Transfer reactions with T-REX for ^{11}Be

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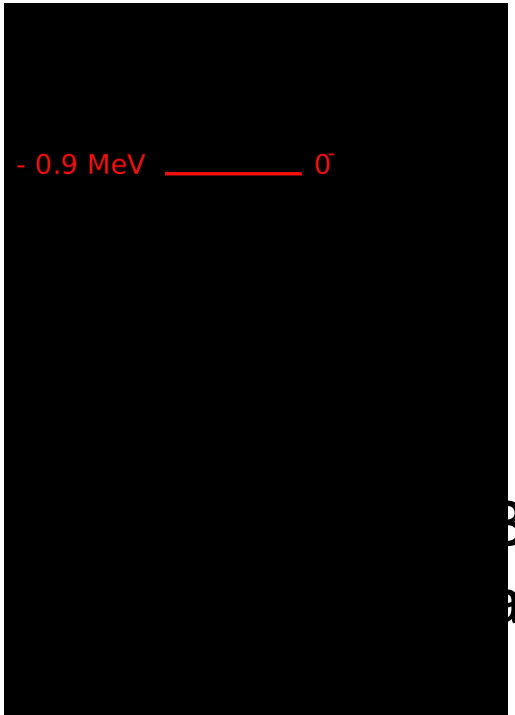
Transfer reactions with ^{11}Be

- Halo nucleus (also bound excited state…)
- Cluster structures in neighbours
- N=8 broken in ^{12}Be



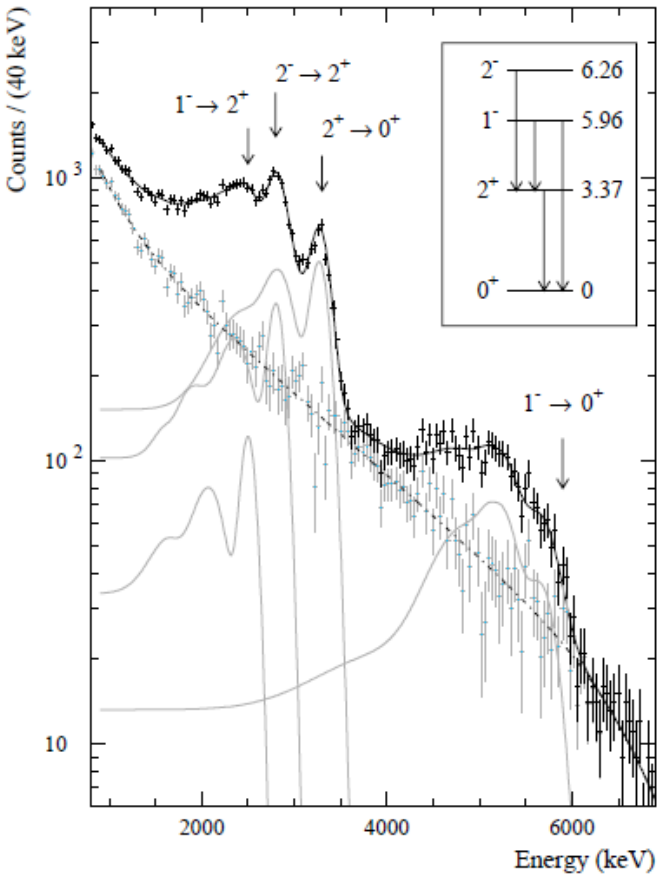
Be
ates

^{11}Be to ^{10}Be

- T. Aumann et al, PRL 84 (2000) 35
  MSU, neutron-knockout

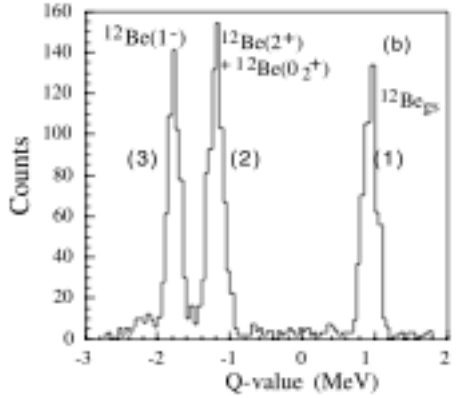
- R. Palit et al, PRC 68 (2003) 034318
  GSI, break-up

  and others…



^{10}Be

^{11}Be to ^{12}Be



R. Kanungo et al, PLB682 (10) 391
n-transfer at Triumf, 5 MeV/u

Neutron knockout establishing N=8 breaking, e.g. A. Navin et al, PRL 85(00) 266; S.Pain et al, PRL 96 (06) 032502

RIKEN exps, excited states on ^{12}Be: H. Iwasaki et al, PLB 481 (00) 7, 491 (00) 8; S. Shimoura et al, PLB 560 (03) 31; N. Imai et al, PLB 673 (09) 179

What remains to do ?

- Resolution for ^{10}Be gamma-spectrum (preferential population to halo candidates 1^- and 2^- ??)
- Separation of ^{12}Be states, check spec. factors
- Search for 0^- excitation in ^{12}Be

IS430 runs

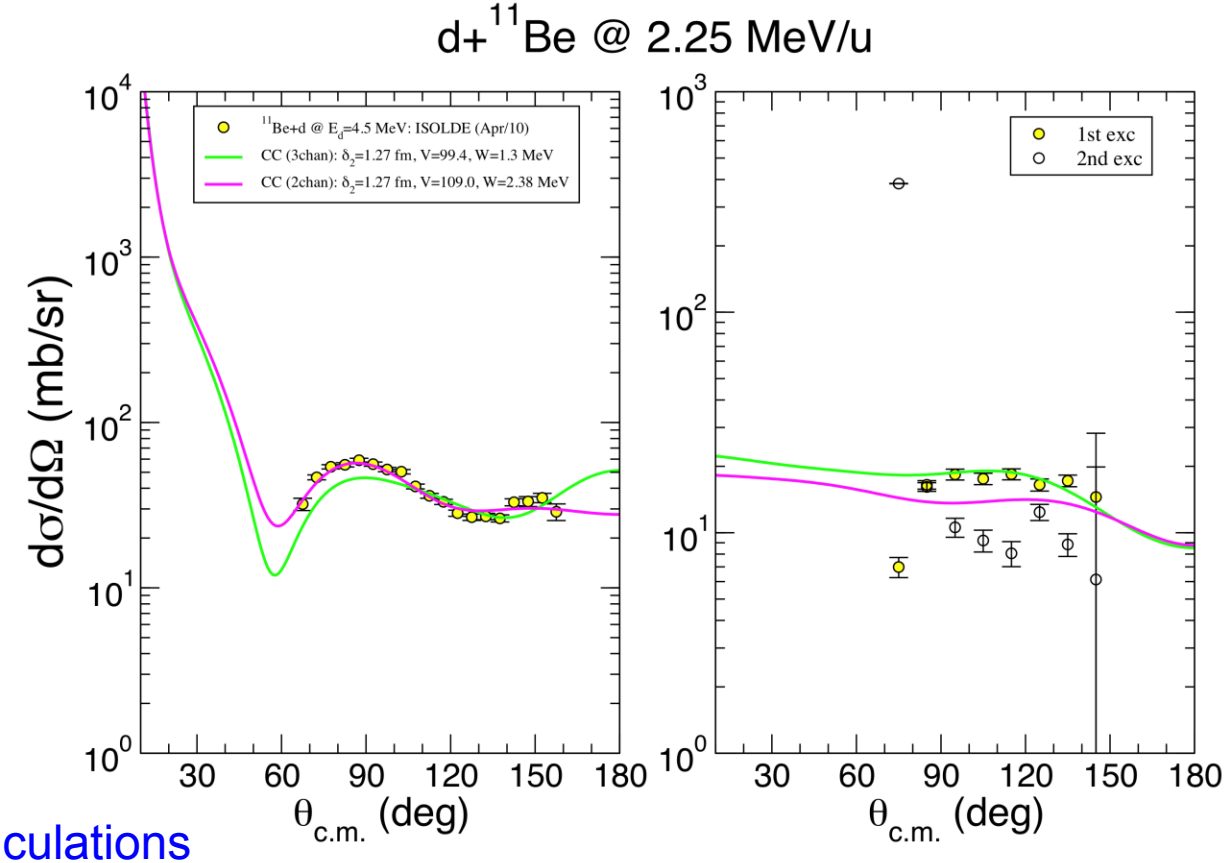
- Sept. 2005 – 2nd beamline
- Oct. 2009 – T-REX (cut short, EBIS problems)
- Sep. 2010 – T-REX (very successful run !!)

  preliminary results, only

Thanks to ISOLDE + REX-ISOLDE team !

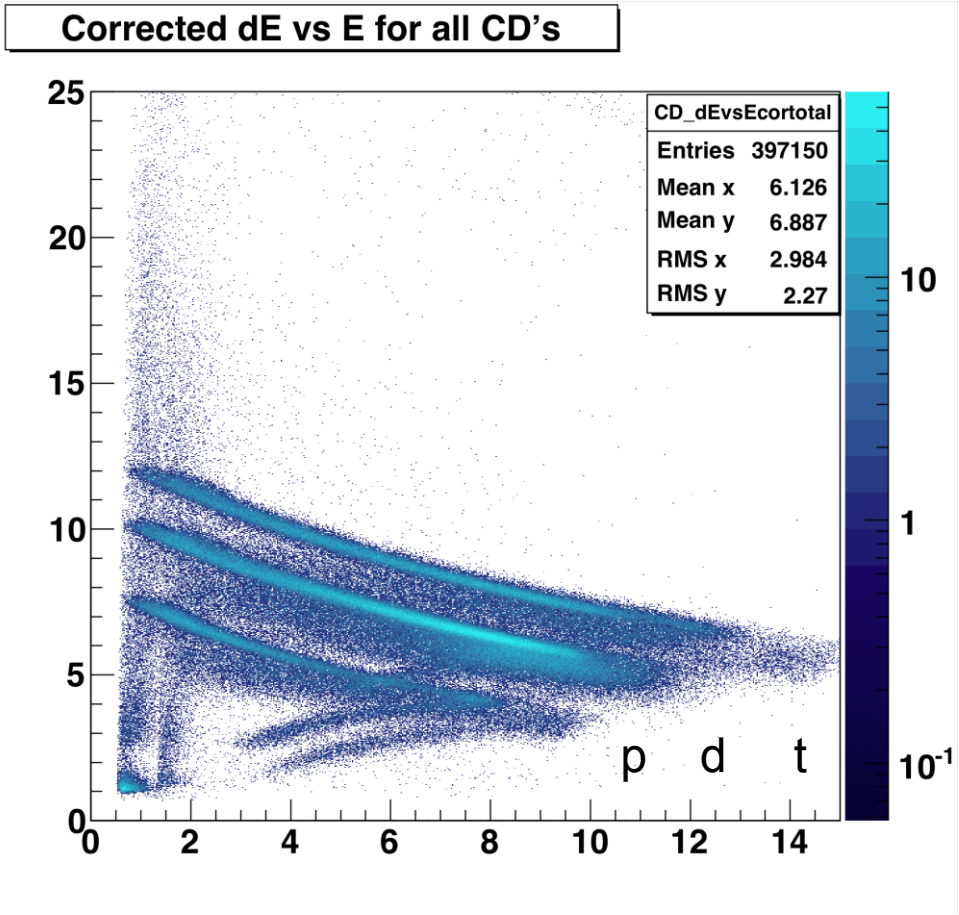
2005 run - results

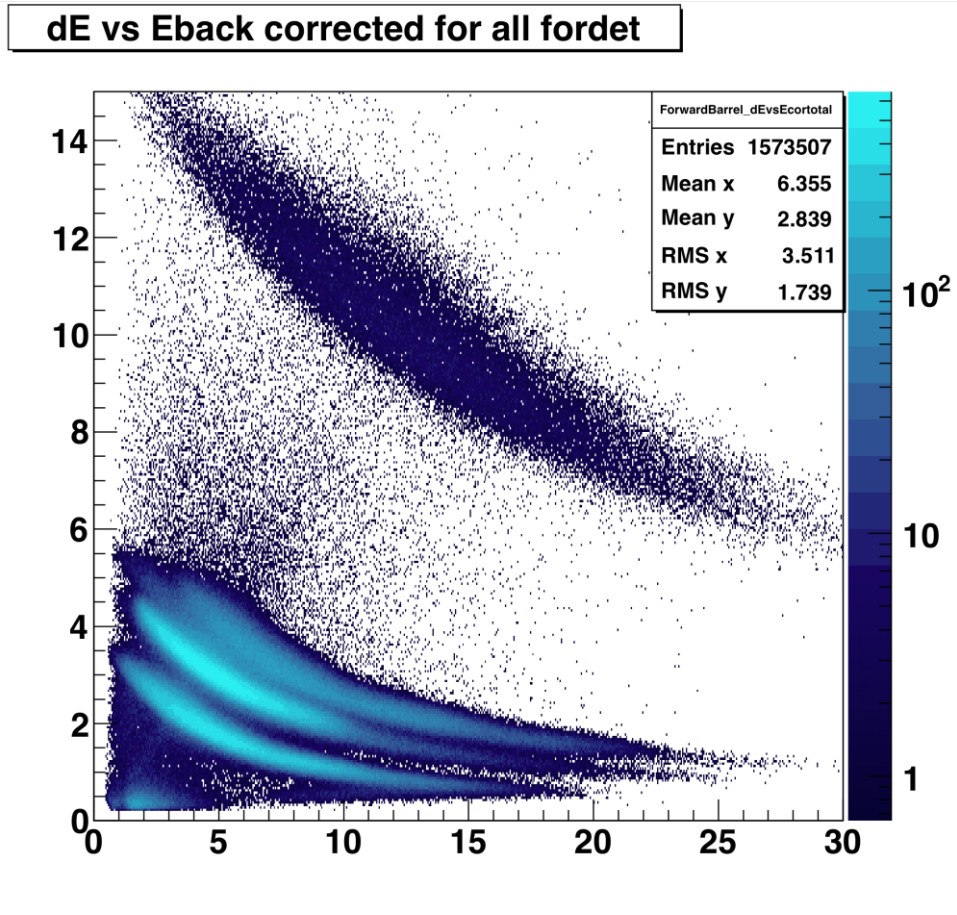
- Beam of ^{11}Be, deuterium target, 2nd beamline



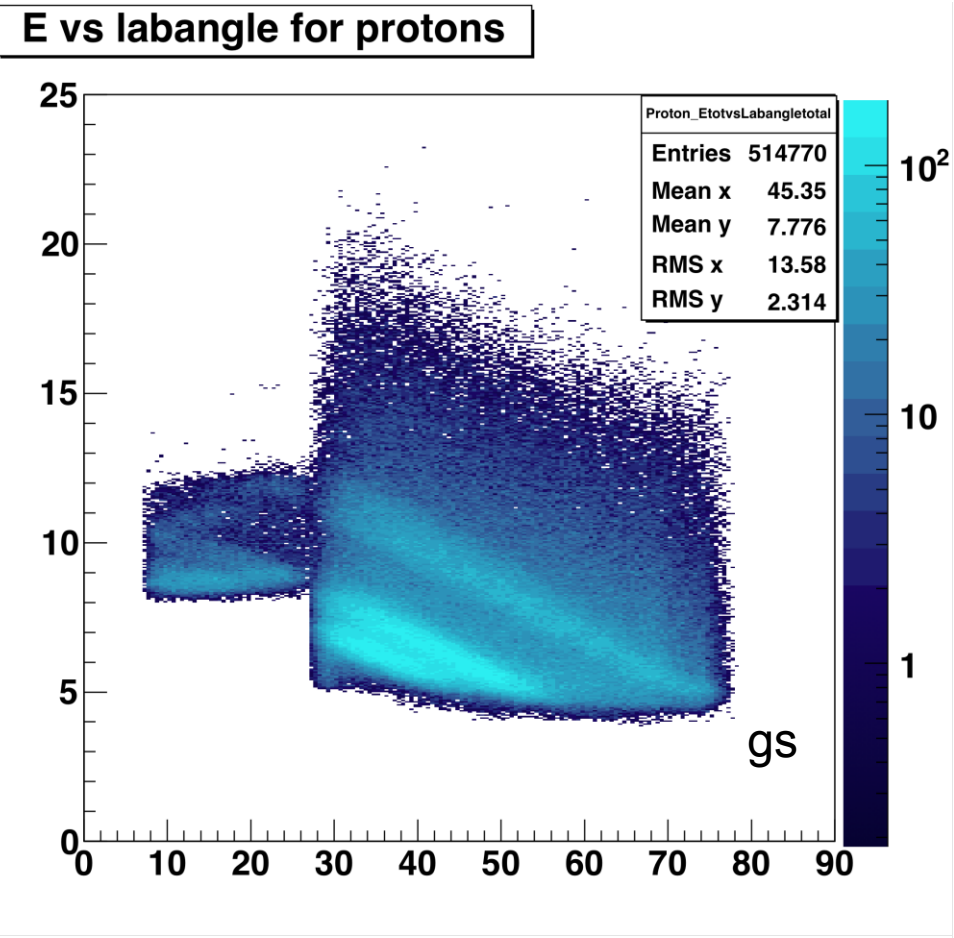
A. Moro, calculations

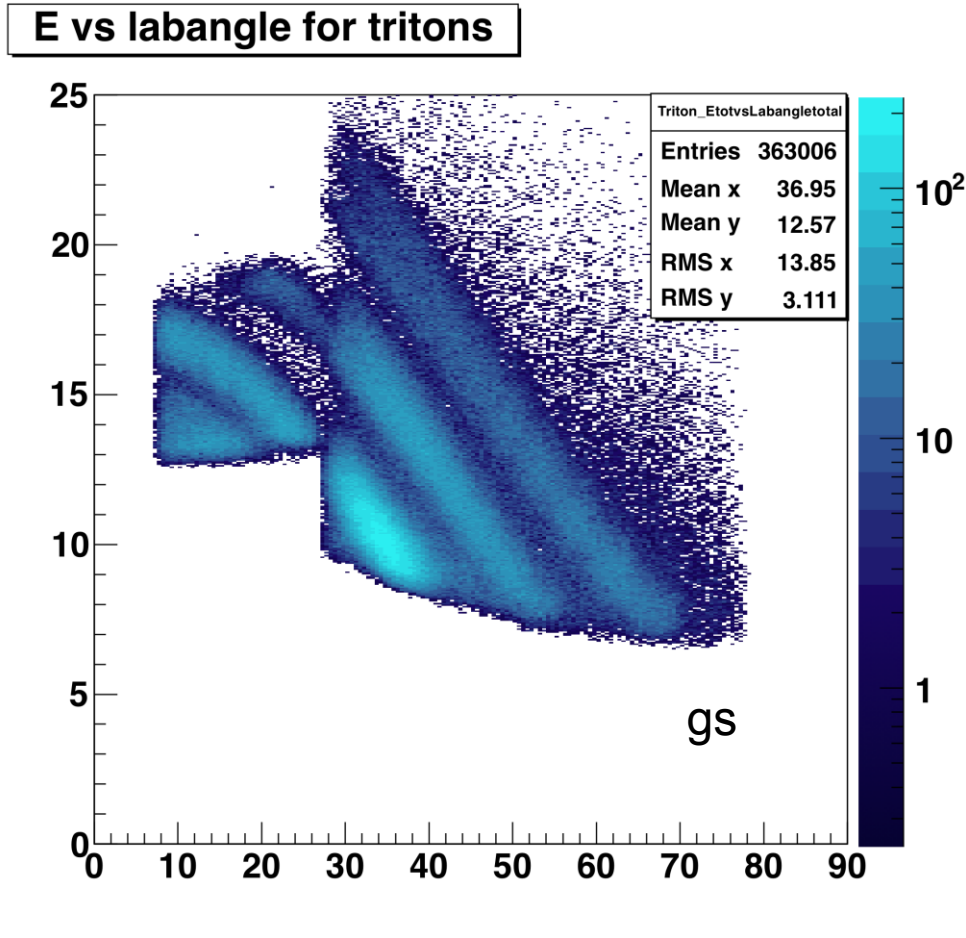
2010: Particle ID via Delta E-E



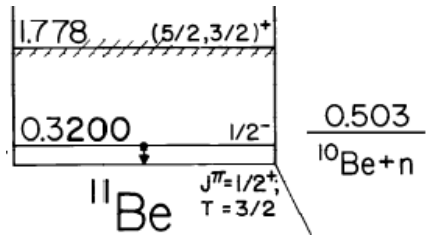


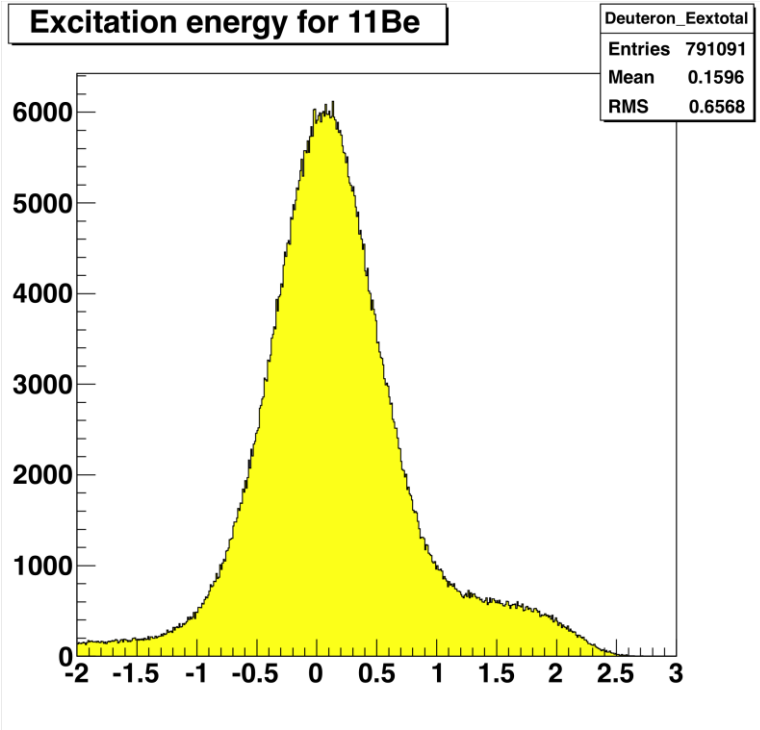
Kinematic curves…

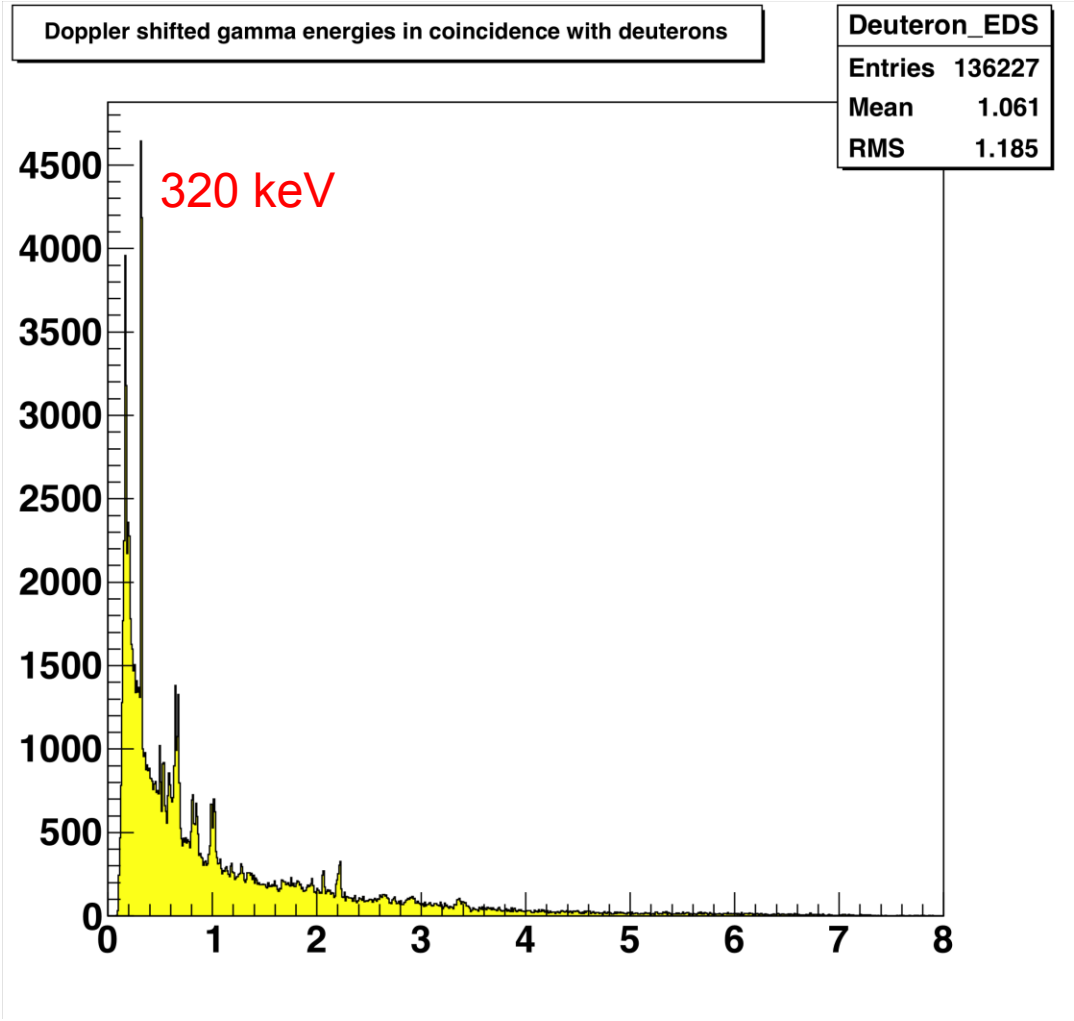


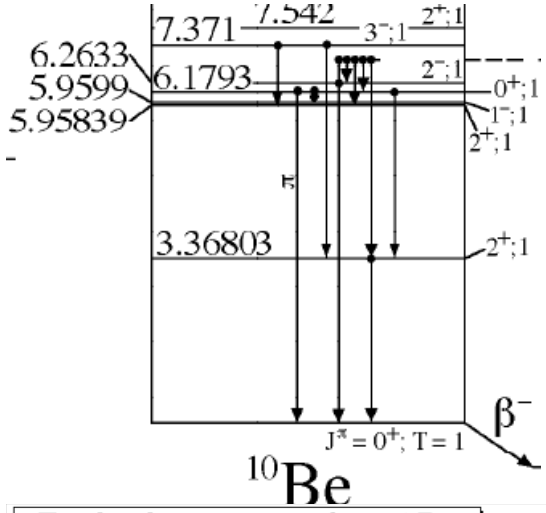


^{11}Be(d,d')


1.778
(5/2,3/2)+
0.3200
1/2−
0.503
10Be+n
11Be
Jπ=1/2+;
T=3/2


Excitation energy for 11Be
Deuteron_Eextotal
Entries 791091
Mean 0.1596
RMS 0.6568
6000
5000
4000
3000
2000
1000
0
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3


Doppler shifted gamma energies in coincidence with deuterons
Deuteron_EDS
Entries 136227
Mean 1.061
RMS 1.185
320 keV
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0 1 2 3 4 5 6 7 8

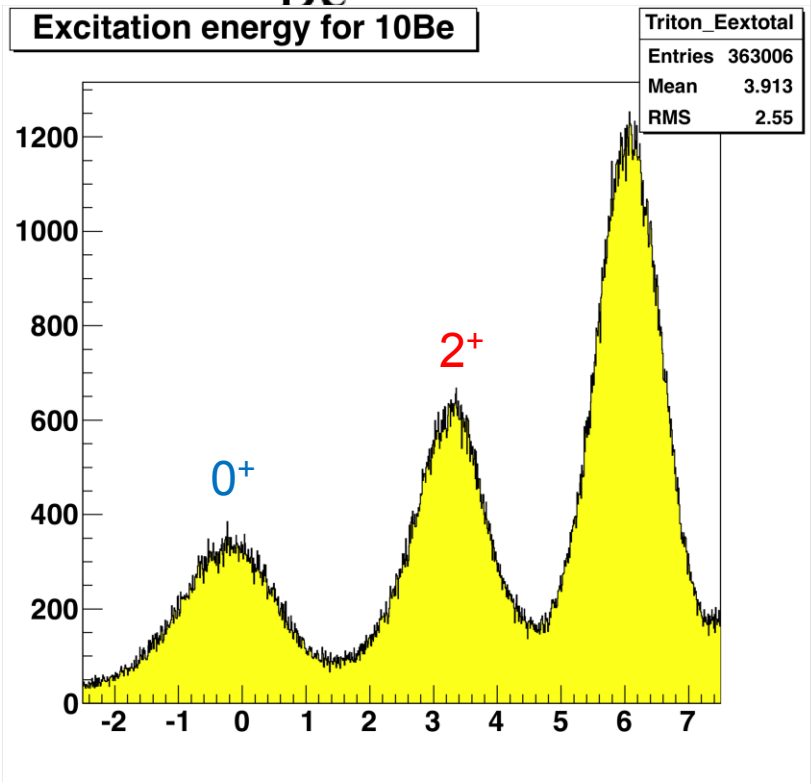


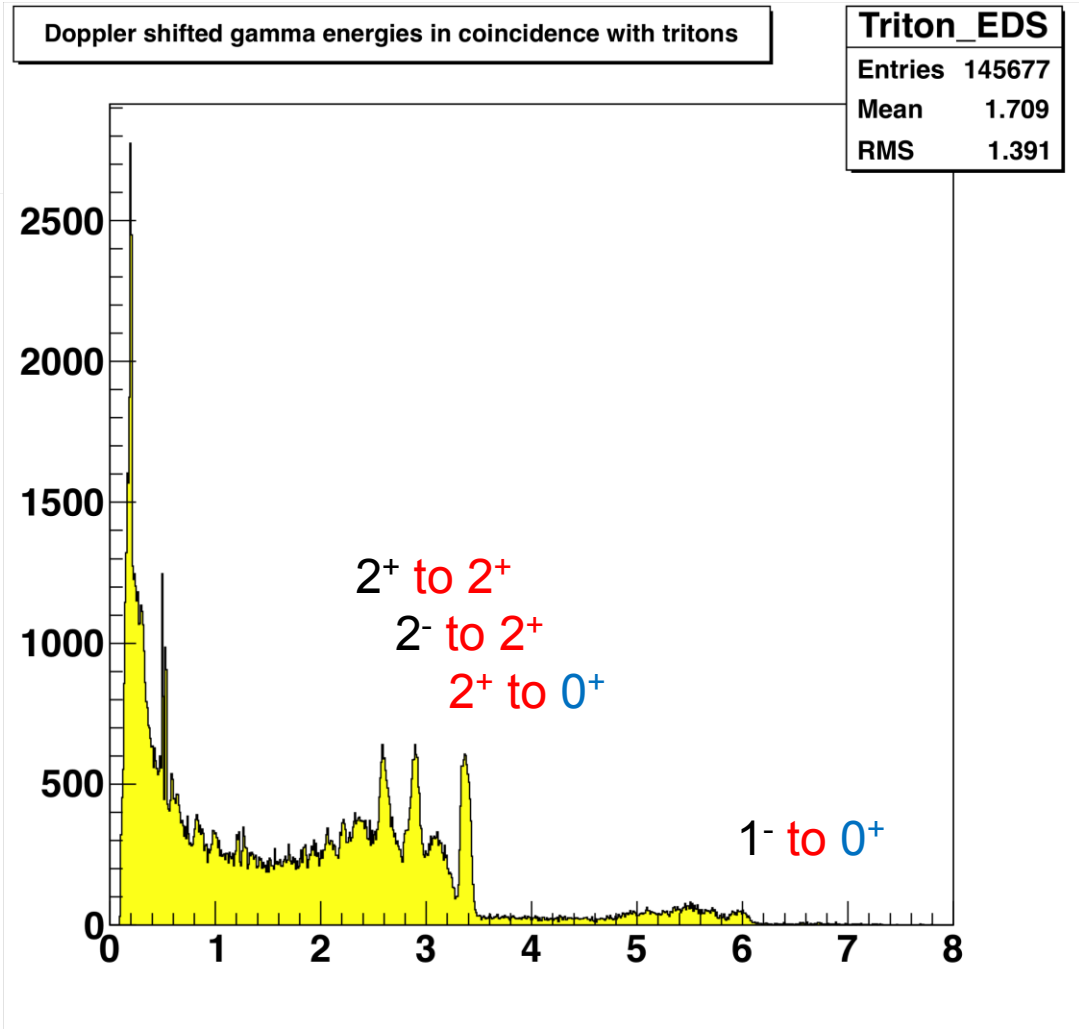
2^+, 1^-, 0^+, 2^-

^{11}Be(d,t)

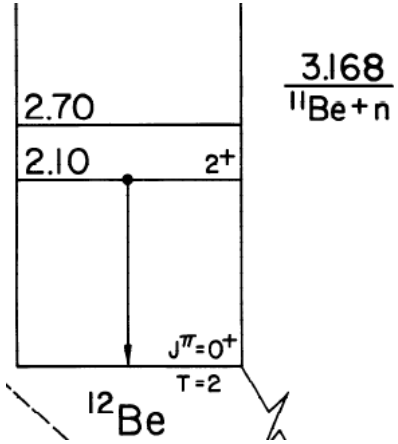
2^+

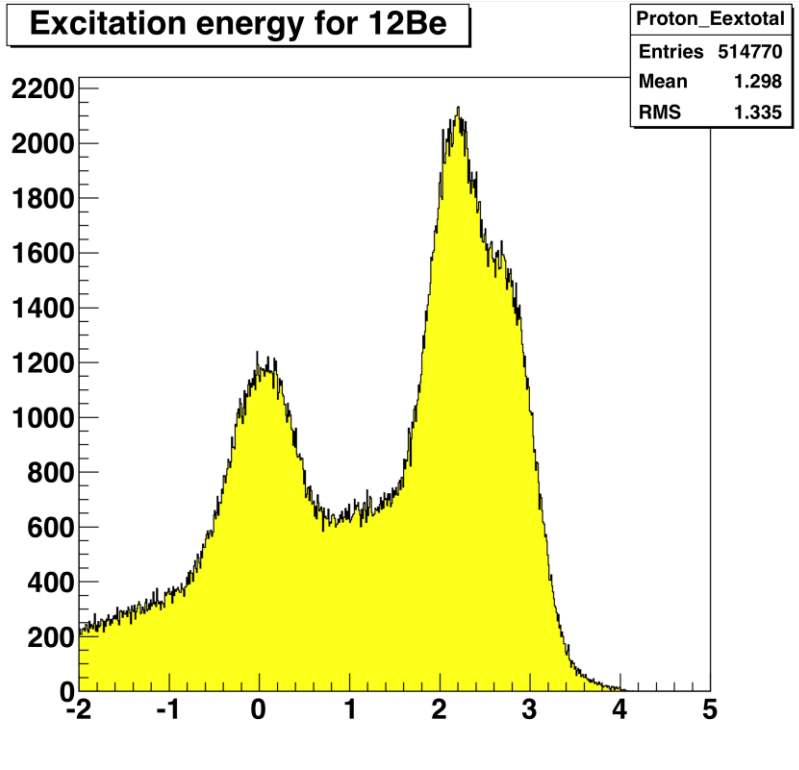
0^+

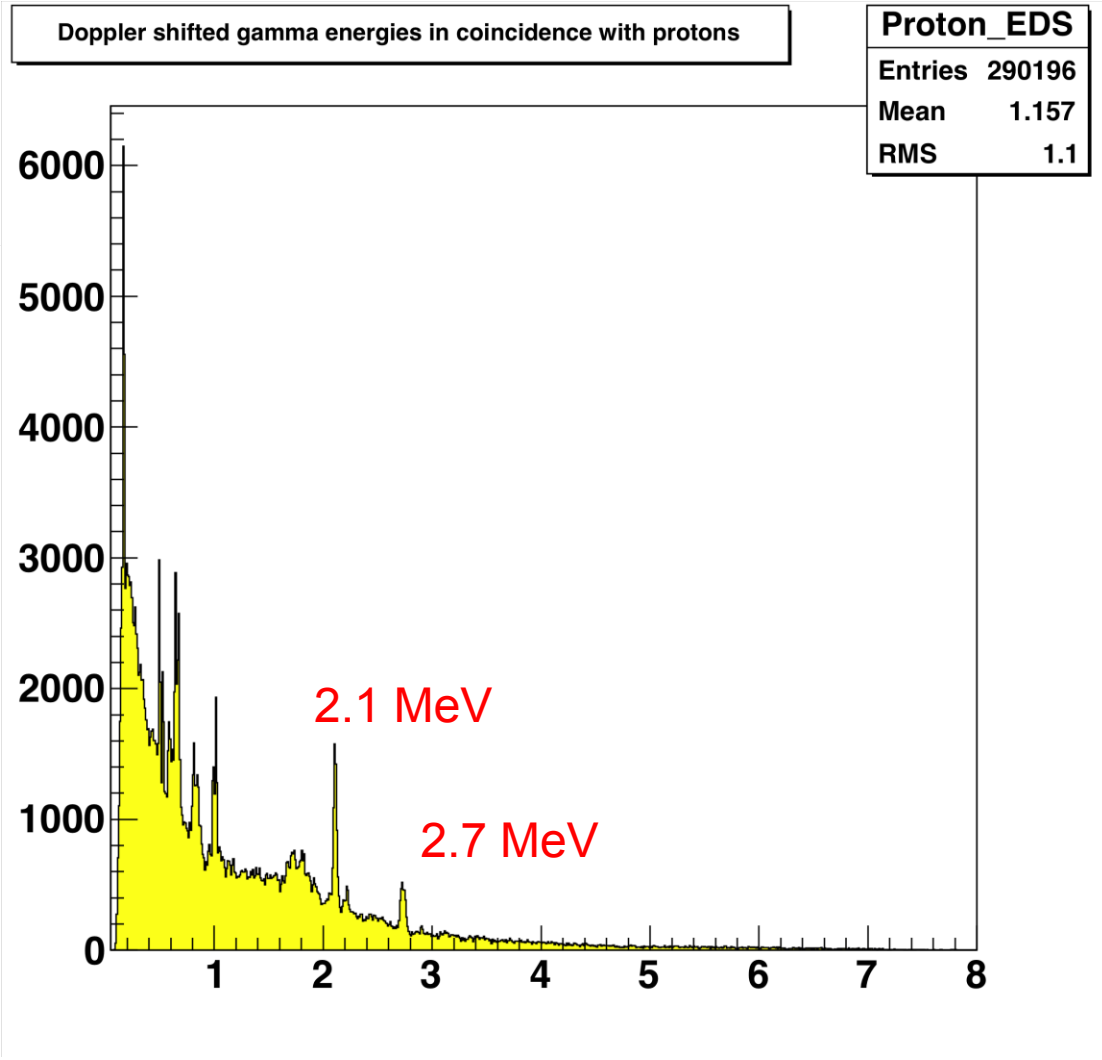




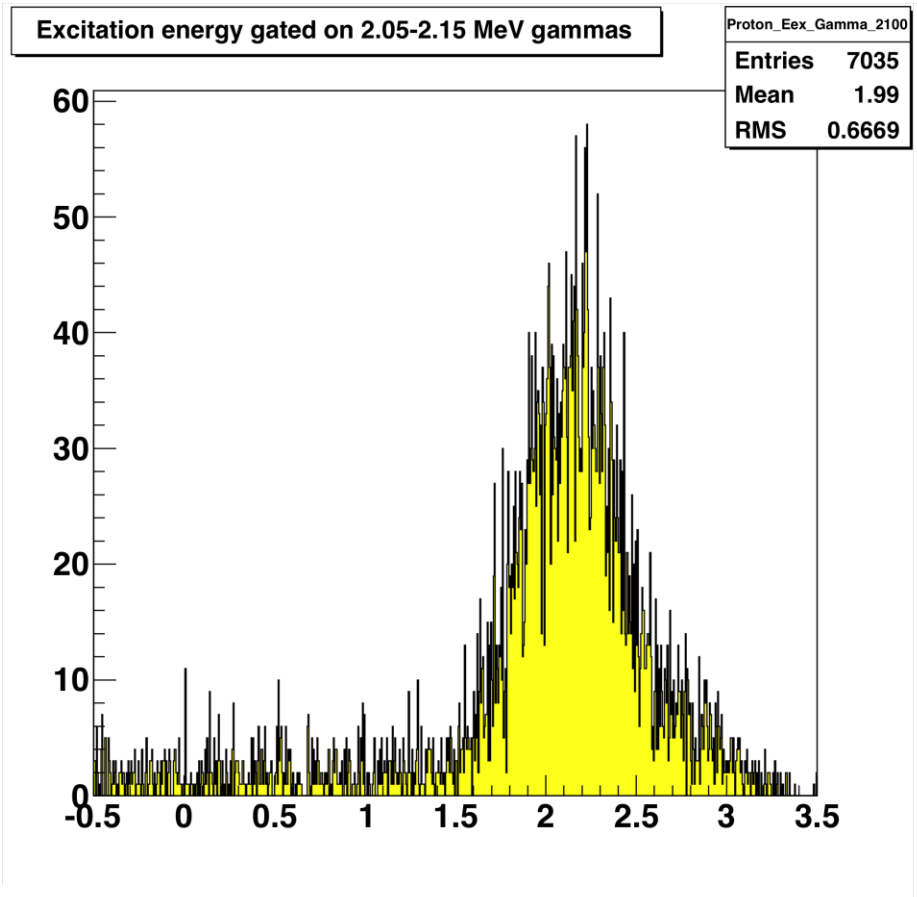
^{11}Be(d,p)

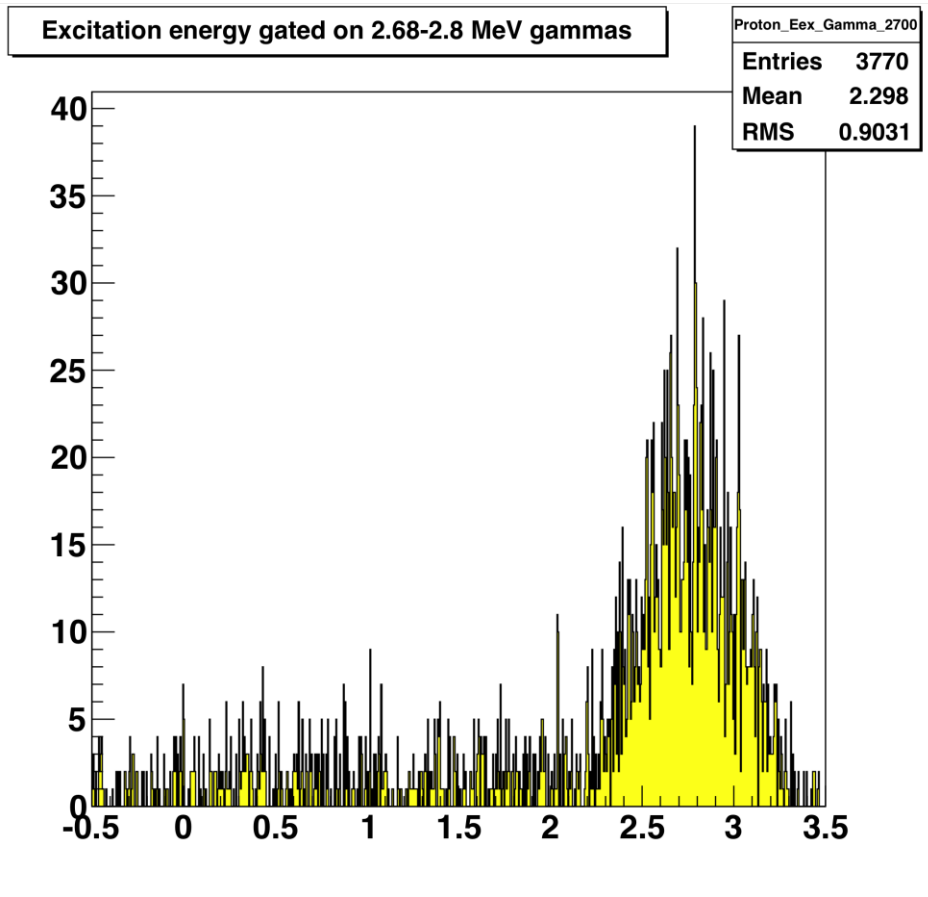

3.168
11Be+n
2.70
2.10
2+
Jπ=0+
T=2
12Be


Excitation energy for 12Be
Proton_Eextotal
Entries 514770
Mean 1.298
RMS 1.335
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-2
-1
0
1
2
3
4
5


Doppler shifted gamma energies in coincidence with protons
Proton_EDS
Entries 290196
Mean 1.157
RMS 1.1
6000
5000
4000
3000
2000
1000
0
2.1 MeV
2.7 MeV
1
2
3
4
5
6
7
8

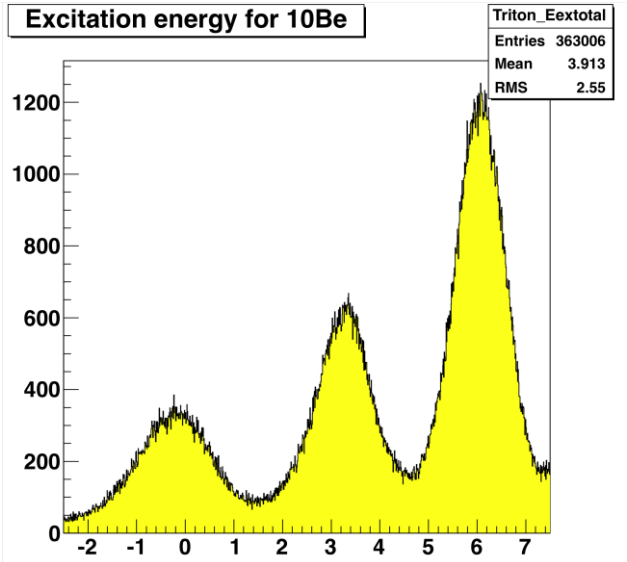
Gamma-gated ^{12}Be spectra

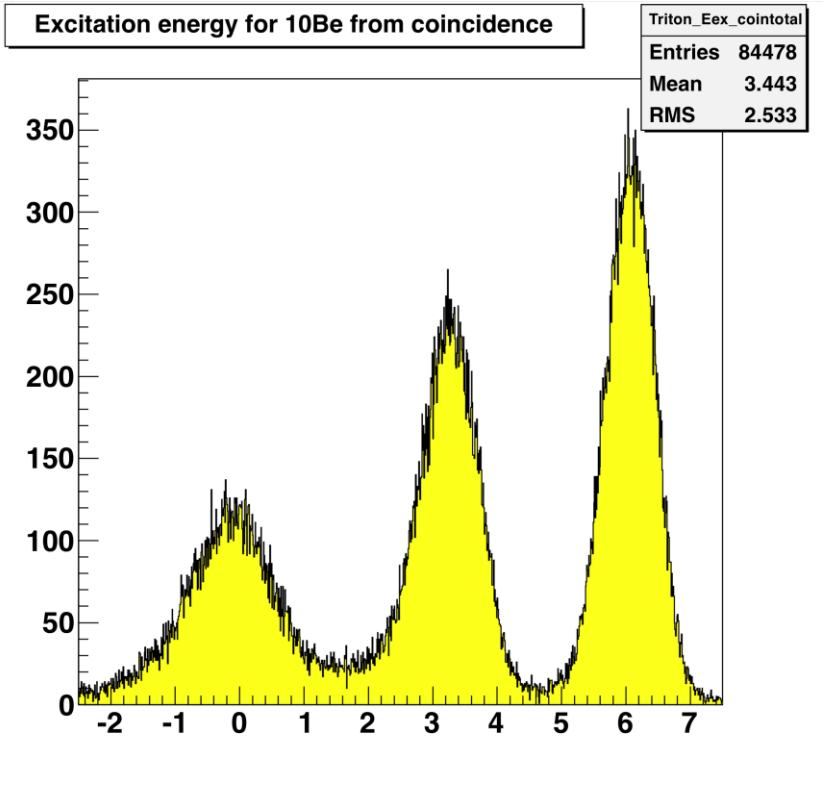




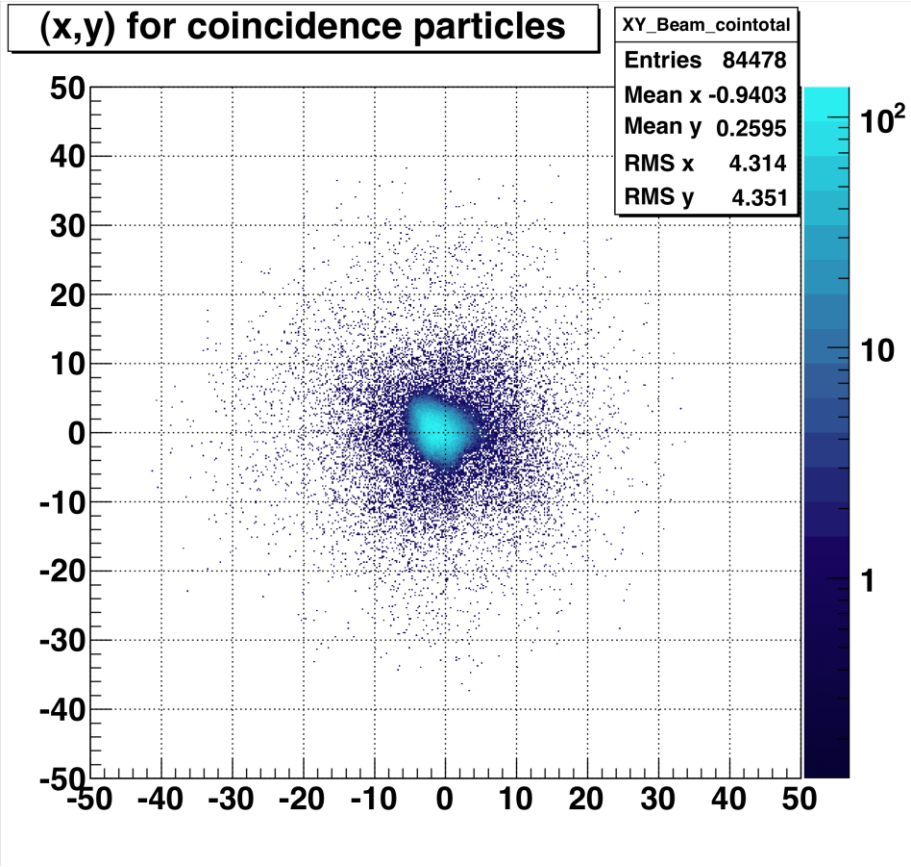
^{10}Be+t coincidences

i.e. complete kinematics





θ_x versus θ_y



What next ?

- Finalize geometry + beam parameters + do proper background subtraction
- Extract differential cross-sections
- Compare to (new !) theoretical calculations
  → spectroscopic factors, halo features, 0^-…

The IS430 collaboration

Participants in the runs and analysis:

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