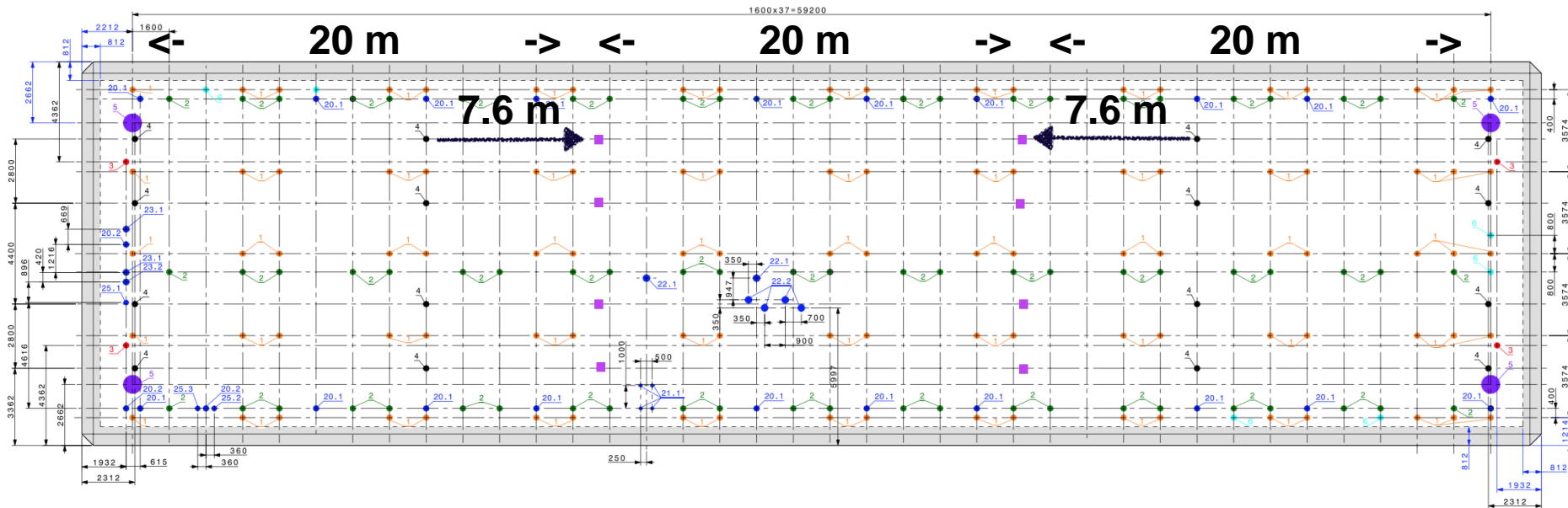# *Update on Radioactive Sources in DUNE*

Juergen Reichenbacher & Jason Stock


DUNE Calibration Task Force

Phone Meeting, 5-Oct-2017

16 Penetration Positions in Alternate Scheme

- A 58Ni-252Cf source will emit 8-9 MeV gammas which are in the right range for calibration the energy response in the SN region. As absolute energy calibrations would otherwise be difficult this capacity should be foreseen.
    - A Ni source will probably need ~100mm space including N moderator.
- Dynamic T-gradient monitors should also be foreseen at the detector ends and it is reasonable to combine these functions in single larger penetrations. Assume a 250 mm crossing tube.
- 16 penetrations total. 8 roughly centered in each TPC drift and 8 at the ends of the detector. The penetrations at the ends should not be more than 0.5m from the field cage but sufficiently far away not to risk the field.
    - Need to check rate when a natural position is determined.

$^{58}Ni(n,\gamma)^{59}Ni$
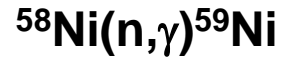
TRI-PP-96-7
Apr 1996

A 7–9 MeV isotopic gamma ray source for detector testing

Joel G. Rogers[a,b], Mark S. Andreaco[b], and Christian Moisan[a]

[a]*TRIUMF, 4004 Wesbrook Mall, Vancouver, B.C., Canada V6T 2A3*
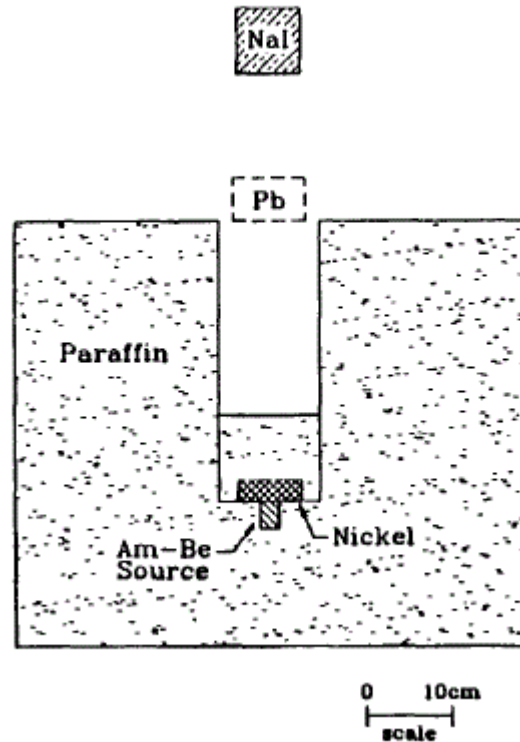[b]*CTI, 810 Innovation Drive, Knoxville, TN 37932, U.S.A.*

Table 1 - Thermal (n,γ) Rates from natural Ni taken from ref. [3]

Gamma Energy (MeV)	Rate (photons/100 captures)
8.997	26
8.532	11
8.119	2.5
7.817	6
7.528	4
7.22	0.4
7.05	0.6
6.839	9
6.58	2
6.34	1
6.10	1.3
5.99	0.4
5.82	3
5.70	0.6
5.31	1.3

[3] E. Troubetzkoy and H. Goldstein, "A compilation of information on gamma ray spectra resulting from thermal neutron capture", USAEC Report, ORNL-2904 Oak Ridge National Laboratory, 1960.

Using Cf-252 (or even better AmLi) would significantly reduce size of source, such that it would fit a 20 cm diameter feedthru

Safety distance of deployed radioactive source wrt. FC

318.66 mm - (250 mm diameter / 2) + ~80 mm shrinkage = 273.66 mm

<- 25 cm ->

penetration

<-20 cm->

<- 27 cm ->

Deployed radioactive source

Field cage at sides of TPCs
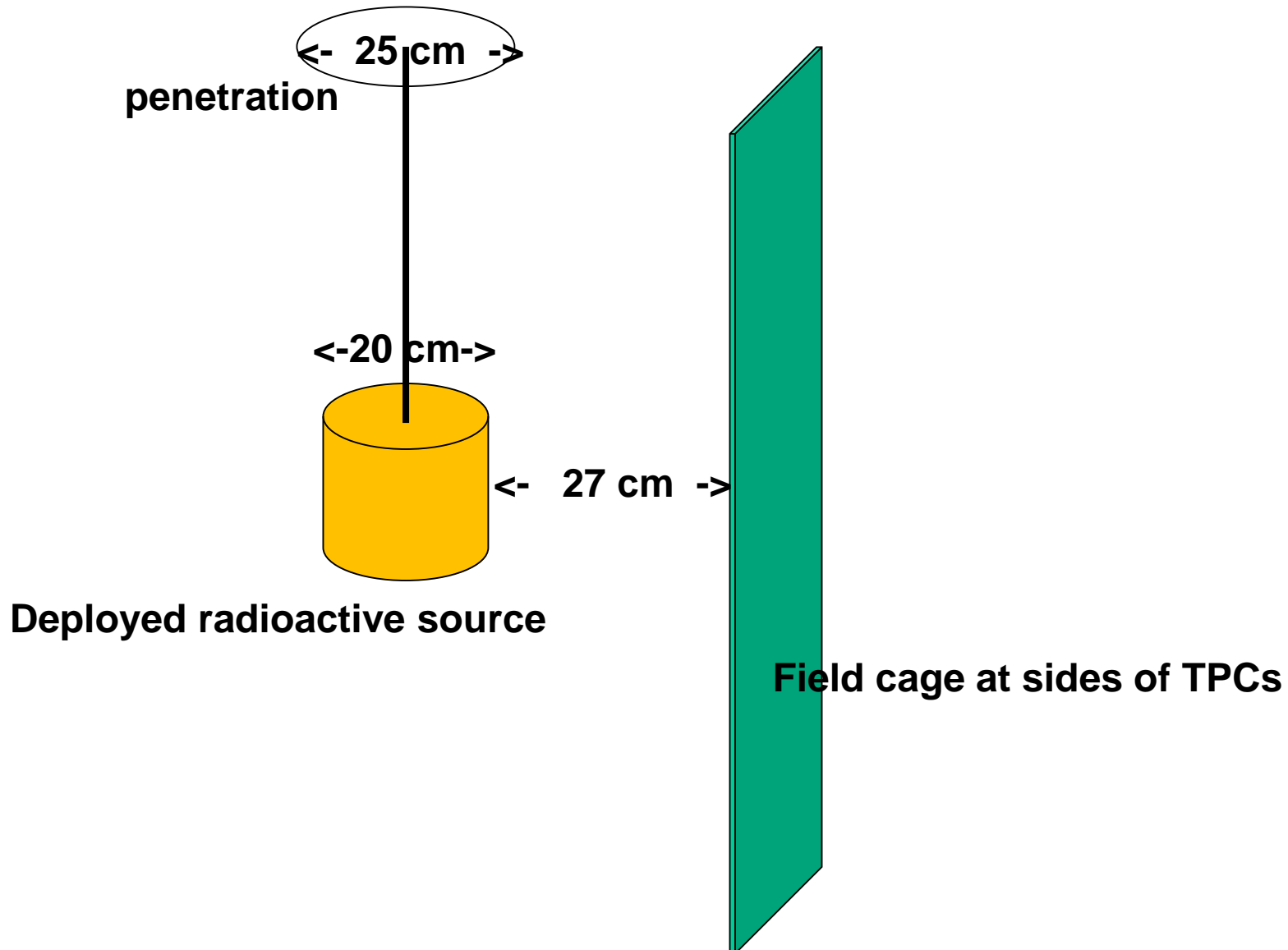
Double Chooz Calibration Deployment System inside Glove Box:
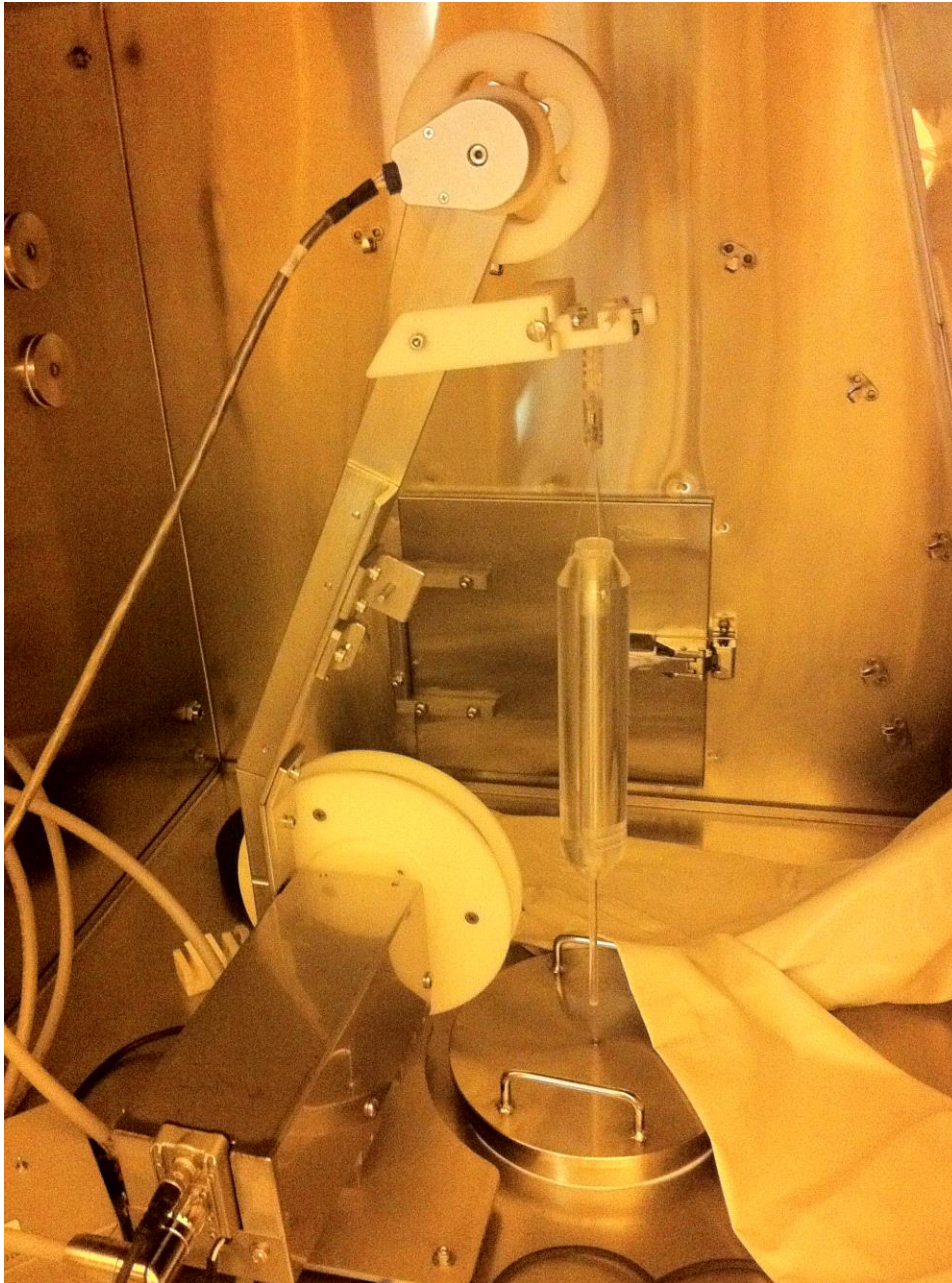
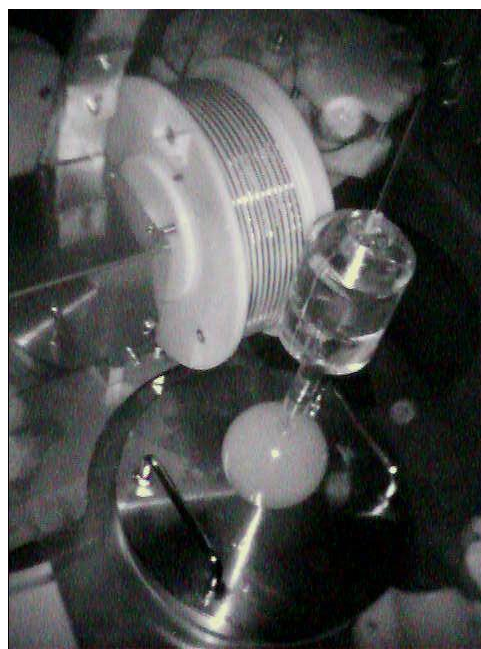**Automated fishline system for target deployments:**

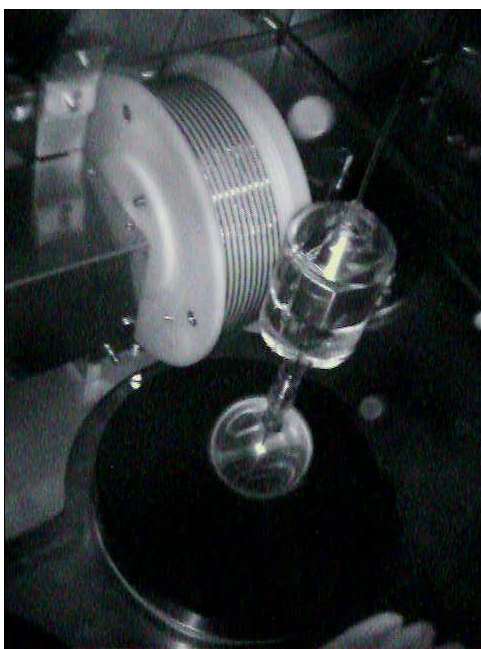**+/-2 mm precision over 7 m**
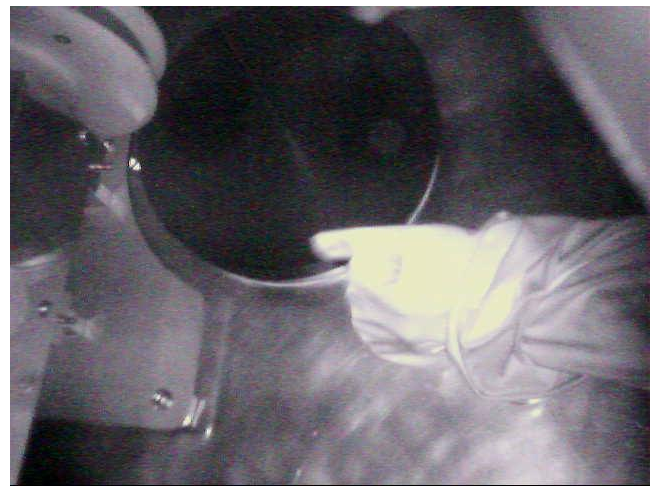
-> 2 systems available in Jan 2018

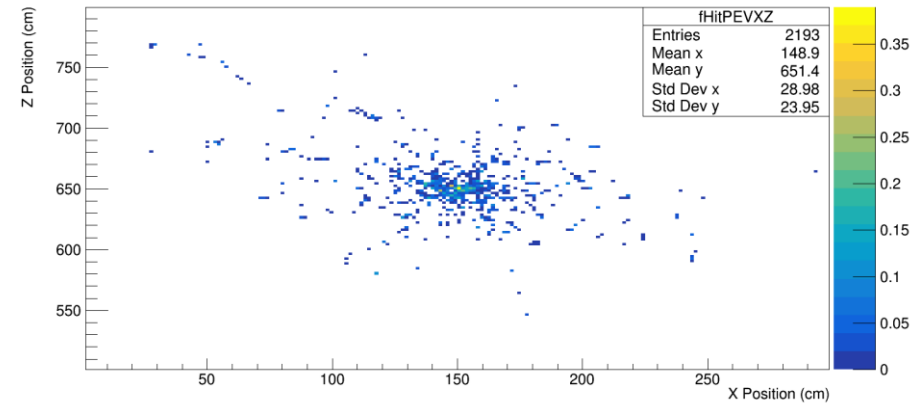**radioactive source** **Blue Laser** **UV Laser** **UV Laser w/ hat**
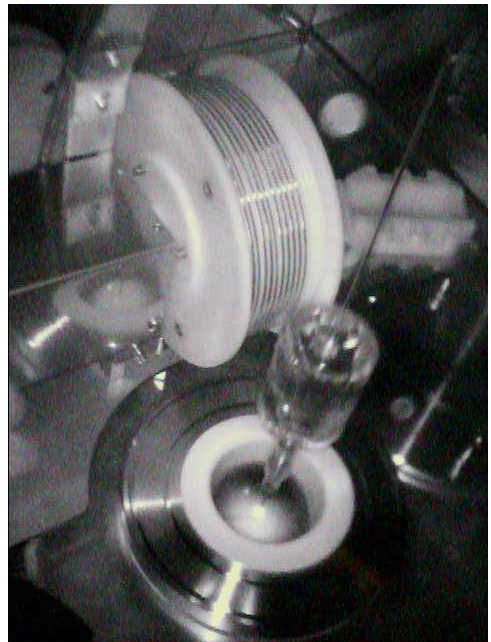
Simulation of 9 MeV gamma's in LAr

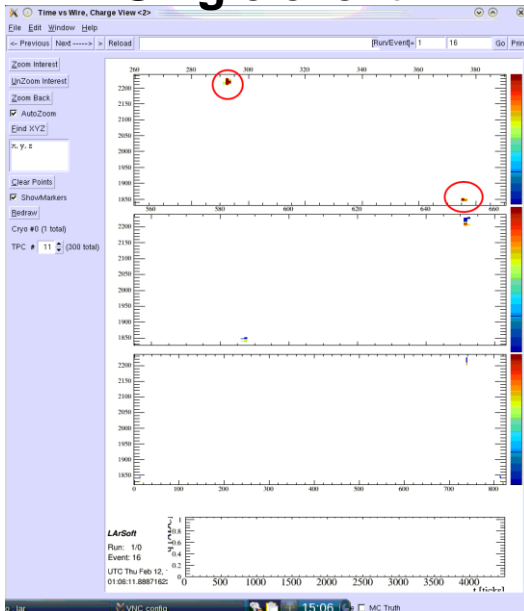Charge Collected (8.997MeV γ X2000)
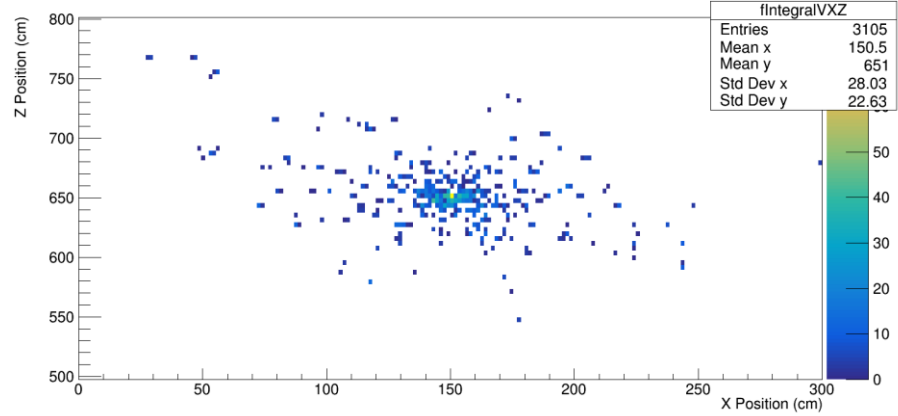
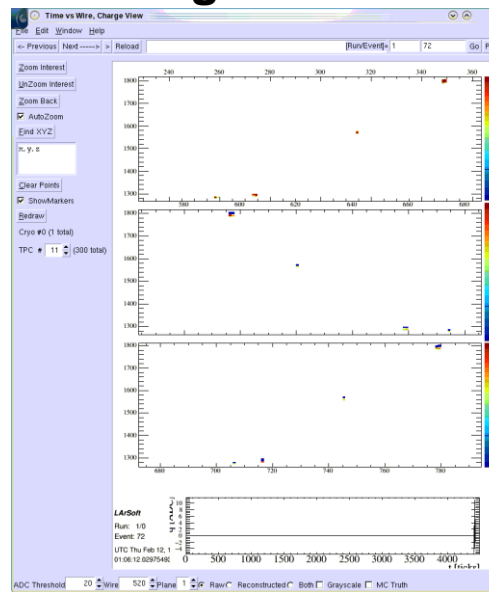PEs Detected (8.997MeV γ X2000)

Single event   Single event   Single event