

16th IACHEC Timing Working group

Yukikatsu Terada, Megumi Shidatsu,
(Timing WG chair/co-chair)

15 May 2024

Timing WG, Logistics

Co-Chair -- New

Dr. Megumi Shidatsu (XRISM, Ehime Univ., Japan)

WG members --- update? yes

Yukikatsu Terada (Suzaku, Hitomi, XRISM, chair),

Megumi Shidatsu (XRISM, co-chair)

Craig Markwardt (NICER), Teruaki Enoto (NICER),

Matteo Bachetti (NuSTAR), Katja Pottschmidt (NuSTAR), Kristin Madsen (NuSTAR)

Felix Fuerst (XMM-Newton), Simon Rosen (XMM-Newton),

Vinay Kashyap (Chandra), Arnold Rots (Chandra),

Amy Lien (Swift), Giancarlo Cusumano (Swift),

Guillaume Belanger (INTEGRAL), Volodymyr SAVCHENKO (INTEGRAL), Lucien Kuiper (INTEGRAL)

Xiaobo LI (HXMT),

Gulab Dewangan (Astrosat), Dipankar Bhattacharya (Astrosat)

Michael Freyberg (eROSITA),

Makoto Sawada (XRISM), Takaaki Tanaka (XRISM), Takumi Shioiri (XRISM),

Juan Zhang (EP)

Toru Tamagawa, (NinjaSat), Naoyuki Ota (NinjaSat) **NEW**

Zhang Juan (EP),

ML: iachec_time@ml.saitama-u.ac.jp (stop in June 2024)

Wiki: <https://wikis.mit.edu/confluence/display/iachec/Timing>

Talks and discussion today

Oral talks

1. Pulsar Cross-calibration
Matteo Bachetti
2. Challenges to Keep the Timing Accuracy of XRISM Timing System in GPS Failure Mode
Megumi Shidatsu

Discussion

1. Systematic Pulsar Cross-calibration
2. Timing cross-calibration with the Crab in March 2024
3. Specific questions from XRISM team
4. Update 'timing calibration status' table
5. Paper plan - short term/long term

Discussion: Systematic Pulsar cross-calibration

1. Software - new version of stingray

- Question: what is the updates from the last version?
- No major update

2. Data share

- Repository is shown in Timing Wiki - NO. Please provide the link @Matteo
- Event FITS file (MJDREF keyword, TIME column, GTI)
- Yuki is now asking permission to share XRISM Event (TIME column only)
- Question: why we need event fits file? To be consistent among instruments
- NinjaSat will join. They can provide the event FITS.

3. Ephemeris

- Shown in Matteo' s presentation.
- Put ephemeris information on the wiki.

Discussion: Systematic Pulsar cross-calibration

4. Pulsars

- 'Crab' first
- Other pulsars?
 - PSR 1821
 - PSR 1937+21
 - Comment: Asking Fermi team is also helpful.

Please provide the information of recent pulsar observations

- ex) EP observation in Mar 2024.

5. Next step -- short term/long term plan

- Add new members to ML (Yuki)
- Circulate the link of Google Doc repository via ML (Matteo)
- Put event files (PoC)

Discussion: Crab campaign Mar 2024

1. Summary by Yuki, see presentation.
2. Ephemeris
 - Use Jodrell Bank radio ephemeris (in FK5, DE200)
3. Data analyses: XRISM
 - PoC: Y.Terada, M.Shidatsu
 - Comment: timing parameter is based on ground calibration
 - Comment: cannot share XRISM event FITS file
4. Data analyses : NICER
 - PoC: C. Markwardt
 - Question: no cleaned event (even when we relax criteria), use 'ufa' ?
 - Craig will check
 - due to FPM_LINDERONLY_COUNT criteria exceeds 500. relax the criteria.
 - Note that the energy scale will be inaccurate. (0.1-0.5 keV shifts)
5. Data analyses: NuSTAR
 - PoC: M. Bachetti
 - Comment: require reprocess using the latest clock-correction file.
https://nustarsoc.caltech.edu/NuSTAR_Public/NuSTAROperationSite/clockfile.php
 - Matteo will analyze the NuSTAR data & Kristin will provide the script to Yuki, Megumi.

Discussion: Crab campaign Mar 2024

- 6. NinjaSat to join? Yes
- 7. HXMT to join (simultaneous)
- 8. We also have another simultaneous Crab observation among EP/FXT & XMM & INTEGRAL & NuSTAR in early March 2024.

Information from ZhangJuan

Crab	20240228、 20240308
PSR B1821-24	20240508-20240511
PSR B1937+21	20240513-20240514
PSR B1509-58	20240507-20240508

Discussion: Questions from XRISM

1. Solar ephemeris, DE420 or DE200?

Which we should use?

.. XRISM PSR B1937+21, phase.

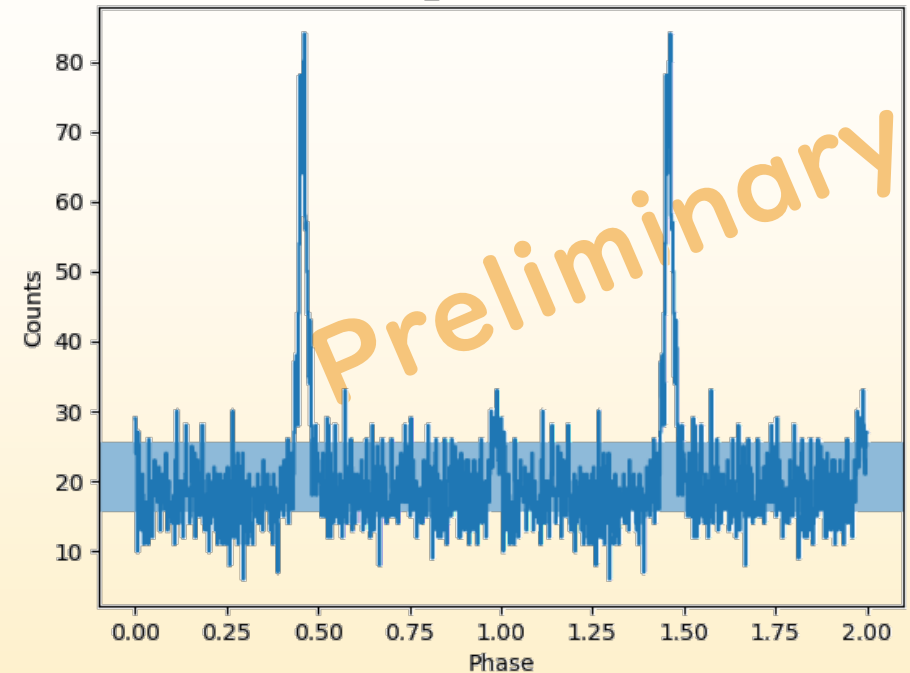
- Comment: DE200 is very old.
- Only merit to use DE200 is JD ephemeris.

2. Barycentric correction tool

- Suzaku, Hitomi, XRISM uses 'barycen' -- no function to use DE420
- NICER, NuSTAR, XTE, uses 'barycorr'
 - Can we update? -- Yes, possible / ask Tess.
 - -- Discuss within XRISM Science operation team (A/I, Yuki).

3. others

Folded Light Curve (PSR_B1937+21 XRISM Resolve hpmps)



Discussion: timing calibration status table

Table, timing calibration requirement and status

- <https://wikis.mit.edu/confluence/display/iachec/Timing>

PoC

-- update?

-- No

Mission	PoC (last updated 27 Apr 2023)
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, Katja Pottschmidt
Astrosat	Gulab Dewangan, Dipankar Bhattacharya
HXMT	Xiaobo LI
NICER	Craig Markwardt, Teruaki Enoto
eROSITA	Michael Freyberg
Suzaku	Yukikatsu Terada
Hitomomi	Yukikatsu Terada
XRISM	Yukikatsu Terada, Megumi Shidatsu
Einstein Probe	Juan Zhang

Table Updates?

Yes, If we have updates (ex. XRISM), please circulate the information via ML.

Yuki will update the table or you can edit the table by yourself.

Discussion: Publication plan

1. Pulsar cross-timing calibration

1. Study never stop.
2. But snapshot can be summarized as a journal paper.
3. Topic: only calibration or inc. science → Let's concentrate on calibration.
4. Time scale:
 1. Use 'barycorr' to fit ephemeris DE430.
 2. Finish XRISM timing calibration and provide FITS for study, in summer-autumn 2024.
 3. Try drafting by the next IACHEC.

2. XRISM timing using simultaneous observation of Crab

1. Describe in XRISM timing calibration paper
or
2. separate paper
→ #1 is ok for XRISM if other missions agrees.

3. Others?

- Comment: Use PSR/PWN model discussed in Non-thermal WG for spectra,