Fermilab Work for Liquid Argon TPC:

started in 2005 (A. Para); technology transfer from ICARUS

aimed at Large Detectors for Long Baseline Neutrino Physics

technical issues: argon purity (without evacuation)

electronics (large capacitance detector)

TPC design (large area)

light collection

DAQ, reconstruction, analysis

cosmic background (surface detector)

Liquid Argon TPC Overview for NuSAG

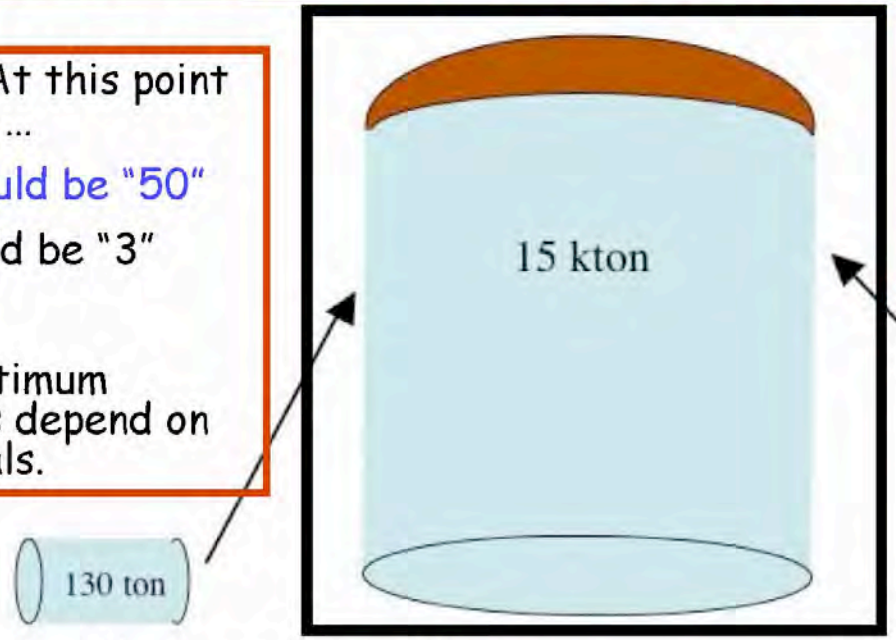
Note: At this point in time ...

"15" could be "50"

"1" could be "3"

etc

The optimum choices depend on the goals.



Submitted to NuSAG by the LArTPC group

Summer 2005

The "LArTPC group" is Fermilab plus 6 universities

Physics Development *using* ***existing*** *technology*
Record **complete neutrino interactions**: (ν_e & ν_μ)
Establish **Physics Collaboration**
Develop **Event Identification**,
Develop **Reconstruction**,
Develop **Analysis**,
Establish successful **Technology transfer**

Engineering Development:
Construction of Tank
Argon Purity
Mechanical Integrity of TPC
Readout S/N
Microphonics due to Argon Flow

Technical Setups

Purity Monitor Development	Materials Tests	5 m Drift Demonstration	Long Wires Tests	Electronics Development

May 17, 2006 DOE Annual Program Review David Finley, Fermilab Slide 8

FNAL, Michigan State, Princeton, Tufts, UCLA, Yale, York (Ca)

Argon Purity

1) achieving purity (long electron drift times)

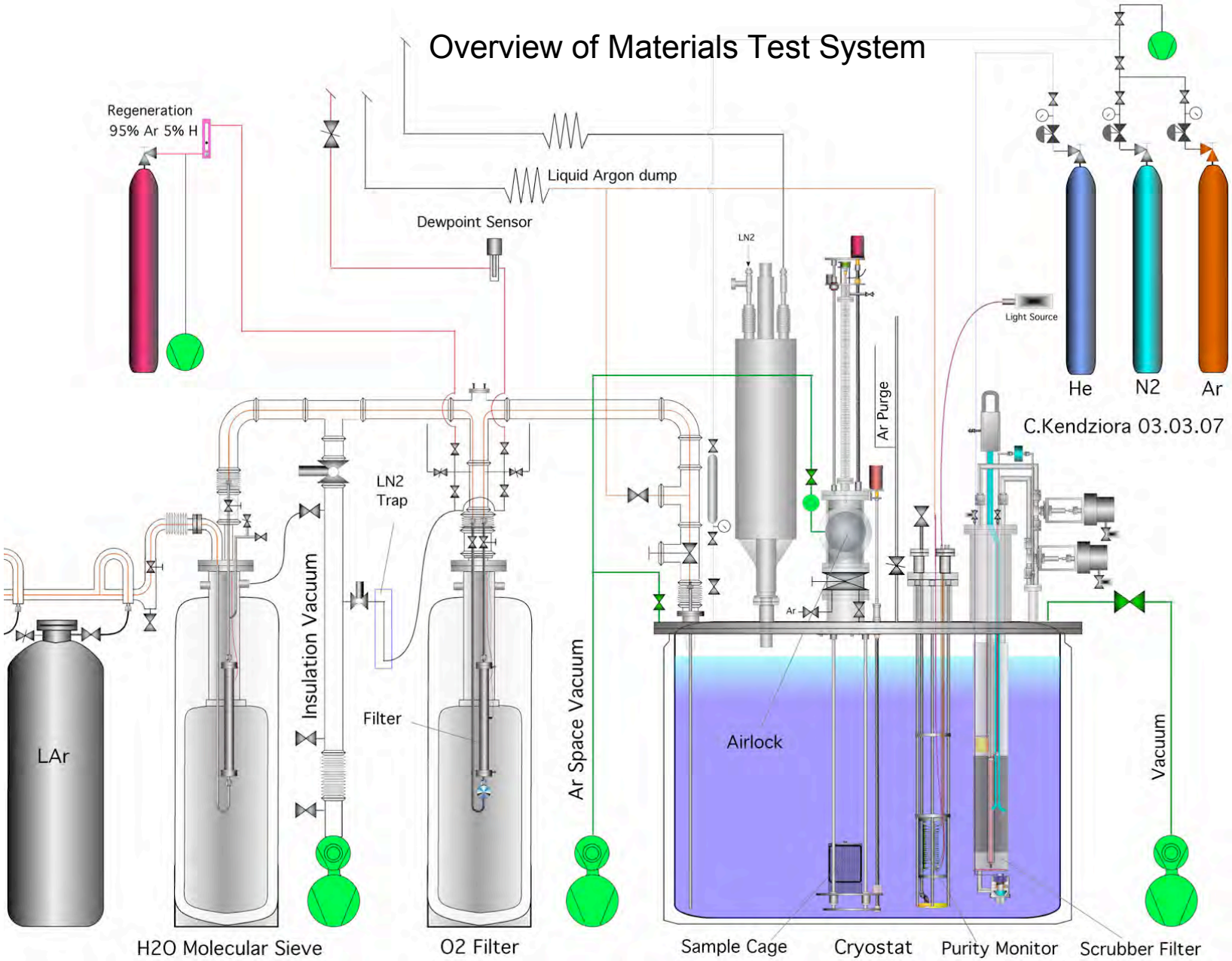
2) measuring purity (oxygen, nitrogen)

3) avoiding contamination by detector materials

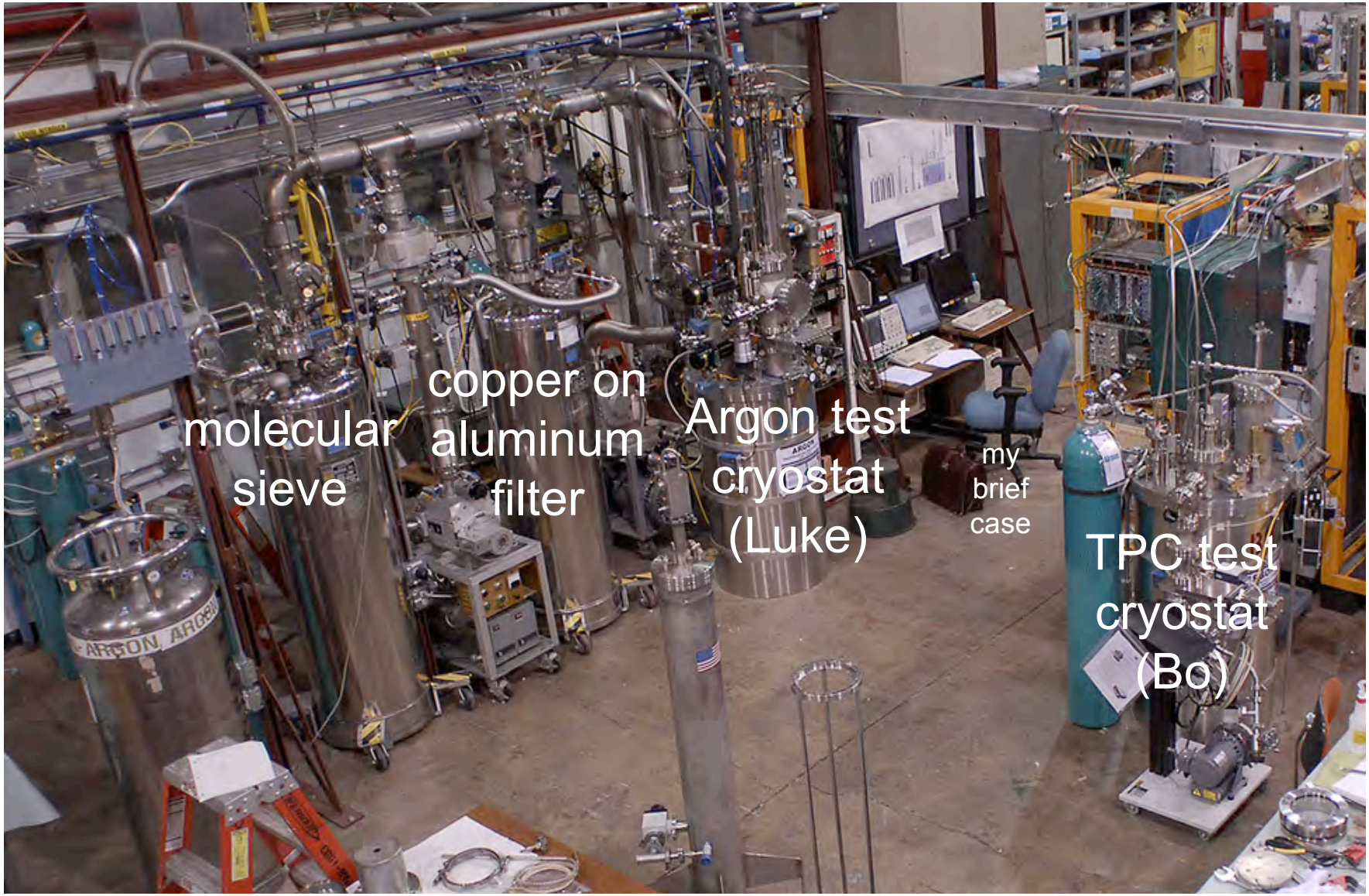
1) home-made, single-pass filtration system (buy supplies)
molecular sieve (water)
copper on aluminum (oxygen)
-> *(are regenerated in place)*

(1 ppb Oxygen (equivalent) => 300 μsec lifetime (need x 20))

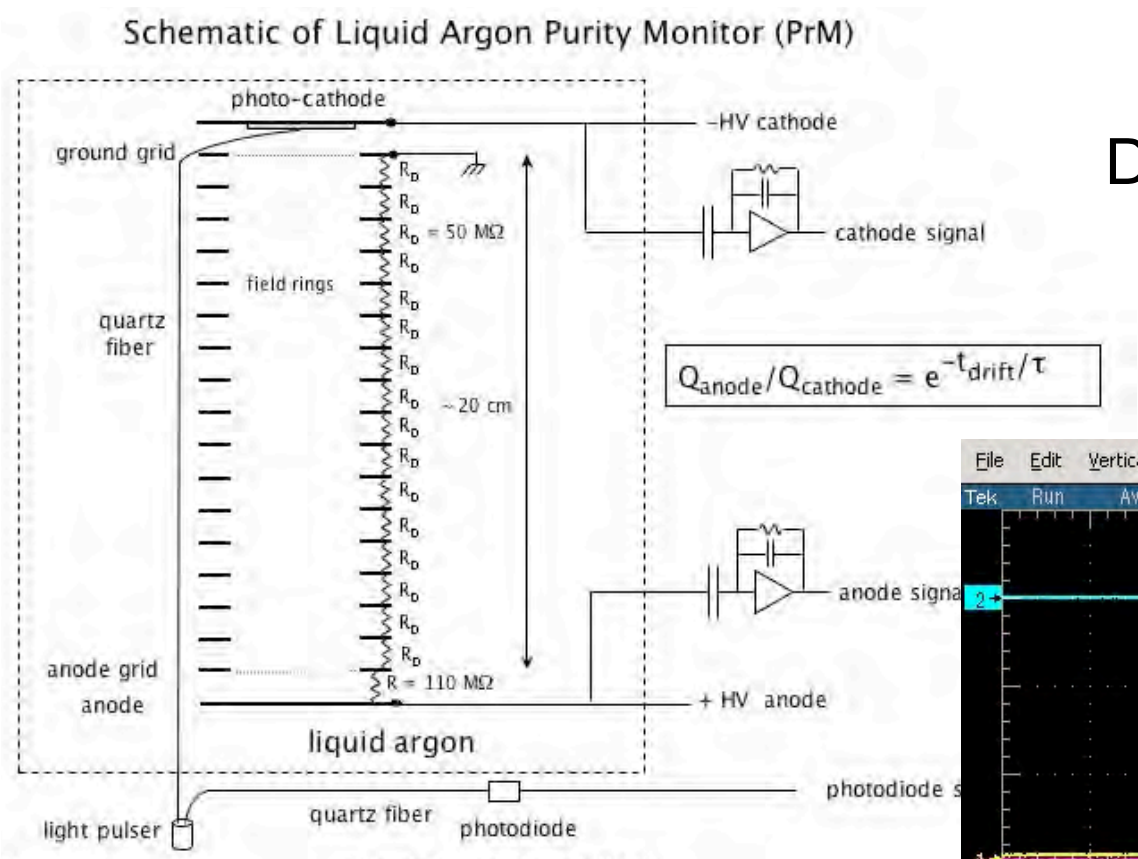
Overview of Materials Test System

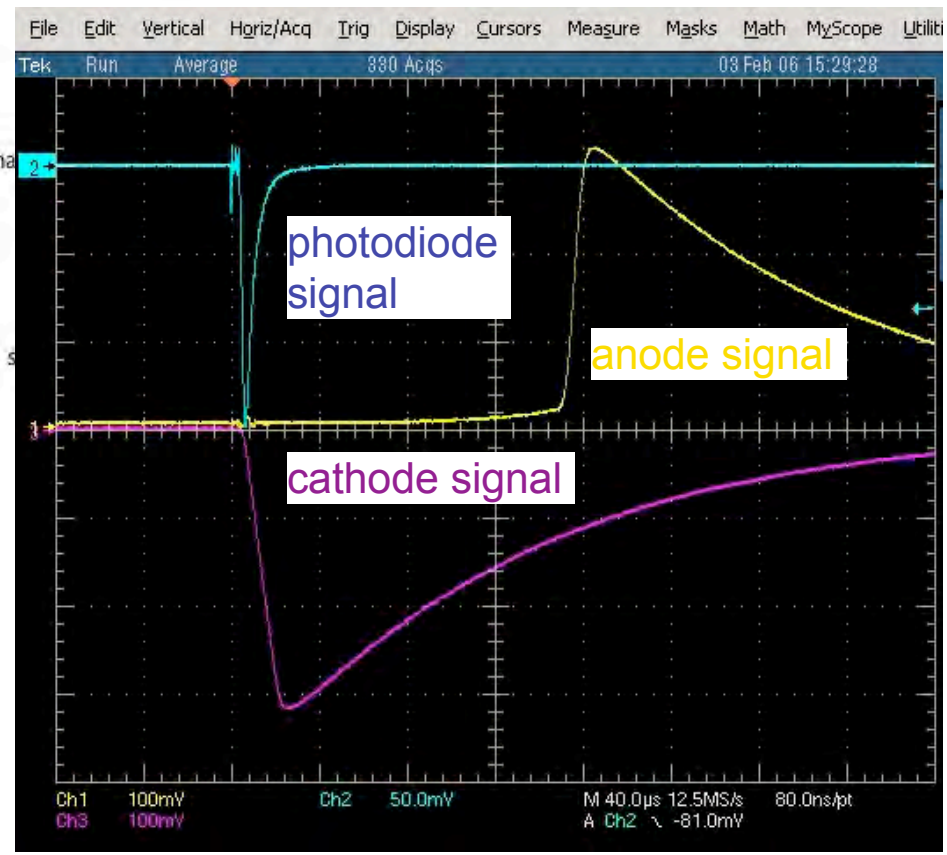


Setup at the Proton Assembly Building (PAB)



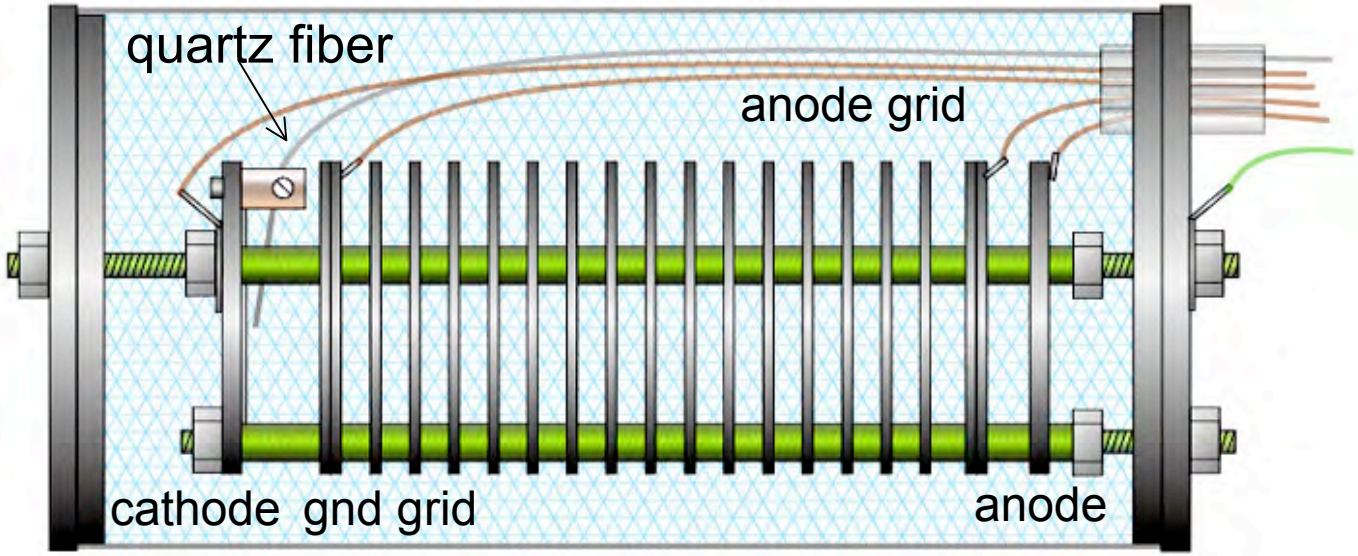
Drift lifetime Measurement

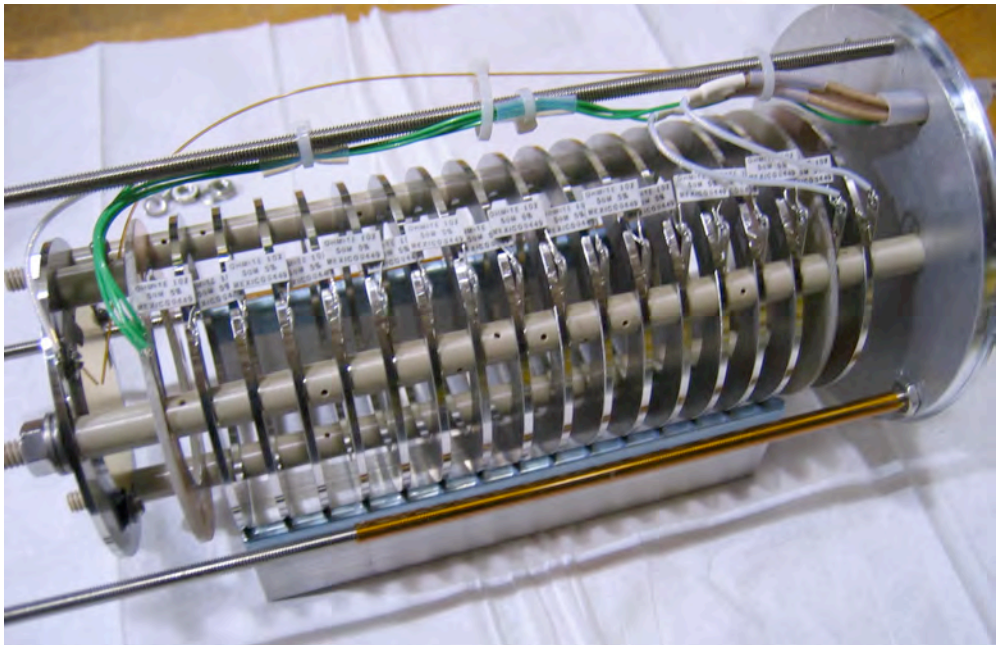




based largely on
G. Carugno, NIM A 292 (1990)

PrM drawing



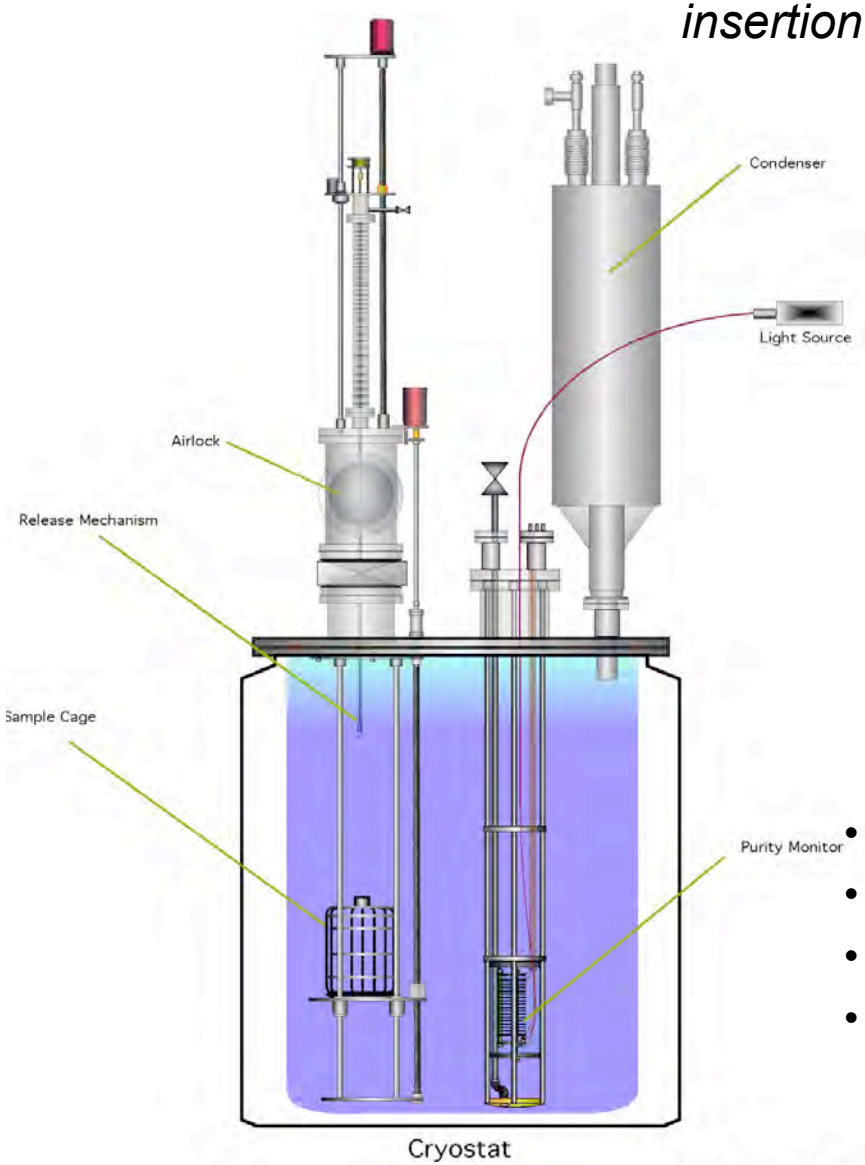


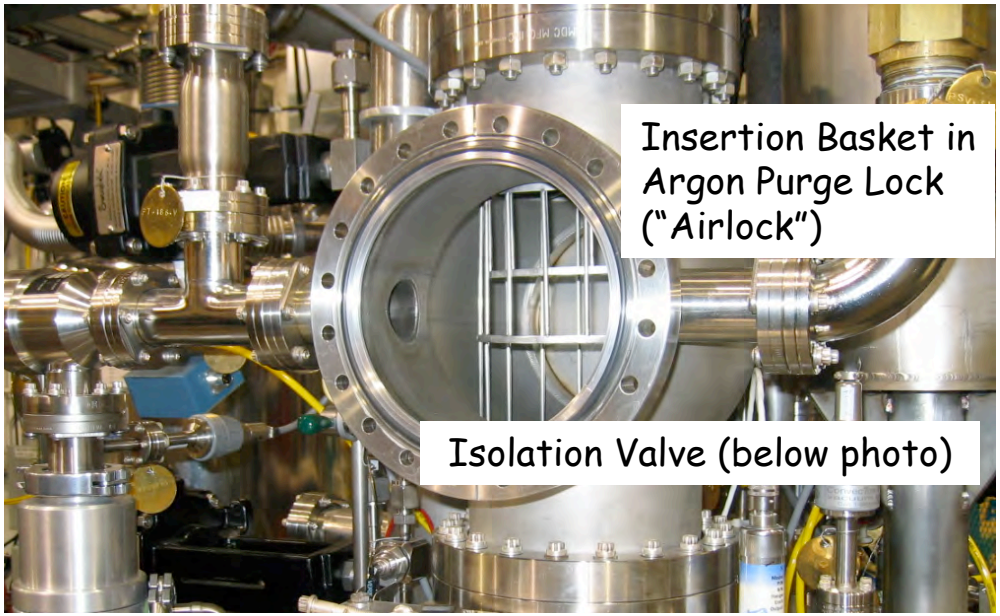
C.Kendziora2/3.05

PrM photograph

The Materials Test Station

insertion of materials without exposure to vacuum

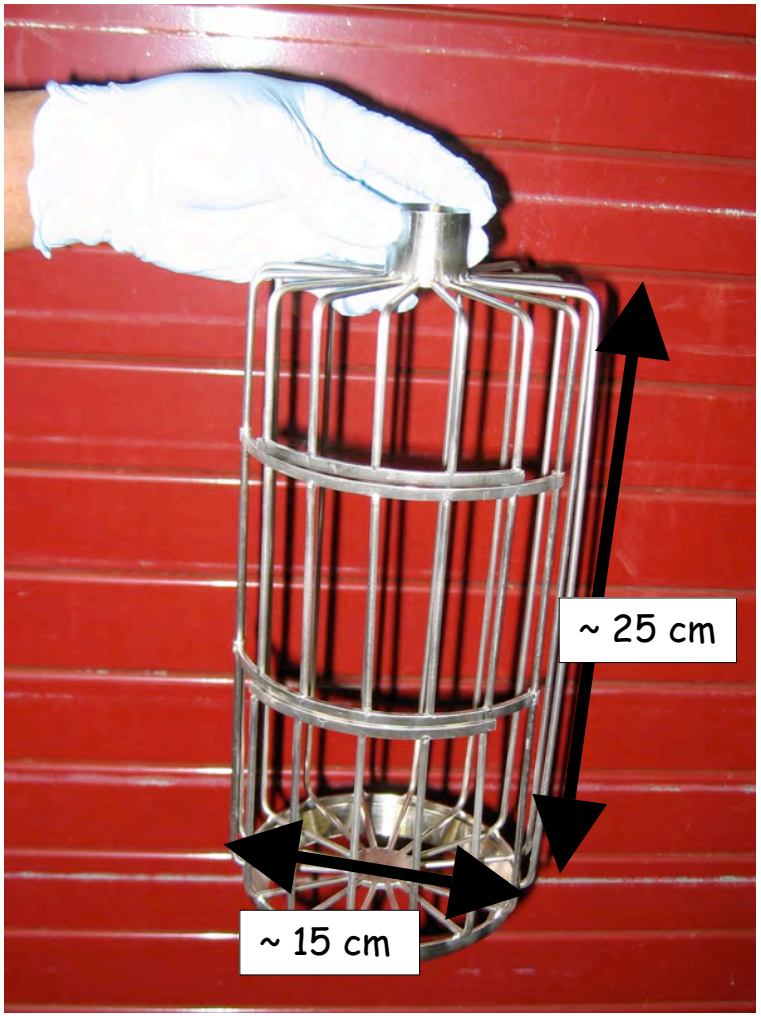




- Put materials in the Sample Cage in the Argon Lock
- Seal the Argon Lock (open in photograph).
- [Evacuate the Argon Lock (or not).]
- Purge with pure argon gas (available from the cryostat).

Materials Test Station

Insertion Basket ("Sample Cage")



- Open the isolation valve.
- Lower the cage into the cryostat
- Close the isolation valve
- Monitor lifetime with Purity Monitor.
- Understand results.

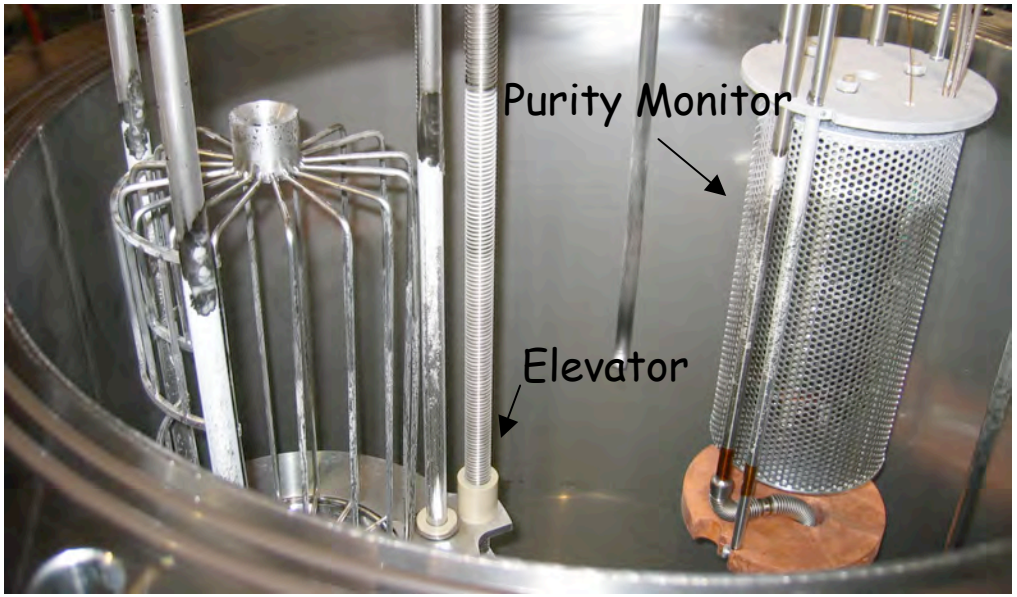
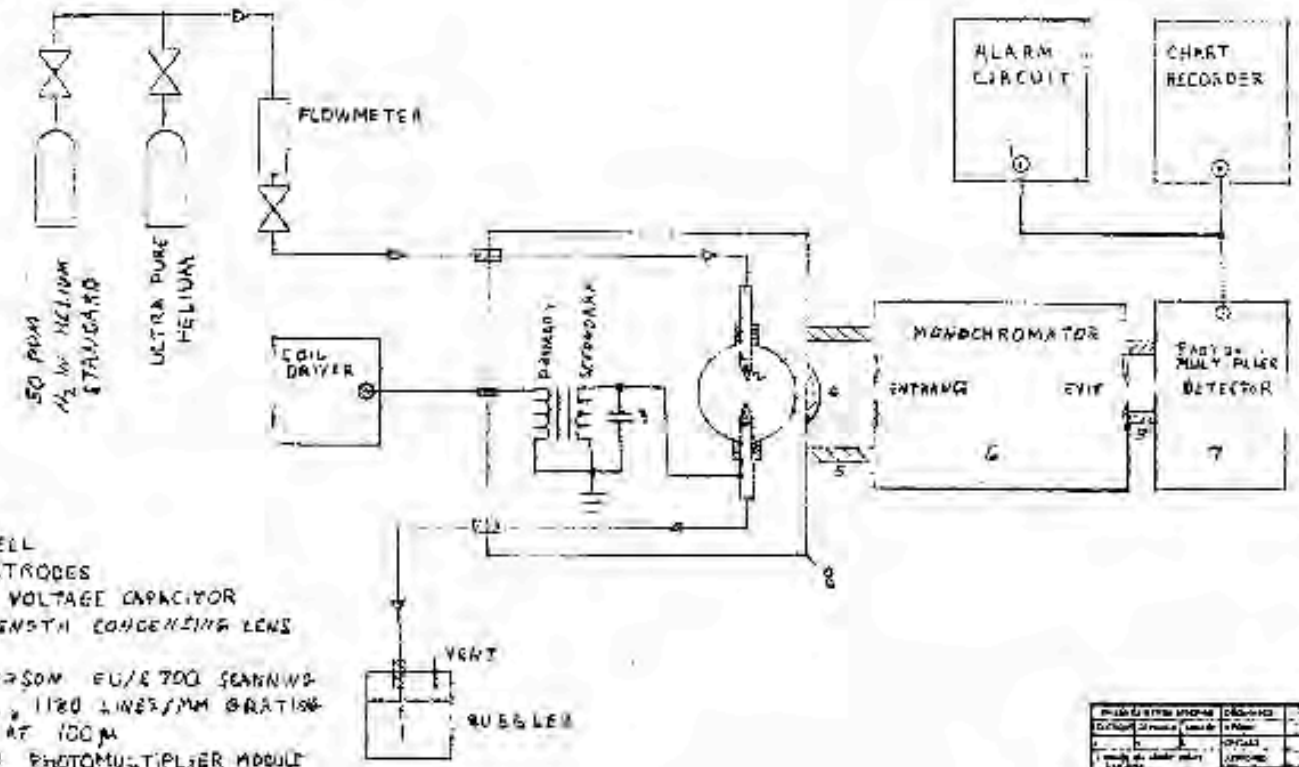


FIG 1 OVERALL PLAN FOR SPECTROGRAPHIC NITROGEN DETECTOR SYSTEM

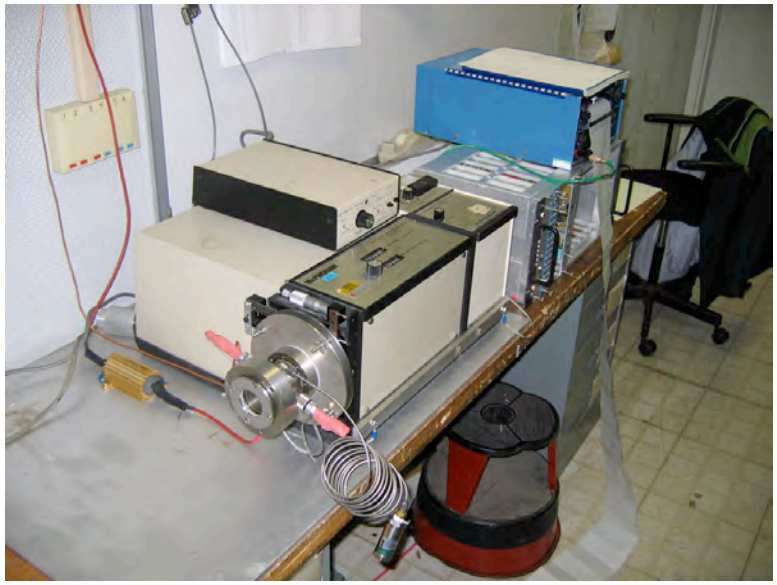


NOTES

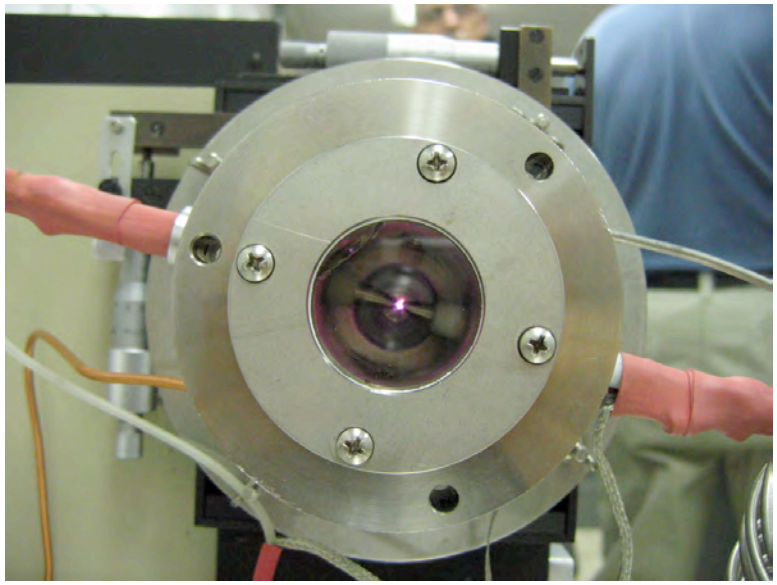
1. QUARTZ GAS CELL
2. TUNGSTEN ELECTRODES
3. 30000 PF HIGH VOLTAGE CAPACITOR
4. 35 mm FOCAL LENGTH CONDENSING LENS
5. LIGHT SEAL
6. SCA / McPHERSON EU/E 700 SCANNING MONOCHROMATOR, 1180 LINES/MM GRATING SLITS ARE SET AT 100 μ
7. SCA / McPHERSON PHOTOMULTIPLIER MODULE MODEL EU-70-30
8. ALUMINUM LIGHT BOX. IMAGE OF LIGHT SOURCE IS FORMED ON MONOCHROMATOR ENTRANCE SLIT BY LENS 4.

NITROGEN DETECTOR SYSTEM

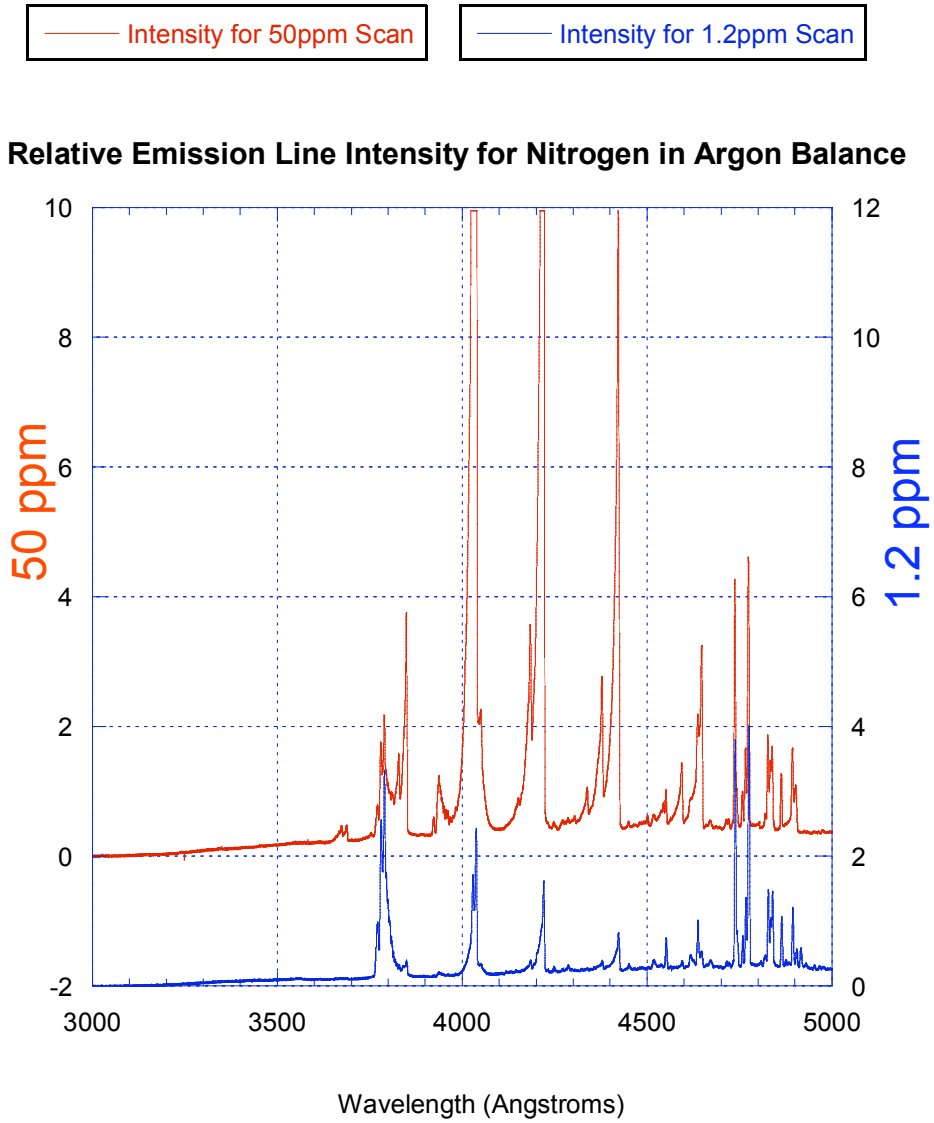
Nitrogen in Argon Measurement
(*based on Nitrogen in Helium for Tevatron)*



arc-cell, monochromator, PMT



the arc



Some context:

FNAL, MSU are working with Yale (Bonnie Fleming) on a 250 liter test TPC to be placed in the NuMI beam at FNAL

A proposal for a 200 ton TPC to go into the Booster Neutrino beam has recently been submitted by BNL, FNAL, MSU, UTA &Yale

FNAL and Yale people are in contact with people in Europe (in and out of ICARUS) on purity and other issues.