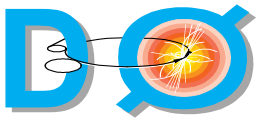


Monte-Carlo data quality control based on package MC_EXAM: a tutorial

A. Zylberstejn

May 23 2003

Introduction : MC_exam history I

- MC_EXAM: an histogram, ntuple or root-tuple maker written at very early stages of D0 II before most analyze packages were written to check Monte-Carlo production.
  - Main contributors: L. Duflot, A.Zylberstejn
- Designed to analyze and/or reconstruct data coming from D0gstar. Intended to be equivalent of EXAMINE for M.C..
  - Information about HITS, DIGI for most sub detectors:SMT, CFT, CAL (DIGI only), CPS, FPS and MUON as well as information on the generated particles were written in the histograms or Ntuple/Rootuple.

    Several bugs found both in GEANT (ex:polycone was wrong) and D0GSTAR (ex:CFT digitization)
- Later on, blocks corresponding to reconstructed quantities (clusters in all the detectors, tracks) were added. In addition, the MCexam_x executable was compiled with some analyze packages allowing to get physics objects variables in the same ntuple.

Introduction : MC_exam history II

- Linked with D0gstar but never used (?)
- Then more and more detector specialized analysis packages becoming available(and less and less users) $\rightarrow$ abandoned and removed from the release.

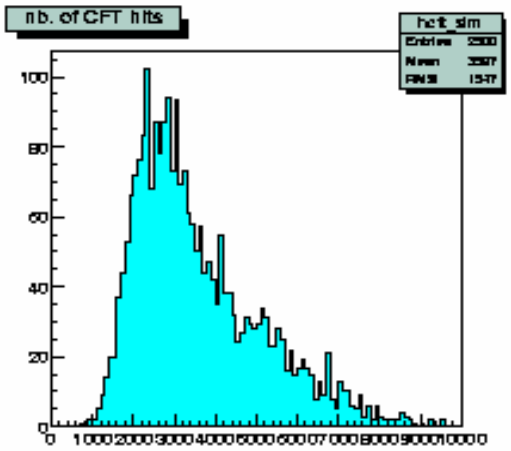
Brief description of MC_Exam

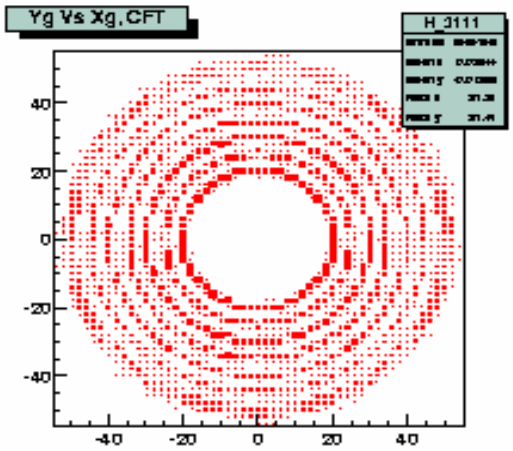
* Framework Package: MC_exam split in 3 main packages: Sim_exam, Reco_exam and MC_exam.
  And 2 “satellites”: gene_exam and trig_exam
* Each package driven by its own two rcp files: framework.rcp and XX_exam.rcp
* In each package the quantities entering in the plots may be re-built using the appropriate keys in “framework.rcp”

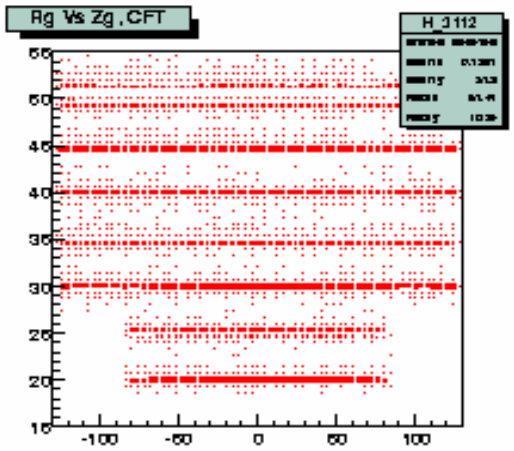
Variables being histogrammed in sim_exam

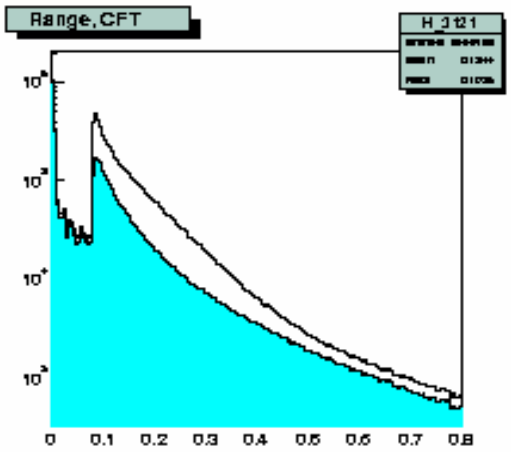
- Generator:
  - GEANT hits: x, y, z, de/dx , range, p,… in all the « sensitive » detectors (except calo)
  - E, ieta, iphi of all hit calo cells or E, ieta, iphi of EM and Hadr. towers
  - px,py,pz,pid,vertex… for KINE
    (chunk level may be selected)
- Simulation:
  - Channel number (strip , layer,… ADC)
  - No analyze of muon detector

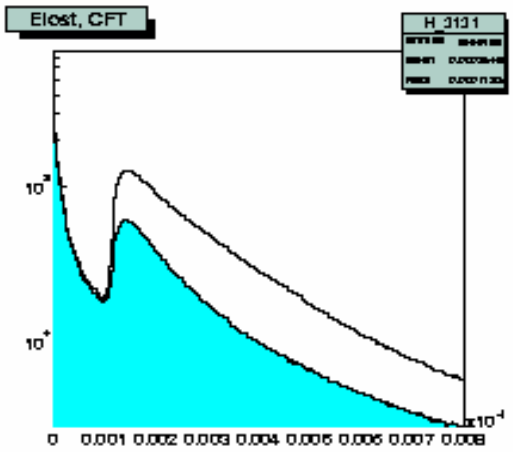
Simulation: CFT

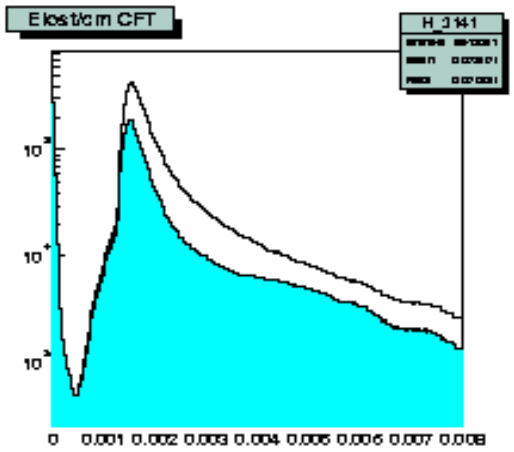




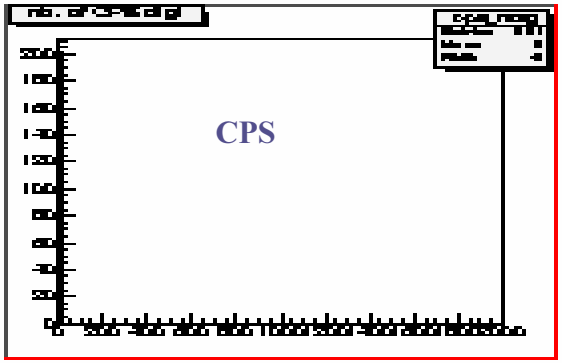


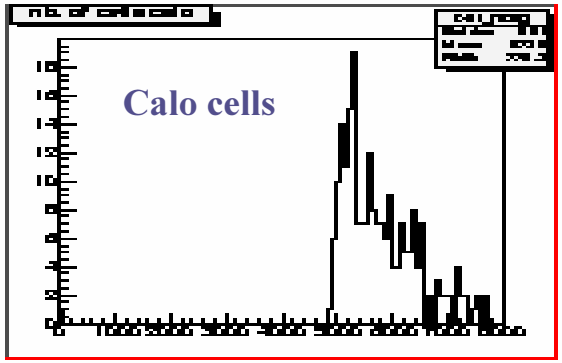


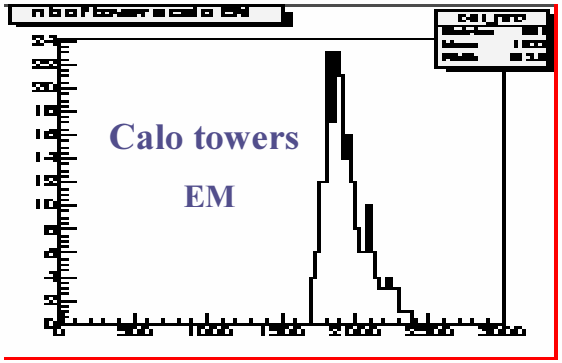


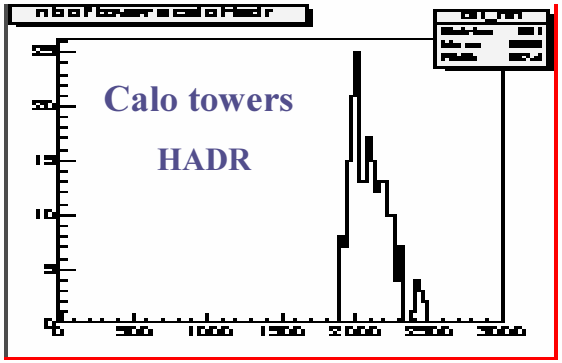


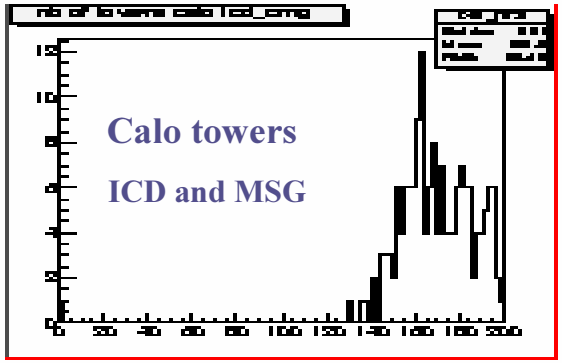
Plots for Zee digitization: nb of hits

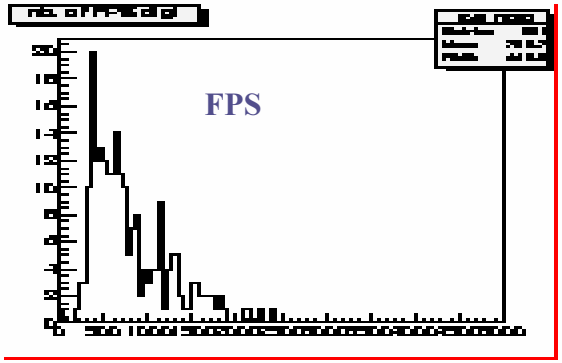


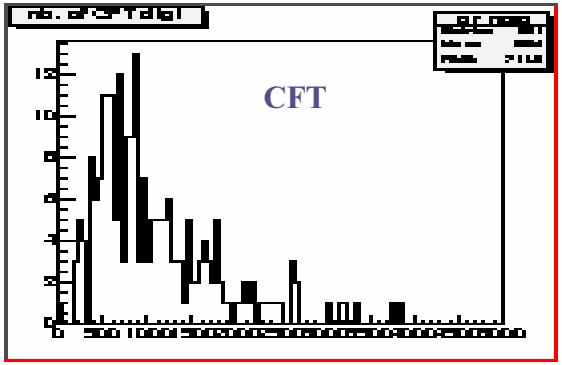


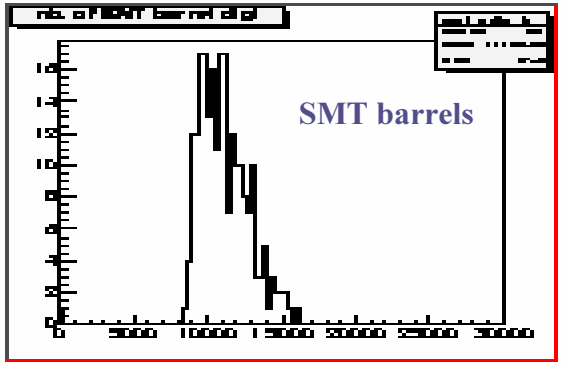


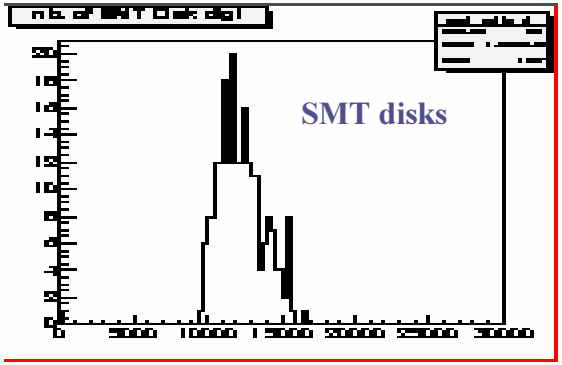




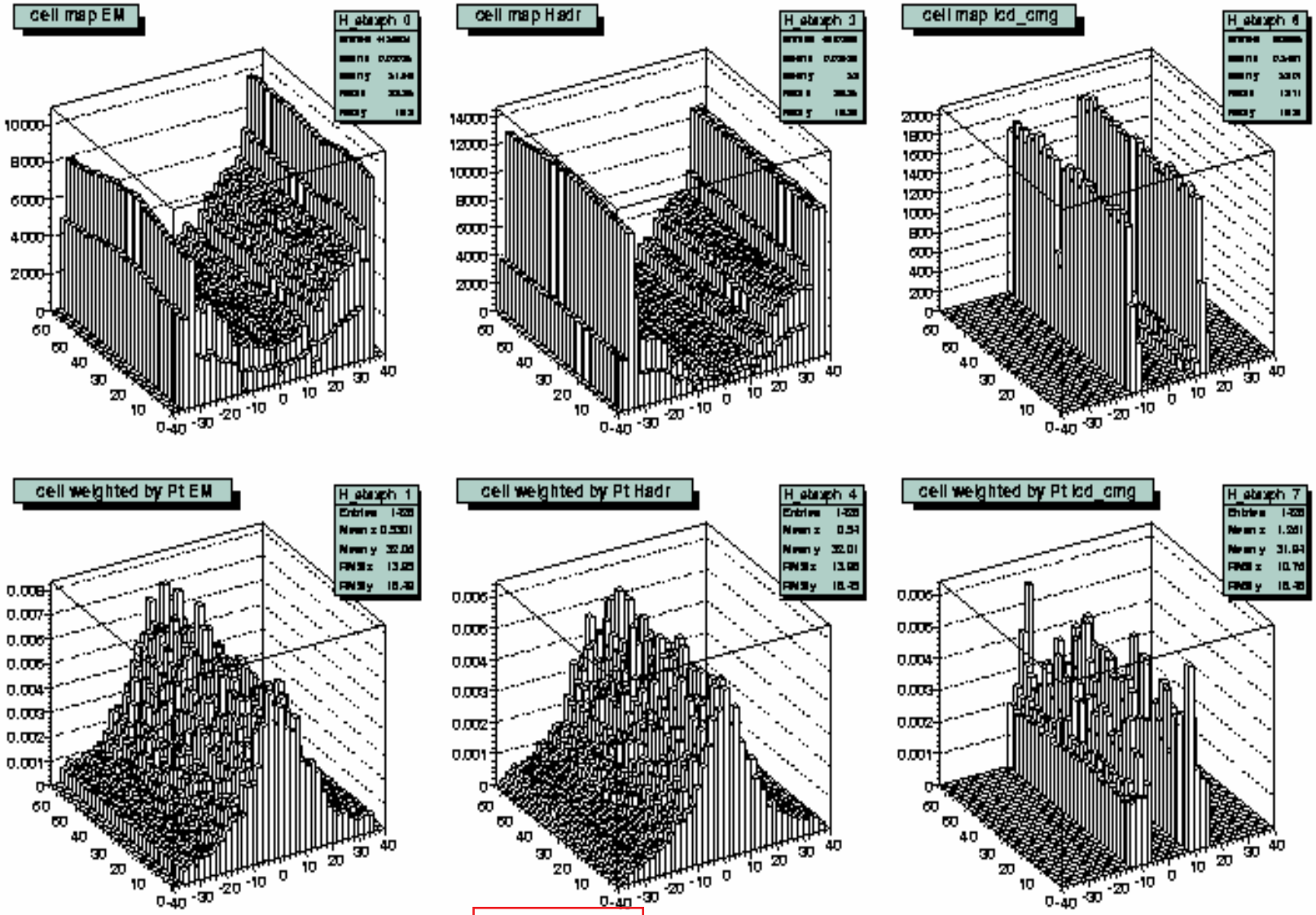








Simulation: Calo

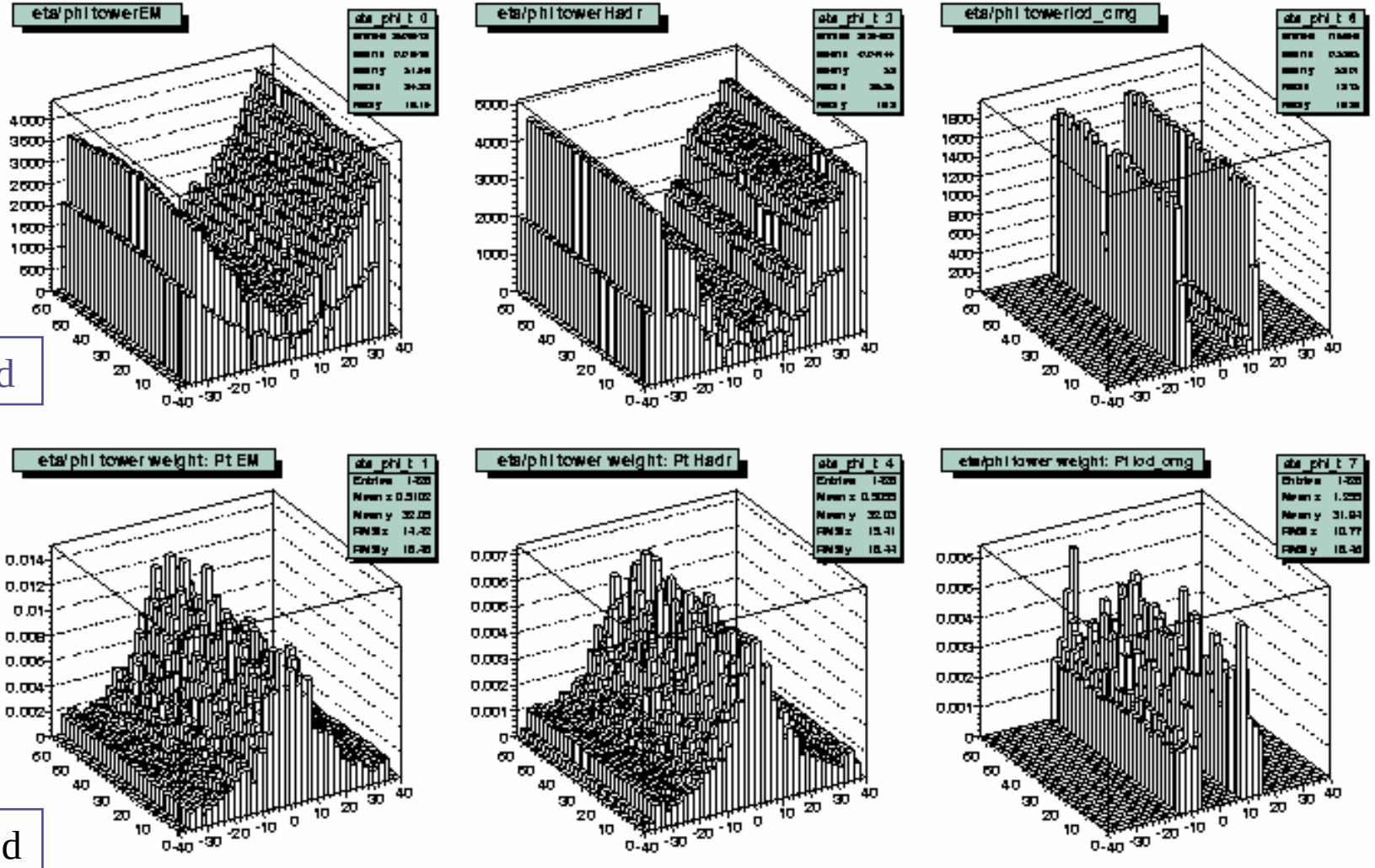


Cells

Simulation: Calo

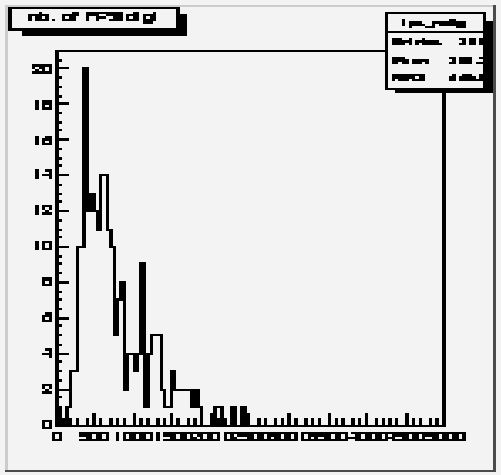
η,ϕ unweighted

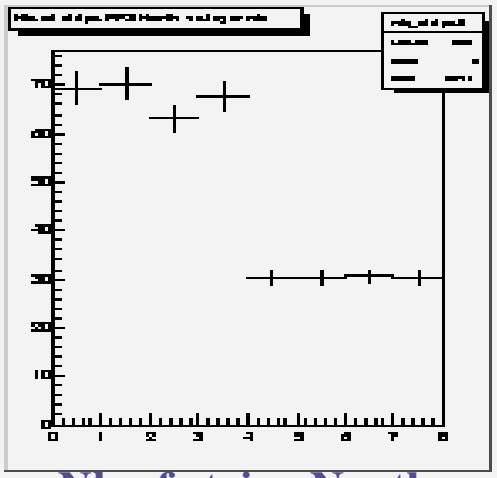
η,ϕ weighted



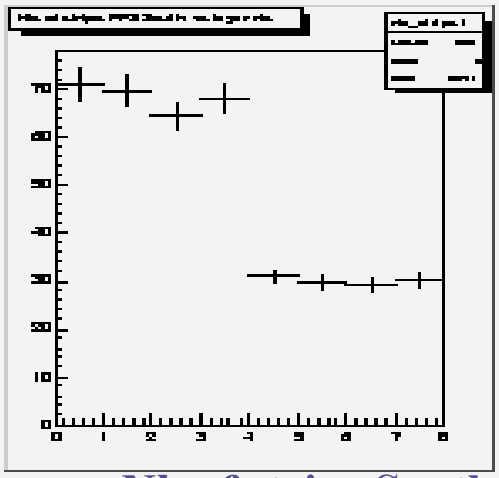
Towers

Plots for Zee digitization



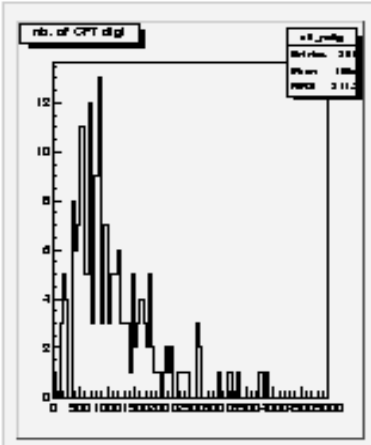


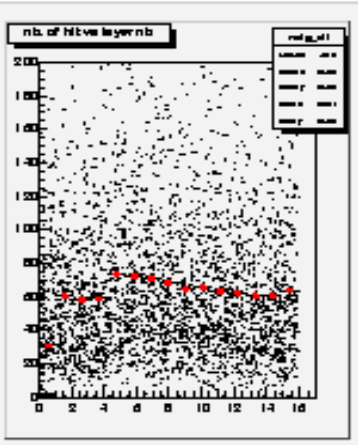
Nb of strips North



Nb of strips South

FPS



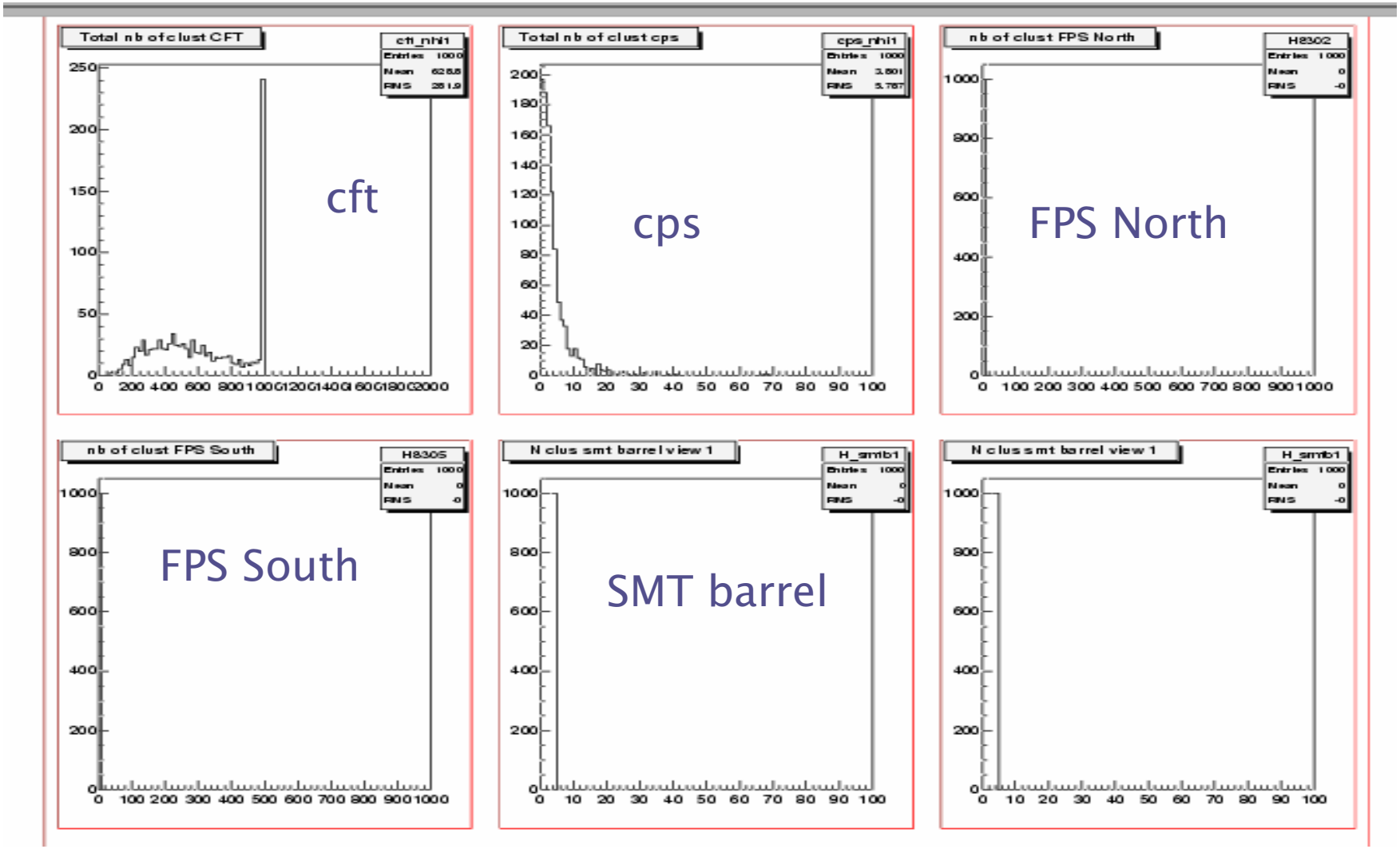


CFT

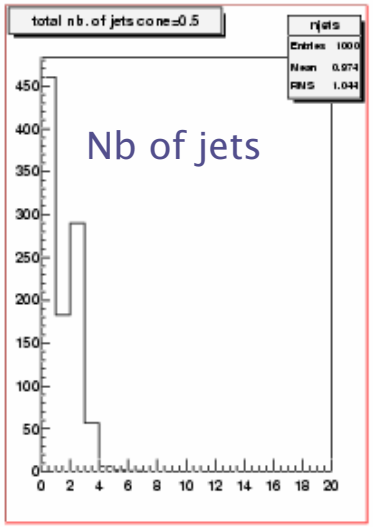
Reco_exam

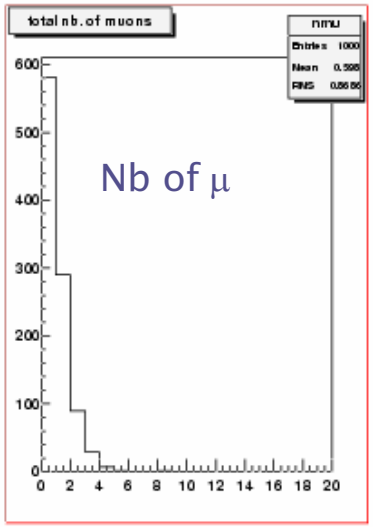
- Works on DST's (or raw data). Not (yet) adapted to Thumbnails
- Plots/Ntuple for quantities defined at the reconstruction level Plotted quantities:
  - Clusters (x, y, z, E, extension…)
  - Physics objects (tracks, jets, electron, muons, vertex) using the appropriate analyze package (not rewritten except for tracks)

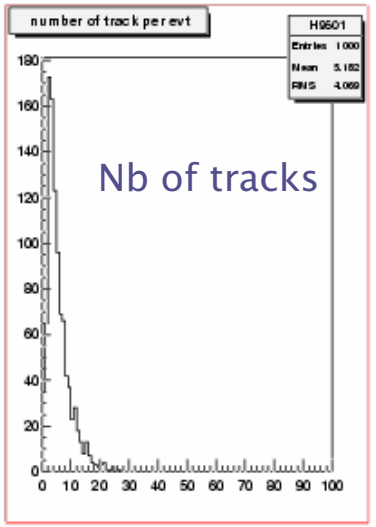
Zee-p1308 reconstruction:nb of clusters

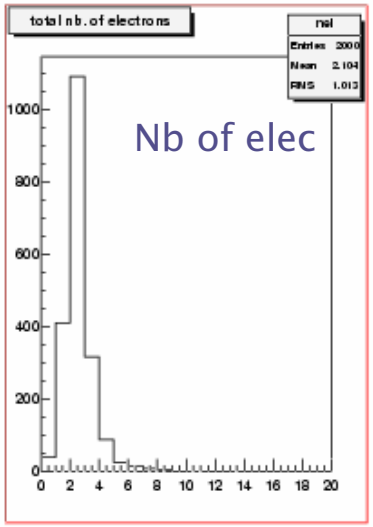


Zee-p1308 reconstruction









Example of quantities plotted at reco level: CFT

- **CFTC : block for clusters**
  - **Ncftc: nb. of information**
  - **lay_cftc:layer number (0 to 15)**
  - **nst_cftc:width of the cluster (in nb. of strips)**
  - **str_cftc: center of the cluster (in nb. of strips)**

MC_exam

- MC_exam==sim_exam and reco_exam linked together.
- Plotted quantities (chosen by turning on/off rcp keys):
  - Hits
  - Digits
  - Generated particles and vertices
  - Clusters
  - Jets
  - Tracks
  - Physics objects

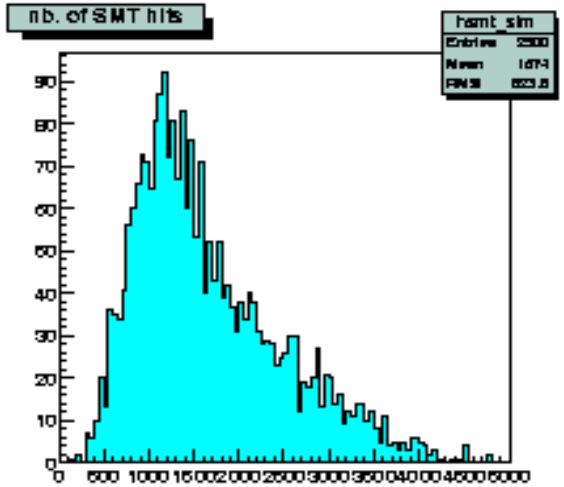
Example of quantities plotted at digi and reco level: CPS

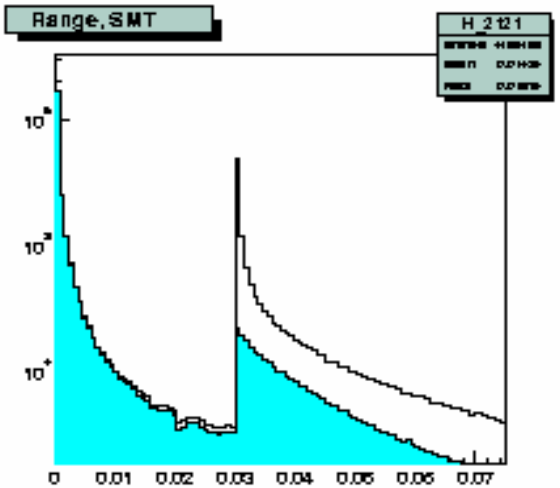
- **CPSD : block for CPS digi**
  - **ncpsd: nb. of information**
  - **e_cpsd: energy**
  - **lay_cpsd: layer**
  - **str_cpsd: strip number**
- **CPSC : block for CPS clusters**
  - **ncpsc: nb. of information**
  - **e_cpsc(ncpsc) energy**
  - **x_cpsc: X in general system**
  - **y_cpsc: Y**
  - **z_cpsc: Z**

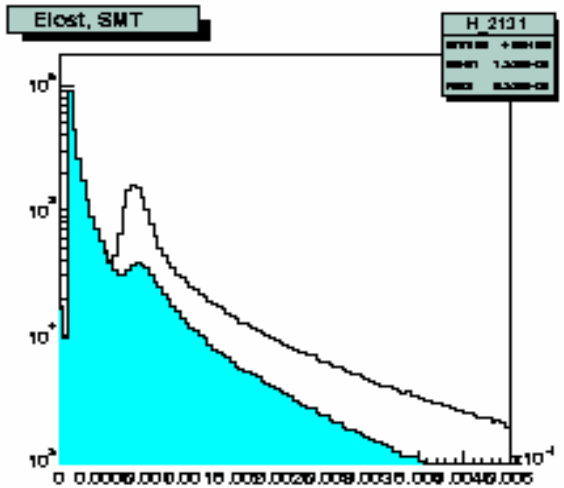
Another example of quantities plotted at digi level: SMT barrel

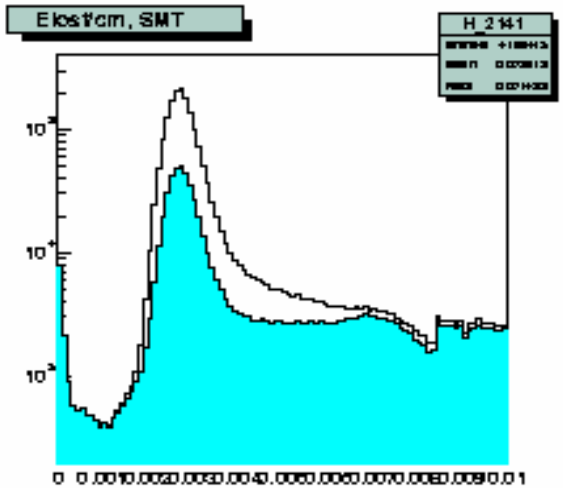
- SMTD: block for SMT barrel digits
  - nsmtd nb. of information
  - e_smtd:
  - iba_smtd: barrel number
  - ild_smtd: ladder number
  - ily_smtd: layer number
  - ist_smtd: strip number
  - iv_smtd: View (n or p side)

Simulation: SMT









Another example of quantities plotted reco level: SMT barrel

- SMTB: block for SMT barrel clusters
  - nsmtb: nb. of information
  - bar_smtb: barrel number
  - ex1_smtb: de/dx "n" side
  - ex2_smtb: de/dx "p" side
  - lay_smtb: layer nb.
  - phi_smtb:
  - st1_smtb: nb. of strips "n" side
  - st2_smtb(nsmtb) nb. of strips "p" side
  - xg_smtb, yg_smtb, zg_smtb

Recent development

- Until recently emphasis put on ntuples and histos.

  Major draw-backs:

  - Histos: predefined histos. Have to modify the code and re-run the program if binning not adequate or more histos
  - Ntuples: limited nb. of information can be written; Incompatibly with many analysis programs(names too long)

- Decided to go to root_tuples → Macros are being written

  (AZ and D. Vilanova)

How to use to check MC production

* Although the packages can deal with any kind of data (real and MC) at various tier

(except TMB –yet– and reco_analyze root_tuples)

will concentrate on MC certification

* Although knowledge of framework and rcp machinery do not seem necessary it does not harm to have some idea how they work

Setting up a working directory

(assuming one does not exist already)

- cd working_dir (your working directory)
- setup D0RunII <release version> (for now on and for clarity we will use as example)
- newrel -t p14.02.00 mcexm (mcexm is an arbitrary name)
- cd mcexm
- d0setwa (not necessary at this stage, just a reminder)
- Access the package and define the rcp files and files for

Access the package and define the rcp files and files for constants

Need access to CVS: if not ask Alan J. to get access

To do only once to set up the environment

- addpkg -h mc_exam
- cd mc_exam/macros
- Util.csh :
  - this will addpkg the packages,
  - make the libraries,
  - make the executables (this may take some time)

Run the job

* Go to mcexm
* D0setwa
* Go to xxx_exam/depending of what type of data you want to histogram
    * cd sim_exam/bin
        to run on d0g data and/or sim
    * cd reco_exam/bin
        to run on dst (not yet on thumbnails)
    * cd mc_exam/bin
        - to run on d0g data and/or sim and/or dst

Run the jobs using scripts

The following scripts in mc_exam/macros are used. They are copied in each of the xxx_exam/bin directory

- create_proj.csh: create sam project (next slide)
- run_job.csh : to run with no sam
- run_sam.csh : to run with sam

Analyzing files on SAM I

if project does not exist check for request ID in certification samples in
http://www_d0.fnal.gov/computing/mcprod/mcc.html

setup sam

and use this number to create the project using
mc_exam/macros/create_proj.csh

Answer to the questions:

project name ?

It is recommended to give a name to you project related to the reaction and to the release number (for instance: ztautau_p14018_no_mb).

p14.01.00 Certification Samples

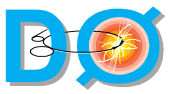
The following requests are the different physics samples generated and stored for the certification process. Two sets of data were created: The first without trigsim as part ofthe processing, and the second with trigsim as part of the processing. Note some of the thumbnails have not been stored due to failures in the new mering scripts.

To select the files from a given physics process you need a set of constraints similar to:

```
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID'    # all files
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID and data_tier digitized' # digitizec
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID and data_tier simulated' # simulatec
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID and data_tier triggersimulated' # tr
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID and data_tier reconstructed' # recor
sam translate constraints  --type=mcrun --dim='global.requestid REQUEST_ID and data_tier thumbnail' # thumbnail
```

All files have been proessed.

Request ID	Status	Group	User	Priority	# Events	Description	Cardfile Vers. Dir. Prod. Decay
Certification Samples Processed through, d0gstar, d0sim, d0reco with 0.0events overlaid							
5710	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 211 --- 100. --- null
5709	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 211 --- 50. --- null
5708	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 211 --- 10. --- null
5707	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 22 --- 100. --- null
5706	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 22 --- 50. --- null
5705	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 22 --- 10. --- null
5704	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 13 --- 100. --- null
5703	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 13 --- 50. --- null
5702	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 13 --- 10. --- null
5701	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 11 --- 100. --- null
5700	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 11 --- 50. --- null
5699	finished	algo	bertram	1	2000	p14 01 00 certification request	single --- 11 --- 10. --- null
5654	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- ztautau
5653	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- zmumu



5653	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- zmumu
5652	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-26 --- hit --- z --- zee
5651	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- zbb
5650	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- ttbar --- incl
5649	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-26 --- ckm --- cdftuned --- bbbarqq
5648	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5647	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5646	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5645	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- gam+jets --- incl
5644	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wtaunu
5643	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wmunu
5642	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wenu
5641	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- wh --- wtaunu+hbb
5640	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- wh --- wmunu+hbb
5639	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- wh --- wenu+hbb
5638	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- minbias --- cdf
5620	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- ztautau
5619	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- zmumu
5618	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-26 --- hit --- z --- zee
5617	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- z --- zbb
5616	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- ttbar --- incl
5615	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-26 --- ckm --- cdftuned --- bbbarqq
5614	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5613	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5612	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- qcd --- incl
5611	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- np --- gam+jets --- incl
5610	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wtaunu
5609	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wmunu
5608	finished	algo	bertram	1	2000	p14 01 00 certification request	v00-04-04 --- hit --- w --- wenu

Analyzing files on SAM II

request id ?

give the number of your choice in column 1 (for instance 5654)

- The script run_create_project is created, look at it and if you are satisfied type: run_create_proj.csh
- 3 projects are being created:
  - ztautau_p14018_no_mb _sim (for d0g)
  - ztautau_p14018_no_mb _dig (for sim)
  - ztautau_p14018_no_mb _rec (for DST)

Analyze d0gstar or sim information

- cd sim_exam/bin
- For d0gstar + kine :
  - No sam: run_job.csh give the full path (without the last « / ») , the file name, the data type (sim) and the number of evts
  - Sam: run_sam_csh give the project name and the number of evts
- For sim + kine :
  - No sam: run_job.csh : give the full path (without the last « :/») , the file name, the data type (dig) and the number of evts
  - Sam: run_sam_csh give the project name and the number of evts

Analyze reco information

- cd reco_exam/bin
  - No sam: run_job.csh give the full path (without the last « / ») , the file name, the data type (rec) and the number of evts
  - Sam: run_sam_csh give the project name, the data type (rec) and the number of evts
- For « mixed » info (simulation+reco+kine): no template (yet)

To Do list

- Make the reco part work on TMB
- Make a reasonable choice of plots
- Finalize root macros (and put them on CVS)
- Superimpose reference plots

  Should we produce reference plots for all reactions?

Strategy ?

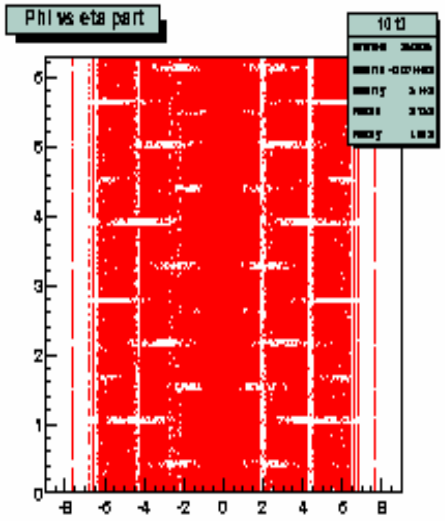
- Should we link sim_exam and gene_exam together with D0gstar? Or run mc_exam on the output of d0gstar/d0sim?
- Should we run reco_exam on DST (and/or thumbnails)?
- Should we produce histos or root-tuples?
- Detector groups/id groups/physics groups to define relevant set of variables to be histogrammed

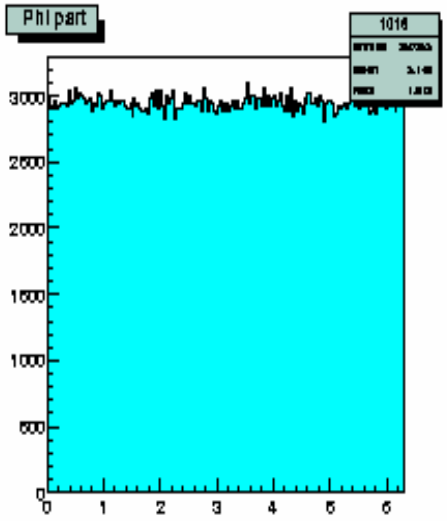
Simulation

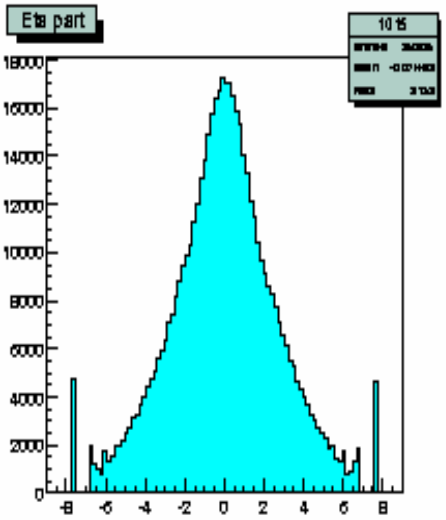
qcd_pt50_p1400_sim.root

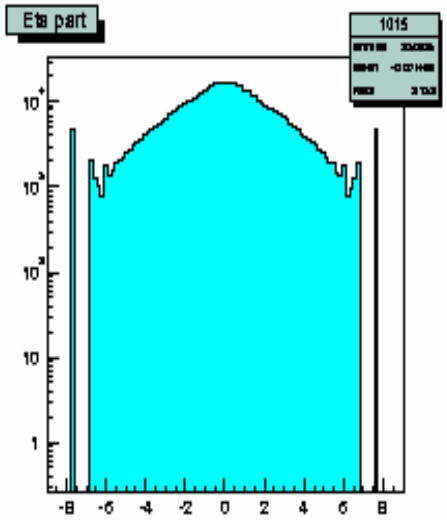
Didier Vilanova

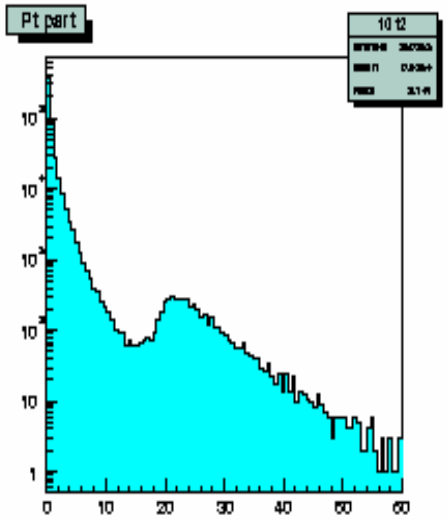
Simulation: Kine



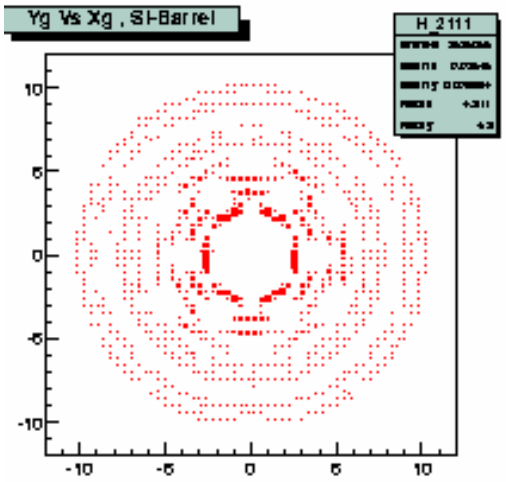


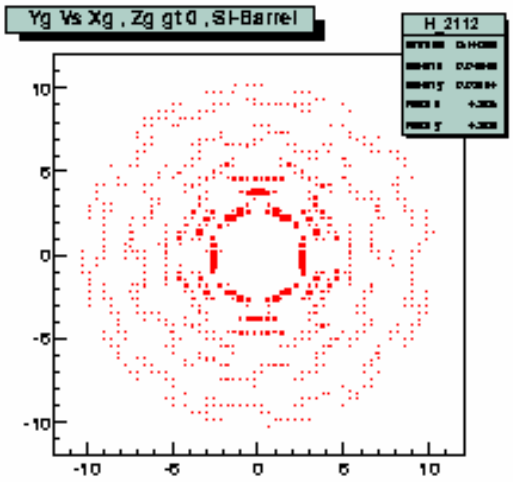


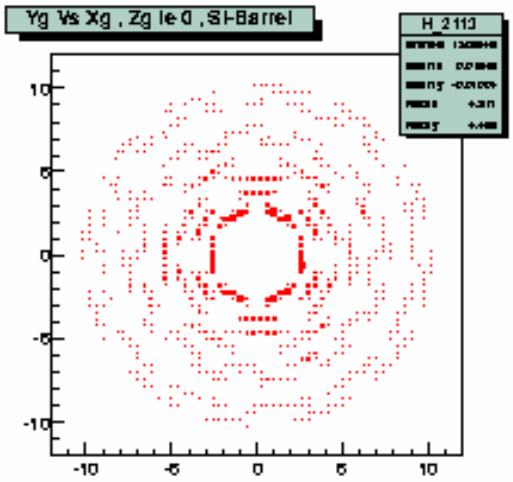


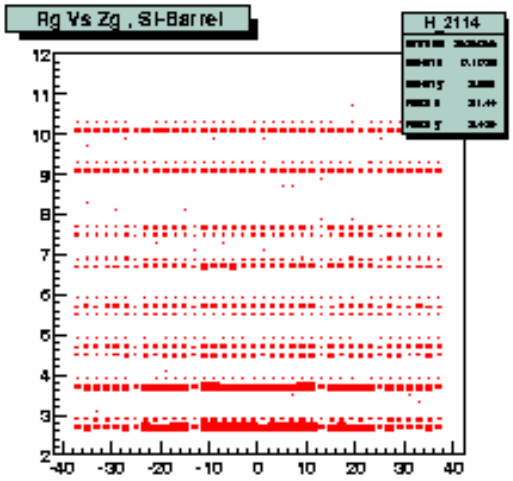


Simulation: SMT Barrel

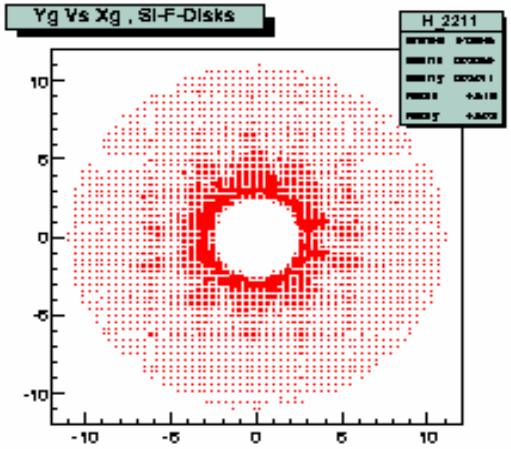


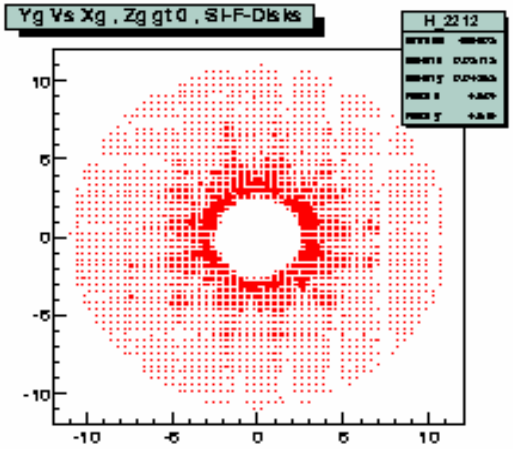


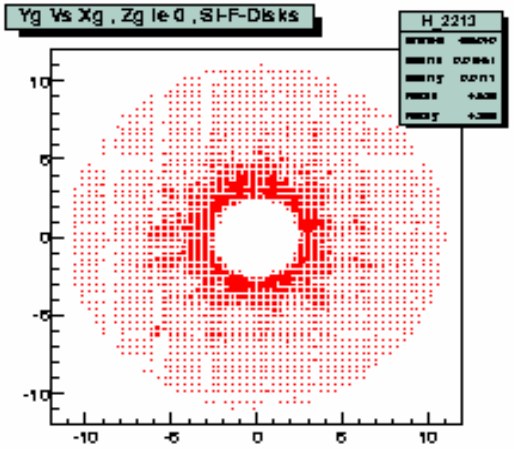


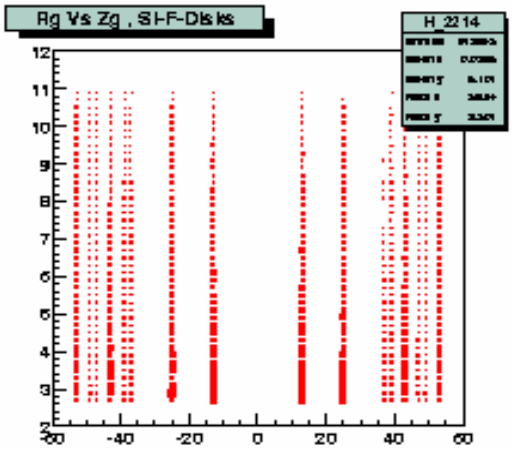


Simulation: SMT F-Disks

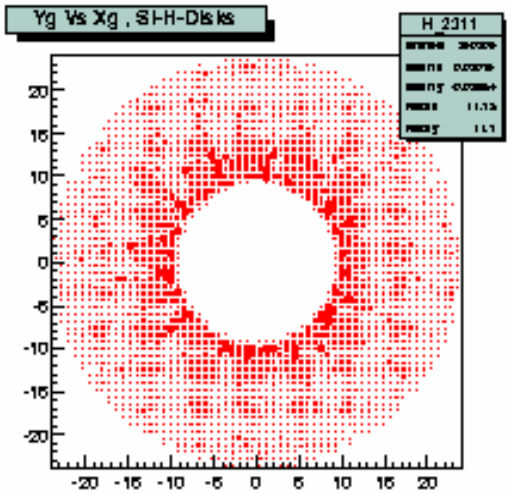


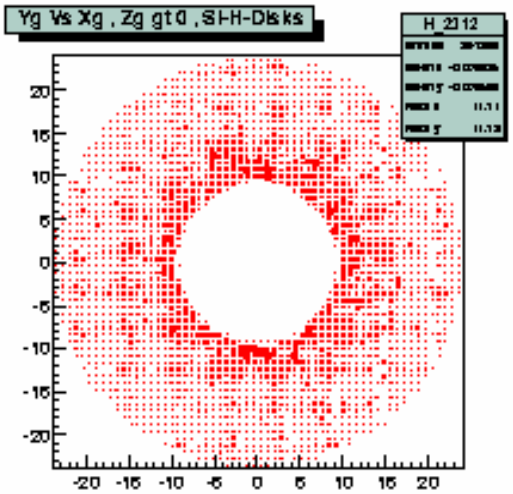


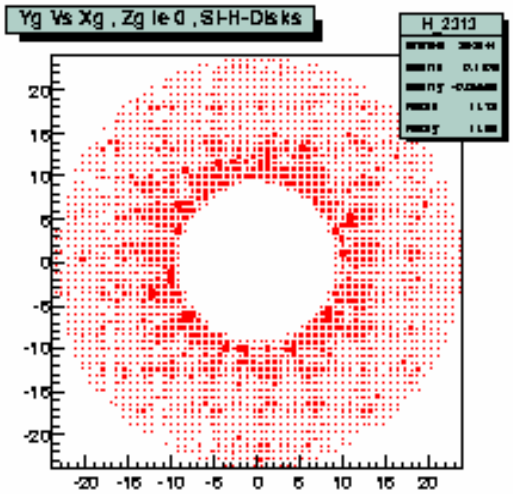


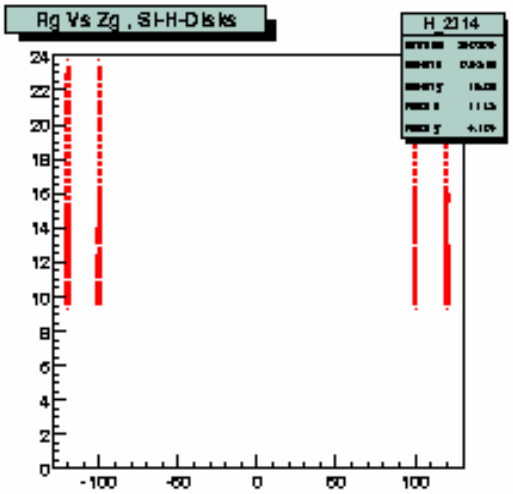


Simulation: SMT H-Disks

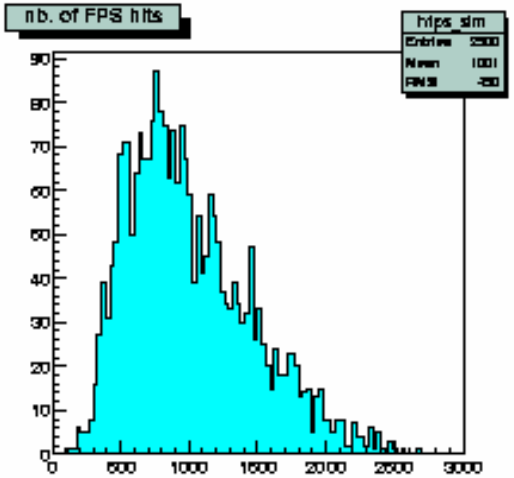


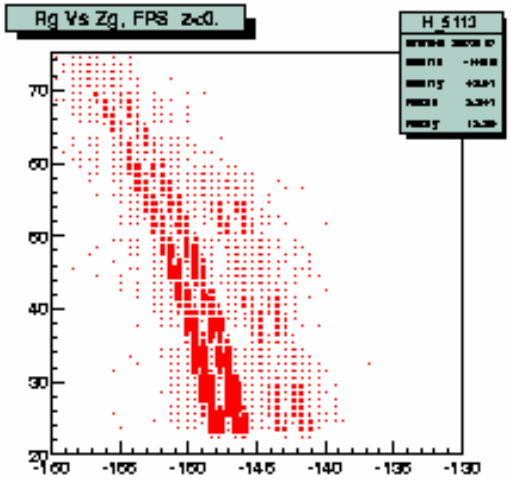


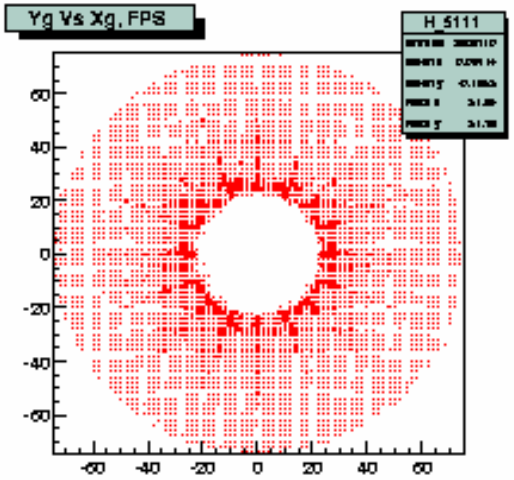


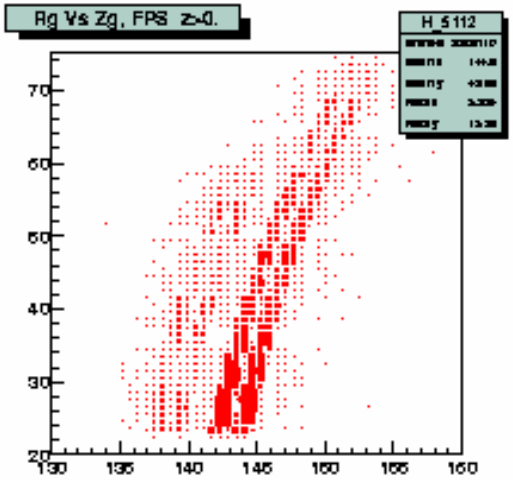


Simulation: FPS

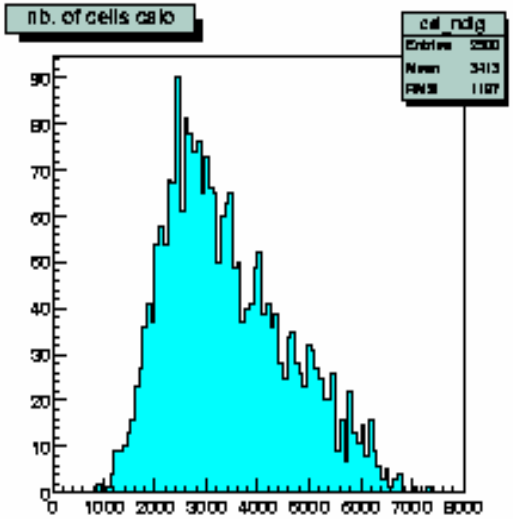


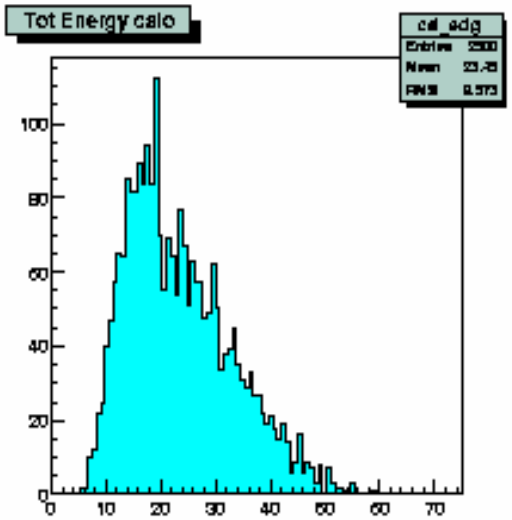


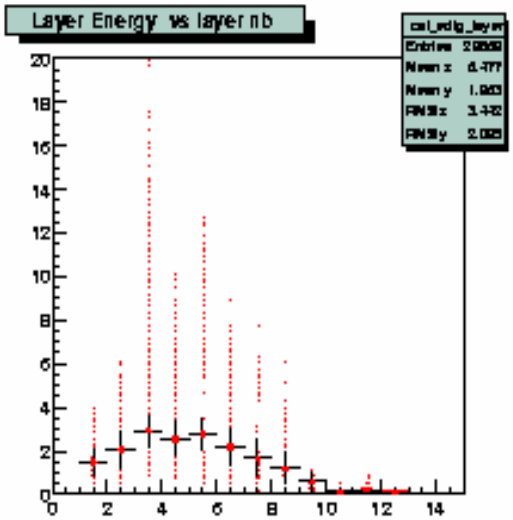


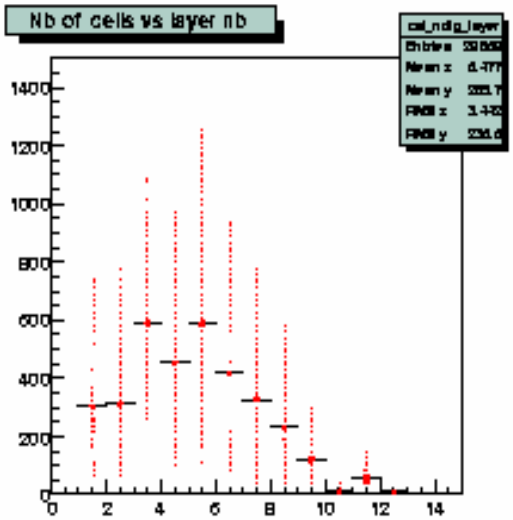


Simulation: Calo

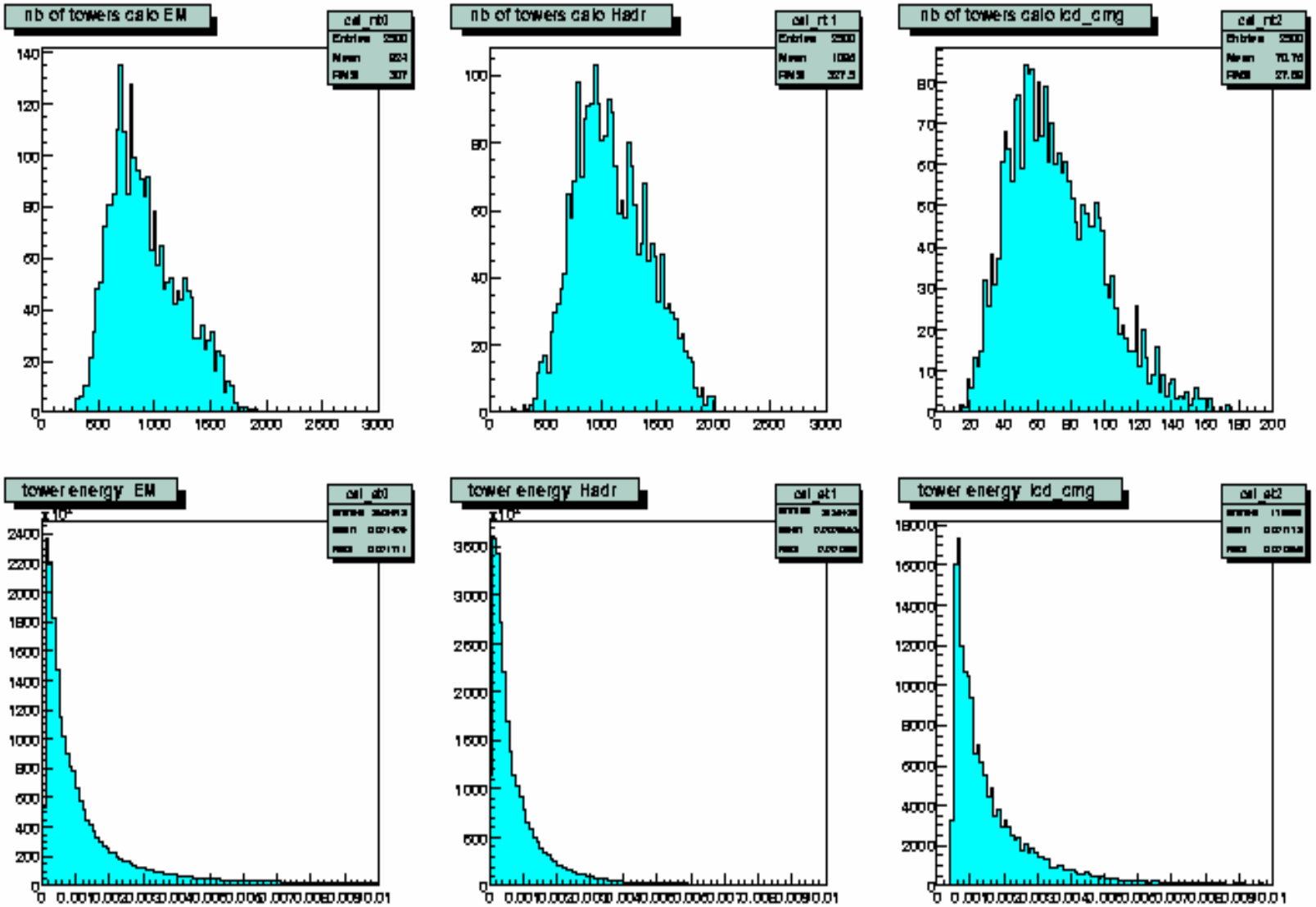




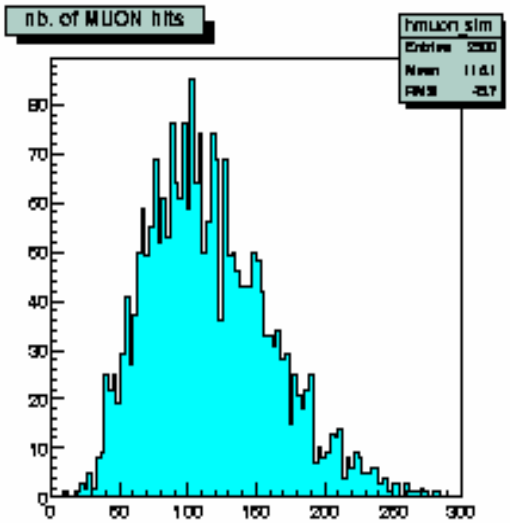


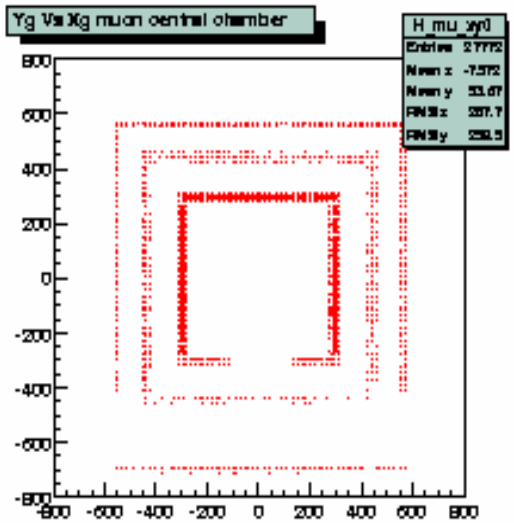


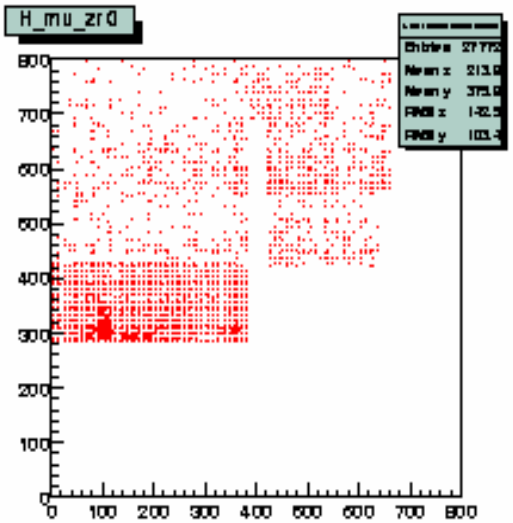
Simulation: Calo

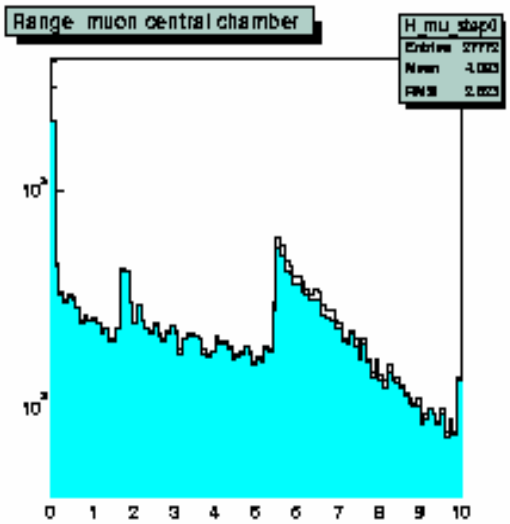


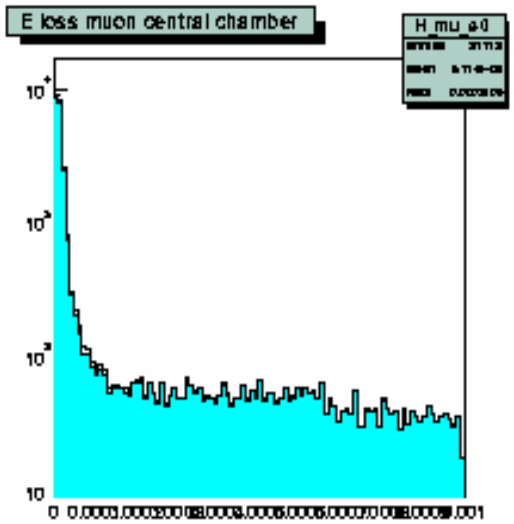
Simulation: muon central chamber

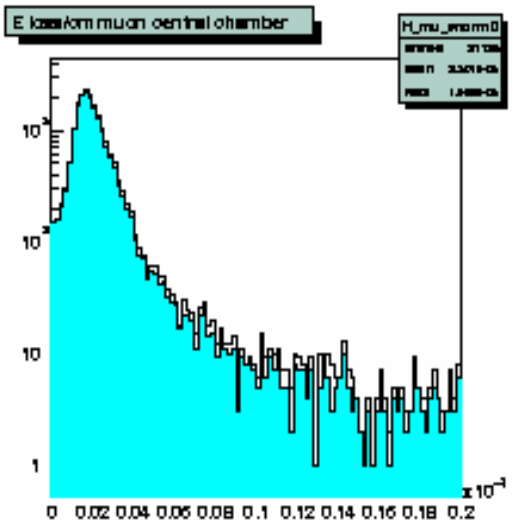




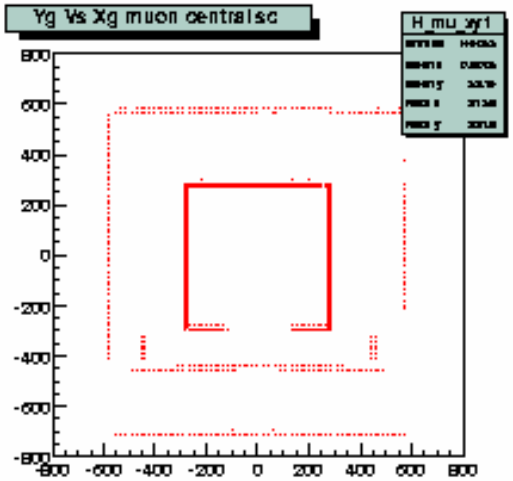


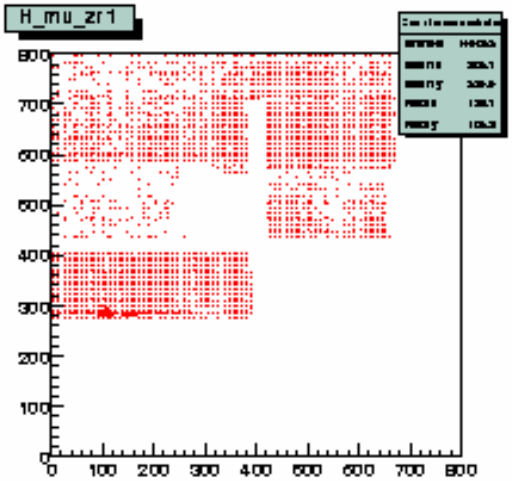


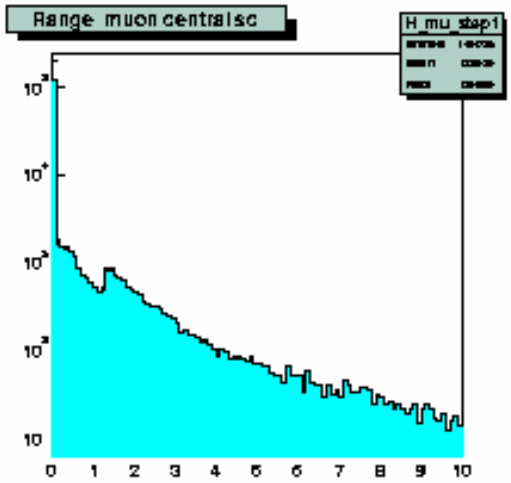


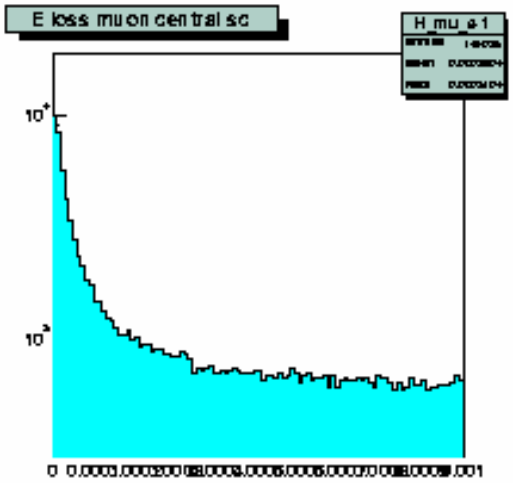


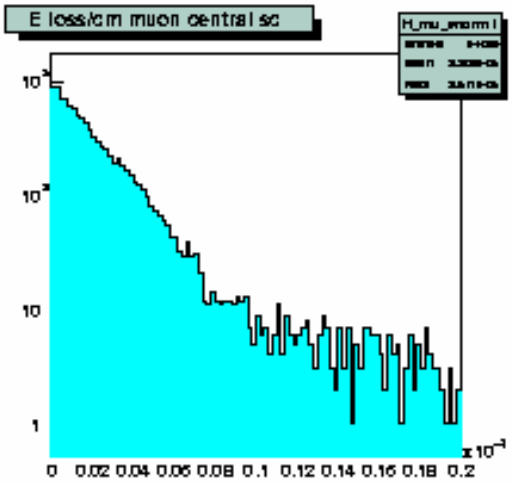
Simulation: muon central Sc



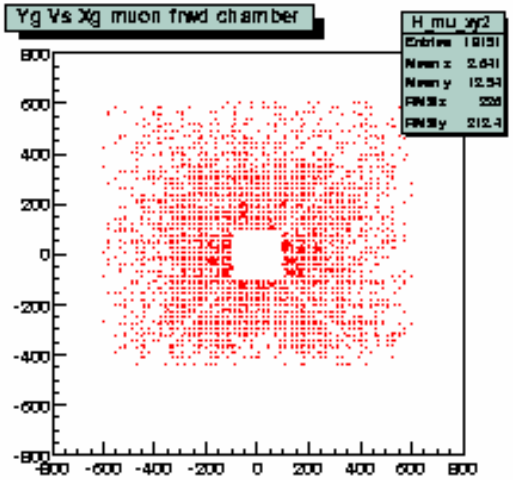


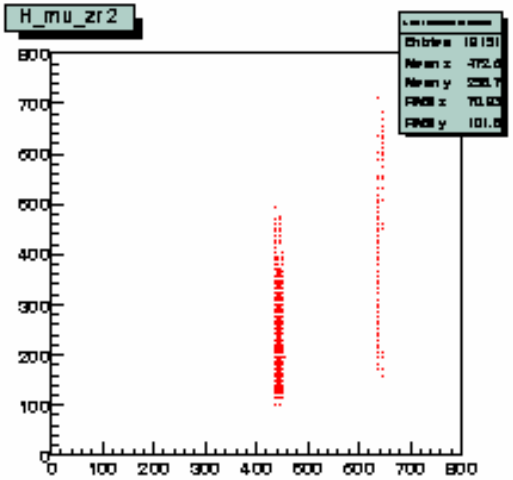


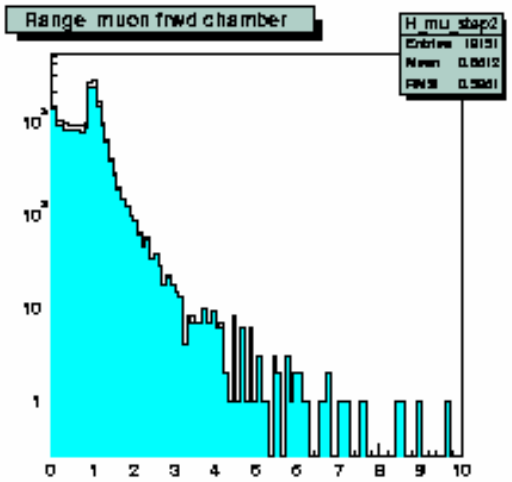


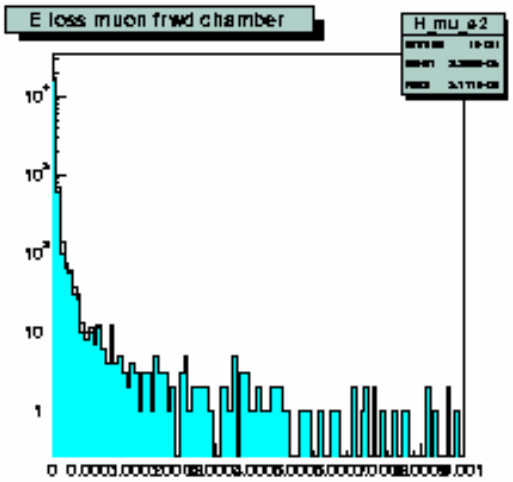


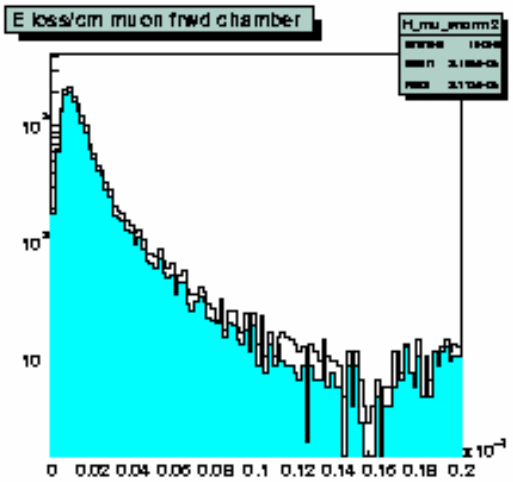
Simulation: muon frwrd chamber











Simulation: muon frwrd Sc