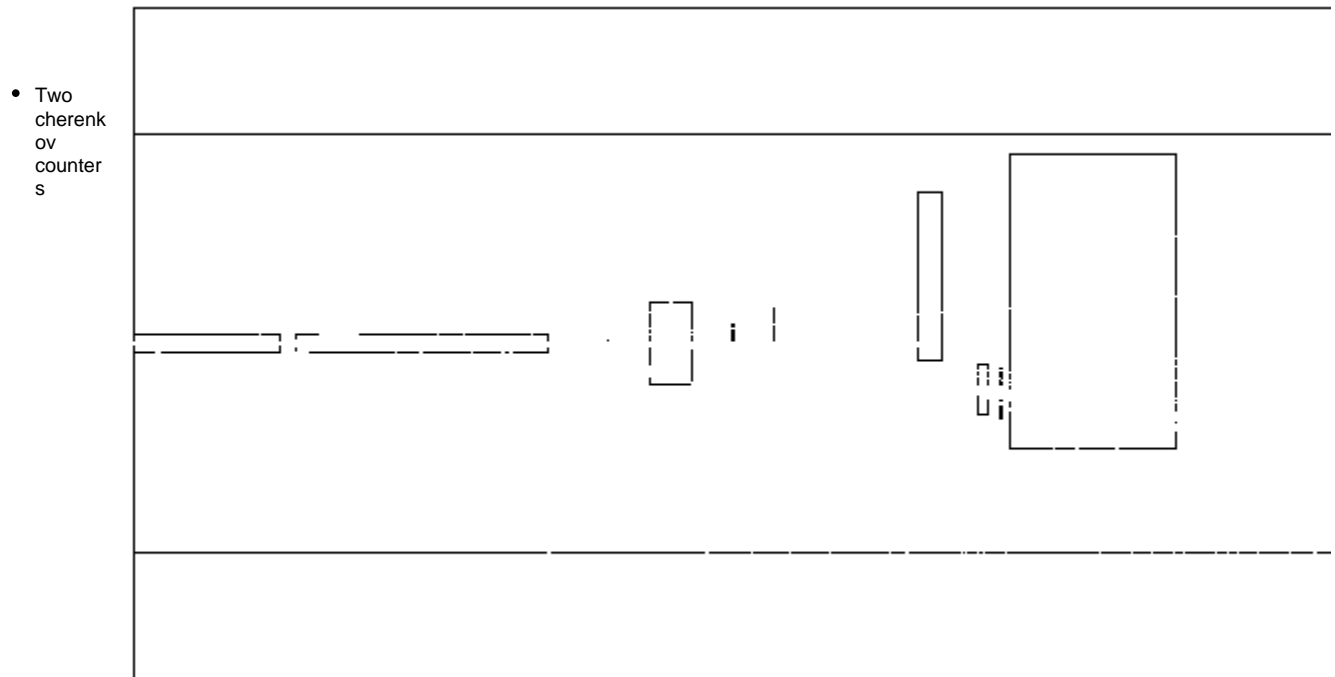# Changes to the generation of the Monte Carlo

I have worked on the code for the Geometry of the PS and SPS simulations. In particular I have added the following:

PS Runs:

The geometry for the positron runs is depicted in the following image:

- Two cherenkov counters
    - Size 5 and 3 m, 0.6 mm Mylar windows at the ends
    - Configurable pressure of the C02 gas (by default 0.1 atm), keyword: /Cern/detector/cherenkovpressure
- Plastic0 and Plastic1 detectors
    - spacing of the two detectors: 2 cm
    - 3mm wide Styrene
    - Size adjustable, typically: 1cm x 1cm keyword: /Cern/detector/triggerywidth and triggerzwidth
    - Position in X adjustable. keyword: /Cern/detector/triggerxpos
- Dump:
    - Position adjustable in x, y, z. keyword /Cern/detector/dumpxpos, dumpypos, dumpzpos
    - Can be moved out of the beam by putting the y-position to a larger value than 100 cm (that is the half-size of the dump in y)
- Annihilator:
    - Position adjustable in x, y, z. keyword: /Cern/detector/annihixpos, annihiypos, annihizpos
    - Can be moved out of the beam by putting the y-position to a larger value than 30 cm (half size of the annihilator in y)
    - Only to be used for the positron runs and the corresponding electron runs
    - Thickness according to blanket, thickness 12 cm (4 times the annihilator foil), density of the material enhanced by factor 10 to increase annihilation fraction
- Plastic2 veto detector
    - 1 cm wide Styrene, 60cm x 60 cm area
    - Position adjustable in x,y,z. keyword: /Cern/detector/vetoxpos vetoypos, vetozpos
    - Can be moved out of the beam by putting the y-position to a larger value than 30 cm (half size of the veto)
    - Can be used for vetoing the charged particles

Additional changes include:

1. Sampling position now from the plastic0 detector, then extrapolating the event back to the start of the beam line. This point is used for the start of the event.

From there the event is propagated through the geometry. Doing so enhances the probability of the particles hitting the trigger plastic0 detector (they do 100%
of the times if we switch off the multiple scattering on the way).

2. By adding the keyword /Cern/detector/positronrun 1 one can write out only the events that triggered plastic0 and plastic1 and did not leave a signal in plastic2.
   These are the events that we eventually are looking for in the positron runs (annihilation events).
3. Added an energy measurement for all the detectors in the beamline to the output. These can be used for cutting on the signals (e.g. requiring no energy measurement
   in the veto plastic2.
4. For the positron annihilation runs, we now decided to use the magnet according to Nicola's suggestion. Otherwise the background from high-energy bremsstrahlungs
   photons would be too high if we use the direct beam.

SPS runs:

Simpler geometry, we shoot directly into the detector. We have the following components:

- Cherenkov counter:

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  - Size 5 and 3 m, 0.6 mm Mylar windows at the ends

-
  - Configurable pressure of the C02 gas (by default 0.1 atm), keyword: /Cern/detector/cherenkovpressure
- Plastic 0 and Plastic1 detector
  - exactly like in the PS geometry