NuTools - Feature #21185

Atmospheric flux rotation by default

10/18/2018 06:48 PM - Gianluca Petrillo

Status:	New	**Start date:**	10/18/2018
Priority:	Normal	**Due date:**	
Assignee:		**% Done:**	0%
Category:		**Estimated time:**	0.00 hour
Target version:		**Spent time:**	0.00 hour

Description

In short: the problem is that atmospheric neutrino fluxes are parametrised by angles respect to the zenith, and GENIE in its wisdom decides that the zenith is the direction of the *z* axis.
On the other end, LArSoft definitely sets *z* direction as the *beam* direction.
My request is for GENIEHelper to rotate the flux for us.

- first, NOvA should weigh in, in that if their *z* is toward the zenith, this request can be rejected immediately
- GENIE allows a rotation to be specified, and GENIEHelper passes one through from the configuration; the rotation that seems to do the trick is

```
[
  +1.0,  0.0,  0.0,  # new x axis in old coordinates
   0.0,  0.0,  1.0,  # new y axis in old coordinates
  -1.0,  0.0,  0.0   # new z axis in old coordinates
]
```

  this rotation swaps *y* and *z*, resulting in *z* pointing west and *x* pointing south (because *x* is not changed, and GENIE *x* points south).
- this request is for such a matrix being used by default by GENIEHelper when dealing with atmospheric fluxes, to be combined with the user-specified one.

Of course this is a breaking change that needs to be carefully pondered and well advertised.
Also of course, this does not fix the azimuth angle: in LArSoft *z* should point away from the beam source, usually not westward.
A new parameter (zFromSouth) might even be added to simplify this; if I am not mistaken, the transformation matrix would become

```
[
  +sin(zFromSouth),  -cos(zFromSouth),  0.0,  # new x axis in old coordinates
         0.0,                0.0,       1.0,  # new y axis in old coordinates
  -cos(zFromSouth),  -sin(zFromSouth),  0.0   # new z axis in old coordinates
]
```

with zFromSouth being defined as the angle respect to south (west is π/2) the beam comes from (in the [0,+π/2] range for DUNE, MINOS and NOvA).

Related issues:

Related to dunetpc - Bug #20034: prodgenie_atmnu	**Work in progress**	**05/28/2018**

History

#1 - 10/19/2018 12:47 PM - Gianluca Petrillo

- Related to Bug #20034: prodgenie_atmnu added