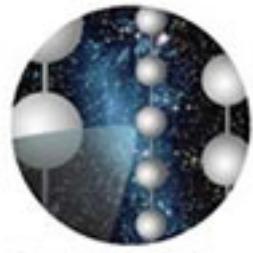


# **IceCube 2008 status report**

**in light of the ICRR Inter-university program**

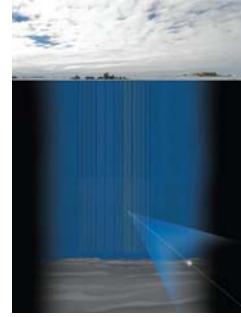
**Shigeru Yoshida**  
**Chiba University**

**<http://www.ppl.phys.chiba-u.jp>**



IceCube

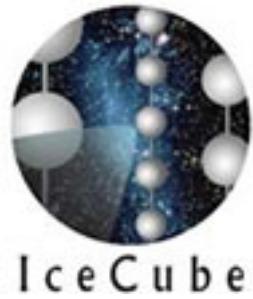
# Grant from the ICRR



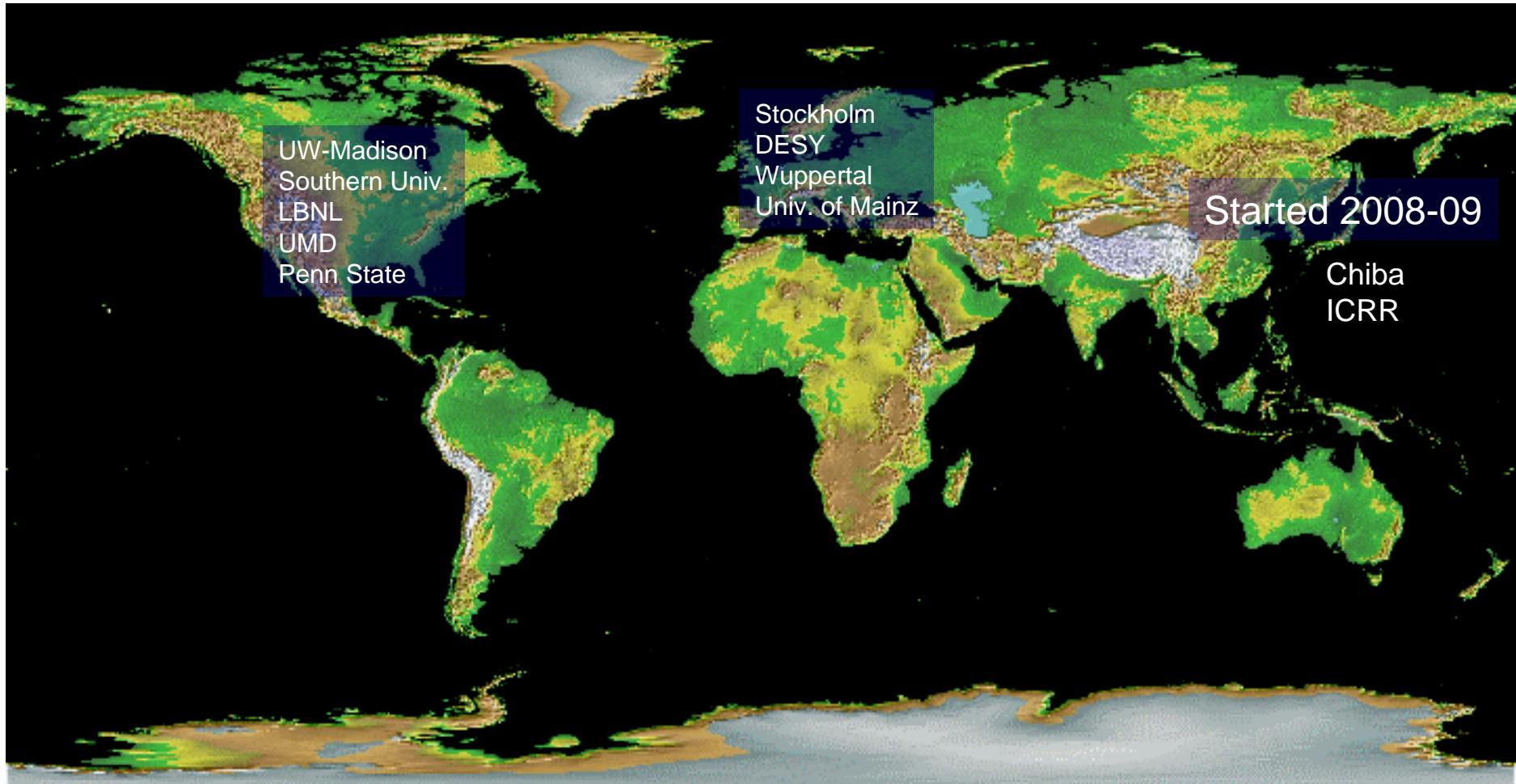
However...

We are one of the **heaviest users** on  
the ICRR computer clusters for research programs  
**NOT hosted** by the ICRR itself

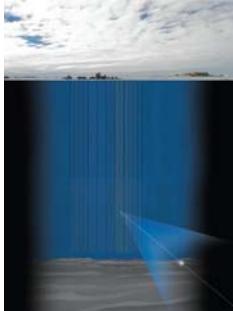
A new way of the university support! ありがとうございます！



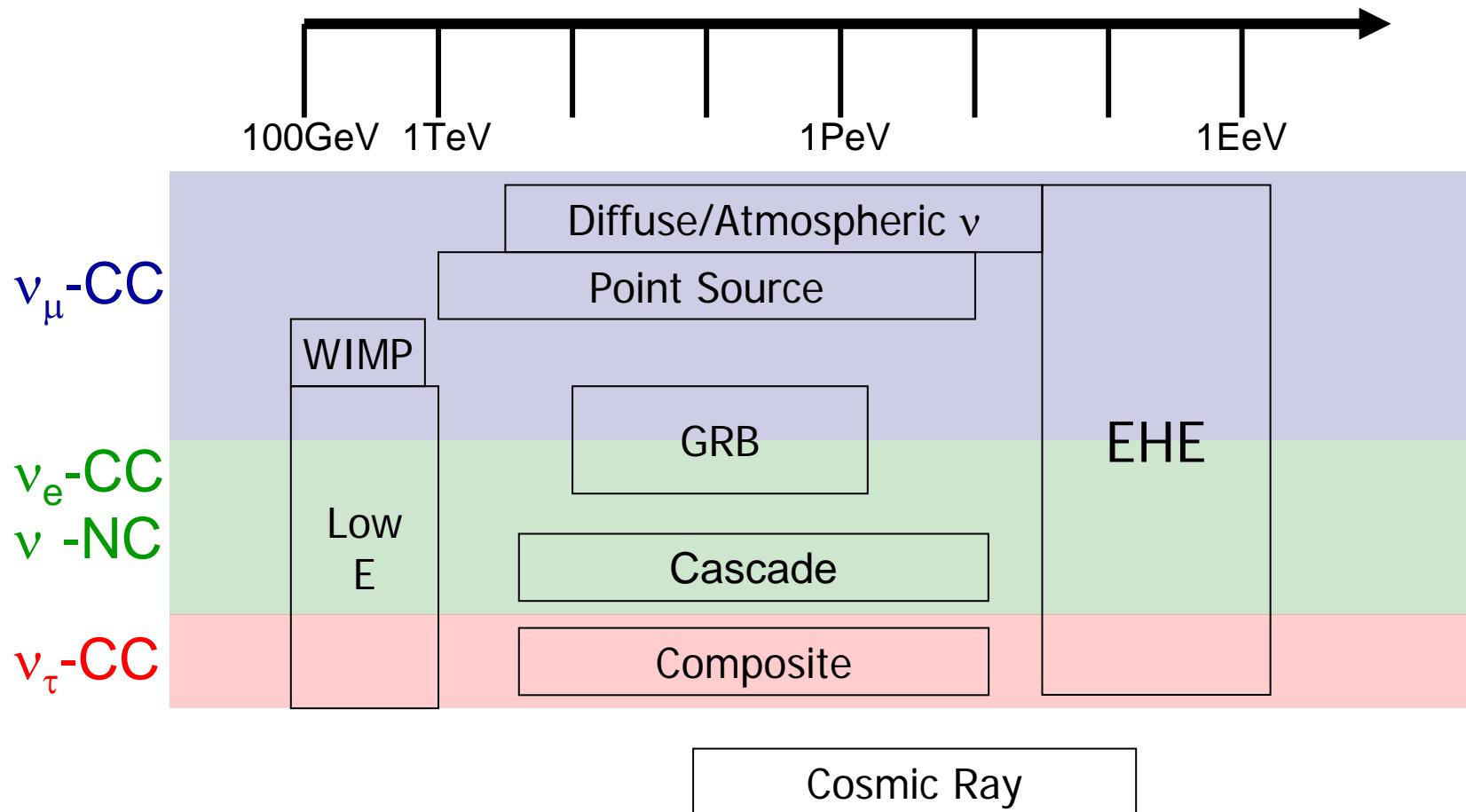
# World network of the IceCube MC production

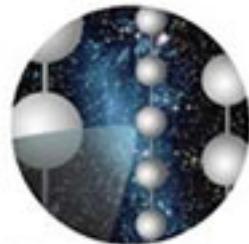


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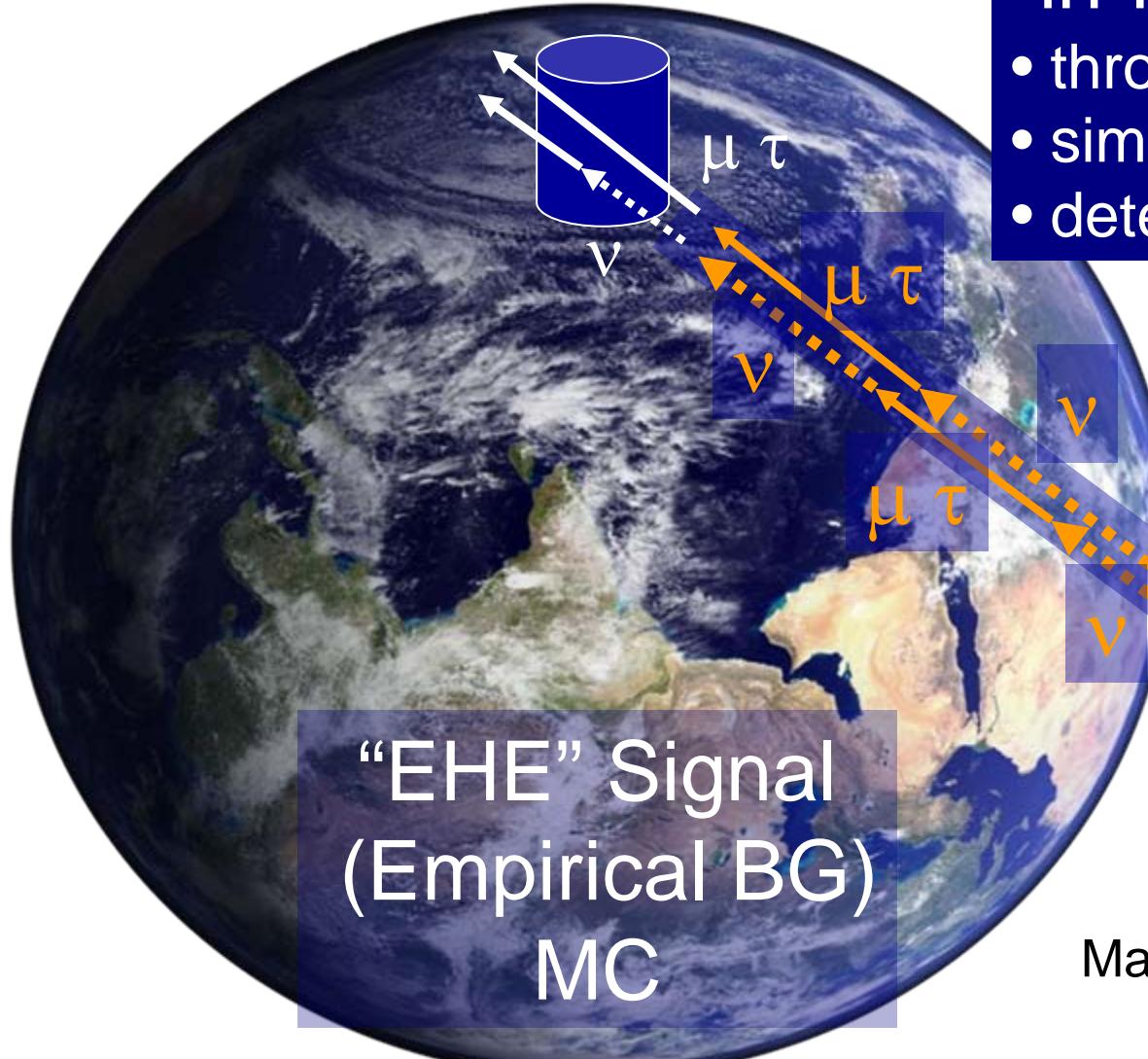
# IceCube working groups





IceCube

# What and how we simulate?



## “in-ice” MC

- throw  $\nu/\mu/\tau$
- simulate C light profile
- detector MC

look up

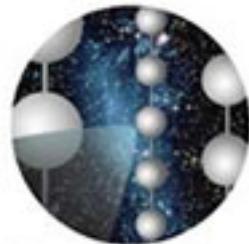
## $\nu$ propagation

- numerically calculated in advance
- weigh a MC event with this result

Mainly run by the Chiba clusters

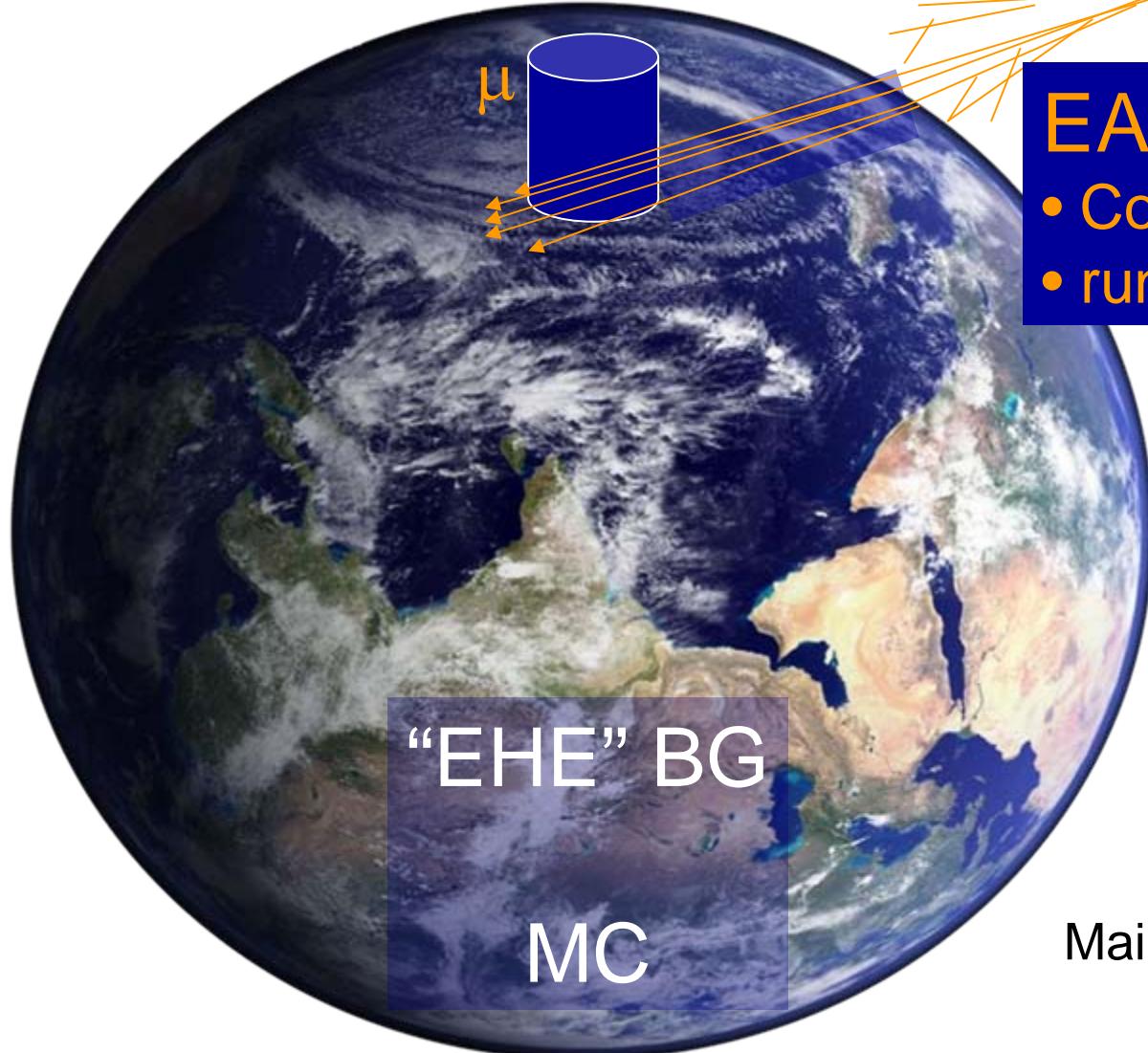


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IceCube

# What and how we simulate?



Weigh an event  
by CR spectrum

## EAS + $\mu$ propagation

- Corsika (P/Fe)  $E^{-1}$  PeV-10EeV
- run  $\mu$  into the  $I^3$  volume

Top down

## “in-ice” MC

- simulate C light profile
- detector MC

Mainly run by the ICRR clusters

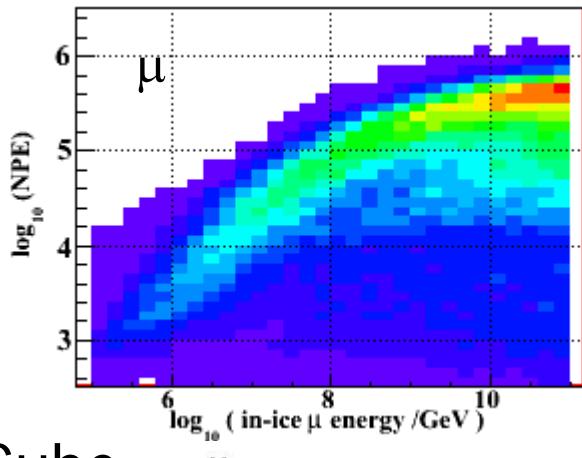


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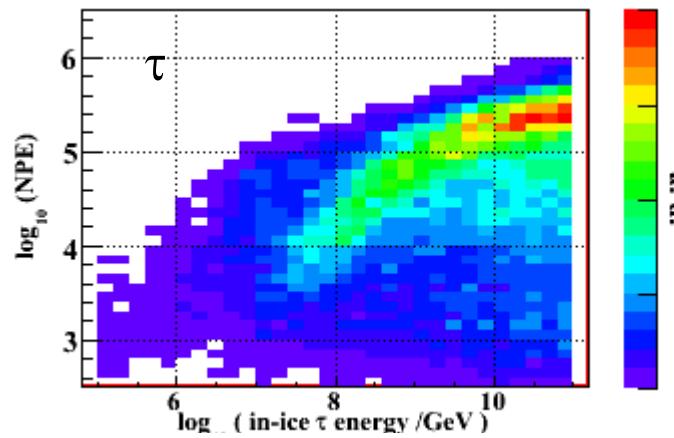


IceCube

2006

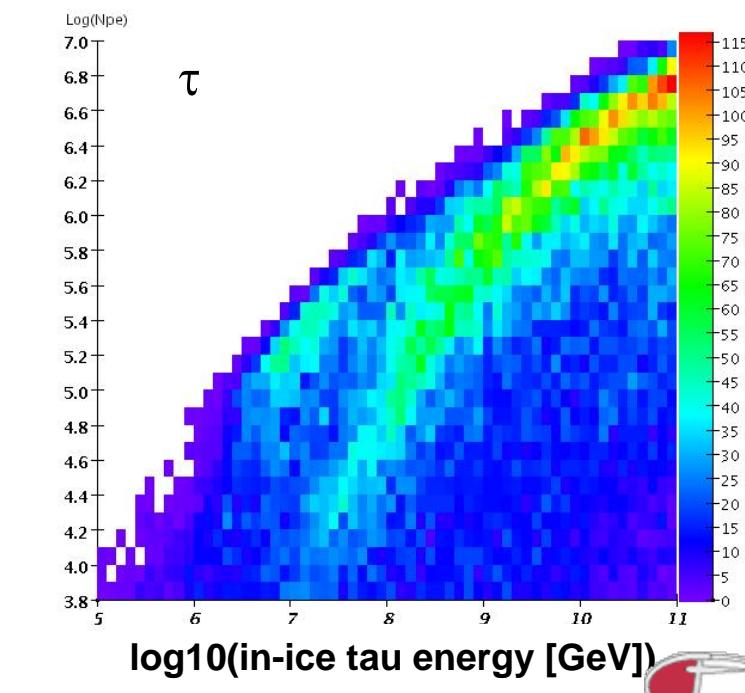
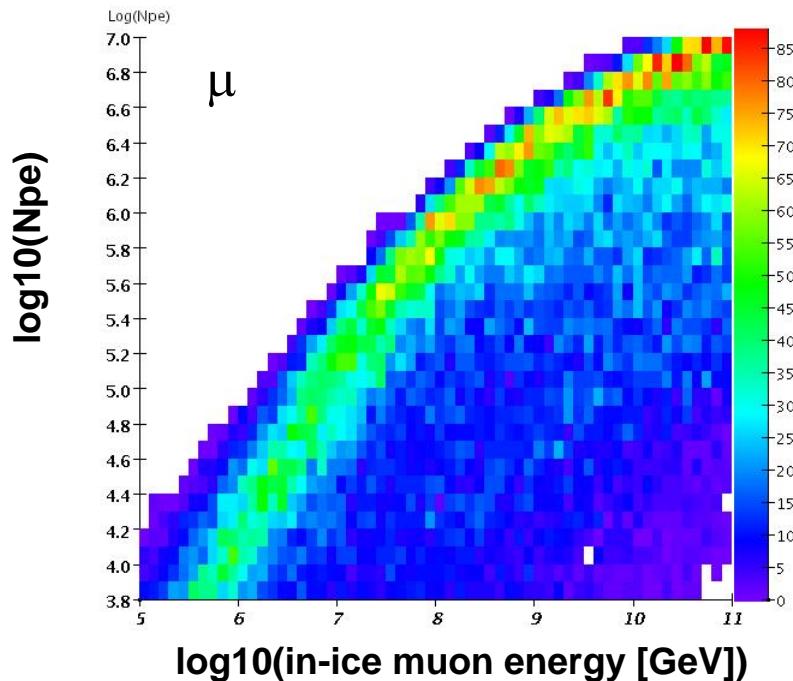


Muon



Tau

Full IceCube

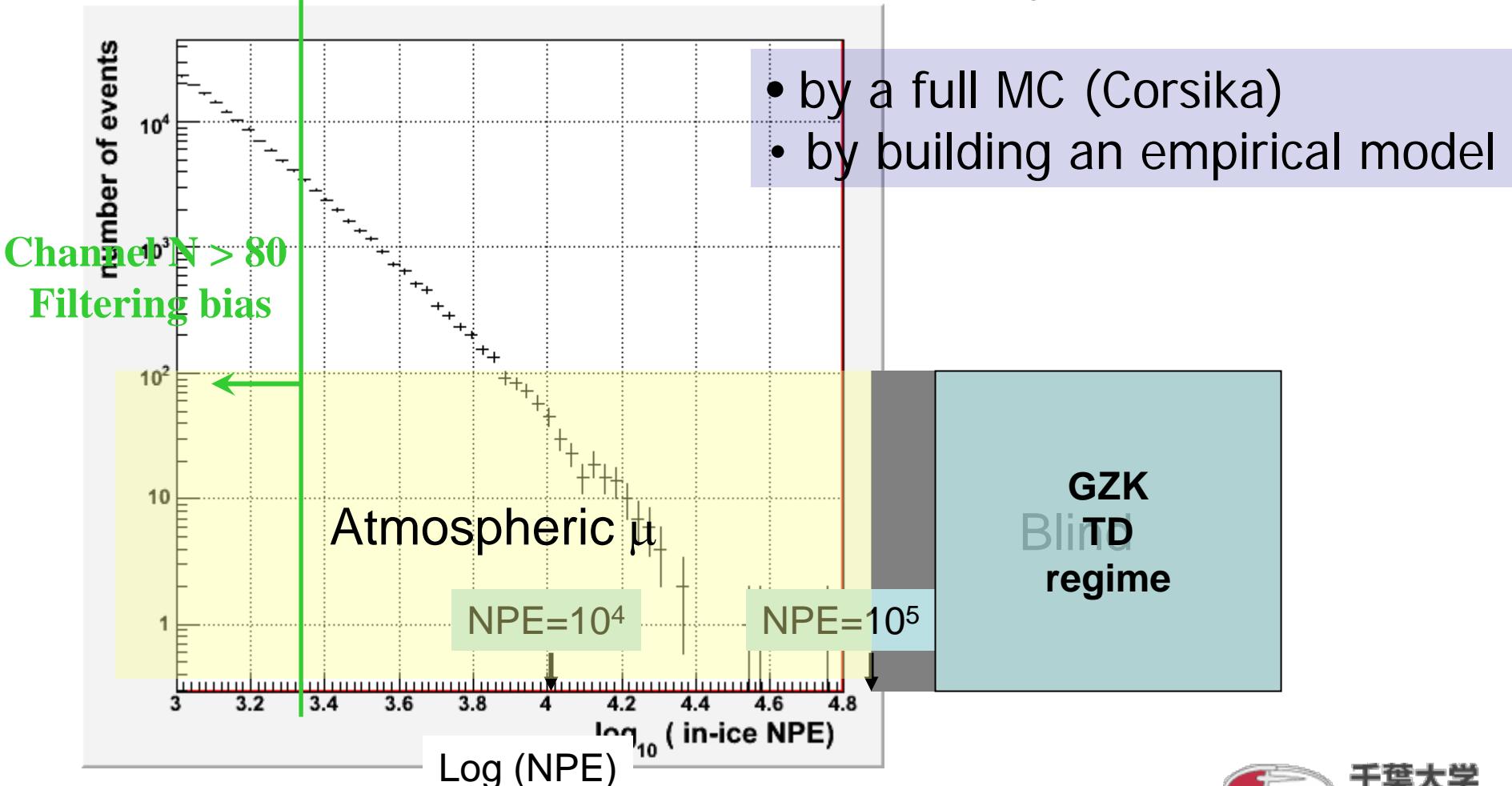


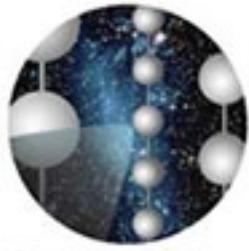


# Background estimate Reliability of extrapolation



Needs MODEL to estimate  $N_{BG}$  at the high energy end



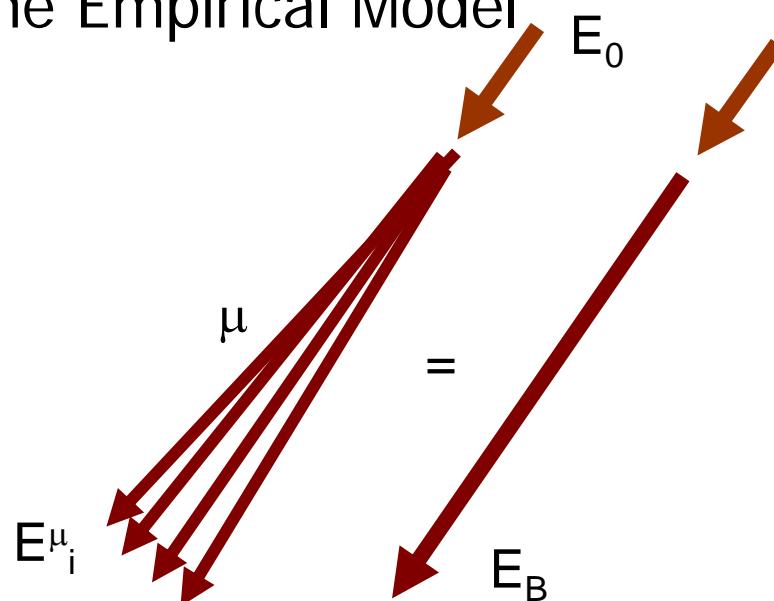


# the Empirical BG model



- Muon Bundles
- Unknown Cosmic Ray Composition
- Possible Prompt Muon production from Charm

The Empirical Model



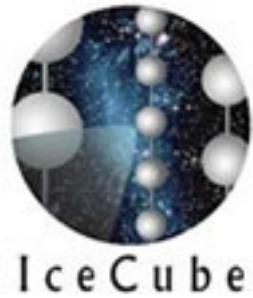
$$\begin{aligned} E_B &\equiv \int_{E_{\text{th}}}^{\infty} \frac{dN_\mu}{dE_\mu} E_\mu dE_\mu \\ &= f(E_0, \boxed{\alpha, E_{\text{th}}}) \end{aligned}$$

Fit with the IC data

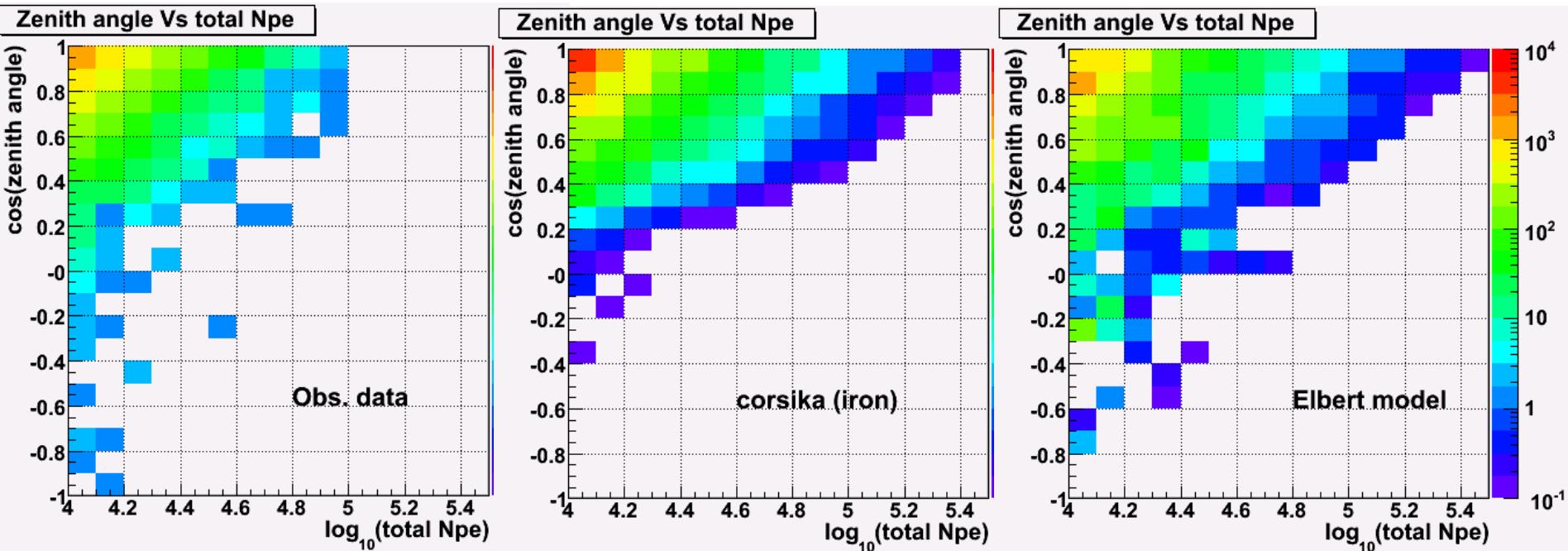
Slope

Min. Energy in a bundle





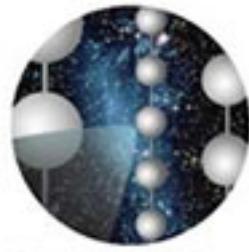
# Data-BG model comparison



2007 observation (242 days)



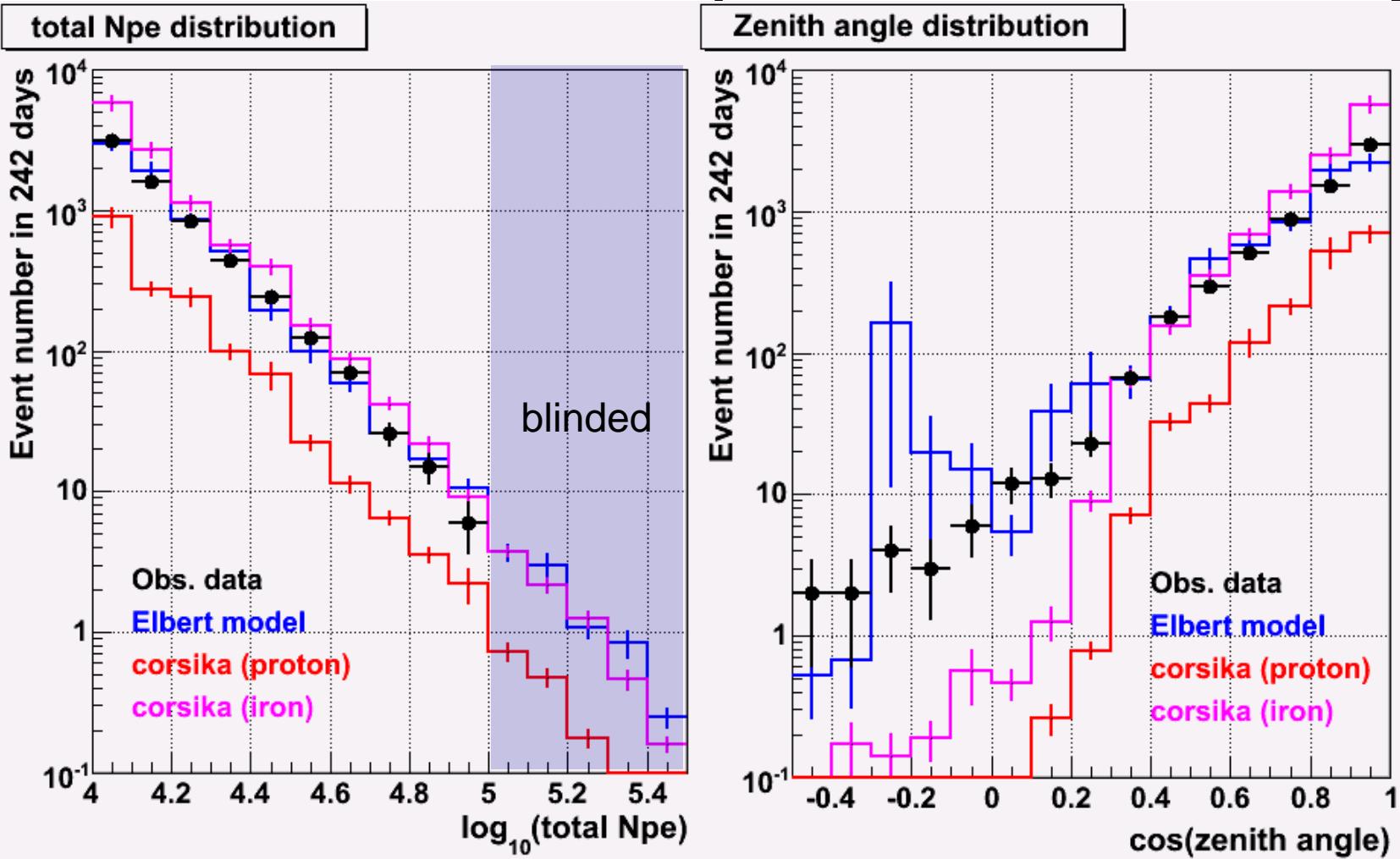
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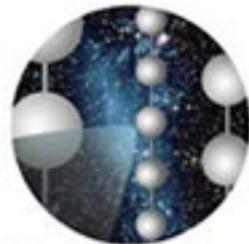
# Data-BG model comparison



2007 observation (242 days)

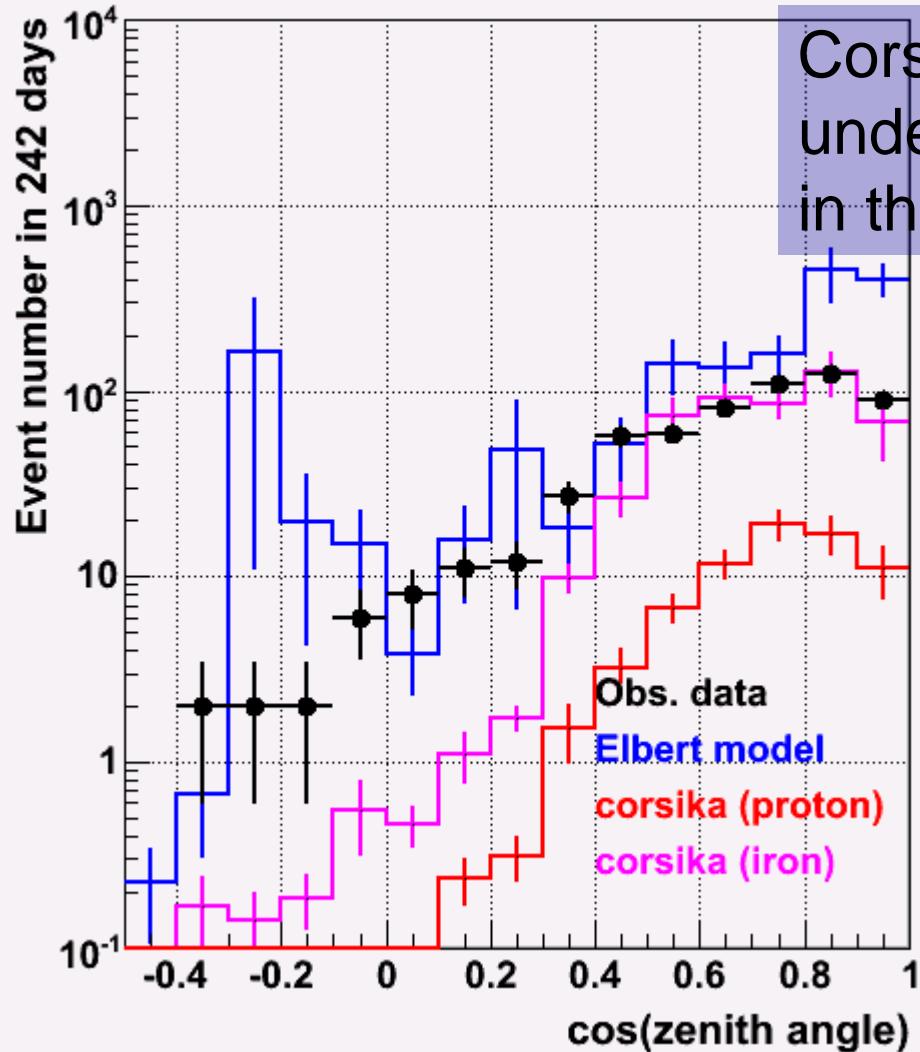


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# Distribution at the deeper ice

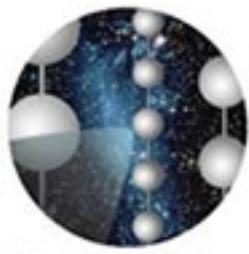
IceCube zenith angle distribution



Corsika-SYBILL  
underestimate BG intensity  
in the horizontal geometry space

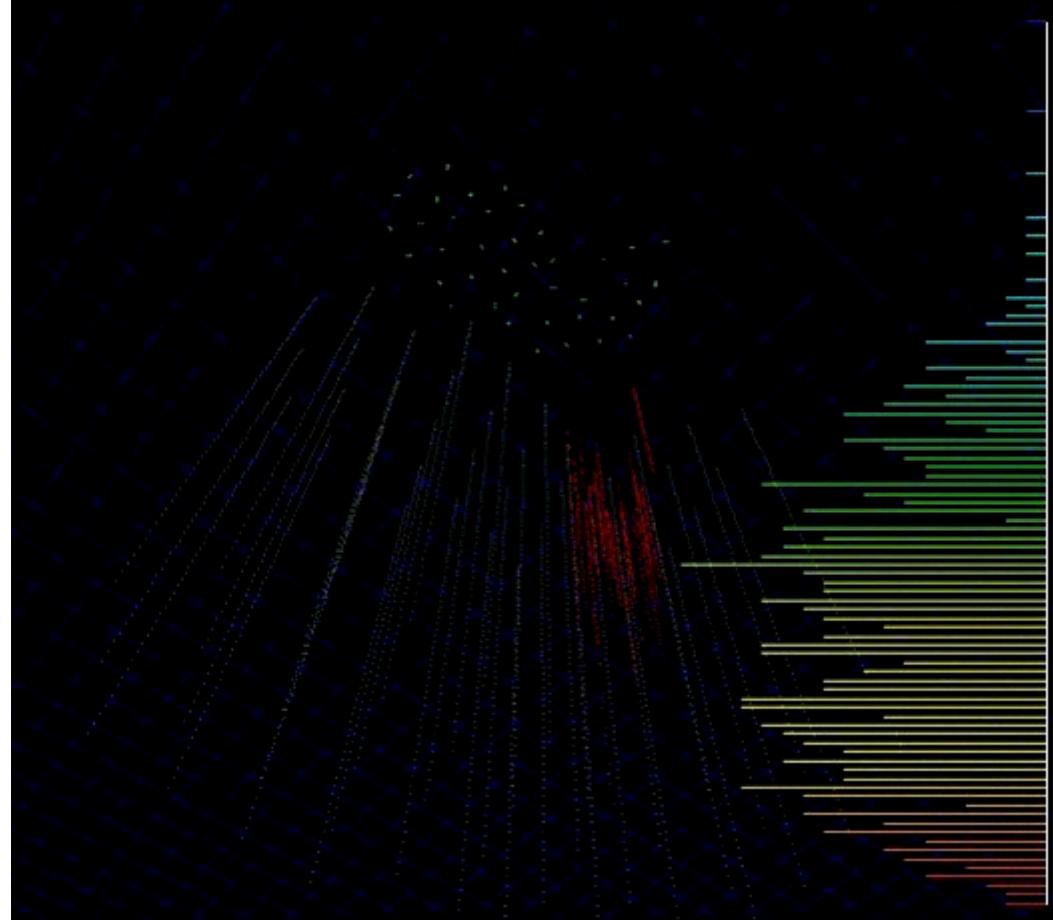
- Systematic error of the ice?
- Particle Physics?





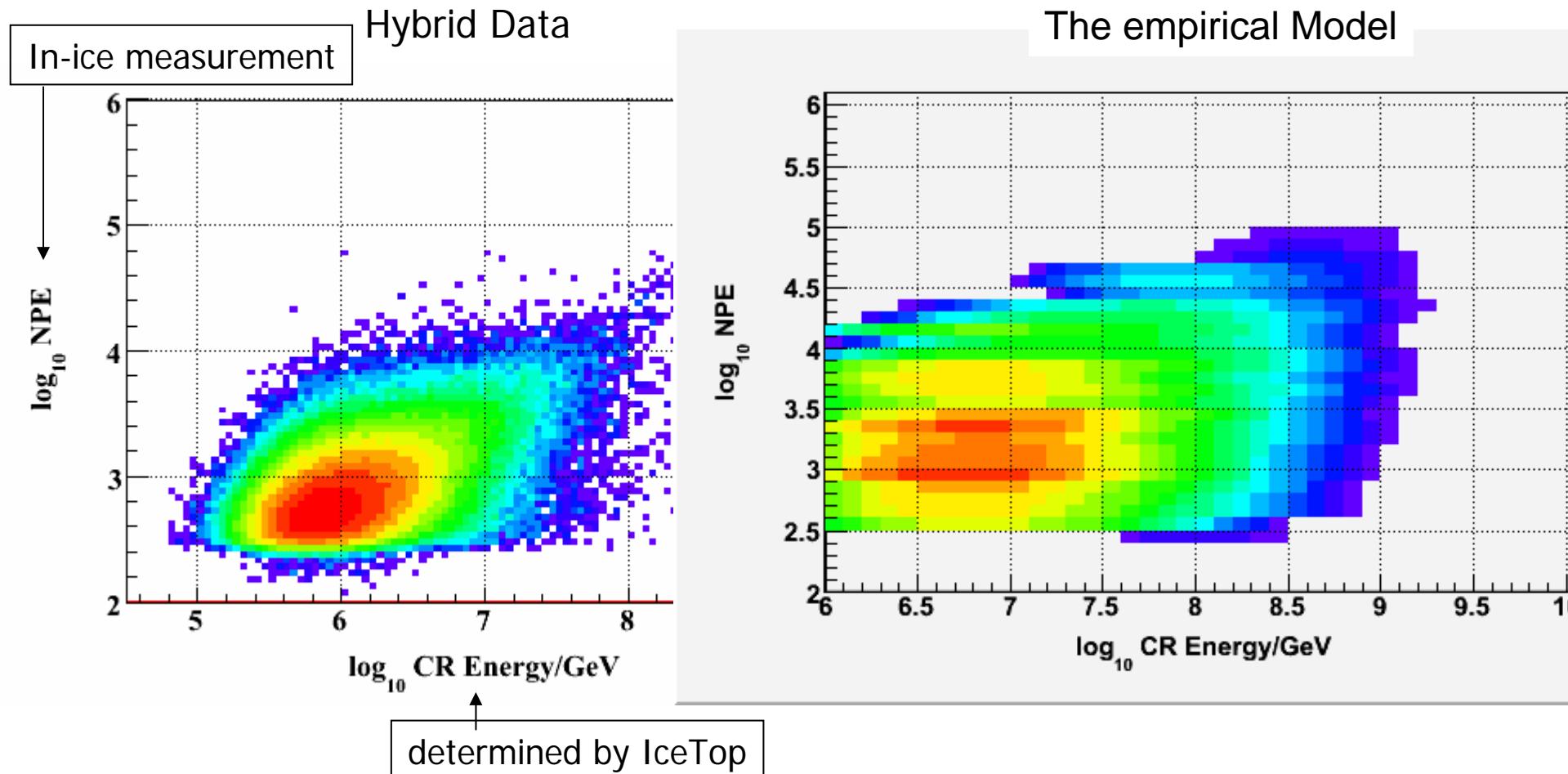
IceCube

# Our Events



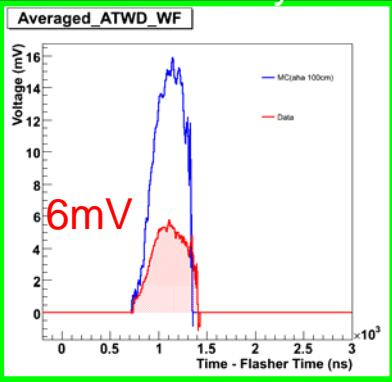


# Verification by the surface – deep ice hybrid events

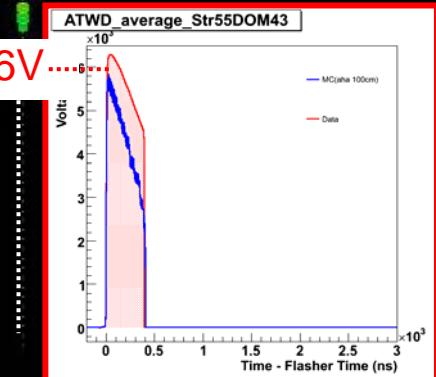


# Energy Scale Calibration

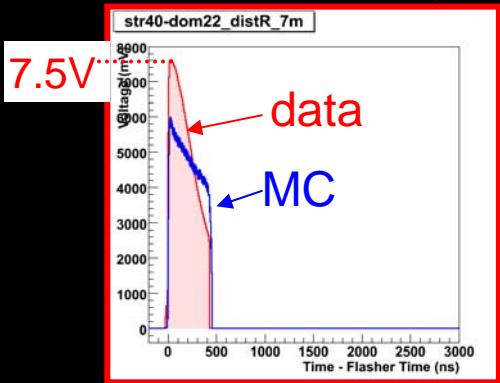
156m away



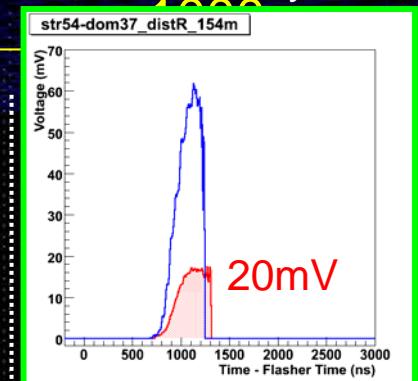
Z=1810m  
9m below



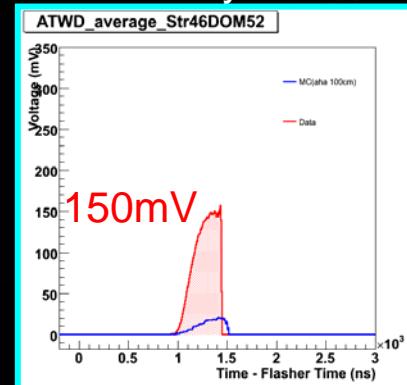
7m above



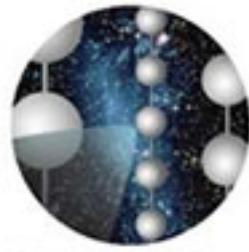
154m away



205m away



Z=2150m  
SC2  
~ $10^8$  GeV



IceCube

# Prospects



- 現在 2007 data ( $0.3 \text{ IceCube} \times 242 \text{ days}$ ) を鋭意 解析中 + 結果公表は ICRC2009 で。
- 2008 data ( $0.5 \text{ IceCube}$ ) も解析を開始。EHE filtered data は全て北半球に転送済み 最初の MC production が進行中
- “Deep Core” がスウェーデン主導で建設開始。  
100GeV – TeV の物理 (“Low Energy”)。  
Hamamatsu-high-QE PMT の較正を終了。
- 共同利用のおかげで MC production power が格段に向上しました。ありがとうございました。(できればもう少し disk 容量をください ~ 10 TB)



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