

*Plan for Software
and Reconstruction
@ Yale*

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OVERVIEW:

- o What to expect from a reconstruction package
- o Fullreco
- o Available LArTPC events
- o MonteCarlo (GEANT3 / GEANT4 / nu-generator)

A GENERAL RECONSTRUCTION SOFTWARE SHOULD:

- Identify the interaction vertex for an arbitrary interaction
- Identify all the particles from that vertex
- Measure the momentum of each particle
- All this should be done automatically (i.e. no visual scan)

THIS IS AN EXTREMELY AMBITIOUS TOP-DOWN APPROACH *** NO SUCH SOFTWARE EXISTS *** I WOULD ARGUE THAT IT IS UNREALISTIC

APPROACH @ YALE:

Try a bottom-up approach:

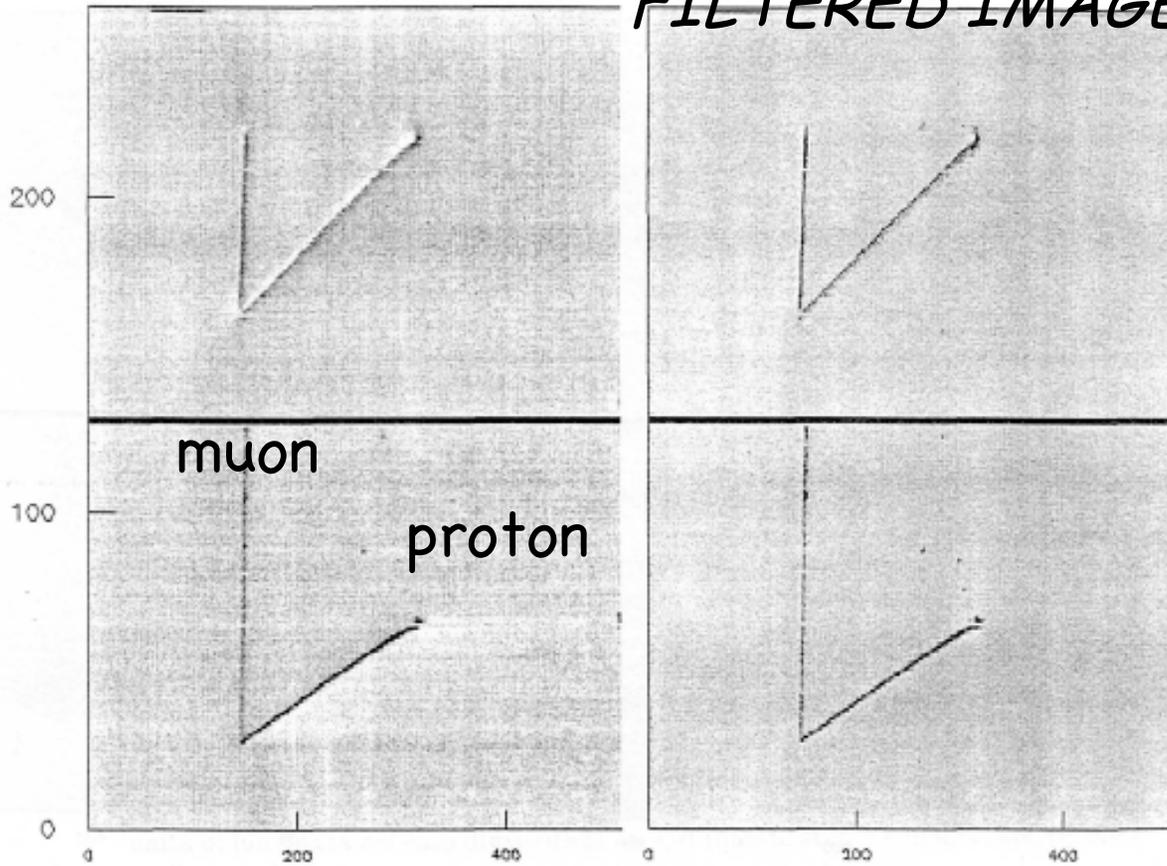
- start from the simplest topology (nu mu CC QE),
- work on a well defined module which can be integrated in a larger package (in this case, Hough xform)
- Work started, we'll see how it goes this later Summer

- Start from existing software from ICARUS (ETH group - Andre` R.): **FULLRECO**, already installed and working at Yale (from some T2K 2km work we did)
- ROOT / C++ ; works with an existing G4 MC ; works with existing ICARUS data
- Can reconstruct the kinematics for simple topologies
- It is not automated
- Compared to other CERNLIB/PAW/F77 software (from ICARUS - did some work on it ~8 years ago) it has the advantage that **1.** has more features **2.** other groups currently working on it

EXAMPLE & EXISTING DATA:

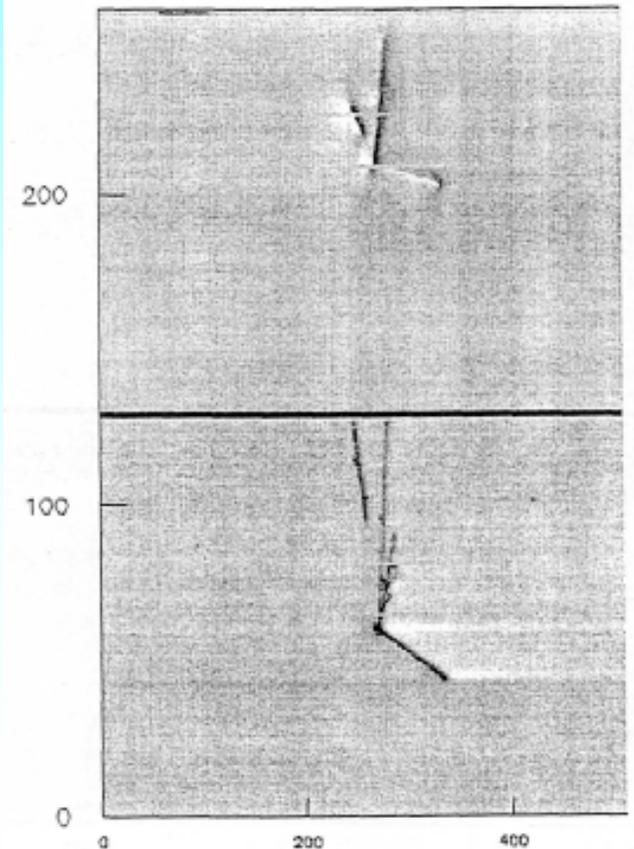
NU CC QE evts from '97 test of a 50l LArTPC @CERN

FILTERED IMAGE



CC QE

CCpi0

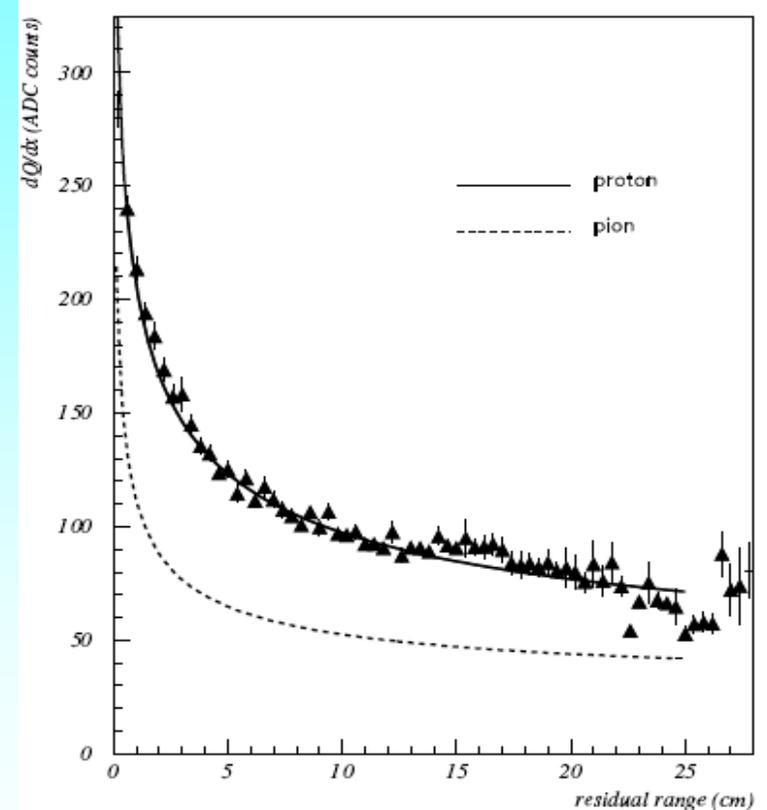
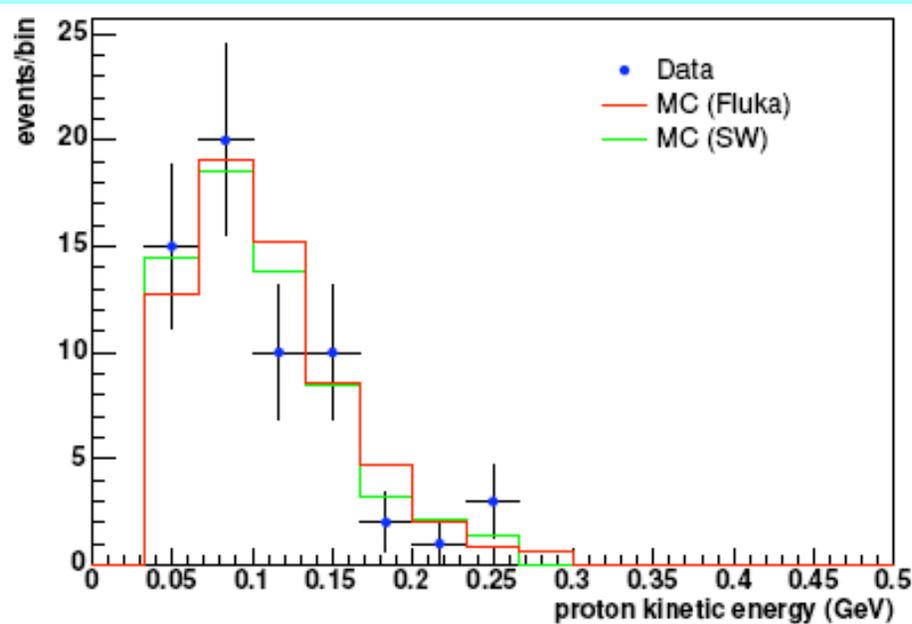


EXAMPLE & EXISTING DATA:

CERNLIB/PAW/F77 analysis package

Visual scan - good to select a CC QE sample less than 1%

The same analysis has been recently repeated using Fullreco (GRANADA U.)
very good agreement...



@YALE we want to work on the data

MONTE CARLO:

GEANT3 based MC from ICARUS, modified to input NUANCE nu-evts files. Already used for a FINeSSE related study presented to the T2K 2km collaboration meeting in Jan. We plan to use it again for studies where a detailed reconstruction is not needed

GEANT4 based MC which comes with Fullreco. The geometry is the one of 100ish ton LArTPC (the T2K 2km proposed one). Will use it for reconstruction studies.

MY COMMENT: existing MC need to be more realistic to be used in testing reconstruction packages. **E.g.1** the response of the induction plane must be properly simulated. This is a long term project. **E.g.2** the nu-generator also needs to be very accurate (nuclear effects etc.)

Summary & Future Plans

2 Yale grad students are working on MC and reconstruction:

- STEVEN LINDEN ON SENSITIVITY STUDIES FOR A LARGE LARTPC (GEANT3);
- COLIN ANDERSON ON FULLRECO, THE 1ST PROJECT A MODULE TO APPLY HOUGH XFORM TO LOW MULTIPLICITY EVTS;
- I'M WORKING ON GETTING "REAL DATA" FOR COLIN