Optimization of the optical array geometry for IceCube-Gen2.

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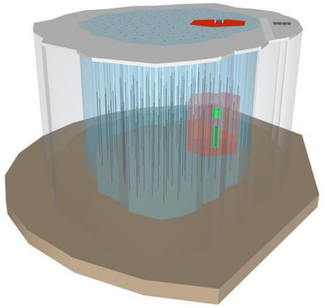
IceCube-Gen2

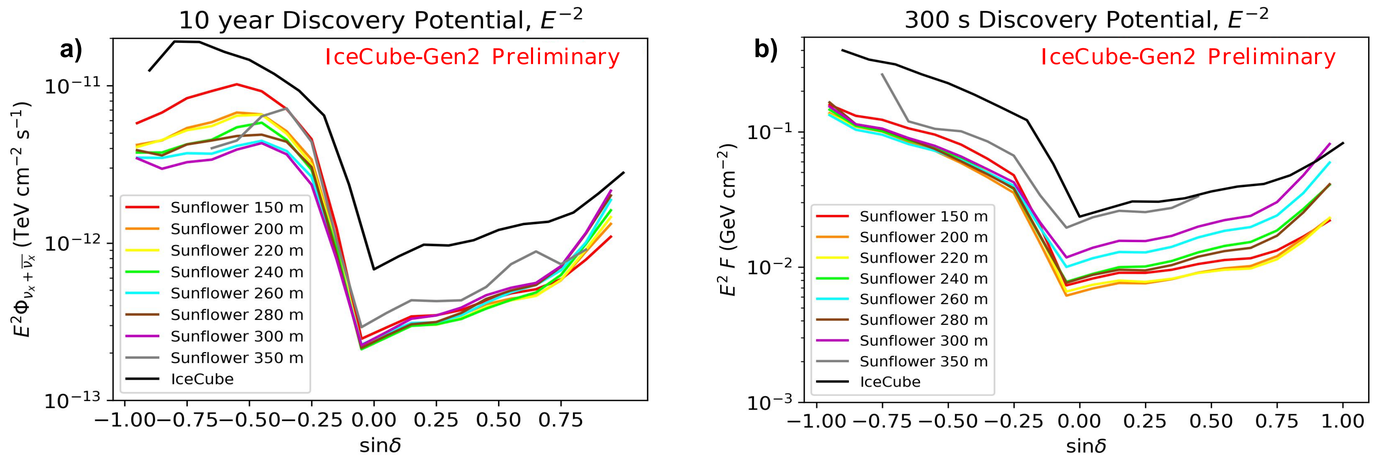


IceCube-Gen2 optical array. Credit: IceCube Collaboration.

IceCube-Gen2 will be an extension of the existing IceCube [1] array aiming to explore the high-energy neutrino sky. Components:

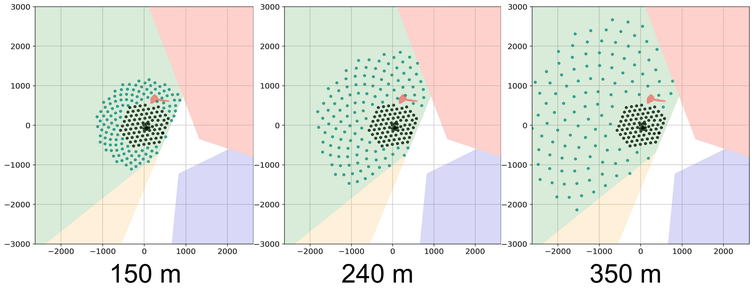
- optical array;
- radio array;
- surface array;
- IceCube Upgrade [2].

Discovery Potentials



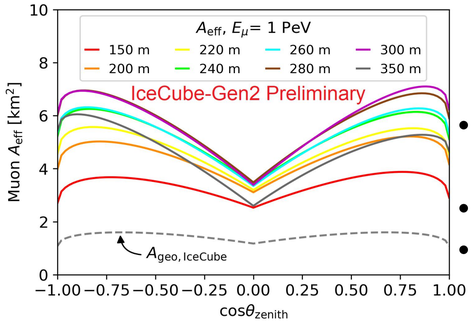
IceCube-Gen2 (optical array, “Sunflower” geometries) discovery potential for **(a)** 10 years of exposure, high-energy cuts applied, **(b)** 300 seconds of exposure, low-energy cuts applied.

“Sunflower” geometries



“Sunflower'”-like geometry is advantageous compared to IceCube's regular grid. Eight values of inter-string spacing parameters were chosen for the optimization study: 150 m, 200 m, 220 m, 240 m, 260 m, 280 m, 300 m, and 350 m.

Monte Carlo simulations and Analysis



The average muon effective area after quality cuts as a function of zenith angle for 1 PeV muons

- Simulated and reconstructed ~50,000 triggered events for each geometry (optimization study for tracks).
- New quality cuts defined: low-energy and high-energy sets.
- Analysis based on [3].
- Point source sensitivities obtained from parameterized detector performance quantities assuming E^{-2} source spectrum and isotropic atmospheric background.

Conclusions

- Discovery potentials differ only slightly (especially at the horizon).
- Spacings between 200 m and 280 m show good performance for both event selections because of their large muon effective area and good angular resolution.

References

[1] **IceCube-Gen2** Collaboration, M. G. Aartsen *et al. Journal of Physics G: Nuclear and Particle Physics 48 no. 6, (Apr, 2021) 060501.*

[2] **IceCube Collaboration**, A. Ishihara *PoSICRC2019(2021) 1031.*

[3] **IceCube-Gen2** Collaboration, J. van Santen *PoSICRC2017(2018) 991.*