

GRID-related activity in Japan

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Outline

- Geant4 Parallelization
- GRID deployment around KEK
- GRID portal on Web
 - ✓ Radiotherapy simulation with GRID



Geant4 Parallelization

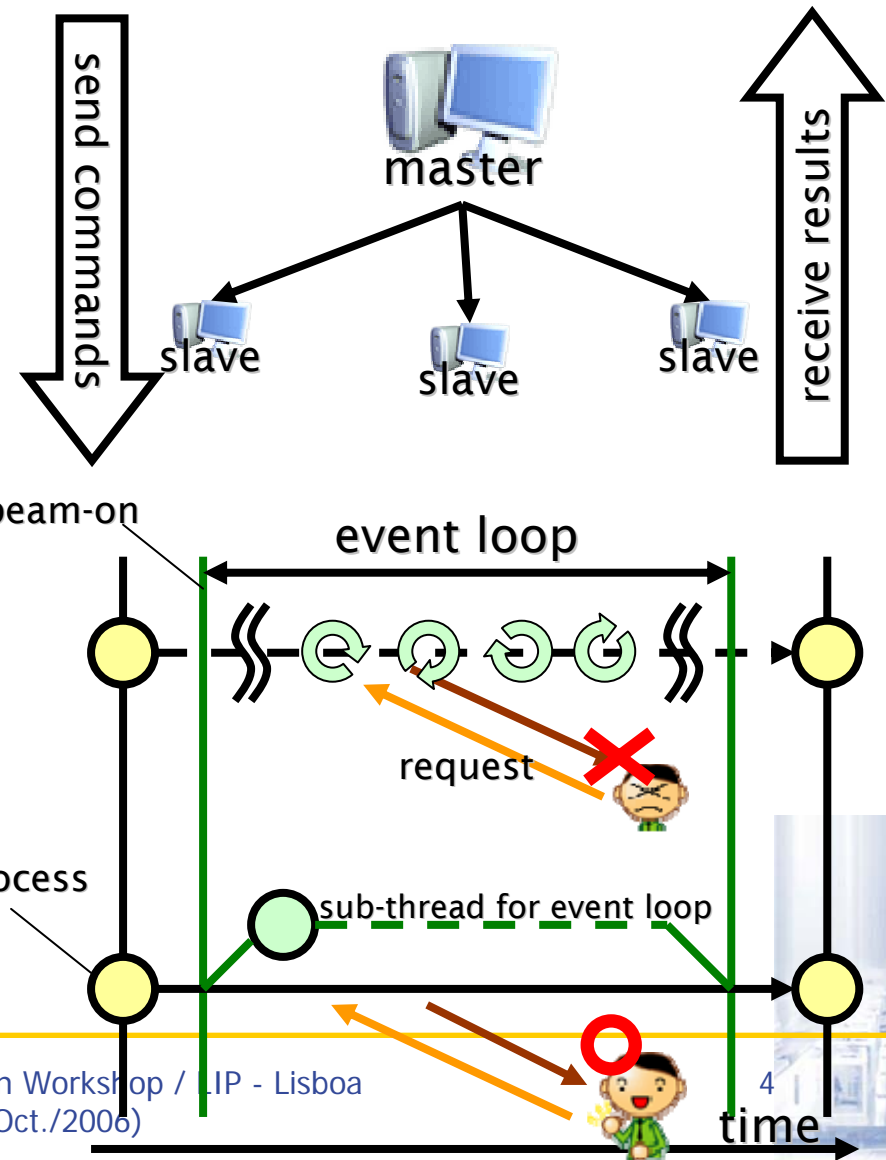
Geant4 Parallelization

Parallel software

- ✓ implemented with MPI.
 - » tested with MPICH and LAM.
- ✓ based on a master-slave model.
 - » UI commands are scattered to the slaves from the master.
 - » The results in each slave are gathered into the master at the end of every event/run.

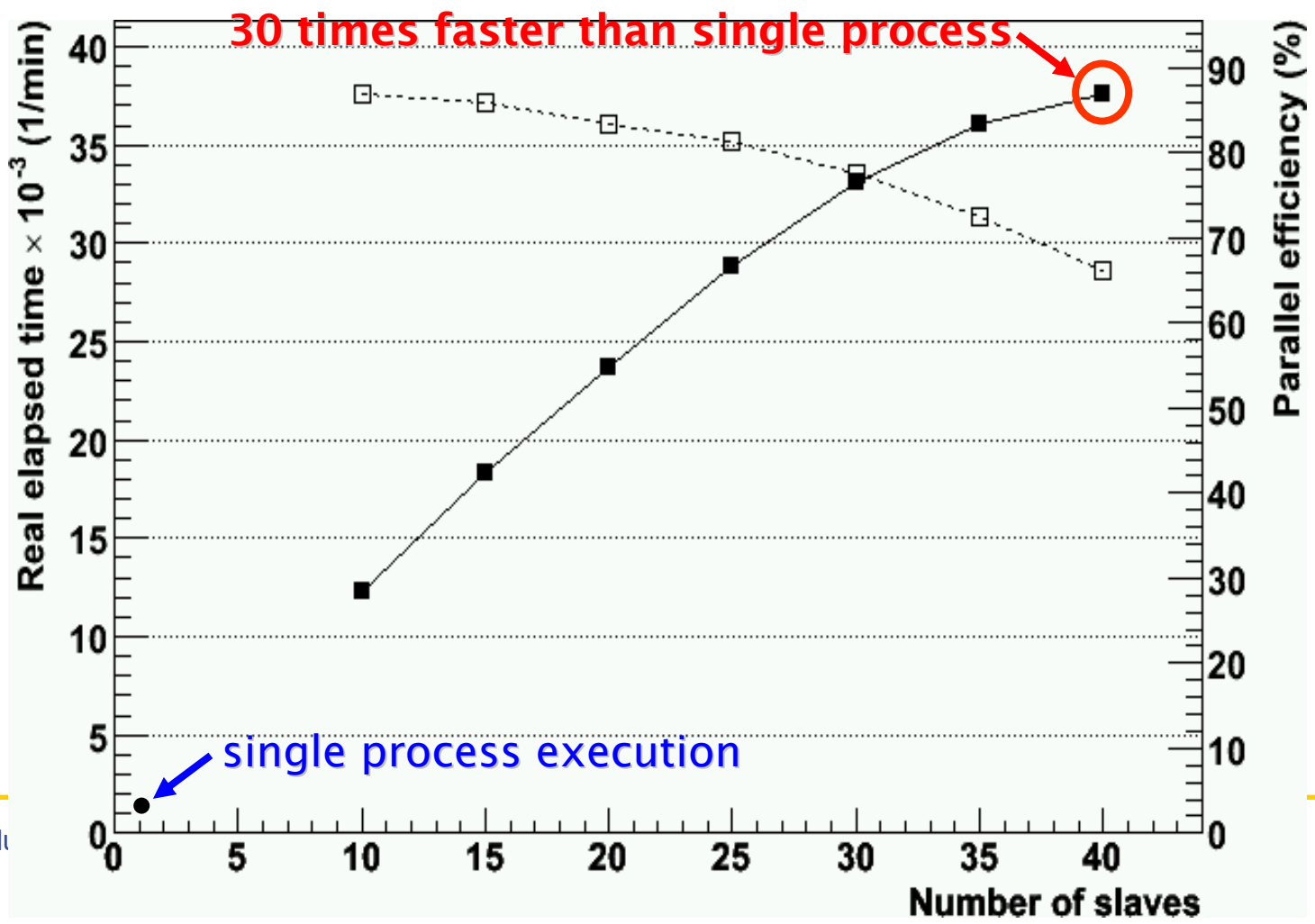
Thread-out of event loop

- ✓ enables the slaves to respond to request from the master.
- ✓ The master can get information of slaves during event loop.



Benchmarking Results

--□-- Parallel efficiency (right-hand scale)
—■— The inverse of real elapsed time (left-hand scale)



Summary on Geant4 Parallelization

- Geant4 parallel components have been implemented using MPI based on master-slave model.
 - ✓ Applications based on these components are executed with one master and one or more slaves.
 - ✓ Existing applications can be parallelized rapidly and easily.
 - » just switching G4RunManager and G4UIsession

- An existing our medical application based on Geant4 was parallelized and tested on our PC cluster.
 - ✓ A parallelized application show the performance gain of nearly 30 times faster on our PC cluster 20 nodes (40 CPUs).
 - ✓ 2nd loop of software improvement
 - ✓ will commit to extended example

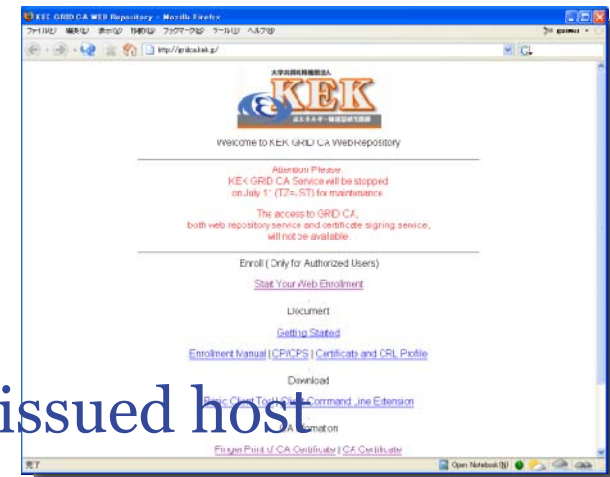


GRID Deployment around KEK

Grid Services provided by KEK

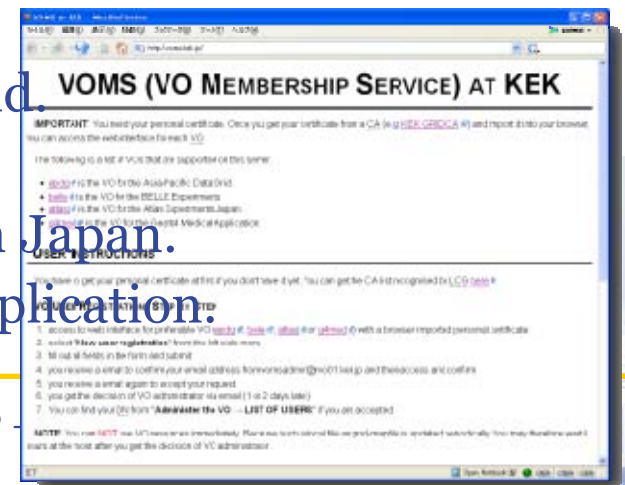
■ CA Service

- ✓ <http://gridca.kek.jp/>
- ✓ started on Feb. 2006.
- ✓ service for Japanese HEP activity
- ✓ # of issued user certificates: 25 / # of issued host certificates: 74



■ VO Membership Service

- ✓ <http://voms.kek.jp/>
- ✓ Supported VOs:
 - » “apdg” is the VO for Asia-Pacific Data Grid.
 - » “belle” is the VO for Belle experiments.
 - » “atlasj” is the VO for Atlas experiments in Japan.
 - » “g4med” is the VO for Geant4 medical application.



GRID System

■ JP-KEK-CRC-01 (Pre-Production System)

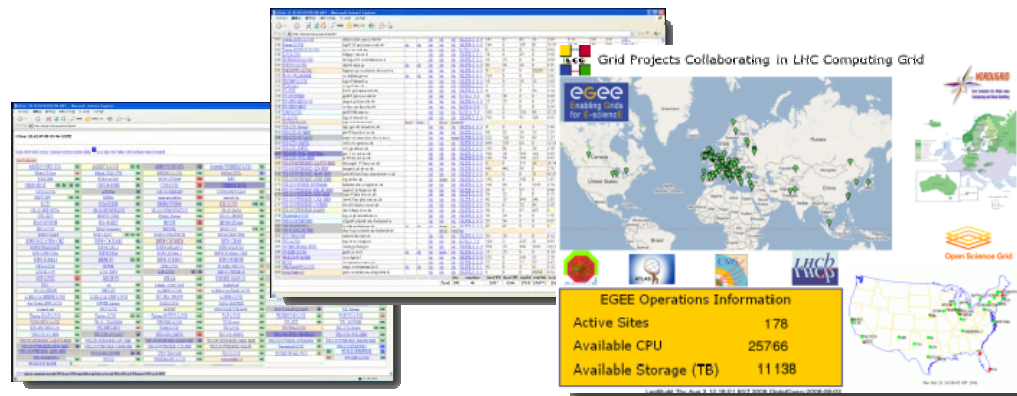
- ✓ since Nov. 2005.
- ✓ registered to GOC. ready to WLCG (World wide LCG).
- ✓ Site role:
 - » practice for production system JP-KEK-CRC-02.
 - » test use among university groups in Japan.
- ✓ Resource and Component:
 - » SL-3.0.5 w/ LCG-2.7
 - » upgrade to gLite-3.0 is done.
 - » CPU: 14, Storage: 1TB
- ✓ Supported VOs:
 - » belle, apdg, dteam and ops

■ JP-KEK-CRC-02 (Production System)

- ✓ since early 2006.
- ✓ registered to GOC. ready to WLCG.
- ✓ Resource and Component:
 - » SL or SLC w/ LCG-2.7
 - » upgrade to gLite-3.0 is done.
 - » CPU: 48, Storage: 6TB (w/o HPSS)
- ✓ Supported VOs:
 - » belle, apdg, atlasj, ilc, dteam and ops

■ JP-KEK-CRC-00 (Testbed System)

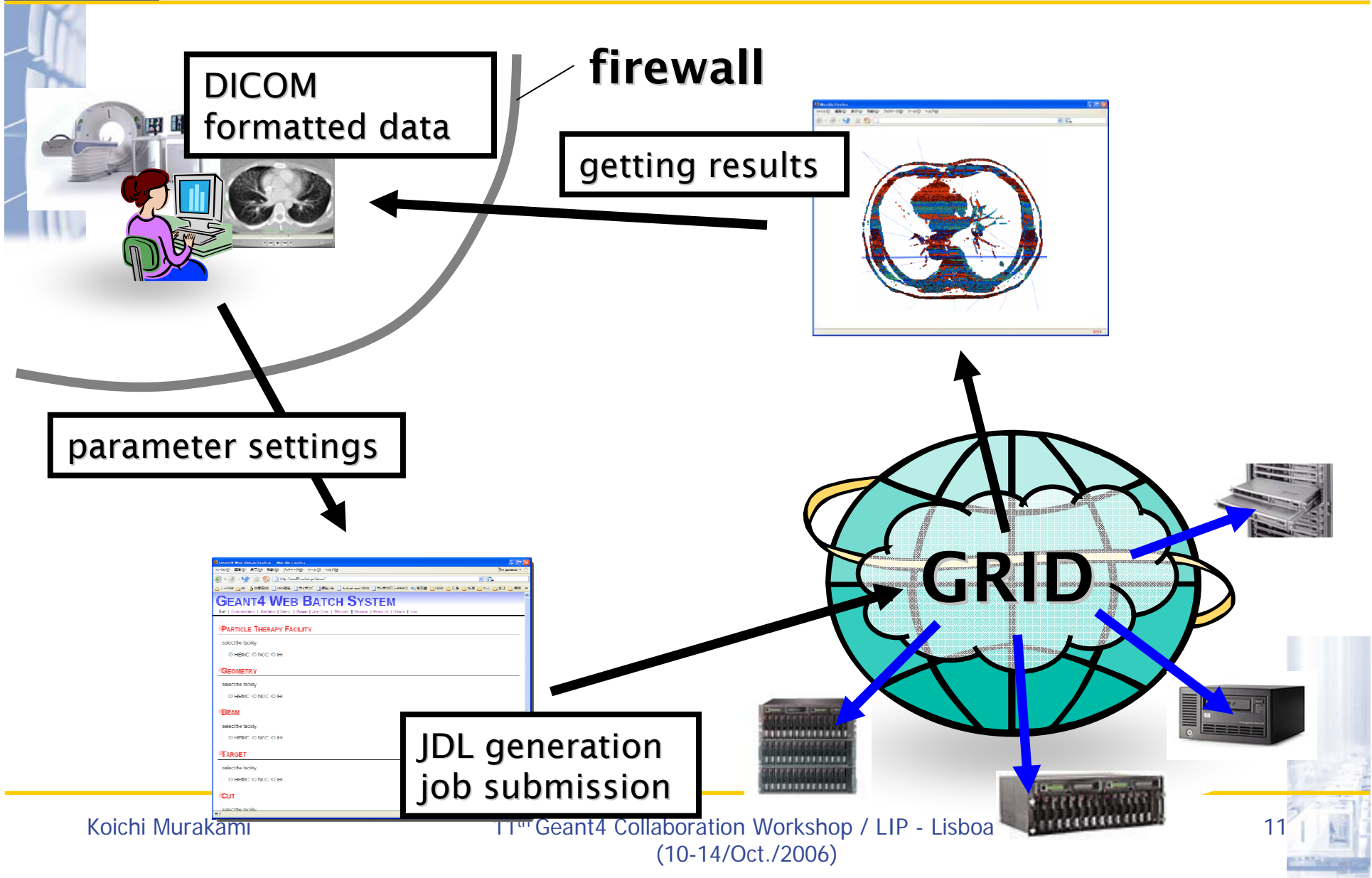
- ✓ since Jun. 2005.
- ✓ Resource and Component:
 - » SL-3.0.5 w/ gLite-3.0 (100% pure)
- ✓ Supported VOs:
 - » belle, apdg, atlasj and g4med



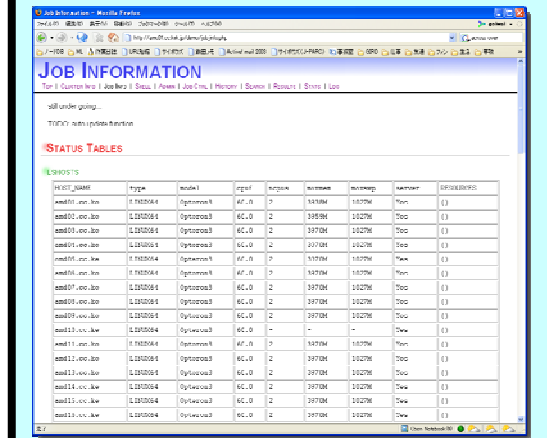
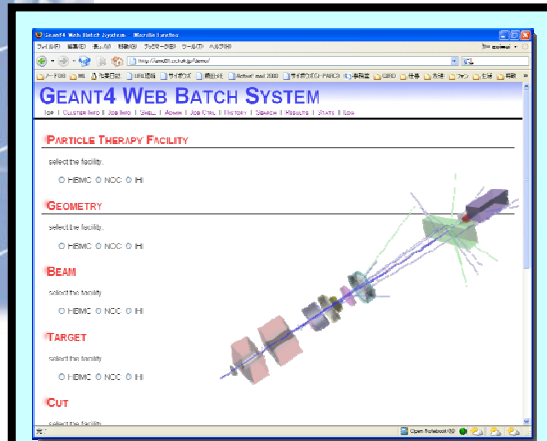
GRID Portal on Web



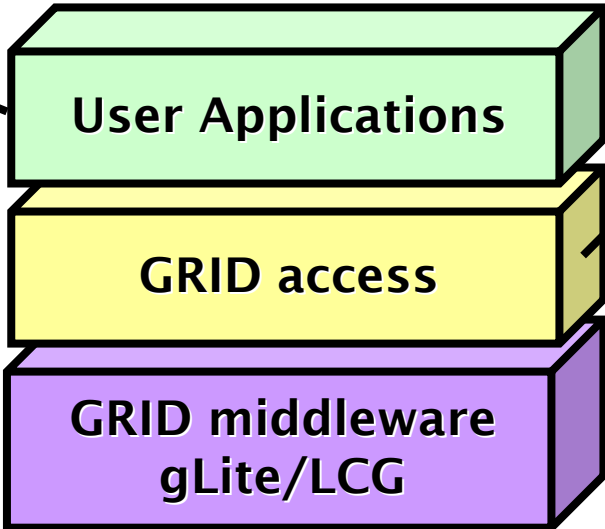
Usecase of Medical Application with GRID



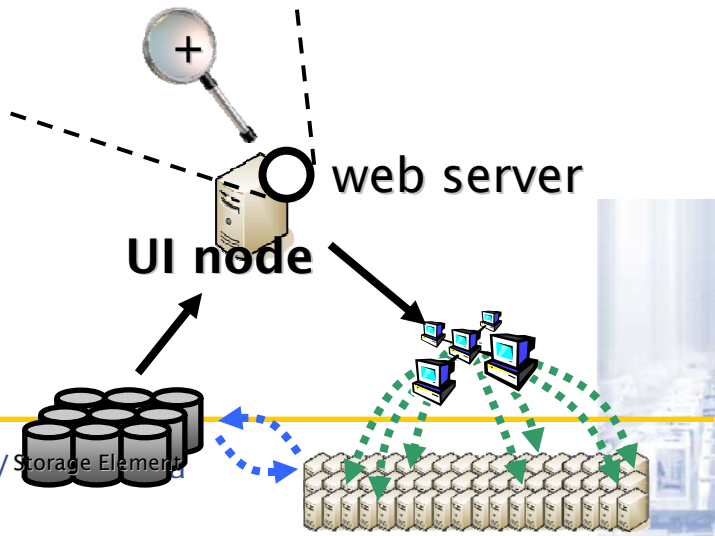
More Structure of GRID Web Interface



- parameter inputs
- JDL auto generation



- issue of proxy certificate
- job management
- job monitoring
- post-process for job outputs



GRID Access Layer

■ GRID API/commands

- ✓ issue of proxy certificates
 - » xxx-proxy-init/info/destroy
- ✓ job management
 - » submission/cancellation
 - xxx-job-submit/xxx-job-cancel
- ✓ job monitoring
 - » xxx-job-status
- ✓ post-process for job outputs
 - » merging job outputs (histogram, etc.)
 - » collection/replication of results
 - xxx-job-get-output, lfc-xxx, lcg-cp, lcg-cr, etc.
- ✓ These staffs are used for communication with the UI node, on which a web server runs.

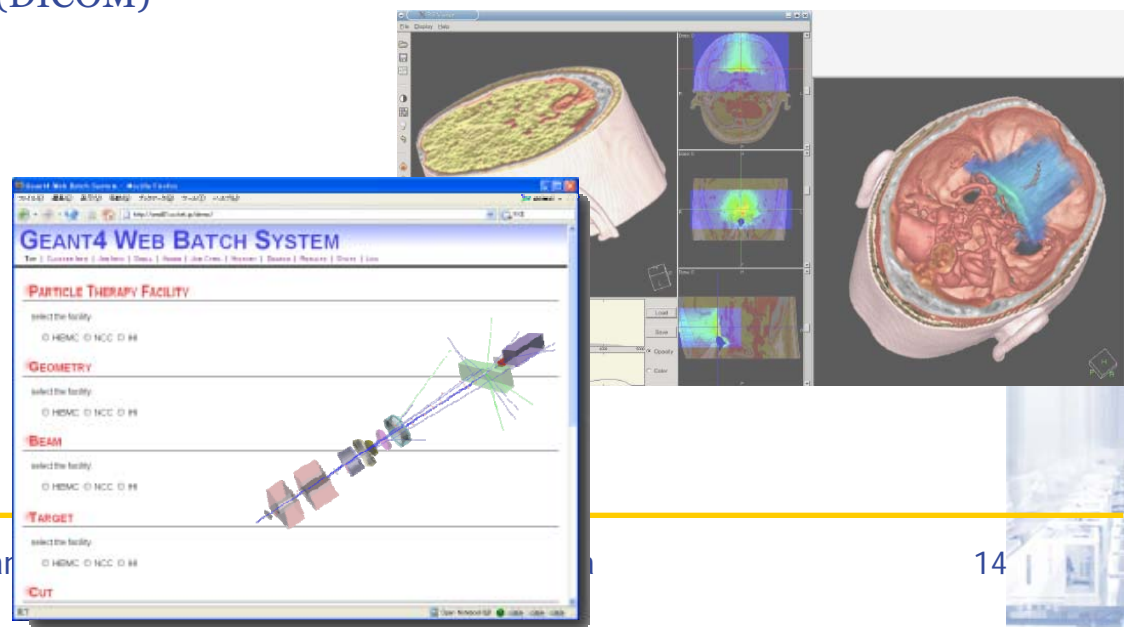
■ HTML generation

- ✓ as a user front-end.
 - » providing front-ends for accessing GRID resources.
- ✓ web pages for job submission, monitoring, etc.
 - » providing functions to automatically generate related web forms.



Radiotherapy Simulation on GRID

- Typical situation of particle therapy simulation;
 - ✓ ~3days/1M events
 - » @ Pentium-4 3.0GHz processor / 1GB memory
 - ✓ massive computing power is required for precise simulation
- Input parameters
 - ✓ Selecting facility
 - » HIBMC/NCC/NIRS-IHI/.... (Japanese facilities)
 - ✓ Geometry (beamline modules)
 - » collimator/wobler magnet/scatterer/range shifter/ridge filter/MLC/...
 - ✓ Target
 - » water phantom/human body (DICOM)
 - ✓ Beam condition
 - » beam energy/beam spread
 - ✓ Simulation parameters
 - » physics lists
 - » cut values
- Outputs
 - ✓ dose distribution
 - » ROOT file/GDD file/...



Current Status & Future Prospects

- Medical application of Geant4 and GRID
 - ✓ high speed MC-based dose calculation system in radiotherapy requires large-scale computing resources.

- Application of GRID is a key component to boost simulation speed.
 - ✓ We are developing an easy-to-use user interface on our GRID environment.
 - ✓ We can get a secure and efficient way of sharing computing resources in the context of GRID technology.
 - » Secure globally-distributed job execution
 - » Web application interface

