Timing WG

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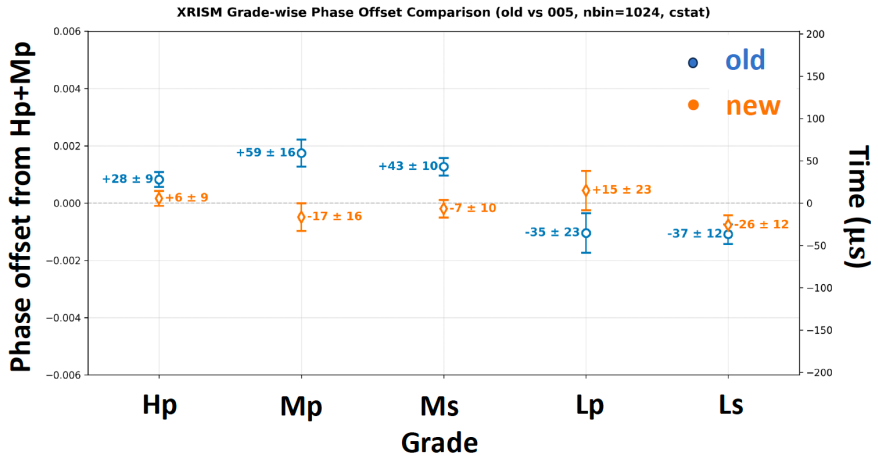
(Timing WG chair/co-chair)

Presentation

1. Verification of the Timing Accuracy of XRISM/Resolve with the Updated CALDB (Yugo Motogami)

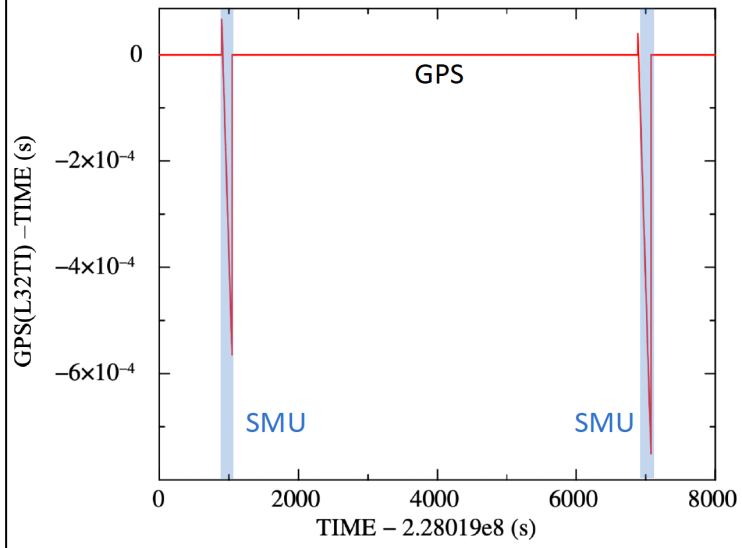
Verification Results



Caldb ver.	standard deviation (μs)
old	44.7
new	16.4

The correction effect is confirmed

GPS → SMU → GPS Transition in March 2026



GPS(L32TI): TIME value converted from L32TI assuming GPS sync.

Two short GPS unlock periods occurred on 2026/03/24 UT.

Successful switchback from SMU to GPS

No timing issue outside the GPS-unlocked period

Paper status

1. **Systematic timing cross calibration (led by Matteo) inc. technique description.**
   - Chandra, EP, Fermi, Hitomi, HXMT, IXPE, MAXI, NICER, NinjaSat, NuSTAR, Suzaku, Swift, XMM, XRISM, and RXTE data are included
     ➔ published!!
     Bachetti et al. (2026), PASP, 138, 014501

2. **Simultaneous timing calibration campaign in Mar 2024 (XRISM, NICER, NuSTAR) (led by XRISM)**
   - XRISM+NuSTAR+NICER results have been published as JATIS papers (2025) Terada et al 2025, Shidatsu et al 2025, and Sawada et al 2025.

3. **Systematic timing cross calibration in hard X-ray to GeV gamma-ray mission (led by Lucien)**
   - See presentation in 13th IACHEC (2018) -- cont. (?)

Presentation

2. Introduction to the recently accepted paper on a timing cross-calibration tool and its application to Crab data (Matteo Bachetti, remote talk)

Publications of the Astronomical Society of the Pacific, 138:014501 (18pp), 2026 January https://doi.org/10.1088/1538-3873/ae2b36

OPEN ACCESS

A Simple, Flexible Method for Timing Cross-calibration of Space Missions

Matteo Bachetti[1], Yukikatsu Terada[2,3], Megumi Shidatsu[4], Craig B. Markwardt[5], Yong Chen[6], Weiwei Cui[6], Giancarlo Cusumano[7], Dawei Han[6], Shumei Jia[6], Chulsoo Kang[2], Vinay L. Kashyap[8], Lucien Kuiper[9], Xiaobo Li[6], Yugo Motogami[2], Naoyuki Ota[10,11], Simone Pagliarella[12,13,14], Katja Pottschmidt[5,15,†], Simon R. Rosen[16], Arnold Rots[8], Makoto Sawada[17], Mutsumi Sugizaki[18], Toshihiro Takagi[4], Takuya Takahashi[10,11], Toru Tamagawa[10,11,19], Youli Tuo[20], Yi-Jung Yang[21], Marina Yoshimoto[4], and Juan Zhang[6]

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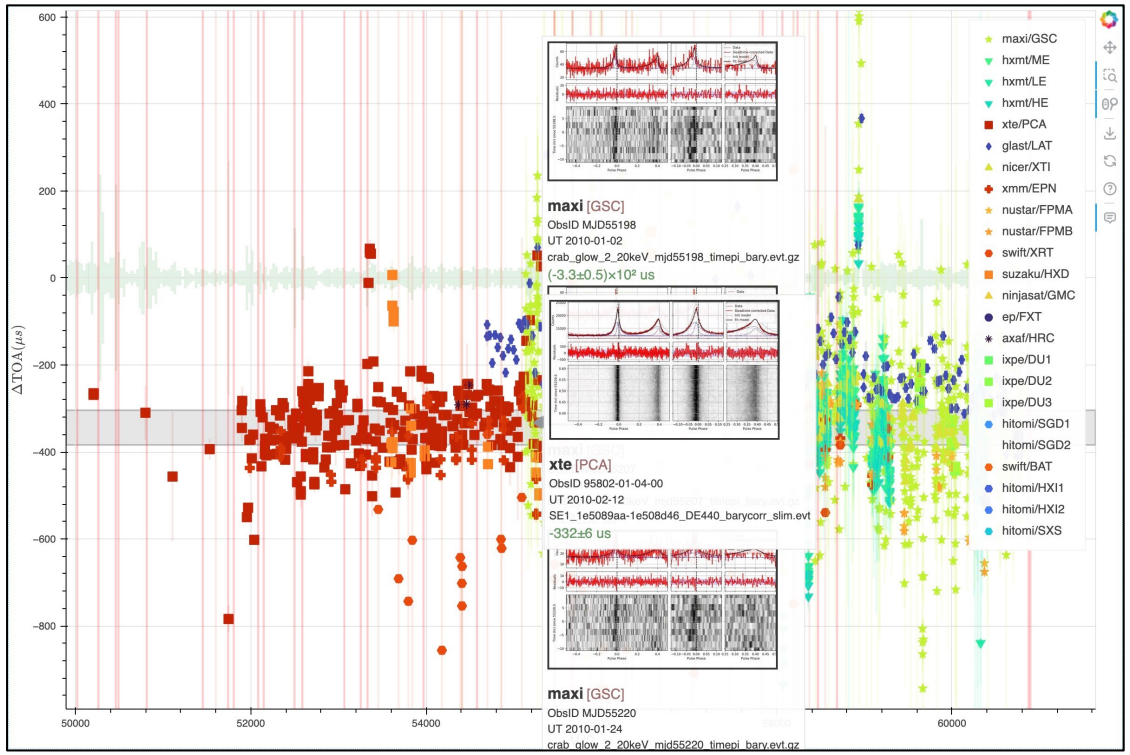

TOA calculation code:
https://github.com/matteobachetti/TOAextractor
Deadtime correction code:
https://github.com/matteobachetti/pulse_deadtime_fix

next step: use the tool with more data (not only of Crab)
and look deeper into the results of each instrument

Coordinated observations for timing calibration?

Crab

XRISM: plan to observe every AO cycle (visibility: Feb. 13 - Apr. 14, Aug. 17 – Oct. 18)
XMM: plan to observe twice a year
NuSTAR: once every couple of months
XPoSat: once every couple of months
EP/FXT: twice in a year (March and September)

Other sources

- B1937+21: XRISM PV data available
- B1821-24?

PoC for instruments on Timing

Mission	PoC (last updated 22 Apr 2026)
RXTE	Craig Markwardt, Arnold Rots
Chandra	Vinay Kashyap, Arnold Rots
XMM-Newton	Felix Fuerst, Simon Rosen
Swift	Amy Lien, Giancarlo Cusumano
INTEGRAL	Guillaume Belanger, Volodymyr SAVCHENKO,Lucien Kuiper
NuSTAR	Matteo Bachetti
Astrosat	Gulab Dewangan, Dipankar Bhattacharya
HXMT	Xiaobo LI
NICER	Craig Markwardt, Teruaki Enoto
eROSITA	Michael Freyberg
Suzaku	Yukikatsu Terada
Hitomi	Yukikatsu Terada
XRISM	Yukikatsu Terada, Megumi Shidatsu
Einstein Probe	Juan Zhang
GRID	Longhao Li
MAXI	Megumi Shidatsu, Mutsumi Sugizaki
Ninjasat	Naoyuki Ota, Takuya Takahashi
SVOM	Shijie Zheng, Olivier Godet, Diego Gotz
XPoSat	Rwitika Chatterjee

https://wikis.mit.edu/confluence/display/iachec/Timing

We also have a mailing list (see the above webpage)

← NEW!!

Updating timing tables

https://wikis.mit.edu/confluence/display/iachec/Timing

Mission/Instruments	Science Requirement Absolute Time		Timing System Design		Timing Ca		
	Requirement	Goal	GPS Receiver	Clock Stability	Offset from the Reference	Deviation, sigma	Reference Time
RXTE/PCA ⭐	10 μsec	none	No		Calibrated: 1 μsec Uncalibrated: ~0 usec (Absolute, not relative to radio)	Calibrated: 3.4 μsec Uncalibrated: 100 usec (max) ~50 usec (std)	TAI
RXTE/HEXTE⭐	10 μsec	none			See above	See above	
Chandra/ACIS	0.25625 s (one minor frame start time)	0.001 s (synchronize minor frame starts)	No (sync DSN)	3.2 μsec	285 ± 6 μsec		
Chandra/HRC		16 μsec			4 ± 4 μsec		

Appendix

other tasks

- update the solar system ephemeris for barycentric correction of XRISM etc. (DE-200 -> DE-430)
  → not yet. But we have requested it.

- use Fermi ephemeris instead of the Jodrell bank one
  → not yet. We would need it for timing analysis of pulsars other than Crab