




IceCube Masterclass

Exposing High-school students to the
Frontiers of Astroparticle Research

Paras Koundal

paraskoundal.com

Bartol Research Institute, University of Delaware

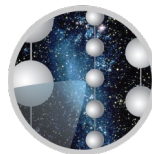
 /ParasKoundal



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UNIVERSITY OF DELAWARE
BARTOL RESEARCH
INSTITUTE



ICECUBE
NEUTRINO OBSERVATORY



ICECUBE MASTERCLASS
AN AUTHENTIC ASTROPHYSICS RESEARCH EXPERIENCE

Admunsen-Scott South Pole Station



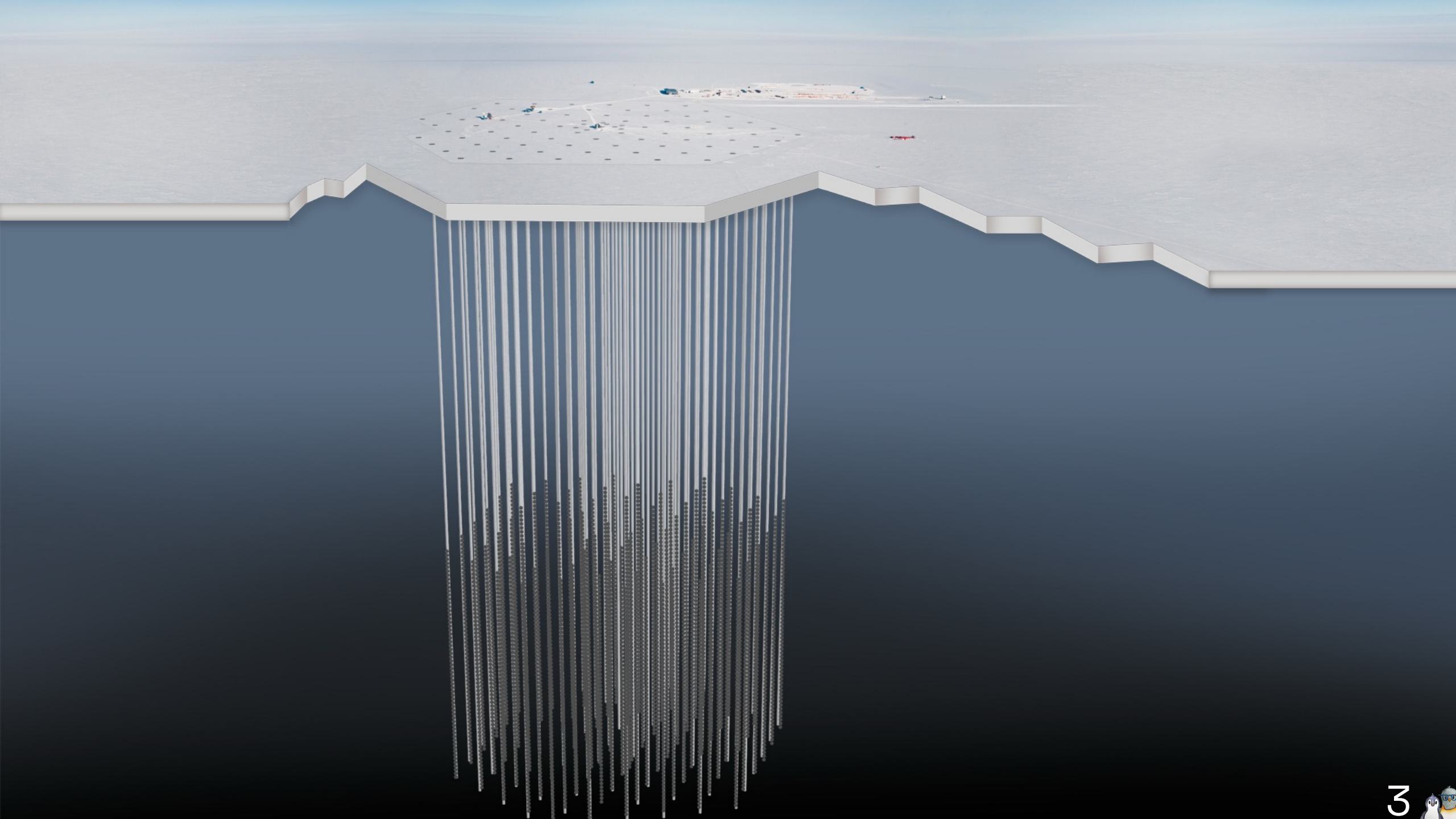
Geographic South Pole



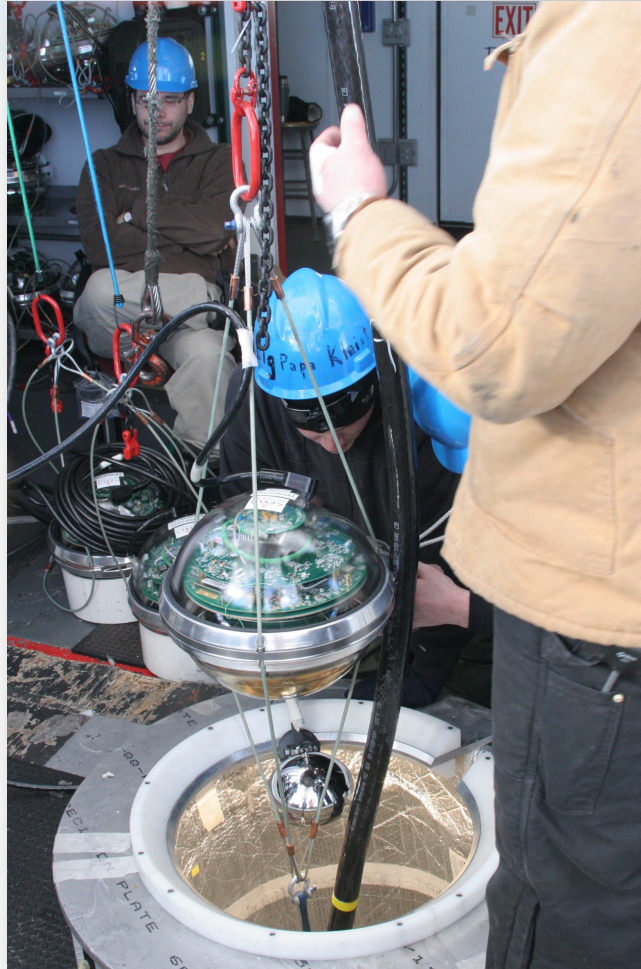
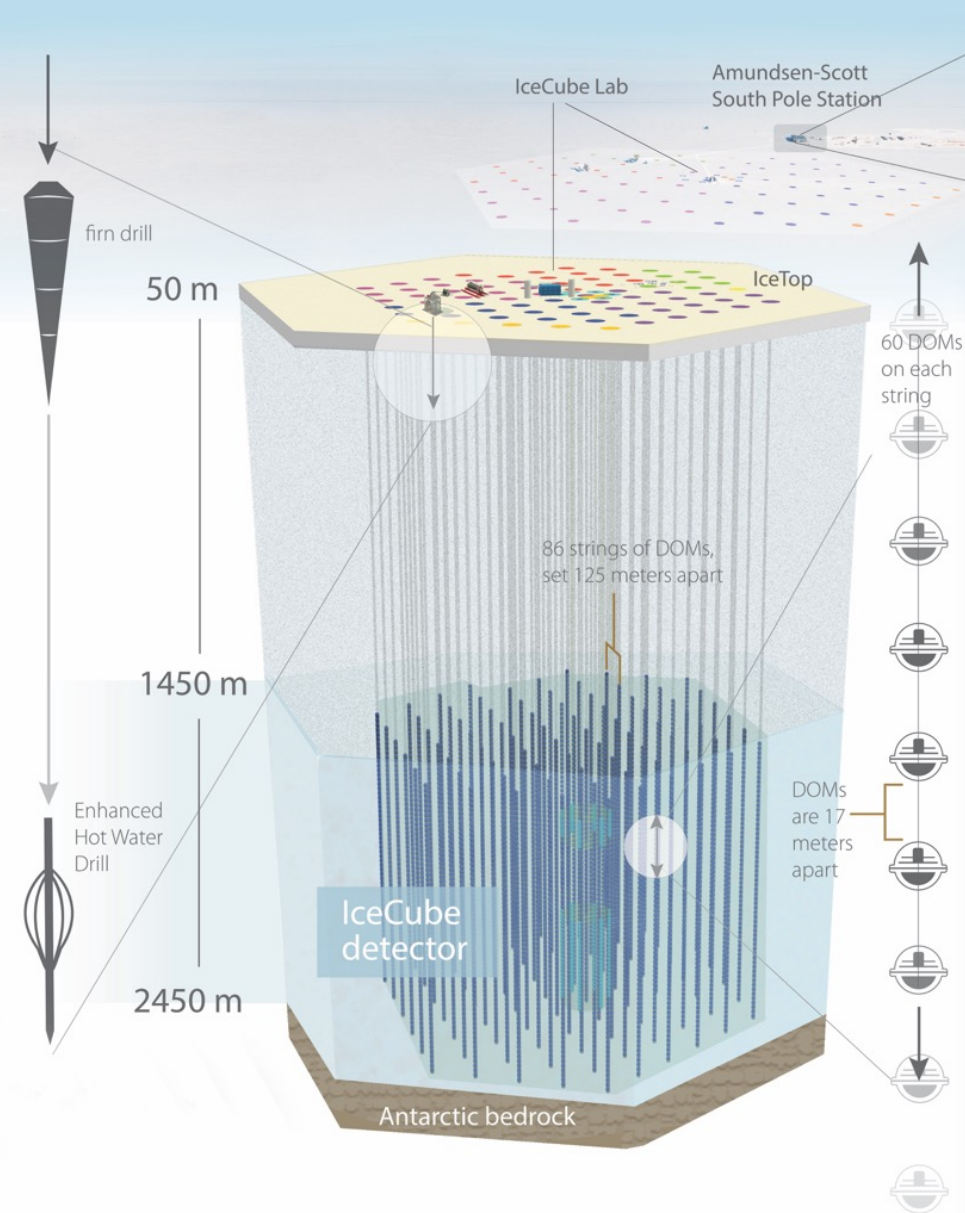
IceCube outline

Skiway



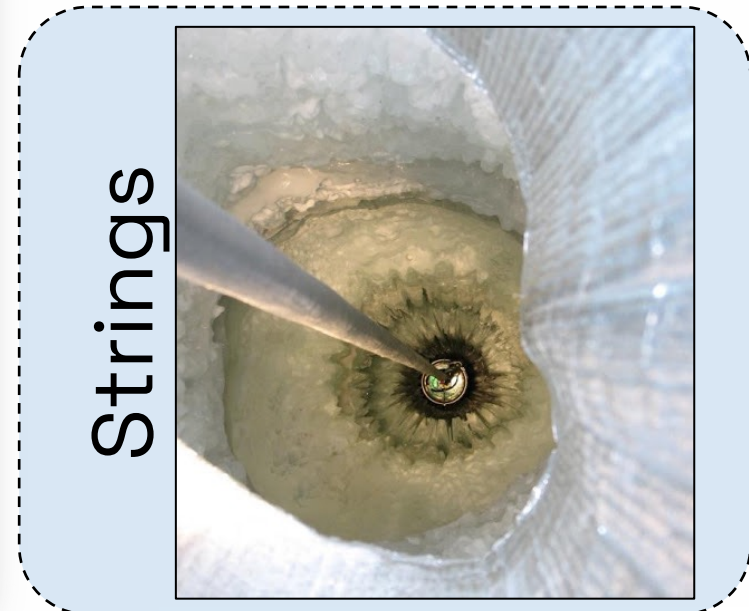


Particle Fishing @ IceCube



Tanks

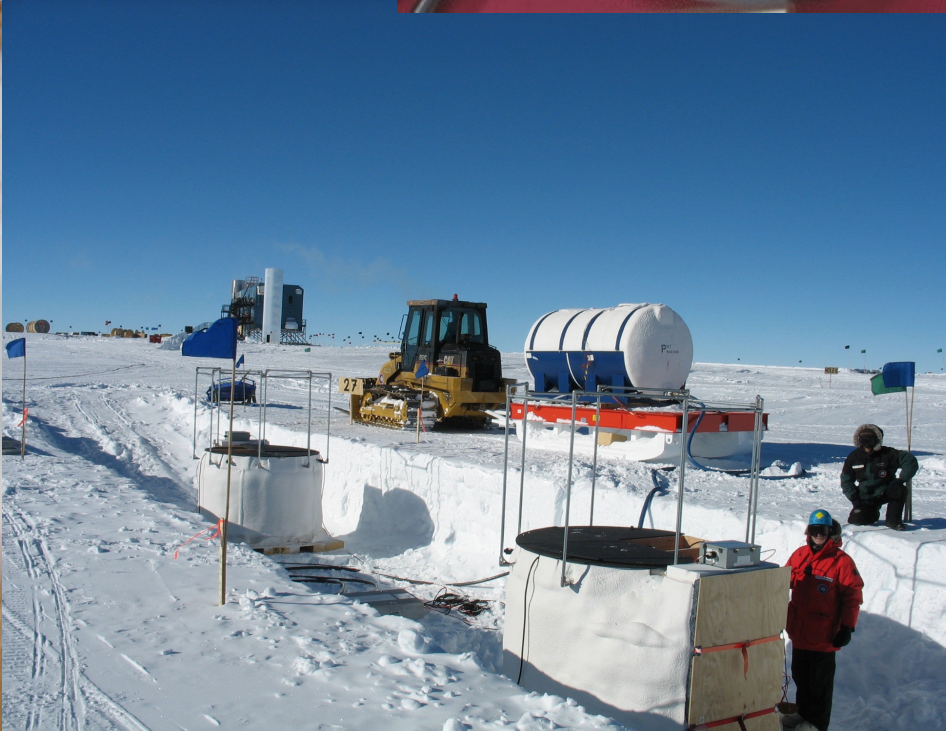
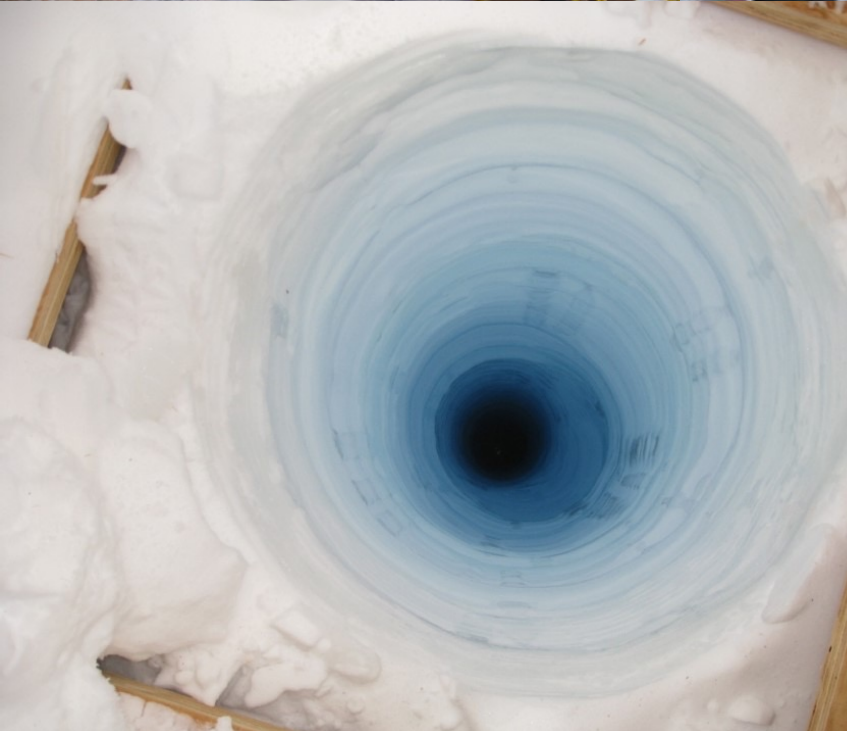
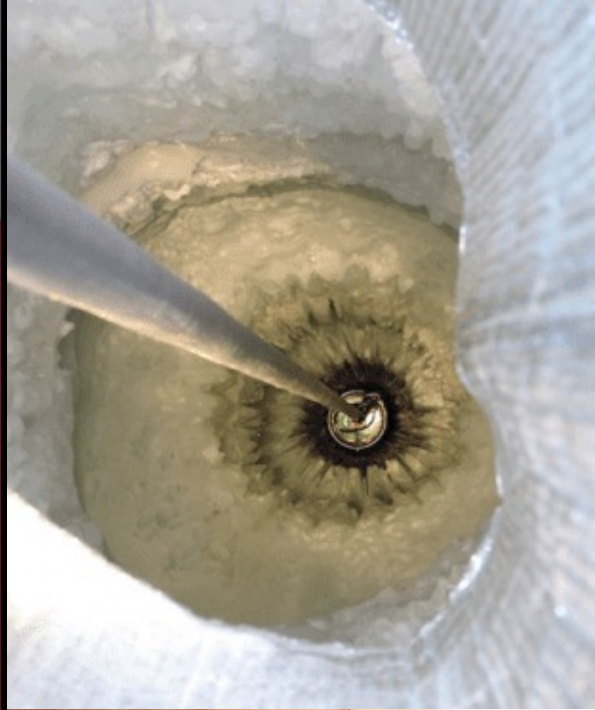
DOMs

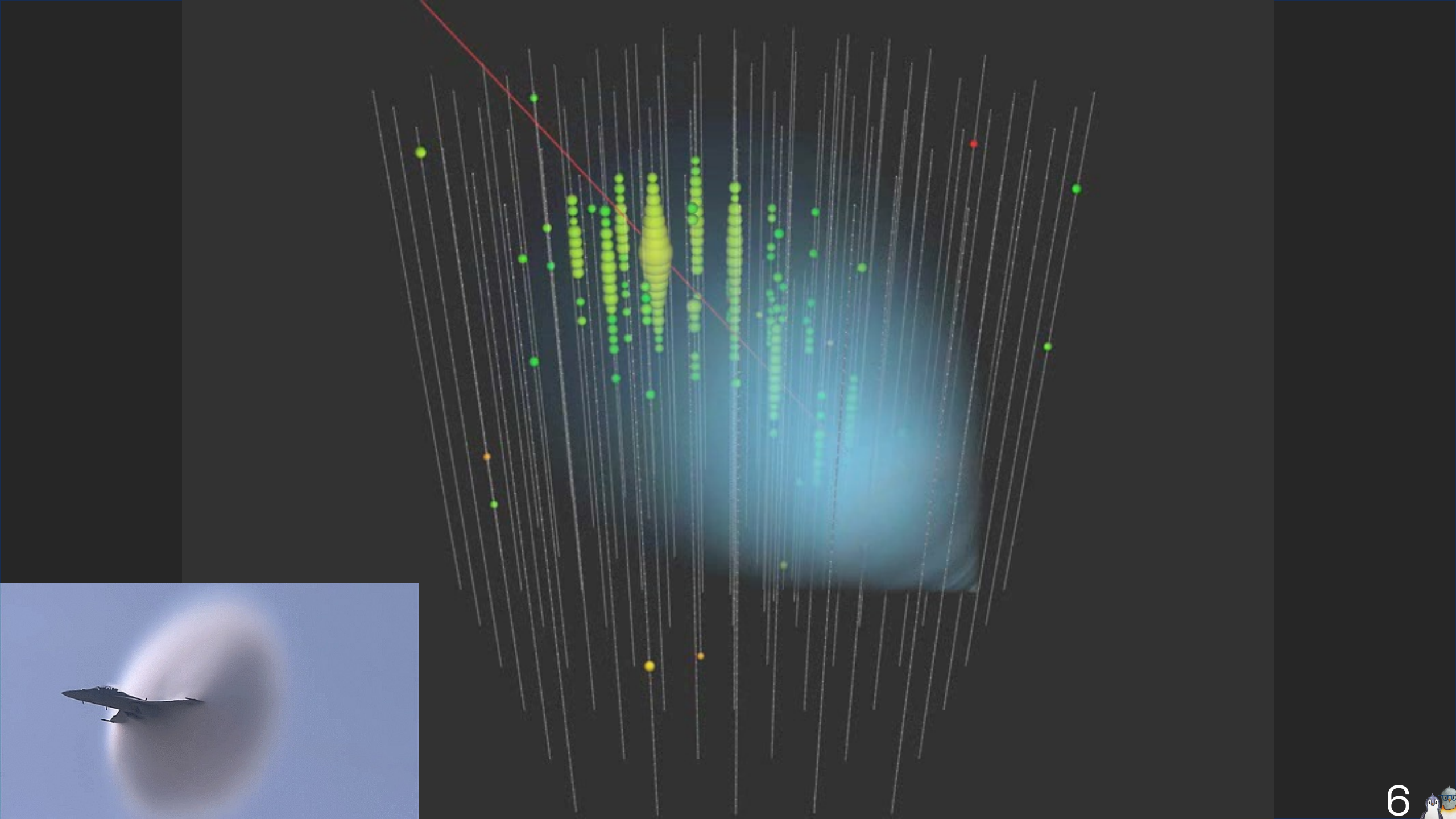


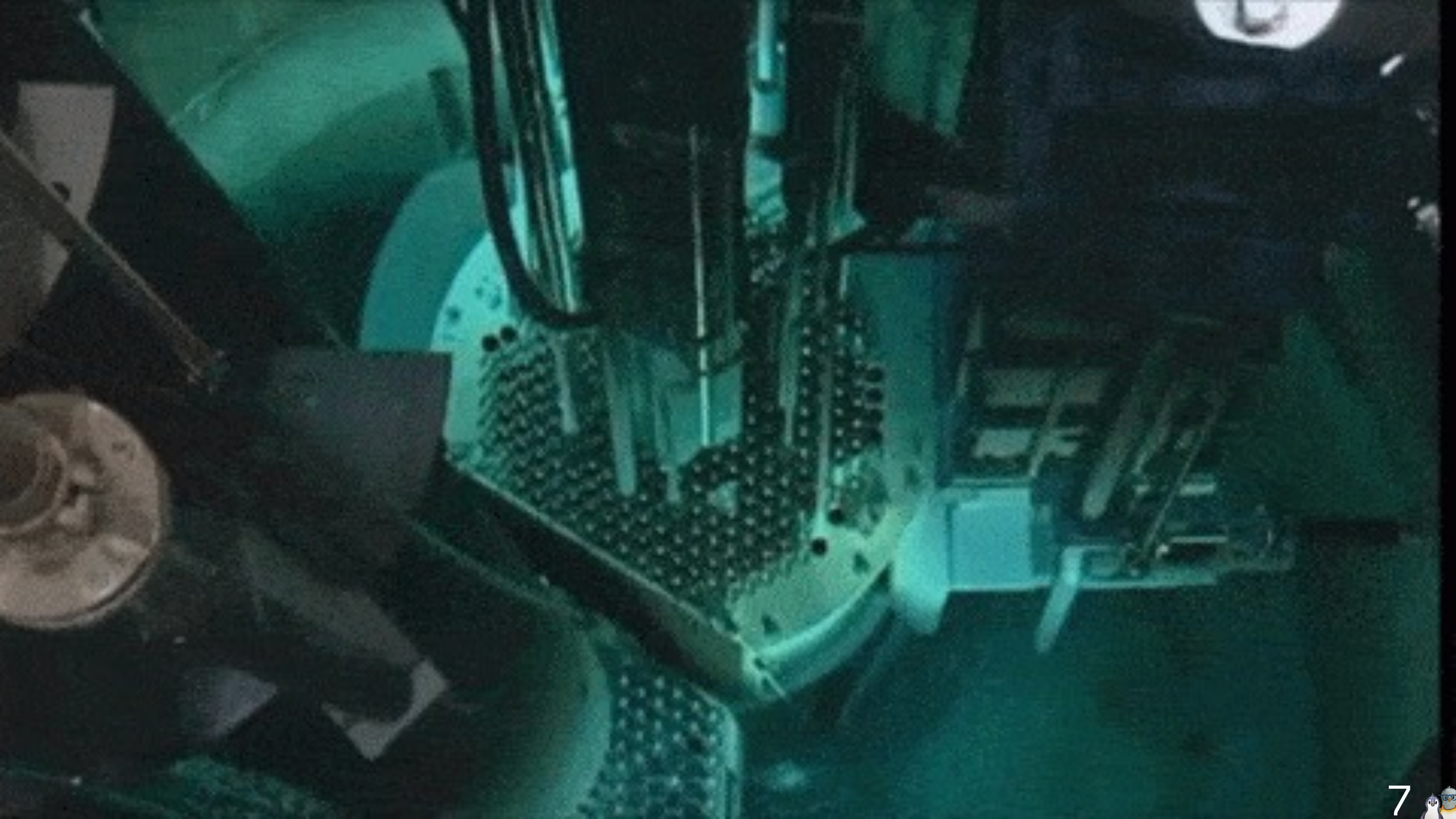
Strings

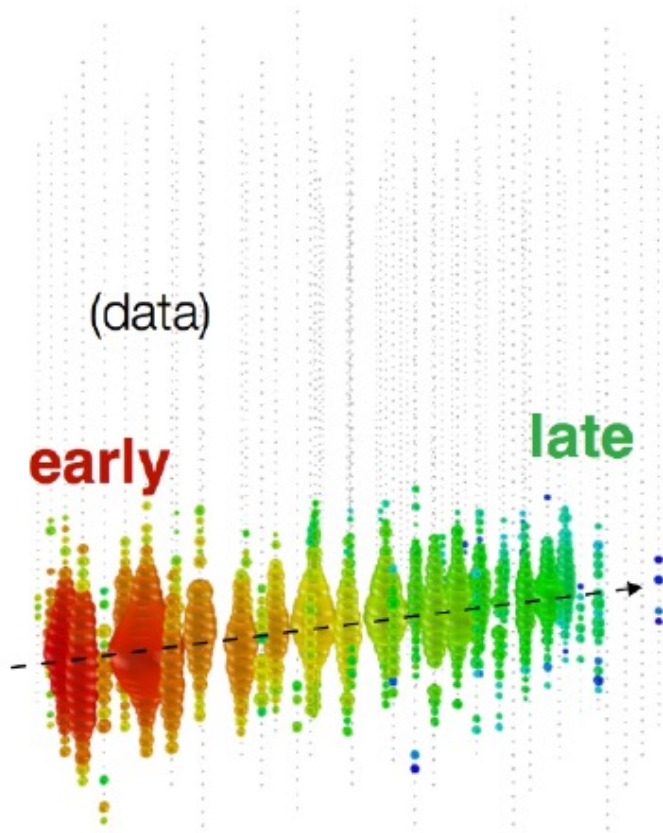
ICETOP

ICECUBE



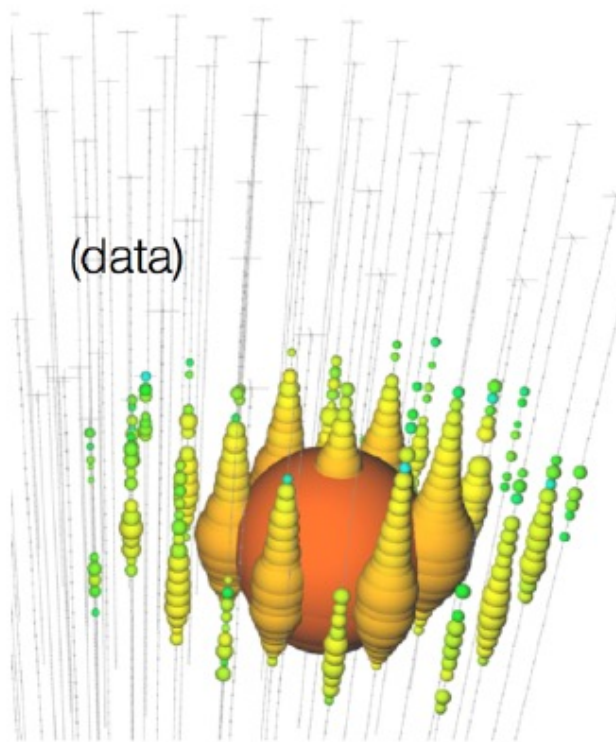






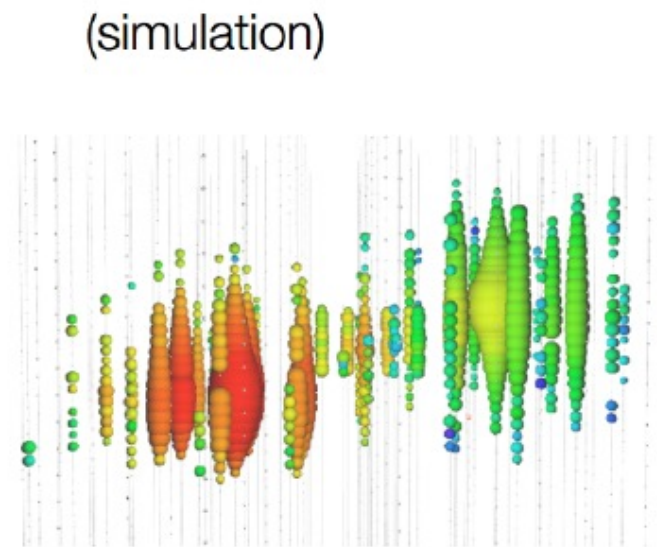
Up-going track

Factor of ~2 energy resolution
 < 1 degree angular resolution



Isolated energy
 deposition (cascade)
 with no track

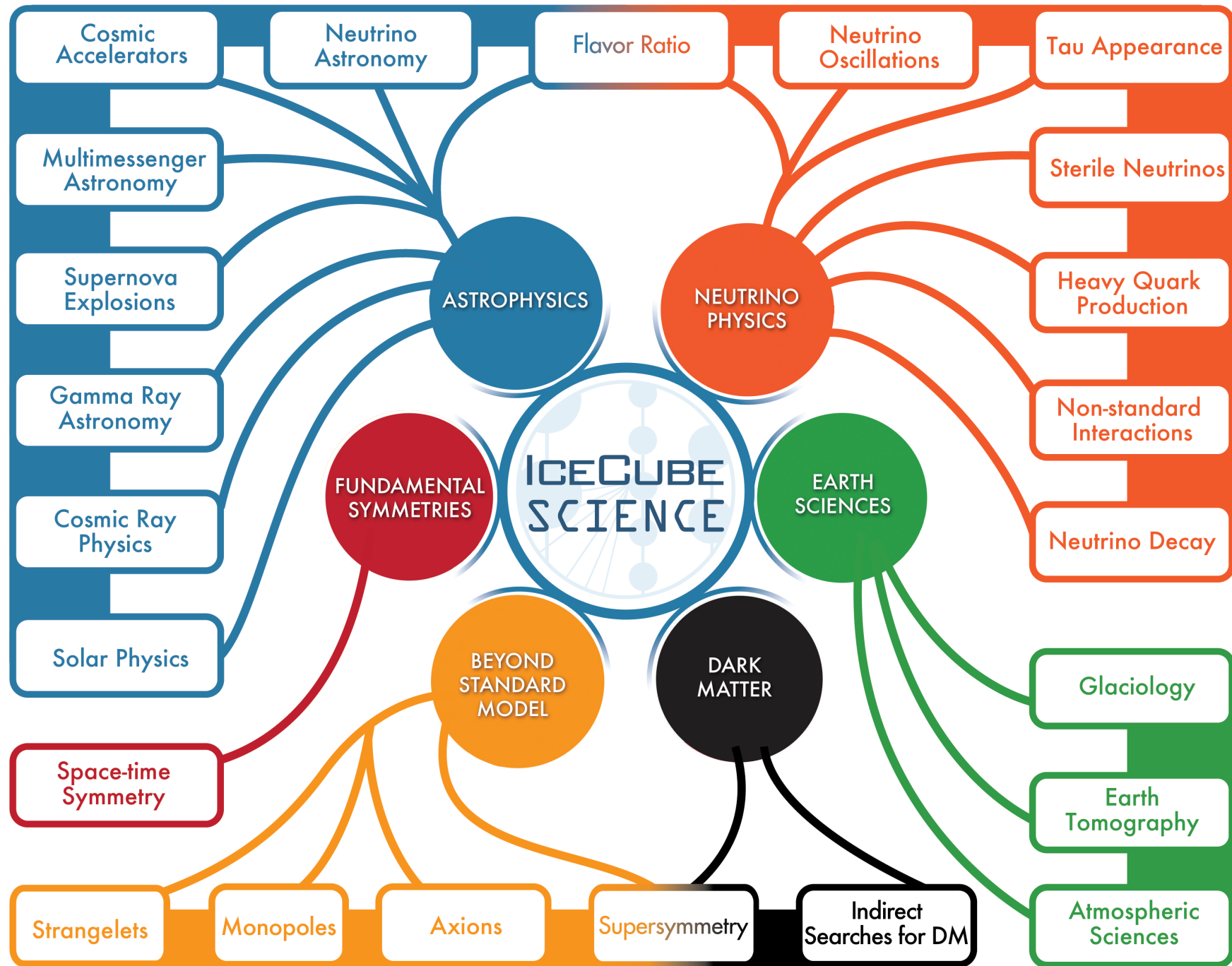
15% deposited energy resolution
 10 degree angular resolution (above
 100 TeV)



Double cascade

(resolvable above ~100 TeV
 deposited energy)

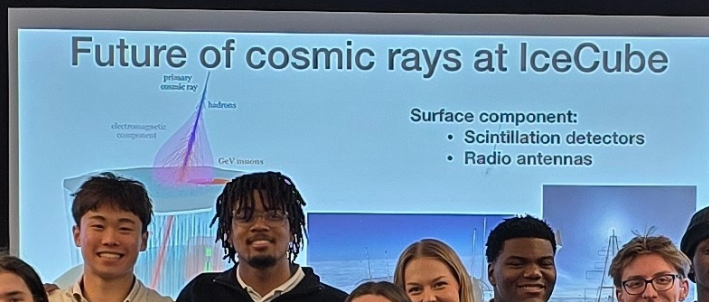




THE HISTORY OF Neutrino Astronomy *in* Antarctica



IceCube Masterclass



Legacy

International Effort



Aim: Expose school students to the field of astroparticle physics
Recent Iteration: March 24th 2026

1st Iteration



.....

7th Iteration



8th Iteration



.....

11th Iteration



Focus

Build Foundations

Hands-on

Interact & Inspire

Build Foundations

Topics

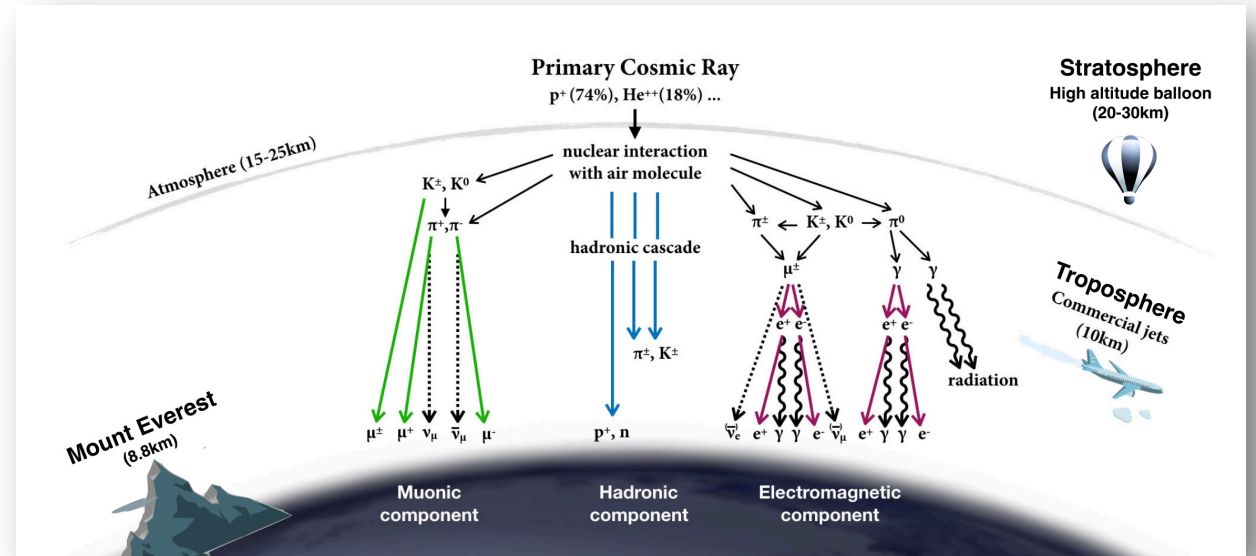
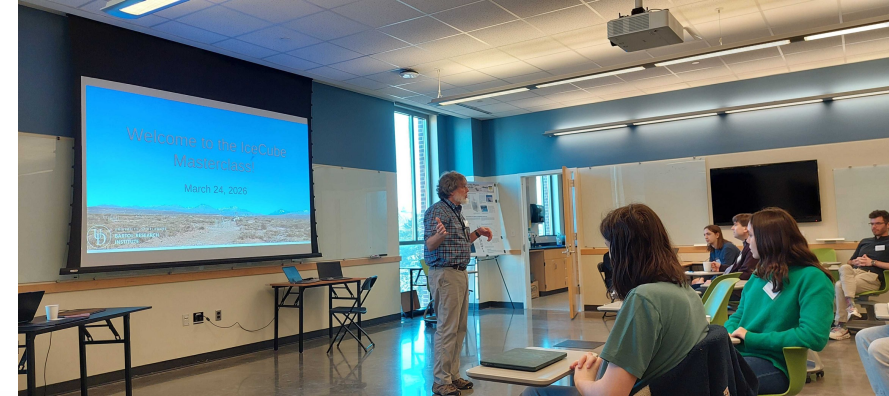
Registration
Welcome
General Introduction to Particle Astrophysics
CosmicWatch
Break
IceCube: intro detector & science
IceCube: event classification exercise
IceCube: Life at South Pole
Why I Joined Astro?
Lunch
IceTop & air shower detection
Analysis task: air-shower reconstruction
Break
Intro energy spectrum measurement
Analysis task: energy spectrum
Energy spectrum wrap up
Break
Research opportunities in IceCube & Closing
Sign-Out / Check-Out
Departure

particle detection {

Ice Cube observatory {

PA: CR obs events {

PA: CR model spectrum {



Hands-On

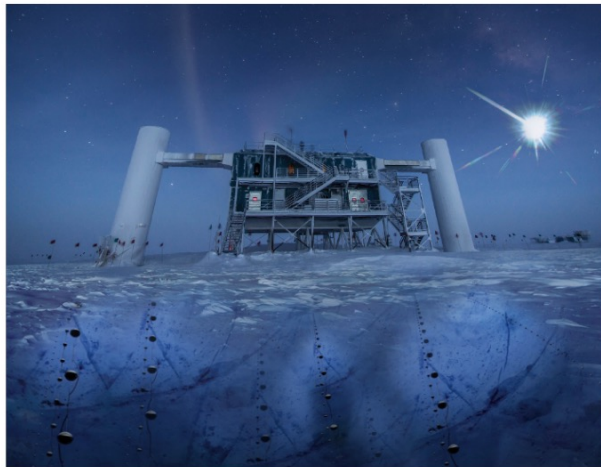
Cosmic-Watch

IceCube

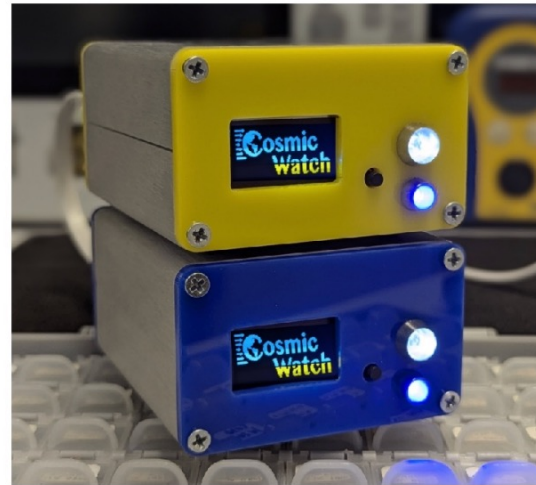
IceTop

Cosmic-Watch

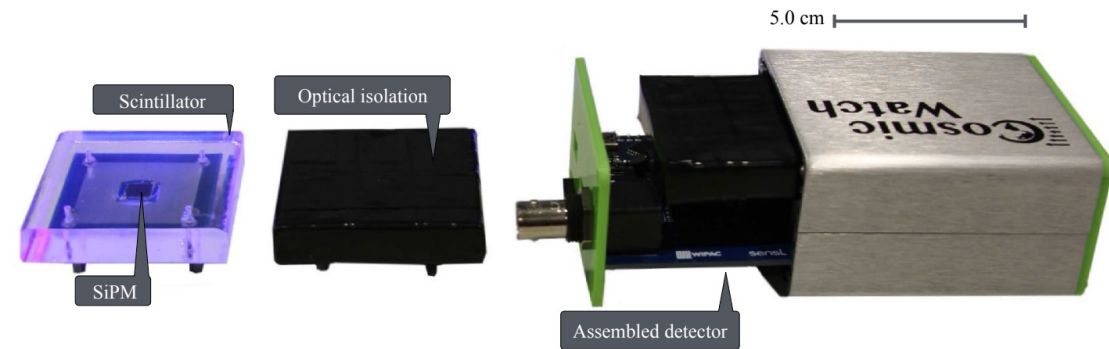
Give students an experience of particle detection using pocket size detectors
(Measure radioactivity in household things)



The **largest neutrino detector** in the world, built in 5 years, cost ~\$279 million

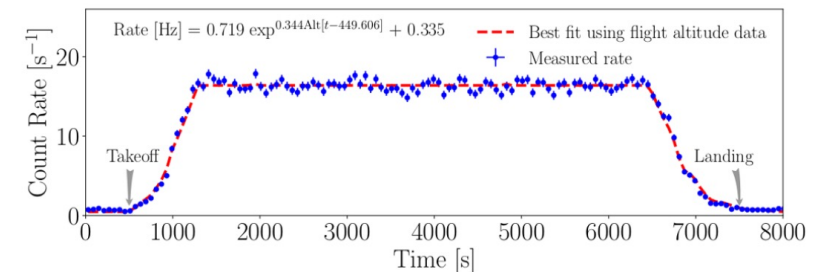


Pocket size detector you can build yourself in ~4h, cost ~\$100

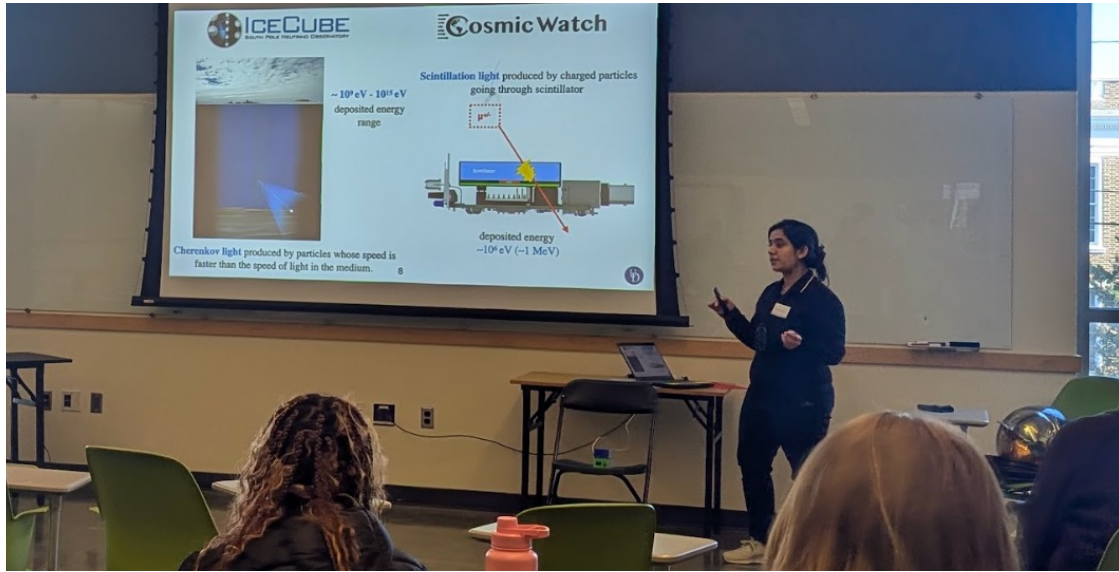


Some fun measurements!

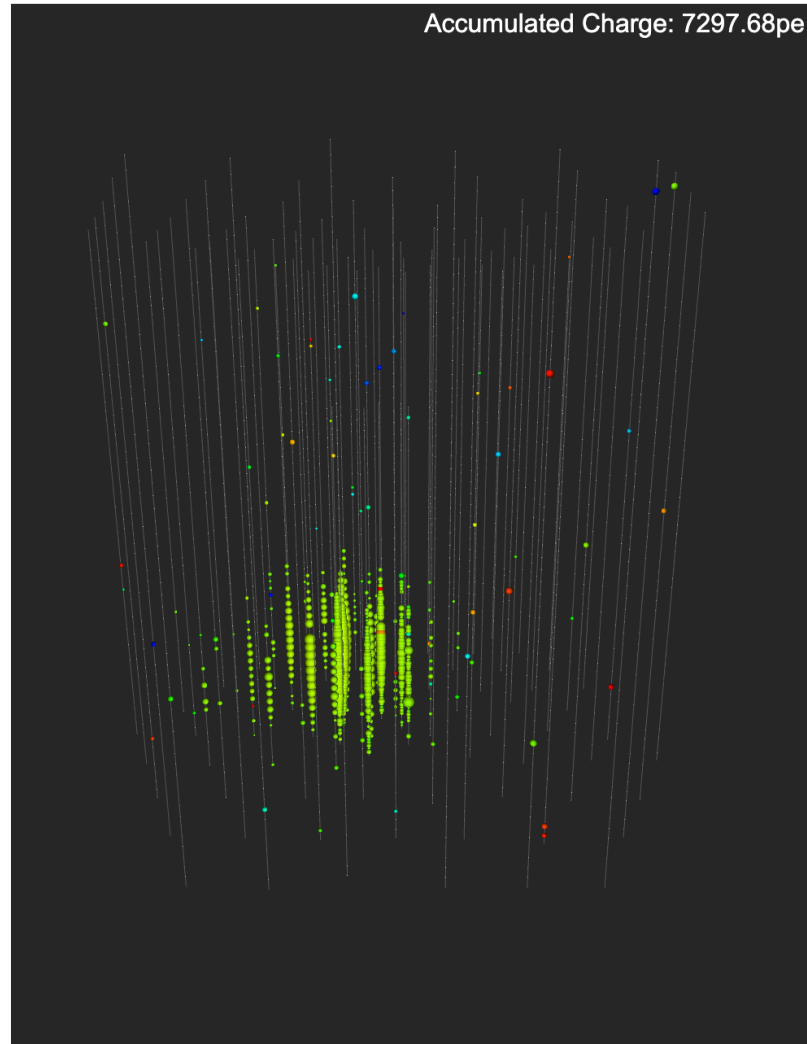
Airplane measurement



Cosmic-Watch



Hands-On: IceCube



Select which type of event you think this is:

- Upgoing track
- Downgoing track
- Cascade
- Coincident events

Submit

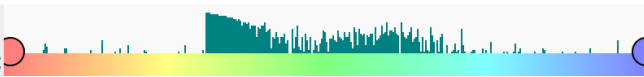
Total: 0/0

Reset Counter

masterclass.icecube.wisc.edu/quiz/particle-id-quiz/

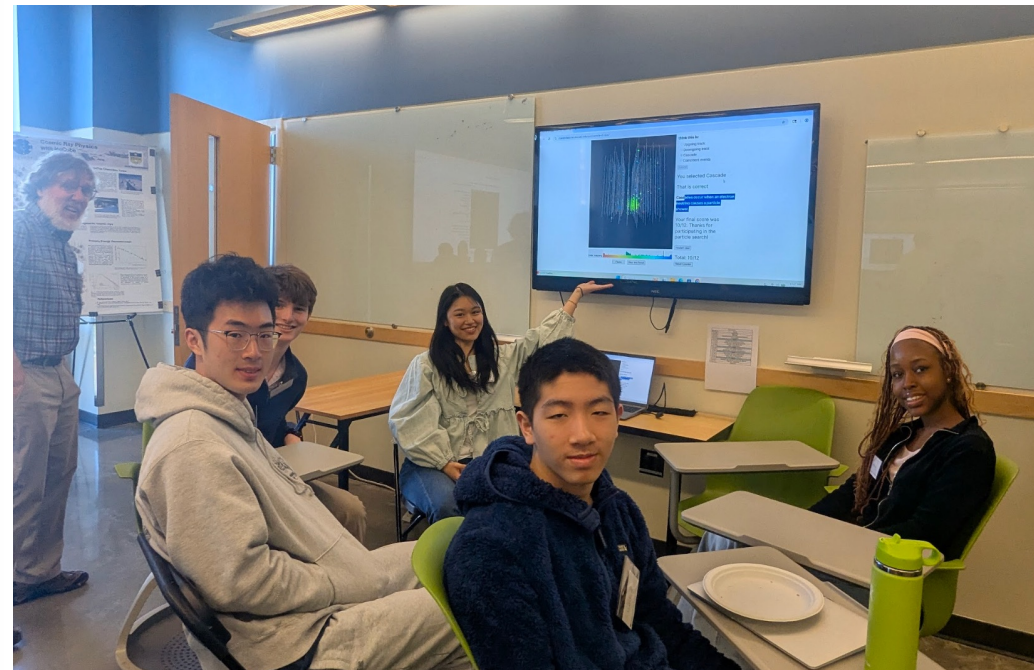


Color mapping:



Play

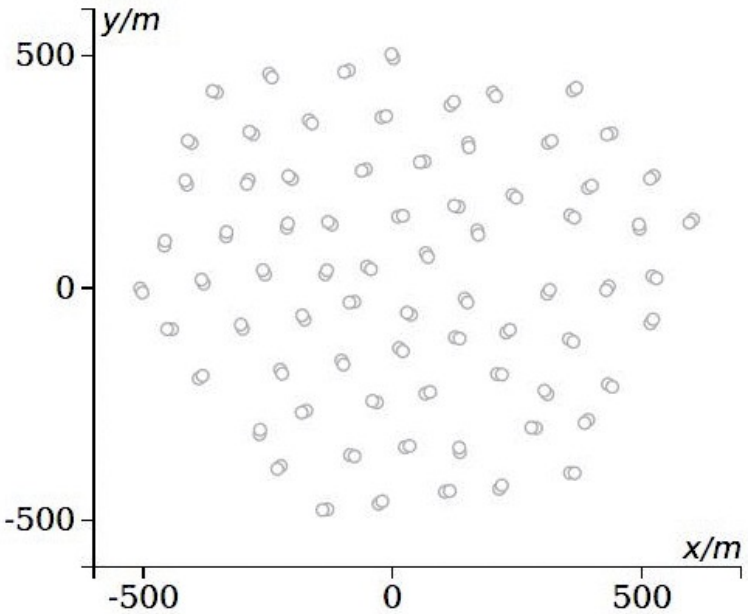
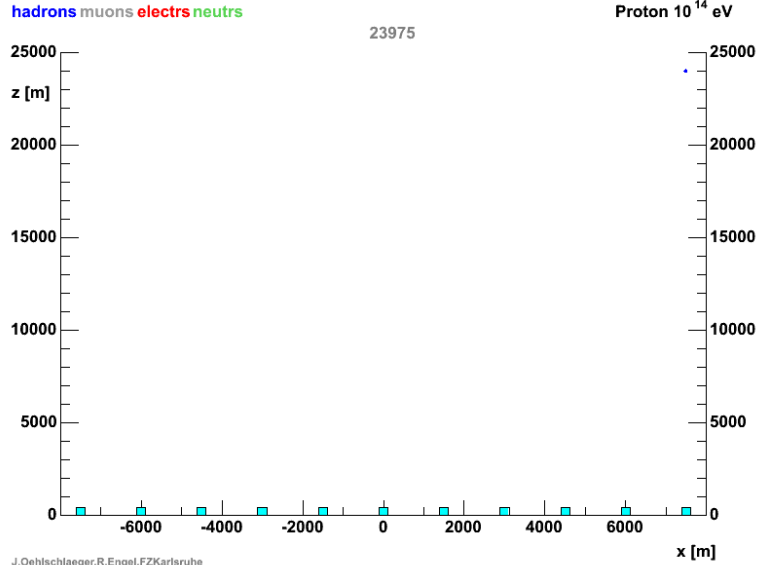
Stop and Reset



Hands-On: IceTop

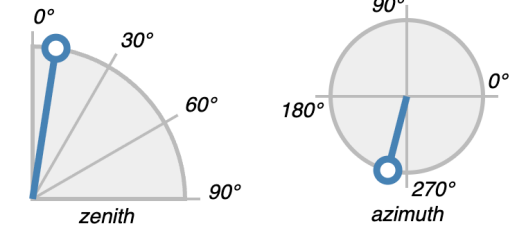
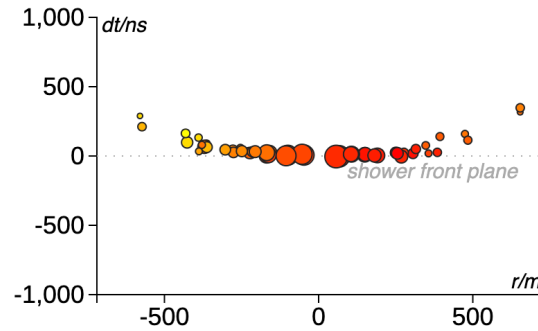
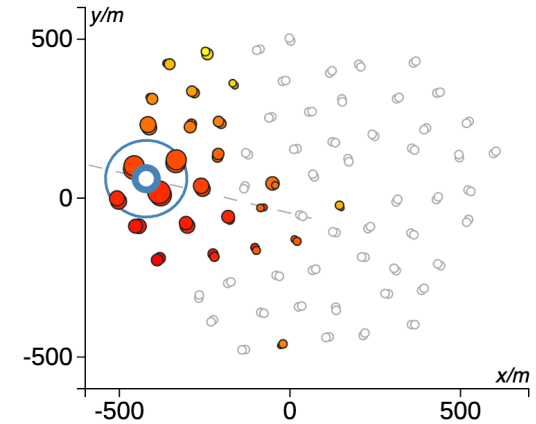
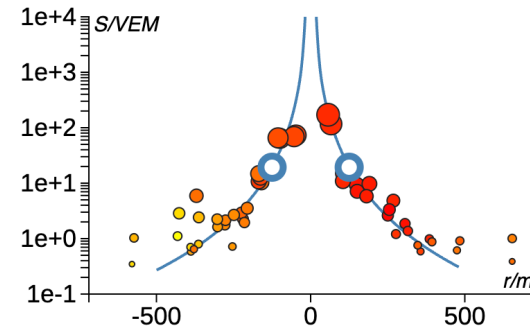


masterclass.icecube.
wisc.edu/quiz/icecube-
simulation/



◀ Event 002 ▶ Movie Save data

S125 = 19.4 VEM



Take a guess! The event is...

Real
Simulated

0 guesses



Hands-On: IceTop

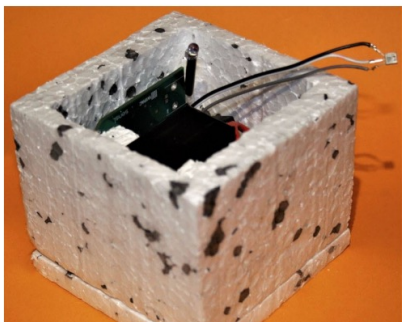
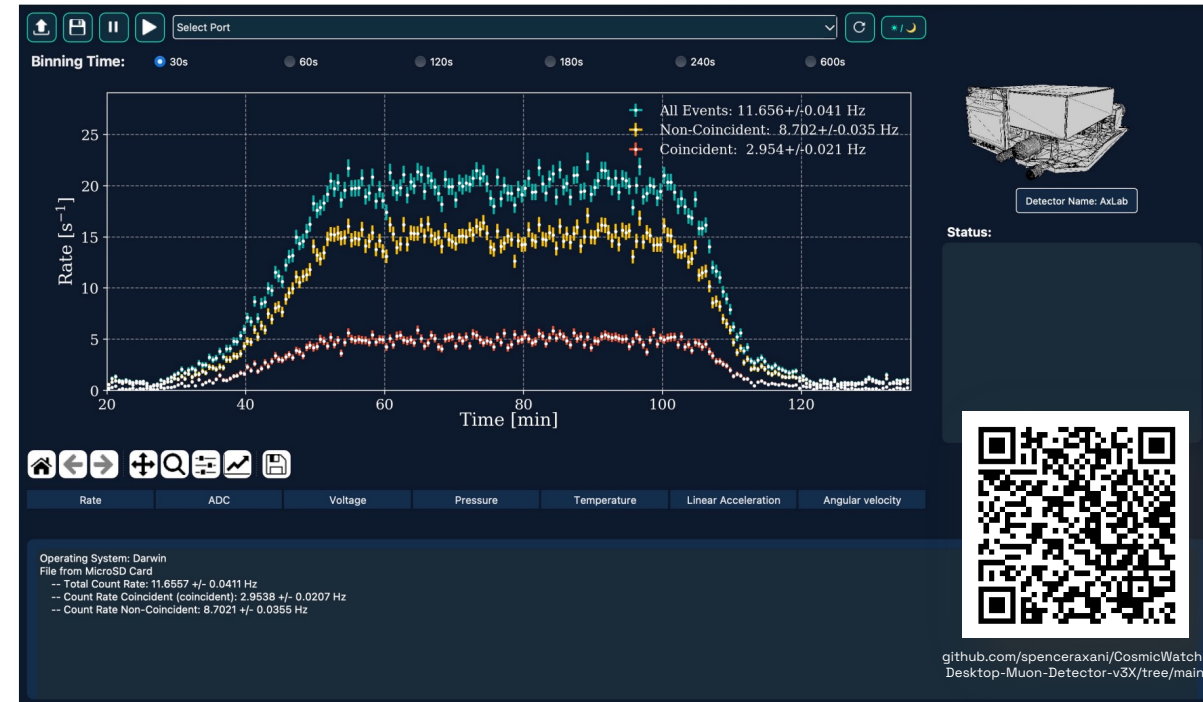


The results from this section were used by students to compare with a published IceCube result



Interact and Inspire

Research Opportunities



IceCube Masterclass

An exposure for students to the field for
astroparticle physics,
with focus on

Building
Foundations

Hands-On
Experimentation

Inspire

paras@udel.edu