MAGIC in ctapipe

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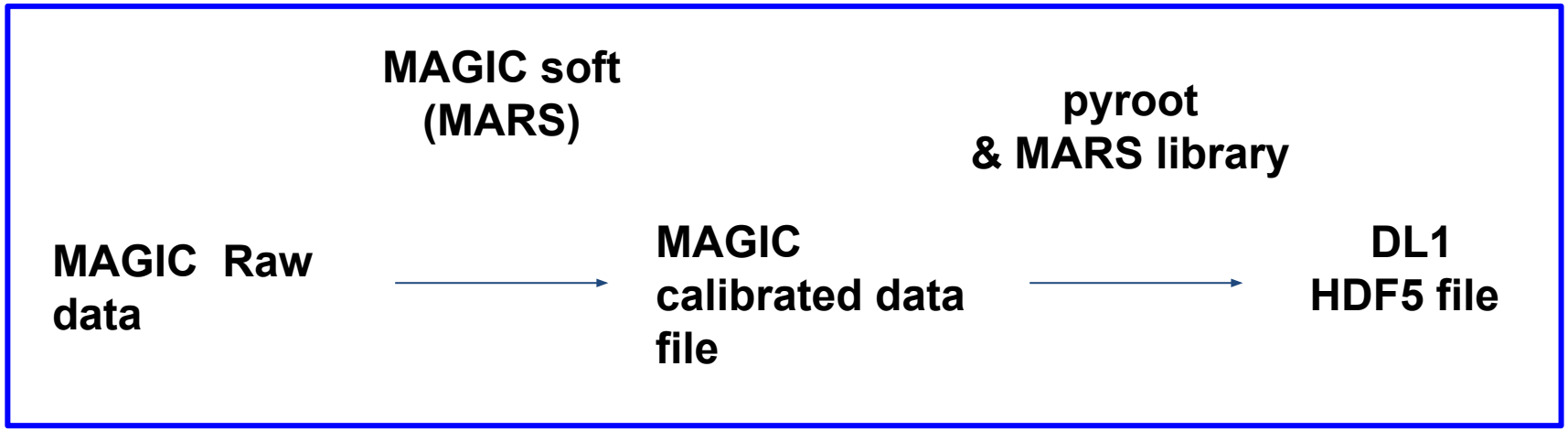
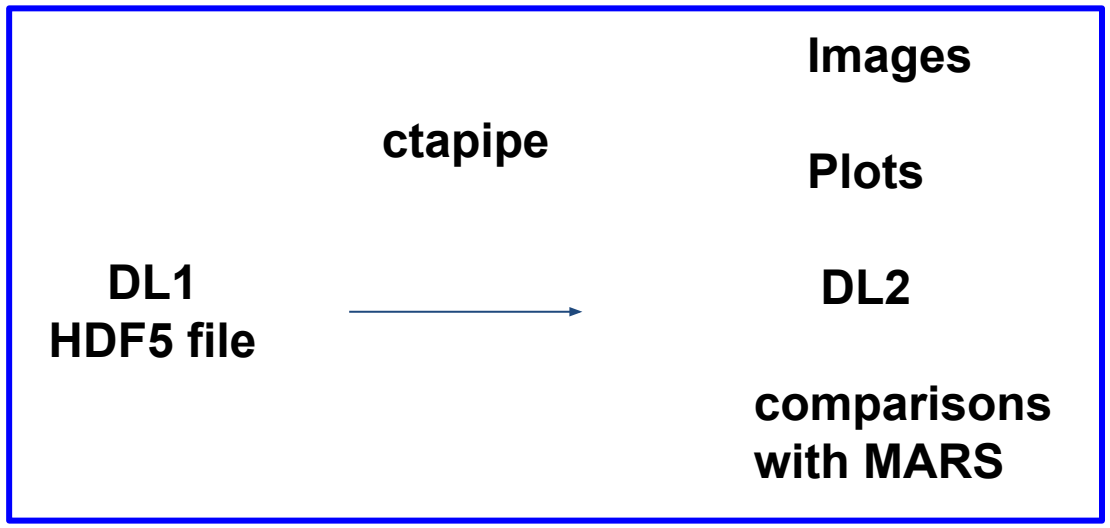
Rationale

- It is better to introduce HESS/MAGIC/VERITAS into ctapipe after calibration→ DL1
- First tests to process MAGIC data in ctapipe based on pyroot+ctapipe → unstable
- Use hdf5 files as an intermediate step to read MAGIC data in ctapipe → no pyroot dependence
- Useful for tests, comparisons…, LST1 commissioning

MAGIC data in ctapipe





Work done so far

- Adding pointing information
- Storing images from MAGIC root file to hdf5 file

https://github.com/cta-observatory/cta-lstchain/blob/master/magic-lst/MAGIC_data_to_hdf5.ipynb

https://github.com/cta-observatory/cta-lstchain/blob/master/magic-lst/M1_magic_data.h5

- Incorporating Magic geometry in ctapipe:

https://github.com/cta-observatory/cta-lstchain/blob/master/magic-lst/MAGICCam.camgeom.fits

- Display of MAGIC events through ctapipe:

https://github.com/cta-observatory/cta-lstchain/blob/master/magic-lst/Display_MAGIC_event.ipynb

- Further analysis with ctapipe: Hillas parameter distributions, theta-square plot, etc.

MAGIC Data: File Format

One file/telescope

Right now files are not merged
1 pointing/event. same table.

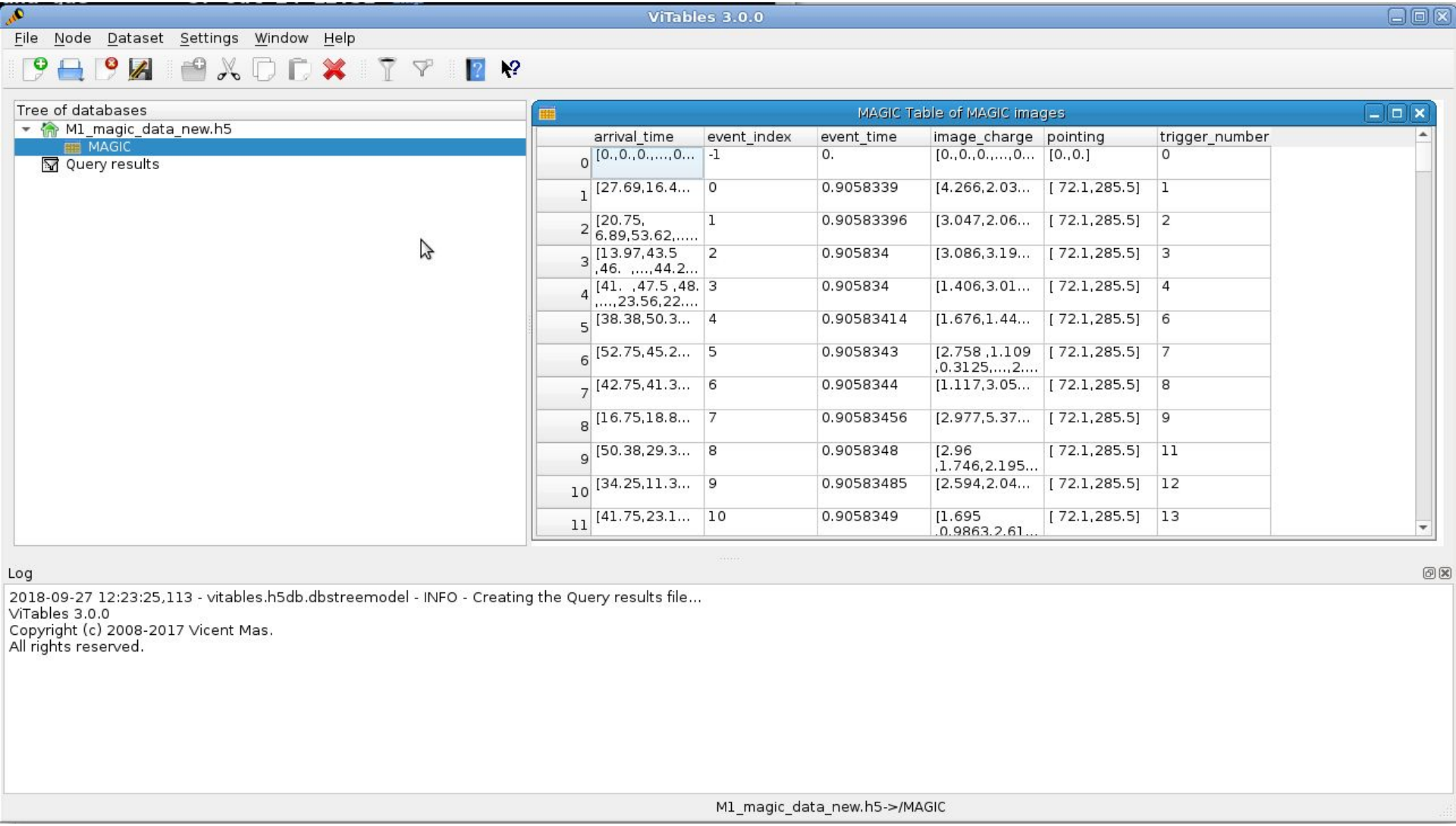
MAGIC 1 Images
Event 1
Event 2
…..
Event N

MAGIC 1 Pointing
Event 1
Event 2
…..
Event N

MAGIC 1 Images
Event 1
Event 2
…..
Event N

MAGIC 2 Pointing
Event 1
Event 2
…..
Event N

HDF5 file https://github.com/cta-observatory/cta-lstchain/tree/master/magic-lst

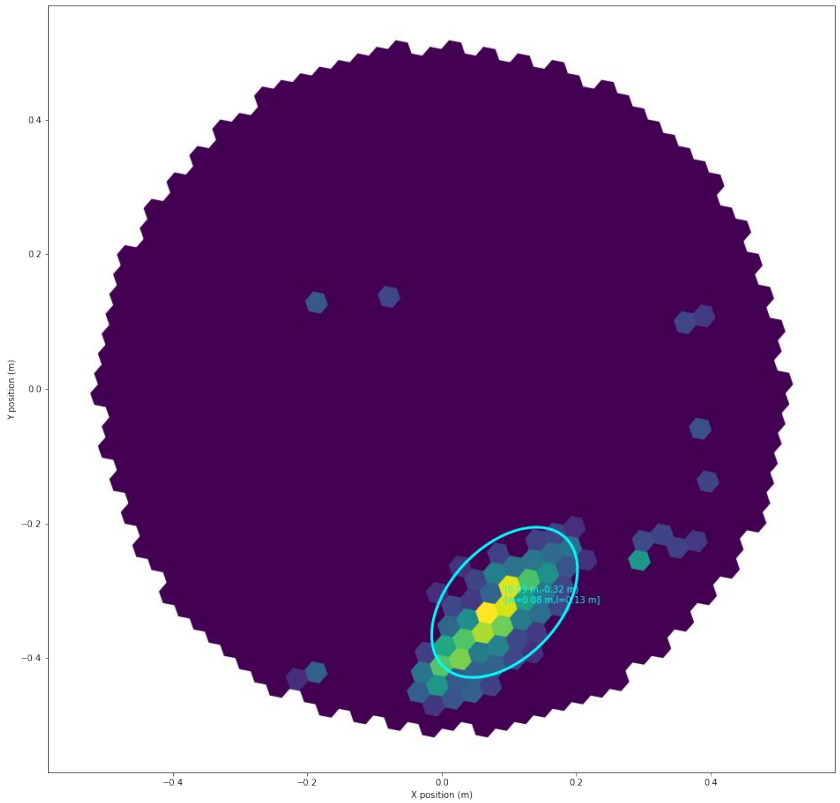


A MAGIC event in CTAPIPE and MARS

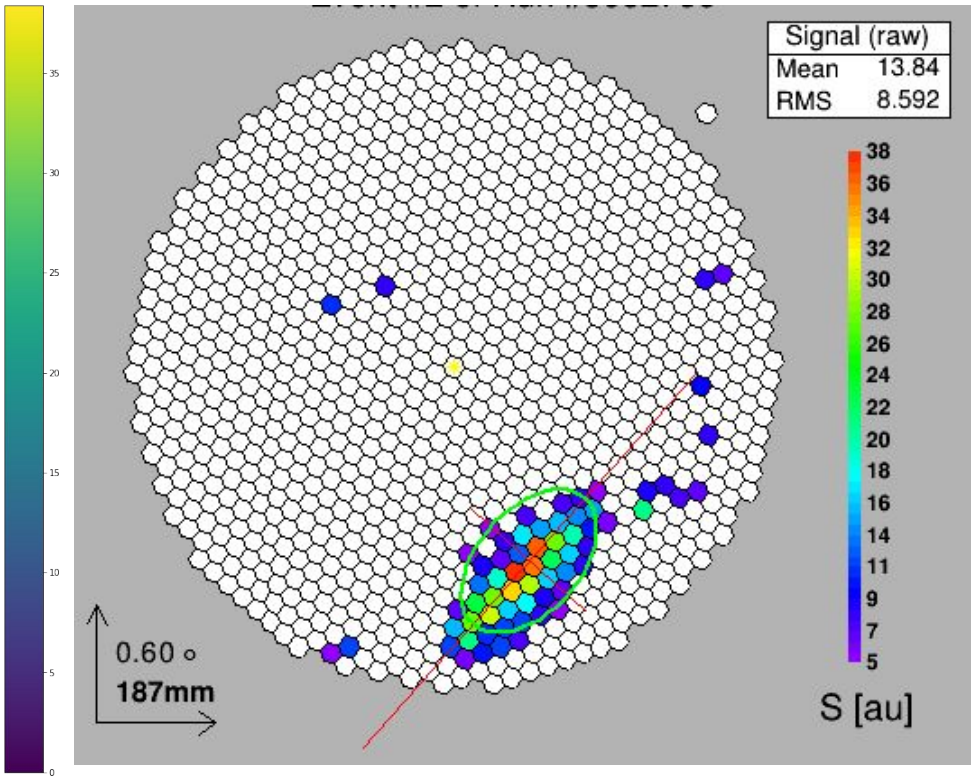
Image Cleaning: Absolute
Picture threshold= 7 p.e.
Boundary Threshold = 5 p.e.
Keep Isolated Pixels = yes

No time constrained cleaning used

CTAPIPE



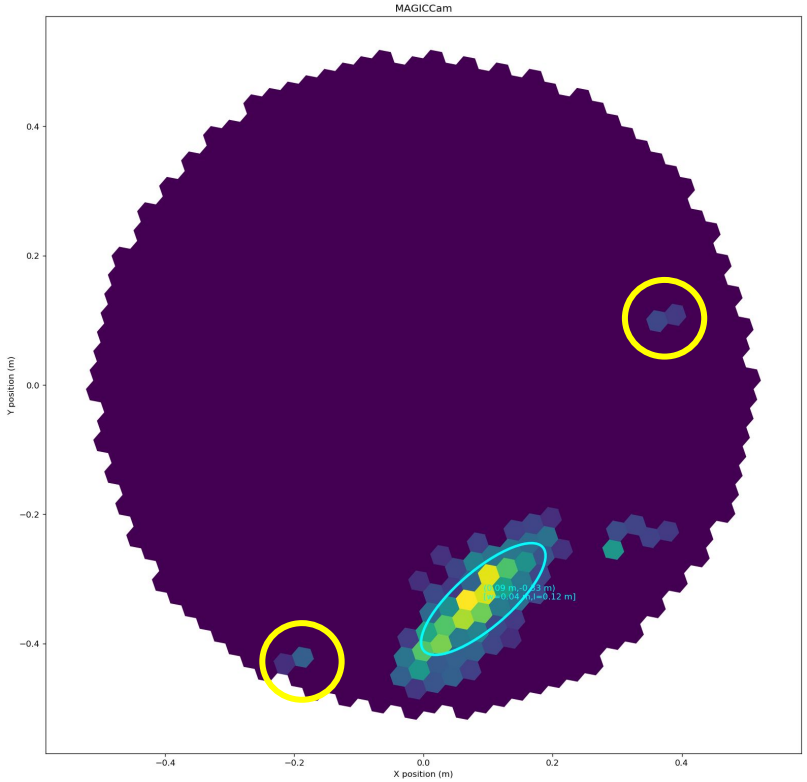
MARS



MAGIC event after additional image cleaning

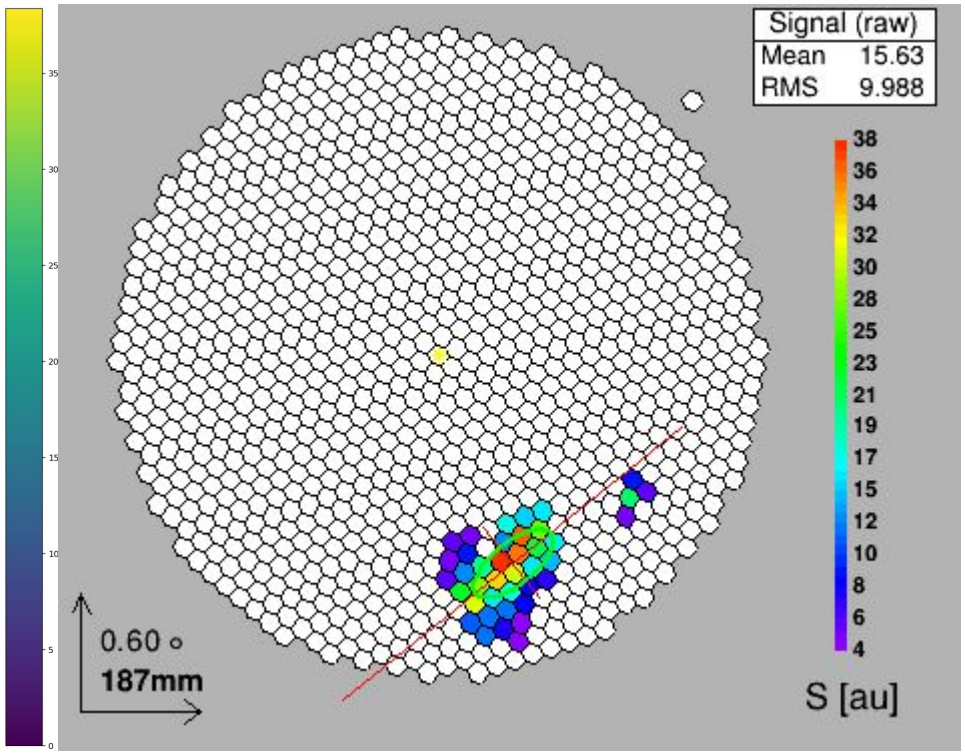
CTAPIPE

Image Cleaning: Absolute
Picture threshold= 7 p.e.
Boundary Threshold = 5 p.e.
Keep Isolated Pixels = **NO**
Time constrained cleaning: **No** (not yet implemented in ctapipe)

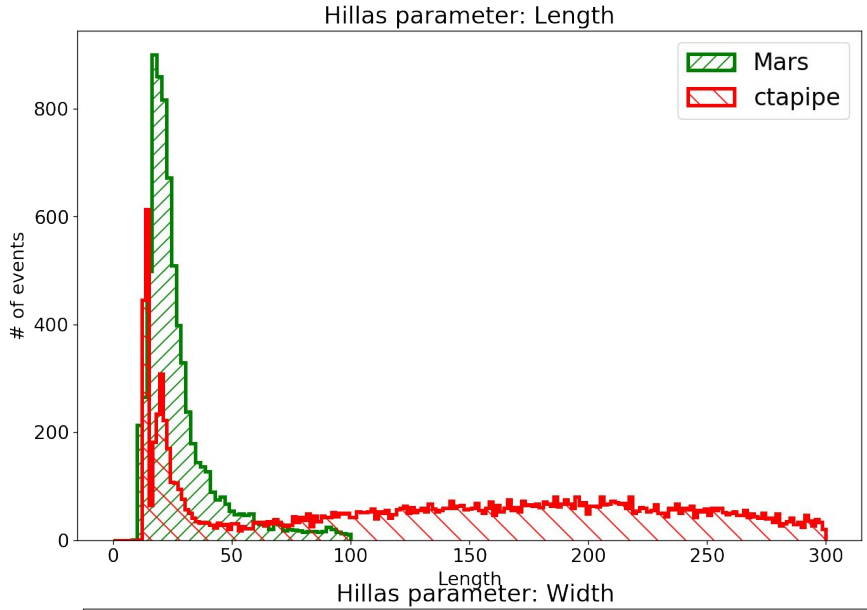


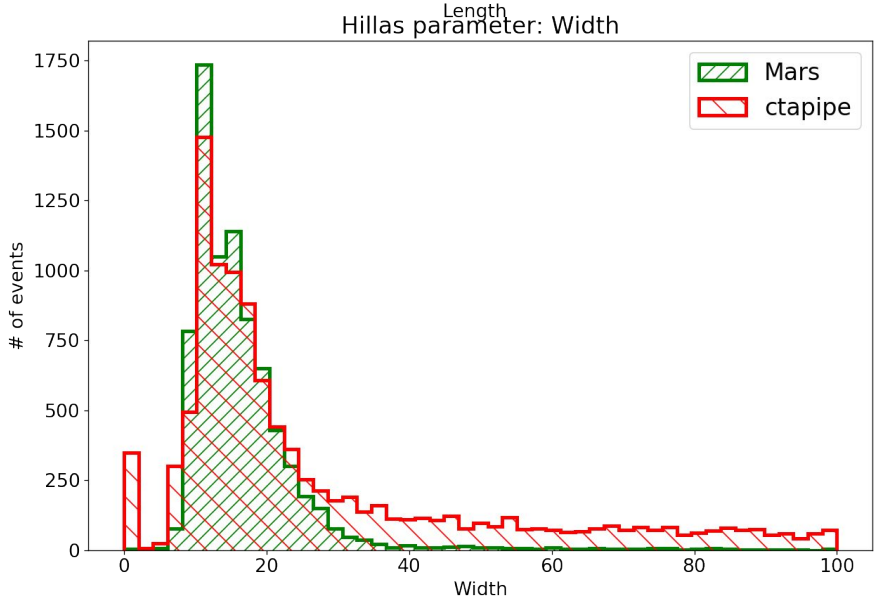
MARS

Image Cleaning: Absolute
Picture threshold= 7 p.e.
Boundary Threshold = 5 p.e.
Keep Isolated Pixels = **NO**
Time constrained cleaning: **Yes.**



Comparison of Hillas Parameters



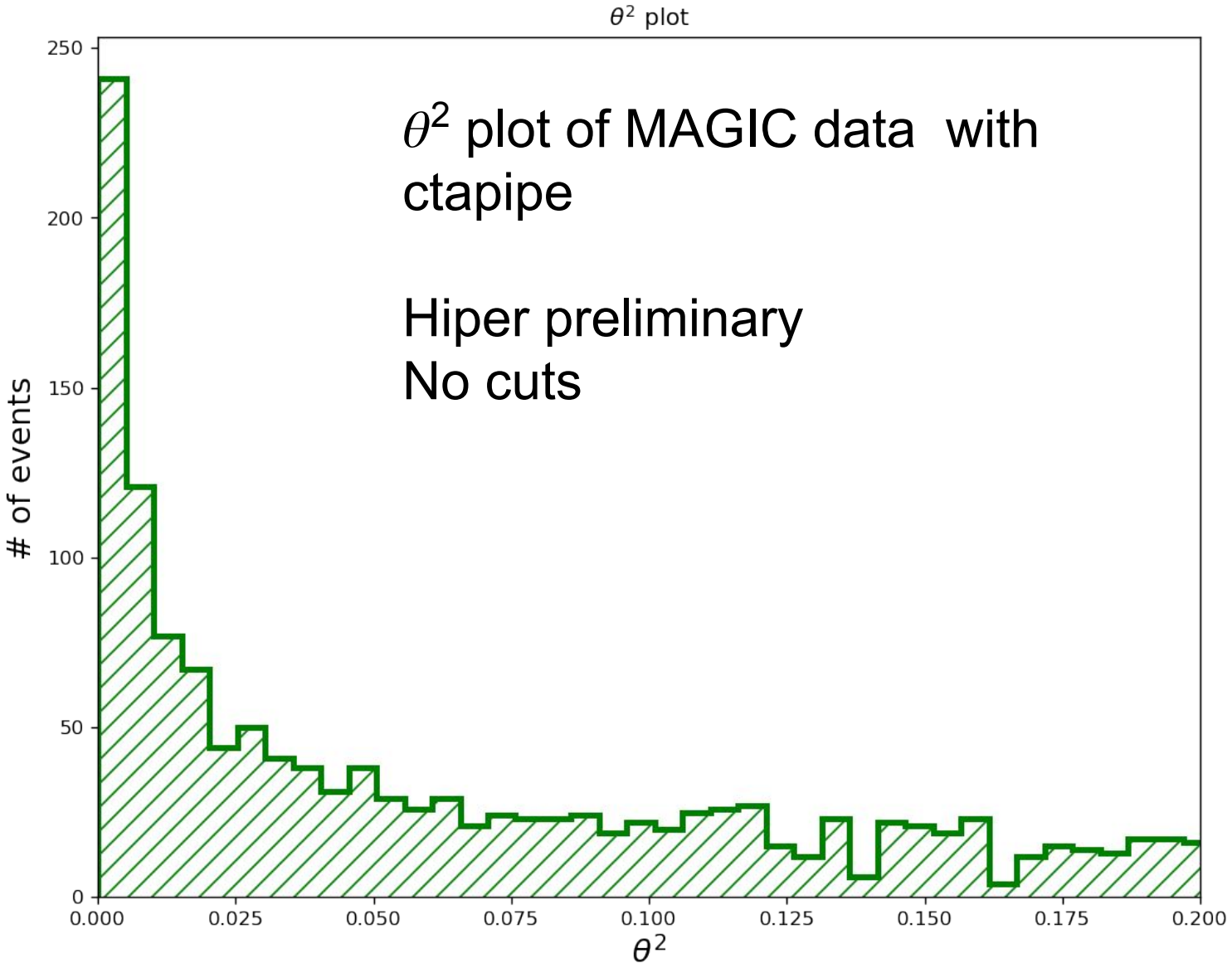


Comparing Hillas parameters in MARS and ctapipe

Hiper preliminary

Mismatch probably due to different image cleaning levels and algorithms

Direction reconstruction using CTAPIPE



Conclusions

- **HDF5 is an easy tool to test formats.**
  No major problem found

- **Very first look exporting MAGIC data**

- **Open questions before proposing a single DL1 format for both use cases: Pointing, file merging...**

- Work developed useful by itself

What next?

- Optimize size of the hdf5 file
- MAGIC simulated root file → hdf5 file
- Incorporate scripts in OSA to convert root to hdf5 file and transfer hdf5 file to LST1 data storage server
- Decision on file merging, format of data, etc.