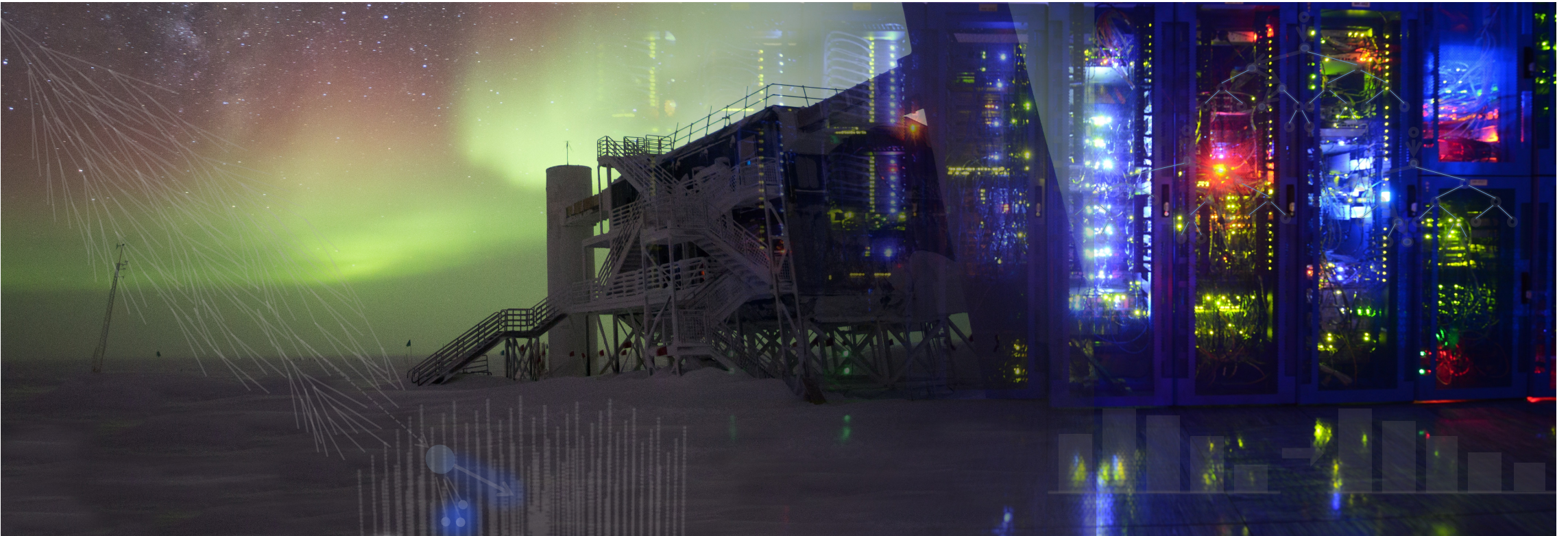




## Unfolding of the Atmospheric Muon Neutrino Spectrum with IceCube

Neutrinos



### Neutrinos

- X Solar
- X/✓ Supernovae
- ✓ Cosmic
- ✓ Atmospheric





# ICECUBE

SOUTH POLE NEUTRINO OBSERVATORY



## IceCube Laboratory

Data is collected here and sent by satellite to the data warehouse at UW-Madison



## Digital Optical Module (DOM)

5,160 DOMs deployed in the ice

50 m

IceTop

1450 m

2450 m

IceCube detector

86 strings of DOMs, set 125 meters apart

DeepCore

Antarctic bedrock



## Amundsen-Scott South Pole Station, Antarctica

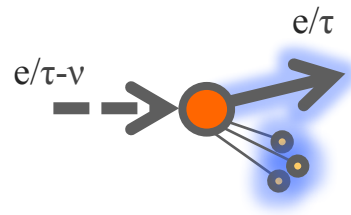
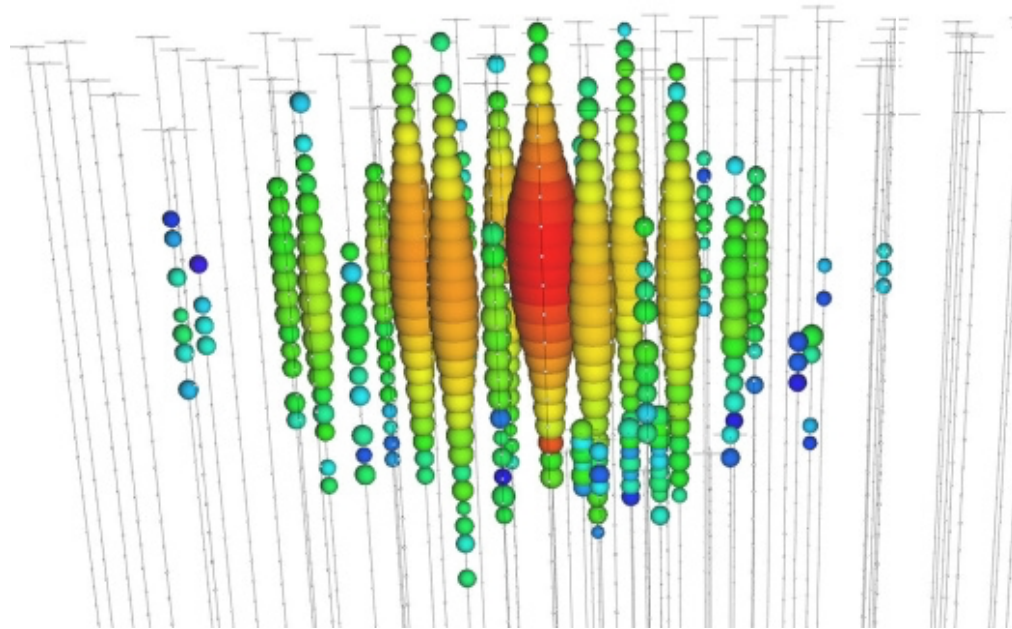
A National Science Foundation-managed research facility

60 DOMs on each string

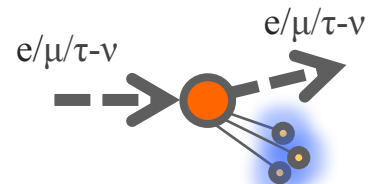
DOMs are 17 meters apart



## Cascades

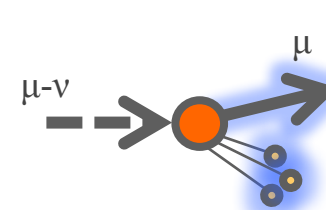
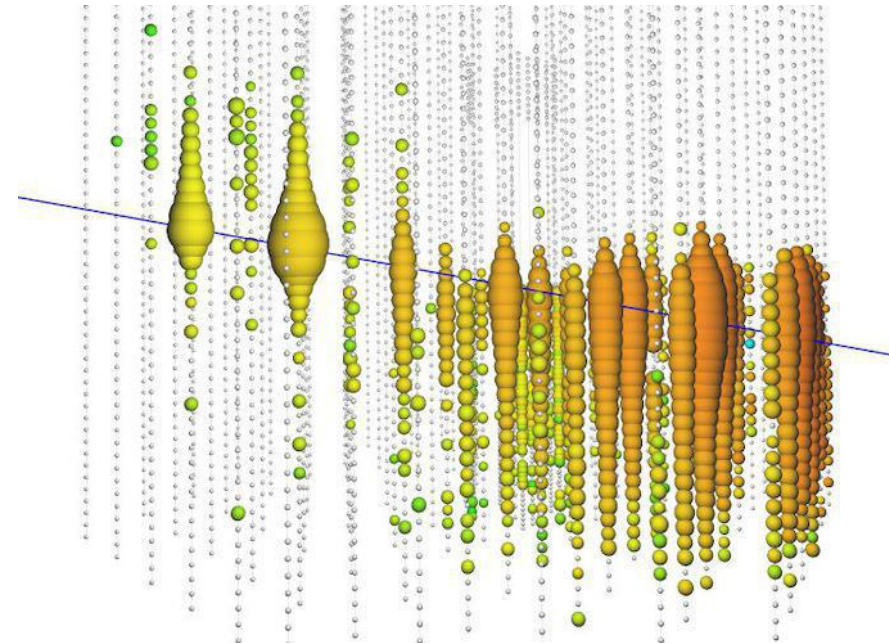


CC-Interaction  
 $e/\tau$ -Neutrino

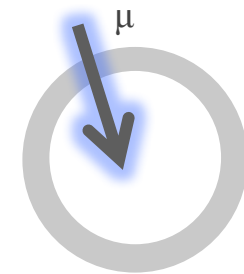


NC-Interaction  
 $e/\mu/\tau$ -Neutrino

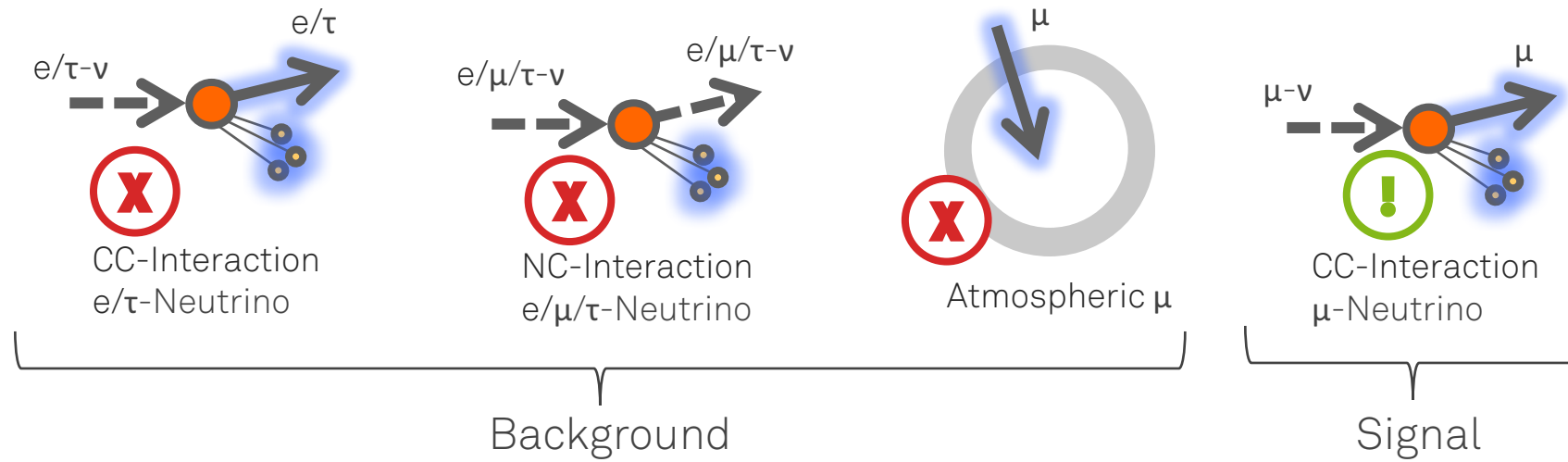
## Tracks



CC-Interaction  
 $\mu$ -Neutrino

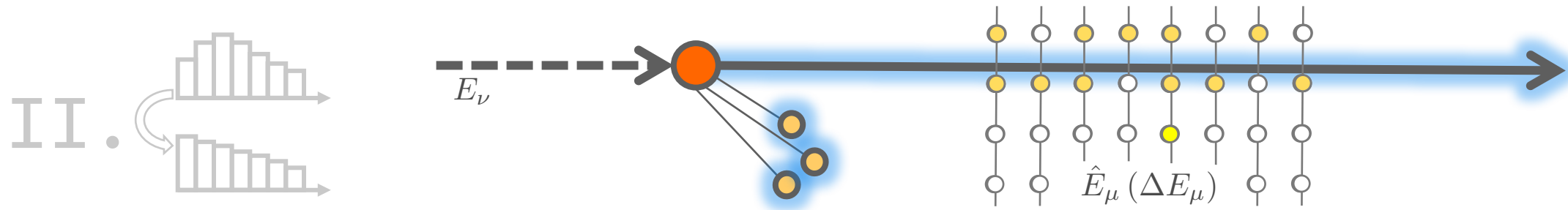
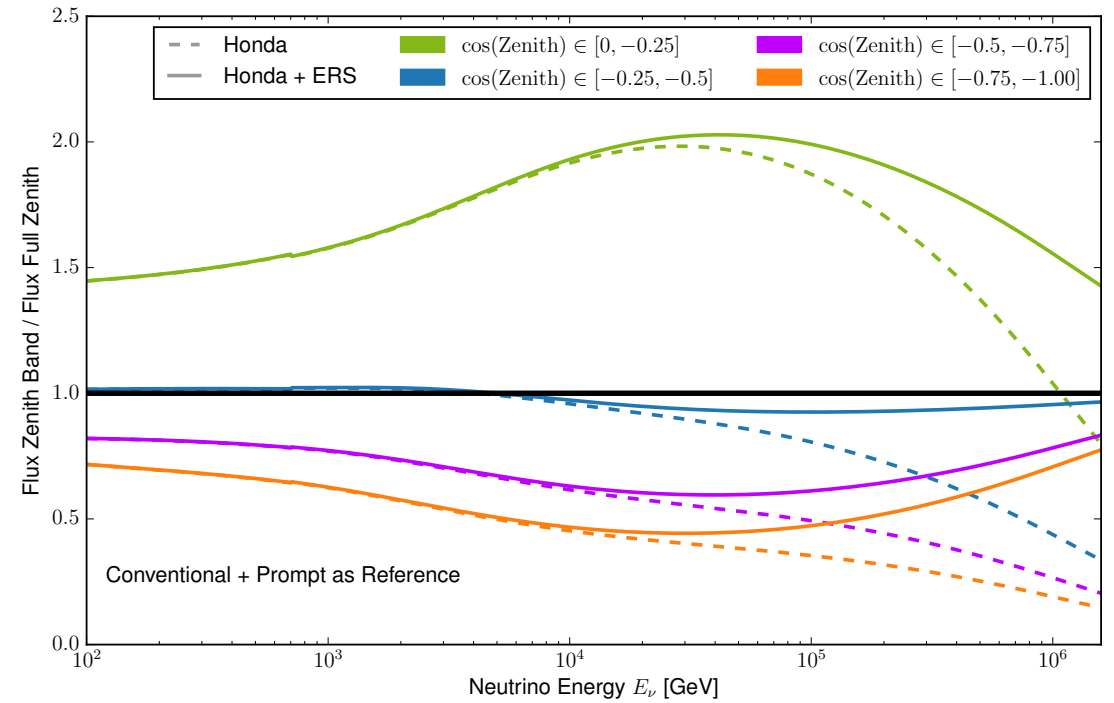
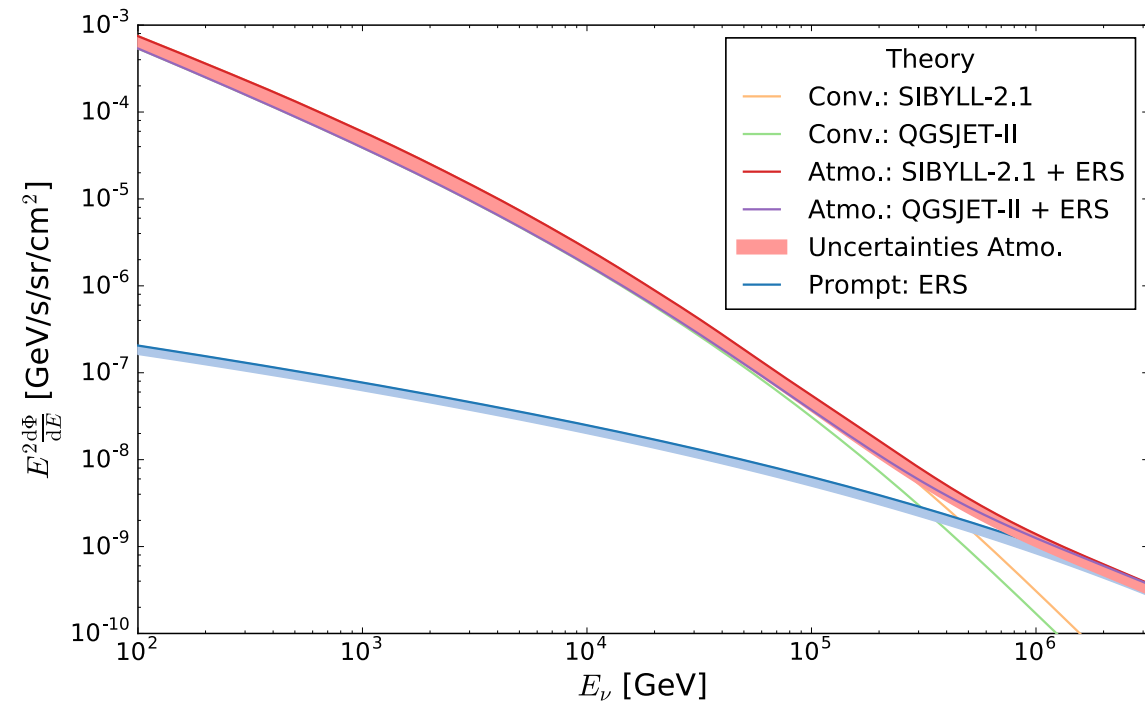


Atmospheric  $\mu$



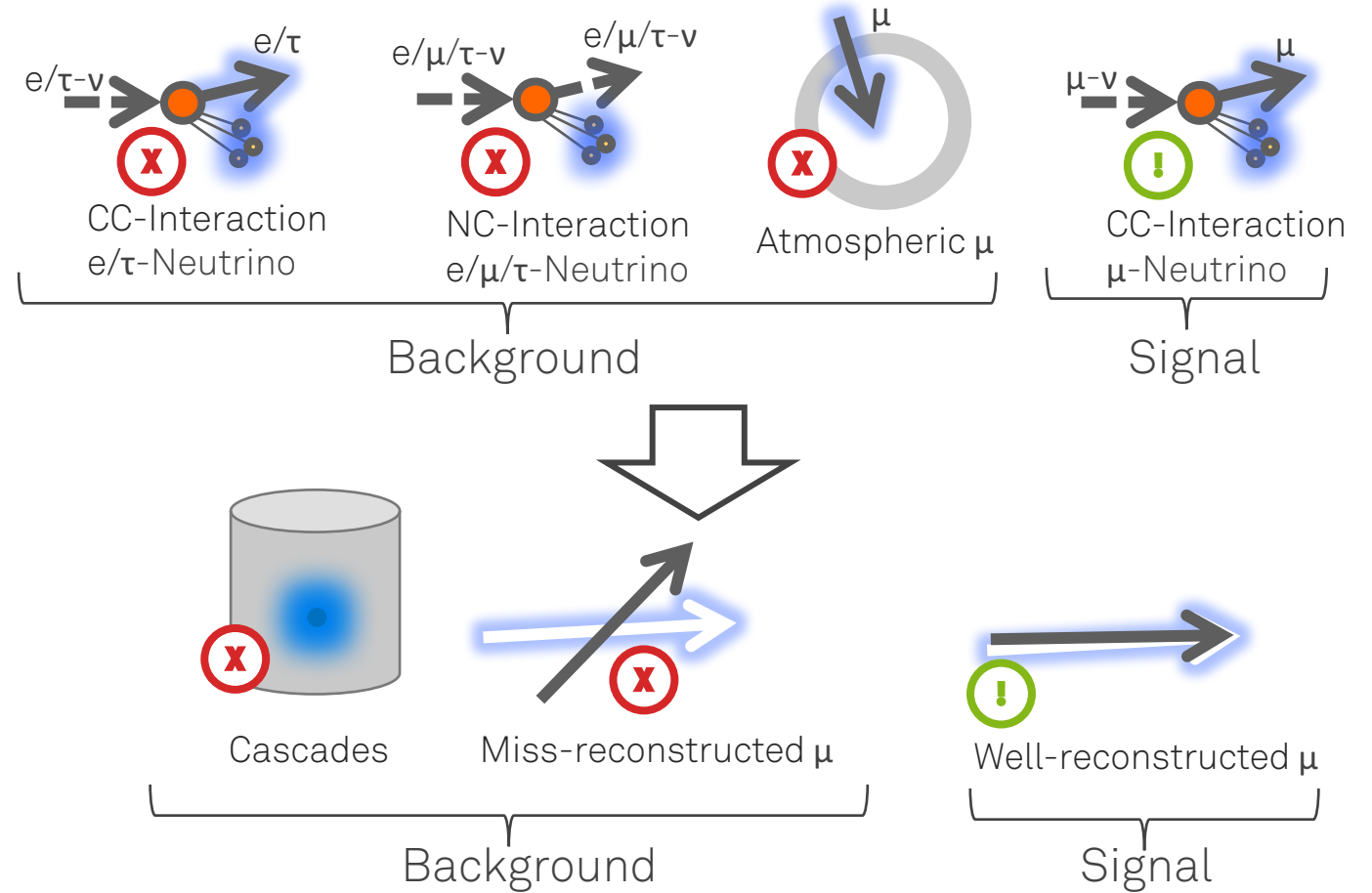
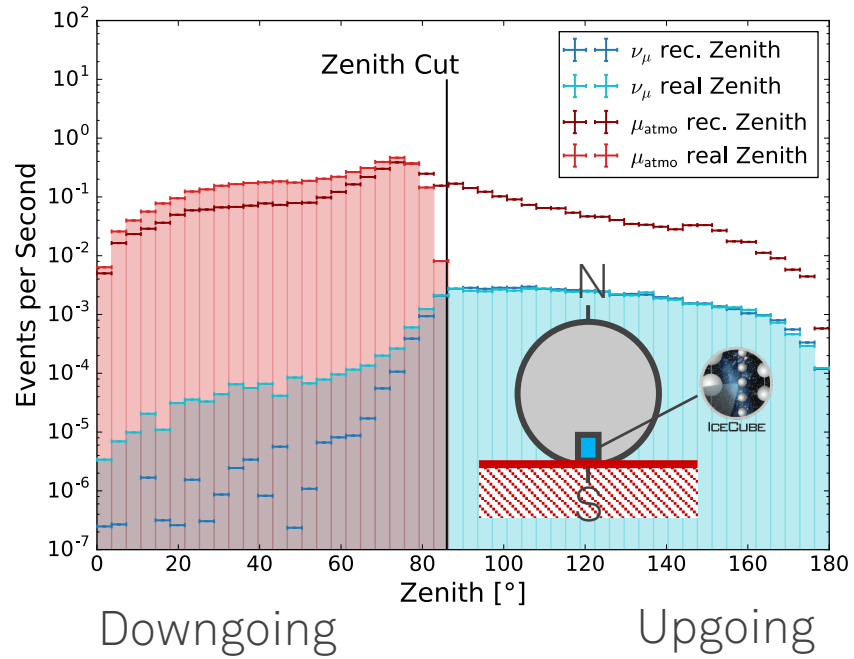
$$\frac{\text{Signal}}{\text{Background}} \approx \frac{1}{1000000}$$

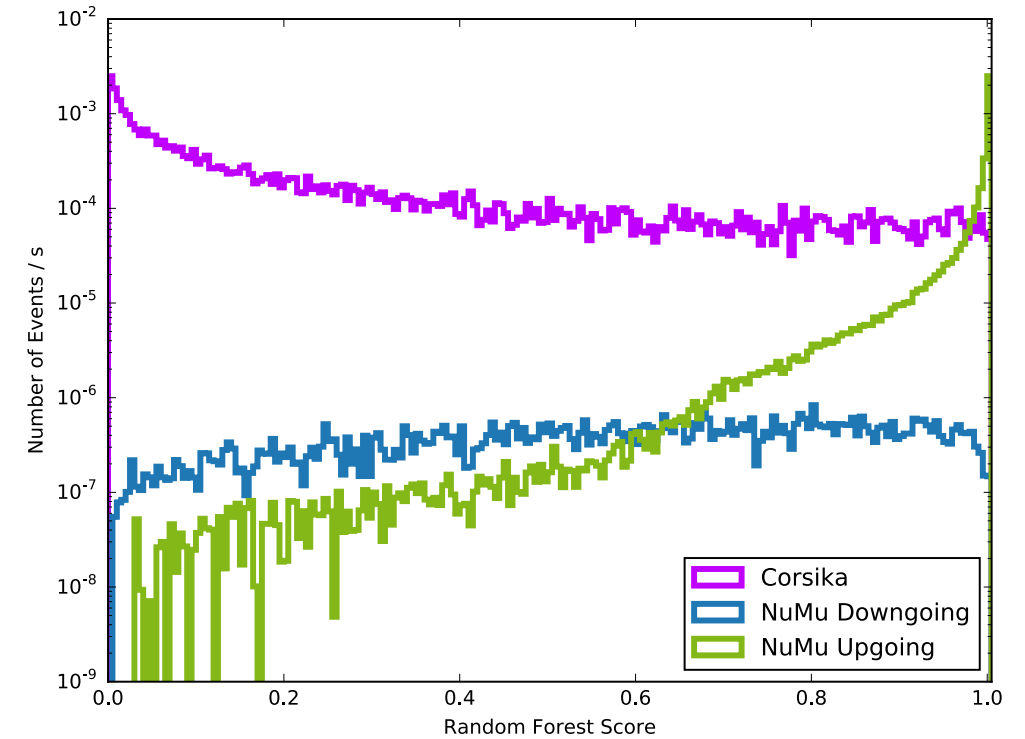
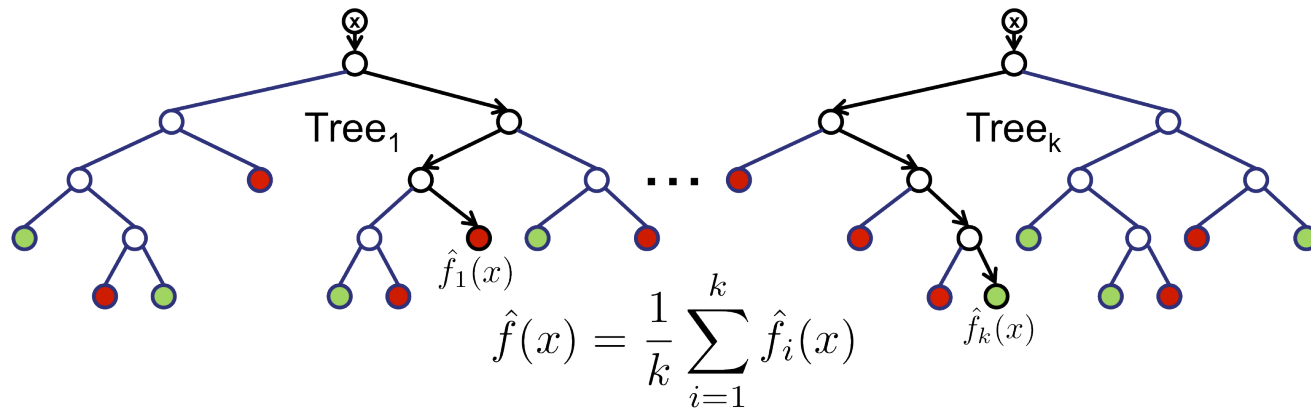




Separation



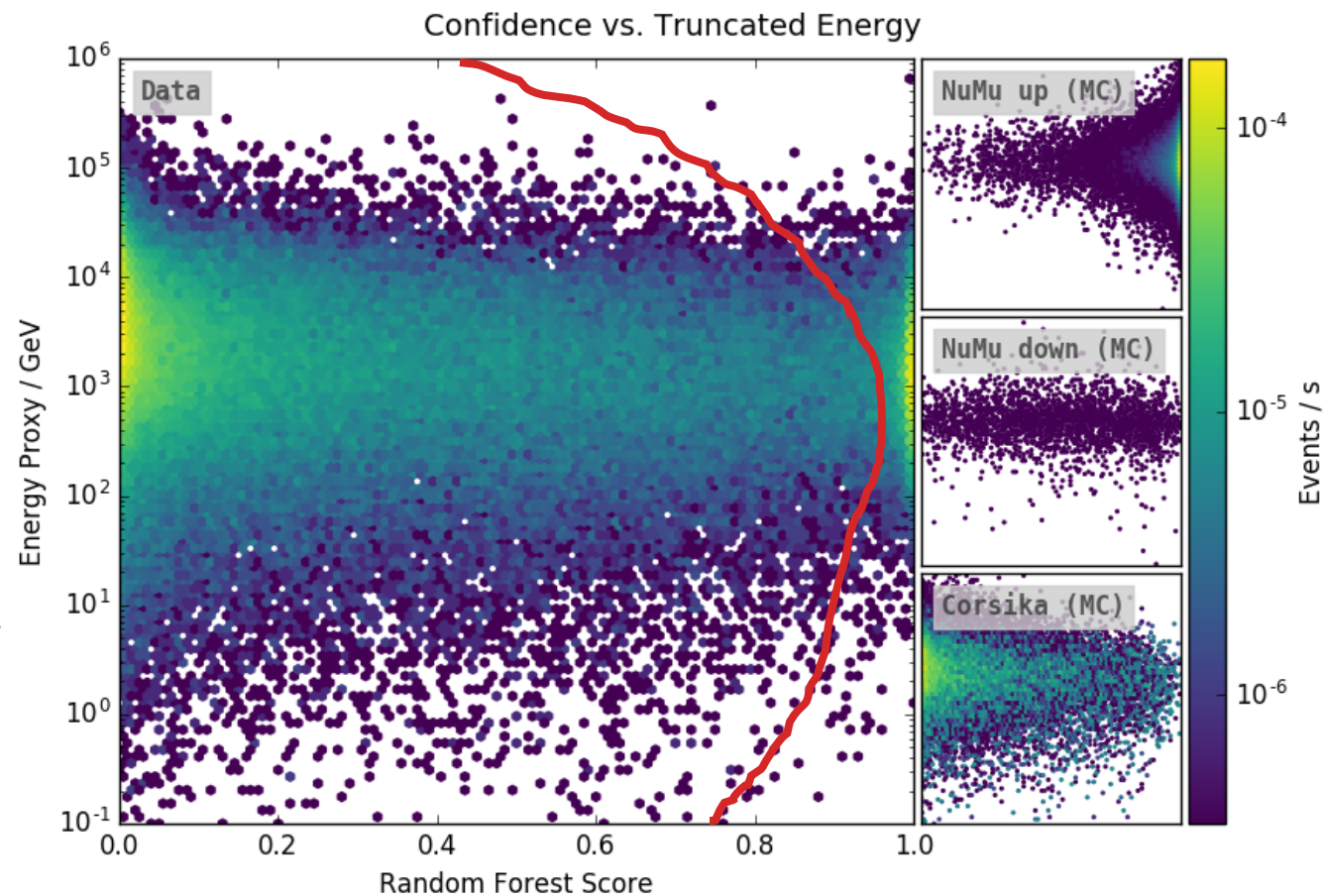




Cut on the Random Forest  
score depending on an  
energy estimator:

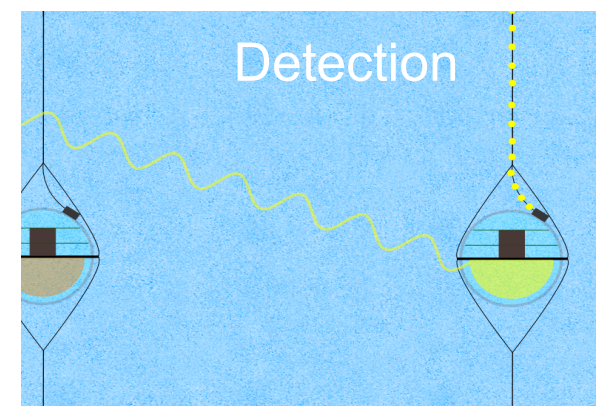
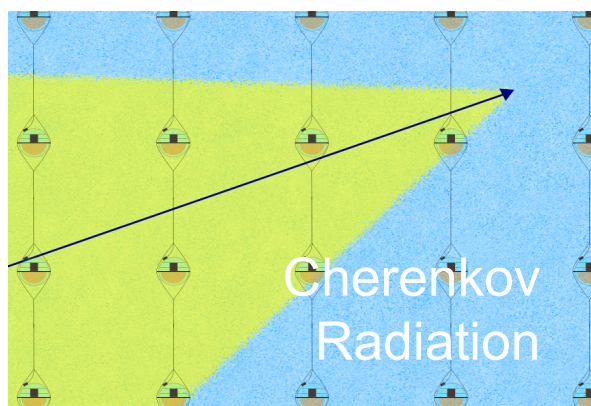
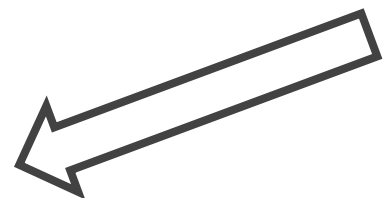
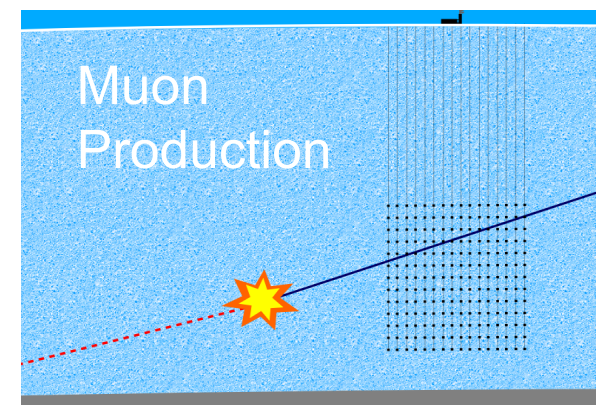
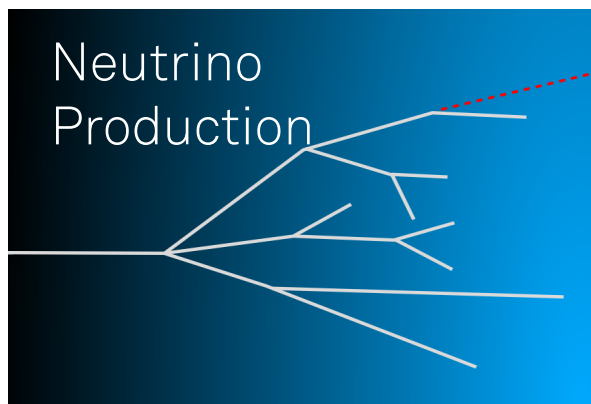
Optimized to fulfil local  
criteria e.g. sliding window  
with a minimal purity

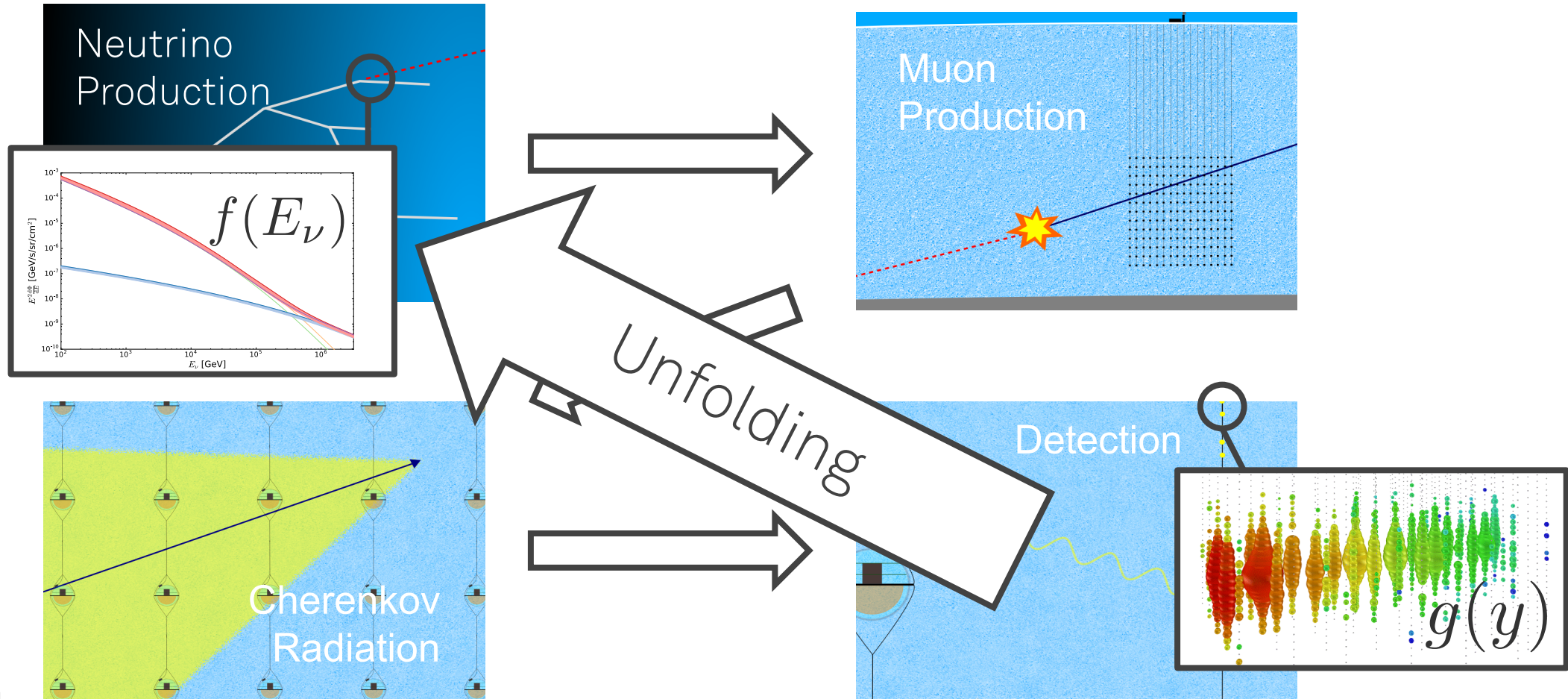
Expectations:  
90000 – 100000 Events per year  
~99% Purity



Unfolding







II. 

$$g(y) = \int A(E_\nu, y) f(E_\nu) dE_\nu$$

## Recent Results: ICRC'15

