

DMC HT Ba T2Z1 First Sample

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on behalf of the DMC Group

HT Meeting

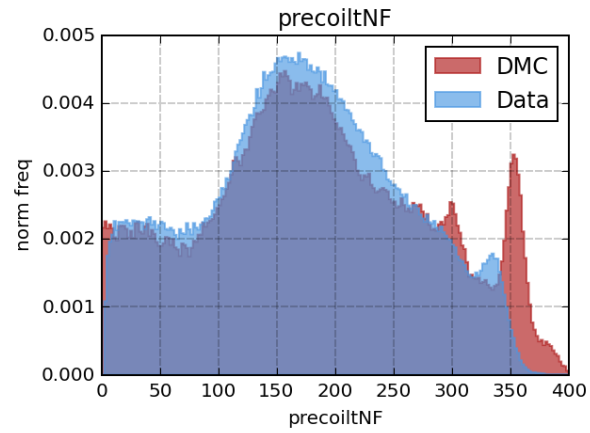
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 - Fix
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Recap on Previous Issues

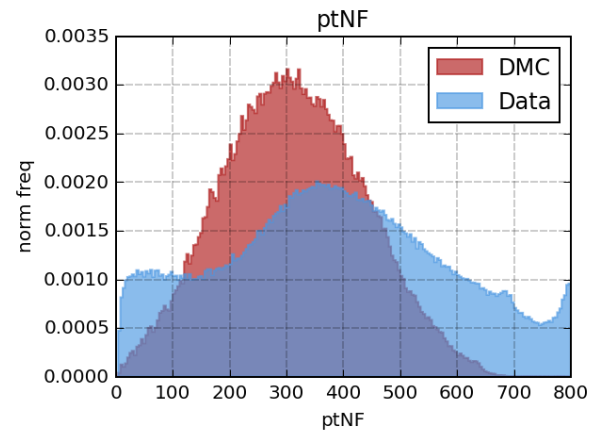
precoilNF

- precoilNF wasn't affected



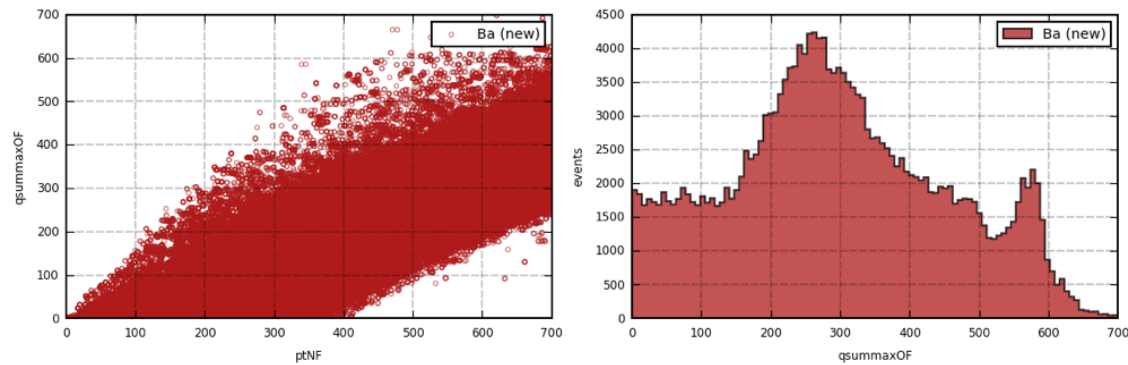
ptNF

- ptNF was busted busted, the ionization energy was broken...



Fix

- The calibrated charge energy in the pre-processing stage was broken
- This scales the pulses to the right amplitude
- But the indices were shifted by one step, thus, qsummax was smeared off to a broad range of ptNF values (see broken plots below)



Code is fixed and good distributions are obtained now!
(The bug surged when optimizing the multi-code submitter reducing the memory allocation and splitting the tasks into engines)

Validation of the first HT Barium T2Z1 sample

DMC:

- ~1,600,000 pulses
- Using noise from:
 - 1306 bg
 - 1305 bg
 - 1304 bg
- ~1,500,00 events (post-processing)

Simulation type: Ba_vacuum_t2z1

Data:

- Barium series from 011303b to 011307a

Basic Cuts

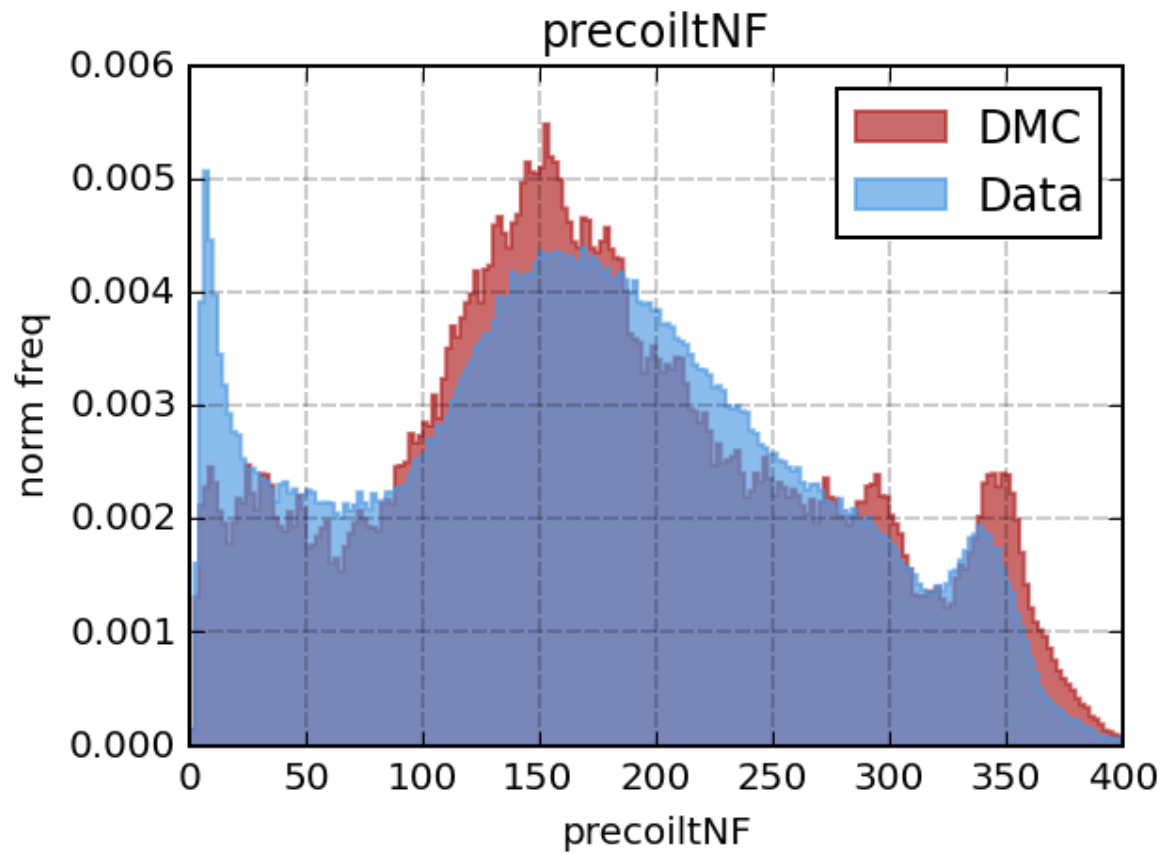
- $5 < \text{ptNF} < 1000$
- Data quality selection cuts:
 - `~cGoodRandom_133`
 - `cAnalysisThreshold_v53_HT`
 - `cTriggeredEvent_133_HT`
 - `cLiveTime_v53_HT`
 - `cGoodEv_v53`

Selection	Events	Fraction	Events	Fraction
No Cuts				
	DMC: 514135	1	Data: 19431502	1
PT Passing				
	DMC: 511777	0.9954	Data: 641131	0.0330
VeryGoodEvent Passing				
	DMC: 511777	0.9954	Data: 389120	0.0200

Energy

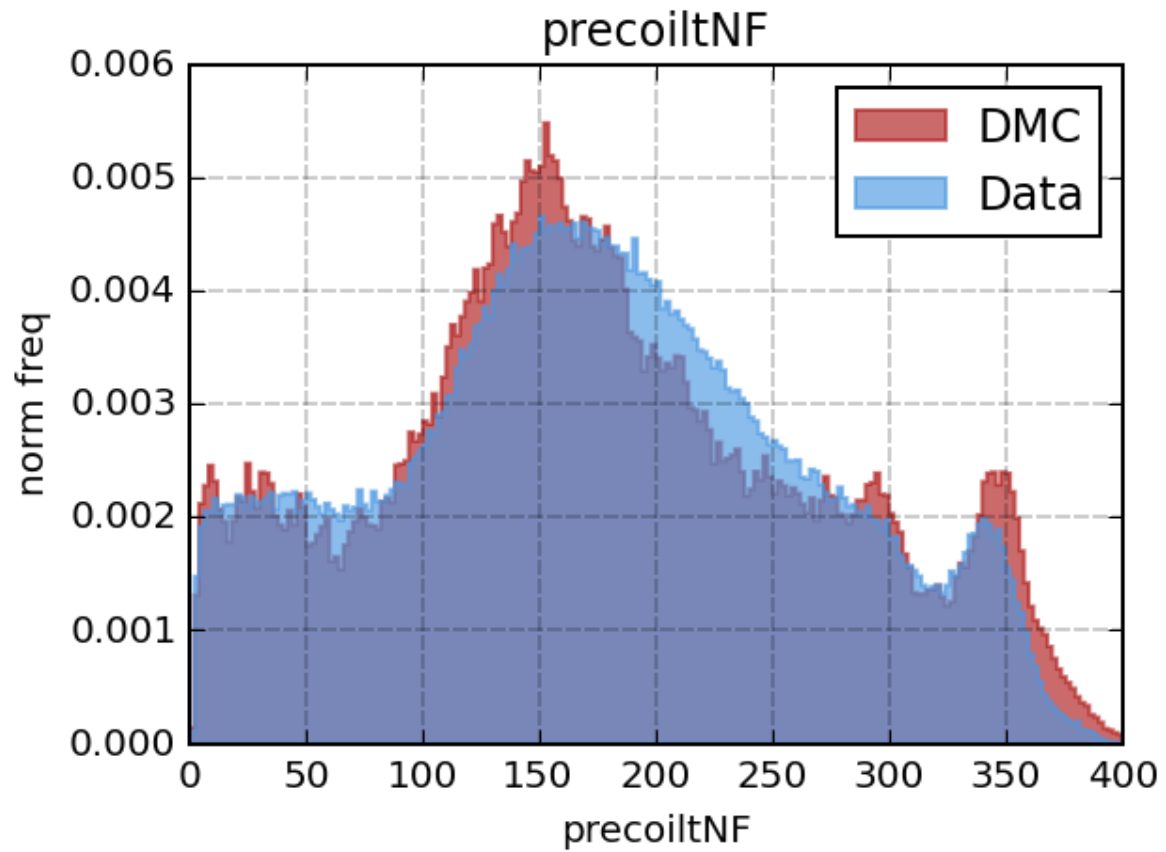
precoiltNF (only ptNF cut)

- 356keV peak is very close to data



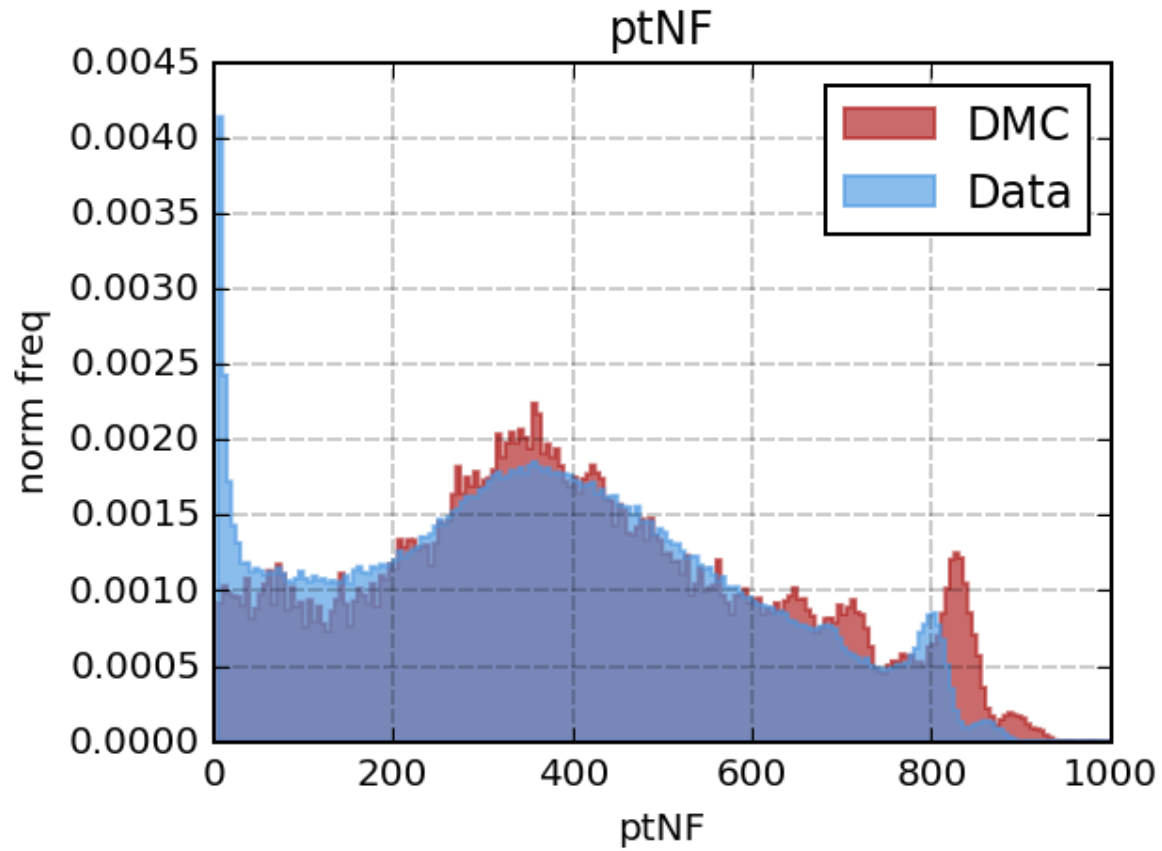
precoilNF (all cuts)

- 356keV peak is very close



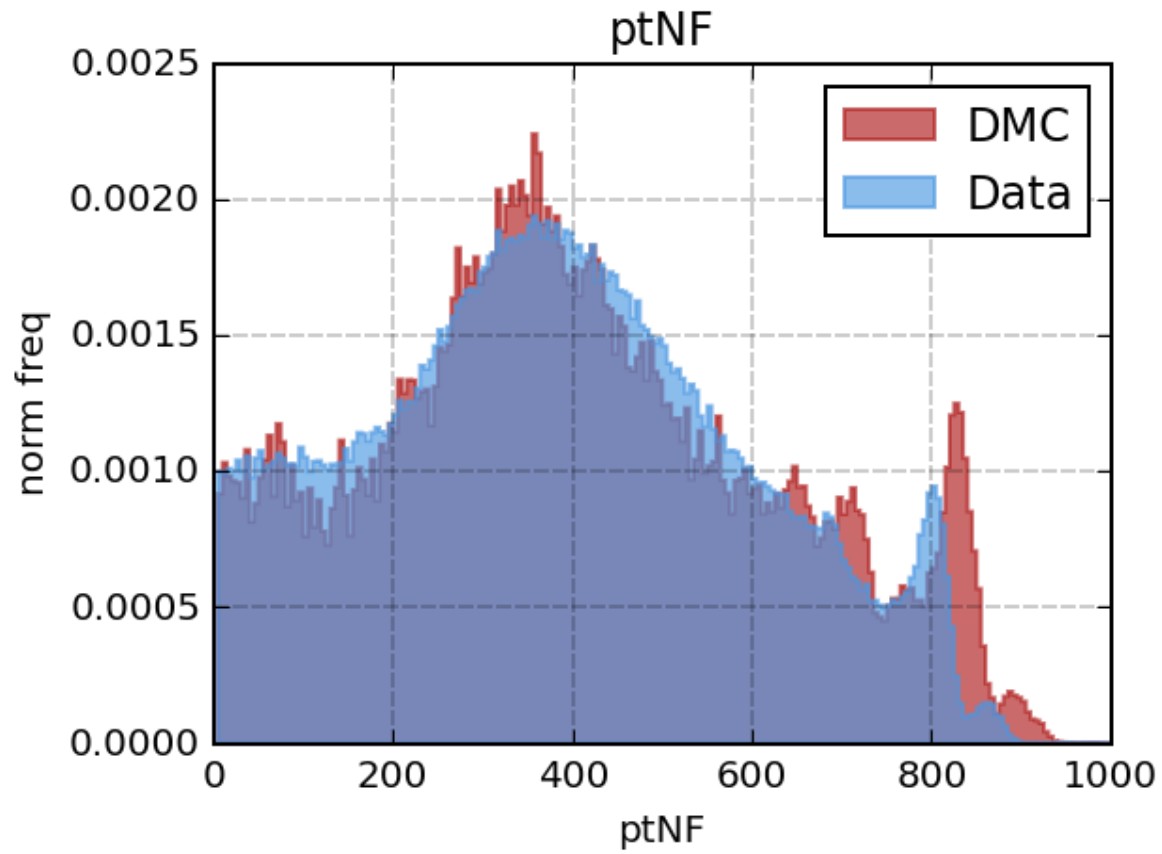
ptNF (no cuts)

- Distribution also matches up well but peaks are slightly shifted



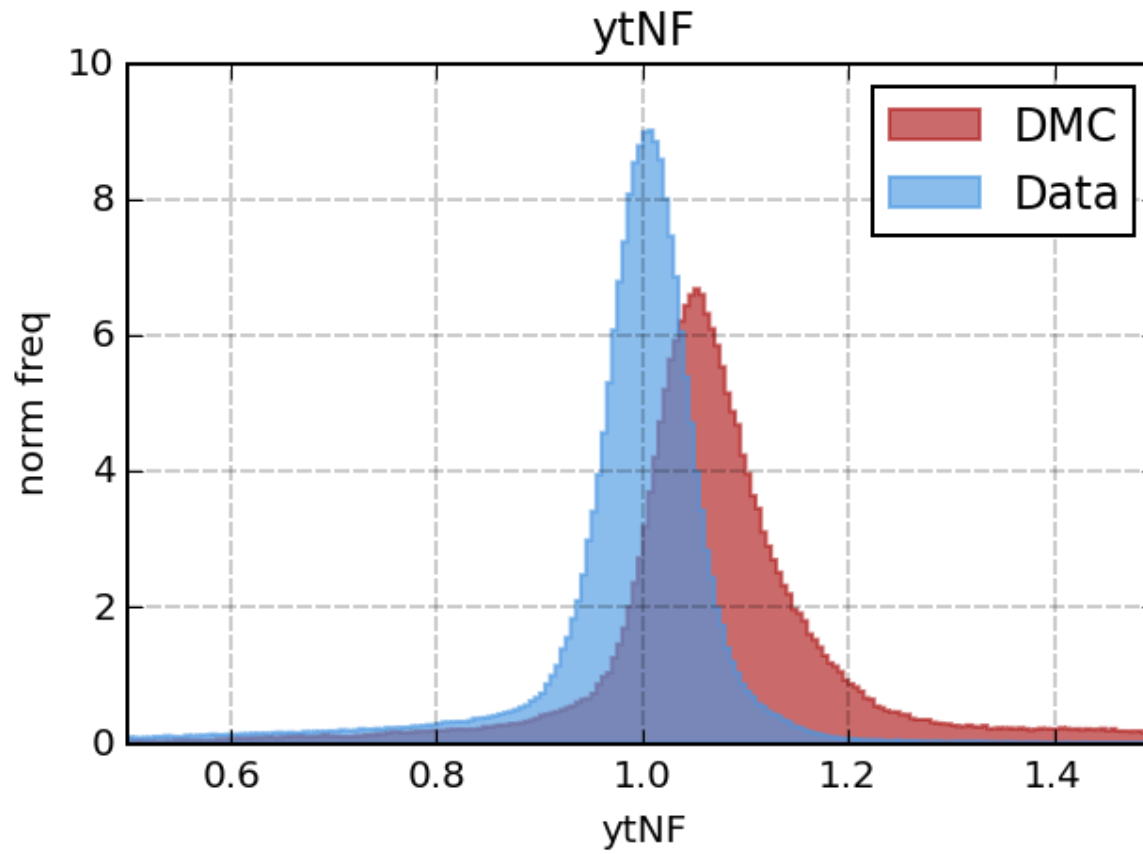
ptNF (all cuts)

- Distribution also matches up well but peaks are slightly shifted



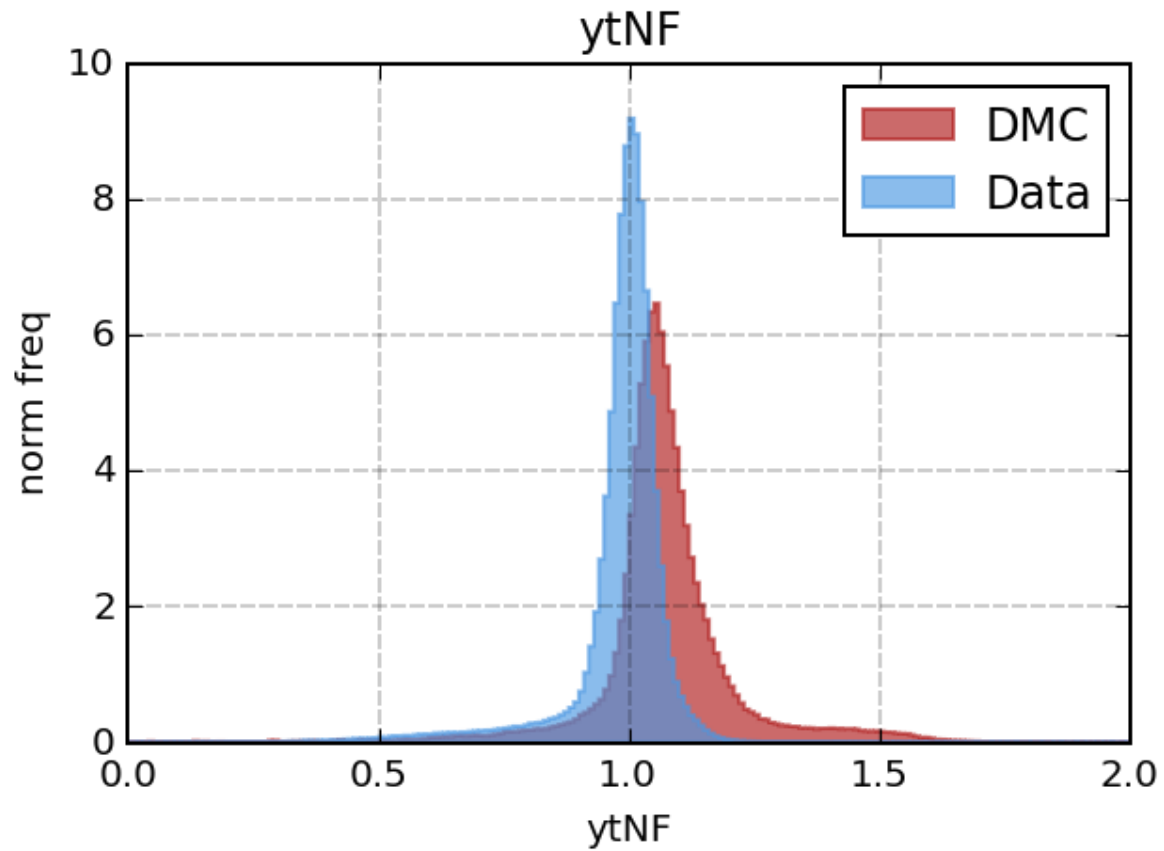
ytNF (no cuts)

- Without cuts it is not in great agreement



ytNF (all cuts)

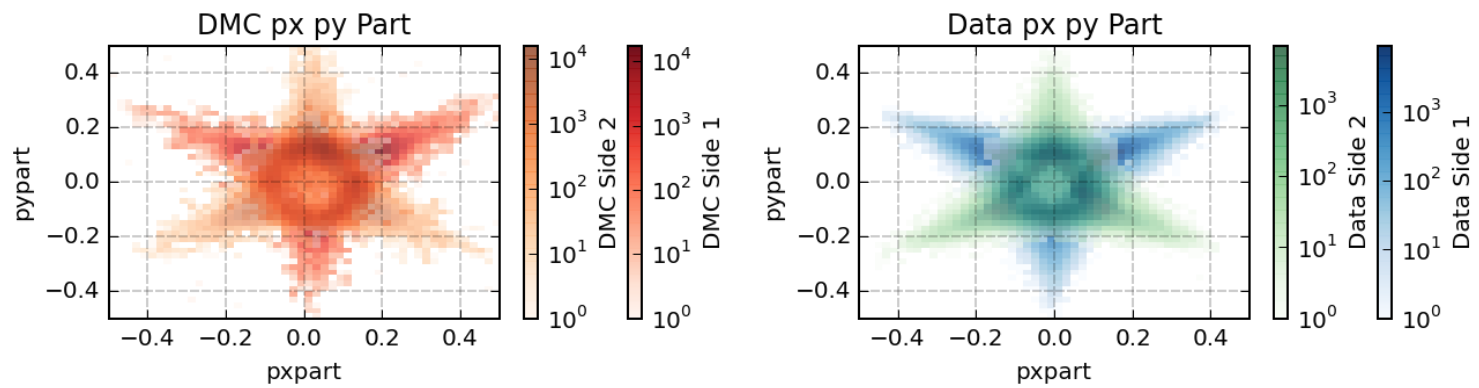
- Adding the cuts brings them closer, maybe it's due to 'background' events?
- Could the right hand tail be overestimated as well?



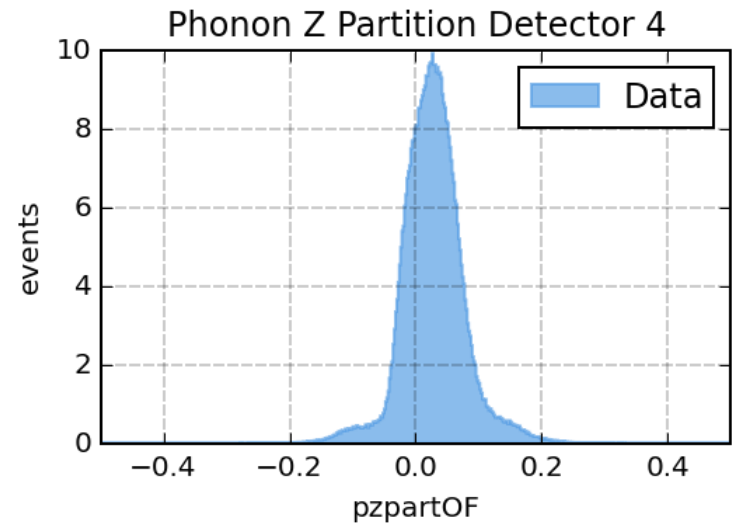
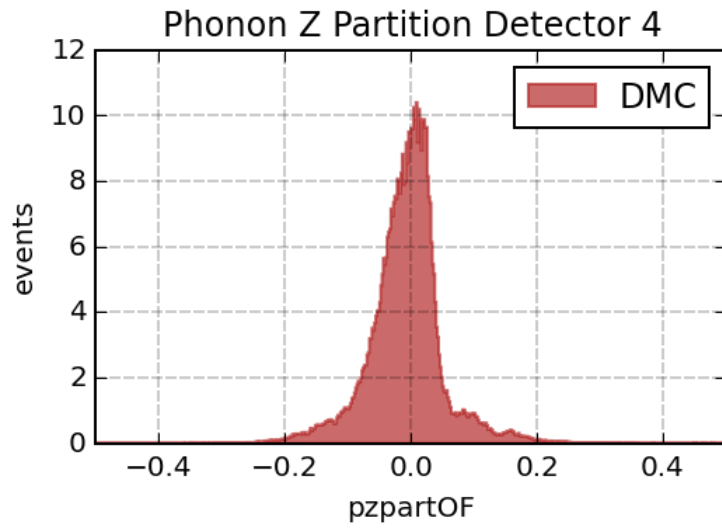
Phonon Partition

px py Partition (all cuts)

- Phonon partition plots are in very good agreement



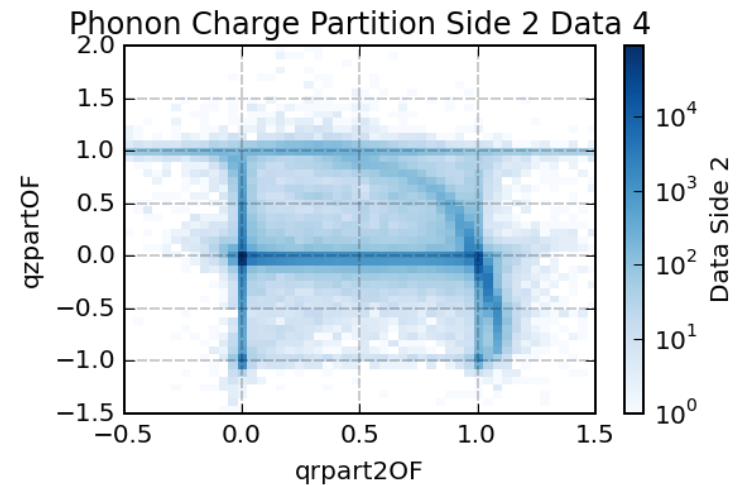
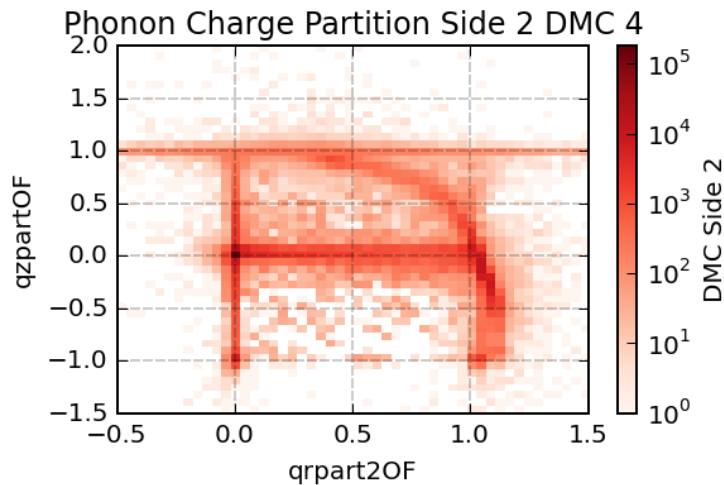
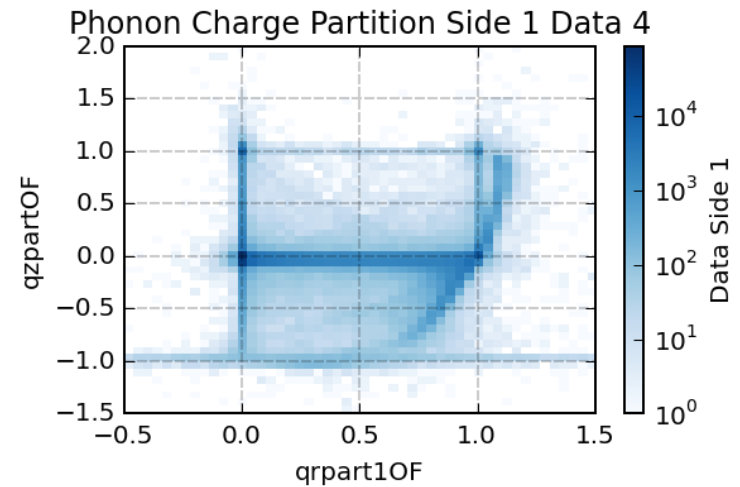
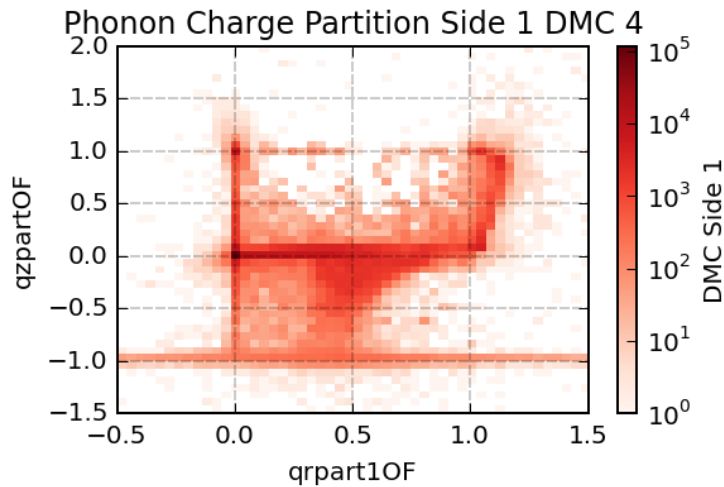
pz Partition (all cuts)



Charge Partition

qrpart qzpart (all cuts)

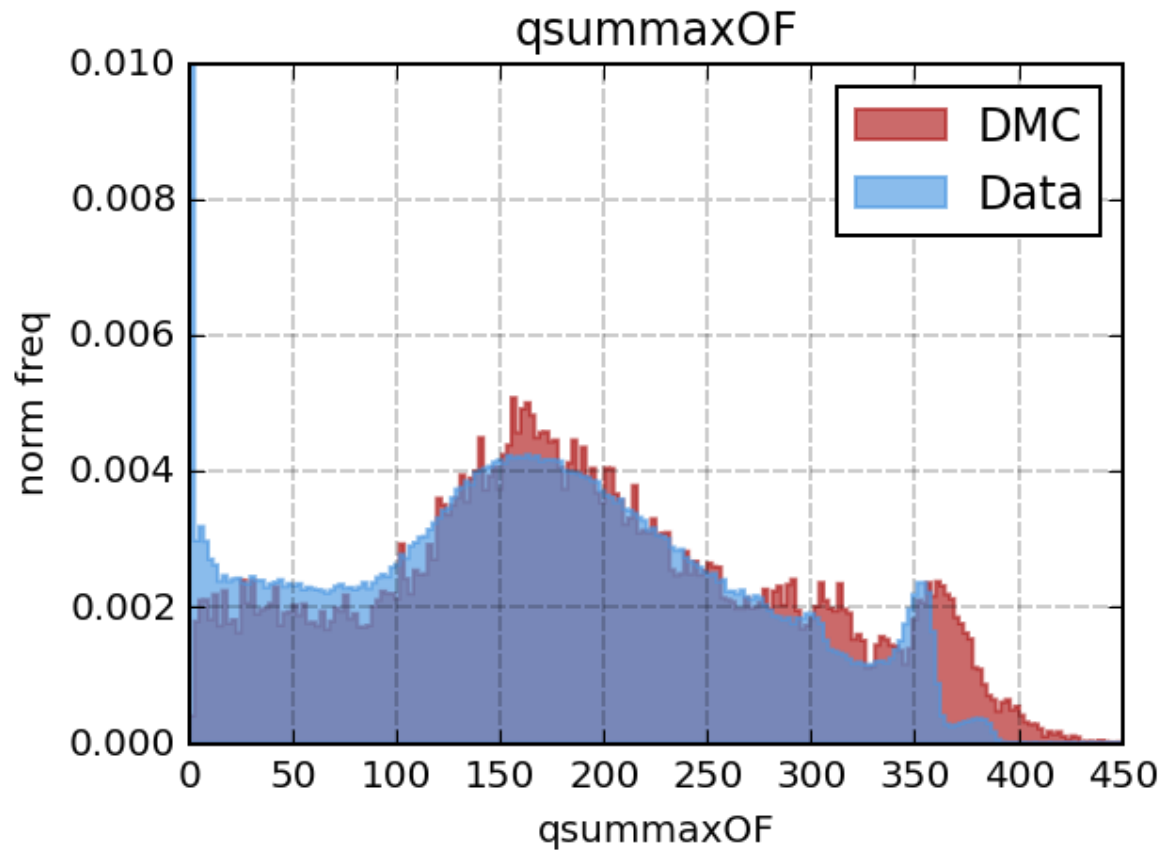
- Charge partitions are also in good agreement
- Slight differences, particularly in side 1



Ionization Energy

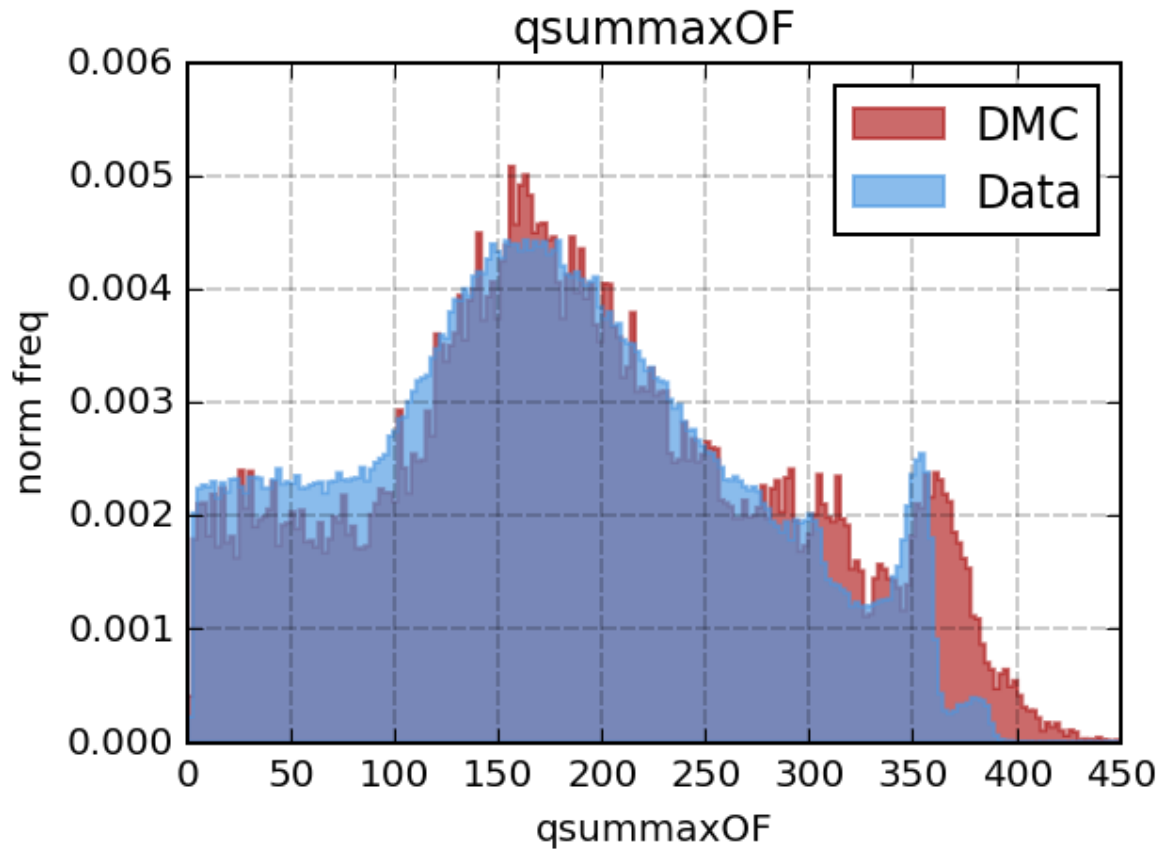
qsummax (no cuts)

- qsummax is now fixed so ptNF and ytNF are in good agreement
- seems like the shape of the tail is slightly off, perhaps it should be sharper?

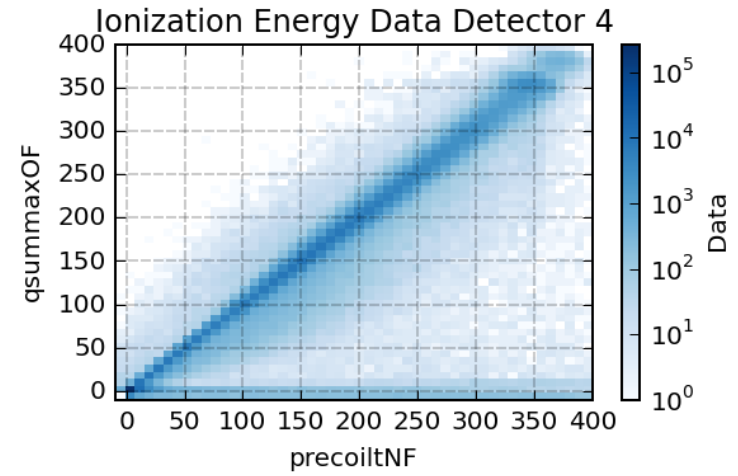
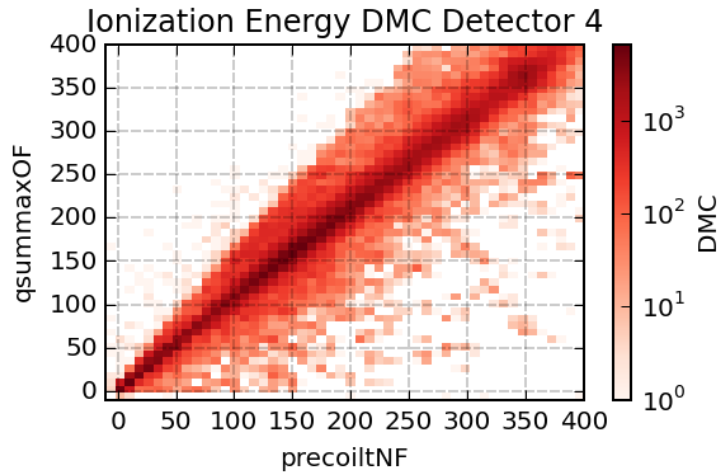


qsummax (all cuts)

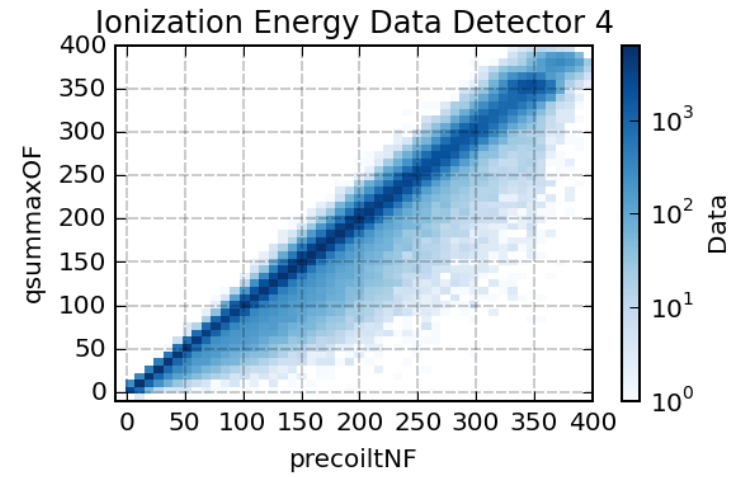
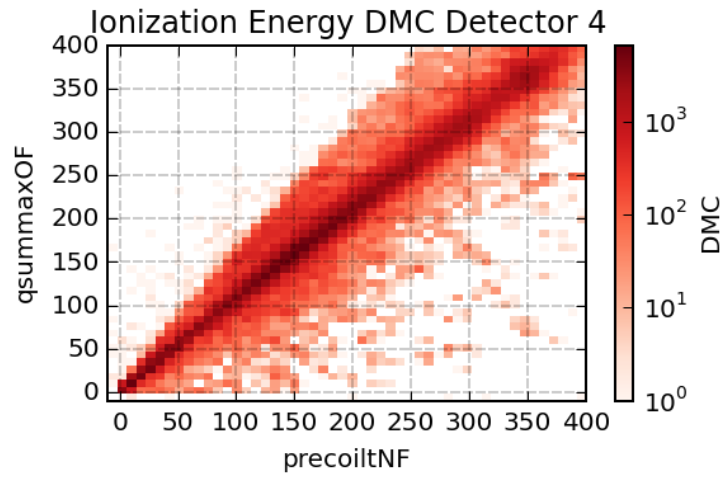
- qsummax is now fixed so ptNF and ytNF are in good agreement
- seems like the shape of the tail is slightly off, perhaps it should be sharper?



precoilNF qsummax (no cuts)

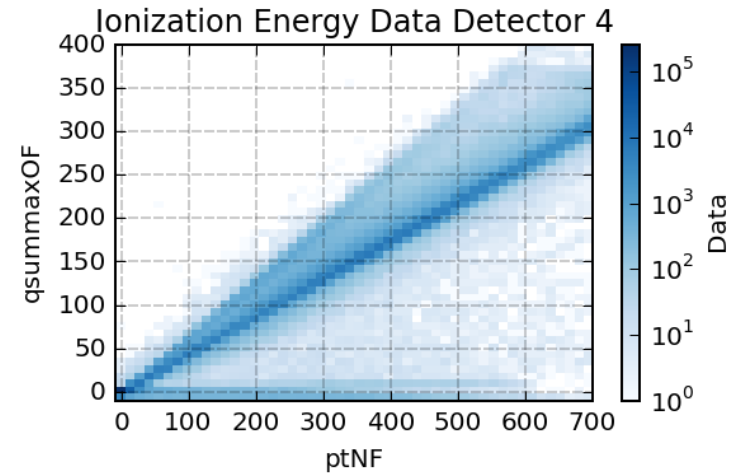
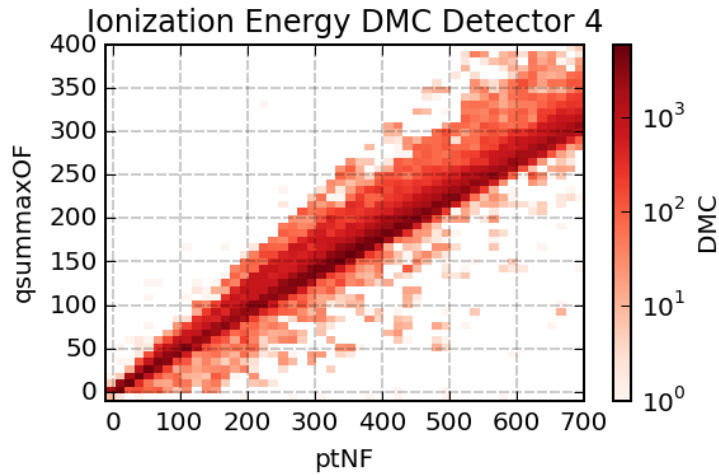


precoilNF qsummaxOF (all cuts)

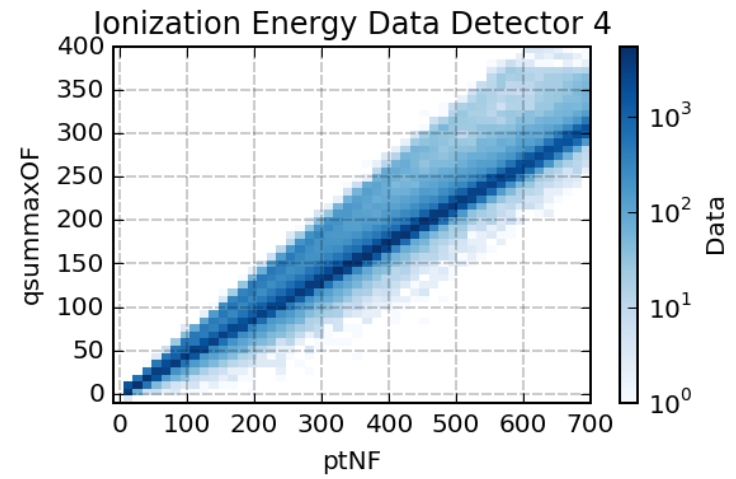
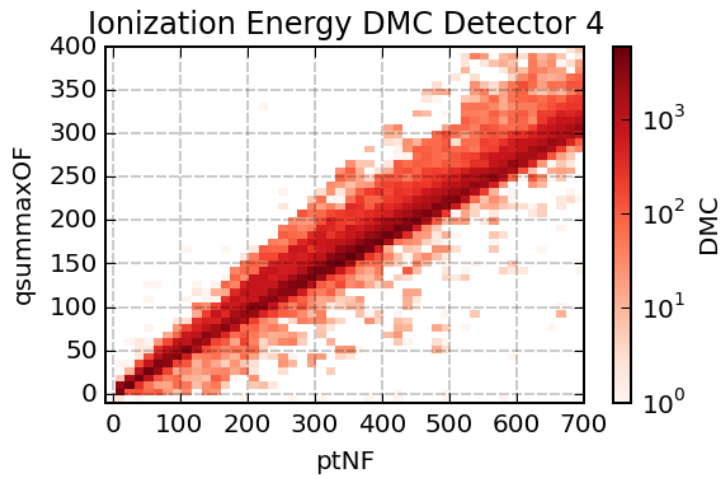


ptNF qsummaxOF (no cuts)

- ptNF comes from the amplitude of the phonon pulse
- this is related to qsummax in the pulse calibration/scaling stage (before processing, after DMC pulse generation)



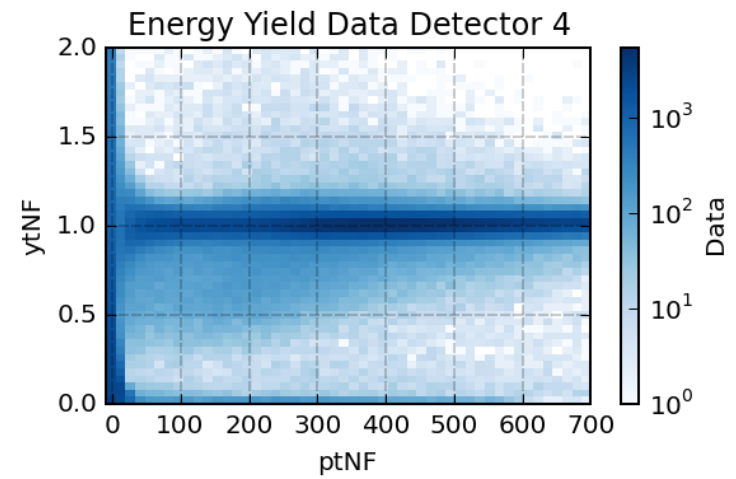
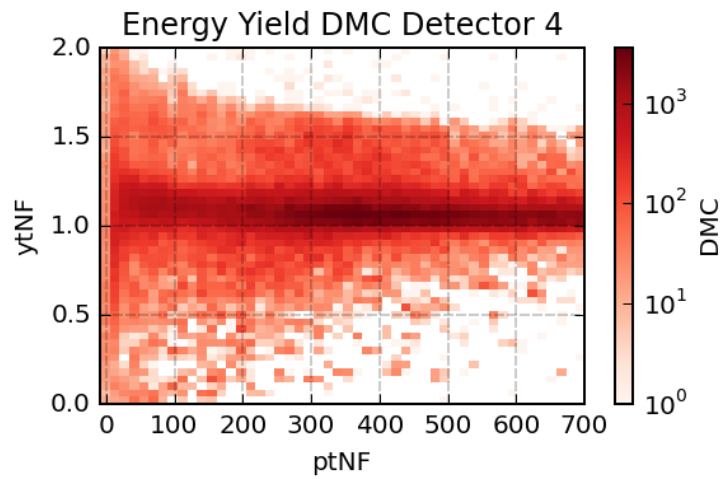
ptNF qsummaxOF (all cuts)



Energy Yield

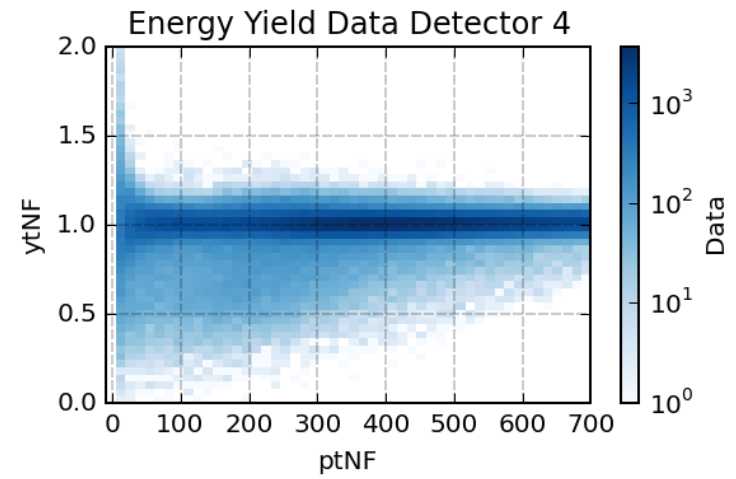
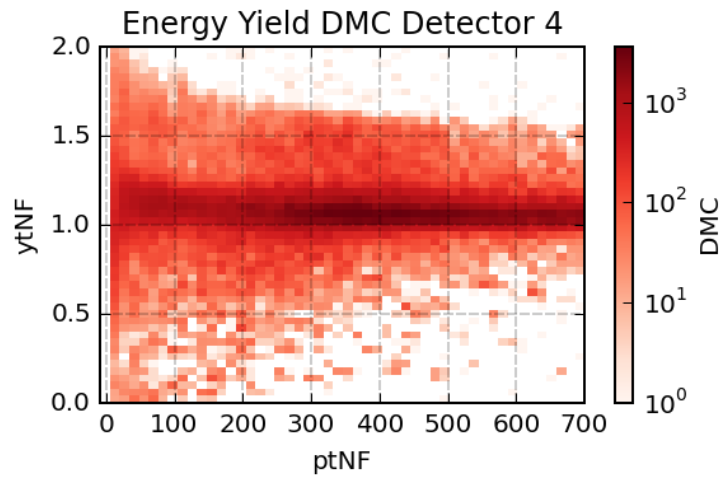
ytNF (no cuts)

- ytNF is obtained from the ratio of qsummaxOF and precoiltNF



ytNF (all cuts)

- ytNF is obtained from the ratio of qsummaxOF and precoiltNF



Conclusions

- Simulations are in very good shape!
- The energy yield might need more care, especially in the right-hand side tail excess
- This is likely caused by the shape of the `qsummaxOF` tail of the 356keV peak
- The previous issues have been fixed, and were only caused in the formatting (pre-processing) stage, due to an index-shifting bug.