
Applications Area Phase II Planning and Status

LCG Comprehensive Review
14-15 November 2005

Pere Mato/CERN



Outline

- ◆ The Applications Area planning exercise
- ◆ Manpower situation
- ◆ Current project status
- ◆ LHCC concerns and recommendations of last review
- ◆ Conclusions

Application Area Focus

- ◆ Deliver the common physics applications software for the LHC experiments
- ◆ Organized to ensure focus on real experiment needs
 - Experiment-driven requirements and monitoring
 - Architects in management and execution
 - Open information flow and decision making
 - Participation of experiment developers
 - Frequent releases enabling iterative feedback
- ◆ Success is defined by adoption and validation of the products by the experiments
 - Integration, evaluation, successful deployment

Phase II planning exercise

- ◆ Process initiated in February
- ◆ Had a round of discussions with PH management, project leaders, experiment architects, experiment representatives, etc.
- ◆ Presentations to the experiments
- ◆ AA internal review (March 30th - April 1st) ([web page](#))
 - “The proposed evolution plan is technically reasonable and supported by all experiments”
 - “The technical details of the plan should continue to be discussed and approved by the Architects Forum”
- ◆ Many discussions in the AF (during May-July)
 - Ironing out some of the problems in the SEAL+ROOT merge
- ◆ The final plan [document](#) approved by PEB (27th September)

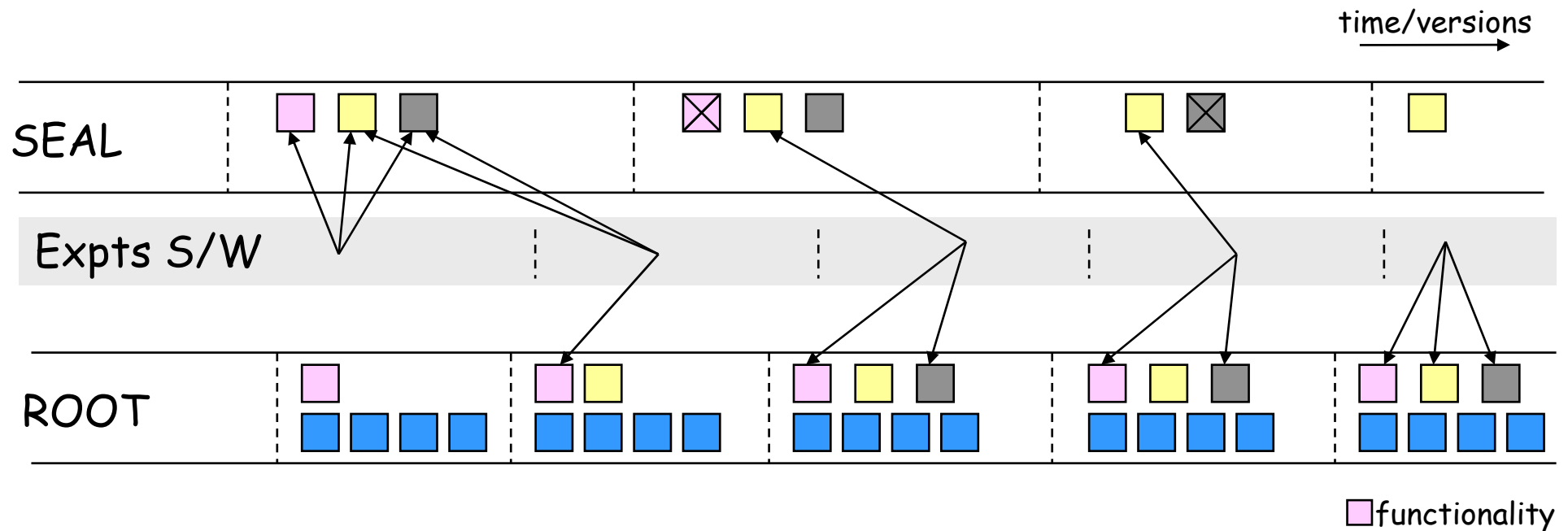
Main change with respect Phase I

- ◆ The main change described in the AA plan [document](#) is the merge of the SEAL and ROOT projects.
- ◆ The main motivations for this merger have been the following:
 - to optimize use of resources by avoiding duplicate development
 - to provide a coherent set of products developed and maintained by the Application Area for the benefit of its clients i.e. the LHC experiments
 - to have the ROOT activity at CERN fully integrated in the LCG organization (planning, milestones, reviews, resources, etc.),
 - to ease the long-term maintenance and evolution of a single set of software products.

SEAL and ROOT Merge

- ◆ The merge consists of two parts:
 1. merge of the development teams into a single team
 2. evolution of the software products into a single set of core software libraries
- ◆ (1) happened immediately (Rene Brun as project leader)
- ◆ (2) was originally foreseen to be completed within a very aggressive timescale but this has now been adapted to allow more time for the experiments to migrate their software
 - Experiments [ATLAS, CMS and LHCb] requested to continue the maintenance of the SEAL libraries
 - SEAL work package added to the ROOT project

Smooth transition for Experiments



- ◆ Adiabatic changes towards the experiments
- ◆ SEAL functionality will be maintained as long as the experiments require

Other Changes

◆ SPI

- Redefinition of its role: provide services directly to experiments
- Reduction of exclusively dedicated manpower
- Direct participation from/to development projects

◆ PI

- Project discontinued. Stopped any development.
- Maintenance of existing packages and moving them to client projects

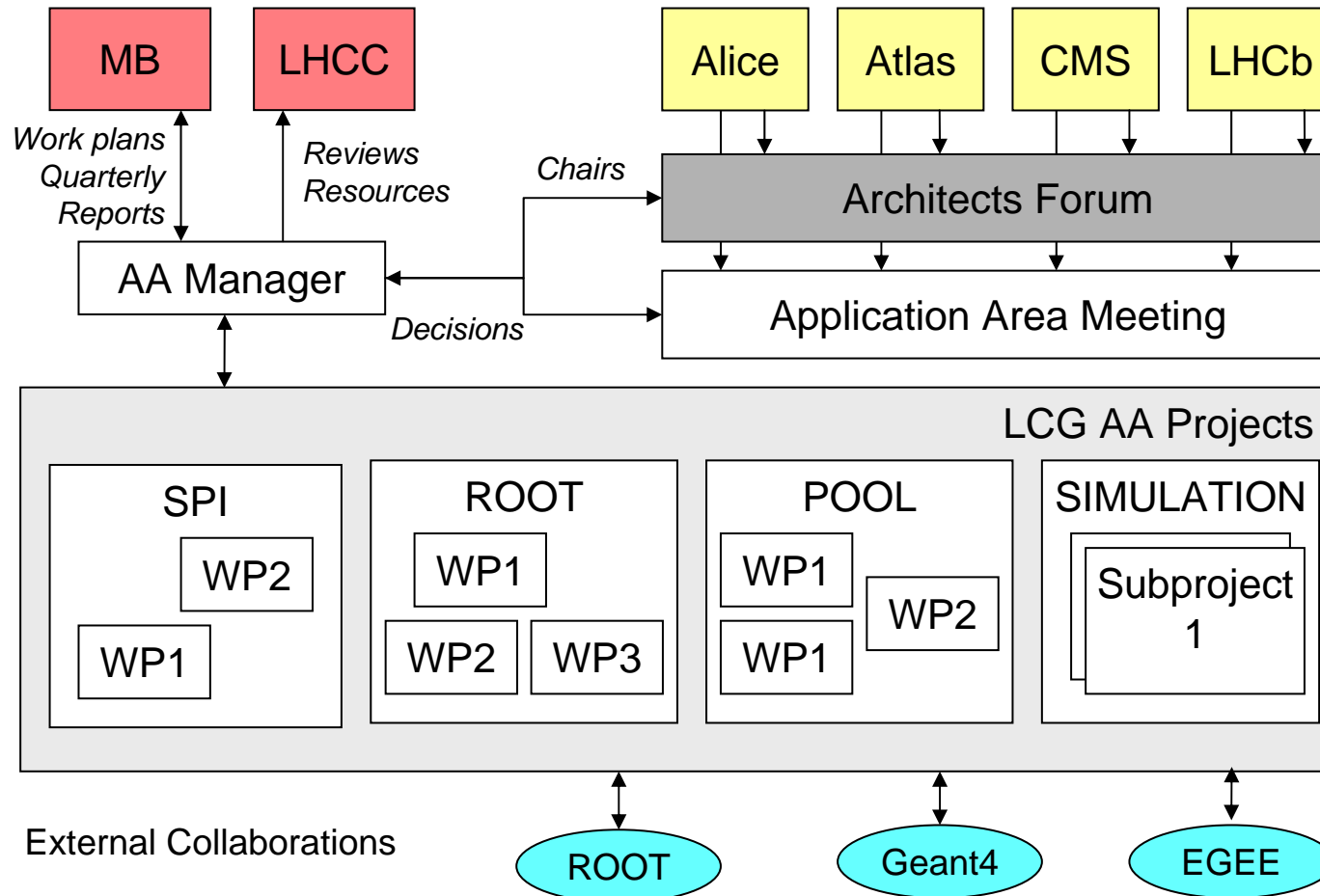
◆ SIMULATION

- Added new subproject Garfield - simulation of gaseous detectors

◆ POOL

- Basically unchanged

Applications Area Organization



AA Projects

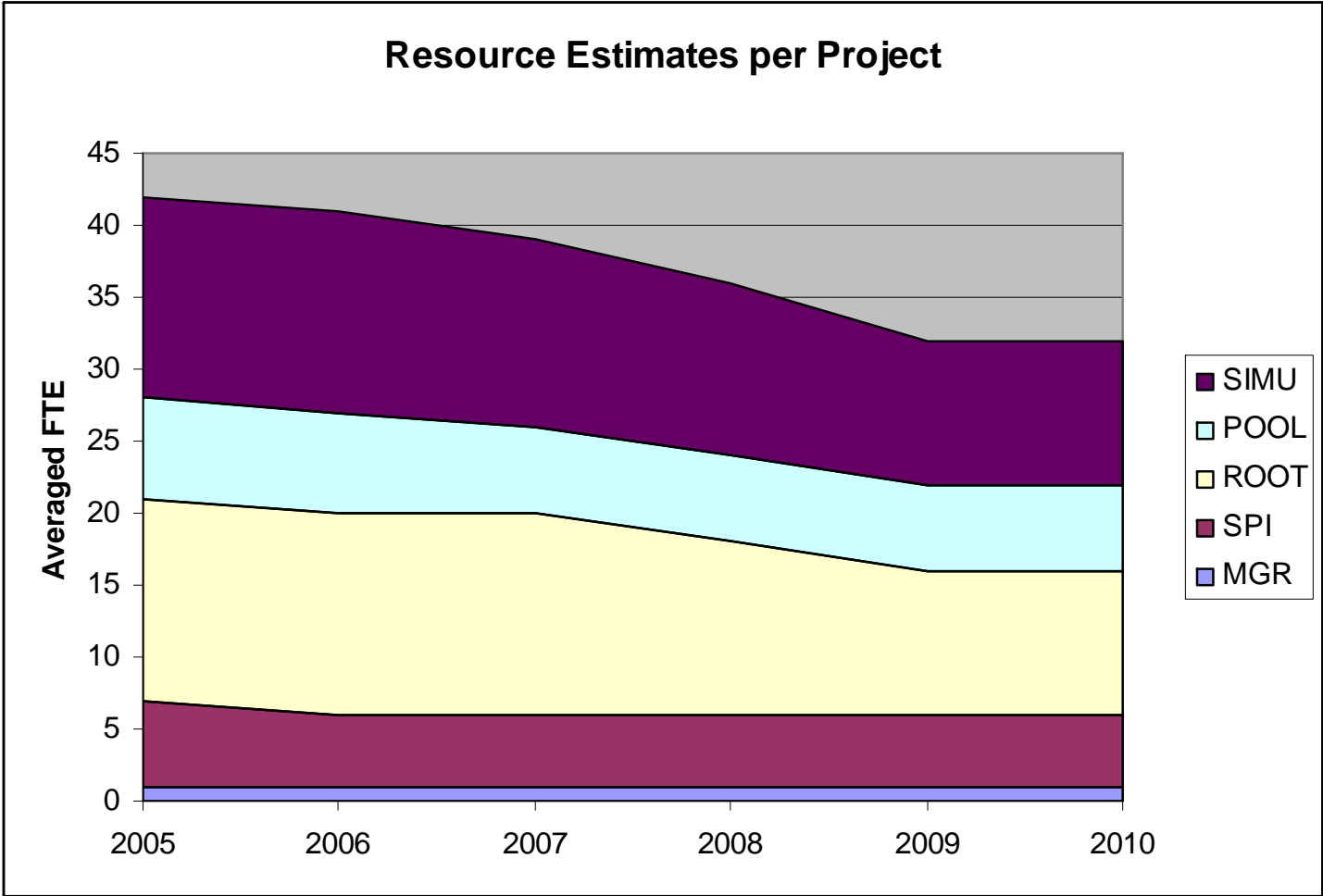
- ◆ SPI - Software process infrastructure (A. Pfeiffer)
 - Software and development services: external libraries, savannah, software distribution, support for build, test, QA, etc.
- ◆ ROOT - Core Libraries and Services (R. Brun)
 - Foundation class libraries, math libraries, framework services, dictionaries, scripting, GUI, graphics, SEAL libraries, etc.
- ◆ POOL - Persistency Framework (D. Duellmann)
 - Storage manager, file catalogs, event collections, relational access layer, conditions database, etc.
- ◆ SIMU - Simulation project (G. Cosmo)
 - Simulation framework, physics validation studies, MC event generators, Garfield, participation in Geant4, Fluka.

Resources (averaged 2005)

Project	Sub-Project	ALICE	ATLAS	BNL	CERN	CMS	EGEE	FNAL	LCG-Russia	LCG-Spain	LHCb	Other	Grand Total
MGR	(blank)				0.9								0.9
MGR Total					0.9								0.9
POOL	Catalog				0.2	0.3							0.5
	Collections		0.5										0.5
	Cool		1.7		0.8						0.1		2.6
	Mgr				0.5								0.5
	Ral				2.2								2.2
	StorageMgr		0.5			0.1					0.2		0.8
POOL Total			2.7		3.7	0.4					0.3		7.1
ROOT	Base	0.2			0.5			0.1				0.1	0.9
	Dictionary		0.2		0.6			0.6				0.2	1.6
	Geom	0.8											0.8
	Graf	0.2			2							0.8	3
	Gui			0.1	1.3							0.2	1.6
	I/O							0.5			0.3		0.8
	Math				2.15							0.1	2.25
	Mgr				1								1
	Proof	0.4			2							0.2	2.6
	Seal				0.2								0.2
ROOT Total		1.6	0.2	0.1	9.75			1.2			0.3	1.6	14.75
SIMU	Framework				0.9								0.9
	Garfield				1								1
	Geant4				7.7								7.7
	Genser				0.45	0.25			1.75	0.25			2.7
	Mgr				0.25								0.25
	Validation				1.5								1.5
SIMU Total					11.8	0.25			1.75	0.25			14.05
SPI	(blank)				3.95		2						5.95
SPI Total					3.95		2						5.95
Grand Total		1.6	2.9	0.1	30.1	0.65	2	1.2	1.75	0.25	0.6	1.6	42.75



Estimated Requirements



Main Milestones

ID	Date	Description and Validation	Notes
SPI			
SPI-1	31.12.05	Provide the tools for generating CMT and SCRAM configurations from a common generic configuration description based on XML description files. Be able to update the web and distribution's kits from the same description.	
SPI-2	28.02.06	Provide a web based "user discussion forum" service interfaced with Savannah. This new service should allow projects and experiments to easily setup and manage discussion subjects.	
ROOT			
ROOT-1	30.09.05	Make available prototypes addressing different topics for the SEAL+ROOT merge (Math libraries, Dictionary libraries, etc.) such that detailed planning for the experiments migration can be established. These prototypes should be available by the ROOT workshop at the end of September.	
ROOT-2	30.09.05	Demonstration of the new the Parallel ROOT facility (PROOF) in a cluster of 32 CPU's provided by CERN/IT. This new version of the system should include asynchronous queries, GUI session controller, interactive batch mode.	
ROOT-3	30.09.06	Demonstrate the performance and robustness of the PROOF system on typical analysis clusters of up to several 100 CPU's under a typical multi-user load doing typical LHC final data analysis on ESD and AOD data sets.	
ROOT-4	31.12.05	Finalization of the fitting and minimization application programming interfaces and integration of the new C++ implementation of Minuit in the ROOT release.	
ROOT-5	31.03.06	The Python interface to ROOT (PyROOT) adapted to directly use the new C++ reflection library (Reflex). This would avoid the intermediate software layers and additional dependencies of the current implementation, improving the overall design and maintainability.	
ROOT-6	30.04.06	The ROOT C++ interpreter (CINT) adapted to use the new C++ reflection library (Reflex). Applications will require a single dictionary with reflection information in memory. Backward compatibility will need to be provided to old ROOT and POOL applications.	
ROOT-7	31.10.06	Complete the merge of SEAL and ROOT functional components into a single set of libraries. All the functionality provided by the existing SEAL libraries will be available in the new set of libraries. End-users if they decide to do it. (experiments) can abandon the old libraries.	



Main Milestones (2)

POOL			
POOL-1	31.10.05	Production quality release of the relational database API (RAL) package, which should include the new interface recently reviewed.	
POOL-1	31.12.05	POOL framework based on new C++ reflection libraries (Reflex) available for the experiments to be used in production. Validation by the experiments completed.	
COOL-1	30.11.05	Conditions Database (COOL) release based on the latest version of RAL including bulk insertion operations and extended tagging functionality.	
COOL-2	31.12.05	First prototypes of API and command line tools for data extraction and cross-population of COOL databases. These tools are important for supporting partial or complete distribution of the experiment's conditions databases with several databases technologies.	
COOL-3	31.03.06	POOL overall performance study and validation of the experiments requirements. This study should identify the areas that will require further work and optimization.	
SIMULATION			
SIMU-1	15.12.05	Apply the Fluka-Geant4 (Flugg) geometry interface to one of the LHC calorimeter test-beam simulation.	
SIMU-2	15.12.05	Production quality release of the MC generator level production framework.	
SIMU-3	20.12.05	New Geant4 public release including positron annihilation and geometry voxelisation improvements in addition to the regular bug fixes and small improvements included on each release.	
SIMU-4	31.12.05	First results of the ATLAS combined and 2004 test-beams data comparisons.	
SIMU-5	31.03.06	Monte Carlo event generator files database (MCDB) publicly available and able to deal with large files.	
SIMU-6	31.10.06	First release of a common framework for handling MC truth information to be used by experiment's simulation programs.	
SIMU-7	31.10.06	Validation of shower parameterization packages completed. The results of the validation should be summarized in a document.	

Project Status



SPI

- ◆ Change of SPI leadership
 - *Andreas Pfeiffer replaces Alberto Aimar*
- ◆ Challenges for phase II
 - *Servicing the LHC experiments more than AA projects*
 - *Opportunity to re-think the scope of SPI*
 - *Coping with reduction of manpower*
 - » Participation from people associated to projects
 - » Optimization of procedures
 - » Automation of procedures
 - » Prioritization of tasks
- ◆ Not a lot of room for new developments
- ◆ Work guided and prioritized by Architects Forum

SPI: Concentrating on the following areas



- ◆ Savannah service
 - Bug tracking, Task management Download area, etc
 - >160 hosted projects, >1350 registered users. Users doubled in one year and many features added
- ◆ Software services
 - Installation and distribution of software (external and LCG AA projects)
 - >90 external packages installed in the external service
 - Update and maintain configuration information for the build systems
- ◆ Software development service
 - Provide tools for development, testing, profiling, QA
 - Provide scripts and documentation adapted to LCG context
- ◆ Web and Documentation
 - Maintain and improve existing web pages and automate content wherever possible

ROOT



- ◆ Provides basic functionality needed by any application
- ◆ Current work packages
 - BASE: Foundation and system classes, documentation and releases
 - DICT: Reflexion system, meta classes, CINT and Python interpreters
 - I/O: Basic I/O, Trees, queries
 - PROOF: parallel ROOT facility, xrootd
 - MATH: Mathematical libraries, histogramming, fitting
 - GUI: Graphical User interfaces and Object editors
 - GRAPHICS: 2-D and 3-D graphics
 - GEOM: Geometry system
 - SEAL: Maintenance of the existing SEAL packages
- ◆ *See Rene Brun's presentation ...*

Merging functionality (sorted by priority)

Functionality	Status
Math libraries	<i>MathCore, MathMore, Minuit</i> in ROOT 5
Vector library	New and included in <i>MathCore</i> library
Linear Algebra	Disagreements between ROOT team and experiments. Possible solutions being studied
Plugin manager	Disagreements. Delayed migration. Using SEAL for the time being.
Dictionaries	Ongoing adaptation of ROOT to <i>Reflex</i> . <i>Reflex</i> and <i>Cintex</i> in ROOT 5
Python Bindings	Converged to the PyROOT solution. Ongoing evolution.
Component Model	Using SEAL component model for the time being
AIDA support	No work done. Not in the plans



POOL



- ◆ Domain of expertise in data persistency, data management, deployment in the Grid and (relational) databases in general
- ◆ The POOL project delivers a number of “products”
 - POOL, CORAL, ORA, COOL
- ◆ Work packages
 - Object storage and references
 - Collections and Metadata
 - Database access and distribution
 - Catalog and Grid integration
 - Conditions Database

POOL, achievements, news



- ◆ Object storage and references
 - Storage manager adapted to new Reflex dictionaries
 - 64bit support
- ◆ Database access and distribution
 - Review of the API, major re-design as an independent product (CORAL)
- ◆ Catalog and Grid integration
 - New catalog interface for gLite, LFC and GLOBUS RLS
 - Interface separation between file lookup and metadata
- ◆ Conditions Database
 - Multi-channel bulk retrieval, support for very large character data (CLOB) and full support for SQLight as backend
 - Significant performance improvements
 - Python interface (PyCOOL)
 - Being validated by ATLAS and LHCb
- ◆ *See Giacomo Govi's presentation...*

SIMULATION, news/achievements - 1

- ◆ New subproject **Garfield** added (Rob Veenhof leader)
 - Implemented interfaces with Maxwell 2D (Ansoft) FEMLAB and Tosca packages.
 - Implemented interface with a new version of Magboltz (program computing the transport coefficients for electrons in gas mixtures), and with a new version of Heed (program simulating ionization processes in gas mixtures).
- ◆ Fluka
 - Major release of Fluka-2005.6 released in July 2005
 - » First under the INFN-CERN agreement (including the source)
 - » Removed PEMF preprocessing stage
 - » Completion of the (online) radioactive decay module
 - » Publication of CERN Yellow Report (CERN-2005-10)
 - » Extension of the PEANUT model to anti-nucleons
 - » Agreed installation in the LCG area
 - Updated Flugg to work with the recent versions of Geant4

SIMULATION , news/achievements -2

◆ Simulation Framework

- GDML - extended schema; new converters (in Python/C++) to import/export detector descriptions in Geant4, Flugg and Root
- Object persistency - prototype implemented for direct object persistency of Geant4 detector description classes (geometry, materials)
- Python - Geant4 steering module using LCGdict/PyLCGdict
- MC-truth - new work package aiming to identify common approach for handling Monte Carlo truth in the experiments

◆ Physics Validation

- ATLAS TileCal 2002 test-beam: application of Flugg and GDML for study response of Geant4 and Fluka against data
- First results on LHCb background radiation studies with Geant4 presented; new fellow A.Howard to progress in the activity
- New results in the verification of Geant4 longitudinal hadronic shower shape for ATLAS and CMS
- Going on activity for the analysis of the ATLAS Combined Test-Beam
- 3rd simple benchmark identified and first preliminary results
 - » Rapidity and transverse momentum distributions of inclusive charged pion produced in 100 GeV hadron (pions, kaons, protons)-nucleus (Mg, Ag, Au) interactions



SIMULATION, news/achievements - 3

◆ Geant4

- New major release: 7.0 (December 2004) and 1 patch (March 2005)
- New minor release: 7.1 (June 2005) and 1 patch (October 2005)
- New developments and improvements included in 12 development releases during the past year
- Validation testing suite created and adapted for use in batch and GRID environments
- LCG note (CERN-LCGAPP-2005-02) of Geant4 validation in LHC experiments simulation production
- New Collaboration Agreement finalised and sent to the Geant4 Collaboration Board (CB) members for final endorsement

◆ Generator Services

- *See presentation by Paolo Bartalini*



Concerns and recommendations from LCG Comprehensive Review in 2004



"The LHCC noted the delays in the integration and validation of the FLUKA package arising from the lack of manpower"

- ◆ The new Fluka has been released in July 2005.
- ◆ The new Fluka together with Geant4 is used and well integrated in the current Simulation Framework and in the Physics Validation sub projects
 - Extensions to FLUGG and usage of GDML to exchange geometry descriptions)
 - ATLAS calorimeter test beam and 3rd simple benchmark
- ◆ New man-power has been added to Simulation Framework and Physics Validation with Manuel Gallas.
- ◆ The new version of Fluka will be now regularly distributed through LCG/SPI and the infrastructure for it has been already put in place.

"The LHCC expressed concern regarding insufficient coordination between AA and the developers of ROOT, which has contributed to delays and uncertainties in AA/ROOT integration in areas such as dictionary convergence and POOL file support in ROOT"

- ◆ We think that the new organization of the Application Area including the ROOT project (with the merged SEAL+ROOT team) under the LCG umbrella with direct participation of the experiments in the decision making process goes in the right direction
- ◆ The practical difficulties are sorted out when they appear

"The Committee noted the concern of LCG Project team over the long-term continuity of personnel and the long term support of products such as the Mathematical Library"

- ◆ This concern has been addressed by the new set of LCG posts. These posts ensure sufficiently the continuity of the program of work in the AA.

Other issues, concerns

- ◆ Coordination between areas for consistent external software configurations
 - POOL has suffered the most
- ◆ Time to build/release the complete software stack (from externals and ROOT to Experiment final programs)
 - Experimentally is about a week
- ◆ Fortran compiler replacing g77 (g95 vs. gFortran)
 - Mainly affecting MC generator codes

Conclusions

- ◆ Plan revisions and updates
 - Quarterly updates as part of the LCG quarterly report
 - Annual updates per project also foreseen
 - Annual/18 months updates in "AA internal reviews"
- ◆ Detailed planning (e.g. scheduling bug fix releases, configuration changes, etc.) discussed and agreed at Architects Forum meetings
- ◆ The projects in AA has made substantial progress in many aspects
- ◆ The Applications Area was organized by Torre more than three years ago. The projects and the organizational structures are mature now