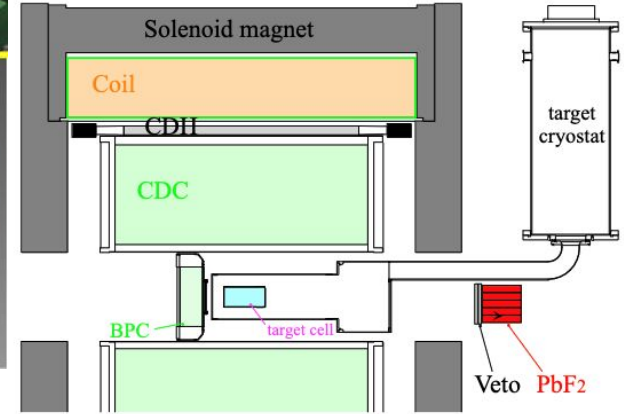
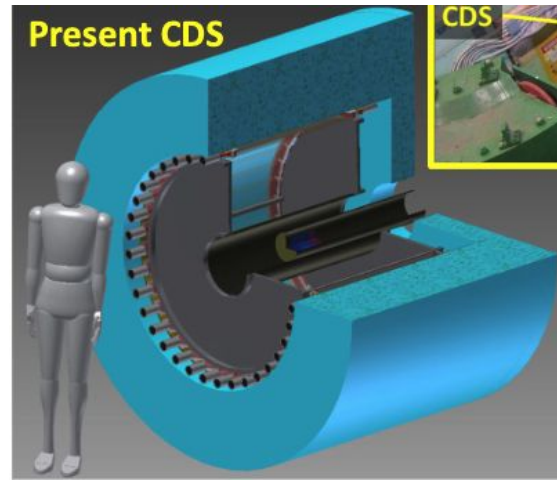
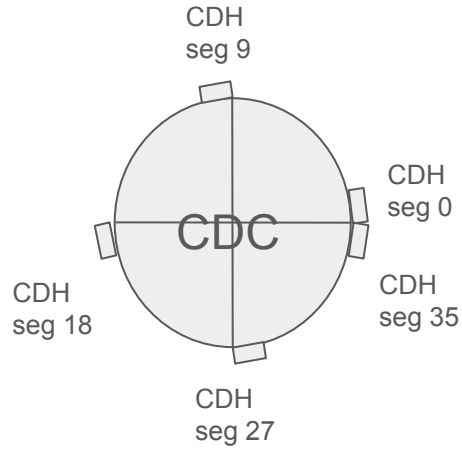


weekly meeting

J-PARC E80

- CDC very rough Layer Efficiency using ArCO₂ / cosmic data in Dec. 2023

2024/7/13 Yuto Kimura, RARiS, J-PARC E80



CDH

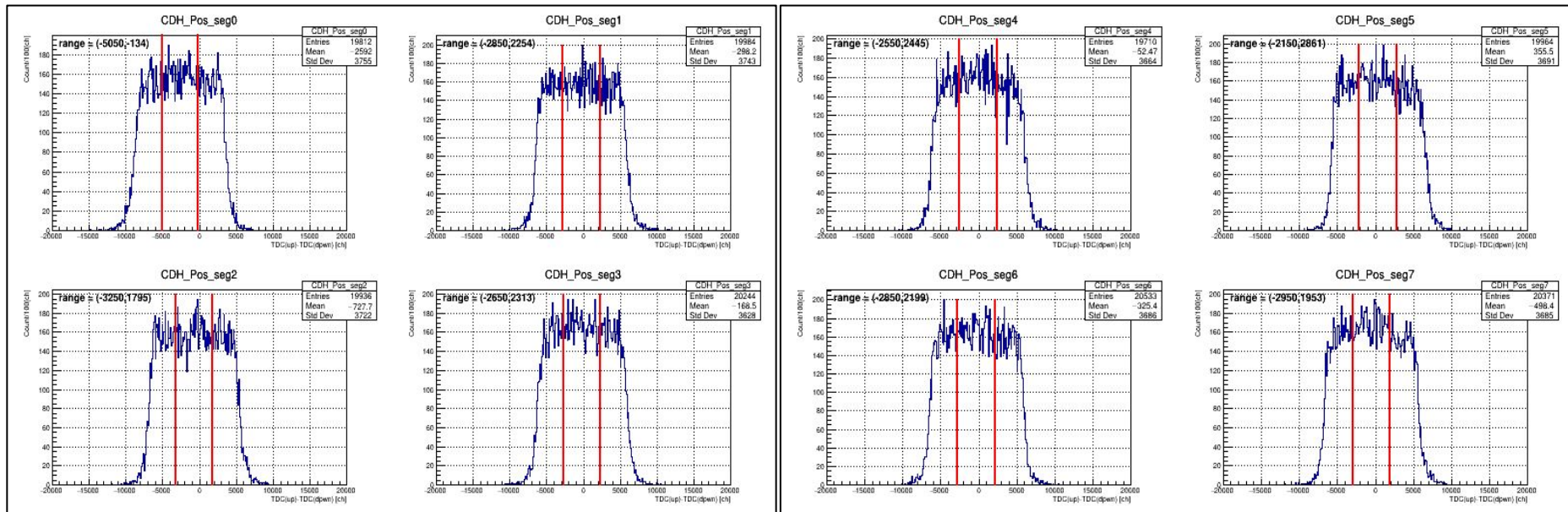
Decided denominator of Layer Efficiency

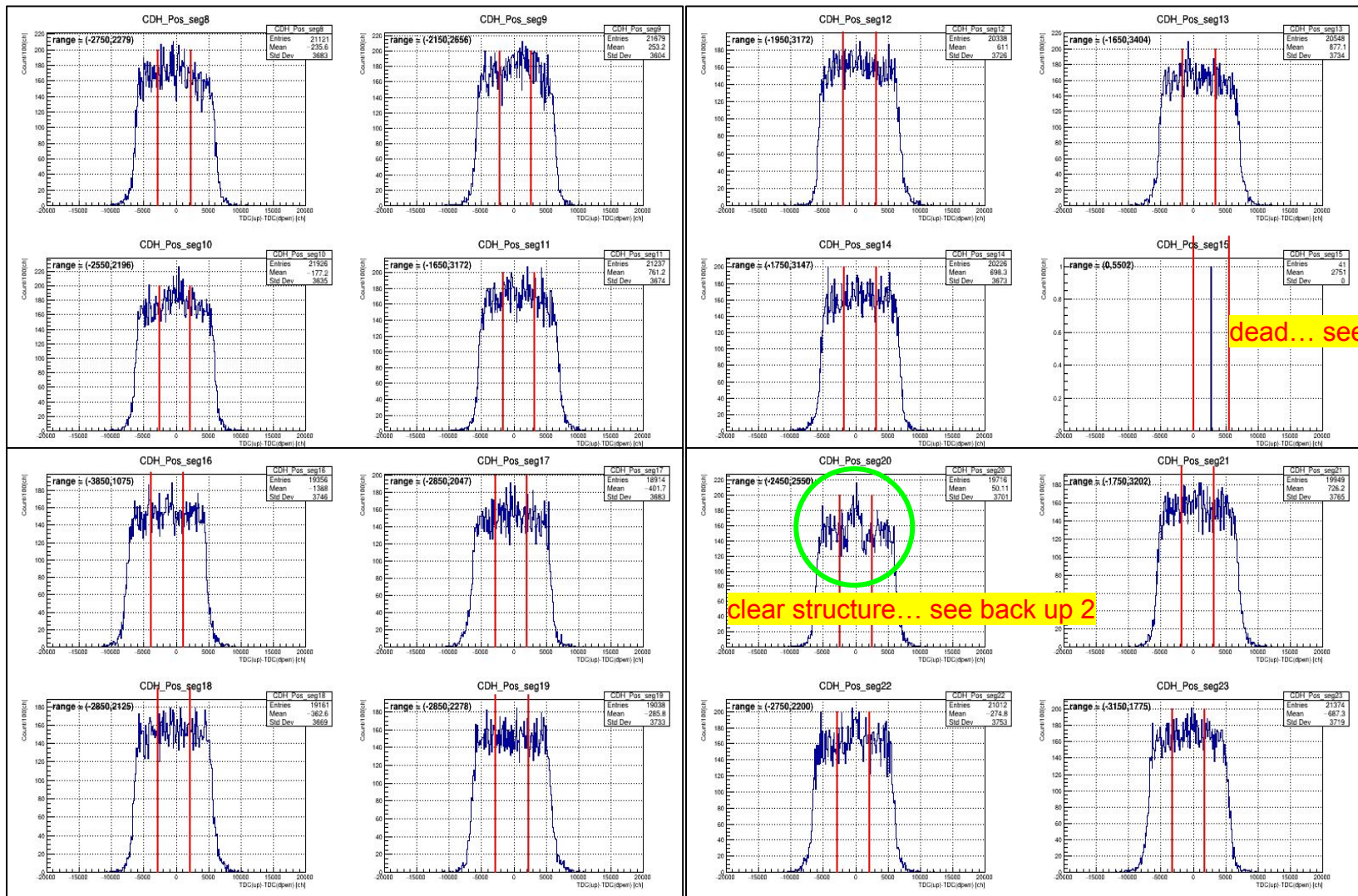
in this report

Data directory:	/group/had/knucl/e15/detector_data/CDCArCO2_2023Dec								
runNo	CDCHV	events	duration	date	start time	end time	Logbook, No	Logbook page	comment
1	2350	44675	0:08:39	2023/12/4	19:32:38	19:41:17	E73, #5	146	
2	2350	116628	0:22:19	2023/12/5	11:16:42	11:39:01	E73, #5	147	
3	2300	232570	0:44:21	2023/12/5	11:42:43	12:27:04	E73, #5	147	
4	2250	317053	1:00:23	2023/12/5	12:30:14	13:30:37	E73, #5	147	
5	2200	315685	0:59:56	2023/12/5	13:32:34	14:32:30	E73, #5	147	
6	1900	1036	0:00:20	2023/12/5	14:33:23	14:33:43	E73, #5	147	junk
7	1900	31064	0:48:57	2023/12/5	14:35:41	15:24:38	E73, #5	147	From this run, only CDH 8-11, 26-29 HV on
8	2000	44973	1:10:48	2023/12/5	15:26:08	16:36:56	E73, #5	148	
9	2100	266	1:44:56	2023/12/5	16:38:33	18:23:29	E73, #5	148	junk
10	2100	0	0:00:20	2023/12/5	18:23:33	18:23:53	E73, #5	148	junk
11	2100	0	0:00:25	2023/12/5	18:24:11	18:24:36	E73, #5	148	junk
12	2100	12239	0:19:31	2023/12/5	18:24:59	18:44:30	E73, #5	148	
23	2150	33398	0:52:35	2023/12/8	11:20:36	12:13:11	E73, #5	150	
24	2400	119987	3:10:16	2023/12/8	13:36:33	16:46:49	E73, #5	150	

HV [V]	# of run	# of events
1900	7	31064
2000	8	44973
2100	12	12239
2150	23	33398
2200	5	315685
2250	4	317053
2300	3	232570
2350	2	116628
2400	24	119987

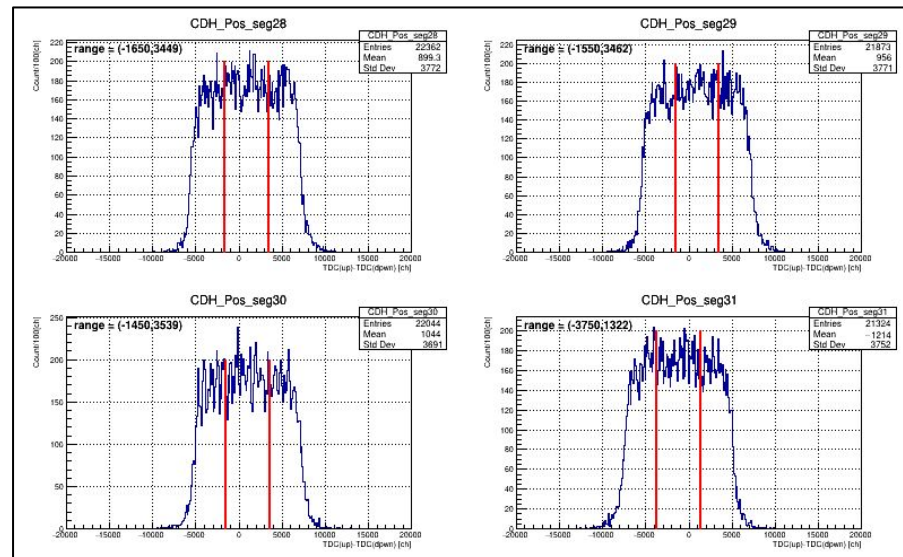
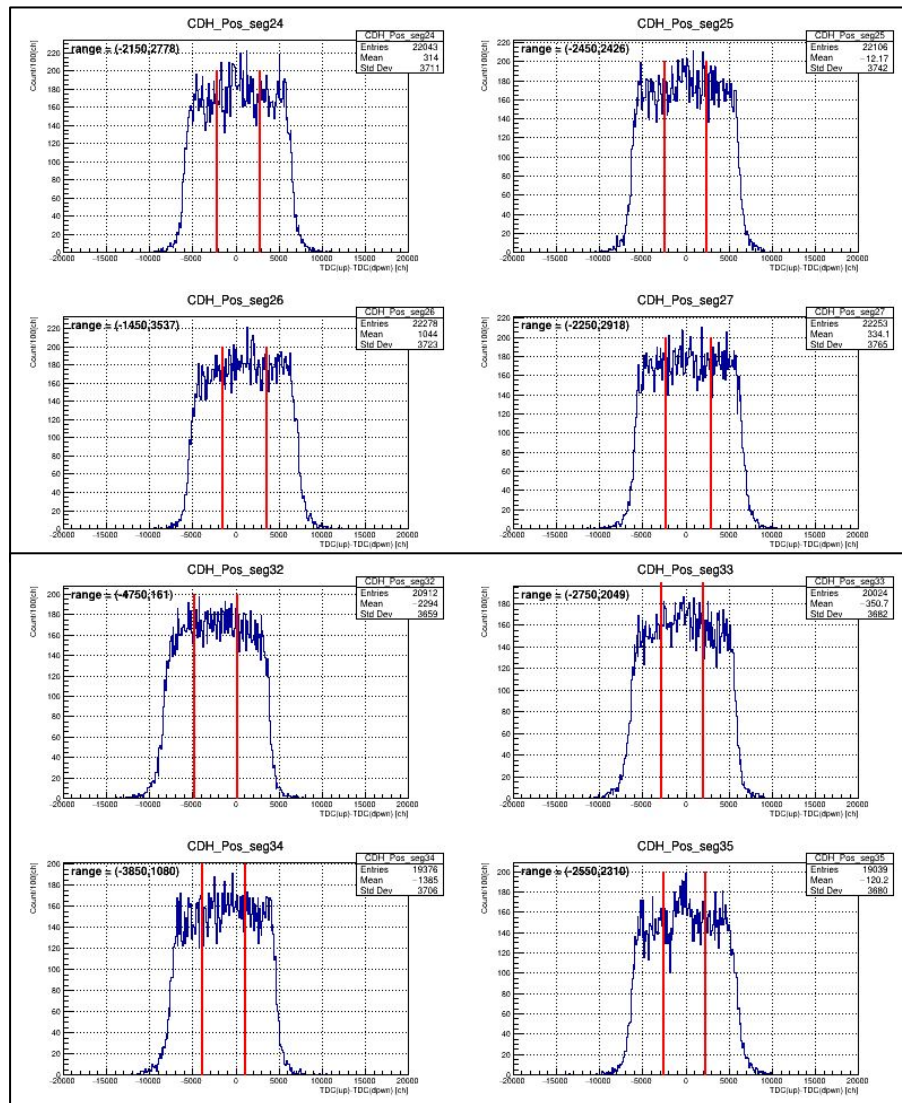
- ArCO2 Run4, cosmic, w/o mag, ~300,000 events
- CDH Hit Position Range determination
 - TDC(up) - TDC(down) (**extracted first hits only**)
 - rejected $0.6 \times$ total events (0.3 both side)
- A structure was found in several segments.





dead... see back up 1

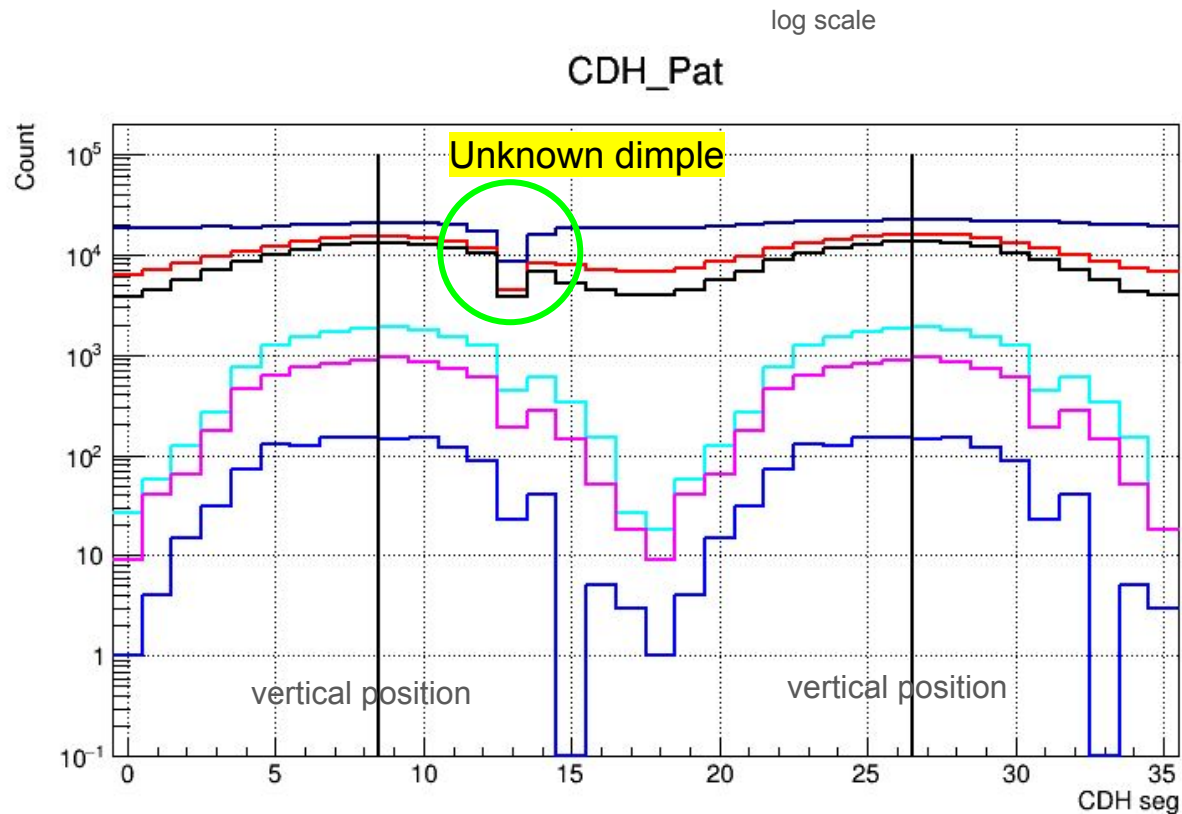
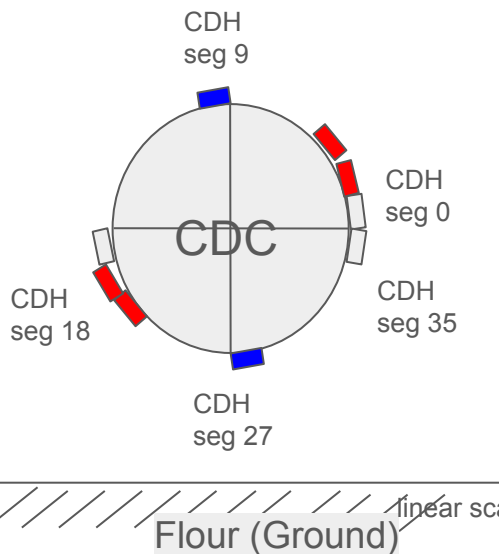
clear structure... see back up 2



- ArCO2 Run4, cosmic, w/o mag, ~300,000 events
- CDH HitPat,
 - Blue: raw, Red: $mul==2$, Black: $mul==2 \& \& \text{not Next Seg}$, Cyan: $mul==2 \& \& \text{level2}$, Magenta: $mul==2 \& \& \text{level1}$, Blue: $mul==2 \& \& \text{level1} \& \& \text{poscut}$
 - Not cutting off by ADC nor TDC values

rough layer efficiency

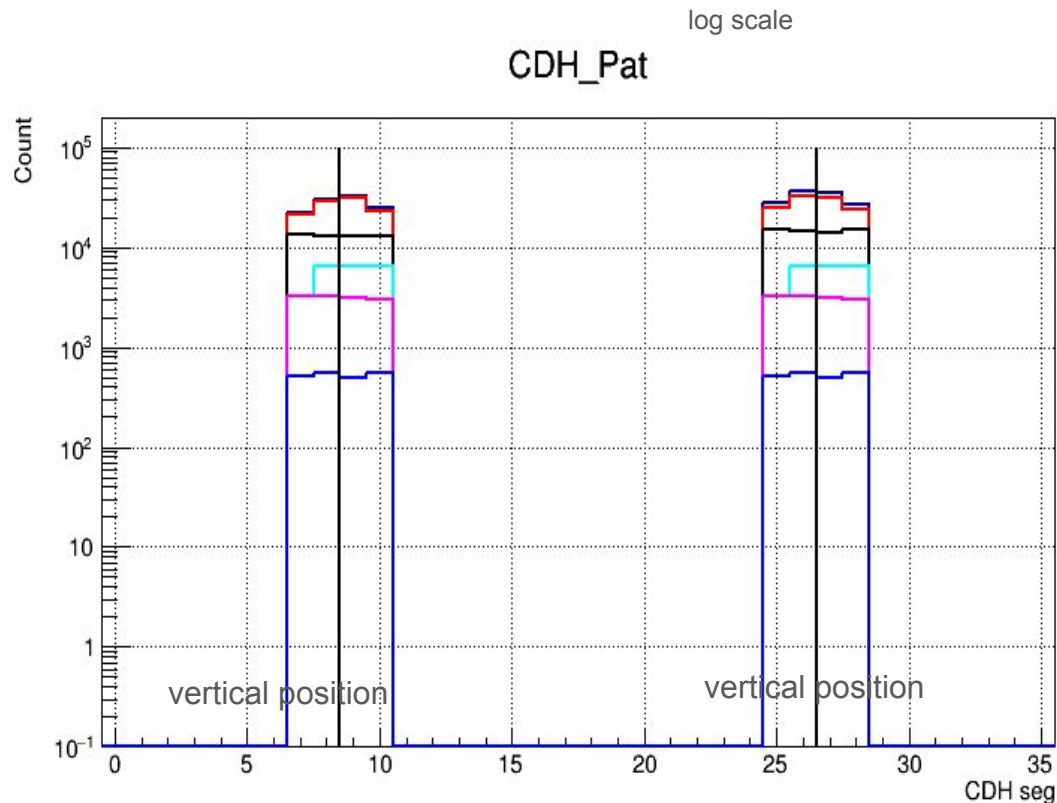
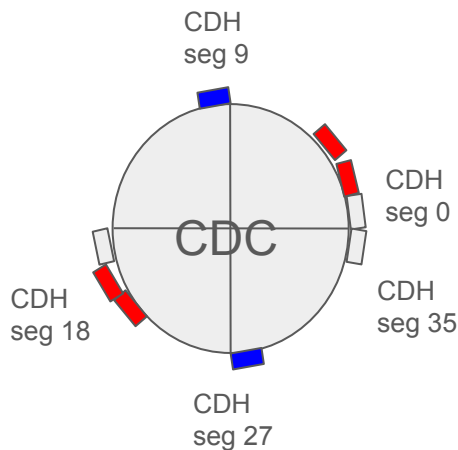
examples of level2 and level1

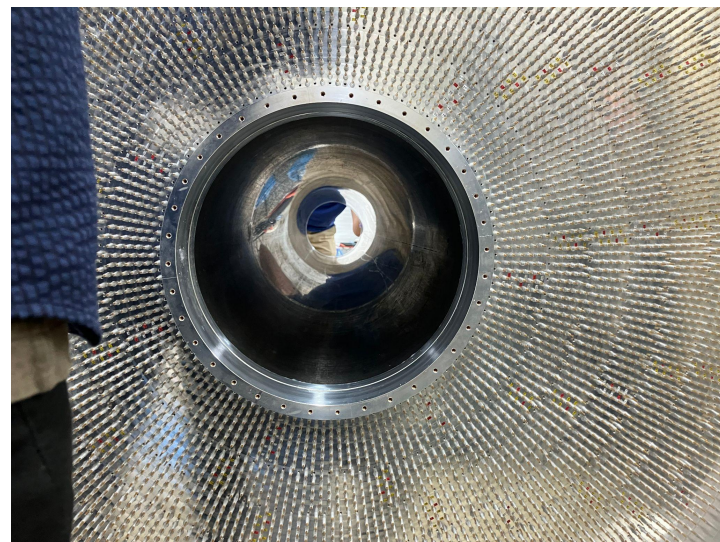
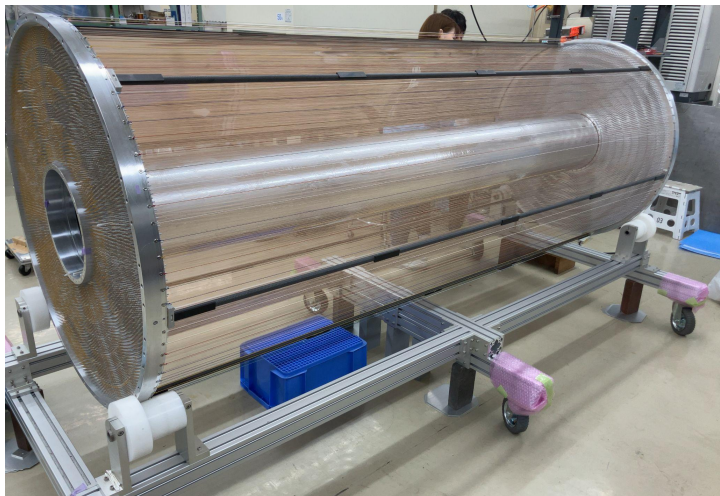


- ArCO2 Run24, cosmic, w/o mag, ~120,000 events
- CDH HitPat,
 - Blue: raw, Red: $mul==2$, Black: $mul==2 \& \& \text{not Next Seg}$, Cyan: $mul==2 \& \& \text{level2}$, Magenta: $mul==2 \& \& \text{level1}$, Blue: $mul==2 \& \& \text{level1} \& \& \text{poscut}$
 - Not cutting off by ADC nor TDC values

rough layer efficiency

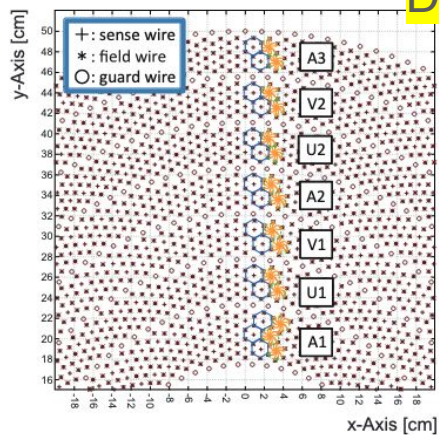
examples of level2 and level1





CDC

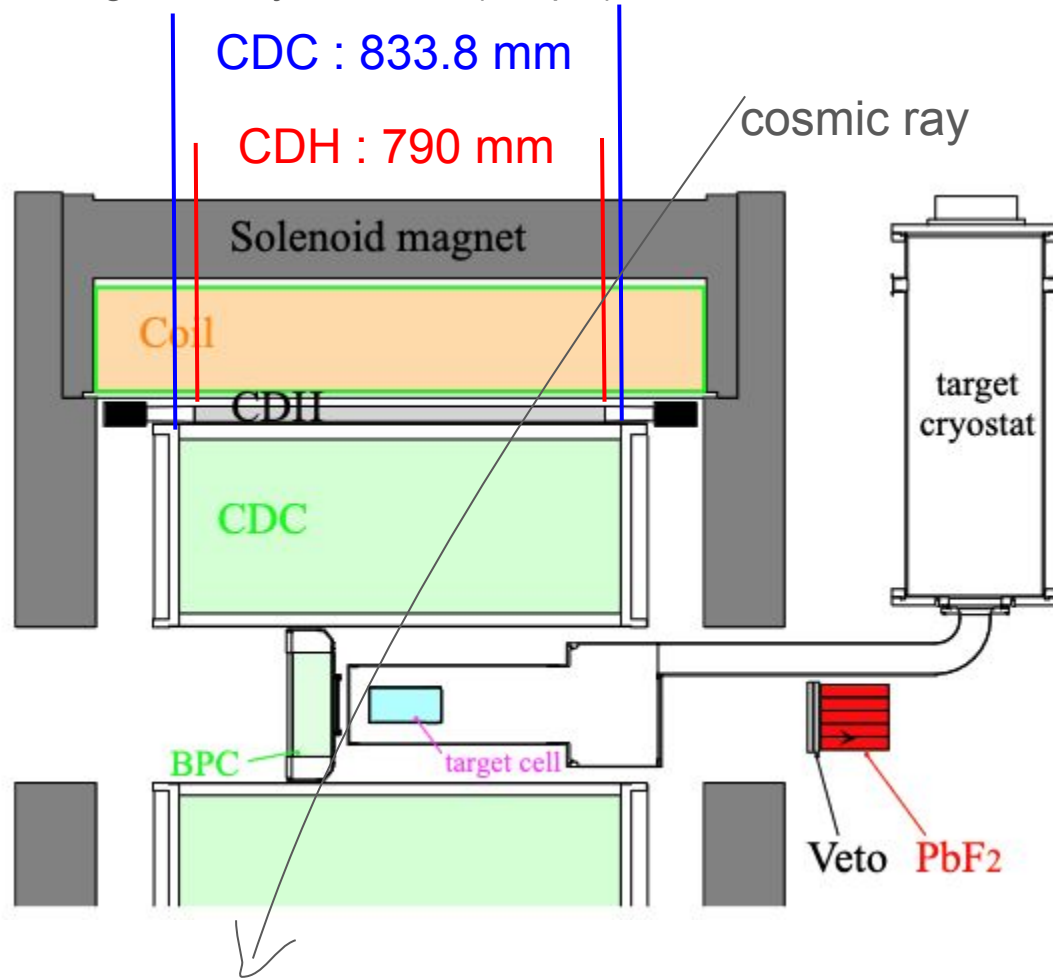
Decided numerator of Layer Efficiency



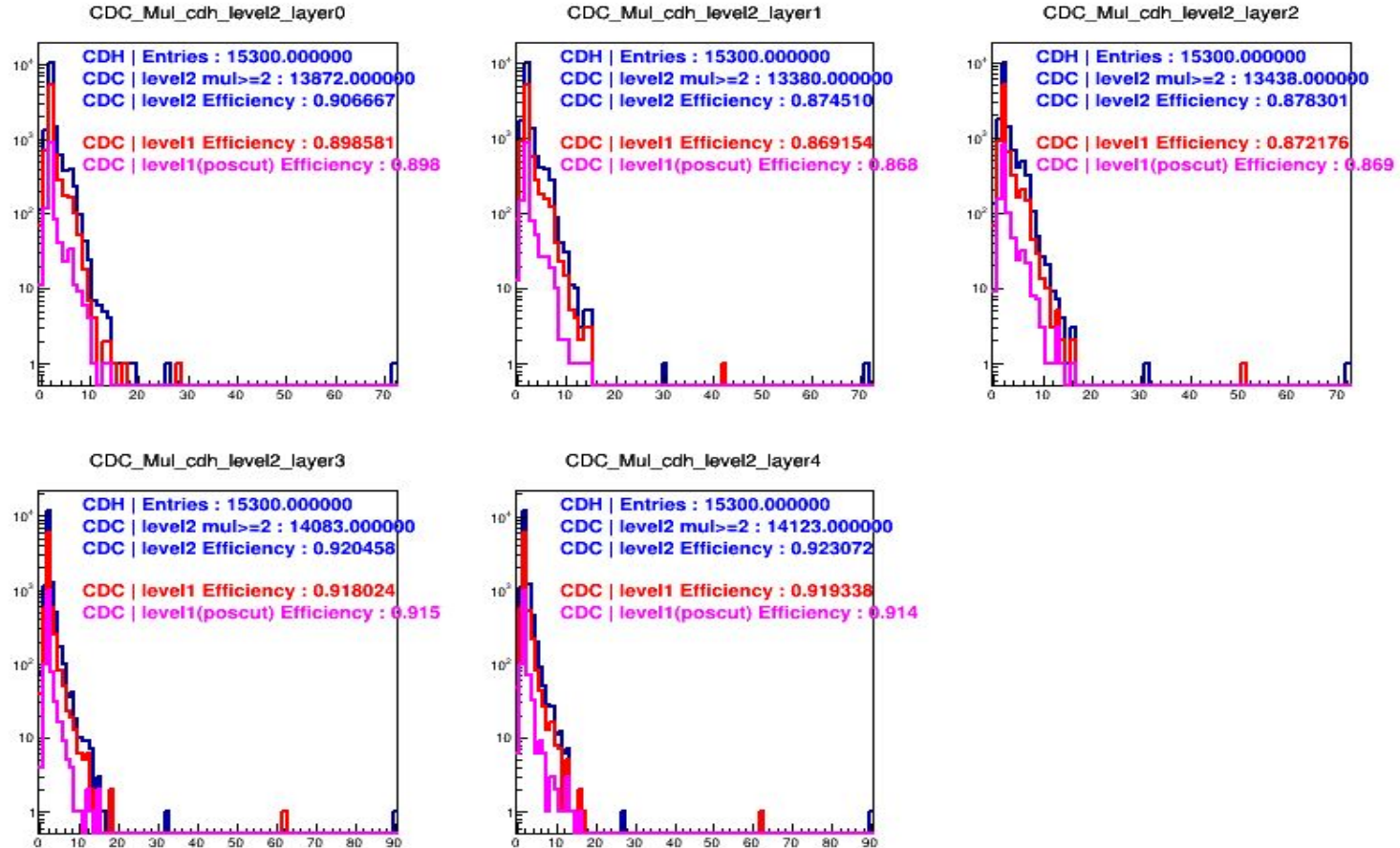
Super-layer	layer	Wire direction	Radius (mm)	Cell width (degree)	Cell width (mm)	Stereo angle (degree)	Signal channels per layer
A1	1	X	190.5	5.00	16.7	0	72
	2	X'	204.0		17.8	0	
	3	X	217.5		19.0	0	
U1	4	U	248.5	4.00	17.3	-2.27	90
	5	U'	262.0		18.3	-2.39	
V1	6	V	293.0	3.60	18.4	2.42	100
	7	V'	306.5		19.3	2.53	
A2	8	X	337.5	3.00	17.7	0	120
	9	X'	351.0		18.4	0	
U2	10	U	382.0	2.40	16.0	-2.82	150
	11	U'	395.5		16.6	-2.92	
V2	12	V	426.5	2.25	16.7	2.96	160
	13	V'	440.0		17.3	3.05	
A3	14	X	471.0	2.00	16.4	0	180
	15	X'	484.5		16.9	0	

Figure 46: Cell structure of the CDC.

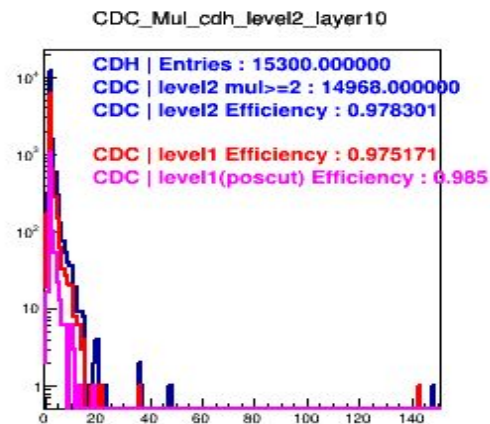
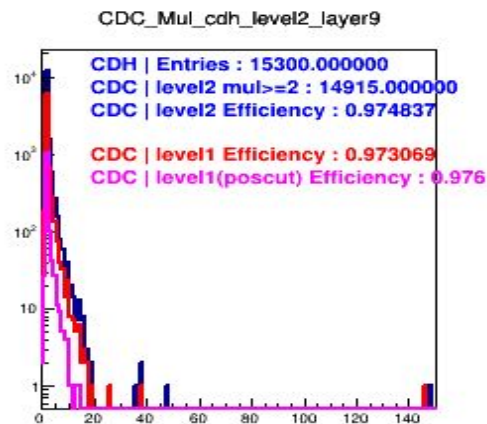
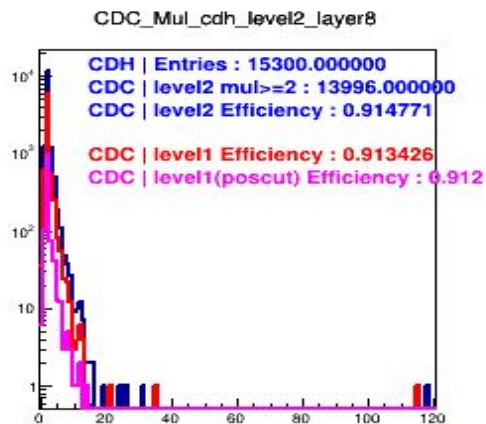
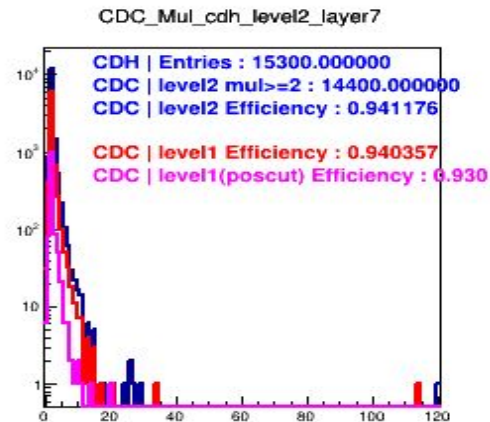
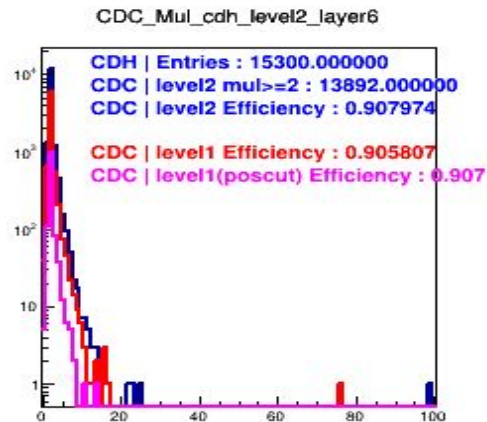
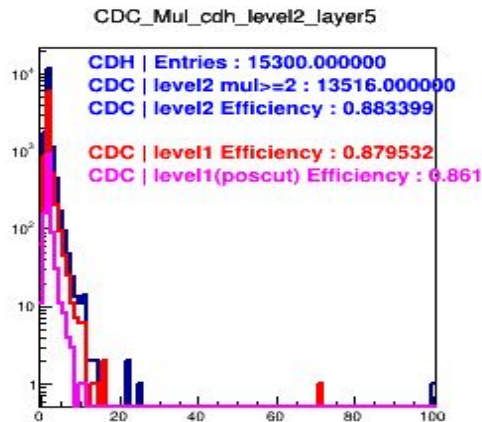
Not need to limit the hit range of CDH, for deriving CDC layer efficiency, but cutted off CDH edge events just in case (like p.8)



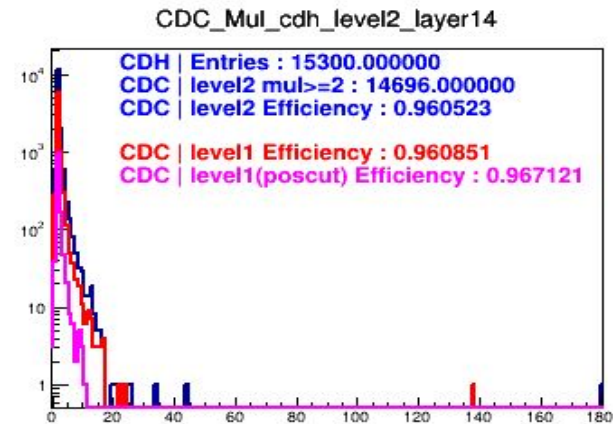
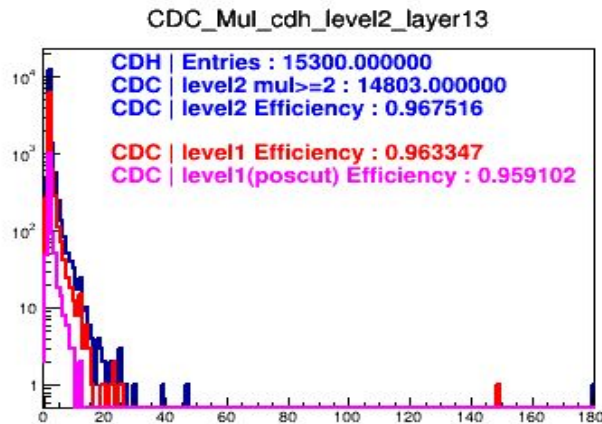
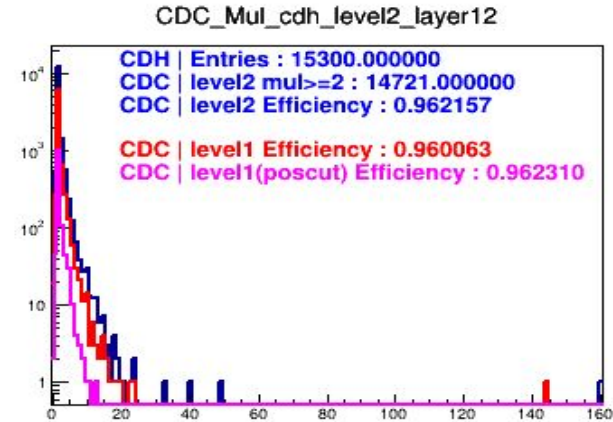
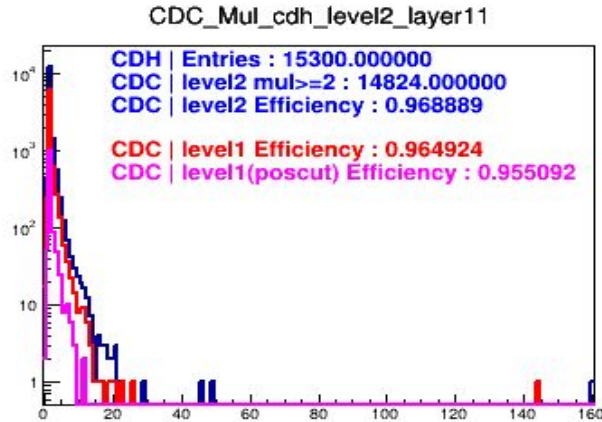
- ArCO2 Run4, cosmic, w/o mag, ~300,000 events
- multiplicity for each layer
- rough layer efficiency = “mul ≥ 2 ” / “entries”



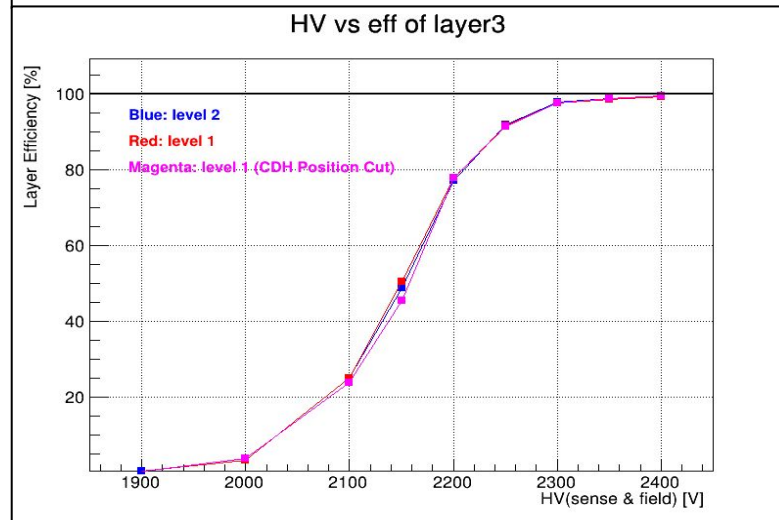
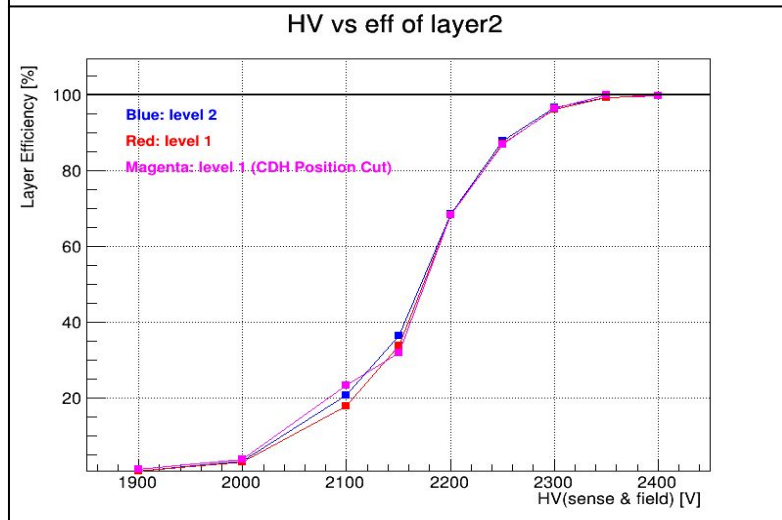
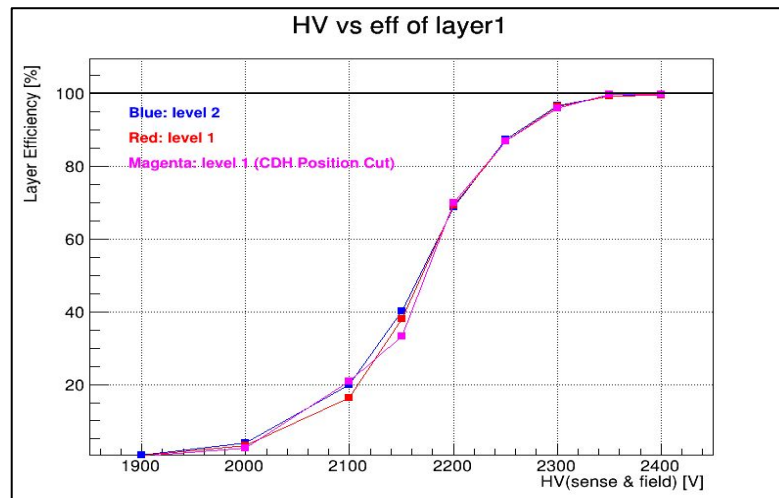
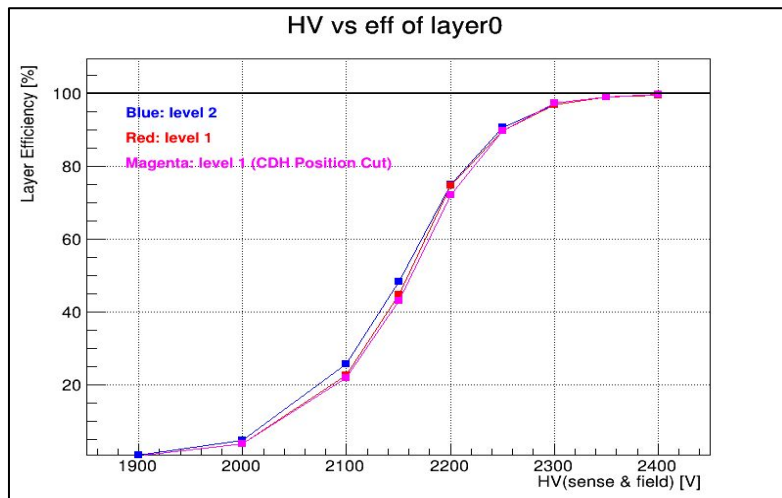
- ArCO2 Run4, cosmic, w/o mag, ~300,000 events
- multiplicity for each layer
- rough layer efficiency = “mul $\geq$ 2” / “entries”



- ArCO2 Run4, cosmic, w/o mag, ~300,000 events
- multiplicity for each layer
- rough layer efficiency = “mul $\geq$ 2” / “entries”

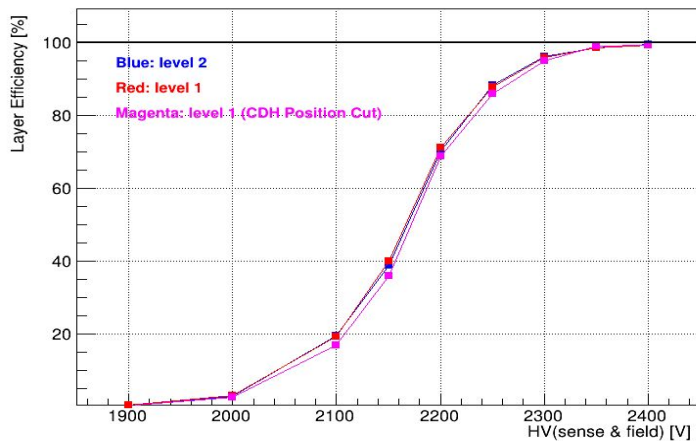


- ArCO2 Run2~24, cosmic, w/o mag
- HV vs rough layer efficiency, for each layer

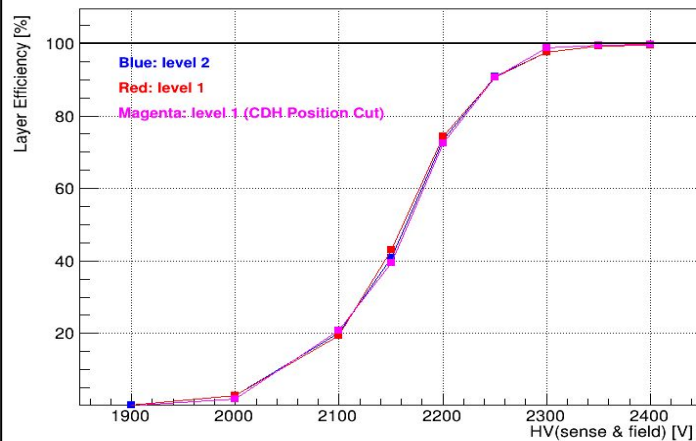


- ArCO2 Run2~24, cosmic, w/o mag
- HV vs rough layer efficiency, for each layer

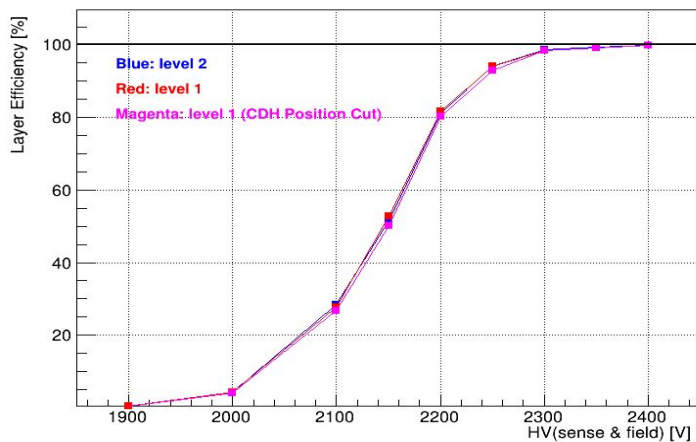
HV vs eff of layer5



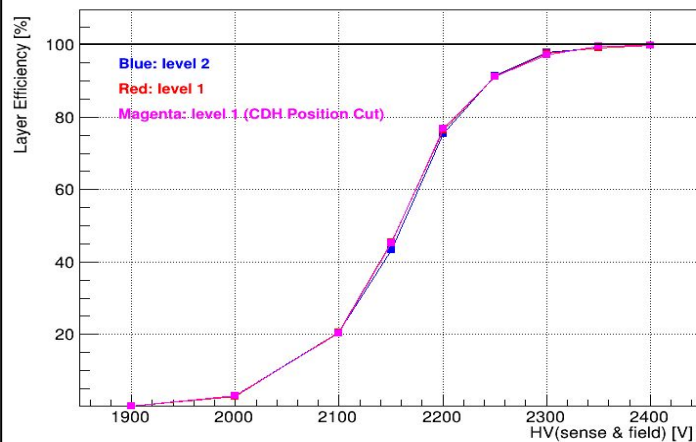
HV vs eff of layer6



HV vs eff of layer7

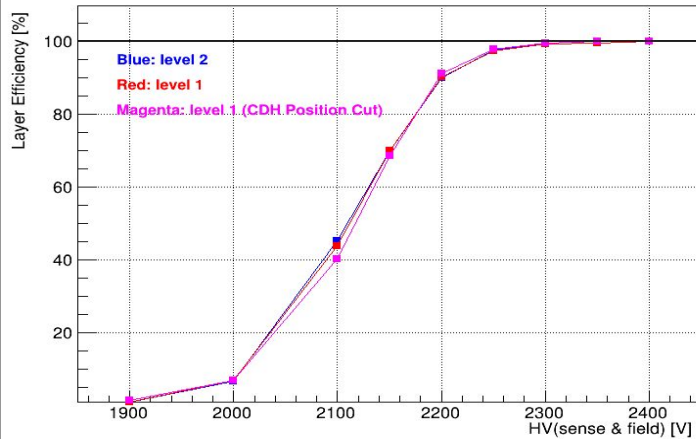


HV vs eff of layer8

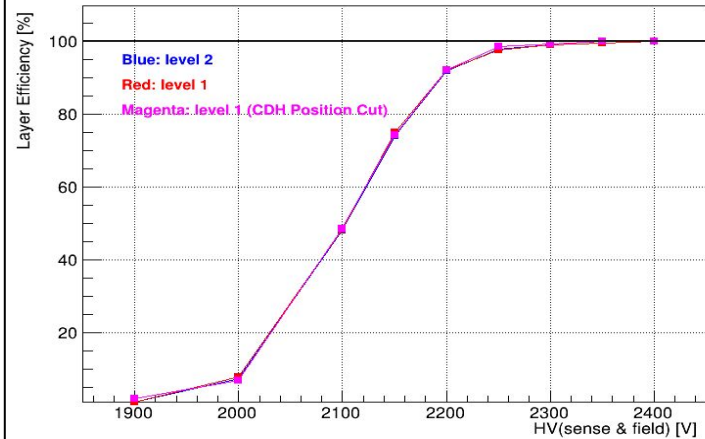


- ArCO2 Run2~24, cosmic, w/o mag
- HV vs rough layer efficiency, for each layer

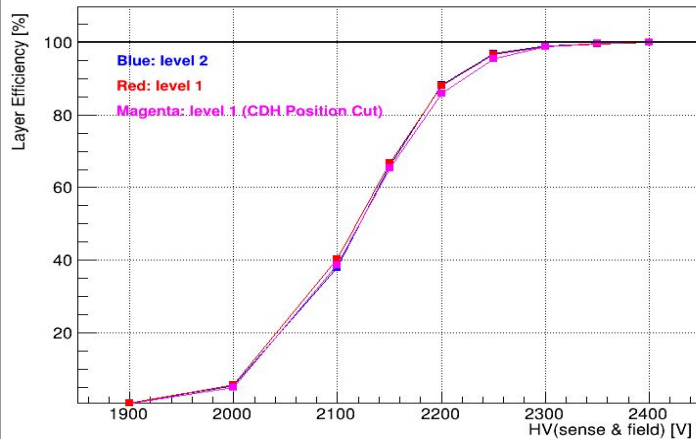
HV vs eff of layer9



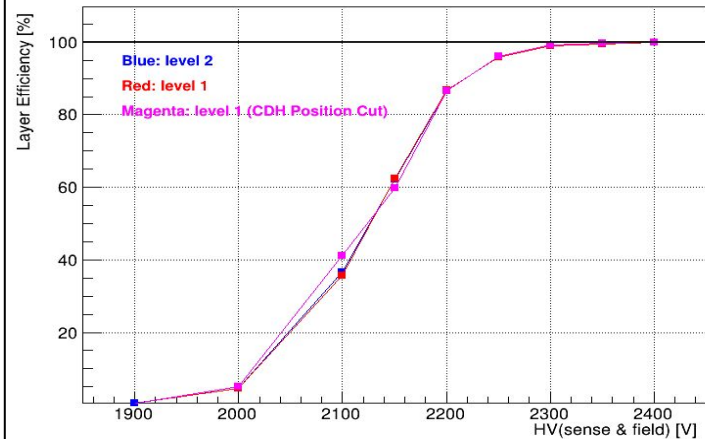
HV vs eff of layer10



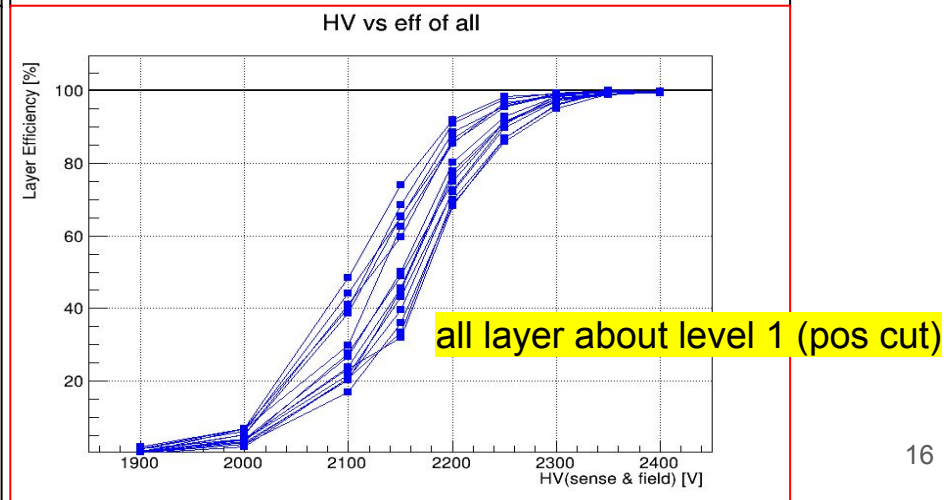
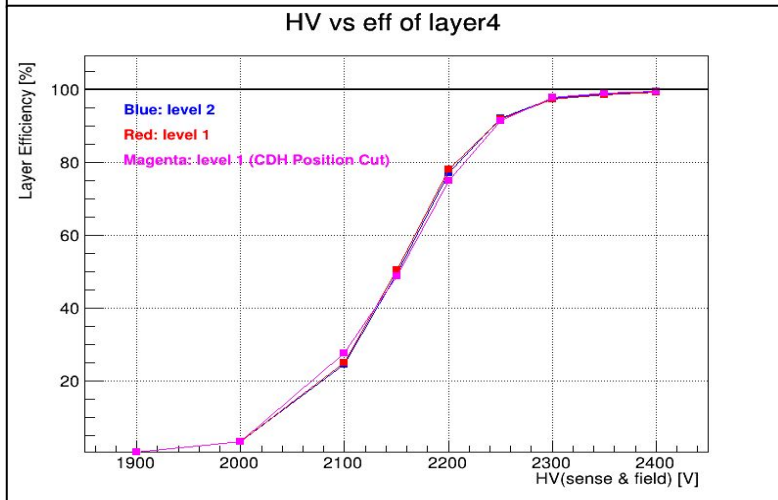
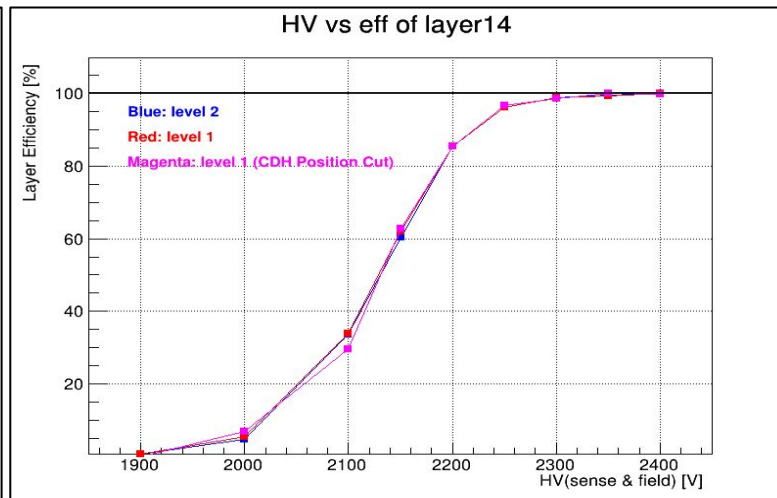
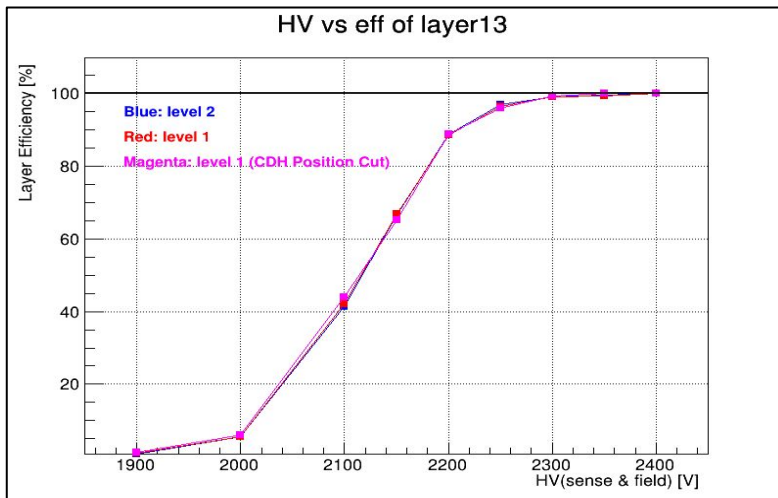
HV vs eff of layer11



HV vs eff of layer12



- ArCO2 Run2~24, cosmic, w/o mag
- HV vs rough layer efficiency, for each layer



Summary

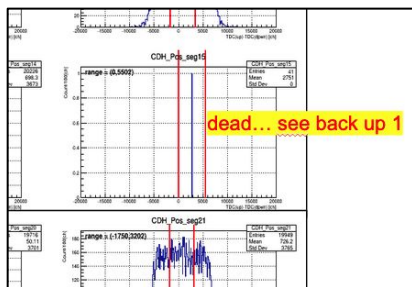
- could see efficiency curve → succeeded to take data
- for all layers, rough eff ~ 0% by 1900V, then goes to ~100% around 2350 ~ 2400V
- when overwriting efficiency curves of all, could see some difference of them between 2000~2300V
- not evaluate these errors yet, → maybe not need to do it yet

Suggestion

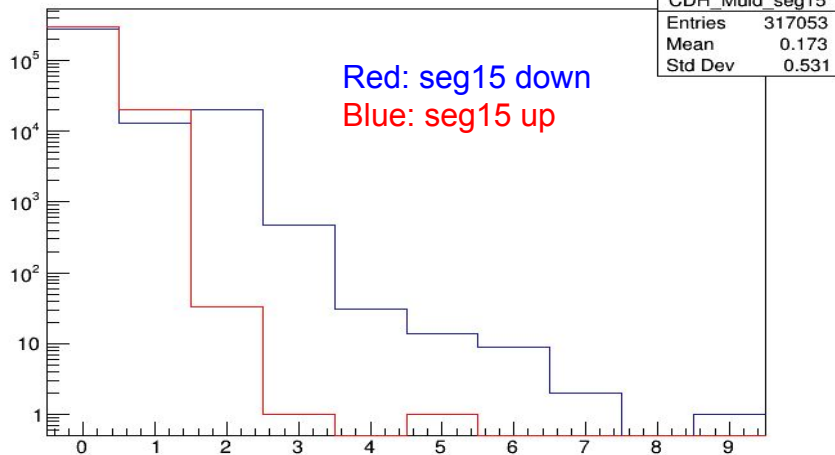
- want to take data as intervals of measured points are more narrow
 - 25V interval for each measured point
 - can store 1,000,000 events within 3~4 hours
 - 4 points / a day
 - 24 points (1900V ~ 2400V) / 6 days

Back Up 1

- ArCO2 Run4, cosmic, w/o mag
- Somehow Mul_d is too high...
- TDC_d has three peaks...
- I don't understand what happened at all.



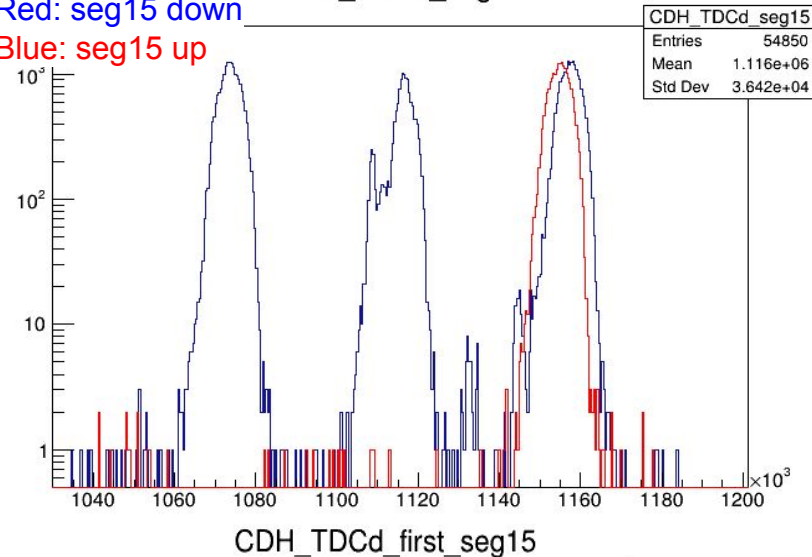
CDH_Mul_d_seg15



Red: seg15 down
Blue: seg15 up

Red: seg15 down
Blue: seg15 up

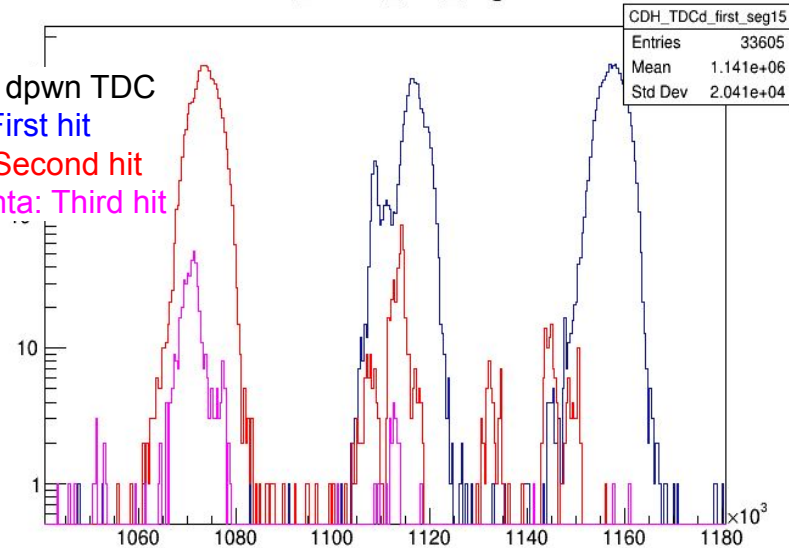
CDH_TDCd_seg15



CDH_TDCd_first_seg15

seg15 dpwn TDC

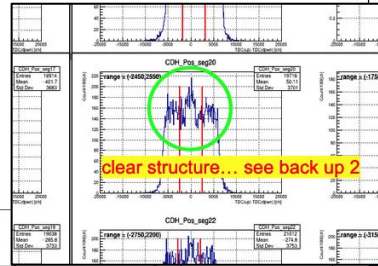
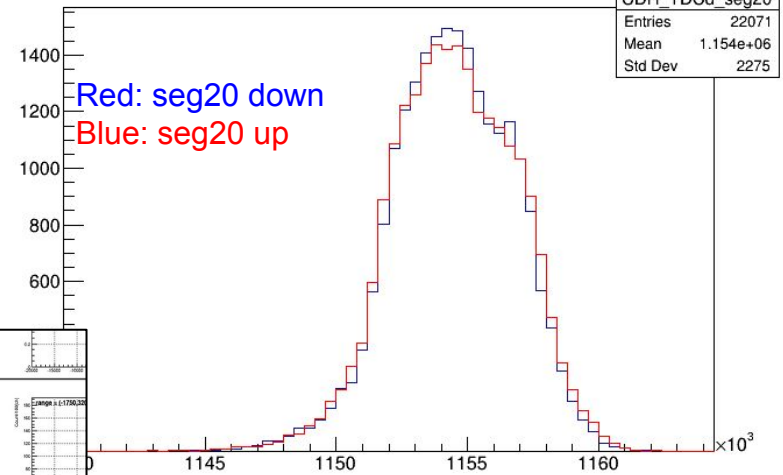
Red: First hit
Blue: Second hit
Magenta: Third hit



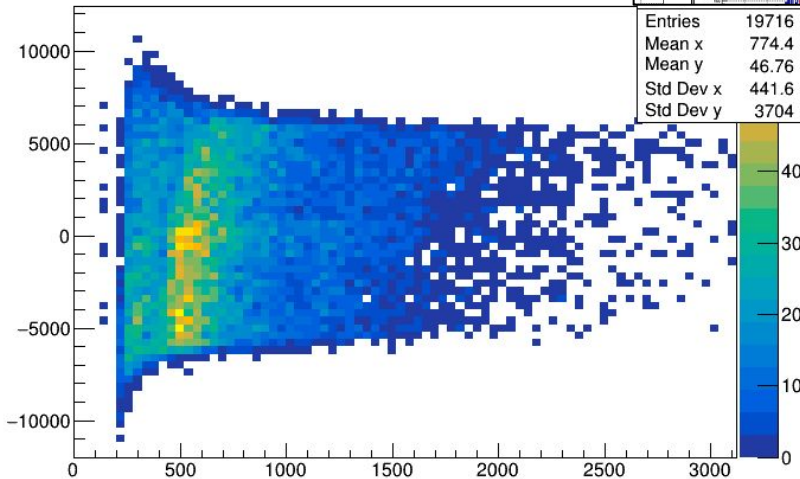
Back Up 2

- ArCO2 Run4, cosmic, w/o mag
- Unknown structure exists in CDH position.
- TDC up and down exactly overlap.
- Could not see any specific correlation between Pos and ADC.
- Why has this structure been born?

CDH_TDCd_seg20



CDH_Pos_ADCu_seg20



CDH_Pos_ADCd_seg20

