Dark matter experiment with CCD detectors

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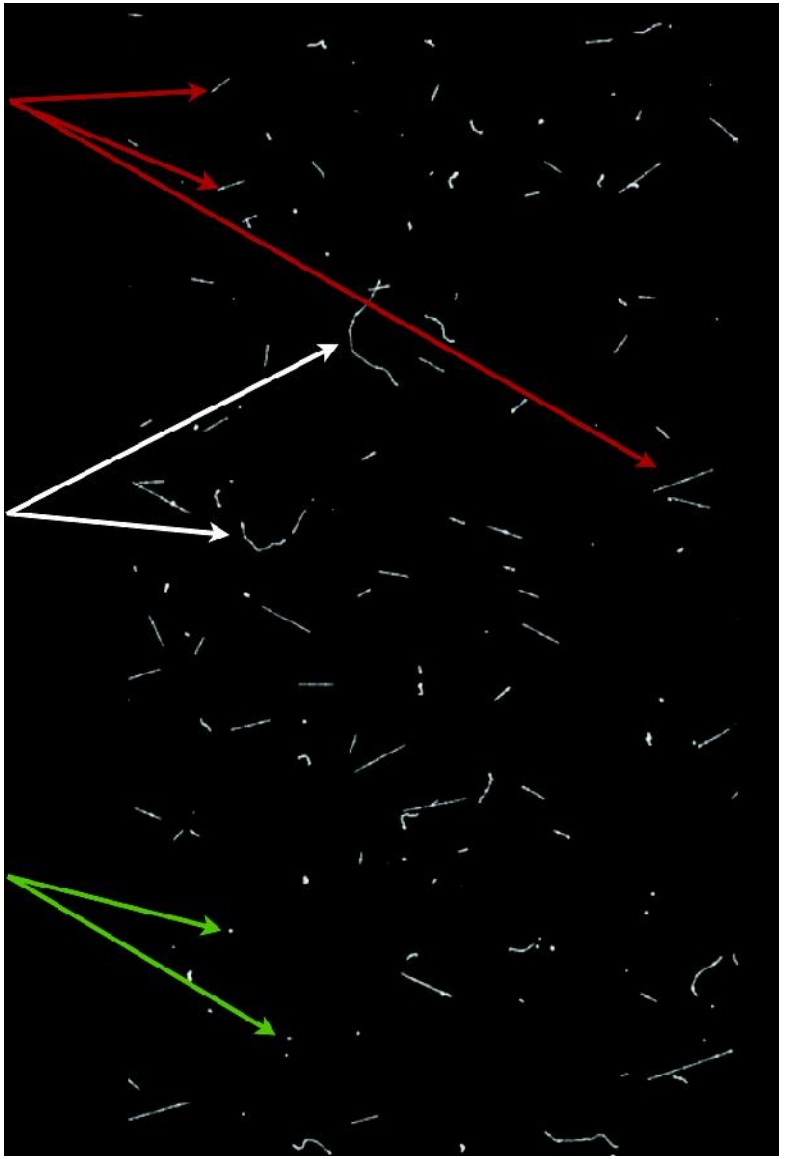
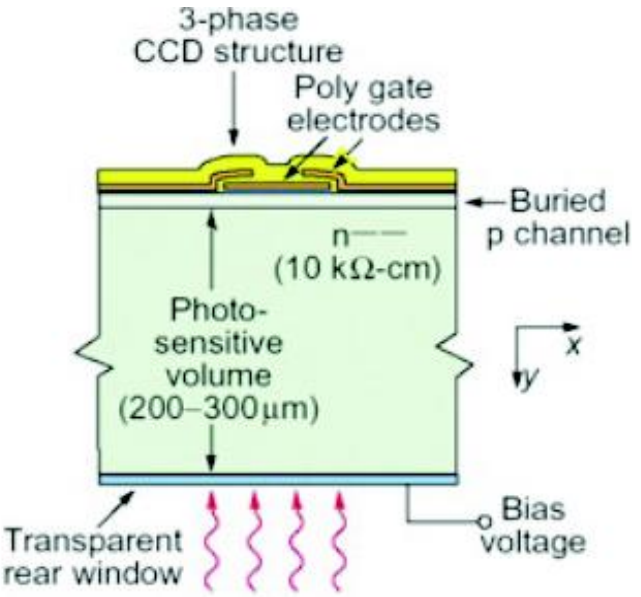
Radiation in CCD's

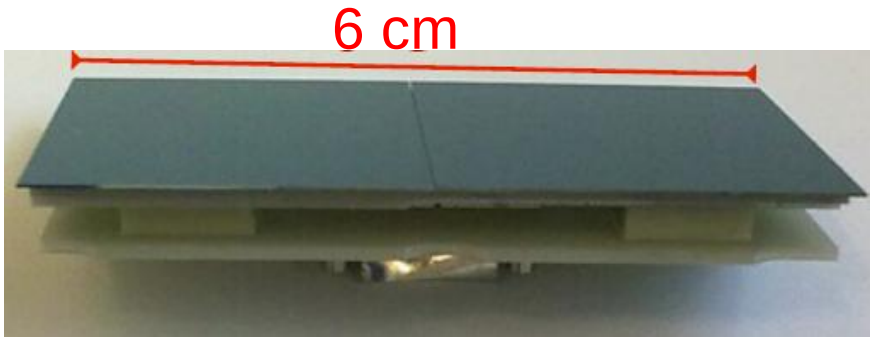
muons

electrons

nuclear recoils (diffusion limited)



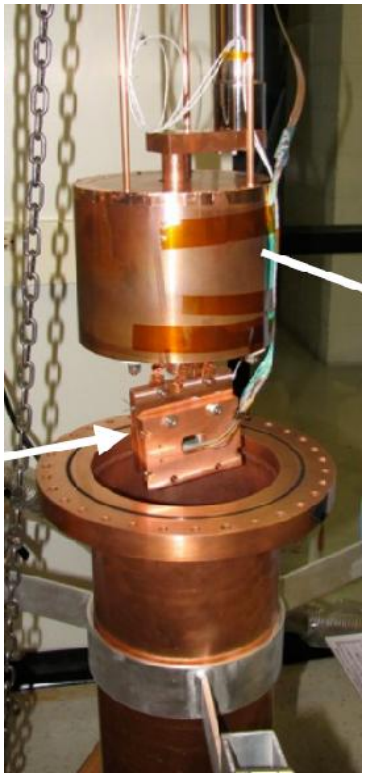




1 gram of Si per board

(see J. Molina's talk)

DAMIC at FNAL (T987)

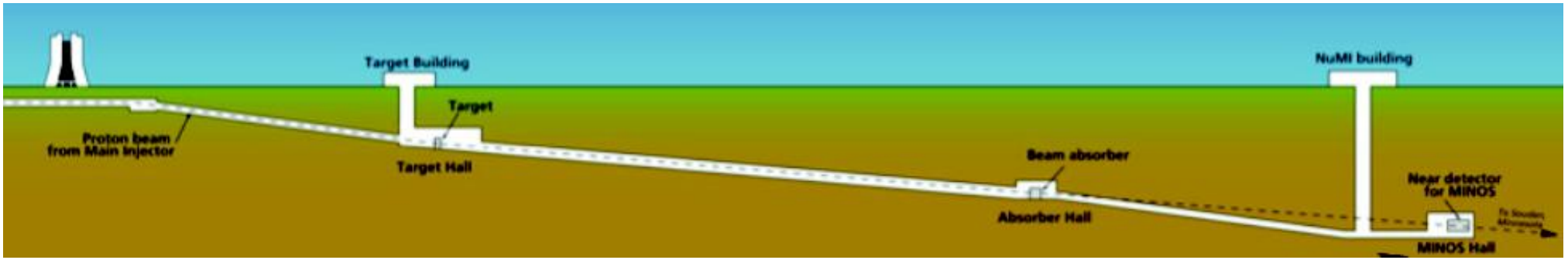


Ran test with 1 CCD in MINOS near detector hall in 2010 at a depth of ~107 m.

Obtained impressive limits for DM with 11 g-day and thr @0.04 keVee

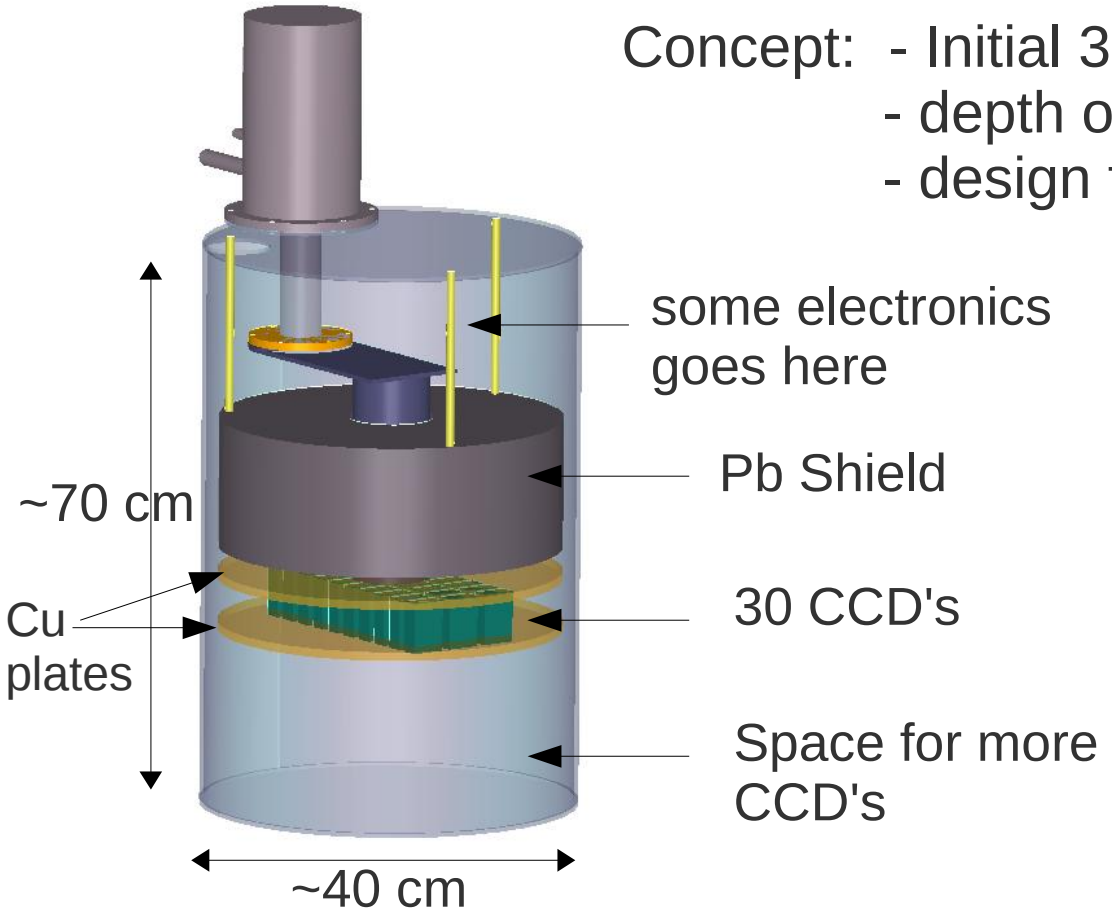
Group working on 8 g detector (and further extensions).

(For most recent developments see J. Molina's talk)



Beginning of a Mexican CCD detector

Group at ICN & Eng. Inst. at UNAM in Mexico City just started collaborating with FNAL DAMIC group for the design of a CCD detector.



Concept: - Initial 30 g of Si scalable to 100 g
- depth of 500 m or more inside a mine
- design follows DAMIC prototypes

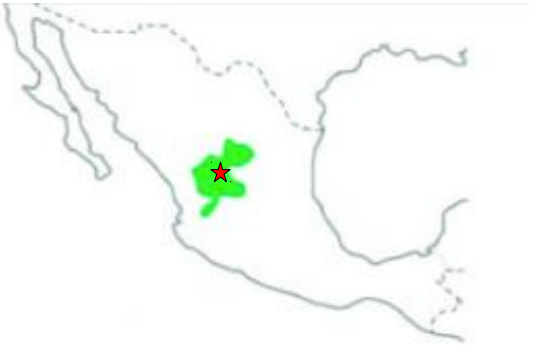
Exploring possible sites in Mexico for an underground location for a DM search and develop the technique.

Also planning to apply this technology to search for coherent scattering of neutrinos ($\nu+A \rightarrow \nu+A$) from a nuclear reactor.

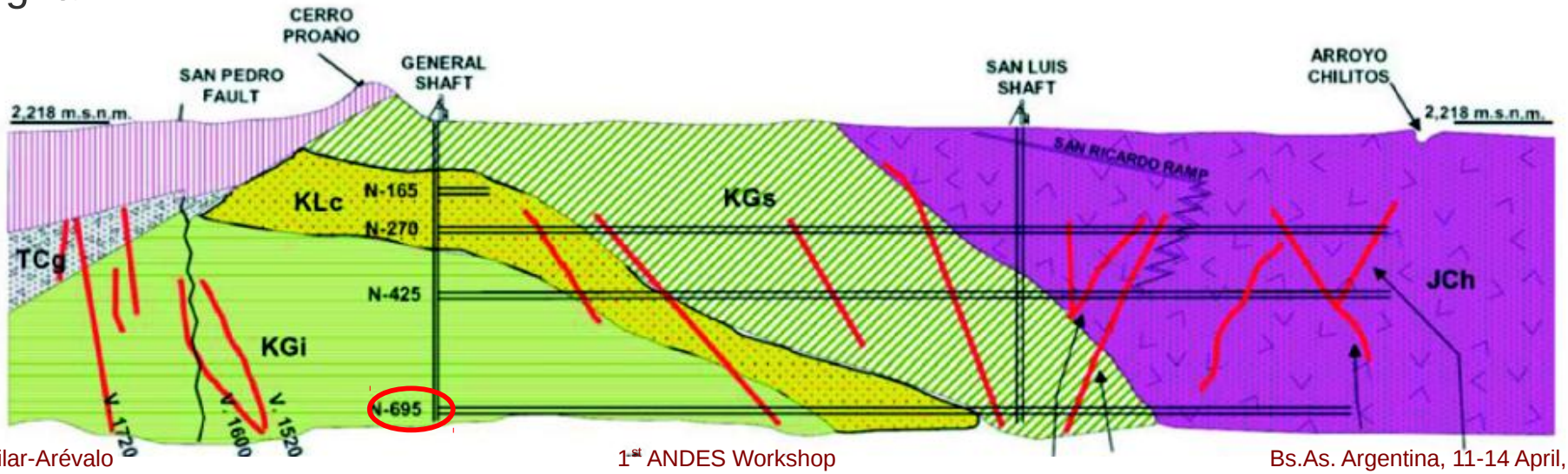
A very natural extension of this goals is to put a similar detector in ANDES

Possible site for a northern CCD DM-detector

- Have visited several mines in Mexico
- Best candidate: *Proaño* mine at Fresnillo Zacatecas (~2,200 m altitude).
- Level N-695 offers >1000 m.w.e. (ρ~2.2 gcm^{-2}) reasonable for a DM search with CCD detectors.
- Mining company (Peñoles) has expressed its interest in cooperating with the project.
- Planning characterization of the site this year.
- Still looking for other potential candidates



Northern (Mexico) and southern (ANDES) detectors can help in observing the annual modulation of a possible DM signal.



Another application for a CCD detector

- Coherent ν–A scattering predicted by the SM but not observed yet.
- Enhancement in $\sigma \sim A^2$ (A: mass #) Low nuclear recoil E → *Hard to detect*

Laguna Verde nuclear plant (Veracruz):

- 2 BWR-5 reactors
- 2 GW thermal power each
- Estimated ~100 coherent scat. evts per day in a 30 g CCD detector.

We are also planning to apply CCD technology to search for coherent scattering of neutrinos ($\bar{\nu}+A \rightarrow \bar{\nu}+A$) from a nuclear reactor.

At the same time we are working towards a nuclear safeguards project at this plant (UNAM-UMICH-UAS collaboration) based on Gd-doped plastic scintillators.