

# The Surface Array Enhancement of IceCube

**A comprehensive overview of the planned cosmic-ray surface detector at the South Pole**

Roxanne Turcotte on behalf of the IceCube Collaboration  
at the Matter and the Universe (MU) Days 2021

25.11.2021

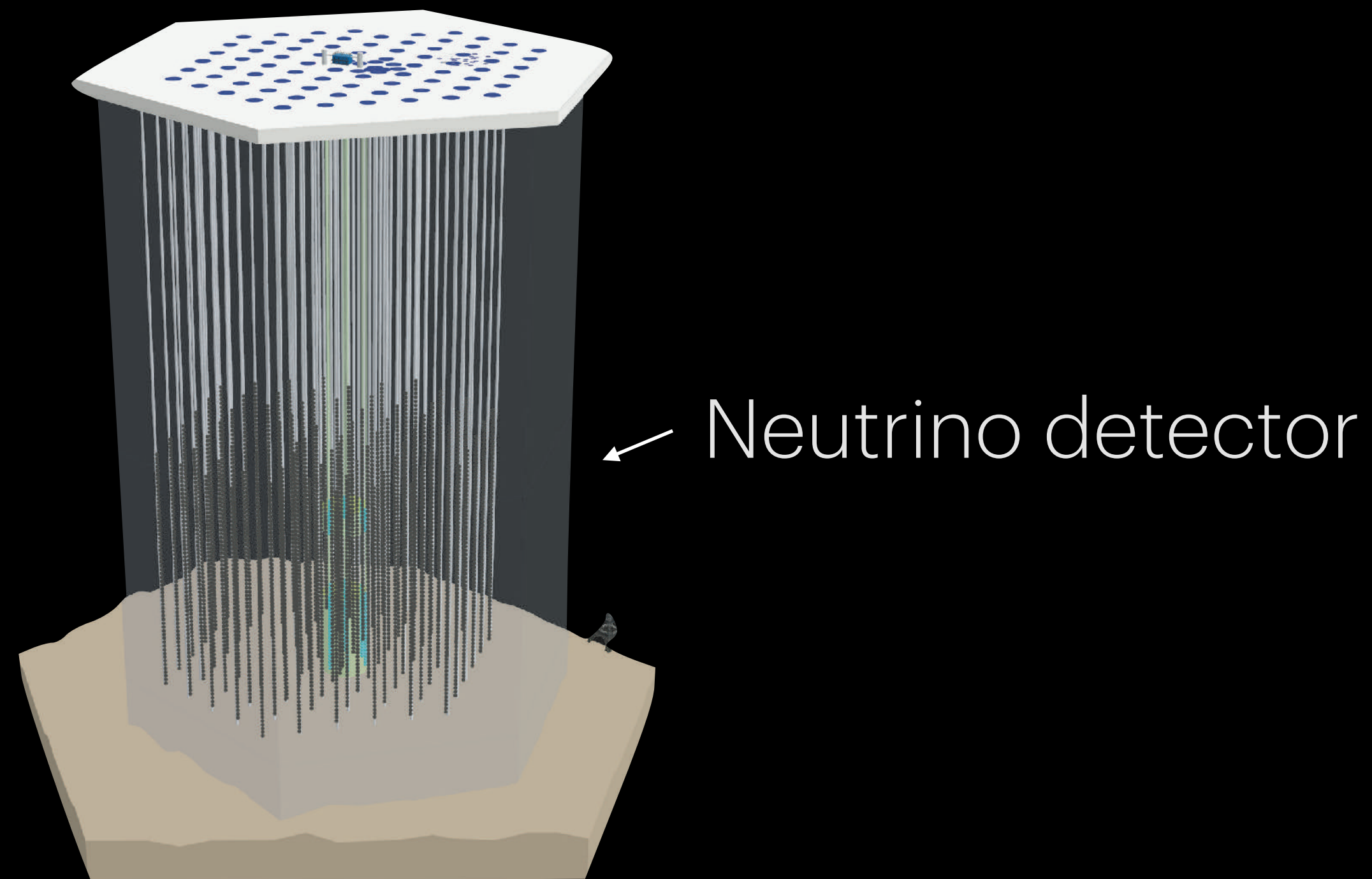


European Research Council  
Established by the European Commission

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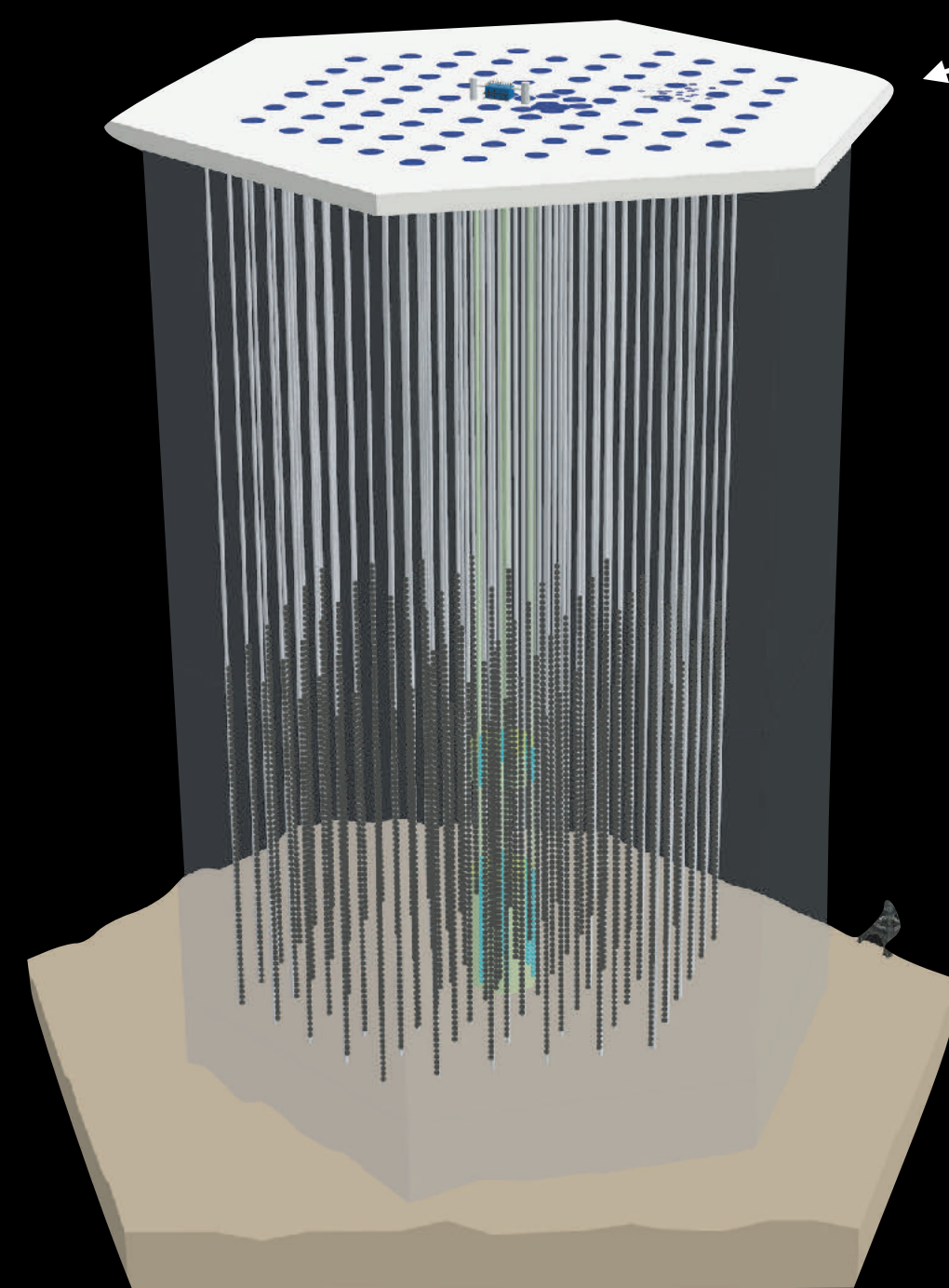
# The IceCube Neutrino Observatory

In-ice neutrino detector



# The IceCube Neutrino Observatory

Also a cosmic-ray detector !



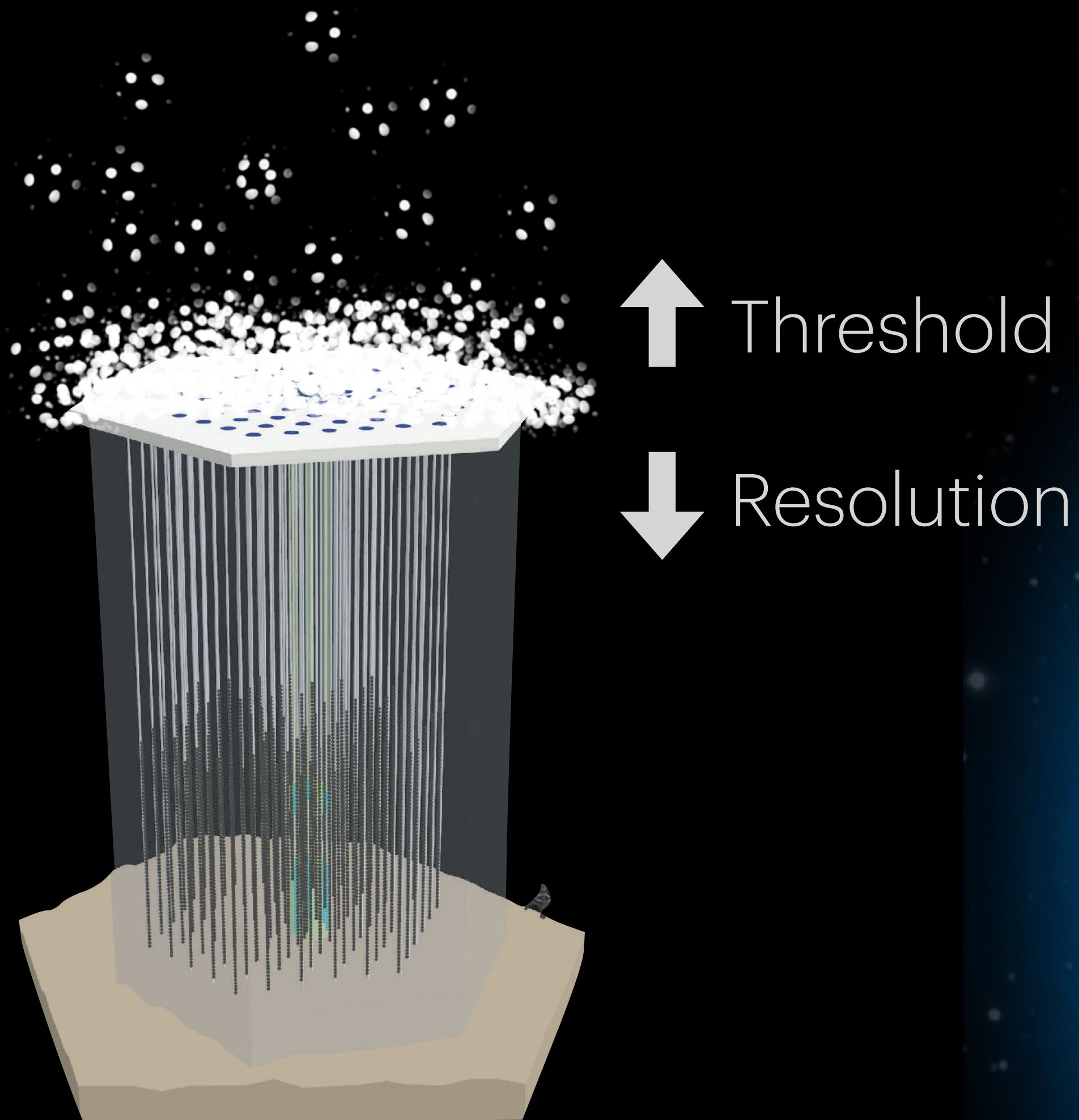
← IceTop

- 162 ice Cherenkov tanks
- Atmospheric background veto
- Cosmic-ray detector



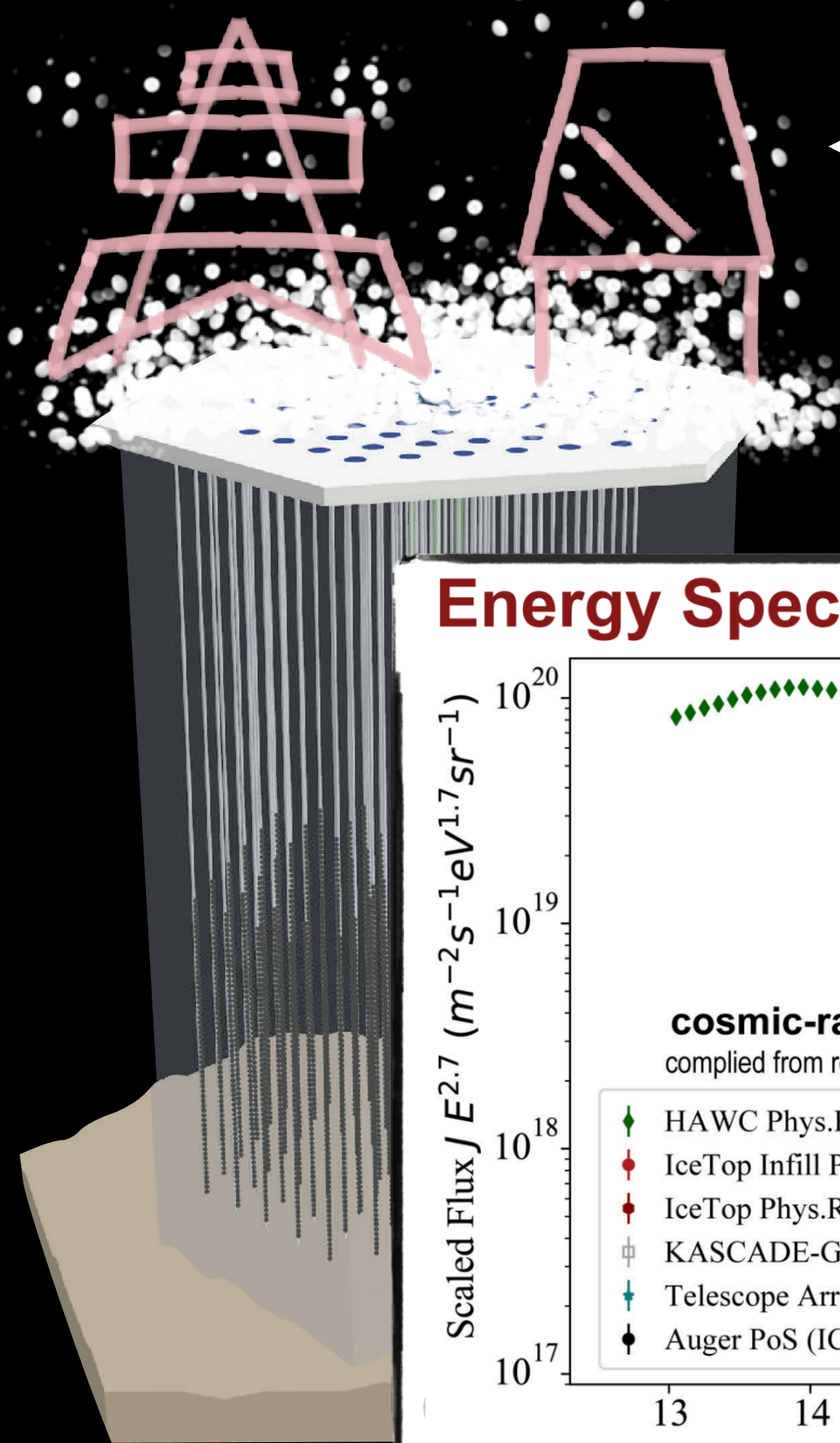
# The IceCube Neutrino Observatory

Snow accumulated over the years...

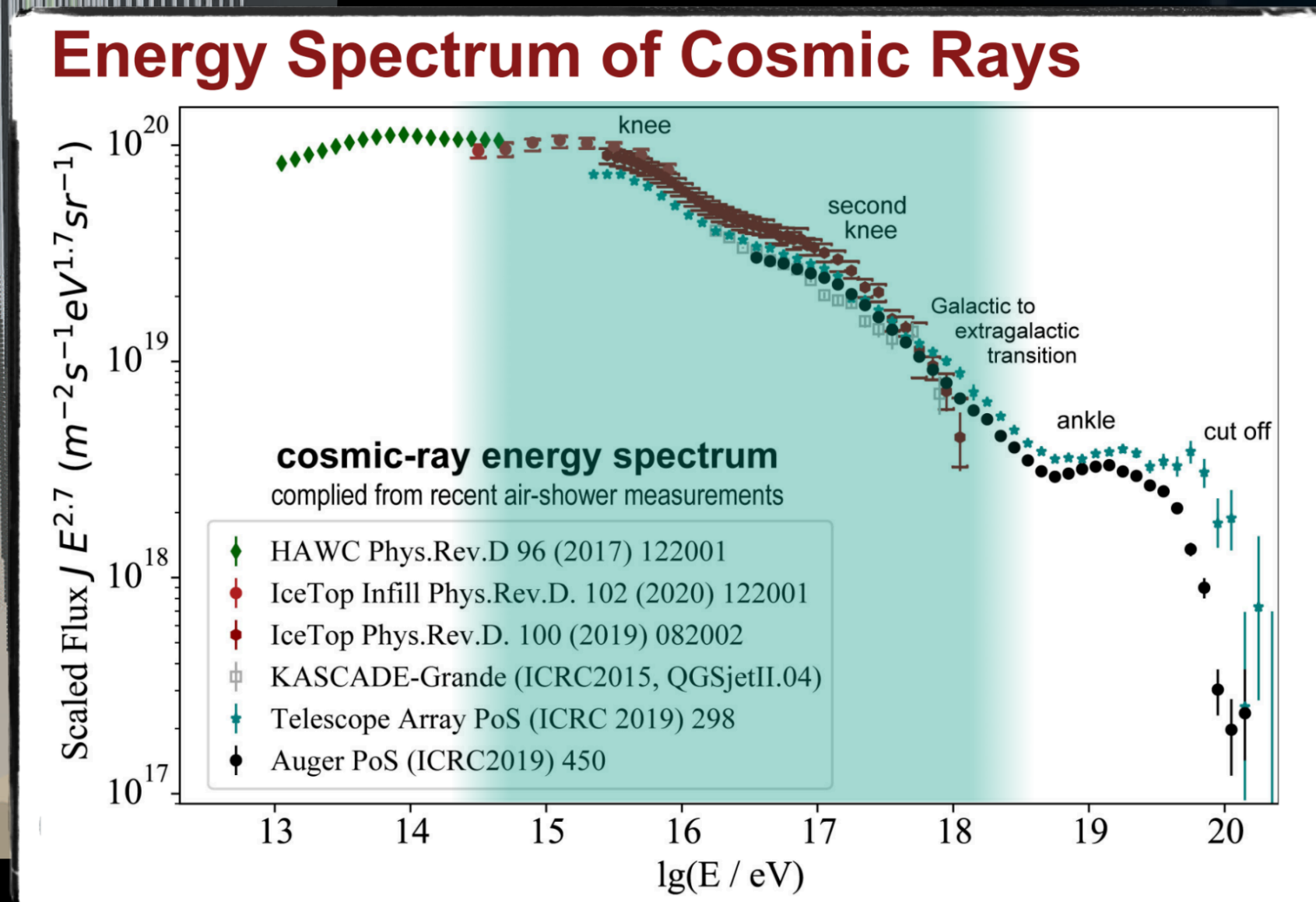


# The Surface Array Enhancement

Science goals



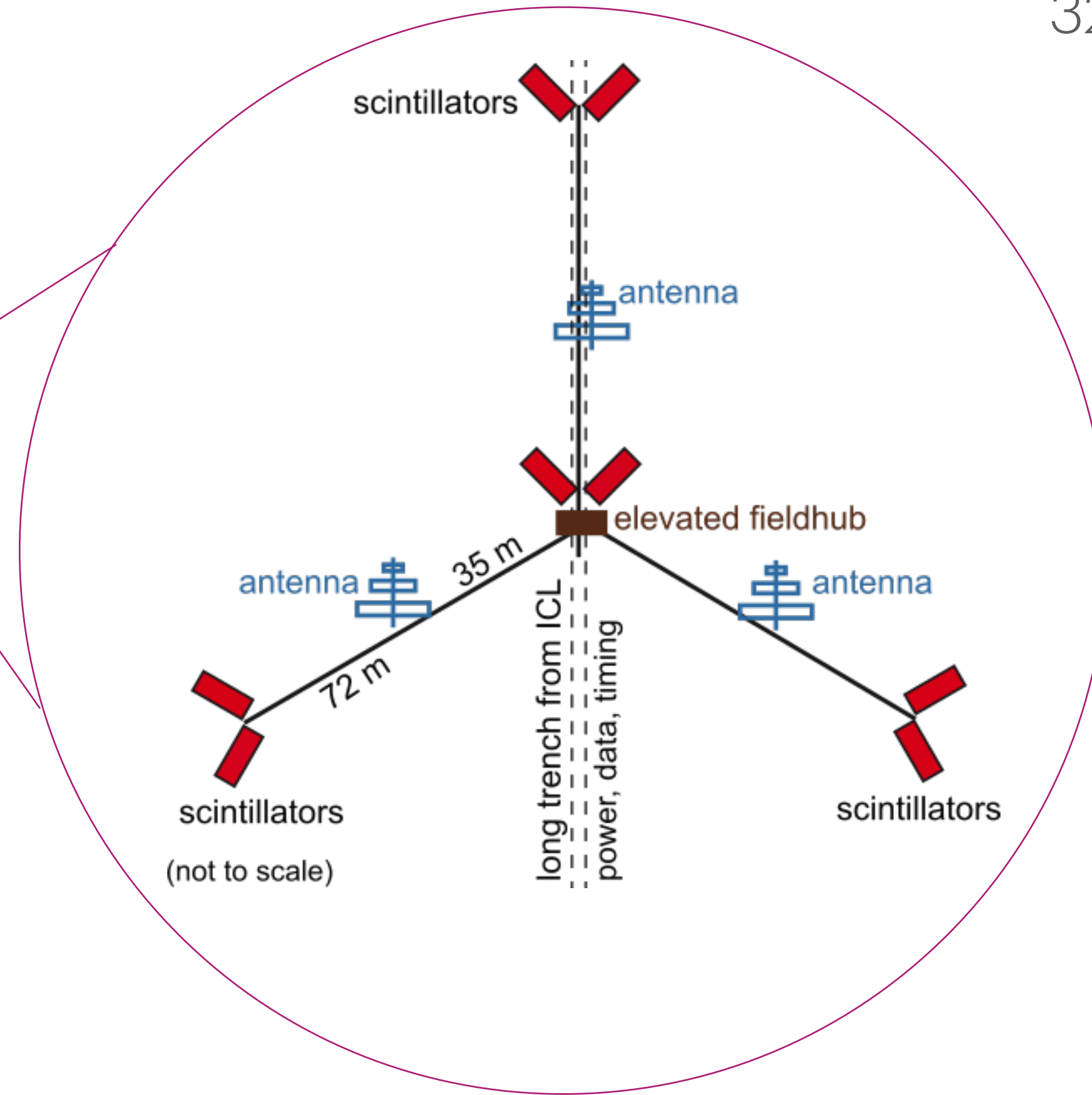
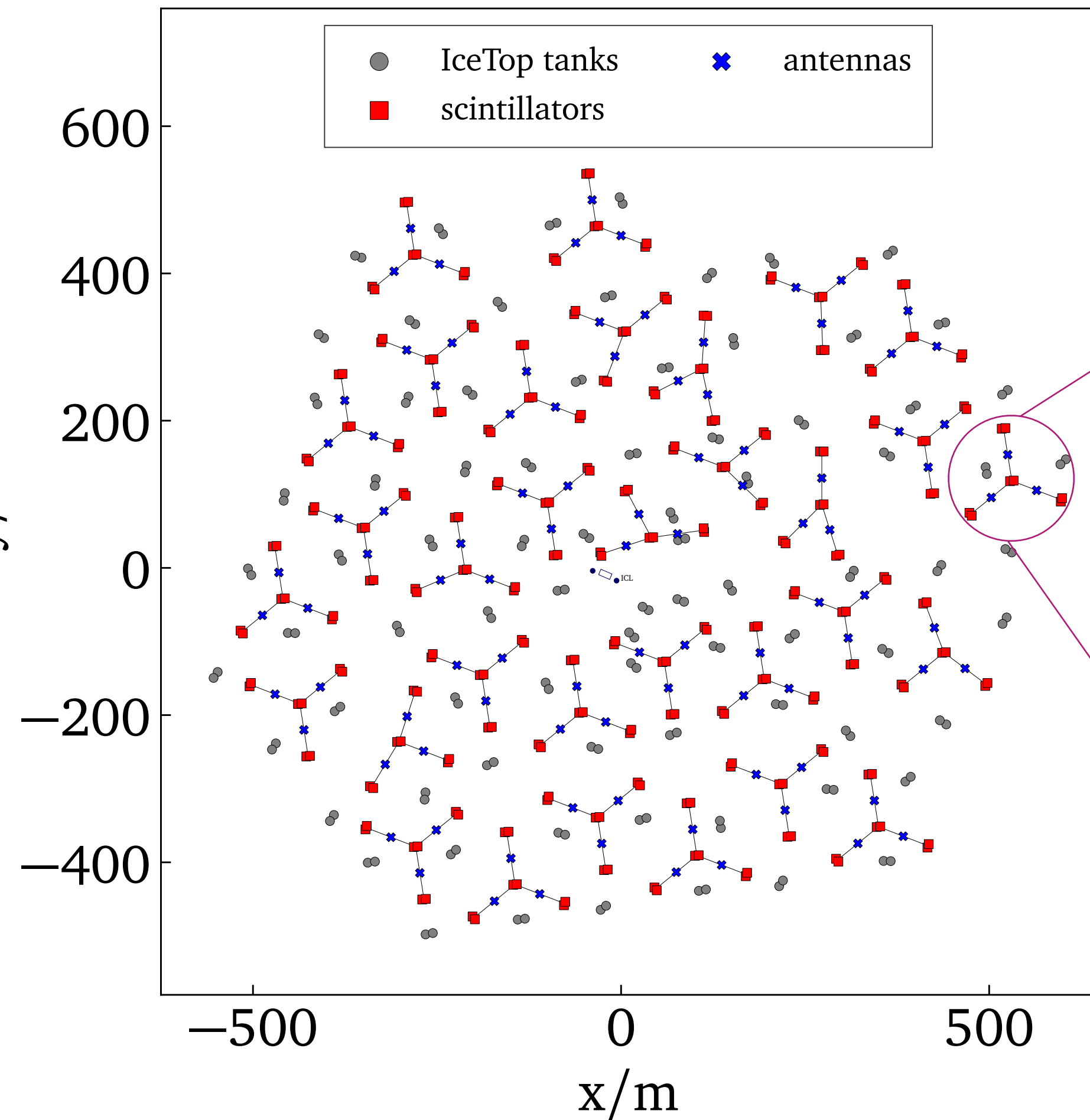
Enhanced surface array



- This array will improve the measurements in the hundreds TeV to few EeV range of the cosmic-ray spectrum.
- Therefore increasing our understanding of the highest energy cosmic-rays from our galaxy!

Planned

# Surface Array Enhancement



## Layout

- 32 Stations with
- 8 scintillation panels
- 3 antennas
- 1 insulated FieldHub

## Prototype station

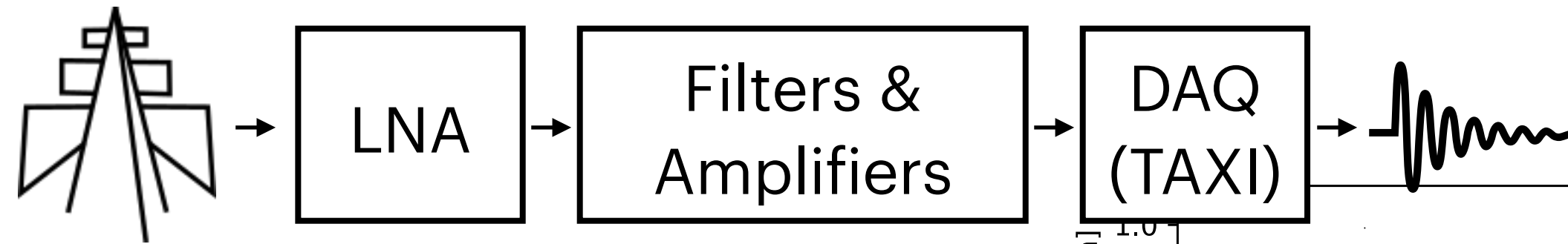
Hybrid station deployed in **January 2020**

**Operating continuously**  
(background and event data)

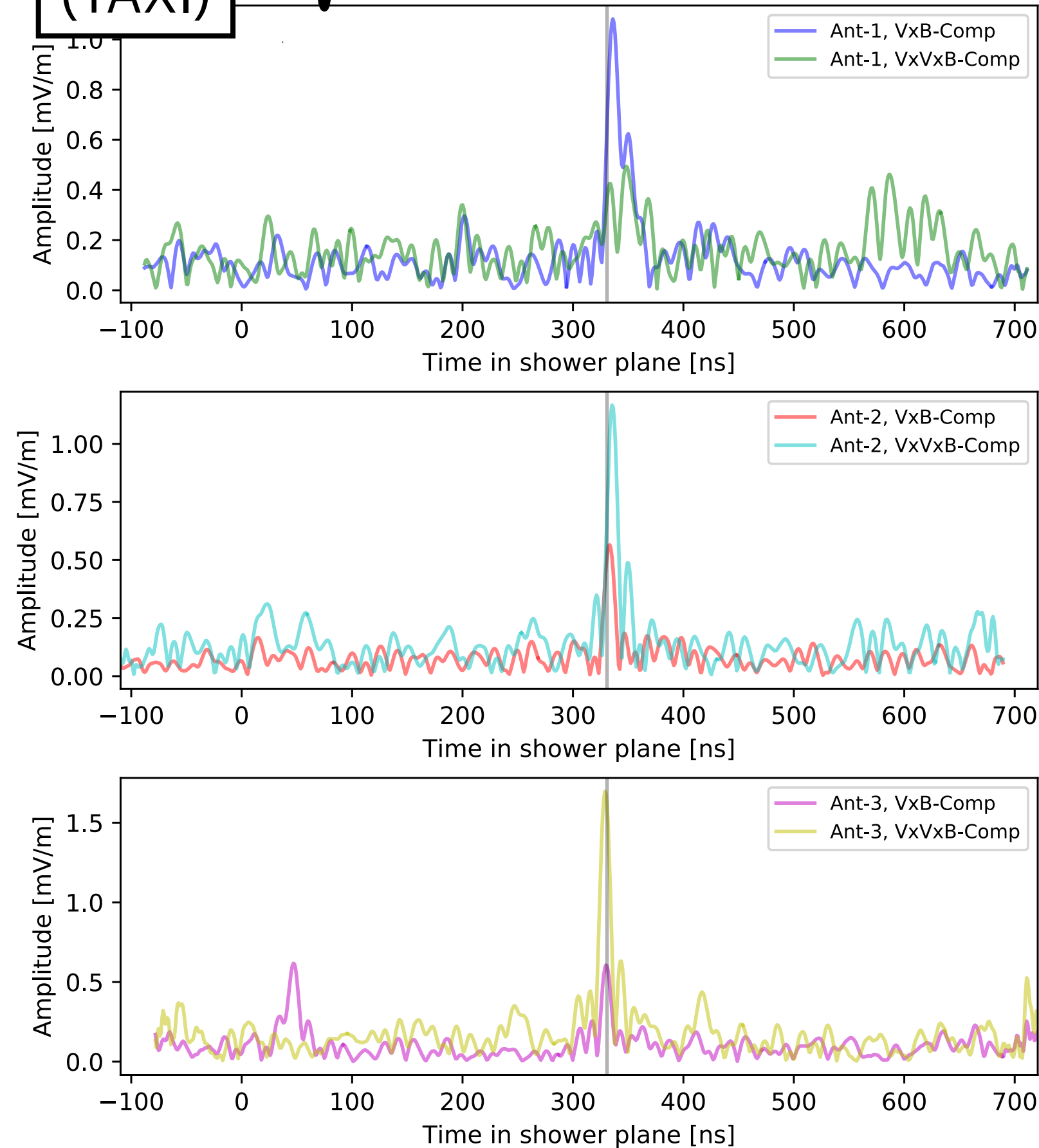
**Air showers recorded!**

Stay tuned! More to come in the future

# Radio Antennas



Elevated antenna from the prototype station

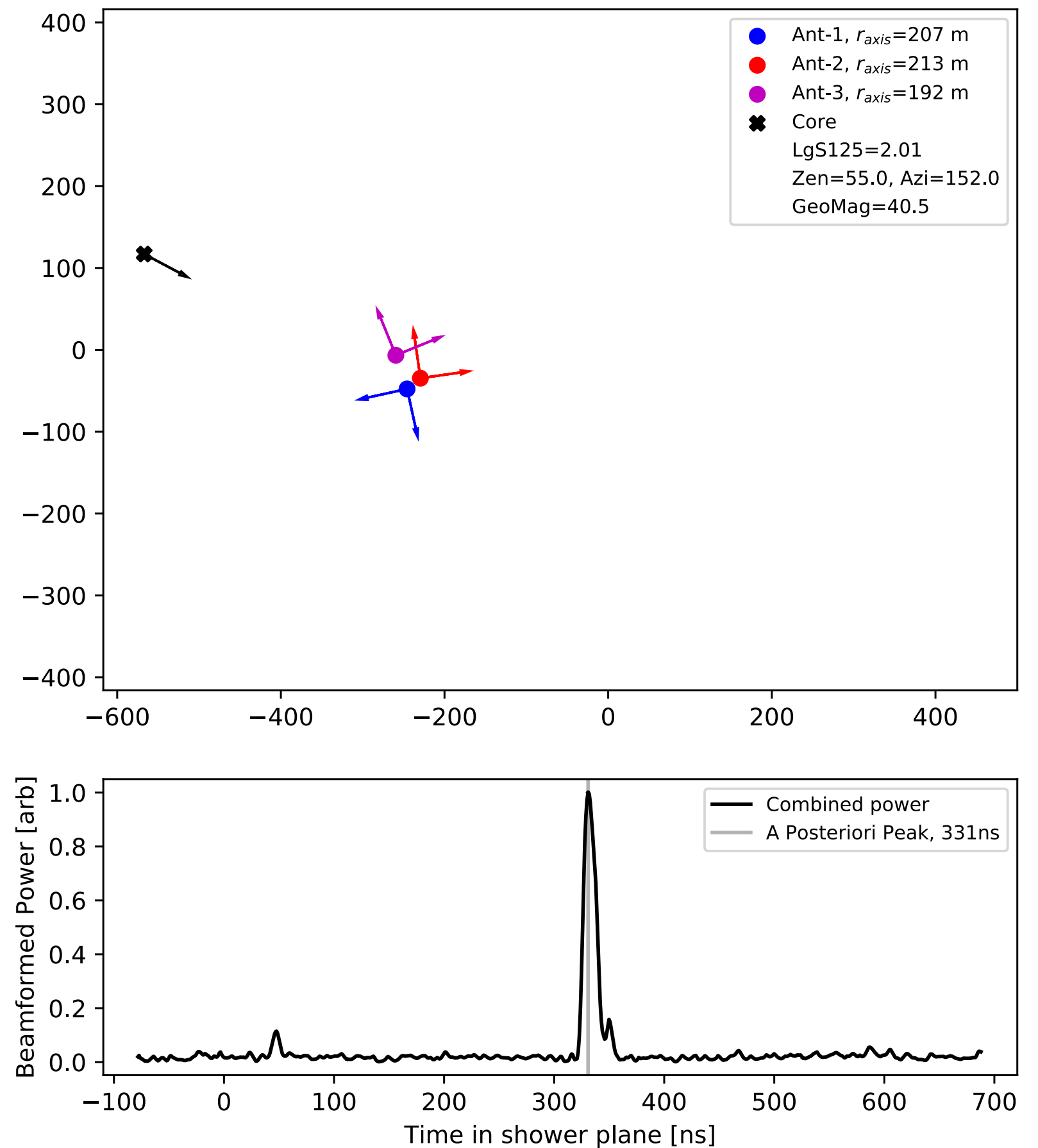


## Quick facts :

SKALA-V2 LPDA Antennas

Nominal bandwidth : **70MHz to 350MHz**

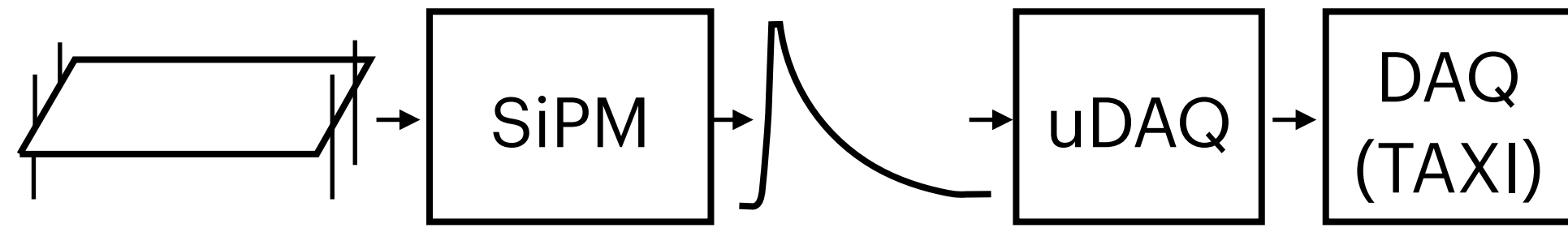
higher than the other main radio cosmic-rays experiments



plot from A. Coleman

Scintillation

# Detectors



## Quick facts :

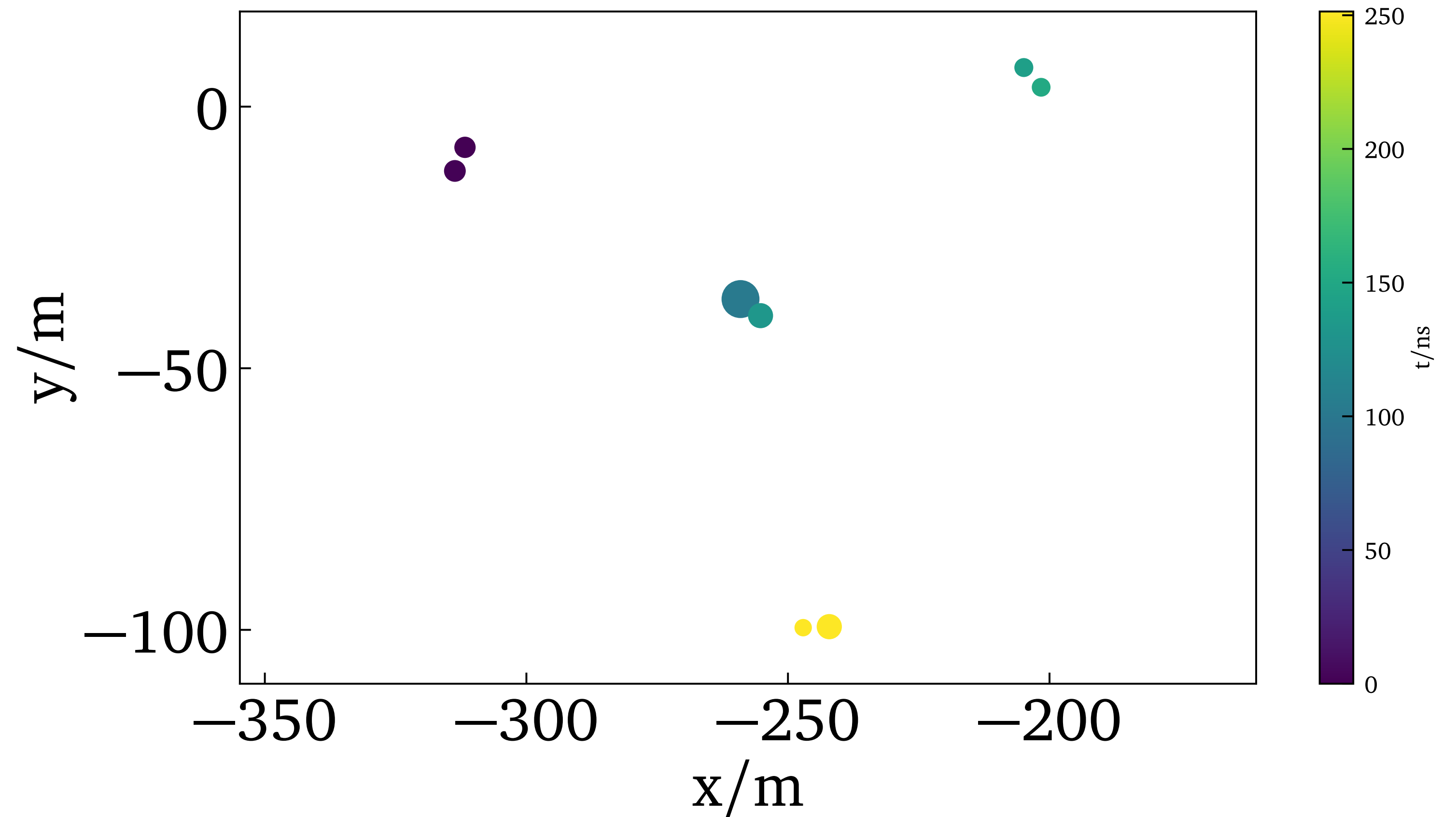
1.5 m<sup>2</sup> active area

Organic plastic scintillation bars

Silicon Photomultiplier (**SiPM**)



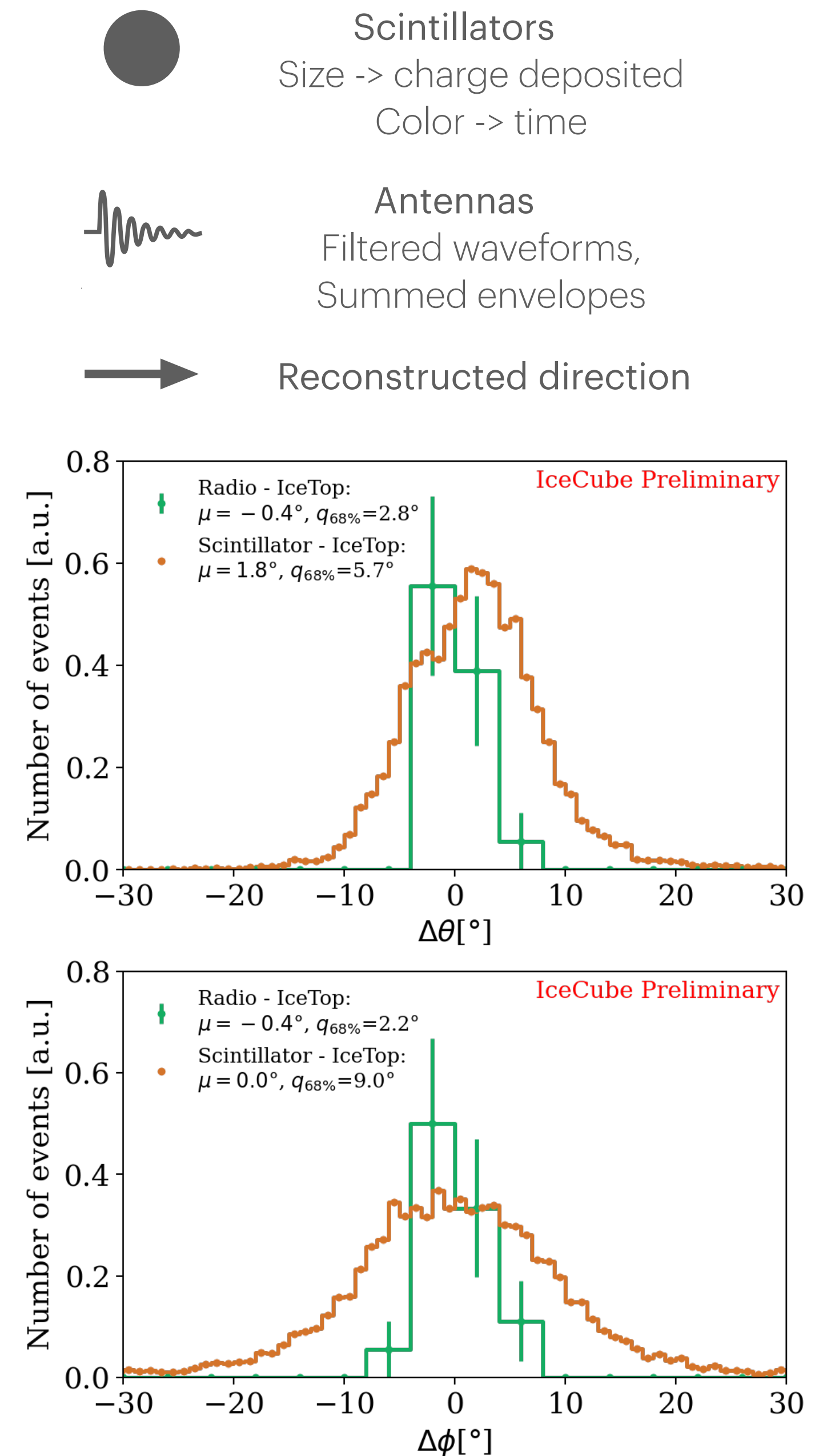
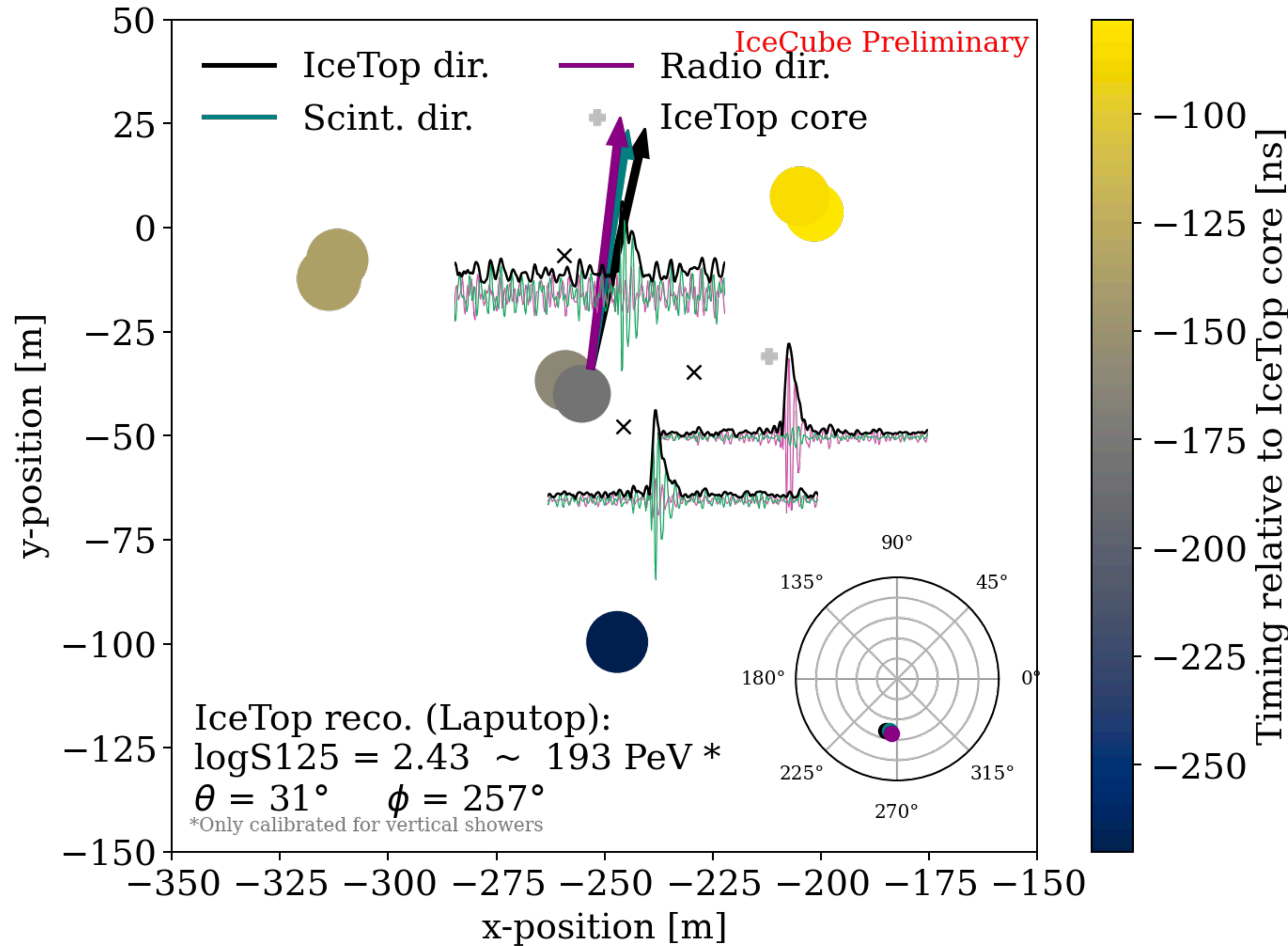
*Elevated scintillator from the prototype station*



plot from M. Oehler



# Triple Coincidences



PoS(ICRC2021)314 (H. Dujmovic)

# Conclusion

- We have a prototype station working since January 2020
- We recorded coincident air showers with this new hybrid system and compared it with IceTop
- Good agreement with simulations (not covered in this talk)
- We are working on further analysis, hardware improvements and on the production of the complete array

**Thank you for your attention !!**

# Peak into the future

- This prototype station will be used as the baseline for the surface array of IceCube-Gen2

