B.T. Fleming
T962 Review
May 17, 2007

T962 Review

- Motivation
- Collaboration
- Topics for Review

Motivation:
Expose a small (~250 liter active volume)
LArTPC to the NuMI neutrino beam

- See low energy (1-3 GeV) neutrino interactions in a LArTPC
  - specifically NCπ°s and ν_e
- gain experience operating stabily over months

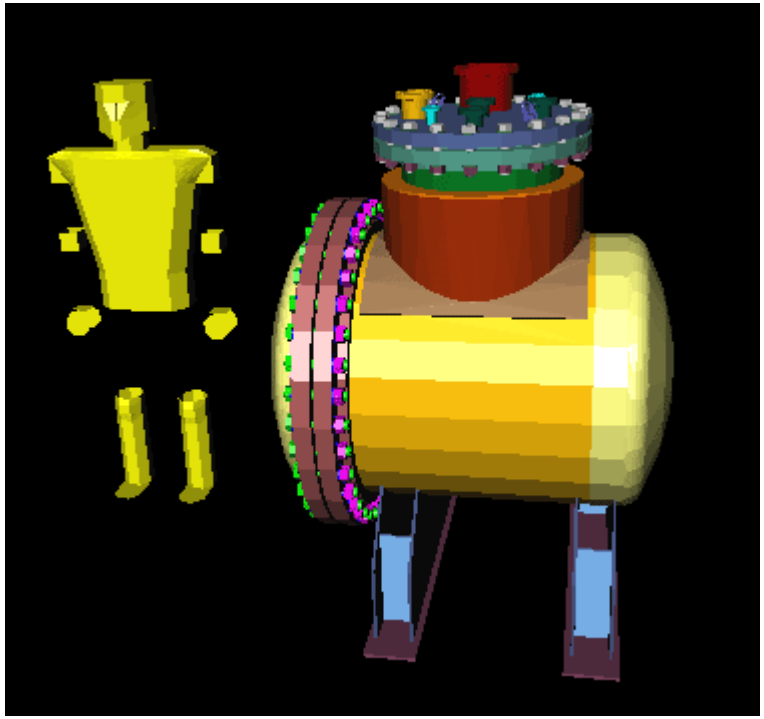
These are firsts:

- only other TPC to see neutrinos was ICARUS 50l
  - 50 liter volume
  - 24 GeV beam
  - published ~100 ν_μ CCQE events

Neither the 50 liter nor other TPCs (including T600) has operated continuously, for months, underground.

Cryostat:

- ~500 liters total volume
- ~250 liters active volume
- .5 x .5 x 1m TPC



sit just upstream of the MINOS near detector (as PEANUT has done)

use MINOS as muon catcher

Expected event rates determined from PEANUT event rates

PEANUT (October 2005):

- NuMI LE beam: 1 x 10^{-15} ν_μ/pot/ton
- PEANUT target mass: 0.4 tons → ~200 events/day
- NuMI Intensity: 5 x 10^{17} pot/day

T962 (Fall 2007):

- NuMI LE beam: 1 x 10^{-15} ν_μ/pot/ton → ~300 ν_μ CC events/day
- T962 target mass: 0.42 tons
- NuMI Intensity: 7.5 x 10^{17} pot/day

for 6 month run in front of MINOS:
(~200 days) -- 60,000 events
in active volume

~600 ν_e CC events

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Collaboration Participation

Fermilab: Bruce Baller, Cat James, Gina Rameika, Niki Saoulidou
Cryogenic Engineers: Rich Schmitt, Bob Sanders

Cryogenic engineering and safety analysis
Project management and installation underground
Interface with MINOS detector

Yale: Colin Anderson, Alessandro Curioni, Bonnie Fleming, Steve Linden, Mitch Soderberg, Josh Spitz
Mechanical Engineer: Larry Bartoszek

Cryostat and TPC design
Component testing and TPC assembly and commissioning

Michigan State University: Carl Bromberg
Electronics Engineer: Dan Edmunds

Electronics design, construction, and installation

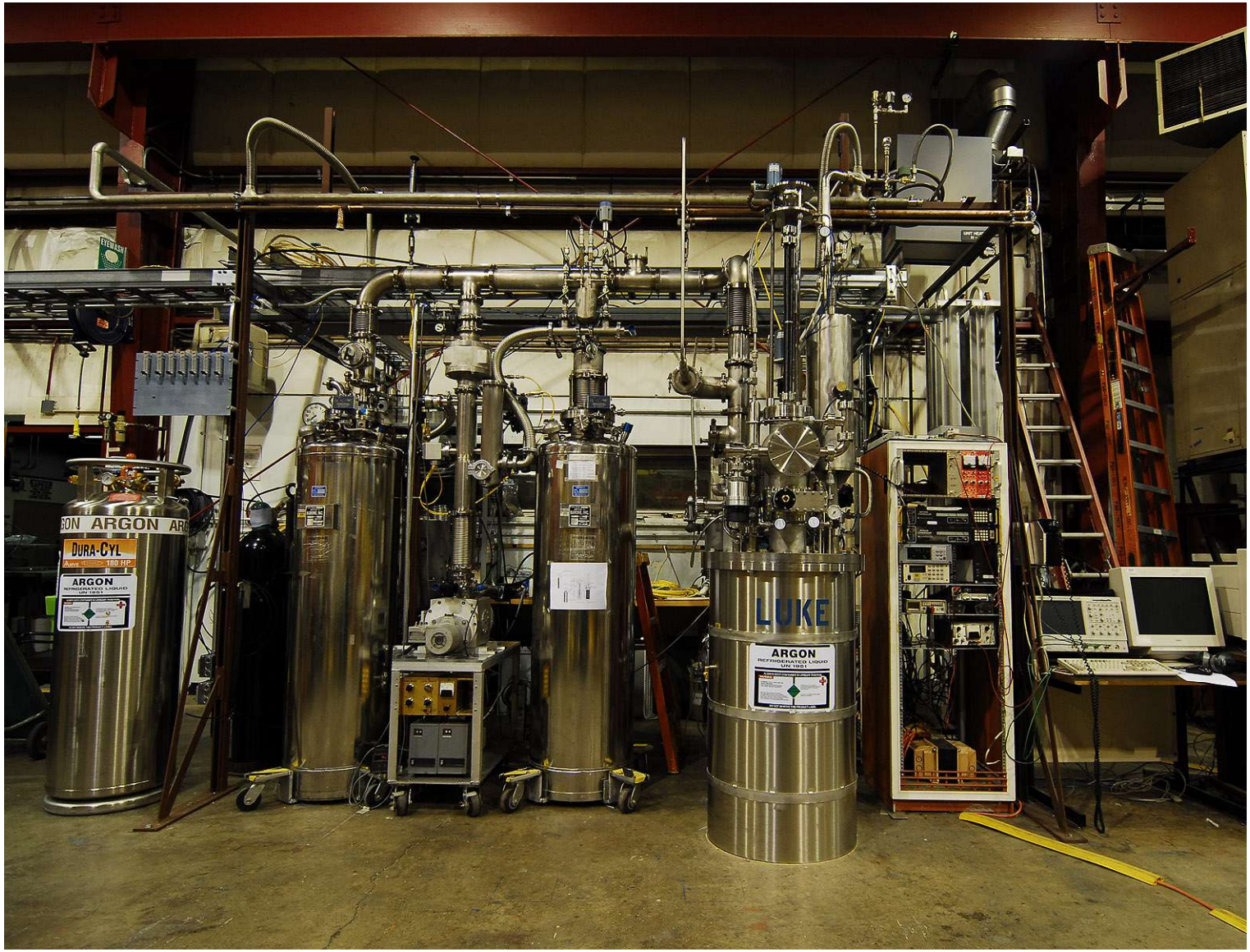
Project builds off existing
efforts at FNAL, Yale, and MSU....

Fermilab group:

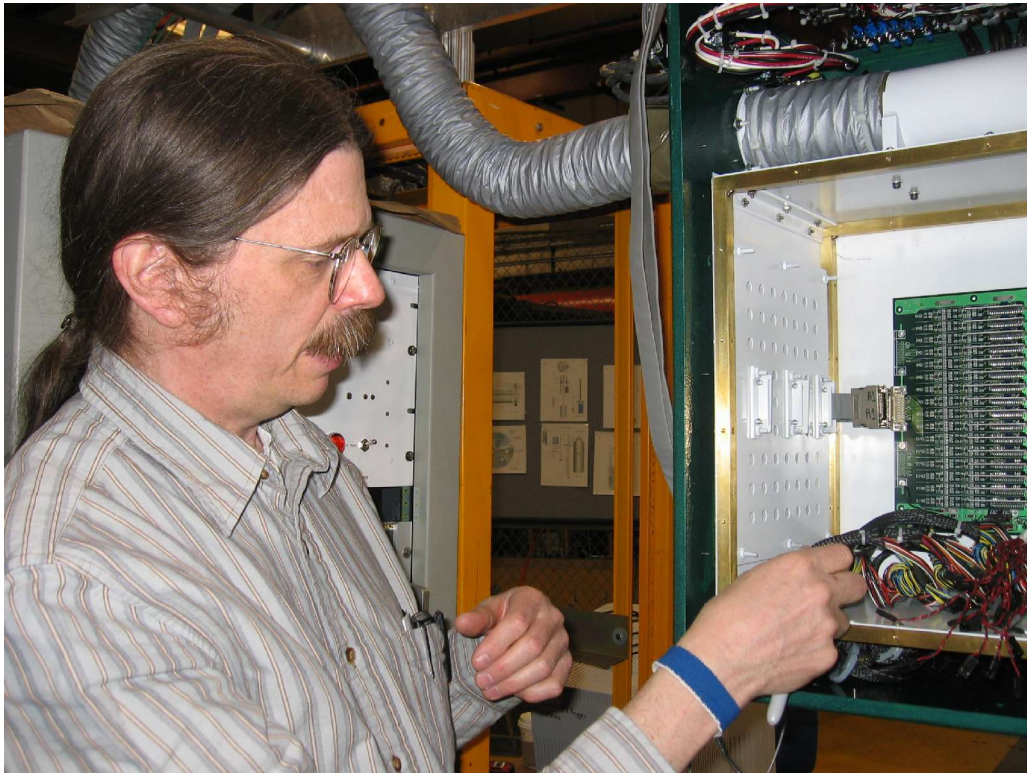
PEANUT and MINOS
-experience operating underground and in conjunction with MINOS

DONUT: Experience with reconstruction for multi-track events

LAr purity, TPC and Cryogenics: Extensive work at PAB



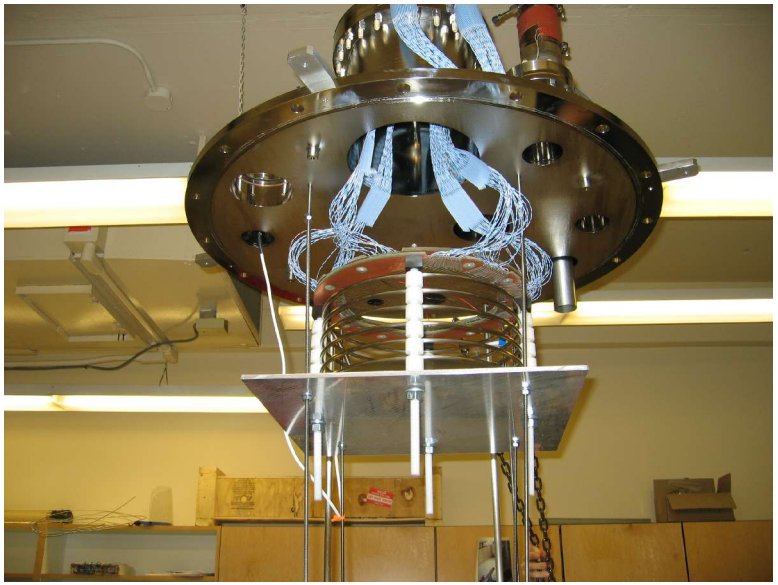
Michigan State group



development of electronics, under test in PAB prior to development/assembly for T962

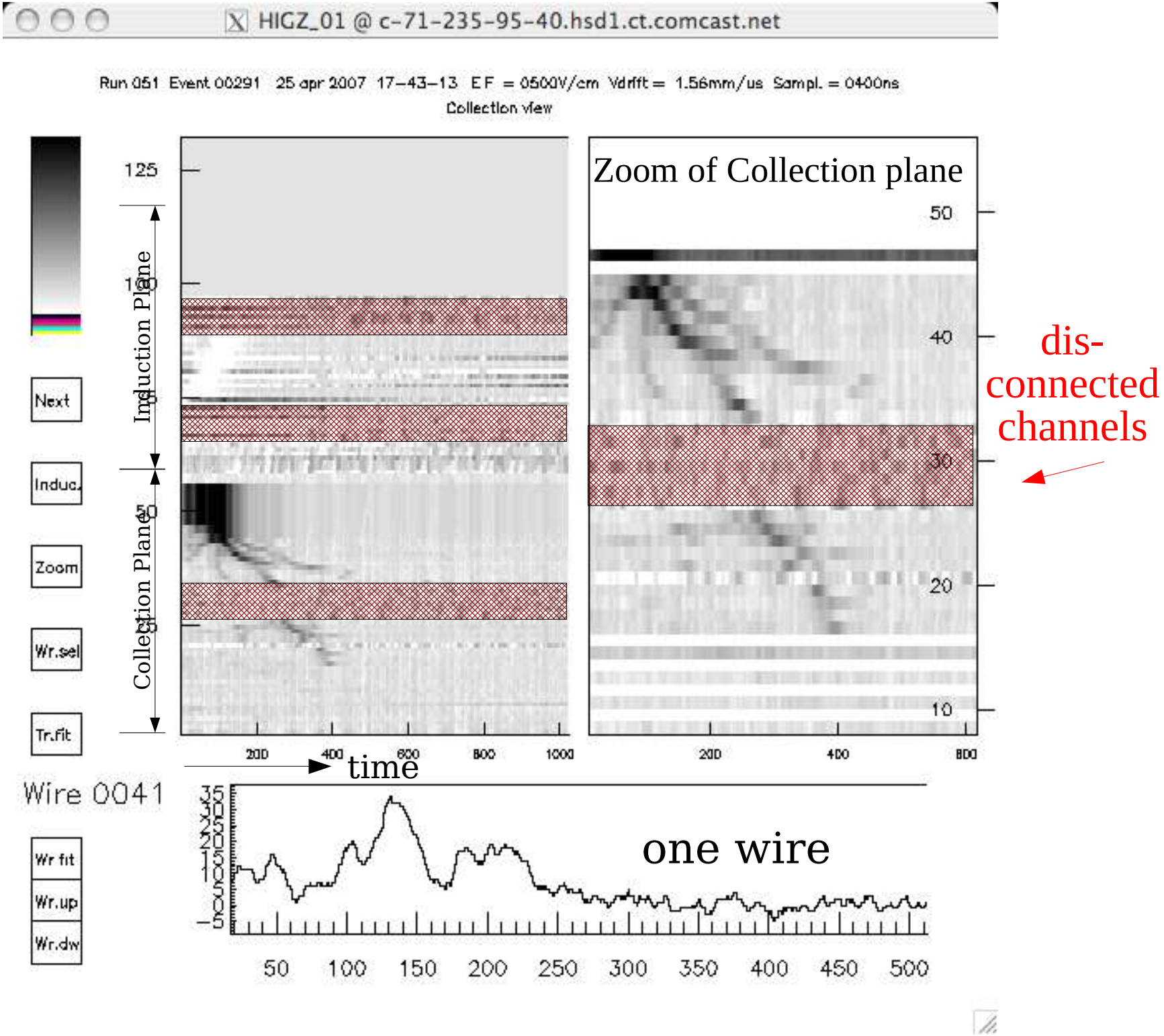
Yale group

LAr: Small lab testing purity and TPCs
First tracks seen last month!



Simulation and Reconstruction:

-GEANT3 MC coupled with fully automated reconstruction package.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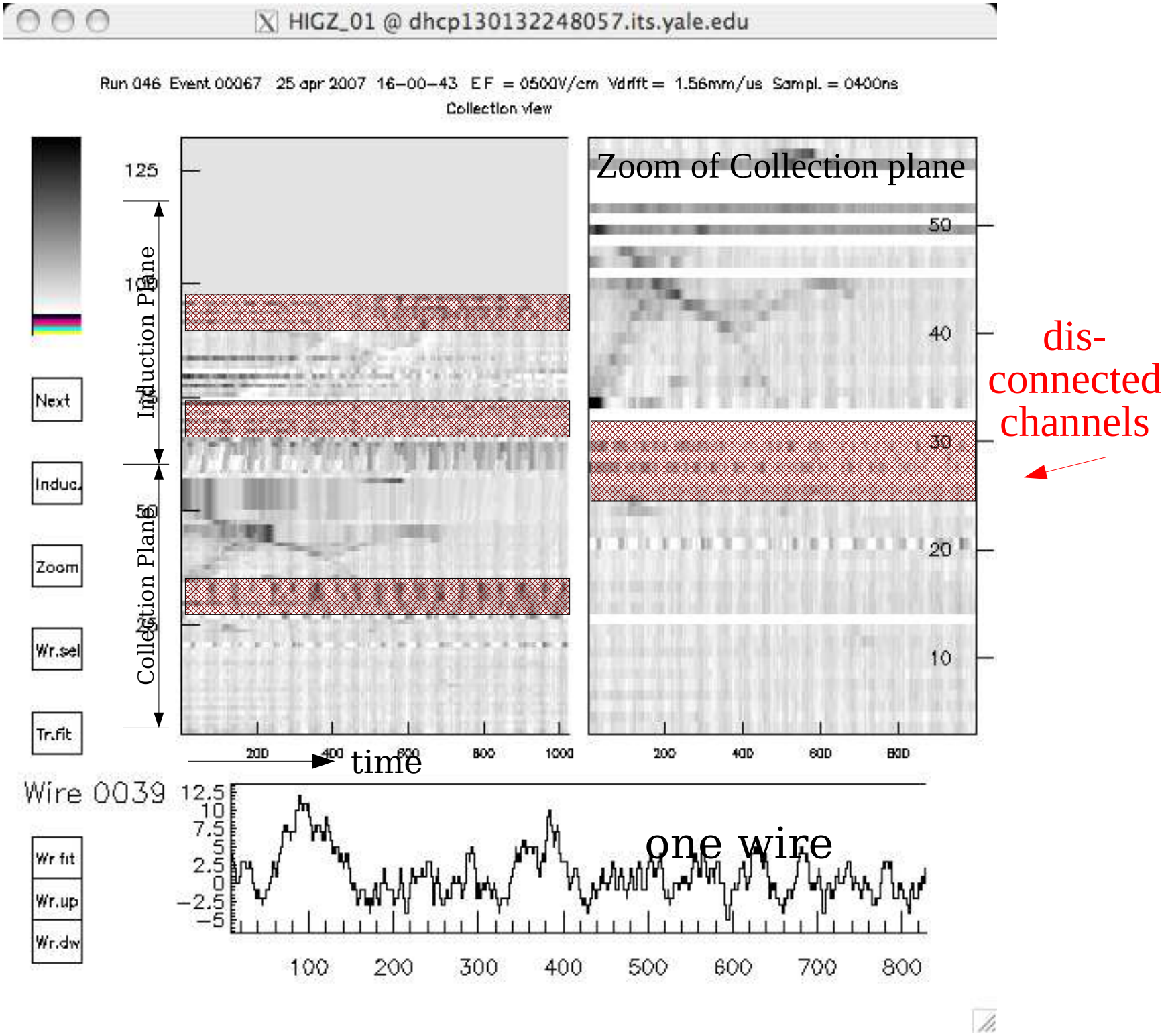
Run 051 Event 00291 25 apr 2007 17-43-13 EF = 0500V/cm Vdrift = 1.56mm/us Sampl. = 0400ns
Collection view
Zoom of Collection plane
Induction Plane
Collection Plane
Next
Induc.
Zoom
Wr.sel
Tr.fit
time
Wire 0041
Wr fit
Wr.up
Wr.dw
one wire
dis-
connected
channels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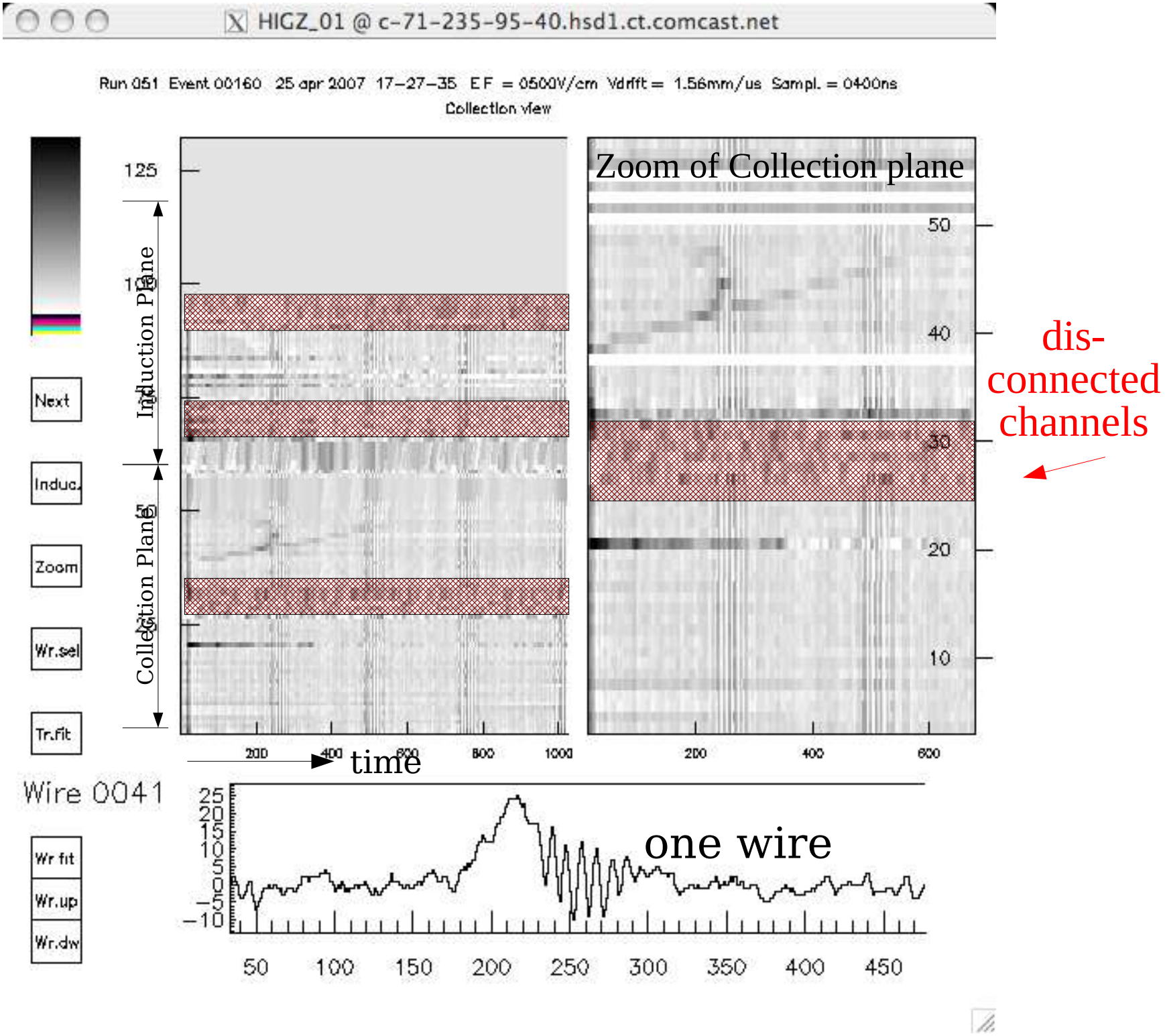
Collection view
Zoom of Collection plane
Induction Plane
Collection Plane
Next
Induc.
Zoom
Wr.sel
Tr.fit
time
Wire 0039
Wr fit
Wr.up
Wr.dw
one wire
dis-
connected
channels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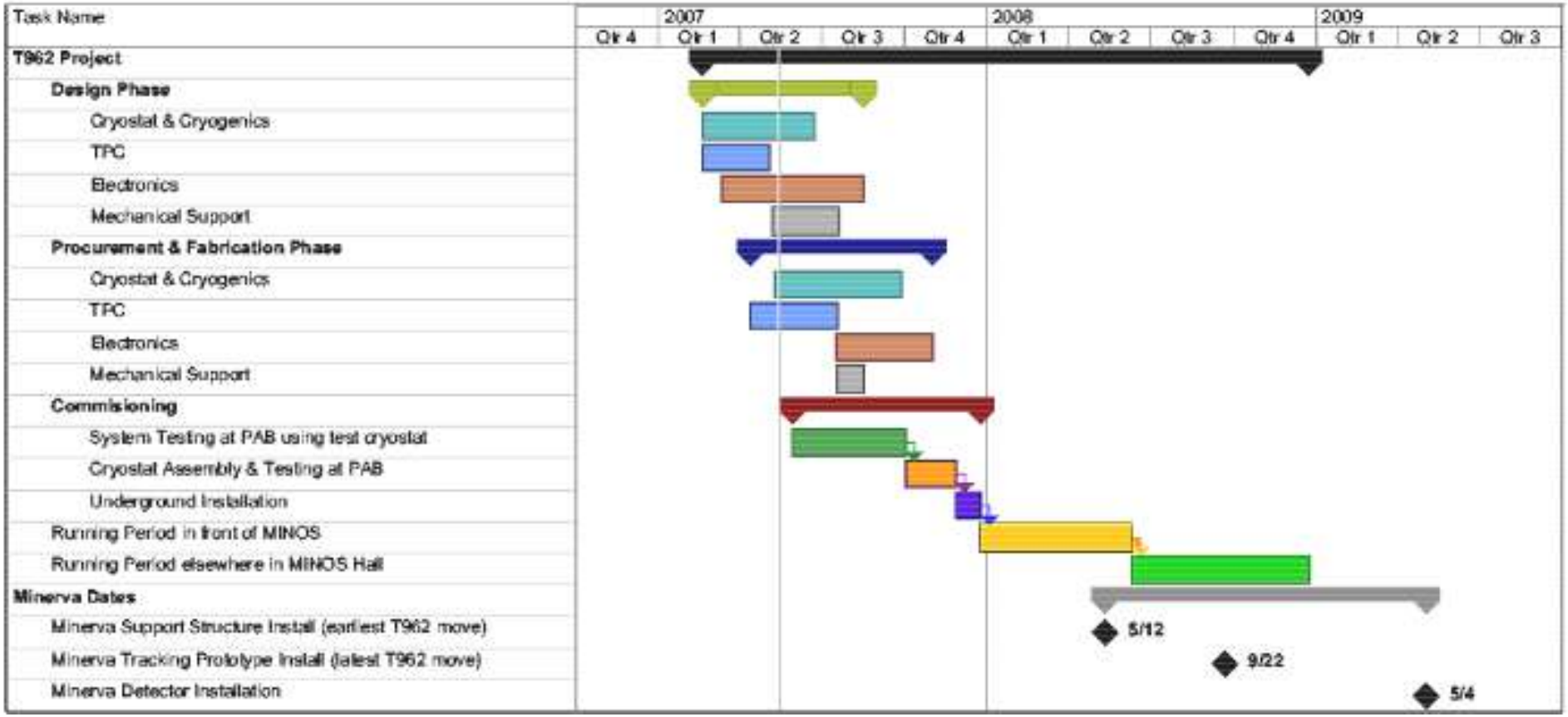
Collection view
Zoom of Collection plane
Induction Plane
Collection Plane
Next
Induc.
Zoom
Wr.sel
Tr.fit
time
Wire 0041
Wr fit
Wr.up
Wr.dw
one wire
dis-
connected
channels

Overview of Schedule



Running begins at the end of this year, first upstream of MINOS then upstream of MINERvA

Overview of Costs

Cash Flow as of Wed 5/16/07
T962_Project

	Feb '07	Mar '07	Apr '07	May '07	Jun '07	Jul '07	Aug '07
L. Bartoszek		$2,850.00	$3,990.00	$3,610.00			$190.00
BE drafting			$1,440.00	$10,320.00	$960.00	$3,600.00	$240.00
B. Sanders							
R. Schmitt							
T962 Group							
Yale Group							
MSU EE							
FNAL Tech Crew							
FNAL Lab 6 Tech							
FNAL Lab 8 Tech							
Electrician							$10,000.00
Pipefitters						$10,000.00	
Cryostat						$50,000.00	
Cryo Cooler				$30,000.00			
Signal Feedthrough				$4,000.00			
HV Feedthrough				$1,200.00			
Other Feedthrough				$5,000.00			
Cryo Plumbing						$15,000.00	
Vacuum Pump & Gauges				$10,000.00			
Purity Monitor				$6,000.00			
Cryo Filter				$10,500.00			
DAQ parts							
TPC Parts				$3,000.00			
TPC HV Supply			$4,000.00				
PMB Boards						$40,000.00	
Electronics Cables						$5,000.00	
Electronics Crates & PS						$5,000.00	$5,000.00
Total		$2,850.00	$9,430.00	$83,630.00	$960.00	$128,600.00	$15,430.00

Starting to spend $ now

Cash Flow as of Wed 5/16/07
T962_Project

	Sep '07	Oct '07	Nov '07	Dec '07	Jan '08	Total
L. Bartoszek						$10,640.00
BE drafting						$16,560.00
B. Sanders						
R. Schmitt						
T962 Group						
Yale Group						
MSU EE						
FNAL Tech Crew						
FNAL Lab 6 Tech						
FNAL Lab 8 Tech						
Electrician						$10,000.00
Pipefitters						$10,000.00
Cryostat						$50,000.00
Cryo Cooler						$30,000.00
Signal Feedthrough						$4,000.00
HV Feedthrough						$1,200.00
Other Feedthrough						$5,000.00
Cryo Plumbing						$15,000.00
Vacuum Pump & Gauges						$10,000.00
Purity Monitor						$6,000.00
Cryo Filter						$10,500.00
DAQ parts						
TPC Parts						$3,000.00
TPC HV Supply						$4,000.00
PMB Boards						$40,000.00
Electronics Cables						$5,000.00
Electronics Crates & PS						$10,000.00
Total						$240,900.00

funded through NSF CAREER award

working to fund through FNAL

Overview of this Review

1) Project overview (Bonnie)
2) Mechanical design of cryostat
   and placement underground (Larry)
3) ODH/Cryo (Bob)
4) Electronics (Carl)
5) TPC/Purity monitor (Mitch)
6) Cost/Schedule/Installation/Safety reviews (Cat)

Things you won't hear about today
(not time critical, but things we are thinking about)

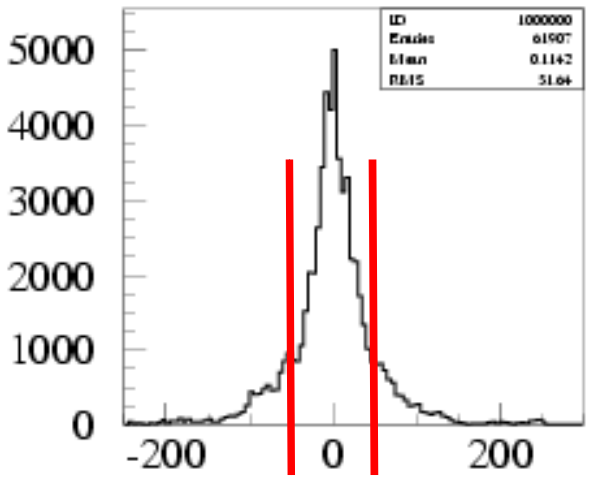
Detector Simulation: GEANT3 simulation of T962 exists (built from ICARUS MC). Moving towards GEANT4 simulation.

Reconstruction: Fully automated track and vertex finding algorithm developed within the root framework at Yale
(~mm vertex resolution and ~deg angular resolution)

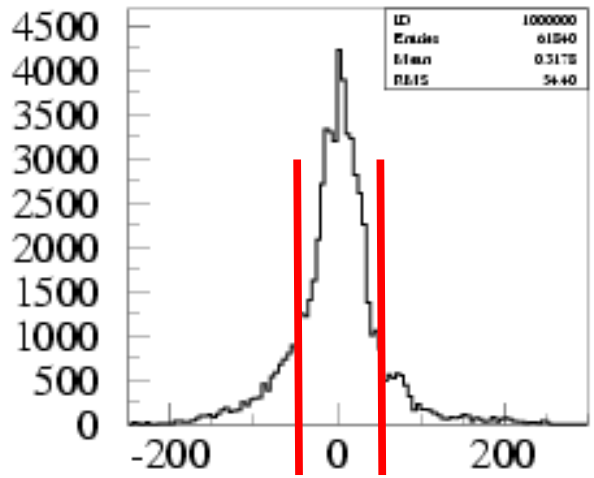
Reconstruction algorithm (based on experience from DONUT) under development at FNAL

Interface with MINOS trigger and data: Gina has experience doing this with PEANUT.

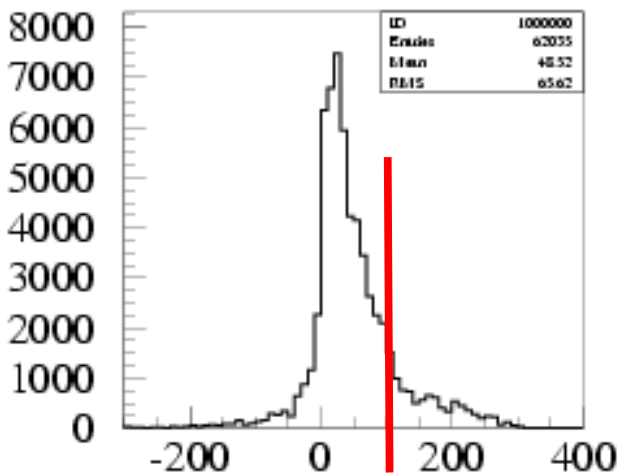
Neutral current π° events are mostly contained in TPC



lateral spread **X** (cm)



lateral spread **Y** (cm)



longitudinal spread Z (cm)