Extending ctapipe image reconstruction using FACT methods

Lukas Nickel and Maximilian Nöthe

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Overview

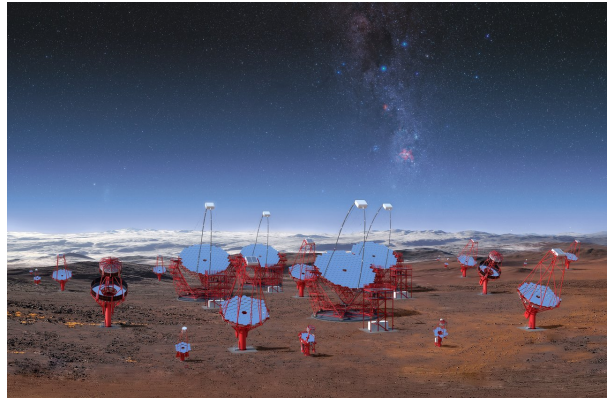
- What is CTA?
  Taking stereoscopic reconstruction to the extreme: The Cherenkov Telescope Array.

- Progress of ctapipe
  How is CTA data going to be handled? ctapipe: A low-level data processing pipeline software for CTA.

- What can we learn from FACT?
  The First G-APD Cherenkov Telescope: Transfering knowledge from single telescope analysis.

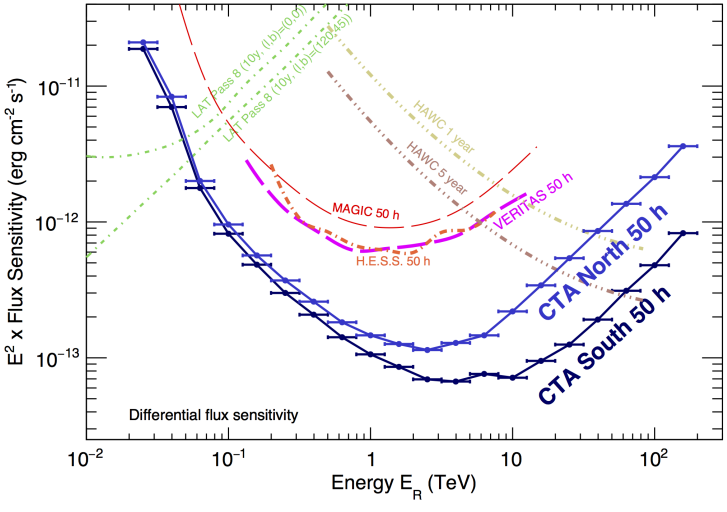
Experiment

- ”Cherenkov Telescope Array”
- Proposed in 2005, currently in pre-production
- Two arrays of multiple telescopes (>100) instead of single telescopes
- Goals: Extend observable energy range(20GeV-300TeV), huge field of view() (EM Spektrum mit Einordnung der verschiedenen Experimente?)
- Status: First light on LST and Schwarzschildt-Couder-Telescope



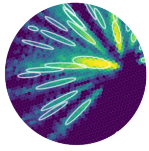
Visualization of the different telescope types. [3]

Expected sensitivity [2]



ctapipe

- Pipeline for low level cta data
- https://github.com/cta-observatory/ctapipe
- Mainly **python** based
- In development since 2015
- Calibration, Cleaning, Coordinate Transformations, Hillas-Parameter, 3D-Reconstruction, Visualization

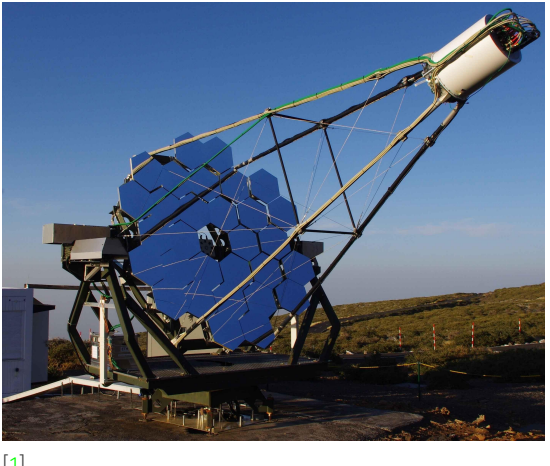


ctapipe

python™

What is FACT?

- ”First G-APD Cherenkov Telescope”
- operating in la palma since 2011
- single telescope
- unis aufzählen?
- gapd’s interessant für cta? wie genau? was ist das? wer nutzt das?



[1]

Why does it matter?

1. Knowledge in developing a processing pipeline
2. Single telescope analysis
3. Some features and methods might be useful for ctapipe
4. e.g. cleaning based on arrival time

Cleaning methods

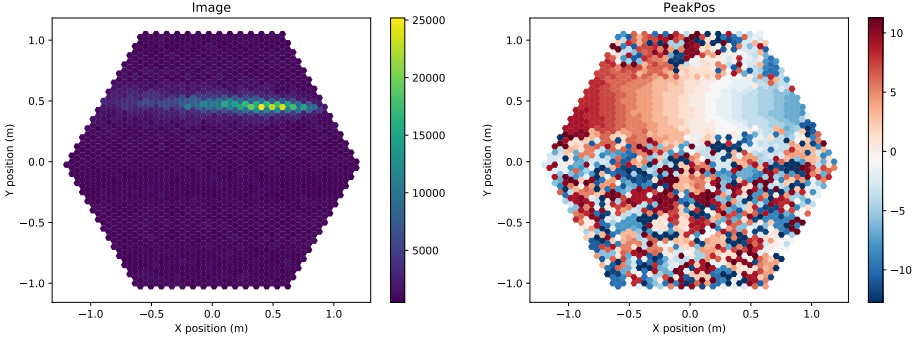
Tailcuts Cleaning

1. ”two treshold procedure”
2. pixels above t1 will be kept
3. neighboring pixels above t2 will be kept
4. ”lonely” pixels wont survive

FACT image cleaning

1. similar behaviour, but also uses information about the arrival times
2. pixels with a very different arrival time than their neighbours get removed
3. removes ”lonely” pixels multiple times
4. one would assume less separated pixels
5. intensity threshold should probably be a bit more loose than with tailcuts

timing information



Intensity and relative arrival time for a MC gamma-event

Finding distinctive islands

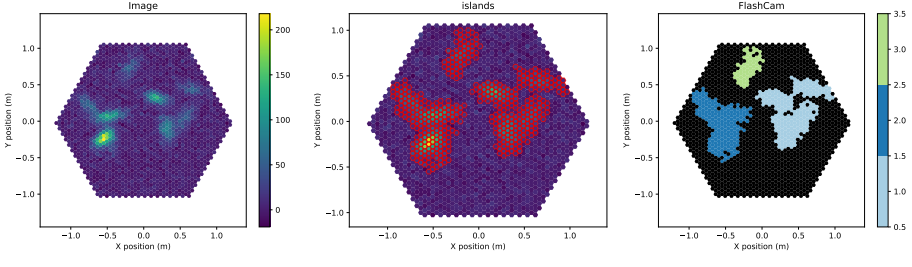


Abbildung: islands, toyshower on flash cam

Number of islands

g/h separation

erklären
bild von verschiedenen configs

energy regression

erklären
bild von verschiedenen configs

islands

mit einer config vergleichen (oder 2: tailcut und beste fact config)

H Anderhub u. a. „Design and operation of FACT – the first G-APD Cherenkov telescope“. In: Journal of Instrumentation 8.06 (Juni 2013), P06008–P06008. DOI: 10.1088/1748-0221/8/06/p06008. URL: https://doi.org/10.1088%2F1748-0221%2F8%2F06%2Fp06008.

The CTA Consortium. Die Quellen hiervon noch angeben? URL: https://www.cta-observatory.org/science/cta-performance.

CTA/M-A. Besel/IAC (G.P. Diaz)/ESO. 2018. URL: https://www.eso.org/public/germany/images/eso1841a/.