NCC pi0 simulation notes and how to run the simulations
Rich's areas

CVS areas
ncc code: offline/packages/ncc

Analysis code:offline/analysis/ncc_sim/nccpi0_1

workareas:
    nccsim
/direct/phenix+data08/FORWARD_UPGRADES/seto/simulationchain/work
    runjobs /direct/phenix+zdata03/phnxreco/ncc/seto/runjobs
    simdata
/direct/phenix+data08/FORWARD_UPGRADES/seto/simulationchain/work/simdata
    runall /mnt/disk2/seto/phenix/ncc/nccsim/setopi0/runall (local)

/direct/phenix+data08/FORWARD_UPGRADES/seto/simulationchain/work/work3/s
etopi0/runall (bnl)

You need
1) signal files
2) background files
BNL: nccsim/runjobs e.g. ppminbias
hijing

To produce these you need to
1) generate the siignal or background raw events (hijing, pythia etc)
a) signal files
typically these dont have to have a signal generated. PISA can do it
b) background files
BNL: nccsim/runjobs e.g. ppminbias
hijing - make_hijing_par.pl with produce hijing.par files
       - runhijing_bnl.pl with submit these to condor
       - output looks like hijingzeb.out
You can read these with a zebrea read file evtzeb2root in
event_gen/bin/linux/evtzeb2root

2) run it through PISA to get a PISAEvent.root
a) signal
nccsim/setopi0/pisafun/runallyallpt.csh will produce PISA files and then
run Fun4Muons_Pisa.C for pi0 singal in bins of pt and y
chic- in the nccsim/runjobs area under rvchic etc - again PISA provides
a generator - condorpisa.job
b) background runjobs/ppminbias/pisa/run_bnl.pl will make
subdirectories and submit jobs to condor

3) produce a dst using Fun4Muons_Pisa.C
a) signal pi0 -explained above
          chic - e.g. in rvchicnorth condorfun.job
b) background
  e.g. in runjobs/ppminbias/pisa/rundst.pl

Its nice to run the PISA and Fun4Muons_PISA in the same area since
PISA produces some files that Fun4Muons needs.

OUTPUT AREAS FOR SIMULATION/INPUT FOR ANALYSIS:
simdata - most of the signal
background - see /phenix/zdata03/phnxreco/ncc/seto/filelists
 which will have filelists for the background and macros to build them

there are macros to make the filelists too

4) do the analysis step which does
a) a merge between background and signal
b) analyze merged to produce real and mixed event histograms
c) analyze background only to produce background histograms
These are done (locally) in
~/nccsim/setopi0/runall
./ppmb/suballypt.csh will submit all merge jobs
./ppmb/back/subback.pl will submit all background jobs. You need
to run many more of these to get enough statistics. These use
filelist.txt which must be linked here

d) then you need to fit these to give S/B etc
i)first hadd all the background jobs to one file in ppmb/back
../../haddback3.pl - this will use the filelist to hadd all the jobs
togother
and put a histogram file in ppmb, where the fitter expects to get it
(ncc_pi0_b_allyallpt.root).

in ./ppmb ../drawallyallpt3.csh will run drawpi03.pl for all the bins of
pt
and y if you want. The nice thing about drawpi03.pl is that it will hadd
several bins together if you want.

It is here that the first manipulation of data files from phenix fits
and the luminosity is needed.

These produce
  - gif files of the fits and stuff
  - root files with some relatvant histograms
  - txt files which are used to make cross sections
all of these have a main file a lo file and a hi file
e) gather all bins and make a cross sections plot or whatever
  -to do this cat all files from one rapidity called main_info_Y1.0-1.5
_pt*.txt
into info.txt
  - now in ppmb
root ../drawppspec3.C
and get pp1.gif, pp2.gif, pp3.gif
the cross section, efficiency, signal to background etc.

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$\sigma^{pp}{}_{inel}$=42 mb

$E\,\frac{d^3\sigma}{d^3p} = \frac{1}{2\pi}\,\frac{1}{p_T}\,\frac{d^2\sigma}{dp_T\,dy} = 1.22\,x10^{-2}\,mb\,GeV^{-2}$ at pt=2-2.5 or p_T =2.22 (bin shift corrected)

$\frac{1}{\sigma^{pp}{}_{inel}}\,\frac{1}{2\pi}\,\frac{1}{p_T}\,\frac{d^2\sigma}{dp_T\,dy} = \frac{1}{2\pi}\,\frac{1}{p_T}\,\frac{d^2N}{dp_T\,dy} = \frac{1.22\,x10^{-2}\,mb\,GeV^{-2}}{42\,mb}$ (am I missing a factor of the multiplicity?)

$\frac{d^2N}{dp_T\,dy} = 2\pi\,p_T\,\frac{1.22\,x10^{-2}\,mb\,GeV^{-2}}{42\,mb} = 2\pi\,(2.22\,GeV)\,\frac{1.22\,x10^{-2}\,mb\,GeV^{-2}}{42\,mb} = 4.05\,x10^{-3}\,GeV^{-1}$

But I have used $\frac{d^2N}{dp_T\,dy} = \frac{1\,\pi^0}{(0.5\,GeV)\,(0.5)} = 4\,GeV^{-1}$

for the background under this, every event has a 2 GeV π^0 , so to correct this I need to use the background events only

I need to multiply the background events by a factor f= $\frac{4}{4.05\,x10^{-3}}$~1000 for this particular p_T bin

The factor gets much larger for higher p_T

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Now lets do an example. I will look at the pi0's in min bias pp events. I will look at the pt-2-2.5 bin. I embed 10K pi0s between y=1-1.5 and pt=2.-2.5 into pp min bias background and reconstruct the pi0's. I will call this the merge sample with Nmerge=10K. I also run just minbias background and I reconstruct 50K of these with Nbkg=50K. I will call this the background sample In both of these samples, I have a mixed bkg. In the merged sample, I have carefully made the mixed bkg to be a mixure of a gamma from a merged event and another gamma from a bkgd event. In the background sample, I simply mix two gamma from two different bkg events.

Now not every event has a pi0 between 2 -2.5 GeV. In fact I throw the events with 1 pi0 for every Delta pt = 0.5 GeV and Delta y =0.5, meaning I am throwing a

$\frac{dN}{dptdy} = \frac{1}{(0.5\,GeV)/(0.5)} = 4\,GeV^{-1}$. To figure out how many there should be in reality I figure out the dN/dpt/dy above and get $4.05\,x10^{-3}\,GeV^{-1}$. So for every merge event I need $f = \frac{4}{4.05\,X10^{-3}} \sim 1000$ background events

Now I will assume I get Ntotape = $1\,x10^9$ min bias events in a real run.

Now let me define some histograms

signal = merge 2gamma invariant mass with the background subtracted.

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