CDC ArCO2 Study in Aug. 2024 to check its feasibility 2

Tune the XT parameters

Used Run & Condition

44	2350	747491	9:54:00	2024/8/1	10:06:41	20:00:00	E73, #9	157	GIO scaled
45	2400	236613	3:09:00	2024/8/1	20:05:34	23:14:00	E73, #9	158	GIO scaled
46	2375	518986	6:52:07	2024/8/2	10:05:53	16:58:00	E73, #9	158	GIO scaled

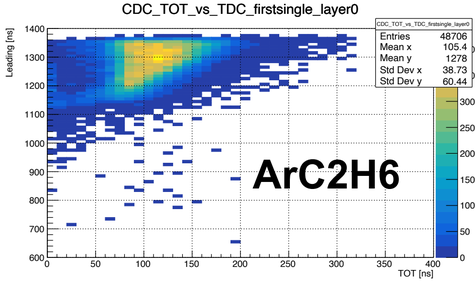
- Online Trigger ; CDH Cosmic (with All Seg) <— same as beam time cosmic
- Removed Scaler from DAQ data node? (Due to its wrong busy)
- ASD <— same as beam time cosmic
  - U-Vth 1.50 V, D-Vth 1.50 V
  - U-V+ 3.55 V, D-V+ 3.65 V
  - U-V- 3.39 V, D-V- 3.39 V
- Gas Flow <— I have no idea how to compare it to ArC2H6
  - Ar : CO2 = 90 : 10
  - In ~50 SCCM, Out ~45 SCCM (Mass Flow Meter)

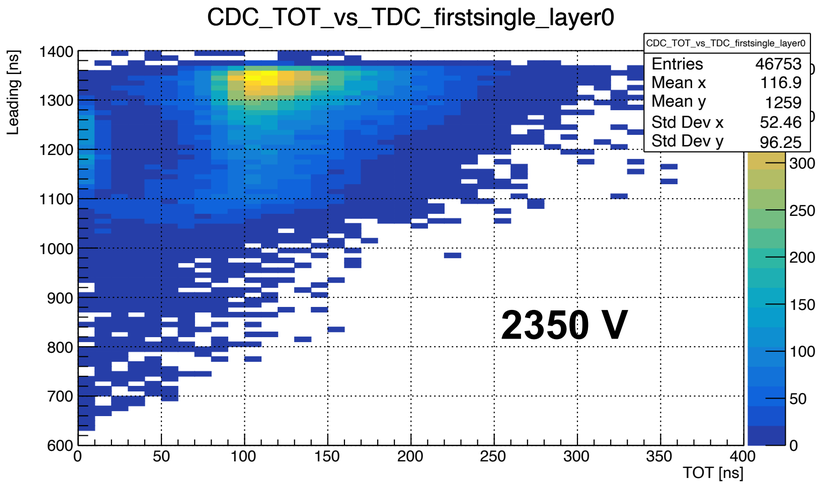
- Temprature inside CDC ; ~ 38 °C <— same as beam time cosmic

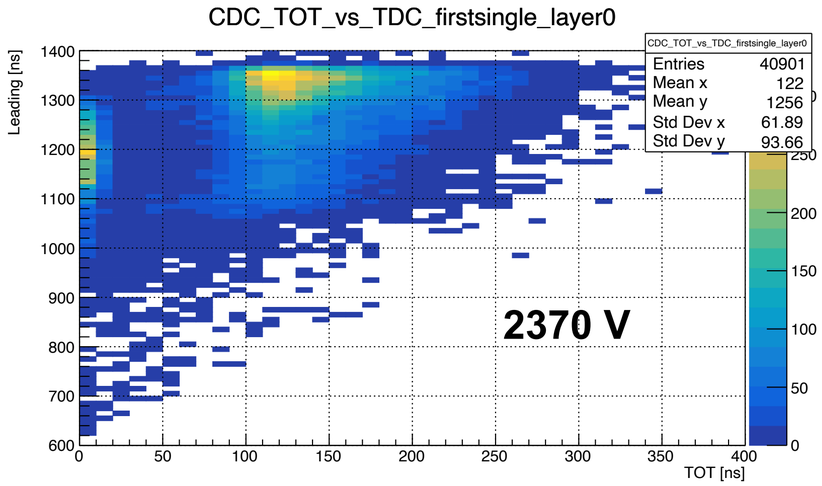
Summary of the previous discussion & its continuation

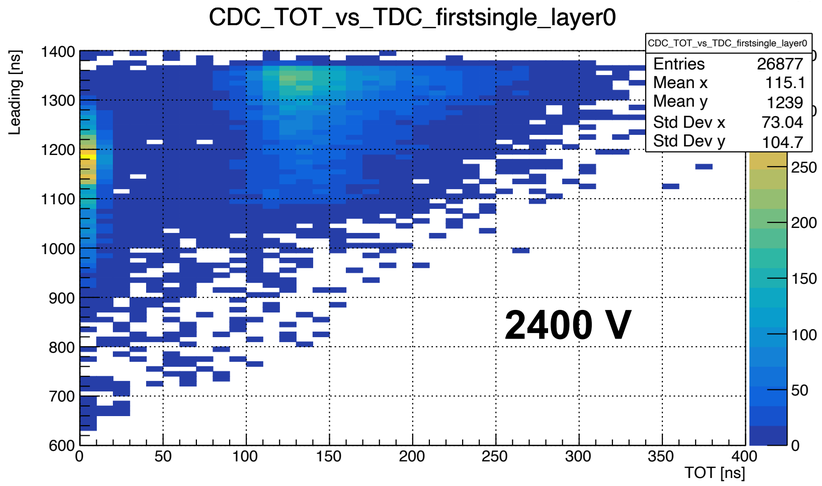
- Checked Hit pattern, Multiplicity, TDC and TOT distributions
- Compared these between the case of ArCO2 and ArC2H6

- The shapes of Mul, TDC and TOT are totally different from when using ArC2H6.
- In TOT vs TDC plot, signal region can be separated from noise region
  - e.g.) after cutting by “First Hit && Mul==2”, (using 230,000 events)







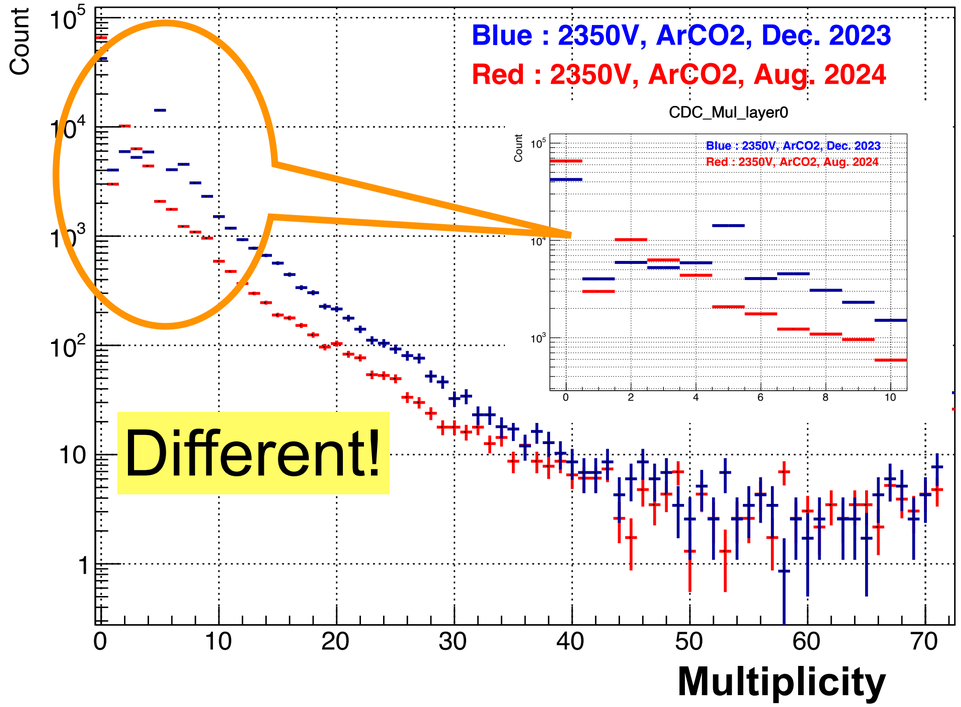


Summary of the previous discussion & its continuation

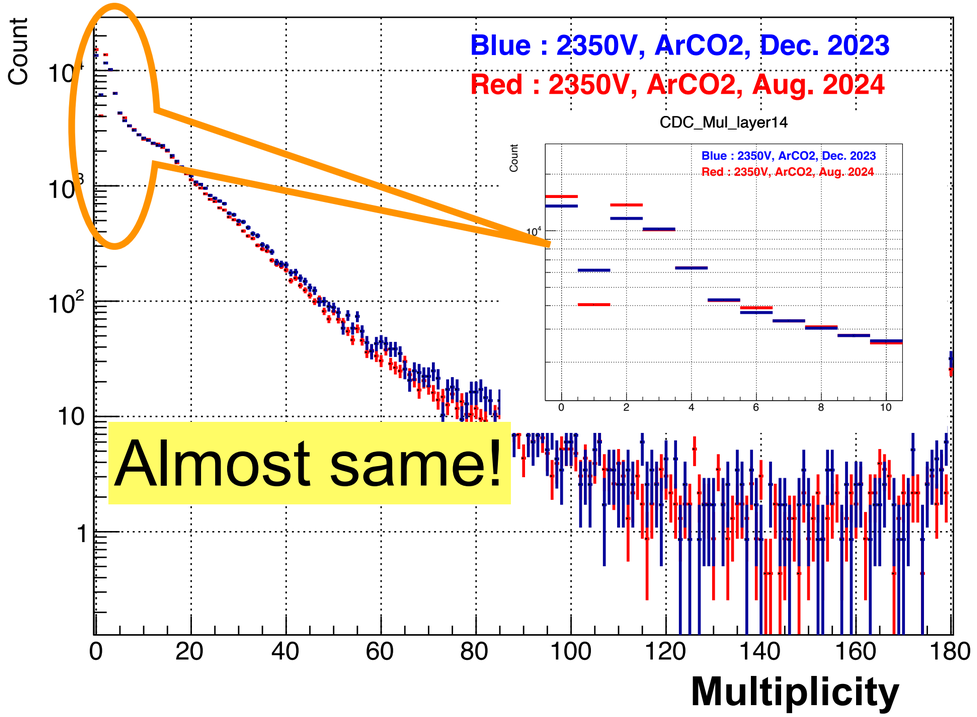
- Compare Mul with Dec. 2023
  - Used Run2 and 44 (2350V)
- Is Gurde HV the same?
- Is Gas Flow the same?
- Is temp the same?

	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	

CDC_Mul_layer0



CDC_Mul_layer14

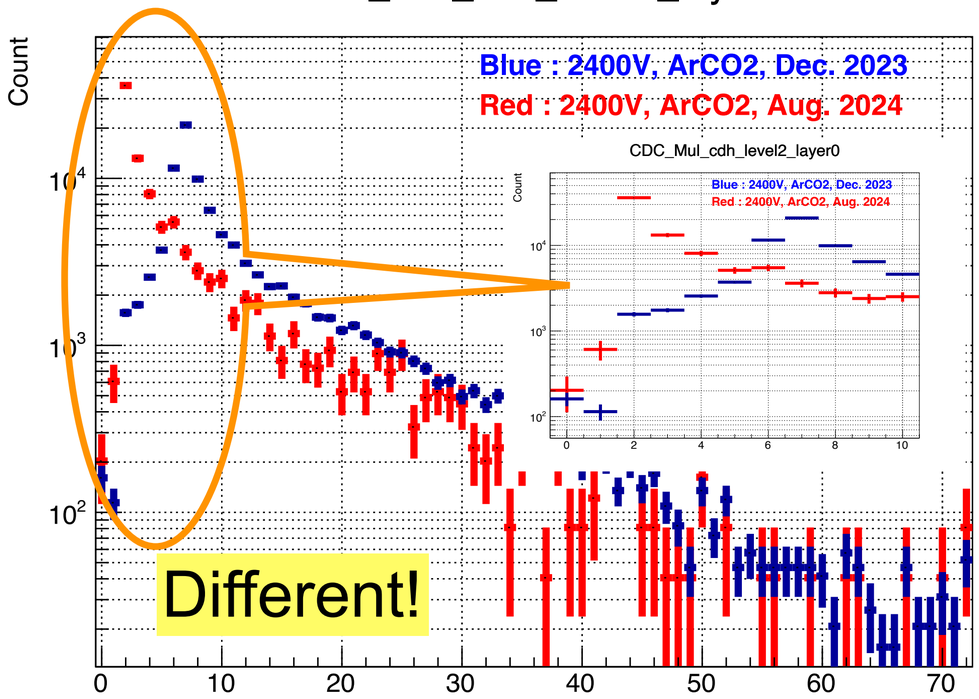


Summary of the previous discussion & its continuation

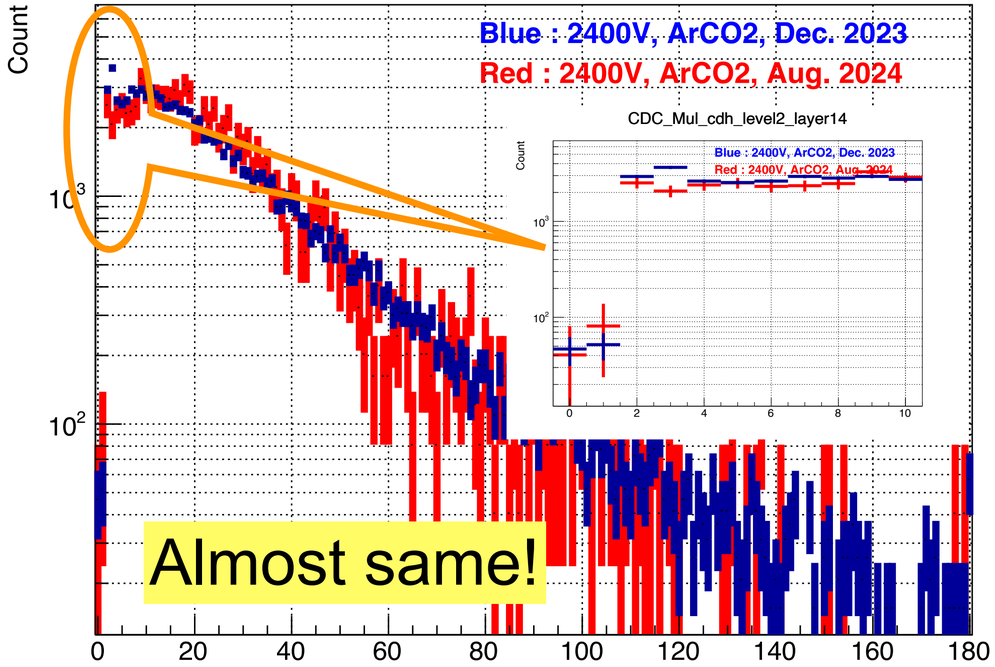
- Compare Mul with Dec. 2023
  - Used Run24 and 45 (2400V)
  - Used CDH 8-11, 26-29 in both case
- Is Gurde HV the same?
- Is Gas Flow the same?

nts	duration	date	start time	end time	Logbook, No	Logbook page	comment
44675	0:08:39	2023/12/4	19:32:38	19:41:17	E73, #5	146	
116628	0:22:19	2023/12/5	11:16:42	11:39:01	E73, #5	147	
232570	0:44:21	2023/12/5	11:42:43	12:27:04	E73, #5	147	
317053	1:00:23	2023/12/5	12:30:14	13:30:37	E73, #5	147	
315685	0:59:56	2023/12/5	13:32:34	14:32:30	E73, #5	147	
1036	0:00:20	2023/12/5	14:33:23	14:33:43	E73, #5	147	junk
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
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	

CDC_Mul_cdh_level2_layer0

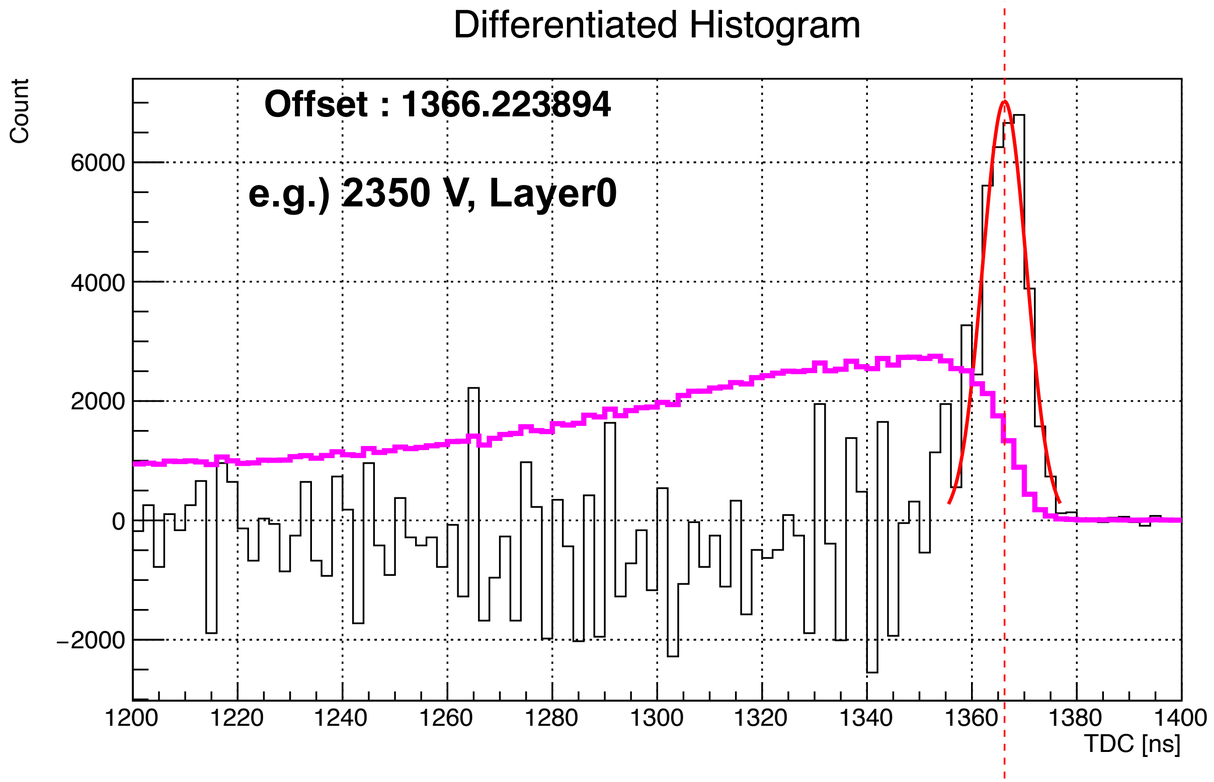


CDC_Mul_cdh_level2_layer14

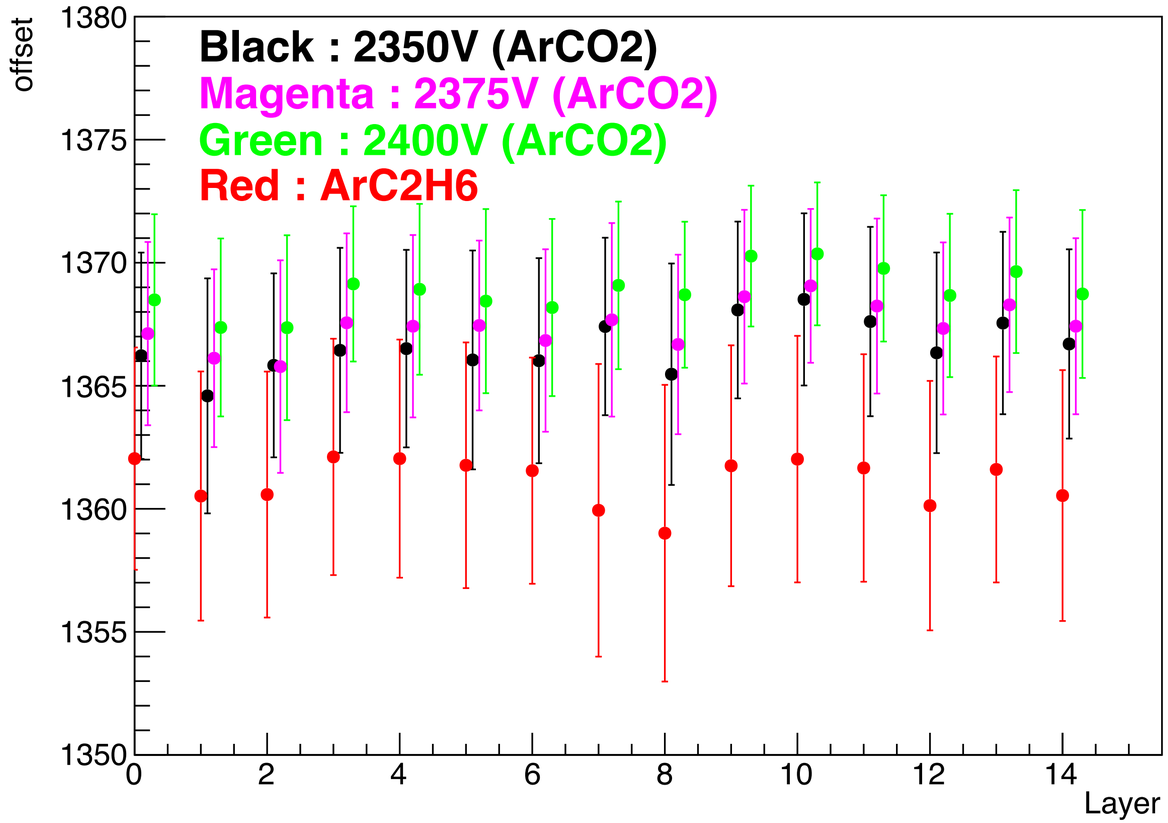


Determination of TDC offset

- Used run44, 45, 46, 600 (230,000 events)
- Used Leading TDC (after only TOT cut)
- Differentiated Hist was scalsed by *50.
- Gaussian fit (2 times iterated)
- Offset = mean value



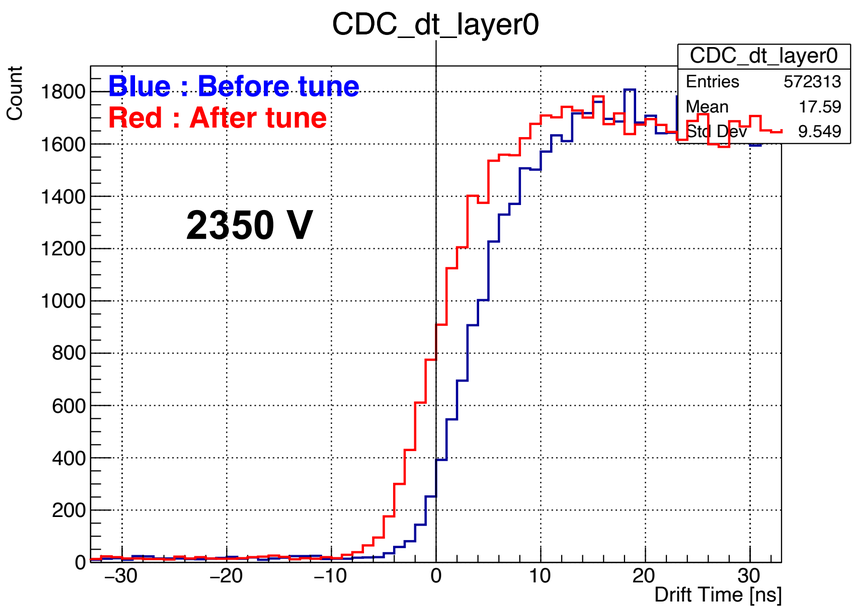
Offset vs Layser vs HV

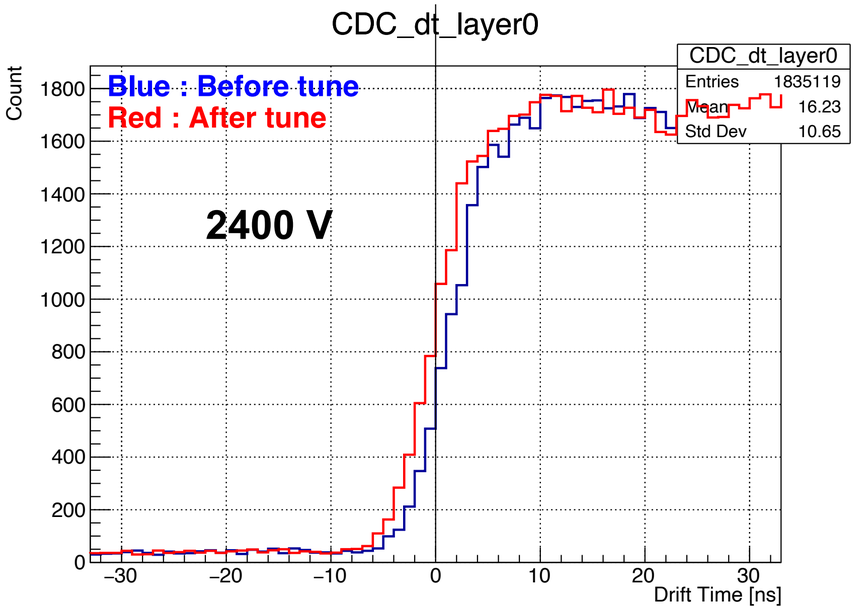


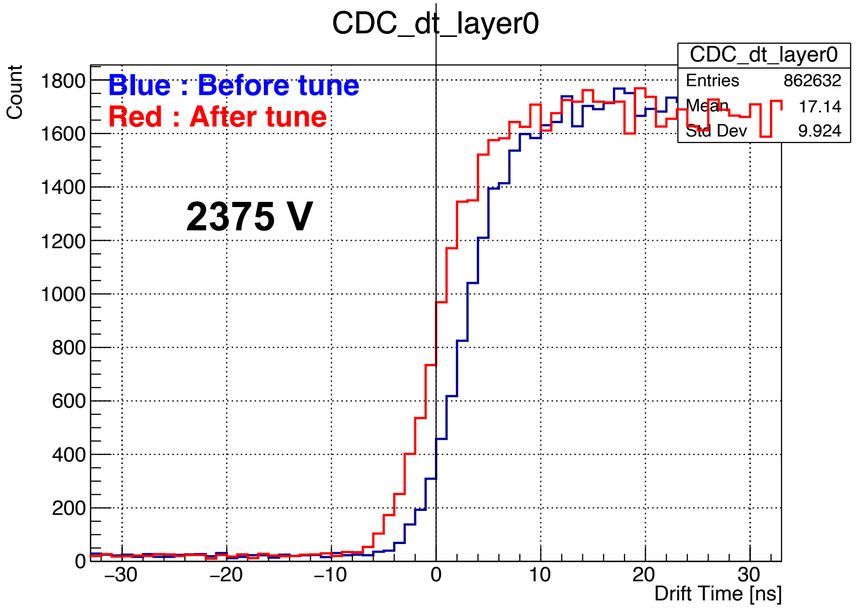
- With 1 sigma as error bar (~7 ns)
- Systematic shift coresponding to HV

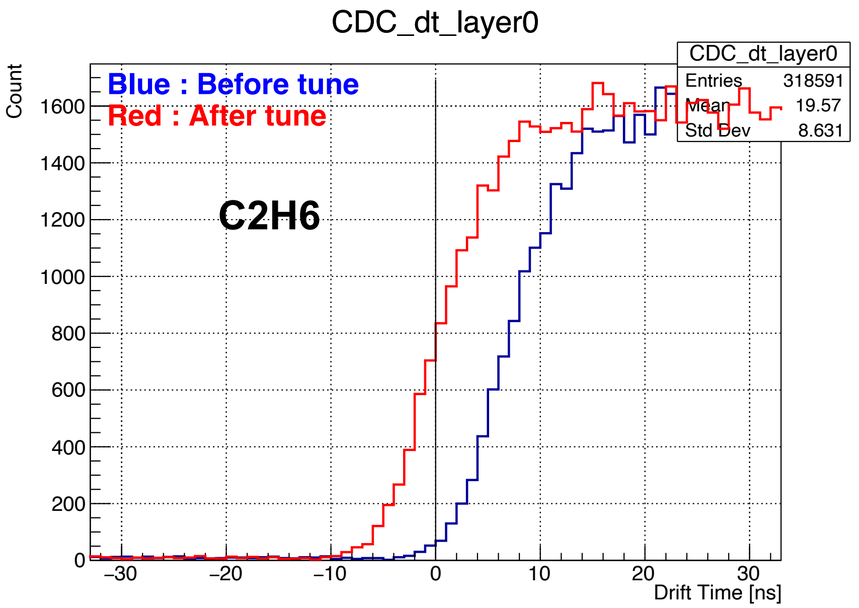
Drift Time Before and After tuning (e.g. Layer0)

- Non event selection
- Looks good







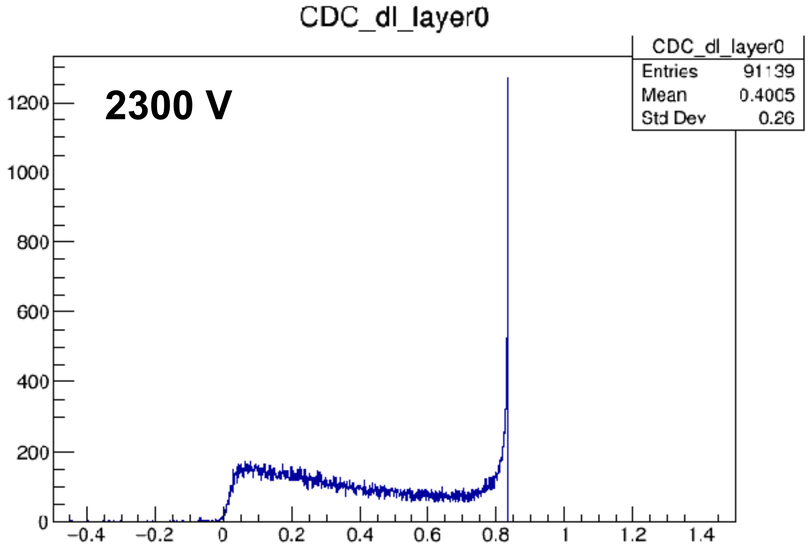


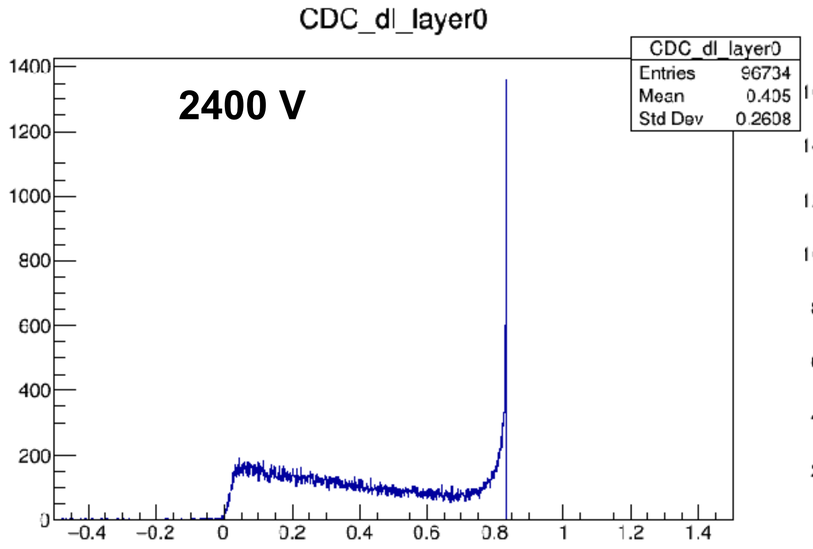
Drift Length Before tuning (e.g. Layer0)

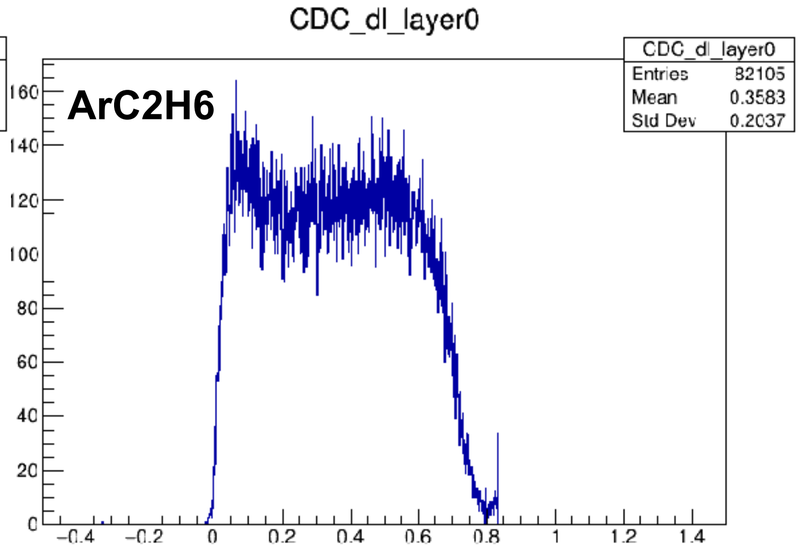
Cosmic 3min/10k ev

CDCTree 20sec/10k ev

- Used 200,000 events (CDCTree.cc)
- ArCO2 vs ArC2H6
- Of course, Bad in ArCO2 because of using XT param for ArC2H6





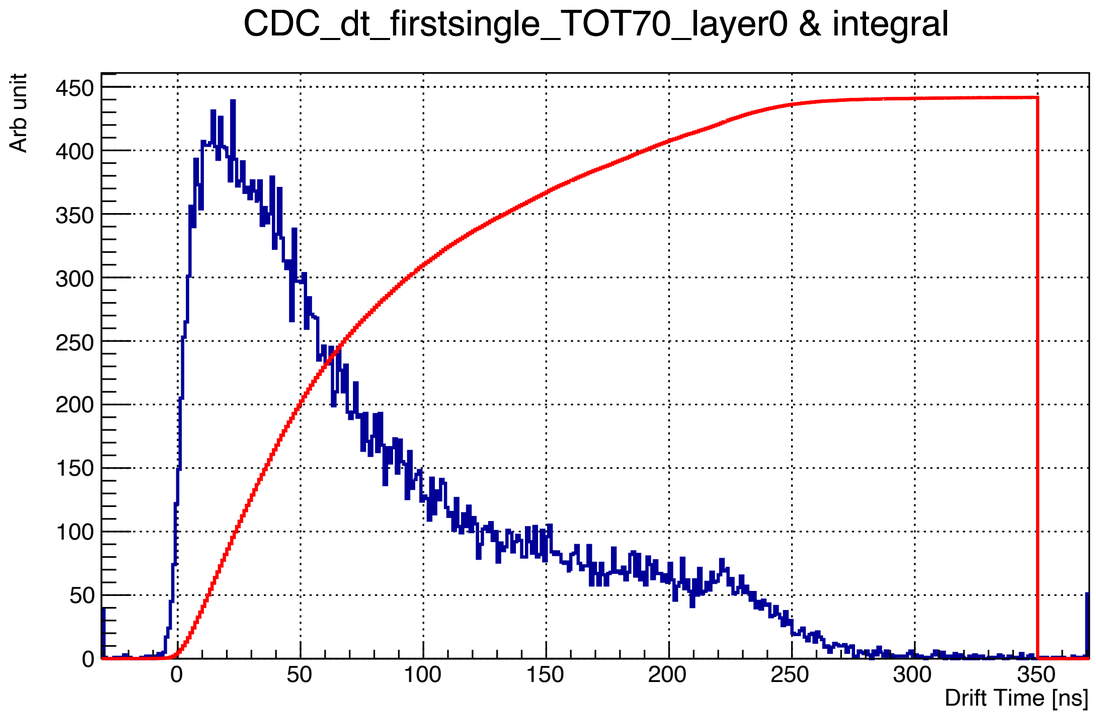


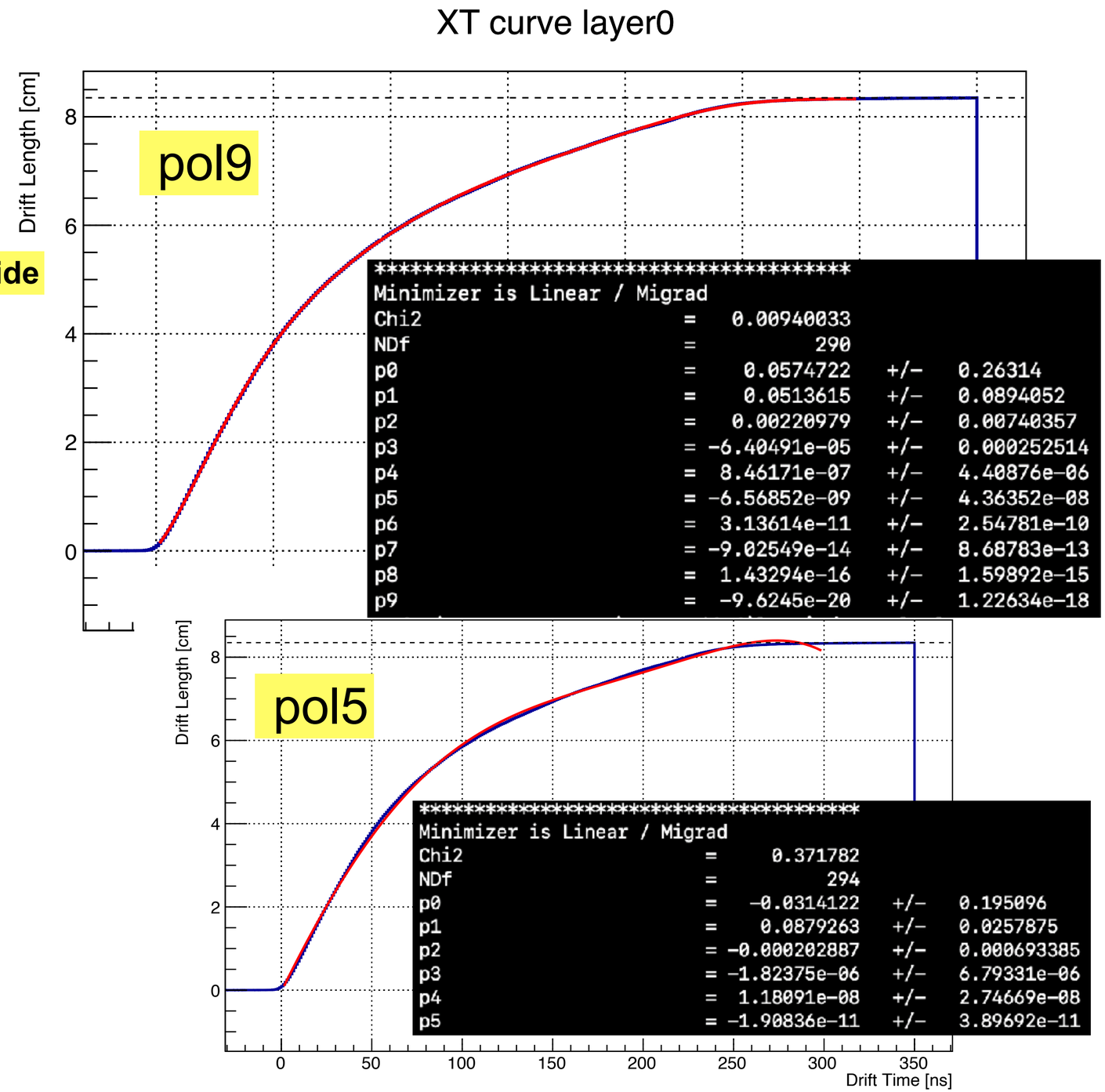
XT curve (e.g. Layer0)

- 2350 V, ArCO2, 230,000 events
- Used “dt_firstsingle_TOT70”

the most clean events I can provide

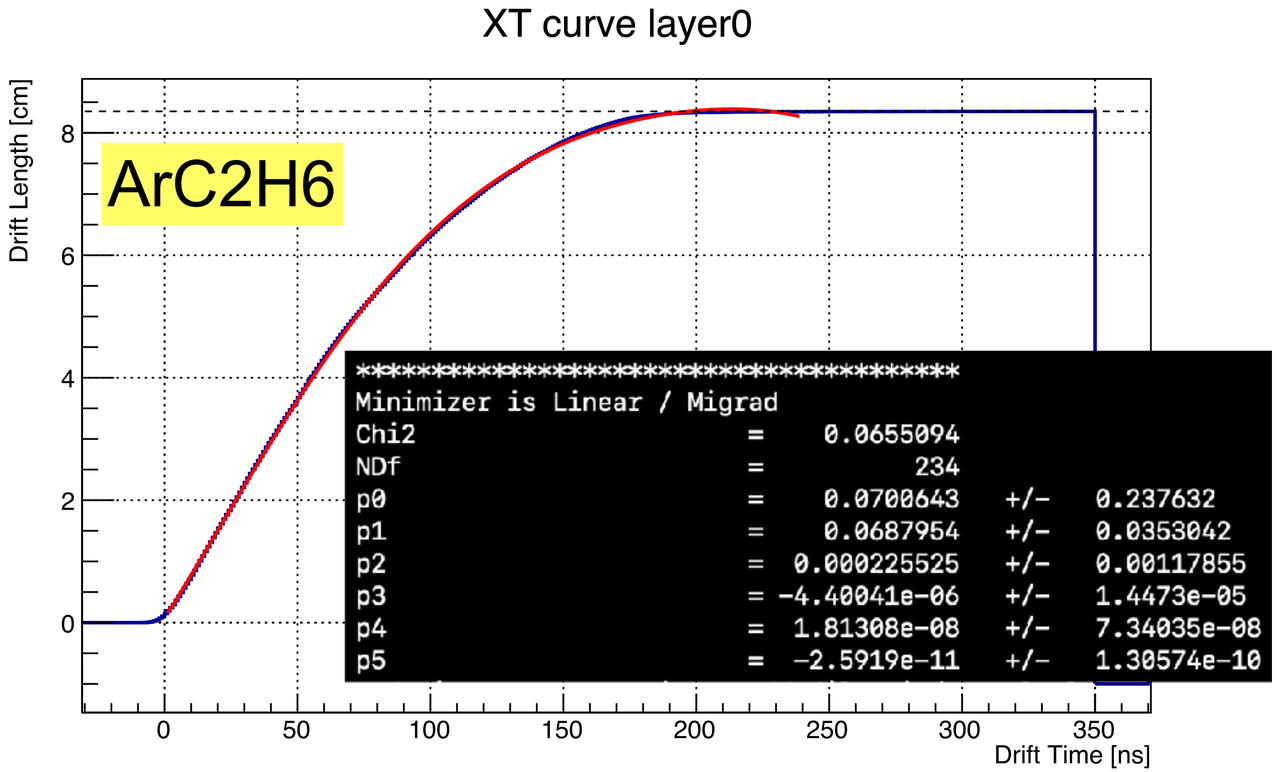
- Fitted pol9, (7), 5



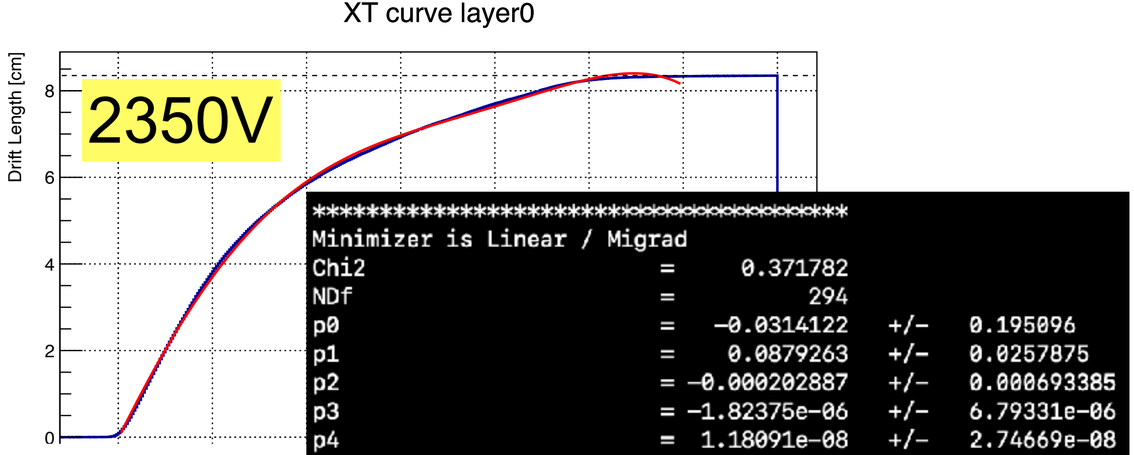


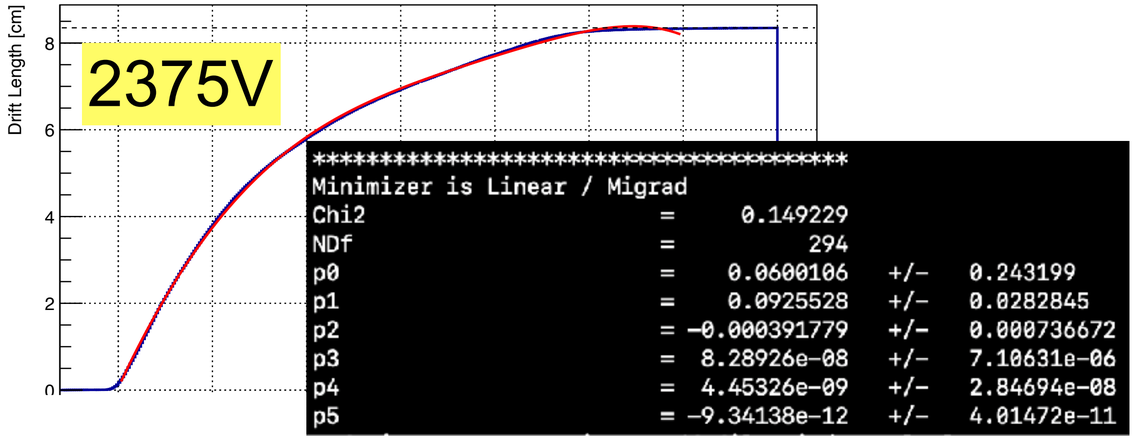
XT curve (e.g. Layer0)

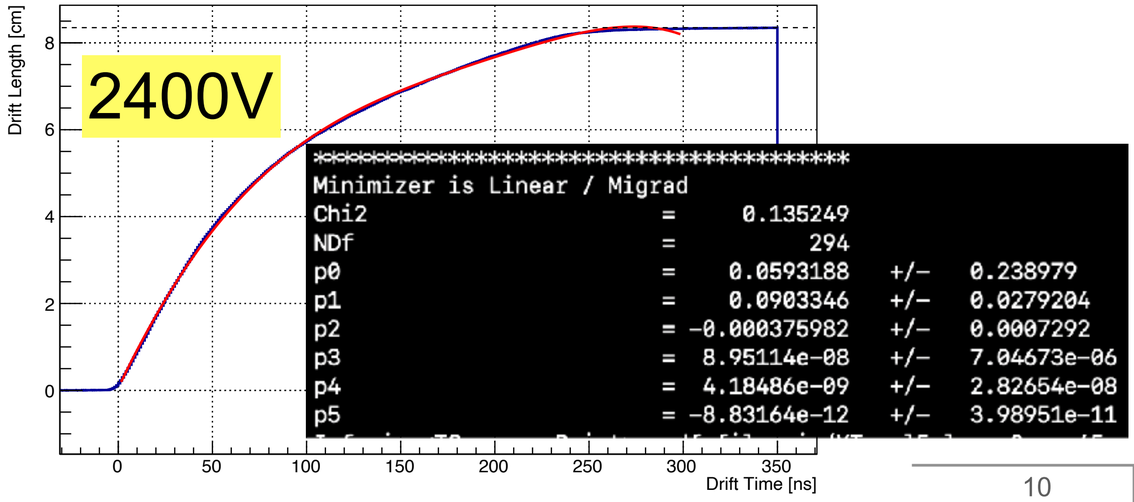
- ArCO2 vs ArC2H6, 230,000 events
- Used “dt_firstsingle_TOT70(40)”
  the most clean events I can provide
- Fitted pol5



Should use pol5? pol9? From here, pol5.







My XT param don’ t work well.

Mine

CID	Layer	Wire	npar	p0	p1	p2	p3	p4	p5			
100	0	-1	6	2.97417e-02		3.21352e-03		8.74813e-05		-1.35189e-06	7.35667e-09	-1.36939e-11
100	1	-1	6	2.77934e-02		4.02210e-03		5.66826e-05		-9.36094e-07	4.97847e-09	-8.91003e-12
100	2	-1	6	2.27978e-02		4.57646e-03		3.41082e-05		-5.77981e-07	2.80142e-09	-4.56008e-12
100	3	-1	6	2.73596e-02		3.48261e-03		7.24388e-05		-1.13909e-06	6.21936e-09	-1.16271e-11
100	4	-1	6	2.00386e-02		4.49508e-03		3.13570e-05		-5.55735e-07	2.88272e-09	-5.03231e-12
100	5	-1	6	1.83826e-02		4.64287e-03		2.85083e-05		-5.02568e-07	2.46271e-09	-4.03261e-12
100	6	-1	6	2.35265e-02		4.09735e-03		4.36554e-05		-6.71283e-07	3.22012e-09	-5.16110e-12
100	7	-1	6	1.13319e-02		5.18364e-03		2.37156e-05		-5.48629e-07	3.00391e-09	-5.33979e-12
100	8	-1	6	1.65194e-02		5.14112e-03		2.40406e-05		-5.46043e-07	2.91749e-09	-5.02636e-12
100	9	-1	6	2.08623e-02		4.17958e-03		4.69081e-05		-7.83586e-07	4.16136e-09	-7.50707e-12
100	10	-1	6	1.74468e-02		4.14266e-03		4.95584e-05		-8.18551e-07	4.35220e-09	-7.84340e-12
100	11	-1	6	2.08553e-02		4.60301e-03		2.86473e-05		-5.41859e-07	2.88751e-09	-5.13091e-12
100	12	-1	6	2.77339e-02		3.64026e-03		5.69114e-05		-8.58055e-07	4.33728e-09	-7.42401e-12
100	13	-1	6	2.05080e-02		3.86323e-03		5.98954e-05		-9.50097e-07	4.97829e-09	-8.84285e-12
100	14	-1	6	2.29164e-02		3.93782e-03		5.81324e-05		-9.44803e-07	5.04163e-09	-9.05509e-12

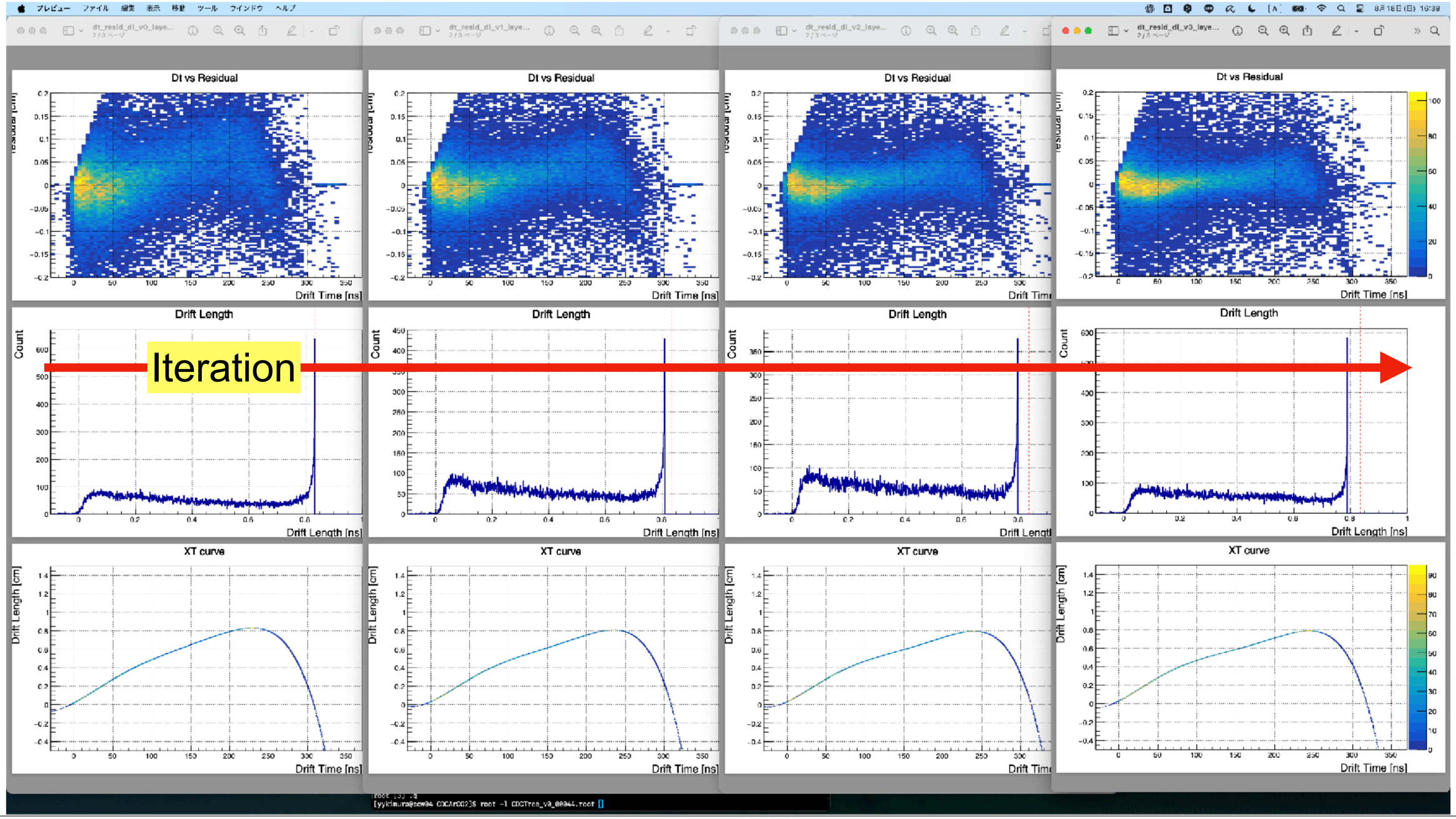
What’s the difference ?

Hashimoto-san’s

CID	Layer	Wire	npar	p0	p1	p2	p3	p4	p5			
100	0	-1	6	3.04092e-02		3.84018e-03		4.99539e-05		-7.43719e-07	3.71227e-09	-6.35126e-12
100	1	-1	6	2.61421e-02		4.56538e-03		2.60254e-05		-4.39220e-07	2.06525e-09	-3.22779e-12
100	2	-1	6	2.01871e-02		5.14480e-03		8.61225e-06		-2.36526e-07	1.06826e-09	-1.51322e-12
100	3	-1	6	2.30344e-02		4.25231e-03		3.03385e-05		-4.54825e-07	2.07137e-09	-3.15807e-12
100	4	-1	6	1.70858e-02		4.58914e-03		2.08205e-05		-3.42171e-07	1.50360e-09	-2.16573e-12
100	5	-1	6	1.92629e-02		4.59281e-03		2.09427e-05		-3.47095e-07	1.53767e-09	-2.22521e-12
100	6	-1	6	1.63484e-02		4.75782e-03		1.53348e-05		-2.77289e-07	1.17637e-09	-1.59425e-12
100	7	-1	6	1.19289e-02		5.06461e-03		1.65243e-05		-3.58616e-07	1.73190e-09	-2.69459e-12
100	8	-1	6	1.28659e-02		5.30079e-03		9.26627e-06		-2.77784e-07	1.34292e-09	-2.02386e-12
100	9	-1	6	1.95680e-02		4.11169e-03		3.83564e-05		-5.90521e-07	2.91324e-09	-4.85483e-12
100	10	-1	6	1.70432e-02		4.51946e-03		2.76960e-05		-4.59463e-07	2.20321e-09	-3.49056e-12
100	11	-1	6	2.09731e-02		4.17534e-03		3.35941e-05		-5.10988e-07	2.41372e-09	-3.81551e-12
100	12	-1	6	1.92180e-02		4.43256e-03		2.57247e-05		-4.15427e-07	1.93701e-09	-2.98363e-12
100	13	-1	6	1.72241e-02		4.49199e-03		2.98244e-05		-4.97789e-07	2.41703e-09	-3.87803e-12
100	14	-1	6	1.84870e-02		4.41204e-03		2.97966e-05		-4.81551e-07	2.31173e-09	-3.71298e-12

XT param tune

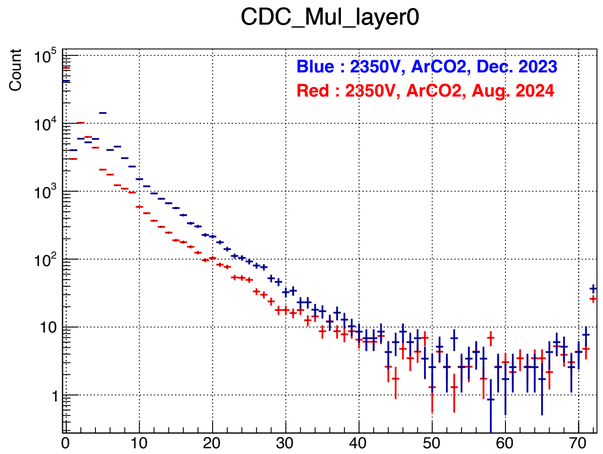
I don’t really understand.

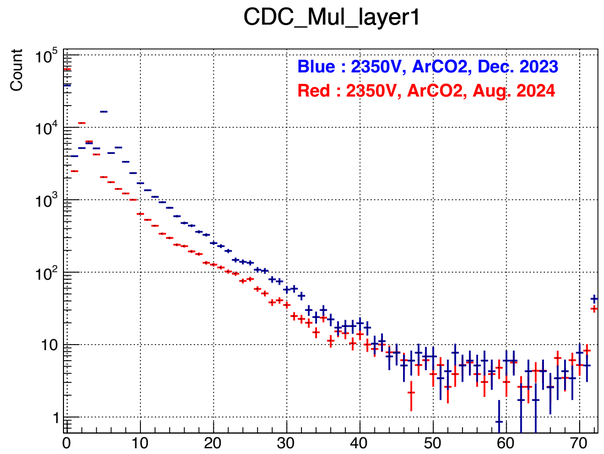


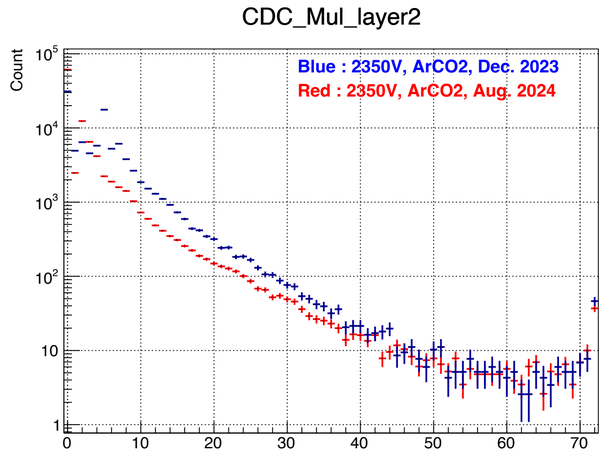
Back Up

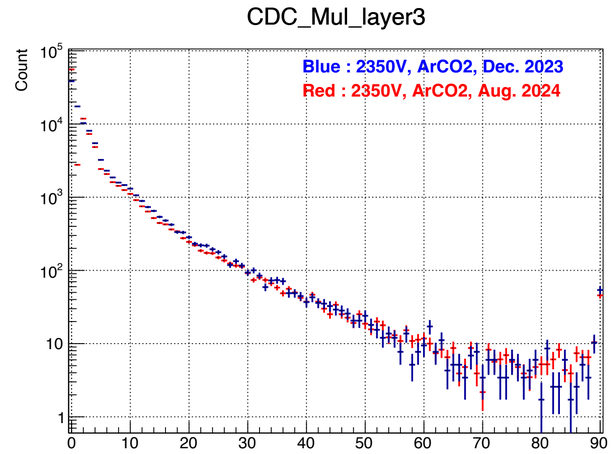
Raw Multiplicity 2023 vs 2024 at 2350 V (Layer0~7)

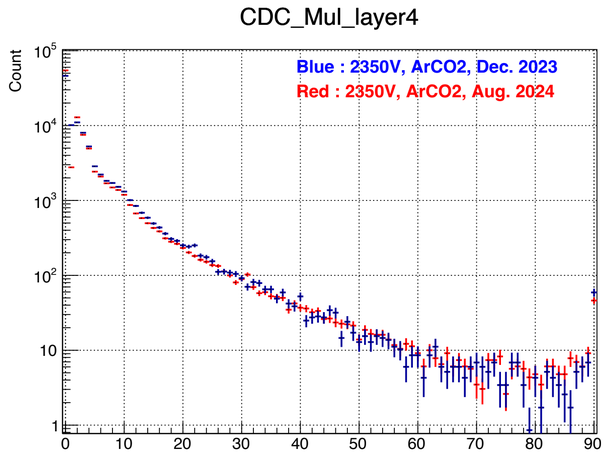
- Used run2 and run44, ArCO2 data <u>Only Layer0~2 are aparently different each other.</u>
- Scaled by 100,000 events <u>2023 has bigger Mul than 2024 in general.</u>

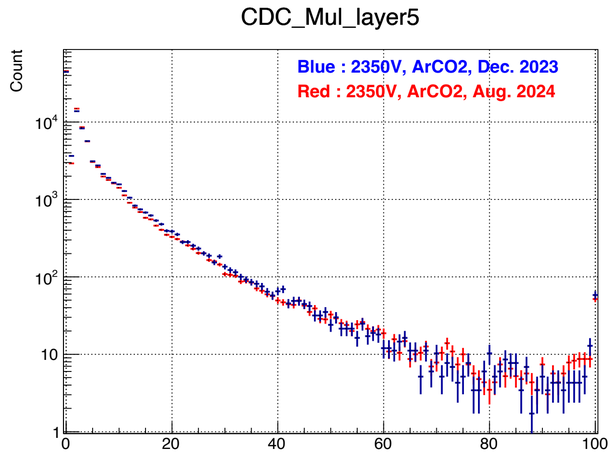


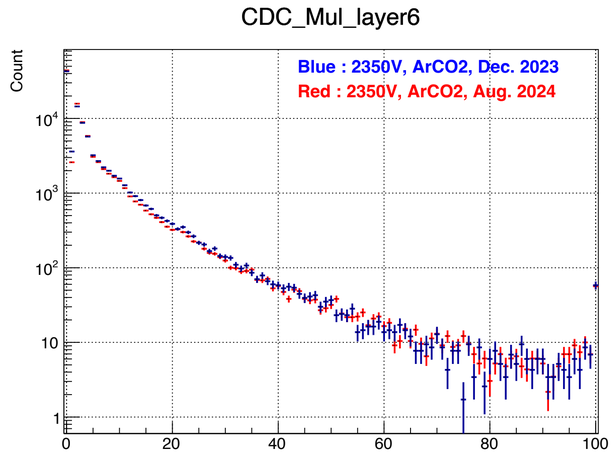


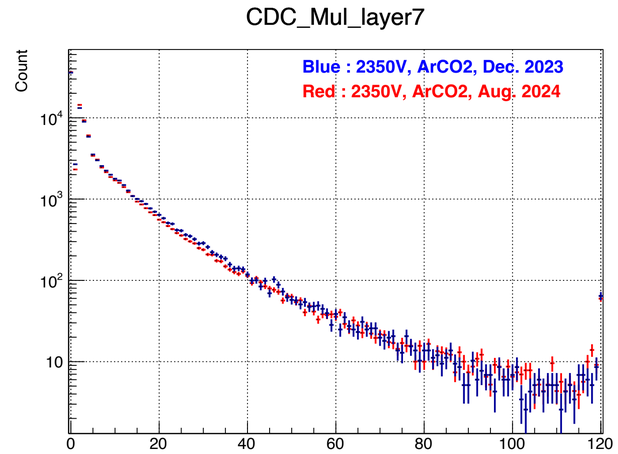










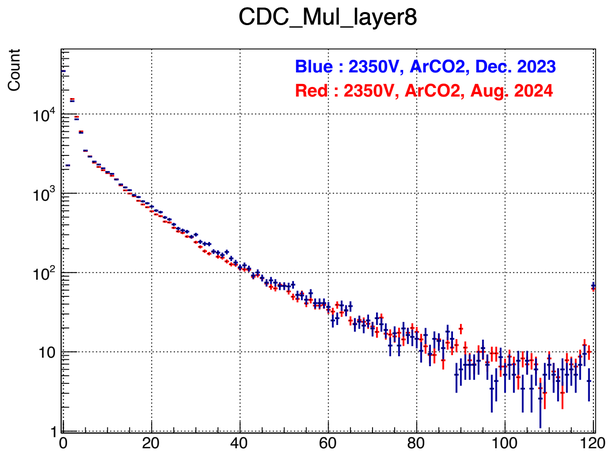


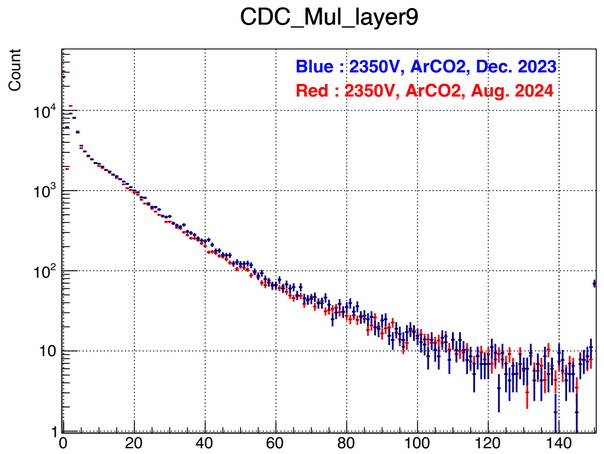
Raw Multiplicity 2023 vs 2024 at 2350 V (Layer8~14)

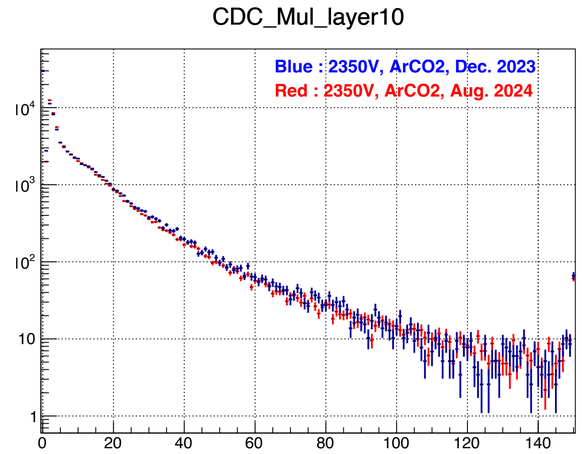
- Used run2 and run44, ArCO2 data
- Scaled by 100,000 events

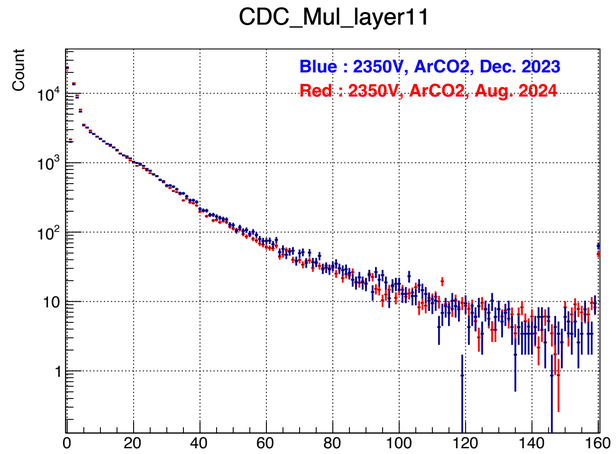
Only Layer0~2 are aparently different each other.

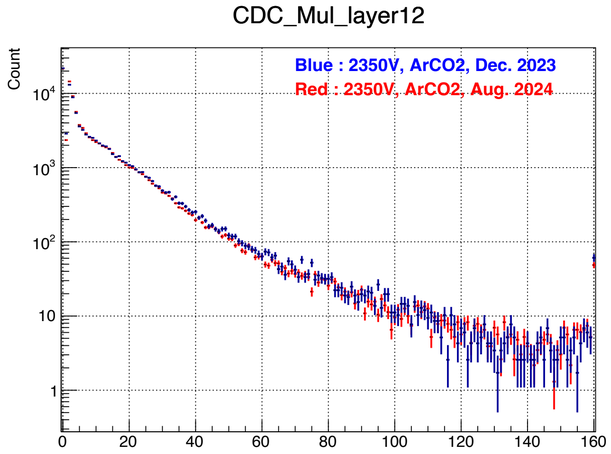
2023 has bigger Mul than 2024 in general.

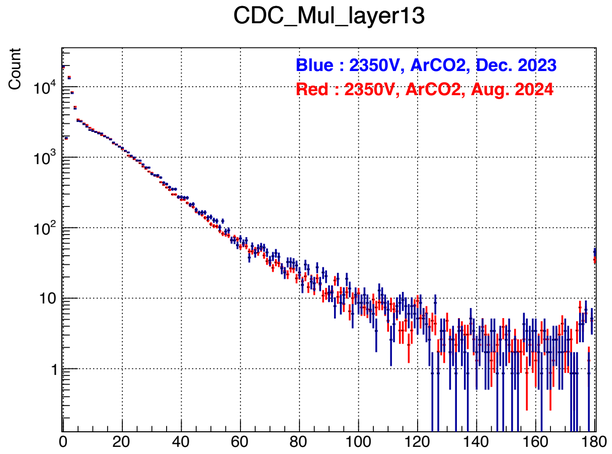


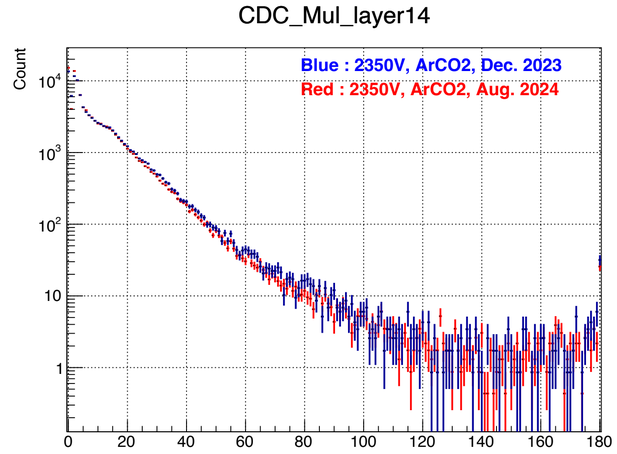












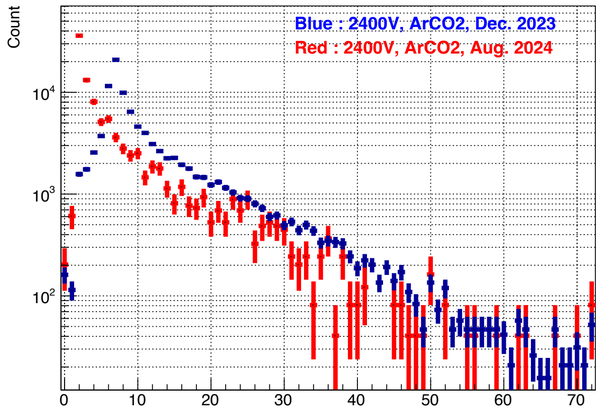
Multiplicity 2023 vs 2024 at 2400 V (Layer8~14)

- Used run24 and run45, ArCO2 data
- Scaled by 100,000 events
- CDH 8~11, 26~29

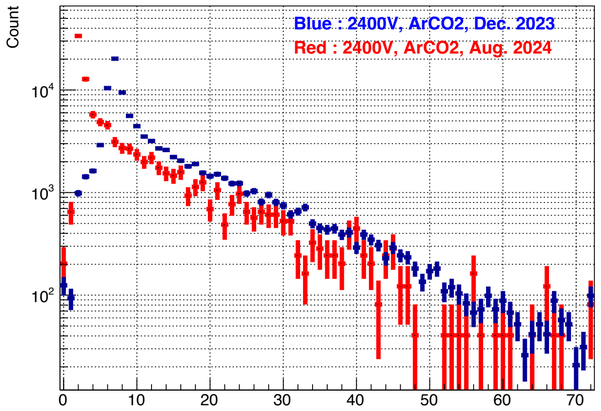
Only Layer0~2 are aparently different each other.

2023 has bigger Mul than 2024 in general.

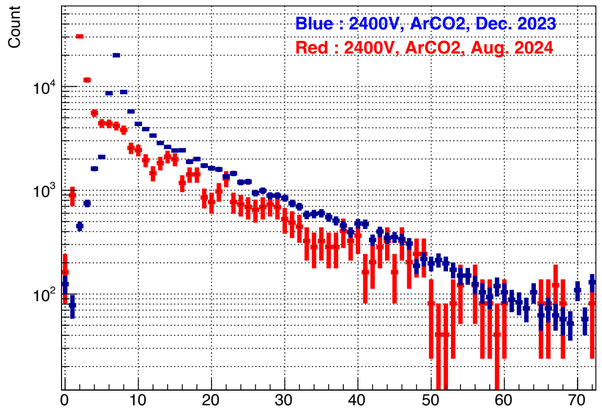
CDC_Mul_cdh_level2_layer0



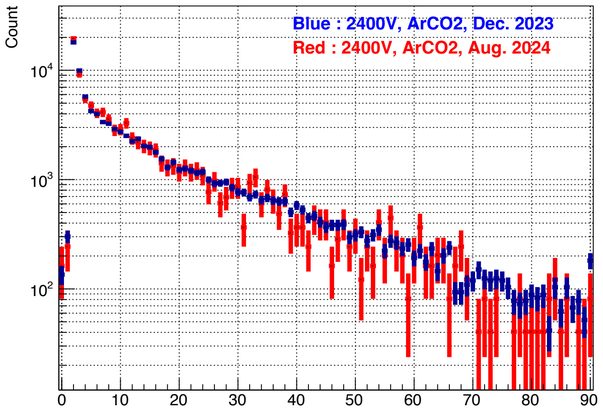
CDC_Mul_cdh_level2_layer1



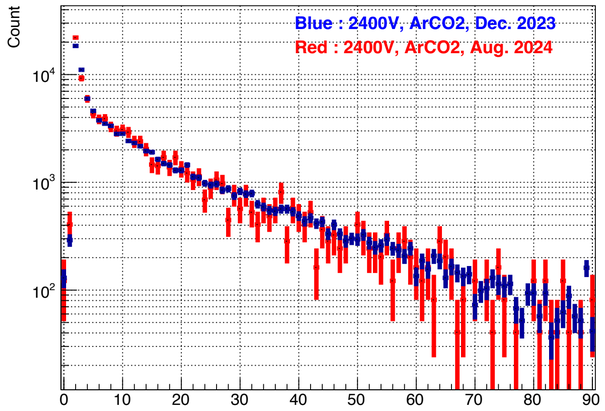
CDC_Mul_cdh_level2_layer2



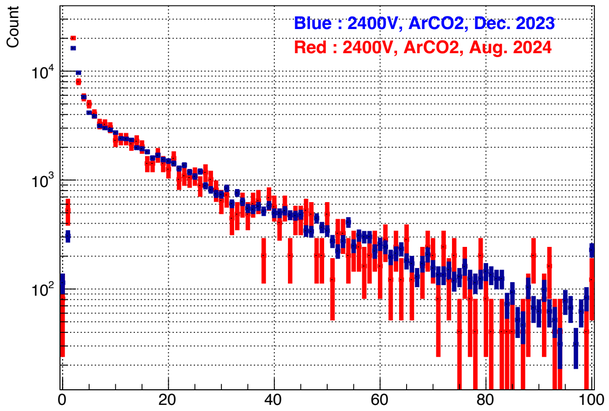
CDC_Mul_cdh_level2_layer3



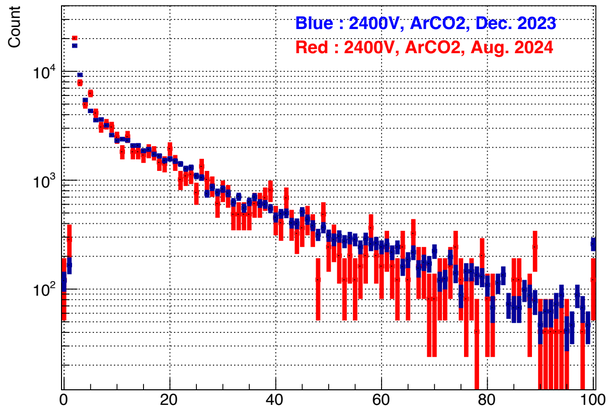
CDC_Mul_cdh_level2_layer4



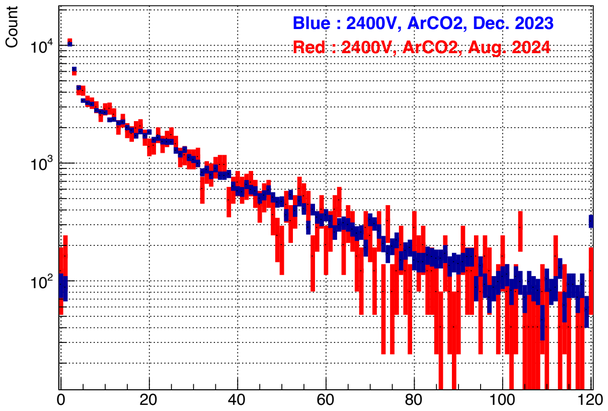
CDC_Mul_cdh_level2_layer5



CDC_Mul_cdh_level2_layer6



CDC_Mul_cdh_level2_layer7

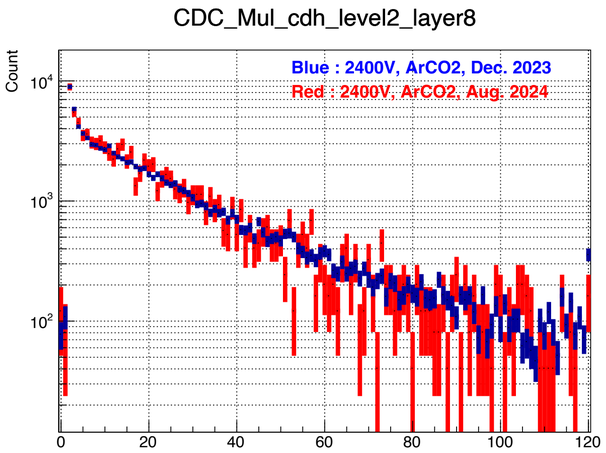


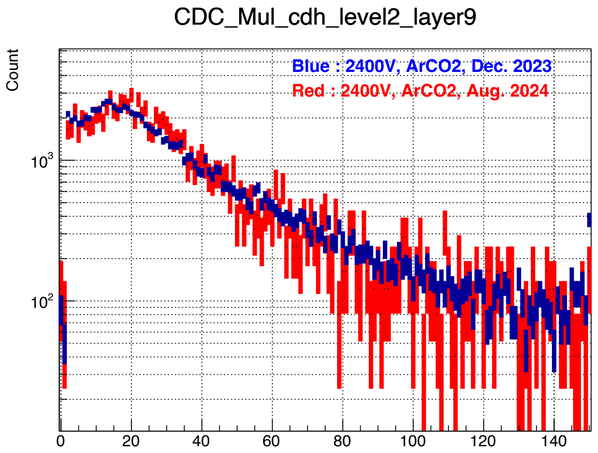
Multiplicity 2023 vs 2024 at 2400 V (Layer8~14)

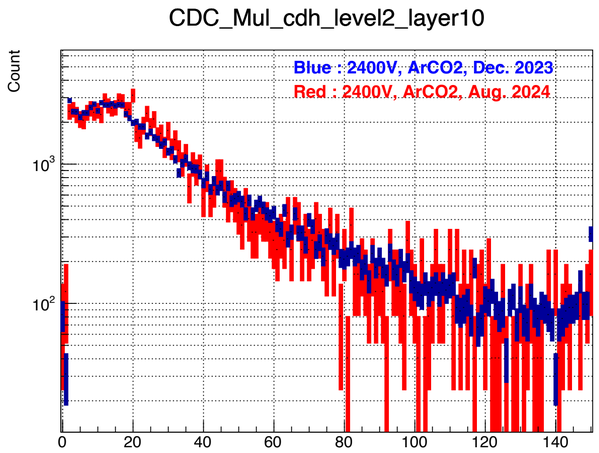
- Used run24 and run45, ArCO2 data
- Scaled by 100,000 events
- CDH 8~11, 26~29

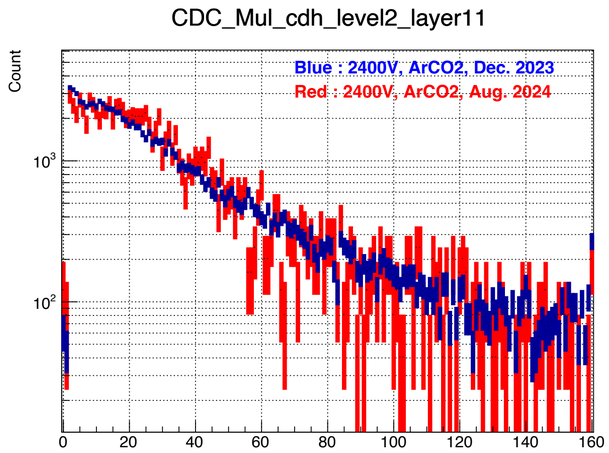
Only Layer0~2 are aparently different each other.

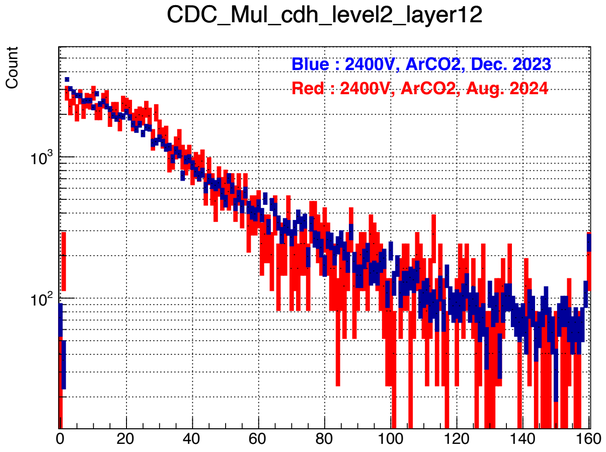
2023 has bigger Mul than 2024 in general.

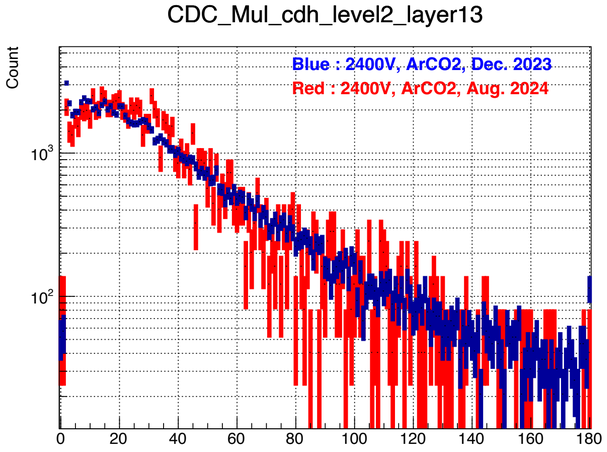


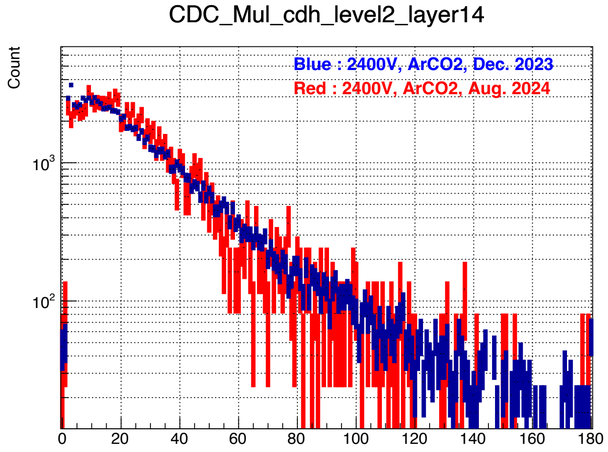




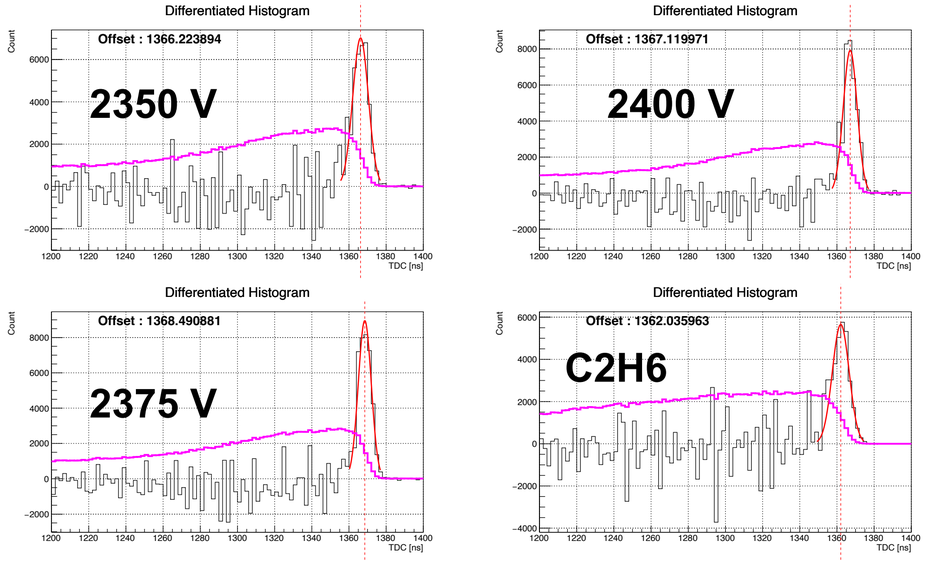




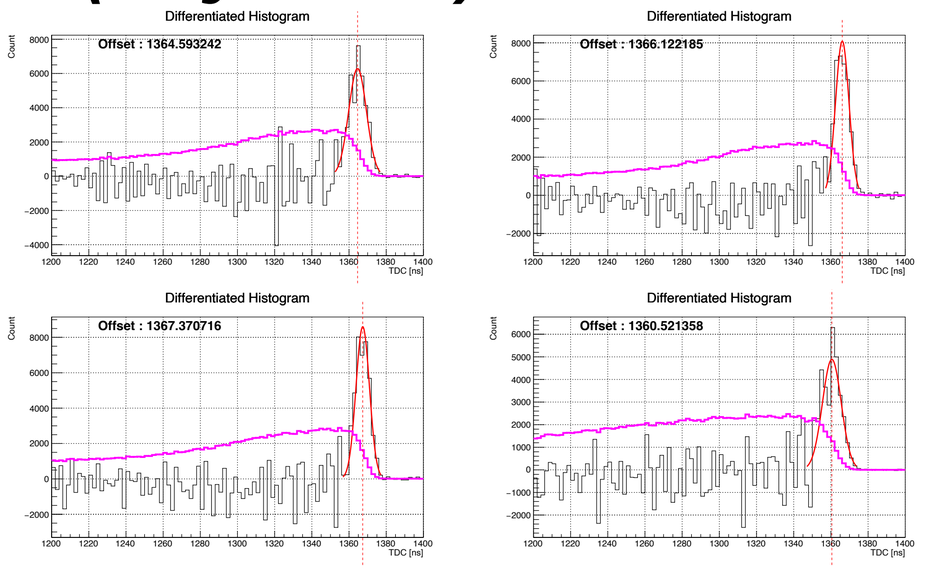




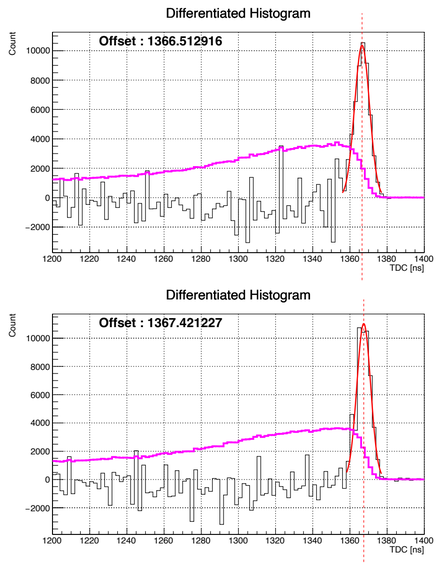
Determination of TDC offset (Layer0~4)



Layer0

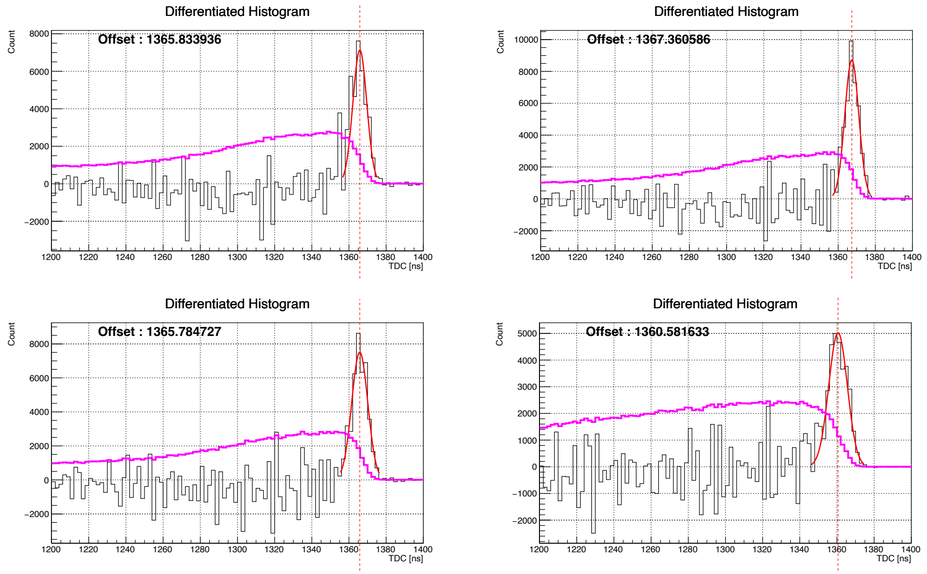


Layer1

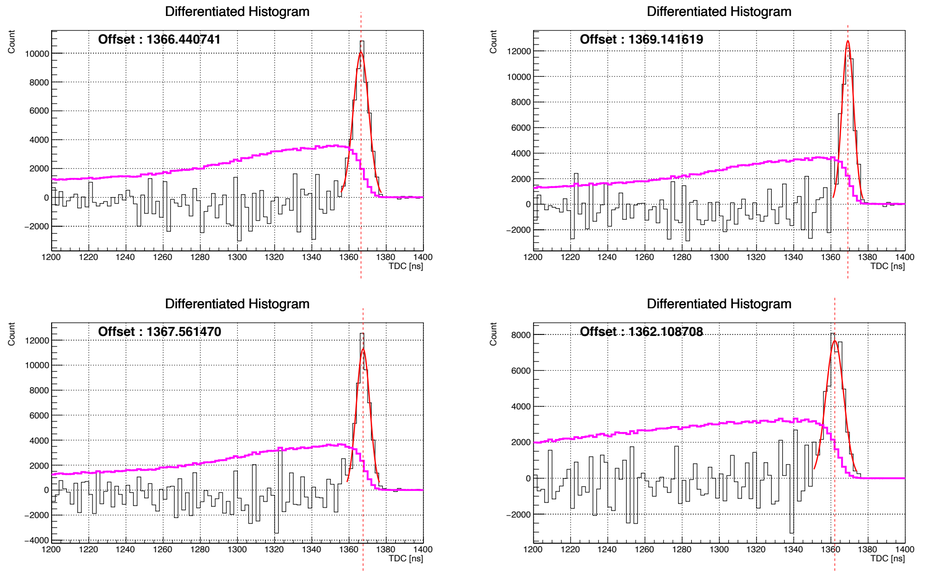


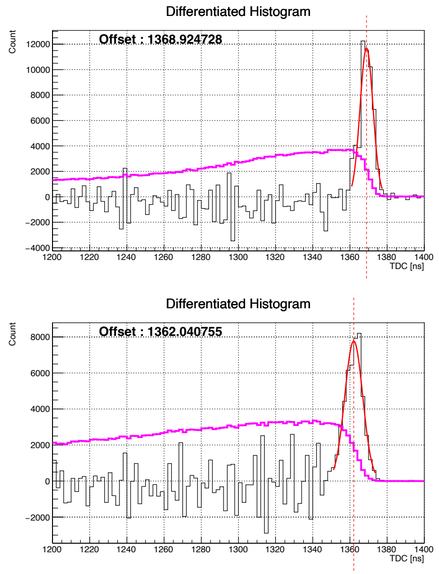
Layer4

Layer2

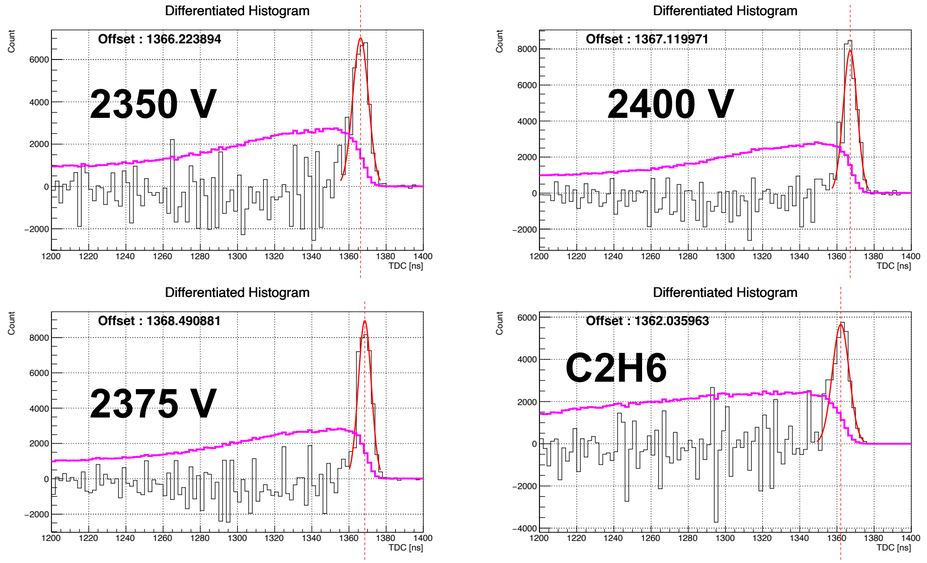


Layer3

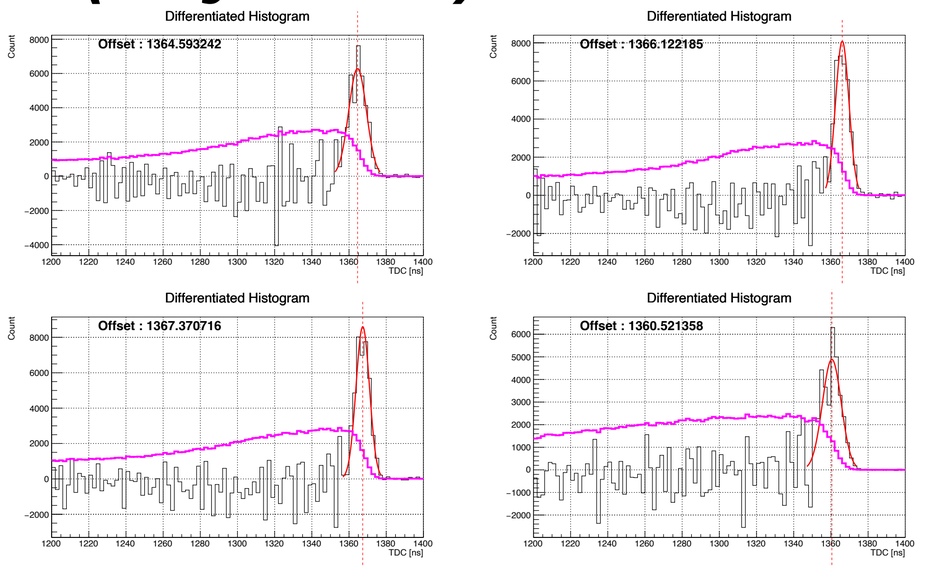




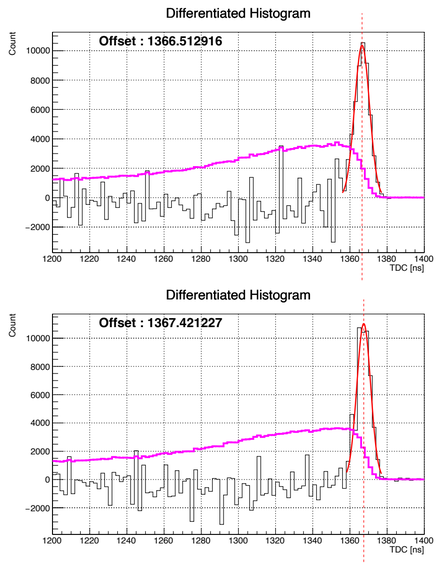
Determination of TDC offset (Layer0~4)



Layer0

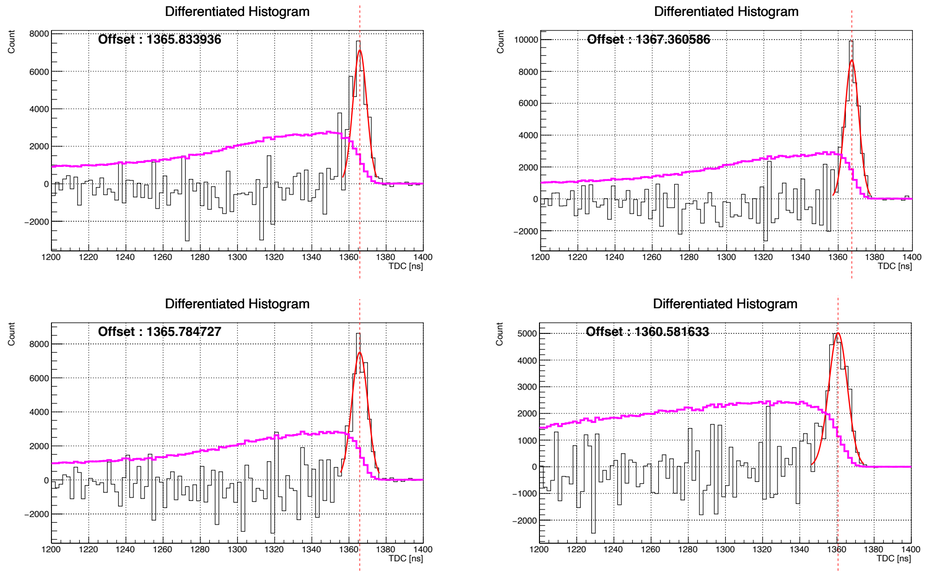


Layer1

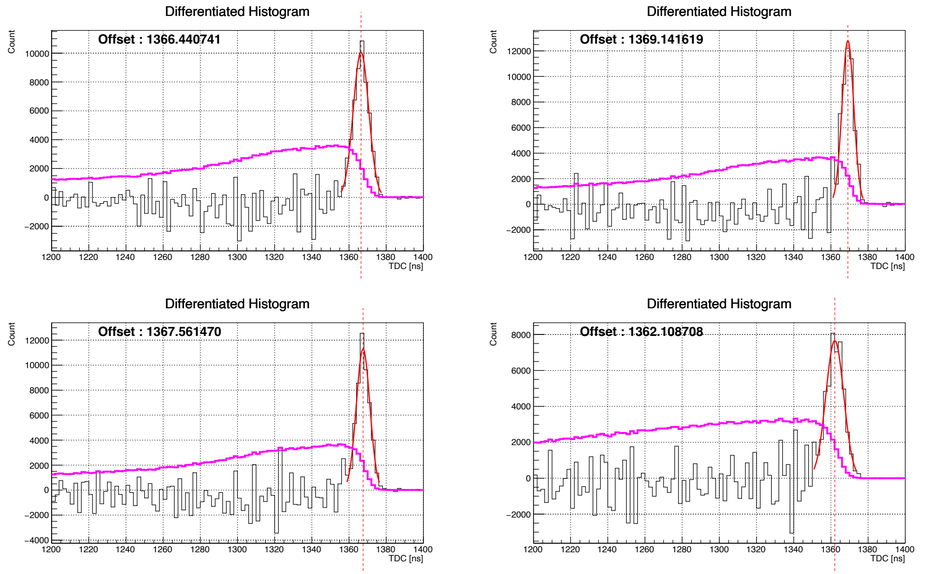


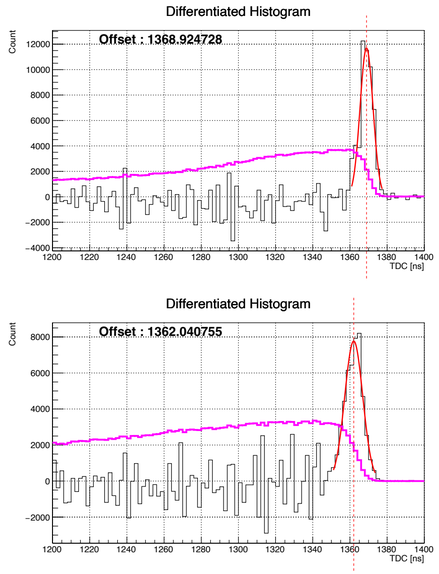
Layer4

Layer2

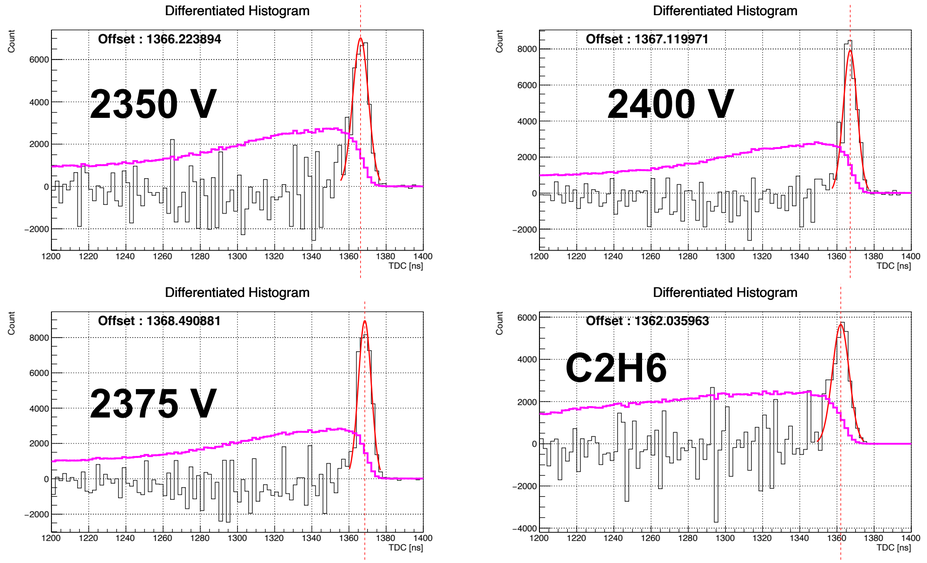


Layer3

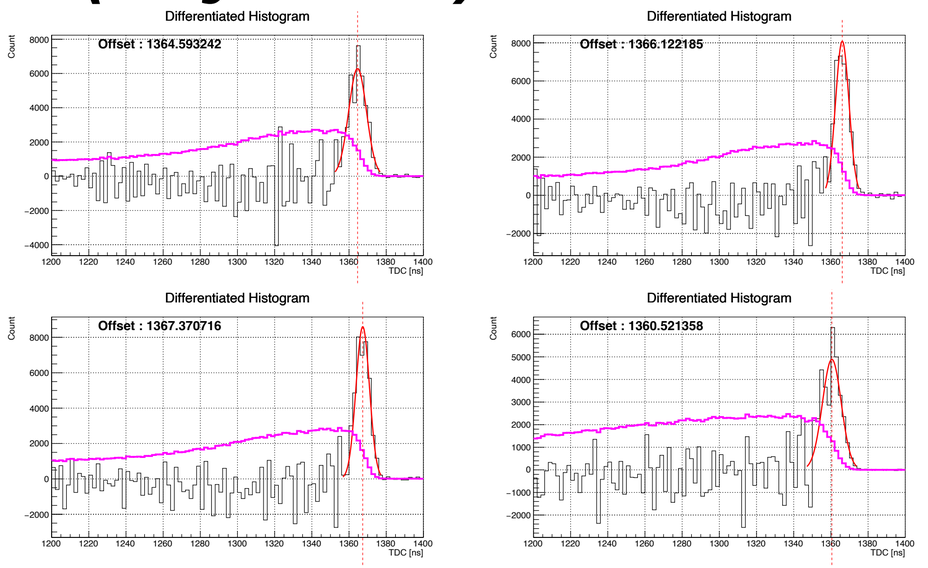




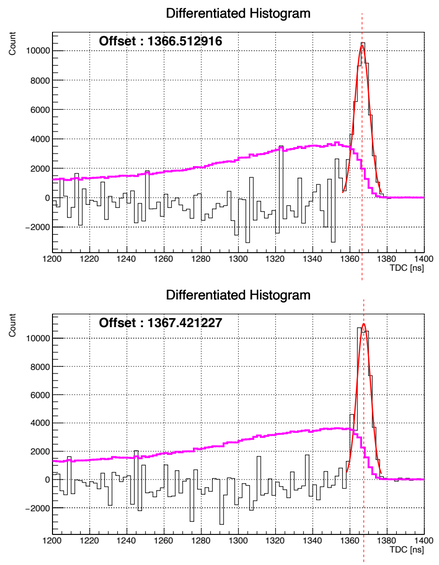
Determination of TDC offset (Layer0~4)



Layer0

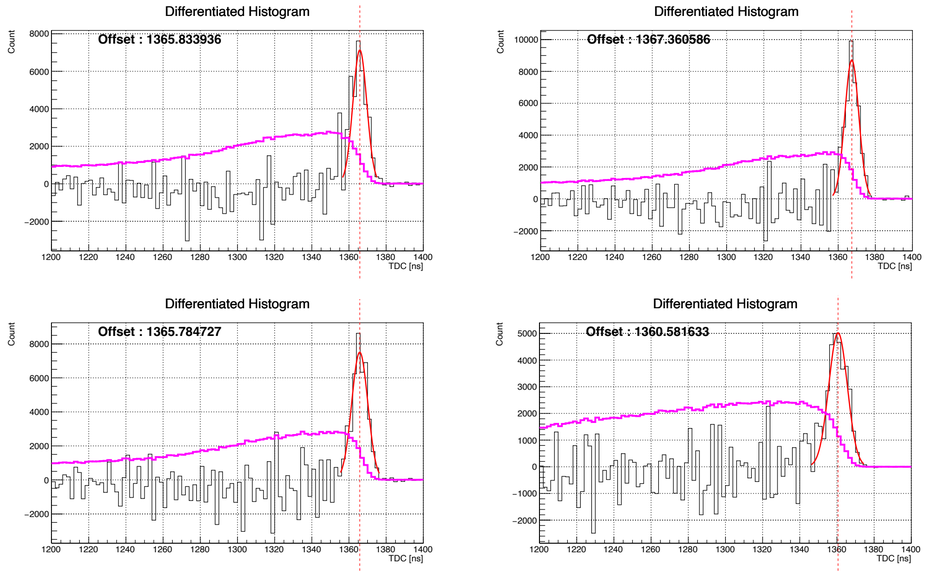
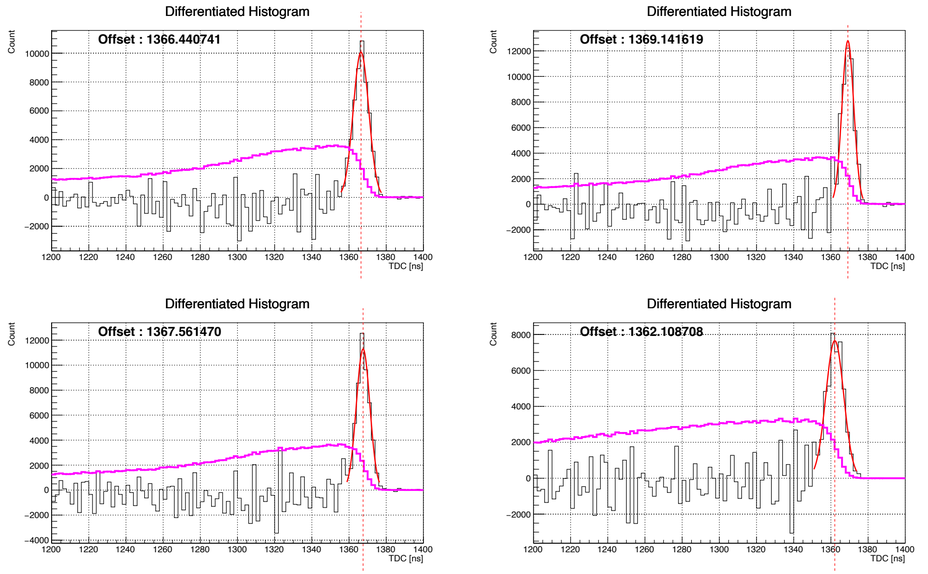
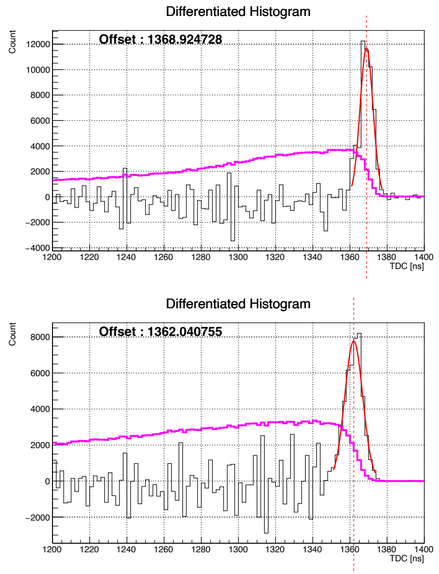


Layer1



Layer4

Layer2



Layer3