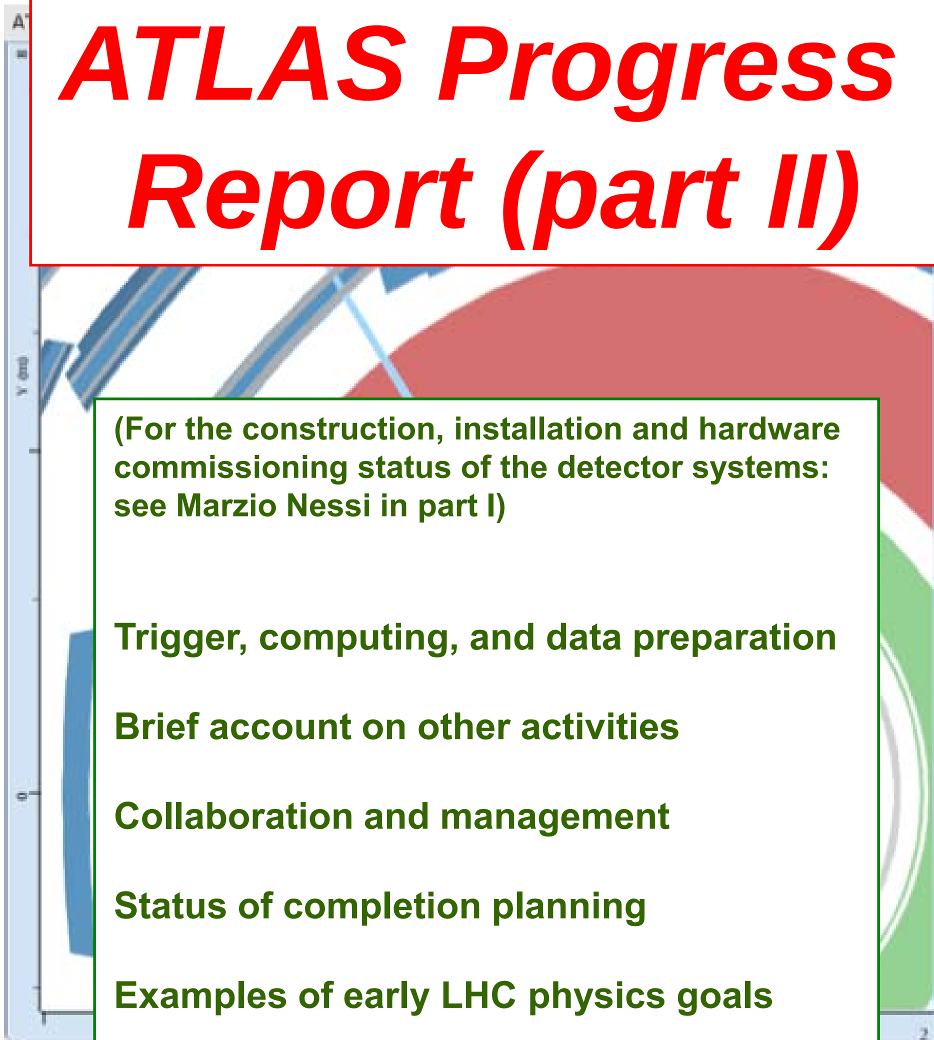
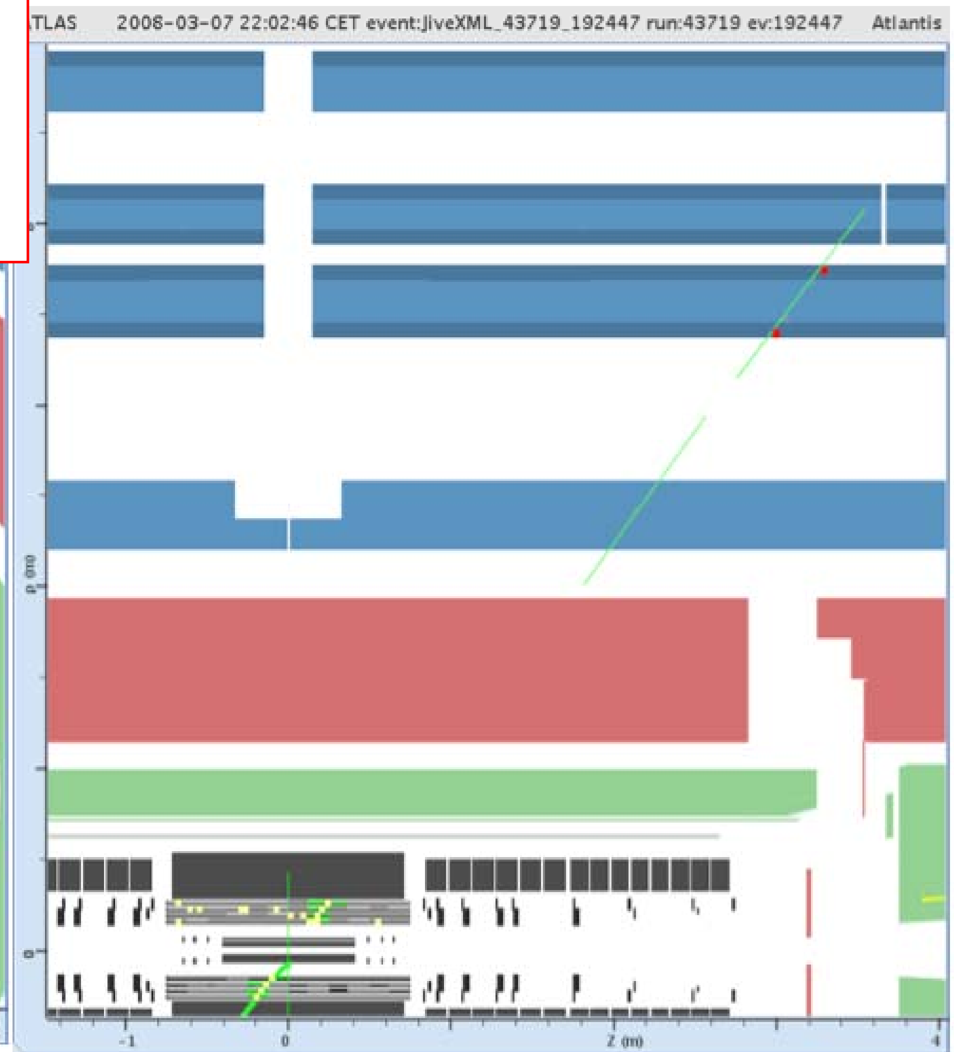
CERN-RRB-2008-034 15th April 2008

ATLAS Progress Report (part II)





(For the construction, installation and hardware commissioning status of the detector systems: see Marzio Nessi in part I)

Trigger, computing, and data preparation

Brief account on other activities

Collaboration and management

Status of completion planning

Examples of early LHC physics goals

Conclusions

CB

Publications Committee, Speakers Committee

ATLAS management: SP, Deputy SPs, RC, TC
Collaboration Management, experiment execution, strategy, publications, resources, upgrades, etc.

TMB

Executive Board

Detector Operation (Run Coordinator)
Detector operation during data taking, online data quality, …

Trigger (Trigger Coordinator)
Trigger data quality, performance, menu tables, new triggers, ..

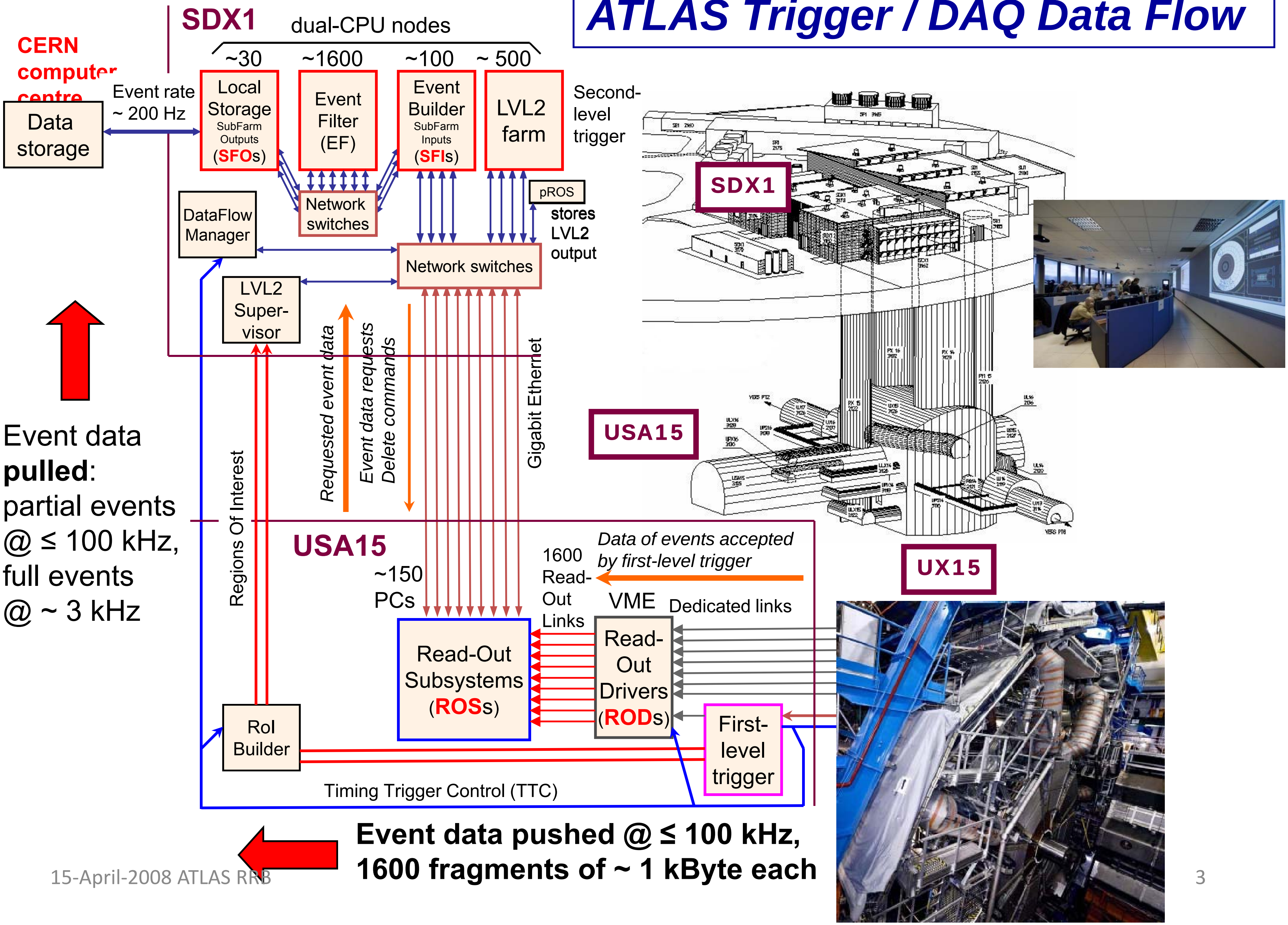
Computing (Computing Coordinator)
SW infrastructure, GRID, data distribution, …

Data Preparation (Data Preparation Coordinator)
Offline data quality, first reconstruction of physics objects, calibration, alignment (e.g. with $Z \rightarrow ll$ data)

Physics (Physics Coordinator)
optimization of algorithms for physics objects, physics channels

(Sub)-systems:
Responsible for operation and calibration of their sub-detector and for sub-system specific software …

ATLAS Trigger / DAQ Data Flow



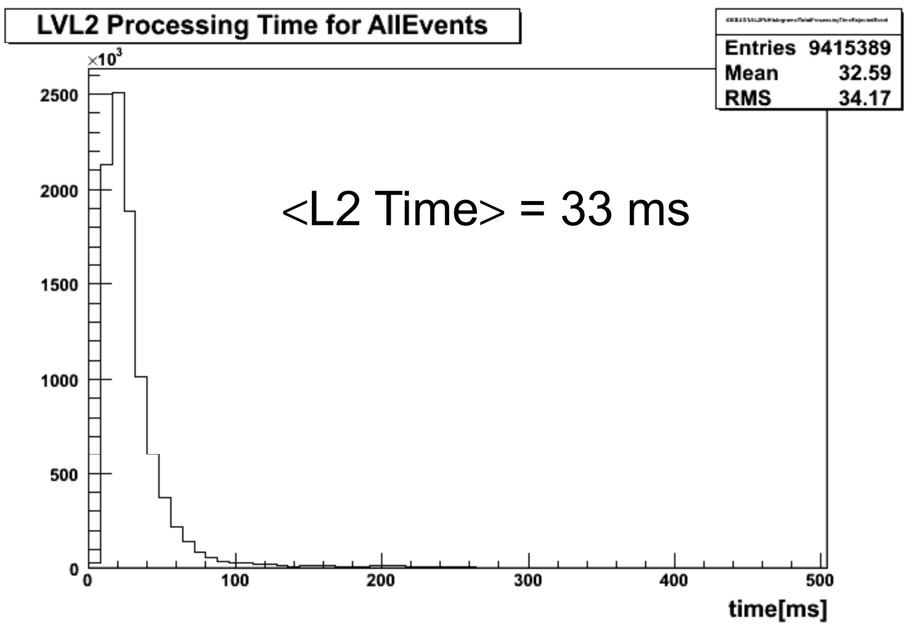
Some recent highlights from the Trigger activity

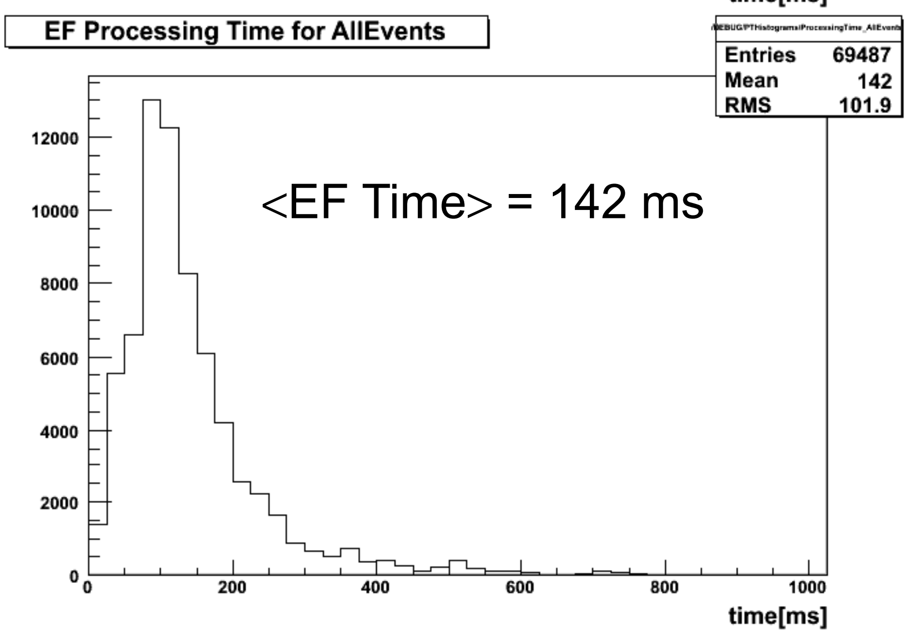
- **Trigger algorithms**
  - **Comprehensive suite of algorithms spanning trigger signatures**
    - **Muon, electron/photon, tau, jet, b-jet, missing-ET, and B-physics**
  - **Including minimum-bias trigger for use in early running**
    - **Provides data for physics studies, commissioning detector and rest of trigger system**
  - **Including cosmic-ray triggers**
    - **Used already now in detector and trigger commissioning**
    - **Will be used in longer term to collect data for detector alignment studies**

- **Trigger core software and event-data model**
  - **Improving and completing software to provide detailed results from online LVL2 and EF processing (stored with raw data in bytestream format)**
  - **Implementing tools for access to trigger data at various levels in the data-reduction chain**
  - **Work ongoing for tools providing the trigger results for offline analysis**

- **Trigger Menus**
  - **Rather extensive initial menus exist for various luminosities**
    - **These will certainly evolve in the light of experience with beam**
  - **Simplified menus for day-1 operations**
  - **Commissioning plan is being refined**
  - **Menus address issues of monitoring and measurement of trigger efficiencies**
  - **Basic assessment and manipulation tools exist, but need to be developed further**

The ATLAS High Level Trigger being tested



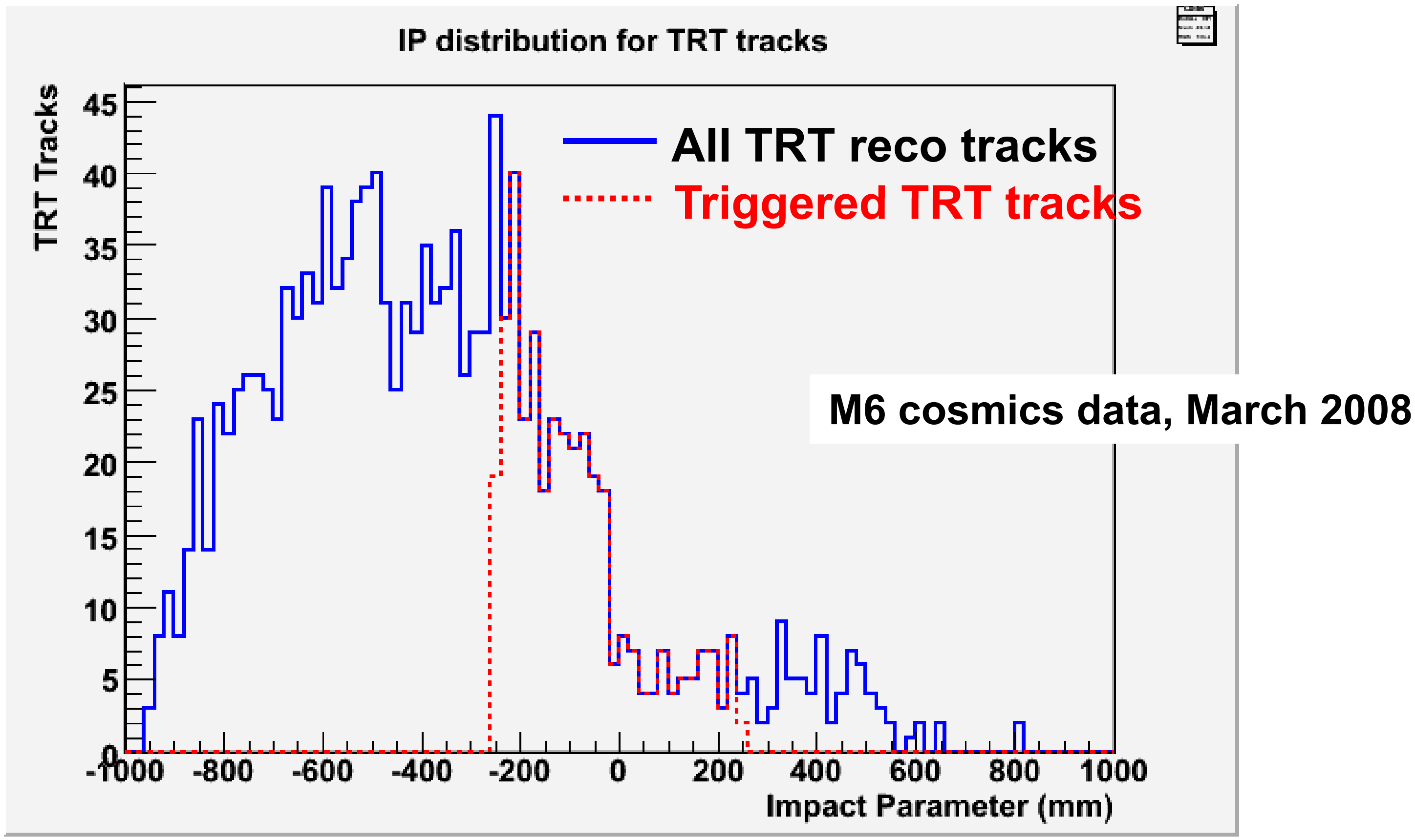


24h test run in ATLAS end of March 2008 through a Minimum Bias simulated data sample which have been selected by level-1

Average total time taken by L2 and EF trigger levels:

- **<L2 Time> = 33 ms (40ms nominal)**
- **<EF Time> = 142 ms (1s nominal)**

Trigger used in the ATLAS commissioning runs



The trigger required TRT tracks reconstructed online within the pixel volume (equiv. to impact parameter ≤ 25 cm around zero)

Triggered events (red) end up in one stream file, non-triggered events (blue) into another one: proves trigger and streaming are working

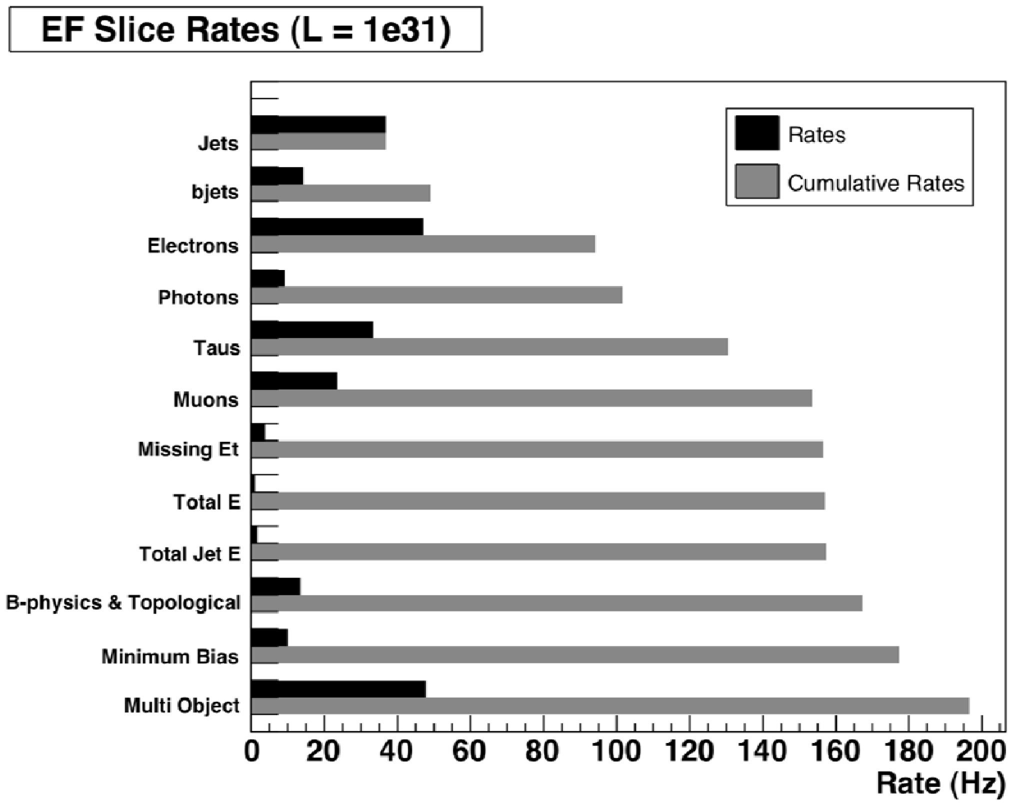
Trigger Menu Developments

Comprehensive menu for L = 10^{31} $cm^{-2}s^{-1}$ developed

- Over 300 signatures studied, but much less used at the beginning
- Low thresholds, loose selections and pass-through triggers
  - As would be needed for the early running phase
- Exercised in Full Dress Rehearsal

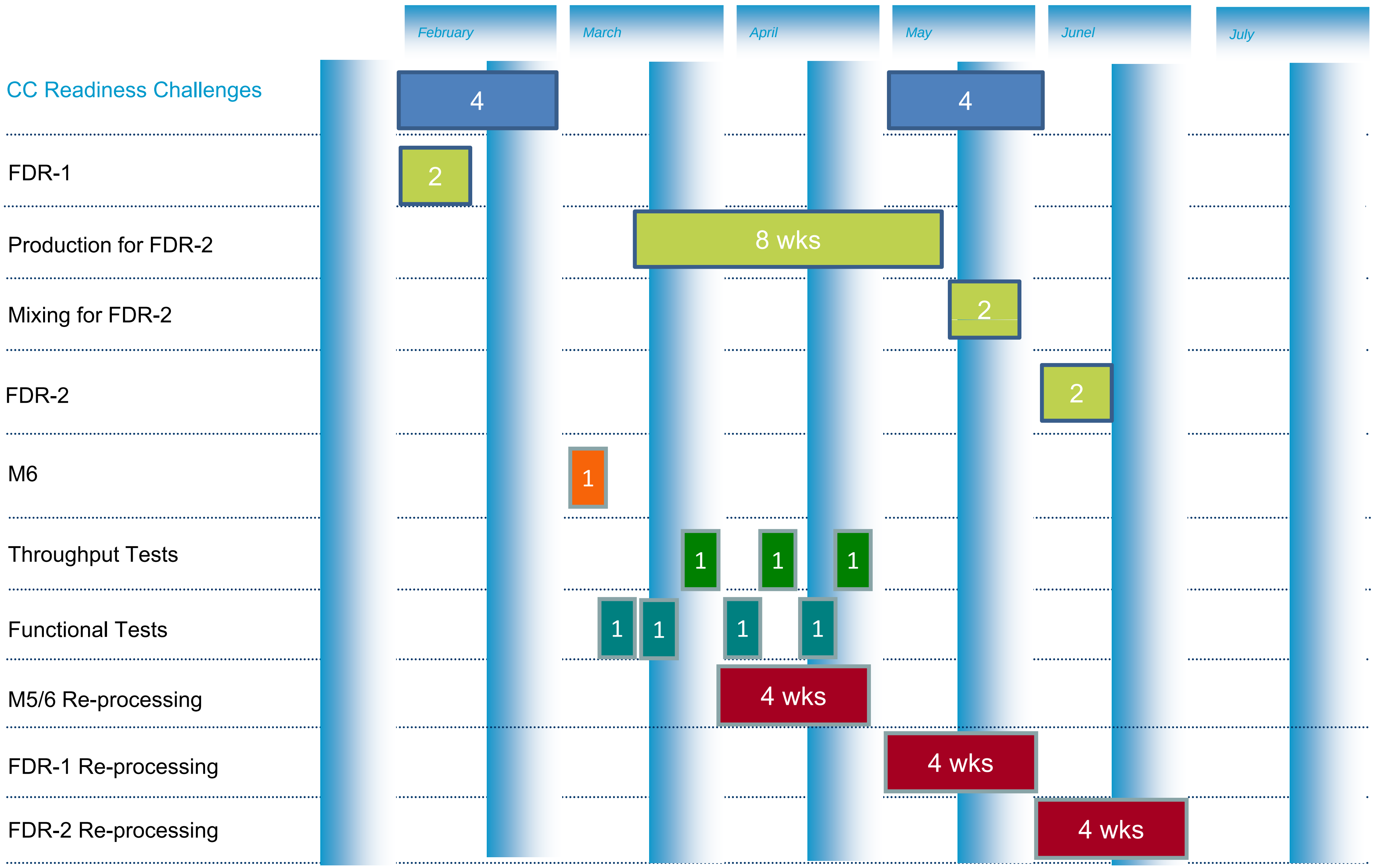
Some lowest un-prescaled signatures at 10^{31}

e12	19 Hz
2e5	7 Hz
g20	7 Hz
mu10	18 Hz
2mu4	2.3 Hz
4j23	7 Hz
t25i+xE30	3.5 Hz
2b23	3 Hz



Simpler 'day-1' trigger menus will be used at start-up

Computing operation



A Hierarchical Model, Fully Embedded in the wLCG as Backbone

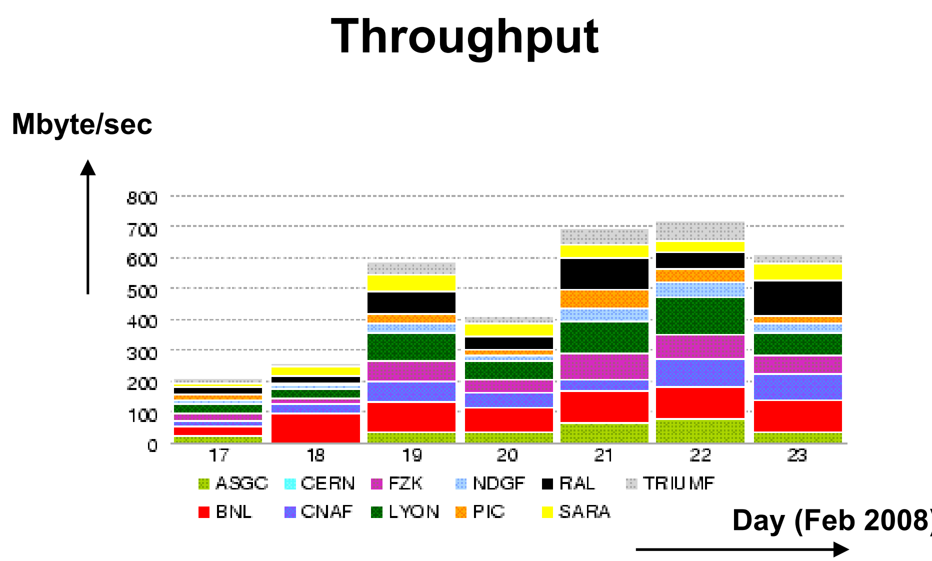
- **We have defined a hierarchical computing model that optimises the use of available resources, given a number of constraints:**
  - **Not all computing centres are of equal size nor offer the same service levels**
  - **We need to distribute RAW data to have 2 safely archived copies (one copy at CERN, the second copy elsewhere)**
  - **We must distribute data for analysis and also for reprocessing**
  - **We must produce simulated data all the time**
  - **We must replicate the most popular data formats in order to make access for analysis as easy as possible <u>for all members of the Collaboration</u>**

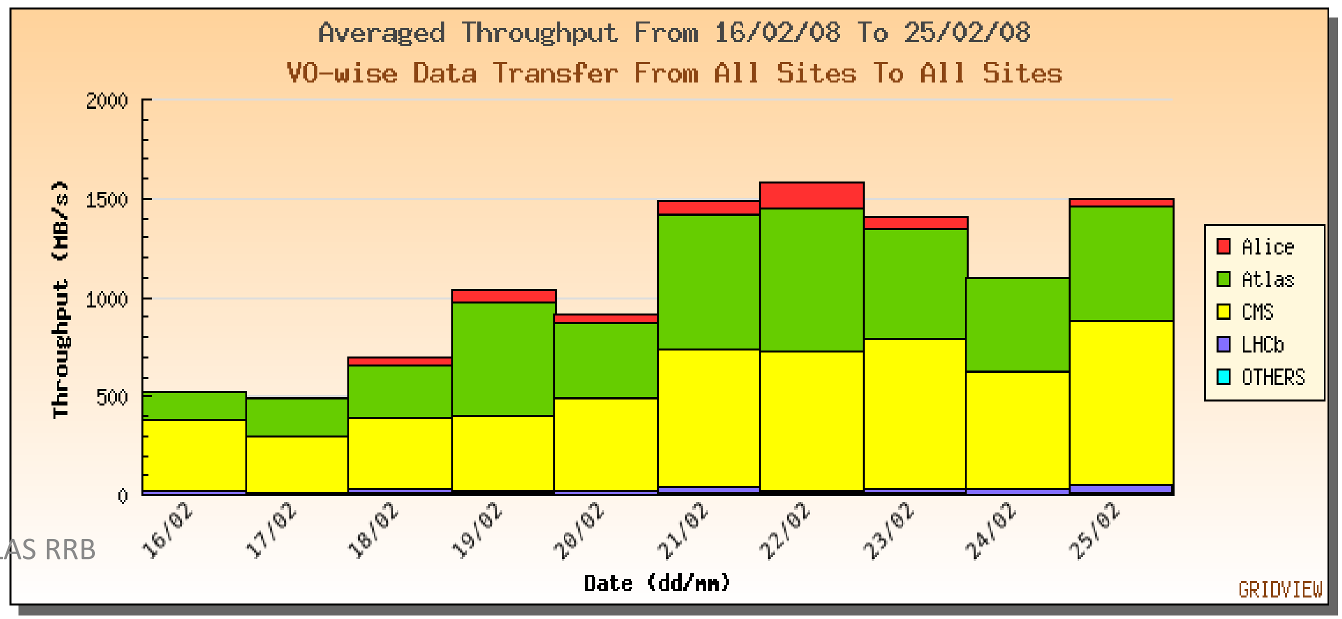
- **The ATLAS Distributed Computing hierarchy:**
  - **1 Tier-0 centre: CERN 1 CAF (CERN Analysis Facility)**
  - **10 Tier-1 centres:**
    BNL (Brookhaven, US), NIKHEF/SARA (Amsterdam, NL),
    CC-IN2P3 (Lyon, FR), KIT (Karlsruhe, DE), RAL (Chilton, UK),
    PIC (Barcelona, ES), CNAF (Bologna, IT), NDGF (DK/SE/NO),
    TRIUMF (Vancouver, CA), ASGC (Taipei, TW)
  - **33 Tier-2 centres, some of them geographically distributed, in most participating countries**
  - **Tier-3 centres in essentially all participating institutions**

Throughput during CCRC, the Common Computing Readiness Challenge

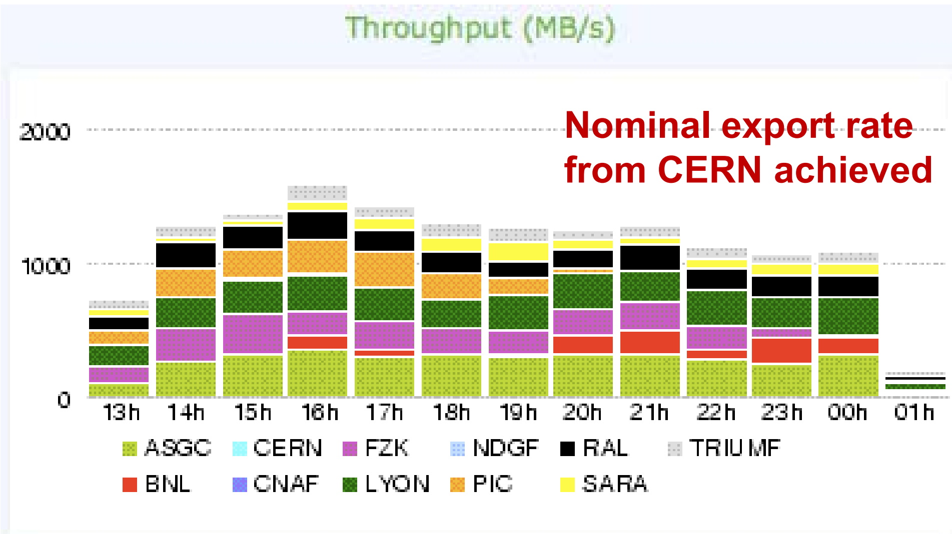
- **Generated data files of realistic sizes**
  - **RAW to all Tier-1s to tape**
  - **ESD and AOD to all Tier-1s to disk**
  - **Ramped up to nominal rates**
  - **Full Computing Model with MoU shares**

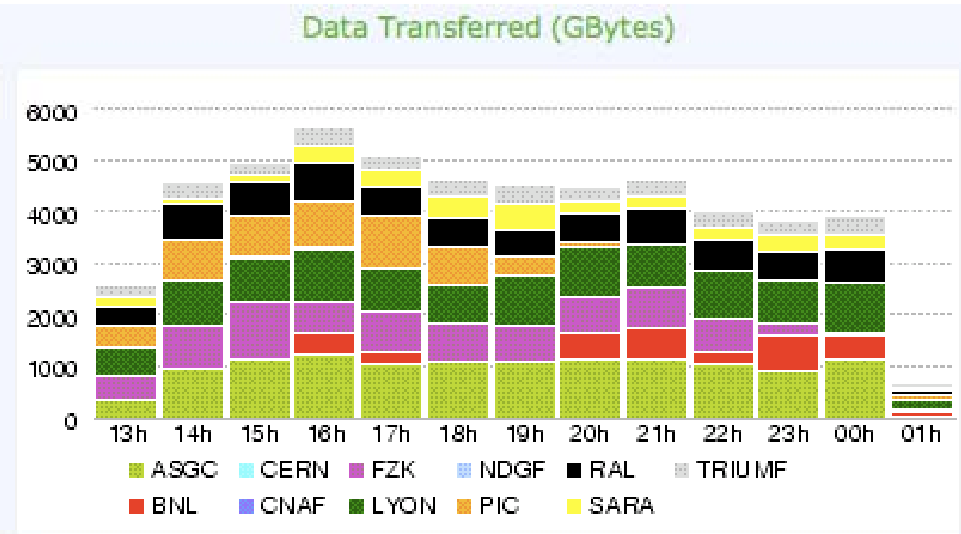
- **Relatively good throughput achieved**
  - **Sustained 700 MB/s for 2 days**
  - **Peaks above 1.1GB/s for several hours**
  - **Errors understood and fixed**

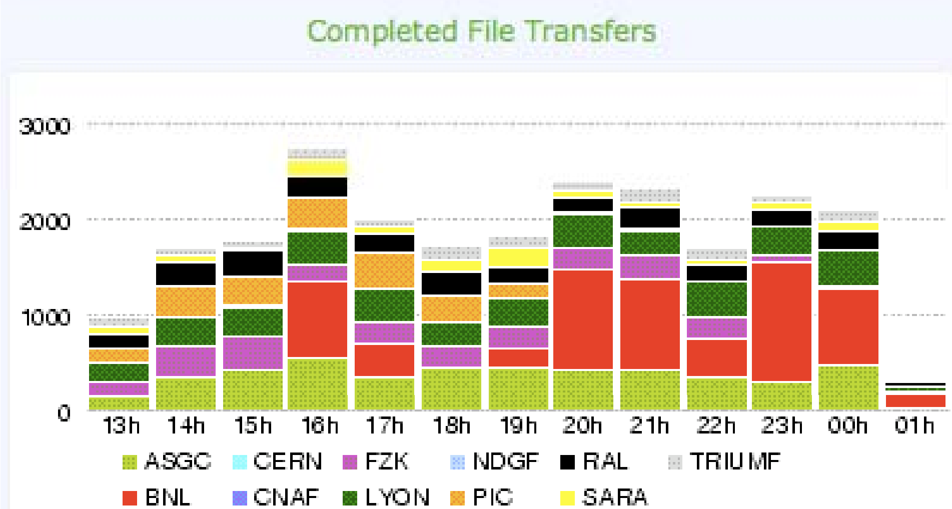




Data Transfer Throughput Test - 28 March 2008

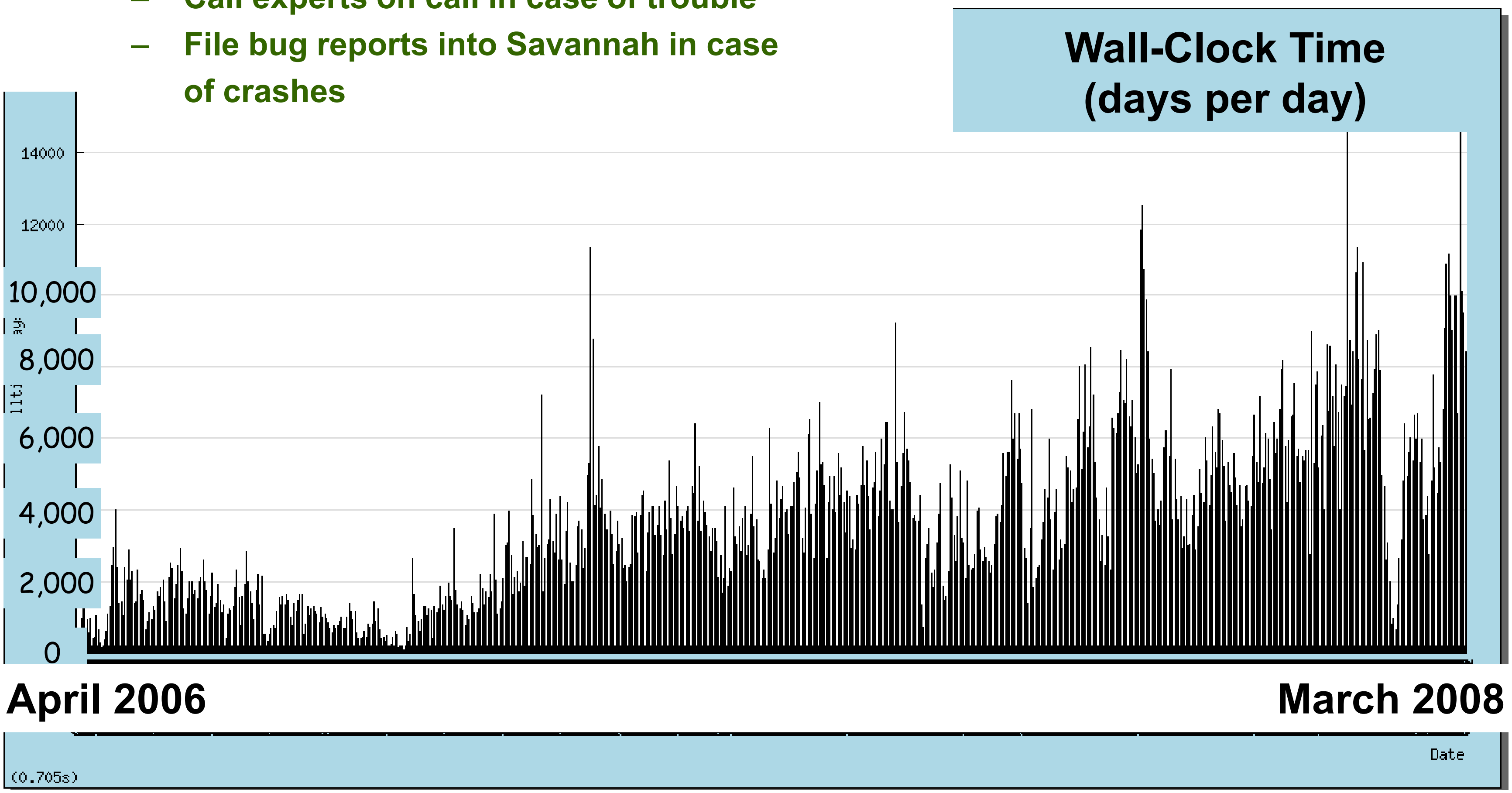




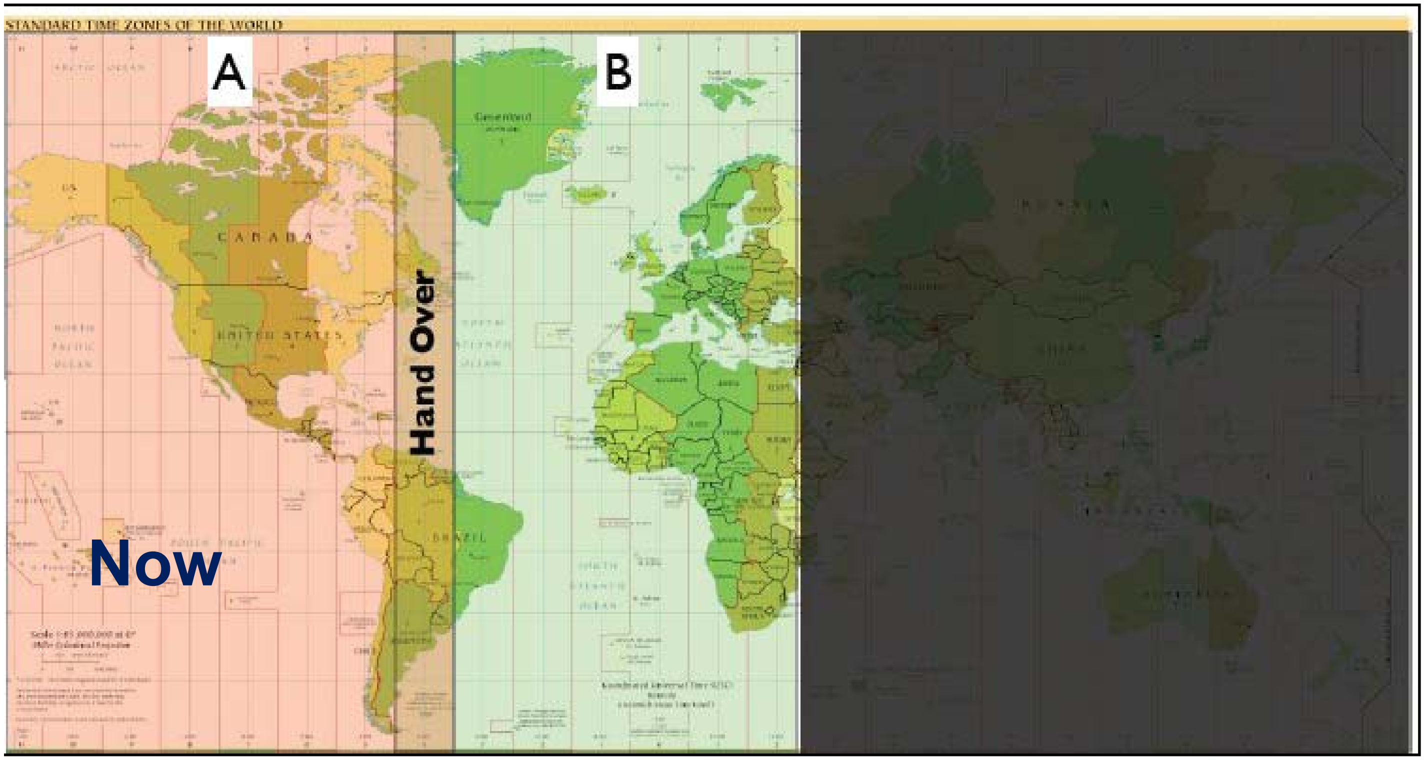


Simulation Production Operations

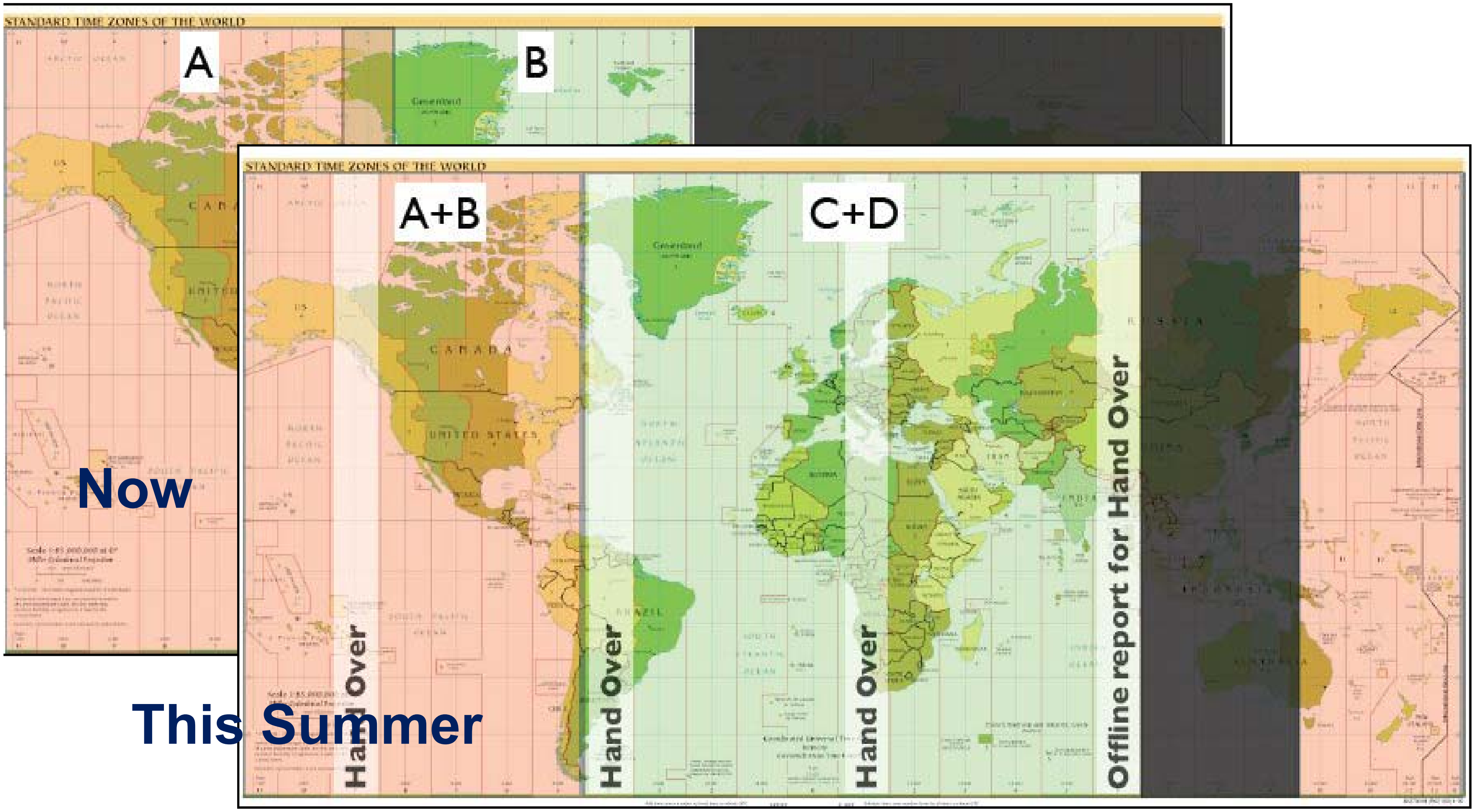
- Simulation production and shifts started some time ago
- Structured shifts started in January 2008
    - Shifts are run from people’s home institutes
- Shift tasks:
    - Monitor running tasks
    - Monitor data transfer within clouds
    - Call experts on call in case of trouble
    - File bug reports into Savannah in case of crashes



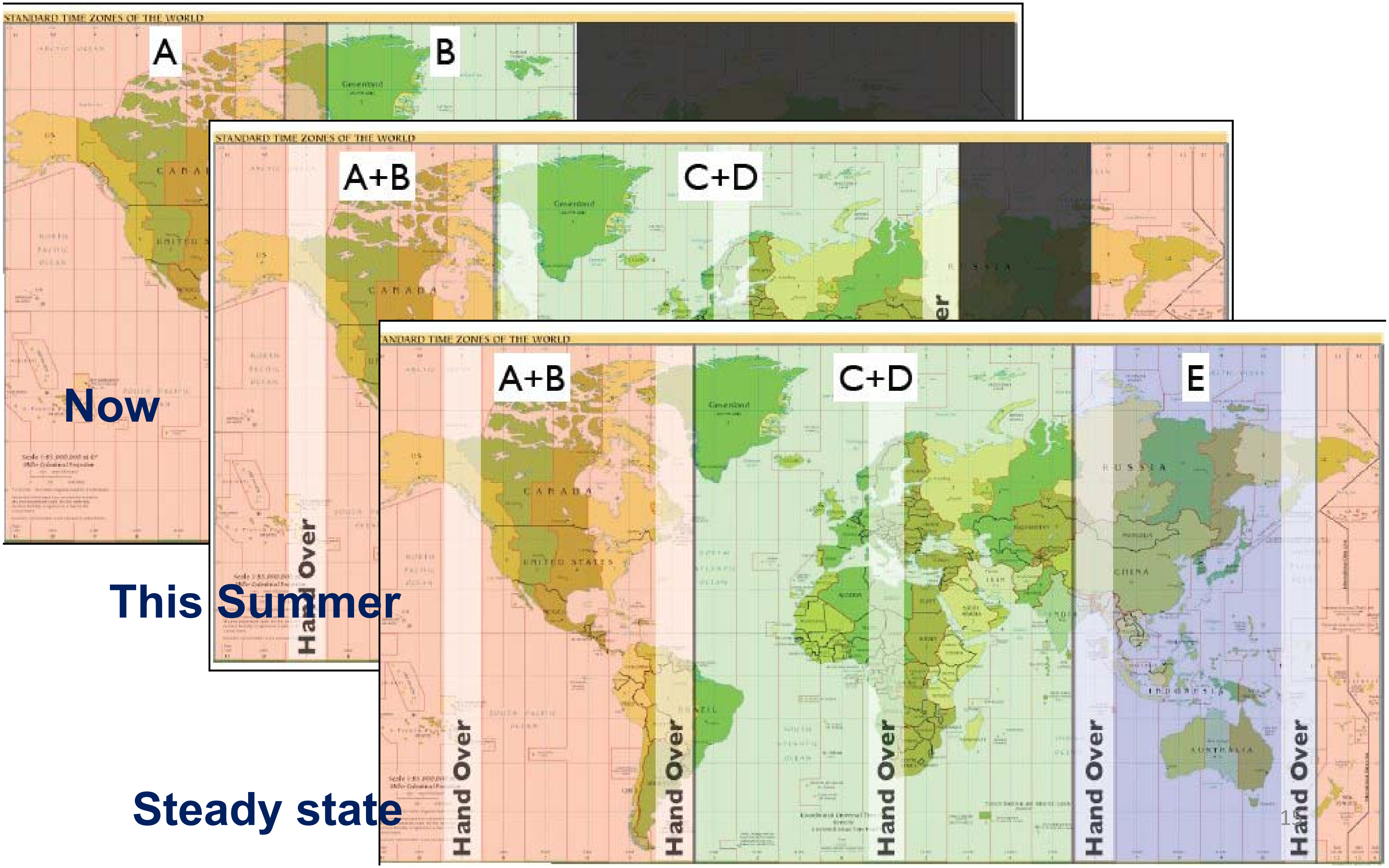
Simulation Shift Coverage



Simulation Shift Coverage



Simulation Shift Coverage



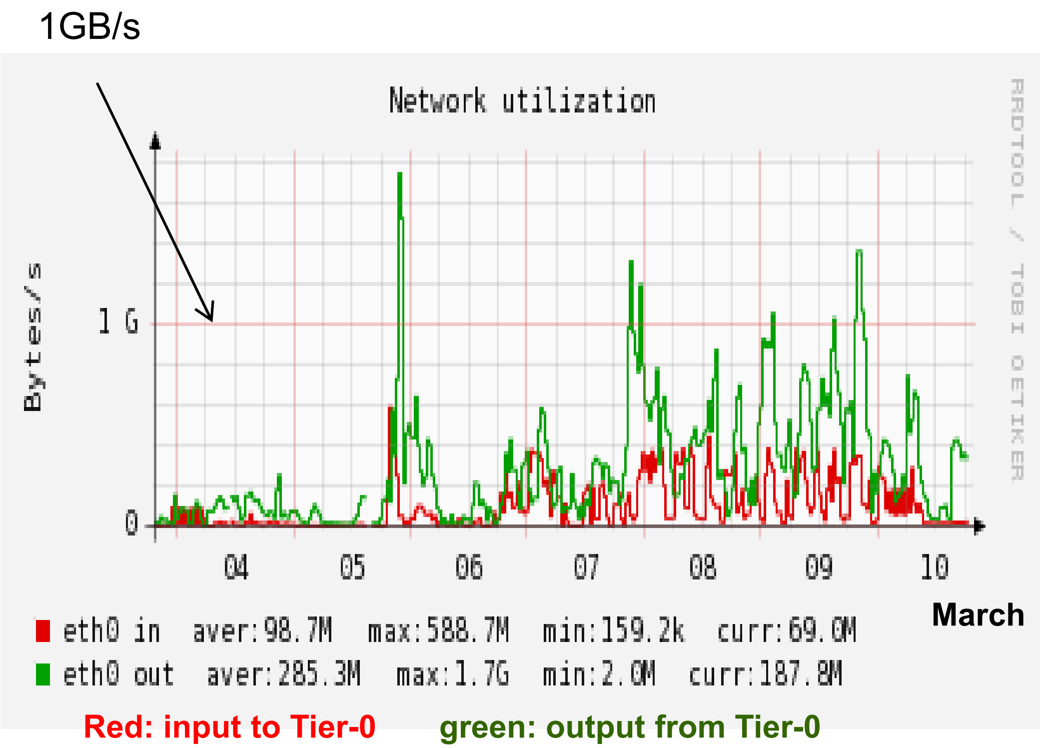
M6 Offline and Tier-0 processing

Reconstruction and monitoring software chain

- Online - event display, monitoring ok; combined monitoring code in place
- Offline @ Tier-0 provided monitoring and fast feedback already during 'Integration Weeks' → very helpful for detector system commissioning

Tier-0

- Received ~ 40TB of 'good' data → 8TB of derived data
- RAW and summary data (ESD) replicated to Tier-1s
- Run very smoothly (>20k processing jobs) and reconstruction software in good shape
  - Fast fixes at start, then no crashes in >10k of jobs
- Replication of muon calibration data to 4 Tier-2s exercised for first time



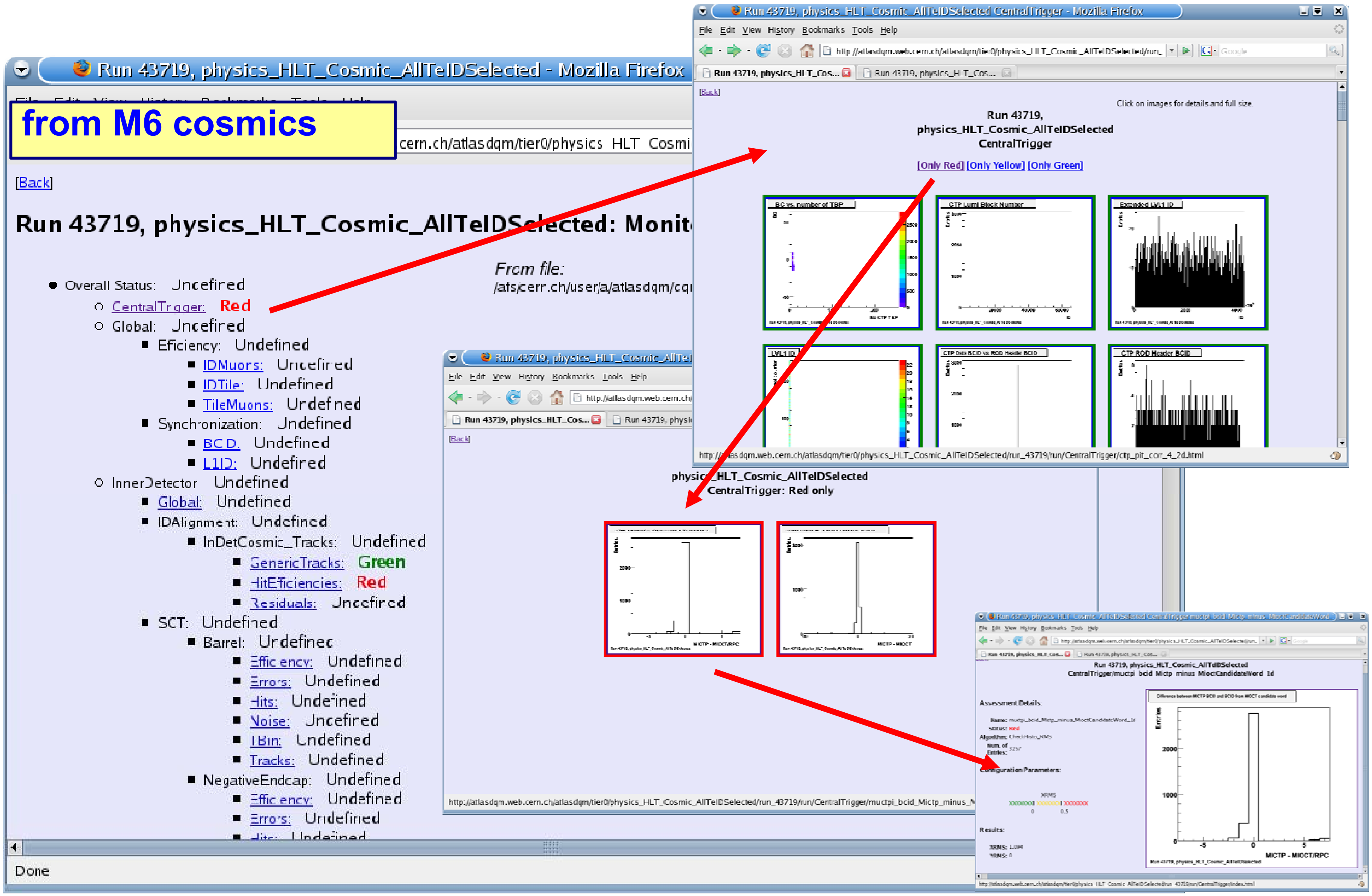
Red: input to Tier-0 green: output from Tier-0

Data Quality Infrastructure

M6 cosmics

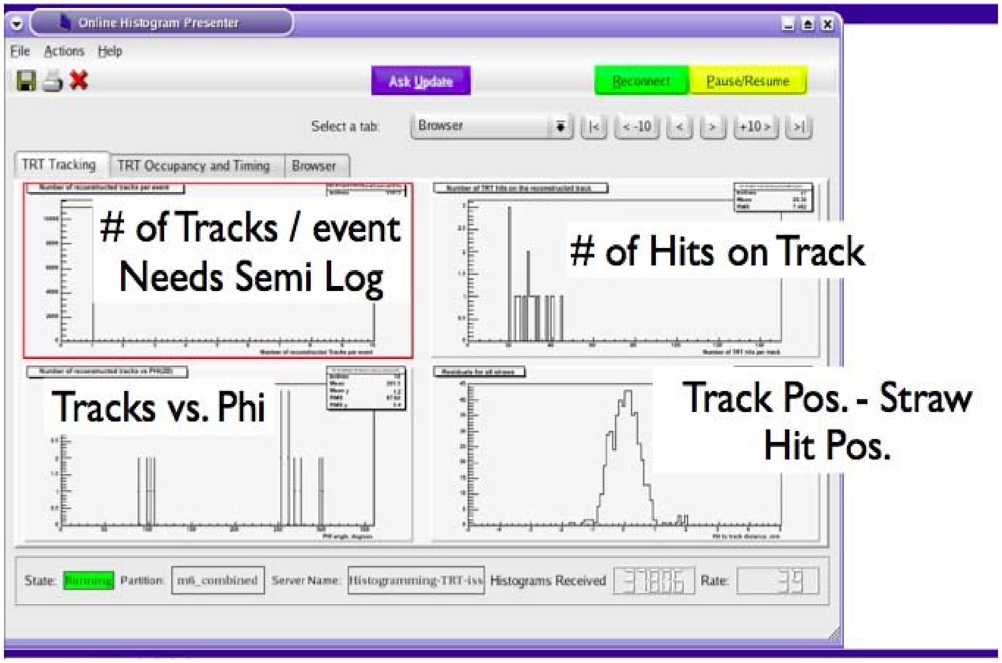
- **First test of combined online and offline DQ chain**
  - **general DQ shifter coverage during 3-day combined cosmics data taking**
  - **automatic checking of both online and (first time) offline histograms**
    - **more than 1700 online histograms automatically checked**
    - **online histogram checking results automatically filled into Status Database**
  - **various existing or new on-/offline tools to display data quality**
    - **online + offline web displays and dedicated displays for histograms and automatic checking results, trigger rates etc.**
    - **DQ Status Database web browser and updater**
    - **regular Atlantis 2D event display running in the Control Room, also VP1 3D display available**

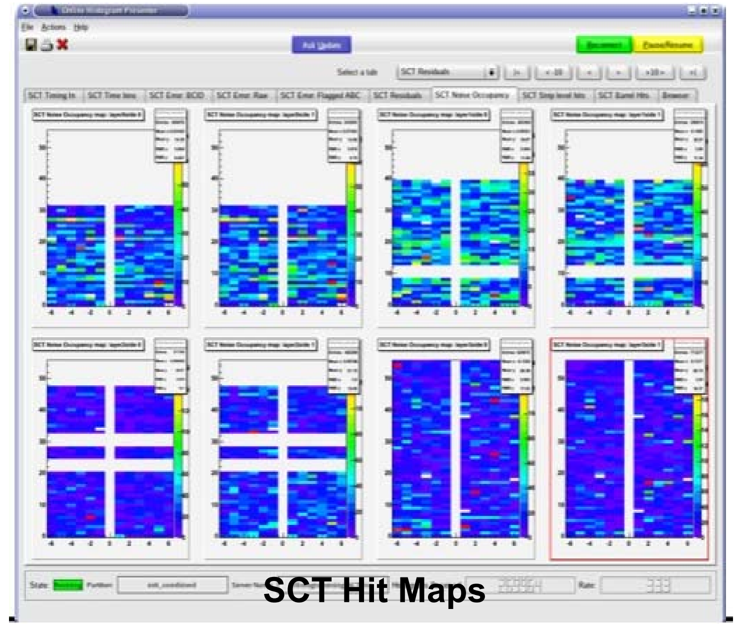
Offline Web Display

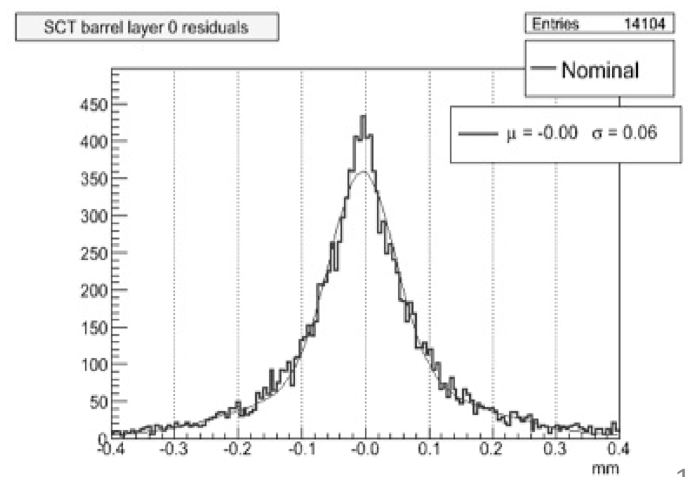


ID Monitoring

- **Monitoring at several levels: sub-detector and combined**



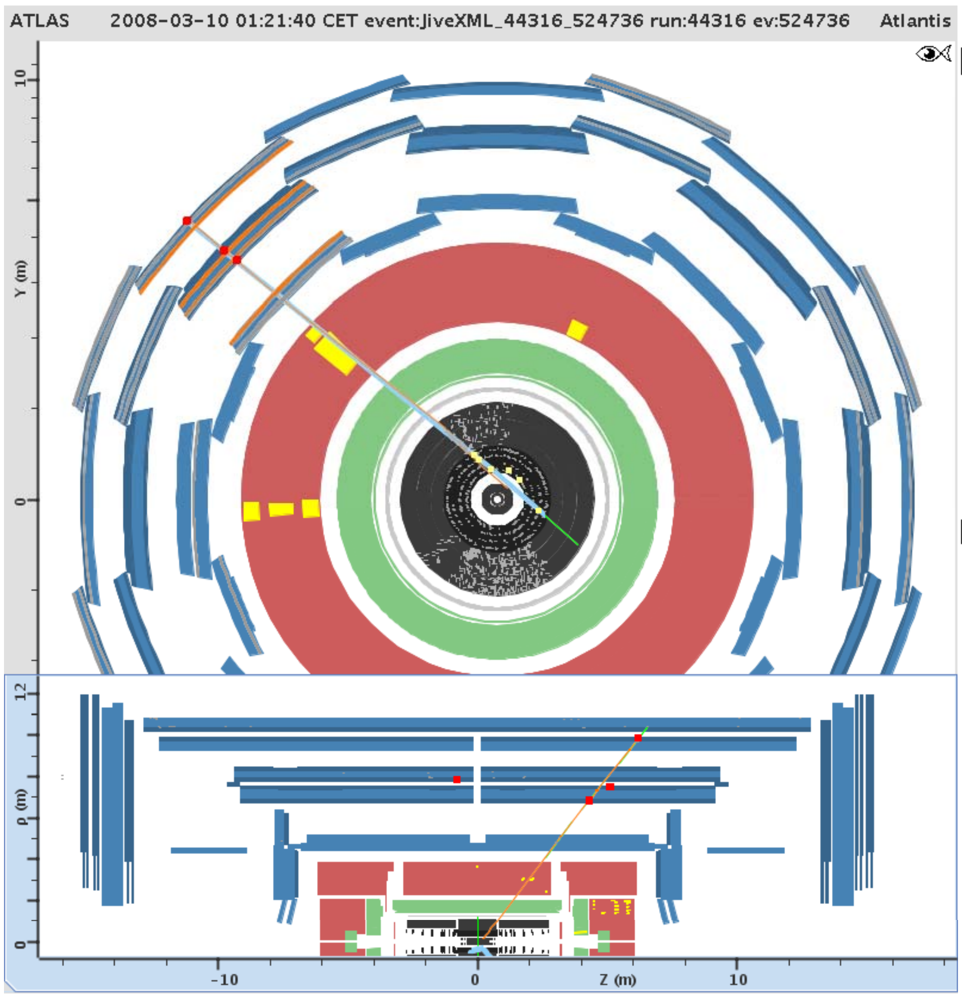


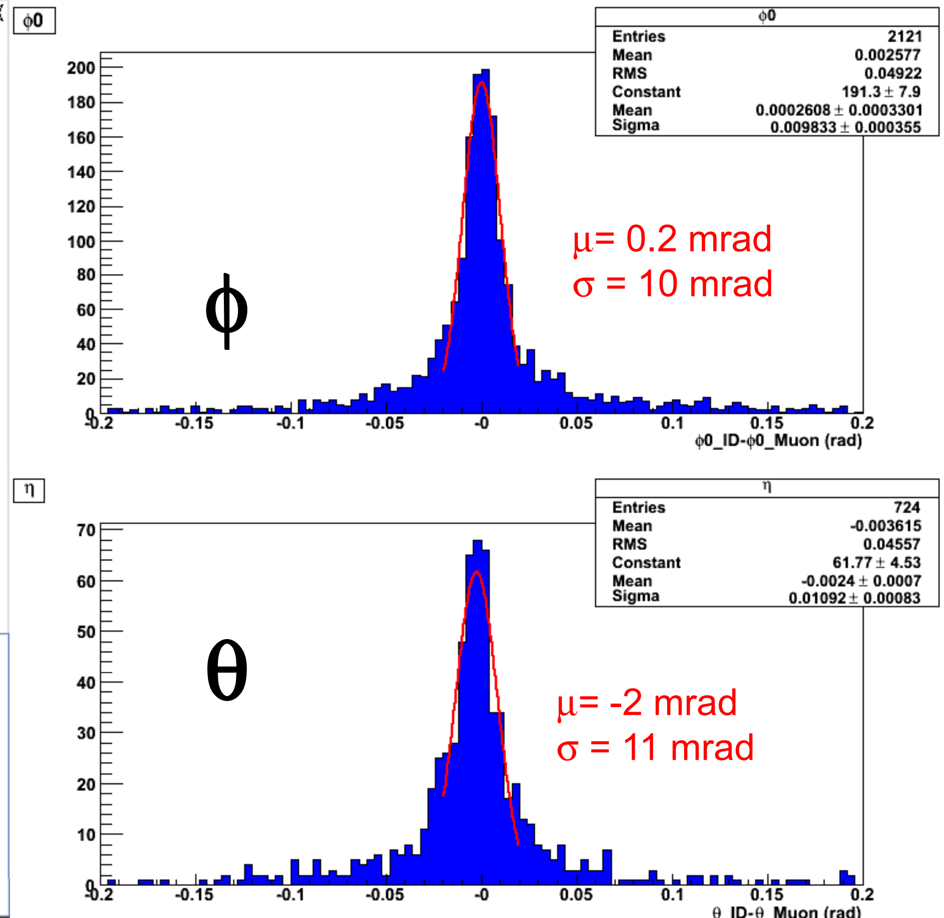


- **Running first alignment checks**
  - **~ 5000 tracks**
  - **SCT residuals (GlobalChi2 method)**

Offline combined tracking

M6 cosmics tracking through Muon System and Inner Detector (TRT + SCT)





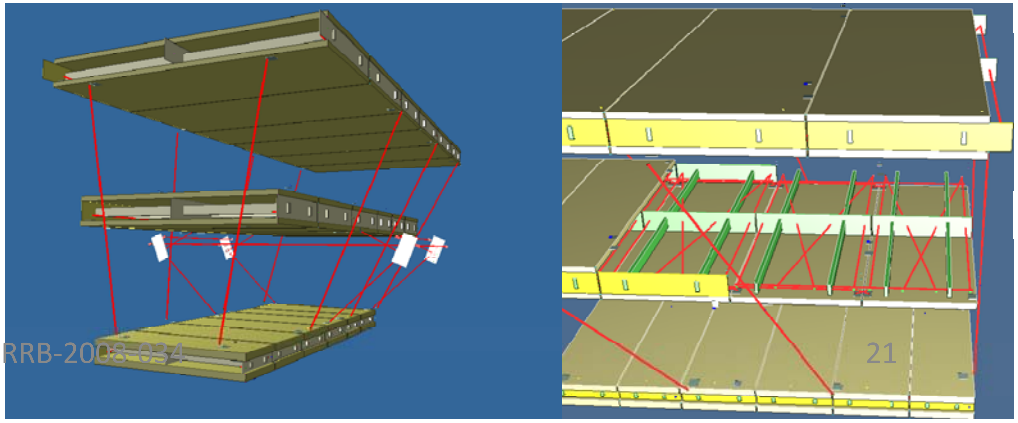
Matching between muon and inner detector tracks

Calibration and Alignment Data

- **An exhaustive list of all calibration and alignment tasks has been worked out for the global coordination, and to estimate the computing needs**

- **Calibration tasks can be subdivided into different categories:**
  - **Electronic calibration performed at the ROD level during the inter-fills or during LHC machine downtime**
    - **SCT threshold scans (1h)**
    - **LAr: pedestals (30'), ramps (30')**
    - **Tiles: pedestals (1h), charge injection scan (1h), laser linearity (1h)**
  - **Electronic calibration performed during physics data taking (empty bunches)**
    - **Tiles single charge injection, laser single amplitude**
  - **Optical alignment of the ID and of the muon spectrometer**
    - **Every ~half hour. Part of DCS: asynchronous with data taking**

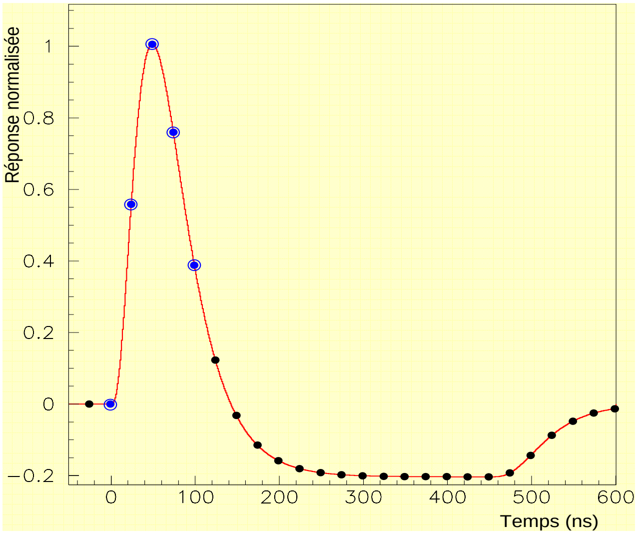
5816 optical sensors in the muon system



Calibration and Alignment Data (cont'd)

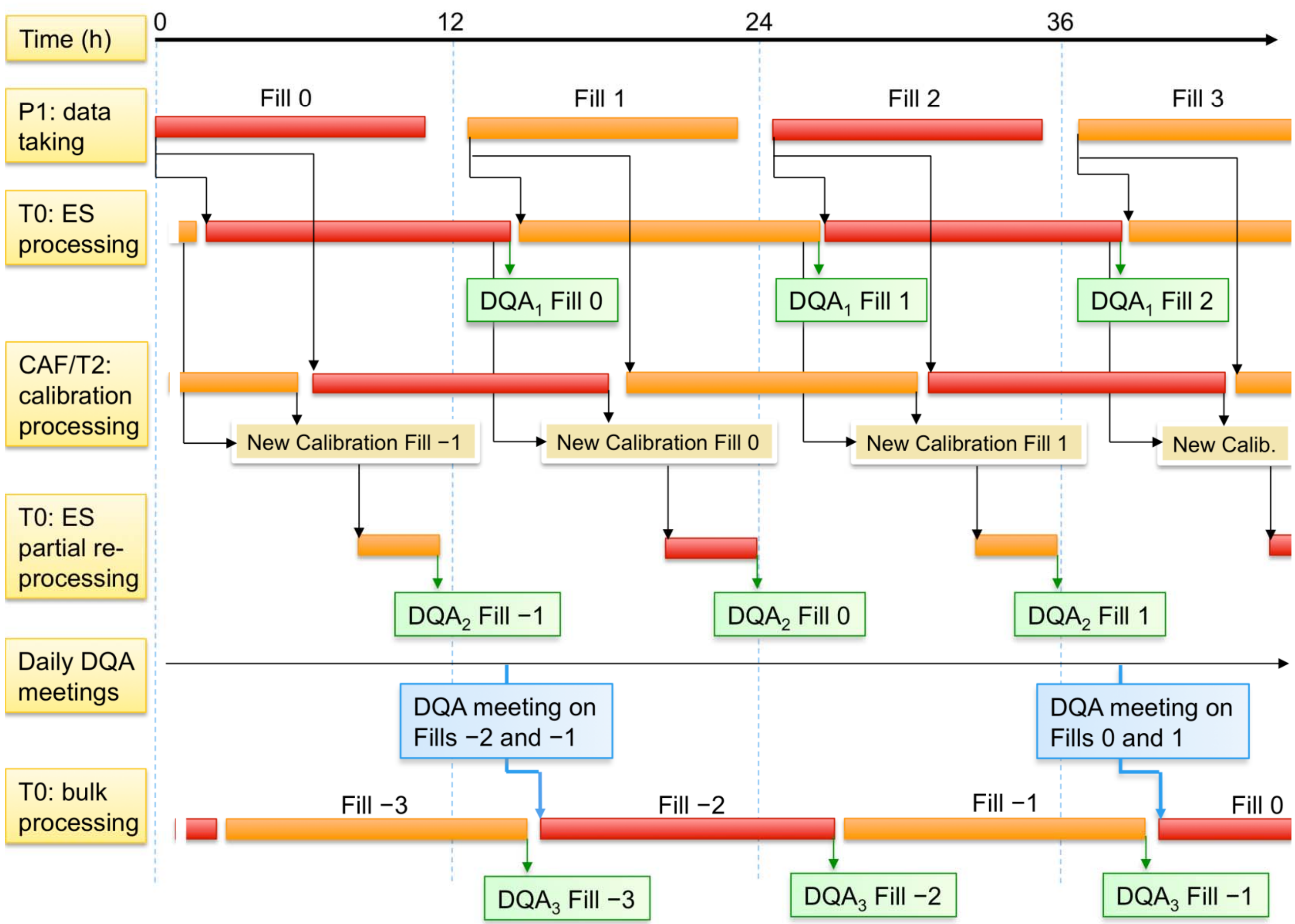
- **Offline calibration or alignment tasks using the express stream (special output data stream for calibration and quality monitoring data)**
  - **ID: beam spot position determination**
  - **LAr: pedestals in random events**
  - **Z → ee calibration → corrections at the cell level**
  - **Alignment of the ID w.r.t. Muon Spectrometer**

- **Offline calibration/alignment tasks performed on specific calibration/alignment streams**
  - **ID alignment: stream based on isolated high energy pions (pT>5GeV) selected at L2 from L1 Tau triggers + cosmic events**
  - **Pixel clustering parameters**
  - **TRT straw calibration**
  - **LAr: Monitoring of the ionization pulse shape**
    - **Calibration stream from partial event building after L2 keeping only the ROI of the high signal cells written with 5 samples:**
  - **Muons: High statistic stream (up to 10kHz single μ) built at L2 and directly shipped to 4 Tier-2 centres for MDT tube calibration, alignment with tracks, and more generally for monitoring**

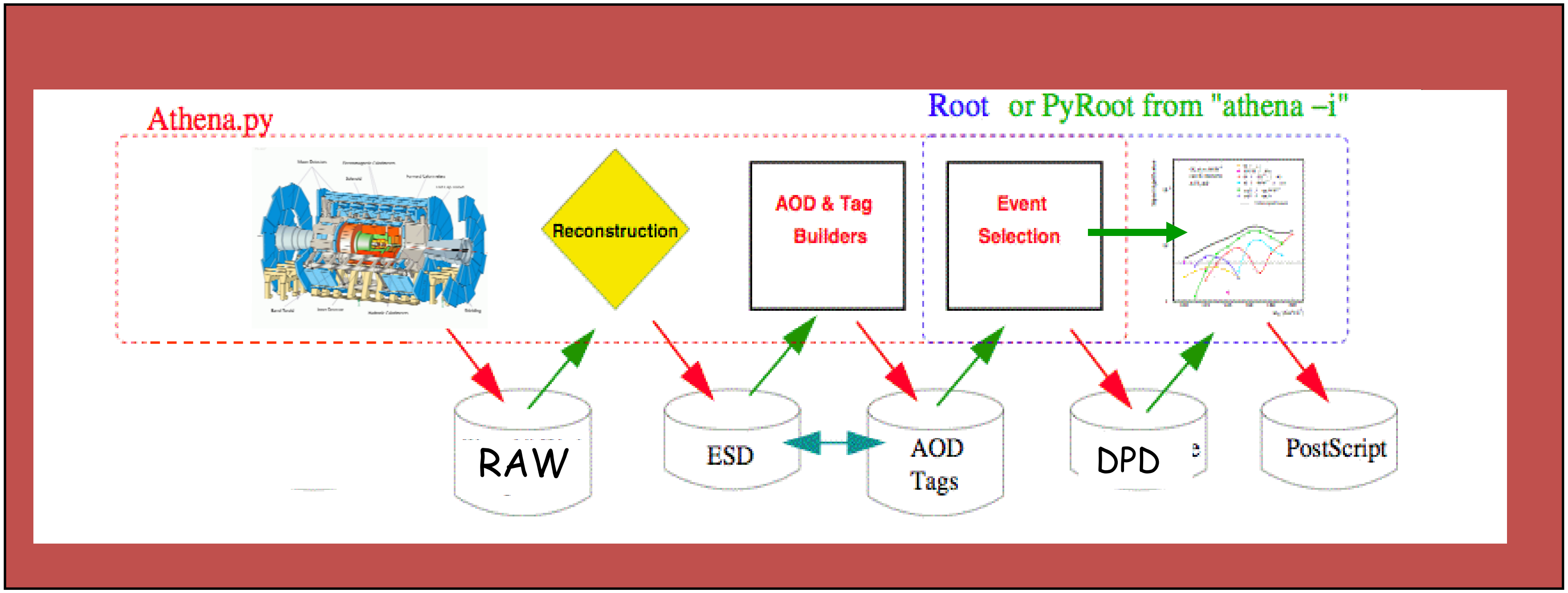


Calibration sequence with Express Stream (ES) data as input for the prompt physics data reconstruction

(already exercised in large parts during the FDR – see later)



Software chain

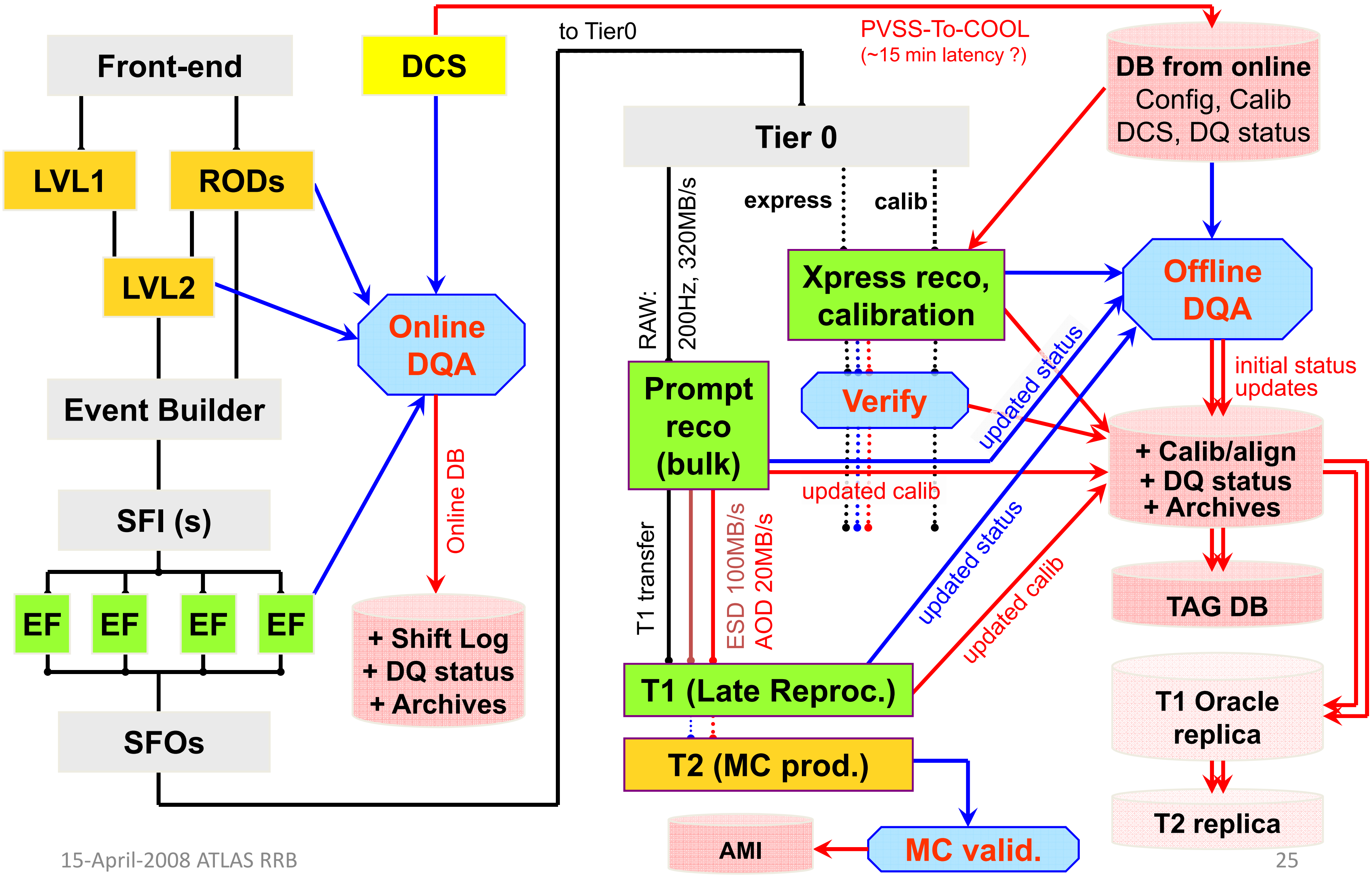


RAW Event data from TDAQ: **~ 1.6 MB**
ESD (Event Summary Data): output of reconstruction (calo cells, track hits, ..): **~ 1 MB**
AOD (Analysis Object Data): physics objects for analysis (e,γ,μ,jets, …): **~ 100 kB**
DPD (Derived Physics Data): equivalent of old ntuples: **~ 10 kB** (format to be finalized)
TAG Reduced set of information for event selection: **~ 1 kB**

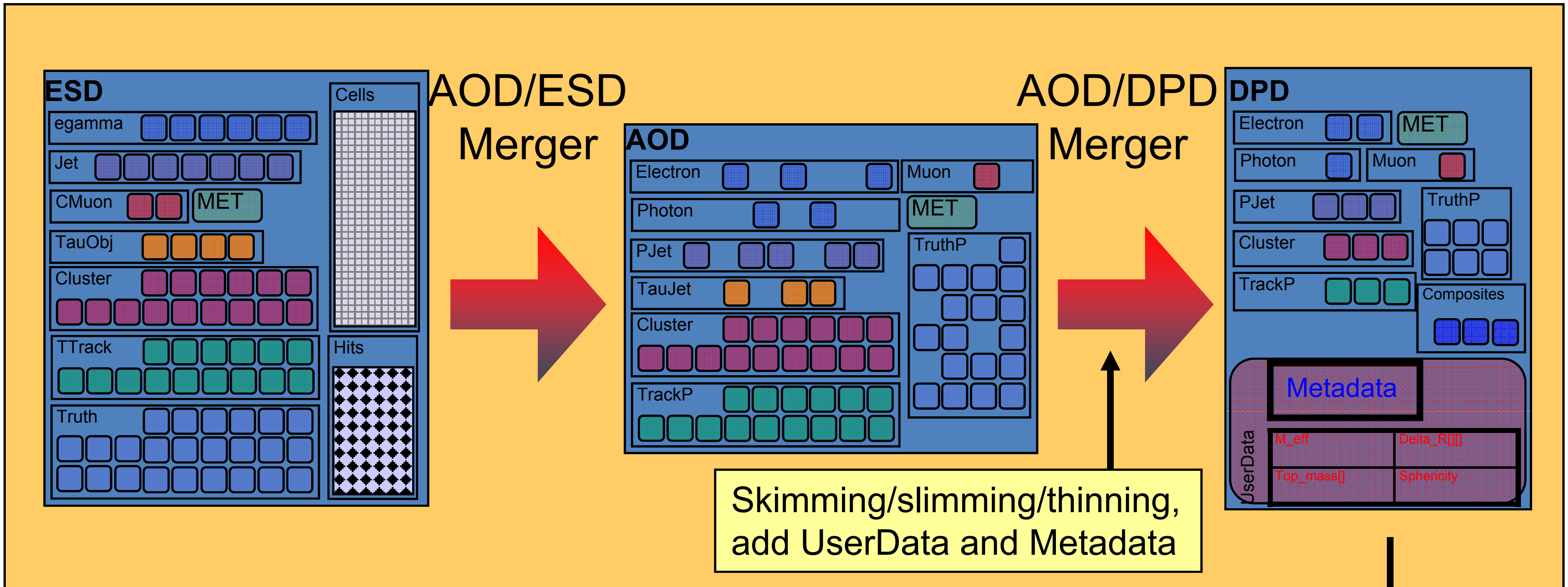
Huge efforts were made over last year(s) to keep ESD and AOD sizes to the above values (constrained by storage resources). As a result, ESD and AOD today are better optimized from technical and content (targeted to first data taking) point of views

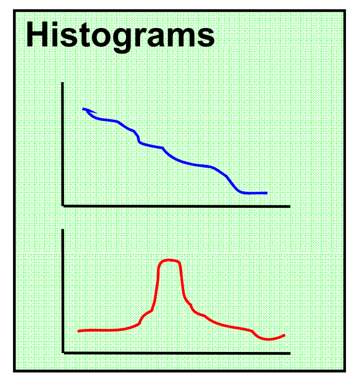
Note: the SW infrastructure is much more complex than in the above sketch. E.g. one important component is Database, in particular the Condition Database, where calibration & alignment constants and most of metadata (e.g. detector quality and luminosity information) are stored

Data Preparation: A lot of effort being made to monitor, assess and record data quality information at all data flow levels



The Analysis Model is being finalized





- **This model is very elegant and "clean" since it allows:**
  - **-- the same code to run at all levels, from primary AOD to DPD**
  - **-- seamless code porting Athena ⇔ ROOT**
  - **-- the same analysis to be performed in different frameworks (Athena batch, Athena interactive, ROOT)**

Glossary

ESD	**Event Summary Data**	**Skimming**	**select fraction of events**
AOD	**Analysis Object Data**	**Slimming**	**select some objects**
DPD	**Derived Physics Data**	**Thinning**	**reduce object information**

Full Dress Rehearsal (FDR)

Play data through the computing system just as for real data from the LHC

- start at point 1, as for real data

- process data at CERN Tier-0, various calibration & data quality steps

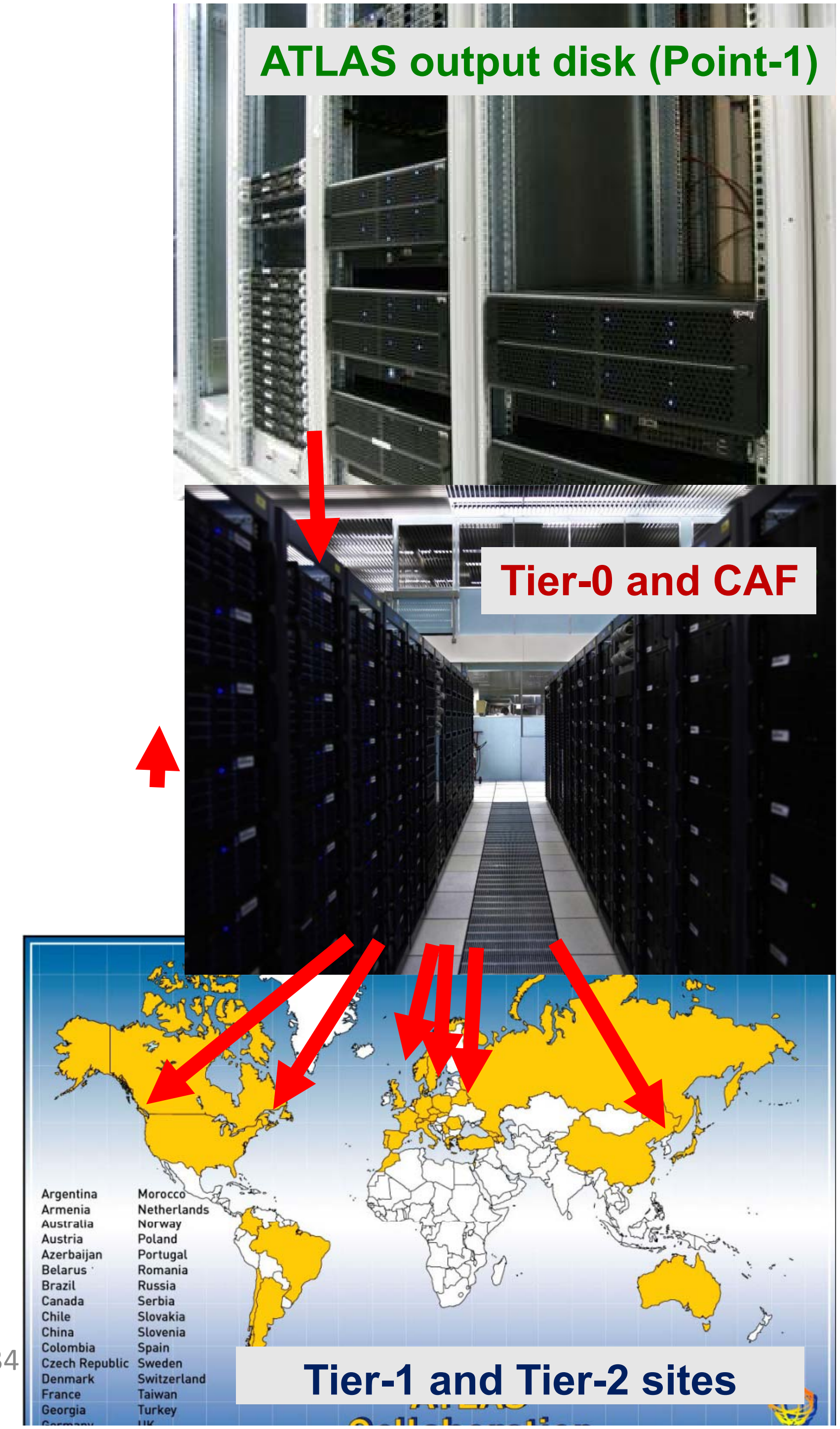
- ship out to the Tier-1s and Tier-2s for physics analysis

Complementary to 'milestone runs' which test the real detector, but only with simple cosmic rays

Two 'FDR runs' of one week each

Find out what won't work yet with real data...

A vital preparation for processing and analysing the first LHC data

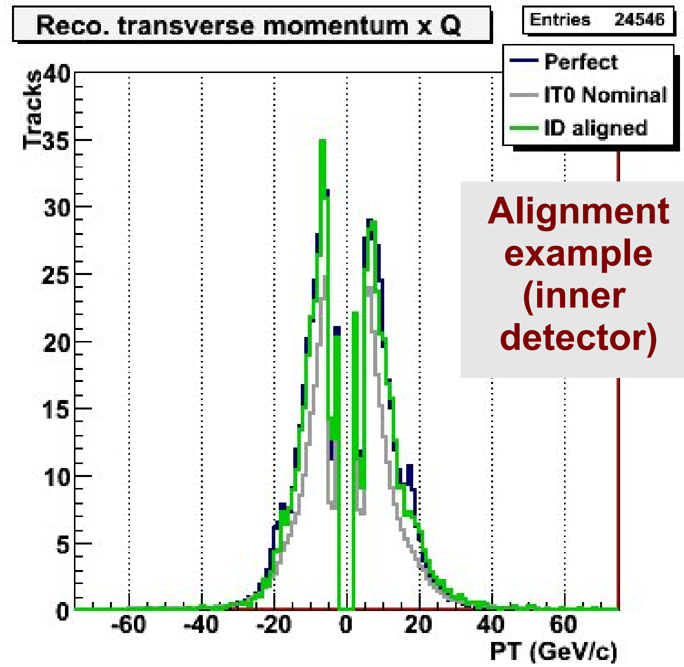


Full Dress Rehearsal, part 1 (FDR-1)

Week of February 4th
– played 3 ‘fills’, low-luminosity data (a small sample)

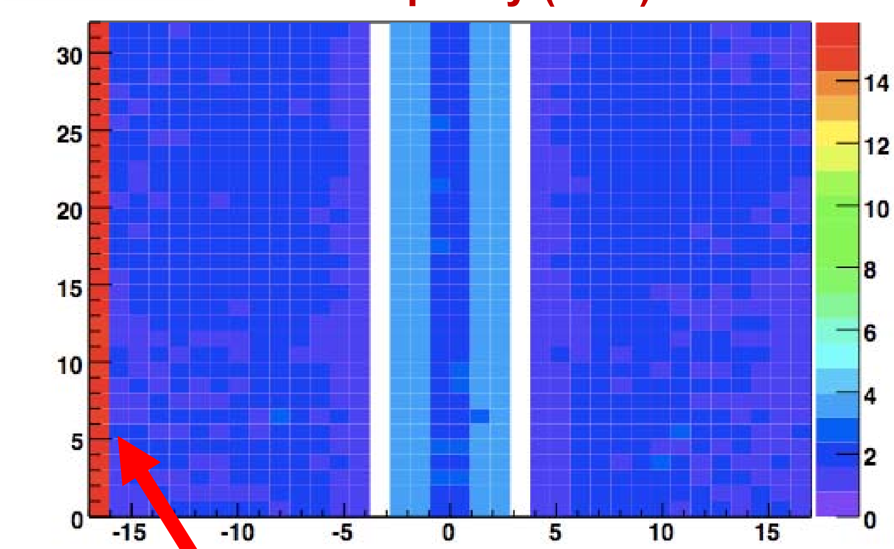
Exercised ‘as for data’:

- **inner detector alignment procedure**
- **data quality monitoring and reporting**
- **reconstruction of the data after expected 36h delay**
- **distribution to Tier-1 & 2 sites after a few days**
- **analysis started within a week**

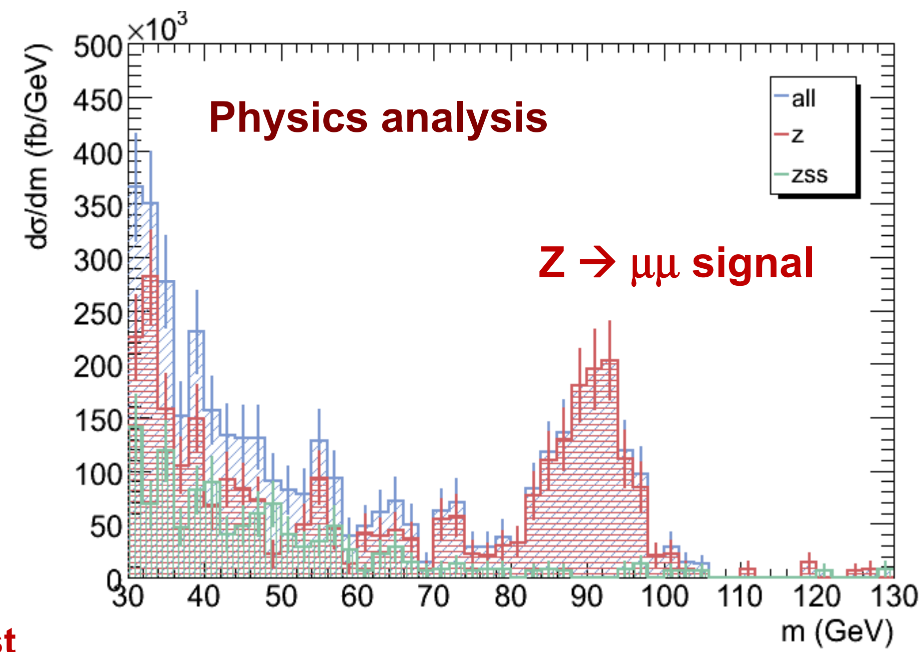


Alignment example (inner detector)

Data quality (TRT)



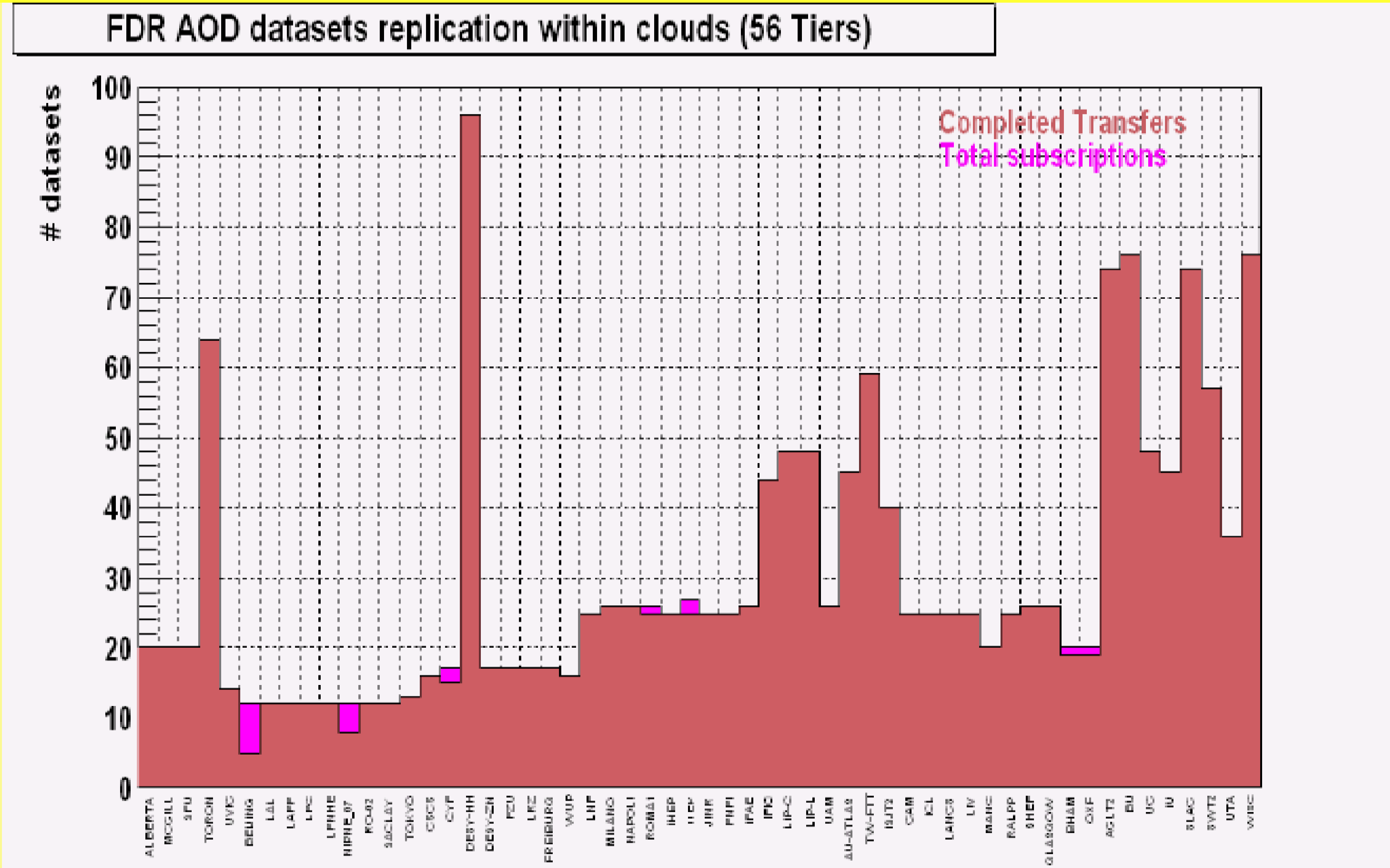
Bad calibration – spotted & fixed very fast



Physics analysis

Z → μμ signal

FDR Feb 2008. Data Transfer to Tier-2s



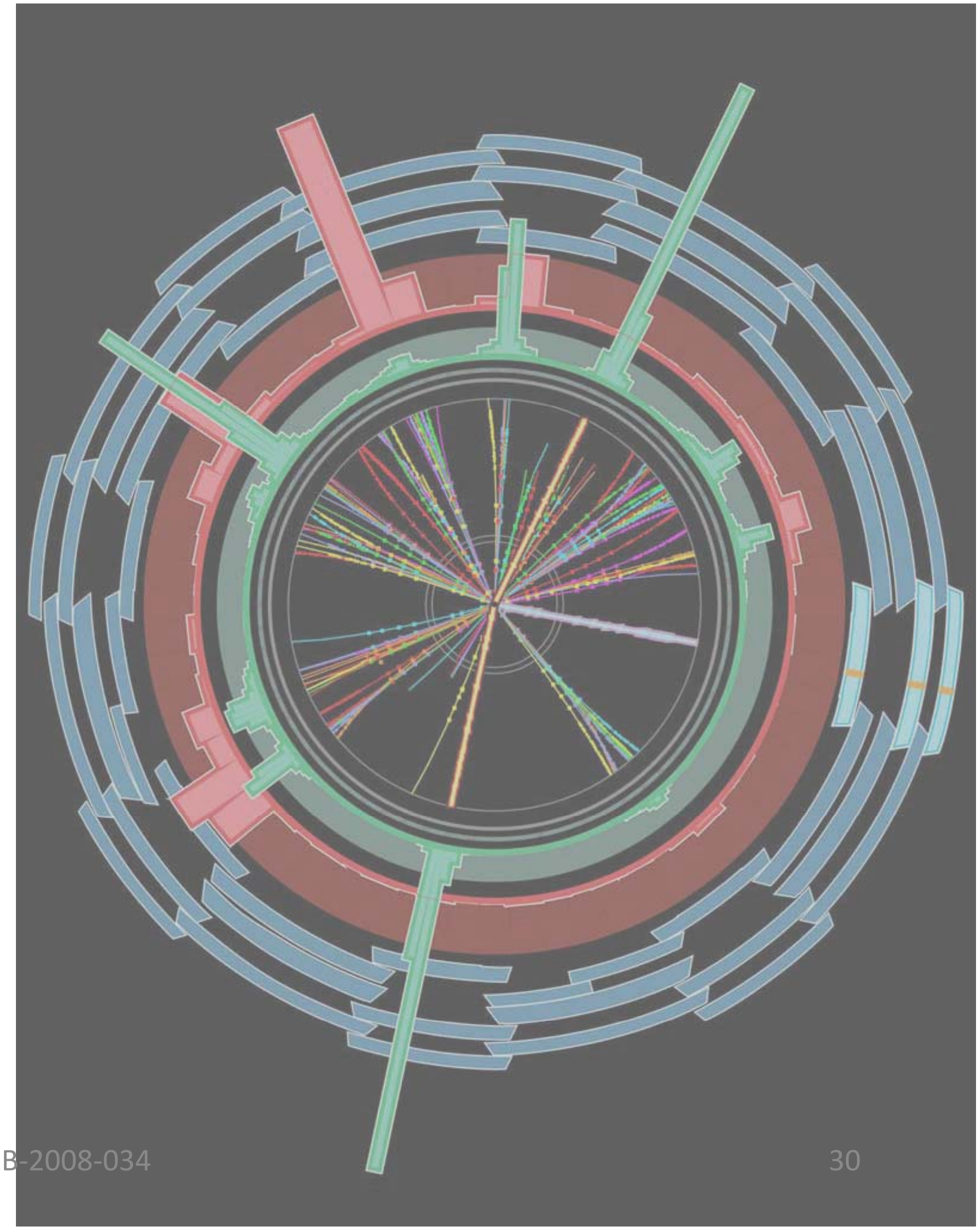
Full Dress Rehearsal, part 2 (FDR-2)

Scheduled for the start of June

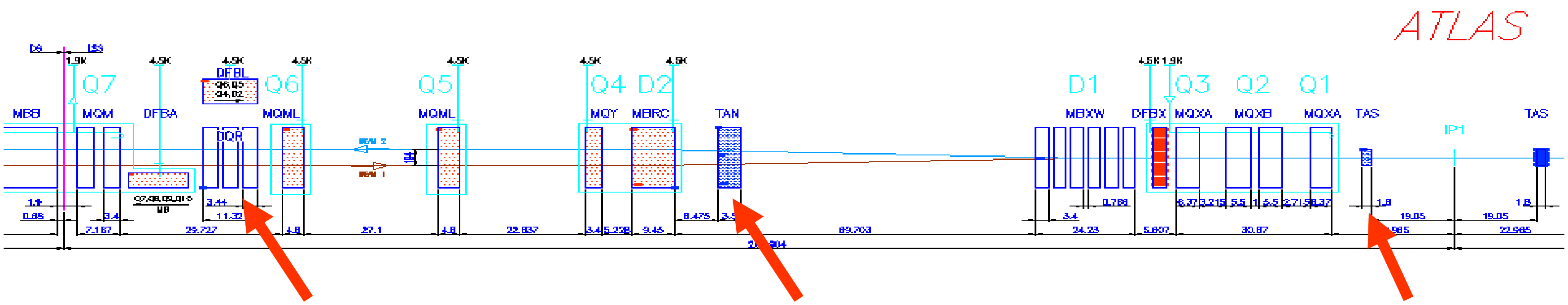
Similar to FDR-1, but procedures closer to real data-taking

- **higher luminosity data**
- **more calibration and alignment**
- **muon calibration at four sites in Germany, Italy and the US**
- **automated procedures at Tier-0**
- **faster data quality tests/feedback**
- **quality checking at worldwide sites**
- **faster export of data to Tier-1/2, fast start-up of physics analysis (hours rather than days)**

Two months to build on the experience before collisions!



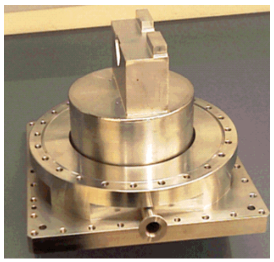
ATLAS Forward Detectors

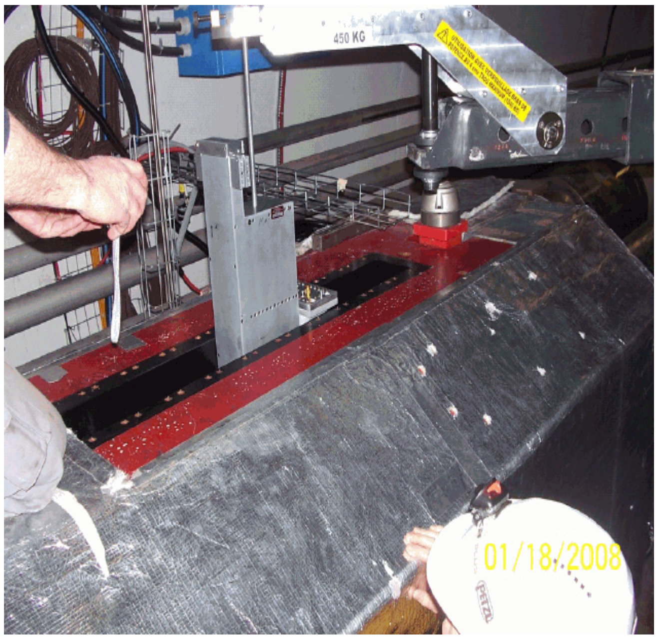


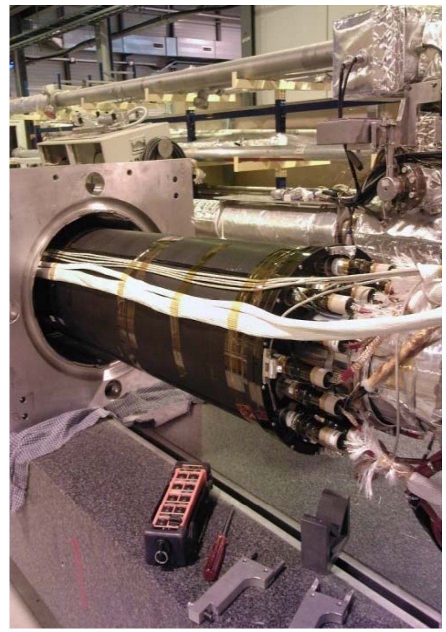
ALFA at 240 m

ZDC at 140 m

LUCID at 17 m







Absolute Luminosity for ATLAS

TDR submitted CERN/LHCC/2008-004

Zero Degree Calorimeter

Phase I (partially) installed

Luminosity Cerenkov Integrating Detector

Phase I ready for installation

Operation Task Sharing is now being put in place

A reminder of the framework:

The operation of the ATLAS experiment, spanning from detector operation to computing and data preparation, will require a very large effort across the full Collaboration (initially estimated at ~600 FTE effort per year, of which some 60% require presence at CERN)

The framework that has been approved by the Collaboration Board in February 2007 aiming at a fair sharing of these duty tasks (‘Operation Tasks’, OTs) is now being implemented and the systems and activity areas are using a dedicated Web tool for the planning and documentation

The main elements are:

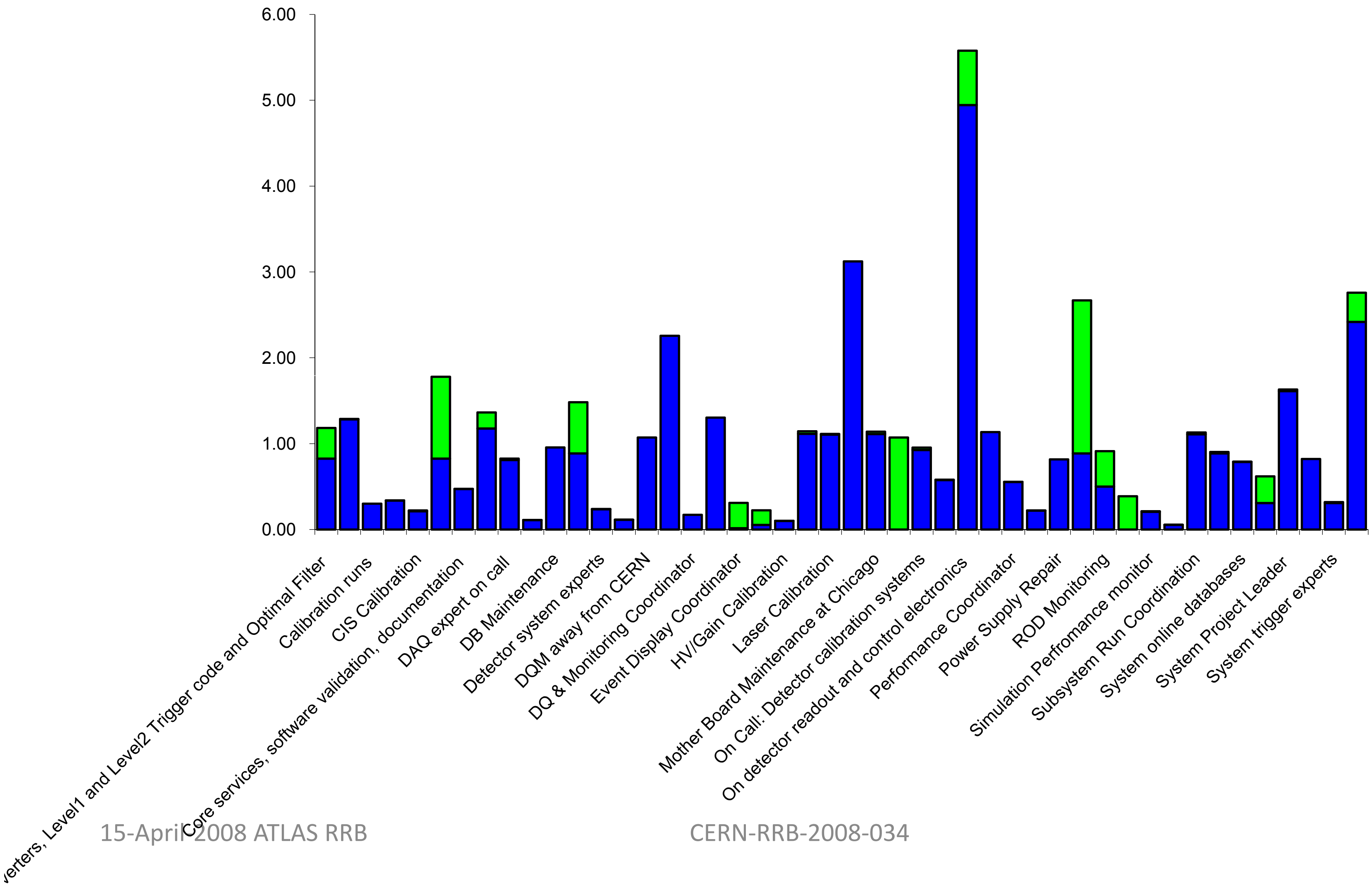
- OTs needs and accounting are reviewed and updated annually
- OTs are defined under the auspices of the sub-system and activity managements
- Allocations are made in two steps, expert tasks first, and then non-expert tasks

- The ‘fair share’ is proportional to the number of ATLAS authors (per Institution or Country)
- Students are ‘favoured’ by a weight factor 0.75
- New Institutions will have to contribute more in the first two years (weight factors 1.5 and 1.25)

Note that physics analysis tasks, and other privileged tasks, are not OTs, of course

An example of the Operations Tasks web tool usage

Tile Calorimeter planning: FTEs identified (blue) and still missing (green) over the year 2008



ATLAS organization to steer R&D for upgrades (recalling from earlier RRBs)

ATLAS has, in place and operational, a structure to steer its planning for future upgrades, in particular for R&D activities needed for possible luminosity upgrades of the LHC ('sLHC')

This is already a rather large and broad activity…

The main goals are to

- **Develop a realistic and coherent upgrade plan addressing the physics potential**
- **Retain detector experts in ATLAS with challenging developments besides detector commissioning and running**
- **Cover also less attractive (but essential) aspects right from the beginning**

The organization has two major coordination bodies

Upgrade Steering Group (USG)
(Existing since three years, with representatives from systems, software, physics, and relevant Technical Coordination areas)

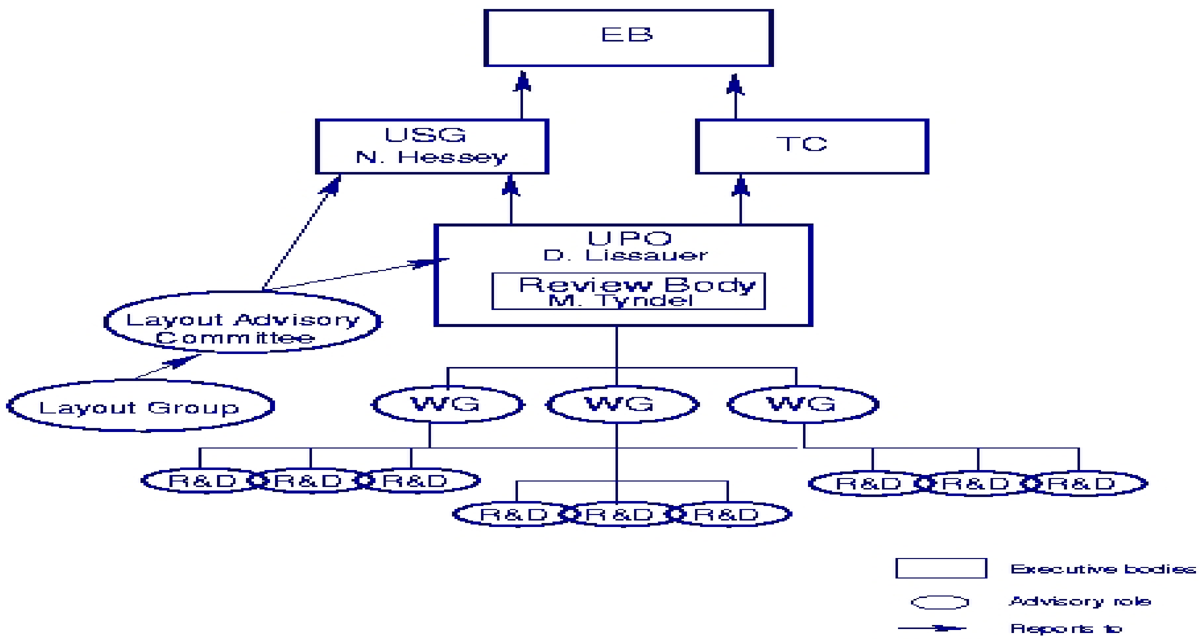
Project Office (UPO)
(Operates since more than a year, fully embedded within the Technical Coordination)

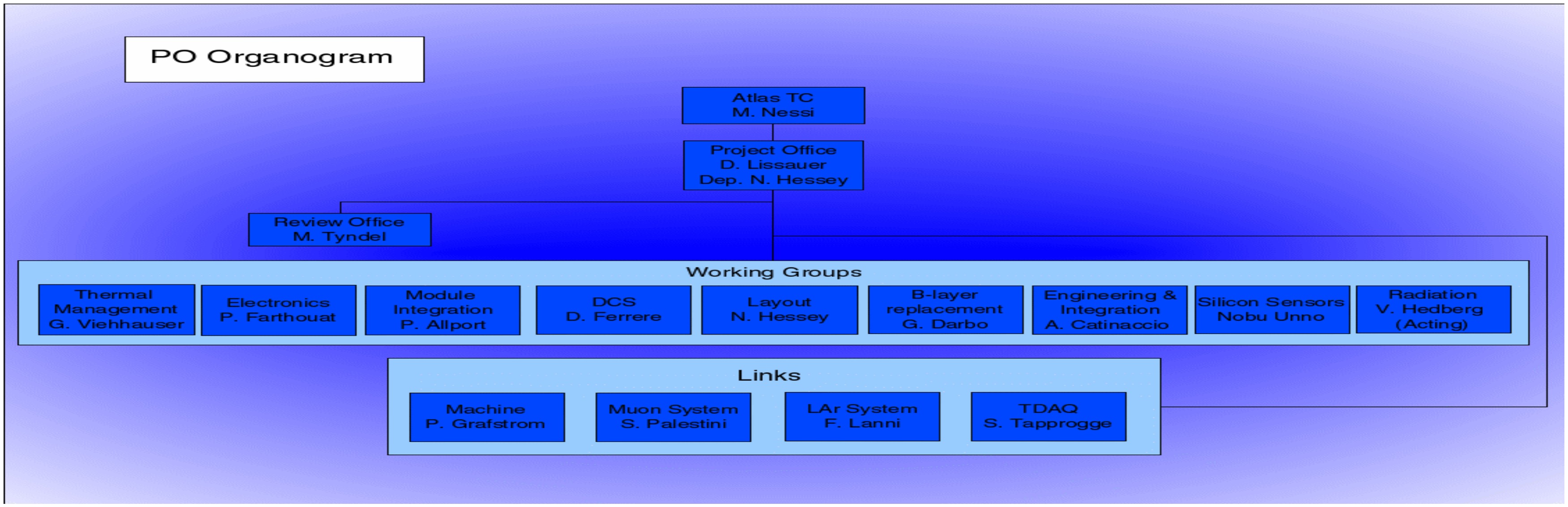
Upgrade R&D proposals are reviewed and handled in a transparent way within the Collaboration

There is a good and constructive synergy from common activities with CMS where appropriate

The LHCC is expected and welcome to act as global review body for the overall ATLAS upgrade plans

ATLAS Upgrade Organisation





Updated status of ATLAS sLHC upgrade proposals

Sheet3

Short name (click for full proposal)	Title	Principle contacts	Status
			26/03/08
Opto	Radiation Test Programme for the ATLAS Opto-Electronic Readout System for the SLHC for ATLAS upgrades	Cigdem Issever	Approved by EB
Staves	Development and Integration of Modular Assemblies with Reduced Services for the ATLAS Silicon Strip Tracking Layers	C. Haber, M. Gilchriese	Approved by EB
ABCNext	Proposal to develop ABC-Next, a readout ASIC for the S-ATLAS Silicon Tracker Module Design	F. Anghinolfi, W. Dabrowski	Approved by EB
Radiation BG	Radiation background benchmarking at the LHC and simulations for an ATLAS upgrade at the SLHC	Ian Dawson	Approved by EB
n-in-p sensors	Development of non-inverting Silicon strip detectors for the ATLAS ID upgrade	Hartmut Sadrozinski	Approved by EB
SiGe chips	Evaluation of Silicon-Germanium (SiGe) Bipolar Technologies for Use in an Upgraded ATLAS Detector	Alex Grillo, S. Rescia	Approved by EB
3D Sensors	Development, Testing, and Industrialization of 3D Active-Edge Silicon Radiation Sensors with Extreme Radiation Hardness: Results, Plans	Sherwood Parker now Cinzia Da Via	Approved by EB
Modules	Research towards the Module and Services Structure Design for the ATLAS Inner Tracker at the Super LHC	Nobu Unno	Approved by EB
Powering	Research and Development of power distribution schemes for the ATLAS Silicon Tracker Upgrade	Marc Weber	Approved by EB
Segmented Straw	R&D of segmented straw tracker detector for the ATLAS Inner Detector Upgrade	Vladimir Peshekhonov	Not approved as ATLAS relevant
Gossip	R&D proposal to develop the gaseous pixel detector Gossip for the ATLAS Inner Tracker at the Super LHC	H van der Graaf	Expression of interest received

Page 1

Updated status of ATLAS sLHC upgrade proposals

Sheet3

SoS	Expression of Interest: Evaluations on the Silicon on Sapphire 0.25 micron technology for ASIC developments in the ATLAS electronics readout upgrade	Ping Gui and Jingbo Ye	Approved by EB
Thin pixels	R&D on thin pixel sensors and a novel interconnection technology for 3D integration of sensors and electronics	H-G. Moser	Approved by EB
Muon Micromega	R&D project on micropattern muon chambers	V. Polychronakos, J. Wotschack	Approved by EB
TGC	R&D on optimizing a detector based on TGC technology to provide tracking and trigger capabilities in the MUON Small-Wheel region at SLHC	G. Mikenberg	Proposal received by USG
MDT Readout	Upgrade of the MDT Readout Chain for the SLHC	R. Richter	Expression of interest received
MDT Gas	R&D for gas mixtures for the MDT detectors of the Muon Spectrometer	P. Branchini	Expression of interest received
Selective readou	Upgrade of the MDT Electronics for SLHC using Selective Readout	R. Richter	Expression of interest received
Migh rate MDT	R&D on Precision Drift-Tube Detectors for Very High Background Rates at SLHC	R. Richter	Expression of interest received
Diamond	Diamond Pixel Modules for the High Luminosity ATLAS Inner Detector Upgrade	M. Mikkuz	Approved by EB
ID Alignment	ID Alignment Using the Silicon Sensors	H. Kroha	Expression of interest received
Fast Track Trigg	FTK, a hardware track finder	M. Shochet	Approved by EB
Versatile Link	The Versatile Link Common Project	Francois Vasey	Sent to CB for comments
LAr FE Electroni	R&D Towards the Replacement of the Liquid Argon Calorimeter Front End Electronics for the sLHC	G. Brooijmans	EoI Received

Page 2

Updated status of ATLAS sLHC upgrade proposals

Sheet3

LAr Optolink	R and D of a radiation resistant high speed optical link for the ATLAS Liquid Argon Calorimeter readout	Jingbo Ye	EoI Received
LAr ROD	Research and Development of Readout Driver (ROD) for the upgrade of the Liquid Argon Calorimeter Front-End Readout	Hucheng Chen	EoI Received
FCAL cold	Development of new ATLAS Forward Calorimeters for the Upgrade	J. Rutherfoord	EoI Received

Members of ATLAS are also very active collaborators in the EU project for the preparatory phase of the LHC luminosity upgrade

LARGE HADRON COLLIDER UPGRADE

Page 3

Collaboration composition

Since the RRB in October 2007 there were no formal admissions of new Institutions in the Collaboration which would call for an endorsement from today's RRB

There are however three new Institutions that have submitted formal Expressions of Interest to join ATLAS

The Collaboration Board will take at the earliest in July 2008 a decision, following the standard procedures defined in the initial Construction MoU

Julius-Maximilians-University of Würzburg, Germany
(Muon software, computing, sLHC R&D, outreach)

Palacký University in Olomouc, Czech Republic
(Fibre tracking in the forward Roman Pots)

University of Texas at Dallas, U.S.A.
(Pixels, computing)

In all three cases people have already been involved in ATLAS activities since at least a few years

At this stage the RRB is just invited to take note of these future admissions

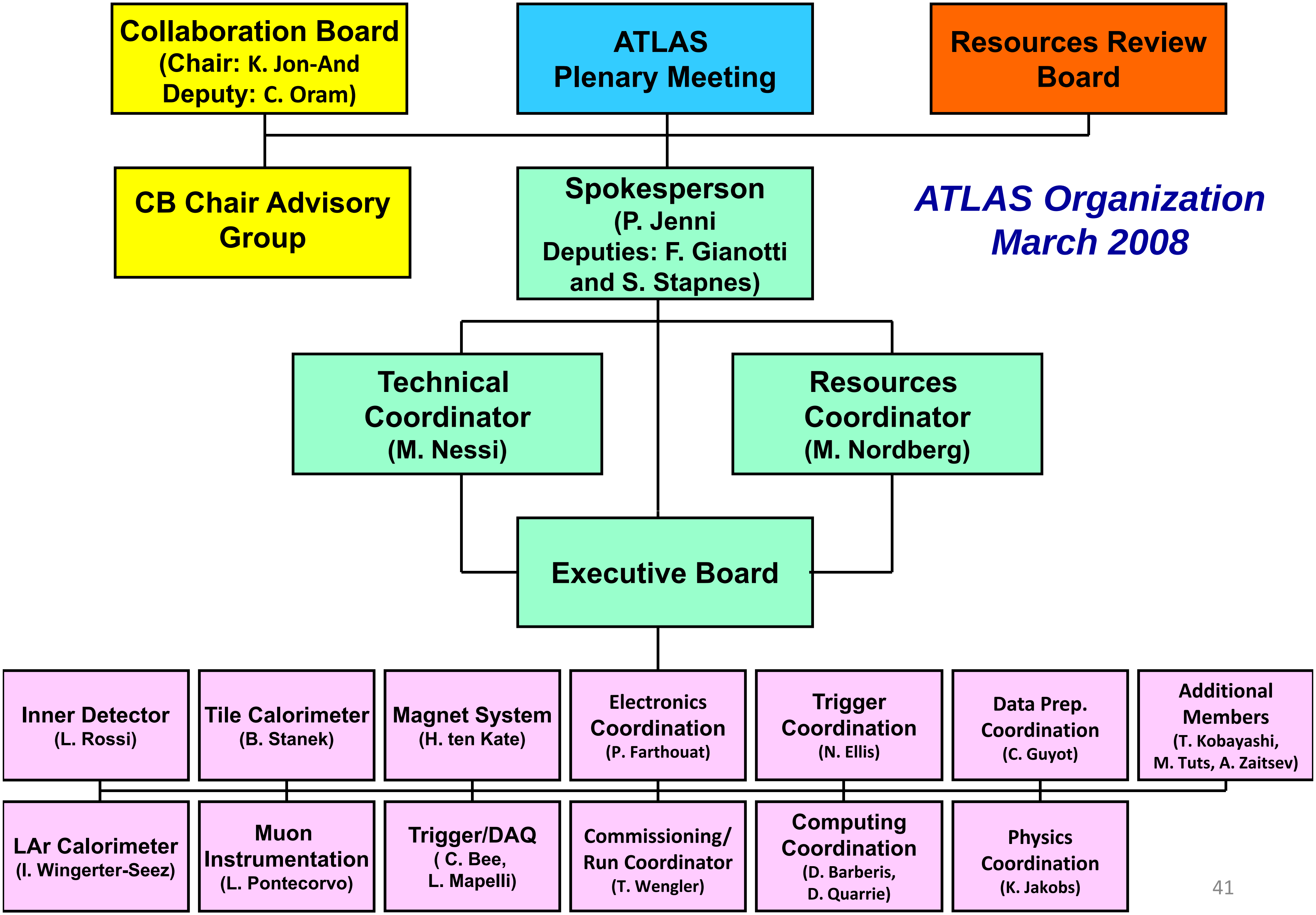
ATLAS Collaboration

(Status April 2008)

37 Countries
167 Institutions
2200 Scientific Authors total
(1750 with a PhD, for M&O share)

Albany, Alberta, NIKHEF Amsterdam, Ankara, LAPP Annecy, Argonne NL, Arizona, UT Arlington, Athens, NTU Athens, Baku, IFAE Barcelona, Belgrade, Bergen, Berkeley LBL and UC, HU Berlin, Bern, Birmingham, UAN Bogota, Bologna, Bonn, Boston, Brandeis, Bratislava/SAS Kosice, Brookhaven NL, Buenos Aires, Bucharest, Cambridge, Carleton, Casablanca/Rabat, CERN, Chinese Cluster, Chicago, Chile, Clermont-Ferrand, Columbia, NBI Copenhagen, Cosenza, AGH UST Cracow, IFJ PAN Cracow, DESY, Dortmund, TU Dresden, JINR Dubna, Duke, Frascati, Freiburg, Geneva, Genoa, Giessen, Glasgow, Göttingen, LPSC Grenoble, Technion Haifa, Hampton, Harvard, Heidelberg, Hiroshima, Hiroshima IT, Indiana, Innsbruck, Iowa SU, Irvine UC, Istanbul Bogazici, KEK, Kobe, Kyoto, Kyoto UE, Lancaster, UN La Plata, Lecce, Lisbon LIP, Liverpool, Ljubljana, QMW London, RHBNC London, UC London, Lund, UA Madrid, Mainz, Manchester, Mannheim, CPPM Marseille, Massachusetts, MIT, Melbourne, Michigan, Michigan SU, Milano, Minsk NAS, Minsk NCPHEP, Montreal, McGill Montreal, FIAN Moscow, ITEP Moscow, MEPhI Moscow, MSU Moscow, Munich LMU, MPI Munich, Nagasaki IAS, Nagoya, Naples, New Mexico, New York, Nijmegen, BINP Novosibirsk, Ohio SU, Okayama, Oklahoma, Oklahoma SU, Oregon, LAL Orsay, Osaka, Oslo, Oxford, Paris VI and VII, Pavia, Pennsylvania, Pisa, Pittsburgh, CAS Prague, CU Prague, TU Prague, IHEP Protvino, Regina, Ritsumeikan, UFRJ Rio de Janeiro, Rome I, Rome II, Rome III, Rutherford Appleton Laboratory, DAPNIA Saclay, Santa Cruz UC, Sheffield, Shinshu, Siegen, Simon Fraser Burnaby, SLAC, Southern Methodist Dallas, NPI Petersburg, Stockholm, KTH Stockholm, Stony Brook, Sydney, AS Taipei, Tbilisi, Tel Aviv, Thessaloniki, Tokyo ICEPP, Tokyo MU, Toronto, TRIUMF, Tsukuba, Tufts, Udine/ICTP, Uppsala, Urbana UI, Valencia, UBC Vancouver, Victoria, Washington, Weizmann Rehovot, FH Wiener Neustadt, Wisconsin, Wuppertal, Yale, Yerevan

ATLAS Organization March 2008



Updated Financial Overview

Financial framework

Initial Construction MoU 1995	**475 MCHF**
Updated construction baseline	**468.5 MCHF**
Additional Cost to Completion (accepted in RRB October 2002) based on the Completion Plan (CERN-RRB-2002-114)	**68.2 MCHF**
Additional CtC identified in 2006 and detailed in CERN-RRB-2006-069)	**4.4 MCHF**
Total costs for the initial detector	**541.1 MCHF**

Missing funding at this stage for the initial detector:

Baseline Construction MoU, mainly Common Fund **7.2 MCHF**
(of which 2.6 MCHF are in progress of being paid, and 4.6 MCHF remain at risk)

2002 Cost to Completion (CC and C&I) calculated shares **9.2 MCHF**
(of which 2.8 MCHF are in progress of being paid, and assuming that the U.S. will provide their remaining 4.5 MCHF on a best effort basis, 2 MCHF remain at risk)

It must be stressed that all these resources, already specified in the 2002 Completion Plan, are needed to complete the initial detector

Note for planning purposes that the following items are not included:

- ***This assumed beam pipe closure end August 2007, estimated additional manpower costs of 200-250 kCHF per month (partially covered elsewhere, not all on CtC, to be assessed at the end of the installation)***
- ***No provision for future 'force majeure' cost overruns***
- ***Re-scoping of the design-luminosity detector, estimated material costs of parts not included in present initial detector (CERN-RRB-2002-114)*** ***20 MCHF***
- ***Forward detectors parts (luminosity) not funded yet*** ***1.5 MCHF***

Cost to Completion, and initial staged detector configuration

As a reminder from previous RRB meetings:

The Cost to Completion (CtC) is defined as the sum of Commissioning and Integration (C&I) pre-operation costs plus the Construction Completion (CC) cost in addition to the deliverables

The following framework was accepted at the October 2002 RRB (ATLAS Completion Plan, CERN-RRB-2002-114rev.):

CtC	**68.2 MCHF**	**(sum of CC = 47.3 MCHF and C&I = 20.9 MCHF)**

Commitments from Funding Agencies for fresh resources (category 1)	**46.5 MCHF**
Further prospects, but without commitments at this stage (category 2)	**13.6 MCHF**

The missing resources, 21.7 MCHF, have to be covered by redirecting resources from staging and deferrals

The funding situation will be reviewed regularly at each RRB, and is expected to evolve as soon as further resources commitments will become available

The physics impact of the staging and deferrals was discussed in detail with the LHCC

It was clearly understood that the full potential of the ATLAS detector will need to be restored for the high luminosity running, which is expected to start only very few years after turn-on of the LHC, and to last for at least a decade

Cost to Completion Funding (kCHF)

(Status CERN-RRB-2008-031 31st March 2008)

Funding Agency	Cost to Completion 2002 (CtC) calculated share Total	CC	C&I	Member Fee 2004-6 (incl. in CC)	New funding (category 1) incl. Member F Total	New funding requests (category 2) Total	CtC 2006 proposed sharing Total
Argentina					**75**		
Armenia	**66**	48	18	38	**45**		
Australia	**357**	242	115	75	**357**		
Austria	**67**	52	15	38	**80**		
Azerbaijan	**43**	38	5	38	**38**		
Belarus	**85**	75	10	75	**75**		
Brazil	**64**	47	17	38	**41**		
Canada	**2090**	1528	562	263	**2090**		
Chile					**38**		
China NSFC+MSTC	**141**	99	42	38	**141**		
Colombia					**38**		
Czech Republic	**316**	196	120	113	**316**		
Denmark	**422**	290	132	38	**58**	375	
France IN2P3	**5890**	4176	1714	225	**5890**		
France CEA	**1940**	1379	561	38	**1940**		
Georgia	**42**	37	5	38	**42**		
Germany BMBF	**4531**	3250	1281	338	**4531**		
Germany DESY					**38**		
Germany MPI	**1093**	761	332	38	**1093**		
Greece	**261**	173	88	113	**261**		
Israel	**739**	497	242	113	**739**		
Italy	**6638**	4650	1988	450	**6288**		
Japan	**4362**	3029	1333	563	**4362**		
Morocco	**57**	47	10	38	**42**		
Netherlands	**1934**	1368	566	75	**1934**		
Norway	**581**	391	190	75	**581**		
Poland	**136**	94	42	75	**136**		
Portugal	**446**	265	181	38	**339**	107	
Romania	**140**	85	55	38	**140**		
Russia	**2991**	1995	996	263	**1759**		
JINR	**1066**	660	406	38	**521**		
Serbia					**300**		
Slovak Republic	**72**	53	19	38	**82**		
Slovenia	**223**	152	71	38	**223**		
Spain	**1706**	1109	597	113	**1706**		
Sweden	**1691**	1121	570	150	**1691**		
Switzerland	**2372**	1701	671	75	**2372**		
Taipei	**445**	318	127	38	**445**		
Turkey	**85**	75	10	75	**75**		
United Kingdom	**4387**	3063	1324	450	**4387**		
US DOE + NSF (1)	**12245**	8438	3807	1238	**12245**		
CERN	**8452**	5770	2682	38	**9300**		4400
Total	**68176**	47272	20904	5563	**66779**	482	**4400**

(1) The remaining 4.5 MCHF to C&I is provided on a best effort basis
New funding requests as prospects (category 2) are without firm commitment from the Funding Agencies

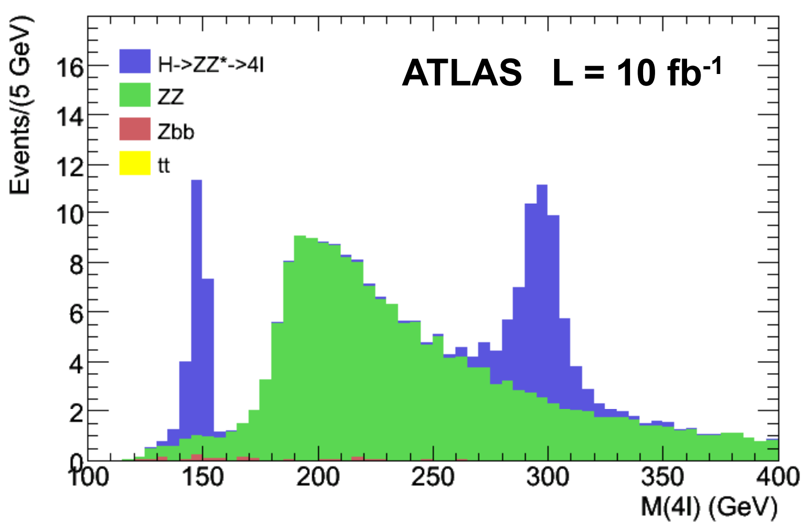
ATLAS Physics

Two examples from the recent so-called Computing System Commissioning (CSC) studies, which are being documented in a book of about 2500 pages

Search for Higgs Bosons

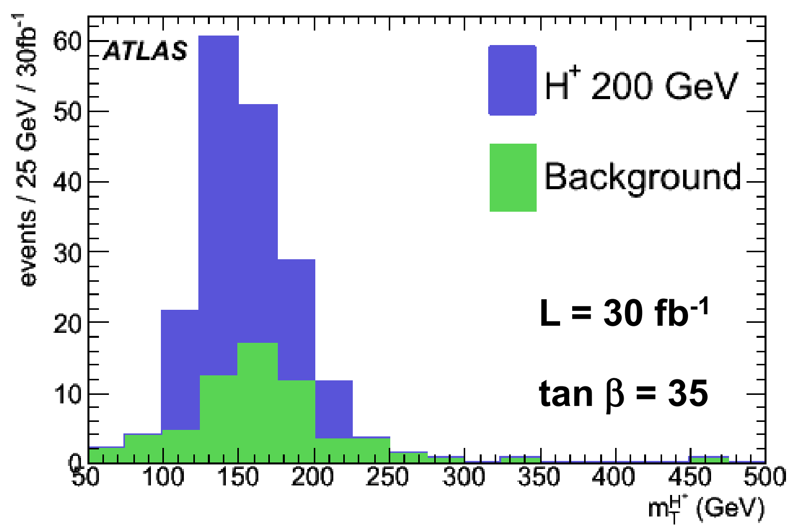
Standard Model

$$H \to ZZ(*) \to \ell\ell\ \ell\ell$$

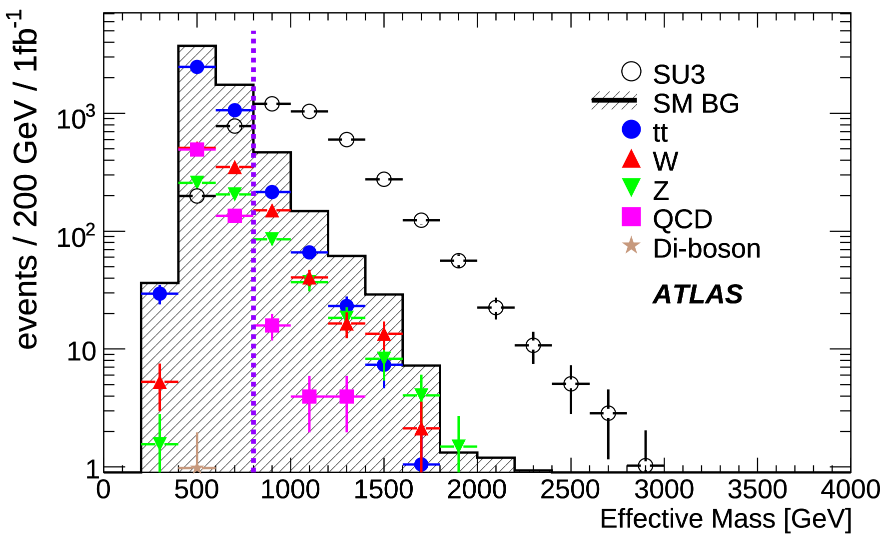


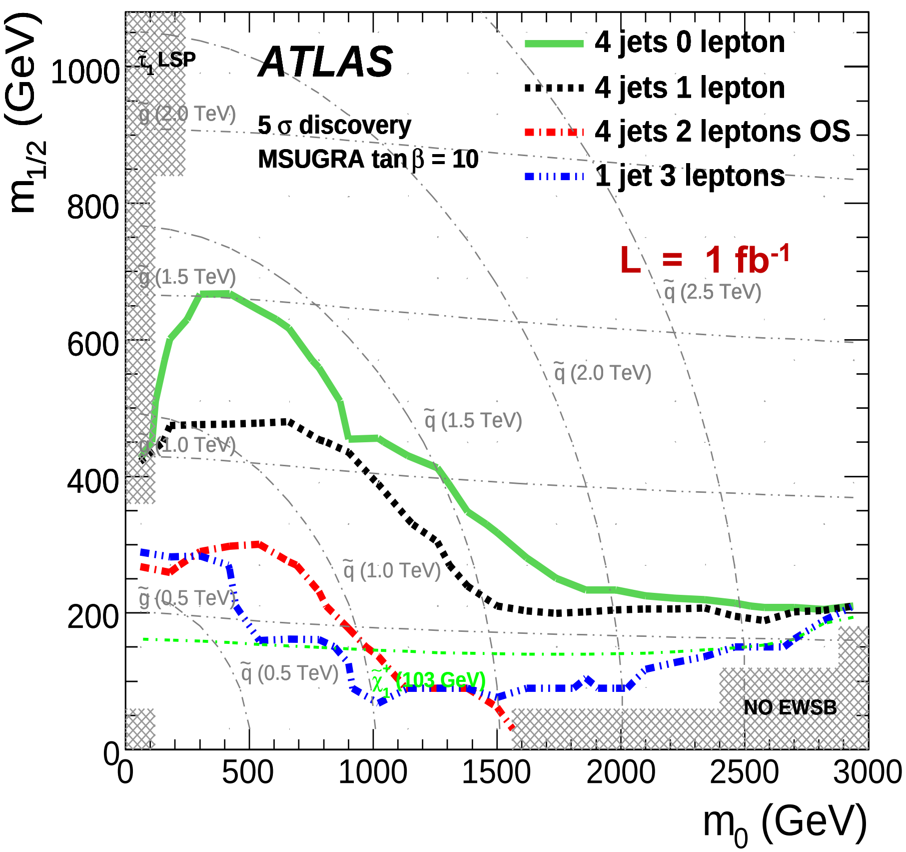
Charged Higgs boson in Supersymmetry (MSSM)

$$gb \to t\, H^{+} \to jjb\ \ \tau\nu$$



Search for Supersymmetric Particles





ATLAS reach for (equal) Squark- and Gluino masses:

0.1 fb^{-1}	**⇒**	**M ~ 750 GeV**
1 fb^{-1}	**⇒**	**M ~ 1350 GeV**
10 fb^{-1}	**⇒**	**M ~ 1800 GeV**

Deviations from the Standard Model due to SUSY at the TeV scale can be detected fast !

(Tevatron reach typically 400 GeV)

Conclusions

The ATLAS project proceeded within the framework of the accepted 2002 Completion Plan, all the resources requested in that framework are needed to complete the initial detector, and also just sufficient to cover the additional CtC costs as reported in 2006

Construction and installation are now ending, and the emphasis has strongly shifted onto the commissioning and the start-up of operation

Very major software, computing, trigger, data preparation and physics activities are Underway, demonstrating readiness for exploiting the LHC data

The worldwide LHC Computing Grid (WLCG) is the essential backbone for the ATLAS distributed computing resources needed for the Analysis Model

ATLAS is on track for the eagerly awaited LHC physics

(ATLAS expects to remain at the energy frontier of HEP for the next 10 -15 years, and the Collaboration has set in place a coherent organization to evaluate and plan for upgrades in order to exploit future LHC machine high-luminosity upgrades)

(Informal news on ATLAS is available in the ATLAS eNews letter at http://atlas-service-enews.web.cern.ch/atlas-service-enews/index.html)