Diphotons

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Fake Rate Study

Aim:
estimate the fake rate of a diphoton sample using a jet + photon sample

Photon Data

Data studied is from the cph208 datasample (4.8.4 production)

The data was taken from
9th February 2002 to 12th January 2003,
Run numbers 138425-156487
Good runs were selected (from run Summary)
corresponds to a unique good run integrated luminsity of 82 pb^{-1}, which when scaled up by 2 %to account for official luminosity, gives 84 pb^{-1}

The Stntuple data is on fcdfsgi2 at
/cdf/data37b/s0/exotic/photon/stntuple/cph208/GI135*.*/*
Stntuple version 4.9.1, tag dev_239 (as used for the winter conferences)
The data was studied with version 4.9.1hpt1 of the offline code.

Trigger

PHOTON_10_ISO, this is prescaled by 1600

- Level 1
  L1_EM8_v2 : $>$ 8 GeV EM tower
- Level 2
  L2_EM10_ISO_PS1600_v2 : $>$ 10 GeV EM tower, EM cluster must have HAD/EM $<$ 0.125, ISO $<$ 3 GeV of 15 %
- Level 3
  L3_NULL_v1 : pass L2 result

Applied Cuts to the photon

Baseline Analysis Cuts for High Pt Photons V1.0	
Variable	Cut
Had/Em	$<$ 0.055 + 0.00045 * ECorr
Chi2 (Strips+Wires)/2.0	$<$ 20
N track (N3D)	$<=$1
Track Pt	$<$ 1+0.005*EtCorr GeV
Cone 0.4 IsoEtCorr	EtCorr$<$20: $<$ 0.1*EtCorr
	EtCorr$>$20: $<$ 2.0+0.005*EtCorr
Cone 0.4 Track Iso	$<$ 5.0+0.005*EtCorr
2nd CES cluster	EtCorr$<$18: $<$ 0.14*EtCorr
(strip and wire)	EtCorr$>$18: $<$ 2.4+0.01*EtCorr
Fiducial	Ces $|X|<$21 cm,
	9$<$ Ces $|Z|<$230 cm

Good Photon Events

Skimmed the initial ISO10 datasample (2735133 events)

- 200159 event pass PHOTON_10_ISO trigger
- 167688 events pass " " and in Good Runs
- 4394 events pass " " and have at least 1 good photon satisying cuts
- 4101 events pass " " and also have a good vertex in the event

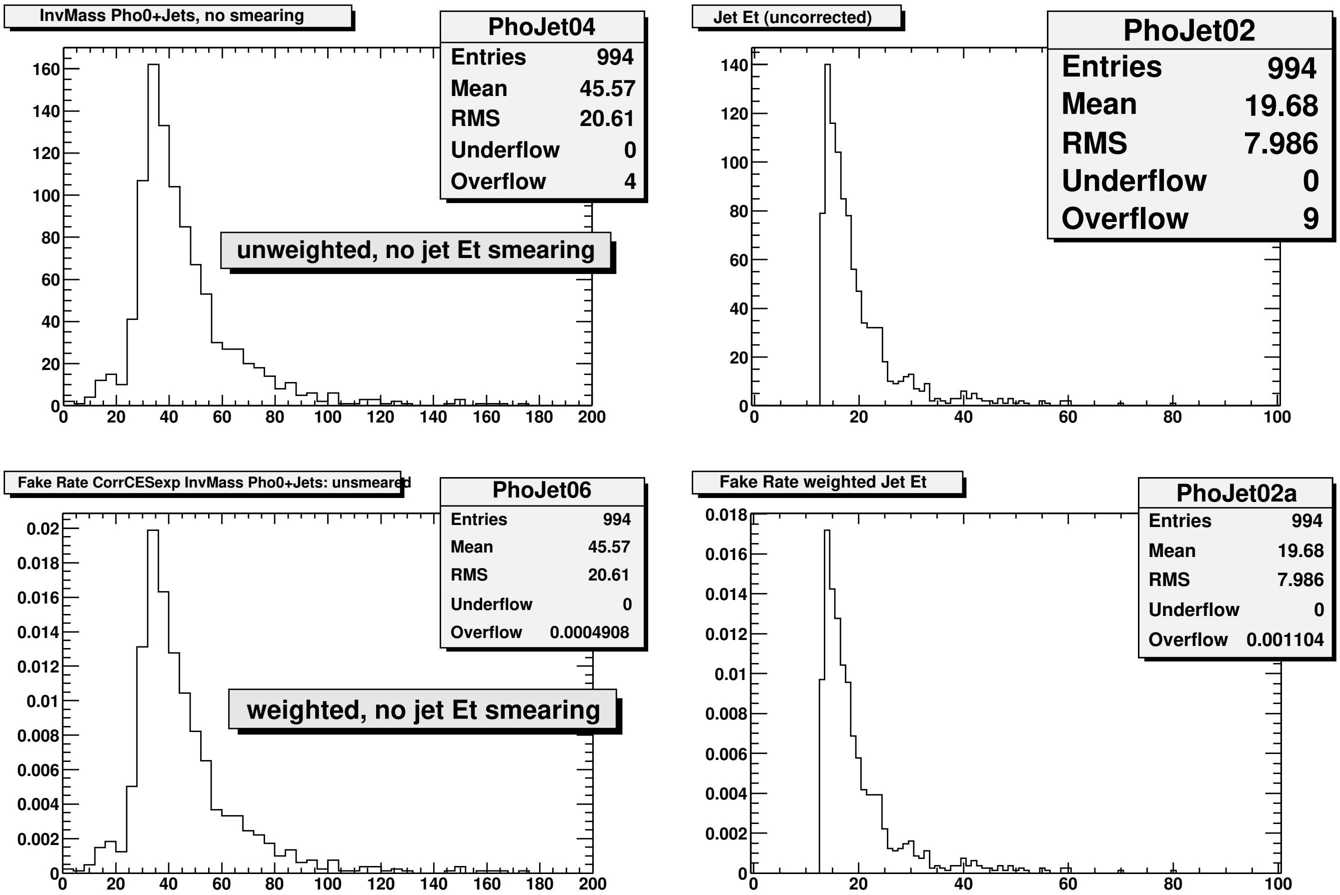
Now look for jets

- 884 events have at least 1 jet with Et>13:
- 787 events have 1 jet with Et>13
- 85 events have 2 jets with Et>13
- 11 events have 3 jets with Et>13
- 1 events have 4 jets with Et>13
- $\rightarrow$ 994 combinations of photon+jet with Et>13 GeV

Jet+Pho invariant mass distribution, with no Jet E smearing

no Jet E smearing, i.e. assume jet fakes a photon of the same energy

unweighted and fake rate weighted



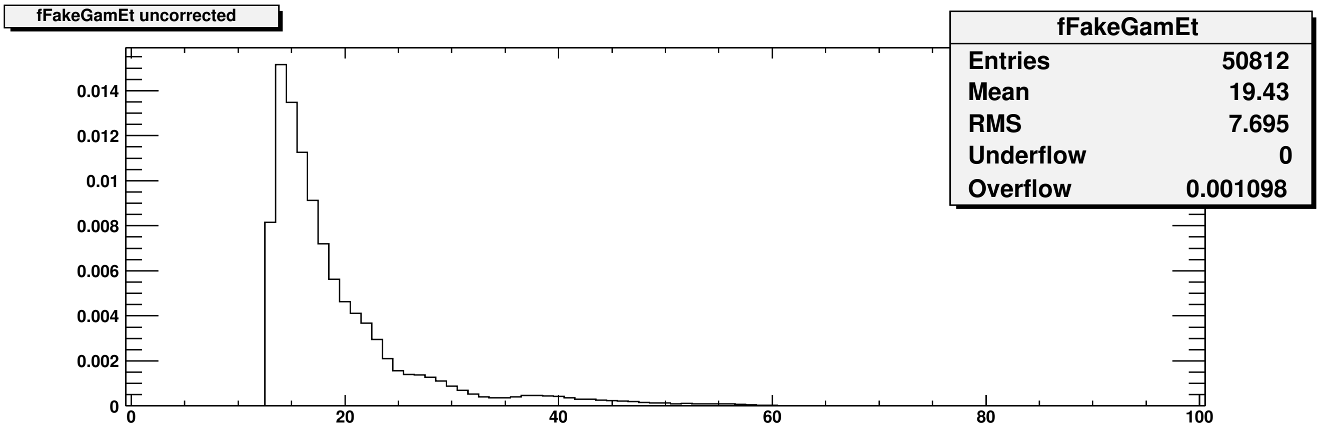
Fake rates used are from Helen Hayward (Liverpool) (CDF note 6363)
They have an exponential form: fakeRate = exp(a+b*Et)+ c,
where Et = jet Et, a = -0.119686; b = -4.91131 and c = 0.000122700

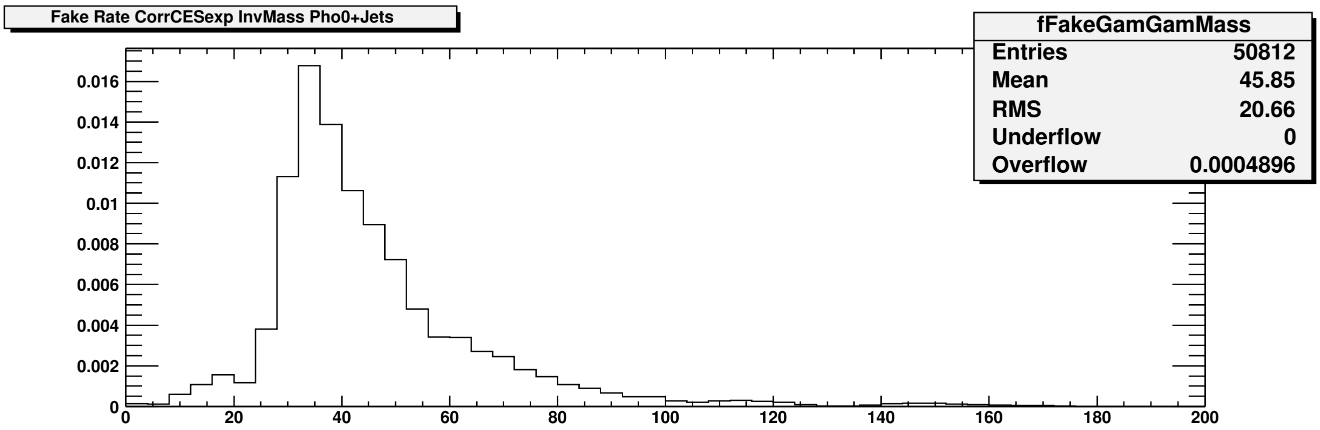
Jet+Pho invariant mass distribution (ps), with Jet E smearing,

The fake photons from jets have a differenct energy than the orginal jet

Smear the jet E by a gaussian with mean of 0.934 and width of 0.0428

Integrated over the gaussian, by looping over -3 σ to +3.01 σ in bins of 0.1. $\rightarrow$ 61 entries per jet (assuming all have Et>13), which are weighted according to the gaussian



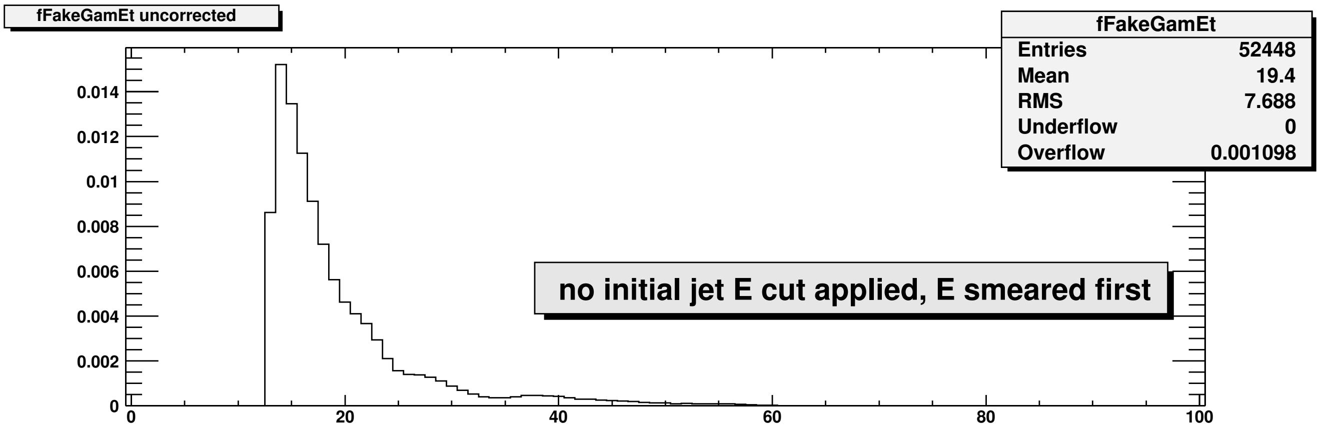


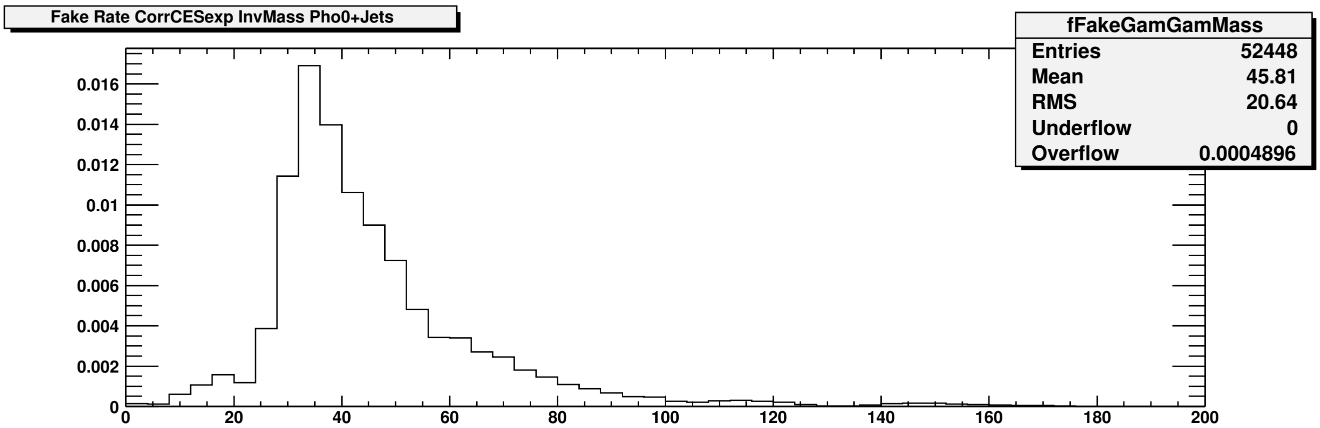
Above show Et> 13 GeV cut applied before smearing?

Jet+Pho invariant mass distribution (ps), with Jet E smearing,

Apply Et> 13 GeV cut before or after smearing?

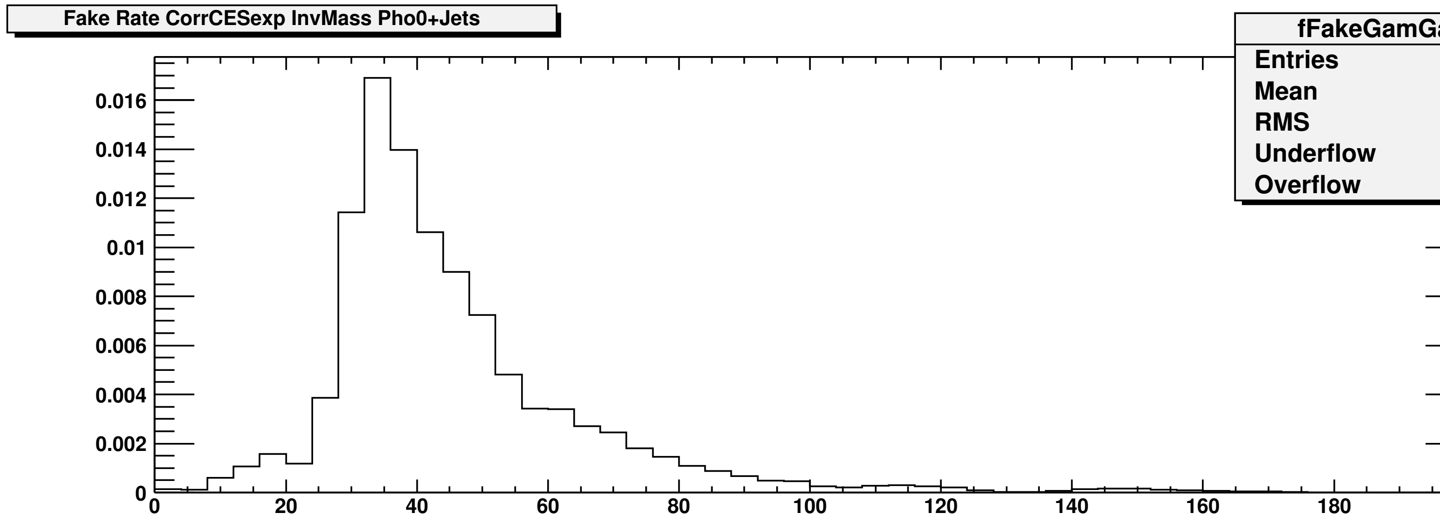
Apply the Et> 13 GeV after smearing means that jets with an energy of 12 GeV (12.25*(0.934+3*0.428)=13.01) also make a small (weighted) contribution to the jet distribution above 13 GeV.
1044 events rather than 884 events with a jet entry with Et>13 GeV





Diphoton Fake rate distribution

Next need to normalise to the luminosity in the diphoton sample, NB trigger prescale of 1600
So scale up by 1600 to get expect fake diphoton distribution in the diphoton sample (with the same luminosity.)



Other work and Future Plans

- Generate NLO diphoton MC using Diphox
  results so far on my webpage:
  http://home.fnal.gov/ pratt/diphotons/diphotons.html
- Use side bands to get another estimate of the background distribution
  aitem Generate fits to the background distributions
- Generate RS model diphoton MC
- Consider high Et photon triggers (ISO and had/em cuts)
- Aim to get analysis blessed for the EPS!
  $\rightarrow$ present status report in the Exotics meeting next week