First PhotonIDAnalysis on PhotonJet_Sample (Summer09)

Nadja Hüdepohl 21.04.2010

Program Overview

Loop over GenParticleCollection

PdgID = 22 and Status() = 3

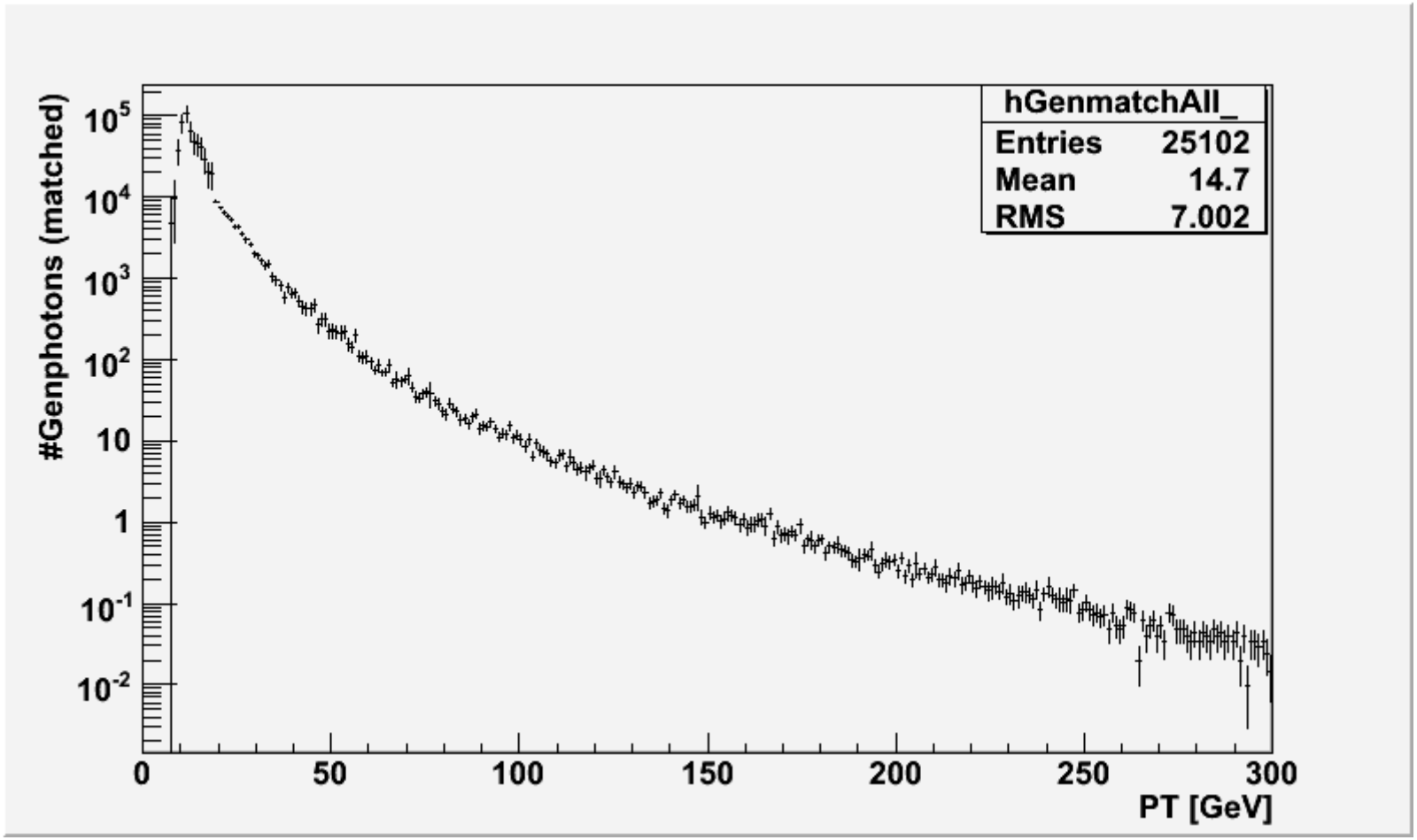
Loop over Reco::Photons

PtCut > 0.5 Gev
ΔR < 0.1 and minΔR
VetoVector check

If RecoPhoton matched to Gen

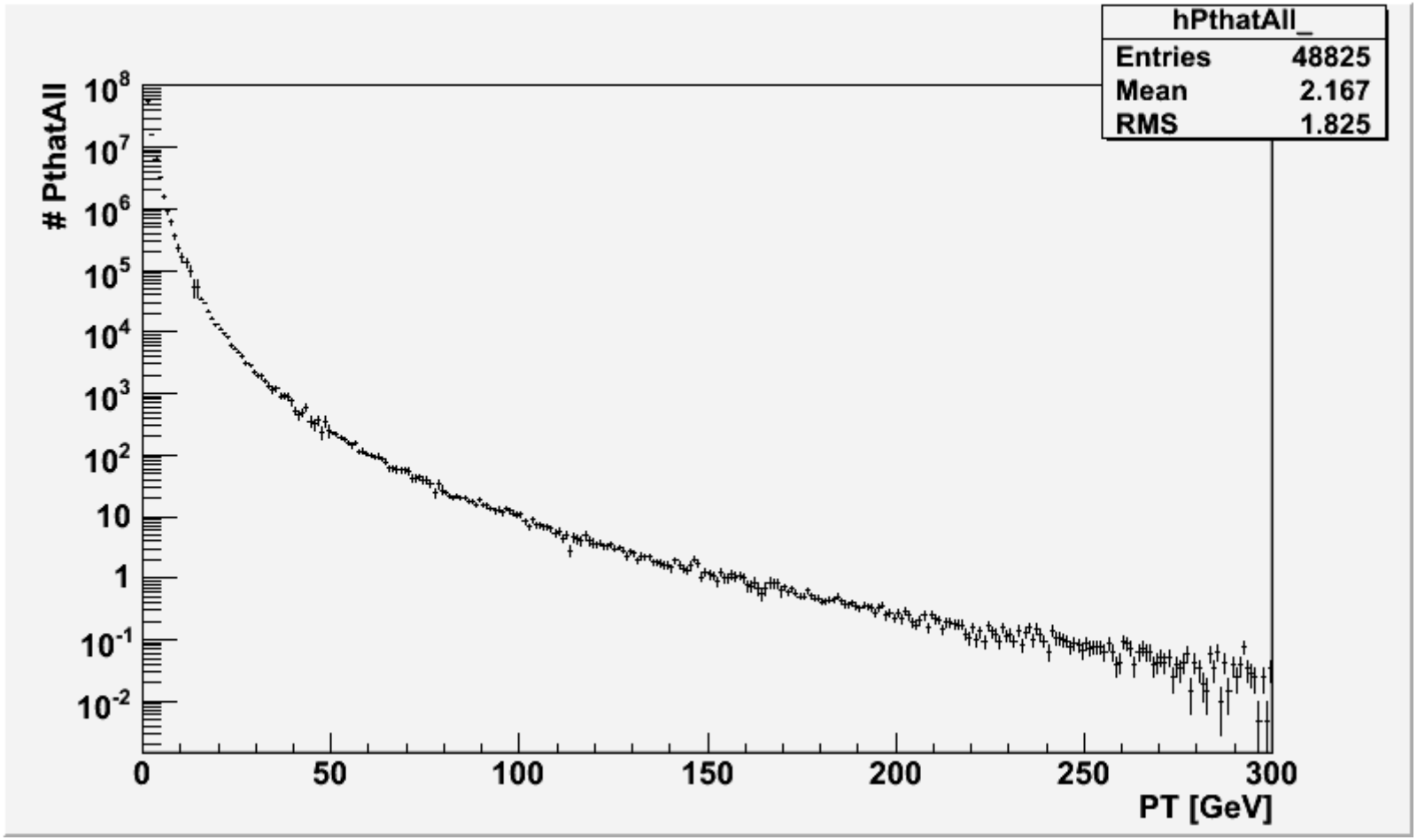
Filling VetoVector
Get Quality Flag
Filling histograms

GenPhoton (matched)* - Distribution over full Pt-Range(0-300Gev)

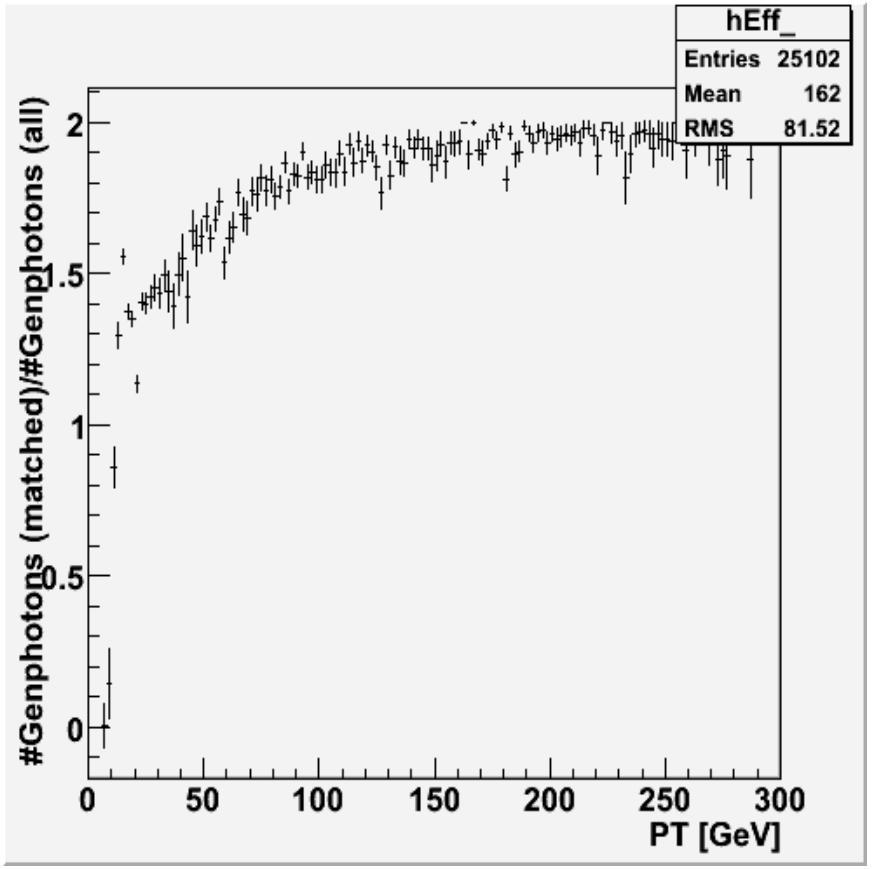


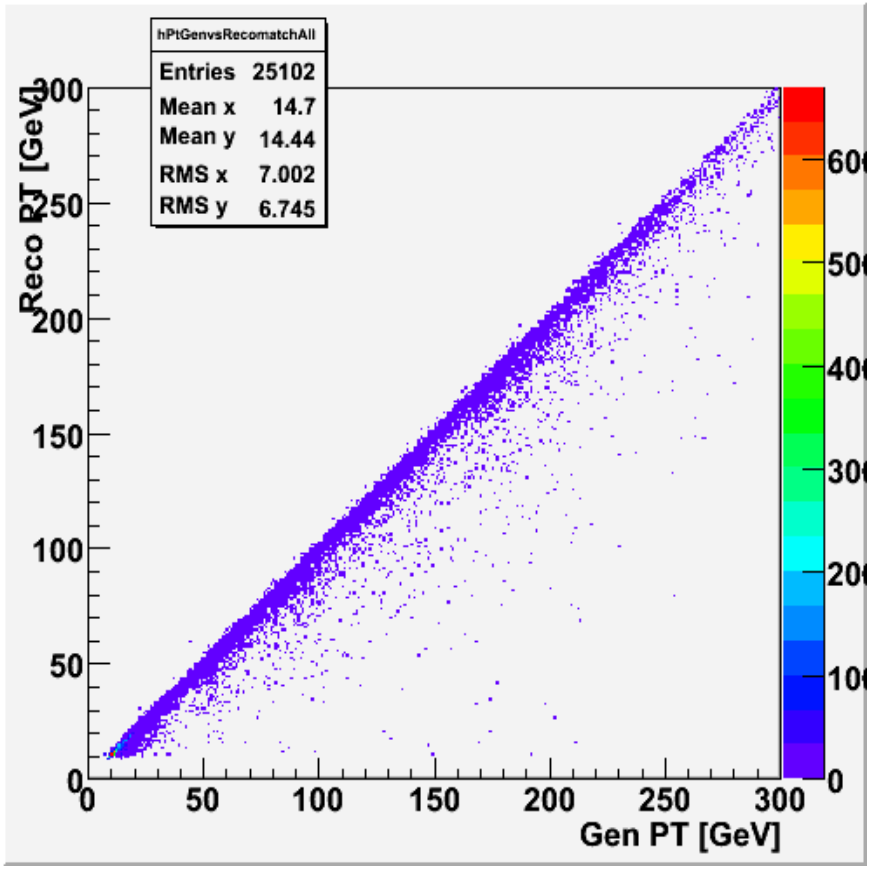
*GenPhoton (matched) are GenPhotons to which a RecoPhoton is matched

Pthat-Distribution over full Pt-Range (0-300Gev)



Efficiency and PtGen vs. PtReco





Quality Flags

LooseEM (EB):

- ECalRecHit isolation < 5+0.15*ph Pt GeV
- HCal Tower isolation < 5 GeV
- HadOverEM < 0.5

LooseEM (EE):

- ECalRecHit isolation < 5+0.15*ph Pt GeV
- HCal Tower isolation < 7 GeV
- HadOverEM < 0.5

LoosePhoton (EB):

same as LooseEM (EB) plus:
- ECalRecHit isolation < 5+0.0045*ph Pt GeV
- Hollow Cone track isolation < 9 GeV
- HadOverEM < 0.15

LoosePhoton (EE):

same as LooseEM (EE) plus:
- ECalRecHit isolation < 5+0.02*ph Pt GeV
- Hollow Cone track isolation < 9 GeV
- HadOverEM < 0.15

TightPhoton (EB):

- same as above plus: sigma_ietaieta* < 0.013

Technical details for the above isolation requirements:
ECalRecHit: Cone $\Delta R = 0.4$, excluding eta-strip 0.04, and inner cone 0.06, with an energy threshold of $|E| > 80$ MeV.
HadOverEM: Cone $\Delta R < 0.15$ in HCal divided by SuperCluster energy.
HCal Tower isolation: Ring $\Delta R = 0.15$ to 0.4
Track: Ring $\Delta R = 0.04$ to 0.4

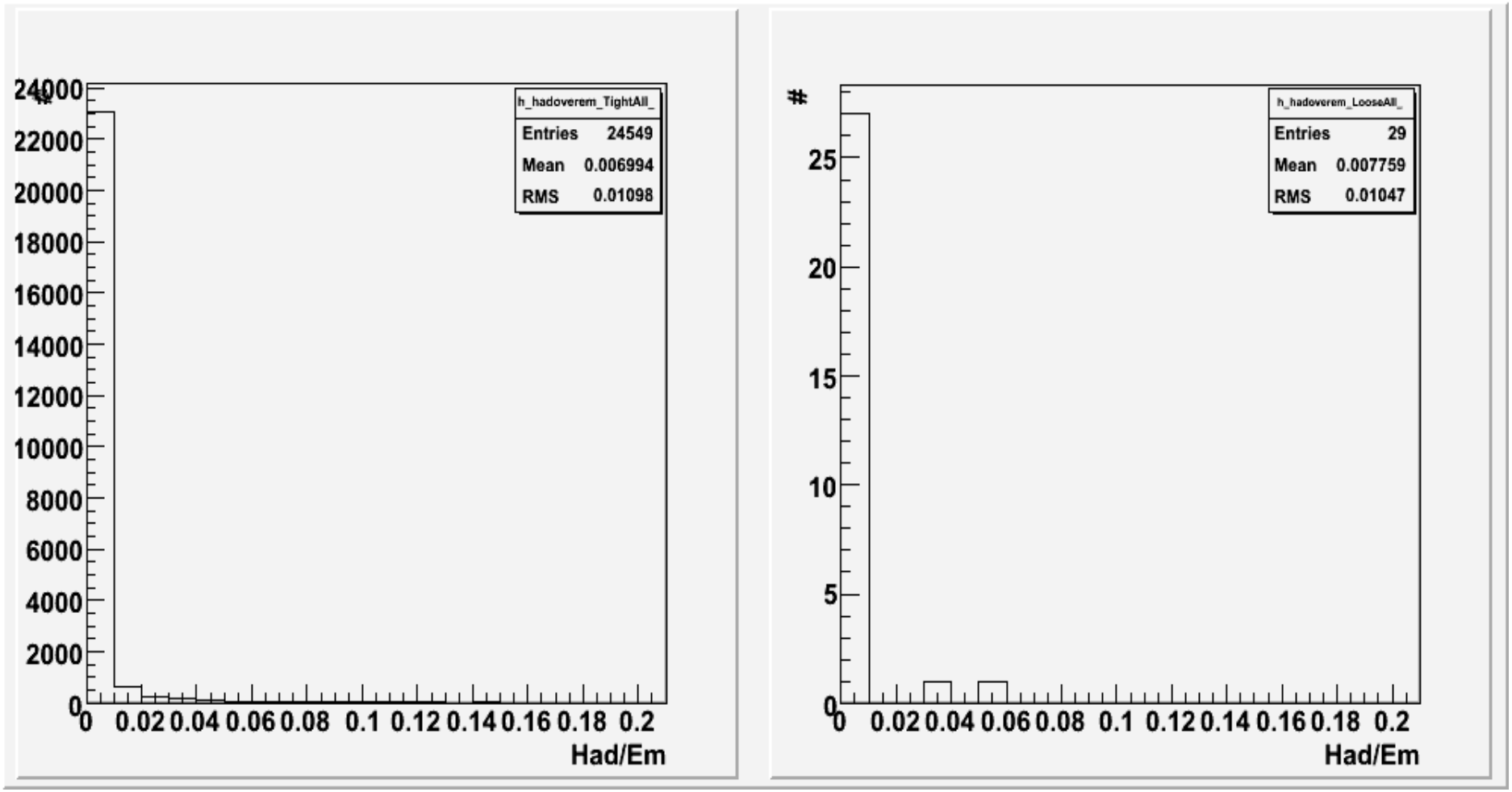
In this samples for matched RecoPhotons

Tight	Loose	False	Sum
24549 (97.8%)	29 (0.1%)	524 (2.1%)	25102

*log(energy) weighted width in eta for the 5x5 array of crystals about the maximum crystal

HadOverEm

ratio of hadronic to EM energy - Quality Flag requirement : HadOverEm < 0.15 (both)



PhotonIDVariables

Fiducial Flags

sEBEEGap = true when (Barrel/Encap boundary)

1.479 < |η| < 1.579

isEBGap = true when (supermodule boundaries in phi)

1.65 < | φ - int(φ * 9/π) * π / 9 | < 1.85

isEBGap = true when (supermodule boundaries in eta)

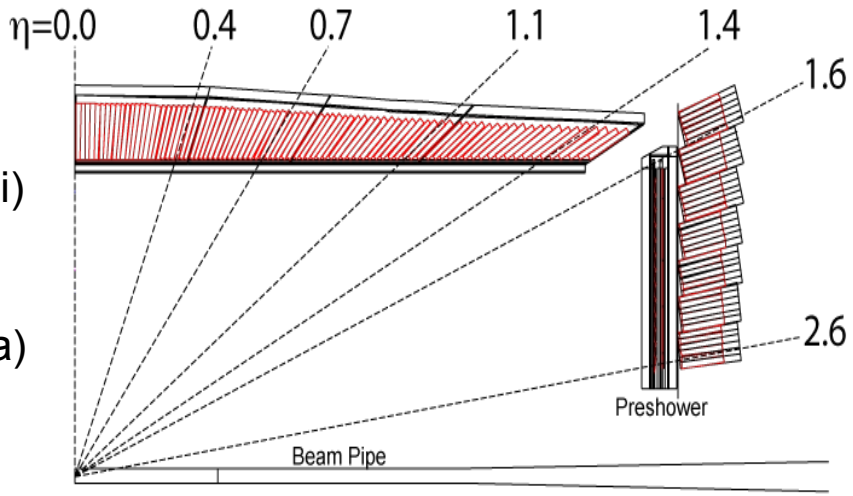
|η| < 0.05

0.4 < |η| <.5

0.75 < |η| <.85

1.1 < |η| <1.2

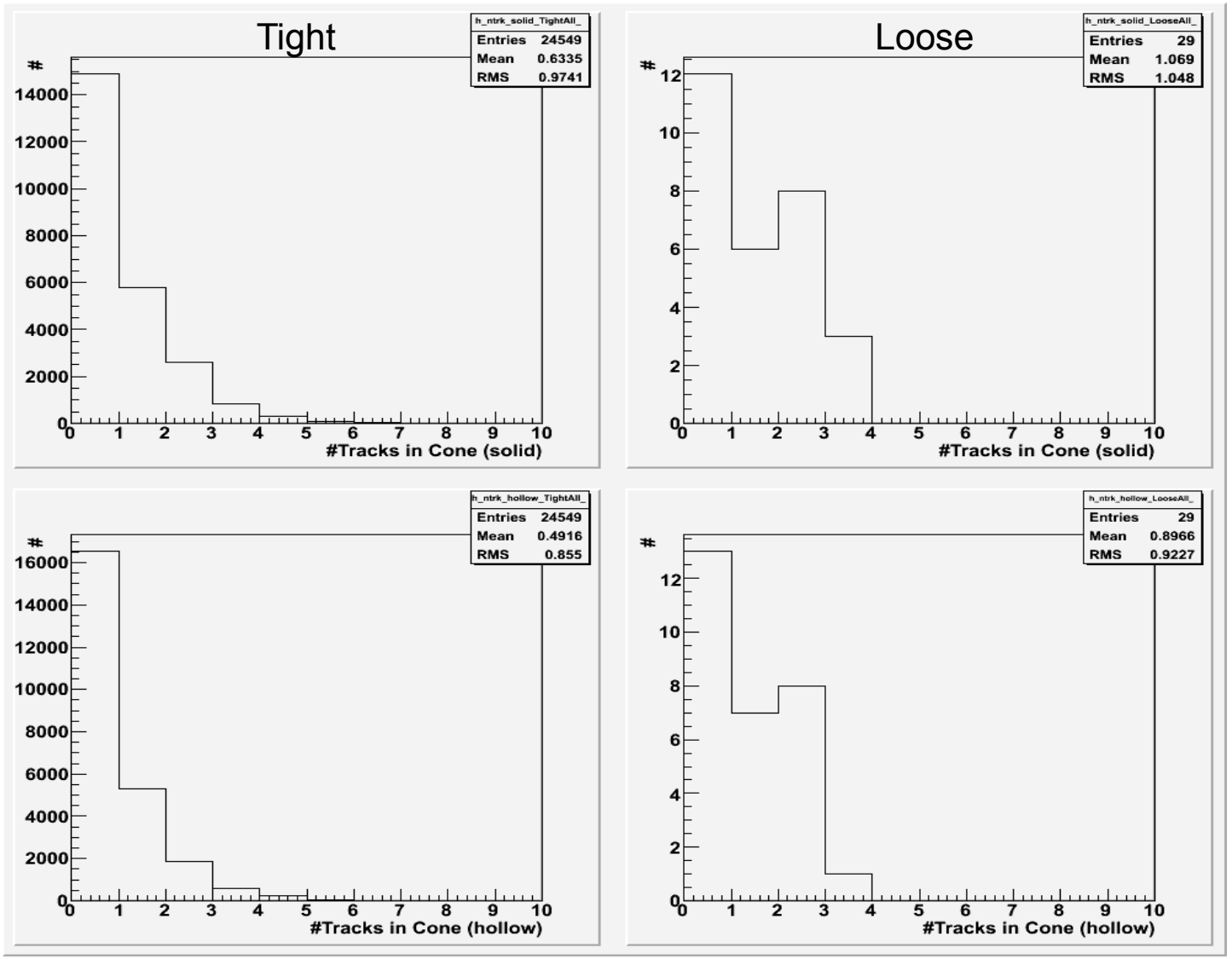
1.43 < |η|



In the samples:

	EB Gap	EE Gap	EBEE Gap
Tight	2243 (9%)	0	1452 (6%)
Loose	3 (10%)	0	1 (3%)

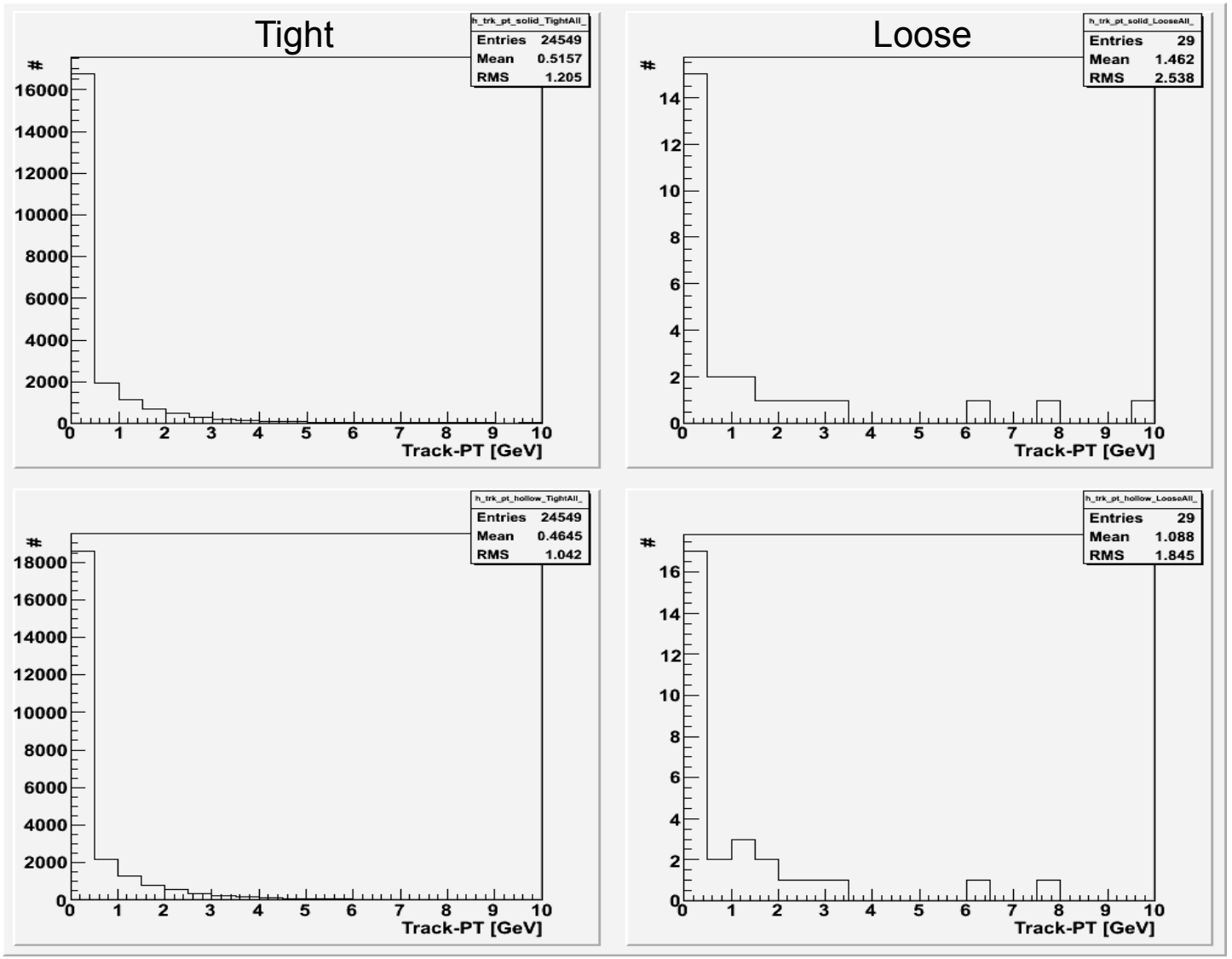
Isolation Variables – Number of Tracks in a ConeD04



Solid (dR = 0.4)

Hollow (dr = 0.06)

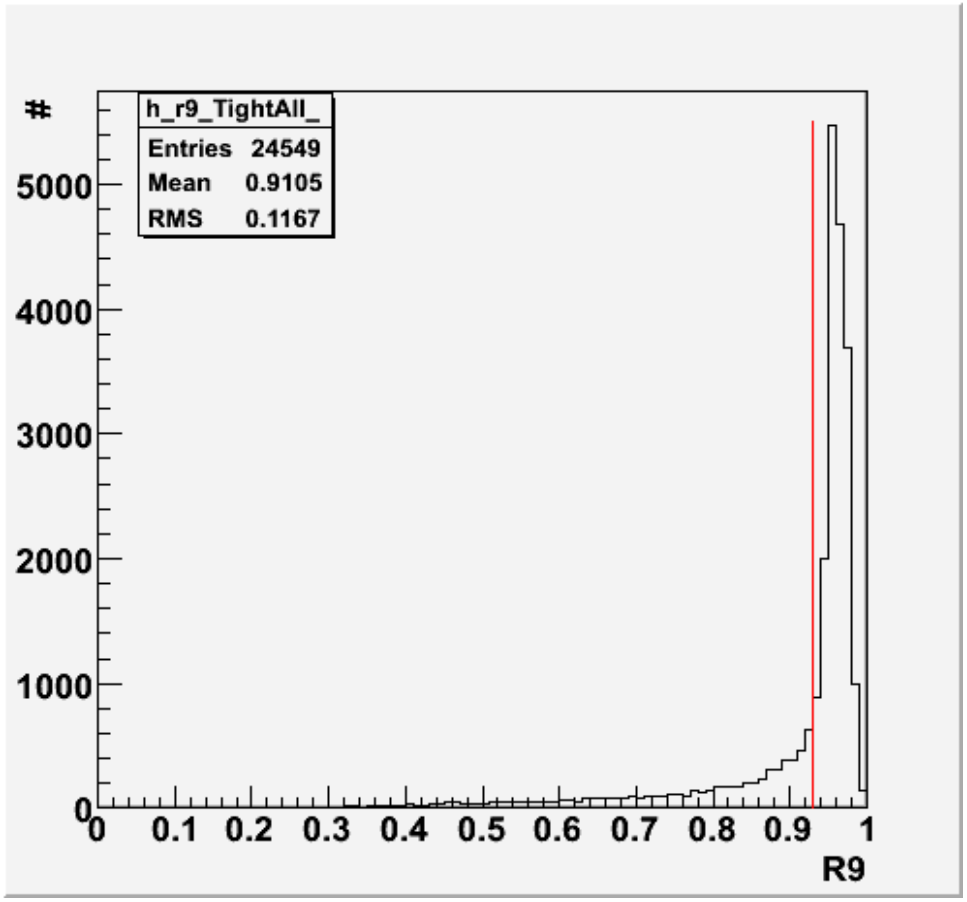
Isolation Variables – Pt Sum of Tracks in a ConeD04



Solid (dR = 0.4)

Hollow (dr = 0.06)

Shower Shapes – R9



R9 – Ecal based quantity

is used as a measure of how likely it is that this photon candidate is a conversion

$$R9 = \frac{e3x3}{SCrawEnergy}$$ * **

R9 < 0.93 (converted)
→ PhotonEt = Super Cluster energy

R9 > 0.93 (unconverted)
→ PhotonEt = e5x5 energy*
+ PreShowerEnergy

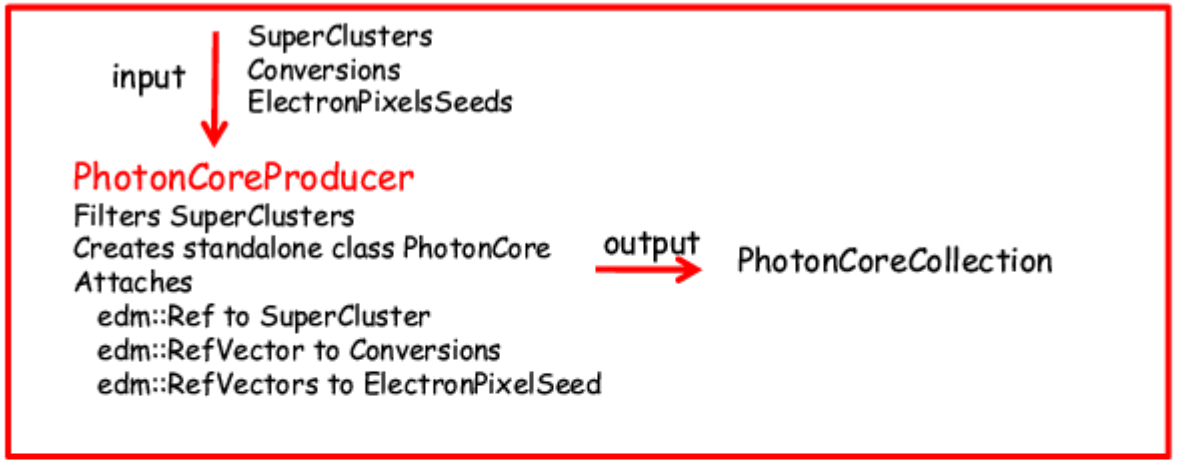
*the sum of energy in a AxA array about the highest energy crystal
** raw uncorrected energy (sum of energy of component BasicClusters)

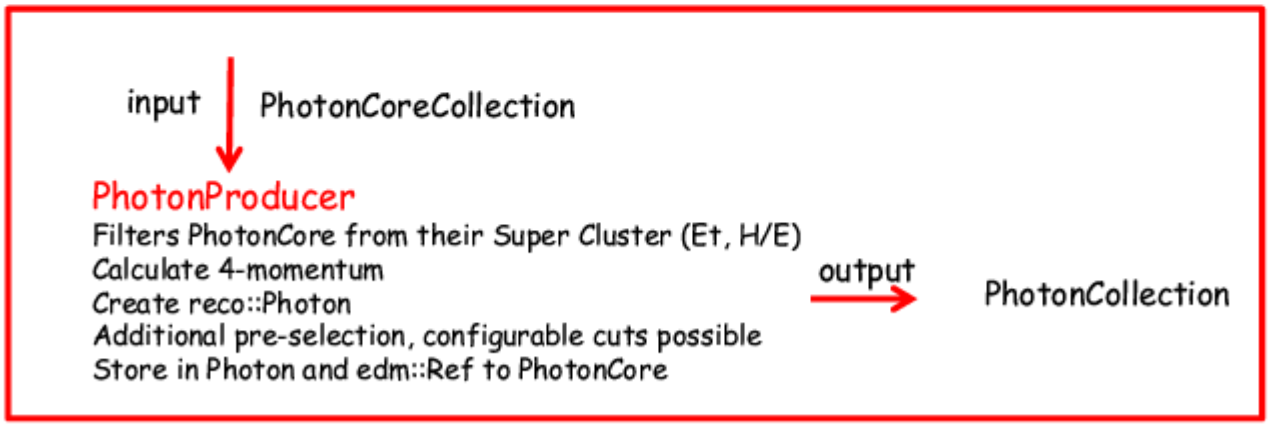
Backup

Sample Overview

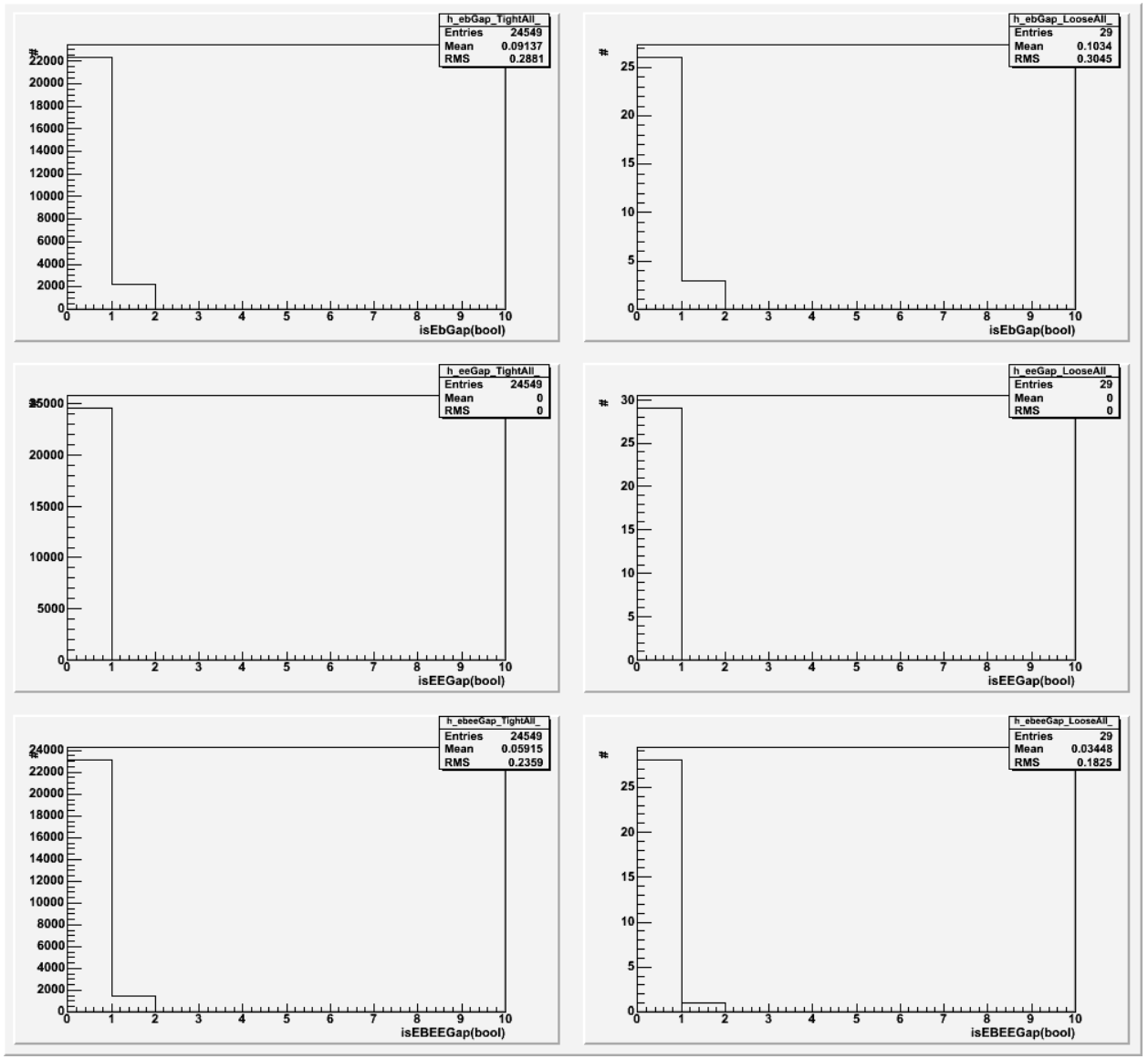
Pt-Range	#Events	cross section	Lumi	GenPh (all)	GenPh (m)	RecoPhotons(all)
0to15	17820	8.45E+007	0.000210987	17827	95	101
15to20	6840	1.15E+005	0.059633827	6841	4347	4653
20to30	6480	5.72E+004	0.113326338	6483	4575	5406
30to50	1350	1.65E+004	0.081719128	1352	1020	1471
50to80	4160	2.72E+003	1.527726772	4167	3533	5799
80to120	4482	4.46E+002	10.04482295	4483	4109	7234
120to170	2988	8.44E+001	35.39026412	2995	2863	5098
170to300	4669	2.26E+001	207.050998	4677	4560	8340

The Photon Producer

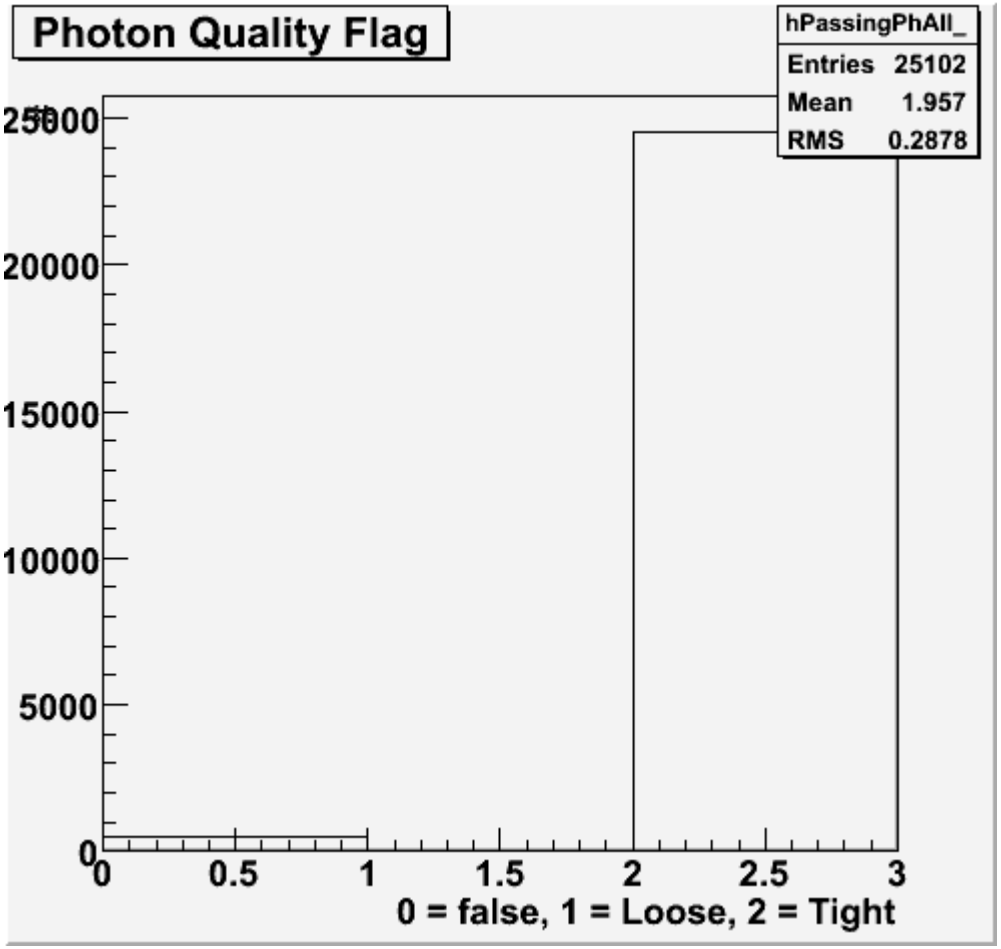




Is EE/EB/EBEEGap for Tight and Loose



Photon Quality Flag



	Tight	Loose	FALSE
25102	24549	29	524

Efficiency

	Tight	Loose	FALSE
25102	24549	29	524