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CN2PY secondary beam line design
LAGUNA-LBNO

CERN Meeting

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Topics: Status of the new procedure to optimize the beam profile

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Work in progress:

- Automatize FLUKA input file generation & running
- Implement LBNO GloBES into optimization procedure
- Reduce CPU time by skipping neutrino tracking
- Find a good methodology for the optimization

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Work in progress:

- Automatize FLUKA input file generation & running — 90% DONE
- Implement LBNO GloBES into optimization procedure — 90% DONE
- Reduce CPU time by skipping neutrino tracking — 20% DONE
- Find a good methodology for the optimization — 0% DONE (But good ideas)

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Automatize FLUKA input file generation & running:

- Python scripts to generate input file and launching runs based on a set of parameters

- Flexible list:
  - can use 1 or 2 horns,
  - can change horn shapes continuously
  - can add any other necessary parameters

- Scripts to process data from FLUKA and generate the input flux files for GloBEs

- GloBES used as a black box:
  - inputs: spectra from 2 horn polarities x 4 nu flavours
  - Output: CPV sensitivity plot

```
arg_dict = {'input':"NA",
            'tgt_rad':4.0,
            'tgt_l':1.3,
            'tgt_p':0.0,
            'h1_v':1,
            'h1_i':220.0,
            'h1_z':300.0,
            'h1_r':83.8,
            'h1_z1':80.0,
            'h1_r1':3.49898,
            'h1_nz':3.0,
            'h1_nr':0.902378,
            'h1_r2':10.292,
            'h2_s':1,
            'h2_v':1,
            'h2_p':8.0,
            'h2_i':225.0,
            'h2_z':300.0,
            'h2_r':130.0,
            'h2_z1':97.6,
            'h2_r1':27.1166,
            'h2_nz':7.2,
            'h2_nr':4.11637,
            'h2_r2':27.0318}
```

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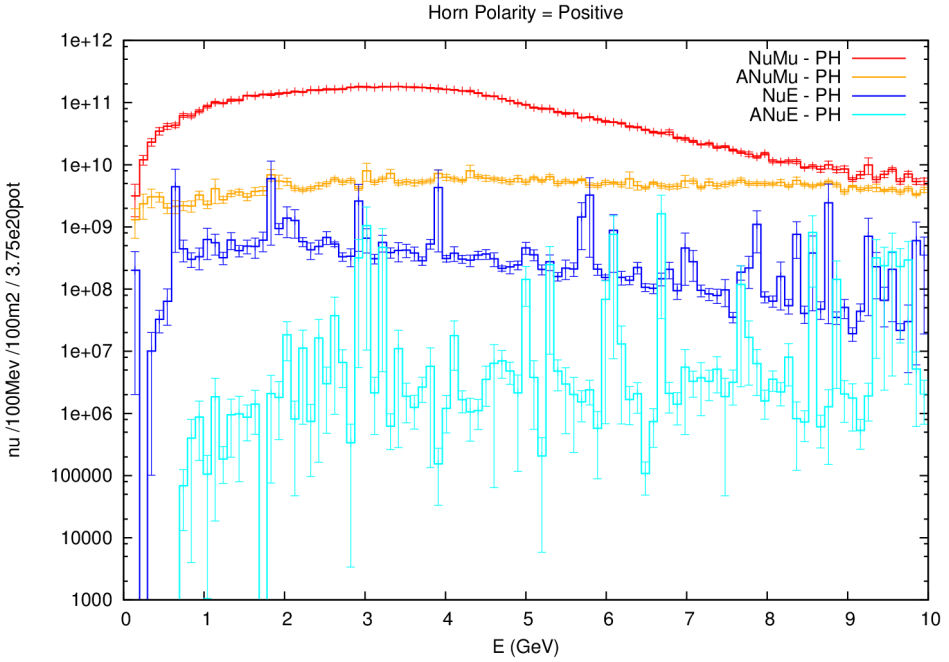
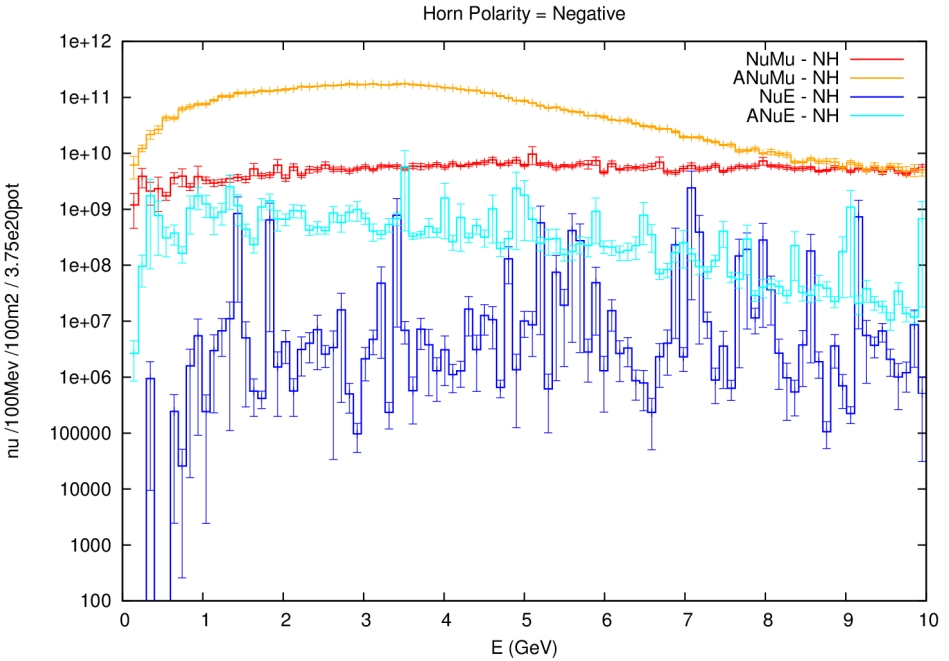
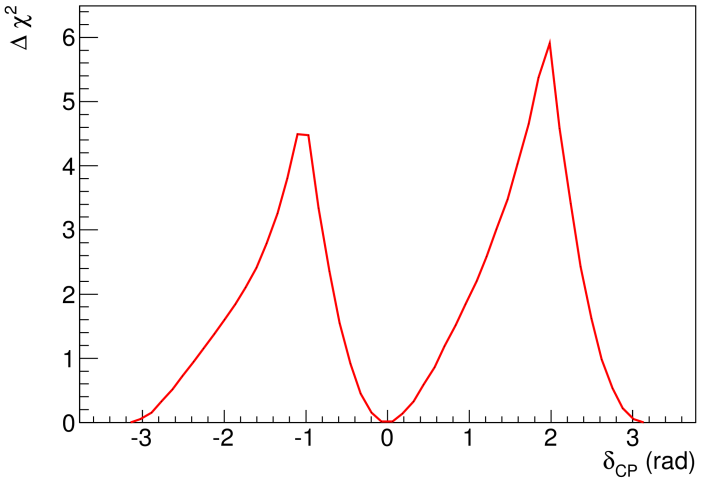
Implement LBNO GloBES into optimization procedure





SPS 1.5e20 pot/year * 10 years 75% numu 25%antinumu

-> globesjob.sh 1 standard_conf_PHF.root 7.5 standard_conf_NHF.root 2.5 1 outputfile



- **Reduce CPU time by skipping neutrino tracking :**
    - Score the status of secondaries after focusing
    - Compute the contribution from each secondary to the nu spectrum at FD based on its energy, position, and momentum direction
    - Add all contributions to generate a nu flux

- **Find a good methodology for the optimization :**
    - Suggestions from Vassilis: use “genetic algorithm”
    - Well suited for minimization problem of complex system with large set of parameters and making use of MC calculations
    - Available librairies in Python + Vassilis's help