

Advanced statistic projects advertisement

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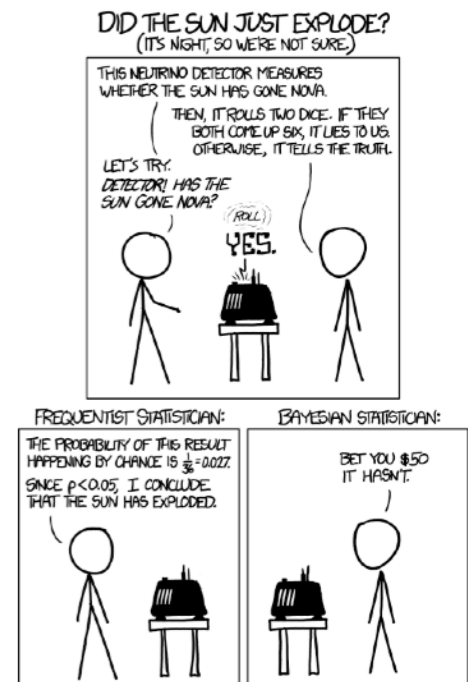
Madison, bootcamp, 2017



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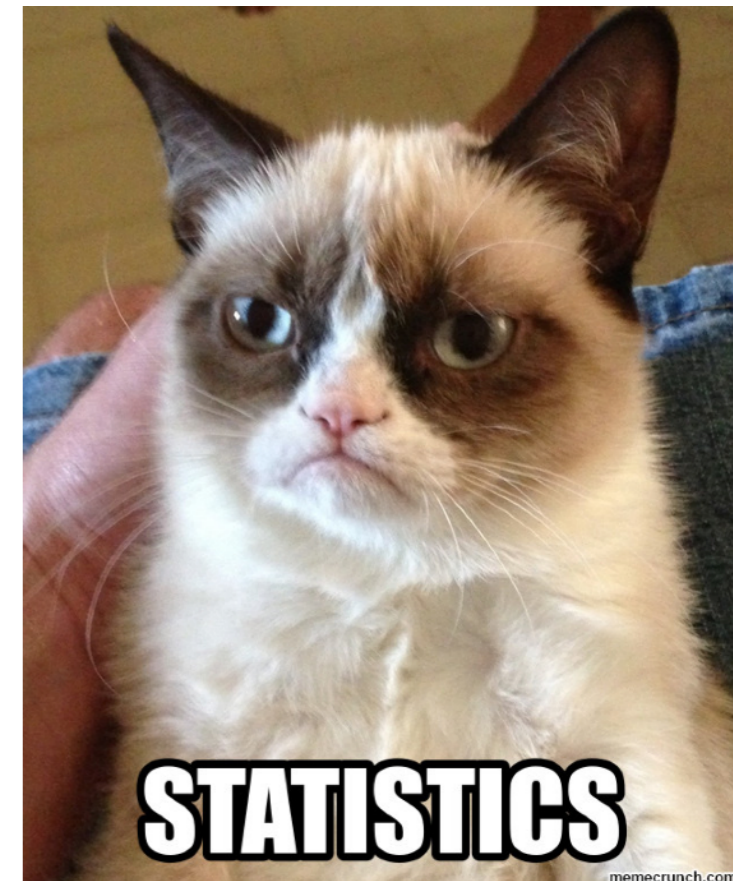
**Massachusetts
Institute of
Technology**



We propose **two projects** to illustrate the usage of *cool* statistical techniques:

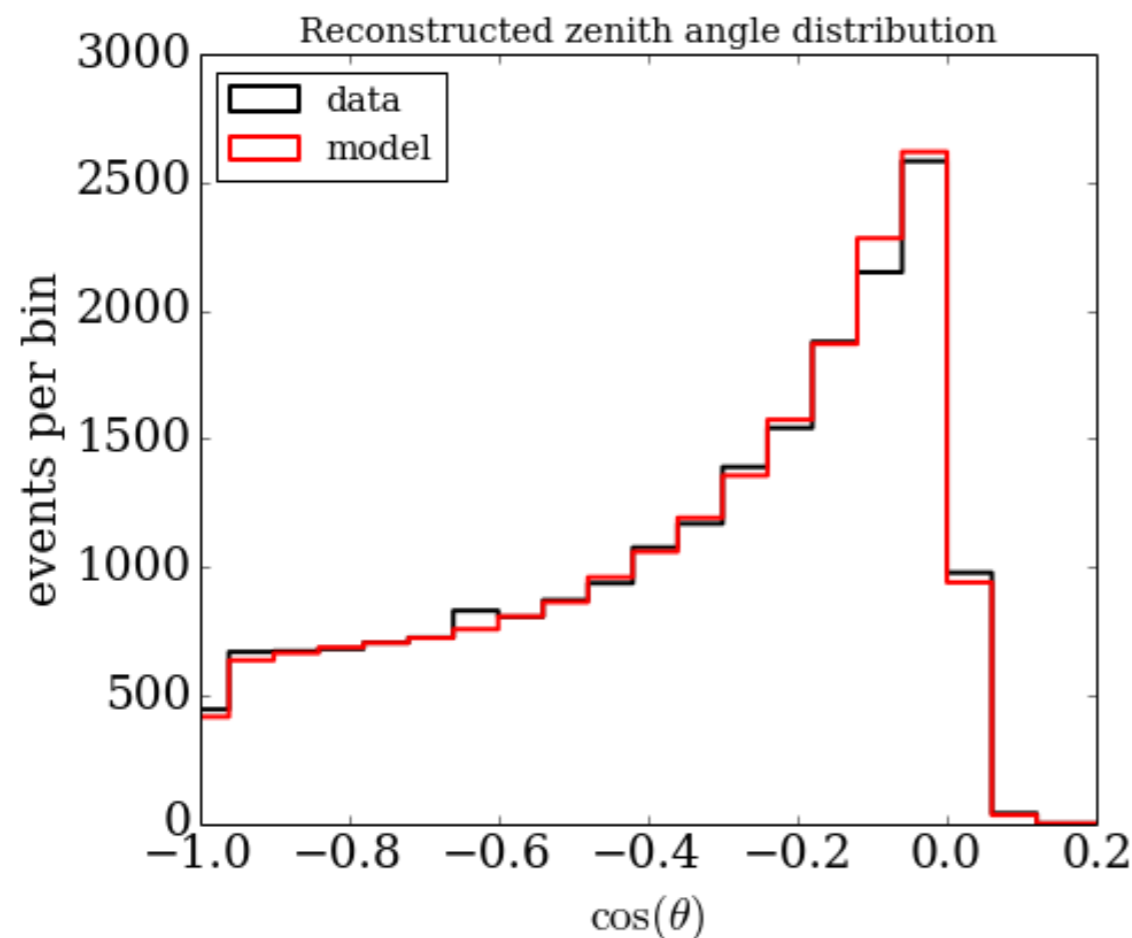
A *Toy study* of the atmospheric neutrino distribution.

B Point Source *stacking* analysis with the HESE events.



A Toy study of the atmospheric neutrino distribution.

- In Brief: You will be given atmospheric neutrino data and a *toy model* that explains the data. The model has several *parameters*. You have to find the confidence (credibility) regions of the parameters.

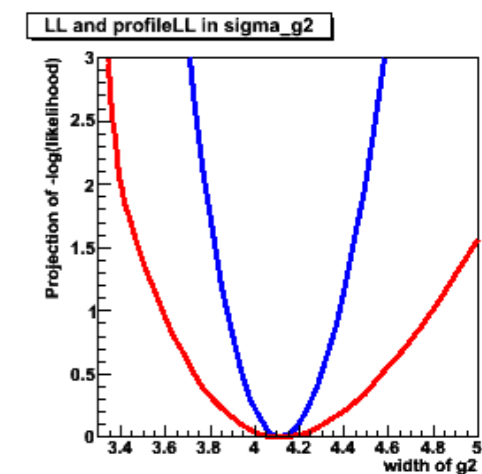
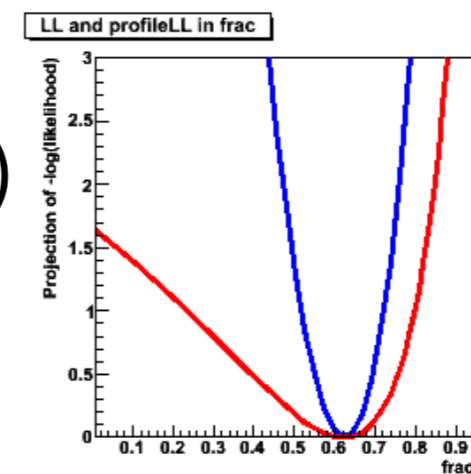
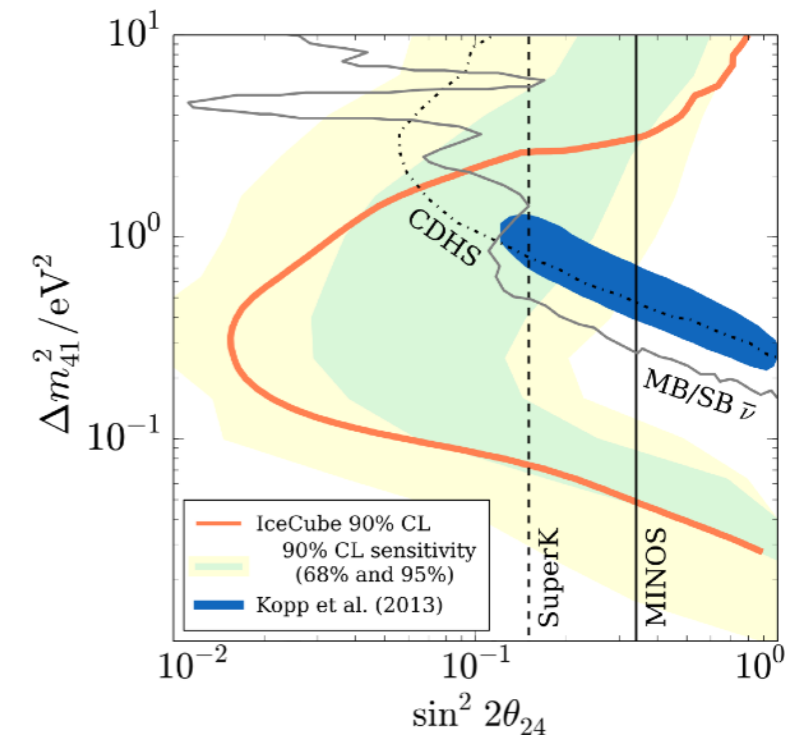


model:

$$\phi_{\text{atm}}(E_\nu, \cos \theta) = N_0 \left(\phi_\pi + R_{\pi/K} \phi_K \right) \left(\frac{E_\nu}{E_0} \right)^{-\Delta\gamma}$$

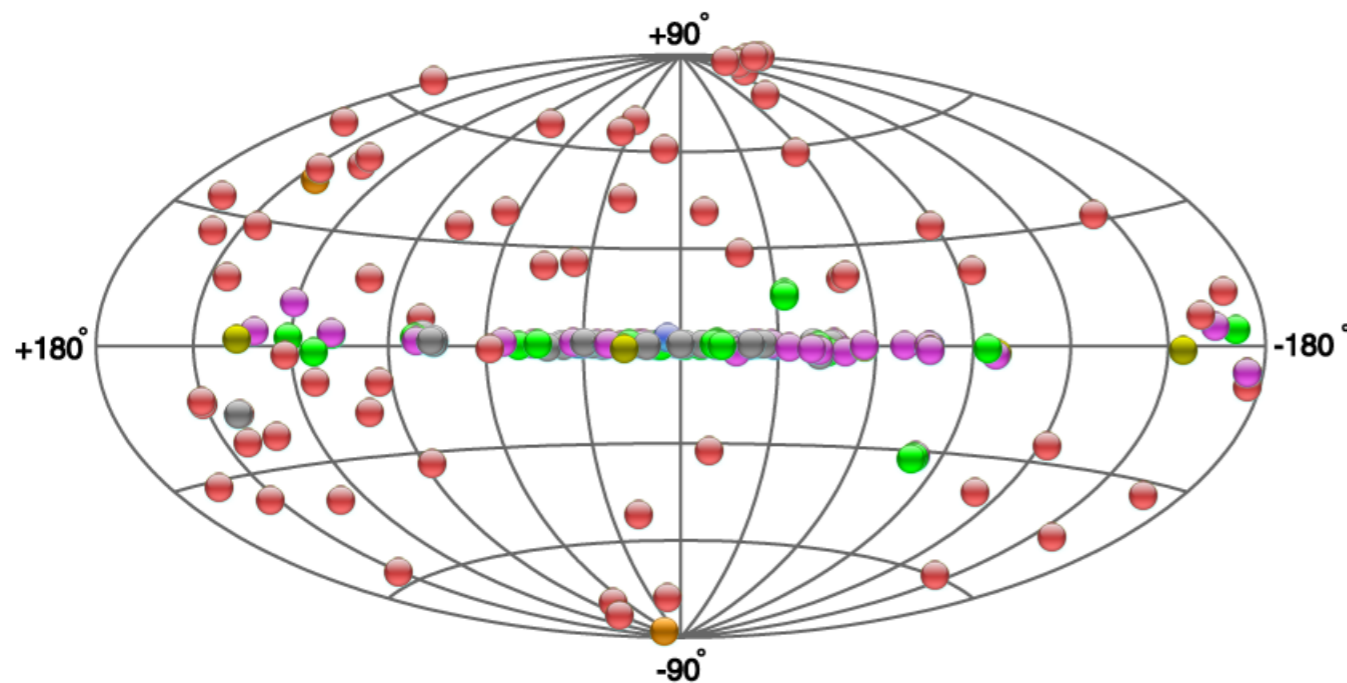
A *Toy study* of the atmospheric neutrino distribution.

- Things we will discuss:
 - ★ Binned likelihood construction.
 - ★ Nuisance parameters and priors.
 - ★ Estimation of confidence limit ranges using the *brazilian* construction.
 - ★ Likelihood profiling and confidence interval. (frequentist)
 - ★ Likelihood marginalization and credibility region. (bayesian)

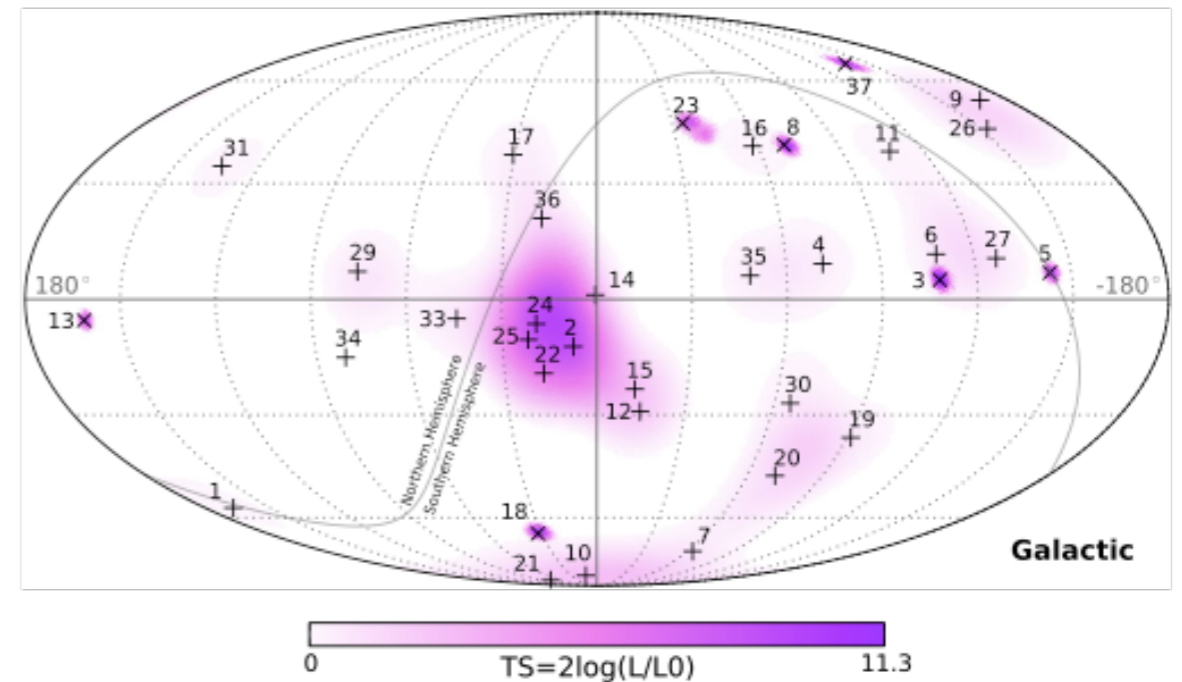


B Point Source *stacking* analysis with the HESE events.

- In Brief: You will be given the HESE 3 year sample and several catalogs. You have to find if there is evidence of spacial correlation between the two sets.



(TeVcat)



(HESE skymap)

B Point Source *stacking* analysis with the HESE events.

- To make it more interesting we have created *fake* catalogs too. Some are correlated, some are not. You have to find out.

- Things we will discuss:

- ★ The PS stacked likelihood and test statistic.
- ★ Hypothesis rejection in the bayesian construction.
- ★ Hypothesis rejection in the frequentist construction (p-value calculation using *scrambling*).

