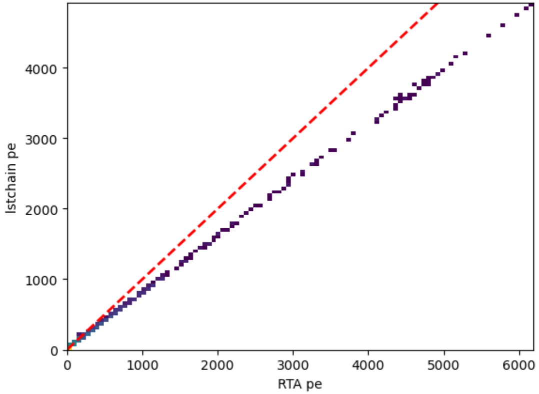
# New version of LST real time analysis

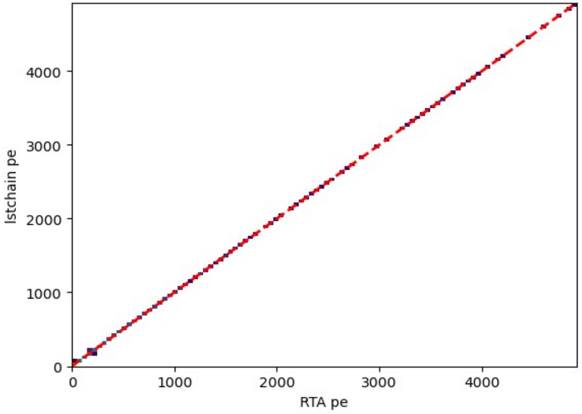
# What’s new

- Bug correction for the time reconstruction
- Temporal cleaning (remove pixel of Hillas if not at least one neighbor at < 2ns)
- Lot of work on the optimisation to be able to use this real time (~2500 ev/s/CPU)

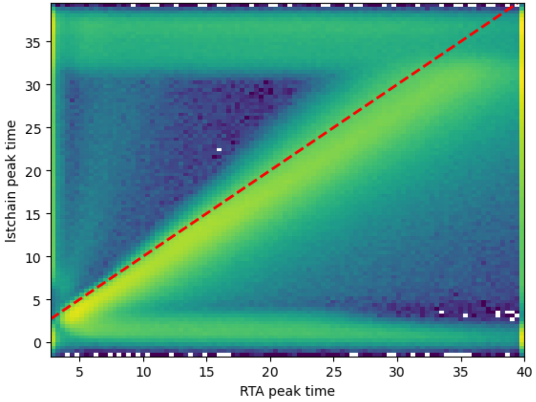
# Comparison pixel by pixel (MC)



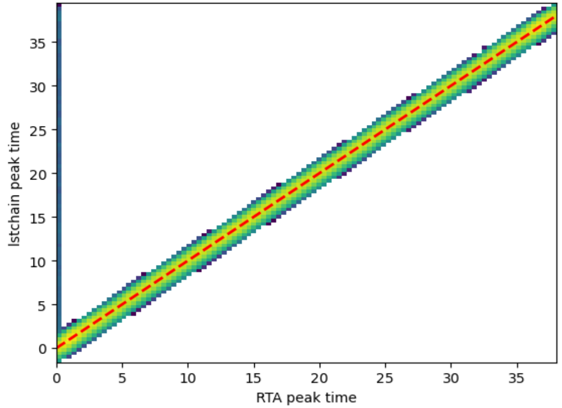

```
correlation :  [[1.         0.99800326]
[0.99800326 1.        ]]
```




```
correlation :  [[1.         0.99999812]
[0.99999812 1.        ]]
```

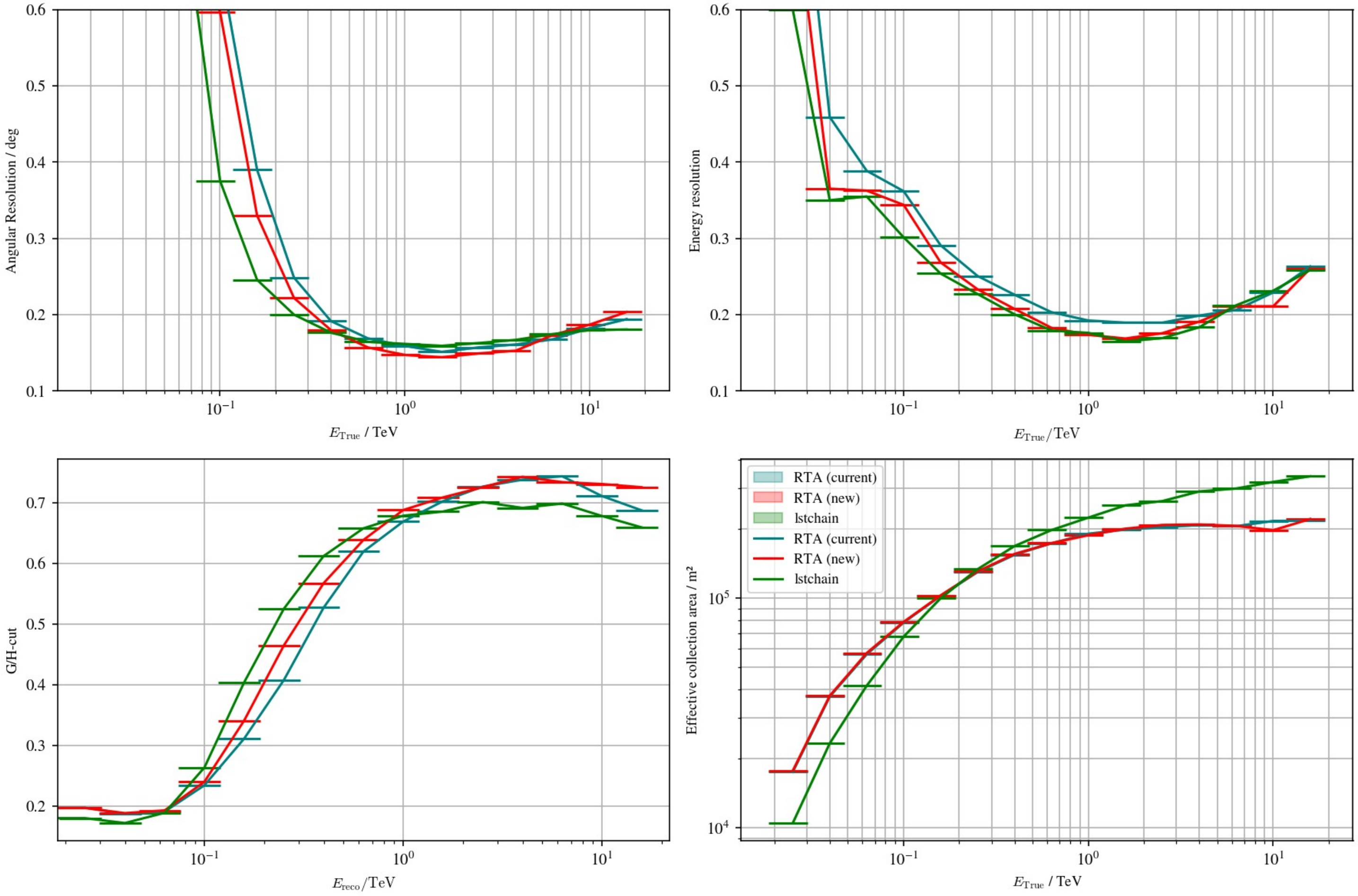



```
correlation :  [[1.         0.48170111]
[0.48170111 1.        ]]
```

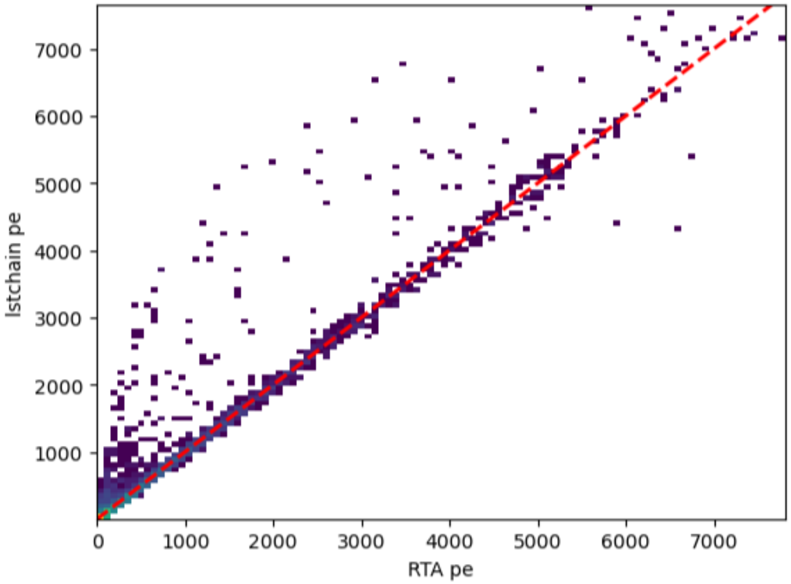



```
correlation :  [[1.         0.99773017]
[0.99773017 1.        ]]
```

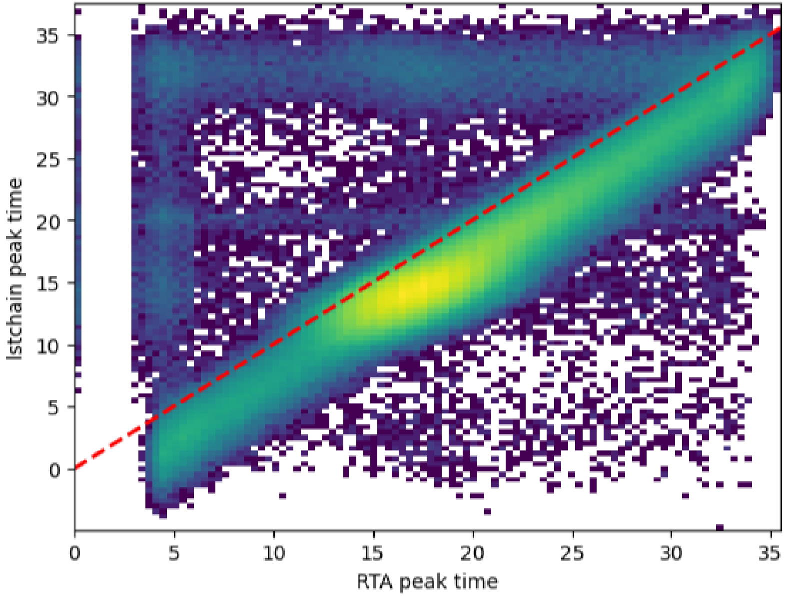
# Results Simulations



# Comparison pixel by pixel (Real data)




```
correlation :  [[1.         0.97743515]
[0.97743515 1.        ]]
```



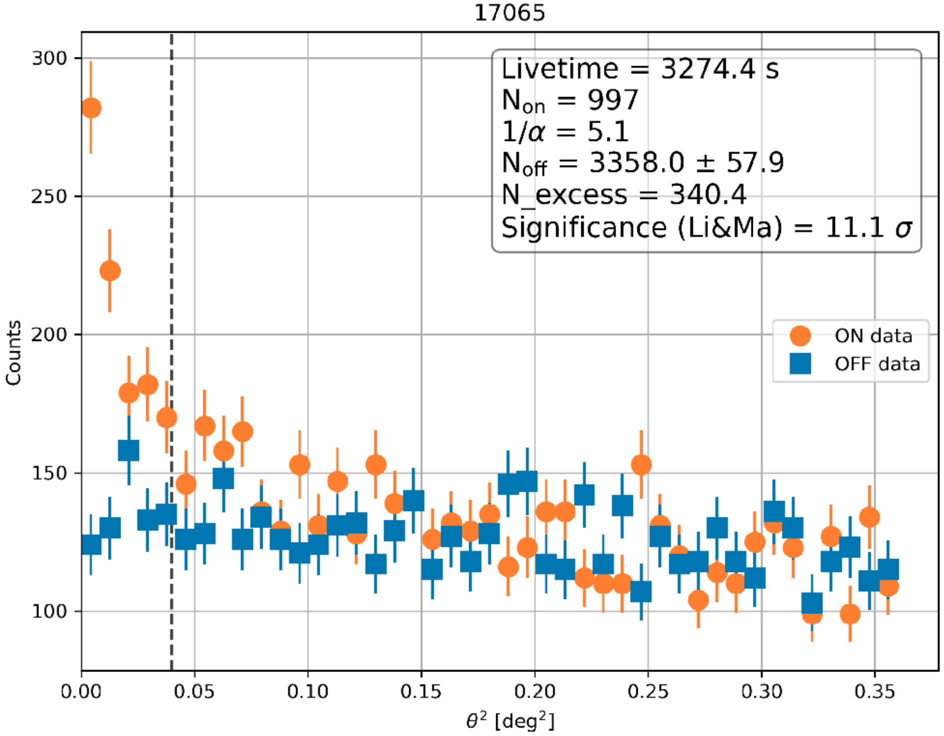

```
correlation :  [[1.         0.84728268]
[0.84728268 1.        ]]
```

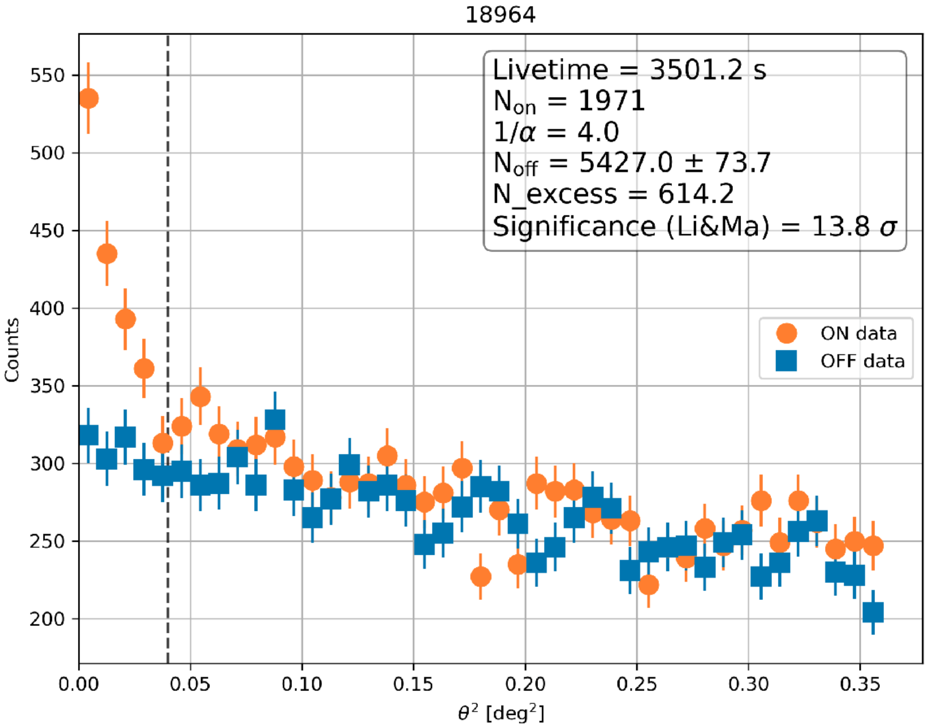
# First Crab results

22° → 35° zenith

Gammaness > 0.65

42° → 33° zenith



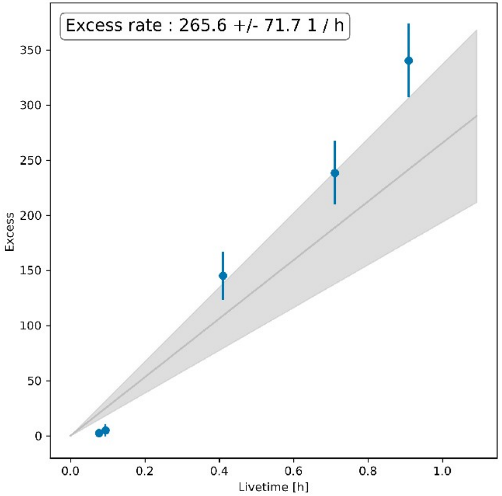
# Crab results

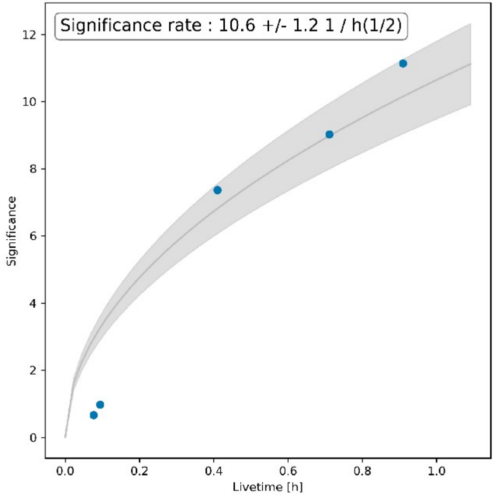
Old

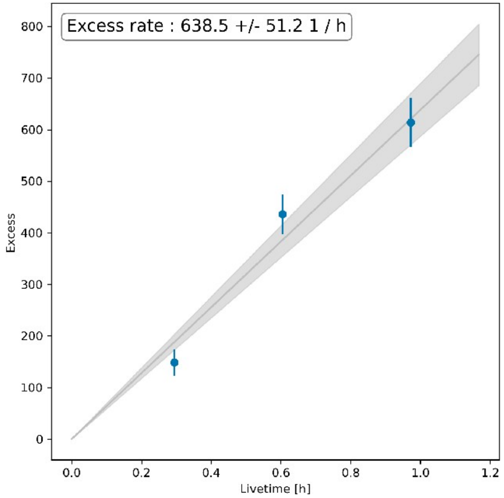
22→35 zenith

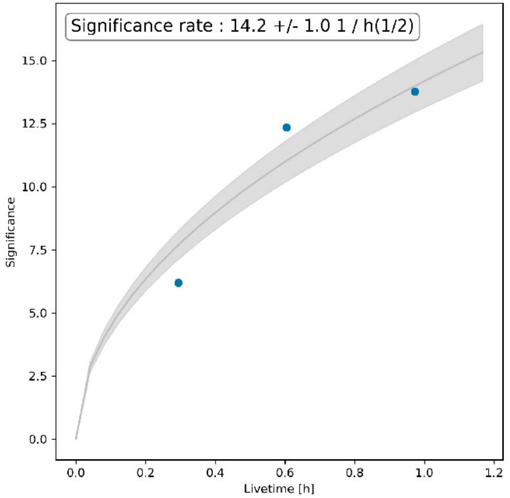
New

42→33 zenith



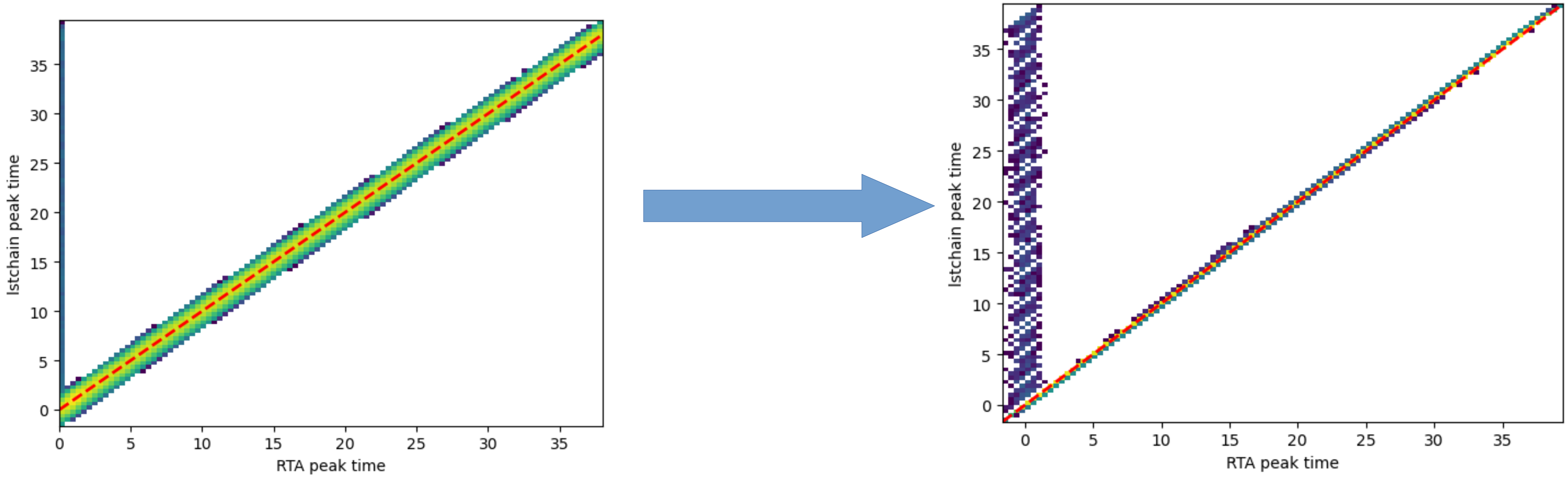




~ x2 improvement

# Next Improvement

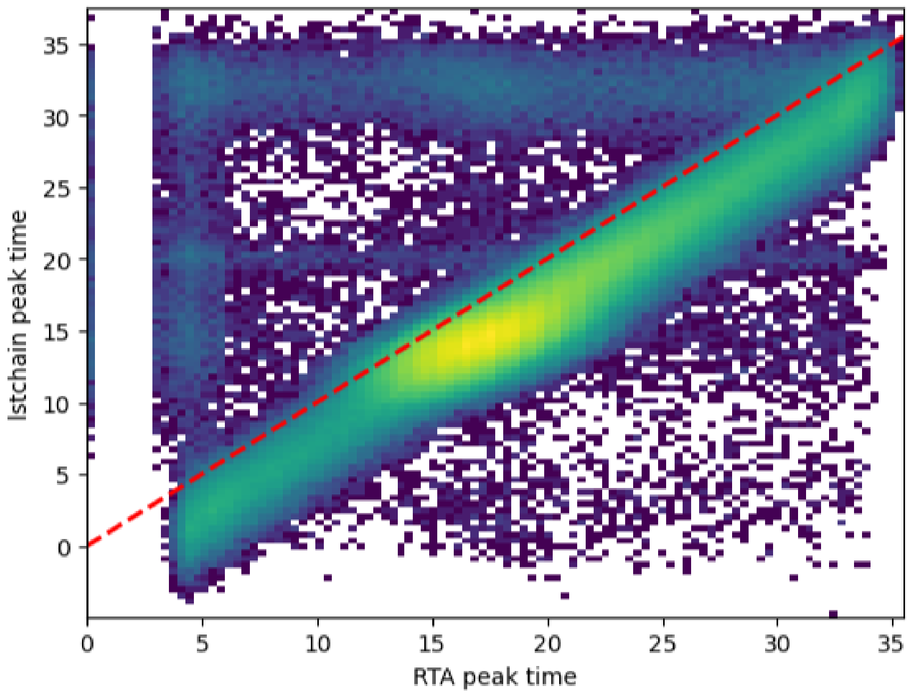
- Time calibration (~1.26 ns spread between pixels)



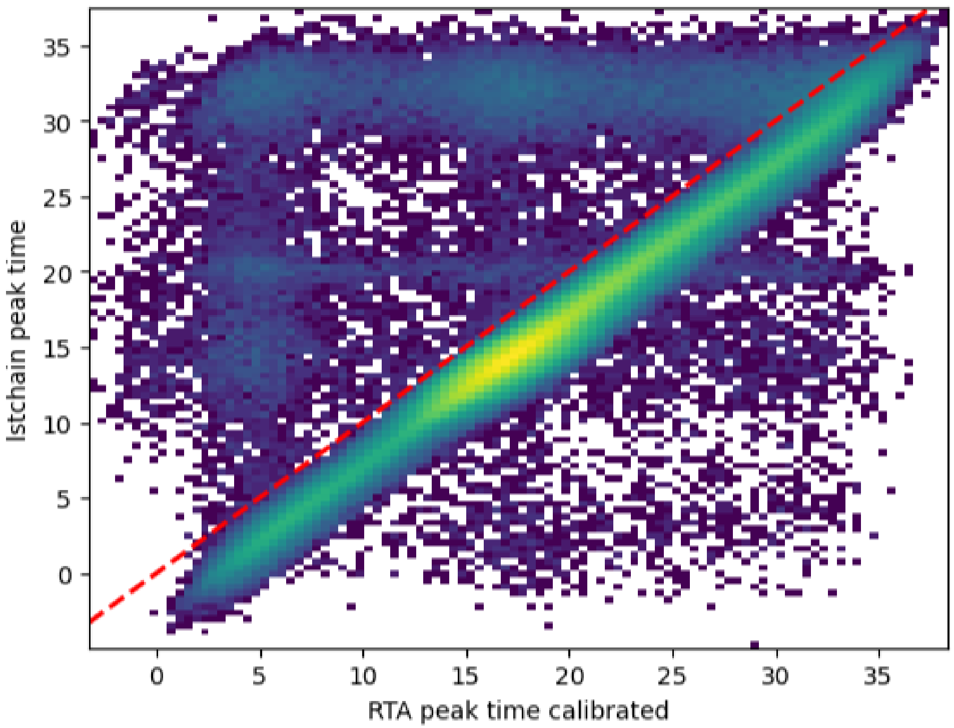

```
correlation :  [[1.          0.99773017]
[0.99773017 1.        ]]
```

- On-going : Currently need to update simulations to include the calibration per run
- Next : Performance on MC, Produce RFs and

# Time real data after calibration




correlation :  [[1.          0.84728268]
[0.84728268 1.        ]]

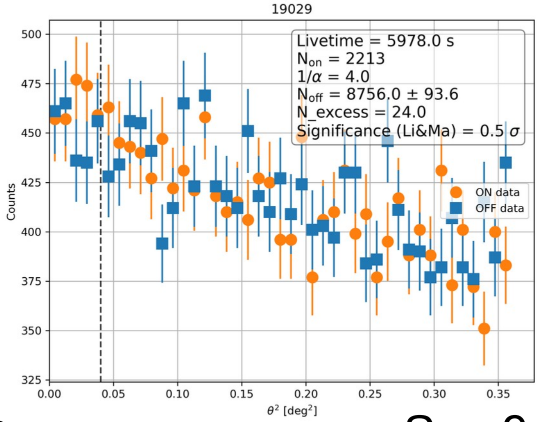



correlation :  [[1.          0.87600579]
[0.87600579 1.        ]]

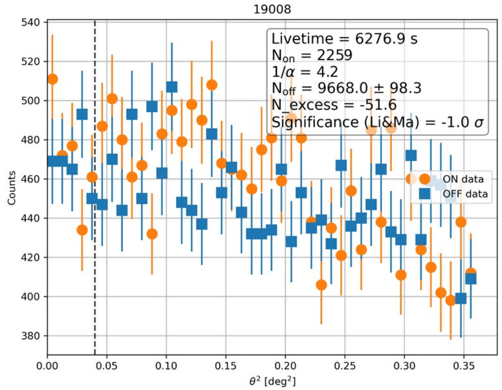
# Cut optimisation

- Recent discussion and observation of 4c 27.50 (z = 1.25) motivated me to start to put more time on this topic
- RTA no detection of 4C but cuts are not optimized
- Tried to implement a simple version of the cut optimizer in a first step to have an idea of the cut needed to observe a z=1.25 source

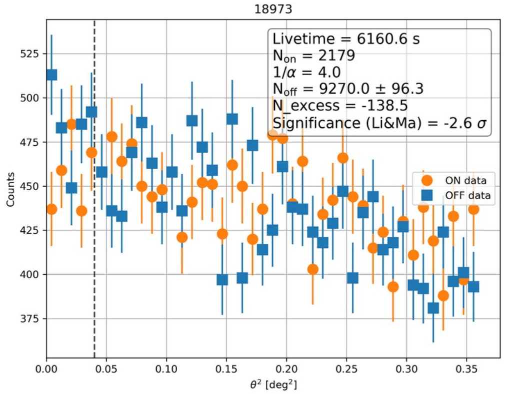
Sep 11



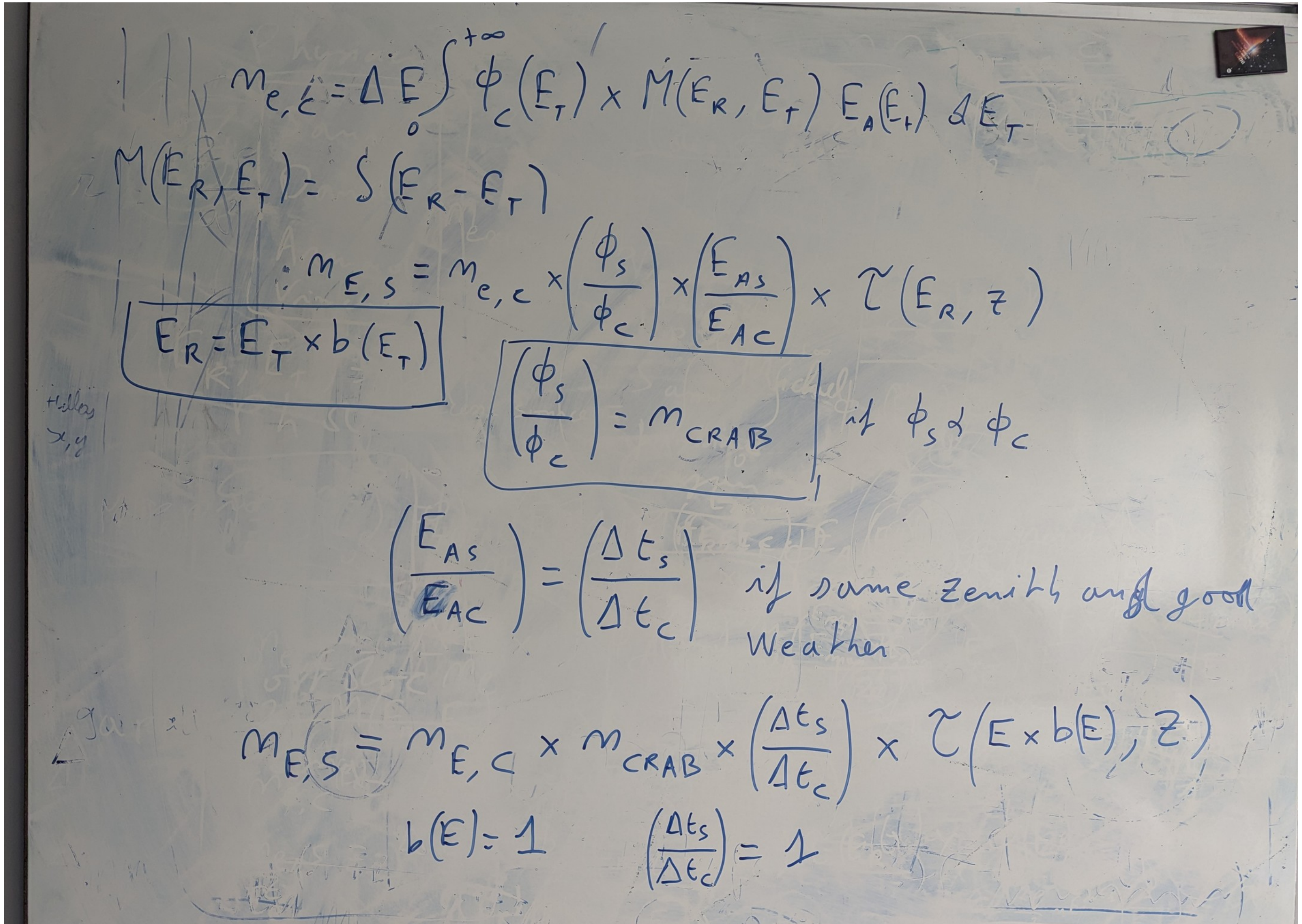

Sep 10




Sep 9

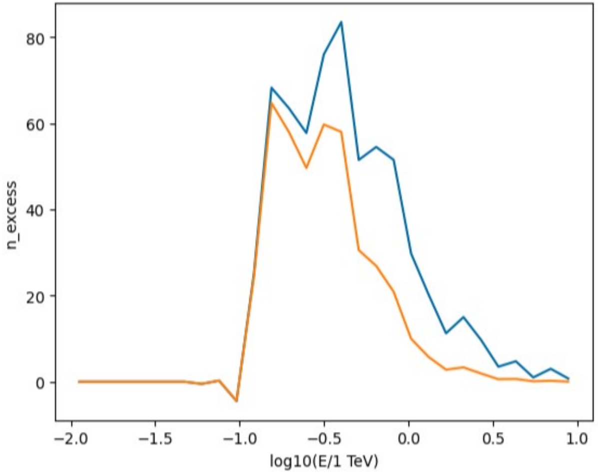


# Cut Optimisation (maths)



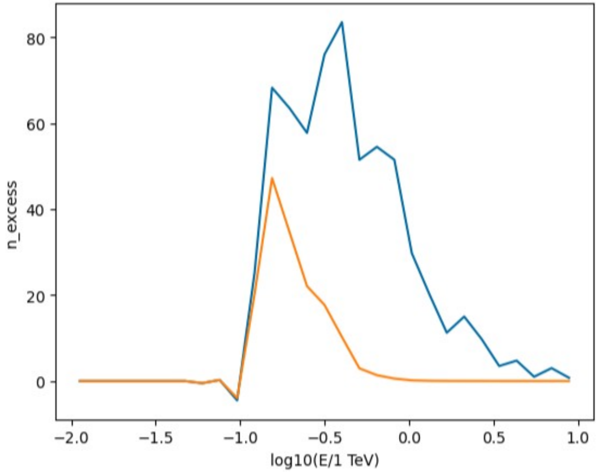
# EBL corrected excess

z=0.1



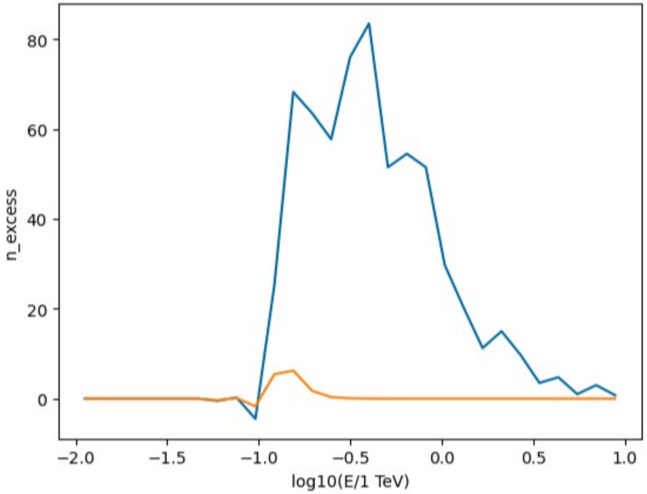

[9.18234879]

z=0.4




[3.51045598]

z=1.25

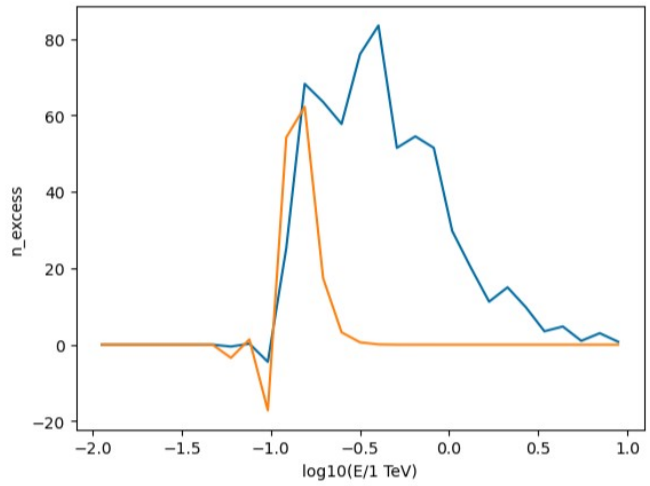



[0.27678447]

Current RTA cut, no chance to observe 4C (~ 0.3 sigma / sqrt(h)) if 4C is 1 Crab (at least with the current cuts)
Observable in ~320 hours … :(

# EBL corrected excess

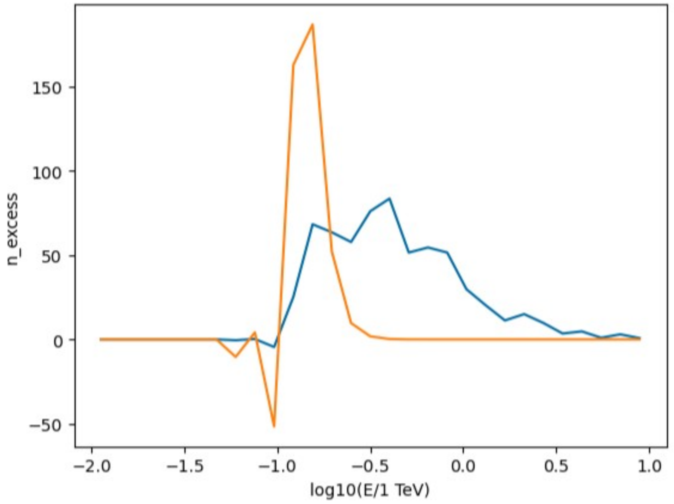
z = 1.25, 10 crab




[2.72883129]

Observable in ~3.4 hours

z = 1.25, 30 crab

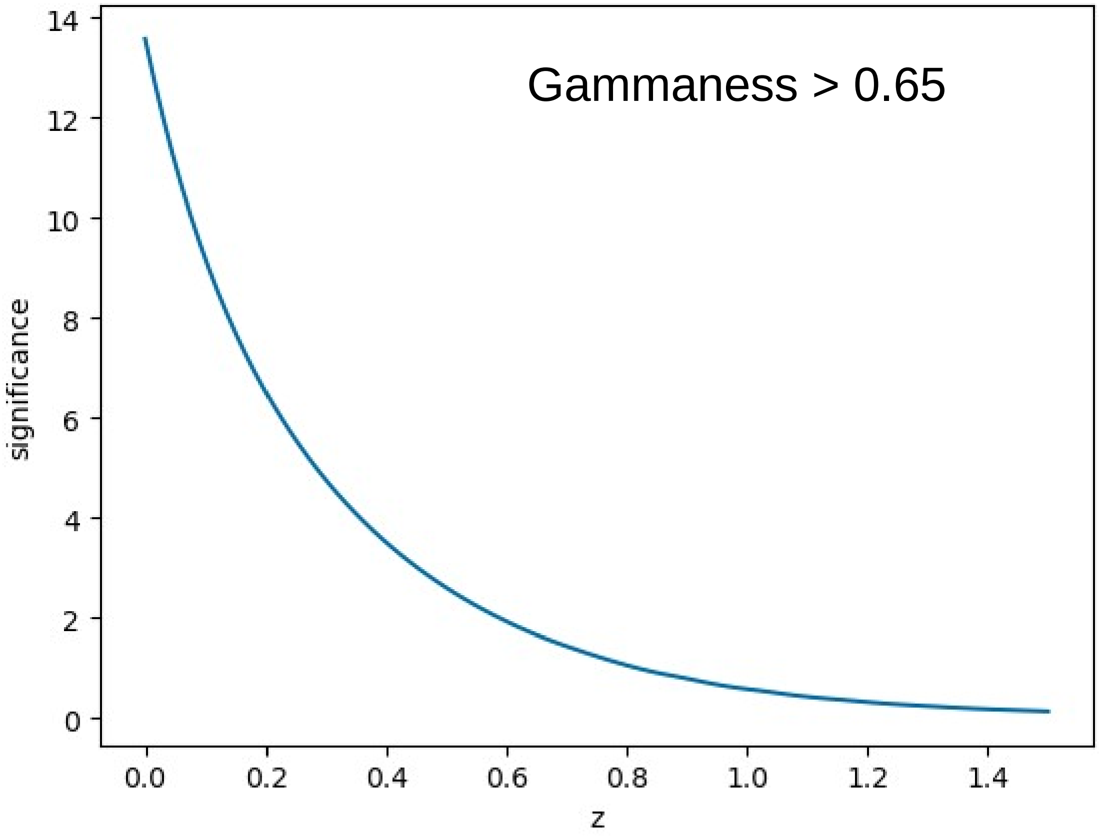



[7.94869397]

Observable in ~0.4 hours

# Significance versus redshift

- Next step is optimisation
- Produce significance versus z for different cuts (0.4→0.9)
- Make a 3D table (significance, z, gammaness_cut)
- Choose the gammaness_cut that maximise significance to z =1.25
- Use it on 4C data
- That is the program of my afternoon



# Next steps

- Perform this simple analysis on 4C
- Share the notebook
- Further investigation :
  - Add a b(E) from mig matrix
  - Try to do the maths for a gaussian migration (no idea how to deal with it)
- Can be applied easily on lstchain as well (inputs are Crab DL3 with different cuts)
- Make a 4D table (significance, z, gammaness_eff/theta_eff, zenith) is probably a good start