Extending the IceCube Search for Astrophysical Neutrino Sources in the Northern Sky to 13 Years of Data

Elena Manao[1]*, Chiara Bellenghi[1], Martin Ha Minh[1], Tomas Kontrimas[1], Martin Wolf[1] for the IceCube Collaboration
[1] Technical University of Munich, *elena.manao@tum.de

IceCube Preliminary

$-\log_{10}(p_{local})$

NGC 1068

Credit: Hubble Space Telescope

NGC 4151

CGCG 420-015

NGC 7469

Credit: NASA/ESA/ A. van der Hoeven

X-ray bright non-blazar AGNs

- NGC 1068 is exceptionally bright in X-rays
- Assuming a correlation between X-ray and neutrino luminosities, search for neutrino emission from X-ray bright sources
- 47 AGNs tested for the first time by this analysis

Binomial Test: probability of finding a signal from a group of objects that are too weak to be interesting on their own but possibly significant as an ensemble

Results in evidence for a signal excess from 11 sources with a global significance of 3.3σ
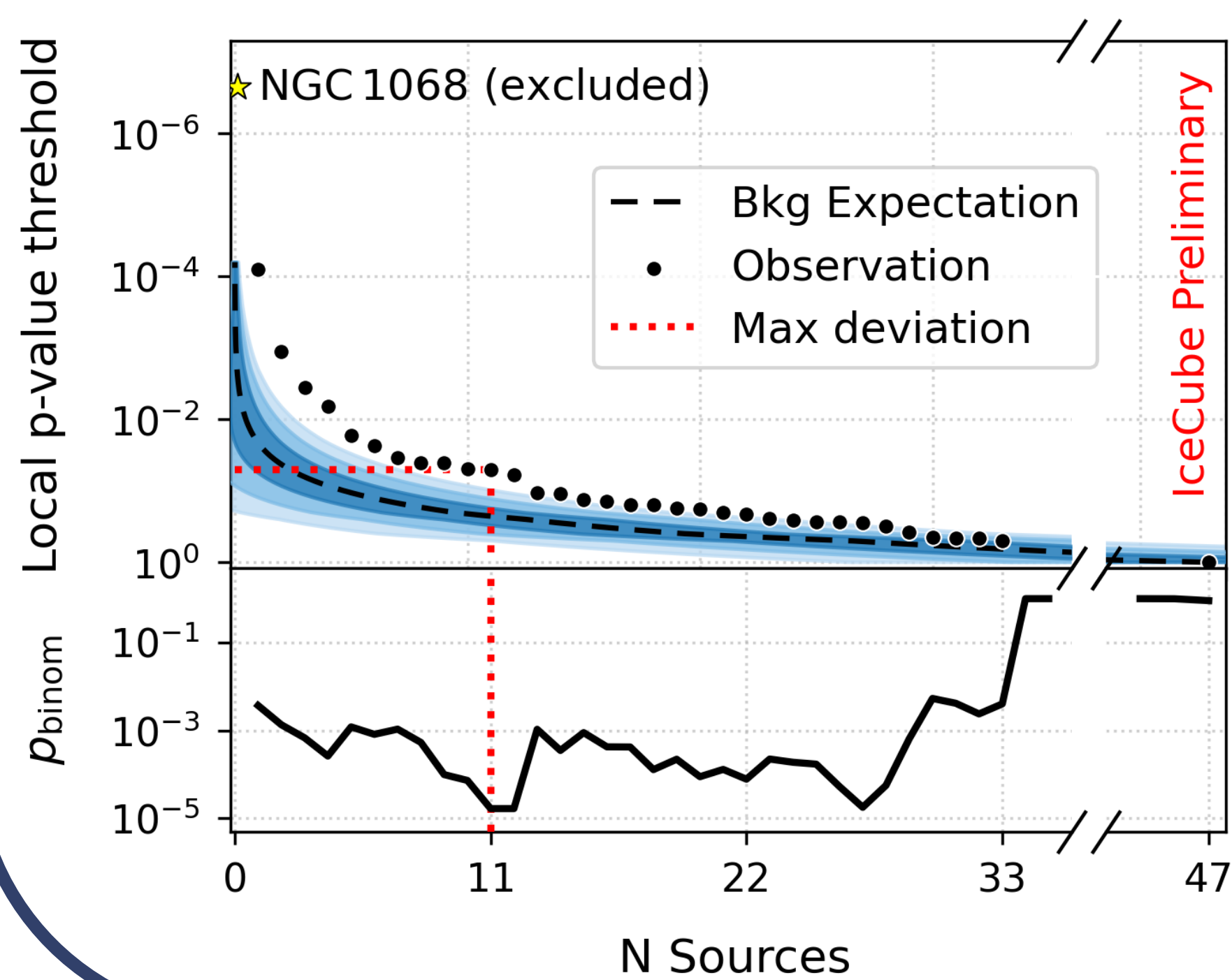
Most numerous excess of sources ever identified by IceCube provides indication of a possible population of neutrino emitters

The strongest emission in the Sky
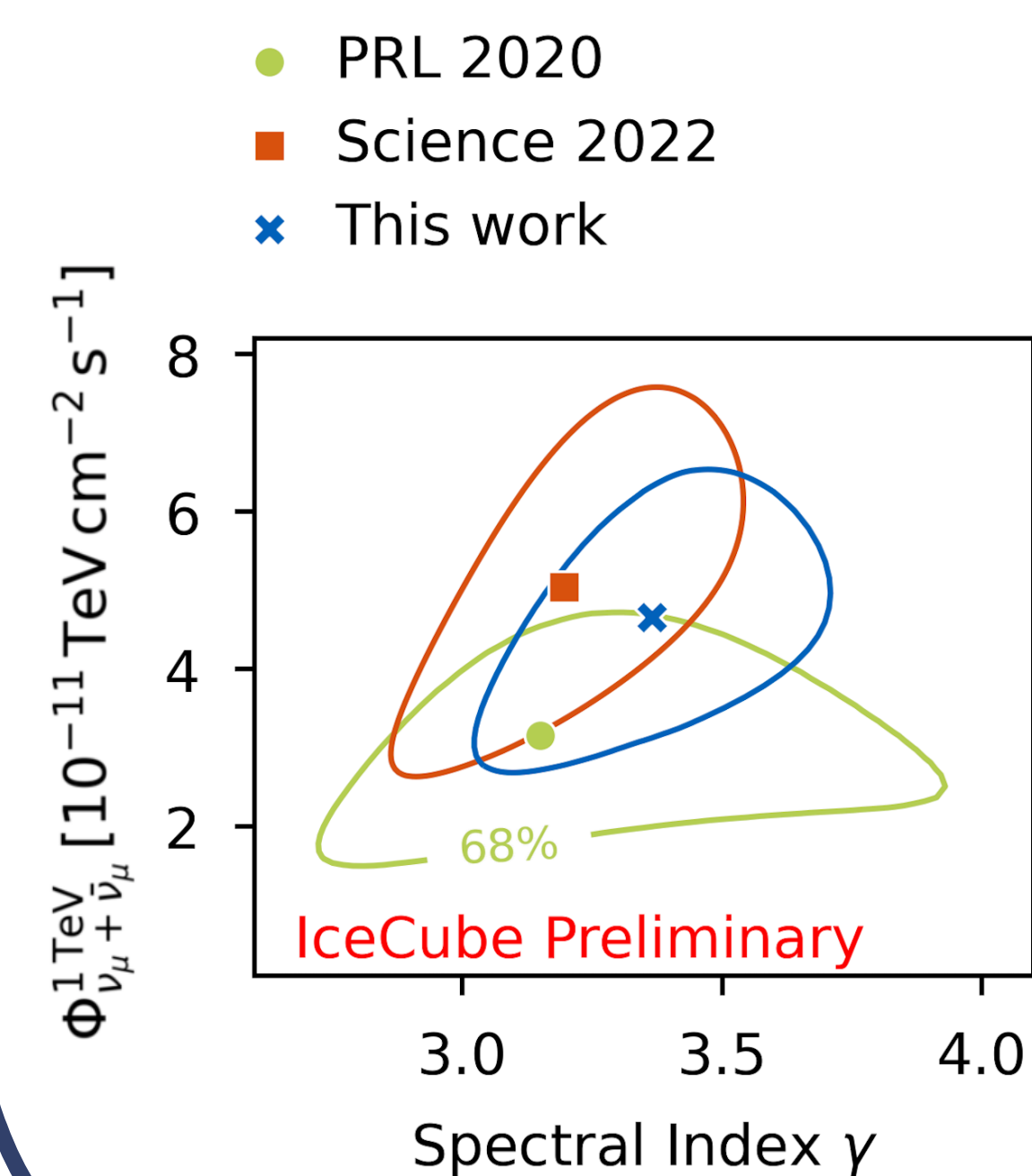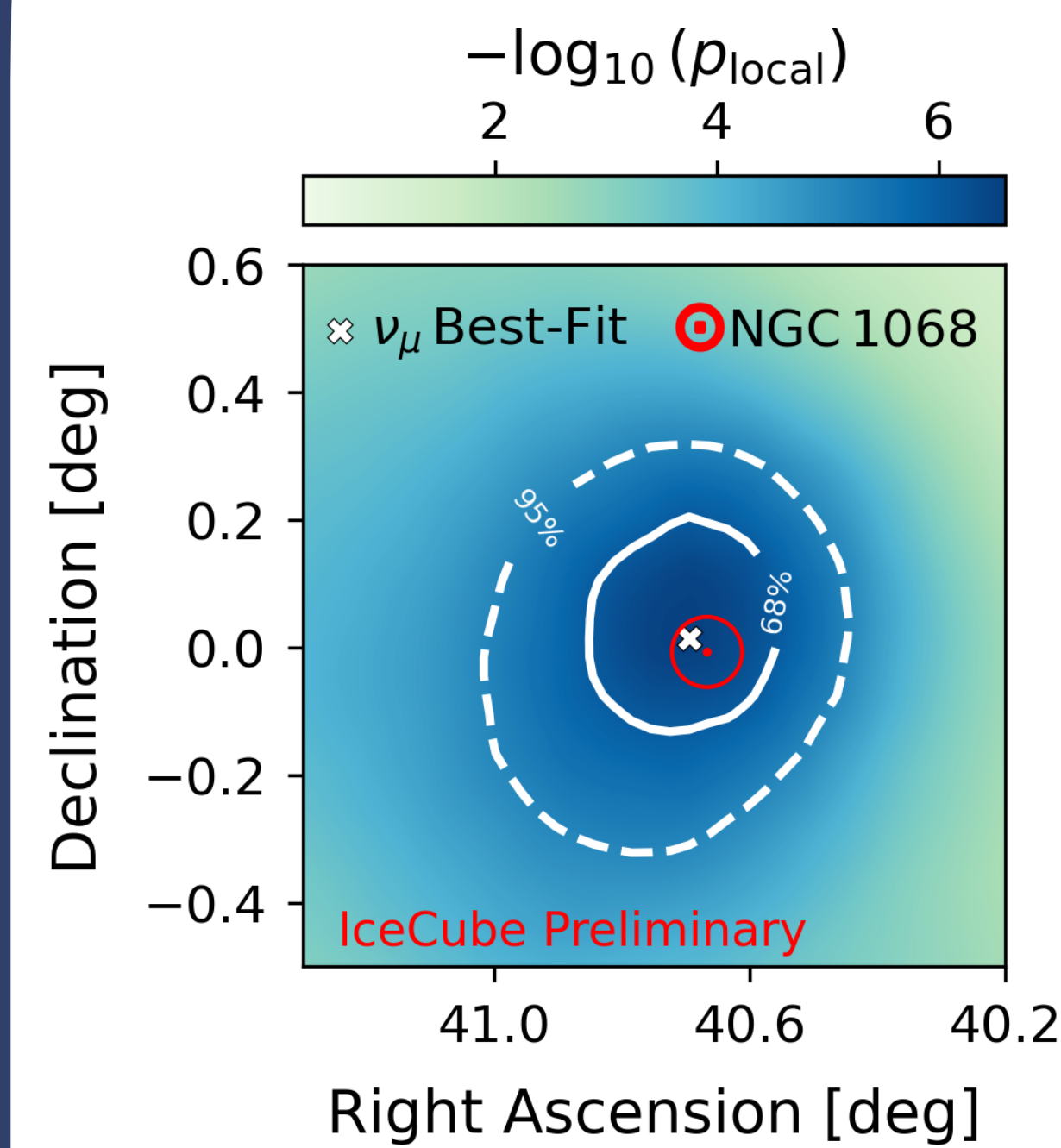
- **This work:** neutrino emission from NGC 1068 with a global significance **4.0σ**
- **Previous result:** **4.2σ evidence** (Abbasi et al. Science 2022)
- Significance decreases, but new events contribute to the excess
- **Next step:** better characterisation of the signal

Dataset

13 years of neutrino-induced muon tracks from the Northern Sky.

9 years dataset (previous work)

13 years dataset
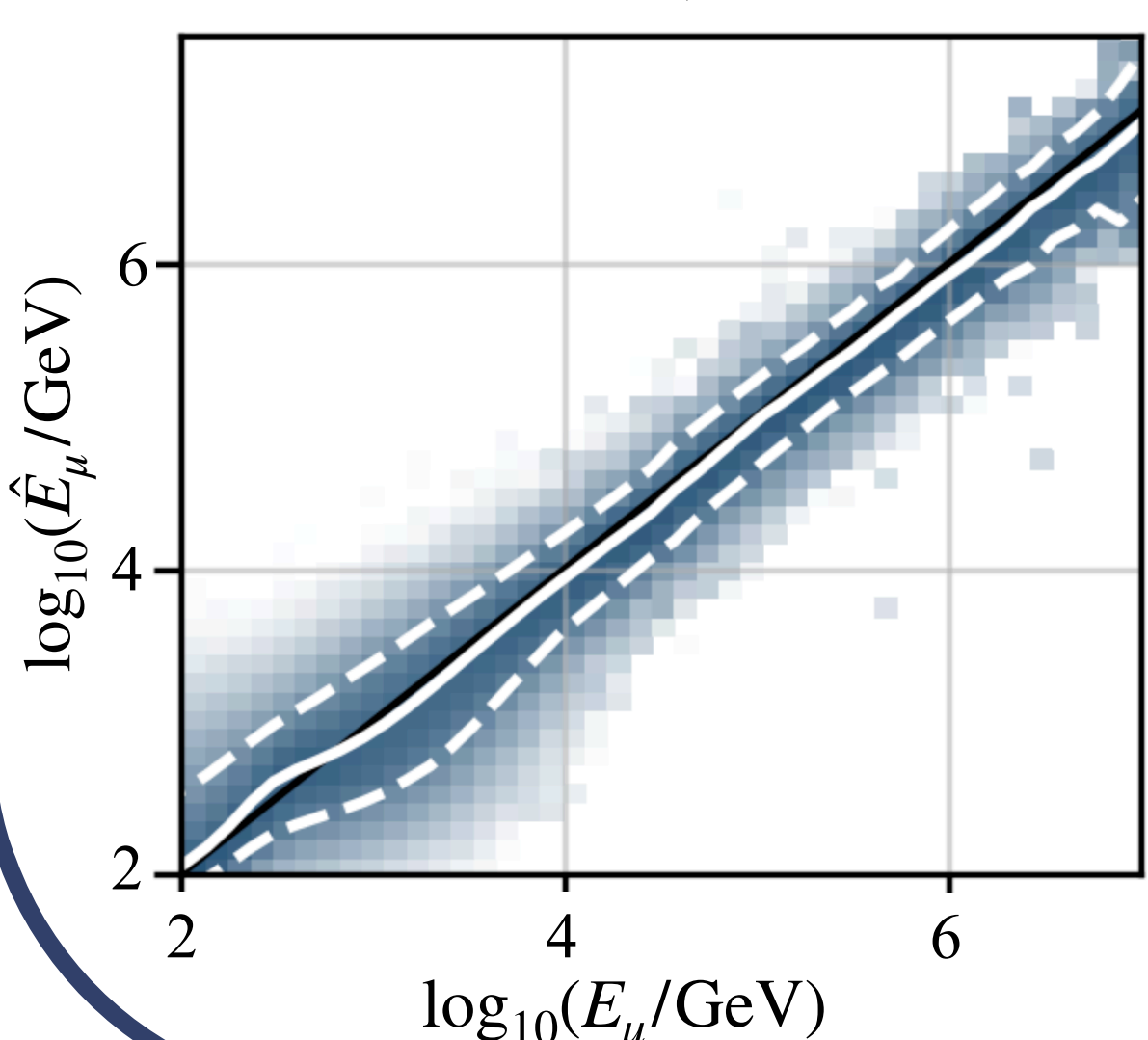
Good resolution both for energy and angular reconstructions
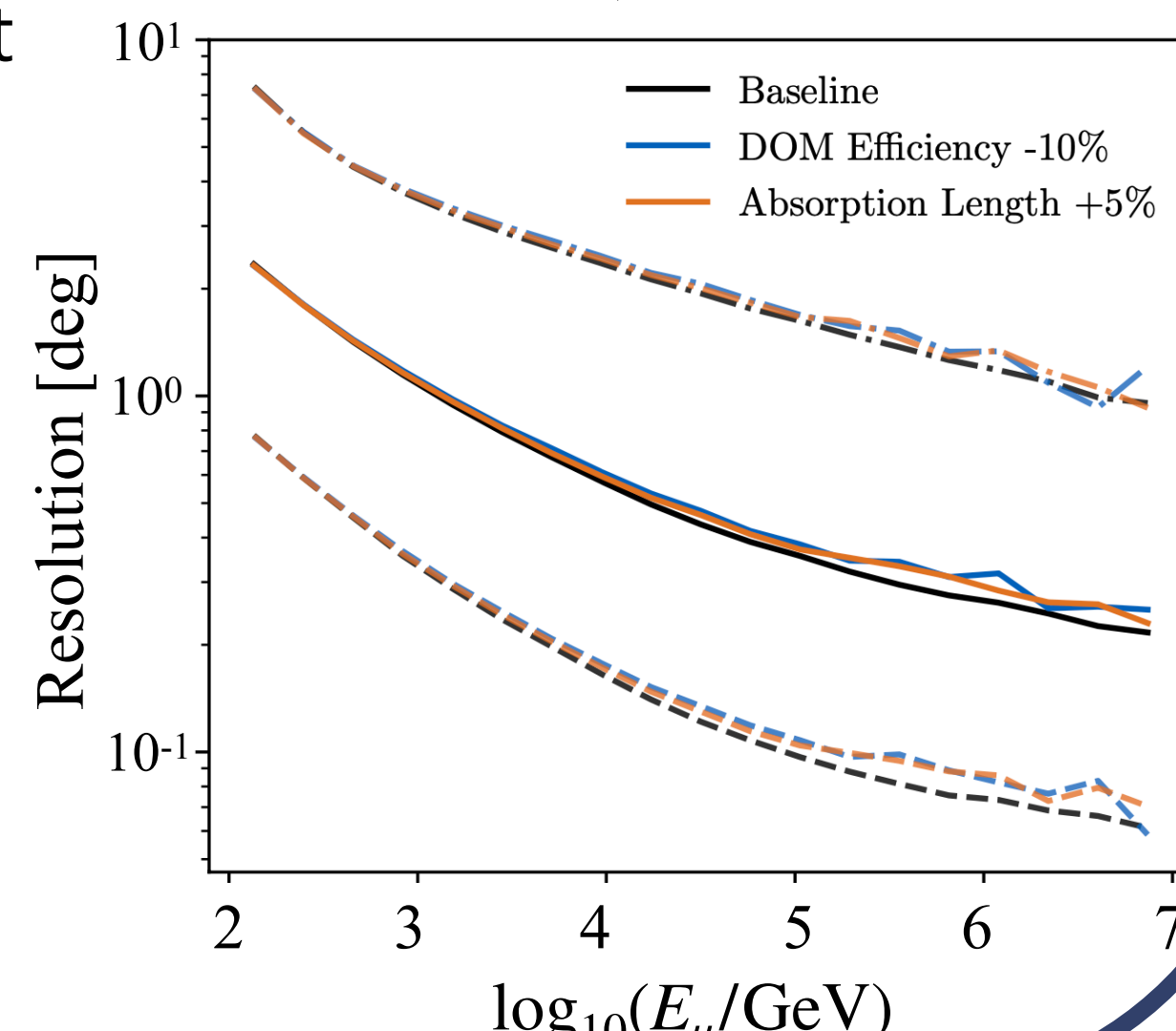
Method

Unbinned likelihood analysis:

$$\mathscr{L} = \prod_{i=1}^{N} \frac{n_s}{N} S_i + \left(1 - \frac{n_s}{N}\right) B_i$$

Goal: find an excess of events that deviates from the background only hypothesis

Fit parameters: mean number of events $- n_s$
spectral index $- \gamma$ of S_i