

A Detailed Look at the 133 GeV Feature in Pass 7 and Pass 8

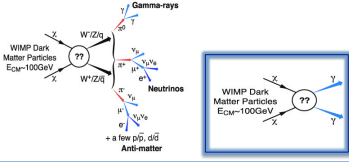
R. Caputo (University of California, Santa Cruz)
on behalf of the Fermi Large Area Telescope Collaboration

Summary: We present a detailed comparison of the data using both P7Rep and P8 event level selection and reconstruction near 133 GeV in the Galactic Center and the Earth Limb

A gamma-ray emission line, if detected, is a strong signature of the annihilation or decay of dark matter. A tentative emission feature near the Galactic Center was reported by several groups at ~ 133 GeV in the first 3.7 years of Fermi-LAT data. Since the previous Fermi-LAT Collaboration analysis, which used the Pass 7 reprocessed (P7Rep) event analysis, two more years of data are available. Additionally, the collaboration is transitioning to a new event-level analysis framework, Pass 8 (P8). Both the event-level reconstruction and selection have been improved with P8. We present a detailed comparison of the P7Rep and P8 data near 133 GeV in the Galactic Center and in the Earth Limb.

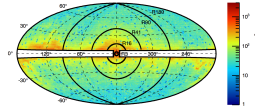
A Dark Matter Signature

Dark matter annihilating into gamma rays [1]:



Earth Limb
• $111^\circ < \theta < 113^\circ$
• $|\theta_R| > 52^\circ$
• Clean class

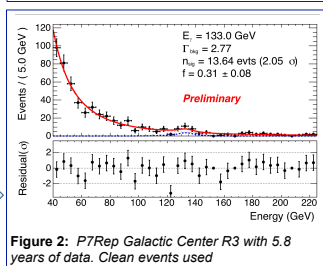
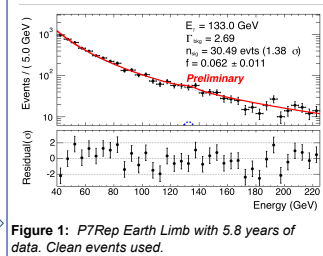
Signal ROIs



Galactic Center R3
• $(\cos b)(\cos l) > \cos 3^\circ$
• Clean class

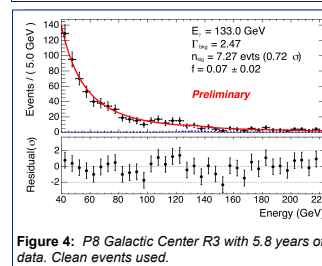
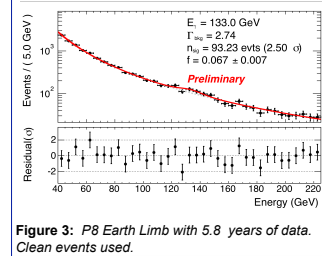
P7Rep Data: 5.8 years

• 2D - events categorized by BestEnergyProb, unbinned

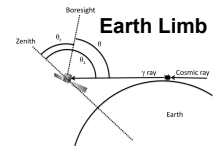


P8 Data: 5.8 years

• Increased A_{eff}
• Improved Energy Reconstruction

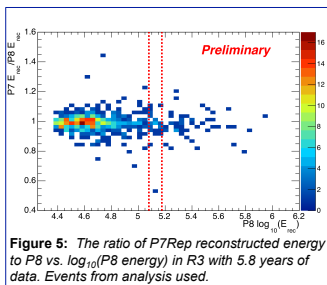


Earth Limb
• $\sim 60\%$ overlap
• $\sim 40\%$ increase



Galactic Center R3
• Similar to Limb
• $\sim 60\%$ overlap
• $\sim 40\%$ increase

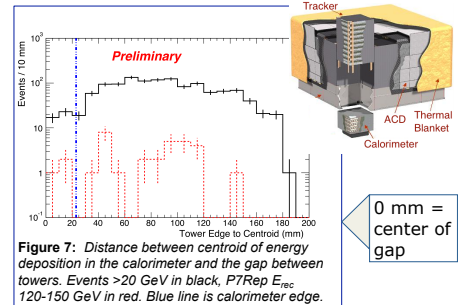
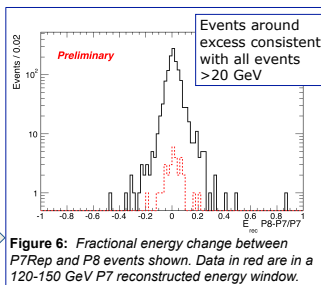
Direct comparison Galactic Center R3: P7Rep vs. P8



Event by event comparison

Several quantities tested for correlation with fractional energy change (P7Rep and P8). Highest was from distance to cal tower edge

Near tower edge
RMS: ~ 0.09
Away from Tower edge: RMS ~ 0.065



0 mm = center of gap

Conclusions

- With the additional 2 years of data, the significance of the 133 GeV excess in the Galactic Center (R3) has decreased with respect to the previous Fermi-LAT Collaboration analysis.
- When the data are reanalyzed using the Pass 8 event-level reconstruction and selection, the significance of the line decreased further. This is due in part to the difference in energy reconstruction within 40 mm of the edges of the calorimeter towers. Overall differences in the energy reconstruction between the passes are within the energy resolution of the calorimeter.

References

- [1] Baltz, A. E., et al., JCAP 07 (2008) 013 [arXiv:0806.2911]
- [2] Ackermann, M., et al., PRD 88 (2013) 082002 [arXiv:1305.5597]
- [3] Atwood, W. B., et al., APJ 697 (2009) 1071-1102 [arXiv:0902.1089]