1% CORSIKA events production for KM3NeT using GRID
CORELib

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Introduction

This preliminary production has been agreed together with the KM3NeT Simulations and Analysis Working Groups. The GRID computing infrastructure and the KM3NeT Virtual Organization have been used.

A limited production (~1% of the total foresaw by KM3NeT) has been made in order to fill 7 energy ranges of the primary proton:

Energy range (GeV)	Number of events
200-1000	10000000
1E3-1E4	10000008
1E4-1E5	1000002
1E5-1E6	100000
1E6-1E7	10000
1E7-1E8	1000
1E8-1E9	100

For each energy range a proper number of events has been set, in order to guarantee a proper statistical sample and to reproduce a spectrum similar to the one of cosmic rays. The selected energy spectrum has a power law with slope equal to -2.

Four different sub-production have been done changing the high energy interaction model each time, using:
- QGSJET01 with TAULEP option
- QGSJET01 with CHARM option
- QGSJETII-04 with TAULEP option
- EPOS LHC with TAULEP option

in order to determine the best choice in terms of computation time and quality of the production for the full production.

The version of CORSIKA used is the last currently (Apr 29 2016) avaliable: **7.5000**.

Compilation parameters

A list of the compilation parameters shared among the four sub-productions follows:
- Detector geometry: VOLUMEDET (zenithal angular distribution proportional to $\sin(\vartheta)$)
- Low energy hadronic interaction model: GHEISHA
- Optional features:
    - Curved atmosphere
    - Neutrino production

- Particle prehistory (i.e. particles mother and grandmother informations)

Datacard parameters

The following datacard parameters were used to configure CORSIKA. In addition, the SEED and ERANGE parameters have been set, run by run, with random integer numbers and the corresponding energy range limits, respectively.

Parameter name	Value (T = "True", F = "False")	Description
PRMPAR	14	particle type of primary particle (14 = proton)
ESLOPE	-2.	slope of primary energy spectrum
THETAP	0. 89.	range of zenith angle (degree)
PHIP	-180. 180.	range of azimuth angle (degree)
OBSLEV	0.	observation level (cm)
FIXCHI	0.	starting altitude (g/cm**2)
MAGNET	27.67 34.96	magnetic field above the Capopassero site (KM3NeT/ARCA)
HADFLG	0 0 0 0 0 2	flags hadronic interaction & fragmentation
ECUTS	1.E2 1.E2 1.E2 1.E2	energy (GeV) cuts for hadrons (w/o neutral pions), muons, electrons and neutral pions & photons, respectively
NUADDI	T	additional info for neutrinos
MUADDI	T	additional info for muons
MUMULT	T	muon multiple scattering angle
ELMFLG	T T	e-m interaction flags (NKG, EGS)
STEPFC	1.0	multiple scattering step length fact.
RADNKG	200.E2	outer radius for NKG lateral density distribution
LONGI	F 10. F F	longitudinal distribution & step size & fit & out
ECTMAP	1.E4	cut on gamma factor for printout
MAXPRT	1	maximum number of printed events
ATMOD	1	US Standard atmosphere as parametrised by Linsley
DEBUG	F 6 F 1000000	debug flag and log.unit for out (disabled)

Output files

A total number of 209 GRID jobs, corresponding to the same number of data files, have been executed. The events have been split in different runs in order to have output files with size less than about 1GB and computation time less than 1 week, according to dedicated preliminary study.
The output data files (total size ~210 GB) are stored on a GRID Storage Element (SE) and are available, via the SRM protocol in the following folder:

srm://se.scope.unina.it:8446/srm/managerv2?
SFN=/dpm/scope.unina.it/home/km3net.org/user/cpellegrino/corsika-75000/

See the attached "bookkeeping_corelib_2016-04-28.csv.gz" file for a detailed list of information for each run.