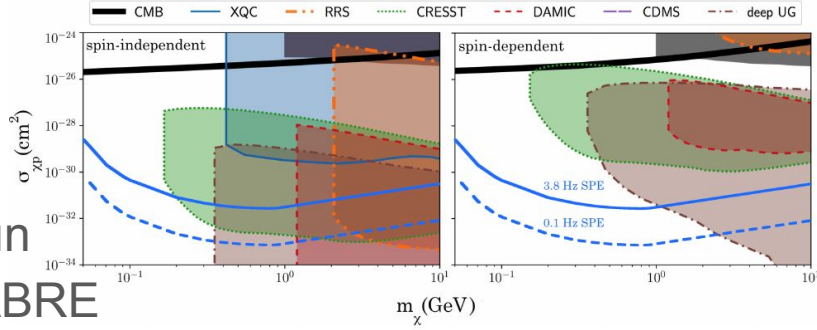


SIMP search with the SABRE veto

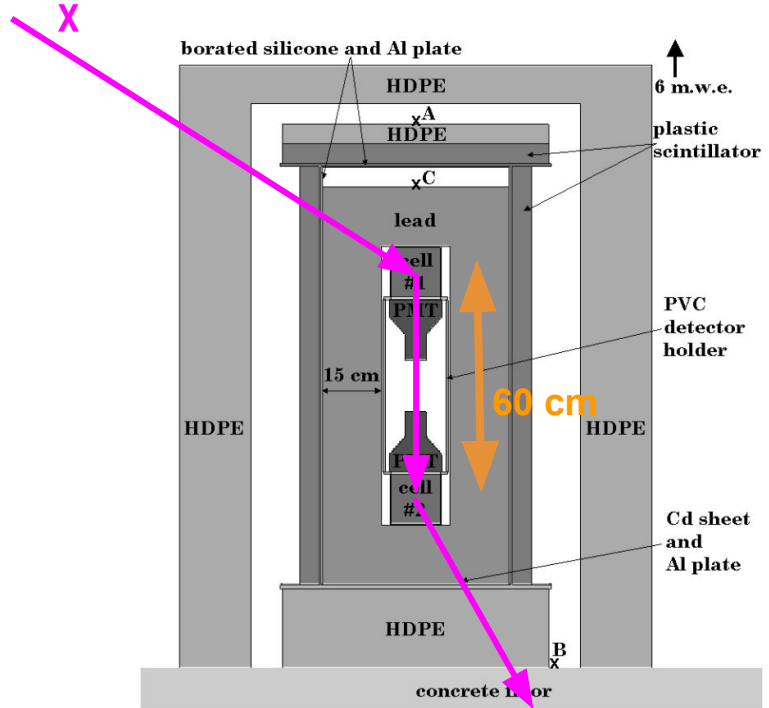
Original idea: DM is strongly interacting but light.

Underground detectors are blind -- need surface run

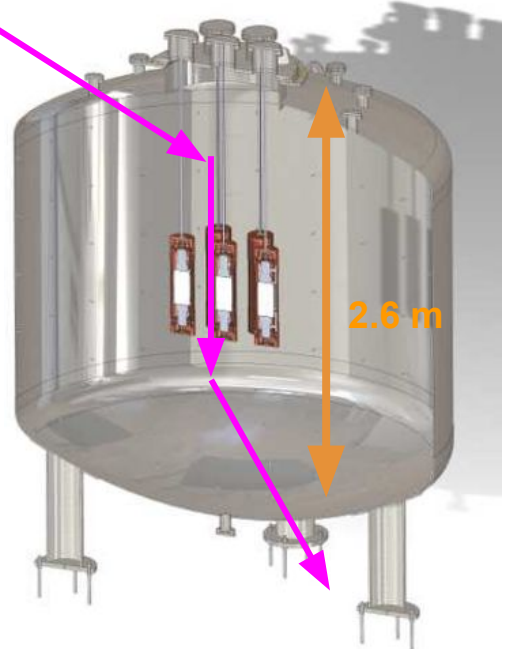
Collar (<https://arxiv.org/pdf/1805.02646.pdf>)



SABRE

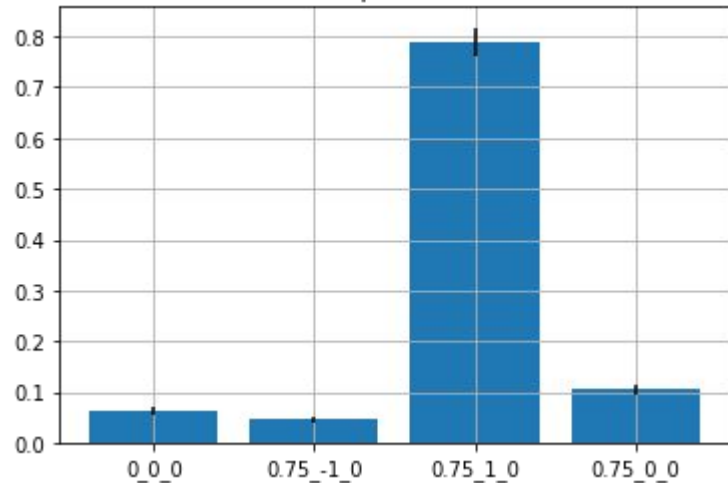


Needs position reconstruction at low energy



50 keV

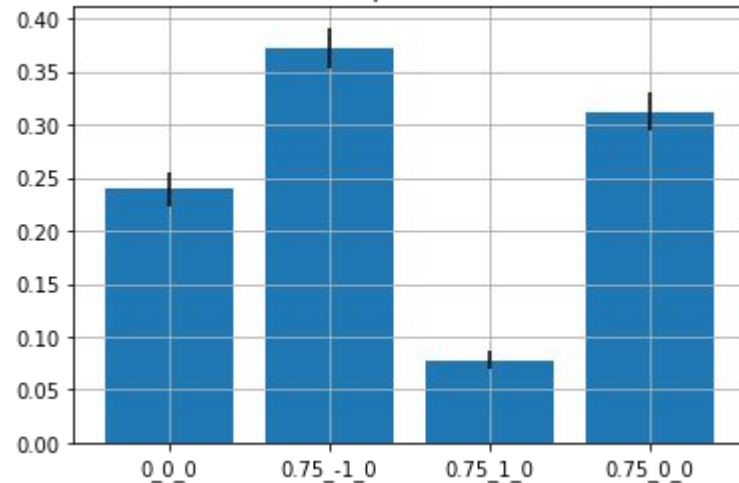
50 keV, True position: (0.75,1,0)



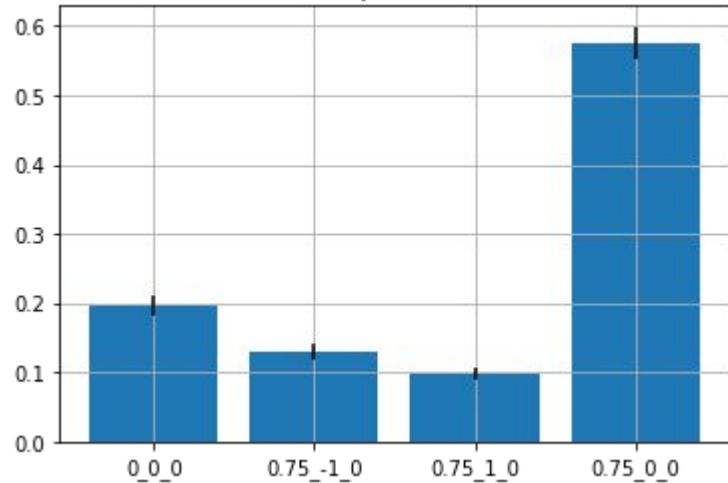
(0.75, 1, 0) m,
(0.75, -1, 0) m,
(0.75, 0, 0) m,
(0,0,0) m

Classify location of
single events via
likelihood.

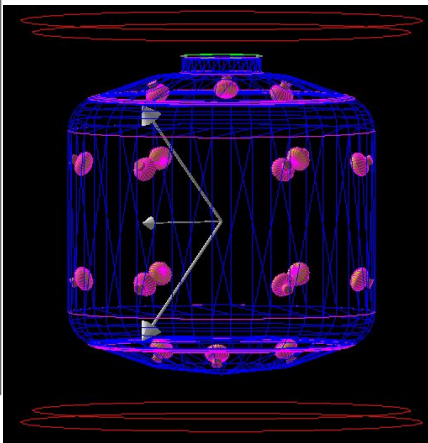
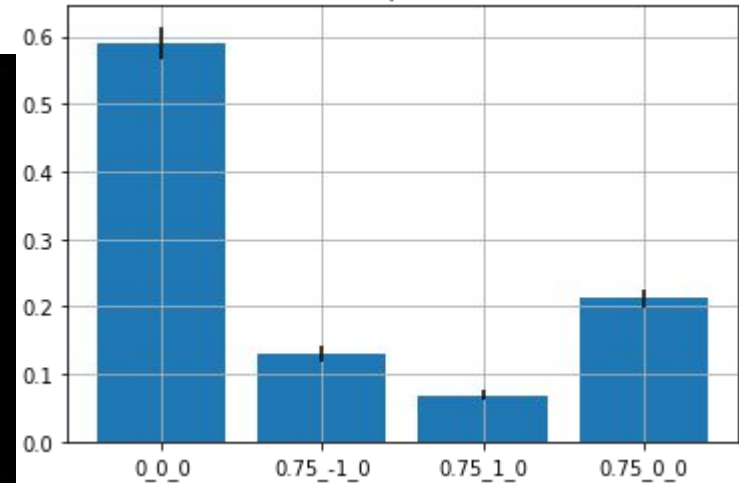
50 keV, True position: (0.75,-1,0)



50 keV, True position: (0.75,0,0)



50 keV, True position: (0,0,0)

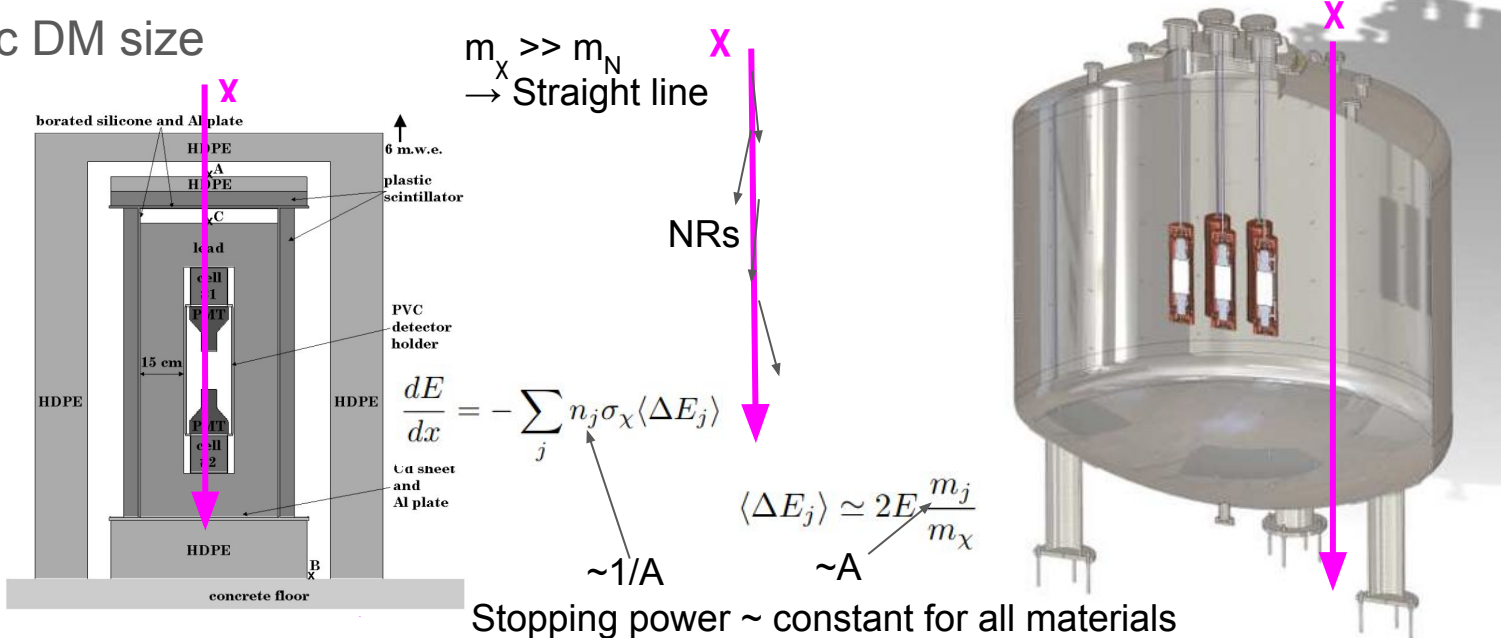


SIMP Composite DM search with the SABRE veto

(Not as) Big as a Barn: Upper Bounds on Dark Matter-Nucleus Cross Sections

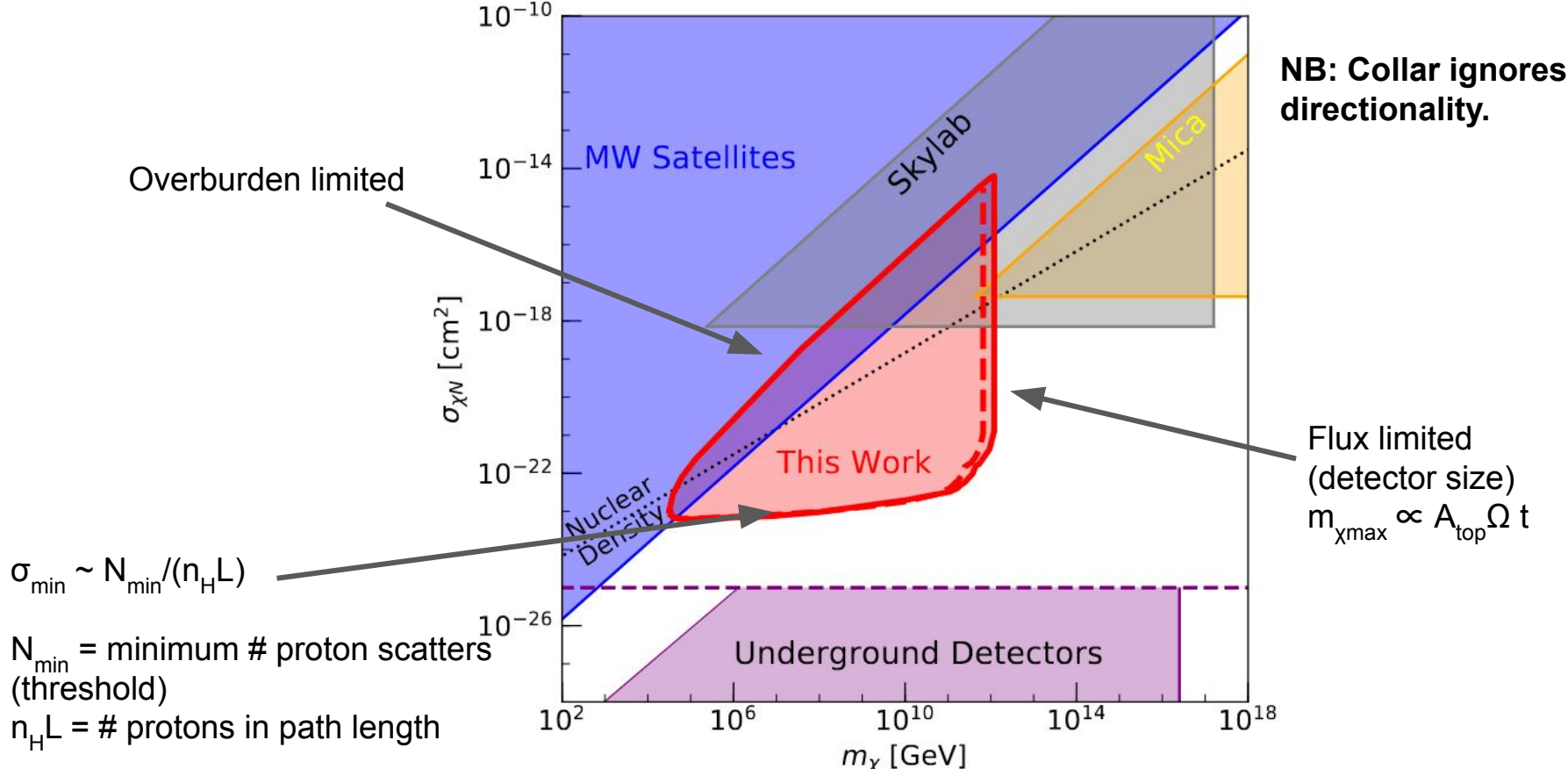
<https://arxiv.org/pdf/1907.10618.pdf> → point-like DM undergoing contact interactions can't have cross-sections > geometric nuclear size.

But, composite DM (with a finite geometric extent) can have large cross-sections.
 $\sigma \sim$ geometric DM size



Composite DM search with the SABRE veto

Collar <https://arxiv.org/pdf/2008.10646.pdf>

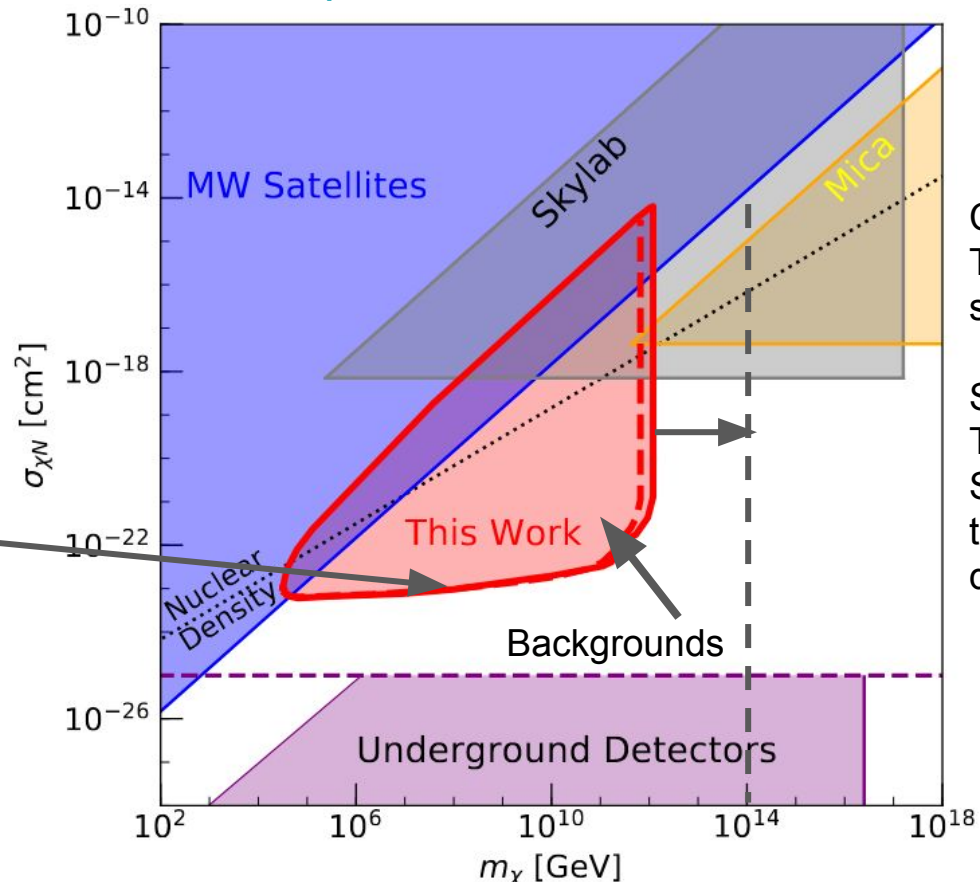


Composite DM search with the SABRE veto

Collar <https://arxiv.org/pdf/2008.10646.pdf>

Collar:
2*5" cells, L ~ 25 cm,
10 keVee threshold

SABRE veto:
L~2.5 m
→ need ~ 100 keVee
threshold to match limit
(feasible).



Collar:
Top area ~80 cm²,
solid angle penalty ~10⁻³

SABRE veto:
Top area ~ 5x10⁴ cm²
Solid angle → better
than Collar but harder to
quantify.

Composite DM search with the SABRE veto

Questions:

- Would an underground search (concurrent with SABRE) be possible?
 - What would we need to modify?
 - Trigger?
 - Calibration method?
- How feasible would it be for other detectors to carve out this parameter space?
 - Above-ground segmented LS → PROSPECT
 - Surface runs of other DM detectors?
 - Very large detectors with a decent threshold like Borexino?
- How does directionality change these limits?
- Does the daily modulation from being in the lee of the DM wind help?
- Alternatively, does the lowered flux by attenuation in the Earth hurt?
- How interesting is composite DM generally?