T962: Purity and TPC

PPD Review

http://t962.fnal.gov

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Introduction

T962 will have brand new purity system and TPC.

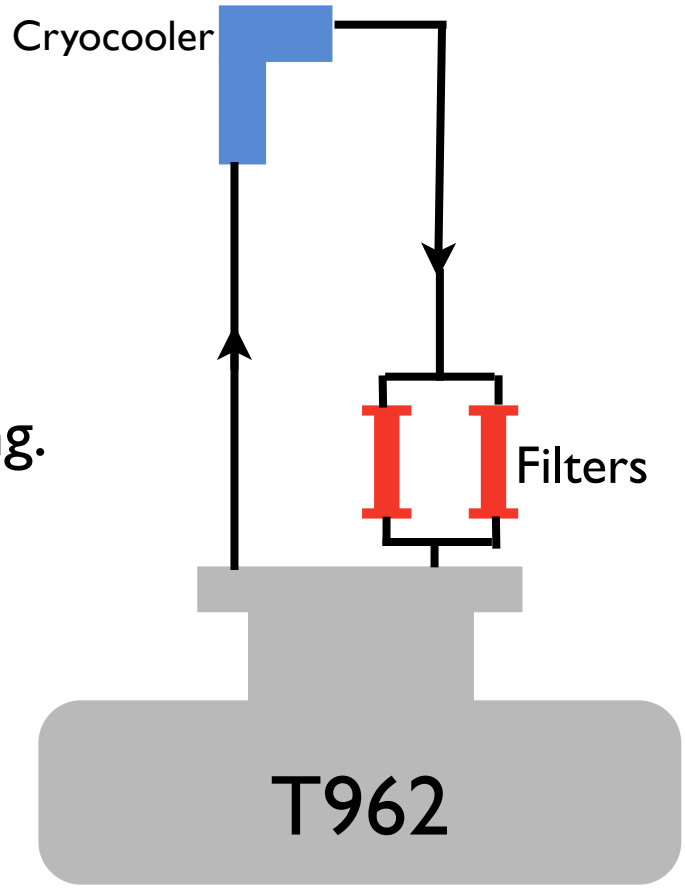
This talk:

- Purity
  - Filters - How we get pure argon.
  - Monitor - How we measure the argon purity.
- TPC - Rectangular box (.5m x .5m x 1.0m), with ~470 channels of readout.

Filters and Recirculation

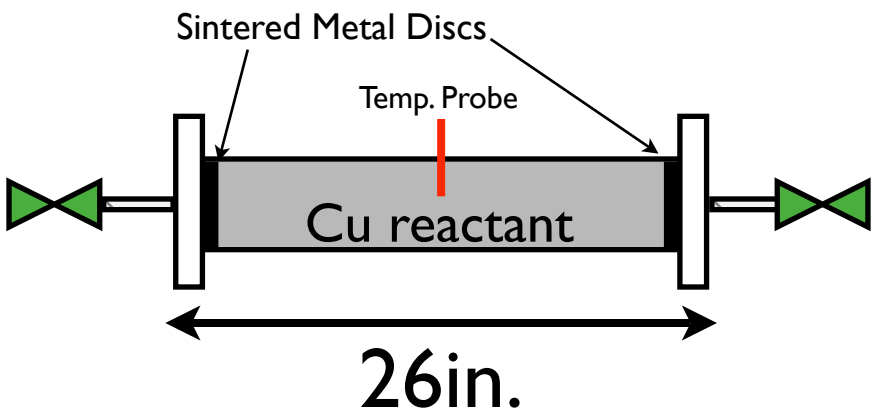
- Argon flows through oxygen absorbing filters before entering tank.
- Making 3 new filters for T962.
- Keep two filters down in hall...flow through only one.
- Have been able to drive liquid through with 2 p.s.i. pressure.
- Lots of experience at Yale/Fermilab successfully using these filters.

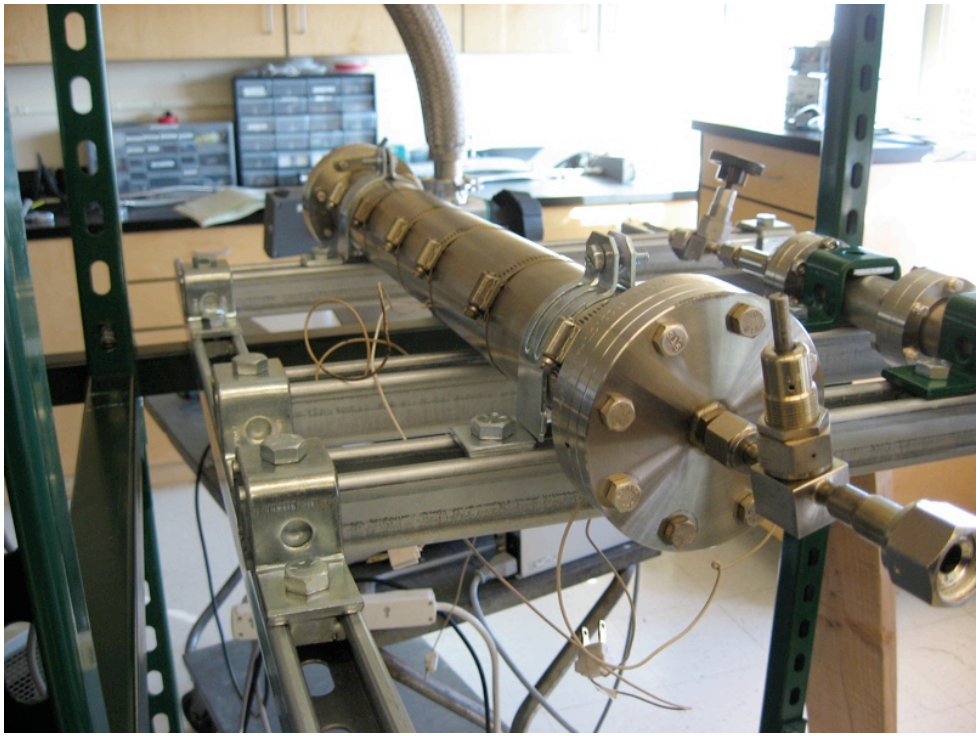
- 300W cryocooler more than enough for estimated 50W heat load.
- Big cryocooler allows us to fill without venting.
- Complete volume exchange every 4 days.



Purity: Filter Details

- Filter filled with Engelhard reactant (i.e. - Copper granules)
- Sintered metal disks on end flanges add further filtering power.
- Temperature probe useful during regeneration.
- Already have ordered/received most parts for filters.

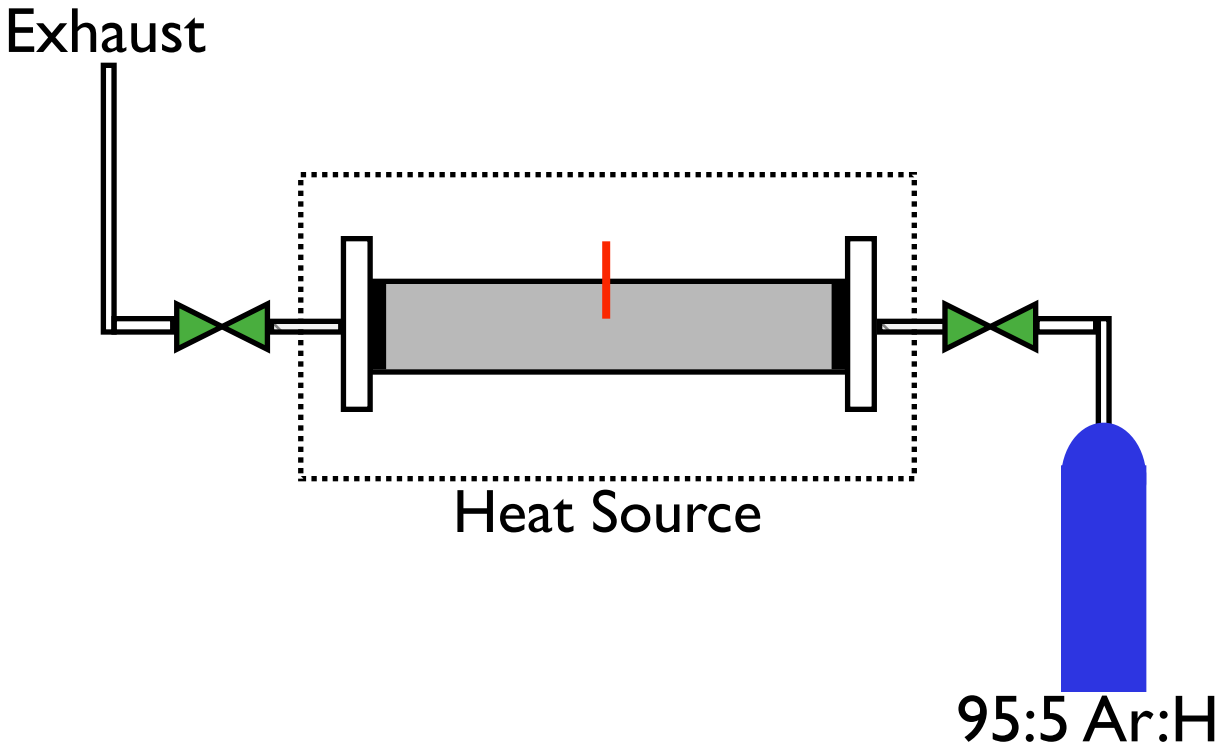




Filter at Yale

Purity: Filter Regeneration

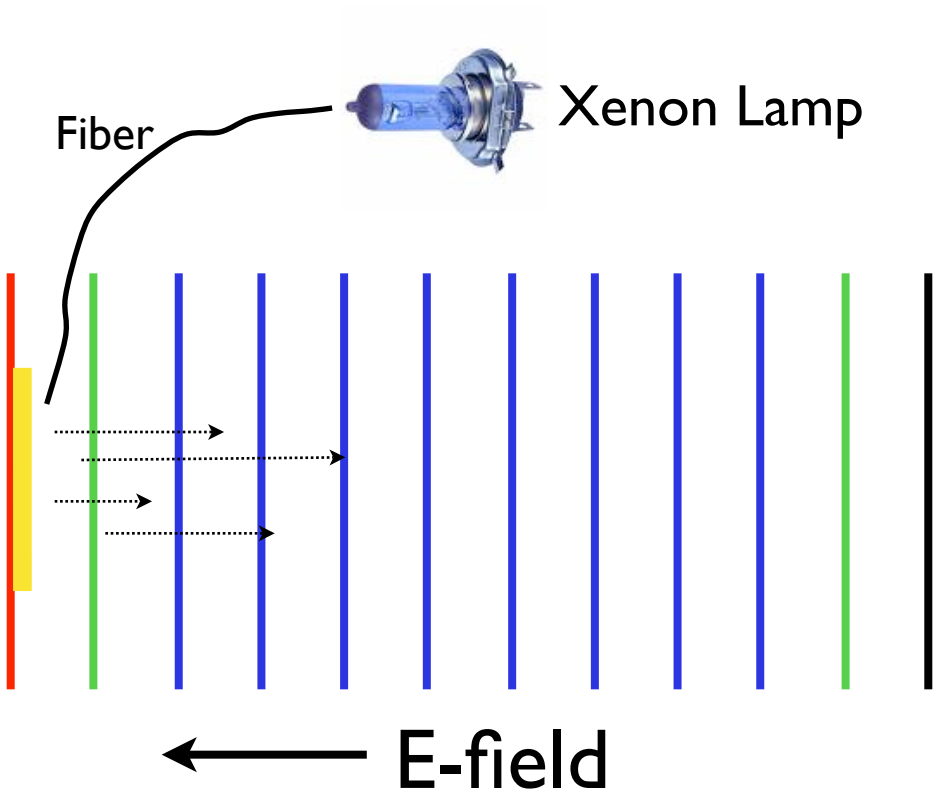
- Over time Engelhard reactant becomes saturated.
- Regenerate by flowing Ar:H (95:5) gas through heated filter (~250°C).
- Flow 500 volumes over 2 hours.
- Procedure has worked successfully many times at Yale/FNAL.
- FNAL already has station set up for regenerating.

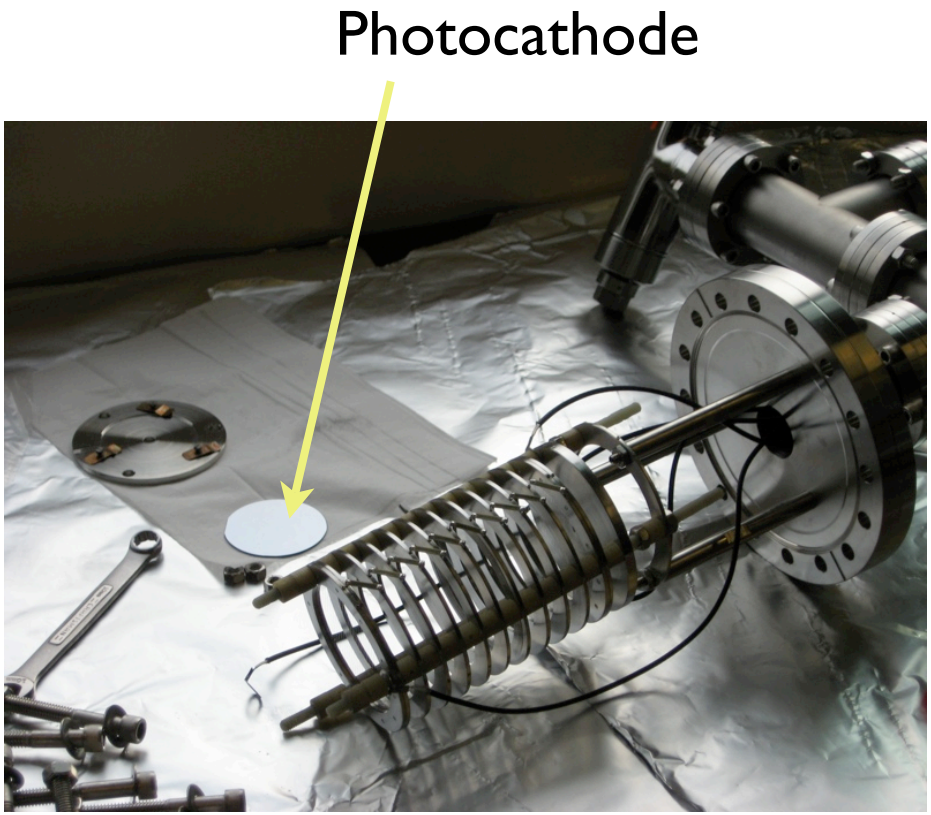


Yale Filter Regeneration

Purity: ICARUS-style Monitor

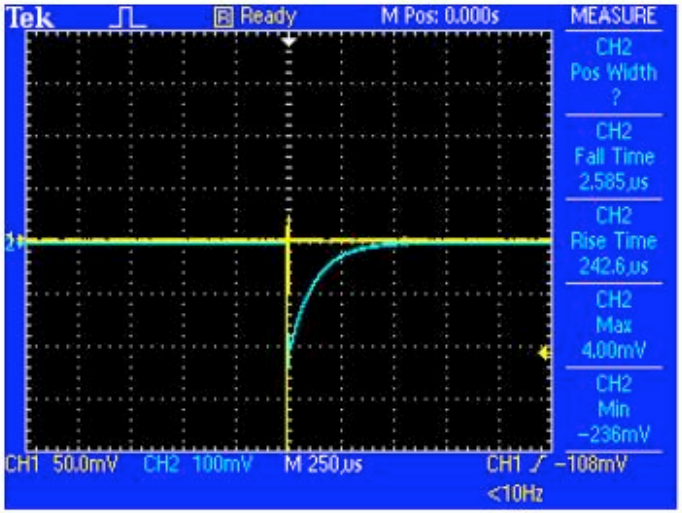
- Purity Monitor measures pulses of electrons entering/exiting a drift field.
- Light directed onto photocathode, ejecting photoelectrons into monitor.
- Drift field is ~200V/cm (adjustable).
- Drift length is ~14cm.



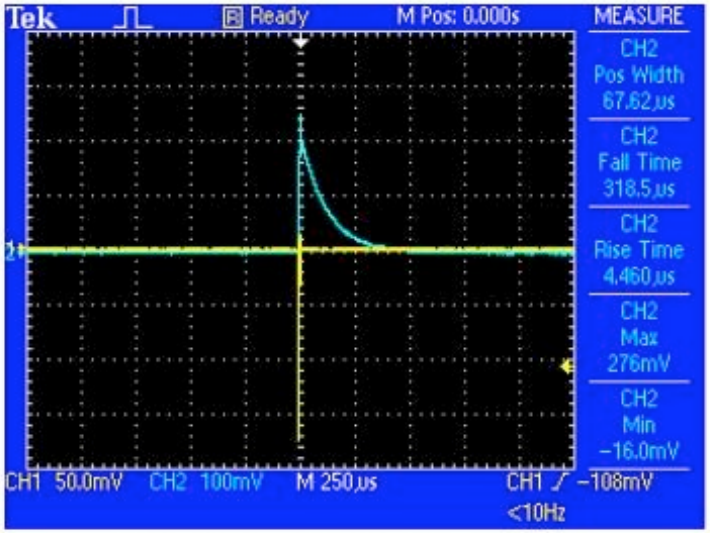


Purity Monitor at Yale

Purity Monitor: Signals

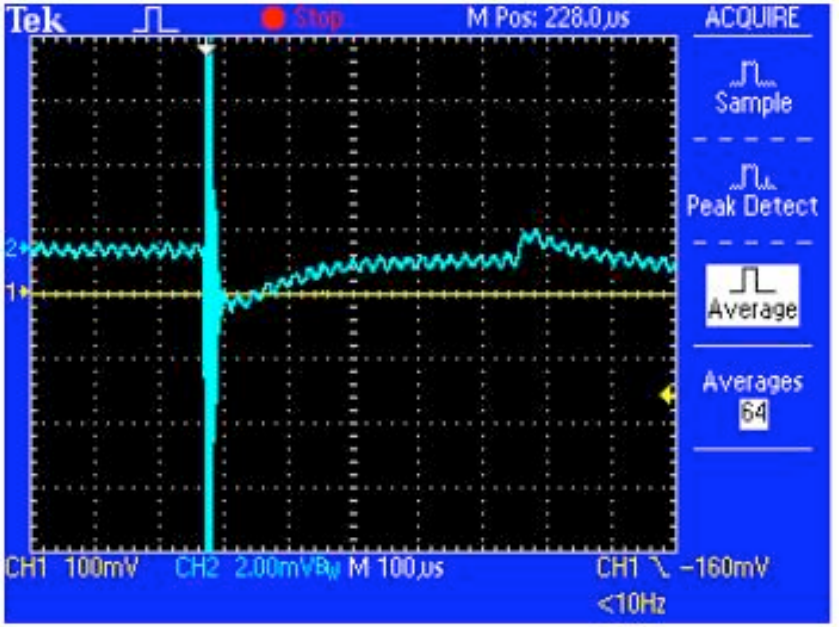


Cathode Signal in Vacuum



Anode Signal in Vacuum

Electron lifetime in LAr can be determined from pulses observed on cathode and anode



Cathode+Anode Signal in LAr

$$\tau_e = \frac{-t_{\mathrm{drift}}}{\ln(\frac{Q_A}{Q_C})}$$

Purity Monitor: Details

- Might use existing purity monitor from Yale, but also plan to build one with smaller diameter (due to space issues) this summer.
- Oriel flashlamp system ordered.
- Mainframe from PREP to supply/monitor voltages to purity monitor.
- Setting up small recirculation system this summer at PAB to commission lamp/purity-monitor/slow-controls before arrival of the T962 tank.

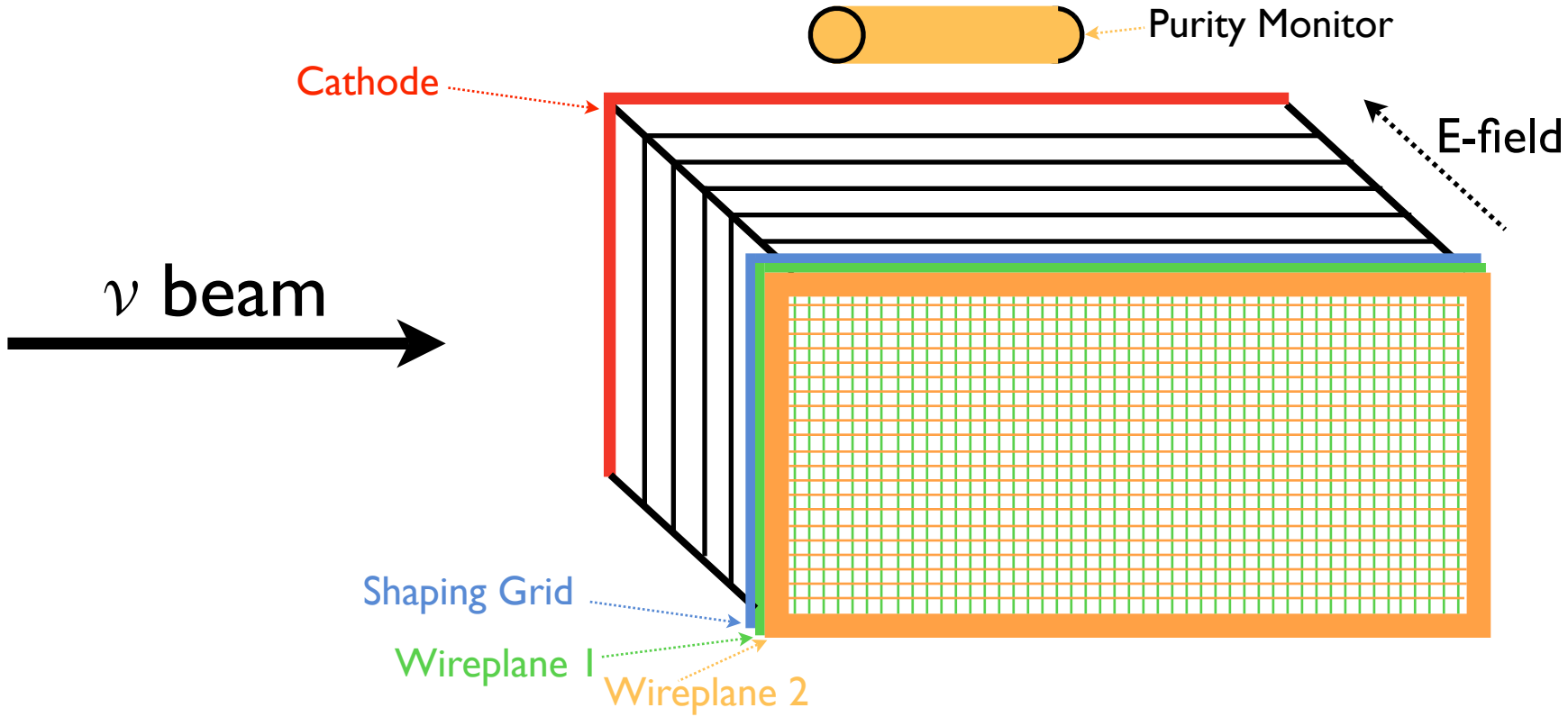
Oriel Flashlamp system

LeCroy HV Mainframe

T962 Monitoring

- Will have the ability to monitor pressures/liquid-levels/voltages/ etc... from above ground.
- Plan to store monitoring information in database.
- Plan to be able to remotely control all voltages.
- No shifts will be required during normal operation!

TPC Parameters

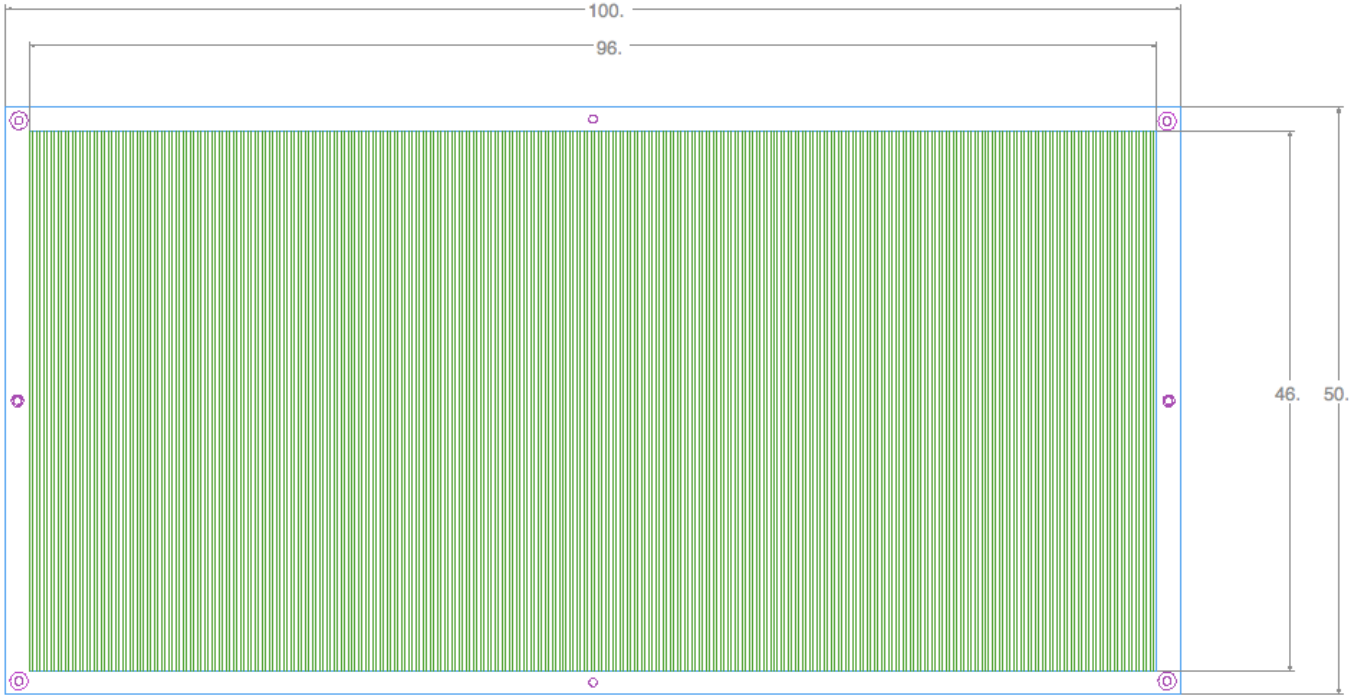


Wireplanes	2 +1 field shaping grid.
Number of Wires	Collection - 320 (46cm): Induction - 153 (96cm)
Wire Pitch	3mm
Wireplane Spacing	5mm
Operating Voltage	25kV (~500V/cm)
Field Cage Material	Copper Clad G10

TPC Construction

- Jim Schellpfeffer at Lab8 will prepare all the G10 pieces for us.
- Lab8 has experience/equipment for doing precision routing of G10
- Unknowns:
  - How to mount TPC inside vessel,
  - How much G10 material needed to support stress of all wires.
- Plan to begin TPC tests/construction in June.
- Test wireplanes by cold shock.

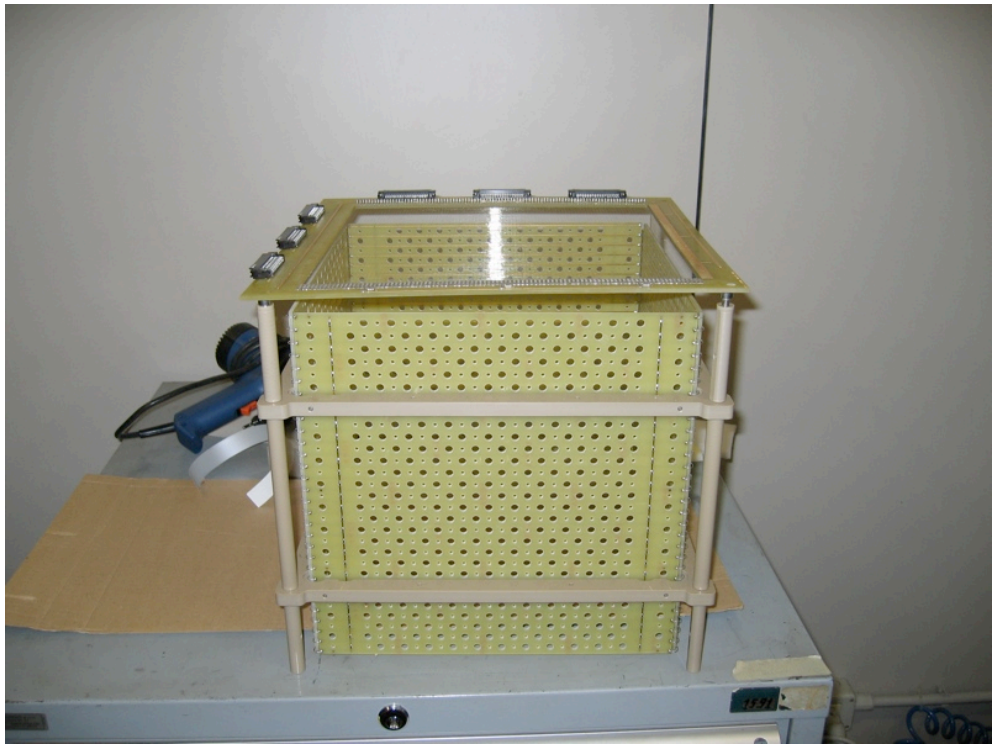
Wireplane with 320 0.46m long wires.

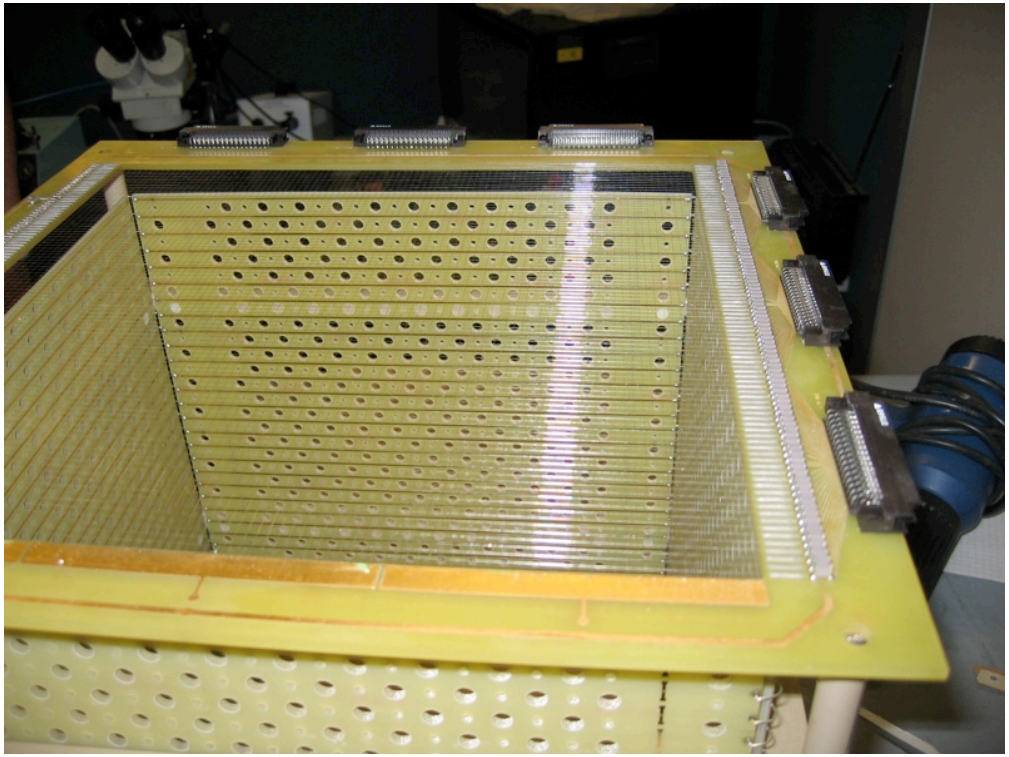


Wire Tension: ~1lb/ft →
>450 lb frame.

TPC Design

- Example TPC (Italy)
- Perforated field box to allow flow.





Backup Slides

Purity Monitor Feedthroughs

SHV Feedthrough for Purity Monitor HV

Fiber feedthrough... uses Indium to seal.