

Software & Analysis updates

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Introduction

- The issue that FELIX generates huge mount of data was fixed
 - Thank you for hard work at 1008
 - The cause of the issue was that the ROC generates the unexpected calibration (like) data, namely “triggerless” mode. This issue was fixed by masking these unexpected data at FELIX
- I am working to reconstruct Z-vertex with INTT

Run10448: Huge amount of data generated

```
Processing runConvertInttData.C("/bbox/commissioning/INTT/beam/beam_intt1-00010448-0001.evt")...
```

```
./beam_intt1-00010448-0001_event_base.root
```

```
ctor InttEvent
```

```
packet = 3002
```

```
nevt : 0
```

```
858
```

```
NBad Hits
```

```
lader= 0, ngood      4121, nbad      2
lader= 1, ngood      5934, nbad      2
lader= 2, ngood      6200, nbad      2
lader= 3, ngood      3528, nbad      0
lader= 4, ngood      6256, nbad      2
lader= 5, ngood      3633, nbad      0
lader= 6, ngood      3617, nbad      2
lader= 7, ngood        0, nbad 440366157
lader= 8, ngood        0, nbad 21127120
lader= 9, ngood        0, nbad 20869058
lader= 10, ngood       0, nbad 14076818
lader= 11, ngood       0, nbad 384199102
lader= 12, ngood       0, nbad 145049142
lader= 13, ngood       0, nbad 13745648
```

Run10448=before fixing issue

```
c/commissioning/INTT/beam/beam_intt1-00020444-0000.evt")...
.root
```

Run20444 = after fix

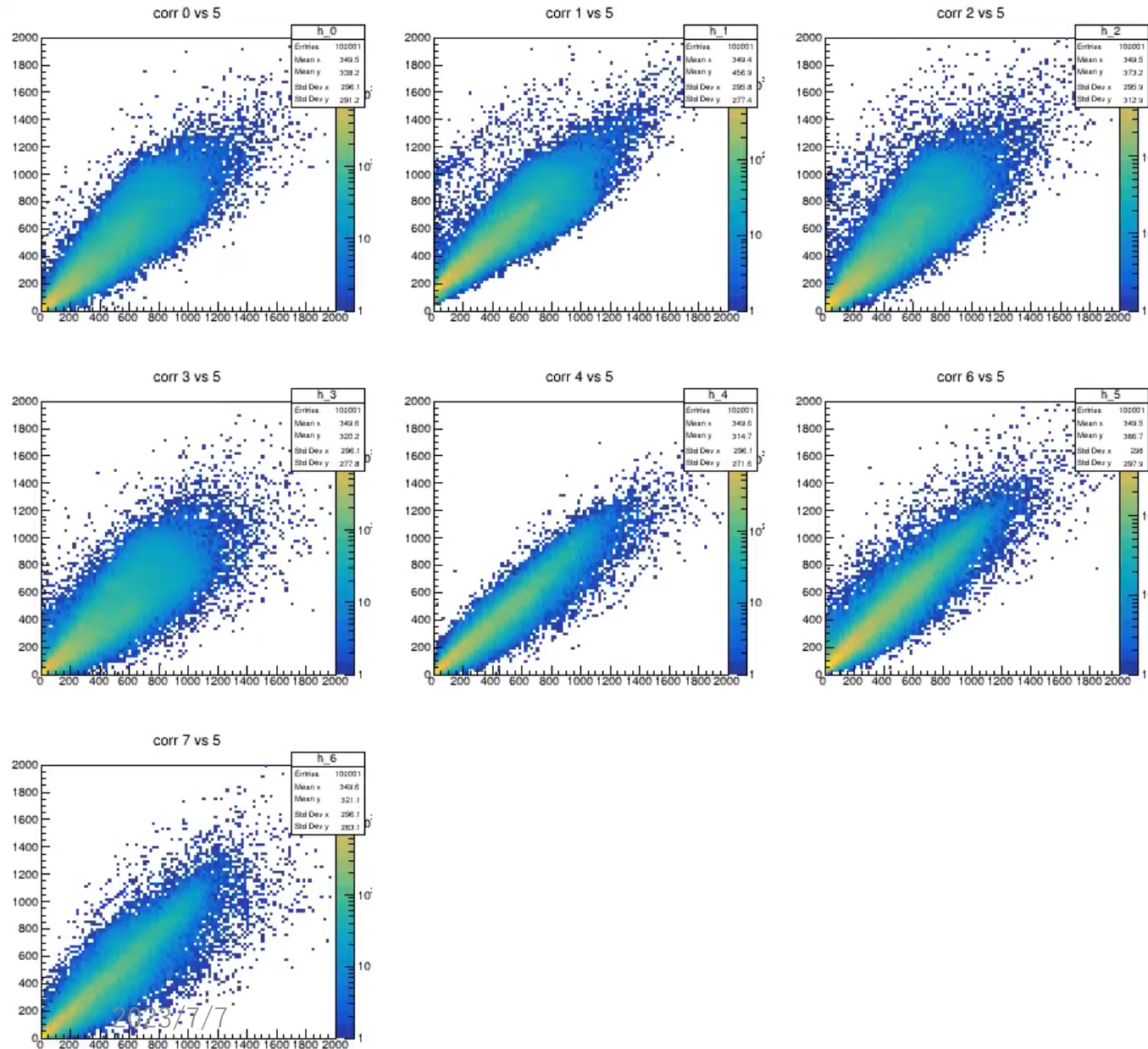
- Ngood = Nwords associated with BCO_FULL
- Nbad = Nwords not associated with any BCO_FULL
 - These bad word can not be decoded

```
1000
```

```
NBad Hits
```

```
lader= 0, ngood      63469, nbad      0
lader= 1, ngood      86744, nbad      0
lader= 2, ngood     142604, nbad      7
lader= 3, ngood      72163, nbad      0
lader= 4, ngood      59479, nbad      0
lader= 5, ngood      4004, nbad      0
lader= 6, ngood      65996, nbad      0
lader= 7, ngood      63868, nbad      0
lader= 8, ngood      92197, nbad     21
lader= 9, ngood      91189, nbad      0
lader= 10, ngood     66892, nbad      0
lader= 11, ngood     63420, nbad      0
lader= 12, ngood     87262, nbad     21
lader= 13, ngood     64008, nbad      0
```

Nclusters correlation between FELIXs :Run20444



- Nice correlations for all felixs
- Nclusters looks too many
 - Need to investigate in more details

Toward the Z-vertex reconstruction with INTT

- Z-vertex reconstruction

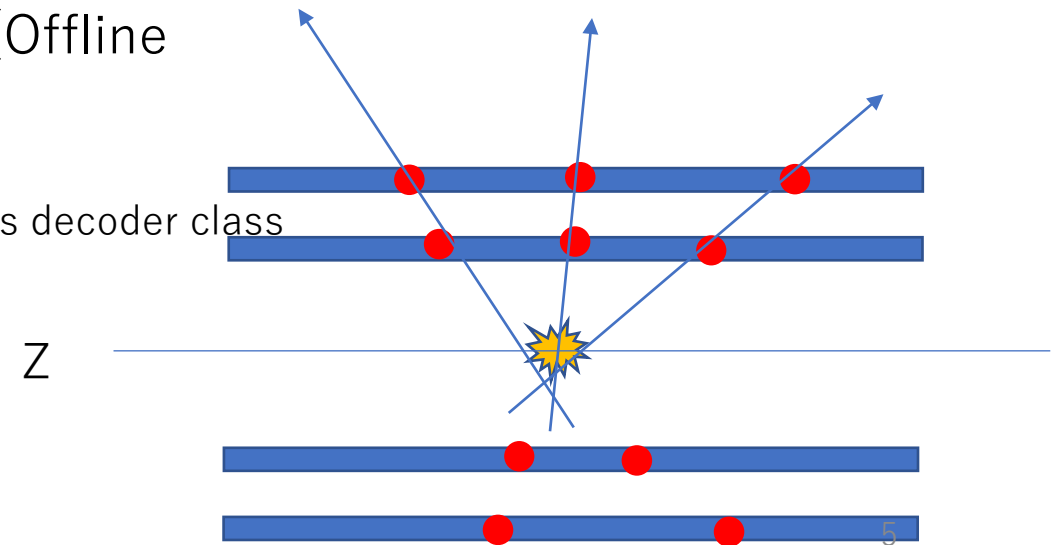
1. Connect two hits at the inner and outer layers to make a tracklet.
2. Calculate the focal point of these tracklets in 3D

Before the calculation, I check the distance of tracklet to the original point (0,0) in X-Y plane.

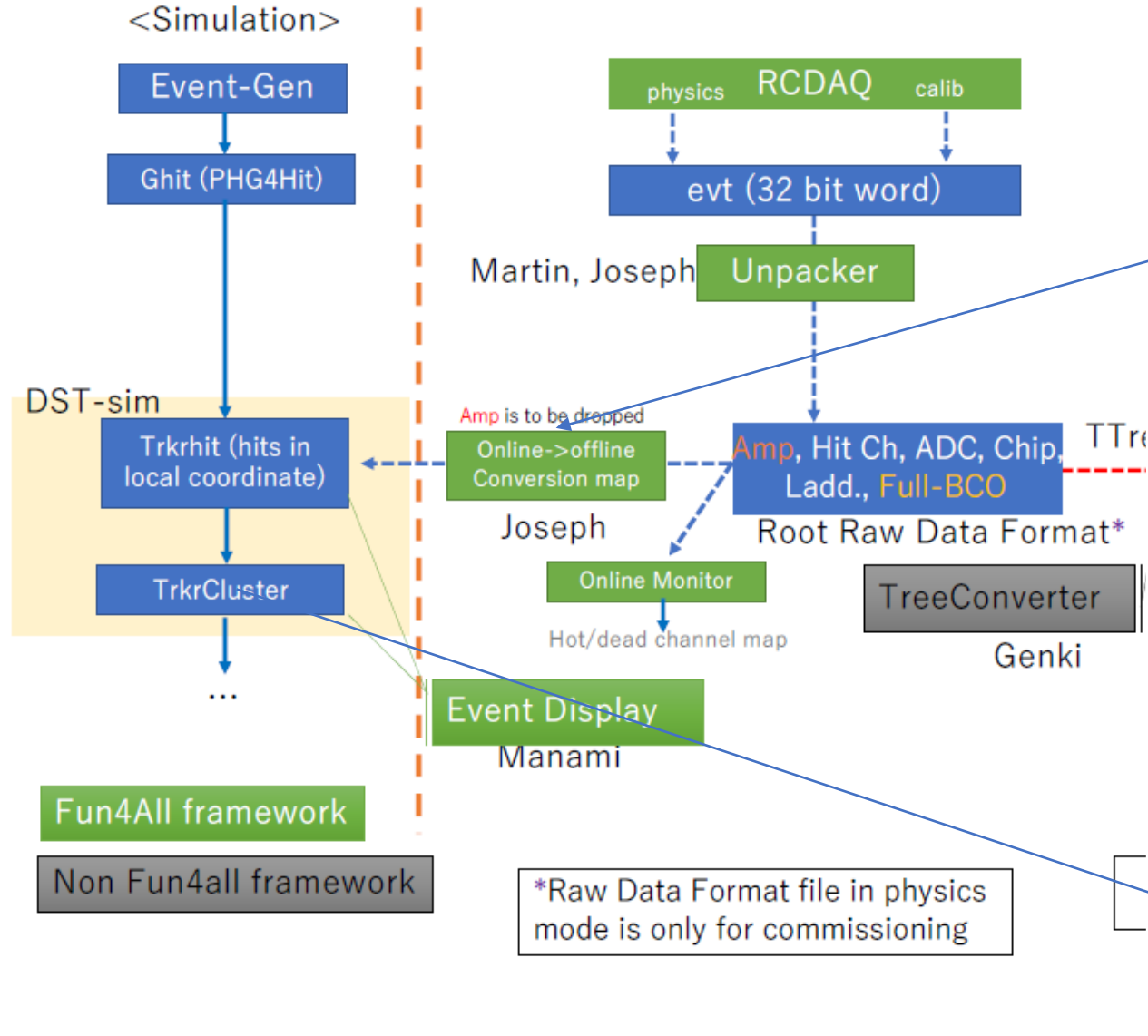
- To do this, I made some useful code

- Use EventBase tree as input to reconstruction DST(Offline reconstruction)
 - I started with MC reconstruction code and modified it
 - The issue in the decoder still remain. I cannot use Joseph's decoder class
 - Hits are not grouped in to single BCO_FULL
 - No synchronization among 8 FELIX

- **I made the code to input the event-based tree to DST reconstruction**

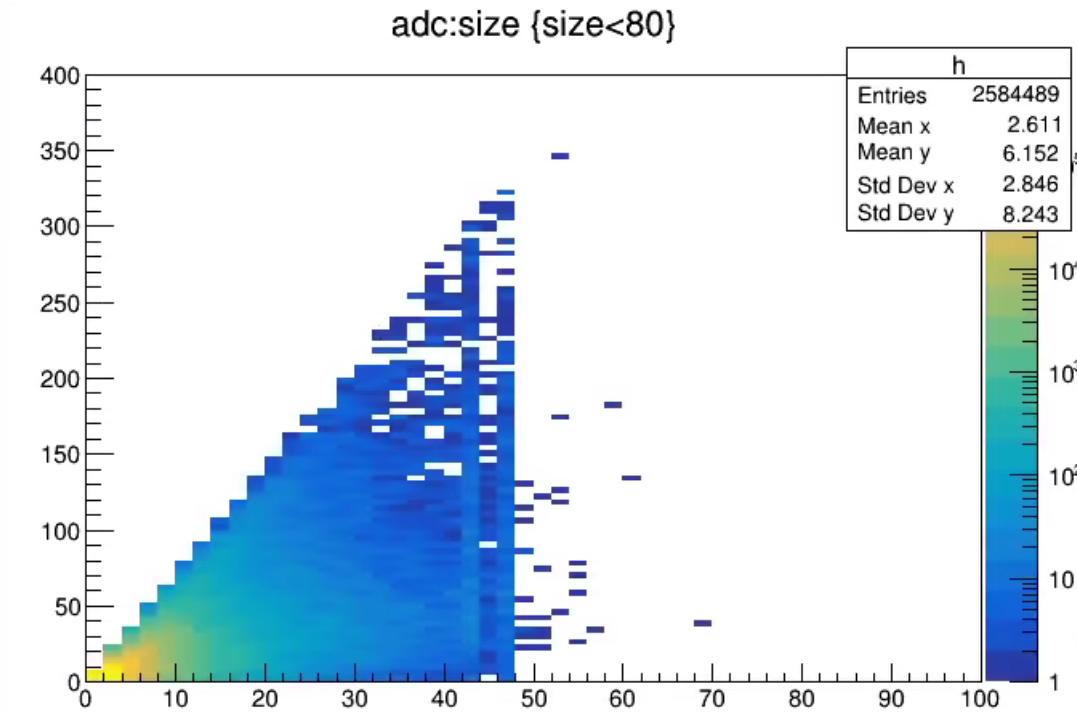


Data Flow

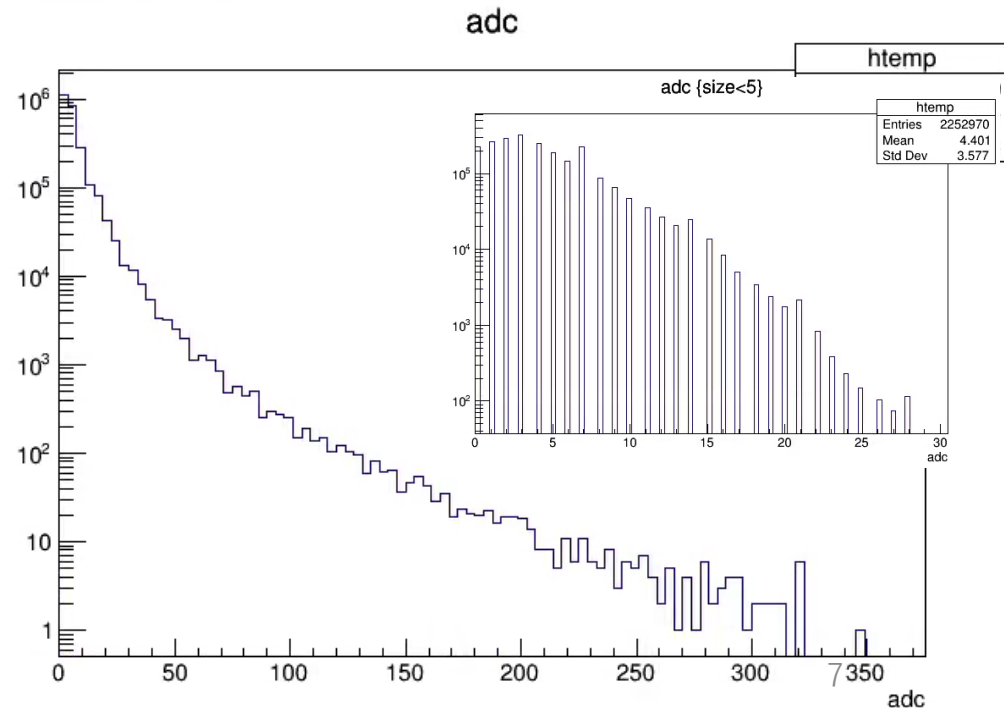
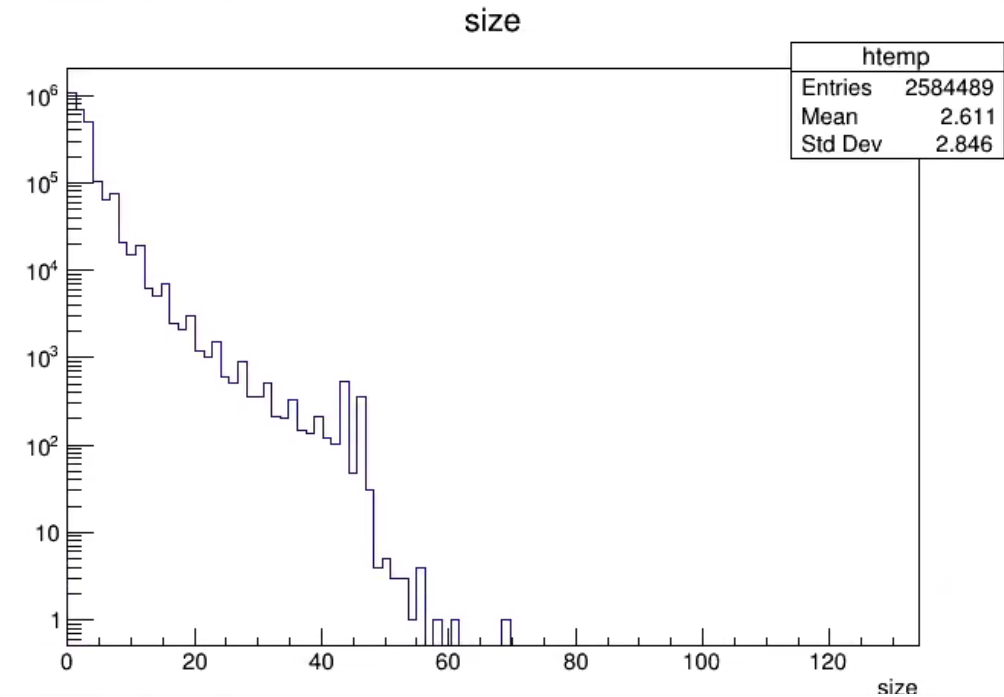


- InttEvent (event class)
- Joseph's RawDataDecoder and Manami's EventDisplay are quit helpful to make it

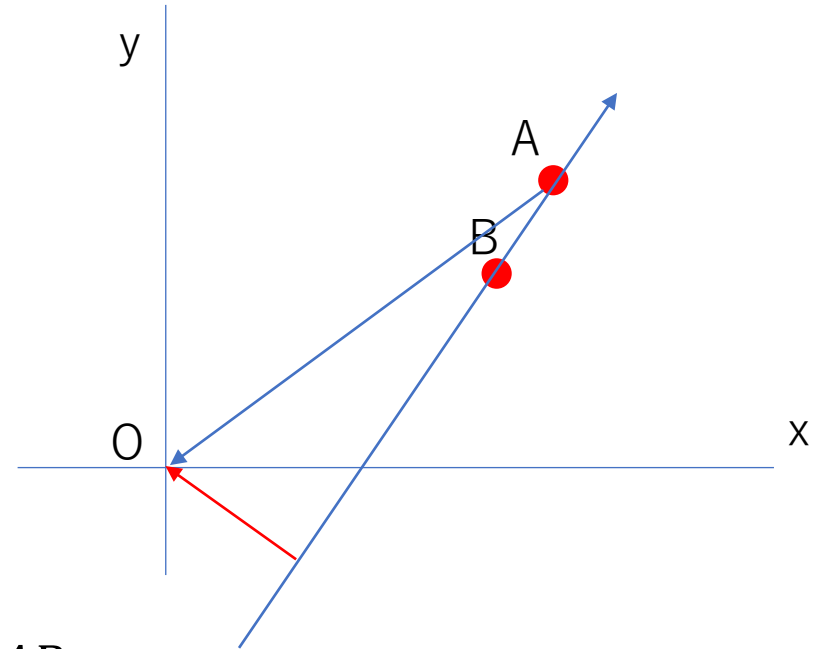
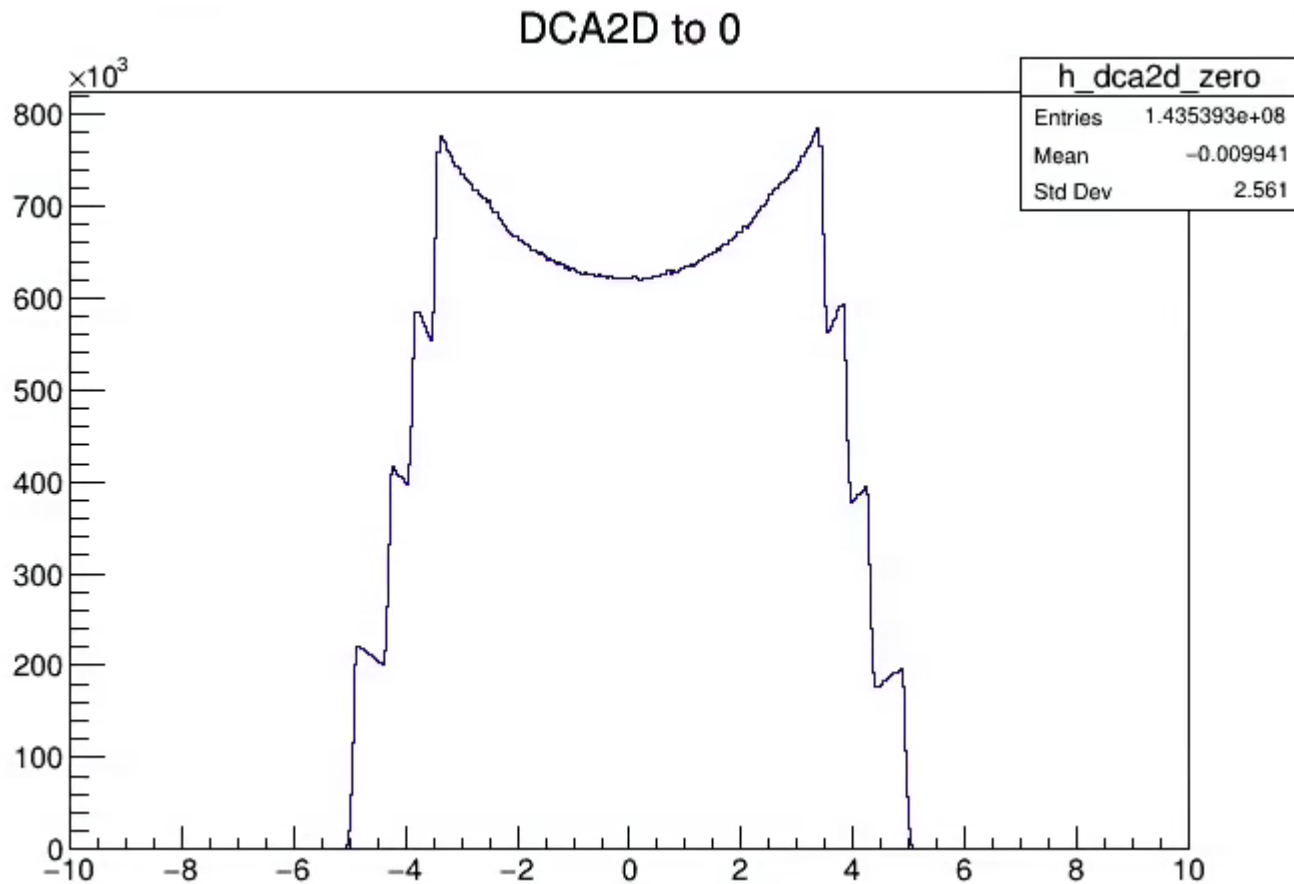
Clustering results by Offline



- Maximum value of a cluster ADC is too high
 - Issue: clustering has done with rawADC(0-7). This needs to use the corresponding DAC values
- Cluster size is also too large
- Rawdata needs to be checked more



DCA to the original point in XY



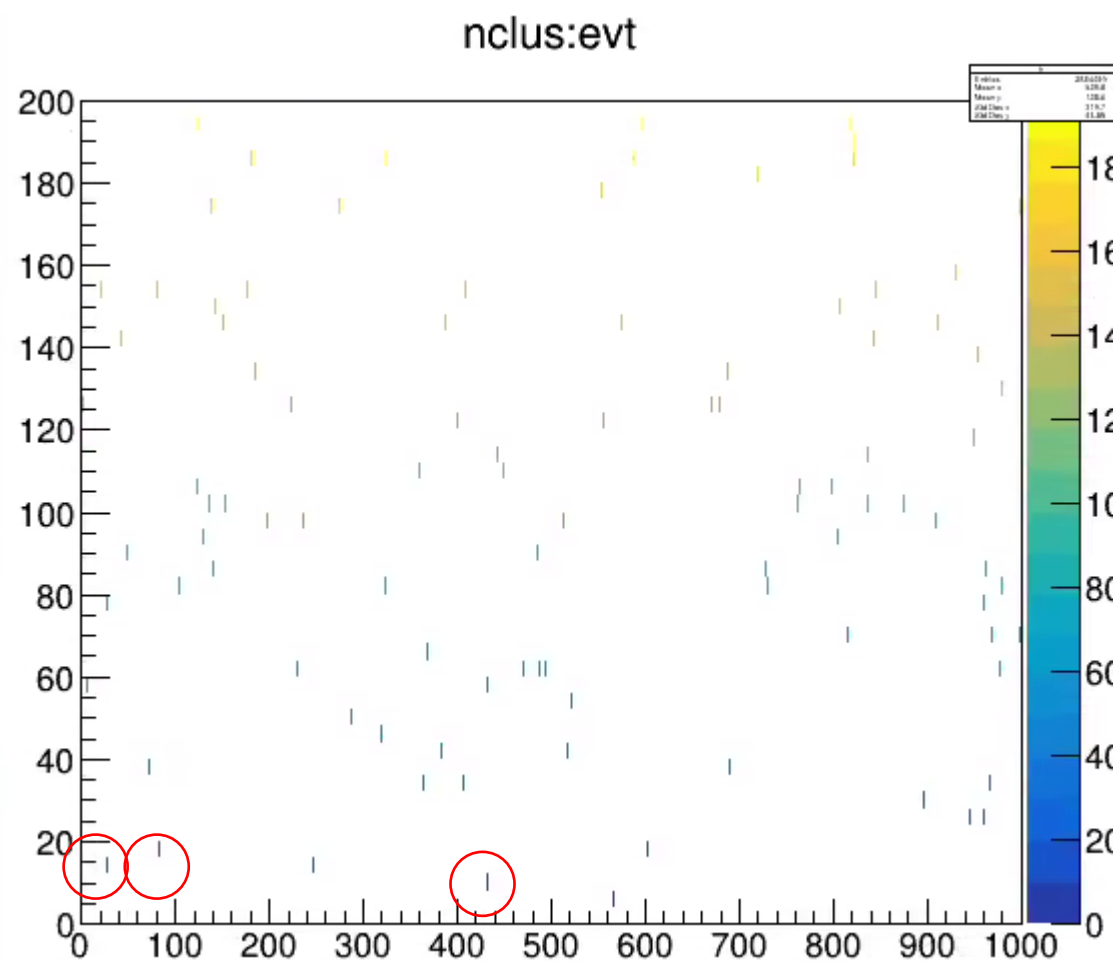
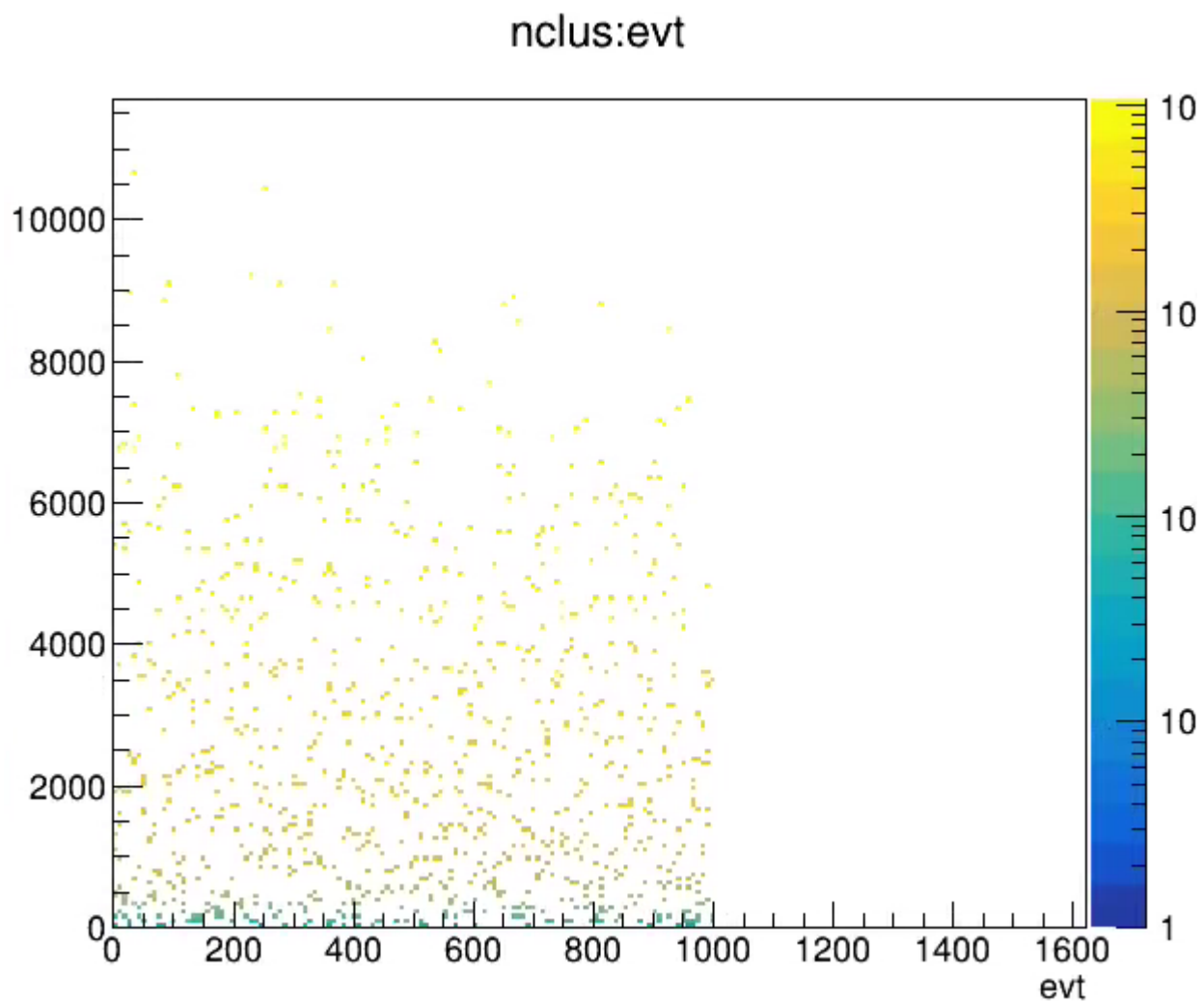
$$u = \frac{AB}{|AB|}$$

$$v = AO$$

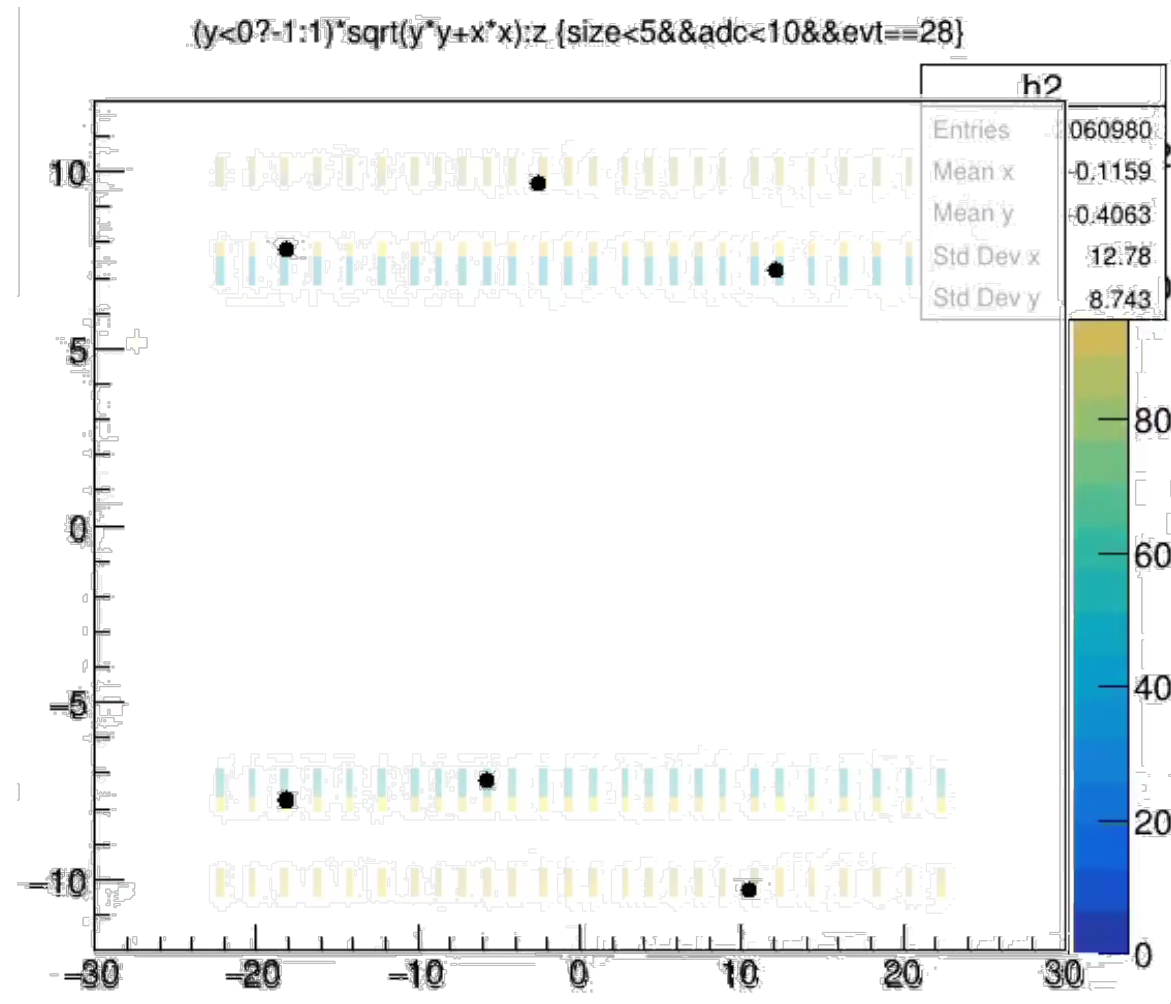
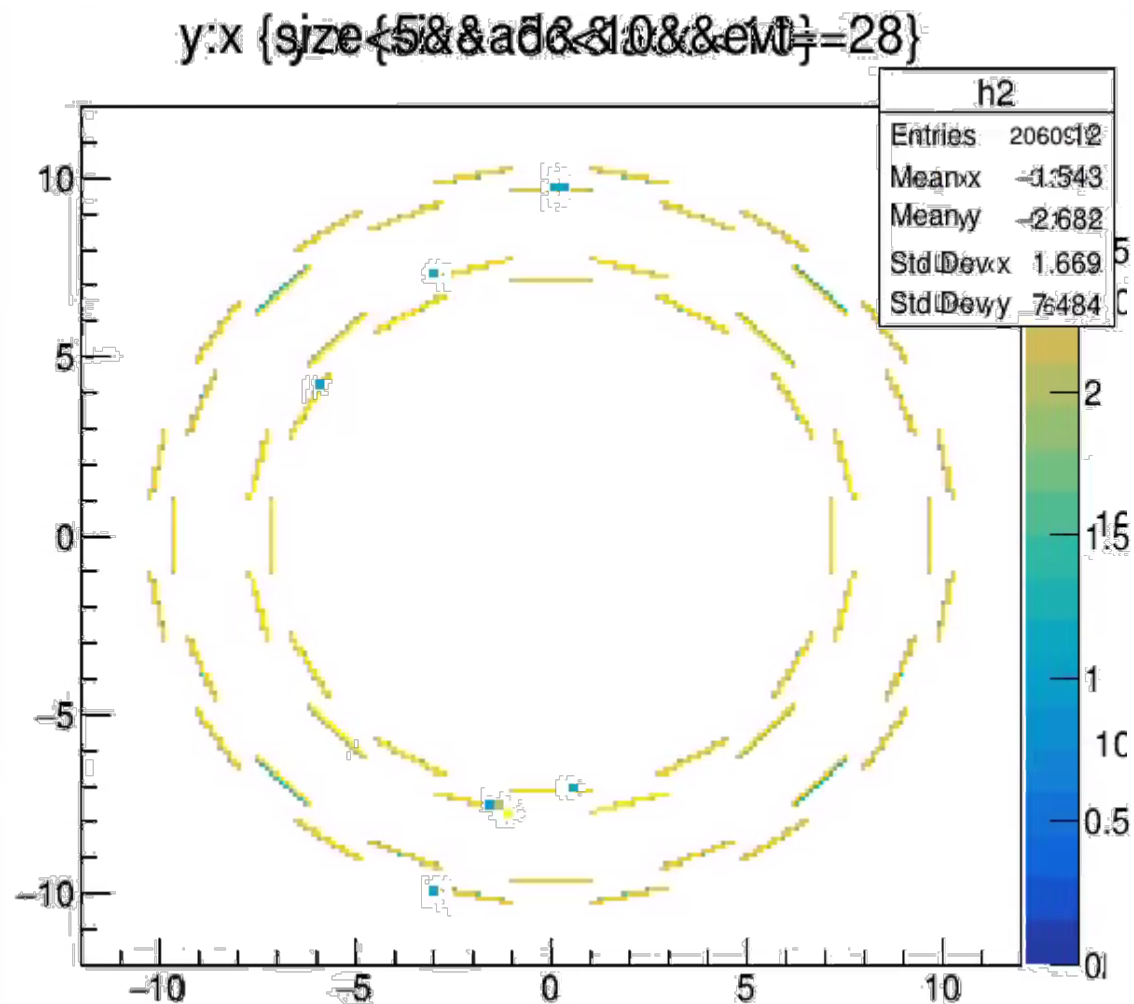
$$l = v \times u$$

- No peak at 0
 - Loose tracklet cuts
 - Angle $< 0.05 \times \pi$
 - Distance AB $< 5\text{cm}$

Ncluster vs events

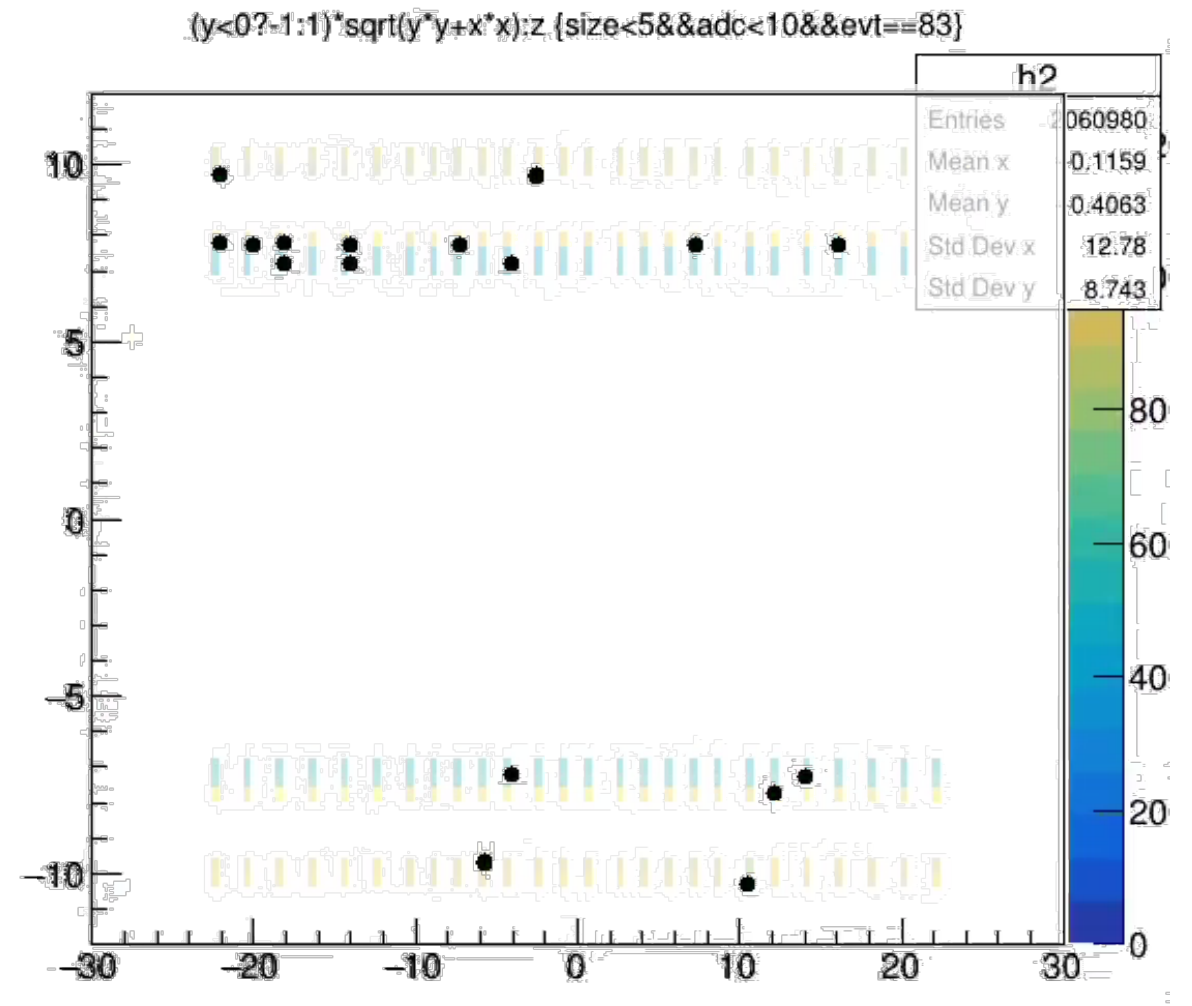
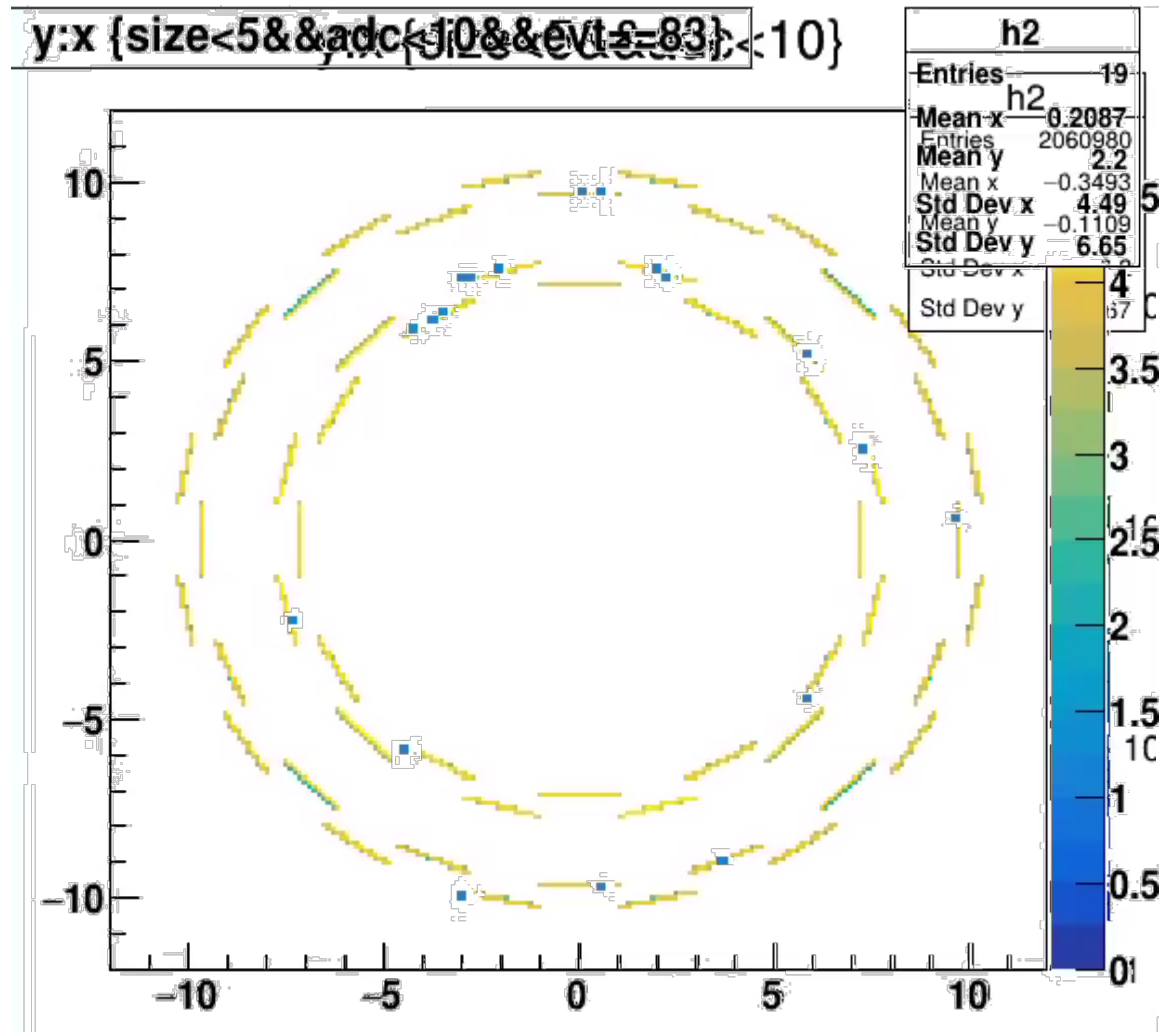


Event=28



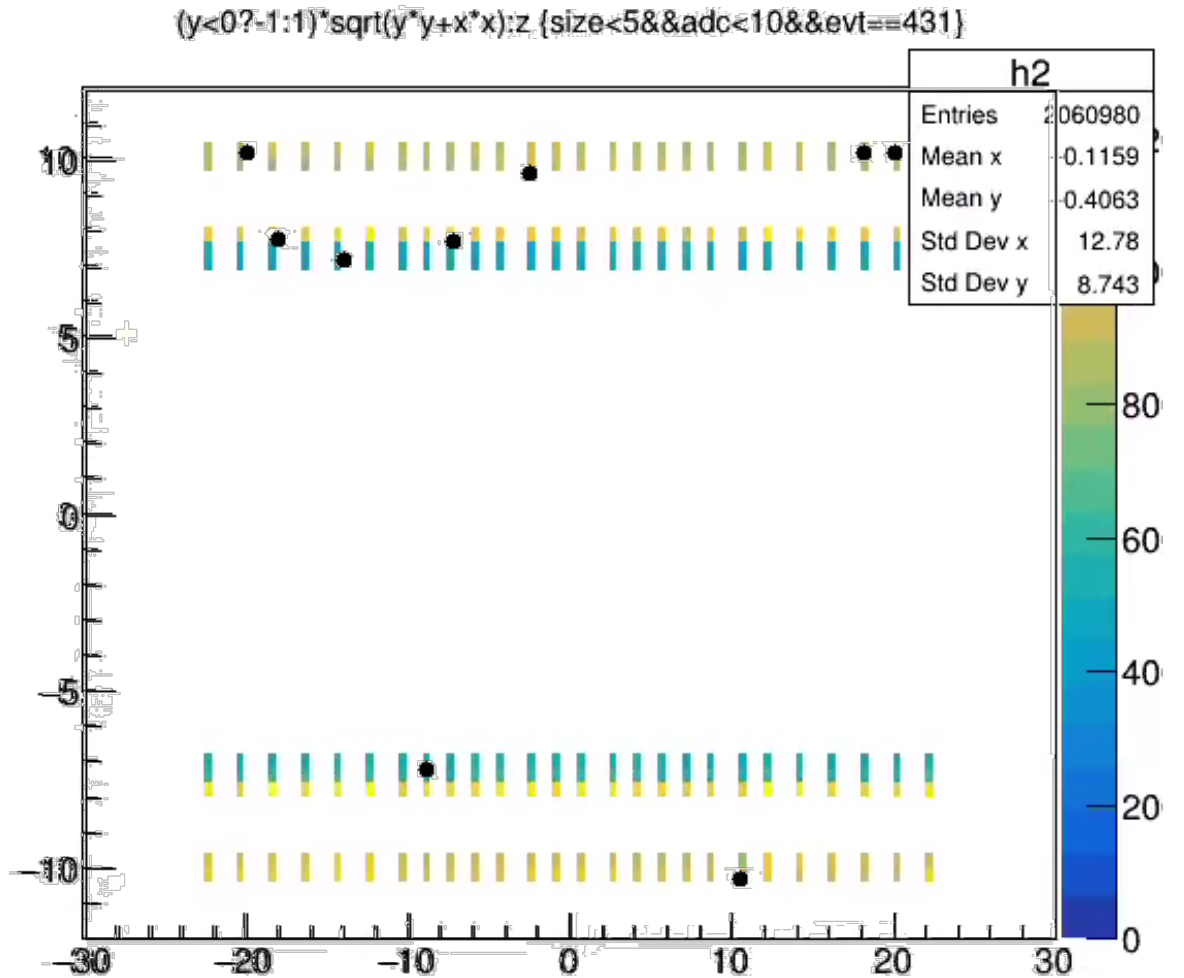
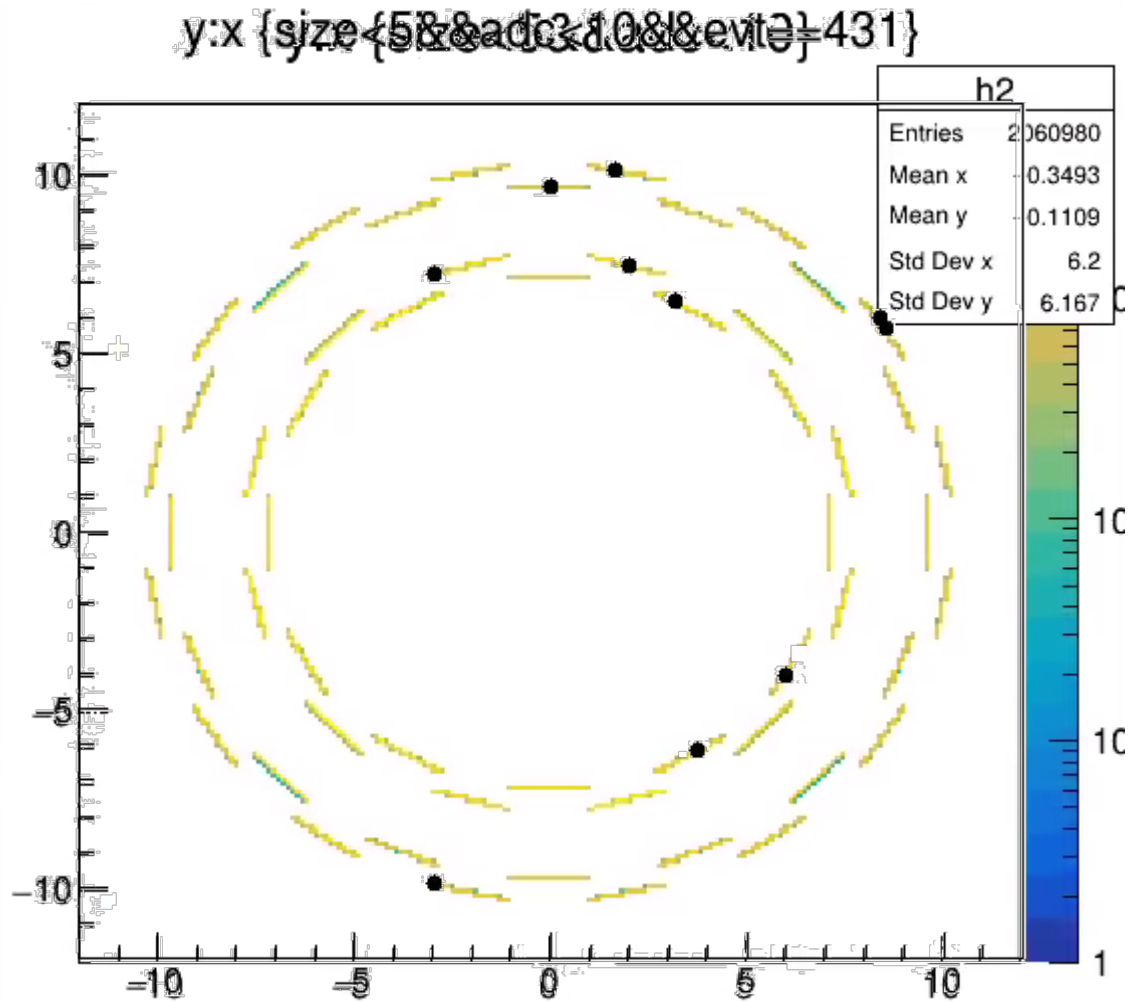
トラックが引けていないように見える

Event =83



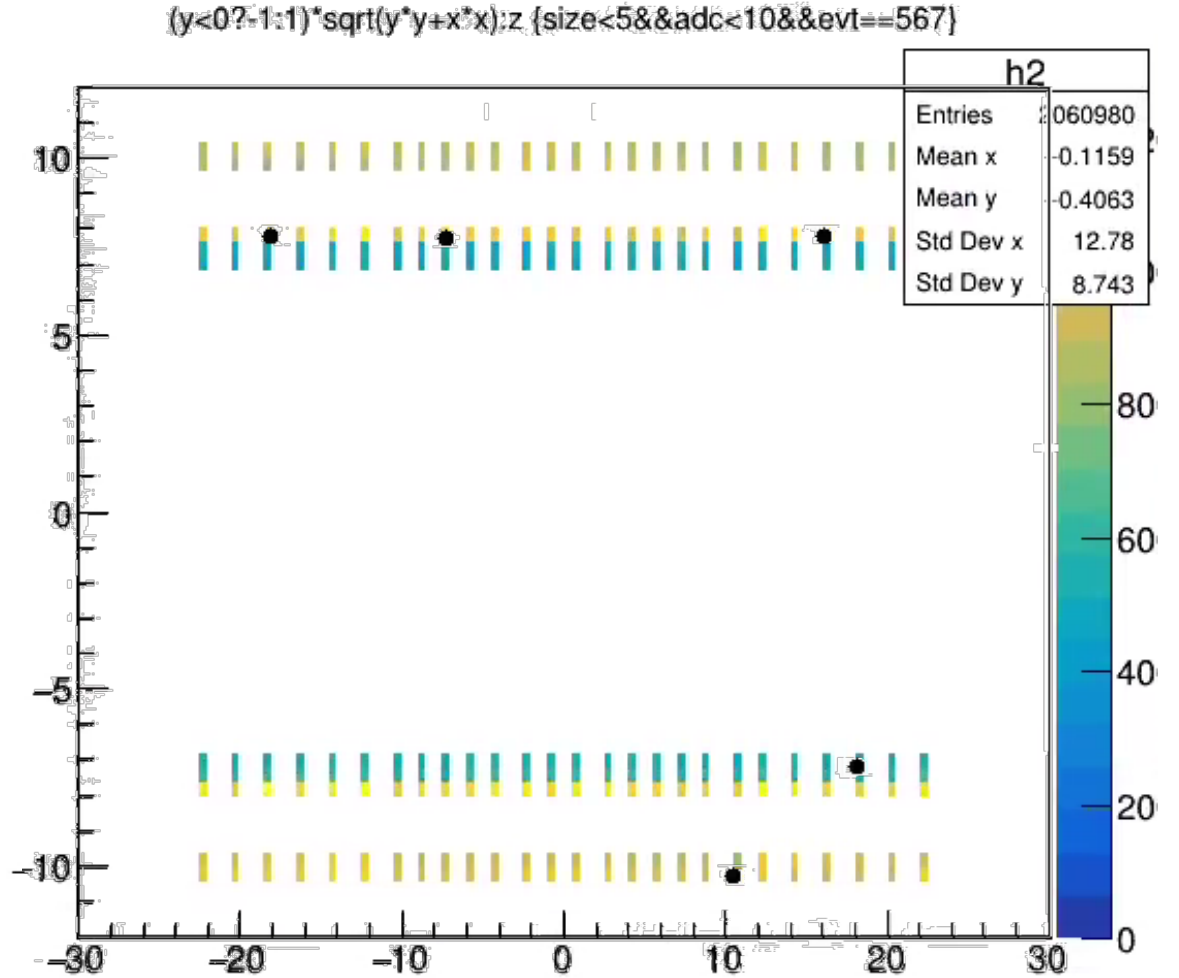
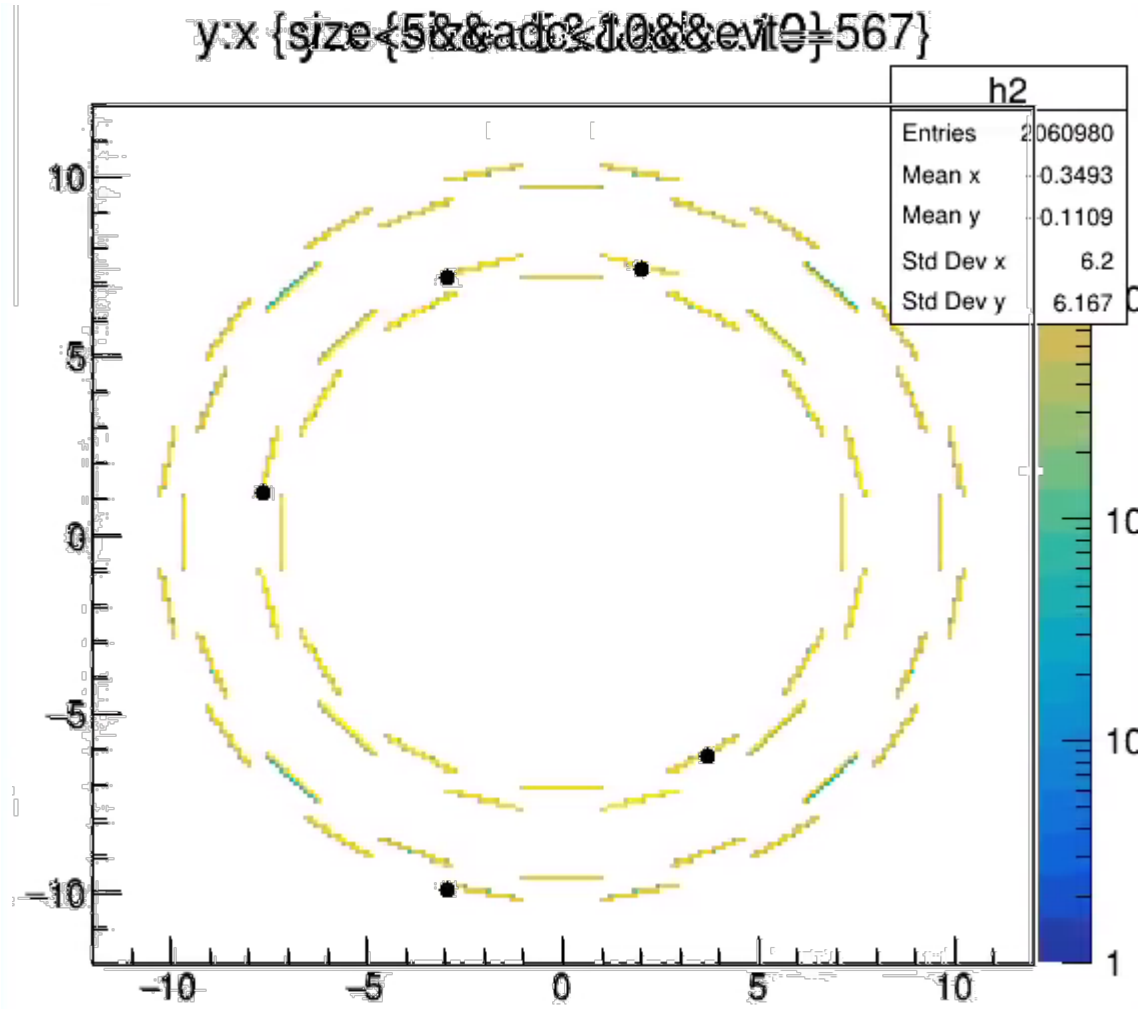
No track candidate seen by eye

Event =431



No track candidate seen by eye

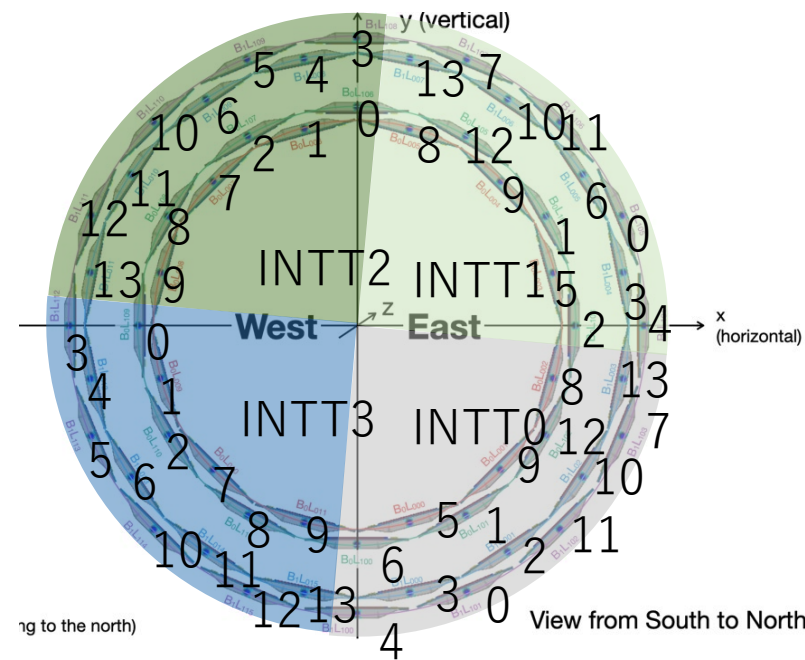
Event = 567

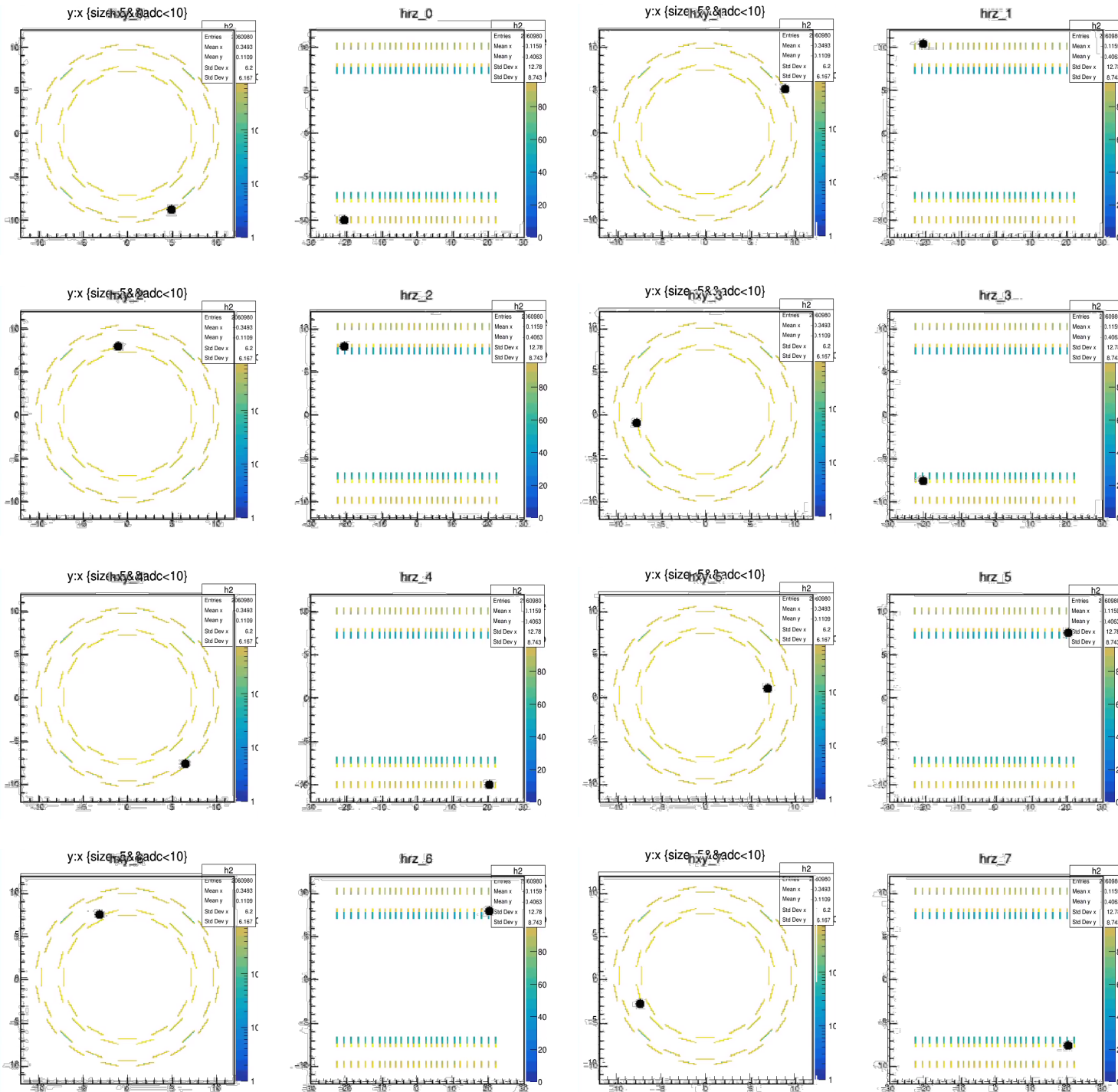


No track candidate seen by eye



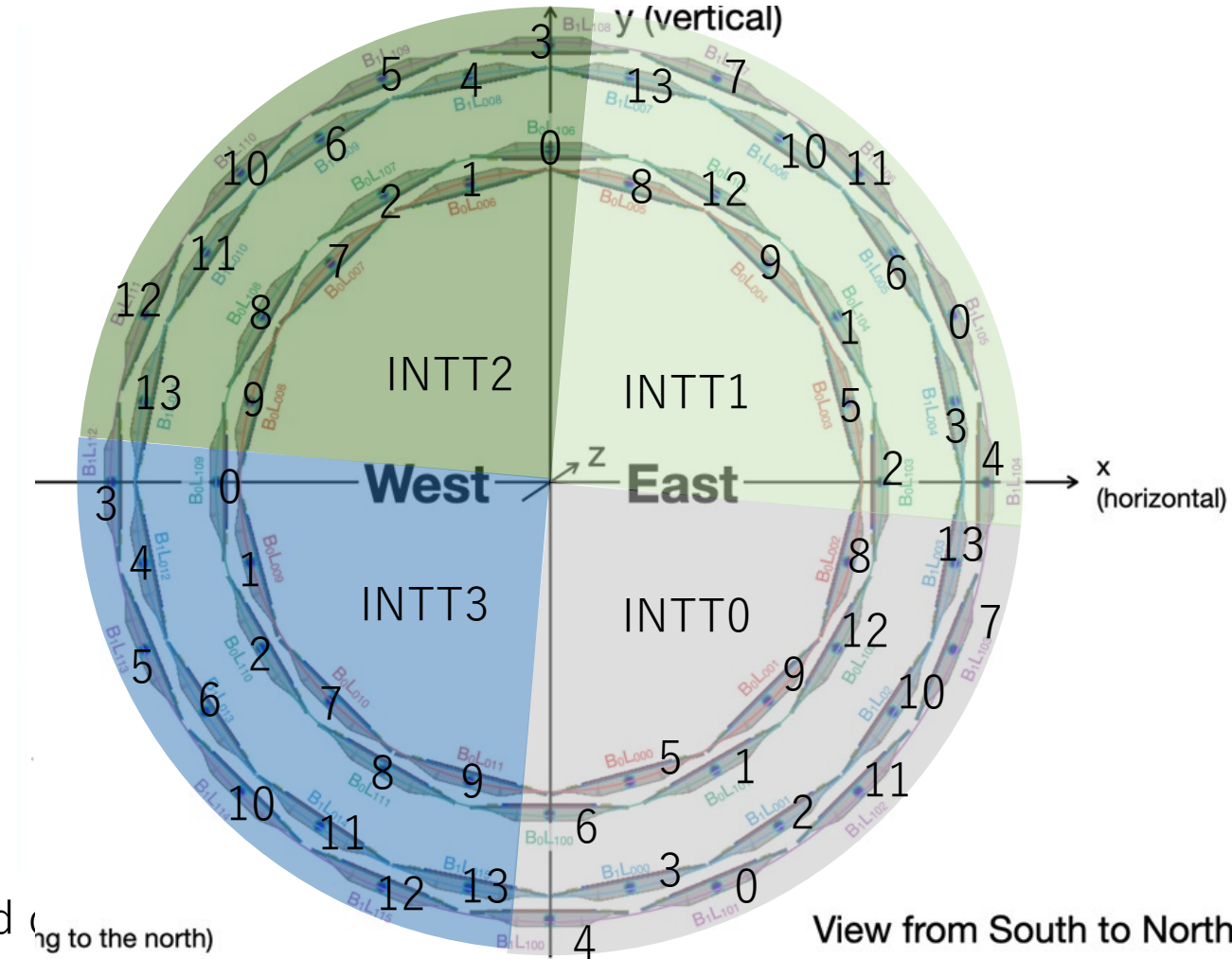
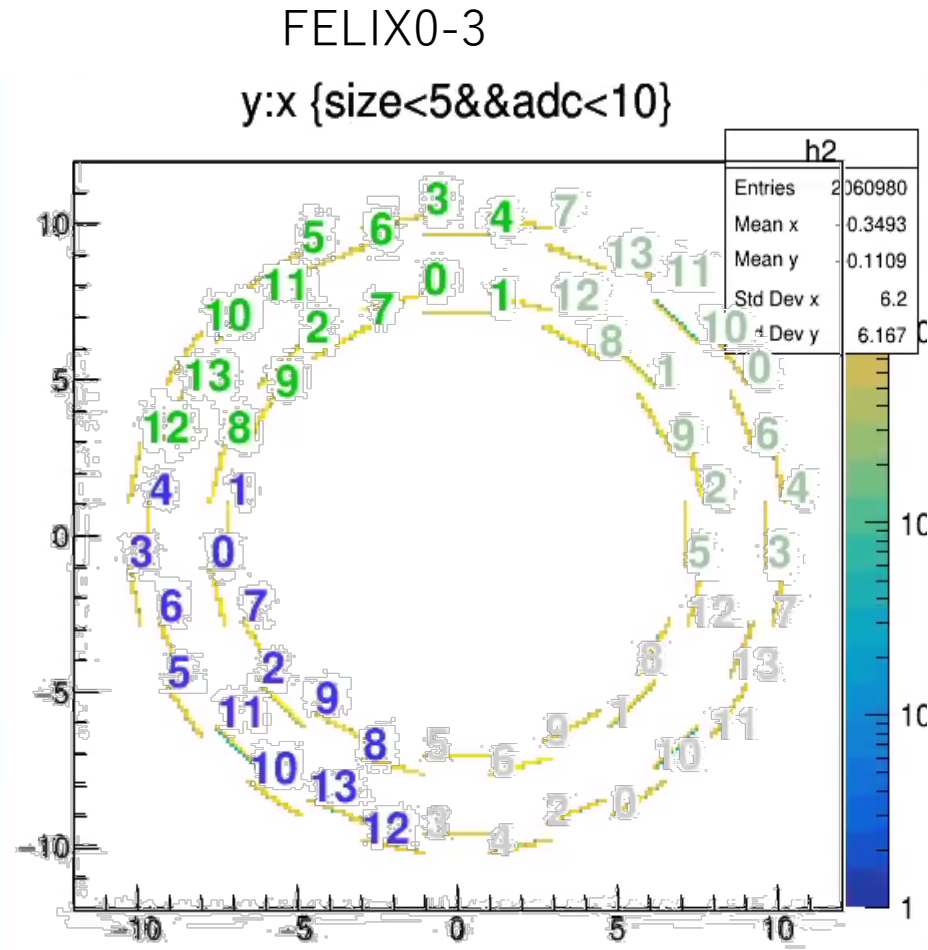
- FELIX=0-7
- Module=0
- Chip=1, chan=0,
- FELIX position looks wrong





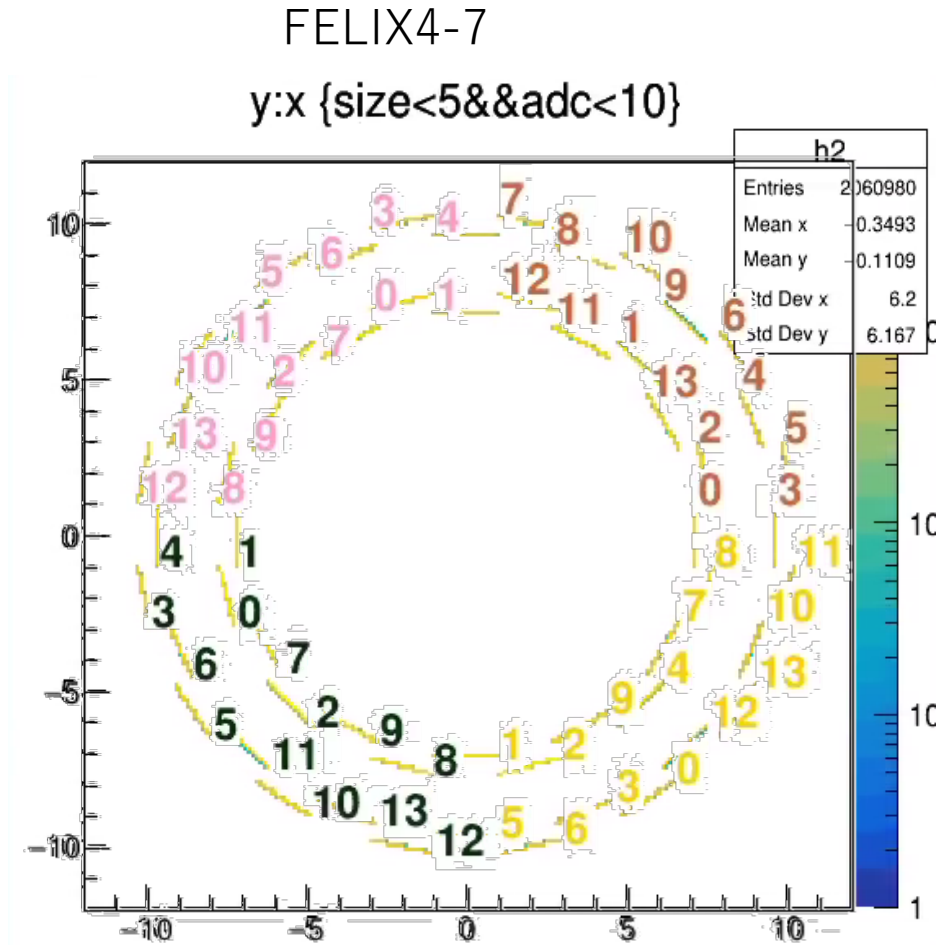
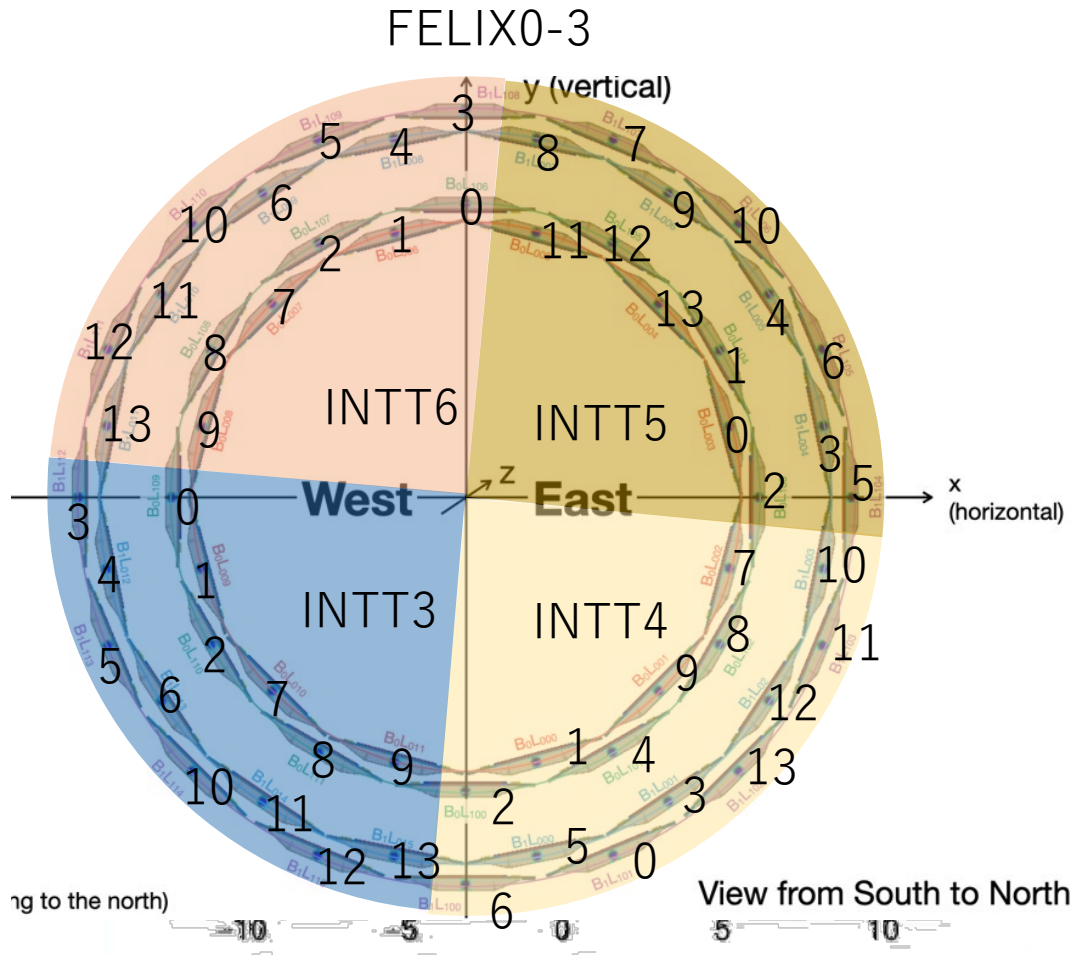
- Need to update
 - I modified the code in my private area
 - FELIX position with $-\pi/4$

Checking the conversion between Raw and Offline



Thanks Joseph for making this complicated (going to the north)
This looks like different with the spread sheet

Checking the conversion between Raw and Offline



Thanks Joseph for making this complicated conversion code
This looks like different with the spread sheet

Need to modify (2)

- In InttRawDataDecoder
 - This should be Y and X (y for chip is first)

```
offline = Intt::ToOffline(rawdata);

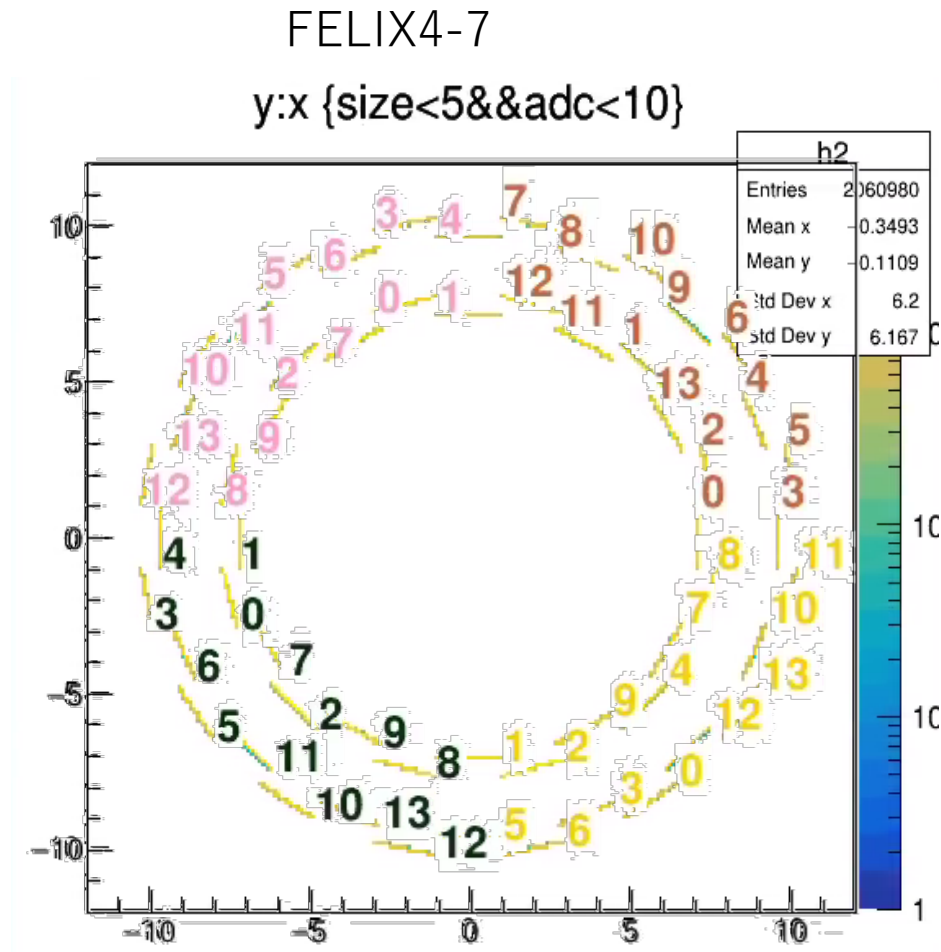
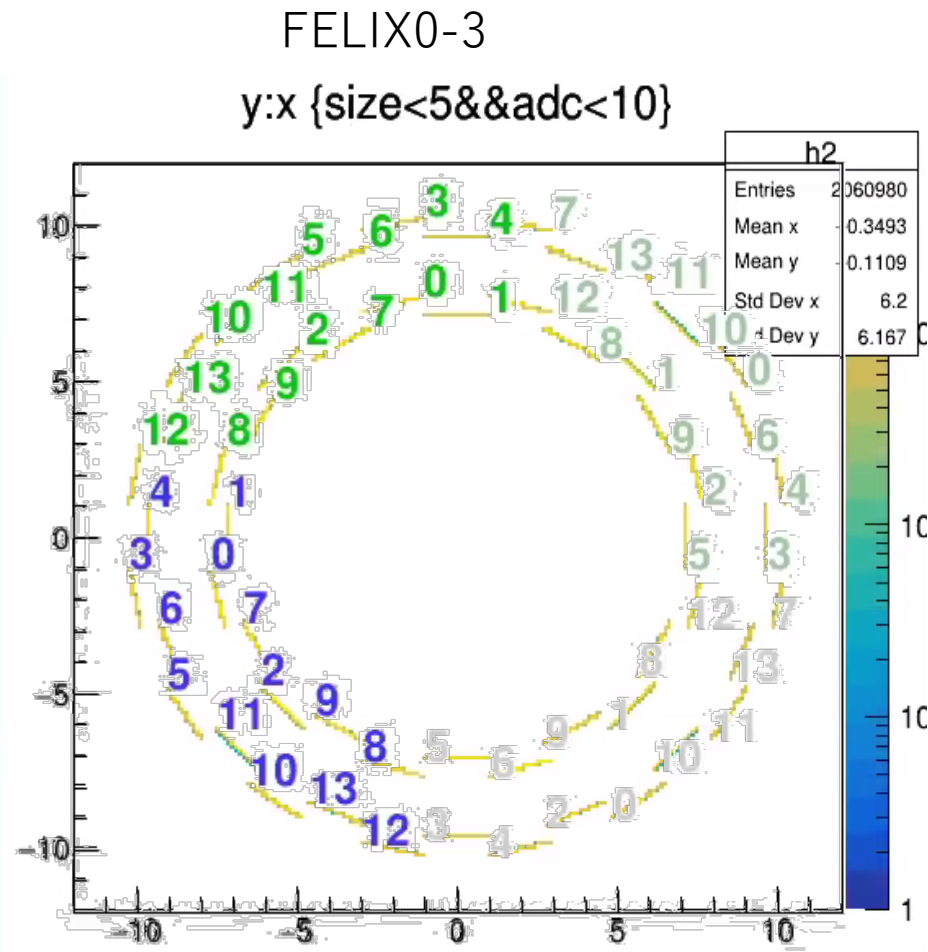
hit_key = InttDefs::genHitKey(offline.strip_x, offline.strip_y);
hit_set_key = InttDefs::genHitSetKey(offline.layer, offline.ladder_z, offline.ladder_phi, bco);

hit_set_container_itr = trkr_hit_set_container->findOrAddHitSet(hit_set_key);
hit = hit_set_container_itr->second->getHit(hit_key);
if(hit)continue;
```

Summary

- Z-vertex reconstruction is under preparation
 - I made the code to input the real data to the reconstruction framework
 - I could run the code and get the cluster X-Y-Z position with the data.
- Tracklet looks not actual track from the collision
 - Something is wrong in the channel conversion to 3D hit position and clustering, Need to investigate
- Manami is working

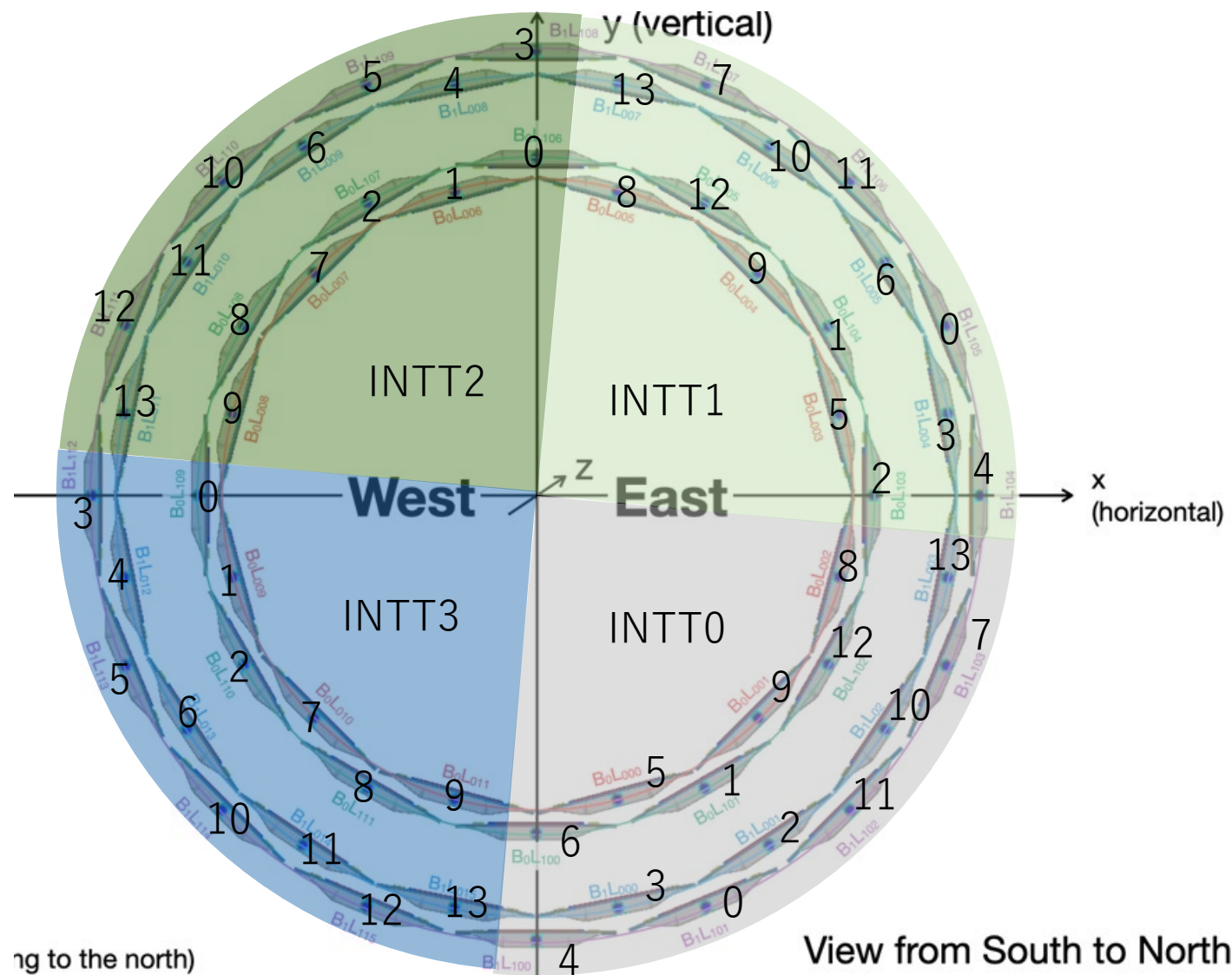
Checking the conversion between Raw and Offline



Thanks Joseph for making this complicated conversion code
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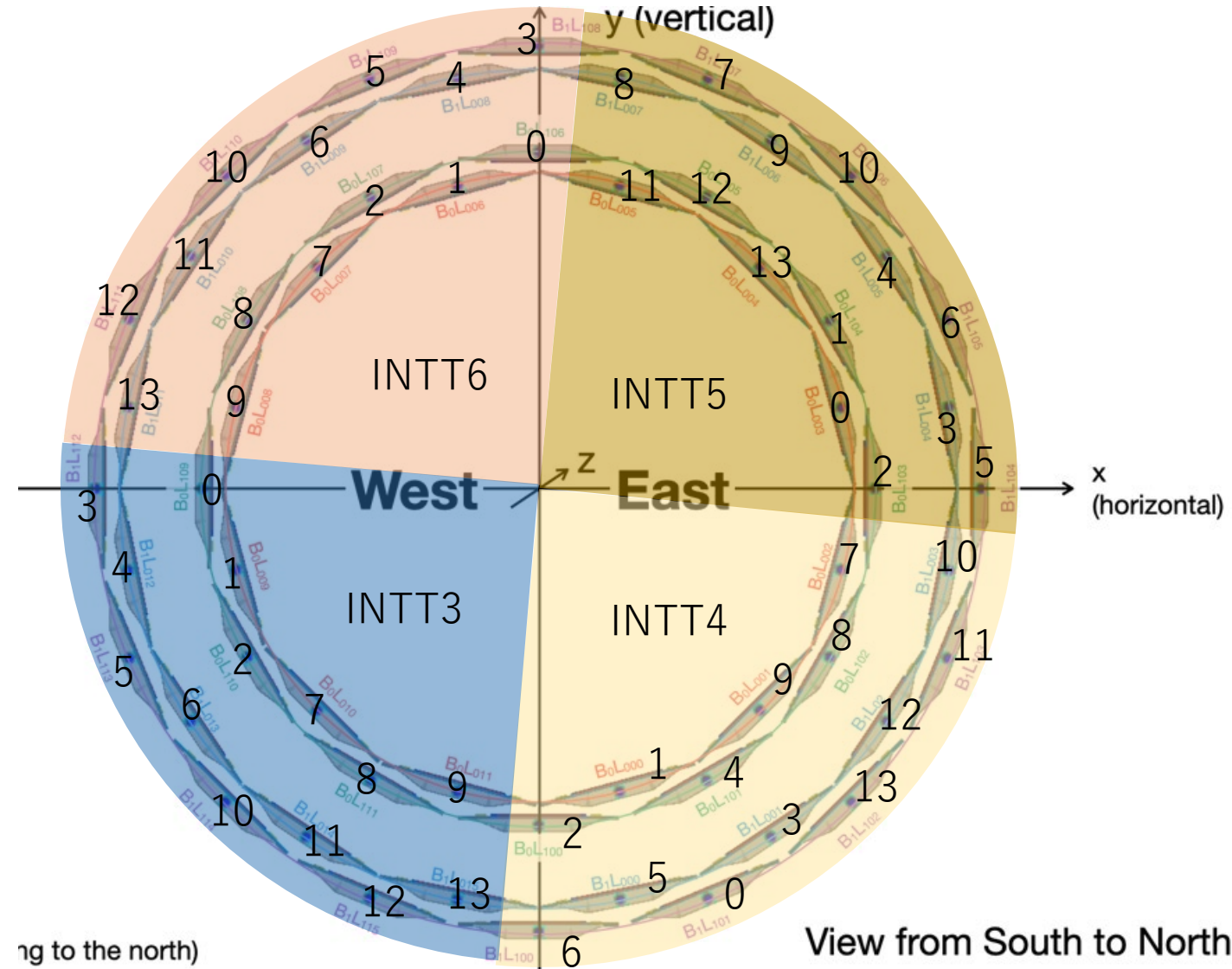
3001	0	B1L1 01S	3002	0	B1L1 05S	3003	0	B0L1 06S	3004	0	B0L1 09S
	1	B0L1 01S		1	B0L1 04S		1	B0L0 06S		1	B0L0 09S
	2	B1L0 01S		2	B0L1 03S		2	B0L1 07S		2	B0L1 10S
	3	B1L0 00S		3	B1L0 04S		3	B1L1 08S		3	B1L1 12S
	4	B1L1 00S		4	B1L1 04S		4	B1L0 08S		4	B1L0 12S
	5	B0L0 00S		5	B0L0 03S		5	B1L1 09S		5	B1L1 13S
	6	B0L1 00S		6	B1L0 05S		6	B1L0 09S		6	B1L0 13S
	7	B1L1 03S		7	B1L1 07S		7	B0L0 07S		7	B0L0 10S
	8	B0L0 02S		8	B0L0 05S		8	B0L1 08S		8	B0L1 11S
	9	B0L0 01S		9	B0L0 04S		9	B0L0 08S		9	B0L0 11S
	10	B1L0 02S		10	B1L0 06S		10	B1L1 10S		10	B1L1 14S
	11	B1L1 02S		11	B1L1 06S		11	B1L0 10S		11	B1L0 14S
	12	B0L1 02S		12	B0L1 05S		12	B1L1 11S		12	B1L1 15S
	13	B1L0 03S		13	B1L0 07S		13	B1L0 11S		13	B1L0 15S
3005	0	B1L1 01N	3006	0	B0L0 03N	3007	0	B0L1 06N	3008	0	B0L1 09N
	1	B0L0 00N		1	B0L1 04N		1	B0L0 06N		1	B0L0 09N
	2	B0L1 00N		2	B0L1 03N		2	B0L1 07N		2	B0L1 10N
	3	B1L0 01N		3	B1L0 04N		3	B1L1 08N		3	B1L1 12N
	4	B0L1 01N		4	B1L0 05N		4	B1L0 08N		4	B1L0 12N
	5	B1L0 00N		5	B1L1 04N		5	B1L1 09N		5	B1L1 13N
	6	B1L1 00N		6	B1L1 05N		6	B1L0 09N		6	B1L0 13N
	7	B0L0 02N		7	B1L1 07N		7	B0L0 07N		7	B0L0 10N
	8	B0L1 02N		8	B1L0 07N		8	B0L1 08N		8	B0L1 11N
	9	B0L0 01N		9	B1L0 06N		9	B0L0 08N		9	B0L0 11N
	10	B1L0 03N		10	B1L1 06N		10	B1L1 10N		10	B1L1 14N
	11	B1L1 03N		11	B0L0 05N		11	B1L0 10N		11	B1L0 14N
	12	B1L0 02N		12	B0L1 05N		12	B1L1 11N		12	B1L1 15N
	13	B1L1 02N		13	B0L0 04N		13	B1L0 11N		13	B1L0 15N

FELIX0-3 ladder map



FELIX4-7 ladder map

3001	0	B1L1 01S	3002	0	B1L1 05S	3003	0	B0L1 06S	3004	0	B0L1 09S
	1	B0L1 01S		1	B0L1 04S		1	B0L0 06S		1	B0L0 09S
	2	B1L0 01S		2	B0L1 03S		2	B0L1 07S		2	B0L1 10S
	3	B1L0 00S		3	B1L0 04S		3	B1L1 08S		3	B1L1 12S
	4	B1L1 00S		4	B1L1 04S		4	B1L0 08S		4	B1L0 12S
	5	B0L0 00S		5	B0L0 03S		5	B1L1 09S		5	B1L1 13S
	6	B0L1 00S		6	B1L0 05S		6	B1L0 09S		6	B1L0 13S
	7	B1L1 03S		7	B1L1 07S		7	B0L0 07S		7	B0L0 10S
	8	B0L0 02S		8	B0L0 05S		8	B0L1 08S		8	B0L1 11S
	9	B0L0 01S		9	B0L0 04S		9	B0L0 08S		9	B0L0 11S
	10	B1L0 02S		10	B1L0 06S		10	B1L1 10S		10	B1L1 14S
	11	B1L1 02S		11	B1L1 06S		11	B1L0 10S		11	B1L0 14S
	12	B0L1 02S		12	B0L1 05S		12	B1L1 11S		12	B1L1 15S
	13	B1L0 03S		13	B1L0 07S		13	B1L0 11S		13	B1L0 15S
3005	0	B1L1 01N	3006	0	B0L0 03N	3007	0	B0L1 06N	3008	0	B0L1 09N
	1	B0L0 00N		1	B0L1 04N		1	B0L0 06N		1	B0L0 09N
	2	B0L1 00N		2	B0L1 03N		2	B0L1 07N		2	B0L1 10N
	3	B1L0 01N		3	B1L0 04N		3	B1L1 08N		3	B1L1 12N
	4	B0L1 01N		4	B1L0 05N		4	B1L0 08N		4	B1L0 12N
	5	B1L0 00N		5	B1L1 04N		5	B1L1 09N		5	B1L1 13N
	6	B1L1 00N		6	B1L1 05N		6	B1L0 09N		6	B1L0 13N
	7	B0L0 02N		7	B1L1 07N		7	B0L0 07N		7	B0L0 10N
	8	B0L1 02N		8	B1L0 07N		8	B0L1 08N		8	B0L1 11N
	9	B0L0 01N		9	B1L0 06N		9	B0L0 08N		9	B0L0 11N
	10	B1L0 03N		10	B1L1 06N		10	B1L1 10N		10	B1L1 14N
	11	B1L1 03N		11	B0L0 05N		11	B1L0 10N		11	B1L0 14N
	12	B1L0 02N		12	B0L1 05N		12	B1L1 11N		12	B1L1 15N
	13	B1L1 02N		13	B0L0 04N		13	B1L0 11N		13	B1L0 15N

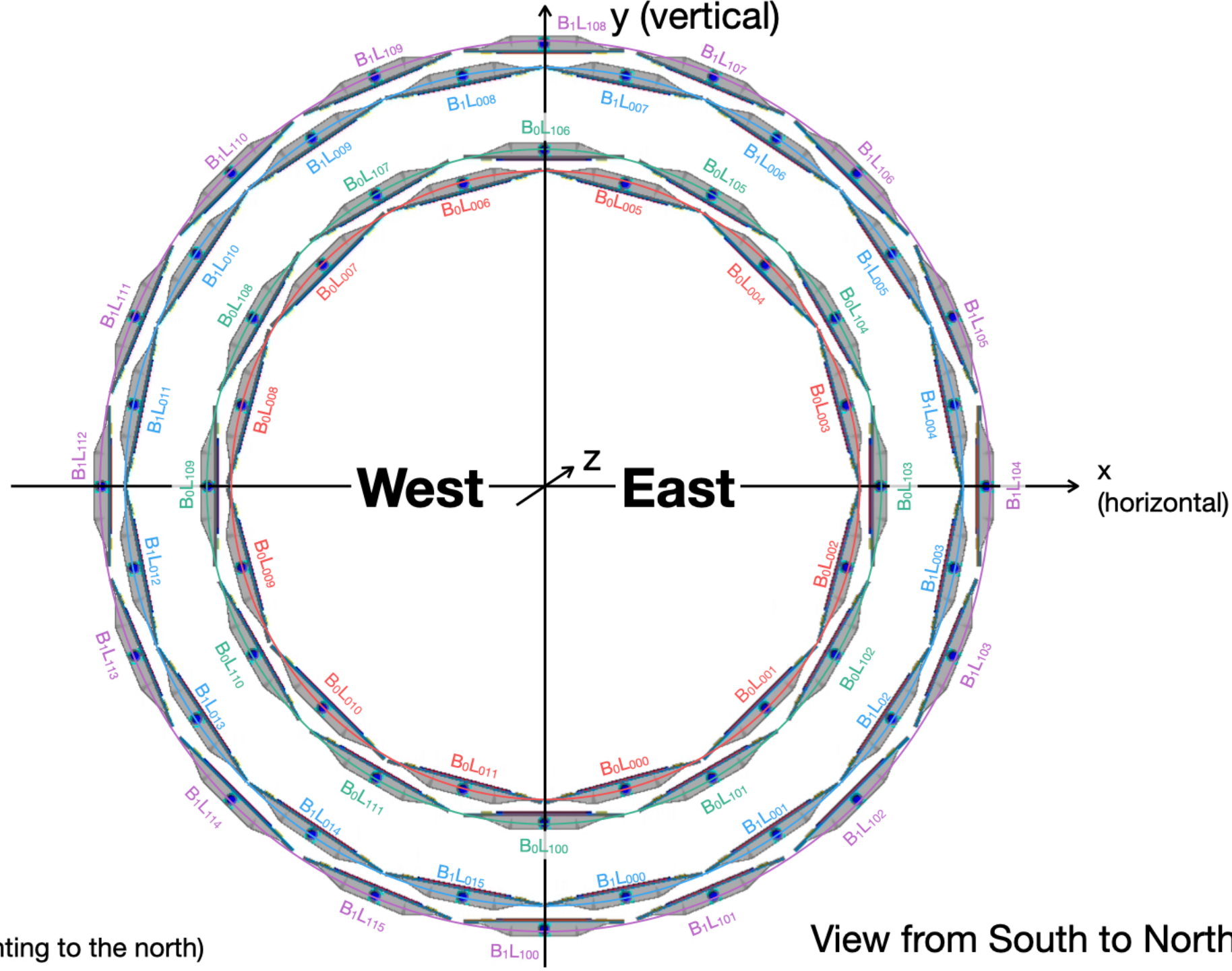


Notation: $B_x L_{yzz}$

x: Barrel ID (0 for inner or 1 for outer)

y: Layer ID (0 for inner or 1 for outer)

zz: Ladder ID (from 0 to 15)



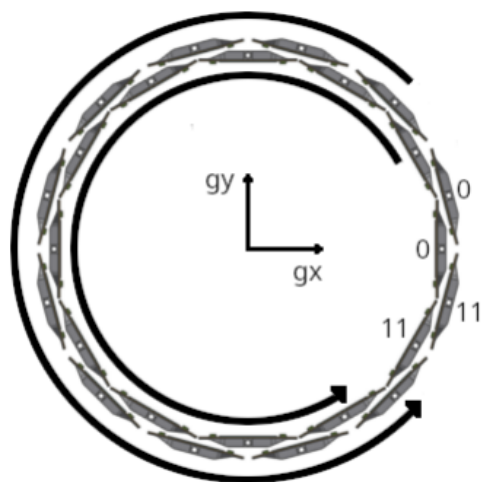
Axis

x-axis: $\vec{y} \times \vec{z}$

y-axis: Vertically upward direction

z-axis: The blue beam direction (pointing to the north)

Ladder_phi (Layers 3 & 4)



Ladder_phi (Layers 5 & 6)

