



Full 10kt FD-HD Sim/SigProc

Haiwang Yu (BNL)

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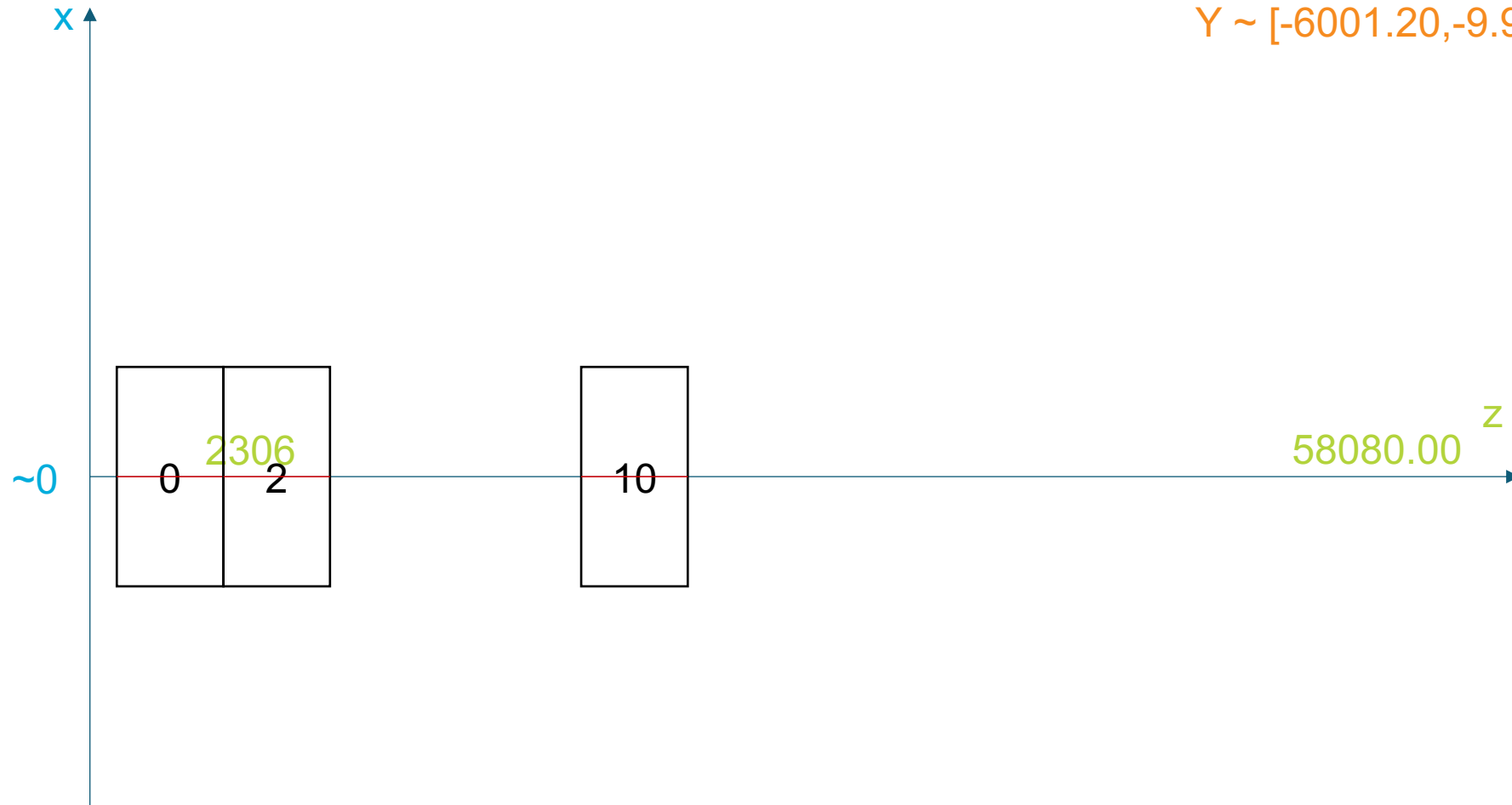
DUNE FD Sim/Reco Meeting



Outline

- gdml → wire geom in WC format
 - gdml (from V. Pec): https://github.com/vpec0/dunecore/blob/feature/vpec_add_fd_full_geom_gdml/dunecore/Geometry/gdml/dune10kt_v7_refactored.gdml
 - dump → txt: <https://github.com/HaiwangYu/dunefd-geom>
 - txt → json.bz2: wire-cell-python
 - 57a0ac5ede5234bd738905a46d7539eb10f12d52 (this commit works)
- new configuration sub-folder “dune10kt-hd”
 - params forked from dune10kt-1x2x6
 - <https://github.com/WireCell/wire-cell-toolkit/tree/master/cfg/pgrapher/experiment/dune10kt-1x2x6>
 - dev area: <https://github.com/HaiwangYu/hydra-skip/tree/main/cfg/pgrapher/experiment/dune10kt-hd>
- run 1-event

APA numbering, dune10kt-1x2x6

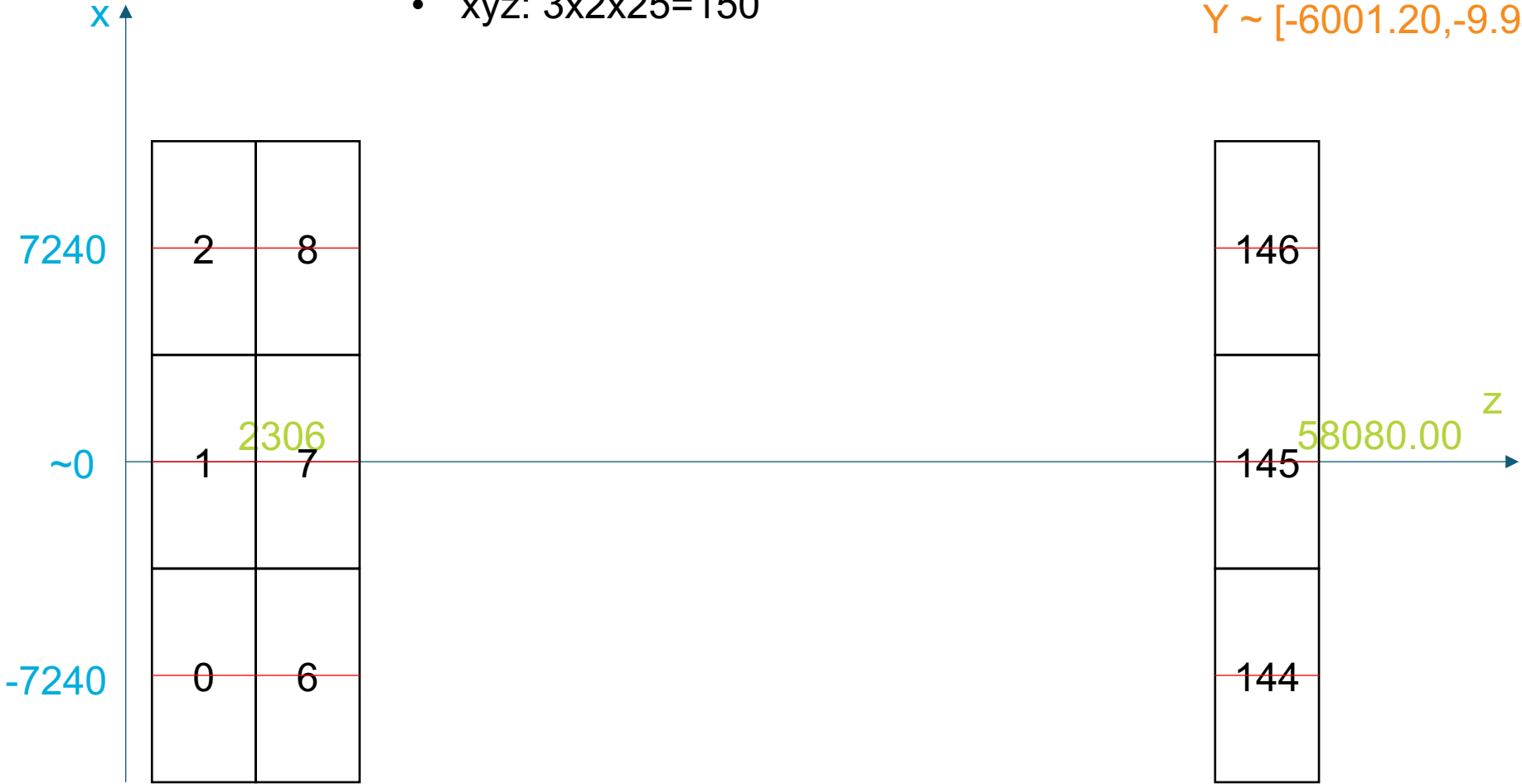


Y ~ [-6001.20,-9.94], [9.94,6001.20]

APA numbering, dune10kt v7 refactored

- dune10kt_v7_refactored.json.bz2
- xyz: 3x2x25=150

Y ~ [-6001.20,-9.94], [9.94,6001.20]



apa_cpa distance?

```
38 "volumes": [
39   {
40     "faces": [
41       {
42         "anode": -7221.9645,
43         "cathode": -3632.3375000000001,
44         "response": -7131.4844999999996
45       },
46       {
47         "anode": -7301.0355,
48         "cathode": -10890.6625,
49         "response": -7391.5155000000004
50       }
51     ],
52     "name": "apa0",
53     "wires": 0
54   },
55   {
56     "faces": [
57       {
58         "anode": 39.535499999999999,
59         "cathode": 3629.1624999999999,
60         "response": 130.0155
61       },
62       {
63         "anode": -39.535499999999999,
64         "cathode": -3629.1624999999999,
65         "response": -130.0155
66       }
67     ],
68     "name": "apa1",
69     "wires": 1
70   },
71   {
72     "faces": [
73       {
74         "anode": 7301.0355,
75         "cathode": 10890.6625,
76         "response": 7391.5155000000004
77       },
78       {
79         "anode": 7221.9645,
80         "cathode": 3632.3375000000001,
81         "response": 7131.4844999999996
82       }
83     ],
84     "name": "apa2",
85     "wires": 2
86   },

```

w2w = 60.3, match

apa_cpa = 0.5*apa2apa (u2u) = 3635.265(gdml) != 3630.75 (jsonnet)

```
1 anode:0 face:0 X=[-7240.51,-7230.99]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
2   0: x=-7230.99mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)
3   1: x=-7235.75mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)
4   2: x=-7240.51mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
5 anode:0 face:1 X=[-7310.06,-7300.54]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
6   0: x=-7310.06mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)
7   1: x=-7305.30mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)
8   2: x=-7300.54mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
9 anode:1 face:0 X=[30.02,39.54]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
10  0: x=39.54mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)
11  1: x=34.78mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)
12  2: x=30.02mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
13 anode:1 face:1 X=[-39.54,-30.02]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
14  0: x=-39.54mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)
15  1: x=-34.78mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)
16  2: x=-30.02mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
17 anode:2 face:0 X=[7300.54,7310.06]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
18  0: x=7310.06mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)
19  1: x=7305.30mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)
20  2: x=7300.54mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
21 anode:2 face:1 X=[7230.99,7240.51]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm
22  0: x=7230.99mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)
23  1: x=7235.75mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)
24  2: x=7240.51mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
```

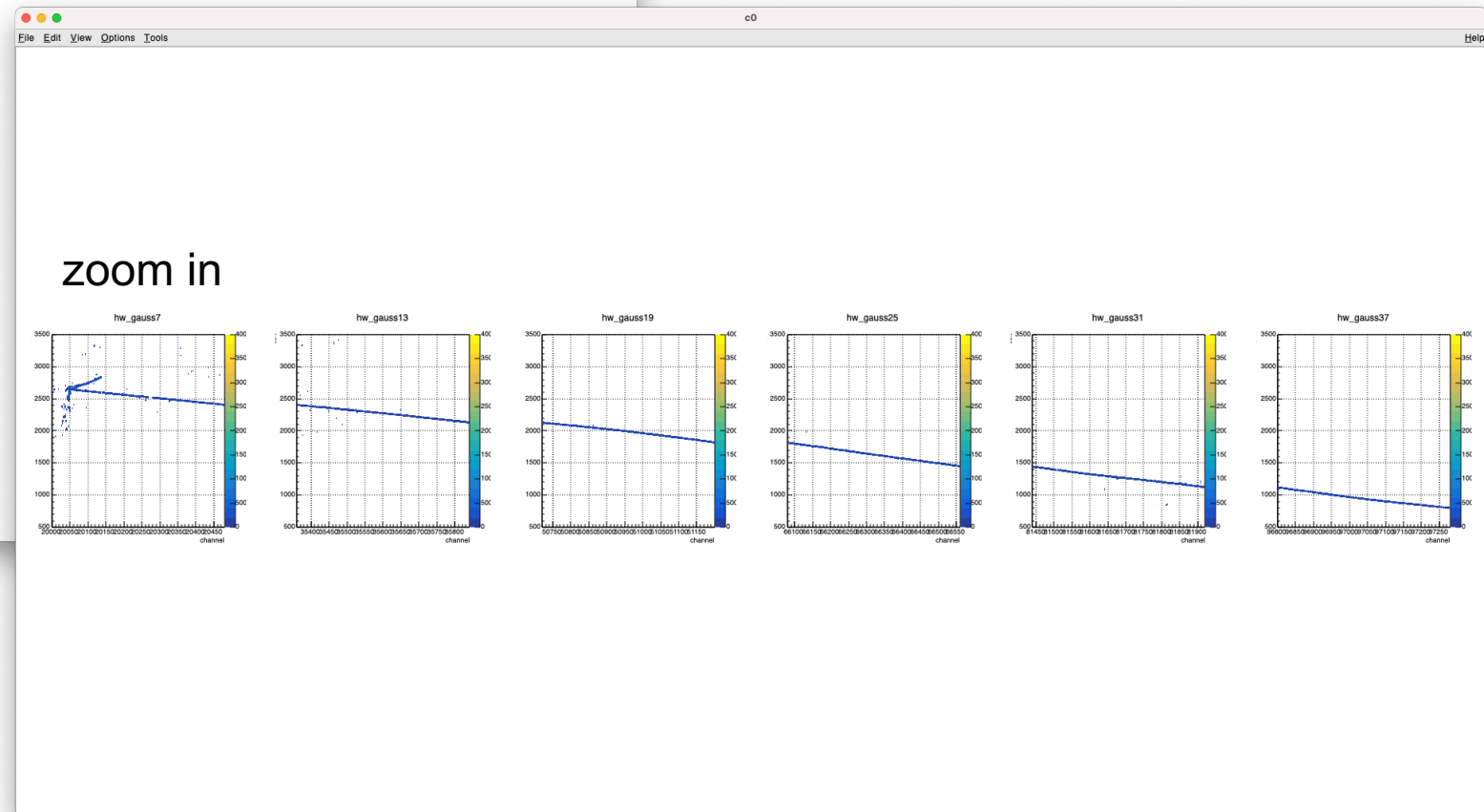
use gdml values

```
38 "volumes": [  
39 {  
40   "faces": [  
41     {  
42       "anode": -7230.9944999999998,  
43       "cathode": -3636.8525,  
44       "response": -7140.5144999999993  
45     },  
46     {  
47       "anode": -7310.0654999999997,  
48       "cathode": -10904.2075,  
49       "response": -7400.5455000000002  
50     }  
51   ],  
52   "name": "apa0",  
53   "wires": 0  
54 },  
55 {  
56   "faces": [  
57     {  
58       "anode": 39.535499999999999,  
59       "cathode": 3633.6774999999998,  
60       "response": 130.0155  
61     },  
62     {  
63       "anode": -39.535499999999999,  
64       "cathode": -3633.6774999999998,  
65       "response": -130.0155  
66     }  
67   ],  
68   "name": "apa1",  
69   "wires": 1  
70 },  
71 {  
72   "faces": [  
73     {  
74       "anode": 7310.0654999999997,  
75       "cathode": 10904.2075,  
76       "response": 7400.5455000000002  
77     },  
78     {  
79       "anode": 7230.9944999999998,  
80       "cathode": 3636.8525,  
81       "response": 7140.5144999999993  
82     }  
83   ],  
84   "name": "apa2",  
85   "wires": 2  
86 }
```

```
1 anode:0 face:0 X=[-7240.51,-7230.99]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
2 → 0: x=-7230.99mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)  
3 → 1: x=-7235.75mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)  
4 → 2: x=-7240.51mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)  
5 anode:0 face:1 X=[-7310.06,-7300.54]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
6 → 0: x=-7310.06mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)  
7 → 1: x=-7305.30mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)  
8 → 2: x=-7300.54mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)  
9 anode:1 face:0 X=[30.02,39.54]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
10 → 0: x=39.54mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)  
11 → 1: x=34.78mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)  
12 → 2: x=30.02mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)  
13 anode:1 face:1 X=[-39.54,-30.02]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
14 → 0: x=-39.54mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)  
15 → 1: x=-34.78mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)  
16 → 2: x=-30.02mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)  
17 anode:2 face:0 X=[7300.54,7310.06]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
18 → 0: x=7310.06mm dx=9.5200mm n=1149 pitch=(4.6670 +/- 0.000059 [4.6611<4.6732], p0=4.6670)  
19 → 1: x=7305.30mm dx=4.7600mm n=1148 pitch=(4.6662 +/- 0.000052 [4.6618<4.6692], p0=4.6649)  
20 → 2: x=7300.54mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)  
21 anode:2 face:1 X=[7230.99,7240.51]mm Y=[-6001.20,-9.94]mm Z=[-0.00,2306.38]mm  
22 → 0: x=7230.99mm dx=-9.5200mm n=1149 pitch=(4.6686 +/- 0.000068 [4.6630<4.6729], p0=4.6691)  
23 → 1: x=7235.75mm dx=-4.7600mm n=1148 pitch=(4.6672 +/- 0.000049 [4.6623<4.6702], p0=4.6671)  
24 → 2: x=7240.51mm dx=0.0000mm n=480 pitch=(4.7900 +/- 0.000006 [4.7870<4.7905], p0=4.7900)
```

1-event test

- 1 numu g4.root generated long time ago for FDVD study



1-event test

HD test: dunegpvm08, apptainer, v09_82_01d00

	CPU time (sec)	VmHWM (GB)	magnify output (MB)
6apa	56	6.0	2.2
6apa-skip (2)	19	6.0	
150apa	870	6.2	50
150apa-skip (9)	72	6.2	4.6
VD-320 (Mar/25)	4032	4.8	
VD-320-skip (15,Mar/25)	259	4.5	
VD-320 (May/13)	1717	4.6	
VD-320-skip (15,May/13)	109	5.0	

VD was tested ~2024-03-25, may need a re-testing?

To-do

- Validations:
 - volume
 - Which apa-cpa dist. to use?
 - wire/channel numbering
 - time offsets
 - interface to LArSoft
- Optimizations: total time vs. CPU time?
 - loading cfg time
 - loading geom time
- Option to save out raw ADC?
- Cleanup and update repos
 - Coordination with others (e.g., V. Pec, L. Paulucci and D. Brailsford)

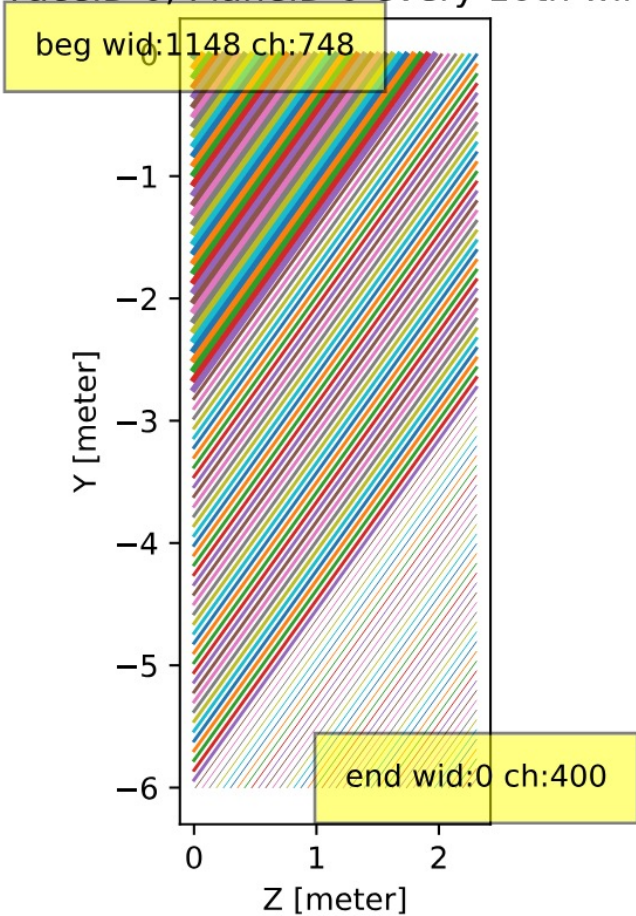
```
31571 TimeReport ----- Time summary [sec] -----
31572 TimeReport CPU = 109.475846 Real = 112.544419
31573
31574 MemReport ----- Memory summary [base-10 MB] -----
31575 MemReport VmPeak = 6357.48 VmHWM = 4962.07
31576
31577 Art has completed and will exit with status 0.
31578
31579 real    7m4.012s
31580 user    7m42.090s
31581 sys     0m5.243s
```

dune10kt-vd

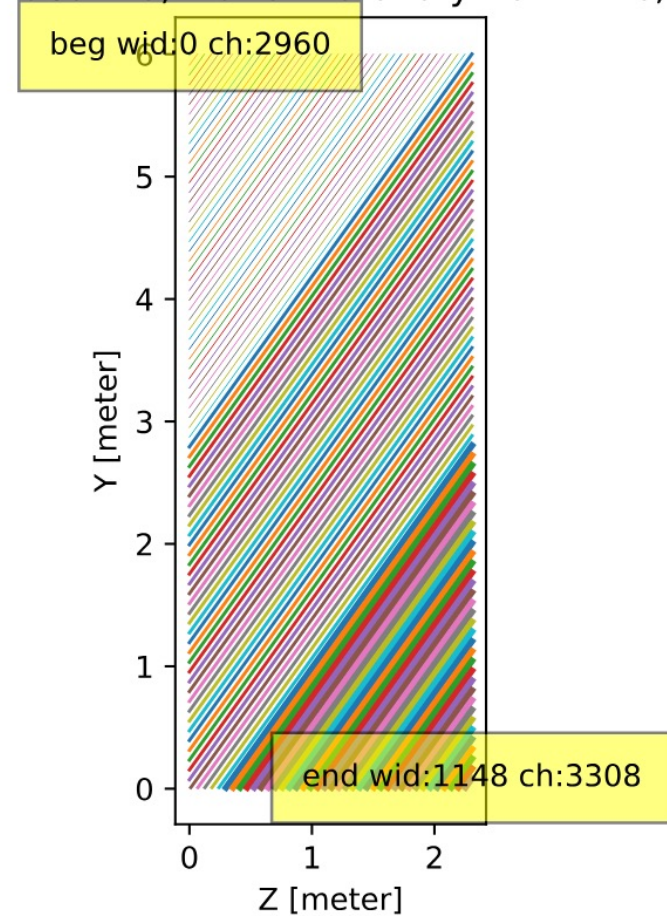
backups

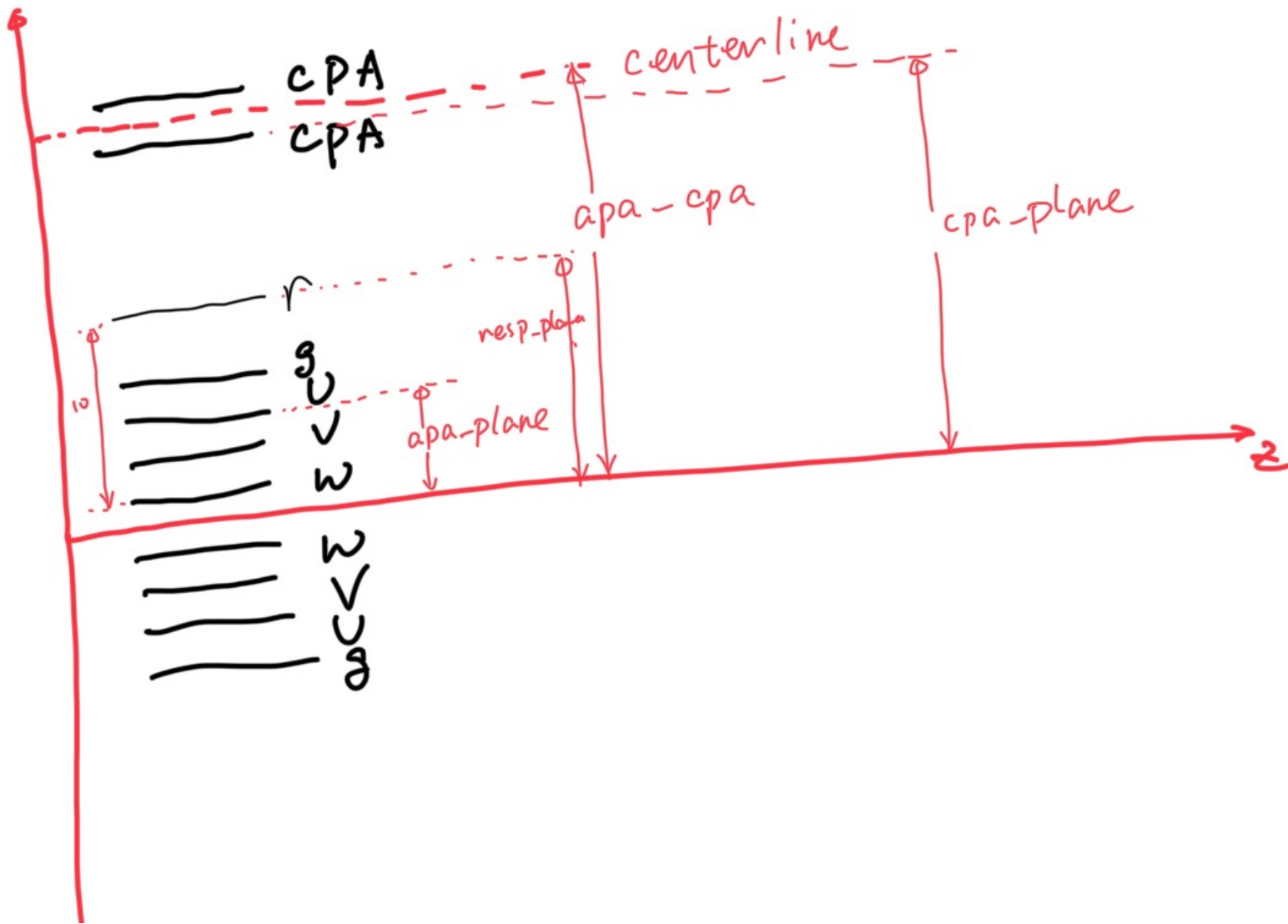
dune10kt-1x2x6

AnodeID 0, FaceID 0, PlaneID 0 every 10th wire, x=0.040m



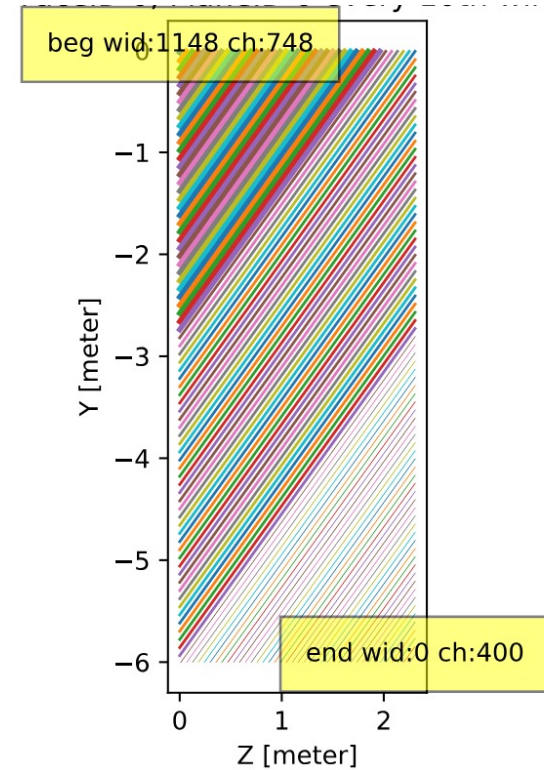
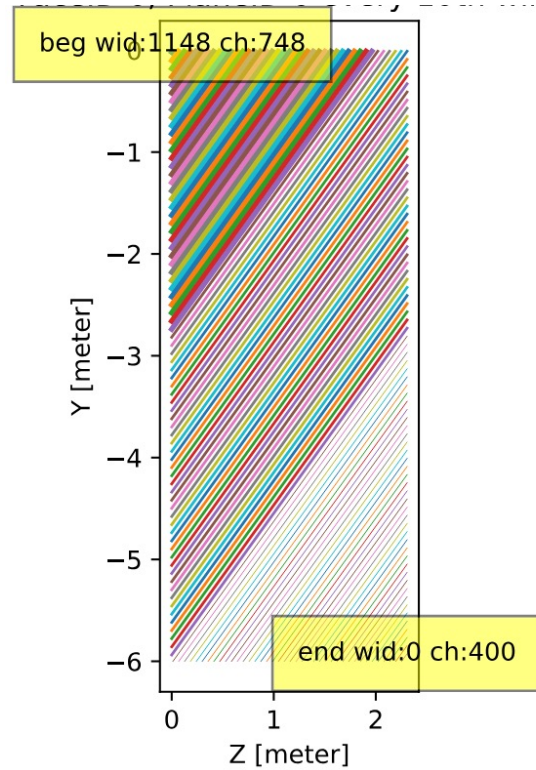
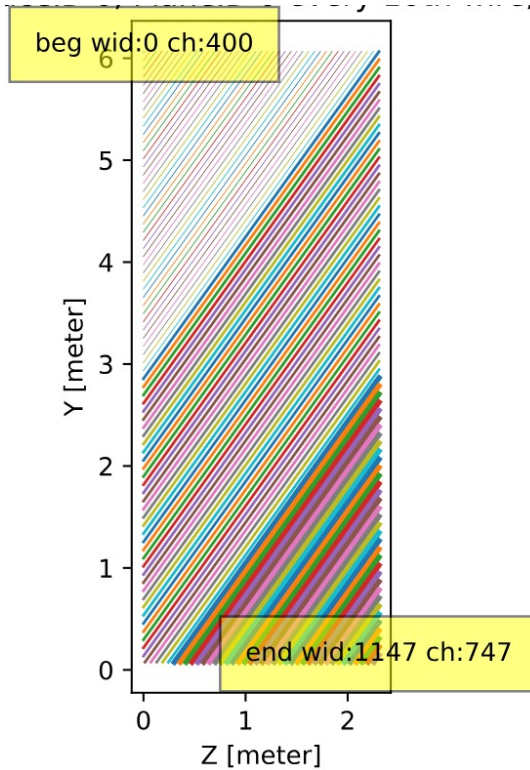
AnodeID 1, FaceID 0, PlaneID 0 every 10th wire, x=0.040m





wire numbering

- <https://www.phy.bnl.gov/~hyu/wire-cell-data/dev/protodune-wires-larsoft-v4.pdf>
- <https://www.phy.bnl.gov/~hyu/wire-cell-data/dev/dune10kt-1x2x6-wires-larsoft-v1.pdf>
- https://www.phy.bnl.gov/~hyu/wire-cell-data/dev/dune10kt_v7_refactored.pdf



cat /proc/cpuinfo