SPD benchmarks for choosing of the magnetic system

We want to measure (some of) the following processes:

- Drell-Yan pair production (muon and electron-positron ones);

- processes with prompt photons in the final state;

- processes with production of large p_T mesons and baryons (semi-inclusive and inclusive);

- light and heavy vector meson production.

For the above processes, we want to measure production asymmetries as a function of the polarization state of the colliding beams.

We consider two types of the magnetic system: solenoid and toroid.

For making a choice, we want to compare some distributions.

Initial particle distributions

Event generator: PYTHIA 6. Proton-proton interactions. SQRT(S) = 26 GeV, number of interactions: 10^7.

For further considerations, we take only particles, produced directly in the collision or in decays of short-lived resonances that exit the beam pipe and have energies above 100 MeV.

Beam pipe dimensions: R = 10 cm, L = infinite.

Distributions:

- charged meson multiplicity
- charged baryon multiplicity
- neutral mesons' multiplicity (besides π^0)
- neutron multiplicity
- π^0 multiplicity (albeit they do not leave the pipe)
- photon multiplicity
- muon and e^+/e^- multiplicities
- p, p_T, ϑ and φ distributions of charged mesons, per type
- p, p_T, ϑ and φ distributions of photons
- p, p_T, ϑ and φ distributions of muons and e^+/e^-

Then, we consider that the particles travel through a solenoidal or toroidal magnetic field:

- solenoidal (B= ?, field volume: R= ?, L = ?)

- toroidal (B= ? or field map ?; field volume: R= ?, L = ?, 6 or 8 coils with dimensions ... ?)

and (some of them) reach the front surface of the calorimeter (this surface in space still to be defined).

Distributions at the front surface of the EM calorimeter:

- charged meson multiplicity
- charged baryon multiplicity
- neutral meson multiplicity (if any)
- neutron multiplicity
- photon multiplicity
- muon and e^+/e^- multiplicities
- p, p_T, ϑ and φ distributions of charged mesons, per type
- p, p_T, ϑ and φ distributions of photons
- p, p_T, ϑ and φ distributions of muons and e^+/e^-
- E ϑ and φ distributions of electromagnetic showers produced by the e.m. interacting particles on their way to the EM Calo front surface
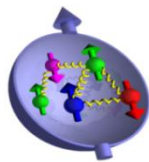
Benchmarks

- Ratios "**distribution at EM Calo surface / initial distribution**", in cases where they make sense, and **overall acceptance**.

- **We want also to have the same initial and final distributions and ratios for the Drell-Yan pairs produced in the interactions of (unpolarised,** for the moment**) proton beams** (separately for μ^+/μ^- and e^+/e^-) **and for prompt photons**.