

# DATA ANALYSIS USING TAGs AND GANGA

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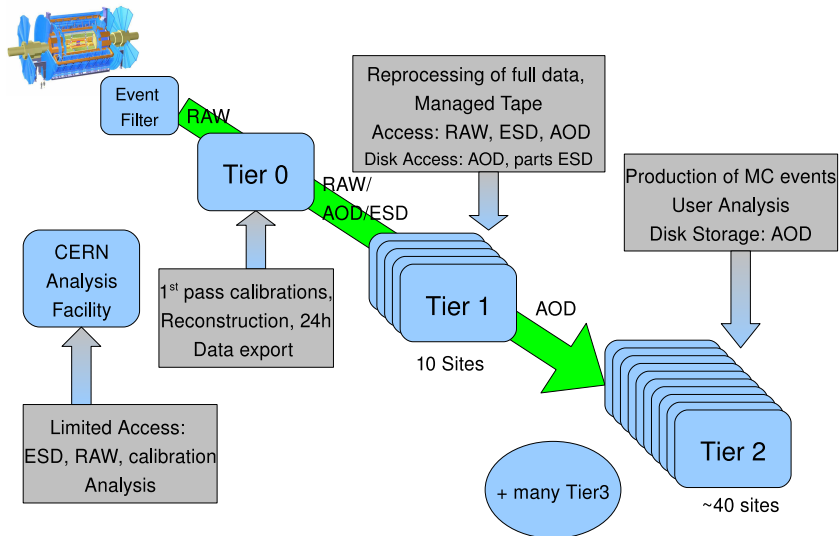
Ludwig-Maximilians-Universität München, Germany

13 May 2008/ATLAS DESY NAF & FDR Tutorial



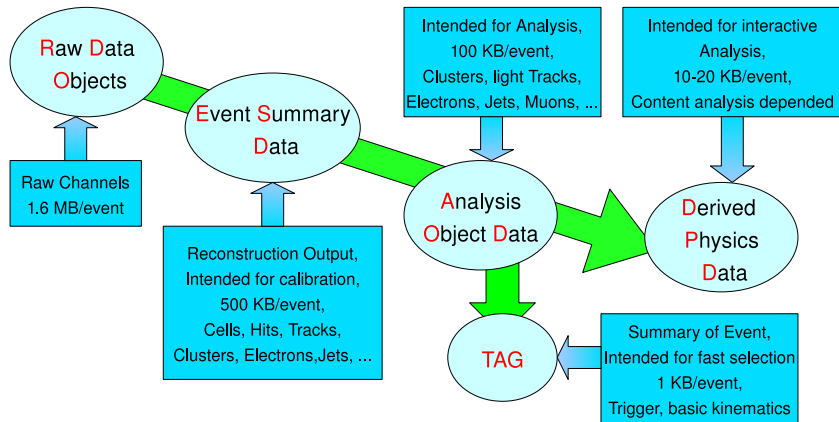
- ① DISTRIBUTED ANALYSIS MODEL IN ATLAS
- ② DISTRIBUTED ANALYSIS USING GANGA
- ③ CONCLUSIONS

# ATLAS DATA REPLICATION AND DISTRIBUTION



# ATLAS EVENT DATA MODEL

Refining the data by: Add higher level info, Skin, Thin, Slim



- Heterogeneous grid environment based on 3 grid infrastructures:



- Grids have different middle-ware, replica catalogs and tools to submit jobs  
  
⇒ Hide differences from the ATLAS user

# DISTRIBUTED ANALYSIS MODEL I

The distributed analysis model is based the ATLAS computing model

- Data is distributed in Tier1/Tier-2 facilities by default  
available 24/7
- user jobs are sent to the data  
large input datasets (100 GB up to several TB)
- Results must be made available to the user  
potentially already during processing
- Data is added with meta-data and bookkeeping in catalogs

# DISTRIBUTED ANALYSIS MODEL II

Need for: Distributed Data Management (DDM)

- Managed by DDM system DQ2 (Don-Quijote 2)
- Automated file management, distribution and archiving throughout the whole grid using a Central Catalog, FTS, LFCs
- Random access needs a pre-filtering of data of interest  
e.g. Trigger or ID streams or TAGs (event-level meta data)

Current situation and implementation

- Data from MC Production System is currently consolidated by DDM-operations team on all Tier1 and then all Tier2 sites
- Analysis model foresees Athena analysis of AODs/ESDs and interactive use of Athena-aware-ROOT tuples
- Analysis tuple format(s) in flux

# ATLAS DATASET REPLICATION

DDM Location Catalog Browser - Mozilla Firefox

Suchen:  version:

Located in:

Order results by:  50 results  [Advanced search](#)

Result page 1 - 1 of about 14 results for **trig1\_misal1\_mc12.005322.PythiaVBFH170wwll.recon.AOD.v13003003\_tid017852** (0.0686337947845 seconds)

| Site/Dataset/Version                                                                                                       | Transfer State | Completeness | Last Update         |
|----------------------------------------------------------------------------------------------------------------------------|----------------|--------------|---------------------|
| <a href="#">TRIUMF-DISK</a> / <a href="#">trig1_misal1_mc12.005322.PythiaVBFH170wwll.recon.AOD.v13003003_tid017852</a> / 1 | INACTIVE       | 3 / 3        | 2007-12-11 17:39:08 |
| <a href="#">TRIUMF-DISK</a> / <a href="#">trig1_misal1_mc12.005322.PythiaVBFH170wwll.recon.AOD.v13003003_tid017852</a> / 2 | INACTIVE       | 11 / 11      | 2008-02-25 13:58:49 |
| <a href="#">FZK-DISK</a> / <a href="#">trig1_misal1_mc12.005322.PythiaVBFH170wwll.recon.AOD.v13003003_tid017852</a> / 2    | INACTIVE       | 11 / 11      | 2008-02-25 14:36:53 |

<http://atlddmtrack.cern.ch/location/>

End user tools - all , , dq2-'' tools (like dq2-1s)

<source~/afs/cern.ch/atlas/offline/external/GRID/ddm/DQ2Clients/setup.sh>

# ATLAS DATA REPLICATION WITHIN DE CLOUD

- Tier1: FZK/GridKa
  - all data from MC production in DE cloud is aggregated
  - Currently also AODs and ESDs available, later controlled access
- Tier2s:
  - DESY-HH, DESY-ZN, GOEGRID
  - WUP, UNI-FREIBURG
  - LRZ-LMU, RZG-MPPMU
  - CSCS, FZU, CYF, HEPHY-UIBK
- At least 2 full copies of AODs will be available in DE Tier2s, one of them DESY, probably some more ESDs (RAW ?)
- So at NAF can use DESY storage element and SGE batch

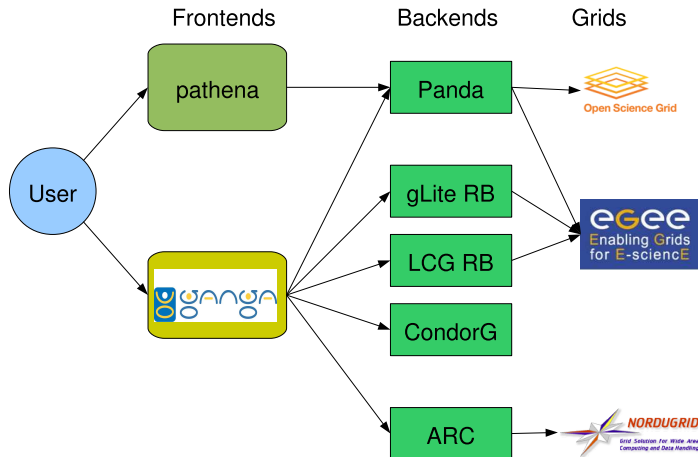
Job goes to the data:

Naive assumption: Grid  $\approx$  large batch system

- Provide complicated job configuration jdl file (Job Description Language)
- Find suitable Athena software, installed as distribution kits in the Grid
- Locate the data on different storage elements
- Job splitting, monitoring and book-keeping
- etc.

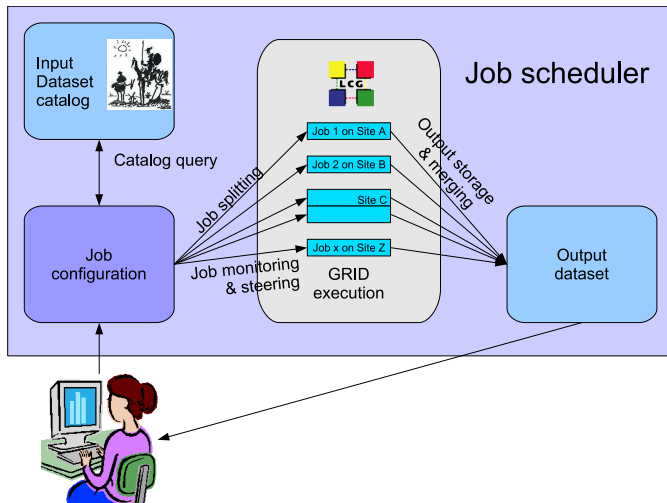
$\Rightarrow$  Need for automation and integration of various different components

# DISTRIBUTED ANALYSIS - CURRENT SITUATION



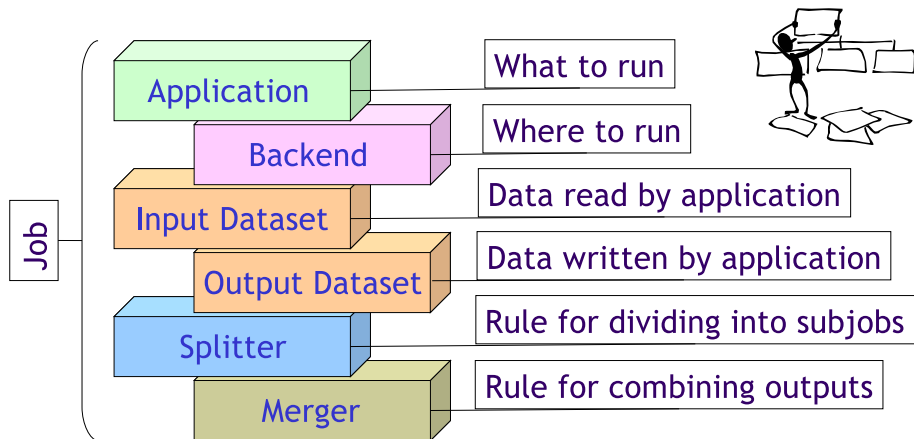
# DISTRIBUTED ANALYSIS

How to combine all these: **Job scheduler/manager: GANGA**



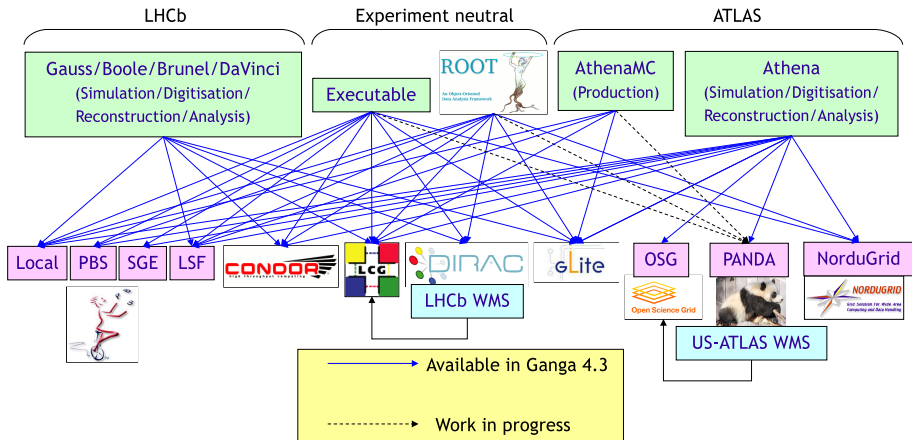
# GANGA JOB

- GANGA is based on a simple, but flexible, job abstraction
- A job is constructed from a set of building blocks, not all required for every job



# GANGA BACKENDS AND APPLICATIONS

- GANGA simplifies running of ATLAS (and LHCb) applications on a variety of Grid and non-Grid back-ends



# JOB DEFINITION USING ATLAS SOFTWARE I

GANGA offers three ways of user interaction:

- Shell command line
- Interactive IPython shell
- Graphical User Interface

Job definition at command line for GRID submission:

```
ganga athena
--inDS csc11.005320.PythiaH170wll.recon.A0D.v11004107
--outputdata AnalysisSkeleton.aan.root
--split 3
--lcg
AnalysisSkeleton_topOptions.py
```

# JOB DEFINITION USING ATLAS SOFTWARE II

Job definition within GANGA IPython shell:

```
j = Job()
j.application=Athena()
j.application.prepare(athena_compile=False)
j.application.option_file='$HOME/athena/12.0.5/InstallArea/jobOptions
j.splitter=AthenaSplitterJob()
j.splitter.numsubjobs = 3
j.merger=AthenaOutputMerger()
j.inputdata=DQ2Dataset()
j.inputdata.dataset='csc11.005145.PythiaZmumu.recon.AOD.v11004103'
j.inputdata.match_ce=True
j.outputdata=DQ2OutputDataset()
j.outputdata.outputdata=['AnalysisSkeleton.aan.root']
j.backend=LCG()
j.submit()
```

# DISTRIBUTED ANALYSIS TUTORIALS AND SUPPORT

<https://twiki.cern.ch/twiki/bin/view/Atlas/GangaTutorial44>

<https://twiki.cern.ch/twiki/bin/view/Atlas/GangaTutorial44NAF>

<https://twiki.cern.ch/twiki/bin/view/Atlas/UsingDQ2>

<https://twiki.cern.ch/twiki/bin/view/Atlas/DDMEndUserTutorial>

- Many tutorials at various places over the last year



- Ganga User support and Feedback:  
[hn-atlas-GANGAUserDeveloper@cern.ch](mailto:hn-atlas-GANGAUserDeveloper@cern.ch)
- Grid Middleware related:  
<http://www.ggus.org>

# RECENT ISSUES OF DISTRIBUTED ANALYSIS USING GANGA

- Over 1400 unique users since beginning of 2007
- Over 850 ATLAS users have tried Ganga at least once
- About 80 ATLAS Ganga users per week
- User feedback drives the development
- Still seeing occasionally site/middleware instabilities
  - distributed analysis depends on many different components
- DDM/DQ2 development and operations:
  - New DQ2JobSplitter with site-index/tracker for incomplete datasets
  - Data distribution with complete datasets is a key issue
- Keep up with newest Athena releases and features
- Site specific problems need to be chased up
  - GangaRobot/SAM tests for automatic analysis site checks
- User Support is an area of concern

- What are TAGs:
  - Event-level meta data written as part of primary AOD production
  - Stored in a database (file based or relational), 1 KB per event
  - Quickly filter or skim through the events
  - Contains run numbers, triggers, physics attributes
  - References to AOD, but also ESD and RDO
- TAGs can be stored in:
  - ordinary ROOT files (ROOT TAGs)
  - TAG content in Relational Databases (Relational TAGs).

## How to use TAG root files in Athena ?

- Modify `AnalysisSkeleton_topOptions.py`:

- Remove the line

```
ServiceMgr.EventSelector.InputCollections=["your_data_file.AOD.pool.root"]
```

- Add the following five lines which:

- Supply a tag file as input in place of an AOD file;
- Let `EventSelector` know that the input is a tag file;
- Tell the `EventSelector` which reference to use (tags can also navigate to ESD and RAW);
- Specify a filter predicate;
- Add a "ReadCatalog" in which the AOD files pointed to by the tags have been registered

# USING TAGS III

- Translated into jobOption code:

```
ServiceMgr.EventSelector.InputCollections = [  
  "/afs/naf.desy.de/user/e/elsheus/public/tutorial/fdr08_run1_StreamEgamma_o1_r1  
  ]  
ServiceMgr.EventSelector.CollectionType = "ExplicitROOT"  
ServiceMgr.EventSelector.RefName = "StreamAOD"  
ServiceMgr.EventSelector.Query = "RunNumber==003070 && NLooseElectron>1"  
ServiceMgr.PoolSvc.ReadCatalog += [  
  "xmlcatalog_file:/afs/naf.desy.de/user/e/elsheus/public/tutorial/PoolFileCata  
  ]
```

- All above can be automatically handled by Ganga:
  - Provide: `j.inputdata.tagdataset='tagdatasetname'`
  - Or upload: `tag.tar.gz` (output from ELSSI)
  - In Ganga 5 some improvements
  - GangaTNT to access TAG database

## Tutorial:

- NAF specific setups:

<https://twiki.cern.ch/twiki/bin/view/Atlas/GangaTutorial44NAF>

- General Ganga

<https://twiki.cern.ch/twiki/bin/view/Atlas/GangaTutorial44>