Status 2024-02-09

SPD Tracker group

February 9, 2024

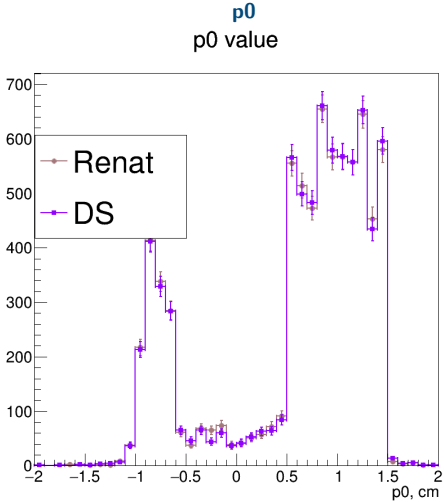
Contents

Tracking information

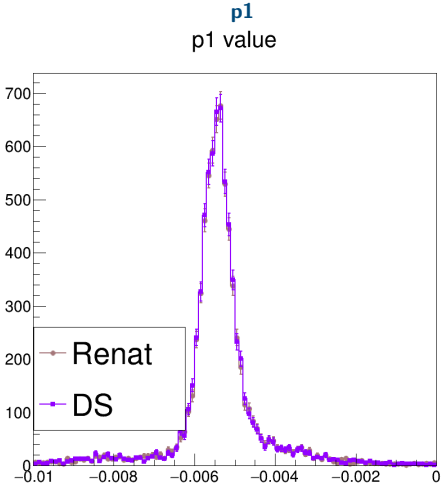
- Since end of 2022 we are using straw-stand software for:
  - Alignment (using linear 2-point fit)
  - Track reconstruction (using lsf)
- I created another procedure for fitting using pol1 LSF
  - Alignment information from straw-stand sw partially used
- While comparison with straw-stand sw I found:
  - There is no pol coefficient uncertainties
  - Used fitting with equal weights (no cluster position uncertainties used) !

Fit coefficients

p0



p1

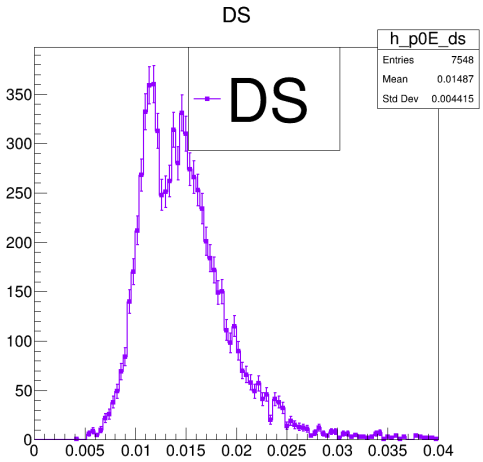


- There is no significant difference in values.
- All values in cm, for compatibility to straw-stand fit output. Will be changed to mm.

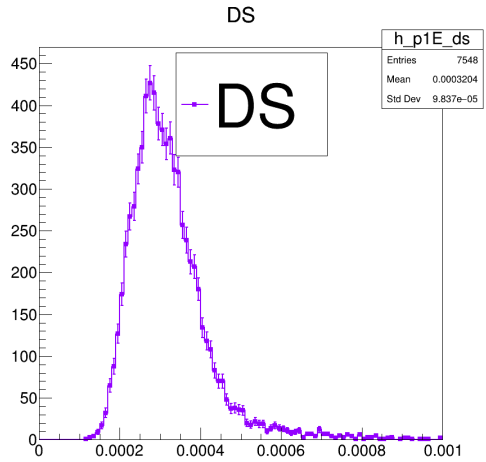
Fit coefficients uncertainties

Tracking was completed with uncertainty calculation:

p0 uncertainty

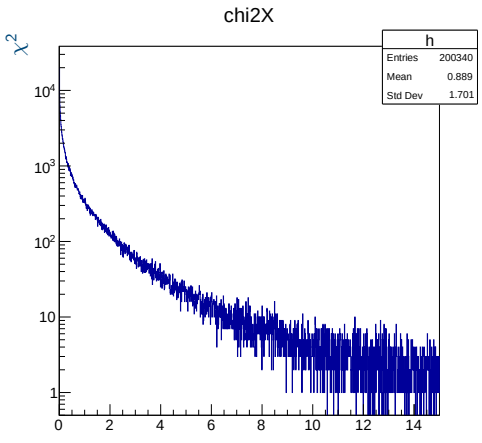


p1 uncertainty

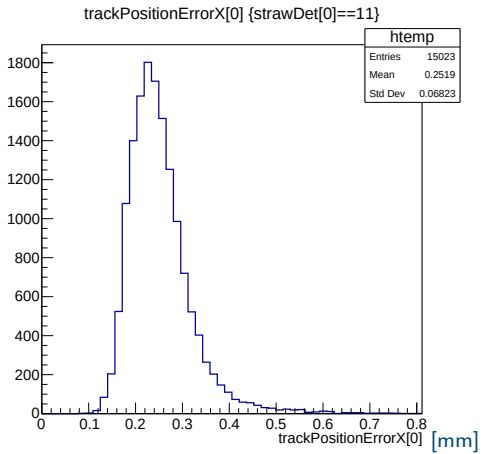


Chi2 and calculated coordinate uncertainty

Track χ^2



Calculated track uncertainty at 10mm straw



Seems, mean uncertainty are about 250μm.
Uncertainty calculated as propogated from pol1 parameters uncertainty.

Golden run list

Golden run list, TB-23-August

Two runs compared:

- TB-23-August-43 VMM, 3mV/fC, 25ns – μ rate: 22.9 *kHz*
- TB-23-August-108 TIGER – μ rate: 21.7 *kHz*

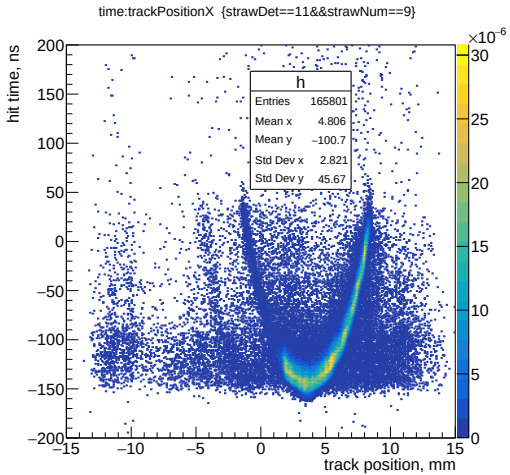
straw	Run TB-23-August-43: Rate (in-spill), Hz	Run TB-23-August-43: Rate (out-of-spill), Hz	Run TB-23-August-43: Rate with pseudotrack, Hz	Run TB-23-August-108: Rate (in-spill), Hz	Run TB-23-August-108: Rate (out-of-spill), Hz	Run TB-23-August-108: Rate with pseudotrack, Hz
10mm#9	4.2K	5.5	800	7.3K	3.5K	840
10mm#10	4.7K	6.5	1000	6.5K	600	370
20mm#4	5.1K	8	700	6.1K	2.8K	630
20mm#5	7K	8.5	1000	6.1K	3.6K	870
5mm#19	2.3K	3	600	2K	1.5	580
5mm#18	2.9K	36.5	600	2.1K	2.25	640
5mm#20	2.7K	9.5	400	**11K ?**	**18K ?**	420

We have compatible rates, regardless of the noise level ?

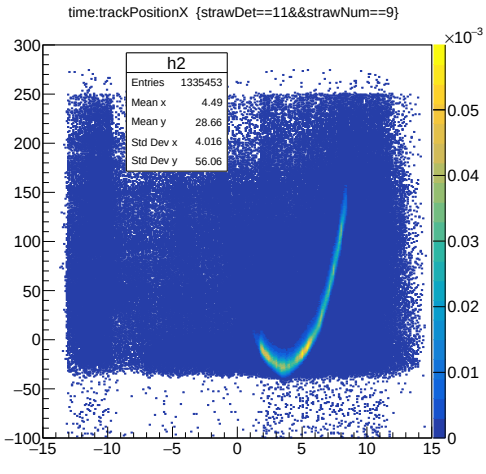
Golden run list, TB-23-August

Comparing 10mm straw #9 R(T) distribution
(scaled to tiger sci0 sum):

TB-23-August-43



TB-23-August-108



Golden run list, TB-23-July

Two runs compared:

- TB-23-July-69 VMM, 3mV/fC, 25ns – μ rate: 24 *kHz*
- TB-23-July-78 TIGER – μ rate: 22.5 *kHz*

straw	Run TB-23-July-69: Rate (in-spill), Hz	Run TB-23-July-69: Rate (out-of-spill), Hz	Run TB-23-July-69: Rate with pseudotrack, Hz	Run TB-23-July-78: Rate (in-spill), Hz	Run TB-23-July-78: Rate (out-of-spill), Hz	Run TB-23-July-78: Rate with pseudotrack, Hz
10mm#10	2.4K	12	620	6.7K	3.6K	660
10mm#11	?	5.75	610	5.9K	147	730
10mm#12	3.9K	4	450	5.3K	980	440
10mm#13	570	1	30	5.2K	10	210
20mm#4	8.8K	15.25	440	5.6K	73	260
20mm#5	9.0K	12	1K	4.8K	62	640
20mm#6	3.7K	8.25	380	4.9K	23	570
20mm#7	6.8K	194.75	220	4.7K	10	140
5mm#19	2.4K	2	320	4.8K	86.75	510
5mm#20	2.6K	13.5	350	4.2K	2.2K	450
5mm#21	150	0.5	15	3.9K	98	430
5mm#22	3.9K	52.75	430	3.7K	670	410
5mm#23	2.5K	4.75	240	4.8K	5.6K	290

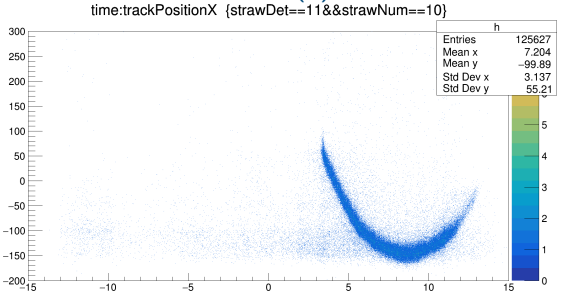
Still, looks like compatible rates?

X-talks and mis-merging

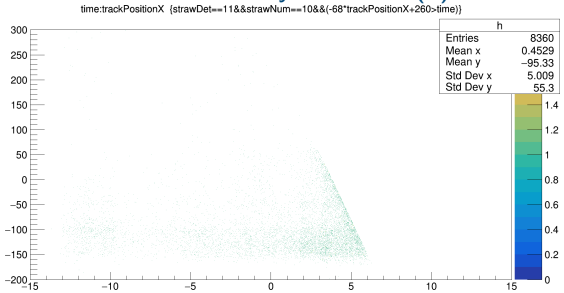
Mis-merged hits

Run TB-23-August-43 (VMM, 3 mV/fC && 25ns, 45K gain) used:

Full R(T)



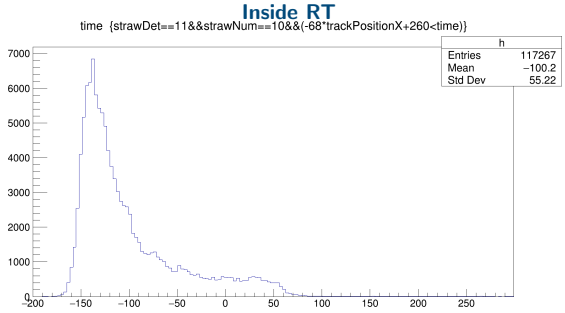
Events definately outside of R(T)

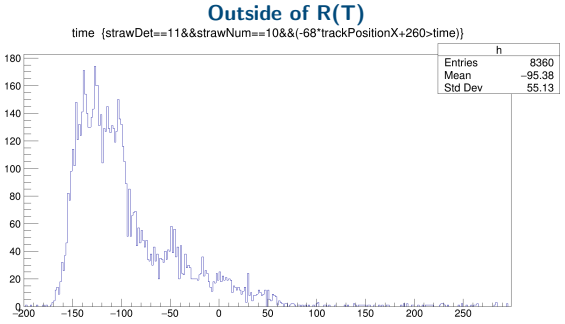


- We can see a about 6.6% of hits outside of R(T).
- From noise rate, we can expect about 0.1% events from noise.
- R(T) data splitted to two parts: outside of RT (right plot) and with RT. (simple linear cut used)

Mis-merged hits

Time distribution of hits inside and outside RT :

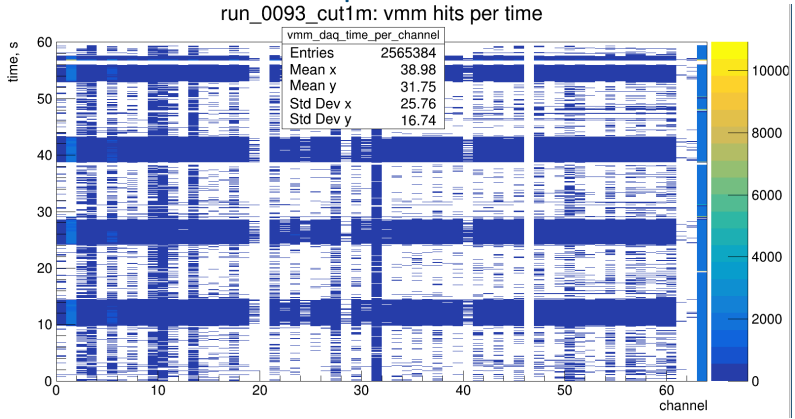




- Time distribution looks similar
- It seems, that events are the wrongly merged events
- Further check needed

Mis-merged hits

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

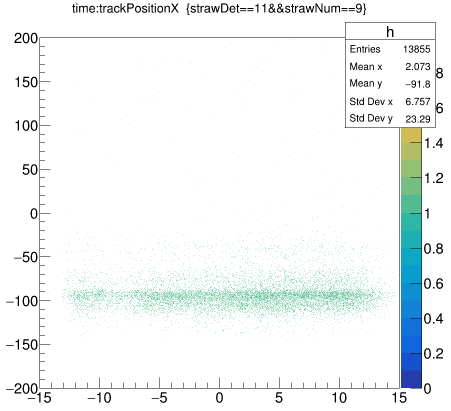


- We can see spill structure even on channels with HV OFF
- Spill rate on channels without HV about 20 times larger then out-of-spill rate (full table in backup)

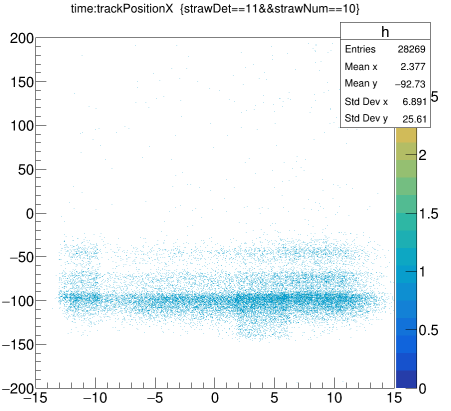
10mm straw without HV

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

10mm straw #9 RT



10mm straw #10 RT

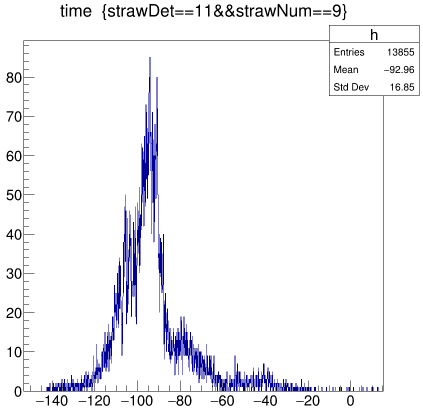


- No normal R(T) structure
- Rate is below that the in-spill channel rate

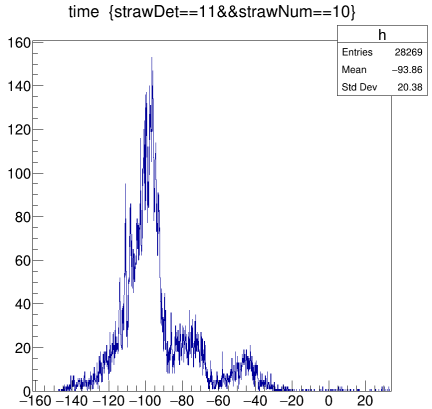
10mm straw without HV

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

10mm straw #9 time distribution



10mm straw #10 time distribution

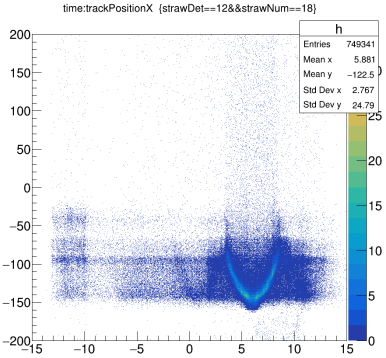


Also, it isn't looks like x-talks.

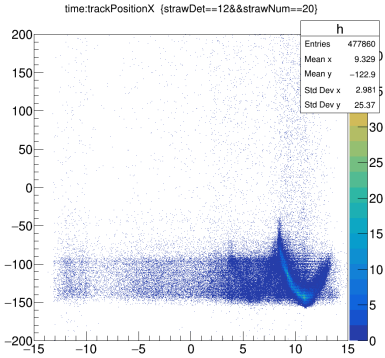
5mm straw X-Talks

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

5mm straw #18 RT



5mm straw #20 RT

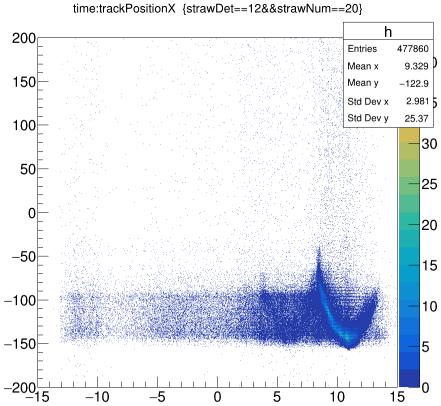


- There is small amount of X-Talks from straw 18 (channel 31) to straw 20 (channel 27)
- Also, we see X-talks from straw 16 (channel 35) to straw 18 (channel 31)
- X-talks are less then 7% of full straw 20 RT
- X-talks from straw 18 to straw 20: less then 4.5% of straw 18 hits (33.8K events from 749.3K events on straw 18)

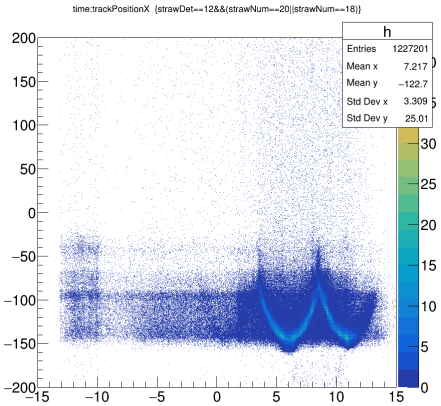
5mm straw X-Talks

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

5mm straw #20 RT



5mm straws #18 and #20 together



Definately, X-talks

Backup slides

Error propogation

$$f(x) = p_0 + p_1 \cdot x$$

$$\Delta f(x0) = \sqrt{(\Delta p_0)^2 + (\Delta(p_1 x))^2}$$

$$\Delta(p_1 x) = (p_1 x) \cdot \sqrt{\left(\frac{\Delta p_1}{p_1}\right)^2 + \left(\frac{\Delta x}{x}\right)^2} = \left|\frac{\Delta p_1}{p_1}\right| \cdot (p_1 x)$$

Golden run list, TB-23-July and TB-23-August

run	asic	μ rate(in spill), Hz	TIGER Sci0 rate(in spill), Hz	VMM Sci0 rate(in spill), Hz	TIGER Sci0 rate(out of spill), Hz	VMM Sci0 rate(out of spill), Hz	Pseudotrack rate, Hz
TB-23-August-43	vmm	22.9K	19.1K	16.6K	0.25	0.5	2K
TB-23-August-108	tiger	21.7K	19.6K	0	2K	1.9K	90
TB-23-July-69	vmm	24K	19.2K	17.5K	0	0.5	1.6K
TB-23-July-78	tiger	22.5K	19K		0		1.7K

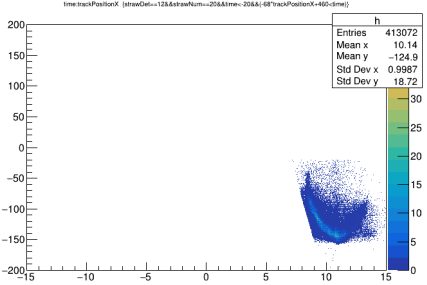
TB-23-August-65 straw rates

straw	Rate (in-spill), Hz	Rate in spill, ratio to 5mm#19, %	Rate (out-of-spill), Hz	Rate with pseudotrack, Hz	Rate with pseudotrack, ratio to 5mm#19, %
10mm#9	75	3.13	0.5	12.9	2.08
10mm#10	189.5	7.90	1.25	26	4.20
20mm#3	8.75	0.36	0.5	2.9	0.47
20mm#4	34.5	1.44	0.25	7.9	1.27
20mm#5	98.5	4.10	1	16.25	2.62
5mm#19	2.4K	**1**	2.75	620	**1**
5mm#18	2.7K	112.5	29	650	104.84
5mm#20	2.7K	112.5	6.75	410	66.13

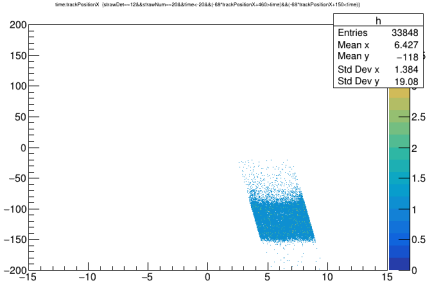
5mm straw X-Talks

Run TB-23-August-65 (VMM, **+0.68Bar**, 3 mV/fC && 25ns, 45K gain only on 5mm) used:

5mm straw #20 RT region



5mm straws #18 region on #20 RT



- X-talks are less then 7% of full straw 20 RT
- X-talks from straw 18 to straw 20: less then 4.5% of straw 18 hits (33.8K events from 749.3K events on straw 18)