

INTEGRAL/ISGRI observations of the pulsar PSR 1509-58

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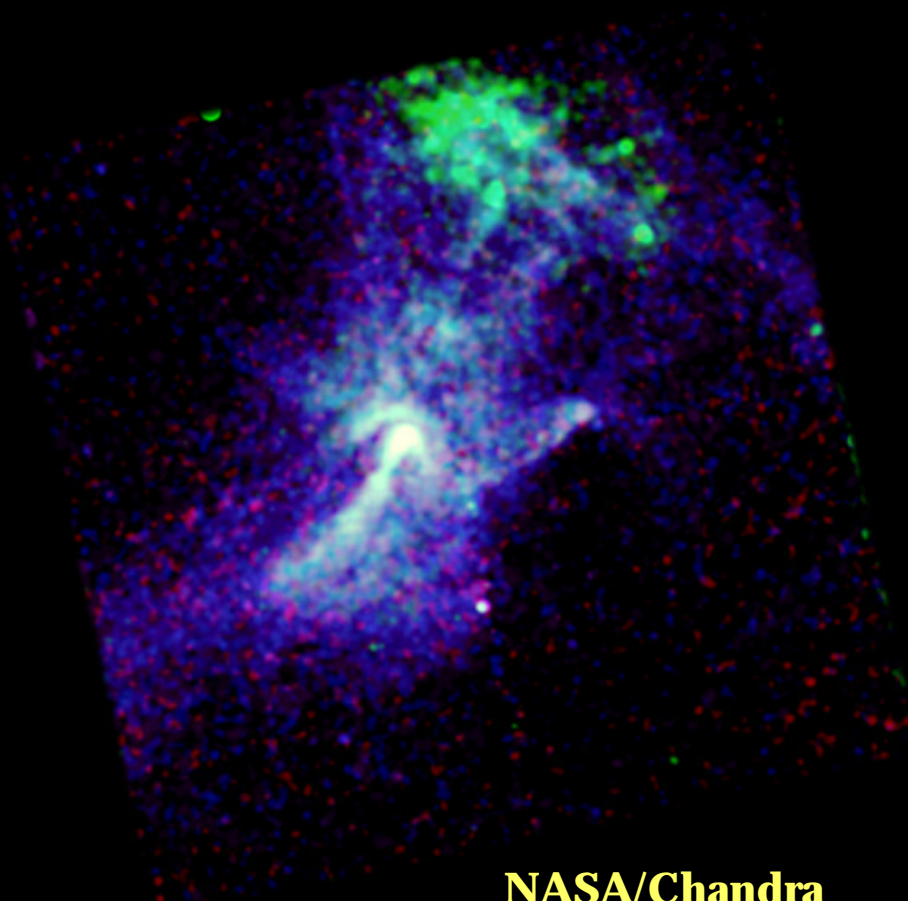
(1):CEA Saclay/DSM/DAPNIA/Sap, Gif sur Yvette, FRANCE

(2):NASA GSFC, Code 661, Greenbelt, MD 20771, USA

PSR 1509-58

- Period: 151 ms.
- Characteristic age: 1570 years. Belongs to the class of the young pulsars
- Magnetic field: $3.1 \cdot 10^{13}$ Gauss.
- Morphology of the plerion similar to the Crab (Jet + Torus)
- Plerion detected up to TeV region (HESS).
- Pulsed emission has been observed in radio, soft X-rays and gamma-rays < 100 MeV.

Interest of PSR 1509-58



NASA/Chandra

- Low energy cutoff (< 30 MeV) can be due to splitting photons attenuation. ($B > 0.2 B_{cr}$)
- Spectral softening in the X/ γ range.
- Asymmetric pulse could be composed of 2 pulses not separated in phase.

Observations of PSR 1509-58

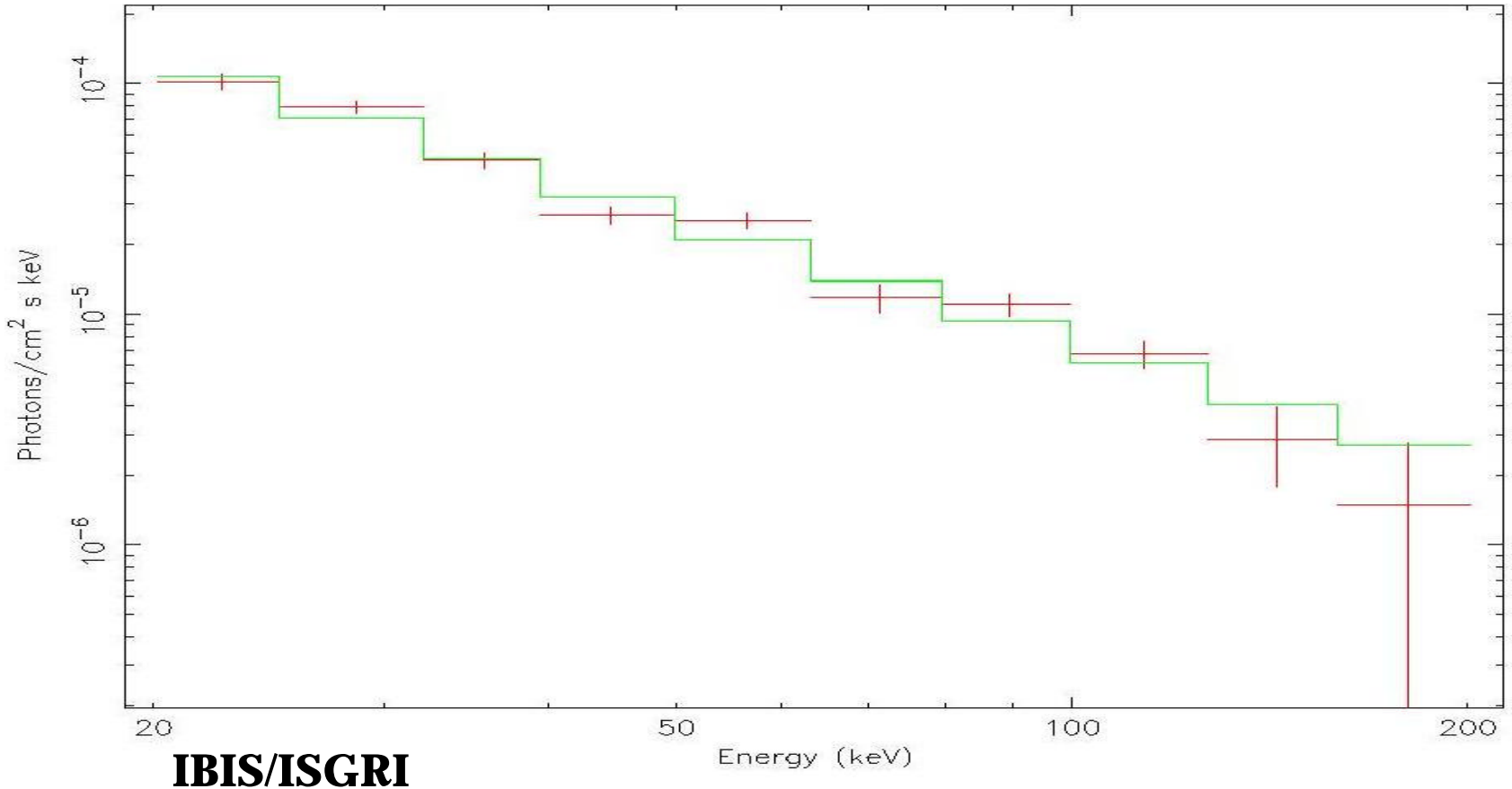
ISGRI image of the field around PSR1509-58 (20-30 keV)



PSR 1509-58

- 114 SCW \Rightarrow 210 ks (CP 25 ks)
 - Core Program + Public Data
(Rev 36,46,50,55,57,58,60,16)
 - SN Ratio :
 - 17 σ (20-30 keV)
 - 15 σ (30-50 keV)
 - 9 σ (50-100 keV)
 - 6 σ (100-200 keV)
- ⊄ No detections beyond 200 keV with ISGRI.**

Spectral analysis



Power law spectra with spectral index :

$$\alpha = -1.77 \pm 0.06$$

Work on phase spectroscopy on going

Timing analysis using the image deconvolution (1/2)

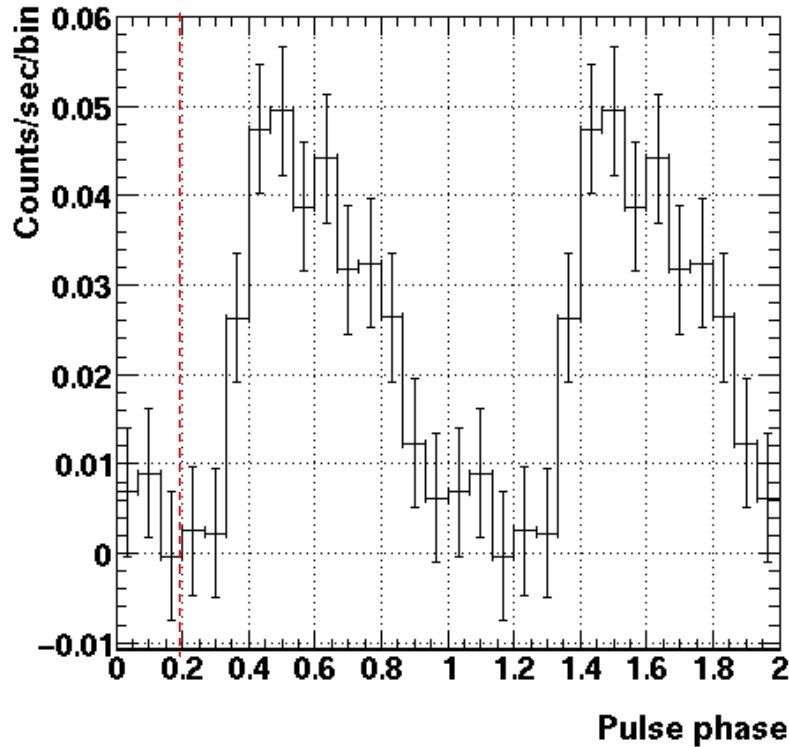
How we proceed ?

- Compute for each event the phase value.
- Fill ISGRI detector map with events in a given phase bin.
- Deconvolve this shadowgram and compute the source count rate.
- Make the source light curve.

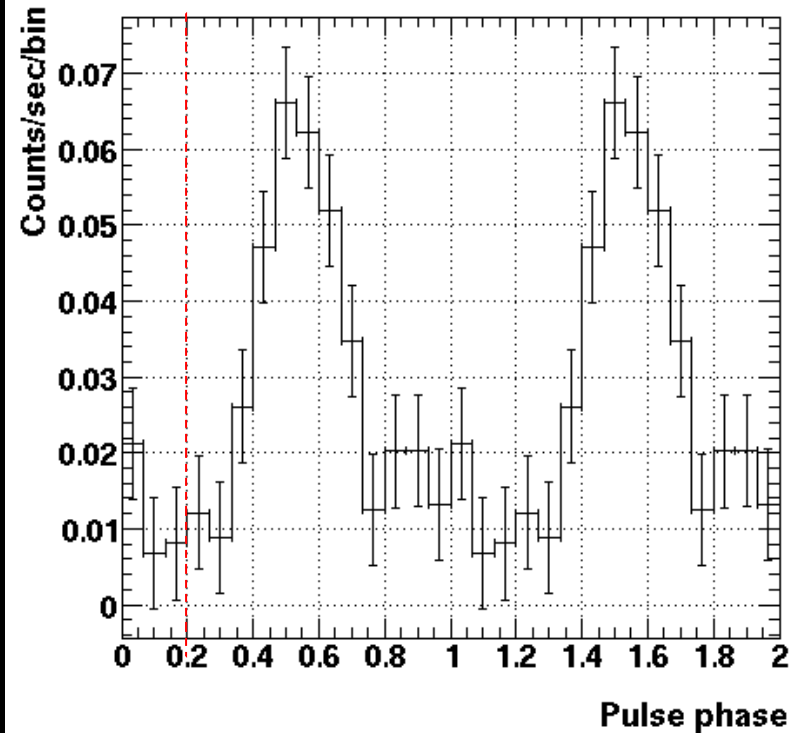
⇒ Background is automatically subtracted.

⇒ Measure directly the unpulsed emission.

Timing analysis using the image deconvolution (2/2)



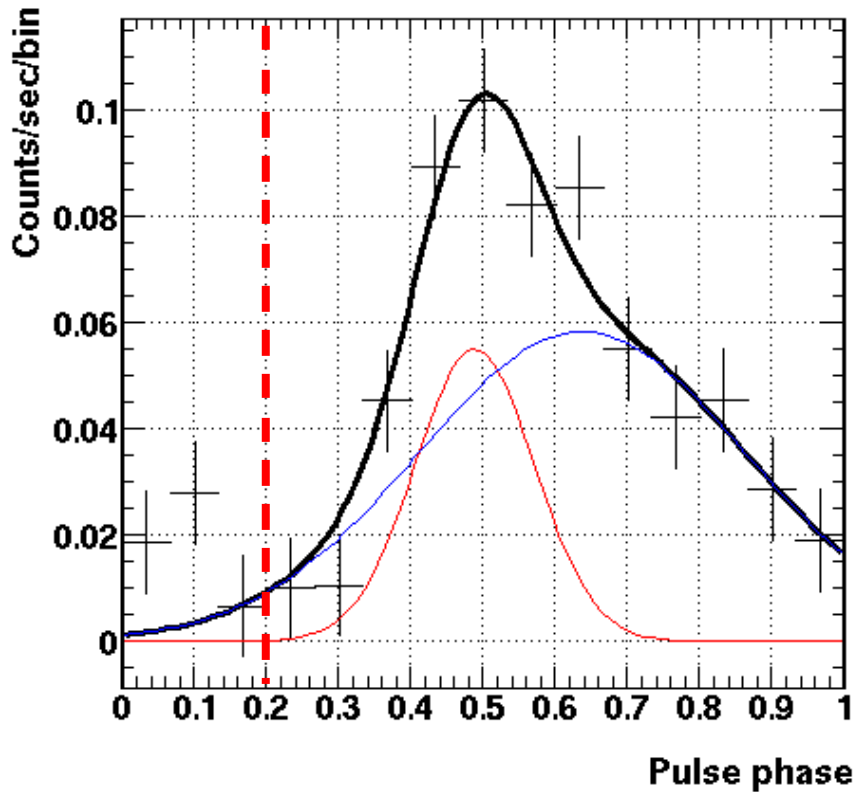
20-30 keV



30-50 keV

Light curve structure

Radio Phase



15-40 keV

- γ -ray pulse lags the radio signal by 0.30 in phase.
- Pulse profile adjusted with two Gaussians.
- Fitted parameters in good agreement with what was found with BeppoSAX (Cusumano & al. 2001).
- Detailed studies of the profile at different energies under investigation.

Conclusions and perspectives

- Light curves structure in good agreement with previous missions.
- Unpulsed component, and thus the plerion is not yet clearly detected \Rightarrow 1 Ms open time observation (PI W.Hermsen).
- Deep study of the plerion (Integral + HESS, theory, ...).
- Phase spectroscopy of the pulsar.
- Detailed studies of the pulse profile at different energies.