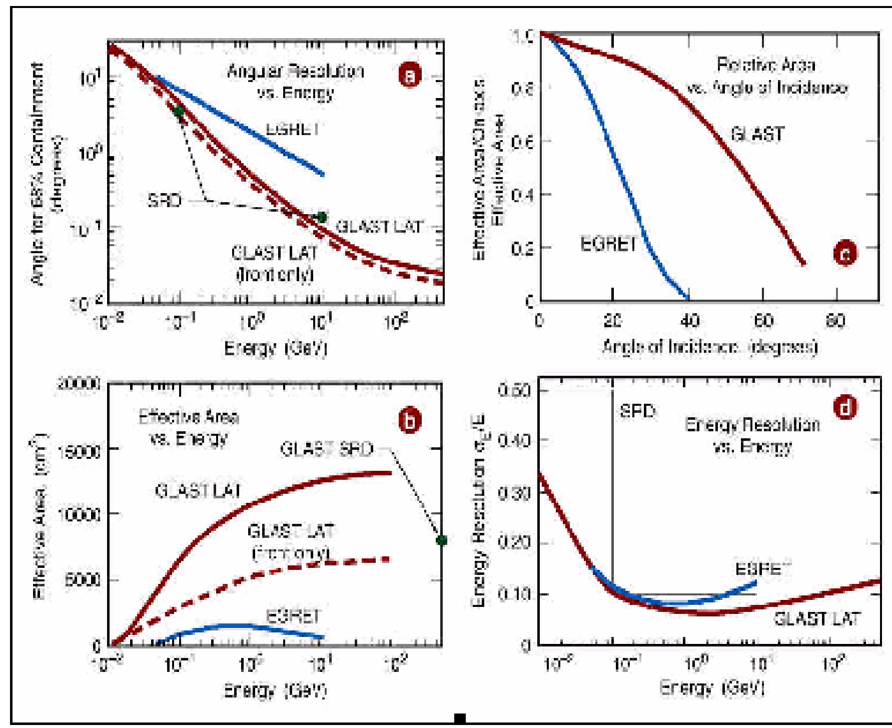
The LAT 4-panel plot, revisited

Toby Burnett



The proposal, from Steve

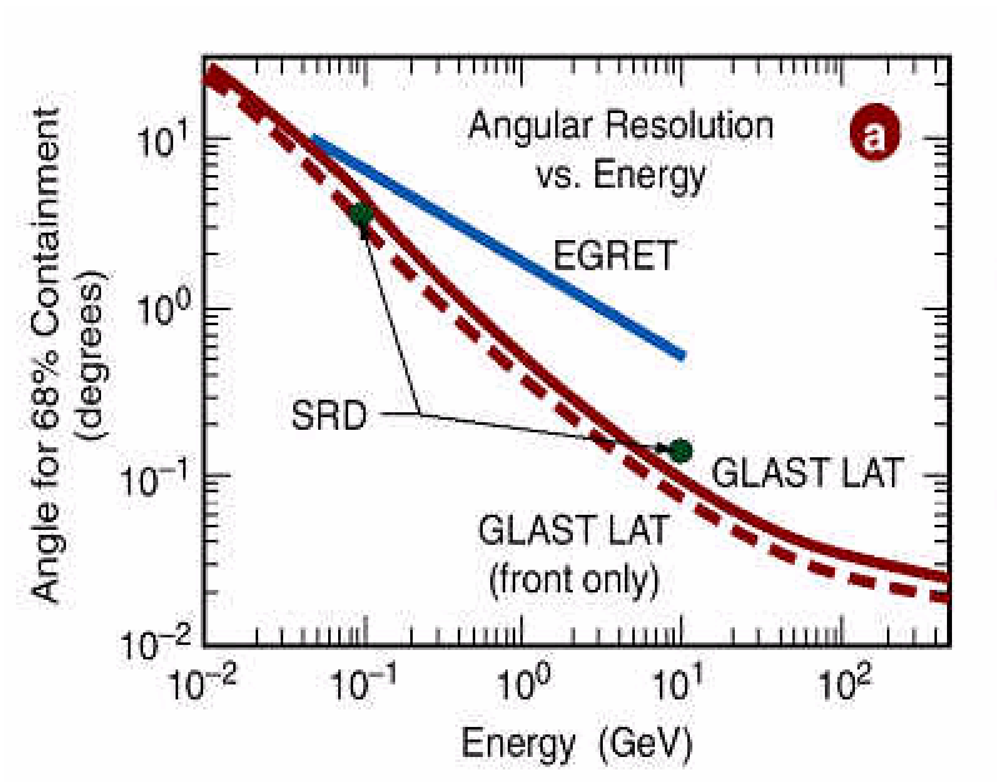
- Update the LAT performance plots now at http://www-glast.slac.stanford.edu/software/IS/glast_lat_performance.htm
- Use all_gamma, v4r2 release, DC1 cuts
- In the future, connect with Science Tools versions of the IRF functions
- Question:
  - Can one reliably use IRF functional representations?

My response: see the Point Source Analysis

- There are three memos in LAT docs on the subject:
  - AN-3455, a proposed PSF functional representation
    - Note: we have not had a discussion about using it!
  - AN-3456, analysis of all-gamma with GR v4r2, DC1 cuts, including fits to the PSF and Aeff
  - AN-4369, Implications for point source sensitivity.
    - Two plots from this memo are in the LAT performance page

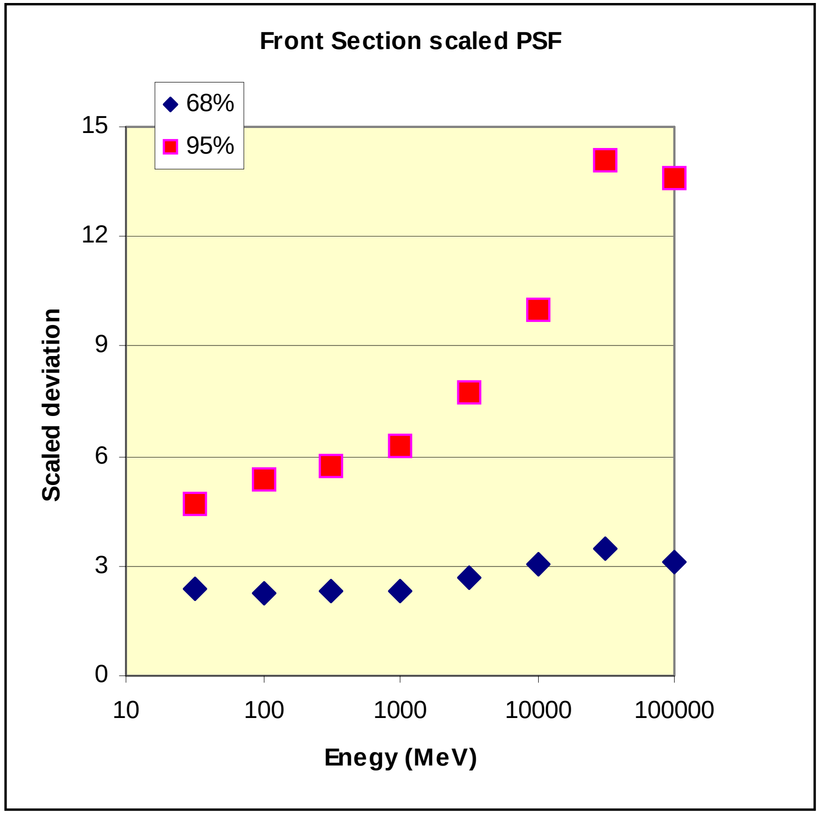
- This analysis covers panels a, b, c.

Panel a: the PSF



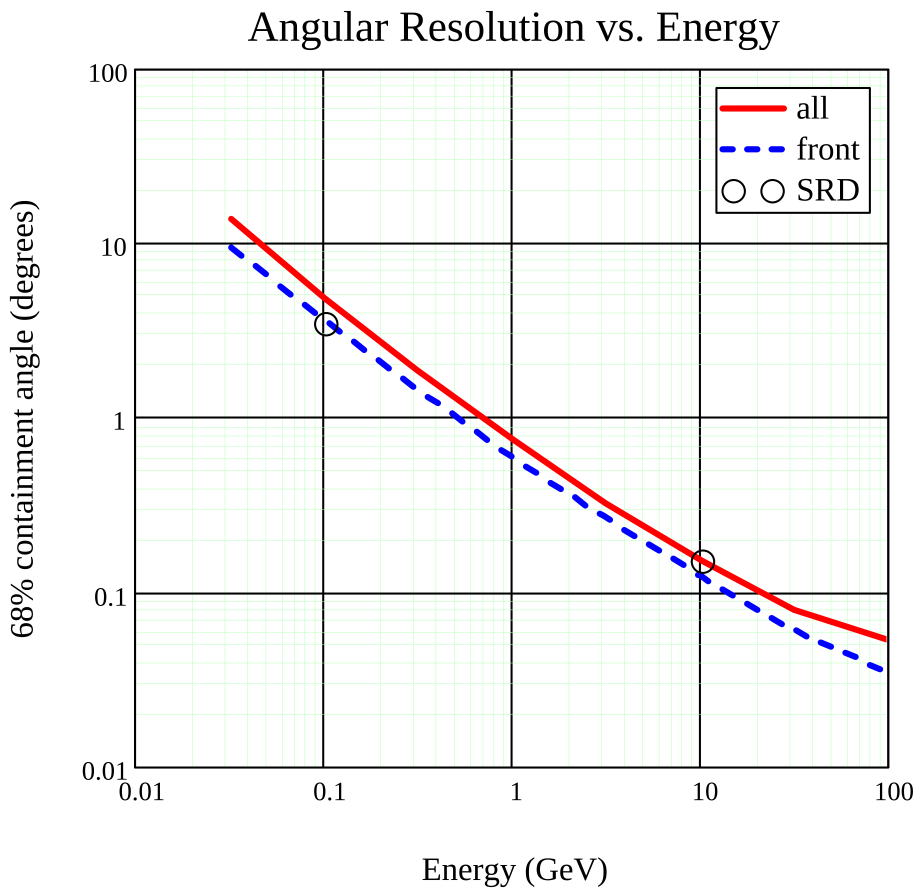
- It is normal incidence. I interpret it as the first bin in cos(θ), so θ<26 deg.
- I evaluate in 2 bins per energy decade, using the Atwood function of the generated energy to scale the deviation

Panel a, cont.



- Example of the results. The Atwood scaling function removes most of the energy dependence, but the shape depends on energy.
- Each point is then rescaled back to degrees…

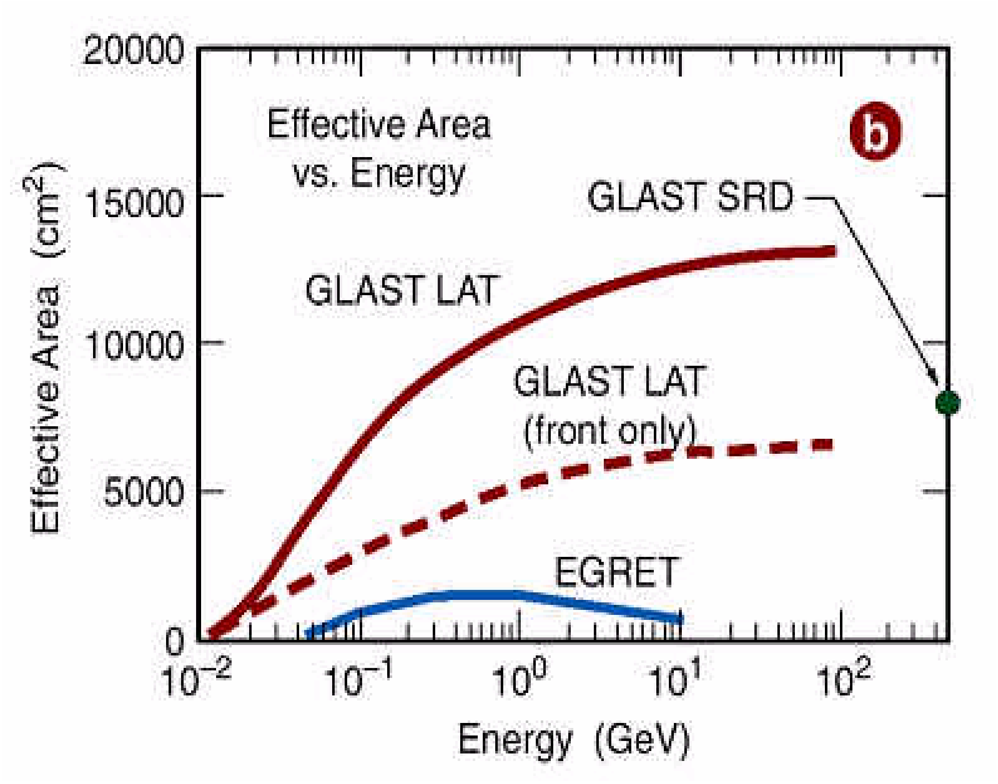
Panel a: the new result



Panel a: the data, in degrees

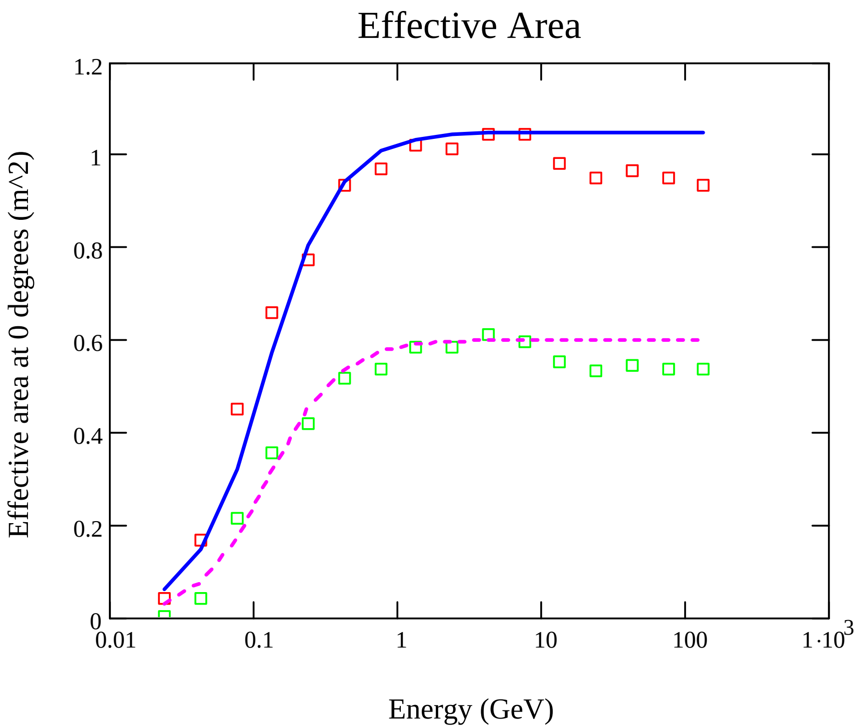
energy	front		back		all	
(MeV)	68%	95%	68%	95%	68%	95%
32	9.528	19.057	14.924	35.487	13.566	32.502
100	3.594	8.647	6.22	15.313	4.733	12.273
316	1.472	3.627	2.471	6.052	1.87	4.903
1.00E+03	0.579	1.556	0.973	2.448	0.738	1.969
3.16E+03	0.266	0.762	0.398	1.088	0.318	0.925
1.00E+04	0.121	0.395	0.189	0.606	0.15	0.482
3.16E+04	0.061	0.249	0.104	0.419	0.08	0.323
1.00E+05	0.034	0.147	0.078	0.284	0.053	0.193

Panel b



- This must include the background-suppression cuts, but that is somewhat science-dependent.
- The cuts actually introduce a “wart”. We expunge this!

Panel b

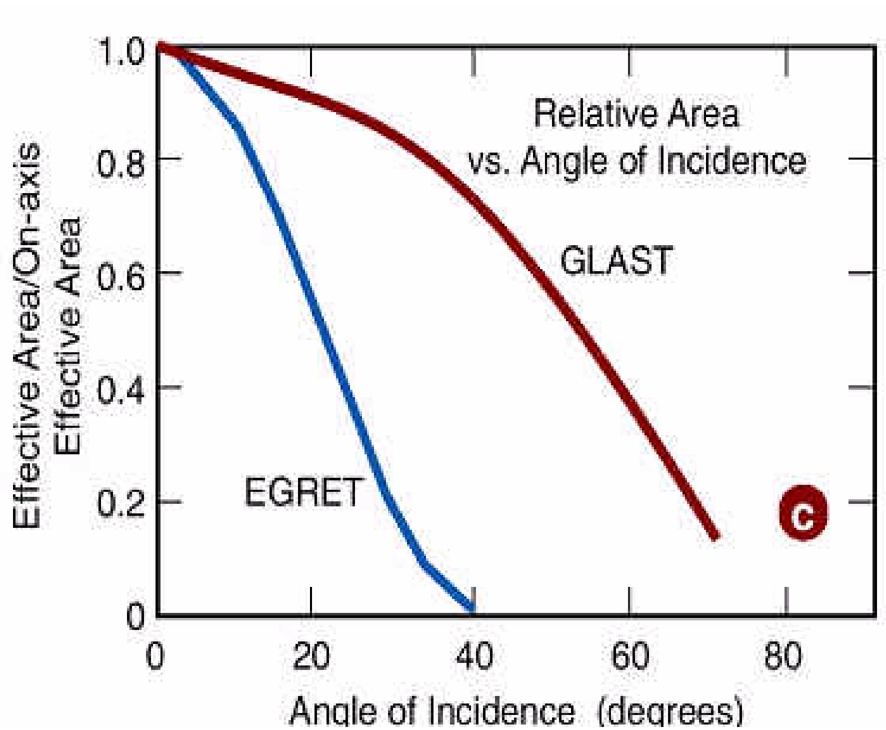


- Points are integral for 0-18 degrees, increased by 4% to extrapolate to normal incidence
- Lines are simple “logistic function” representations

$$A_{lg}(E,p) := \frac{p_0}{1 + \exp\left(-p_2 \cdot \log\left(\frac{E}{p_1}\right)\right)}$$

parameter	tot	front
P_0 (m²)	1.05	0.6
P_1 (MeV)	120	125
p_2	4.0	4.1

Panel c

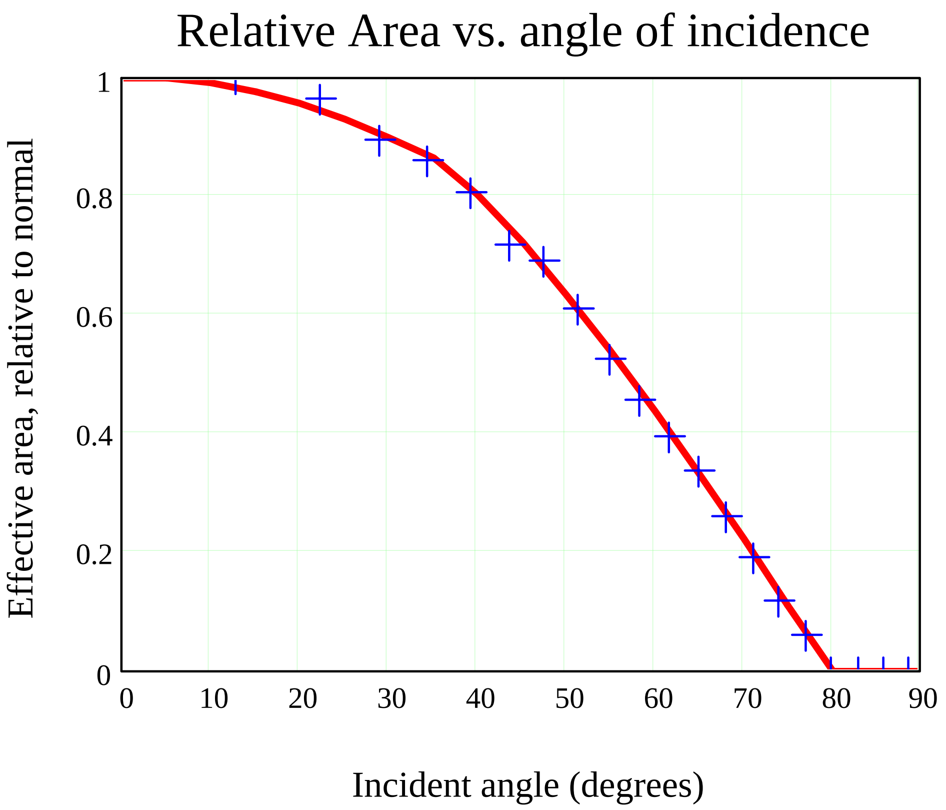


- This is slightly energy dependent. Don't know what was used here, I'll take the results for 1000 GeV, front+back.

Panel c

- Curve is a simple linear (in cos theta) fit with two segments, generated by the following function (z is cosθ)

$$EA(z) := \begin{array}{|l} a \leftarrow 0.32 \\ b \leftarrow 0.8 \\ c \leftarrow 0.18 \\ \text{return } \dfrac{z+a}{1+a} \text{ if } z > b \\ (\text{return } 0) \text{ if } z < c \\ \dfrac{(z-c)\cdot(b+a)}{(1+a)\cdot(b-c)} \end{array}$$



$$
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c \leftarrow 0.18 \\
\text{return } \dfrac{z+a}{1+a} \quad \text{if } z > b \\
(\text{return } 0) \quad \text{if } z < c \\
\dfrac{(z-c)\cdot(b+a)}{(1+a)\cdot(b-c)}
\end{array}
$$