# Analysis framework for Multi-messenger Astronomy with IceCube

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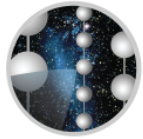
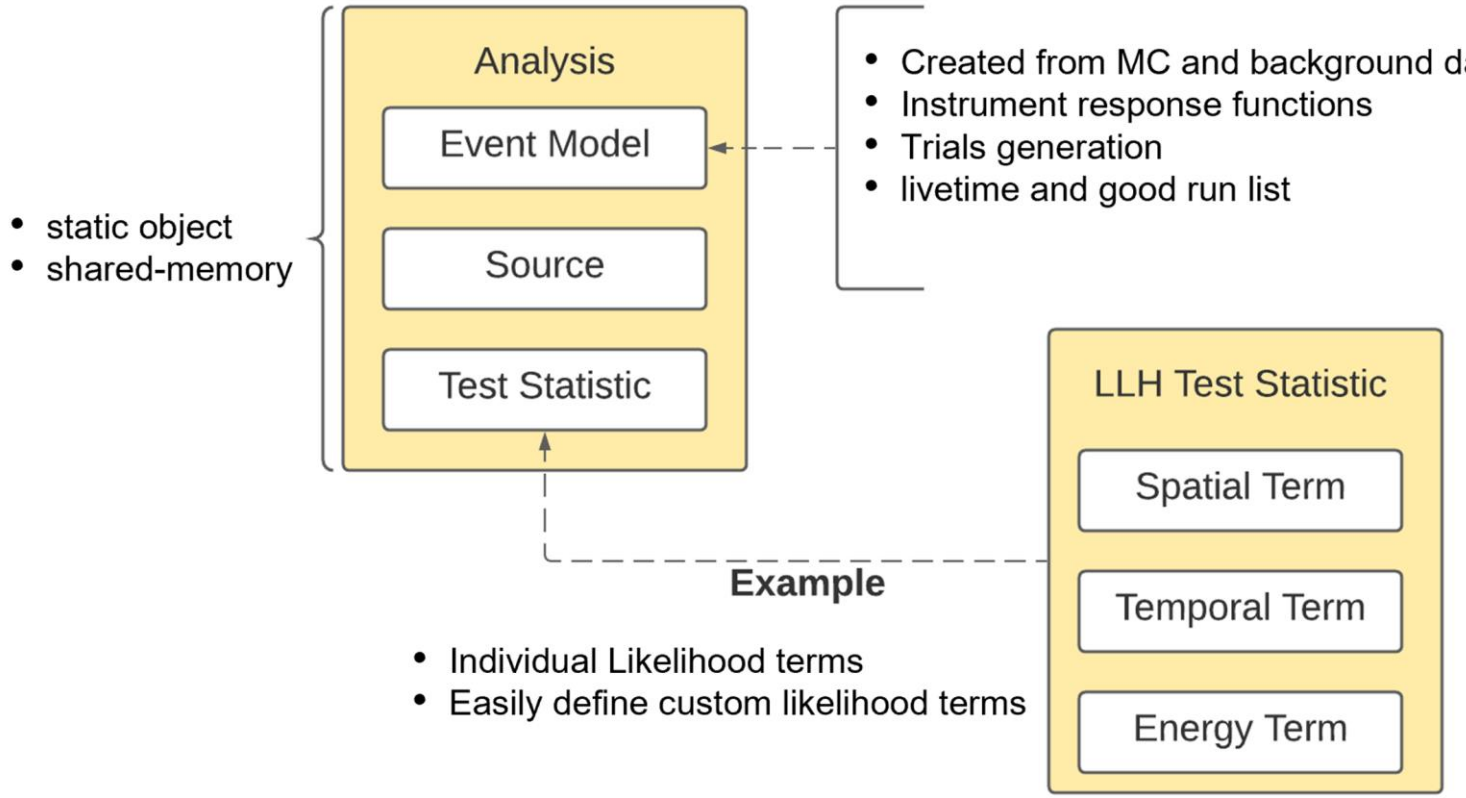


ICECUBE SOUTH POLE NEUTRINO OBSERVATORY

# Multi-messenger Astronomy with IceCube

- A new analysis software
- Compatible with Multi-Mission Maximum Likelihood (3ML) framework
- Joint-fit across different instruments

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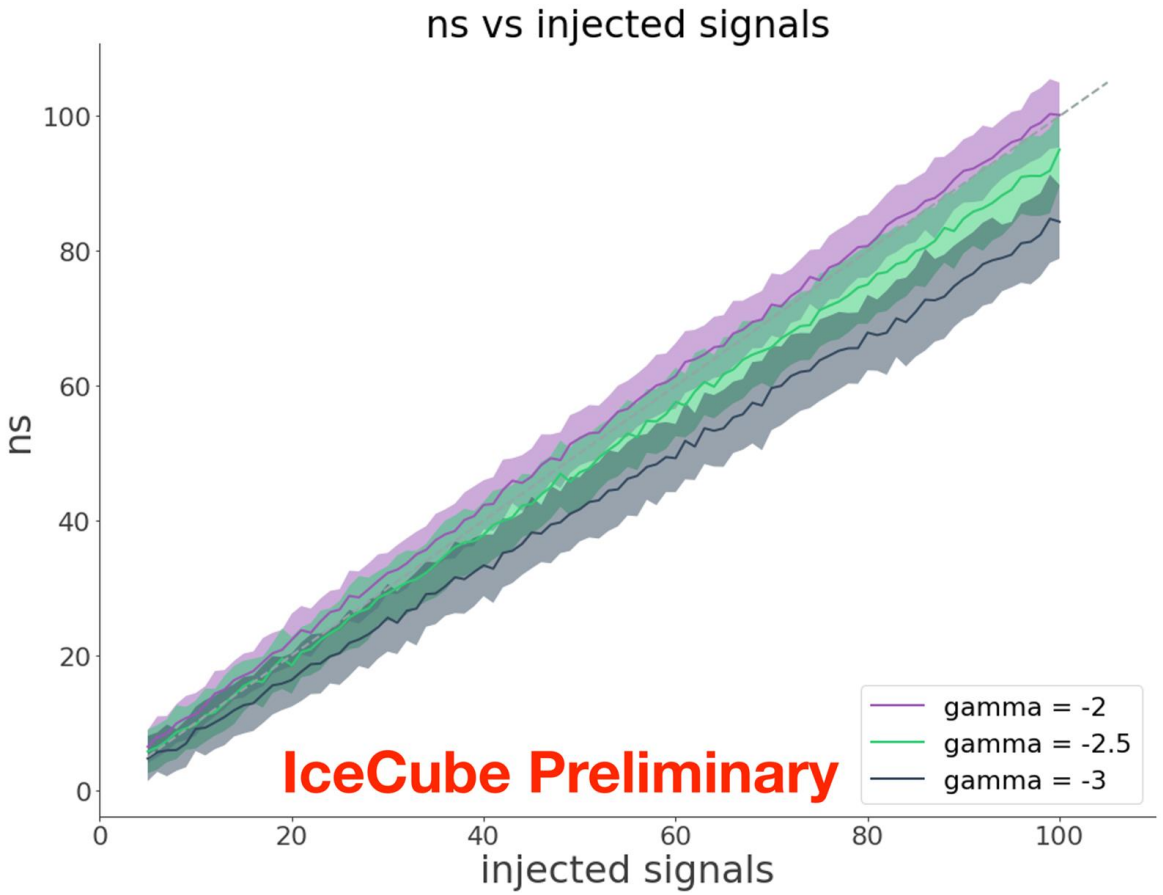
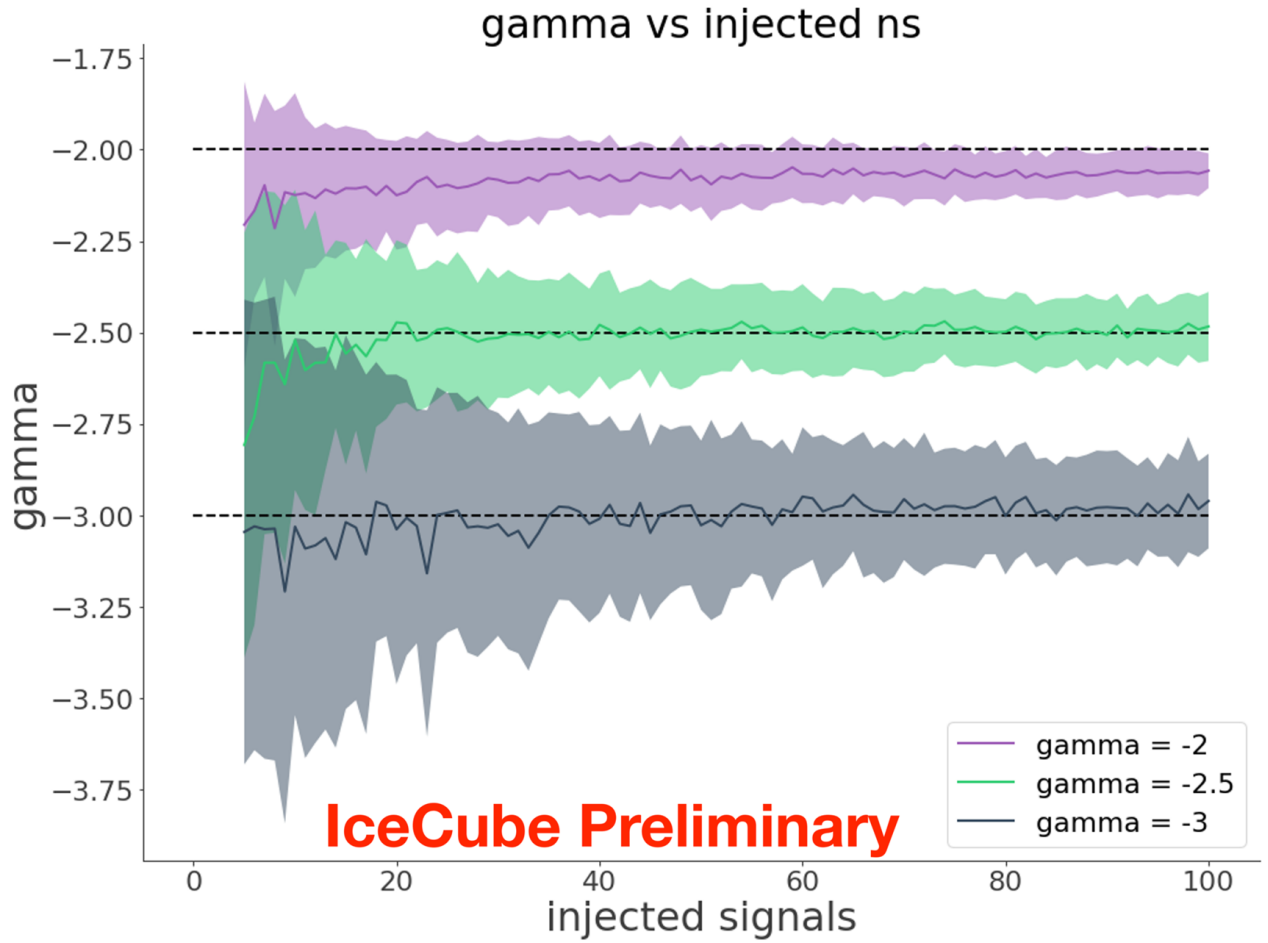
NSF

# Signal and spectral bias

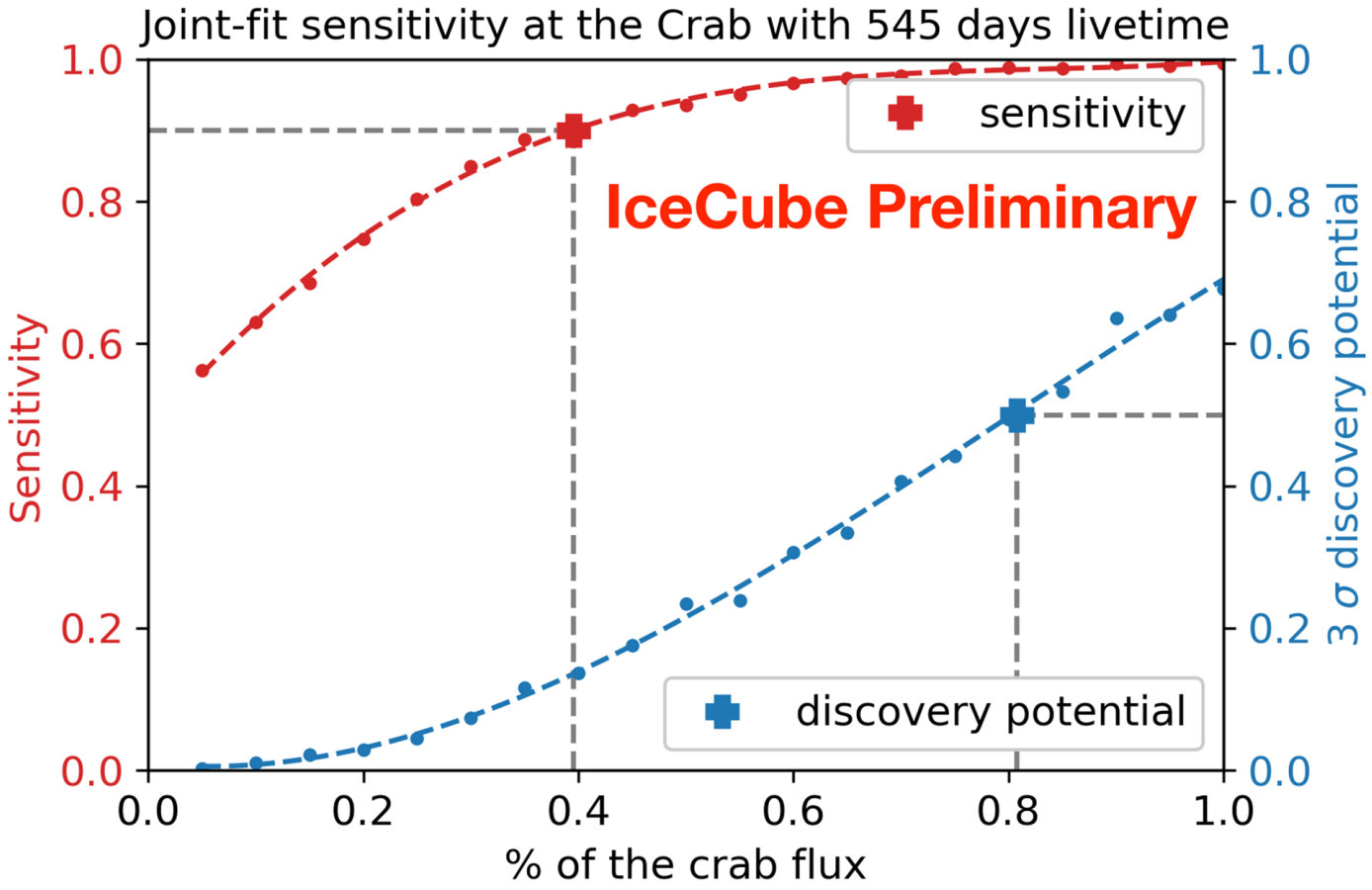



Ability for the software to fit the correct spectrum

# Example Joint-fit with HAWC

- Fitting HAWC public data on Crab nebula[1][2] and IceCube data with injected neutrinos
- Constraints the spectral shape of gamma rays and neutrino to be the same




Validating the joint-fit capability

# Reference

[1] A. Abeysekara, A. Albert, R. Alfaro, C. Alvarez, J. Álvarez, R. Arceo, J. Arteaga-Velázquez,H. A. Solares, A. Barber, N. Bautista-Elivar, et al. The Astrophysical Journal 843 no. 1, (2017) 39

[2] A. Abeysekara, A. Albert, R. Alfaro, C. Alvarez, J. Álvarez, J. A. Camacho, R. Arceo,J. Arteaga-Velázquez, K. Arunbabu, D. A. Rojas, et al. The Astrophysical Journal 881 no. 2,(2019) 134