**Origin of the “Gamma” peak in the HAND.**

I'm looking for your advice regarding peak in TOF spectrum for HAND. The peak is appearing in the position that should correspond to the gamma radiation (or pions).

In order to understand the origin of this peak (and to double check the timing calibration) I plot 5 different version of this spectrum. Taken at chronological order.

1) TOF for He4 target at the beginning of first production point, 500 MeV/c.
2) TOF for Carbon target during the first production settings, AFTER we fixed the BigBite timing issues.
3) TOF for LD2 (following the carbon run).
4) He4 by the end of the first production point.
5) TOF for He4 during the second production point.

The replay for all files included all trigger types.
The cuts that I used where: no edtm, DBB.evtypebits&(1<<3) and left HRS acceptance.

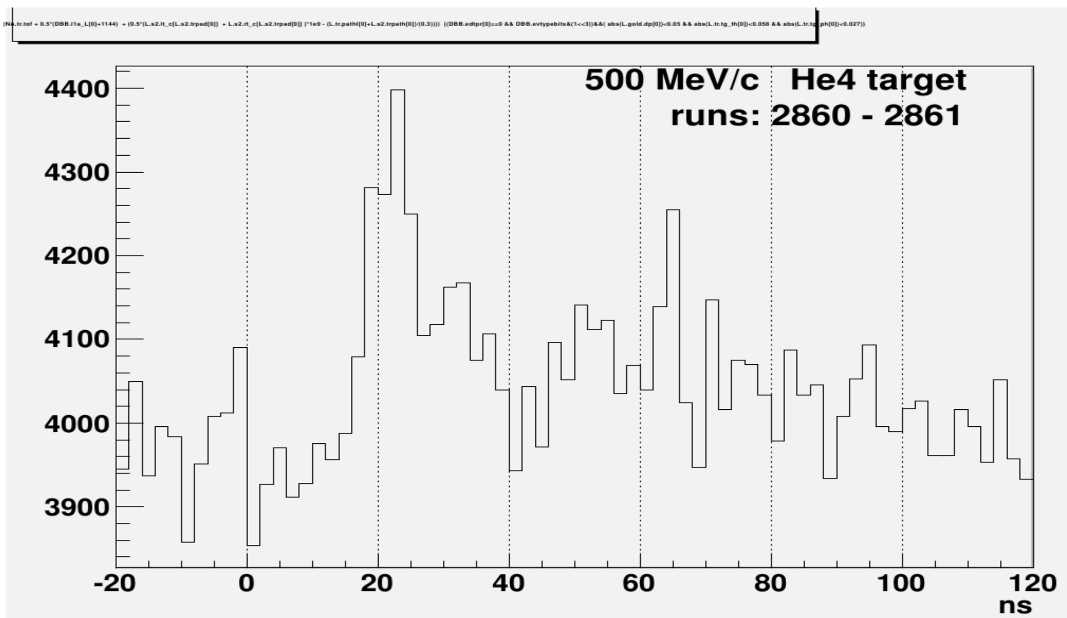
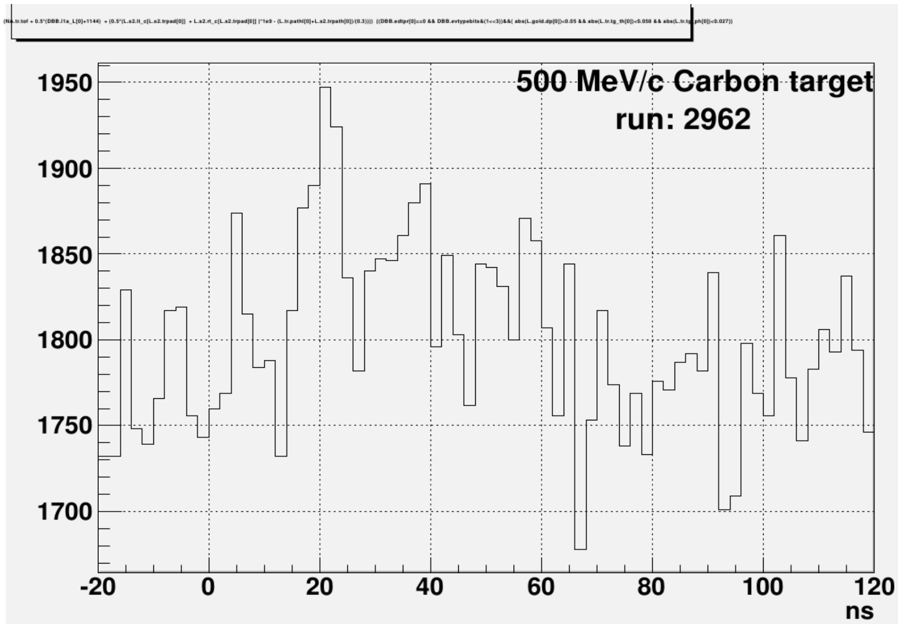
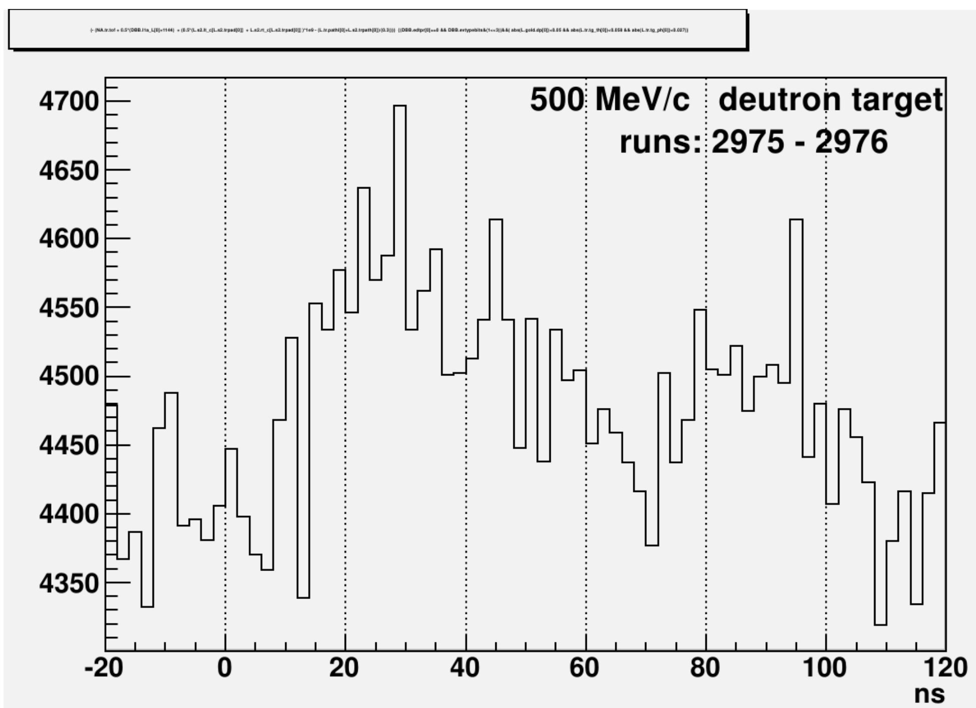



Fig 1


500 MeV/c Carbon target
run: 2962
1950
1900
1850
1800
1750
1700
-20
0
20
40
60
80
100
120
ns
fig 2


500 MeV/c deutron target
runs: 2975 - 2976
4700
4650
4600
4550
4500
4450
4400
4350
-20
0
20
40
60
80
100
120
ns
fig 3

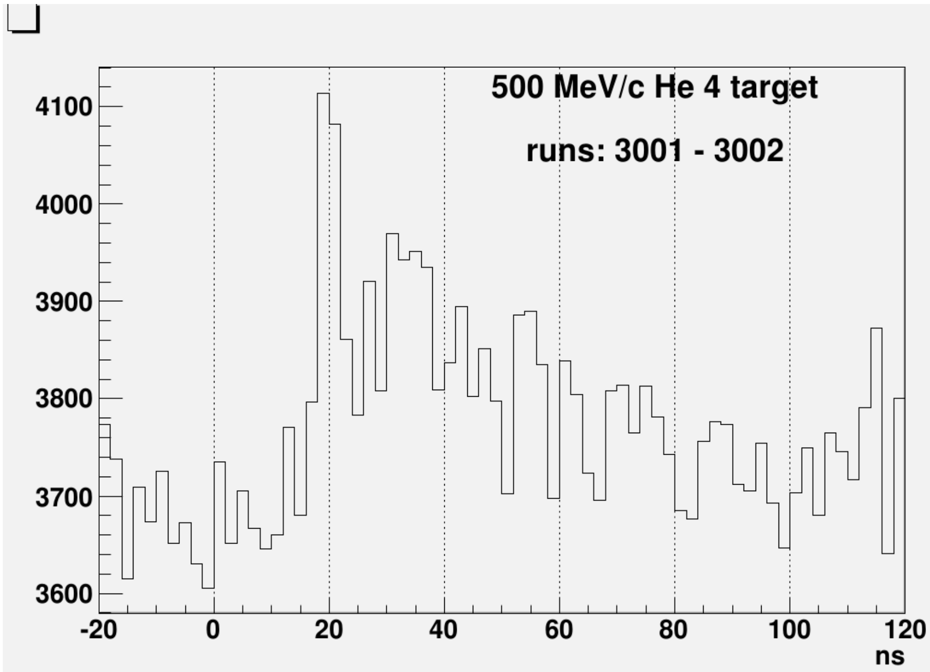



fig 4

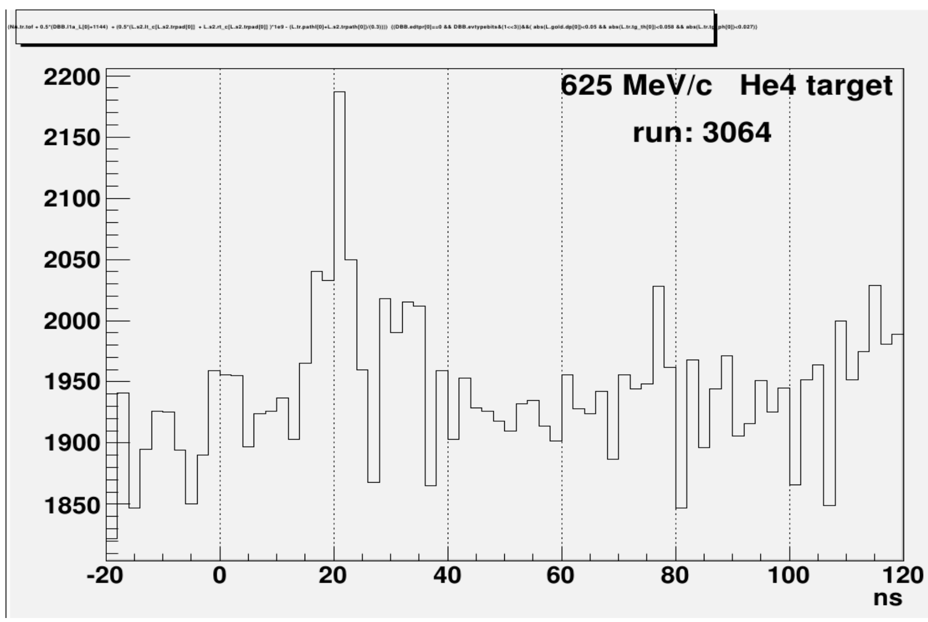



fig 5

The time scale, is absolute time, calibrated using triple coincidence on Deuteron. The sigma of the "gamma" peak is consistent with HAND resolution ~2 ns.
I see almost no change in the position of this peak during two kinematical settings.

**The main question is why we don't see the "gamma peak" in the LD target (fig 3)?**

if I plot the missing mass, for one body process:

$$(p_i + m_p - p')^2 = m^2$$

where pi – is the incoming momentum-energy 4 vector, mp – proton mass, p' – outgoing electron
I expect to get this distribution around 1 GeV. Howver, I get different result:

for one body process:

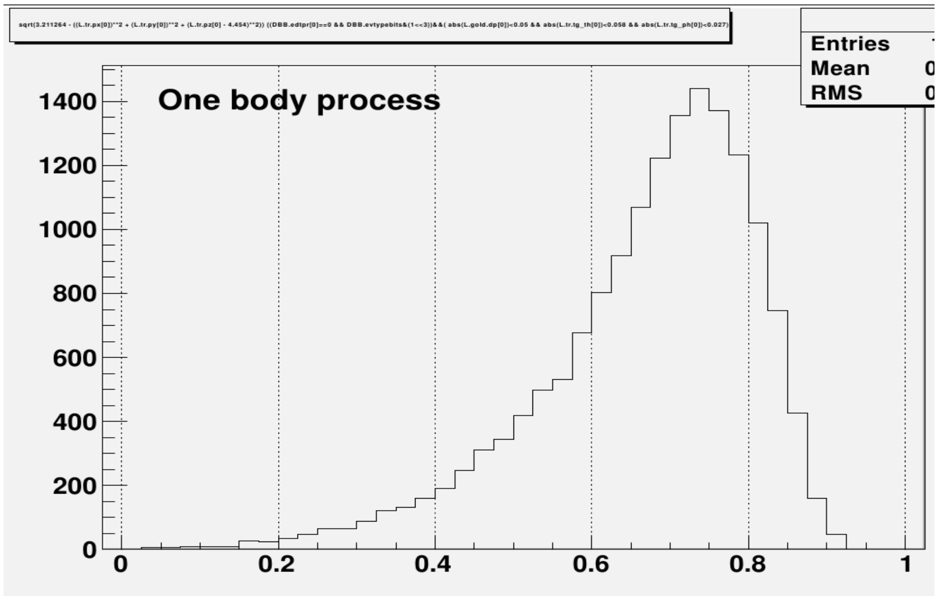



fig 6: X-axis in [GeV]

for two body process:

$$(p_i + m_D - p')^2 = m^2$$

where m_D - is the Deuteron mass.

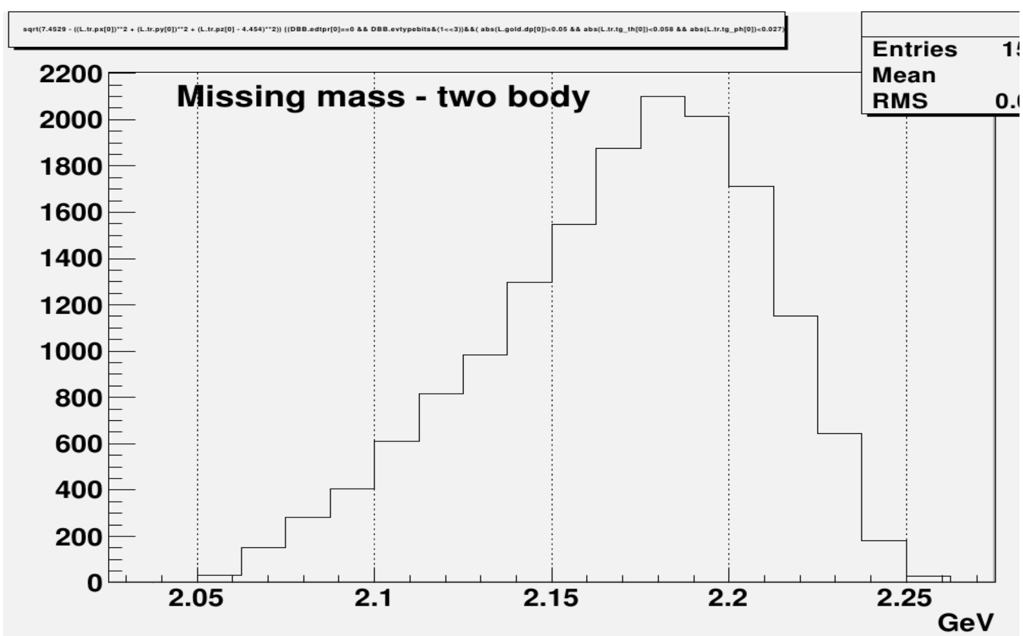



fig 7