

Simulations needed for the FT TDR

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- Requirements for the FT
- Detector optimization
- Track reconstruction
- Physics performance

Simulations needed to formulate requirements for the FT

Beam: pbar at 15 GeV/c,

Targets: H₂, interaction rate = 2x10⁷/s; N, Au; interaction rate = ?

1. **Counts/cm²/s** vs. distance r from beam axis at z-positions of the tracking stations
(*needed for estimation of the straw detector aging if the MIPs dominate*)
2. **Energy loss/ 1cm straw length/s** vs. **x-y coordinate** in FT1
(*estimation of the aging if the MIPs are not dominating*)
3. Distribution of **counts/s** over straws in one straw tube layer of each tracking station
(*estimation of occupancies in electronic channels*)
4. **Multiplicity of tracks** per event in FT1
5. **Distribution of momentum** of particles
 - a) emitted from the target in the angular range of FT (*useful for specification of required momentum acceptance*)
 - b) and passing through FT1
 - c) and passing through FT1+FT3
 - d) and passing through FT1+FT3+FT5

Detector optimization

Magnetic field in the dipole magnet fixed to e.g. 2 Tm
Muons generated from the target point

1. Tracking station **FT6 before or after** the forward RICH ?
(*comparison of the momentum resolution*)
2. **Inclination angle** of the skewed modules (5 deg. ?)
(*determination of resolutions for momentum components: $\delta p_x/p$, $\delta p_y/p$, $\delta p_z/p$, as a function of the inclination angle*)
3. **Required active area** of FT6 (but can be also checked for FT3, 4, 5)
(*intensity distribution in x-y plane at z-position of a given tracking station can be done e.g. with muons generated with various momenta e.g. 0.2, 0.3, 0.5, 1., 5., 10 GeV/c*)
4. Answer to the question if **FT3, 4 is needed or not**;
(*has to be based on analysis of selected benchmark channels*)

Track reconstruction

Fixed field in the dipole magnet e.g. 2 Tm

Muon tracks generated from the target point

- a. without pile up with background tracks
- b. with additional tracks coming from accidental coincidences with background events generated with DPM at the maximum pbar-p interaction rate. Time window = 130 ns (max. drift time), number of background events generated according Poisson distribution.)

1. Reconstruction efficiency as a function of emission angle at the target; can be checked for a few values of muon momenta
2. Momentum resolution as a function of absolute value of muon momentum
3. Resolution of azimuthal and polar angle reconstructed at the target point

Physics performance

Suggested benchmark channels

(essential from the point view of FT: high multiplicity of reaction products and/or strong forward peaking of produced particles)

a. $\bar{p} p \rightarrow \psi(4040) \rightarrow D^* D^* \rightarrow K^+ K^- \pi^+ \pi^- \pi^+ \pi^-$

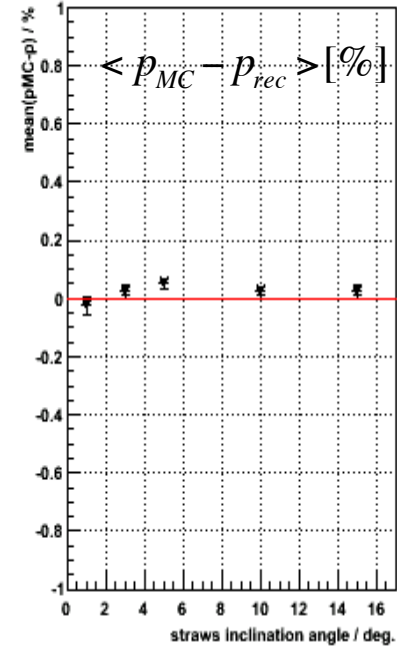
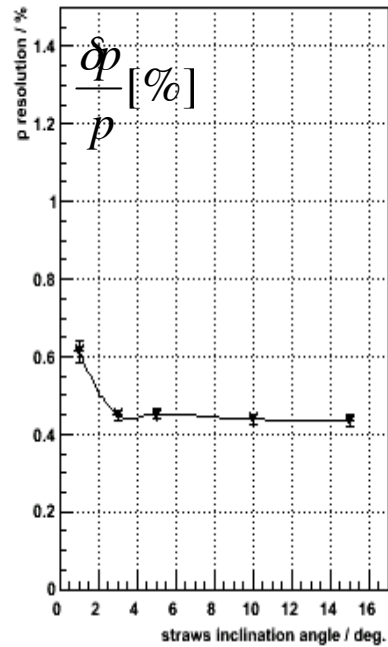
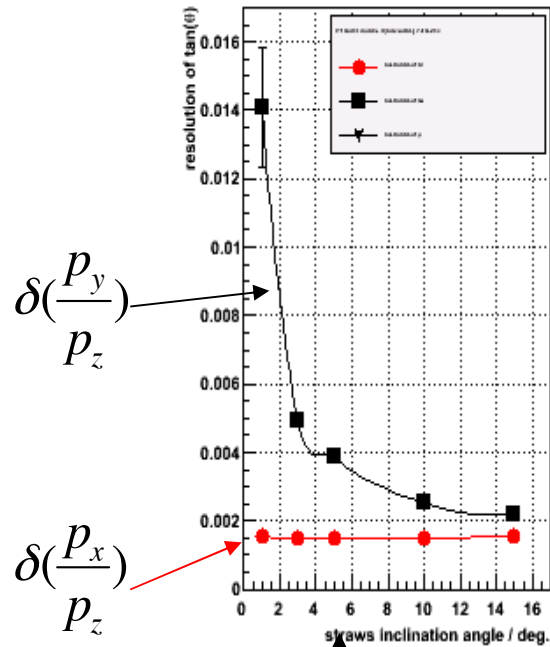
b. $\bar{p} p \rightarrow \Lambda \bar{\Lambda} \rightarrow \bar{p} p \pi^+ \pi^-$

1. Reconstruction efficiency without and with FT:
MVD+STT+GEM+FT vs. MVD+STT+GEM
2. Resolution of invariant masses

Backup slides

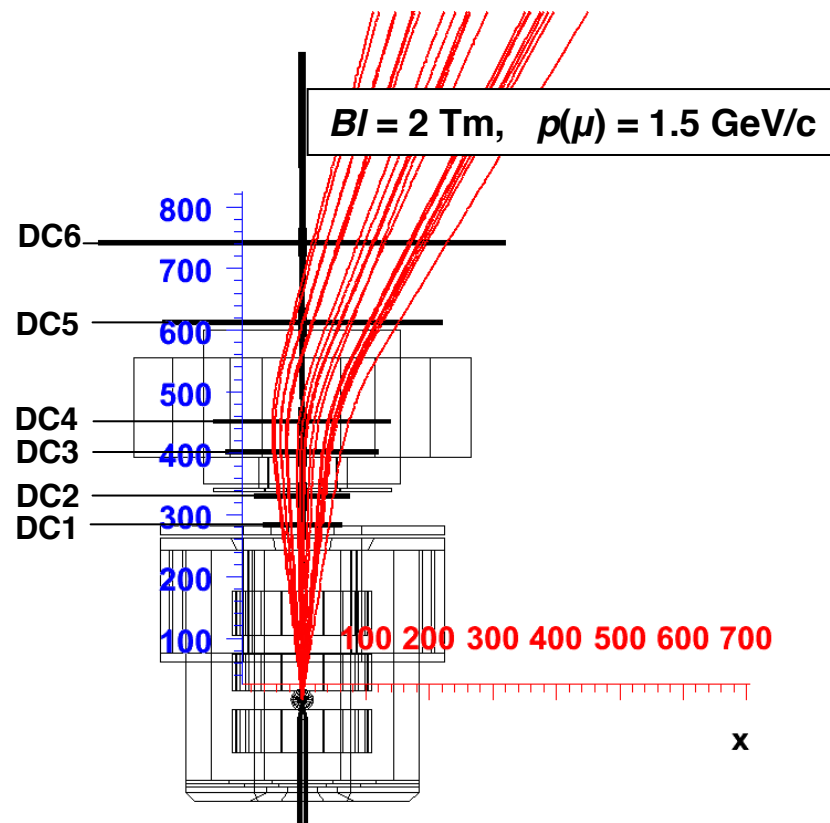
Choice of wire inclination

- Particles: 0.5 GeV/c muons
- Dipole magnet setting: for 7.8 GeV/c beam

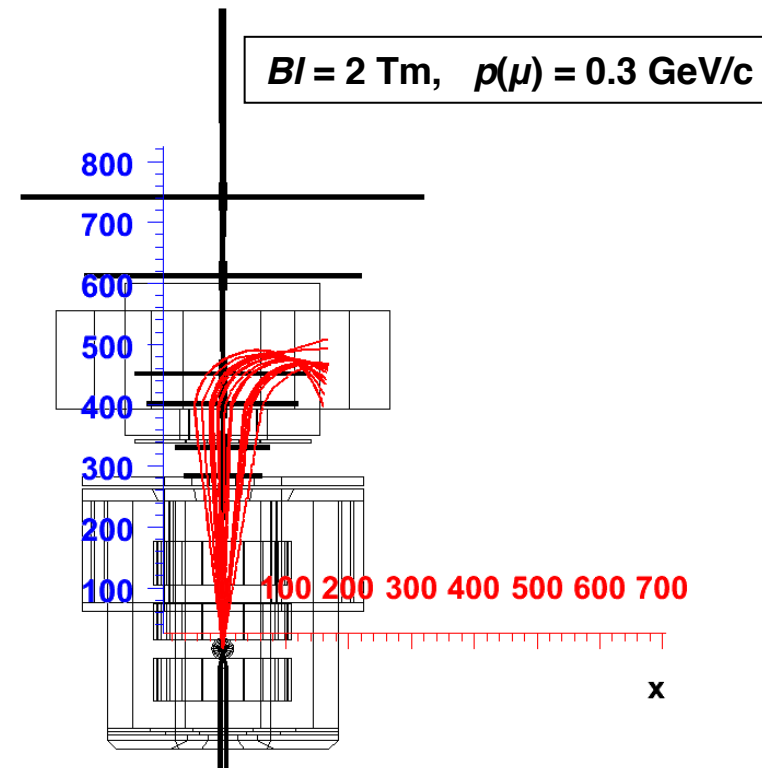


5 deg. inclination chosen

Momentum acceptance of the FS



Acceptance for $p > \sim 5\% (p_{beam})$



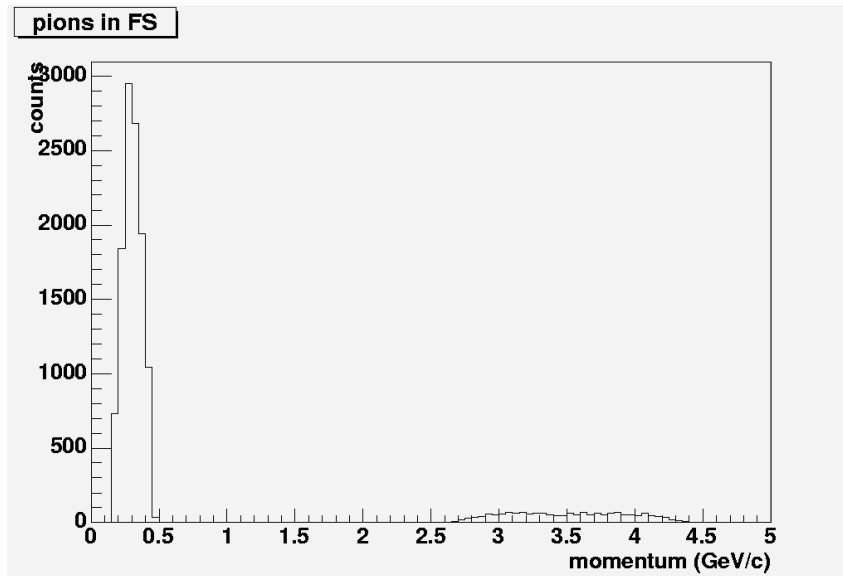
$\sim 5\% (p_{beam}) > p > 2\% (p_{beam})$

Simulations of $\Psi(4040)$ reconstruction

$$\bar{p}p \rightarrow \Psi(4040) \rightarrow D^{*+}D^{*-} \rightarrow D_0\pi^+ D_0\pi^- \rightarrow K^+K^- \pi^+\pi^-$$

$p_{beam} = 8 \text{ GeV}/c$, generated 11000 events,
for 9206 events, one or more particles in FS

Momentum spectra of pions in FS



Momentum spectra of kaons in FS

