Computing at SuperB

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Detector Evolution from to

- Babar and Belle designs have proven to be very effective for B-Factory physics
- A SuperB detector is possible with today's technology
- Some areas require moderate R&D and engineering developments to improve performance

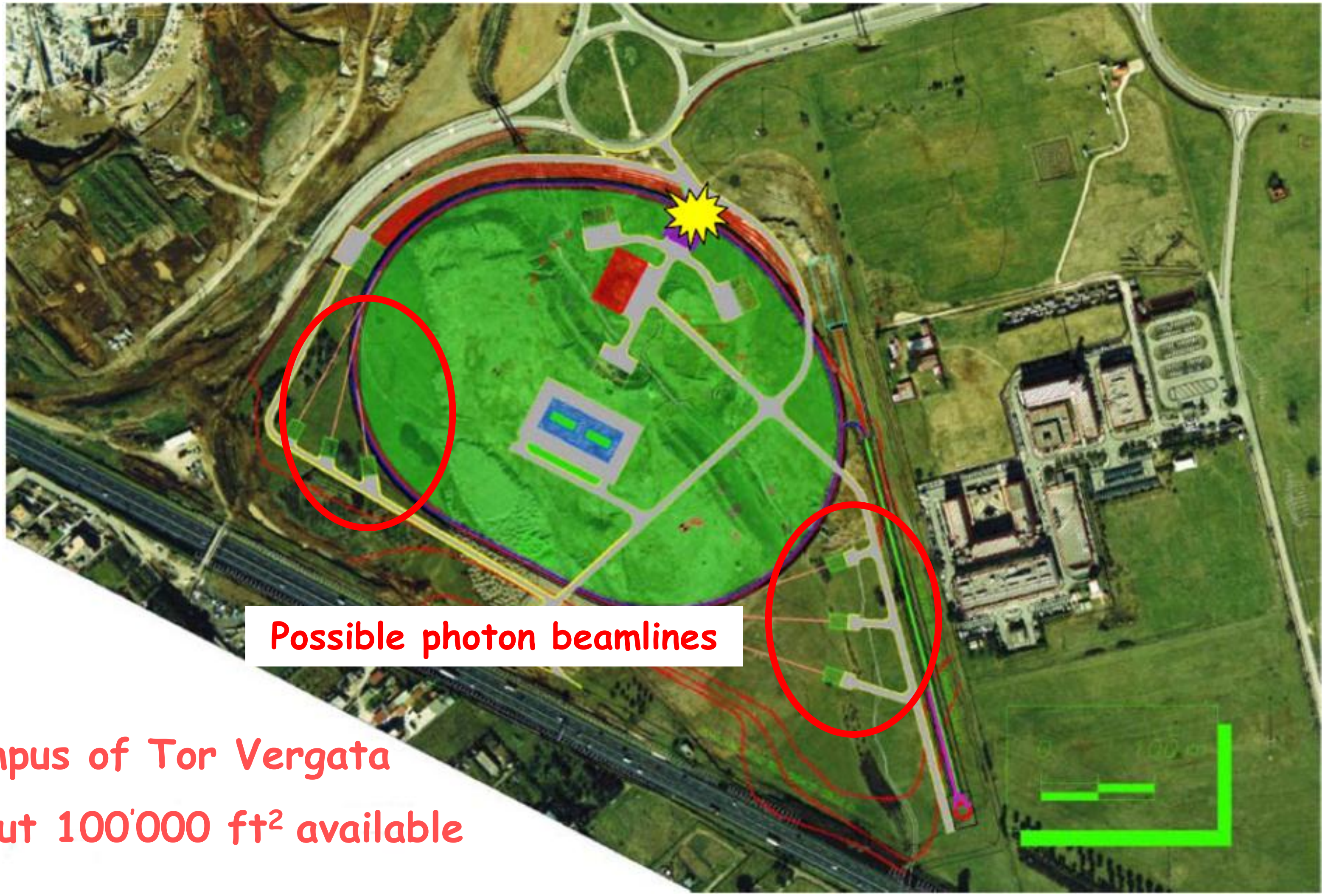
The Accellerator Strategy

- SuperB is a 2 rings, asymmetric energies (e- @ 4.18, e+ @ 6.7 GeV) collider
  - target luminosity of 10^{36} cm^{-2} s^{-1} at the Υ(4S)

- Design criteria:
  - Minimize building costs
  - Minimize running costs (wall-plug power and water consumption)
  - Reuse of some PEP-II B-Factory hardware (magnets, RF)

- SuperB can also be a good "light source": work is in progress to design Synchrotron Radiation beamlines (collaboration with Italian Institute of Technology)

SuperB @ Tor Vergata (1/2)



Campus of Tor Vergata

about 100'000 ft^2 available

SuperB @ Tor Vergata (2/2)

SuperB Computing Model

- Baseline is an extrapolation of BaBar computing model to a luminosity 100 times larger.
- "Raw data" from the detector will be permanently stored, and reconstructed in a two step process
- Monte Carlo data will be processed in the same way
- Selected subset of Detector and MC data, the "skims", will be made available for different areas of physics analysis
- Improvements in constants, reconstruction code, or simulation may require reprocessing of the data or generation of new simulated data

SuperB Computing Needs

- **Limited precision due to many assumptions:**
  - Raw Event size ~100kByte (= 3 x BaBar)
  - Mini/Micro event size = 2 x BaBar
  - CPU / unit lumi: 3 x BaBar
  - 2 copies of raw data
  - Skim expansion factor: 5
  - Some fraction of Mini on disk (100% -> 10%)
  - Equivalent amount of MC "lumi"
  - Raw data stored on tape

- **Storage grows from O(50) PB to O(600) PB in 6 years.**

- **CPU grows from 500 to 12,000 KHepSpec in 6 years.**

Computing infrastructure and ReCaS project

- Storage, Server and Infrastructure specifications for UNINA, INFN-NA, are completed.
- UNIBA, INFN-BA and INFN-CT require more detailed specifications (4 months).
- The first tenders (NA & BA) will start soon.

Planned Resources

	CPU kHepSpec	Storage (PByte)
UNINA	6	0,8
INFN-NA	2	0,3
UNIBA	10	2,5
INFN-BA	3	0,5
INFN-CT	7	0,8
INFN-CS	5	0,6
TOTAL	33	5,5

Distributed Resources

27 sites are available to the SuperB VO

From: Canada, France, Italy, Poland, UK and USA

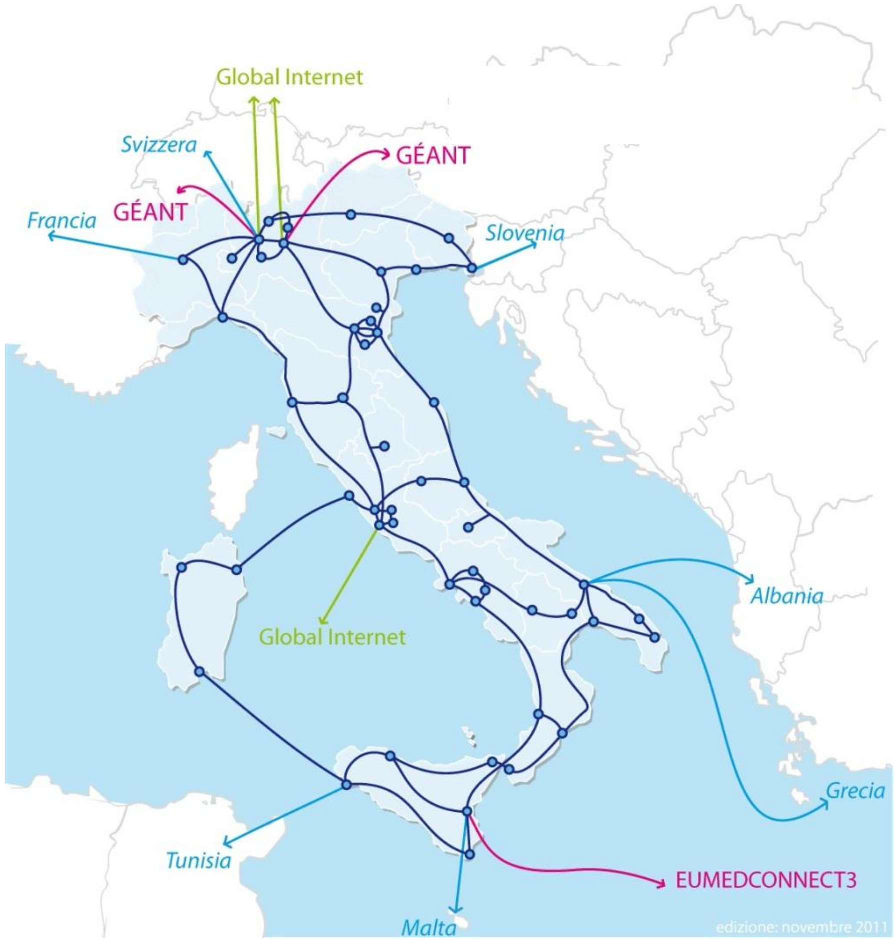
Site	Min (cores)	Max (cores)	Disk (TB)	SRM layer	Grid Org.	Site contacts
RAL(T1)	200	1000	25	Castor	EGI	F. Wilson, C. Brew
Ralpp	50	500	5	dCache	EGI	F. Wilson, C. Brew
Queen Mary	300	2000	150	StoRM	EGI	A. Martin, C. Walker
Oxford Univ.	50	200	*1*	DPM	EGI	K. Mohammad, E. MacMahon
IN2P3-CC(T1)	*500*	*1000*	*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

Computing Network

The sites are now migrating to GARR-X network:

- **Dark fibers between major scientific and academic institutions, including SuperB sites**
- **Since october 2012, dedicated 10 Gbps network connection between the SuperB Data Center sites**
- **Upgrade to 40 Gbps when needed**



- National backbone links provided by the GARR-X project
- Cross Border Fibers links
- Networks links to GÈANT and EUMEDCONNECT3
- Peering point to Global Internet

R&D Parallel Computing (1/3)
GPGPU Testing

- Main Goal: Understand the impact, benefits and limits using the GPGPU architecture

- delegate part of the code that you can parallelize through the use of the GPGPU: determine the impact on performance
- Extracting sources of parallelism in SuperB applications

Computing R&D (2/3)
Distributed Storage

- Testing storage solutions:
  - Work on going on: Hadoop, GlusterFS

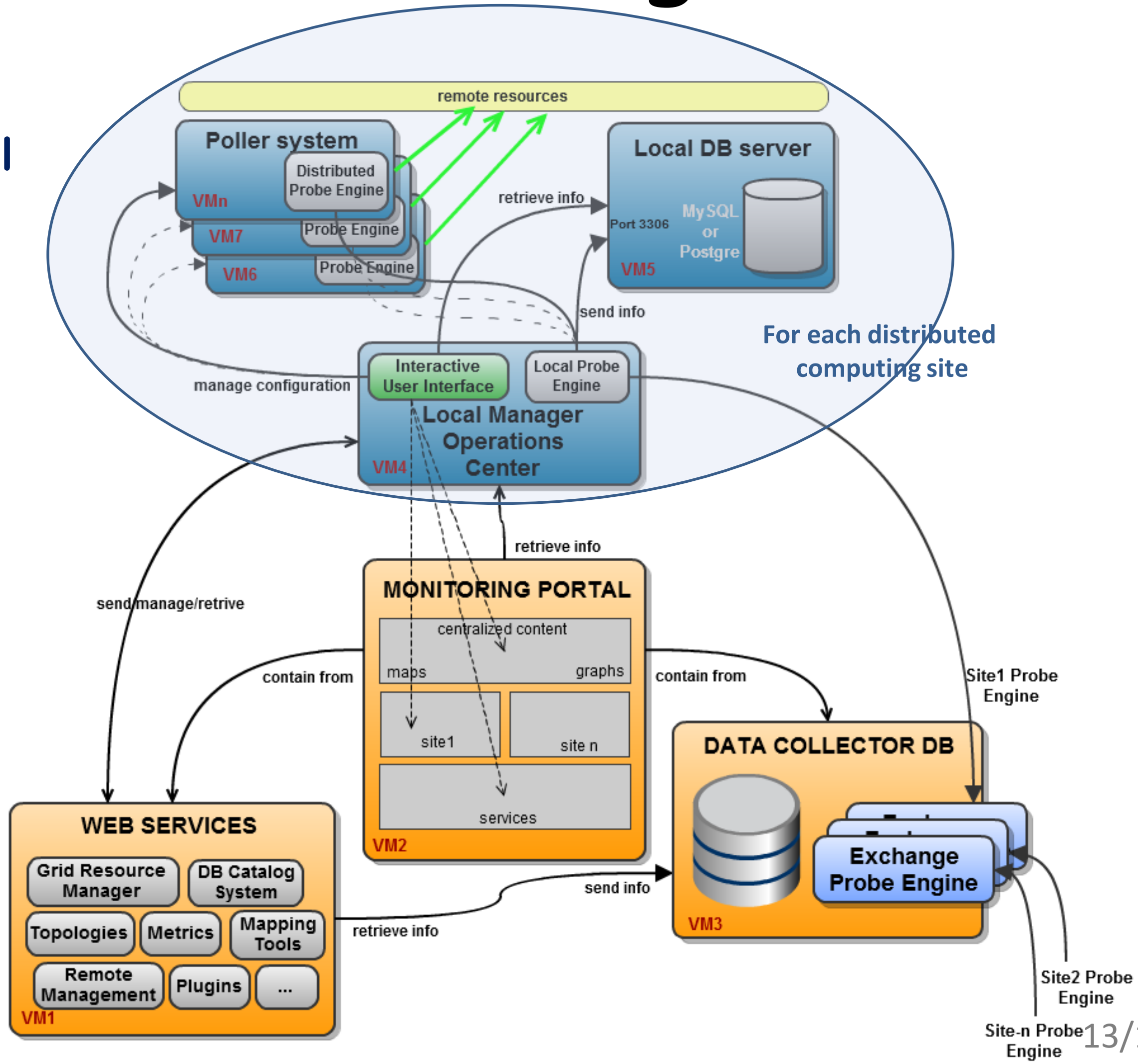
- Testing remote data access:
  - Developing and testing software access library

- Testing remote data access using HTTP protocols
- Testing SuperB code over WAN to measure the performance
- Try to decrease the performance loss on remote data access

Design and test a software solution for Distributed Tier1 center

Computing R&D (3/3) Distributed Monitoring

- *A centralized monitoring system will able to monitor all services, starting from basic layer to application layer*
- *A Layer2-like network will" ensure the visibility of monitoring remote nodes between sites over a cloud distributed infrastructure*
- *Using Liferay as a portlet container, we could integrate several etherogeneous tools, allowing an integrated vision of all sites*



Conclusions

- First “raw data” in 2017 (hopefully)
- Synchrotron light in 2015
- R&D on computing in progress now
- First availability of data centers (5 Pbyte, 33 KHepSpec) in january 2014

Thanks!