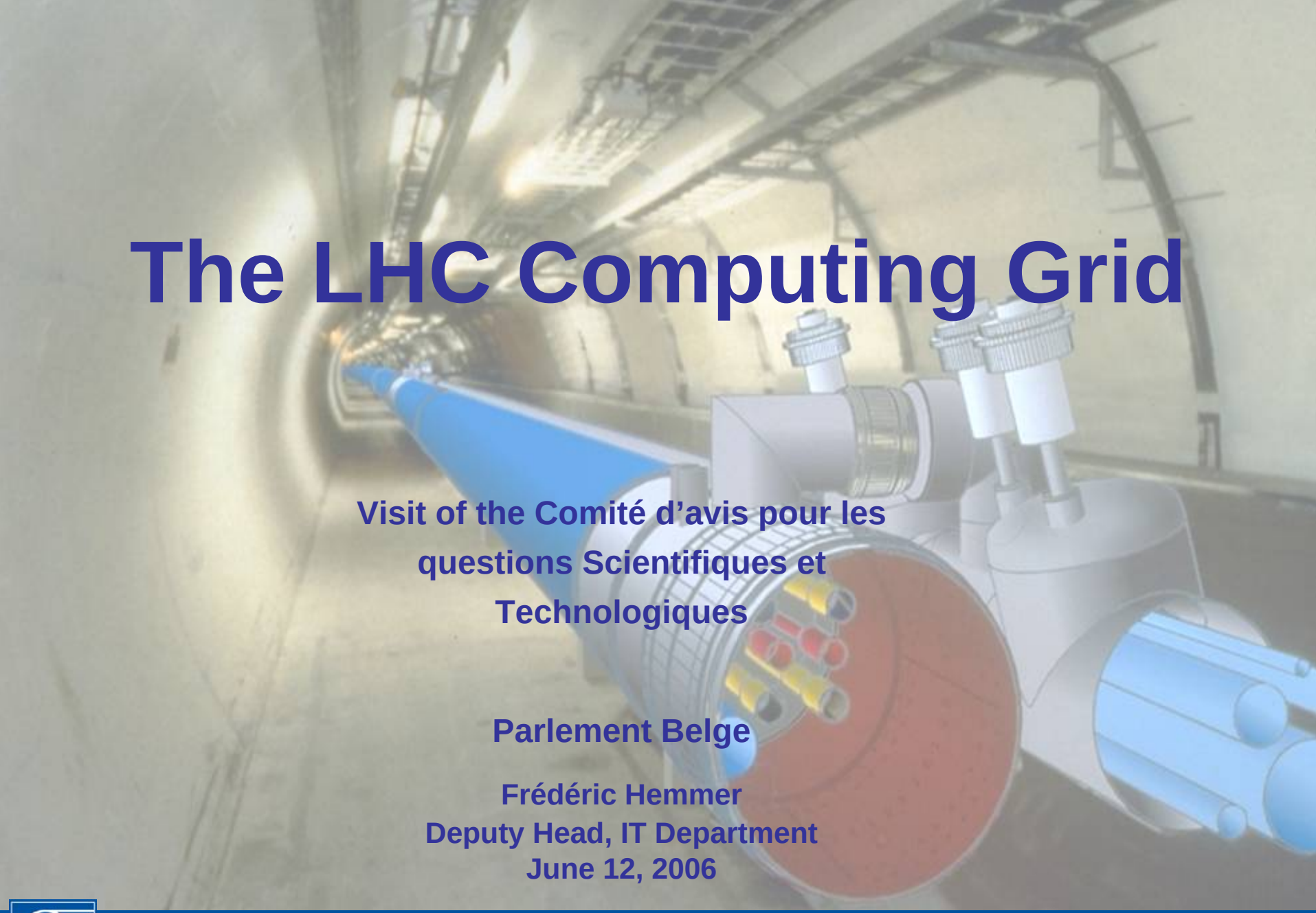


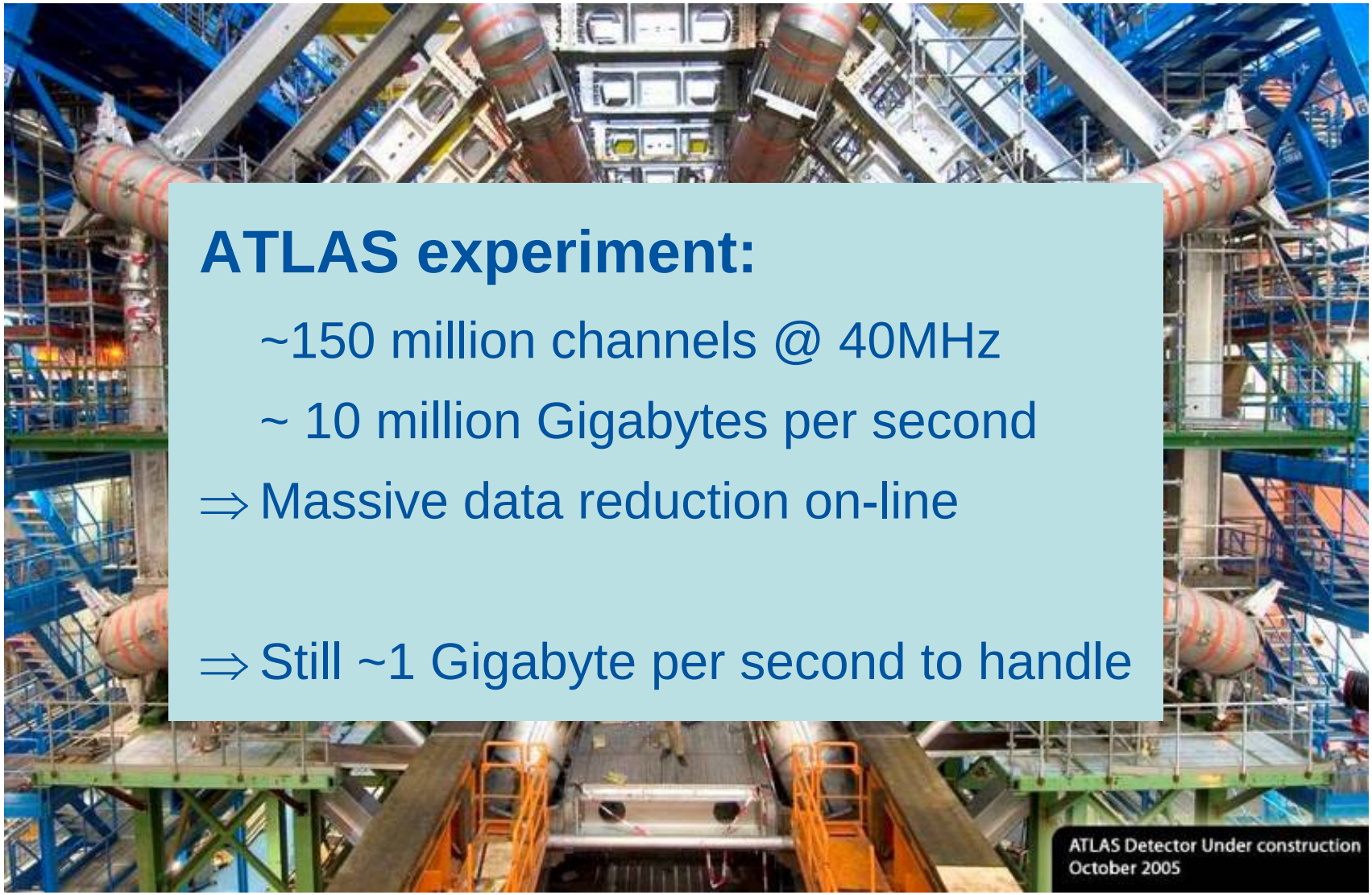
The LHC Computing Grid

Visit of the Comité d'avis pour les questions Scientifiques et Technologiques

Parlement Belge

Frédéric Hemmer
Deputy Head, IT Department
June 12, 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

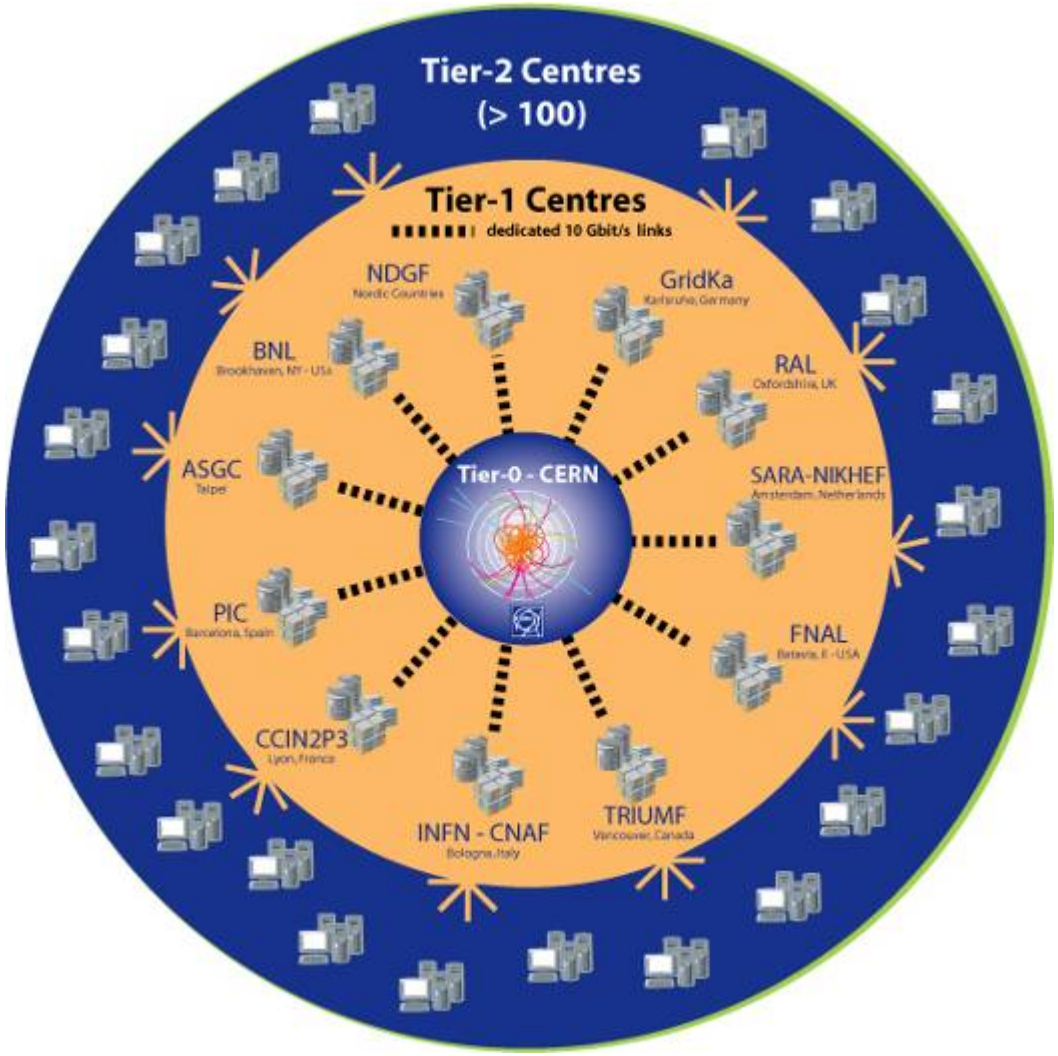
The Data Challenge

- 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



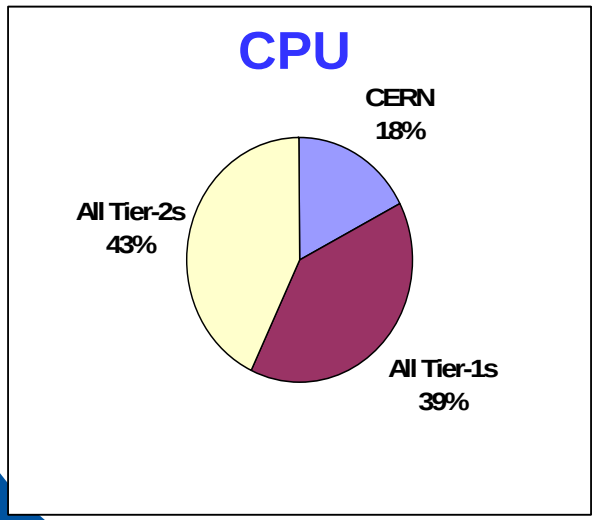
~ 100K of today's fastest processors

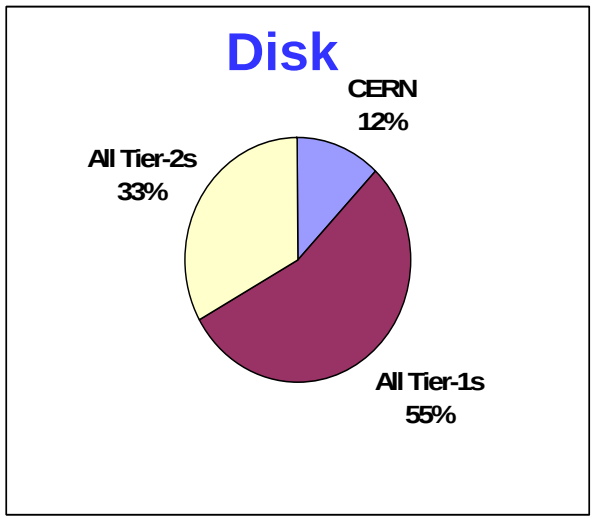
Summary of Computing Resource Requirements

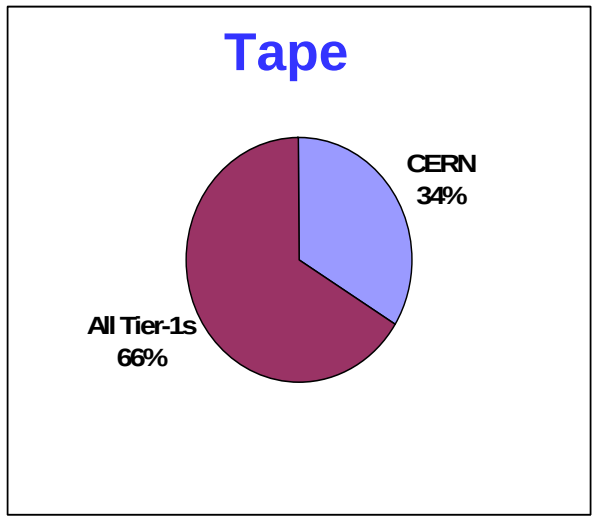
All experiments - 2008

From LCG TDR - June 2005

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







LHC Computing Grid Project - a Collaboration

Building and operating the LHC Grid –
a global collaboration between

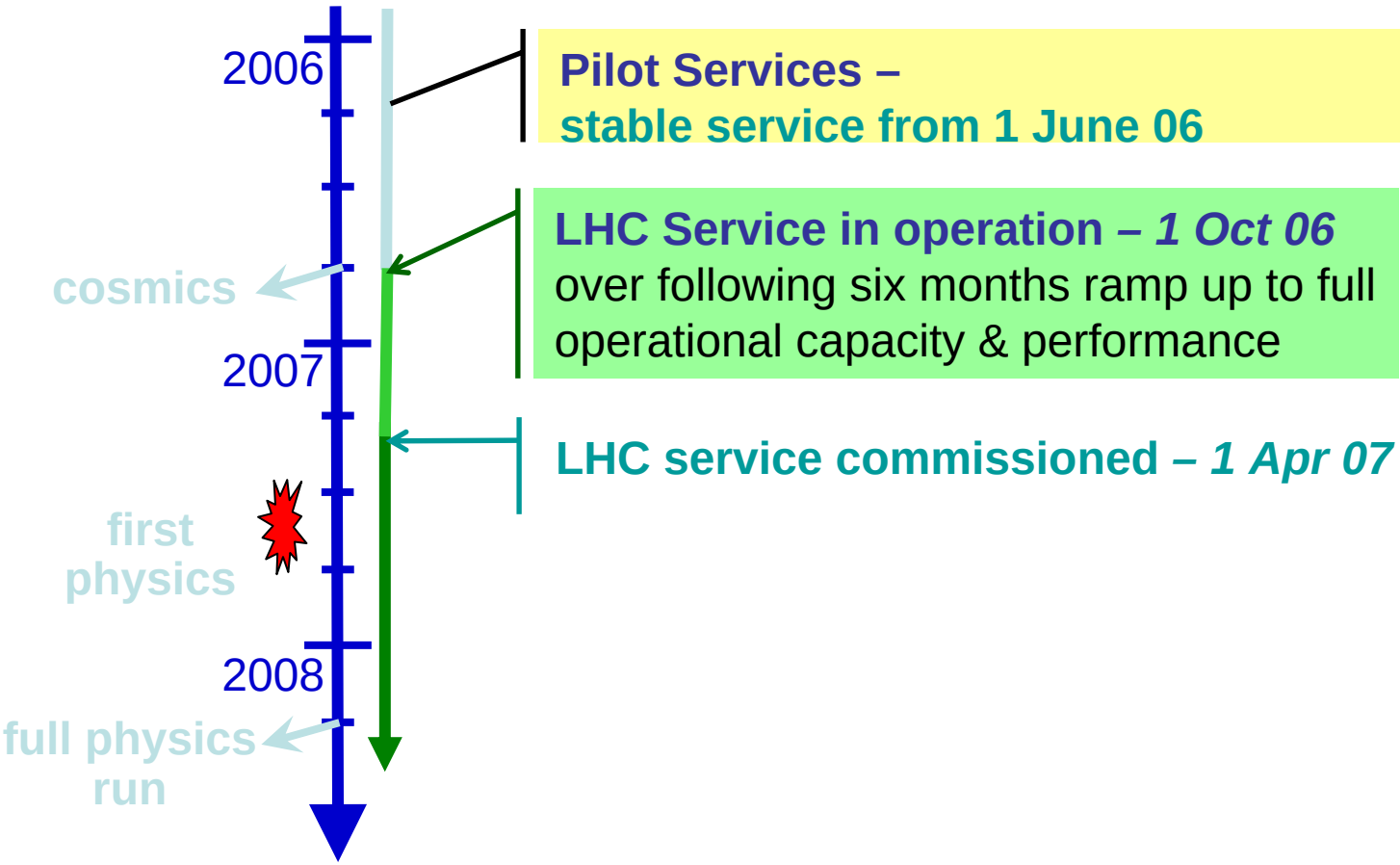
- The physicists and computing specialists from the LHC experiments
- The national and regional projects in Europe and the US that have been developing Grid middleware
- The regional and national computing centres that provide resources for LHC
- The research networks

Researchers

Computer Scientists & Software Engineers

Service Providers

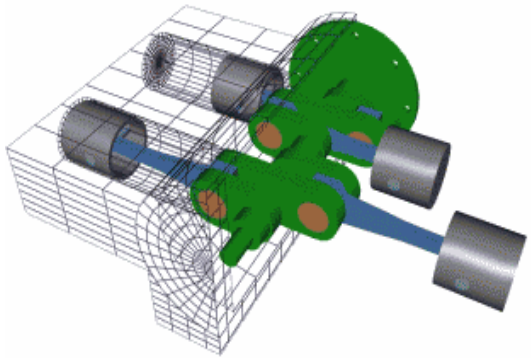
LCG Service Deadlines



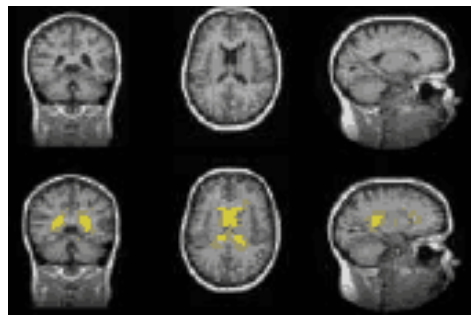
Impact of the LHC Computing Grid

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

Bio-informatics



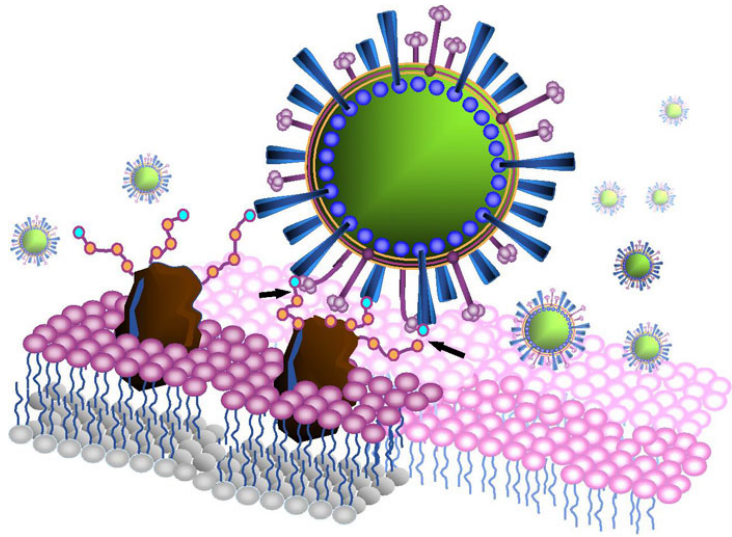
Education, Training



Medical Imaging

Example: EGEE Attacks Avian Flu

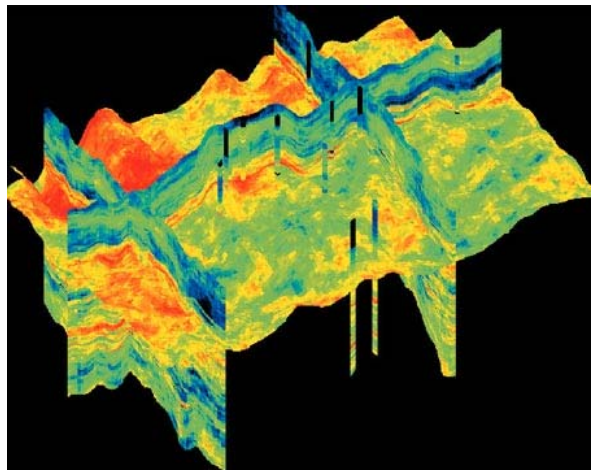
- EGEE used to analyse 300,000 possible potential drug compounds against bird flu virus, H5N1.
- 2000 computers at 60 computer centres in Europe, Russia, Taiwan, Israel ran during four weeks in April - the equivalent of 100 years on a single computer.
- Potential drug compounds now being identified and 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.*

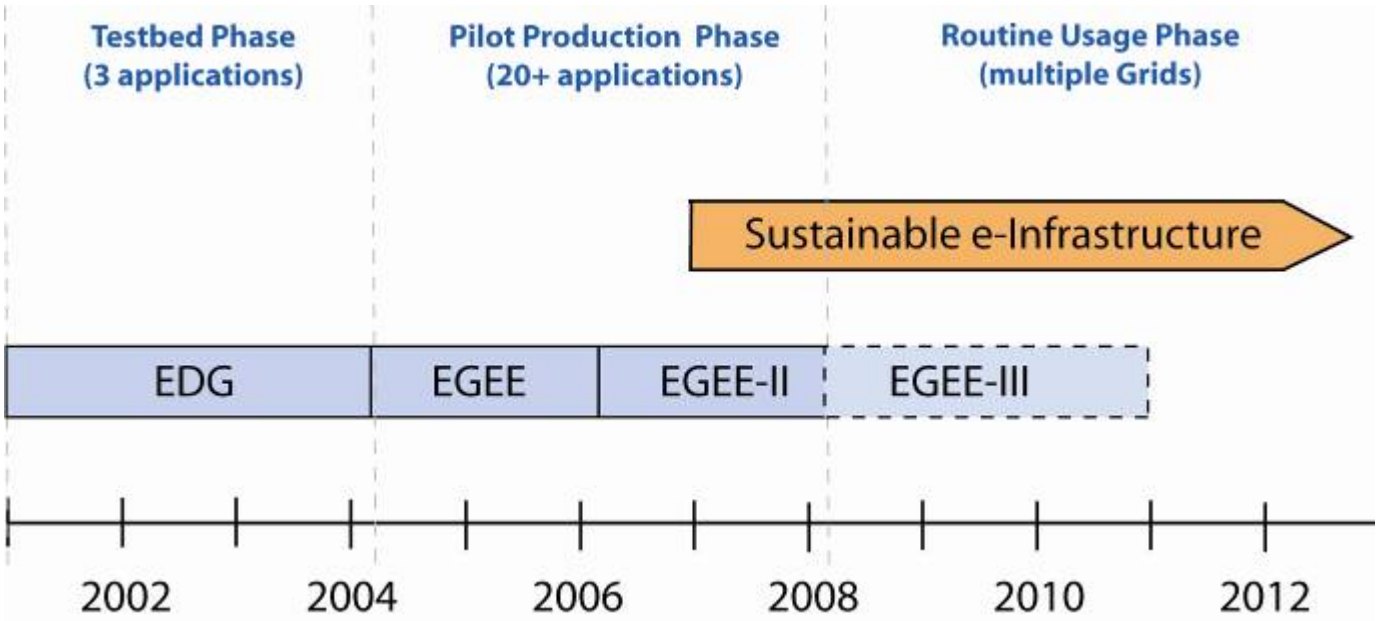
Example: Geocluster industrial application

- 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.



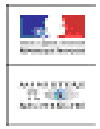
Towards a European Grid Infrastructure

- 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)



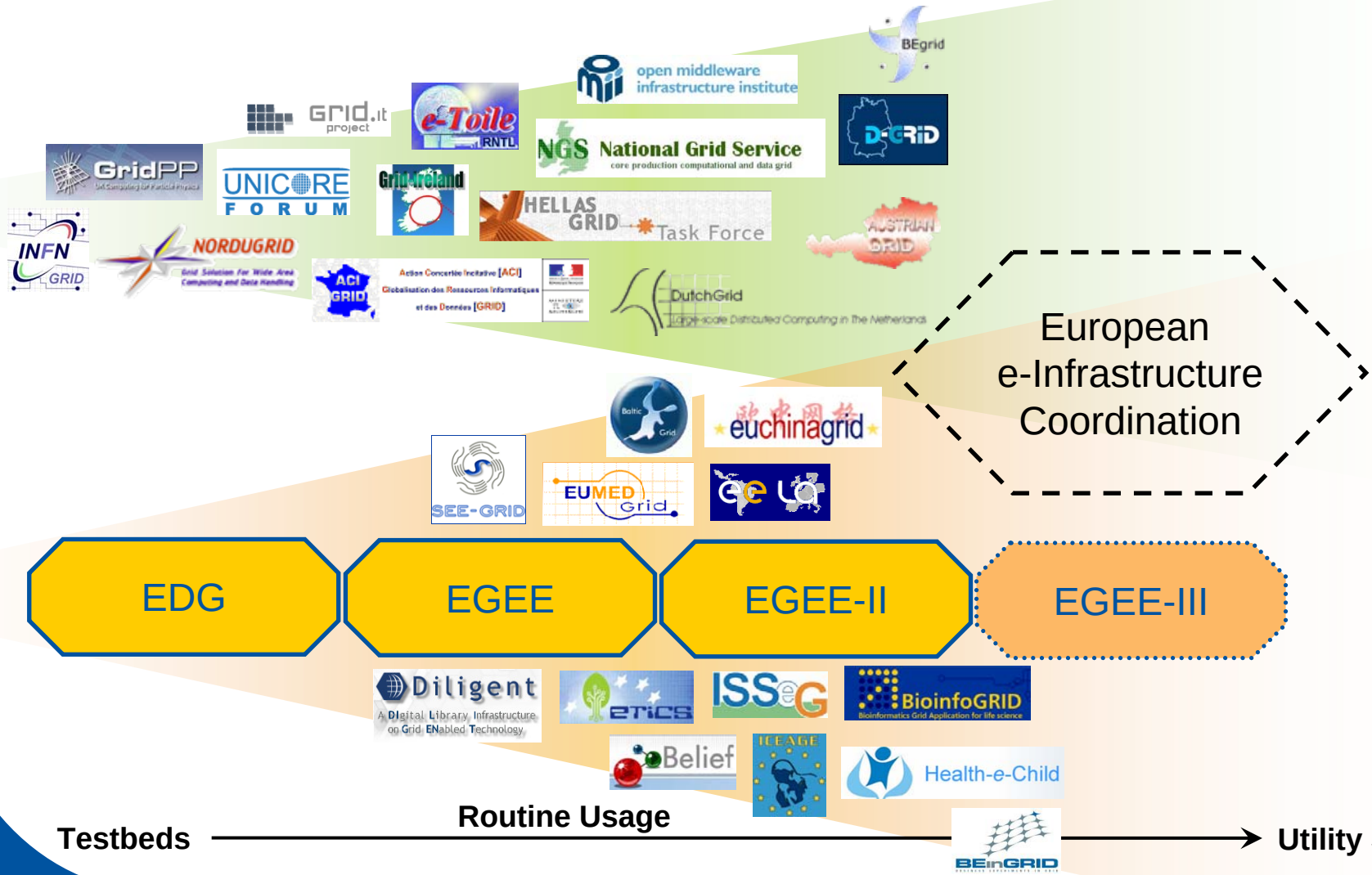
Grids in Europe

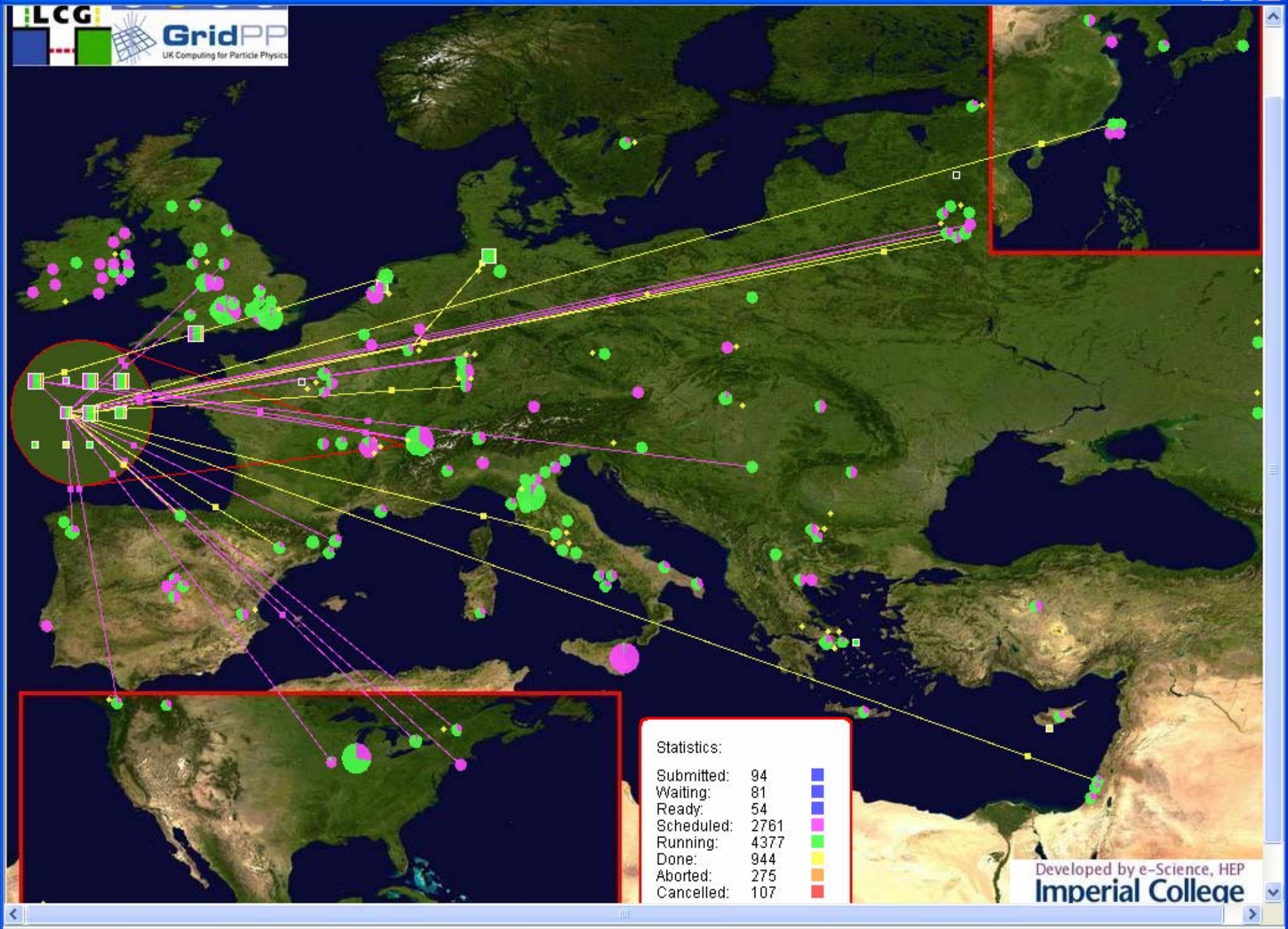
- Great investment in developing Grid technology
- Sample of National Grid projects:
  - Austrian Grid Initiative
  - Belgium: BEGrid
  - DutchGrid
  - France: e-Toile; ACI Grid
  - Germany: D-Grid; Unicore
  - Greece: HellasGrid
  - Grid Ireland
  - Italy: INFNGrid; GRID.IT
  - NorduGrid
  - UK e-Science: National Grid Service; OMII; GridPP



- EGEE provides framework for national, regional and thematic Grids

Evolution


BEgrid
open middleware infrastructure institute
grid.it project
e-Toile RNTL
NGS National Grid Service
core production computational and data grid
D-GRID
GridPP
UNICORE FORUM
Grid-Ireland
HELLAS GRID Task Force
AUSTRIAN GRID
INFN GRID
NORDUGRID
ACI GRID
Action Concertée Incitative [ACI]
Globalisation des Ressources Informatiques et des Données [GRID]
DutchGrid
European e-Infrastructure Coordination
Baltic Grid
euchinagrid
SEE-GRID
EUMED Grid
eela
EDG
EGEE
EGEE-II
EGEE-III
Diligent
A DIgital Library Infrastructure on Grid ENabled Technology
eTICS
ISSeG
BioinfoGRID
Bioinformatics Grid Application for life science
Belief
ICEAGE
Health-e-Child
BEinGRID
Testbeds
Routine Usage
Utility Service



Java Applet Window