A scintillator and radio enhancement of the IceCube surface detector array

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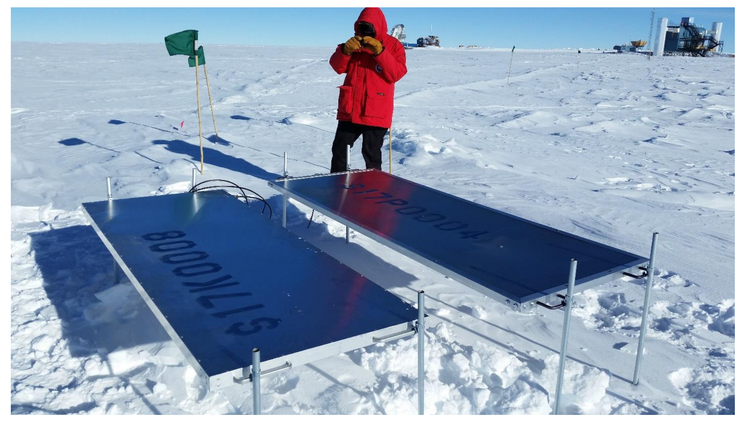
Motivation

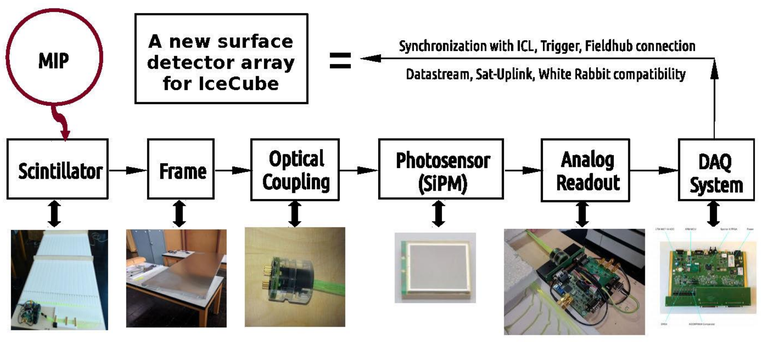
- Cross-calibration with IceTop (e.g. snow attenuation effects)
- Improved capabilities for studying cosmic rays
- Lowering threshold for air-shower observations
- Improved sensitivity to primary gamma rays
- Improvement of surface veto capabilities for neutrinos
- R&D effort towards a large surface extension of IceCube-Gen2

[1,2]

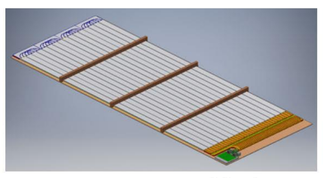


Prototyping

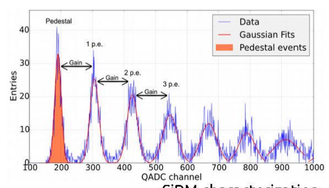
[3,4,5]



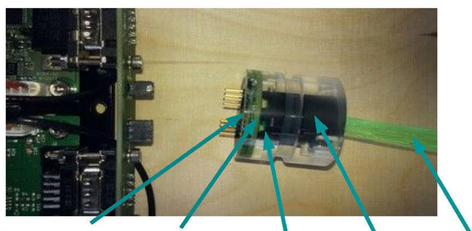
- Prototype scintillation detector stations deployed at SP Jan. 2018
- Planned 37 stations with 7 detectors each within IceTop footprint
- Prototypes with two DAQ concepts in operation at South Pole
- SKA radio antennas fit purposes and are prepared for deployment
- Low internal noise and good sensitivity for inclined signals
- Hybrid particle and radio DAQ under development

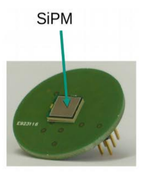


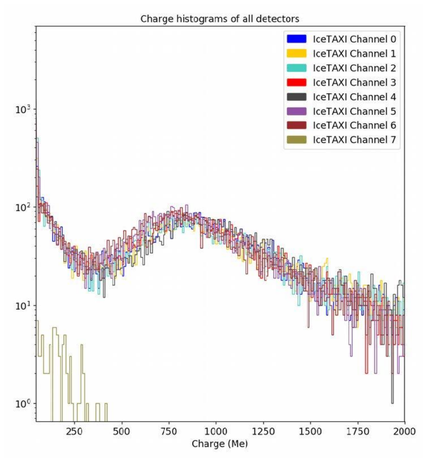
CAD of the detectors

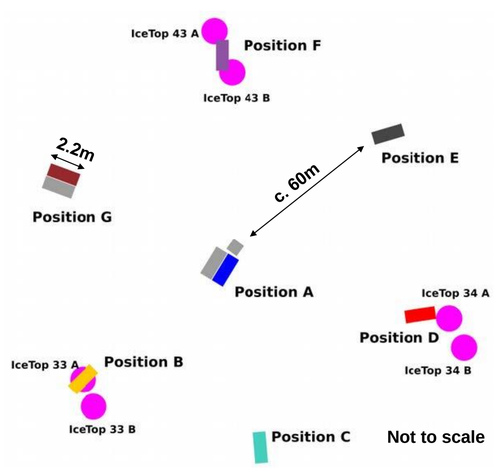


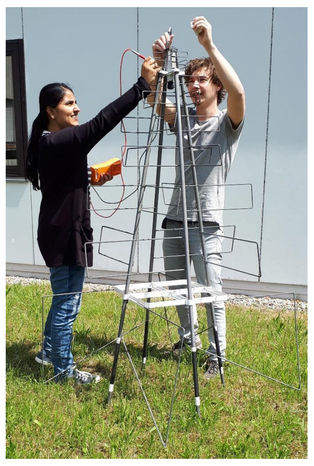
SiPM characterization







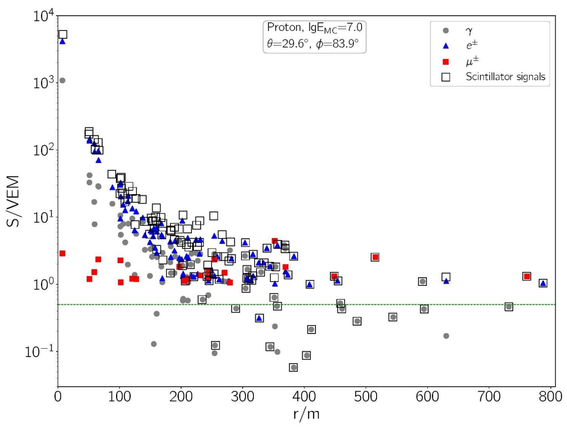


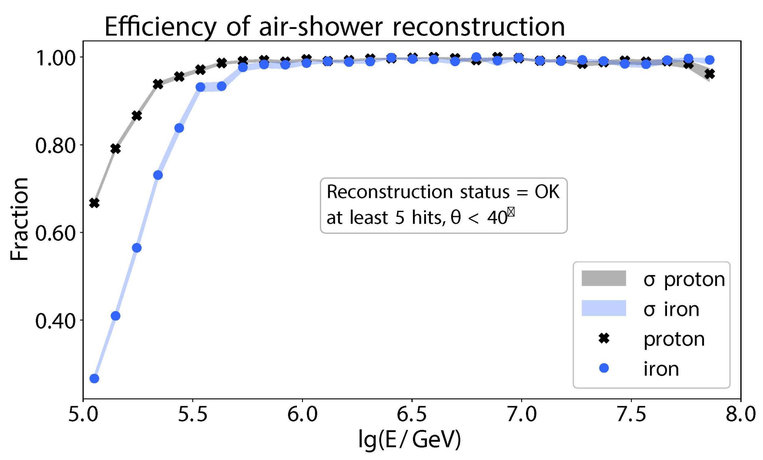


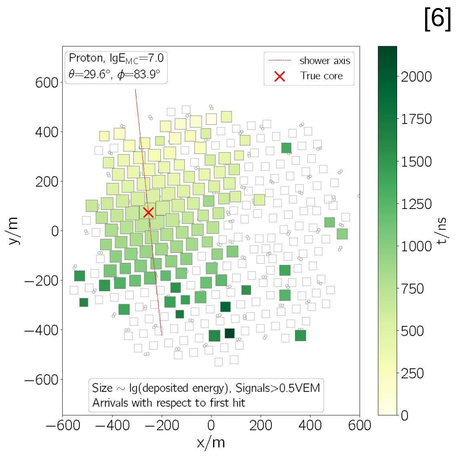
Simulation: scintillators

- Detection and reconstruction efficiency > 50% for energies above $10^{14.2}$eV
- Array fulfills science requirements

[6]



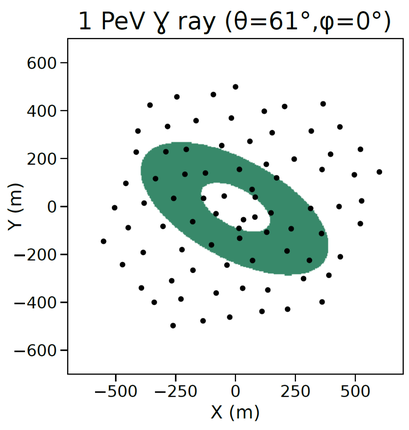


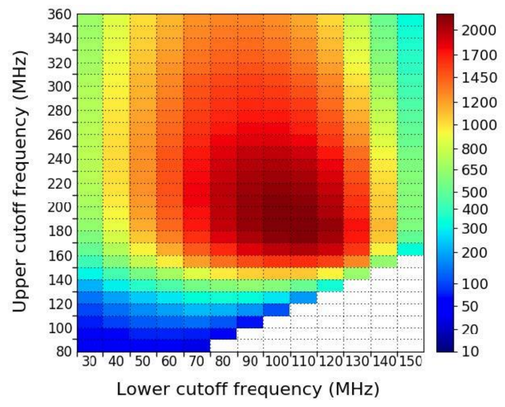


Simulation: radio

- Optimal frequency band of 100-190 MHz
- Improves signal-to-noise ratio
- Lowers detection threshold
- Measurement of inclined air showers
- Allows search for PeV gamma rays from Galactic Center
- IceCube site well suited for observation of Galactic Center

[7]





References

- [1] D. Seckel et al., [IceCube Coll.], PoS (ICRC2015)694
- [2] F. G. Schröder, [IceCube-Gen2 Coll.], ARENA 2018
- [3] T. Huber et al, [IceCube-Gen2 Coll.], PoS (ICRC2017)401
- [4] T. Karg, A. Haungs, et al., arxiv.org (1410.4685)
- [5] T. Huber, [IceCube-Gen2 Coll.], TeVPA 2018
- [6] A. Leszczynska, [IceCube-Gen2 Coll.], 26th E+CRS 2018
- [7] A. Balagopal, A. Haungs, F. Schröder et al, ARENA 2018

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