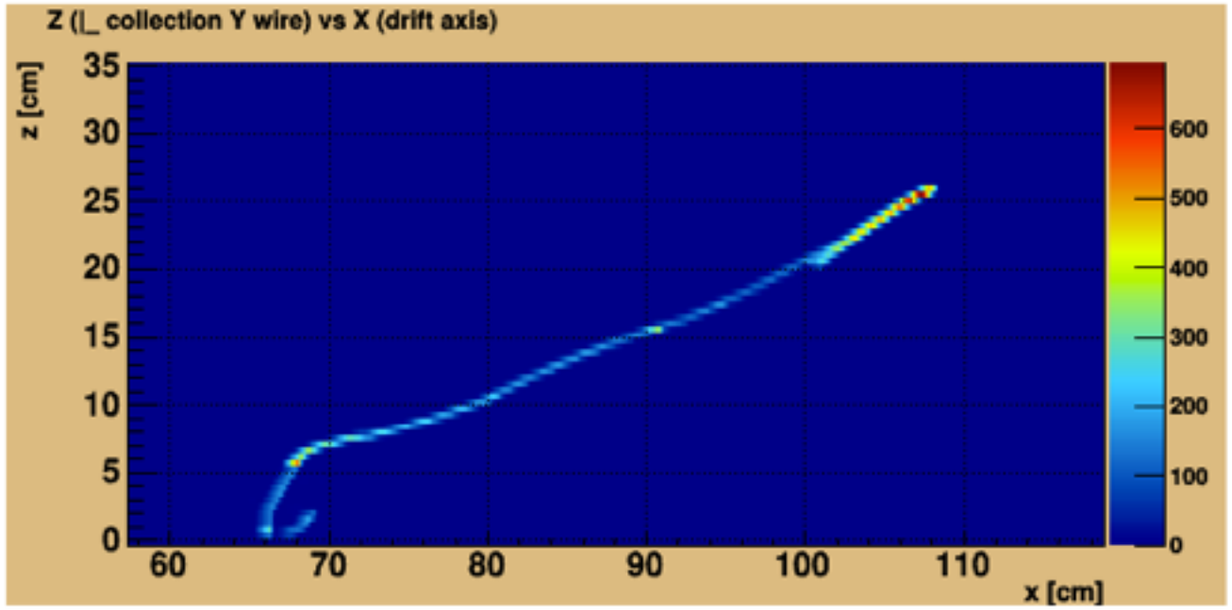
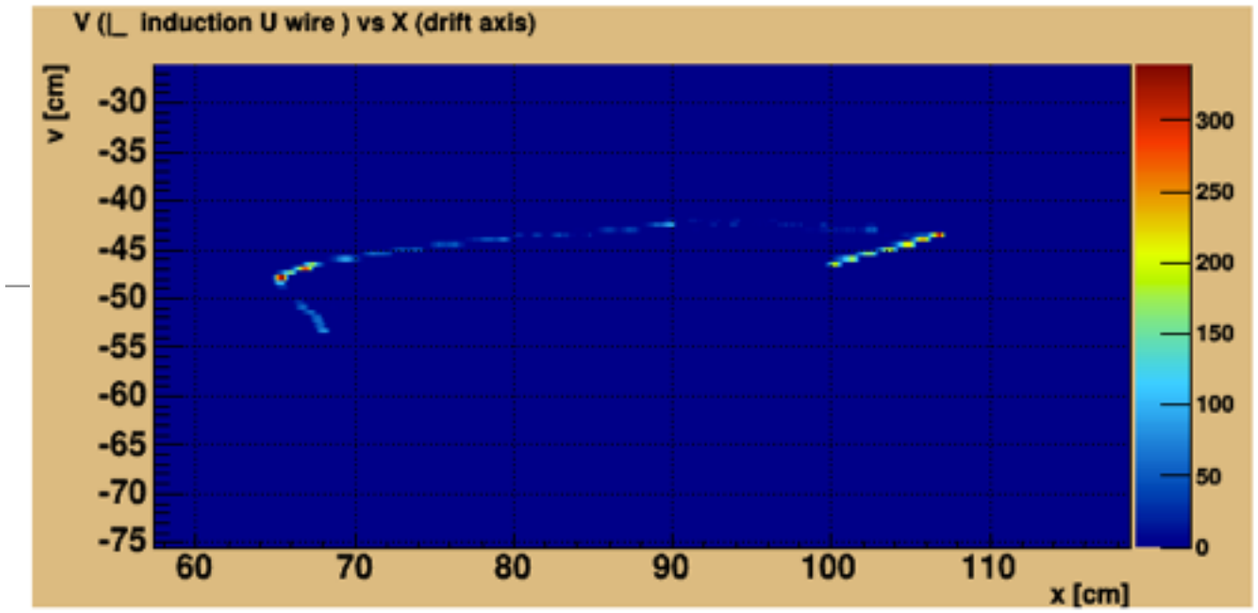
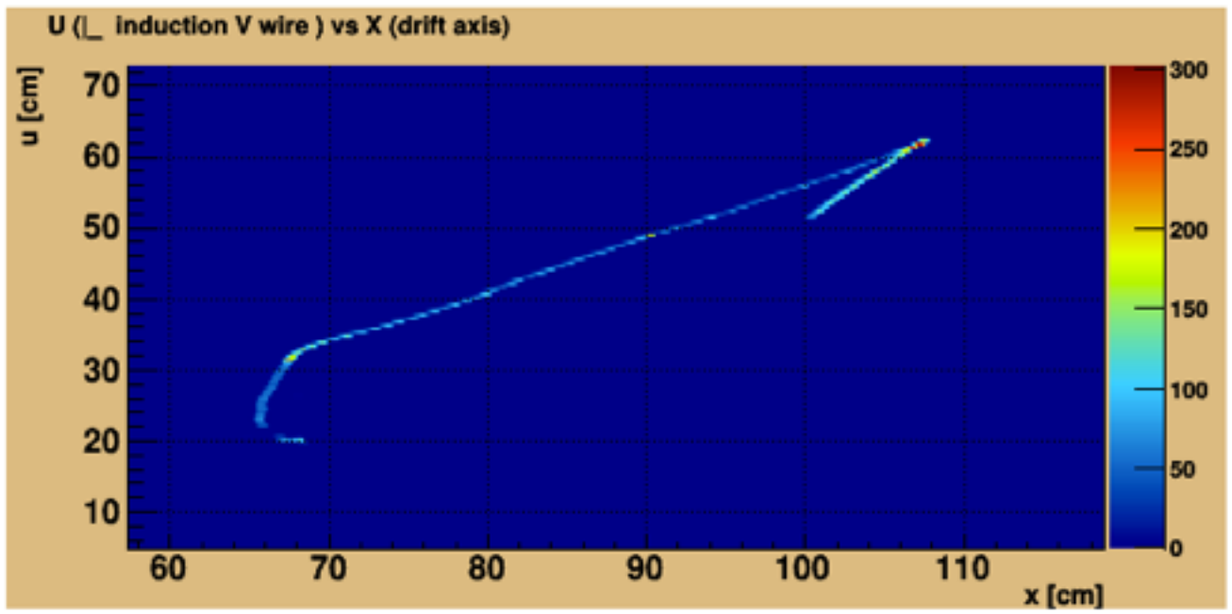
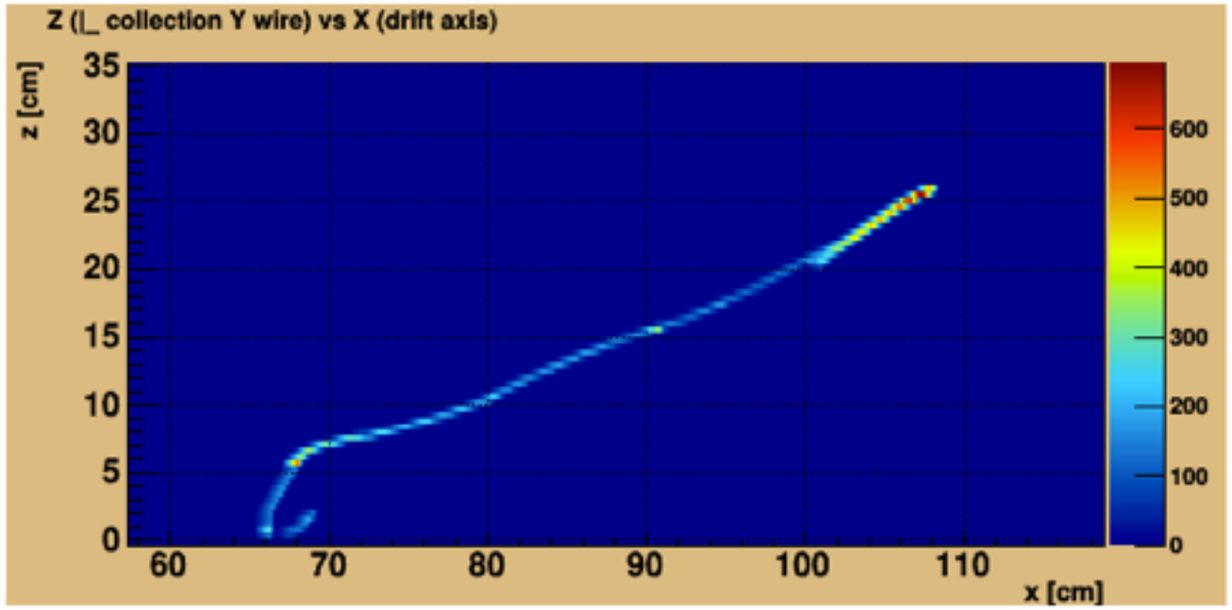


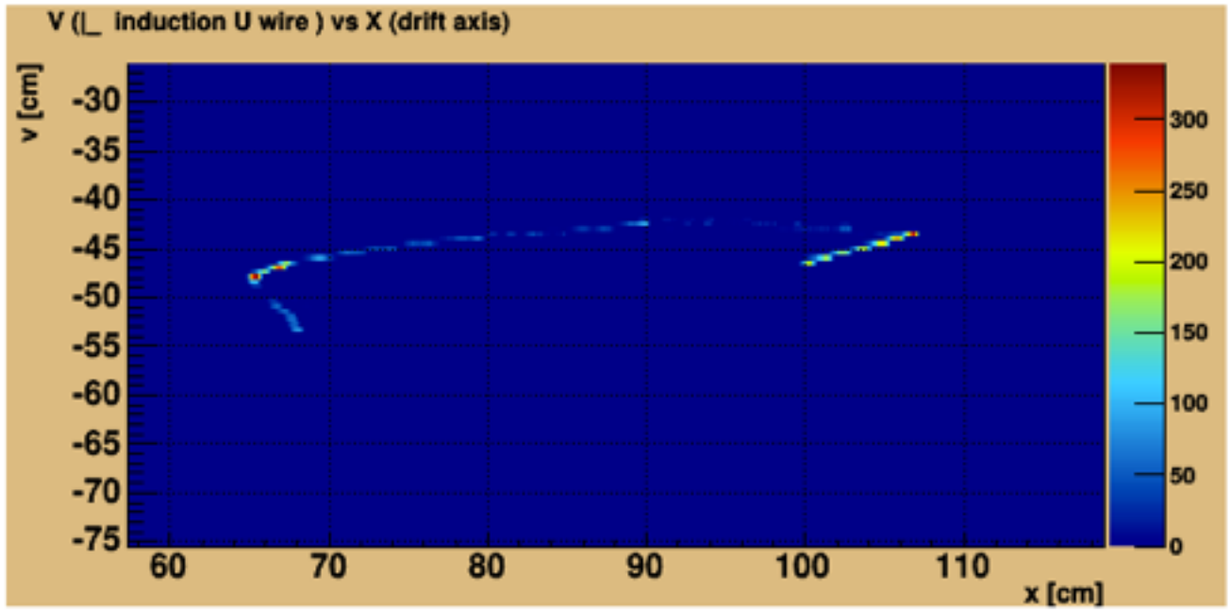


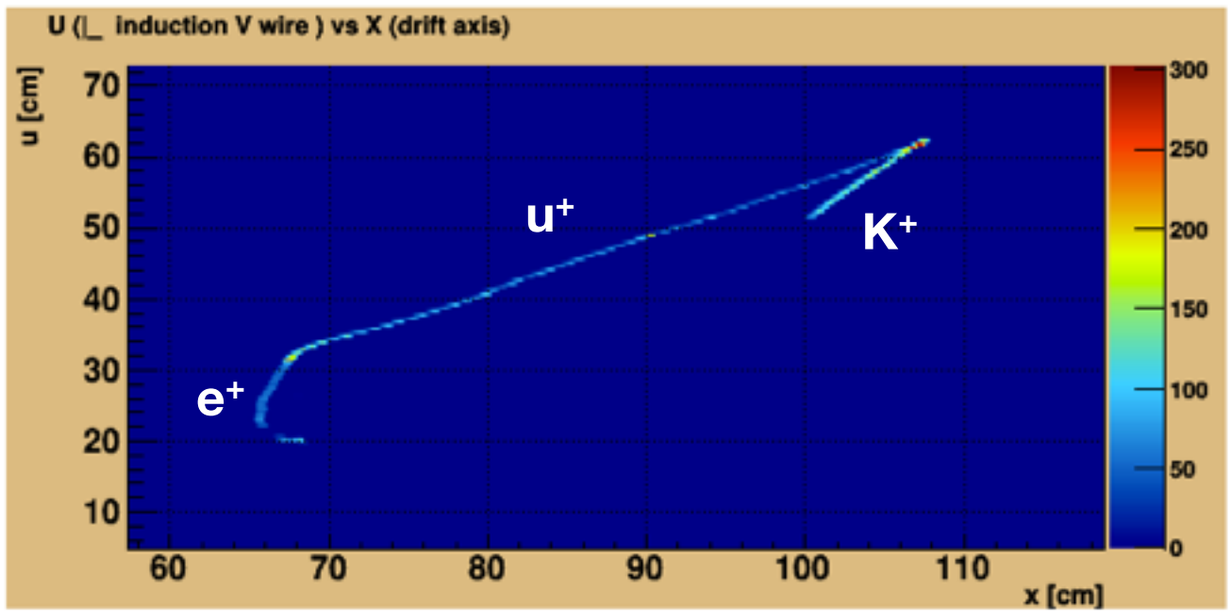


Event Display for LBNE 35ton

Chao Zhang
BNL







$$p \rightarrow K^{+}\overline{\nu}$$

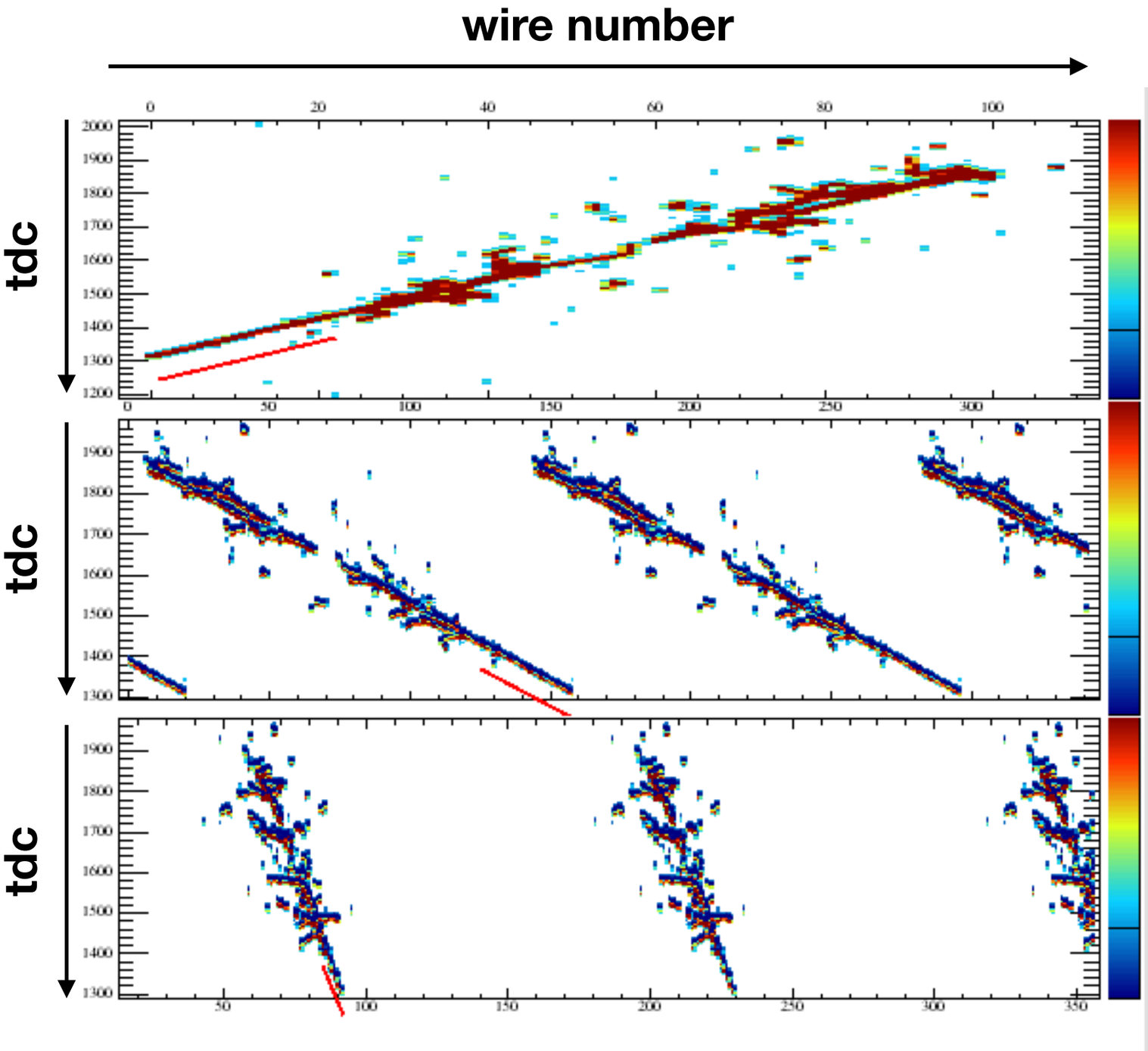
12.4 ns

63% $K^{+} \rightarrow \mu^{+}\nu_{\mu}$

21% $K^{+} \rightarrow \pi^{+}\pi^{0}$

Why Another Event Display

The “official” LBNE event display

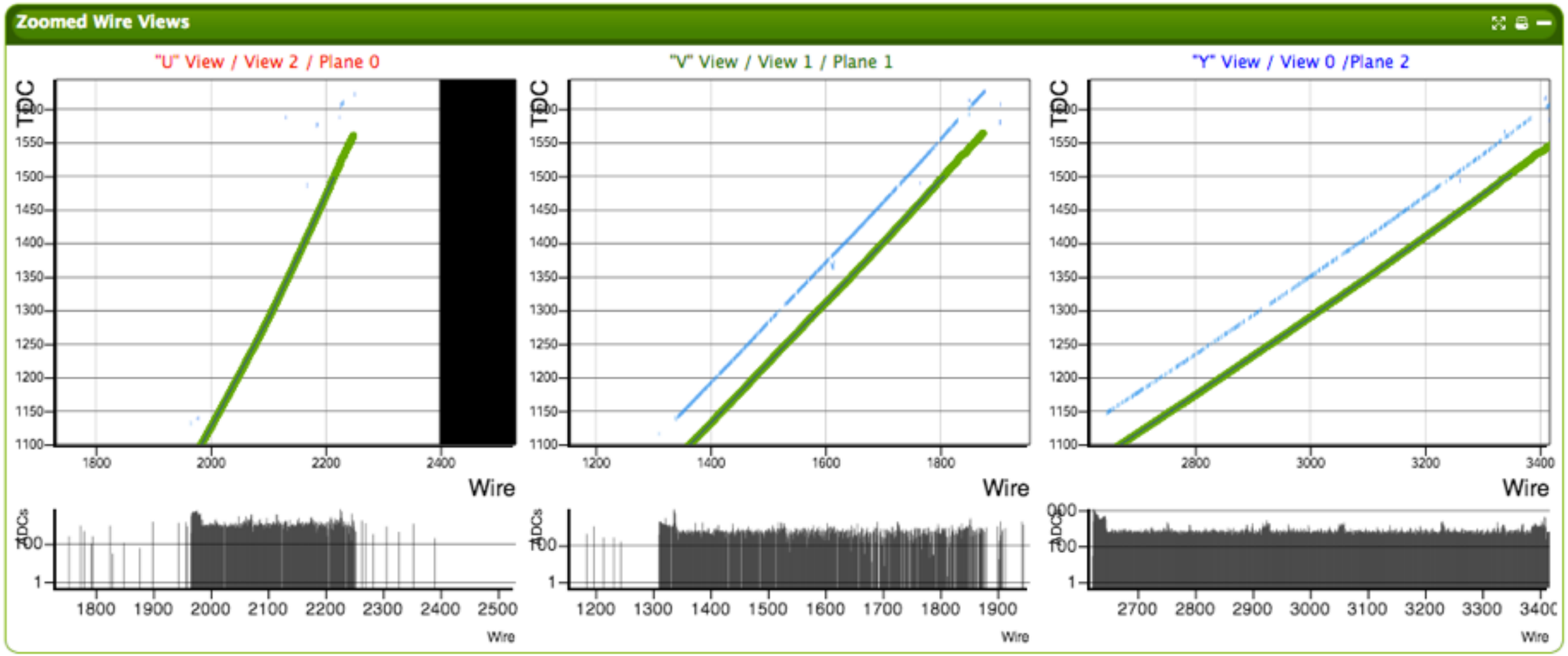


- Hard to form a mental image of the topology
  - tdc should be a common axis
  - wire number / tdc should be translated to distance
  - didn’t take into account the 35t geometry (different size APA’s)
  - color scale is hard to see dE/dx
  - not enough handle on Truth info
- Slow
  - depends on LarSoft (meaning can only run on Fermi Lab clusters for now); x11 forwarding from Fermi Lab is slow.

A Better Event Display (MicroBoone)

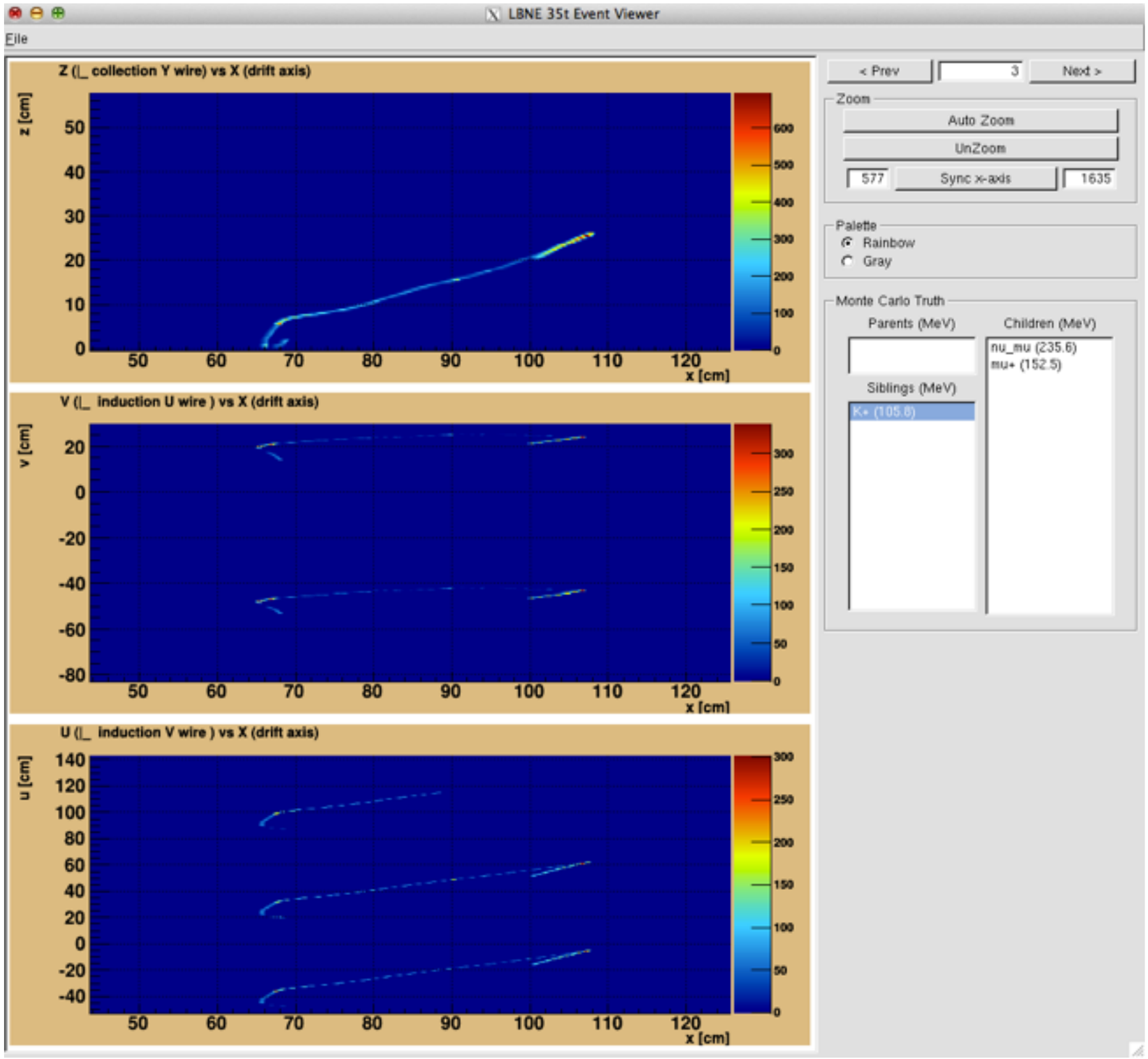
http://argo-microboone.fnal.gov/

Nathaniel Tagg



- Very fancy, many functions
- Still want to implement some customized functions (Xin's experience)
- Speed is better, but still can be non-responsive sometimes. (web based, data transferred through network)

Chao's Event Display

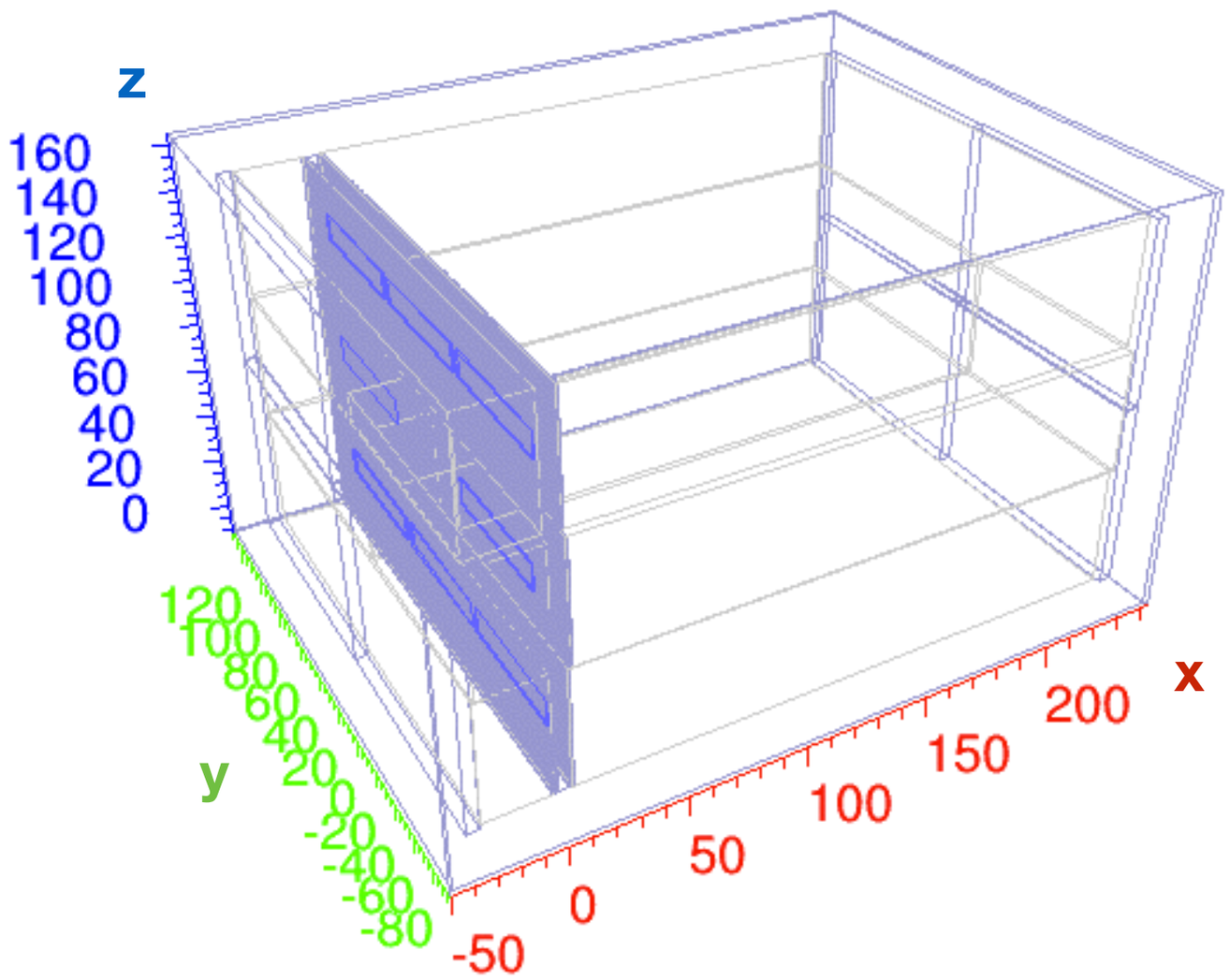


- Standard ROOT GUI running on desktop
- Can install on local computer, only need ROOT. (Need convert MC data to standard ROOT TTree format, using Chao's script)
- Fast and responsive
- 35t geometry implemented
- Easy handle on truth info
- Better color scale?
- Still a work in progress

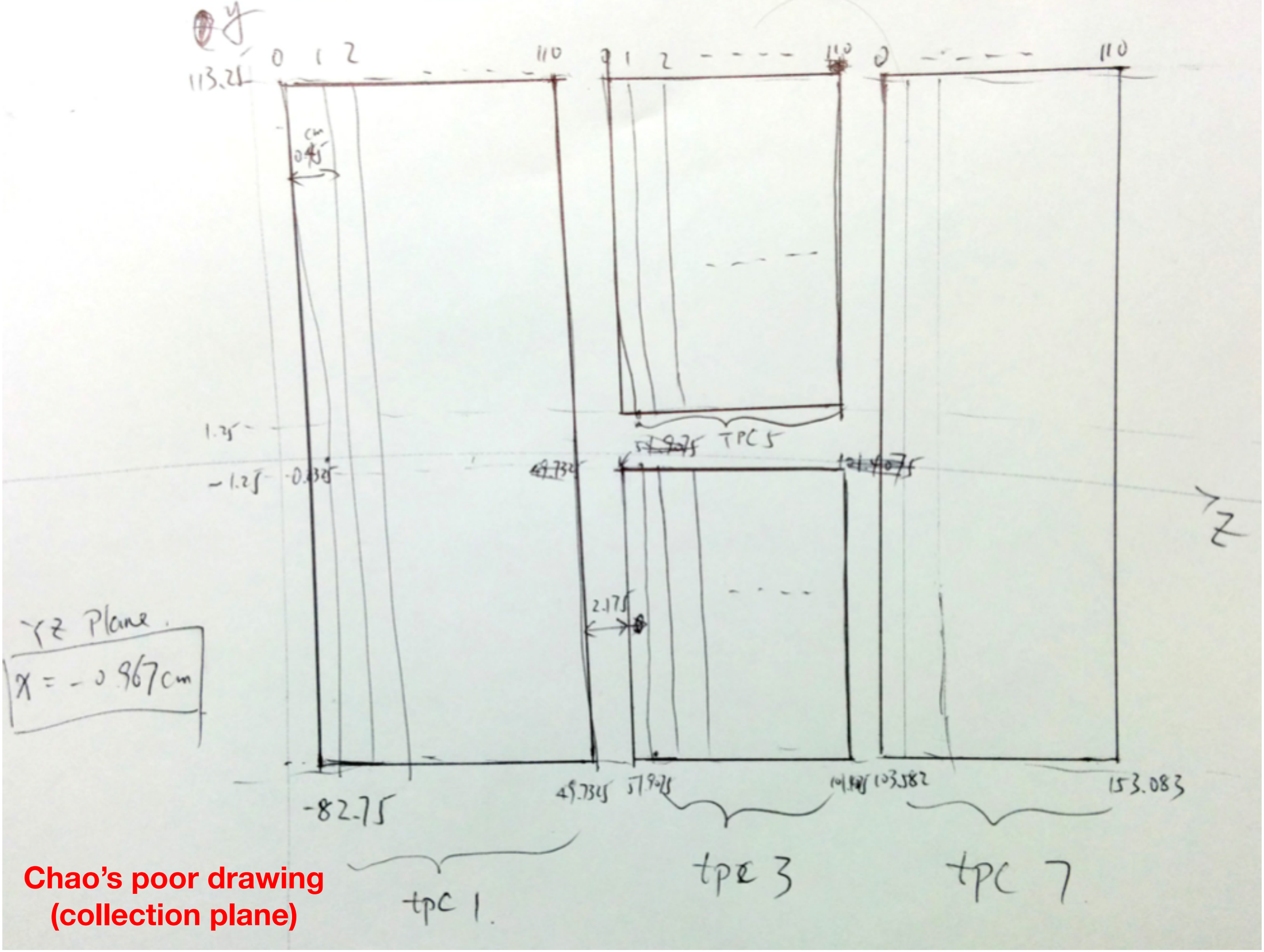
will show live demo later

https://github.com/czczc/LArViewer

35 ton Geometry In Simulation



- all units in cm's
- "x" is the drifting direction. x=0 is approximately the wire planes. which divides the detector into long/short drifting volumes
- "y" is the physical vertical direction (collection wire direction.) y=0 is the middle of the gap between the two small APA's
- "z" is direction perpendicular crossing all collection wires
- In simulation, the detector is divided into 8 "virtual TPCs": 4 APA x 2 (long or short volume)



YZ Plane.

$X = -0.967\,cm$

Chao's poor drawing (collection plane)

Chao's poor drawing (induction planes)

U plane

(X = −0.015)

TPC1

TPC5

TPC3

TPC7

(0)

(1)

(233)

(182)

(356)

−82.744

−85.244

0.2452

U

100.917

Z

V plane

(X = −0.491)

y

113.243

(0)

(1)

(342)

(225)

(186)

−82.0383

−85.2438

0.2435

49.9315

52.6064

101.607

153.282

Z

35 ton Geometry In Simulation

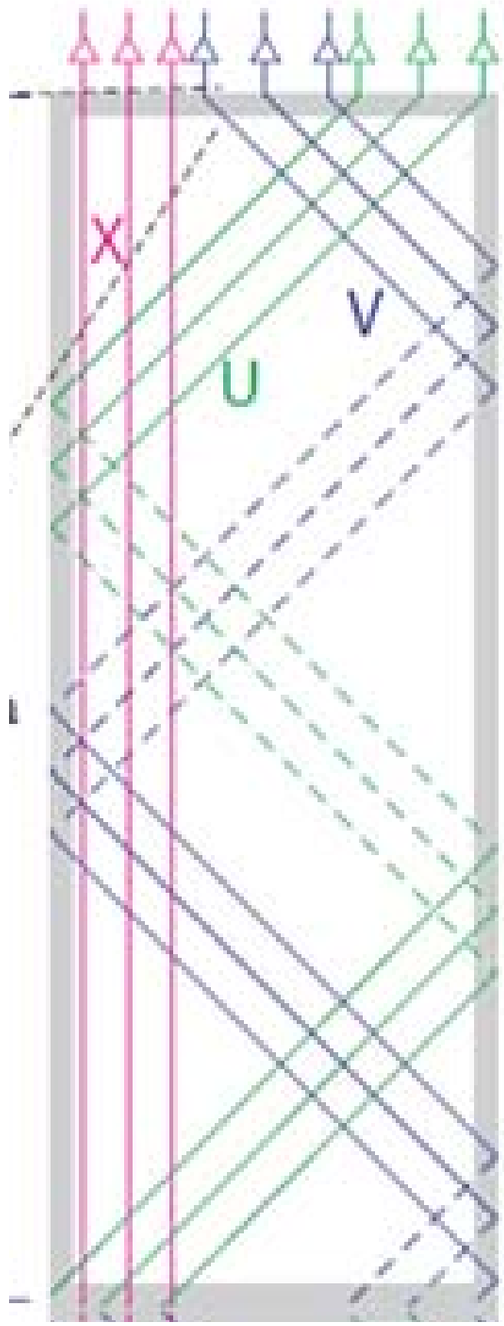
- Wires (in software, a straight line in a plane defines a wire, i.e. no wrapping)
  - Y (collection): 111 wires in all 4 APA's
  - U: 357 x 2 + 193 + 234
  - V: 343 x 2 + 187 + 226

- Total 1992 channels. Each channel can map to several wires.

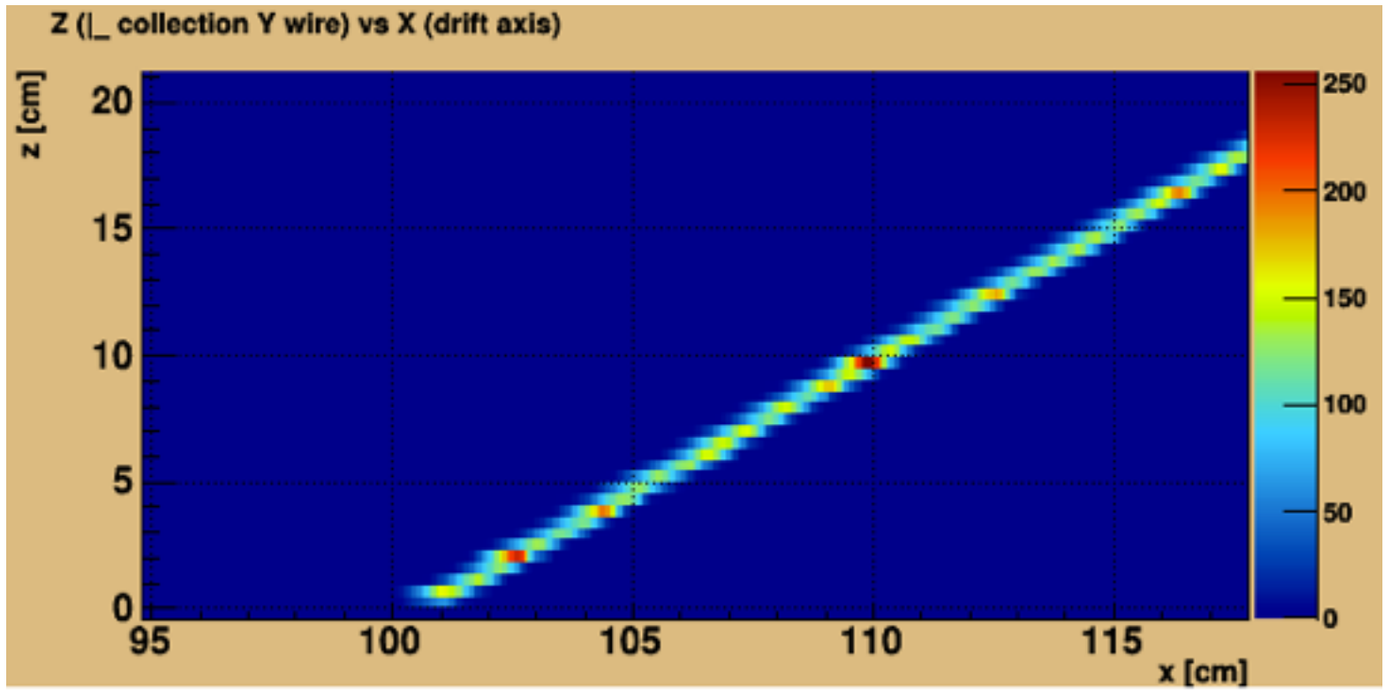
- In software mapping, the U wire wrapped in the back (in the V direction viewing from the front) is flipped to the front as if it's in the U direction.

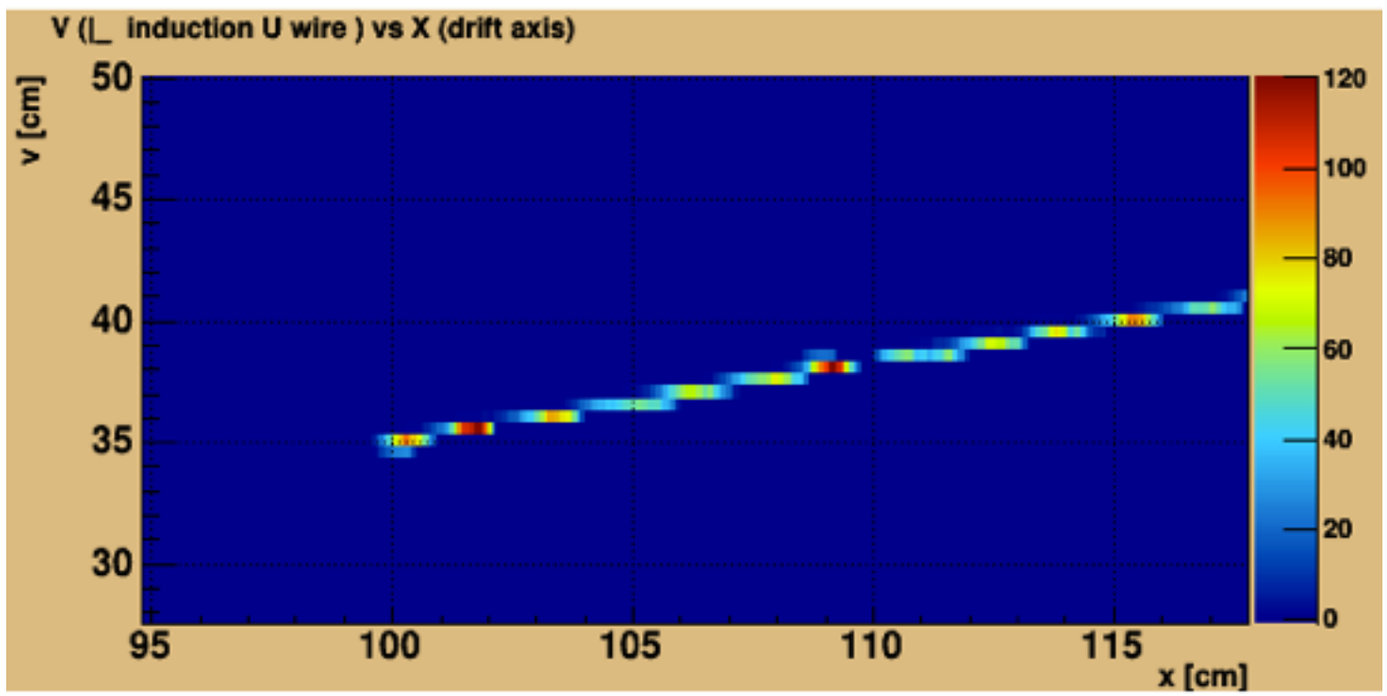
- Wire counting direction is different for the 2nd APA in U/V plane

- Wire pitch size different in Y plane?
  - Y: 0.45 cm; U/V: 0.4888 cm

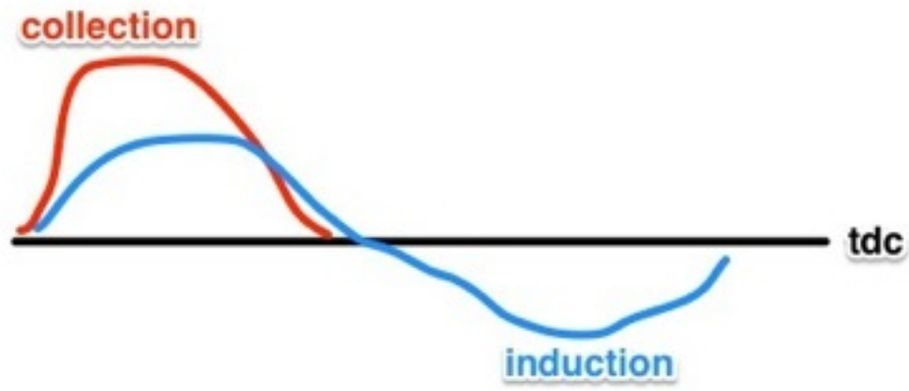


Explain the Histogram

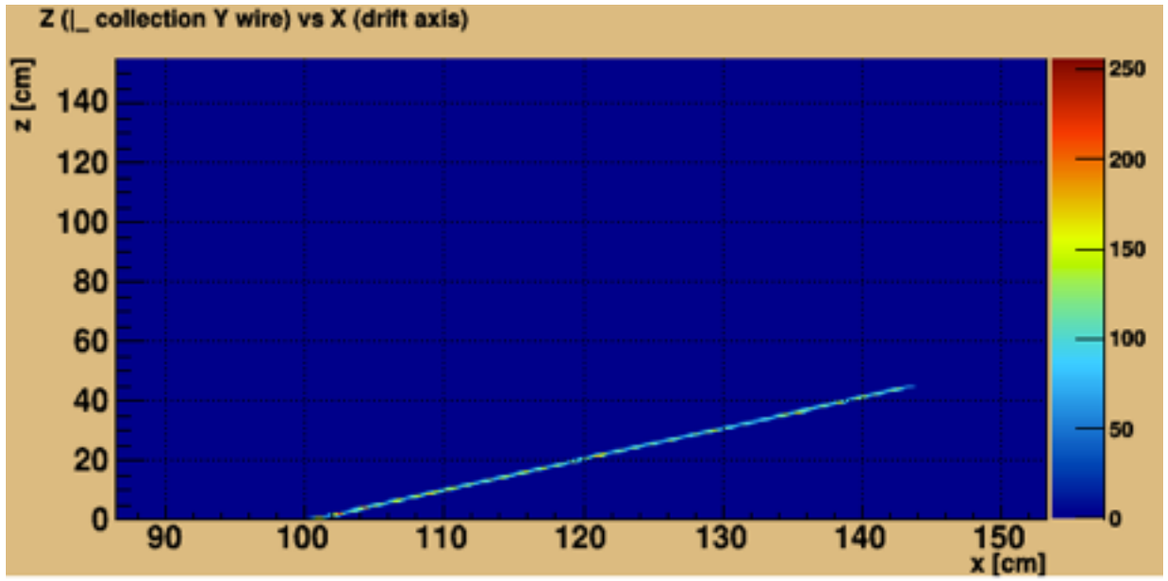


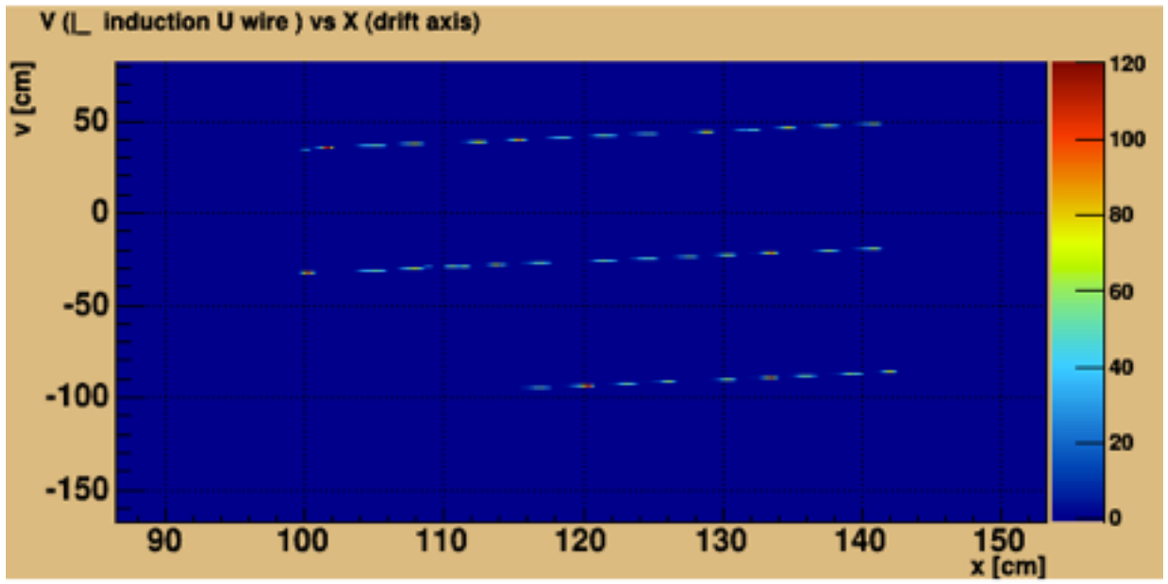


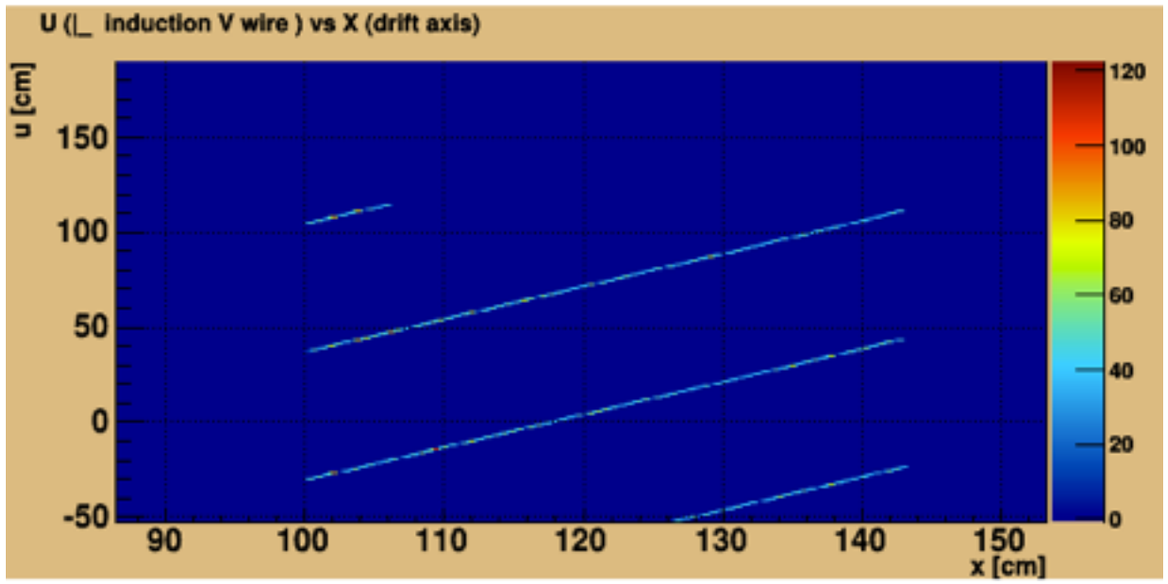
- x = tdc * 0.775 mm/tdc
  (1 tdc = 0.5 usec)
  (drift velocity = 1.55 mm/us)
- z/v/u = channel -> wire -> location
- color = adc value at that tdc
  (for induction plane, only display positive signal)



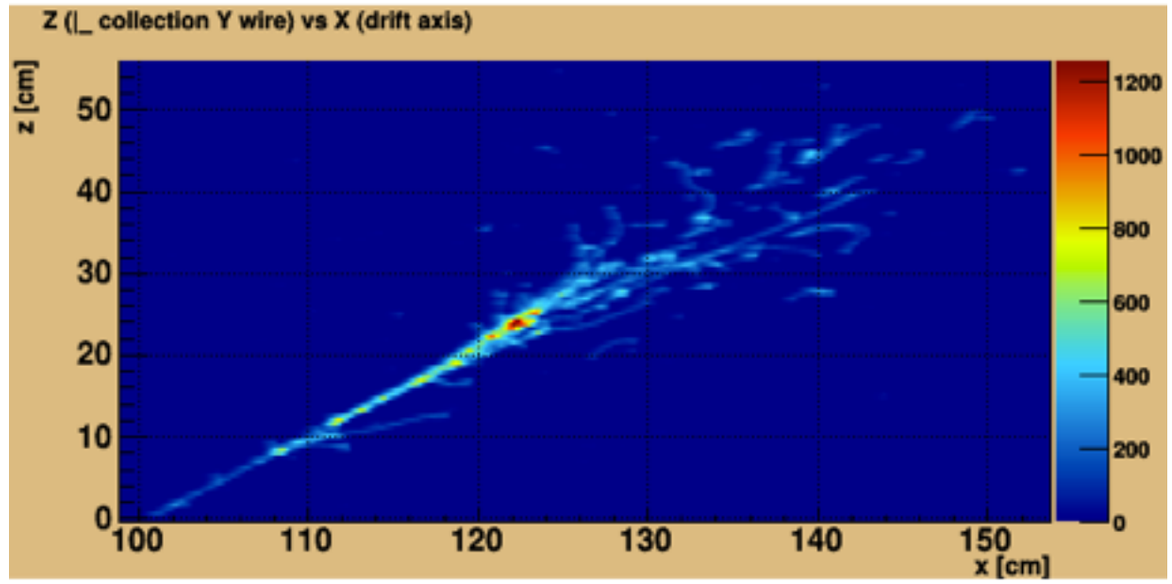
A Muon (2 GeV)

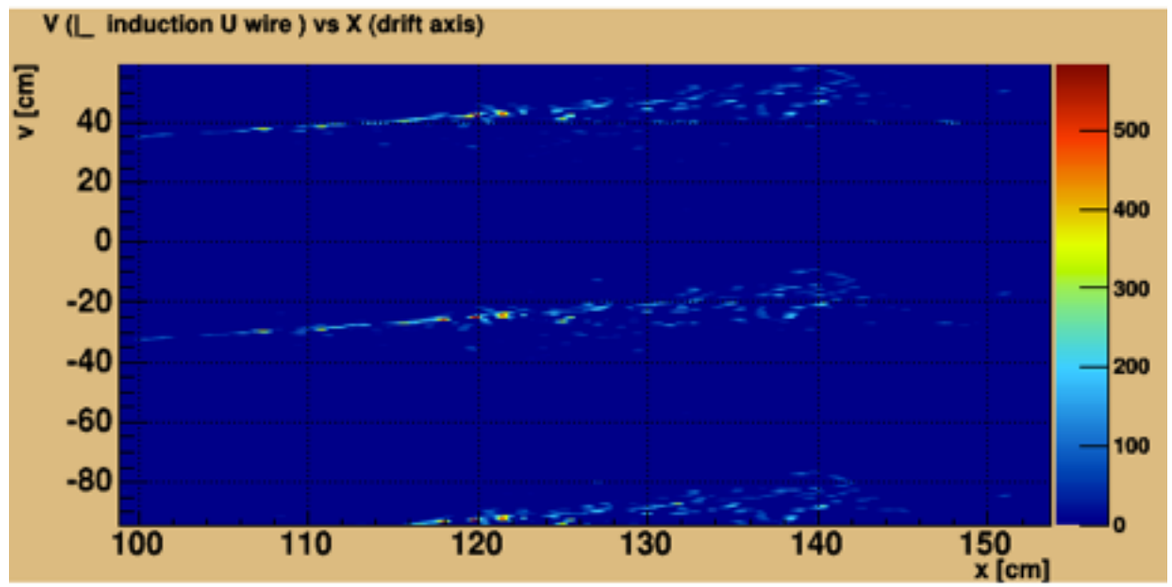


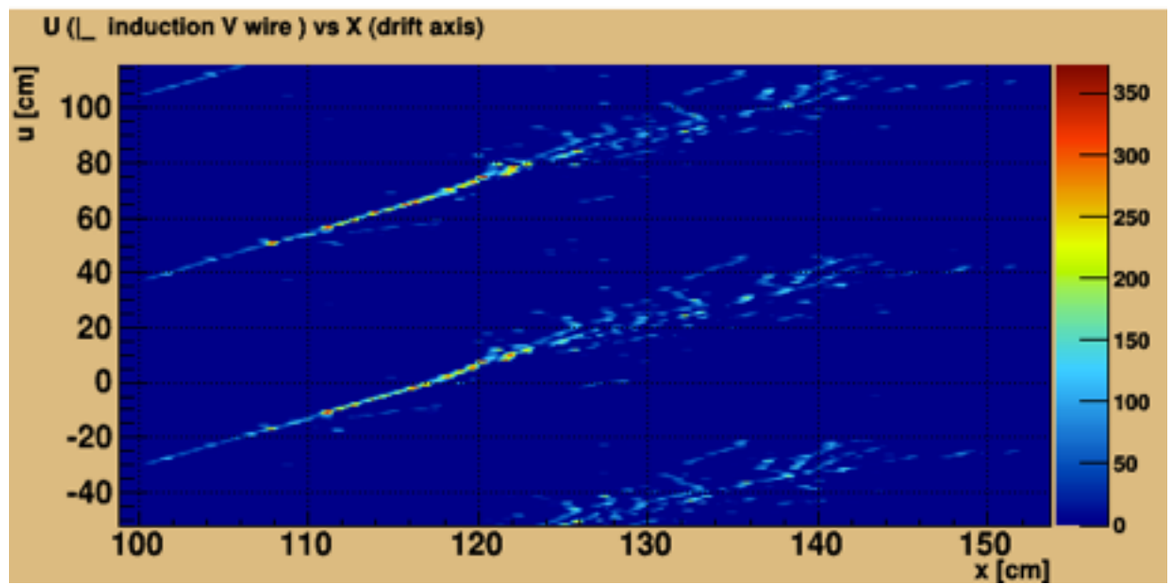




A Electron (2 GeV)







Event Display Live Demo

To Do List

- Refining the event display
  - Feedback needed. You can download the code from Github (https://github.com/czczc/LArViewer). Instructions and an example file is included.
  - Simulating more examples for us to look at, as a ‘hand scan’ training experience. What are the interesting events for 35ton?
- Looking further down the analysis chain: calibration and reconstruction
- Share the software experience with the group
  - Will post somewhere on the wiki or other places