Fermi LAT's View of the Galactic Center Region

B. Canadas, A. Morselli and V. Vitale
on behalf of the Fermi Large Area Telescope Collaboration

Summary:

The inner region of the Milky Way Galaxy is a complex one with a large number of point sources and intense diffuse gamma ray emissions. Furthermore the innermost part of this region (e.g. the Galactic Centre) is considered to be coincident with the Milky Way dark matter halo highest density. An analysis of the Fermi LAT data within a 45degX45deg region around the direction of the galactic centre with 32 months of Fermi LAT data has been performed. Here some details of this analysis and a study of the innermost 5degX5deg region are reported.

A Study of the innermost 5degX5deg region

Description of the analysis

The inner galaxy is a very complex region, rich in gamma-ray sources and with a strong diffuse foreground coming from the interaction of cosmic rays with the interstellar medium.

Here, we show a preliminary characterization of the innermost 5 x 5 degrees region around the galactic center, using 32 months of data above 1GeV. A small RoI has been chosen in order to minimize the number of degrees of freedom introduced by the spectral parametrization of the sources. Moreover, we exploit the smaller size of the LAT PSF for energies above 1GeV with respect to lower energies, significantly reducing the photon leakages in and off the RoI.

We have performed a binned likelihood analysis using the P7V6 [1] clean and extra-clean classes (front and back converted), using different GALPROP [2,3] galactic diffuse background models (only two shown here). In these models, some parameters and features such as the distribution of cosmic rays sources or the IC component are changed. Regarding the sources, we have used the positions in a 2FGL catalog candidate, and fitted their spectra to log parabolae or to power laws with exponential cutoffs in the case of known pulsars.

These results show that it is possible to find combinations of galactic diffuse emission models and sources that flatten the residuals. An improvement in the understanding of the instrument response, materialized in the new P7 set of IRFs together with a more detailed characterization of sources, seem to reduce the residuals. Moreover, the spectra of the most significant sources are stable when the galactic diffuse emission model is changed.

Caveats

We must note, however, that there are some **CAVEATS** in this analysis that need to be considered:

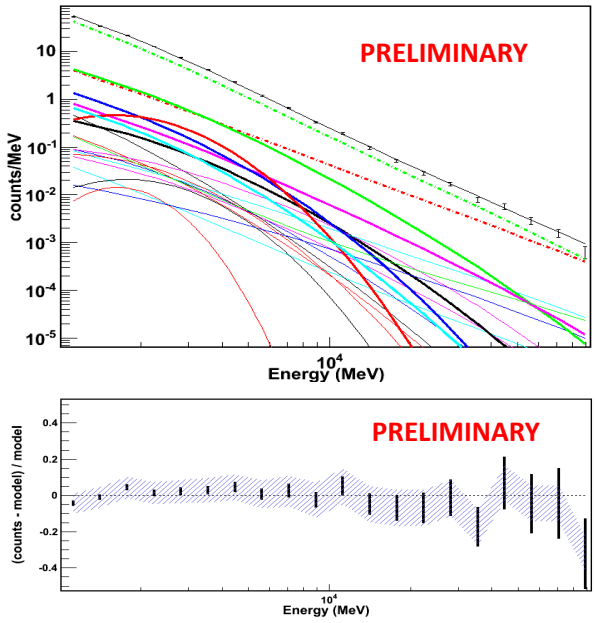
- These results are **PRELIMINARY**, a big effort is being dedicated to the understanding of the galactic diffuse emission, and the list of candidate sources might still change before the definitive results are ready.

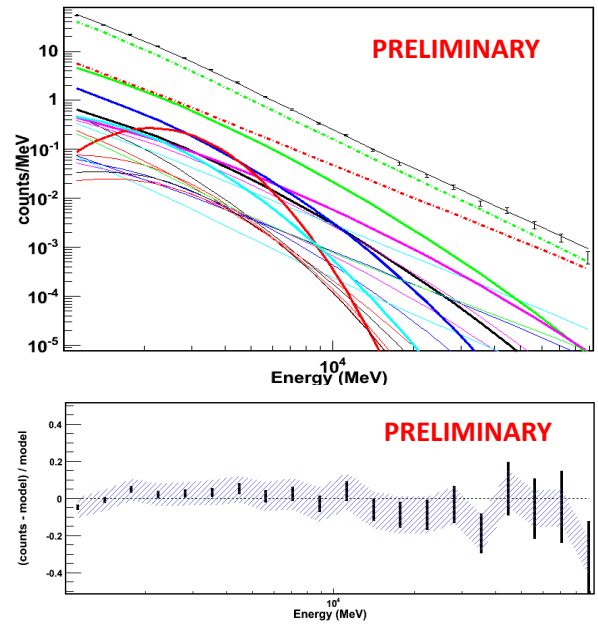
- The isotropic component resulting from this analysis is higher than that found for the EG diffuse emission. This might be due to other isotropic-like contributions present in that region (like unresolved sources, for example), that still needs to be understood.

- This is an analysis above 1GeV. Analyses with lower energy thresholds are on-going and the overall results might change.

References

1. R.Rando et al. for the Fermi Collaboration (poster @ III Fermi Symposium)
2. A.Strong et al., 2004, ApJ 613, 962S
3. A.Strong et al., 2007 Annu. Rev. Nucl. Part. Sci., 57, 285





These figures correspond to the analysis described above. Each box contains the results of one of the two reported analyses. In the upper figure inside each box, are shown the counts spectra resulting from the binned likelihood analysis. Data are represented by the points with statistical error bars, and the thin black line is the sum of all the components included in the model. The dot-dashed lines correspond to the two diffuse emissions considered: in green, the galactic diffuse emission, in red the isotropic emission. The rest of colored lines correspond to the sources in the model. Those with higher significance have been represented with double solid lines. In the lower figure inside each box, the corresponding residuals ((counts-model)/model). The dashed blue region represents the systematic uncertainties.