

Requirements for Underground Detectors (#area51)

Strategic Considerations

Goals and Context

To get high profile for underground detectors and their physics within Snowmass/P5, we have two challenges:

1. Convincing our colleagues
2. Convincing the funding agencies

These have different complexities....

Our Colleagues and Snowmass

- Most critical issue is just the *physics*
- Fortunately science done by underground detectors is very compelling
 - Direct detection of dark matter
 - Neutrinoless double beta decay
 - Nucleon decay
 - Neutrino oscillations and CP, mass hierarchy
 - Precision solar neutrino measurements and non-standard effects
 - Etc.

But viewed a different way...

Our Colleagues and Snowmass

But viewed a different way...

- “Underground detectors and science are totally boring”
 - They measure just “one number”
 - And just set a limit on that number anyway---can’t guarantee a discovery
 - Nothing happens in these detectors---trigger rates a Hz or lower
 - Technology is a big yawn---detectors are “big and dumb”
 - Too little information about signal even if there was one to learn anything
- “Underground detectors are too expensive relative to scientists involved”
 - LNBF+DUNE will be about ~\$2 M/physicist
- Not a lot of “moving parts” for university/post-doc/student involvement

Funding Agencies and Snowmass/P5

Being funded by multiple agencies/offices---
DOE/HEP, DOE/NP, NSF-EPP, NSF-PA, NSF-NP---
is a Bad Thing.

Each agency would like another one to deal with us.

Funding Agencies and Snowmass/P5

And agencies have different perspectives (“cartoon” version):

- DOE/HEP likes *technology* even if same physics can be done more simply
- DOE/NP likes *facilities* ---accelerators, colliders, multi-user instruments
- NSF like *sole ownership* of things but funding big projects can take a long time
- And NSF has a much broader mandate that just physics

So a “big tank of water” or even “liquid cryogen” used by a collaboration of 100 people and costing tens to hundreds of millions or more...doesn’t really excite any of them.

What to do?

- Of course, push the science
- Consider and push novel technical approaches and new “enabling technologies”
 - Particularly if they enable additional sensitivity
 - (But even if they don’t)
 - And even if they might cost more
- Consider multipurpose detectors with broad scientific reach
 - Mitigates the “one number problem”
 - Provides interesting signals even if the headline is a limit
 - Involves more people, mitigates the \$/physicist issue
 - Can re-use existing facilities/detectors in some cases
- Don’t shy away from complex facilities (veto counters, calibrations, purification plants, materials facilities, etc.)