

The LHC Computing Grid

The background of the slide is a photograph of the LHC tunnel, showing the long, curved structure with overhead lighting. Overlaid on the right side is a 3D cutaway diagram of a superconducting magnet assembly, showing internal components like the cryostat and the superconducting coils.

**Visit of Mr. Antoine Grassin to CERN
Directeur de la Coopération Scientifique
et Universitaire**

**Frédéric Hemmer
Deputy Head, IT Department
16 May 2006**



New frontiers in data handling

ATLAS experiment:

~150 million channels @ 40MHz

~ 10 million Gigabytes per second

⇒ Massive data reduction on-line

⇒ Still ~1 Gigabyte per second to handle

ATLAS Detector Under construction
October 2005



The Data Challenge

- LHC experiments will produce **10-15 million Gigabytes** of data each year (about 20 million CDs!)
- LHC data analysis requires a computing power equivalent to ~ **100,000 of today's fastest PC processors.**
- Requires many cooperating computer centres, CERN providing only ~20% of the computing resources



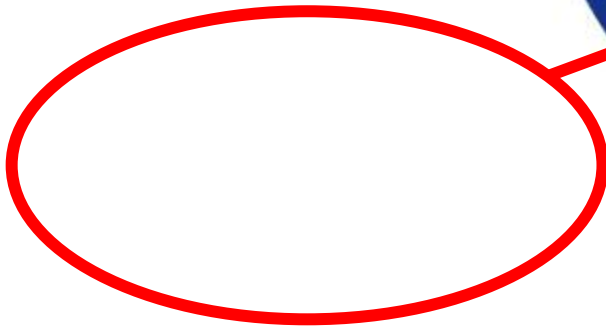
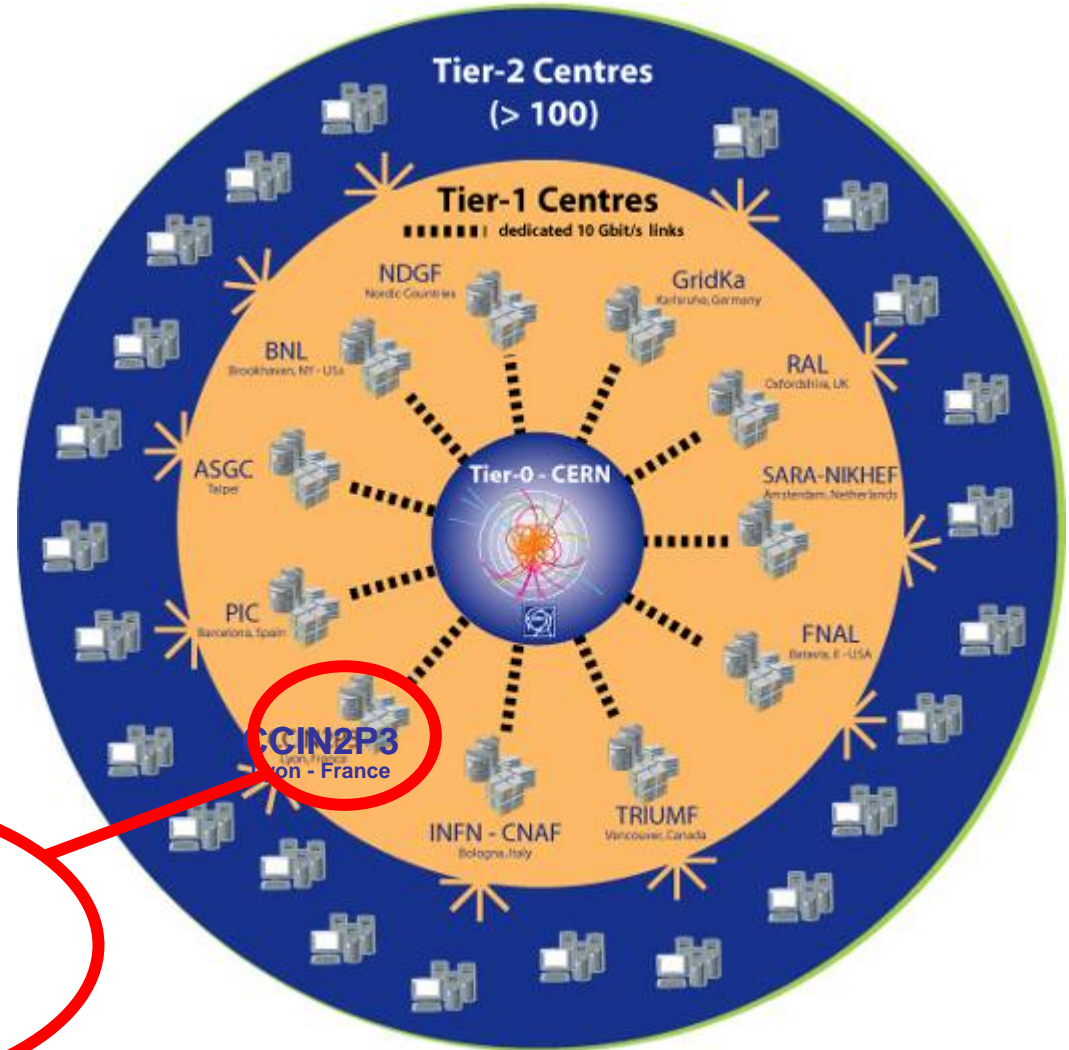
Solution: Connect Computer Centres via the Grid





LHC Computing Grid project (LCG)

- More than 100 computing centres
- 12 large centres for primary data management: CERN (Tier-0) and eleven Tier-1s
- 38 federations of smaller Tier-2 centres
- 40 countries involved



~ 100K of today's fastest processors

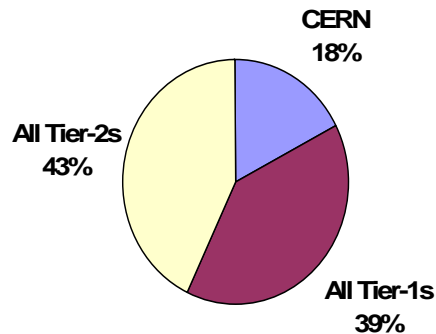
Summary of Computing Resource Requirements

All experiments - 2008

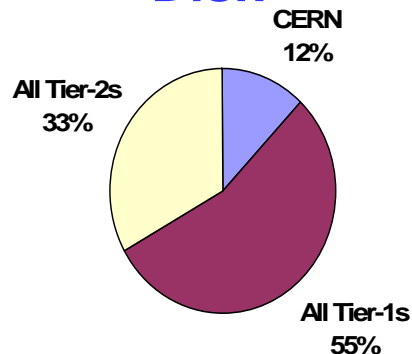
From LCG TDR - June 2005

	<i>CERN</i>	<i>All Tier-1s</i>	<i>All Tier-2s</i>	<i>Total</i>
CPU (MSPECint2000s)	25	56	61	142
Disk (PetaBytes)	7	31	19	57
Tape (PetaBytes)	18	35		53

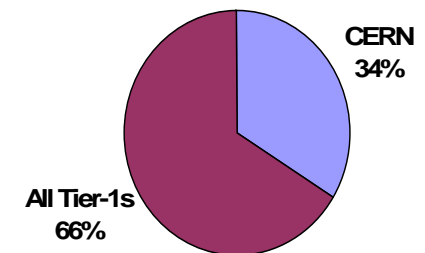
CPU



Disk



Tape



LHC Computing Grid Project - a Collaboration

Building and operating the LHC Grid –
a global collaboration between

- The physicists and computing specialists from the LHC experiments
- The national and regional projects in Europe and the US that have been developing Grid middleware
- The regional and national computing centres that provide resources for LHC
- The research networks

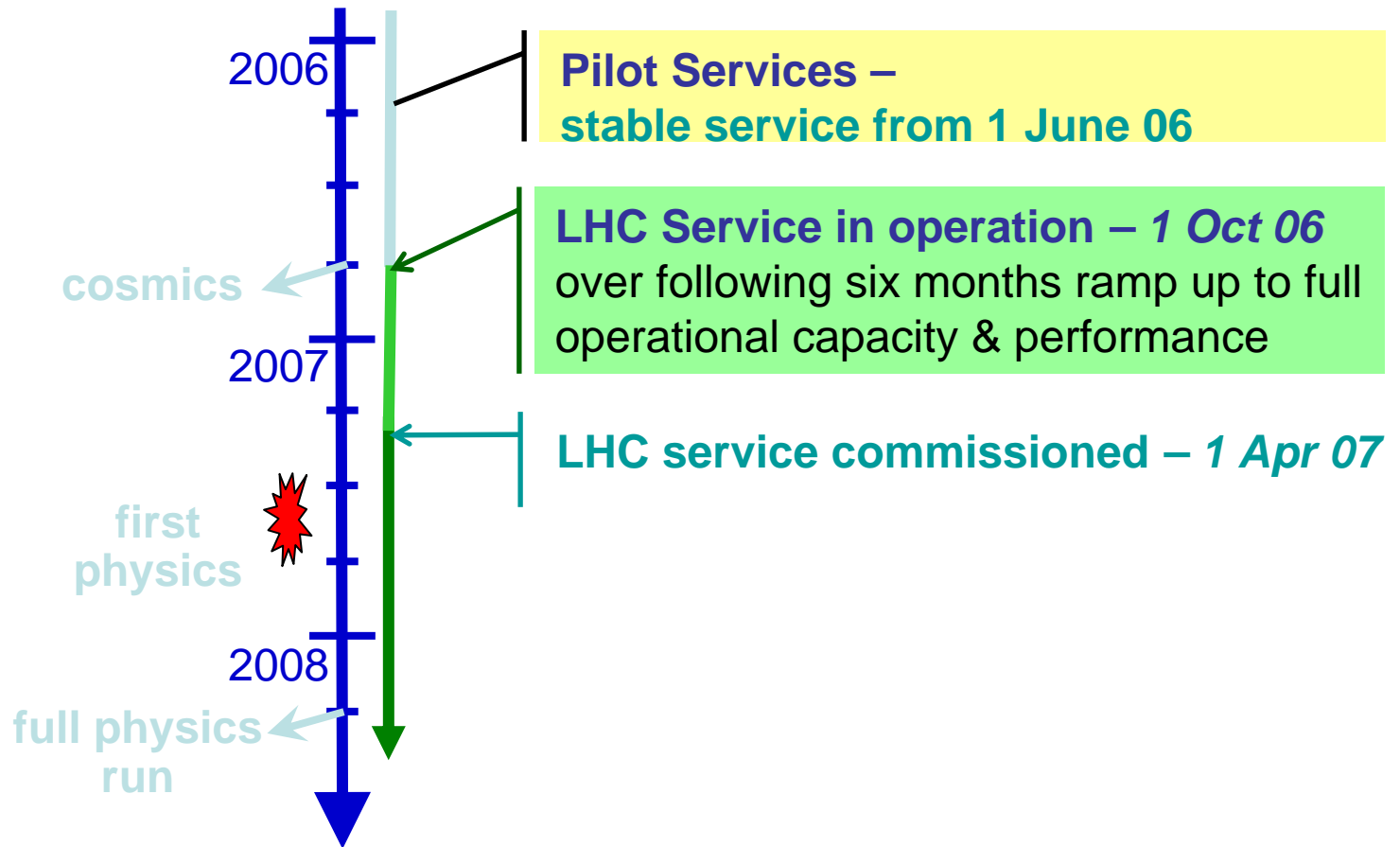
Researchers

Computer Scientists &
Software Engineers

Service Providers



LCG Service Deadlines

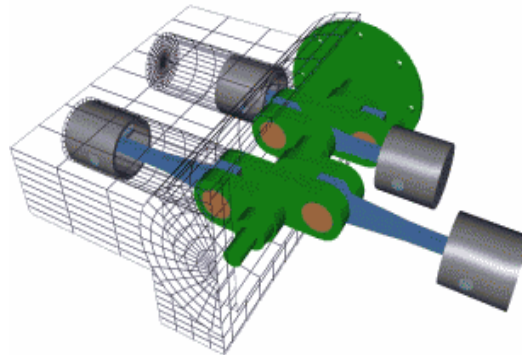


Impact of the LHC Computing Grid

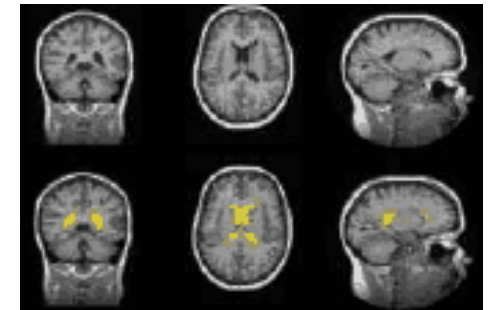
- LCG has been the driving force for the European multi-science Grid EGEE (Enabling Grids for E-scienceE)
- EGEE is now a global effort, and the largest Grid infrastructure worldwide
- Co-funded by the European Commission (~130 M€ over 4 years)
- France is a key contributor to EGEE
- EGEE already used for >20 applications, including...



Bio-informatics



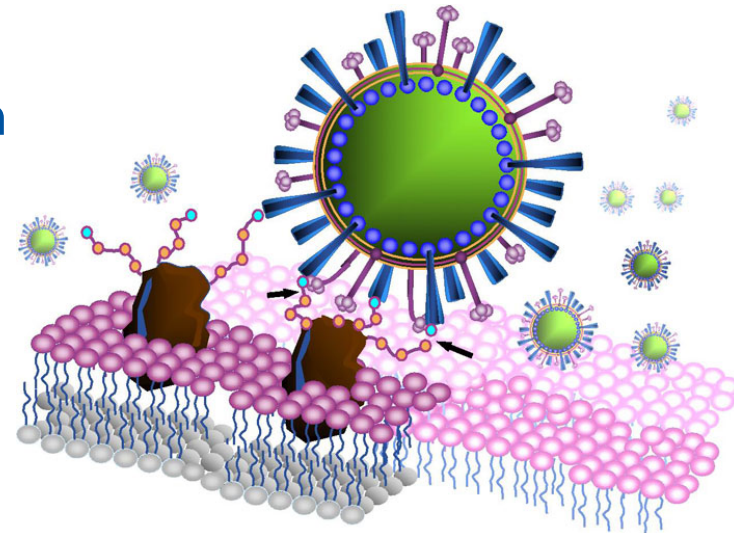
Education, Training



Medical Imaging

Example: EGEE Attacks Avian Flu

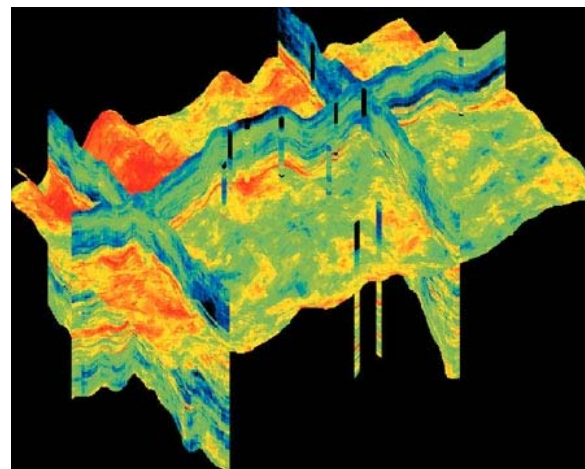
- EGEE used to analyse 300,000 possible potential drug compounds against bird flu virus, H5N1.
- 2000 computers at 60 computer centres in Europe, Russia, Taiwan, Israel ran during four weeks in April - the equivalent of 100 years on a single computer.
- Effort led by researchers at Clermont-Ferrand (CNRS), and Lyon (Université Blaise Pascal)
- Potential drug compounds now being identified and ranked



Neuraminidase, one of the two major surface proteins of influenza viruses, facilitating the release of virions from infected cells. Image Courtesy Ying-Ta Wu, AcademiaSinica.

Example: Geocluster industrial application

- The first industrial application successfully running on EGEE
- Developed by the Compagnie Générale de Géophysique (CGG) in France, doing geophysical simulations for oil, gas, mining and environmental industries.
- EGEE technology helps CGG to federate its computing resources around the globe.



Towards a European Grid Infrastructure

- Europe is in a leading position in scientific Grids thanks to EGEE
- Must ensure transition from projects to a sustainable e-infrastructure
- Requires creation of National Grid Infrastructures
- Requires coordination by a new European Organization (FP7)

