S444 analysis -update 4

11.09.2024
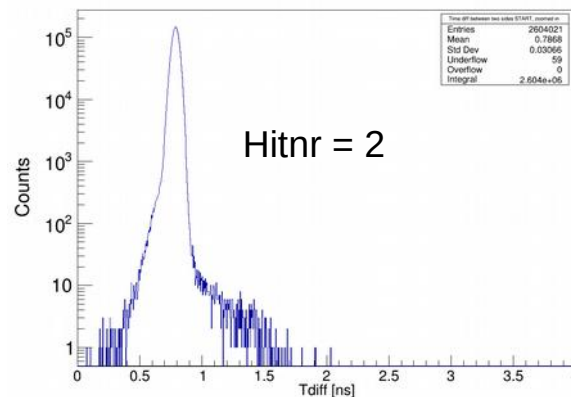
Start Detector

Multi-hit-capable, 2 PMTs,left,right

Cut:
iTraw[iDet * nChs + iCh][mult[iDet * nChs + iCh]] = hit→GetRawTimeNs();
// RawPos = TrawRIGHT - TrawLEFT corresponds to x increasing from RIGHT to LEFT
        iRawPos = iTraw[0][multR] – iTraw[1][multL];

if (iRawPos < fRawPosPar->GetParam(0))
            continue;
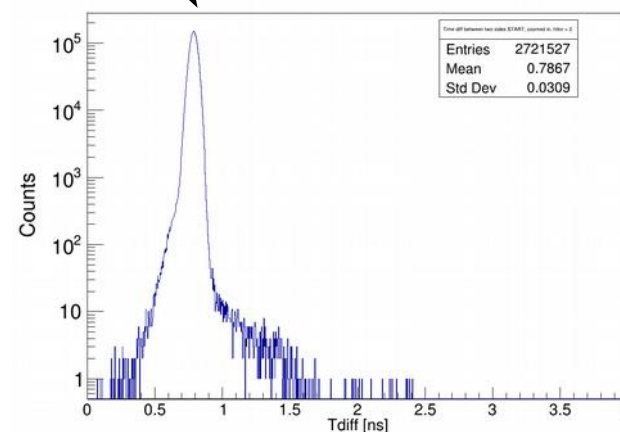   if (iRawPos > fRawPosPar->GetParam(1))

Hitnr = 2

Hitnr > 2

Going to singleTcal level
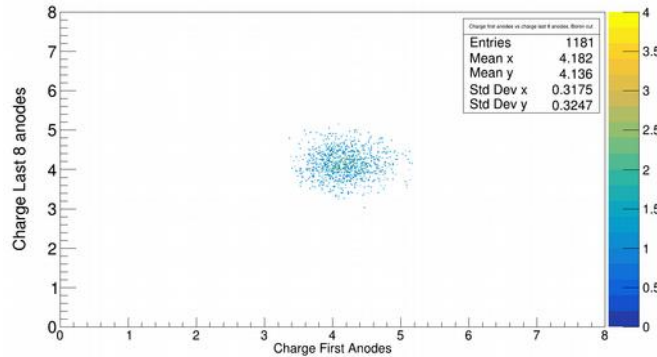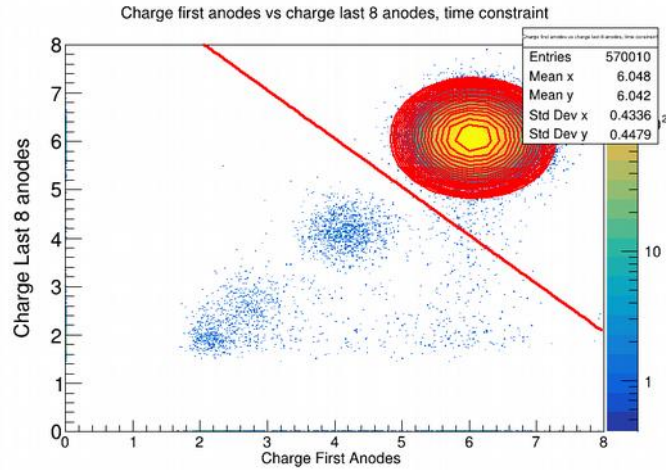(making constrain to t_diff)
Between 0.555 and 1.946
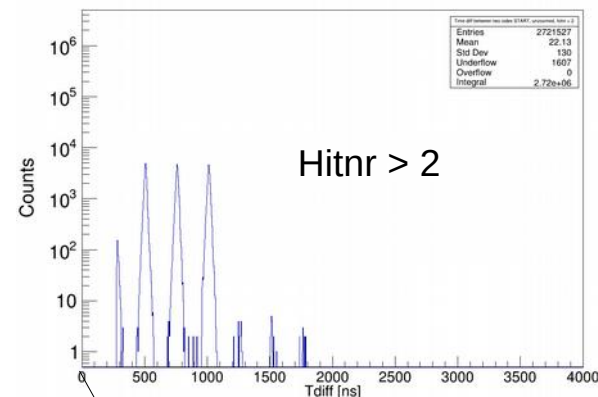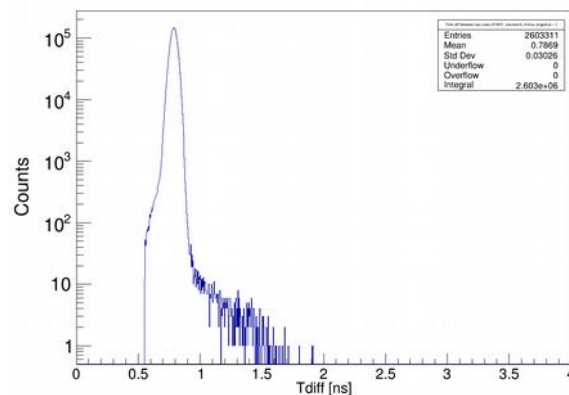
zoom in

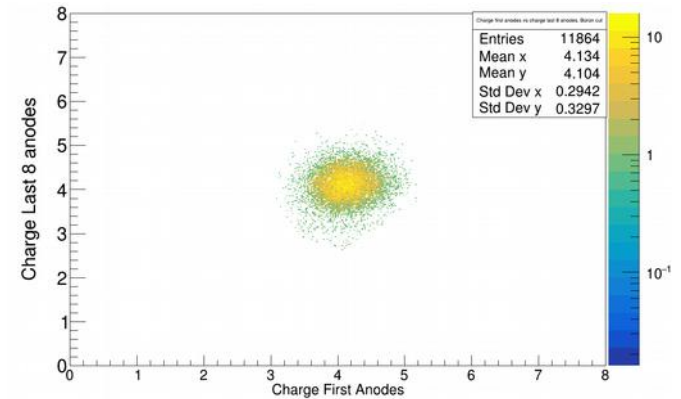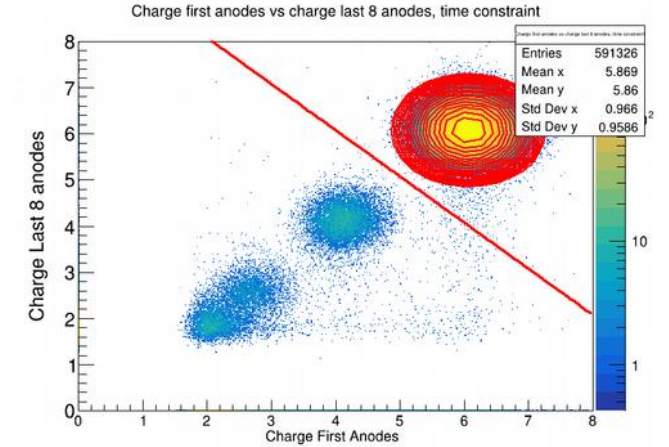# Reaction cross section Z → 5 (Boron)

400 AMeV

Empty

Target
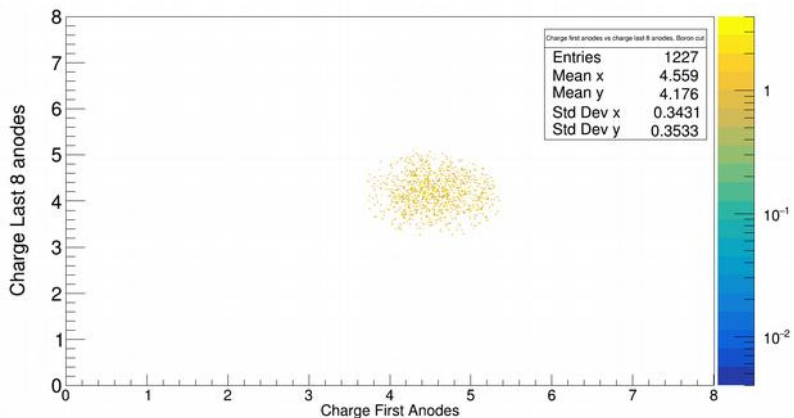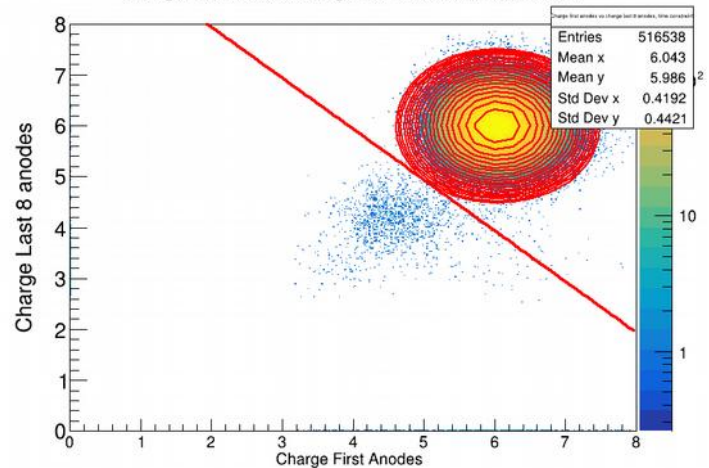
550 AMeV
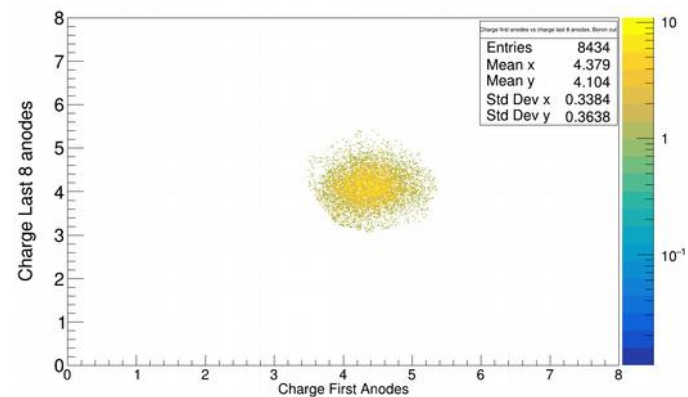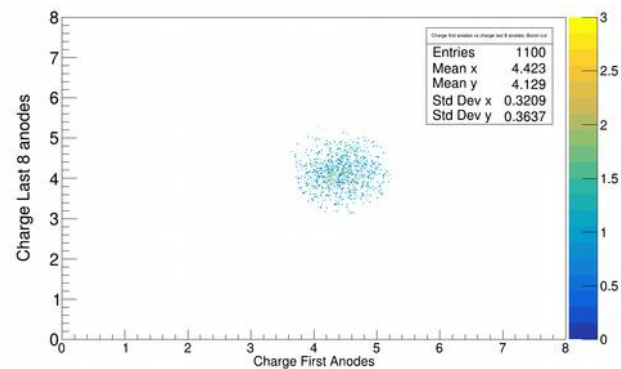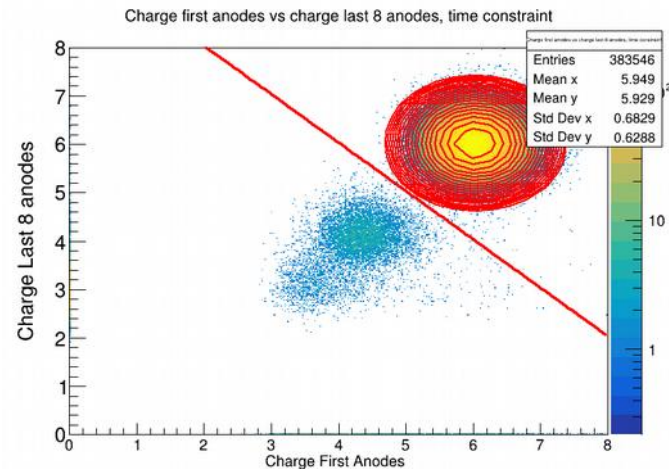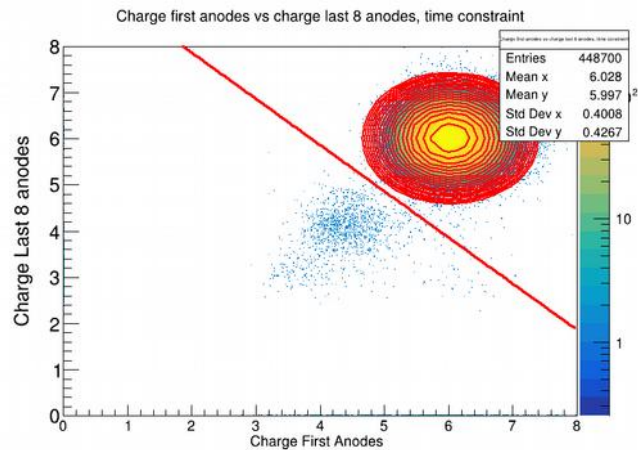
Empty

Target

650 AMeV

Empty

Charge first anodes vs charge last 8 anodes, time constraint

Charge first anodes vs charge last 8 anodes, time constraint	
Entries	516538
Mean x	6.043
Mean y	5.986
Std Dev x	0.4192
Std Dev y	0.4421

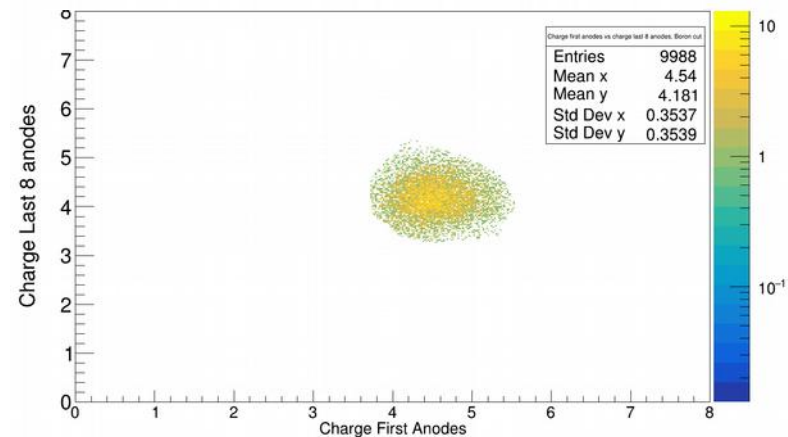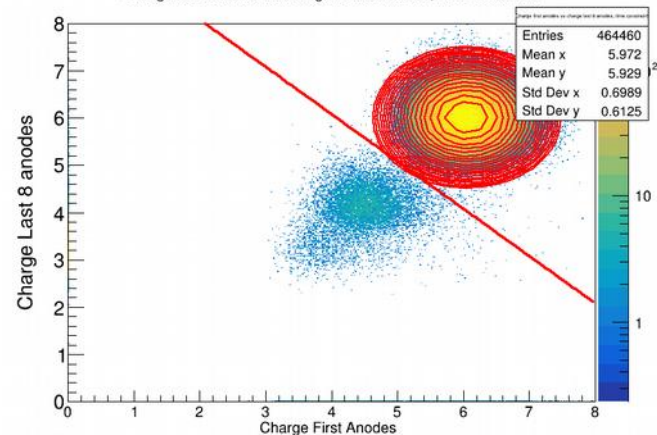| Charge first anodes vs charge last 8 anodes, Boron cut	
Entries	1227
Mean x	4.559
Mean y	4.176
Std Dev x	0.3431
Std Dev y	0.3533

Target

Charge first anodes vs charge last 8 anodes, time constraint
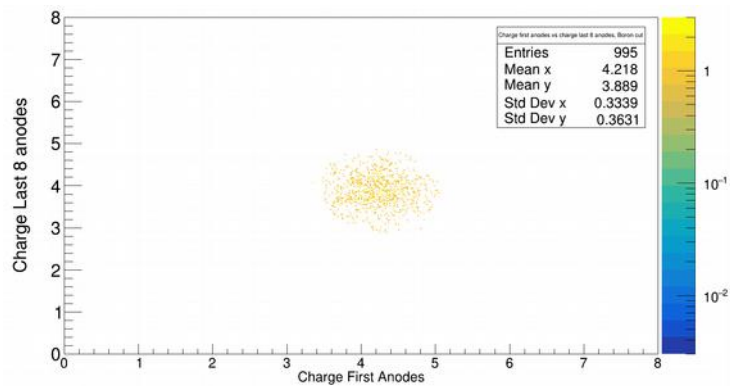
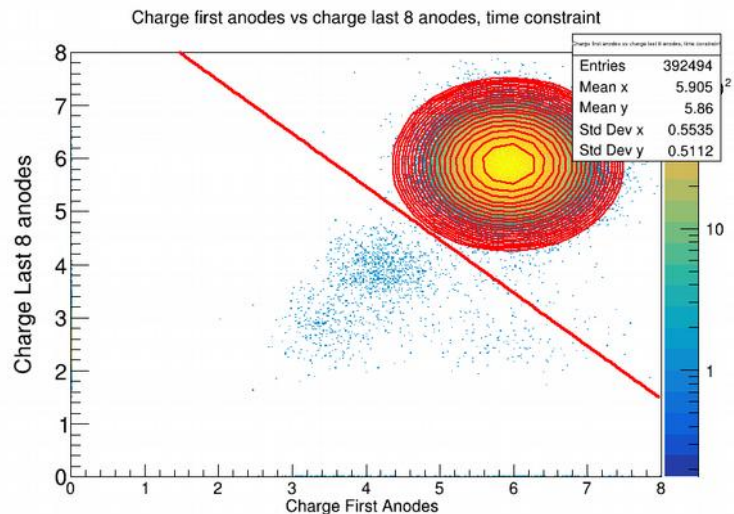| Charge first anodes vs charge last 8 anodes, time constraint	
Entries	464460
Mean x	5.972
Mean y	5.929
Std Dev x	0.6989
Std Dev y	0.6125

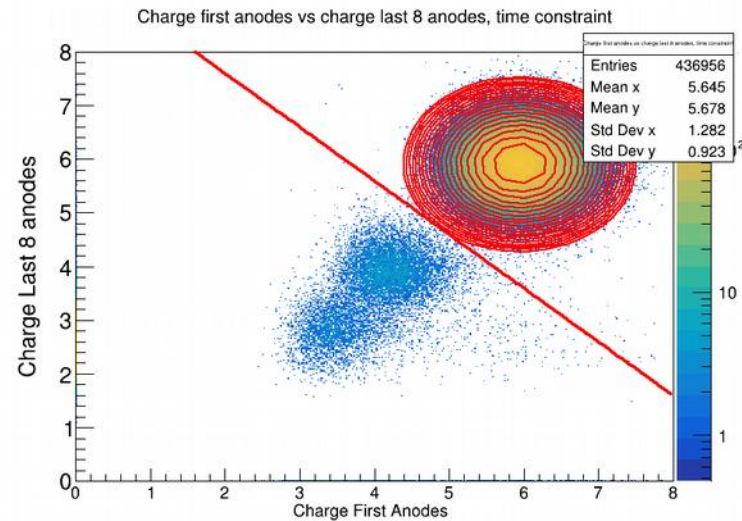| Charge first anodes vs charge last 8 anodes, Boron cut	
Entries	9988
Mean x	4.54
Mean y	4.181
Std Dev x	0.3537
Std Dev y	0.3539

800 AMeV
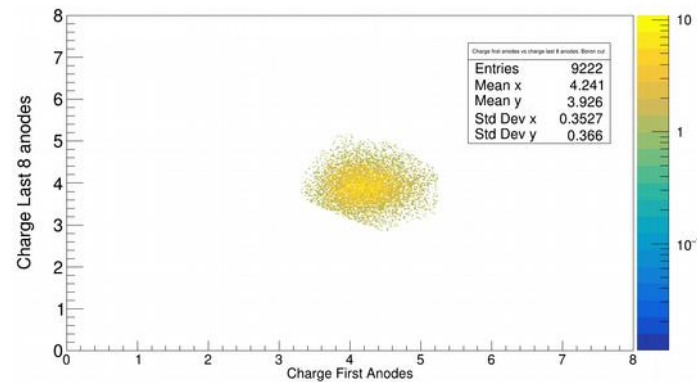
Empty

Target

Cross section results Z= 6 → Z = 5

Energy	:	Cross section: mbarn
400		79.5
550		83.9
650		81.7
800		83.0

Without empty target substraction:

Energy	:	Cross section: mbarn
400		89.6
550		95.9
650		93.3
800		95.4

Ratio survived/incoming:

Target runs		Empty runs	
400	0.981922	400	0.997945
550	0.980678	550	0.997576
650	0.981187	650	0.997652
800	0.980777	800	0.997484

Cross Section Empty Target:

Energy	Cross section: mbarn
400	10.1
550	11.9
650	11.5
800	12.3

Drift Times in TWIM MUSIC

Calibration of x position in TWIM Music done by:

TWIM

MW1   MW2
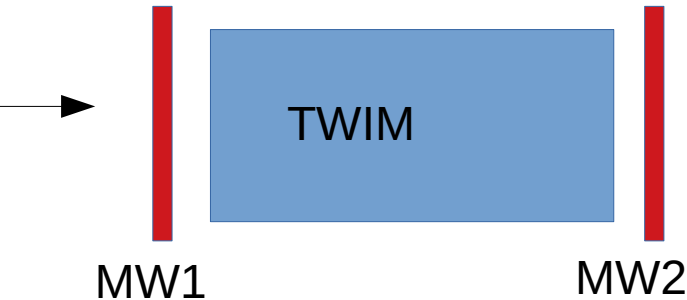
- Interpolate x position on anode by x_MW1 &2
- Plot x_pos_anode vs drift time
- Fit with **x_pos = v*drift_time + c**

e$^-$ drift velocity ~ 0.005-0.006cm /ns

Why don't we have negative values of twim times? Or why are they limited by around 32k?

Timining concept - "window of interest",see :
https://www.mesytec.com/products/datasheets/MDPP-16_SCP-RCP.pdf

The input trigger can be shifted internally by +/-25 us and starts a **window** of interest with adjustable width (1.5 ns to 25 us). All triggers generated by the CFD discriminators from the channel inputs, which fall into this **window**, are sent to a large data buffer for read out by The VME bus. The transmitted data are:
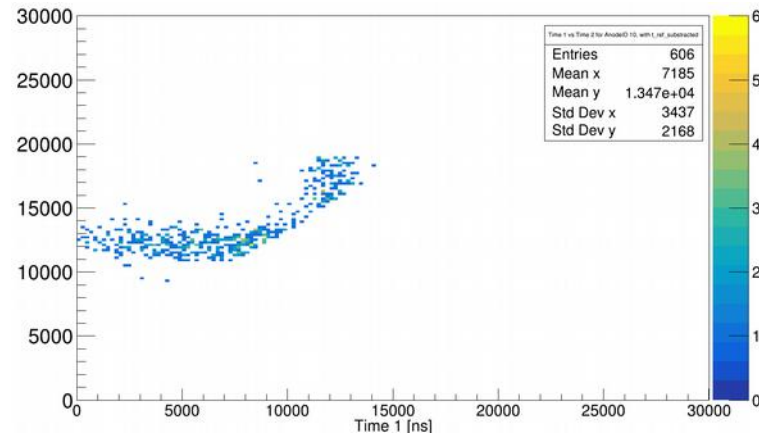
- the time difference to the **window** start (in 24 ps resolution)

- the converted shaper amplitude.

- over/underflow, and pileup flags

Time diff between two hits in anodenr = 10 vs overall meas. Charge (a.u.!)
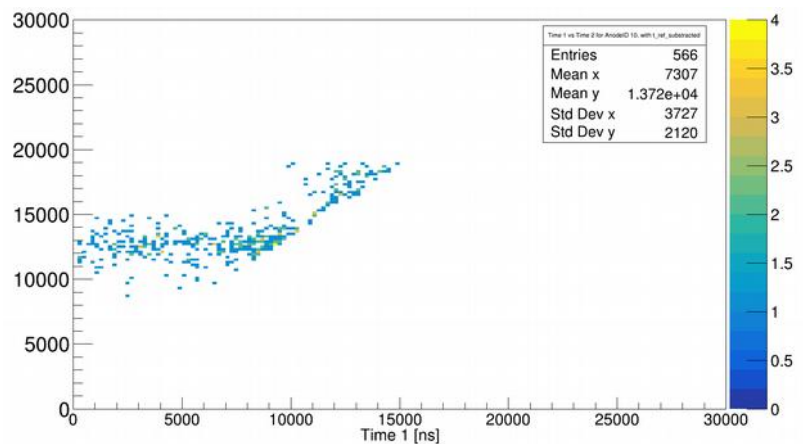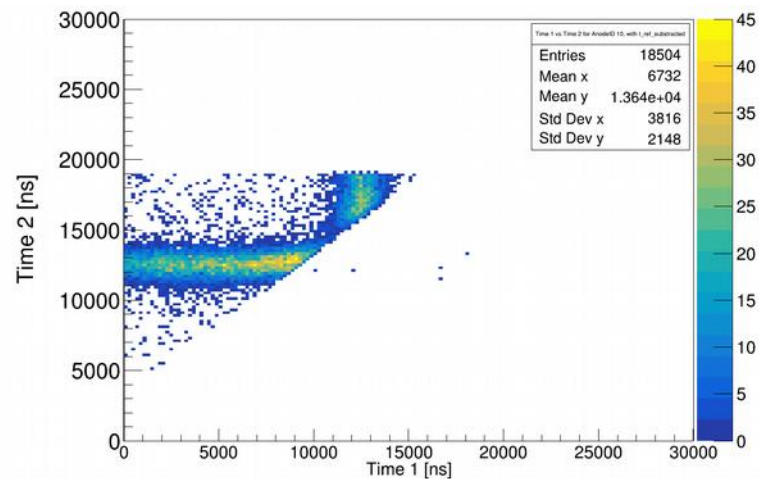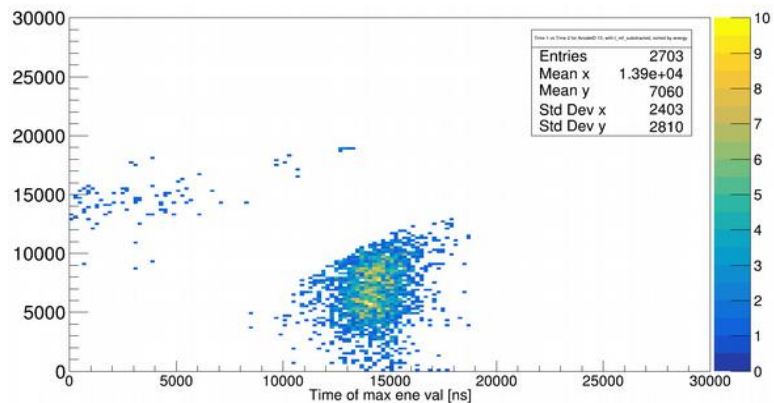
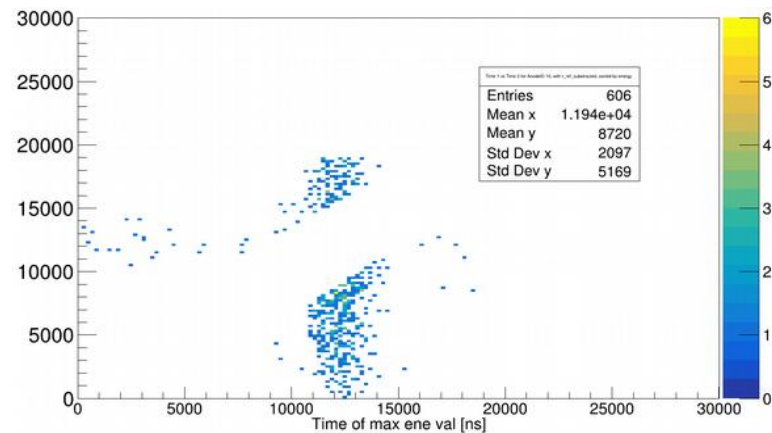## 400 AMeV
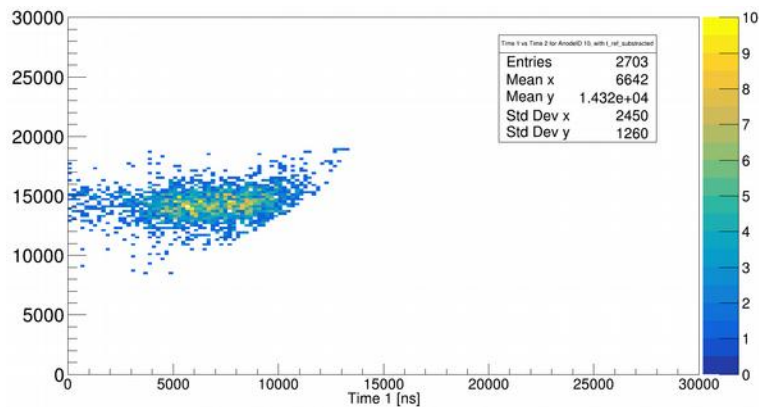
650 AMeV

550 AMeV

800 AMeV

Time diff between two hits in anodenr = 10 vs overall meas. Charge (a.u.!)
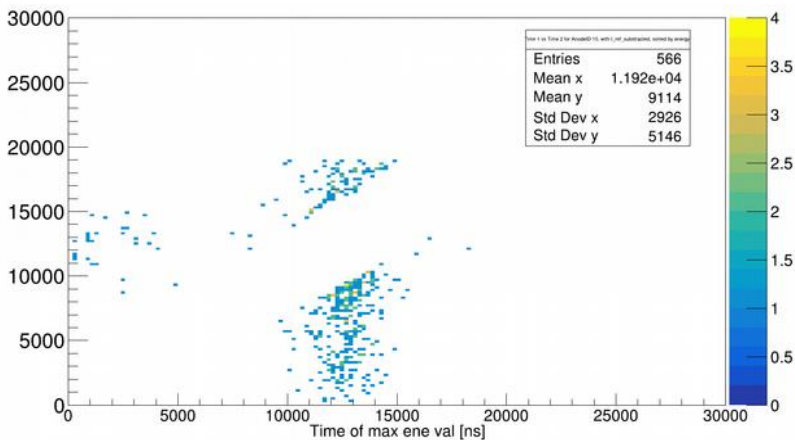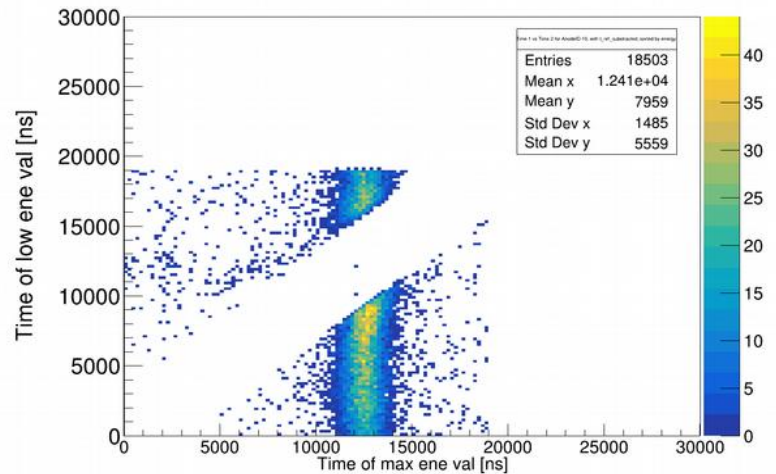
Cut: E1 > E2 ⟶ Sorting by energy

400 AMeV
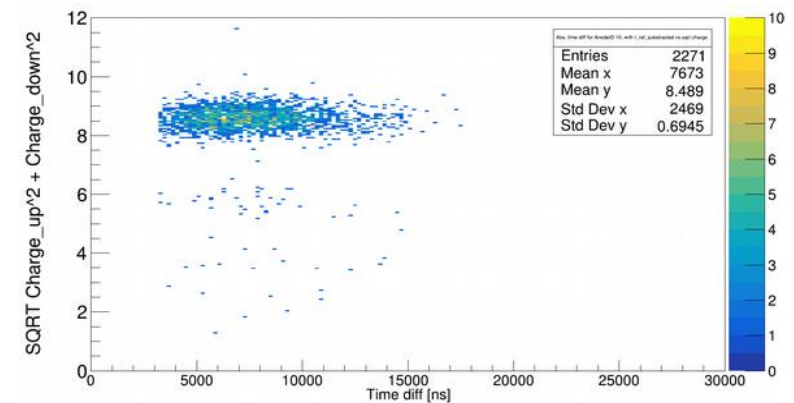
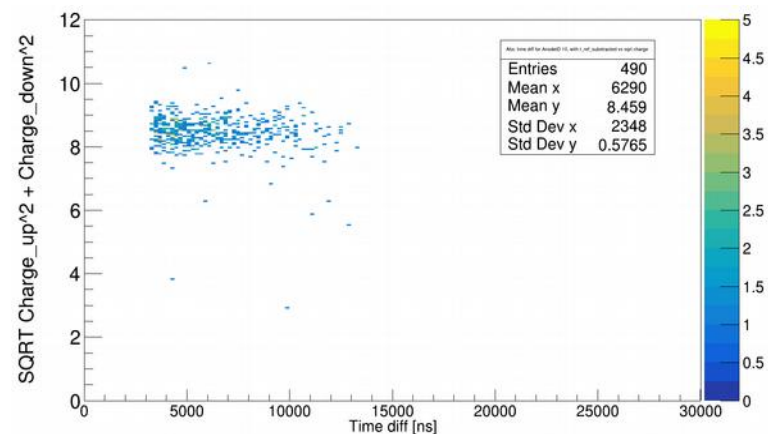

650 AMeV

550 AMeV

800 AMeV
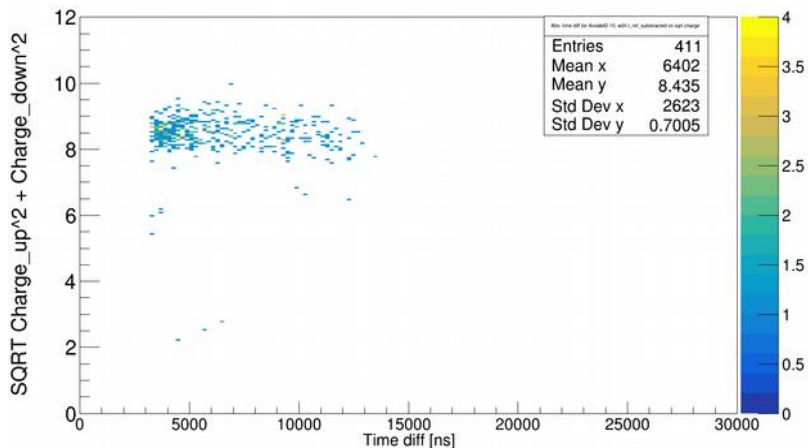
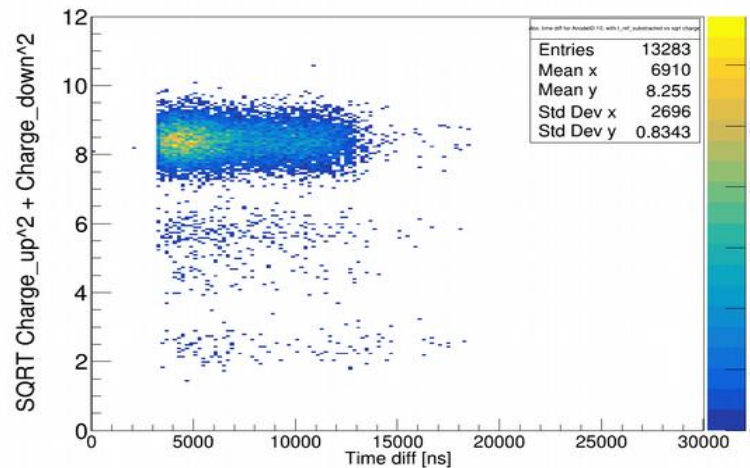# Overall charge (a.u.) vs abs(t_diff), for anode = 10
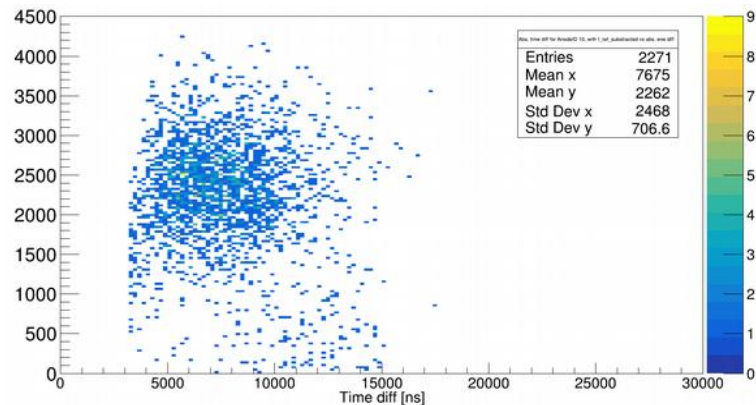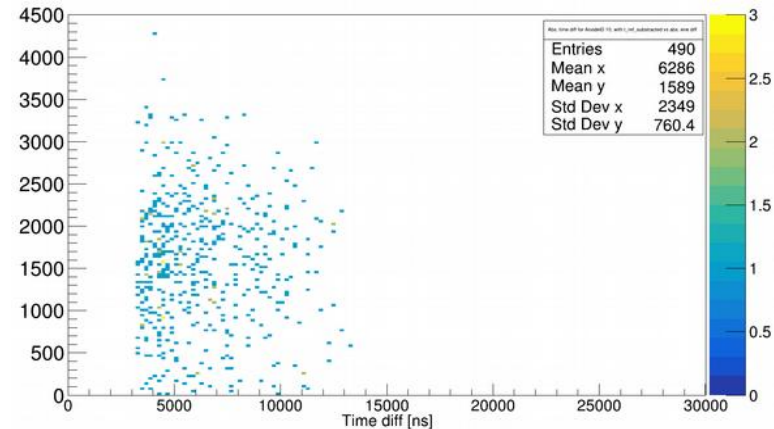
400 AMeV

650 AMeV

550 AMeV

800 AMeV

abs(energy_diff) vs abs(t_diff), for anode = 10
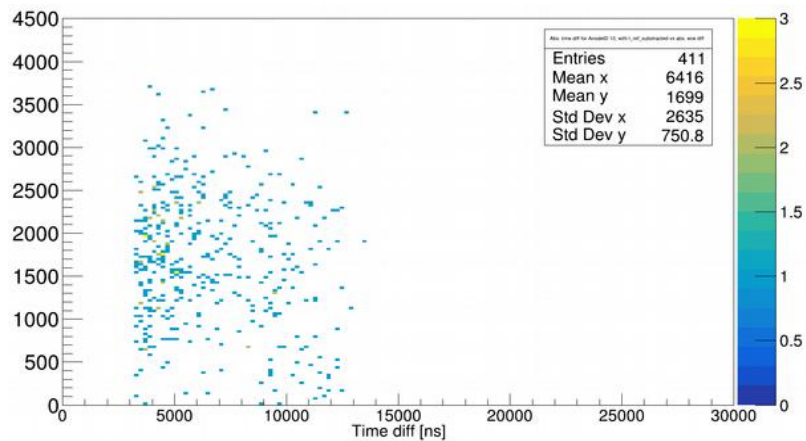
400 AMeV

650 AMeV

550 AMeV

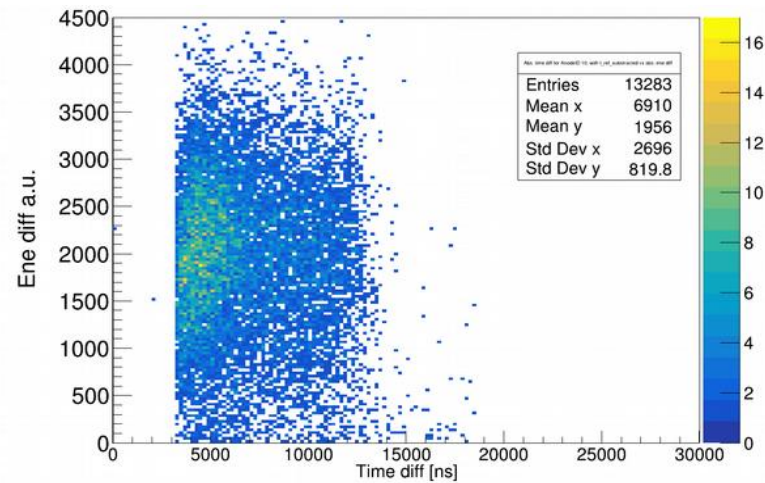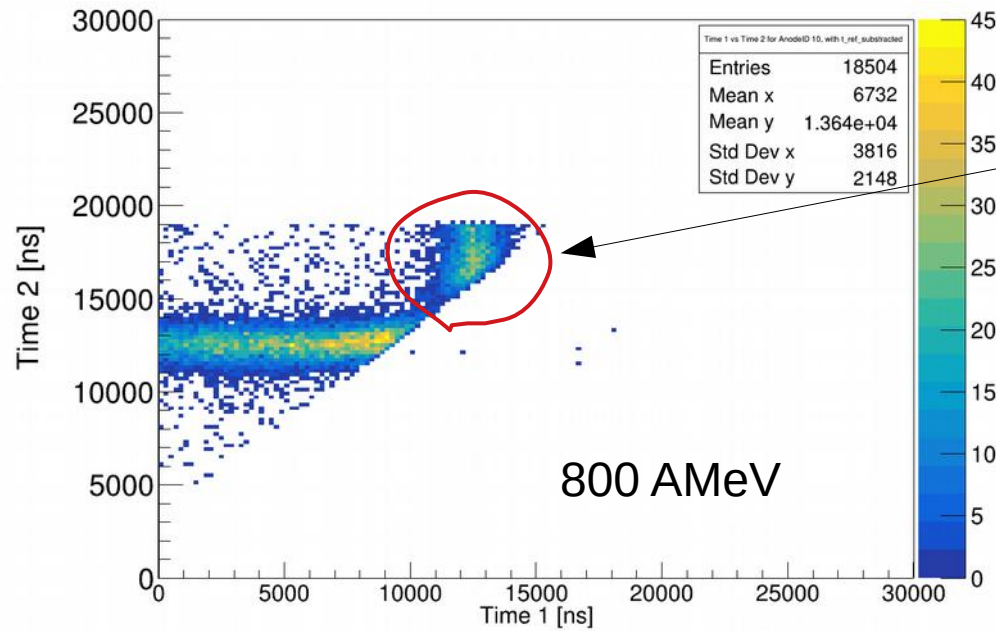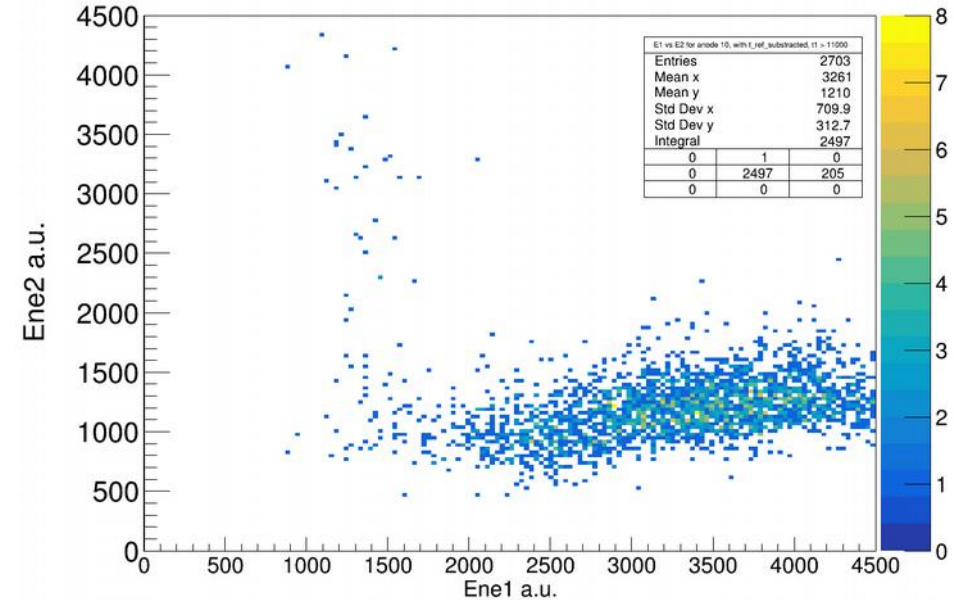**800 AMeV**

How does the energy distribution look here?

800 AMeV

You should select E1, not E2 (noise, delta electrons...)

Check again correction factor:

Cross section @ 400: N_reacted ~16%, cross section = ~800mbarn

Difference in cross section between 400 and 800 AMeV should be:
~60 mbarn

We have 30 mbarn

30mbarn more needed → correction factor should be: 0.6%

I get as correction factor 1.00342 → 0.3% → ~15 mbarn

How can I have events with t_ref/t_trig in TWIM, but no energy deposition?

Old E-Mail from Julien:

This is something which can happen if an ion came just befor your window of interest. It internally triggers the MDPP-16, which treats the data.until 2 x shaping times. during that time period, the module get unavailable and cannot operate anymore. Thus, there is a slight change to miss the good guy which woulld come in the time interval when the module is in actual dead time.