Very Brief Considerations on TPC Design

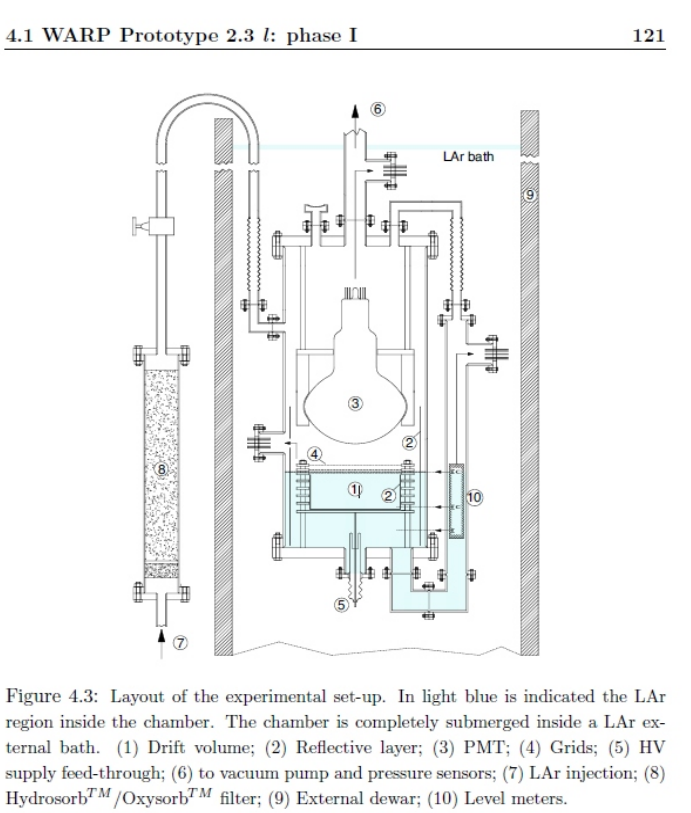
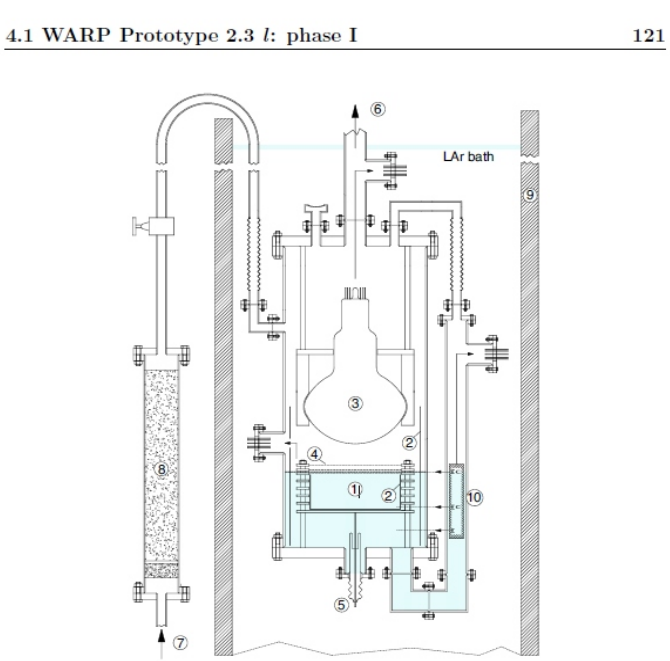


Figure 4.3: Layout of the experimental set-up. In light blue is indicated the LAr region inside the chamber. The chamber is completely submerged inside a LAr external bath. (1) Drift volume; (2) Reflective layer; (3) PMT; (4) Grids; (5) HV supply feed-through; (6) to vacuum pump and pressure sensors; (7) LAr injection; (8) Hydrosorb^{TM}/Oxysorb^{TM} filter; (9) External dewar; (10) Level meters.

- Not much in the way of literature available
- L. Grandi (WARP 2.3 liter) thesis is my main reference
- My apologies for perhaps superficial look at this problem

What Did WARP Do?



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- Cooled by immersion in open LAr bath
- No recirculation system
- No refrigeration system (just keep bath full)
- No level control- fill to line and let it sit
- IMHO, level control and recirculation are the most technically difficult parts of TPC design.

Implications for SCENE

- WARP 2.3 ran for months, much longer than anticipated SCENE beam exposure
- However it was VERY simple
- Was able to see underground neutrons w/o shielding, and then to set a dark matter limit (-ish)

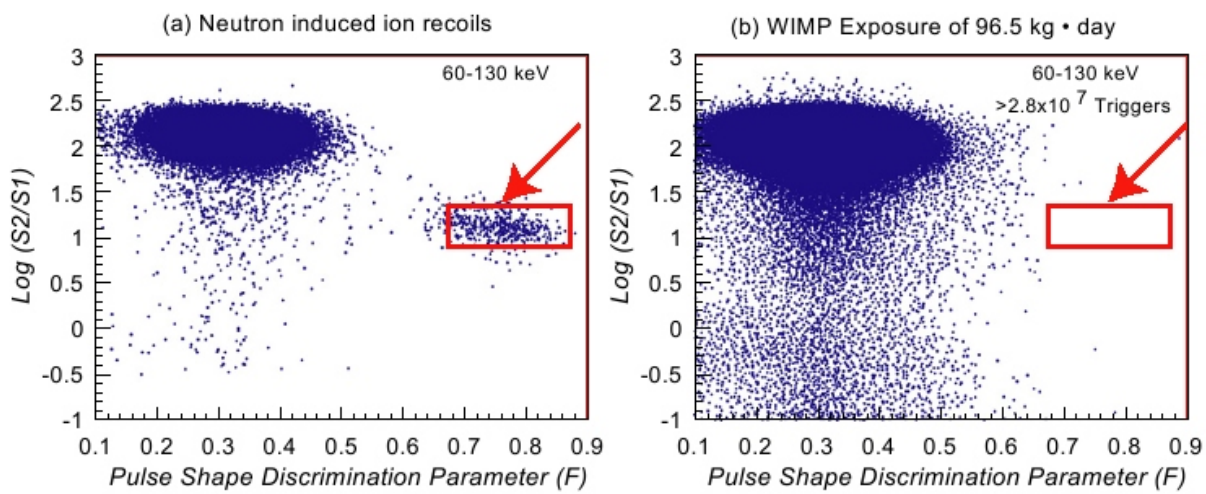


Fig. 7. Same distributions as in Fig. 6 but in the energy interval 60–130 keV.

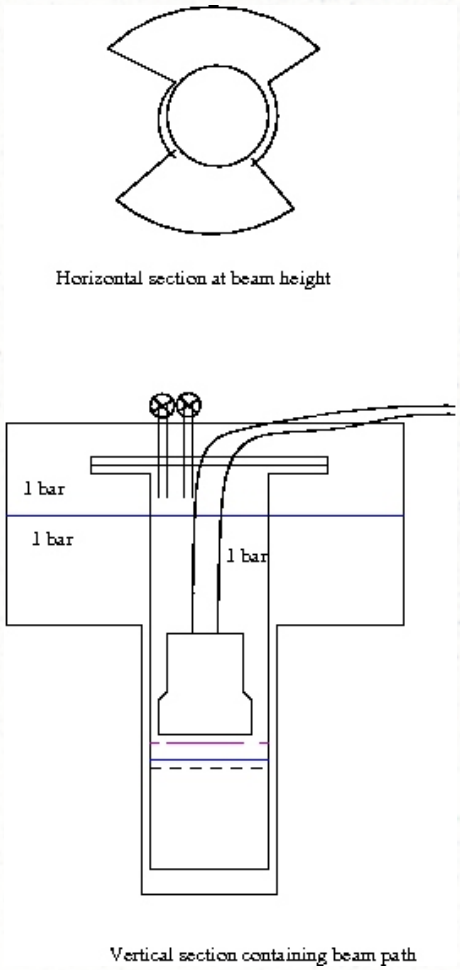
Thoughts on SCENE Design in View of WARP 2.3 I

- We should consider the open cryostat, sealed operation mode of operation
- Brings dramatic reduction in amount of engineering/fabrication work to realize the experiment
- Brings dramatic reduction in complexity of operation, which is a big factor in a short-term beam test

Disadvantages?

- Extra LAr outside active volume?
  - This is shared with our default design. A cut-out external reservoir or re-entrant entrance and exit windows could be designed to mitigate this.
- Purity penalty?
  - May not exist. For example, FNAL setup uses internal filters intermittently and stays extremely pure. Use a simple, bakeable design and we could easily get away with it.
  - Depends on goals of experiment. It will in any case be difficult to measure lifetimes better than ~100-200 uS with <~5cm drift
- I can't think of any others, maybe you can...

Possible Starting Point



Outer LAr bucket has to be double-wall or super-insulated, not shown as such

Thickness of inactive LAr traversed by beam is minimized

Passive cooling, ssealed operation.