Mio SWG virtual meeting

24 February 2022

Go Murakami

BepiColombo project

Japan Aerospace Exploration Agency (JAXA)

Mio Science Working Group meeting

24 Feb 2021 21:00JST/13:00CET

- **1. Updated status of Mio**
  - General operations report
- **2. Upcoming operations plan**
- **3. Future updates on baseline observation/downlink plan in Mercury orbit phase**
  - Status of observation/downlink planning & verification tool
  - Upcoming plans
- **4. Data handling and archiving**
- **5. Others**
  - **MSA VFB#2 paper**
  - **Extension of MoU and LoA**

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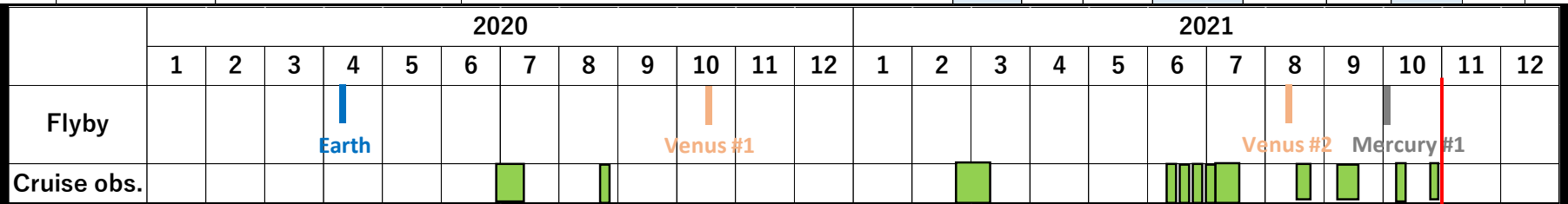
Observation summary 2020-2021

Period		Event	Geometry (coordination)	Instrument									
Start	End			MEA	MIA	MSA	HEP-e	HEP-i	ENA	MGF	PWI	MDM	MSASI
2020/04/09	**2020/04/11**	**Earth flyby**	**Closest altitude: 12700 km**	O	O	O	O		O	O	O		
2020/06/29	2020/07/12	Cruise obs.	Planetary radial alignment	○			○		○	○	○	○	
2020/08/20	2020/08/25	Cruise obs.	Cometary dust trail crossing	○			○		○	○	○	○	
2020/10/14	**2020/10/16**	**Venus flyby #1**	**Closest altitude: 10700 km**	O	O	O	O		O	O	O		
2021/02/22	2021/03/08	Cruise obs.	Bepi-PSP close and radially aligned/cone, Bepi-SolO in quadrature	○			○						
2021/06/12	2021/06/16	Cruise obs.	Bepi-SolO close and radially aligned/cone, Bepi-Stereo A are in quadrature	○			○						
2021/06/19	2021/06/21			○			○			○			
2021/06/25	2021/06/27			○			○			○			
2021/06/29	2021/07/01			○			○			○			
2021/07/06	2021/07/15	Cruise obs.	Cone-Parker geometry with different parker spiral (Bepi-SolO-Mars)	○			○			○			
2021/08/09	**2021/08/11**	**Venus flyby #2**	**Closest altitude: 550 km**	O	O	O	O		O	O	O	O	
2021/08/14	2021/08/19	Cruise obs.	Cone-Parker (Bepi-SolO)	○			○			○			
2021/09/07	2021/09/16	Cruise obs.	Cone-Parker (Bepi-SolO-PSP-Stereo A)	○			○			○			
2021/10/01	**2021/10/03**	**Mercury flyby #1**	**Closest altitude: 200 km**	O	O	O	O		O	O	O	O	
2021/10/07	2021/10/08	Cruise obs.	Parker (Bepi-SolO) Cone (Bepi-Earth)	○			○			○			
2021/10/25	2021/10/28	Cruise obs.	Quadrature (Bepi-Stereo A)	○			○			○			



MIO Activity 2021

2022.2.24

	Checkout/maintenance		
	30 March – 1 April	**MDP software update (ver.10) including a new version of middleware**	**Completed**
	15 April-10 May	MDP Running test	Completed
	17-18 June	Cruise C/O#5, **BAT charging**	Completed
	22-24 June	MIA, MSA, HEP program update and function check	Completed
	28 June	VSB2 dry-run with new MDP middleware	Completed
	24 November	Cruise C/O#6	Completed
	25 November	MSA HV ramp test with shorter sequence (BC_SC-104)	Completed: shorter HV ramp sequence was achieved
	Science observation		
	12-16 June	Cruise observation solar-wind mode (MEA1, HEP-e)	Completed
	19-21 June 25-27 June 29 June – 2 Jul	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed
a-1	5 – 15 Jul	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed
a-2	~~19 – 30 Jul~~		Canceled
	10 Aug	Venus flyby#2	Completed
b	14 – 19 Aug	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed
c	7 – 15 Sep	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed
	2 Oct	**Mercury Flyby#1**	Completed
d	7 – 8 Oct	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed
e	~~16 - 28 Oct~~ 25 - 28 Oct	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF	Completed

MIO Activities 2021 special mentions

<MDP >

- MDP software (ver.10) including a new version of middleware was uploaded, followed by a running test
- 595 hrs of running time accumulated. SRAM 1-bit error counts were DPU1:428, DPU2:199, no WDT errors nor other critical errors.
- Results support that the WDT error measures included in the new middleware is effective.

<Cruise checkout #5 + BAT recharge>

- battery recharge activity (first after launch), SOC recovered from 10% to 15%

<Flybys>

- Battery temperature was close to high limit during Mercury flyby#1. MOSIF heater operation baseline was updated to avoid this situation in the future.

Anomaly Status / Outstanding Items

Description	Status
Marman clamp band and MMO separation switch status observed to toggle between “Released” and “Not released” [BC_SC-5] -> MPO onboard software was updated to handle the false status. Raw values will be monitored regularly. Root cause investigation is still open, with low priority.	Open
Unpredictable generation of MIO MSA mission data[BC_SC-76] -> Investigation is ongoing. Meanwhile a workaround has been applied to MSA operations and observations.	Open
MDP middleware shutdown(CPU_HALT) due to watchdog timer(WDT) expiration. [BC_SC-89] -> Closed after MDP software update to v.10 and successful running test.	Closed
Unexpected early end of MSA HV ramp during Feb.2020 checkout [BC_SC-104] -> A re-test using the automatic ramp sequence is scheduled in March 2022. Meanwhile a short version of the manual ramp sequence was verified on 25/11/2021, this will be used for MSB#2.	Open
Sudden decrease of CNV-B current [BC_SC-111] -> A new onboard monitoring service was implemented on MPO to put MIO safely in dormant mode if this occurs while MIO is ON. Root cause investigation is still open. So far this event has happened twice, MIO was dormant in both cases.	Open
Temperature increase at MSB1 [BC_SC-218] -> MOSIF heater operation baseline for closer sun distance was discussed and agreed with ESOC. JAXA is now permitted to control the MOSIF preheating configurations to avoid the spacecraft from getting too warm. The new baseline is applied from the March 2022 observations.	Open

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MIO Operation schedule for 2022/1H

2021.11.25

	Checkout/maintenance		
	9 - 10 March	MSA software/table update + check	Procedures distributed to PIs, please confirm and provide feedback if any by 27 Feb.
	11 March	PWI software update + check	
	15 March	MSA HV ramp test with OCL command (BC_SC-104)	
	Week of 16 May	Cruise C/O#7	Nominal cruise checkout sequence, no additional activities.
	Science observation		
	6-9 March	Comet Encke dust trail crossing (MDM) SPM measurement in background	Confirmed, procedures have been submitted to ESOC
	11 – 15 March	Ion observation campaign (MSA and MIA) Cruise observation solar-wind mode (MEA1, HEP-e) + MGF SPM measurement in background	Ion observation campaign (add MSA and MIA) with SERENA was proposed and **to be confirmed** 1. 11-13 Mar ->OK 2. 2-4 April 3. 28-30 April
	17 Mar – 8 May	Cruise observation solar-wind mode (MEA1, HEP-e) + MGF SPM measurement in background	#ENA team requested to add observation & procedure update -> To be discussed
	23 June	Mercury Flyby#2	
			Please note that the schedule may change in the future.

Upcoming operation in March 2022

				DOY	Week	Station	Duration	BOT	EOT
			Latest uplink of delayed TC files	067	10	NNO	5:29	08/03/2022 05:09:00	08/03/2022 10:38:00
MSA software update	MDP, MSA	No	software update: No interaction / duration 2.5 hrs	068	10	CEB	4:54	09/03/2022 14:11:00	09/03/2022 19:05:00
MSA function check		No	No interaction / duration 0.5 hrs						
PWI software update	MDP, PWI	No	First half > no interaction, duration 2.5 hrs		out of pass				
PWI software update	MDP, PWI	No	second half > interactive, duration 2.5 hrs	069	10	CEB	5:00	10/03/2022 14:18:00	10/03/2022 19:18:00
PWI function check	MDP, PWI	No	check : no interaction, 2 hrs	070	10	NNO	4:00	11/03/2022 06:31:00	11/03/2022 10:31:00
						short observation window between 11/03 and 15/03 pass			
MSA HV ramp test by OCL command	MDP, MSA	Yes	Interactive, duration 1.5 hrs	074	11	NNO	4:00	15/03/2022 06:20:00	15/03/2022 10:20:00

Note: both stpstrg and szstpstrg (data distribution servers) are currently down

-JAXA is trying to recover them before 9 March 2022

-If recovery is failed, real time monitoring of telemetry outside JAXA will not be possible

-> Screen sharing via Zoom will be an option

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Ground segment updates

Mio observation/downlink planning and verification tool

-Purpose: generate and verify science observation and downlink plans

-Long-term plan (baseline observation/downlink plan): 1 Mercury year (88 days) duration

-Short-term plan: 1 week duration, twice a week

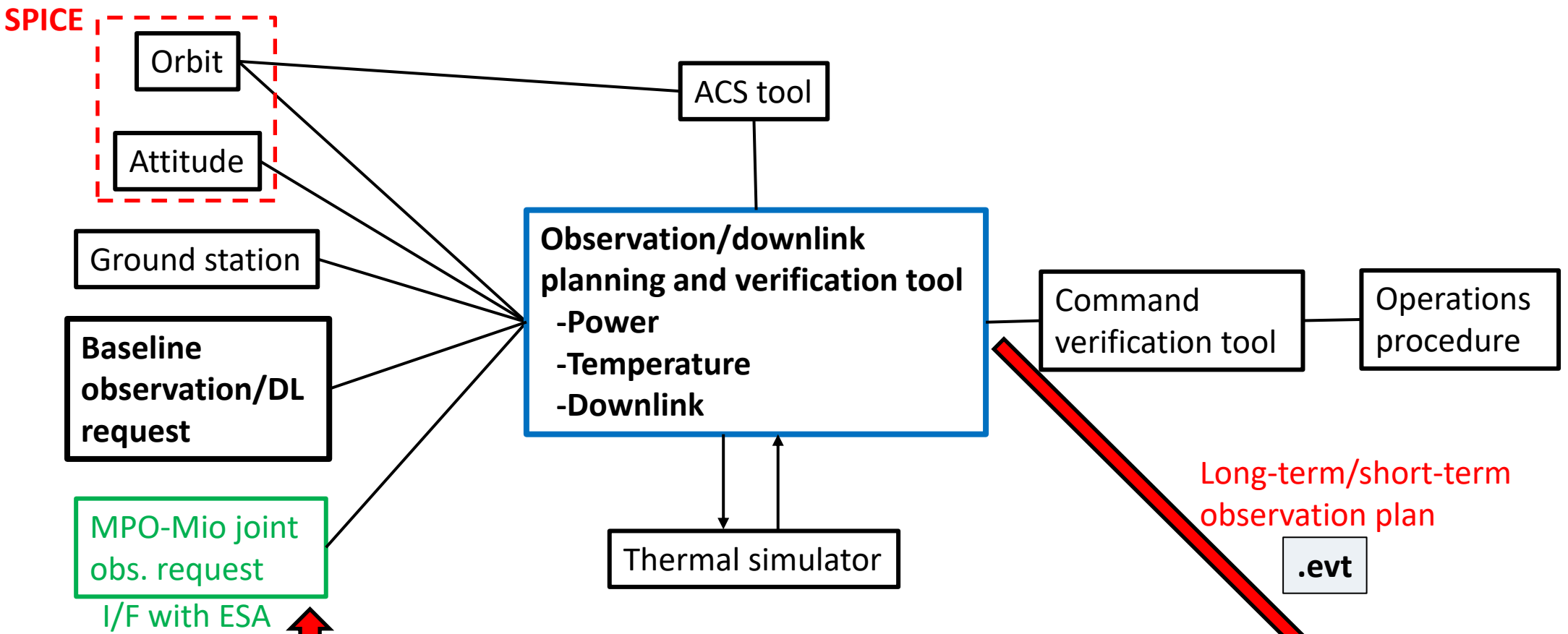
-MPO-Mio joint observation request: the tool can check whether it is included or not

-Schedule:

FY2021: interface tests with other tools

FY2022: training, tests with Mio simulator, and updating the baseline plans for observation and downlink

Mio observation/downlink planning and verification tool



Mio observation/downlink planning and verification tool

I/F tests of the tool (17-18 November 2021)

-3 Cases

-Long-term plan: 19/02/2026 – 18/05/2026

-Short-term plan #1: <22/02/2026 – 01/03/2026> + <25/02/2026 – 04/03/2026>

-Short-term plan #2: <28/03/2026 – 04/04/2026> + <31/03/2026 – 07/04/2026>

-> **Sample files of observation plan (OBS_PLAN.evt) are available**

-Input parameters for **power verification are still under implementation**

-**Thermal simulator tool will be updated by the end of March 2022**

-> **We will start to update the Mio baseline plans for observation and downlink after April 2022**

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4. Data handling and archiving

The members of MMO-DHAT

Lead: I. Shinohara, PDS (/SPICE): Y. Yamamoto

Co-lead: S. Matsuda (-> Kanazawa Univ.)

- **MGF** A. Matsuoka, Daniel Schmid
- **PWI** Y. Kasahara, Y. Kasaba, L. Bylander, J. Karlsson, P. Henri, X. Vallieres, M. Dekkali, F. Sahraoi, L. Mirioni, J. Lichtenberger, H. Kojima, S. Matsuda, M. Moncuquet
- **MEA, MIA, MSA** Y. Saito, S. Yokota, Y. Harada, A. Barthe, E. Penou, N. Andre, A. Barthe, S. Aizawa, B. Katra, L. Hadid, D. Delcourt, M. Fraenz, N. Krupp
- **ENA** K. Asamura, M. Wieser, Y. Futaana, M. Shimoyama, L. Kalla, S. Fatemi
- **HEP** K. Takashima, T. Mitani, M. Hirahara
- **MSASI** G. Murakami, T. Sato
- **MDM** M. Kobayashi, T. Hirai

ESA observer: S. Martinez, M. Bentley

Mio Science Center (Nagoya U./ISEE): Y. Miyoshi

MIO Reformatter

No updates

[Account request]

If you need a new account, please contact us.

Account list (as of Sep. 2019):
pwi, pwi-ewo, pwi-mef, pwi-am2p, pwi-sor, pwi-scdb, pwi-isdm
mmo-mppe, mmo-mia, mmo-mea, mmo-msa, mmo-hep, mmo-ena
mmo-msasi, mmo-mdm, mmo-mgf, mmo-matsuda

[Password login was disabled]

We disabled password authentication on October 11, 2019.
Use your SSH key for authentication when you connect to rfmmo.
Please feel free to contact us if you have any connection problems.
If you have any issues, please contact us.

[System replace was done]

rfmmo was replaced to new server (RHEL7) in 2020.
All settings (accounts, networks, …) was automatically handed over.
Data & scratch space (/nasA_mmo) was mounted the same as before.

MIO Reformatter

[Data availability (SIRIUS)]

Final CCSDS binary data (by the end of 2021) are available on SIRIUS.
Use VCID=$(30)_{10}$, ANTID=$(240)_{10}$, TIME_KIND=2 to acquire data.

[Executed command list]

We put the list of executed commands at the following directory of rfmmo:

- JAXA format (.cml): /data/MMO/esoc/cmdlog/

  Note:
  Because the commanding is controlled by the ESA system during the cruise phase, the executed time listed in the JAXA format is not accurate.

- ESA format (.xml): /data/MMO/esoc/cmdlog_xml/

  Note:
  Executed command name listed in the ESA format is sometimes wrong.
  (This is due to the specification of ESA's commanding system.)

[SYSTEM HK]

We put the SYSTEM HK telemetry in .csv at the following directory of rfmmo:

- /nasA_mmo/matsuda/sys/HK

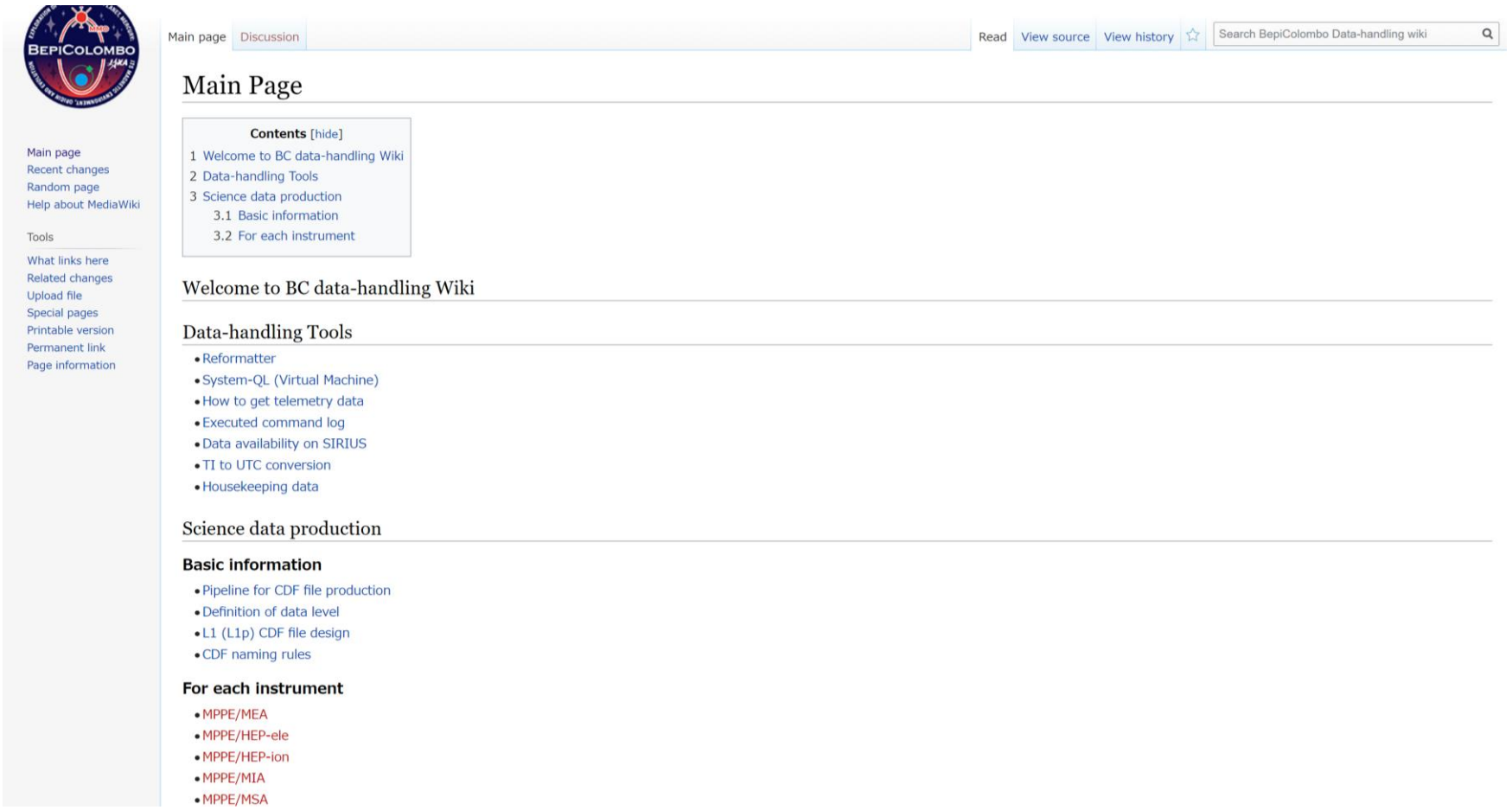
Note: we can generate CDF file if reqeusted

Tools

[MIO data-handling Wiki]

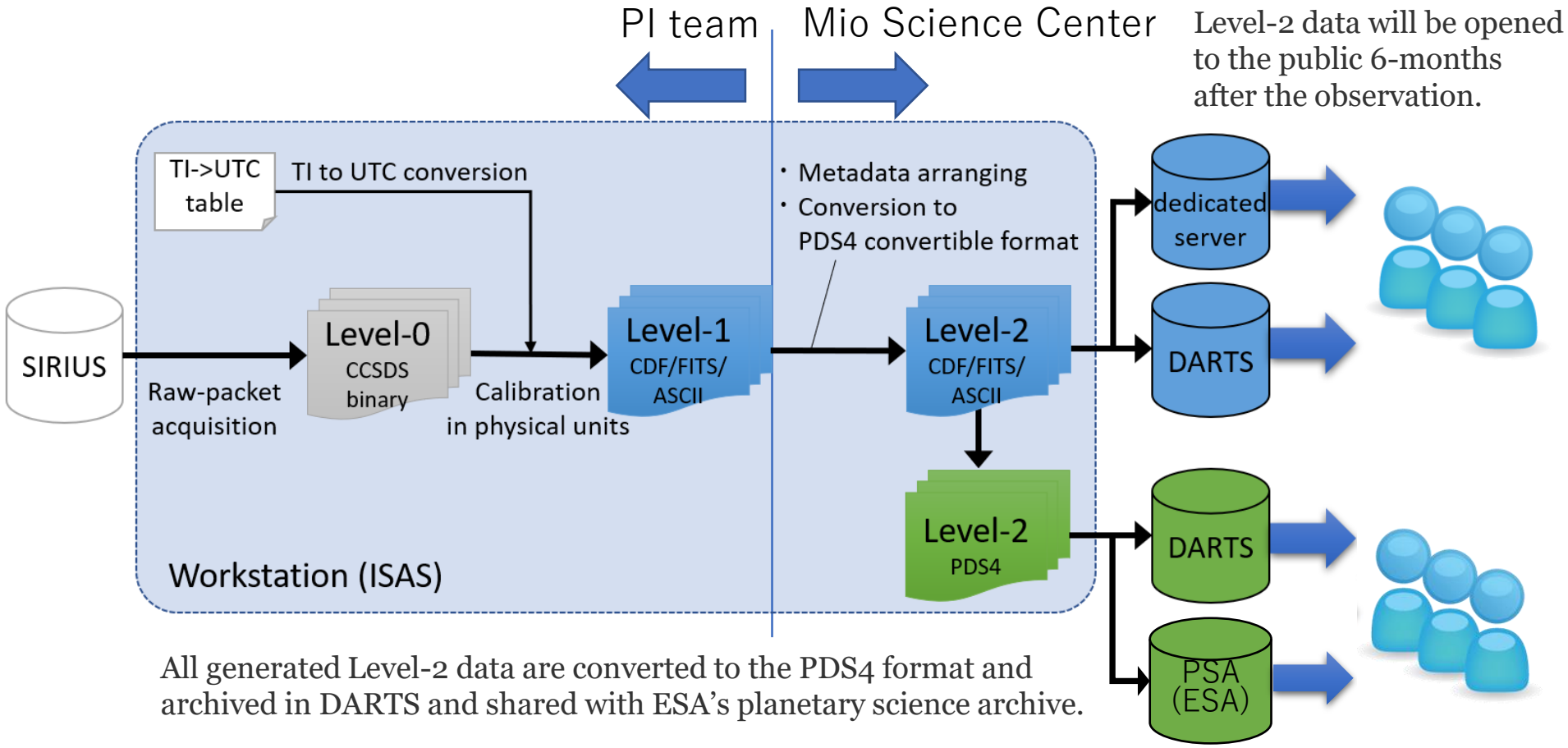
"Data-handling Wiki" is available:
https://sprg.isas.jaxa.jp/bc/mw/

All information regarding on the MIO data-handling are gathered.
ID/pass: please request to Go Murakami



3. Pipeline for Science data production

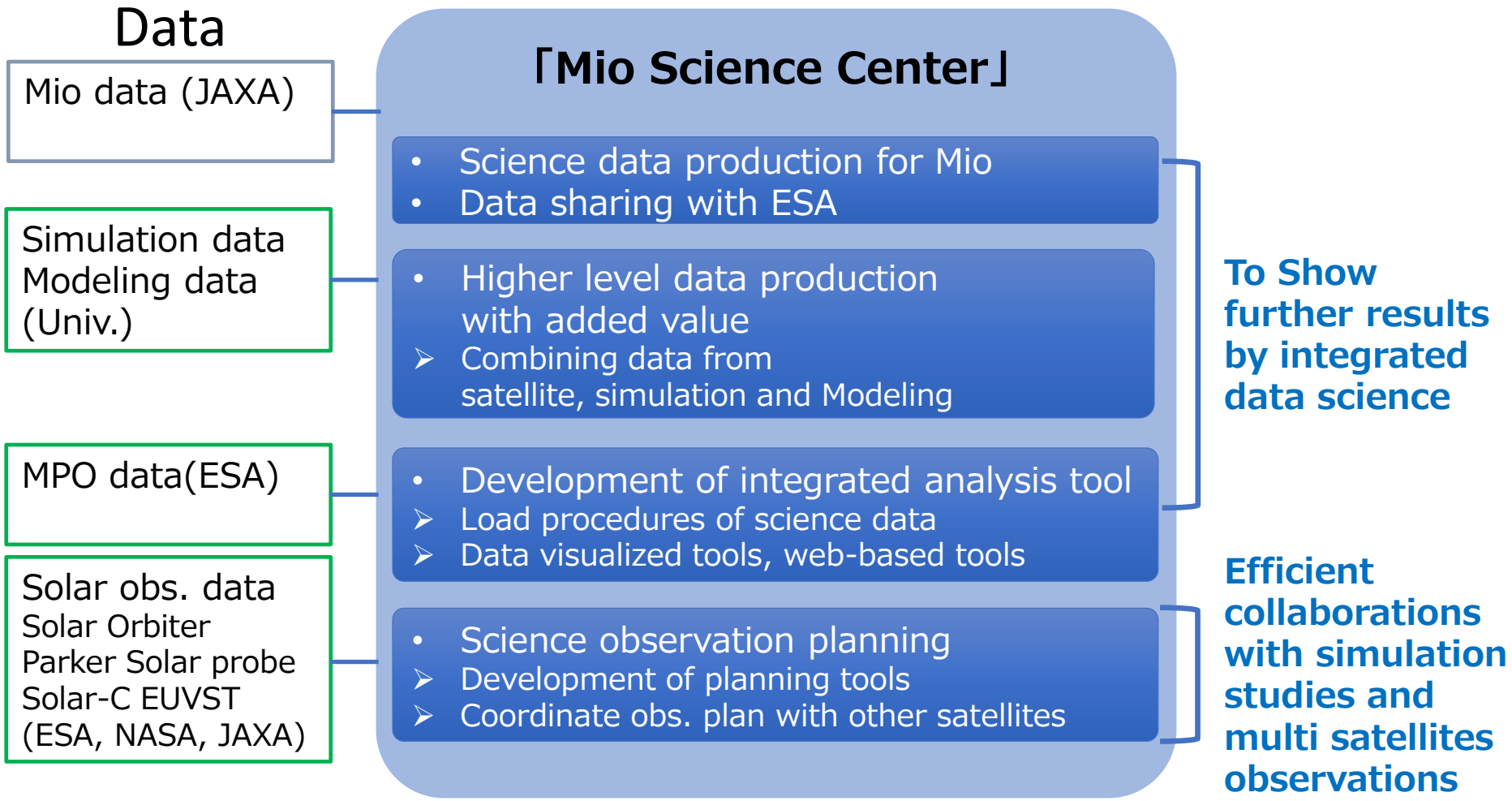
No updates



Level	Contents	Scope	File format
Level-0	Raw-telemetry	Internal	CCSDS-Binary
Level-1	Calibrated data in physical units	Internal	CDF, FITS, ASCII
Level-2	Calibrated data in physical units with appropriate metadata	Public	CDF, FITS, ASCII PDS4
Level-3	Processed data by combining multiple data from different instruments	Public	CDF, FITS, ASCII PDS4

3. Role of Mio Science Center

No updates



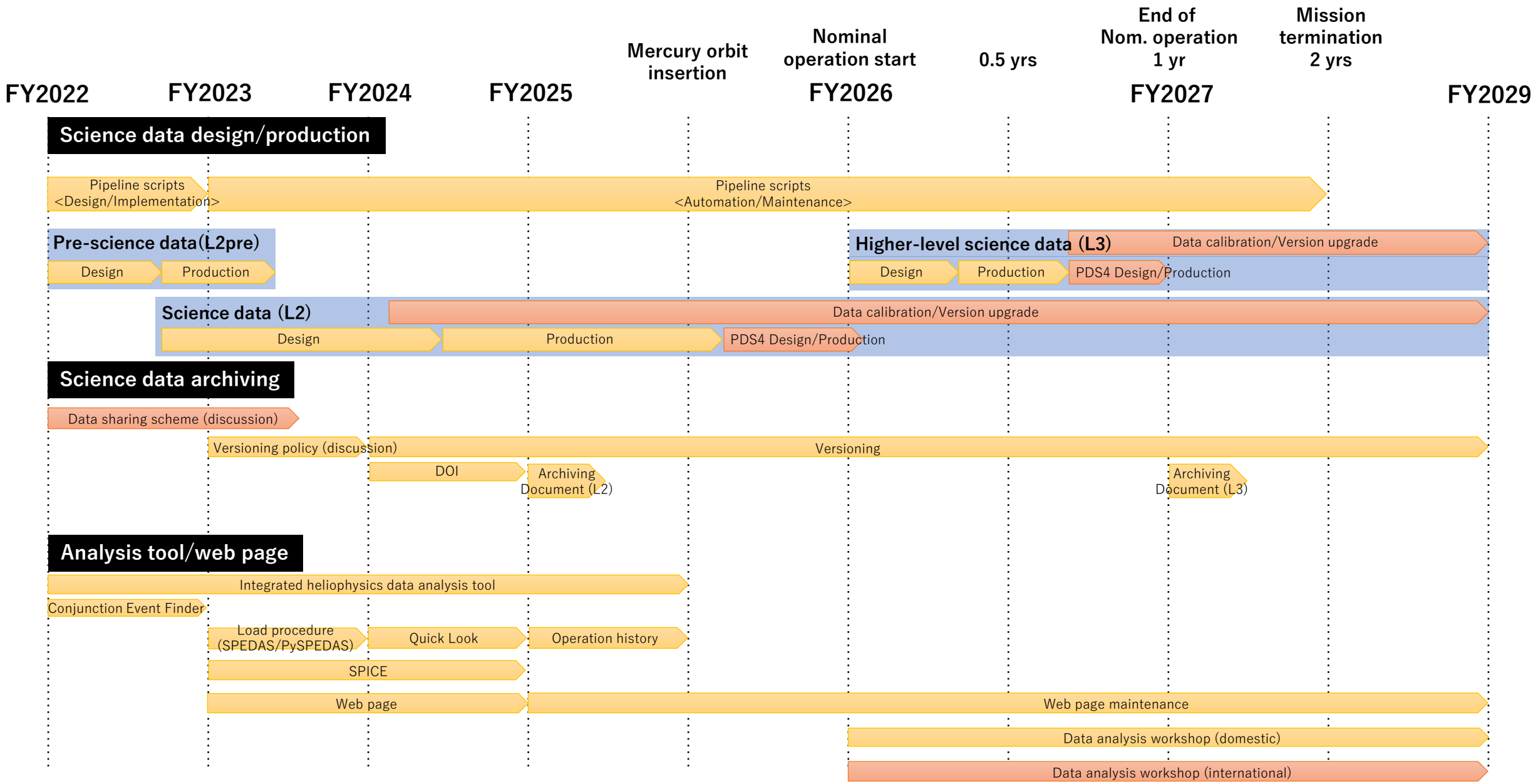
Mio plasma wave and particle instruments

Summary and current status of science data processing

Instrument	Sub-component	# of science data products			Current status (as of May 2021)		
		L	M	H	Level 1 CDF	Level 1 plot	Level 1p (calibrated) CDF
MGF DC and LF magnetic field	MGF-I	2	2	2	Ongoing	Ready (internal)	Ongoing
	MGF-O	2	2	2	Ongoing	Ready (internal)	Ongoing
MPPE Plasma particle and neutrals	MEA	< 24			Almost ready	Ready (internal)	Ongoing
	MIA	9	4	4	Partially ready	Ready (internal)	Ongoing
	MSA	< 21			Ongoing	Ready (internal)	Ongoing
	HEP-ele	1	1	1	Ongoing	Ongoing	Ongoing
	HEP-ion	2	2	2	-	-	-
	ENA	2			Ongoing	Ongoing	Ongoing
PWI Electric field and plasma waves	EFD	3	3	2	-	-	-
	WFC/OFA	4	10	4	Ready	Ready (internal)	Ongoing
	SORBET	3	6		Ready	Ready (internal)	Ongoing
	AM2P	2			-	-	-

105 major products

Schedule (TBD)



Status of Mio Science Center

- Agreement between JAXA/ISAS and Nagoya Univ./ISEE was made
- -> Mio Science Center (a part of Heliospheric Science Center) activity will start from April 2022
- Job opportunity for Designated associate/assistant professor is open
  - Application deadline: 28 February 2022
  - https://en.nagoya-u.ac.jp/employment/upload_images/20220201_isee_en.pdf

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MoU and LoA issue

- MoU and LoA s regarding BepiColombo
  - ESA-JAXA MoU
  - CNES-JAXA MMO LoA
  - CNES-JAXA MPO LoA
  - DLR-JAXA LoA
  - FSA-JAXA LoA
  - IWF-JAXA LoA
  - SNSB-JAXA LoA
- Expiry Date: December 31st , 2022
- JAXA has started the process to update the MoU with new dates. We proposed the new expiry date of December 31st , 2029.

MoU and LoA issue (2)

- We will start the process to update the LoAs in the near future (probably after the MoU expiry date is determined).
- The new expiry date will be the same as the MoU.

<u>Minor updates for all LoA</u>
-Member list
-POC information

<u>Only for JAXA-CNES LoA</u>
-Add supports in operations

Thank you!

Stay safe!

Illustration by Masayuki Ishikawa