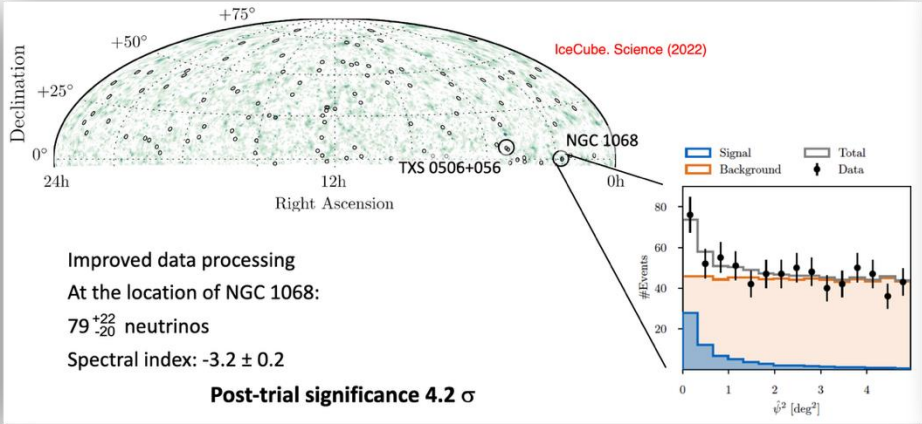


The Pacific Ocean Neutrino Experiment (P-ONE)

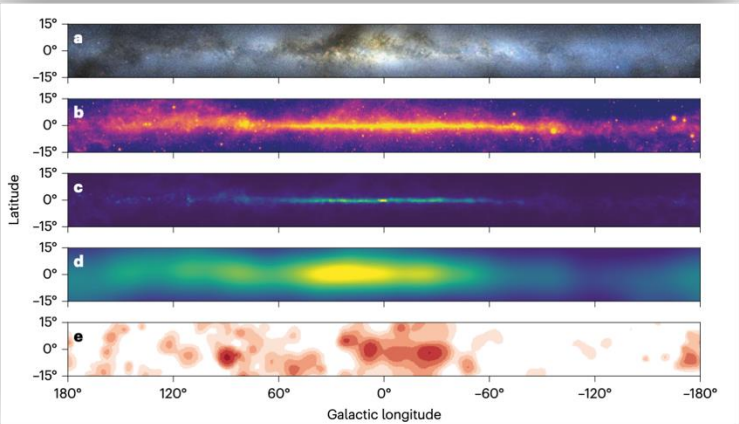
Ignacio Taboada
Georgia Institute of Technology

The nascent field of high-energy neutrino astrophysics

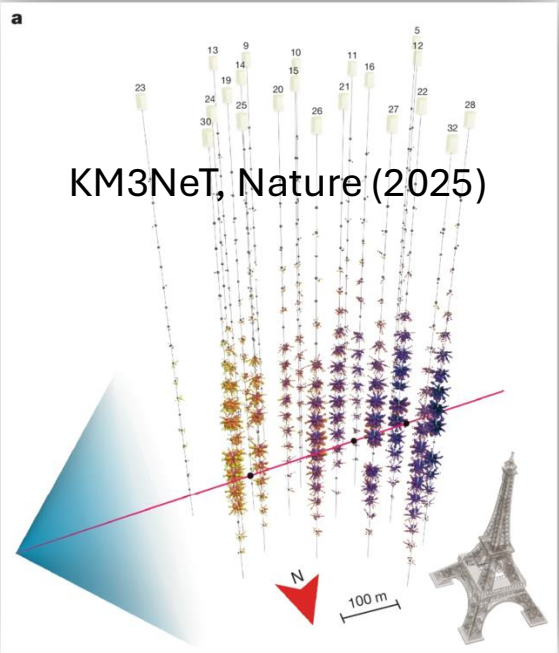
IceCube, Science (2022)



IceCube, Science (2023)



KM3NeT, Nature (2025)



P-ONE's motivation

Build on IceCube's legacy

Complement instantaneous field of view of all neutrino telescopes

Contribute to a global network of neutrino telescopes

Resolve sources in the Milky Way

Identify more extragalactic neutrino sources



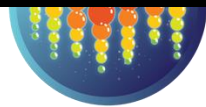
ASTROPHYSICAL NEUTRINOS
DISCOVERED

2013



BLAZAR TXS 0506+056
NEUTRINO EMISSION IDENTIFIED

2018



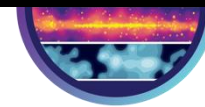
GLASHOW RESONANCE
NEUTRINO IDENTIFIED

2021



ACTIVE GALAXY NGC 1068
NEUTRINO EMISSION IDENTIFIED

2022



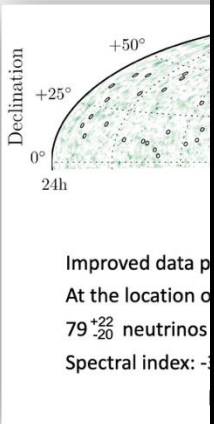
MILKY WAY
NEUTRINO EMISSION IDENTIFIED

2023

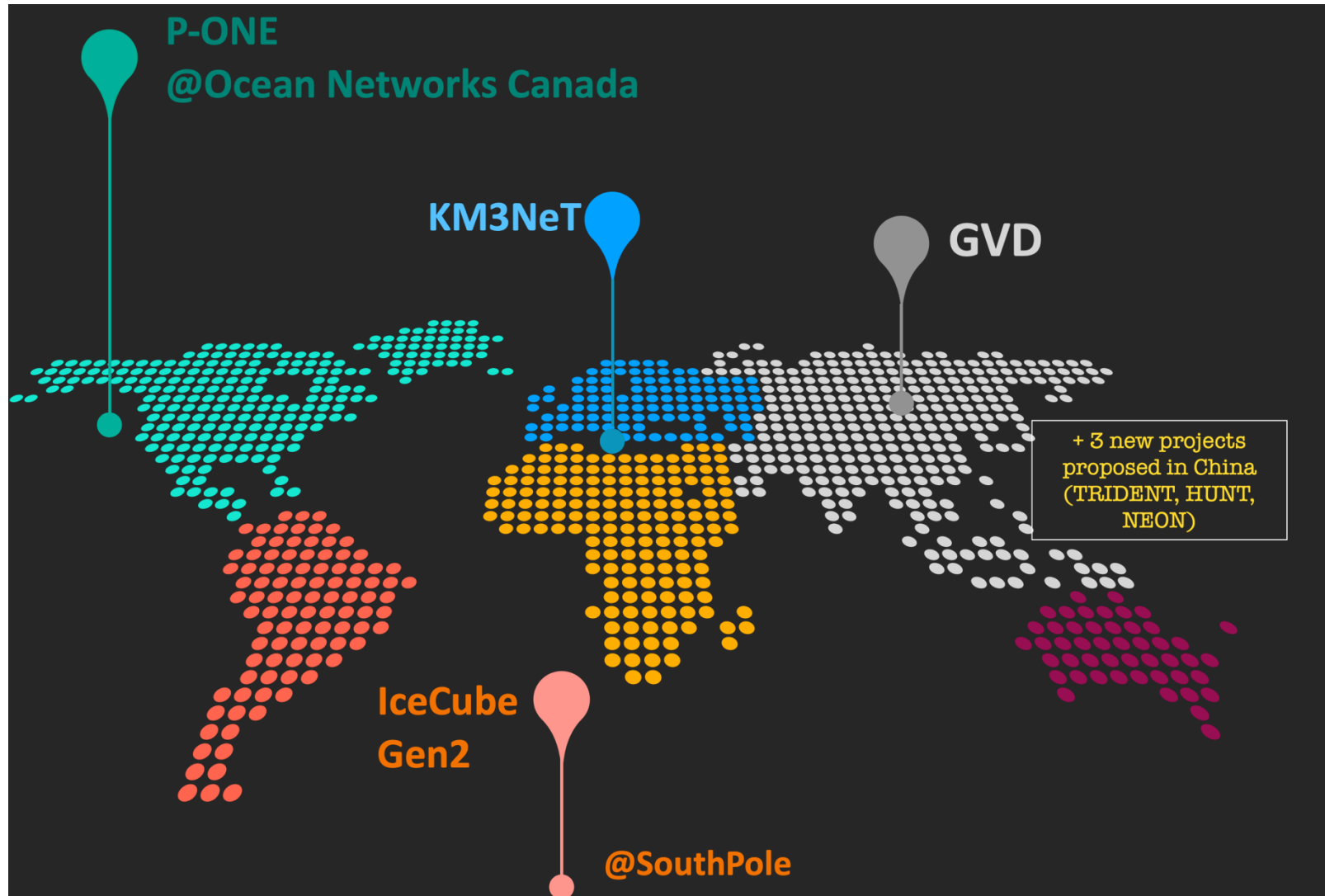


ASTROPHYSICAL TAU
NEUTRINOS IDENTIFIED

2024



Existing and planned Neutrino Telescopes

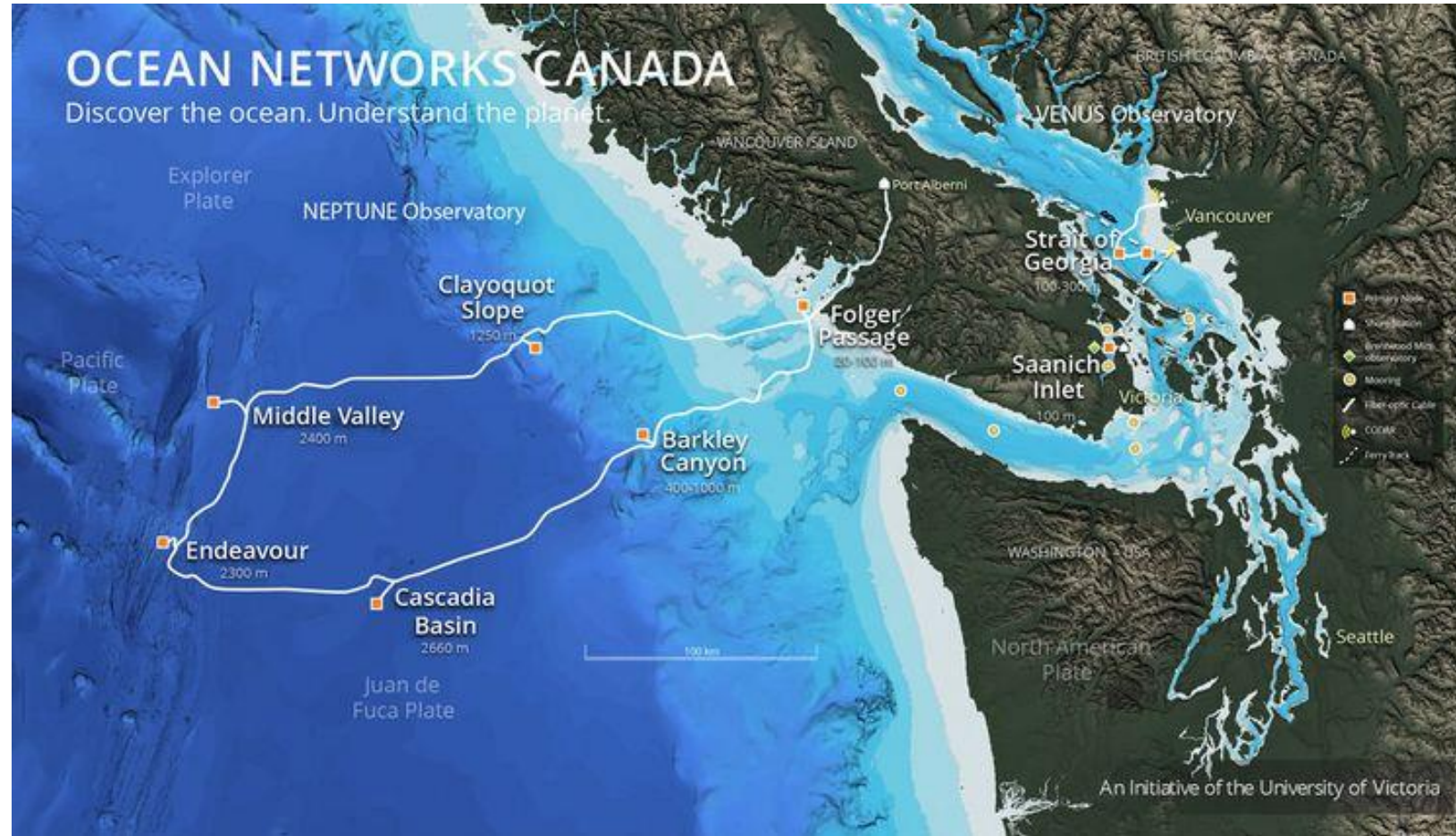


P-ONE site

Ocean Networks Canada (ONC)

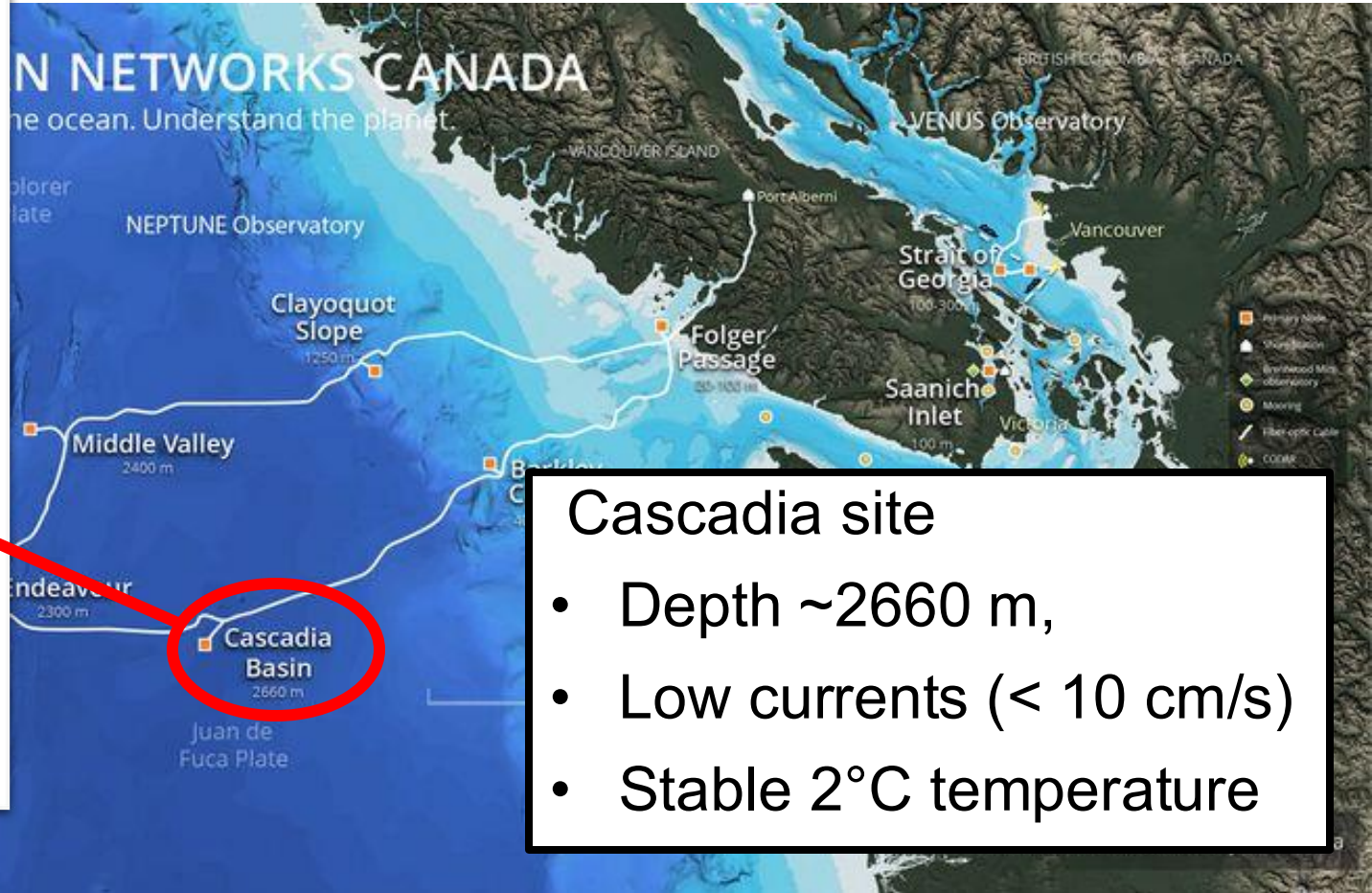
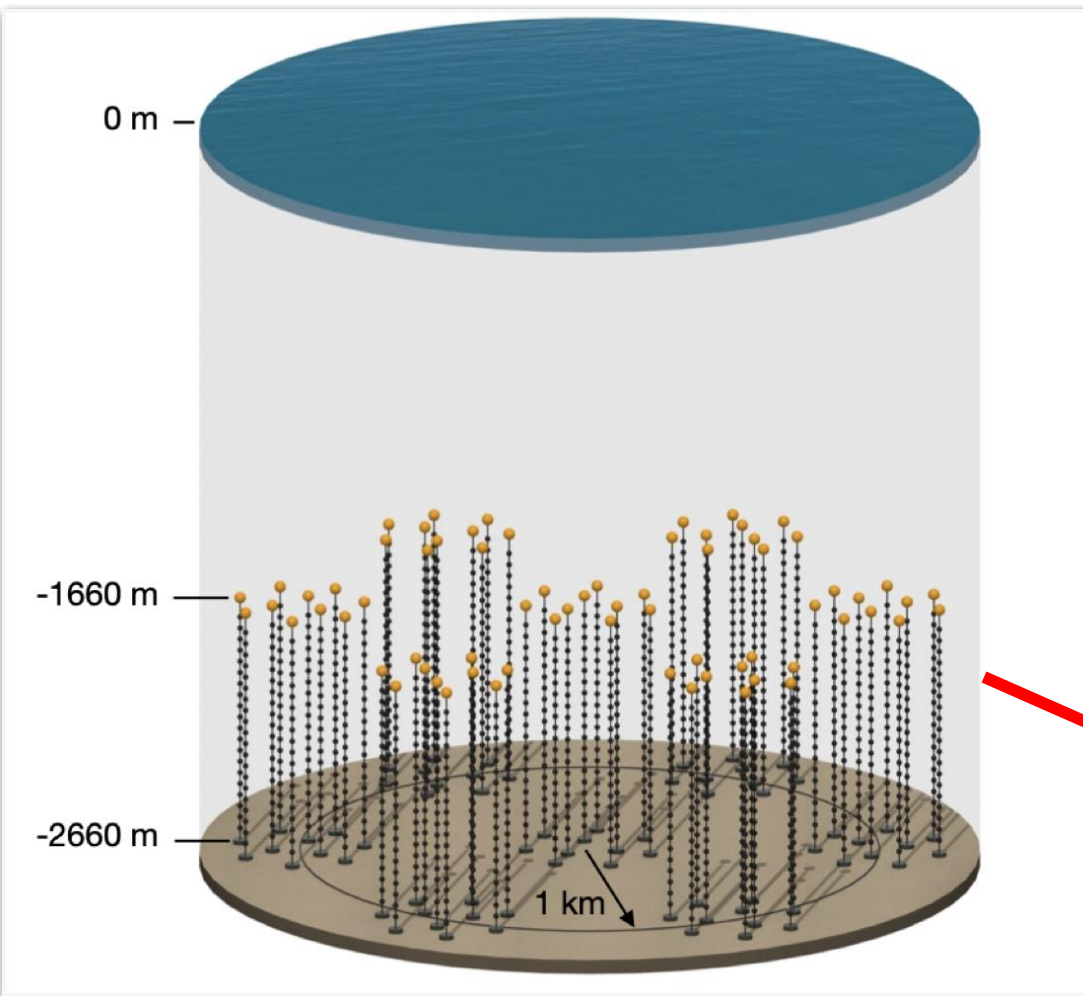
World's largest undersea network

- 800-km loop
- 8 kW x 6 nodes
- 2 Gbit



NEPTUNE observatory

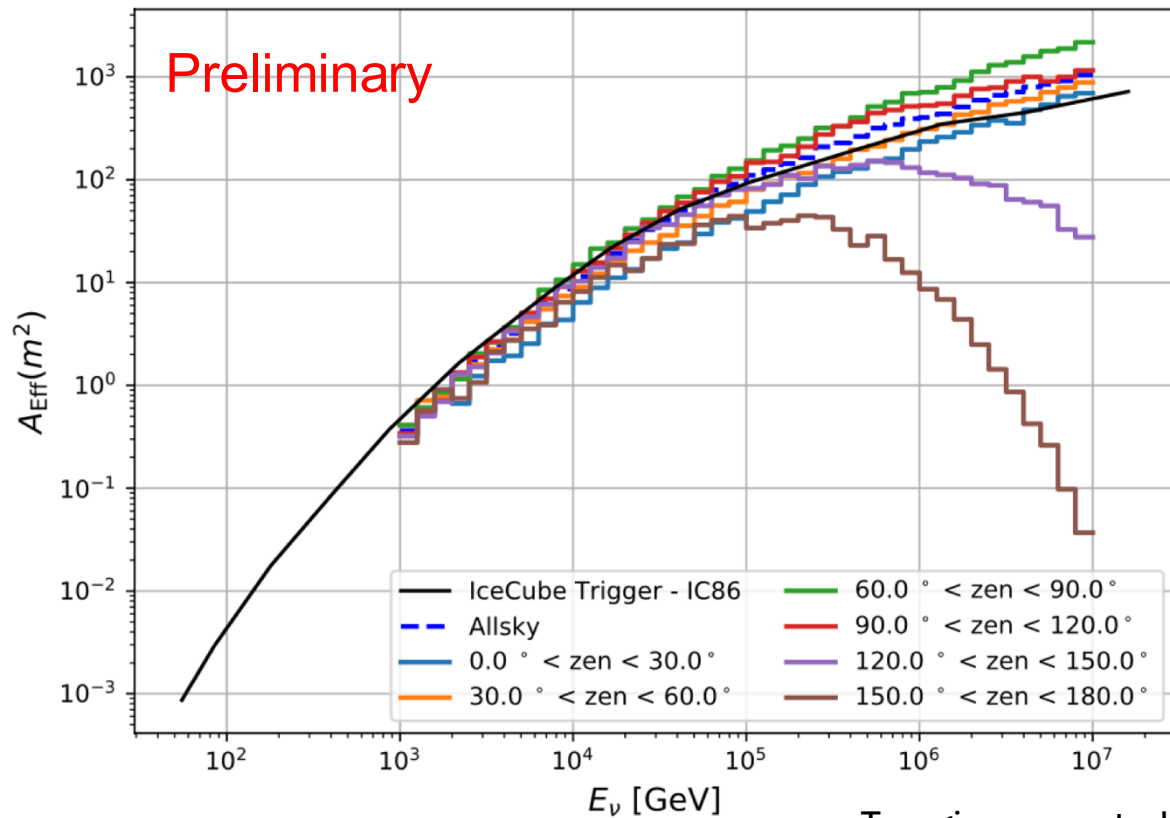
P-ONE site



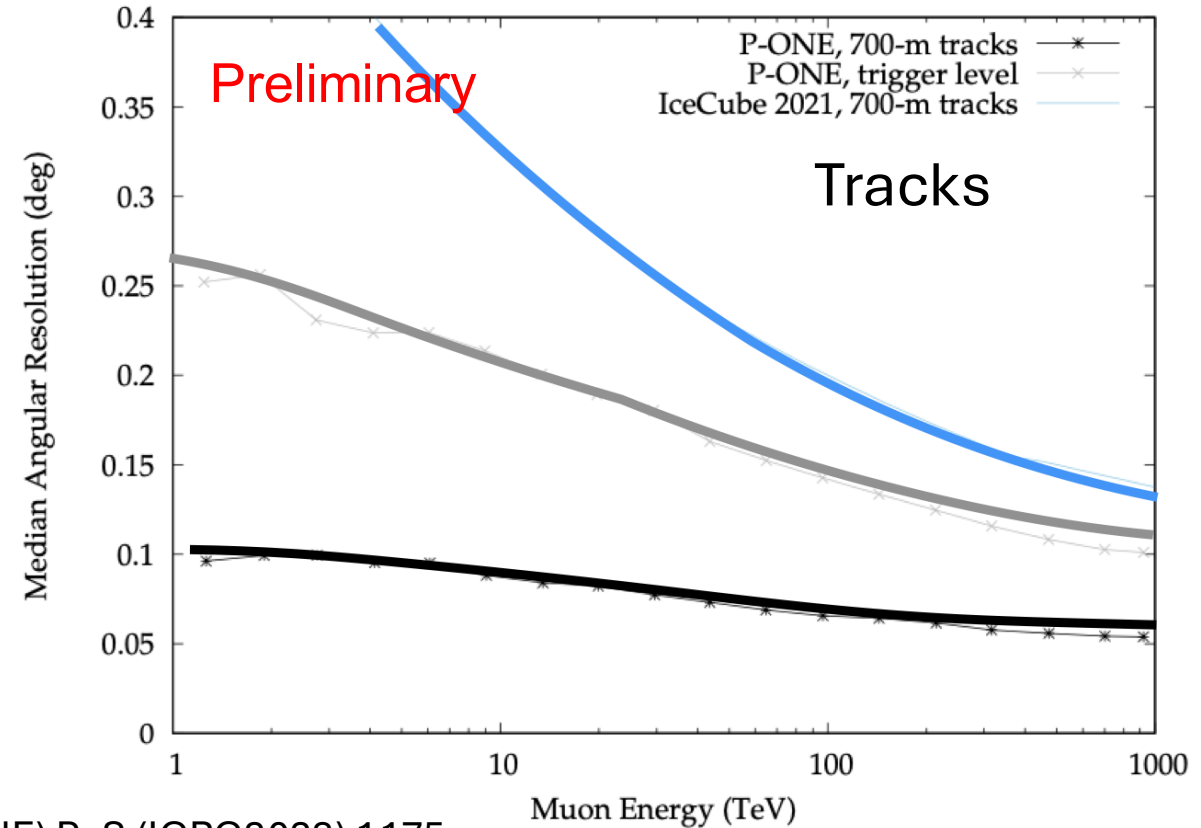
Cascadia site

- Depth ~2660 m,
- Low currents (< 10 cm/s)
- Stable 2°C temperature

Focus on angular resolution



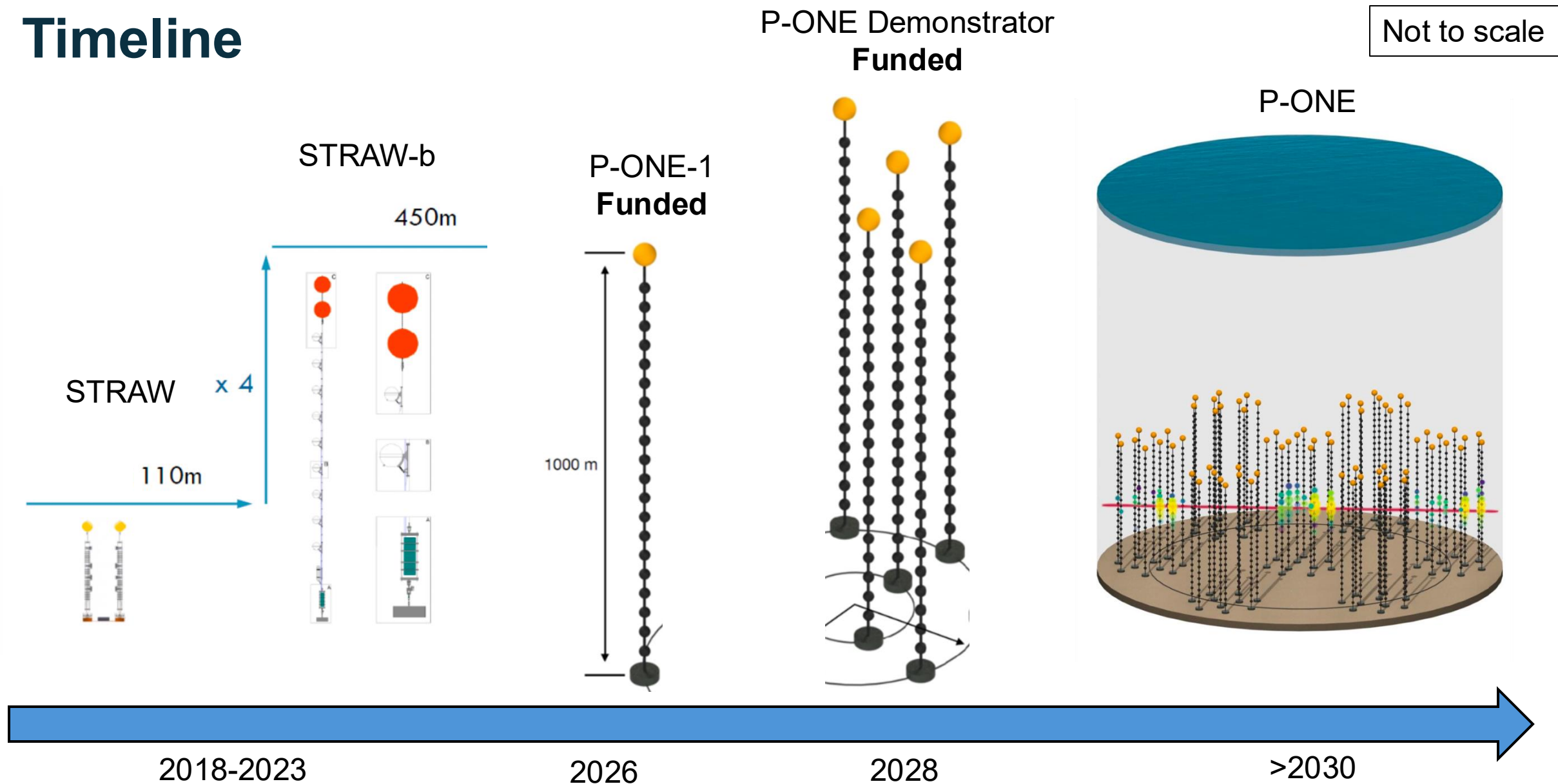
Twagirayezu et al. (P-ONE) PoS (ICRC2023) 1175



Euclidean Universe approximation: $N(> f) \propto f^{-3/2}$

5x better ang. Resolution -> **10x more extragalactic sources**

Timeline



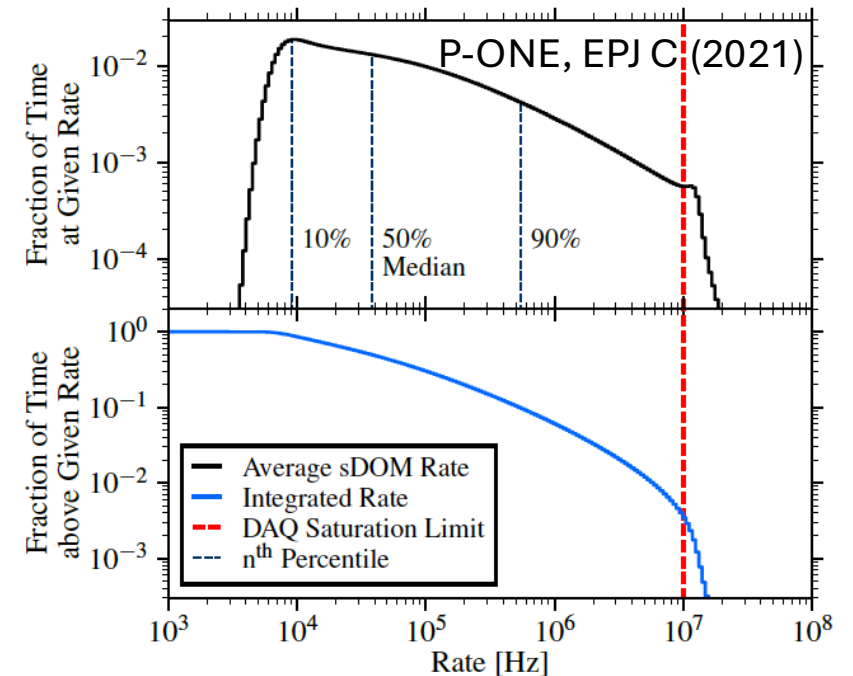
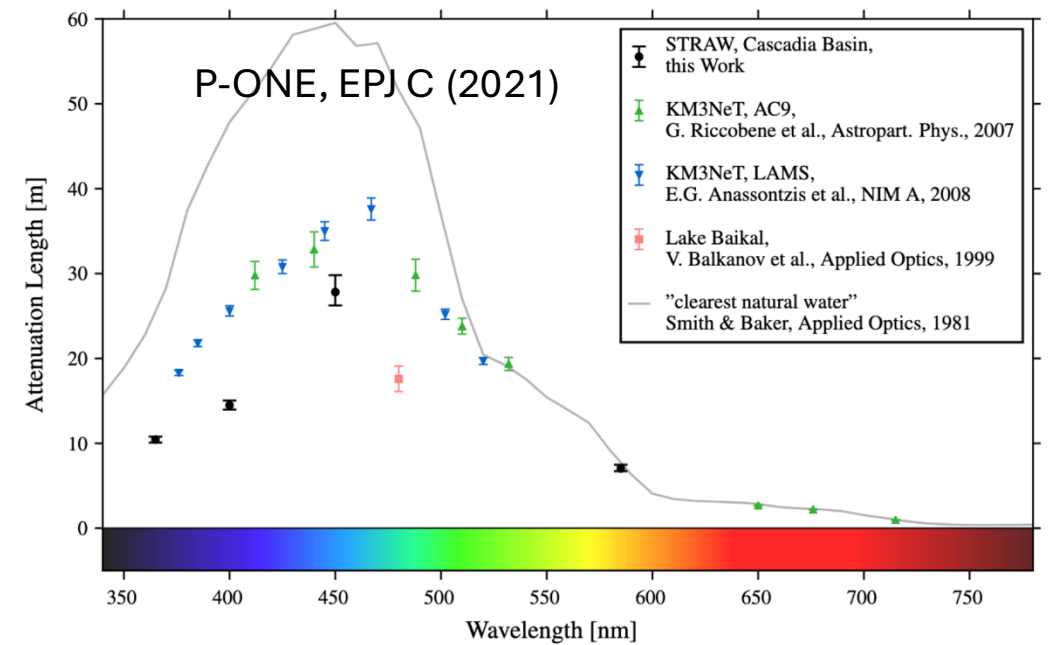
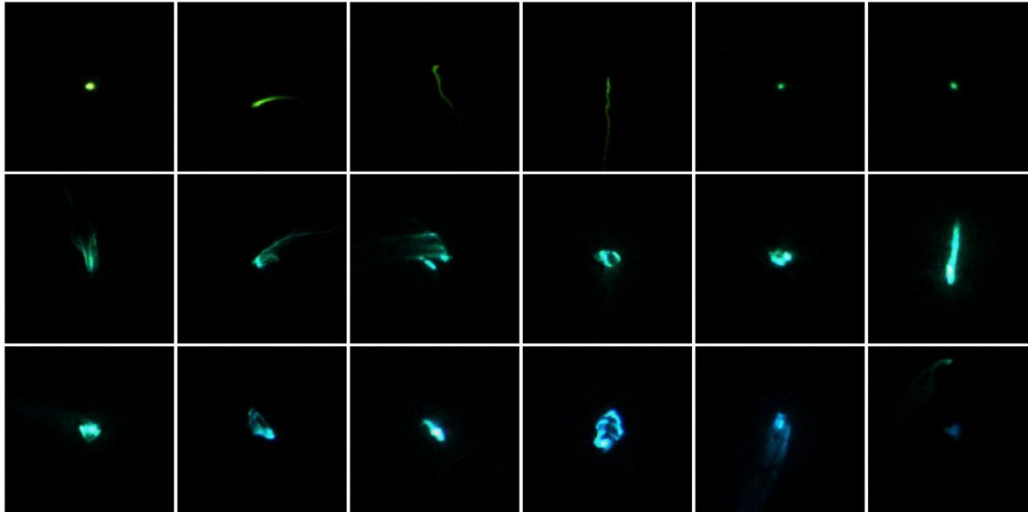
STRAW and STRAW-B

5-years operation of STRAW (98% uptime)

Attenuation Length $\sim 30\text{m}$ @ 450nm

^{40}K background quantified

Bioluminescence and biofouling identified as main challenges



Simulations of Bioluminescence

Navier-Stokes in 2-D, stitched to make 3-D simulation

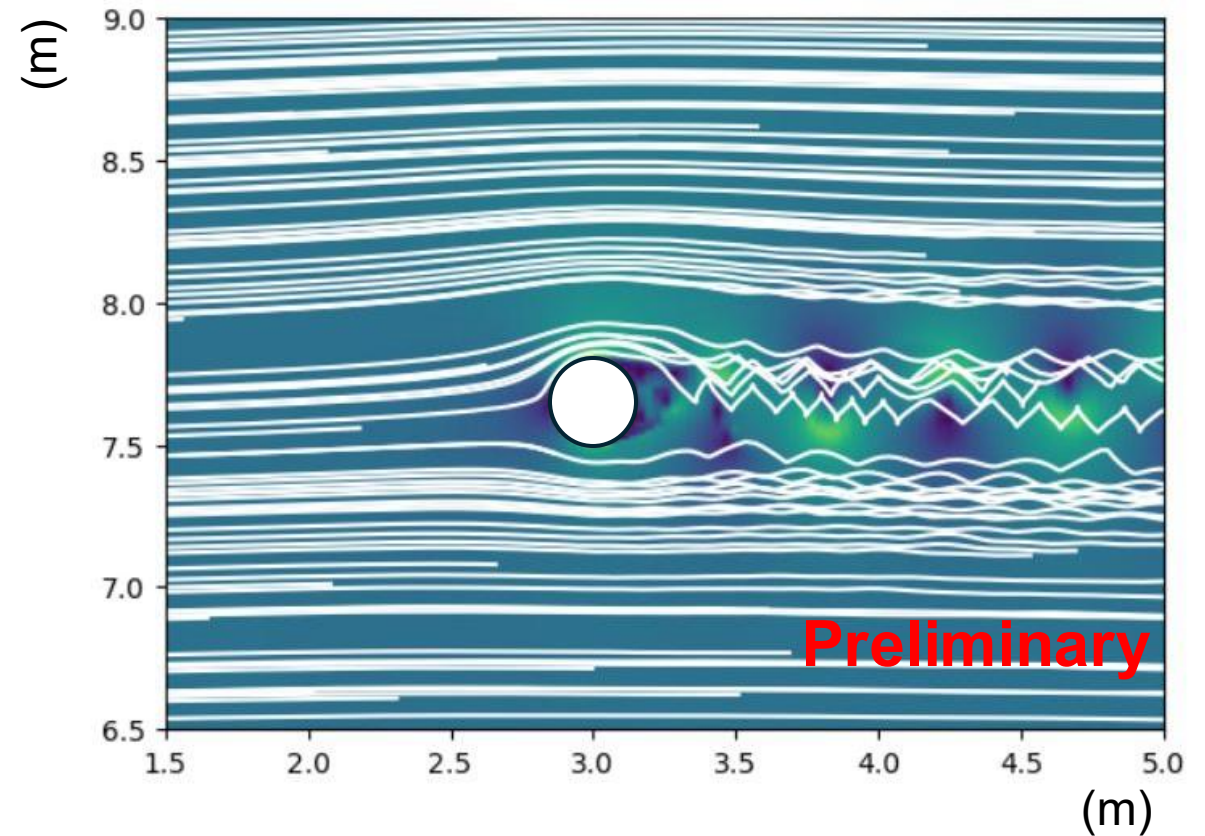
$v = 1, 2, 10 \text{ cm/s}$

Organism density to match STRAW observations

Use Firedrake / 4th Day code

Meighen-Berger et al. arXiv:2103.03816

Validate trigger algorithm



P-ONE lines

1 km line with 20 modules

Connector-less design

18 Optical and 2 calibration modules

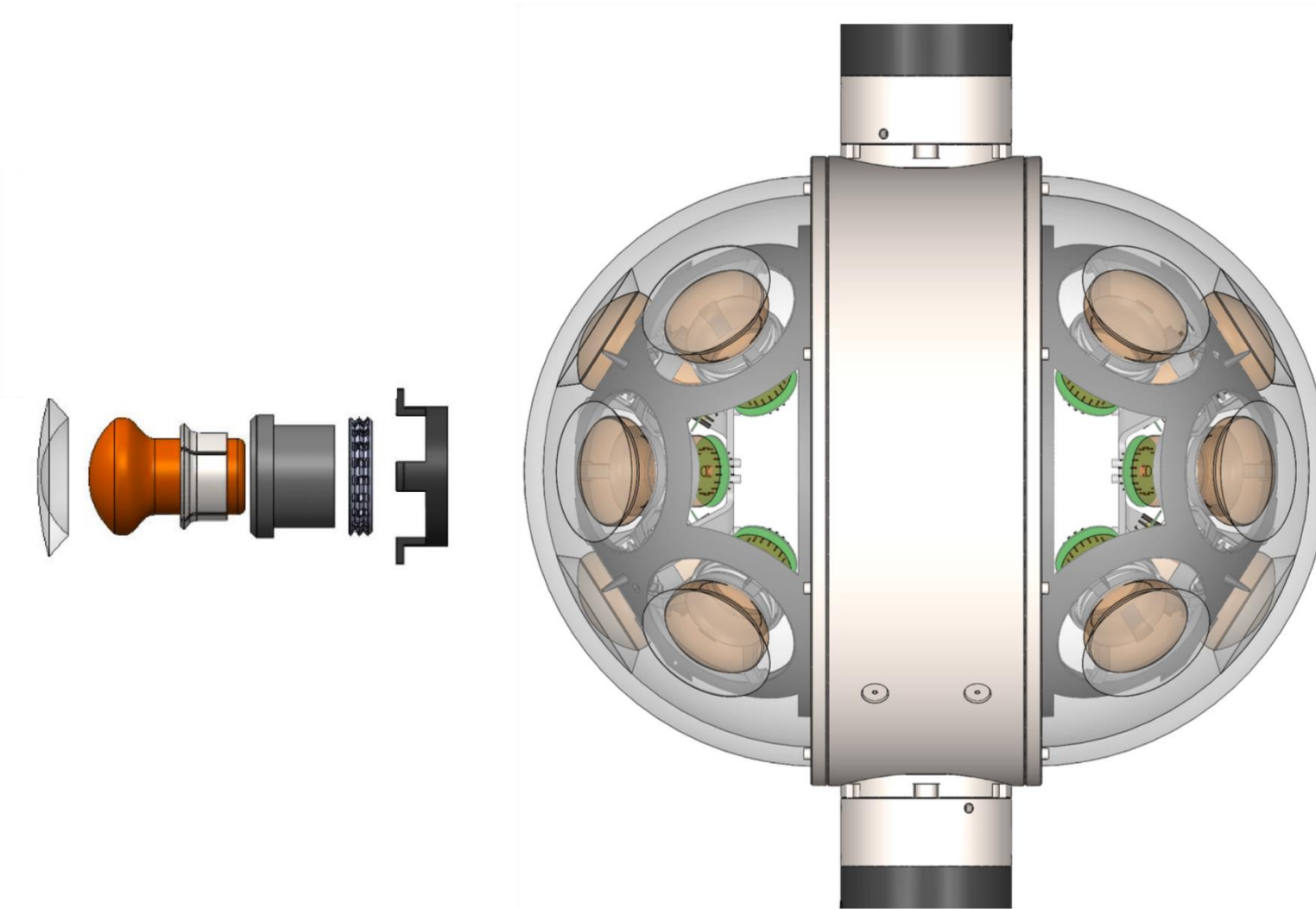
Many calibration systems, acoustic & optical

Sub-ns time synchronization

Deployment frame serves as anchor and contains mooring network infrastructure



P-ONE Optical Modules (P-OM)



16 PMTs

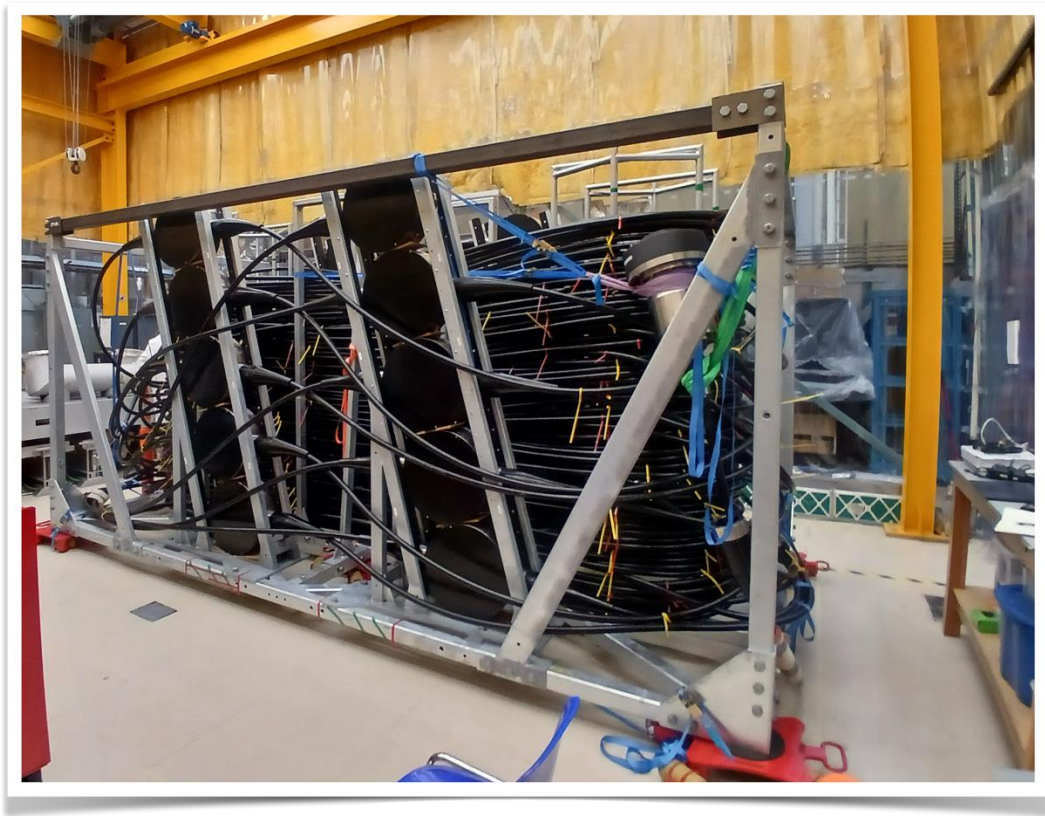
- 3" Hamamatsu R14374-10
- 300-650 nm
- TTS ~ 1.3 ns
- QE ~ 27%

10 inserts for calibration devices

Modular, spring-loaded mounting structure

Optical gel pads to match index of refraction

Integration of the P-ONE-1 line @ TRIUMF



Conclusions

Getting ready to deploy the first line in 2026!

Major design decisions have been taken

P-ONE Demonstrator: 2028

