



XRISM

Science operations Plan

Y. Terada (Saitama U./ISAS),
On behalf of XRISM science operations team



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The XRISM Mission

ü Recovery mission of Hitomi satellite

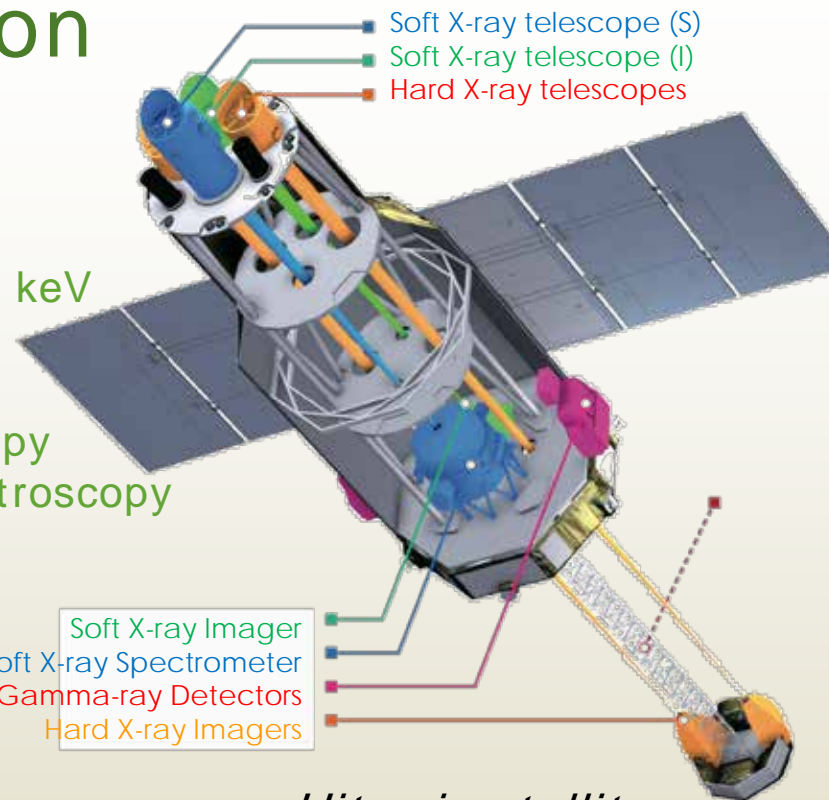
Hitomi: X-ray observation in 0.3 – 600 keV

- High resolution spectroscopy
- Wide FOV Imaging
- Hard X-ray Imaging spectroscopy
- Super sensitive gamma-ray spectroscopy

XARM: recovery below 10 keV

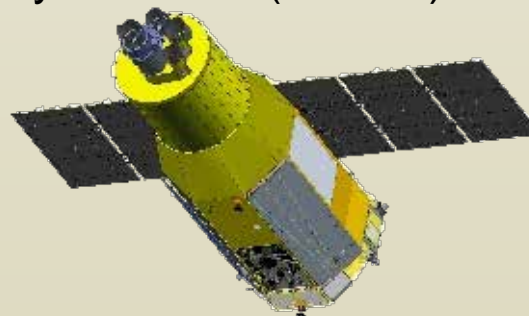
- high resolution spectroscopy
- Wide FOV Imaging

Soft X-ray Imager
Soft X-ray Spectrometer
Soft Gamma-ray Detectors
Hard X-ray Imagers



Hitomi satellite

ü X-ray Astronomical Recovery Mission (XARM) since 2016

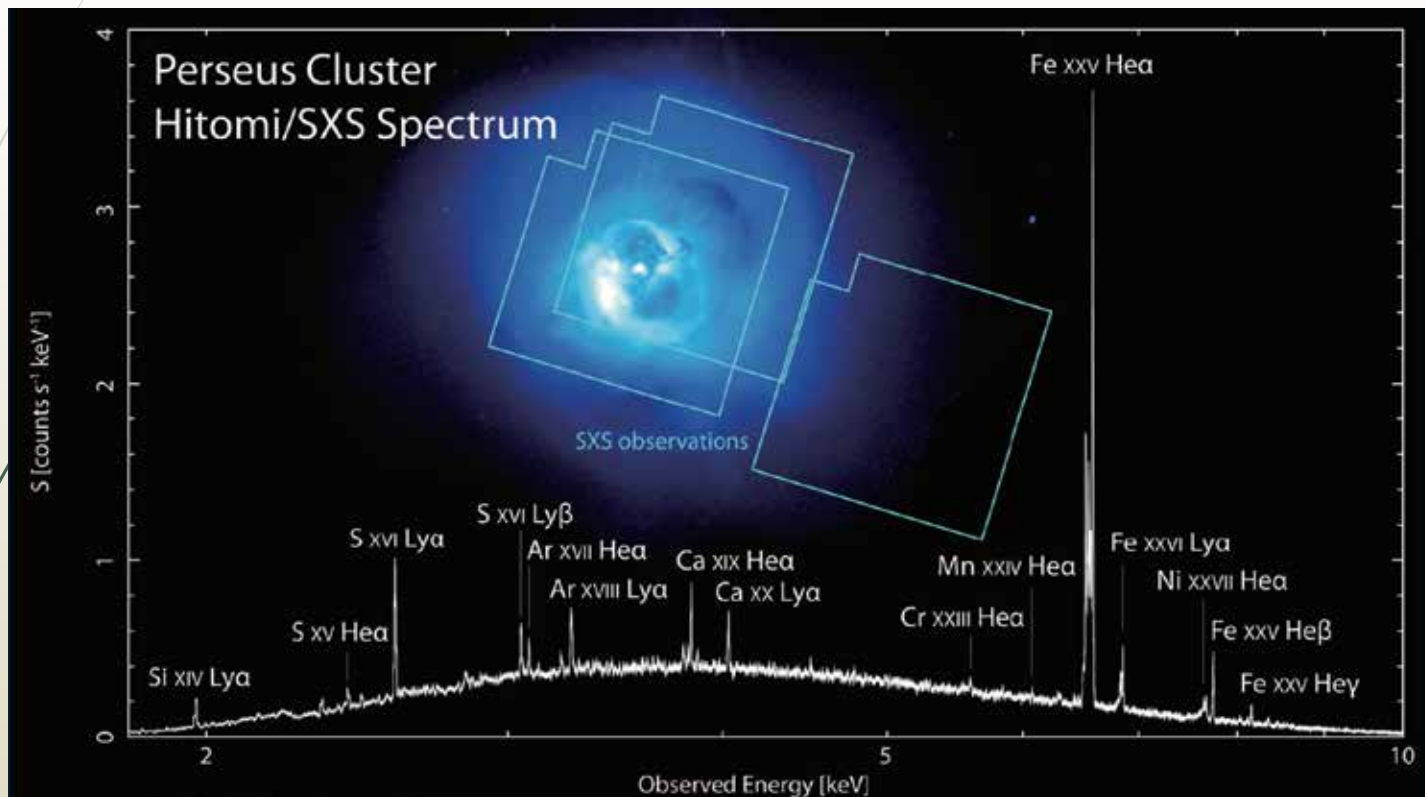




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The XRISM Mission

ü Just we want to recover ...



ü X-ray Astronomical Recovery Mission (XARM)

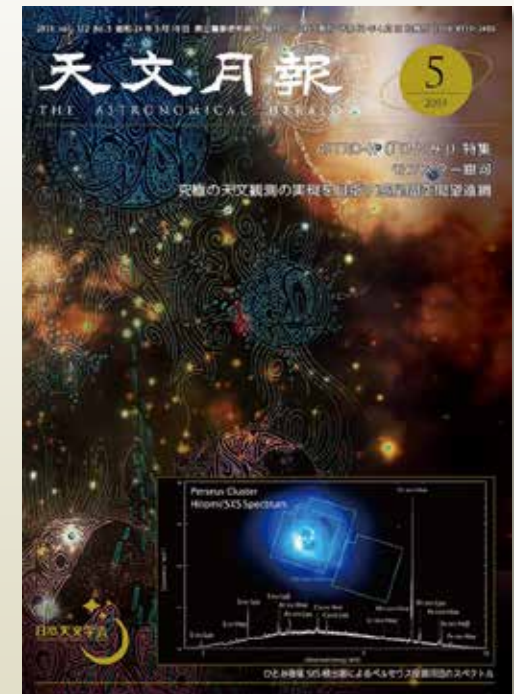
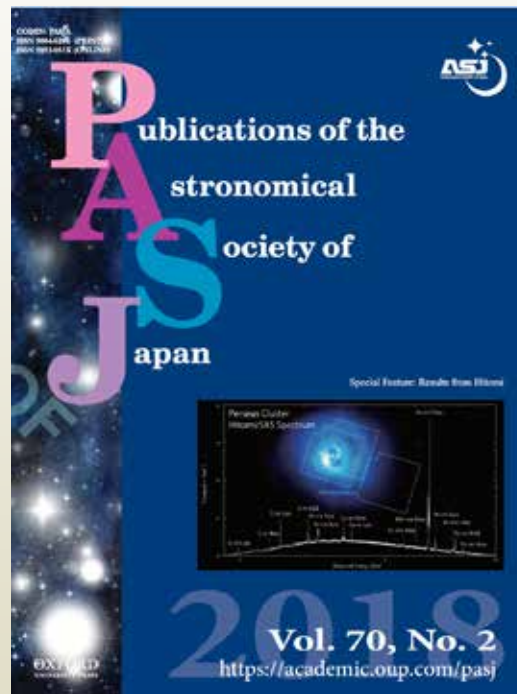
à X-Ray Imaging and Spectroscopy Mission (XRISM) since 2018

<http://xrism.isas.jaxa.jp/>



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This plot used several times..





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Ref.) Scientific Outputs from Hitomi

Perseus Cluster

12 papers

The Quiescent Intracluster Medium in the Core of the Perseus Cluster	A.Fabian	Nature	2016 July
Hitomi constraints on the 3.5 keV line in the Perseus galaxy cluster	M. Markevitch	ApJL	2016 July
Solar abundance ratios of the iron-peak elements in the Perseus cluster	H.Yamaguchi	Nature	2017 Nov
Measurements of resonant scattering in the Perseus cluster core with Hitomi SXS	K.Sato	PASJ	1710.04648
Atmospheric gas dynamics in the Perseus cluster observed with Hitomi	Y.Ichinohe	PASJ	1711.00240

NGC1275

Hitomi Observation of Radio Galaxy NGC 1275: The First X-ray Microcalorimeter Spectroscopy of Fe-K{alpha} Line Emission from an Active Galactic Nucleus	H.Noda	PASJ	1711.06289
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N132D

Hitomi Observations of the LMC SNR N132D: Highly Redshifted X-ray Emission from Iron Ejecta	E.Miller	PASJ	1712.02365
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RXJ1856-3754

PASJ Hitomi Special

(Calibration paper only)	--	--	2018	--
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IGR J16318-4848

Glimpse of the highly obscured HMXB IGR J16318-4848 with Hitomi	H.Nakajima	PASJ	1711.077
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G21.5-0.9

Hitomi X-ray Observation of the Pulsar Wind Nebula G21.5-\$-0.9	H.Uchida	PASJ	1802.05068
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Crab

Search for Thermal X-ray Features from the Crab nebula with Hitomi Soft X-ray Spectrometer	M.Tsujimoto	PASJ	1707.00054
Hitomi X-ray studies of Giant Radio Pulses from the Crab pulsar	Y.Terada	PASJ	1707.08801
Detection of polarized gamma-ray emission from the Crab nebula with the Hitomi Soft Gamma-ray Detector	H.Odak	PASJ	1810.00704

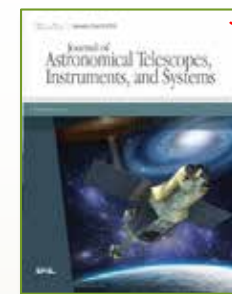
New





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Ref.) Instruments papers



*JATIS Hitomi
Special*

	Title	Author	Journal
AH	The Hitomi (ASTRO-H) x-ray astronomy satellite	T. Takahashi	JATIS
SXS	Thermal analyses for initial operations of the soft x-ray spectrometer onboard the Hitomi satellite	H. Noda	JATIS
	Porous plug phase separator and superfluid film flow suppression system for the soft x-ray spectrometer onboard Hitomi	Y. Ezo	JATIS
	Calibration sources and filters of the soft x-ray spectrometer instrument on the Hitomi spacecraft	Cor P. de Vries	JATIS
	In-orbit operation of the soft x-ray spectrometer onboard the Hitomi satellite	M. Tsujimoto	JATIS
	Performance of the helium dewar and the cryocoolers of the Hitomi soft x-ray spectrometer	R. Fujimoto	JATIS
	Design, implementation, and performance of the Astro-H SXS calorimeter array and anticoincidence detector	C. Kilbourne	JATIS
	Design, implementation, and performance of the Astro-H soft x-ray spectrometer aperture assembly and blocking filters	C. Kilbourne	JATIS
	Vibration isolation system for cryocoolers of soft x-ray spectrometer on-board ASTRO-H (Hitomi)	Y. Takei	JATIS
	Design and on-orbit operation of the soft x-ray spectrometer adiabatic demagnetization refrigerator on the Hitomi observatory	P.J. Shirron	JATIS
	System design and implementation of the detector assembly of the Astro-H soft x-ray spectrometer	Meng P. Chiao	JATIS

cont.

Continue.

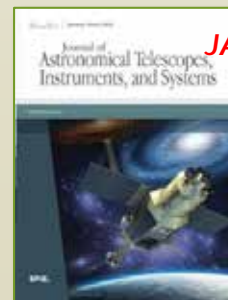


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Ref.) Instruments papers(cont.)

	Title	Author	Journal
SXS	In-flight performance of pulse-processing system of the ASTRO-H/Hitomi soft x-ray spectrometer	Y. Ishisaki	JATIS
★	In-flight performance of the soft x-ray spectrometer detector system on Astro-H	F. S. Porter	JATIS
★	In-flight calibration of Hitomi Soft X-ray Spectrometer. (1) Background	C. A. Kilbourne	PASJ
★	In-flight calibration of the Hitomi Soft X-ray Spectrometer. (2) Point spread function	Y. Maeda	PASJ
★	In-flight calibration of Hitomi Soft X-ray Spectrometer. (3) Effective area	M. Tsujimoto	PASJ
★	Ground calibration of the Astro-H (Hitomi) soft x-ray spectrometer	M. E. Eckart	JATIS
★	In-flight verification of the calibration and performance of the ASTRO-H (Hitomi) Soft X-ray Spectrometer	M. A. Leutenegger	JATIS
SXI	Soft X-ray Imager aboard Hitomi (ASTRO-H)	T. Tanaka	JATIS
★	In-orbit performance of the soft X-ray imaging system aboard Hitomi (ASTRO-H)	H. Nakajima	PASJ
SXT	★ Ground-based x-ray calibration of the Astro-H/Hitomi soft x-ray telescopes	R. Iizuka	JATIS

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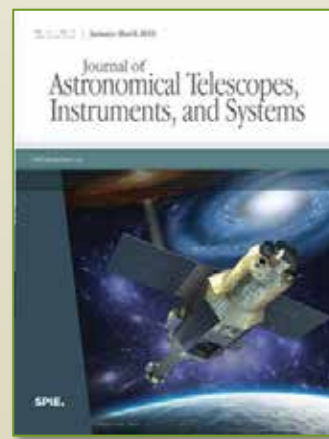
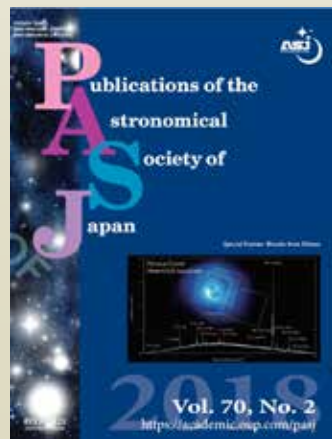
JATIS Hitomi
Special

★ Calibration, performance

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Ref.) Instruments papers (cont.)

	Title	Author	Journal
HXI	The hard x-ray imager onboard Hitomi (ASTRO-H)	K. Nakazawa	JATIS
★	In-orbit performance and calibration of the hard x-ray imager onboard Hitomi (ASTRO-H)	K. Hagino	JATIS
HXT	Supermirror design for Hard X-Ray Telescopes on-board Hitomi (ASTRO-H)	K. Tamura	JATIS
★	On-ground calibration of the Hitomi Hard X-ray Telescopes	H. Mori	JATIS
★	In orbit performance of the Hard X-ray Telescope (HXT) on board the Hitomi (ASTRO-H) satellite	H. Matsumoto	JATIS
CAMS★	In-flight performance of the Canadian Astro-H Metrology System	L. Gallo et al.	JATIS
SGD★	Design and performance of Soft Gamma-ray Detector onboard the Hitomi (ASTRO-H) satellite	H. Tajima	JATIS
Time★	Time assignment system and its performance aboard the Hitomi satellite	Y. Terada	JATIS
Soft	Astro-H/Hitomi data analysis, processing, and archive	L. Angelini	JATIS



★ Calibration, performance

Hitomi Special On-line!



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XRISM Instruments

Instrument	FOV/pix	E (FWHM @6 keV)	Energy band
Resolve (XMA + X-ray micro calorimeter)	2.9' / 6 x 6 pix	7 eV (goal 5 eV)	0.3 – 12 keV
Xtend (XMA + X-ray CCD)	38' / 1280 x 1280 pix	< 250 eV at EOL (< 200 eV at BOL)	0.4 – 13 keV

Presentations by Maurice & Takuya & Makoto

Presentations by Koji & Hikari & Kiyoshi

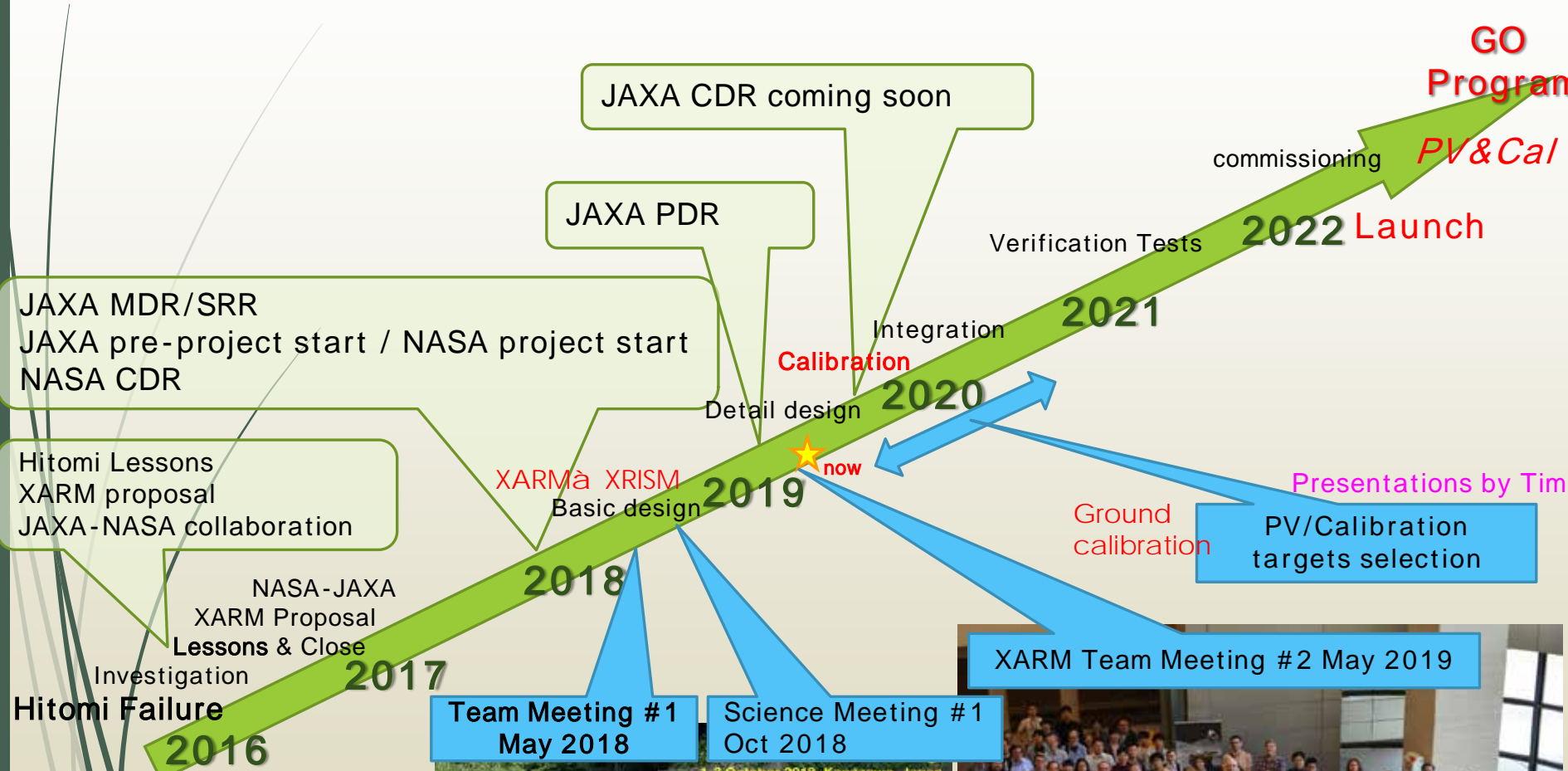




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XRISM Mission status

(May 2019)





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Group photo last week



Many IACHEC members



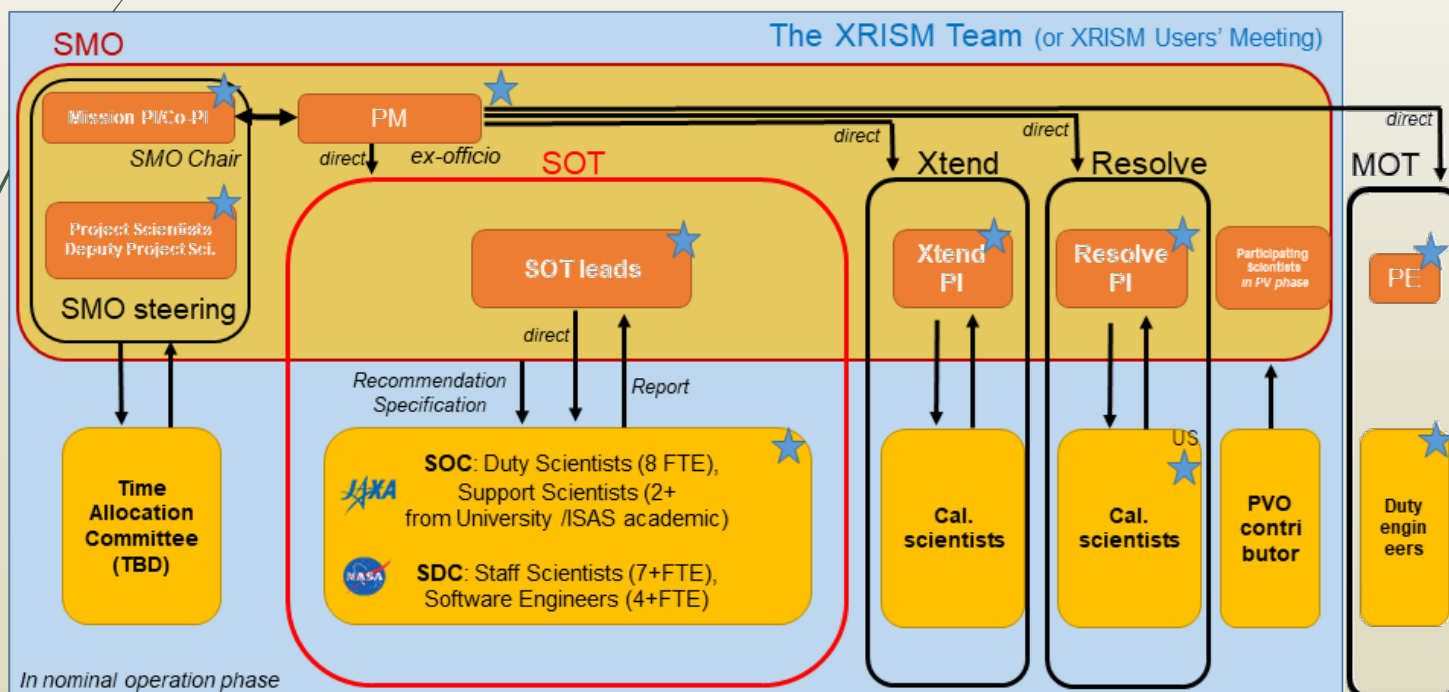
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XRISM Science Operations

Goal: Enhance Science outputs from XRISM mission

Team structure:

- ü Science Management Office (PI, PS, inst./soft/science team lead) *decisions*
- ü Science Operations Team *actual operations & preparation*





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Science Operations Team

SOT Responsibilities

- Operation Planning
- Data Processing and Distribution (and Archive)
- Analyses Software development and release, CALDB release
- User Support

SOT Team Structure

Science Operations Team (SOT)



Science Data Center(SDC)

SDC Product Development Lead
SDC Science Lead

Data Center Team

- Pipeline Lead
 - Developer
- Archive Lead
- Analysis Tools Lead
- CALDB Lead
- Xtend Lead

Guest Observer Facility and User Support

- Lead
- GO Support



Science Operations Center(SOC)

SOC Lead

Preparation Phase

- **Data Processing & Planning Group**
 - Chairs
 - Development scientists
- **Performance Validation & Optimization Group**
 - Chair
 - Development scientists
- **User Support Group**
 - Chairs
 - Development scientists
- Development Engineers from Company

Operation Phase

- Duty scientists
- Support scientists
- Operators

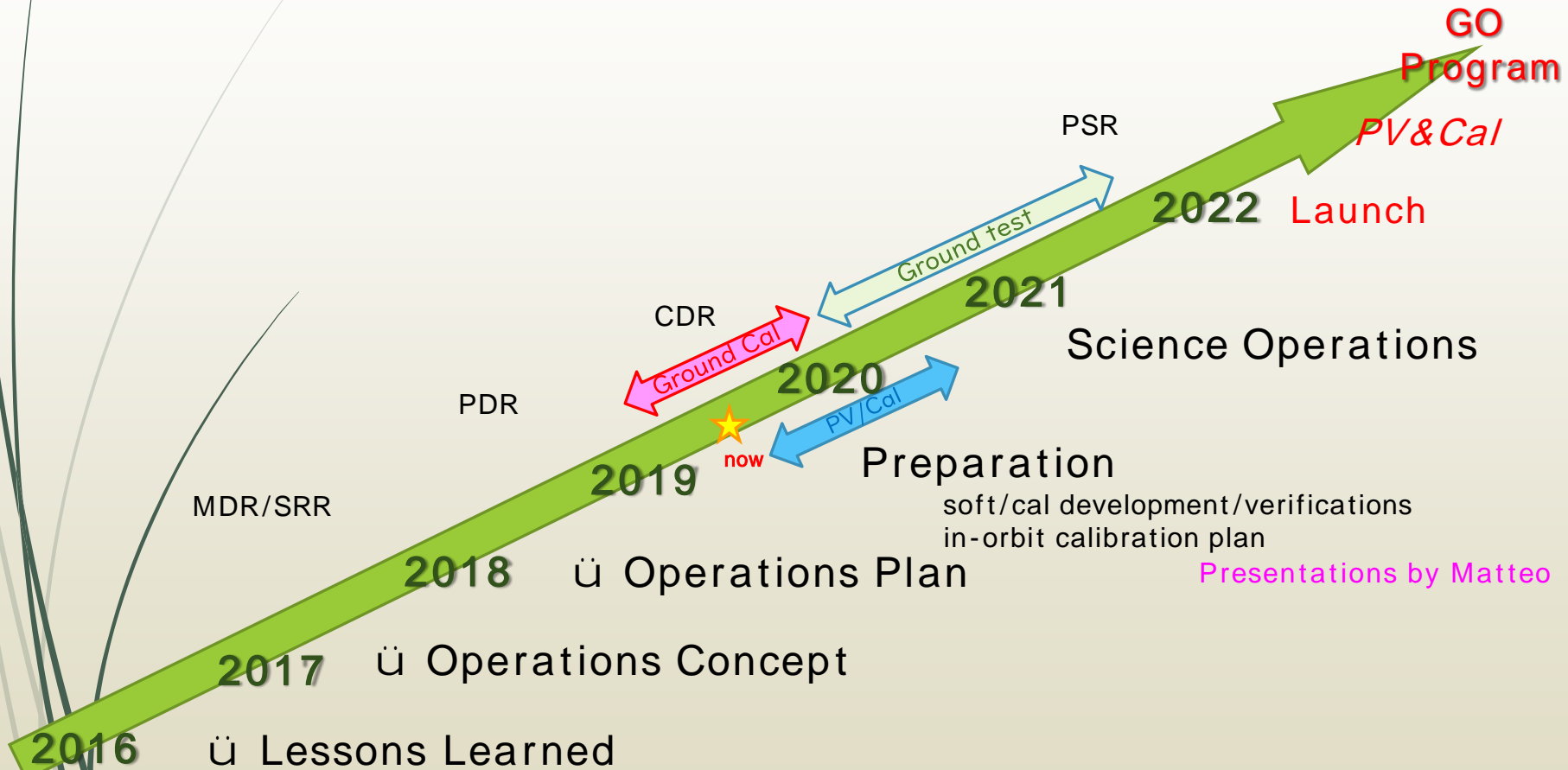


ESAC

(TBD)



Science Operations Timeline



Part of science operations starts before launch

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Lessons learned from ASCA/Suzaku/Hitomi

ASCA

The pipeline/analyses software are developed by instrument teams.

- 😊 Software tasks are well verified via on-ground calibration measurements.
- 😞 Some are NOT public, (called as an “ animal software ”), providing better results than official tools; “ unfair ”



Suzaku

The pipeline/analyses software are developed by instrument teams.

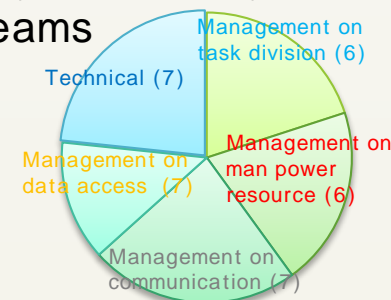
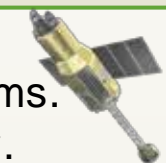
- 😊 core libraries of quick look system & public ftools are shared. No animal.
- 😞 Software development by Instrument teams causes unexpected software freeze and schedule delay of delivery.
- 😞 User support staffs appointed by agency should concentrate on the science operation. If not, activities sometimes freeze.



Hitomi

The Software/Calibration Team was defined independent from instrument teams.

- 😊 No trouble in pipeline, well calibrated products, no delay of delivery.
- 😞 Tough task for communication between multiple sub-teams
- 30 lessons learned from Hitomi were listed for SCT on
 - Task division between Japan and US
 - Team structure and WBS
 - Communication issues
 - Policies on data process and rights.



XRISM Concept & Plan

We try to solve reflection point in LLs of past missions.
(I hope those LLs may help SO of future missions)

XRISM operation concept

1. Clear division between Mission Operations & Science Operations so that scientists can concentrate on Science Operations.
2. Define Operations Plan (including team structure and interface etc) in the early phase of the mission.
3. Start operations from the ground test.
4. All members appointed by agency.

XRISM operation Plan

- Follow the concept & set tasks and detail plan
- All the operations are defined as tasks; but we reserved a room for Performance Verification and Optimization task;
ex.) find “known” behavior of instruments related to the performance, and setting up “new” calibration items etc..

We just finish these stages and start development of actual tools etc as a preparation of coming science operations stage.