MARS flux simulations - update

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Technical problems

- Detectors are small 0.75x0.75x0.05 cm$^3$

- Direct MARS simulations can not provide acceptable statistical accuracy in reasonable time (7x24 hours 16 CPU)

- Two ways to get small enough statistical errors:
  1. using large detector size
  2. pre-calculate sources for all detectors and run sources until get small statistical errors
Choice of methods

- Even with 20x20x0.1 cm$^3$ detectors statistical errors exceed 40% for one of detectors in run
- Jet vertical radius is determined by magnetic field:
  - 0 Tesla – 8.65 mm, 5 Tesla – 8.4 mm, 10 Tesla – 7.95 mm.
  Jet horizontal radius is same for round jet, but density is reduced.
  For elliptic jet horizontal radius is 0.25 cm$^2$/vertical radius.
  Ilias model is used to determine beam size as function of beam intensity
- Source terms were calculated for 7 setups:
  - elliptic jet, 0 Tesla, 0.25 Tp
  - elliptic jet, 5 Tesla, 16 Tp
  - elliptic rising radius jet, 5 Tesla, 16 Tp
  - round jet, 0 Tesla, 0.25 Tp
  - round jet, 5 Tesla, 16 Tp
  - no jet, 0 Tesla, 0.25 Tp
  - no jet, 5 Tesla, 16 Tp
Detector size in simulation

- All previous calculation were performed with large detectors. It is important to check how results depends on detector size.
- Simulations with large detector size (with reduced and/or real density) overestimate results obtained with real detector size.
- It is more simple to run jobs with real detector size and pre-calculated sources, then find acceptable large detector size.
Preliminary results

14 GeV/c proton on gravity affected mercury jet

Charged particle flux, no jet, 14 GeV/c
Conclusion

- Simulation of particle detector signals should be performed with real detector size.
- It looks like that difference of detector signals for round and elliptic jet are not small.
- Systematic problems with -20 degree detector still unclear.
- Simulation with 5 other inputs should clarify dependence of detector signals on magnetic field and beam intensity.
- Update of measured detector signals at 14 and 24 GeV/c and different magnetic fields and beam intensities is needed.