# Computing Status

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Torino

V SuperB Collaboration Meeting
Pisa, September 19th, 2012

# Outline

- FastSim & Physics Tools.
- FullSim & Background. -> FullSim & Background session.
- Distributed Computing -> Distributed Computing session.
- Status of PON ReCaS.
- R&D -> R&D session.

# Improvement in EMC response in FastSim (1)

**E. Manoni**

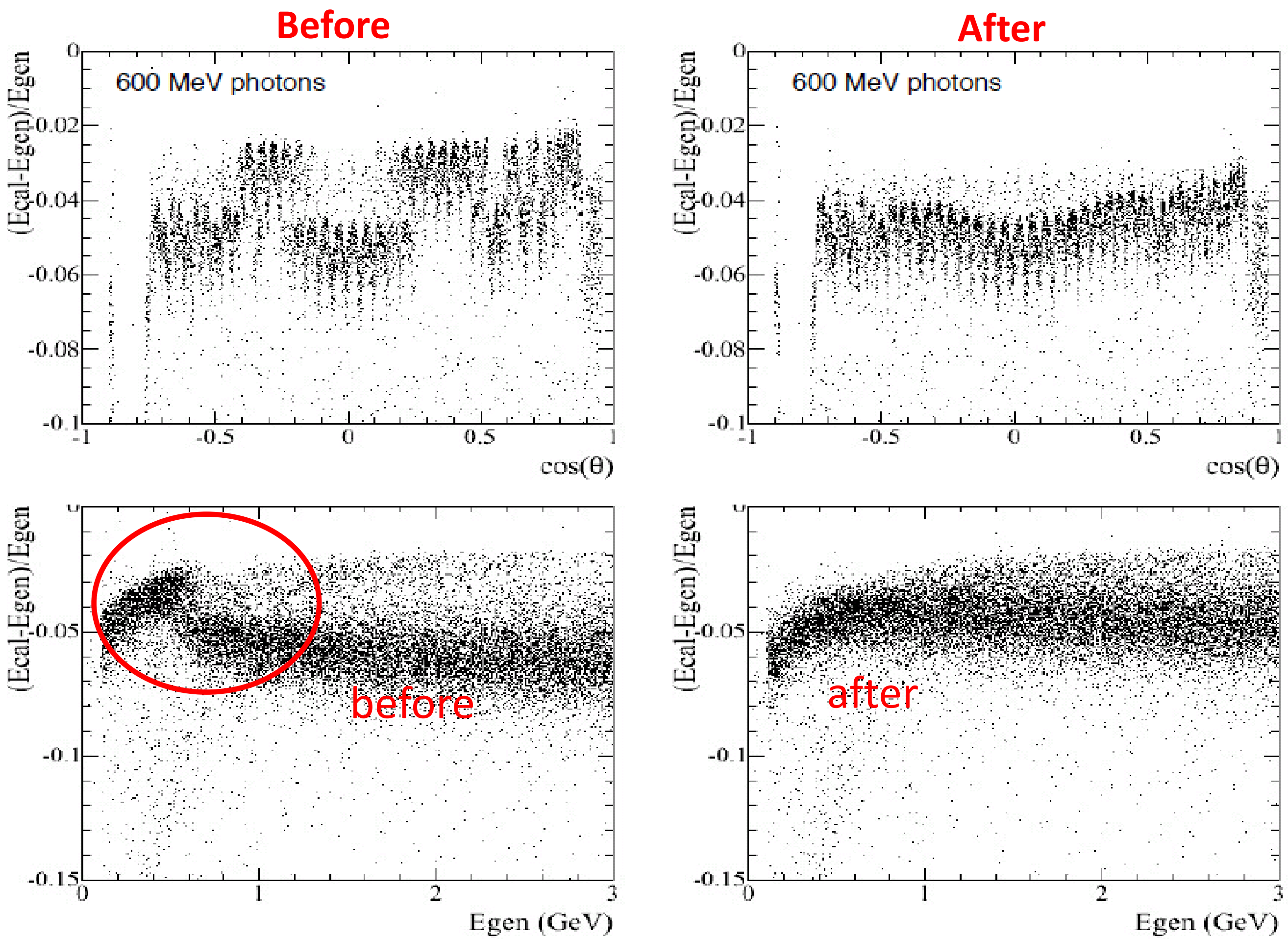
- Improved algorithm to parameterize EMC response and reproduce FullSim EMC performances
- Main steps of the algorithm
  - calibrate reconstructed energy peak
  - evaluate “intrinsic width” due to approximation on EMC geometry and shower development
  - smear calibrated energy accounting for “intrinsic width” and expected shape of reconstructed energy (Crystal Ball function) from FullSim
- Algorithm implemented and tested in FastSim V0.3.2, not committed yet

# Improvement in EMC response in FastSim (2)

Improved the 'intrinsic energy resolution vs energy' pattern for photons in 0.5 GeV region (before there was a discontinuity)

**C. Cheng**

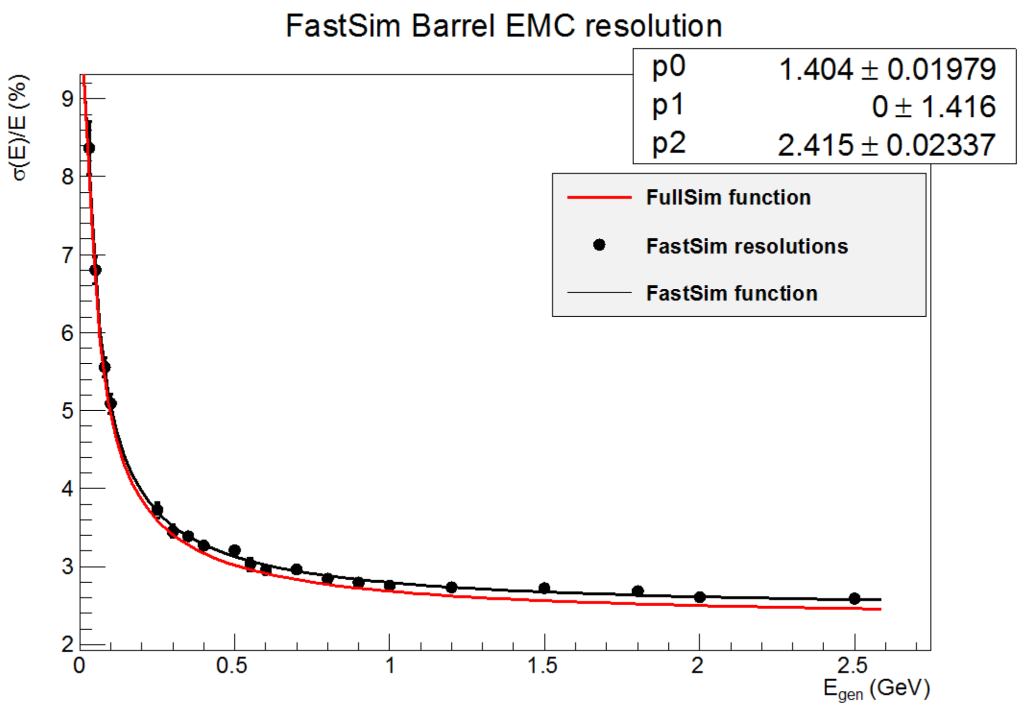
"Intrinsic" resolution (without smearing)



# Improvement in EMC response in FastSim (3)

E. Manoni

- Barrel resolution
  - better agreement between FastSim and FullSim in the low energy range
  - good improvement with respect to previous comparison results




- FullSim resolution function:

$$\frac{\sigma(E)}{E} = \frac{p_0}{\sqrt{E}} \oplus \frac{p_1}{E} \oplus p_2$$

  - $p_0$ = 1.38%, $p_1$=0, $p_2$=2.3%
  - used as input for FastSim

[Details at Thursday EMC-II session]

# FullSim & Background Studies (1)

A. Perez

- Summer Production for Background Studies with two geometries:
  - Geometry_CABIBBO-V03: current default geometry. This includes:
    - **Final focus**: more realistic W-shield compatible with space available and integration constrains. Conical shape of 3cm thick and cylindrical shape 4.5cm thick with increased external radius.
    - **SVT**: newest L0 model (F. Bosi). L1-L5 model adapted to the SuperB angular coverage (±300 mrad)
    - **DCH**: Internal radius increased to make room for W-shield (265 → 265 mm); new foils of copper and Aluminium according to latest drawings
    - **EMC**: Hybrid CsI-LYSO fwd-end-cap model and RadFET monitors
    - **IFR**: new iron/Boron-loaded-polyethylene shields
    - **Detector Hall**: more realistic model using Fabrizio Raffaeilli drawings
    - **Solenoidal detector field**: field was extending beyond the Super-conducting magnet volume and was not zero inside the FDIRC FBLOCK.
  - Geometry_CABIBBO-V03_LYSO: same as previous one, but with the Fwd-EMC replaced by full-LYSO. Used as control geometry to compare the Hybrid-Fwd-EMC

# FullSim & Background Studies (2)

- Data sets:
  - Rad-Bhabha (DE/E = k > 30%): main Rad-bhabha component giving backgrounds on the detector. Two geometries:
    - Geometry_CABIBBO-V03: 15k bunch-crossings
    - Geometry_CABIBBO-V03_LYSO: 12k bunch-crossings
  - Rad-Bhabha (0.5 < k < 30%): verify that low k Rad-bhabha is negligible. Check for contribution to neutron cloud.
    - Geometry_CABIBBO-V03: 20k bunch-crossings
  - Pairs:
    - Geometry_CABIBBO-V03: 100k bunch-crossings
  - Touschek HER/LER:
    - Geometry_CABIBBO-V03: 90k (198k) for HER (LER) primaries
  - Beam-Gas:
    - Geometry_CABIBBO-V03: 285k (283k) for HER (LER) primaries
  - Synchrotron Radiation: first time this samples is produced. Main contribution on innermost layers of SVT
    - Geometry_CABIBBO-V03: 9.8k (9.6k) for HER (LER) bunch-crossings

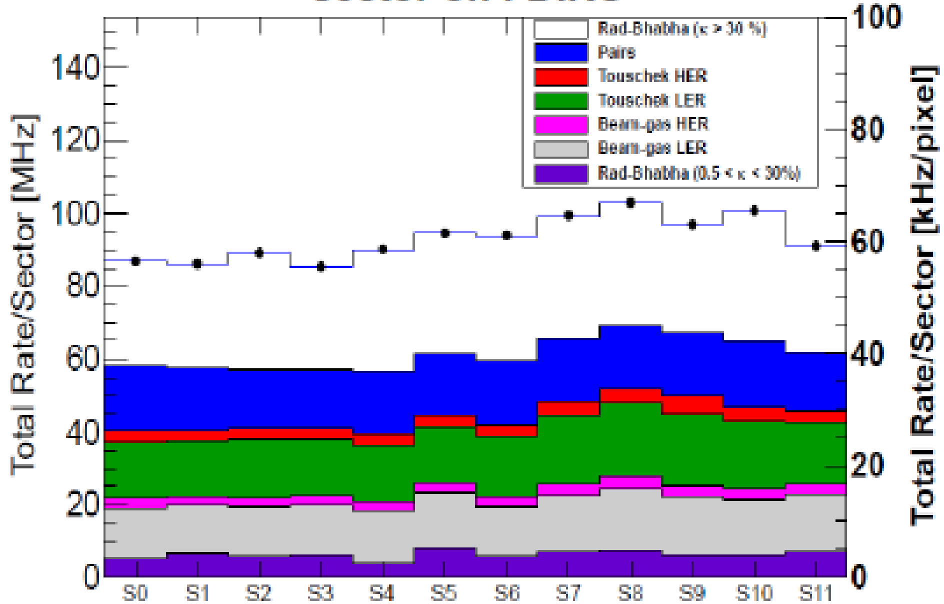
# FullSim & Background Studies (3)

- At every production we have a more complete model of different backgrounds and a more detailed geometry.

- Found a problem with FDIRC geometry related with the MaPMT photocathode using BK7 glass. The problem was fixed (replacing material to Aluminium) and committed but not in time for Summer-2012 production.
  - Summer-2012 samples are still usable applying a post-production patch.

# Summer 2012 production: Some results

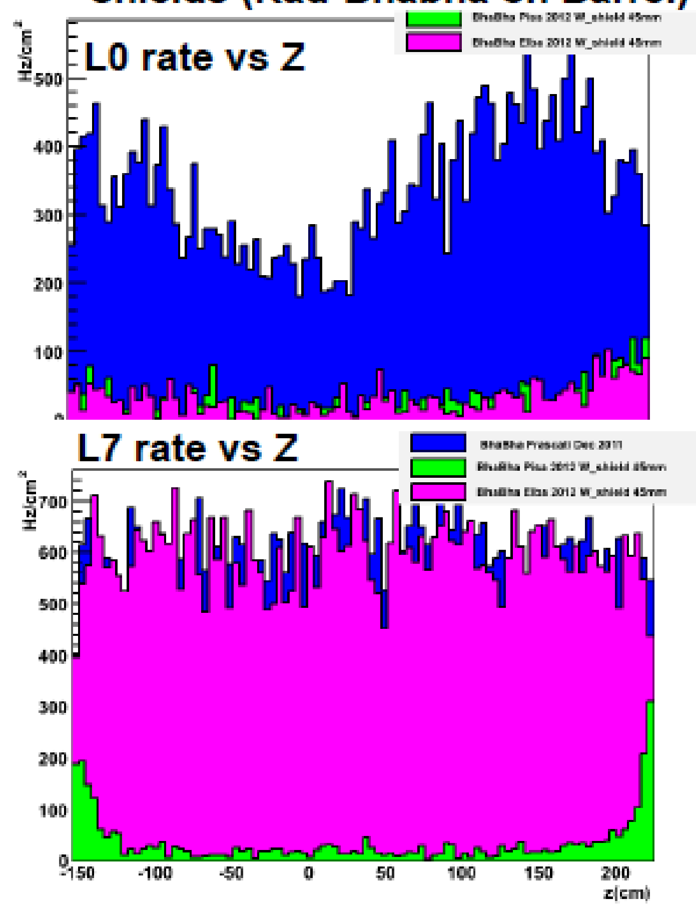
**Total background rate per sector on FDIRC**



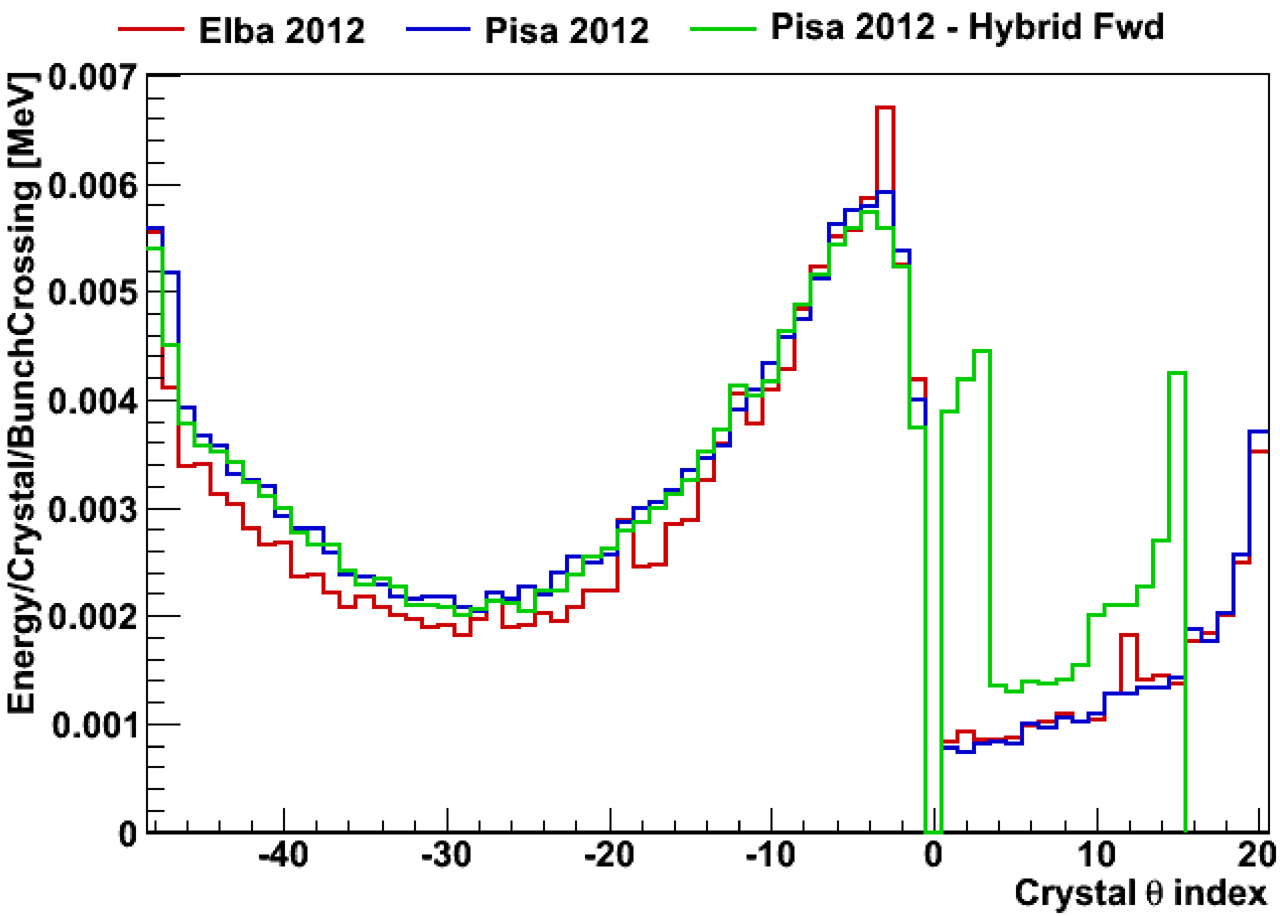

- FDIRC: low ΔE/E Rad-bhabha is 10% of total Rad-bhabha background
- IFR: significant reduction on the neutron rate on Barrel with new shields (1 order of magnitude)

LNF Dec 2012
Elba 2012
Pisa 2012

**IFR: n0 flux reduction with new shields (Rad-Bhabha on Barrel)**



# Summer Production: EMC



# Distributed Resources

27 sites are available to the SuperB VO.
From: Canada, France, Italy, Poland, UK and USA

A. Fella

| Site | Min (cores) | Max (cores) | Disk (TB) | SRM layer | Grid Org. | Site contacts |
|---|---|---|---|---|---|---|
| RAL(T1) | 200 | 1000 | 25 | Castor | EGI | F. Wilson, C. Brew |
| Ralpp | 50 | 500 | 5 | dCache | EGI | F. Wilson, C. Brew |
| Queen Mary | 300 | 2000 | 150 | StoRM | EGI | A. Martin, C. Walker |
| Oxford Univ. | 50 | 200 | *1* | DPM | EGI | K. Mohammad, E. MacMahon |
| IN2P3-CC(T1) | *500* | *1000* | *16* | dCache | EGI | N. Arnaud, O. Dadoun |
| Grif | 50 | 300 | 2 | DPM | EGI | N. Arnaud, O. Dadoun |
| in2p3-lpsc | 50 | 100 | 2 | DPM | EGI | J.S. Real |
| in2p3-ires | 50 | 100 | 2 | DPM | EGI | Y. Patois |
| CNAF(T1) | 500 | 1000 | 180 | StoRM | EGI | A. Fella, P. Franchini |
| Pisa | 50 | 500 | 0.5 | StoRM | EGI | A. Ciampa, E. Mazzoni, D. Fabiani |
| Legnaro | 50 | 100 | 1 | StoRM | EGI | G. Maron, A. Crescente, S. Fantinel |
| Napoli | 500 | 2000 | 15 | DPM | EGI | S. Pardi, A. Doria |
| Bari | 160 | 260 | 0.5 | StoRM/Lustre | EGI | G. Donvito, V. Spinoso |
| Ferrara | 10 | 50 | 0.5 | StoRM | EGI | L. Tomassetti, A. Donati |
| Cagliari | 10 | 50 | 1 | StoRM | EGI | D. Mura |
| Perugia | 10 | 50 | 1 | StoRM | EGI | R. Cefala' |
| Torino | 50 | 100 | 2 | DPM | EGI | S. Bagnasco, R. Brunetti |
| Frascati | 30 | 100 | 2 | DPM | EGI | E. Vilucchi, G. Fortugno, A. Martini |
| Milano | 50 | 100 | 2 | StoRM | EGI | N. Neri, L. Vaccarossa, D. Rebatto |
| Catania* | ? | ? | ? | StoRM | EGI | G. Platania |
| Slac | 400 | 400 | 10 | NFS | OSG | S. Luiz, W. Yang |
| Caltech | 200 | 400 | 4.5 | NFS | OSG | S. Lo, F. Porter, P. Ongmongkolkul |
| Fnal* | 50 | 400 | 1 | dCache | OSG | M. Slyz |
| OhioSC* | ? | ? | ? | dCache | OSG | R. Andreassen, D. Johnson |
| Victoria | 50 | 100 | 5 | dCache | EGI | A. Agarwal |
| McGill* | 100 | 200 | 1 | StoRM | EGI | S. Robertson, S.K. Nderitu |
| Cyfronet | 100 | 500 | 10 | DPM | EGI | L. Flis, T. Szepienie, J. Chwastowski |
| Total | 3570 | 11510 | 440 | | | |

* VO enabling procedure in progress

# Distributed Resources Status

- Full distributed resource testing phase is slowly progressing
  - ~1/3 of the sites are misconfigured
    - Testing, fixing, reinstalling, contacting is slowly going on
    - Need manpower
- VO enabling operations at remote sites
  - **McGill**: testing services in progress
  - **SLAC**: ok
  - **Caltech**: ok
  - **Fermilab**: ok
  - **Ohio Supercomputing Center**: enabling process is stopped

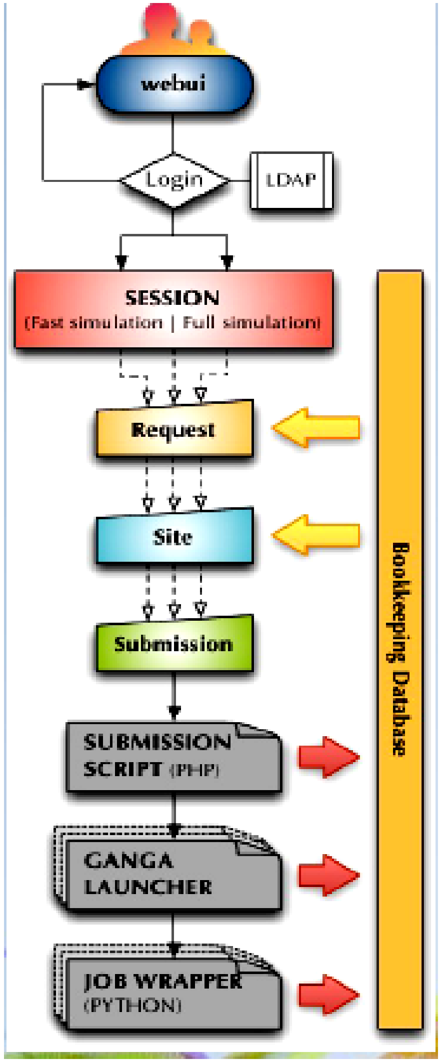
# OSG (1)

- A cooperation with OSG support group is in place since four months:
  - Meeting participants: A. Fella, G.Garzoglio (OSG support leader), S. Luitz, M.Slyz, T.Ievshin.
- Goal is to fit the SuperB requirements to OSG computing peculiarities.
  - Authentication, resource setup, training issues.
  - Site contacts interface.
  - All OSG sites ccould be enabled.
    - Efforts focused on SLAC, Caltech, Fermilab and Ohio Supercomputing Center.

# OSG (2)

- OSG council - SuperB meeting on July 10th
- SuperB presented comments and requirements related to its distributed computing activities
  - OSG support to CVMFS distributed software installation
  - Use of GlideinWMS as submission system
  - New OSG information service publishing on WLCG/EGI BDIIs is under discussion
    - We are invited to participate to the work
  - Enabling VOMS Role in OSG is a big issue
  - Nagios monitoring per VO enabled in OSG Grid
    - Request for installation of SuperB required packages in OSG WN release has been accepted

# Production System




- FullSim summer production
  - The first on distributed resources
  - The first using the new generation production system
    - Production goals have been accomplished
    - Outcome: set of improvements and bug fixes

- M.Manzali, the primary developer left
- C.De Santis is moving to production system issues
- Two students from Ferrara:
  - REST interface refactoring
  - Production system debugging

- **See the presentation in the «Distributed computing session» on Sept 20th at 16:30**

# Analysis System Prototype

- The main developer left the group in June, need a replacement
- Minor progress in testing functionality and debugging
- Collaboration with Ganga team
  - Evaluation of general Dirac backend adoption
  - Request of implementation of general Dirac backend is accepted
  - We are looking for new developers and testers

# Dirac Project

- A fruitful collaboration with Polish computing group started on June '12
  - Goal: setup and configure a Dirac system to fulfil the SuperB requirements
  - General work plan:
    - Simulation production use case (in progress)
    - Workload Monitor system
    - Analysis use case integrated with Ganga system
    - Mass data transfer system

- Bi-weekly meeting (http://superb.infn.it/restricted-distributed-computing)
- **«Distributed computing» session, Sept 20th at 16:30**

# Data Model and Data Storage

- Storage system evaluation
  - HadoopFS on WAN: testbed on Bari and Napoli
- Data access framework library development
  - Data access optimization on local and WAN scenario
  - Mask the low level storage system DA layer at the sites
  - Useful support from ROOT development team
- Geographically distributed data center study (stand by)

- **«Computing R&D» session, 16:30 Sept 20th**

# ReCaS Status


**Tender already started**

- INFN-Napoli (rack, chiller and telecontrol system) 351 KEuro
- UNINA - (Cooling system components) 88 KEuro
- UNINA - (FC storage for ReCaS site) 59 KEuro
- INFN-Bari – (server and internal storage) 190 KEuro

**Tender ongoing**

- INFN-Cosenza Infrastructure and Hardware 500 KEuro
- UNINA – Hardware 850 KEuro
- Production sites start-up 120 KEuro (30K euro for each Site)

# R&D on Framework Parallelization (1)

**Padova & CNAF**

- The analysis of a specific executable and analysis pattern, taken from FastSim, helped us to disclose the intrinsic parallelism among modules
  - FastSim  modules can run concurrently
- Our aim is to exploit parallelism at module and at event level (we inject more events into the analysis chain)
  - In this way we analyze more events concurrently with physics modules that run also concurrently
  - By now algorithm level parallelism is not an issue (but suggestions on possible ways to explore from our physicists colleagues are more than welcome)
- After a preliminary study we decided to adopt a "require-provide" schema to describe physics modules in the analysis chain
- The tool we chose to translate this schema is Intel® Threading Building Block (Tbb)

# R&D on Framework Parallelization (2)

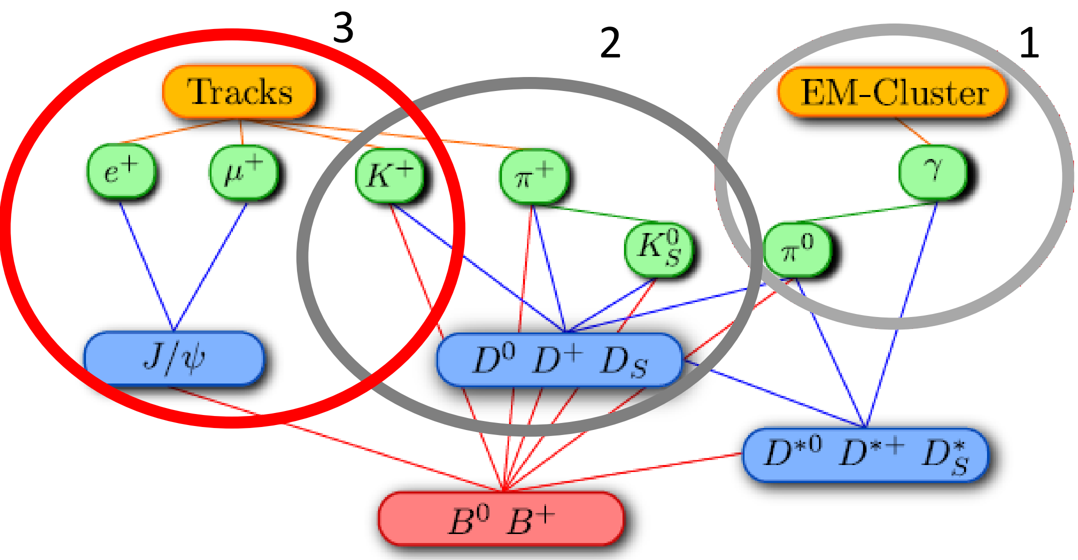
- The “require-provide” schema was used to track dependencies among modules in order to put them inside a Tbb “graph” object
- A simple event level parallelism was implemented as a baseline for performance tests
  - We wanted to be sure that parallelism really makes things run faster
- A complete graph object was then implemented to exploit parallelism among modules
  - Some work has been spent also to overcome some limits of Tbb
- A more flexible parallelism among events has been finally implemented

# R&D on Framework Parallelization (3)

- The prototype, based on the BaBar framework, is working and currently under test of the performances
  - More details in the parallel session on Computing R&D
- Module level parallelism is limited by "static" objects and Fortran code (mainly common blocks)
  - Work is underway to improve data locality and thread safeness of critical modules
- This work is a great baseline (and a good training exercise) to develop a new and natively parallel analysis framework

# B-meson reconstruction algorithm on GPU use-case

**Napoli**




| stage | particelle |
|---|---|
| 1 | tracks, $K_S$, $\gamma$, $\pi^0$ |
| 2 | $D^{\pm}_{(s)}$, $D^0$, e $J/\psi$ |
| 3 | $D^{*\pm}_{(s)}$ e $D^{*0}$ |
| 4 | $B^{\pm}$ e $B^0$ |

**Combinatorial problem**

**Problem Metallization**: given N quadrivector (spatial component and energy), combine all the couple without Repetition. Then calculate the mass of the new particle and check if the mass is in a range given by input.

**GOAL**: Understand the impact, benefits and limits of using the GPGPU architecture for this use case, through the help of a toy-model, in order to isolate part of the computation.

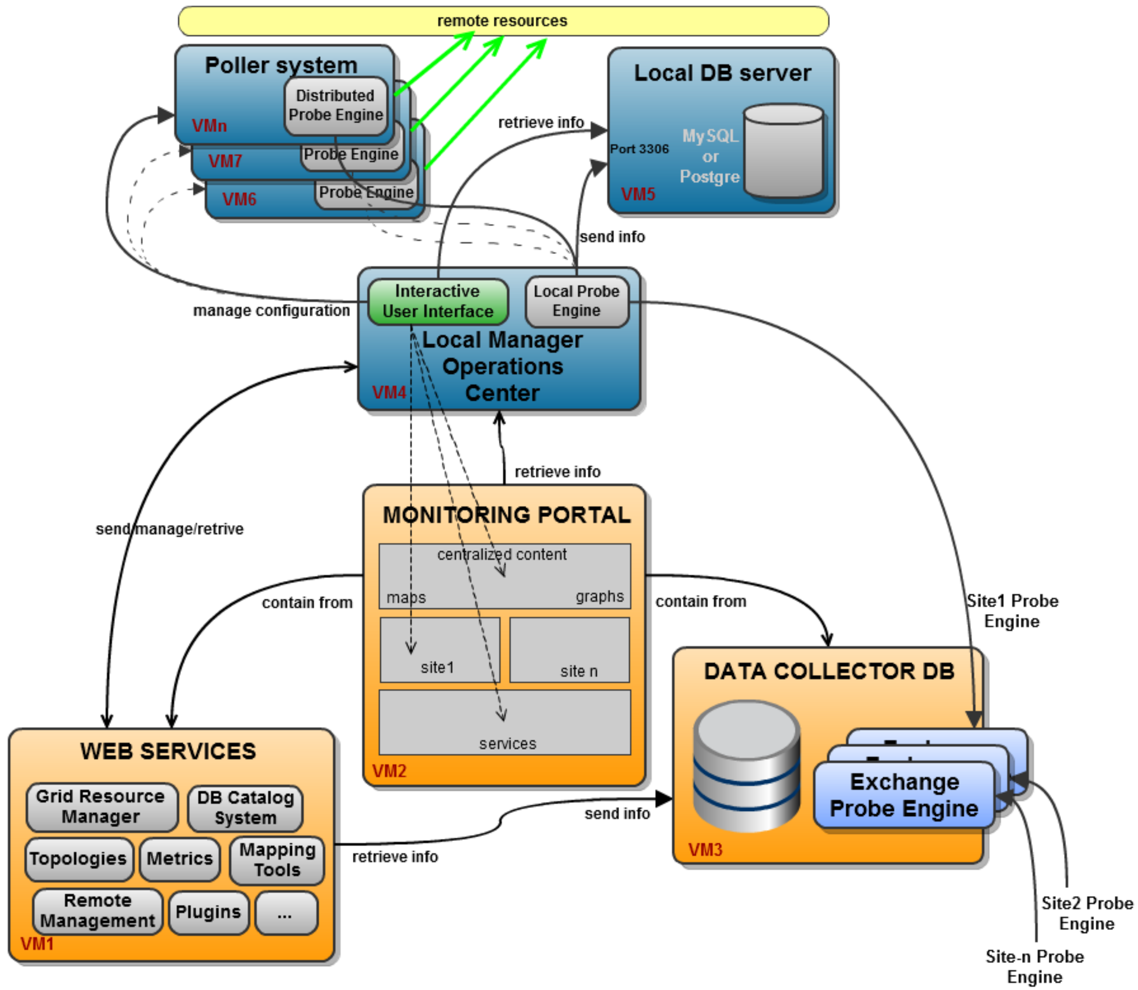
**Toy model implemented in CUDA C by several undergraduate students.**

**The algorithm is close to be finished. It will be completed in the next few months. The debugging activities are already started with real data in input, in order to test the performances in a more realistic environment.**

# Monitoring on a IaaS Cloud model infrastructure (manager site)

- A centralized portal for all types of services and authentication
- Data collector DB: data replication and data warehousing
- A machine will contains the web application to use all services

Integration of all heterogeneous systems and data presentation



# Conclusions

- The computing group is supporting the collaboration by providing:
  - Collaborative Tools
  - Physics Tools: FastSim, etc.
  - FullSim
  - Production Tools
  - Bookkeeping Tools
- There is an active R&D program aimed at the design of the computing model.
- The activities funded under the Pon ReCaS are an important step forward into building the computing infrastructure.
- A severe lack of manpower is affecting us.
- Come and join the fun !