A brief review of the conference Computing in High Energy and nuclear Physics - CHEP 2009

(Prague, 21-27 March 2009)

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Presentation plan

- **Quick review**
  - Online computing
  - Event Processing
  - Software Components, tools and databases
  - Hardware and Computing Fabrics
  - Grid Middleware and Networking Technologies
  - Distributed Processing and Analysis
  - Collaborative Tools
- **LHC authority opinion on the computing**
- **Conclusion**
- **Spare slides**

CHEP 2009 program

- **Online computing (28)**
- **Event Processing (36)**
- **Software Components, tools and databases (40)**
- **Hardware and Computing Fabrics (18)**
- **Grid Middleware and Networking Technologies (43)**
- **Distributed Processing and Analysis (35)**
- **Collaborative Tools (8)**
- **Posters (553)**
- **Conference site http://www.particle.cz/conferences/chep2009/**
- **Registered 738 participants**

Summary (for Online computing)

- Huge amount of computing in the online field
- All have set up Frameworks
- Huge SW-development in the online field
- Cosmics proofed online systems are working
- The way how to use multicore usage is open

Event processing - 1

- **Frameworks & EDM:**
  - 114 Experience with the CMS EDM - Dr. Benedikt Hegner (actually me)
  - 55 File Level Provenance Tracking in CMS - Dr. Christopher Jones
  - 113 PAT: the CMS Physics Analysis Toolkit - Giovanni Petrucciani
  - 210 ROOT: Support For Significant Evolutions of the User Data Model - Philippe Canal
  - 457 Parallel ALICE offline reconstruction with PROOF - Peter Hristov
- **Event Simulation and Generation**
  - 25 New models for PIXE simulation with Geant4 - Dr. George Weidenspointner
  - 382 Validation of Geant4 Hadronic Physics Models at Intermediate Energies - Sunanda
  - 98 GEANT4E Track Extrapolation in the Belle Experiment - Prof. Leo Pilonen
  - 479 ATLAS Upgrade Simulation with the Fast Track Simulation FATRAS - Dr. Andreas Salzburger
  - 68 Tuning and optimization of the CMS simulation software - Dr. Fabio Cossutti
  - 460 Parallelization of ALICE simulation - a jump through the looking-glass - Matevz Tadel
  - 444 Monte Carlo Generators in Atlas software - Dr. Judith Katzy

- **Reports on data taking and MC operations:**
  - 73 Overview of the LHCb Tracking System and its Performance on Simulation and on First Data - Manuel Schiller
  - 242 Data Quality Monitoring for the CMS Silicon Strip Tracker BORGIA, Maria Assunta
  - 403 Commissioning of the Muon Track Reconstruction in the ATLAS Experiment WILLOCQ, Stephane
  - 84 A New Tool for Measuring Detector Performance in ATLAS Dr. STRAESSNER, Arno
  - 284 The CMS Computing, Software and Analysis Challenge Dr. MANKEL, Rainer
  - 375 The Software Framework of the ILD detector concept at the ILC detector - Dr. Frank Gaede
  - 497 Offline computing for the Minerva experiment SCHELLMAN, Heidi
- **Statistics**
  - 533 Overview of the new ROOT statistical software MONETA, Lorenzo
  - 331 BAT - The Bayesian Analysis Toolkit KOLLÃ¡R, Daniel

- **Event Reconstruction techniques:**
  - 117 Ring Recognition and Electron Id in the RICH detector of the CBM Experiment at FAIR - Semen Lebedev
  - 434 Vertex finding in pile-up rich event for p+p and d+Au collisions at STAR Mrs. REED, Rosi
  - 130 A framework for vertex reconstruction in the ATLAS experiment at LHC Dr. PROKOFIEV, Kirill
  - 190 An overview of the b-Tagging algorithms in the CMS Offline software Dr. BOCCI, Andrea
  - 294 Ideal tau tagging with TMVA multivariate data-analysis toolkit Mr. HEIKKINEN, Aatos
  - 144 CMD-3 Detector Offline Software Development Mr. ZAYTSEV, Alexander
- **Trigger Software:**
  - 159 The Muon High Level Trigger of the ATLAS experiment VENTURA, Andrea
  - 215 ATLAS Tau Trigger: from design challenge to first tests with cosmics DAM, Mogens

- **Software Performance:**
  - 266 HEP C++ meets reality -- lessons and tips - Mr. EULISSE, Giulio
  - 482 CMS Software Performance Strategies - Dr. ELMER, Peter
  - 128 The ATLAS Simulation Validation and computing performance studies - Dr. Adele Rimoldi
  - 65 Validation of software releases for CMS - Dr. Oliver Gutsche
- **Event display:**
  - 78 The Virtual Point 1 Event Display for the ATLAS Experiment - Dr. Thomas Kittelmann
  - 54 Fireworks: A Physics Event Display for CMS - Dr. Kovalskyi Dmytro

Event processing - 2

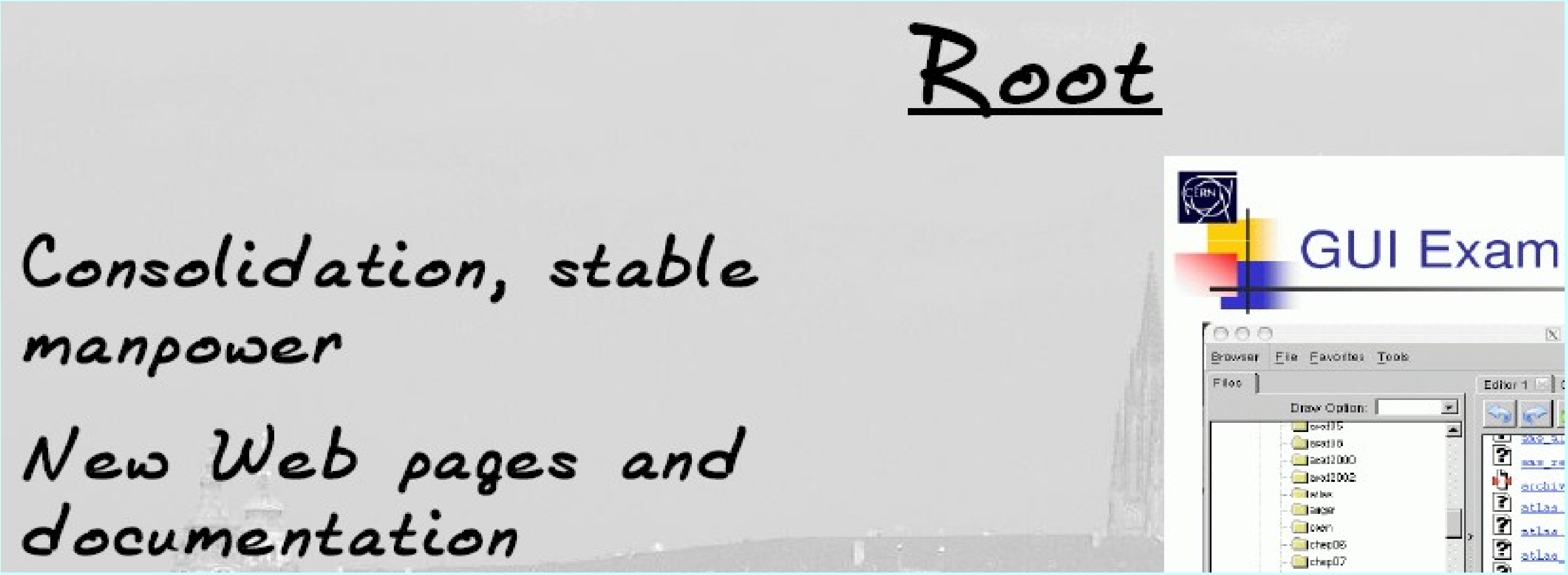
How to summarize a session with 8 different topics?

- It's all about performance. Both physics performance and software performance.
- The two can conflict with each other. In order to improve the physics performance you have to calculate more.
- However it is possible that using physcis performance as a guide, you can figure out what you DO NOT have to do.

Software Components, Tools and Databases

- 36(+1-1) talks + 72 posters
  - Databases, Data, Metadata
  - Python
  - Multicore, Parallelization
  - Frameworks
  - Monitoring
  - Development Environment
  - Virtualization
  - Performance
  - Simulation

Software Components, Tools and Databases - 2



Hardware and Computing fabrics - 1

Paper category

- Benchmarking
  - 1
- operation experience
  - Data/computing center
    - 6
  - Experiments
    - 4
      - 2DAQ
- Data/computing center infrastructure
  - 1
- New technology
  - 5
  - Virtualization, SSD, new processor, file system

Hardware and computing fabric - 2

- Use of SSD to speedup the disk IO
- Use of virtual machines (Xen)
- Advanced storage technology at ALICE DAQ (especially because all data are in ROOT format)
- SL4 until Oct 2010 but do not delay with SL5
- Lustre is favorite distributed filesystem in HEP (evaluated at FNAL)
- Cooling, HPSS, HEP-SPEC2006

Grid middleware and networking technologies - 1

- 44 oral presentations
- 76 posters

By category:

10	general
3	software distributions
14	operations
10	security
22	data
16	workload
28	monitoring
2	information systems
7	networking
4	interoperability
4	other

By origin:

5	ALICE
8	ATLAS
15	CMS
3	LHCb
4	CDF
15	EGEE
34	LCG
4	Nordugrid
13	OSG
19	other

Grid middleware and networking technologies - 2

- Interoperation (EGEE, NORDUGRID, OSG)
  - CRAB (CMS) via gLite to ARC (NORDUGRID)
  - Panda (ATLAS) to ...
- Monitoring
  - Network monitoring
  - Job status monitoring
- Data management (FeDex, LFC, FTS, etc., etc.)
- Security
- Clouds – Grids, European Grid Initiative (EGI)
- IPv4 until 2011 ? IPv6 is 'almost' unavoidable but … how to guarantee it ?

Grid middleware and networking technologies - 3

Grid Middleware for WLCG

- serious critical view of big "customer"
- not all expectations met by the grid
- some things work: single sign-on, data transfer, simple catalogues, etc.
- disappointment in robustness and reliability
- generic services not easy to achieve
- decouple complexities and dependencies, leverage virtualization
- extensive discussion, most controversial talk
  - eagerly waiting for the paper for a more in depth analysis

- Shevel's mark

Grid middleware and networking technologies - 4

- production grids are there
- middleware is usable and used
  - job management, job management, monitoring, security
  - some expectations were not met, why?
- standards are emerging
  - long but unavoidable way to go
- networking
  - bandwidth use keeps pace with technology progress
  - urgent to close digital divide

- Shevel's mark

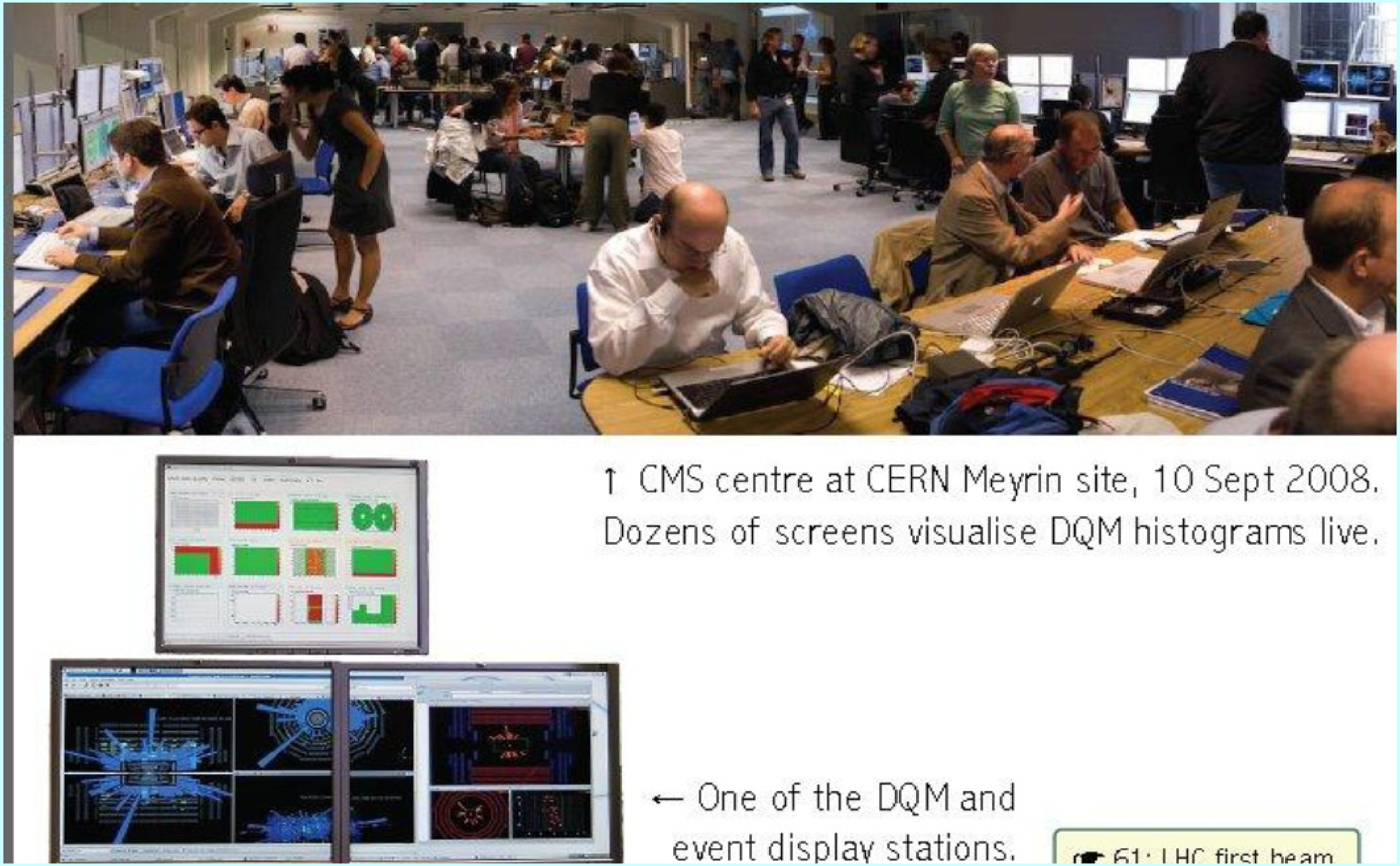
Distributed Processing & Analysis 1

Some session statistics

- Altogether 35 oral presentations
  - Many thanks to the presenters for the excellent talks!
- Summary range of topics
  - Analysis storage solutions (SCALLA/XROOTD)
  - PROOF
  - Experiment and middleware specific analysis management systems (many names, mentioned in the following slides)

Main magic words: XrootD, Ganga, PanDa, Proof, ARC, Dirac, GAUDI

Distributed Processing & Analysis 2



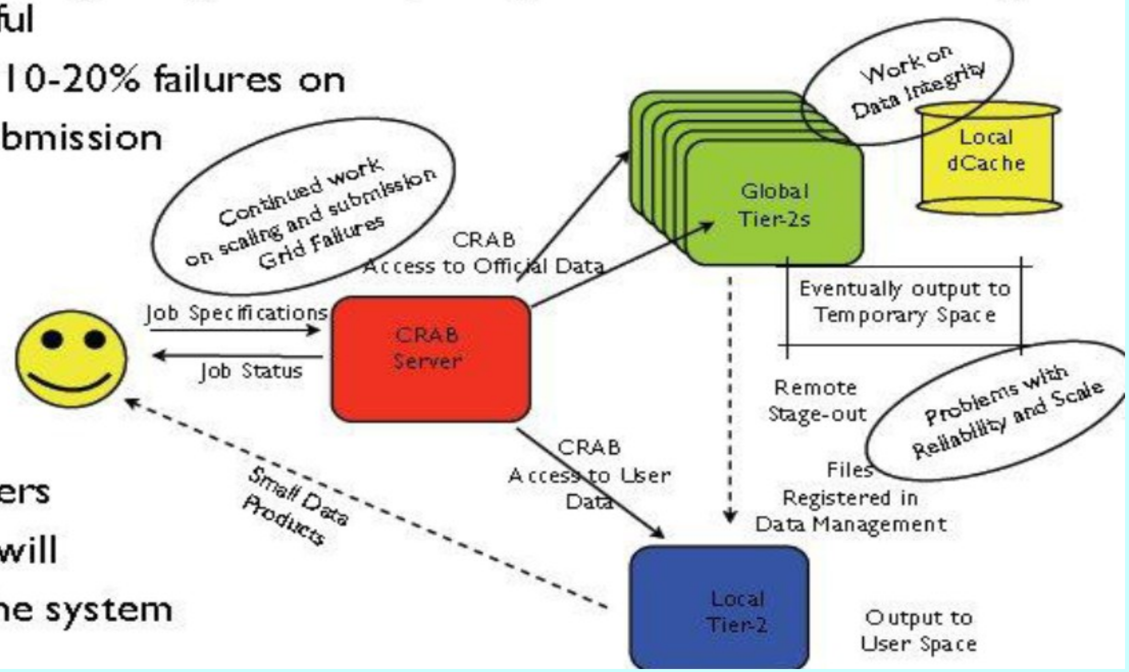
Distributed Processing & Analysis 3

Challenges for the CMS Computing Model in the First Year

Analysis

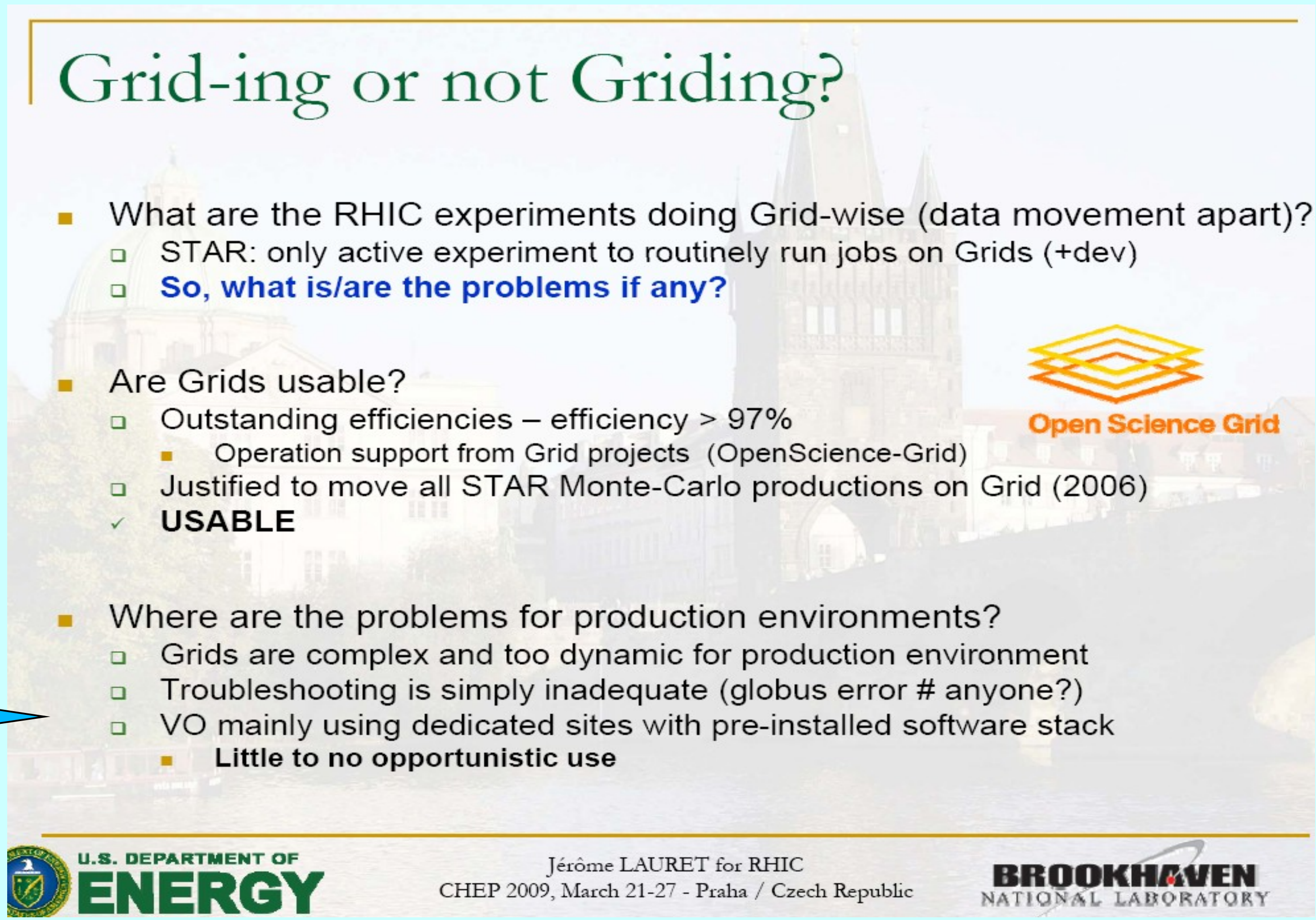
How the system will work with 2000 collaborators?

- CMS Remote Analysis Builder (CRAB) shields the user from the underlying complexity, but a many things have to succeed for analysis to be successful
- CMS sees 10-20% failures on analysis submission



Clear adding users and workflows will further stress the system

Distributed Processing & Analysis 4



- Shevel's mark

Distributed Processing & Analysis 5

Still unclear if sites and computing systems are ready for the user data analysis - extensive tests are foreseen

Authorization on storage systems is still too crude

26 March 2009 Chep09: WLCG Collaboration Workshop Summary

Distributed Processing & Analysis 6

Summary

- Clearly a lot of progress in the user analysis tools in the past year
  - Not surprising – 'how to do analysis efficiently' is the question all experiments are asking themselves
- Commonalities between the different experiments
  - Job placement with data
  - Reliance on glide-in jobs for prioritization
    - To a lesser extent on local batch queues
  - Development of sophisticated frameworks to handle the user analysis on and off the Grid
    - Which come on top of the existing Grid tools or work directly with the centre batch systems
    - And with a considerable arrays of 'helper' and 'debugging' options
  - Reliance on prompt analysis facilities in various forms
    - A lot of them are PROOF-enabled
    - PROOF is also entering the Grid (and your multi-core laptop)

- Shevel's mark

Collaborative Tools 1

CMS Centres Worldwide: a New Collaborative Infrastructure

Evo (Enabling Virtual Organizations)

High Definition Videoconferencing for High Energy physics

High Definition Videoconferencing for High Energy physics

Dirac Secure Web User interface

Indico Central – Events Organization,

ergonomics and Collaboration Tools

LHC authority opinion

The LHC Machine and Experiments: Status and Prospects

CHEP

Prague, March 23, 2009

Sergio Bertolucci

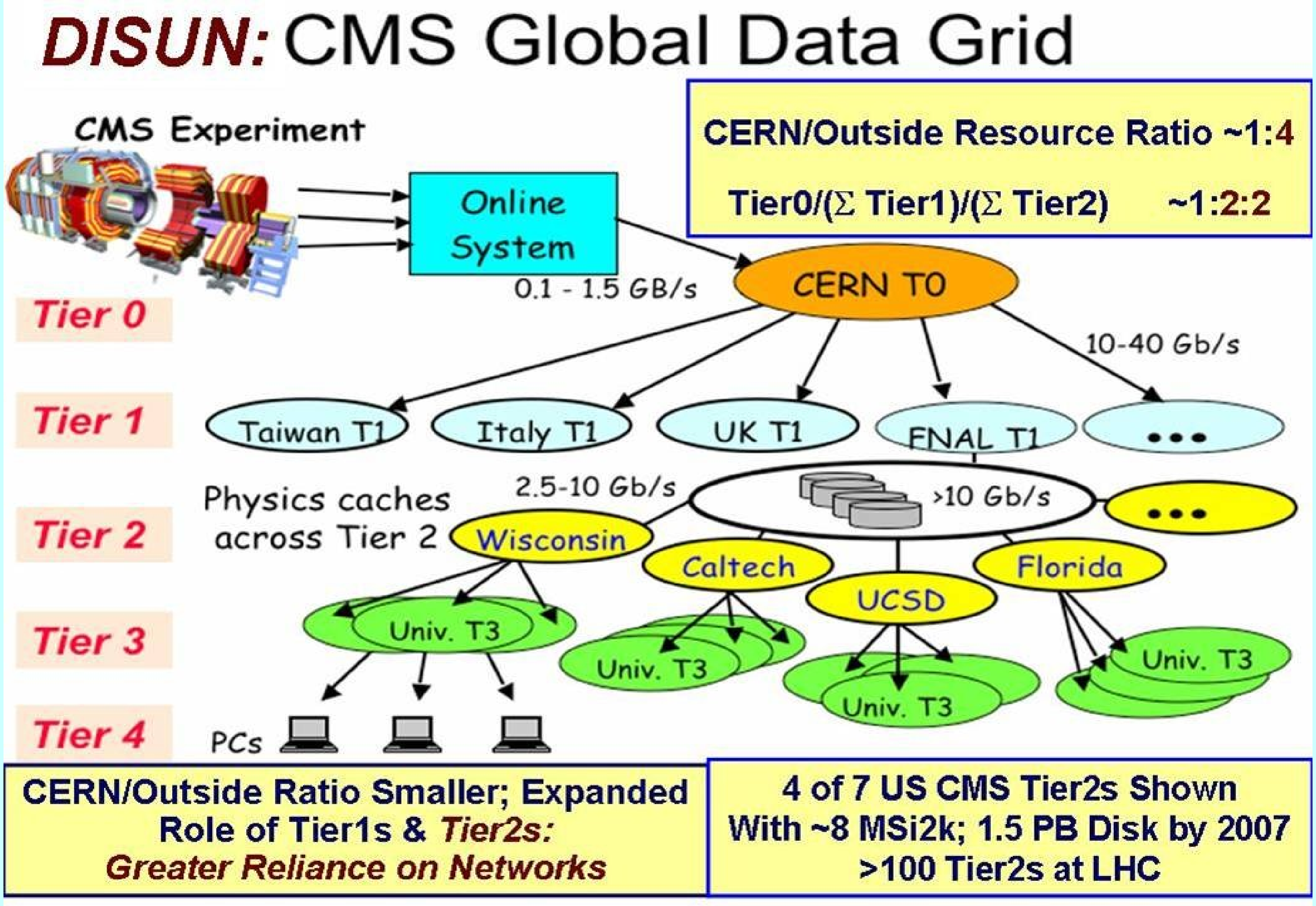
CERN

Sergio Bertolucci conclusion

Tier-0/1/2s generally working well:

- Substantial improvement in reliability, availability, monitoring, usage during 2008 (CCRC08)
- Some delays in procurements for 2009 (and 2008)
- Pledged resources still needed in 2009-10
- **Need to stress-test system with ATLAS & CMS reconstructing data simultaneously**
- **Need to validate the model for "chaotic analysis"**
- Continue to improve communications between Tier-0, Tier-1s, Tier-2s and users

LCG Architecture



Main aim of the LCG

- The purpose of the LHC Computing Grid is
  - To provide the computing resources needed to process and analyse the data gathered by the LHC Experiments.
  - to provide common software for this task and to implement a uniform means of accessing resources
- The LCG project [aided by the experiments] is addressing this by
  - assembling at multiple inter-networked computer centres the main offline data storage and computing resources needed by the experiments and operating these resources in a shared grid-like manner

What are the Tiers

- Tier0 is at CERN
  - receives the raw and other data from the Experiments' online computing farms and records them on permanent mass storage. It also performs a first-pass reconstruction of the data
- Tier1 Centres
  - provide a distributed permanent back-up of the raw data, permanent storage and management of data, a grid-enabled data service, perform data-heavy analysis and re-processing, and may undertake national or regional support tasks, as well as contribute to Grid Operations Services.
- Tier2 Centres
  - provide well-managed, grid-enabled disk storage and concentrate on tasks such as simulation, end-user analysis and high-performance parallel analysis

How many countries, sites, etc.

MoU Signatories

- 33 countries have signed the MoU
  - 1 more in progress
  - In many cases several signatures
- Tier-0
- 11 Tier-1 sites
- 61 Tier 2 federations
  - 120 individual Tier 2 sites
- Accounting and reliability reported.
- Quite a few more that run WLCG

Australia	Netherlands
Austria	Norway
Belgium	Pakistan
Canada	Poland
China	Portugal
Czech	Romania
Denmark	Russia
Estonia	Slovenia
Finland	Spain
France	Sweden
Germany	Switzerland
Hungary	Taipei
Italy	Turkey
India	UK
Israel	Ukraine
Japan	USA
Korea	

CONCLUSION: My own opinion based on personal discussions on the conference

- A lot of developers are involved into the Grid infrastructure
- The Grids …
  - Not all expectations have been met by Grid
  - More problems than it was expected at the beginning (around 2002).
- Does each physicist really need to use Grid? It depends.
  - If you can not avoid of using Grid let you do.
  - If you can avoid of using Grid – do not use it.
- **Be aware of trade offs!**

Grid at PNPI

- Conditions to keep Grid cluster (aka Tier 2/3) facilities at PNPI
  - Good network connectivity (I am afraid around 10 Gbit is mandatory)
    - Remark: Now we have really less than 100 Mbit
  - The paid team who can help end users.
  - Real needs to use it on site, i.e. participation in a collaboration scale computing activity.
- Can one use Grid if PNPI will not have Grid facilities on site? Yes, it is possible with less requirements to the network connectivity.
- Network connectivity is the main point.

Spare slide 1

The GigaFitter

- Designed as a possible replacement of the current Track Fitter
- Can overcome the SVT limits and increase SVT performances at high luminosity

Thanks to Xilinx for kind donation!

Based on modern FPGA

Xilinx VIRTEX 5 : 65 nm – 550 MHz device

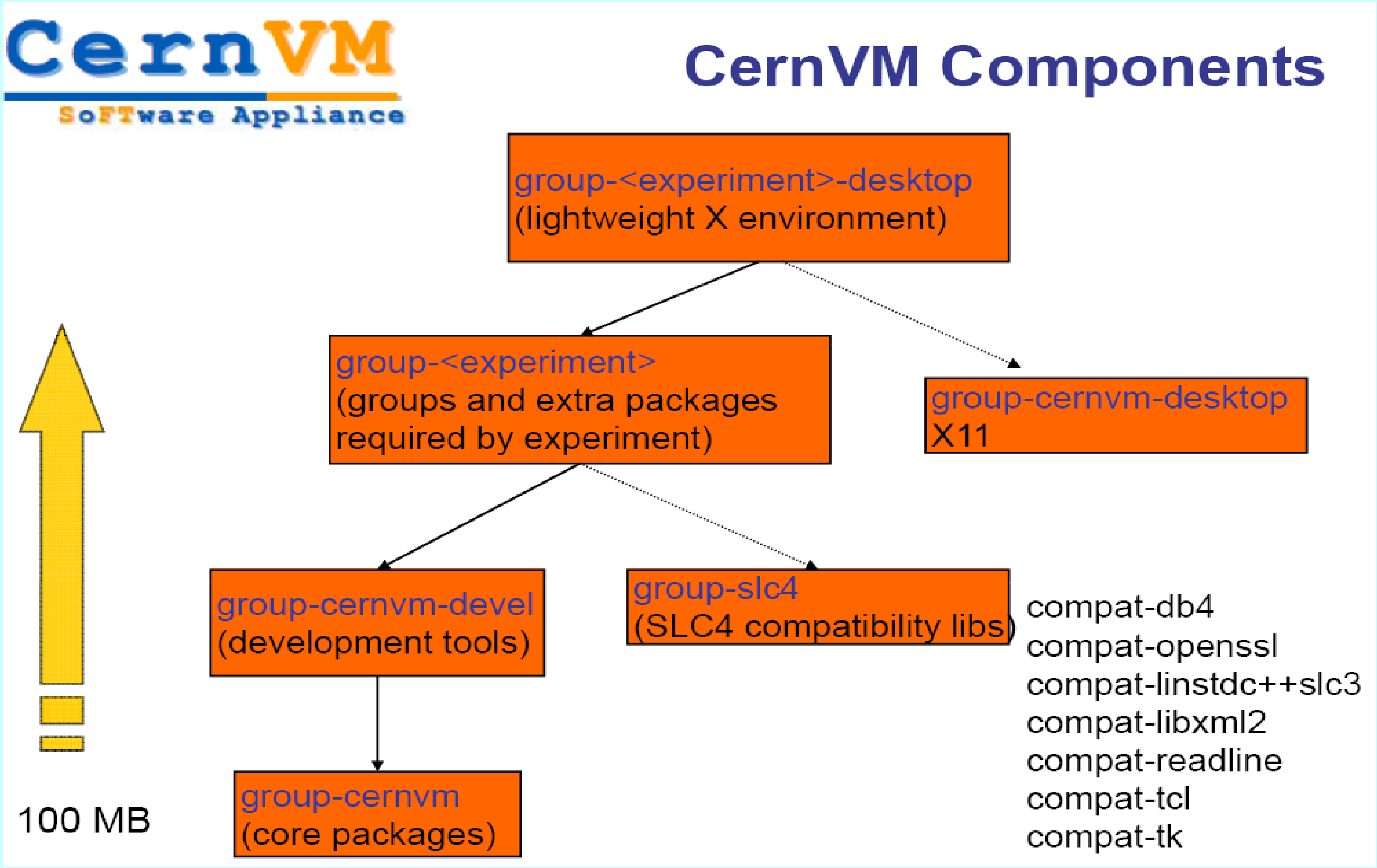
Provided with **640 DSP**

- 25 x 18 bit multipliers
- 48 bit adders

Can use full hit resolution → 18 x 18 multipliers, no need for precalculated terms stored in big memories

Memory available to store **more patterns and more constant sets!**

Spare slide 2: virtualization



Spare slide 3: Grids or/and (?) Clouds

Last spare slide:
New technology

Segwey – amazing vehicle