COMPUTING

Introduction & Status



<u>L. Tomassetti</u> University of Ferrara and INFN

on behalf of the SuperB Computing Group

	Tuesday, September 13, 2011		Wednesday, September 14, 2011		Thursday, September 15, 2011
8:00	Registration				
8:30	PLENARY	8:30	PARALLEL 4	8:30	PARALLEL 8
5 20 30 25 20	Introduction and Status Welcome Project status (M. Giorgi) Physics (A. Bevan) Detector (F. Forti) Computing (L. Tomassetti)	FB 320 FB 321 FB 240	DET: ETD COMP: FULLSIM PHYS	FB 320 FB 321 FB 240 tbc	DET: ETD COMP: R&D PHYS DET: INTEGRATION
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FB 323	IFR			11:30	PLENARY
					TOPICAL SEMINAR (J. ELLIS)
12:30	Lunch	12:30	Lunch	12:30	Lunch
14:00	PARALLEL 2	14:00	PARALLEL 6	14:00	PLENARY
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Computing Sessions



OUTLINE

- Efforts devoted to develop and support software tools and a computing infrastructure needed for carrying out detector design and performance evaluation studies for the Detector TDR
 - Full Simulation
 - Fast Simulation & Physics Tools
 - Distributed Computing
 - Collaborative Tools

R&D Program for the future activities (and the Computing TDR)

FULL SIMULATION

Packaged version

- Already presented at Elba meeting
- Better code maintenance and development
- Ability to produce detector-specific packages
- Results identical to monolithic version
- Migration has been completed
- Developments on legacy Bruno stopped



A. Di Simone

FULL SIMULATION

- Robustness improvements to minimize the crashed / failed / frozen jobs in production
 - Better handling of 'stuck tracks' by introducing a custom exception handling, which kills the problematic track only, instead of killing the full event
 - Polycone geometry instead of tube sections to overcome a bug in the G4 libraries, that resulted in jobs hanging

A. Di Simone, E. Paoloni, A. Perez

FULL SIMULATION

- Production Tools have been adapted to the new packaged structure
- The latest FullSim production has been completely done using the new version
- BRN code validation:
 - Rad-BhaBha events (10% of Elba 2011 production)
 - Comparison with latest Elba production (old Bruno code)
- New Fwd-EMC geometries:
 - Rad-BhaBha events (20k bunch crossings)
 - Study of different Fwd-EMC geometries (CSI and BGO crystals)
- Touschek simulation Touschek losses from STAR code (Manuela Boscolo)
 - Use losses as primaries for Bruno simulation
 - Samples for LER and HER losses are being analysed
- Background frames production for FastSim:
 - Short production is being validated
 - Larger scale production in the coming days

Do not miss the FullSim and the Background parallel sessions on Wednesday

A. Perez

FAST SIMULATION

- Development efforts in the last months:
 - recommended release for general users is V0.2.7
 - development release V0.3.0 under validation (to be completed by September)
 - Major changes include:
 - migration from CLHEP HepAList's to std::vector<T>, from HepString's to std::string
 - Decoupling of generator packages from FastSim packages through a new intermediate package, so they can be used in FullSim without bringing in unwanted linking dependencies

M. Rama, et al.

FAST SIMULATION

- Next production will use the new V0.3.x release
- It will be focused on Physics studies
- The Physics group will identify the interesting channels in the next few months

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 Tentative schedule is: end of 2011, beginning of 2012

FAST SIMULATION

- Fast simulation tutorial (for beginners) in the Joint Computing + Physics session on Wed 24 at 11am
 - Part I: overview of FastSim
 - Part II: interactive tutorial
- See the Indico agenda for more details

The requirements to follow the second part interactively are:

- having installed a test release before the session (or just play with the output ROOT files),
- having ROOT (>5.20 if possible) installed on the laptop.

PHYSICS TOOLS

- Many opportunities to contribute:
 - detector response simulation in FastSim (SVT, DCH, DIRC, EMC, IFR)
 - PID selectors
 - simulation of background
 - physics analysis tools (tagging, vertexing, ...)
 - development of 'skims' for physics studies
 - documentation

for more information contact M. Rama

Refactoring of the production tools:

A. Fella, E. Luppi, LT

- Framework moved to template technology (✓)
- New Bookkeeping database schema adopted (✓)
- Grid authentication adopted in job/database communications (✔)
- Job script ported to python (✓)
- FullSim production on the Grid is under development (by Sept.)
- Setup and integration of new Grid monitor services (by Sept.)
- Production data distribution: via job or via Grid service (test)

See the Distributed Computing session on Wed 14 at 14:00

- 19 sites are enabled for SuperB production nowadays
 - The following are the information about on going site enabling process:
 Thanks to the site contacts for the valuable work
 - Ohio Supercomputer Center (OSC),
 Contact: Rolf Andreassen
 Status: testing
 - INFN Catania
 Contact: Giuseppe Platania
 Status: software installation
 - Polish Grid (PL-Grid)
 Contact: J. Chwastowski
 Status: VO enabling in progress

CNAF operations

- Storage system layer upgrade (Next week)
 - Frontend and backend separation (improvements in load balancing and reliability)
 - File transfer via http protocol and improvements on monitor
- CNAF disk space: user area and production repository anticipated 50TB added to gpfs_superb, total 100TB – Next week
- **FTS** (File Transfer Service) is activated and successfully used on the channels: CNAF ⇔ IN2P3 and CNAF ⇔ RAL
- LJSFi The Light Job Submission Framework for Installation
 Distributed software management Start in October
- CVMFS CERN Virtual Machine FS
 Experiment software distribution Start in October

A. Fella, et al.

User Tools for Grid access

- The GANGA SuperB layer is under development
- Use cases: analysis and personal production
 - Automatic job data preparation
 - Automatic running site selection
 - Job stage out setup configuration
 - On line job monitoring
 - Integration with bookkeeping DB
 - End of September: GANGA hands on meeting

See the Distributed Computing session on Wed 14 at 14:00

A. Fella, et al.

- Distributed Framework evaluation (R&D)
- Dirac system:
 the use case for analysis has been successfully tested
 - production use case under test
- PhEDEx system: starting phase
 - Requirement evaluation
 - Group under definition
 - Testbed instance will be installed at CNAF

COLLABORATIVE TOOLS

SuperB Portal System

S. Longo, et al.

- The new Liferay based Portal System is up-and-running at <u>http://superb.infn.it</u>
- Integration of tools inside the portal:
 - Joomla collaboration site content: completely available through the portal
 - Alfresco Document Manager: integration is completed, also with SSO
 - Wiki: available inside the portal, SSO is on the way
 - Software Repository (Trac): available through the portal.
 SSO feasibility already demostrated, will be implemented as soon as possible
 - «New user registration» procedure implemented.
 Will be improved with new features (registration to mailing lists, etc.)
 - Forum: online in the tools section of the portal, ready to be tested by collaboration members

COLLABORATIVE TOOLS

Administrative Database

- A new Database was developed to host SuperB members related data: contact information, affiliations, groups, collaboration and council membership, fields of interest, etc.
- The Database is available through the portal, with different views depending on the user role
 - Guests can access the list of division and collaboration members
 - Users can access and modify their own contact information
 - Principal Investigators are allowed to modify data related to their institution and to consult the list of users belonging to the same institutions
 - HR Managers can access the full dataset, i.e. the complete list of users with their affiliation, the list of institution, groups, collaboration, etc. (with full write access)

- The Second SuperB Computing R&D Workshop has been held in Ferrara on July 4 – 7, 2011
- The covered topics have been:
 - New CPU Architectures, GPU's and Framework
 - Machine Control System / ETD / Online
 - Software Development Tools
 - Distributed Computing
 - Storage

See the Computing R&D session on Thu 15 at 8:30

P. Elmer, et al.

New CPU Architectures, GPU's and Framework

- Next generations of generic computers will contain several multicore vector cpus connected with manycore accelerators
- Efficient software will require a design that highlights parallelism
 - Novel problem decomposition
 - High granularity task (allow global optimization of DAG)
 - Explicit memory model
- The Event Processing Framework will have to enable such an approach

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- Task scheduling
- Memory Model & Data transformation
- Library of optimized algorithms

V. Innocente, et al.

New CPU Architectures, GPU's and Framework

- Optimization on many cores:
 - Efficient use of shared resources
 - Minimize communication
 - Remove synchronization-barriers
 - Streamline code to allow vectorization
 - New programming paradigm: Think local and parallel! Decompose a problem vertically (parallel) first, then horizontally (sequentially); prefer deterministic algorithm to recursion, hit/miss
- Make (part of) FastSim, Reco running on Intel-Mic
- Port to GPU critical components of GEANT4, RootFit, other...

- Machine Control System / ETD / Online
- A first meet and greet of the Machine Control System R&D and Detector ETD/Online R&D efforts
- Continue the discussion between Accelerator Computing / Control Systems and SuperB Online
 - Determine overlap / common R&D topics
 - Find ways to collaborate
- Ideas for follow-up workshops
 - Accelerator control workshop (October? Frascati?)
 - Add a "Control Systems Day" to the forthcoming ETD/Online workshop for TDR writing (November? CERN?)

S. Luitz, et al.

Software Development Tools

- Take decision on good development planning and policies + QA early
- Must take decision on what/how much BaBar code will be kept by SuperB
- Code parallelization may take advantage of QA tools:
 - Extend analysis of SuperB code (valgrind, igprof)
 - It should also help identifying the code to be rewritten from scratch
- Think about building tools:
 - CMake, Git, Etics, ...
 - most require a clear and clean definition of development workflow
- More coordination among developers (Fast and Full) to identify common strategies and policies

M. Corvo, et al.

Software Development Tools

- Activity is in progress in order to provide SuperB with a new framework which is able to exploit the new CPUs' architectures (multi/many cores)
- Experience with the old (BaBar) system in order to understand its mechanisms is needed:
 - Isolate the current framework, build it as a standalone tool and use it to execute some exercises ('Hello World' to start with)
- Parallelization exercises: Analysis / Algorithm level
 - Extend the exercises trying to define a (simple) graph of dependencies among some (possibly few) physics modules and algorithms in order to exploit parallel scheduling
 - Evaluate some products: Intel Thread Building Blocks (TBB), Apple
 Grand Central Dispatch (GCD), Boost.Task . . .
 M. Corvo, et al.

Distributed Computing

- LHC experiments trend has been summarized
 - Beyond MONARC ⇒ full mesh connections, no more strict Role/use-case per site relationship
 - Job submission: pure data driven \Rightarrow dynamic data placement
 - Job data access: $LAN \Rightarrow WAN$
 - Job data access: read only data and meta-data via http based + caching systems
 - Currently, job is piloted
- Design information to be taken into account for future plans have been collected on various aspect of HEP distributed environment:
 - Workload management, data access, data placement/transfer, metadata management, data structure, ...
- R&D work proposal:
 - Define a prototype design for each of the macro subject starting by the up to date LHC solutions/trends

A. Fella, E. Luppi, LT, et al.

Distributed Computing

- Job data access
 - Explore http/webdav data access frameworks
 - CVMFS for read-only job file access
 - Frontier evolution studies (starting later)
 - EOS/NFS4 data access by jobs in WAN scenario (with storage group)
- Data transfer management system, comparison
 - Phedex system evaluation
 - P2DP system evaluation
- Grid resource management framework
 - Evaluation of Dirac system (on going)
 - Evaluation of PANDA system

Storage

- Indentified some key issues:
 - What will be the datacenters involved in SuperB data analysis?
 - What are the main point-to-point network flows that we expect to have?
 - It would be important to get realistic benchmarks in term of I/O usage
- Local Storage System tests:
 - Going on testing users code against interesting storage solutions: Lustre, Hadoop, Xrootd, GlusterFS, ...
- Grid Data Management:
 - Test DIRAC to exploit DMS features, dataset replication, ...
 - Automatic file distribution systems (e.g. CVMFS)

G. Donvito, S. Pardi, et al.

Storage

- Future activity on
 - **Job locality**:

Trying to understand if SuperB can use a paradigm in which the job run as closer as possible to the data

Distributed Sites:

Testing how we can set-up a distributed Tier1 in italy

• NFSv4.1:

Testing if pNFS could be of interest for SuperB in the next year

Remote data access:

Testing if SuperB code is already usable in high latency network and provide feedback to the developers

OPPORTUNITIES

- We need people! Groups are undersized and project, plans and ideas are growing
- Full Simulation, Fast Simulation, Reconstruction,
 Data Persistency, Bookkeeping, Distributed
 Computing, Collaborative tools, R&D Program, ...

Contact F. Bianchi

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Computing Sessions



THANKS FOR YOUR ATTENTION