

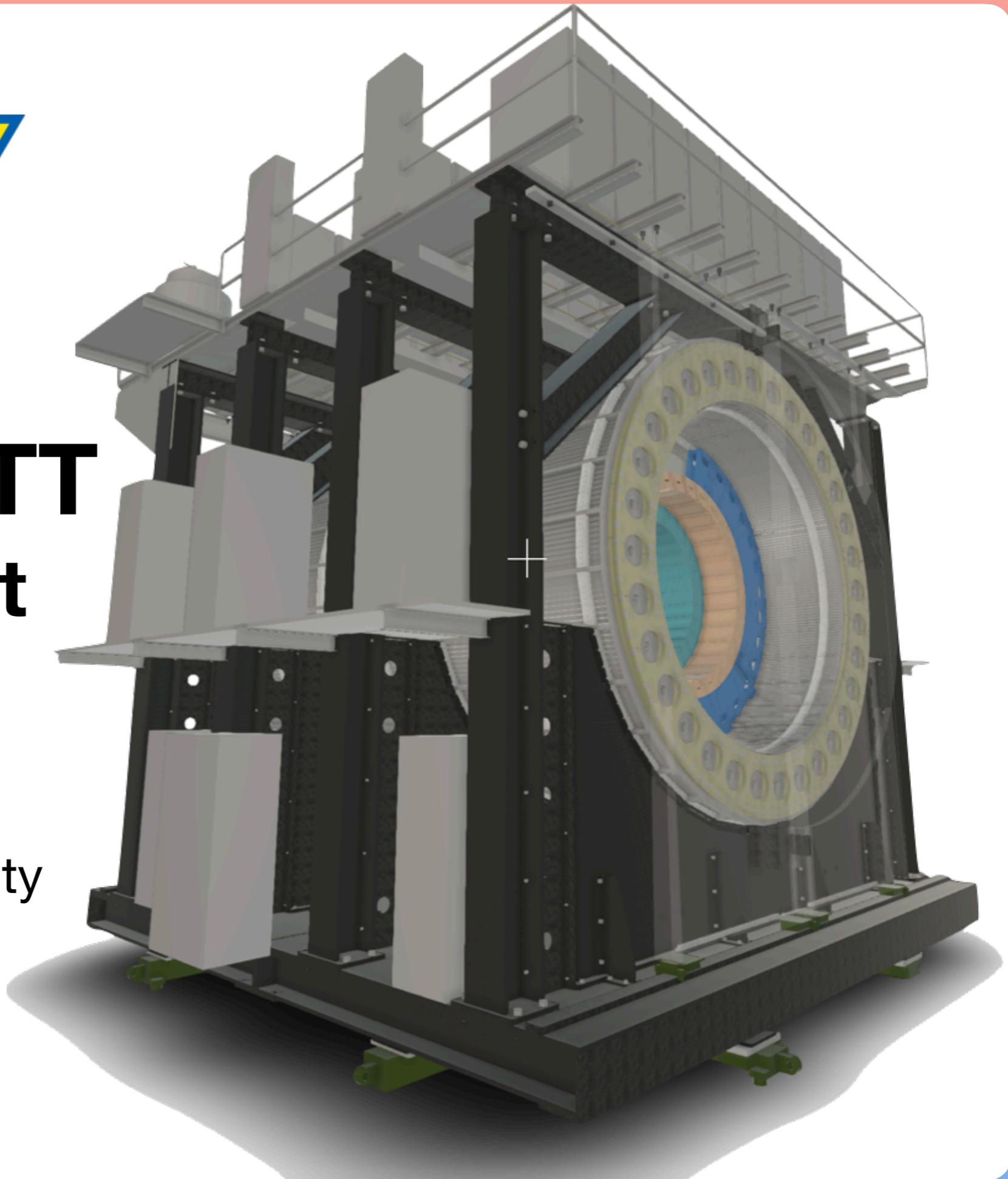


SPHENIX INTT - Weekly Report

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- Several features have been added, the macro is more flexible now.
 - Layer alignment (optional, 4 layer only)
 - Compatible with 3 or 4 layers case
 - number of event to be studied
 - 2 methods to choose the study chip (slot) is provided.
- The event preselection becomes tighter !
 - $INTT_event = 1$ (coincidence signal of 3 sci + 1 INTT hit)
 - `camac_tdc6` within a certain range
 - `camac_adc` < a certain cut (optional)
 - No double saving event (optional)
 - Golden track considered only (optional)

Macro preparation for Testbeam2021



- 3 added branches in filter_N_v3.c makes the analysis easier
 - nele : number of element in the this event (vector)
 - DSE : double saving event indicator
 - If double saving event appears, DSE = 1, else DSE = 0
 - eID : event ID

```

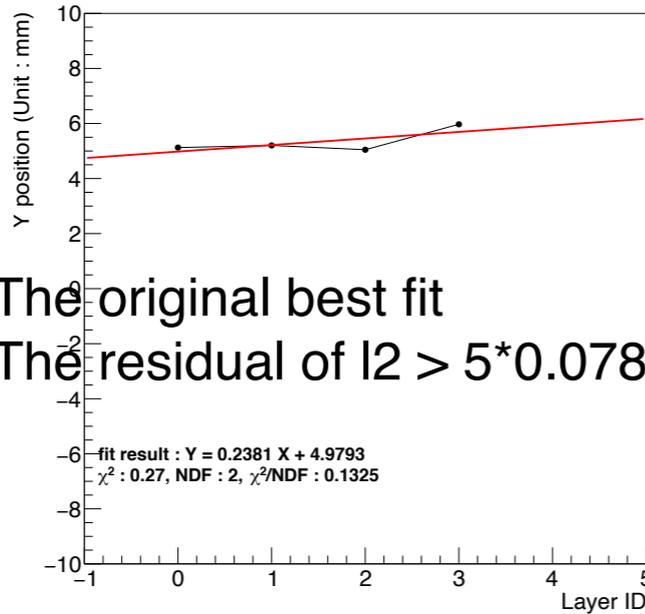
*****
*   Row   * Instance * camac_adc * camac_tdc * INTT_even *   module *   chip_id *   chan_id *   adc *   nele *   DSE *   eID *
*****
*   5855 *         0 *      45 *      165 *         1 *         2 *         5 *        29 *         3 *         1 *         0 *        5855 *
*   5855 *         1 *      99 *      140 *         1 *         *         *         *         *         1 *         0 *        5855 *
*   5855 *         2 *      94 *      145 *         1 *         *         *         *         *         1 *         0 *        5855 *
*   5855 *         3 *         *         0 *         1 *         *         *         *         *         1 *         0 *        5855 *
*   5855 *         4 *         *         0 *         1 *         *         *         *         *         1 *         0 *        5855 *
*   5855 *         5 *         *      909 *         1 *         *         *         *         *         1 *         0 *        5855 *
*****
    
```

Event profile example

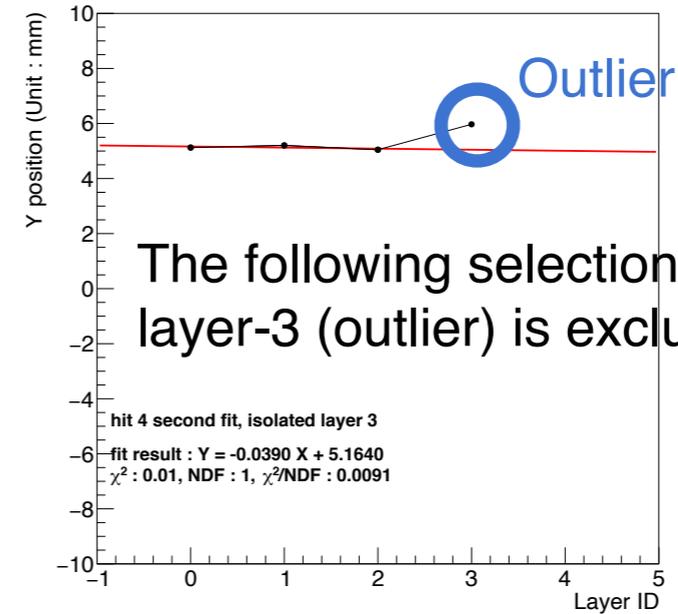


Example of event profile : 1110

4 hit PLC : 1864-0, eID : 2207, chip : 5, chan : 5.125, 5.203, 5.047, 5.971



4 hit PLC : 1864, eID : 2207, chip : 5, chan : 5.125, 5.203, 5.047, 5.971



```

*****
*   Row   * Instance *   camac_adc *   camac_tdc * INTT_even *   module *   chip_id *   chan_id *   adc *   nele *   DSE *   eID *
*****
*   2207 *         0 *         45 *         152 *         1 *         6 *         5 *         62 *         3 *         22 *         0 *   2207 *
*   2207 *         1 *         99 *         140 *         1 *         5 *         5 *         61 *         3 *         22 *         0 *   2207 *
*   2207 *         2 *         92 *         132 *         1 *         8 *         5 *         63 *         5 *         22 *         0 *   2207 *
*   2207 *         3 *           *           0 *         1 *         2 *         5 *         41 *         1 *         22 *         0 *   2207 *
*   2207 *         4 *           *           0 *         1 *         2 *         5 *         42 *         1 *         22 *         0 *   2207 *
*   2207 *         5 *           *         882 *         1 *         2 *         5 *         43 *         1 *         22 *         0 *   2207 *
*   2207 *         6 *           *           *         1 *         2 *         5 *         44 *         0 *         22 *         0 *   2207 *
*   2207 *         7 *           *           *         1 *         2 *         5 *         45 *         0 *         22 *         0 *   2207 *
*   2207 *         8 *           *           *         1 *         2 *         5 *         46 *         0 *         22 *         0 *   2207 *
*   2207 *         9 *           *           *         1 *         2 *         5 *         47 *         1 *         22 *         0 *   2207 *
*   2207 *        10 *           *           *         1 *         2 *         5 *         48 *         0 *         22 *         0 *   2207 *
*   2207 *        11 *           *           *         1 *         2 *         5 *         49 *         0 *         22 *         0 *   2207 *
*   2207 *        12 *           *           *         1 *         2 *         5 *         50 *         0 *         22 *         0 *   2207 *
*   2207 *        13 *           *           *         1 *         2 *         5 *         51 *         1 *         22 *         0 *   2207 *
*   2207 *        14 *           *           *         1 *         2 *         5 *         52 *         1 *         22 *         0 *   2207 *
*   2207 *        15 *           *           *         1 *         2 *         5 *         53 *         0 *         22 *         0 *   2207 *
*   2207 *        16 *           *           *         1 *         2 *         5 *         54 *         1 *         22 *         0 *   2207 *
*   2207 *        17 *           *           *         1 *         2 *         5 *         55 *         1 *         22 *         0 *   2207 *
*   2207 *        18 *           *           *         1 *         2 *         5 *         56 *         1 *         22 *         0 *   2207 *
*   2207 *        19 *           *           *         1 *         2 *         5 *         57 *         1 *         22 *         0 *   2207 *
*   2207 *        20 *           *           *         1 *         2 *         5 *         58 *         1 *         22 *         0 *   2207 *
*   2207 *        21 *           *           *         1 *         2 *         5 *         59 *         3 *         22 *         0 *   2207 *
*****
    
```

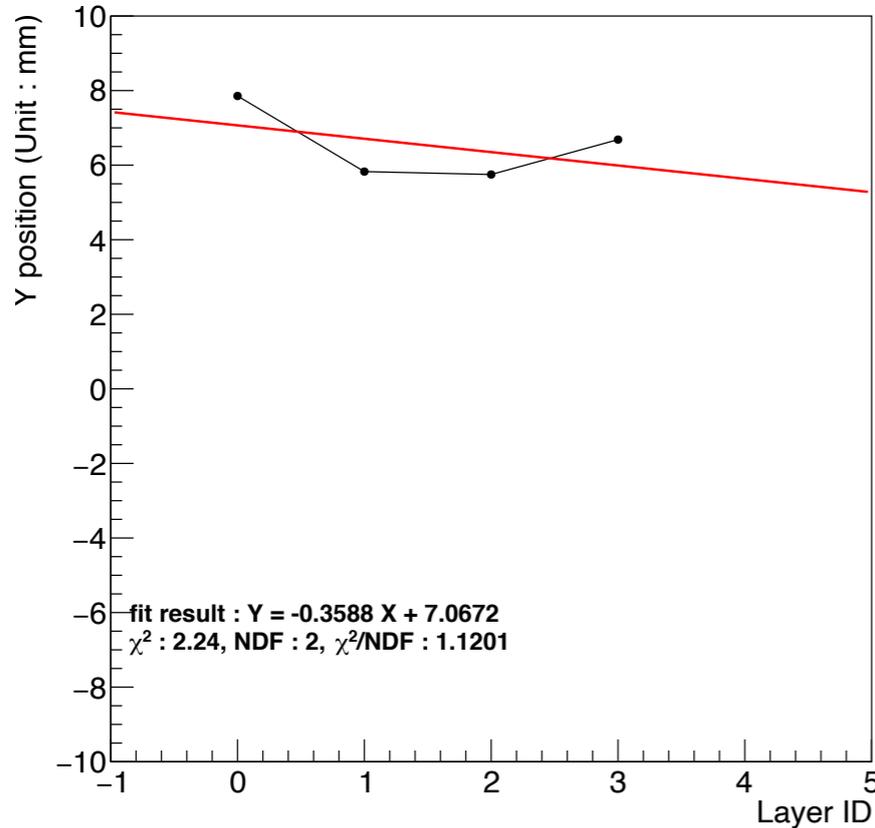
Same cluster !

Event profile example



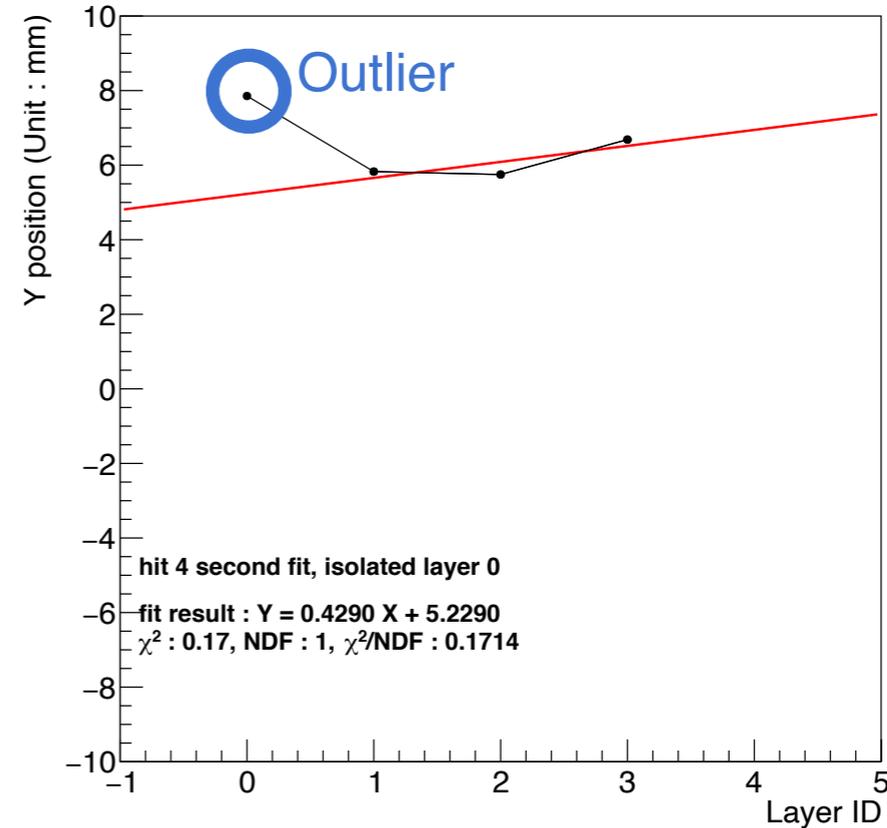
Example of event profile : 0111

4 hit PLC : 5965-0, eID : 7092, chip : 5, chan :7.855, 5.827, 5.749,6.685



The original best fit
 The residual of l1 > 5*0.078mm

4 hit PLC : 5965, eID : 7092, chip : 5, chan :7.855, 5.827, 5.749,6.685



The following selection, layer-0 (outlier) is excluded

```
[root [1] tree_both->Scan("camac_adc:camac_tdc:INTT_event:module:chip_id:chan_id:adc:nele:DSE:eID","eID==7092")
*****
*   Row   * Instance * camac_adc * camac_tdc * INTT_even *   module *   chip_id *   chan_id *   adc *   nele *   DSE *   eID *
*****
*   7092 *     0 *     47 *    159 *     1 *     6 *     5 *    27 *     3 *     4 *     0 *   7092 *
*   7092 *     1 *    100 *    140 *     1 *     5 *     5 *    53 *     3 *     4 *     0 *   7092 *
*   7092 *     2 *    101 *    138 *     1 *     8 *     5 *    54 *     3 *     4 *     0 *   7092 *
*   7092 *     3 *     *     0 *     1 *     2 *     5 *    42 *     2 *     4 *     0 *   7092 *
*   7092 *     4 *     *     0 *     1 *     *     *     *     *     4 *     0 *   7092 *
*   7092 *     5 *     *    821 *     1 *     *     *     *     *     4 *     0 *   7092 *
*****
```

Other examples of rejected event



Too large adc

```
root [1] tree_both->Scan("camac_adc:camac_tdc:INTT_event:module:chip_id:chan_id:adc:nele:DSE:eID","eID==8000")
```

Row	Instance	camac_adc	camac_tdc	INTT_event	module	chip_id	chan_id	adc	nele	DSE	eID
8000	0	45	178	1	6	5	67	4	9	0	8000
8000	1	169	141	1	5	5	68	6	9	0	8000
8000	2	1834	158	1	8	5	69	3	9	0	8000
8000	3	*	0	1	2	5	69	3	9	0	8000
8000	4	*	0	1	2	5	70	3	9	0	8000
8000	5	*	886	1	2	5	71	1	9	0	8000
8000	6	*	*	1	2	5	72	0	9	0	8000
8000	7	*	*	1	2	5	73	0	9	0	8000
8000	8	*	*	1	2	5	74	1	9	0	8000

Only 1 hit

Row	Instance	camac_adc	camac_tdc	INTT_event	module	chip_id	chan_id	adc	nele	DSE	eID
5855	0	45	165	1	2	5	29	3	1	0	5855
5855	1	99	140	1	*	*	*	*	1	0	5855
5855	2	94	145	1	*	*	*	*	1	0	5855
5855	3	*	0	1	*	*	*	*	1	0	5855
5855	4	*	0	1	*	*	*	*	1	0	5855
5855	5	*	909	1	*	*	*	*	1	0	5855

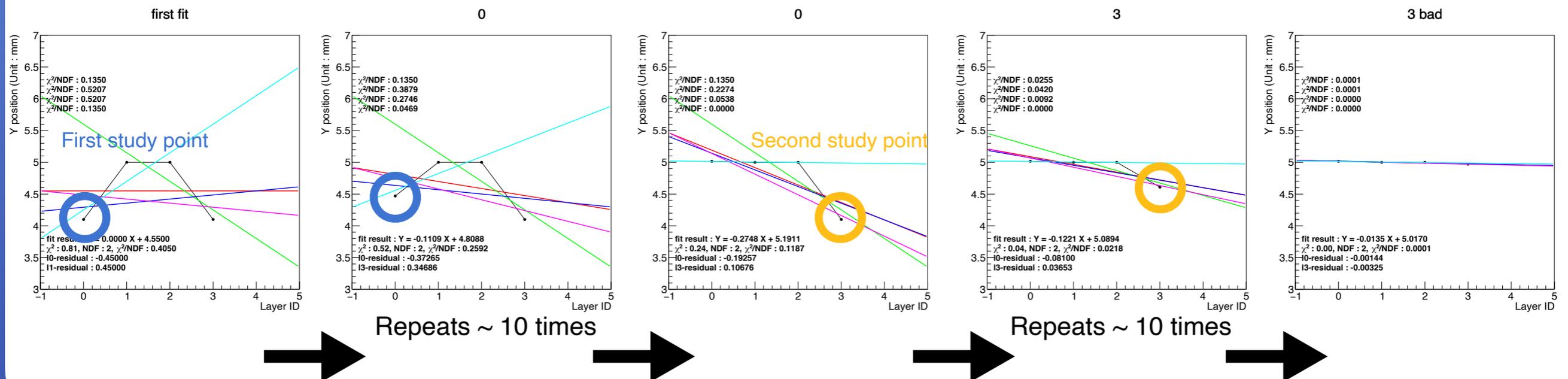
Only 1 cluster

Row	Instance	camac_adc	camac_tdc	INTT_event	module	chip_id	chan_id	adc	nele	DSE	eID
11244	0	54	146	1	6	5	92	5	2	0	11244
11244	1	146	139	1	2	6	109	3	2	0	11244
11244	2	111	126	1	*	*	*	*	2	0	11244
11244	3	*	0	1	*	*	*	*	2	0	11244
11244	4	*	0	1	*	*	*	*	2	0	11244
11244	5	*	843	1	*	*	*	*	2	0	11244

Alignment algorithm



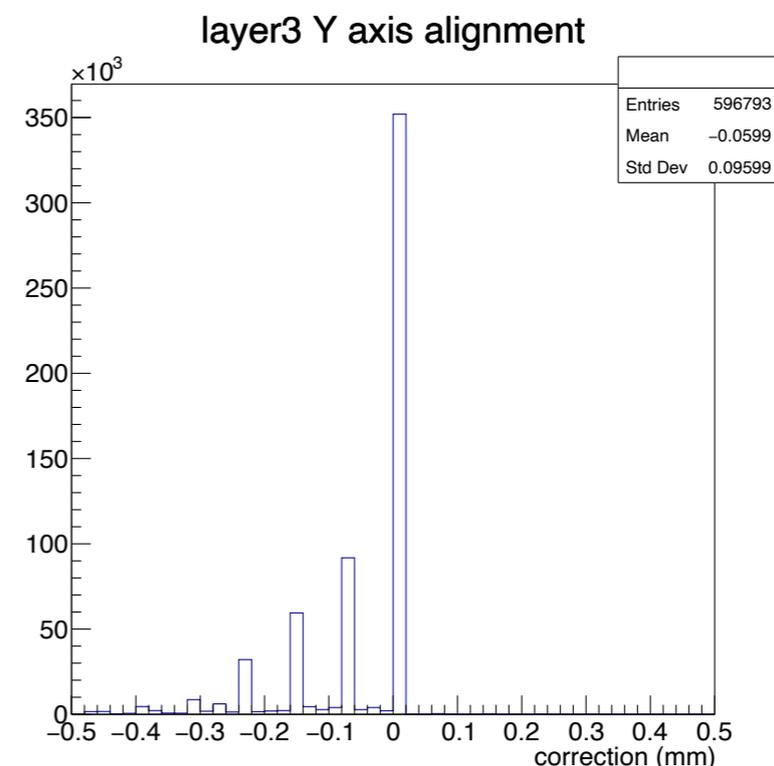
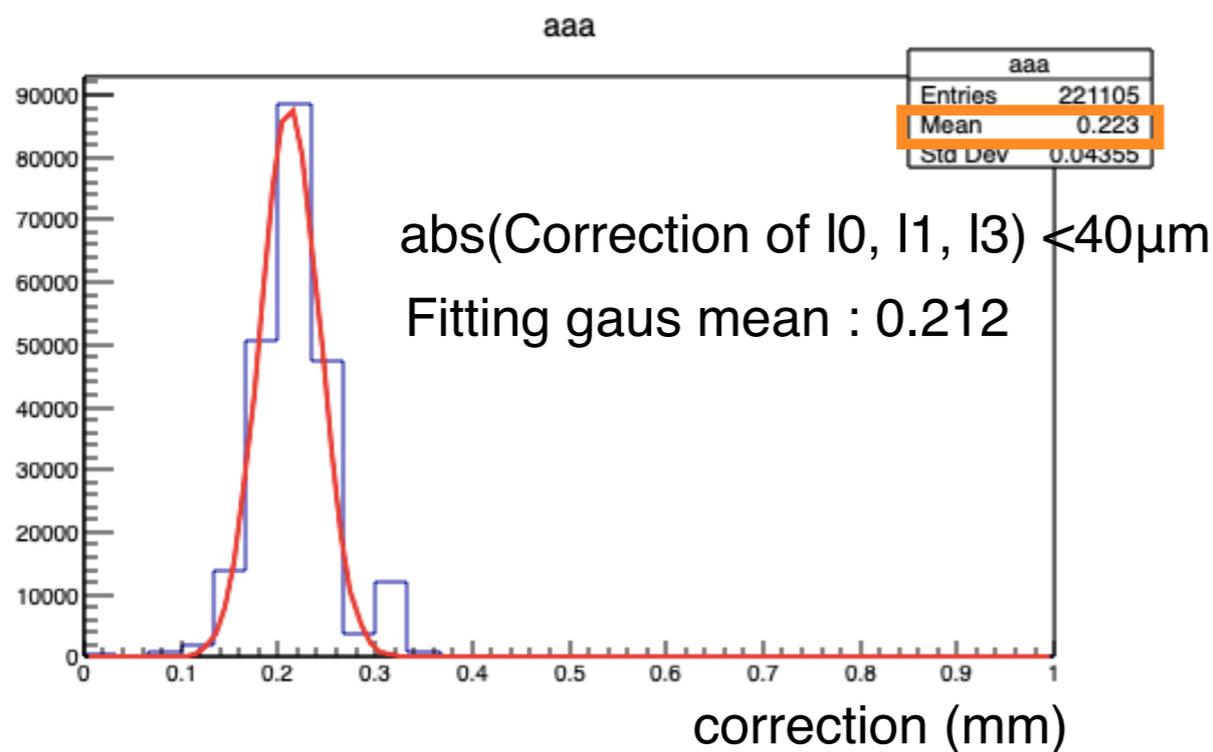
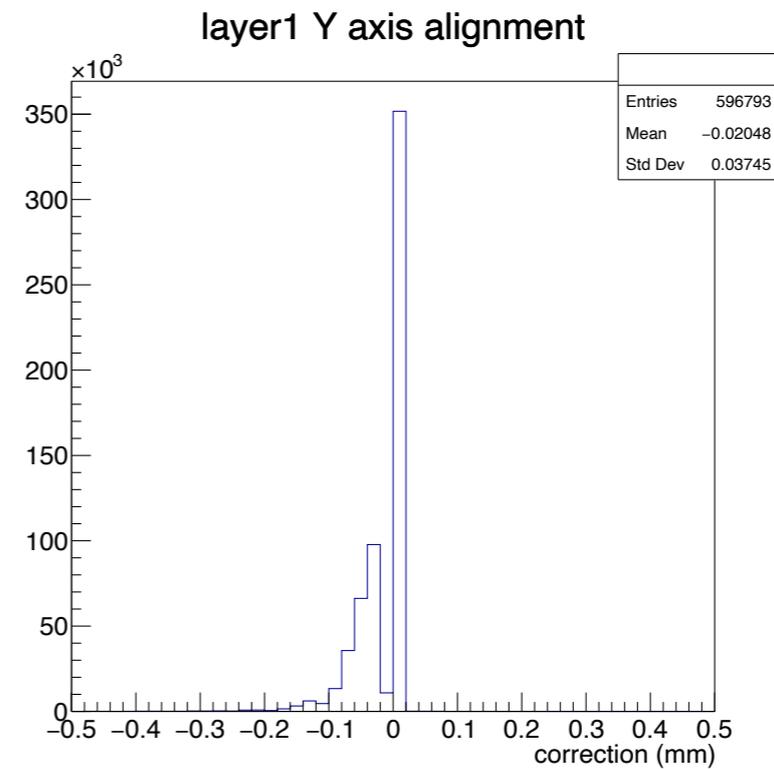
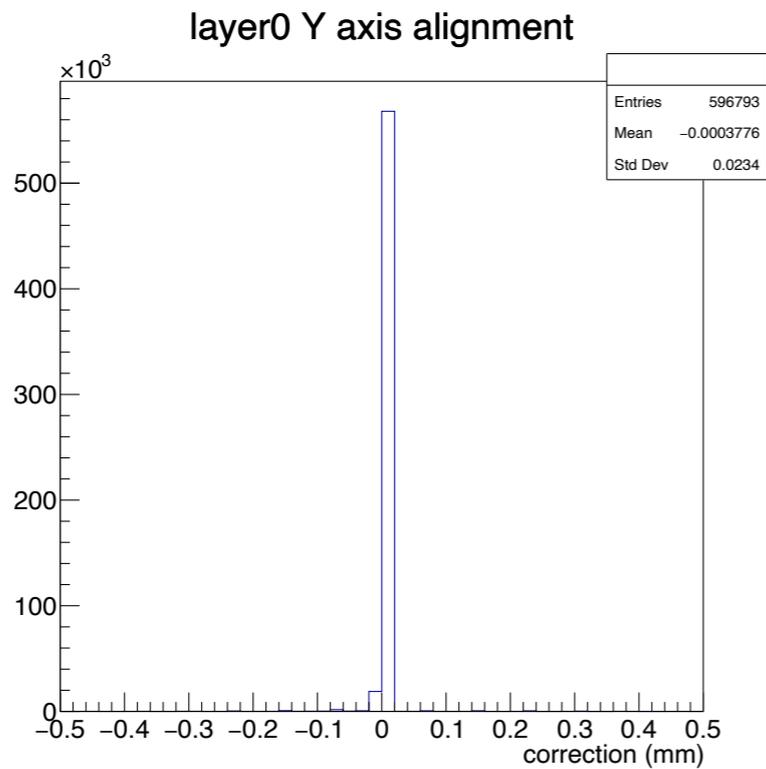
- Only works on 4 layers Testbeam
 - Global fit (red line) : 4 points fitting line
 - 4 Local fits (rest color): 3 points fitting line
- The procedures to correct the layer position
 1. Find the point with largest residual (layer 0 in the example)
 2. Correct the point position by $0.3 \times$ original residual
 3. Fit the points again
 4. Check the new $r\text{-}\chi^2$ of Global fit and 4 local fits
 5. If all $r\text{-}\chi^2$ become smaller : calculate new residual, repeat action 2 and 3
 6. If one of $r\text{-}\chi^2$ becomes larger or residual $< 3\mu\text{m}$: stop, back to the previous position.
 7. Move to the next point



Alignment results



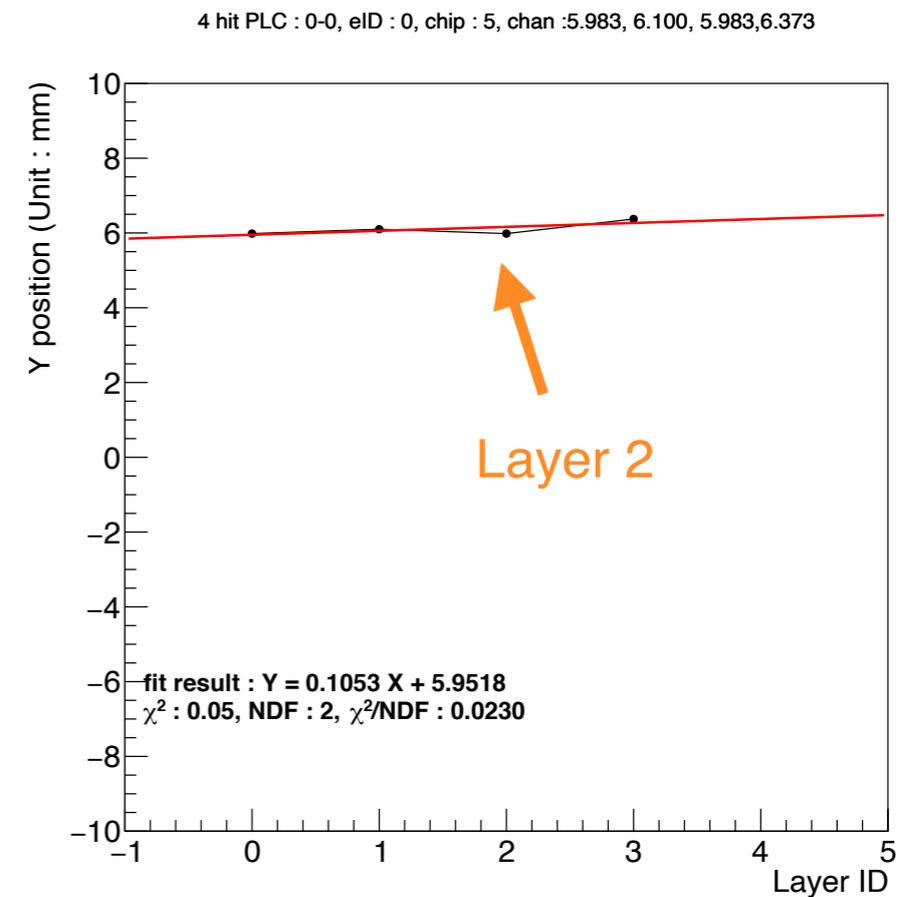
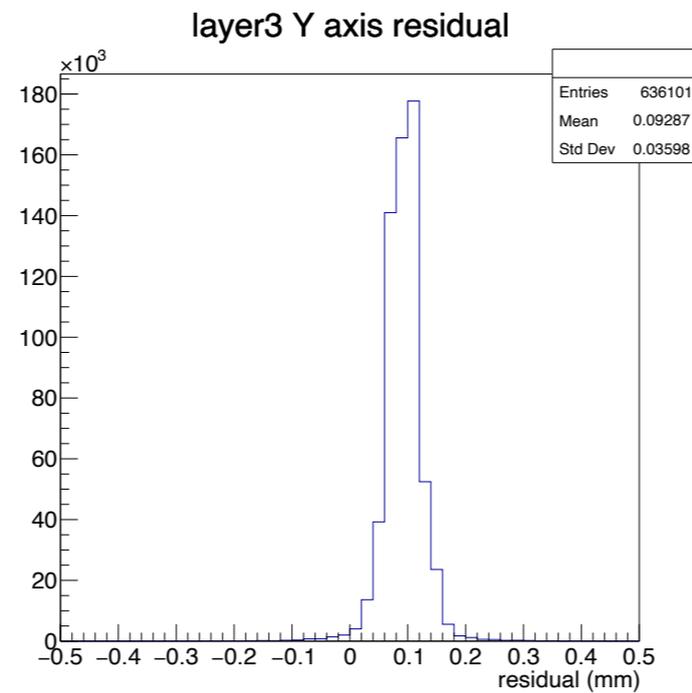
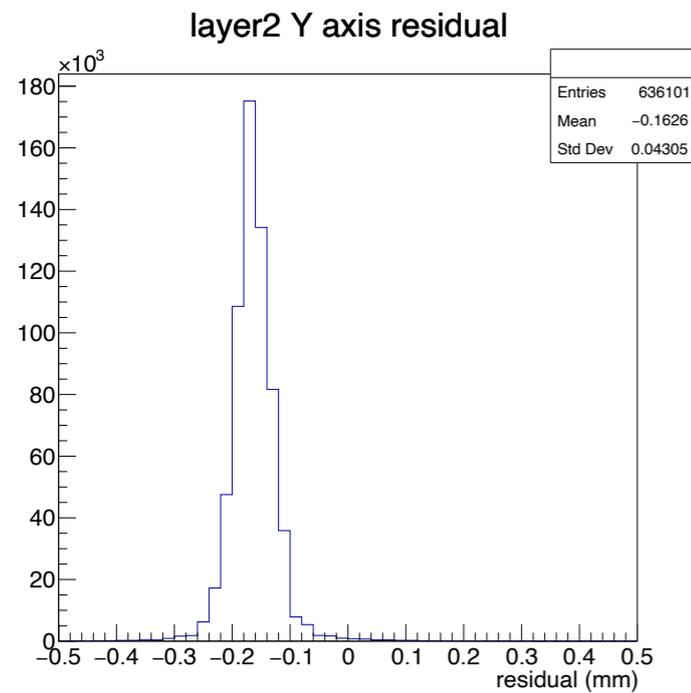
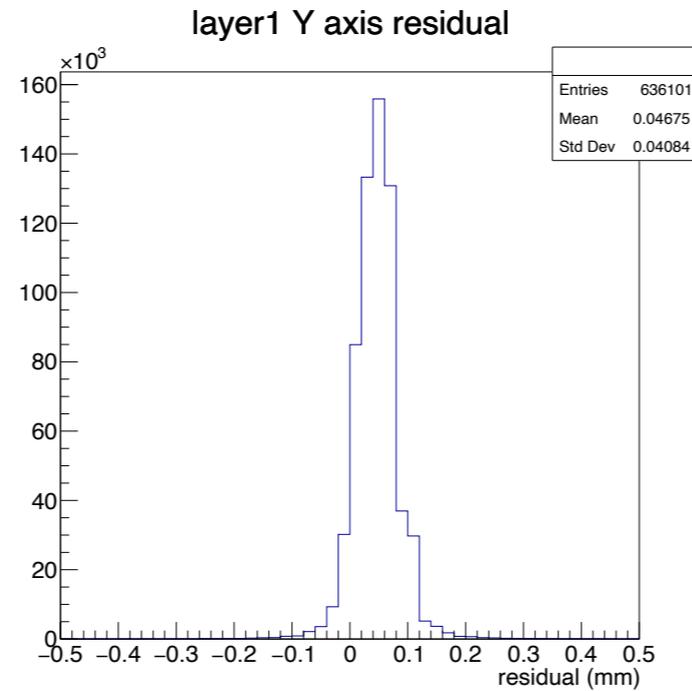
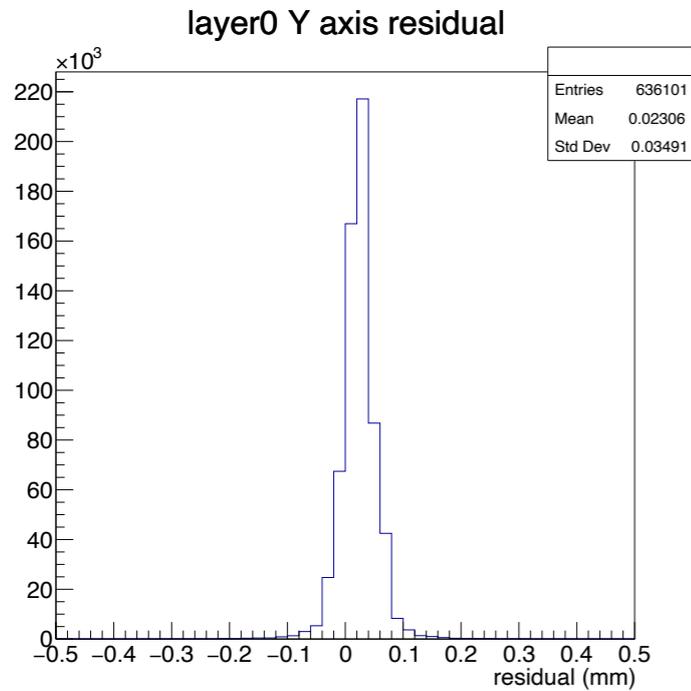
Ladder 2 has a + 234 μm offset in Y axis



Alignment results



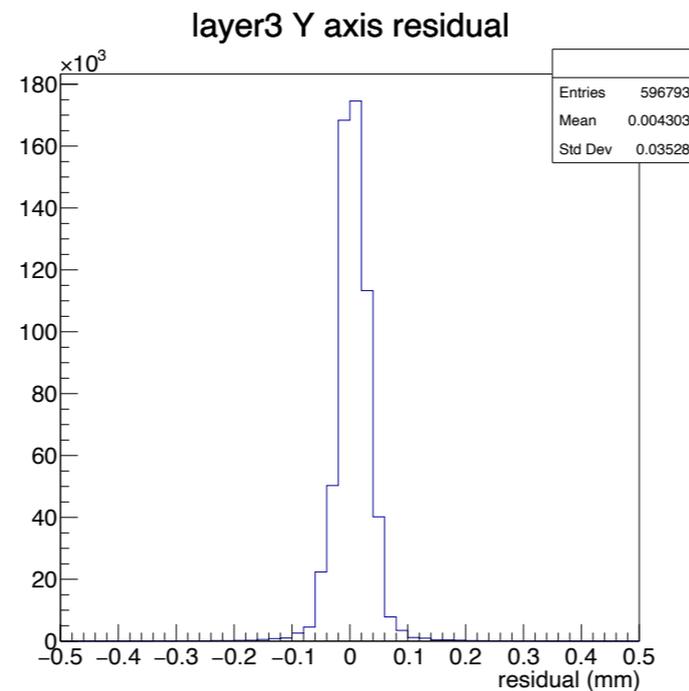
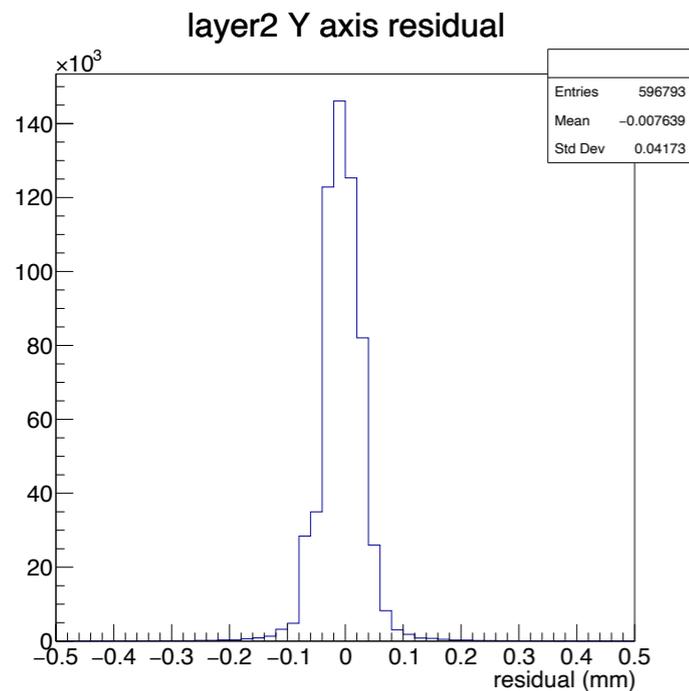
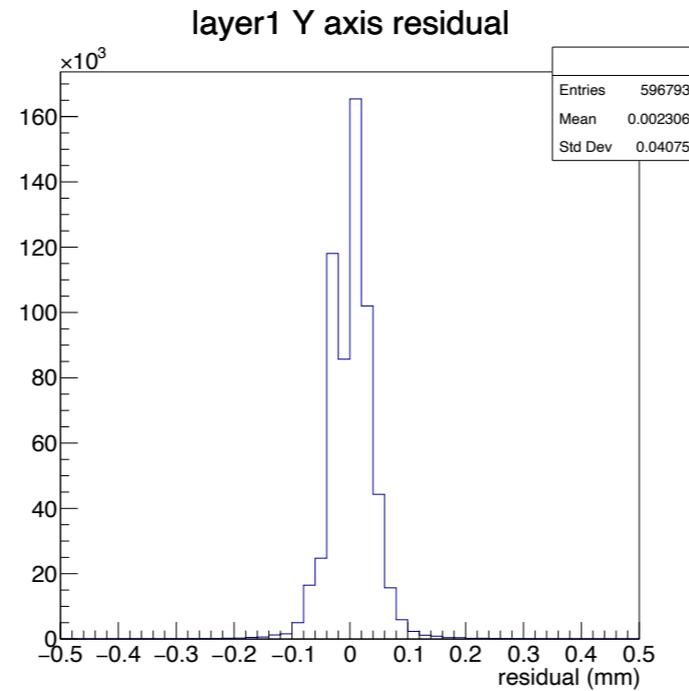
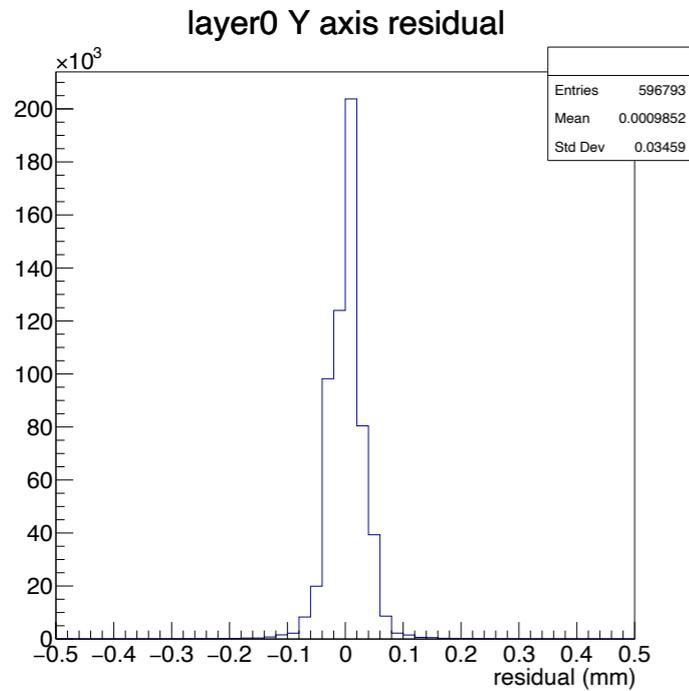
Ladder 2 has a + 234 μm offset in Y axis



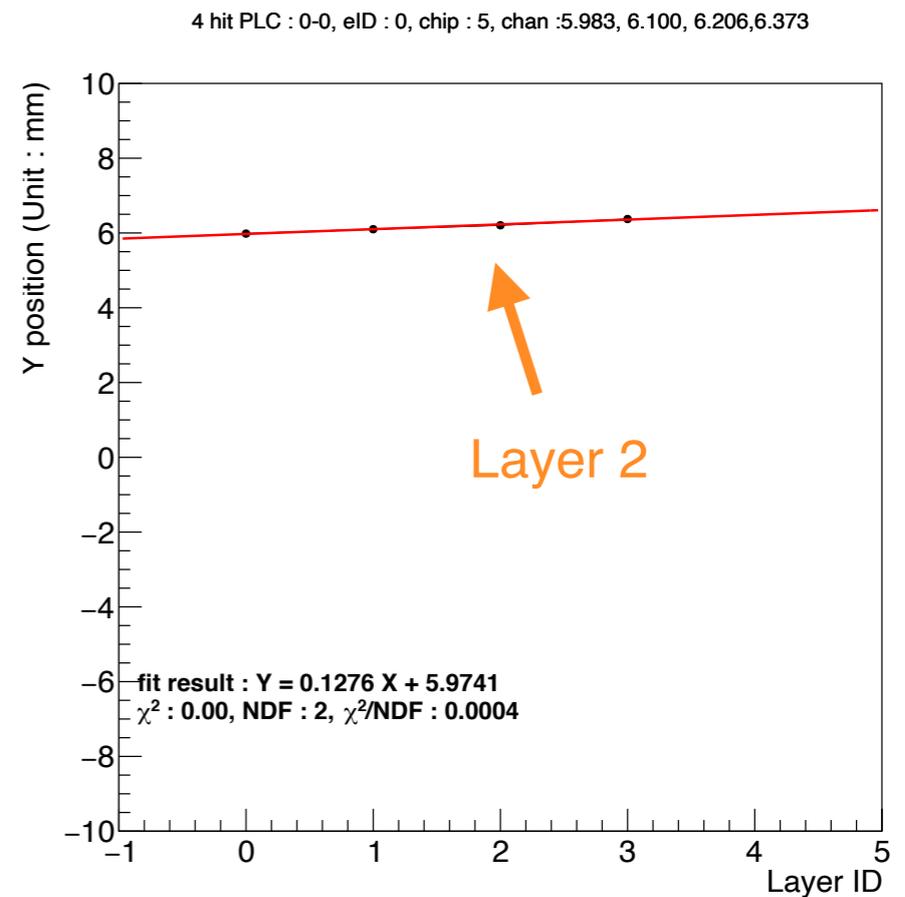
Alignment results add offset



Ladder 2 has a + 234 μm offset in Y axis



Layer2 - 0.223 mm



Summary



- Several features are added in the tracking macro
 - Layer alignment (4 layers only)
 - Compatible with 3 or 4 layers case
- The event preselection is powerful now
 - `INTT_event = 1`
 - `camac_tdc6` range cut
 - `camac_adc` cut
 - Double saving event selection
 - Golden track selection
- Next step :
 - Some plots will be added for online monitoring.
 - Upload the macro on GitHub after adding the description.
 - Consider the Testbeam box rotation into alignment algorithm.
 - Multi-tracks in one event

Back up



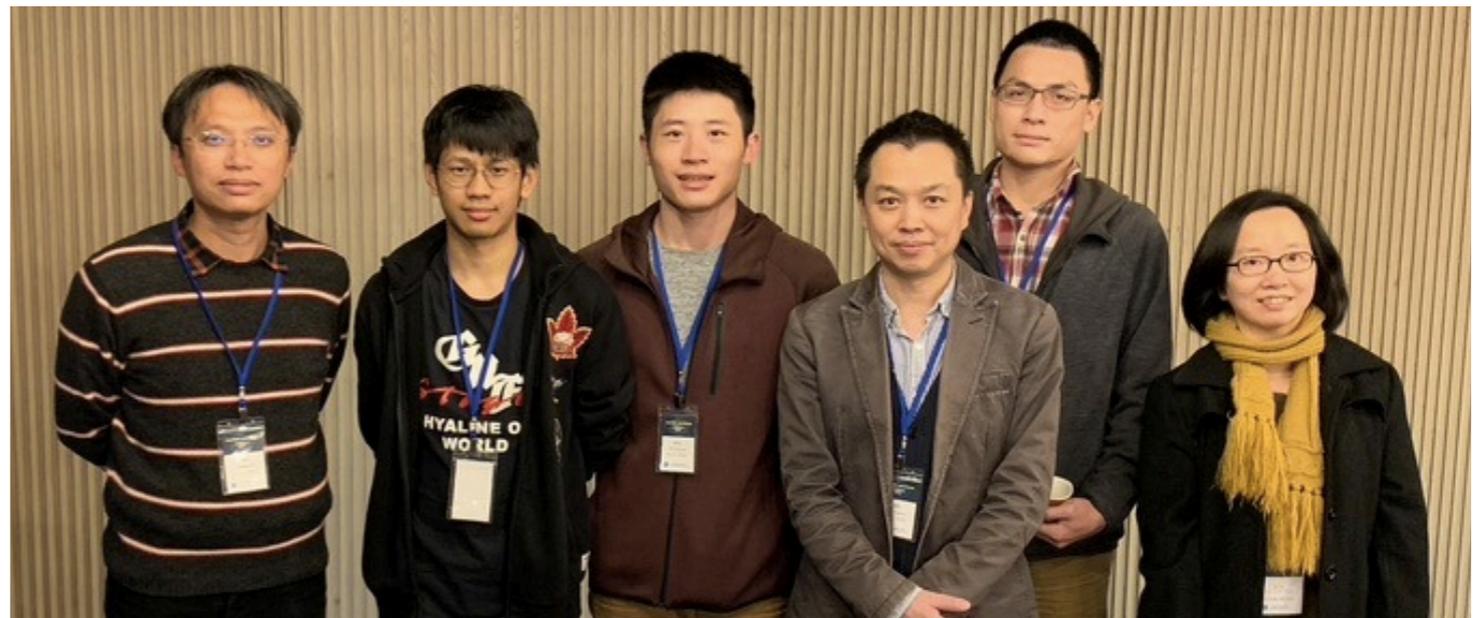
Taiwan INTT team



Ou-Wei Cheng



Kai-Yu Cheng



Chia-Ming Kuo Cheng-Wei Shih Lian-Sheng Tsai
Wei-Che Tang Rong-Shyang Lu Jenny Huang

Issue of double saving event



MC → interface macro → filter macro → tracking ana macro
 TestBeam → filter macro → tracking ana macro

Interface macro : to convert the MC data format into TestBeam data format
 filter macro : to filter the double saving hits in each event.

Some hits seem to be recorded twice : 1<->3, 2<->4, 5<->7 and 6 <-> 8. I think it is ok as long as both are identical.

one event
real data

```

*****
* Row * Instance * event * chip_id * chan_id * module * adc * bco * bco_full * camac_tdc * camac_adc * INTT_even *
*****
* 17 * 0 * -1 * 22 * 84 * 6 * 2 * 111 * 62063 * 138 * 204 * 1 *
* 17 * 1 * -1 * 22 * 83 * 6 * 1 * 111 * 62063 * 140 * 206 * 1 *
* 17 * 2 * -1 * 22 * 85 * 6 * 1 * 111 * 62063 * 167 * 245 * 1 *
* 17 * 3 * -1 * 22 * 83 * 6 * 1 * 112 * 62064 * 0 * * 1 *
* 17 * 4 * -1 * 22 * 85 * 6 * 1 * 112 * 62064 * 0 * * 1 *
* 17 * 5 * -1 * 21 * 103 * 5 * 7 * 113 * 62065 * 676 * * 1 *
* 17 * 6 * -1 * 16 * 0 * 5 * 0 * 113 * 62065 * * * 1 *
* 17 * 7 * -1 * 21 * 103 * 5 * 7 * 114 * 62066 * * * 1 *
* 17 * 8 * -1 * 16 * 0 * 5 * 0 * 114 * 62066 * * * 1 *
    
```

But if you check another event shown below, you can see there is one hit recorded twice but with different adc....

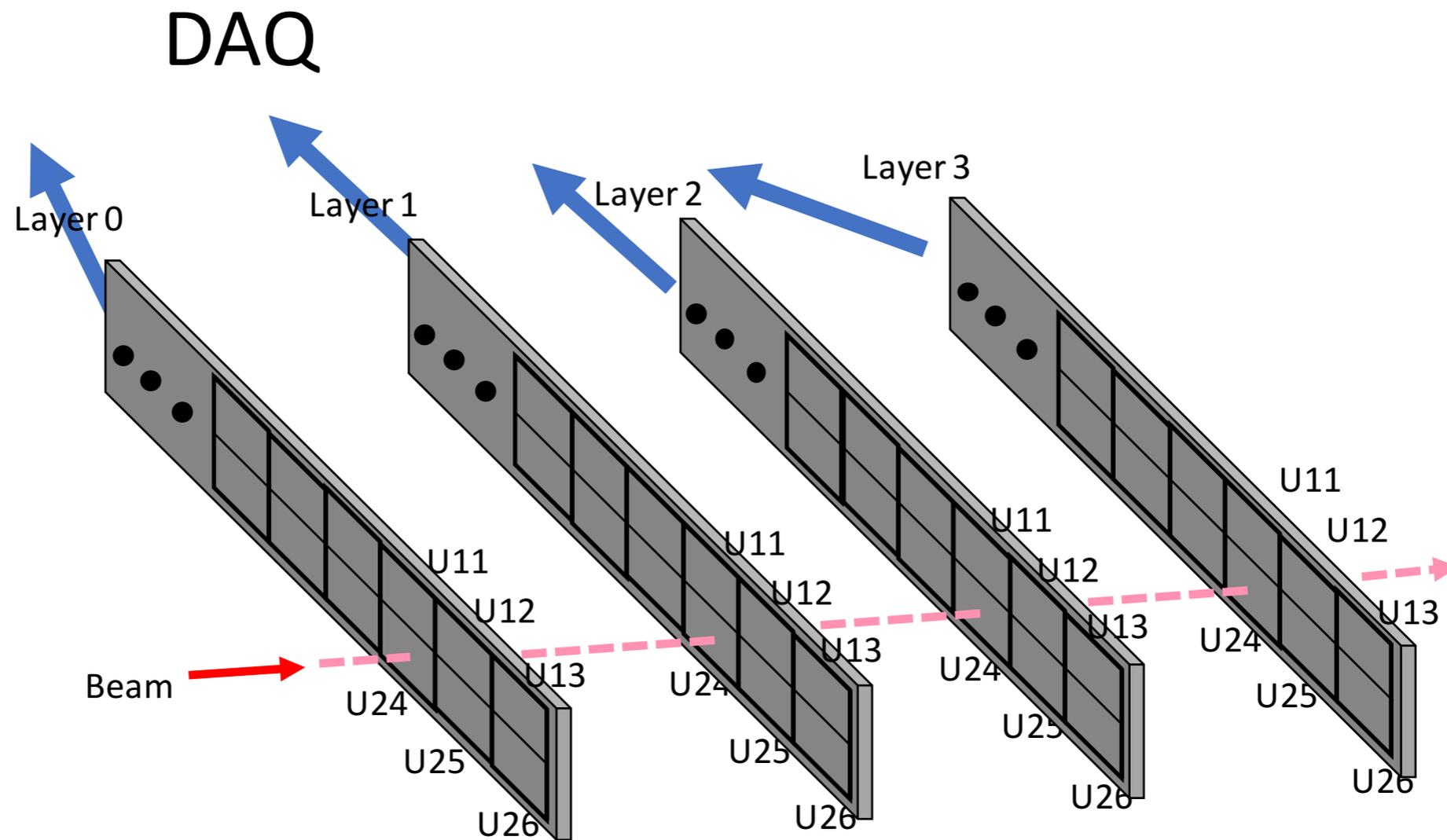
one event
real data

```

*****
* Row * Instance * event * chip_id * chan_id * module * adc * bco * bco_full * camac_tdc * camac_adc * INTT_even *
*****
* 11 * 0 * -1 * 21 * 127 * 5 * 7 * 90 * 53850 * 156 * 161 * 1 *
* 11 * 1 * -1 * 21 * 126 * 5 * 1 * 90 * 53850 * 140 * 212 * 1 *
* 11 * 2 * -1 * 21 * 126 * 5 * 7 * 90 * 53850 * 132 * 379 * 1 *
* 11 * 3 * -1 * 5 * 107 * 6 * 2 * 90 * 53850 * 0 * * 1 *
* 11 * 4 * -1 * 21 * 8 * 5 * 7 * 90 * 53850 * 0 * * 1 *
Type <CR> to continue or q to quit ==>
* 11 * 5 * -1 * 21 * 120 * 5 * 3 * 90 * 53850 * 600 * * 1 *
* 11 * 6 * -1 * 21 * 5 * 5 * 2 * 90 * 53850 * * * 1 *
* 11 * 7 * -1 * 16 * 0 * 5 * 0 * 90 * 53850 * * * 1 *
* 11 * 8 * -1 * 21 * 66 * 5 * 6 * 91 * 53851 * * * 1 *
* 11 * 9 * -1 * 16 * 0 * 5 * 0 * 91 * 53851 * * * 1 *
    
```

It will effect on tracking result as the energy-weighted method is applied.

Current Testbeam setup in G4



Channel ID order

