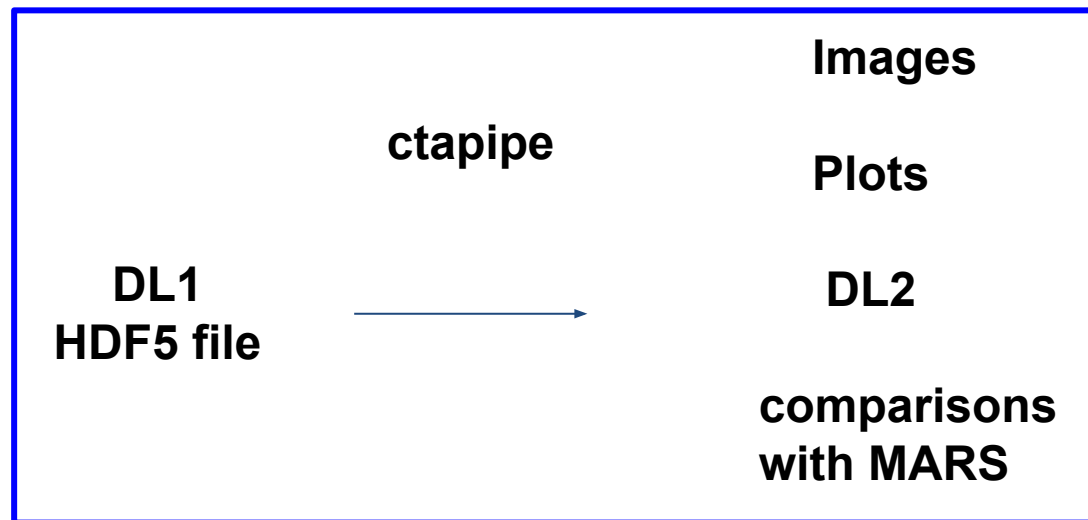
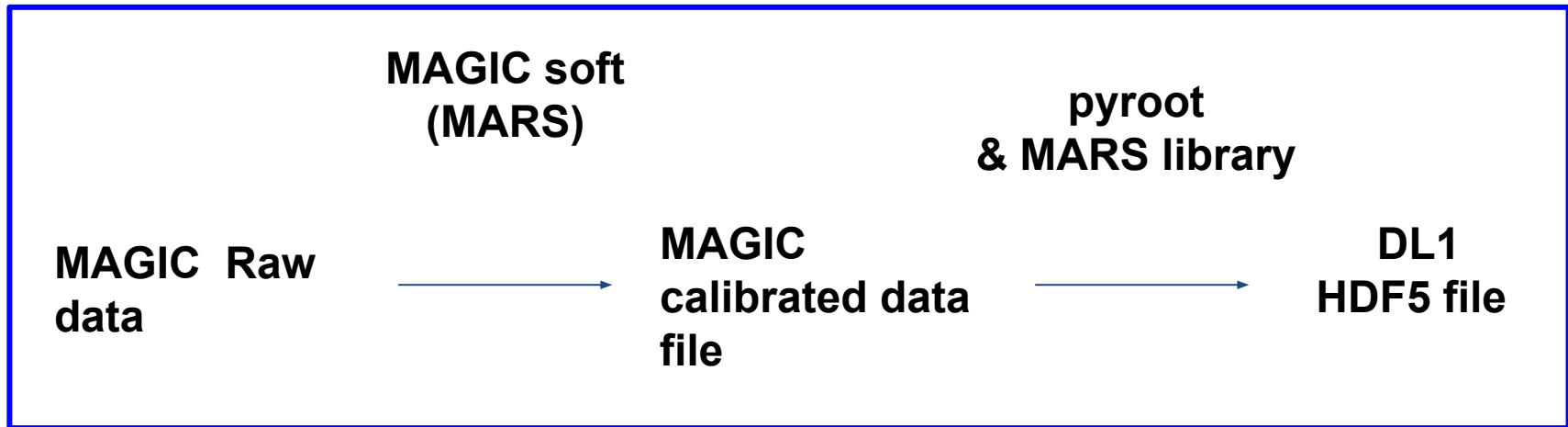


L. Saha, D. Carreto-Fidalgo, JL Contreras

## 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



- 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/MAGIC_data_to_hdf5.ipynb)

[https://github.com/cta-observatory/cta-lstchain/blob/master/magic-lst/M1\\_magic\\_data.h5](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](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.

## 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-1stchain/tree/master/magic-1st>

ViTables 3.0.0

File Node Dataset Settings Window Help

Tree of databases

- M1\_magic\_data\_new.h5
  - MAGIC
  - Query results

MAGIC Table of MAGIC images

	arrival_time	event_index	event_time	image_charge	pointing	trigger_number
0	[0.,0.,0.,...,0...	-1	0.	[0.,0.,0.,...,0...	[0.,0.]	0
1	[27.69,16.4...	0	0.9058339	[4.266,2.03...	[ 72.1,285.5]	1
2	[20.75, 6.89,53.62,.....	1	0.90583396	[3.047,2.06...	[ 72.1,285.5]	2
3	[13.97,43.5 ,46. ....,44.2...	2	0.905834	[3.086,3.19...	[ 72.1,285.5]	3
4	[41. ,47.5 ,48. ....,23.56,22....	3	0.905834	[1.406,3.01...	[ 72.1,285.5]	4
5	[38.38,50.3...	4	0.90583414	[1.676,1.44...	[ 72.1,285.5]	6
6	[52.75,45.2...	5	0.9058343	[2.758 ,1.109 ,0.3125,....,2....	[ 72.1,285.5]	7
7	[42.75,41.3...	6	0.9058344	[1.117,3.05...	[ 72.1,285.5]	8
8	[16.75,18.8...	7	0.90583456	[2.977,5.37...	[ 72.1,285.5]	9
9	[50.38,29.3...	8	0.9058348	[2.96 ,1.746,2.195...	[ 72.1,285.5]	11
10	[34.25,11.3...	9	0.90583485	[2.594,2.04...	[ 72.1,285.5]	12
11	[41.75,23.1...	10	0.9058349	[1.695 ,0.9863,2.61...	[ 72.1,285.5]	13

Log

2018-09-27 12:23:25,113 - vitables.h5db.dbstreemodel - INFO - Creating the Query results file...  
ViTables 3.0.0  
Copyright (c) 2008-2017 Vicent Mas.  
All rights reserved.

M1\_magic\_data\_new.h5->/MAGIC

## Image Cleaning: Absolute

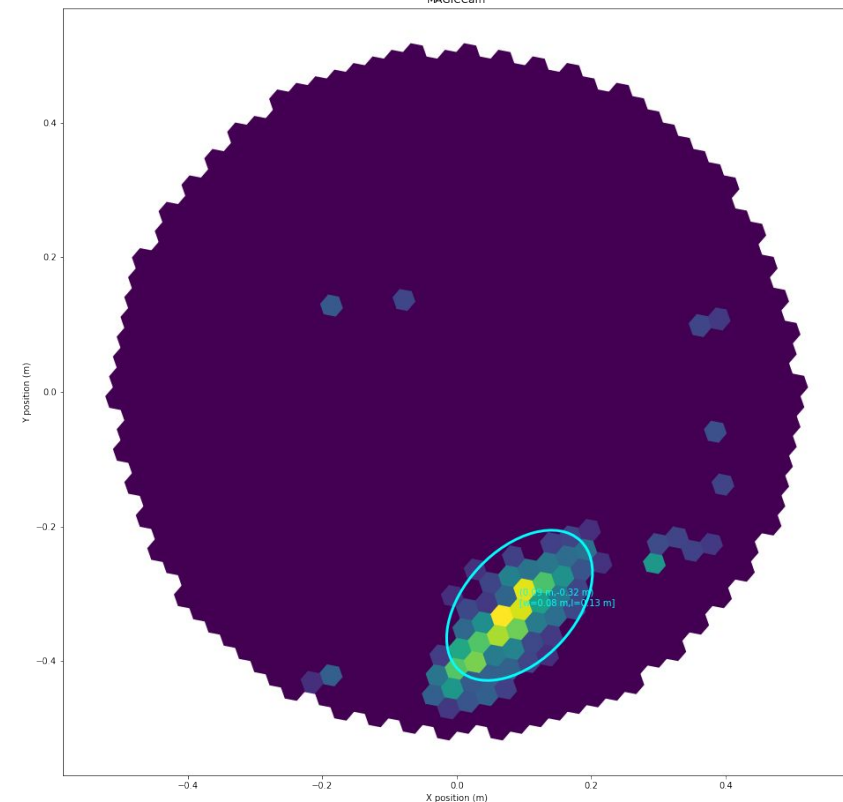
Picture threshold= 7 p.e.

Boundary Threshold = 5 p.e.

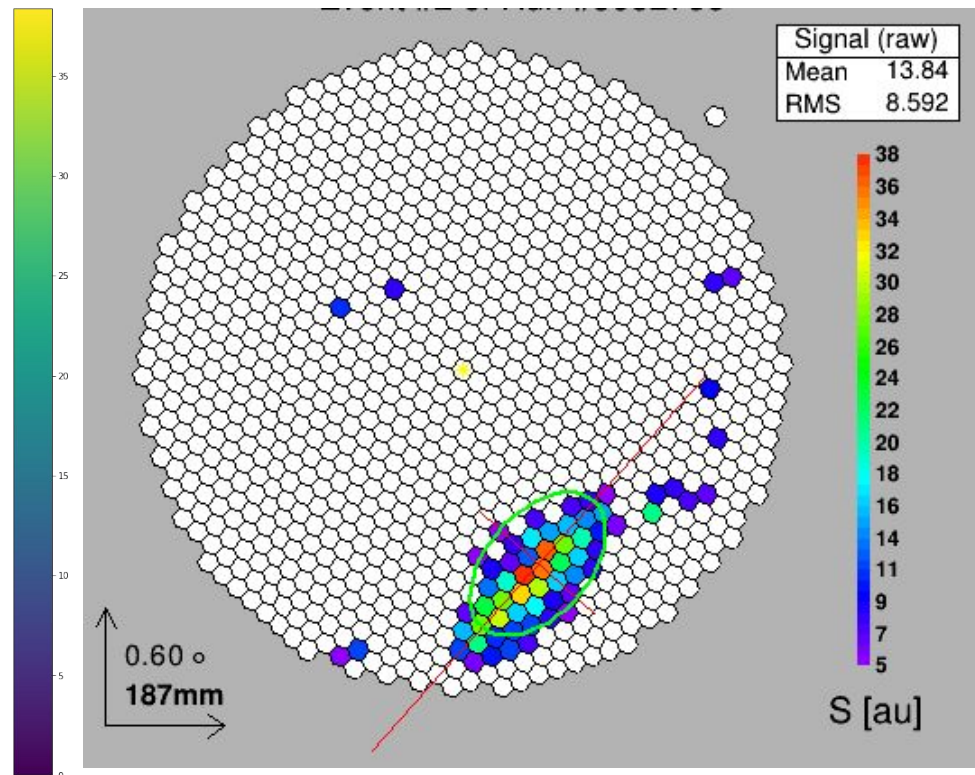
Keep Isolated Pixels = yes

No time constrained  
cleaning used

CTAPIPE



MARS



## CTAPIPE

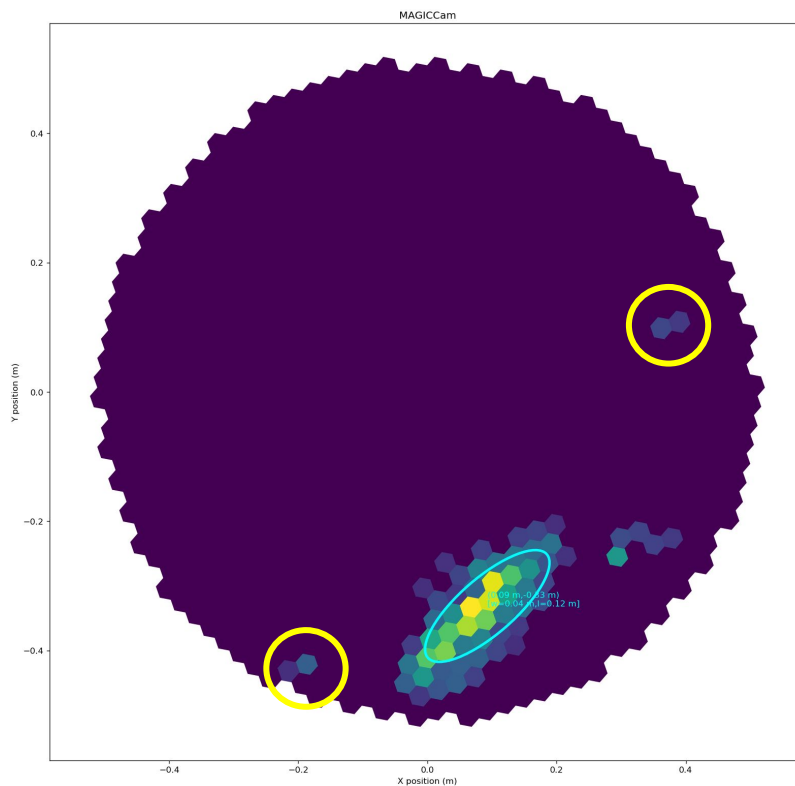
### Image Cleaning: Absolute

Picture threshold= 7 p.e.

Boundary Threshold = 5 p.e.

Keep Isolated Pixels = **NO**

Time constrained cleaning: **No** (not yet implemented in ctapipe)



## MARS

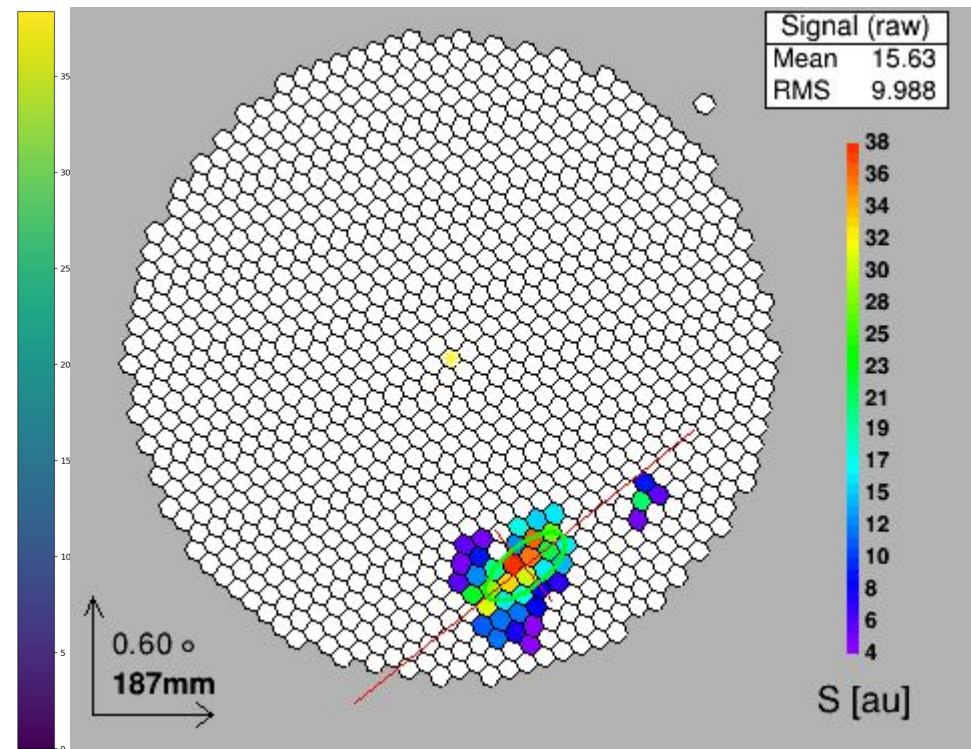
### Image Cleaning: Absolute

Picture threshold= 7 p.e.

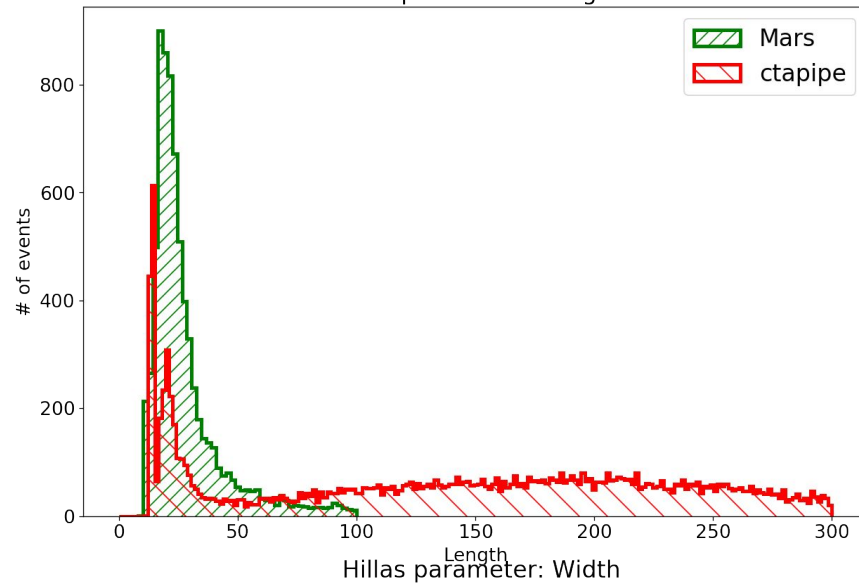
Boundary Threshold = 5 p.e.

Keep Isolated Pixels = **NO**

Time constrained cleaning: **Yes.**



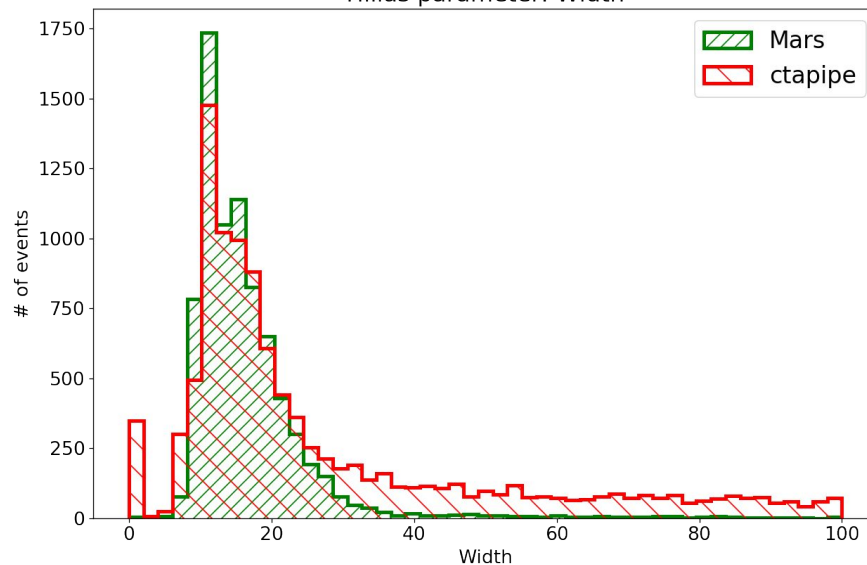
Hillas parameter: Length



Comparing Hillas parameters  
in MARS and ctapipe

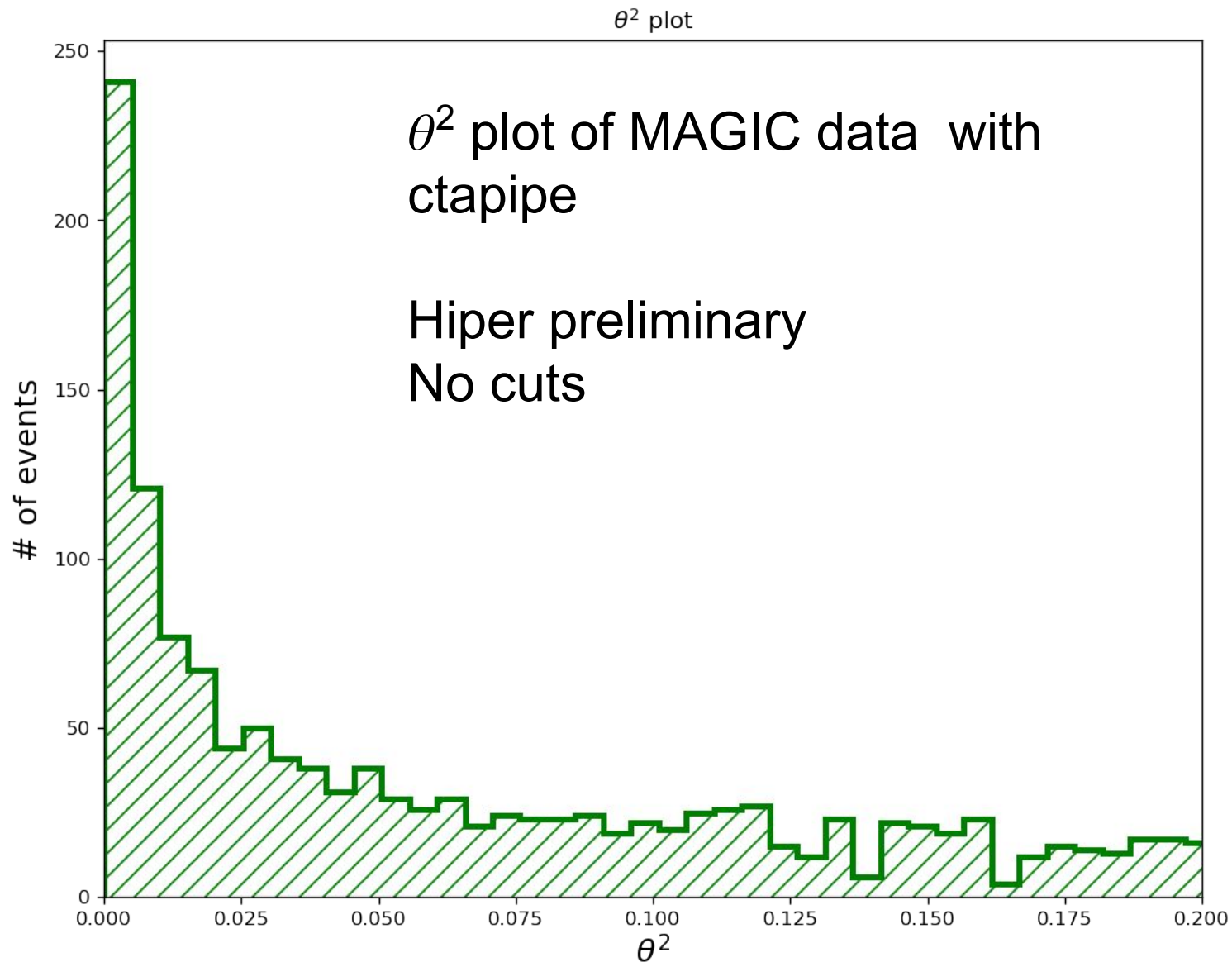
Hiper preliminary

Hillas parameter: Width



Mismatch probably due to  
different image cleaning levels  
and algorithms





- **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**

- 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.