SUSY MC Validation

B. Antunovic, W. Ehrenfeld

Outline:

- **RTT (Run Time Tester)**

  ->definition and purpose

  ->validation package (SUSY view)

- **AOD based validation tools**

  ->the idea of AOD based analysis

  ->kinematic distributons, resolution, efficiency

  ->validation of full simulation and fast shower parametrisation

RTT (Run Time Tester): Definition

- RTT is a Python coded framework that can setup and run Athena (and non-Athena) jobs

- A package can run in:
  ->batch mode (from the RTT launch code)
  ->interactive mode

  release based

  local based

- Uses CMT to ascertain which packages have tests to be run

- Launched daily by CRON job at CERN

- Executes any post-job activities specified (root macros, run user specified scripts etc.)

- Results are kept and published to a user specified directory which as HTTP served allows easy at-a-distance consultation and download

Individual validation job running in the RTT (SUSYView)

- Contact:
  ->each validation test class must have a contact person responsible for checking the result of the test every day
  (5 people make shifts in SUSY validation group)

- Input:
  ->information to the RTT is passed via configuration files
  ->needed data (MC) samples must be created with the latest validated release

- Validation procedure:
  ->job submission (when the nightly release is completed)
  ->job checking (build log, run log, post-processing log files)
  in case of job success (seems to be really rare!!!) the results are displayed as plots_SU3.html file for jets, electrons, taus, missing ET and some SUSY variables
  ->other post job activities and reporting to the developers

Some RTT plots from this week

- Last four days (during my shift), as usual, RTT job was crashing

🙂 Good news:

->RTT does not crash due to SUSY validation package, but due to other packages which are used (MissingET, Atlfast etc.)

💥 Bad news:

->Due to RTT crashing SUSY Validation package does not finish successfully and therefore I have no RTT plots to entertain you

AOD based validation

- The aim:
  -> supply the AOD based validation tool
  -> have access to all available information on AOD level

- Why AOD based analysis?
  -> make new and important contribution to the SUSY validation group since the currently official SUSY validation package is based mostly on SUSYView
  -> comparison of the full to the the fast simulation is performed for the first time in the SUSY working group

- Validation package:
  -> being developed in release 13
  -> running locally in DESY
  -> have started with the validation of the single electron samples in order to understand the athena framework and the container access

Validation data sets used

- Validation data sets (single electron sample studied):

  ->full simulation

  Et=10 GeV (Nevents=2400)

  Et=25 GeV (Nevents=2000)

  New magnetic field and misaligned geometry with material distortions

  ->fast simulation

  Et=10 GeV (Nevents=5000)

  Et=25 GeV (Nevents=7000)

  Data simulated with parametrized Genat showers

Full simulation validation data sample Et=25GeV is used for all plots shown except for the comparison

IsEM flag definition

- IsEM definition:

  e/gama candidates have to pass a series of cuts based on the cluster and track properties which are encoded in the EM bits

- IsEM==Tight (==0)

  all cuts are applied

- IseM==Medium

  (all calo + track quality + cluster-track matching in eta and phi)

- IsEM==Loose (only calo bits (3 out of 4))

IsEM flag

IsEMBits

calo bits
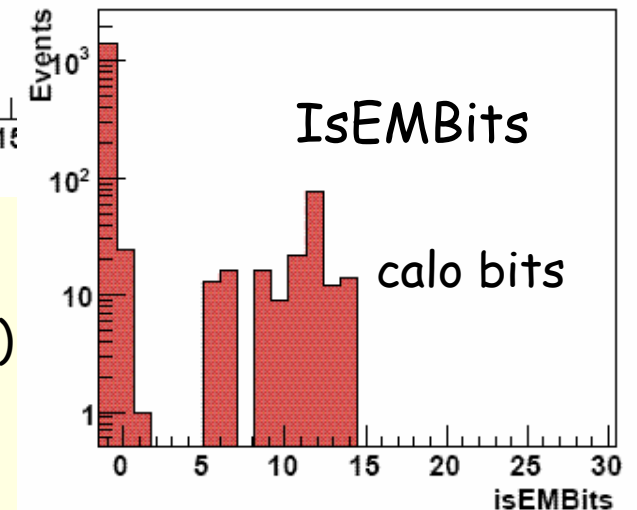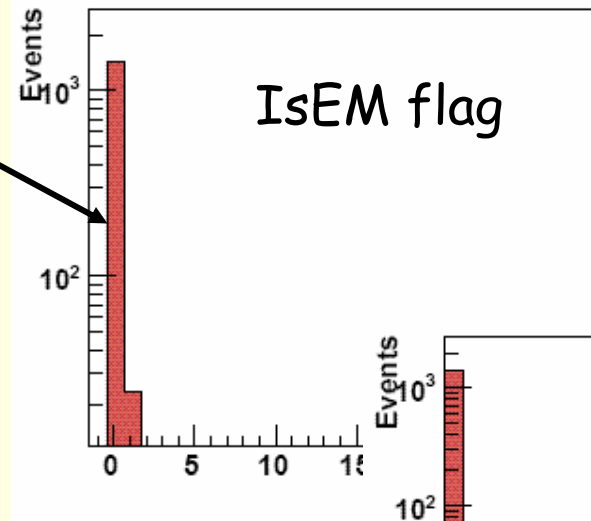
Electron Identification Variables

• Do we really access electrons?
 ->check Nel, charge, PdgId
distributions for reconstructed electons

• Electrons (e+ and e-) are selected, but
sometimes 2 rec. electrons per event
Bremss/bug/feature???)
=>check electron properties
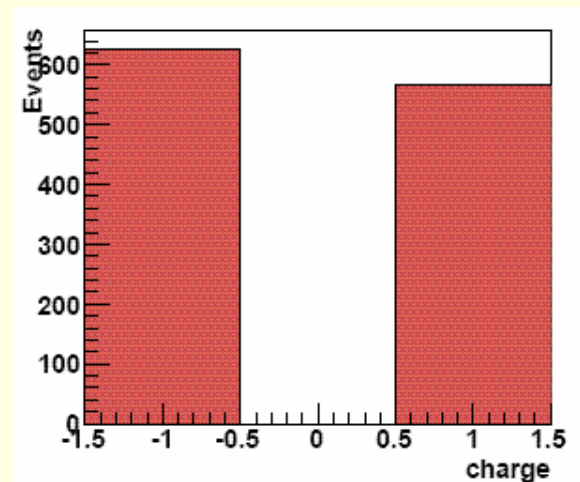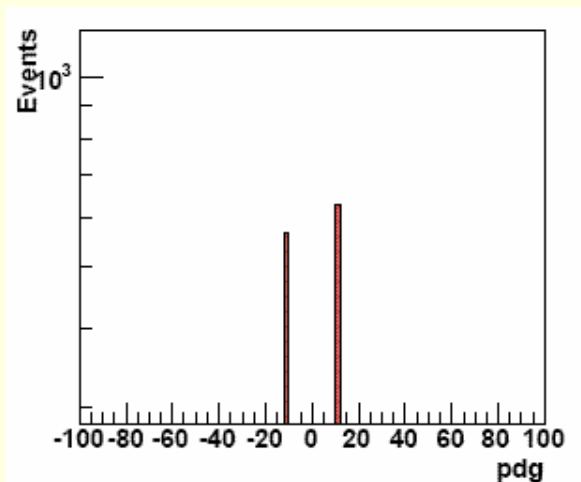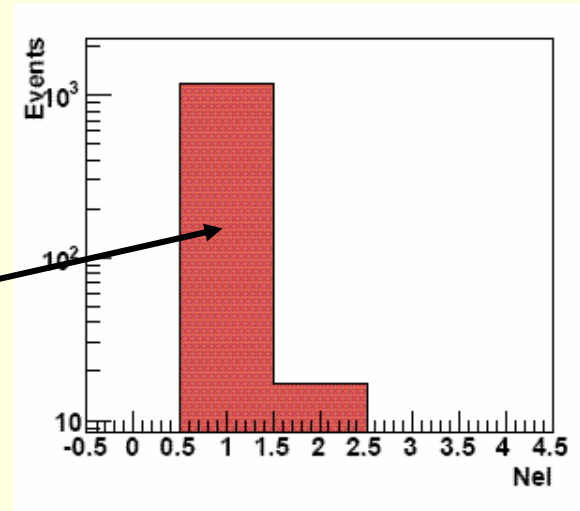
Generator kinematic variables

•Generator variables accessed
 via GEN_AOD container

•Selection:
 ->abs (PdgId)==11
 ->status stable
 ->barcode of the production vertex
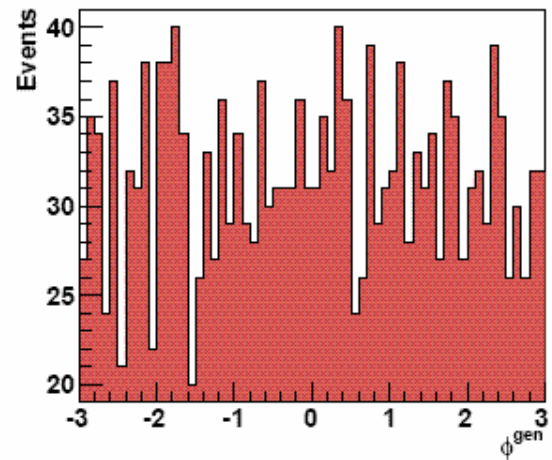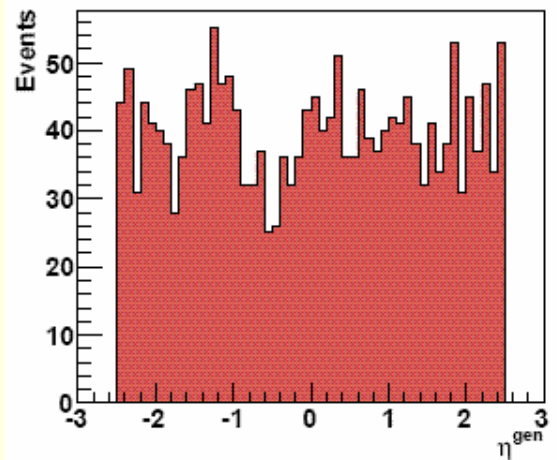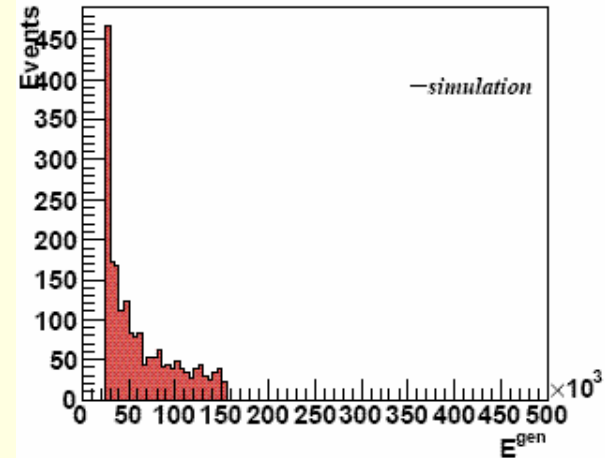
Reconstructed kinematics variables

- Access to the reconstructed variables using ElectronAODCollection

- Electron selection:
  - ->abs (pdgId)==11
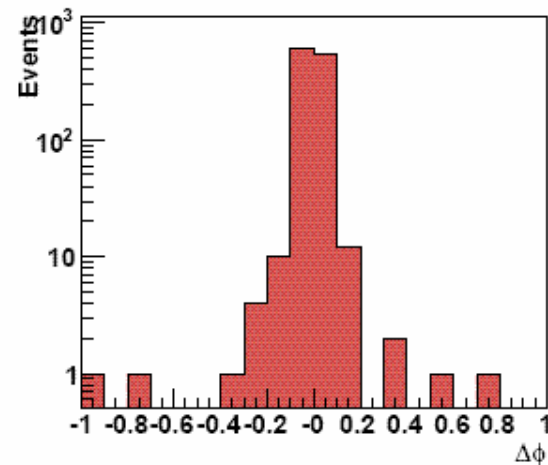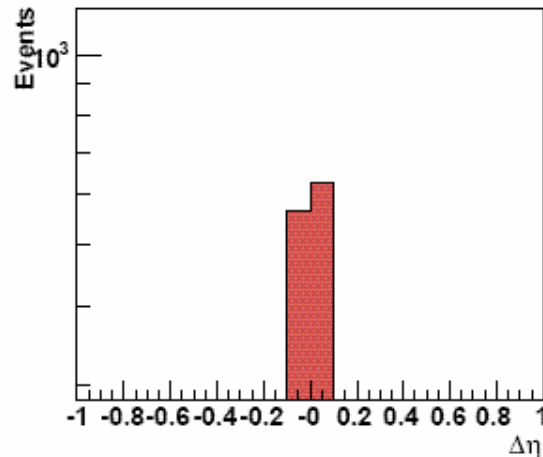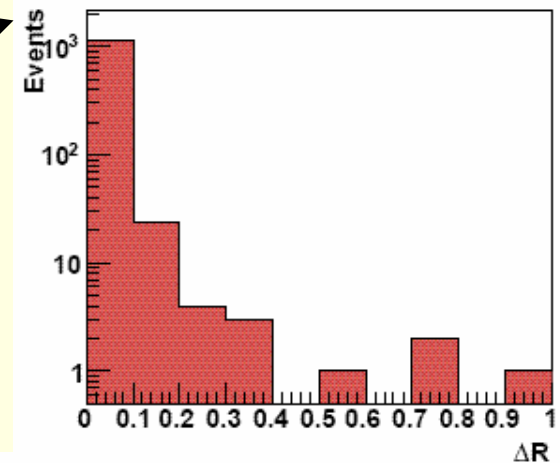 - ->tight electrons (isem==0)
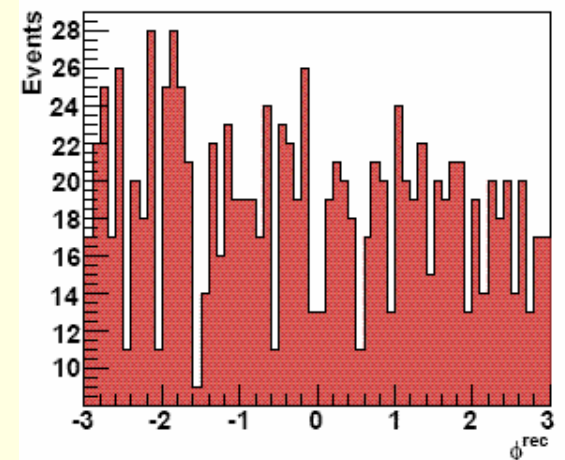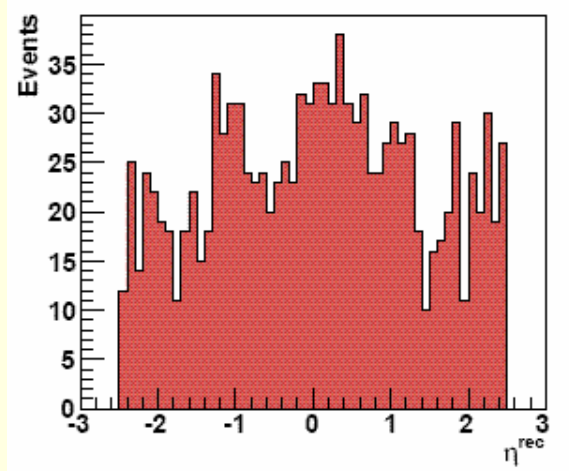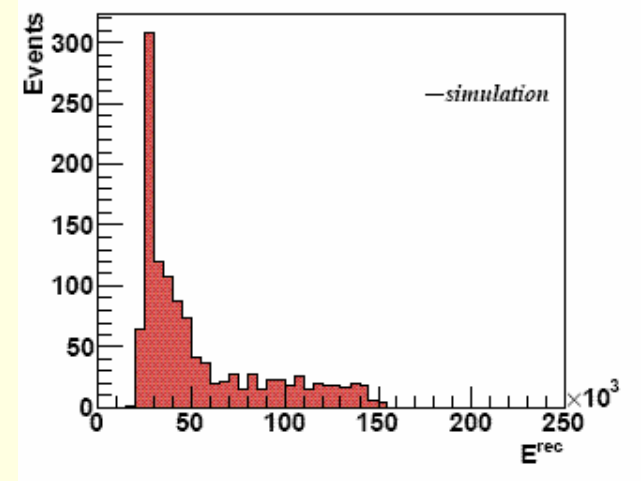
Match reconstructed with generated electron

Match reconstructed to the generated electron using:

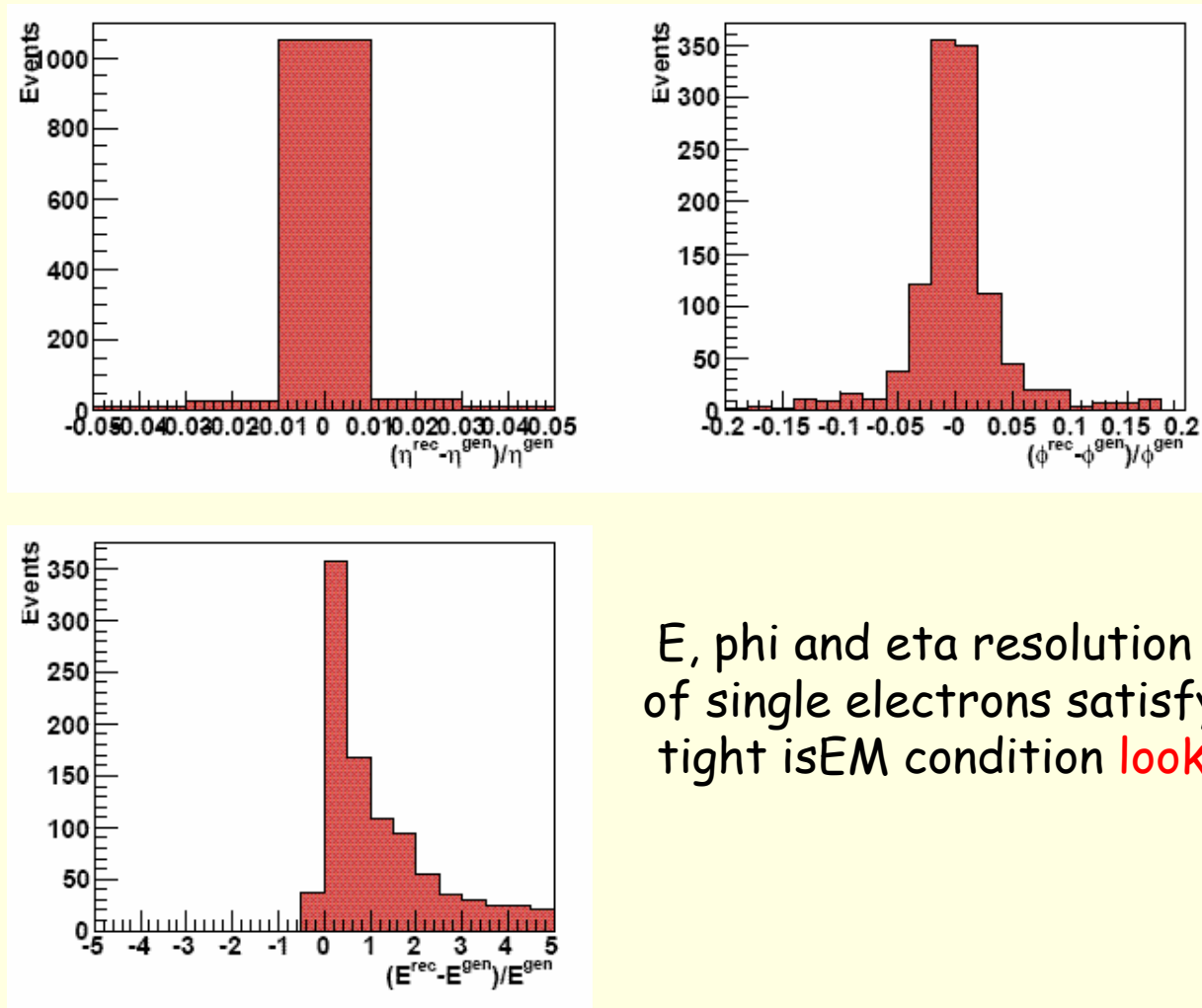$$\Delta R = \sqrt{\Delta \eta^2 + \Delta \varphi^2}$$

$$\Delta \eta = \eta^{rec} - \eta^{gen}$$

$$\Delta \varphi = \varphi^{rec} - \varphi^{gen}$$
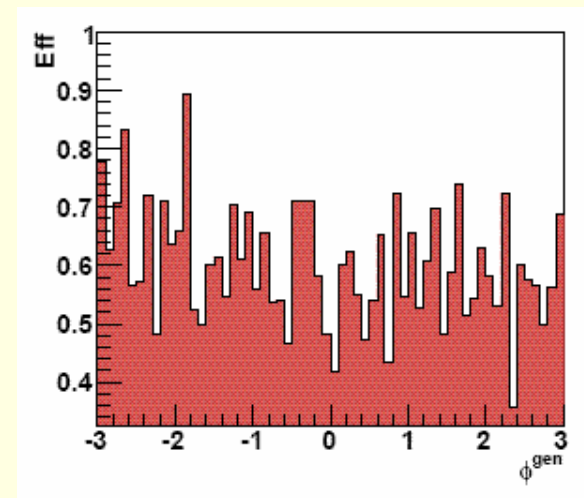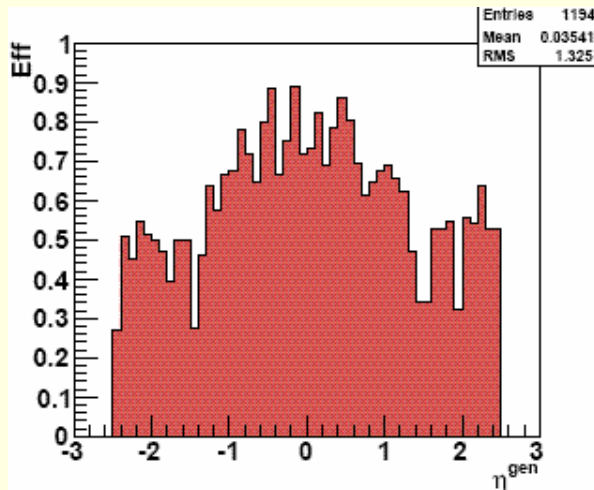

Good match in eta and phi

Resolution of eta, phi, E

E, phi and eta resolution
of single electrons satisfying
tight isEM condition look good

# Electron Reconstruction Efficiency

Tight electrons (isEM==0)

Efficiencies derived using the Electron AOD Container

ET (GeV)	Tight	Medium	Loose
>10	43%	59%	81%
>25	60%	74%	85.7%

Problems with 2 electron events

- Check full and fast simulation for Et=10GeV and Et=25GeV

- Check reconstructed events with 2 electrons

- same track properties (charge, pt, phi, eta), but the cluster energy differs slightly

- Event example:
  run=7000 event=1291
  all variables same except
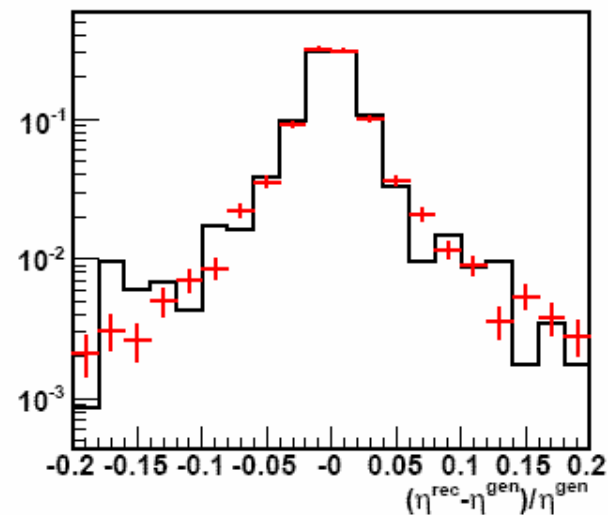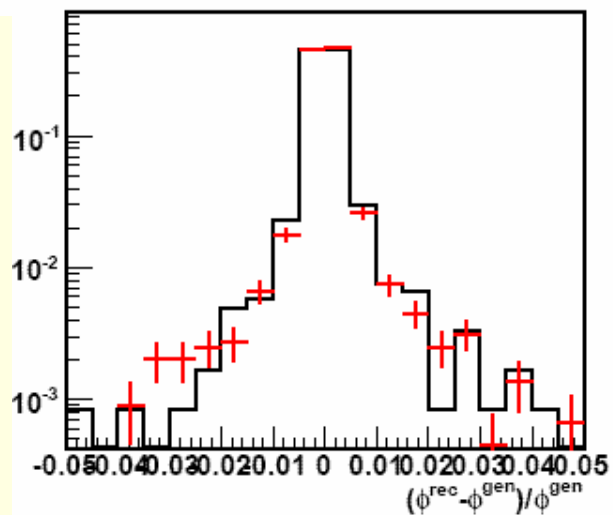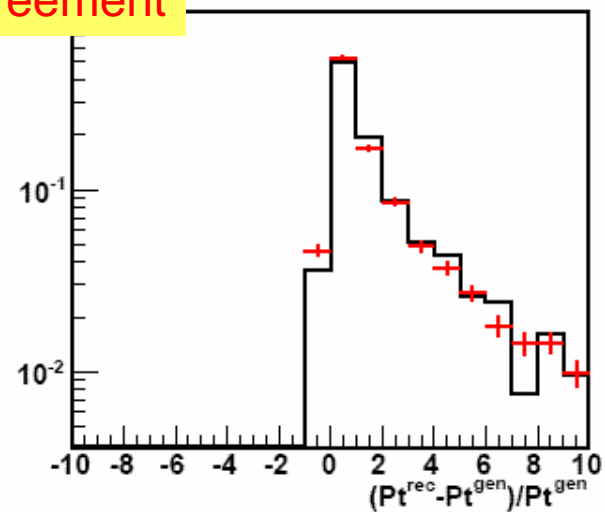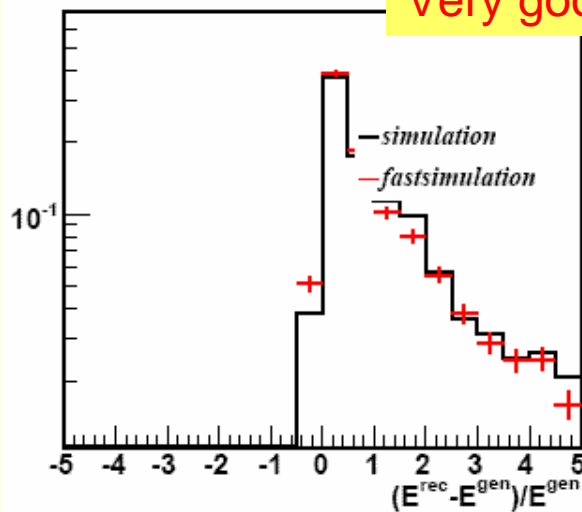 ele1: enerec=7243
  ele2: enerec=7398

  ->this is most likely the bug in the reconstruction algorithm
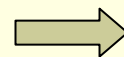
  Discussion ongoing with the Egamma people

Full vs fast simulation

Very good agreement

Summary and outlook

- The AOD based SUSY validation package is uner development in release 13

- First look into the single electrons has been done:
  ->resolution and electron reconstruction efficiency have been studied and look fine
  ->full to the fast simulation comparison looks very good
  ->problems observed with double reconstructed electrons

- Next steps:
  ->increase statistics
  ->look for the Brems. photons
  ->look into the SU3 files
  ->extend the validation to the photons, jets and maybe missing ET