



Gamma Rays Using IceTop

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UDel – May 21, 2014



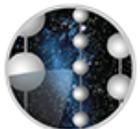


Goal is to answer
this...

- Can we use IceTop for looking at High Energy Gamma Rays?

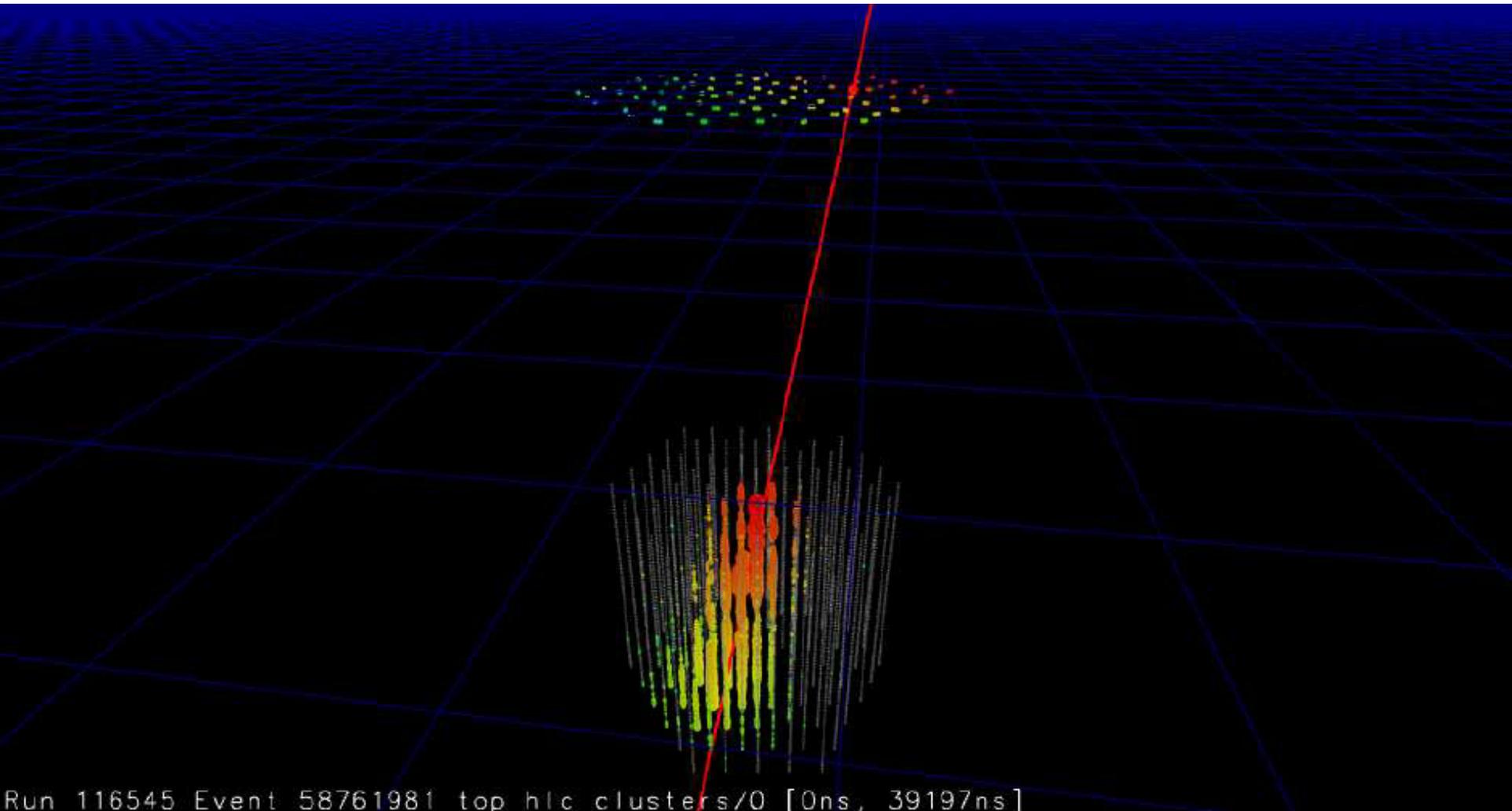
What will WE do
today?

- Find a way to separate Gamma Ray air showers from Proton(Hydrogen) / Iron air showers using IceTop.
- Present the Analysis during Phone Call?





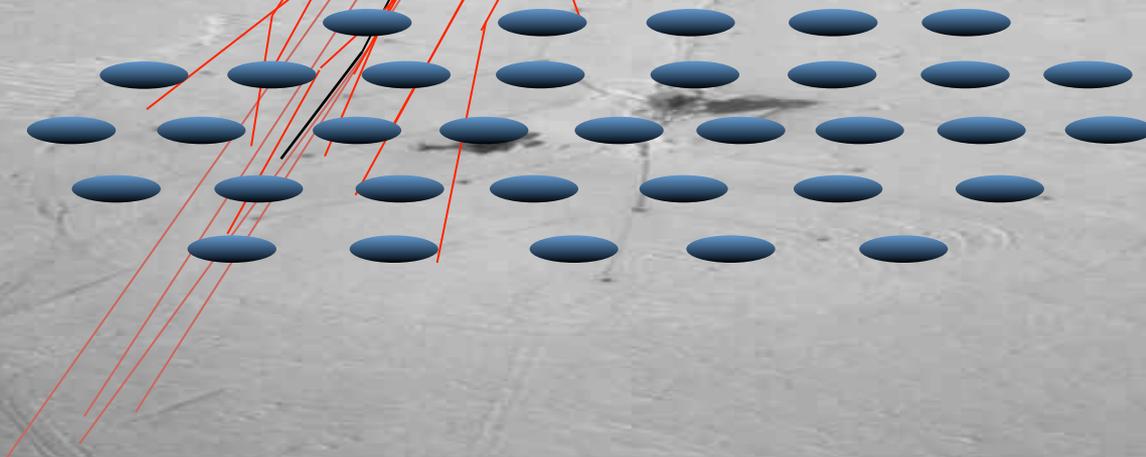
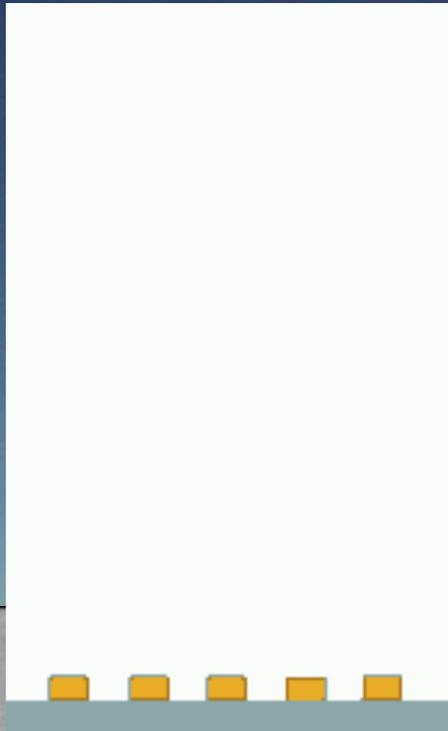
What is IceTop?



Primary Cosmic Ray/ Gamma

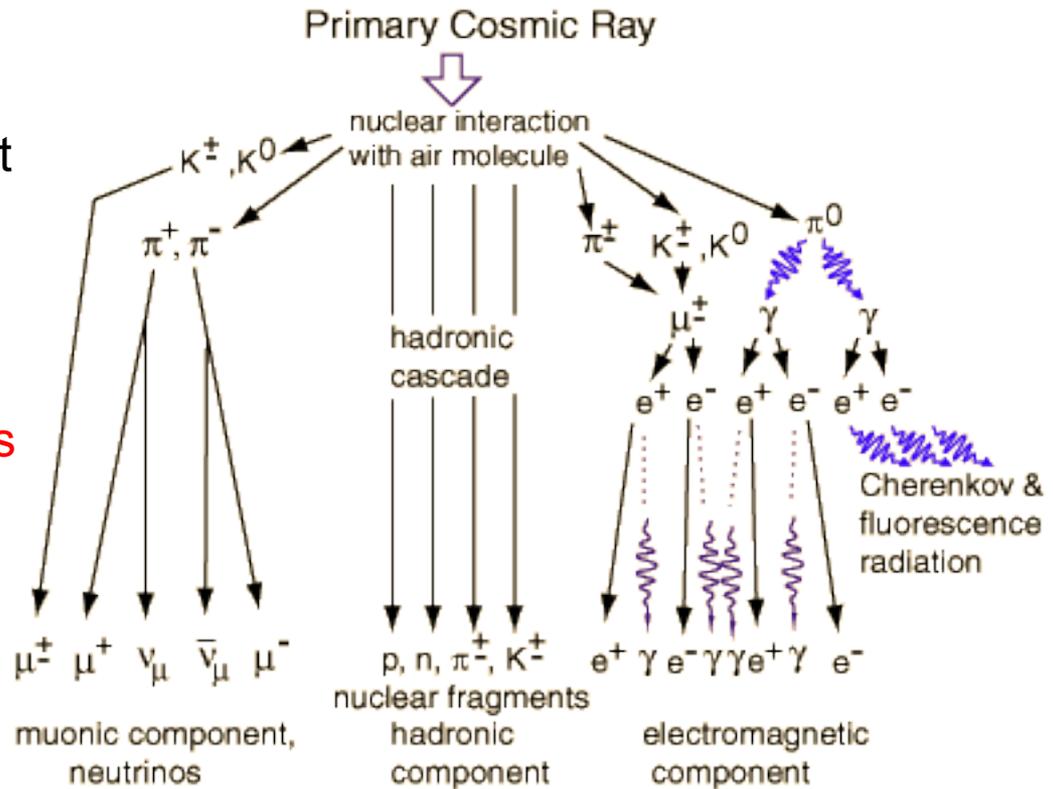
Interaction with atmospheric nuclei

Air Shower



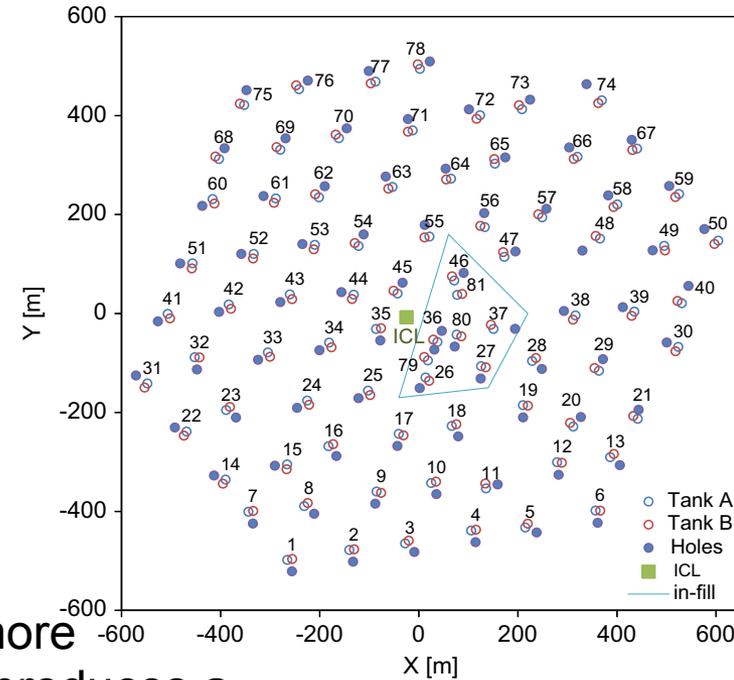
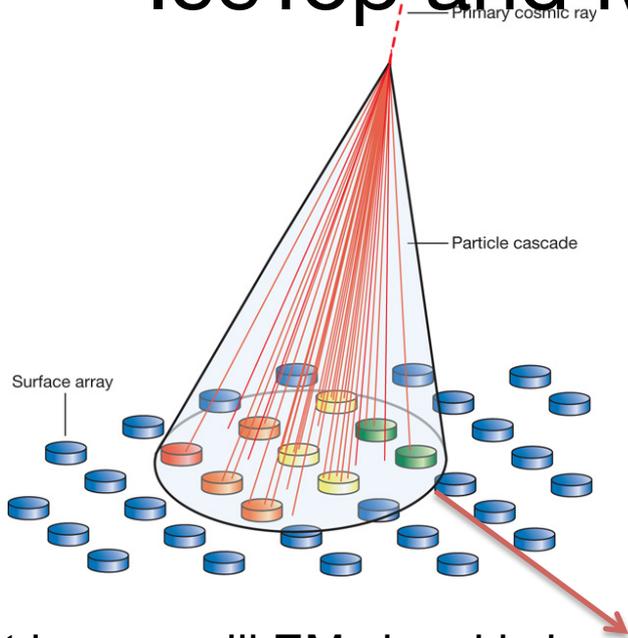
Gamma Ray (Light) Showers Vs. Proton(Hydrogen)...Carbon...Iron Showers

- Air Showers have:
 - Electro-Magnetic Component (i.e. electrons, positrons, gamma rays)
 - Muons
- Air showers arising from gamma rays have 10 times less Muons as compared to Proton (lightest cosmic ray).
- As compared to Iron(heavier cosmic ray), this difference is even bigger.





IceTop and Measuring Muon Content



At larger radii EM signal is low and Muon signal is more prominent. 1 Muon passing through an IceTop tank produces a signal of about 100 pe. (approx).

At smaller radii you have strong EM signal and that makes it difficult to differentiate Muon Signal.



Analysis Method

‘Isolated-spherical-chicken study’ – first step towards studying the real bird !

- We make indirect observation:
 - Study signal generated by Simulated showers at first - so we know what we are looking at.
 - What we have today is:
 - Simulated Gamma/Proton/Iron Showers of fixed Energy and coming vertically down from the zenith.
 - In real data we will have showers of all energies and from all angles...



Sample Simulated Shower

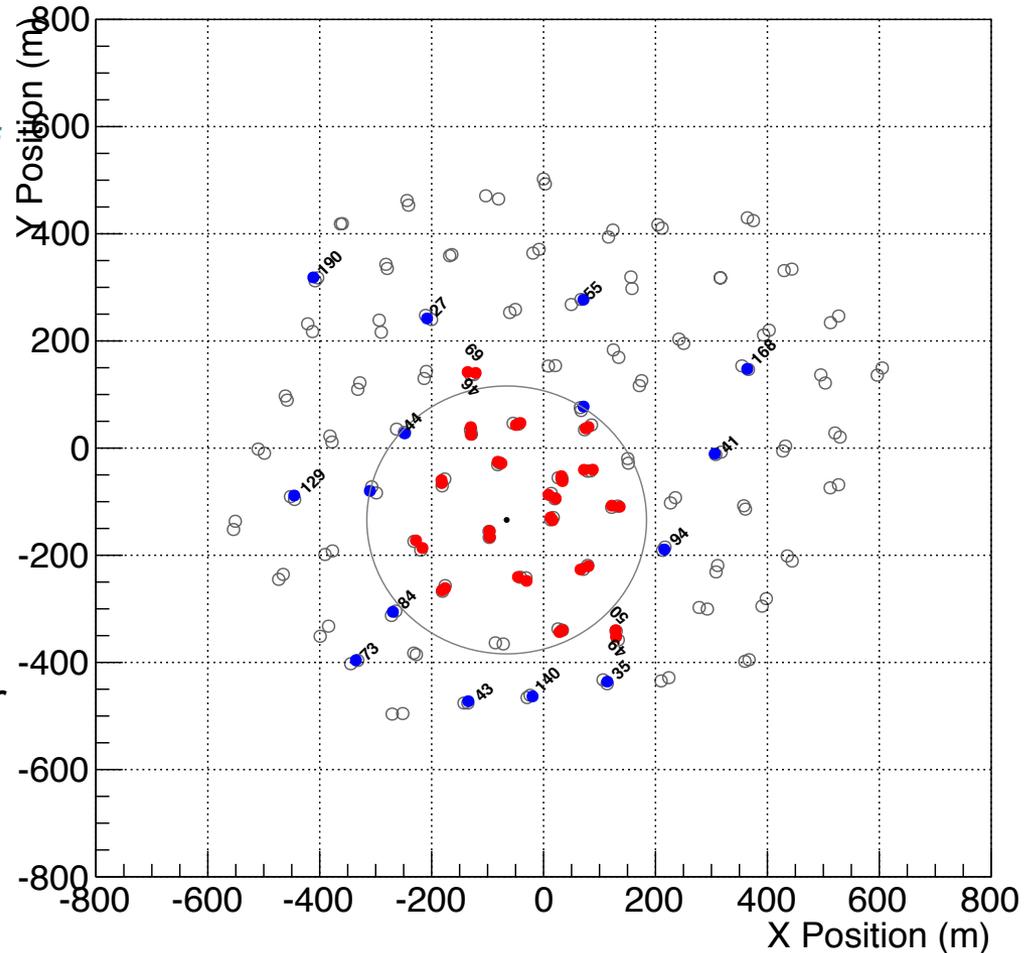
Remember!!

>We want to measure Muon content of shower. 1 Muon will create 100 pe (approx)

>>We look at outer part of the shower...

>>We look at tanks with signal more than 100 pe...

>> Either count number of tanks or calculate total charge in those tanks – FOR EACH SHOWER/ EVENT.





Let's get our hands dirty...

- Three Groups – Gamma, Proton, Iron...
- Each makes a histogram of Total Charge After Cuts. (Radius and Charge cut)
- Then we compare histograms...
- And figure out how to identify a Gamma air shower !



So... Can we use IceTop for Gamma Ray Search?



The End.



DECO

- Convert your cell phone into a Cosmic Ray detector!