AraSim Document (unofficial version)

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I. INTRODUCTION

Making an manual for AraSim.

II. SETTINGS CLASS

Currently, there are 8 parameter values we can set for AraSim from Settings class. These variables are set as default values When class "Settings" is called, default values which shown on Table. I will be automatically assigned.

Name	Description	Default value
NNU	total number of neutrinos to generate	100
ICE_MODEL	1=depth dependent on index of refraction, 0=off	1
CONSTANTCRUST	set crust density and thickness to constant values	0
CPMSTAMTICETHICKNESS	set ice thickness to the thickness of ice	0
FIXEDELEVATION	fix the elevation to the thickness of ice	0
MOOREBAY	1=use Moore's Bay measured ice field attenuation length for the west land, 0=use South Pole data	0
EXPONENT	set single neutrino energy or neutrino flux model. More detail will be followed	19.

TABLE I: Parameter values for Setting class.

If you want to change any parameter values from default values, you can just set any new values at "setup.txt" file. In setup.txt file, all sentences starts with "/" will be neglected when AraSim read this file. So, you can leave any comments on setup.txt file. When you want to change any parameter value, just put the name of parameter and put "=" and finally put the value which you want. For example, if you want to change "NNU", just type

NNU=1000

in setup.txt file. You can change many parameters and the order of parameters are not important.

III. DETECTOR CLASS

Now, after you set the parameters as previous section, next thing we can look on is setting the detector. For now (091611), there are 3 options when we call Detector class. In AraSim.cc, there are variable called "mode" which decides which detector layout will be used.

Mode	Description	Reading file
0	Detector layout as testbed.	testbed_info.txt
1	Small number of stations	ARA_N_info.txt
2	Large number of ARA stations. Shape as pentagon.	ARA-37_info.txt

TABLE II: Mode description for Detector class.

Like in Settings class, Detector class also have default values and this default values can be modified by editing txt files mentioned in Table. II.

Parameter name	Description	Default value
core_x	x position of center of pentagon	0
core_y	y position of center of pentagon	0
R_string	Distance between center of pentagon and string	10m
R_surf	Distance between center of pentagon and surface antenna	60m
z_max	Total depth of string. There is an antenna at the bottom of string.	200m
x_btw	Distance between antennas on the string.	20m
number_of_stations	Total number of stations.	1
station_spacing	Distance between stations.	2000m

TABLE III: Mode 1 parameters which can be modified through ARA_N_info.txt file.

More detailed information about each mode is followed.

A. Mode : 0

In mode 0, AraSim will read testbed_info.txt file. In testbed_info.txt file, it sets total number of strings (number_of_string = 4) and location of all strings (x, y) and each antennas (2 antennas on each string, z). The value after the "z" indicates the model of the antenna. When number 0 shows after depth "z", it means the antenna is a v-pol bicone antenna while number 1 means the antenna is a h-pol bowtie-slotted cylinder antenna. The location for antennas are from Peter Gorham's spreadsheet.

B. Mode : 1

In mode 1, AraSim will read ARA_N_info.txt file. Mode 1 is for small number of ARA stations, from 1 to 7 stations. As the number of stations go up, the layout of stations will become pentagon with 2 stations on the side. (layout for 7 stations will be pentagon with 2 stations on the side) In ARA_N_info.txt file, you can set total number of stations (number_of_stations = 1), and distance between center of pentagon and strings (R_string), and distance between center of pentagon and surface antennas (R_surf). In the present version of AraSim, we can't change the number of strings and surface antennas in one station (4 strings and 4 surface antennas). And the layout of strings and surface antennas are following Fig. 1. We can only change the distances for now.

We can also change the center of pentagon. By default, center of pentagon layout is x = 0, y = 0. And in ARA_N_info.txt, you can change the the center location with parameters core_x and core_y. For example, you can set center of pentagon as x = 10m, y = 5m by

Parameter name	Description	Default value
core_x	x position of center of pentagon	0
core_y	y position of center of pentagon	0
R_string	Distance between center of pentagon and string	10m
R_surf	Distance between center of pentagon and surface antenna	60m
z_max	Total depth of string. There is an antenna at the bottom of string.	200m
x_btw	Distance between antennas on the string.	20m
stations_per_side	Total number of stations.	4
station_spacing	Distance between stations.	2000m

TABLE IV: Mode 2 parameters which can be modified through ARA-37_info.txt file.

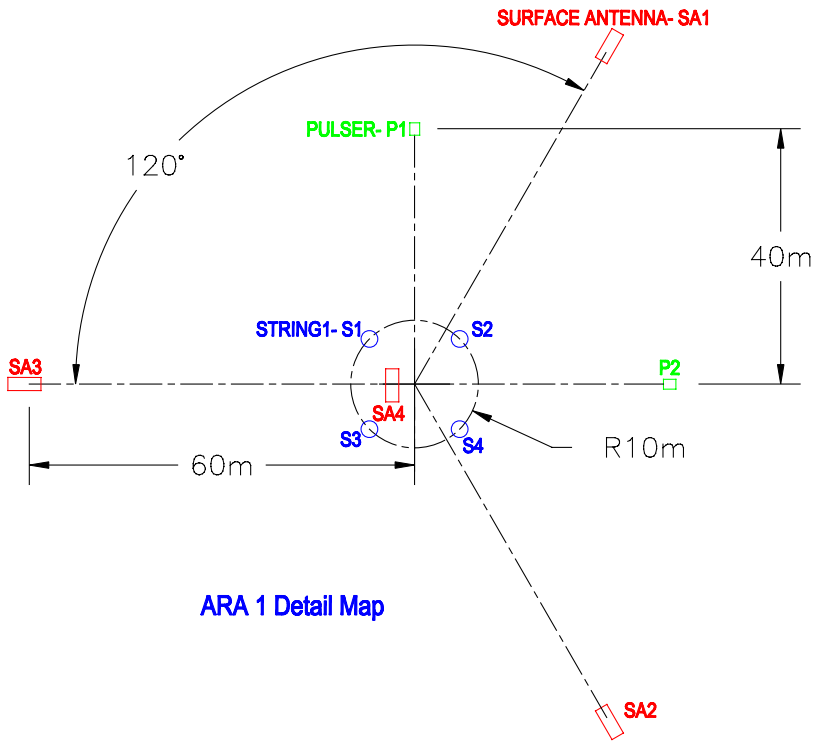

FIG. 1: ARA 1 detail map. Each ARA stations have same layout of strings and surface antennas.

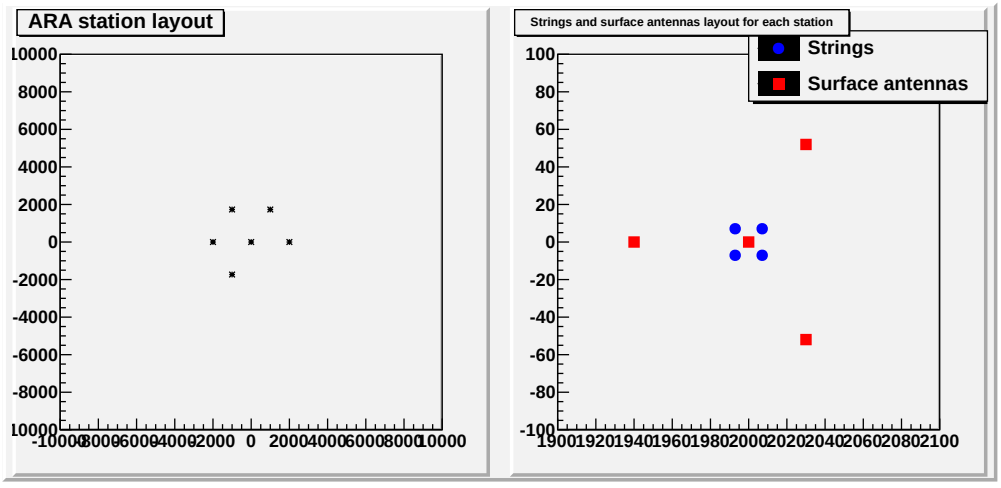

FIG. 2: Result of mode 1, 6 stations. Left : layout of stations. Right : layout of one station's string and surface antennas.

core_x = 10

core_y = 5

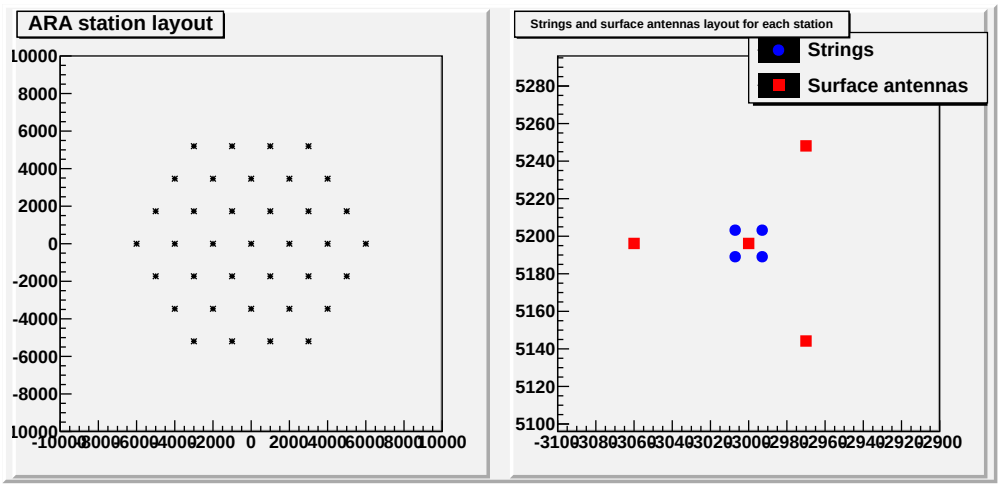

FIG. 3: Result of mode 2, default setting. ARA 37 station layout is shown on left plot, while layout of each station is shown on right plot.

C. Mode : 2

Mode 2 is for the case when there are numerous of stations. In Mode 2, layout of stations is always pentagon, and you have to set the number of stations on the side (number_per_side) which determinds total number of stations. Default value for the number of stations on the side is 4, which is the number for ARA-37.