Istituto Nazionale di Fisica Nucleare
LABORATORI NAZIONALI DI LEGNARO

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DSAM of ^{56}Ni

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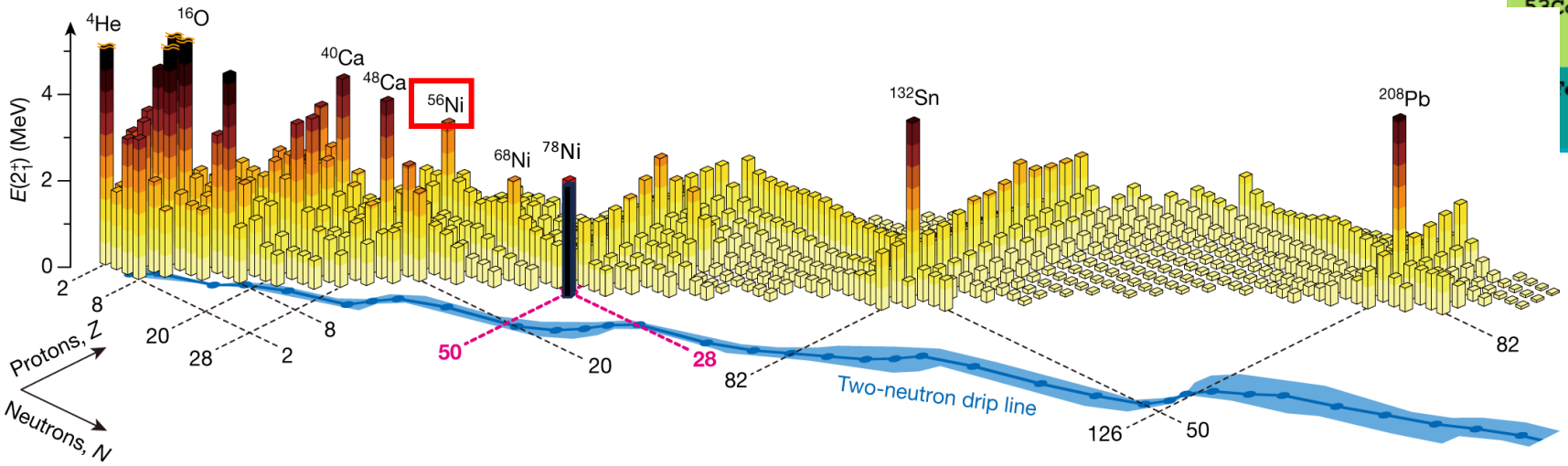
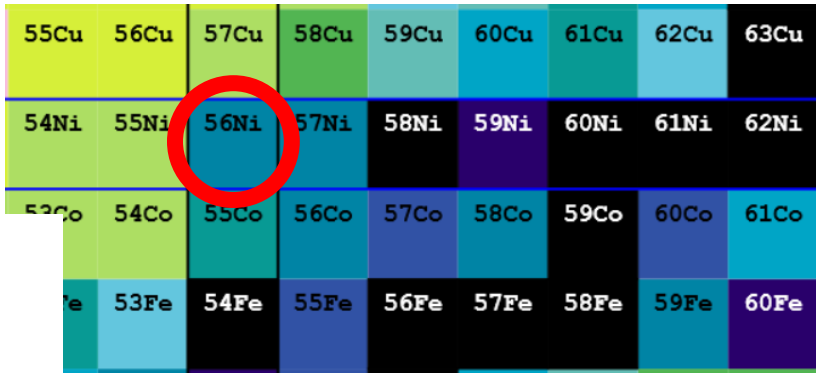
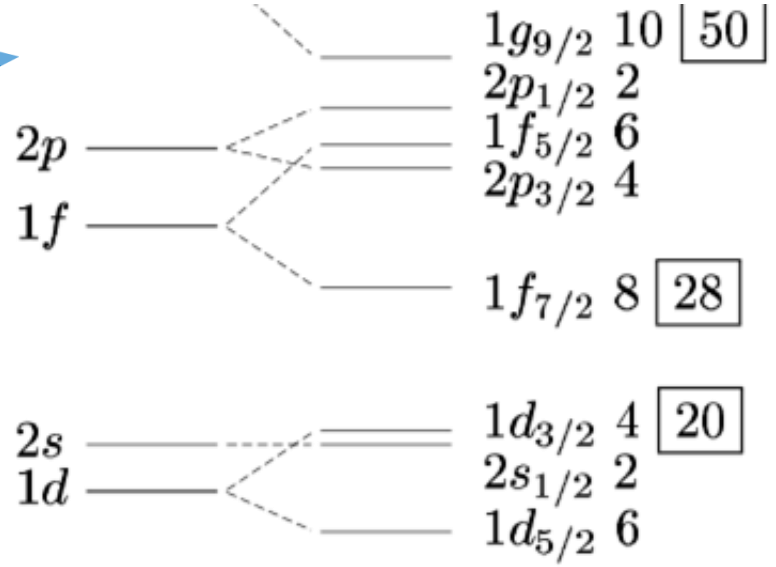
Physics motivation

N = Z = 28: the (not so) doubly-magic ^{56}Ni nucleus

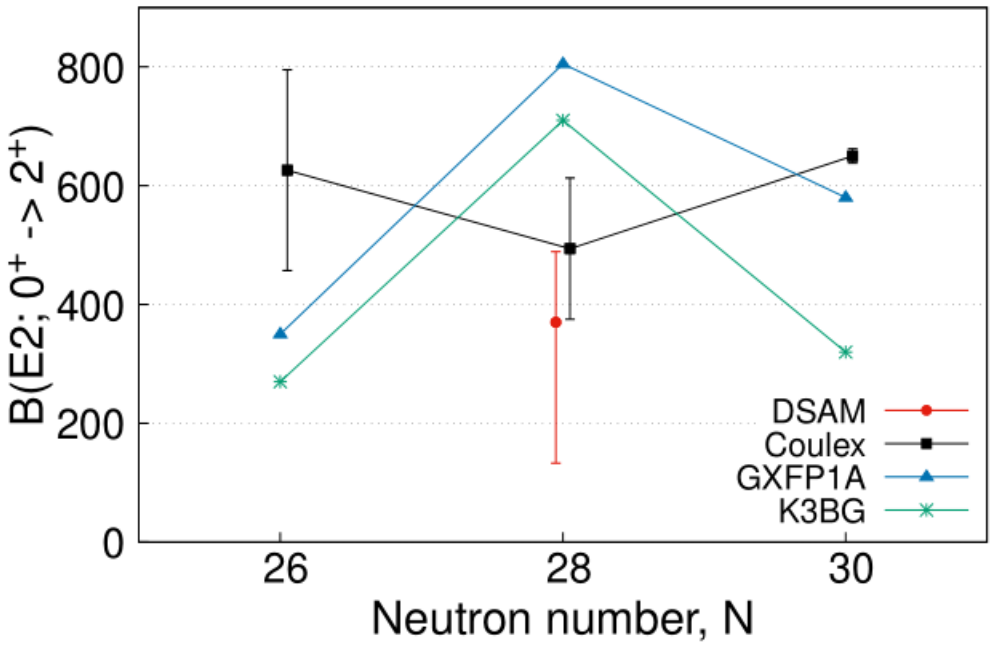
Soft doubly-magic nucleus, with large **core-breaking** components already in the ground state.







E2 strengths



$f_{7/2}$ occupation numbers GXPF1A – 8p-8h exc. allowed		
^{54}Ni	^{56}Ni	^{58}Ni
0^+ π: 7.4 ν: 5.6	0^+ π: 7.6 ν: 7.6	0^+ π: 7.4 ν: 7.7
2_1^+ π: 7.3 ν: 5.6	2_1^+ π: 6.8 ν: 6.8	2_1^+ π: 7.3 ν: 7.6
The 2^+ is made via neutrons in $f_{7/2}$, plus a small breaking of the N=28 core	The 2^+ is made via p/n excitations breaking the Z=N=28 core	The 2^+ is made via neutrons in the space above N=28

DSAM

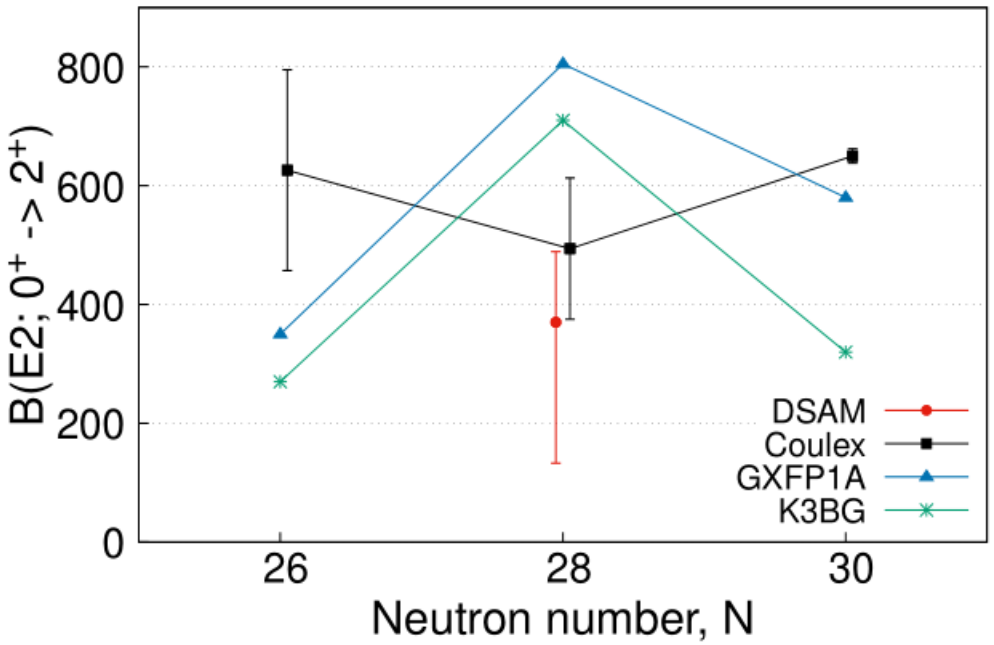
feeding from upper state not determined

Intermediate-energy Coulomb excitation

entangled nuclear and Coulomb contributions

low statistics

E2 strengths



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DSAM

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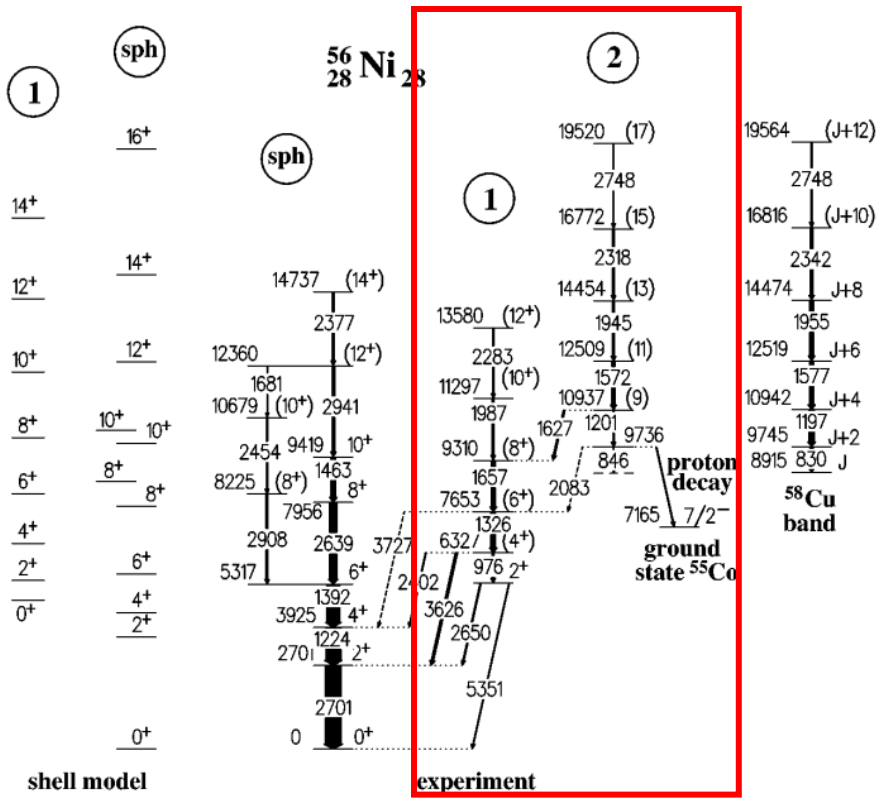
Shell model overestimates the B(E2)?

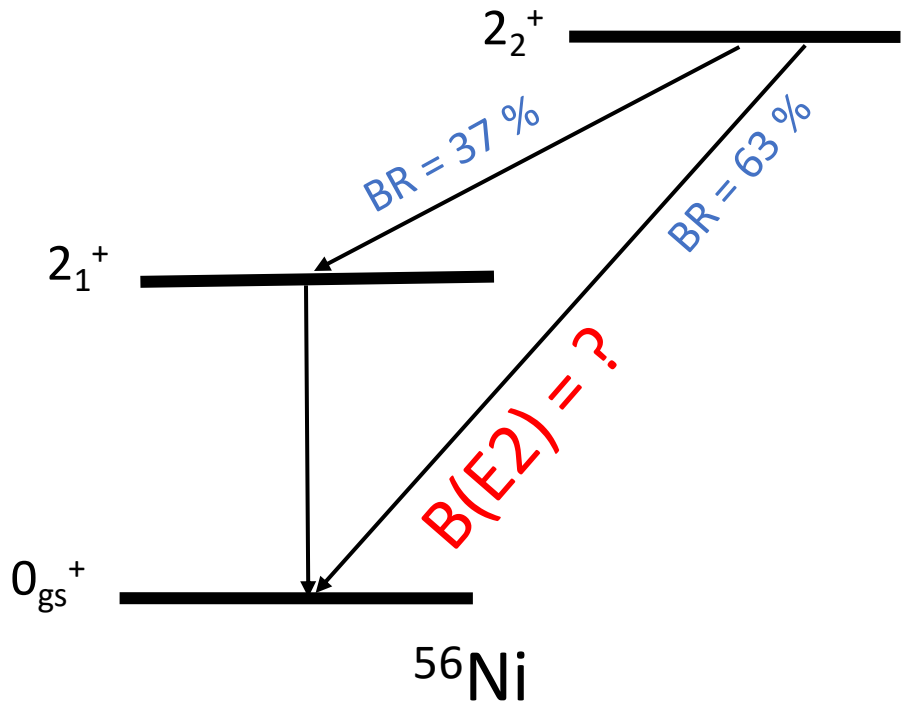
- wrongly modeled core-breaking?
- isospin symmetry breaking?

Mixing of deformed and spherical bands?



Rotational band identified at low E*, based on 4p-4h excitations in the pf shells, and reproduced by LSSM calculations.

D. Rudolph et al., Phys. Rev. Lett. **82** (1999) 3763



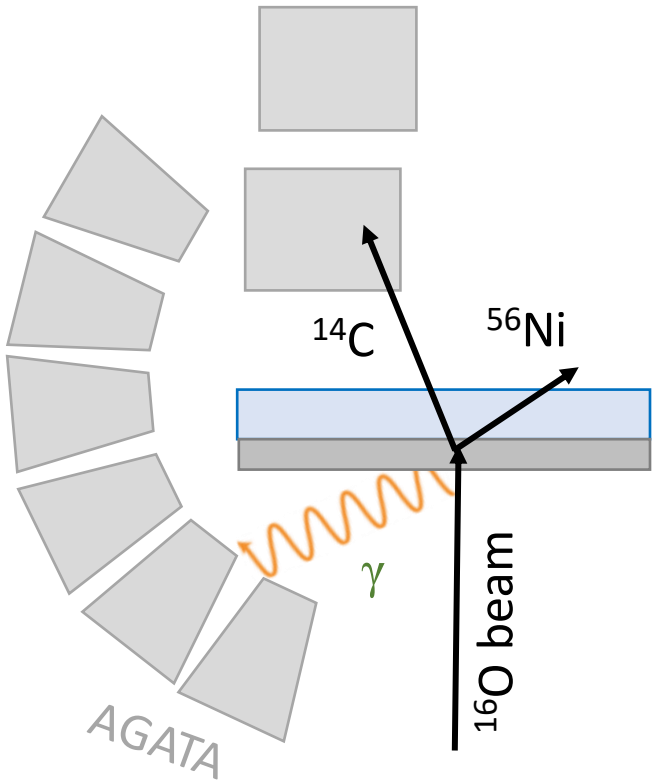
A strongly suppressed B(E2; 2_2^+ -> 0_1^+), as predicted by GXPF1A, would imply no mixing between spherical and deformed configurations but difficult to account for the experimental BR.

A large B(E2; 2_2^+ -> 0_1^+) of several W.u. would imply significant mixing between spherical and deformed configurations.

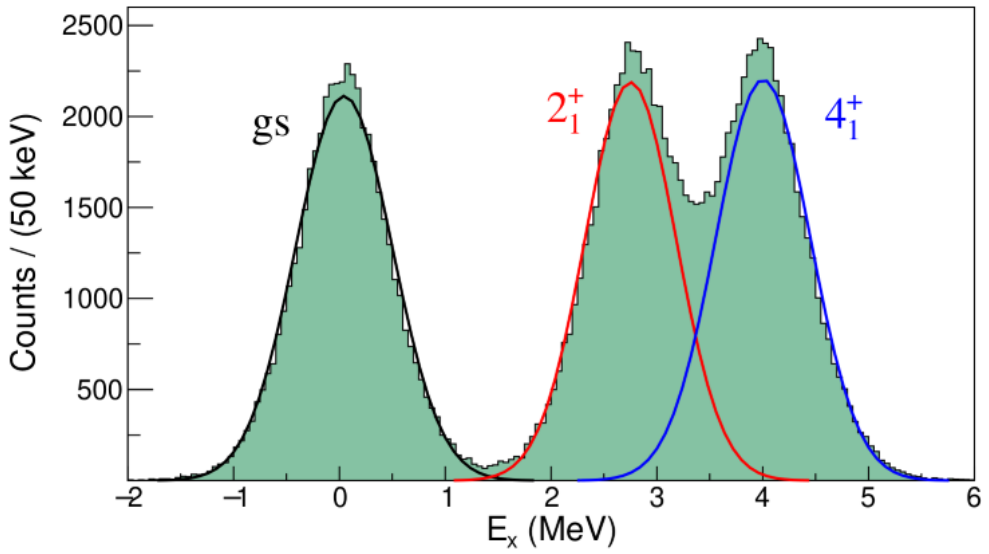
Experiment

Experiment

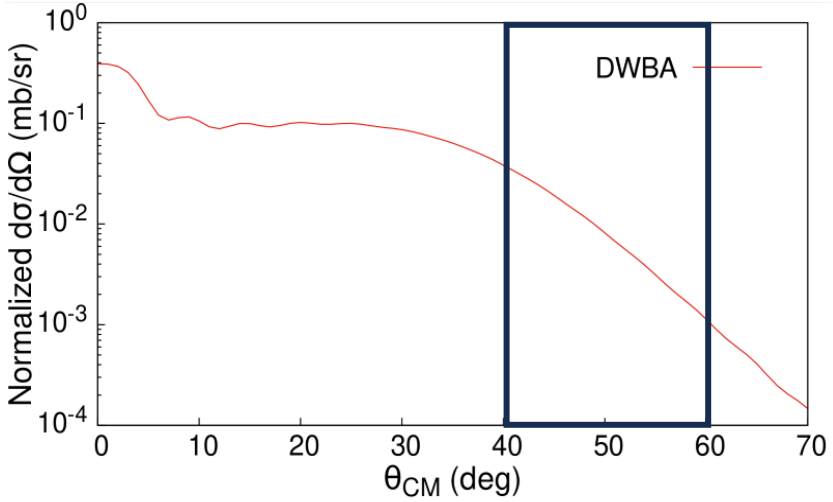
E-ΔE telescopes

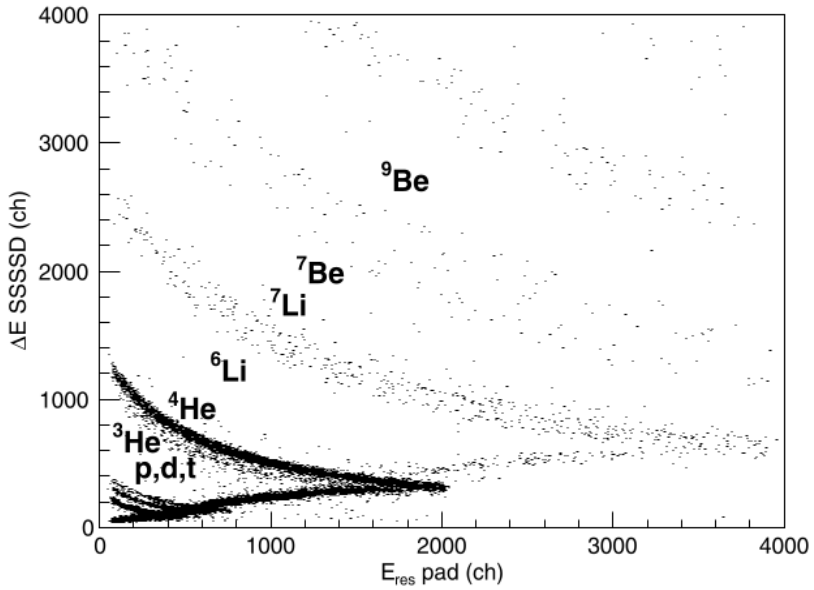


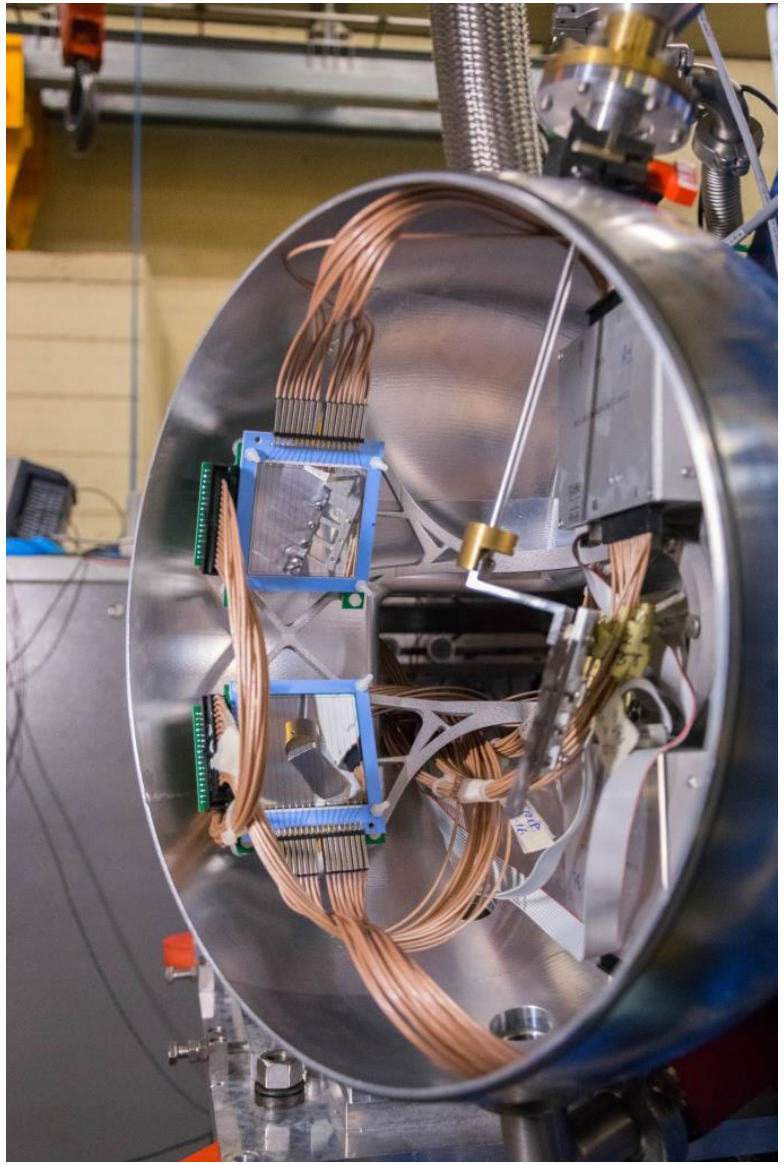
Nb backing (0.5 mg/cm^2)
^{54}Fe target (0.4 mg/cm^2)



Experiment


DWBA
Normalized dσ/dΩ (mb/sr)
θCM (deg)

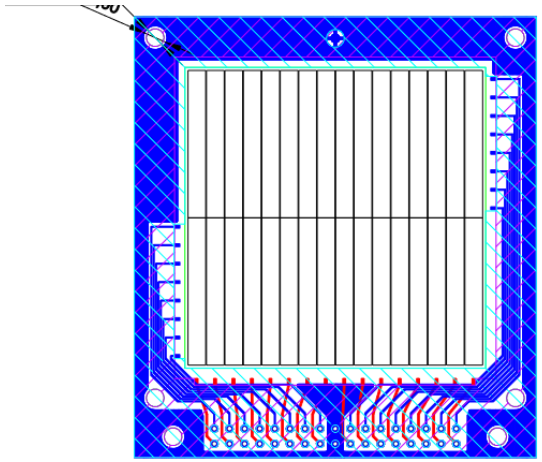

9Be
7Be
7Li
6Li
4He
3He
p,d,t
ΔE SSSSD (ch)
Eres pad (ch)



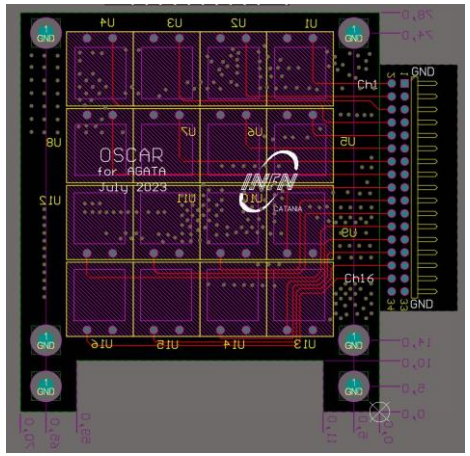
Calibration(s)

Position calibration

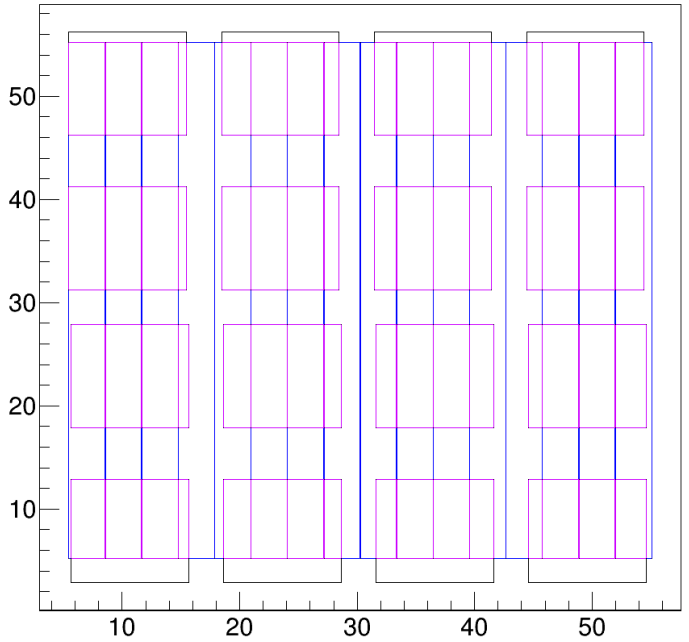
dE layer



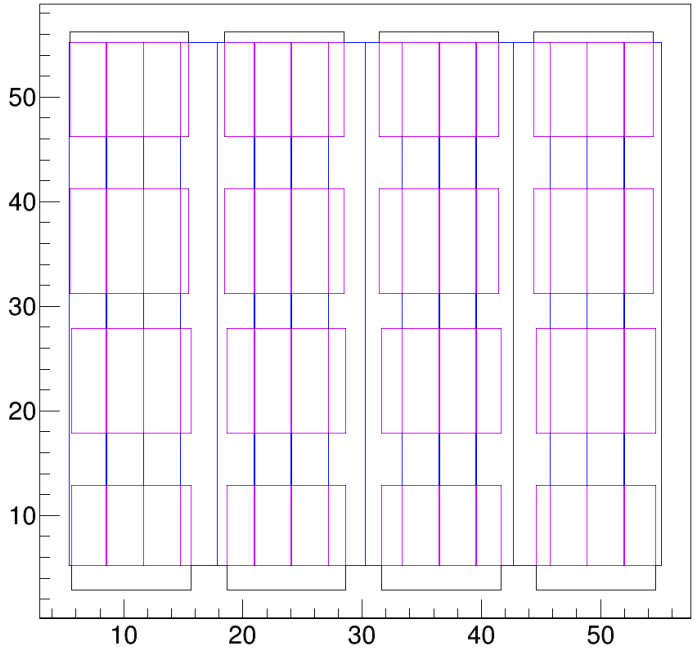
E layer



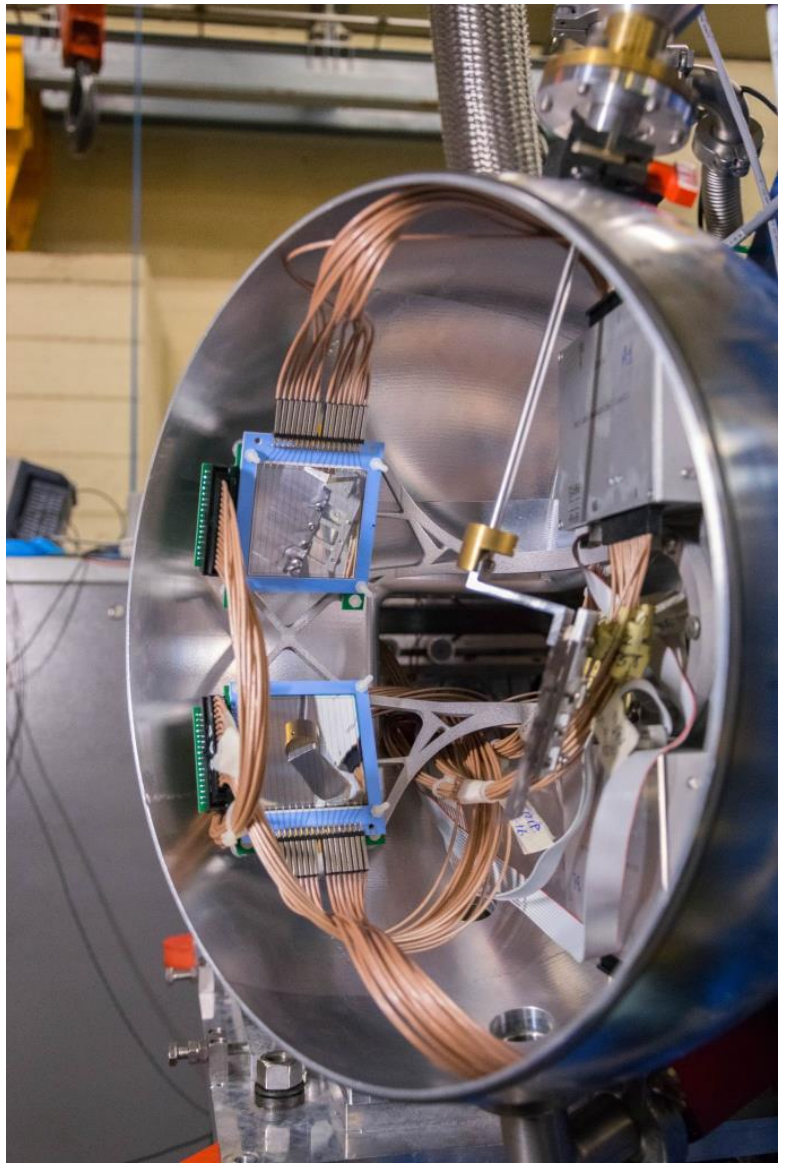
Blu



Nero

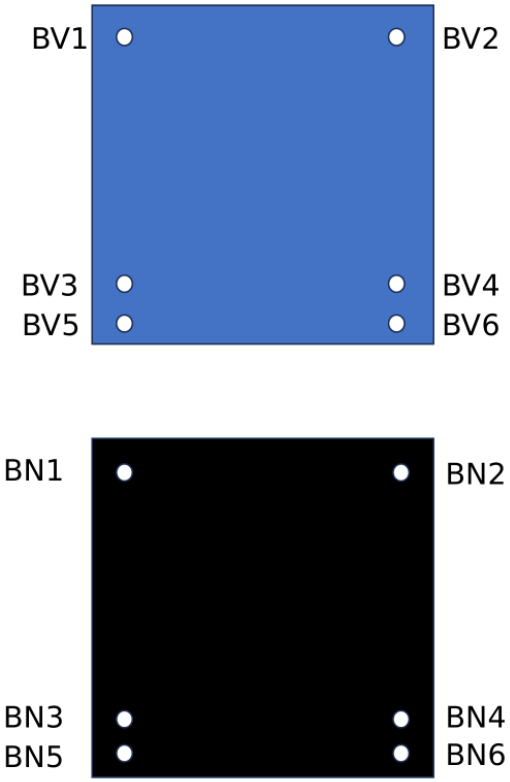


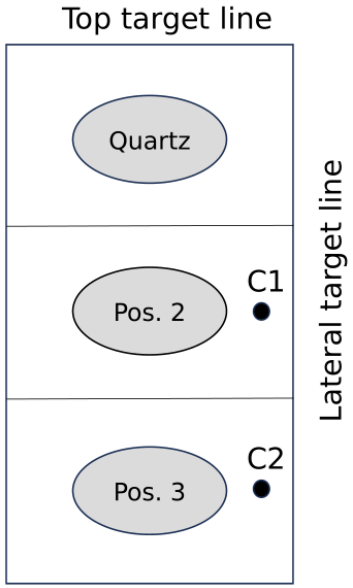
128 pseudo-telescopes

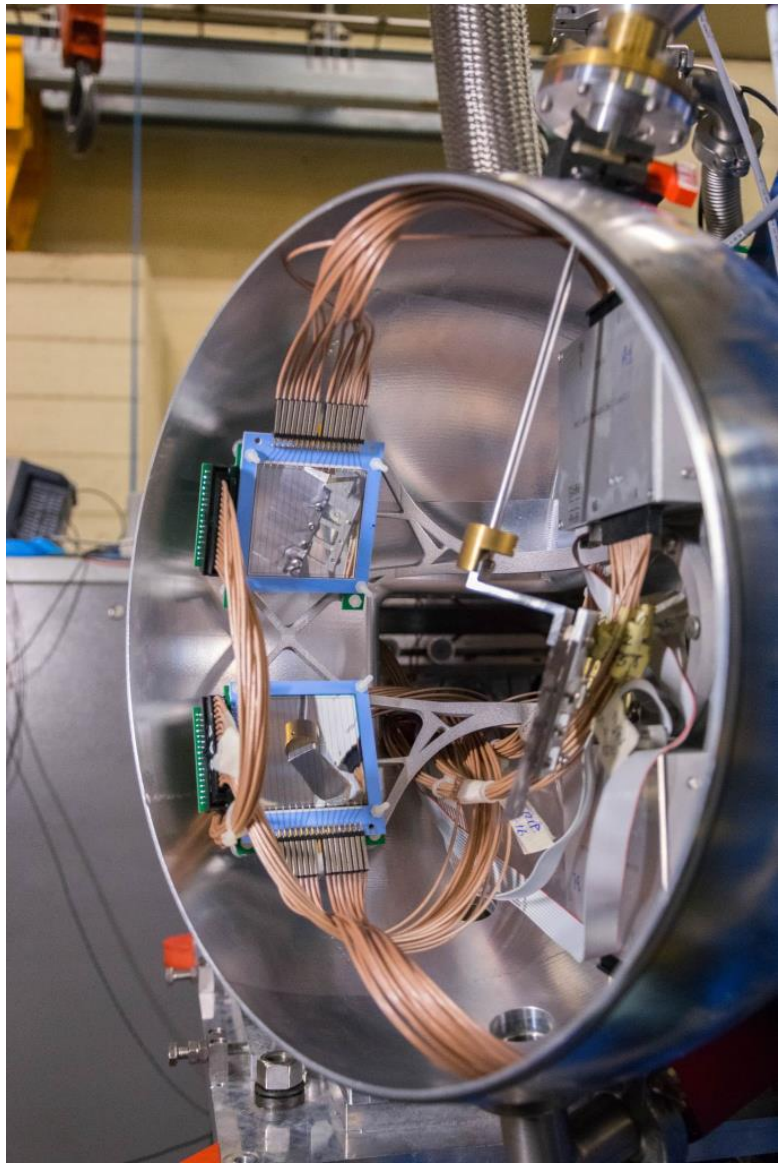


Position calibration

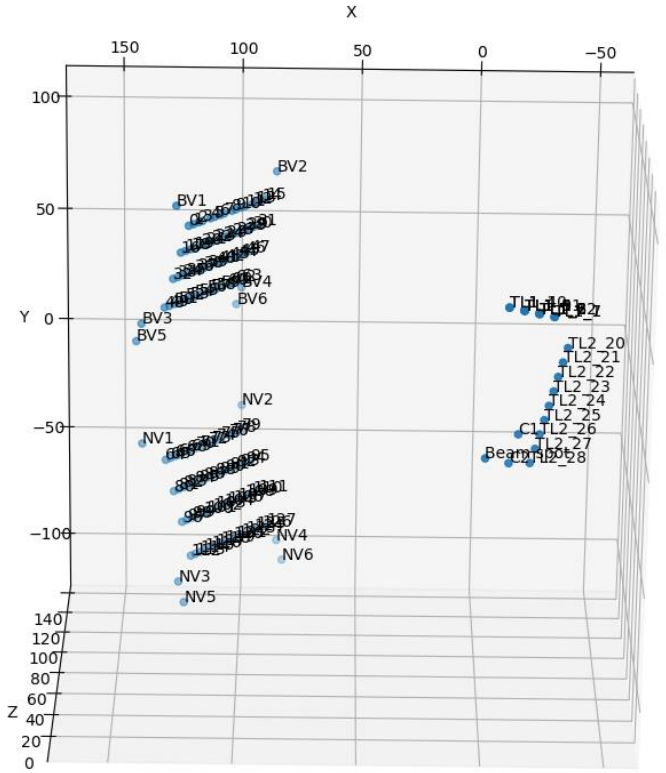
Laser measurements







Position calibration

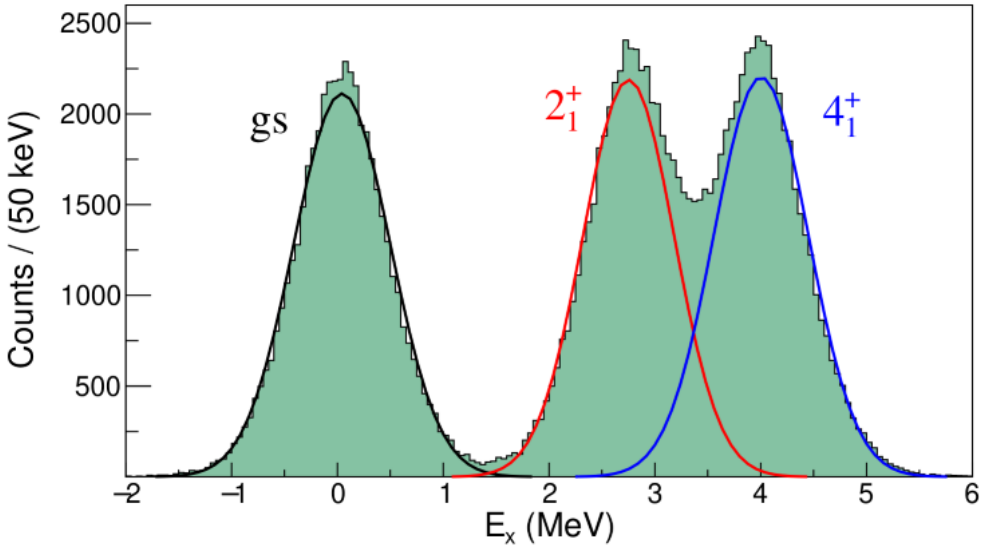


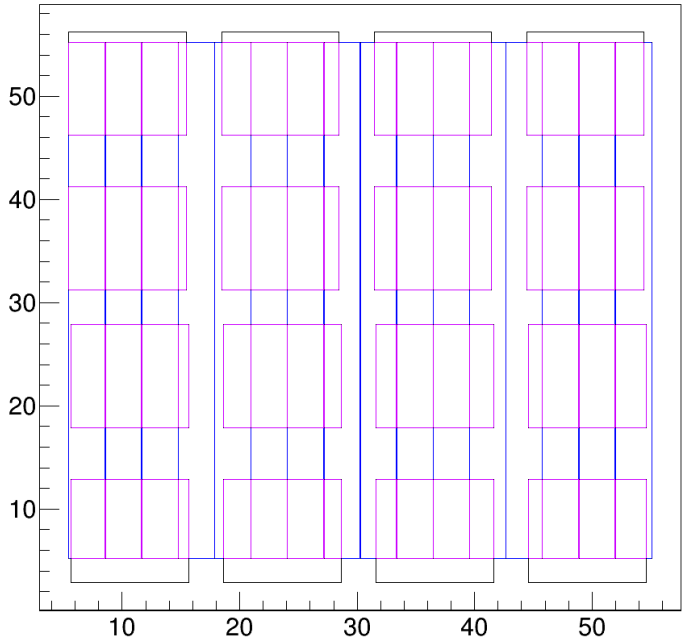
...waiting for corrected coordinates

Energy calibration

Energy calibration using 80, 70, 60, 55, 50 MeV beam on 100µg of ^{197}Au

- 2 energy calibration parameters for E and dE layers
- front dE dead layer thickness
- back dE + front E dead layer thickness





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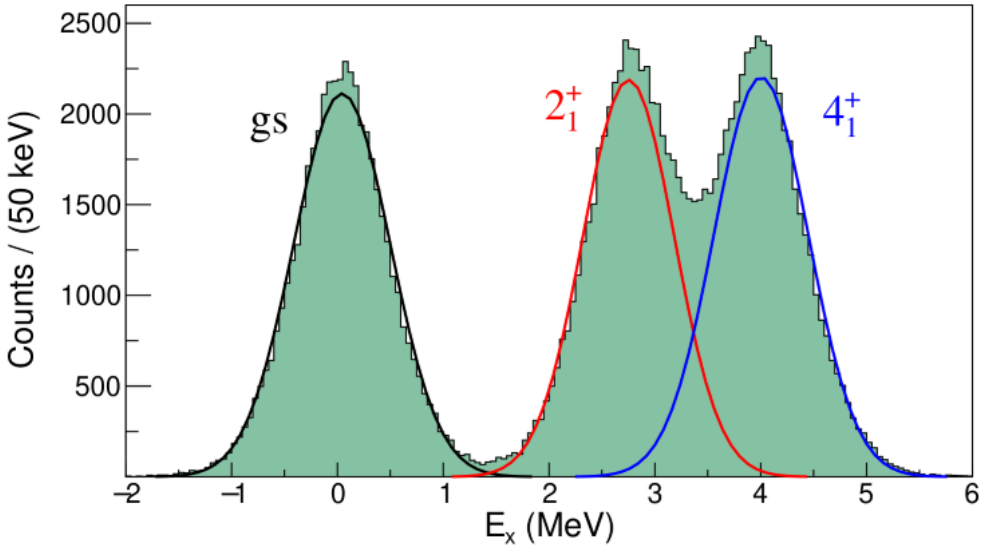
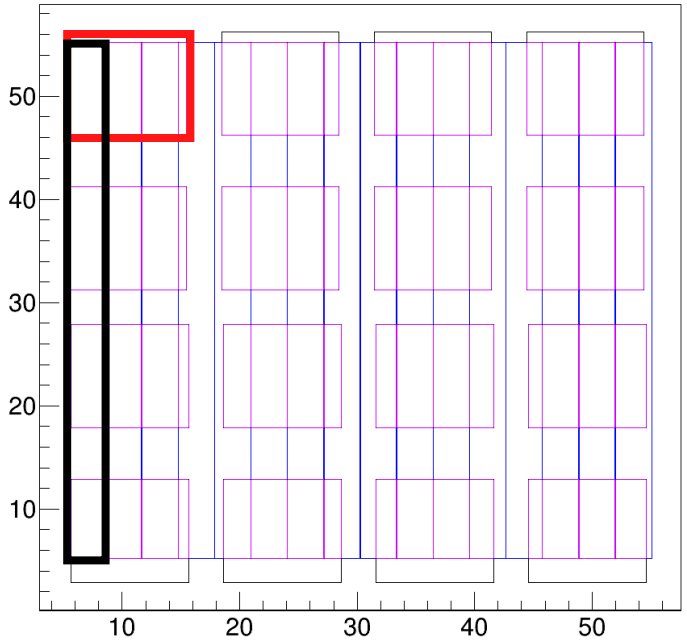


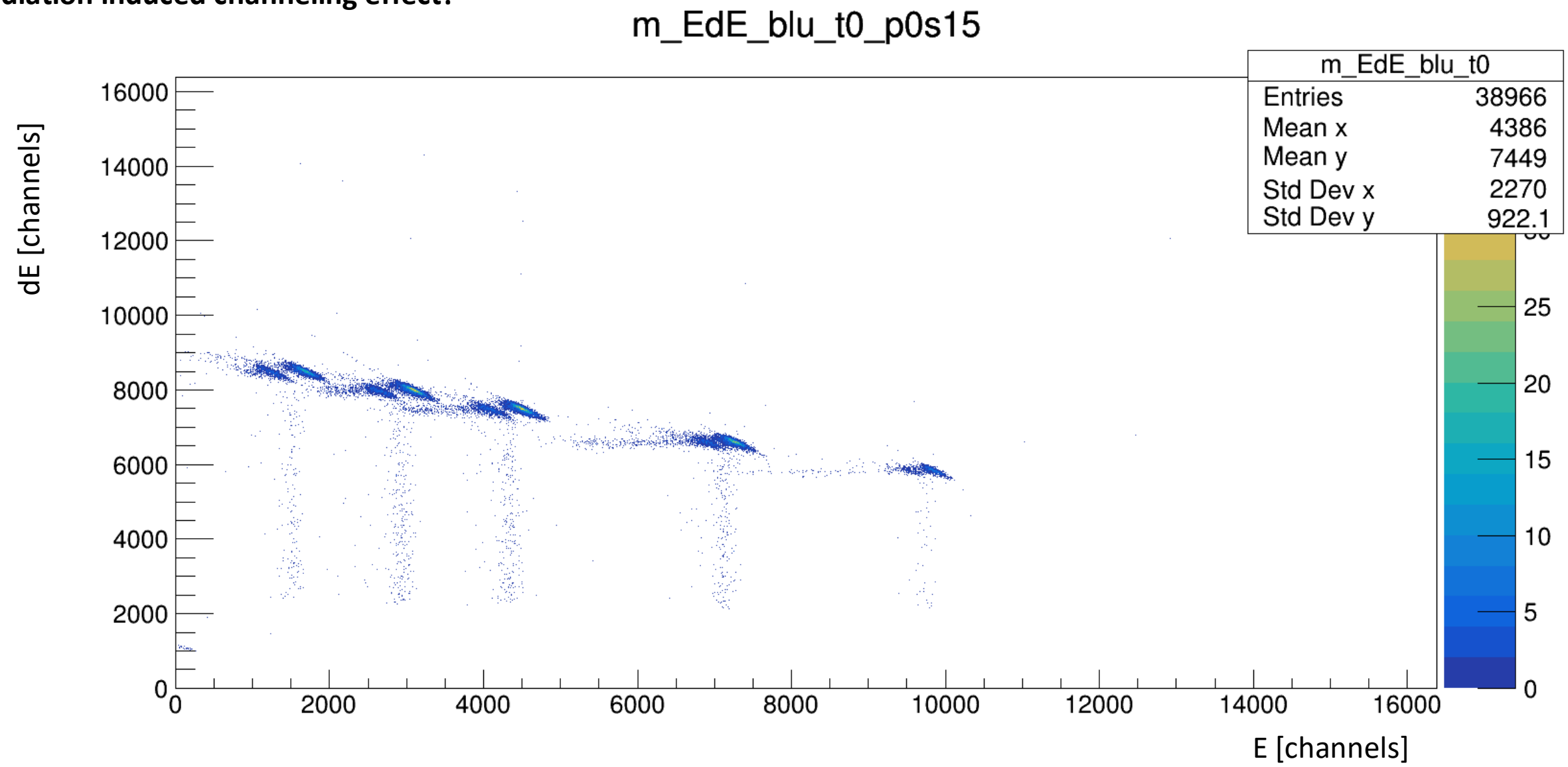


Minimization blocks

- same energy calibration parameters for same pad/strip

Energy calibration... difficulties

Radiation induced channeling effect?



Energy calibration... difficulties

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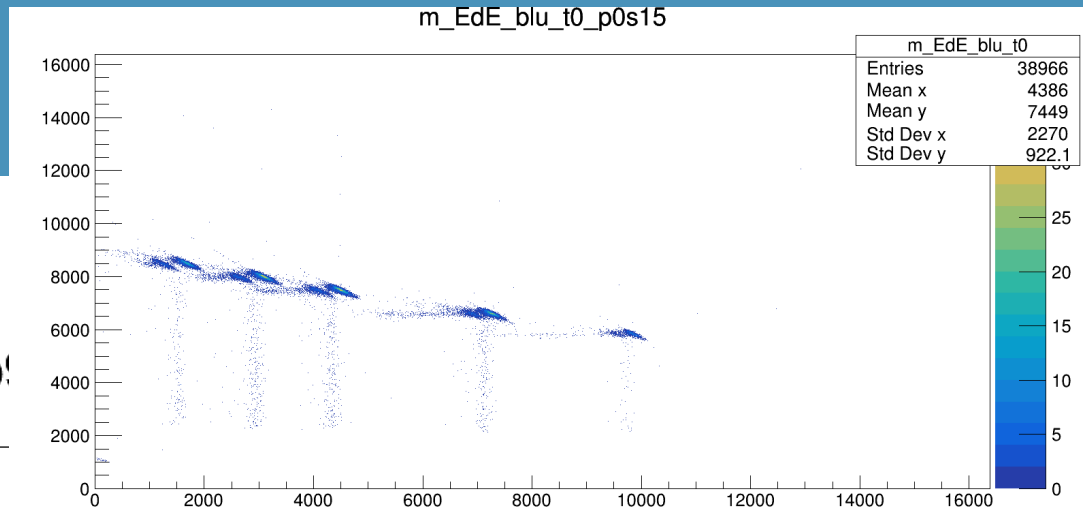
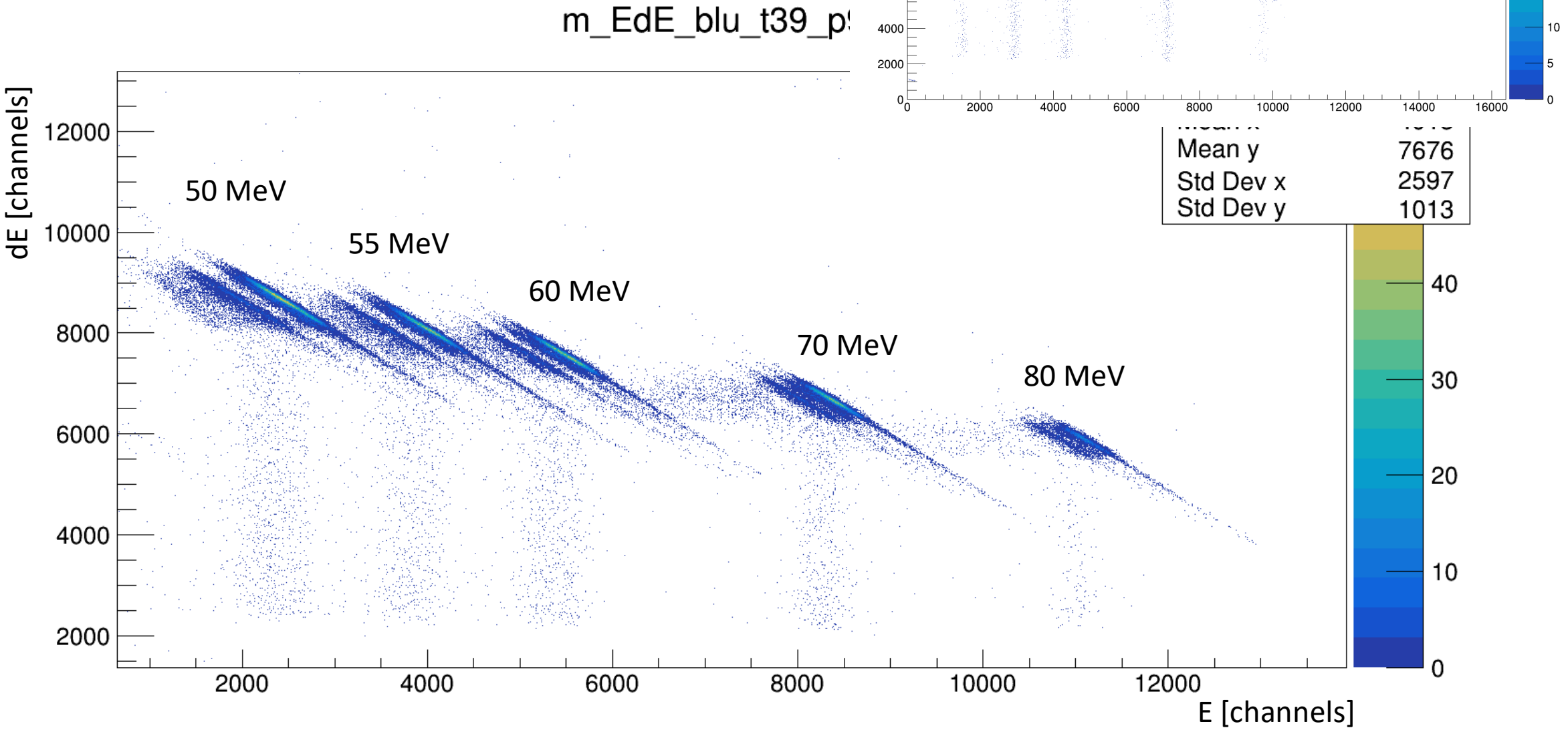
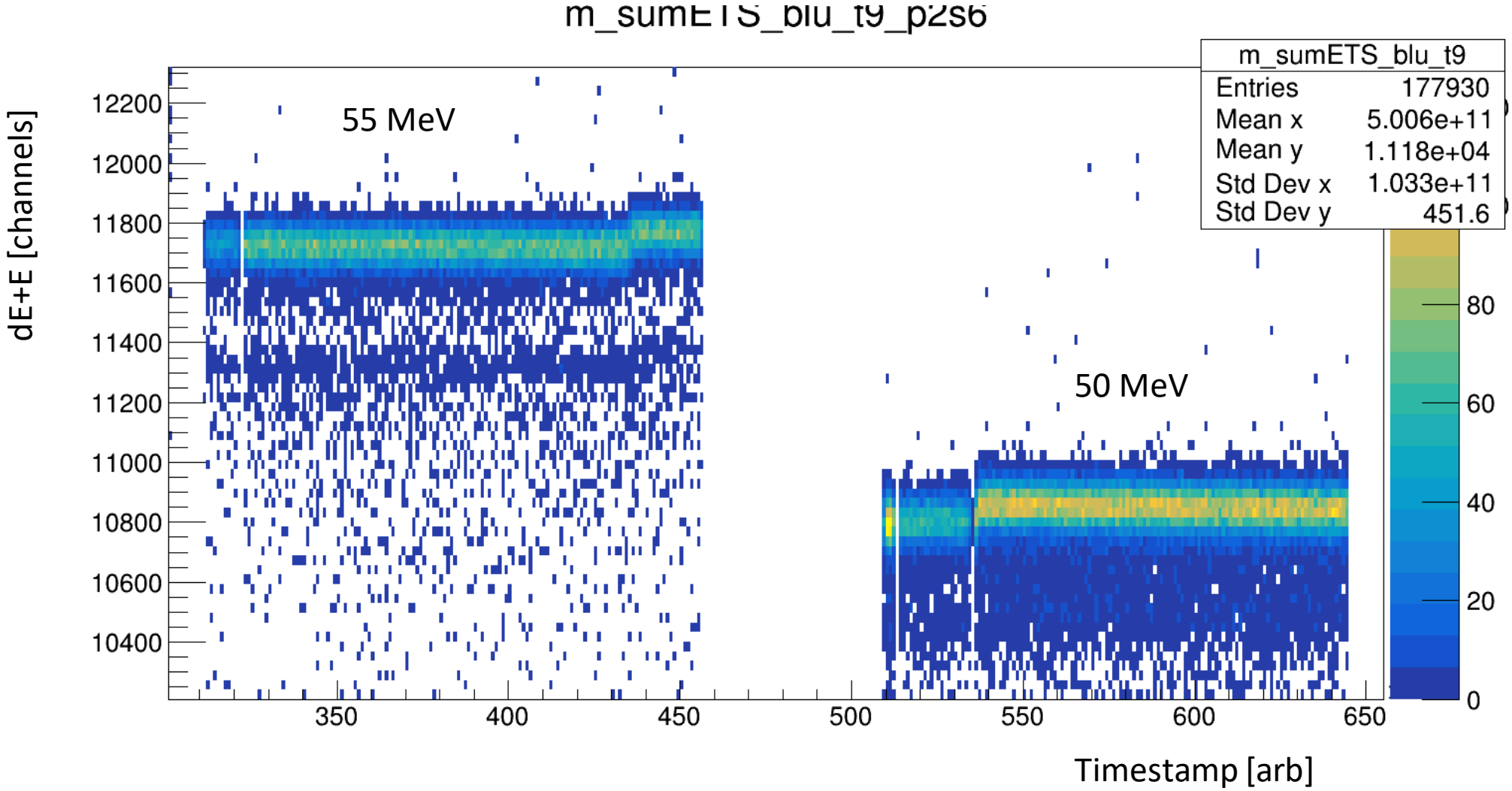




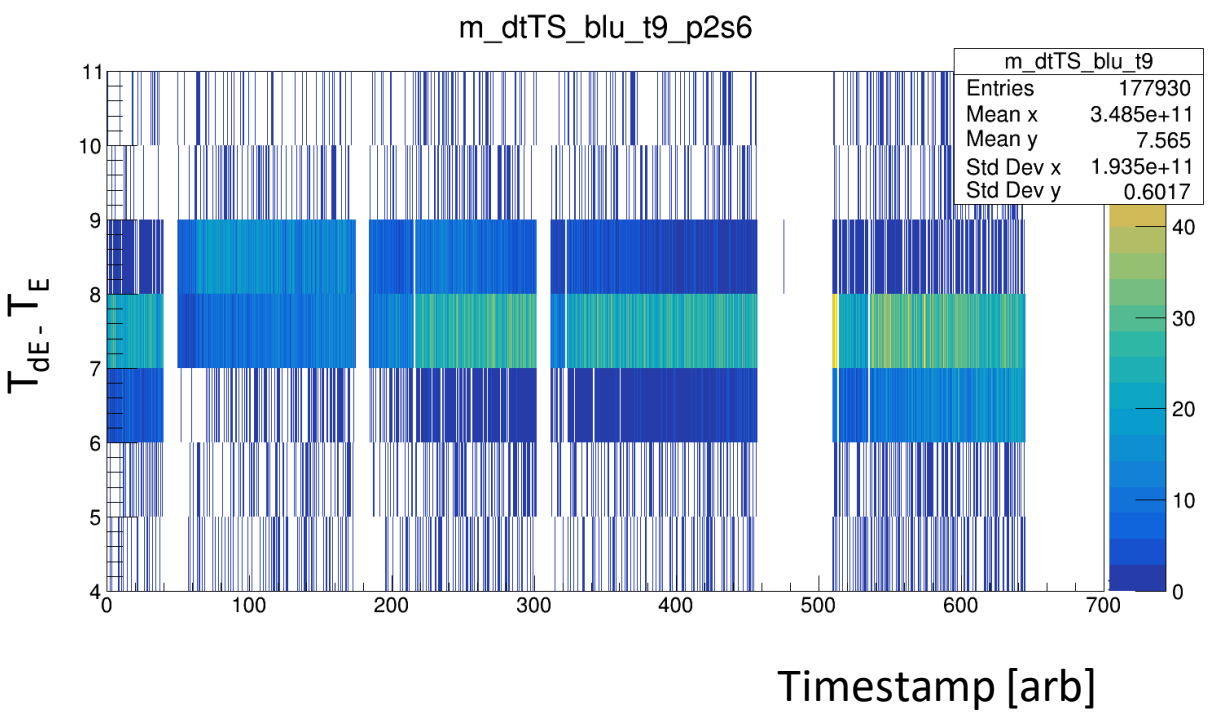
Energy calibration... difficulties

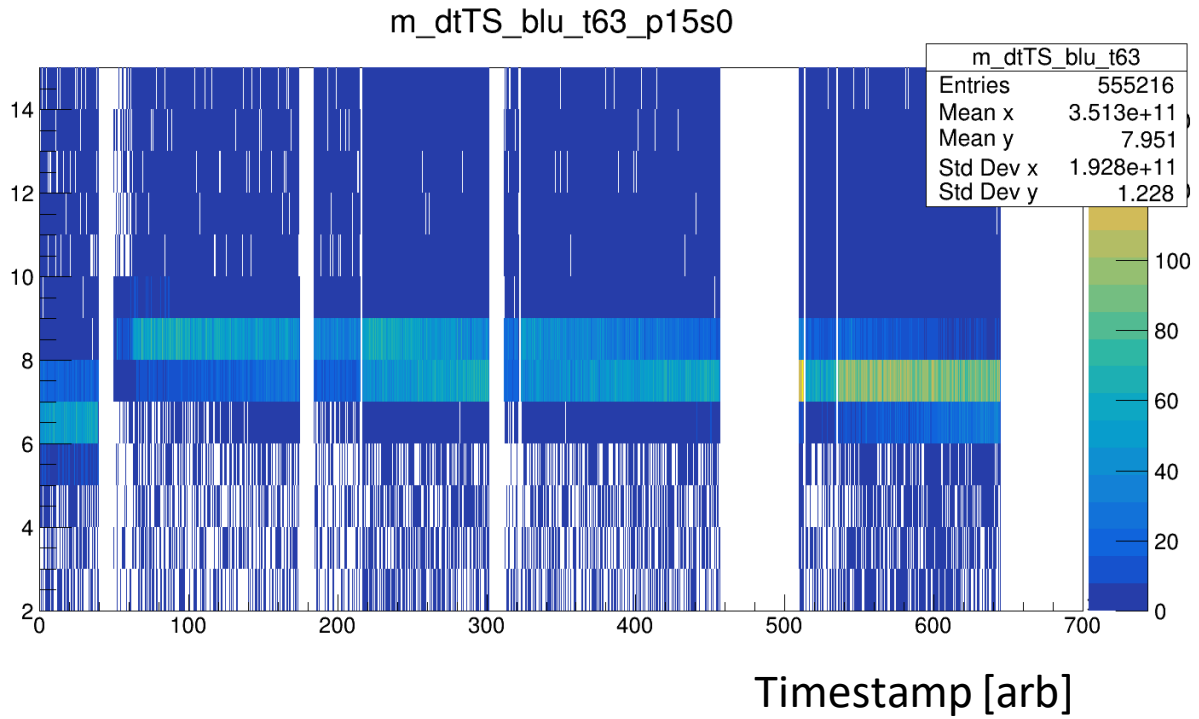
Gain drift during calibration…



Energy calibration... difficulties

In-run drifting dE-E coincidence window





Questions?

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