We present the actual scheme for the Onsite Analysis on the MAGIC Cherenkov Telescopes at La Palma. Due to their low energy threshold, MAGIC acquires data of atmospheric showers at a rate of almost 300 Hz, which translates in up to 900 GB per night. A fast on-site data reduction is needed to detect hardware problems and in many cases to decide on observation strategies. The data are calibrated and pre-processed at the MAGIC site using automated scripts on multiprocessor systems. The Onsite Analysis system provides the official data for the MAGIC collaboration.

Abstract

Data reduction

Approximately 99% of the data volume gathered by the MAGIC telescopes comes from the data acquisition. This volume can be calculated taking into account four parameters: Event rate R, Number of pixels P, Digitalization sample S and dynamic range D. The data volume rate will be: 

\[ R \times P \times S \times D. \]

Onsite Computing system

The MAGIC collaboration has deployed a powerful computer system at the telescope site: it contains 2 data acquisition and control computers + 9 multiprocessor analysis systems. For storage purposes we have at our disposal 4 RAID systems with capacities between 7 and 21 Tbytes. Details of the machines are shown in the following table.

<table>
<thead>
<tr>
<th>Number of machines</th>
<th>CPU cores</th>
<th>CPU (Ghz)</th>
<th>RAM (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>2.8</td>
<td>8</td>
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<tr>
<td>2</td>
<td>4</td>
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<td>5</td>
<td>8</td>
<td>2</td>
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<tr>
<td>1</td>
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</tr>
<tr>
<td>1</td>
<td>8</td>
<td>2.3</td>
<td>3</td>
</tr>
</tbody>
</table>

Onsite Analysis

As said before, data go through an on-site reduction before being transferred outside the island. The software is launched as soon as the data are digitalized and observation results are available normally before the next night. The data are divided in batches (about 20 min of data) which run independently in different processors. Its robust design requires minimal human interaction. We can divide data reduction in four stages, depending on the data resulting of each step:

- **Raw** data consists of the digitized pulses recorded by the camera for each event.
- **Calibrated** data contains physical information at pixel level: light recorded and arrival time with errors. There is a reduction of a factor ten in data volume, partially due to compression.
- **Images** are reconstructed from the calibrated data and expressed in terms of combinations of their first moments; the Hillas parameter [2]. They are 100 times smaller than raw files.
- **Observation** results are obtained from the statistical analysis of images including a strong background rejection.

### Statistics

We have implemented the scripts needed to compute statistics concerning the Onsite Analysis performance. This is accessible via web, where users can find reports about analysis delay, CPU status and disk space, together with summaries for the last three nights.

### Outlook

MAGIC is an ever-changing system due to constant hardware and software improvements. Currently we work to make Onsite Analysis more autonomous, stable and impervious to these changes. We also aim to provide users with more complete statistics and other useful information.

### Conclusions

- A fast on-site data reduction system has been further developed. Reduced data arrive after few hours at the datacenter, where the collaboration can access the official data.
- Together with the quick look online analysis the system allows for fast reaction for source scheduling and follow up observations.
- Onsite Analysis scripts provide a very fast and efficient method to control hardware performance.

### References