AGN observations with < 100 GeV threshold with H.E.S.S. II

Carlo Romoli – DIAS
on behalf of the H.E.S.S. Collaboration

Outline

- H.E.S.S. and H.E.S.S. II
- AGNs at ~100 GeV threshold
- Implications for EBL studies
- Conclusions

H.E.S.S. in phase II

- 4+1 telescopes:
  - 12 m +28 m diameter
- Energy threshold down to ~30 GeV (for pulsar studies)
- Different analysis mode:
  - MONO, STEREO, COMBINED

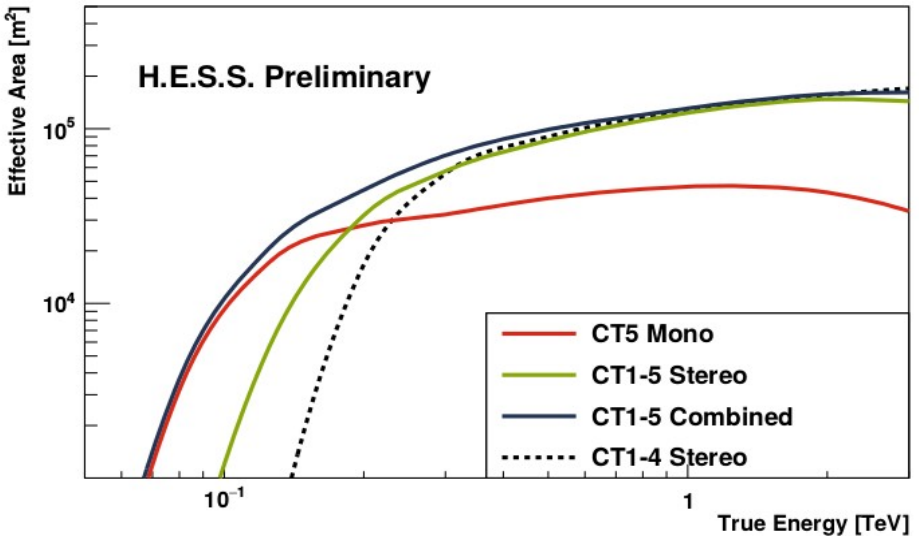
MONO:

- Low energy threshold
- Limited angular resolution and sensitivity
- BEST SUITABLE for bright object at high redshift (AGNs or GRBs)

STEREO:

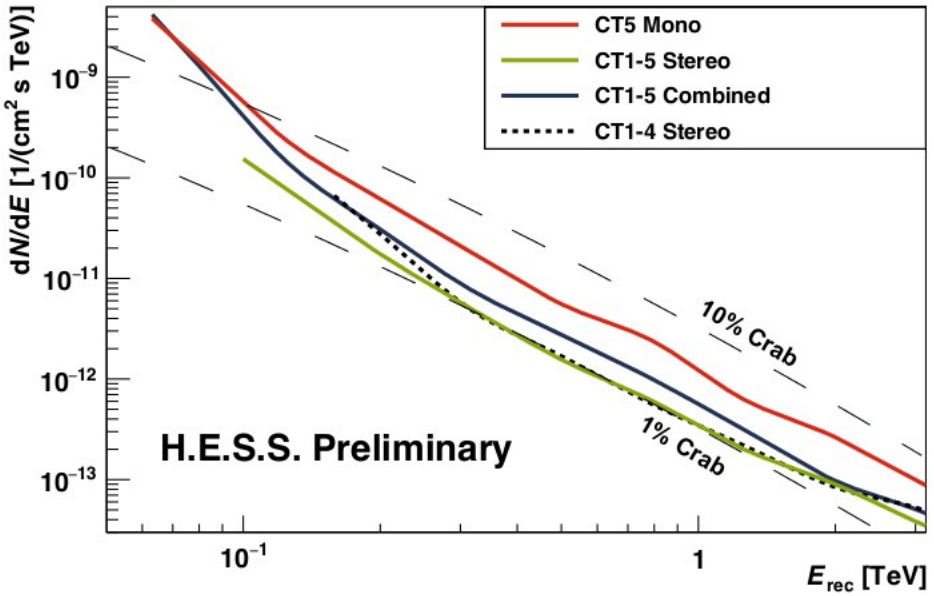
- Higher energy threshold
- High angular resolution and good sensitivity
- BEST SUITABLE for fainter sources and morphology study

H.E.S.S. in phase II



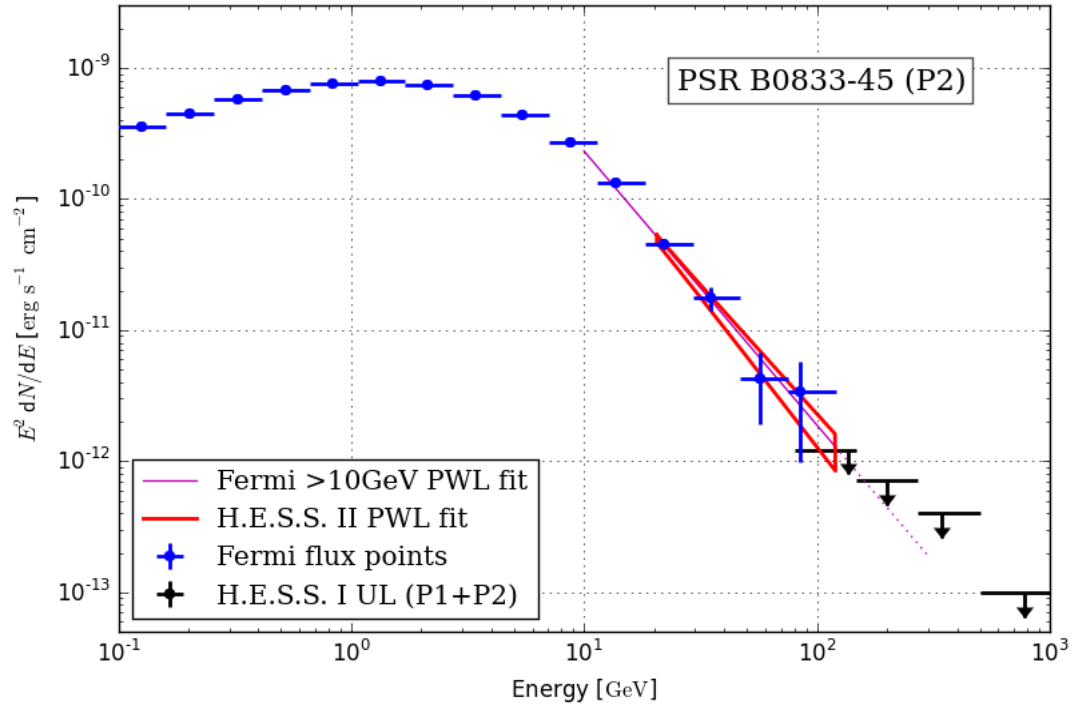
Effective Area for different subarrays

Sensitivity curve after 50 hrs for a 5 sigma detection



H.E.S.S. results

- Some recent results from H.E.S.S.
  - Vela pulsar down to 30 GeV



Thanks to the phase II

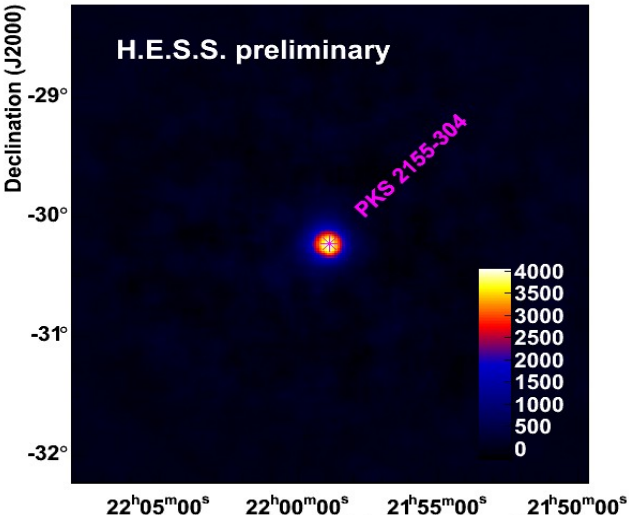
From Gajdus ICRC2015

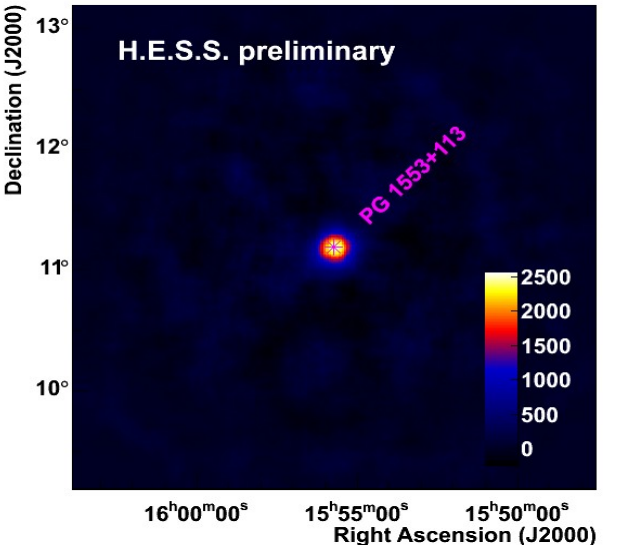
Lowering the threshold below 100 GeV

- Better overlap with *Fermi*-LAT
- Opening the field to observe more distant sources (MAGIC and VERITAS examples)
  - Dealing with the EBL

First HESS results ~100 GeV

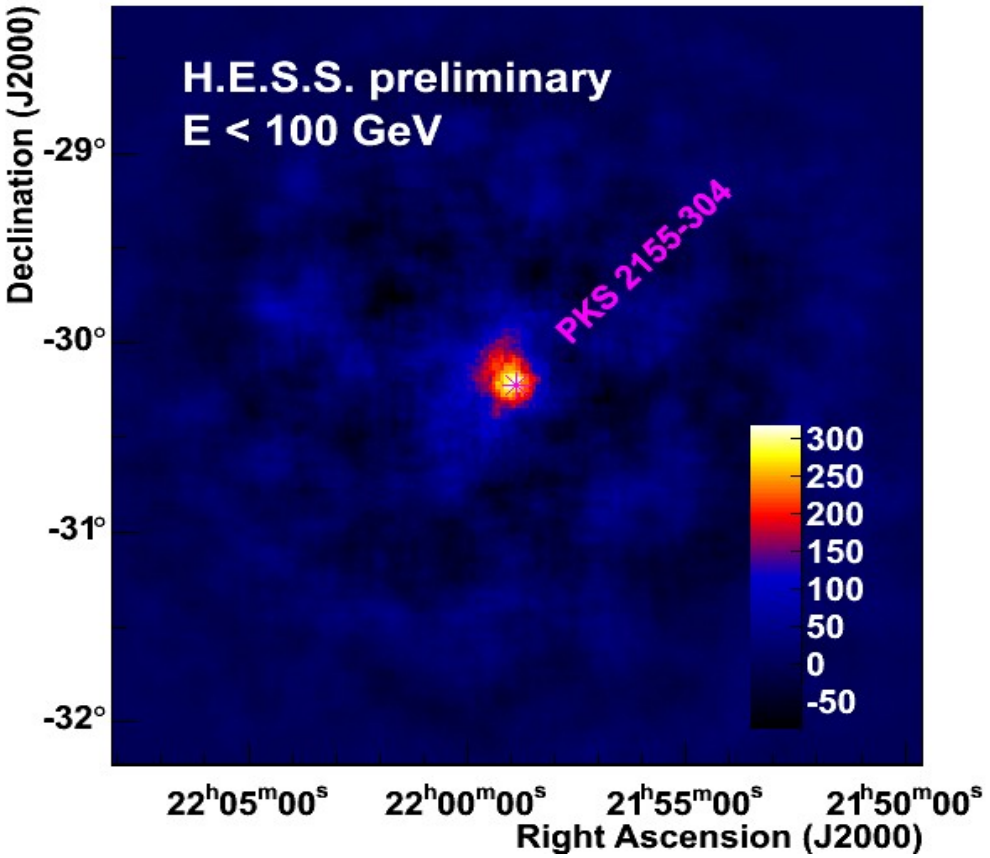
- Analysis using MONO (CT5 only) data
  - PKS 2155-304 (z = 0.116)
    - Favourable zenith angle
    - Widely studied with H.E.S.S.
    - 56 hours between 2013 and 2014
  - PG 1553+113 (0.43 < z < 0.58)
    - Bright distant blazar
    - Steep spectrum
    - 16.8 hours taken in 2013

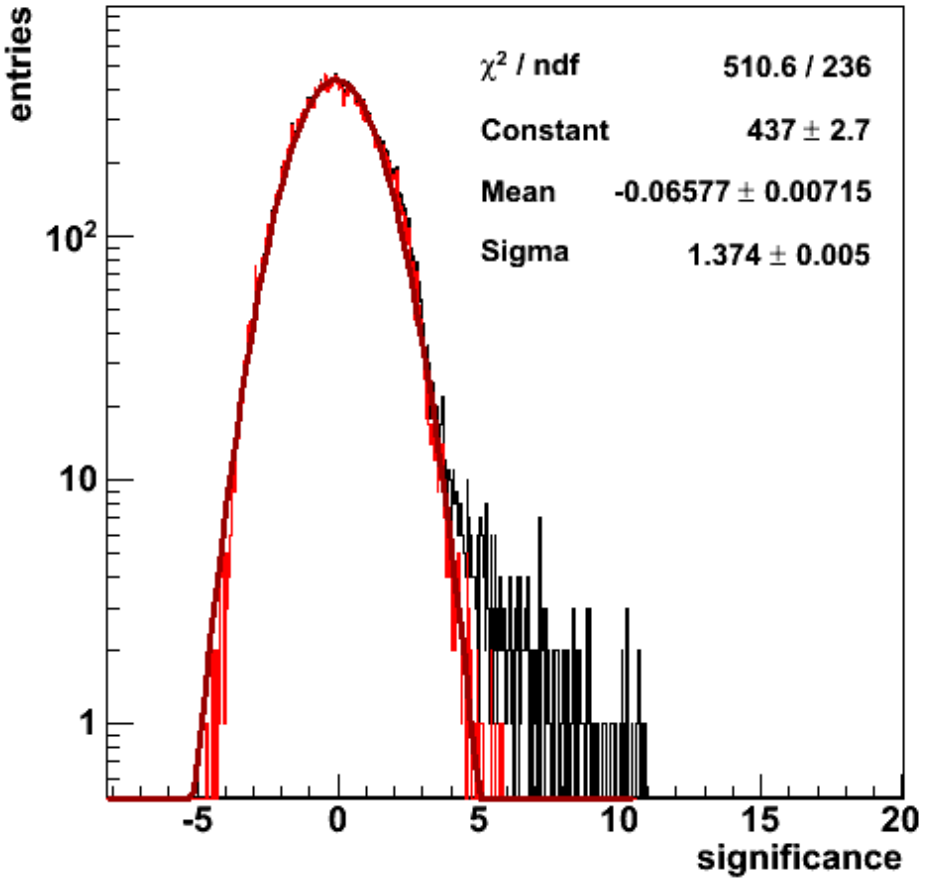




PKS 2155-304

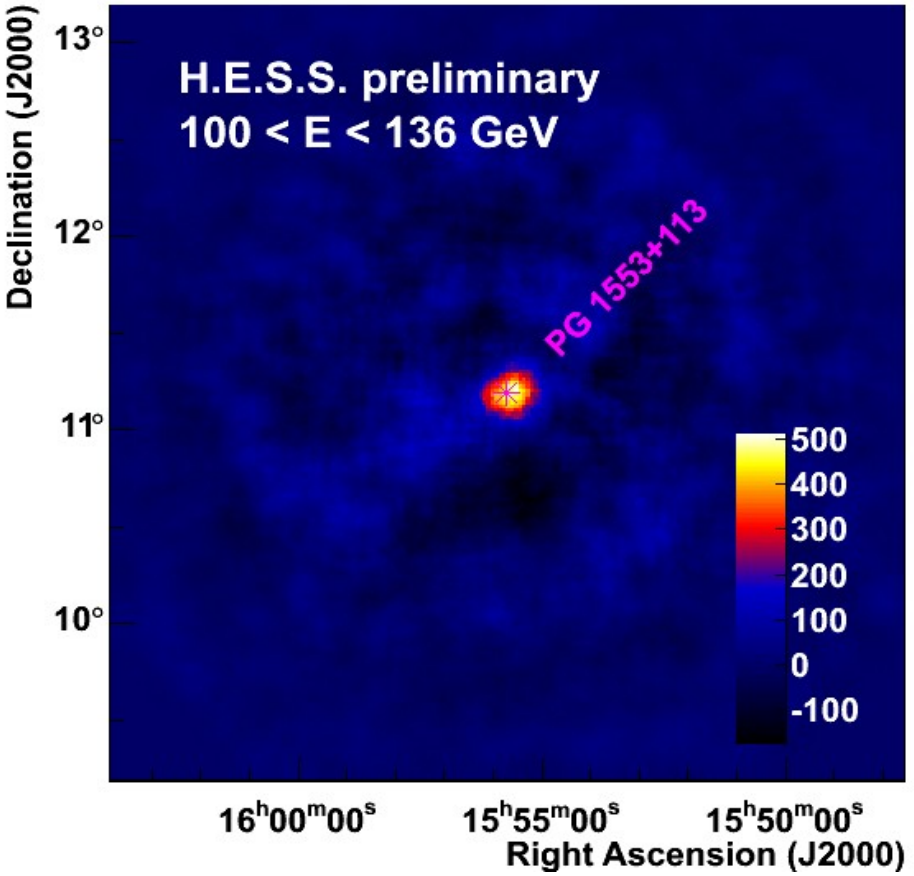
- At the threshold (~85 GeV)

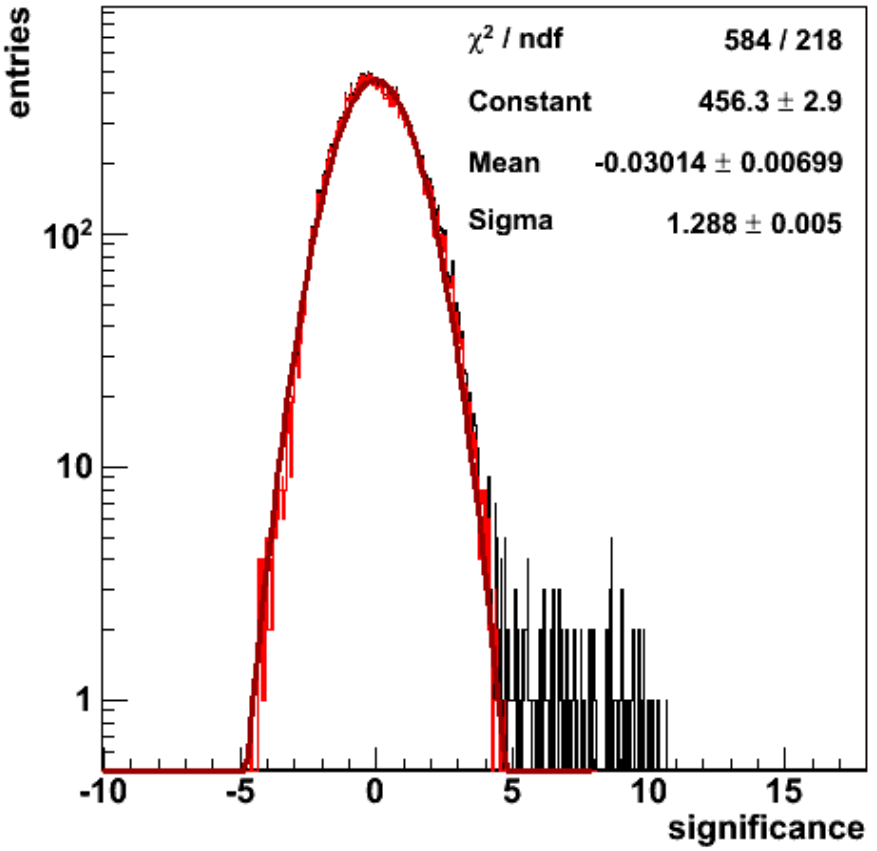




PG 1553+113

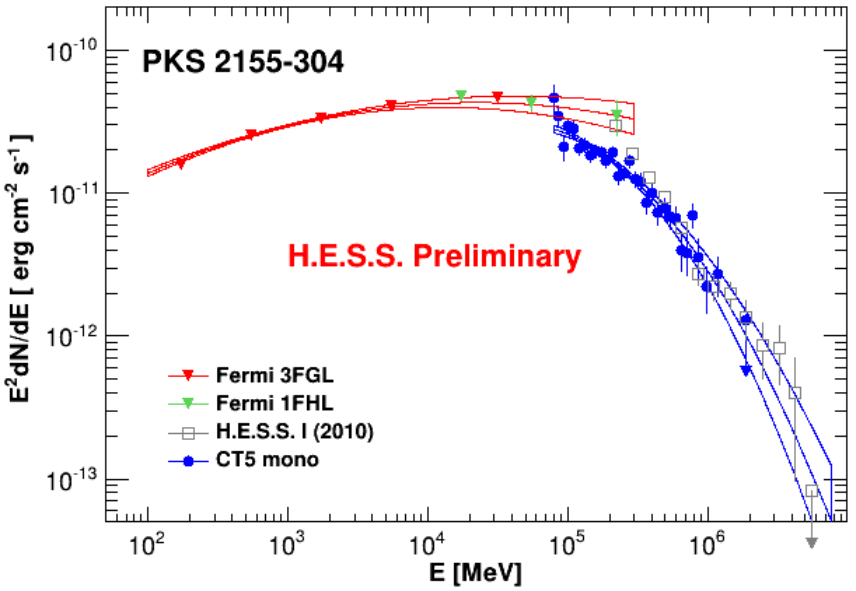
- At the threshold (~100 GeV)

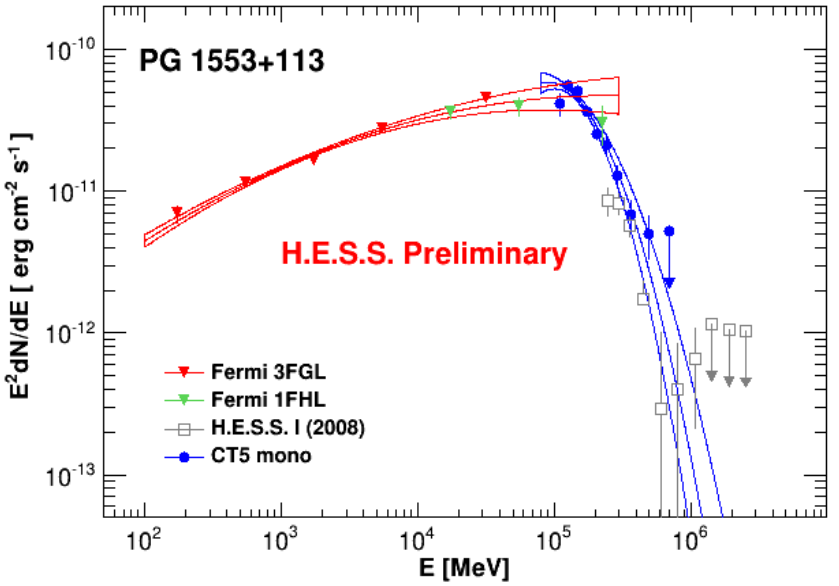




Spectra

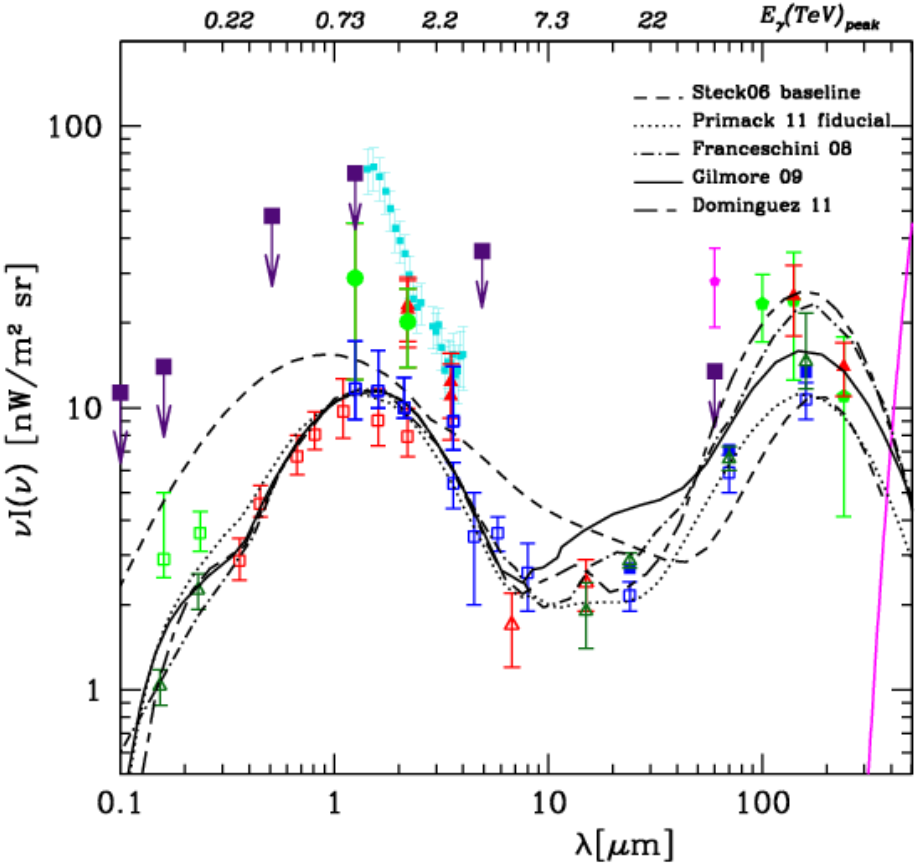
- Use of the MONO analysis:
  - Clear curvature in the spectrum
  - EBL-induced cutoff at the transition between the instruments





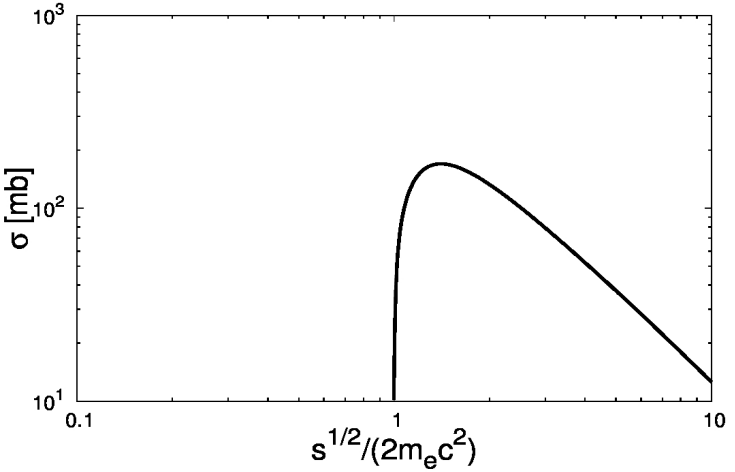
The Extragalactic Background Light

EBL shape



Costamante, 2013 1 μm ~ 1 eV

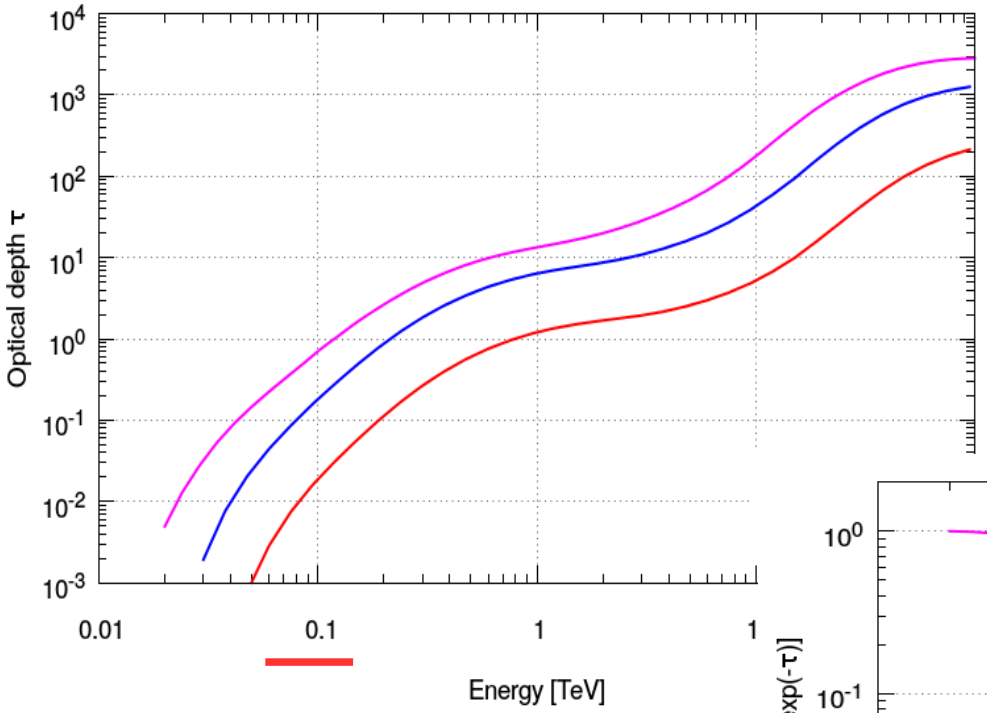
γ-γ cross section



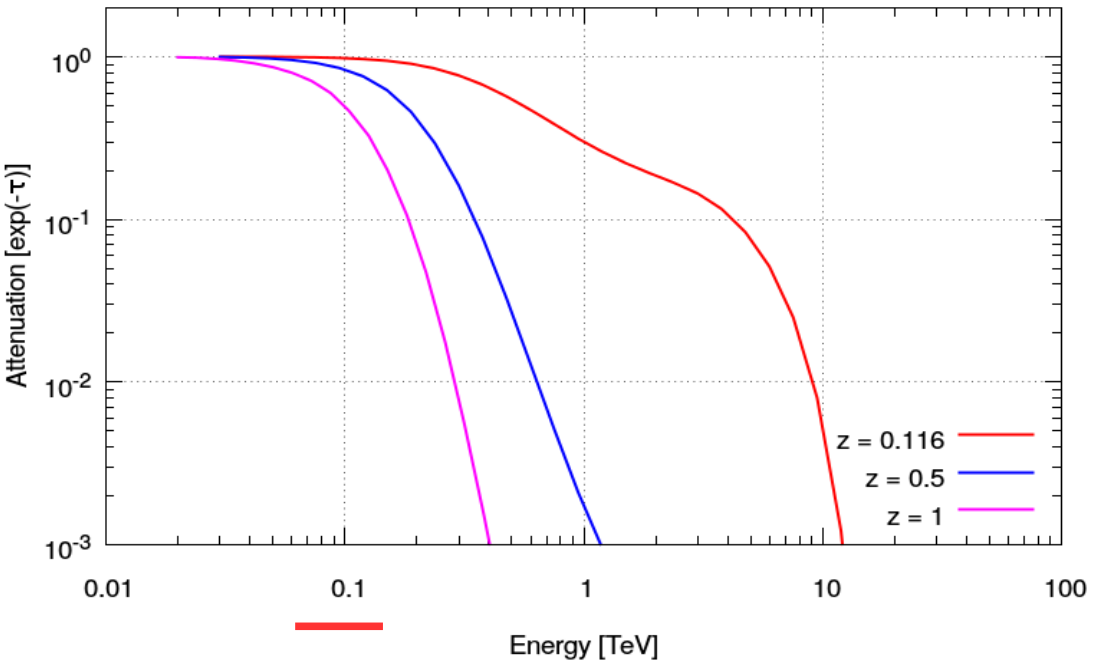
Attenuation of high energy gamma ray photons due to the optical-near infrared photons

$$E_\gamma^{\mathrm{TeV}} E_\gamma^{\mathrm{eV}} \approx 1$$

EBL attenuation



Using the Franceschini's model (2008)

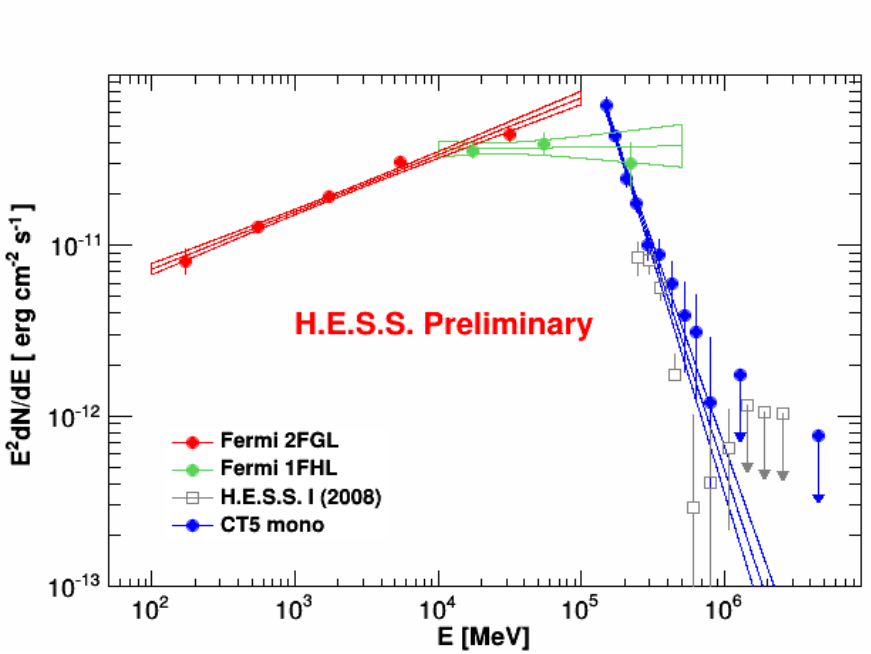


Lower energy -> Higher distance

Conclusions

- Robust results to show the ability of H.E.S.S. II to lower the threshold below the 100 GeV limit
- Possibility to probe the EBL at higher redshifts
- Good overlap with the Fermi-LAT

- Still room for improvement!



PG 1553+113

THANK YOU!