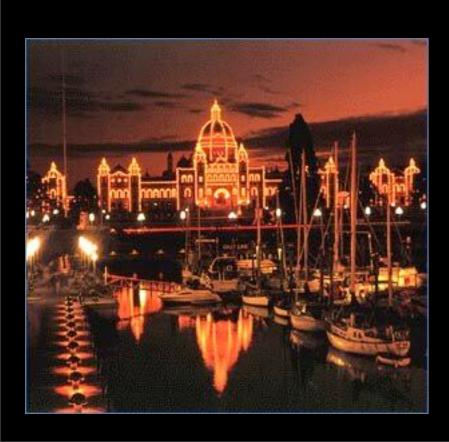# Summary of software components, tools and databases track

Federico Carminati

CHEP 2007

Victoria, BC

Canada

Disclaimer

- 10 hours of talks in 20'... = 1/60!

- I apologise for what I will not say

- And also for what I will say

The session at a glance

- 33 talks
  - 11 on Data Storage and DB
  - 5 on ROOT
  - 4 on analysis
  - 4 on performance
  - 4 on MC
  - 3 on Offline environment
  - 1 data quality
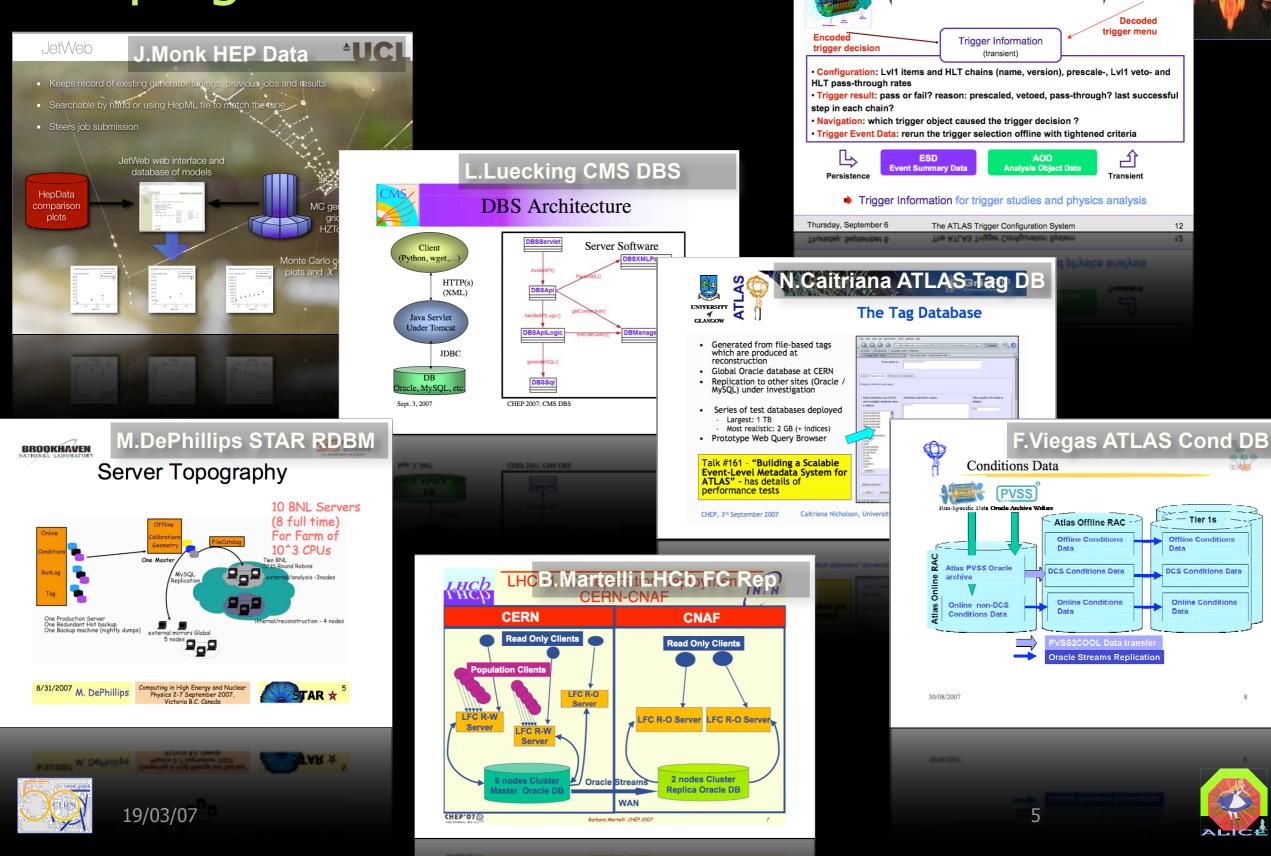 - 1 on Grid

Data storage & DB

- Metadata is a main worry for LHC experiment
  - Where are my data?
  - What do I do with 1Bfiles if I lose the catalogue?
- Few common building blocks
- A lot of bare plumbing
- Not everything has been thoroughly tested or understood (see STAR talk)
- Usually an underestimated software problem
  - Blindly throwing hardware at it may make the problem worse!
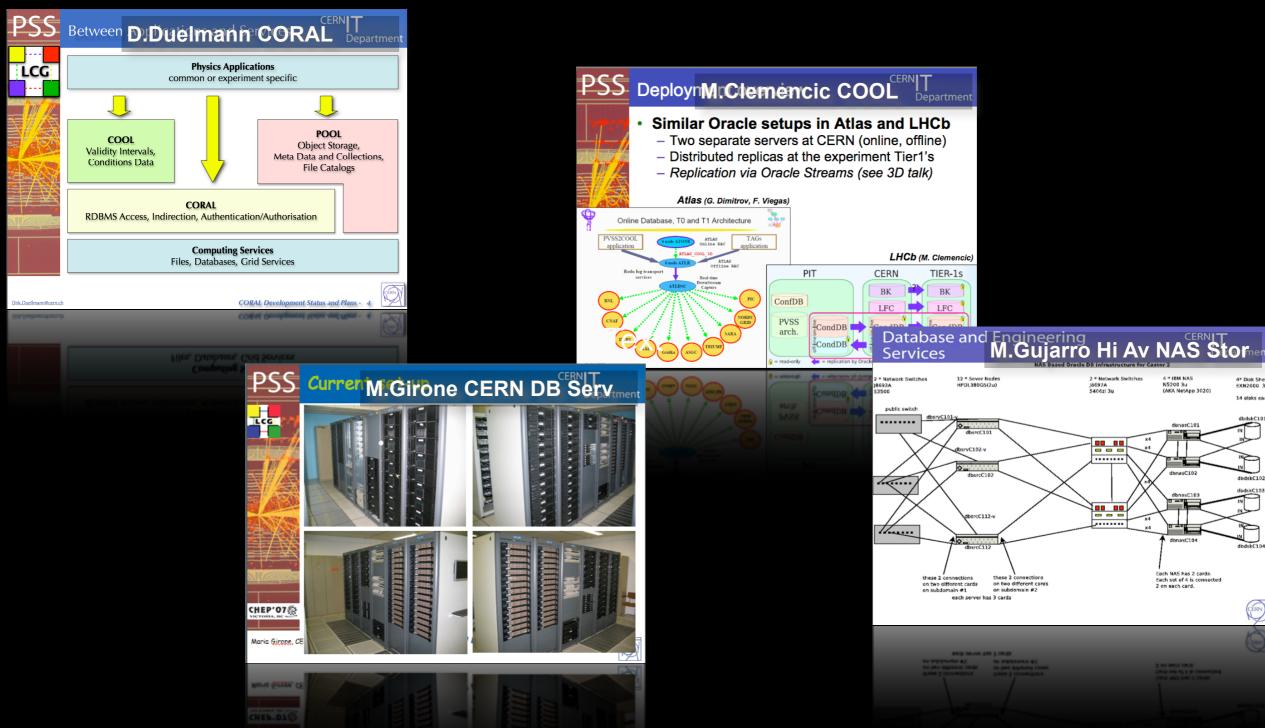
Keeping track of the data

J.Monk HEP Data

JetWeb — UCL

- Keeps record of existing generator tunings, previous jobs and results
- Searchable by hand or using HepML file to match the tune
- Steers job submission

JetWeb web interface and database of models

HepData comparison plots

MC gen... grid... HZTo...

Monte Carlo ... plots and χ²

J.Selzer ATLAS Trig Conf

Configuration Data in Offline Analysis

| Configures for Data taking | TriggerDB All configuration data | Decoded Trigger Menu | online DB (COOL) |

Decoded trigger menu

Encoded trigger decision → Trigger Information (transient)

- **Configuration:** Lvl1 items and HLT chains (name, version), prescale-, Lvl1 veto- and HLT pass-through rates
- **Trigger result:** pass or fail? reason: prescaled, vetoed, pass-through? last successful step in each chain?
- **Navigation:** which trigger object caused the trigger decision ?
- **Trigger Event Data:** rerun the trigger selection offline with tightened criteria

Persistence — ESD Event Summary Data — AOD Analysis Object Data — Transient

➡ Trigger Information for trigger studies and physics analysis

Thursday, September 6 — The ATLAS Trigger Configuration System — 12

L.Luecking CMS DBS

DBS Architecture

Client (Python, wget,...)

HTTP(s) (XML)

Java Servlet Under Tomcat

JDBC

DB Oracle, MySQL, etc.

Server Software

DBSServlet
DBSApi
DBSApiLogic
DBSSql

DBSXMLP...
ParseXML()
invokeAPI()
handleAPILogic()
getConnection()
executeQuery()
generateSQL()

DBManage...

Sept. 3, 2007 — CHEP 2007: CMS DBS

N.Caitriana ATLAS Tag DB

UNIVERSITY of GLASGOW — ATLAS

The Tag Database

- Generated from file-based tags which are produced at reconstruction
- Global Oracle database at CERN
- Replication to other sites (Oracle / MySQL) under investigation
- Series of test databases deployed
  - Largest: 1 TB
  - Most realistic: 2 GB (+ indices)
- Prototype Web Query Browser

Talk #161 – "Building a Scalable Event-Level Metadata System for ATLAS" - has details of performance tests

CHEP, 3rd September 2007 — Caitriana Nicholson, University...

M.DePhillips STAR RDBM

BROOKHAVEN NATIONAL LABORATORY

Server Topography

Online
Conditions
RunLog
Tag

Offline
Calibrations
Geometry
FileCatalog

One Master

MySQL Replication

10 BNL Servers (8 full time) For Farm of 10^3 CPUs

Two BNL DNS Round Robins

external/analysis -3nodes

internal/reconstruction - 4 nodes

One Production Server
One Redundant Hot backup
One Backup machine (nightly dumps)

external mirrors Global 5 nodes

external mirrors Global 5 nodes

8/31/2007 M. DePhillips | Computing in High Energy and Nuclear Physics 2-7 September 2007, Victoria B.C. Canada | STAR ⭐ 5

B.Martelli LHCb FC Rep

LHCb — LHCb FC Replication CERN-CNAF

| CERN | CNAF |

Read Only Clients | Read Only Clients

Population Clients

LFC R-W Server
LFC R-W Server
LFC R-W Server
LFC R-O Server

LFC R-O Server
LFC R-O Server

6 nodes Cluster Master Oracle DB → Oracle Streams WAN → 2 nodes Cluster Replica Oracle DB

CHEP'07 VICTORIA, BC — Barbara Martelli CHEP 2007 — 7

F.Viegas ATLAS Cond DB

PVSS

Conditions Data

Run-Specific Data Oracle Archive Writers

Atlas Online RAC

Atlas PVSS Oracle archive

Online non-DCS Conditions Data

Atlas Offline RAC

Offline Conditions Data
DCS Conditions Data
Online Conditions Data

Tier 1s

Offline Conditions Data
DCS Conditions Data
Online Conditions Data

PVSS2COOL Data transfer
Oracle Streams Replication

30/08/2007 — 8

19/03/07

5

The common tools

D.Duelmann CORAL

M.Clemencic COOL

M.Girone CERN DB Serv

M.Gujarro Hi Av NAS Stor

The Database environment

- Large investment in manpower and hardware
  - Both at CERN and in the T1 centres
  - Oracle is the base technology

- More commonality among experiments would help
  - But some common tools exists (CORAL, COOL, 3D, POOL)
    - except ALICE
  - 27 talks at CHEP on these products (see D.Duelmann talk)

- The integration with the Grid world is not straightforward
  - Replication, security, access...

ROOT

O.Couhet ROOT Graphics

R.Brun BOOT ... for BOOT

Matrix Operations Performances

- Comparison ROOT (*TMatrix*/*SMatrix*) and CLHEP (*HepMatrix*)
  - lxplus (new Intel dual-core 64 bits) running slc4 with gcc 3.4.6

slc4_ia64_gcc346
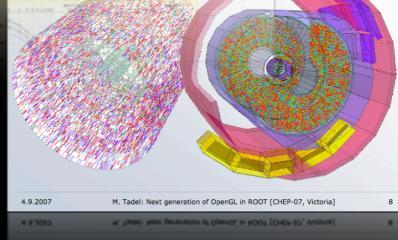- SMatrix
- TMatrix
- SMatrix_sym
- TMatrix_sym
- HepMatrix
- HepMatrix_sym
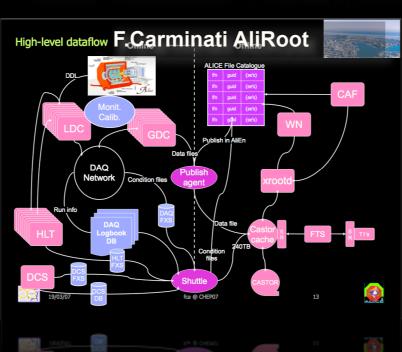
CHEP 2007, Victoria, September 3-7, 2007   Lorenzo Moneta, CERN/PH-SFT   15

Parametric Functions

A parametric surface is defined by three functions:

$S(u,v) : \{x(u,v), y(u,v), z(u,v)\}$.

Example, a conchoid:

```
TGLParametricEquation p1("Conchoid",
    "1.2*u*(1+cos(v))*cos(u)",
    "1.2*u*(1+cos(v))*sin(u)",
    "1.2*u*sin(v)-1.5*1.2*u",
    0., 6*TMath::Pi(), 0., TMath::TwoPi());
```

Parametric surfaces can be drawn using a GL-plot

Olivier Couet   CHEP 2007   2-7 September 2007

- Reorganize the internal structure with more granularity and reduce dependencies as much as possible.
- Provide a system kernel as small as possible (code and memory) easy to install, possibly a stand-alone executable module less than a few Megabytes in memory (say <10).
- Reorganize several components (eg TBrowser) such that other applications can easily plug-in their services.

DLLs
source
Install only
Easy acce...
ROOT.exe
ROOT
ROOT.exe
ROOT.py
network
graf
Lib with patch
graf

Rene Brun: Booting ROOT with BOOT   International Conference on Computing in High Energy and Nuclear Physics   2-7 Sept 2007 Victoria BC Canada   8

M.Tadel OpenGL in ROOT

ALICE TPC

4.9.2007   M. Tadel: Next generation of OpenGL in ROOT [CHEP-07, Victoria]   8

F.Carminati AliRoot

High-level dataflow

ALICE File Catalogue

Monit. Calib.
LDC
GDC
CAF
WN
DDL
Publish in AliEn
DAQ Network
Data files
Publish agent
xrootd
Run info
HLT
DAQ Logbook DB
DAQ FXS
Data file
Castor cache
FTS
T1's
Condition files
HLT FXS
240TB
DCS
DCS FXS
Shuttle
CASTOR
DCS DB

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P.Canal ROOT I/O & Trees

Float, double and space… (2)

Double32_t compression and precision

Number of significant digits

Increase precision

Save space

Compression factor

Chep 2007   Philippe Canal (FNAL)   8

A.Gheata ROOT-VMC-G4

TPC – 5K particles, physics + field

1013 sec.
G4 + TGeo
step size distribution for dstep>0 and edep>0

1024 sec.
Was 2144 sec. in GEANT4 8.2 ! -isotropic safety issue
G4

step g4root   step G4 native
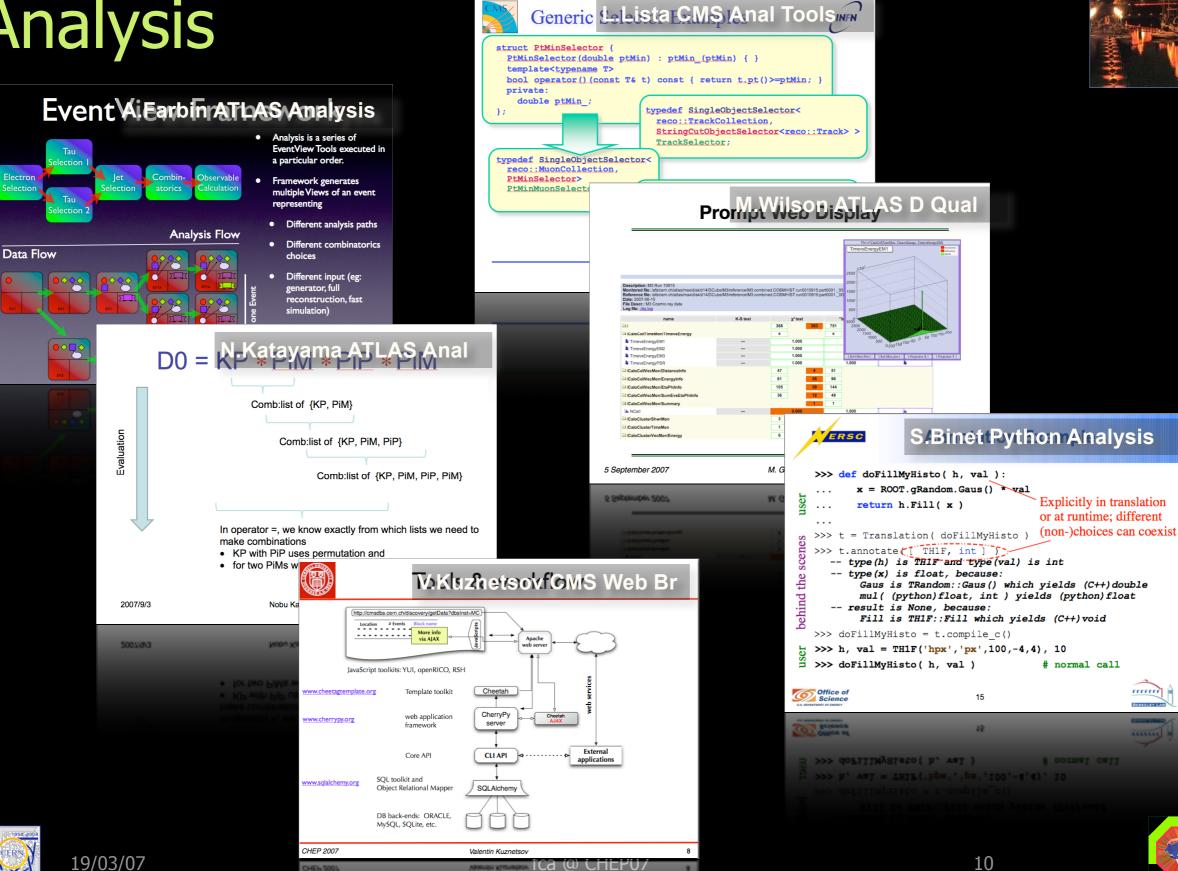
14

19/03/07   fca @ CHEP07   8

ROOT

- ROOT is being actively developed
- Graphics and IO seem to be the most active areas
- Progress on BOOT is steady
  - When we will be able to use it?
- The VMC suite is now "virtually" complete
  - The G4 interface is being validated
- The system is in active phase of "refactorisation"
  - A large potential for future growth

Analysis

L.Lista CMS Anal Tools

M.Wilson ATLAS D Qual
Prompt Web Display

Event V.Farbin ATLAS Analysis
View Framework

N.Katayama ATLAS Anal

S.Binet Python Analysis

V.Kuznetsov CMS Web Br

Analysis

- Where all the challenges meet
  - Distributed system, high complexity, user defined types, schema evolution, experiment policies, metadata access, computing model, resource allocation and availability, data tagging and provenance

- Emphasis on the user interface
  - Python seems to be a majority choice
  - But it does not come for free

- Problem statement is very similar
  - Local analysis crippled by lack of resorces
  - Distributed analysis still not "battle hardened"

Analysis

- Role of the Web UI unclear
- No well tested solution is present
- A lot of open questions
- I have my own
  - Why it became all so compicated?
  - How did we do before?

MonteCarlo

I.Hrivnacova Virt Geo Mod

F.Gaede LCGO ILC Geom

M.Kirsanov MC Validation
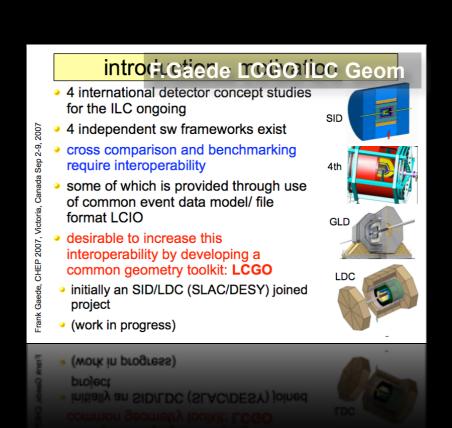
MonteCarlo
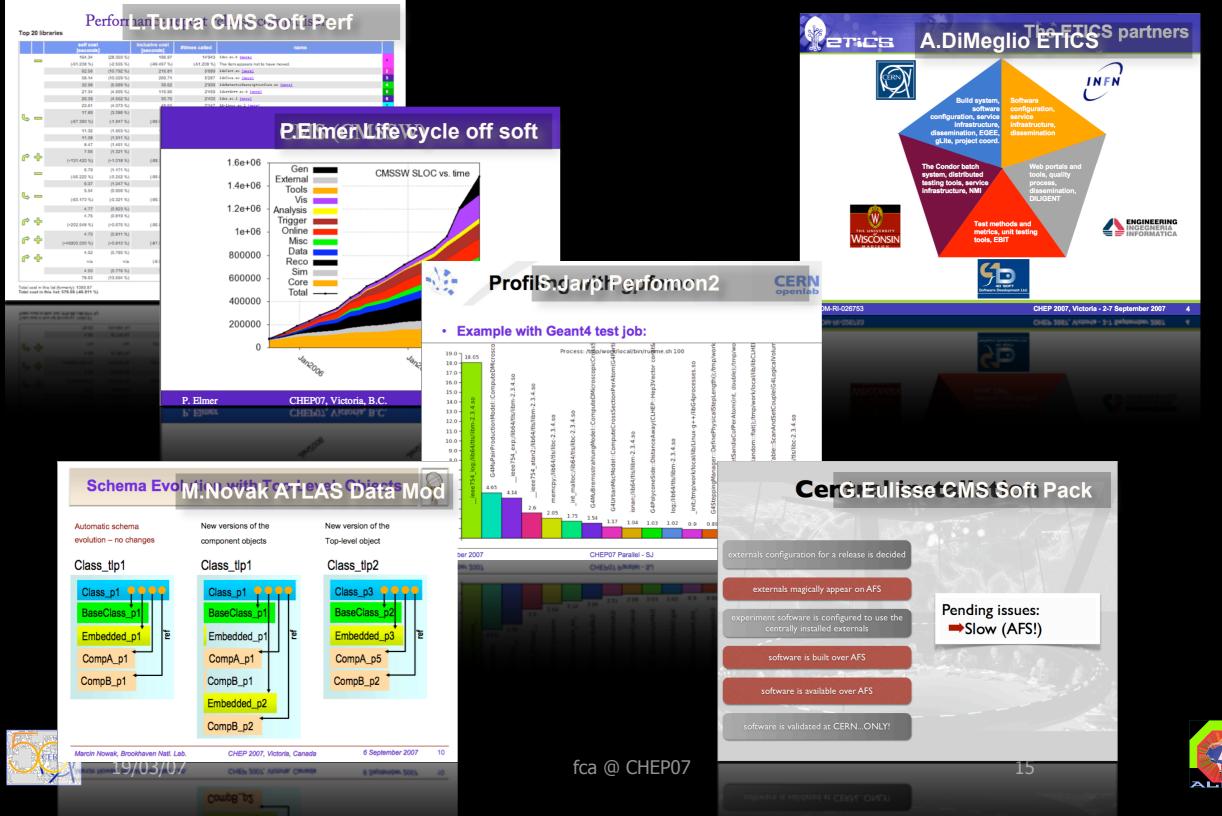
- Geometry remains the sore point
- An independent geometry representation is the general trend
- Hopefully we should not miss the boat of commonality here
- These are wheels very expensive to reinvent
  - And everybody tends to restart from the square rather than the circle

Code development / optimisation / lifecycle

L.Tuura CMS Soft Perf

P.Elmer Life cycle off soft

A.DiMeglio ETICS

S.Jarp Perfomon2

M.Novak ATLAS Data Mod

G.Eulisse CMS Soft Pack

- It would have deserved a track of its own
- Software development / lifecycle
  - A lot of hype few years ago... then silence
  - Is the good-old-way so good?
  - Did we throw the baby out with the bath water?
- SE may be overrated, but <u>some</u> process control could help
- Software distribution and packaging is certainly not experiment specific!
  - Again a lost occasion for some commonality

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- Program performance assessment is much more difficult with C++
  - But essential given the resources we are asking for
- Multicores add to the complexity of the problem
- The lack of good tools is a major problem

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- A very rich and interesting track
- A clear shift from theory to practice
  - Now we have to make it work
  - We should not forget that during the lifecycle of an experiment almost all the software is rewritten
- MetaData access is a major concern
- ROOT development continues very actively
- Software optimisation and maintenance is now moving into the spotlight

Conclusion

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