Cherenkov Telescope Array

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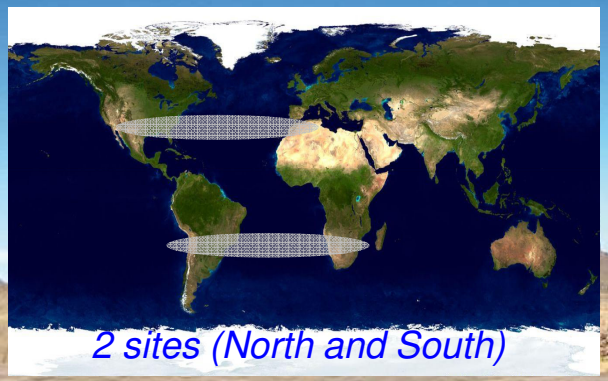
CTA in a nutshell

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.



2 sites (North and South)

(More details in the poster in the exhibition hall)

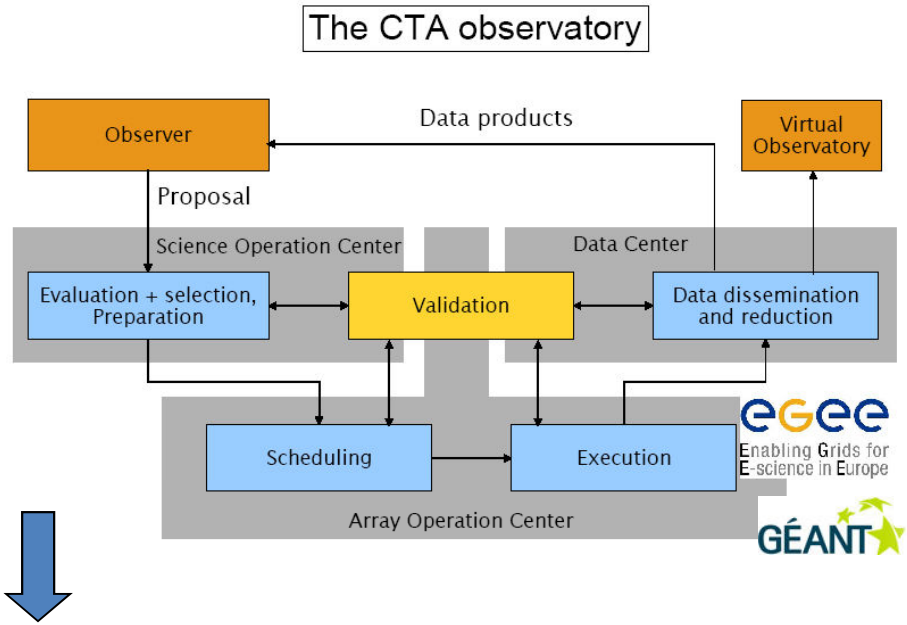
ICT vision

The CTA OBSERVATORY main sub-systems:

Science Operation Center, organization of observations;

Array Operation Center, the on-site service;

Data Center, is the place for software development, data analysis, data reduction, data archiving and data dissemination to observers



Existing ICT-based infrastructures, such as **EGEE** and **GEANT**, are potential solutions to provide the CTA observatory with best use of e-infrastructures.

This possibility is studied within a dedicated sub-project of the CTA Design Study: the CTA Computing Grid (**CTACG**) project.

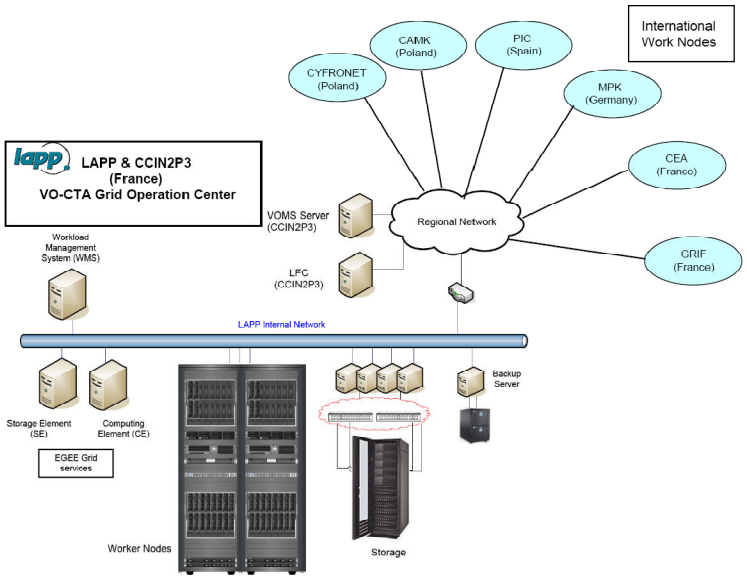
ICT vision (EGEE application)

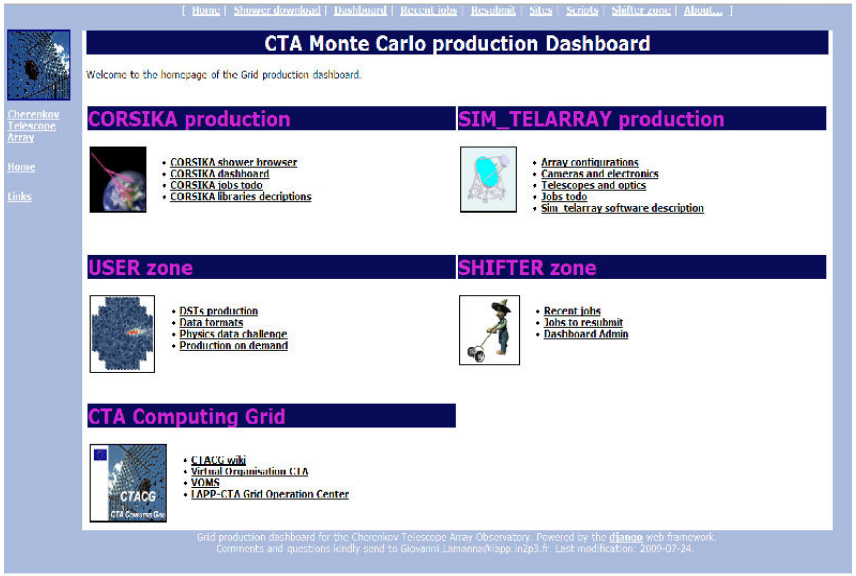
The main issues inherent to the observatory work flow:

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

CTACG-VISION: application of EGEE and GEANT e-infrastructures for such issues through a dedicated global **CTA EGEE Virtual Organization**.

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





ICT requirements and (a possible CTACG) **ICT architecture**

DATA ⇒ Total data volume from CTA in the range ***1 to 3 PB per year***.

- ***Storage needs:*** temporary storage on site (Array-Operations-Center). Permanent storage in Europe and for different classes of data and applications (e.g. calibrations, MC, Sci. Data). Ultimate products are digested scientific data files (e.g. FITS format) requiring limited storage.

- **CTACG solution**: ***Distributed storage among the EGEE-CTA-VO Work-Nodes: data-type and applications as a function of WNs capacity. FITS files are uploaded in the distributed Virtual Observatory Astrophysics data base (through the EGEE-VO framework).***

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- ***Compute needs:*** CE on site (Array-Operations-Center) for acquisition, preliminary calibration and monitoring. No particular computing needs for the off-line.

- **CTACG solution**: ***Tier1 and Tier2 LCG clusters (e.g. CCIN2P3, LAPP, CYFRONET, PIC,..) are already used in support of the EGEE-CTA-VO and suited as learned by experiences with HESS, MAGIC and the CTA-VO. The Array-Operations-Center will be one more VO-Work Nodes.***

ICT requirements and (a possible CTACG) **ICT architecture**

- ***Networking***: candidate sites under study to host CTA are in South of Africa, Argentina, Chile, Canary Isl., Mexico, Hawaii.. *The pan-European end-to-end networking is a critical issue.*

  The traditional approach (e.g. current IACTs H.E.S.S. and MAGIC) data transport, through magnetic tapes is not applicable to CTA (technology aged, expensive and unpractical).

- **CTACG solution**: ***The (Virtual-Distributed-)Data-Center and the Array-Operations-Center (VO-Work Nodes) demand a dedicated broad band connection (> Gb/s).***

  GEANT ***e-infrastructures should be considered in the choice of the site.***

(Example: South Africa Grid (SAGrid) initiative a high-speed submarine West African Cable System (WACS) (to reach Europe) is due to come into operation between 2009 and 2011.)

(Remind: Data transfer delay acceptable. IACTs has limited duty-cycle (night).)

ICT requirements and (a possible CTACG) **ICT architecture**

- ***Data Access:*** to be guaranteed to a worldwide community and users of different level of experience with different requirements:
  -Networking is again an issue;
  -Concurrent applications to be managed;
  -Secure but easy access at all levels.

- **CTACG solution***:*

  -Pan-European GEANT networking and/or optimization of communication among main Work Nodes of the EGEE-VO-CTA is straightforward.

  - A dedicated EGEE-VO-CTA Grid Operation Center minimize costs and optimize performance trough a dedicated grid-scientific gateway (e.g. the CTACG MC-dashboard) for grid jobs administration as well as all levels of data analysis (including natural interface to Virtual Observatory for data dissemination).

  - The gateway is secure by means of grid certificate for VO-users, but providing grid job on demand (generic proxy to not-certified users) will be open to everybody.

Challenges and Suggestions

- ***Technical challenges:***

- network and synchronization between Array Center and (Distributed-)Data Center

- Scientific Grid-Gateway open to and serving all level of observers

- ***Political challenges:***

- convince <u>part</u> of the community (not familiar with GRID and EC e-infrastructures initiatives as EGI and GEANT) about the validity of the solution proposed with the CTACG approach.

- ***Suggestions*** *(and expected feedback from this meeting):*

- The CTACG project needs direct contacts and guide-lines from EC, EGI and GEANT to better plan its feasibility study and to find support to complete it.

CTA Current Status & Timeline

- ***Status:***

- The EGEE-CTA-VO is active for the MC production and analysis purposes and has just started the development of the gateway ("dashboard").

- The CTACG-architecture feasibility study will last until 2011.

The CTA Observatory construction is starting in 2013 and completed in 2018;

Running with partial configuration already in 2014.

	06	07	08	09	10	11	12	13
Site exploration	■	■	■					
Array layout	■	■	■					
Telescope design		■	■	■				
Component prototypes			■	■	■			
Array prototype					■	■		
Array construction						■	■	■
Partial operation							■	■