milliQan and FORMOSA

Update for the 2025 IIHE Annual Meeting

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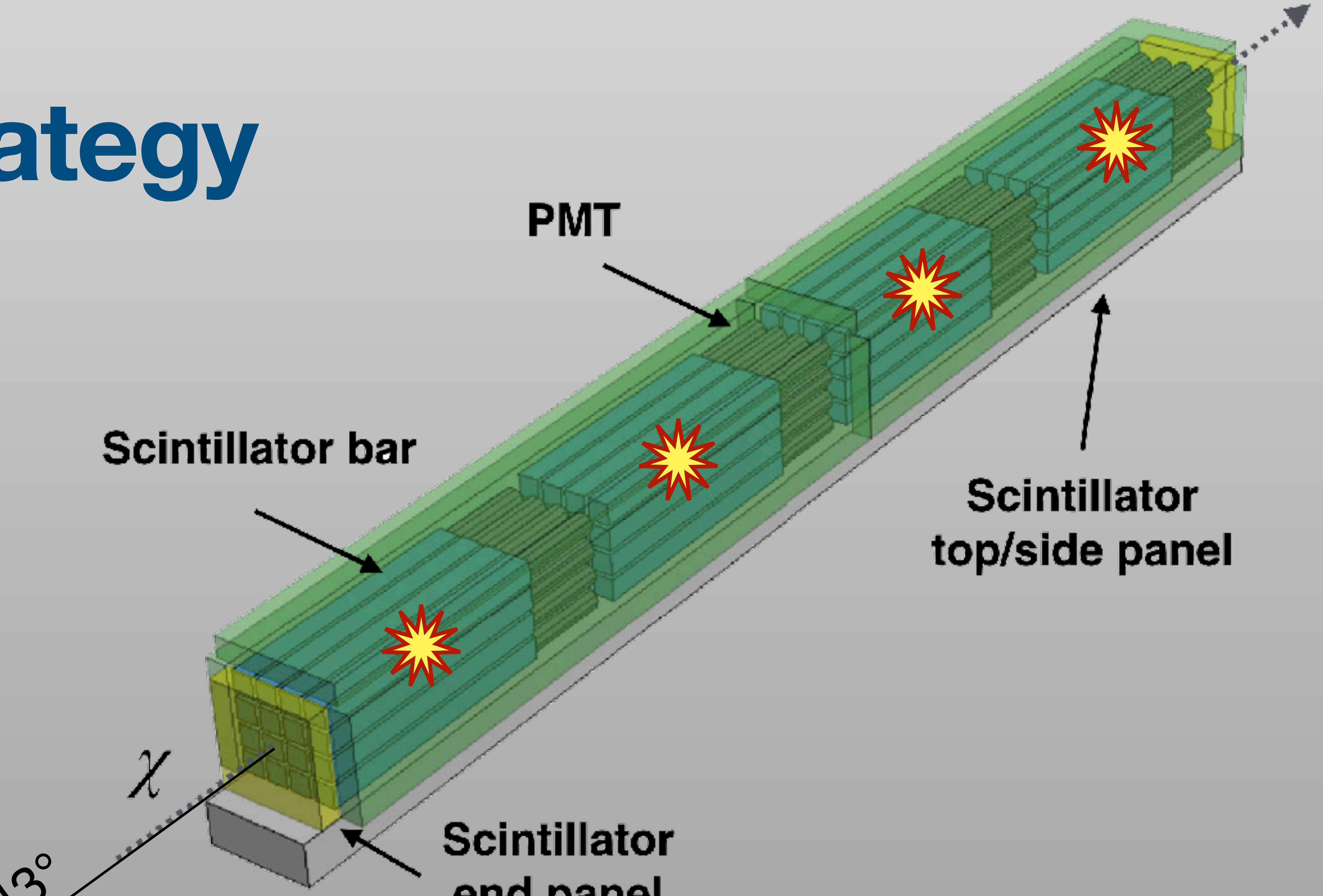
where
charge quantization
dark sector

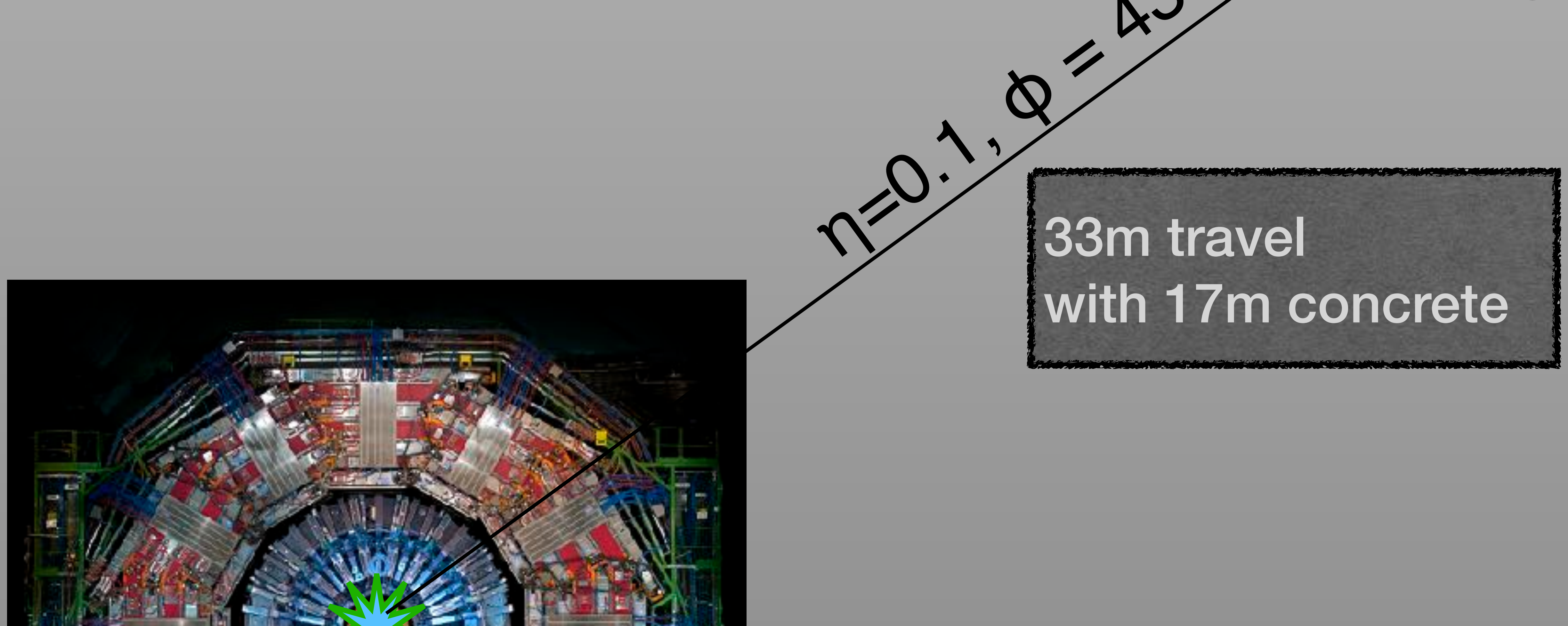
Millicharged particles in EW scale dark sector

Images: Particle Zoo, CORSIKA and CMS

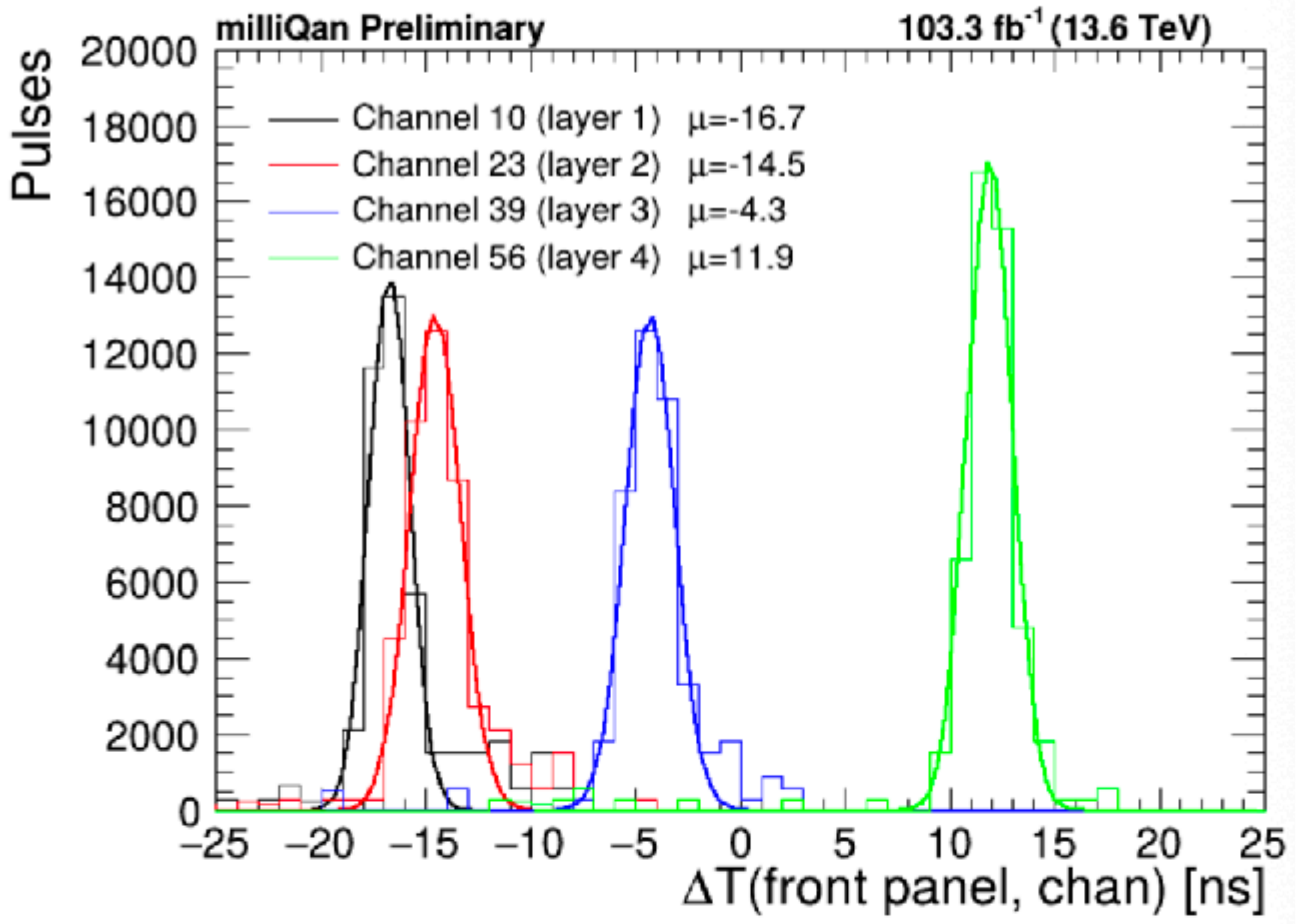
The milliQan Bar strategy

- mCP deposits very little light!
- Suppress random background: require 4 in a row coincidence (v=c)
- Align to CMS IP

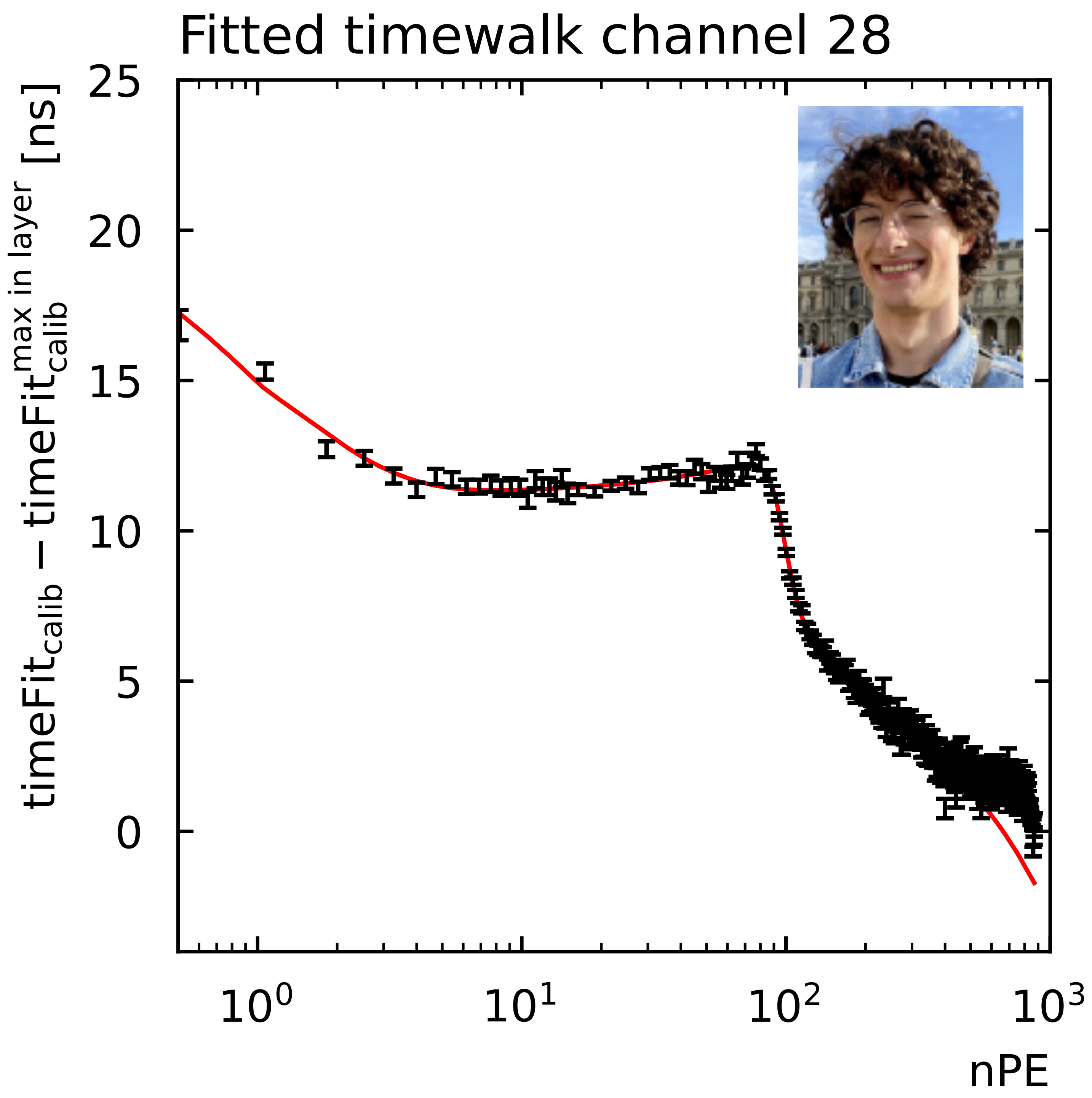




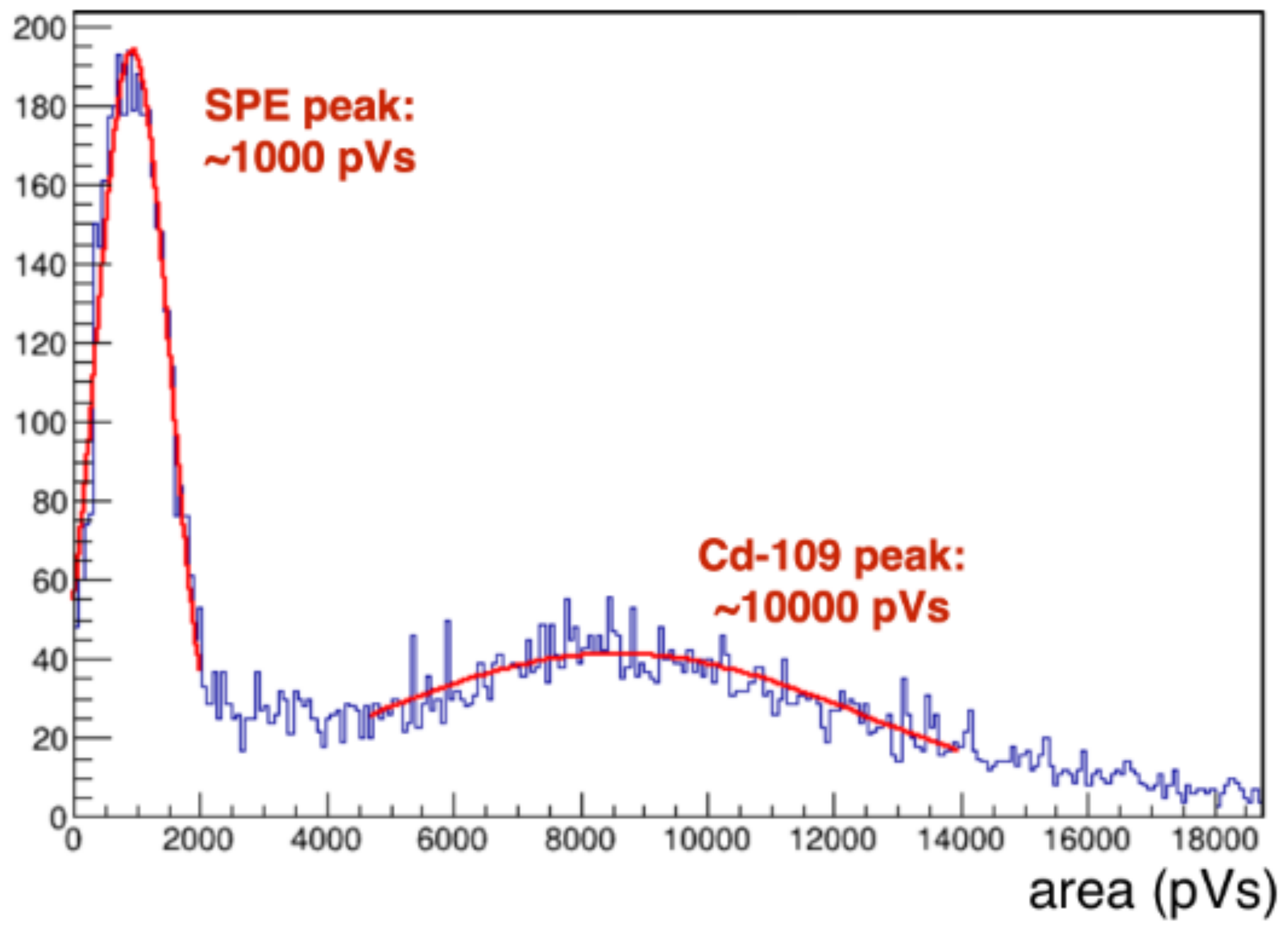
Key calibrations for analysis



suppress background: tight timing cut (20ns):
calibrate with beam muons



correct timing for low-energy timewalk:
calibrate with shower products



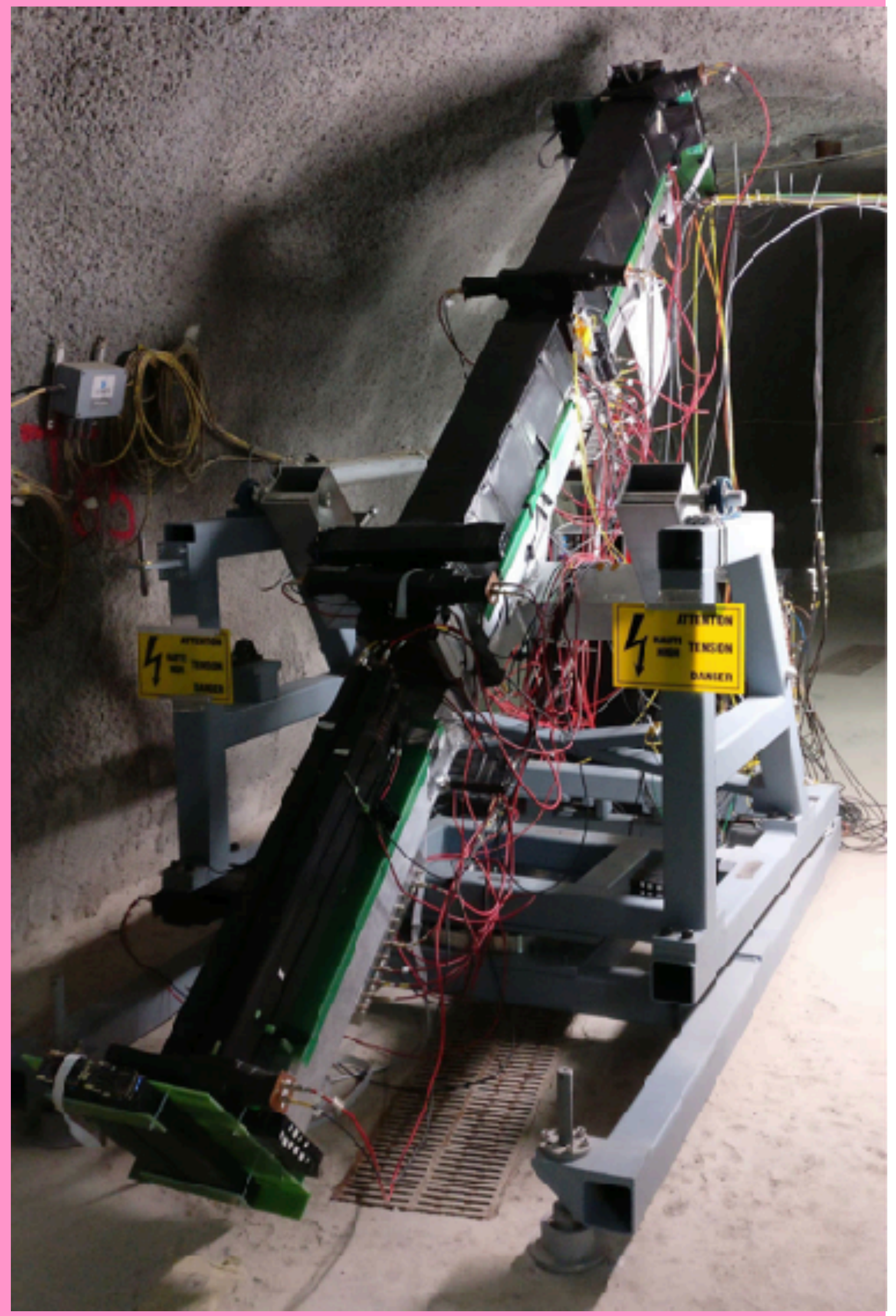
For gen MC to pulse injection:
calibrate reponse with Cd-109 Xrays

Leading limits for mCPs!

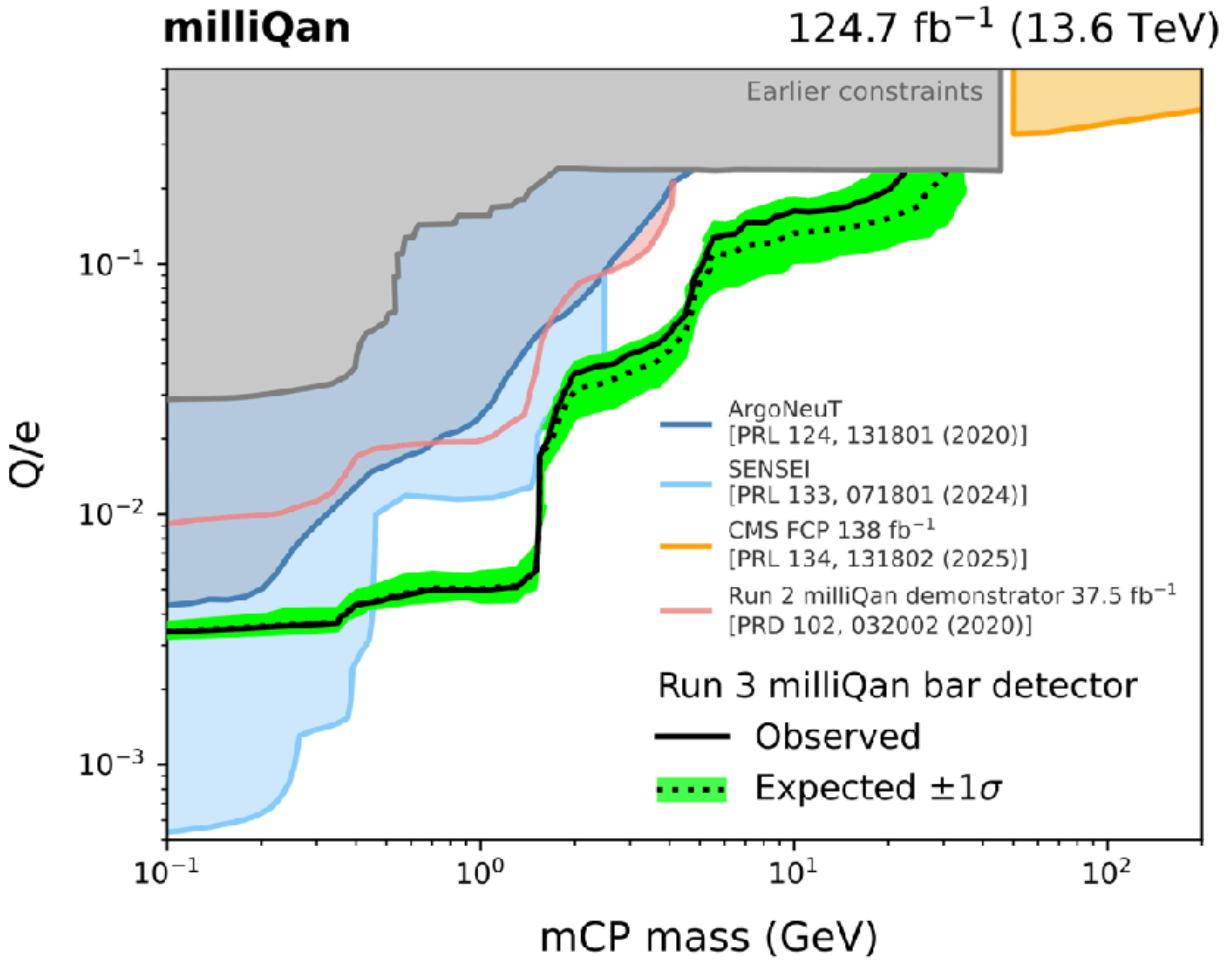
- Recorded: (124.7 ± 3.8) fb^{-1}
  with (0.16± 0.01) muons/pb^{-1}

- Under Background only hypothesis:
  no excess

Signal region	Prediction	Observation
SR1	$0.10^{+0.12}_{-0.07}$	0
SR2	$0.87^{+0.33}_{-0.26}$	2



95% confidence level S+B limit



Phys. Rev. Lett. 135, 121802

The IIHE Contribution

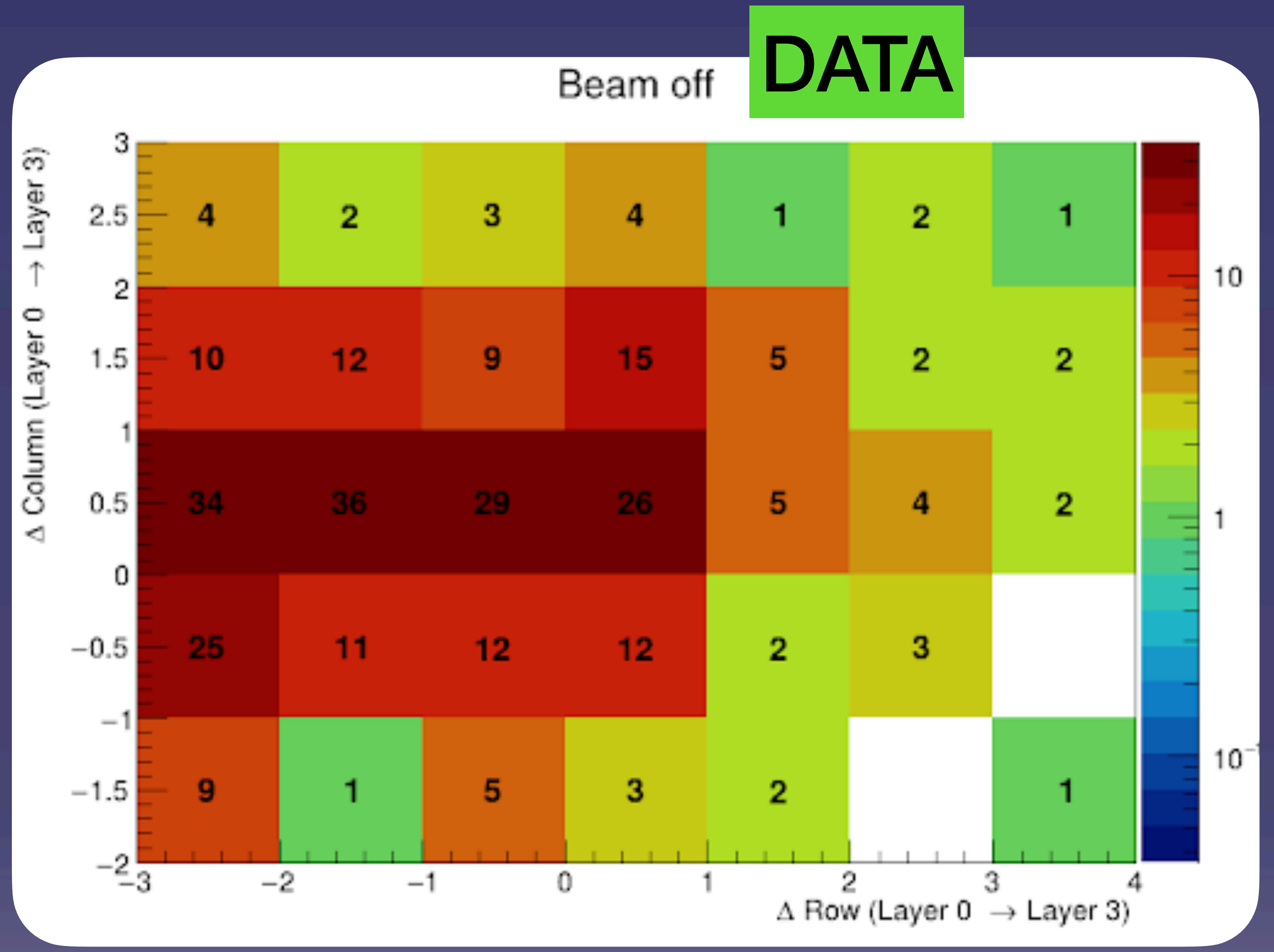
atmospheric millicharged particles

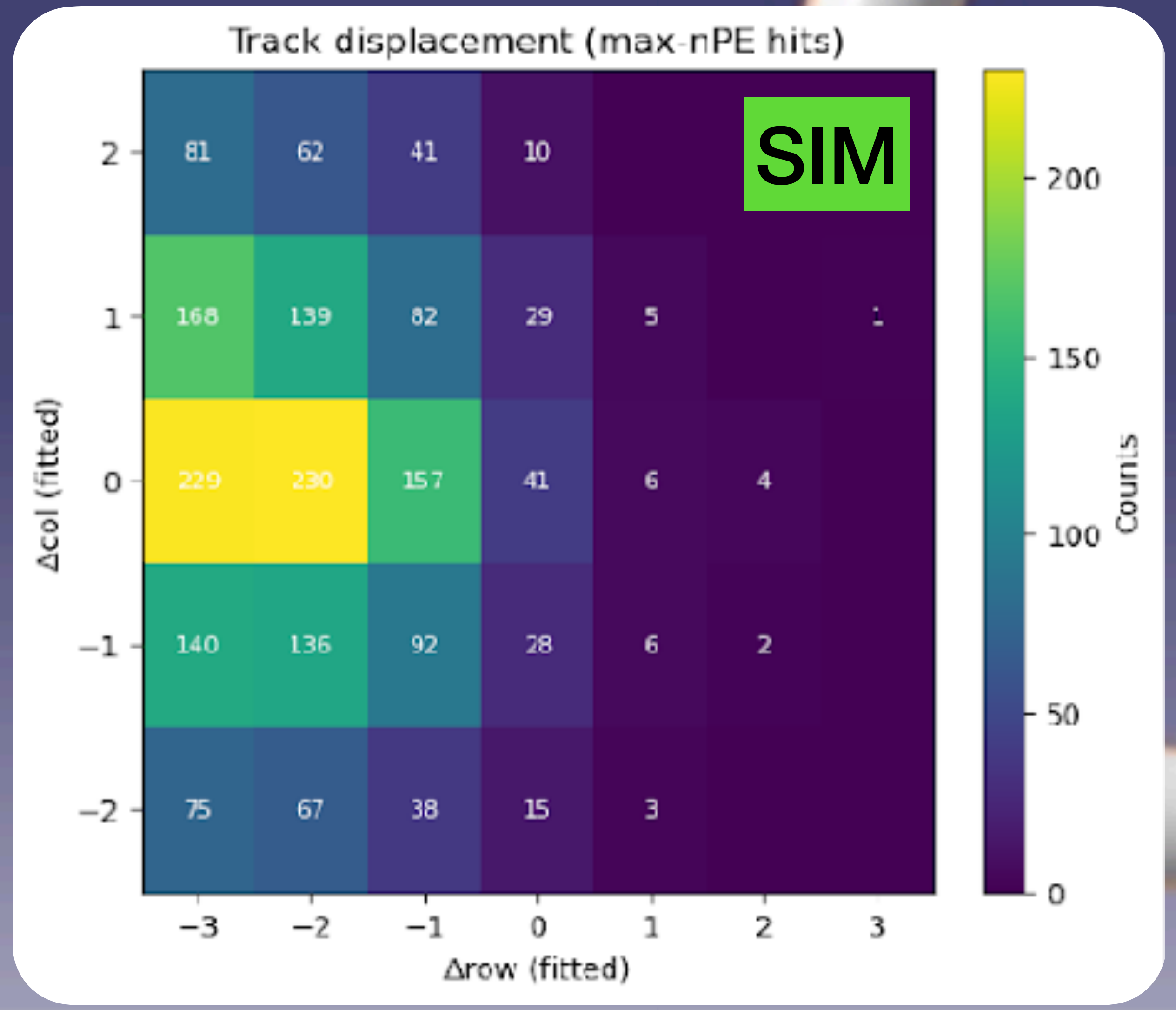
Image: Apple but probably NASA

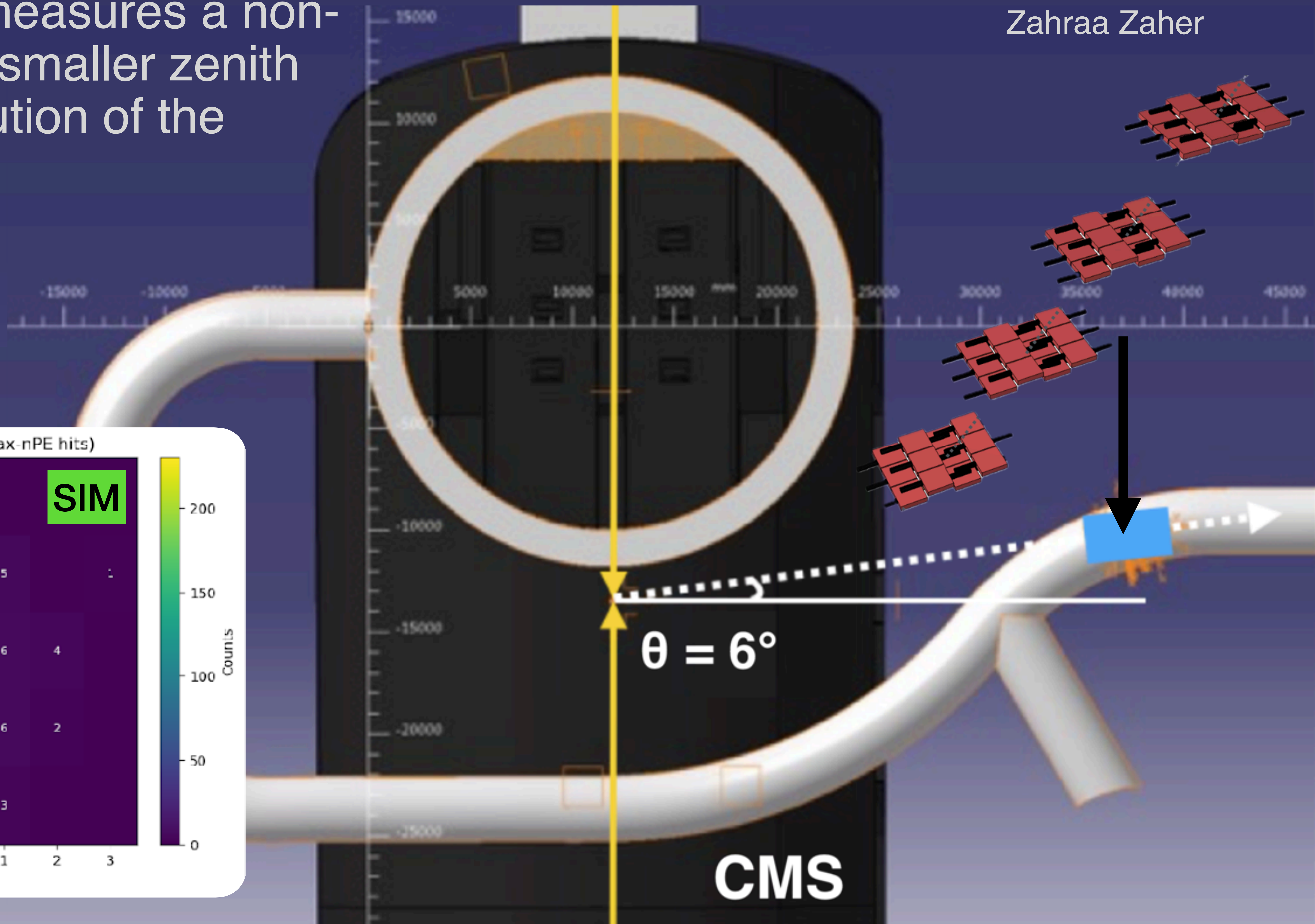
Muon background at the Slab detector

Zahraa Zaher

Zahraa studies cosmic track deviation while though the Slab detector. The asymmetric detector measures a non-uniform angular distribution which favors smaller zenith angles consistent with the $\cos^2(\theta)$ distribution of the cosmic flux. This was simulated as well.



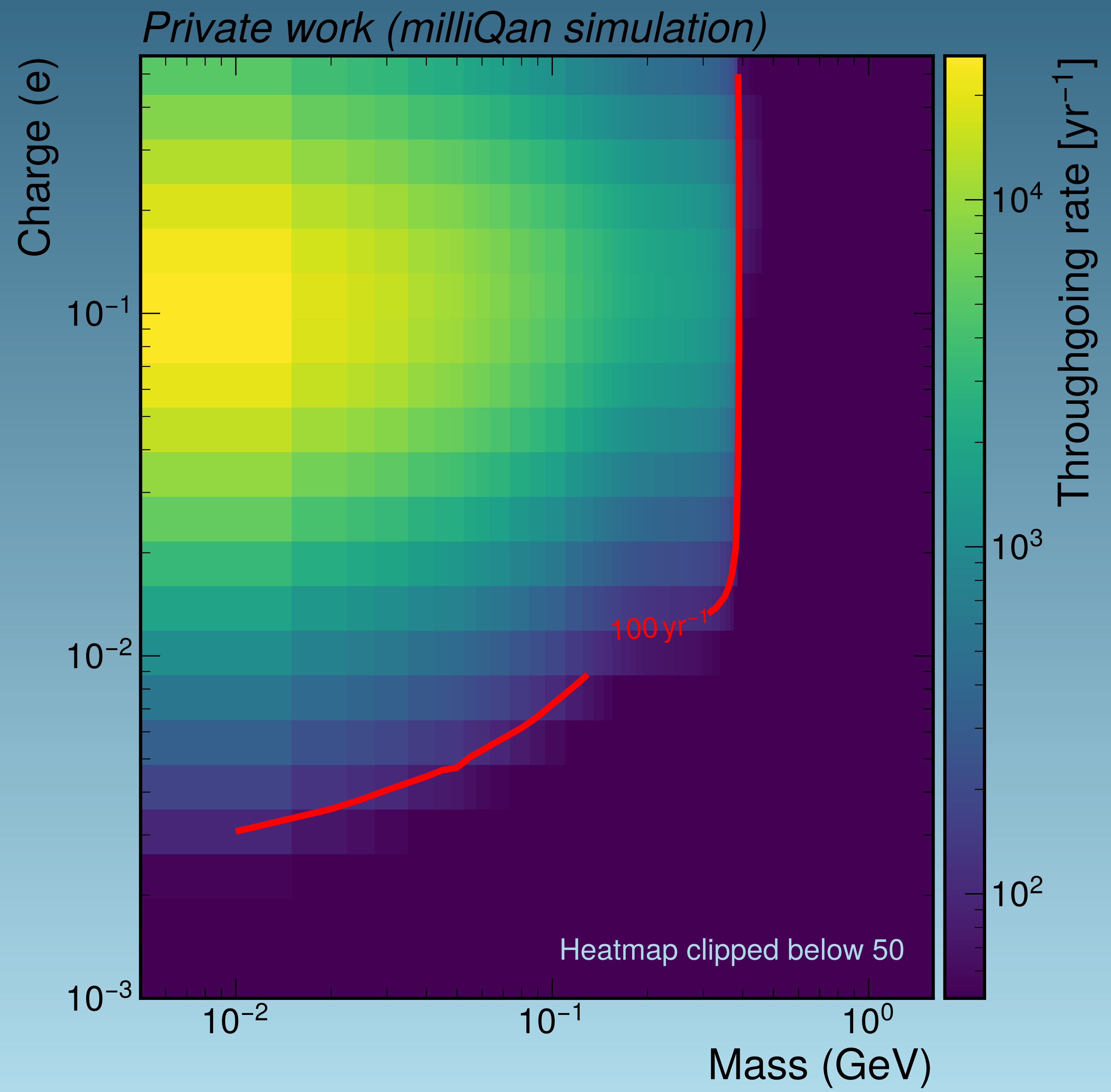




Atmospheric mCPs analysis + trigger design

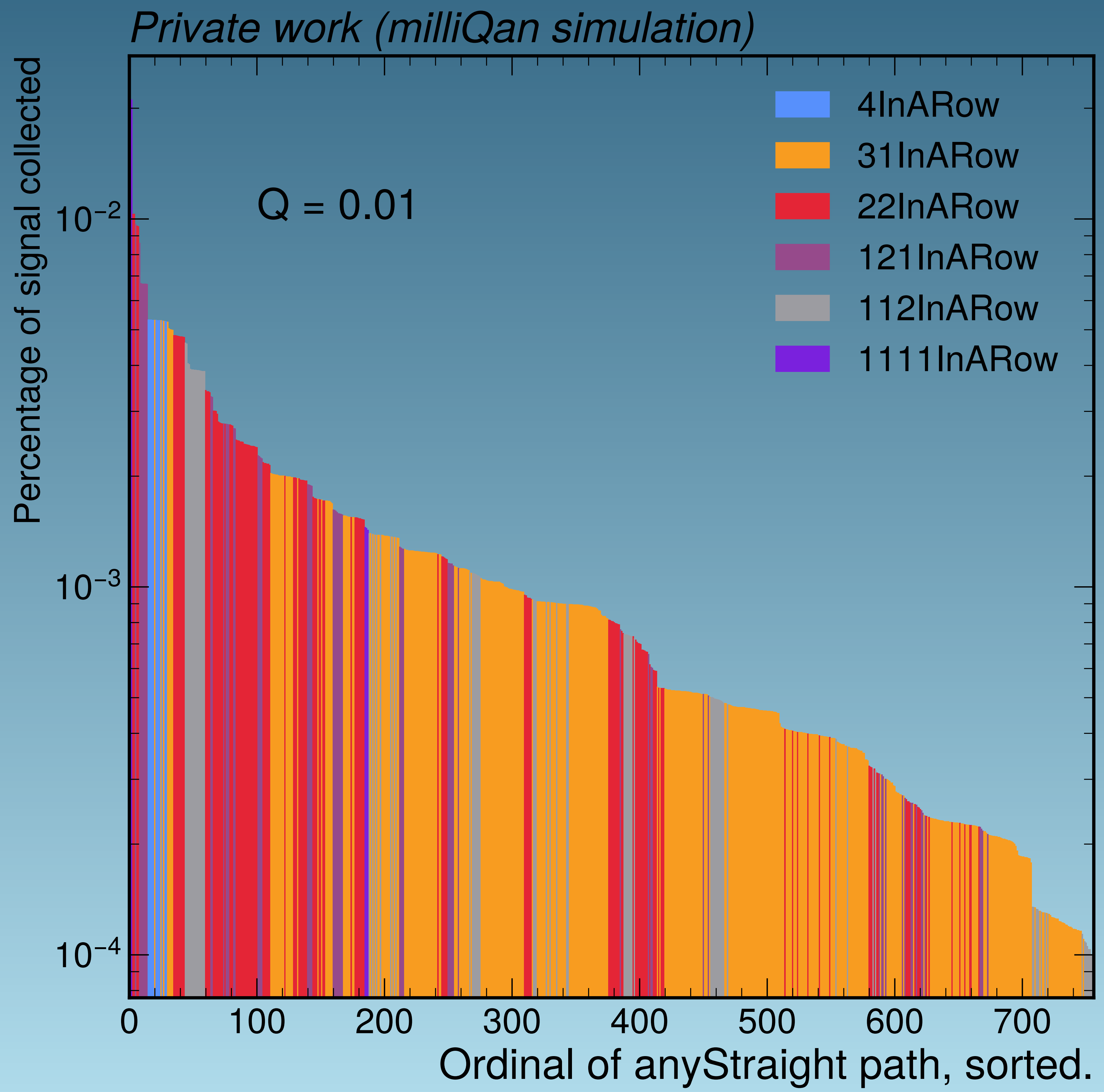
Tiepolo Wybouw

Analysis status:
sensitivity to meson decay mCPs



Next steps:
SIM (CORSIKA + propagation)

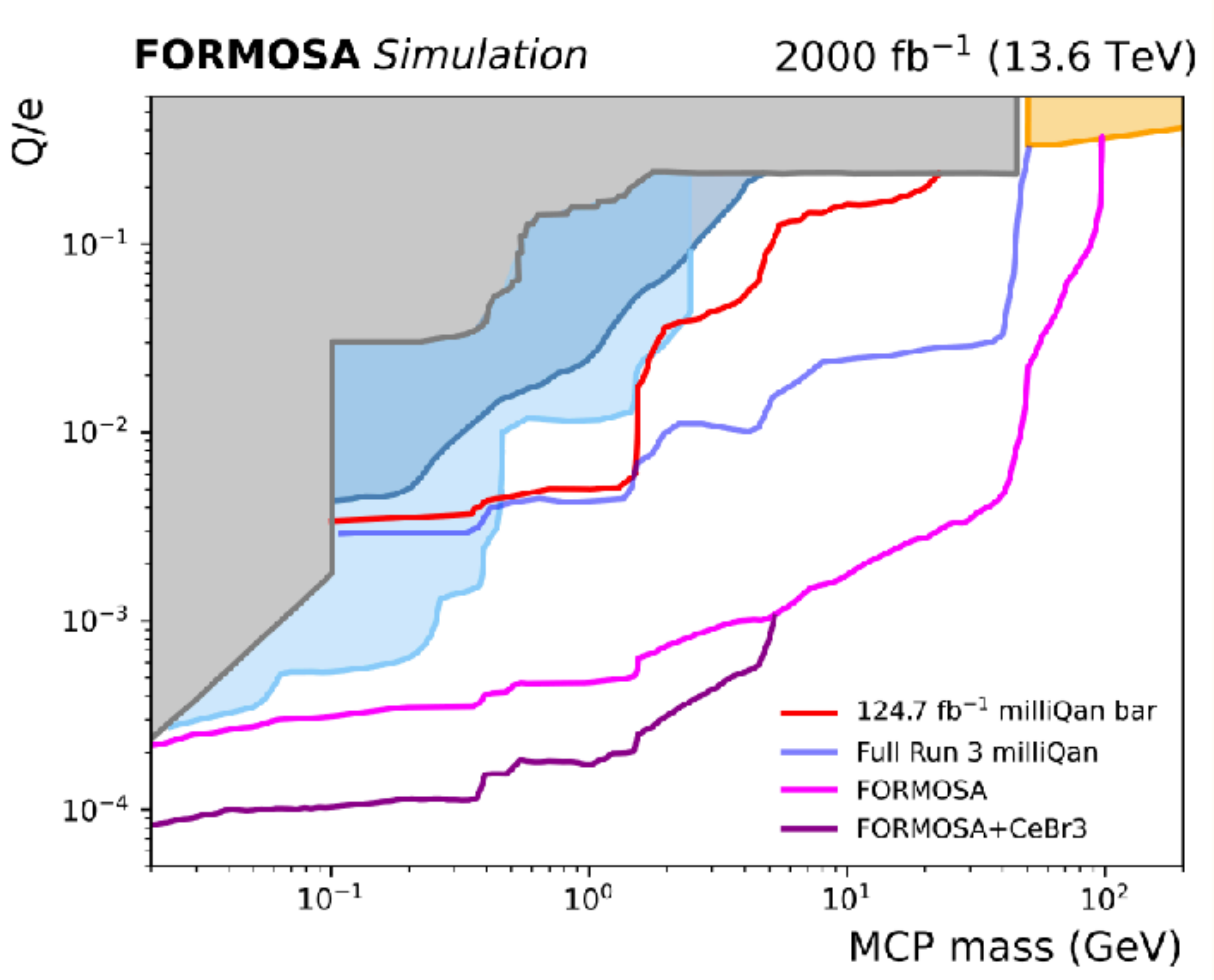
Trigger designed using MC

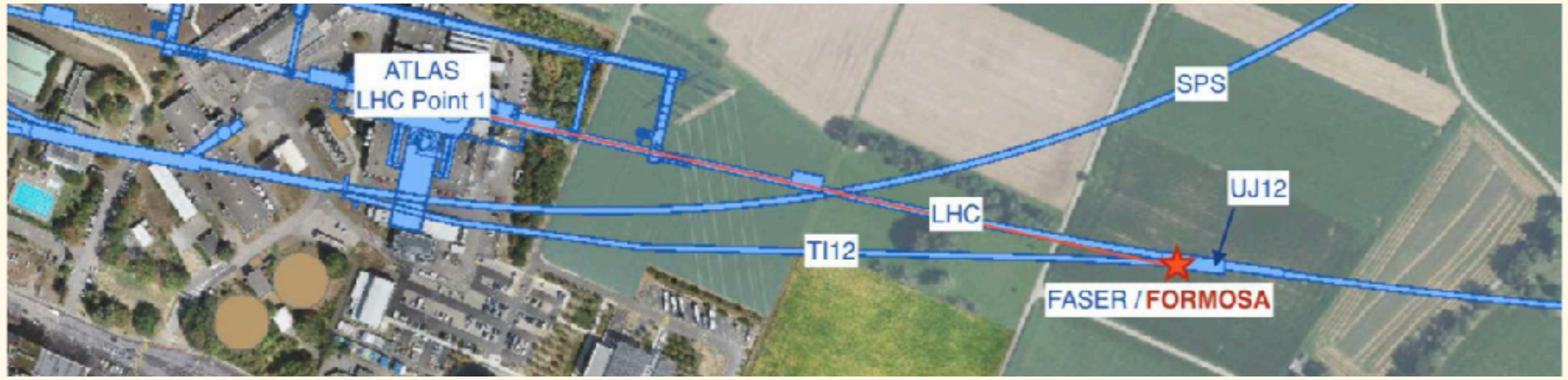


Next steps:
Implement! + timing calibrations for Slab

FORMOSA

milliQan's sister experiment





Part of FPF with input to ESPPU!

FORMOSA Side Panel wrapping and trigger board install

Steven

Zahraa

Tiepolo

So long and thanks for all the slides