The SuperB Real (and Virtual) Organization

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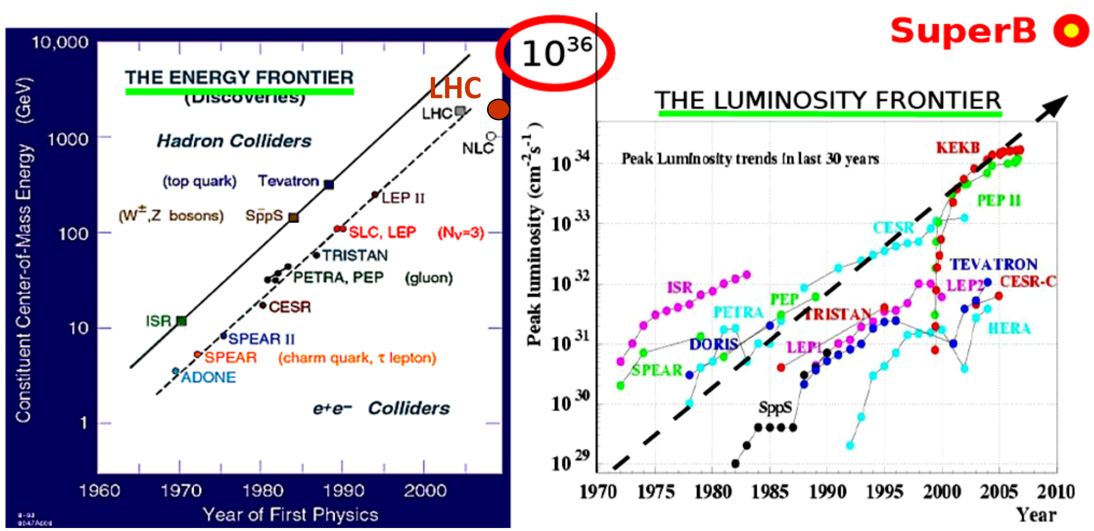
OSG Council 07/10/12

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")



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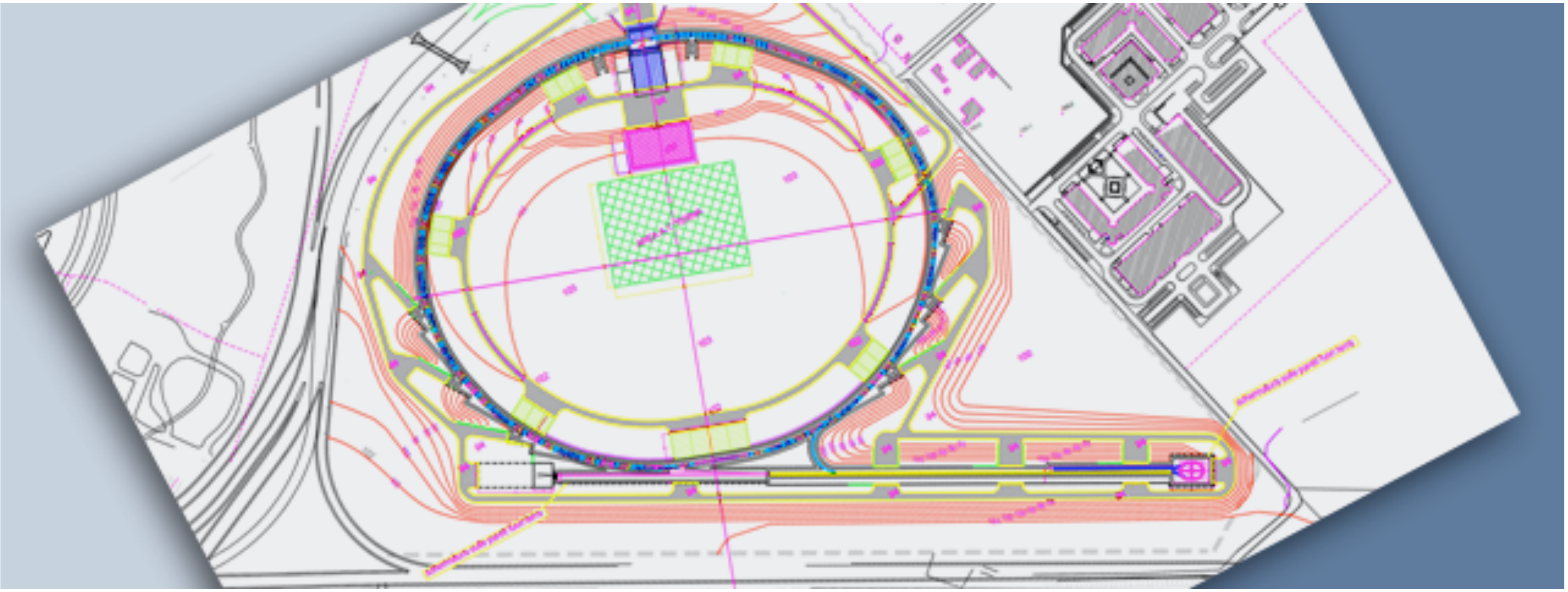
SuperB Physics Goals

- Some of the 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 Υ(4S) and a few months at Charm threshold with peak luminosity of 1×10^{36} cm^2 s^{-1}.

The Nicola Cabibbo Lab



- Created in October 2011 as joint venture of INFN and University or Rome
- Located on a green field site of Tor Vergata University (near Frascati / LNF and Rome)
- Ring circumference ~1200m

http://www.cabibbolab.it

The SuperB Machine

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

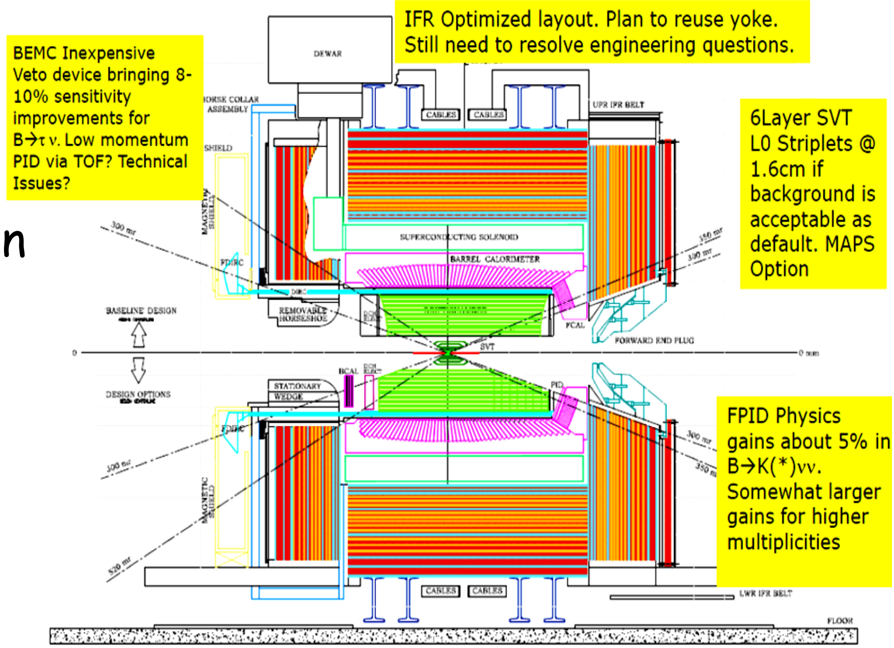
The Detector

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



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 challenges and 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
    - Grid computing? It's the baseline.
    - Cloud technologies applicable on SuperB timescales?
    - Funding will most likely drive us to having ~5-10 mid-size data centers, mostly in Europe
      - Flat hierarchy. No or a distributed "Tier-0"? Peer-to-peer topology of Tier-1 centers?
      - Group some smaller regional centers (in Italy) into "Virtual Tier-1" (common management)
- SuperB Computing TDR in 2013

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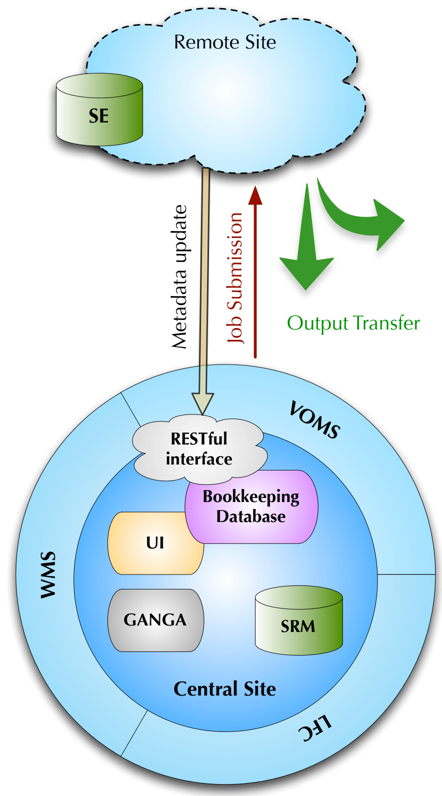
The Data

- Computing requirements (full lumi, steady-state, **storage includes replication**):
  - Raw data
    - 25kHz x 200kByte = 5 Gbyte/s
    - ~160 PByte/year
  - Disk storage growth ~ 10-20PByte/year
  - Tape storage growth ~ 200 Pbyte/year
  - CPU growth ~ 2 MHEPSpec06 / year
    - 1 reprocessing cycle per year

Distributed Computing System (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
  - Transfer the output to SE at CNAF or other target site
- 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

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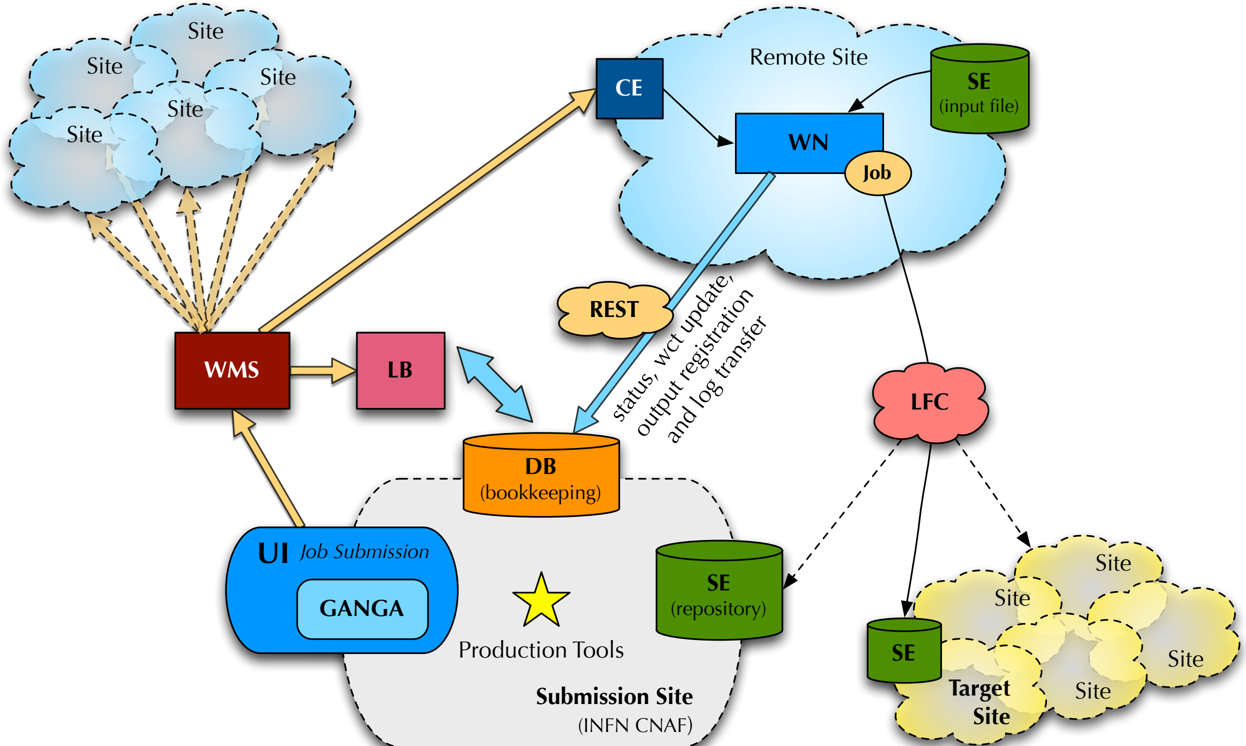
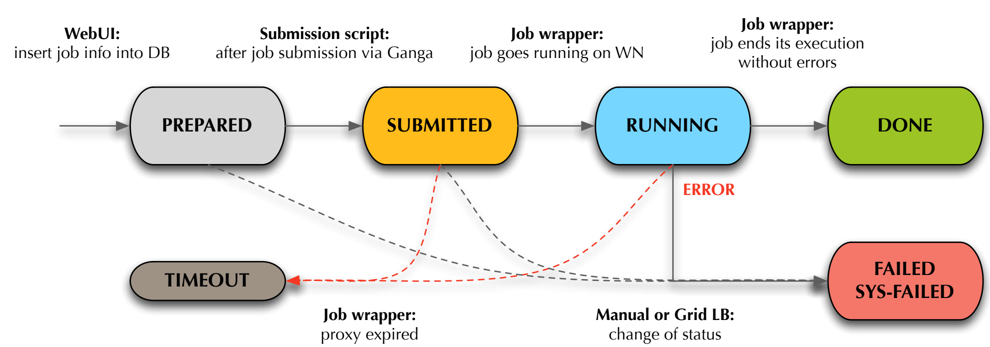
Distributed Computing System (2)



INFN CNAF in Bologna is our central site:

- Job submission
- Bookkeeping DB
- File catalog



Sites

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	L. Fano'
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			

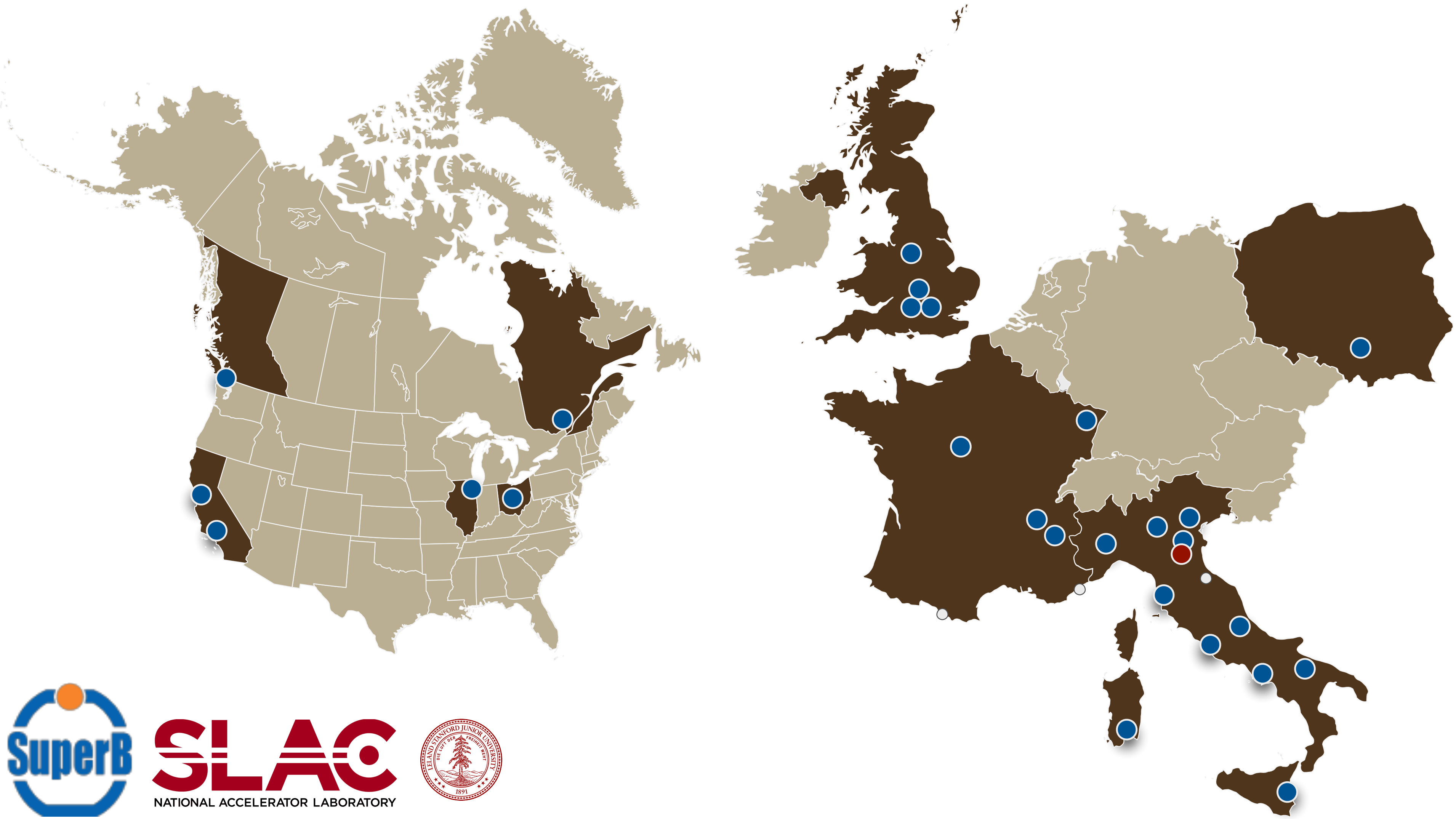
* VO enabling procedure in progress

~3000 - ~10000 cores!
- In a mix of temporary and permanent allocations

Predominantly EGI

Current OSG sites with SuperB resources:
- SLAC
- Caltech
- OSC (in progress)
- FNAL (in progress)

Geographical Locations of our Sites



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Current Computing Activities

- Main activities
  - Support tools and computing to study beam and detector for the upcoming Technical Design Report and beyond
    - Full Sim (GEANT4) and FastSim
    - All Grid-Based (see sites on next slide)
    - We are 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.

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SuperB and OSG

- We are an "OSG VO" (superbvo.org)
- Resource allocations at SLAC and Caltech
- Collaboration with OSG support group has been excellent
  - SuperB requirements have been mapped on OSG general services
  - VO has been enabled for simulation production at SLAC, FNAL and Caltech (WIP at OSC)
- We will run a simulation production campaign in September

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"
- Very interested in technical collaborations and sharing of experience in our R&D areas
  - Frameworks, storage, distributed computing
- On the practical side
  - If we get really serious about OSG use, we would probably want a VOMS replica in OSG-land.