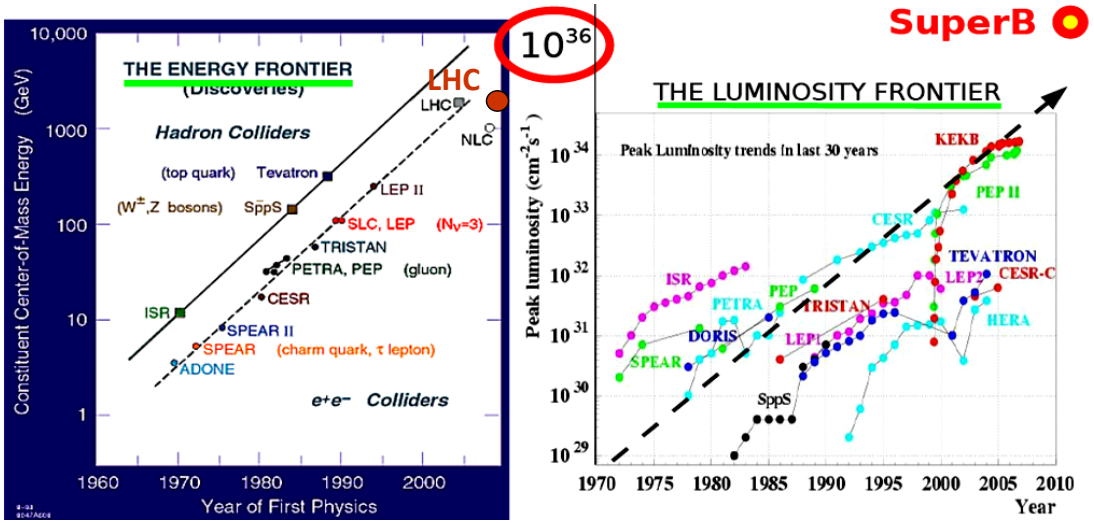
The SuperB Real (and Virtual) Organization

Steffen Luitz, SLAC

OSG Forum 10/13/2011

What is SuperB?

- Next-generation "Flavor Factory" to be built near Frascati (Rome) in Italy
  - 1st-generation B-Factories (BaBar and Belle) have collected ~1.5ab-1 together
    - Many physics results
  - Goal: collect 50-100ab-1 in 5 years
- Search for New Physics - complementary approaches
  - Relativistic approach – increase the energy and look for the production of new particles. ("Energy Frontier")
  - Quantum approach – increase the luminosity (and number of collisions collected) and look for effects of physics beyond the standard model in loop diagrams. ("Intensity Frontier")



SuperB

SLAC NATIONAL ACCELERATOR LABORATORY

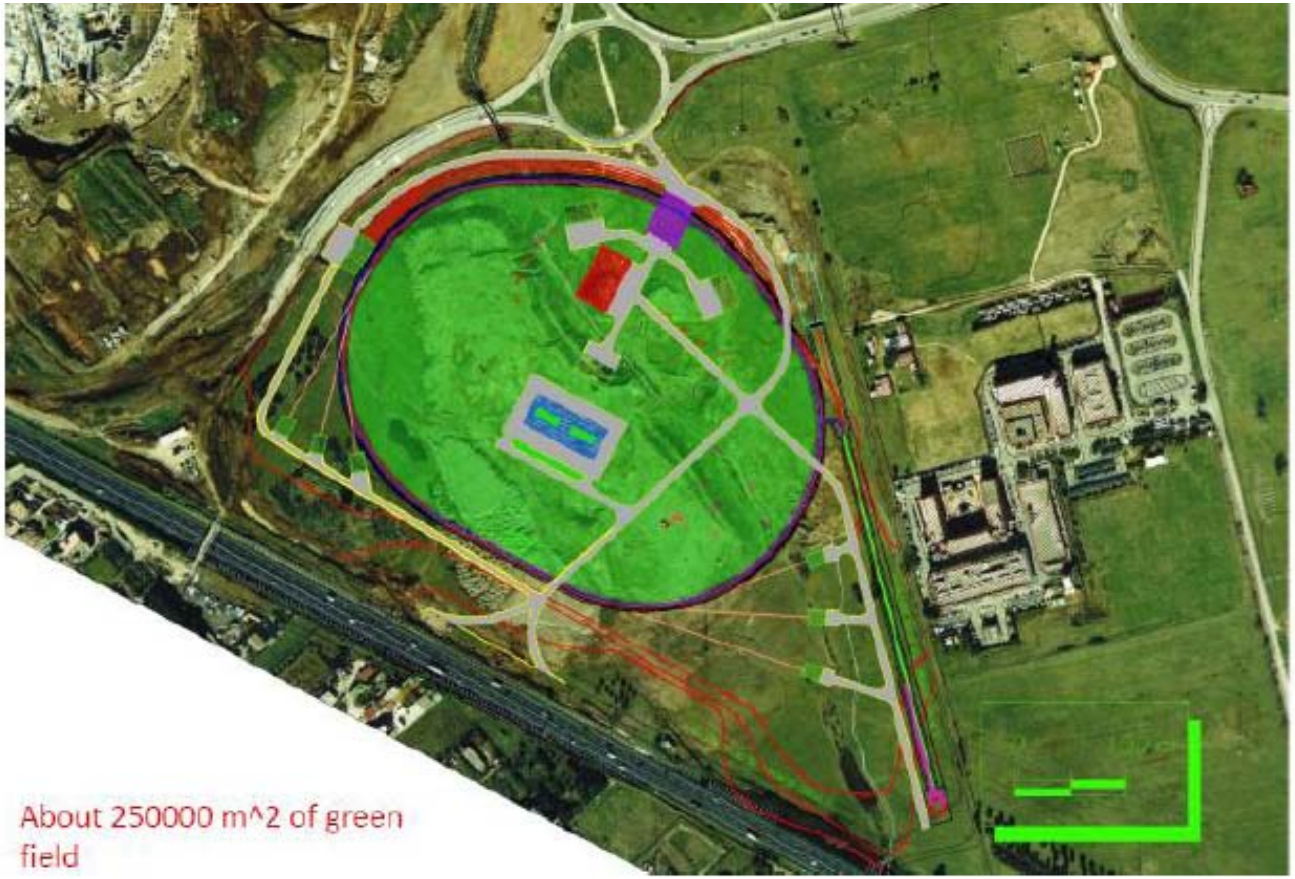
SuperB Physics Goals

- Goals
  - Increase precision of BaBar and Belle by a factor of ~10
  - Challenge the CKM at the 1% level
  - Improve sensitivity for Lepton Flavor Violation in tau decays by 10-100
  - Explore T-violation in tau
  - CPV in Charm sector
  - Spectroscopy
- This rich menu can be effectively mined with 75 ab^{-1} in 5 years at Y(4S) and a few months at Charm threshold with peak luminosity of 10^{35} cm^2 s^{-1}.

SuperB SLAC NATIONAL ACCELERATOR LABORATORY

The Nicola Cabibbo Lab "Cabibbolab"

- Official formation of the lab has been announced a few days ago!
- Located on a green field site of Tor Vergata University (near Frascati / LNF and Rome)



http://www.interactions.org/cms/?pid=1031120

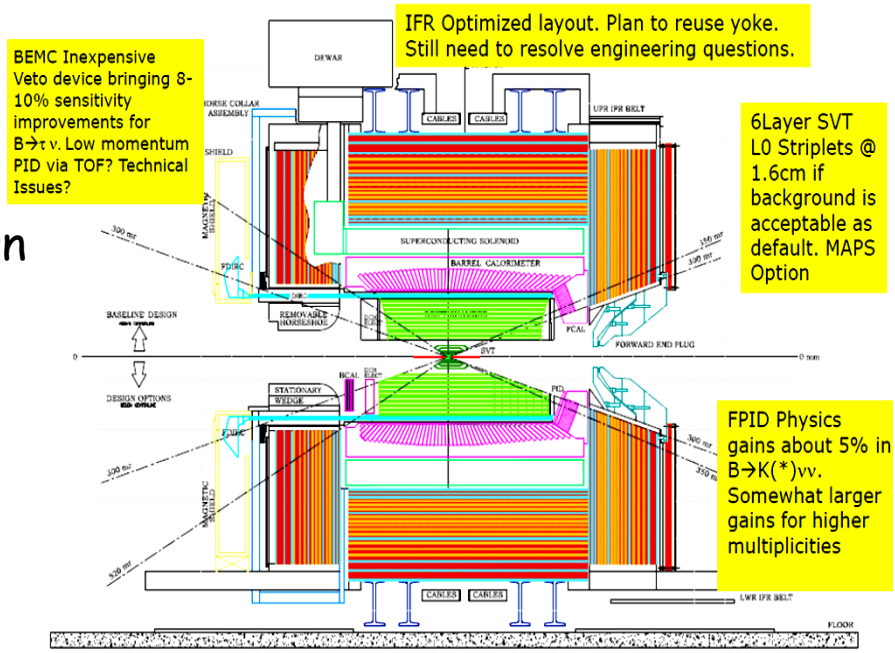
The Detector

Baseline reusing BaBar:

- Fused silica bars (DIRC)
- Barrel EMC CsI(Ti)
- Superconducting coil and flux return

Elements to be upgraded / replaced:

- Beam pipe, interaction region
- Silicon vertex detector
- Drift chamber
- Photon detectors for DIRC
- Forward EMC
- IFR scintillator
- Electronics, Trigger, DAQ



SuperB SLAC NATIONAL ACCELERATOR LABORATORY

The SuperB Machine

- Fundamental improvements:
  - Low emittance (small focus in the interaction point)
  - Crab waist technique
  - Low beam currents

The Computing Model

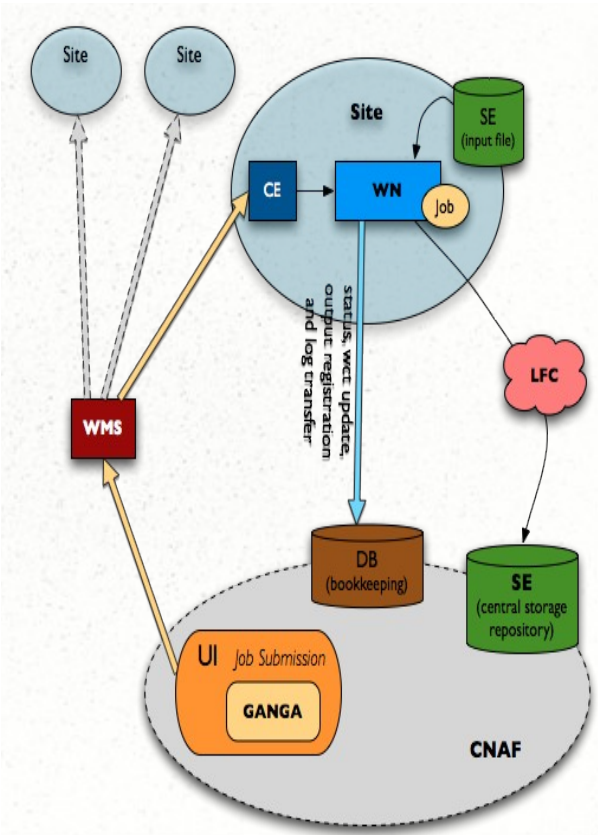
- A lot of experience from BaBar computing
  - We can make a good guess of the requirements and resource needs of SuperB
  - Data Flow, (Re-)Processing, Skims, analysis, etc.
  - In fact, BaBar has provided the code base to SuperB
- It's a starting point for the SuperB Computing Model, but we expect major evolution over the next few years
  - Framework & Code
    - Multi/ManyCores + GPUs
    - Adopt existing frameworks?
  - Storage and Data Access
    - Parallel / cluster file systems, Hadoop-like FS? …?
    - Databases?
  - Distributed Computing
    - LHC-experiment-like grid computing? It's the baseline.
    - Cloud technologies applicable on SuperB timescales?
    - Funding will most likely drive us to having ~10 mid-size data centers, mostly in Europe
      - Flat hierarchy. No or a distributed "Tier-0"? Peer-to-peer topology of Tier-1 centers?
- SuperB Computing TDR in 2012

The Data

- Computing requirements (full lumi, steady-state, storage includes replication):
  - Raw data
    - 25kHz x 100kByte = 2.5 Gbyte/s
    - 78PByte/year
    - Disk storage growth ~ 10-20PByte/year
  - Tape storage growth ~ 100 Pbyte/year
  - CPU growth ~ 2 MHEPSpec06 / year
    - 1 reprocessing cycle per year

Distributed Computing System Prototype (1)

- GANGA system performs job submission from CNAF UI to sites
- Direct submission via WMS to site CEs
- Job run time tasks
  - Access DB for initialization and status update via REST
  - Retrieve/access input files from local Storage Element (LCG-Utils)
  - Transfer the output to CNAF SE (LCG-Utils)
- Prototype has provided SuperB with about 170 CPU-years in 2010 to produce ~10^{10} FastSim events



	Sept. '09	Feb. '10	Jul. '10
Analysis stream	2	5	6
job done, failure rate	5K, 10%	20K, 8%	160K, 10%
Number of event	2.25 x 10^8	1.6 x 10^9	8.6 x 10^9
Involved site	1	9	15
WallClockTime	6 years	19 years	150 years
Disk occupancy (TB)	0.5	5	25
Peak job running	500	2500	7000

SuperB SLAC NATIONAL ACCELERATOR LABORATORY

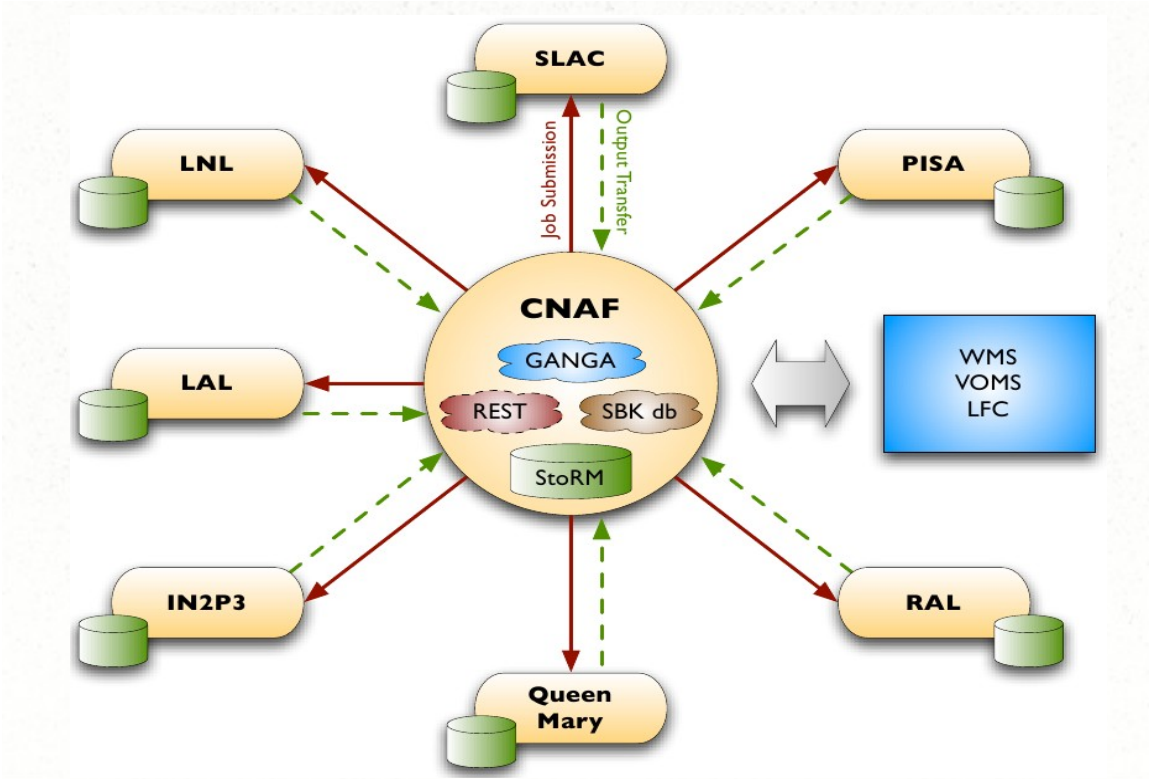
Distributed Computing System Prototype (2)

INFN CNAF in Bologna is and remains our central site:

- Job submission
- Bookkeeping DB
- File catalog

Improvement currently being implemented:

- Assign jobs to sites (e.g. depending on physics request)



SuperB SLAC NATIONAL ACCELERATOR LABORATORY

Sites

Site	Min (cores)	Max (cores)	Available (TB)	Data Access	Grid Flavor
CNAF	500	1000	66	StoRM	EGI
SLAC	400	400	10	NFS	OSG
CALTECH	250	680	4.5	NFS	OSG
RAL	200	1000	10	Castor	EGI
RALPP	50	300	5	dCache	EGI
Queen Mary	300	3456	120	StoRM	EGI
Oxford Univ.	50	200	1	DPM	EGI
CCIN2P3	500	1000	10	dCache	EGI
GRIF	50	300	2	DPM	EGI
Victoria	50	100	1	dCache	EGI
Pisa	50	500	0.5	StoRM	EGI
Legnaro	50	100	1	StoRM	EGI
Napoli x3	200	1000	20	DPM	EGI
Bari	80	130	0.5	StoRM/Lustre	EGI
Ferrara	10	50	0.5	StoRM	EGI
Cagliari	10	50	1	StoRM	EGI
Perugia	10	50	1	StoRM	EGI
Torino	50	100	2	DPM	EGI
Milano	50	100	2	StoRM	EGI
Catania	50	100	1	StoRM	EGI
OSC	?	?	?	?	OSG
Polish Grid	?	?	?	?	EGI
Total	2910	10616	259		

- ~3000 - ~10000 cores!
  - In a mix of temporary and permanent allocations
- Predominantly EGI
- Current OSG sites:
  - SLAC
  - Caltech
  - OSC

SuperB

SLAC NATIONAL ACCELERATOR LABORATORY

Current Computing Activities

- Two main activities
  - Support tools and computing to study beam and detector for the upcoming Technical Design Report (Spring 2011) and beyond
    - Full Sim (GEANT4) and FastSim
    - All Grid-Based (see sites on next slide)
    - We might be interested in using OSG opportunistic cycles for our production peaks.
  - Computing R&D for the future
    - What do we need to do to stay on Moore's law?
      - Multi-/Many-cores, GPU
    - Storage (internet-scale technologies)
    - Distributed computing (Grid / Cloud / … ?)
- SuperB has inherited the BaBar software
  - Major rewrites expected per outcome of the R&D
    - Framework, distributed computing, etc., etc.

SuperB SLAC NATIONAL ACCELERATOR LABORATORY

OSG Short-Term Plans

- Set up our own OSG-site contacts group
  - Exchange information about site setup (SuperB-specific)
    - Enabling VO, etc. etc.
  - Recipes for SuperB sites
- Learn / Understand EGI/OSG interoperability in much more detail
  - We are real beginners!
- VOMS replica setup
  - Current SuperB VOMS at CNAF
  - Would like a replica in OSG-land

SuperB SLAC NATIONAL ACCELERATOR LABORATORY

Future Needs

- SuperB will be an exciting experiment but a relatively small collaboration
- Use existing tools (middleware, data distribution, etc.) as much as possible
- Very interested in lightweight tools
  - Not so much in big solutions

SuperB SLAC NATIONAL ACCELERATOR LABORATORY