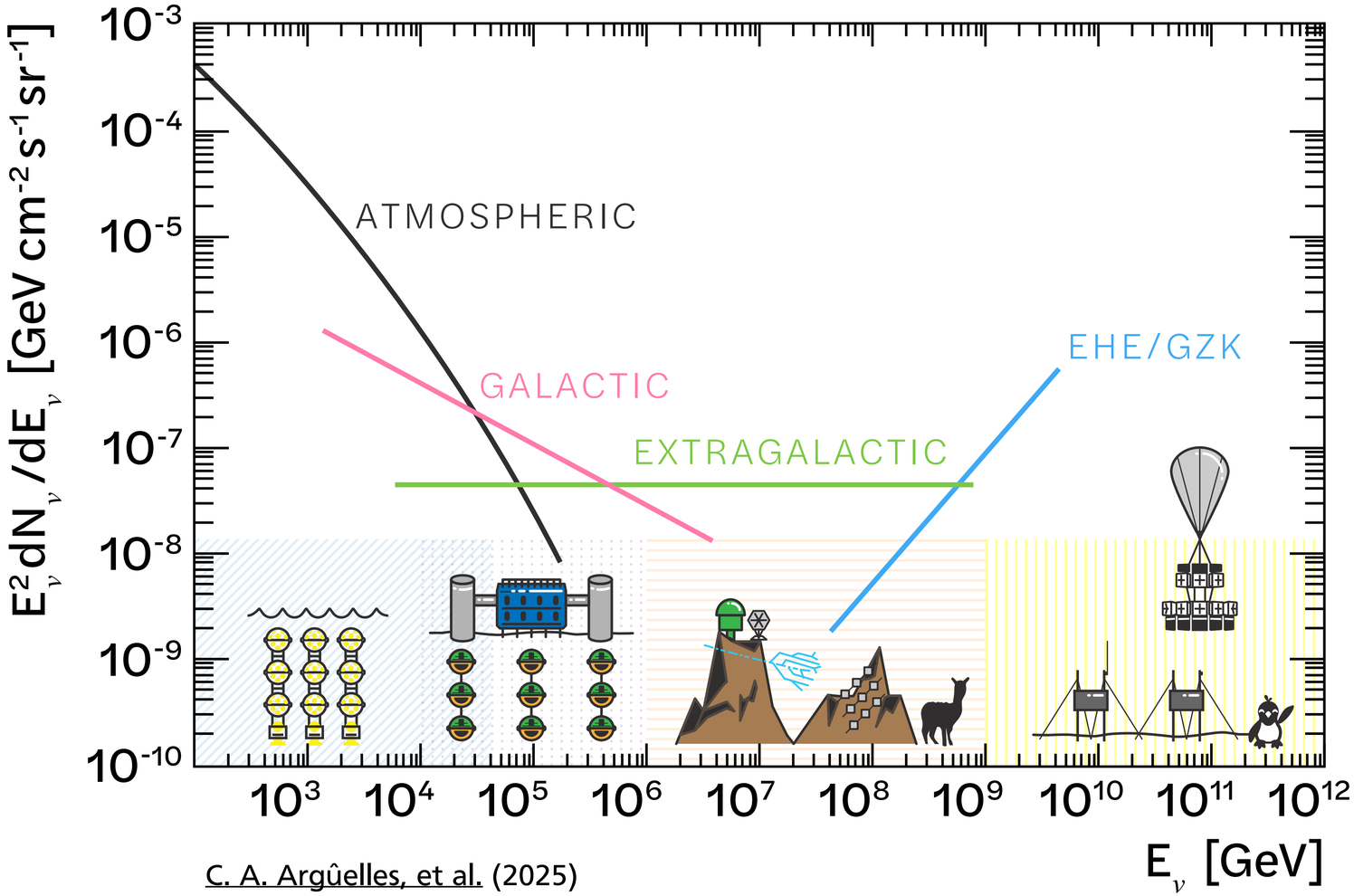
TAMBO: A Deep-Valley Neutrino Telescope

Jeffrey Lazar
15 Oct., 2026
IPA Symposium • Madison, WI USA



Neutrino Astronomy

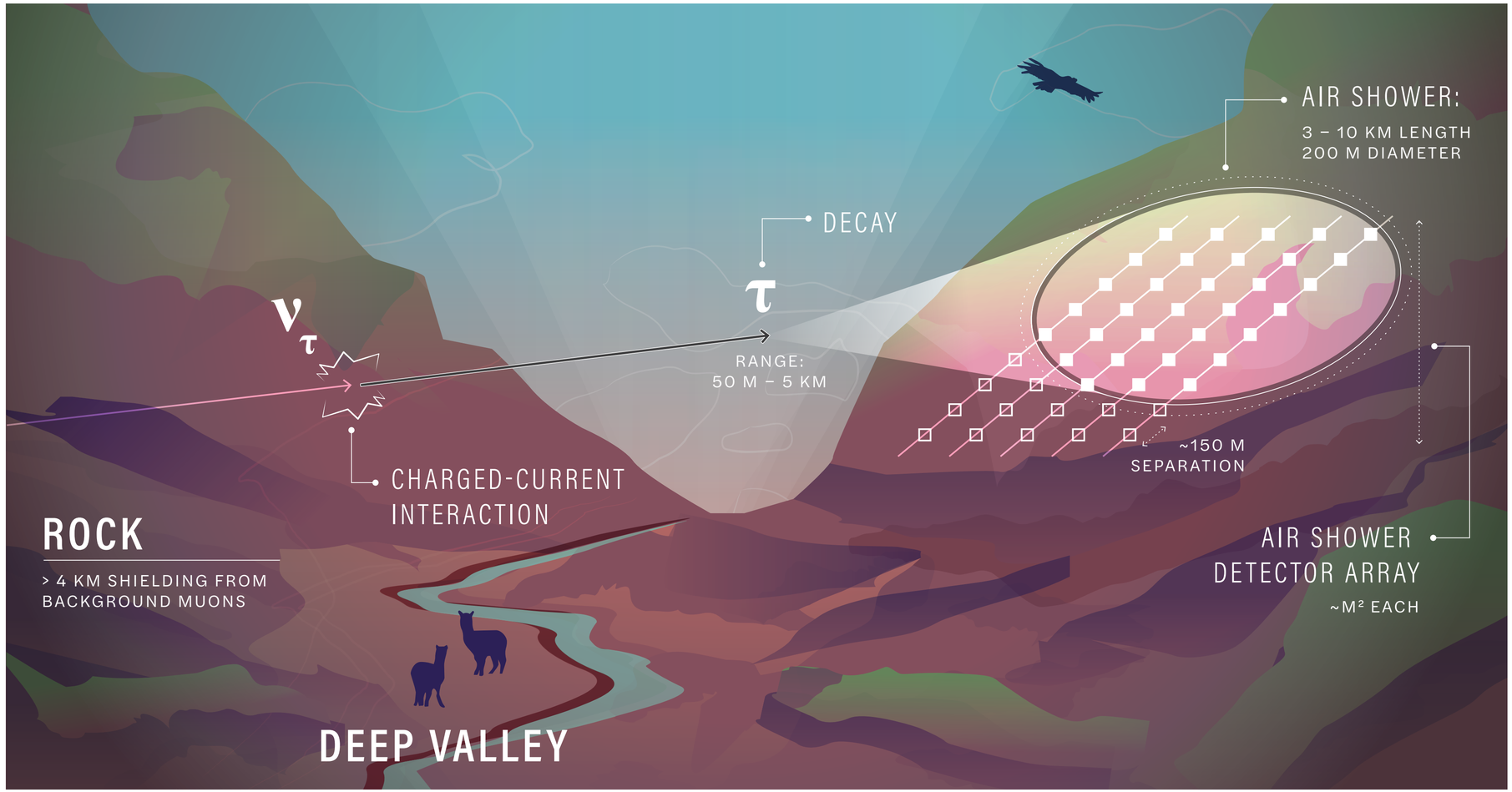
The science of using the natural world in clever ways to detect rare events



C. A. Argüelles, et al. (2025)

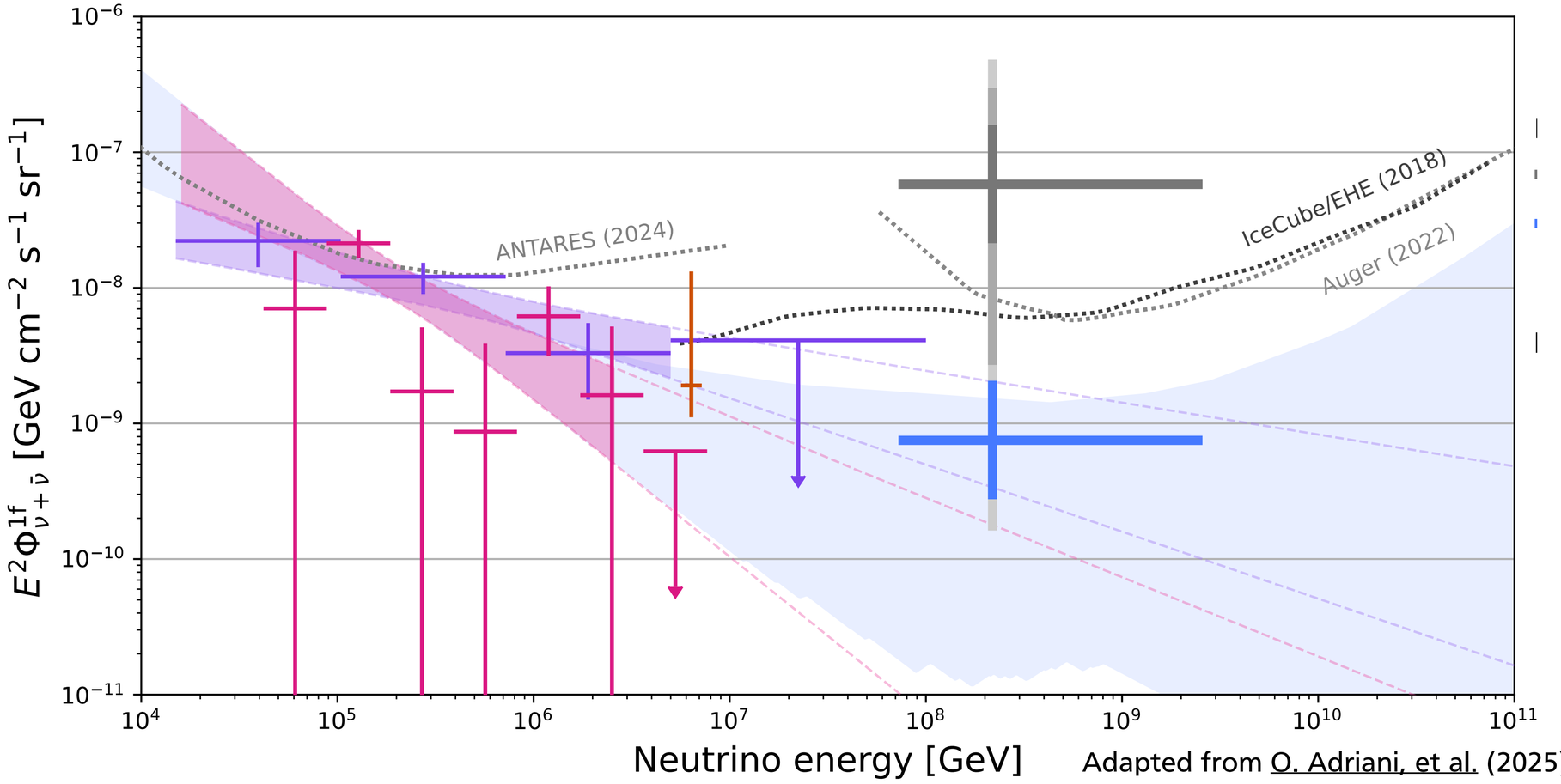
Tau Air-Shower Mountain-Based Observatory

TAMBO is a new way to transform the natural world into a neutrino telescope



TAMBO as Energy Bridge

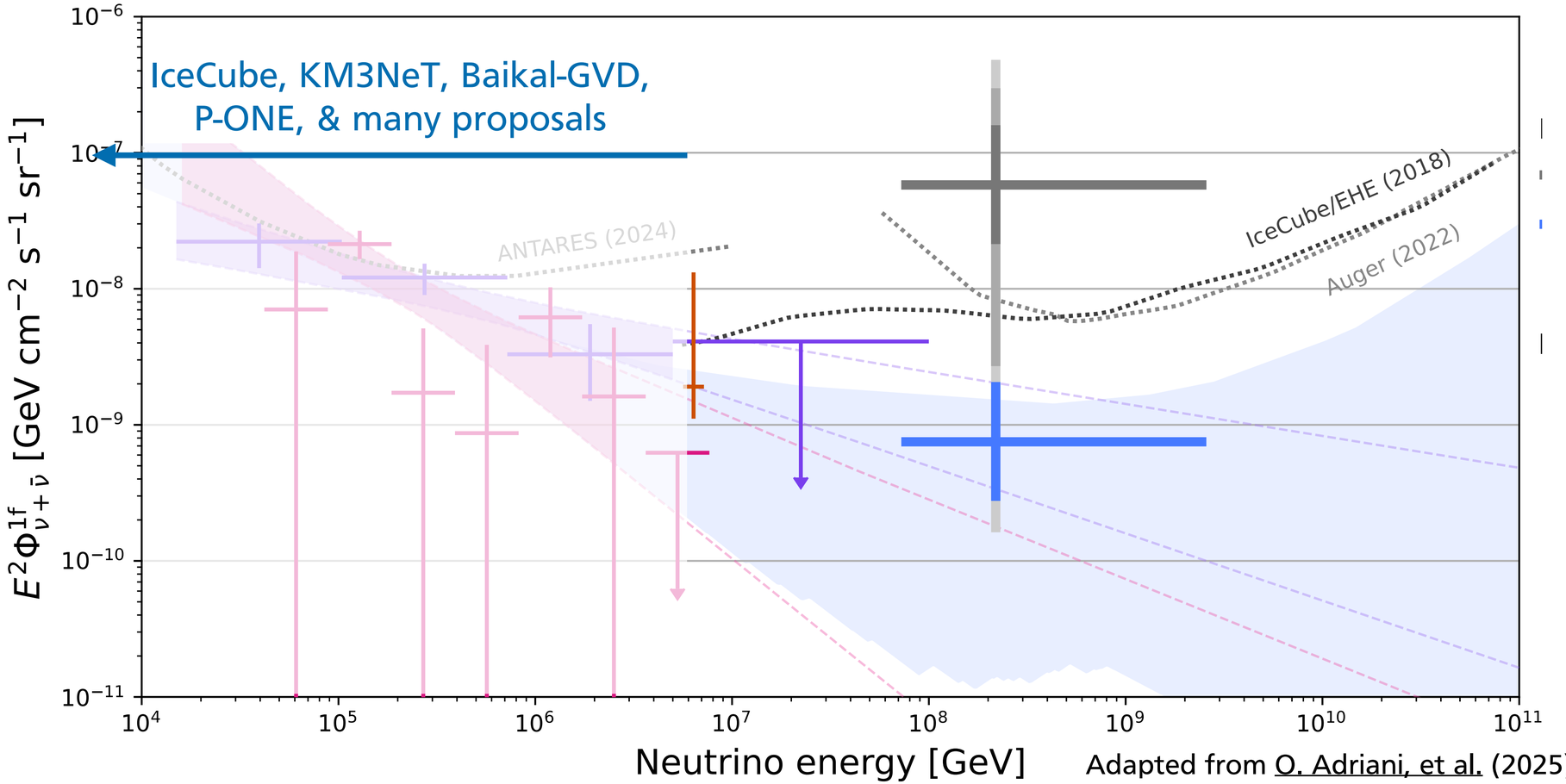
TAMBO will cover the energy range between Cherenkov telescopes and radio neutrino telescopes



Adapted from O. Adriani, et al. (2025)

TAMBO as Energy Bridge

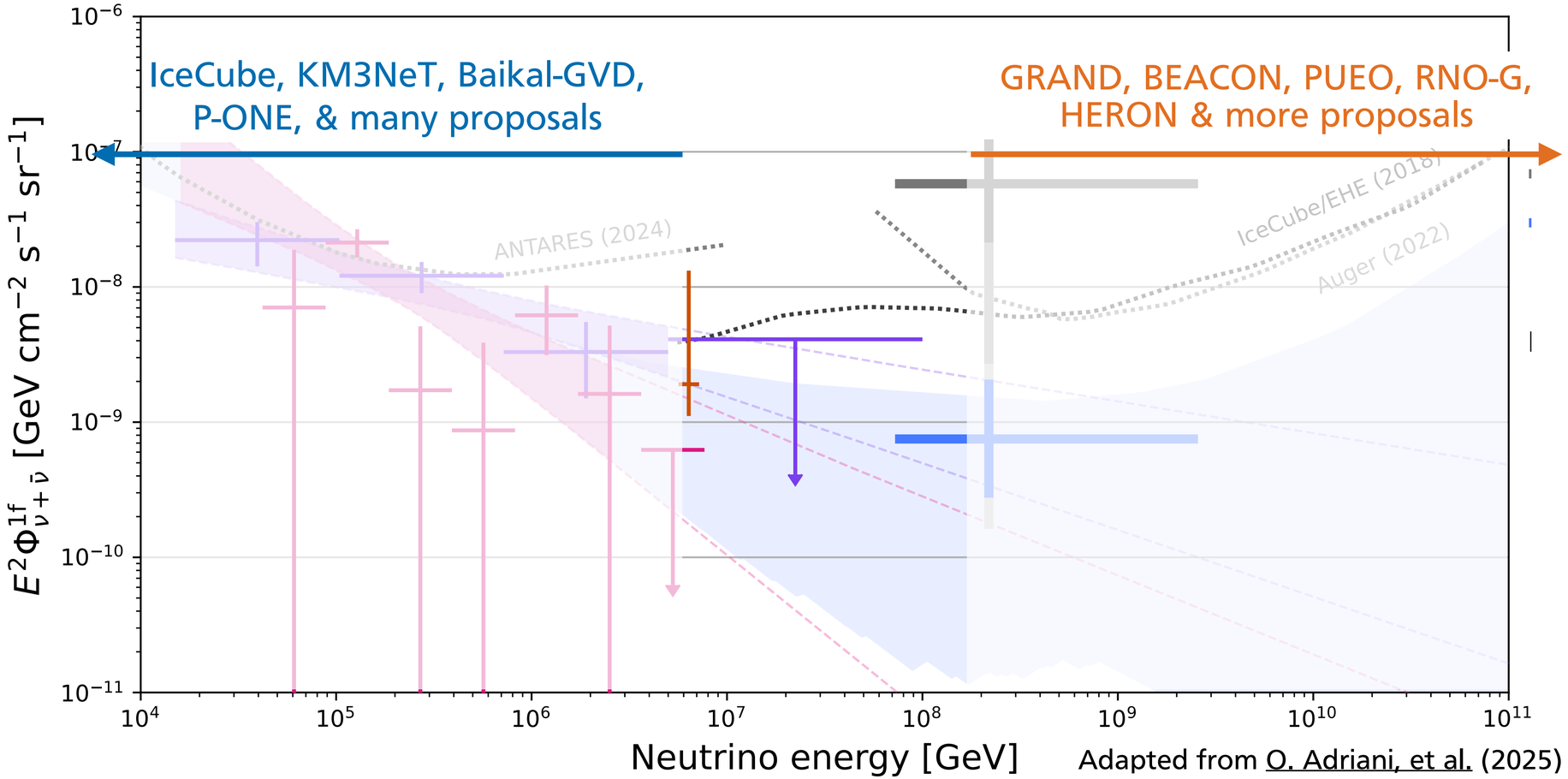
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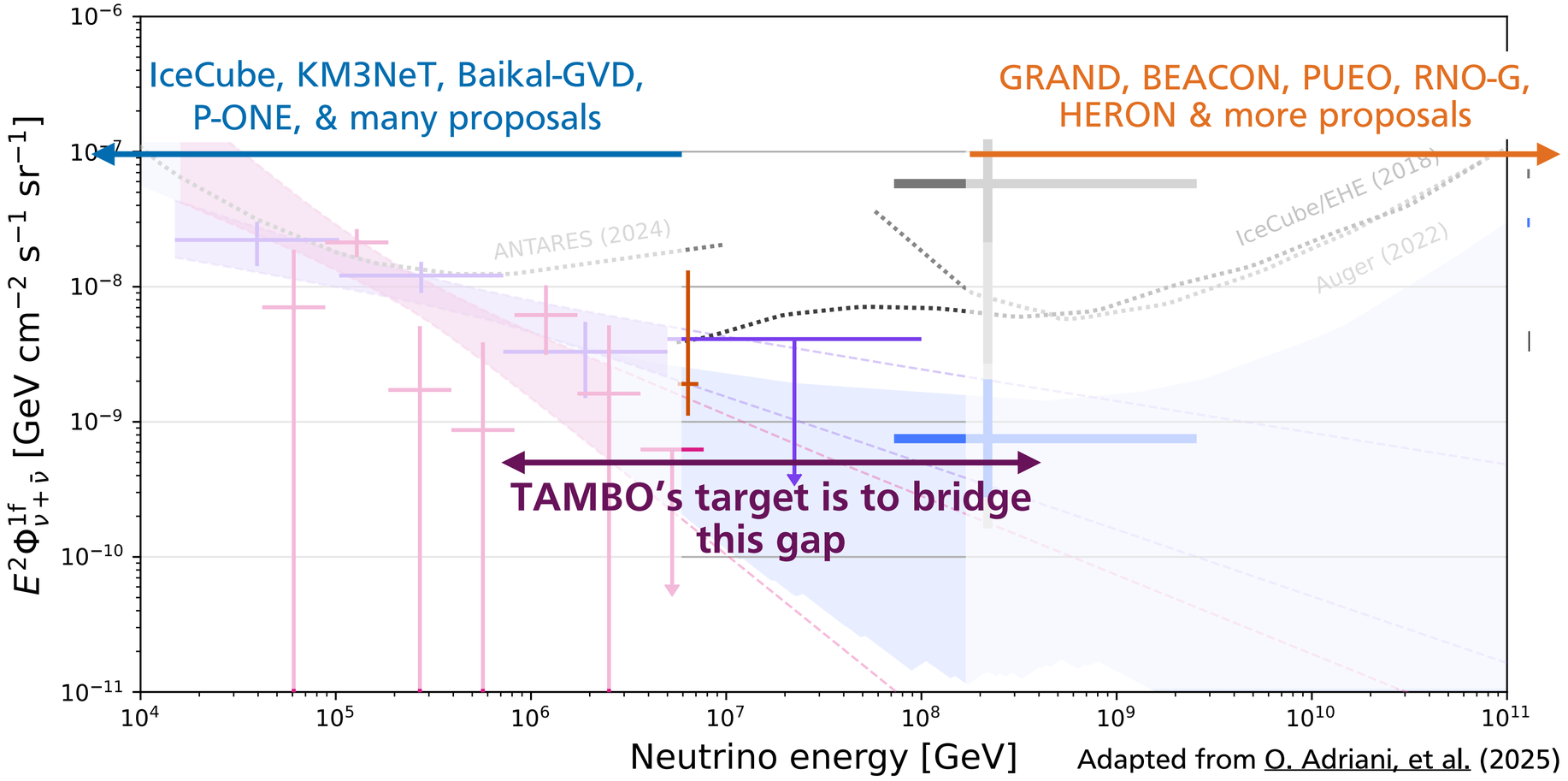
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TAMBO as Energy Bridge

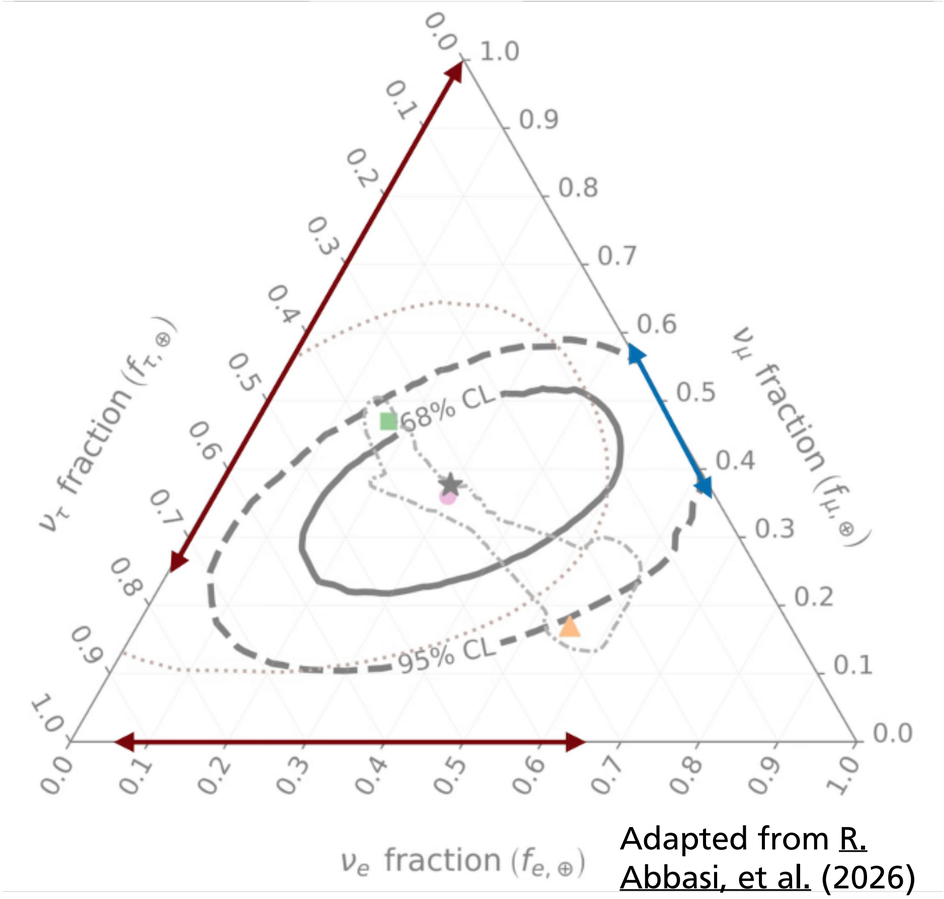
TAMBO will cover the energy range between Cherenkov telescopes and radio neutrino telescopes



Adapted from O. Adriani, et al. (2025)

TAMBO as Flavor Resolver

TAMBO's detection principle breaks the flavor degeneracy

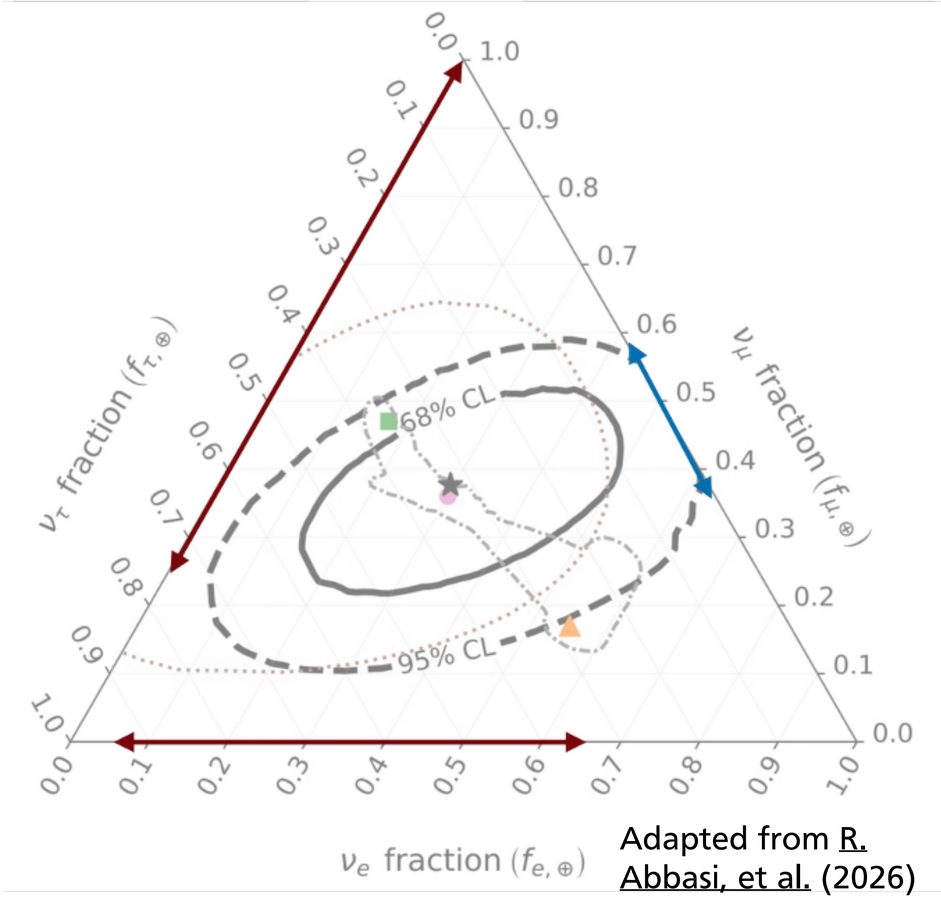


Adapted from R. Abbasi, et al. (2026)

IceCube only, all energies

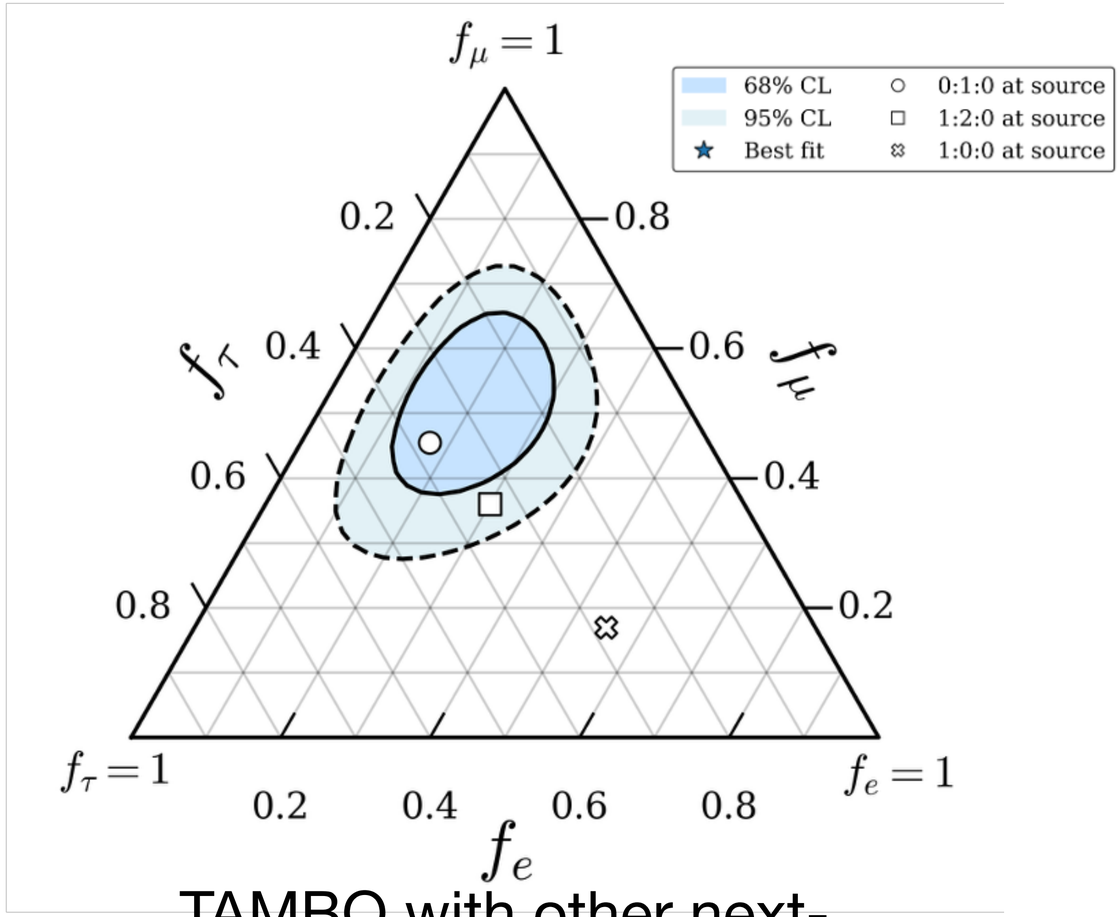
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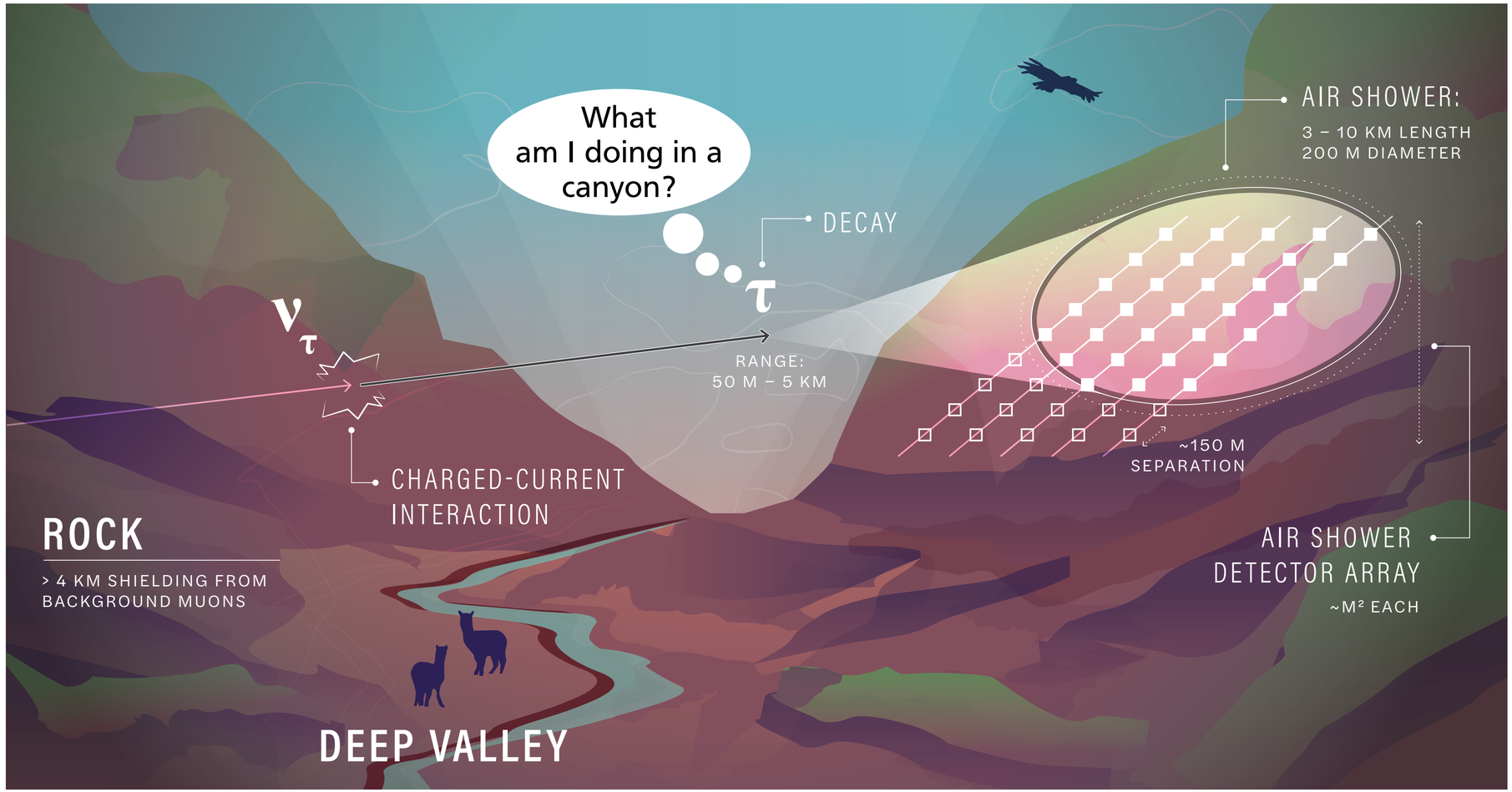
IceCube only, all energies



TAMBO with other next-gen telescopes, 1-100 PeV

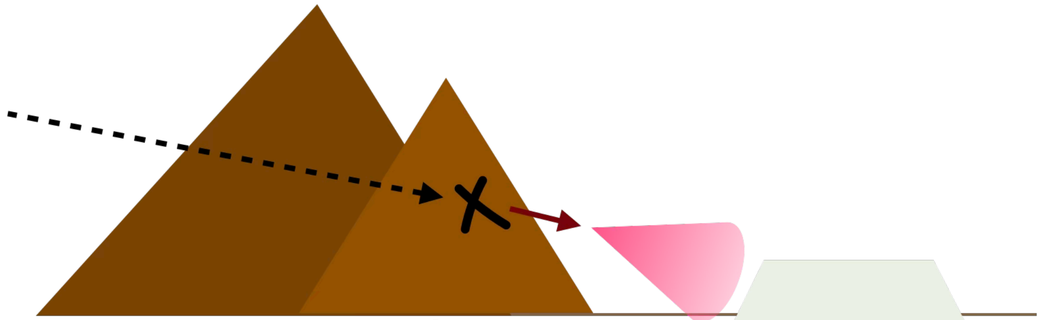
TAMBO Design

Or, why are we in a canyon



TAMBO Design

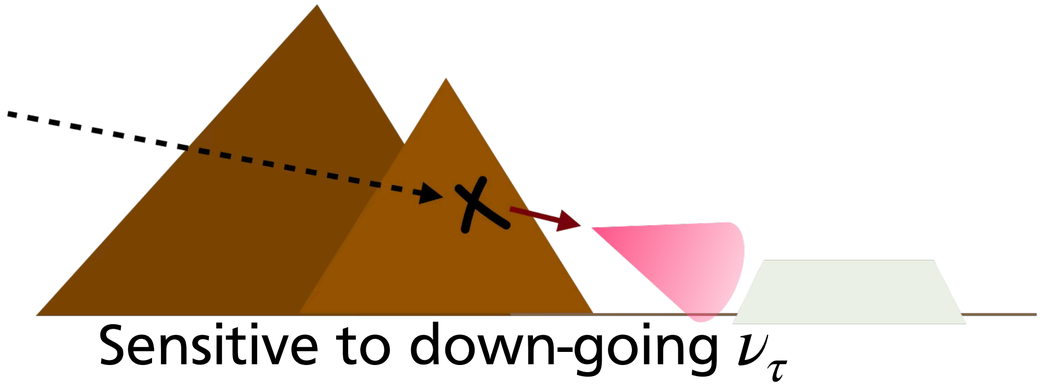
Canyons enhance geometrical acceptance



Sensitive to down-going ν_τ

TAMBO Design

Canyons enhance geometrical acceptance



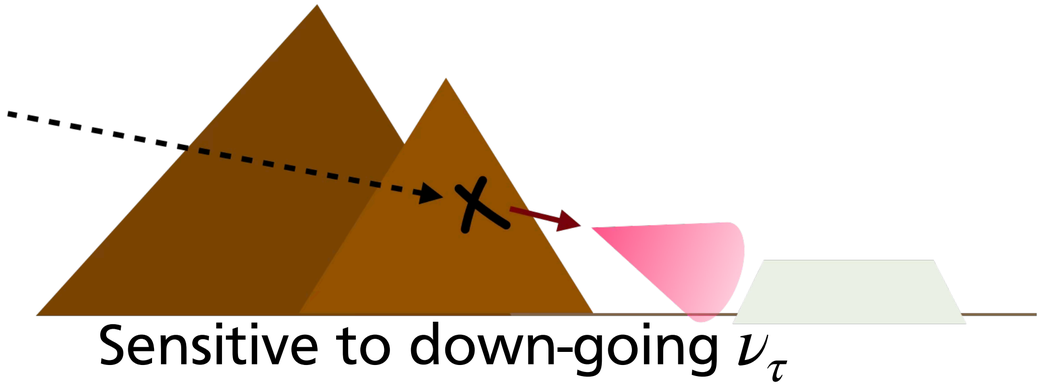
Sensitive to down-going ν_τ



Sensitive to up-going ν_τ

TAMBO Design

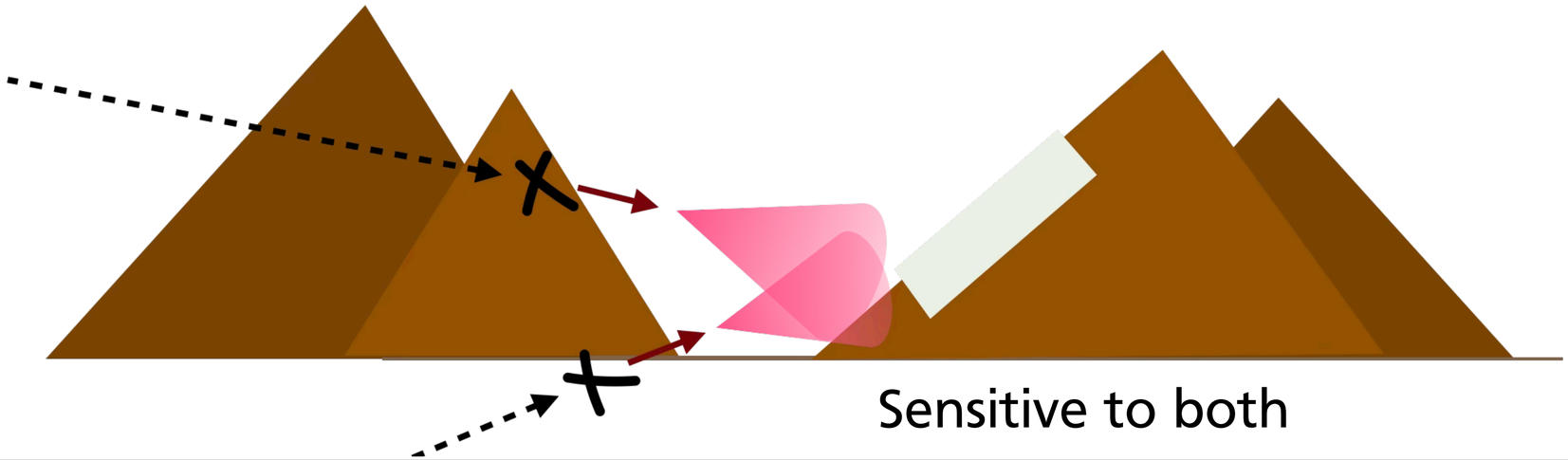
Canyons enhance geometrical acceptance



Sensitive to down-going ν_τ



Sensitive to up-going ν_τ

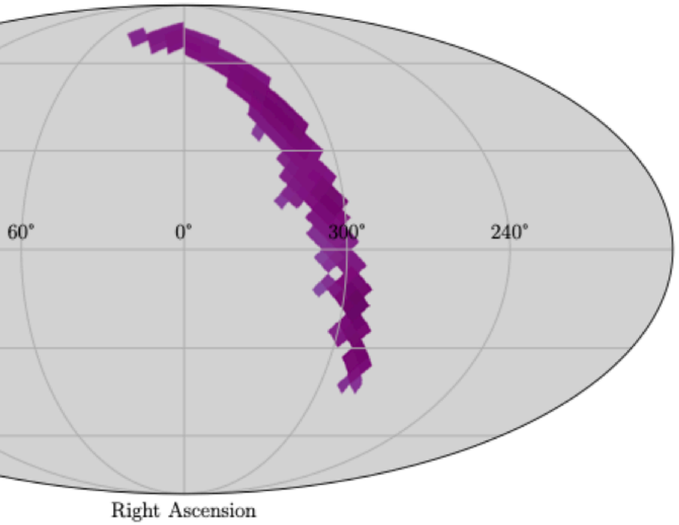


Sensitive to both

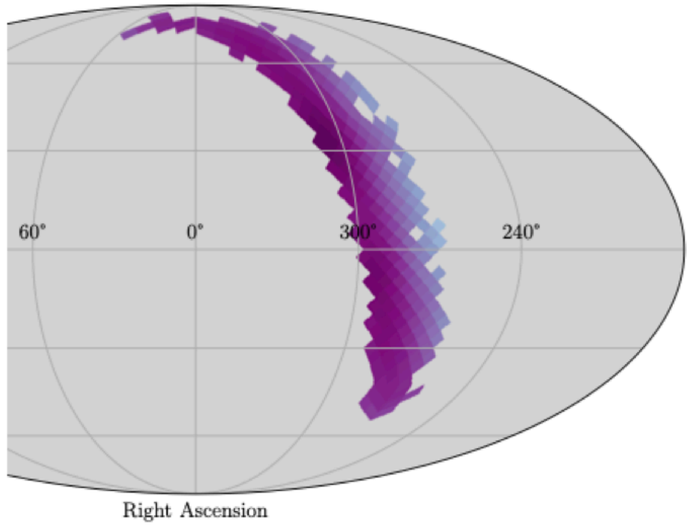
TAMBO Design

Canyons enhance geometrical acceptance

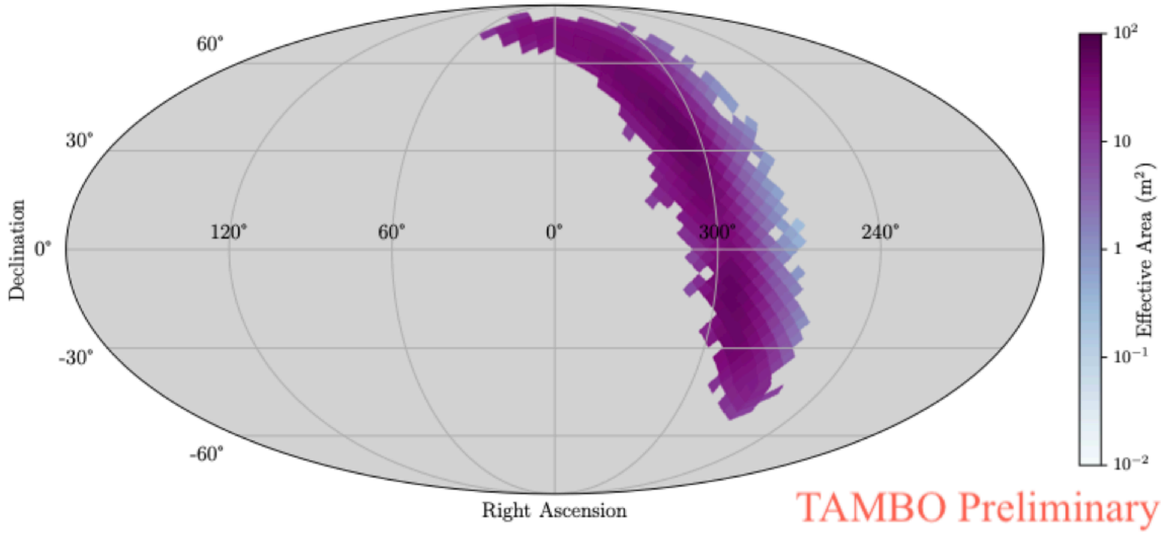
Down-going



Up-going

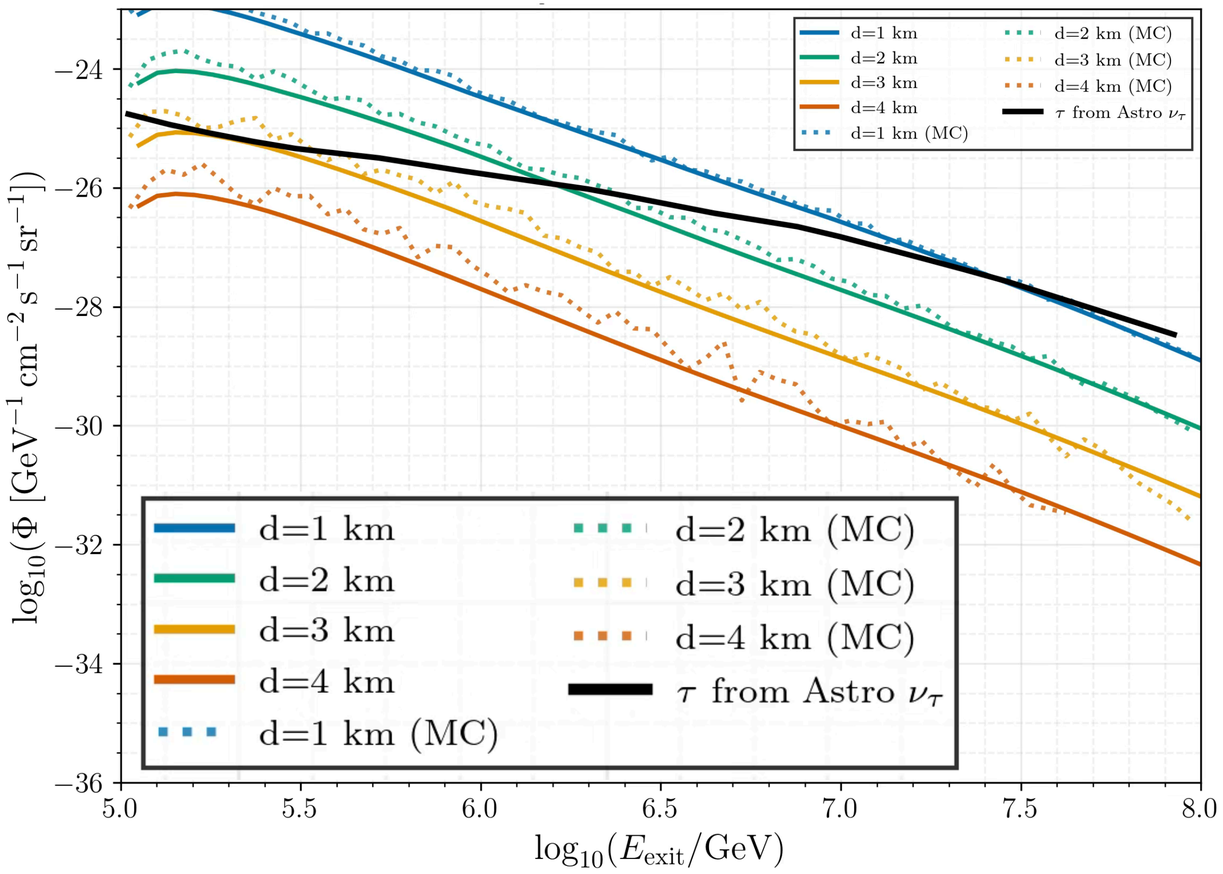


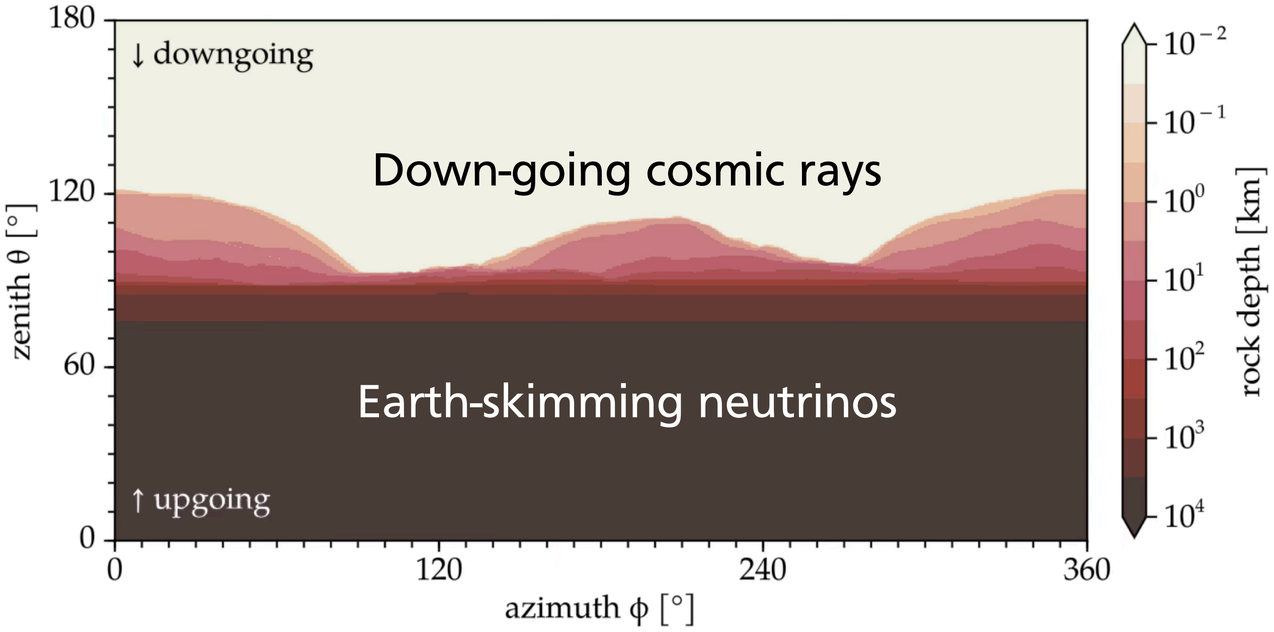
Full acceptance



TAMBO Design

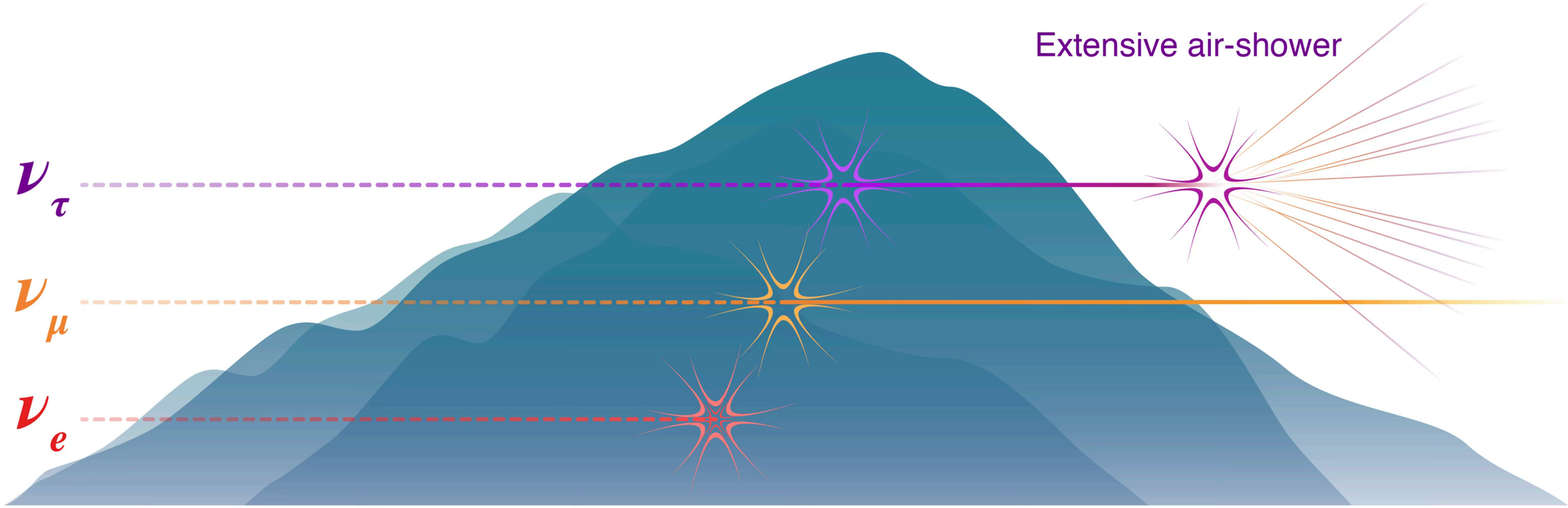
Canyons filter backgrounds





TAMBO Design

Canyons filter backgrounds

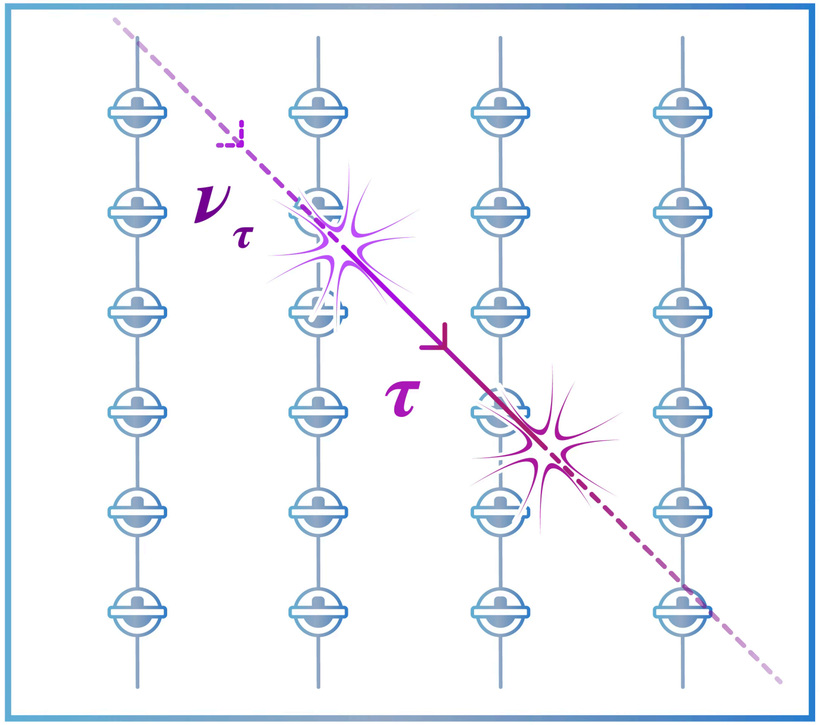


All flavors have same interaction probability, but:

- Electrons shielded by rock
- Muons are very good at retaining energy
- Only τ efficient at creating shower

TAMBO Design

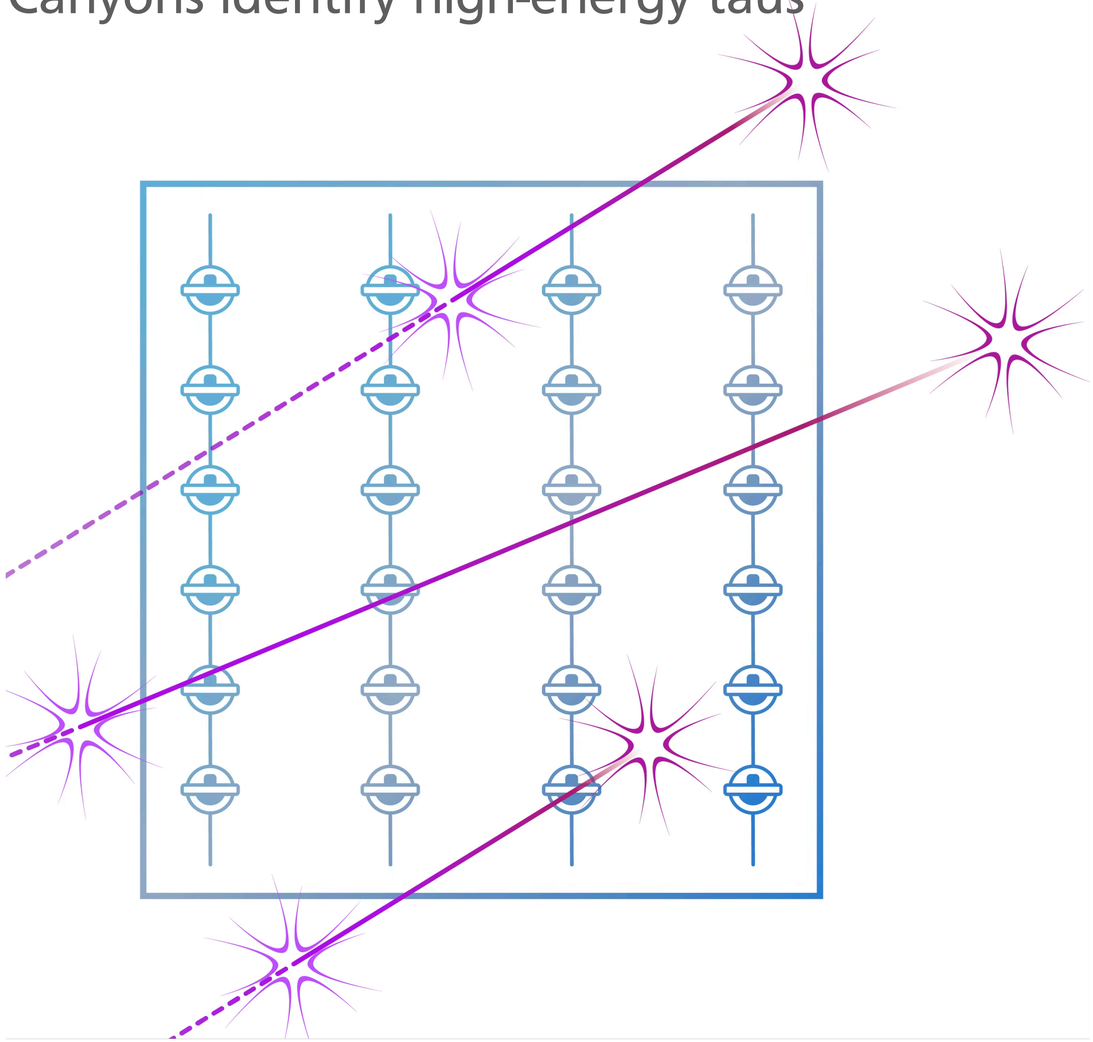
Canyons identify high-energy taus



- Volumetric detectors use “double-bangs” to identify ν_τ

TAMBO Design

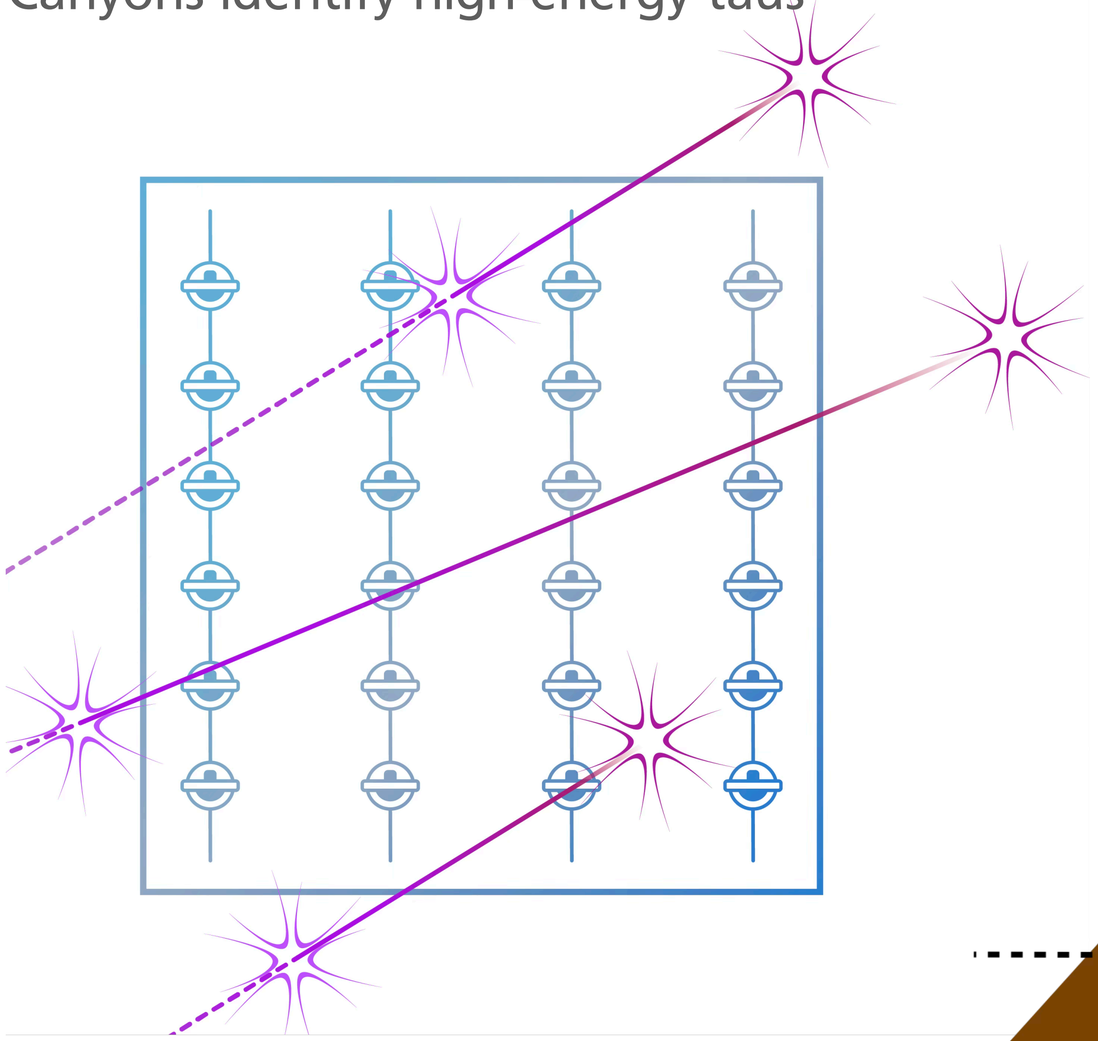
Canyons identify high-energy taus



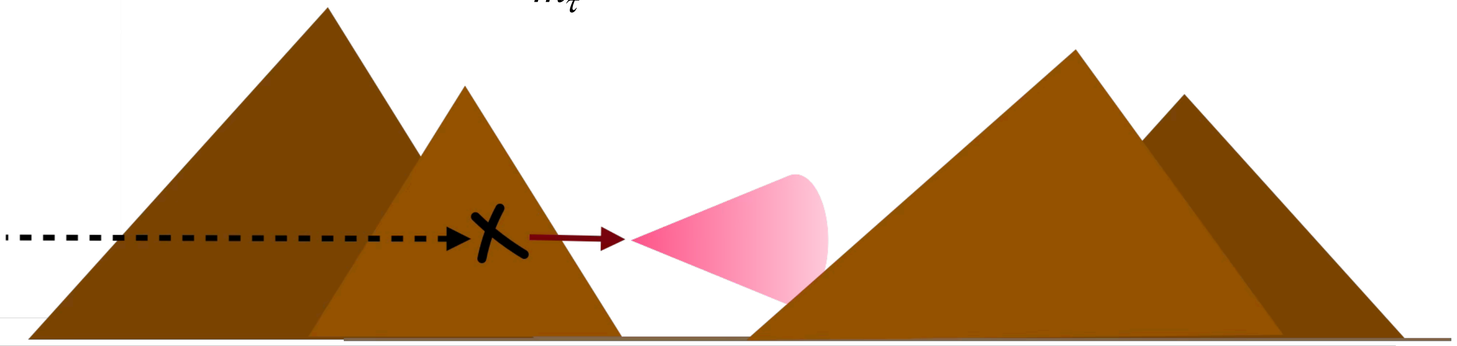
- Volumetric detectors use “double-bangs” to identify ν_τ
- High-energy tau identification in volumetric detectors is inefficient
  - $L_\tau \approx 50\,\mathrm{m}\,\left(E_\tau/\mathrm{PeV}\right)$

TAMBO Design

Canyons identify high-energy taus

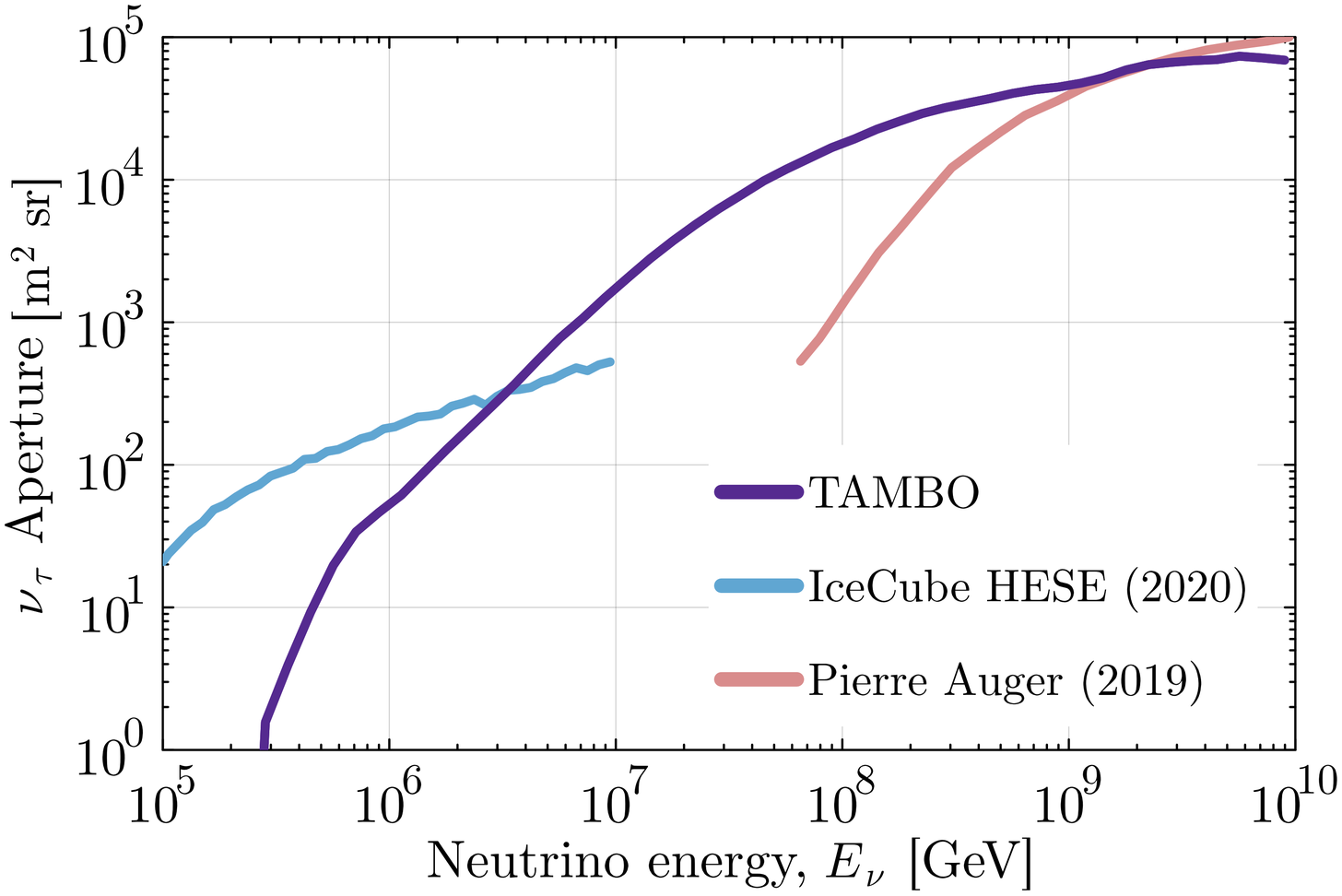


- Volumetric detectors use “double-bangs” to identify ν_τ
- High-energy tau identification in volumetric detectors is inefficient
  - $L_\tau \approx 50\,\mathrm{m}\,\left(E_\tau/\mathrm{PeV}\right)$
- Canyon-based observatories increase efficiency with energy
  - $N_\tau \sim \Phi_\nu\,\sigma_{\nu p}\,L_\tau^0\,\dfrac{E_\tau}{m_\tau}$



TAMBO Exposure

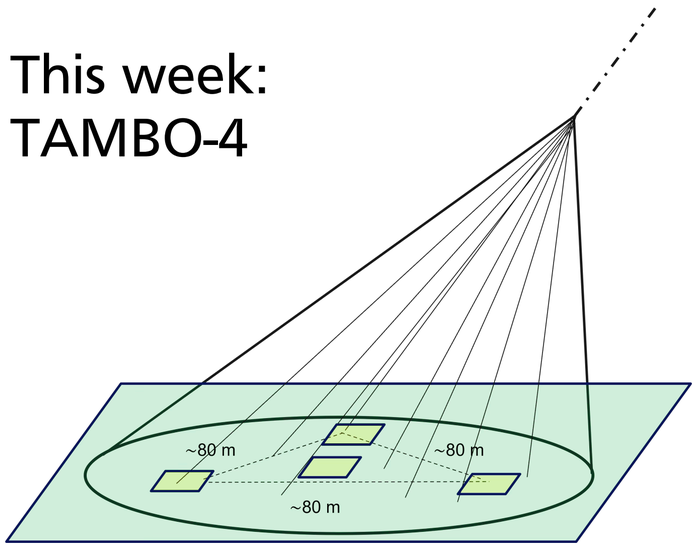
TAMBO's exposure surpasses others' over 2.5 orders of magnitude



TAMBO Timeline

A staged timeline or growth

This week: TAMBO-4

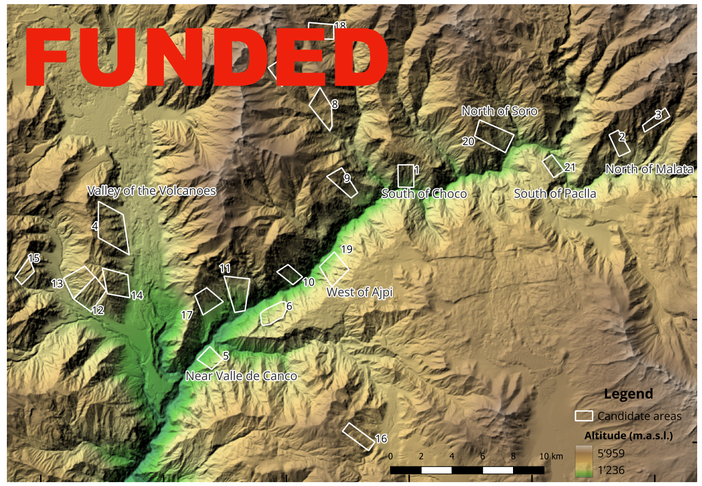


Small test array

Detector & electronics prototypes

2026–2028: TAMBITO

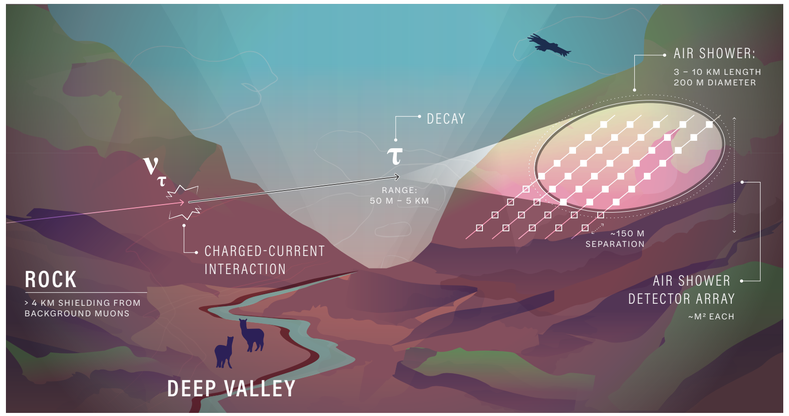
JOHN TEMPLETON FOUNDATION



Pilot array in canyon geography

Deployment techniques, backgrounds, responsible siting

2028–the future: TAMBO-5k

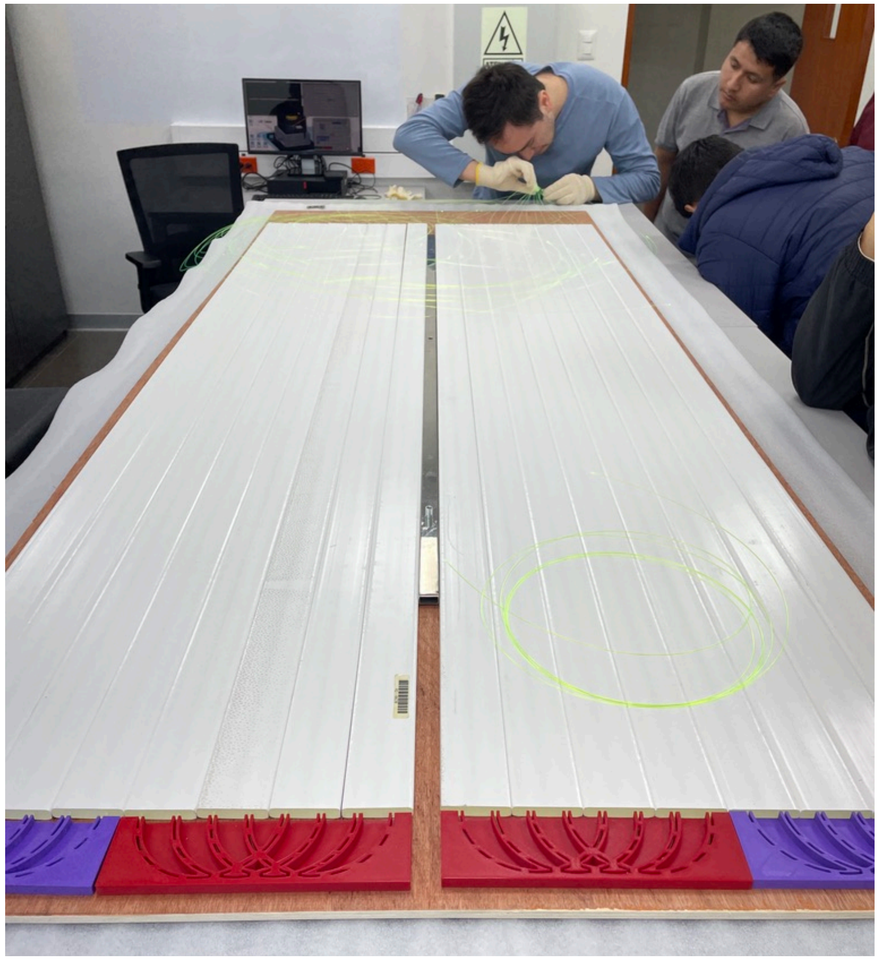


TAU AIR-SHOWER MOUNTAIN-BASED OBSERVATORY (TAMBO)

Target full size array

TAMBO-4

A testbed for readout and reconstruction coming this week





Thanks to KIT and UW-Madison for their generous contributions to kick-start the project!

TAMBITO Site Selection

A multidisciplinary team recently visited several sites in the Colca Valley



- Coporaque (Lower / Upper)
- Mirador de Agotrek
- Huambo

TAMBITO Site Selection

They started discussion with local communities and learned about the local culture





Joined in festival to clean irrigation canals



Learned about representation of stars in Andean textile designs

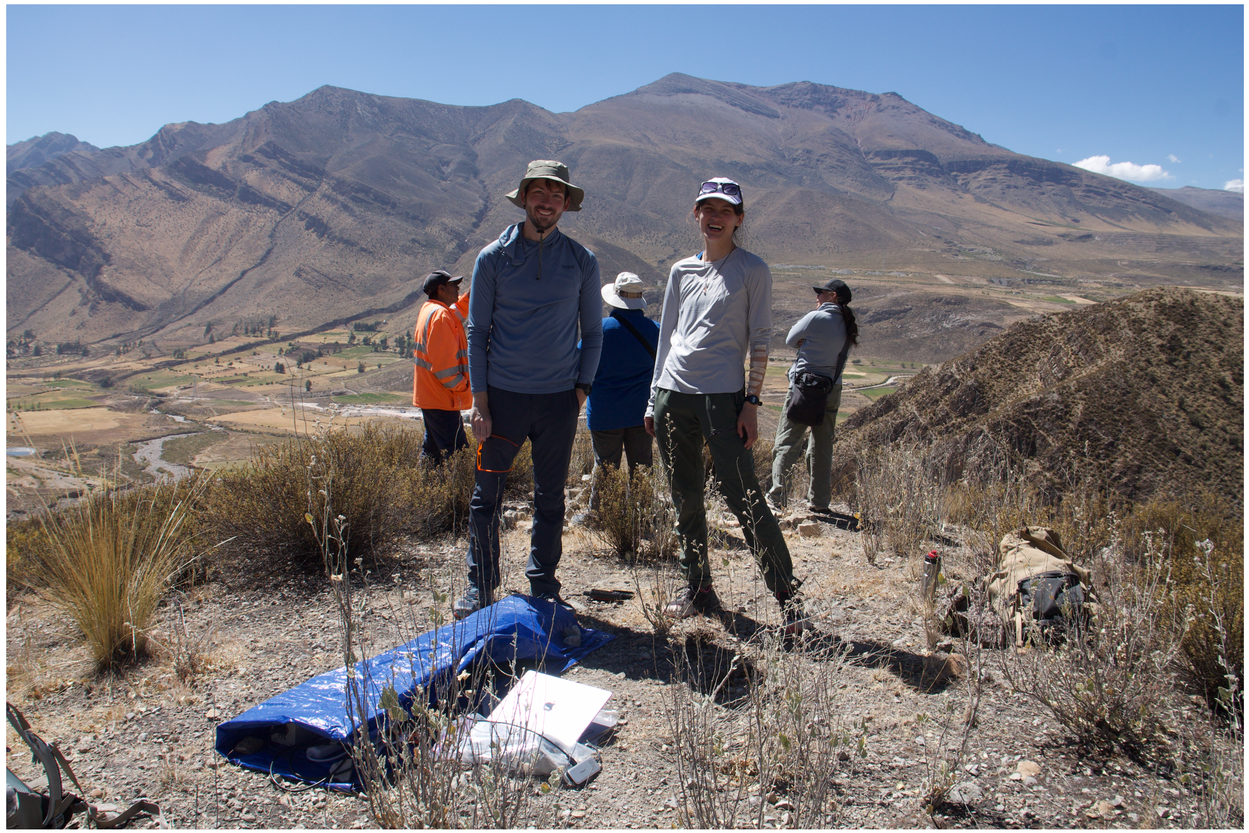




Colca Valley Measurements

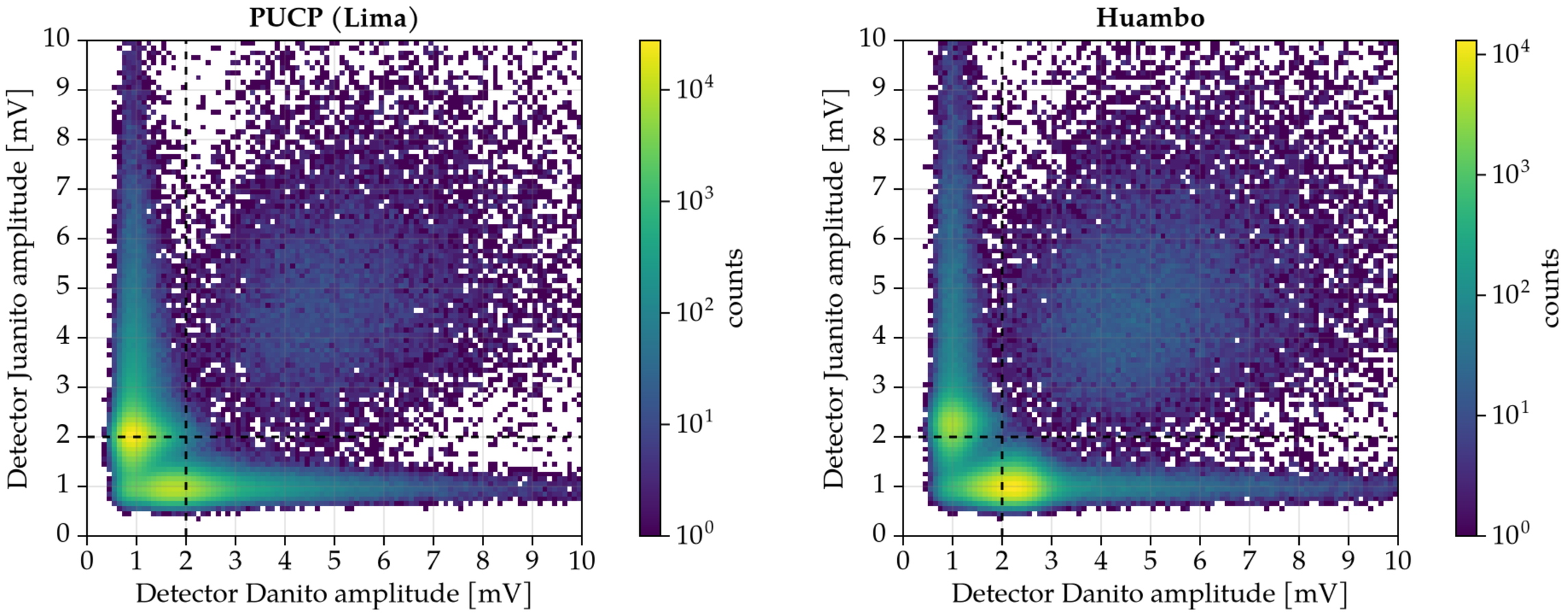
And took muon measurements on backpack-sized panels





Colca Valley Measurements

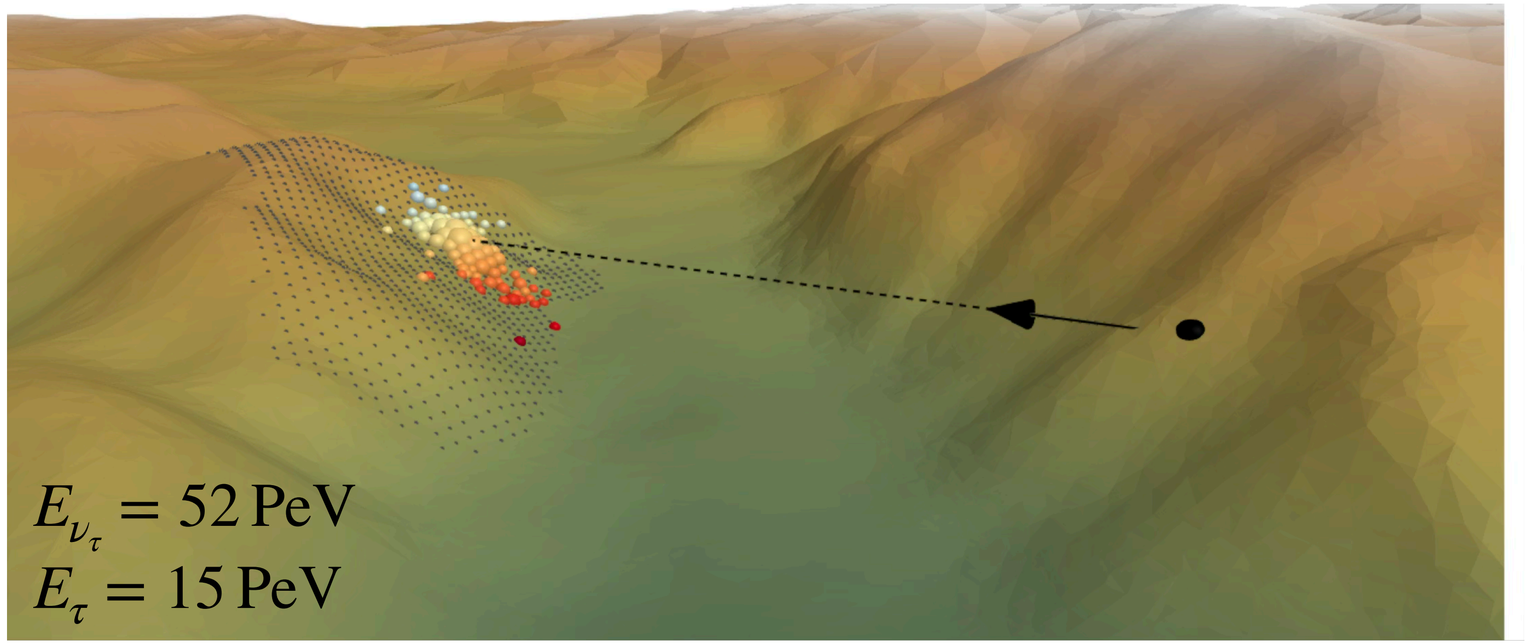
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TamboSim.jl

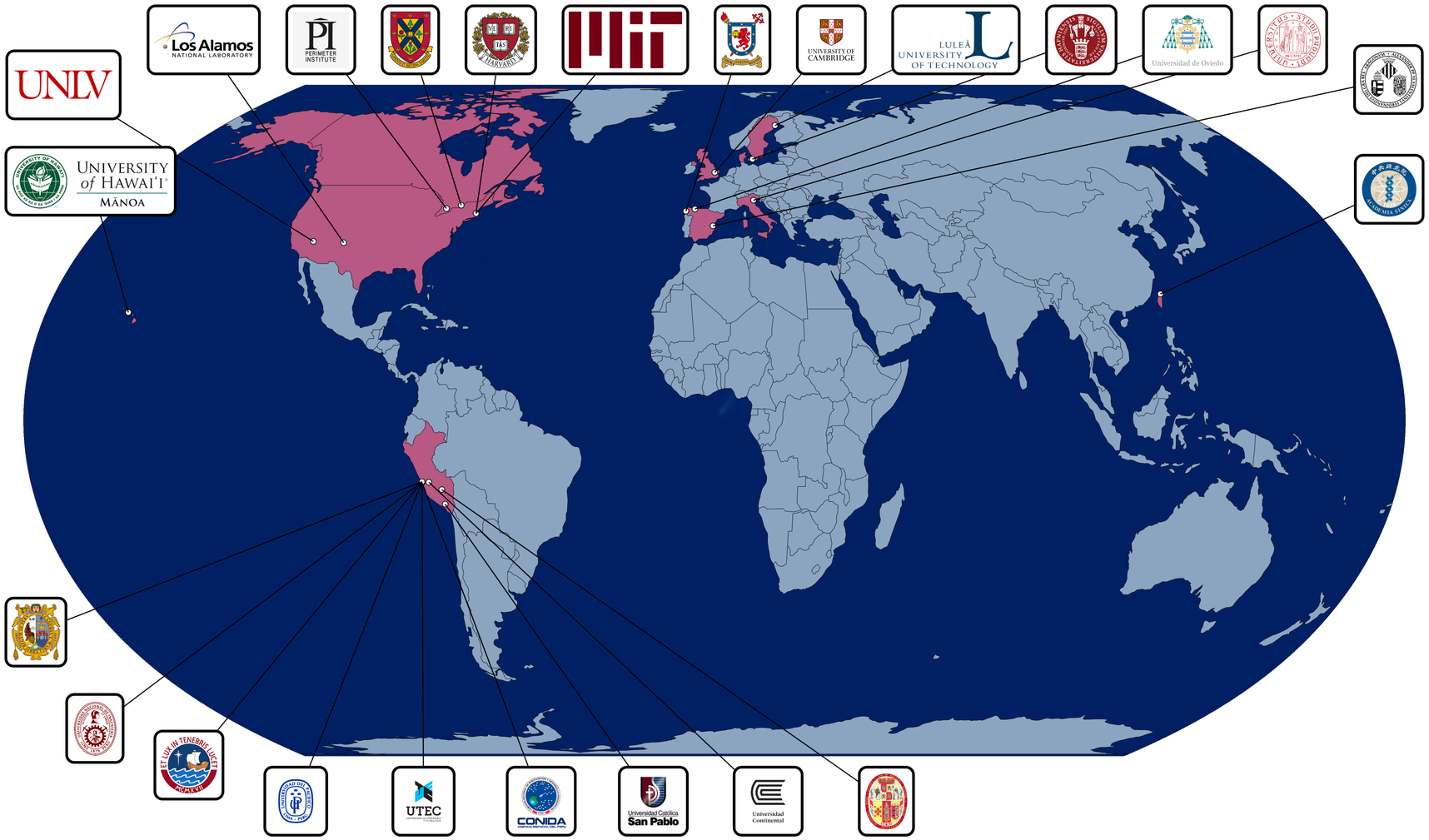
A Julia-based simulation package

- Simulation supports arbitrary geometries
  - This has also been implemented in CORSIKA8
- Publicly available on GitHub



TAMBO Collaboration

We’re small, but mighty. Come along!



Summary & Outlook

- TAMBO is a new approach to transforming the natural world into a neutrino telescope
- TAMBITO funded; development began in August 2025.
- Overview paper published in Nature Astronomy
- Interested in joining? Contact Will Thompson or Carlos A. Argüelles

