

# WG1/WG2 Joint experimental detector talks summary

*(Walter/Choubey/Schwetz/McFarland/Nieves/Hayato)*

- Status of MIND Simulation and Analysis *A. Laing*
- TAsD *M. Ellis*
- R&D Towards huge liquid Argon Detectors *T. Maruyama*
- Event Reconstruction in LAr TPCs *O. Palamara*
- Proton Identification in future WC detectors *C. Walter*
- Liquid Scintillator detectors for high energy neutrinos *S. Smith*
- Peanut at FNAL *A. Russo*
- Neutrino beam flux systematics *L. Loiacono*

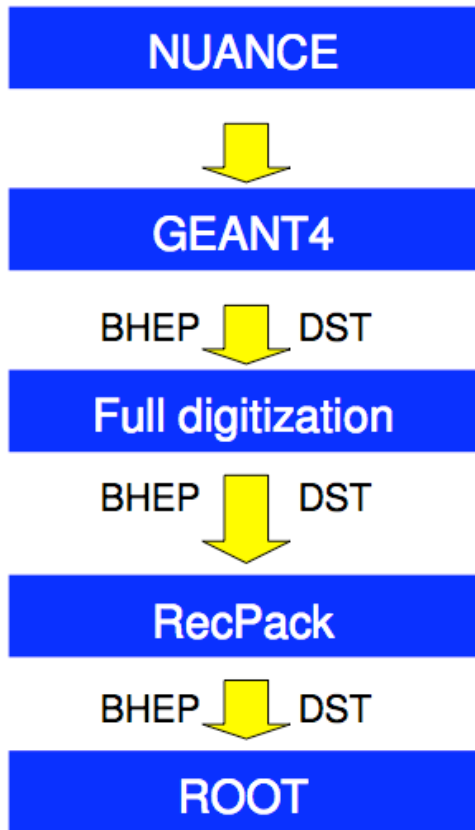
*Chris Walter  
Duke University  
NuFact09 IIT  
July 25<sup>th</sup> 2009*

# New Detectors, New Techniques

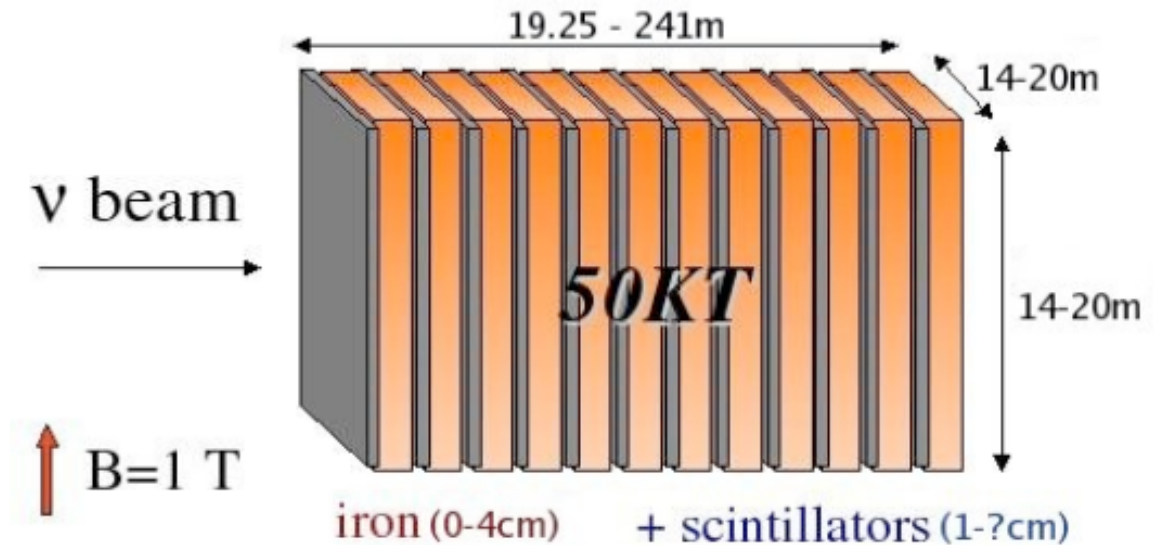
- This session focused on work and simulations for **new detectors** that would be used in neutrino factories and beta beams.
- This included continuing work on MIND and T ASD including the first simulation and reconstruction work package for MIND.
- New progress in detector R&D for Lar
- There are some brand new ideas presented in this meeting along with new techniques for addressing problems.
- I will point out some **highlights**.

# MIND

Baseline Detector for golden channel measurement at the neutrino factory

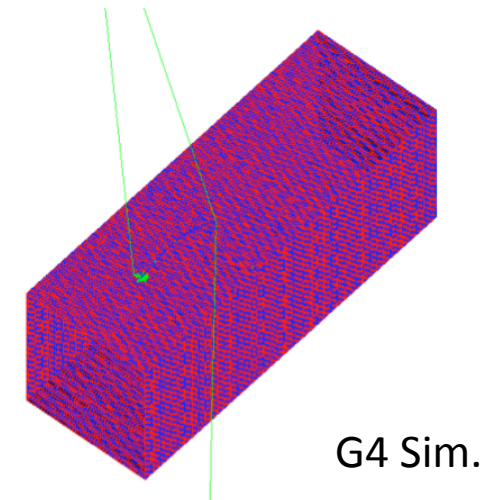
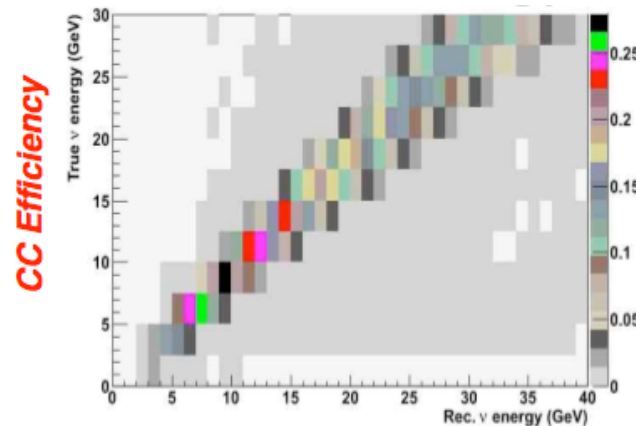


From Laing



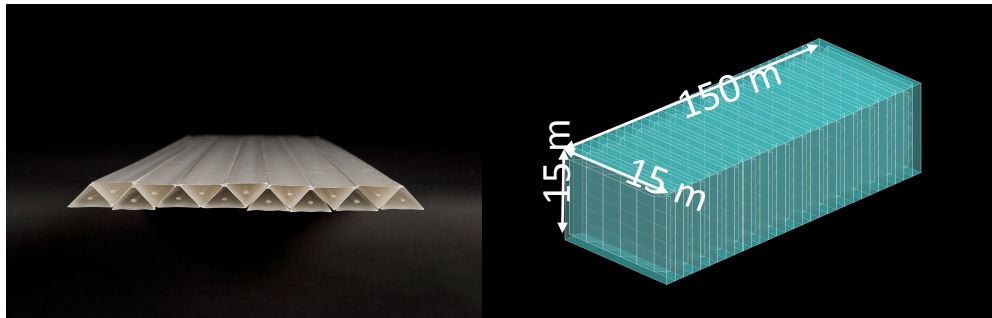
**LAST YEAR:** Start of reconstruction code.

**THIS YEAR:** First analysis chain running with preliminary results.

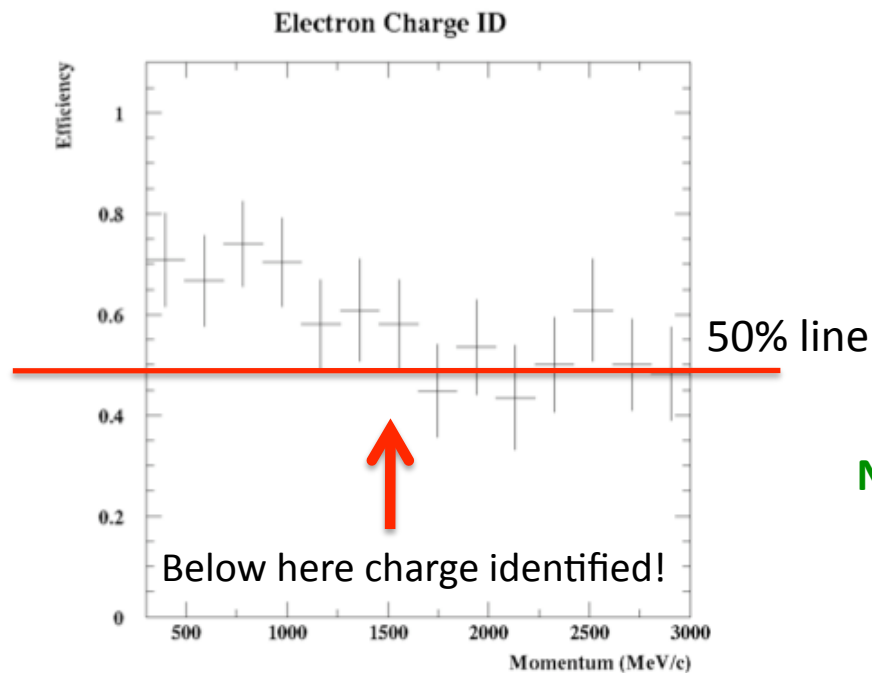
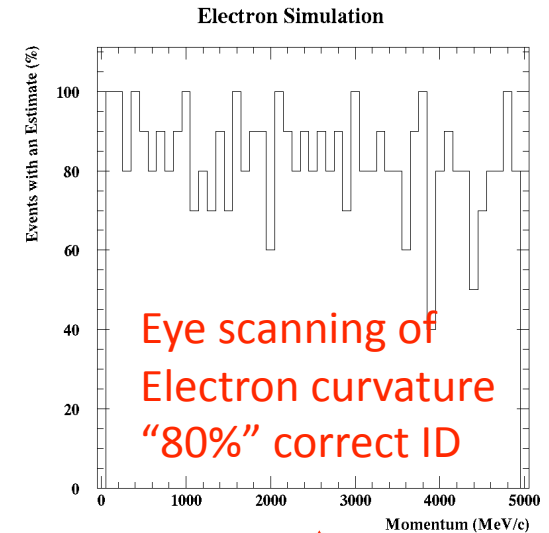


# TASD Detector

From Ellis



**THIS YEAR:** New simulations + systematic scanning by  
A team of people for efficiency, curvature etc.



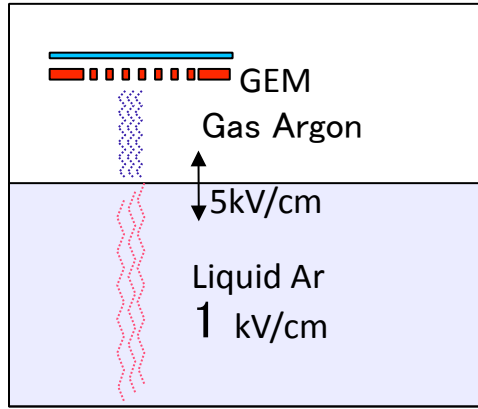
**LAST YEAR:** Start of eye scanning  
for curvature.

**Homework:** Check in systematic  
way.

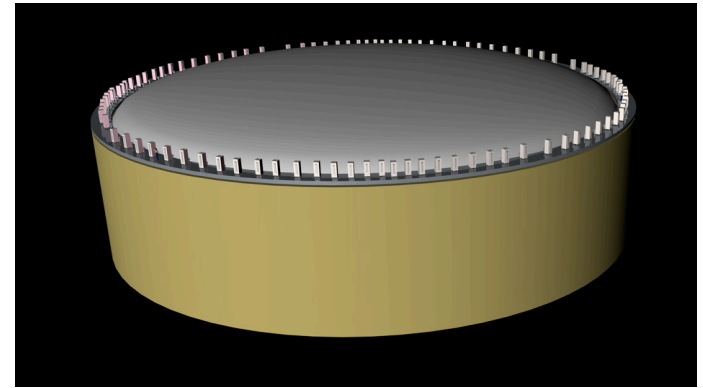
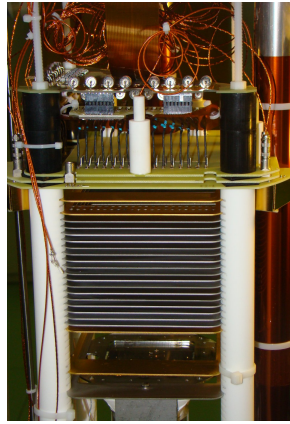
**New Homeworks:** Make automatic algorithms.  
Is this charge ID good enough  
for platinum?

# Big Progress in LAR R&D!

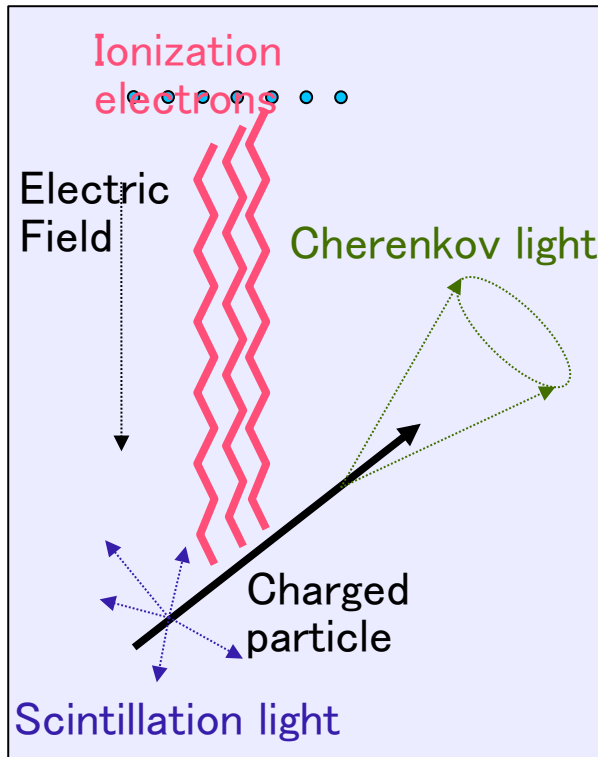
From Maruyama



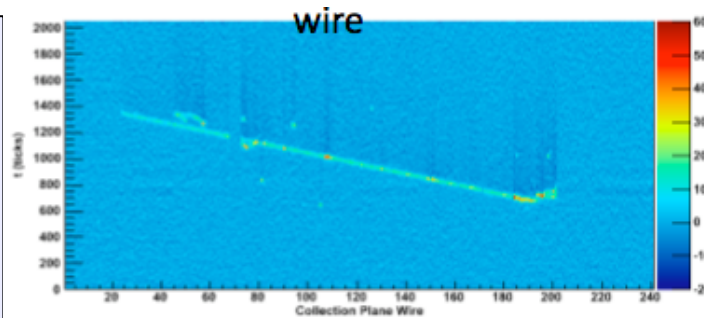
Double phase



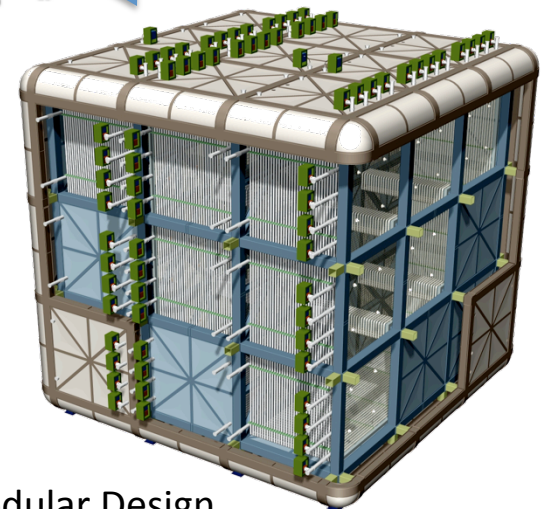
Single Volume



Closed dewar



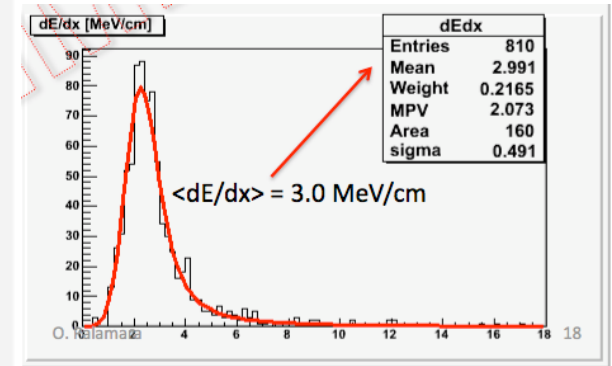
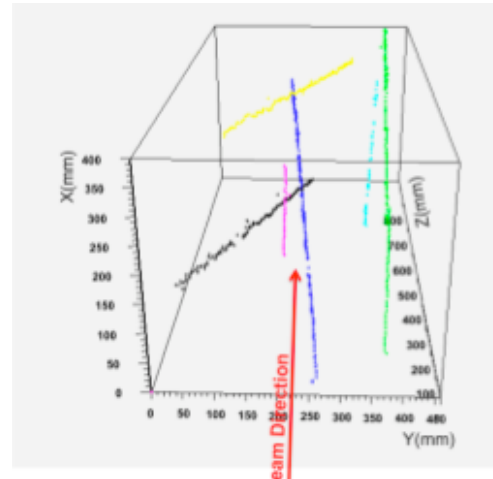
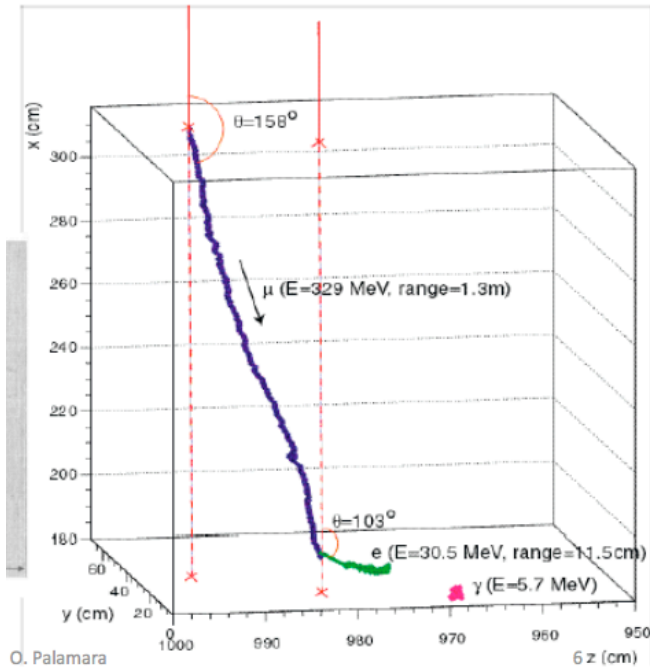
Both the US and EU/Japan are working towards solving the R&D issues needed for ~100kton detectors.



Modular Design

# LAR Reconstruction

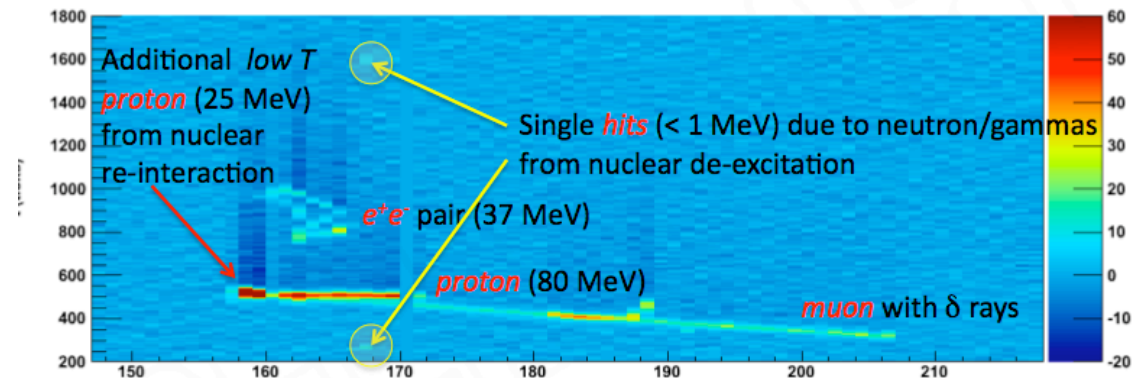
From Palamara



Examples from ArgoNeut

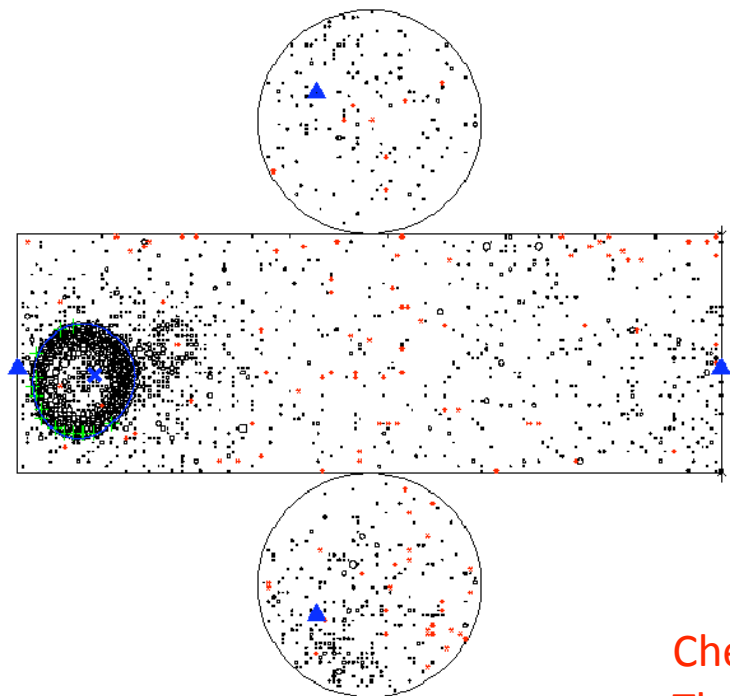
Icarus T600 test from 90s was  
The first real large scale test of  
Automatic reconstruction.

Now groups are working on  
reconstruction in new detectors.



Example of sensitivity to nuclear effects.

# SK proton ID algorithm from SK for future projects From Walter



Cherenkov  
Threshold.

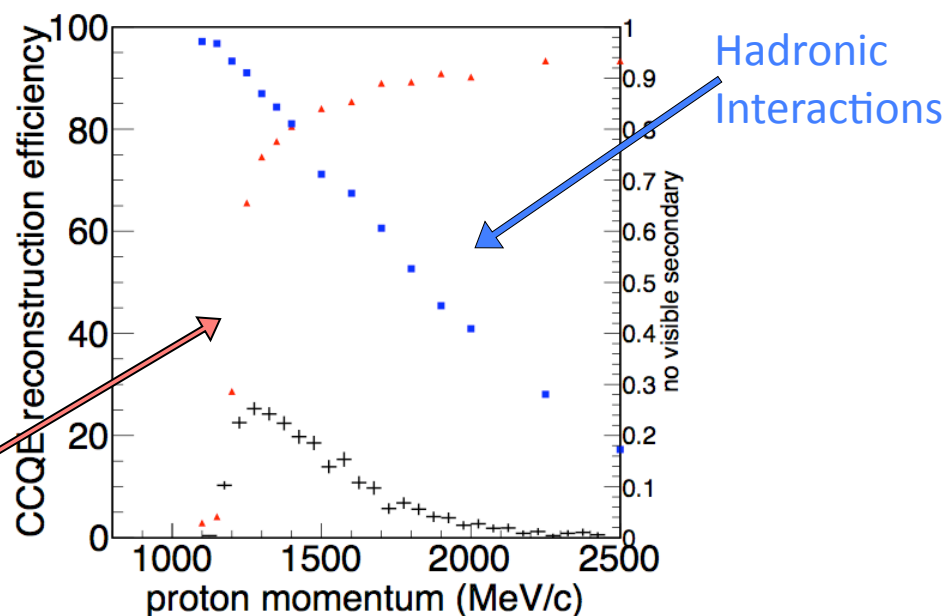
This technique gives good energy resolution,  
high CCQE purity and neutrino tagging.

Let  $V$  be the 4-vector

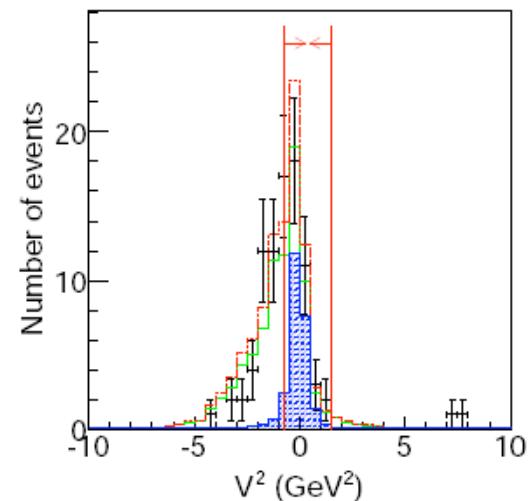
$$V = P_p + P_l - P_n,$$

where  $P_p$ ,  $P_l$ , and  $P_n$  are the 4-momenta of the  
proton, lepton, and target neutron.

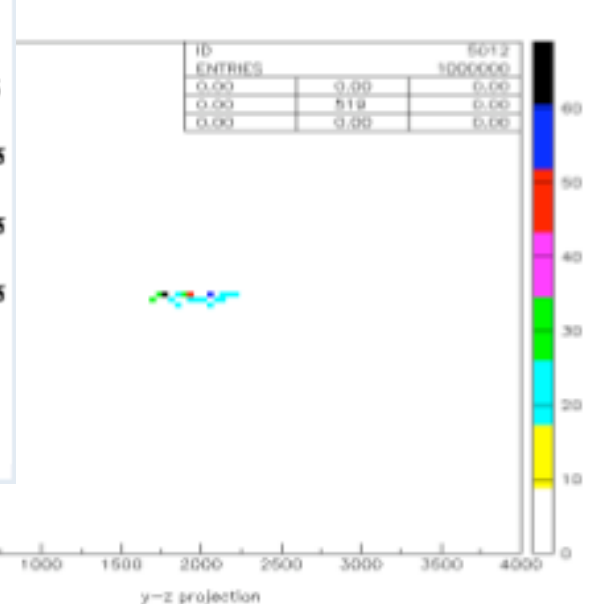
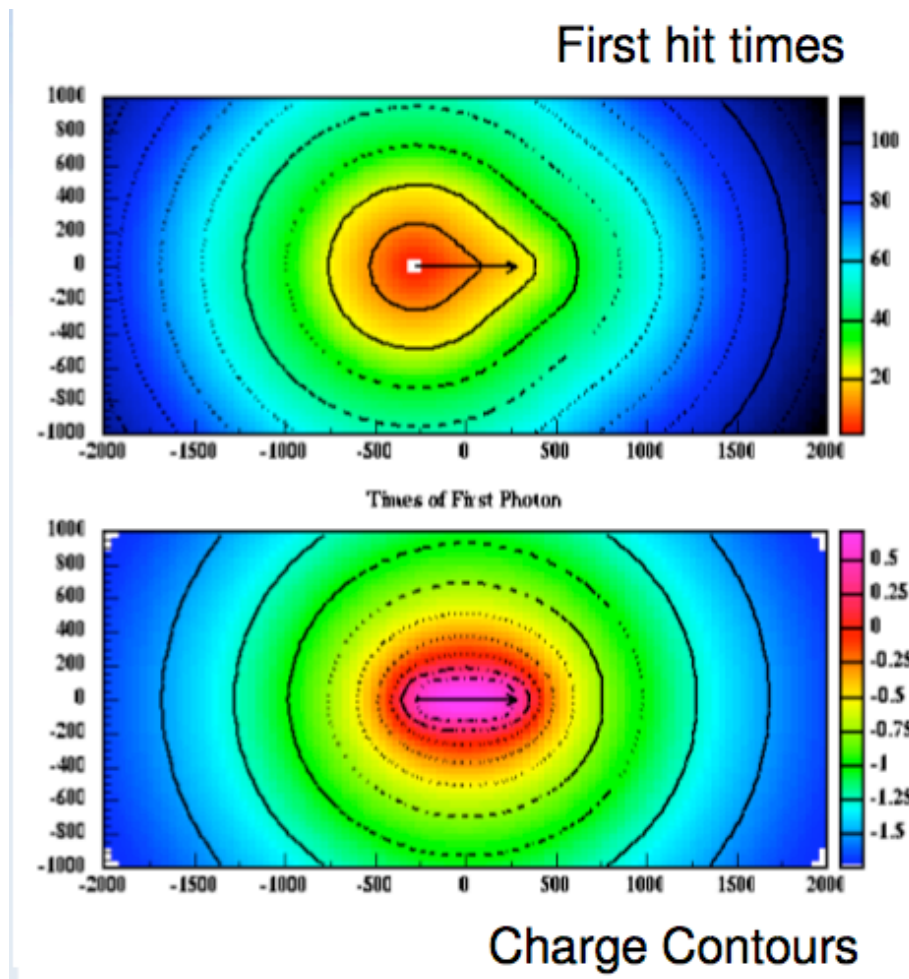
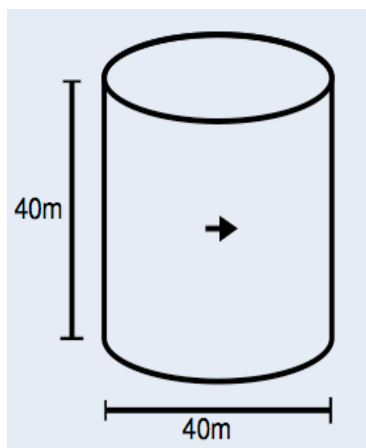
Lorentz invariant quantity  $V^2$  must be  $m_\nu^2 \approx 0 \text{ eV}^2/c^4$



Good for Wideband beams and high Energy  
beta beams.



# Liquid Scintillator for high energy beams



New work to try to reconstruct tracks in a scintillator detector using first hit times could open new possibilities

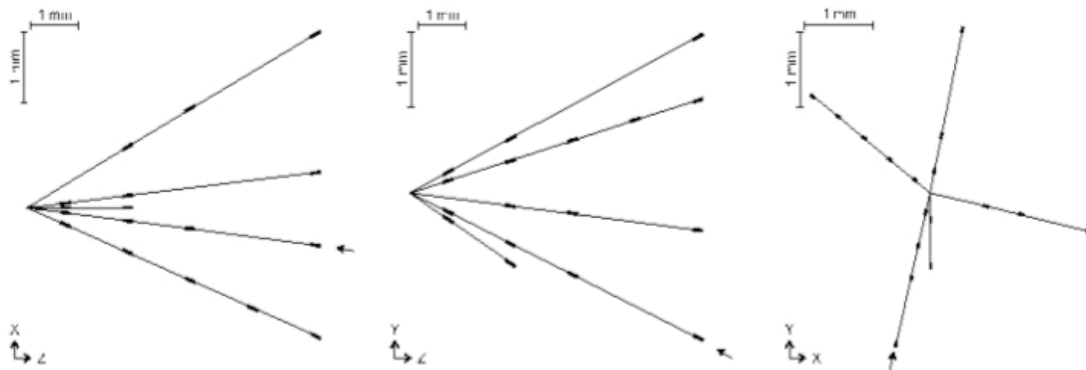
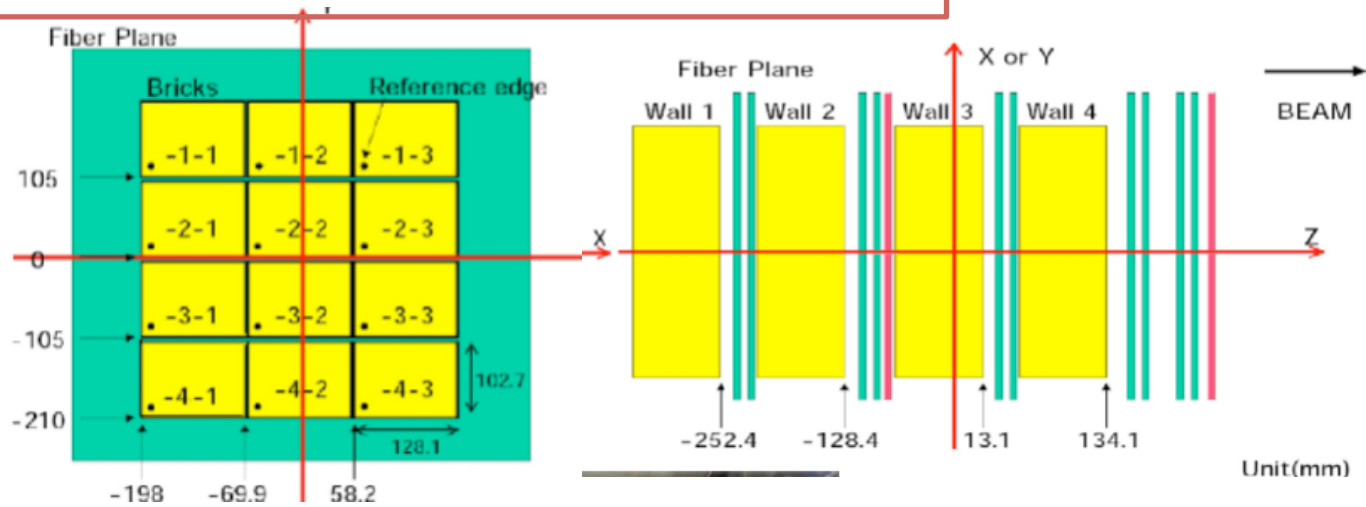
(EX: CERN -> LENA)

From Smith

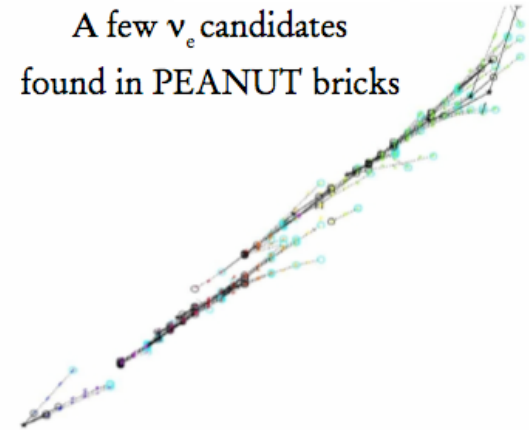


# Peanut

Hybrid detector: Emulsion-lead targets and scintillating fibre tracker (SFT detector)



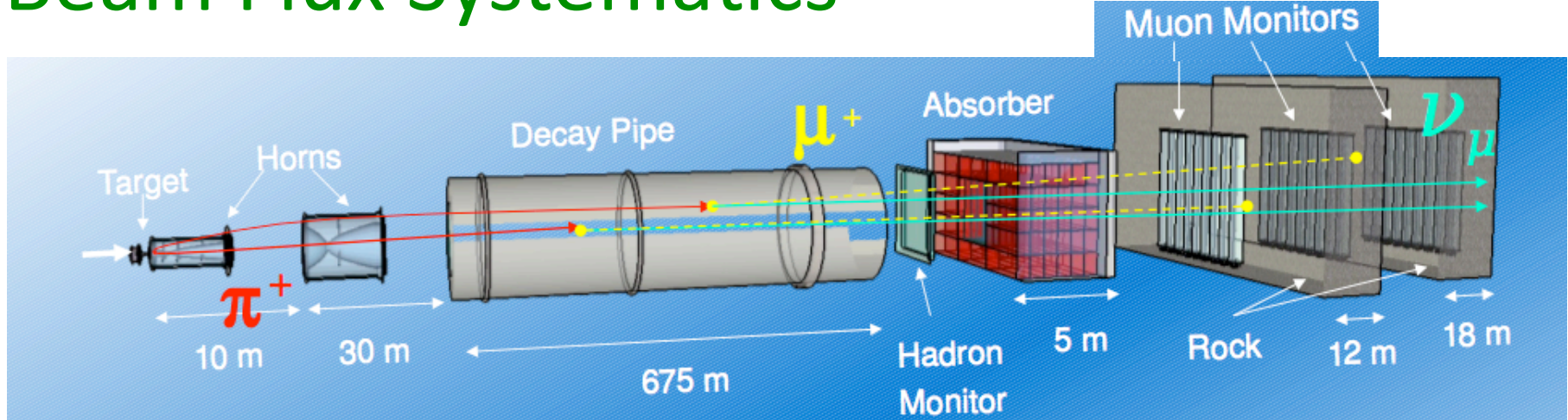
Fully reconstructed event



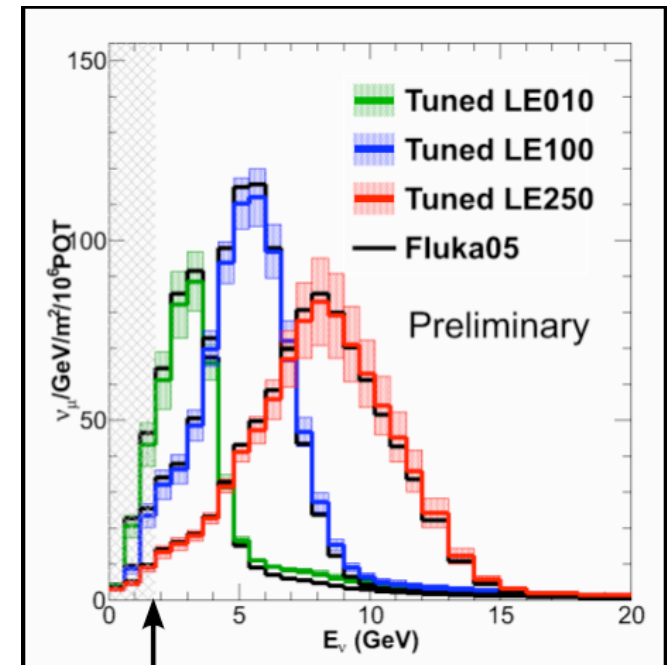
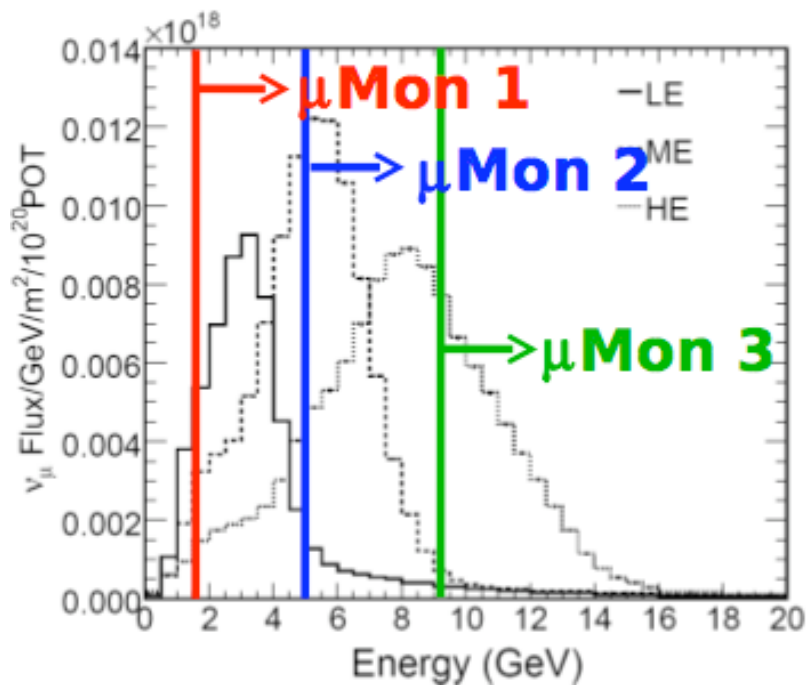
A few  $\nu_e$  candidates found in PEANUT bricks

# Beam Flux Systematics

From Loiacono



Measurements of the event rate in the muon monitors were used to tune the beam MC to make flux measurements.



# My Conclusions

- There is a lot of activity on future detector design.
- A few of the “homeworks” from last year have been addressed.
- Many of the outstanding questions can't be addressed yet because the reconstruction and simulation work is not yet at a mature level.