CTA Data Processing

Introduction

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Subject

What

New algorithms and tools to improve:

- the *data processing pipeline* in CTA, HESS and (maybe) Fermi
- the *sky image* creation and analysis (gamma sources)

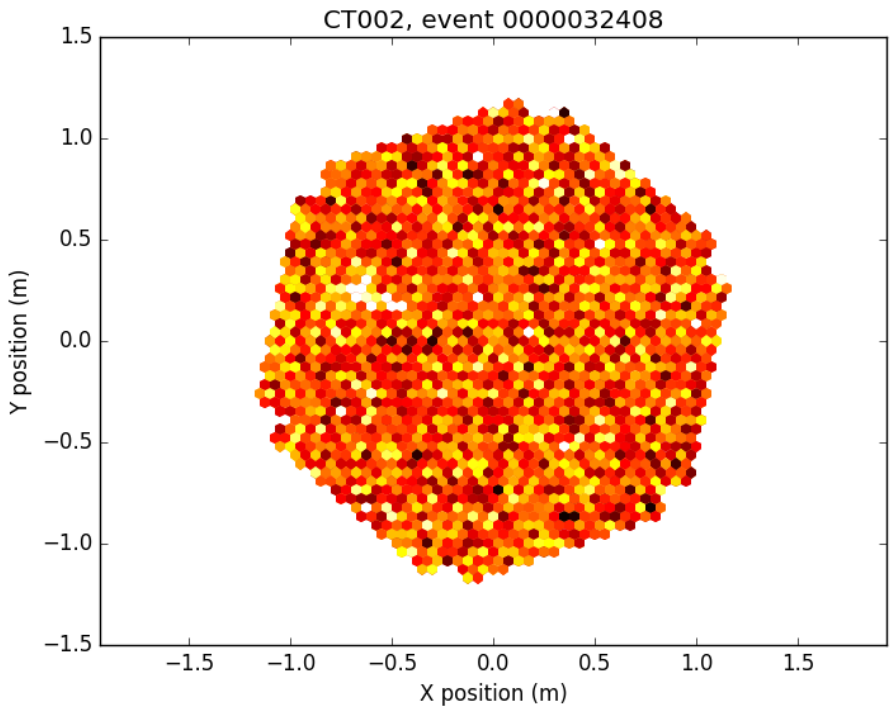
Goals

- For the data processing pipeline:
  - A better detection and discrimination of events
  - Face a big increase in data volume with CTA
- For the sky image creation and analysis:
  - Rebuild events more accurately
  - Make cleaner and more accurate sky images

The problems

Detect events

- A lot of “noise” (instrumental noise, background noise, ...)



The problems

Discriminate events

- What kind of cosmic ray is observed ?
  - a photon (gamma) ?
  - an atomic nucleus (mostly protons) ?
  - an electron ?
- Keep photons only

The problems

Data volume (for CTA)

$\sim$10 telescopes
$\times$ $\sim$1000 pixels
$\times$ $\sim$10 times
$\times$ $\sim$10000 events/sec
$=$ *several Giga bytes per second*

- That's more than the LHC!
- Implies *real-time analysis* to reduce by a factor of 20 to 100 the data volume on-site

The problems

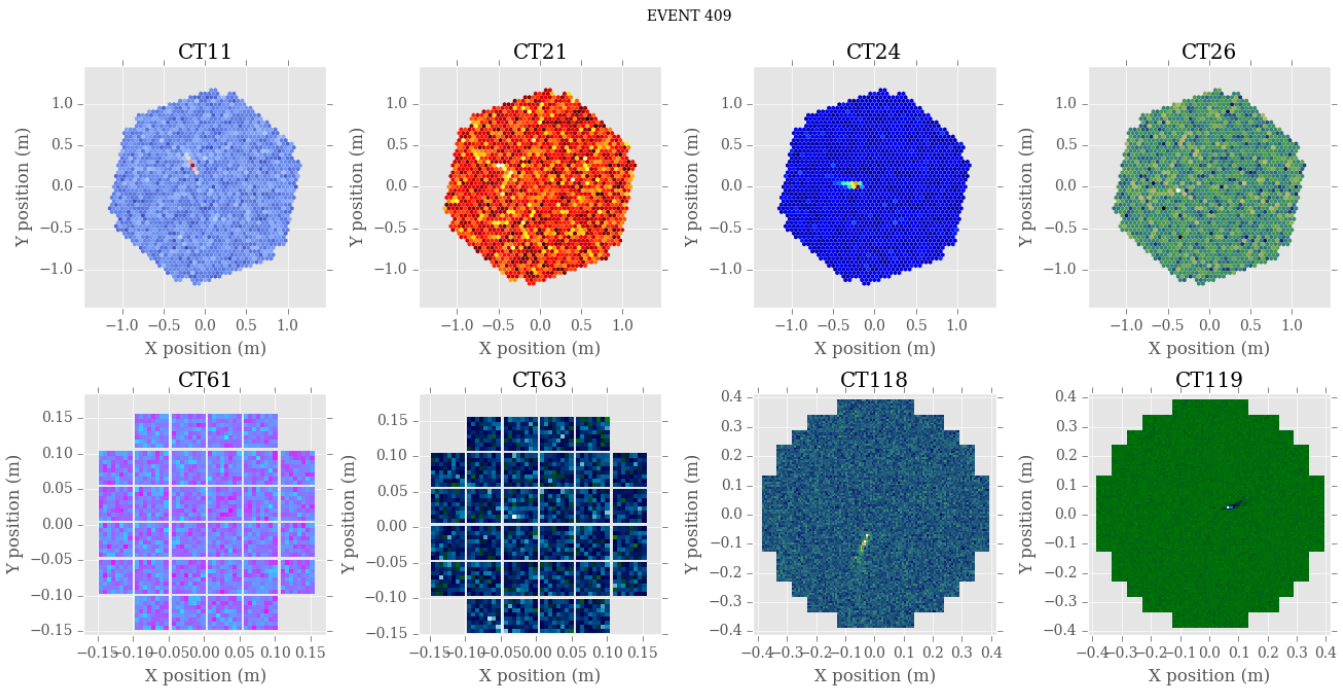
Rebuild events

- Where does it come from spatially ?
- What is it's energy ?

The problems

"Unusual" camera and pixel shape

- Hexagonal pixels, gaps, ...
- Most "general" tools and algorithms are not adapted



Work plan

Step 1 Detect and locate events in raw images

- Reduce noise form images with *sparse methods*: DFT, wavelets, curvelets, ...
- Recover missing parts with *inpainting methods*

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- Shapelet based classification
- Machine Learning or other methods ?

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Step 3 Rebuild events (source, energy, ...) + make sky images

- Machine Learning, likelihood minimization, data synchronization, and other methods (to be defined)

Next presentations

CTA data pipeline - Image cleaning:

- PDF: `http://www.jdhp.org/dl/cta-data-pipeline-image-cleaning.pdf`
- Source code: `https://github.com/jdhp-sap-docs/cta-data-pipeline-image-cleaning`

References I