

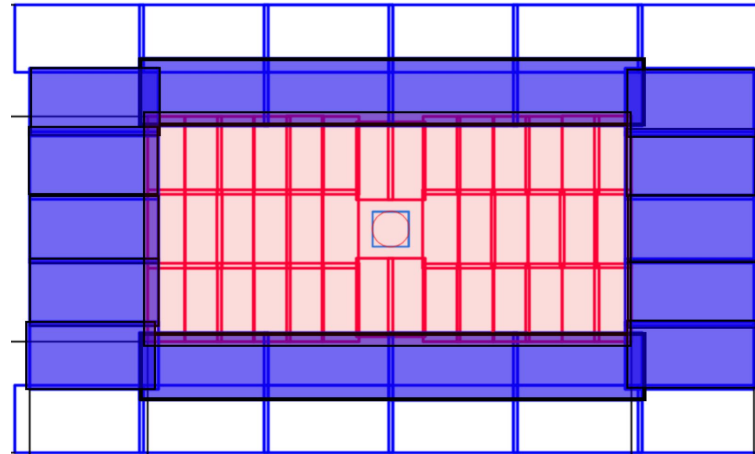
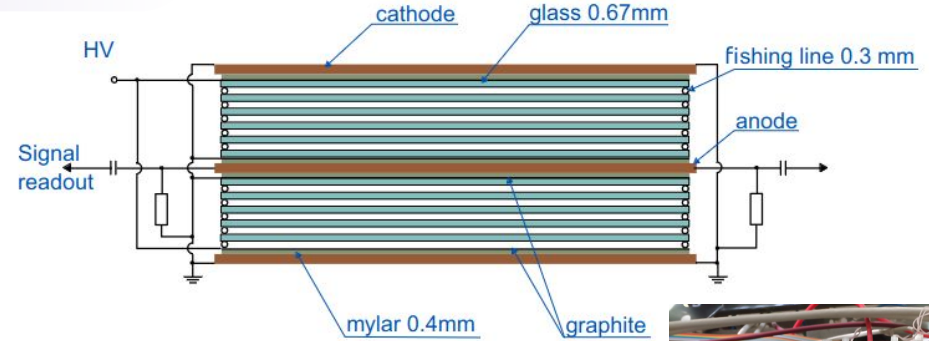
# New data flow processing for TOF700

Irina Zhavoronkova  
Mikhail Rummyantsev

# TOF700 system

Active area (big; small)	30×56 cm <sup>2</sup> ; 35×16 cm <sup>2</sup>
Strips per MRPC	16; 32
Number of MRPCs (TDR)	30; 40
Present	18; 41
Total active area (TDR)	3.15×2.01 m <sup>2</sup>
Present	3.15×1.56 m <sup>2</sup>
FEE channels total	3200
The MRPC time resolution	60ps
Efficiency of the MRPC	>95 %

TOF700 mRPC cross section

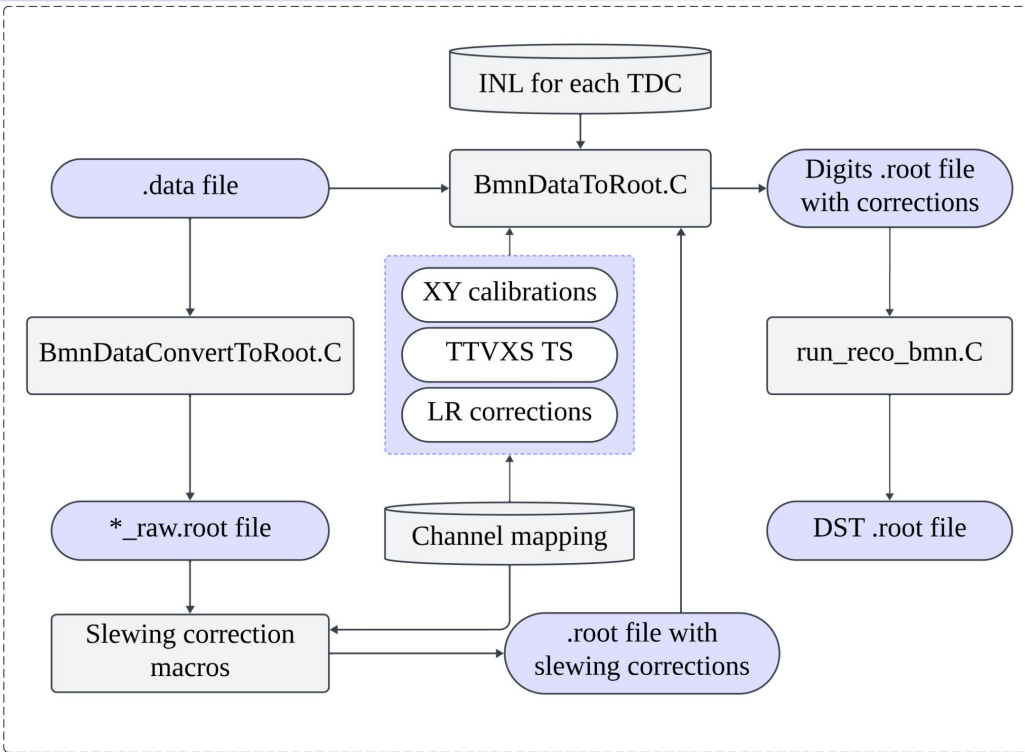


TDR TOF700 scheme. Planes filled with color are present in the system at this point



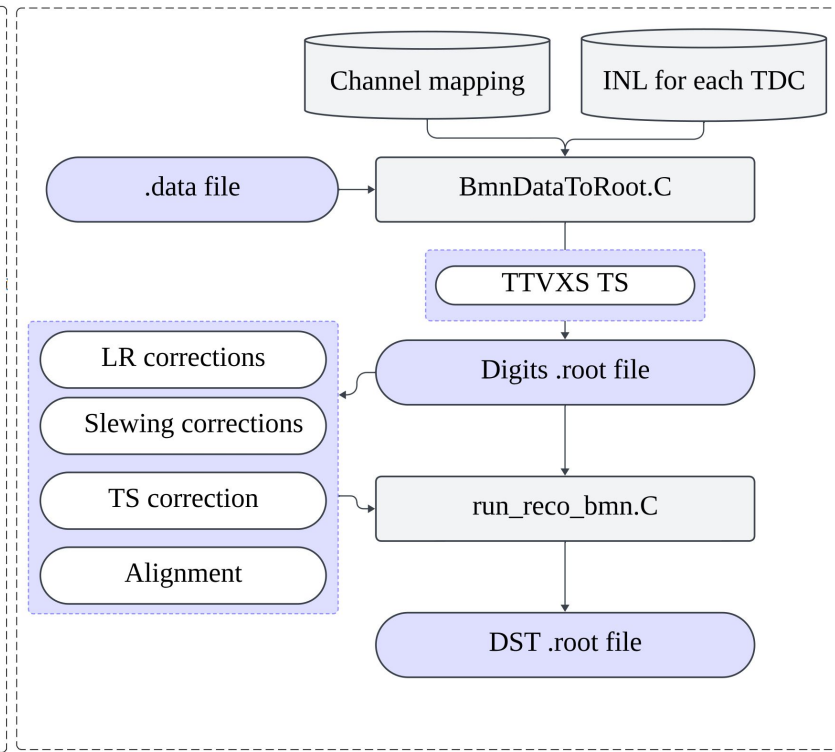
Small TOF700 mRPC

# Data flows



Old data flow for TOF700

“digits” have all the time corrections: both for electronics and detector physics features



New data flow for TOF700 DST production

“digits” have electronics corrections only  
And hits account for the physics of detectors

```
bmnroot > input > ≡ TOF700_map_period_8.txt
```

```
1 ncrates
2 4
3
4 crate TTVXSID
5 0 0CD9B71A
6 1 0CD9141F
7 2 0A9FE645
8 3 0AA0C505
9
10 nslots
11 51
```

```
67 nchambers
68 59
69
70 chamber chamberID
71 15 16.2
72 1 28.1
73 2 3.1
74 16 17.2
75 4 29.1
76 5 4.1
77 17 18.2
78 7 30.1
79 8 5.1
80 18 19.2
81 10 31.1
```

```
13 crate slot devsernum dnlname dnfile
14 0 0 0AA1186F 0 TDC72VXS-0AA1-186F.txt
15 0 7 076D439B 3 TDC64VHLE-076D-439B.ini
16 0 8 076D4EC3 3 TDC64VHLE-076D-4EC3.ini
17 0 9 076D2C3D 3 TDC64VHLE-076D-2C3D.ini
18 0 10 0611A227 3 TDC64VHLE-0611-A227.ini
19 0 11 0611D05F 3 TDC64VHLE-0611-D05F.ini
20 0 12 0611DFD2 3 TDC64VHLE-0611-DFD2.ini
21 0 13 076CB905 3 TDC64VHLE-076C-B905.ini
22 0 14 076CB8F5 3 TDC64VHLE-076C-B8F5.ini
23 0 15 076C9F94 3 TDC64VHLE-076C-9F94.ini
24 0 16 076C9E50 3 TDC64VHLE-076C-9E50.ini
25 0 17 06E90439 3 TDC64VHLE-06E9-0439.ini
26 1 5 0611A24C 3 TDC64VHLE-0611-A24C.ini
27 1 6 06123539 3 TDC64VHLE-0612-3539.ini
28 1 7 0611C0BE 3 TDC64VHLE-0611-C0BE.ini
29 1 8 0611D047 3 TDC64VHLE-0611-D047.ini
30 1 9 0611A24B 3 TDC64VHLE-0611-A24B.ini
31 1 10 06E9042C 3 TDC64VHLE-06E9-042C.ini
32 1 11 076C9E5B 3 TDC64VHLE-076C-9E5B.ini
33 1 12 06E90430 3 TDC64VHLE-06E9-0430.ini
34 1 13 076CBA7F 3 TDC64VHLE-076C-BA7F.ini
35 1 14 07A91E93 3 TDC64VHLE-07A9-1E93.ini
36 1 15 07A91E90 3 TDC64VHLE-07A9-1E90.ini
37 1 16 07A91E87 3 TDC64VHLE-07A9-1E87.ini
```

```
131 crate slot chamber cable
132 0 7 53 1
133 0 8 54 1
134 0 8 55 2
135 0 9 42 2
136 0 10 43 2
137 0 9 44 1
138 0 10 21 1
139 0 11 9 0
140 0 12 14 0
141 0 13 15 0
142 0 14 17 0
143 0 15 19 0
144 0 16 16 0
145 0 17 18 0
146 1 5 22 1
147 1 5 23 2
148 1 6 20 0
149 1 7 3 0
150 1 8 0 0
151 1 9 6 0
152 1 10 13 0
153 1 11 7 0
154 1 12 1 0
```

How TOF700 mapping used to look like...

The existing map consists of 4 parts, referring to and implying one another in a unordered way



```
bmnroot > input > ≡ TOF700_map_period_8.txt
```

```
1 ncrates
2 4
3
4 crate TTVXSID
5 0 0CD9B71A
6 1 0CD9141F
7 2 0A9FE645
8 3 0AA0C505
9
10 nslots
11 51
```

```
67 nchambers
68 59
69
70 chamber chamberID
71 15 16.2
72 1 28.1
73 2 3.1
74 16 17.2
75 4 29.1
76 5 4.1
77 17 18.2
78 7 30.1
79 8 5.1
80 18 19.2
81 10 31.1
```

13	crate	slot	devsernum	dnltype	dnlfile
14	0	0	0AA1186F	0	TDC72VXS-0AA1-186F.txt
15	0	7	076D439B	3	TDC64VHLE-076D-439B.ini
16	0	8	076D4EC3	3	TDC64VHLE-076D-4EC3.ini
17	0	9	076D2C3D	3	TDC64VHLE-076D-2C3D.ini
18	0	10	0611A227	3	TDC64VHLE-0611-A227.ini
19	0	11	0611D05F	3	TDC64VHLE-0611-D05F.ini
20	0	12	0611DFD2	3	TDC64VHLE-0611-DFD2.ini
21	0	13	076CB905	3	TDC64VHLE-076C-B905.ini
22	0	14	076CB8F5	3	TDC64VHLE-076C-B8F5.ini
23	0	15	076C9F94	3	TDC64VHLE-076C-9F94.ini
24	0	16	076C9E50	3	TDC64VHLE-076C-9E50.ini
25	0	17	06E90439	3	TDC64VHLE-06E9-0439.ini
26	1	5	0611A24C	3	TDC64VHLE-0611-A24C.ini
27	1	6	06123539	3	TDC64VHLE-0612-3539.ini
28	1	7	0611C0BE	3	TDC64VHLE-0611-C0BE.ini
29	1	8	0611D047	3	TDC64VHLE-0611-D047.ini
30	1	9	0611A24B	3	TDC64VHLE-0611-A24B.ini
31	1	10	06E9042C	3	TDC64VHLE-06E9-042C.ini
32	1	11	076C9E5B	3	TDC64VHLE-076C-9E5B.ini
33	1	12	06E90430	3	TDC64VHLE-06E9-0430.ini
34	1	13	076CBA7F	3	TDC64VHLE-076C-BA7F.ini
35	1	14	07A91E93	3	TDC64VHLE-07A9-1E93.ini
36	1	15	07A91E90	3	TDC64VHLE-07A9-1E90.ini
37	1	16	07A91E87	3	TDC64VHLE-07A9-1E87.ini

131	crate	slot	chamber	cable
132	0	7	53	1
133	0	8	54	1
134	0	8	55	2
135	0	9	42	2
136	0	10	43	2
137	0	9	44	1
138	0	10	21	1
139	0	11	9	0
140	0	12	14	0
141	0	13	15	0
142	0	14	17	0
143	0	15	19	0
144	0	16	16	0
145	0	17	18	0
146	1	5	22	1
147	1	5	23	2
148	1	6	20	0
149	1	7	3	0
150	1	8	0	0
151	1	9	6	0
152	1	10	13	0
153	1	11	7	0
154	1	12	1	0

## The updated mapping

```
bmnroot > input > ≡ TOF701_PlaceMap_RUN8.txt
```

```
1 0CD9B71A 7 076D439B
2 0CD9B71A 8 076D4EC3
3 0CD9B71A 9 076D2C3D
4 0CD9B71A 10 0611A227
5 0CD9B71A 11 0611D05F
6 0CD9B71A 12 0611DFD2
7 0CD9B71A 13 076CB905
8 0CD9B71A 14 076CB8F5
9 0CD9B71A 15 076C9F94
10 0CD9B71A 16 076C9E50
11 0CD9B71A 17 06E90439
12 0CD9141F 5 0611A24C
13 0CD9141F 6 06123539
14 0CD9141F 7 0611C0BE
15 0CD9141F 8 0611D047
16 0CD9141F 9 0611A24B
17 0CD9141F 10 06E9042C
18 0CD9141F 11 076C9E5B
19 0CD9141F 12 06E90430
20 0CD9141F 13 076CBA7F
```

includes 2 parts as 2 files. They are explicit and easy to understand.

```
bmnroot > input > ≡ TOF700_map_period_8.txt
```

```
1 ncrates
2 4
3
4 crate TTVXSID
5 0 0CD9B71A
6 1 0CD9141F
7 2 0A9FE645
8 3 0AA0C505
9
10 nslots
11 51
```

```
67 nchambers
68 59
69
70 chamber chamberID
71 15 16.2
72 1 28.1
73 2 3.1
74 16 17.2
75 4 29.1
76 5 4.1
77 17 18.2
78 7 30.1
79 8 5.1
80 18 19.2
81 10 31.1
```

```
13 crate slot devsernum dnlname dnfile
14 0 0 0AA1186F 0 TDC72VXS-0AA1-186F.txt
15 0 7 076D439B 3 TDC64VHLE-076D-439B.ini
16 0 8 076D4EC3 3 TDC64VHLE-076D-4EC3.ini
17 0 9 076D2C3D 3 TDC64VHLE-076D-2C3D.ini
18 0 10 0611A227 3 TDC64VHLE-0611-A227.ini
19 0 11 0611D05F 3 TDC64VHLE-0611-D05F.ini
20 0 12 0611DFD2 3 TDC64VHLE-0611-DFD2.ini
21 0 13 076CB905 3 TDC64VHLE-076C-B905.ini
22 0 14 076CB8F5 3 TDC64VHLE-076C-B8F5.ini
23 0 15 076C9F94 3 TDC64VHLE-076C-9F94.ini
24 0 16 076C9E50 3 TDC64VHLE-076C-9E50.ini
25 0 17 06E90439 3 TDC64VHLE-06E9-0439.ini
26 1 5 0611A24C 3 TDC64VHLE-0611-A24C.ini
27 1 6 06123539 3 TDC64VHLE-0612-3539.ini
28 1 7 0611C0BE 3 TDC64VHLE-0611-C0BE.ini
29 1 8 0611D047 3 TDC64VHLE-0611-D047.ini
30 1 9 0611A24B 3 TDC64VHLE-0611-A24B.ini
31 1 10 06E9042C 3 TDC64VHLE-06E9-042C.ini
32 1 11 076C9E5B 3 TDC64VHLE-076C-9E5B.ini
33 1 12 06E90430 3 TDC64VHLE-06E9-0430.ini
34 1 13 076CBA7F 3 TDC64VHLE-076C-BA7F.ini
35 1 14 07A91E93 3 TDC64VHLE-07A9-1E93.ini
36 1 15 07A91E90 3 TDC64VHLE-07A9-1E90.ini
37 1 16 07A91E87 3 TDC64VHLE-07A9-1E87.ini
```

```
131 crate slot chamber cable
132 0 7 53 1
133 0 8 54 1
134 0 8 55 2
135 0 9 42 2
136 0 10 43 2
137 0 9 44 1
138 0 10 21 1
139 0 11 9 0
140 0 12 14 0
141 0 13 15 0
142 0 14 17 0
143 0 15 19 0
144 0 16 16 0
145 0 17 18 0
146 1 5 22 1
147 1 5 23 2
148 1 6 20 0
149 1 7 3 0
150 1 8 0 0
151 1 9 6 0
152 1 10 13 0
153 1 11 7 0
154 1 12 1 0
```

## The updated mapping

```
bmnroot > input > ≡ TOF701_PlaceMap_RUN8.txt
```

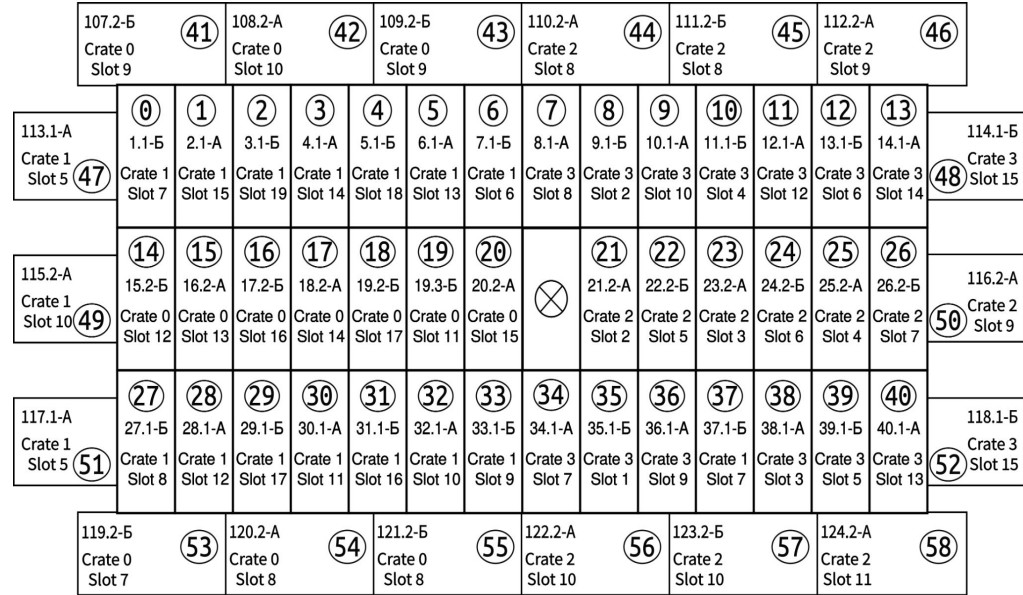
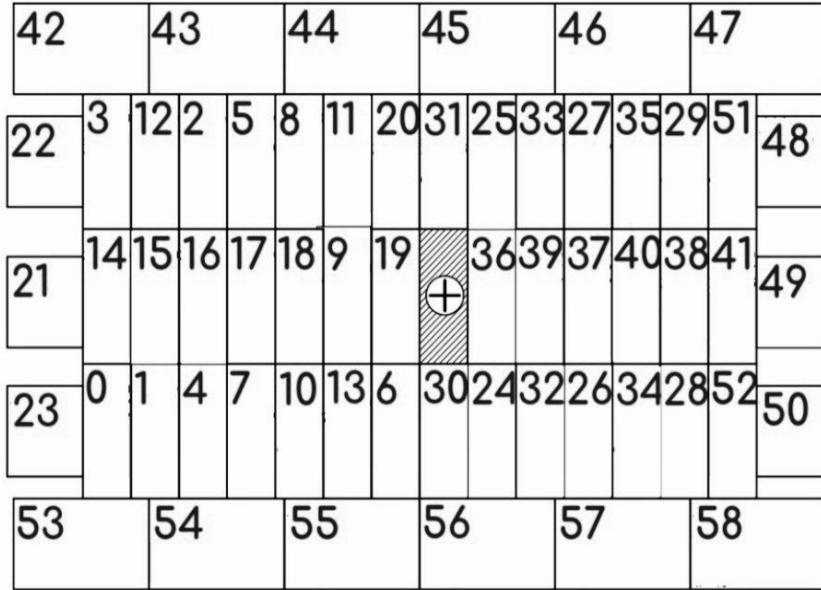
```
1 0CD9B71A 7 076D439B
2 0CD9B71A 8 076D4EC3
3 0CD9B71A 9 076D2C3D
4 0CD9B71A 10 0611A227
5 0CD9B71A 11 0611D05F
6 0CD9B71A 12 0611DFD2
7 0CD9B71A 13 076CB905
8 0CD9B71A 14 076CB8F5
9 0CD9B71A 15 076C9E94
```

```
bmnroot > input > ≡ TOF701_StripMap_RUN8.txt
```

```
1 0611C0BE 0 0 0 L
2 0611C0BE 1 0 1 L
3 0611C0BE 2 0 2 L
4 0611C0BE 3 0 3 L
5 0611C0BE 4 0 4 L
6 0611C0BE 5 0 5 L
7 0611C0BE 6 0 6 L
8 0611C0BE 7 0 7 L
9 0611C0BE 8 0 8 L
10 0611C0BE 9 0 9 L
11 0611C0BE 10 0 10 L
12 0611C0BE 11 0 11 L
13 0611C0BE 12 0 12 L
14 0611C0BE 13 0 13 L
15 0611C0BE 14 0 14 L
16 0611C0BE 15 0 15 L
17 0611C0BE 16 0 0 R
18 0611C0BE 17 0 1 R
19 0611C0BE 18 0 2 R
20 0611C0BE 19 0 3 R
```

# TOF700 layout scheme

S. Merts



Old scheme of TOF700 system

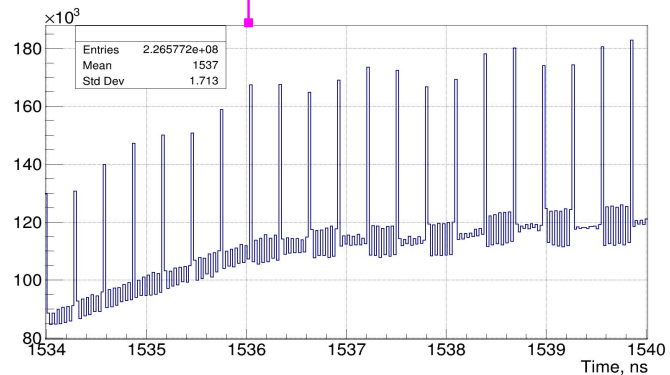
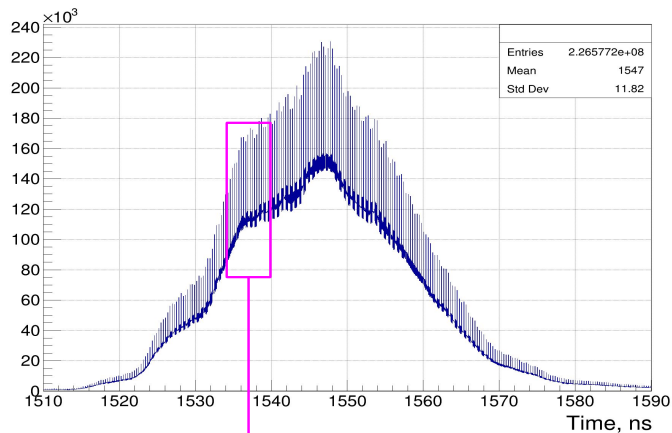
Plane numbers in the scheme do not match IDs  
in the ROOT geometry

New scheme of TOF700 system

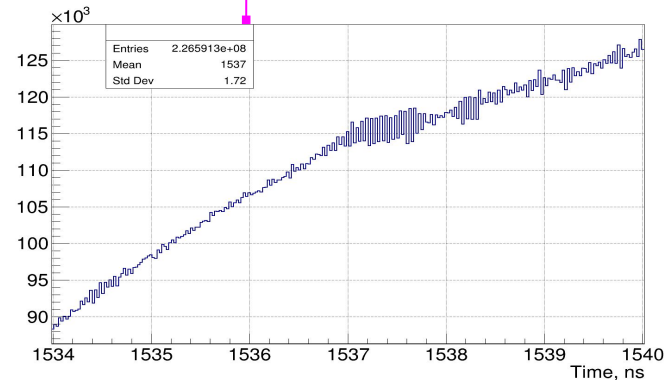
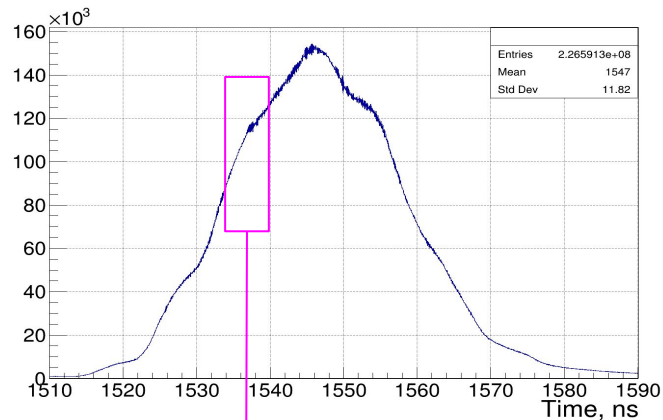
Plane IDs in the scheme **do** match IDs in the  
ROOT geometry

# Integral Non-Linearity correction

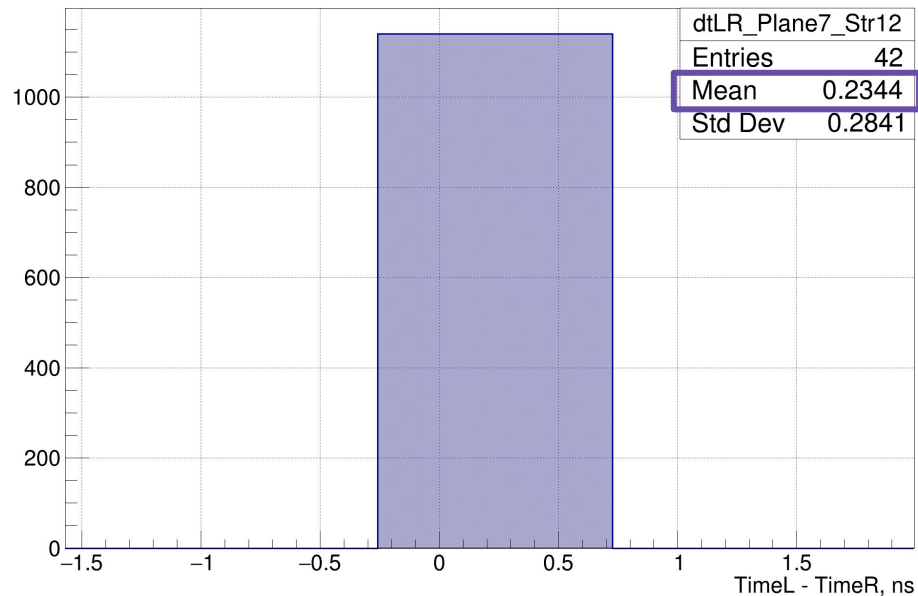
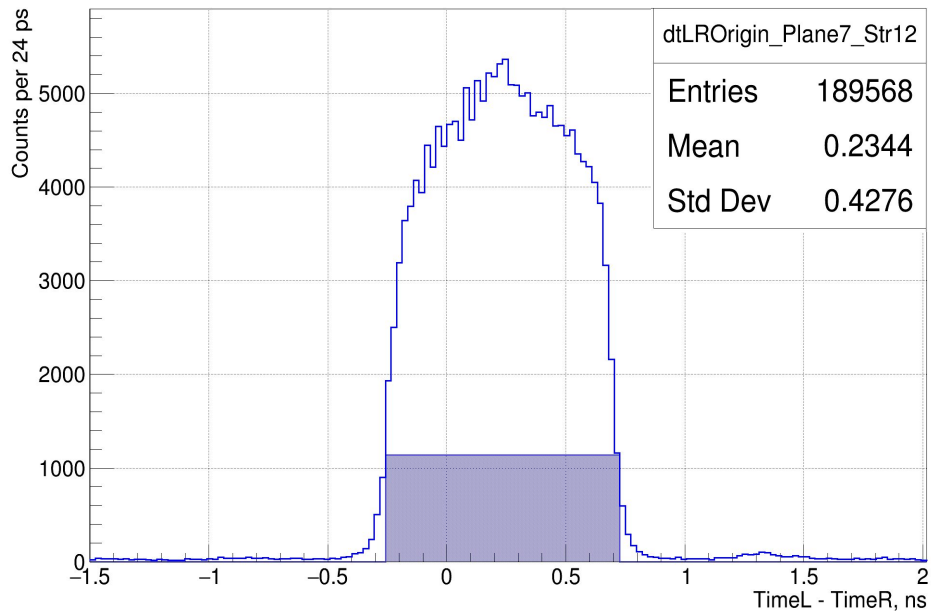
before



after



# Cable Length correction



```
bmnroot > input > ≡ TOF701_LRCorr_RUN8.dat
```

1	Plane	Strip	Mean
2	=====		
3	0	0	0
4	0	1	-0.210937
5	0	2	-0.128906
6	0	3	-0.175781
7	0	4	-0.0585938
8	0	5	-0.175781

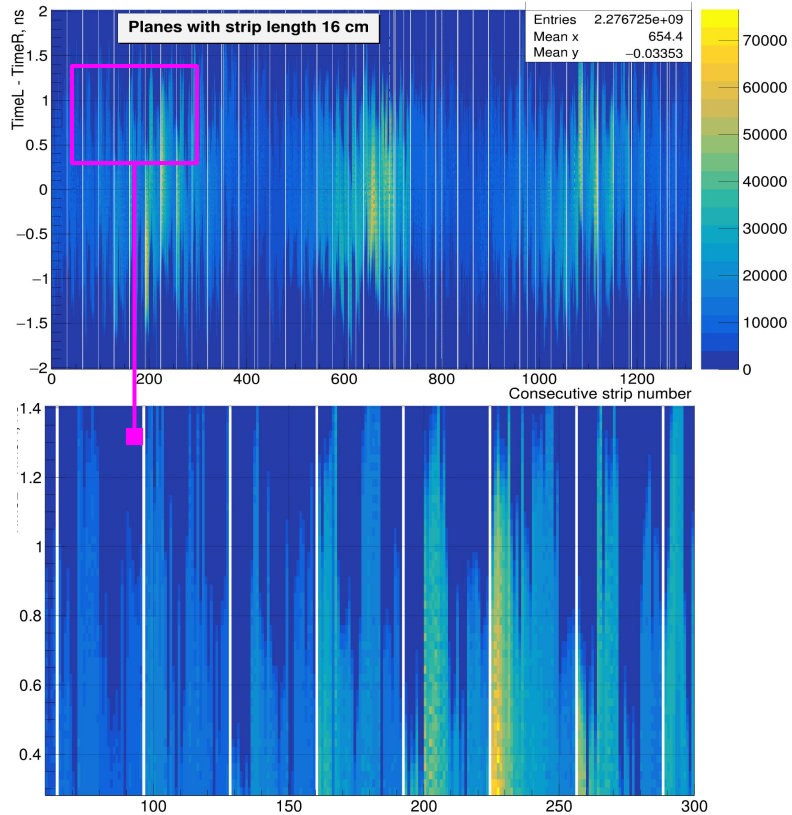
```
bmnroot > input > ≡ TOF701_LRCorr_RUN8.dat
```

234	7	7	0.234375
235	7	8	0.046875
236	7	9	-0.046875
237	7	10	0.0585937
238	7	11	-0.128906
239	7	12	0.234375
240	7	13	0.0351563

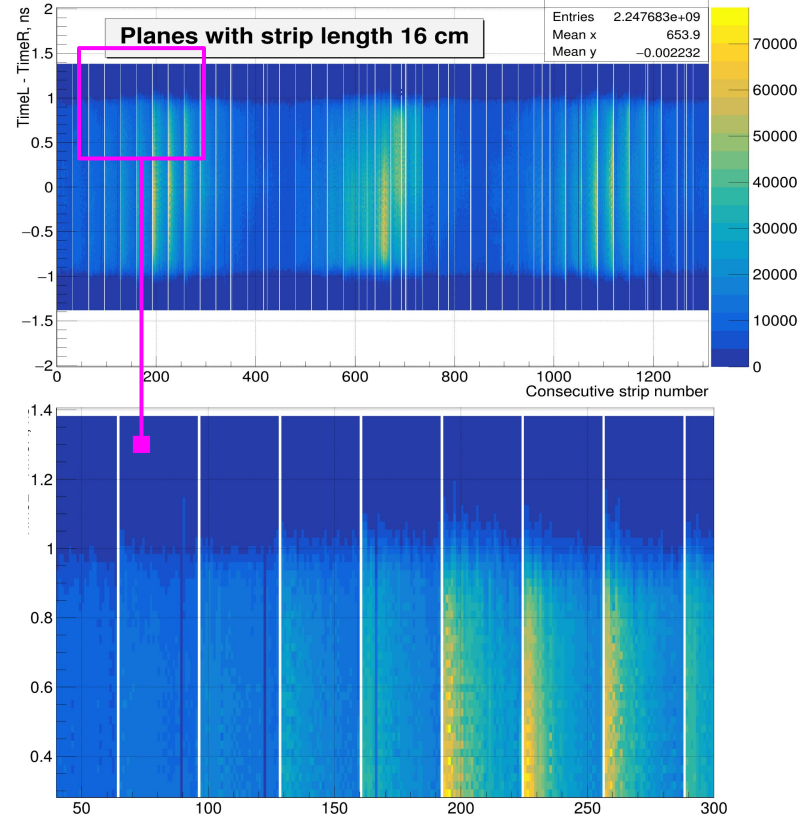


# Cable Length Correction

before



after



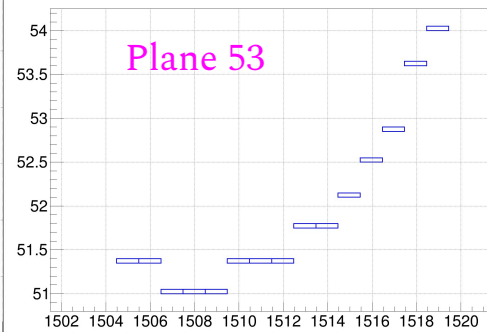
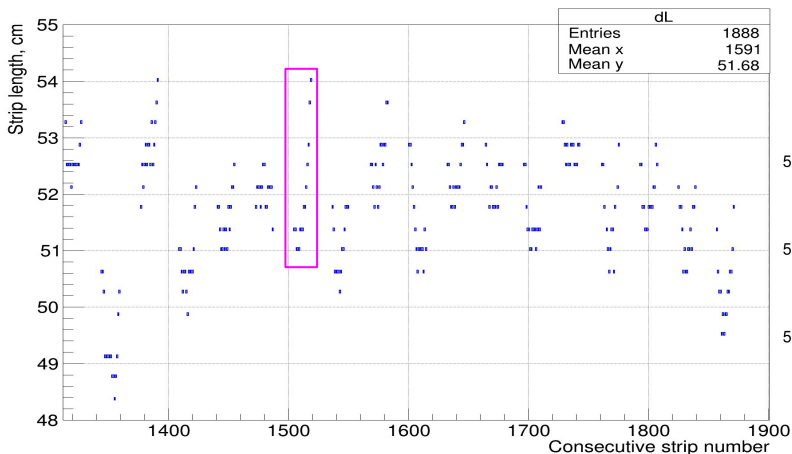
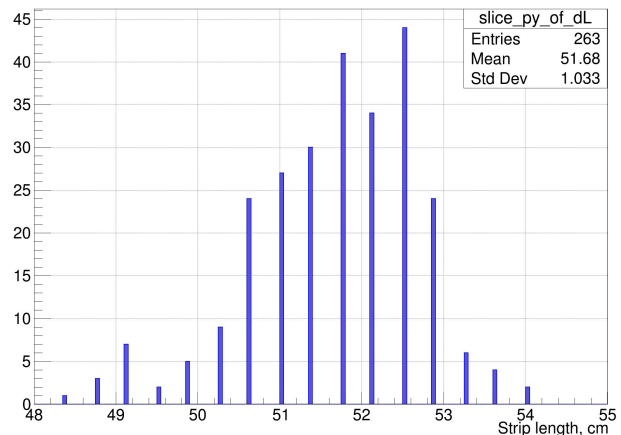
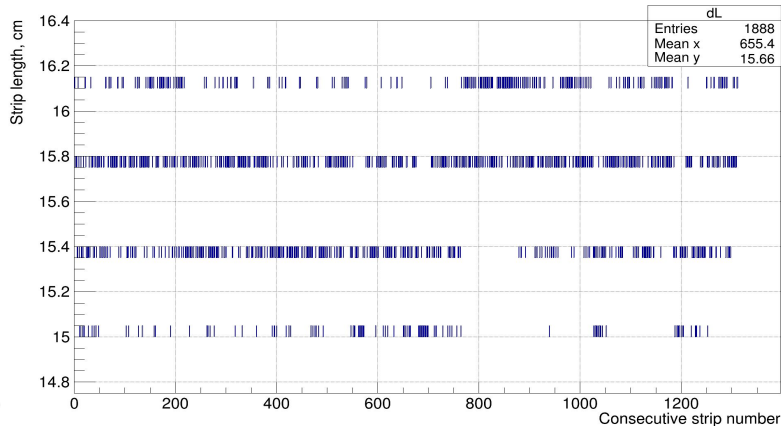
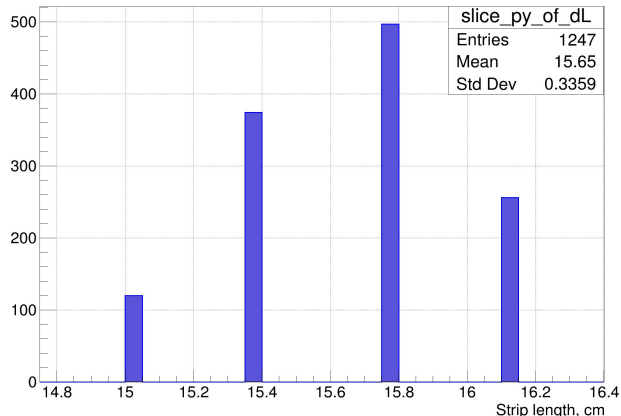
# Cable Length Correction

$$dL = \frac{TimeL - TimeR}{SignalVelocity}$$

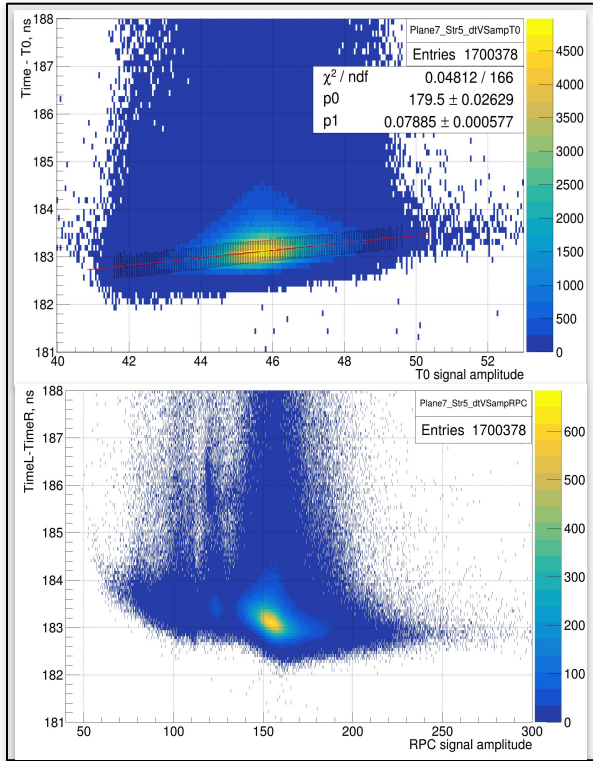
$$SignalVelocity = 0.0625 \text{ ns/cm}$$

For “short” strips reconstructed length is expected to be less 16 cm - presumably due to uneven conductive coating on the edges of the active area of planes.

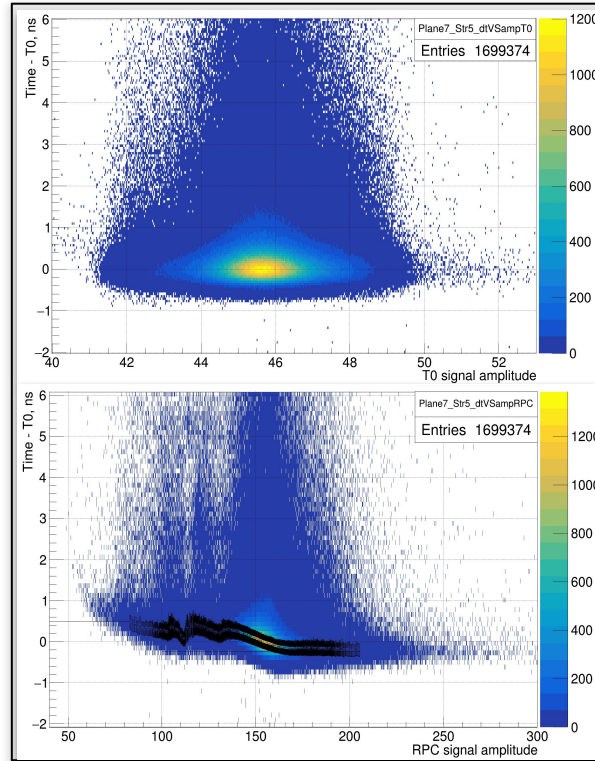
For “long” strips reconstructed length varies a lot.



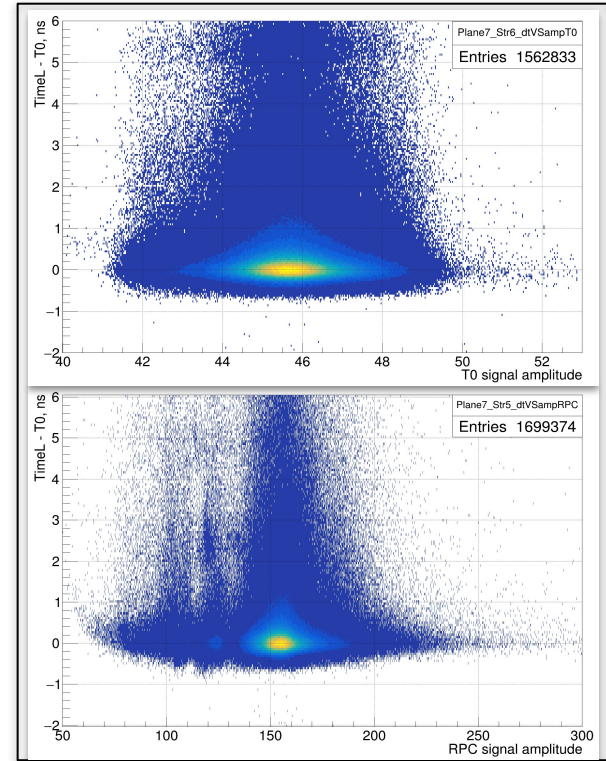
# Slewing Correction



before slewing correction



after T0 slewing correction



after T0&RPC slewing correction

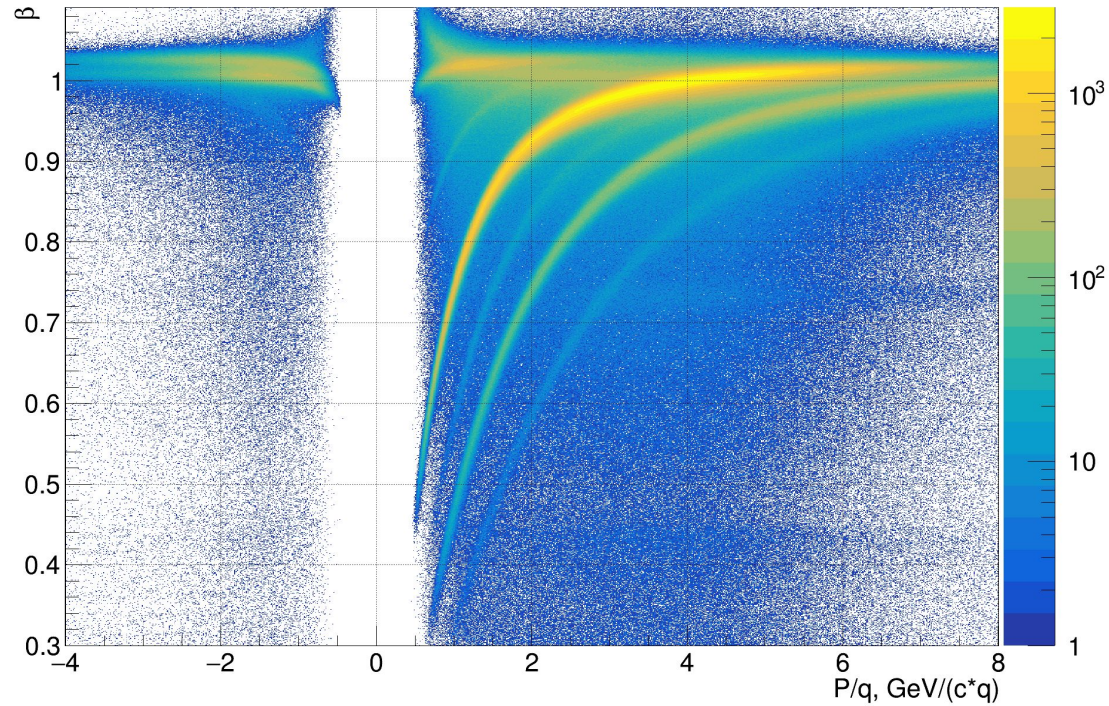


# Time Shift Correction

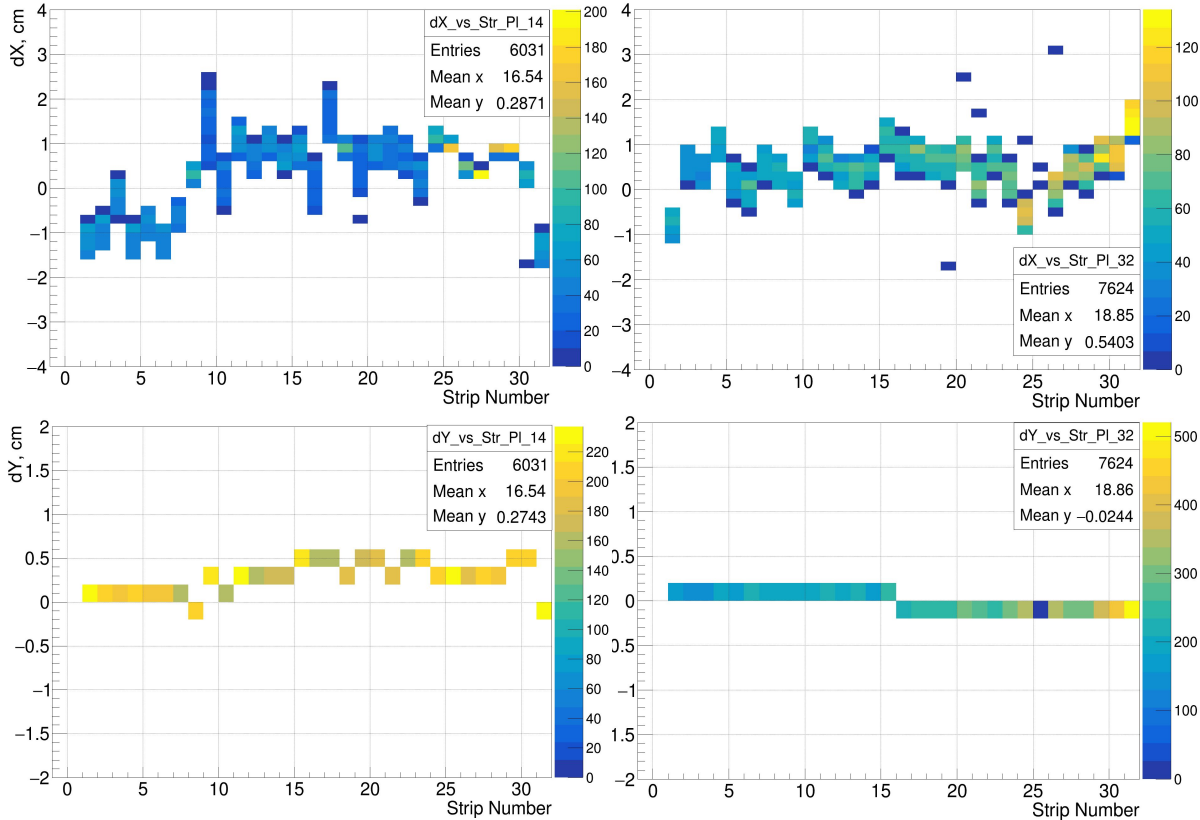
Step 1. Time shift as time of flight of particle with  $\beta \approx 1$ :

$$TS_{strip} = \frac{((X,Y,Z)_{strip} - (X,Y,Z)_{target})}{c}$$

Step 2. Time shift for protons from  $\beta$ -p/q plot



# Hit coordinates comparison



$$dX = X_{\text{hit.NEW}} - X_{\text{hit.DST}}$$

$$dY = Y_{\text{hit.NEW}} - Y_{\text{hit.DST}}$$

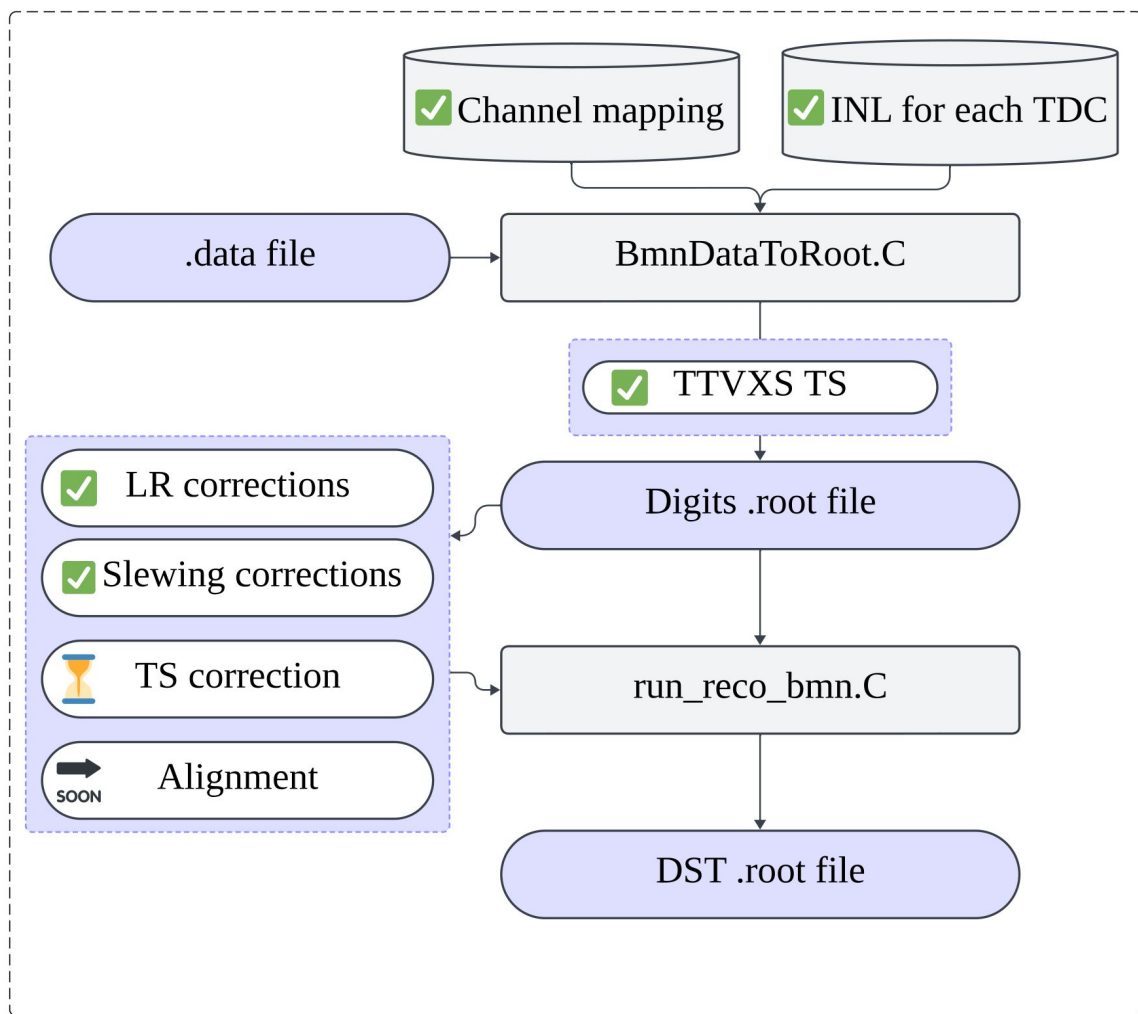
**99.995 %** of hits from DST matches hits from the new code.

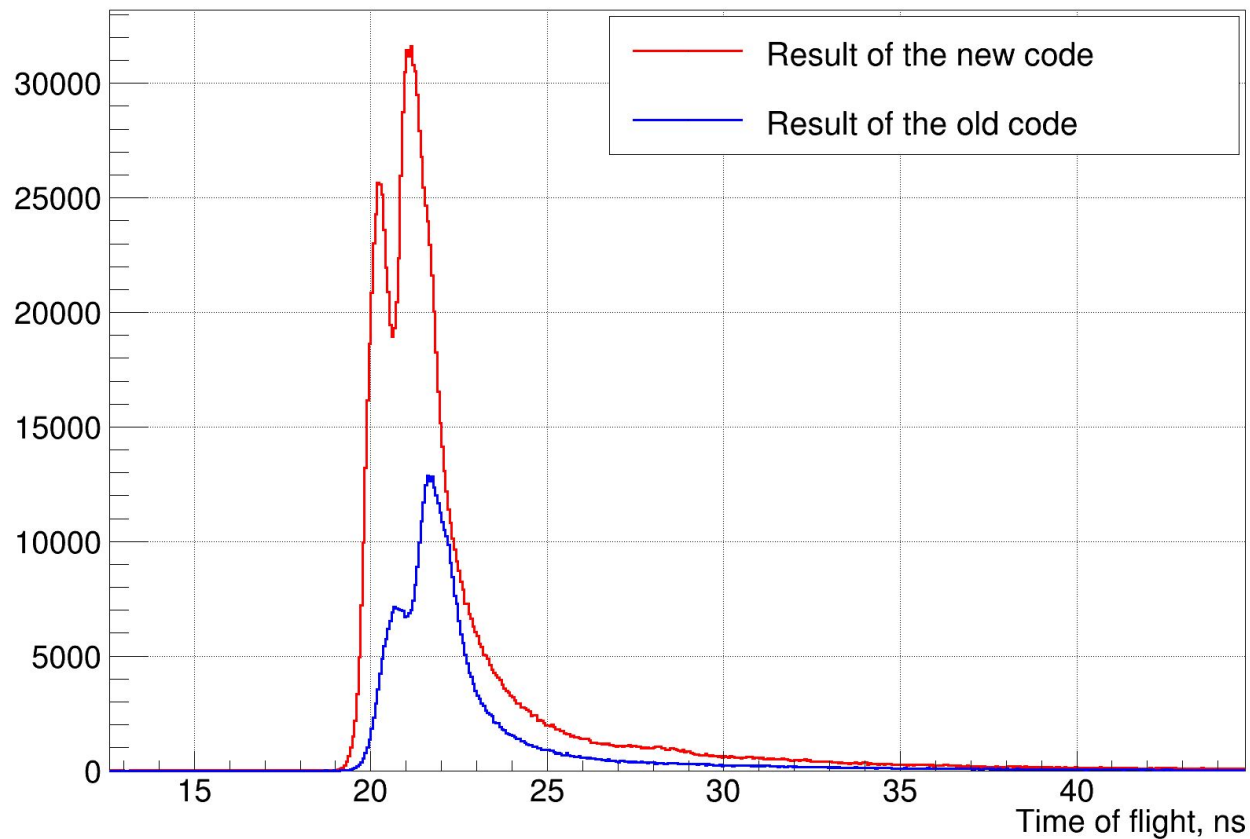
**3 times more** hits reconstructed by the new code

checked on files from runs 7842, 7853, 7914

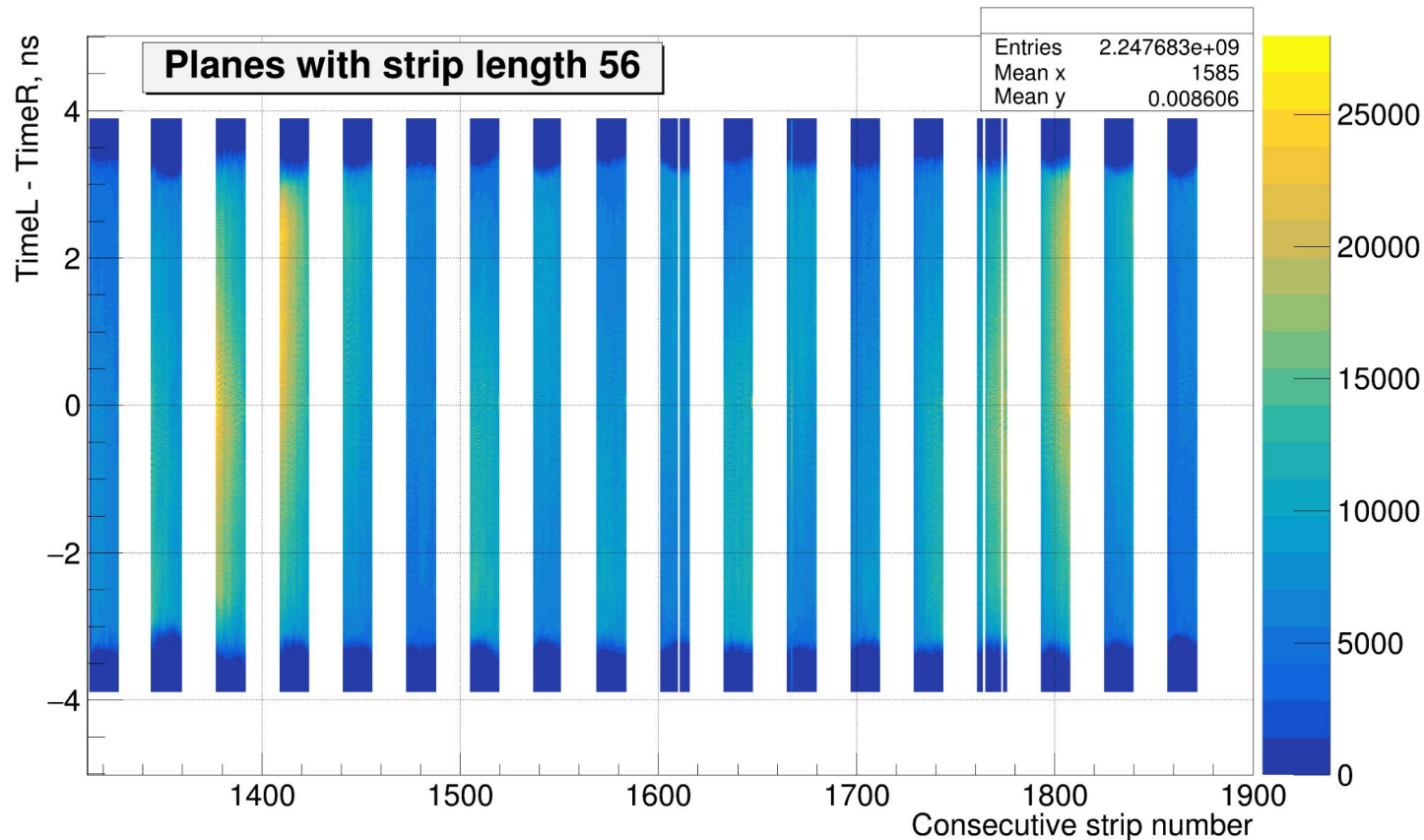
# Summary

1. The TDC placement map and channel rewritten. LR and slewing corrections are completed.
2. Time shift and alignment to be completed soon.
3. The new code for digits production is done and ready to use.
4. DST production code is being tested.





Number of hits in the same file of the same run for production by the old and the new code



LR correction result for the big planes

Gaps are due to the fact that big planes have 16 strips, while numbering assumes 32