This quarter saw important changes in the scope and structure of Applications Area activities as well as significant advances in the work of the project. Two major new projects were initiated, the Physicist Interfaces Project (PI) and the Simulation Project. The PI project received SC2 endorsement to commence work in well defined areas after an initial workplan was presented, and work has begun. A Simulation Project structure and organization were defined and a leadership team was assembled which developed a workplan submitted to and approved by the SC2. The plan involves major efforts in a generic simulation framework, the simulation engines to be used in it (Geant4 and FLUKA), physics validation and generator services. An existing project, the Mathematical Libraries Project, was incorporated into the SEAL project. As a result of these changes the Applications Area WBS has seen some changes this quarter, and the WBS numbering in this report reflects the changes. Work in existing projects made important advances. SPI's web development portal, Savannah, received enthusiastic endorsement and broad adoption among LCG projects and LHC experiments. POOL released a new version able to store objects of greater complexity such that testing against realistic event models of the experiments can now begin. It makes use of new SEAL dictionary services which support object definition via C++ header files and loading of the LCG dictionary. POOL and SEAL are on track to meeting the major milestones of the next quarter, pre-production and production releases of POOL (including SEAL components) in April and June.

An assessment of needed vs. available manpower in the SPI project through 2003 as current people transition to other projects is pending and must be completed in the next quarter. A concern with respect to the future schedule is the continuing absence of the distributed aspects of the physicist interface from the scope of the project, which may necessitate the modification and/or delay of Level 1 milestones in distributed production and analysis currently scheduled for November 2003 and April 2004.

LCG-funded manpower was stable during the quarter, with one new arrival (assigned to SPI). Increases were seen in the participation of the experiments, most notably in the simulation project, and in IT/DB’s POOL participation.

**WBS 1.1.1 - Software process and infrastructure (SPI)**

Project Leader: Alberto Aimar, CERN IT/API

In this quarter the SPI effort was devoted to fulfilling the milestones planned and agreed with project management and the SC2 in October 2002. At the beginning of the quarter the project was staffed with a total of ~7FTE. The main SPI goals of this quarter were to stabilize the services already available in a beta status in the previous quarter. Most of the general services are available to all parts LCG project and beyond, e.g. to the LHC experiments.

One major challenge for SPI in the next quarter is to manage the transition of people that have worked in SPI as they move to new projects. As per the project plan they are replaced with newcomers in the SPI project but in some cases this can be difficult. It will be vital to reach a stable equilibrium in which the available resources are sufficient for the support and maintenance of stable and robust services plus any continuing development that is needed.

SPI maintains and manages the CVS repositories of the other LCG Applications Area projects (Seal, Pool, PI) and also of the LCG Grid Deployment projects. Waiting for a general CVS service in IT that is under definition, SPI provides a service that is adequate for the current size of the projects hosted.
In December 2002 SPI started to organize and structure a service to provide "external software" needed by the LCG projects. The purpose of the service is to provide all the software packages (libraries and applications) needed by the LCG projects so that they do not need to perform the installations themselves. The service provides, in March 2003, about thirty packages in the versions and platforms needed by the projects. SPI has defined a standard procedure to provide these installations and a well documented web-site for documenting the external software installed.

The web-based "project portal" for software development based on Savannah is available and in production since the end of the previous quarter. This service has proven to be very popular, and is now in use by the LCG projects and by more that twenty projects in the LHC experiments. SPI added integration to the existing CERN facilities, such as CERN mailing lists, Kerberos authentication of the portal users, bulk registration of users via import of lists from external files. Every effort has been made to communicate changes and needs to GNU Savannah developers such that we can keep in phase with the ‘official’ version of Savannah, but we have had difficulty getting responses from the GNU Savannah team.

Scram was chosen as the software configuration tool for the Applications Area in December 2002. In this quarter the main task of SPI was to improve the performance, begin the port to Windows and help all the LCG projects to use Scram in their February releases. Now SPI is working on standardizing the usage of Scram and training users.

SPI improved the automatic system to generate "code documentation" (Doxygen, LXR and ViewCVS) by also collecting log information on the operations done on the repository (commits, updates, etc), SPI has deployed a "testing framework" to standardize the way projects perform unit and regression testing. CppUnit and Oval which have been available for some time are now effectively used by the projects, and SPI also support PyUnit for testing of Python applications. Other services that we keep available are a memory leak finder (Valgrind), guidelines for coding and design, and standards for CVS repository structure and release directory structure.

In order to have the infrastructure used effectively by the LCG projects, SPI assigned resources to help in a practical way the projects and perform a "quality assurance" function by actively encouraging LCG projects to use the SPI development guidelines and testing facilities. The QA infrastructure is under definition and suffers from the fact that CERN resources assigned to it have changed due to causes external to SPI and LCG. New resources have been assigned and a new person will be ramping up in this area in the next quarter.

SPI started to organize training courses as needed by the LCG users. In February SPI and the ROOT team organized a three day course on ROOT. A tutorial on Scram is being prepared for early in next quarter and the ROOT course will be repeated, video-recorded and made available on the Web.

An automated (‘nightly’) build system was selected for LCG use, the NICOS system developed and used by ATLAS. An initial installation conducting prototype automated nightly builds of POOL was set up. Needed improvements and features are currently being solicited from the projects. The system needs take-up and feedback from the projects to make it a useful deployed tool, and we expect this to happen in the next quarter.

The first version of the SPI services is basically ready as per the plan presented at the SC2 last fall. The automated build system needs take-up and refinement based on feedback from the projects as mentioned. In addition to the integration and replacement of people, the main features that will be tackled in Q2 are the distribution of LCG software and completing a consistent and well-documented "workbook" for the SPI services. The SPI project continued to benefit tremendously from a very effective group of LCG supported hires working on the infrastructure.
WBS 1.1.2 - Persistency framework (POOL)

Project Leader: Dirk Duellmann, CERN IT/DB

During this quarter one major POOL release (V0.4) has been produced with only minor (1 week) delay with respect to its schedule. This release further extended the functionality of the POOL framework, integrated POOL with a first pre-release of SEAL, and added compliance with the CVS structure as defined by SPI. Both POOL and SEAL now use a common SCRAM ToolBox defining the set of external packages and are installed in a single LCG release area.

Significant limitations of the POOL storage manager – the support of only elementary types and structures of them – have been relaxed with V0.4, which adds support for C++ arrays and standard library containers (std::vector and std::list).

While POOL V0.3 still required user written dictionary code to persist user objects, this requirement has been removed in POOL V0.4 which uses the SEAL dictionary generator to automatically generate dictionary code from C++ header files. Several low level services and facilities have been factorised out of POOL and moved into the SEAL project as they where not specific to the persistency framework implementation: message service, base classes for exceptions and status code.

The POOL internal release procedure has been streamlined – tag numbering and release rules have been introduced which are also being evaluated for use in other LCG projects. The build of consistent sets of package tags has further been automated via a set of python scripts around SCRAM as central configuration management tool. Both allowed significant improvement in the latency between a developer package tag announcement and the release of a complete (internal) build of POOL in the shared release area.

Three presentations on various aspects of POOL were accepted and presented at CHEP 2003. A POOL release schedule for 2003 was proposed to PEB and presented to the experiments, to no objection, and is now the basis for planning. S. Tomar from CAT, Indore, India stayed at CERN for one month to discuss and document the requirements for a RDBMS based proof-of-concept implementation of the pool storage manager. This is an exploratory, non critical path effort and is thus well suited to an effort remote from CERN.

Not directly as part of the POOL project but still very relevant for POOL are the functionality and robustness improvements in ROOT which have been developed in response to requirements for ROOT based persistency in ATLAS and CMS. In particular the use of ROOT in environments with updates to existing files has been significantly stress tested and improved, and the support for STL persistency has been significantly extended and improved.

There were some arrivals and departures during the quarter, but overall there were no major changes in POOL manpower. IT/DB undertook greater involvement in the collections work package to respond to manpower shortages in that area.

Next quarter are vital milestones for the POOL project: the V1.0 production pre-release in April, and the production release in June.

WBS 1.1.3 – Core libraries and services (SEAL)

Project Leader: Pere Mato, CERN EP/SFT

The first version of the program of work for the SEAL project was presented to the SC2 on January 10th 2003 and approved, but the SC2 would like to see the project status at the first important milestone (release of a pre version 1) to be presented in the April SC2. The Mathematical Libraries project has been incorporated into the SEAL project as a work package starting from February. It was felt that the project overhead of a separate project was disproportionate to the scope of the work in math libraries. In addition to Matthias Winkler and
Fred James that were working on the MathLib project, the development team has been extended with Christian Arnault, RD Shaffer and Zhen Xie to work in the LCG dictionary work package and with Radovan Chytracek to work in the foundation libraries and plugin management.

- **Foundation libraries.** We imported the ClassLib library (CMS) to the SEAL repository. For the time being it is to be used internally by SEAL while we make the proper extraction and adaptation to the agreed conventions. It provides a few basic classes to be used by POOL, released as part of the v0.1 pre-release at the end of February.
- **Plugin Management.** The design of the low level plugin management mechanisms has been defined. The first implementation based on the Iguana (CMS) one is being implemented.
- **Math Libraries.** The prototype of Minuit in C++ is being moved to the SEAL CVS repository following the agreed structure and conventions. This prototype implements Migrat and Minos functionality.
- **LCG Dictionary.** The Reflection packages moved from POOL have further developed and minor problems have been fixed. A new package (DictionaryGenerator) has been developed to generate the dictionary C++ code form header files using the gccxml tool and has been released as part of the v0.1 pre-release end of February. This package is used in the ‘CMSEExample’ test software to exercise the functionality and identify any problems with the CMS event model. Similar work is being done with the ATLAS ‘GuineaEvent’ test software.
- **Scripting Services.** The evaluation of the existing products (SIP, Boost.Python, SWIG, raw Python API) to build python extension modules has started. Two examples are being used for this task: The ROOT extension module (PyROOT) using Boost.Python and the GSL extension module (PyGSL) using directly the Python API.
- **Basic Framework services.** We just started to identify the components and their basic design.

Two pre-releases of the SEAL software were produced at the end of February. The main emphasis has been the delivery of the dictionary generation and as an exercise of integration with POOL under SCRAM. The first version of the release and test infrastructure has been developed and the team members have acquired some experience with it. At the end of the quarter the first public release was being readied, as scheduled. Major milestone next quarter is the release of SEAL V1.0 with essential functionality sufficient to be adopted by the experiments, and first versions of basic framework services and scripting support.

**WBS 1.1.4 – Physicist Interface (PI)**

Project Leader: Vincenzo Innocente, CERN EP/SFT

The Physicist Interface project was established on 25/11/2002. It encompasses the interfaces and tools by which physicists will directly use the software. It was supposed to cover interactivity (the "physicist's desktop"), analysis tools, visualisation, distributed analysis, and grid portals.

In order to evaluate requirements, constraints, expectations, and identify possible common products and projects, the project leader met representatives of the computing and physics groups of the four LHC experiments during the month of December. Contacts were also established with other possible clients and providers such as EU- and US- grid projects, Geant4, Root, computing groups in other major HEP laboratories and other LCG project areas. This survey was used as a base of a project proposal that was presented at the SC2 on January 29th that encompassed four work packages: WP1 - Analysis Services; WP2 - Analysis Environment; WP3 - Grid Physicist Interface; WP4 - Event & Detector Visualisation. A fifth work-package, WP5 - Infrastructures & Documentation, was added later to group all supporting activities. SC2, on February 7th, decided to approve the WP1 and WP2, delay WP4 to May, and to re-scope WP3. SC2 also advised to further study the sharing of responsibility among SEAL, POOL and PI projects for many of the components of WP2.
Following the decision of SC2, Andreas Pfeiffer and Lorenzo Moneta joined the project both at 50% of their time. Andreas took the responsibility of the Analysis Services work package and will also act as liaison with SPI. Lorenzo is contributing to the software development in WP1 and will be responsible of the contact with the experiments. During this first quarter work has concentrated mainly on WP1 and WP5.

The project was presented in the Application Area Meeting on March 12th.

WP 1.1 - AIDA: Preparations for a review of the AIDA interfaces have started by defining and implementing a "Proxy layer" on top of the existing AIDA 3.0 interfaces. This layer will provide analysis objects with "value semantics" while preserving and exposing the full functionality of the AIDA interfaces. Together with documentation and examples, the library will then be used as a basis for a user-review of the AIDA interfaces. A first release of these components is foreseen for March 19. An open presentation in the Application Area Meeting is foreseen for April 9th.

WP 1.2 - Root implementation of AIDA: This work package will provide an implementation of the AIDA interfaces, as defined by the previous work package including the feedback from the user-review, based on Root.

WP 1.3 - AIDA interface to SEAL and POOL services: Use of SEAL and POOL to provide AIDA with services such as object blackboard and persistency. This work package will be started once the user-review of AIDA has been finished and after a more detailed definition of the needed SEAL and POOL services.

WP 5 - Infrastructures & Documentation: A web portal to the project has been made available. A Savannah code development portal for the project has been established. A CVS repository has been set up. It has been fully configured with SCRAM. The SPI-supported code browsing tools view-CVS, lxr, and Doxygen have been made available.

WBS 1.1.5 – Simulation

Interim Project Leader: Torre Wenaus, BNL/CERN EP-SFT

During this quarter the new Simulation Project took shape, following the mandate of the SC2 in December and the guidance of the Simulation RTAG and the MC Generator RTAG. Broad consultation with experiment computing leaders, experiment simulation experts, simulation engine developers and others led to a proposal for a broadly scoped but cohesive simulation project consisting of several subprojects, several of them large themselves. A strong team of subproject leaders was assembled. The overall project leader role, currently held by T. Wenaus on an interim basis, will be a relatively ‘thin’ role to provide overall vision, coherence and coordination. The defined subprojects and their leaders are: Generic Simulation Framework (Andrea dell’Acqua); Geant4 (John Apostolakis) encompassing the LHC participation in Geant4; Fluka Integration (Alfredo Ferrari); Physics Validation (Fabiola Gianotti); and Generator Services (Paolo Bartalini). The project leader team developed a workplan laying out work packages, priorities, needed and available manpower, milestones and deliverables across the defined subprojects. The plan was presented to and approved by the SC2 in March, and project activities were commencing at the end of the period. The project is seeing very good support and participation from the experiments and the simulation projects. Priorities for the next quarter are defining the high level design and implementation approach of the generic framework, establishing an initial support infrastructure for MC generators, and reviewing simulation physics requirements.

WBS 1.1.6 - ROOT participation

The LCG applications area contributes effort to the ROOT project. ROOT is used to implement vital parts of applications area software such as the object streaming technology of
POOL. The LCG-contributed effort to mainstream ROOT development areas liberates the core members of the ROOT team to devote greater time to the specialized developments in ROOT I/O and elsewhere required by LCG software. Ilka Antcheva and Valeriy Onouchine are LCG-supported personnel contributing to GUI development, documentation, and a new implementation of ROOT on Windows using Win32GDK. During the quarter the ROOT team collaborated with POOL participants to provide ROOT extensions necessary for dictionary cross-population between POOL and ROOT and for supporting POOL persistency of STL containers using ROOT. In addition, LCG-funded effort in the person of Gerardo Ganis (working with ALICE and ROOT) contributes directly to Applications Area related activities in distributed analysis; specifically in this quarter to the adaptation of ROOT’s distributed analysis facility PROOF for the use of Grid-based authentication.

**WBS 1.1.7,1.18 – Core/Grid Interface & Experiment Integration**

Through this activity the Applications Area provides direct assistance to the experiments at the interface between core software and the grid, and supports the adaptation of physics applications the grid environment. At present the Applications Area provides two LCG-supported people for this area. Oxana Smirnova works with ATLAS on the integration and deployment of ATLAS simulation and reconstruction production on the grid – currently on the EDG testbed and soon on LCG-1. She also represents the Applications Area on GDB/WG1 and on the GAG. Gerardo Ganis works with ALICE and the ROOT team on different aspects of Grid-enabling ROOT as discussed earlier.

**Milestone performance during the quarter**

**WBS 1.1.1 - SPI:**
- Full infrastructure suite including nightly builds in place (Feb)
  - Completed end Feb, with the last element of the nightly build system officially installed and doing nightly prototype POOL builds. Project take-up of the system still required (see new milestones)
- SPI workplan for 2003+ approved (Mar)
  - Incomplete. Principal outstanding issue is personnel profile, matching need and availability, still being worked. Probably OK barring unexpected departures, but still has to be laid out in a plan. New date: end May.

**WBS 1.1.2 - POOL:**
- POOL workplan for 2003+ approved (Feb)
  - Completed March 5 with the presentation – to no objection – of the 2003 workplan.
- Persistency support for objects with STL containers, and driven from C++ header file descriptions [joint with SEAL] (Mar)
  - Completed with the March 7 release of POOL V0.4, which uses SEAL V0.1.1

**WBS 1.1.3 - SEAL:**
- Establish external software decision process (Feb)
  - Incomplete. Victim of higher priorities in addressing immediate POOL needs.
- Joint POOL/SEAL milestone above (Mar)
  - Completed, see above
- Math libraries initial workplan approval (Jan)
  - Completed in January with the SC2-agreed assimilation of math libraries as part of SEAL, and an initial program focusing on GSL enhancements in India and Minuit re-engineering in C++ at CERN

**WBS 1.1.4 - PI:**
- Report on experiment consultations (Jan)
  - Completed in January
- Initial workplan approval (Feb)
  - Completed in February

**WBS 1.1.5 - Simulation:**
- Project launch (Feb)
  - Completed end January with the establishment of high level project organization and leader; project plan begun
- Initial workplan approval (Mar)
  - Completed in March with SC2 presentation and approval of workplan

**Anticipated important near term milestones**

**WBS 1.1.1 - SPI:**
- Software library complete (May)
- SPI 2003 workplan including manpower profiles complete (May)

**WBS 1.1.2 - POOL:**
- POOL pre-production release (Apr)
- Nightly builds deployed in POOL (May)
- POOL production release (Jun)

**WBS 1.1.4 - SEAL:**
- First set of GSL enhancements available (May)
- SEAL V1.0 release (Jun)
- Nightly builds deployed in SEAL (Jun)
- Establish external software decision process (Jun)

**WBS 1.1.5 - PI:**
- AIDA interface review completed (May)
- PI analysis environment project definition completed (May)

**WBS 1.1.6 - Simulation:**
- Generator librarian and alpha version of support infrastructure in place (Jun)
- Generic framework high level design and implementation approach defined (Jun)
- Simulation physics requirements revisited (Jul)