Summary

of the Diffuse / Point Source session

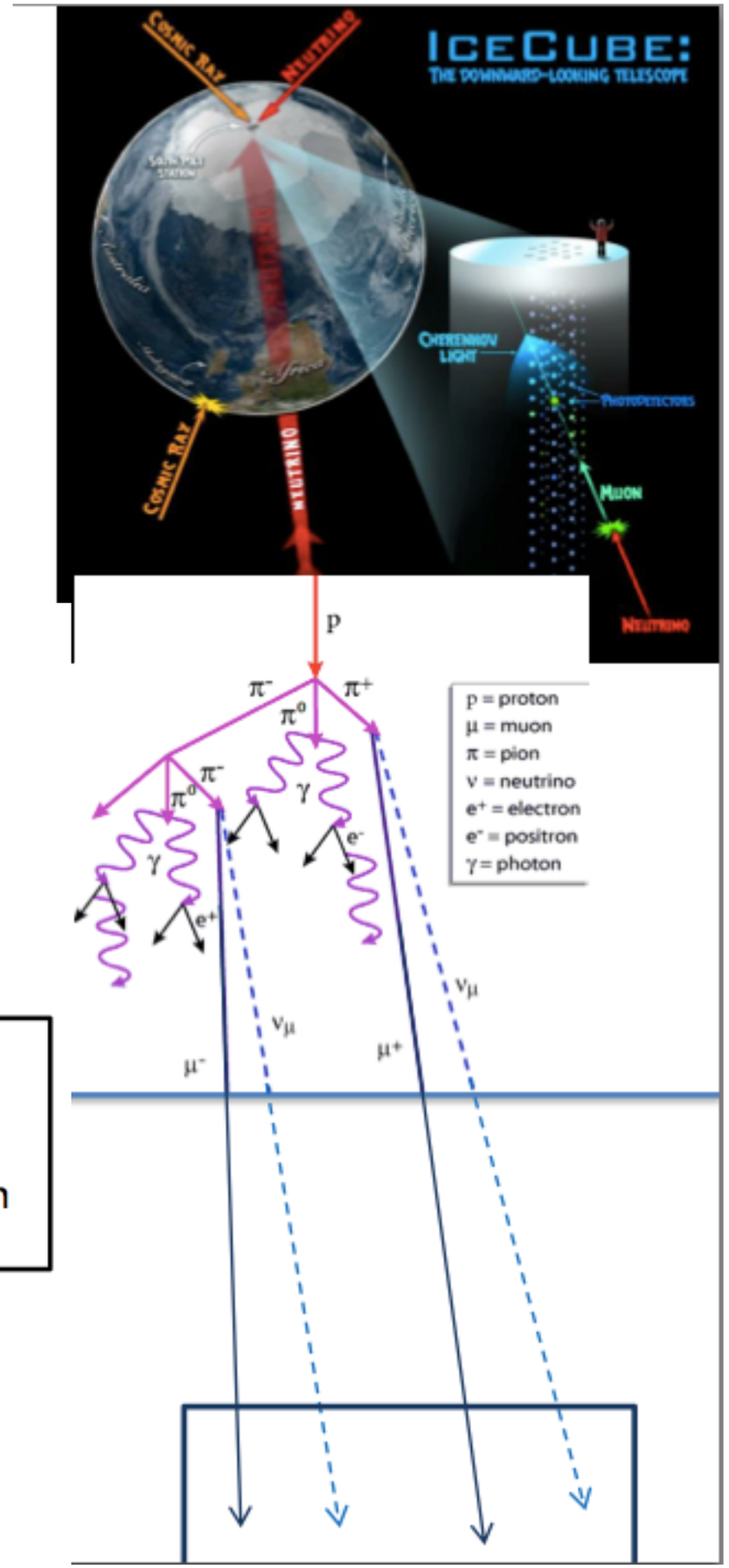
Jürgen Brunner & Markus Ackermann

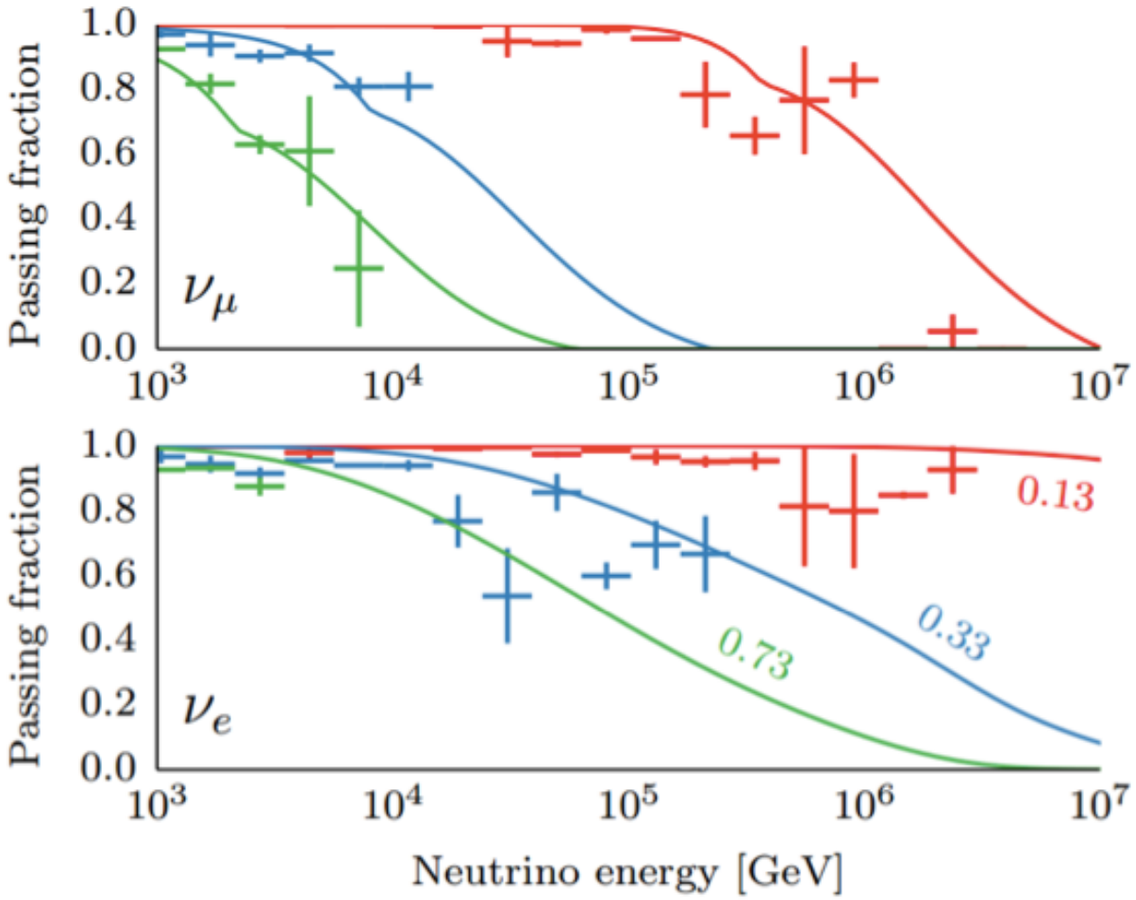
Point source & diffuse analysis

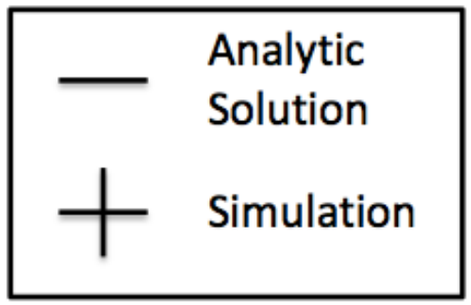
- Effects of surface & self veto
- KM3Net Sensitivities to diffuse fluxes and point sources
- Combined ANTARES & IceCube analysis
- Some thoughts on future GNN analyses

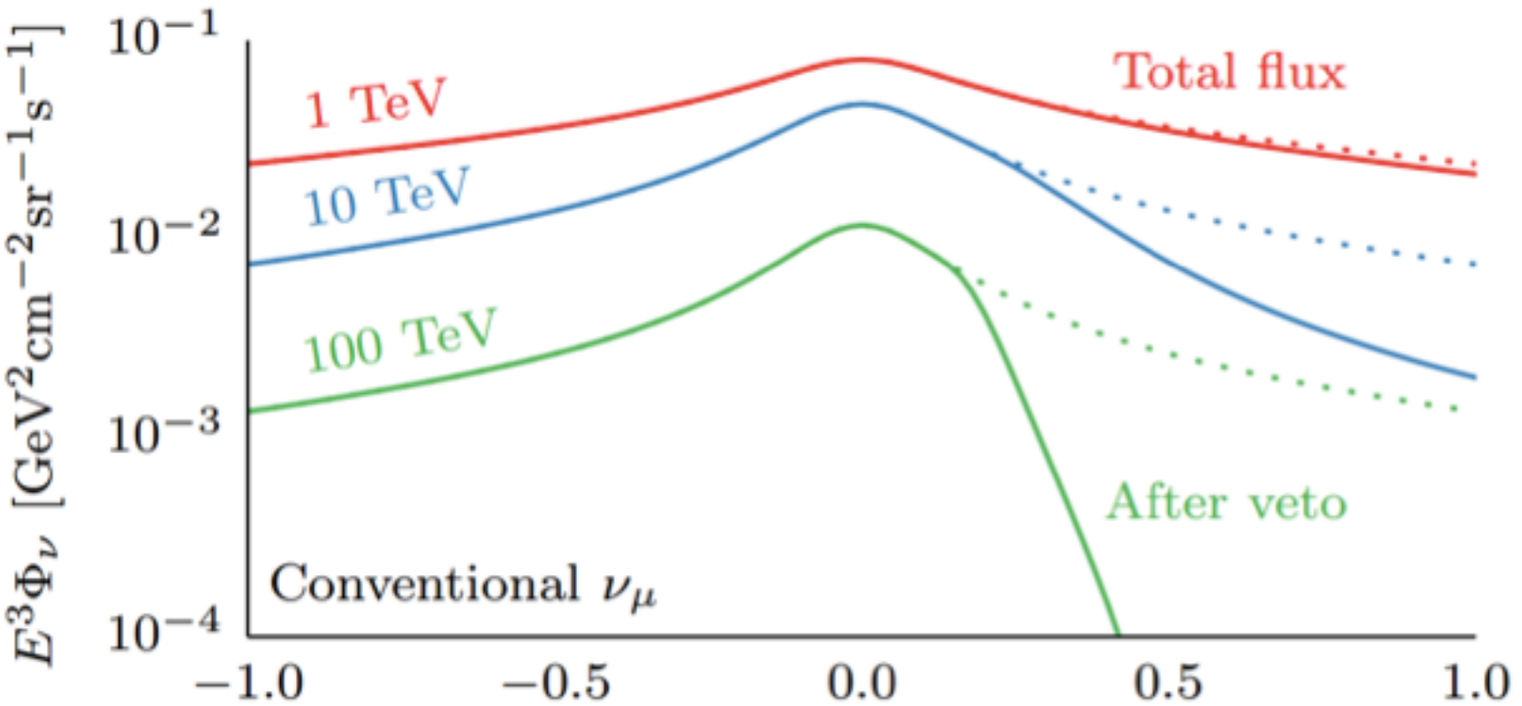
The Generalized Neutrino Self-Veto for Neutrino Telescopes

Kyle Jero
in collaboration with **Jakob van Santen**, **Thomas Gaisser**, and **Albrecht Karle**

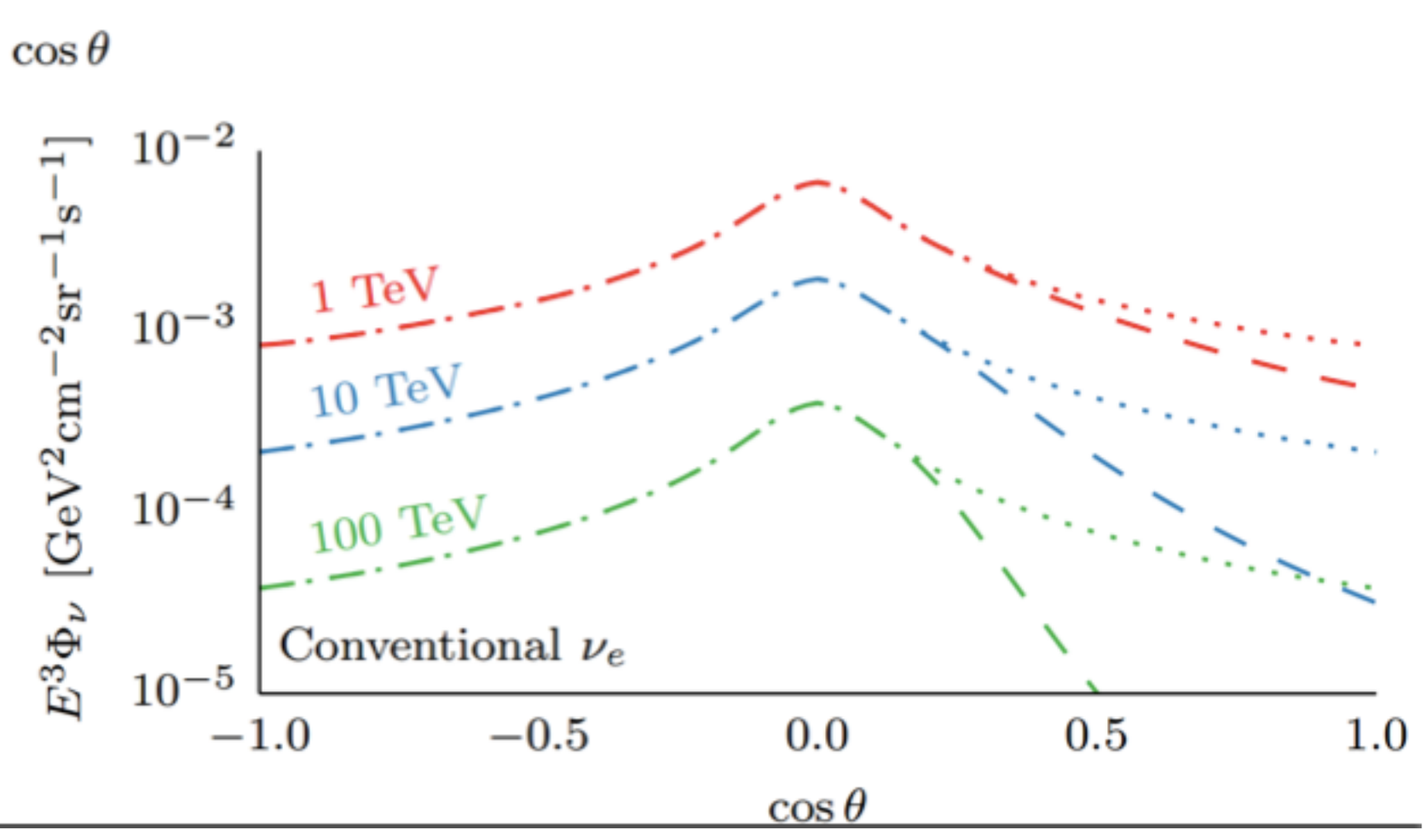








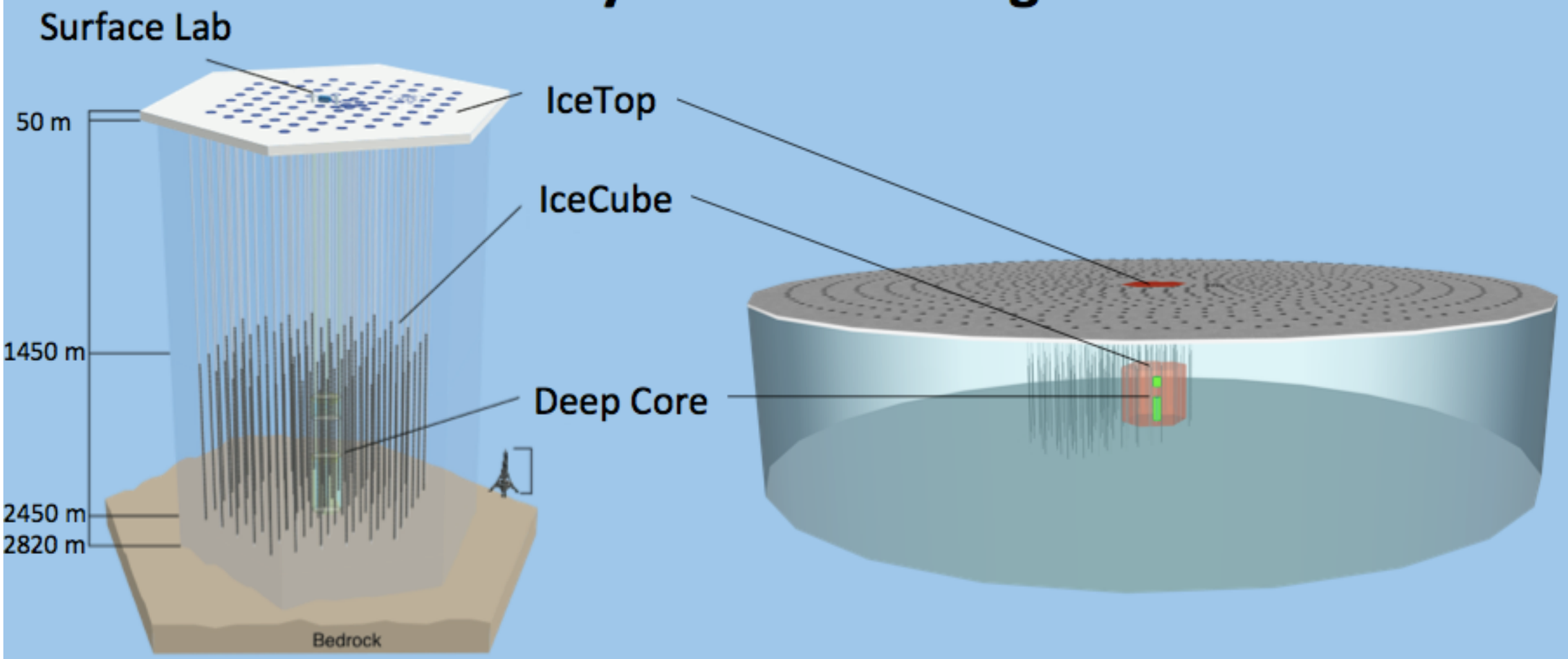
Effect on conventional neutrinos



IceVeto

A high-energy extension for IceCube.

by Jan Auffenberg



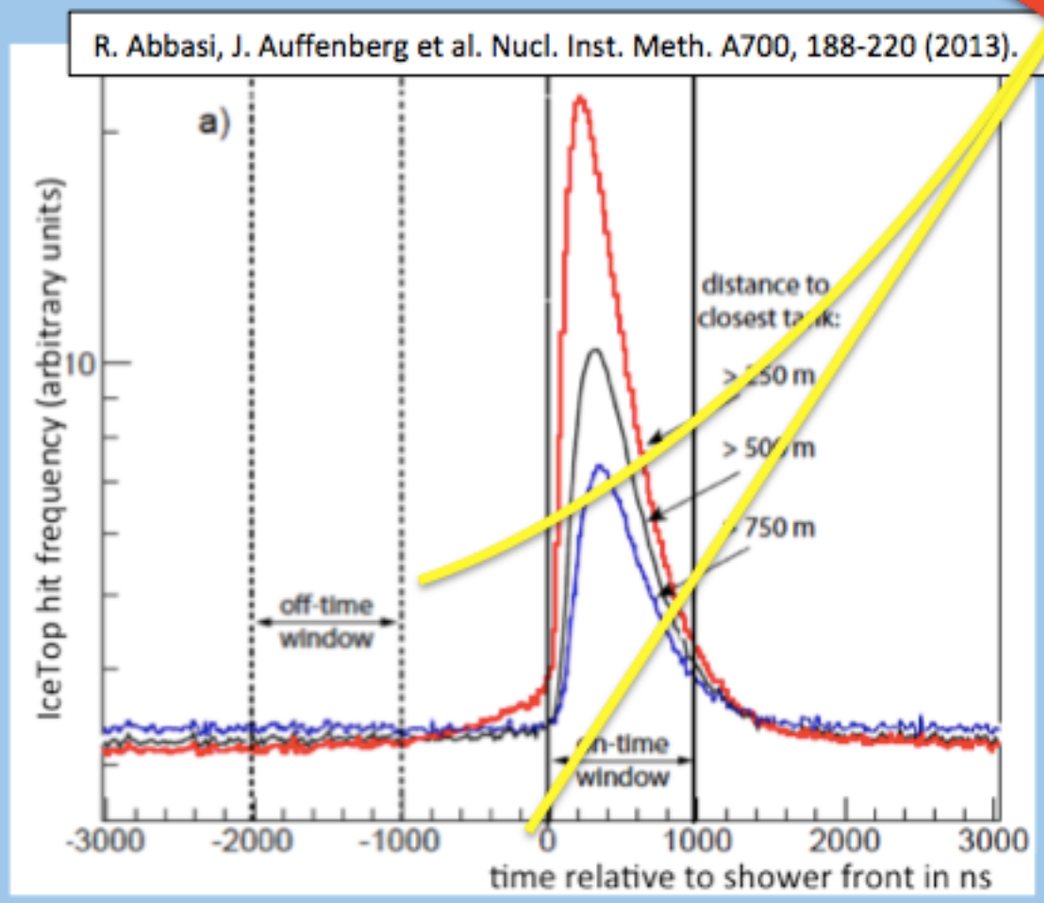
IceTop Veto

IceCube

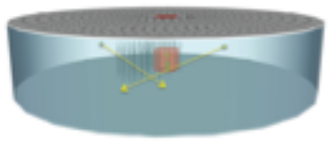
Air-Shower Front

IceCube (InIce)

Coincidence



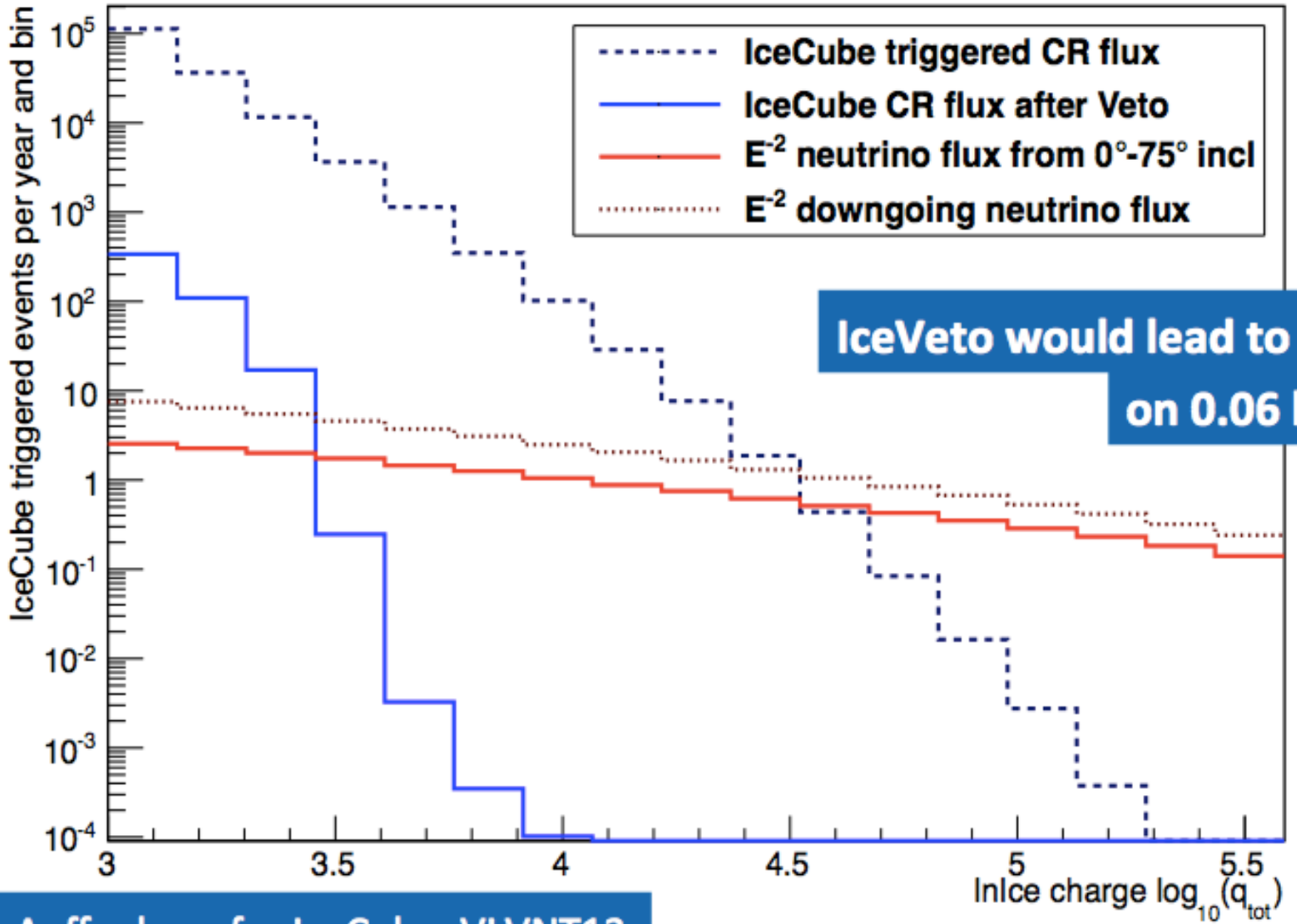
J. Auffenberg for IceCube: ICRC13 ID 0373



IceVeto Performance

IceCube

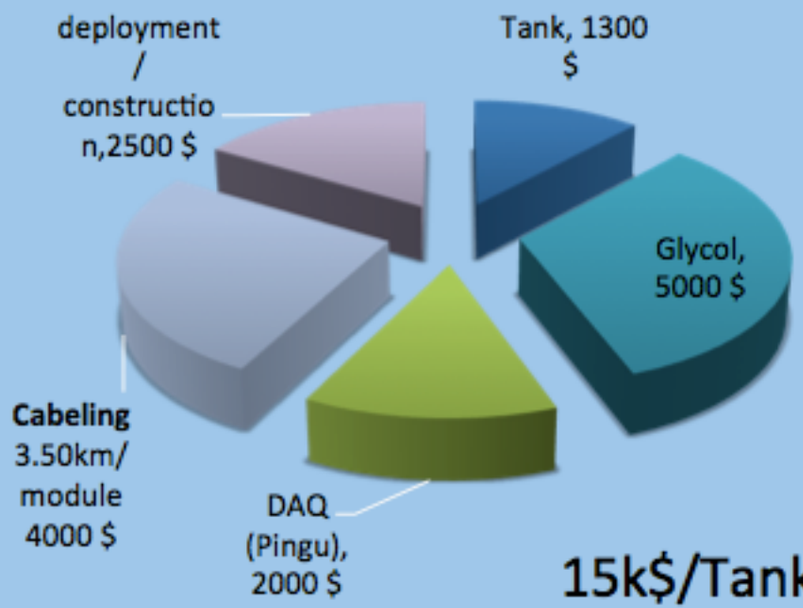
Veto efficiency and neutrino flux calculated **based on real data.**



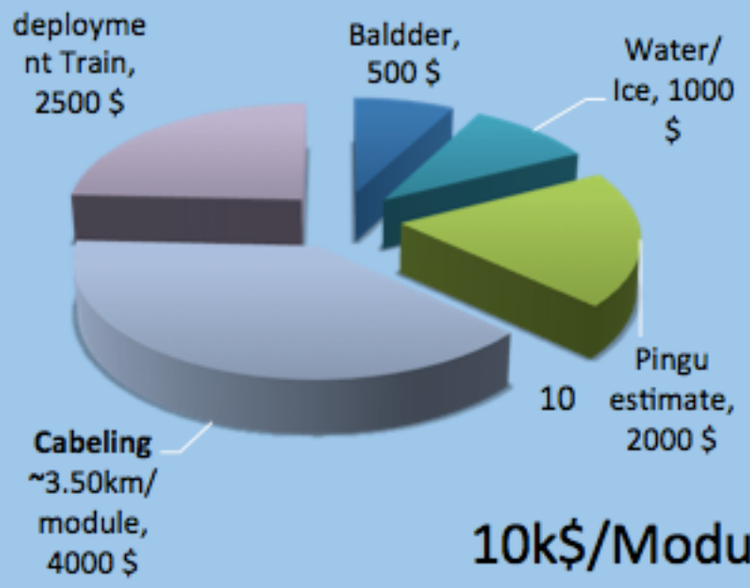
IceVeto would lead to ~10 tracks per year on 0.06 background events!

J. Auffenberg for IceCube: VLVNT13

Simple cost estimate based on IceTop



15k$/Tank



10k$/Module

- Tank: $1300 (2007: $1135) or just a bladder ($500)
- Tyvec Liner: $330 (2007: $300)
- Maybe Glyocol instead of Water: $5000 (price at the south pole vs. just south pole water $1000)
- DAQ + PMT: $2000 (PINGU estimate very likely less)
- Cabling (~3.50 km per module): ~$4 000 000
- Deployment $2500 per module or less?

Total: $8400 - $13500 per module

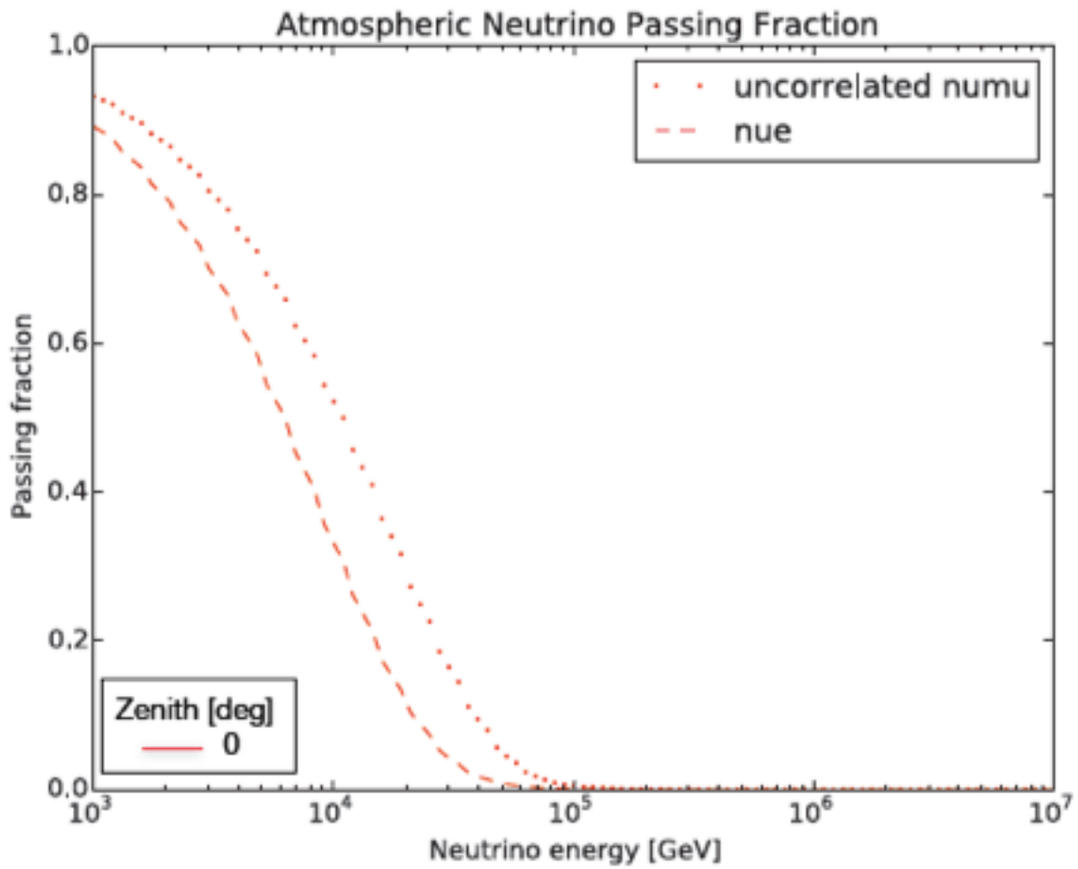
$ 10 – 20 Million for IceVeto

< 1/10 IceCube

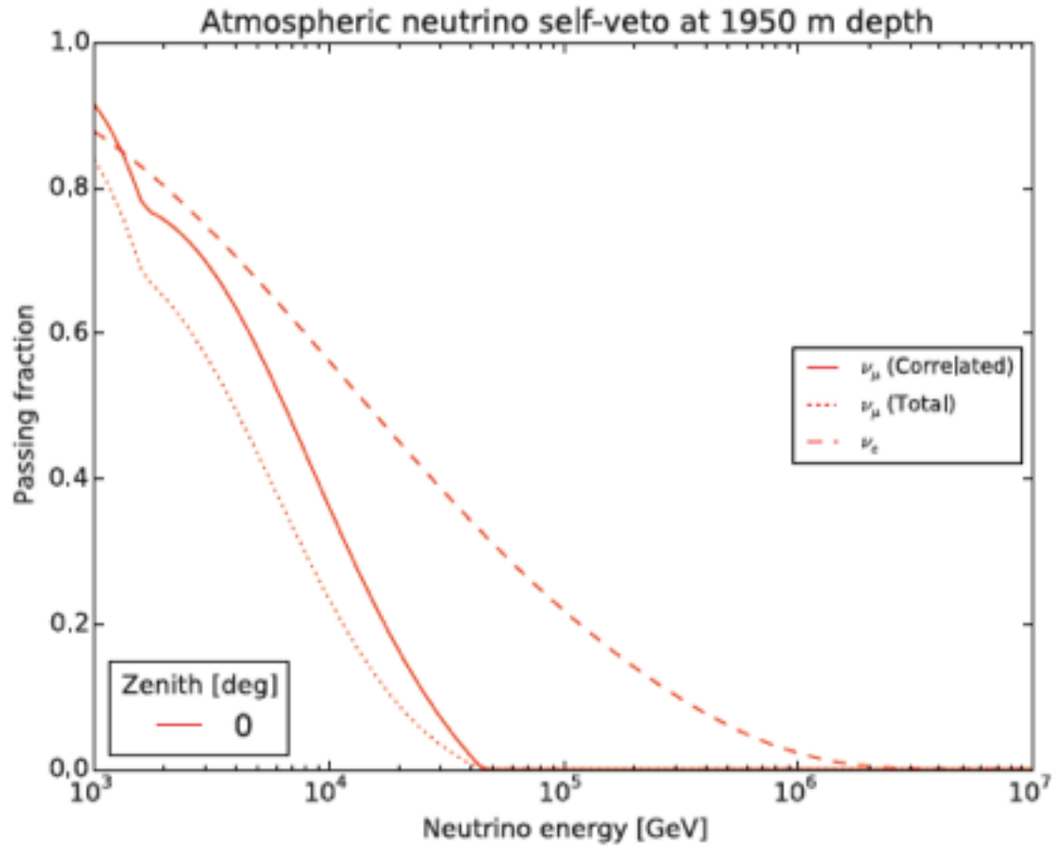
Slide credit to Ramesh Koirala

UNIVERSITY of DELAWARE

Surface Veto and Self Veto



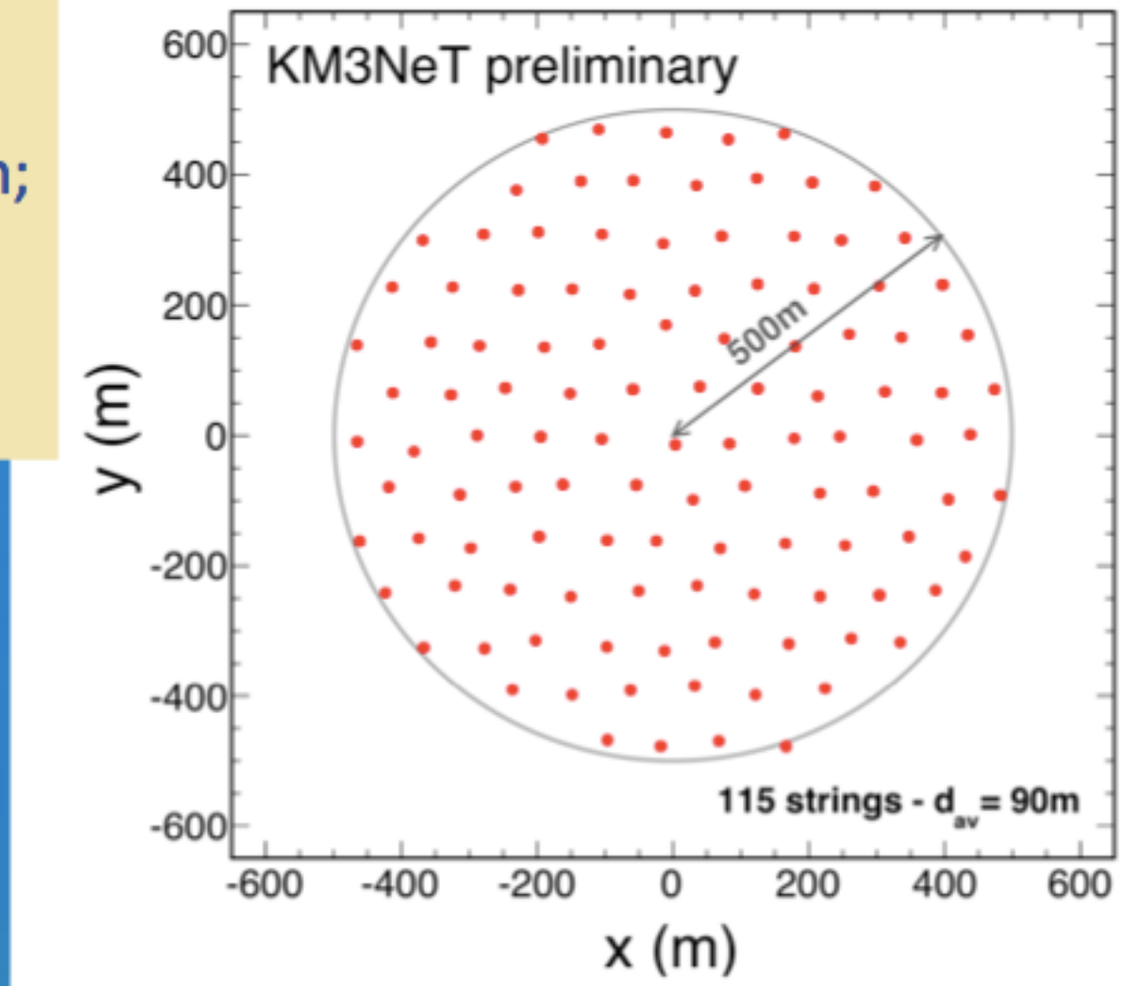
Surface Veto



Self Veto

Detector Layout

KM3NeT building block
- ✓ 115 strings x blocks;
- ✓ average distance between strings: 90 m;
- ✓ number of OMs per string: 18;
- ✓ distance between OMs: 36 m;
- ✓ Volume of a single block: 0.5 km^3.



KM3NeT phase1.5 → 2 building blocks
KM3NeT phase2 → 6 building blocks

Diffuse flux sensitivity studies for KM3NeT

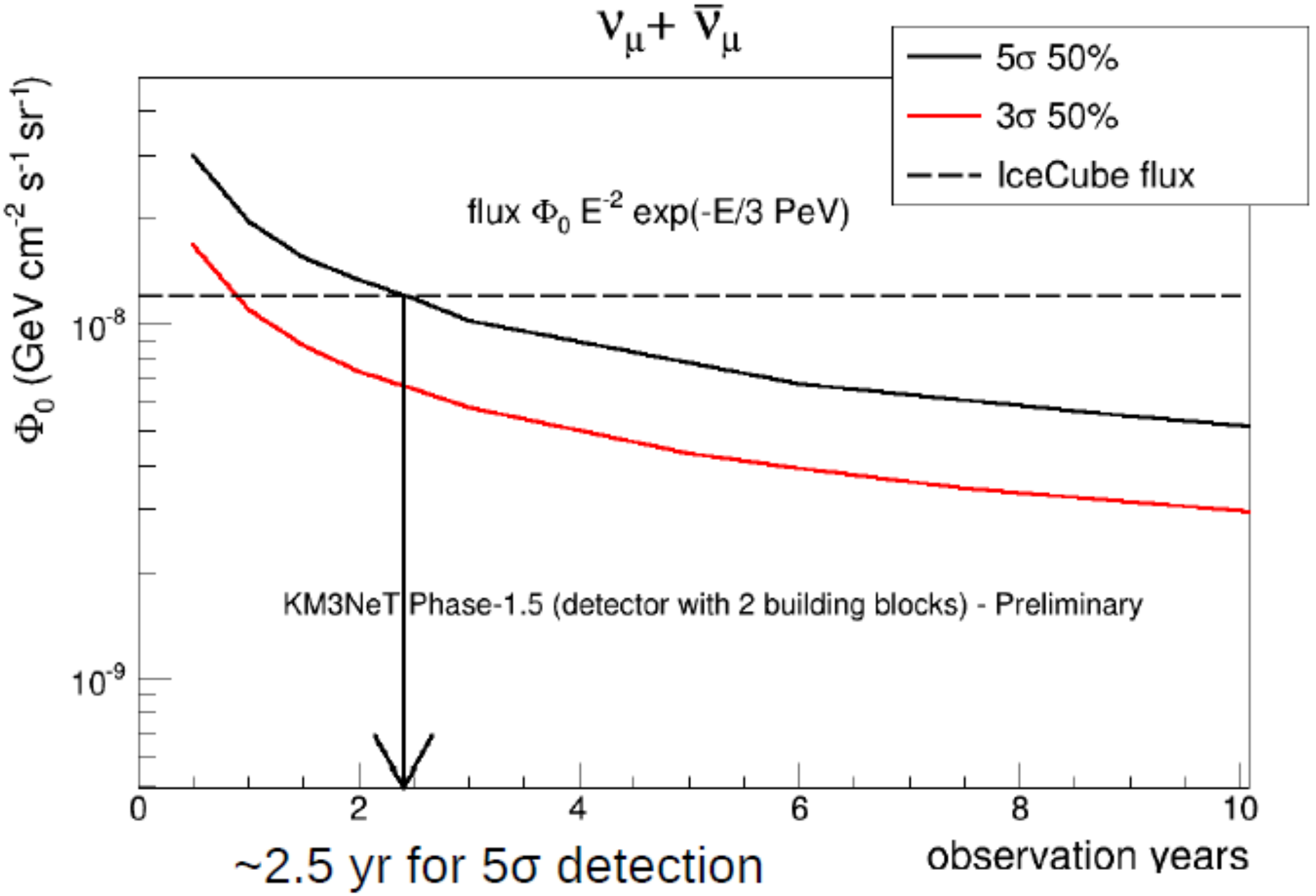
Phase 1.5 : 2 building blocks

Question : How many years to confirm IceCube signal
Used Flux 1.2 10^{-8} E^{-2} cutoff 3 PeV

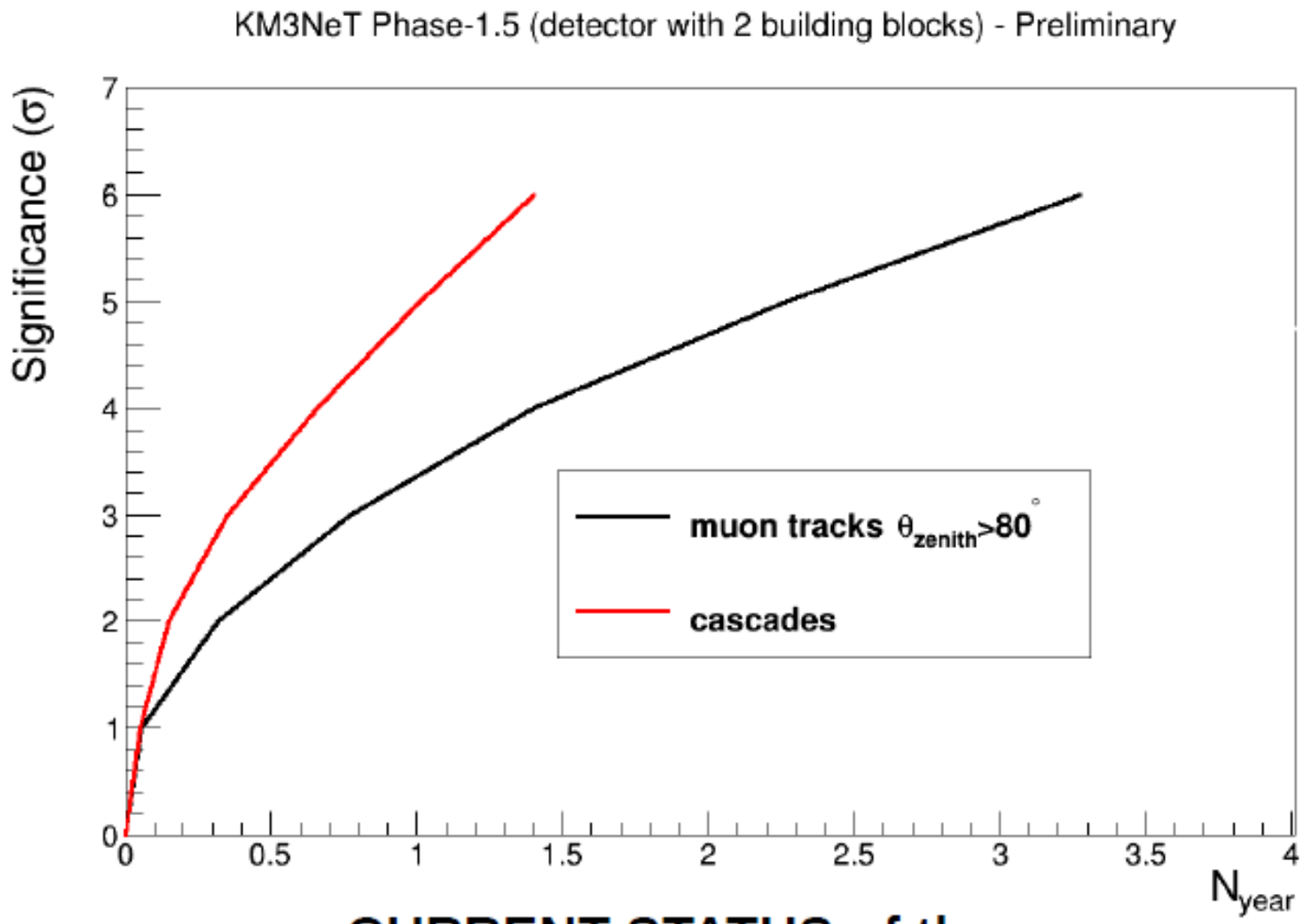
Luigi Antonio Fusco
University of Bologna and INFN – Sezione di Bologna

MANTS-GNN Collaboration, CERN, 20-21 September 2014

Tracks: max-likelihood method



Significance for detecting IceCube flux

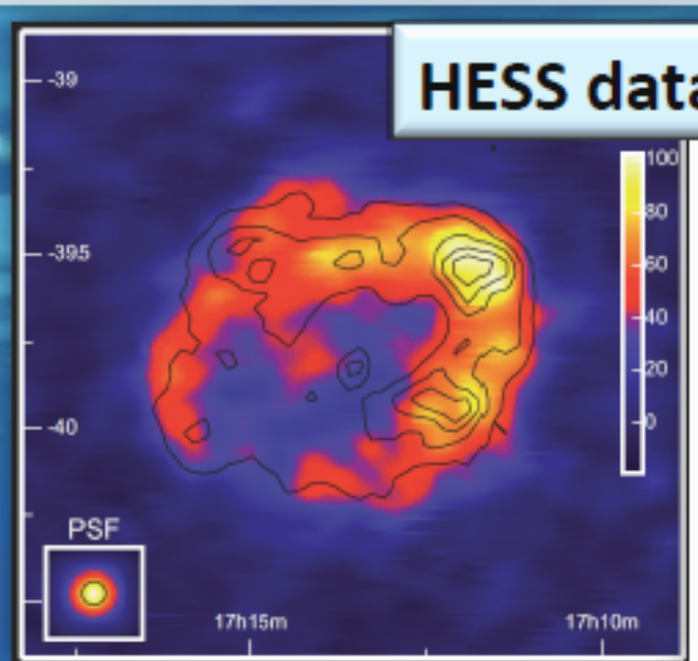


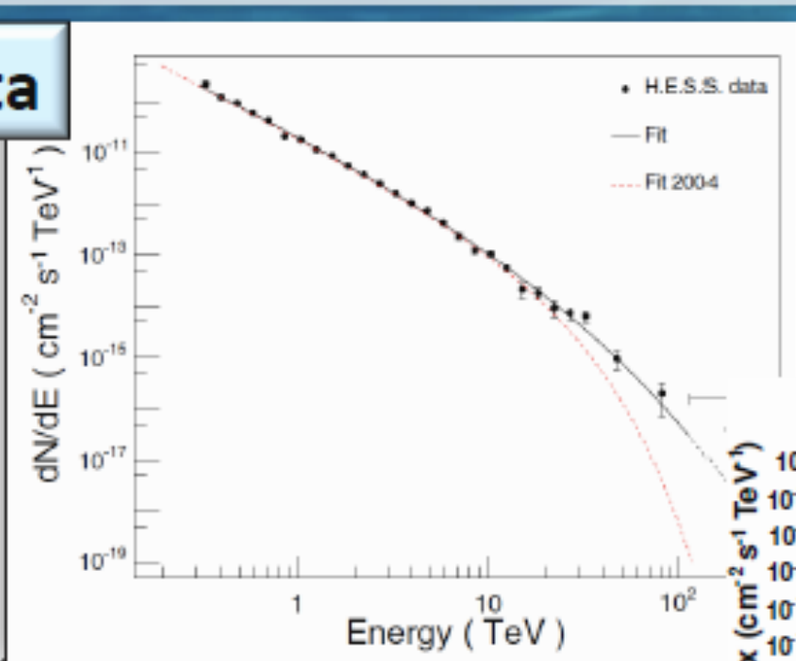
CURRENT STATUS of the analyses: max. likelihood

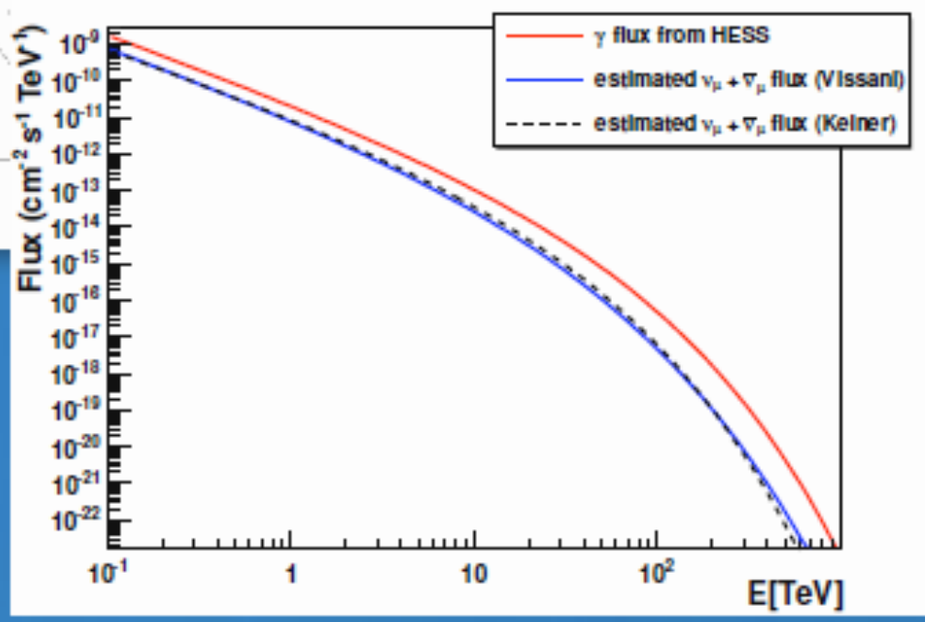
17

- Further improvement in cascade channel expected by using Aarts new strategy

SNR RXJ1713.7-3946







Good reference case:

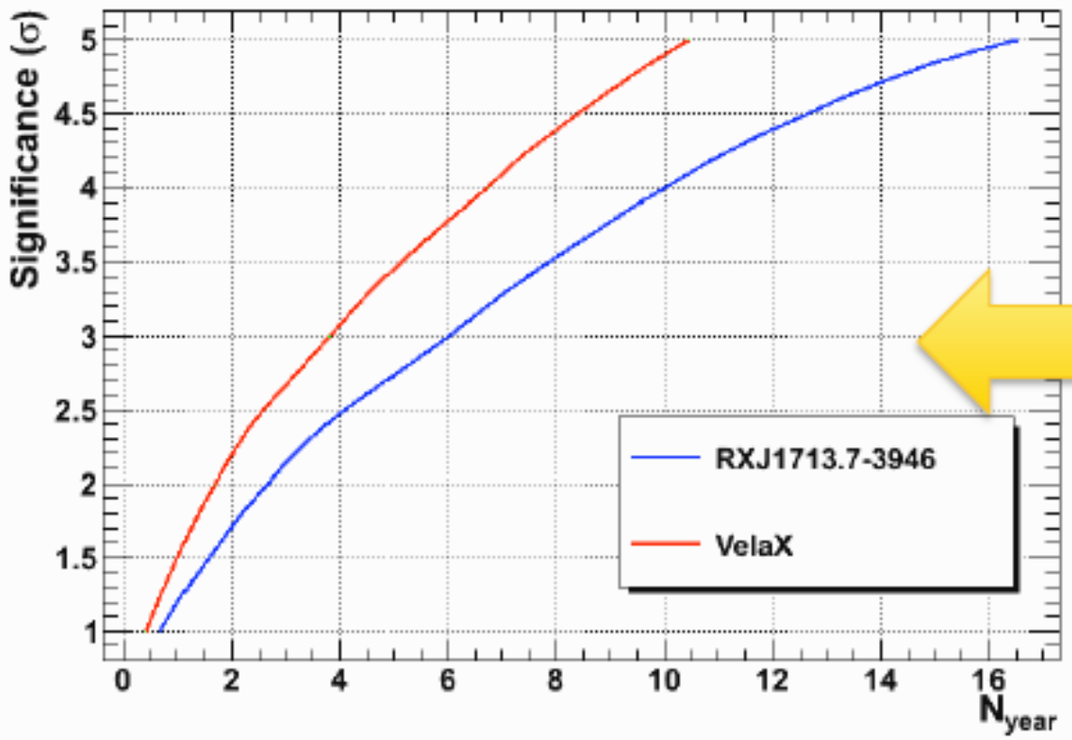
- ✓ High γ-ray flux measured
- ✓ γ-ray spectrum measured up to about 100 TeV
- ✓ Visible for about the 80% of the time by KM3NeT

Source simulated as a neutrino emitting homogeneous disk of 0.6° radius and a neutrino spectrum calculated following Kelner et al., PRD 74 (2006) 034018

$$\Phi(E) = 16.8 \times 10^{-15} \left[\frac{E}{TeV}\right]^{-1.72} e^{-\sqrt{\frac{E}{2.1TeV}}} GeV^{-1} s^{-1} cm^{-2}$$

Vela X and RXJ1713.7-3946 disc. years

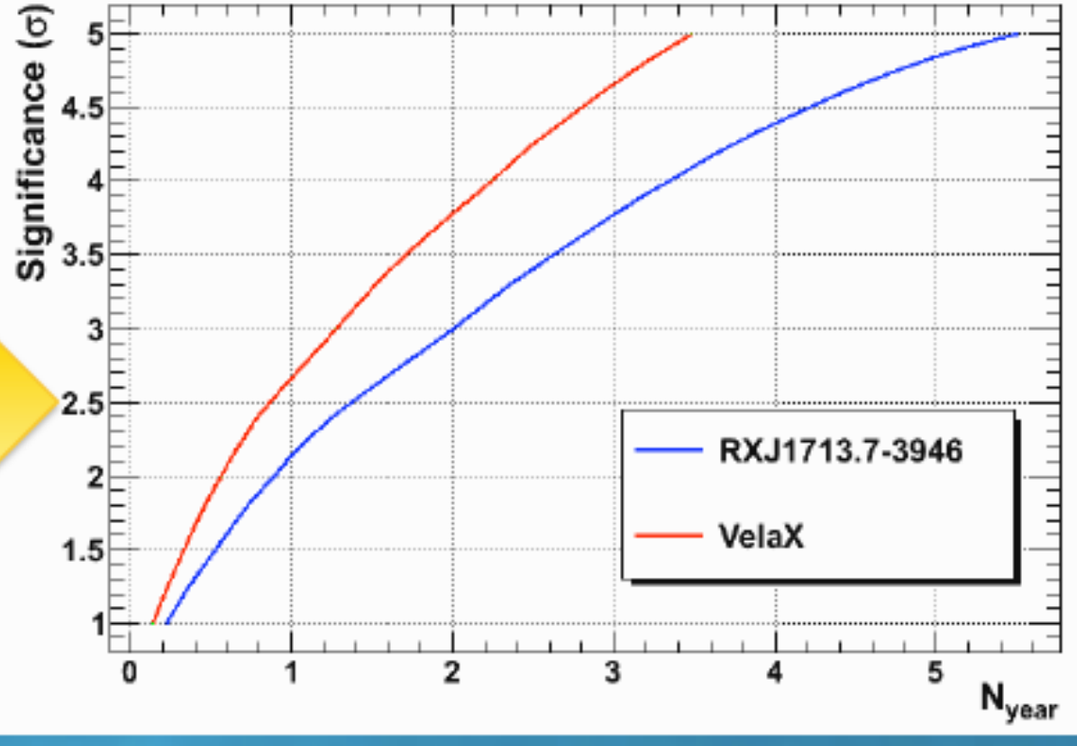
KM3NeT Phase1.5 - (detector with 2 building blocks) - Preliminary



3σ in about 4years for the VelaX and 6years for the RXJ1713.7-31946 for KM3NeT phase1.5

KM3NeT Phase2 - (detector with 6 building blocks) - Preliminary

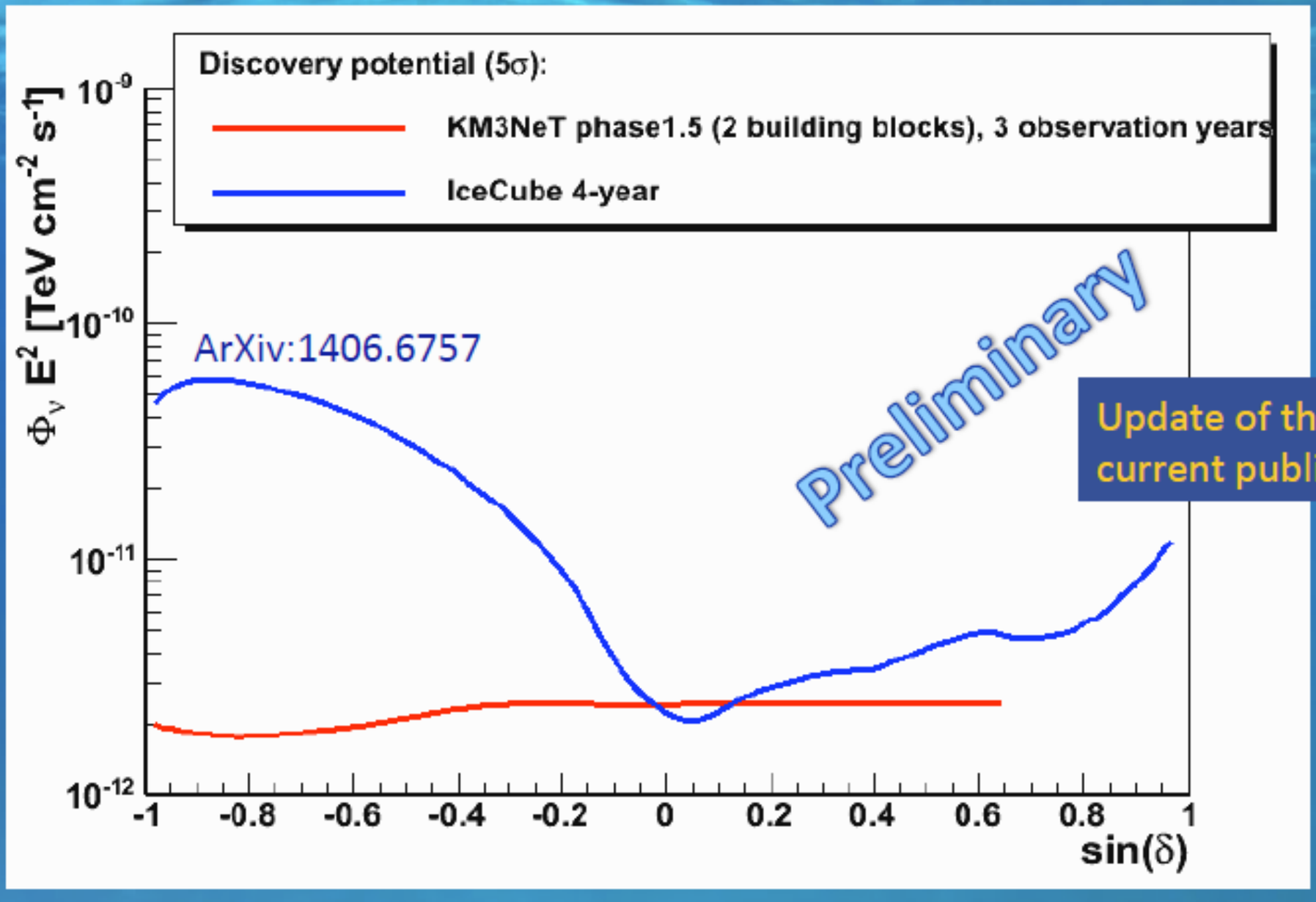
5σ in about 3.5years for the VelaX and 5.5years for the RXJ1713.7-31946 for KM3NeT phase2



Discovery for point source E^{-2} spectrum as a function of δ

Discovery potential as a function of the declination:

- point-source with E^{-2} spectrum



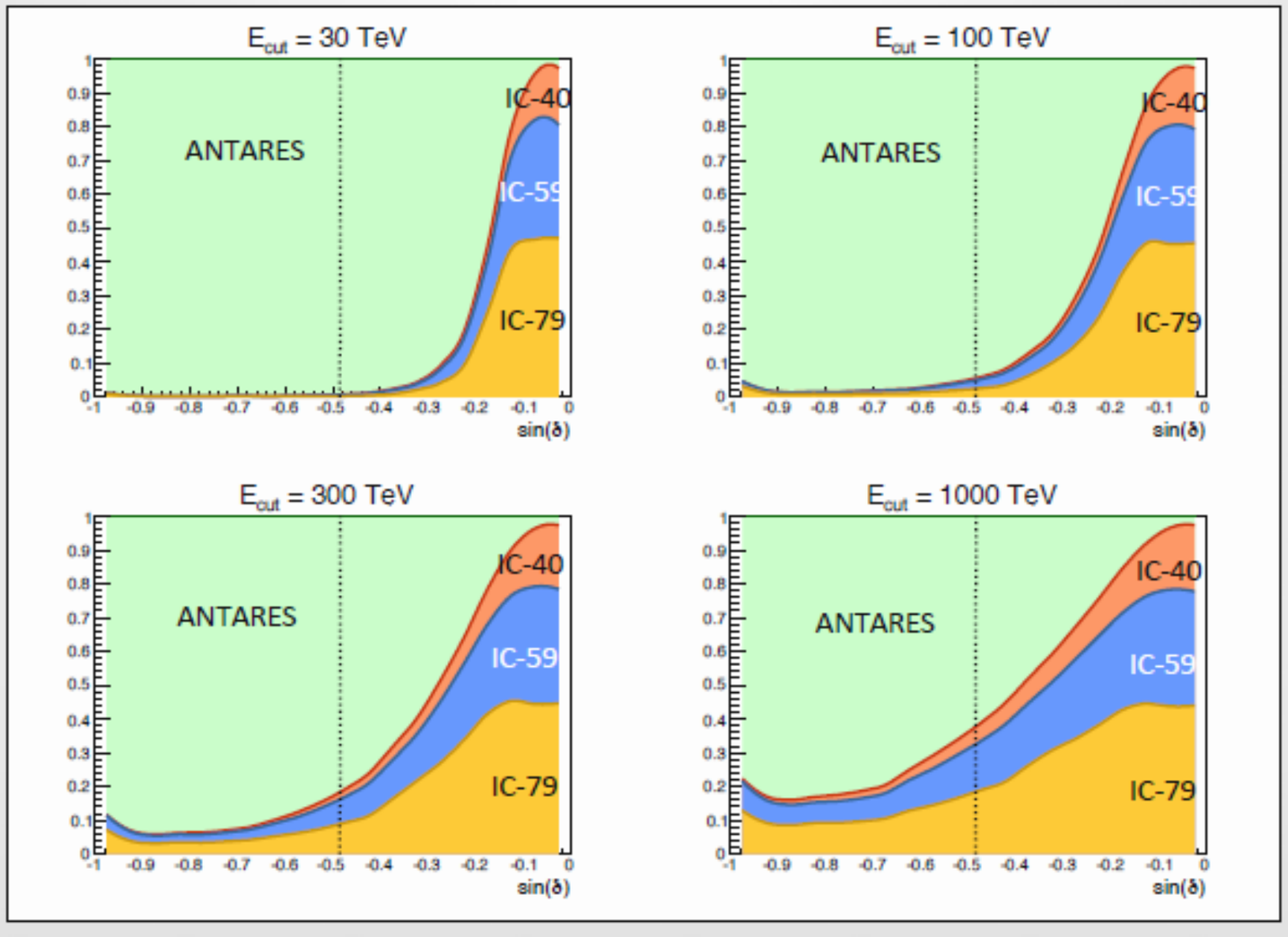
ANTARES-IceCube combined point-source analysis

J. Brunner, J. Barrios-Martí

GNN-MANTS 2014 meeting (Geneva)

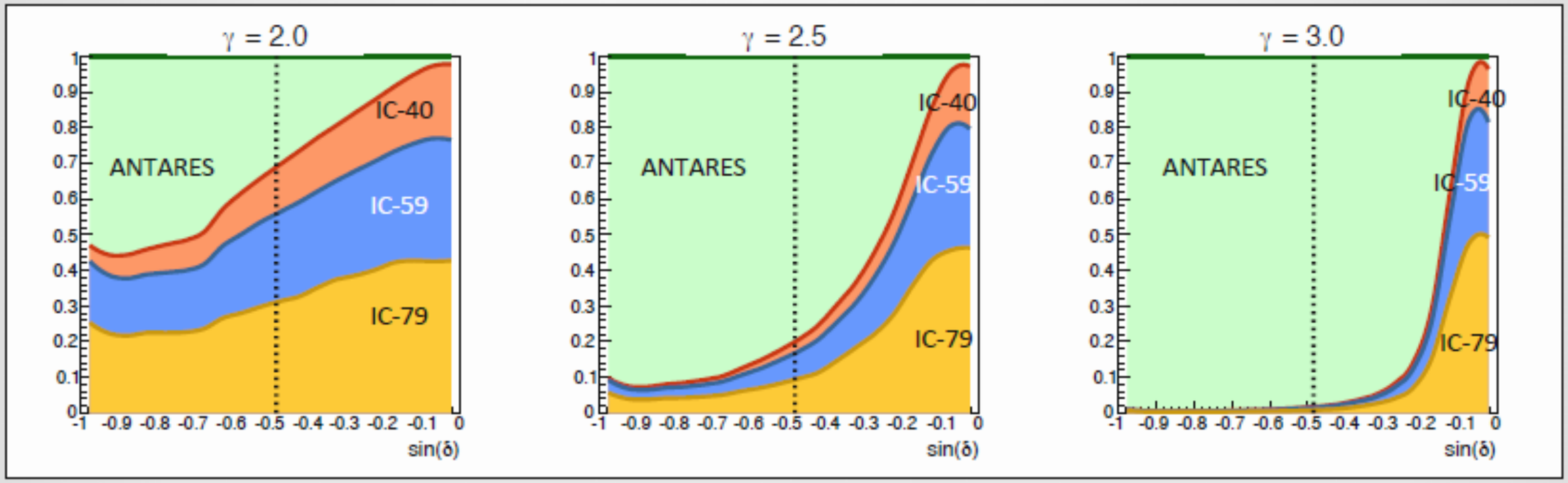
(21st September, 2014)

Relative contribution: Different $E_{cutoffs}$



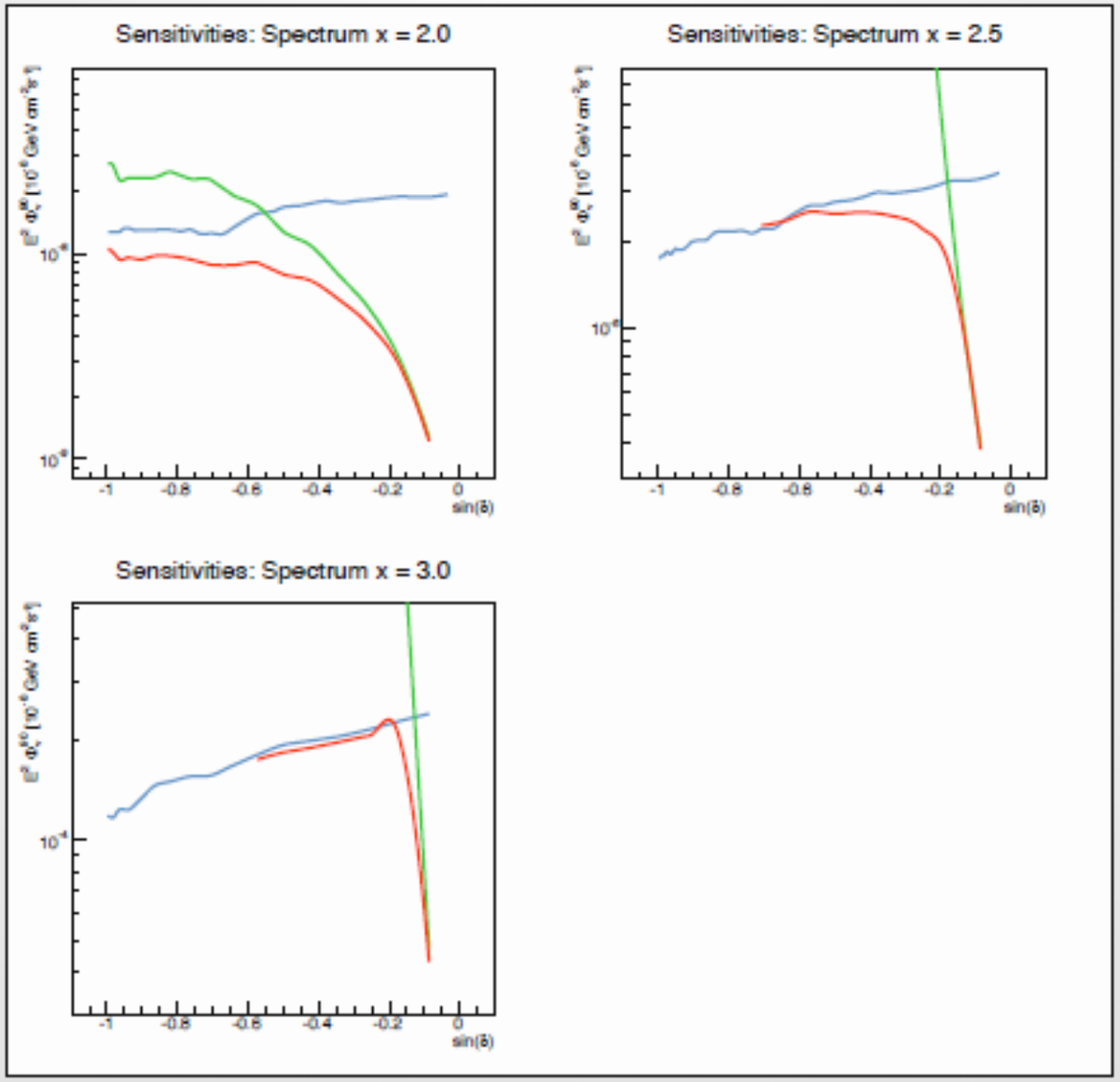
Relative acceptances for different energy cutoffs: IC40, IC59, IC-79 and ANTARES. Smaller energy cutoffs result in a higher ANTARES contribution (IC events are more energetic). Dotted-black line indicates the declination of the Galactic Centre.

Relative contribution: Different spectra



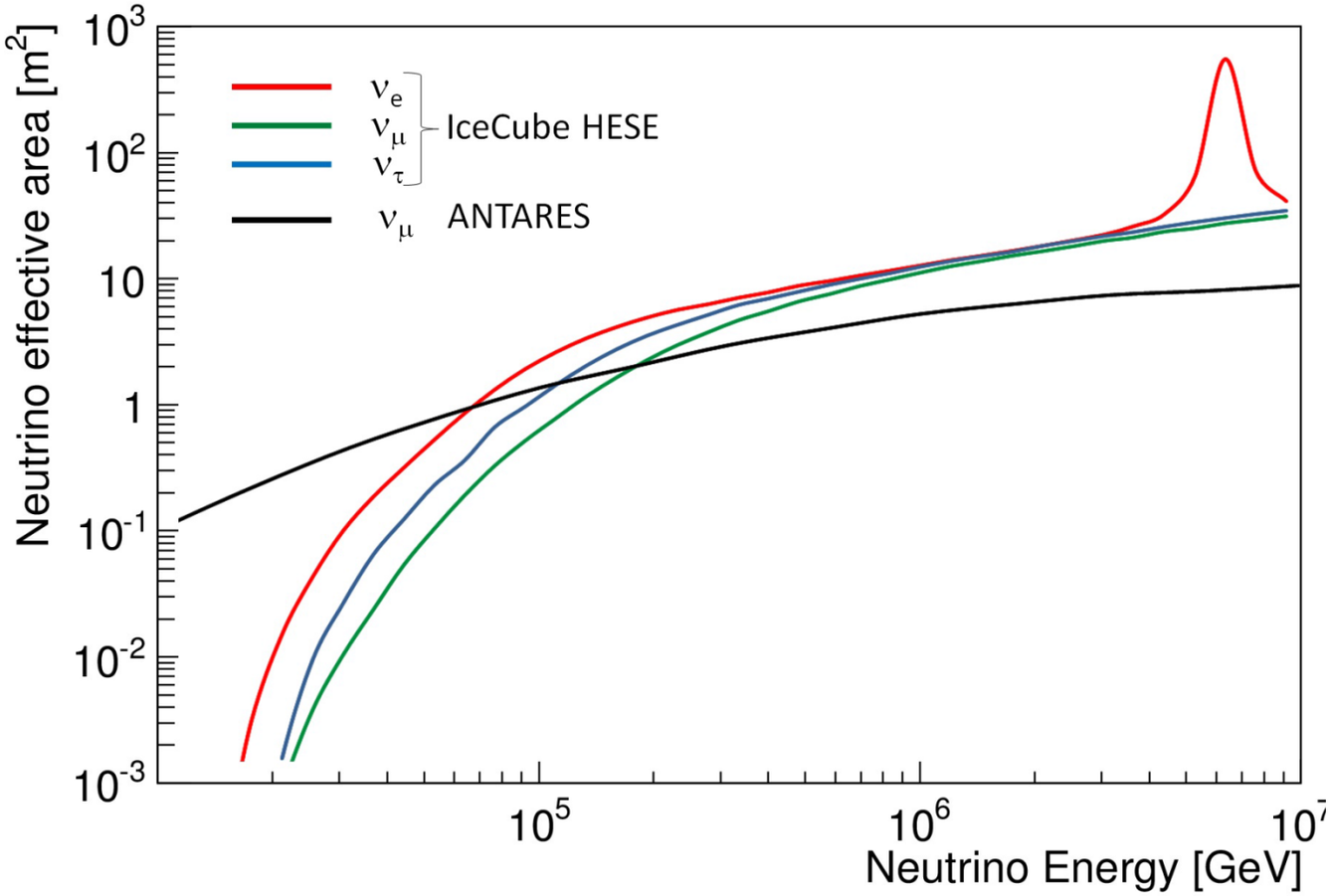
Relative acceptances for different energy spectra: IC40, IC59, IC-79 and ANTARES.
The higher the spectrum, the lesser the IC contribution (IC events are more energetic). Black dotted line indicates the declination of the Galactic Centre.

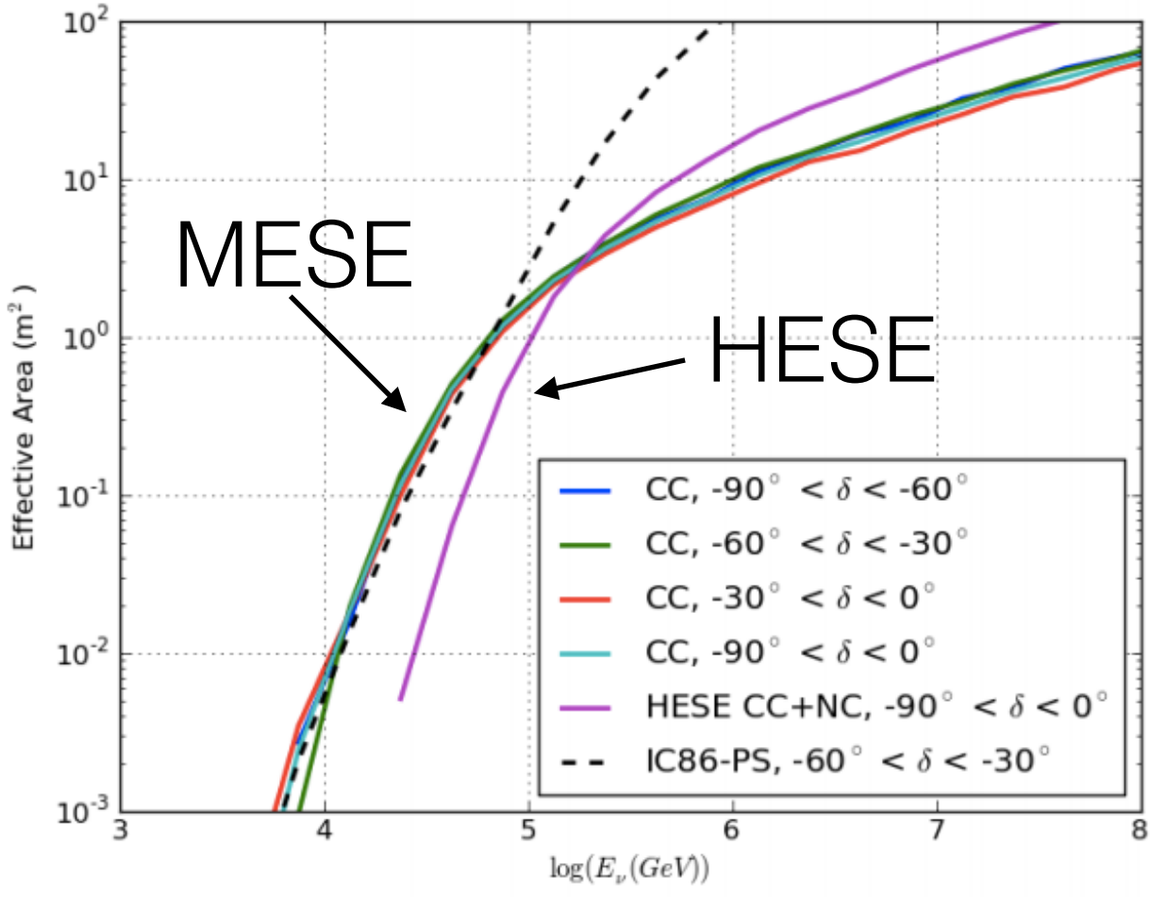
ANTARES+IC40+59+79 sensitivities



Sensitivities for different energy cutoffs:
Combined ANTARES and IC40+59+79, ANTARES and IC40+59+79.

HESE vs. Antares effective area





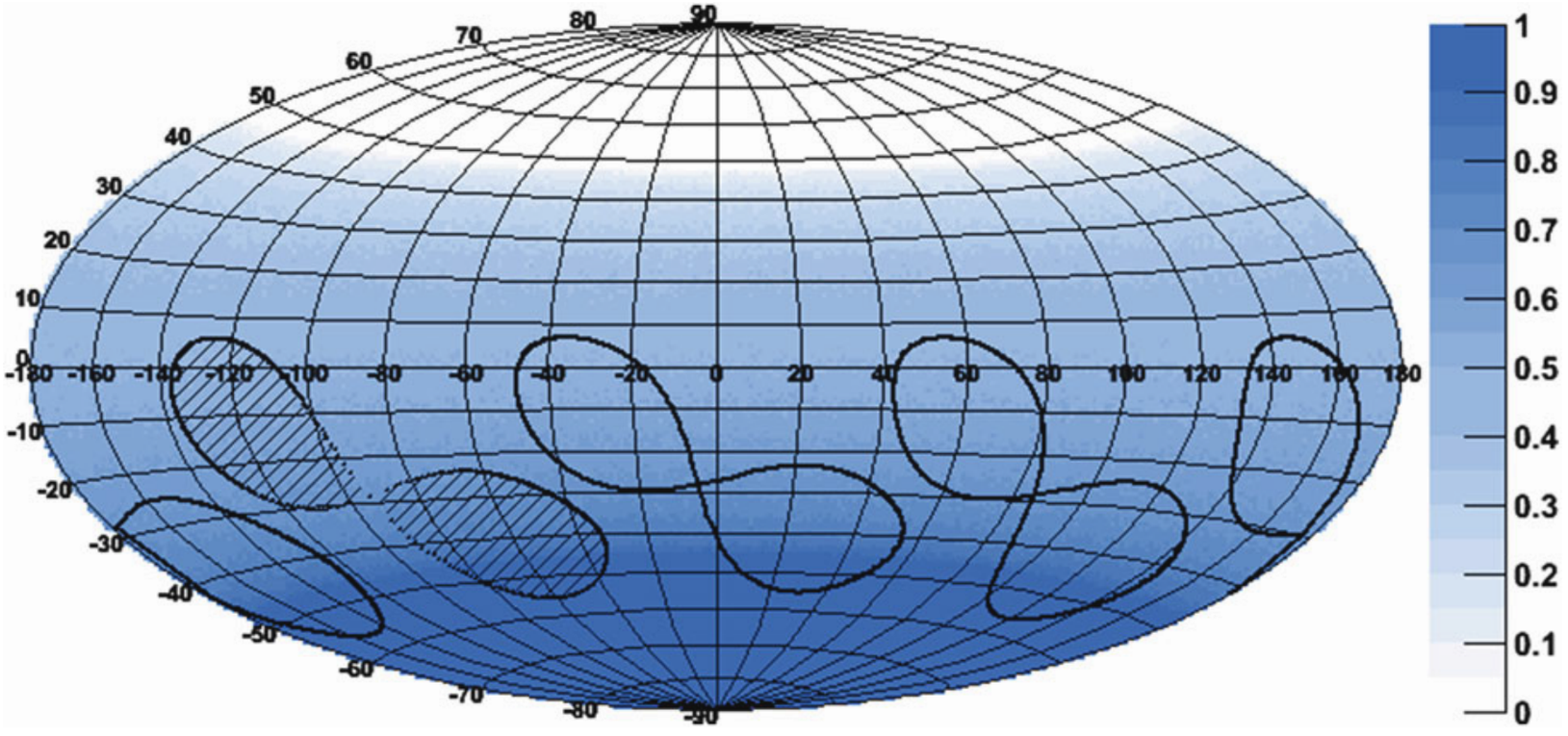
- In IceCube:
  HESE → MESE (starting tracks, optimized for PS)

- Better performance in Southern Hemisphere than standard PS search

- Combination of Antares PS sample with MESE improves the sensitivity to Galactic sources

Extended Sources

- Consider Southern hemisphere object
- Fermi Bubbles (below : on/off region)
- Galactic plane



Extended & Dedicated flux models

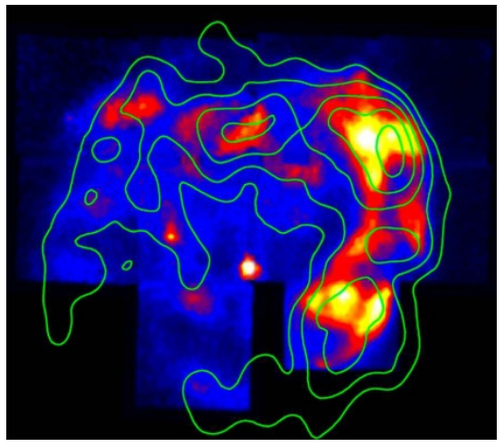
- Two examples from Antares analysis

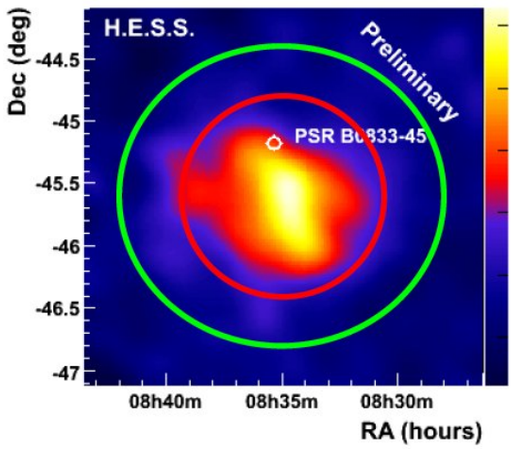
  RX J1713.7-3946 Vela X

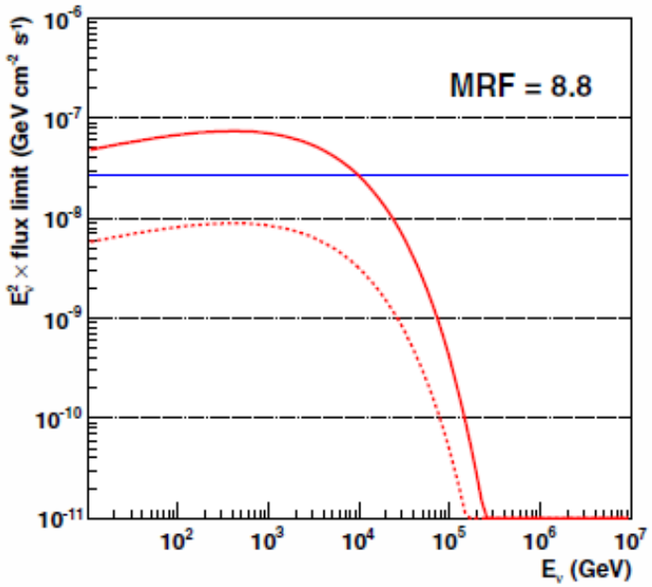
- Models from A. Kappes

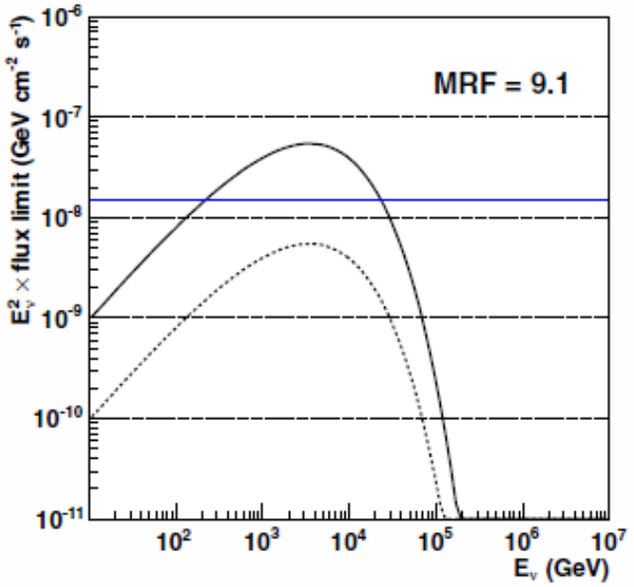
- Not considered for present combined analysis (almost no improvement when including IC data !)

→Find interesting models/ sources for combination





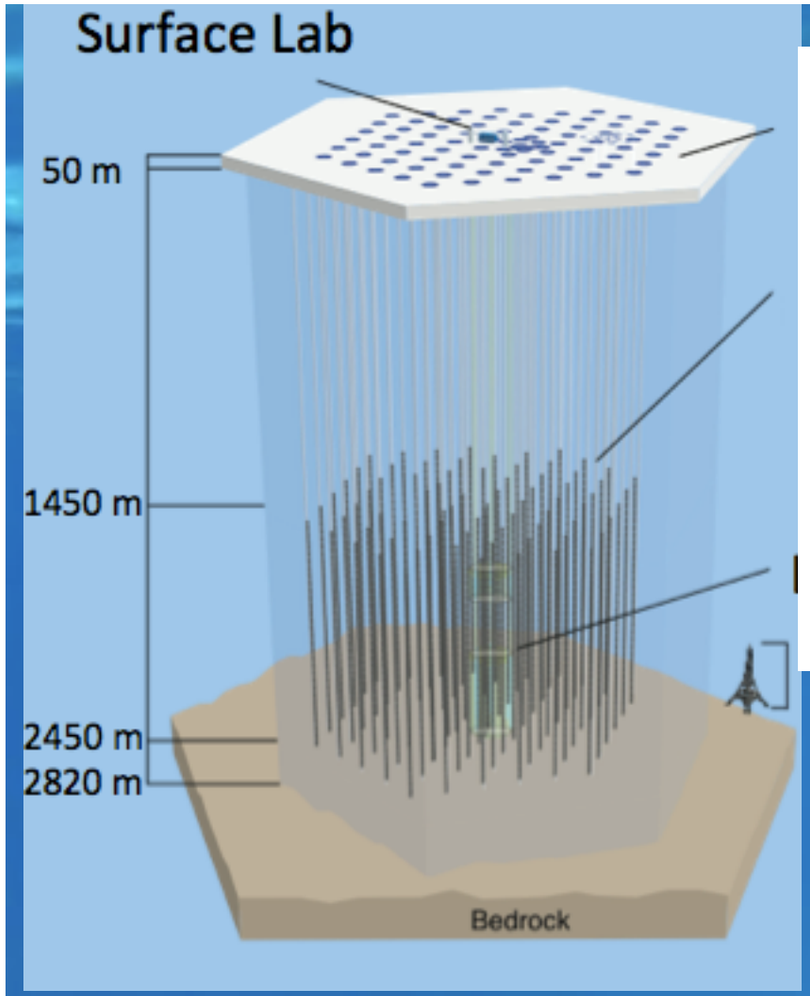




Further ideas

- 2 point correlation → many weak sources
- Transients : GRB, AGN flares ….
- Time/space correlations between IC & ANT without external assumptions
- Alert sending between IC/ANT, AMON

Next steps



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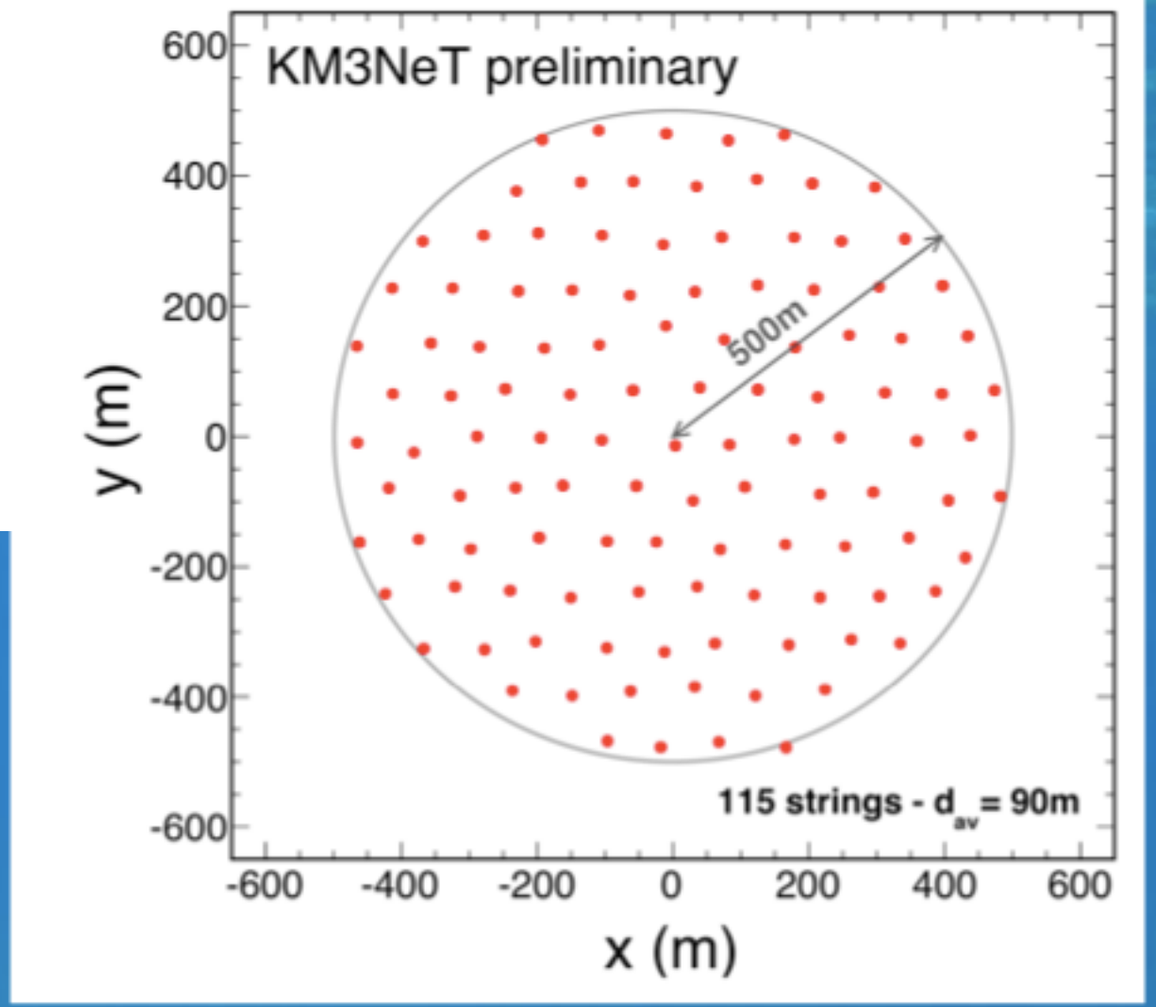

Antares: ~ 0.04 km³

KM3NeT phase 1: ~ 0.13 km³

KM3NeT phase1.5 → 2 building blocks **~ 1 km³**

KM3NeT phase2 → 6 building blocks **~ 3 km³**