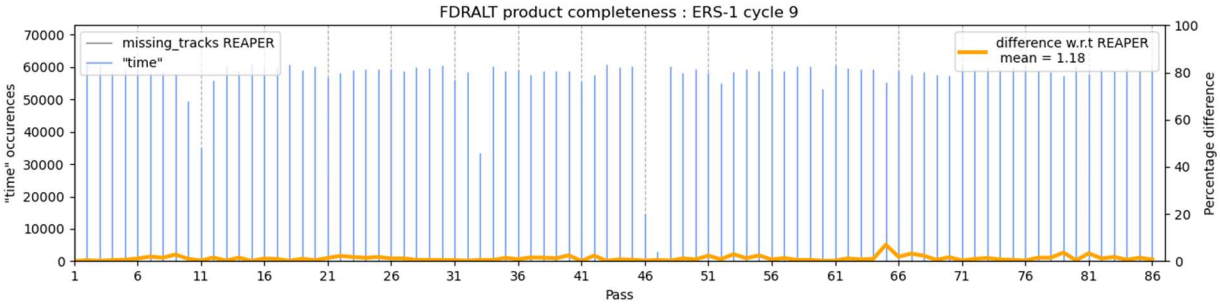

Figure 2-143 : Cycle 9

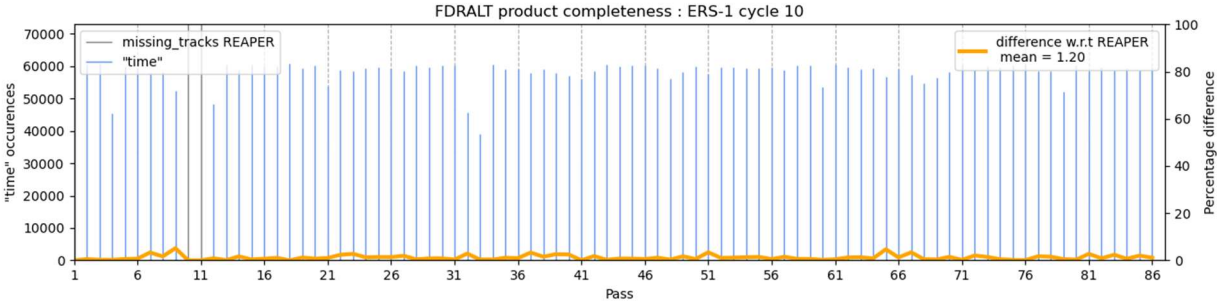

Figure 2-144 : Cycle 10

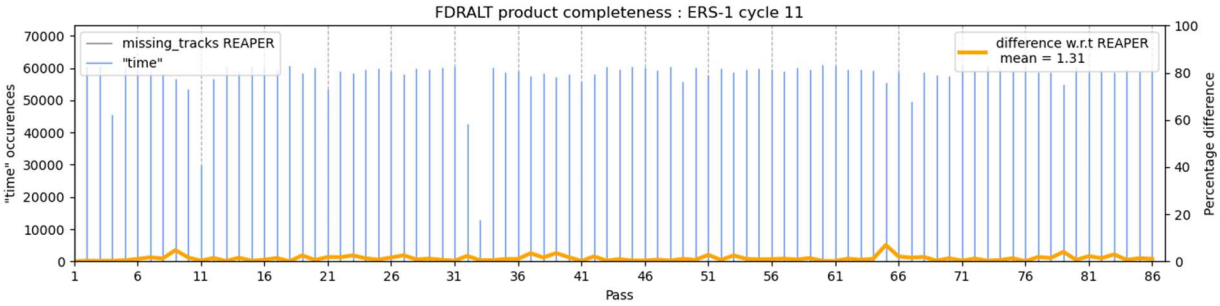

Figure 2-145 : Cycle 11

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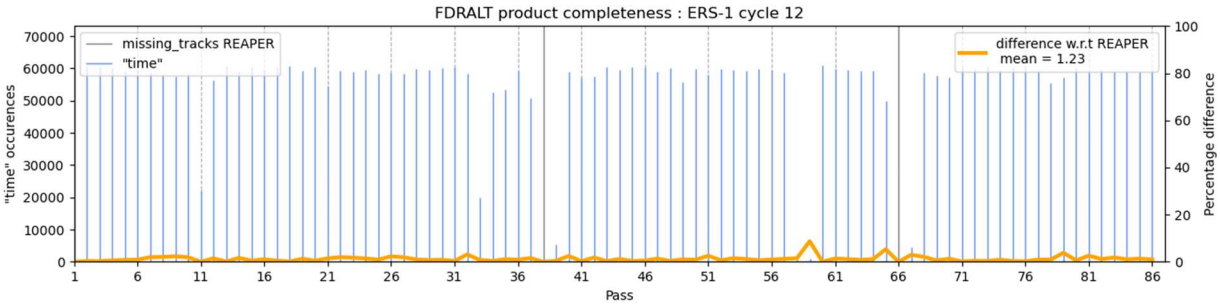

Figure 2-146 : Cycle 12

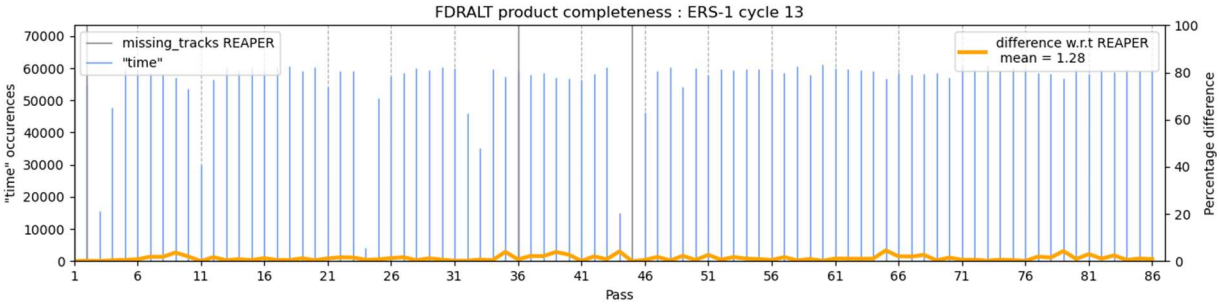

Figure 2-147 : Cycle 13

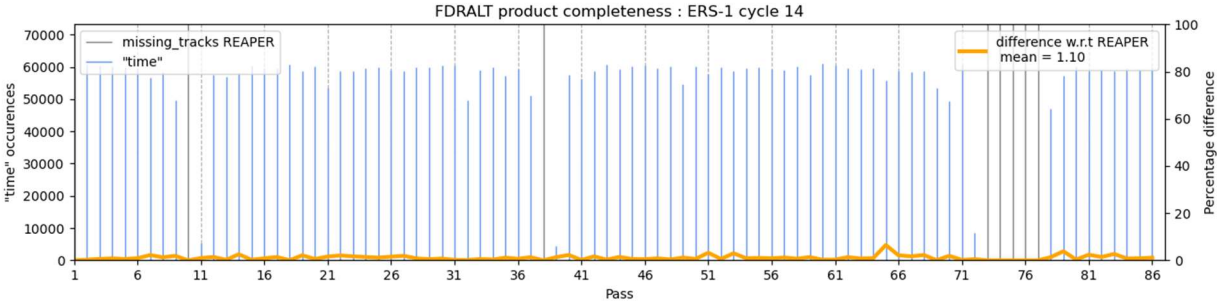

Figure 2-148 : Cycle 14

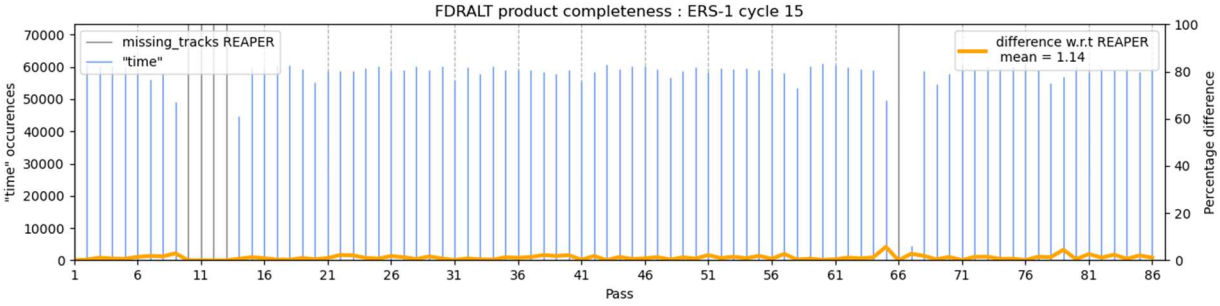

Figure 2-149 : Cycle 15

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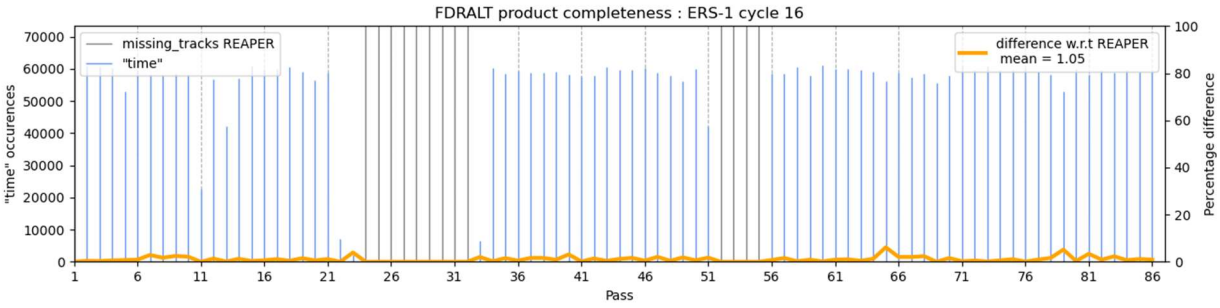

Figure 2-150 : Cycle 16

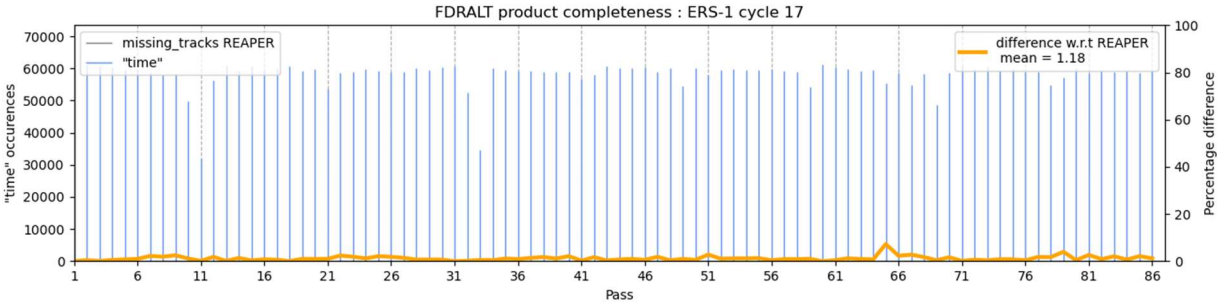

Figure 2-151 : Cycle 17

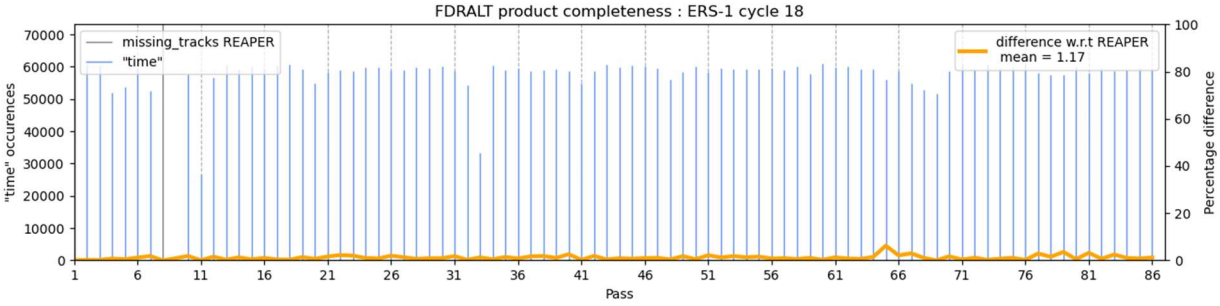

Figure 2-152 : Cycle 18

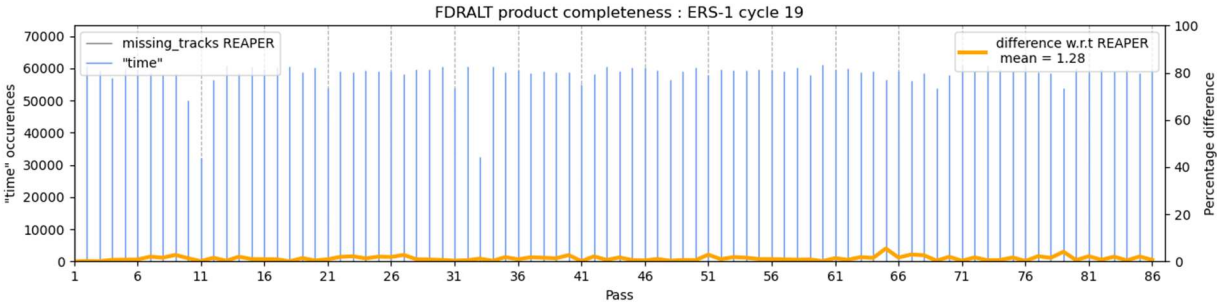

Figure 2-153 : Cycle 19

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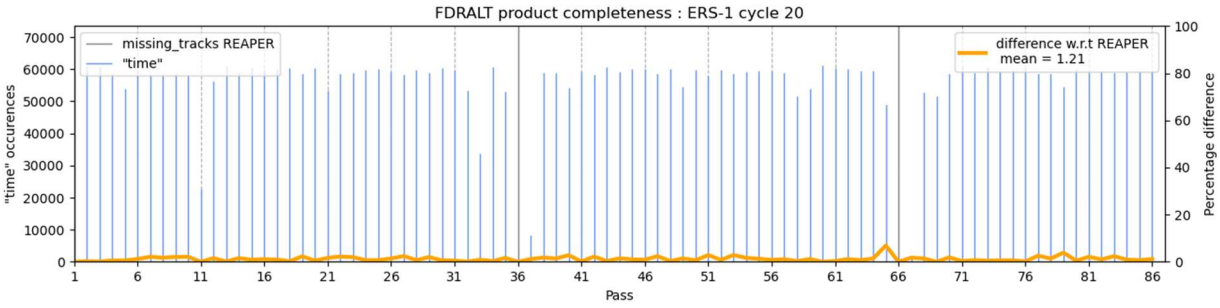

Figure 2-154 : Cycle 20

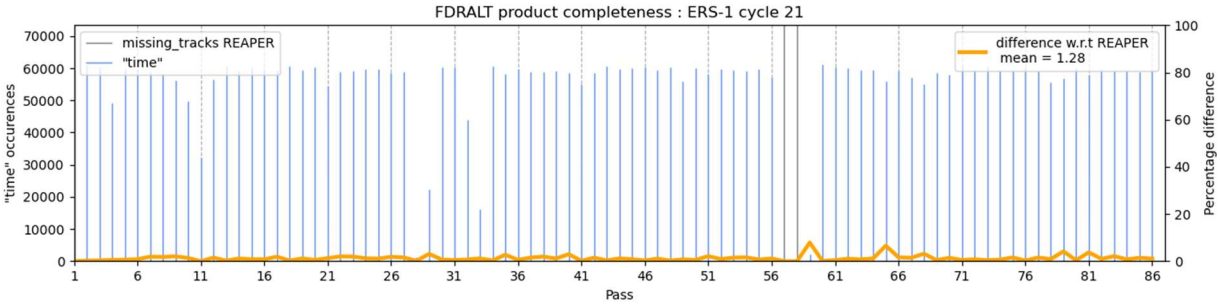

Figure 2-155 : Cycle 21

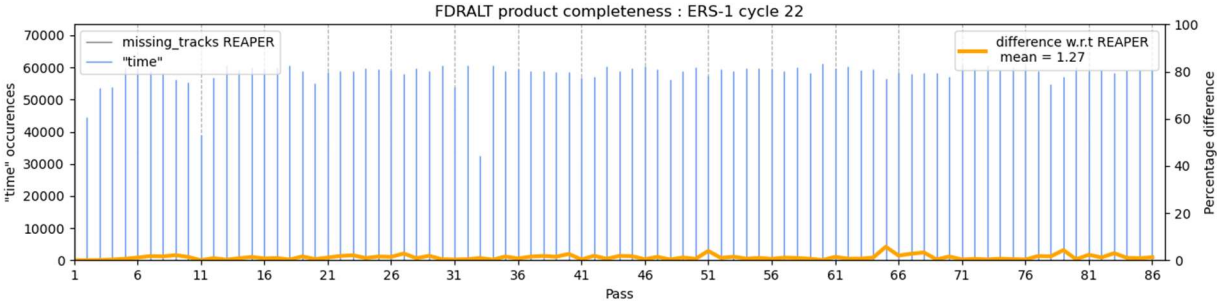

Figure 2-156 : Cycle 22

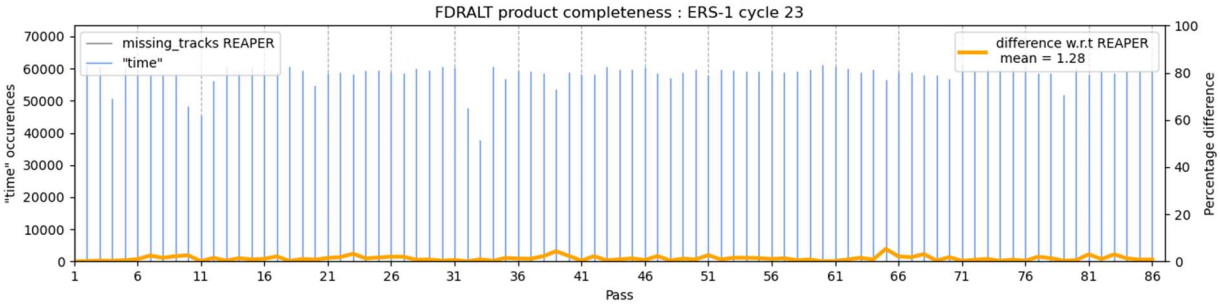

Figure 2-157 : Cycle 23

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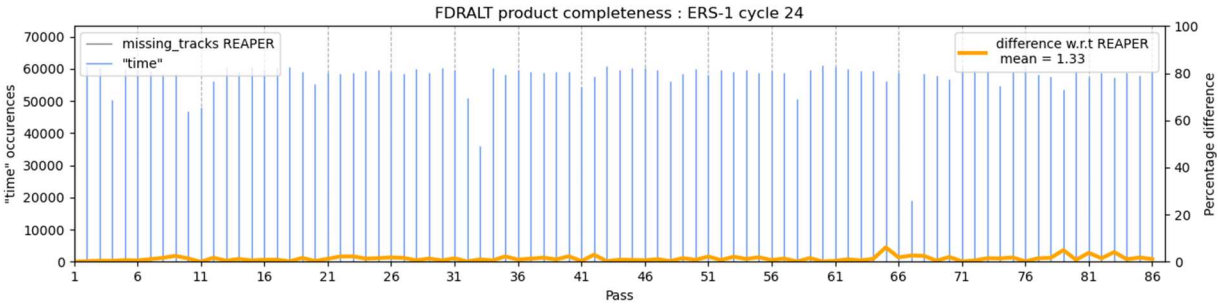

Figure 2-158 : Cycle 24

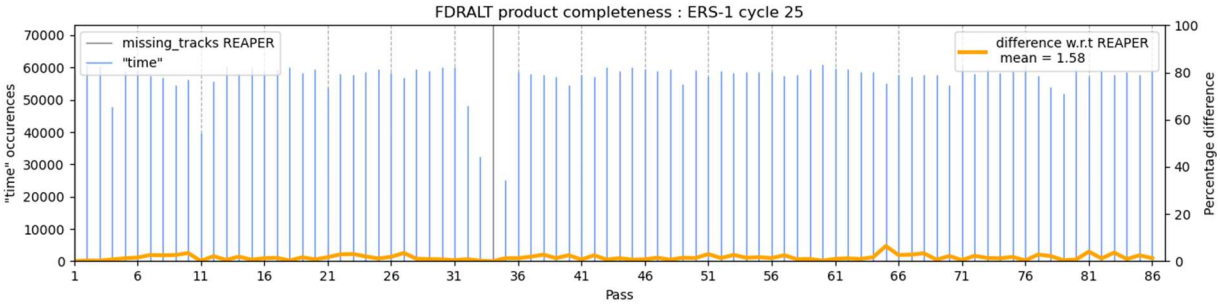

Figure 2-159 : Cycle 25

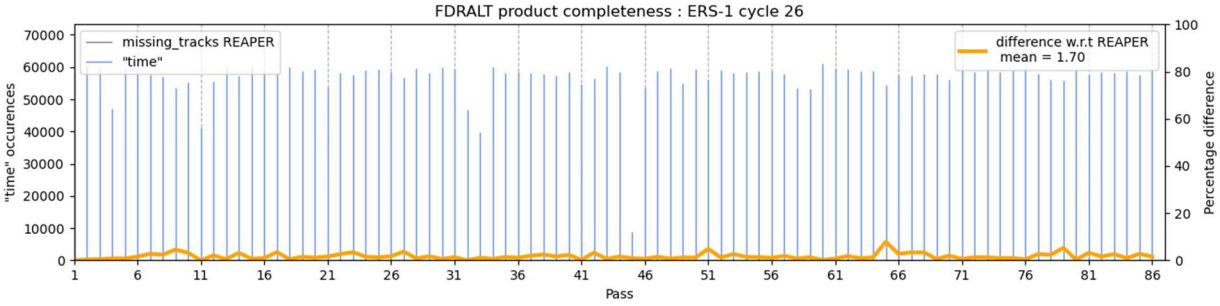

Figure 2-160 : Cycle 26

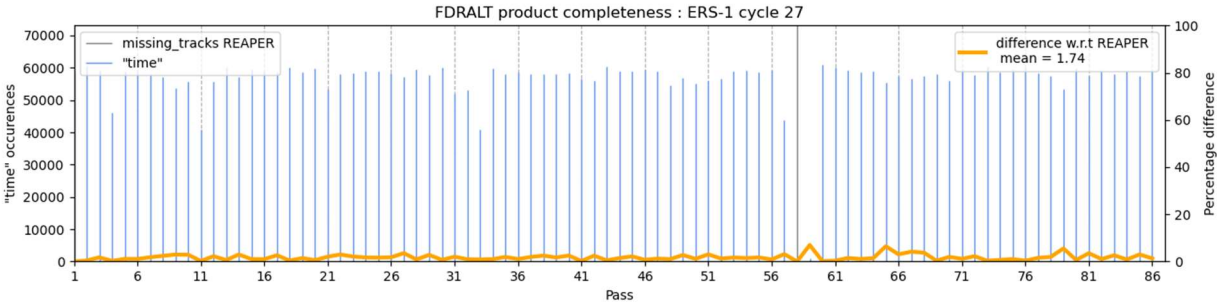

Figure 2-161 : Cycle 27

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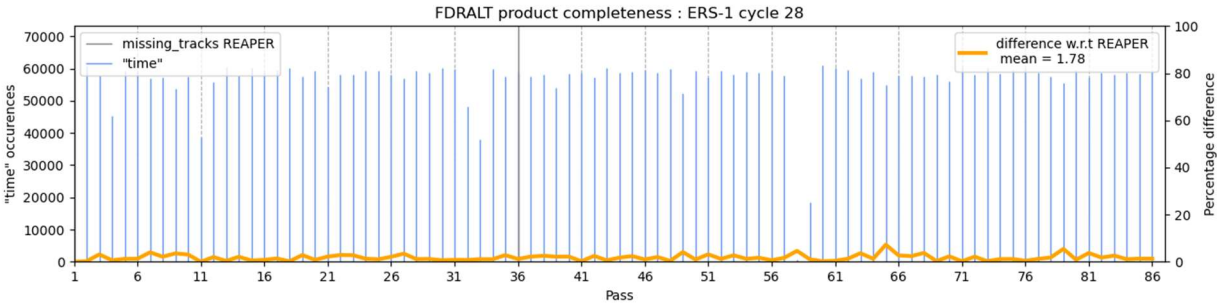

Figure 2-162 : Cycle 28

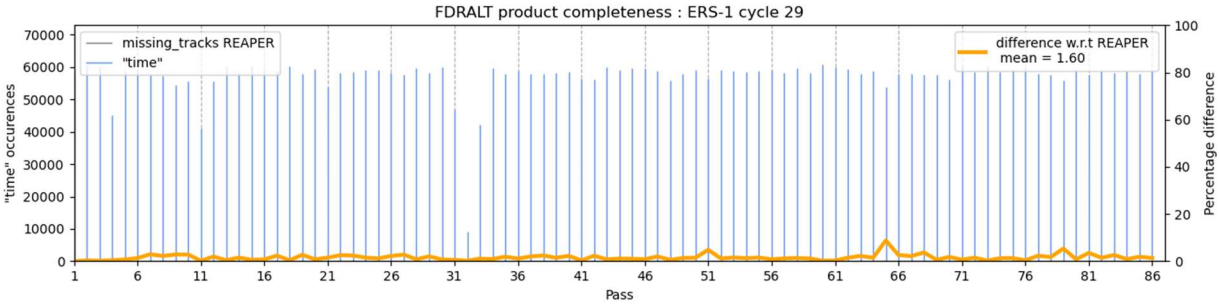

Figure 2-163 : Cycle 29

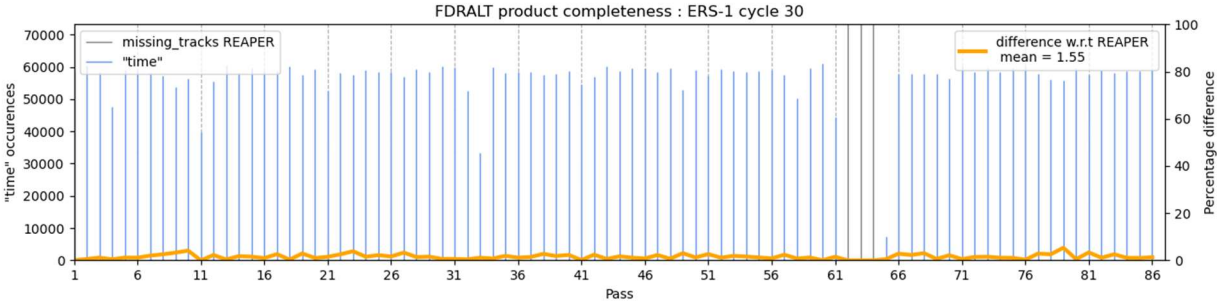

Figure 2-164 : Cycle 30

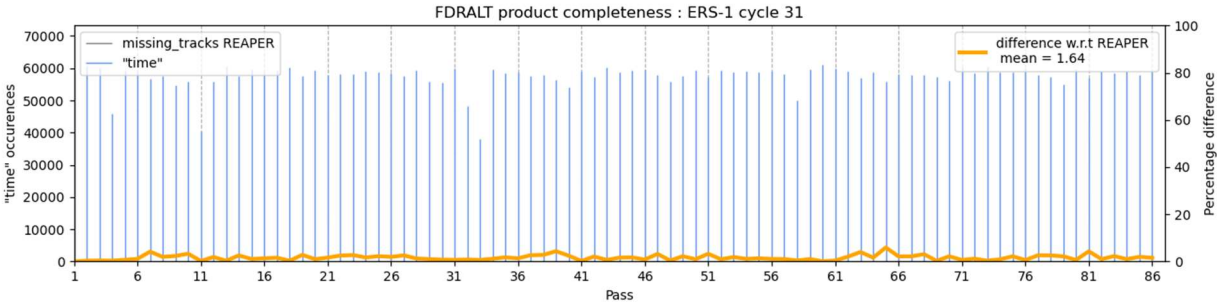

Figure 2-165 : Cycle 31

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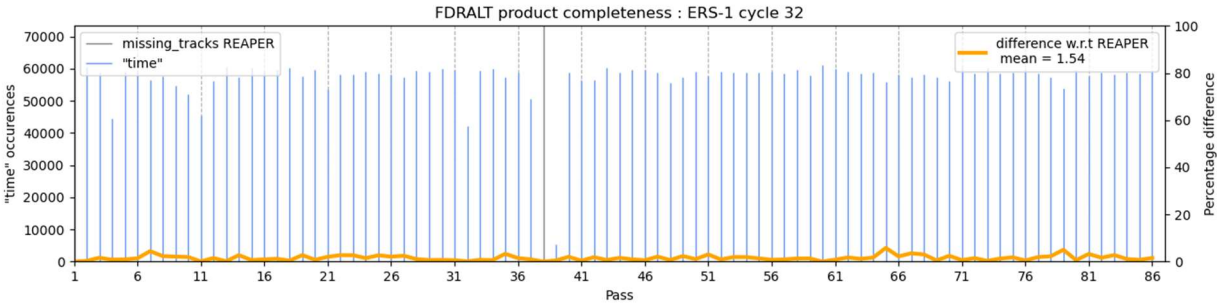

Figure 2-166 : Cycle 32

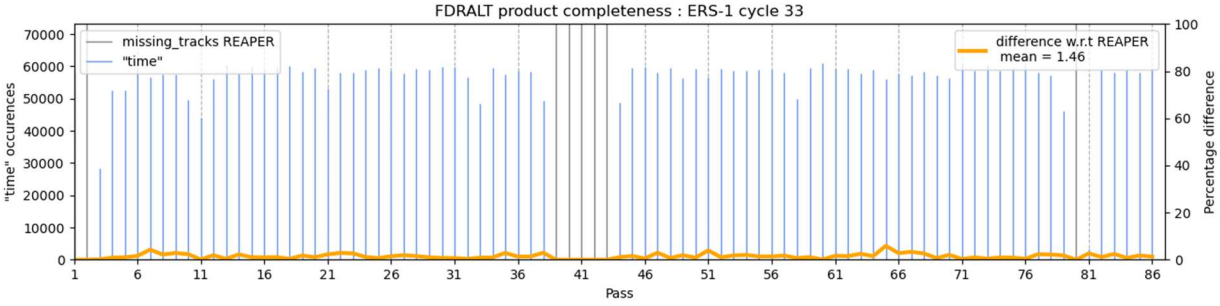

Figure 2-167 : Cycle 33

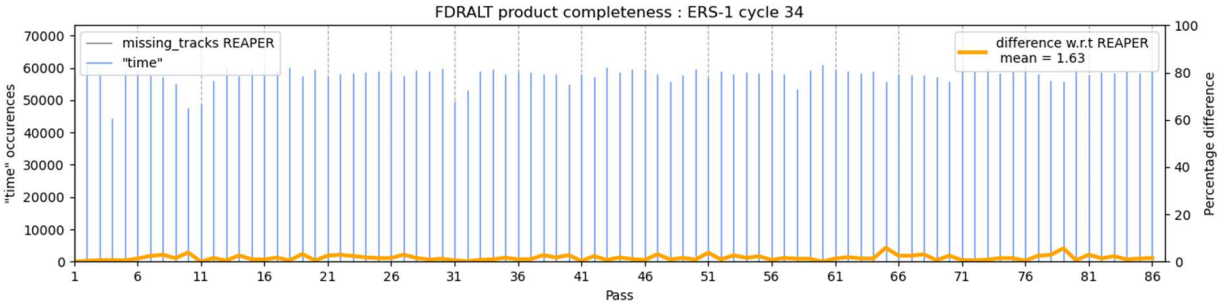

Figure 2-168 : Cycle 34

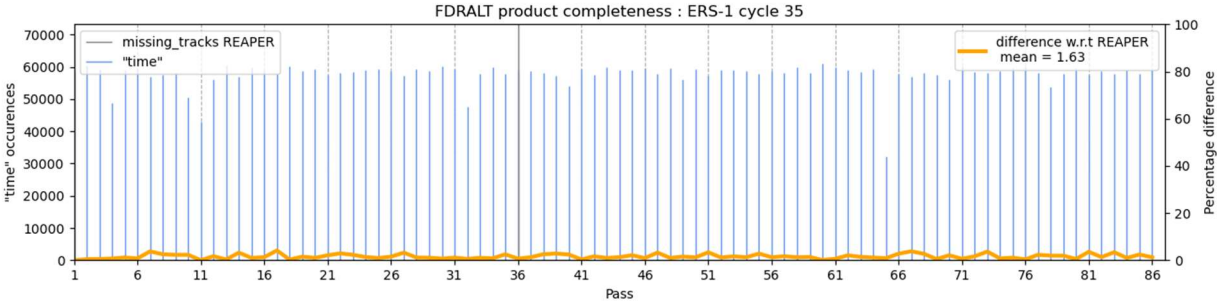

Figure 2-169 : Cycle 35

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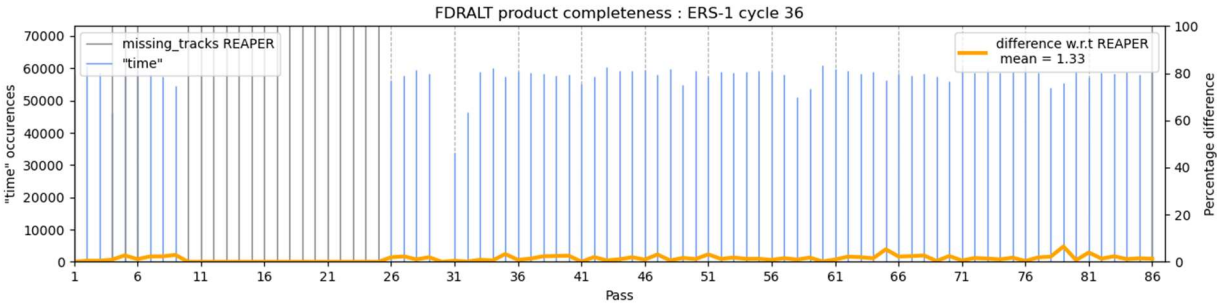

Figure 2-170 : Cycle 36

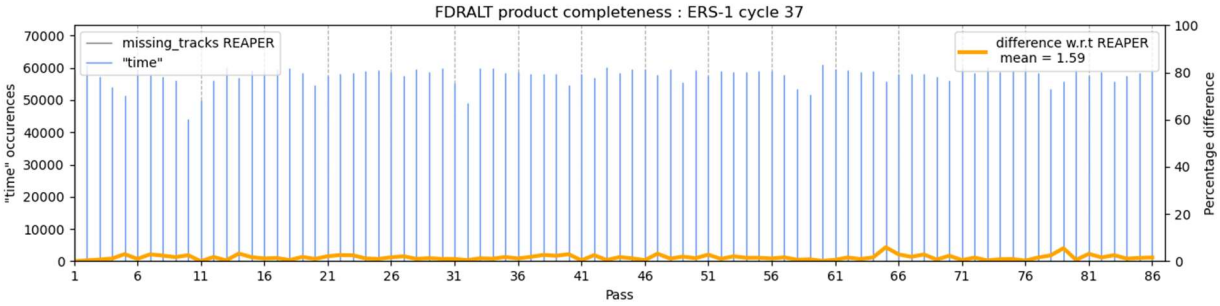

Figure 2-171 : Cycle 37

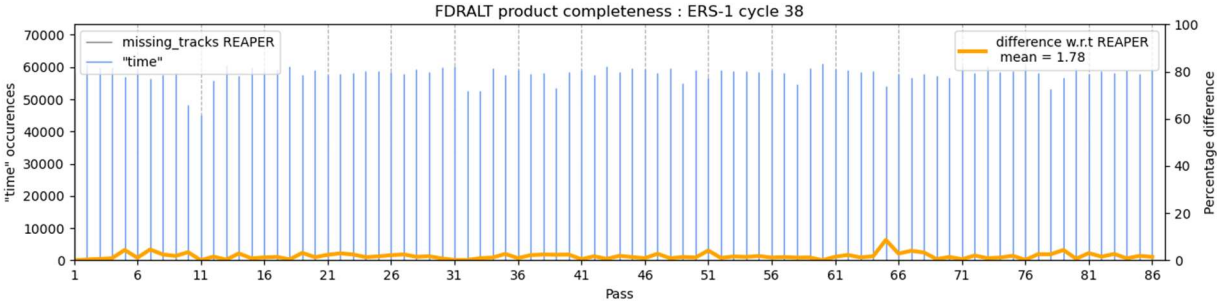

Figure 2-172 : Cycle 38

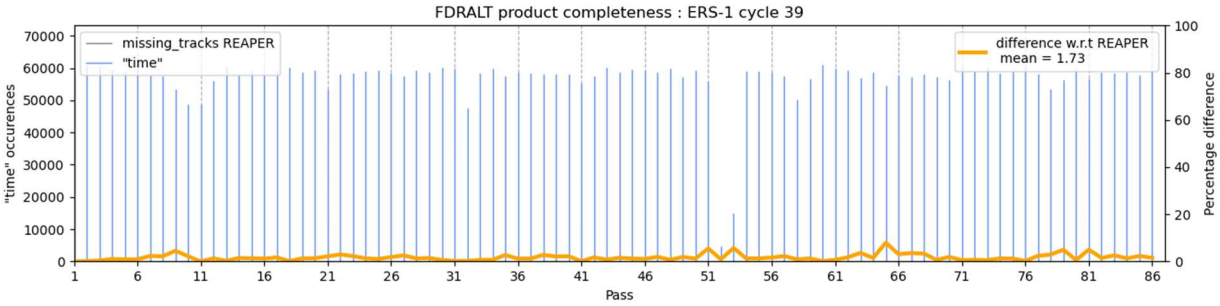

Figure 2-173 : Cycle 39

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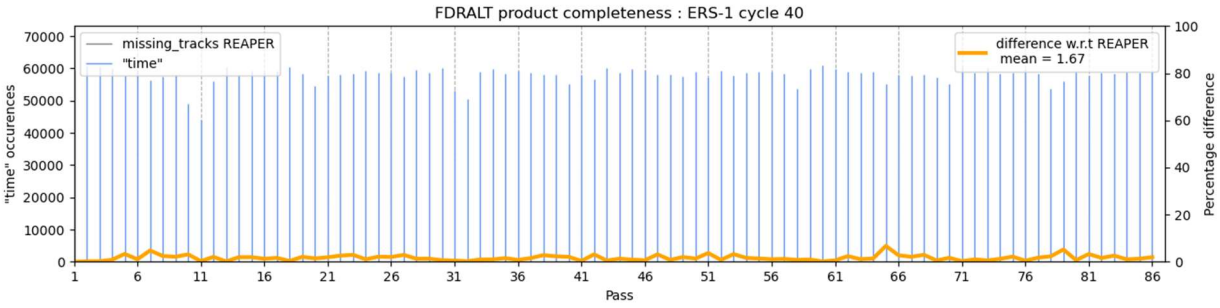

Figure 2-174 : Cycle 40

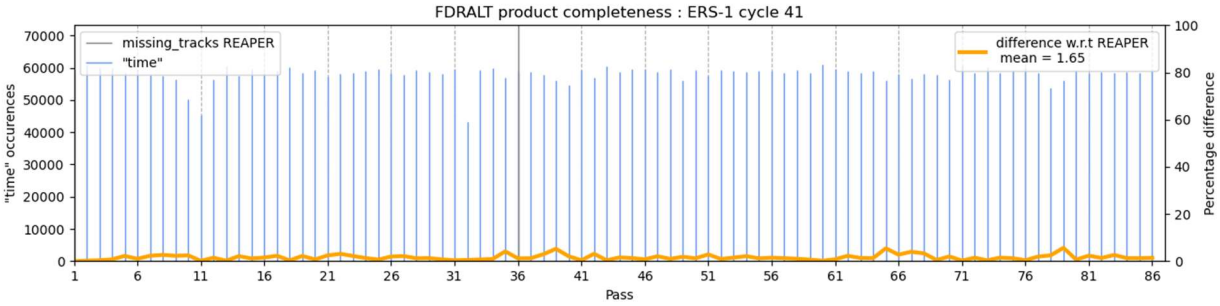

Figure 2-175 : Cycle 41

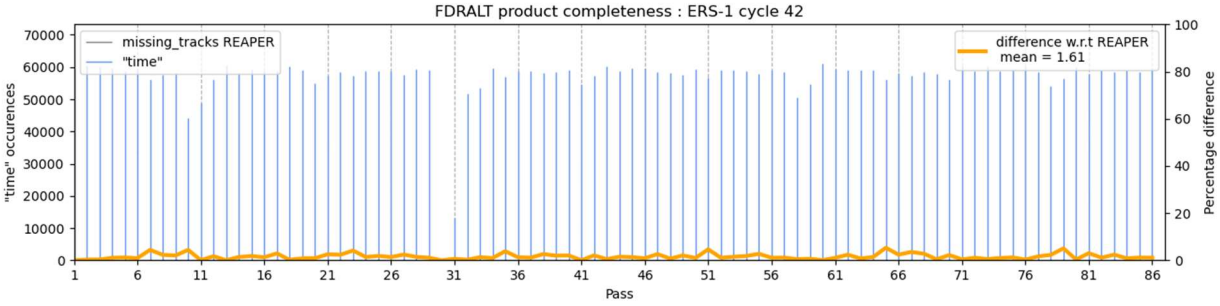

Figure 2-176 : Cycle 42

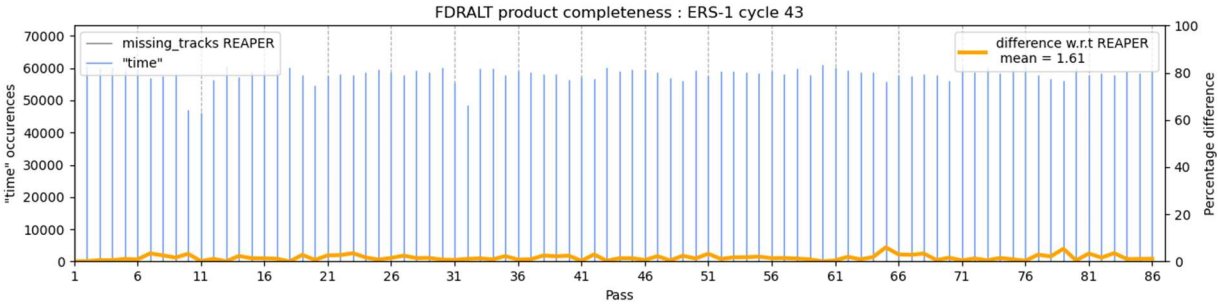

Figure 2-177 : Cycle 43

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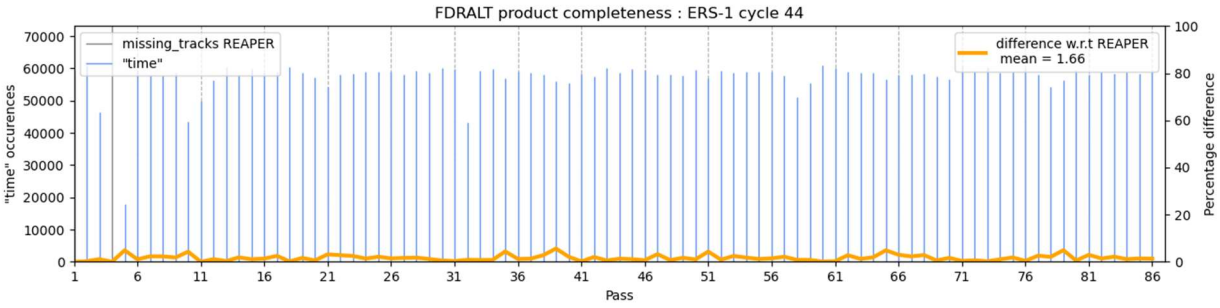

Figure 2-178 : Cycle 44

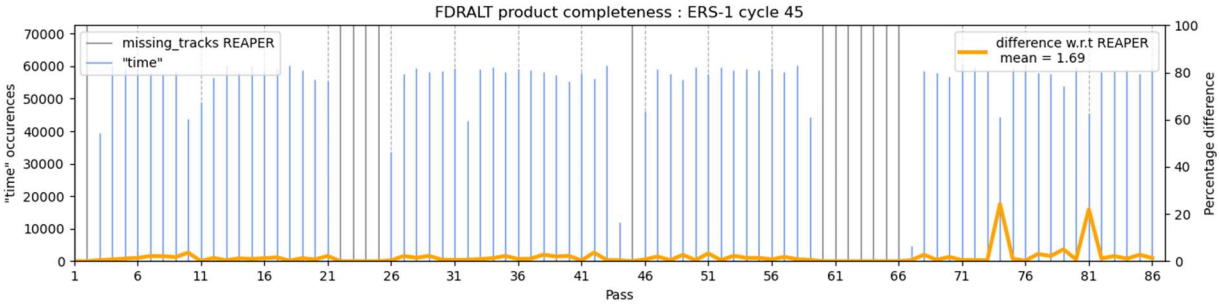

Figure 2-179 : Cycle 45

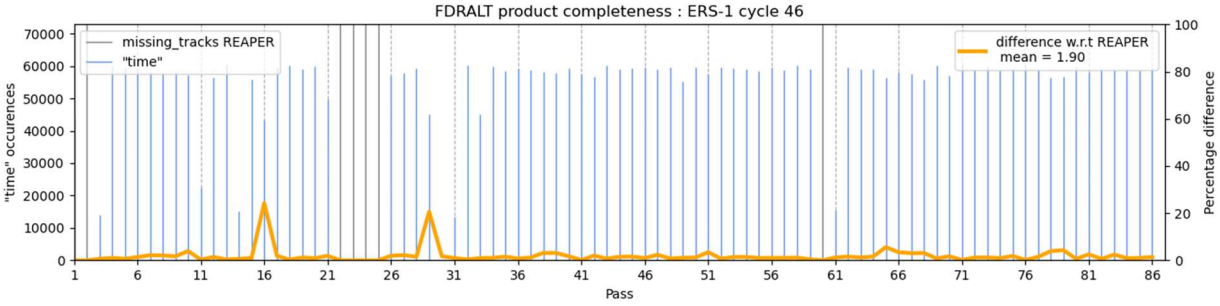

Figure 2-180 : Cycle 46

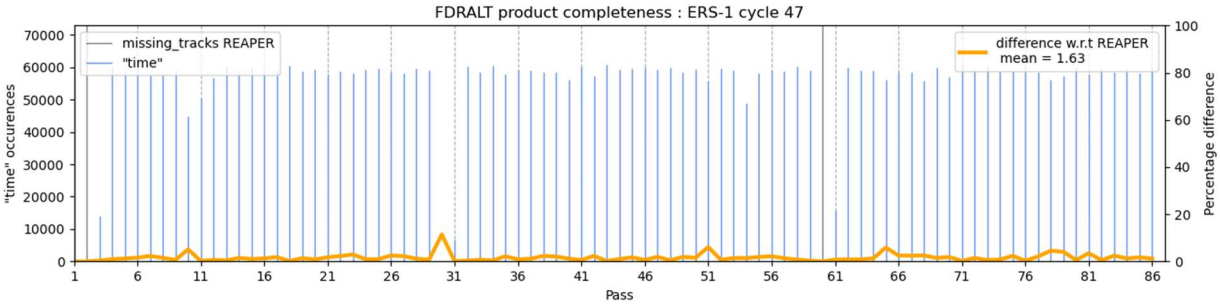

Figure 2-181 : Cycle 47

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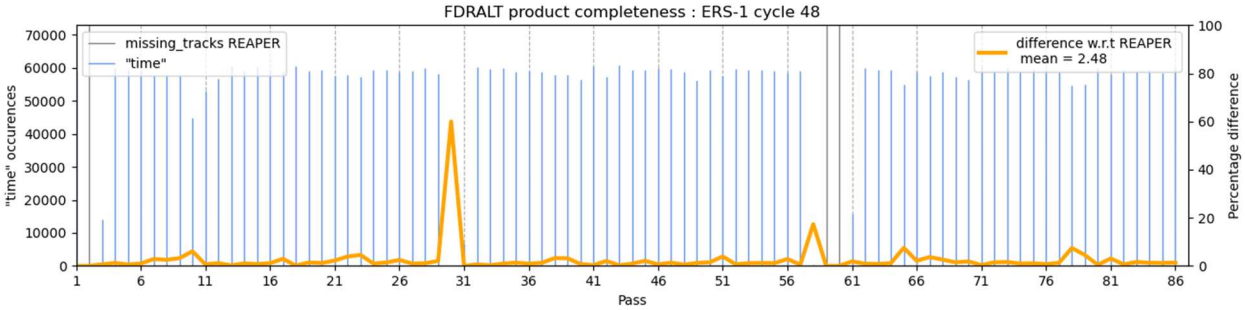

Figure 2-182 : Cycle 48

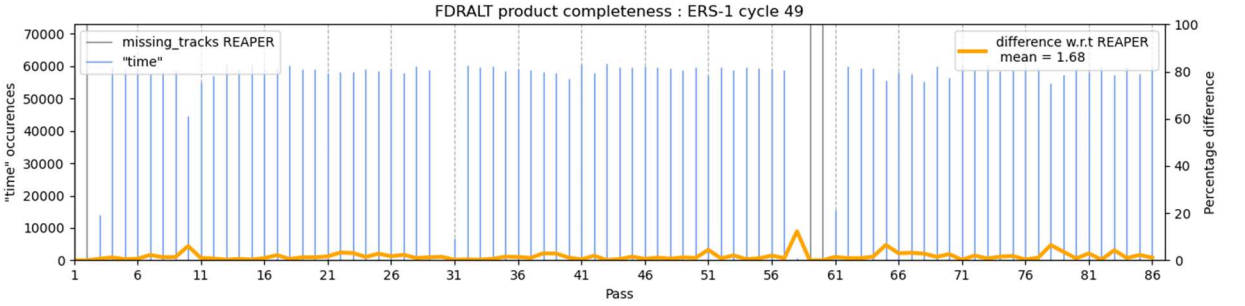

Figure 2-183 : Cycle 49

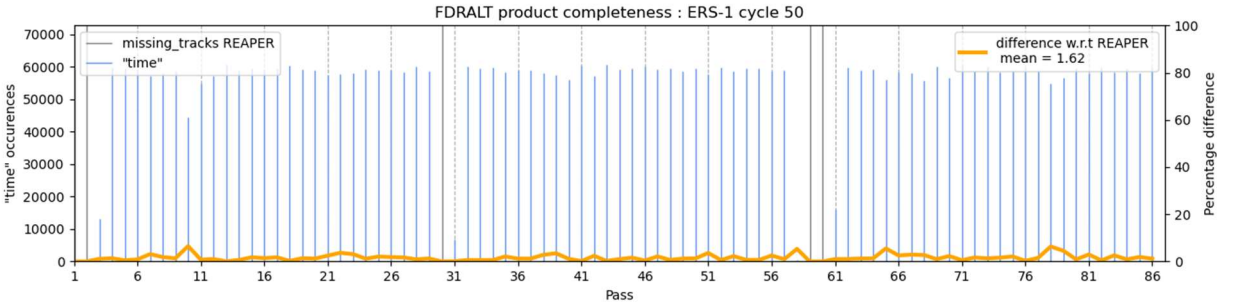

Figure 2-184 : Cycle 50

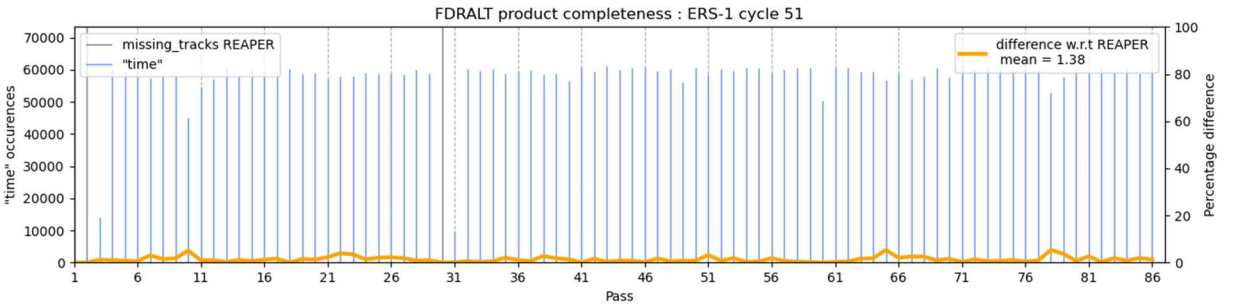

Figure 2-185 : Cycle 51

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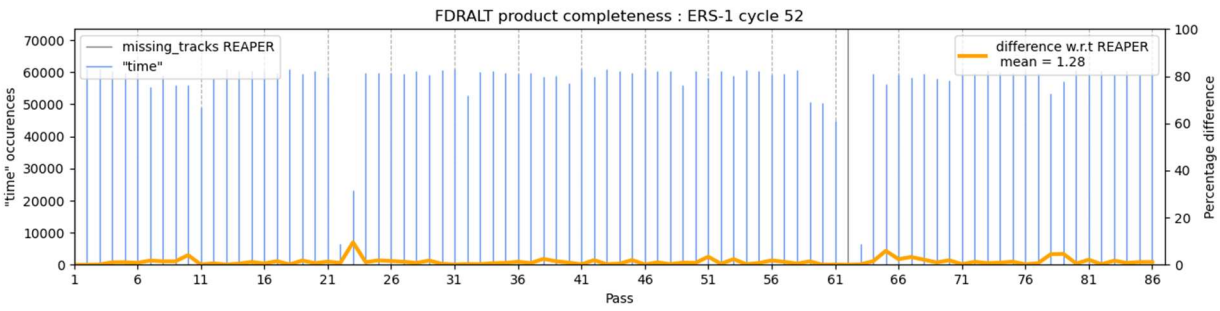

Figure 2-186 : Cycle 52

2.3.2 1992

2.3.2.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1992 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.
- Change of orbit phase occurred after cycle 82 according to Table 2-13.

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ERS-1 year 1992			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
52	1	1	62
53	2	2	2, 36
54	0	0	
55	12	12	6--17
56	12	12	75-86
57	10	10	1--10
58	9	9	15-20, 47, 80, 81
59	0	0	
60	1	1	36
61	0	0	
62	2	2	32, 58
63	11	11	71-81
64	0	0	
65	0	0	
66	0	0	
67	9	9	35-43
68	42	42	45-86
69	13	13	1--13
70	0	0	
71	0	0	
72	0	0	
73	0	0	
74	0	0	
75	1	1	4
76	0	0	
77	0	0	
78	1	1	66
79	0	0	
80	0	0	
81	3	3	38, 85, 86
82	6	6	1, 60-64
83	33	33	2-6, 31-36, 210, 489-497, 664-671, 873, 875, 918
84	77	77	152, 318, 350-361, 490-492, 518, 520, 522-527, 548, 550, 576, 578, 604, 606, 608, 634, 662, 664, 690, 692, 694, 720, 722, 748-750, 812, 813, 871-1002
85	74	74	1-13, 56, 57, 60, 570-621, 739-741, 972, 973, 1001
86	170	170	230-372, 847-873
87	85	85	36, 147-167, 305-309, 516, 537-565, 569-574, 608, 630-643, 699, 713-715, 782, 808
88	19	19	53-57, 176, 268-273, 342-345, 580, 782, 1001
89	24	24	320-322, 561-581
90	8	8	238, 352, 404, 598, 599, 780, 907, 948

Figure 2-187 : List of missing tracks for year 1992

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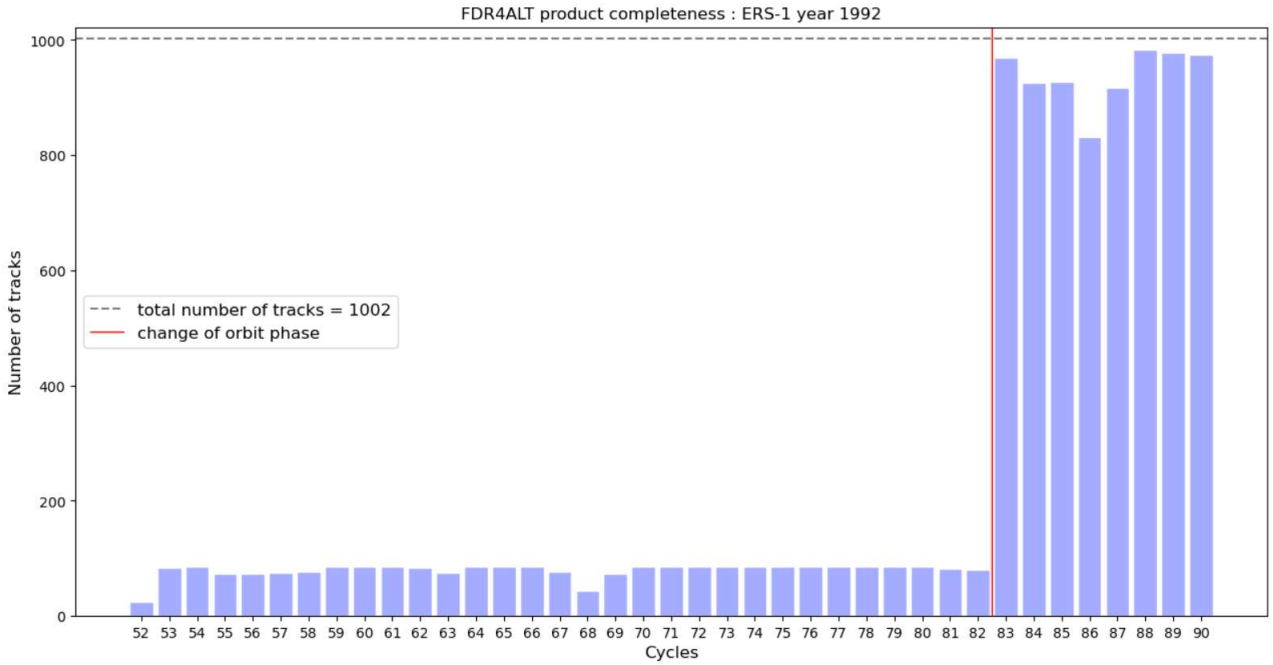

Figure 2-188 : Cyclic monitoring of the number of tracks completeness of year 1992.

2.3.2.2 Cycle by cycle

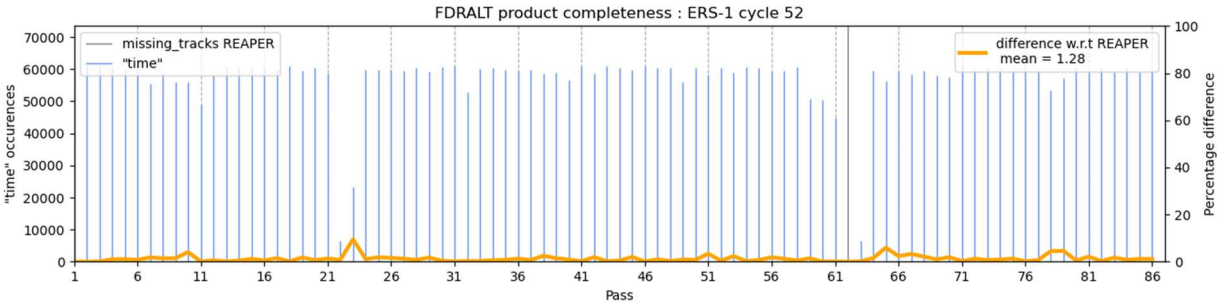

Figure 2- 2-189 : Cycle 52

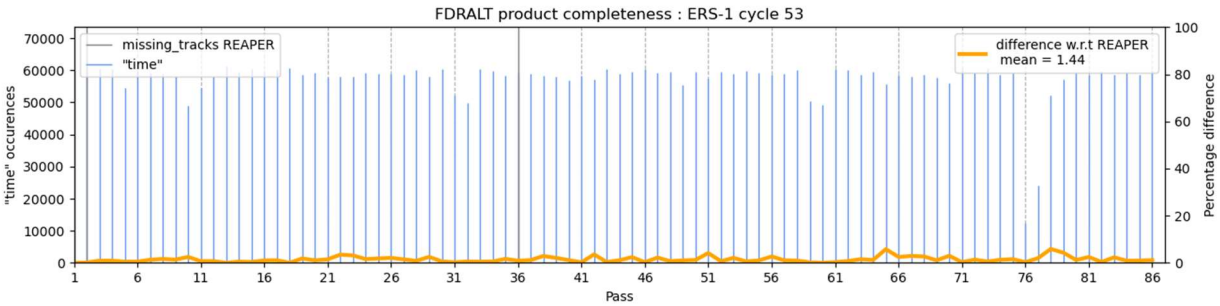

Figure 2-190 : Cycle 53

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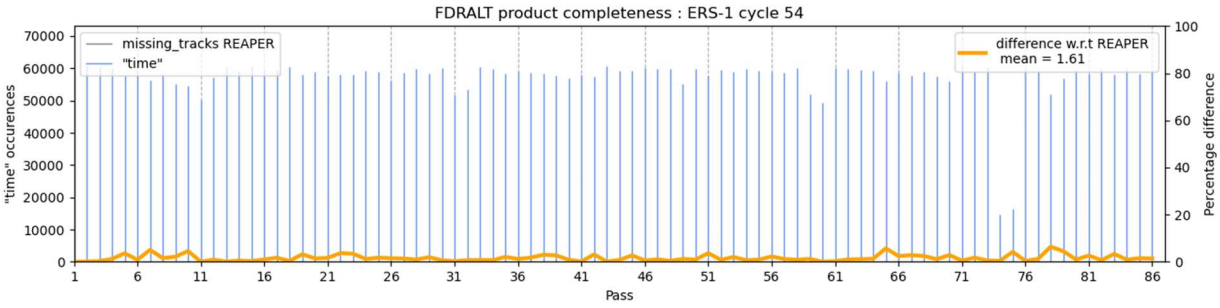

Figure 2-191 : Cycle 54

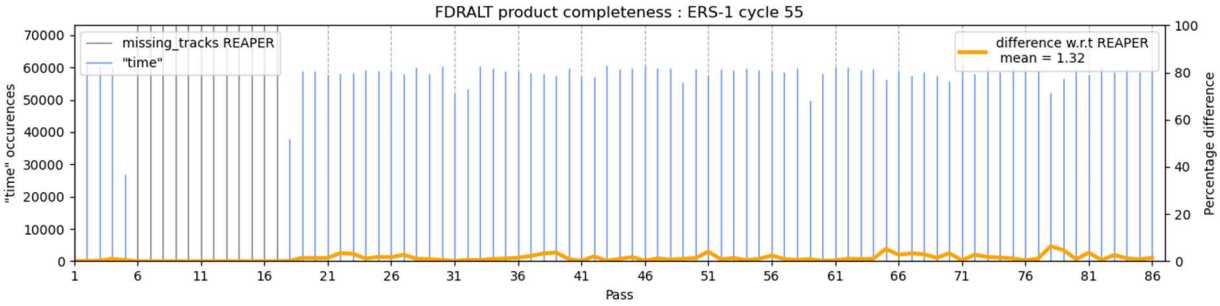

Figure 2-192 : Cycle 55

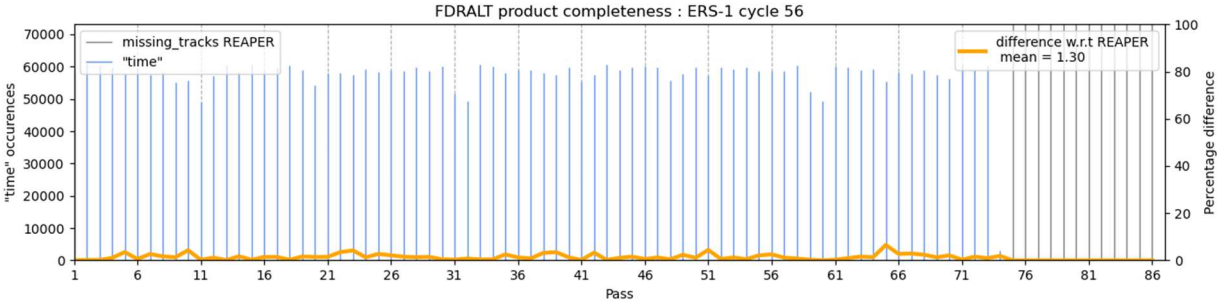

Figure 2-193 : Cycle 56

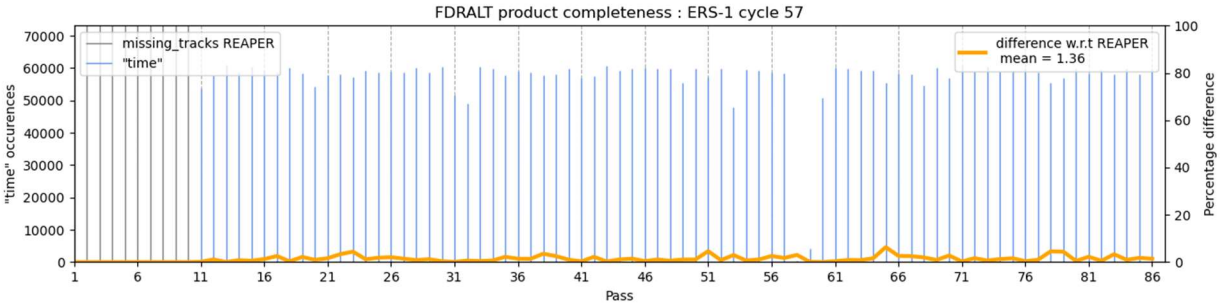

Figure 2-194 : Cycle 57

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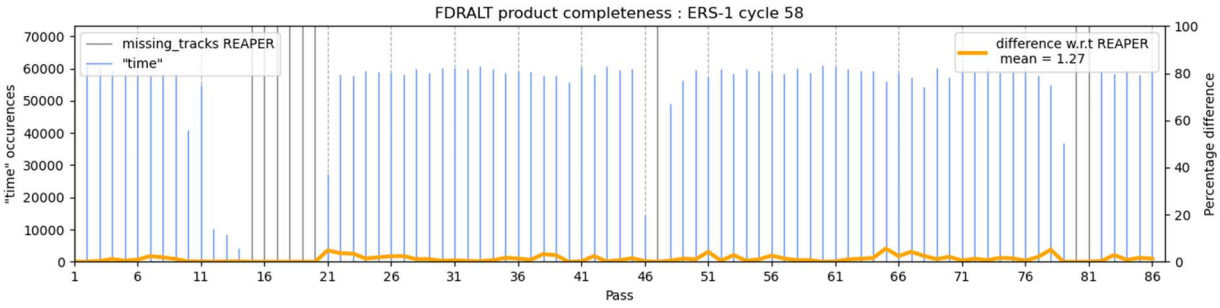

Figure 2-195 : Cycle 58

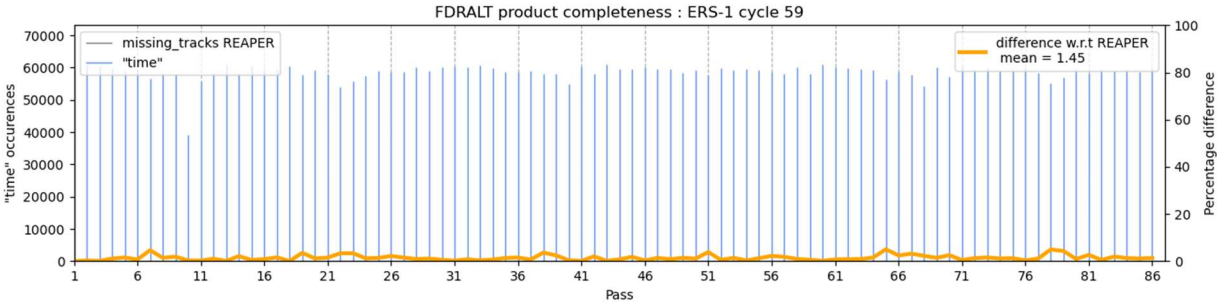

Figure 2-196 : Cycle 59

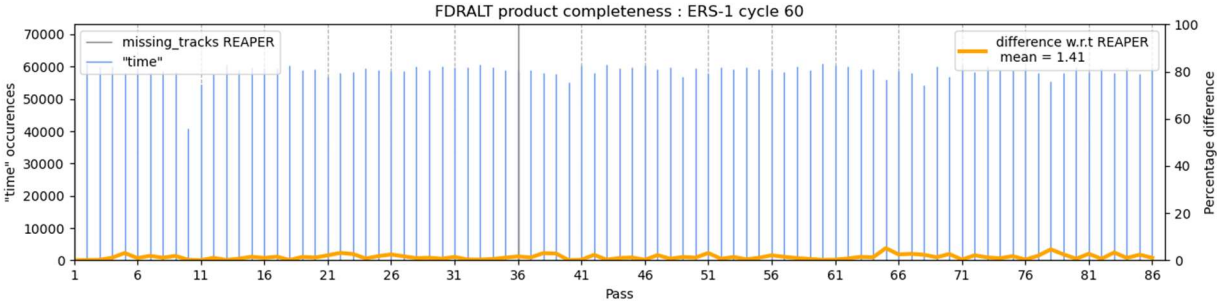

Figure 2-197 : Cycle 60

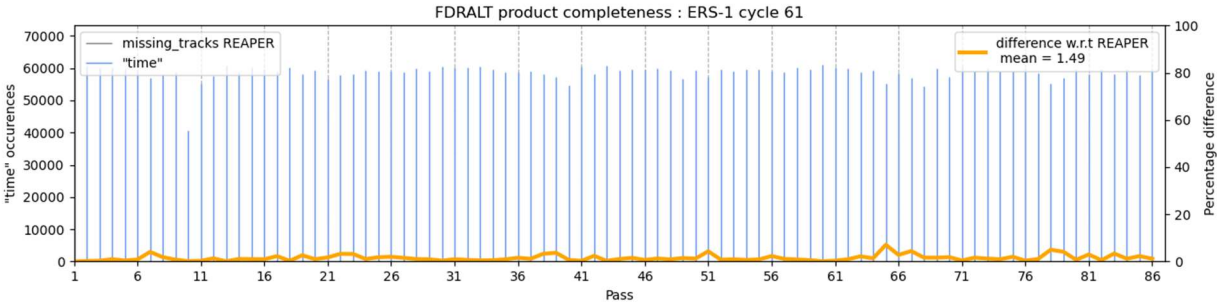

Figure 2-198: Cycle 61

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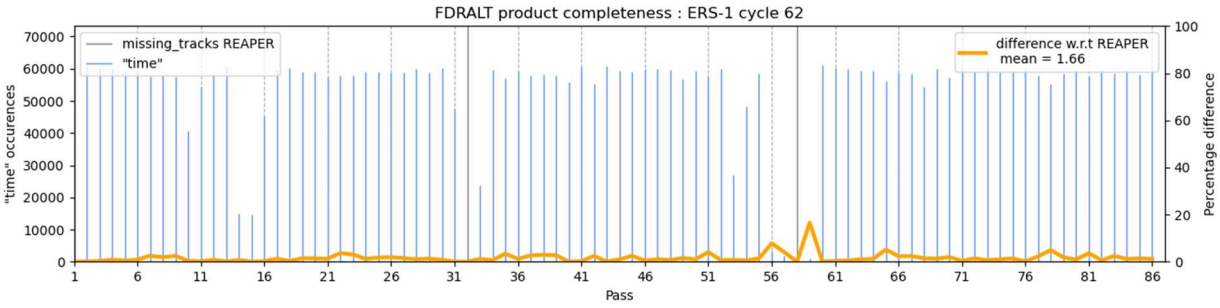

Figure 2-199: Cycle 62

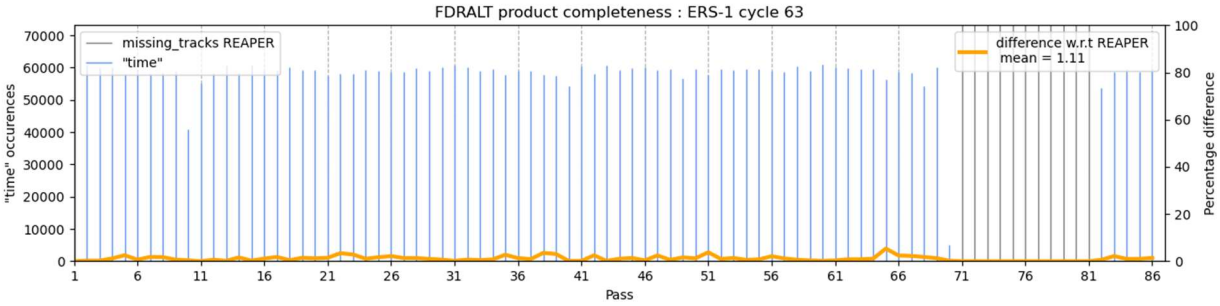

Figure 2-200: Cycle 63

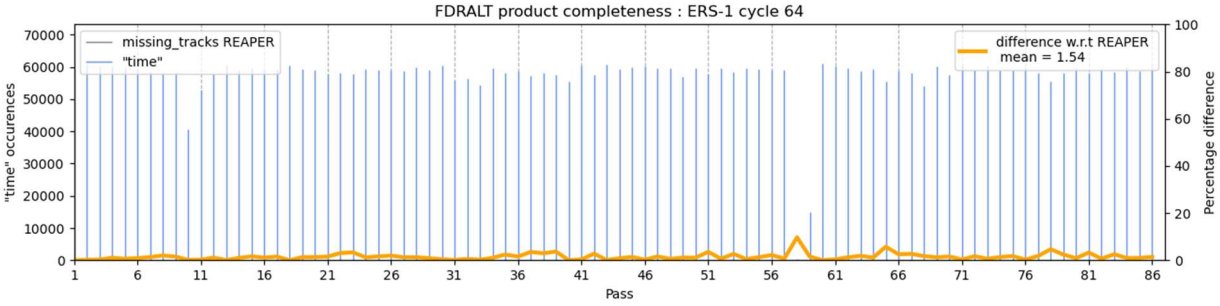

Figure 2-201: Cycle 64

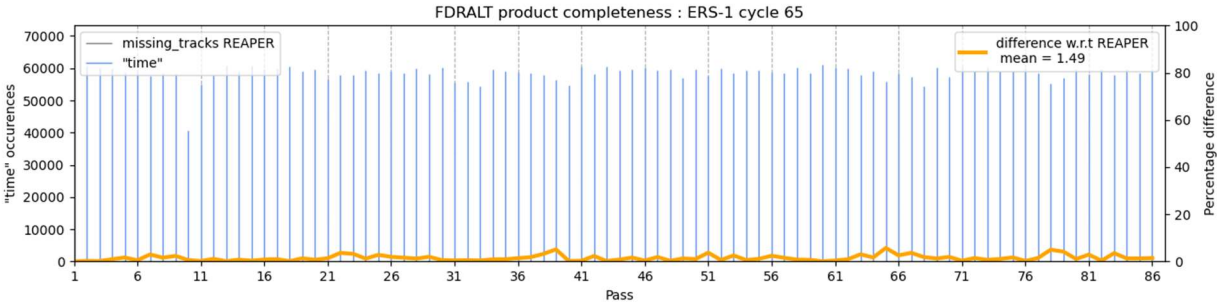

Figure 2-202: Cycle 65

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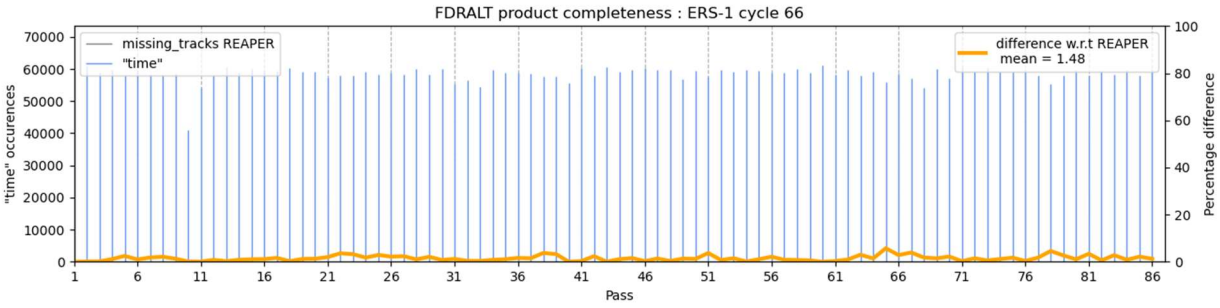

Figure 2-203: Cycle 66

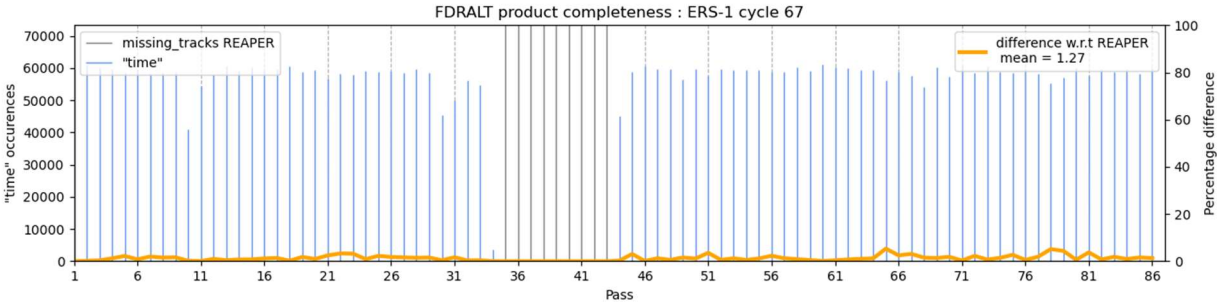

Figure 2-204: Cycle 67

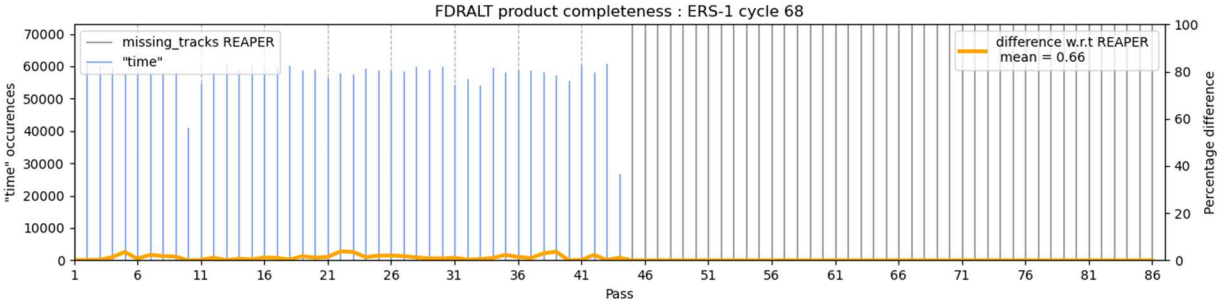

Figure 2-205: Cycle 68

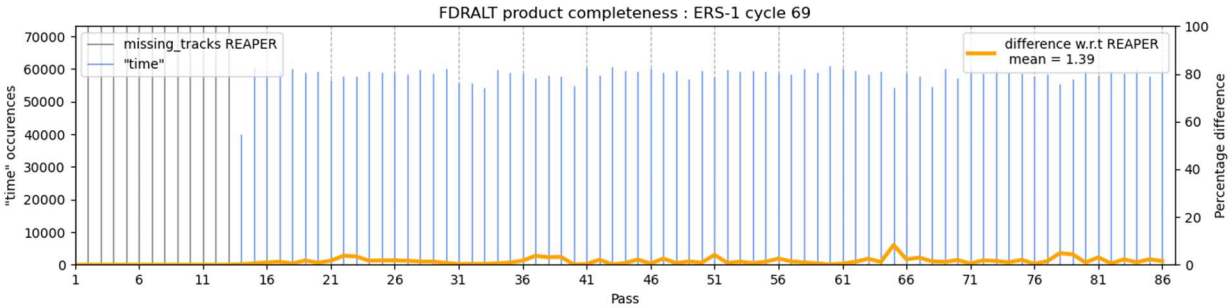

Figure 2-206 : Cycle 69

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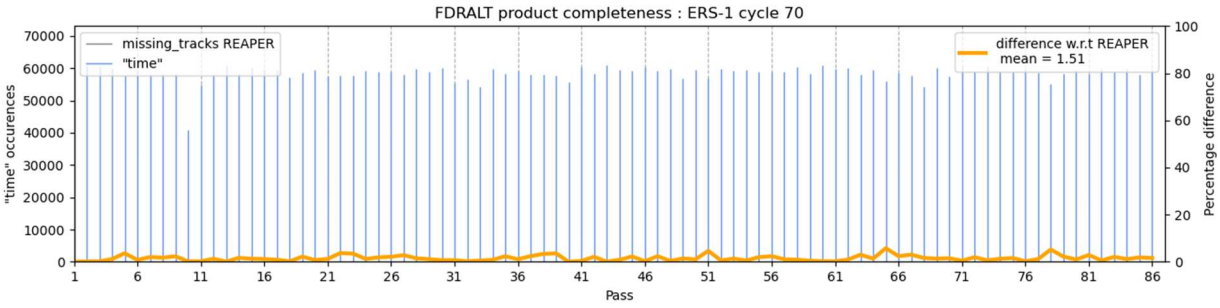

Figure 2-207 : Cycle 70

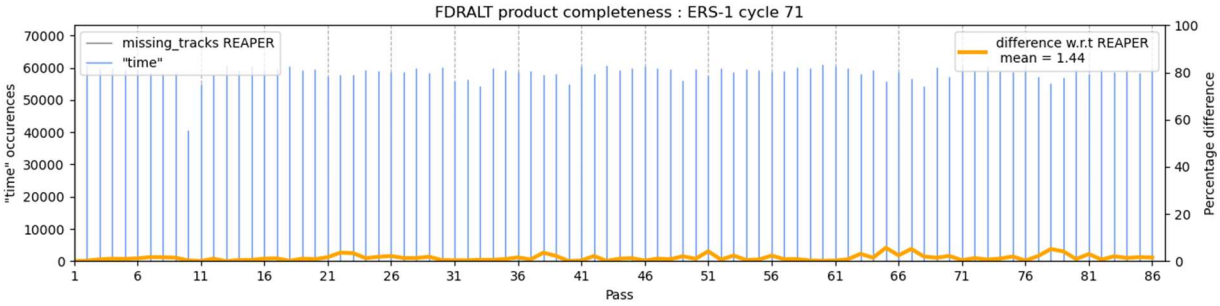

Figure 2-208 : Cycle 71

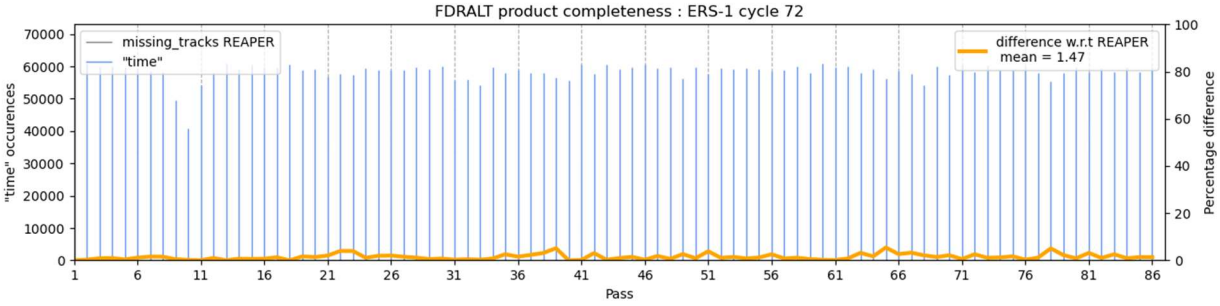

Figure 2-209 : Cycle 72

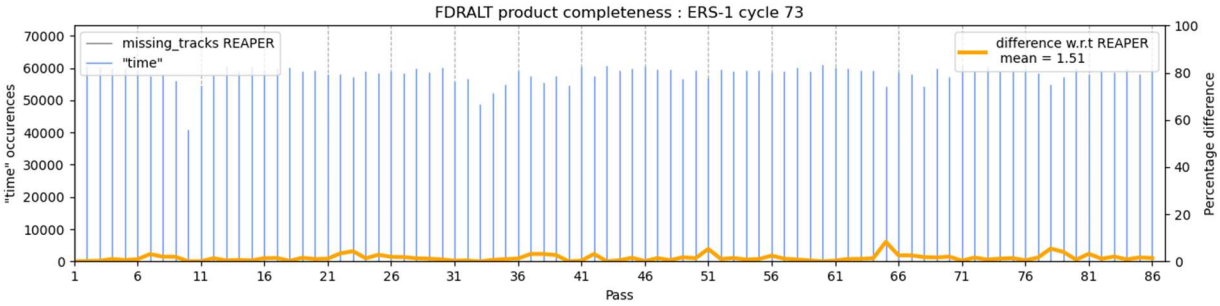

Figure 2-210 : Cycle 73

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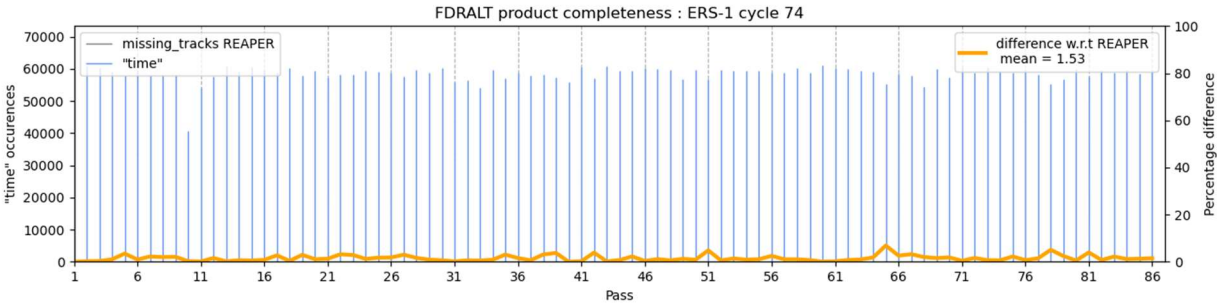

Figure 2-211 : Cycle 74

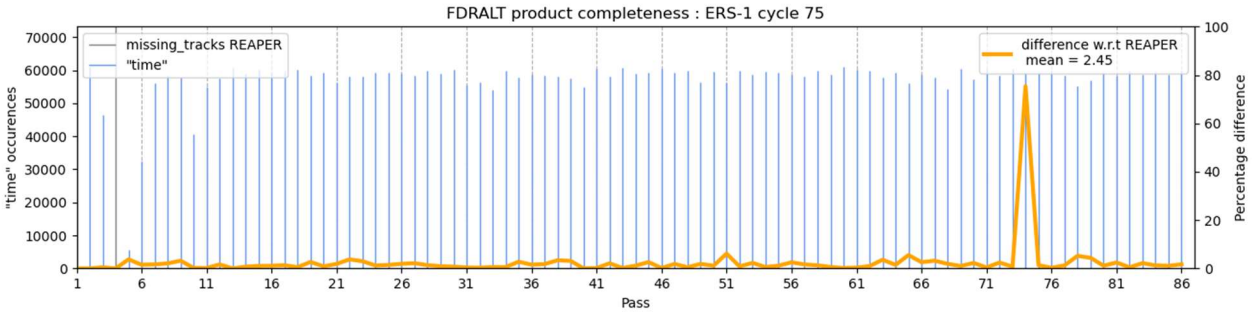

Figure 2-212 : Cycle 75

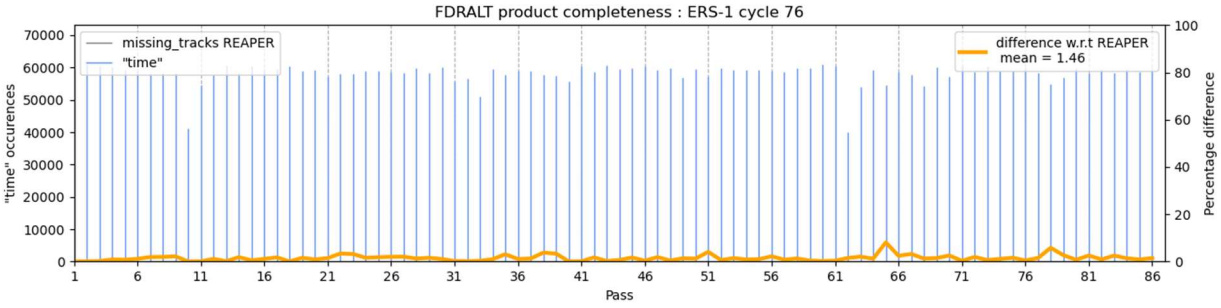

Figure 2-213 : Cycle 76

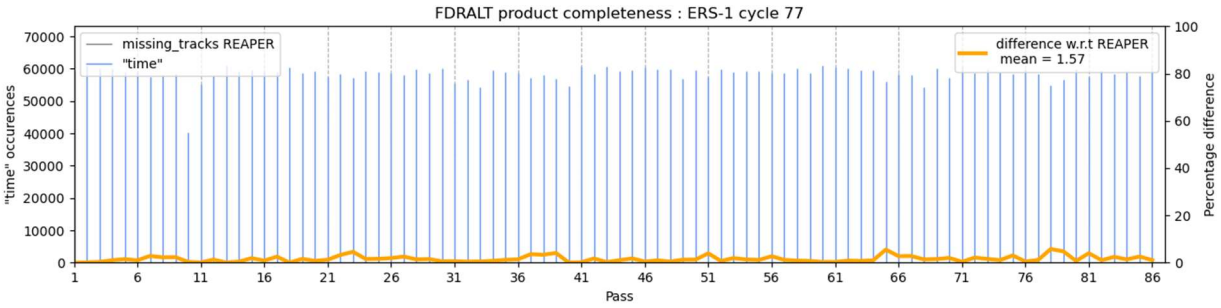

Figure 2-214 : Cycle 77

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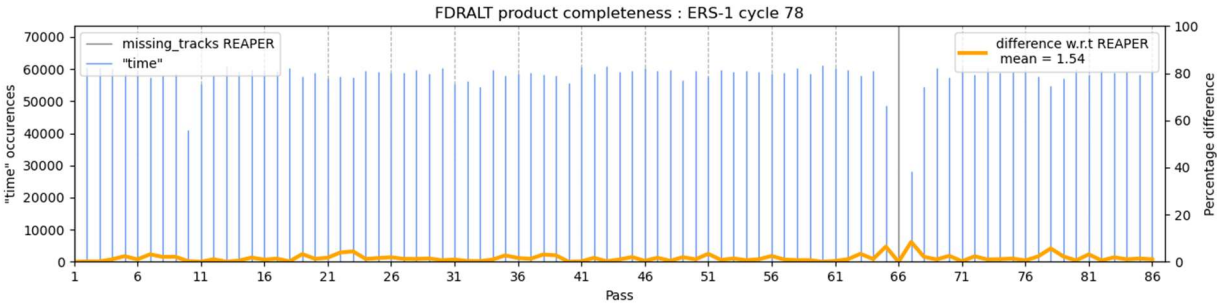

Figure 2-215 : Cycle 78

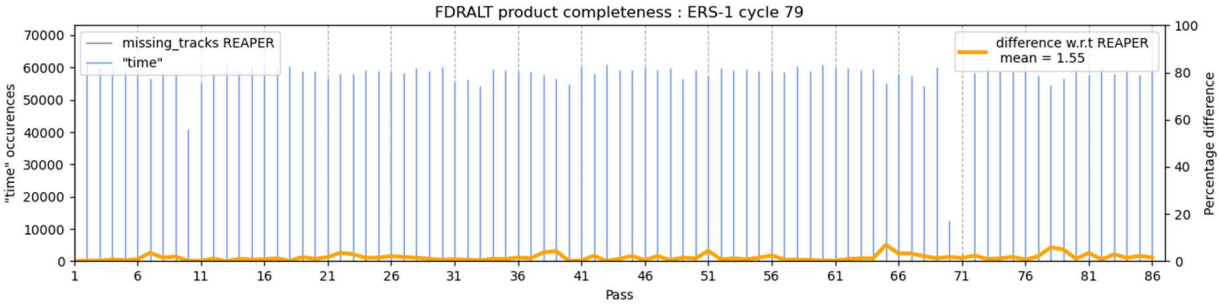

Figure 2-216 : Cycle 79

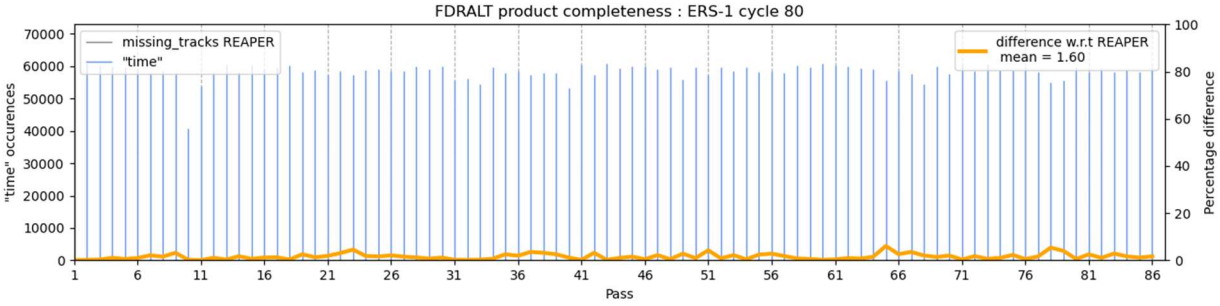

Figure 2-217 : Cycle 80

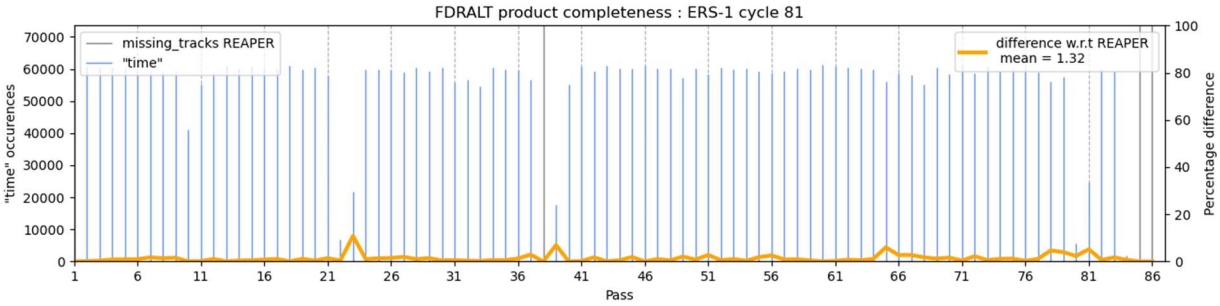

Figure 2-218 : Cycle 81

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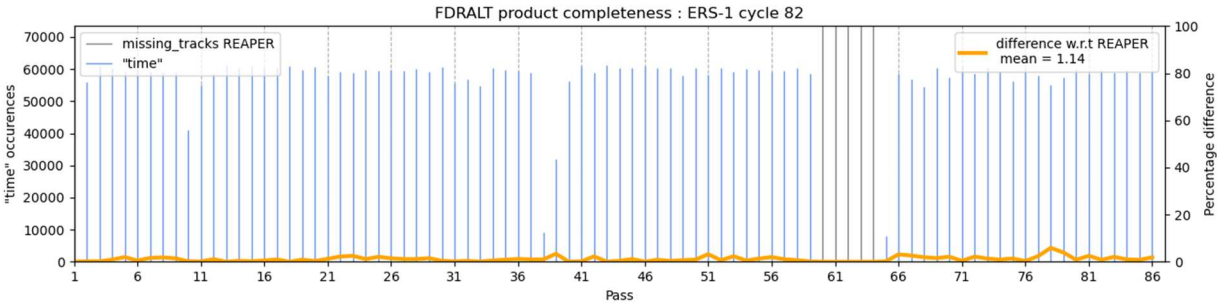

Figure 2-219 : Cycle 82

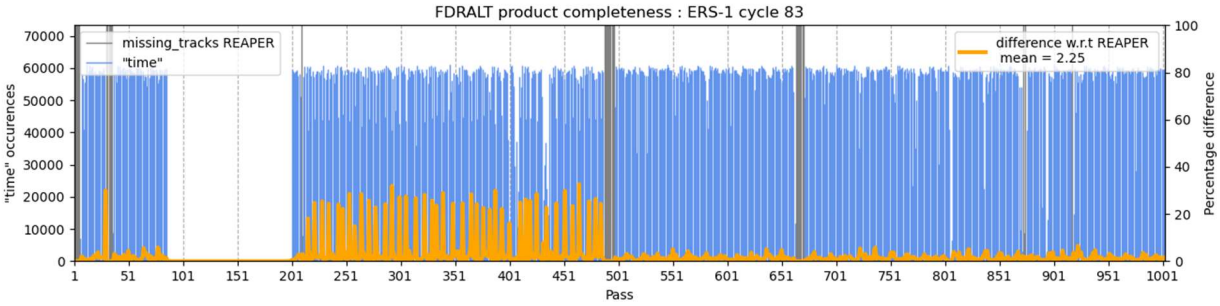

Figure 2-220 : Cycle 83

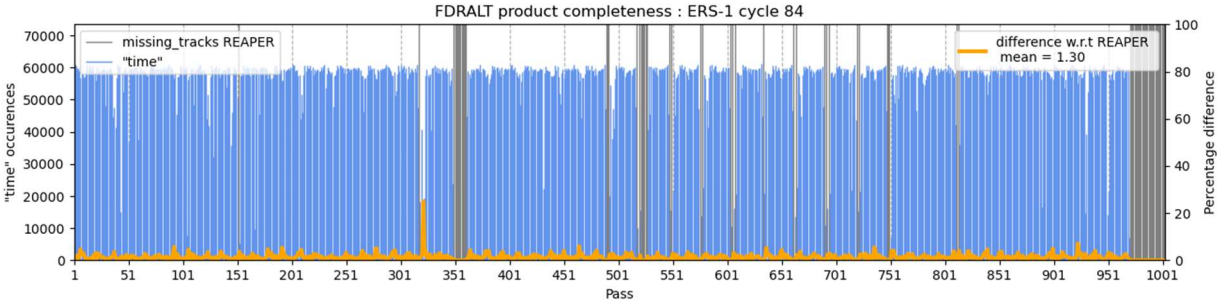

Figure 2-221 : Cycle 84

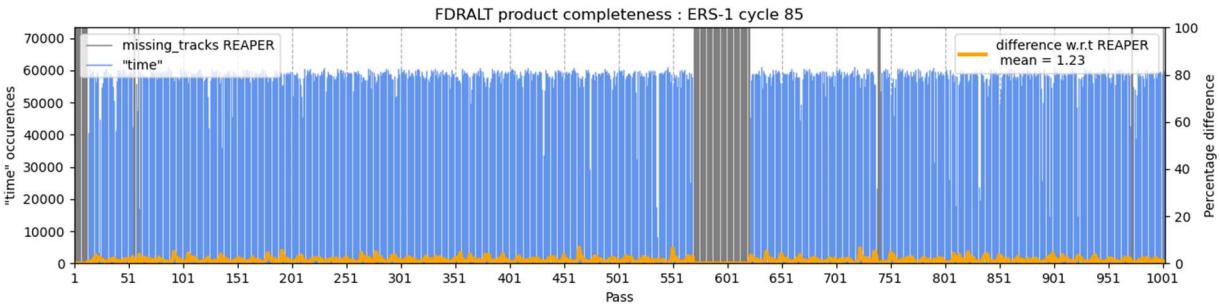

Figure 2-222 : Cycle 85

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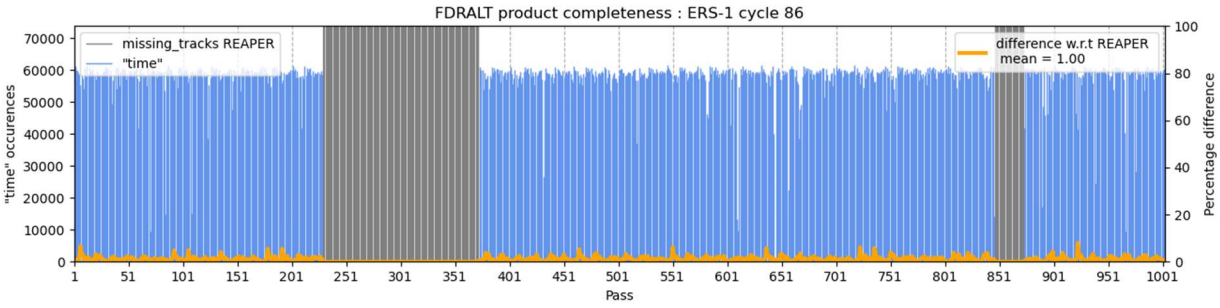

Figure 2-223 : Cycle 86

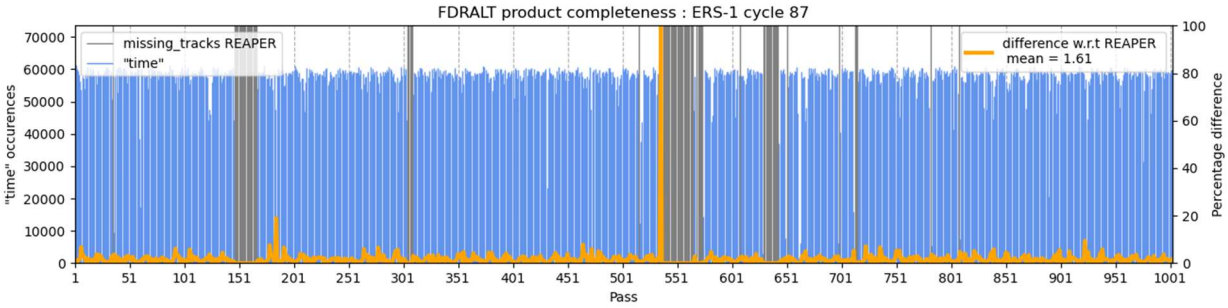

Figure 2-224 : Cycle 87

The orange peak in the graph above is due to the fact that the time vector of the REAPER product for track 535 of cycle 87 contains only 38 points, compared with 0 points for the FDRALT product, representing a difference of 100% between the two products.

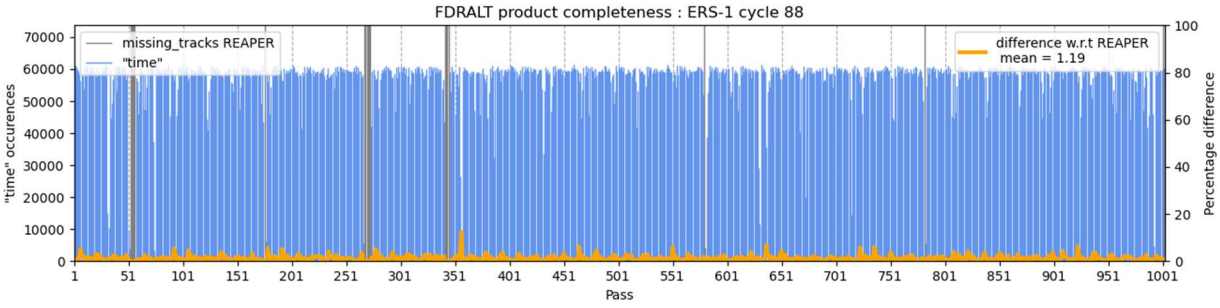

Figure 2-225 : Cycle 88

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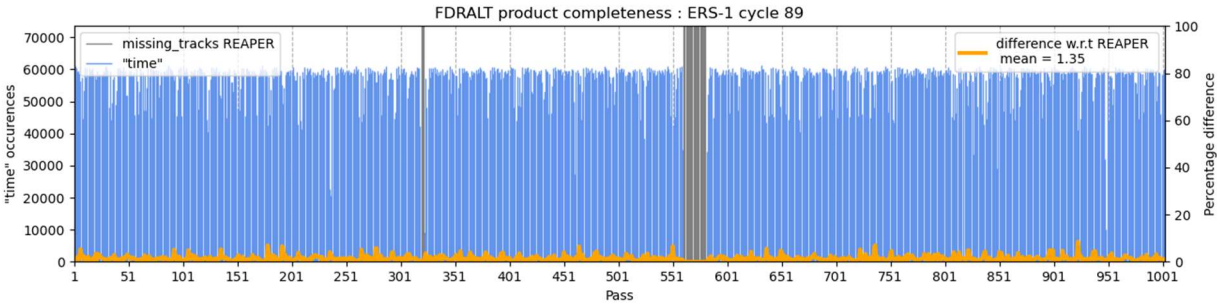

Figure 2-226 : Cycle 89

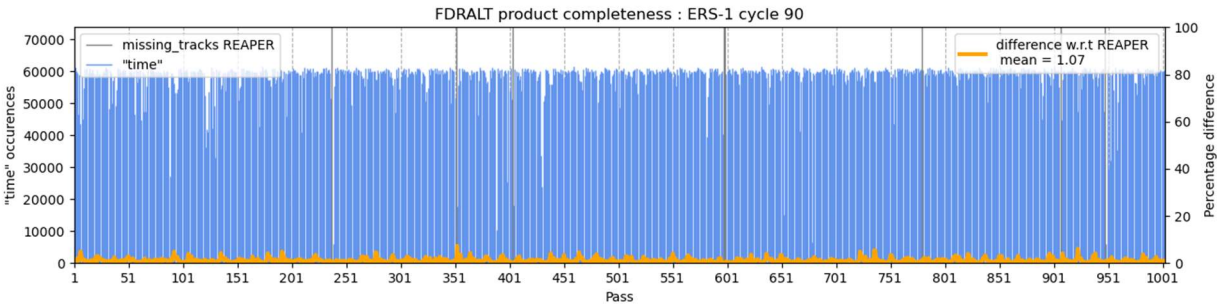

Figure 2-227 : Cycle 90

2.3.3 1993

2.3.3.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1993 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.
- Change of orbit phase occurred after cycle 100 according to Table 2-13.

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ERS-1 year 1993			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
90	8	8	238, 352, 404, 598, 599, 780, 907, 948
91	24	24	199, 236, 285, 371, 392, 393, 436, 457, 522, 635, 636, 657, 688, 689, 718, 743, 780, 829, 877, 918, 939, 980, 1001, 1002
92	11	11	1, 6, 116, 331, 376, 913, 963, 996-999
93	54	54	6, 518, 877-905, 925-929, 944-961
94	0	0	
95	3	3	503, 872, 873
96	14	14	67-77, 266, 318, 961
97	17	17	266, 531-576
98	19	19	290-303, 395, 589, 821-823
99	7	7	473, 745, 746, 924-927
100	39	39	79, 324-327, 343, 591-595, 617-625, 666-673, 792, 794-797, 877-881, 911, 912
101	2	2	96, 97
102	0	0	
103	0	0	
104	0	0	
105	0	0	

Figure 2-228 : List of missing tracks for year 1993

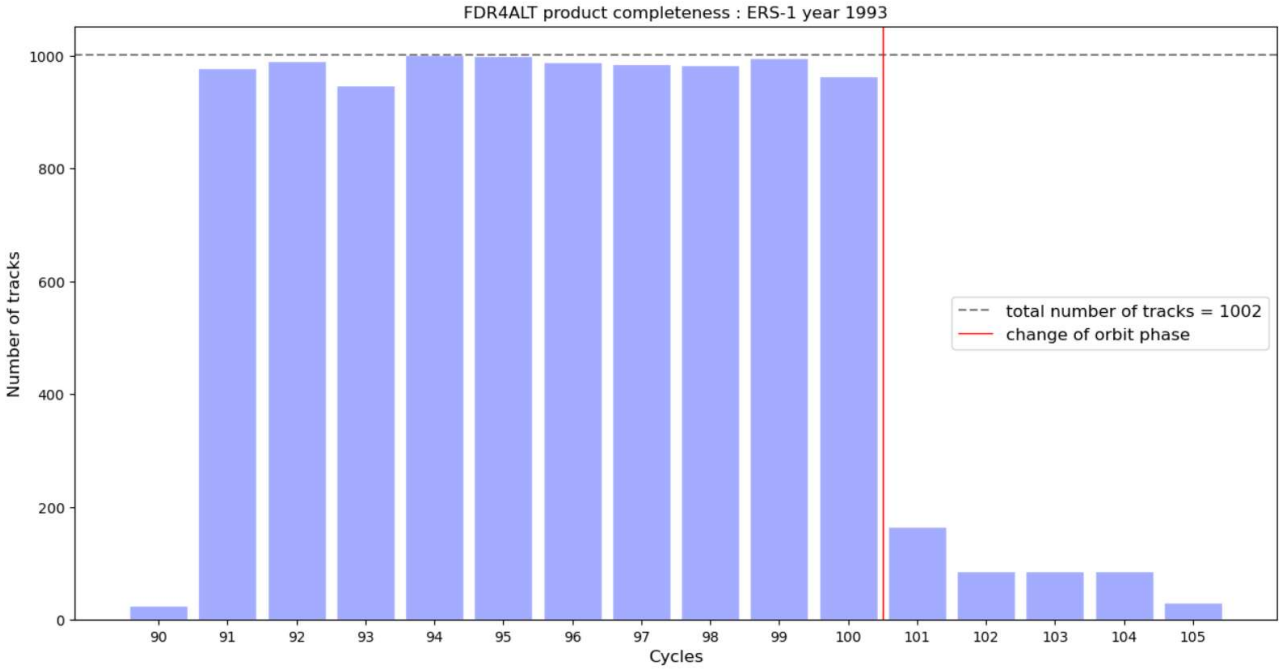

Figure 2-229 : Cyclic monitoring of the number of tracks completeness of year 1993

2.3.3.2 Cycle by cycle

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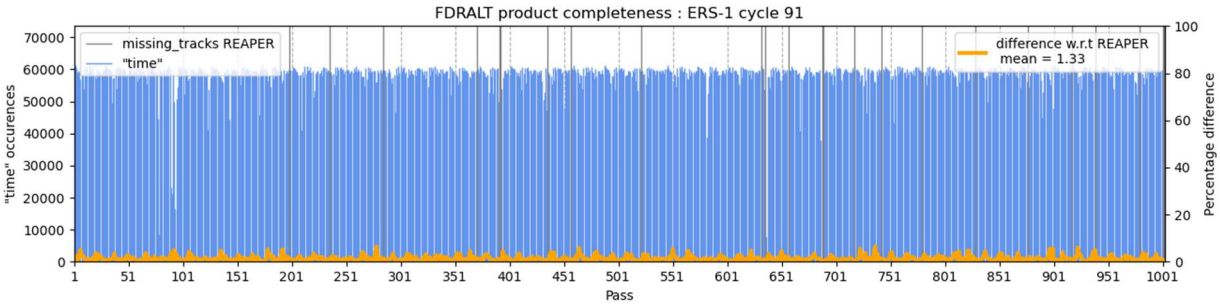

Figure 2-230 : Cycle 91

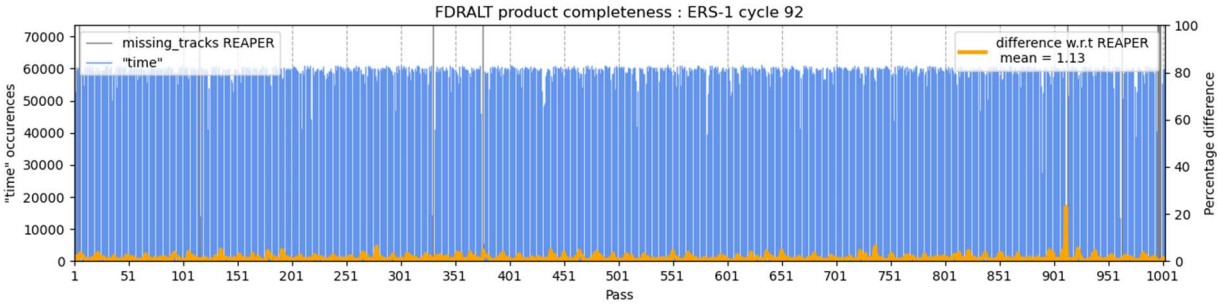

Figure 2-231 : Cycle 92

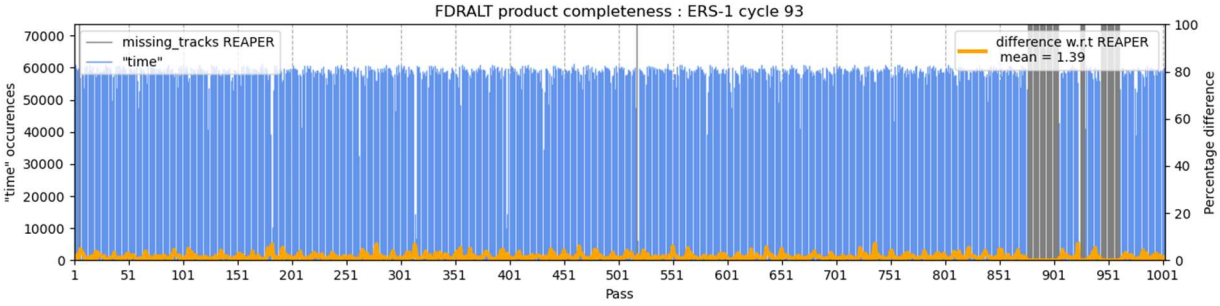

Figure 2-232 : Cycle 93

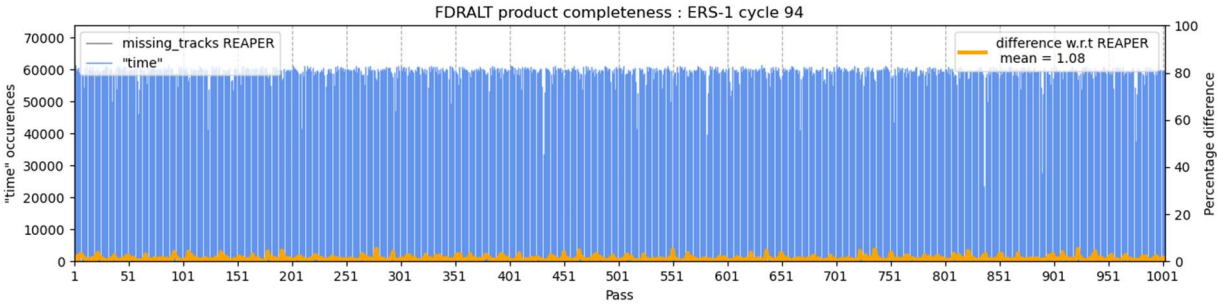

Figure 2-233 : Cycle 94

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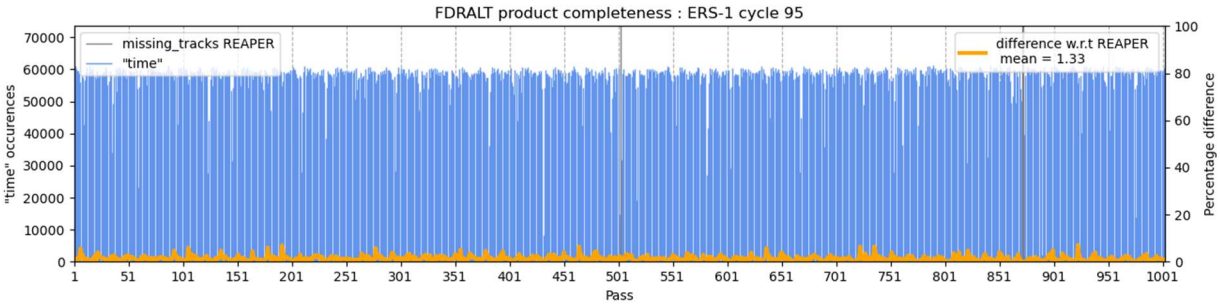

Figure 2-234 : Cycle 95

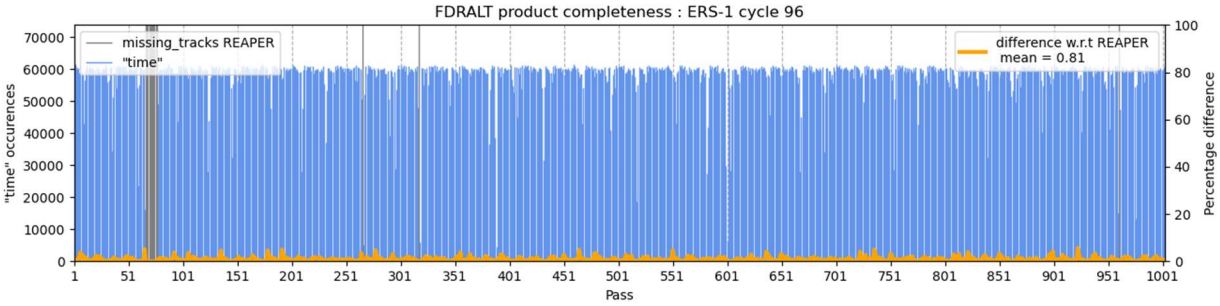

Figure 2-235 : Cycle 96

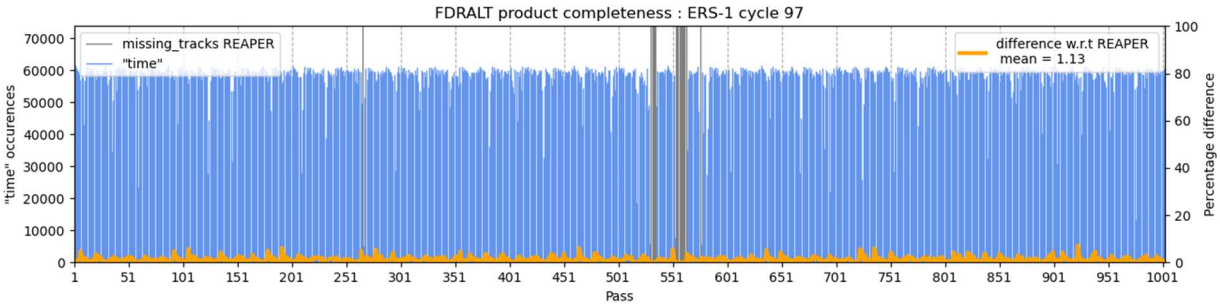

Figure 2-236 : Cycle 97

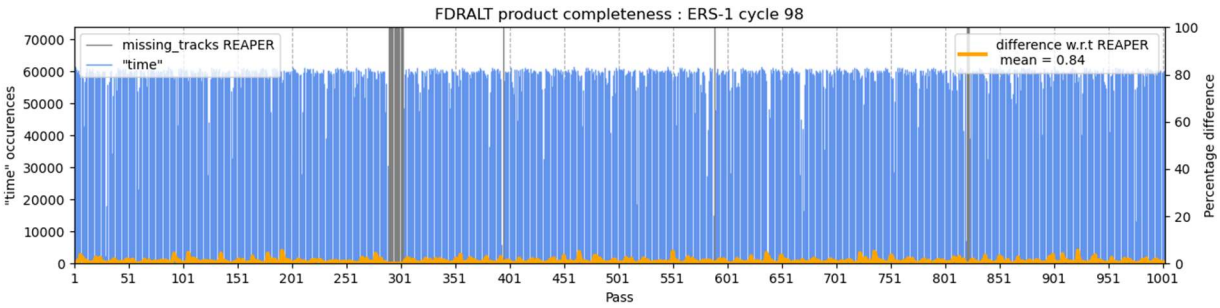

Figure 2-237 : Cycle 98

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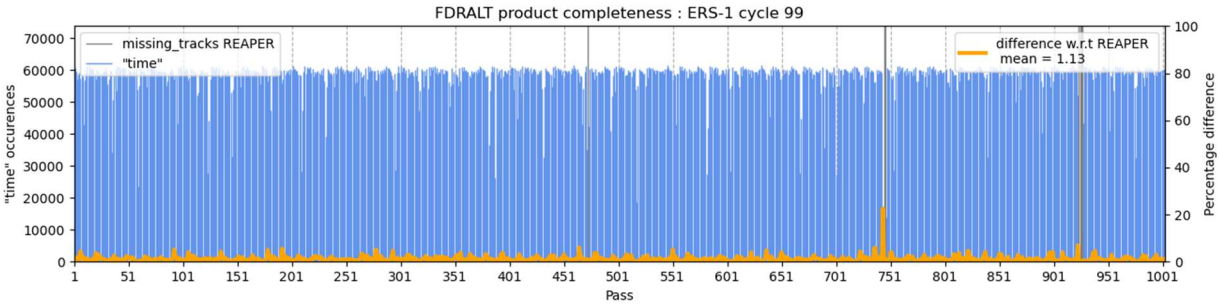

Figure 2-238 : Cycle 99

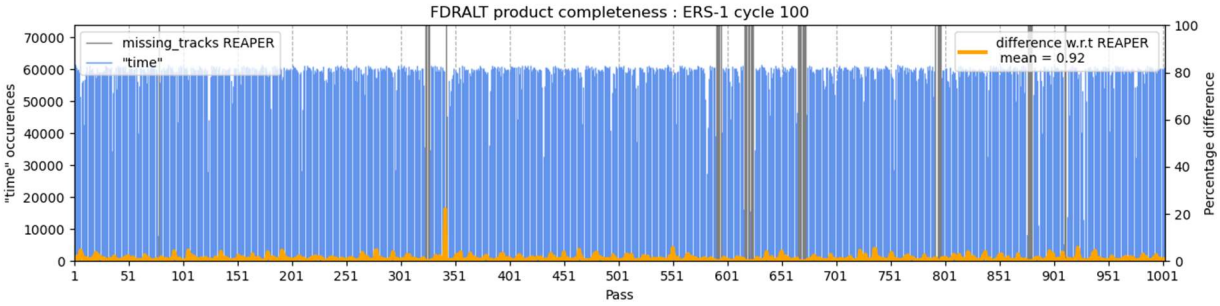

Figure 2-239 : Cycle 100

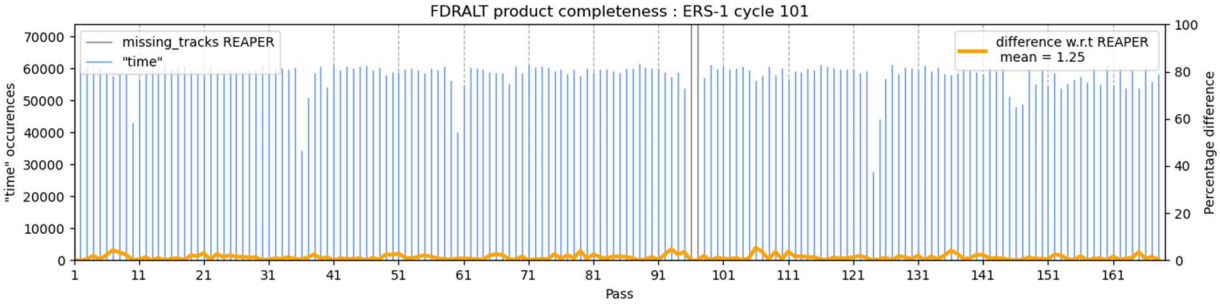

Figure 2-240 : Cycle 101

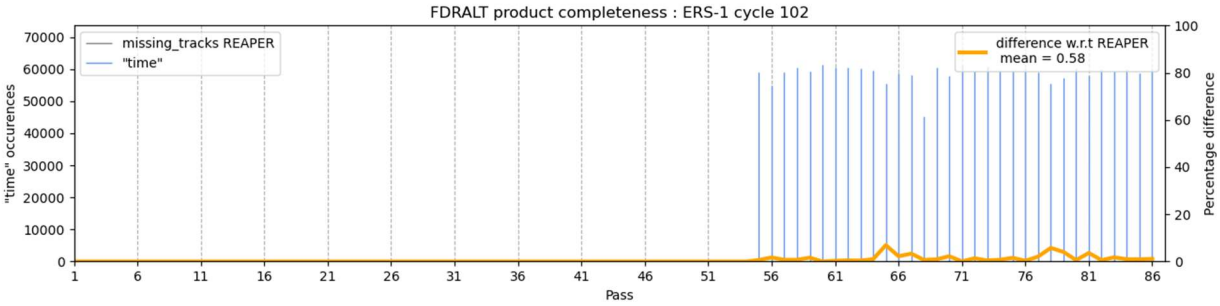

Figure 2-241 : Cycle 102

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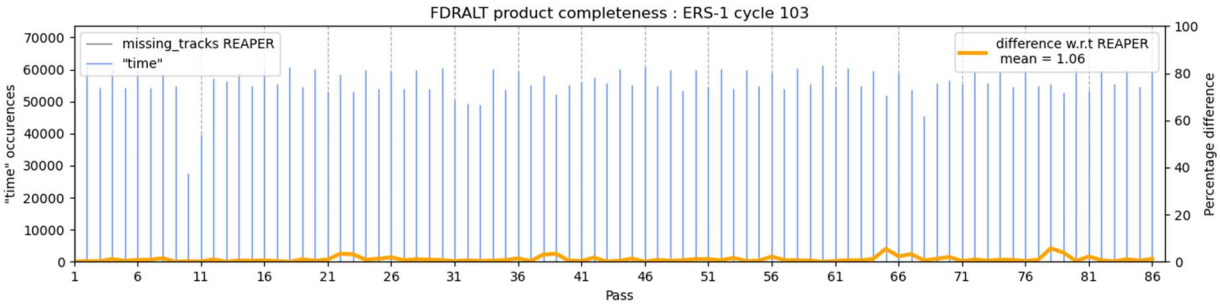

Figure 2-242 : Cycle 103

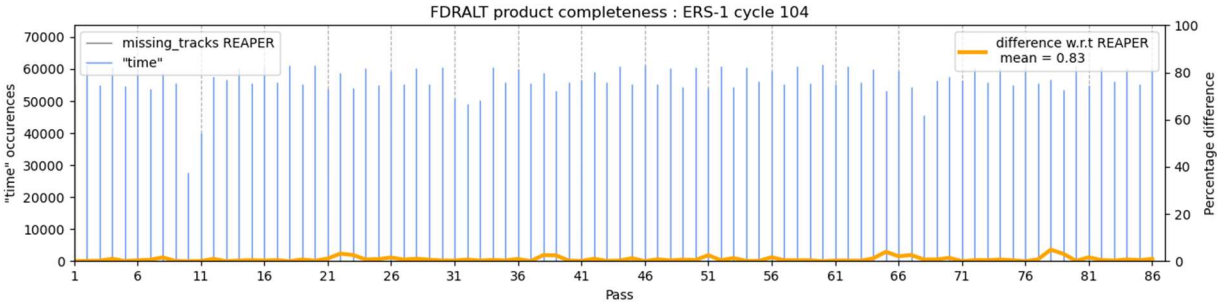

Figure 2-243 : Cycle 104

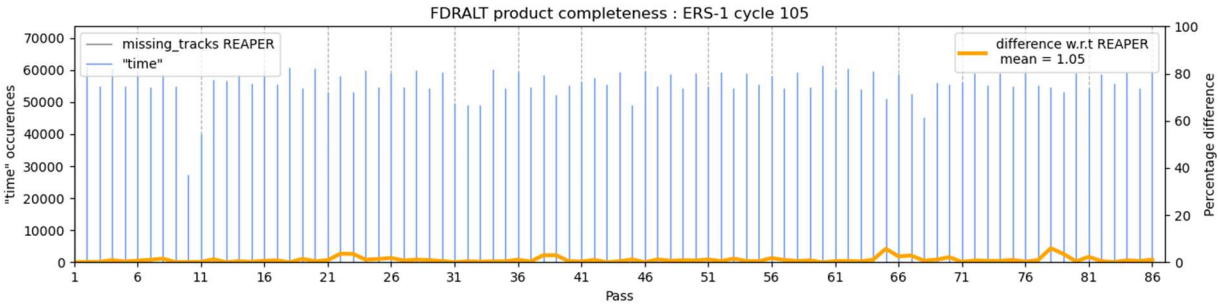

Figure 2-244 : Cycle 105

2.3.4 1994

2.3.4.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1994 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.
- Change of orbit phase occurred after cycle 138 according to Table 2-13.

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ERS-1 year 1994			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
105	0	0	
106	0	0	
107	0	0	
108	2	2	59, 60
109	0	0	
110	0	0	
111	0	0	
112	6	6	49-56
113	1	1	21
114	0	0	
115	19	19	1--19
116	0	0	
117	1	1	49
118	1	1	160
119	0	0	
120	0	0	
121	0	0	
122	6	6	15-20
123	0	0	
124	0	0	
125	0	0	
126	0	0	
127	0	0	
128	1	1	62
129	0	0	
130	0	0	
131	0	0	
132	0	0	
133	25	25	6--30
134	0	0	
135	0	0	
136	0	0	
137	2	2	2, 71
138	0	0	
139	30	30	3809, 3822-3833, 3966, 4510-4519, 4559, 4624-4628
140	98	98	90-92, 352, 518, 576, 606, 719, 720, 728, 729, 748, 776, 805, 806, 834, 862, 891-894, 920, 948-950, 977, 978, 1006, 1034, 1063, 1064, 1092, 1120-1122, 1150, 1178, 1206-1208, 1236, 1264, 1572, 1573, 1597-1610, 1649, 1752, 1769, 1782, 2270-2577, 3074, 3077-3087, 3113-3215, 3251-3255, 3594-3603, 3648
141	3	3	4787-4789
142	97	97	432, 851-853, 984, 1245-1257, 1913, 1920, 1921, 1923-1935, 1986, 2095, 2096, 2494, 2497, 3078, 3291-3293, 3546, 3547, 3562, 3564, 3566, 3592, 3594, 3622, 4210-4237, 4536, 4565-4577, 4581, 4746, 4747

Figure 2-245 : List of missing tracks for year 1994

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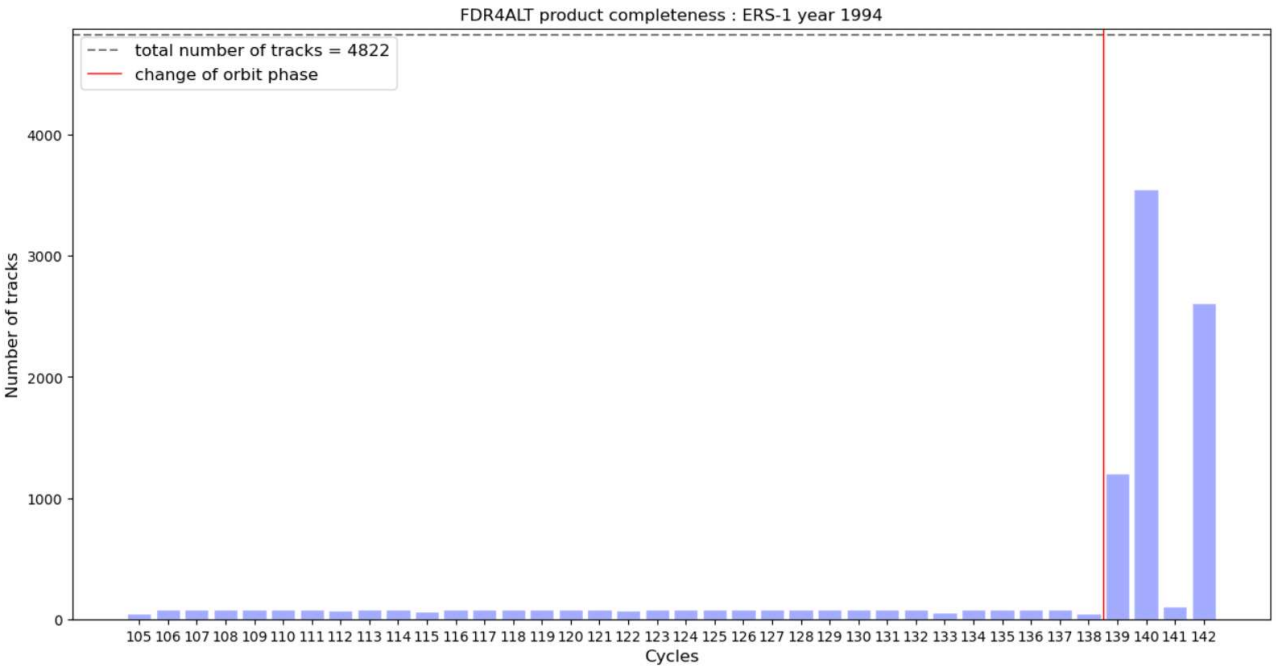

Figure 2-246 : Cyclic monitoring of the number of tracks completeness of year 1994

2.3.4.2 Cycle by cycle

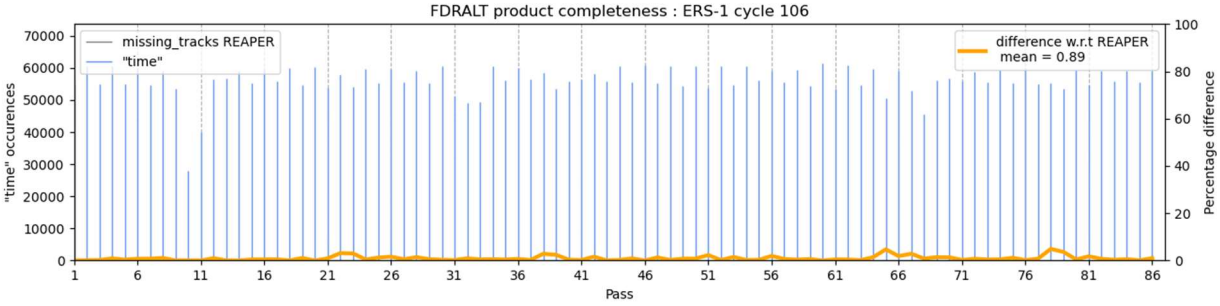

Figure 2-247 : Cycle 106

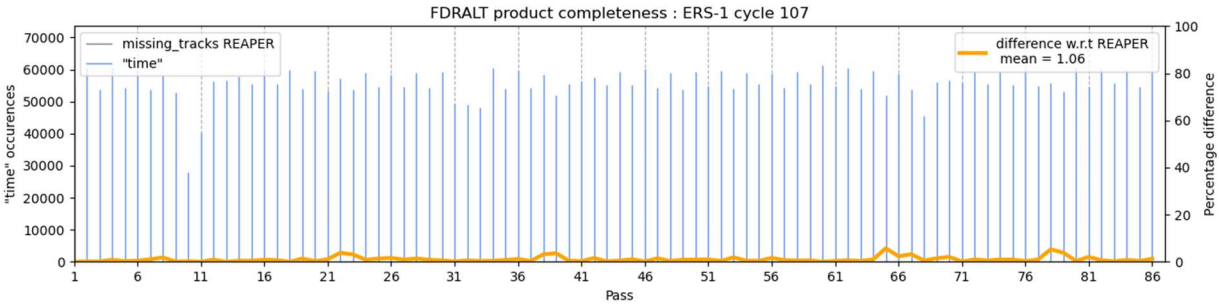

Figure 2-248 : Cycle 107

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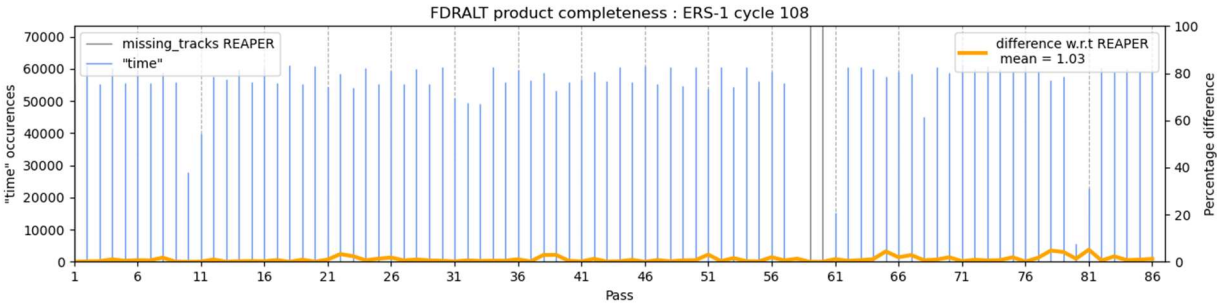

Figure 2-249 : Cycle 108

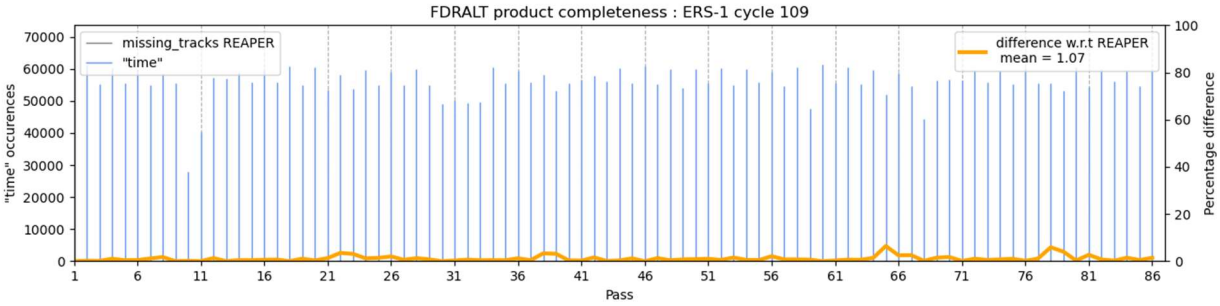

Figure 2-250 : Cycle 109

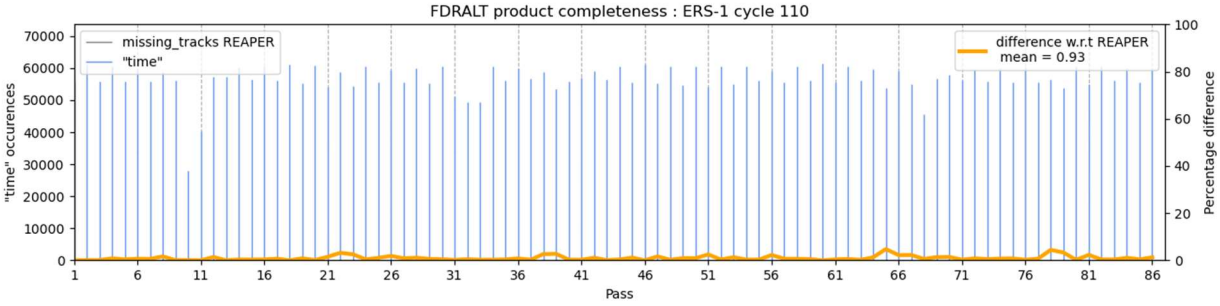

Figure 2-251 : Cycle 110

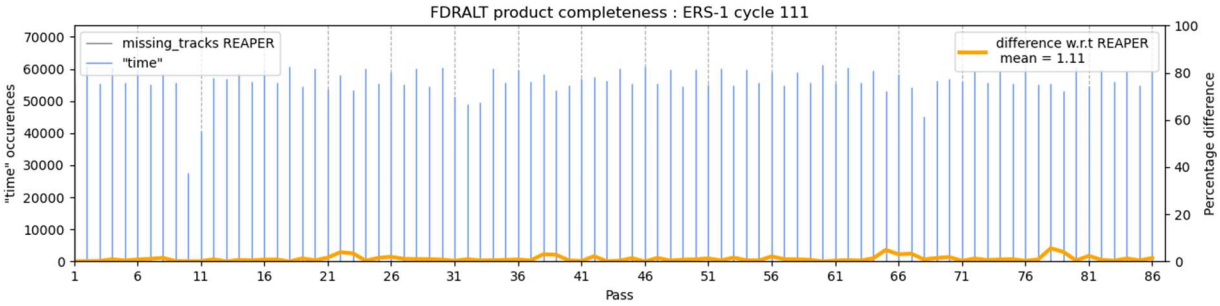

Figure 2-252 : Cycle 111

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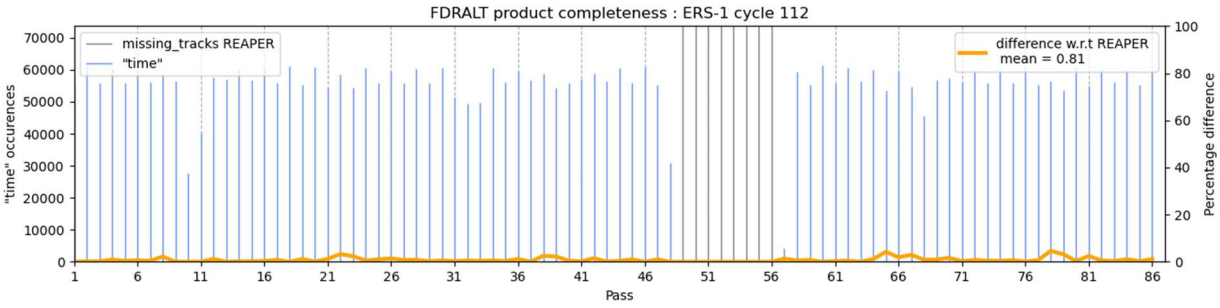

Figure 2-253 : Cycle 112

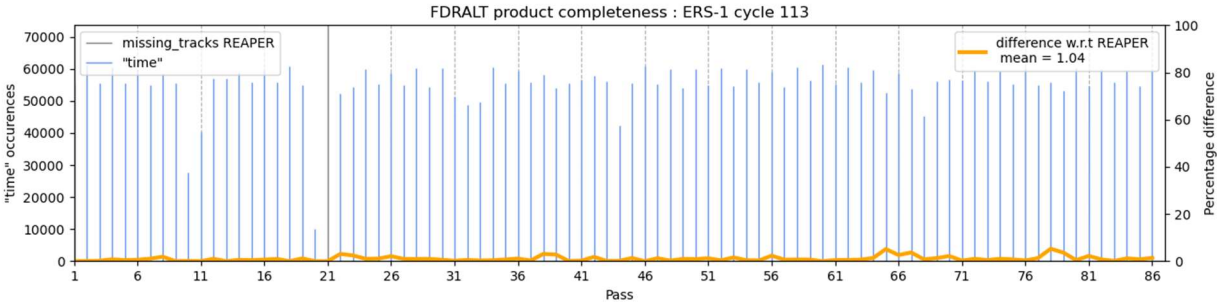

Figure 2-254 : Cycle 113

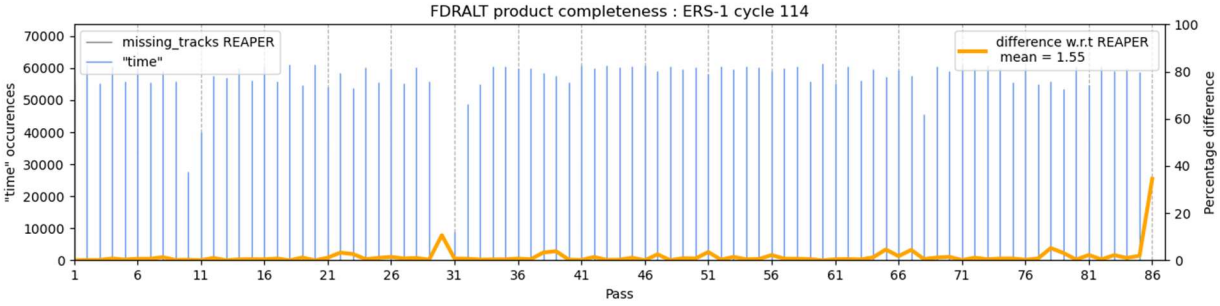

Figure 2-255 : Cycle 114

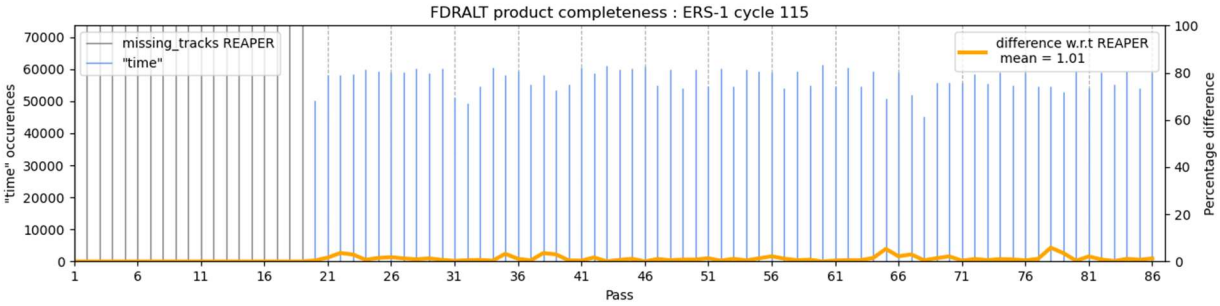

Figure 2-256 : Cycle 115

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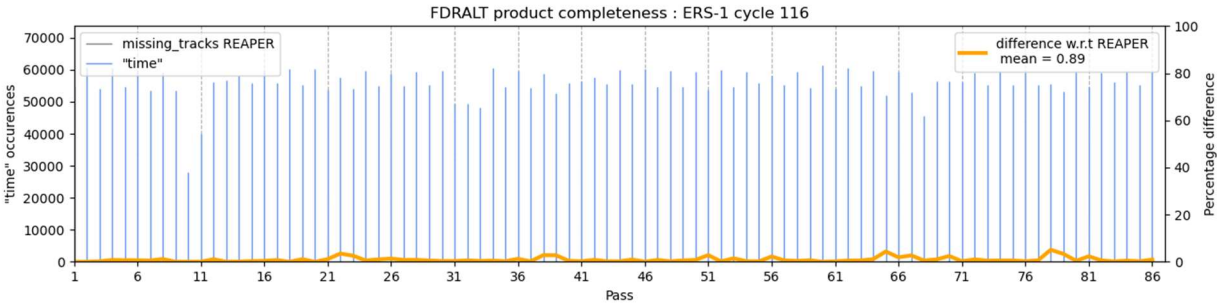

Figure 2-257 : Cycle 116

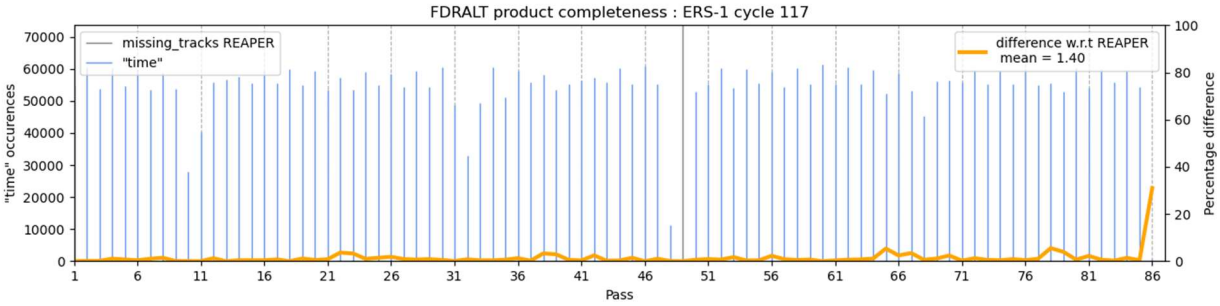

Figure 2-258 : Cycle 117

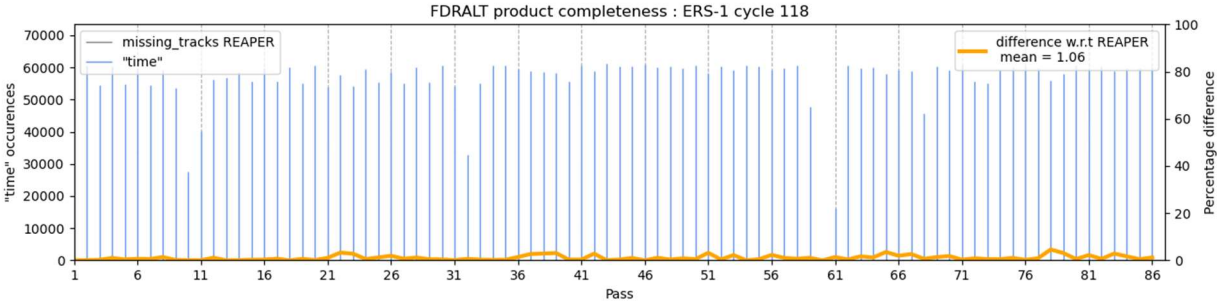

Figure 2-259 : Cycle 118

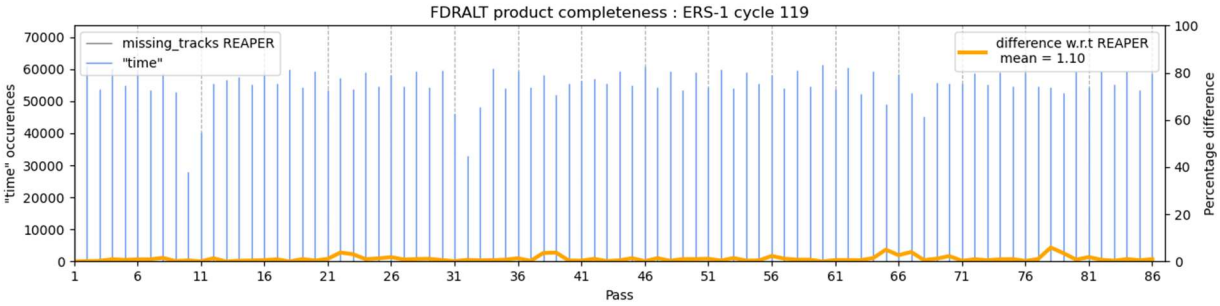

Figure 2-260 : Cycle 119

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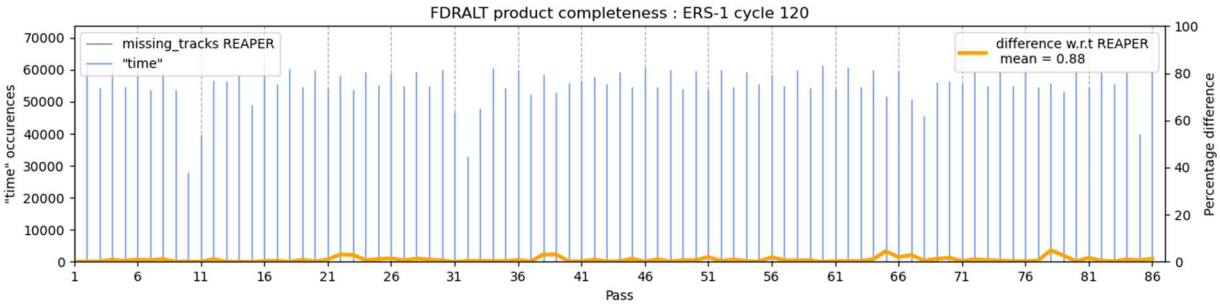

Figure 2-261 : Cycle 120

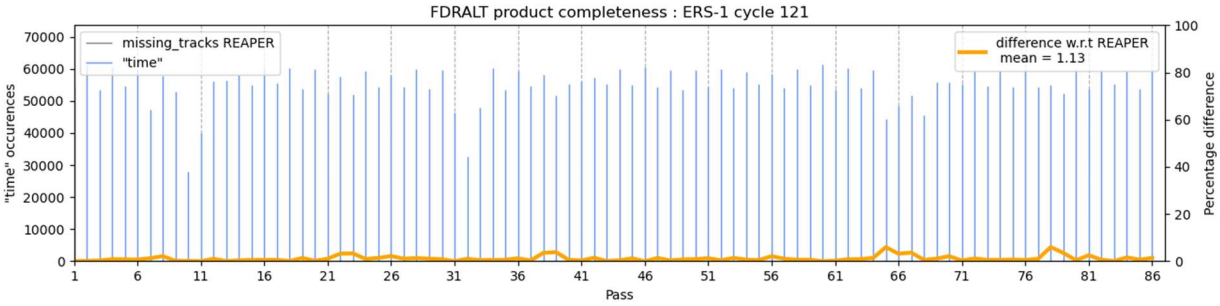

Figure 2-262 : Cycle 121

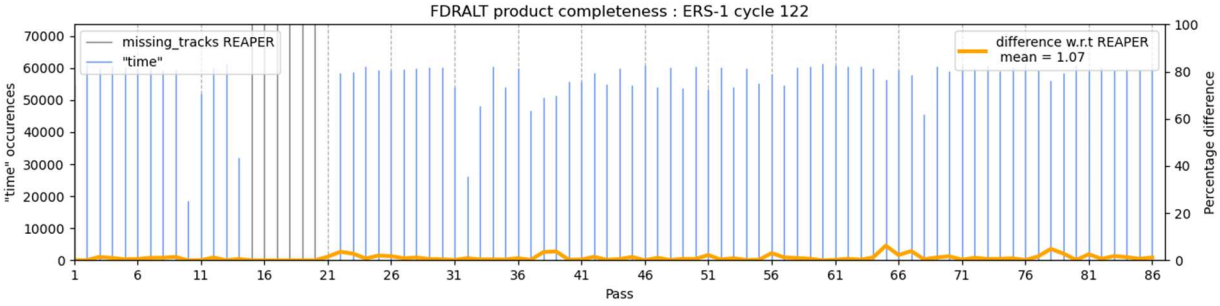

Figure 2-263 : Cycle 122

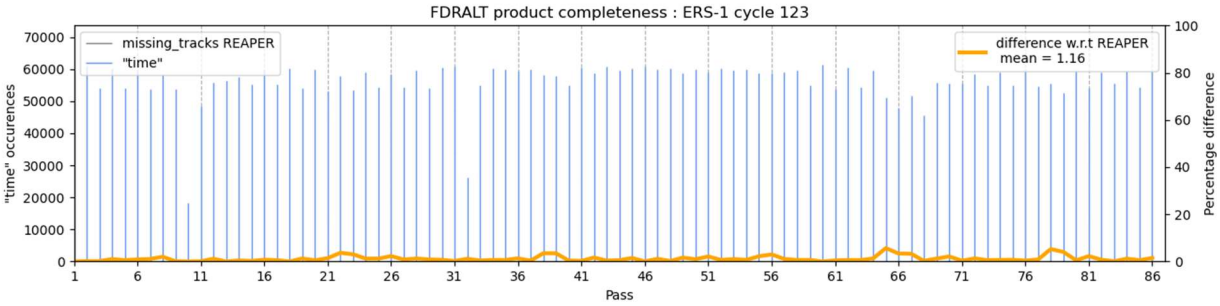

Figure 2-264 : Cycle 123

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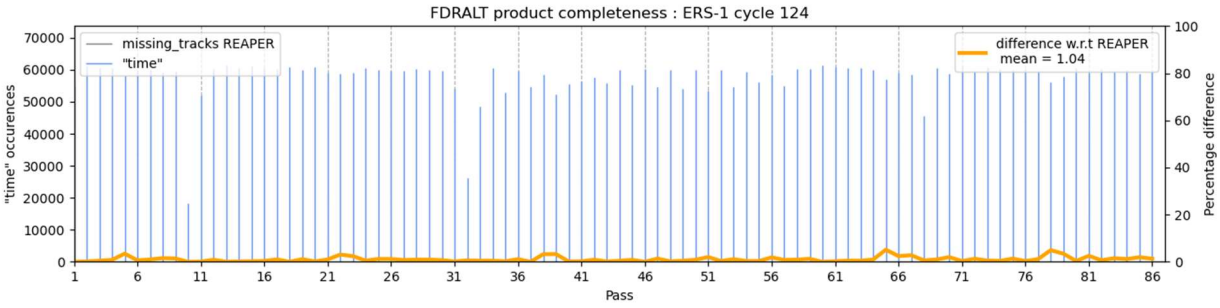

Figure 2-265 : Cycle 124

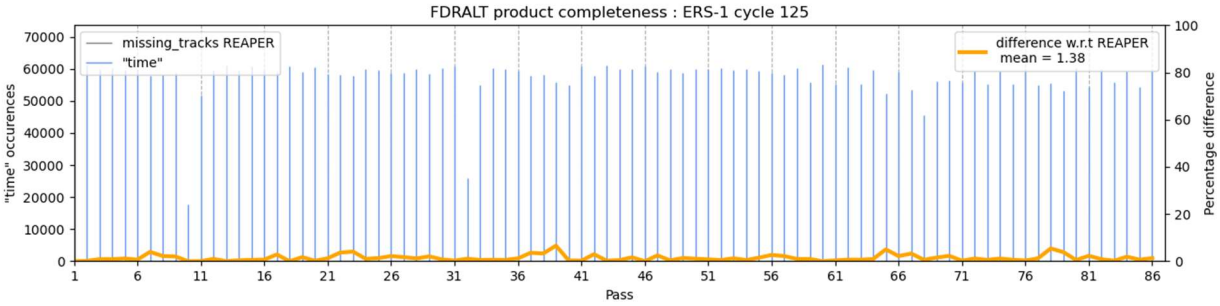

Figure 2-266 : Cycle 125

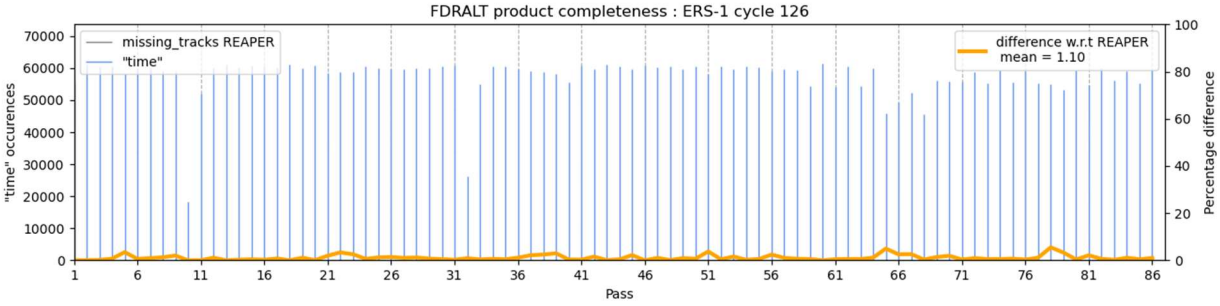

Figure 2-267 : Cycle 126

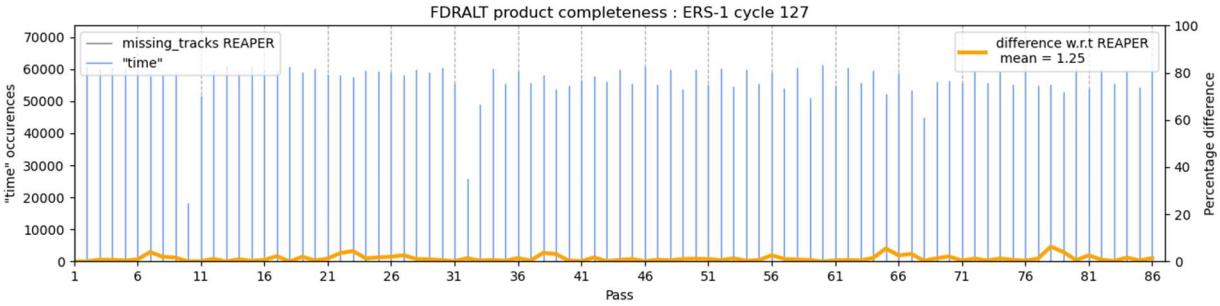

Figure 2-268 : Cycle 127

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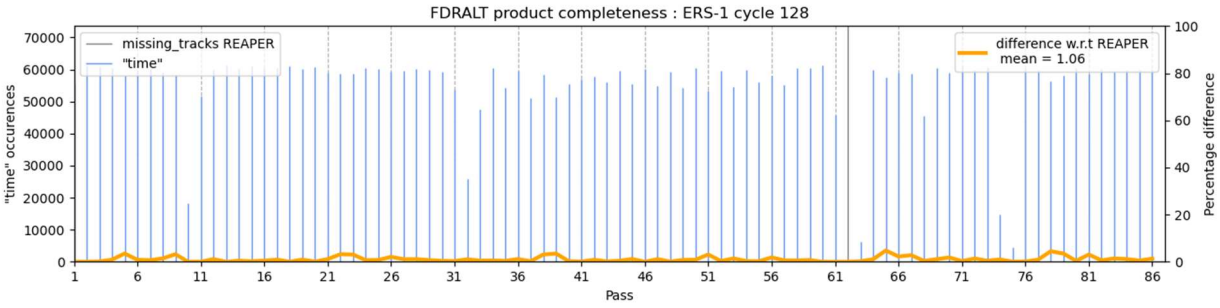

Figure 2-269 : Cycle 128

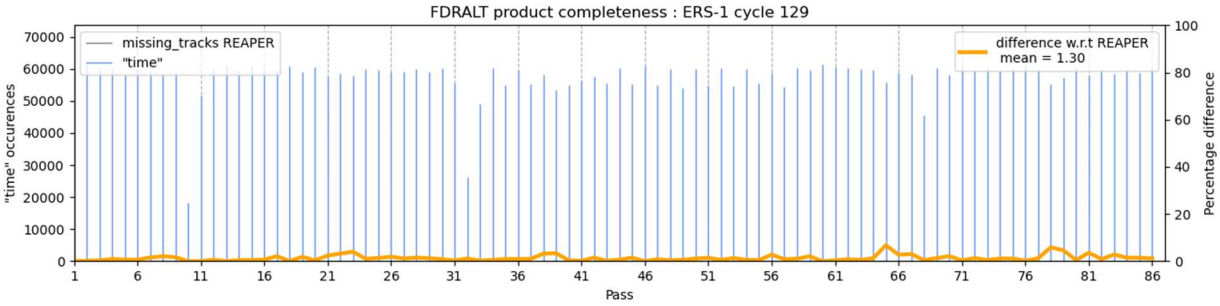

Figure 2-270 : Cycle 129

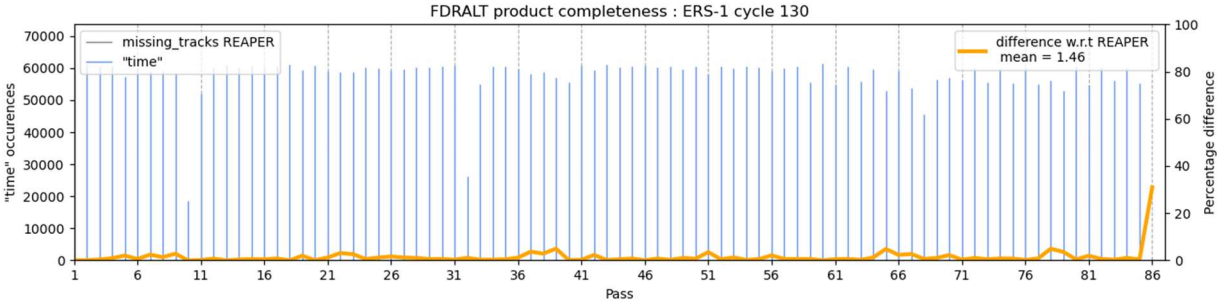

Figure 2-271 : Cycle 130

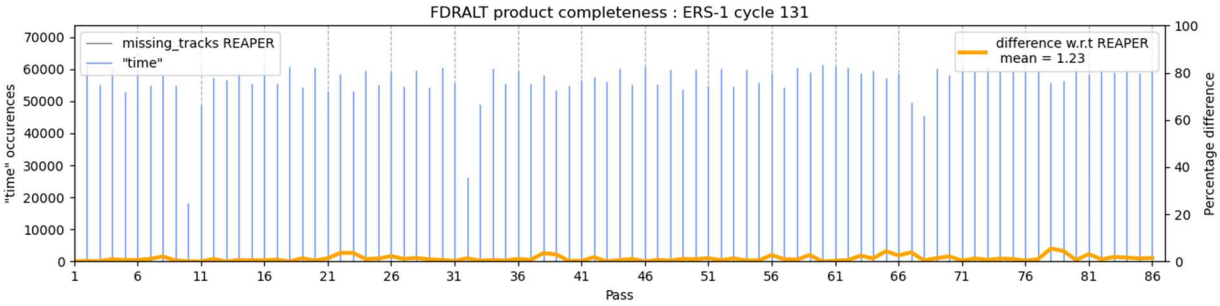

Figure 2-272 : Cycle 131

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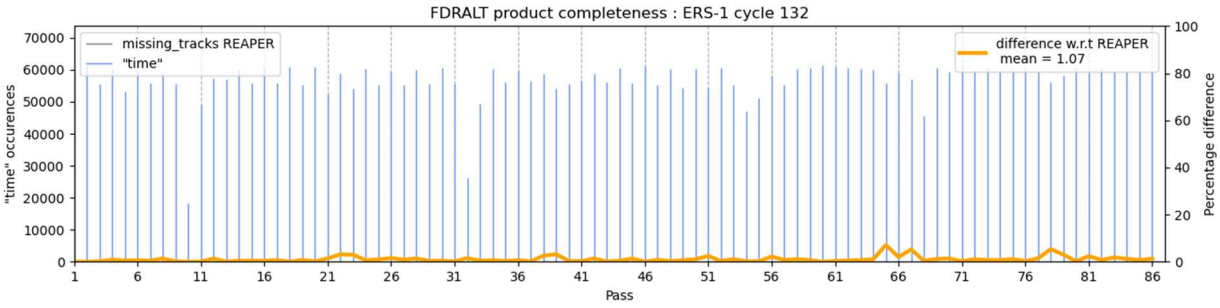

Figure 2-273 : Cycle 132

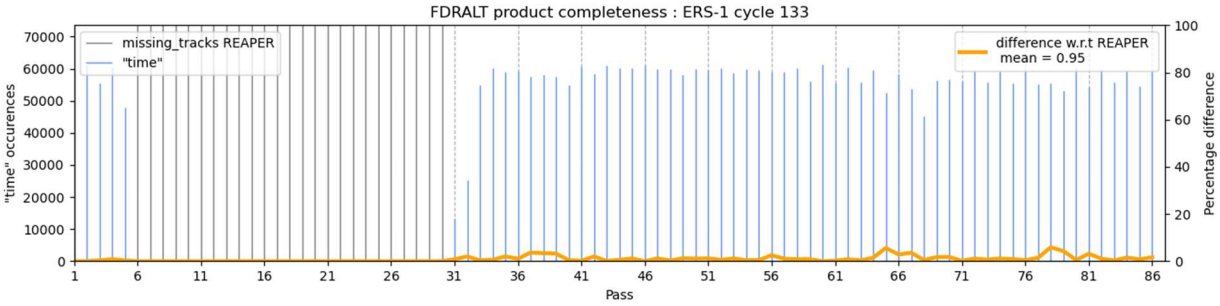

Figure 2-274 : Cycle 133

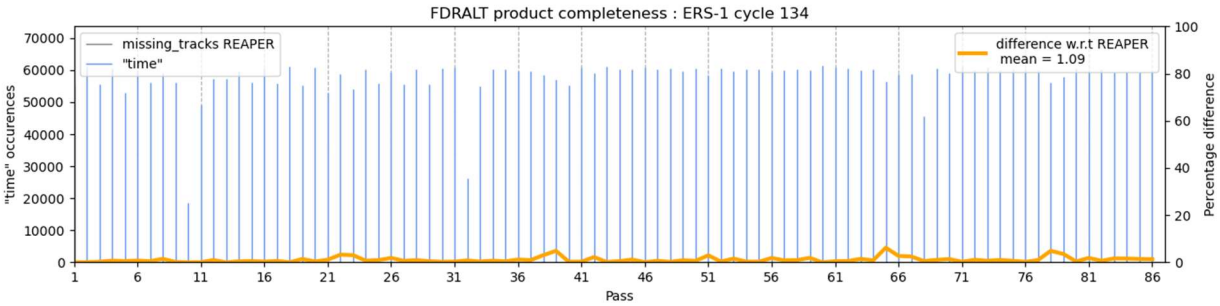

Figure 2-275 : Cycle 134

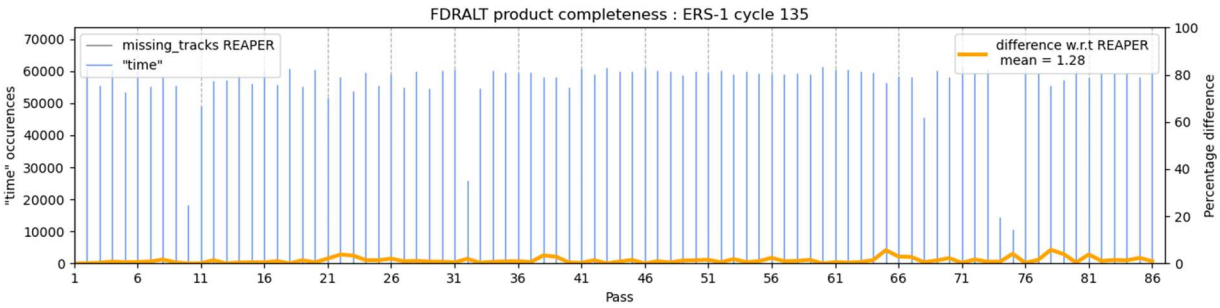

Figure 2-276 : Cycle 135

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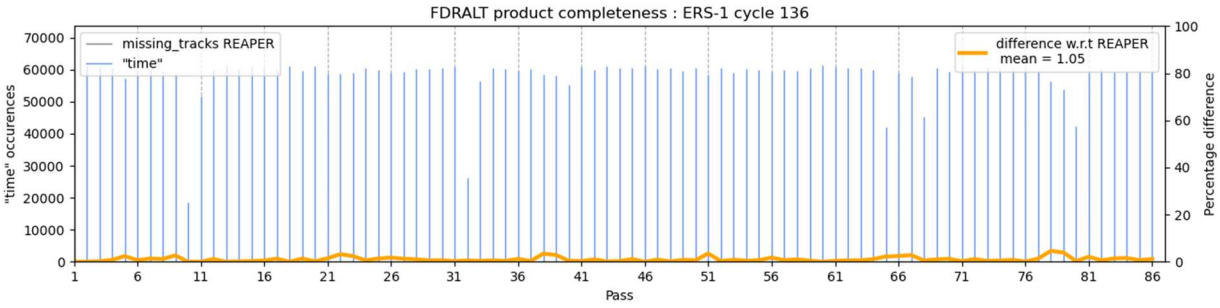

Figure 2-277 : Cycle 136

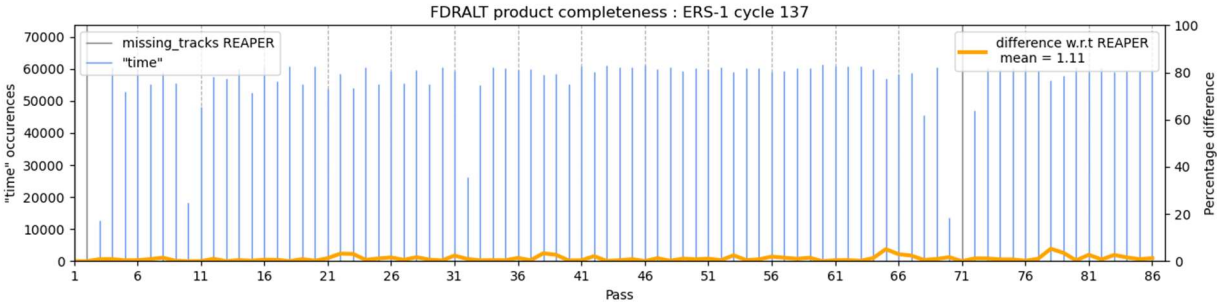

Figure 2-278 : Cycle 137

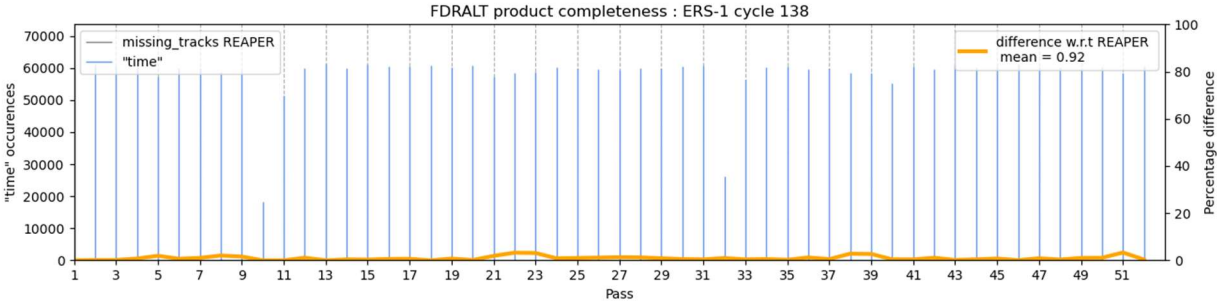

Figure 2-279 : Cycle 138

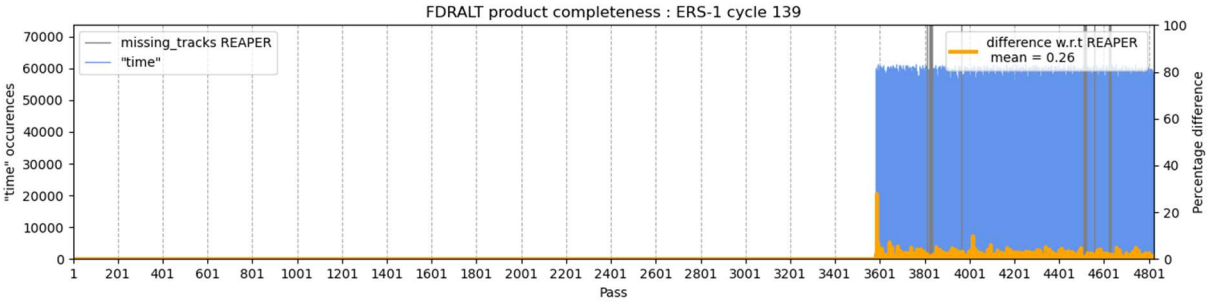

Figure 2-280 : Cycle 139

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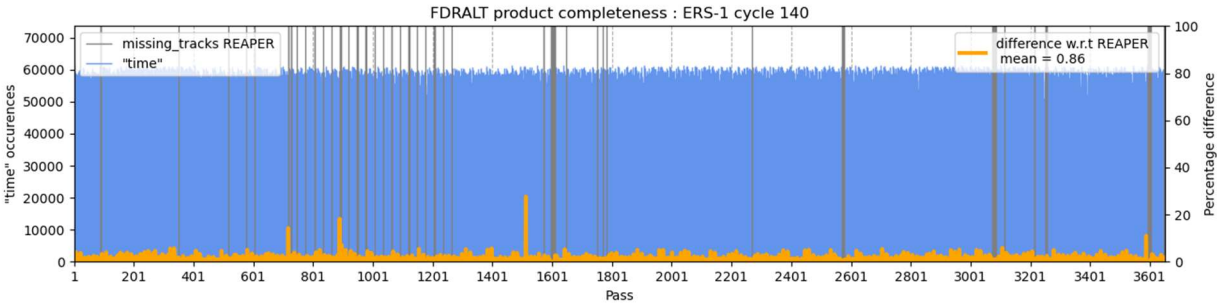

Figure 2-281 : Cycle 140

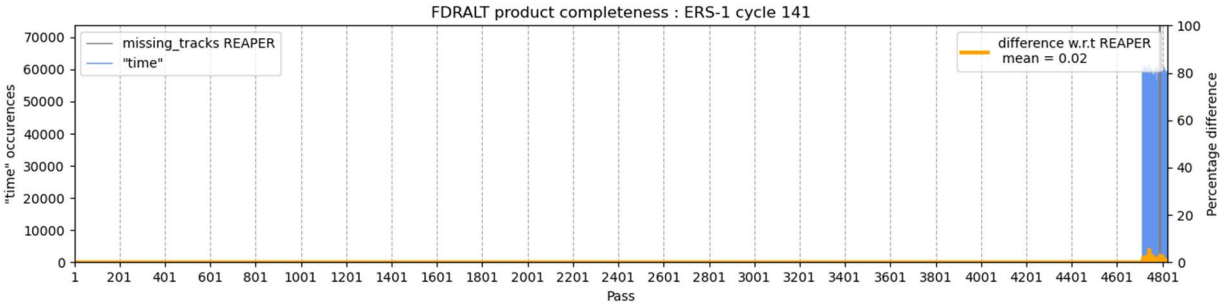

Figure 2-282 : Cycle 141

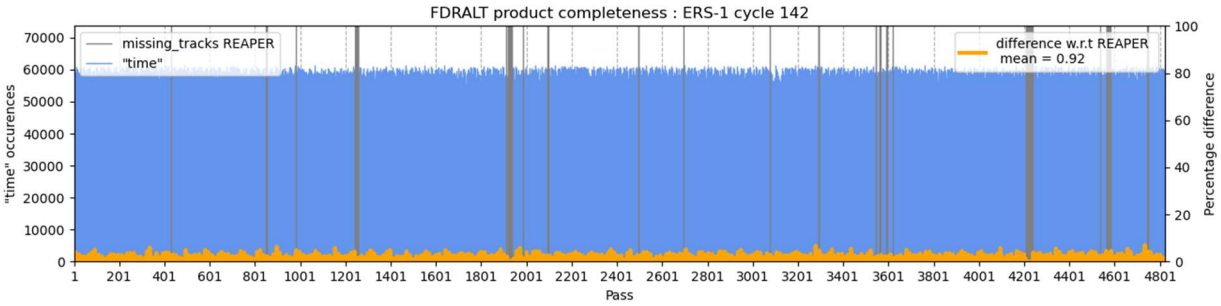

Figure 2-283 : Cycle 142

2.3.5 1995

2.3.5.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1995 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.
- Change of orbit phase occurred after cycle 142 according to Table 2-13.

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ERS-1 year 1995			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
142	97	97	432, 851-853, 984, 1245-1257, 1913, 1920, 1921, 1923-1935, 1986, 2095, 2096, 2494, 2497, 3078, 3291-3293, 3546, 3547, 3562, 3564, 3566, 3592, 3594, 3622, 4210-4237, 4536, 4565-4577, 4581, 4746, 4747
143	0	0	
144	13	13	445-457
145	184	184	253-255, 296-303, 345-402, 432-488, 518-570, 572-574, 658, 881
146	45	45	365, 479-483, 546, 946-973, 991-999, 1002
147	67	67	1-45, 77-81, 346-355, 546, 657, 793-795, 857, 952
148	25	25	71, 150, 195, 262-266, 428, 429, 436, 440, 441, 784-787, 978-985
149	1	1	606
150	5	5	316, 548-550, 987
151	9	9	68, 146-150, 174, 612, 613
152	7	7	103-105, 122, 680, 681, 980

Figure 2-284 : List of missing tracks for year 1995

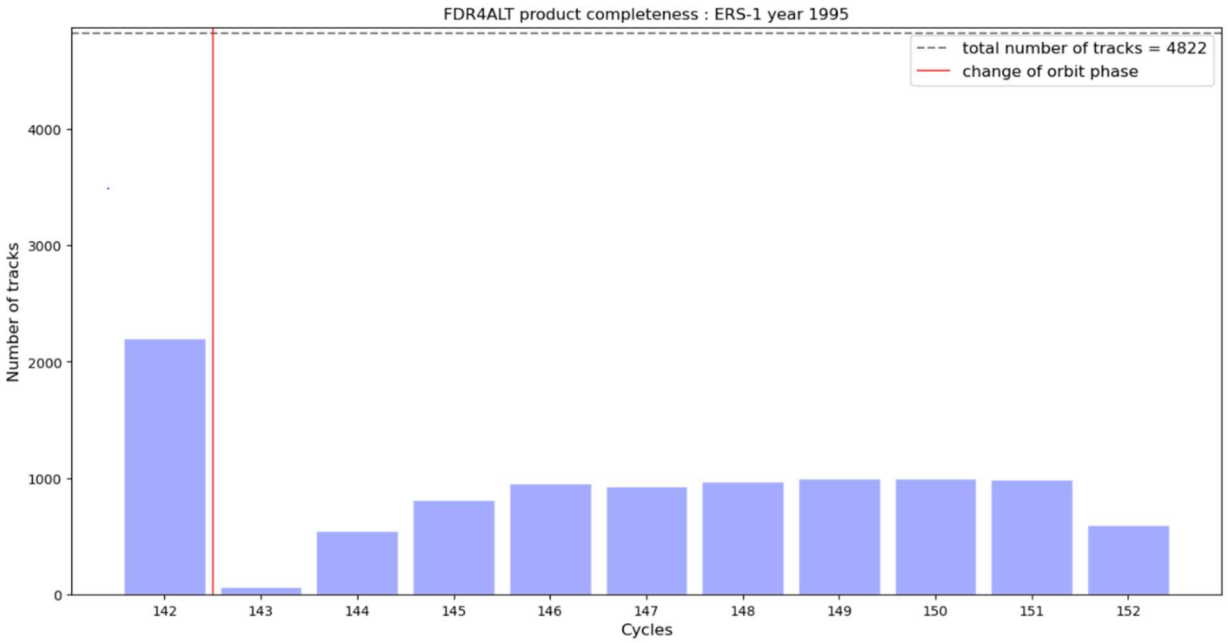

Figure 2-285 : Cyclic monitoring of the number of tracks completeness of year 1995

2.3.5.2 Cycle by cycle

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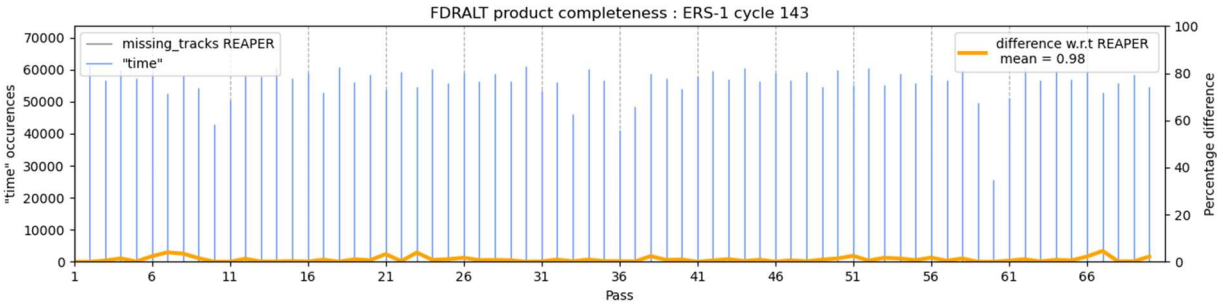

Figure 2-286 : Cycle 143

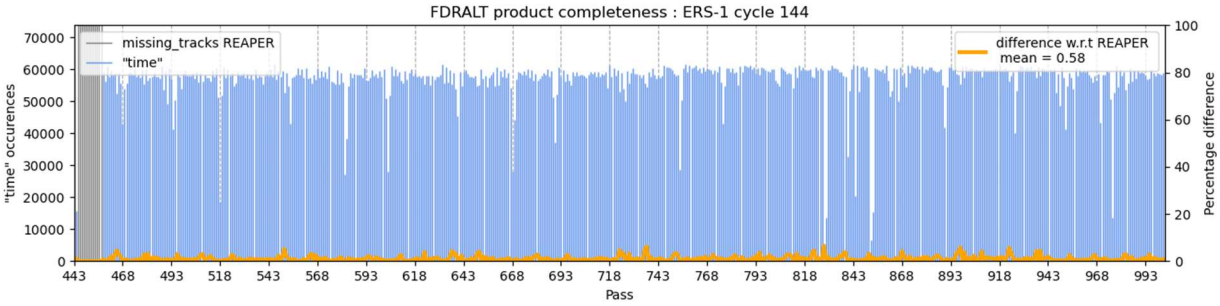

Figure 2-287 : Cycle 144

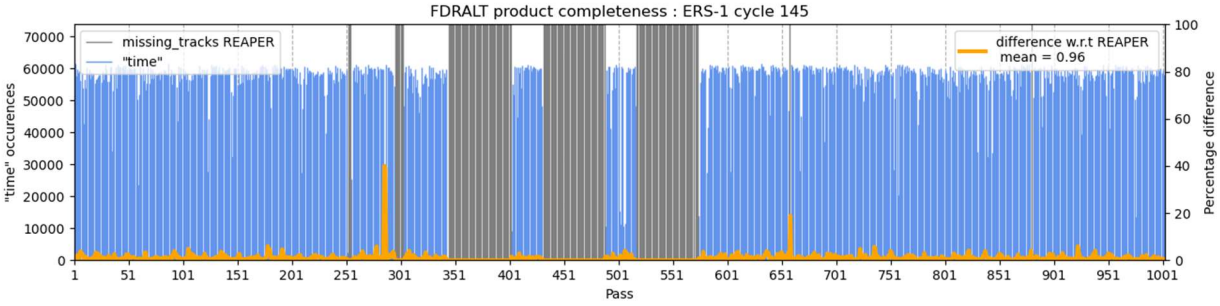

Figure 2-288 : Cycle 145

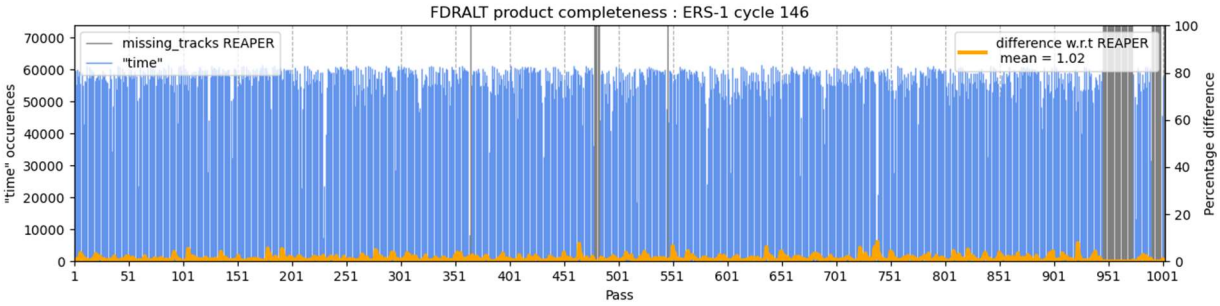

Figure 2-289 : Cycle 146

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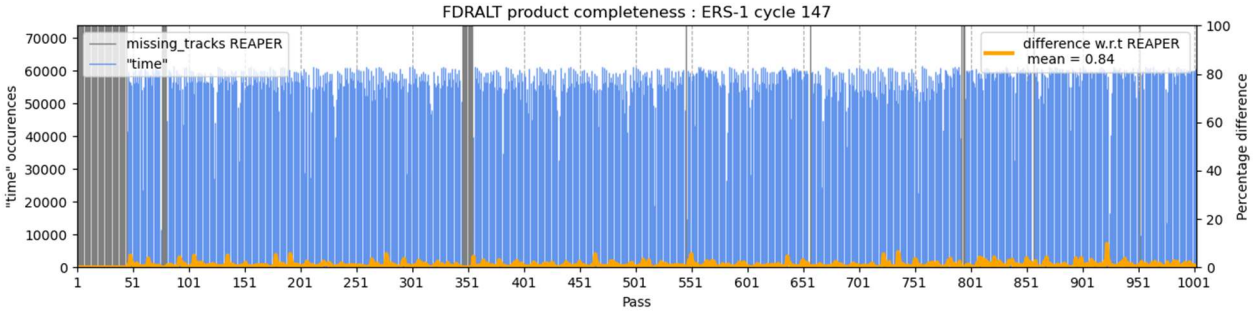

Figure 2-290 : Cycle 147

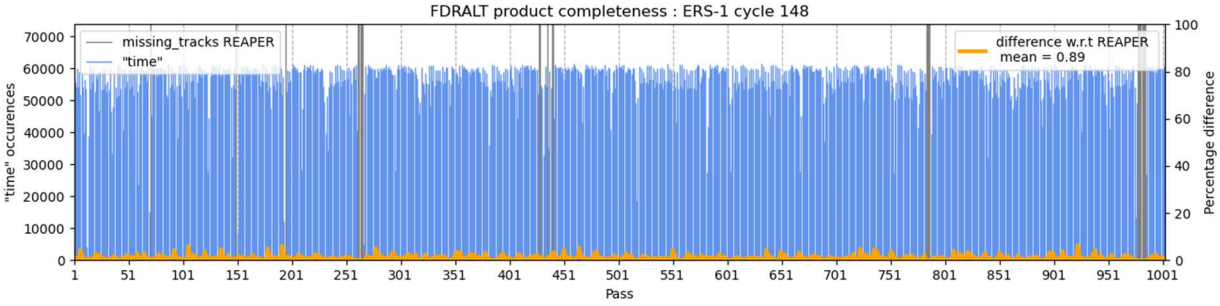

Figure 2-291 : Cycle 148

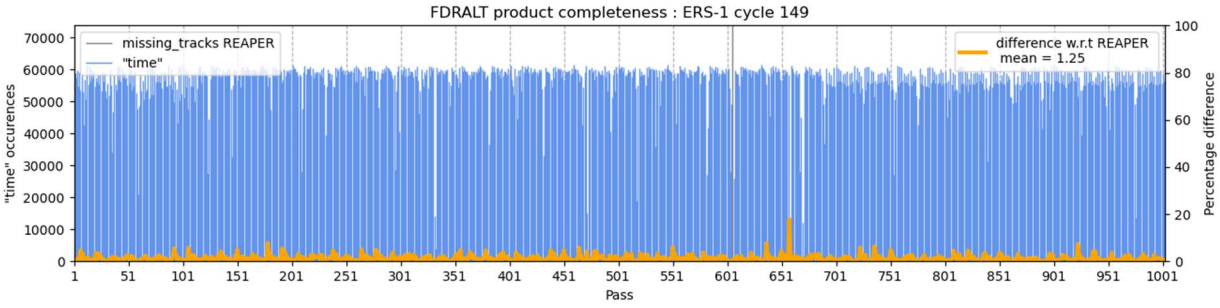

Figure 2-292 : Cycle 149

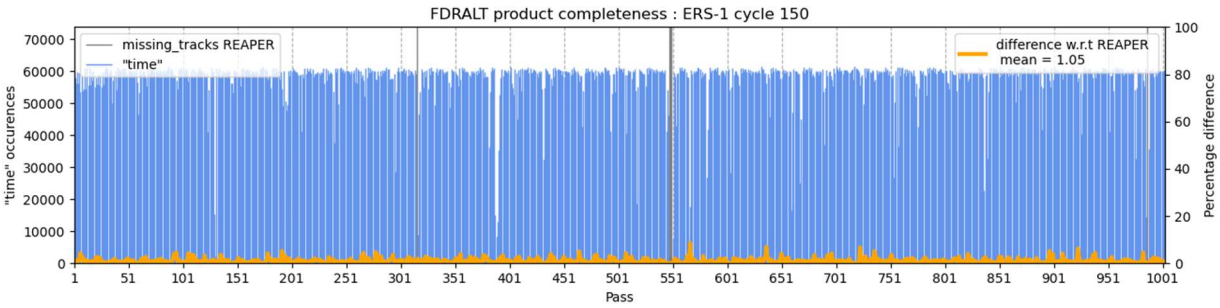

Figure 2-293 : Cycle150

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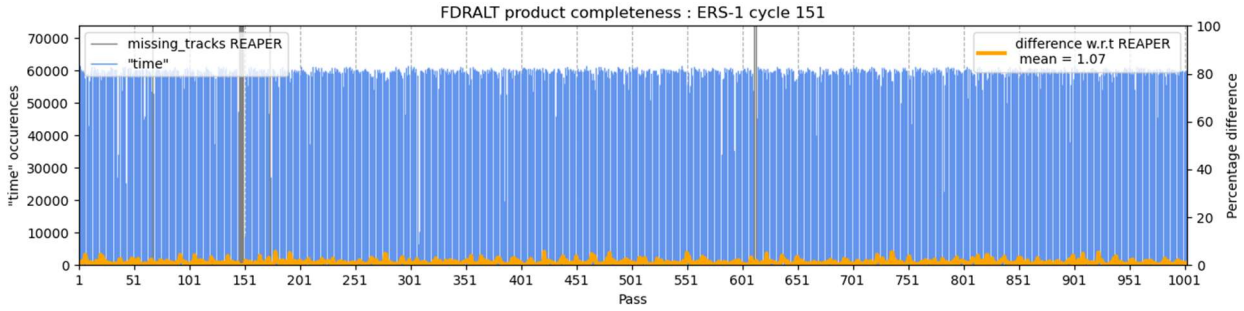

Figure 2-294 : Cycle 151

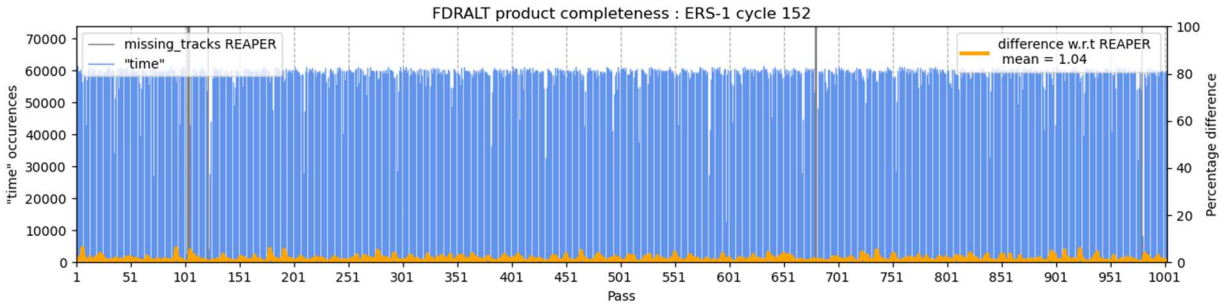

Figure 2-295 : Cycle 152

2.3.6 1996

2.3.6.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1996 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.3.
- Last cycle processed during the project is cycle 156 corresponding to the ERS-1 end of tandem phase with ERS-1. See [D-5-03] or https://earth.esa.int/eogateway/missions/ers/description for more information.

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ERS-1 year 1996			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
152	7	7	103-105, 122, 680, 681, 980
153	2	2	496, 931
154	2	2	118, 608
155	19	19	26-28, 59-69, 247, 758-761
156	13	13	4-11, 204, 378, 436, 453, 821

Figure 2-296 : List of missing tracks for year 1996

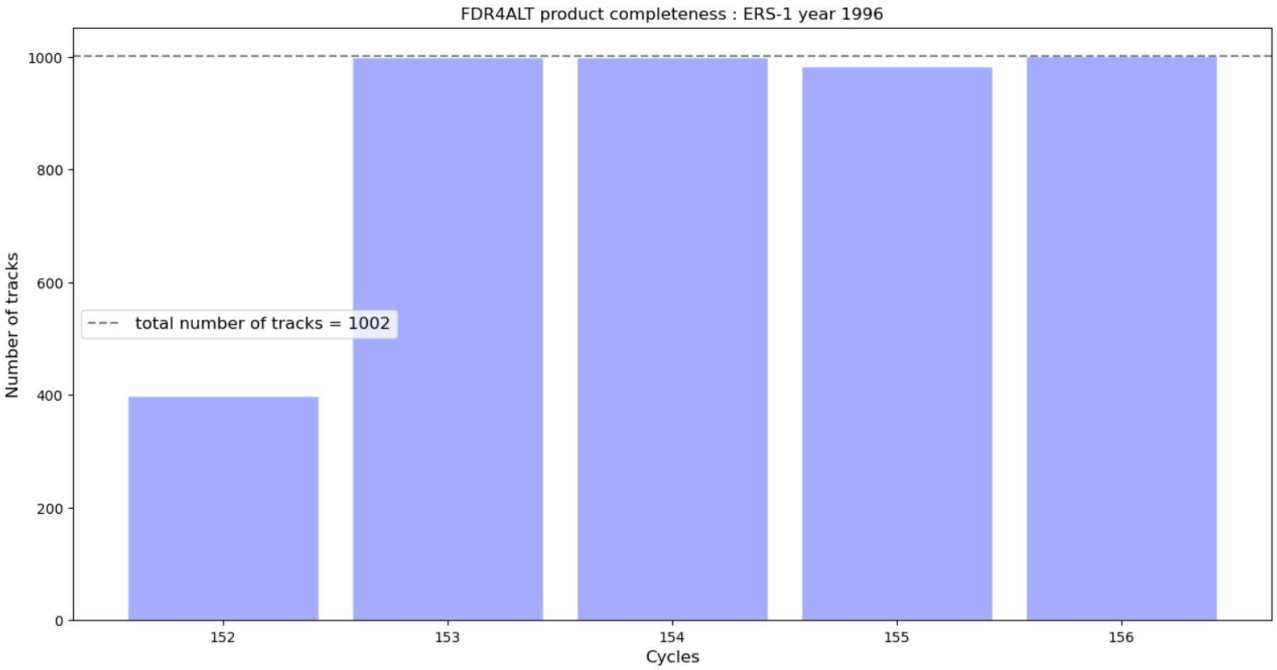

Figure 2-297 : Cyclic monitoring of the number of tracks completeness of year 1996

2.3.6.2 Cycle by cycle

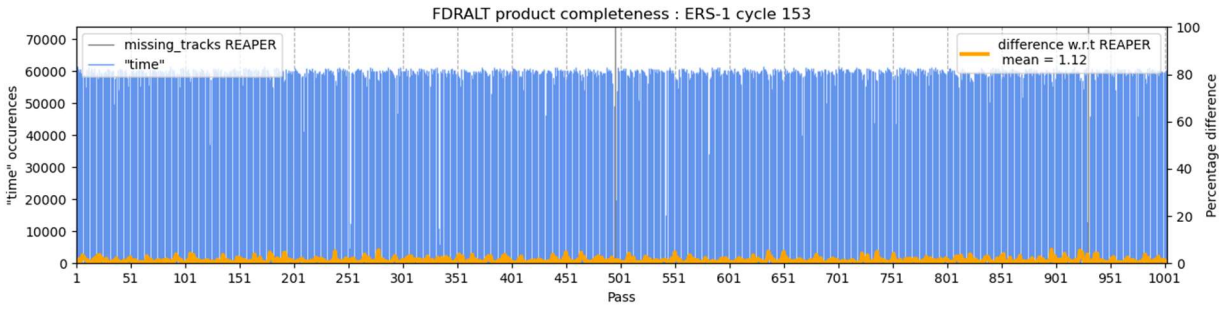

Figure 2-298 : Cycle 153

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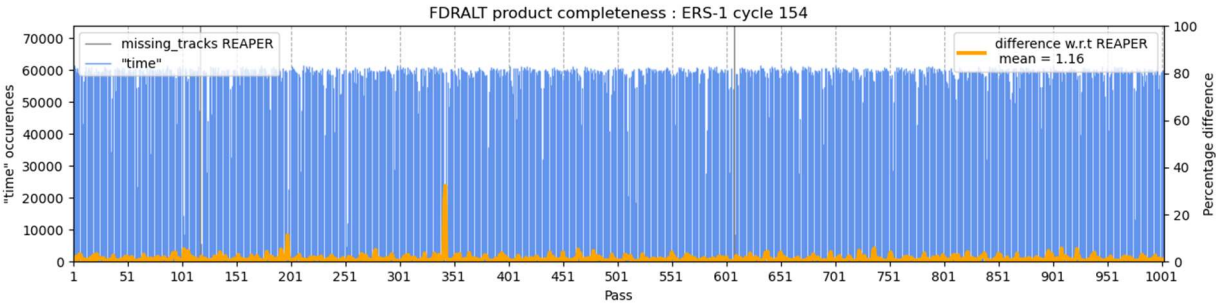

Figure 2-299 : Cycle 154

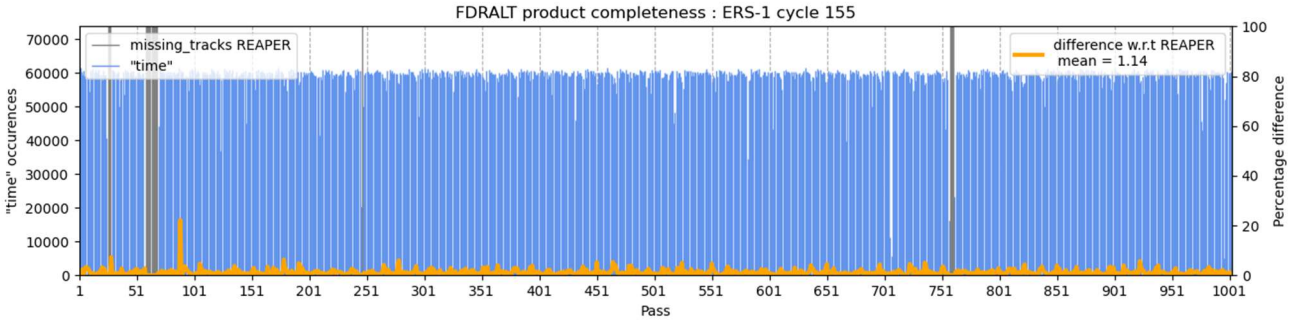

Figure 2-300 : Cycle 155

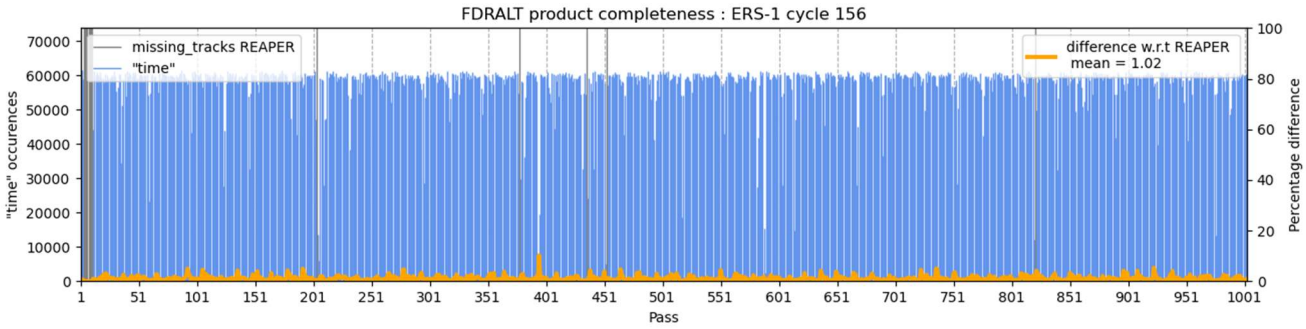

Figure 2-2-301 : Cycle 156

2.4 ERS-2

For ERS-2, it is more difficult to assess the completeness of the dataset for two main reasons:

- The ALT FDR corrected the so-called “time jumps” issues of the REAPER dataset. Therefore, the number of time occurrences between FDR4ALT and REAPER is different. Figure 2-302 shows the percentage of time occurrences edited per cycle for the ERS-2 mission. More information about the time jump correction performed in the frame of the FDR4ALT project can be found in the Detailed Processing Model Document [D-2-01] and the Product Validation Report Document [D-4-02]

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- The REAPER Level-2 products are sliced per orbit and not per pass (half-orbit). The Table 2-14 illustrates the different mission phases that defined different repeat orbit cycle. For more information, please refer to [D-5-03].

- For the ESA cycle report on the performance of RA altimeter during nominal operations, please see: https://earth.esa.int/eogateway/instruments/ra-ers/quality-control-reports

• Name	Start	End	Repeat cycle
Launch	21-Apr-95	-	-
Payload switch-on and verification	21-Apr-95	02-May-95	35 days
Commissioning Phase, or Phase "A"	02-May-95	17-Aug-95	35 days
Phase "B": Tandem	17-Aug-95	03-Jun-96	35 days
Phase "B": Multidisciplinary	03-Jun-96	5-Sep-11	35 days
End of Mission	5-Sep-11	-	-

Table 2-14 : ERS-2 mission Phases

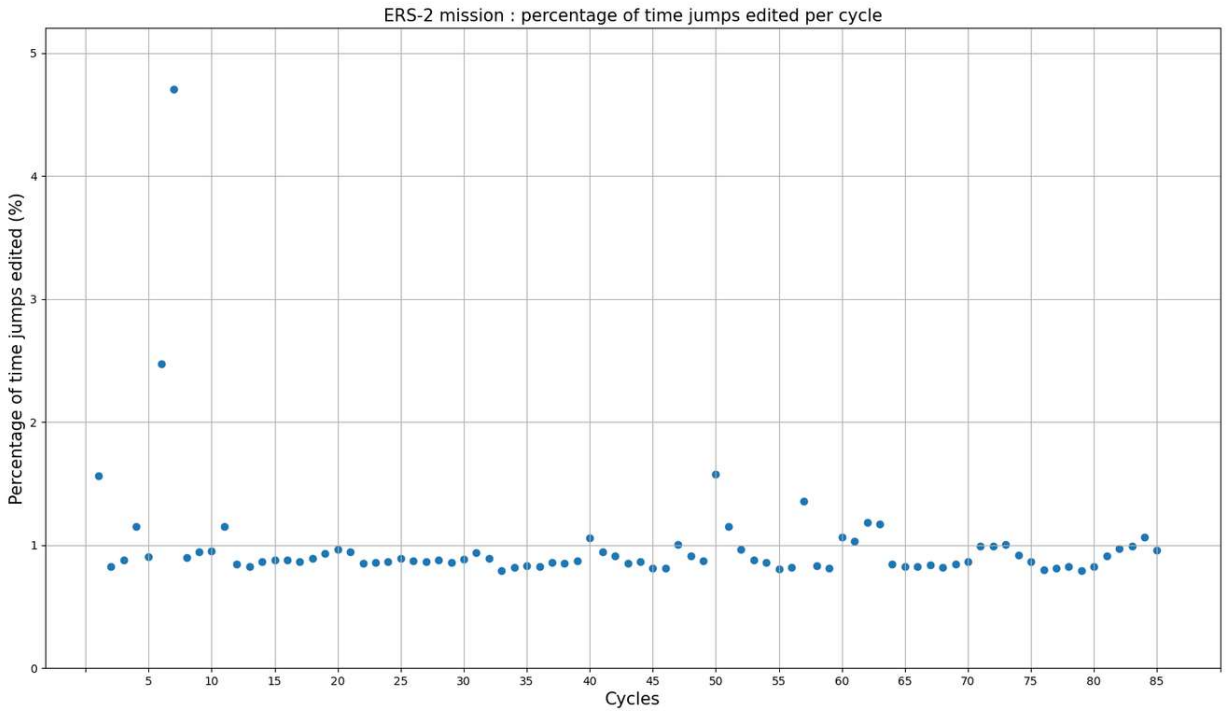

Figure 2-302 : Percentage of time occurences edited per cycle

2.4.1 1995

2.4.1.1 Overview of the year

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Completeness report of the FDR4ALT data is done for year 1995 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.
- Change of orbit phase occurred during this year according to Table 2-14.

ERS-2 year 1995			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
0	956	956	1-948, 979-987
1	69	69	77, 90-94, 116-122, 127-129, 148-155, 174, 234-241, 262-264, 288, 151-155, 174, 234-241, 262-264, 288, 439-443, 529, 546-552, 574, 615-617, 632-638, 660, 724, 746, 749-752, 774
2	20	20	85, 318-324, 449, 663-666, 748, 834-838, 860
3	58	58	57, 58, 92-99, 120, 193-199, 374, 409-413, 451-455, 475-479, 957-973, 976-982
4	95	95	183-185, 221, 466-471, 507-511, 604, 722, 750-759, 877-943, 952
5	17	17	518-522, 710-715, 862-866, 987
6	19	19	118-120, 292-299, 423-425, 793-797
7	32	32	18, 19, 94-113, 316-319, 915-920

Figure 2-2-303 : List of missing tracks for year 1995

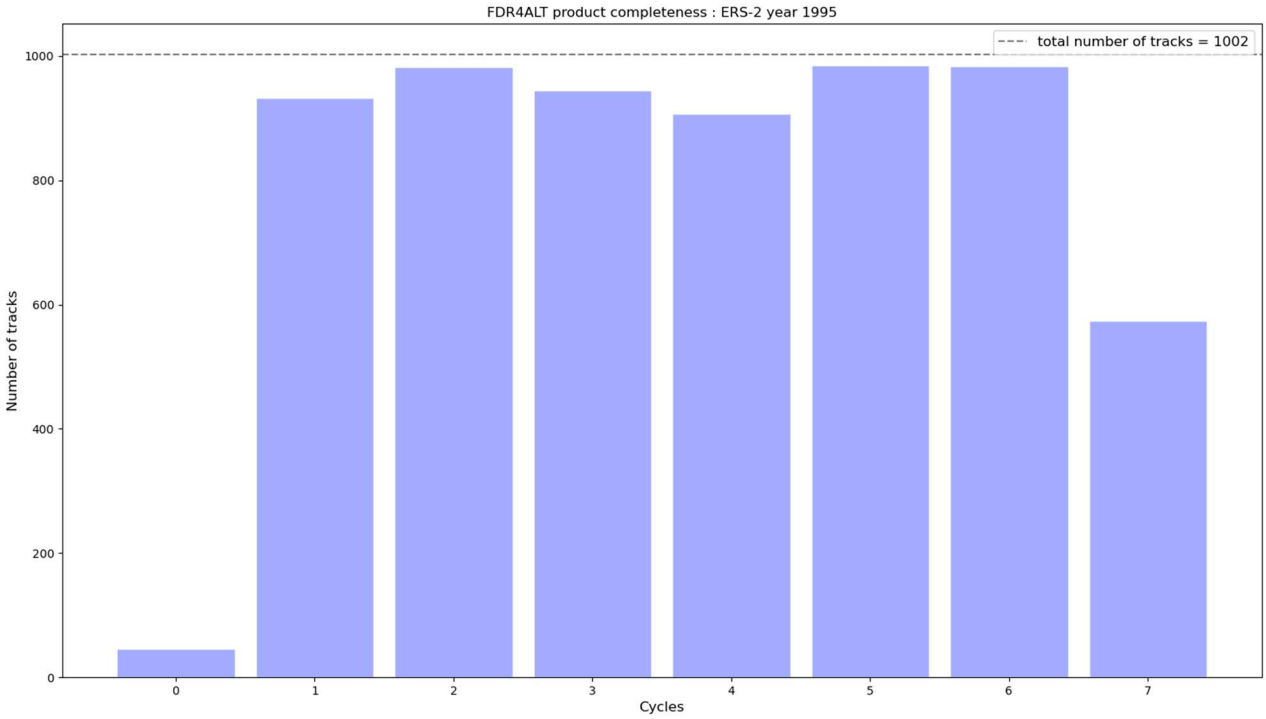

Figure 2-2-304 : Cyclic monitoring of the number of tracks completeness of year 1995

2.4.1.2 Cycle by cycle

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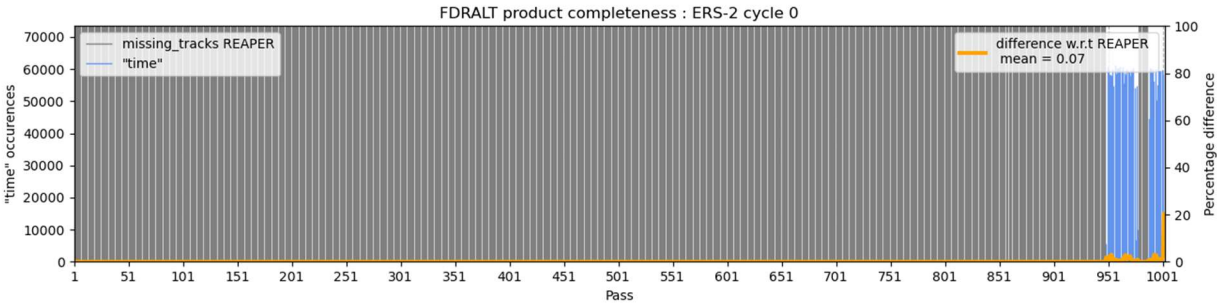

Figure 2-2-305 : Cycle 0

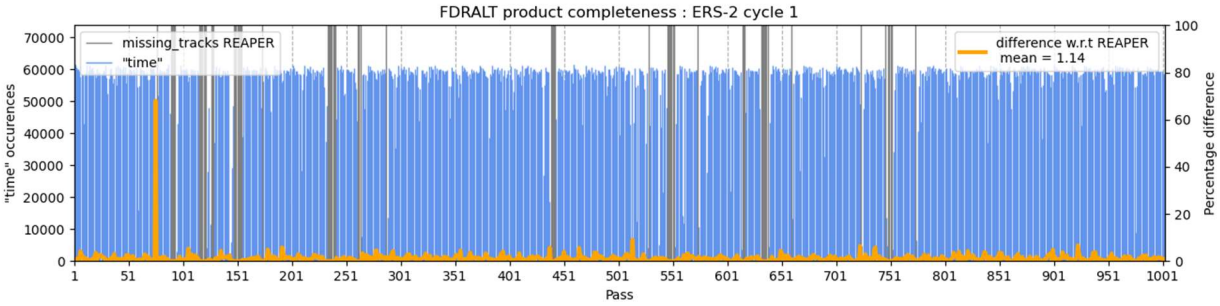

Figure 2-2-306 : Cycle 1

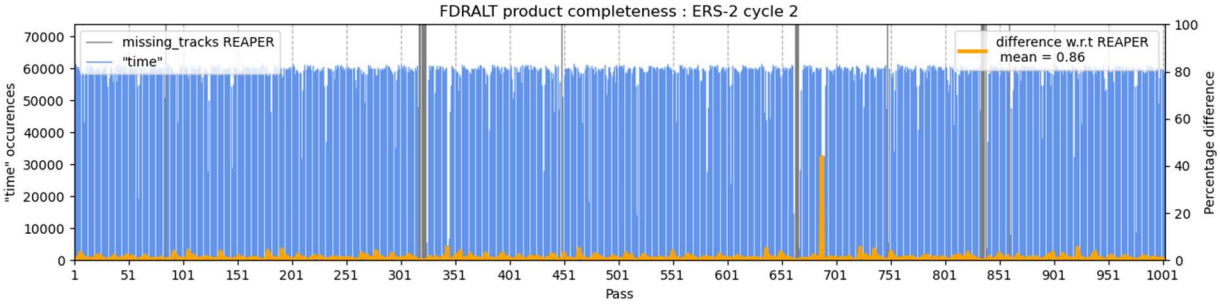

Figure 2-2-307 : Cycle 2

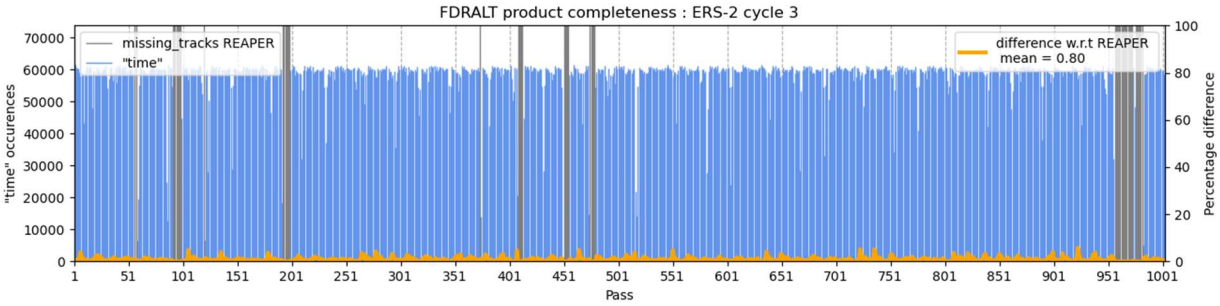

Figure 2-2-308 : Cycle 3

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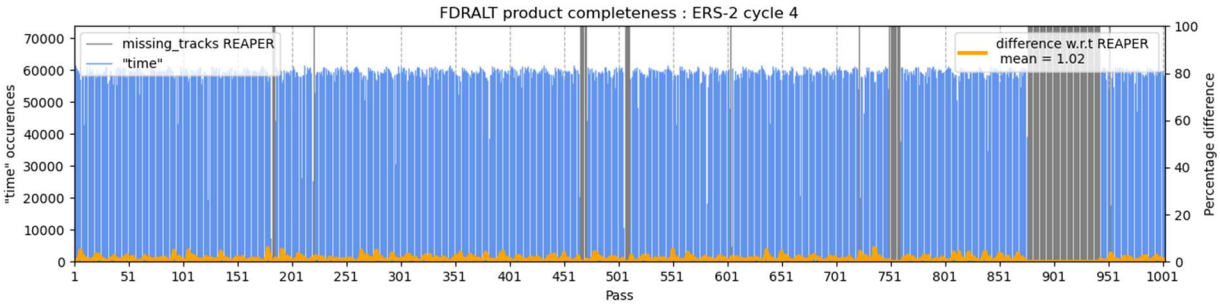

Figure 2-2-309 : Cycle 4

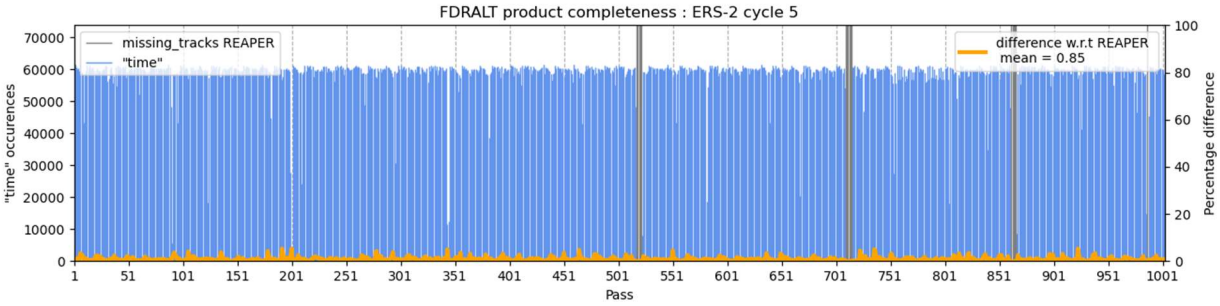

Figure 2-2-310 : Cycle 5

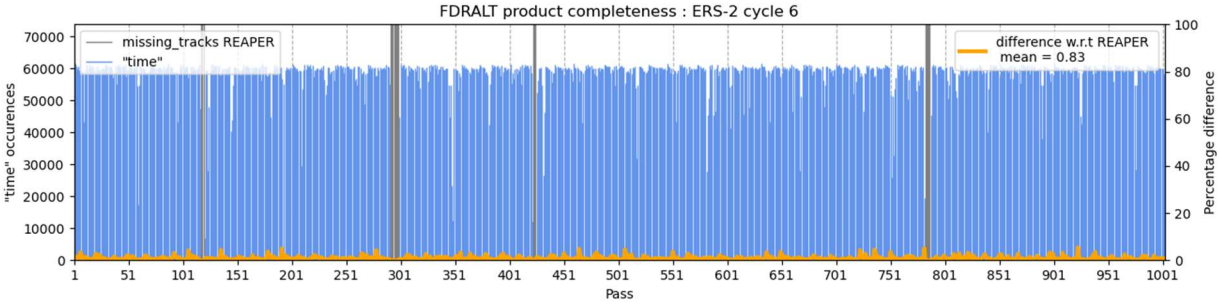

Figure 2-2-311 : Cycle 6

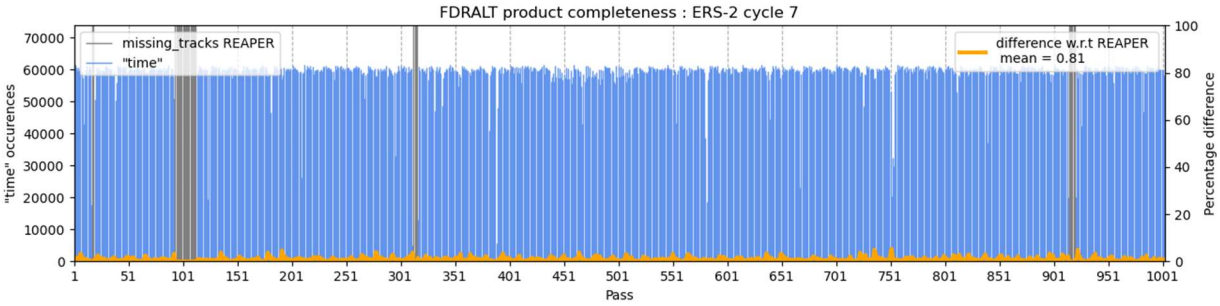

Figure 2-2-312 : Cycle 7

2.4.2 1996

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2.4.2.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1996 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

ERS-2 year 1996			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
7	32	32	18, 19, 94-113, 316-319, 915-920
8	96	96	60, 75-79, 182-200, 243-311, 843, 845
9	53	53	262, 421-425, 486, 505, 548, 554-565, 585-589, 885-888, 892-894, 920, 926-941, 950, 990, 991
10	14	14	4-6, 62, 64, 79, 157, 309, 427, 832, 898-901
11	55	55	77, 103, 317-327, 348, 380-383, 386-397, 507, 580, 631, 632, 900-921
12	25	25	83, 102, 103, 197-199, 386-389, 449-451, 713, 776-780, 924-929
13	16	16	68-73, 106, 107, 481-485, 537, 804, 843
14	14	14	189, 213-219, 415-417, 758, 759, 980
15	15	15	576, 619-621
16	13	13	75, 397-399, 411-417, 701, 836
17	63	63	25-43, 170-185, 202, 271, 284-287, 311-313, 685-703
18	15	15	449, 669-671, 741-746, 904, 905, 931-933

Figure 2-2-313 : List of missing tracks for year 1996

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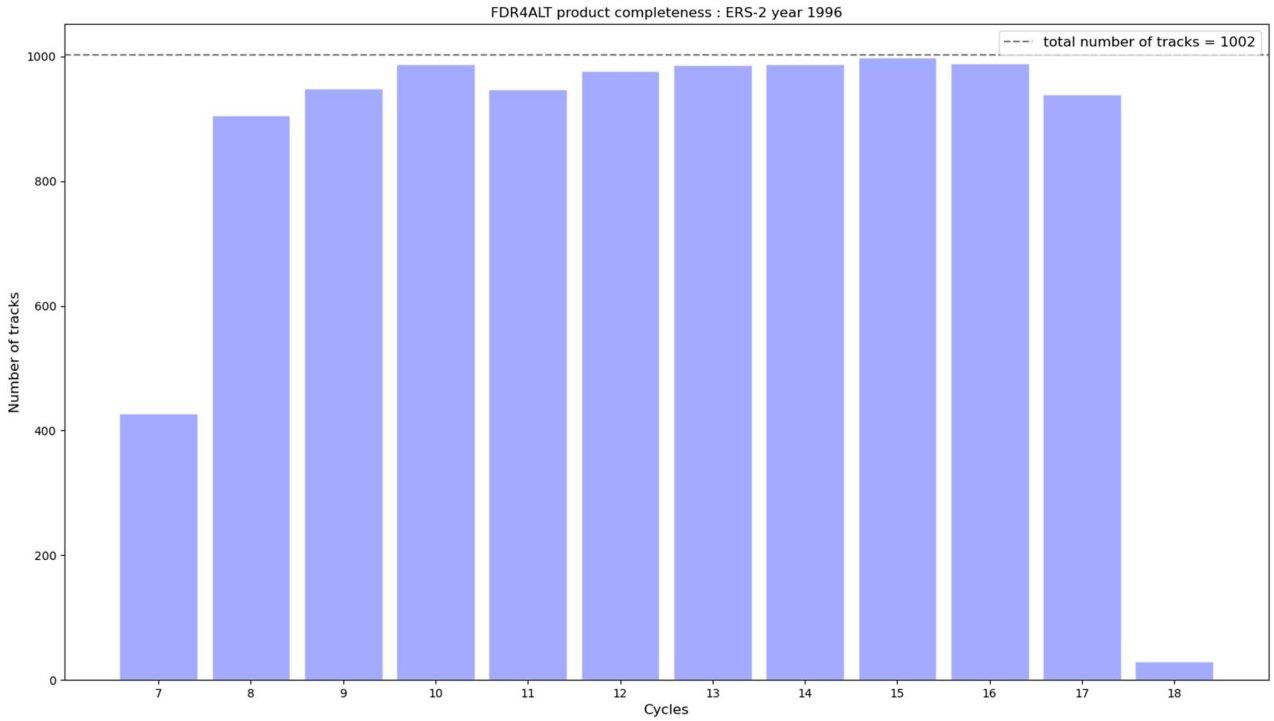

Figure 2-2-314 : Cyclic monitoring of the number of tracks completeness of year 1996

2.4.2.2 Cycle by cycle

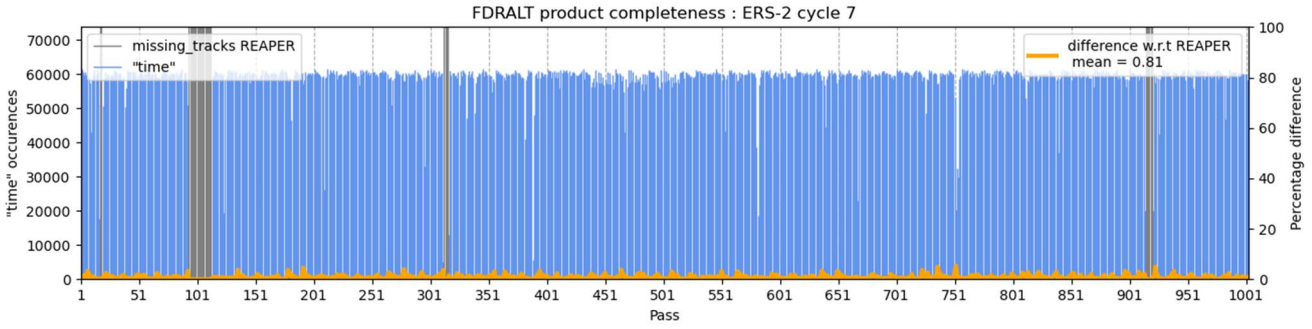

Figure 2-2-315 : Cycle 7

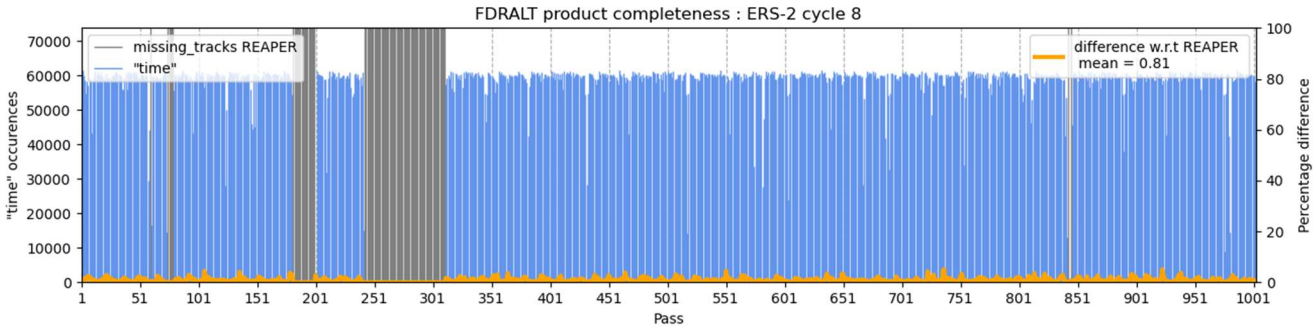

Figure 2-2-316 : Cycle 8

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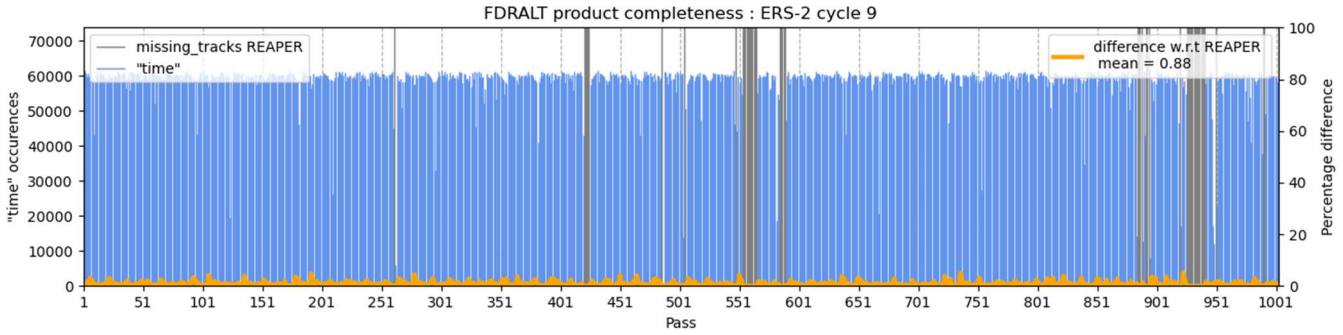

Figure 2-2-317 : Cycle 9

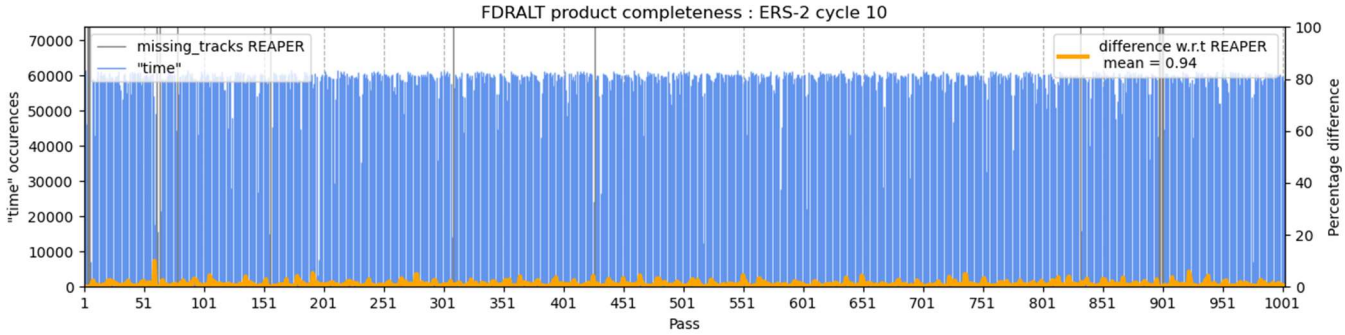

Figure 2-2-318 : Cycle 10

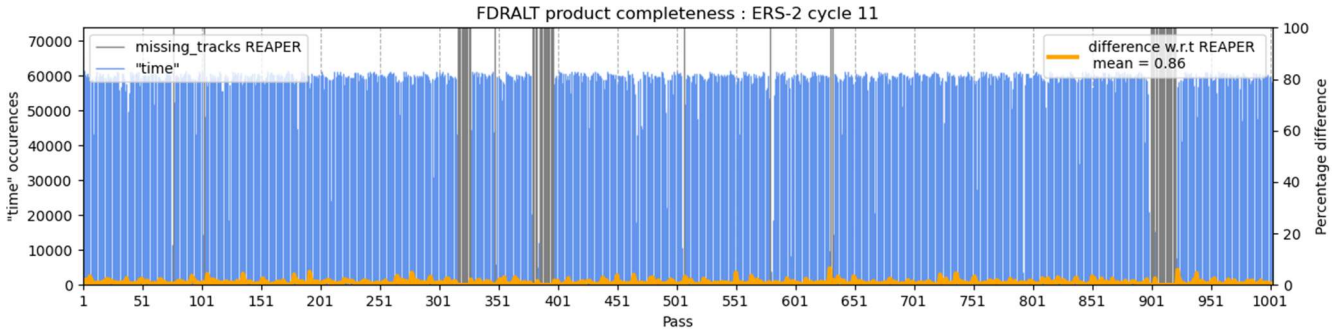

Figure 2-2-319 : Cycle 11

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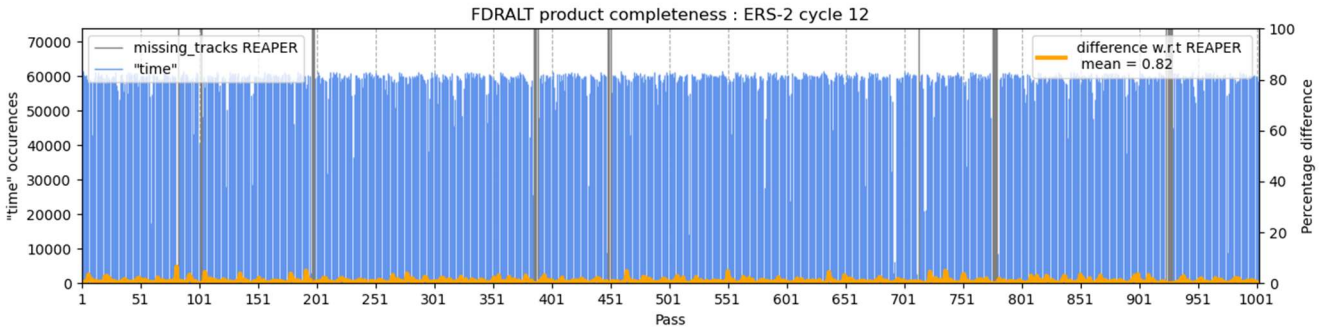

Figure 2-2-320 : Cycle 12

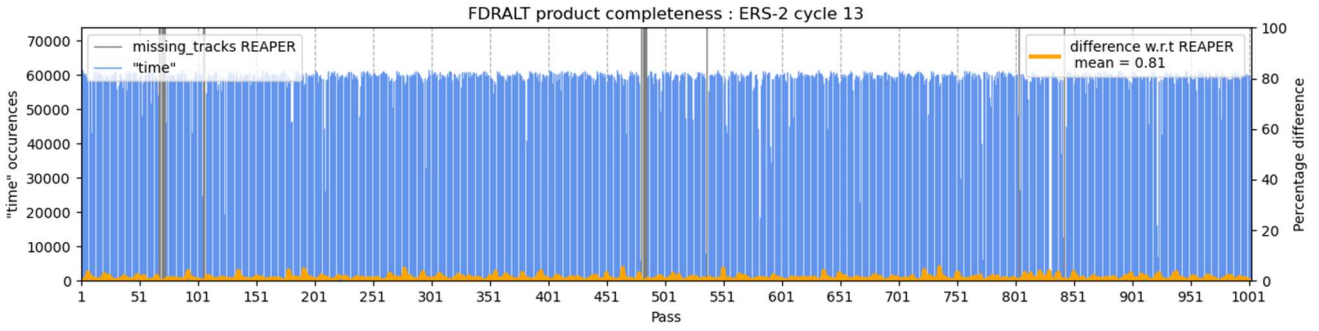

Figure 2-2-321 : Cycle 13

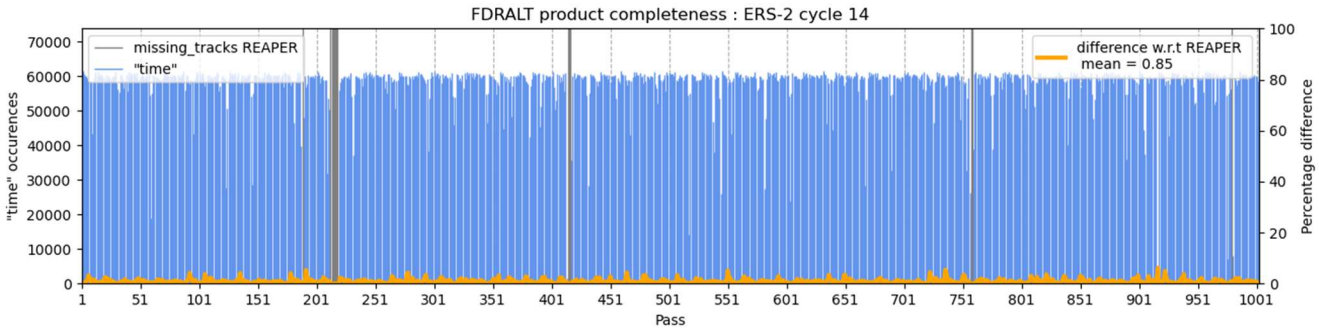

Figure 2-2-322 : Cycle 14

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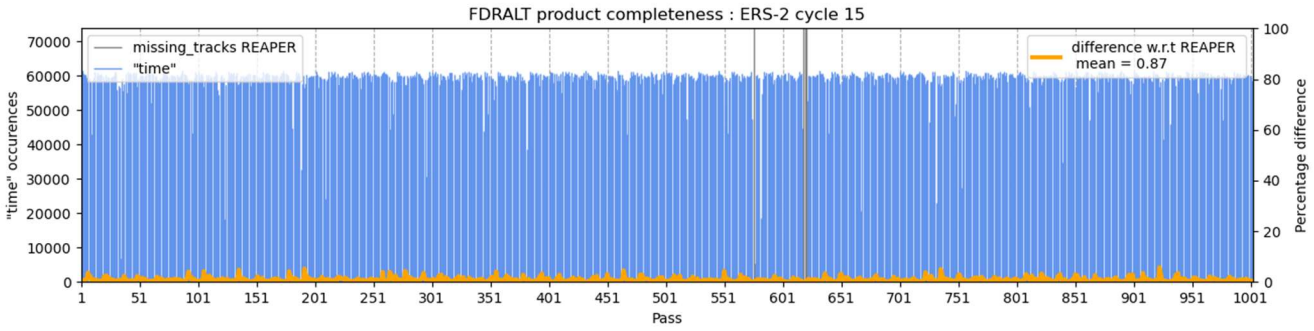

Figure 2-2-323 : Cycle 15

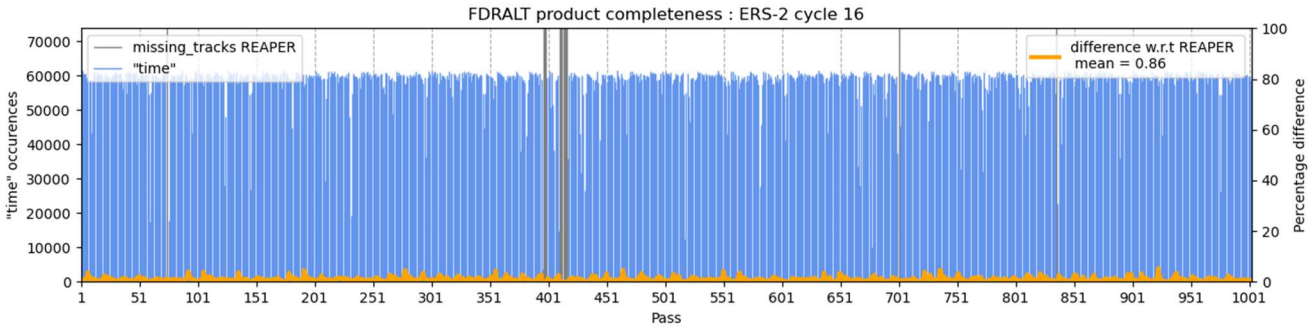

Figure 2-2-324 : Cycle 16

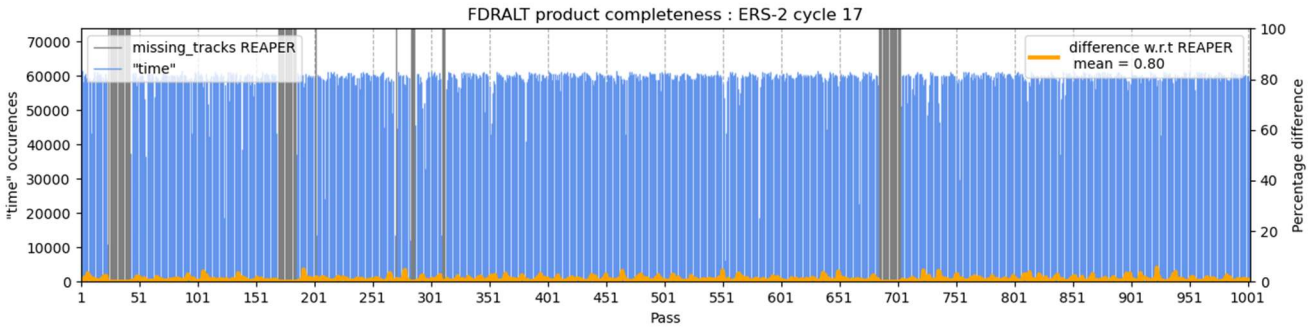

Figure 2-2-325 : Cycle 17

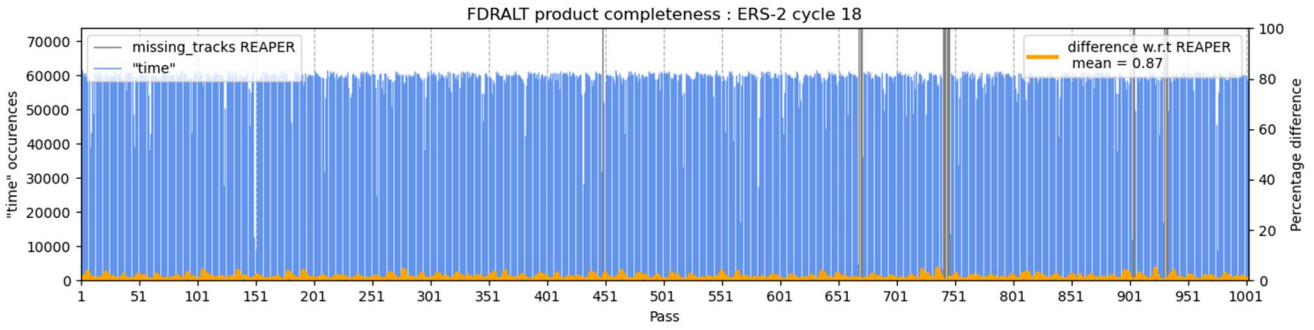

Figure 2-2-326 : Cycle 18

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2.4.3 1997

2.4.3.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1997 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

ERS-2 year 1997			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
18	15	15	449, 669-671, 741-746, 904, 905, 931-933
19	57	57	152, 290-331, 548-550, 624, 625, 784, 786, 787, 943, 944, 963-966
20	61	61	60-64, 89-101, 115-127, 142, 143, 407-413, 509-515, 535-543, 675-677, 740, 741
21	92	92	32-36, 78, 79, 175-185, 325-329, 338, 339, 380, 404-408, 434-438, 443, 463-471, 490-494, 518-524, 552, 579-585, 610, 662-666, 696, 724, 752, 781-785, 810, 834-838, 920-924, 948
22	76	76	4-6, 32-38, 94, 118-120, 136-145, 152, 208, 238, 262-264, 290-292, 348-350, 376-378, 404-410, 415, 419, 434-436, 562, 563, 576-578, 791-795, 917-931
23	29	29	103-107, 144, 301-303, 327-329, 568, 569, 866, 944-957
24	6	6	318-322, 471
25	25	25	32-36, 122, 139-152, 232-236
26	21	21	32, 36, 124, 125, 167-183
27	1	1	602
28	12	12	122, 638-645, 806-808

Figure 2-2-327 : List of missing tracks for year 1997

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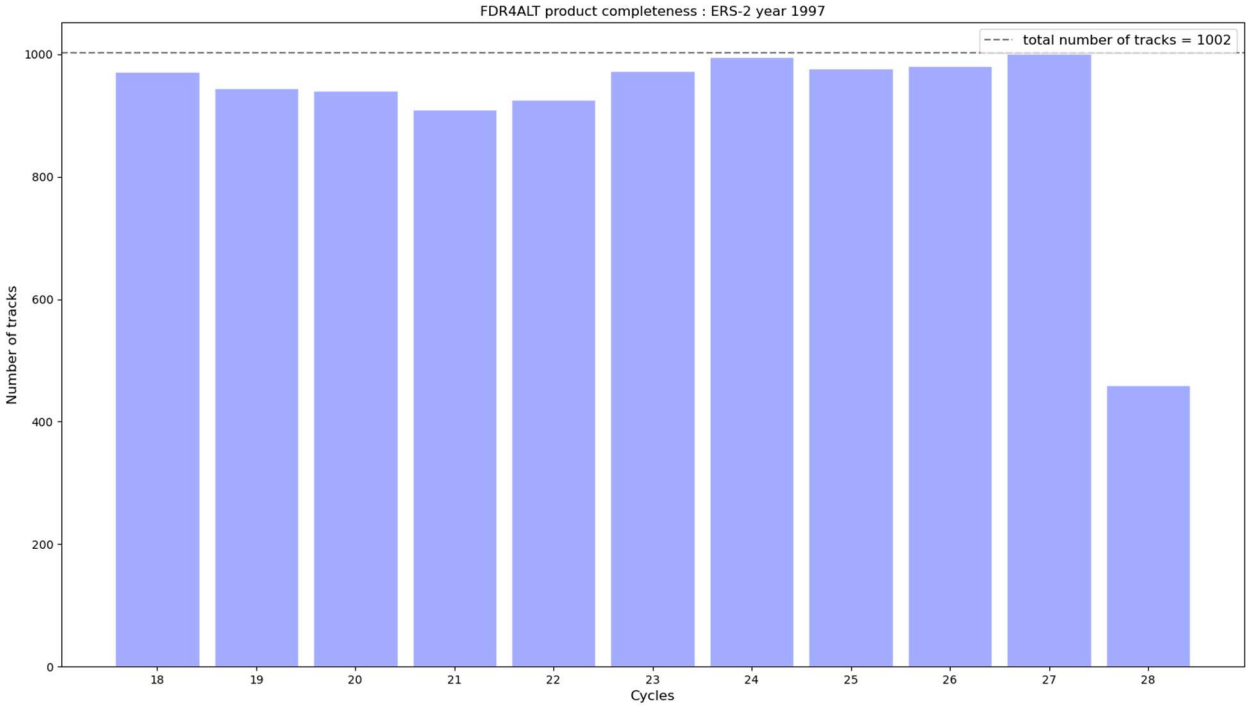

Figure 2-2-328 : Cyclic monitoring of the number of tracks completeness of year 1997

2.4.3.2 Cycle by cycle

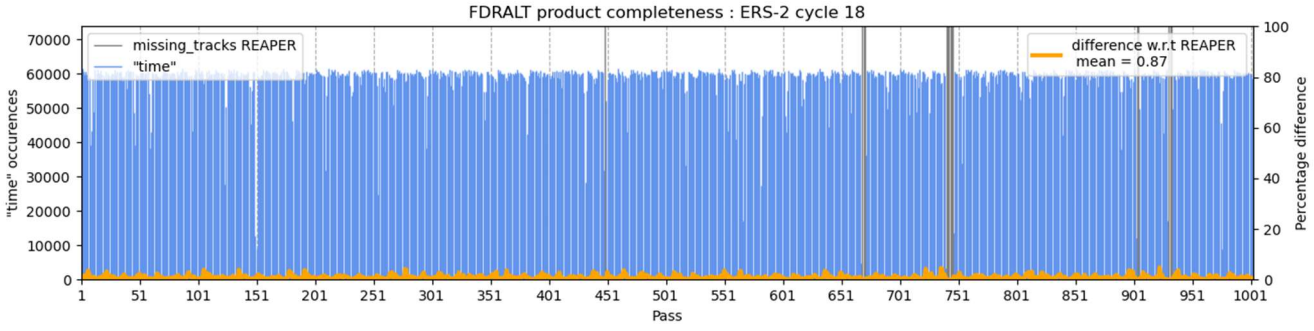

Figure 2-2-329 : Cycle 18

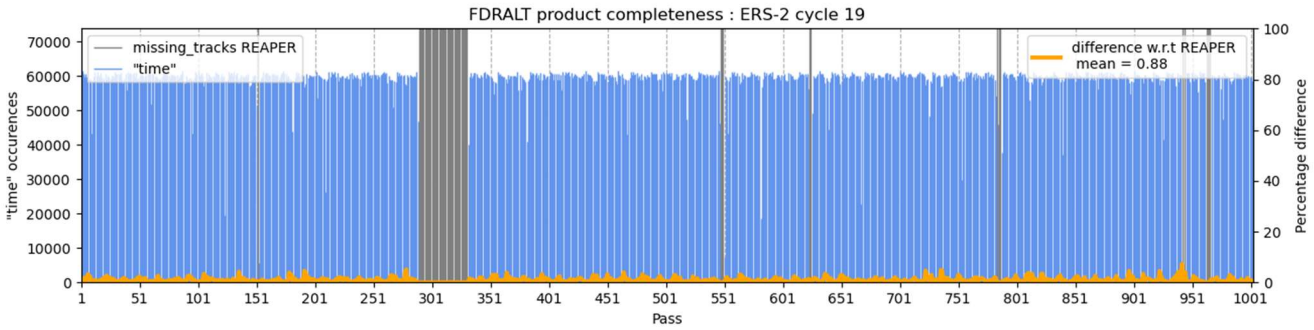

Figure 2-2-330 : Cycle 19

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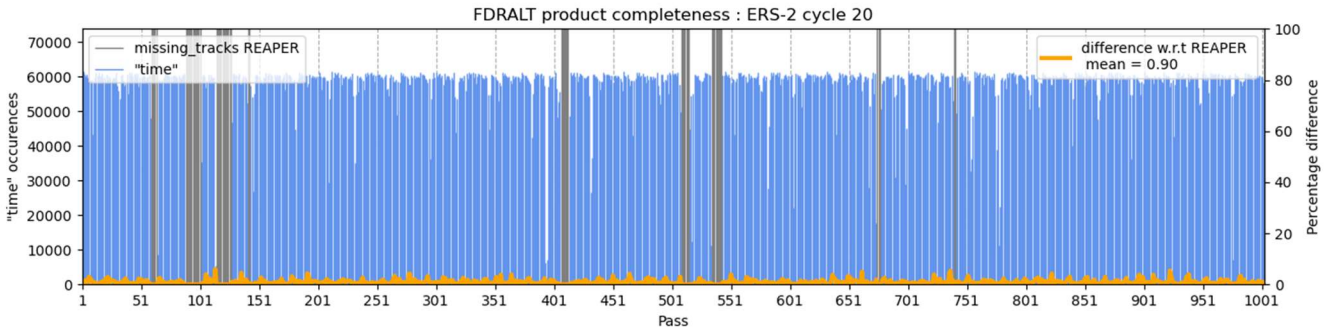

Figure 2-2-331 : Cycle 20

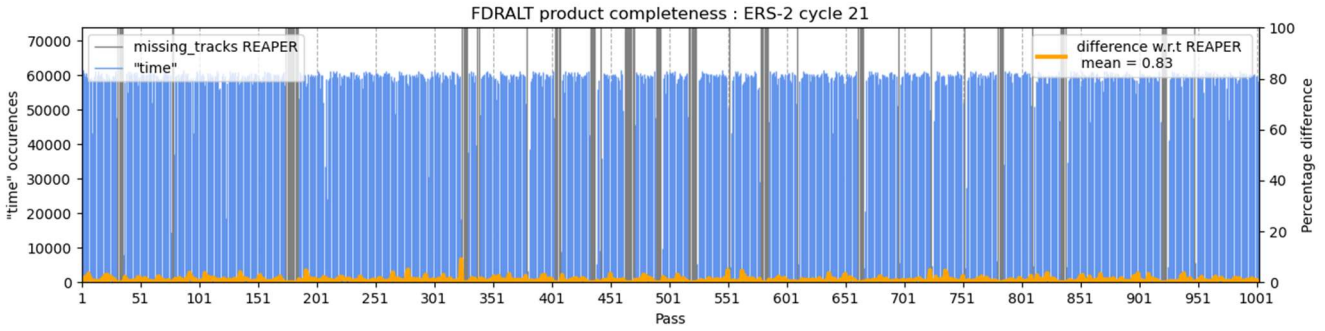

Figure 2-2-332 : Cycle 21

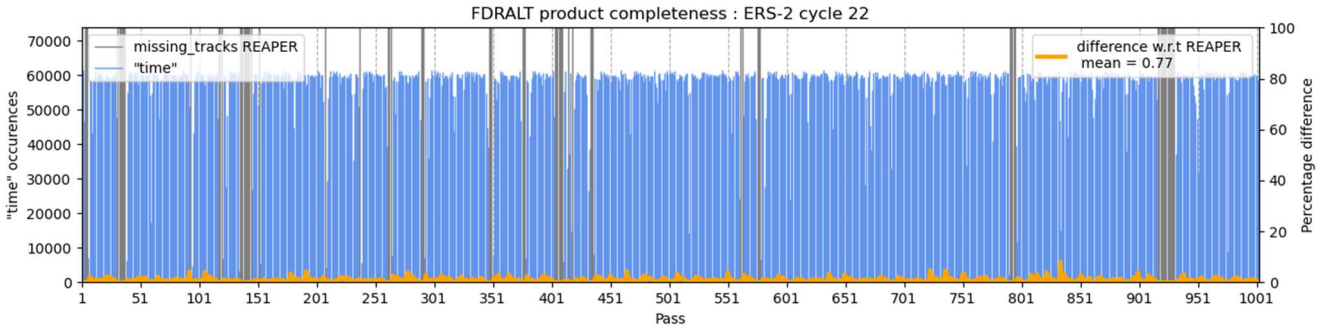

Figure 2-2-333 : Cycle 22

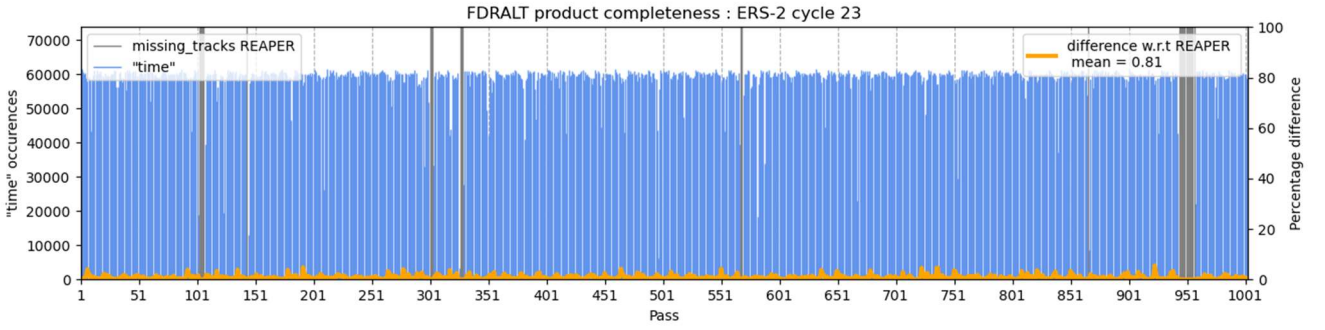

Figure 2-2-334 : Cycle 23

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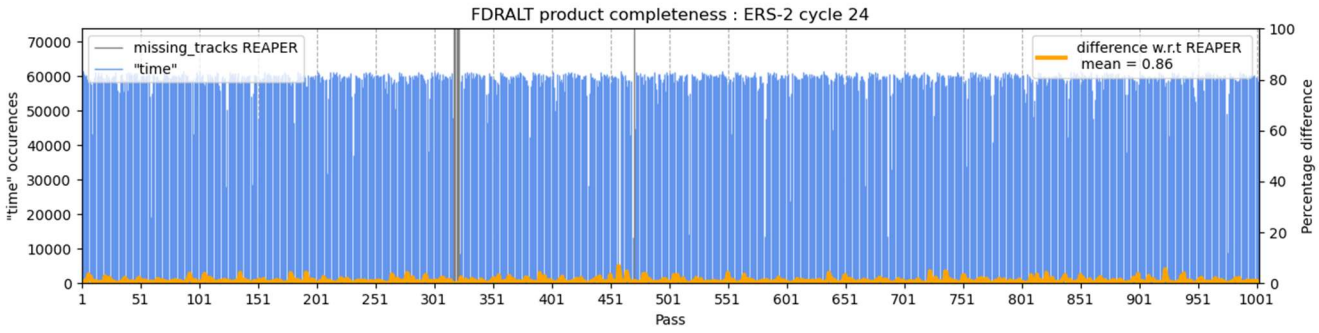

Figure 2-2-335 : Cycle 24

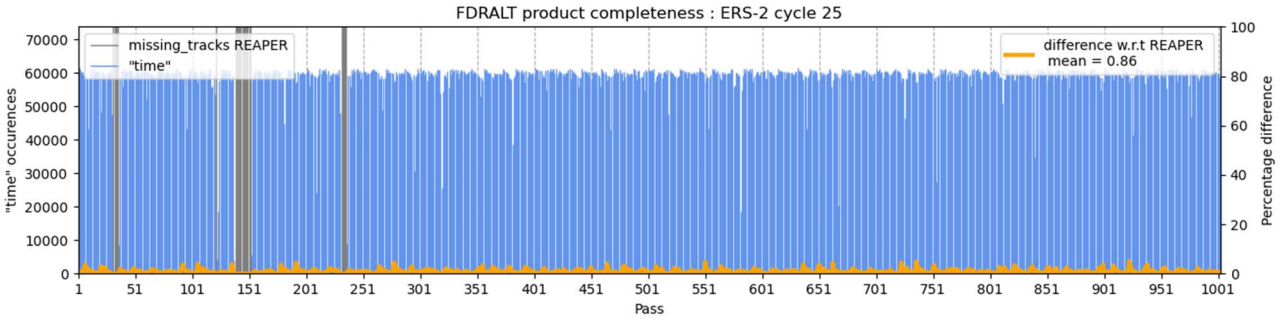

Figure 2-2-336 : Cycle 25

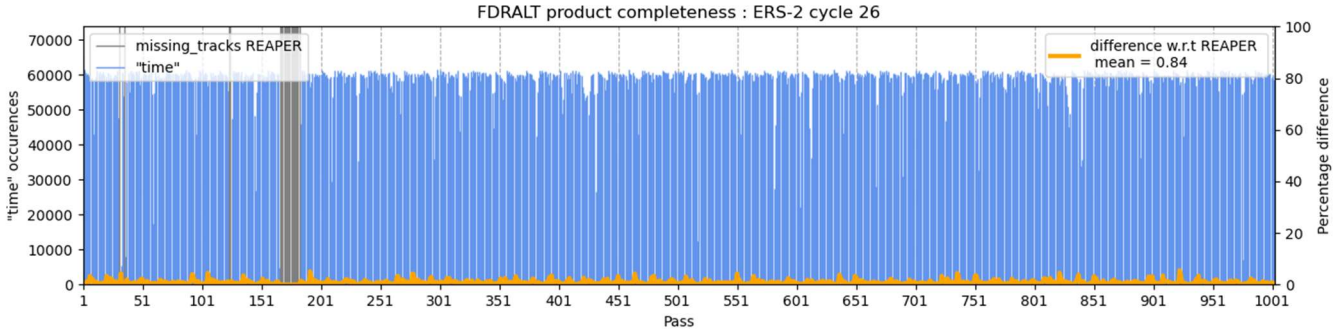

Figure 2-2-337 : Cycle 26

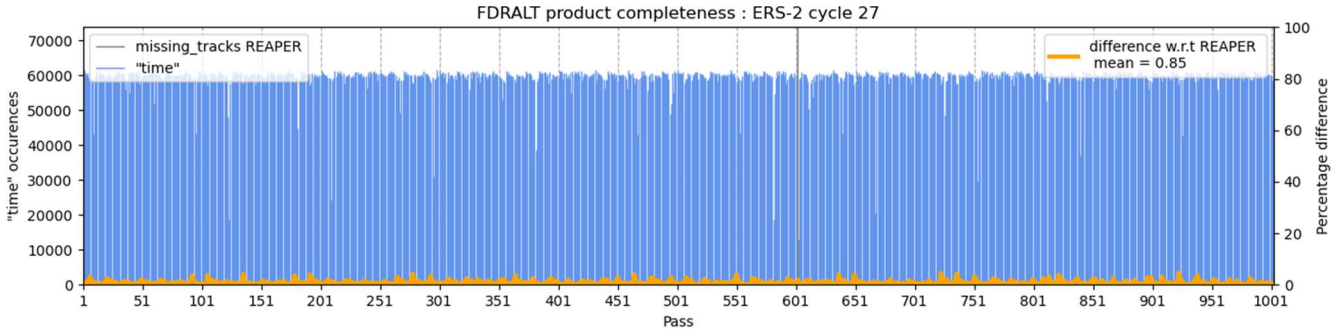

Figure 2-2-338 : Cycle 27

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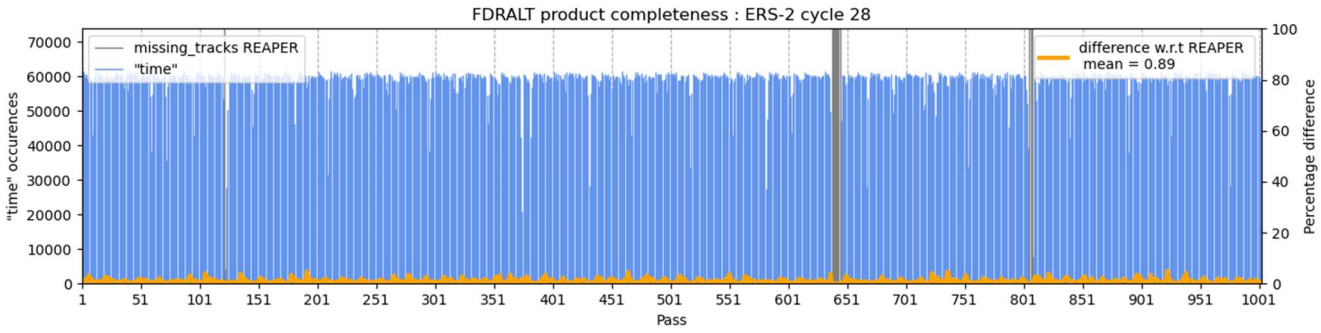

Figure 2-2-339 : Cycle 28

2.4.4 1998

2.4.4.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1998 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

ERS-2 year 1998			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
28	12	12	122, 638-645, 806-808
29	17	17	898-916
30	35	35	548, 578-587, 618-623, 664-666, 696, 724, 782, 808-810, 838, 868, 948-954
31	14	14	53-66
32	118	118	90-94, 431, 432, 690-694, 726-730, 733-744, 852-941, 946
33	28	28	25-29, 266, 391-400, 789-793, 965-971
34	29	29	8, 290-292, 404-408, 421-425, 615-629, 866
35	42	42	32-34, 271-275, 729, 730, 733-744, 819-825, 827-831, 836-843
36	36	36	96-100, 103-114, 139-141, 235-245, 939, 966-969
37	38	38	620-647, 688, 804, 866-873
38	2	2	436, 961

Figure 2-2-340 : List of missing tracks for year 1998

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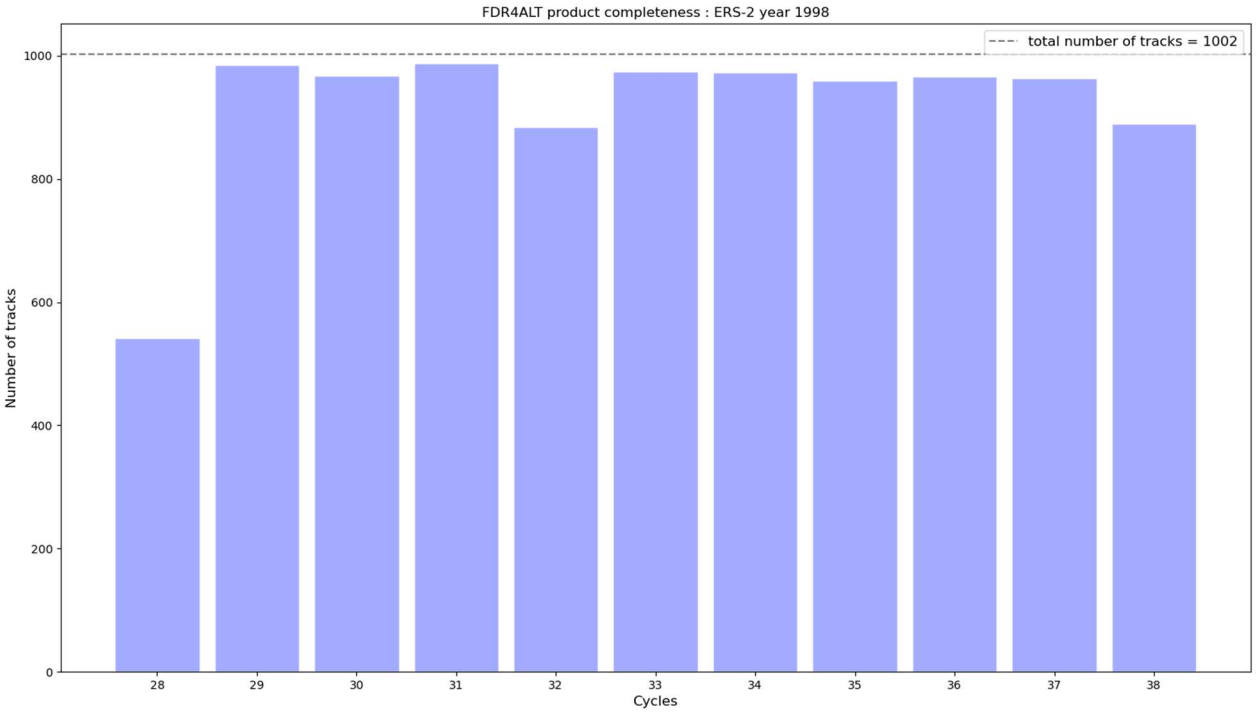

Figure 2-341 : Cyclic monitoring of the number of tracks completeness of year 1998

2.4.4.2 Cycle by cycle

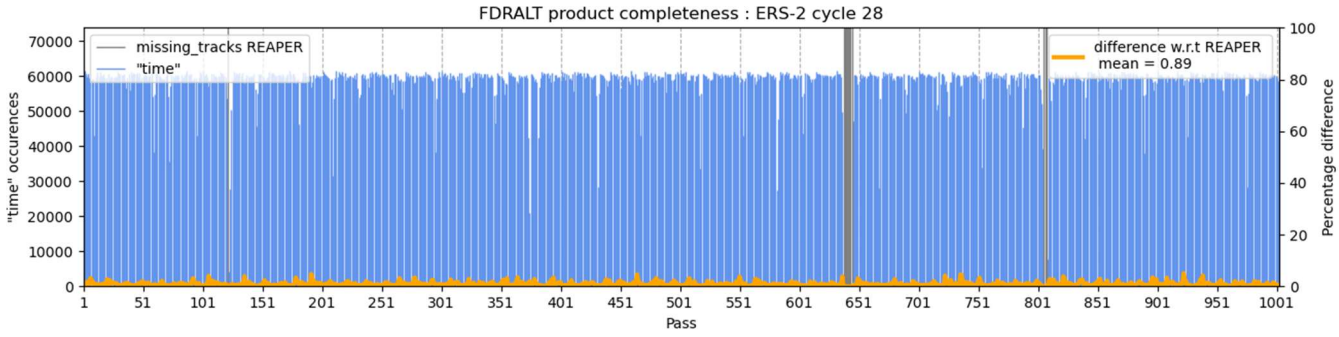

Figure 2-2-342 : Cycle 28

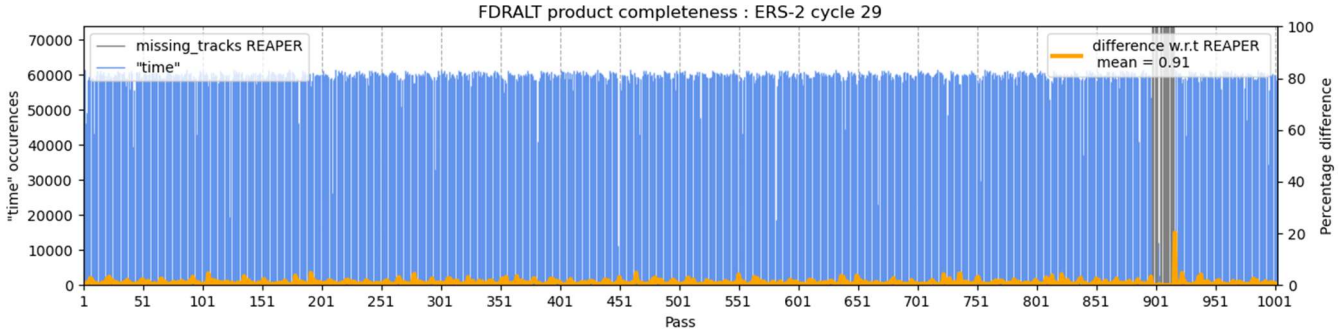

Figure 2-2-343 : Cycle 29

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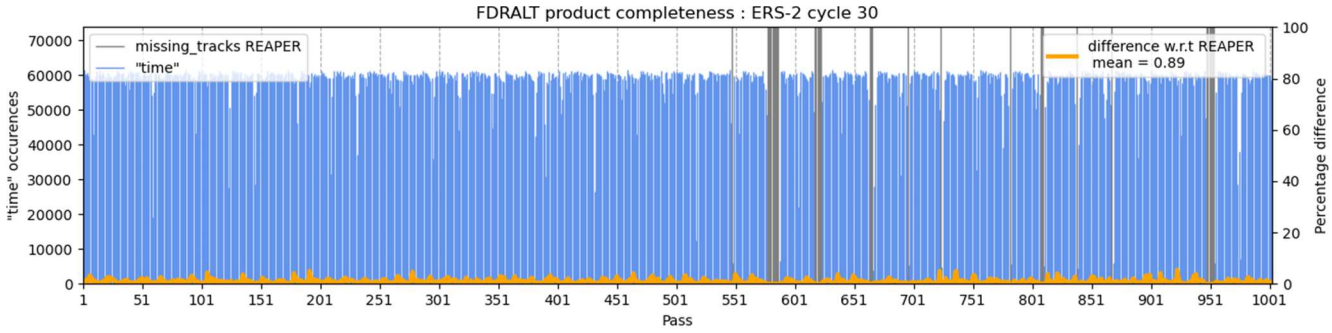

Figure 2-2-344 : Cycle 30

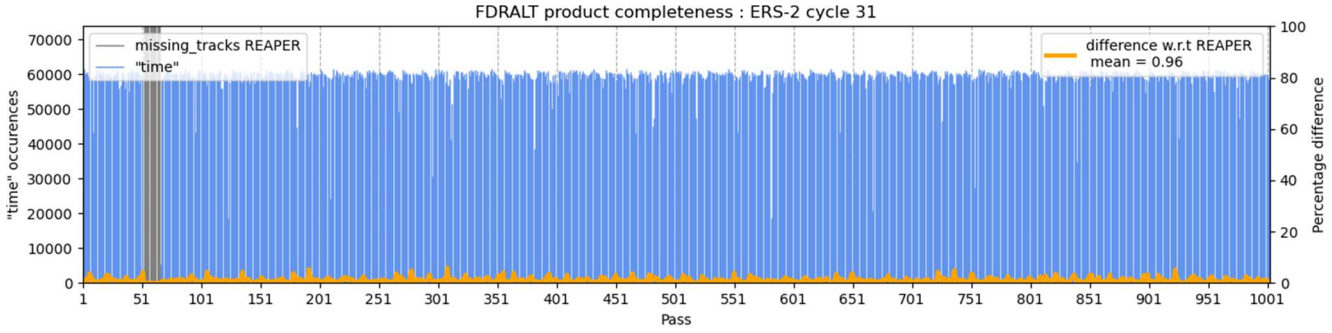

Figure 2-2-345 : Cycle 31

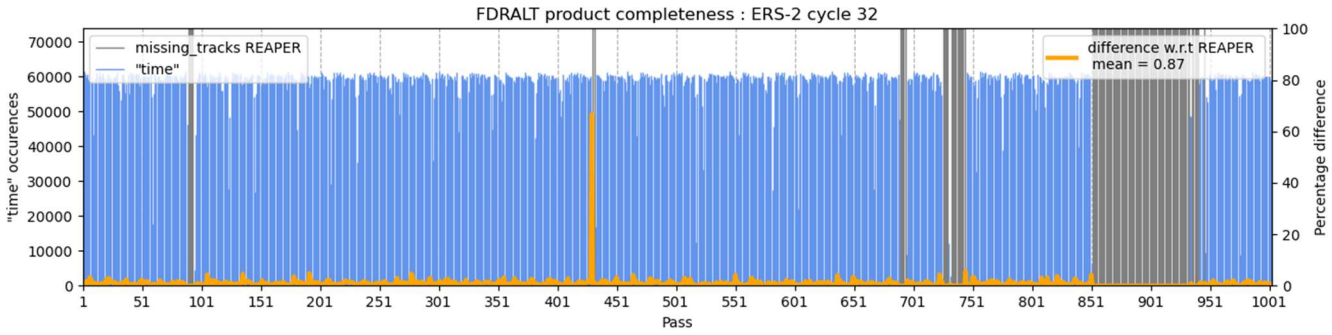

Figure 2-2-346 : Cycle 32

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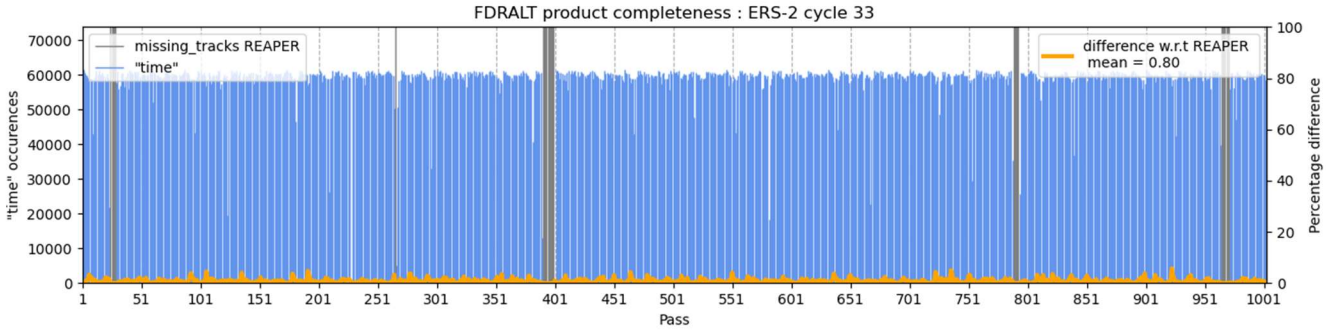

Figure 2-2-347 : Cycle 33

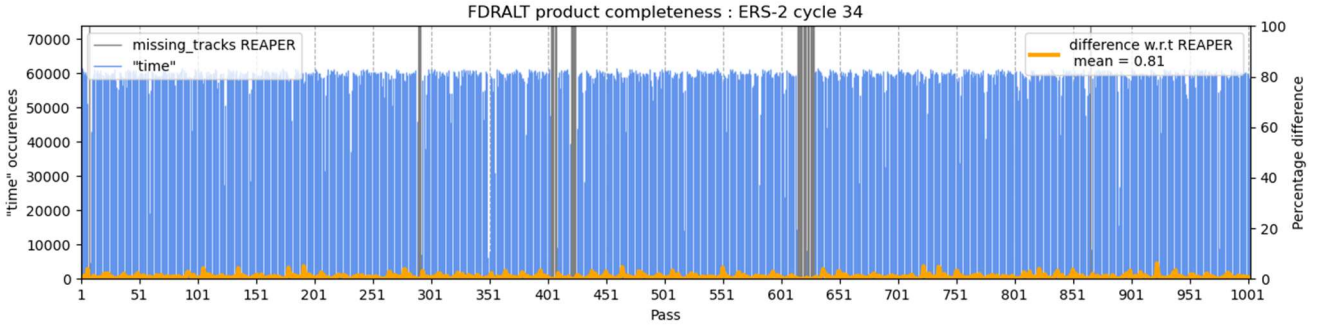

Figure 2-2-348 : Cycle 34

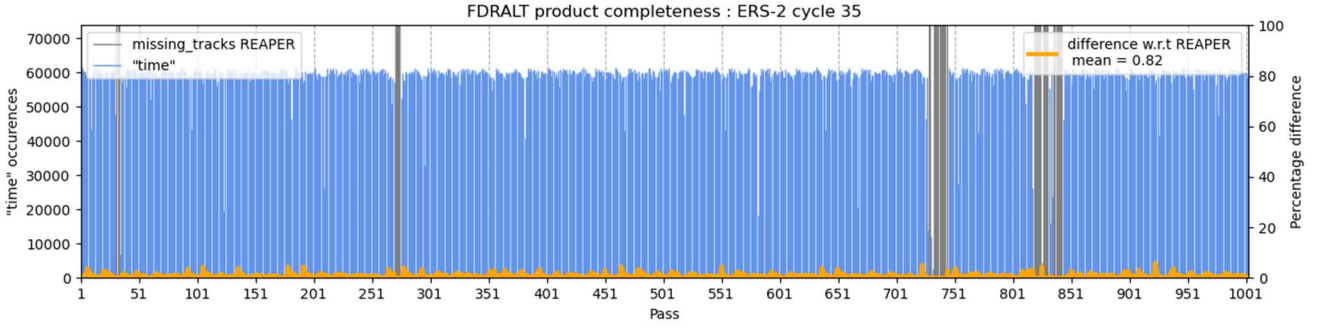

Figure 2-2-349 : Cycle 35

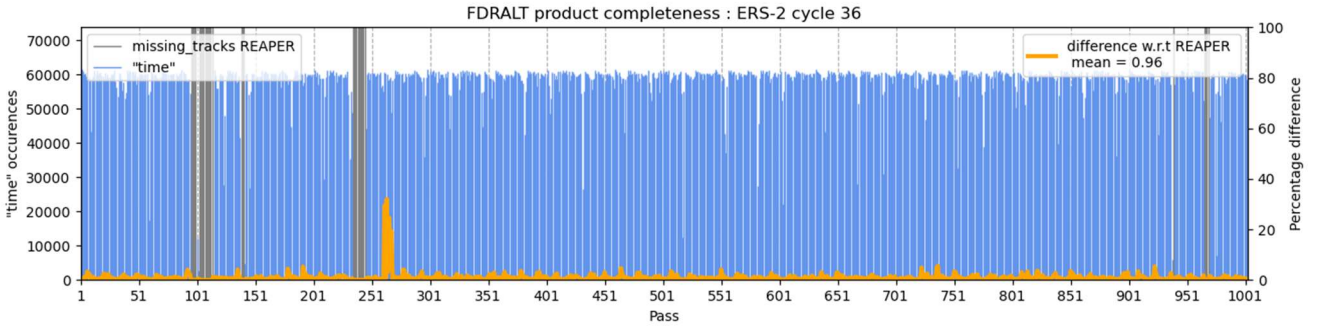

Figure 2-2-350 : Cycle 36

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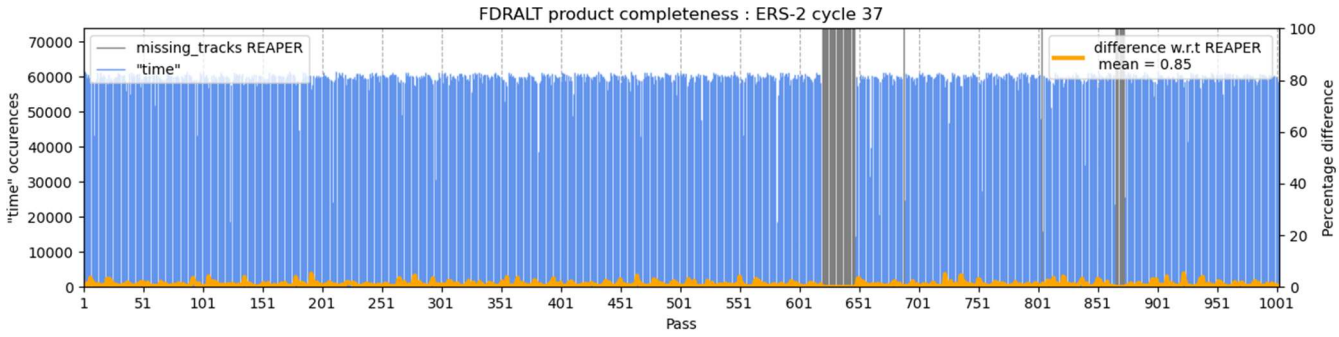

Figure 2-2-351 : Cycle 37

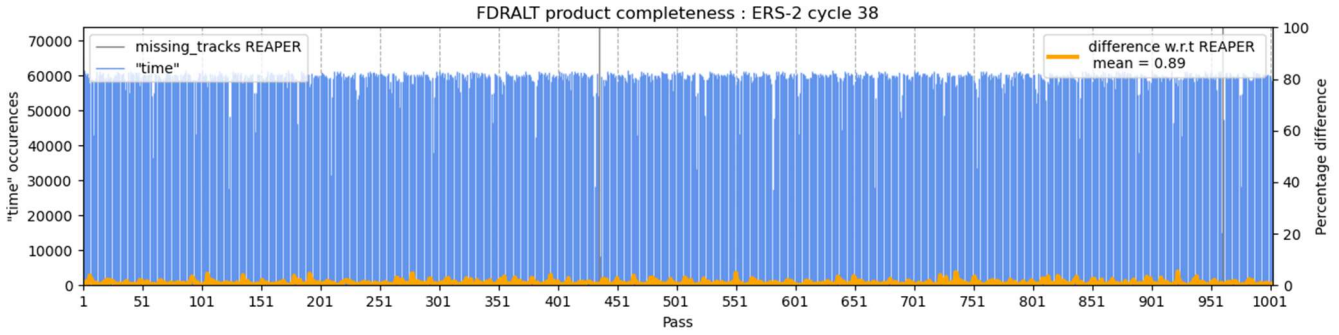

Figure 2-2-352 : Cycle 38

2.4.5 1999

2.4.5.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 1999 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

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ERS-2 year 1999			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
38	2	2	436, 961
39	5	5	677-681
40	6	6	438, 660, 838, 921, 922, 982
41	6	6	152, 348-350, 460, 924
42	39	39	30, 169, 267-273, 316, 462-473, 522-531, 717, 718, 918-922
43	17	17	118, 236-243, 632, 681-686, 868
44	0	0	
45	0	0	
46	61	61	262, 264, 322, 666, 754-772, 784-794, 796-800, 920-924, 948-954, 961-972
47	144	144	4-38, 68-97, 230, 240-250, 252-256, 412-415, 440-444, 447-450, 452-458, 582-594, 596-600, 754, 755, 776-782, 789-794, 796-800, 806-810, 834-838
48	144	144	53-77, 122, 182, 183, 210-222, 224-228, 262-266, 296-314, 468-472, 475-478, 480-486, 526-536, 538-543, 726-730, 733-736, 738-744, 754-766, 768-772, 892-896, 920-922
49	93	93	90-94, 230, 259, 260, 305-364, 526-531, 860, 948-954, 984-988, 991-994, 997

Figure 2-2-353 : List of missing tracks for year 1999

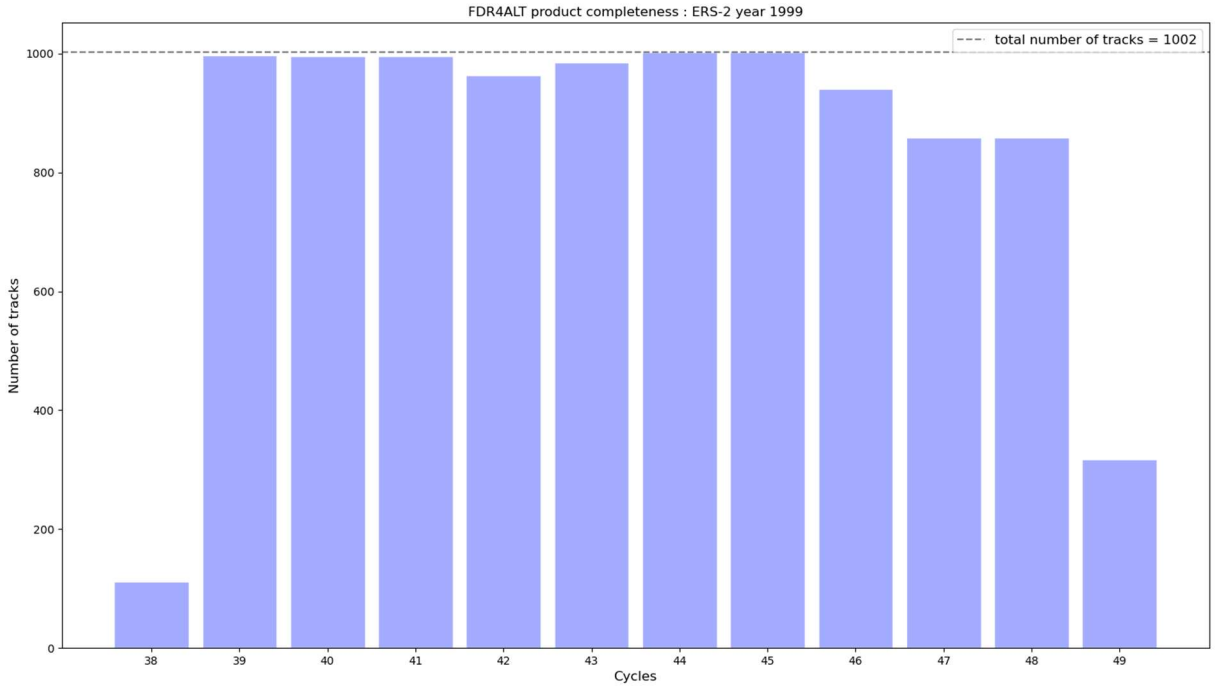

Figure 2-2-354 : Cyclic monitoring of the number of tracks completeness of year 1999

2.4.5.2 Cycle by cycle

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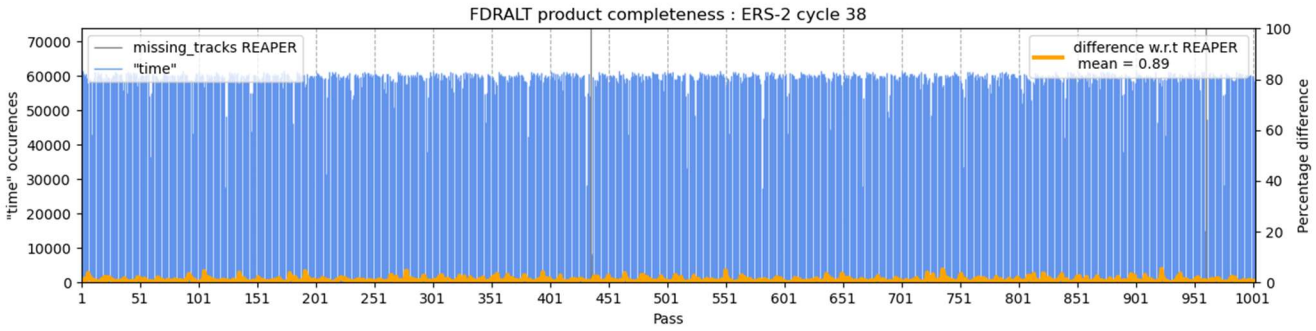

Figure 2-2-355 : Cycle 38

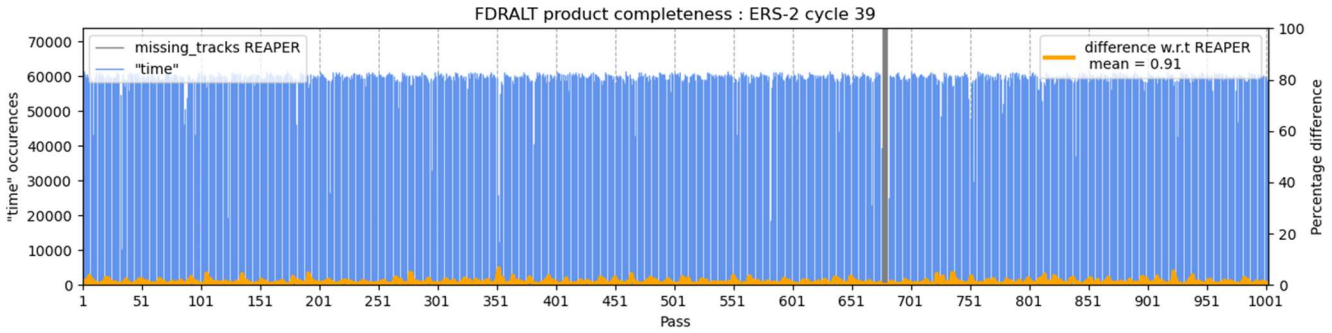

Figure 2-2-356 : Cycle 39

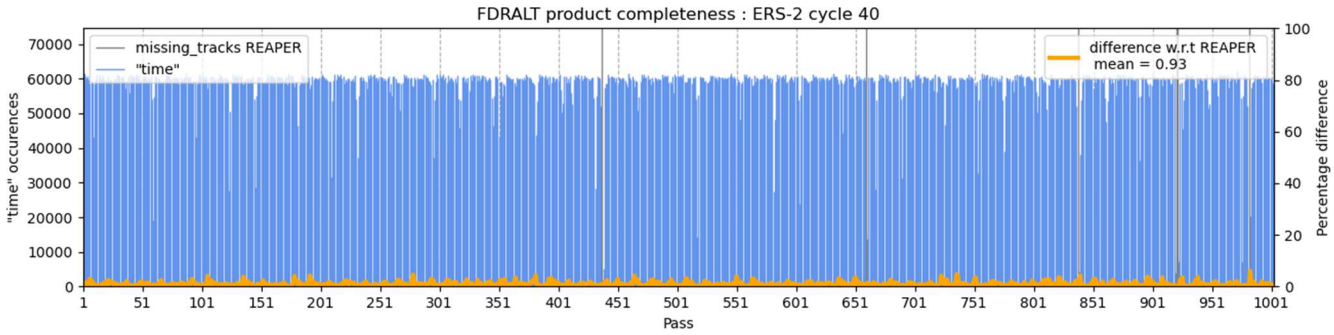

Figure 2-2-357 : Cycle 40

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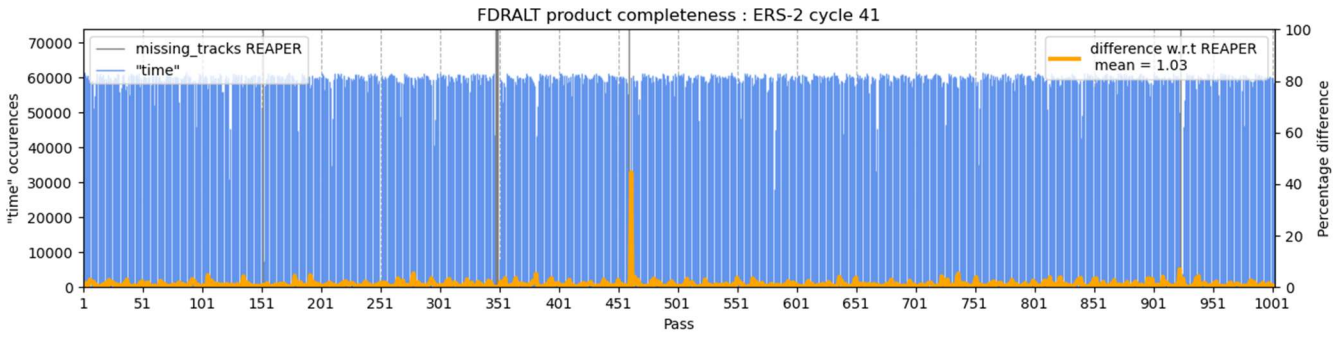

Figure 2-2-358 : Cycle 41

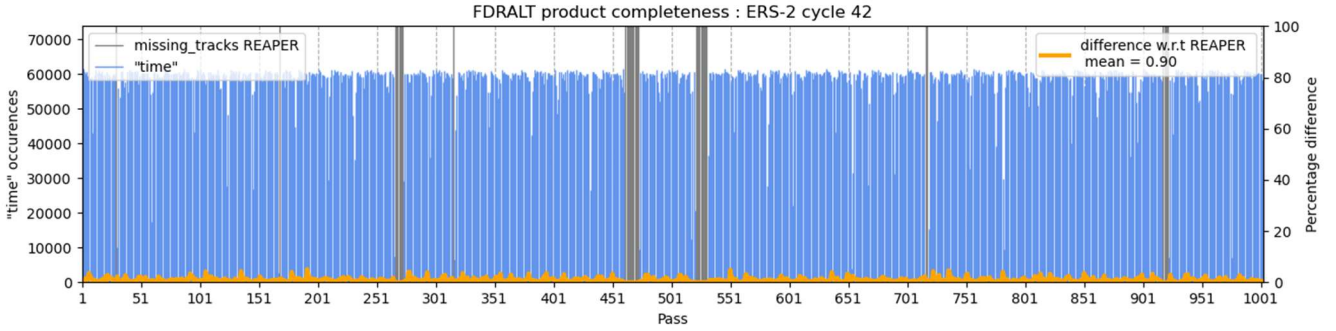

Figure 2-2-359 : Cycle 42

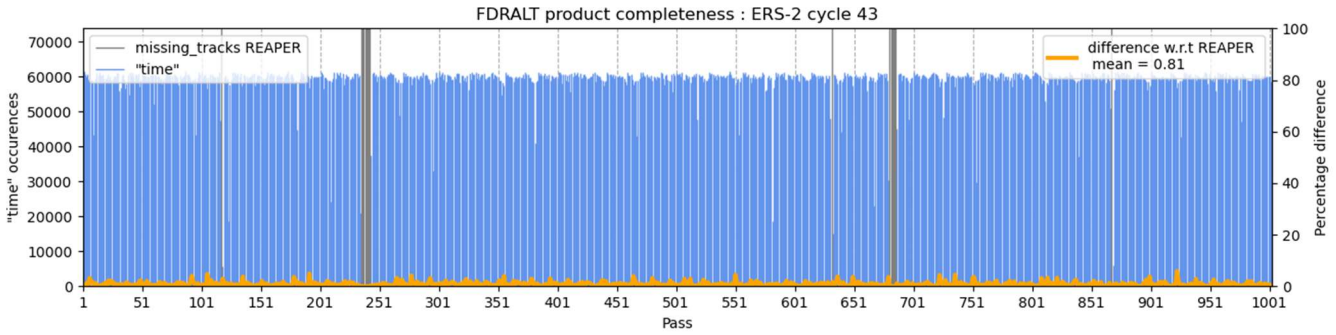

Figure 2-2-360 : Cycle 43

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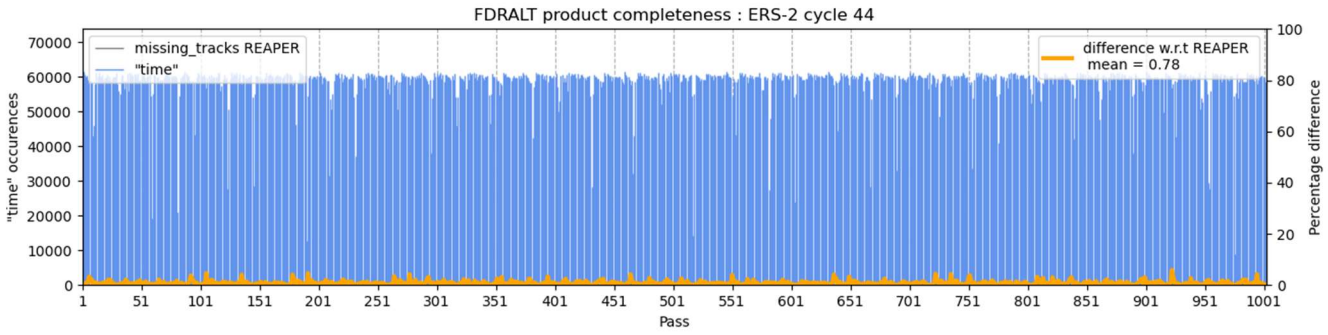

Figure 2-2-361 : Cycle 44

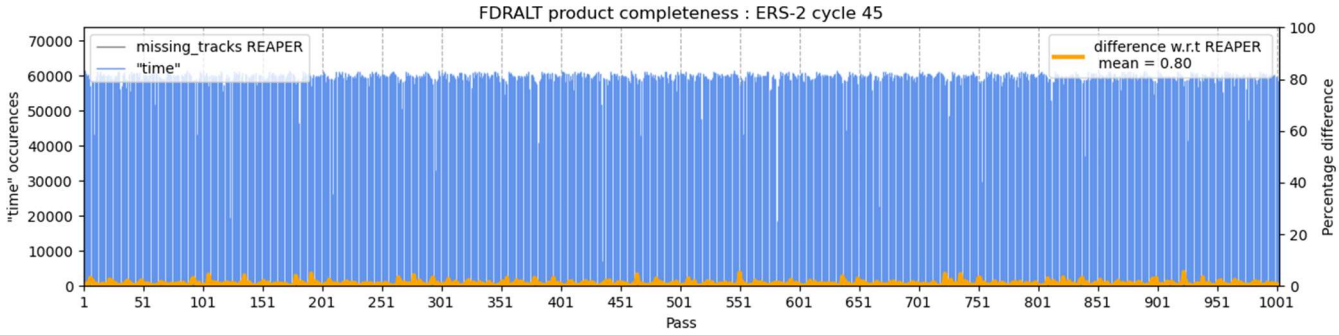

Figure 2-2-362 : Cycle 45

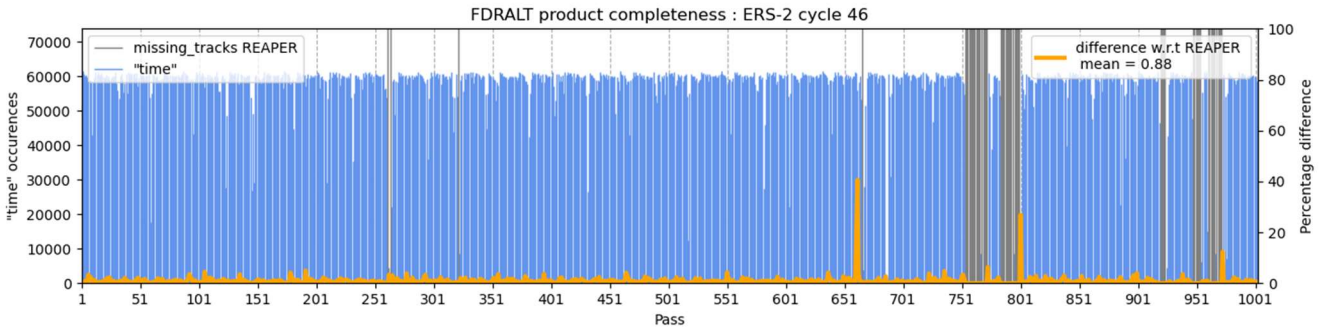

Figure 2-2-363 : Cycle 46

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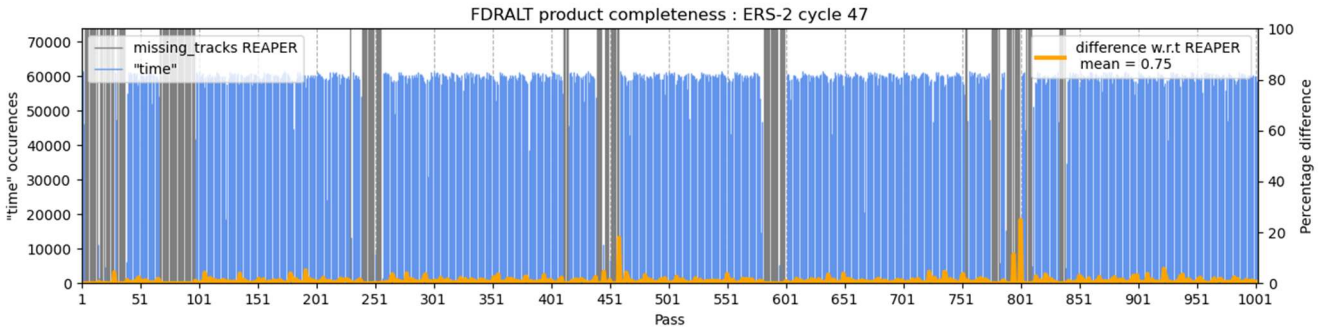

Figure 2-2-364 : Cycle 47

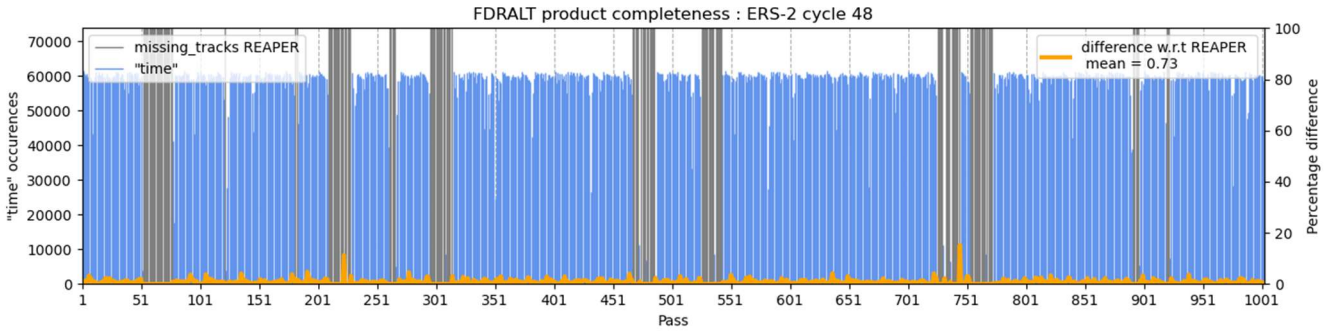

Figure 2-2-365 : Cycle 48

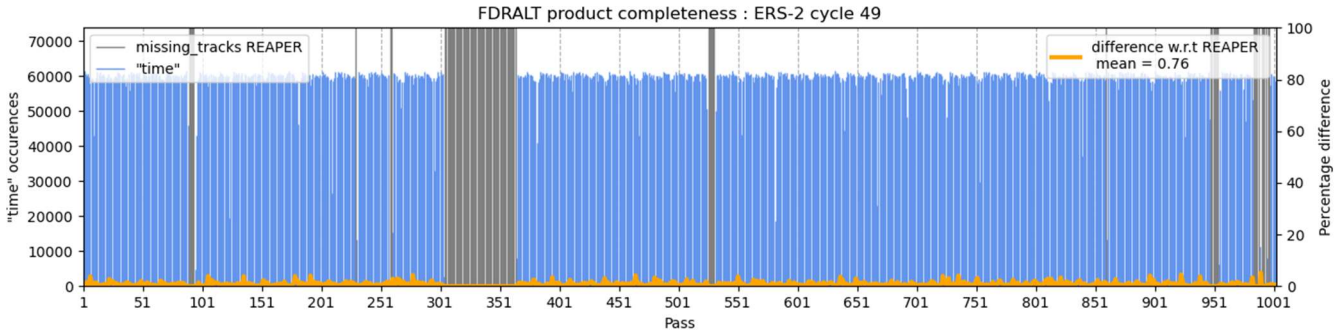

Figure 2-2-366 : Cycle 49

2.4.6 2000

2.4.6.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2000 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

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ERS-2 year 2000			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
49	93	93	90-94, 230, 259, 260, 305-364, 526-531, 860, 948-954, 984-988, 991-994, 997
50	132	132	60-66, 116, 122, 133-144, 173-189, 230, 382-475, 535
51	23	23	631, 632, 713-733
52	43	43	554-558, 561-564, 566-572, 733-736, 738-744, 898-902, 905-908, 910-916
53	0	0	
54	361	361	116-129, 496-826, 864-879
55	17	17	526-543
56	10	10	176-180, 545, 546, 857, 858, 920
57	88	88	36, 339-422, 950-952
58	32	32	146, 524, 548-552, 580, 662-666, 834-838, 948-954, 976-982
59	78	78	43-56, 96-100, 103-106, 108-114, 185, 408-410, 477-503, 956-966, 968-973

Figure 2-2-367 : List of missing tracks for year 2000

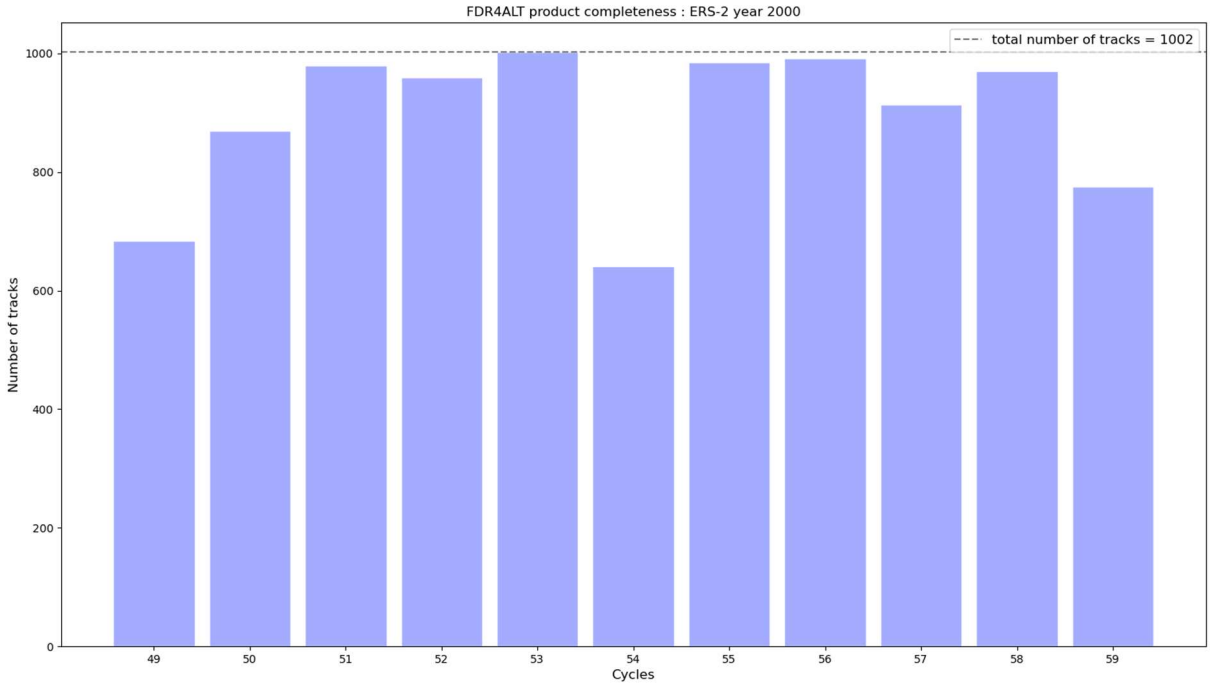

Figure 2-2-368 : Cyclic monitoring of the number of tracks completeness of year 2000

2.4.6.2 Cycle by cycle

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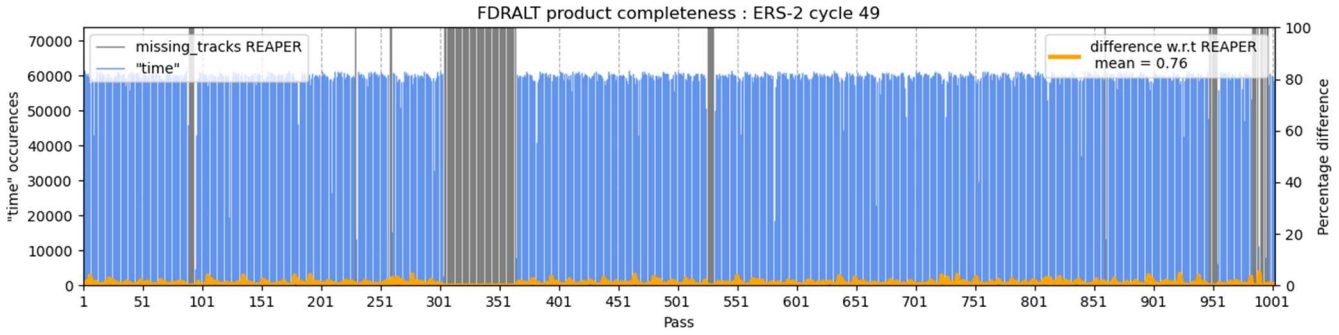

Figure 2-2-369 : Cycle 49

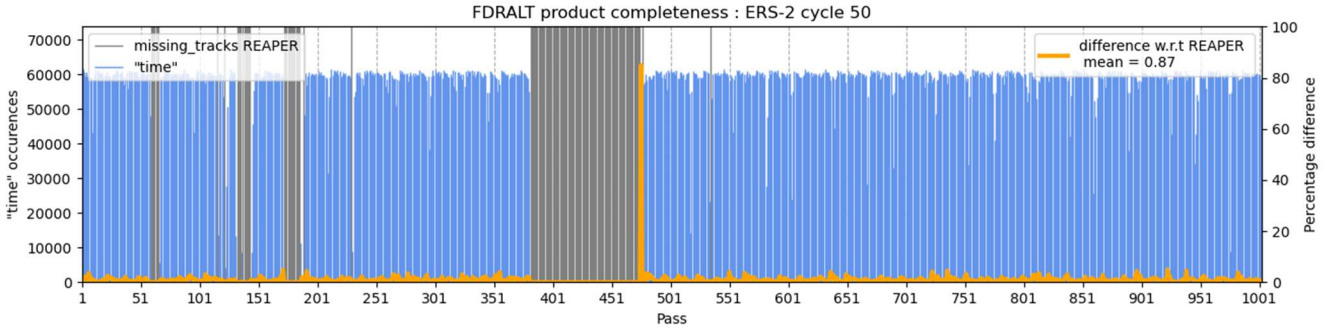

Figure 2-2-370 : Cycle 50

The orange peak in the graph above is due to the fact that the time vector of the REAPER product for track 475 of cycle 50 contains only 20 points, compared with 3 points for the FDRALT product, representing a difference of 85% between the two products.

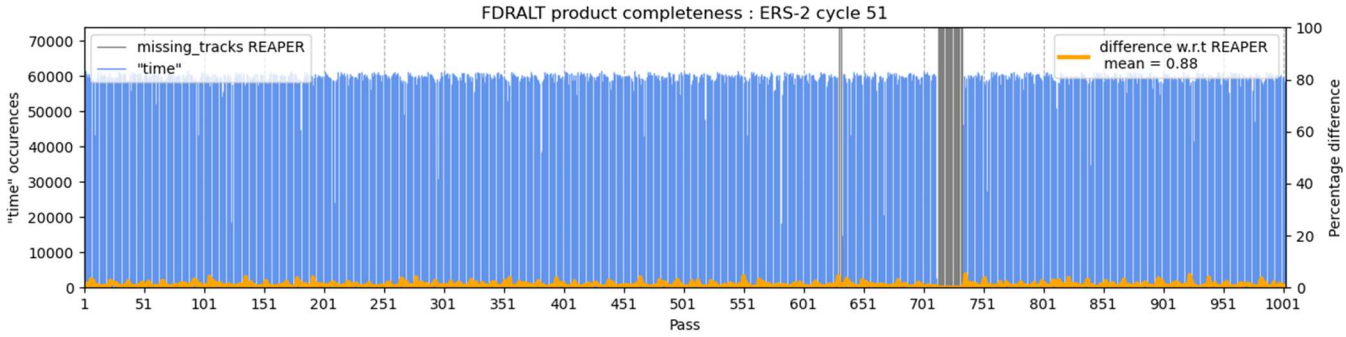

Figure 2-2-371 : Cycle 51

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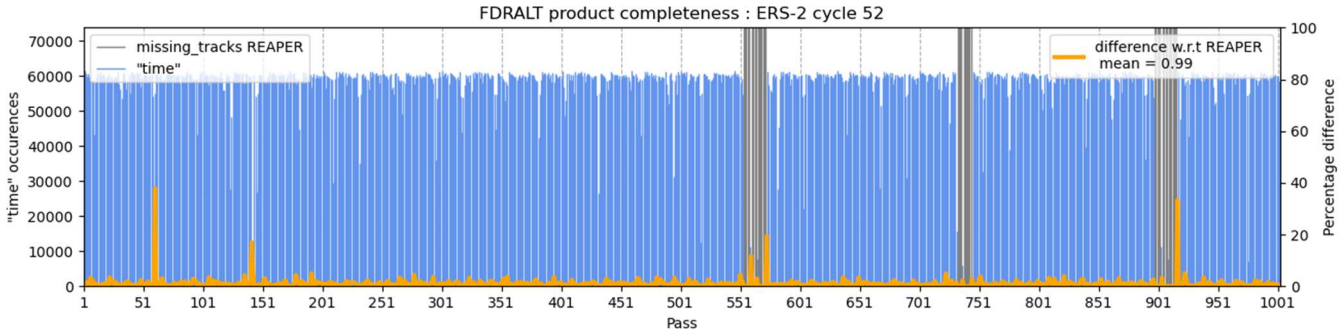

Figure 2-2-372 : Cycle 52

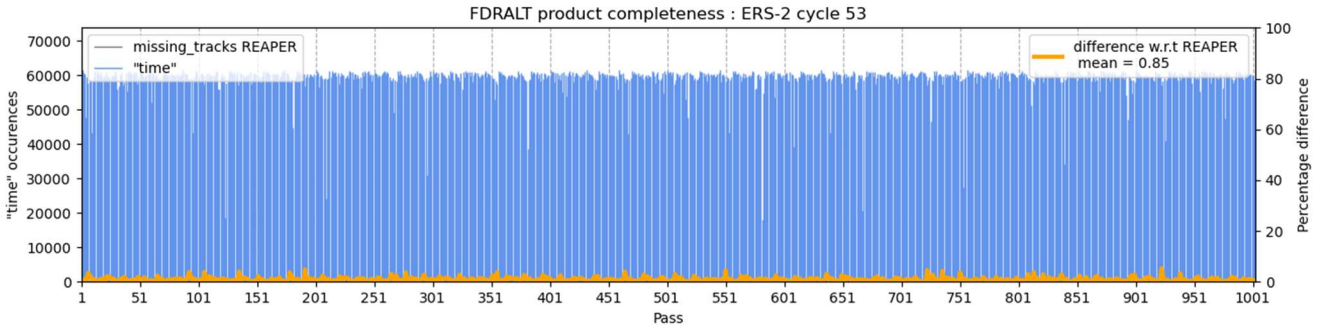

Figure 2-2-373 : Cycle 53

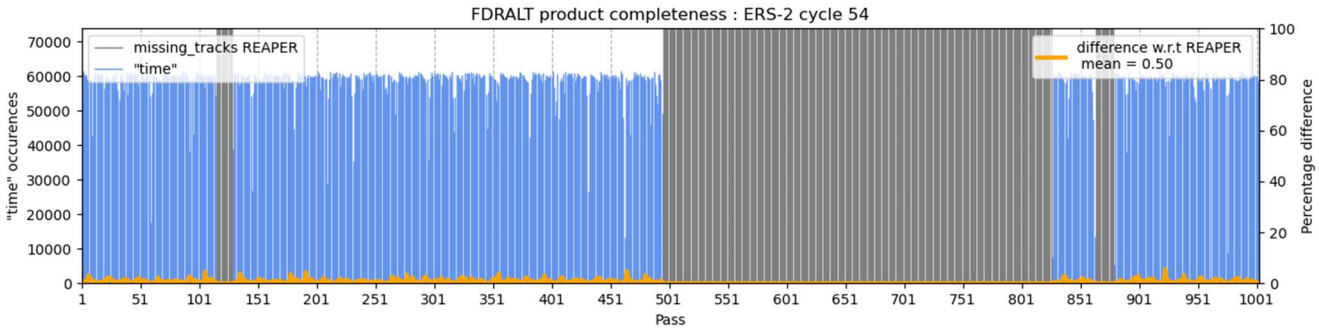

Figure 2-2-374 : Cycle 54

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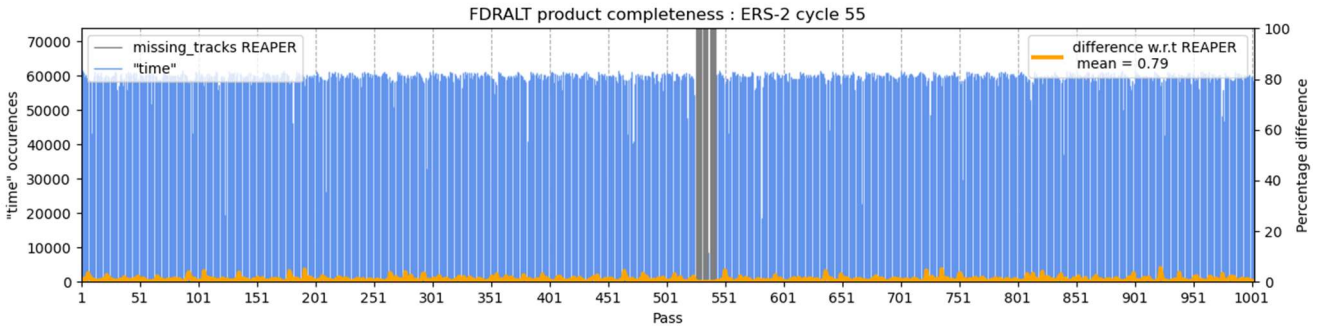

Figure 2-2-375 : Cycle 55

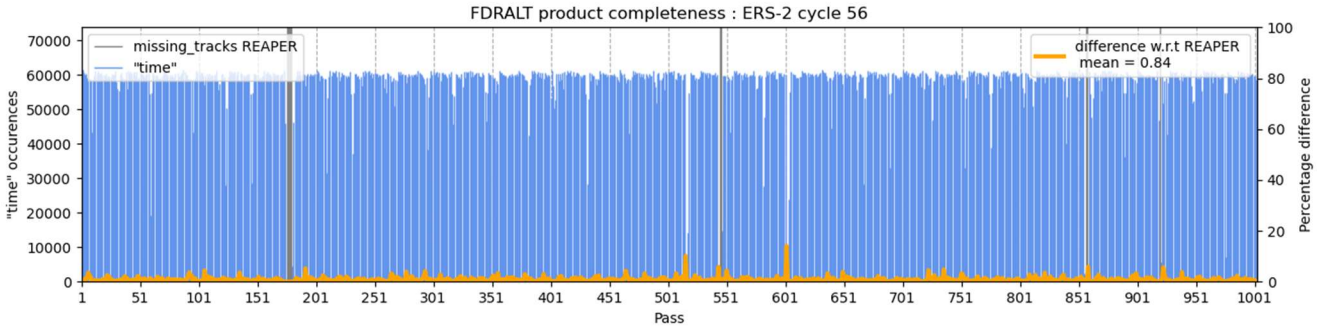

Figure 2-2-376 : Cycle 56

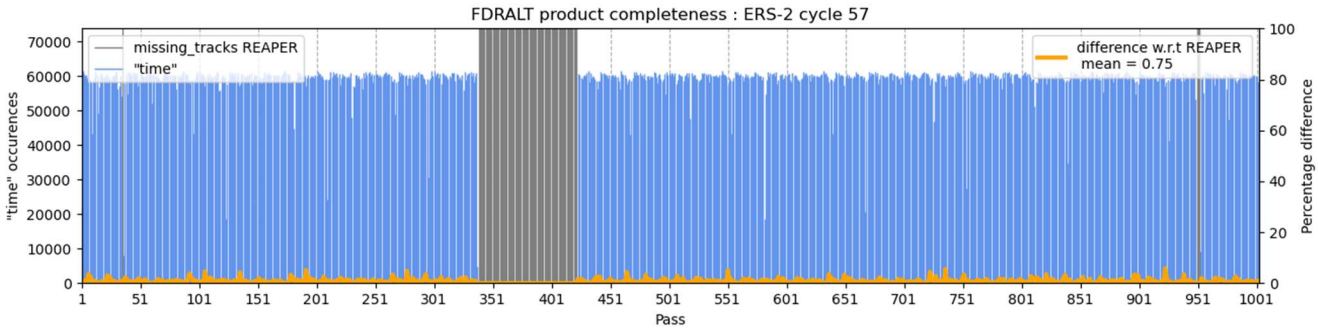

Figure 2-2-377 : Cycle 57

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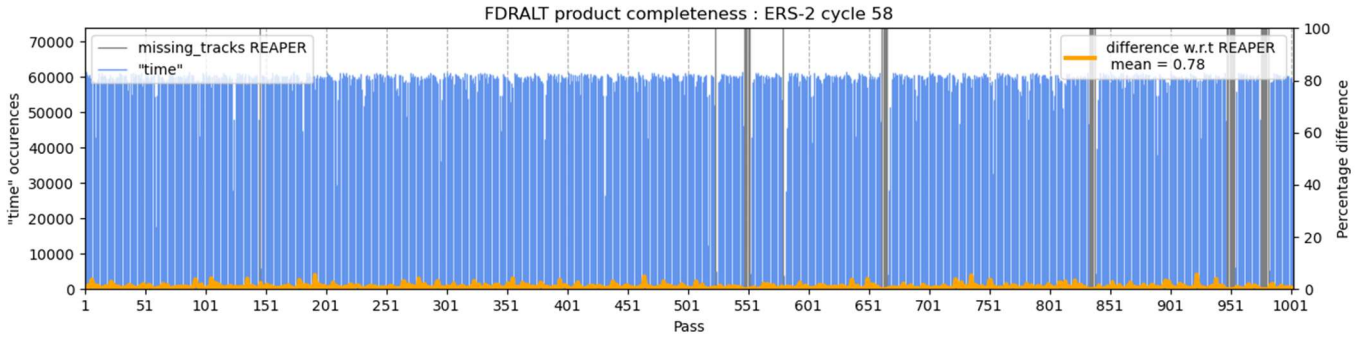

Figure 2-2-378 : Cycle 58

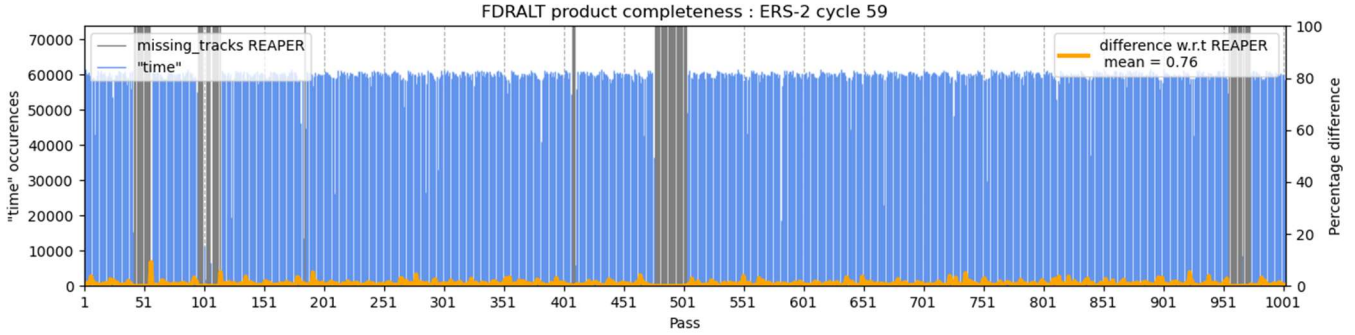

Figure 2-2-379 : Cycle 59

2.4.7 2001

2.4.7.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2001 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

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ERS-2 year 2001			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
59	78	78	43-56, 96-100, 103-106, 108-114, 185, 408-410, 477-503, 956-966, 968-973
60	577	577	36-47, 218-221, 257-787, 806-810, 834-838, 862-868, 892-896, 920-922, 948-952
61	124	124	4-8, 32-36, 60-64, 118-122, 146-152, 176-180, 204-208, 232-236, 262-266, 294, 295, 318-324, 348-352, 380, 404-410, 434-438, 462-466, 548-552, 604-610, 690-696, 752, 776-780, 806-810, 834-838, 892-896, 920-924
62	54	54	4-8, 90-94, 146, 150, 232-238, 369-381, 404-410, 578-580, 604, 608-610, 634-638, 664-666
63	105	105	176-180, 266, 636-644, 647-650, 652-655, 657, 658, 770-772, 774, 798-873
64	24	24	90-92, 106-111, 554-558, 561-564, 566-572
65	6	6	720, 748-752
66	13	13	352, 780-791
67	18	18	918-935
68	64	64	378-387, 679-684, 941-989
69	36	36	214-247, 281, 660
70	1	1	518

Figure 2-2-380 : List of missing tracks for year 2001

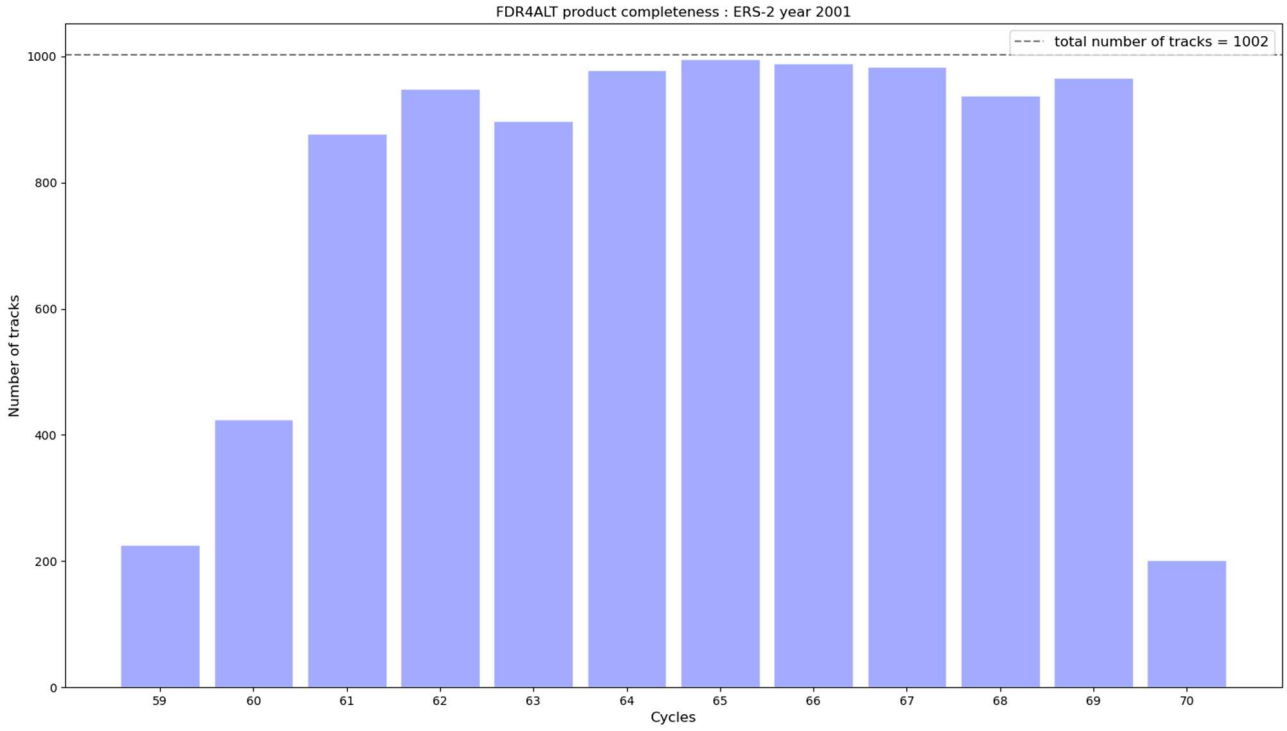

Figure 2-381 : Cyclic monitoring of the number of tracks completeness of year 2001

2.4.7.2 Cycle by cycle

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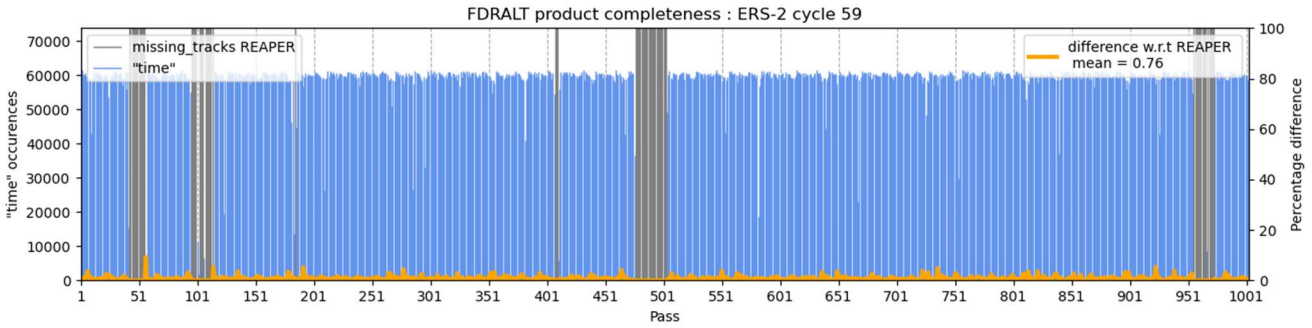

Figure 2-2-382 : Cycle 59

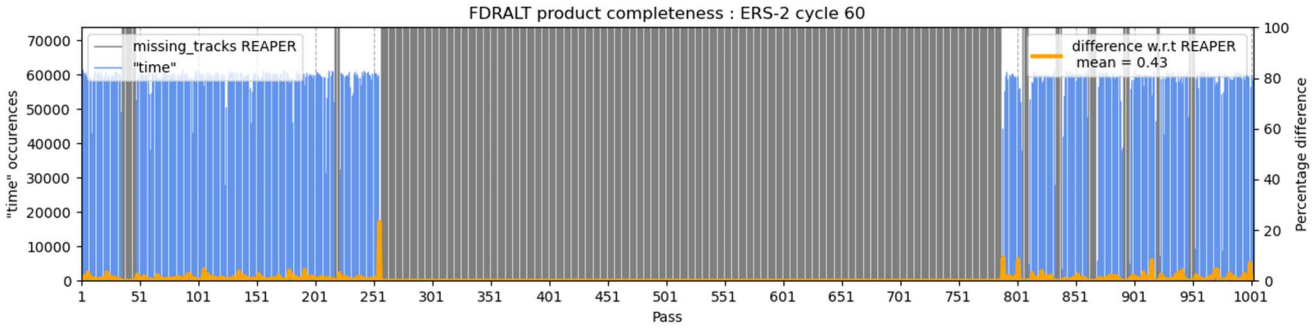

Figure 2-2-383 : Cycle 60

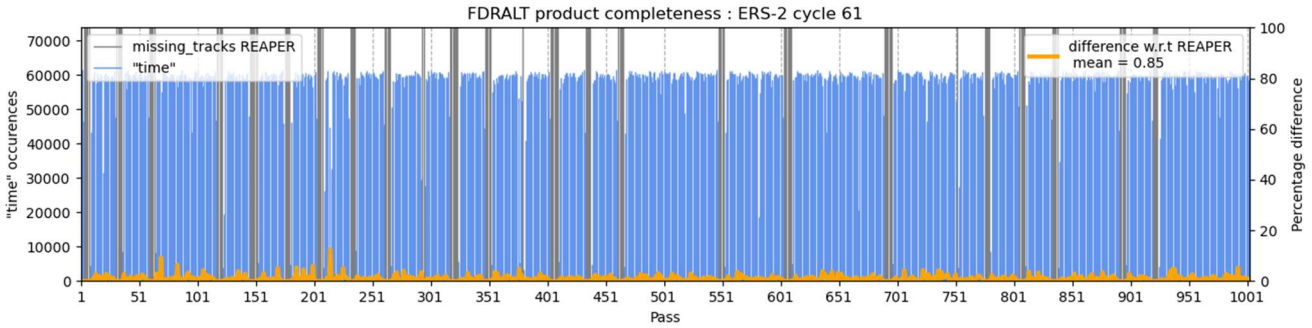

Figure 2-2-384 : Cycle 61

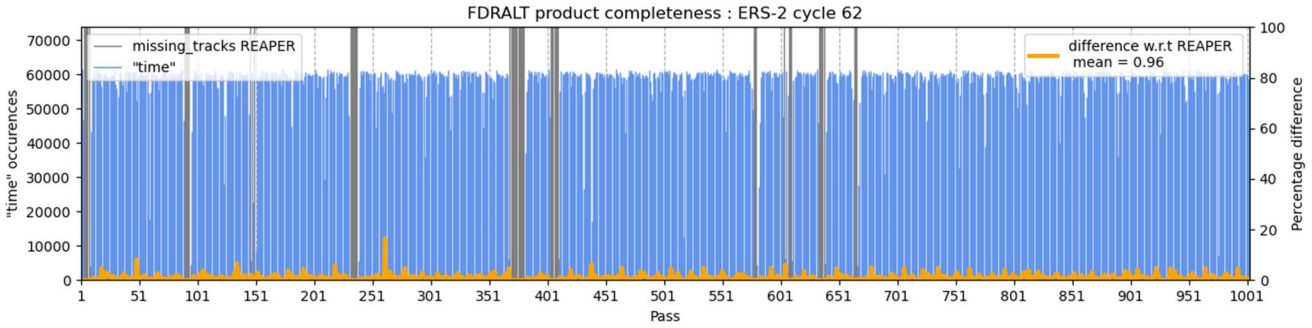

Figure 2-2-385 : Cycle 62

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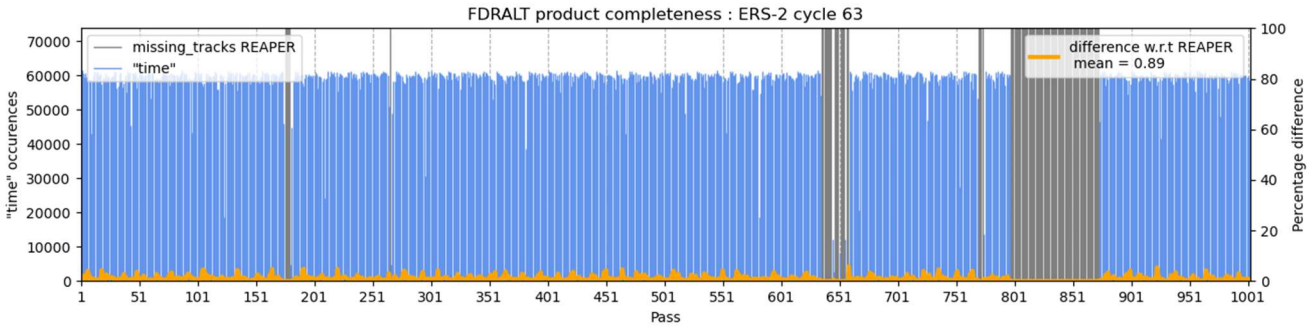

Figure 2-2-386 : Cycle 63

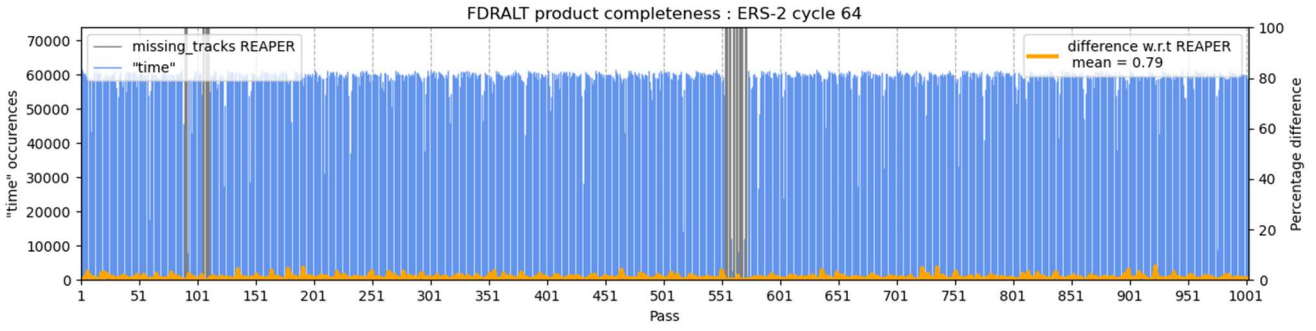

Figure 2-2-387 : Cycle 64

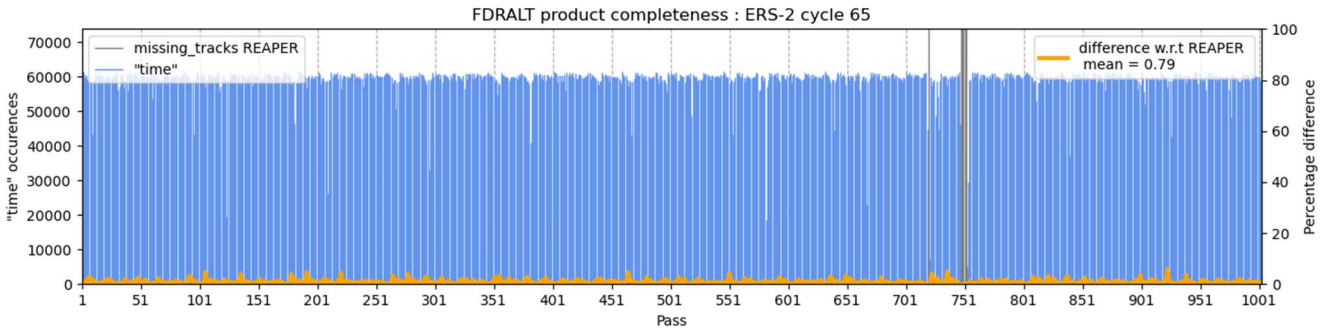

Figure 2-2-388 : Cycle 65

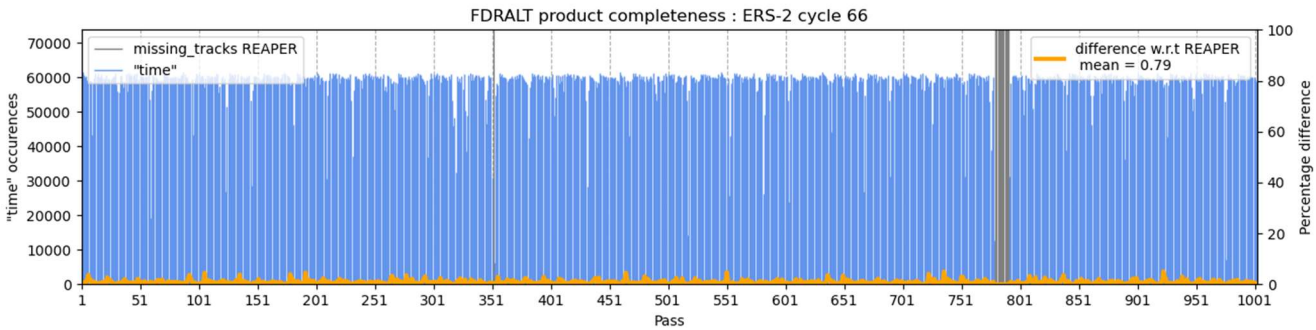

Figure 2-2-389 : Cycle 66

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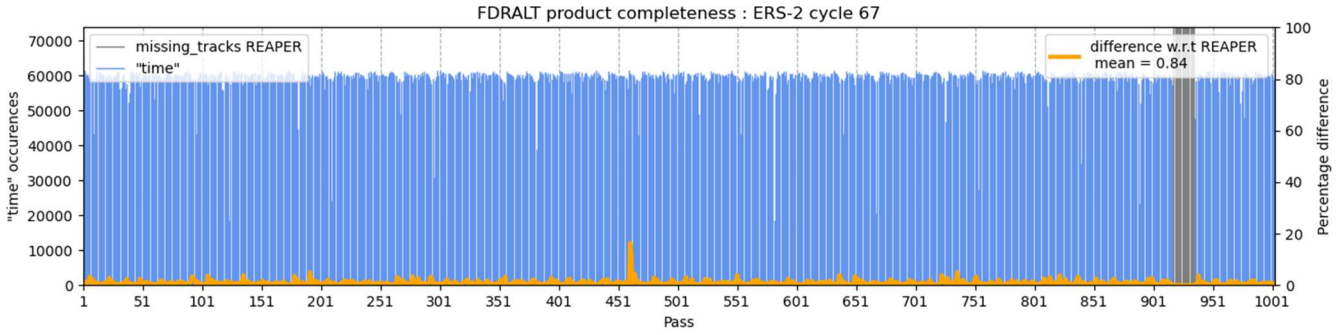

Figure 2-2-390 : Cycle 67

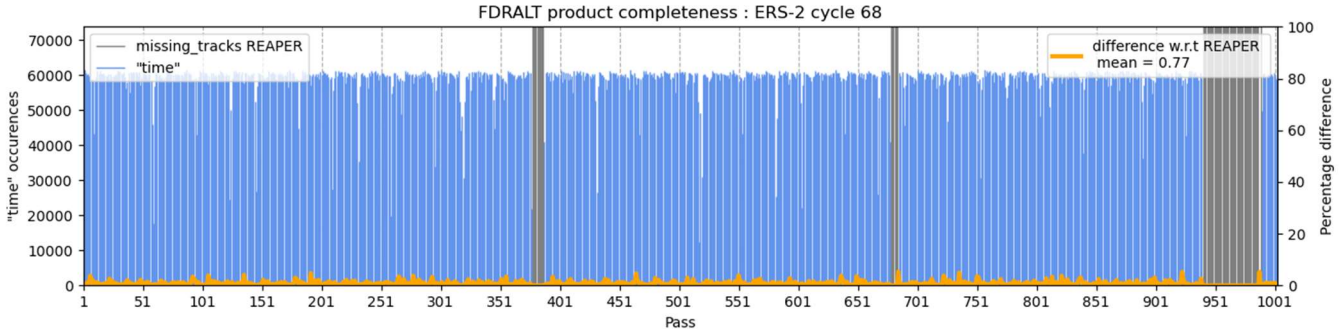

Figure 2-2-391 : Cycle 68

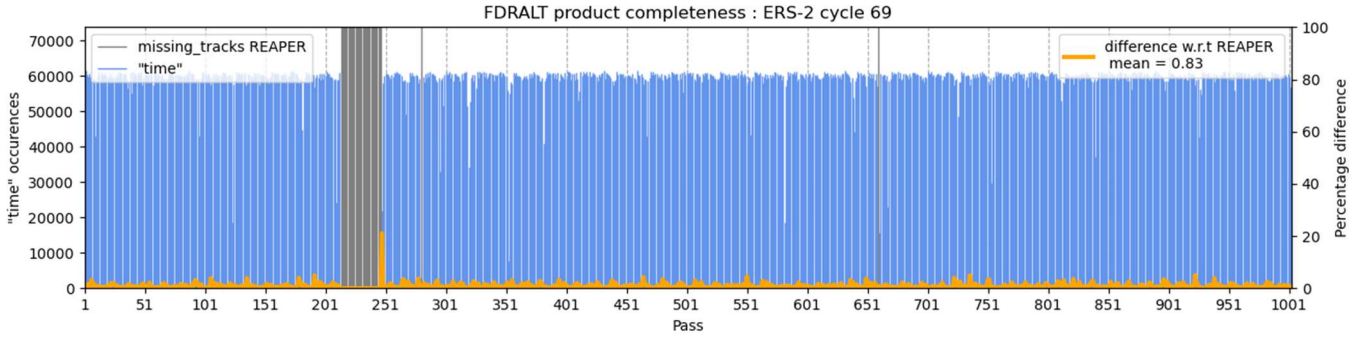

Figure 2-2-392 : Cycle 69

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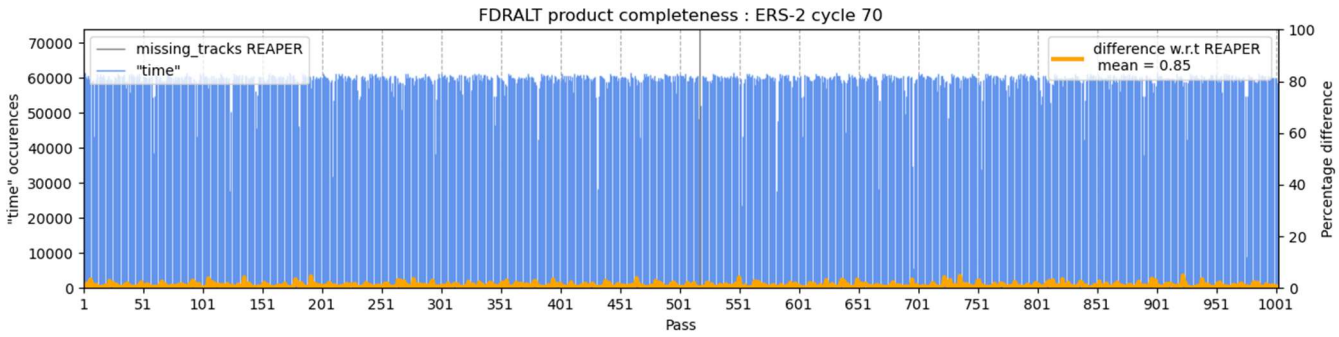

Figure 2-2-393 : Cycle 70

2.4.8 2002

2.4.8.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2002 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.

ERS-2 year 2002			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
70	1	1	518
71	19	19	148-161, 273-277
72	387	387	92-458, 622-626, 711-727, 838
73	32	32	316-331, 486-501
74	8	8	548-550, 606, 608, 778-780
75	7	7	352, 449-454
76	0	0	
77	0	0	
78	15	15	277, 435-447, 574
79	27	27	398-423, 894
80	24	24	1-8, 292-304, 834-838

Figure 2-2-394 : List of missing tracks for year 2002

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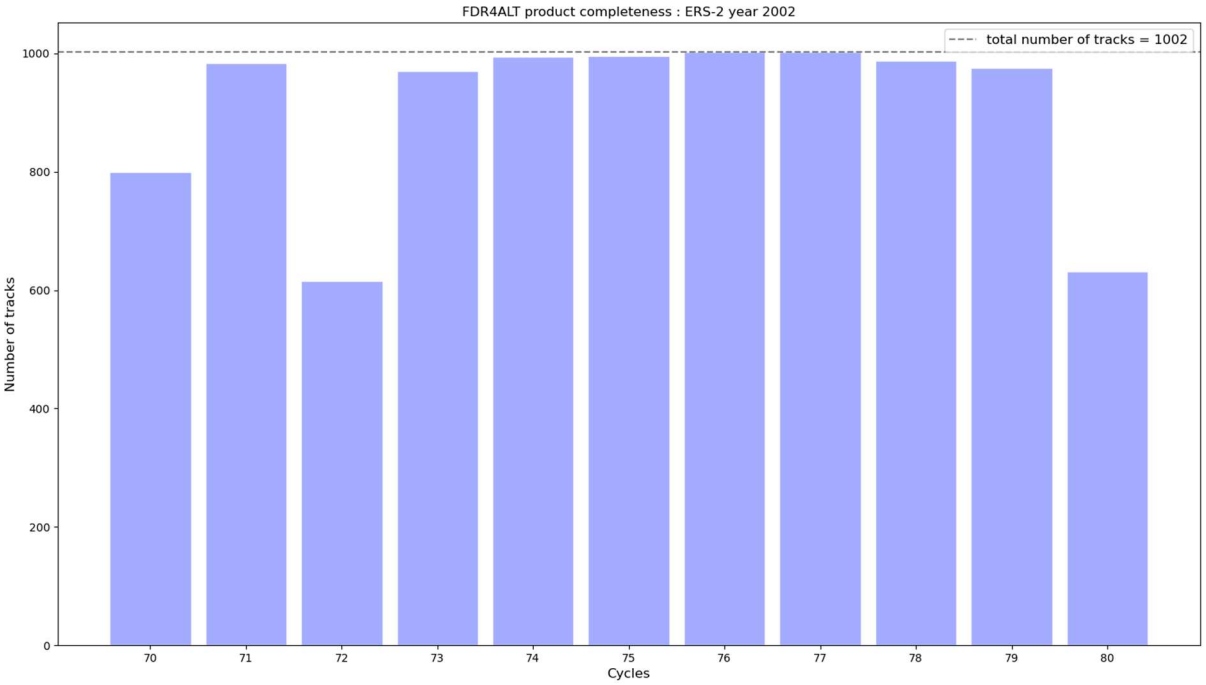

Figure 2-2-395 : Cyclic monitoring of the number of tracks completeness of year 2002

2.4.8.2 Cycle by cycle

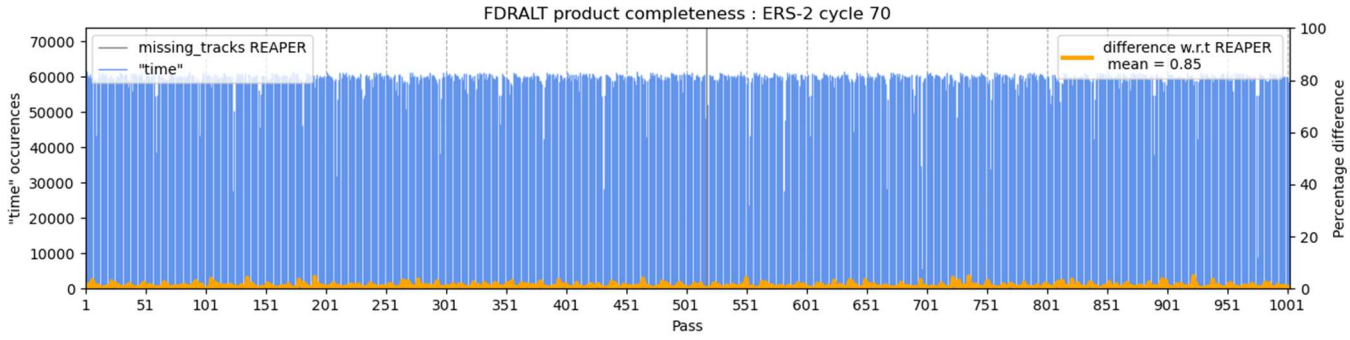

Figure 2-2-396 : Cycle 70

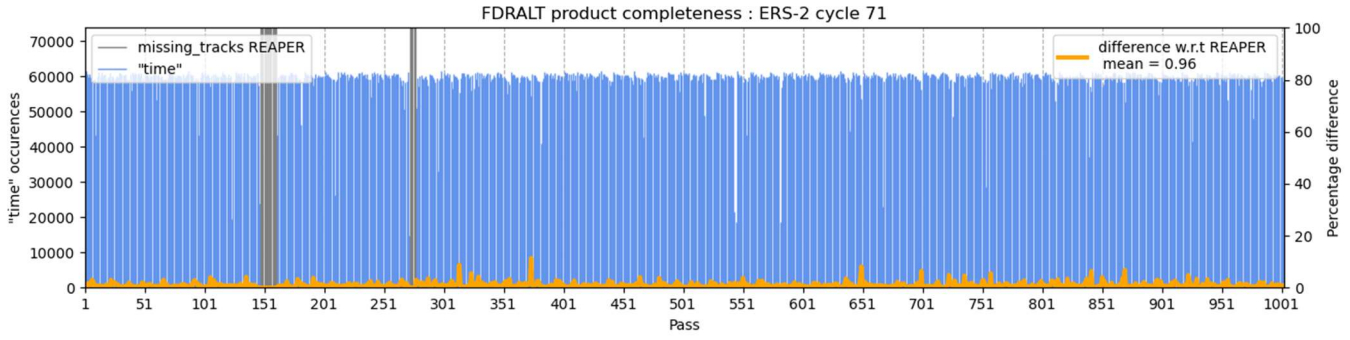

Figure 2-2-397 : Cycle 71

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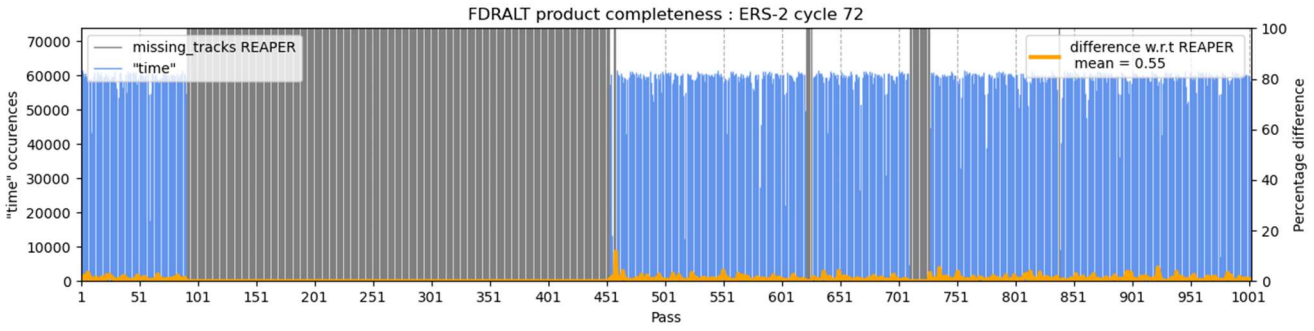

Figure 2-2-398 : Cycle 72

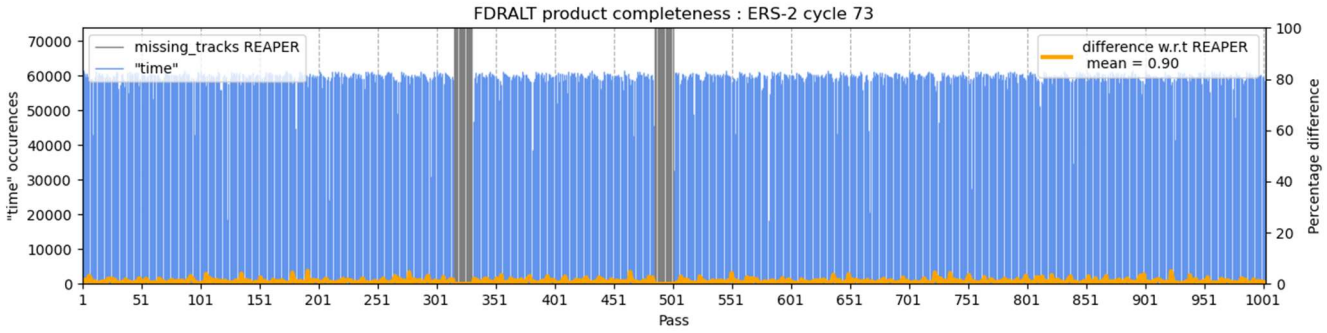

Figure 2-2-399 : Cycle 73

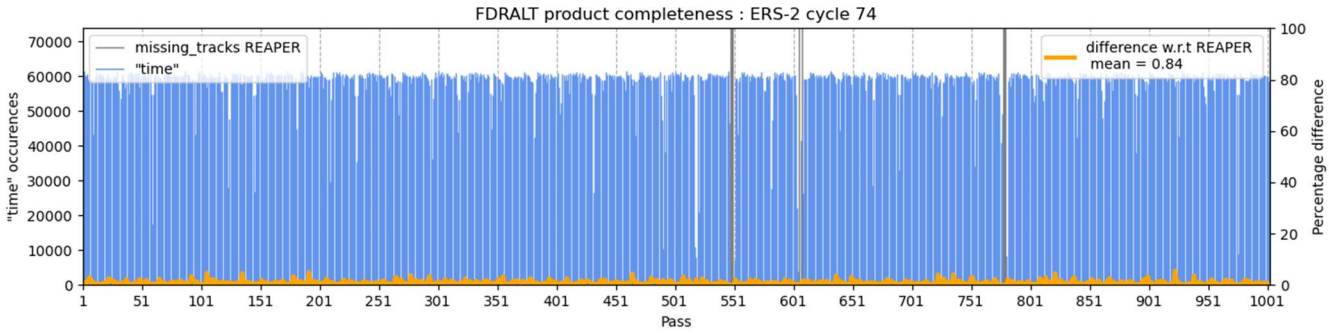

Figure 2-2-400 : Cycle 74

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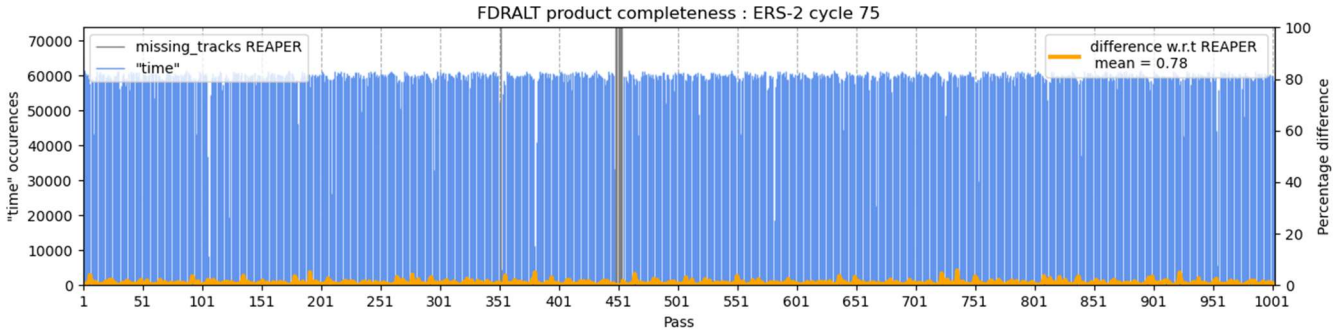

Figure 2-2-401 : Cycle 75

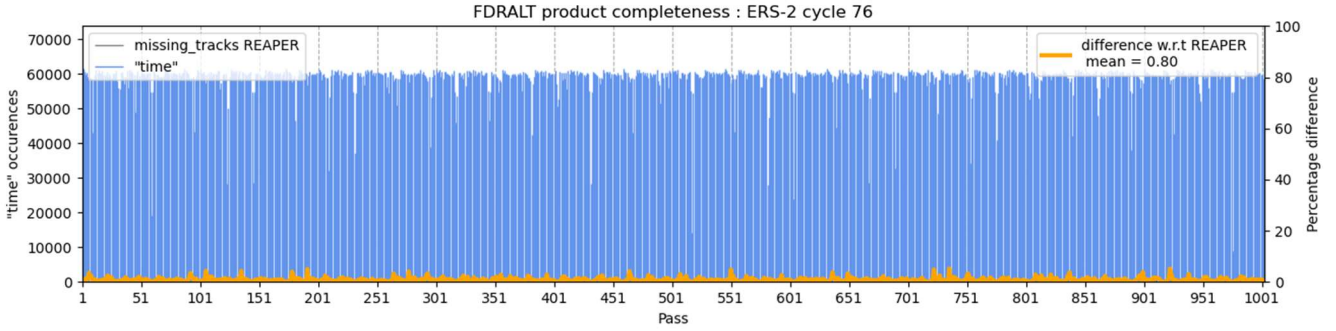

Figure 2-2-402 : Cycle 76

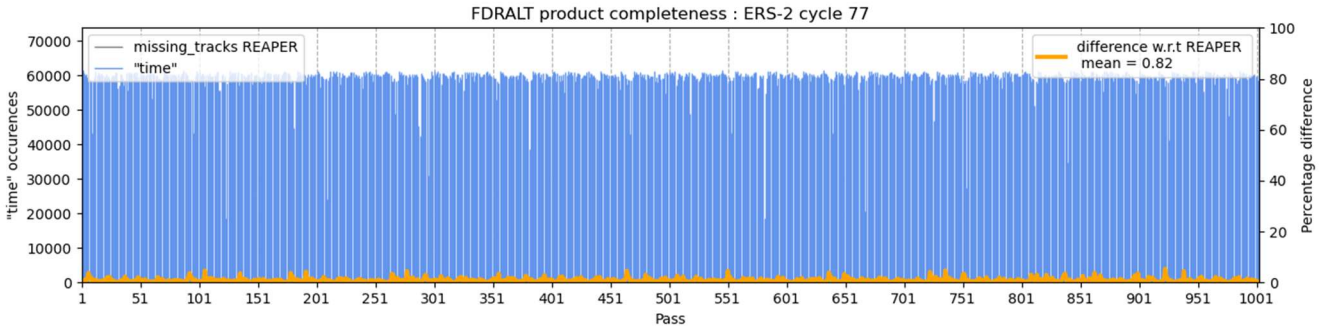

Figure 2-2-403 : Cycle 77

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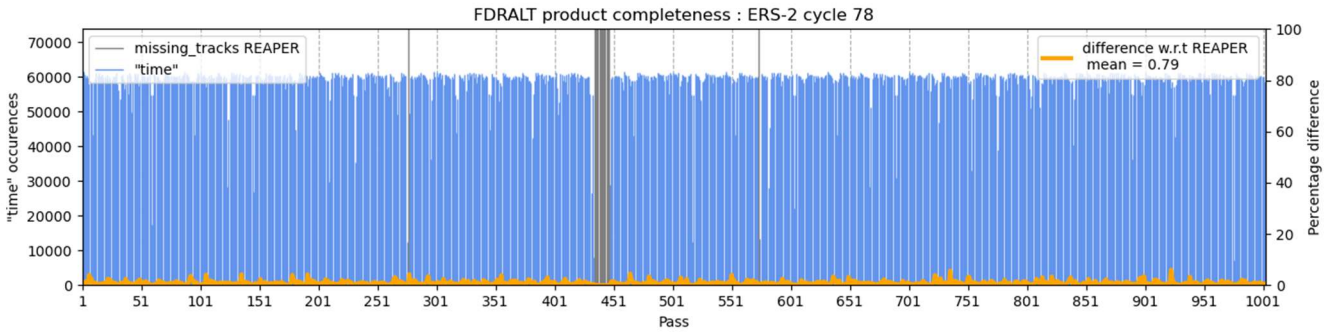

Figure 2-2-404 : Cycle 78

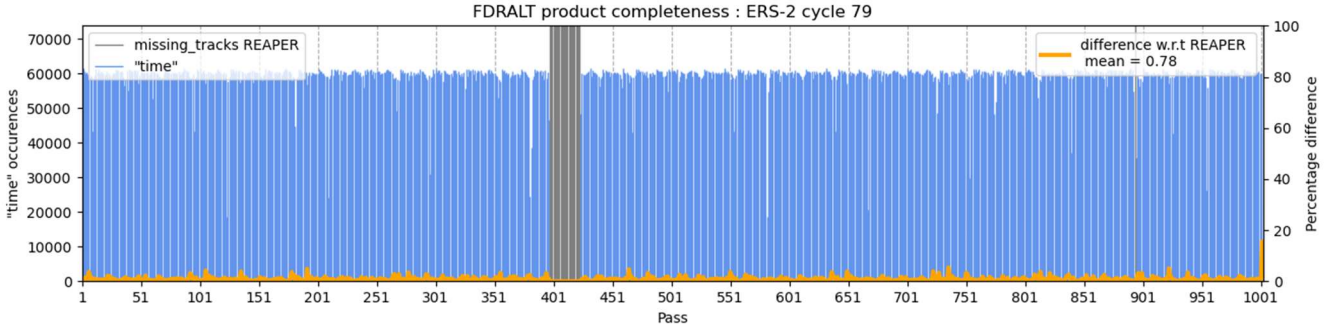

Figure 2-2-405 : Cycle 79

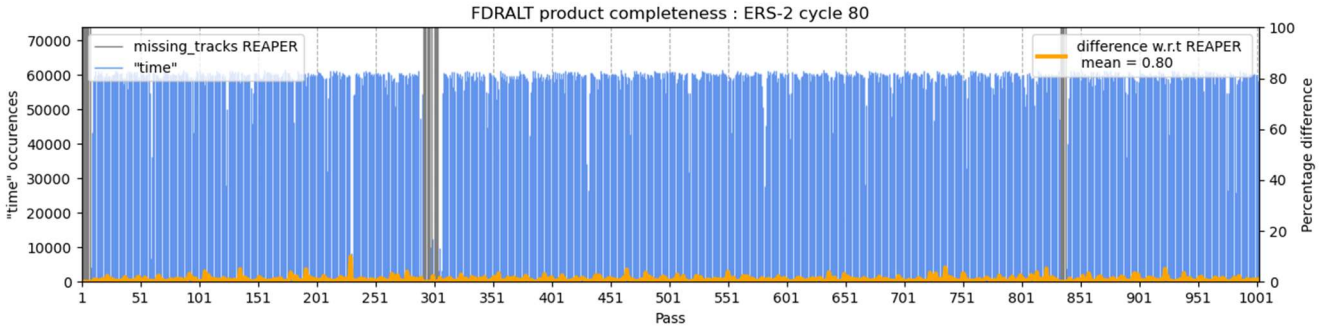

Figure 2-2-406 : Cycle 80

2.4.9 2003

2.4.9.1 Overview of the year

Completeness report of the FDR4ALT data is done for year 2003 and presented in the table and figure below.

In summary:

- All cycles are 100% complete in term of tracks' availability. Very small data loss around 1% (impacting all cycles) due to time jumps editing as explained in 2.4.
- Last cycle processed during the project is cycle 85 corresponding to the ERS-2 tape record failure event. See [D-5-03] https://earth.esa.int/eogateway/missions/ers/description

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for more information.

ERS-2 year 2003			
Cycles	Number of missing tracks (REAPER)	Number of missing tracks (FDR4ALT)	Missing tracks
80	24	24	1-8, 292-304, 834-838
81	42	42	204-208, 236, 290-294, 468, 469, 701-715, 832, 887, 929-936, 938-941, 943, 944
82	16	16	60, 64-66, 92-94, 365-371, 376, 892
83	5	5	382, 384, 385, 832, 918
84	108	108	30, 43-47, 127, 503-595, 632, 743, 764-769
85	436	436	320-331, 564-1002

Figure 2-2-407 : List of missing tracks for year 2003

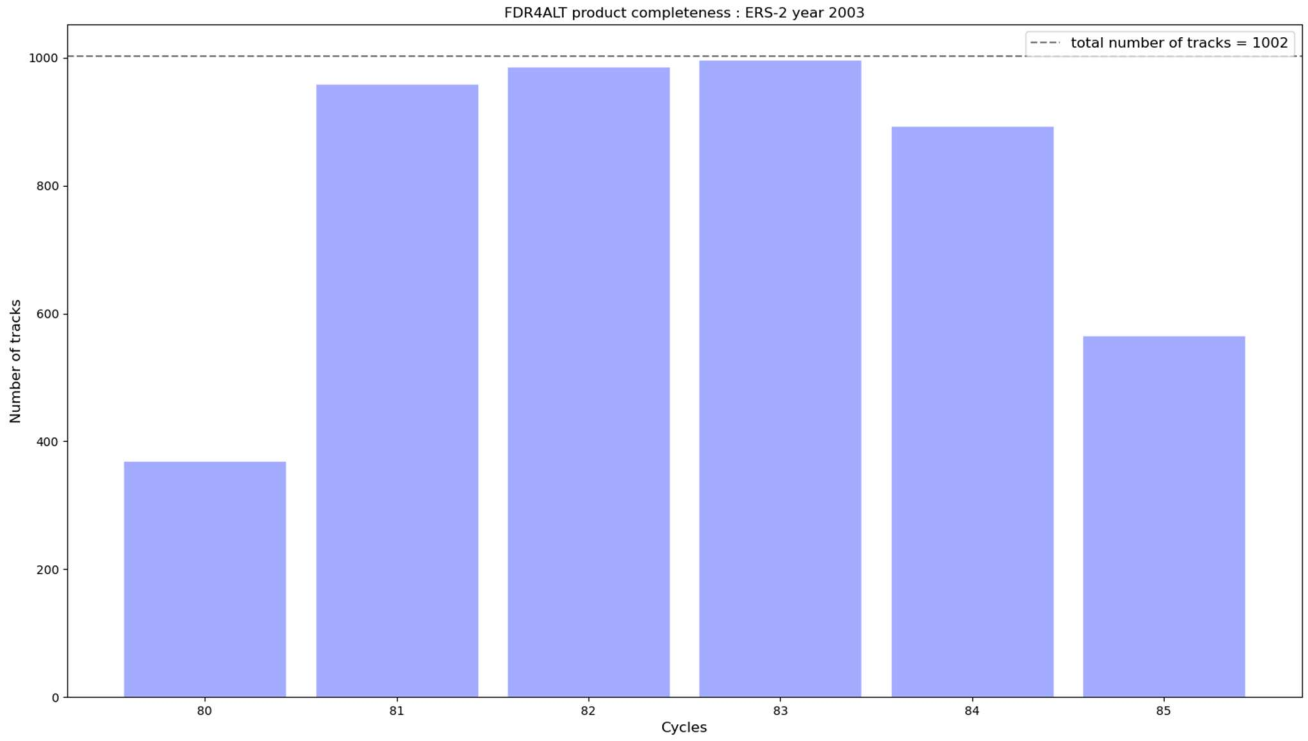

Figure 2-2-408 : Cyclic monitoring of the number of tracks completeness of year 2003

2.4.9.2 Cycle by cycle

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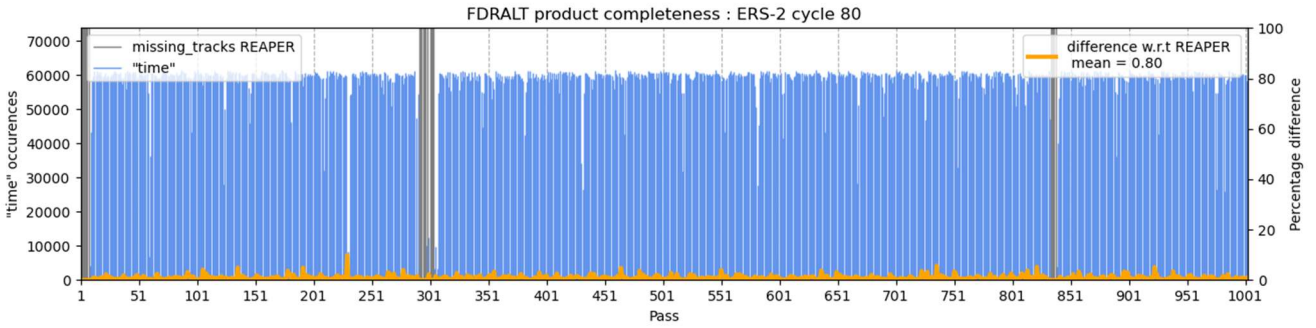

Figure 2-2-409 : Cycle 80

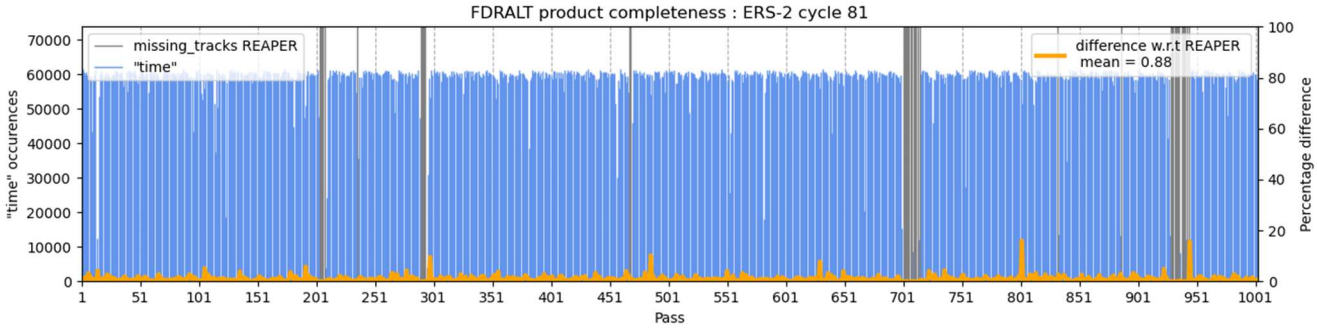

Figure 2-2-410 : Cycle 81

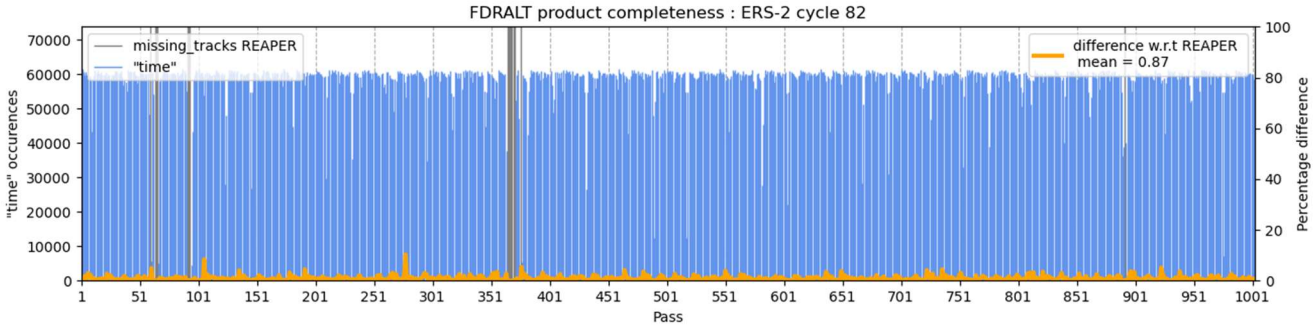

Figure 2-2-411 : Cycle 82

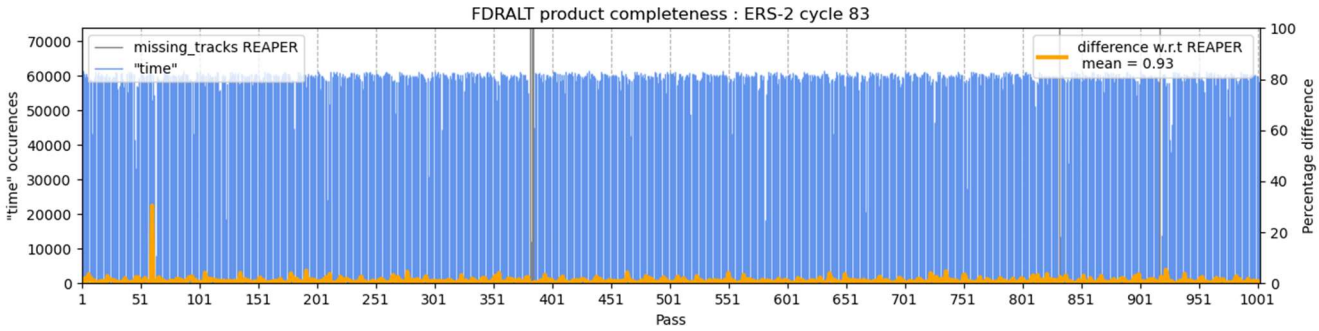

Figure 2-2-412 : Cycle 83

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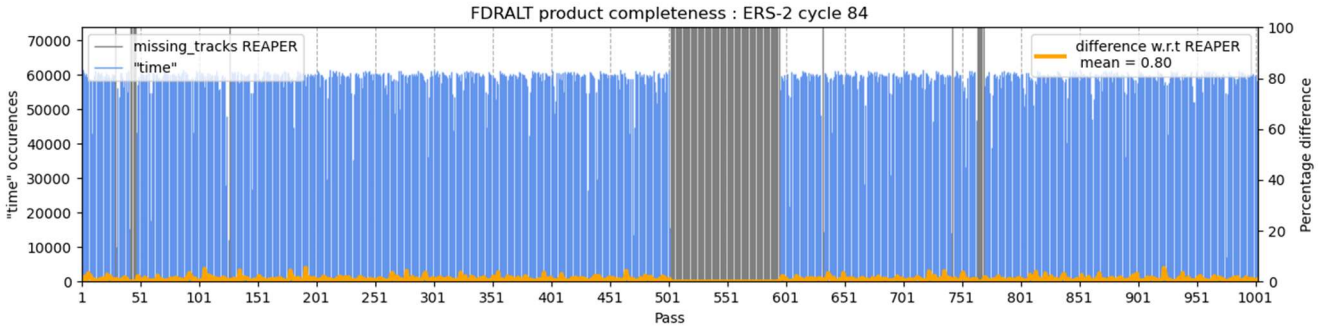

Figure 2-2-413 : Cycle 84

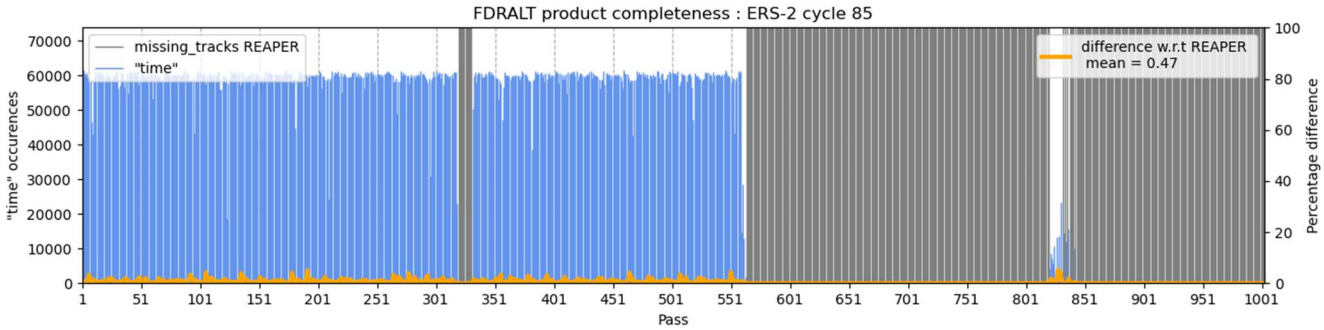

Figure 2-2-414 : Cycle 85

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Appendix A - FDR4ALT deliverables

The table below lists all FDR4ALT deliverables with their respective ID number and confidentiality level.

Document	ID	Confidentiality Level
Products Requirements & Format Specifications Document	[D-1-01] [D-2-02]	Public
Roadmap & Product Summary Document	[D-1-02]	Project Internal
Data Requirements Document	[D-1-03]	Project Internal
System Maturity Matrix	[D-1-04]	Project Internal
Examples of products	[D-1-05]	Project Internal
Review Procedure Document	[D-1-06]	Project Internal
Review Data Package	[D-1-07]	Project Internal
Phase 1 Review Report Document	[D-1-08]	Project Internal
Detailed Processing Model Document	[D-2-01]	Public
Round Robin Assessment Report Document	[D-2-03]	Public
Data Production Status Report	[D-3-01]	Project Internal
Final Output Dataset	[D-3-01]	Public
Product Validation Plan	[D-4-01]	Project Internal
Product Validation Report	[D-4-02]	Public
Uncertainty Characterization Definition Document	[D-5-01]	Public
Uncertainty Characterization Report	[D-5-02]	Public
Product User Guide	[D-5-03]	Public
Completeness Report: ALT	[D-7-01]	Public
Completeness Report: MWR	[D-7-02]	Public

Table 2-15 : List of FDR4ALT deliverables

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Appendix B - ENVISAT mission events

The table below provides the list of events affecting the RA2 mission, during the ENVISAT lifetime: 1 March 2002 - 8 April 2012.

	Generic mission or RA2 instrument event
	RA2 Instrument unavailability*
	Payload/Platform unavailability*
	Transition to YSM**

* Instrument/Payload/Platform unavailabilities started to be referenced in 2004 (referenced as EN-UNA in Description column)

* *Does not correspond to a RA2 instrument unavailability, but the Service Module has been switched down to YSM (Yaw Steering Mode) instead of nominal SYSM (Stellar Yaw Steering Mode). This could result in degraded geolocation.

Acronyms:

- CTI – Configuration Table interfaces
- FOV – Field Of View
- HXM – High Speed Multiplexer
- ICU – Instrument Control Unit
- MCMD – Macrocommand
- OBDH – On Board Data Handling
- OBT – On-Board Time
- OCM – Orbit Control Manouvre
- RFSS – Radio Frequency SubSystem
- SEU – Single Event Upset
- SM – Service Module
- SODAP – Switch-On and Data Acquisition Plan
- SPSA – Signal Processor Subassembly
- SYSM – Stellar Yaw Steering Mode
- USO – Ultra Stable Oscillator
- YSM – Yaw Steering Mode

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Year	Start time	Stop time	Start orbit	Stop orbit	Description	Duration (Hours)
2002	01/03/2002 1:07	-	1	-	ENVISAT Launch from Kourou, French Guiana	-
2002	11/03/2002	11/03/2002	153	155	SODAP: RA2 in IF mode	-
2002	12/03/2002	-	167	-	SODAP: RA2 in measurement mode (Tracking or Open Loop Acquisition mode)	-
2002	13/03/2002	-	176	-	SODAP: First S-Band anomaly: Evidence of echo accumulation	
2002	01/04/2002 12:16	08/04/2002 18:38	450	554	RA2 out of measurement mode: RA2 ICU in Suspended mode	174.37
2002	11/05/2002 12:54	14/05/2002 18:32	1022	1069	RA2 out of measurement mode: Payload switch off	77.63
2002	17/05/2002 8:45	24/05/2002 14:58	1106	1210	RA2 out of measurement mode: RA-2 switched to Heater0/Refuse mode due to an attempt to clearCTI	174.22
2002	27/05/2002 1:38	30/05/2002 10:13	1245	1293	RA2 out of measurement mode: Payload switch off	80.58
2002	05/06/2002 21:18	10/06/2002 19:25	1385	1465	RA2 out of measurement mode: Payload switch off	94.12
2002	24/06/2002 16:18	26/06/2002 16:03	1654	1683	RA2 out of measurement mode: RA2 in Standby mode following execution of commands sent to the instrument aiming at resolving the problem of S-Band anomaly	47.75
2002	27/06/2002 14:24	28/06/2002 13:19	1696	1710	RA2 out of measurement mode: RA2 ICU in Suspended mode	22.92

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2002	01/07/2002 21:36	02/07/2002 17:55	1758	1770	RA2 out of measurement mode: RA-2 to Reset/Wait mode as a result of the ICU software problem	20.32
2002	08/07/2002 14:37	08/07/2002 16:17	1854	1855	RA2 out of measurement mode : RA-2 down for SPSA patches upload	1.67
2002	18/07/2002 11:05	18/07/2002 11:16	1995	1995	RA2 out of measurement mode : RA-2 down for upload of patches to SPSA	0.18
2002	22/07/2002 12:19	22/07/2002 12:30	2053	2053	RA2 out of measurement mode: RA-2 down for upload of patches to SPSA	0.18
2002	04/08/2002 18:56	05/08/2002 16:44	2243	2256	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	21.8
2002	08/08/2002 0:00	09/08/2002 17:48	2289	2314	RA2 out of measurement mode: RA-2 in Reset/Wait mode. ICU locked.	41.8
2002	23/08/2002 10:38	23/08/2002 10:53	2510	2510	RA2 out of measurement mode: Validated Equipment Switch-On using the latest CTI	0.25
2002	08/09/2002 7:10	10/09/2002 19:07	2737	2773	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	59.95
2002	25/09/2002	-	-	-	ENVISAT Phase 2 - Exploitation Phase: RA2 Full Resolution Mission	-
2002	09/10/2002 13:34	10/10/2002 8:56	3184	3196	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	19.37
2002	18/11/2002 4:38	19/11/2002 19:18	3752	3775	RA2 out of measurement mode: Planned SM switch off due to Leonid shower preparation	38.67

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2002	21/12/2002 4:31	21/12/2002 12:52	4224	4229	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	8.35
2003	16/01/2003 1:52	17/01/2003 17:00	4594	4618	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	39.13
2003	25/01/2003 23:56	25/01/2003 19:54	4736	4763	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	43.97
2003	20/02/2003 7:27	22/02/2003 14:20	5099	5132	RA2 out of measurement mode: unplanned Payload switch off	54.88
2003	02/03/2003 12:46	03/03/2003 16:46	5245	5262	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	28
2003	15/03/2003 4:21	17/03/2003 19:00	5426	5464	RA2 out of measurement mode: unplanned Payload switch off	62.65
2003	17/03/2003 21:09	18/03/2003 18:50	5465	5478	RA2 out of measurement mode: RA2 in Heater0/Refuse mode	21.68
2003	08/04/2003 15:08	09/04/2003 17:12	5776	5792	RA2 out of measurement mode: RA2 ICU in Reset mode following the detection of two consecutive Format Header errors	26.07
2003	15/04/2003 6:23	15/04/2003 17:29	5871	5878	RA2 out of measurement mode: RA2 ICU in Reset mode following the detection of two consecutive Format Header errors	11.1
2003	24/04/2003 13:20	25/04/2003 9:15	6004	6016	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	19.92
2003	05/05/2003 12:30	06/05/2003 10:01	6161	6174	RA2 out of measurement mode: RA2 ICU in Reset mode following the detection of two consecutive Format Header errors	21.52

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2003	11/05/2003 11:06	12/05/2003 10:14	6246	6260	RA2 out of measurement mode: RA2 ICU in Reset mode following the detection of two consecutive Format Header errors	23.13
2003	18/05/2003 6:25	19/05/2003 15:59	6343	6364	RA2 out of measurement mode: Switch-down for SM Command software upgrade and OCM	33.57
2003	01/06/2003 14:36	02/06/2003 9:20	6549	6560	RA2 out of measurement mode: RA2 ICU in Reset mode following the detection of two consecutive Format Header errors	18.73
2003	26/07/2003 15:28	26/07/2003 17:25	7337	7338	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	1.95
2003	31/07/2003 16:11	31/07/2003 18:06	7409	7410	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	1.92
2003	15/08/2003 16:40	15/08/2003 18:35	7624	7625	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	1.92
2003	30/08/2003 15:28	30/08/2003 20:47	7838	7841	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout	5.32
2003	04/09/2003 22:52	06/09/2003 16:41	7914	7939	RA2 out of measurement mode: Payload switch off	41.82
2003	12/09/2003 15:19	12/09/2003 15:47	8024	8024	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to MCMD timeout	0.47
2003	21/09/2003 15:36	21/09/2003 17:33	8153	8154	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to MCMD timeout	1.95

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2003	27/09/2003 0:28	27/09/2003 12:52	8229	8237	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	12.4
2003	29/10/2003 6:47	29/10/2003 12:58	8691	8695	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	6.18
2003	02/11/2003 15:16	03/11/2003 12:08	8754	8766	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies	20.87
2003	26/11/2003 13:31	26/11/2003 19:39	9096	9100	RA2 out of measurement mode: Multiple SEU caused ICU switch down.	6.13
2003	03/12/2003 7:18	05/12/2003 16:35	9193	9227	RA2 out of measurement mode: unplanned Payload switch off	57.28
2003	06/12/2003 15:55	10/12/2003 19:16	9241	9300	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to an uncontrolled software action	99.35
2003	09/12/2003 *	10/12/2003 *	-	-	In the course of testing new S/W to improve state vector uploads, the attitude mode of the ENVISAT platform was changed from nominal SYSM to YSM with reduced pointing performance	-
2004	22/04/2004 15:15	22/04/2004 17:07	11216	11217	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to MCMD failure (EN-UNA-2004/0120)	1.87
2004	10/05/2004 2:06	10/05/2004 11:27	11465	11471	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0133)	9.35

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2004	31/05/2004 2:45	31/05/2004 12:01	11766	11772	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0144)	9.27
2004	21/06/2004 7:56	22/06/2004 11:50 *	12070	12087	Transition to YSM satellite pointing due to Star Sensor anomaly	3.9
2004	21/06/2004 14:47	21/06/2004 19:24	12074	12077	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0164)	4.62
2004	18/07/2004 13:47	18/07/2004 19:59	12460	12464	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0181)	6.2
2004	10/08/2004 15:00	11/08/2004 10:59	12790	12802	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0197)	19.98
2004	26/09/2004 13:39	27/09/2004 16:23	13462	13478	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0250). Start of first USO anomaly period when the instrument restarted	26.73
2004	27/09/2004 16:00	29/09/2004 12:00	13478	13504	First USO anomaly period	-
2004	23/11/2004 13:25	24/11/2004 14:10	14292	14307	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2004/0296)	24.75
2004	01/12/2004 10:22	01/12/2004 15:34	14405	14408	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2004/0302)	5.2

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2004	27/12/2004 2:49	27/12/2004 13:49	14772	14779	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2004/0316)	11
2005	26/01/2005 15:50	26/01/2005 21:07	15210	15213	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2005/0027)	5.28
2005	18/03/2005 4:35	18/03/2005 12:58	15933	15938	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0081)	8.38
2005	18/04/2005 5:01	18/04/2005 13:22	16377	16382	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0117)	8.35
2005	23/04/2005 18:37	24/04/2005 11:42	16457	16467	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2005/0126)	17.08
2005	14/05/2005 23:56	15/05/2005 10:53	16760	16767	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2005/0151)	10.95
2005	21/05/2005 0:10	21/05/2005 10:55	16846	16853	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2005/0166)	10.75
2005	04/07/2005 4:41	04/07/2005 11:19	17479	17483	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0217)	6.63
2005	16/07/2005 13:32	16/07/2005 19:58	17656	17660	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2005/0237)	6.43

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2005	17/07/2005 14:43	17/07/2005 19:20	17671	17674	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2005/0240)	4.62
2005	29/07/2005 0:41	29/07/2005 9:58	17834	17840	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2005/0260)	9.28
2005	16/08/2005 16:41	16/08/2005 20:22	18102	18104	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0294)	3.68
2005	30/08/2005 16:01	30/08/2005 19:43	18302	18304	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0348)	3.7
2005	12/09/2005 15:53	12/09/2005 19:47	18488	18490	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0360)	3.9
2005	20/09/2005 12:19	20/09/2005 18:56	18600	18604	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2005/0375)	6.62
2005	04/10/2005 12:47	04/10/2005 16:35	18801	18803	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2005/0408)	3.8
2005	28/10/2005 5:34	28/10/2005 10:39	19140	19143	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2005/0445)	5.08
2006	02/01/2006 12:56	02/01/2006 18:09	20089	20092	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0001)	5.22

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2006	12/01/2006 14:20	12/01/2006 19:12	20233	20236	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a multiple SEU anomaly (EN-UNA-2006/0015)	4.87
2006	30/01/2006 2:07	30/01/2006 11:29	20483	20489	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2006/0023)	9.37
2006	01/02/2006 5:17	01/02/2006 12:04	20514	20518	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0028)	6.78
2006	01/02/2006 16:30	01/02/2006 18:36	20521	20522	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0030)	2.1
2006	01/02/2006 12:04	11/02/2006 0:54	20518	20654	Second USO anomaly period	
2006	13/03/2006 9:36	13/03/2006 17:40	21089	21094	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies(EN-UNA-2006/0094)	8.07
2006	13/03/2006 17:40	02/04/2006 18:00	21094	21380	Third USO anomaly period	
2006	17/03/2006 12:04	17/04/2006 13:26	21148	21149	RA2 out of measurement mode: RA2 ICU in planned Suspended mode to try to solve the problem of USO anomaly (EN-UNA-2006/0099)	1.37
2006	06/04/2006 2:29	08/04/2006 12:31	21428	21453	RA2 out of measurement mode:SM OBDH anomaly (EN-UNA-2006/0116)	58.03

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2006	08/04/2006 12:31	15/05/2006 14:21	21453	21992	Fourth USO anomaly period	
2006	15/05/2006 11:00	15/05/2006 14:21	21992	21994	RA-2 RFSS configured to Side-B redundancy (EN-UNA-2006/0163)	3.35
2006	19/05/2006 9:24	19/05/2006 19:13	22048	22054	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2006/0165)	9.82
2006	20/05/2006 13:24	-	22065		RA2 S-Band RFSS side-B failure	
2006	23/05/2006 15:06	23/05/2006 15:23	22109	22109	RA2 out of measurement mode: RA2 ICU in Standby mode (EN-UNA-2006/0173)	0.28
2006	26/05/2006 13:37	29/05/2006 10:43	22151	22192	RA2 out of measurement mode: RA2 commanded in Heater-1 (EN-UNA-2006/0174)	69.1
2006	03/06/2006 13:14	03/06/2006 18:03	22265	22268	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2006/0182)	4.82
2006	15/06/2006 0:50	15/06/2006 10:11	22429	22435	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following a SEU anomaly (EN-UNA-2006/0192)	9.35
2006	21/06/2006 11:37	21/06/2006 13:20	22522	22523	RA-2 RFSS redundancy configured from Side-B to Side-A (EN-UNA-2006/0197)	1.72
2006	21/06/2006 13:20	01/03/2007 9:19	22523	26142	Fifth USO anomaly period	

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2006	25/06/2006 15:01	25/06/2006 19:46	22581	22584	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode after an uncontrolled Software action (EN-UNA-2006/0205)	4.75
2006	01/08/2006 1:14	01/08/2006 8:54	23102	23107	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following multiple SEU anomaly (EN-UNA-2006/0233)	7
2006	07/09/2006 16:40	10/09/2006 15:47	23641	23684	RA2 out of measurement mode: Payload off due to SM Anomaly(EN-UNA-2006/0270)	71.12
2006	26/10/2006 4:02	26/10/2006 10:32	24335	24339	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following multiple SEU anomaly (EN-UNA-2006/0324)	6.5
2006	02/11/2006 15:20	02/11/2006 20:07	24442	24445	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following multiple SEU anomaly (EN-UNA-2006/0332)	4.78
2006	26/11/2006 8:01	26/11/2006 17:32	24781	24787	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode following multiple SEU anomaly (EN-UNA-2006/0352)	9.52
2006	28/11/2006 7:40	29/11/2006 17:23	24810	24829	RA2 out of measurement mode: Correction - SM Memory Maintenance (EN-UNA-2006/0354)	33.72
2006	12/12/2006 18:02	15/12/2006 15:54	25016	25058	RA2 out of measurement mode: unplanned Payload switch off off (EN-UNA-2006/0370)	69.87
2007	16/01/2007 8:50	16/01/2007 9:11	25512	25512	RA2 out of measurement mode: RA-2 down for SPSA patches upload (EN-UNA-2007/0009)	0.35

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2007	01/02/2007 15:15	01/02/2007 17:11	25745	25746	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Individual Echo MCMD timeout (EN-UNA-2007/0022)	1.93
2007	16/02/2007 0:47	16/02/2007 11:07	25951	25957	RA2 out of measurement mode: RA2 in Reset/Wait mode due to MCMD transfer error (EN-UNA-2007/0043)	10.33
2007	17/02/2007 0:45	19/02/2007 11:11	25965	26000	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0045)	58.43
2007	28/02/2007 18:14	01/03/2007 9:19	26133	26142	RA2 out of measurement mode: RA2 in Standby/Refuse mode due to Measure Individual Echo (IE) commanding conflict (EN-UNA-2007/0051)	15.08
2007	09/03/2007 19:32	12/03/2007 10:13	26262	26300	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0062)	62.68
2007	16/03/2007 12:01	16/03/2007 14:42	26358	26360	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0067)	2.68
2007	20/03/2007 2:32	20/03/2007 9:20	26410	26414	RA2 out of measurement mode: RA2 in Heater0/Refuse mode (EN-UNA-2007/0072)	6.8
2007	29/03/2007 0:59	29/03/2007 9:54	26538	26543	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current. New ICU Flight Patch uploaded (EN-UNA-2007/0081)	8.92
2007	03/04/2007 12:37	03/04/2007 13:48	26616	26617	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current (EN-UNA-2007/0093)	1.18

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2007	04/04/2007 9:49	04/04/2007 11:30	26629	26630	RA2 out of measurement mode: RA2 in Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current (EN-UNA-2007/0094)	1.68
2007	09/04/2007 5:08	09/04/2007 10:36	26698	26701	RA2 out of measurement mode: RA2 in Standby/Refuse following Heater0/Refuse mode due to an out of limit of the High Power Amplifier bus current. During recovery, the SPSA patch (loaded on 16/01/2007) was disabled (EN-UNA-2007/0097)	5.47
2007	27/06/2007 7:23	27/06/2007 7:35	27830	27830	RA2 out of measurement mode : RA-2 down for S-Band Waveform Anomaly, SPSA patches upload (EN-UNA-2007/0164)	0.2
2007	30/06/2007 0:37	02/07/2007 9:51	27869	27903	RA2 out of measurement mode: RA2 in Heater1/Refuse mode (EN-UNA-2007/0167)	57.23
2007	19/07/2007 1:08	19/07/2007 7:38	28141	28145	RA2 out of measurement mode: RA2 in Heater1/Refuse mode (EN-UNA-2007/0181)	6.5
2007	24/09/2007 12:27	27/09/2007 11:13	29107	29149	RA2 out of measurement mode: Payload switch-off due to SM Anomaly (EN-UNA-2007/0220)	70.77
2007	27/09/2007 11:13	03/12/2007 3:00	29149	30103	Sixth USO anomaly period	
2007	02/10/2007 16:15	02/10/2007 20:09	29224	29226	RA2 out of measurement mode: RA2 in Reset/Wait mode due to MCMD transfer error (EN-UNA-2007/0233)	3.9
2007	08/11/2007 13:31	08/11/2007 17:24	29752	29754	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to repeated telemetry anomalies (EN-UNA-2007/0244)	3.88

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2007	03/12/2007 22:00	04/12/2007 13:50	30115	30124	RA2 out of measurement mode: OCM and Maintenance (EN-UNA-2007/0258)	15.83
2007	04/12/2007 13:50	23/01/2008 14:10	30124	30840	Seventh USO anomaly period	
2007	09/12/2007 20:45	10/12/2007 9:14	30200	30207	RA2 out of measurement mode: RA2 in Reset/Wait mode following Telemetry format anomaly (EN-UNA-2007/0271)	12.48
2007	13/12/2007 6:44	13/12/2007 12:39	30249	30252	RA2 out of measurement mode:SM memory maintenance (EN-UNA-2007/0273)	5.92
2008	16/01/2008 16:11	17/01/2008 12:05	30741	30752	RA2 out of measurement mode: RA2 in Heater 2 mode due to HSM anomaly (EN-UNA-2008/0008). No Low Rate Data transmitted	19.9
2008	17/01/2008 23:23	-	30759	-	RA2 S-Band RFSS Side-A failure	-
2008	23/01/2008 13:55	23/01/2008 14:10	30840	30840	RA2 out of measurement mode: RA-2 switched to Standby & Back to Operations for S-Band Anomaly Investigation (EN-UNA-2008/0019)	0.25
2008	01/02/2008 12:00	01/02/2008 12:40	30967	30968	RA2 out of measurement mode: RA2 planned to Heater2 mode to provide stable temperature data after the S-Band failure (EN-UNA-2008/0025)	0.67
2008	13/03/2008 9:33	13/03/2008 19:28 *	31553	31559	Switch down to YSM satellite pointing due to bright object in FOV	9.92
2009	05/01/2009 14:59	05/01/2009 15:04	35822	35822	RA2 out of measurement mode: RA2 switched down to Heater1 mode to clear persistent SPSAanomaly (EN-UNA-2009/0005)	0.08

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2009	15/02/2009 3:38	16/02/2009 13:09 *	36402	36422	Switch down to YSM satellite pointing due to bright object in FOV	33.52
2009	05/03/2009 19:18	06/03/2009 15:10 *	36669	36681	Switch down to YSM satellite pointing due to bright object in FOV	19.87
2009	28/04/2009 13:03	29/04/2009 11:56	37451	37451	RA2 out of measurement mode: full HSM reset (EN-UNA-2009/0078)	22.88
2009	11/05/2009 17:58	12/05/2009 10:39	37627	37637	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2009/0089)	16.68
2009	23/07/2009 15:30	23/07/2009 21:07	38671	38674	RA2 out of measurement mode: RA2 in Reset/Wait mode due to MCMD transfer error (EN-UNA-2009/0116)	5.62
2010	11/01/2010 11:34	11/01/2010 19:05 *	41130	41135	Switch down to YSM satellite pointing due to bright object inFOV	7.52
2010	26/05/2010 12:12	26/05/2010 16:45 *	43063	43066	Switch to YSM satellite pointing due to Star Sensor anomaly	4.55
2010	15/07/2010 15:25	15/07/2010 15:27	43781	43781	RA2 out of measurement mode: RA2 switched down to Heater1 mode to clear persistent SPSA anomaly (EN-UNA-2010/0113)	0.03
2010	01/09/2010 16:30	01/09/2010 16:32	44468	44468	RA2 out of measurement mode:OBT full wrap around (EN-UNA-2010/0133)	0.03
2010	24/10/2010 7:05	-	45222	-	Start of ENVISAT Phase 3 after orbit change	
2011	21/02/2011 16:29	21/02/2011 21:14	46951	46954	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to	4.75

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					telemetry format anomaly (EN-UNA-2011/0026)	
2011	01/04/2011 0:19	01/04/2011 10:53	47502	47508	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0050)	10.57
2011	03/04/2011 15:51	04/04/2011 15:38	47540	47554	RA2 out of measurement mode: Payload switch-off due to SM Anomaly (EN-UNA-2011/0053)	23.78
2011	27/04/2011 3:25	27/04/2011 10:02	47877	47881	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0068)	6.62
2011	22/12/2011 5:46	22/12/2011 10:22	51312	51315	RA2 out of measurement mode: RA2 ICU in Reset/Wait mode due to telemetry format anomaly (EN-UNA-2011/0244)	4.6
2012	23/01/2012 6:45	23/01/2012 11:36	51772	51775	RA2 out of measurement mode: SM Memory Fault (EN-UNA-2012/0016)	4.85
2012	08/04/2012 12:28	No further data	52866	-	Communication loss (EN-UNA-2012/0060)	

Table 2-16 : Table of mission events (credit ESA)

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Appendix C - Acronyms

ALT	Altimetry
CAL	Calibration
CLS	Collecte Localisation Satellite
ENVISAT	ENVIronment SATellite
ERA	ECMWF Re-Analysis
ERS	European Remote-Sensing Satellite
ESA	European Space Agency
FDR	Fundamental Data Records
PTR	Point Target Response
RD	Reference Document
REAPER	Reprocessing of Altimeter Products for ERS

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