IceCube-Gen2 + Radio workshop

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Motivation for this workshop

Develop a coherent approach to neutrino detection at UHE energies – essentially beyond the energies where IceCube sees a flux.

Current situation

- IceCube
  - IceCube Upgrade, midscale level project is underway. (NSF funding $22M)
  - It is also seen as a Phase 1 for IceCube-Gen2, also by NSF.
  - Efforts are underway to advance Gen2.
  - Plans/serious consideration to include radio in scope of Gen2.
  - Development of a broader based white paper. Requires definition of scope.
- Radio
  - ARA running with 5 stations,
  - one station with Phased array, reference for RNO
  - RNO proto-collaboration formed.
  - RNO proposal pending

Decadal white paper - science

Science case underwritten by broader community speaking with one voice.
Detector papers to follow.

Astro2020 Science White Paper

Astrophysics Uniquely Enabled by Observations of High-Energy Cosmic Neutrinos

Thematic Area: Multi-Messenger Astronomy and Astrophysics

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Amy Connolly, *The Ohio State University*
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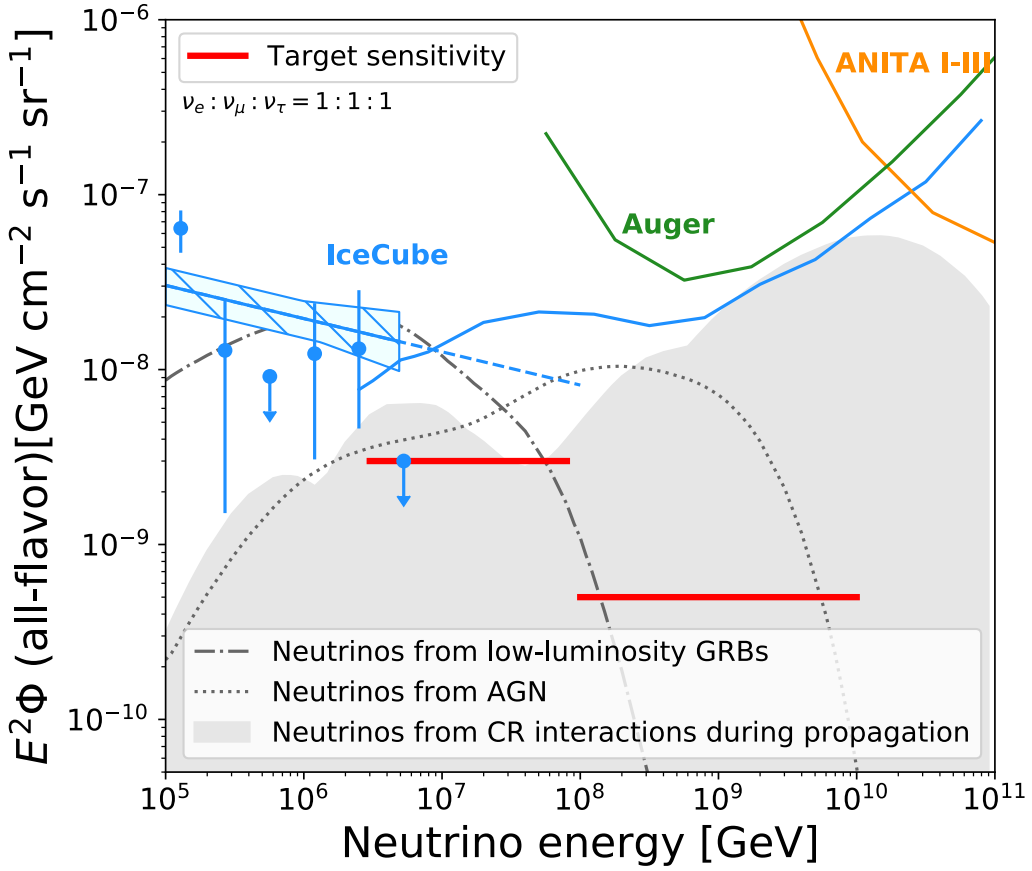
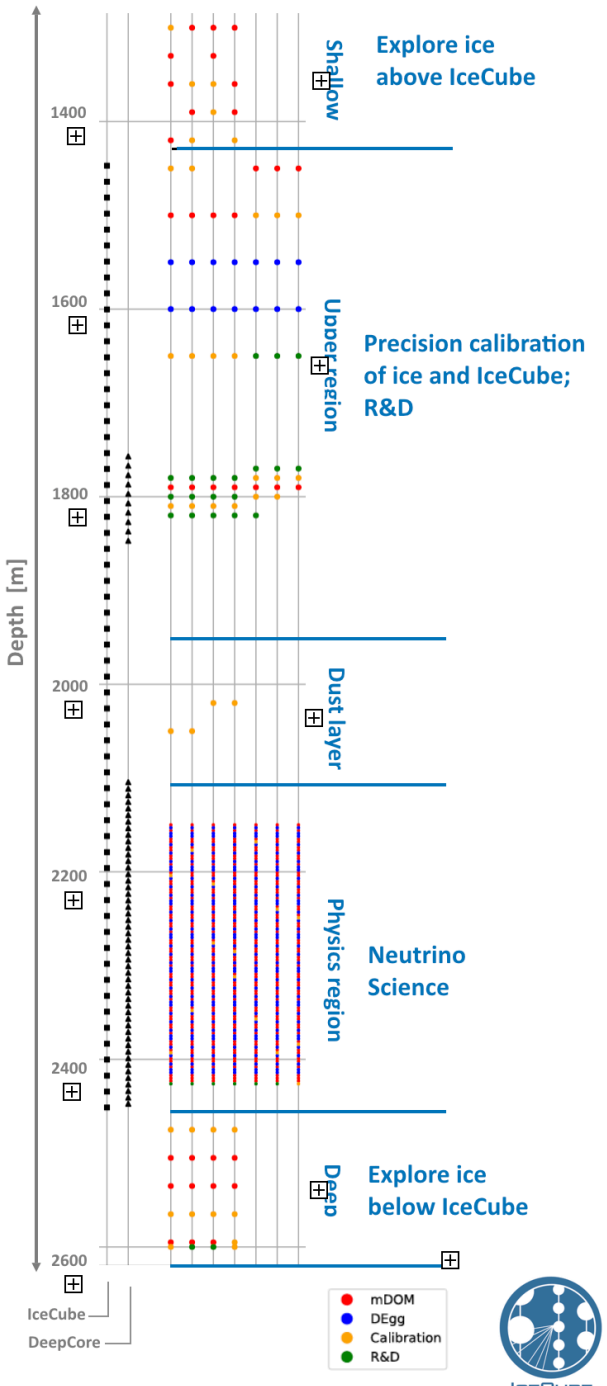
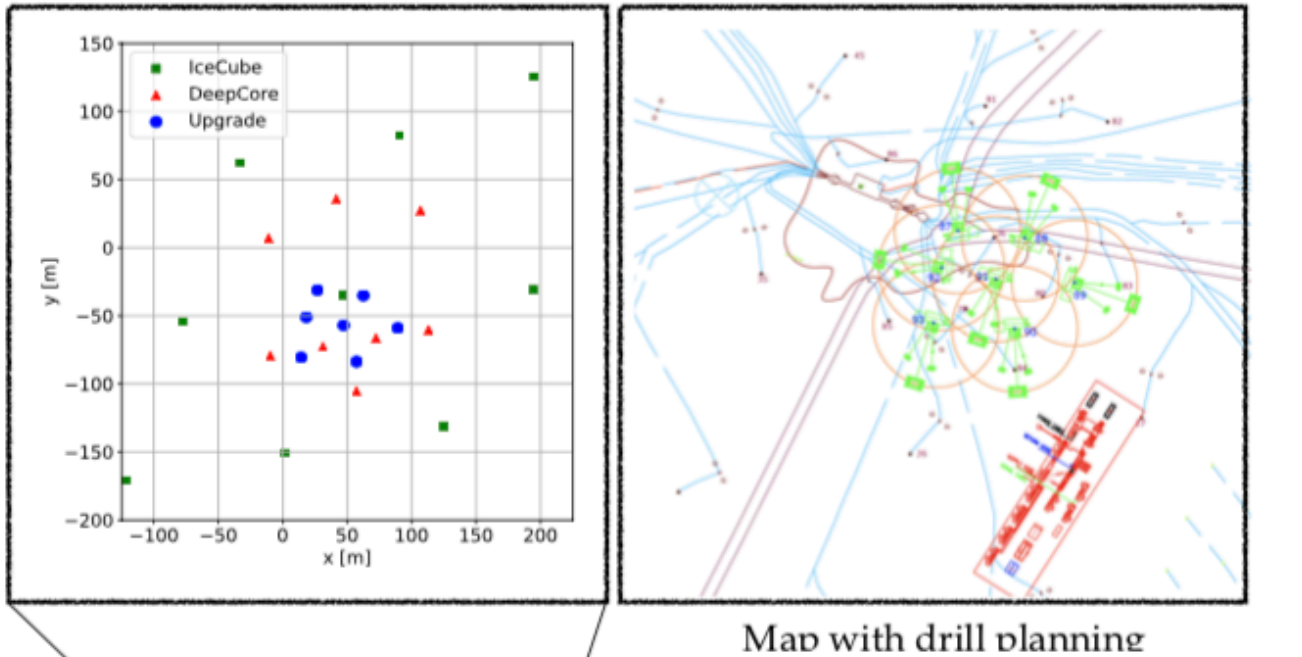
March 2019



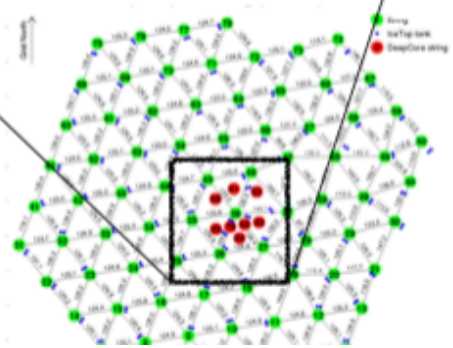
IceCube Upgrade - scope

7 strings in center of IceCube.
Neutrino physics and calibration
Deploy in 2022/23





Map with drill planning

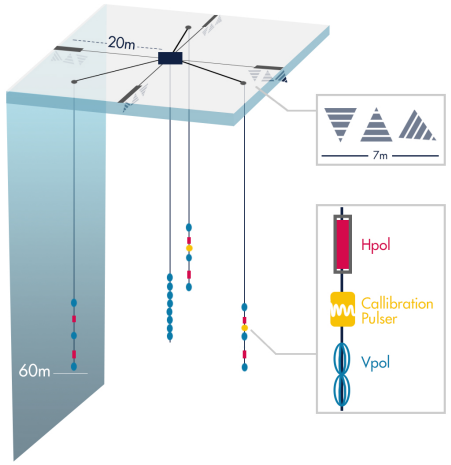


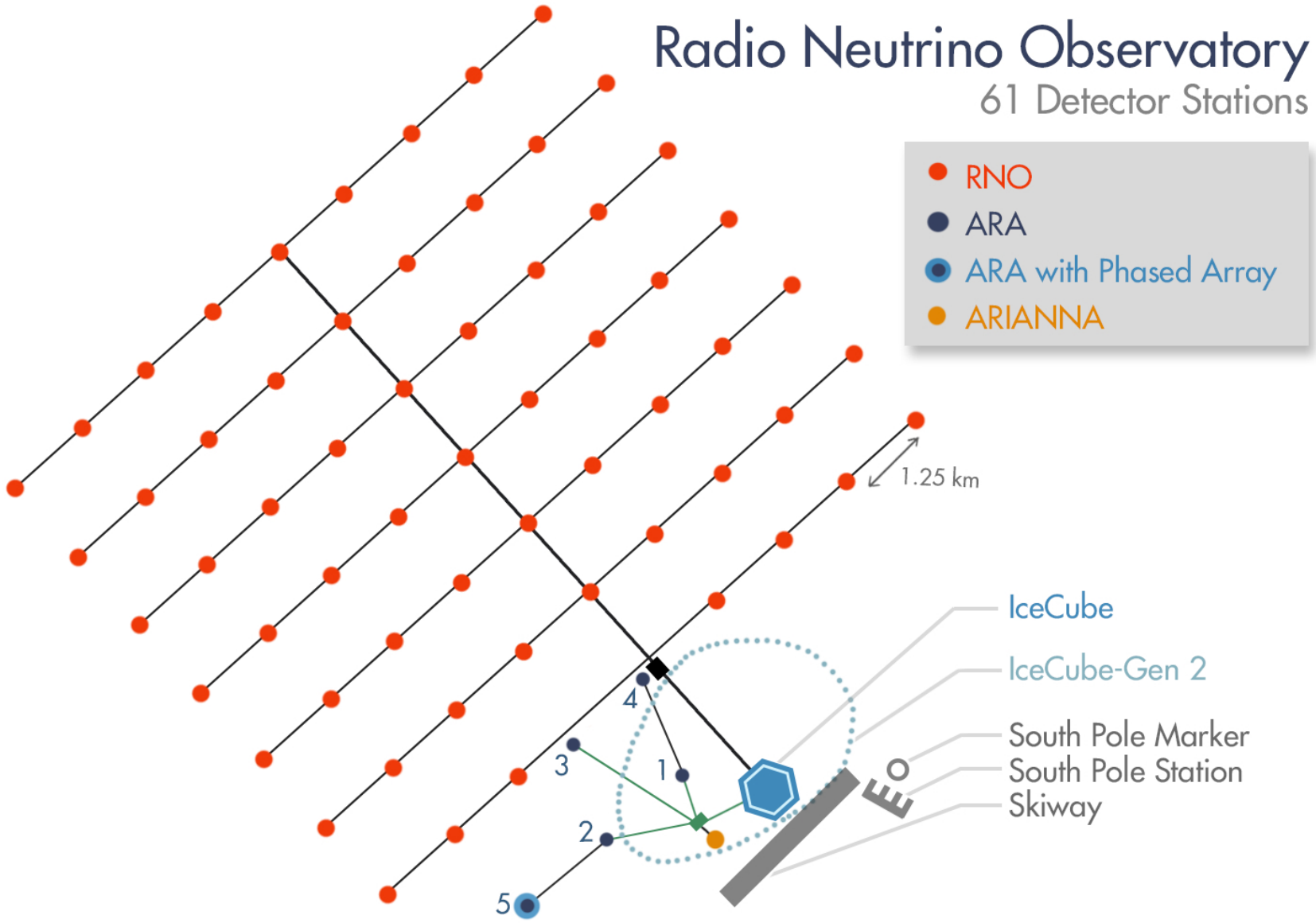
IceCube

Layout
61 stations

Depth: 60 to 100m
Spacing: 1.25 km

Construction schedule:
5 years,
3.5 seasons on ice
complete





IceCube-Gen2

The next Generation IceCube: from discovery to astronomy

Multi-component observatory:

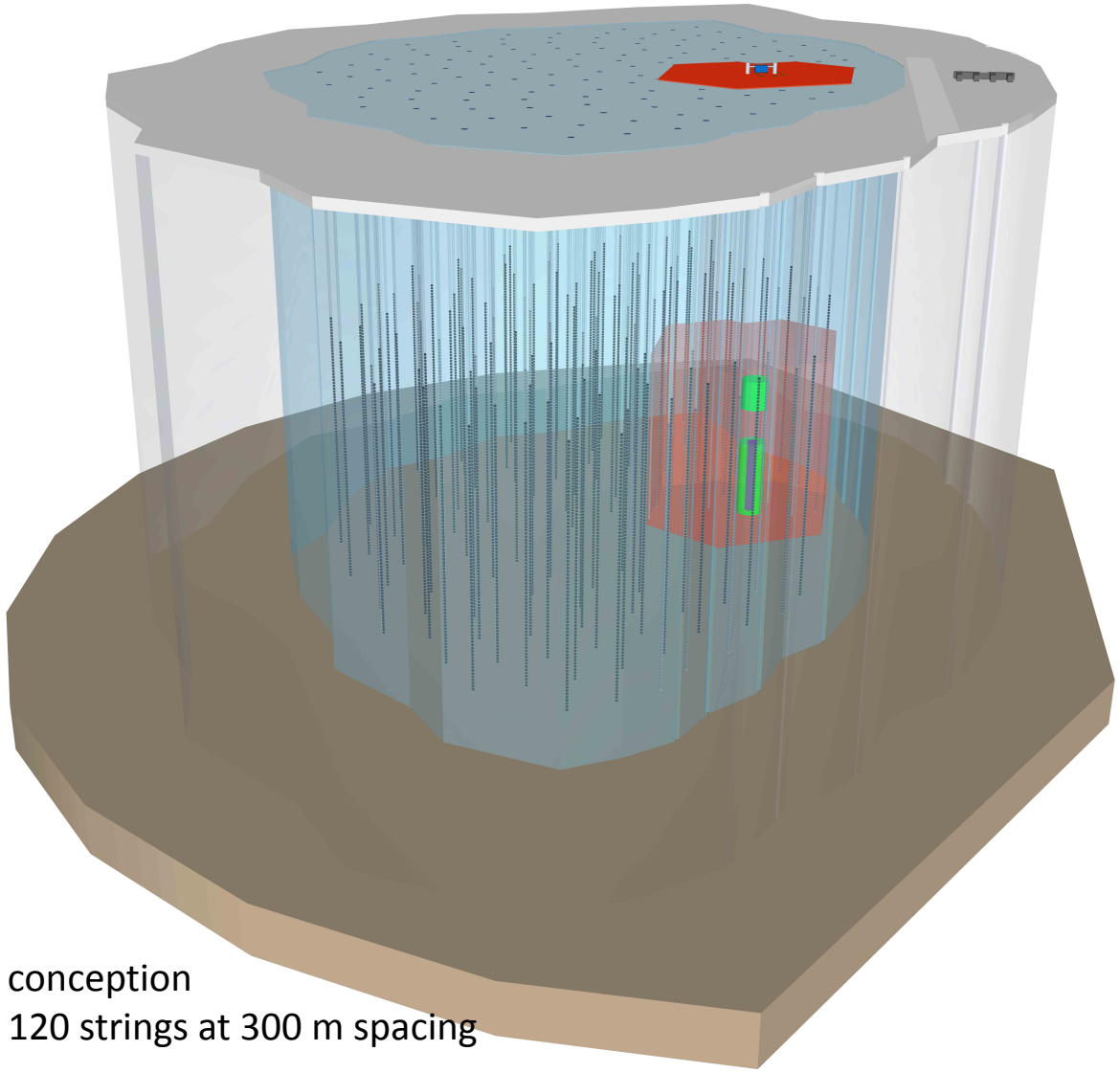
- IceCube-Gen2 High-Energy Array
- Surface air shower detector
- Sub-surface radio detector

Surface Area: ~6.5km^2 (0.9)
Instrumented depth: 1.26 km (1.0)

Instrumented Volume: 8 km^3

Order of magnitude increase of contained event rate at high energies.

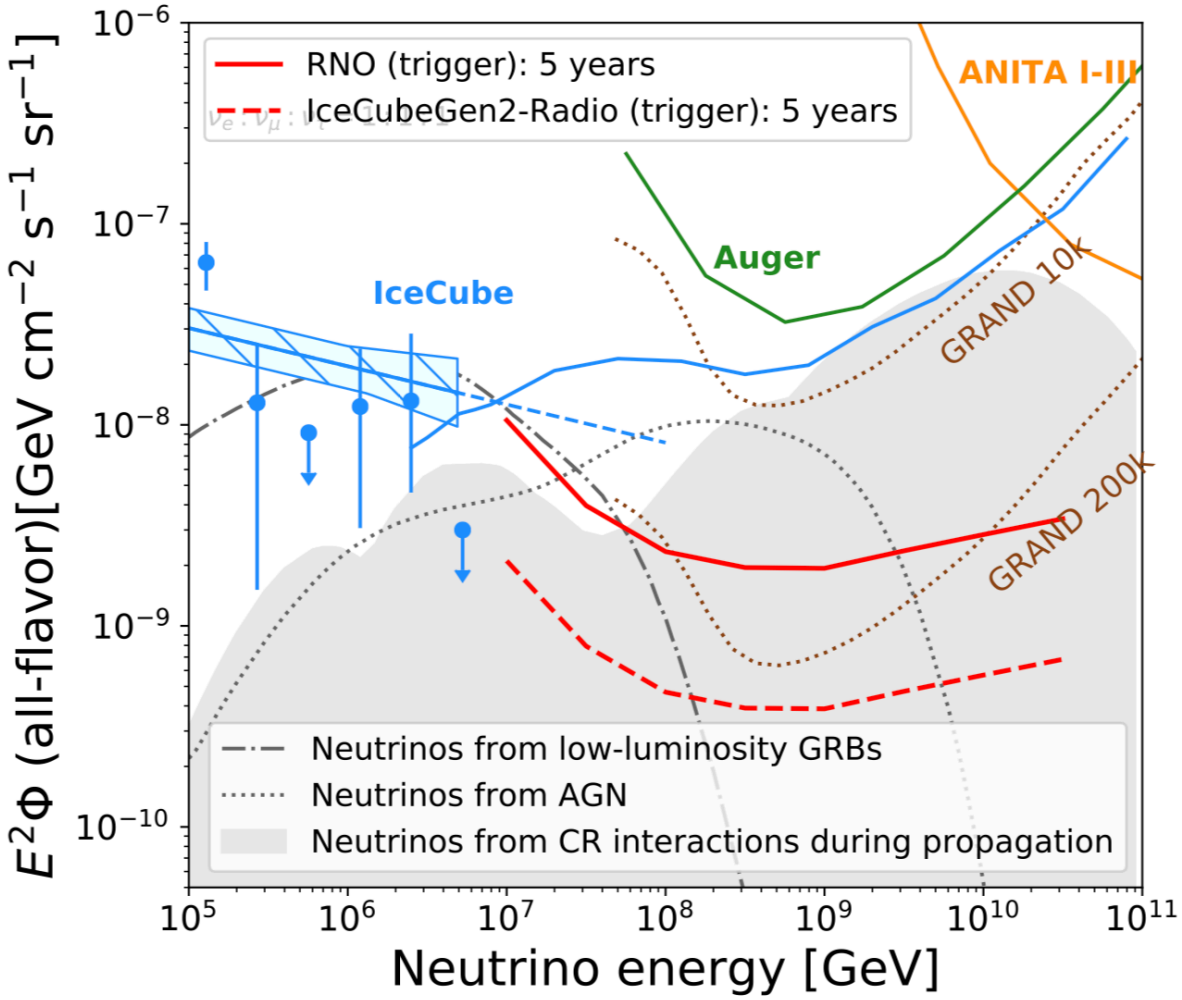
Cost: order $400M



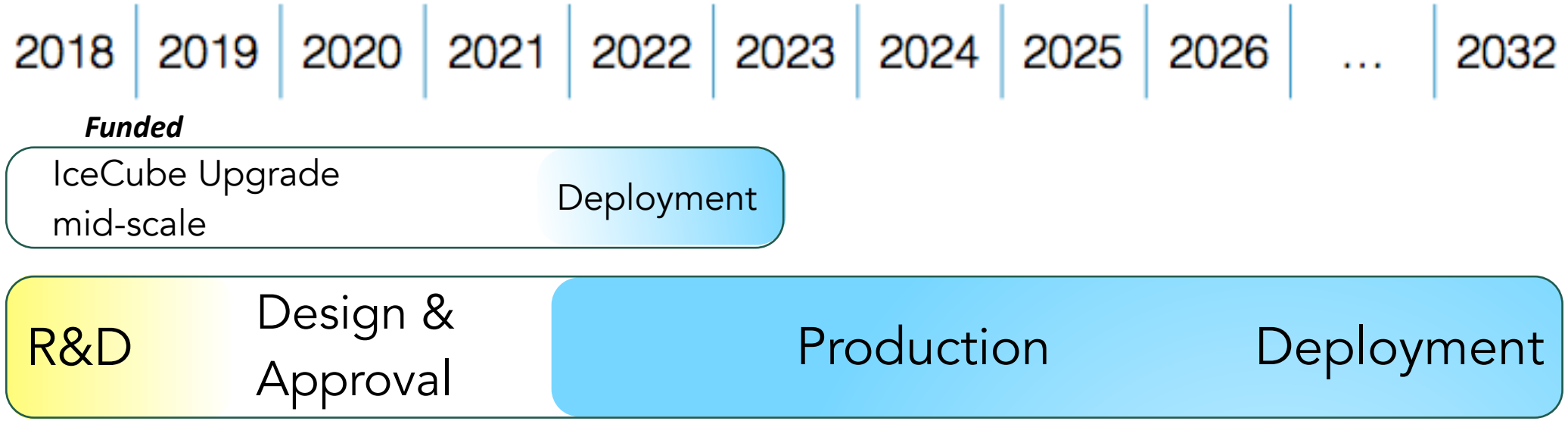
Artist conception
Here: 120 strings at 300 m spacing

Target sensitivity at high energies - beyond RNO

Radio component of IceCube-Gen2 sensitivity, scale, 5x RNO.



IceCube Gen2 schedule



Why discuss this now?

Gen2 planning is happening now (this year, next):

Whitepaper to be written this year

Decadal detector papers need to be written this spring/summer.

Better chance of success if we, as a community have a coherent plan and message.

In order to preserve a radio option in Gen2, need to think about it now and get practical.

If Gen2 goes ahead without radio, it seems hard to imagine a larger scale radio array (after RNO) in parallel to Gen2, certainly at the Pole.

- Science is the same or highly connected.
- Infrastructure and planning clearly benefits from joint approach.
- NSF would likely just not consider it (as an independent thing) and we hear such signals.
- (CMBS4 is the same. There is no path outside the MREFC)

Goals of this workshop

Get everyone up to speed what different parts of the community, namely what IceCube and radio folks are planning to do.

Discuss possible Gen2 radio scenarios: 5 x sensitivity of RNO.

Discuss possible detector architecture (eg less power, are cables still suitable,…)

Is it possible to achieve readiness of radio for MREFC scale construction?

(will require RNO or some adequate support to get there.

There is also a guideline that ~10% of the project cost must be spend on R&D before project start)

Even on RNO scale there is value in coordination:

Benefits of coordination planning, season and population planning

Access of IceCube data infrastructure and operation (ICL, winterovers)

Goals of this workshop

Collaboration matters:

Do I have to become IceCube member to explore this, support this? Answer: no, not now.
Need to establish a working platform beyond this workshop to develop these plans.

Possibilities: Open Gen2 phone call —> evolve towards a radio working group for Gen2
(similar to the RNO phone calls before proposal submission and before we had a design.)

Gen2 project:

clearly there would be subsystem leads, eg a Level 2 manager for radio, along with other Level 2 manager for other things.

Last session, in the afternoon:
Discuss some of topics in the smaller setting.