



Computing for LHCb-Italy

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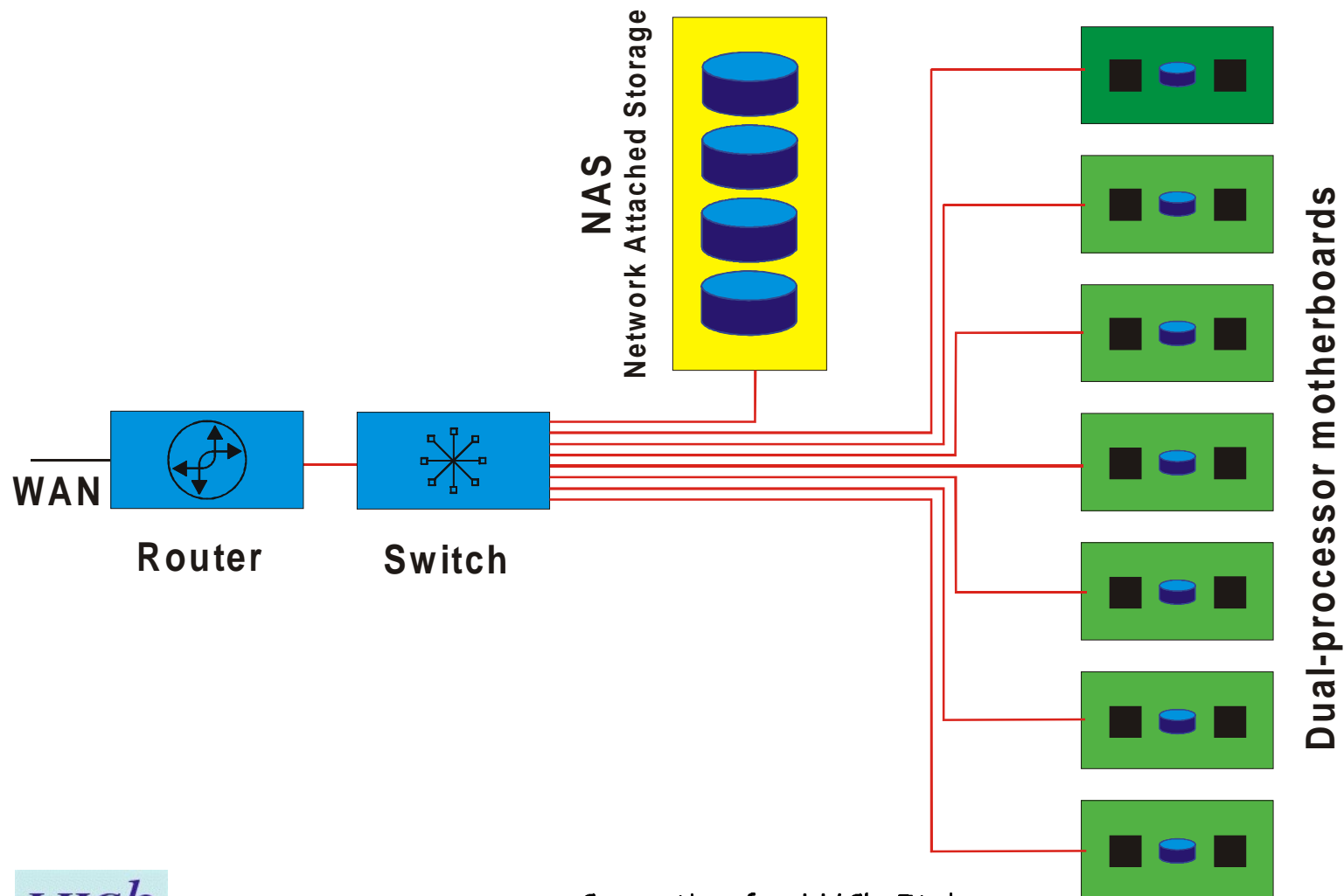
Cagliari, September 13, 2000

LHCb Request for the Year 2001

- 50 CPU 2001 (2300 SI95) Tier-1 computer farm:
 - 25 dual-processor commodity motherboards, rack-mounted with redundant power supply and cooling.
 - 200 GB RAID-5 SCSI disk hosted in a NAS (Network Attached Storage) unit.
 - 100 Mbps Ethernet Switch.
 - Housing and system administration manpower in a "*consorzio di calcolo*".



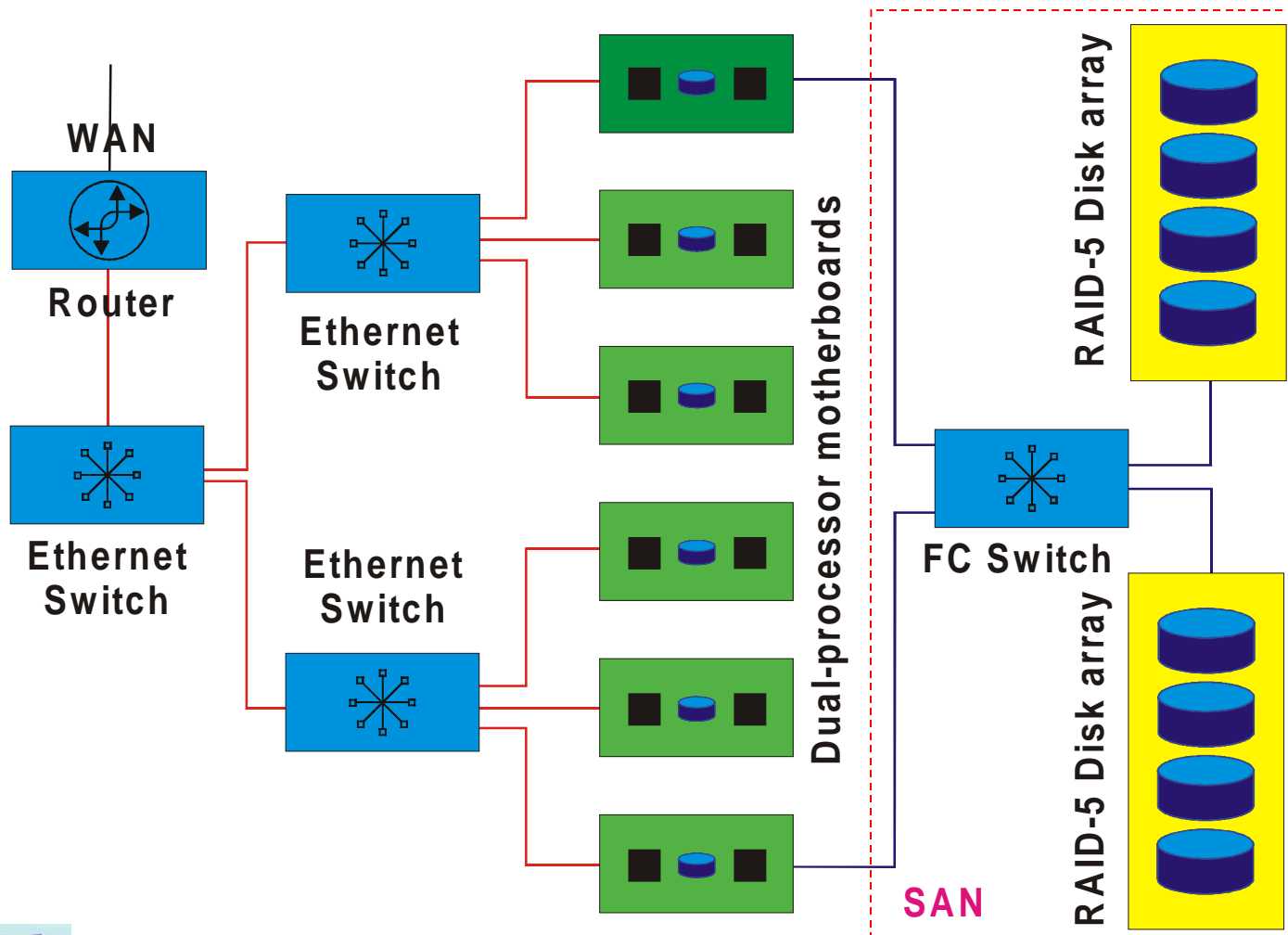
2001 Tier-1 Computer Farm Prototype



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Possible Implementation of 2005 Tier-1 Computer Farm



Request Motivation

- In 2001 we plan to produce simulated events for **detector and trigger optimisation**;
- The Monte Carlo statistics should be such that any trigger efficiency can be determined within a **relative statistical uncertainty of 10%**.
- **The optimisation should be performed on events which are useful** (i.e. will be selected in the physics analyses), that is on events which pass all reconstruction and selection cuts. These events should be therefore processed through the **full reconstruction**.
- To satisfy the above requirements, 10^7 simulated signal events and 2×10^8 simulated background events should be produced. The CPU time required is 3×10^{11} SI95 s.
- If we require the production to be completed in one year (3×10^7 s) the needed computing power is 11500 SI95, that is **2300 SI95** for each one of the 5 regional centres.



Statistics Needed for Trigger Optimisation

Trigger	Signal		Minimum bias	
	Events	CPU time	Events	CPU time
	#	[SI95 s]	#	[SI95 s]
L0	1.5×10^6	5×10^9	3×10^5	4.5×10^8
L1	3×10^6	10^{10}	7×10^6	10^{10}
L2/3	5.5×10^6	2×10^{10}	2×10^8	3×10^{11}

Total Requirements for LHCb Tier-1 (Integral Values)

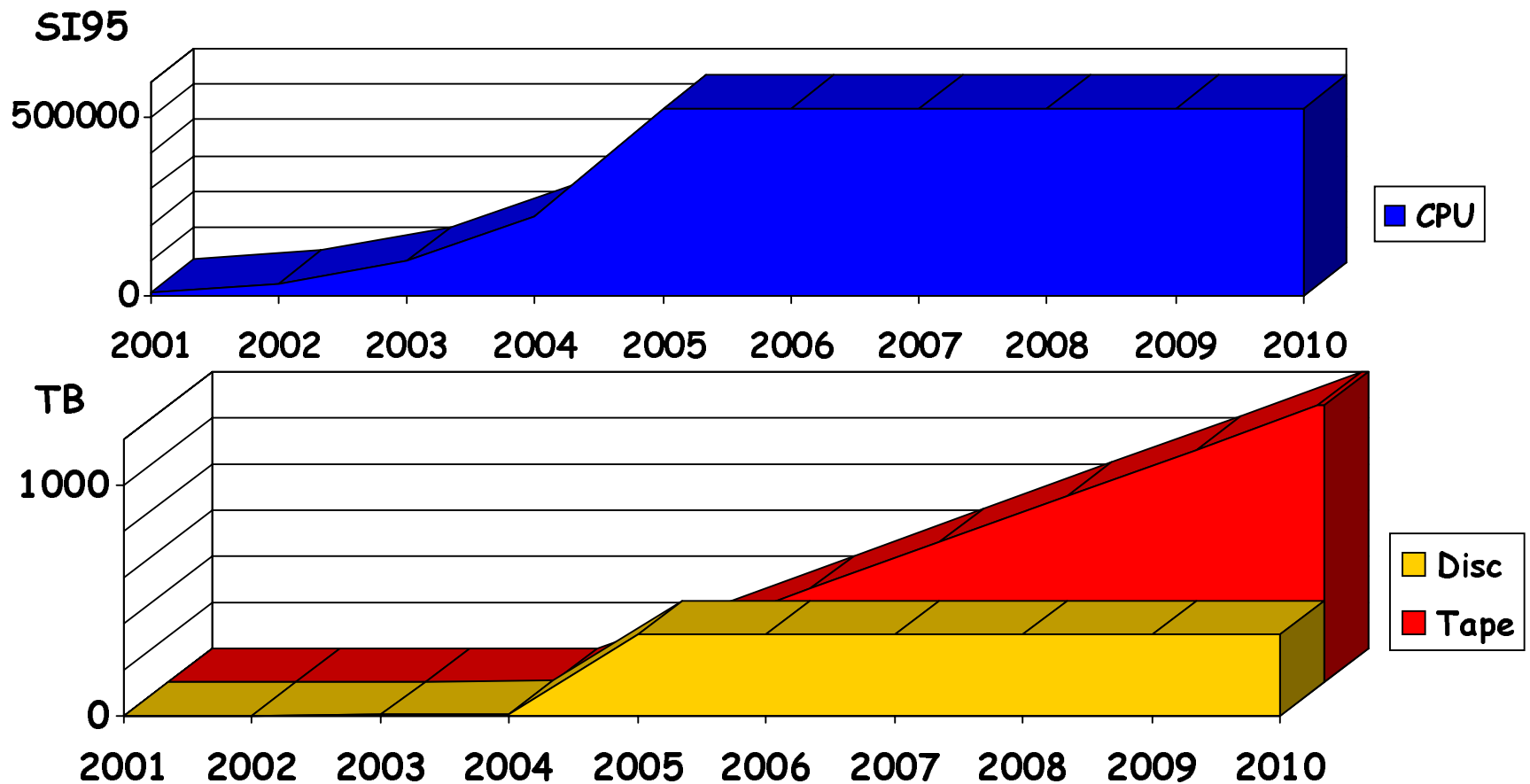
	Units	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Signal events	α^{-1}	10^7	1.2×10^6	3×10^6	5×10^6	10^7					
Background events	α^{-1}	2×10^8	1.2×10^6	4×10^6	10^7	10^9					
CPU for signal	SI95	700	1.15×10^4	3×10^4	5×10^4	10^5					
CPU for background	SI95	10800	1.85×10^4	6.4×10^4	1.6×10^5	4×10^4					
CPU for analysis	SI95	0	4000	7500	1.3×10^4	2.5×10^4					
RAWmc disc	TB	0.5	0.8	1.4	3	202					
RAWmc tape	TB	0.5	0.8	1.4	3	202	404	606	808	1010	1212
ESDmc disc	TB	0.25	0.4	0.7	1.5	101					
AOD disc	TB	0.1	0.1	0.3	0.5	50					
TAG disc	TB	0	0	0.01	0.015	2					



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Total Requirements for LHCb Tier-1 (II)



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Incremental Acquisition of Equipment for LHCb Tier-1

	Units	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CPU	SI95	2300	4500	13500	24200	60500	31500				
Disc	TB	0.2	0.09	0.38	0.69	111.2	22.4				
Tape	TB	0.1	0.06	0.12	0.32	39.8	40.4				

- Resources split up among 5 regional centres.
- In steady state (starting from 2006) replacement every year of 30% of CPU and of 20% of disc.



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The INFN Tier-1 for LHCb

- LHCb-Italy plans to **concentrate** the Tier-1 Regional Centre in only one site, housed in a “consorzio di calcolo”, chosen based on economic convenience.
 - Only one installation.
 - Same architecture of other European Tier-1 centres.
 - No troubles concerning WAN usage (routing, data transfer optimisation to obviate bandwidth limitations, etc.).
 - No organisation and synchronisation requirements.
 - Remote control of concentrated computing resources requires less bandwidth than geographically distributed data and CPUs.
 - Transparent remote control of concentrated resources by institutes will be allowed by GRID middleware.



The INFN Tier-1 for LHCb (II)

- The “consorzio” is concerned with housing of computing resources:
 - Links to electricity grid and computing network;
 - Air conditioning;
 - Uninterruptible power supply;
 - Guardianship.
- To the “consorzio” we plan to *outsource* system administration:
 - Participation to system installation;
 - Administration and monitoring;
 - Intervention in case of hang;
 - Intervention for restoring LAN or WAN connectivity;
 - Backup procedures;
 - Operating system updating and patching.



GRID Middleware Integration

- LHCb collaboration is involved in DATAGRID project.
- Liverpool regional center (MAP) is already working on putting the LHCb computing facility into a GRID environment.
- LHCb-Italy plans to test and to use GRID software in MC production as soon as practicable.
- LHCb-Italy is also involved in core grid development (DATAGRID WP 3).



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Investment Plan for LHCb-Italy

	Units	2001	2002	2003
CPU	[k€]	100	122	228
Switch	[k€]	12	6	12
Rack	[k€]	10	5	15
Hard disc	[k€]	5.5	1.2	3.9
Tape	[k€]	0.11	0.03	0.04
Tape driver	[k€]	4	0	0
Total hardware	[k€]	132	134	259
CPU number (integral)	#	50	111	225
Electric power	[k€]	11	24	48
Housing	[k€]	10	15	28
System administration staff	[k€]	30	50	63
Total operating costs	[k€]	51	89	129
Grand total	[k€]	183	223	388



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Computing Group of LHCb-Italy

	Site	Test-bed	HEP applications	DATAGRID	Total
Mario Alemi	MI	50%	-	-	50%
Walter Bonivento	CA	20%	-	-	20%
Domenico Galli	BO	40%	-	30%	70%
Alberto Gianoli	FE	30%	-	-	30%
Giacomo Graziani	FI	20%	20%	-	40%
Umberto Marconi	BO	40%	-	30%	70%
Marco Paganoni	MI	20%	-	-	20%
Giovanni Passaleva	FI	20%	-	-	20%
Roberta Santacesaria	RM1	-	20%	-	20%
Nicola Semprini Cesari	BO	-	30%	-	30%
Vincenzo Vagnoni	BO	30%	20%	-	50%
Stefania Vecchi	BO	-	40%	-	40%
Total		270%	130%	60%	460%



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