Search for ^{44}Ti in the Vela and the Galactic Center regions using ISGRI

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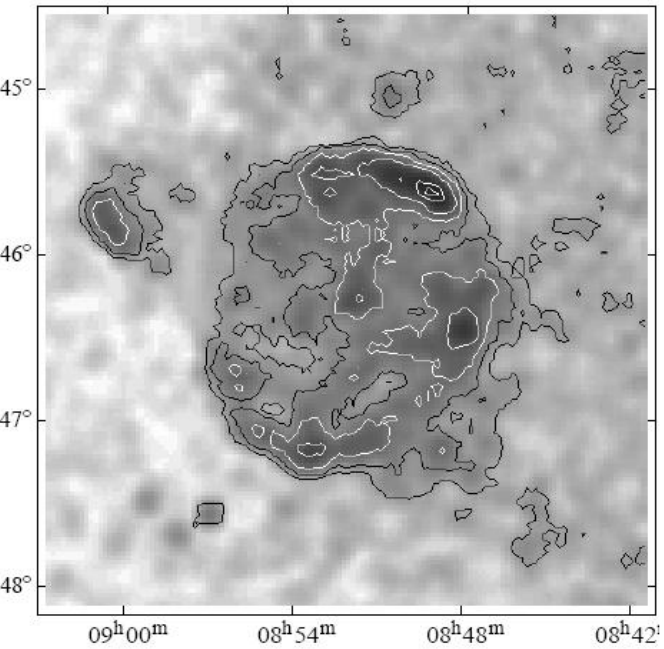
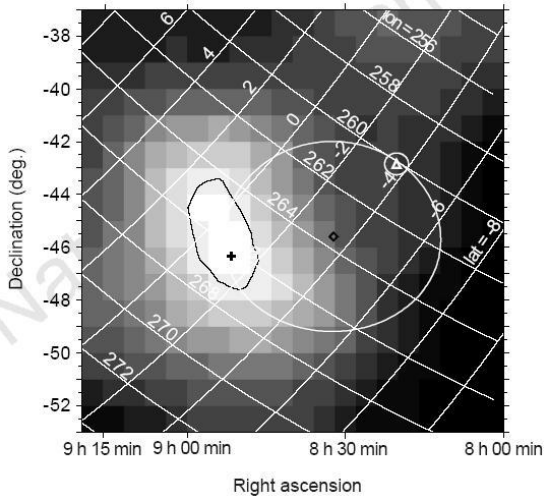
Outline

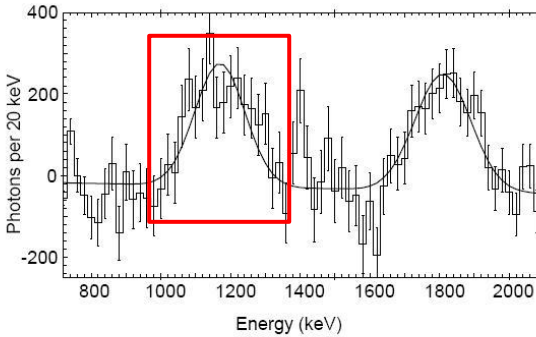
- Overview of Vela Jr SNR
- Analysis of ISGRI data :
  - in the continuum : ASCA non-thermal hot-spots
  - in 68 & 78 keV ^{44}Ti lines : first determination of the ISGRI response to extended sources
- Galactic Central Regions : search for ^{44}Ti lines excesses
- Conclusion & Future improvements :
  - good E correction & ON-OFF -> ^{44}Ti in Vela Jr ?
  - good LT correction -> low-energy continuum emission

Overview of Vela Jr SNR

- Discovery in X-rays with ROSAT (Aschenbach, 98) and in the 1.15 MeV ^{44}Ti line with COMPTEL (Iyudin, 98)







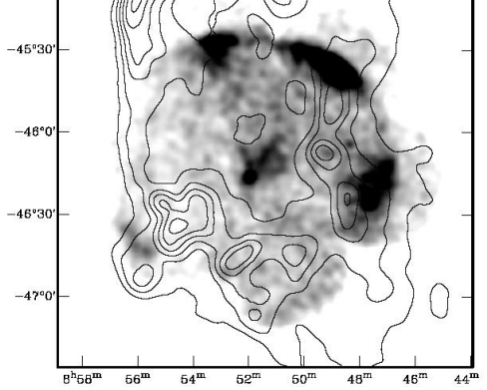
$F_{44} = (3.8 \pm 0.7) \times 10^{-5}$ cm^{-2} s^{-1}

- T ~ 3.10^7 K and τ_{44} ~ 87 y -> young and nearby (F ~ 2°)
- d ~ 200 pc and age ~ 680 y (Aschenbach et al., 99 & Chen,Gehrels, 99)

ASCA observations (Slane et al., 99)

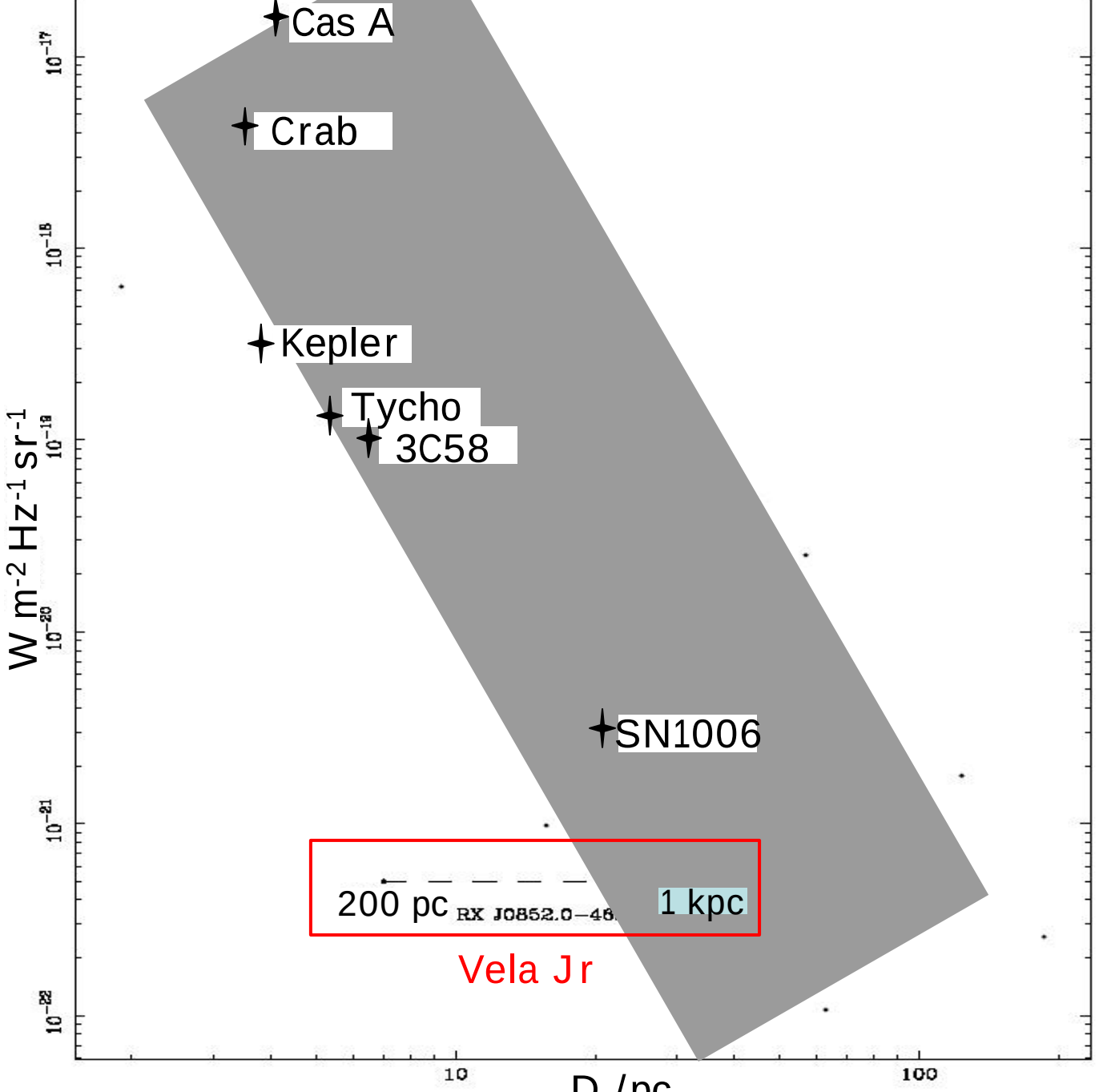
-> non-thermal emission implying high N_H :

not so nearby <-> not so young ...?



Radio observations (Combi et al., 99 & Duncan et al., 00)

- $S_{2.42GHz}$~33 Jy , $S_{1.4GHz}$~40 Jy => a ~ -0.4 => S_{1GHz}~47 Jy
- Weak 1GHz emission if d = 200 pc


Cas A
Crab
Kepler
Tycho
3C58
SN1006
200 pc
RX J0852.0−46
1 kpc
Vela Jr
W m-2 Hz-1 sr-1
D /pc
10
100
10−17
10−18
10−19
10−20
10−21
10−22

01.19.05

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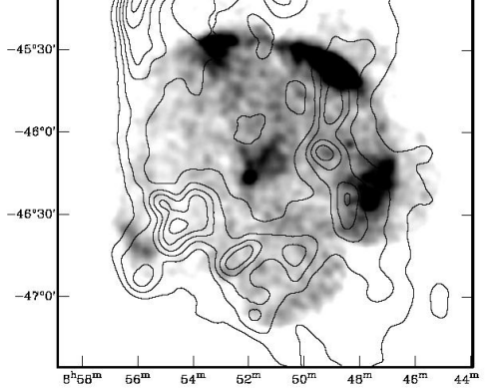

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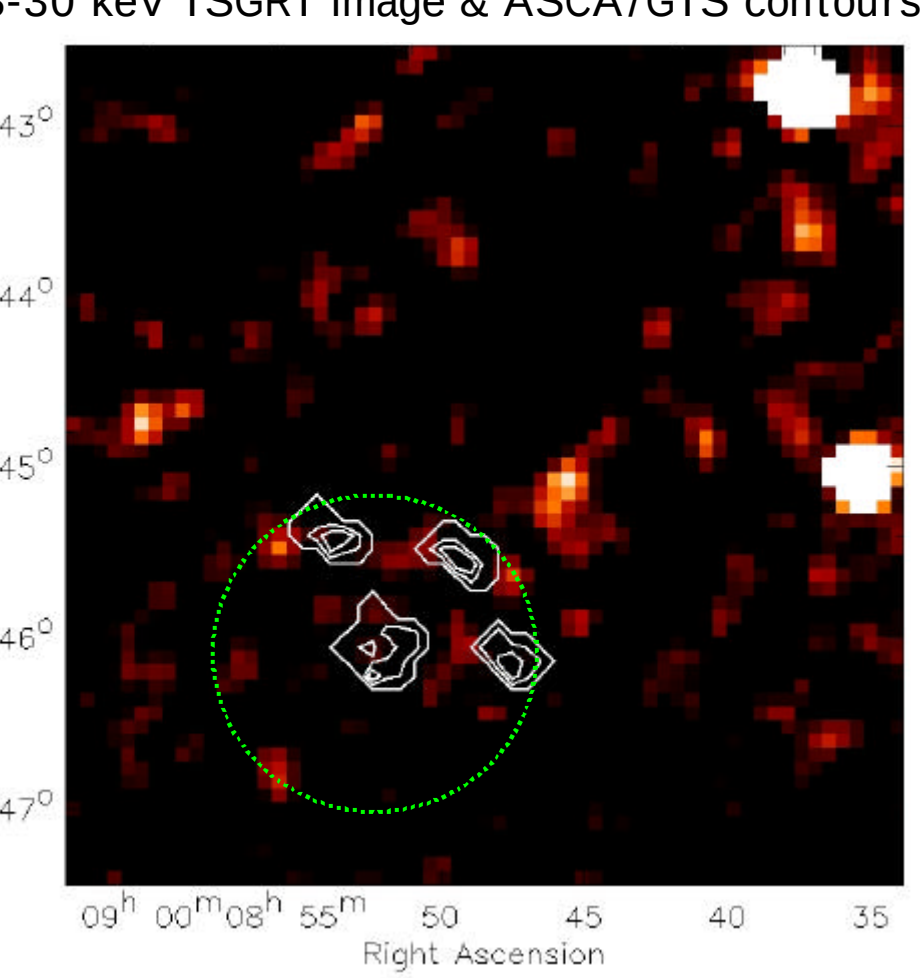
Re-analysis of COMPTEL data (Schönfelder et al., 00) -> results sensitive to events selections : $S/N_{Vela\ Jr}$ from 2s to 4s

Feature at ~ 4.1 keV in ASCA & XMM spectra (Tsunemi et al., 00 & Iyudin et al., 04) -> Overabundance of Ca ... ^{44}Ca ?

Central source -> compact remnant ? (Mereghetti, 01 & Pavlov et al., 01)

Analysis of ISGRI data : in the continuum



Non-thermal emission in Radio and X-rays
-> acceleration up to ~ 100 TeV

HESS image well correlated wit
that of ASCA (Komin et al., 04) :
e^- : IC or p^+ : p°-decay ?

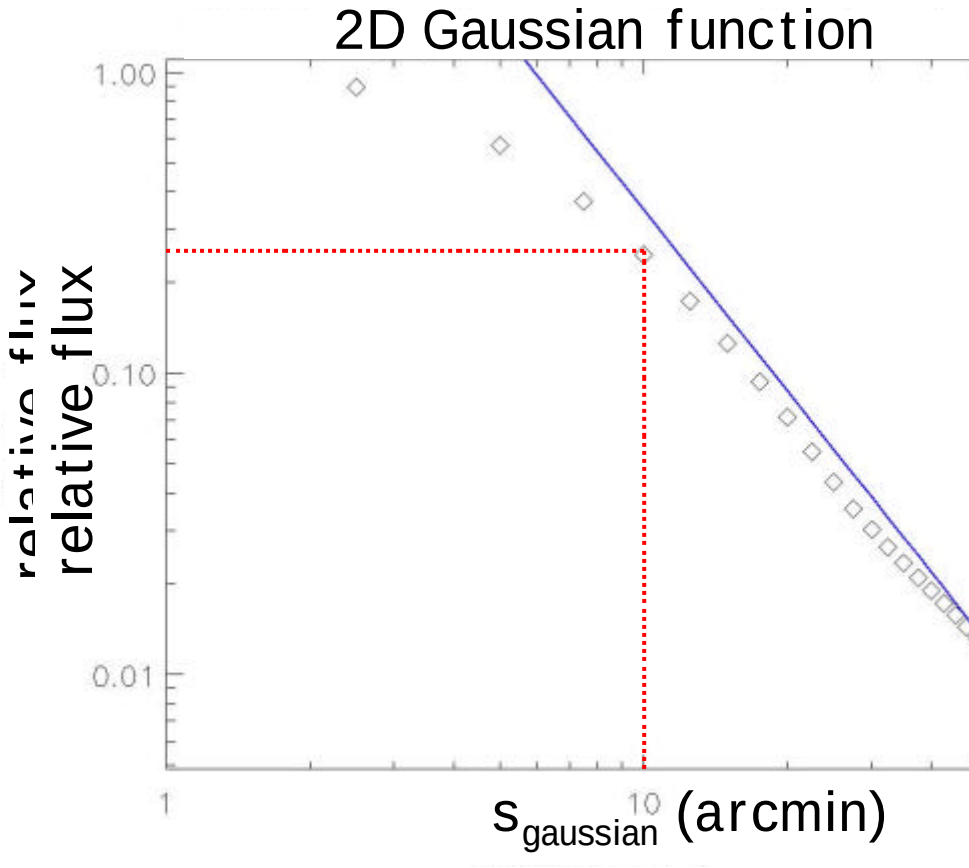
Extrapolation of ASCA spectra
$F_{18\text{-}30keV} \sim 4\times10^{-5}$ cm^{-2} s^{-1}
3s upper limit ~ 6×10^{-5} cm^{-2} s^{-1}

=> Correction of ISGRI pixel low-thresholds !

Analysis of ISGRI data : in the ^{44}Ti lines

- In the 67.9 and 78.4 keV lines -> no point-like excess found in Vela Jr : 3s upper limit ~ 10^{-5} cm^{-2} s^{-1} ~ $F_{COMPTEL}$ /4

- Is ^{44}Ti emitting region an extended-like source ?

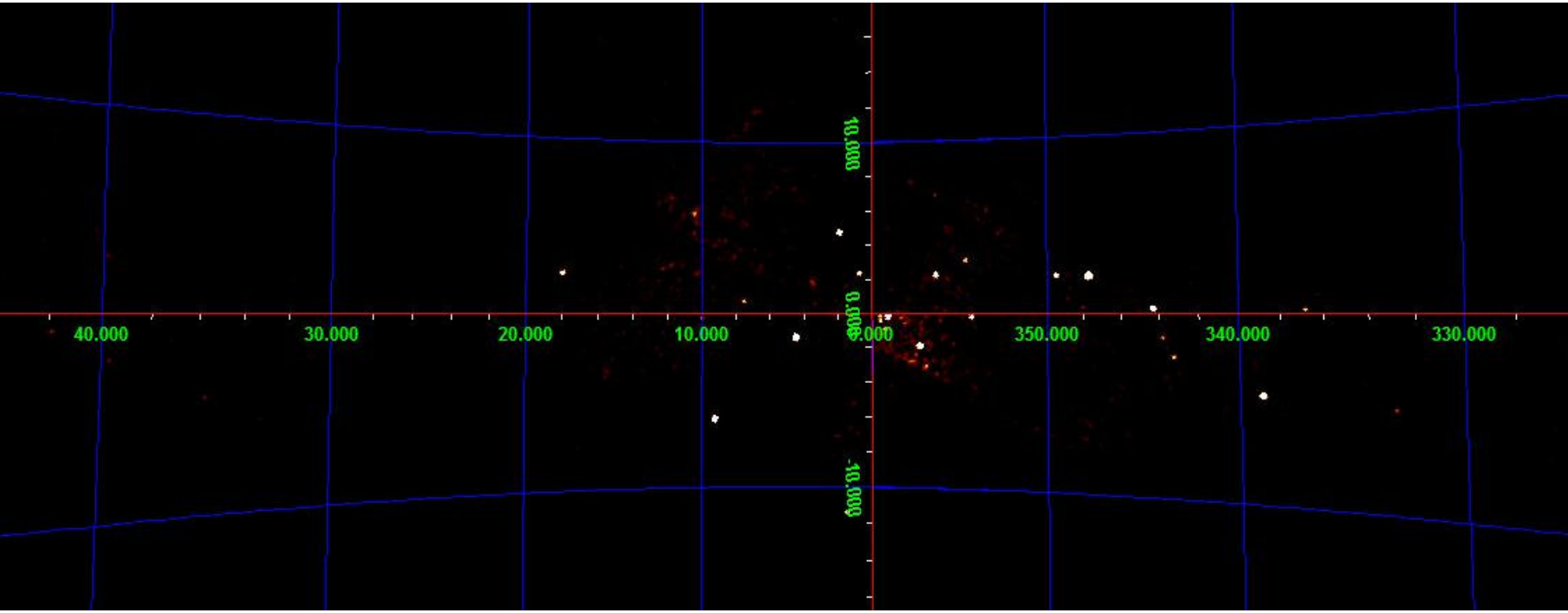


Ideal case (no background)
S = {Simulated Sky} × M,
with { constant source flux
on-axis

Using standard ii_skyimage version for deconvolution

Galactic Central Regions : search for young SNRs

- 2 years of observation : ~ 4 Ms on the Galactic Center
  ~ 1 Ms at l = 320°
- 65-71 keV & 75-82 keV combined image -> S_{3s} ~ 10^{-5} cm^{-2} s^{-1}

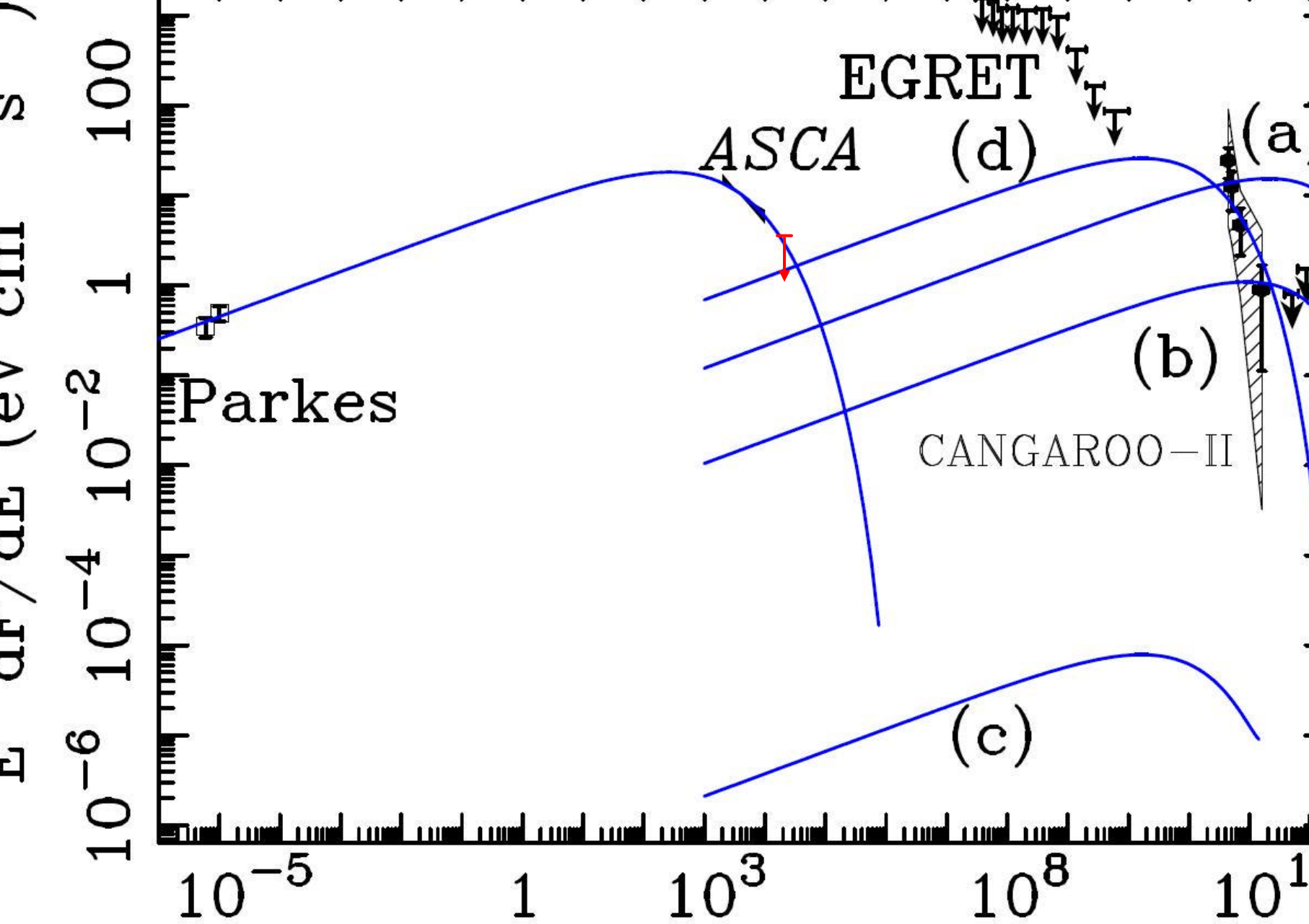


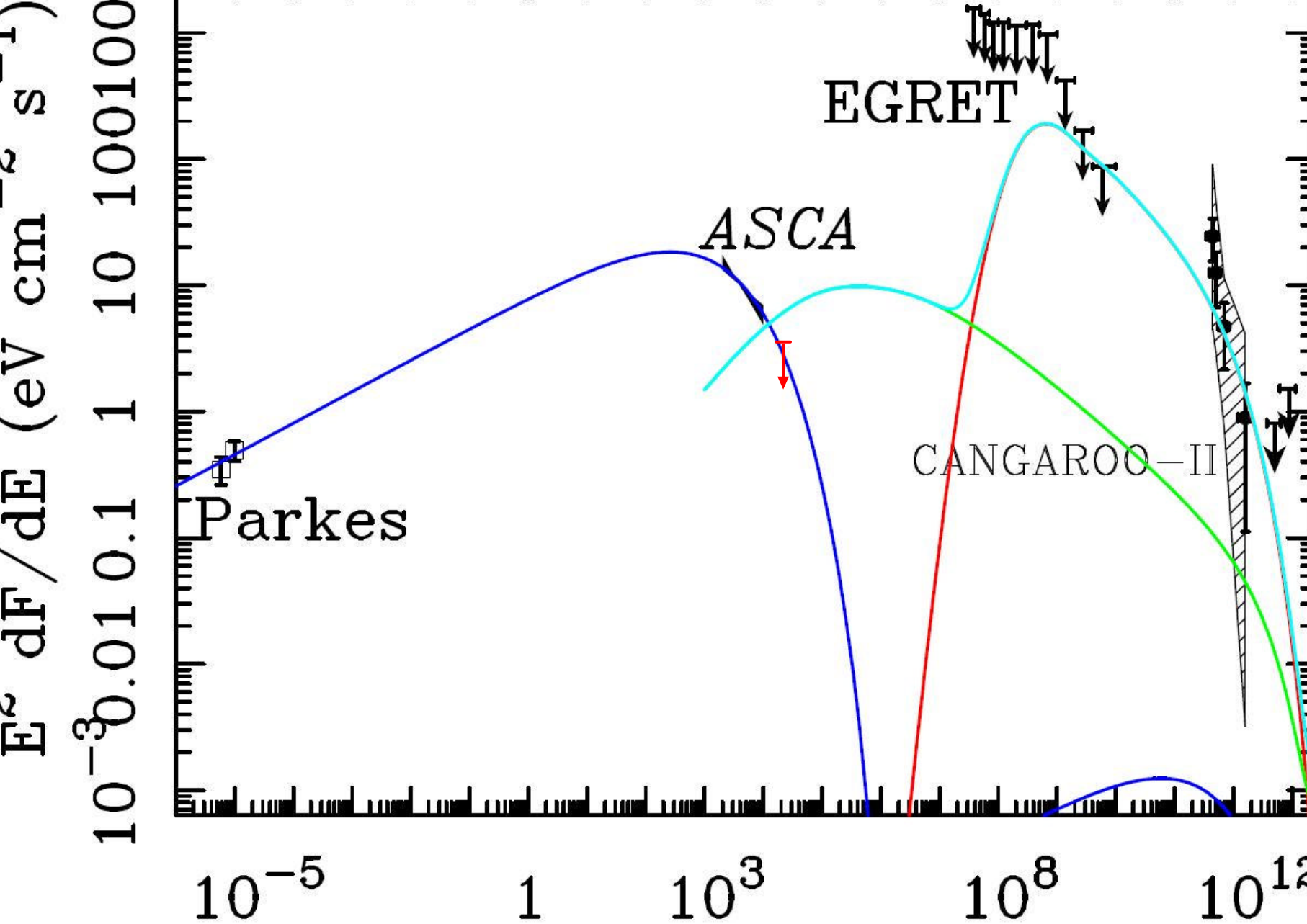
Conclusion & Future Improvements

- Upper limit on ^{44}Ti line flux (~ $F_{COMPTEL}$ /4) from Vela Jr non-compatible with that of COMPTEL for a point-like source

- Better energy correction for gamma-ray lines studies
- ISGRI pixel low-threshold correction -> detection of non-thermal continuum emission from ASCA hot-spots ?
- ON-OFF techniques -> work in progress ...

- Galactic Central Regions -> evaluation of excesses under study. Constraints on ^{44}Ti yield and SNe rate ...


EGRET
ASCA
(d)
(a)
(b)
Parkes
CANGAROO−II
(c)
10^{-6}
10^{-4}
10^{-2}
1
100
10^{-5}
1
10^{3}
10^{8}
10^{1}
E dF/dE (ev cm


EGRET
ASCA
CANGAROO−II
Parkes
$E^2\ dF/dE\ (eV\ cm^{-2}\ s^{-1})$
10^{-3}
0.01
0.1
1
10
100
10^{-5}
1
10^{3}
10^{8}
10^{12}