

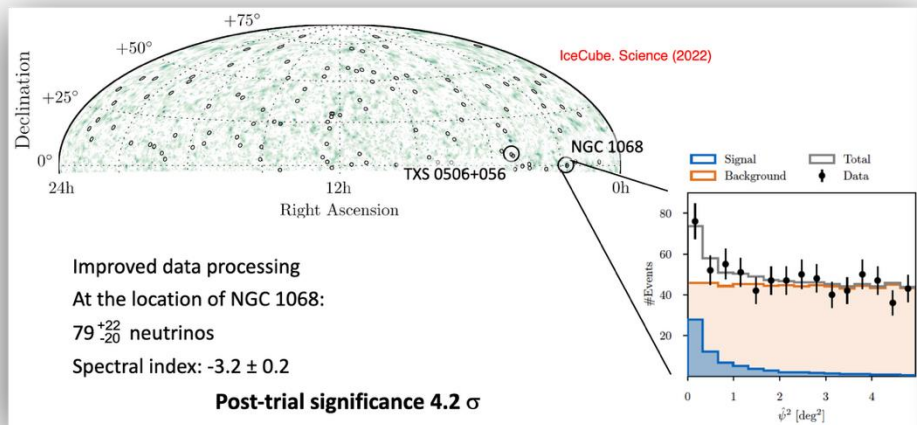


The Pacific Ocean Neutrino Experiment (P-ONE)

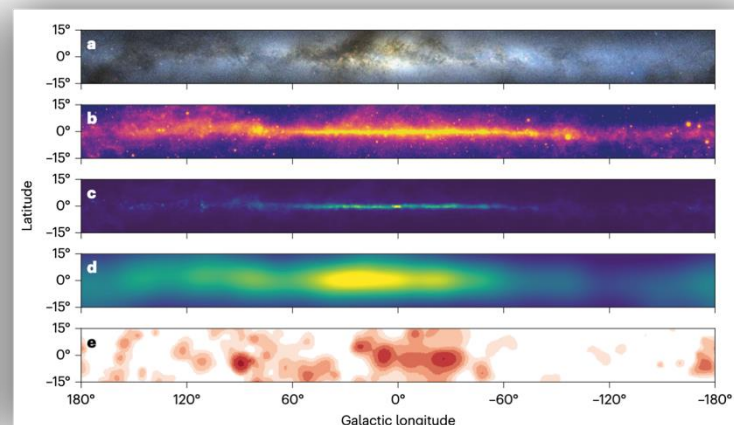
Ignacio Taboada
Georgia Institute of Technology

The nascent field of high-energy neutrino astrophysics

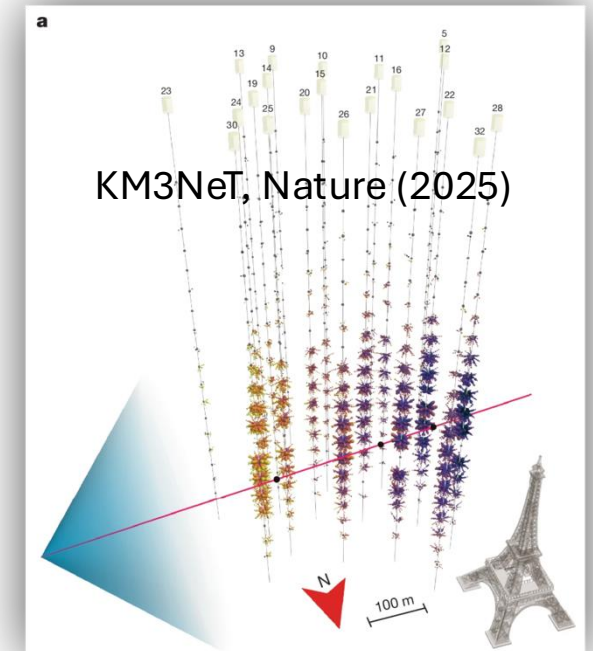
IceCube, Science (2022)



IceCube, Science (2023)



KM3NeT, Nature (2025)



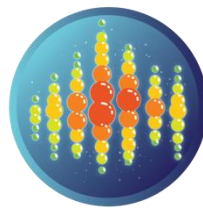
ASTROPHYSICAL NEUTRINOS
DISCOVERED

2013



BLAZAR TXS 0506+056
NEUTRINO EMISSION IDENTIFIED

2018



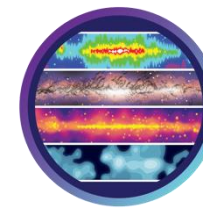
GLASHOW RESONANCE
NEUTRINO IDENTIFIED

2021



ACTIVE GALAXY NGC 1068
NEUTRINO EMISSION IDENTIFIED

2022



MILKY WAY
NEUTRINO EMISSION IDENTIFIED

2023



ASTROPHYSICAL TAU
NEUTRINOS IDENTIFIED

2024

P-ONE's motivation

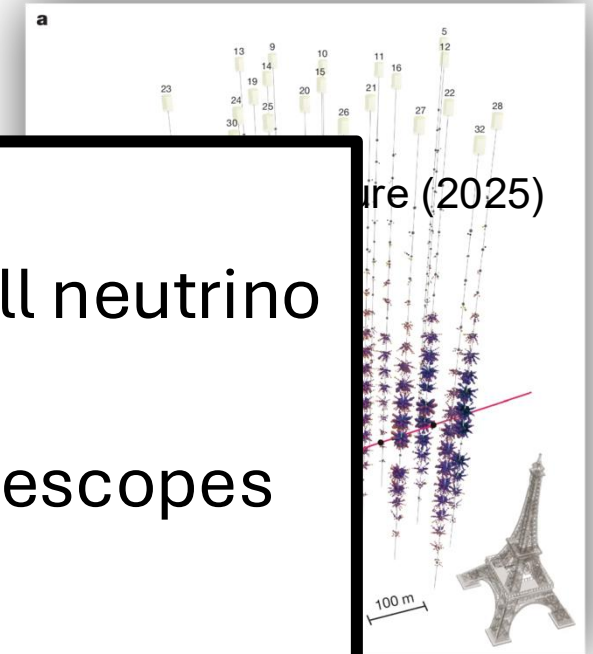
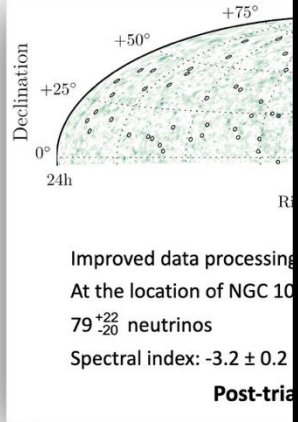
Build on IceCube's legacy

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



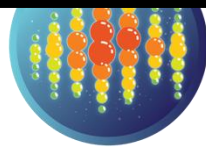
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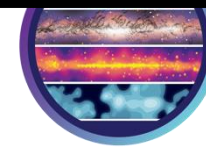
GLASHOW RESONANCE
NEUTRINO IDENTIFIED

2021



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MILKY WAY
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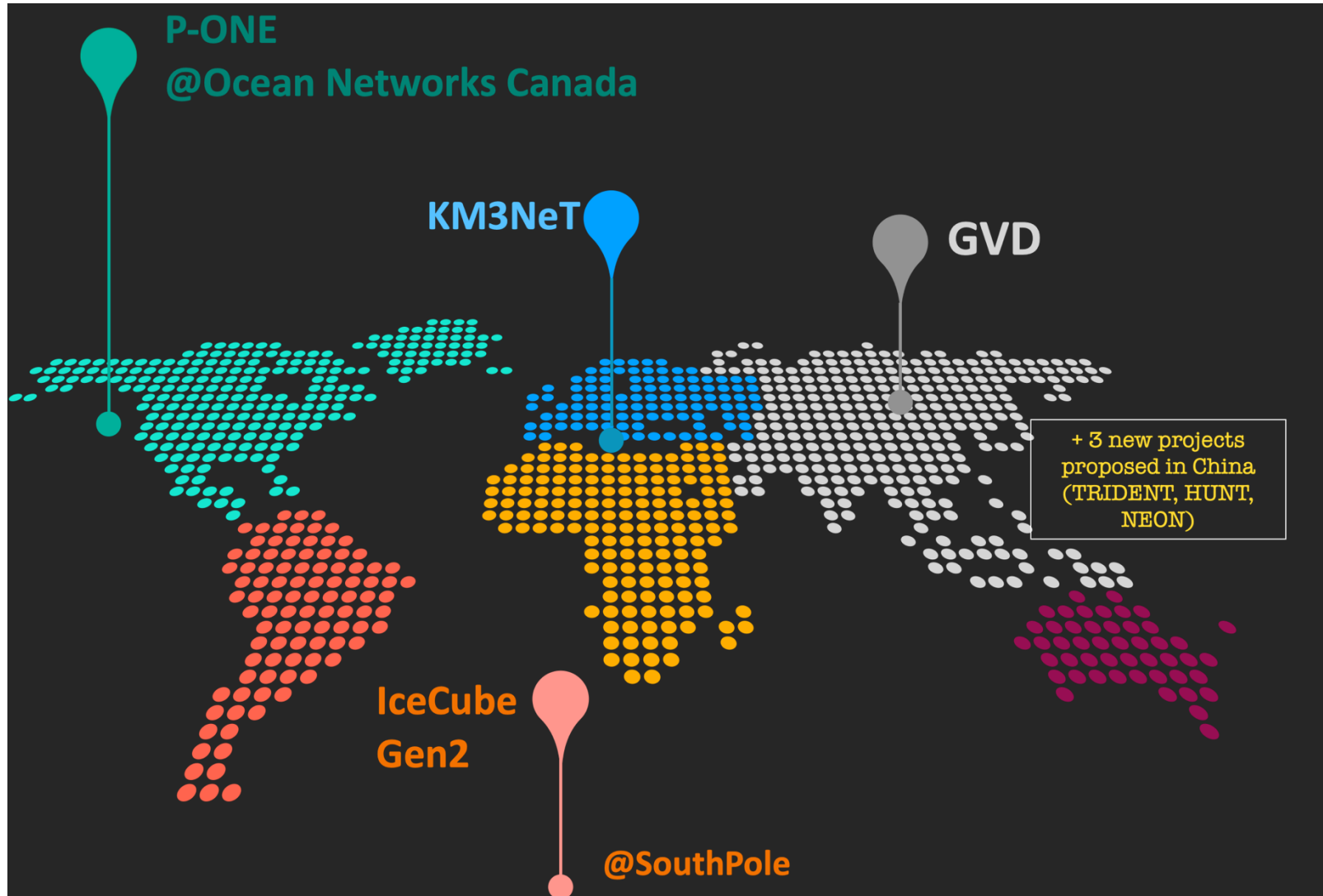
2023



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/s

Cascadia site:

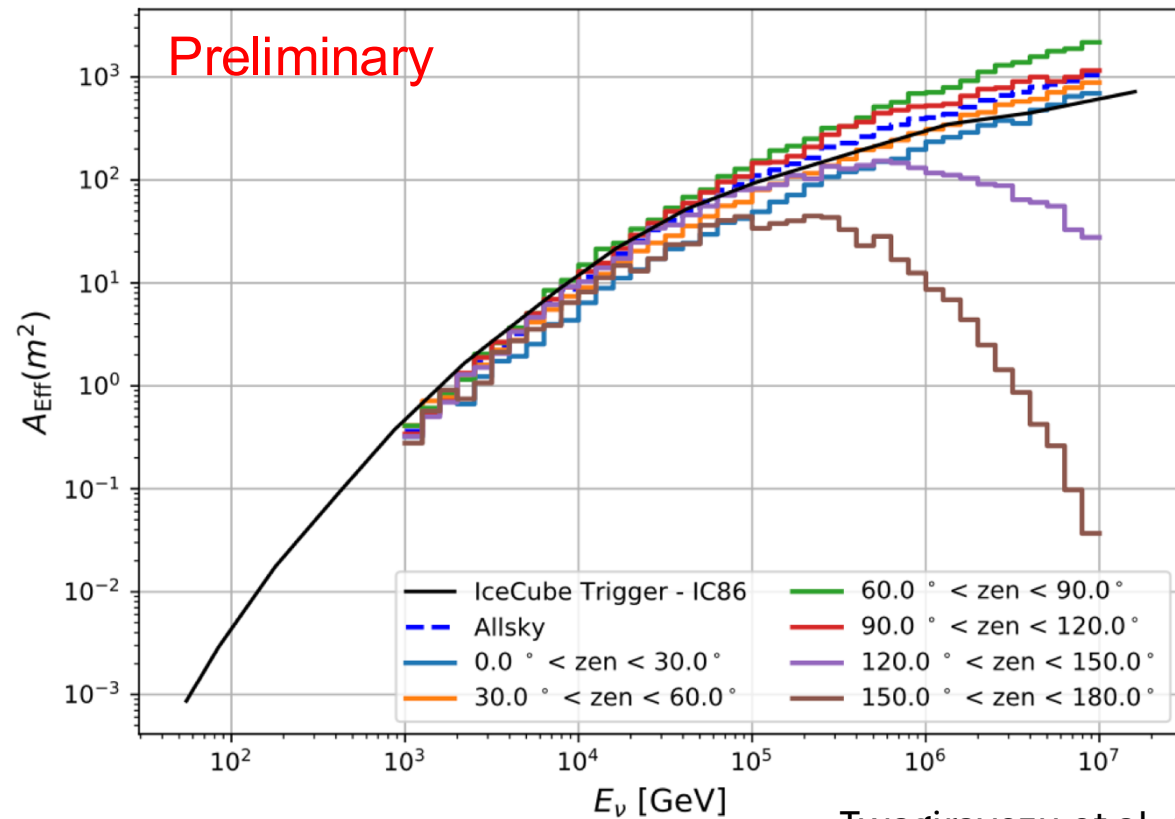
Depth ~2660 m,

Low currents (< 10 cm/s)

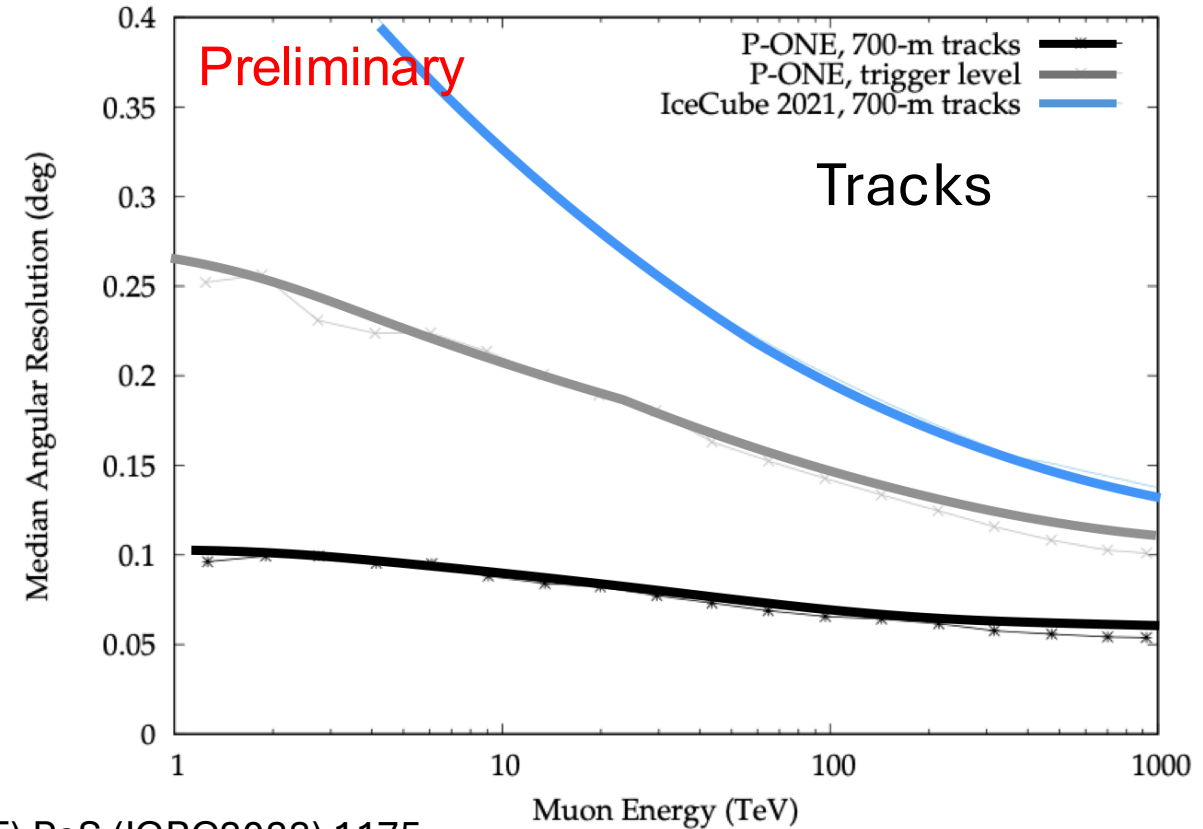
Stable 2°C temperature



Focus on angular resolution



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

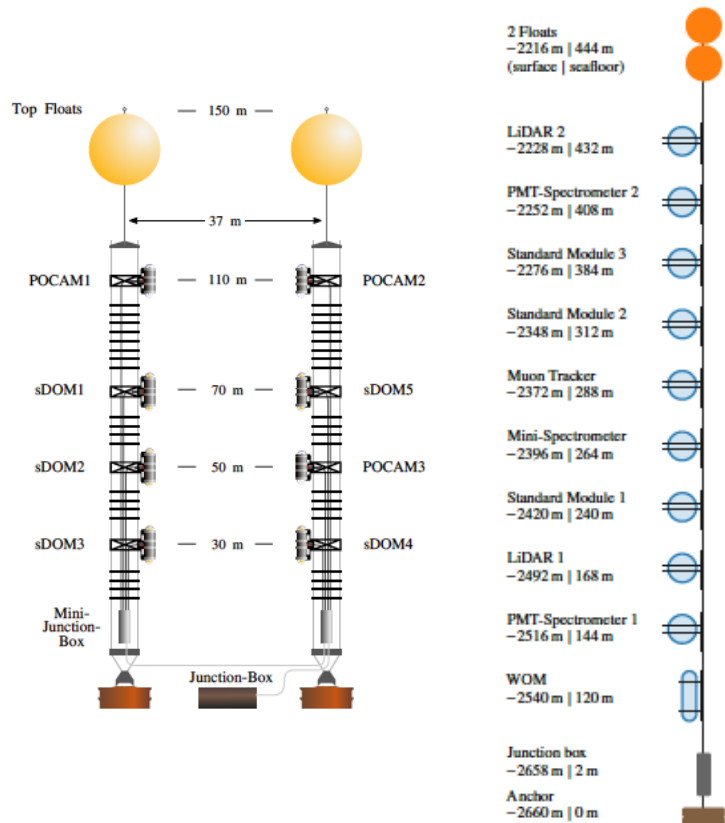


Euclidean Universe approximation, $N(> f) \propto f^{-3/2}$

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

STRAW

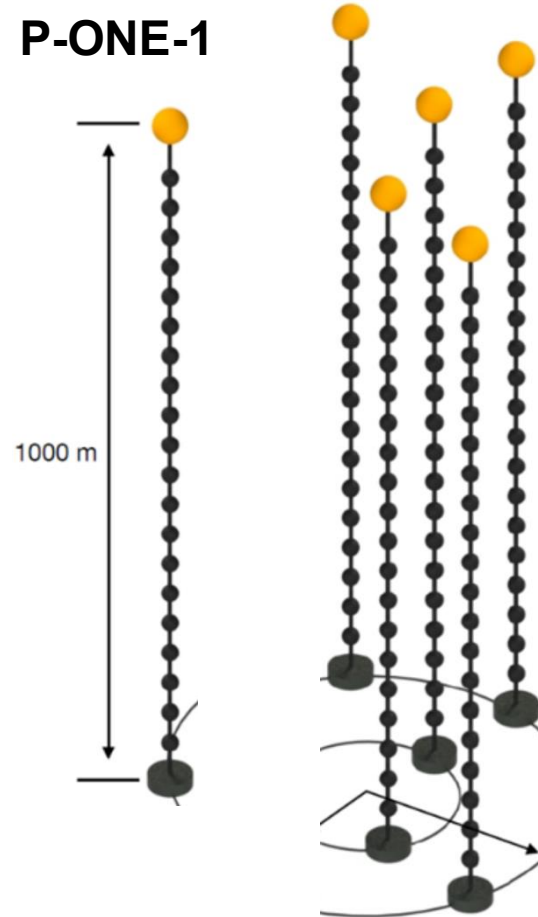
STRAW-b



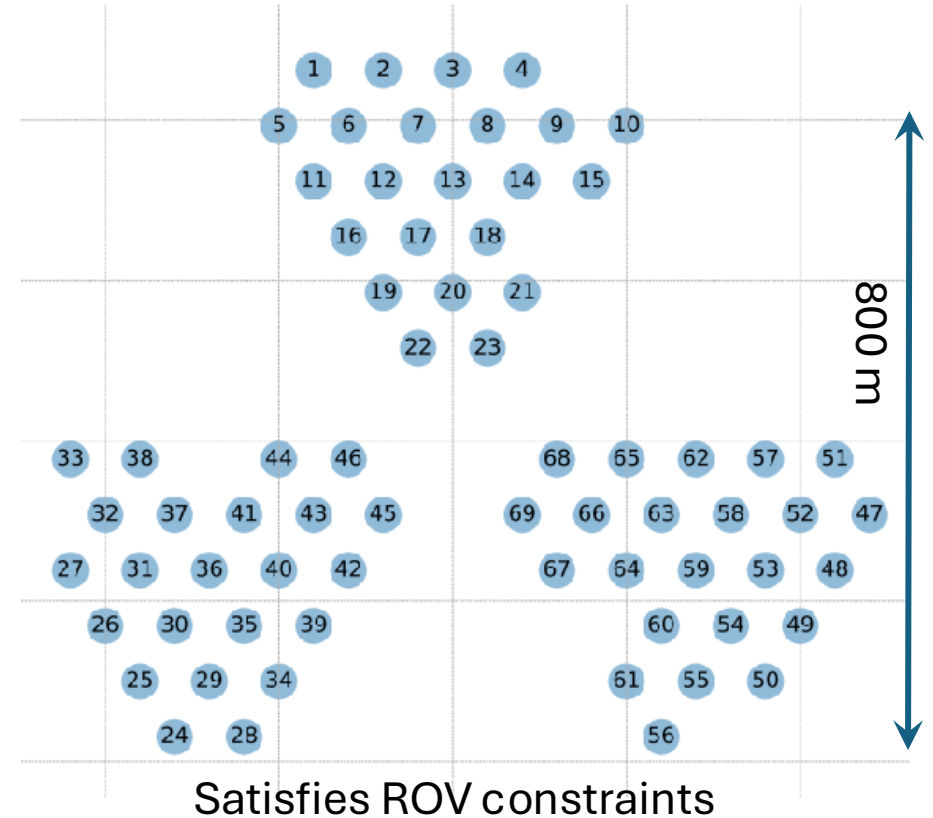
Operated 2018-2023

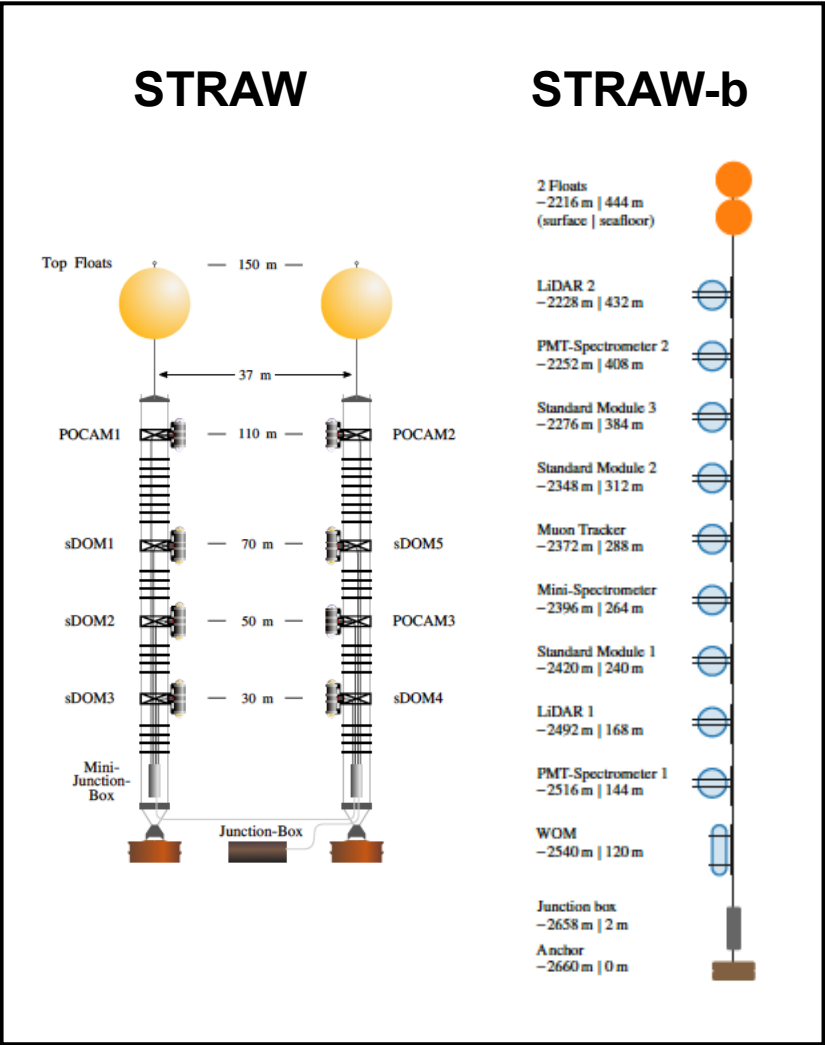
P-ONE Demonstrator

P-ONE-1



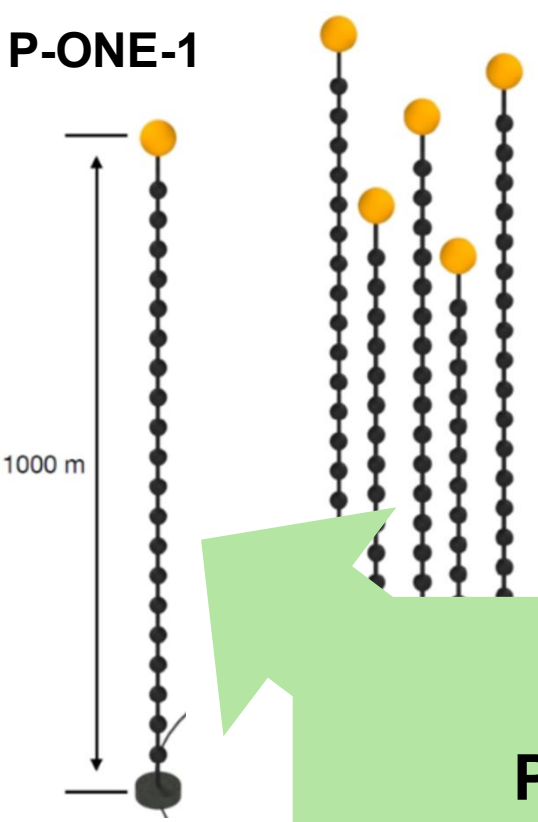
P-ONE Baseline geometry 2026





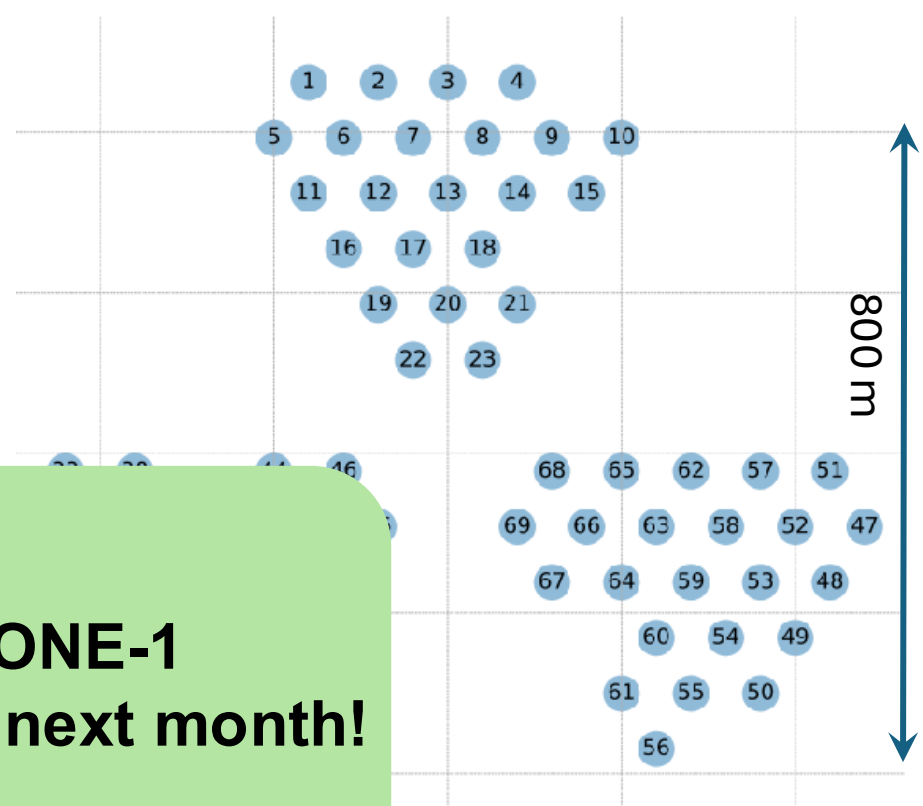
P-ONE Demonstrator

P-ONE-1

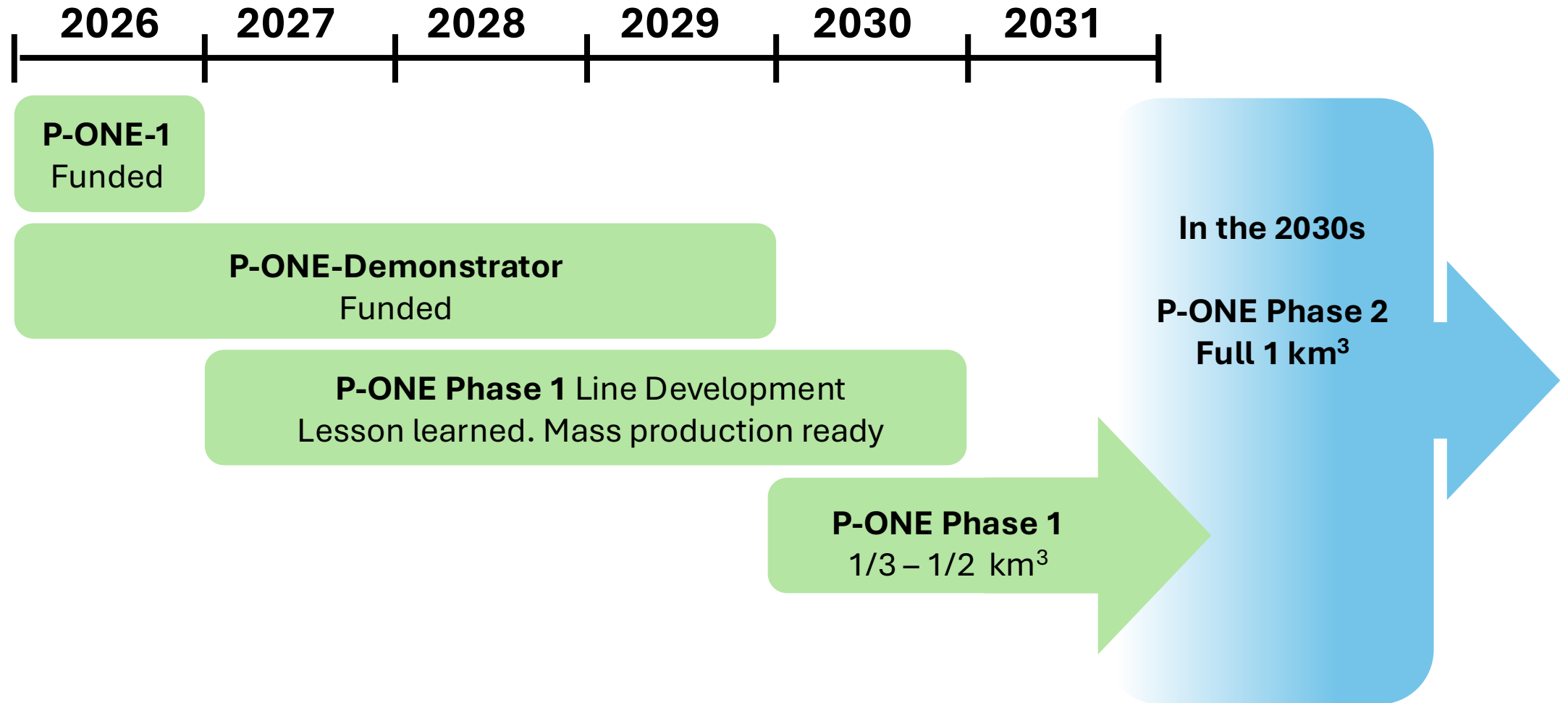


**P-ONE-1
Deploys next month!**

P-ONE Baseline geometry 2026



Timeline



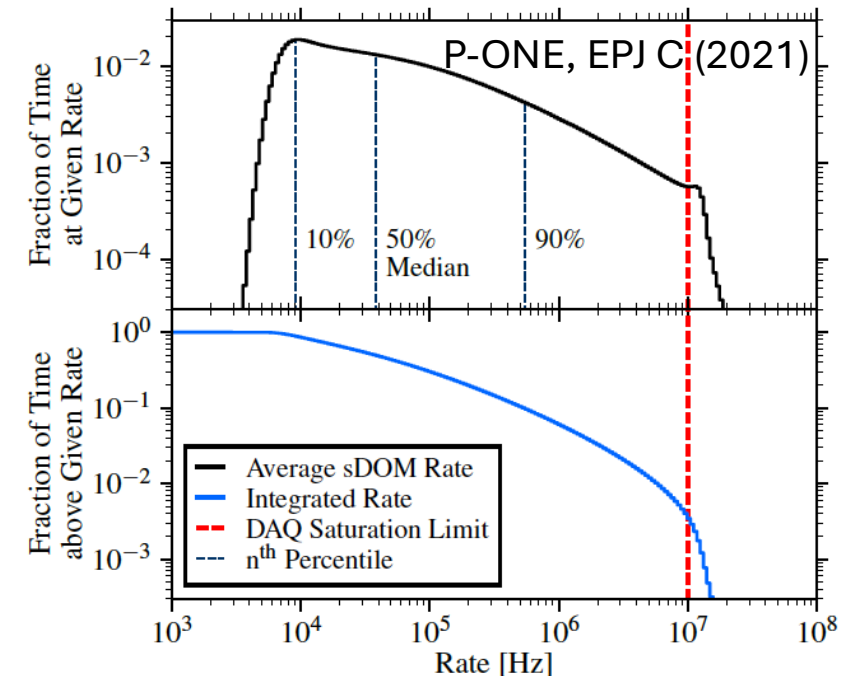
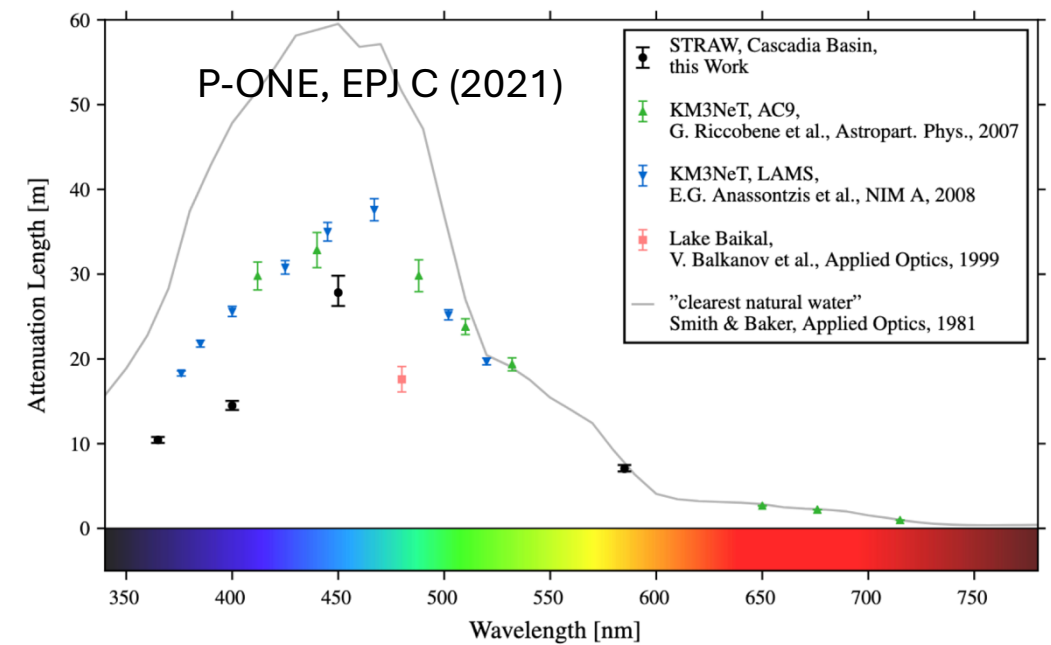
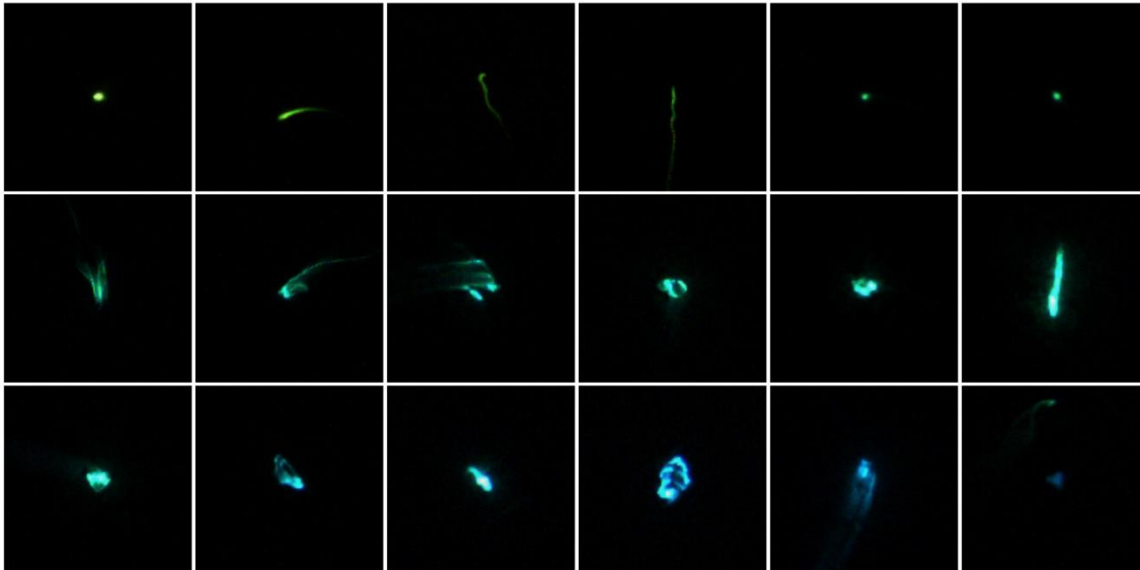
STRAW and STRAW-b

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



P-ONE lines

1 km line with 20 modules

Connector-less design

18 Optical and 2 calibration modules

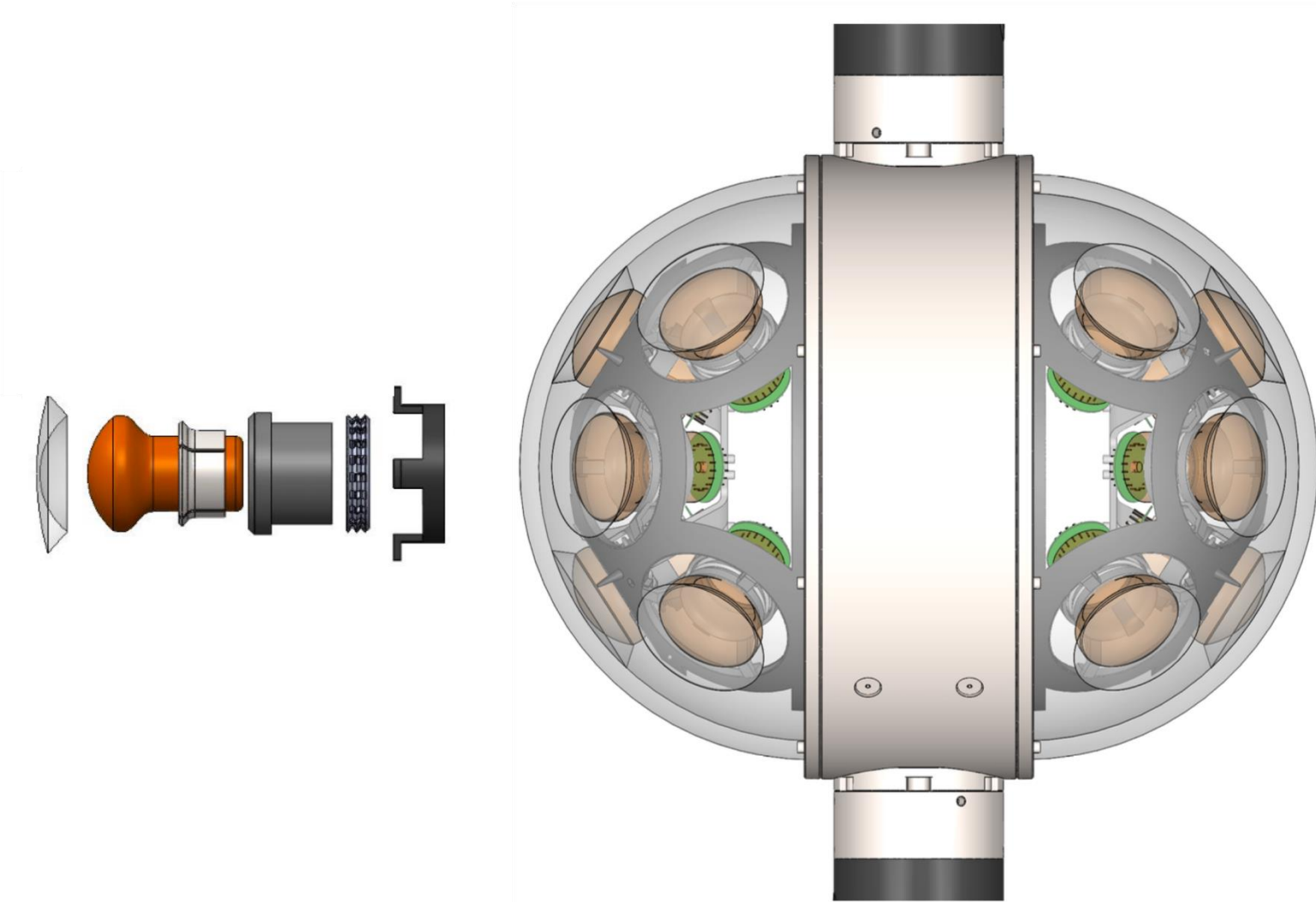
Many calibration systems, acoustic & optical

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

TTS ~ 1.3 ns

QE $\sim 27\%$

10 inserts for calibration devices

Modular, spring-loaded mounting structure

Optical gel pads to match index of refraction

Simulation of Bioluminescence

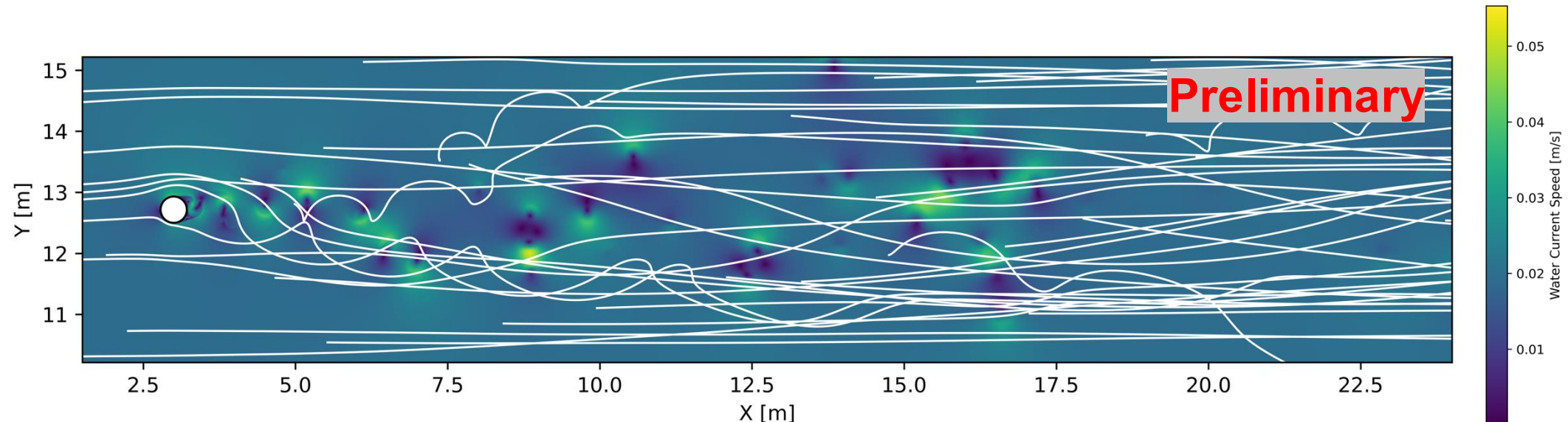
Navier-Stokes in 2-D, stitched into a 3-D simulation

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

Organism density to match STRAW observations

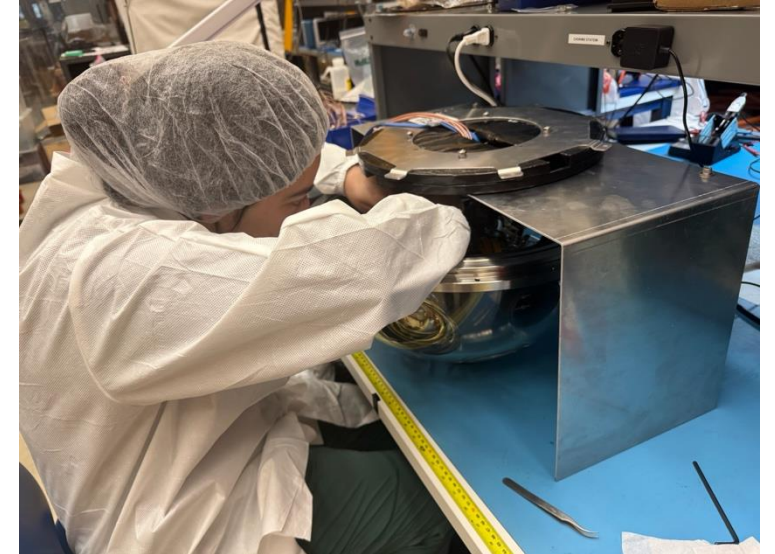
Use Firedrake / Fourth Day code Meighen-Berger et al. arXiv:2103.03816

Validate trigger algorithm

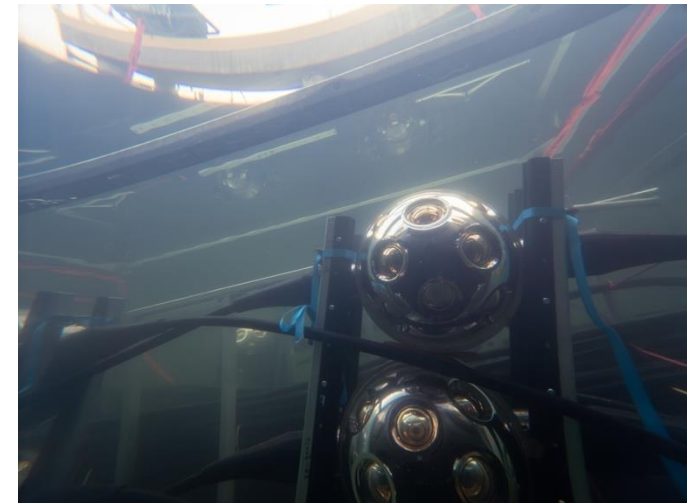
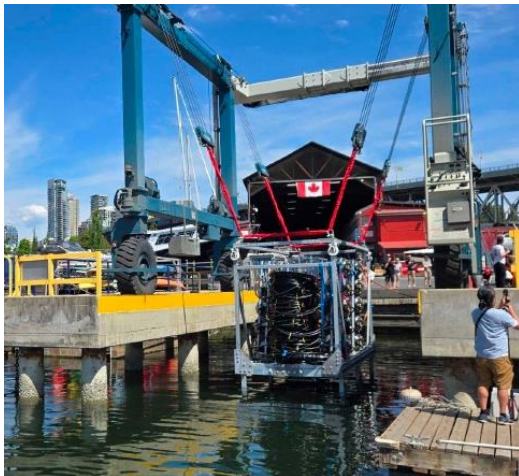


Integration and testing of the P-ONE-1 line @ TRIUMF

Completed May 2026

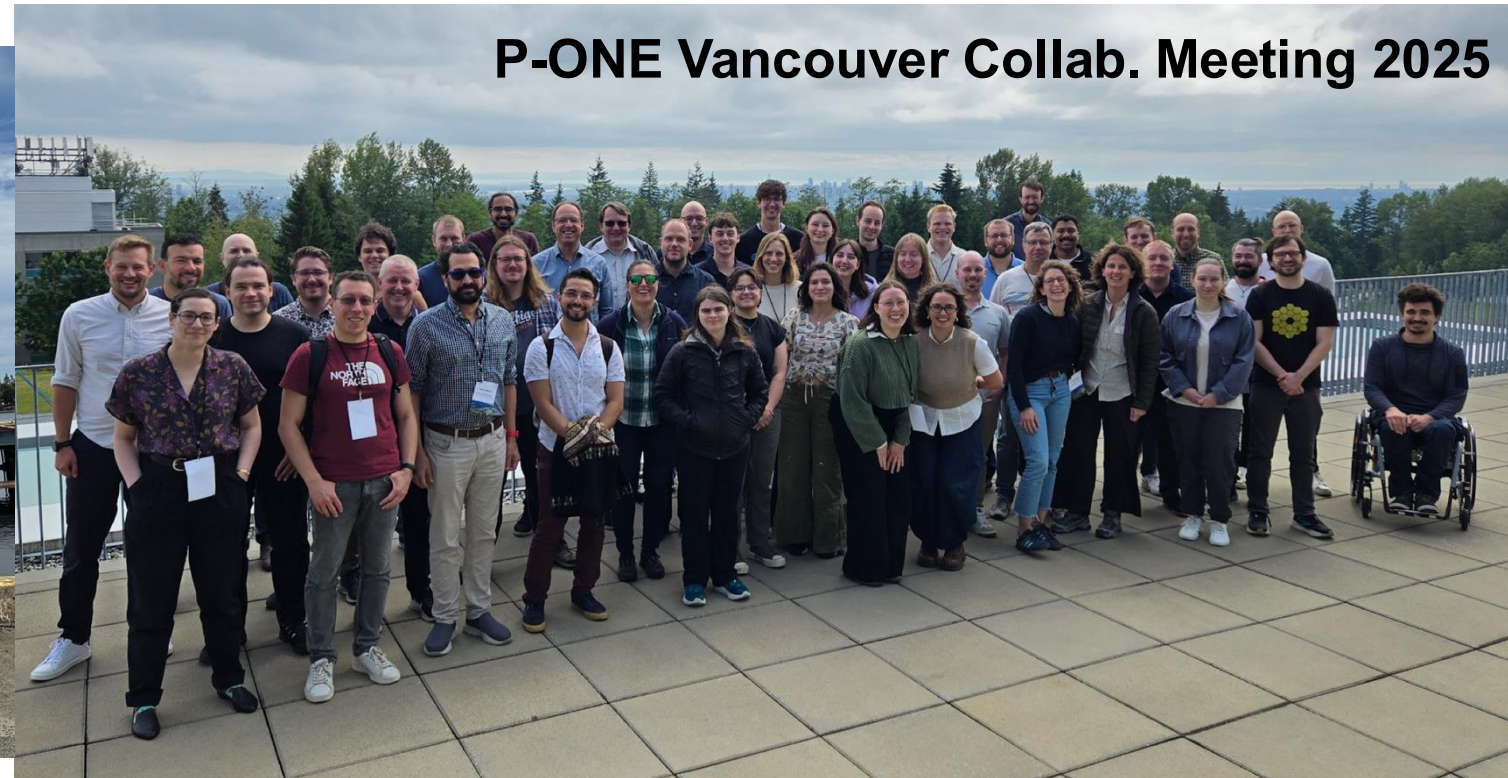


Wet test. Vancouver bay. June 2026.



Conclusions

Getting ready to deploy the first line!
Major design decisions have been taken
P-ONE Demonstrator in 2029



Timeline

