N.Benekos, G.Dedes, S.Horvat, O.Kortner, S.Kotov, J.v.Loeben, C.Valderanis

MPI Monte Carlo Production for the Rome Workshop

MPI, May 23^{th}, 2005

Produced data: Calibration Samples

Sample	Producer	Specifications	Generated (9.0.4)	Simulated (10.0.1)	Digitized (10.0.1)	Reconstructed (10.0.1)
Calibration						
SINGLE MUONS, energy loss determination (dataset 4041 · 4047)	Nektarios	Pt = 5, 6, 10, 20, 50, 250, 500 GeV; B=0	7 x 20 000			
Z->mu mu (dataset 4122)	Oliver, Nektarios, Jörg	Pt(Z) = 0 - 10 GeV	10 000	10 000		
	Oliver, Nektarios, Jörg	Pt(Z) = 10 - 20 GeV	10 000	10 000	10 000	5 900
	Oliver, Nektarios, Jörg	Pt(Z) = 20 - 40 GeV	10 000			
	Oliver, Nektarios, Jörg	Pt(Z) = 40 - 100 GeV	10 000			

Produced data: Signal and Background Samples

Sample	Producer	Specifications	Generated (9.0.4)	Simulated (10.0.1) / (9.0.4)	Digitized (10.0.1) / (9.0.4)	Reconstructed (10.0.1) / (10.0.1)
Signal channels						
H->ZZ->4l (dataset 4330)	Sandra	m(H) = 115 GeV	48 000	5 200	5 200	4 500
(dataset 4331)	Sandra	m(H) = 280 GeV	69 000	7 700	7 200	
pp->ttH,H->bb (dataset 1200)	Sergei, Makis	m(H)=120	30 000	30 000	30 000	10 000
bbA->bb(mu mu) (dataset 4332)	Sandra, Georgios	m(A) = 150 GeV	8 300	7 800	6 000	
(dataset 4333)	Sandra, Georgios	m(A) = 300 GeV	9 100	8 500 / 9 000	8 000 / 4 500	7 700 / 1 400
(dataset 4334)	Sandra, Georgios	m(A) = 450 GeV	9 300			
bbA/H->bb(tau tau) (dataset 4335)	Sandra, Georgios	m(A) = 150 GeV	10 000	10 000	10 000	
(dataset 4336)	Sandra, Georgios	m(A) = 300 GeV	10 000	10 000	10 000	
(dataset 4337)	Sandra, Georgios	m(A) = 450 GeV				
Background channels						
pp->ttbb (dataset 1201)	Sergei, Makis		20 000	10 000	10 000	
tt->(mu nu b)(mu nu b) (dataset 1100)	Sandra, Georgios		10 000	10 000		

Production statistics

MPI computing cluster at the Rechenzentrum Garching

140 jobs can be run at once, less if high CPU consumption:

- 1 MAGIC user with priority rights (40 jobs max.)
- 1(2) ATLAS user(s) with priority rights (40 jobs max. each)
- 6 other ATLAS users (30 jobs max. each)

Process	Start	Nb. events/job	time/event	software related failure rate
Generation	end of March	10k - 50k	∼1 sec	0%
Simulation	end of March	100	∼7 min	∼0-5%
Digitization	end of March	50 - 100	∼2 min	∼0-10%
Reconstr.	end of April	25 (100, high-mem)	∼2 min	∼0-10% ∼0-10%

Some 4 000 jobs have succesfully finished in 40 days of production = ∼20 jobs per user per day.

Sources of problems

Failures due to the software problems:

- runtime errors (DIGI)

```
Stream1.sysExec... FATAL Standard std::exception is caught,
RuntimeError: St9exception
```

```
ToolSvc ERROR Unable to finalize the following tools :
ToolSvc.LArCablingService
```

(dissapears if digitizing 50 instead of 100 events/job)

- no connection to database (SIMUL, DIGI, RECO)

```
POOL/RelationalPlugins/oracle Error ORA-03114: not connected to ORACLE;
```

```
CondDBMySQLCnvSvc FATAL *** ConditionsDB exception caught
```

Sources of problems

Up to now the system is still beeing optimized to user needs.

Failures due to the system problems:

- if too many jobs are in the queue -
  the pending jobs exit after some time with an error flag
  no solution
- no space left in the working directory
  solved by cleaning up the working space
- no connection to the TAPE with the data files
  solution: report to administrator, then sit and wait
- batch system down (mainly on the weekends)
  solution: report to administrator, sit and wait (for monday)

$\Longrightarrow$ The production has to be babysitted on a daily basis.

Validation of the Reconstructed Data

Standard validation tests:

- efficiency of the particle reconstruction (electrons, muons, jets)
- energy and momentum resolution of the reconstructed particles

Validation performed on the following samples:

$H \rightarrow ZZ \rightarrow 4\mathrm{l}$, $tt(H \rightarrow bb)$, $bb(A \rightarrow \mu^+\mu^-)$

- Electrons (EGAMMA):
  only 80% efficiency, p_T-recalibration needed
- Muons (MUONID = MOORE + TRACK PARTICLE):
  90% efficiency (95% for $|\eta| < 1.9$, 80% for $|\eta| > 1.9$) O.K.,
  resolution O.K.
- b-jets (KTBJET):
  40% efficiency O.K.?, reconstructed energy shifted to lower values

Comparison with the CERN Rome-Production

We compare these results with the data from the official CERN Rome-production.

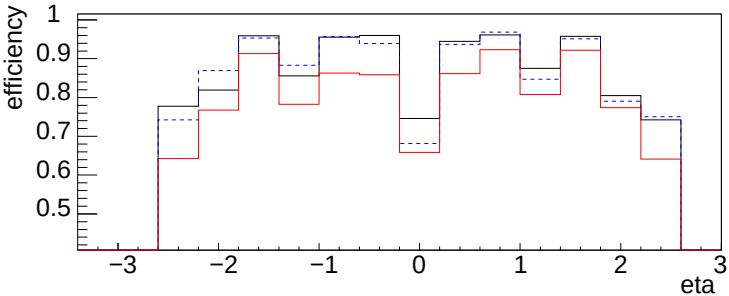
3 $bb(A \rightarrow \mu^+\mu^-)$ samples for the comparison:

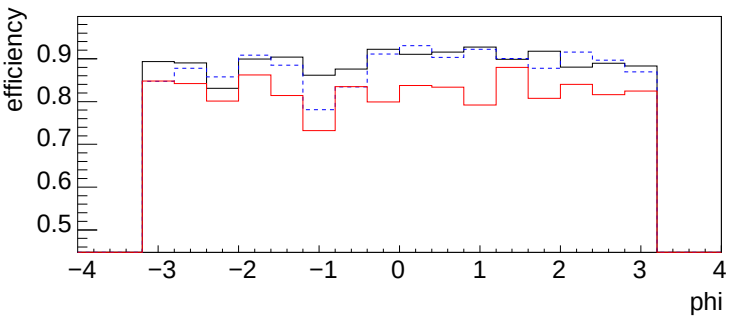
Sample	Nb.events	SIMU	DIGI	RECO	remark
CERN-s904	3500	9.0.4	9.0.4	10.0.1	CERN standard
MPI-s101	7700	10.0.1	10.0.1	10.0.1	our standard
MPI-s904	1400	9.0.4	9.0.4	10.0.1	for the test

$\Downarrow$

- muon efficiency 10% better at MPI (both s9.0.4 and s10.0.1), momentum resolution similar for all three samples
- b-jet efficiency similar for all three samples, b-jet energy shifted by different amounts for s9.0.4 and s10.0.1

Muon Efficiency



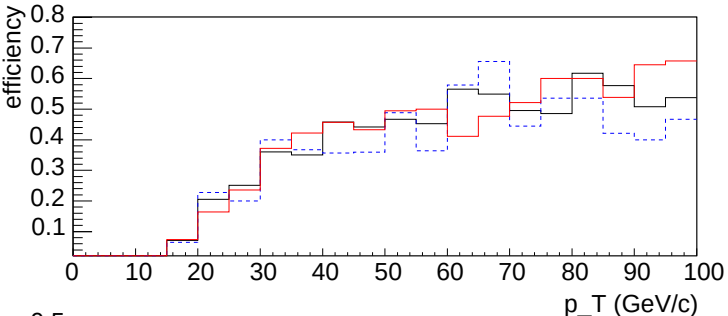


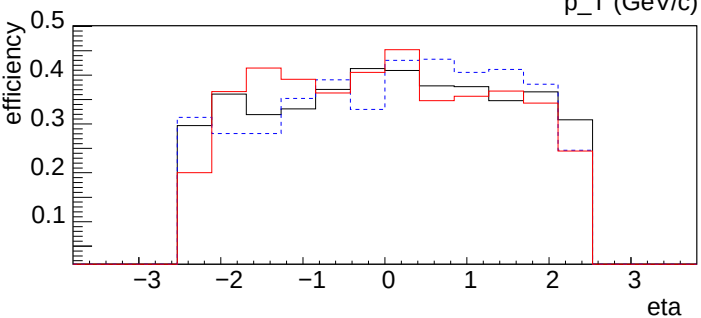
CERN−s904

MPI−s101

MPI−s904

b-jet efficiency



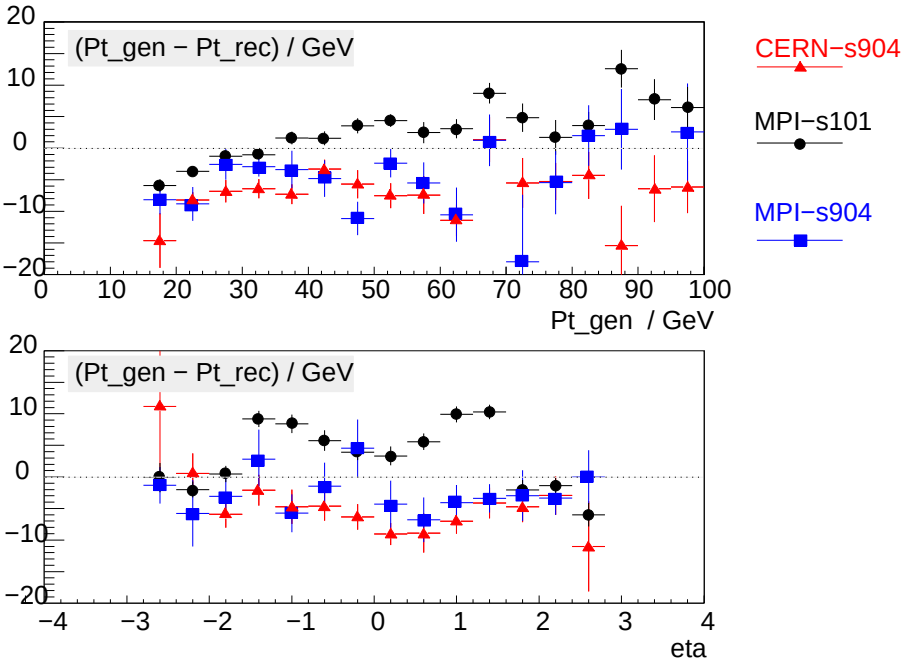


CERN−s904

MPI−s101

MPI−s904

b-jet momentum reconstruction



Summary

- After a month of optimizations, the Garching cluster aproaches the stable setup.
- First samples of Rome data reconstructed.
- Validation:
  Data are far away from perfect, both at MPI and at CERN.
- Comparison with the official CERN production:
  - where does the difference for the muon efficiency come from?
  - differences in the jet simulation using 9.0.4 and 10.0.1 release, but none gives satisfying results for $tt(H \rightarrow bb)$ channel
- Physics analyses (ttH, bbA) are ongoing.