

S444 analysis -update 4

11.09.2024

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

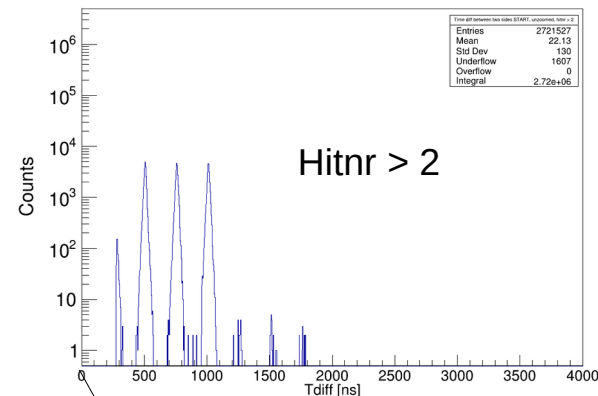
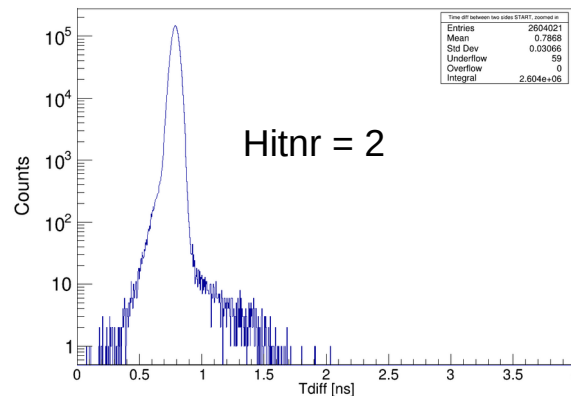
Cut:

```
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];
```

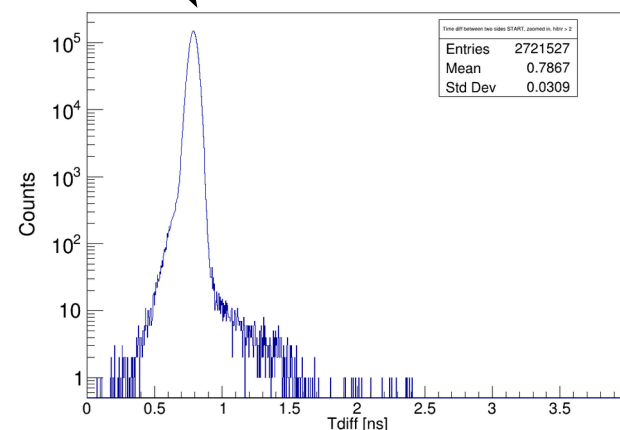
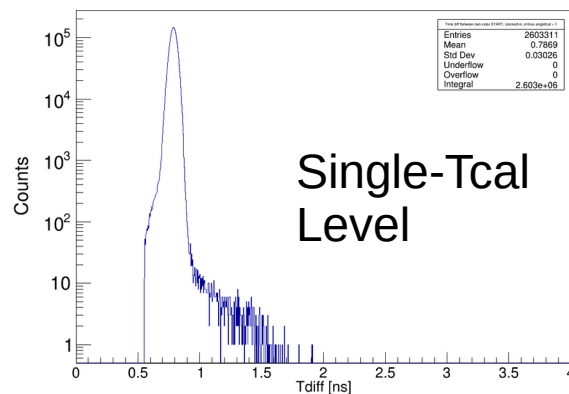
```
if (iRawPos < fRawPosPar->GetParam(0))  
    continue;  
if (iRawPos > fRawPosPar->GetParam(1))  
    continue;
```

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

Start Detector Cal - Level



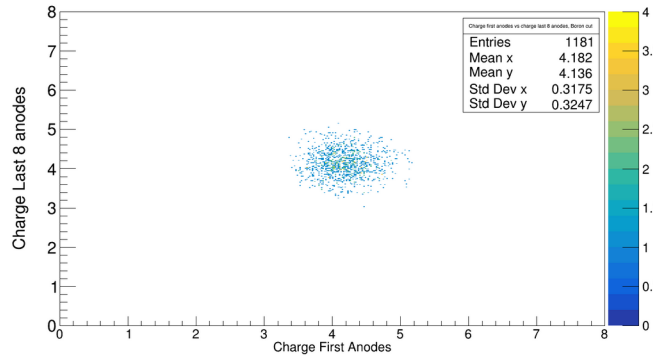
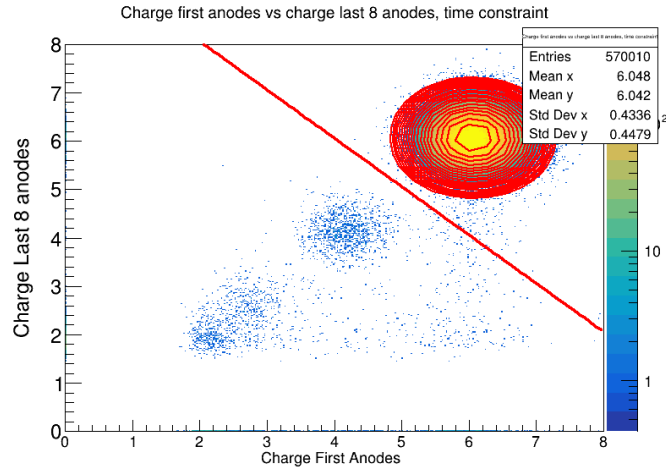
zoom in



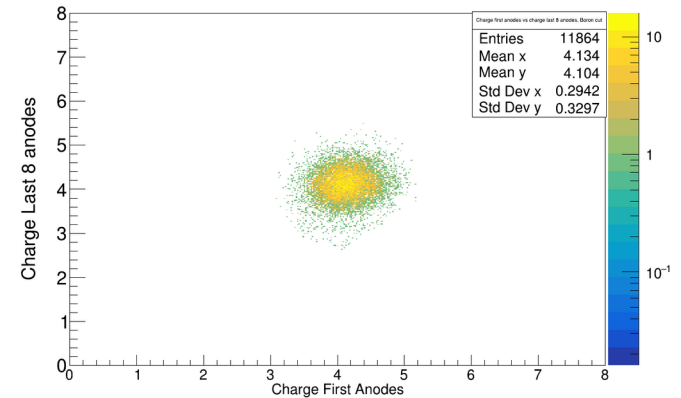
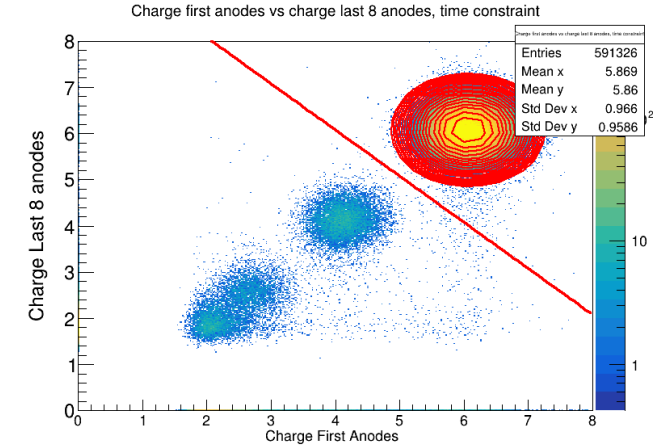
Reaction cross section $Z \rightarrow 5$ (Boron)

400 AMeV

Empty



Target

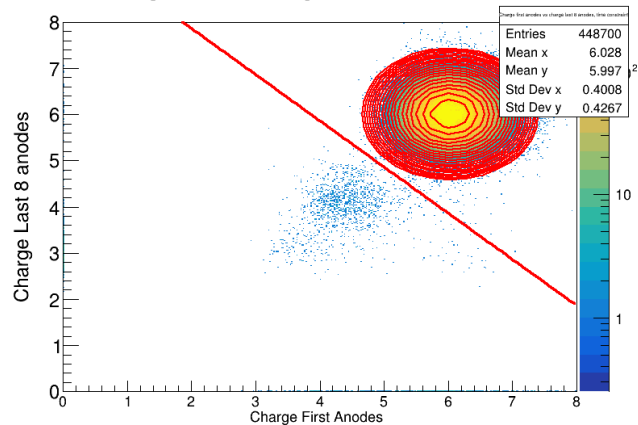


550 AMeV

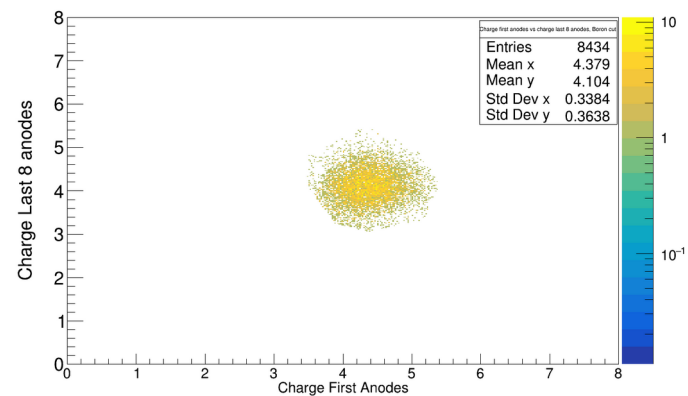
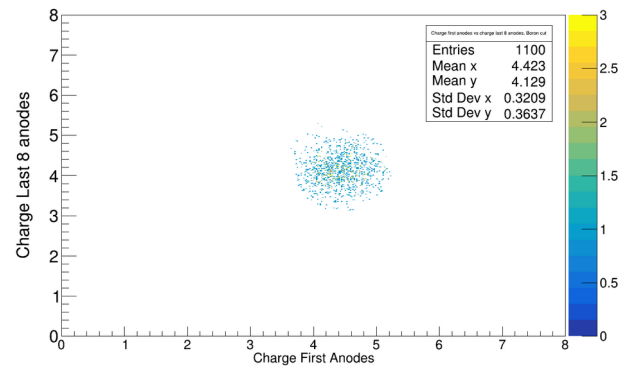
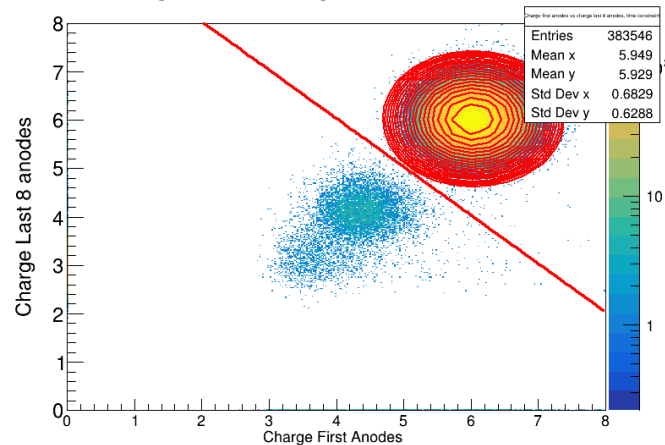
Target

Empty

Charge first anodes vs charge last 8 anodes, time constraint



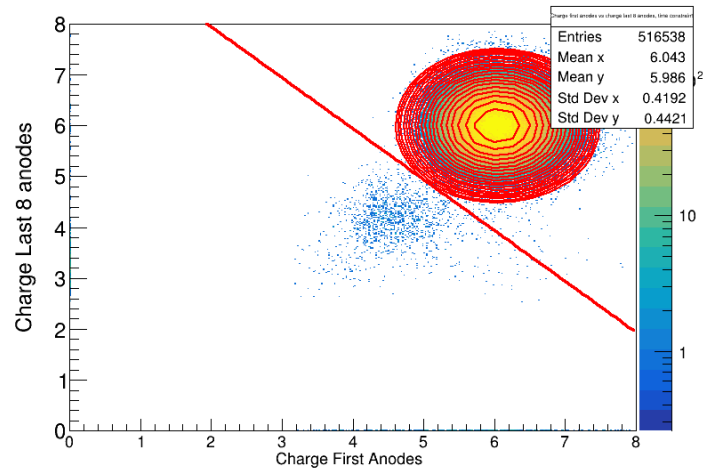
Charge first anodes vs charge last 8 anodes, time constraint



650 AMeV

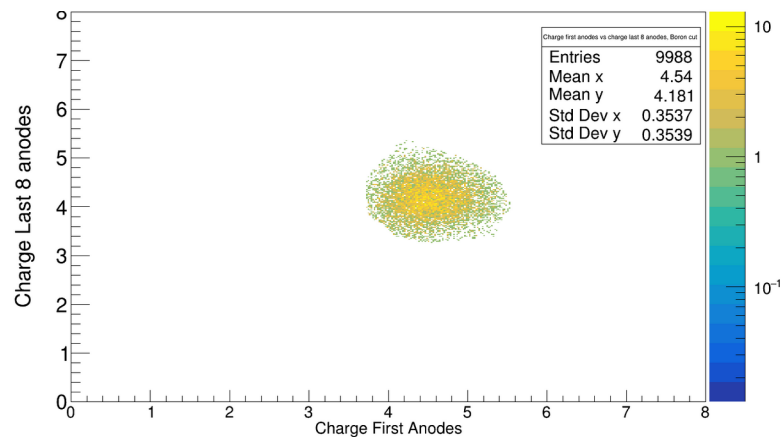
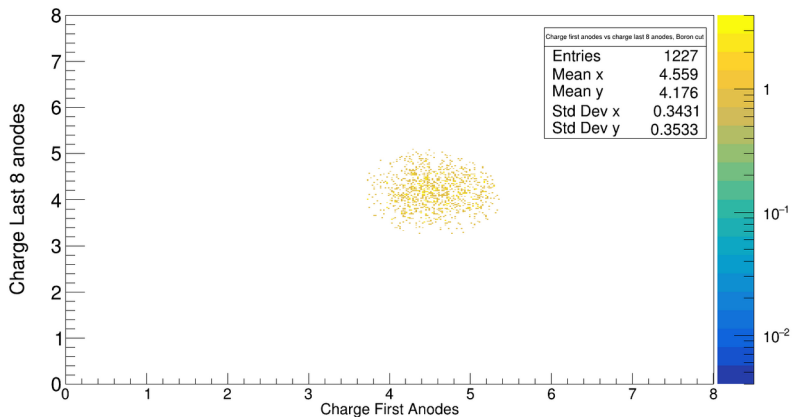
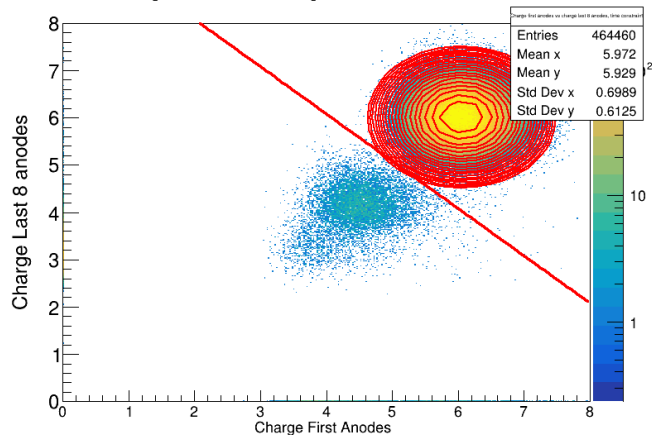
Empty

Charge first anodes vs charge last 8 anodes, time constraint



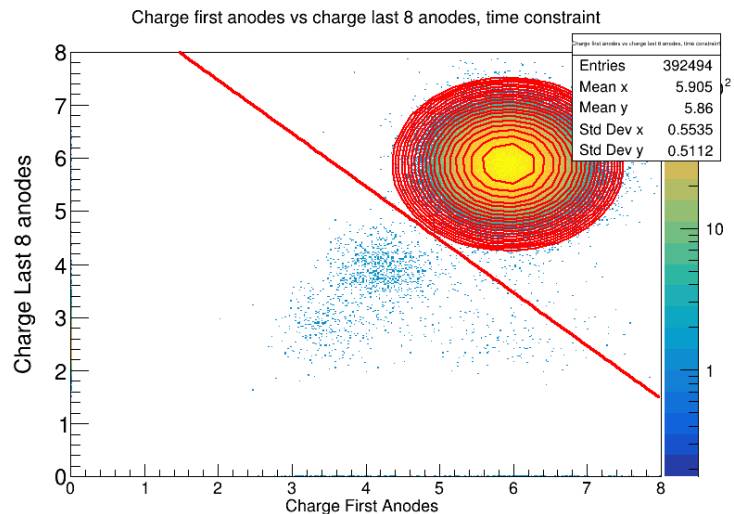
Target

Charge first anodes vs charge last 8 anodes, time constraint

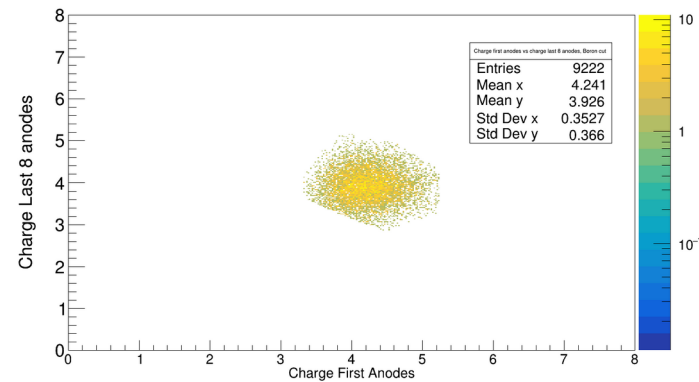
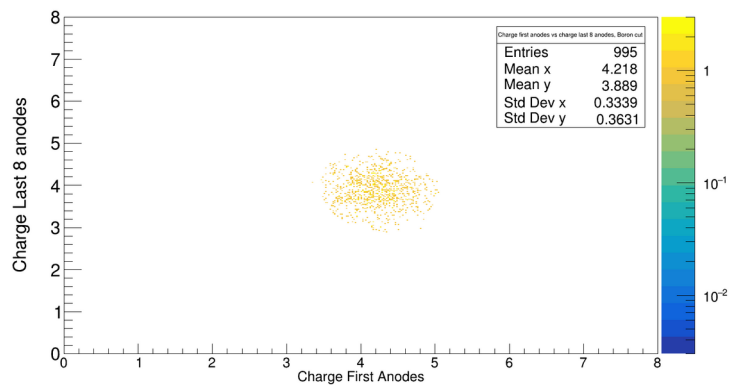
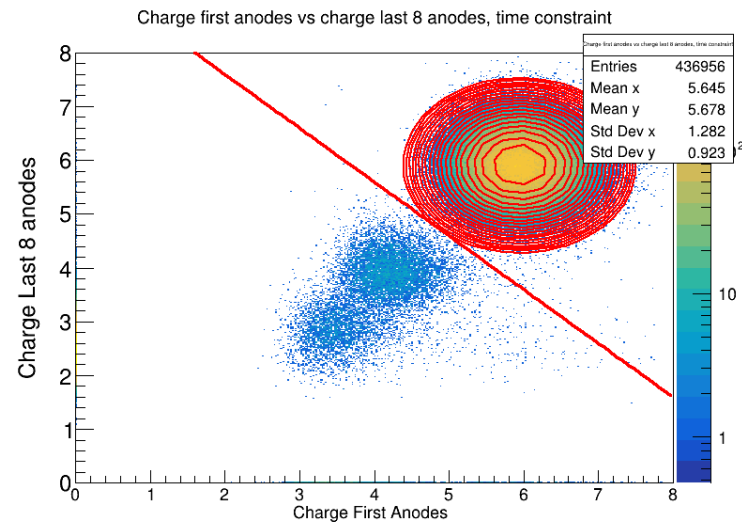


800 AMeV

Empty



Target

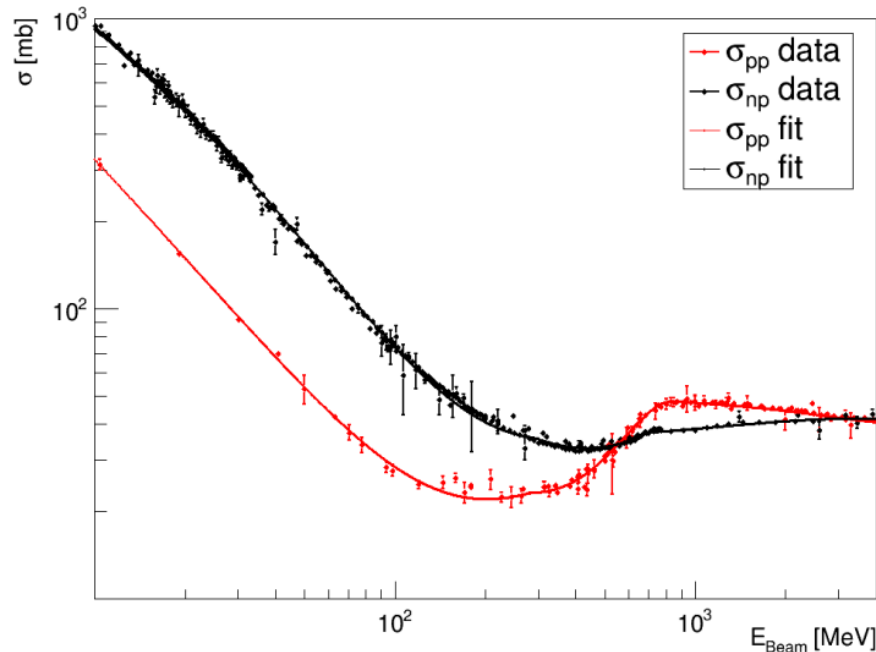


Cross section results $Z=6 \rightarrow Z=5$

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

Without empty target subtraction:

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

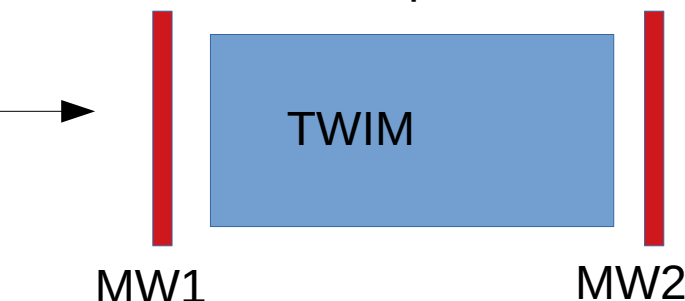


Cross sections need to be scaled as $^{12}\text{C}(p,2p)^{11}\text{B}$ is not the same as pp
But nevertheless cross section difference between 400 and 800 A MeV is not same.

Can this be because of both projectile and target proton have non-negligible inner momentum?

Drift Times in TWIM MUSIC

Calibration of x position in TWIM Music done by:



- Interpolate x position on anode by x_{MW1} & 2
- Plot x_{pos_anode} vs drift time
- Fit with $x_{pos} = v \cdot drift_time + c$

e^- drift velocity $\sim 0.005\text{-}0.006\text{cm/ns}$

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

Timing concept - "window of interest", see :

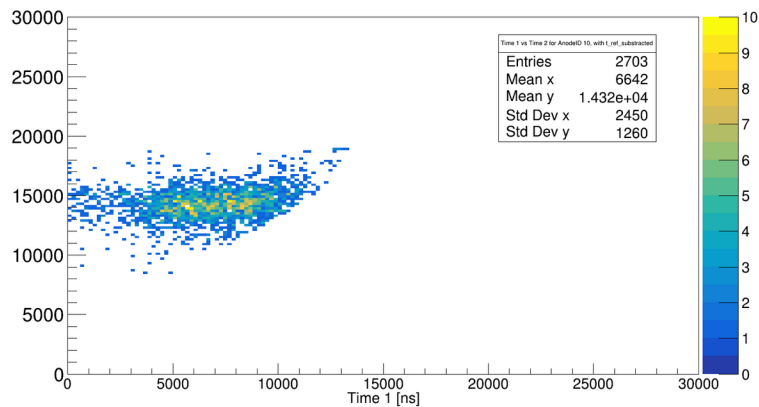
https://www.mesytec.com/products/datasheets/MDPP-16_SCP-RCP.pdf

The input trigger can be shifted internally by $\pm 25\text{ us}$ 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:

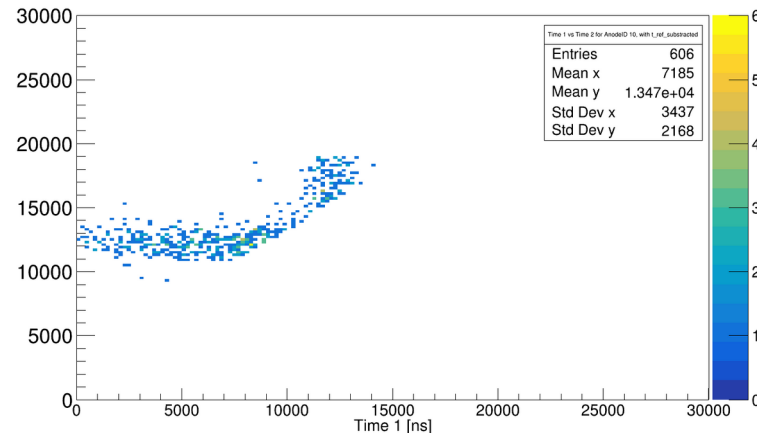
- the time difference to the **window** start (in 24 ps resolution)
- the converted shaper amplitude.
- over/underflow, and pileup flags

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

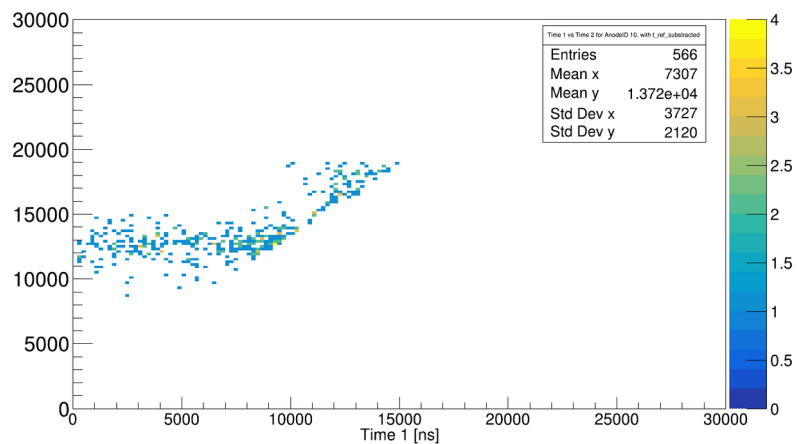
400 AMeV



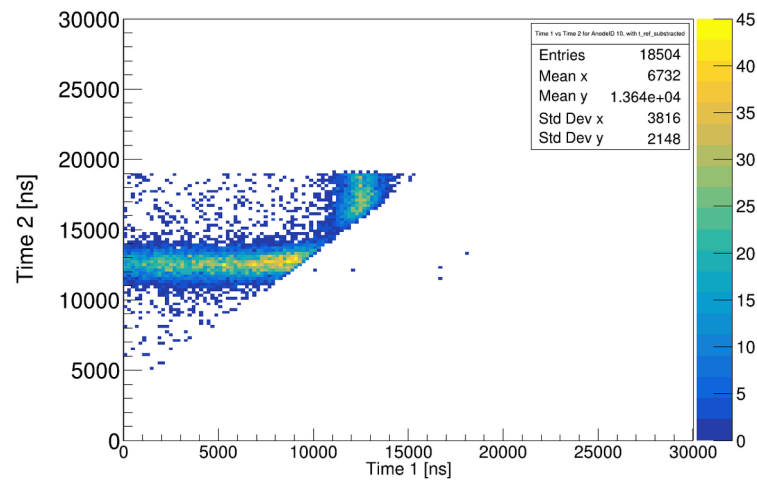
650 AMeV



550 AMeV



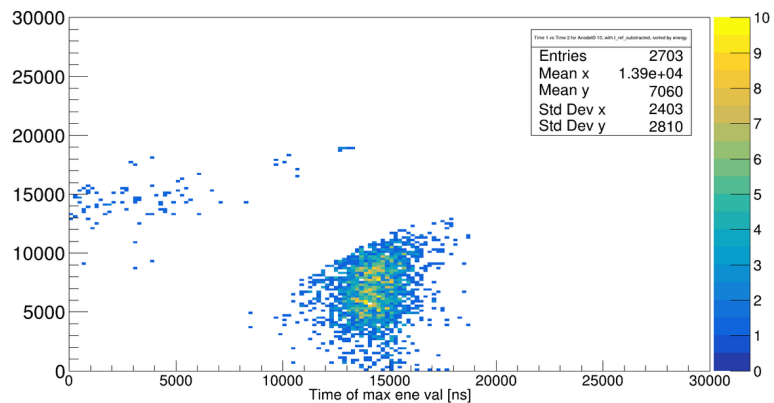
800 AMeV



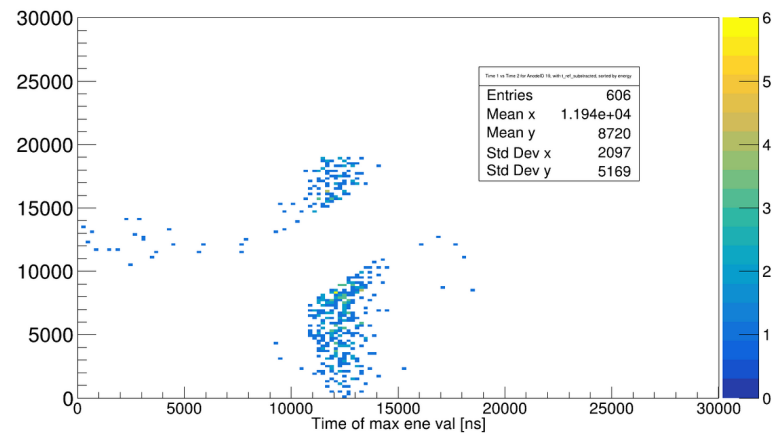
Time diff between two hits in anodenr = 10 vs overall meas. Charge (a.u.!)

Cut: $E1 > E2 \rightarrow$ Sorting by energy

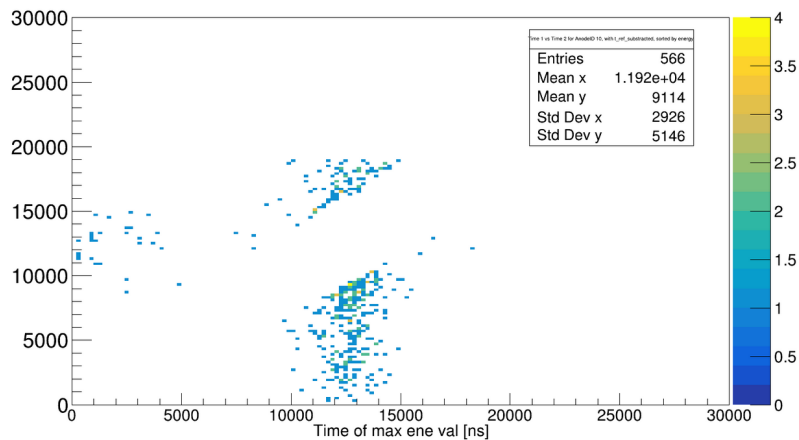
400 AMeV



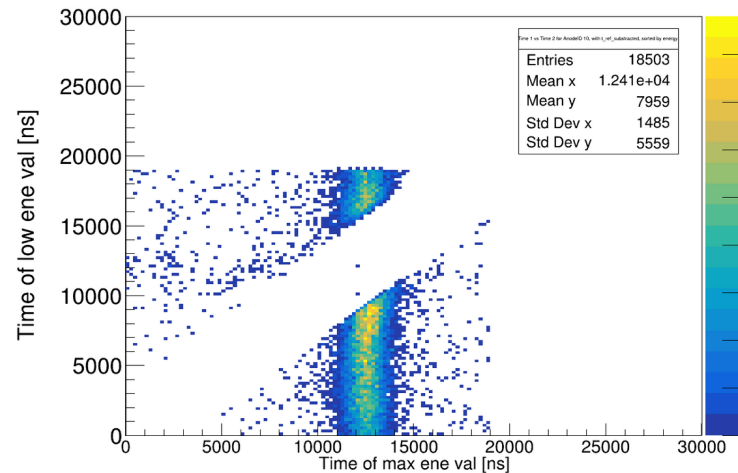
650 AMeV



550 AMeV

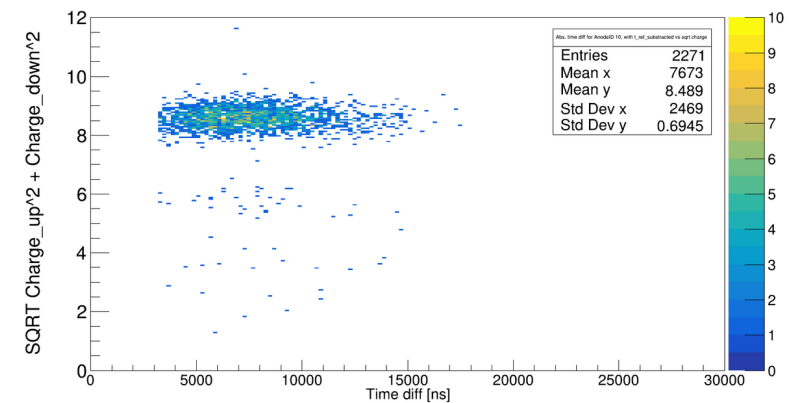


800 AMeV

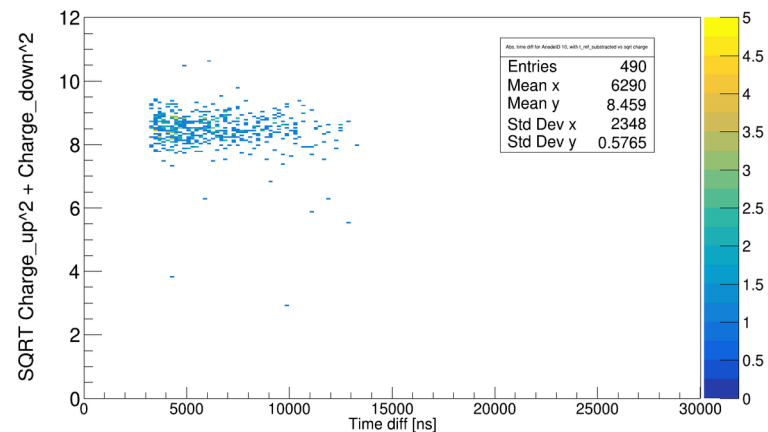


Overall charge (a.u.) vs abs(t_diff), for anode = 10

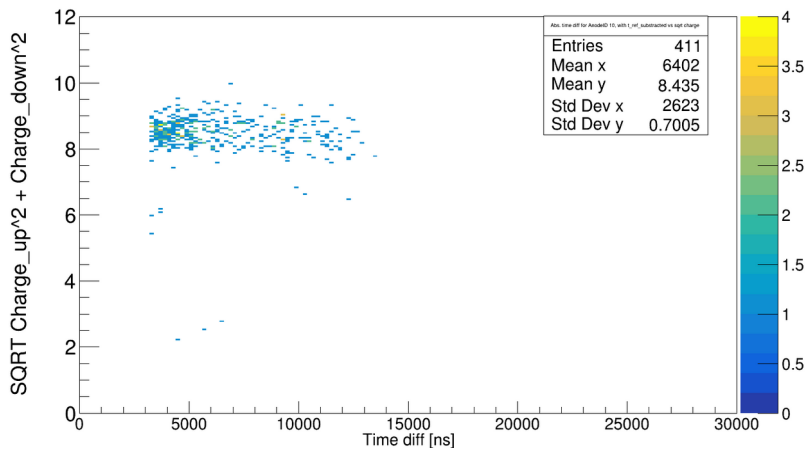
400 AMeV



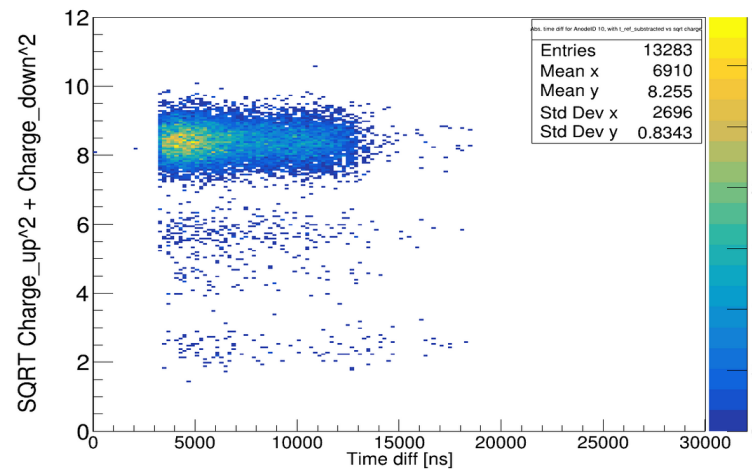
650 AMeV



550 AMeV

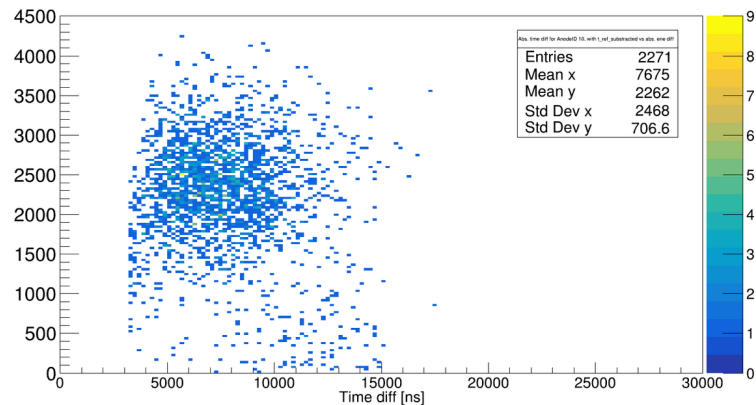


800 AMeV

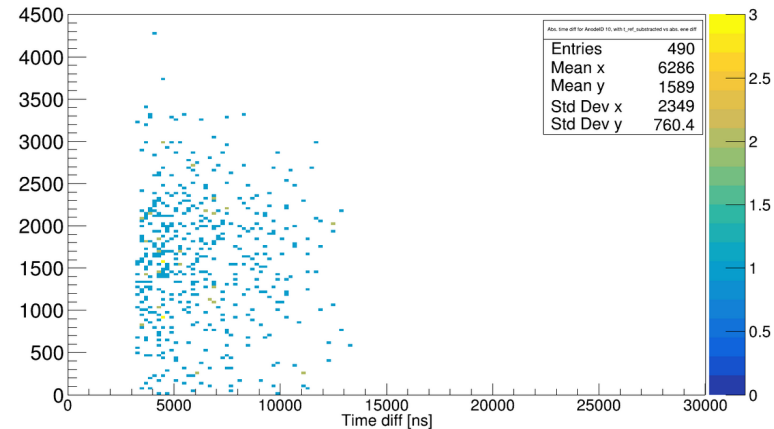


abs(energy_diff) vs abs(t_diff), for anode = 10

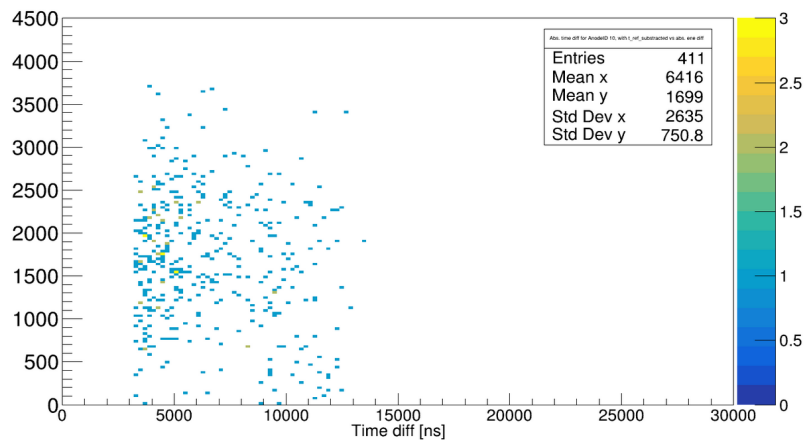
400 AMeV



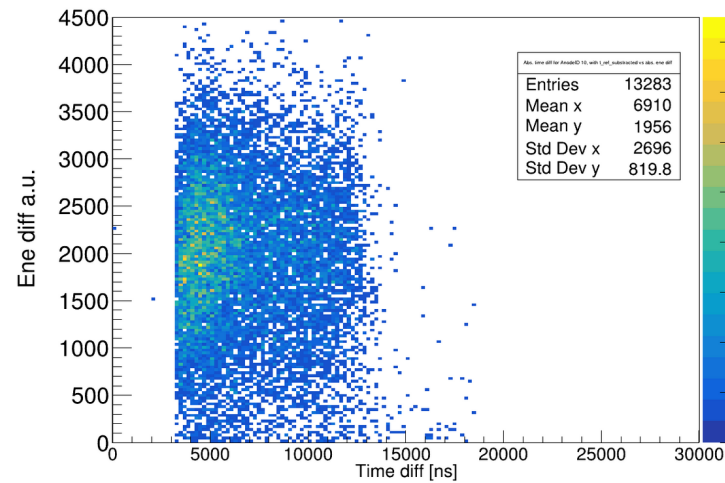
650 AMeV

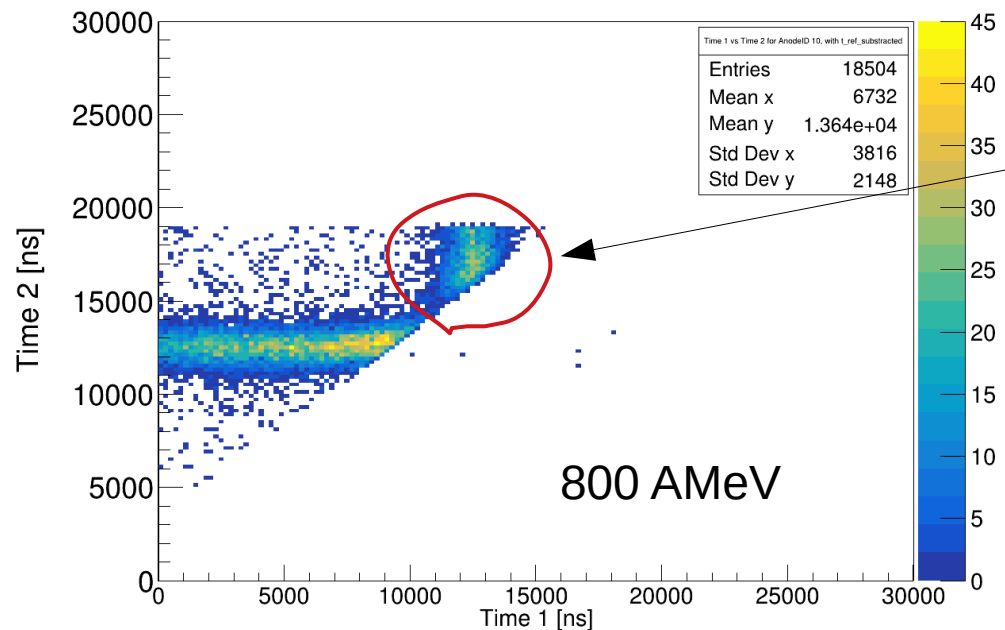


550 AMeV

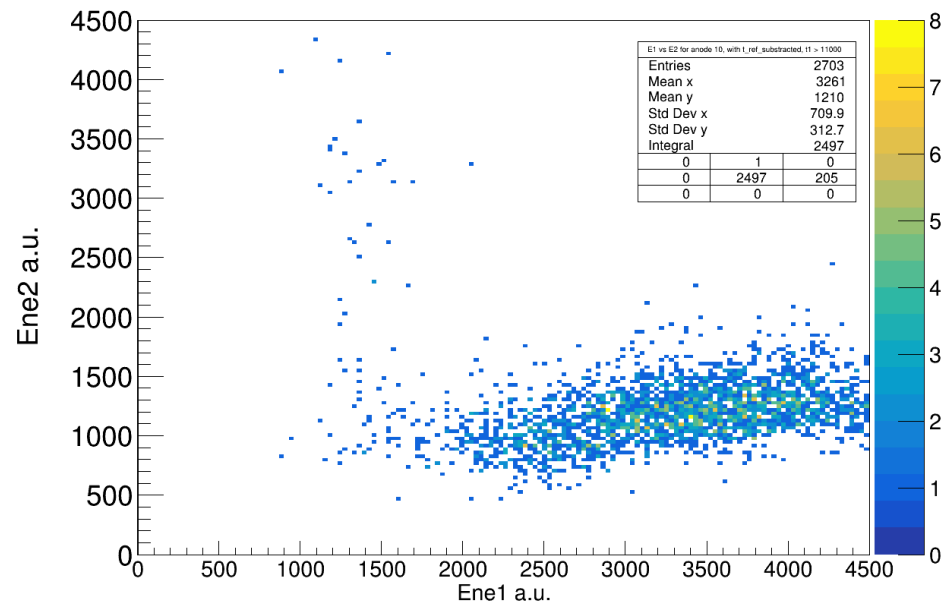


800 AMeV





How does the energy distribution look here?



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

How can I have events with $t_{\text{ref}}/t_{\text{trig}}$ in TWIM, but no energy deposition?

Old E-Mail from Julien:

This is something which can happen if an ion came just before 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 gets unavailable and cannot operate anymore. Thus, there is a slight chance to miss the good guy which would come in the time interval when the module is in actual dead time.