Summaries: Computing

G. Donvito

On behalf of the Computing Group

Tracks

- Computing: Report from CHEP
- Computing: FastSim + Physics Tools
- Computing: Fullsim + Backgrounds
- Computing: Distributed computing
- Computing: R&D
- Computing: Planning

S. Longo

Report from CHEP

- Framework Talks:
  - Parallelism is the key topic
    - A lot of activity on this item
      - We can look at them and learn from them
  - Attempts to write "generic analysis" framework
  - Using new ROOT features (autoflash, optimize baskets) it is possible to improve the analysis performance

AOD Layout	Reading all events	Selective 1% read
OLD: Fully split, 30 MB Auto-flush	55 (±3) ms/ev.	270 ms /ev.
CURRENT: No split, 10 event Auto-flush	35 (±2) ms /ev.	60 ms/ev.

  - A lot of activity in optimizing remote data access
    - Within the same region it is possible to obtain good rates

S. Longo

Report from CHEP

- Framework Talks:
  - Parallelizing frameworks also requires and optimization in reading/writing files in order to improve the aggregate performance
- GPU:
  - Using GPU as an online software trigger
    - Exploiting specific features it is possible to provide up to 170 speedup factor

A. Fella

Report from CHEP

- Distributed Processing and Analysis on Grids and Clouds:
  - several SuperB contributions

- Oral presentation: "**Exploiting new CPU architectures in the SuperB software framework**", M.Corvo
- Oral presentation: "**SuperB R&D computing program: HTTP direct access to distributed resources**", A.Fella
- Poster: "**Testing and evaluating storage technology to build a distributed Tier1 for SuperB in Italy**", S.Pardi
- Poster: "**SuperB Simulation Production System**", L.Tomassetti
- Poster: "**DIRAC evaluation for the SuperB experiment**", A.Fella

A. Fella

Report from CHEP

- Distributed Processing and Analysis on Grids and Clouds:
  - many private meeting with several group involved in activities that could be of interest for SuperB:
    - PhEDEx system evaluation
    - Fermilab resource access
    - ROOT I/O optimization
    - Dirac system
    - GlideinWMS use in OSG
    - Forum of Concurrent Programming Models and Framework
  - LHC Experiments computing model is evolving:
    - streamline systems
    - remove unnecessary components
    - ease operations with limited man power find commonalities
    - scale to higher needs
    - adapt to new technologies

A. Fella

Report from CHEP

- Distributed Processing and Analysis on Grids and Clouds:
  - LHC Experiments computing model is evolving:
    - Finding commonalities among experiments
    - Trying to exploit available technologies like:
      - Torrent, Content Delivery Network, Many Core technologies
    - WAN Data Access:
      - LHCONE
      - Federating storage by means of a common protocol (Xrootd)
        - » ~13 different Sites, 300 unique users, ~2000PB per month
    - The cloud computing is emerging in the HEP community
      - Atlas with HelixNebula, Dirac is supporting Cloud, WNoDeS

A. Fella

Report from CHEP

- Distributed Processing and Analysis on Grids and Clouds:
  - Storage:
    - The storage elements developed in EMI are evolving in order to provide industrial standard interfaces: NFSv4.1, HTTP/ WebDav
  - EMI 3 middleware release:
    - Will provide: FTS3, GFAL2, New File Catalogue
  - OSG has a long life ahead in supporting distributed computing for scientific experiments
    - SuperB is one of those experiments

L. Tommasetti

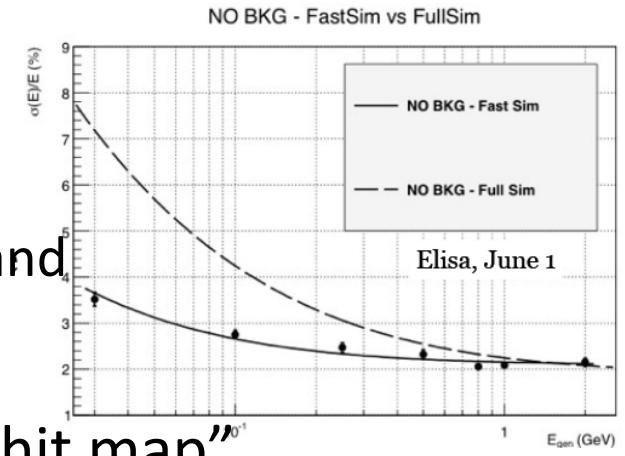
Report from CHEP

- Report on Databases:
  - CMS Condition database:
    - Oracle+Frontier+SQUID
      - Smooth operation: uptime 99.88%
    - Atlas switched to Frontier in 2012
  - NoSQL DB is emerging into HEP community
    - For specific use cases: aggregation, analytics and accounting

Physics tools

EMC in fastsim

C. Cheng



- Defined plan to
  - tune the E resolution in presence of no bkg
  - compare clustering algorithms used in fastsim and Geant4 studies

- Discussion of possible use of a "background hit map" replacing bkg frames for low energy bkg photons

---

Background frames for fastsim

A. Perez

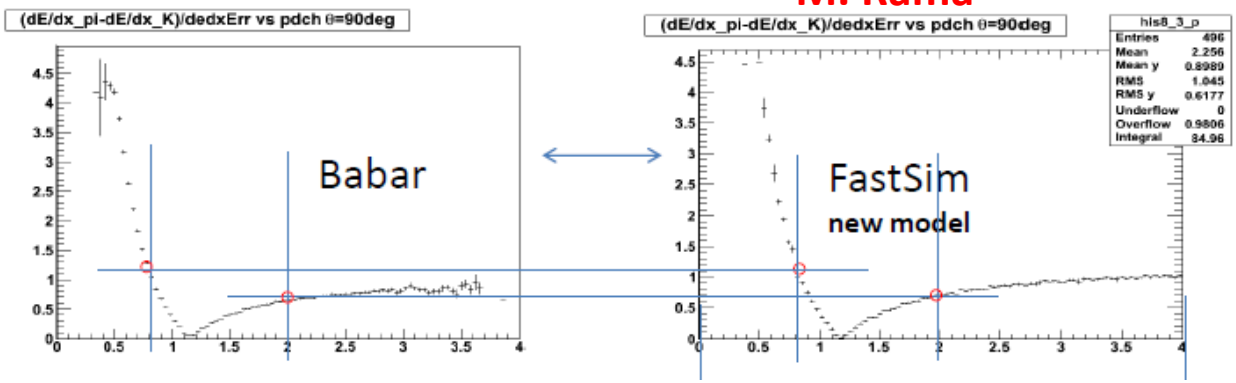
- **Produced bg-frames for all background sources: Rad-bhabha, Pairs, Touschek and Beam-Gas**
- **Developed a code for the treatment of biased samples (Touschek and Beam-Gas)**
- **Code has been validated and used for detector performances studies: EMC and FDIRC in the future**
- **Still need to implement the code inside FastSim Bkg-mixing framework**

Physics tools

M. Rama

New DCH dE/dx model in fastsim

Very good agreement with BaBar DCH performance (assumed to be similar to SuperB DCH performance)



D0 reconstruction and vertexing

G. Inguglia

- Semileptonic Tag at charm threshold: strategy
  - $e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu_e})(\pi^+\pi^-)[\beta\gamma = 0.56]$
  - *Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution*
- Hadron Tag at charm threshold
  - $e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.56]$
  - *Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution*
- Summary table
- Soft pion Tag at the Y(4S)
  - *B^0, D^*, D^0 Vertex Resolution*

work in progress

Physics (tools)

At the "Detector+Physics: Physics performance in presence of background" session

(how we can evaluate the) SuperB physics reach in presence of background

main development needs to perform SuperB physics studies vs background conditions

detector	performance vs background rates in FastSim (FS)	main development needs
SVT	FS takes into account "hit merging/hit confusion" effects of two nearby charged tracks. No real pattern recognition.	Development of background hit map No pat rec
DCH	see SVT	See SVT
FDIRC (and TOF)	Must be evaluated outside FS and then parametrized.	'External' estimate of performance vs background
barrel/fwd EMC	"Automatically evaluated" at reconstruction level.	Tuning of fastsim and fullsim cluster reconstruction vs bkg level (Development of background hit map)
IFR	Could be evaluated at reconstruction level once the bkg hits are overlapped to the event	Understanding of background effect on reconstruction with fullsim Development of background hit map

M. Rama

April 2012 production: Full-simulation (I)

Several samples for machine backgrounds studies were produced

- Rad-bhabha samples for three geometries (which include new FDIRC Lead-steel-polyethylene shield): 10k bunch crossings
  - Geometry_CIPE_V00-00-02 (nominal W-shield ⇒ 3.0cm)
  - Geometry_CIPE_V00-00-02_Tungsten4.5cm (W-shield @ 4.5cm)
  - Geometry_CIPE_V00-00-02_CSI_Tungsten4.5cm (W-shield @ 4.5cm thick and Fwd-EMC is CsI)

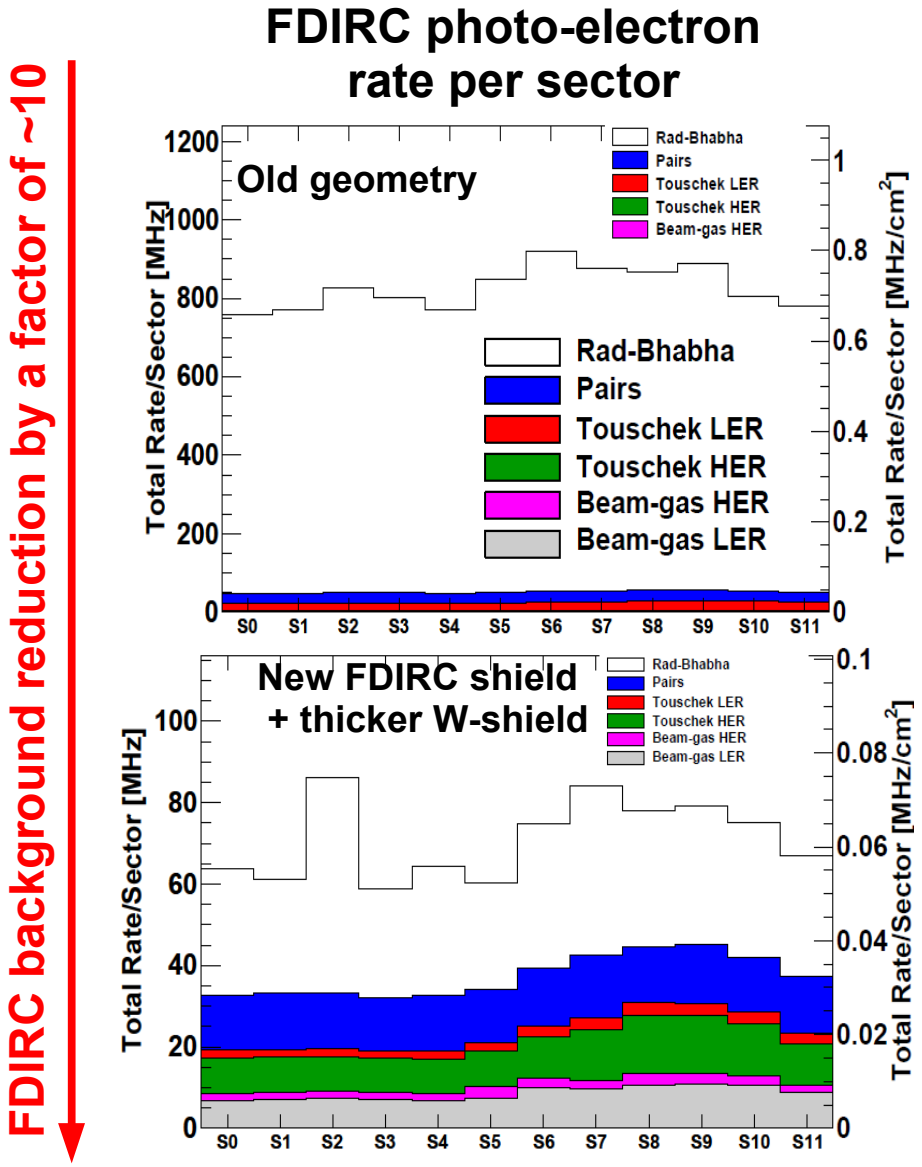
- Other background sources were generated with Geometry_CIPE_V00-00-02_Tungsten4.5cm geometry
  - Pairs (2-photon): 100k bunch crossings
  - Touschek HER/LER: ~250k primary losses
  - BeamGas HER/LER: ~280k primary losses

April 2012 production: Full-simulation (II)

Some interesting results with the produced samples

- Increased tungsten shield significantly reduces machine backgrounds (a factor ~2-4) for several subsystems (EMC, IFR, FDIRC, FTOF)
- FDIRC shield reduces backgrounds by a factor of ~10
- Several studies about FEE dose and fluency
- Background estimates used for detector performance studies, EMC, FDIRC and SVT. Other subsystems will follow

FDIRC background reduction by a factor of ~10



April 2012 production: Fast-sim background frames

- **We also produced the fast-sim bg-frame samples for all the background sources considered up to now** (Geometry with W-shield @ 4.5cm)
  - Rad-bhabha: 1M bunch crossings
  - Pairs (2-photon): 100k bunch crossings
  - Touschek HER/LER: ~250k primary losses
  - BeamGas HER/LER: ~280k primary losses
- **It is the first time Paris, Touschek and BeamGas bg-frame samples are produced with BRN:**
  - Touschek/BeamGas samples are biased: need a code to correctly include these sources in the fast-sim background mixing framework
- **Samples were useful to tune FastSim EMC simulation**

  ⇒ FastSim/FullSim comparison
- **Samples will provide a realistic estimation of machine background effectos on SuperB physics reach**

A. Fella

Distributed computing

- Distributed Computing Work Status:
  - Topics covered:
    - Distributed resources management
      - OSG support Production system
        - » SLAC, Caltech, Fermilab and Ohio Supercomputing Center
    - Distributed analysis system
    - Information systems updates (see C.Desantis talk)
    - Grid resource monitor - Nagios per VO
    - Data model definition (stand by)
    - Dirac evaluation
    - Phedex evaluation (stand by, see A.Fella CHEP report talk)
    - WAN data access (see G.Donvito talk)
    - Storage system evaluation (see G.Donvito talk)
  - Operational issues:
    - ~1/3 of the sites results misconfigured
    - VO enabling operations at remote sites
  - Production system status:
    - Most of the code/functionalities are ready, but
    - the primary developer is leaving now, next production is at risk

A. Fella

Distributed computing

- Distributed Computing Work Status:
  - Analysis system prototype:
    - Main functionality implemented and tested
    - SuperB plugin code resides now on official Ganga project SVN
    - Development of few remaining basic functionality is on course
    - Todo list still long and large test scale is under evaluation
    - Feedback from analysis working group is needed
    - the primary developer will leave within July
  - DIRAC evaluation
    - New Dirac release has been installed
    - Work in progress: Mass data transfer test, direct submission
    - Tested components:
      - Core system, DataManagement, WorkloadManagement, Accounting, Configuration
    - Share metadata and replicas info among EGI File Catalogue and DIRAC File Catalogue
    - Massive data transfer of an entire dataset
    - Resources estimation to improve a DIRAC production ready test infrastructure for SuperB
    - test data integrity check
    - Setup ready for testing a SuperB proper Montecarlo production

A. Fella

Distributed computing

- Distributed Computing Work Status:
  - Monitoring:
    - Nagios per VO service is up and running at CNAF
    - Specific superbvo.org checks will be added within next month
  - Now serious problem on man-power are evident

C. De Santis

Distributed computing

- Database works update:
  - Porting book-keeping database (sbk5) from MySQL (5.1) to PostgreSQL (9.1)
    - Normalization study concerning database compliance to first three normal forms (NF1, NF2 and NF3)
    - Few minor corrections have been recommended in order to make sbk5 NF1, NF2 and NF3 compliant:
    - High avalaibilty study
      - Slony-I was chosen
      - Tests are expected to last 2 or 3 months
    - Complete the ongoing work on Slony-I master/slave system

G. Donvito

Distributed computing

- Distributed storage, work status:
  - Testing Storage Solutions:
    - Hadoop fail-over solutions tested with success (both data and metadata failures)
    - Hadoop patched to be “farm-aware” and provide automatic geographical data replication
    - Future work:
      - Increasing the testbed size
      - Testing with two-three different computing farms
  - Developing data access library:
    - We are building a software library that will easy the access to data for analysis application:
    - Hiding the heterogeneous storage solution
    - Optimizing performance while reading data
    - Try to decrease the performance loss on remote data access

M. Chrząszcz

Distributed computing

- Status of SuperB Computing in Krakow:
  - Interested in collaborating to Ganga and Dirac activities in SuperB
  - Computing infrastructure:
    - 88th in top500
    - Currently SuperB FastSim is beeing installed in Cracow.
    - Very keen on doing central production
    - Study possibility of using FastSim and FullSim on GPU
  - Computing Infrastructure is made available by means of a common abstraction layer that will make much easier the deploying of scientific application

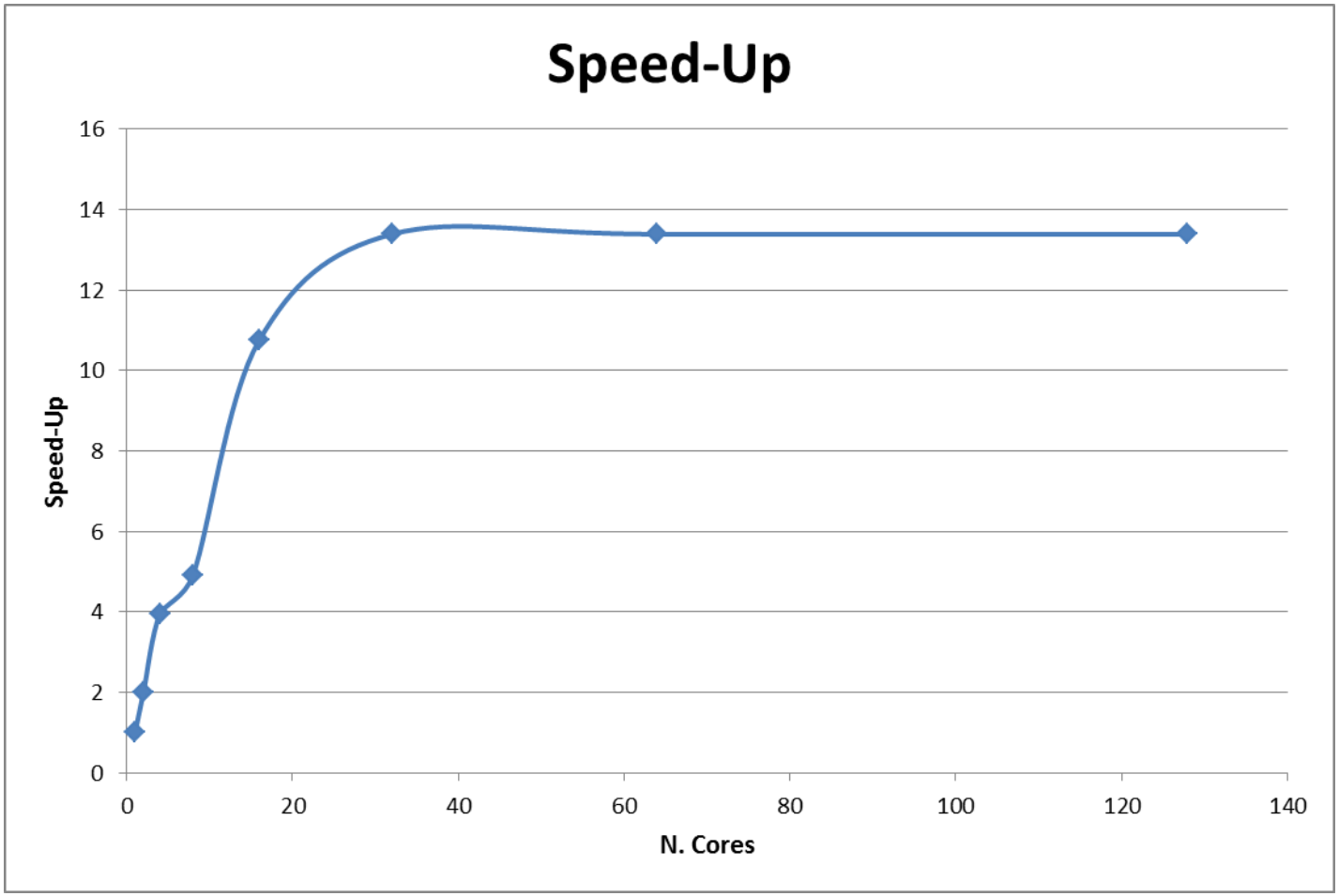
S. Longo

Computing: R&D

- Exploiting new CPU architectures for the SuperB analysis framework:
  - The current analysis frameworks share some features which prevent parallelism
    - Written long time ago thus suffering from severe lack of modern programming paradigms
    - Worst of all intrinsically serial
  - The analysis of a particular dataflow has a main goal:
    - Factorization of the workflow

Num of modules	127
Graph Depth	10
Min Rank	1
Max Rank	54
Avg Rank	12

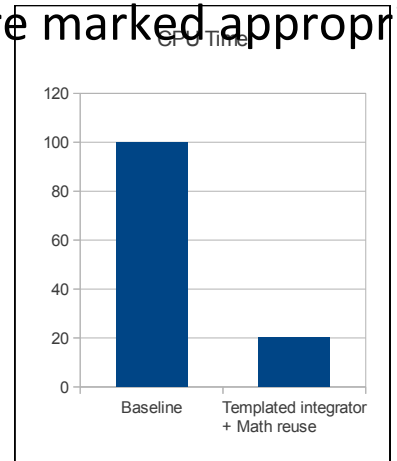
  - The starting point is a specific Fast Simulation executable whose data flow includes 127 modules
  - To show the potential speedup, a parallel scheduling algorithm has been developed
  - It's based on the same idea of an operating system scheduler
    - readiness of tasks
  - Reveal parallel potential inside existing code is strategic
  - It optimizes (hopefully) resources usage
  - Helps to better understand algorithms for future development
  - Current efforts are focused on adapting SuperB framework and modules to Intel Threading Building Blocks infrastructure
  - In the long term we will abandon the current SuperB framework for a new one which is natively parallel and whose prototype will be designed based on our experiences

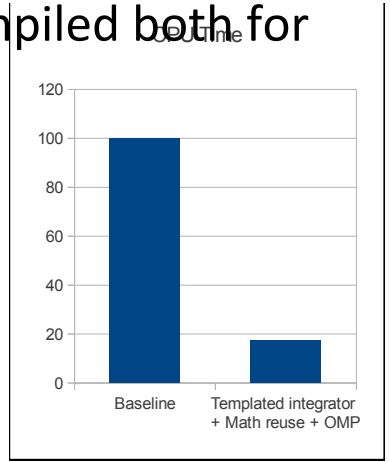

Speed-Up
16
14
12
10
8
6
4
2
0
Speed-Up
0
20
40
60
80
100
120
140
N. Cores

F. Giacomini

Computing: R&D

- Porting EvtGen to the Intel MIC Architecture:
  - MIC: Many-Integrated Core Architecture
  - Target is (part of) EvtGen
    - Limited to the function EvtBtoXsgammaKagan::computeHadronicMass( )
  - First step to understand if and under which conditions MIC is suitable for HEP software
  - Longer-term goal is to smoothly integrate the possibility to offload computation to an accelerator (such as a MIC or a GPU) directly in the software framework of an experiment
  - Native compilation:
    - The whole application is compiled only for the MIC Instruction Set
  - Heterogeneous compilation:
    - Some parts of the code are marked appropriately and compiled both for the host IS and the MIC IS

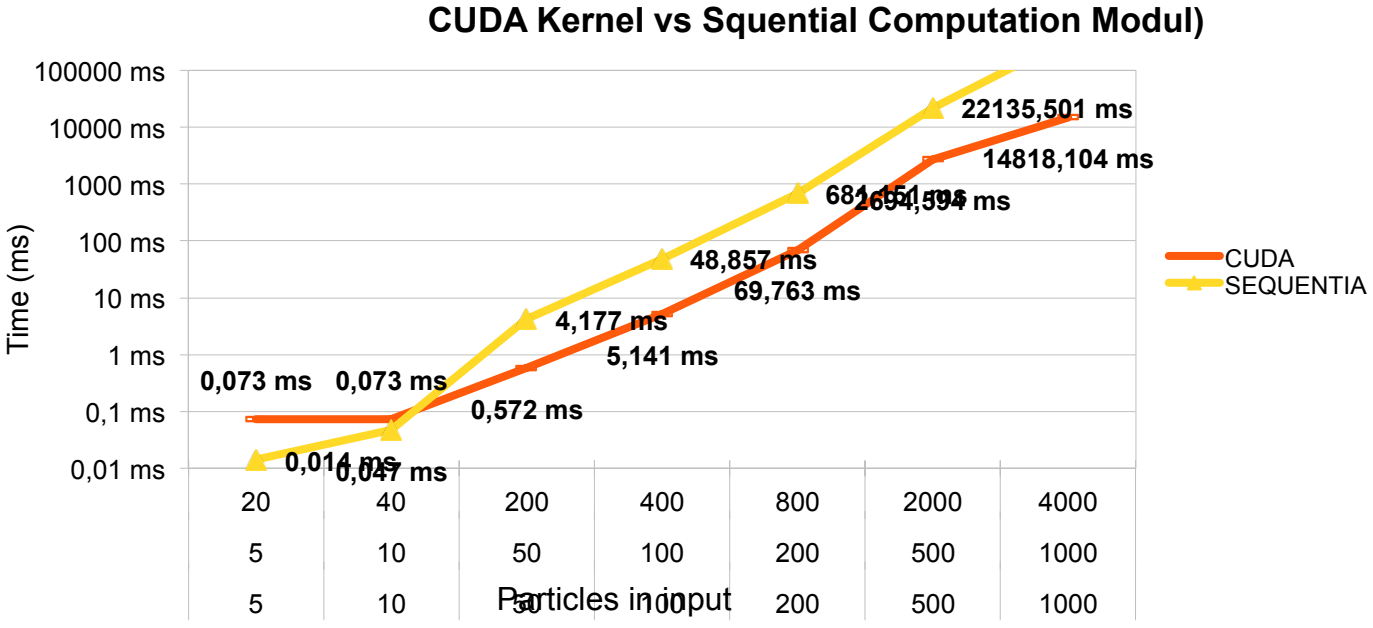




S. Pardi

Computing: R&D

- GPU Evaluation – Update:
  - Achieve know-how on the GPU architectures in order to test the versatility and investigate the adoption for some specific tasks interesting for SuperB
    - 1U rack NVIDIA Tesla S2050
    - 4 GPU Fermi
    - Memory for GPU: 3.0 GB
    - Core for GPU: 448
    - Processor core clock: 1.15 GHz
  - B-meson reconstruction algorithm
    - Understand the impact, benefits and limits of using the GPU architecture for this use case, through the help of a toy-model, in order to isolate part of the computation



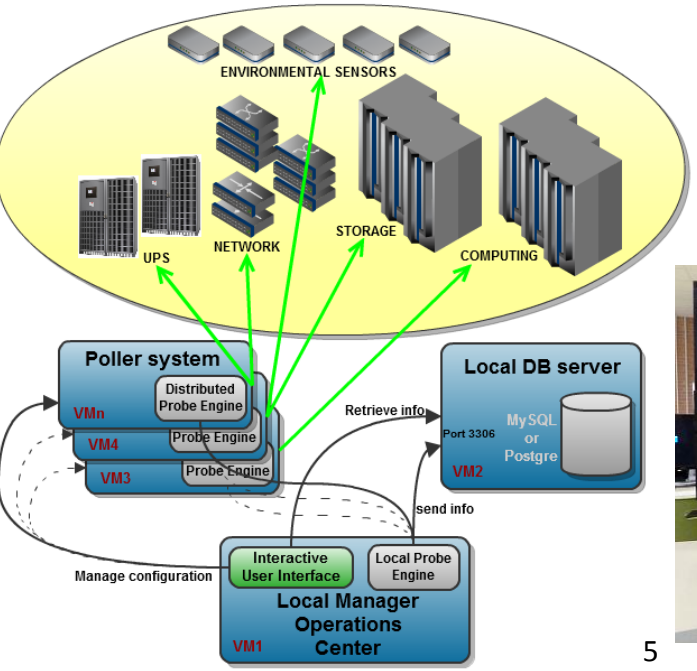
V. Ciaschini

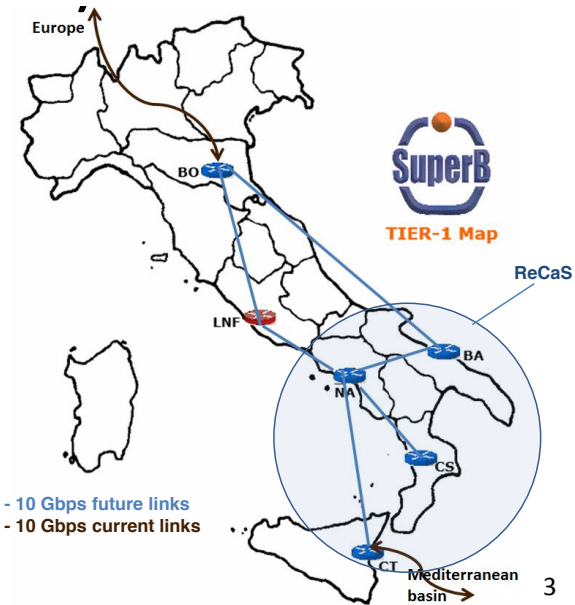
Computing: R&D

- Results of performance testing of SuperB/BaBar applications:
  - Application tested:
    - SkimMini, BetaMini, Moose, FastSim, PacMC, Bruno
  - OS used SL6
    - This is needed to gather information about CPU usage from the kernel
    - It looks like the application are easily portable on SL6
      - It is needed to add only few “compat” libraries
  - Conclusions:
    - BaBar: Clean up the init-phase stat(), Generally clean up I/O, Optimize code
    - SuperB: Generally in much better shape, memory issues present, I/O issues are still present
  - Optimization and fixing should be done before statements on parallelism can be made.

Computing: R&D

- Distributed computing monitoring activities for SuperB:
  - The distributed computing system that will support the SuperB project will need a valid software tool for the management and monitoring
    - A geographically distributed monitoring system
    - This will be particularly important for the “Computing sites for SuperB in Italy (ReCaS)”





Conclusions

- Large number of activities on-going with good results already achieved
- Few students are leaving and important activities could suffer from lack of man power
- New people are joining and are interested in key activities
  - Polish group
- But we still need new people joining the effort