PHENIX technical note
09/07/00

How to run ZDC simulation in PISA

Quick Users' Manual

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1 Making an executable PISA program

To make an executable program from the latest version of PISA carry out the following procedures and commands at your terminal prompt (>).

1.1 Downloading files

Download the latest version of PISA from the official site. Get your access permission to PISA code:

```
> klog <username>
> password:  <AFS user password>
```

Copy the the source and data files to your own directory. The example below creates the directory `simulation/pisa2000` in your current directory into which a complete copy of the PISA file system will be transferred.

```
> cvs co simulation/pisa2000
```

1.2 Making executable

In the directory `simulation/pisa2000` created above go into `lib` and give the command `gmake` (like the example below) to compile and link the files into one executable program.

```
> cd simulation/pisa2000/lib
> gmake -f pisa.mk
```

Before each run of the program set the enviroment variables, if not yet set. For example:

```
> setenv CERNLIB /cern/pro/lib
> setenv DISPLAY rxterm.rhic.bnl.gov:0.0
```

1.3 Running a simulation

Change to the working directory as shown below. Specify your computer platform and the program name (`linux` and pisa in this case). Before starting the program edit the input file (see in Appendix A) entries belonging to ZDC. Set 'HBOO' in `pisa.kumac` to get histograms like that in Appendix B

```
> cd simulation/pisa2000/wrk
> linux/pisa
```

2 Appendix A

2.1 Input file parameters to set for ZDC

Files listed in the subsection titles can be found in the working directory `pisa2000/wrk` of PISA. Lines containing !!! comment indicate ZDC related information.

2.1.1 `gffgo.dat`

This is the standard Geant input file for PISA. Change the 2nd parameter of line 'GEOM' to set the experimental hall definitions (2 means ZDC is included). Set it to 0 if ZDC should be excluded from particle trackings (a smaller hall will be defiened).

```
GEOM    1 2 0 0 0 0 0         !!! INIT, ZDC, ....
AUTO    1                       ! GEANT automatic TMED parameter
SWIT    5 0 1 0 0 0 0 0 0       ! Compressed output
```

2.1.2 `pisa.kumac`

This is the standard kumac file for PISA. The last line belongs to ZDC. The example below shows a full setup configuration. Set any of the ON parameters to OFF if the corresponding detector should not be defined in Geant.

Set the 'HBOO' parameter of ZDC to ' ' if hbooking is not required during the simulation (PISA creates a separate hbook file `gintphnx.hbk` at the end of run). The last parameter in the ZDC line defines de magnetic field of the DX magnets in Tesla. Currently 1 fragmentation model is imlpemented in the program that is represented by the value 'FRG1' of the 6th parameter.

```
* Random number seeds
*
RNDM 001 0
*
* Tracking thresholds
*
CUTS  .001 .001 .010 .010 .010 .001 .001 1.e+4 1.e+4 .010 4.e-7
*
FOUT 'phnx.dat.cZ'              ! Name of output hits file
```

```
FPAR 'phnx.par'                 !  Namelist parameter file for geometry
STEE 'KINE' 'HITS' 'DIGI' 'JXYZ'! Output data structure control
DOUT 'DIGI'                     ! Output data structure control
MAGF 'QUAD' 1.00 0001 0.  0.  0.    !  Magnetic field map control
GEOP 'PIPE'
ANNI  1                         !  GEANT for annihilation on
BREM  1                         !  GEANT for bremsstrahlung on
COMP  1                         !  GEANT for Compton scattering on
LOSS  2                         !  GEANT for Landau fluct.  on
DRAY  0                         !  GEANT for Delta no ray
HADR  4                         !  GEANT for hadrons using FLUKA
MULS  1                         !  GEANT for mult.  scattering on
PAIR  1                         !  GEANT for pair production on
PHOT  1                         !  GEANT for photoel.  effect on
****************************************************************************
*
*       To install a detector turn the switch 'ON'
*
****************************************************************************
VER 'ON' 'FULL' 'P-ID' 'FULL' 'VCAL' 'STCK' ! MVD on with track stack
BBC 'ON' 'FULL' 'ETOT' 'FULL' 'BCAL' 'STCK' ! BBC on with track stack
ITR 'ON' 'IT96' 'ETOT' 'FULL' 'TRKS'        ! Latest Dch, PC1 vers.
CRK 'ON' 'FULL' 'P-PZ' 'FULL' 'CCAL' 'CO2 ' !  RICH with CO2 gas
PAD 'ON' 'PC98' 'P-ID' 'FULL' 'PCAL'        ! Latest version of PC2/PC3
TRD 'ON' 'FULL' 'P-ID' 'FULL' 'TCAL'        ! This is the TEC
TOF 'ON' 'FULL' 'P-ID' 'FULL' 'FCAL' 0.0 0.0!  Time of Flight
EMC 'ON' 'FULL' 'FULL' 'FULL' 'ECAL' 'AUAU' ! EMCal, H.I. with Cerenkov
MUM 'ON' 'FULL' 'ETOT' 'FULL' 'MCAL' 0.  0.  0.  'STCK' 'NNEU' !
MUI 'ON' 'FULL' 'ETOT' 'FULL' 'NCAL' 0.  0.  0.  'STCK' 'NNEU' !
ZDC 'ON' 'FULL' 'ETOT' 'FULL' 'ZCAL' 'FRG1' 'HBOO' 42.7 !!!
```

2.1.3 event.par

This is the standard event parameter file for PISA. ZDC has introduced line1 and 2 (`b_min, b_max`) to allow selection of impact parameter ranges (in fm's). Set parameter `north_south` to 0 or 1, according to only north or both directions are considered in the analysis. Rapidity, momentum, azimuthal and tilte angels below are set to usual values. This is a typical set of parameters that allow for almost the whole momentum domain of the produced or (event) generated particles.

```
$epar
b_min =  0.0,
b_max = 15.0,
y_min = -1.e+20,
y_max = +1.e+20,
p_min =  0.03,
p_max = +1.e+20,
pt_min = 0.00,
pt_max = +1.e+20,
the_min =0.00,
the_max =+180.00,
phi_min =-180.00,
phi_max =+180.00,
xyz0_input = 0.0, 0.0, 0.0,
vrms = 0.025, 0.025, 0.0,
north_south = 1,
nskip_evt = 0,
t0cent = 0.0,
t0width = 0.0,
$end
*************************************************************************
*
* Lines below show how one "includes" only pions using GEANT IDs
*
* iincl = +3,   (0 means all particles to include
* include = 8, 9, 7, 17*0,
*
*************************************************************************
```

3 Appendix B

3.1 Output files of ZDC

The output files that are related to the ZDC detector are the standard ROOT and HBOOK files of PISA (`PISAEvent.root` and `gintphnx.hbk`, respectively). The `.root` file contains all the hit information that belong to an event of a charged particle crossing a Cherenkov fiber, i.e., position, number of photoelectrons produced, momentum, time of flight, particle ID. The figure below has been created by PAW from the HBOOK file `gintphnx.hbk`.

To correlate ZDC results to the ones of other detectors contact the person responsible for the code of that detector.