Outer veto meeting overview
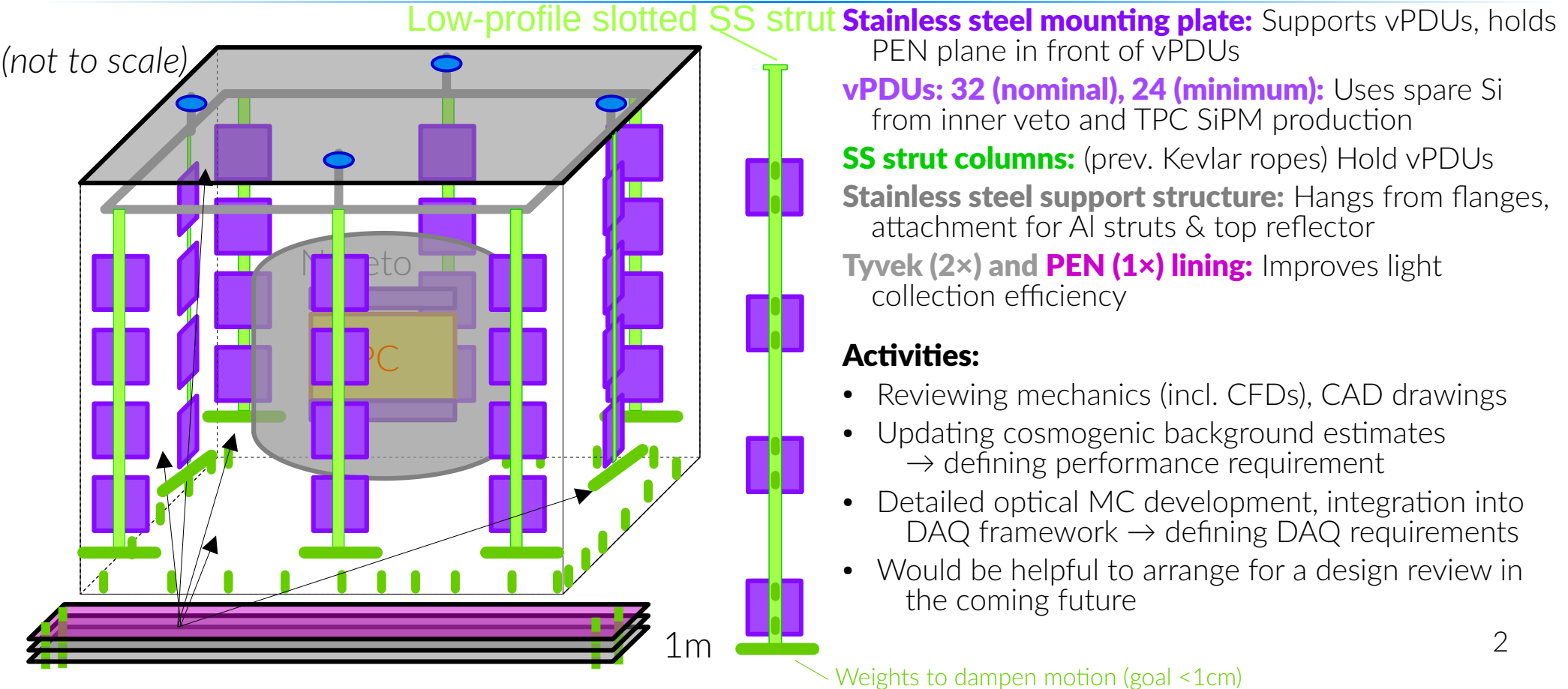
Shawn Westerdale
Outer veto meeting
11 November, 2022

Outer veto overview (some updates)

Low-profile slotted SS strut

(not to scale)

N veto

TPC

1m

Weights to dampen motion (goal <1cm)

Stainless steel mounting plate: Supports vPDUs, holds PEN plane in front of vPDUs

vPDUs: 32 (nominal), 24 (minimum): Uses spare Si from inner veto and TPC SiPM production

SS strut columns: (prev. Kevlar ropes) Hold vPDUs

Stainless steel support structure: Hangs from flanges, attachment for Al struts & top reflector

Tyvek (2×) and PEN (1×) lining: Improves light collection efficiency

Activities:

- Reviewing mechanics (incl. CFDs), CAD drawings
- Updating cosmogenic background estimates → defining performance requirement
- Detailed optical MC development, integration into DAQ framework → defining DAQ requirements
- Would be helpful to arrange for a design review in the coming future

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Activities

- Mechanics and technical design
  - Marco Carlini, Andrea Zani, Kevin Thieme, and Manchester engineer [TBC]— Kevin will present on
    - Alec Peck (UCR Grad student) and Jared Hudnal (UCR undergrad) to join—need to schedule a meeting with all of us to get things started
  - Goal: produce CAD drawings in the next week
- Performance tests of Tyvek samples + PEN in LAr
  - Claudio and Allan
- Optical simulations
  - Zoe → Ellen → Taisiia
  - Goal: understand the impact of design parameters on LY and uniformity, inform design and DAQ
  - Next goal: Simulate ^{39}Ar and external backgrounds with current design parameters (previous work was preliminary, was early design and more approximate background estimates)
- DAQ simulations & design
  - Ashlea + Zoe, with input from Taisiia
- Cosmogenic background (two parallel approaches) -- Aiming for results in next week or two
  - Full FLUKA : Teena, with guidance from Sagar — Teena will present an update today
  - Hybrid FLUKA/g4ds: Daria, Iftikhar, Davide, Paolo – Presented preliminary result w/ high stats at bkgd call: ~1.6×10^{-2} evt/10 yrs

Mechanics and technical design: Chimney placement

- Want to be as close to the walls as possible

- After discussions with CERN cryostat group, Marco has started placing penetrations in approximately the places shown here
  - Will not be perfectly centered

- Andrea suggests routing all cables through 2 chimneys and using the other two only for structural purposes

Location of chimneys to service outer veto
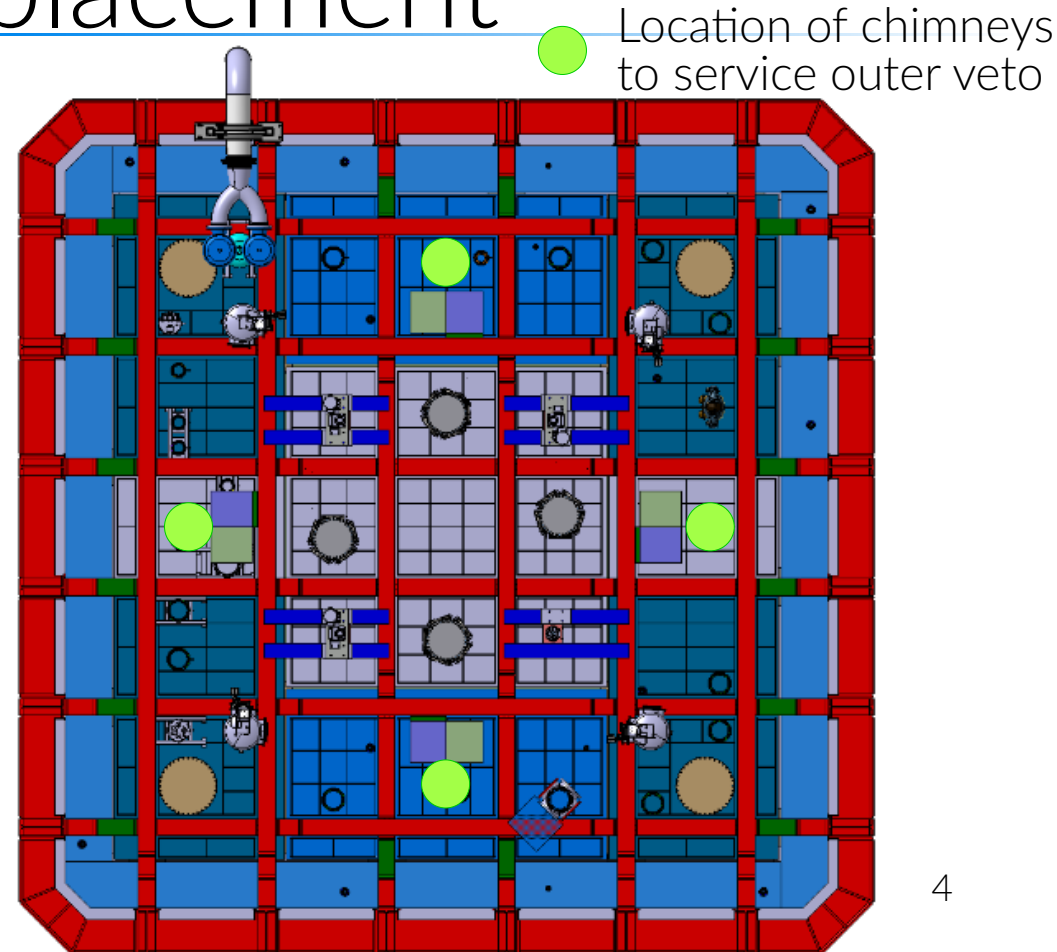
# Mechanics and technical design: Fluid flow simulations

- (see Kevin's slides)

- Simulation of simplified geometry, no gas layer → no convection from the interface
  - Expect convection effects to be negligible after ~10 cm

- Translated velocity field from CFD into pressure calculation on PDU mounting plates

- Typical speeds near walls: 10^{-5}-10^{-4} m/s (slower farther from walls) → pressures like 10^{-7}-10^{-5} N/m^2

- Highest speed near 10cm oriface LAr inlet O(10-2 m/s) → pressure of 0.1-1 N/m^2

- Recommend design for a maximum load of 10 N/m^2 in any direction – Very easily achieved

- Likewise, the force acting on the reflector panels should be very small – these are very low pressures!

- Need to figure out how reflector panels will navigate around piping

Middle   **20 cm from wall**

Velocity Contour 1 [m s^-1]
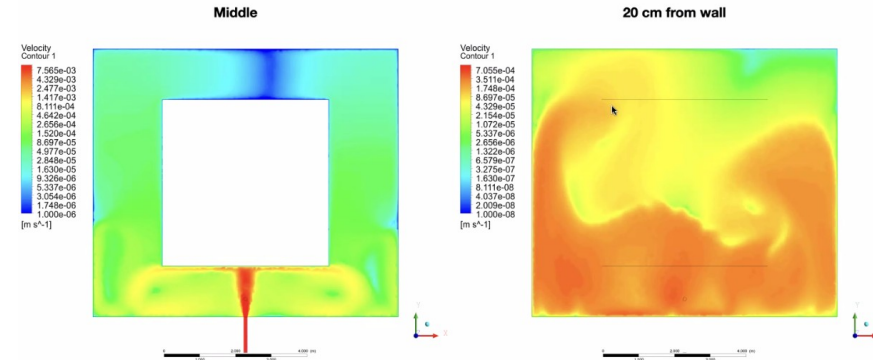
Typical speeds in proximity of the walls: 10^{-5}–10^{-4} m/s
-> corresponds to very small pressures on the sails of 10^{-7}–10^{-5} N/m^2

* The highest speeds directly behind the outlet with 10 cm orifice are O(10^{-2} m/s) which corresponds to 0.1–10 N/m^2

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Middle   **20 cm from wall**

Temperature Contour 1 [K]
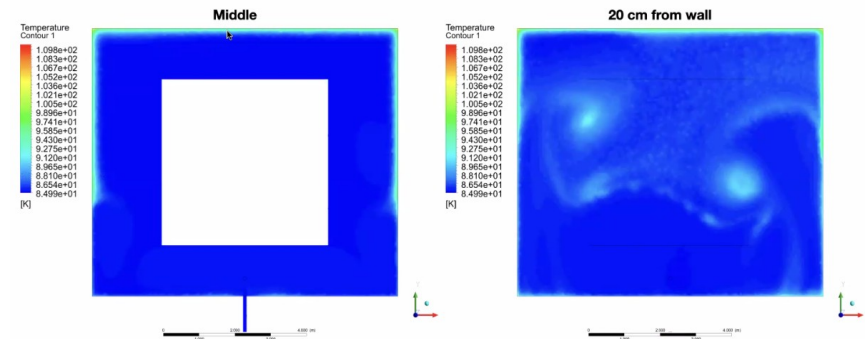
Single-phase simulation!

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Optical simulations

DAQ simulations and design

Cosmogenic background estimates

- At yesterday's Backgrounds call, Paolo presented preliminary update from hybrid approach with 23,100 live years (though not statistically independent): ~1.6×10^{-2} evts/yr

- Update from Teena on full FLUKA approach (see Teena's slides)

  - Event rates in all three detectors comparable to what Sagar had seen

  - Significant work validating energy accounting (records continuous and discrete energy deposition processes in two different routines → two different output files that get merged into one ROOT file

  - Validated physics models to reproduce reasonable neutron capture signals → needed to add low-energy pointwise neutron cross sections