

Next steps (1/2)

Ongoing work

To be discussed

[XX]: input params

G4DS generate E and xyz deposition in TPC (e.g. for gamma and neutron sources) → .fil read with ds20k.py. Work on viewer [Manu]

Not fully clear how to go from g4 deposition → PDM npe

Physics of LAr interaction

[toy]

channel (e.g.20)
npe / channel*
PE Time

[daq]
[mapping]

Electronics characteristics
(inc. CT, DCR, ...)

[sipm]

Interface at work [Manu]

Low Level → # Hits / ch

High Level

Baseline – Raw Data
= waveform (wf)

[reco]

Parameters of the sampling and baseline

Waveform filtering

[arma]

Parameters of SiPM response extracted from laser

Hit Finding

[filtering]

Optimise the parameters ?

Calibration

[??]

Gain extracted from laser

Many hits / ch
→ npe ???

Note: laser calib not done in DS20k but in each test bench certifying SiPM

Pulses finding

[pulses_finding]

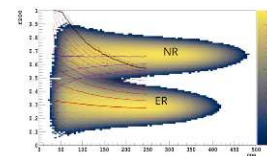
Pulse type [inc. clusterisation]

Best place to contribute (Manu has written the code)?

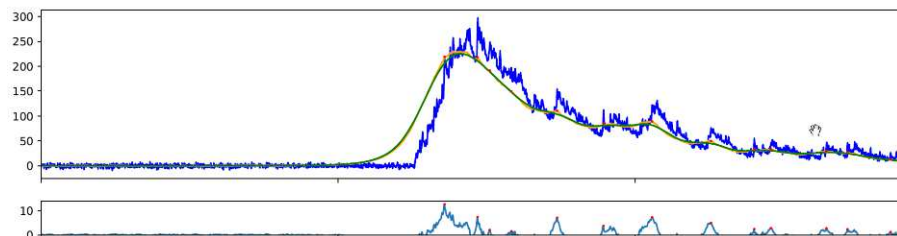
Pulse characterisation

[xyreco]

Energy, x, y, z, f90, NR/ER sep



XY map with hot ch [Manu]



wf Visualisation with Jupyter notebook [Manu]

Neutron (0/0)

- **Manu:** cut on amplitude to see wf in DS20k config.
- **Manu:** Ereco done ??
- **Fabrice:** Understand xyreco with ds20k_xyreco

1- DS20k Simulation data (e.g. gamma and neutron sources in the guide tube)

- View wf, maps of the hot PDMs, Ereco and xy reco for a **single scatter** evt
- ➔ Should help to understand the full chain

provide single scatter evts [1 γ at (0,0,0)]

g4ds

WIMP, radioactive source (Gamma, neutron) → deposition in TPC (x, y, z, E, ER/NR)

pyreco (?)

γ in PDM → npe (S1)

e drift → γ in PDM → npe (S2)

pyreco simu

npe / PDM / t → wfs / ch

pyreco LL reco

Hit finding from Baseline-wfs

pyreco HL reco?

S1/S2, x, y, z, E, ER/NR

2- Proto data : **Manu:** raw data run 1195, 1353

- Run Am [1195, wf2, ch0 + 1353 – evt 7296] : Evt with S1 + S2 from Am identified.
- ➔ Can we reconstruct the energy [and xy position?] of the Am source (59 keV) for this evt ?

PP : Can not find the same evt to compare with pyproto ...

PP : to be done

- Run Laser 1232 evt100 Ch6 : Typical event with laser run. Compare with gun.py

- ➔ More generally compare with results we obtained with Marie using pyproto (useful to optimize hit finding with pyreco) ? **PP :** pk_pdm [fixable] and pk_npe [???] not defined ...

3- pulses_finder (code written by Manu)

- Which figure of merit for the optimisation (for that need to understand the Ereco) ?
- ➔ Usage of AI ?

Test full chain (1/4)

python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_00_v2.fil -o center_00_ev1 -v

DS20k Simulation : single photon located at (x,y,z) shot vertically upwards

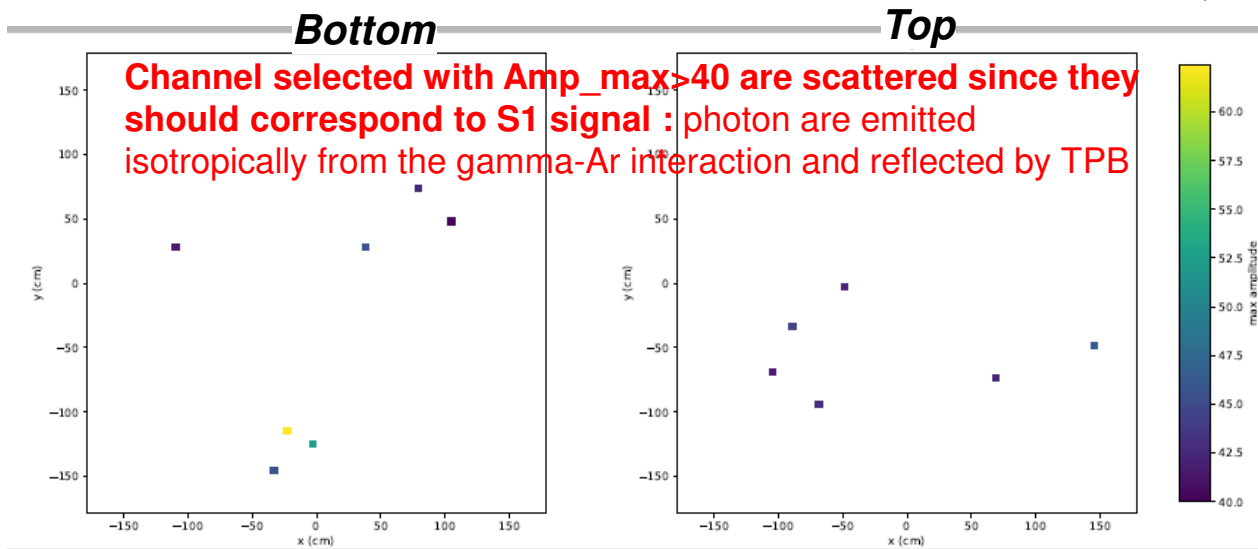
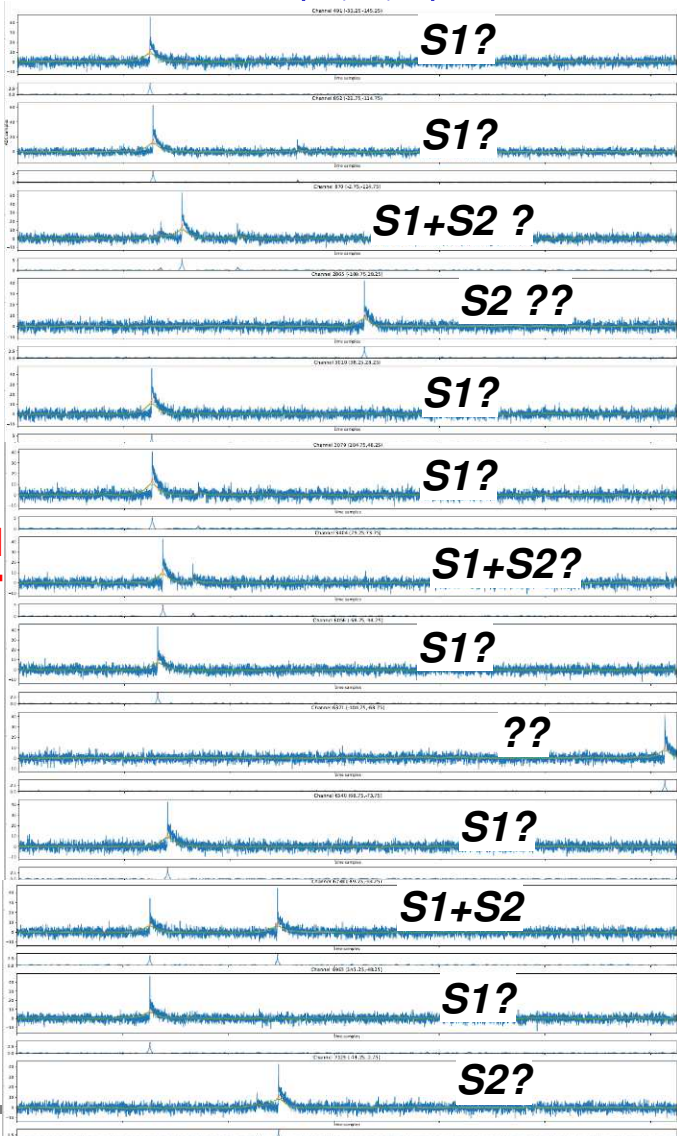
- 100 keV (0,0,0) ev=1 : single scatter

E_{dep_TPC} E_{tot} $E(S1) = 83 \text{ keV}$ $E(S2)=18$
 event (0, 22, 0.0, 100.0, 83.45999908447266, 18.095998764038086,
 0.0, 0.0, 100.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 20288,
 491, 0, 310076, 1, 3, 0)
 $npe_veto, npe_mu, nPh, nDaug, ndep$

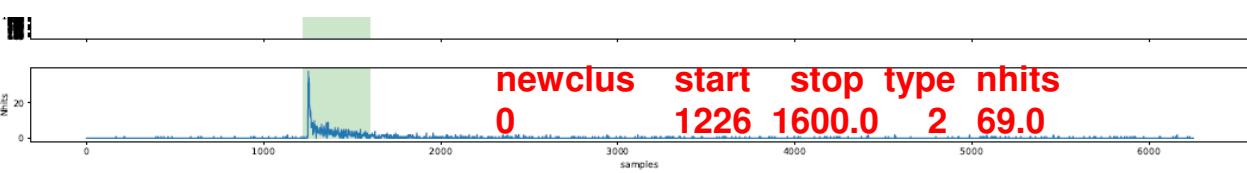
$pdg_id, mat, E, ??, x, g(0,0,0), y, z, g_{Lar} \rightarrow p_e \text{ effect}$

p: 22, 8, 3.1775999069213867, 4321.8076171875, 0.0, 0.0, 0.4321807622909546, 0.014415998873445668,
 11, 8, 88.6076889038086, 130.60342407226562, -0.00011957479728152975, 0.00832558237016201, 0.4394393563270569, 0.014652386644260298,
 11, 8, 8.214713096618652, 2.010924816131592, -0.00014793603622820228, 0.008294944651424885, 0.4394729733467102, 0.014662477293920232)

Amp_max > 40



NOTE: S1 signal (83 keV) can only be seen by summing all ch.



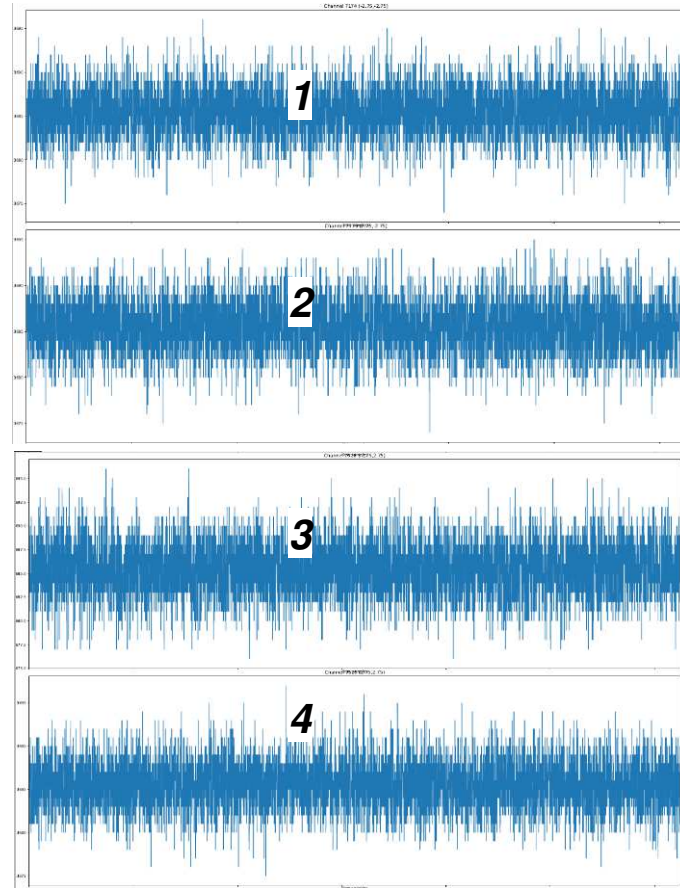
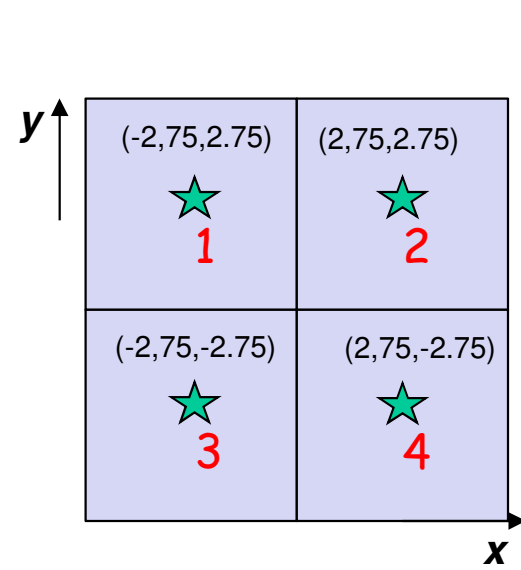
→ Why it is tagged as S2 ... and where is S2 ??

Test full chain (1' / 4)

python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_00_v2.fil -o center_00_ev1 -v

DS20k Simulation : single photon located at (x,y,z) shot vertically upwards

- 100 keV (0,0,0) ev=1 : single scatter

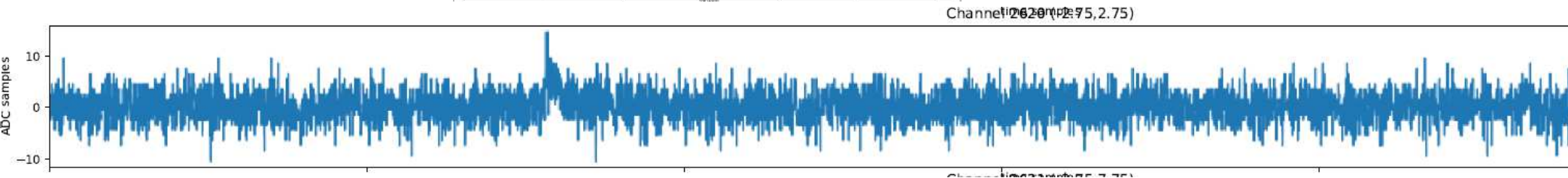


- S2 signal should be centered at (0,0) [electron drifting from the gamma-Ar interaction] → look at the top map of all channels centered on (0,0) +/-5cm

→ See no signal (even if we look at +/-10 cm) ??

→ May be shift from photon from (0,0) → (2.75,2.75) to be at the center of the ch ??

→ ELG try bottom and see something (chance or inversion top-bot ?)



Test full chain (2/4)

```
python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_00_1mev.fil -o center_00_1mev_ev1 -v
```

DS20k Simulation : single photon located at (x,y,z) shot vertically upwards

- 1000 keV (0,0,0) ev=1:multiscatter

<i>Edep_TPC</i>	<i>Etot</i>	<i>E(S1)</i>	<i>E(S2)</i>	
event (0, 22, 0.0, 1000.0, 785.81103515625, 223.50901794433594, 0.0, 0.0,				
1000.0000610351562, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 254486,				
5022,	0, 3918269,	11,	29, 0)	<i>npe</i>
<i>npe_veto, npe_mu,</i>	<i>nPh, nDaug,</i>	<i>ndep</i>		

```
p (22, 8, 0.014619999565184116, 52550.28125, 0.0, 0.0, 5.255028247833252, 0.1752888750439764,
22, 8, 0.028920000419020653, 37284.2265625, 0.9888008832931519, 1.3609747886657715, 8.58236312866211, 0.2996556641685346,
22, 8, 0.24943000078201294, 11926.0048828125, 1.4447733163833618, 2.407040596008301, 8.928961753845215, 0.33943653312214767,
22, 8, 0.3134300112724304, 6042.765625, 1.4121253490447998, 2.674224615097046, 8.387947082519531, 0.3595930303257463,
22, 8, 0.014619999565184116, 77197.8203125, 1.0994030237197876, -4.48311185836792, 11.26366901397705, 0.6170972448463217,
22, 8, 3.1775999069213867, 33819.4296875, -0.4977412223815918, -4.343712329864502, 14.241458892822266, 0.729906721460374,
22, 8, 0.24943000078201294, 95226.046875, -6.602246284484863, 2.8991501331329346, 15.219192504882812, 1.0475466222062626,
22, 8, 0.014619999565184116, 30667.98046875, -7.62908935546875, 3.394275665283203, 12.372142791748047, 1.149843993207571,
22, 8, 3.1775999069213867, 15702.2958984375, -8.961438179016113, 4.017246246337891, 11.822254180908203, 1.2022212129588468,
11, 8, 78.95817565917969, 98.92042541503906, -8.963909149169922, 4.0161614418029785, 11.822040557861328, 1.2024019297367798,
11, 8, 4.5966267585754395, 0.7626596689224243, -7.629077434539795, 3.394270181655884, 12.372127532958984, 1.1498491184588333,
11, 8, 17.371957778930664, 7.227479457855225, -6.6023054122924805, 2.899254322052002, 15.219345092773438, 1.0475720587346973,
11, 8, 10.968050003051758, 3.2887871265411377, -0.49773290753364563, -4.343766689300537, 14.241527557373047, 0.729921059031032,
11, 8, 22.025041580200195, 10.87056827545166, 1.0994986295700073, -4.483370304107666, 11.263569831848145, 0.6171315309307146,
11, 8, 67.66886138916016, 182.2254180908203, 1.4189794063568115, 2.679140090942383, 8.382427215576172, 0.35997992922502653,
11, 8, 74.62660217285156, 89.8387680053711, 1.4201781749725342, 2.6811962127685547, 8.383034706115723, 0.36014766556818184,
11, 8, 7.875829219818115, 18.738998413085938, 1.4457577466964722, 2.407921552658081, 8.930254936218262, 0.3395170699039434,
11, 8, 59.69731521606445, 209.18228149414062, 1.4648897647857666, 2.4057557582855225, 8.935412406921387, 0.3399996567082373,
11, 8, 72.41426086425781, 151.1055450439453, 1.4762330055236816, 2.407956123352051, 8.944628715515137, 0.3402873250151317,
11, 8, 40.068119049072266, 30.741836547851562, 1.4767802953720093, 2.4073288440704346, 8.944621086120605, 0.3403615256294104,
11, 8, 73.319580078125, 302.4278259277344, 0.975278377532959, 1.3663476705551147, 8.603241920471191, 0.30044886263351184,
11, 8, 64.1737060546875, 239.36465454101562, 0.9628766775131226, 1.3754031658172607, 8.61150074005127, 0.30103729542341073,
11, 8, 54.16029357910156, 183.10435485839844, 0.9552172422409058, 1.3640477657318115, 8.612530708312988, 0.30142725843301393,
11, 8, 89.064453125, 118.35304260253906, 0.958324670791626, 1.3561010360717773, 8.613591194152832, 0.3016390882359747,
11, 8, 69.00626373291016, 210.537109375, -0.002682275837287307, -0.0005731608835048974, 5.269014835357666, 0.17577630895882287,
11, 8, 85.38196563720703, 141.508544921875, -0.001227778266184032, 0.0012460483703762293, 5.281667709350586, 0.1760383573820258,
11, 8, 19.34903907775879, 8.699467658996582, -0.0010214498033747077, 0.001146359951235354, 5.281711578369141, 0.17606742619783103,
22, 8, 3.1775999069213867, 4021.000244140625, 1.7316696643829346, 2.1722817420959473, 8.774008750915527, 0.35292968298762817,
11, 8, 78.85601043701172, 98.70231628417969, 1.7323952913284302, 2.1713826656341553, 8.771567344665527, 0.35311009160365403)
```

```
newclus start stop type nhits
0 1230 1604.0 2 2981.0
```

Test full chain (3/4)

```
python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_001_v1.fil -o center_001_ev1 -v  
python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_11_v1.fil -o center_110_ev1 -v
```

DS20k Simulation : single photon located at (x,y,z) shot vertically upwards

- 100 keV (0,0,1m)
- 100 keV (1m,1m,0)

To be investigated when better understanding of the signal pulse (SI.27)

Test full chain (4/4)

```
python exe/ds20k.py -i /sps/darkside/hubaut/g4ds10/Linux-g++/center_00_neutron.fil -o center_00_neutron_ev1 -v
```

DS20k Simulation : single neutron located at (x,y,z) shot vertically upwards

- 100 keV (0,0,0)

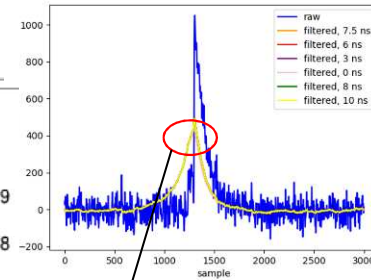
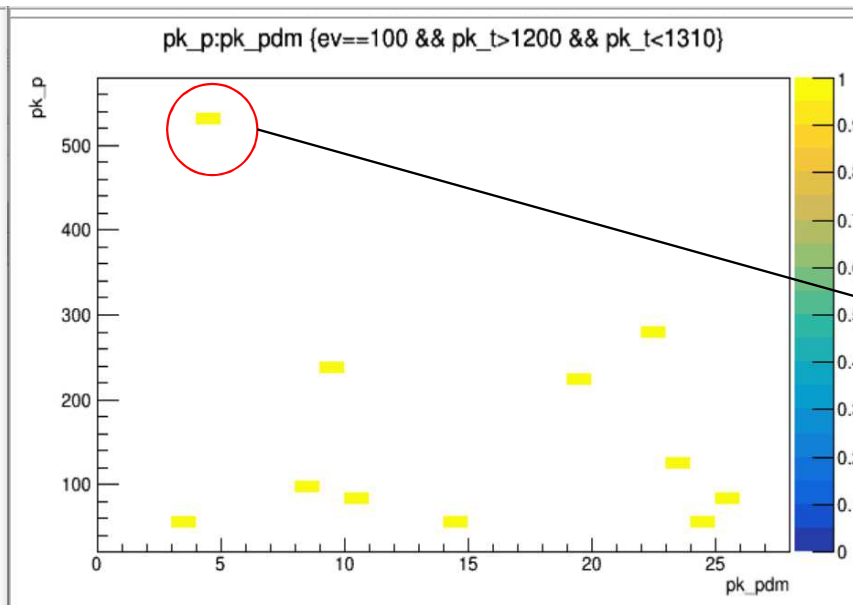
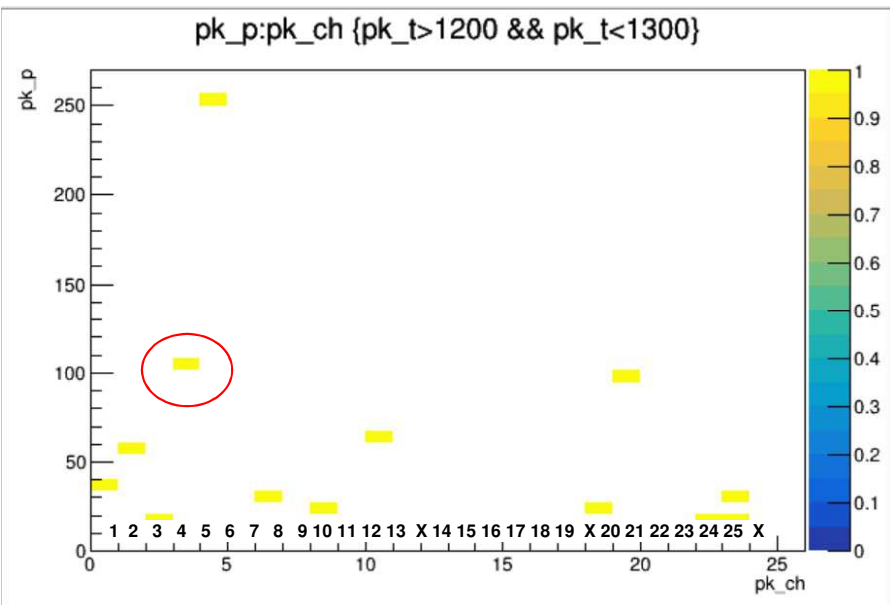
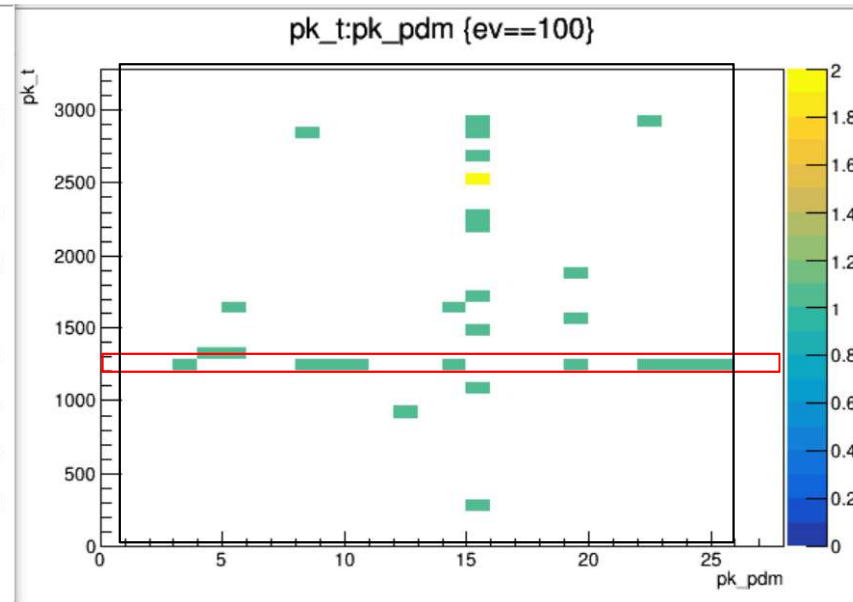
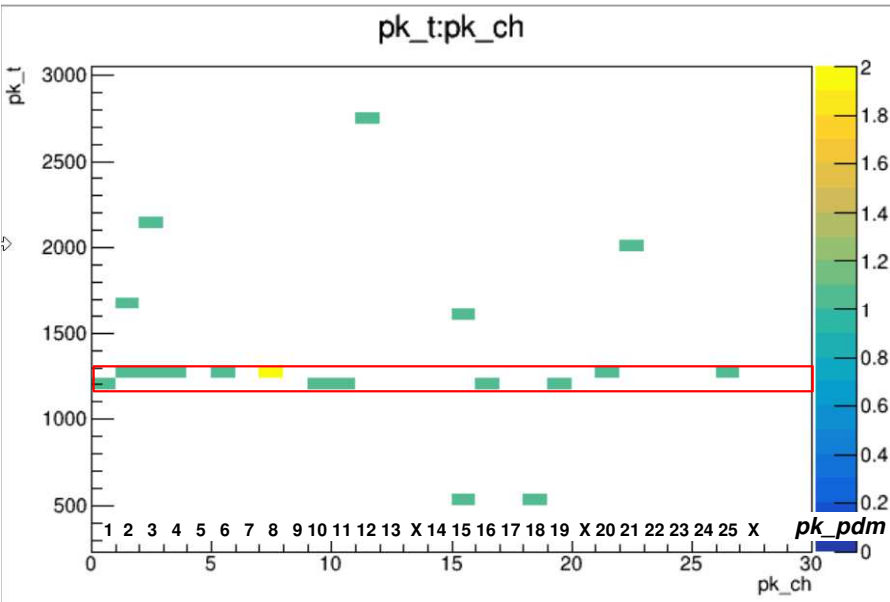
```
Edep_TPC ?? Etot E(S1) E(S2)  
event (0, 2112, 0.0, 100.0, 1928.6082763671875, 620.5093994140625, 0.0,  
0.0, 2584.951171875, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 596453,  
23437, 0, 10071056, 41, 154, 0) npe  
npe_veto, npe_mu, nPh, nDaug, ndep
```

Read Data (1/3)

Laser Run 1232 ev==100

pyreco

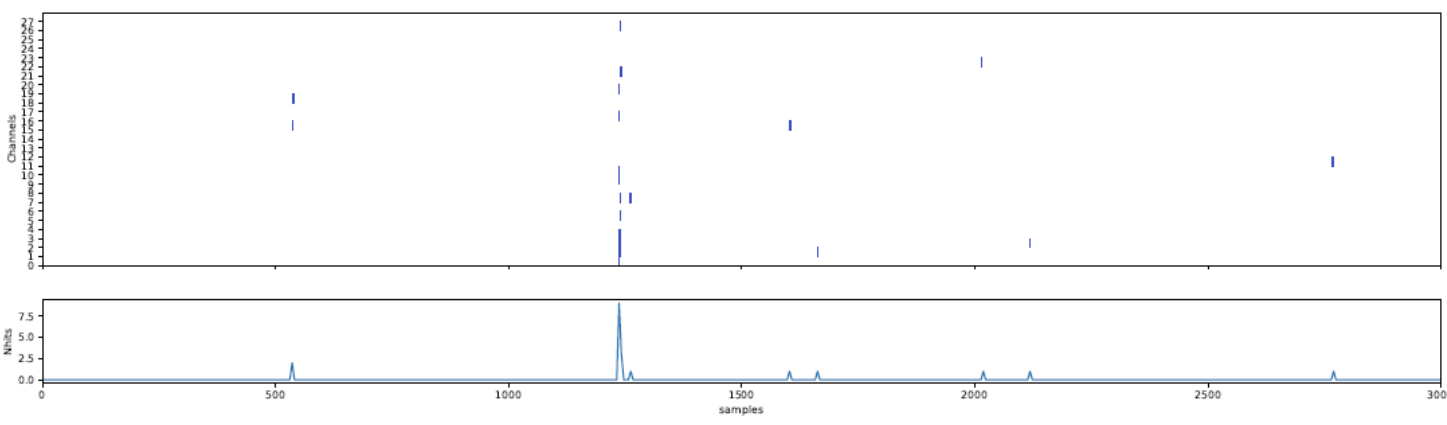
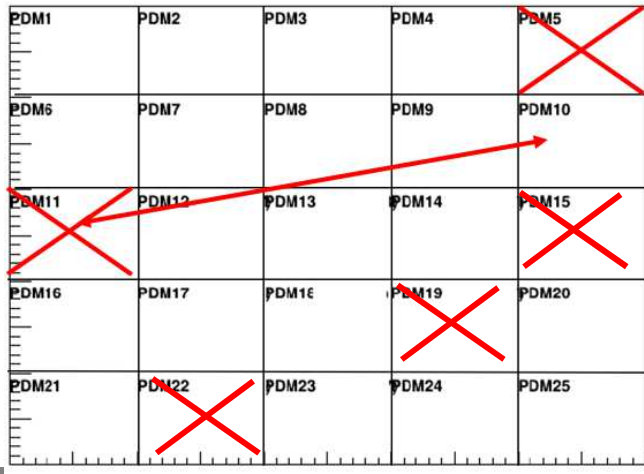
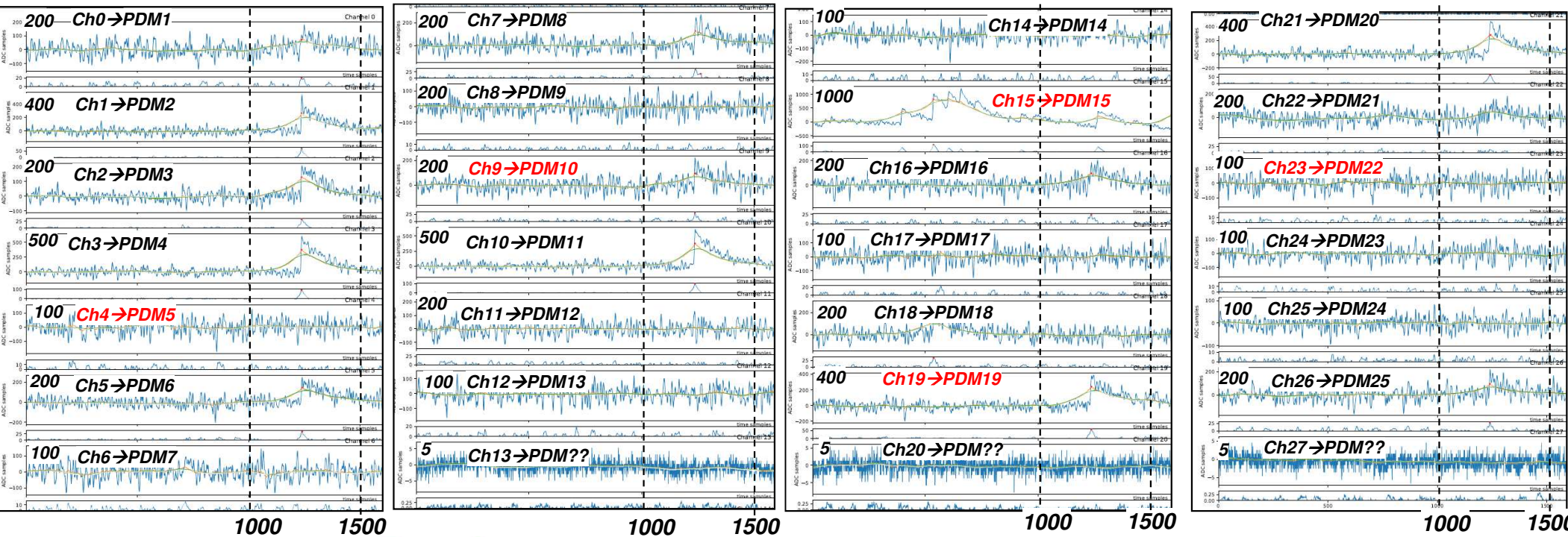
pyproto



PDM4 (ch==6):
pk_p=530

Read Data (2/3)

Chmap=[0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27] but only 25 ch??



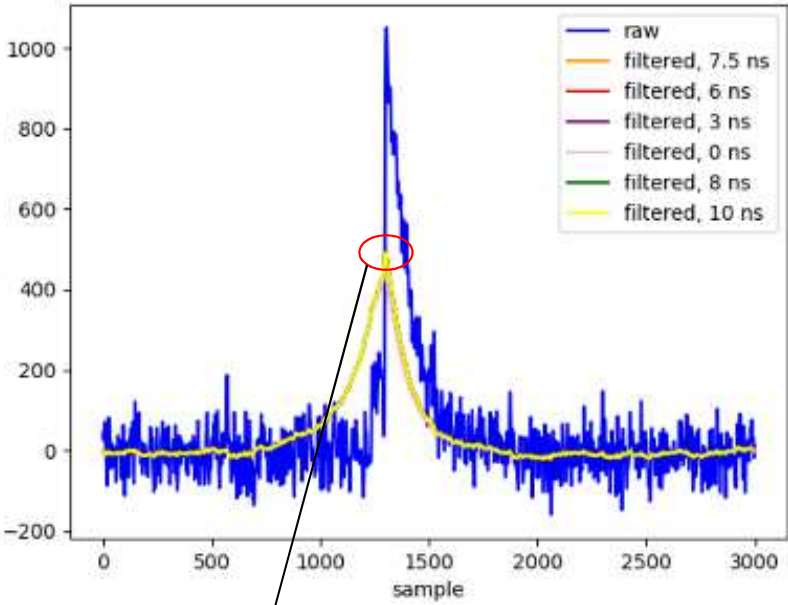
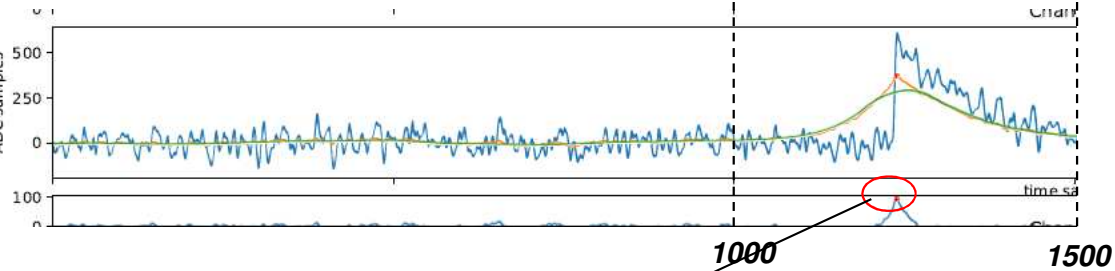
Read Data (3/3)

pyreco

pyproto

Should be the same raw data ?

Ch3 → PDM4



PDM4 (ch==3): pk_p=80

- pk_p = orange-green not peak max as in pyproto
 - pk_npe not filled → calibration (ADC/NPE from laser) not applied
- No NPE reconstructed per PDM but only one energy per cluster ?

PDM4 (ch==6):
pk_p=530
pk_npe=6 (gain ~80)