Requirements and design choices for the forward tracking

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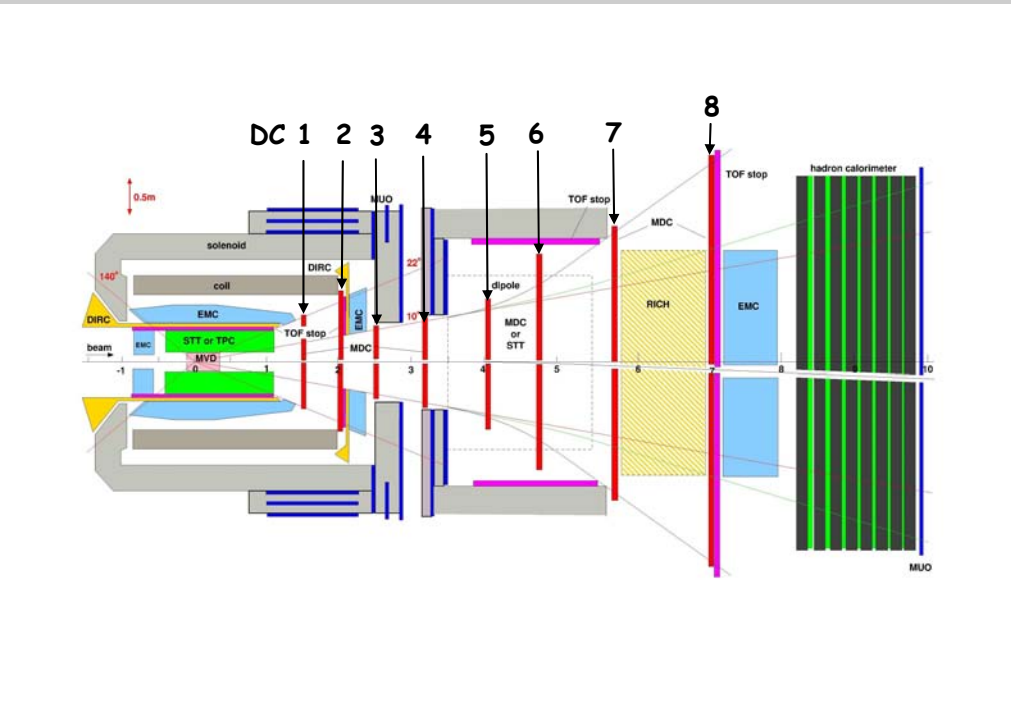


1. Requirements for TS forward tracking detectors

- Angular range: (5°,22°)
- The area $\theta < 5°$: non-sensitive
  (to keep the counting rate possibly low)
- Max. counting rate/wire for 1 cm cells: ~10^5/s (?)
  (will be determined for pbar-p processes using the DPM event generator;
  it has also to be checked for pbar-A interactions)
- Max. rate/cm^2/sek.: $0.7 \cdot 10^4$
  (for pbar-p processes, z=172 cm, x=15 cm (θ = 5°))

- Max. ageing: 0.2 C/cm/year
  (for gas amplification $5 \cdot 10^4$)

- Material budget for active area: < 0.01 X_0
  (comparable with the central tracker)

- Material budget of frame for $\theta < 5°$: ?
  (studies including geometry and material budget of the beam-pipe required)

- Multiplicity of tracks: a few/event
  (for pbar-p interaction)

- Double track resolution: 3 mm
  (typical achievable)

- Magnetic field: 2 T

- Non-uniformities of the field: ?
  (have to be determined for the present positions of the chambers, influence on the chamber performance has to be studied with GARFIELD)

- Momentum resolution: ~1%
  (resolution comparable with one of the central tracker)

- Pos. resolution per detection plane: σ=0.2 mm
  (intrinsic resolution + uncertainty of wire positions + uncertainty of calibration)

- Number of packages of detection planes and total extension in the z-direction: ?

(simulations needed; suggested simplified track and momentum reconstruction:

simulation of tracks including energy losses and multiple scattering in the detector volumes

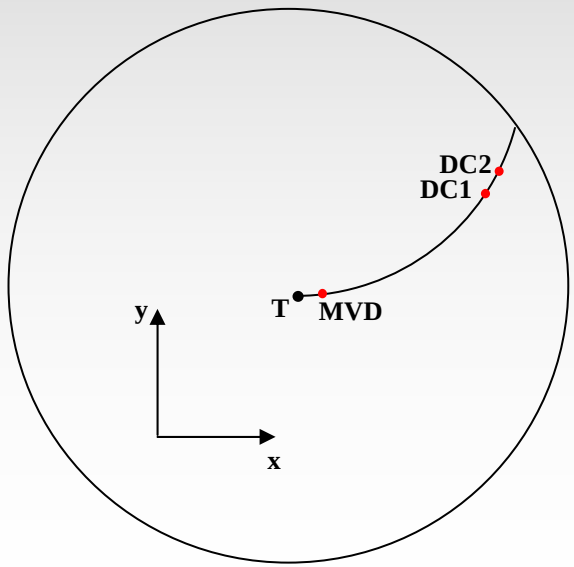
+ smearing of track positions in MVD, DC1, DC2,..

+ fit of a helix to the track positions)

Various scenarios:

- Space available for chambers: Δz=40 cm, 60 cm, 80 cm
- Number od detection planes: 12, 18
- Detection planes grouped in one, two, three packages

Figure of merit: $\Delta p/p(p,\theta)$



2. Requirements for FS tracking detectors

- Angular range: (~1.5°,5°-10°) (DC3, DC4)

  The lower limit (1.5°) has to be investigated in simulations of background (high rate) and of selected channels e.g. $\bar{p}p \rightarrow \Lambda\bar{\Lambda}$ (measurements at very forward angles))

- Max. counting rate/wire for 1 cm cells: ~10^5/s (?)

  (will be determined for pbar-p processes using the DPM event generator)

- Max. rate/cm^2/sek.: $0.9 \cdot 10^4$

  (for pbar-p processes, z=278 cm, x=7.3 cm (θ = 1.5°))

- Max. ageing: ~0.3 C/cm/year
  (for gas amplification $5 \cdot 10^4$)

- Material budget for active area: < 0.015 X_0 chambers
  + 0.015 X_0 air between D3 and DC8

- Multiplicity of tracks: 1-2/event
  (for pbar-p interaction)

- Double track resolution: 3 mm
  (not critical)

- Max. magnetic field along wires: 1 T
- Stray magnetic field: < 0.5 T
  (has to be checked with the current field maps and current positions of DC4 and DC7 chamber)
- Pos. resolution per detection plane: σ =0.3 mm
  (intrinsic resolution + uncertainty of wire positions + uncertainty of calibration)
- Momentum resolution: ~1%
  (has to be checked in simulations analogical to ones for the FS chambers)

Figure of merit: $\Delta p/p\ (p,\theta_h)$ where θ_h - angle with respect to the vertical symmetry plane

- Momentum acceptance of the tracking system
  (one of channels under study for definition of requirements is $\bar{p}p \rightarrow \Lambda\bar{\Lambda}$; simulations are needed to determine the acceptance)

Figure of merit: $A(p,\theta_h)$ where θ_h - angle with respect to the vertical symmetry plane

3. Design choices for the forward tracking detectors

- MDC with cathode wires
- MDC with cathode foils (Dubna design)
- Straw Tube Design

4. Criteria for design choices

- High rate behavior checked in tests of prototypes with accelerator beams
- Ageing rate - test of prototypes with radioactive sources
- Reliability (lack of problems with dead channels, broken or loosen wires etc.) checked in a long term (~0.5 year) test
- Compactness of design important in view of the limited space inside TS
- Material budget