Report on CHEP07

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CHEP'07
Computing in **H**igh **E**nergy and Nuclear **P**hysics

- 474 Attendees
- Occurs every 1.5 years
- Roughly 2/3 to 3/4 of oral presentations were on LHC related projects
- 1 oral and 2 poster presentations from JLab

LHC Data Rates
data taking starts ~ July 2008

LHC experiments - DAQ needs

	ALICE		ATLAS	CMS	LHCb
Number of detectors	18		9	7	11
Number of Trigger levels (HW / SW)	3/1		1/2	1/1	1/1
	865 GB/s	**500 GB/s**	**113 GB/s**	**100 GB/s**	**40 GB/s**
Event size	86.5 MB	2.5MB	1.5 MB	1 MB	40kb
L1 Trigger rate	10 KHz	200 KHz	75 KHz	100 KHz	1 MHz
Detector readout	Trigger/Busy Partial readout		Synchronous		
Bandwidth to mass storage	1.25 GB/s	200 MB/s	300 MB/s	100 MB/s	100 MB/s
	Pb-Pb	p-p			

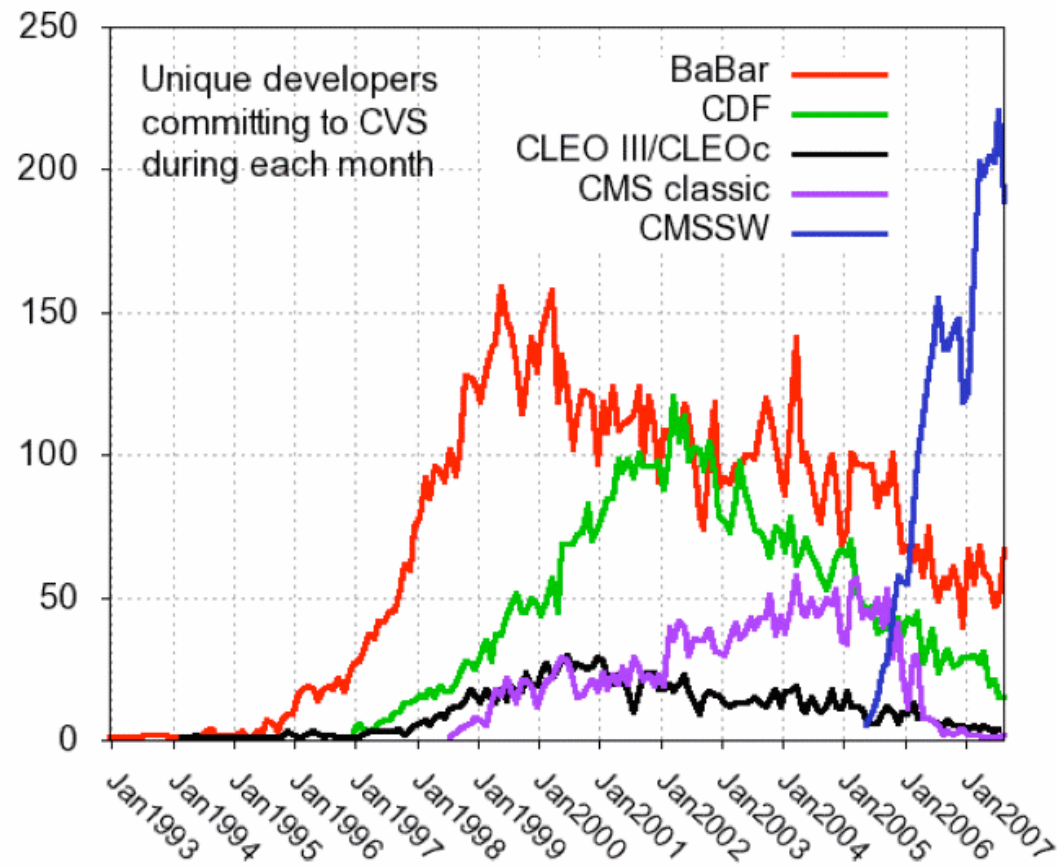Interaction rate : 40 MHz
Large number of channels

From "Data Acquisition at the LHC experiments", by Sylvain Chapeland

Manpower of HEP Experiments

From "Lifecycle of HEP offline Software", P. Elmer, L. Sexton-Kennedy, C. Jones, D. Riley, V. Kuznetsov

Tracking Software

- Most groups seem to use Kalman Filters for fitting (CMS, Atlas, BaBar, …)

- Several groups use conformal transforms for track finding (BES III, PANDA, …)

- BES III compared template matching to conformal transformation and got very similar efficiencies

Tracking in Atlas

- Very modular with easily swapped packages
  - Navigator (material)
  - Propagator (swimming)
  - Extrapolator (parameter propagation)
- Optional global fitter using Newton-Raphson
  - 2x slower than Kalman filter

Virtual Monte Carlo

- Many experiments seemed to be defining their detectors using ROOT's VMC
- VMC used to feed
  - GEANT4
  - GEANT3
  - Reconstruction
  - Event Viewer

CMS "FrameWork"

- Written by Chris Jones who wrote Suez for CLEO-III
- Very Similar to JANA's data access paradigm
  - Data Type
  - Tags: factory, process, method
- Uses rtti for matching data types
  - Must be very careful about how plugins are linked

CMS "FrameWork"

From "Analysis Environments For CMS" by C. Jones, L. Lists, B. Hegner

Data Model

Have events which contain data products
list of tracks

Data are constructed by a module while running in a process
the track finder module creates the list of tracks while in the reconstruction process

Data products are identified by

C++ class type: provides type-safety
std::vector<Track>

module label: a string which was assigned to the module which constructed the object
"trackFinder"

product instance label: if a module inserts multiple objects of the same type into the event, the products are differentiated via this string
"" or "failFit"

process name: a string assigned to the process being run. Keeps data from different processing steps (e.g., HLT and RECO) from interfering.
"Reco"

Must use edm::Ref<> when referring to data between products
A smart pointer which knows how to find data in the Event

CMS "FrameWork"

- No pointers (use edm:Ref<>)
- No "data on demand"
  (against authors better judgement)
- No multi-threading (though they are considering it)
- Based heavily on ROOT - (this is apparently the only option for I/O)

PANDA at GSI

- Search for gluonic excitations is one of their primary goals

- Expect to have detector built in 2012-2013

- DIRC may operate only on timing (no ring imaging)*Y. Enari et al., NIM A 494 (2002) 430-435*

PANDA at GSI

- Central tracker uses straw tubes
  - 6mm diameter tubes
  - R_{inner}=15cm R_{outer}=42cm
  - High pressure gas (factor of 2 resolution improvement)
  - Currently testing dE/dx in prototype
- Tracking code is GEANE package (FORTRAN with C++ wrapper)
- Pattern recognition using IDL package from STAR (conformal transform)

CMS Package Management

- ~80 packages
- ~ 1.7GB of packages (3.5GB installed)
- RPMs with APT
- APT is a modified version
- Built for SLC4
- Looking at supporting other platforms/distribution systems

Misc. Software Topics

- x509 certificates used for authentication
- cmake (used by LDC for ILC)
  - Successor to GNU automake
  - Used by KDE
  - GUI
- streamlog (part of Marlin package)

Misc. Hardware Topics

- Rate of Memory unit/cost not rising proportional to CPU power/cost

- Performance monitoring at hardware level available using Performance Monitoring Unit built into man Intel chips now. (see *perman2*)

- High density racks commercially available: IBMs Blue Gene can put >130k PPC cores into a single 19" rack.

CHEP 2009 - Prague
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