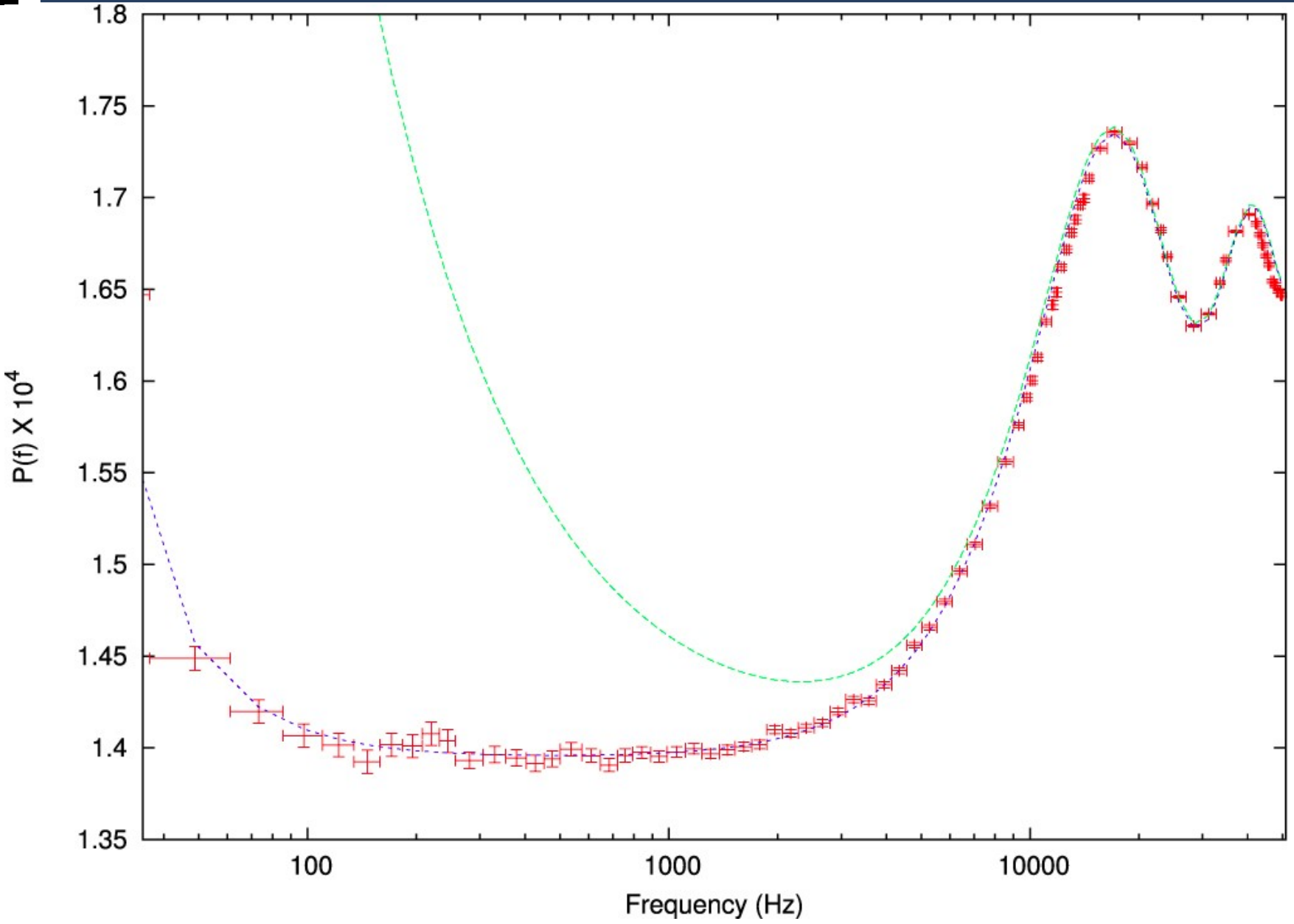
LAXPC Calibration: A User Perspective

Ranjeev Misra (IUCAA)

Rapid Timing: VERY GOOD NEWS

- LAXPC rapid timing (< 100 s) is “perfect”
- Except for a coherent narrow feature at 50 Hz for LAXPC 20 (layer 1), which is easily identifiable..

Rapid Timing: VERY GOOD NEWS



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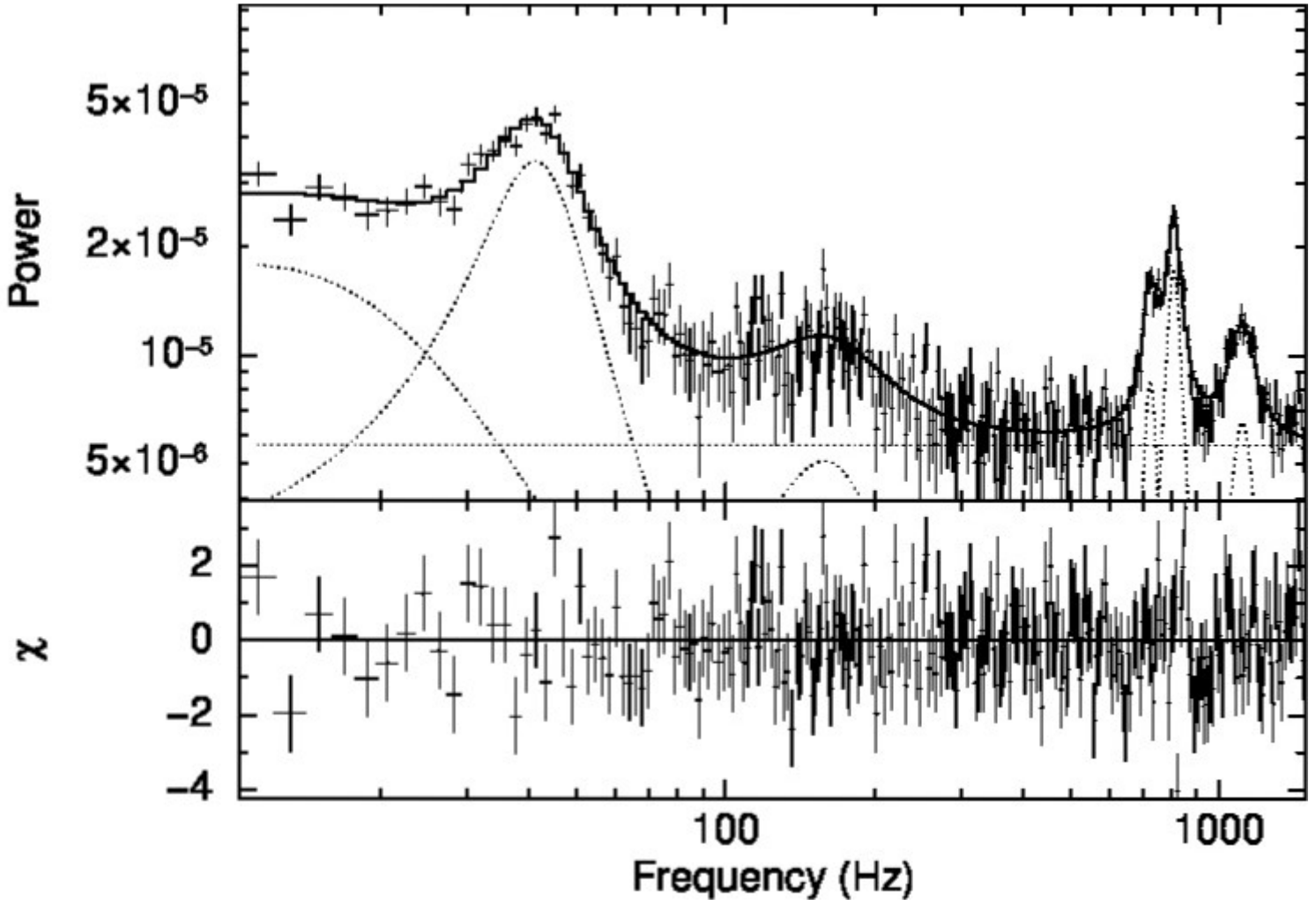
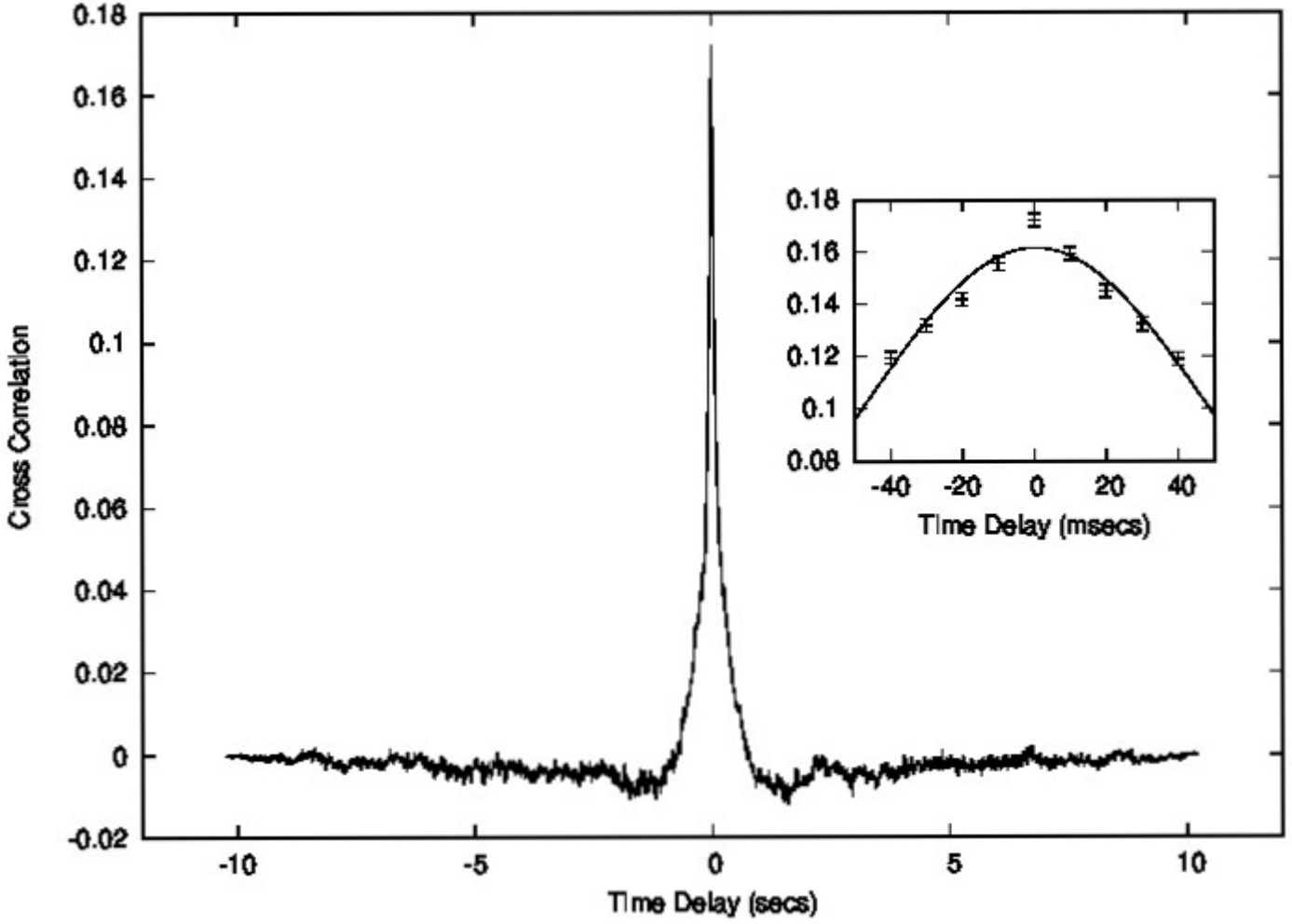


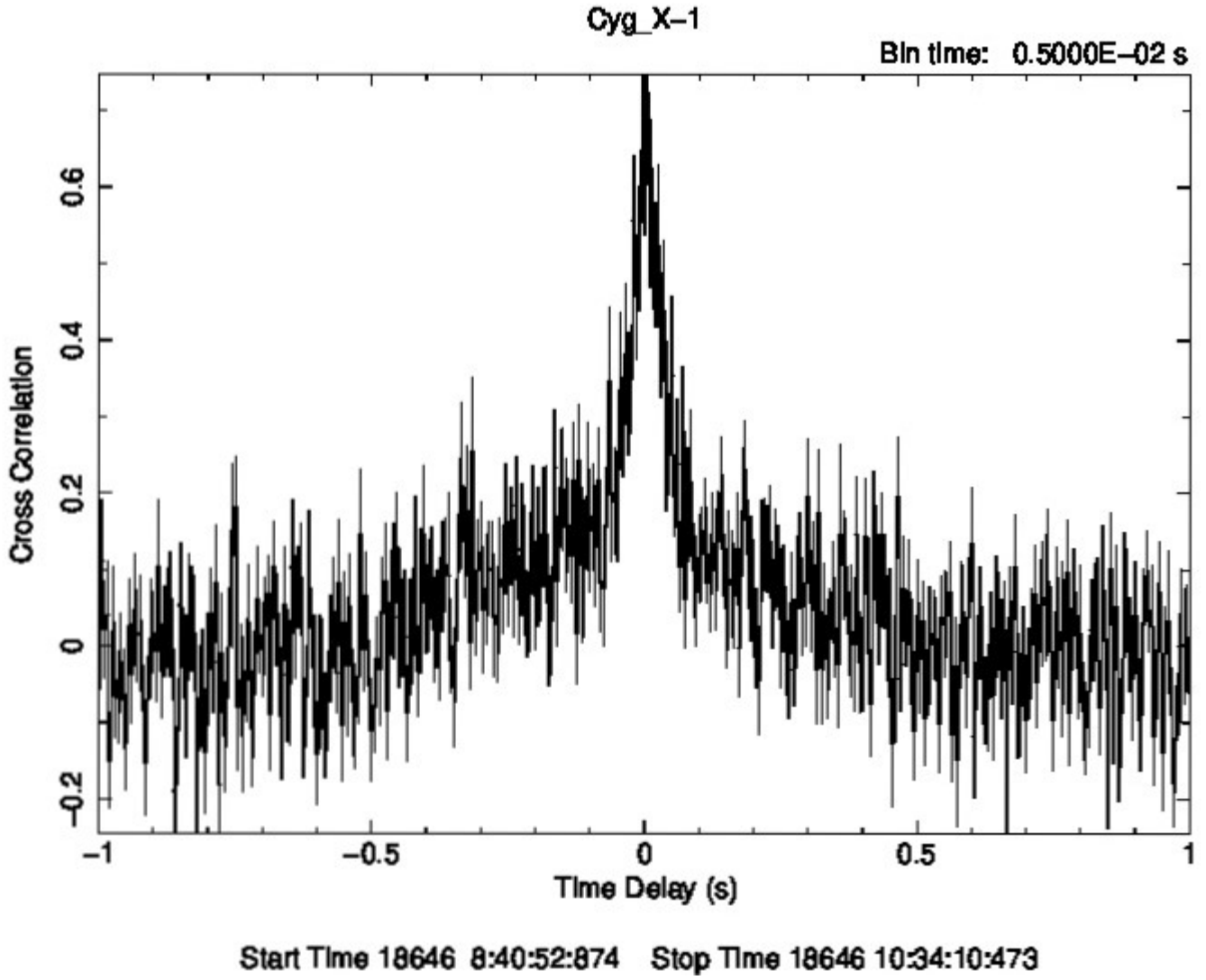
CREDIT: Kewal Anand, J. S. Yadav et. al.

Absolute Timing: VERY GOOD NEWS



NICER and LAXPC...cross correlation

Absolute Timing: VERY GOOD NEWS



HMXT ME and LAXPC...cross correlation 10-20 keV
CREDIT: Gitika Mall et. al.

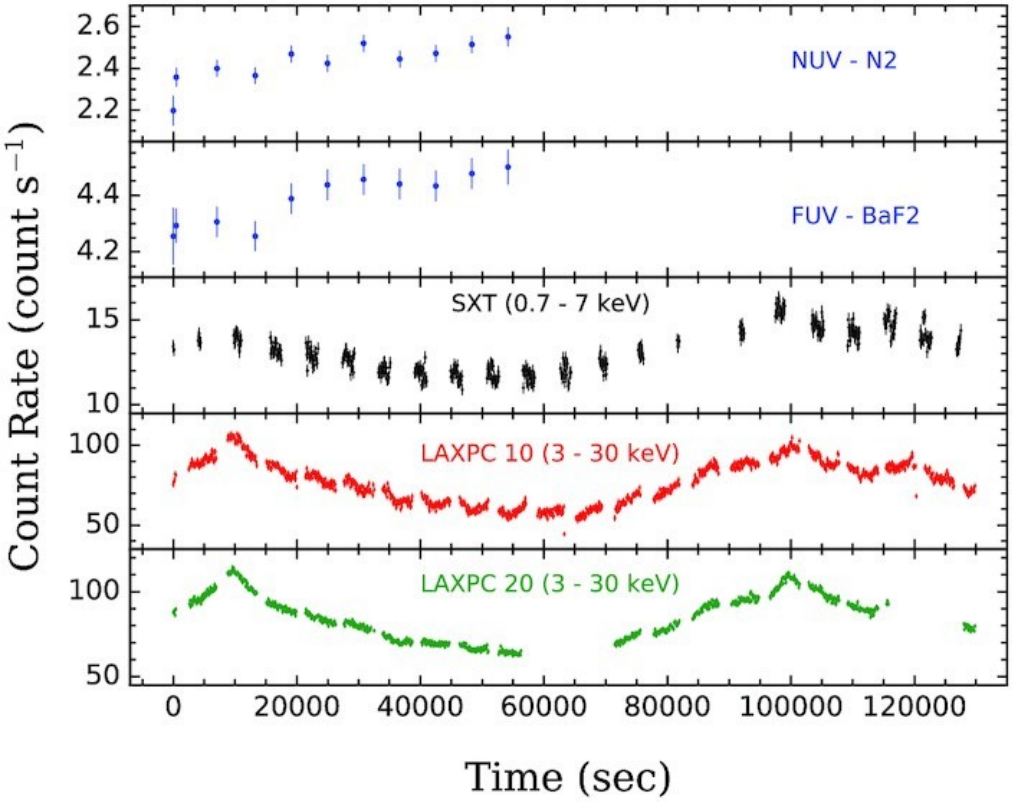
Rapid Timing: VERY GOOD NEWS

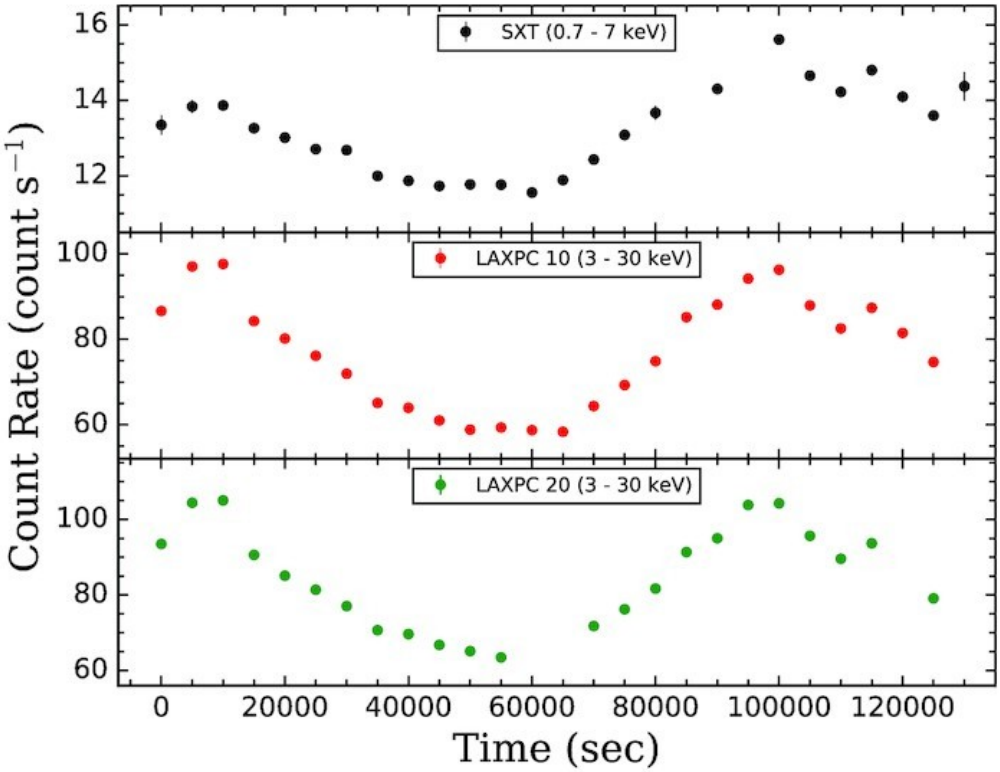
- LAXPC rapid timing (< 100 s) is “perfect”
- Except for a coherent narrow feature at 50 Hz for LAXPC 20 (layer 1), which is easily identifiable..
- THANK YOU TO THE INSTRUMENT TEAM FROM THE USER COMMUNITY!!!!!

Long term studies: GOOD NEWS

- For bright highly variable sources..no issues..
- For faint sources ..background variability needs to be considered..
  - New background model (2021)..very helpful..
- SXT lightcurve can be used to validate results

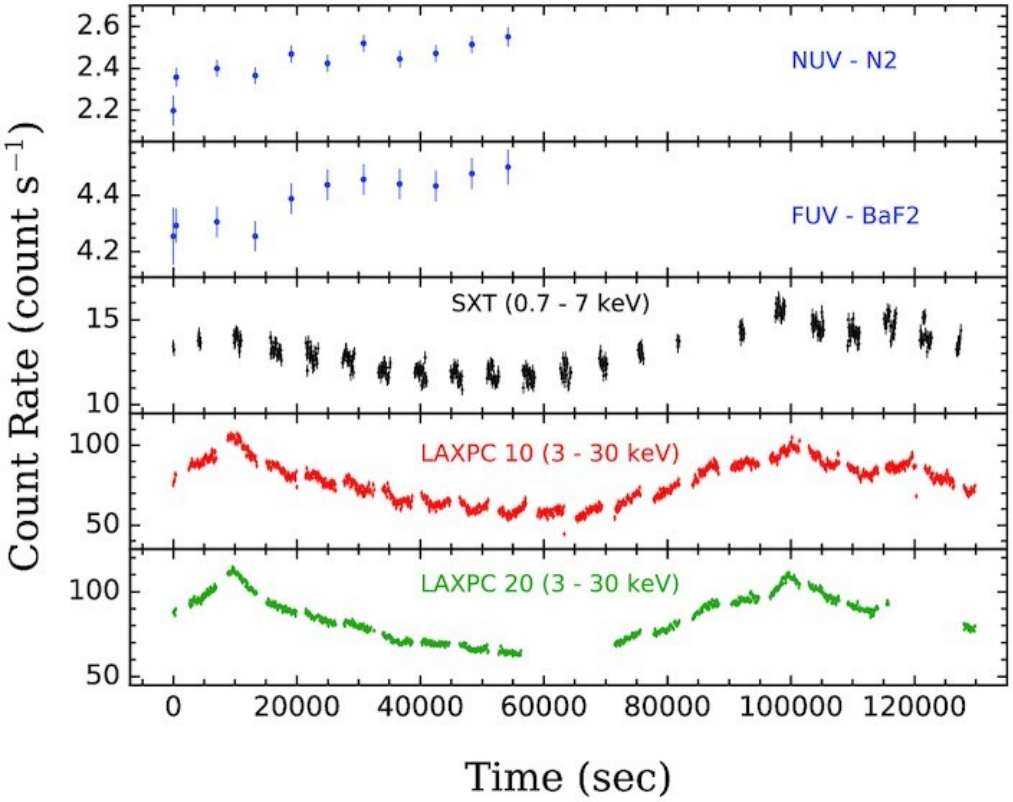
Long term studies: GOOD NEWS

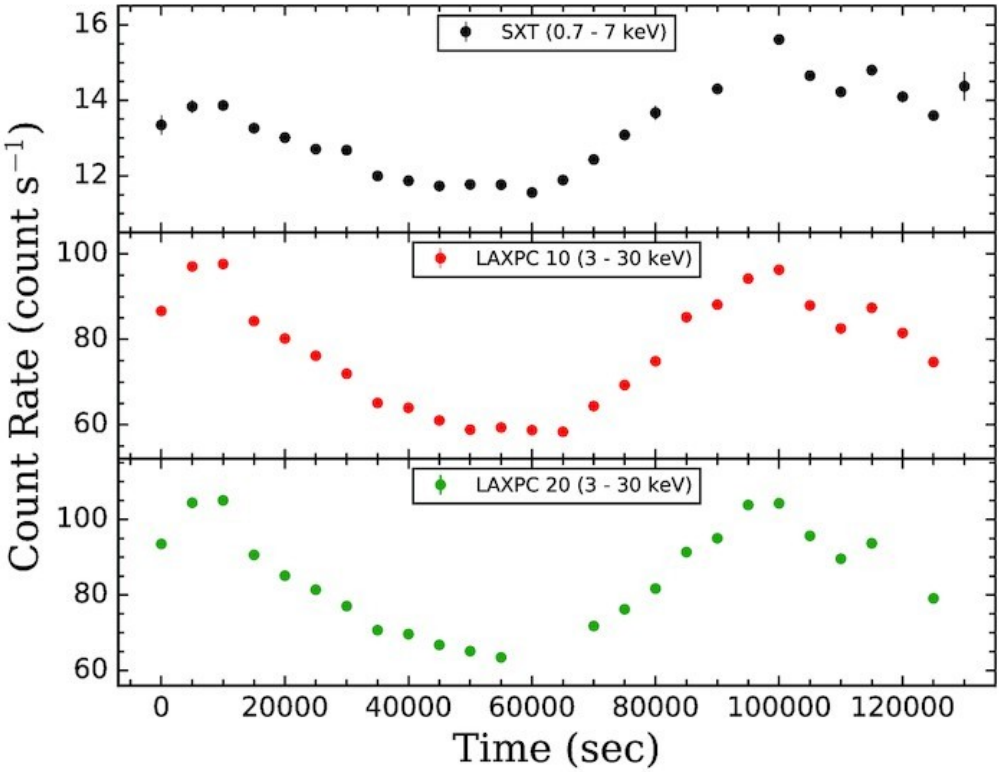




Shah et. al...Data from a blazar

Long term studies: GOOD NEWS





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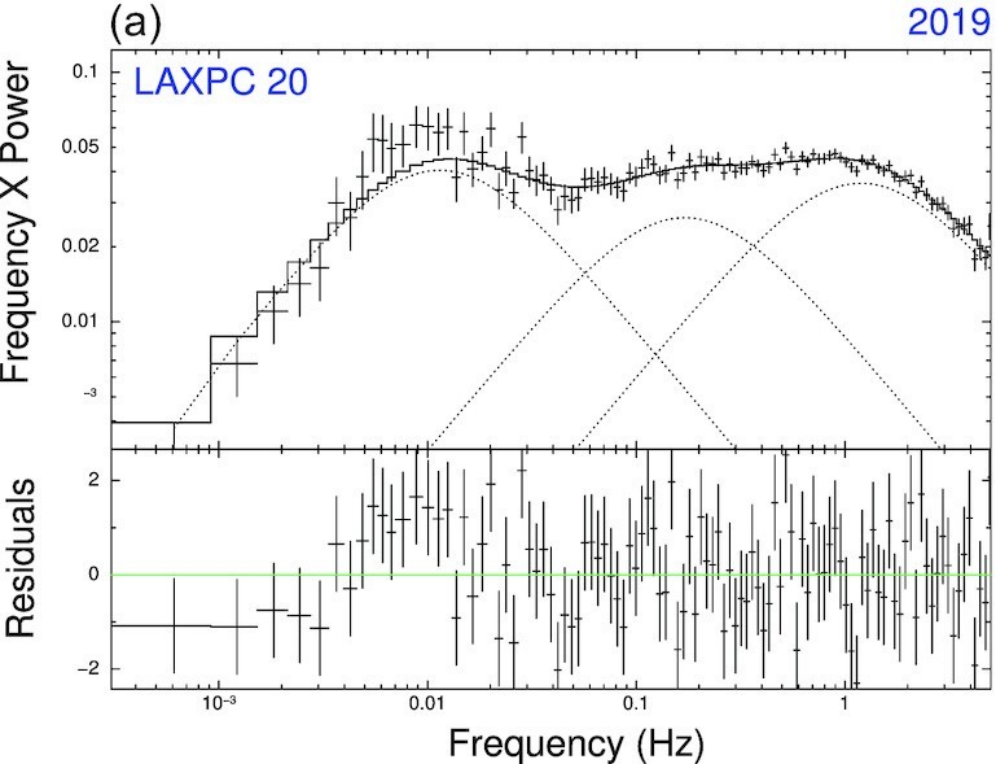
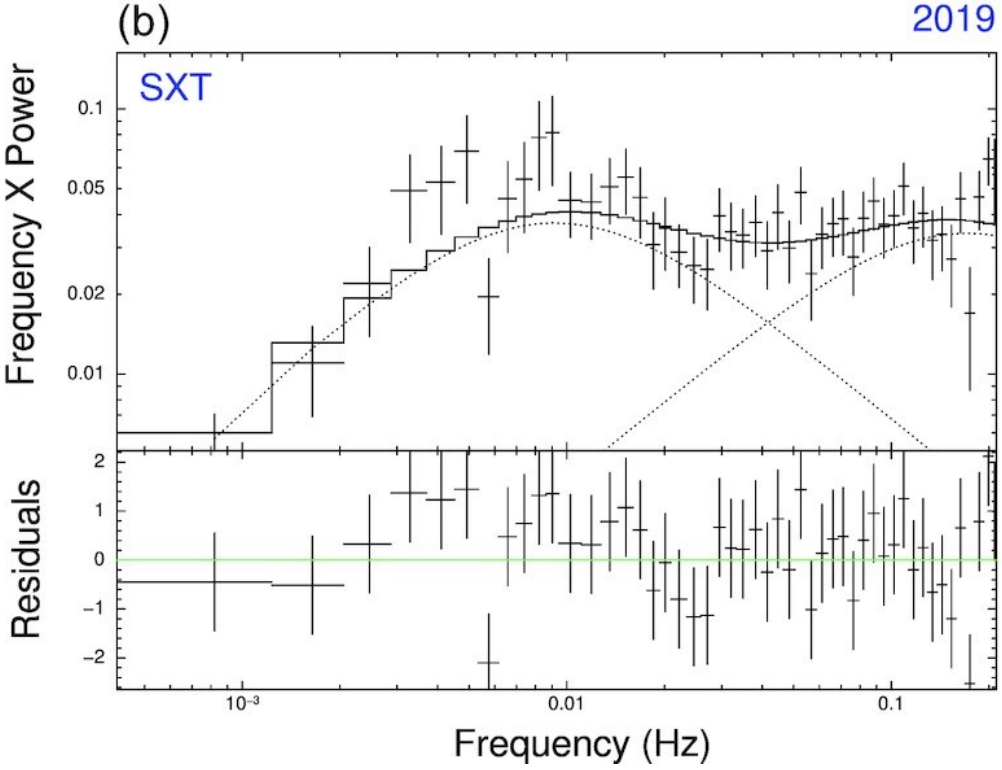




Husain et. al...Data from an X-ray binary

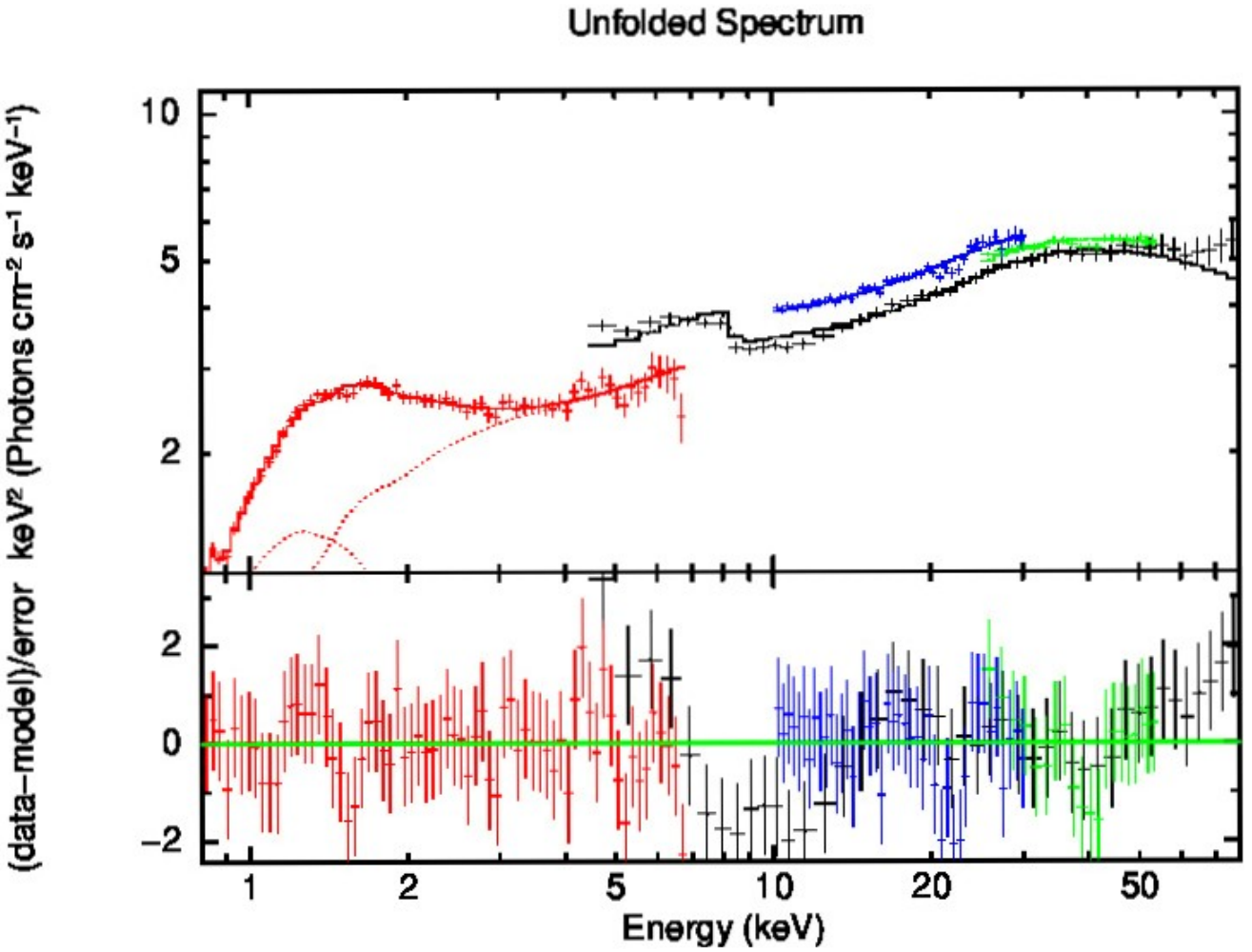
Faint Source Monitoring..

- Poisson limit: 1 milli-crab source flux/spectral index can be constrained for a 5 ksec observation.
- At present, the systematic error on background is of the same order as the Poisson error for 5 ksec.
- Thus, monitoring of a source with with few millicrab flux is feasible and worth doing.
- The flux limit can be decreased by better handle on background systematics

Spectral Studies: GOOD NEWS

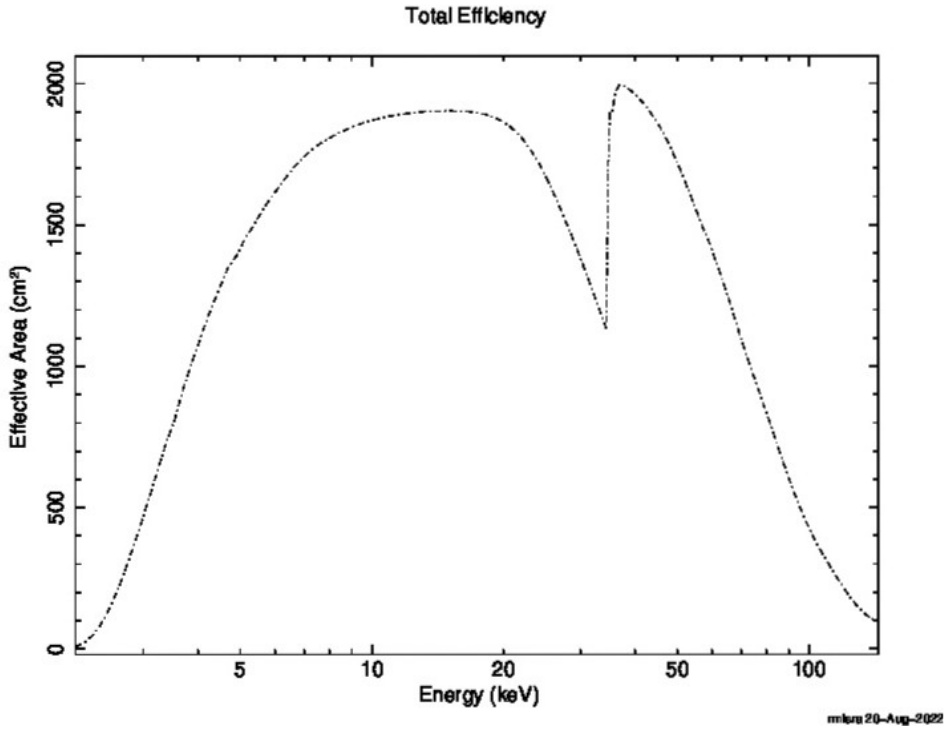
- Systematics have to be included for spectra (3 % or 2 % or...)
- Systematics have to be included for background (3 % or 2 % or..)
- For most X-ray binary and AGN spectral continuum studies provides good results..
  - Determined by SXT spectra..

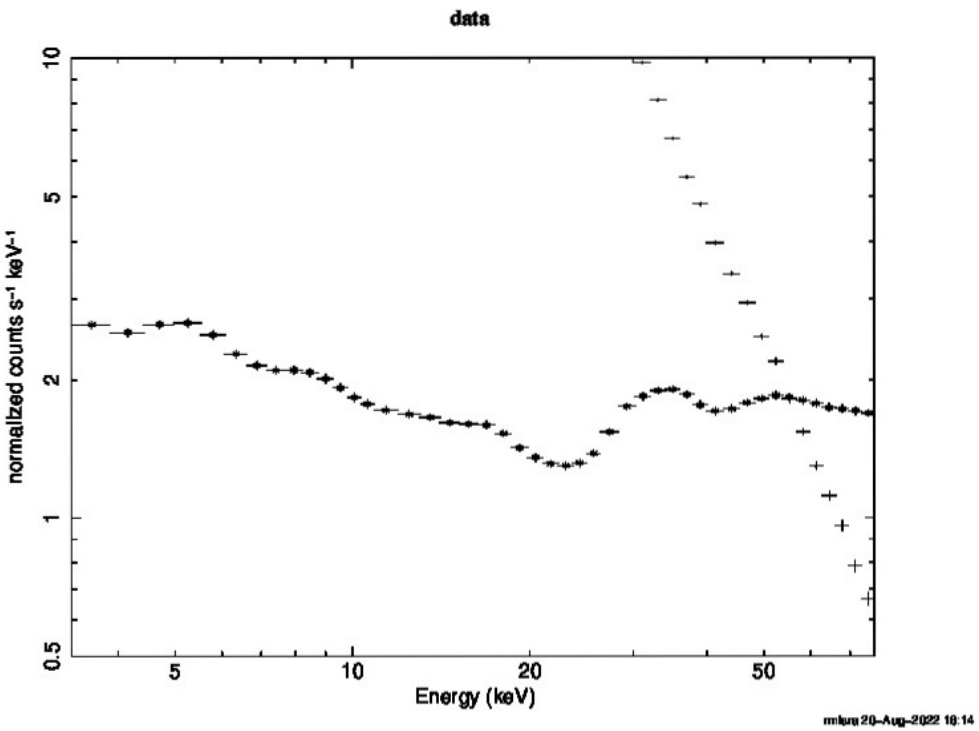
Spectral studies: Good News..



LAXPC (BLACK), SXT(RED), HXMT ME(BLUE), HXMT HE (GREEN)
PRELIMINARY RESULT..Figure by Gitika Mall..

Spectral studies: Not so good news..





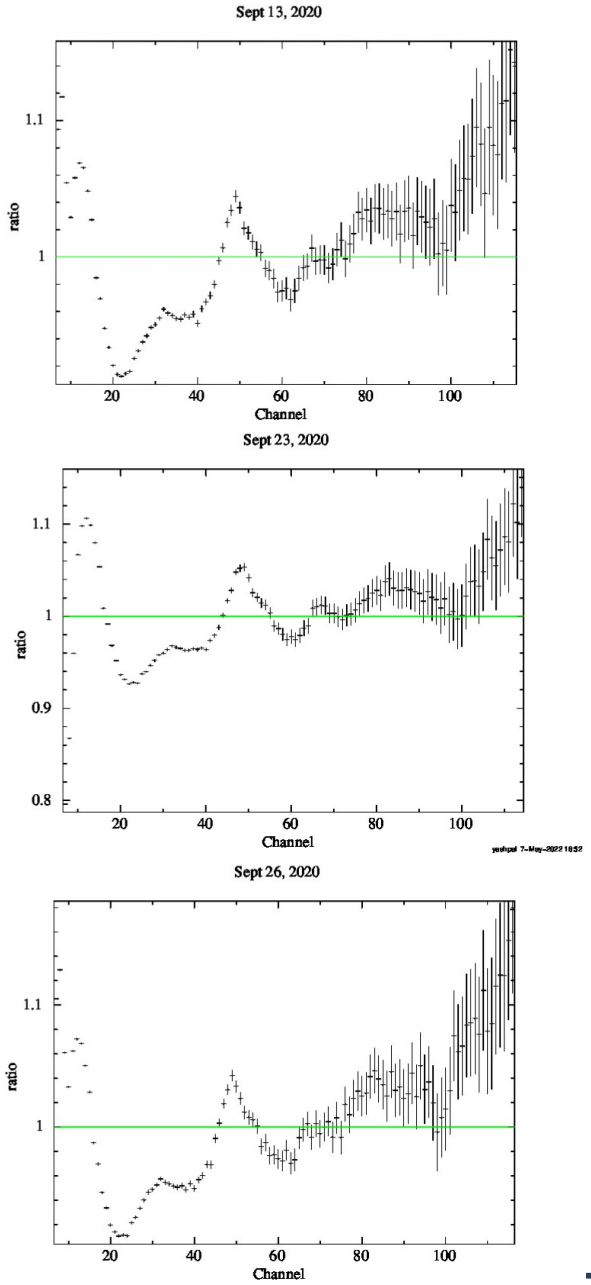
Spectral studies: Not so good news..

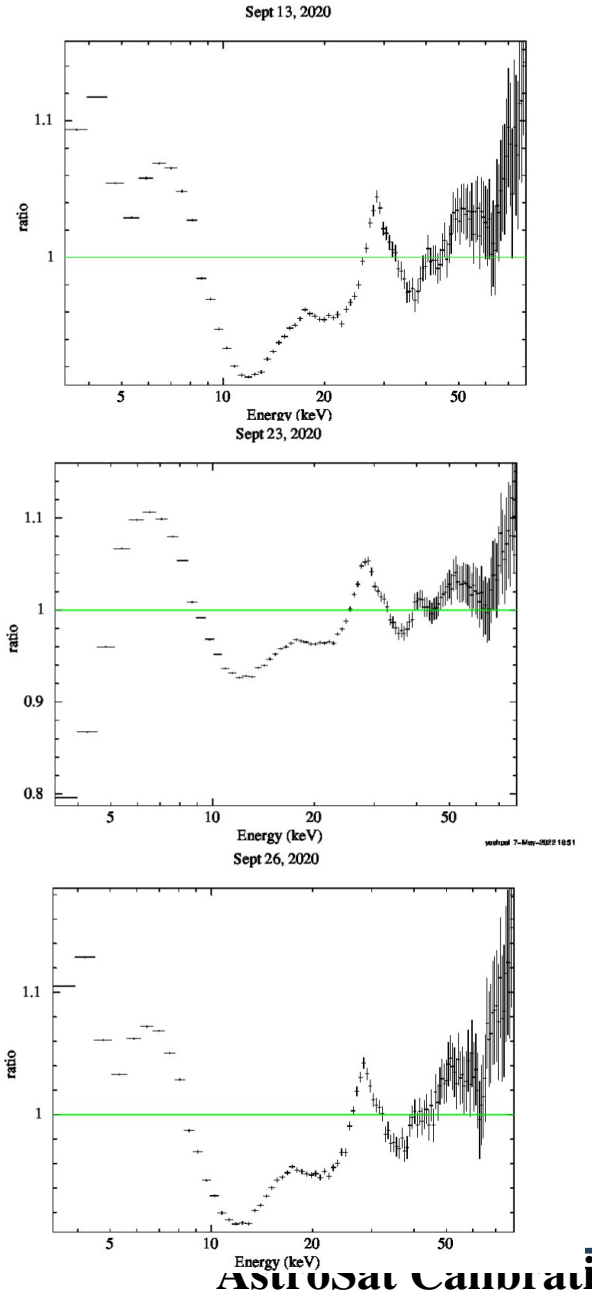
- Study of pulsar cyclotron absorption line at around 30 keV is compromised..
- LAXPC is the only instrument that can in principle do phase resolved cyclotron line analysis of rapid pulsars...

An idea and suggestions….

- Possibility of using Crab observations that are a few days close to the source observation, to empirically improve the spectral fitting..

Crab Analysis..Preliminary: Credit: Yashpal Bhulla





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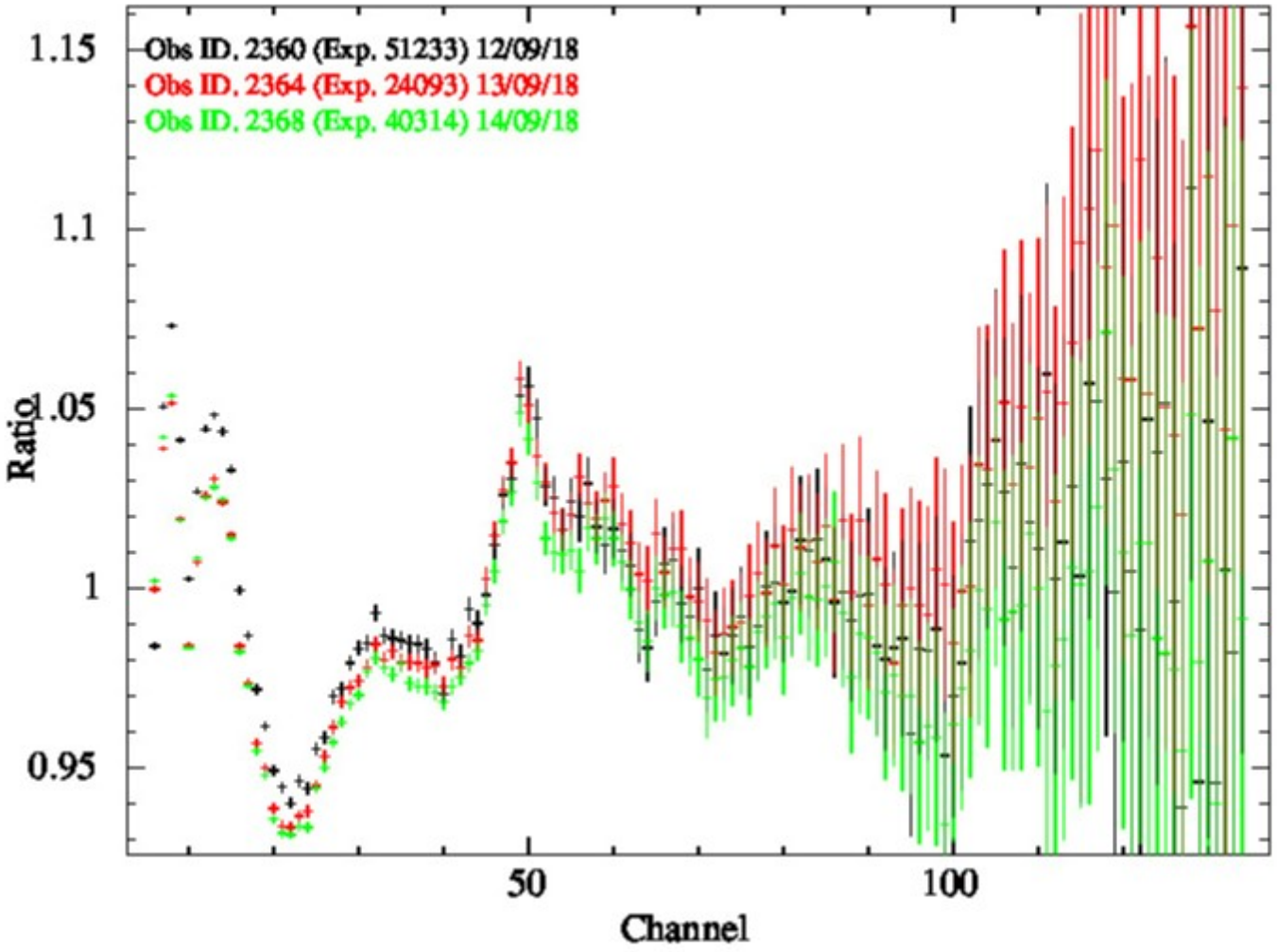

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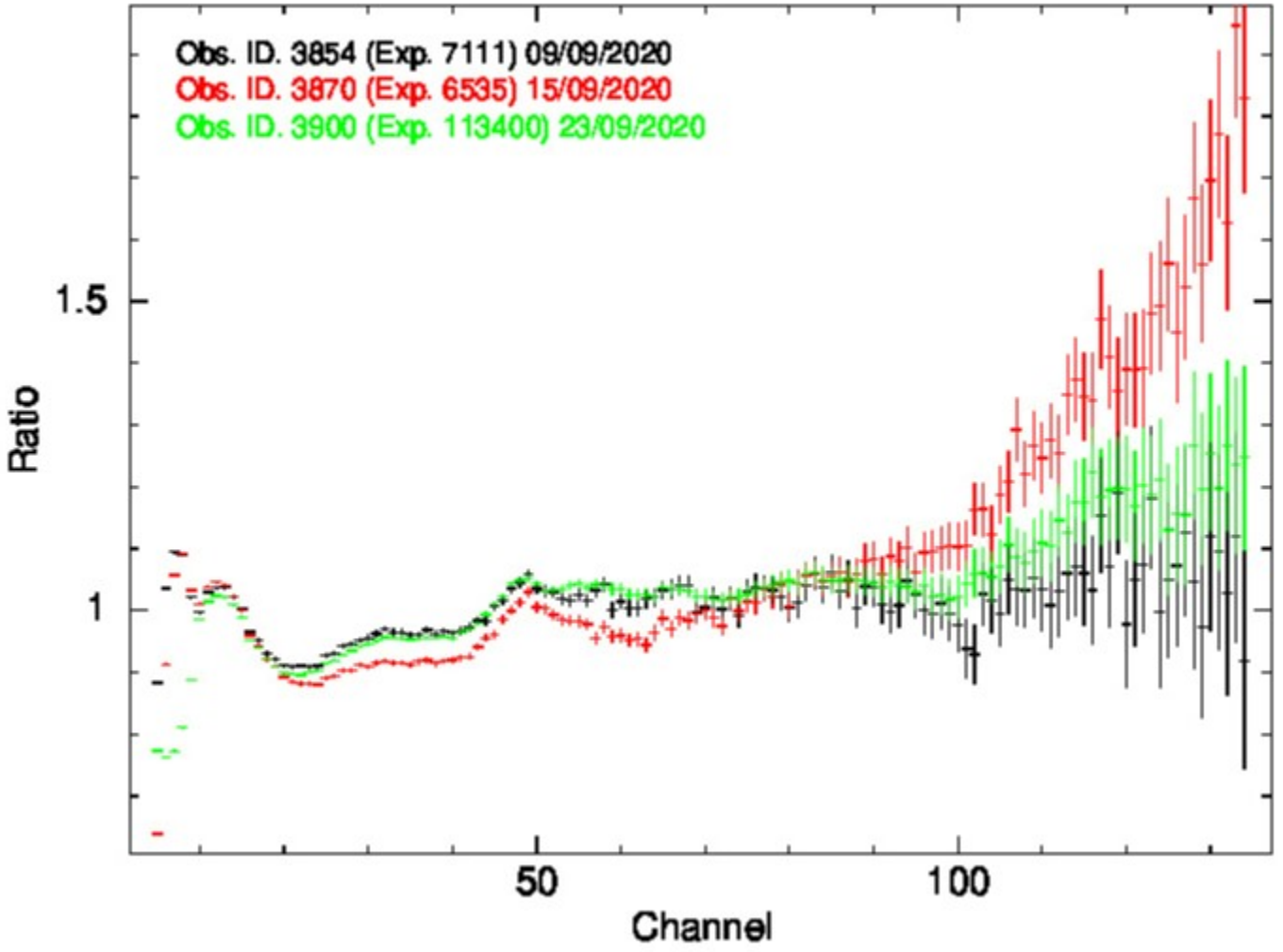

An idea….the plan..

- Observe a pulsar to study phase resolved cyclotron absorption line..
- Follow it up immediately with a Crab observation…
- Correct the source spectra based on Crab residuals...

An idea….Verification....

- Observe any bright source that Nustar is observing..
- Follow it up immediately with a Crab observation…
- Check if the source spectra corrected based on Crab residuals, matches with the Nustar one...

An idea and suggestions….

- Possibility of using Crab observations that are a few days close to the source observation, to empirically improve the spectral fitting..

Suggestions and an idea….

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- Possibility of using Crab observations that are a few days close to the source observation, to empirically improve the spectral fitting..
- Energy dependent systematic errors that can be included in the spectral file.
- Exposure time dependent systematic error for background (energy dependent?)

THANK YOU

Faint source detection: …….