R&D at SDDL

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ANNA PLA   FERMILAB

SDDL R&D , directions

1. MINERVA R&D:

Triangle profile - current
Rectangle profile - future

2. Current status R&D for MINERVA,plans.

3. CALTEC strands R&D : PAST

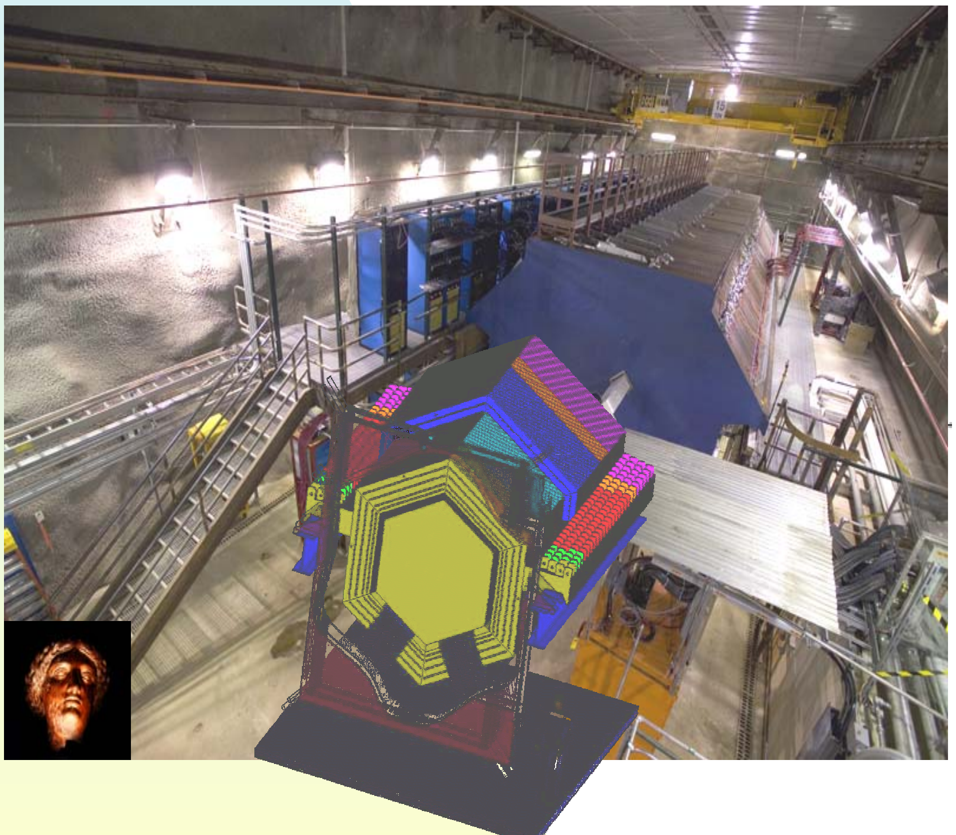
4. R&D plans for CALTEC.

MINERVA

STATUS-approved PAC (Physics Advisory Committee) April 15 2004

What is MINERVA Main INjector ExpeRiment *v*-A

NICADD NIU has sighned a MOU and SOW for 2006



Neutrino Scattering Uncertainties and their Role in Long Baseline Oscillation Experiments

D. A. Harris[4], G. Blazey[10], A. Bodek[13], D. Boehnlein[4], S. Boyd[12], W.K. Brooks[11], A. Bruell[11], H. Budd[13], R. Burnstein[6], D. Casper[2], A. Chakravorty[6,7], M.E. Christy[5], J. Chvojka[13], M.A.C. Cummings[10], P. deBarbaro[13], D. Drakoulakos[1], J. Dunmore[2], R. Ent[11], H. Gallagher[15], D. Gaskell[11], R. Gilman[14], C. Glashausser[14], W. Hinton[5], X. Jiang[14], T. Kafka[15], O. Kamaev[6], C.E. Keppel[5,11], M. Kostin[4], S. Kulagin[8], G. Kumbartzki[14], S. Manly[13], W.A. Mann[15], K. McFarland[13], W. Melnitchouk[11], J.G. Morfin[4], D. Naples[12], J.K. Nelson[16], G. Niculescu[9], I. Niculescu[9], W. Oliver[15], V. Paolone[12], E. Paschos[3], A. Pla-Dalmau[4], R. Ransome[14], C. Regis[2], P. Rubinov[4], V. Rykalin[10], W. Sakumoto[13], P. Shanahan[4], N. Solomey[6], P. Spentzouris[4], P. Stamoulis[1], G. Tzanakos[1], S.A. Wood[11], F.X. Yumiceva[16], B. Ziemer[2], M. Zois[1]

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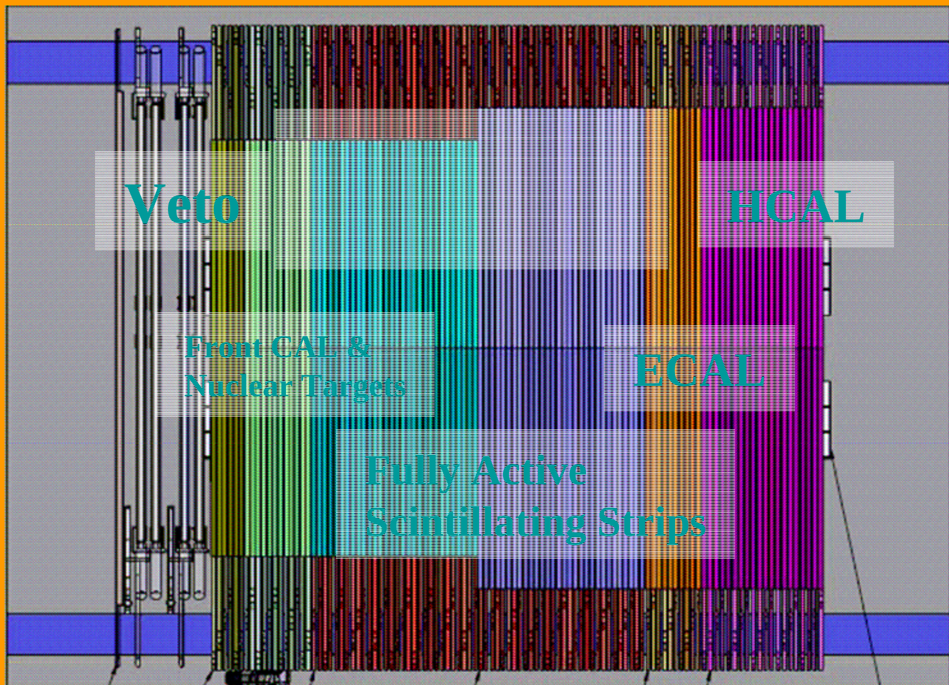
ABSTRACT

The field of oscillation physics is about to make an enormous leap forward in statistical precision: first through the MINOS experiment in the coming year, and later through the NOνA and T2K experiments. Because of the relatively poor understanding of neutrino interactions in the energy ranges of these experiments, there are systematics that can arise in interpreting far detector data that can be as large as or even larger than the expected statistical uncertainties. We describe how these systematic errors arise, and how specific measurements in a dedicated neutrino scattering experiment like MINERνA can reduce the cross section systematic errors to well below the statistical errors.

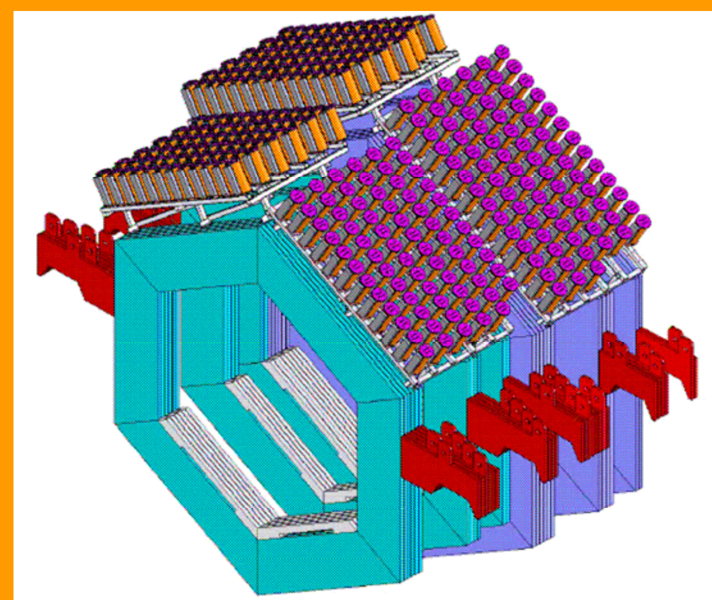
1. Introduction

Over the past 5 years the field of neutrino oscillations has moved from seeing decade-old anomalies in cosmic ray [1)] and solar [2)] neutrino data to cross checks of these anomalies (SNO data [3)] and angular distributions in atmospheric neutrino

Detector Overview

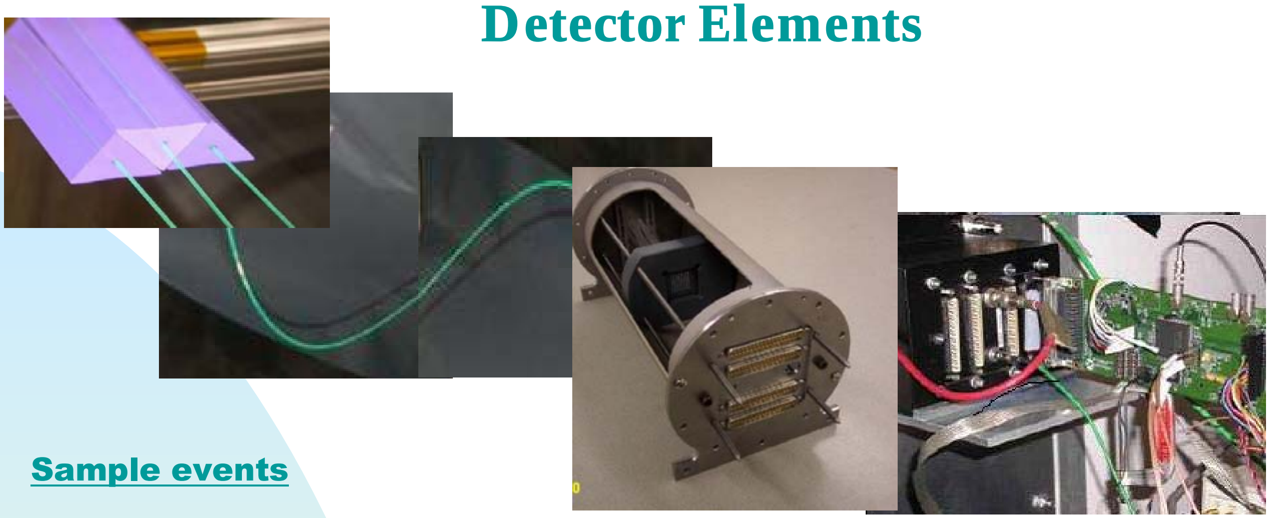


The MINERvA detector takes advantage of the unprecedented high intensity of the NuMI neutrino beam to build a detector capable of full reconstruction of exclusive final states.

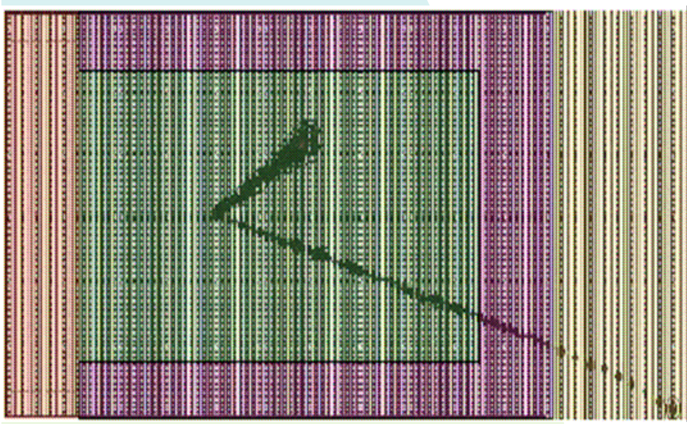


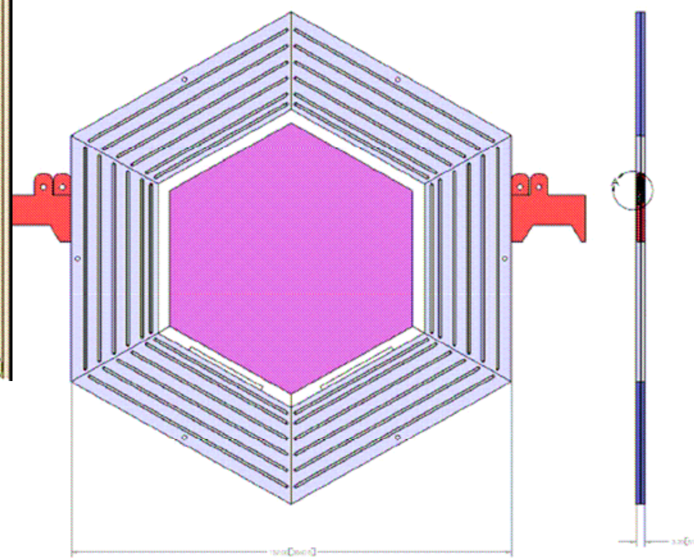
The fully active scintillator target is surrounded by nuclear targets and calorimeters. Interactions in the scintillator (CH_n) can be compared with interactions in the upstream Pb and Fe targets to probe nuclear effects.

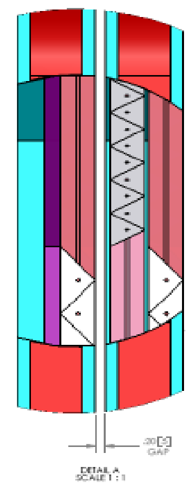
Detector Elements



Sample events







Pb+20%Fe

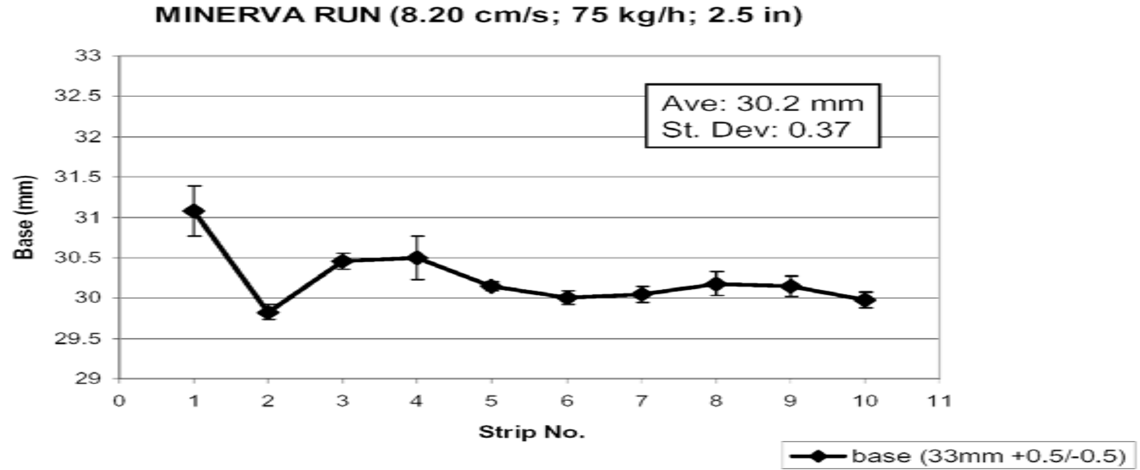
extruded scintillator

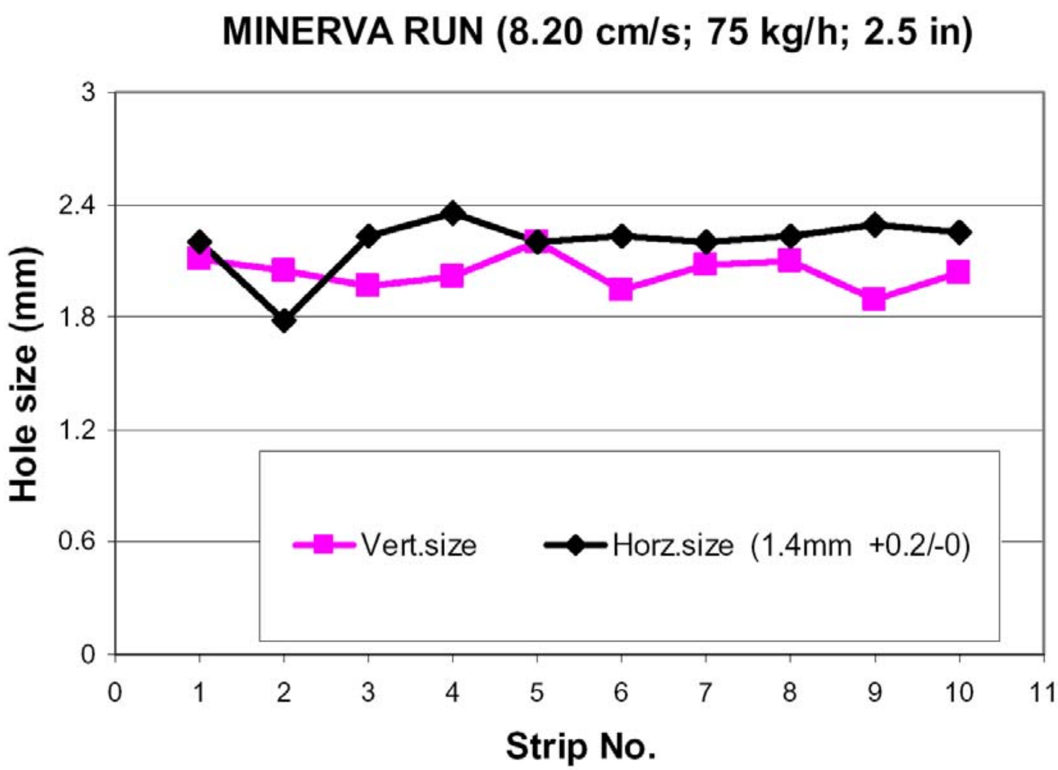
Sample quasi-elastic event:

$\nu_\mu n \rightarrow p \mu^-$

Proton and muon tracks resolved and energy deposited shown as size of hit.

Mech. measurements





Cosmic test results, absolute LY, final.
The results presented at IEEE NSS 2005.

Scaling to the first electron

Npe ~ 28

Gauss fit (left edge)~24 $$N = \left(\frac{A}{\sigma}\right)^2$$

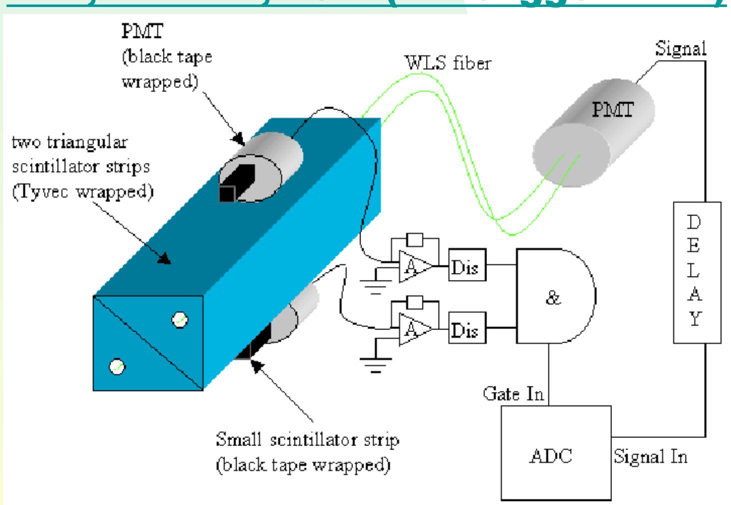
Correction to the scintillator thickness (1.7 cm)

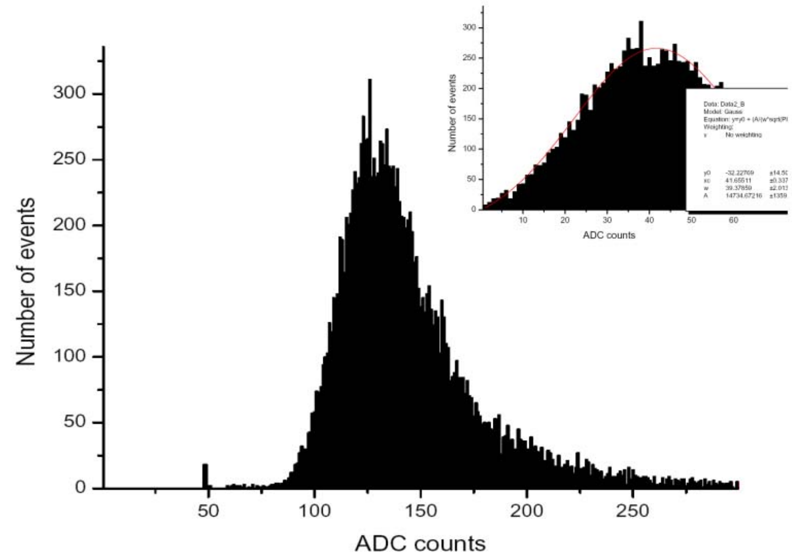
gives ~22 PE,

~ 18 PE.

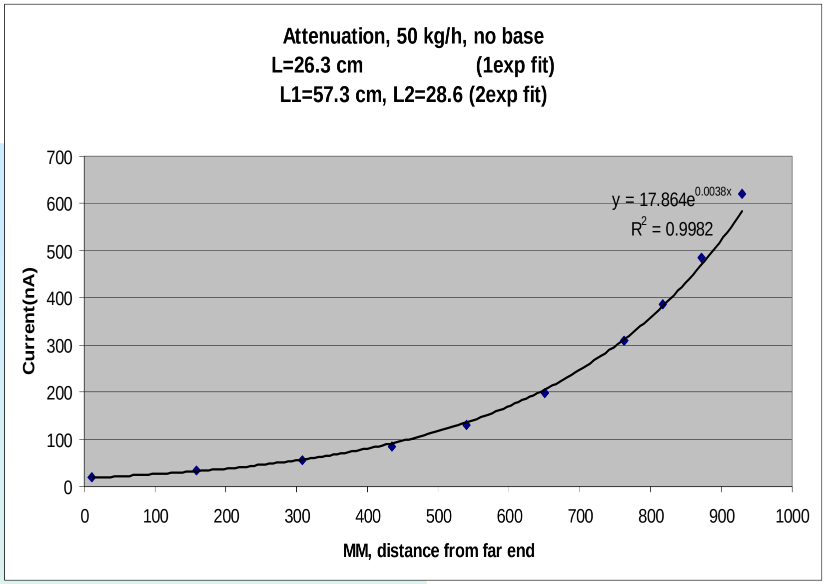
H3178-61 was used

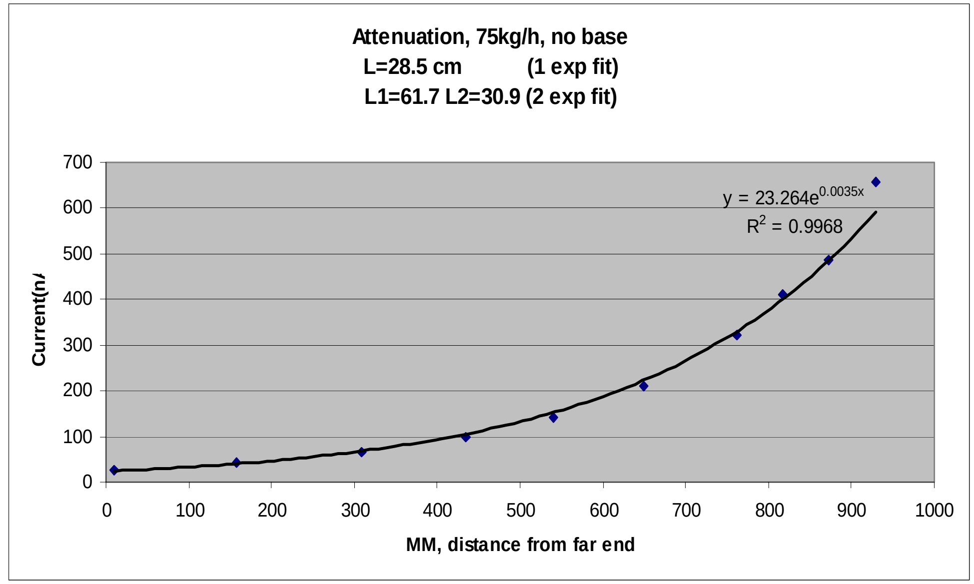
Y11, 1.2 mm,1.5 m(1m trigger-PMT)

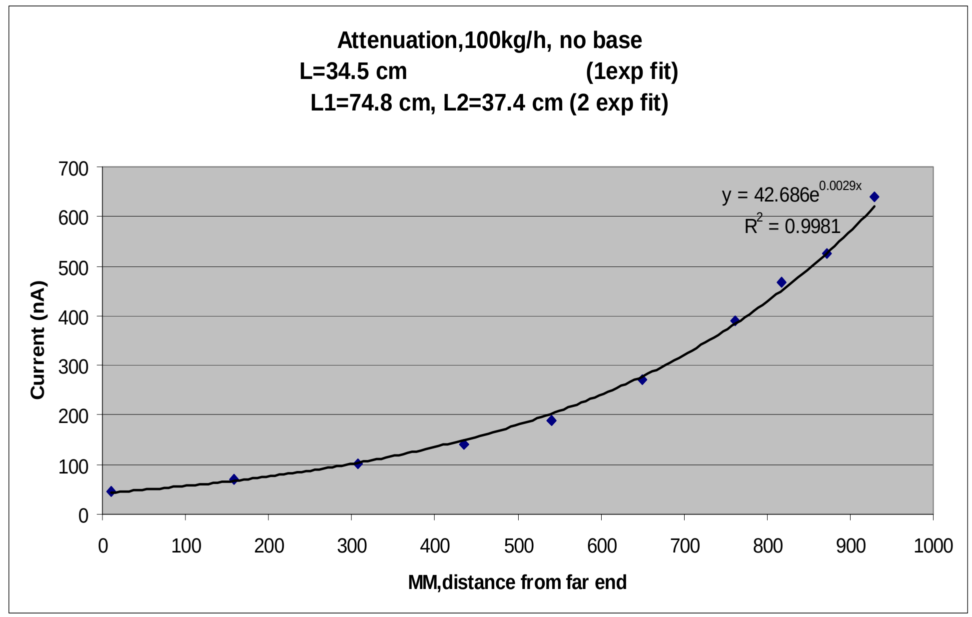




The fibers without reflective end where used !







PROCESSING

RATE

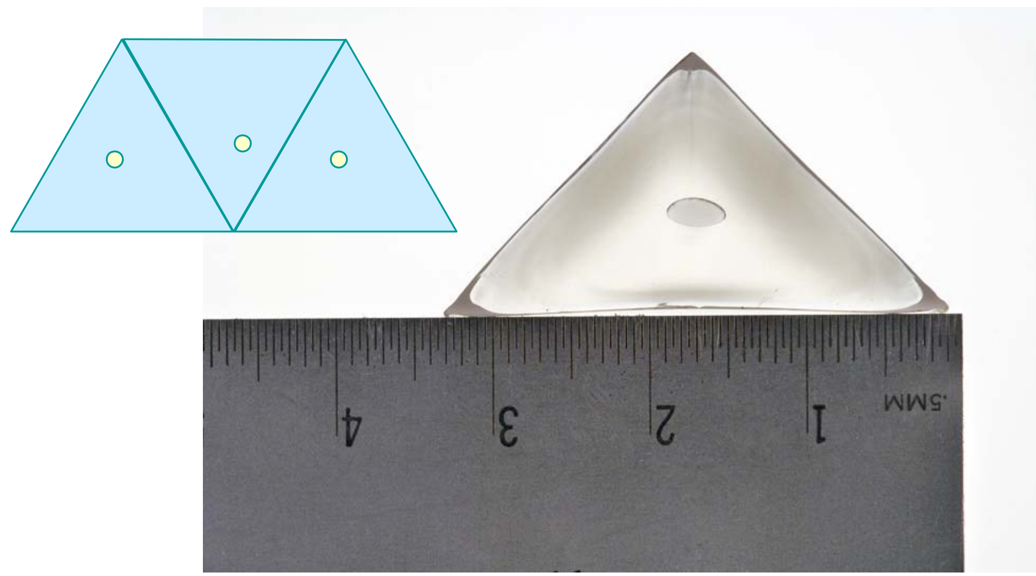
EFFECTS on LAL.

Co-extruded strips, LAL is being measured.

Necessity of the of the next step R&D for MINERVA

- **Currently we produce a new type of scintillator – co-extruded scintillator.**
- **There is some dead area in that new guy.**
- **No test beam so far.**
- **The tests were only carried out with cosmic rays.**
- **Lack of information about uniformity of the response.**

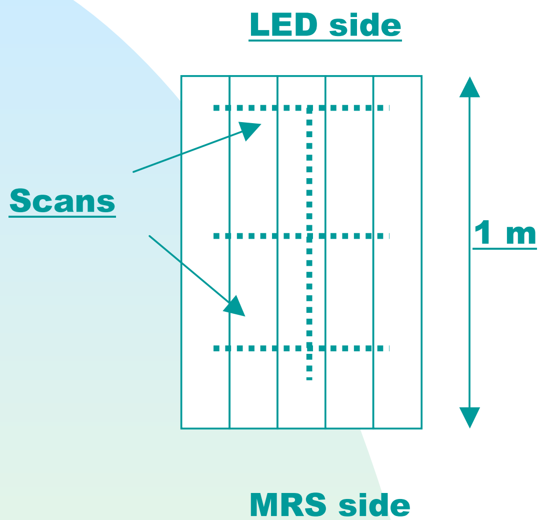
Besides QC (after extrusion process) test beam is a must !

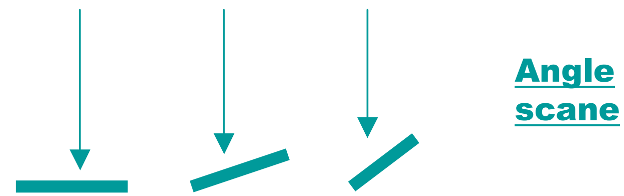


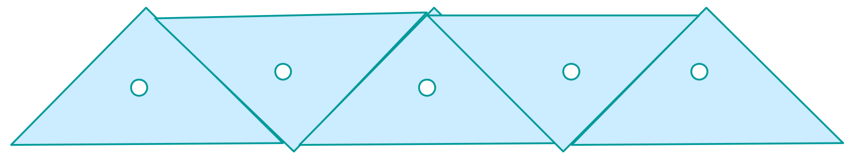
Possible test beam at FNAL

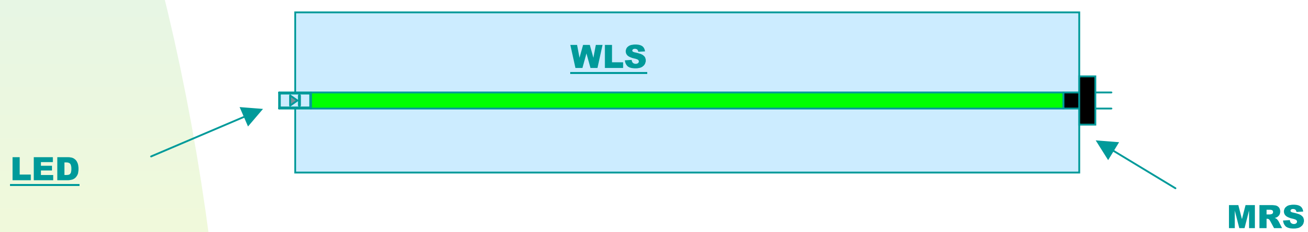
Where?	**FNAL , 120 Gev protons**
What ?	**8 – 9 strips (co-extruded, MINERVA triangle type, 8-9 MRS as readout sensors)**
When?	**Before shutdown, two-three days (during CMS assigned time)**
Who ?	**Me and Sasha ? Kurt ? Mike ? At least 2 persons are to participate.**
DAQ	**CAMAC based available, VME based (CALICE HCAL type) is an option.**
Sensors, strips, fibers	**Available.**
Training	**RAD worker, Controlled Access.**
Mech support, Moving table	**Available.**
Burocracy	**Writing MOU. Discussed with Eric Ramberg.**

Detector to be tested









Particles – pions 120 Gev

Done

WORK IN PROGRESS

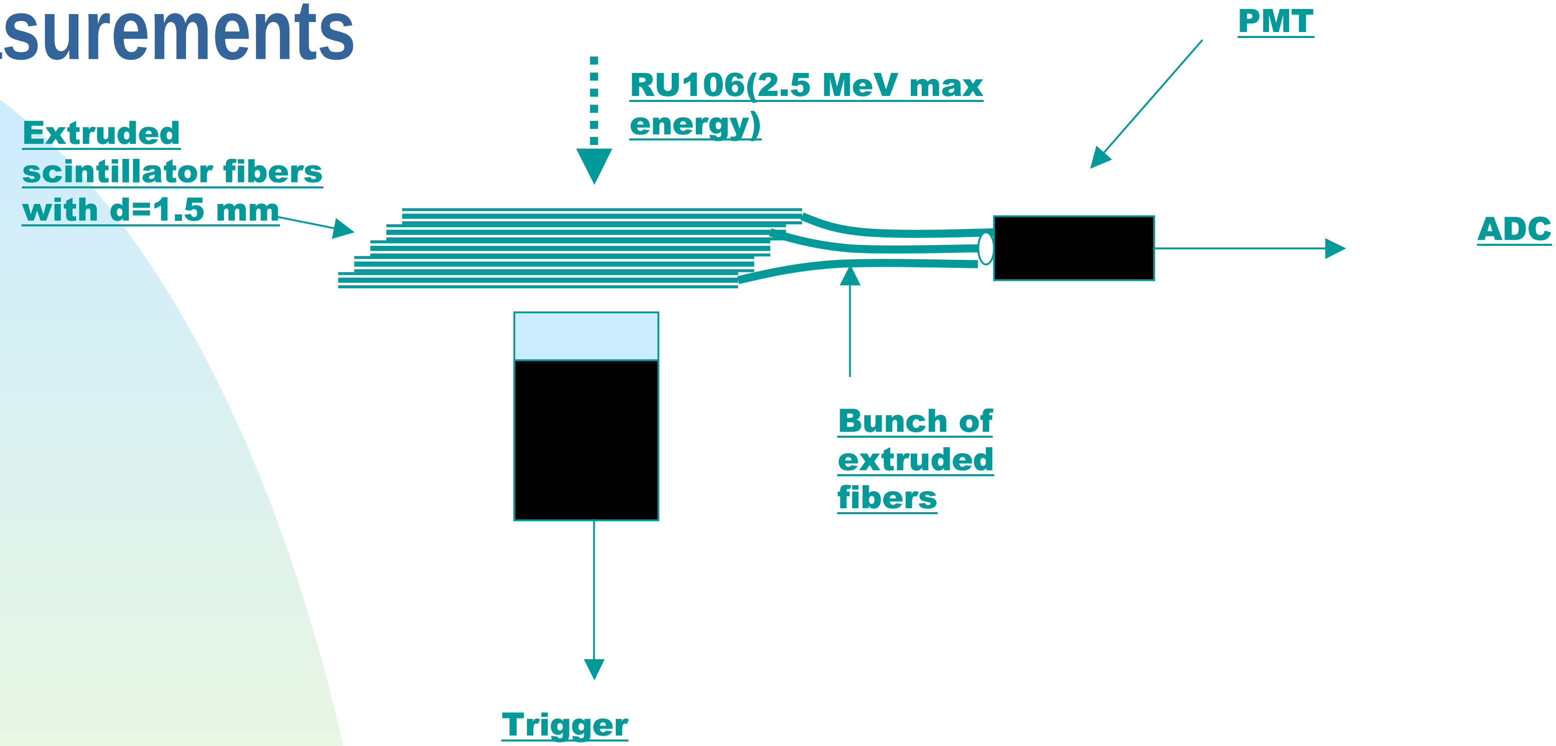
- Co-extruder R&D (installation)
  - 1 month – **October – November 2005**
  - Run triangle die with capstocking
- ID tuning and prototyping
  - 2 months – **November** and **December 2005**
- OD tuning and prototyping
  - 2 months – **January** and **February 2006**
  - Final size – TBD

19mm*15mm

CALTEC strands

- Customer – California Institute of Technology.
- Neutrino Detector Prototype.
- Extrusion of scintillator fibers d=1.5 (~3% size variation) mm, L=110 cm. Done.
- Mech. Measurements, Fluorescence.
- Possible application-beam profile measurements.
- **Is it possible to perform an absolute LY measurements for the scintillator fibers?**

Propose for the absolute LY measurements



As a result we will get very close approximation of the LY from a MIP

Summary

- Status of the R&D at SDDL was discussed.
- Proposal for extruded triangle profile + MRS has been outlined.
- Proposal for the scintillator fibers absolute LY measurements has been outlined.
- http://nicadd.niu.edu/research/extruder/