深層学習を使ってできないかと考えていること

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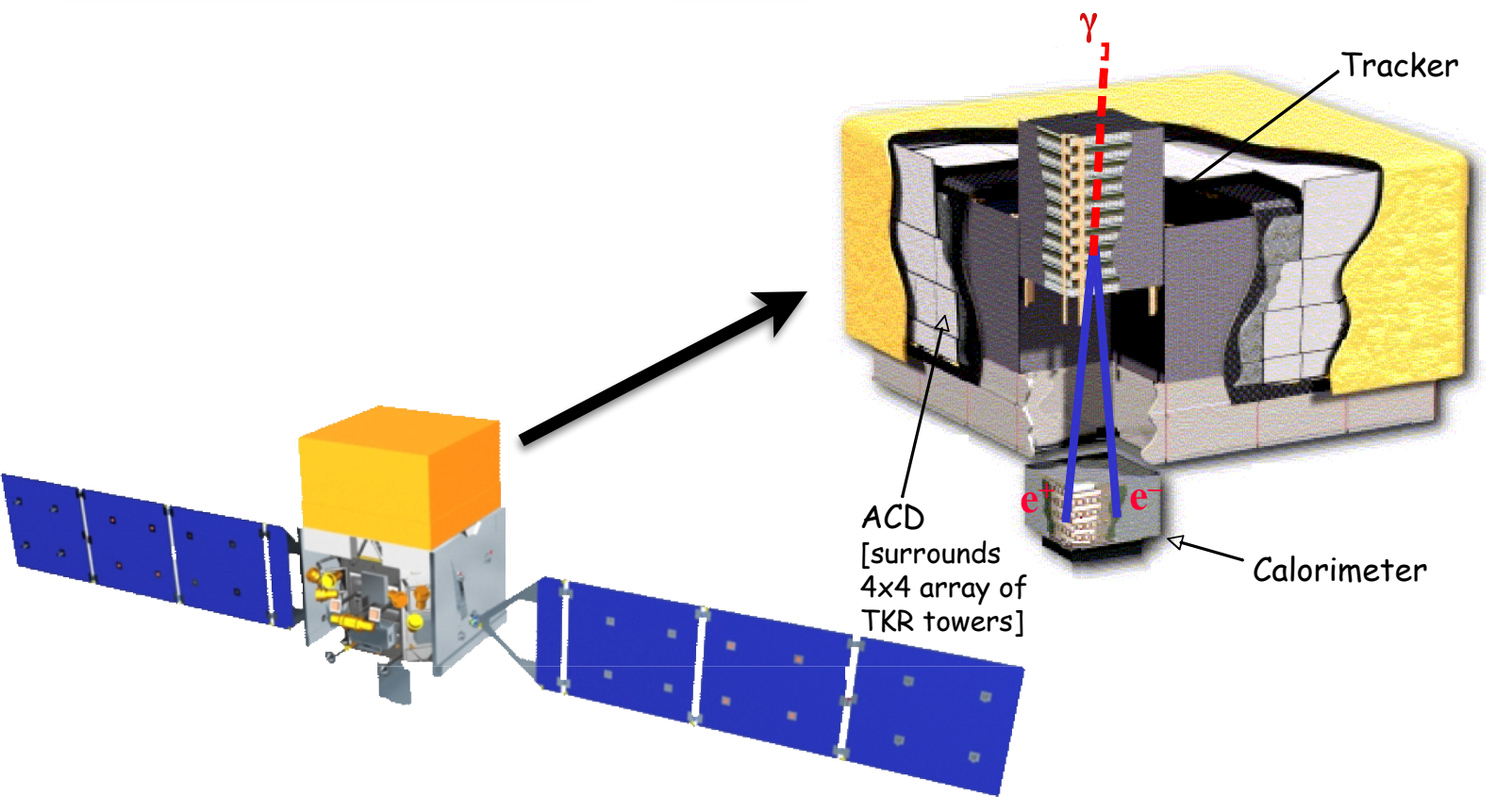
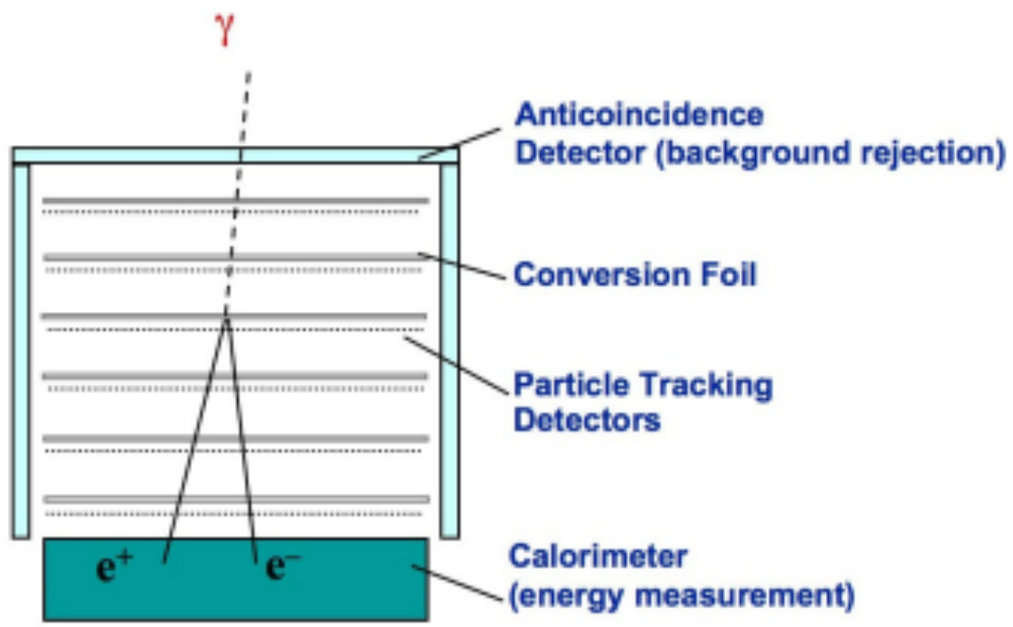
Fermi Large Area Telescope

LAT Specifications

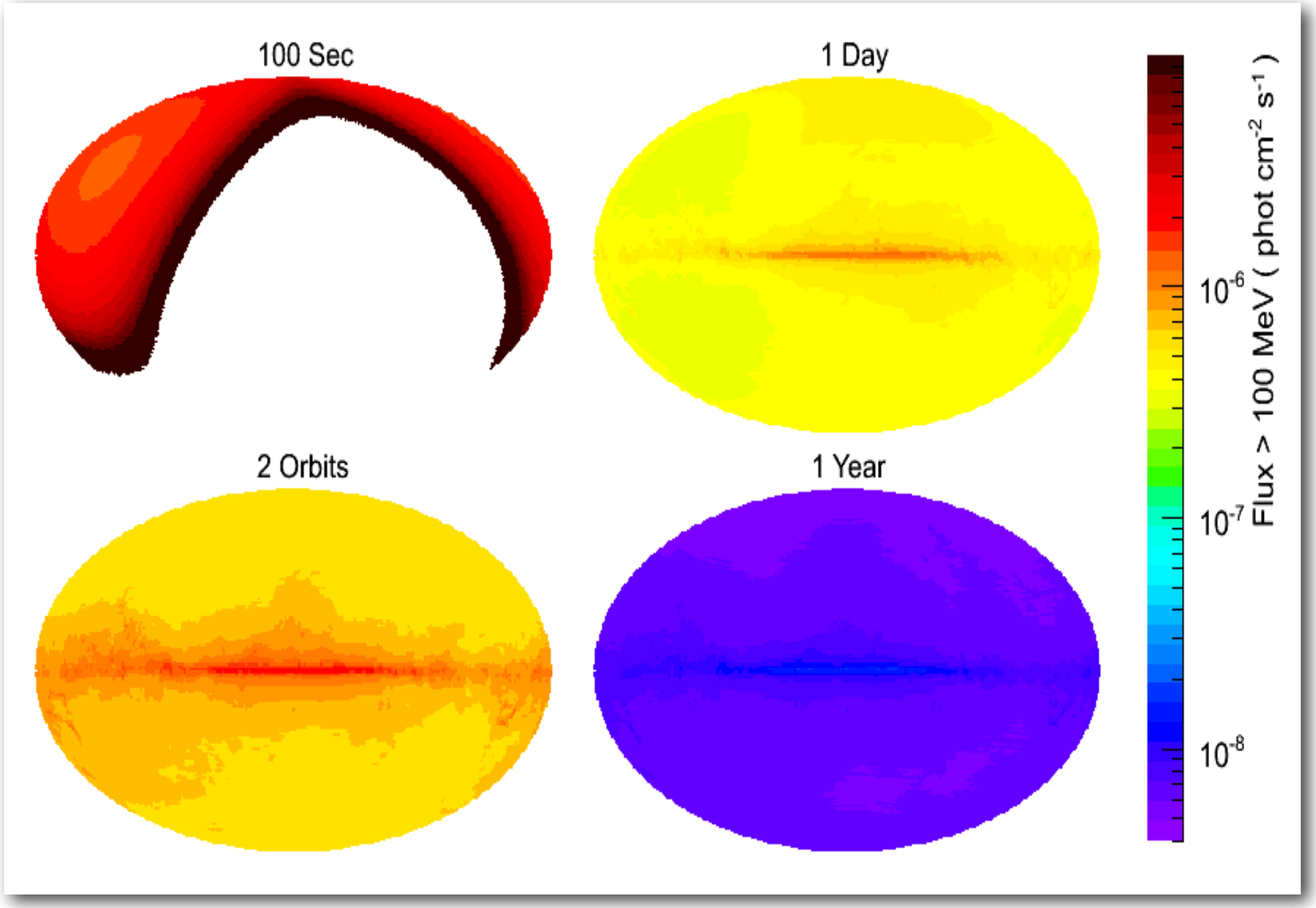
Pair-production telescope launched in June, 2008
Energy Range: from 20 MeV to > 300 GeV
Angler Resolution: < 1° (68% containment at 1 GeV)
Energy Resolution: ~ 10% (68% containment at 1 GeV)
Effective Area: 8000 cm^2 (on axis at 1 GeV)
Field of View: 2.4 sr (all-sky coverage in ~ 3 hr)





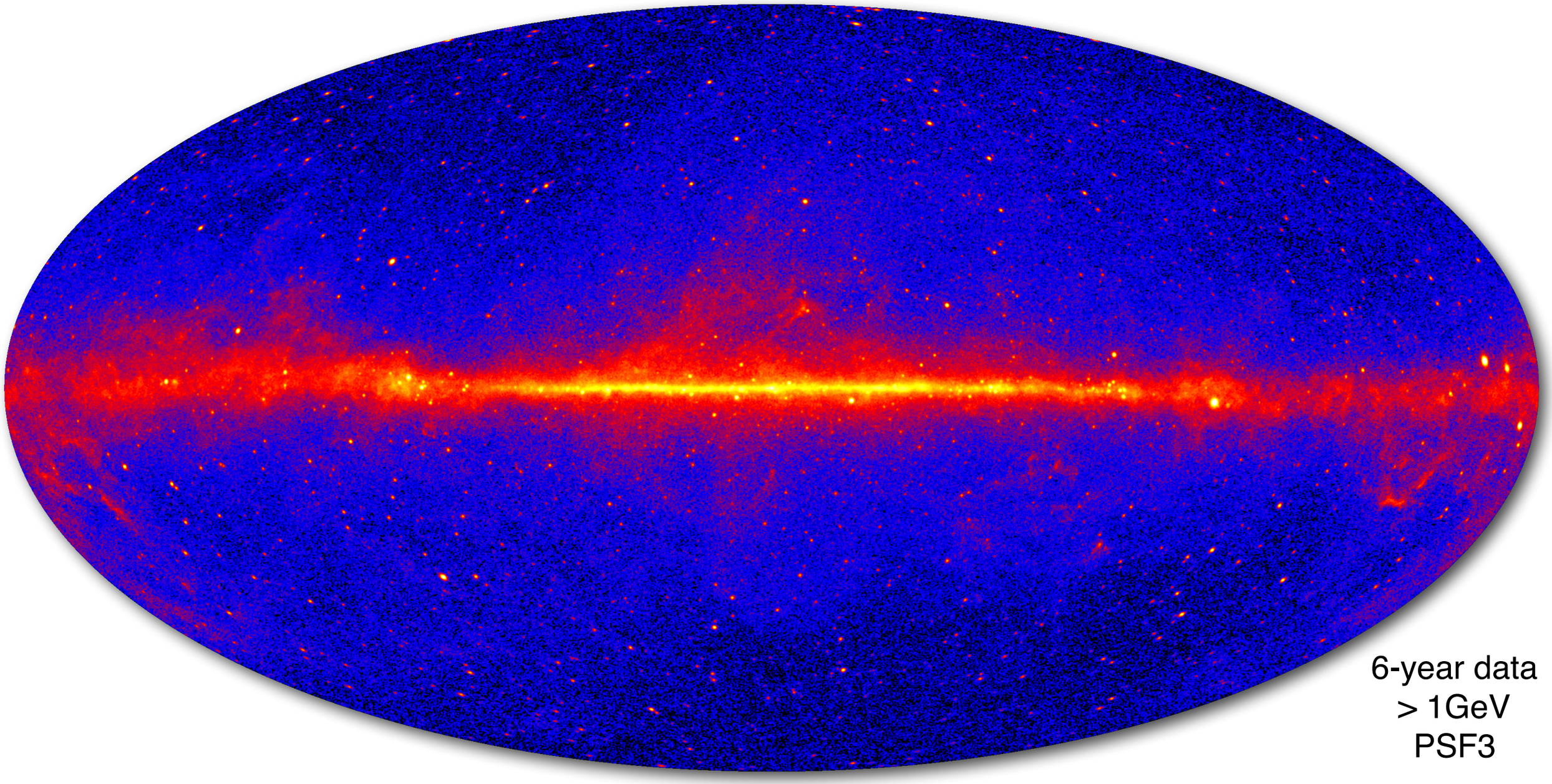
LAT All-Sky Survey

Most of the observation time spent in a survey mode



Atwood+ (2009)

LAT All-Sky Image

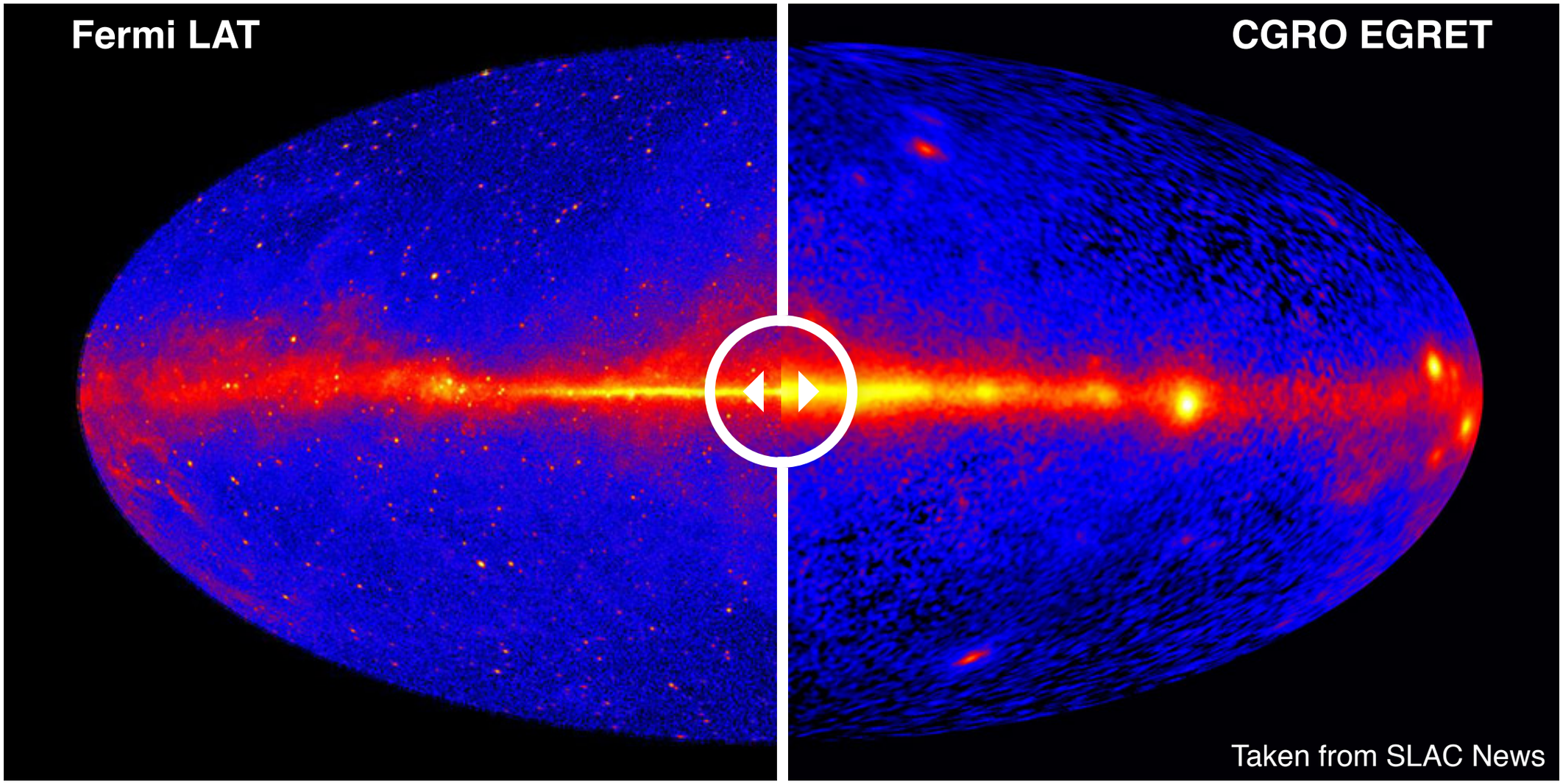


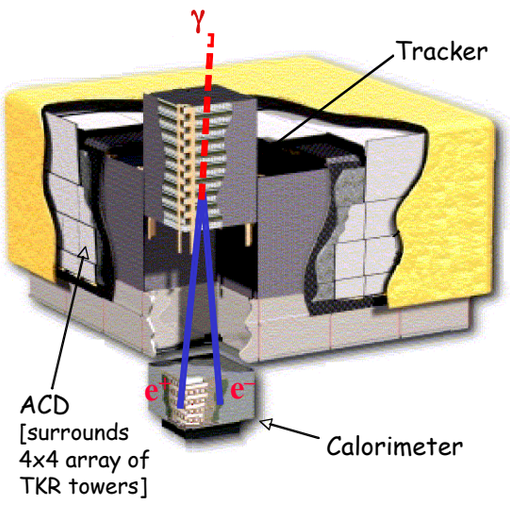
6-year data
> 1GeV
PSF3

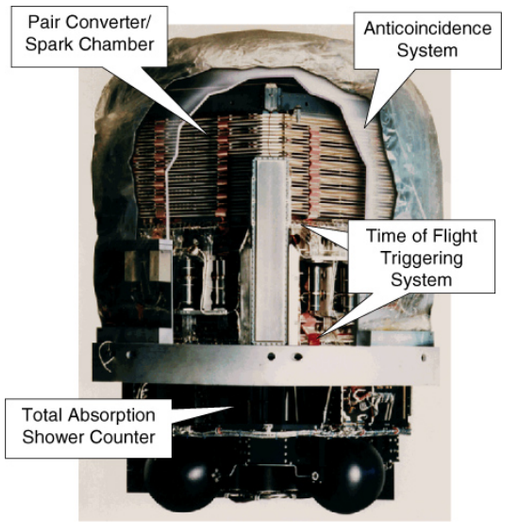
The latest Fermi LAT source catalog (3FGL catalog; Acero+ 2015) contains 3033 sources

cf. 271 sources for 3EG catalog by EGRET onboard Compton Gamma Ray Observatory (CGRO)

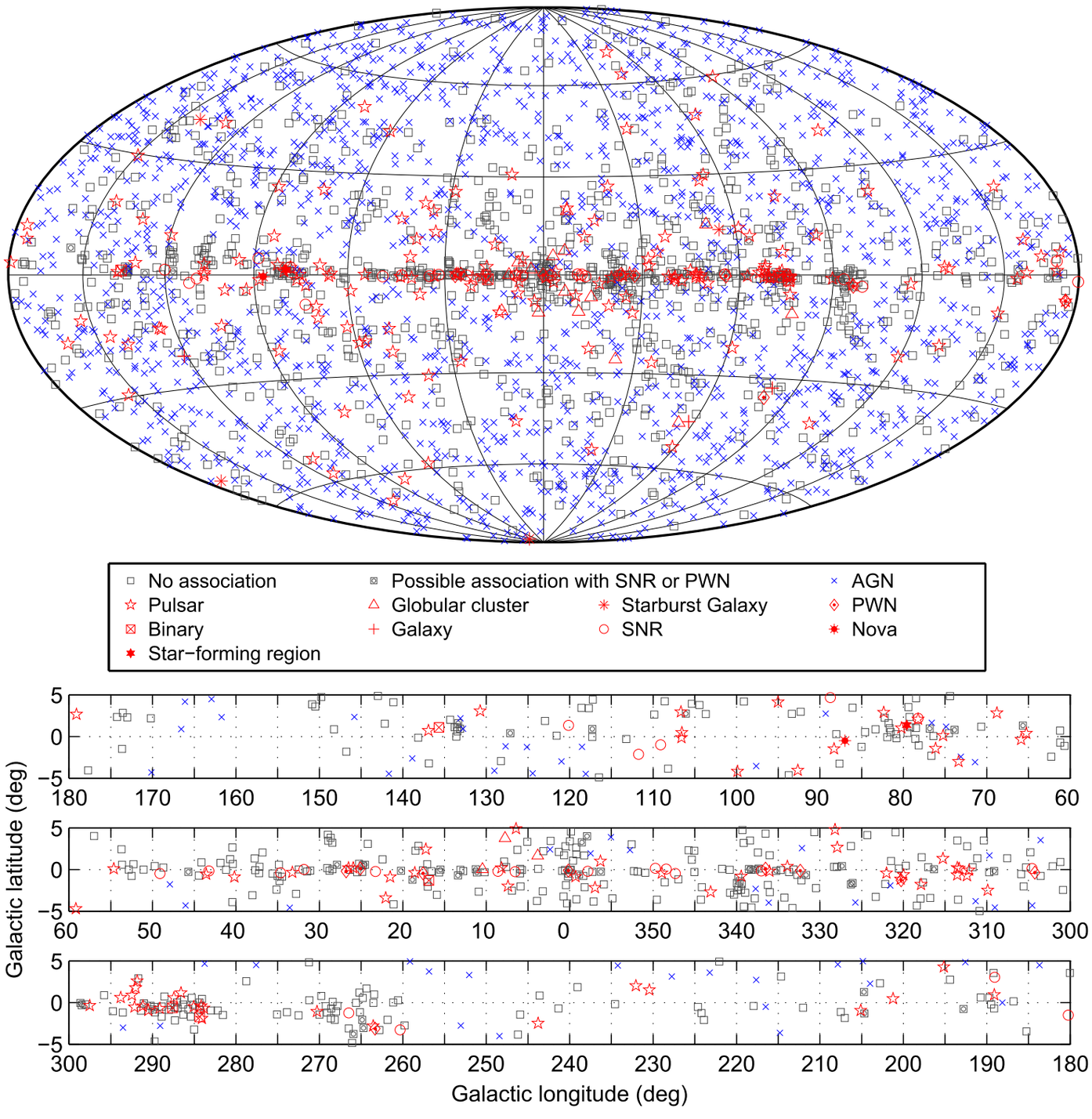
Fermi LAT vs EGRET



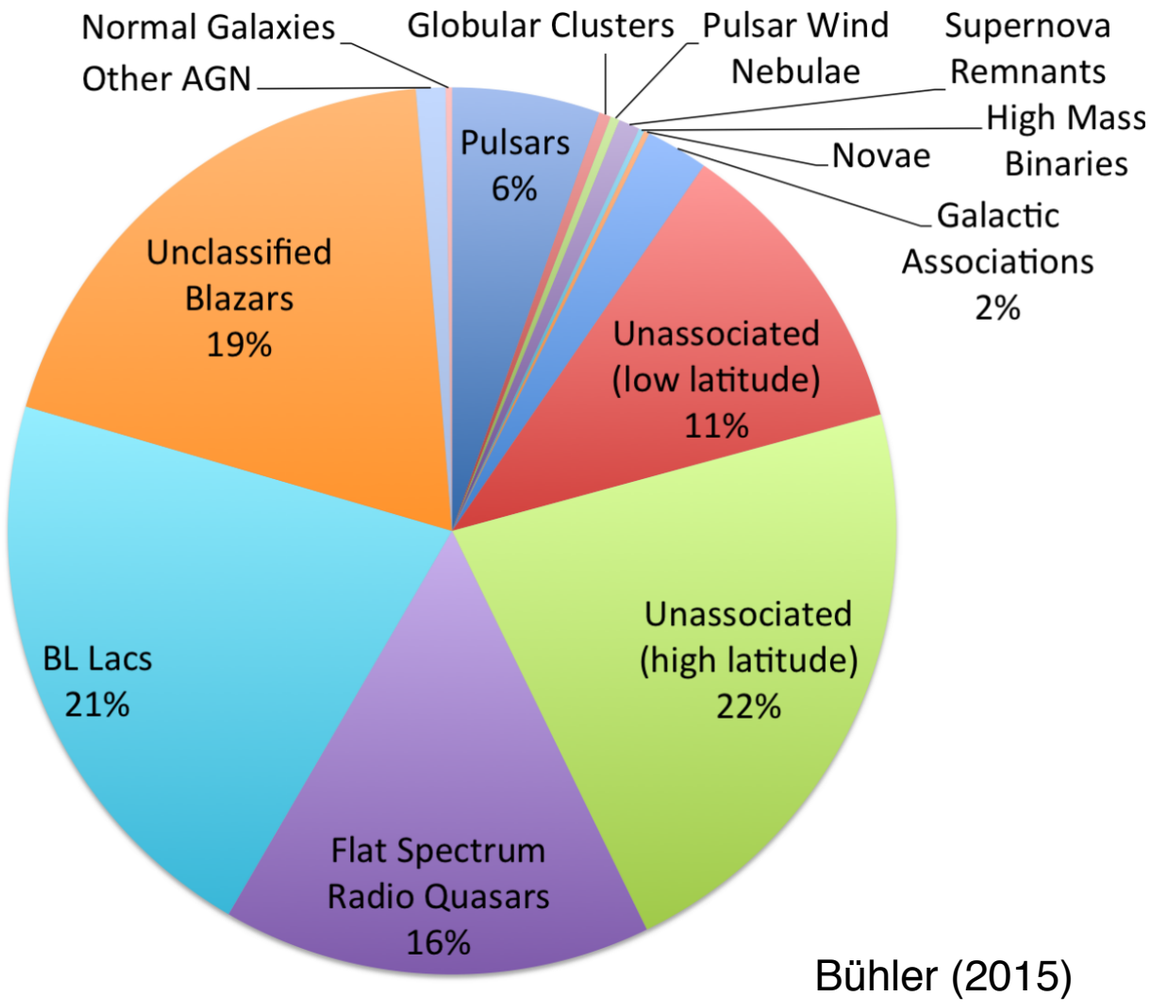




3FGL Catalog



Acero+ (2015)

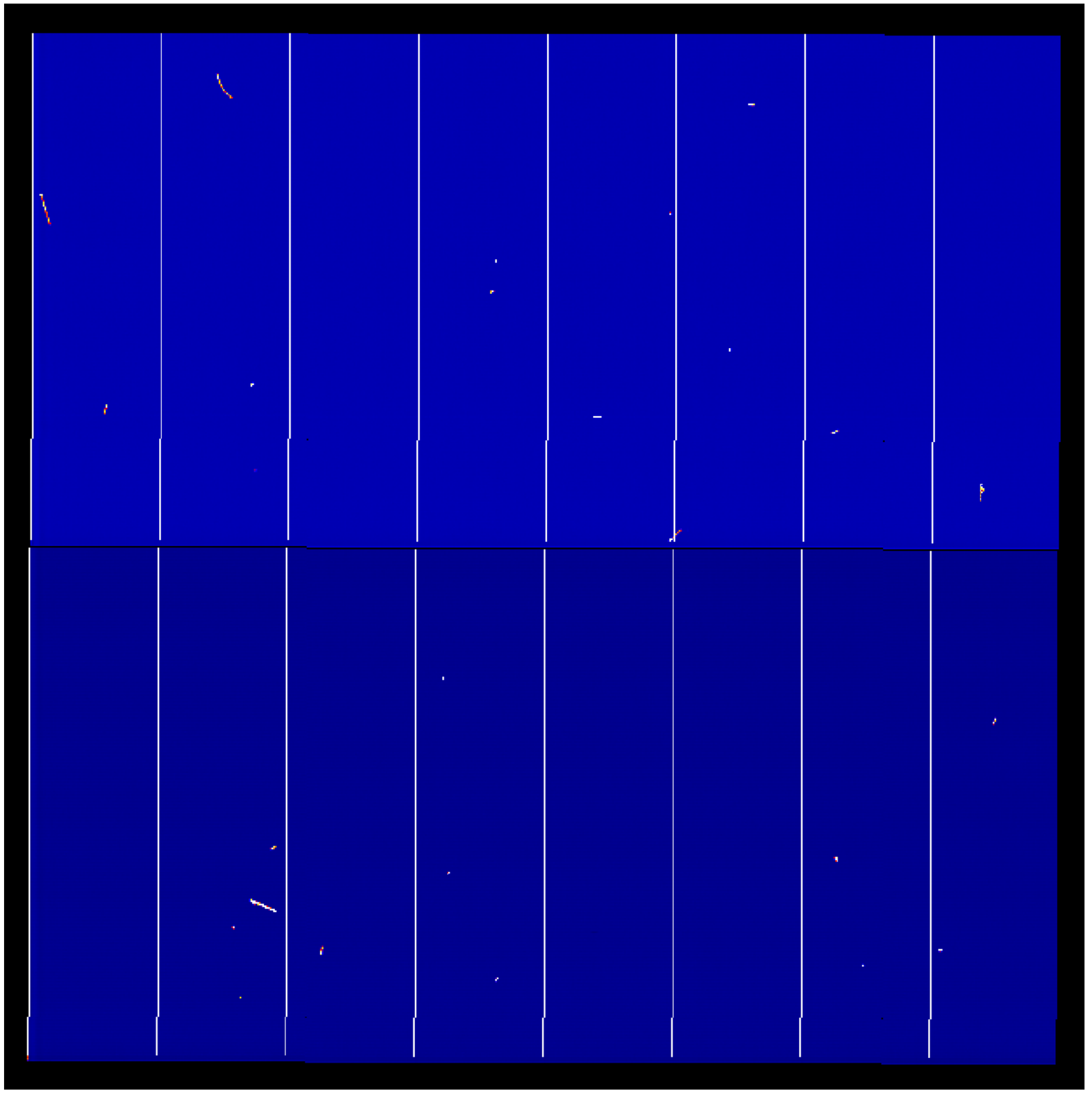


Bühler (2015)

未同定天体を深層学習で？

- 未同定天体から「掘り出し物」を探りあてたい
- ガンマ線データのエネルギー情報や時間情報や他波長のデータからガンマ線源を分類分けしたい (パルサー、ブレーザー、超新星残骸、パルサー星雲、、、)

X 線 CCD の生画像



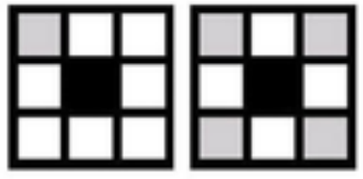
グレード法

[Definition]

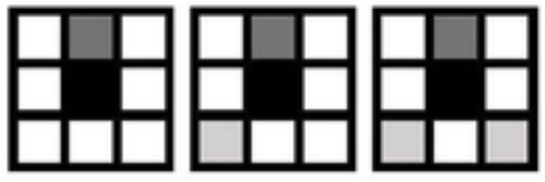
Grade 0
= perfect single

[Examples]

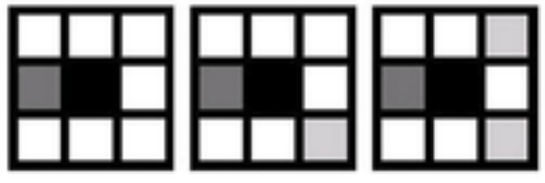
Grade 1
= single
+ detouched corners



Grade 2
= vertical single-sided split
+ detouched corners



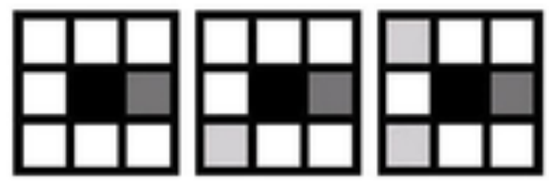
Grade 3
= left single-sided split
+ detouched corners



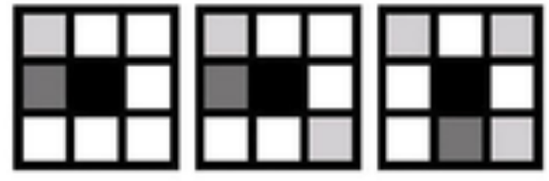
[Definition]

Grade 4
= right single-sided split
+ detouched corners

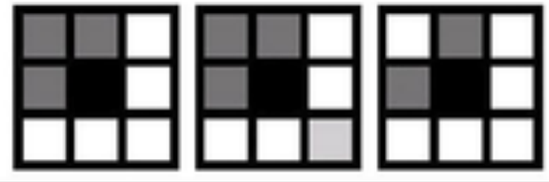
[Examples]



Grade 5
= single-sided split
+ detouched corners



Grade 6
= L-shape or square-shape
+ detouched corners



The center pixel.

A pixel whose PH level is larger than the split threshold and which is included when summing up the PHs.

A pixel whose PH level is larger than the split threshold and which is not included when summing up the PHs.

グレード法で十分か？

- より厚い空欠層
- CMOS センサの台頭 → 複雑なピクセル構造 → 場所ごとに異なる応答、電荷収集効率
- 単純なグレード法では不正確になる可能性大