

PID performance studies w/o SPD&PS

D.Golubkov (ITEP)

Compare the two MC $B^0 \rightarrow K^* \Gamma$ (14 TeV, $L=2 \cdot 10^{33}$) samples with and without SPD/PS.

(DISCLAIMER: all plots are very preliminary, especially the PhotonID ones!)

Selection criteria:

Electron signal:

e^+e^- conversions made from StdNoPIDsDownElectrons, $m(e^+e^-) < 50$ MeV, $\text{vertex_chi2} < 5$, $\text{vertex_Z} > 900$ mm, $\text{MIPS} < 100$, $\text{PT} > 100$ MeV/c, $\text{Prob}(\text{track_chi2}, \text{NDF}) > 1\%$.

Electron background:

all hadron tracks (checked by MCtruth), $\text{PT} > 100$ MeV/c, $\text{Prob}(\text{track_chi2}, \text{NDF}) > 1\%$.

Photon signal:

StdLooseAllPhotons ($\text{chi2_2D} > 4$, $\text{pT} > 200$ MeV/c), matched to MCtrue photon with weight > 0.8 , cut on geometrical distance between reconstructed CaloHypo position and MC photon endvertex: $|\Delta Z| < 150$ mm, $|\Delta R| < 100$ mm
(selection checked by $(\text{mcp-E})/\text{mcp}$ peaking around 0)

Photon background:

StdLooseAllPhotons ($\text{chi2_2D} > 4$, $\text{pT} > 200$ MeV/c), $\text{pT} > 200$ MeV/c, either MC matched to a non-photon or having weight > 0.8 and $|\Delta Z| > 150$ mm, $|\Delta R| > 100$ mm

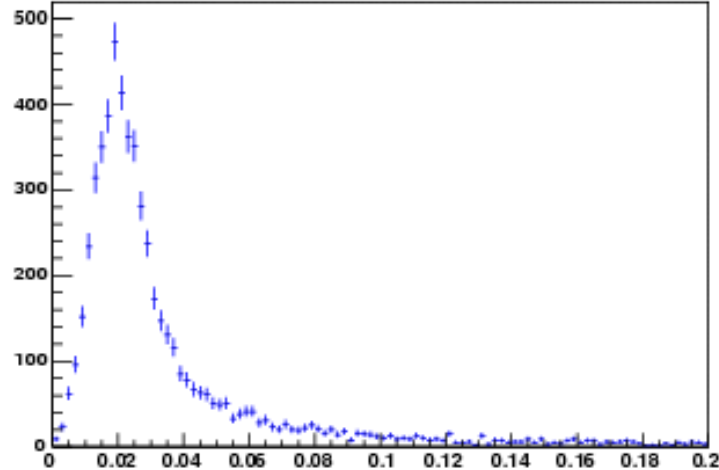
Technical detail for analysis of the upgrade nospdps MC sample:

Solved the initial problem with missing Electrons in the noSPDPS MC sample: one needs to redo electron reco disabling ChargedWithSpd and ClusterWithPrs (otherwise EmCharged CaloHypo is not created), e.g.:

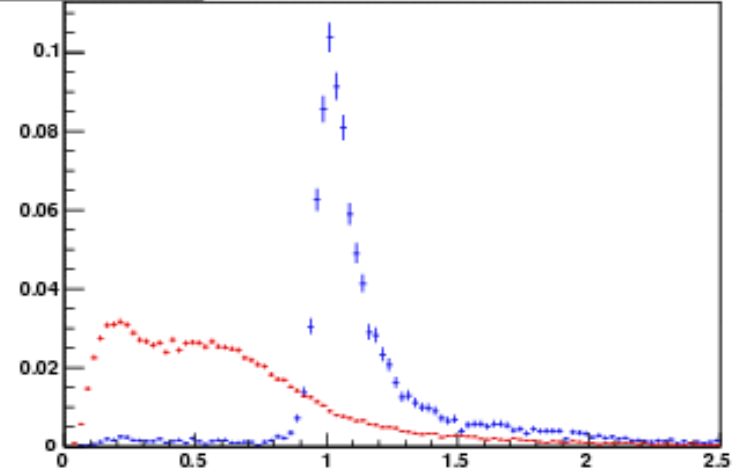
```
# disable ChargedWithSpd and ClusterWithPrs in CaloElectronAlg/SingleElectronRec
def doMyChanges():
    cea = CaloElectronAlg('SingleElectronRec')
    cea.SelectionTools = [      'CaloSelectCluster/ElectronCluster'
                          # , 'CaloSelectChargedClusterWithSpd/ChargedWithSpd'
                          # , 'CaloSelectClusterWithPrs/ClusterWithPrs'
                          , 'CaloSelectorNOT/ChargedWithTracks'          ]
appendPostConfigAction(doMyChanges)
# enable calo re-reconstruction
from Configurables import PhysConf
PhysConf().CaloReProcessing = True
```

Electron Signal/Background selection, NoSPDPS sample

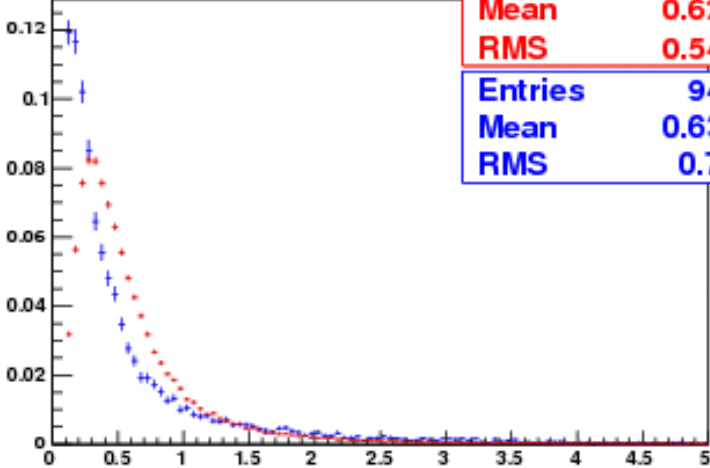
e+e- mass



signal E/p



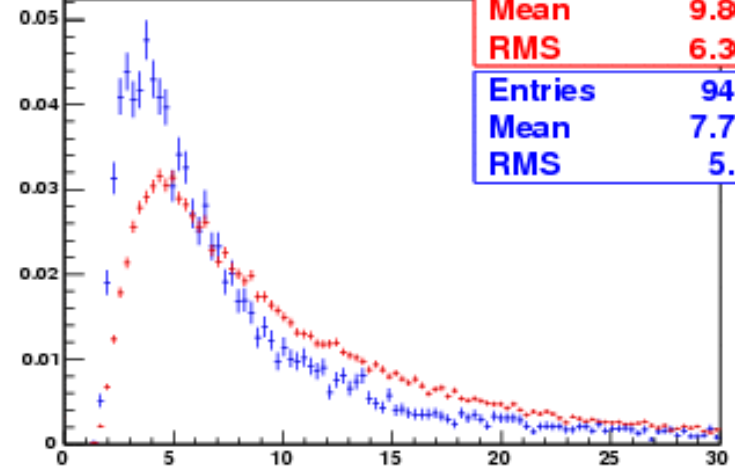
signal pT



Entries	53131
Mean	0.6285
RMS	0.5418

Entries	9419
Mean	0.6333
RMS	0.728

signal p

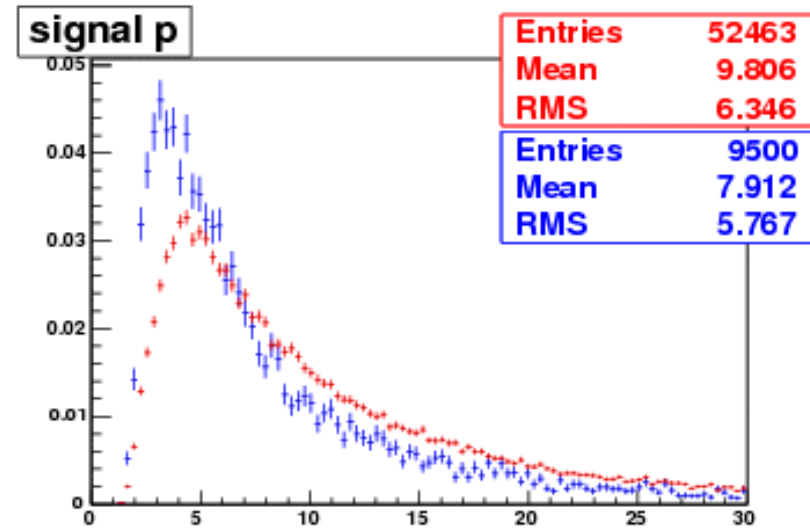
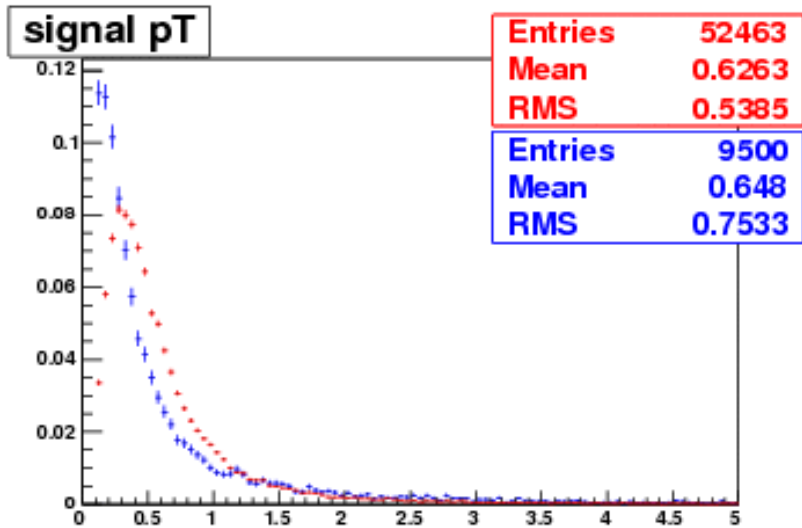
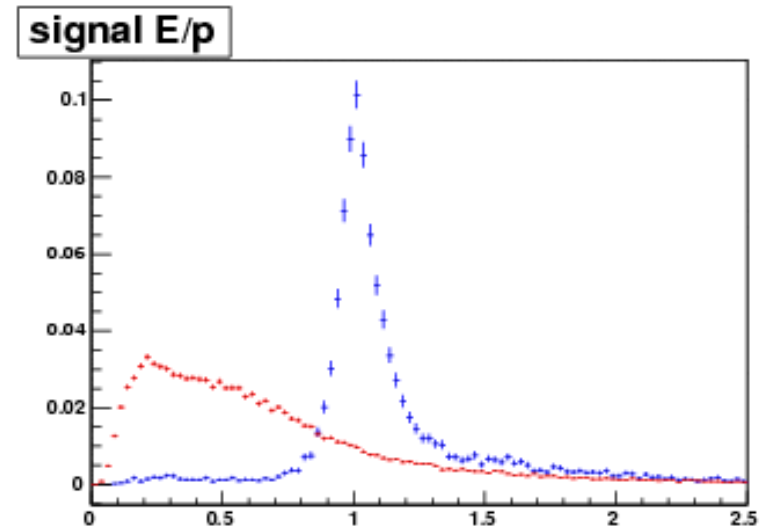
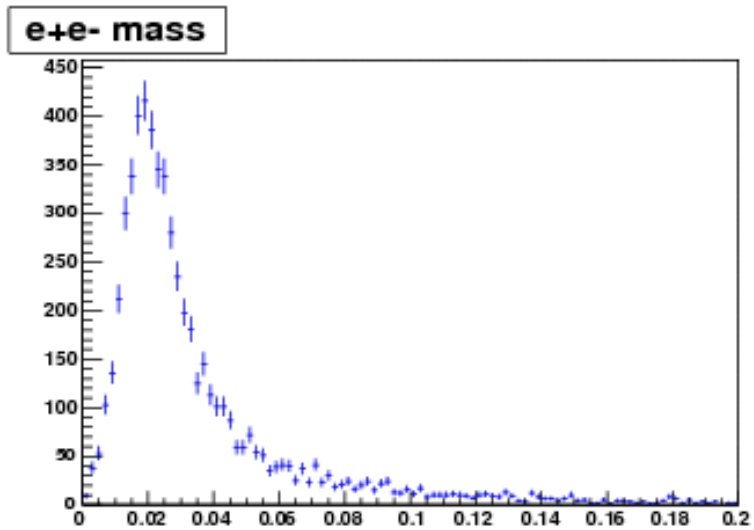


Entries	53131
Mean	9.807
RMS	6.306

Entries	9419
Mean	7.773
RMS	5.75

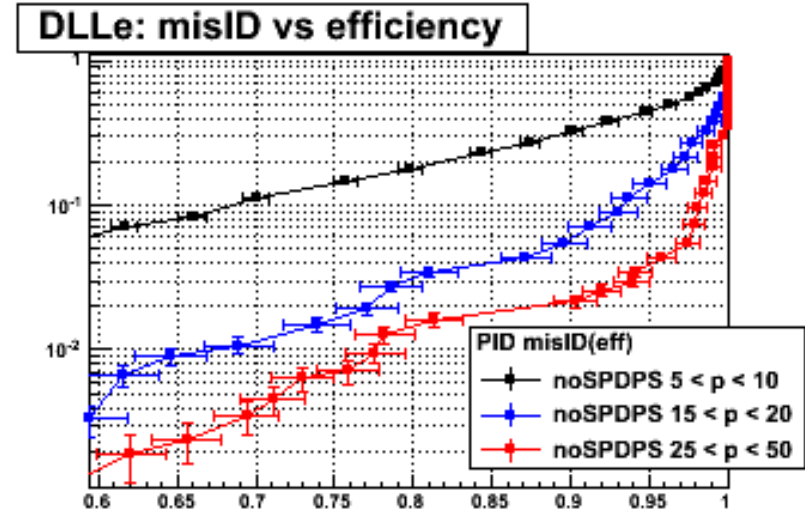
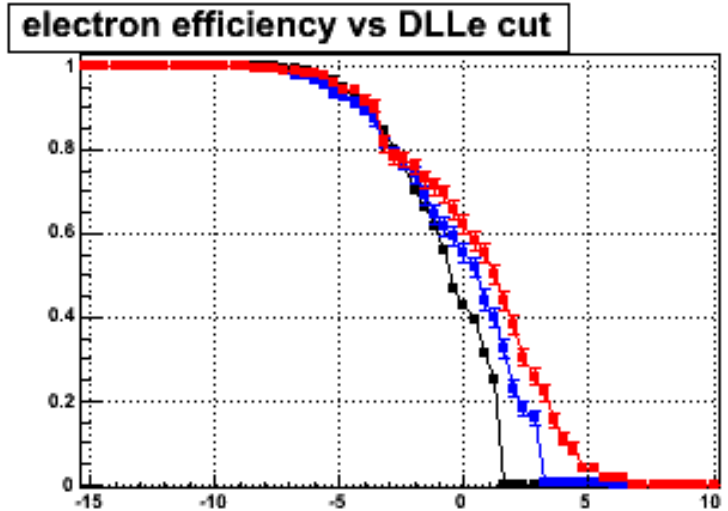
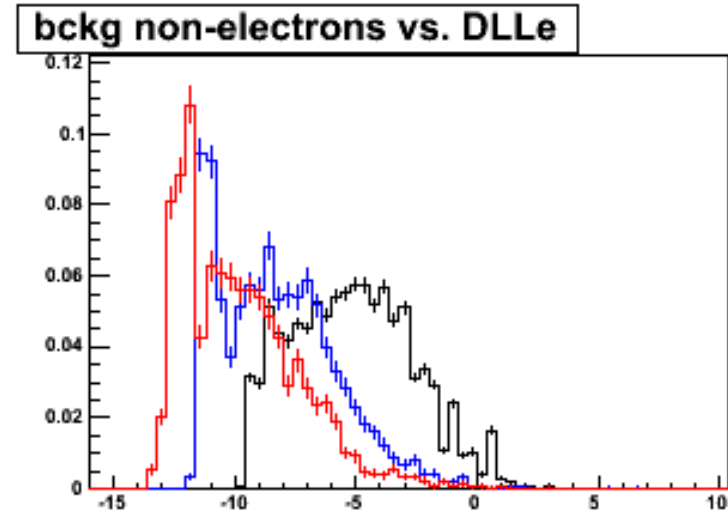
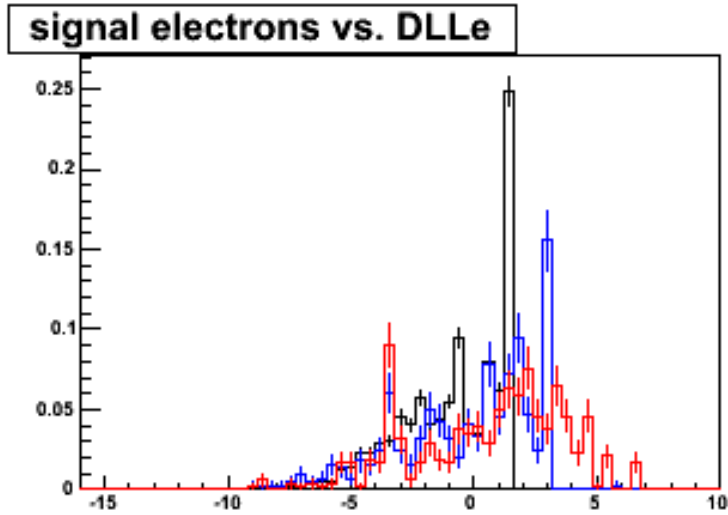
Background smooth around $E/p \sim 1$, rather low background under signal dielectron mass
NB: momentum distributions differ \Rightarrow should do comparison in bins of P

Electron Signal/Background selection, SPDPS sample



Background is smooth around $E/p \sim 1$, rather low background under signal dielectron mass

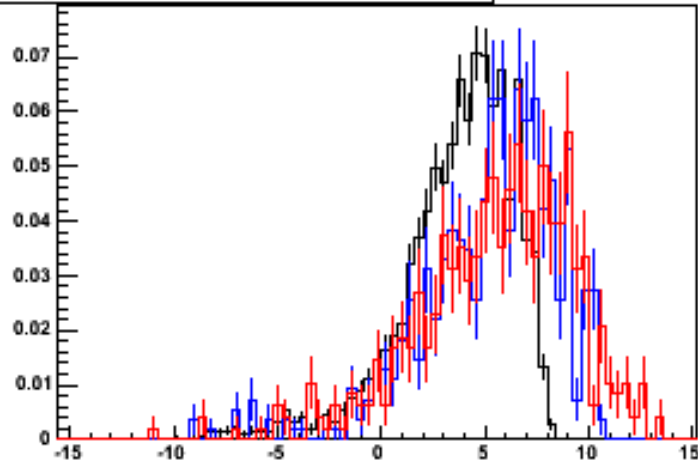
CALO-only misID(eff) in momentum slices, noSPDPS



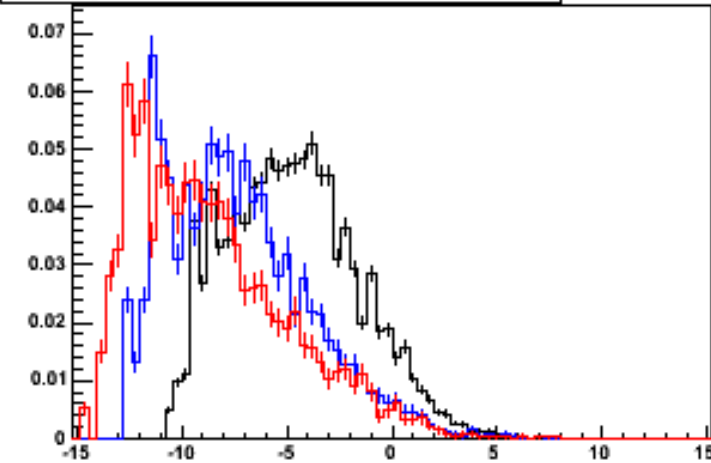
Statistics of electron signal is a bit low for binning in momentum
Typical value at higher P: $\text{misID}(\text{eff}=90\% \mid 15 < p < 20) = \sim 6\%$

CALO-only misID(eff) in momentum slices, SPDPS

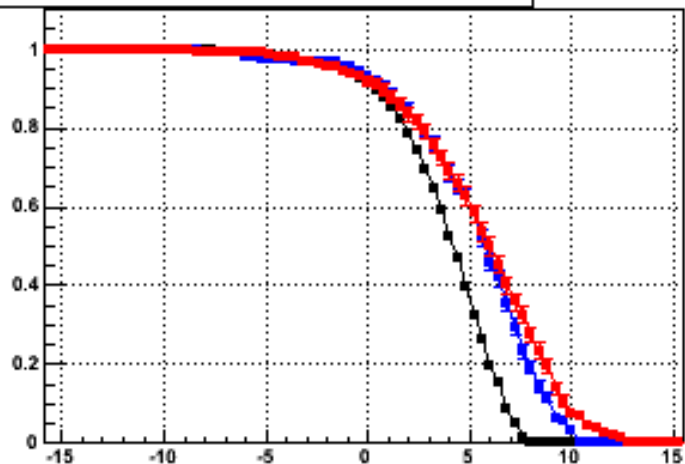
signal electrons vs. DLLe



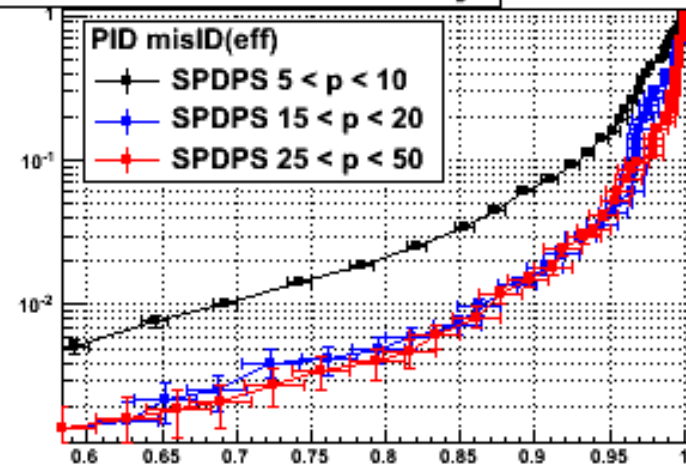
bckg non-electrons vs. DLLe



electron efficiency vs DLLe cut

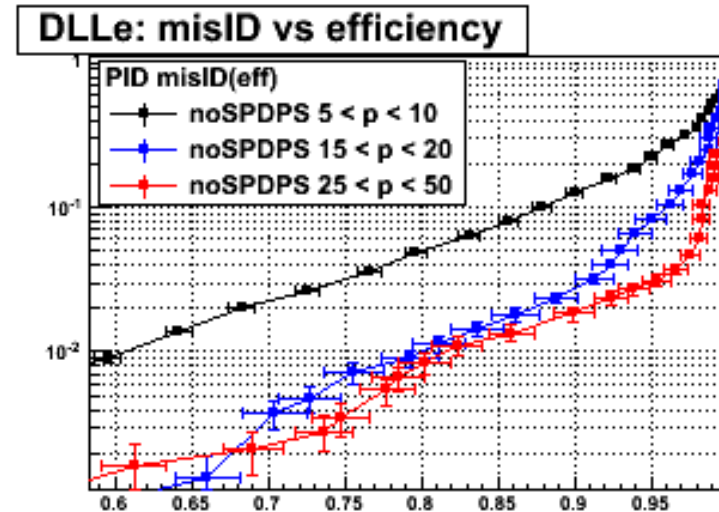
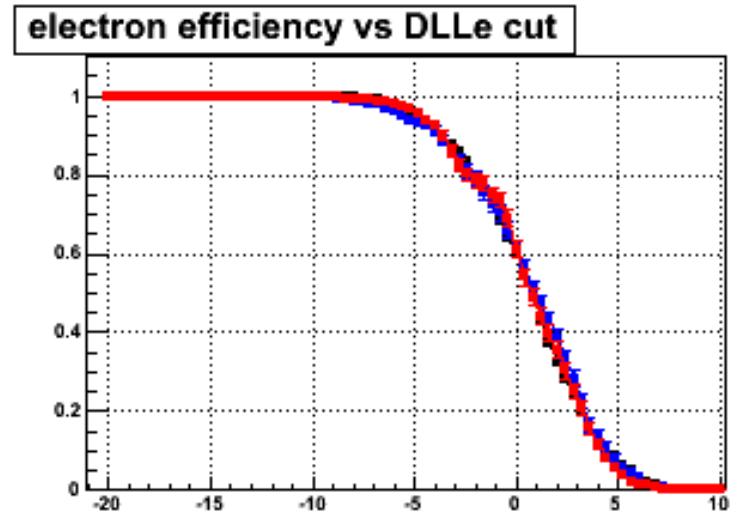
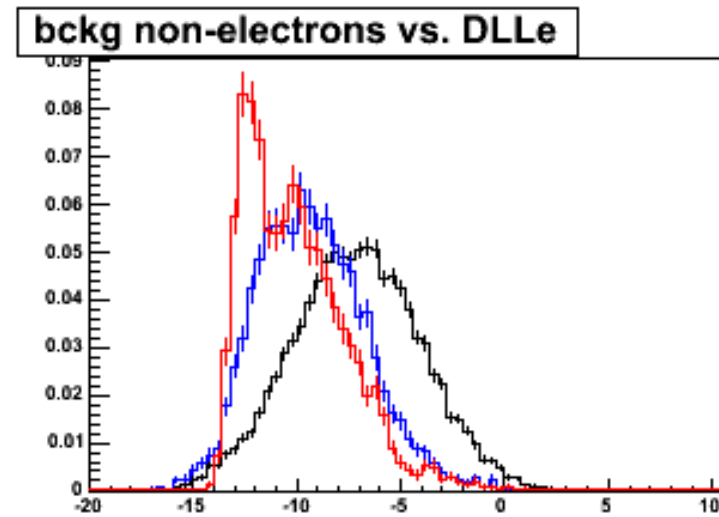
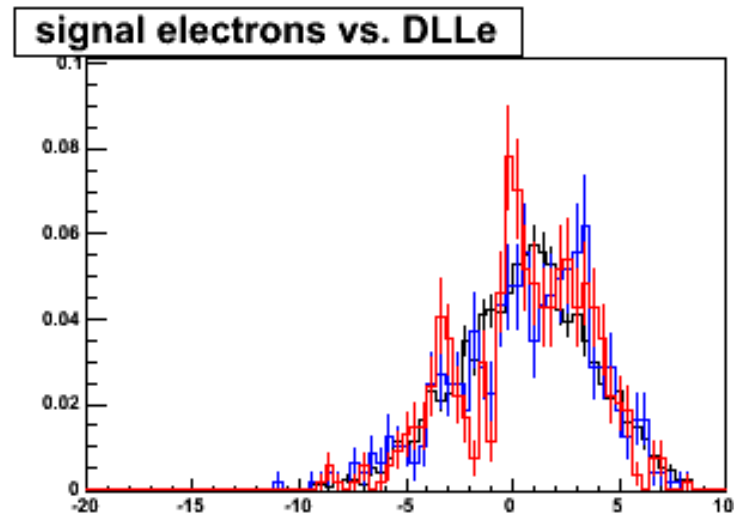


DLLe: misID vs efficiency



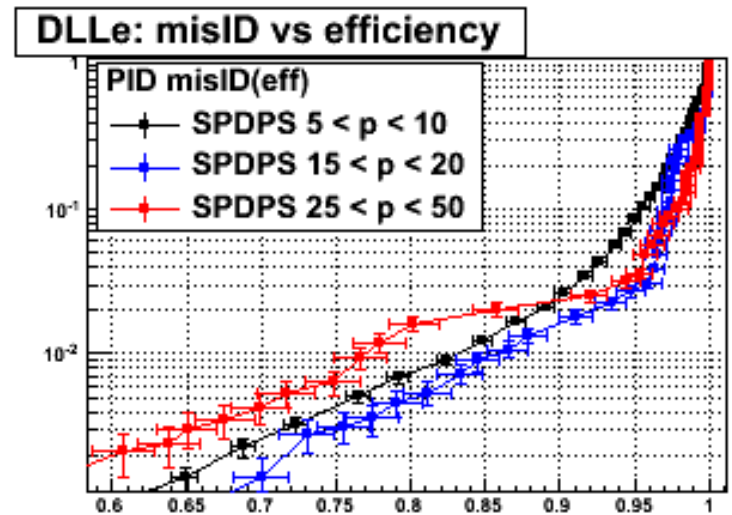
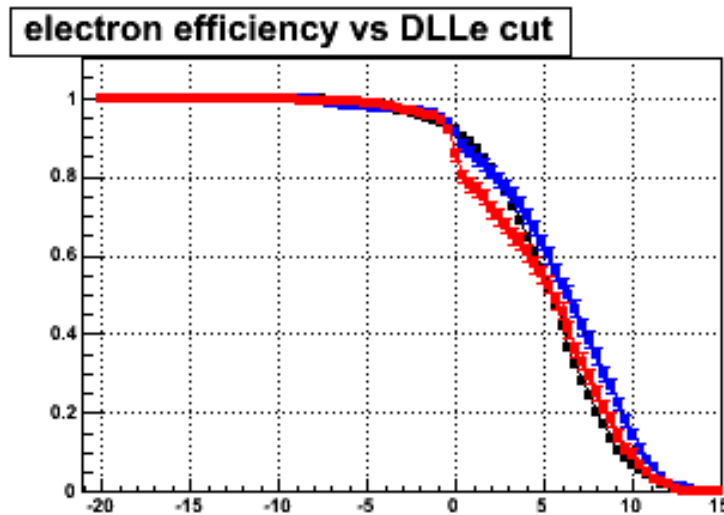
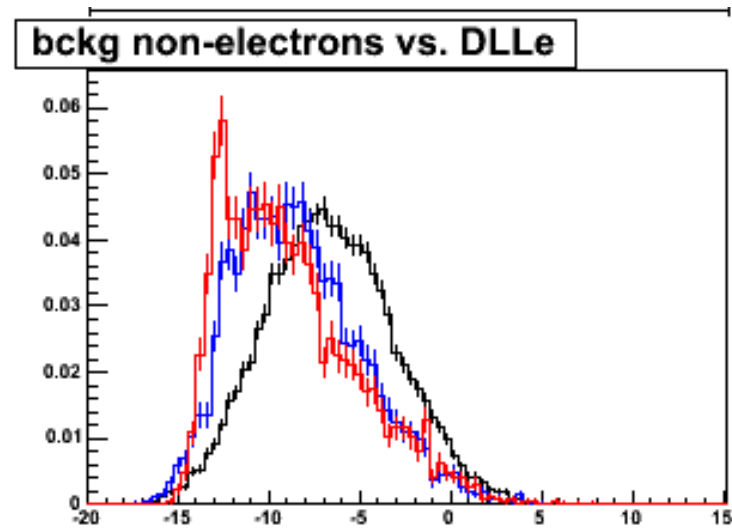
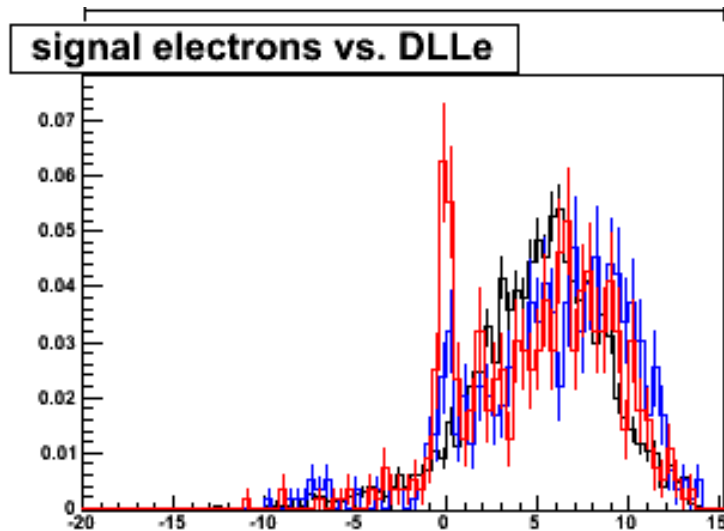
Typical value at higher P: $\text{misID}(\text{eff}=90\% \mid 15 < p < 20) = \sim 2\%$

CALO+RICH misID(eff) in momentum slices, noSPDPS



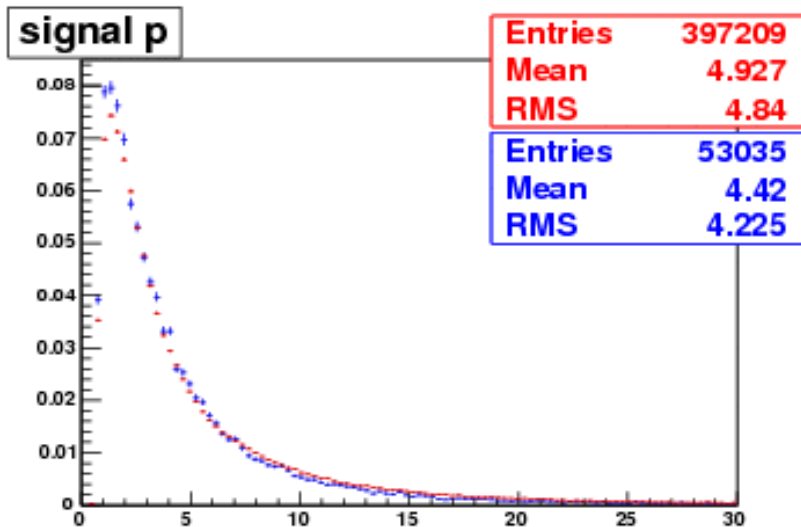
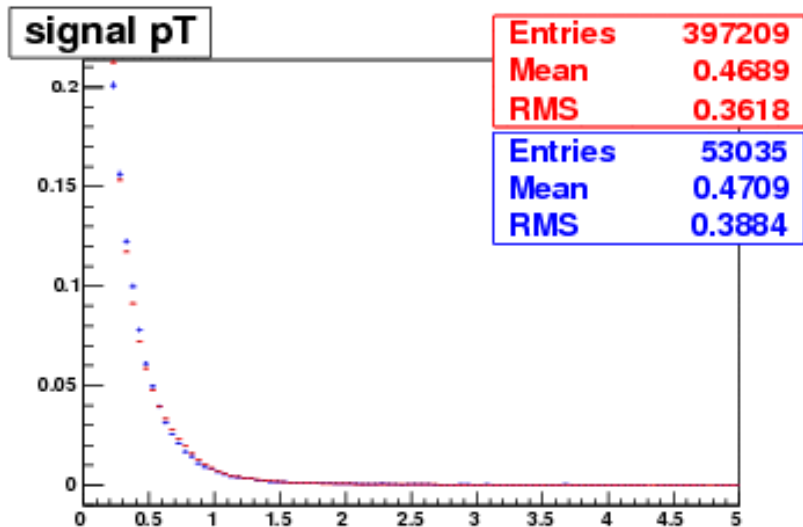
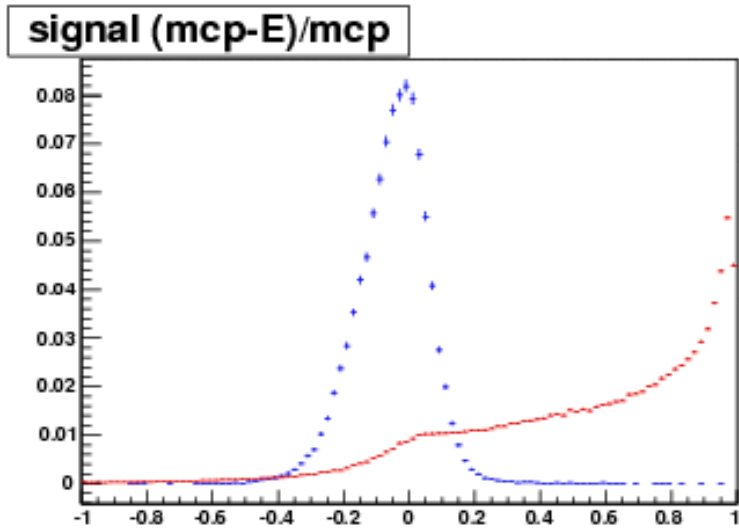
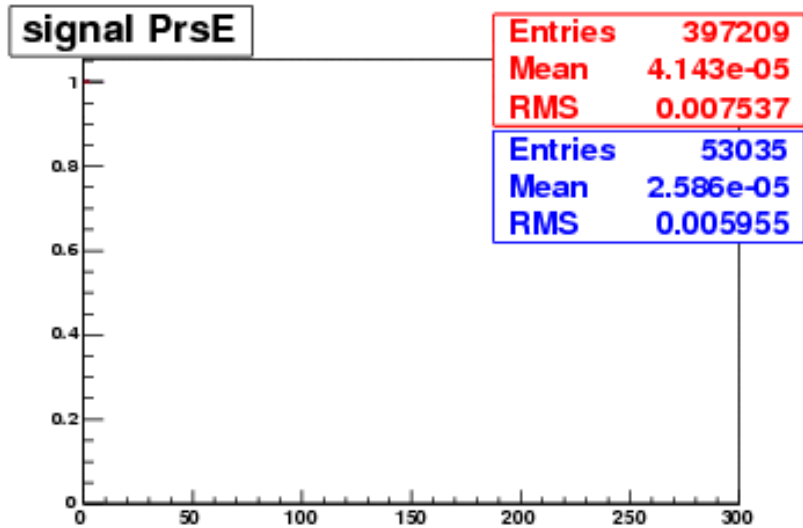
Typical value at higher P: $\text{misID}(\text{eff}=90\% \mid 15 < p < 20) = \sim 3\%$

CALO+RICH misID(eff) in momentum slices, SPDPS



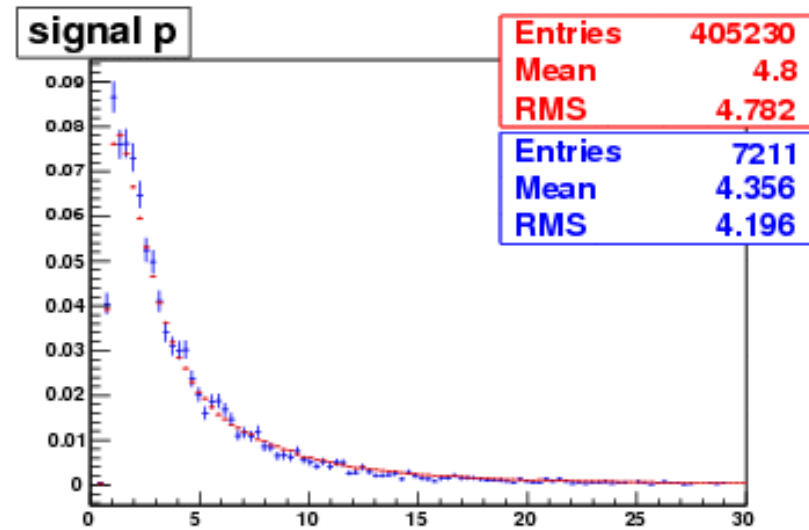
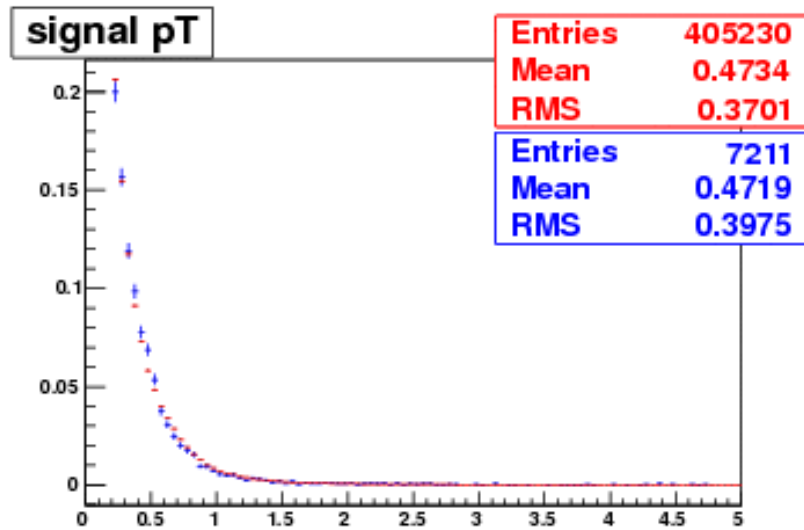
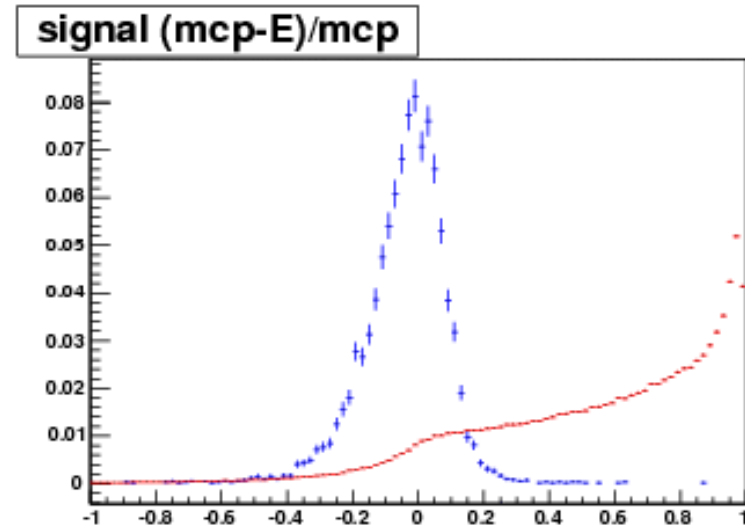
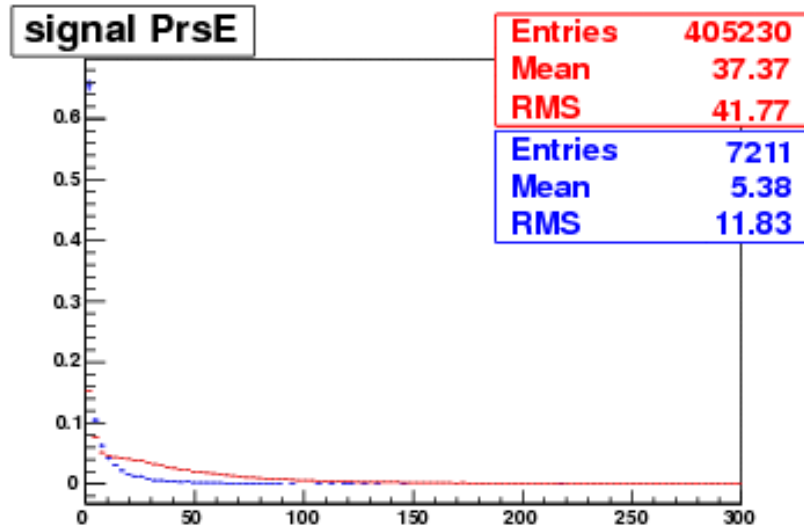
Low-momentum Electron ID significantly better than for noSPDPS,
Typical value at higher P: $\text{misID}(\text{eff}=90\% \mid 15 < p < 20) = \sim 1.5\%$

Photon Signal/Background selection, NoSPDPS sample



Note a bump in the background around '(mcp-E)/mcp == 0' – admixture of real photons (?)
Momentum spectra nicely agree

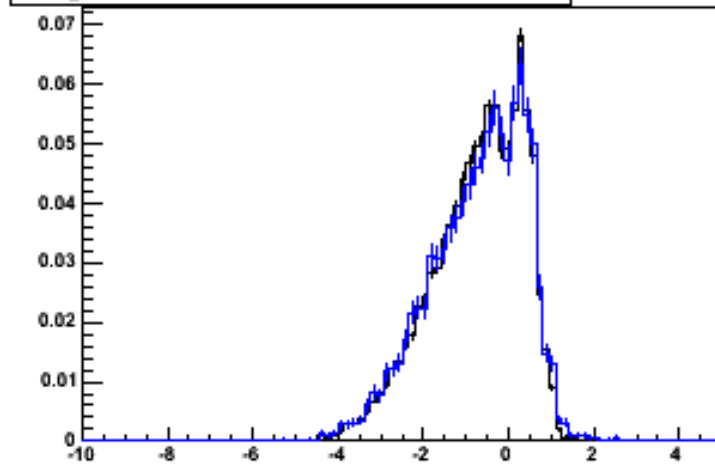
Photon Signal/Background selection, SPDPS sample



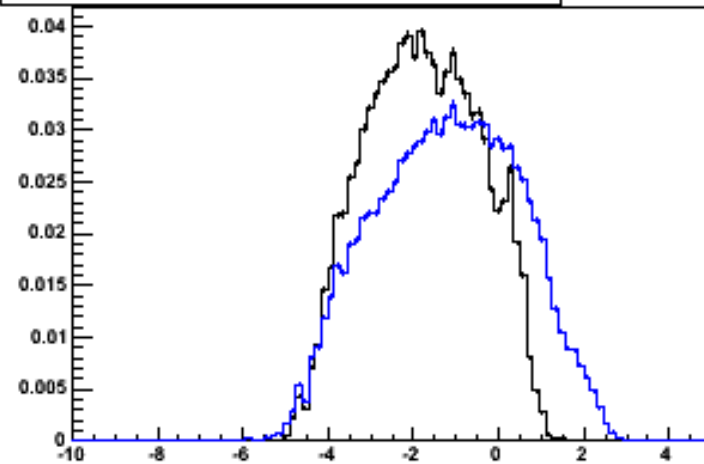
Note a bump in the background around '(mcp-E)/mcp == 0'

Comparison of PhotonID misID(efficiency) with and w/o SPDPS

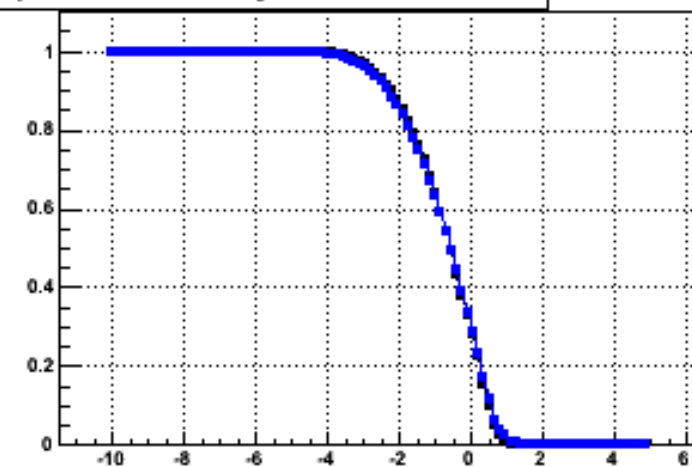
signal photons vs. PhotonID



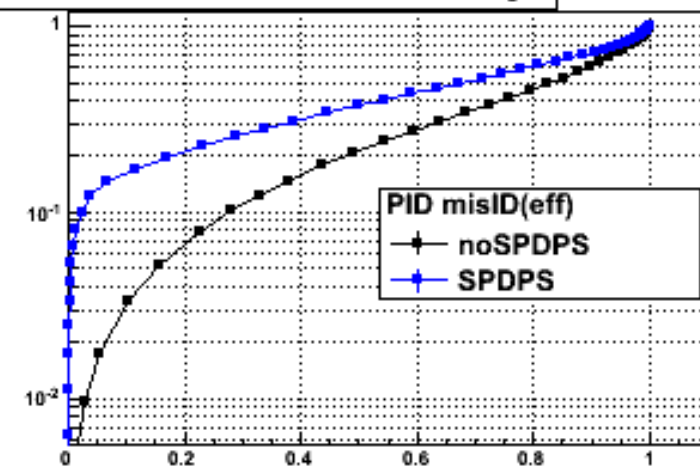
bckg neutral clusters vs. PhotonID



photon efficiency vs PhotonID cut



PhotonID: misID vs efficiency



- poor MisID(eff=90%) = ~60-70% (?)
 - noSPDPS apparently performs better than SPDPS (?)
 - Signal PhotonID distribution doesn't change between noSPDPS and SPDPS (?)
- => probably something is wrong with reco or the choice of signal/background selection

Summary and Very Preliminary results

Preliminary compared Electron and Photon ID in the upgrade MC samples with and without SPD and PS.

Electron ID: as expected, visibly worse w/o SPD and PS, especially at low momenta.

MisID(90%)	noSPDPS	SPDPS	noSPDPS	SPDPS
momentum	CALO-only		CALO+RICH	
5 < p < 10	30%	7%	13%	3%
15 < p < 20	6%	2%	3%	1.5%

Photon ID: first results look unexpected:

- poor MisID(eff=90%) = ~60-70% (?)
- noSPDPS apparently performs better than SPDPS (?)
- Signal PhotonID distribution doesn't change between noSPDPS and SPDPS (?), while background distribution does change

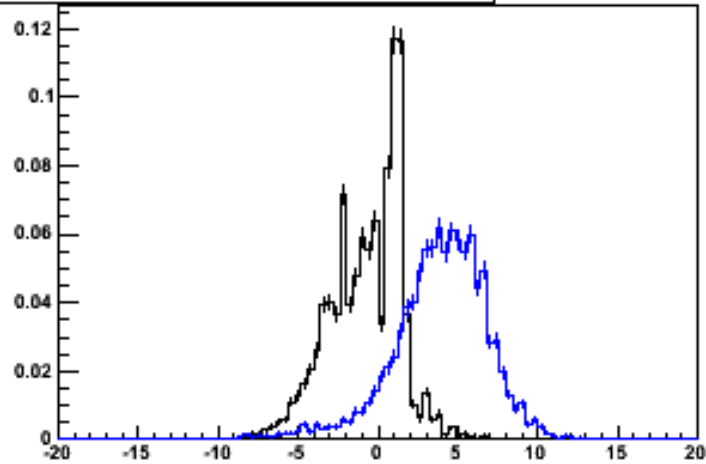
=> perhaps something is wrong with reco or my choice of signal/background selections

Next steps:

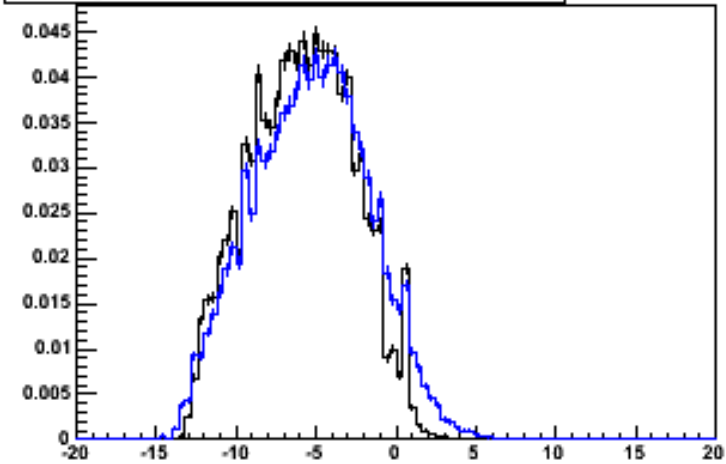
- try relaxing Electron selection to gain more statistics
- check Photon reconstruction (try using CaloClusters instead of StdLooseAllPhotons)
- better understand the Photon signal/background selections:
(try to exactly reproduce Frederic's selection, e.g. remove merged pi0 from signal, ...)

CALO-only Electron misID(efficiency) with and w/o SPDPS

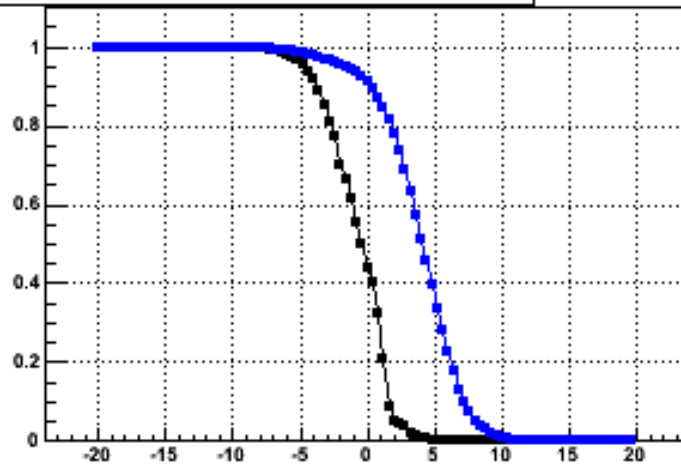
signal electrons vs. DLLe



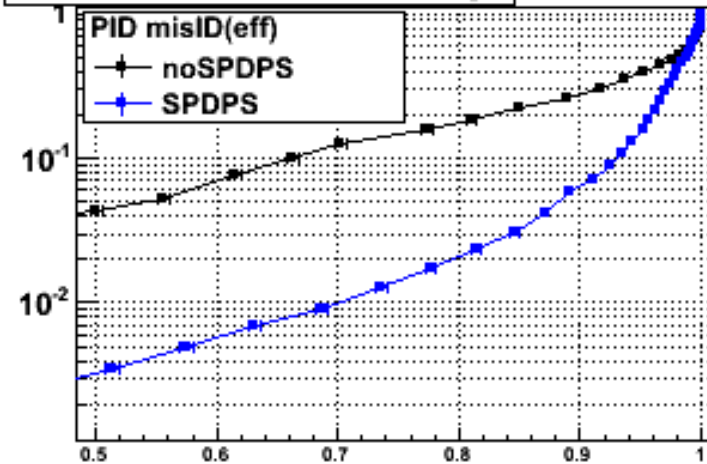
bckg non-electrons vs. DLLe



electron efficiency vs DLLe cut



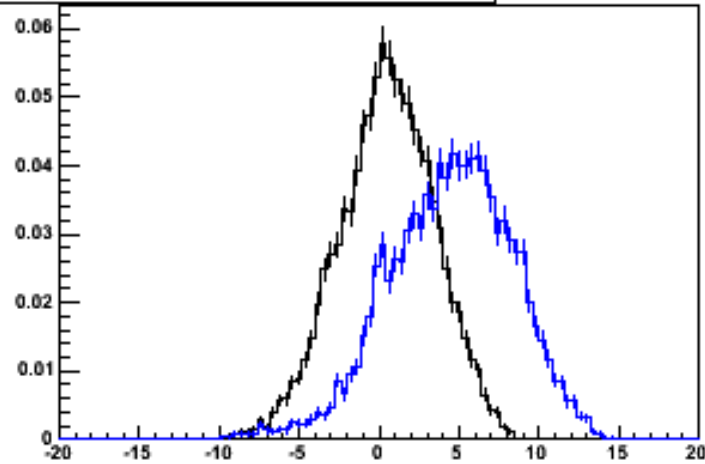
DLLe: misID vs efficiency



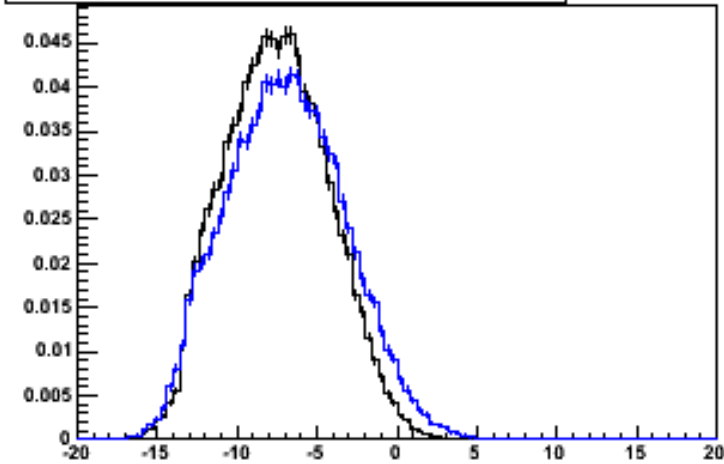
Overall SPDPS w.r.t. noSPDPS is significantly worse (mainly due to low momenta)
NB: absolute scale inaccurate (requires equalizing of signal/background momentum spectra)

CALO+RICH Electron misID(efficiency) with and w/o SPDPS

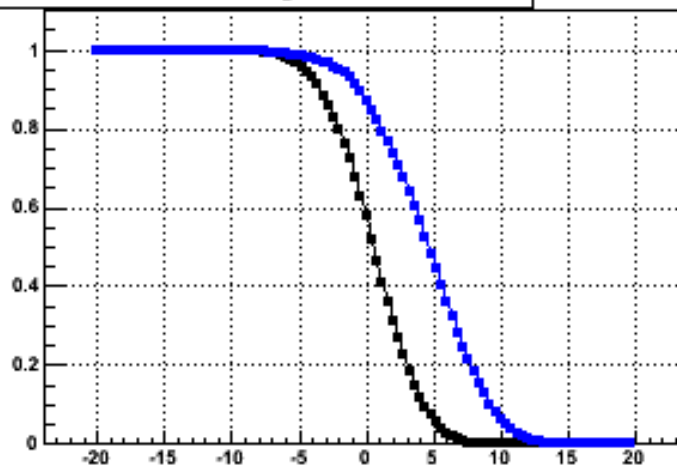
signal electrons vs. DLLe



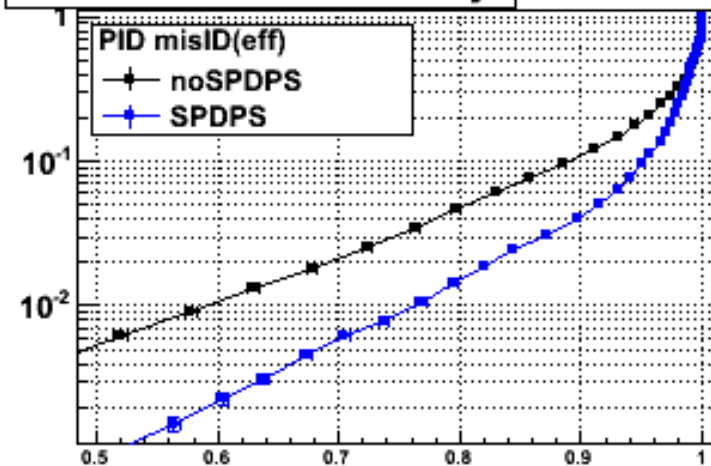
bckg non-electrons vs. DLLe



electron efficiency vs DLLe cut



DLLe: misID vs efficiency



NB: absolute scale inaccurate (requires equalizing of signal/background momentum spectra)