

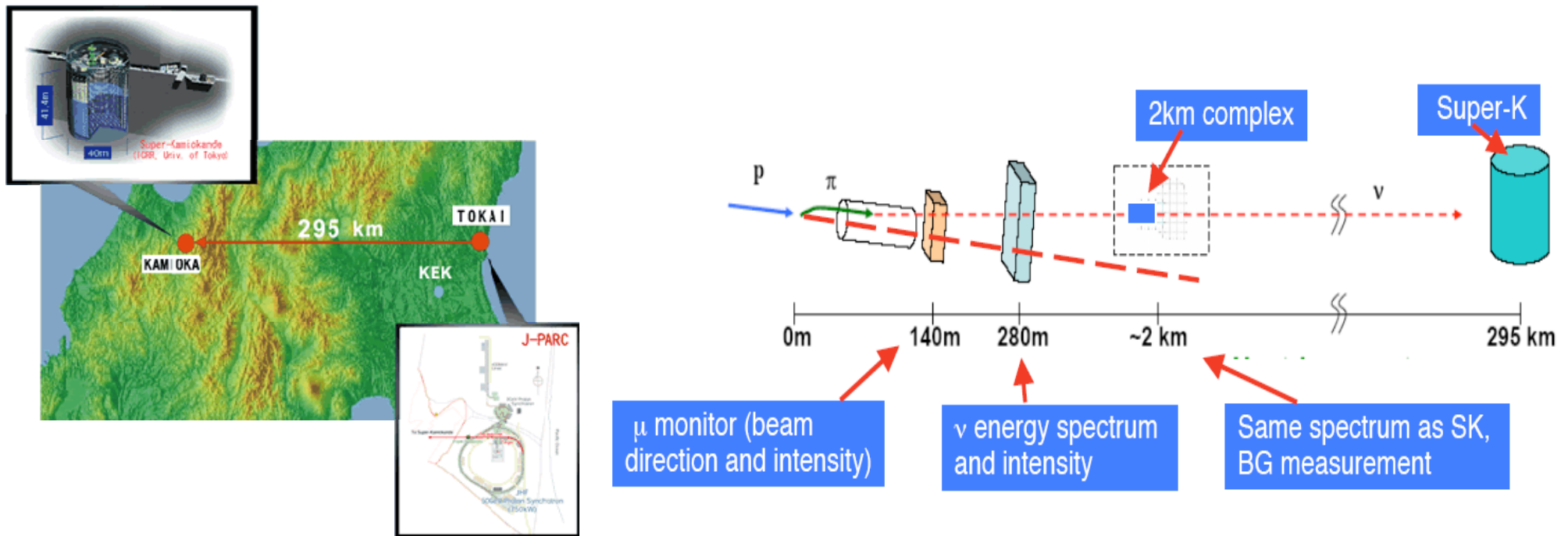
# Qscan: A QtROOT Based Software for Events Reconstruction in LAr TPC Detectors

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ETH Zürich

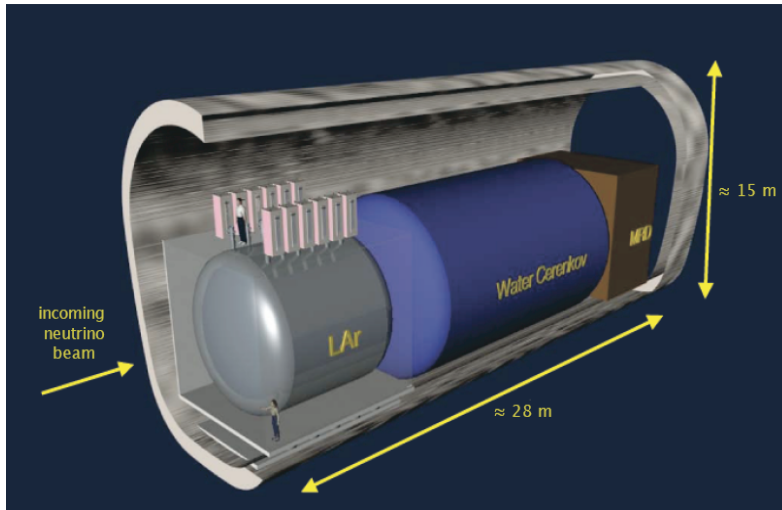
ROOT Workshop 05, September 28-30

# T2K LAr: Overview

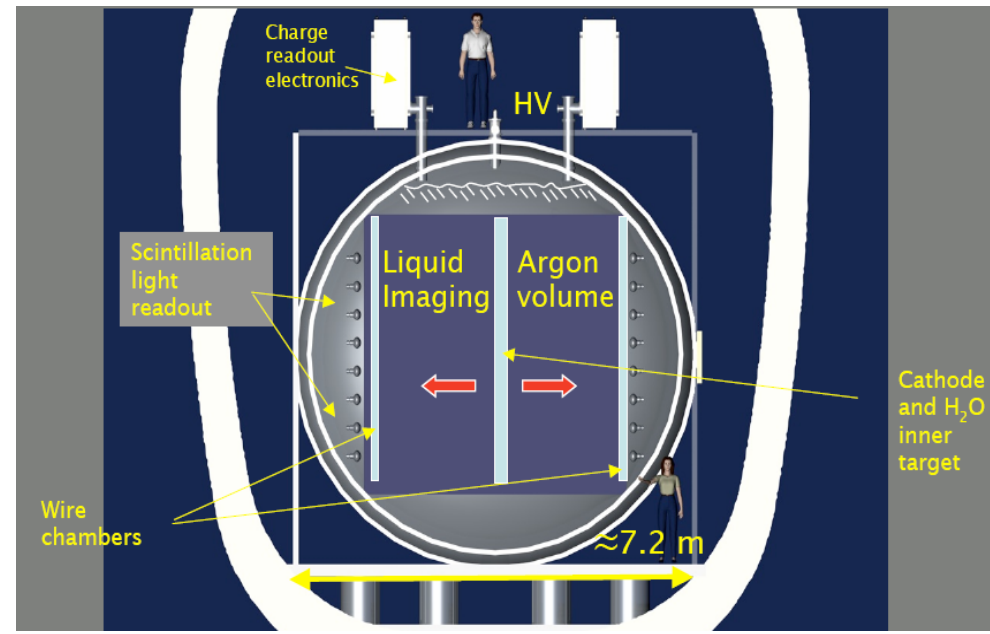
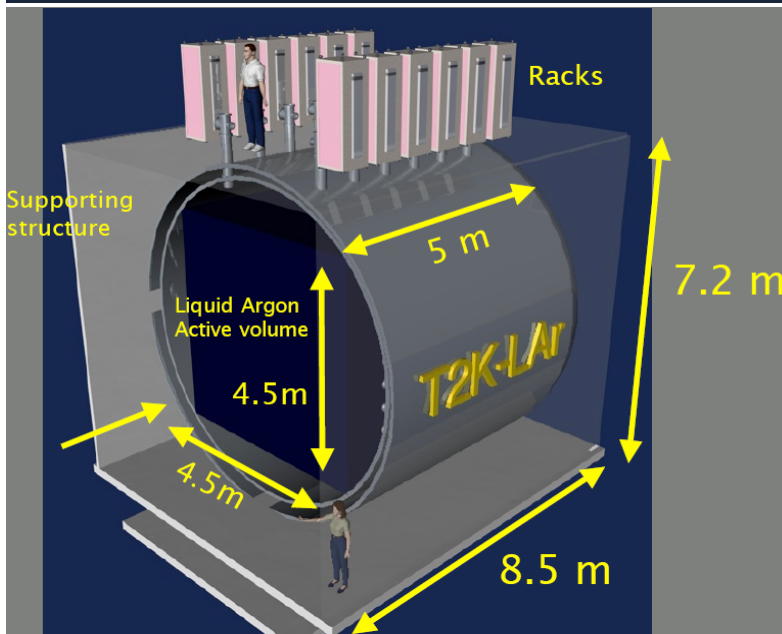


- A long baseline ( $L=295\text{km}$ ) neutrino oscillation experiment foreseen to start in Japan, 2009.
- High intensity neutrino beam generated in the J-PARC 50GeV PS in Tokai and Super-Kamiokande as a far detector (off-axis).
- 4 detector sites: 140 m, 280 m, 2 km and 295 km.

# T2K 2km complex



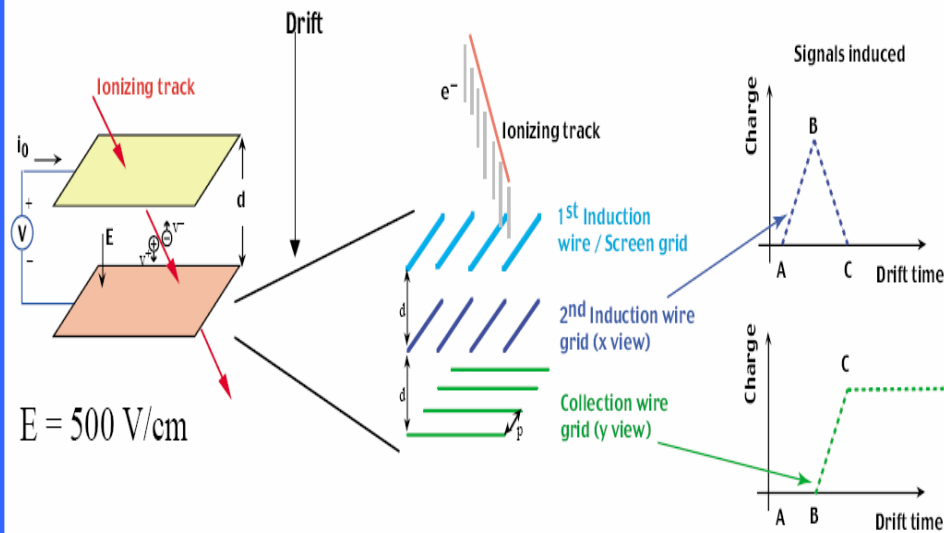
- 100ton LAr TPC + 1kton WC + MRD
- A LAr TPC has been proposed as fine grained detector for the 2km facility.
- Ad hoc software has been developed for MC generation of the events and their reconstruction.



# Liquid Argon TPC

## ICARUS liquid argon imaging TPC (II)

★ Detect electrons produced by ionizing tracks crossing the LAr



Electron-ion pairs are produced  
Electrons give the main contribution to the induced current due to the much larger mobility

$$I_0 = e(v^+ + v^-)/d$$

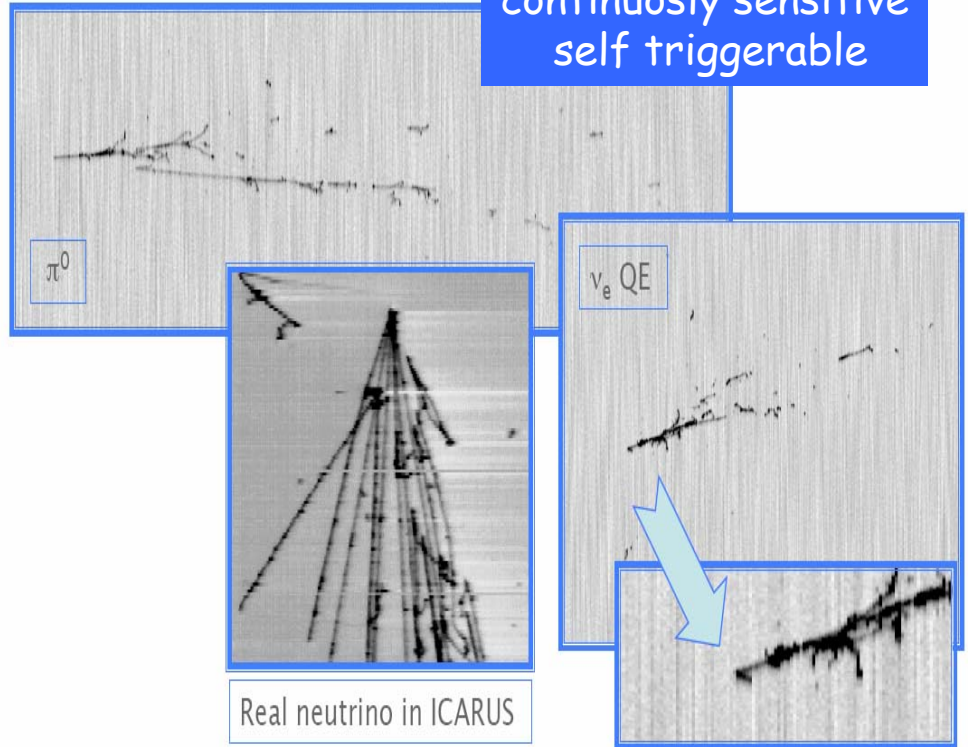
A set of wires at the end of the drift give a sampling of the track  
No charge multiplication occurs near the wires  $\vec{E}$  electrons can be used to induce signals on subsequent wires planes with different orientations  $\Rightarrow$  **3D imaging**

André Rubbia, ETH Zürich, ICARUS Collaboration, 11/201

## Examples of LAr TPC high resolution imaging

High granularity: Sampling =  $0.02 X_0$

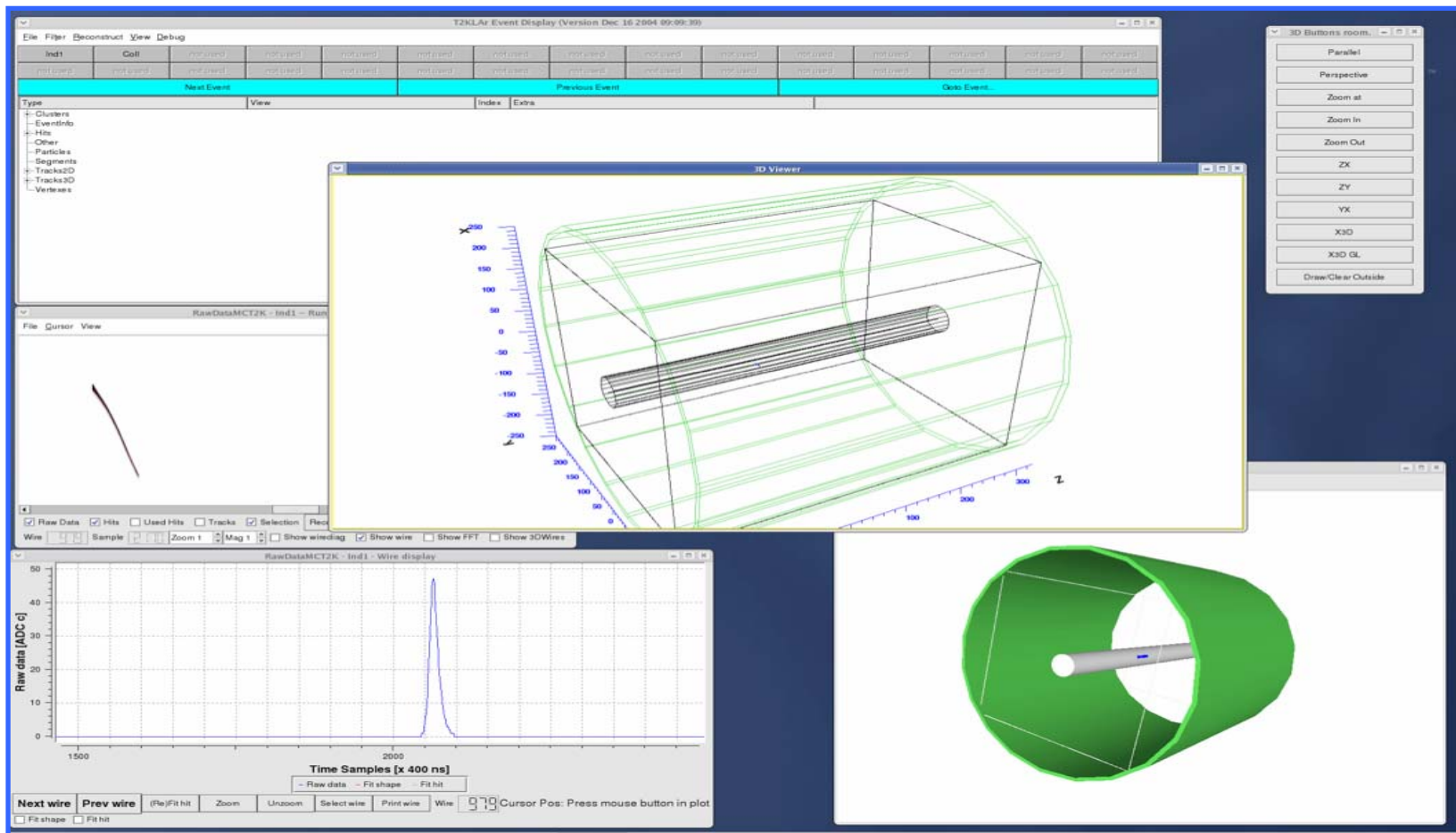
continuously sensitive  
self triggerable





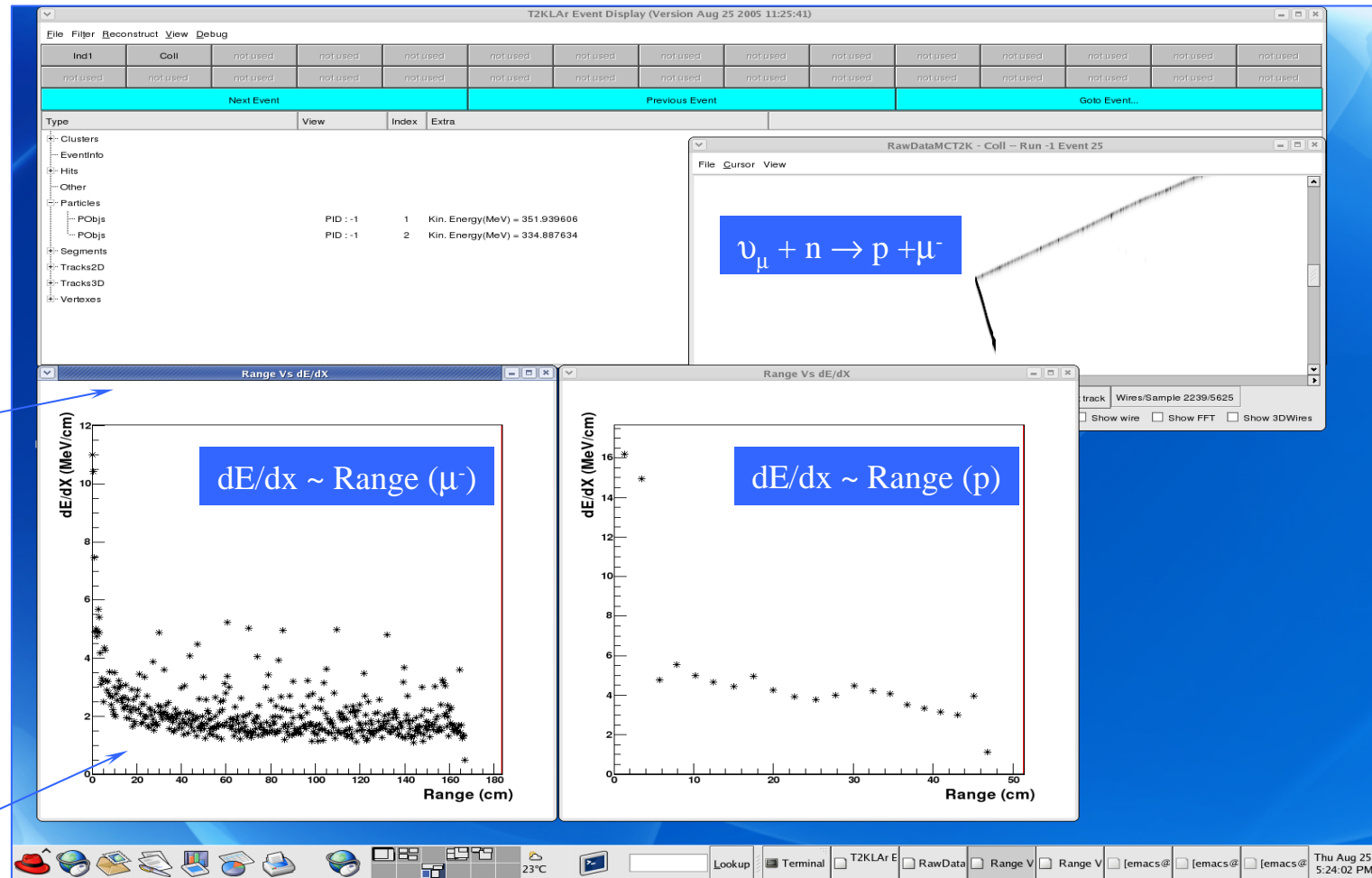
# QScan

- In QScan it is possible to use all the analysis tools and functions of Fullreco.
- Qscan is QtROOT based since 2004 (ROOT v4.00.08).



# Use of Root Classes

- The main advantages are the use of root classes for physical analysis (TGraph, TH1F, Fits, ...) and the straight forward use of the graphics (e.g. OpenGL Viewer).



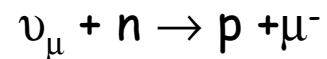
TCanvas

TGraph

# Use of OpenGL

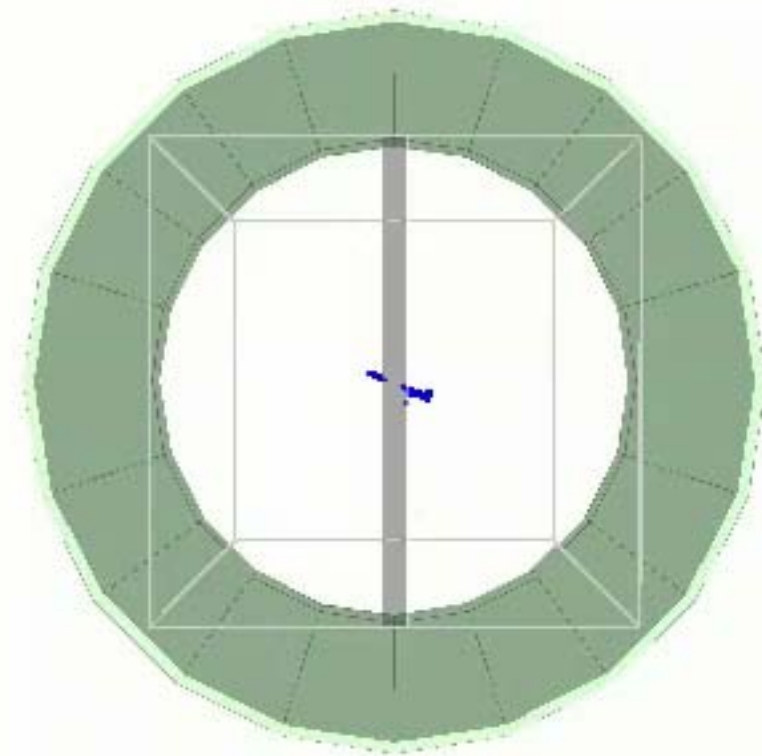
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A quasi elastic event



in the inner target (water)

recoil proton momentum = 660 MeV/c





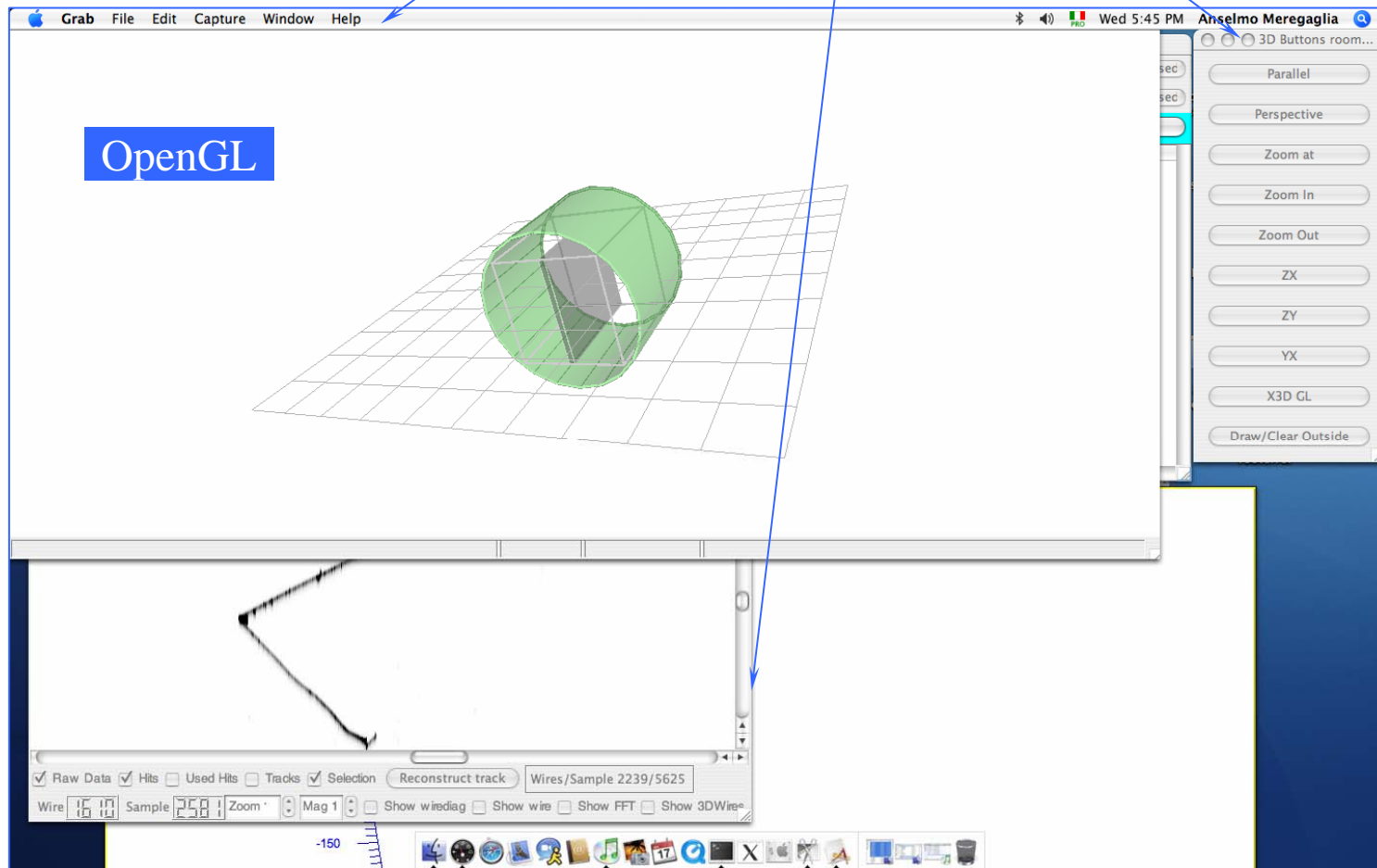
# Qscan on Mac OSX

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- Although it has not been “straight” forward, it was possible to compile Qscan on Mac OSX
- We used gcc 4.0.0 to compile qt3.3.4 and root 4.04.02f (in order to compile it properly we had to select the --disable-cern option) on a iMac G5 with OSX 10.4.2
- The main issue was to modify the Makefile in order to build a true mac application (with its structure such as Contents, info.plist, ...)

# Qscan on Mac OSX (2)

Widgets in the "native" aqua interface



# Acknowledgments

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- Thanks to the people who have been working on QScan since its begin in 2000, at ETH and in many other institutes.
- Thanks to STAR-BNL software group for developing QtROOT, in particular to Valeri Fine for his help and support.

## The End