
Update of EBL studies with DC2 Data

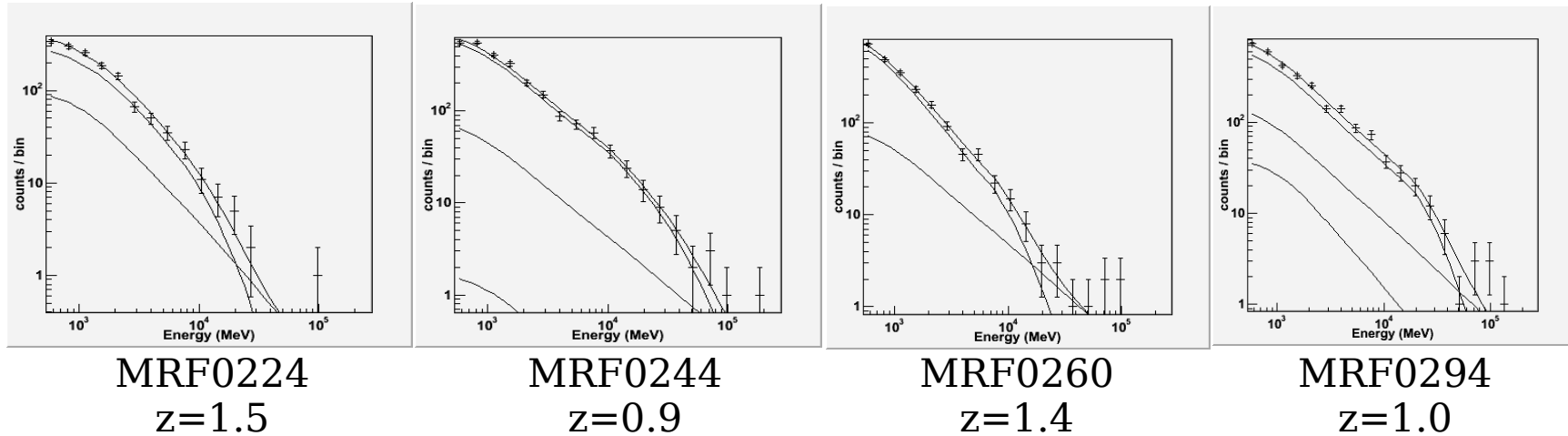
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“Blazar and other AGNs” Science Group

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Previous results:

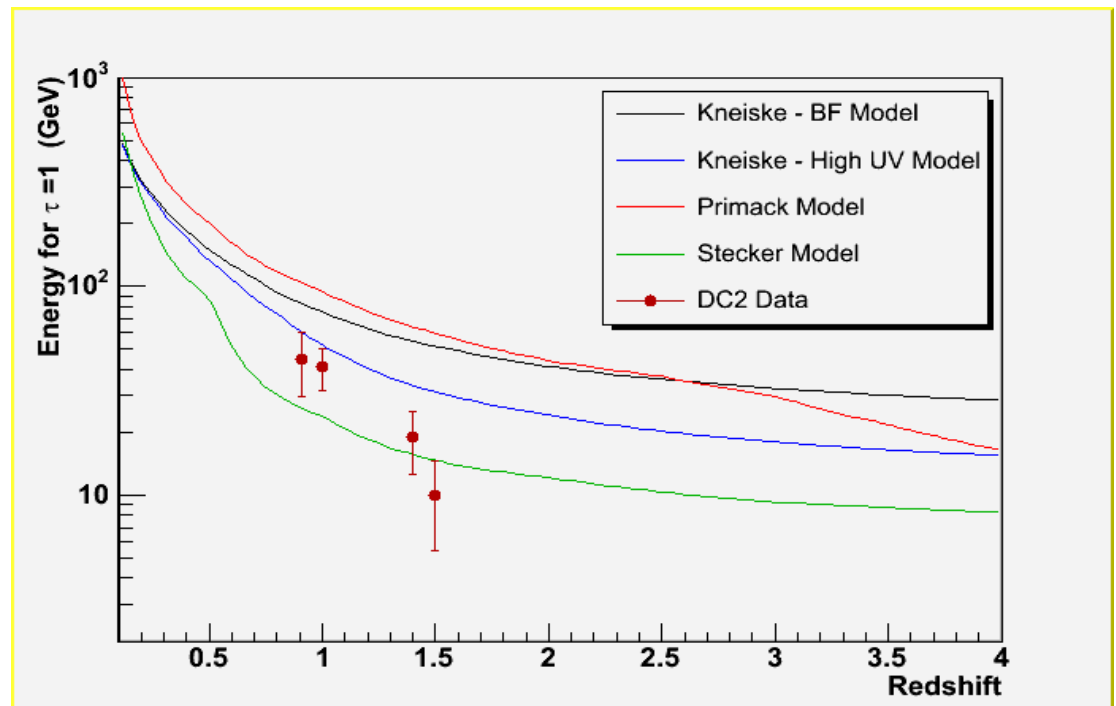


Blazar spectra model:

power law $\times \exp(-\tau)$ with

$$\tau(E) = (E - E_b) / P_1 ; \text{ if } E > E_b$$

- E_b and P_1 are obtained from the likelihood fit
- For a blazar at a given redshift, E_0 is calculated with the results from the fit. $\tau(E_0, z) = 1$

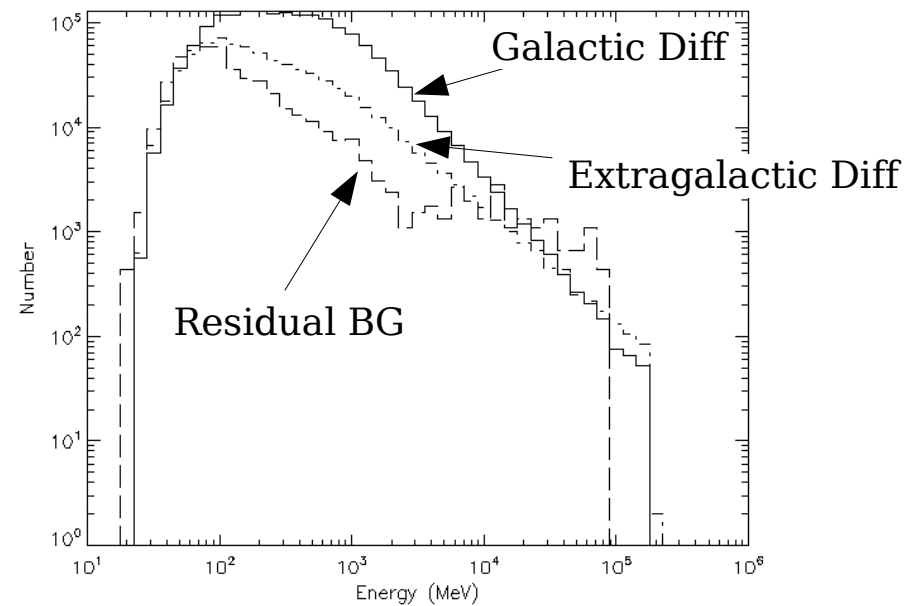


New Development: Residual Background Contamination

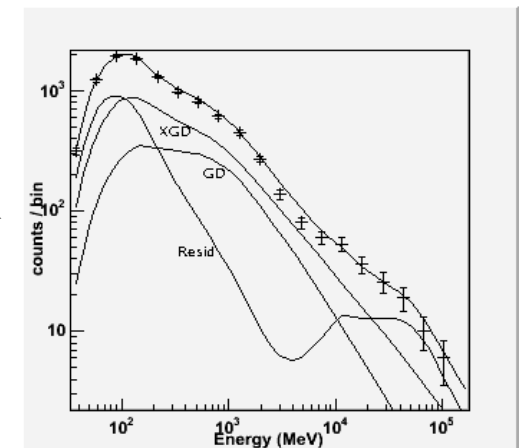
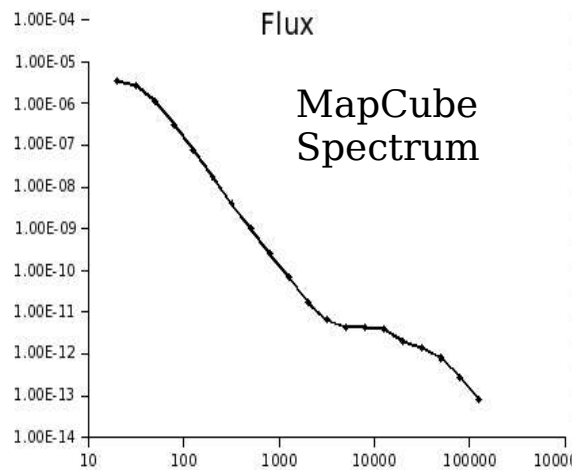
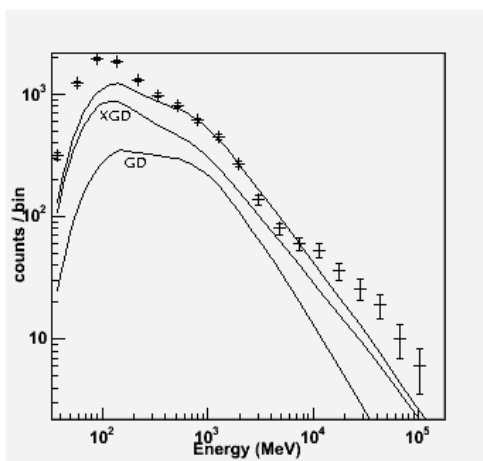
- Seth studied the spectral and spatial distribution of residual background in DC2 data, he found that this contribution is **comparable** to the extragalactic diffuse at low and **high energies**.
<https://confluence.slac.stanford.edu/display/SCIGRPS/Residual+background+and+diffuse+emission>

- Bill Atwood implemented additional cuts that improve the BG rejection substantially at high energies (see link below). These cuts, however, required new variables, that were not implemented in time for the original DC2 data generation. **The reprocessed DC2 data doesn't have these cuts either.** The cuts can be applied by the user (on the root trees).
<http://www-glast.slac.stanford.edu/software/AnaGroup/atwood-2006feb6-BkgRej.pdf>

- Riccardo Rando produced “empirically” a MapCube that accounts for the residual background contribution.



Region of the sky without point sources



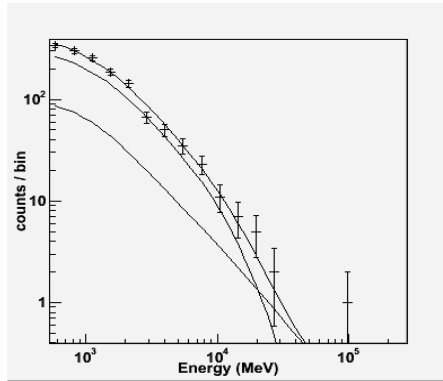
Considerations

- EBL attenuation has a weak spectral signature after just 55 days, (unless the source is very bright and hard)
- EBL attenuation is only relevant for γ -ray energies above 10 GeV, where the contribution from residual background seems to be significant.
- Residual background could wash-off EBL effects and/or induce systematic effects in its determination.

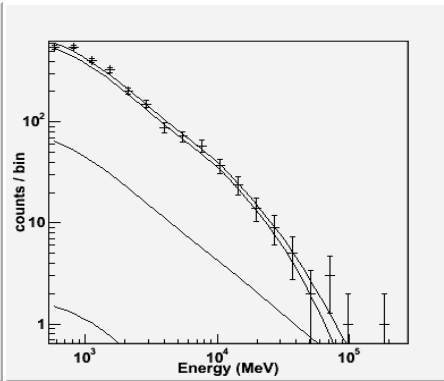
The right thing to do is to apply Bill's new background rejection cuts in the DC2 data (I'm looking into that), in the meantime, let's use Riccardo's “empirical” residual background model...

Reprocessed sources (with Residual BG model)

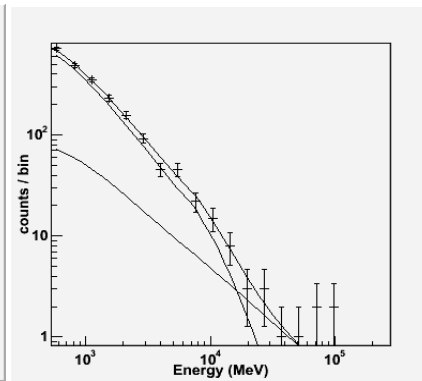
Before



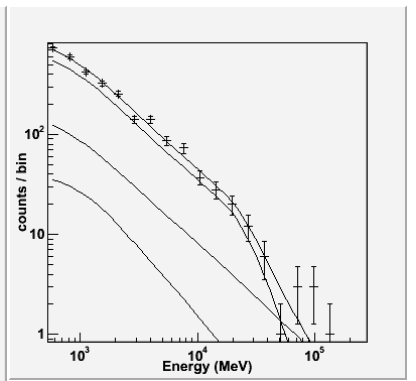
MRF0224
 $z=1.5$



MRF0244
 $z=0.9$

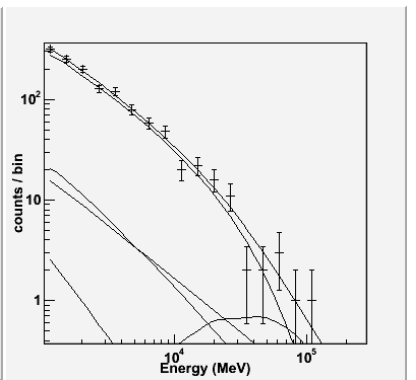
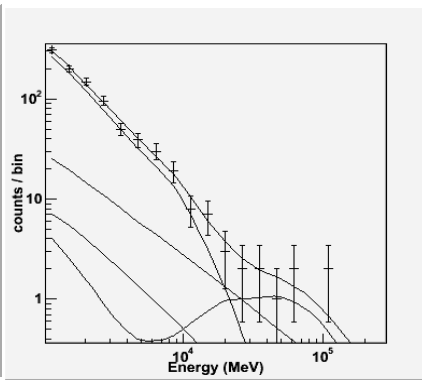
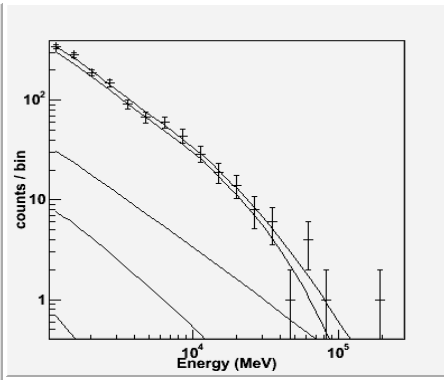
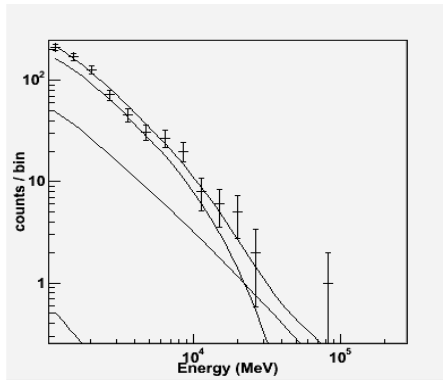


MRF0260
 $z=1.4$



MRF0294
 $z=1.0$

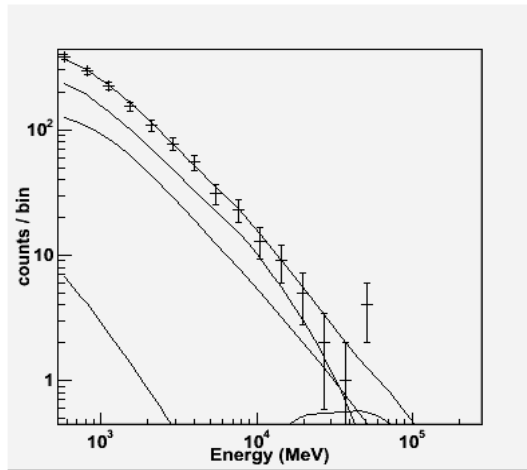
Now



Source	$E_0(\text{GeV})$ before	$E_0(\text{GeV})$ after
MRF0224	10 ± 4.58	11.3 ± 1.9
MRF0244	45 ± 15.5	51 ± 16.3
MRF0260	19 ± 6.3	19 ± 6.3
MRF0294	41 ± 9.4	33 ± 27.4

- The new results are consistent (within errors) with the previous results.
- However, these are sources where the blazar flux with $E > 10$ GeV is well above diffuse background

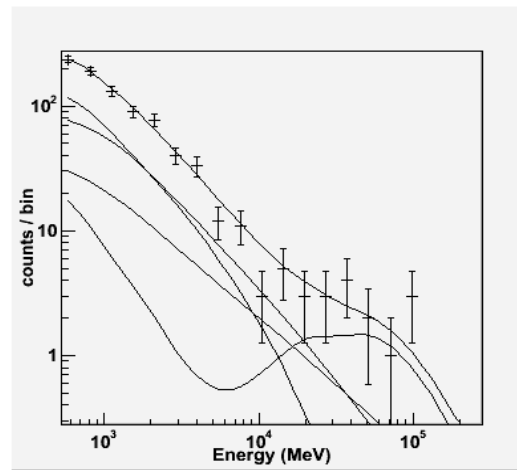
New sources found with EBL-like spectrum (Preliminary)



MRF0110

$z=1.21$

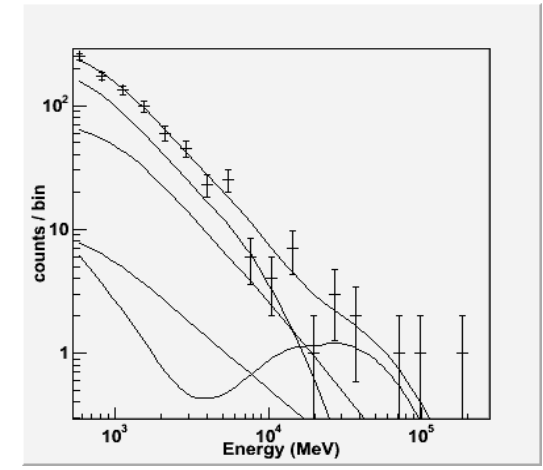
$E_0 = 31.57 \pm 17.47$ GeV



MRF0125

$z=1.5$

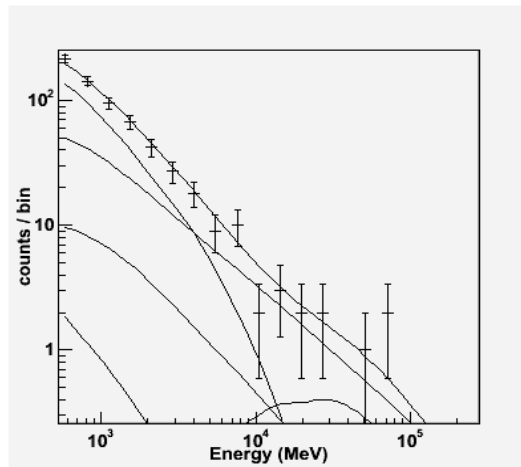
$E_0 = 17.52 \pm 20.11$ GeV



MRF0300

$z=2.1$

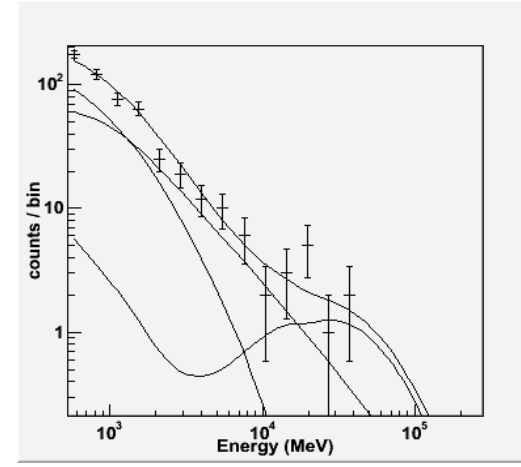
$E_0 = 17.62 \pm 9.96$ GeV



MRF0309

$z=2.85$

$E_0 = 11.24 \pm 15.58$ GeV

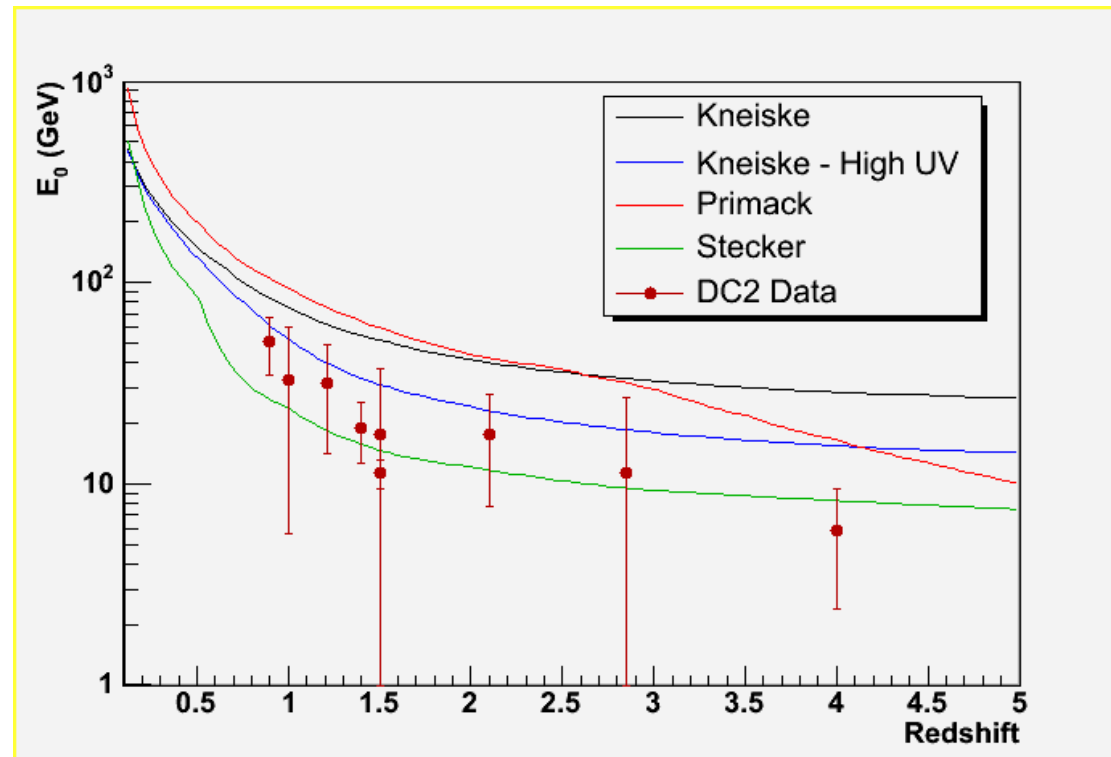


MRF0311

$z=4.0$

$E_0 = 5.89 \pm 3.49$ GeV

Updated Fazio-Stecker Plot for DC2 Data



- The plot above hints that there is a clustering of E_0 as a function of redshift. This supports the hypothesis that there is EBL attenuation.
- Effects that might distort the results:
 - Spectral features in the blazar like energy breaks or rollofs
 - Riccardo's mapcube is just a first approximation to account for the residual background