

MARIACHI

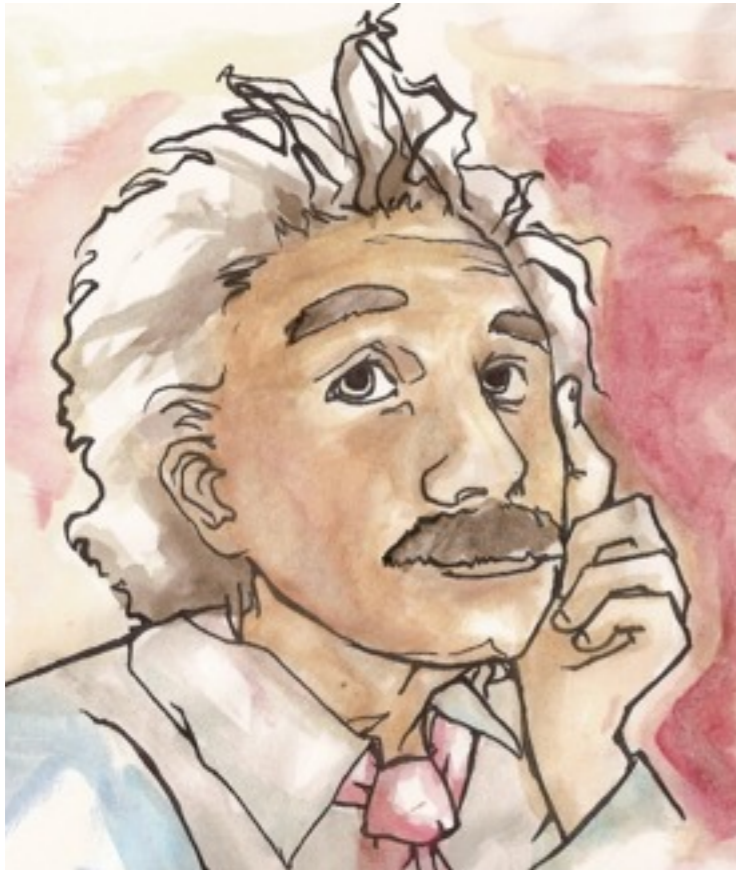
Science by Teachers, Students and Scientists

Helio Takai

Brookhaven National Laboratory

takai@bnl.gov

MARIACHI involves



Scientists



Teachers



Students

To perform an authentic science experiment!

“Science is cool and within reach to anybody.”

The Experiment

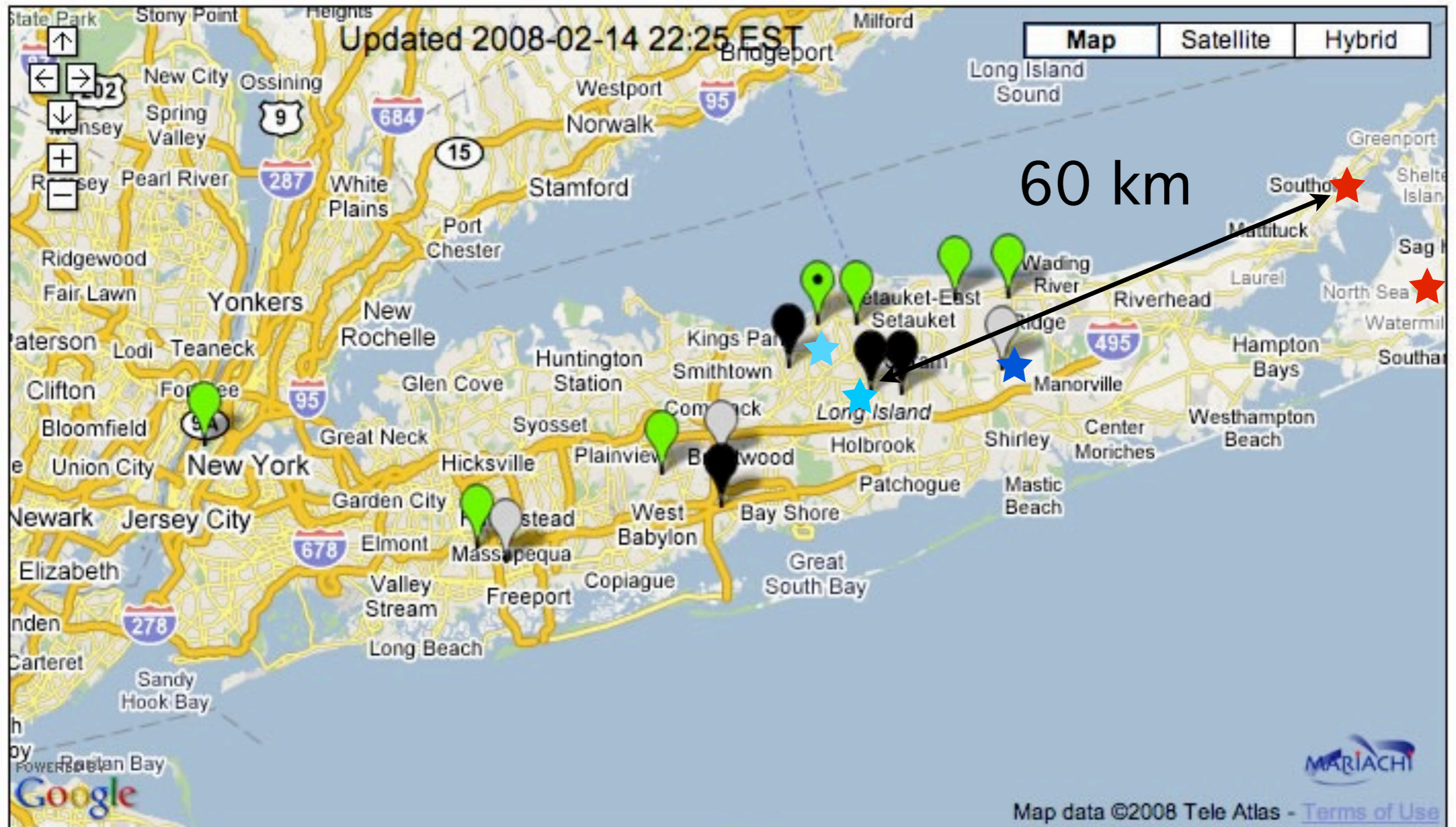
A widely distributed data acquisition collecting data from forward scattering radar, cosmic rays, atmospheric activity, and others. Data is complemented by information from selected sites.


Distributed data analysis performed in classroom with the goal of exploring features in the data.

New sensors and analysis methods developed by Undergraduate and High School students as summer research.


We did learn a lot and would like to share results and experiences.

Mixed Apparatus for Radar Investigation of Atmospheric Cosmic-rays of High Ionization



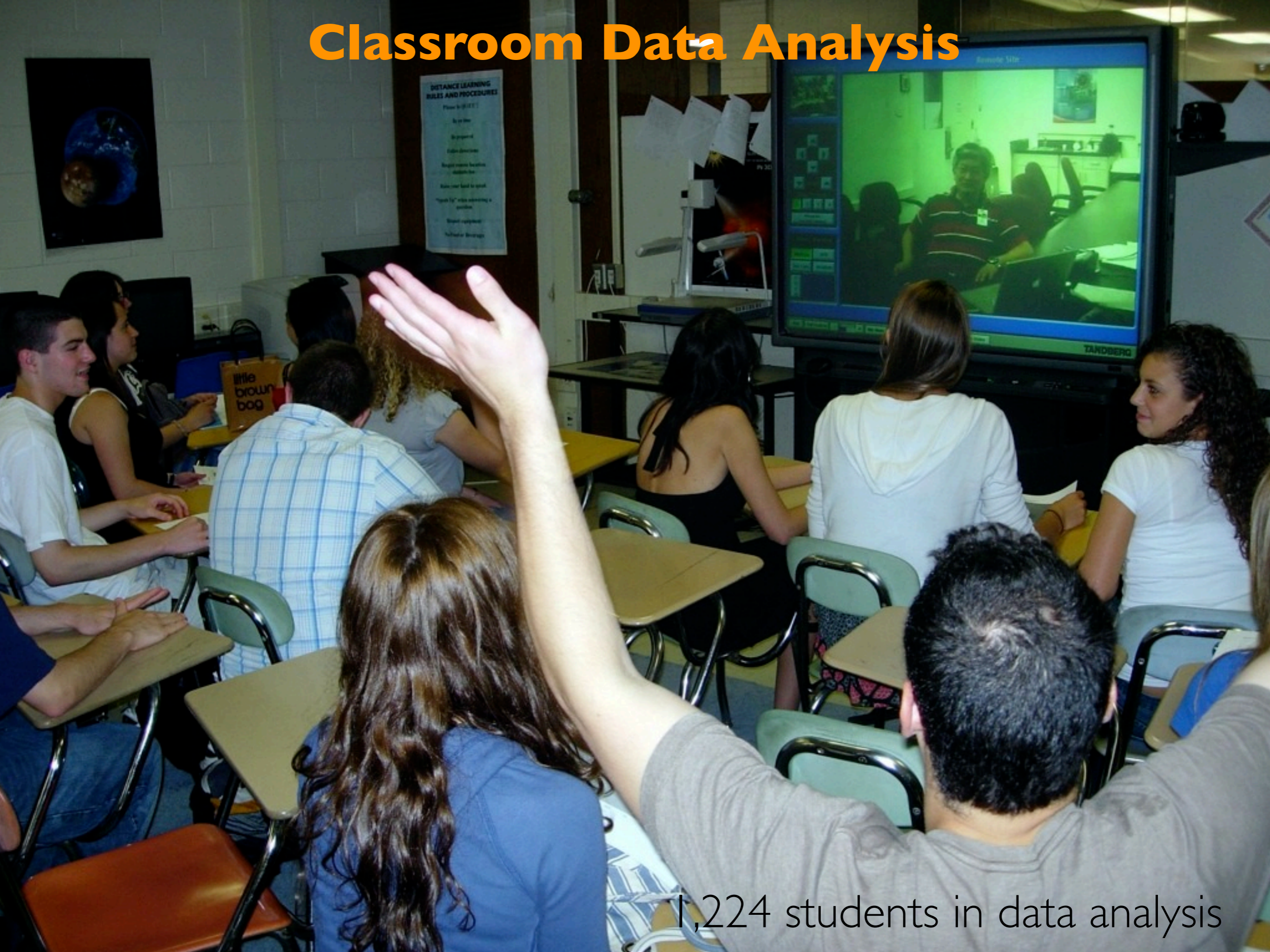
 planned

 offline

 low rate

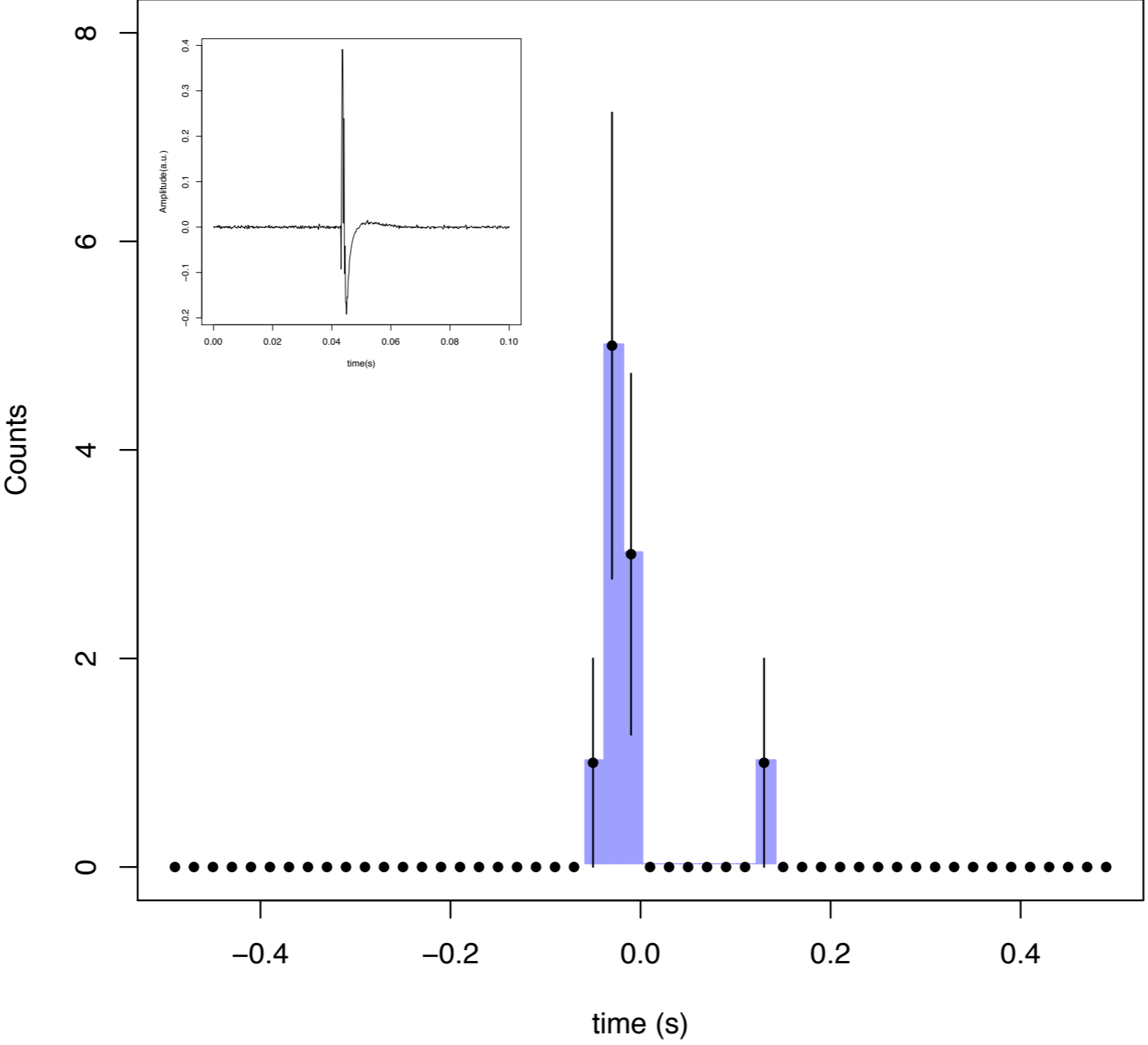
 active

Classroom Data Analysis



1,224 students in data analysis

The events in coincidence found in 2 weeks of data. They roughly point towards the scintillator that triggered.

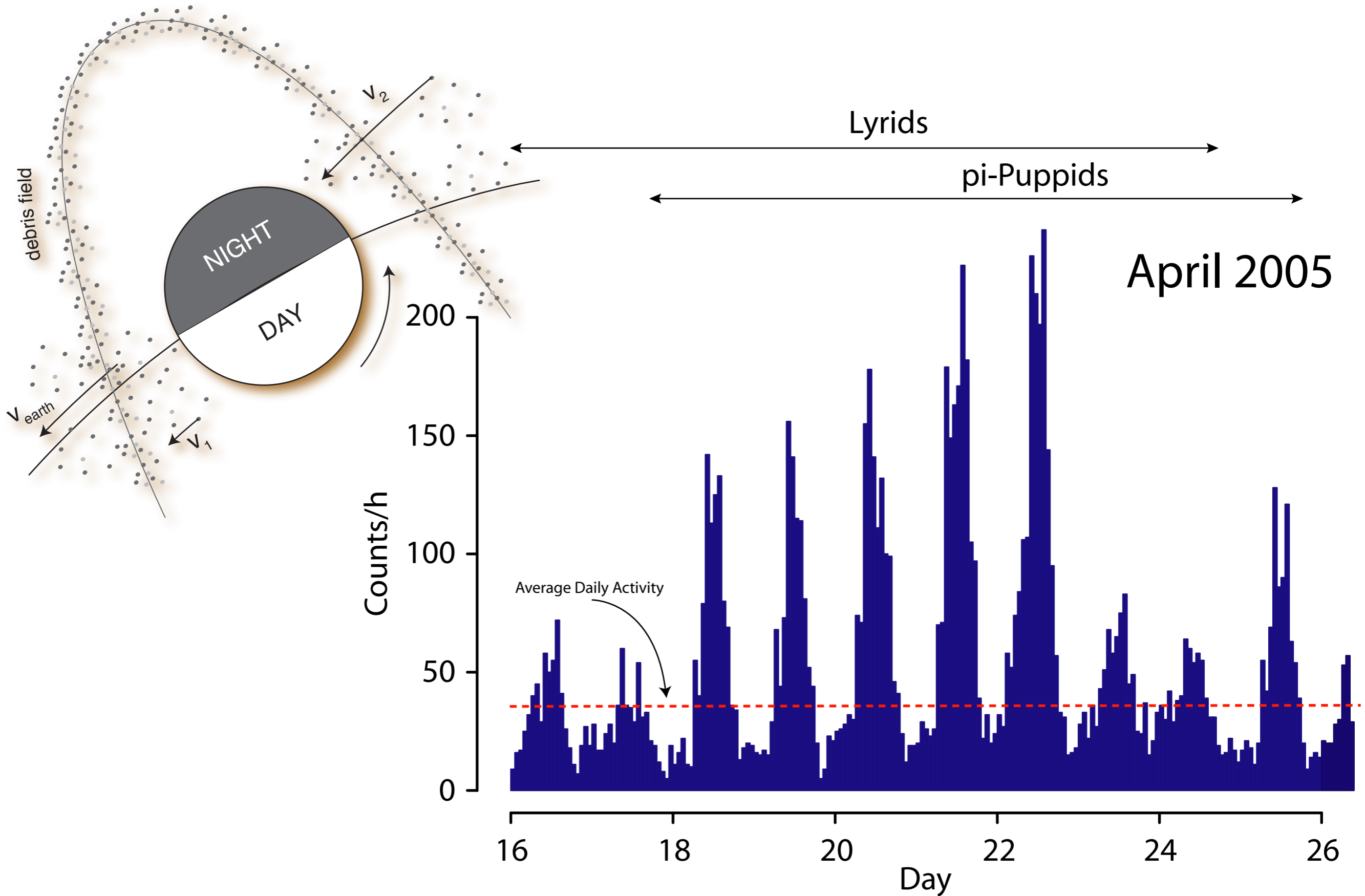


Are they Real??

Dedicated experiment at the TA site in
Delta Utah with ~ 20 collaborators



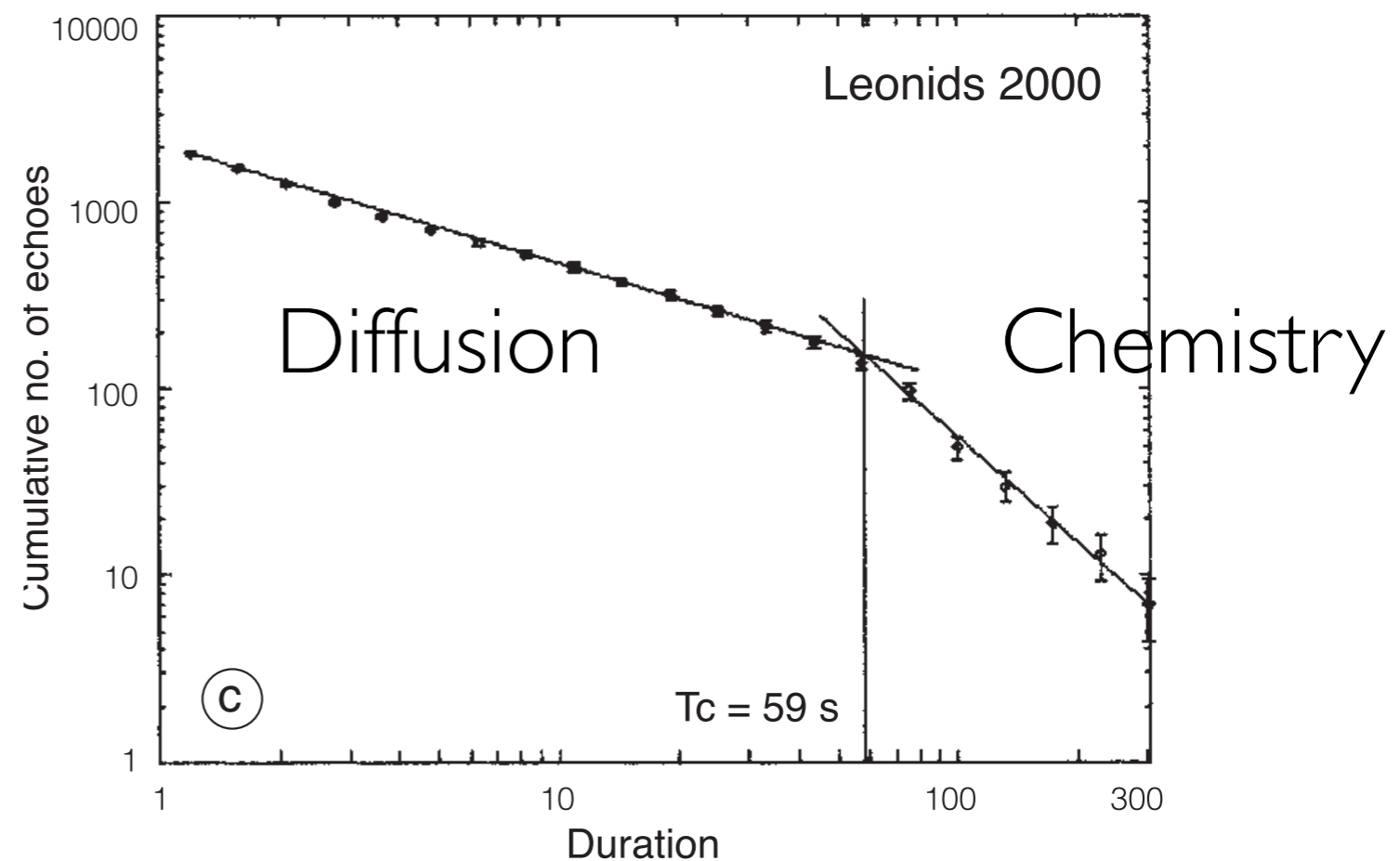
The Lyrids Meteor Shower



Why could this be interesting?

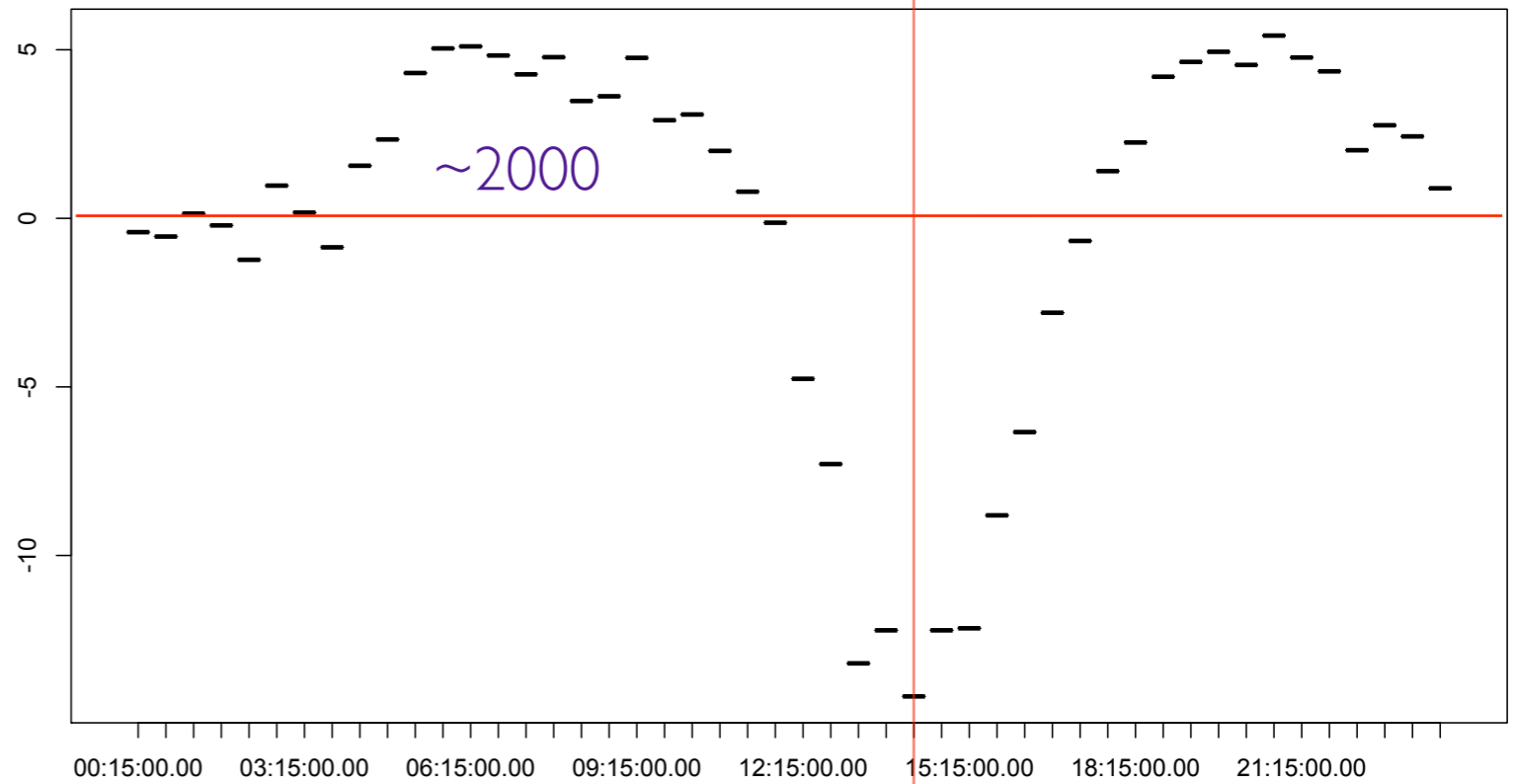
Provides a good understanding of the forward scattering radar.

Meteors could provide a good way to probe the atmosphere at 80-120 km altitude.

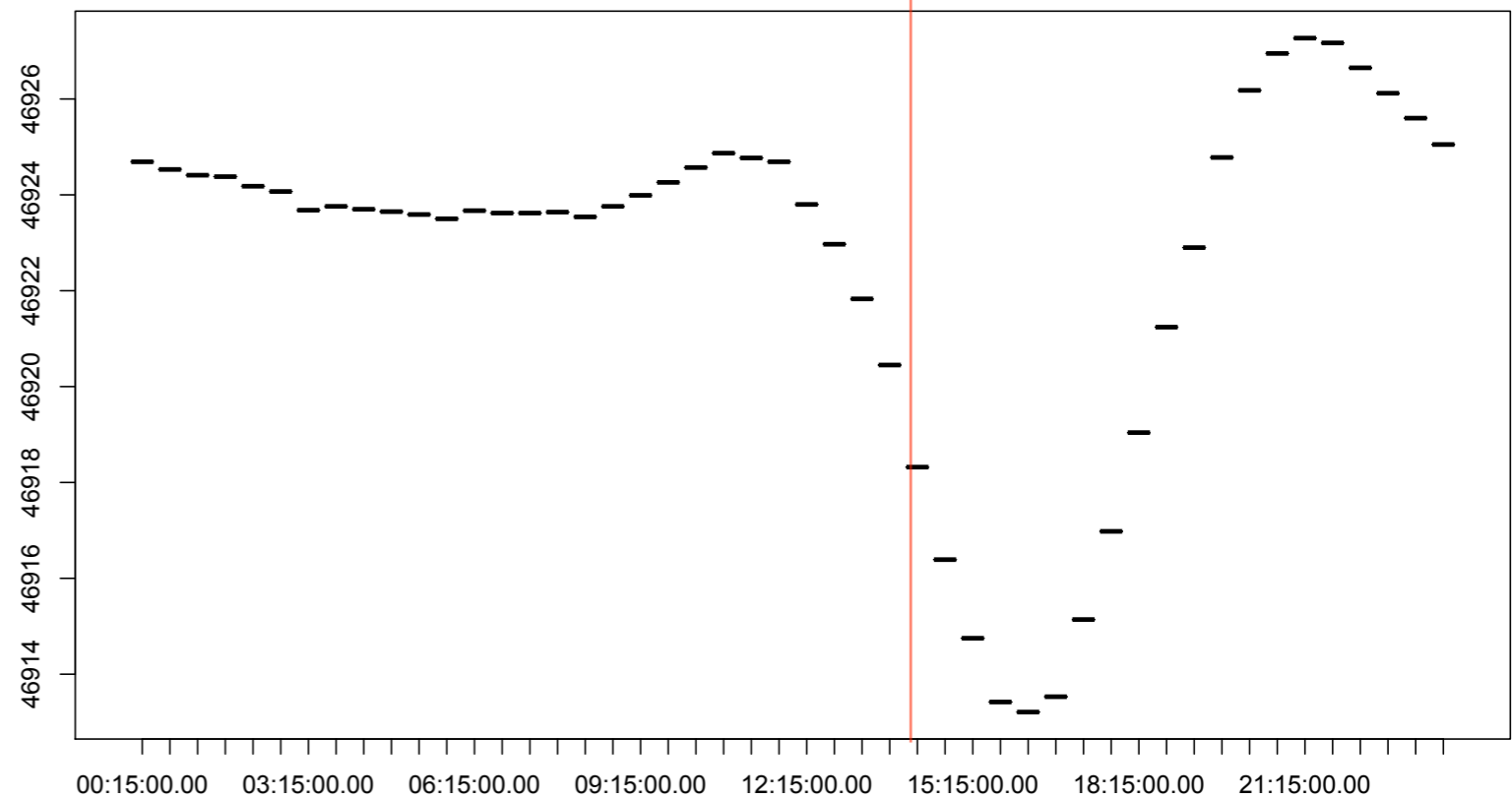


Cosmic ray flux vs Geomagnetic Field

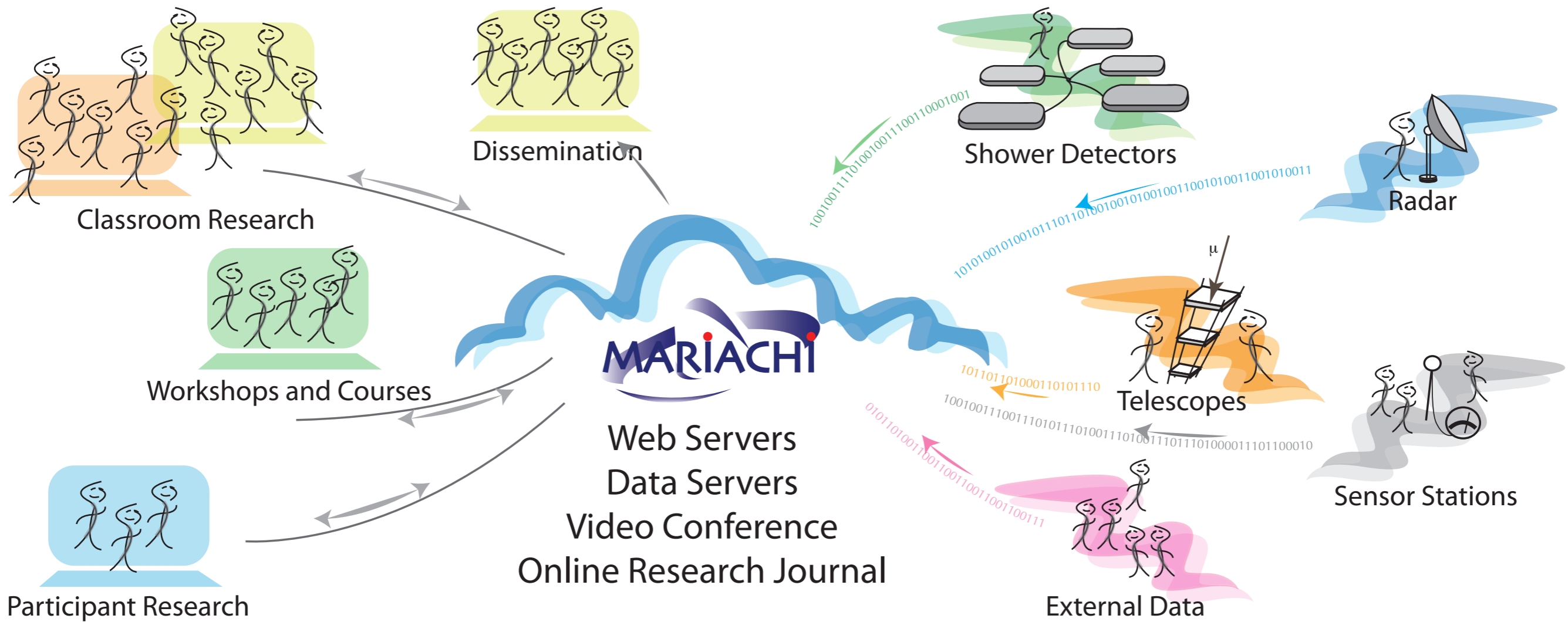
Cosmic ray measurement at Smithtown HS East



Geomagnetic Field at Fredericksburg, VA

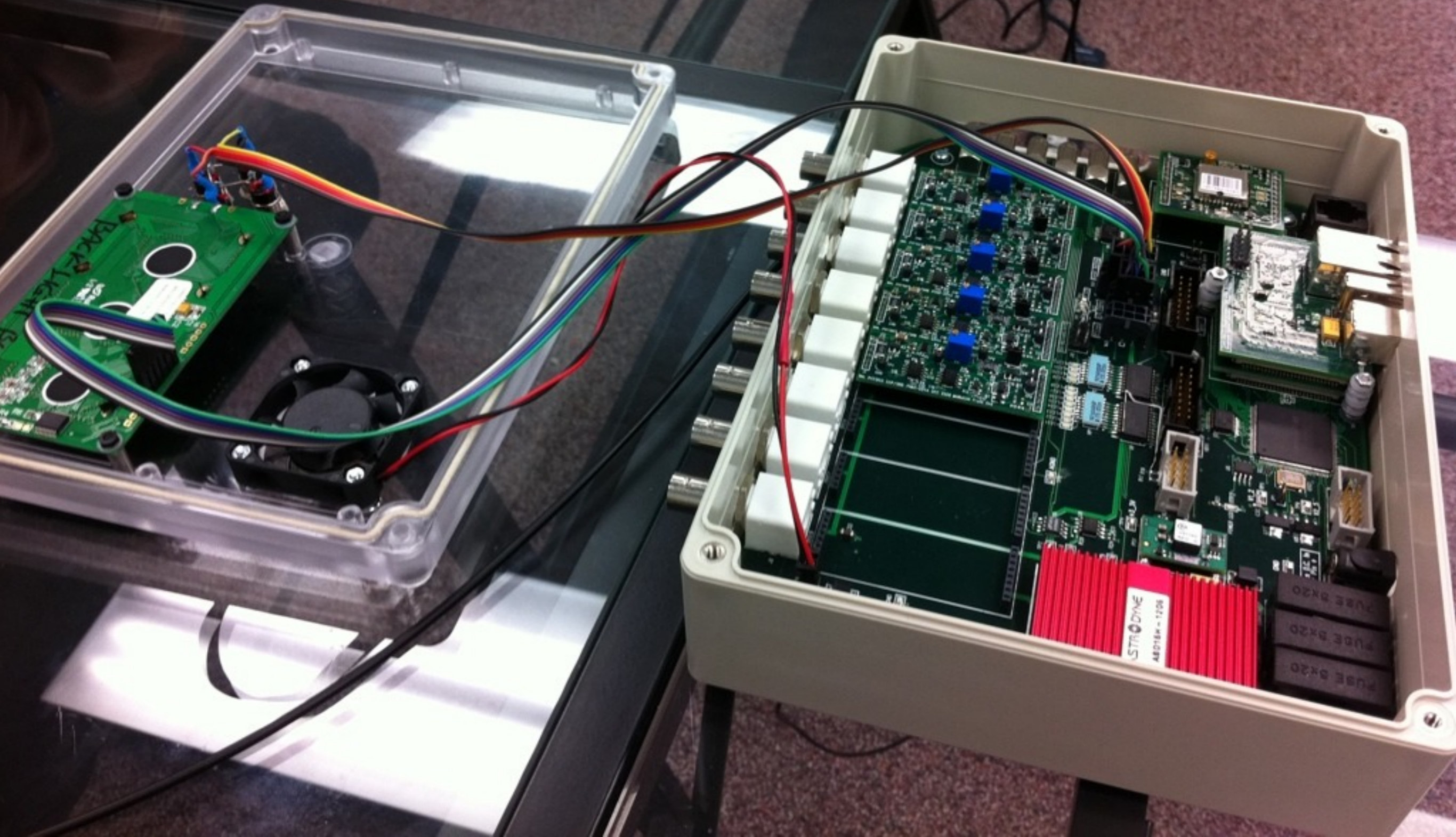


Where is MARIACHI going?



Data Acquisition

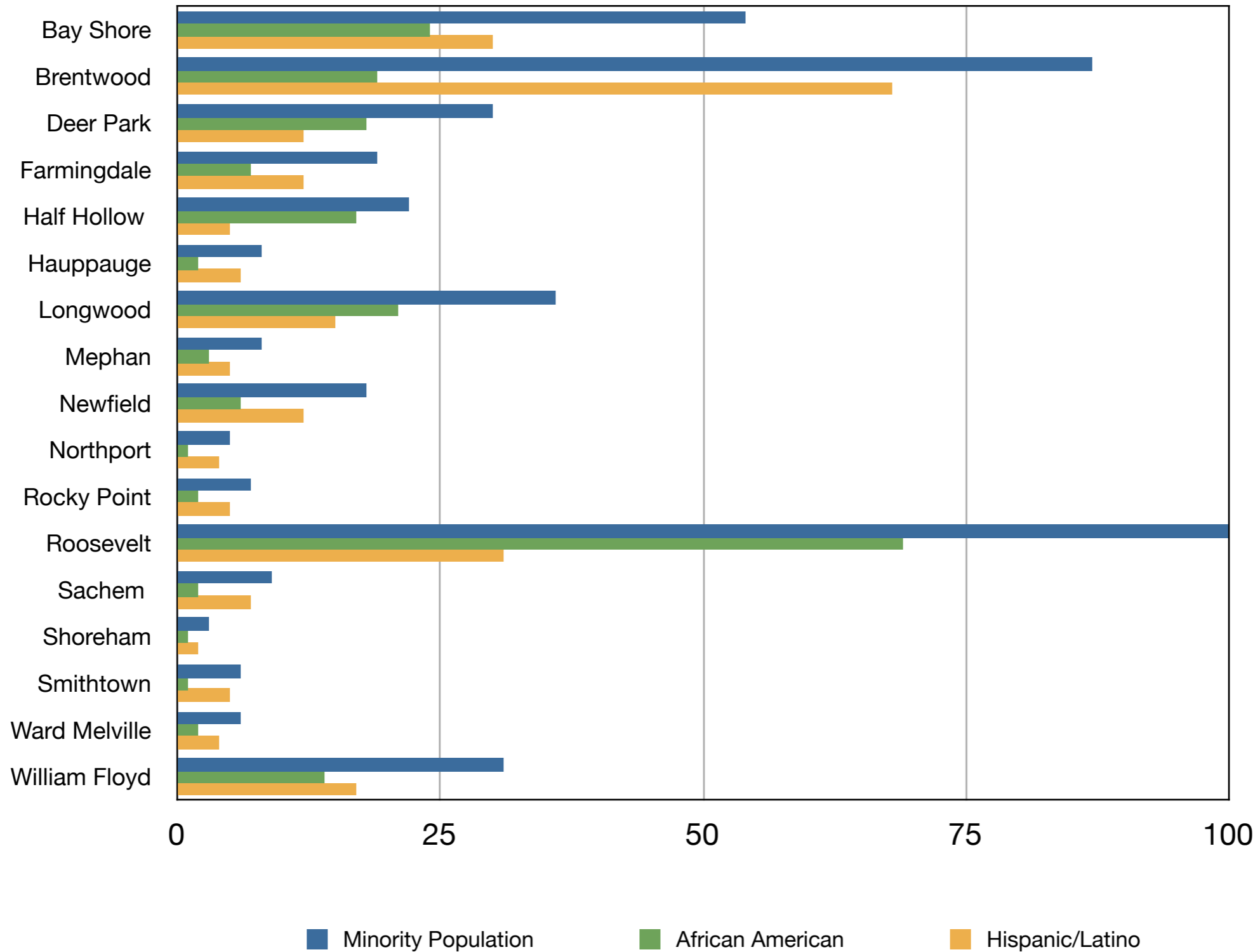
8 channel stand alone



VLF System



We keep statistics...



Minority population at schools involved

Teachers

Common project leads to a strong sense of community

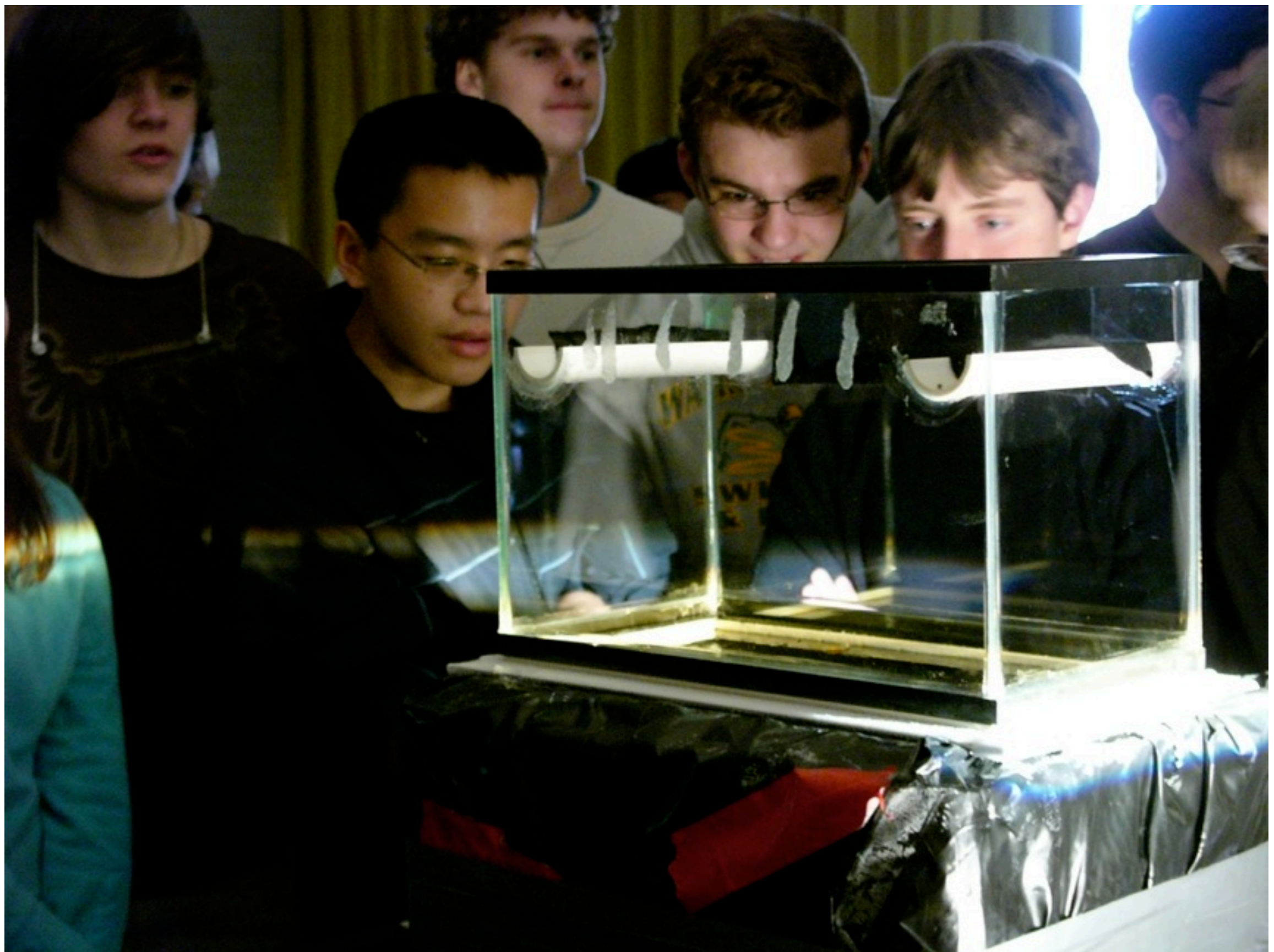
Their active participation led to the creation of powerful educational material to introduce concepts of particle physics in the classroom.

Strong community generate new ideas! For example
Teslamania: Physics Demonstration Competition and Visiting
MasterClass.

Cosmic Chris

(Tara Terzella -Hauppauge HS)

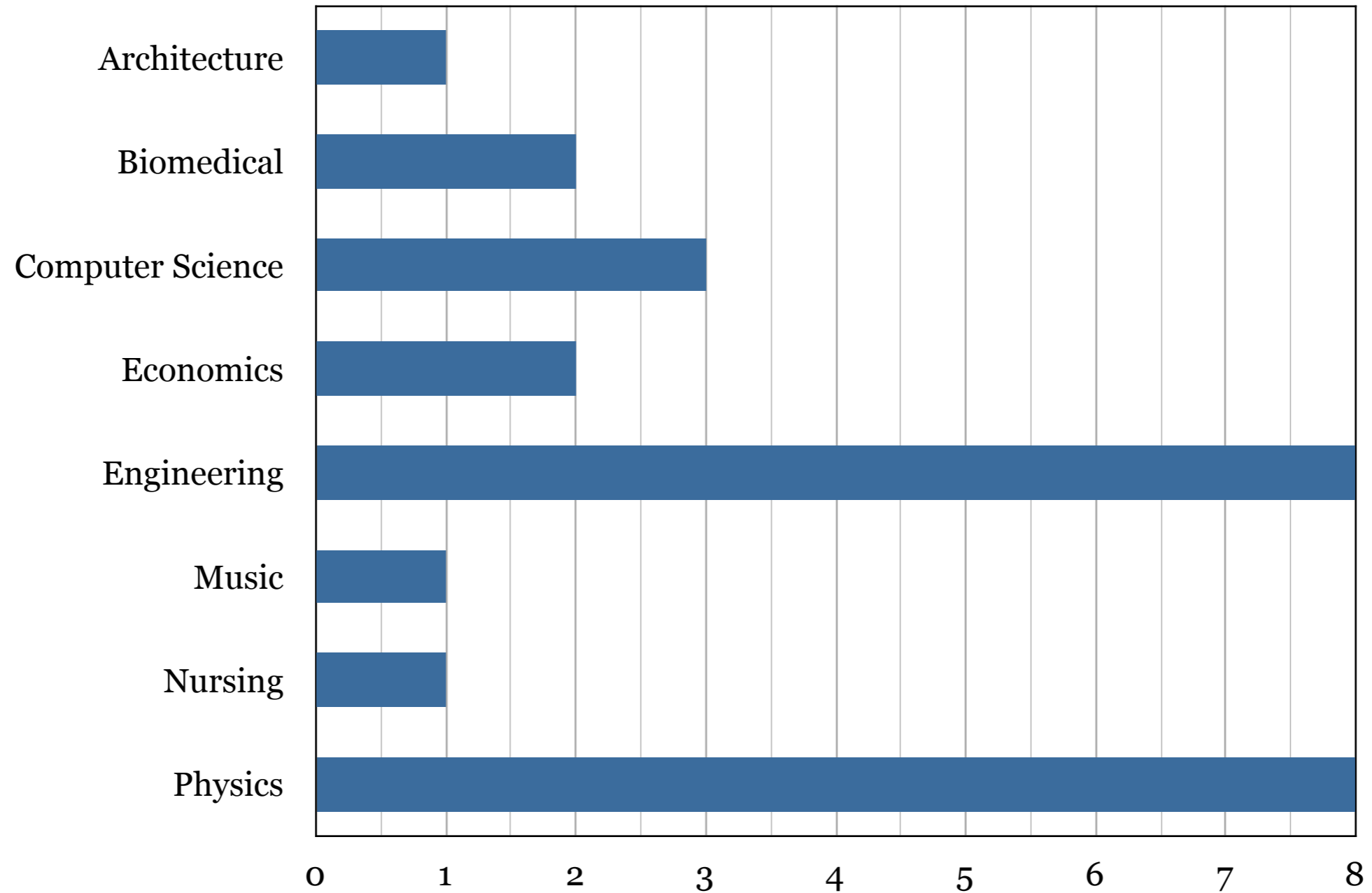




Cloud Chamber

(Tara Falcone, Bill Leacock, Adam Plana, Rich Gearn, Tom Tomaszewski, Jeremy Tomaszewski)

We keep statistics...



HS students majors: completed or declared

Students

HS students.

- We observe that many of them, especially in S&T, find internships as freshmen.
- Except in few cases, we have no influence in their career path.
- They stay in touch for many years.
- What they do as interns has almost no correlation with their majors.

Undergraduate Students

- Excellent experiment for undergraduates - requires creativity and innovation.
- The only influence is encouragement to pursue a PhD.



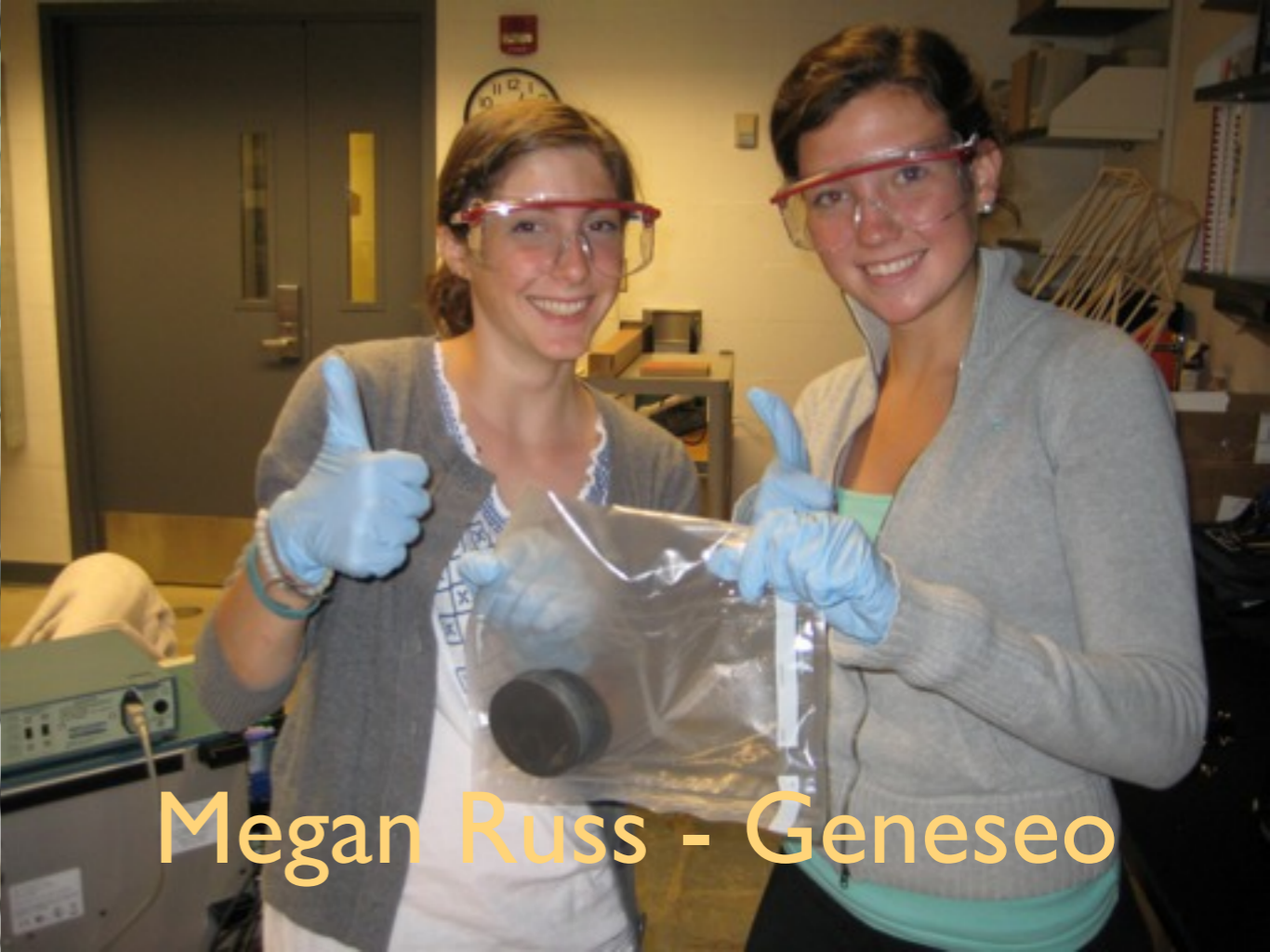
Omal-Hoda Kassim -
Syracuse



Akshay Gupta - Yale



Glen Meyerowitz - Yale



Megan Russ - Geneseo

Summary

The concept of MARIACHI is good. Its implementation is a real challenge considering the large number of variables

Data analysis at schools has been implemented. New tools, e.g. pads and tablets could make this activity more interesting.

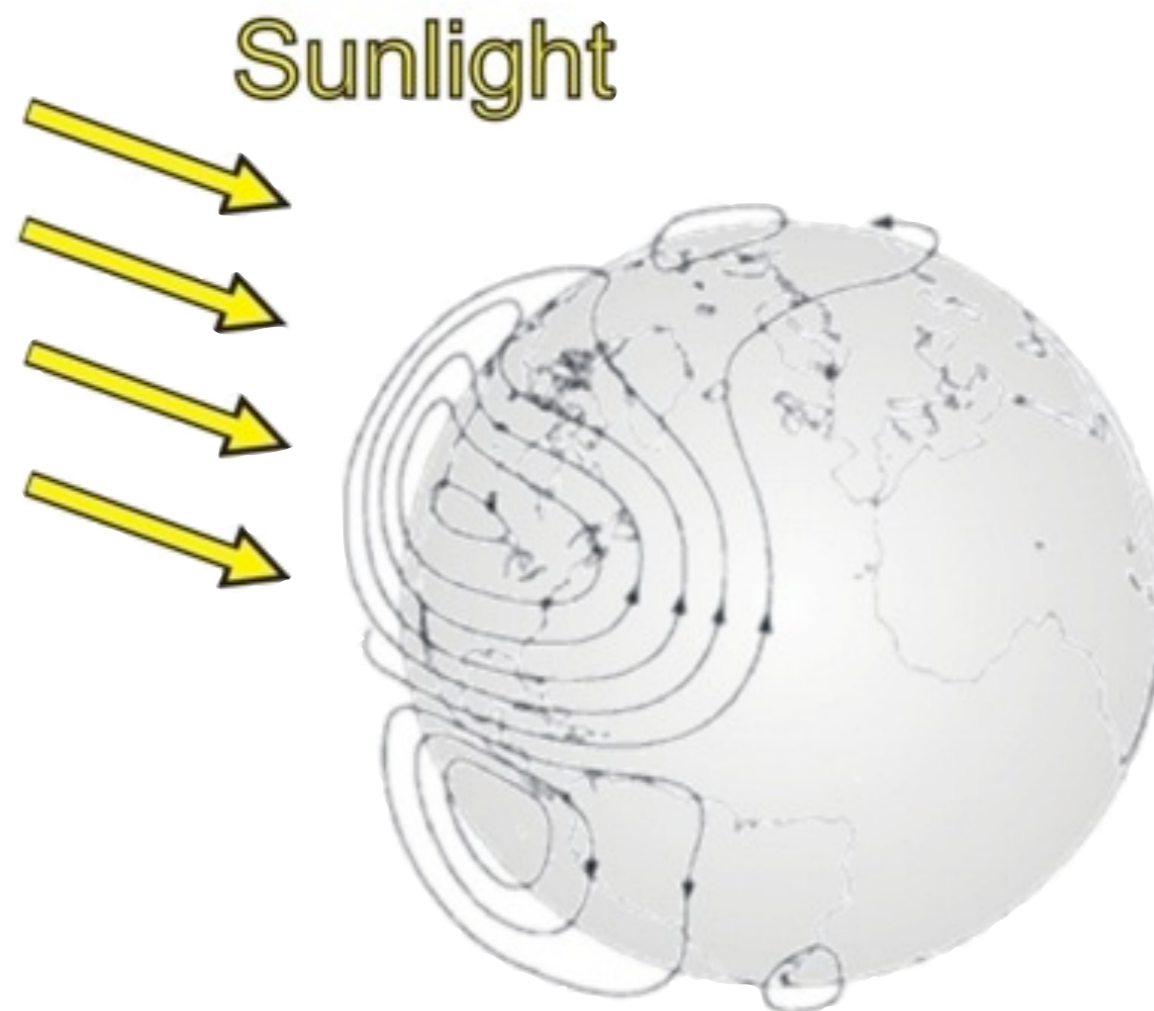
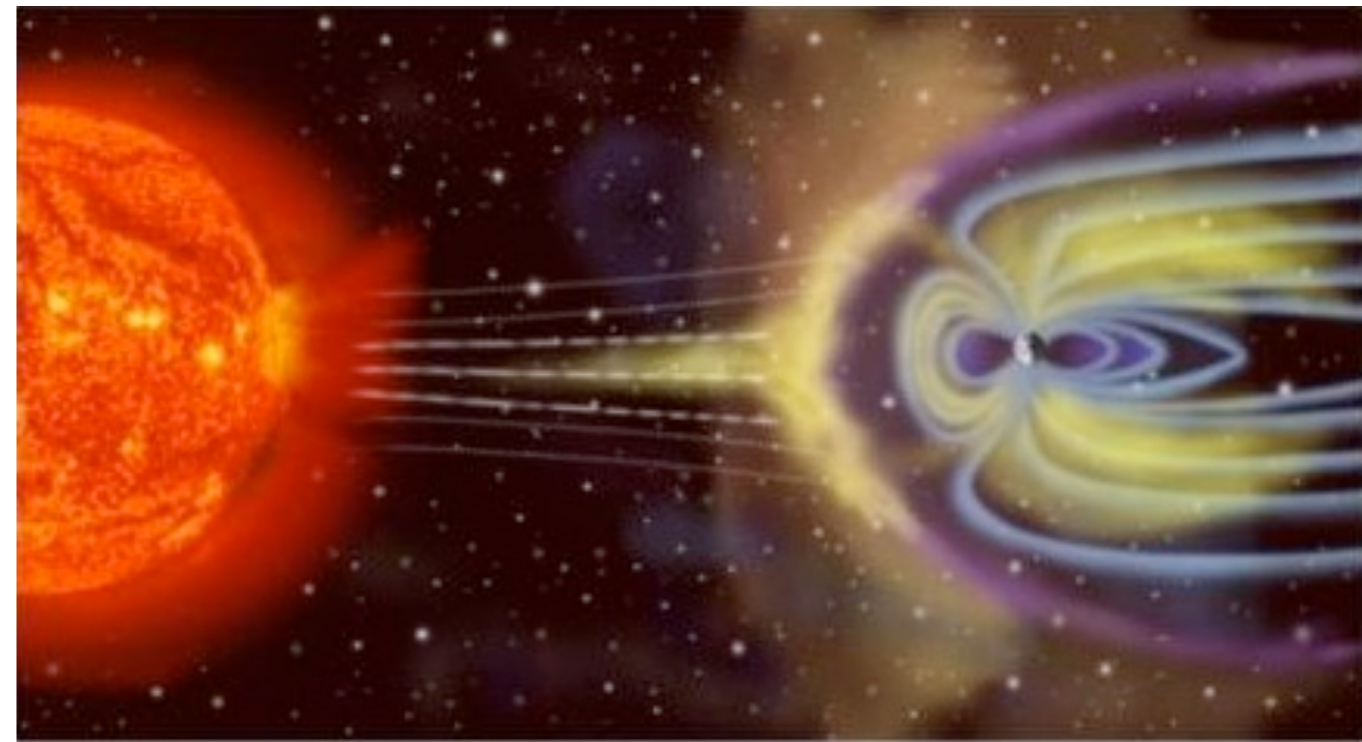
It is a good place to expose high school students to authentic science.

It is a good place to train undergraduate students.

Teachers - A common experiment is the ideal “excuse” to form a strong community.



Long Range Magnetic Field Disturbance



Short Range Magnetic Field Disturbance

BNL Physics Dept.
MuDAQ
PHNX-063A
Feb 2011

"I think,
therefore I AND"
-DesQuartus

<5>