MC Status

Pandola Issue #4

https://baltig.infn.it/pandola/red-daq-light/issues/4

1) produce the energy spectra in the TPC, in coincidence with the LScis, with a set of (minimal) cuts on gamma/neutron PSD and tof. This is the work which we initially did with @sanfilippo and reported at the CMs: all roots/macros are available (indeed, by construction, all LScis tag the same recoil energy, but with a different angle wrt the electric field)

2) re-run the jobs within g4ds (using @kuss geometry). Add the effect of the beam spot size and of the beam divergence (yet, they should be much less important effects for directionality than for low-energy)

3) invent a phenomenological model of S1(E,theta_z) and S2(E, theta_z) to produce S1 and S2, given the recoil energy E and the recoil angle with respect to the E-field. One must assume a resolution for S1 and S2 and a reasonable functional form to model the anti-correlation of the directional effect, e.g. 1 +/- a*cos(theta). I would rely on the experience of @dfranco, Paolo and the others of the MC group to have this part done

4) given the assumptions/models above, produce a plot of S2/S1 vs. cosTheta. Assess what are the minimal performance of the TPC to achieve a positive measurement (= make a claim) and how much we are sensitive to the scale factor "a" of the directionality effect.

Pandola Issue #4.2

re-run the jobs within g4ds (using @kuss geometry). Add the effect of the beam spot size and of the beam divergence (yet, they should be much less important effects for directionality than for low-energy)

@sanfilippo: implemented using the gps method of g4ds

@kuss: needs to wipe over the code and test

Pandola Issue #4.1

produce the energy spectra in the TPC, in coincidence with the LScis, with a set of (minimal) cuts on gamma/neutron PSD and tof. This is the work which we initially did with @sanfilippo and reported at the CMs: all roots/macros are available (indeed, by construction, all LScis tag the same recoil energy, but with a different angle wrt the electric field)

@sanfilippo volunteered. Waits for @kuss to finish #4.2.

Pandola Issue #4.3

invent a phenomenological model of **S1(E,theta_z)** and **S2(E, theta_z)** to produce S1 and S2, given the recoil energy E and the recoil angle with respect to the E-field. One must assume a **resolution for S1 and S2** and a reasonable functional form to model the anti-correlation of the directional effect, e.g. **1 +/- a*cos(theta)**. I would rely on the experience of @dfranco, Paolo and the others of the MC group to have this part done

@paolo: there are too much parameters, i.e.:

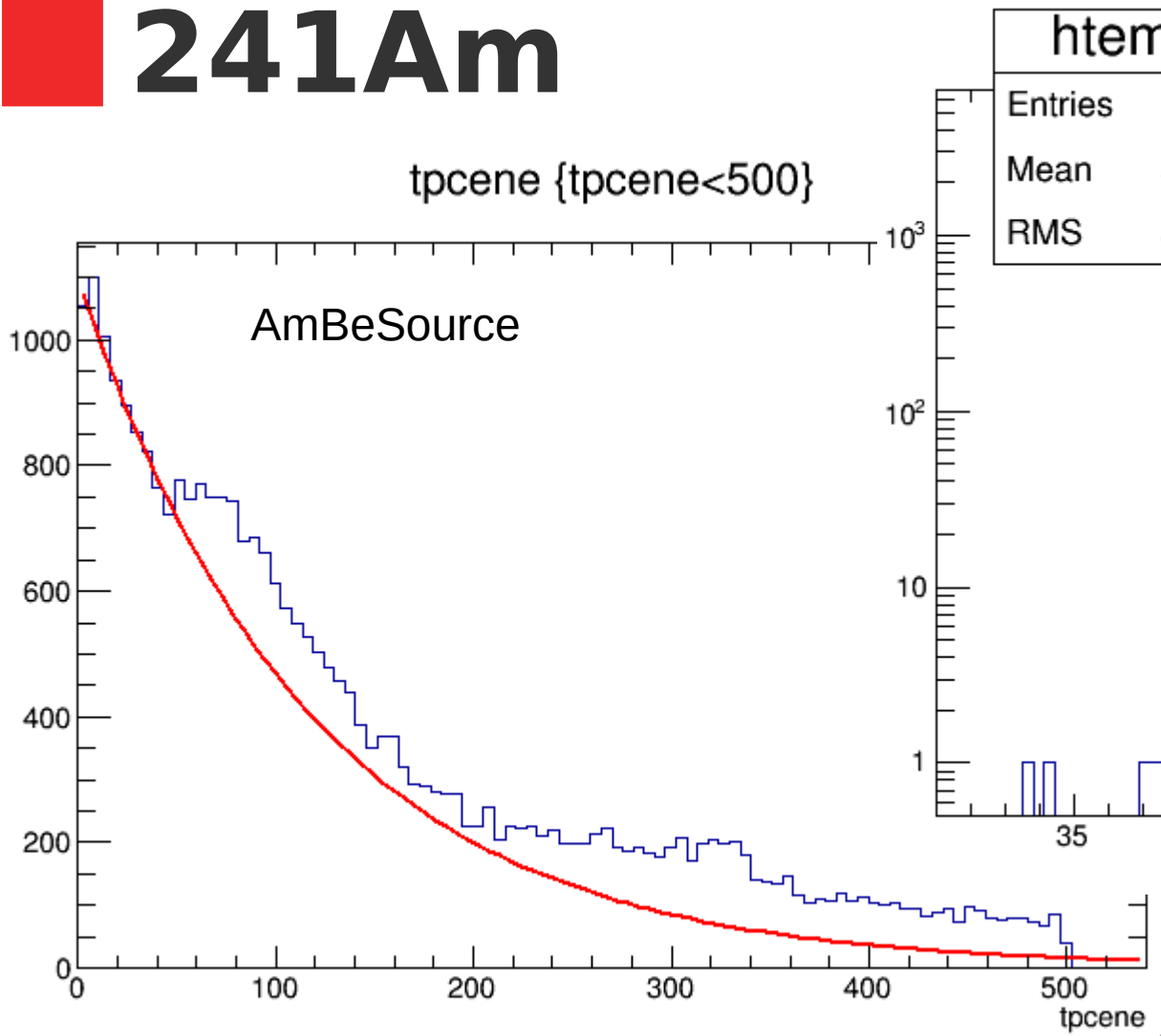
- size of effect?
- S1/S2 resolution with ReD?
- statistics (beam time)?
- → sensitivity

Pandola Issue #4.4

given the assumptions/models above, produce a plot of S2/S1 vs. cosTheta. Assess what are the minimal performance of the TPC to achieve a positive measurement (= make a claim) and how much we are sensitive to the scale factor "a" of the directionality effect.

@paolo: needs issue #4.3

241Am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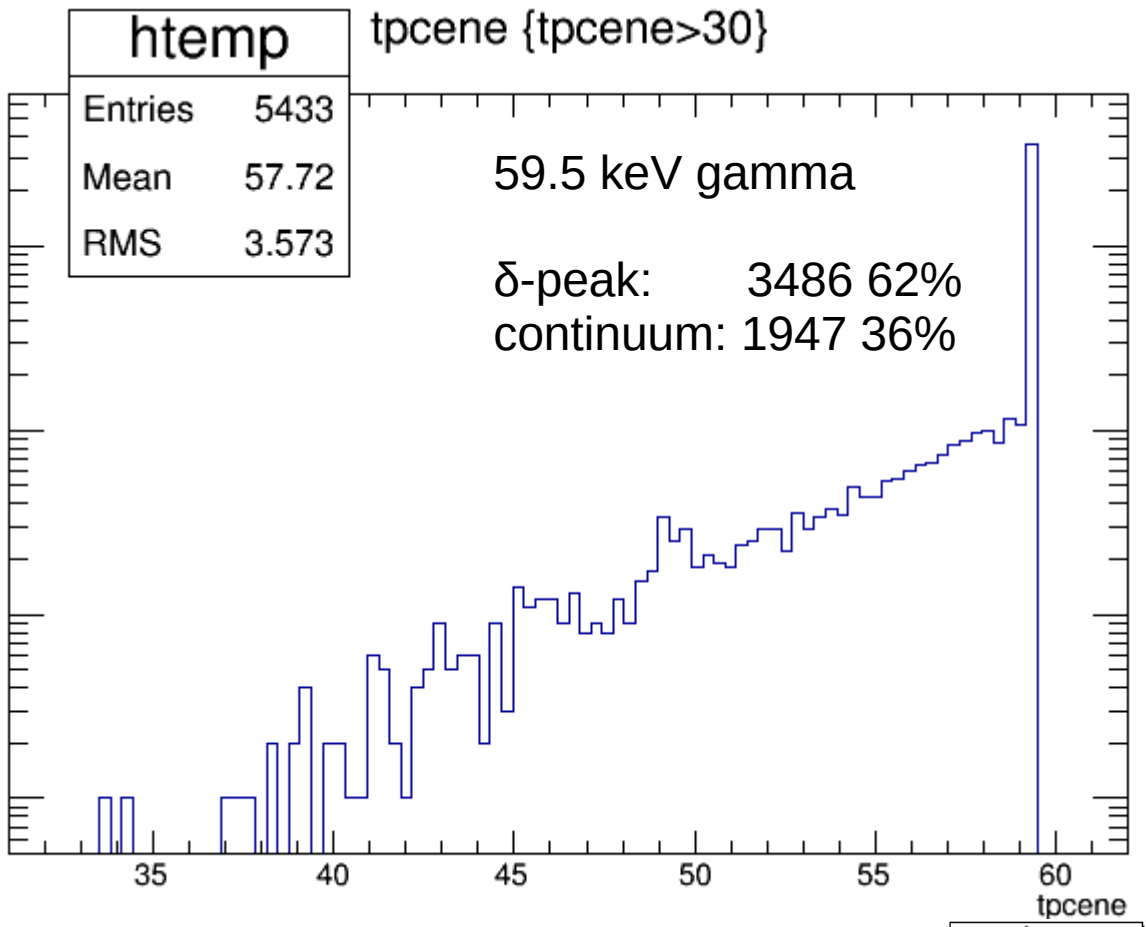
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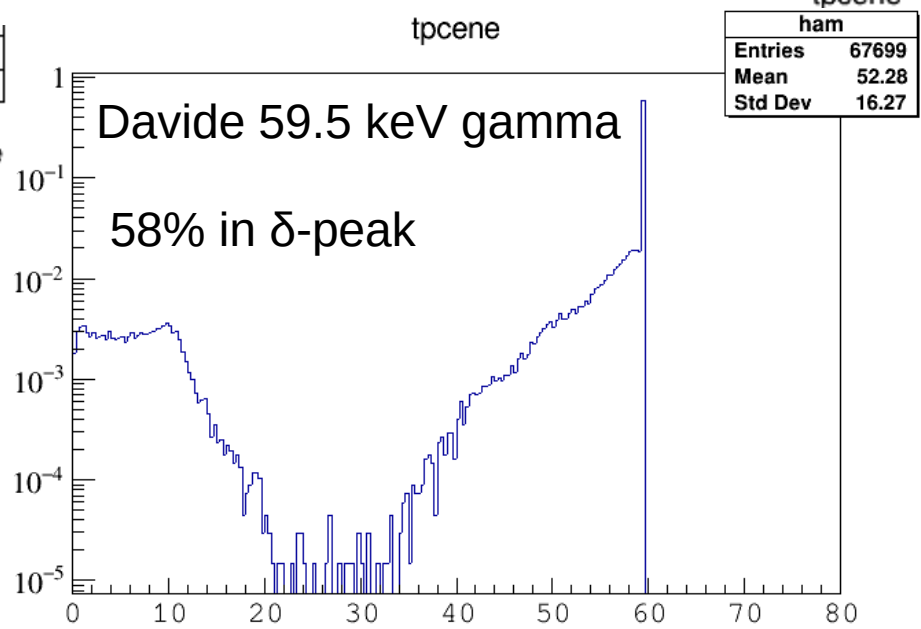
59.5 keV gamma
δ-peak: 3486 62%
continuum: 1947 36%
tpcene


tpcene
ham
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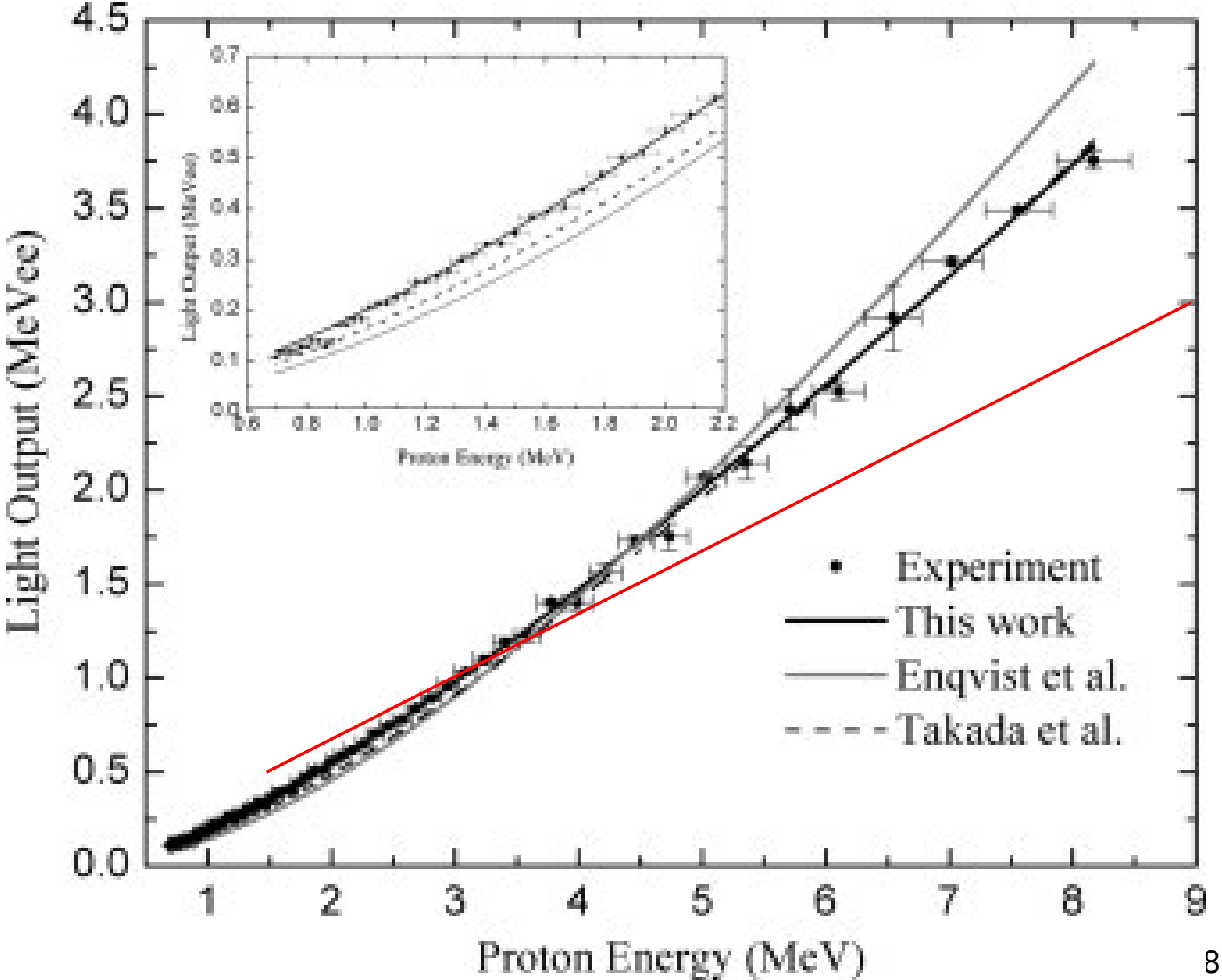
Std Dev 16.27
Davide 59.5 keV gamma
58% in δ-peak

Quenching

Implement neutron quenching in EJ309 as measured by Pino, Stevanato, et al.
Currently 1/3 of the deposited energy is taken (dep_em + dep_hadr/3 + dep_nucl/10)

Thoughts:

E(n) → E(p): q(dep)
8 → 8: q(8)
8 → 4: q(4)
4 → 4: q(4)
8 → 8 dep 8: q(8)
8 → 8 dep 2: q(8)
or q(2)?



MC@CNAF

@kuss:

- run at CNAF (300 cores)
- store fil and root files on *storage/*gpfs_ds50
- code has to be on gpfs too
- take care that jobs won’t write to the same file

- advantage: everybody can check/analyze the files

Model the response: from energy to S1 and S2

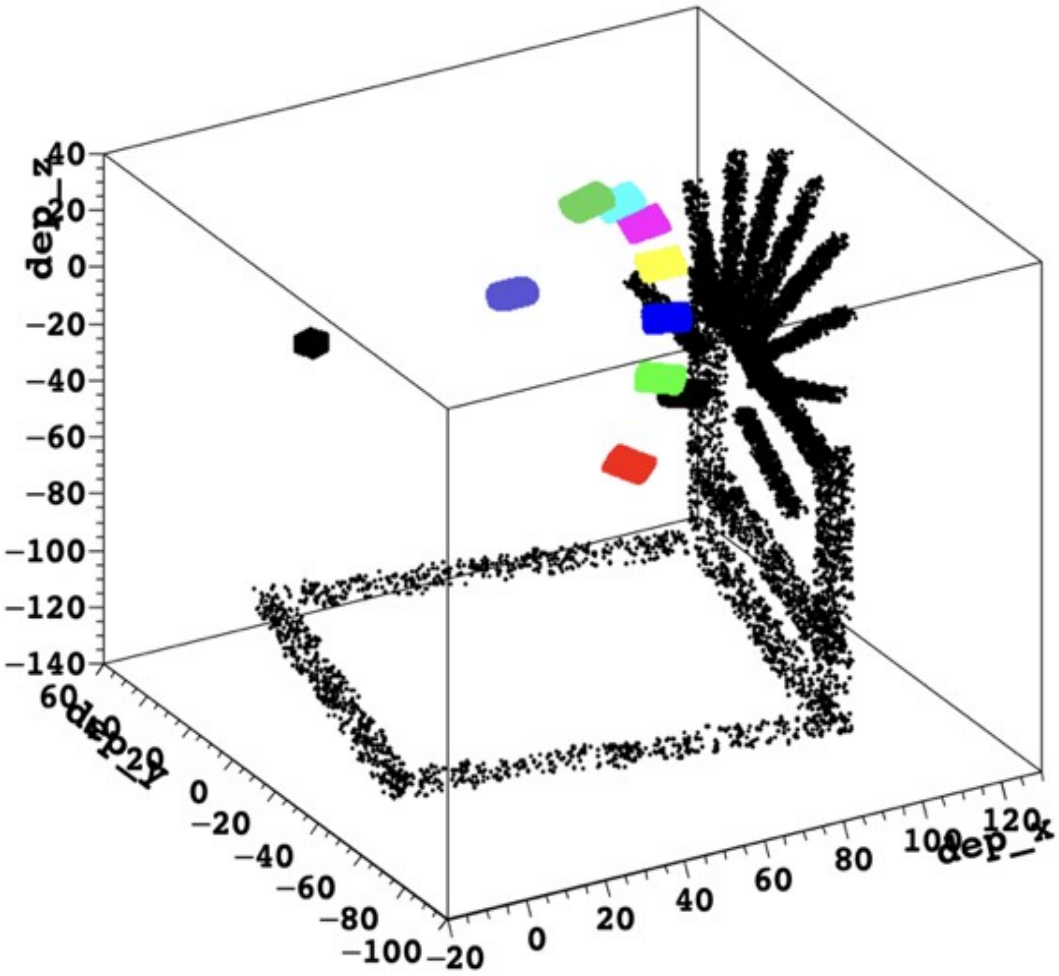
Preliminary full MC, to establish procedure. A toyMC is not enough (need to consider effects of beam width, TPC coincidence).

Start from an actual simulation (3E8 neutrons? in a 3 deg cone).

Selection based on TOF:
35 ns < TPC time < 41 ns &&
20 ns < ND time - TPC time < 26 ns

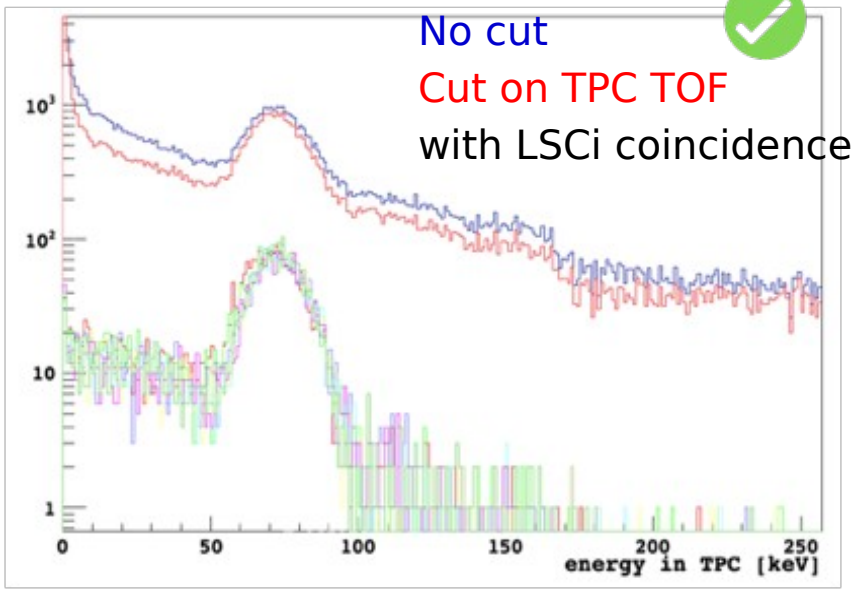
Determine energy deposited in the TPC for TPC-ND coincidence events. *Neglect coincidence with Si for the moment*.

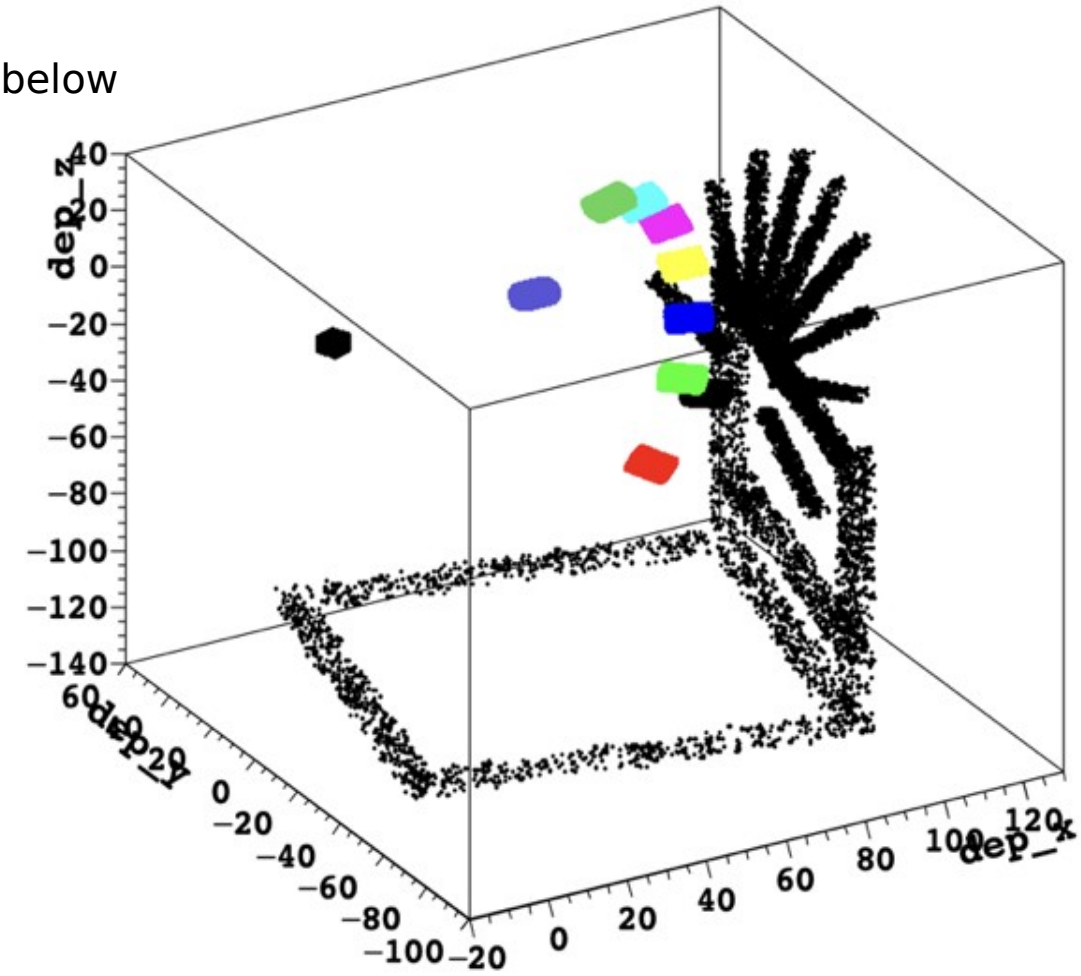
NB store **the azimuthal angle of the recoiling ^{40}Ar** (angle with respect to the drift field).



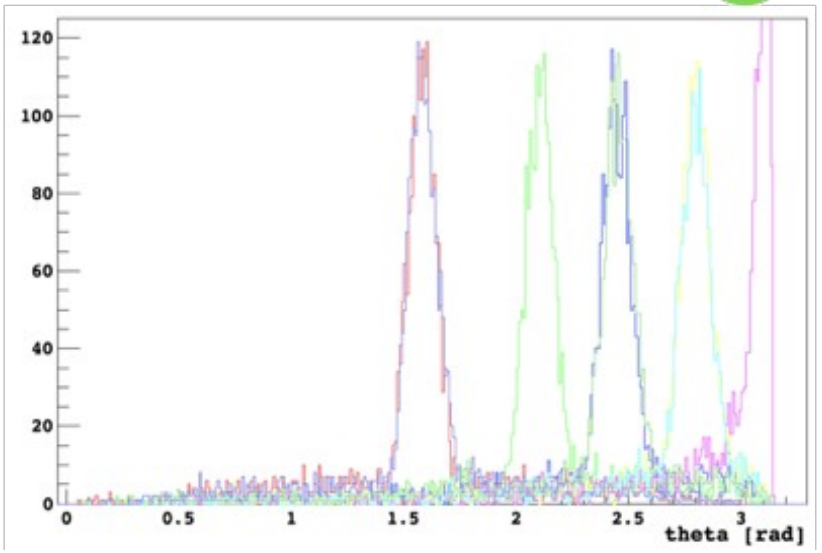
Model the response: from energy to S1 and S2

energy in TPC before and after coincidence and TOF selection





40Ar recoil angle wrt to drift field



Basics of the model

Energy in TPC ——— *L_{Eff} from ARIS* ———> Visible Energy

Visible energy ——— *Model from DS50 and ARIS* ———> ions and excitons (W = 19.5 eV , N_{ex}/N_i = 1)

Free ions ——— *Recombination from ARIS* ———> ions ↓ excitons ↑

recombination (S1)

angle with the field ?

fluctuations ?

Effect of the field: can be INVENTED to reproduce SCENE. Smth like α·cosθ ?

fluctuations: in DS50 we fluctuate (Gaus) independently Ni and Nex only at this point (S1 driven). Need update?

Surviving ions ———> S2

g2 / ionization yield (PE/e-) ?

S2 resolution ?

Excitons ———> S1

g1 / light yield (PE / ph) ?

S1 resolution ?

Measure from current ReD