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# CTA

## Cherenkov Telescope Array

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Giovanni Lamanna

*LAPP - Laboratoire d'Annecy-le-Vieux de Physique des Particules,  
Université de Savoie, CNRS/IN2P3, Annecy-le-vieux, France*



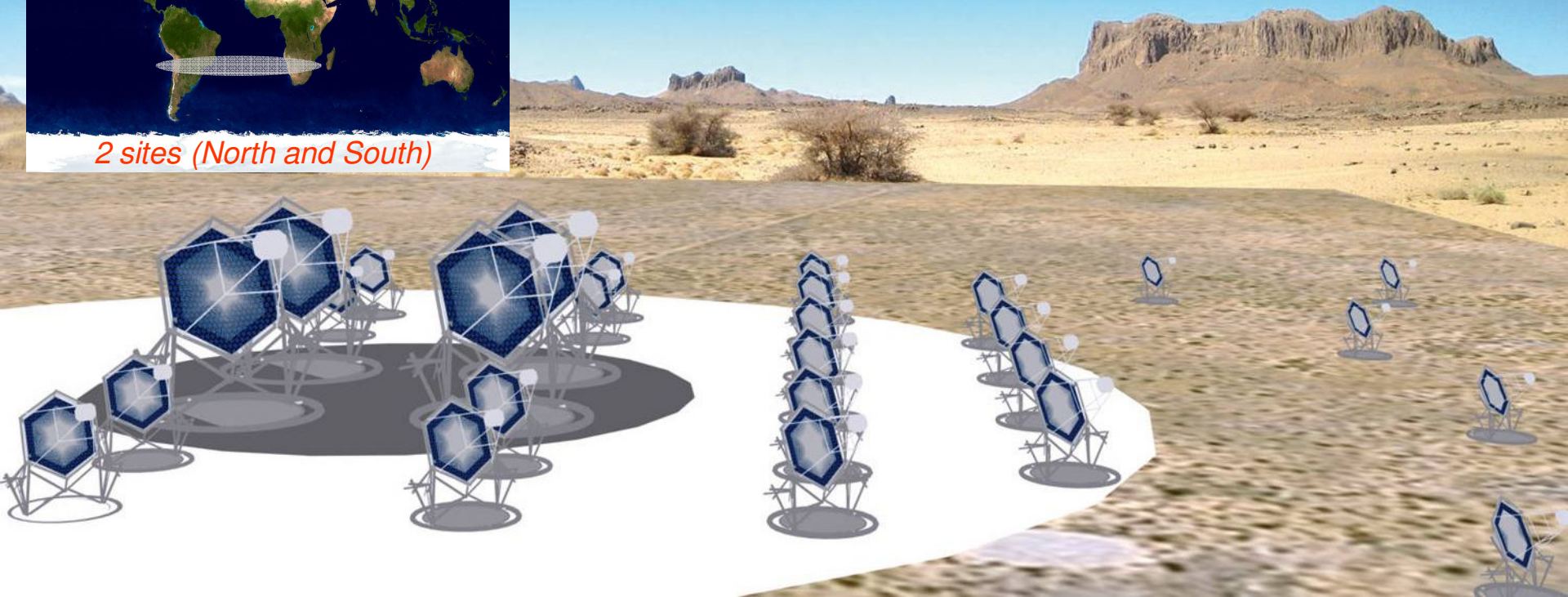
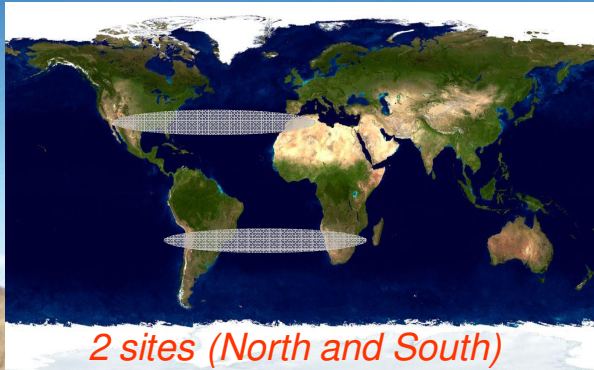
3<sup>rd</sup> DPHEP Workshop  
CERN, 7-8 December 2009

# CTA in a nutshell

CTA is a new project for ground based gamma-ray astronomy planned to consist of several tens of Imaging Atmospheric Cherenkov Telescopes (IACTs).

CTA is an Astroparticle research infrastructure aimed to work as an observatory providing services making gamma-ray astronomy accessible to the entire community.

The CTA international consortium is currently committed in a Design Study phase.



# VHE gamma-rays astronomy

- Cherenkov telescopes detect the optical Cherenkov radiation generated by charged particles in the cascades which high energy gamma rays initiate in the Earth's atmosphere. Using the atmosphere as a detection medium, ground-based gamma-ray detectors achieve large detection areas.



*H.E.S.S.*

*MAGIC*



-In March 2007, the High Energy Stereoscopic System (H.E.S.S.) project was awarded the Descartes Research Prize of the European Commission for offering “A new glimpse at the highest-energy Universe”. H.E.S.S., MAGIC, VERITAS and CANGAROO open a new wavelength domain : very high energy (VHE)  $\gamma$  rays (100 GeV to 100 TeV) probing the “non-thermal” Universe.

# ESFRI and e-infrastructures

The ESFRI - European Strategy Forum on Research Infrastructures Roadmap states that Research Infrastructures “*often require structured information systems related to data management, enabling information and communication. These include ICT-based infrastructures such as Grid, computing, software and middleware.*” and continues with “*e-Infrastructures are critical to all projects in this roadmap*”.

CTA is in the ESFRI roadmap.

The CTA OBSERVATORY main logical-units:

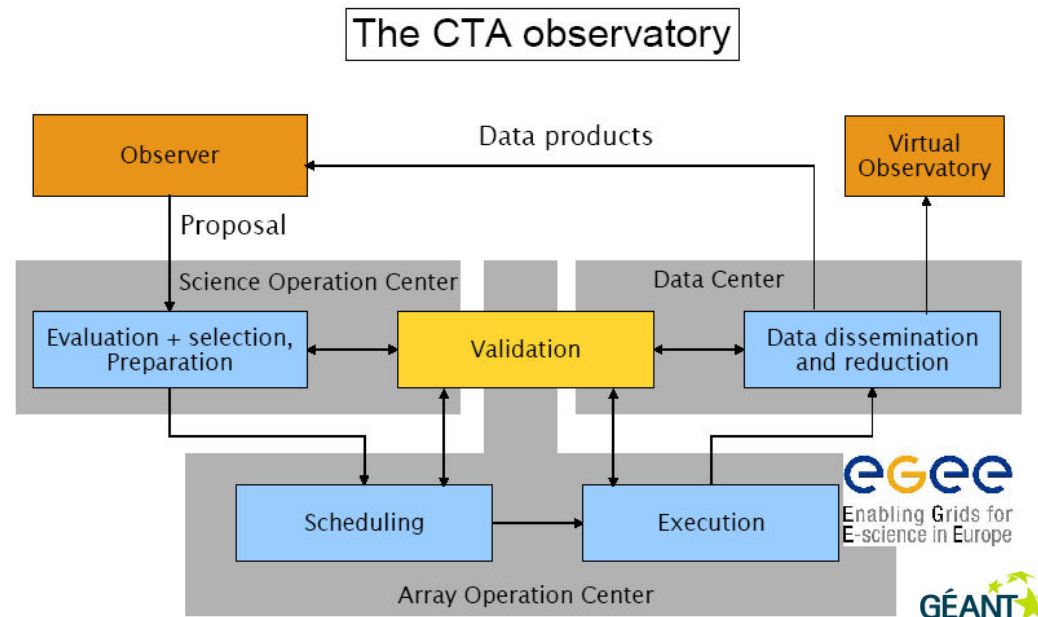
Science Operation Center

Array Operation Center

Data Center

EGEE applications studied within a dedicated sub-project:

CTA Computing Grid (**CTACG**) project.



The main issues of the observatory work flow:

- Monte Carlo simulations (production and analysis)
- Data flow, data transfer and storage
- Data reduction, open data access and analysis,  
and open access to shared computing resources



## The International EGEE VO CTA:

- **13** VO supporting sites (computer centers)

Tier1: CCIN2P3, CYFRONET, PIC,

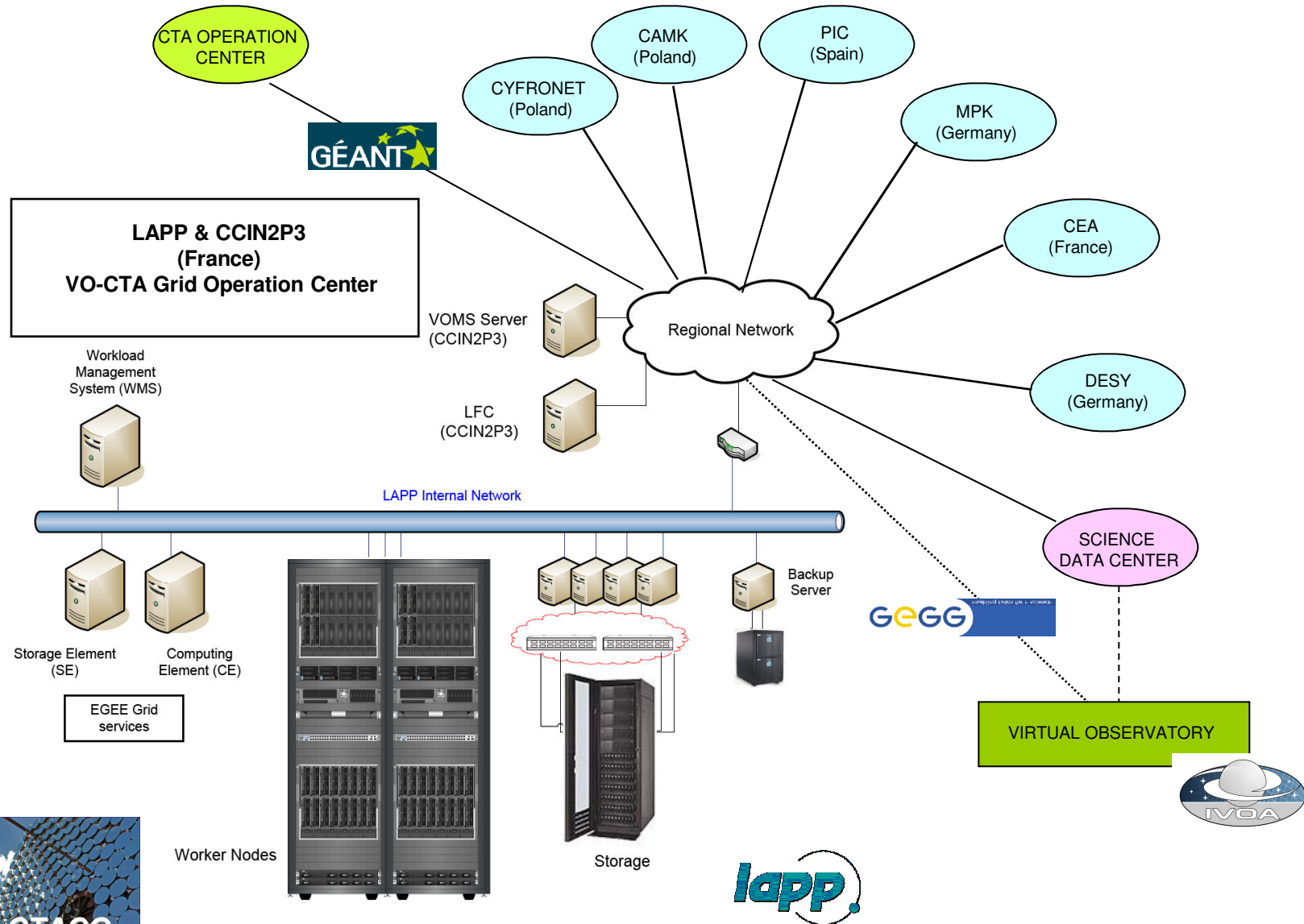
Tier2: LAPP, MPI, DESY

and others: CAMK, CIEMAT, CEA, GRIF (APC, LPNHE, LLR), LPTA  
from **4** countries (France, Germany, Spain and Poland)

*For MC production and analysis ...*

**EGEE positive experiences to fulfill MC requirements (> 400 TB SE, > 300 CPUs CE, ..)**

# CTACG ICT vision



Worker Nodes



# From MC-DASHBOARD ...

- Interactive scripts for multi-job submissions and monitoring.
- Possibility to browser the MC files and find their location in the CTA LFC catalog.
- Monitoring: Access to real time lists of jobs in production or programmed for production is provided.
- Software for data analysis.

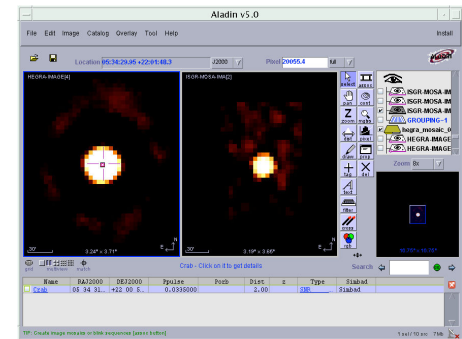
The screenshot shows the 'CTA Monte Carlo production Dashboard' website. At the top, there is a navigation bar with links: Home, Shower download, Dashboard, Recent jobs, Resubmit, Sites, Scripts, Shifter zone, and About... Below this is a dark blue header with the title 'CTA Monte Carlo production Dashboard' and a welcome message: 'Welcome to the homepage of the Grid production dashboard.' The main content area is divided into four sections: 1. 'CORSIKA production' with a list of links: 'CORSIKA shower browser', 'CORSIKA dashboard', 'CORSIKA jobs todo', and 'CORSIKA libraries descriptions'. 2. 'SIM\_TELARRAY production' with a list of links: 'Array configurations', 'Cameras and electronics', 'Telescopes and optics', 'Jobs todo', and 'Sim\_telarray software description'. 3. 'USER zone' with a list of links: 'DSTs production', 'Data formats', 'Physics data challenge', and 'Production on demand'. 4. 'SHIFTER zone' with a list of links: 'Recent jobs', 'Jobs to resubmit', and 'Dashboard Admin'. At the bottom, there is a section for 'CTA Computing Grid' with links: 'CTACG wiki', 'Virtual Organisation CTA', 'VOMS', and 'LAPP-CTA Grid Operation Center'. The footer contains the text: 'Grid production dashboard for the Cherenkov Telescope Array Observatory. Powered by the django web framework. Comments and questions kindly send to Giovanni.Lamanna@lapp.in2p3.fr. Last modification: 2009-07-24.'



# ... to VHE $\gamma$ -ray Science GATEWAY

**VSG**, through a Web-interface will provide:

- A complete, portable and easy to configure user environment for developing and running CTA data analysis locally and on the Grid (login, proxy on demand, selecting data level, data sets, software, and computing);
- Grid services for jobs and resources monitoring, archive access, telescope and observations monitoring, and support to scientist to port their software to the GRID;
- MC datasets and open production for deeper analysis of intermediate level data, On-the-fly reprocessing from the Archives Instruments calibration monitoring and trend analysis;
- **Astronomical tools and services integrating VObs standards and gLite-EGEE middleware for analysis of high level data sets;**
- **Tools and IVOA interfaces for multi-wavelength A&A analysis;**
- Forum and scientific documentation for an up-to-date scientific outreach and strengthening of the VHE gamma ray community.





*This project conjugates the long-term presence and experience in EGEE of the particle physics community and the activities of the astronomical community mainly devoted to the Grid solutions for public access and archive of observatory data.*

*Major challenges in CTA e-infra. applications shared between two communities :*

## **A&A**

- Astrophysical data unified content descriptors*
- Vocabulary for astronomical quantities extended to VHE gamma rays*
- Astronomical catalogs and metadata*
- Standard grammar for database queries*

## **PP**

- Hierarchical data model definition and corresponding implementation of software and computing solutions (for processing and storage)*
- Evolution towards open software and data access*
- Development of Grid Analysis platform at all levels (Virtualization)*
- Implementation of EGEE Grid services for the community.*

The CTA Observatory and in particular the CTACG project are an example of a work-platform where the open data access and open data analysis issues are the motivation for a fruitful sharing and exchange of competences towards the structuring of an integrated Astro-Particle Community...

...which will strength the VHE gamma ray community and will increase awareness and scientific interest to VHE gamma-ray physics.