Ampt_i: An Interface Between AMPT Heavy Ion Event Generator and Athena

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1 Introduction

This package runs Ampt event generator in Athena frameworkand puts the events into the transient store in HepMC format. Optional HepMC ascii output and original text outputs are also available.

AMPT (A Multi-Phase Transport model) uses HIJING for generating the initial conditions, Zhang's Parton Cascade (ZPC) for modeling partonic scatterings, the Lund string fragmentation model or a quark coalescence model for hadronization, and A Relativistic Transport (ART) model for treating hadronic scatterings.

The model is intended to give a coherent and realistic description of the dynamics of relativistic heavy ion collisions. In particular, the model describes well pseudorapidity and transverse momentum distributions of charged hadrons as a function of collision centrality at LHC energies. Detailed description of the model was published in Z.W. Lin et al., Phys. Rev. C72, 064901 (2005). The original AMPTcode is written in FORTRAN and uses text files as input and output.

2 Running Ampt

The Ampt event generator is run from jobOptions script, see for example,
Generators/Ampt_i/share/jobOptions_Ampt.py as follows:

```
athena  jobOptions_Ampt.py >& logfile.txt &
```

3 Input Parameters

3.1 Event Parameters

Parameter	Meaning	Default value
EFRM	$\sqrt{s}$	2560. GeV
Frame	collision frame	CMS
Proj	type of projectile	A
Targ	type of target	A
ATarg	target A number	197
ZTarg	target Z number	79
AProj	projectile A number	197
ZProj	projectile Z number	79
Bmin	minimum inpact parameter	0.
Bmax	maximum inpact parameter	14.6 fm (Min. Bias Au+Au)

3.2 EventVertex Randomization

Parameter	Meaning	Default value
randomizeVertices	flag to set up event vertex randomization	False
selectVertex	if true, fixed vertex is used. Vertex position is defined by Xvtx, Yvtx and Zvtx input parameters	False
wide	allow randoms off the beamline (out of the pipe	False
Xvtx	if **selectVertex** is True, this is vertex X position	0.
Yvtx	if **selectVertex** is True, this is vertex Y position	0.
Zvtx	if **selectVertex** is True, this is vertex Z position	0.

3.3 Miscellaneous Parameters

Parameter	Meaning	Default value
stringSwitch	Switch between standard AMPT (1) and string melting version (4)	4
writeHepMC	Switch to write out ASCII output in HepMC format	False
writeAmpt	Switch to write out original AMPT text output files	False
decayKs	Decay or not K-short	0 (do not decay)
decayPhi	Decay or not ϕ-meson	1 (yes)
decayPi0	Decay or not π^0	0 (do not decay)
iShadow	Flag to enable to modify nuclear shadowing (1=yes, 0=no)	0
dShadow	Factor used to modify nuclear shadowing	1.0
iPhiRP	Flag for random orientation of reaction plane (0=no, 1=yes)	0

To modify, for example, collision energy ($\sqrt{s}$), use the following lines in the jobOptions sctipt: *topAlg.Ampt.EFRM = 1000.;*

4 Random Numbers

Ampt_i is using the AtRndmGenSvc Athena Service to provide the necessary random numbers. Ampt_i is using two streams: AMPT_INIT and AMPT. The first stream is used to provide random numbers for the initialization phase of Hijing and the second one for the event generation. The user can set the initial seeds of each stream via the following option in the jobOption file.

```
AtRndmGenSvc.Seeds = [‘‘AMPT_INIT 2345533 9922199’’, ‘‘AMPT 5498921 659091’’]
```

The above sets the seeds of the AMPT_INIT stream to 2345533 and 9922199 and of the AMPT one to 5498921 and 659091. If the user will not set the seeds of a stream then the AtRndmGenSvc will use default values.

The seeds of the Random number service are saved for each event in the HepMC Event record and they are printed on screen by DumpMC. In this way an event can be reproduced easily. The user has to rerun the job by simply seting the seeds of the HIJING stream (the seeds of the AMPT_INIT stream should stay the same) to the seeds of that event.