Overview of ATLAS Data Challenge

Strongly based on slides of Gilbert Poulard for the ATLAS Plenary on 2003-02-20

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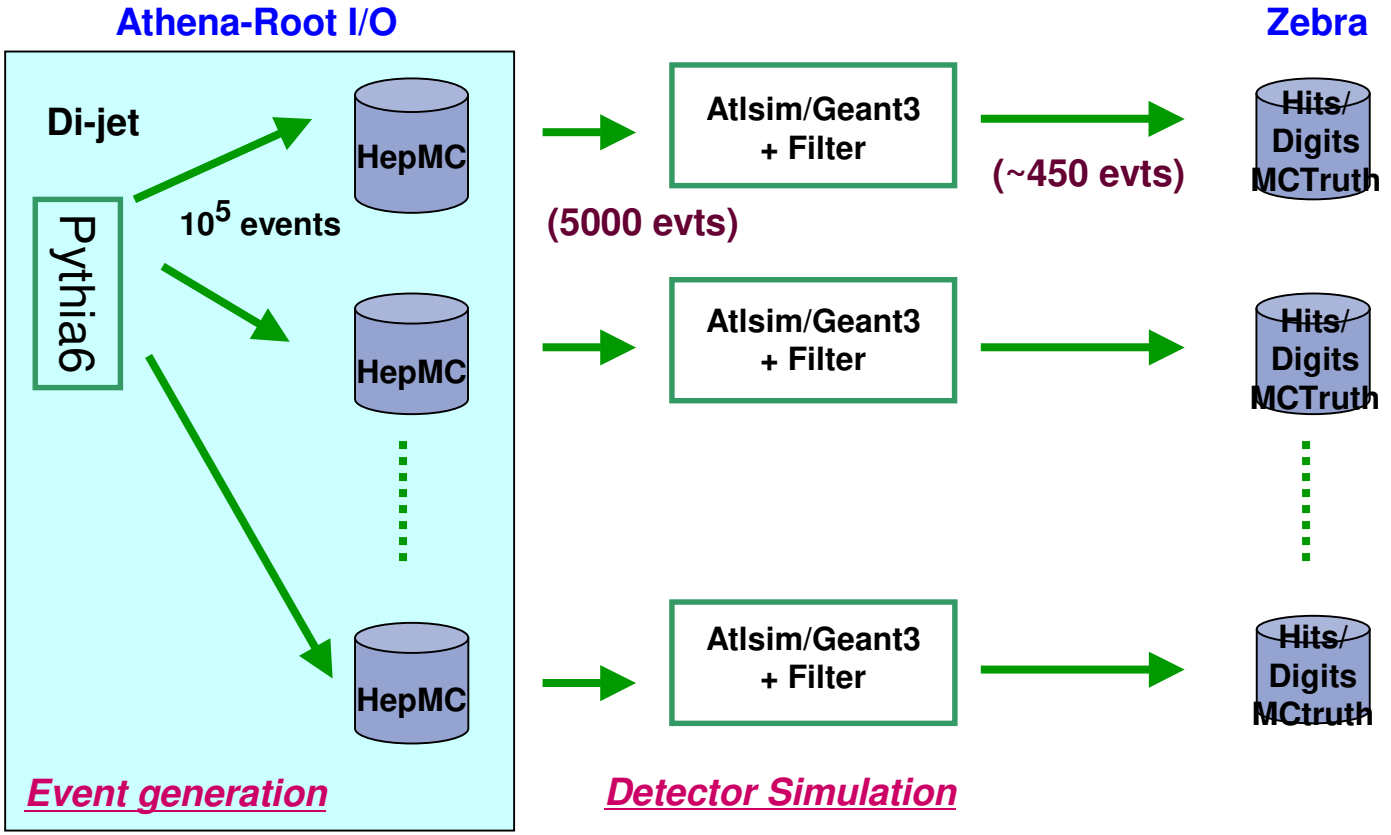
Data Challenge 1

- Main goals:
  - Need to produce data for **High Level Trigger** & Physics groups
    - Study performance of Athena and algorithms for use in HLT
    - High statistics needed
      - Few samples of up to 10^7 events in 10-20 days, O(1000) CPU's
      - Simulation & pile-up
  - reconstruction & analysis on a large scale
    - learn about **data model**; I/O performances; identify bottlenecks etc
  - data management
    - Use/evaluate **persistency technology** (AthenaRoot I/O)
    - Learn about **distributed analysis**
  - Involvement of sites **outside CERN**
  - use of **Grid** as and when possible and appropriate

DC1, Phase 1: Task Flow

- Example: one sample of di-jet events
  - PYTHIA event generation: 1.5 x 10^7 events split into partitions (read: ROOT files)
  - Detector simulation: 20 jobs per partition, ZEBRA output



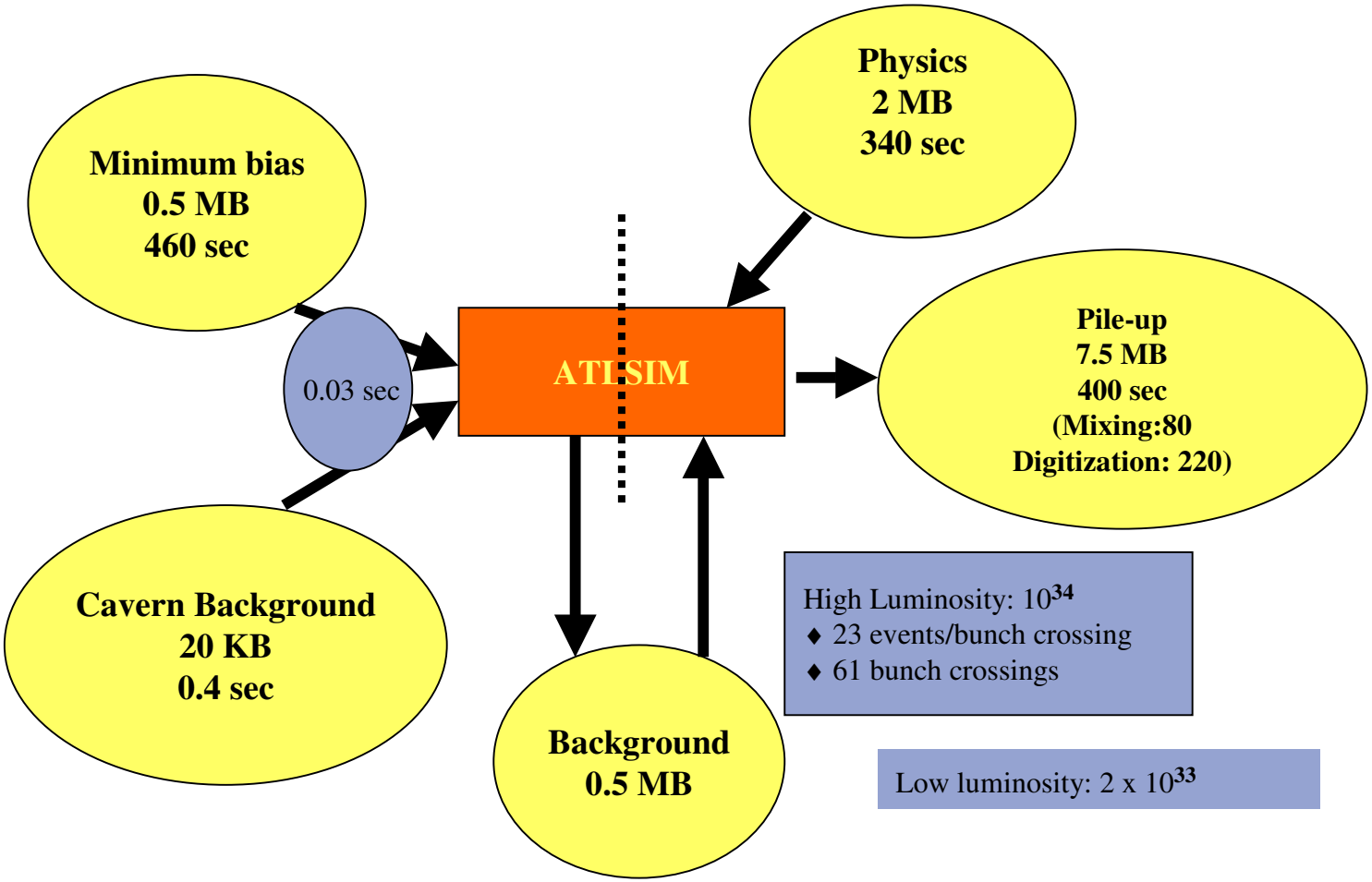
DC1, Phase 1: Summary

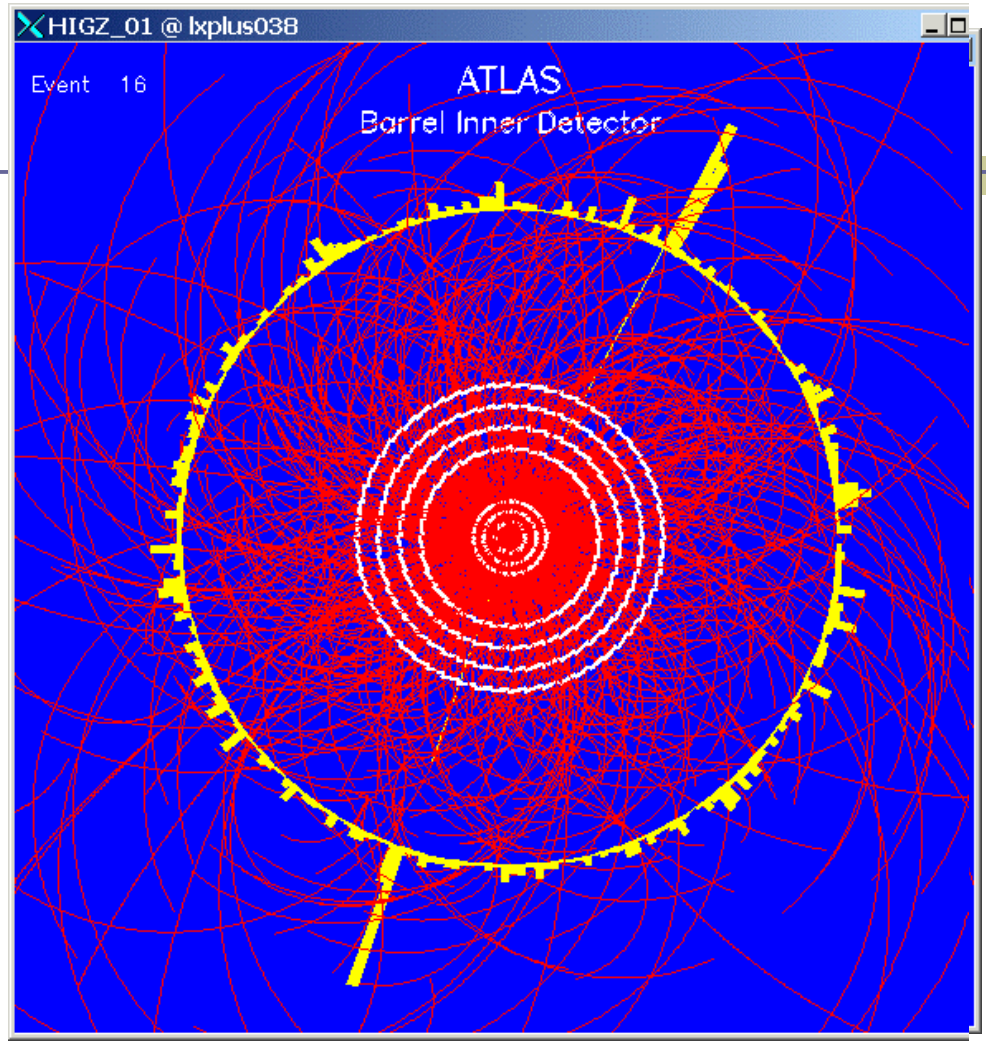
- July-August 2002
- 39 institutes in 18 countries
- 3200 CPU's , approx.110 kSI95 – 71000 CPU-days
- 5×10^7 events generated
- 1×10^7 events simulated
- 30 Tbytes produced
- 35 000 files of output

DC1, Phase 2

- Main challenge: luminosity effect simulation
  - Separate simulation for:
    - Physics events & minimum bias events
    - Cavern background for muon studies
  - Merging of:
    - Primary stream (physics)
    - Background stream(s): pileup (& cavern background)

Pile-up task flow




HIGZ_01 @ lxplus038
Event 16
ATLAS
Barrel Inner Detector

DC1, Phase 2, Pile-up Status

- 56 institutes
- Most production completed by mid-December
  - Include minimum-bias production
  - Low luminosity (2 x 10^{33})
    - Typically 40 minimum bias files used per job
  - High luminosity (10^{34})
    - Up-to 100 minimum bias files
- Not completed yet
  - US-Grid
    - Problems with Grid middleware (*Globus GRAM*)
  - “tails” in few other institutes

Coming: Reconstruction

- Preparation:
  - Building production infrastructure
  - Get the “reconstruction” software ready and validated
  - Include the dedicated code for HLT studies
- Today we are working with the ATLAS software release 5.3.0
  - Not ready for the reconstruction of pile-up data
  - Nevertheless, we intend to run small scale production on validation samples (without pile-up)
    - To ensure that nothing is forgotten
    - To test the machinery
- Expecting to have **6.0.x** as the production release
- Distributed task:
  - Concentrate the data in 9 sites
  - Use as much as possible production databases (AMI & MAGDA)
  - Be ready to use both conventional production and Grid:
    - NorduGrid & US-Grid
    - With dedicated tools:
      - GRAT (Grid Applications Toolkit)
      - AtCom to prepare the jobs

DC2-3-4-…

- **DC2:**
  - **Originally Q3/2003 – Q2/2004**
    - Will be delayed
  - **Goals**
    - Full deployment of EDM & Detector Description
    - Geant4 replacing Geant3 (fully?)
    - Pile-up in Athena
    - Test the calibration and alignment procedures
    - Use LCG common software (POOL, …)
    - Use widely GRID middleware
    - Perform large scale physics analysis
    - Further tests of the computing model
  - **Scale**
    - As for DC1: ~ 10^7 fully simulated events
- **DC3: Q3/2004 – Q2/2005**
  - Goals to be defined; Scale: 5 x DC2
- **DC4: Q3/2005 – Q2/2006**
  - Goals to be defined; Scale: 2 X DC3

DC1 on the Grid

- Three “Grid flavours”:
  - NorduGrid: full production
  - US Grid (VDT): partial production
  - EDG: tests
- DC1 Phase 1: 11 out of 39 sites
  - NorduGrid (*U. of Bergen, NSC Linköping U., Uppsala U., NBI, U. of Oslo, Lund U. etc*)
  - US-Grid (*LBL, UTA, OU*)
- DC1 Phase 2
  - NorduGrid (full pile-up production)
  - US Grid
    - Pile-up in progress
  - Expected to be used for reconstruction
    - Tests with 5.3.0 are underway on both NorduGrid and US Grid

NorduGrid production

- Middleware:
  - Globus-based Grid solution, most services are developed from scratch or amended
  - CA & VO tools – common with EDG, hence common user base
- History:
  - April 5th 2002: first ATLAS job submitted on the NorduGrid (*Athena HelloWorld*).
  - May 10th 2002: first pre-DC1-validation-job (*Atlsim-test using release 3.0.1*).
  - End-May 2002: now clear that NorduGrid is mature enough to do and manage real production.
- DC1, phase1 (simulation):
  - Total number of fully simulated events: 287296 (1.15×10^7 of input events)
  - Total output size: 762 GB.
  - All files uploaded to a Storage Element (U. of Oslo) and registered in the Replica Catalog.
- DC1, pile-up:
  - Low luminosity pile-up for the events above
- Other details:
  - At peak production, up to 200 jobs were managed by the NorduGrid at the same time.
  - Has most of Scandinavian production clusters under its belt (2 of them are in Top 500), however, not all of them allow for installation of ATLAS Software

US ATLAS Grid

- Software installation:
  - Globus gatekeepers at 3 (out of 8) sites
    - Software packaged by the WorldGrid (VDT-based)
  - Pre-compiled binaries distributed to the gatekeepers
  - “Grid scheduler”: pull model
- Approximately 10% of US DC1 commitment
  - Simulation: 200 000 input events, according to the database
  - Pile-up: a more complex task, exposed several problems (some common with EDG)
    - Still struggling

ATLAS-EDG Tests

- Started in August 2002, using DC1 simulation jobs
- Continuous feedback process *a la* WP8 plans of two years ago
- Well-known pattern: one bug crushed, two appear
- EDG 1.4.x is still highly unstable
  - Very inconvenient for ATLAS DC1 jobs, which typically last for 24+ hours
  - Needs a lot of end-user “hacking”
    - Manual RFIO management
    - Manual output post-staging
  - Regular major services failures:
    - Globus & Condor problems
    - RB and JSS problems
    - MDS problems
    - RC problems
    - Even hardware problems

More on Grids

- EDG
  - ATLAS decided to “keep an eye” on what is going on
  - But it seems “difficult” to run a major production with the current “middleware”
- LCG-1
  - Prototype is being deployed
    - should be ready by end-June
  - ATLAS will use the “applications software” (eg. POOL)
  - ATLAS will participate in the “testing”
  - Today ATLAS don’t consider it for production
  - It will become a major concern for DC2 and following DCs