TPG

- STRUCTURE: ROF, DEFT, HVF
- PARAMETERS: $\phi, L, X_0, v_d, (T=L/v_d), N, w$
- **expected** PERFORMANCES: $\Delta x, \Delta y, \sigma_z, \sigma_{pl}, \Delta p_{n}$
- "SIMULATIONS"... vuol sì così colà...
- SOFTWARE $\rightarrow$ *PR*, TF, TM $\leftrightarrow$ TOF, PI, P1
- Online DIAGNOSTICS

- TPG + TOF output for MICE
  - $P_1, P_2, \Delta E_{X_1}, \Delta E_{X_2}, \Delta E_{Y_1}, \Delta E_{Y_2}, P_{1x}, P_{1y}, P_{2x}, P_{2y}, t_1, t_2$

- TIME SCHEDULE
  - R&D, ROF, Tests, FEED, RF
  - HARP, Test, RAL, ROF
  - TPE, TPG1, TPG2

- Cost Estimates
  - Software, Design, Project, Materials, Inventory, Construction, Work
  - Intall., - Debugging, Test, Calib., Work

- TPG chapter x MICE proposal

- INTEGRATION

- Refs.
TPG Parameters

- Magnetic field: \( \phi \) Hexaboard and GEM
- Active Volume Diameter: \( \Phi \)
- Length: \( L \)
- Number of \( u, v, w \) strips: \( N \)
- Strip pitch: \( \rho \)
- \( z \) slices: \( N_z \)
- Gas thickness: \( X_0 \)
- Drift velocity: \( V_d \)
- Max drift time: \( T \)
- FADC sampling time: \( \delta_t \)
- Minimum thickness \( z \) slice: \( \delta z \)
- Gas: \( \text{He-}^4\text{CH}_4 \)
- Readout time: \( \text{ROT} \)

- \( B = 4 \text{ Tesla} \)
- \( \Phi _{\text{hexa}} = 30 \text{ cm} \)
- \( L = 100 \text{ cm} \)
- \( N_{\text{strips}} = 600 \)
- \( \rho_{\text{td}} = 500 \mu\text{m} \)
- \( N_z \geq 100 \)
- \( X_0^3 = 10^{-3} \text{(gas)} \)
- \( X_0^4 = 10^{-3} \text{ downstream foils} \)
- \( V_d = 1 \div 1.6 \text{ cm/\mu sec} \)
- \( T = 60 \div 100 \mu\text{sec} \)
- \( \delta_t_{\text{FADC}} = 100 \text{ nsec} \)
- \( \delta z = 1 \text{ mm} \)
- \( \text{He-}^4\text{CH}_4 = 90-10 \)
- \( \text{ROT} = 10^{-3} \text{ sec} \)
Fig. 1. Cross section of the KLOE detector.

Fig. 2. R–Z distribution of K₂ decay vertices.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Drift chamber performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Value</td>
</tr>
<tr>
<td>δ_r</td>
<td>200 μm</td>
</tr>
<tr>
<td>δ_z</td>
<td>2 mm</td>
</tr>
<tr>
<td>δ_p</td>
<td>0.5% × E</td>
</tr>
<tr>
<td>R(η,θ)</td>
<td>(1.59±0.3) × 10^{-6}</td>
</tr>
<tr>
<td>δM(θ,η)</td>
<td>1 MeV/c</td>
</tr>
</tbody>
</table>

The two end plates of the chamber are kept apart by twelve rods attached to an outer ring. Gas seal is completed by twelve panels which will be mounted after chamber stringing and an inner cylinder. This last is attached to the end plates via two rings at the center of the plates which also provide support for the low B insertion. Panels and inner cylinder carry no loads in our design. The chamber, with spherical end plates, built with either A– or C-fibers, can withstand the tension of ~50000 wires, with good transparency (≤0.1 X₀) to photons from π⁻ decays.

2.2. Gas choice

We have studied the performance of several helium gas mixtures, both with computer simulations [3] and with...
Fig. 2. Momentum resolution for Bhabha’s (left) and reconstructed invariant mass of $\phi \to K^+K^-$ (right).

Fig. 3. Reconstructed invariant mass of $K_S \to \pi^+\pi^-$ and $K_L \to \pi^+\pi^-$. 

fully satisfy design requirements thus allowing a clean observation of CP violating events and preliminary kaon decay studies.

Fig. 2. Momentum resolution for Bragg's law (left) and reconstructed invariant mass of $K^+ - X^-$ (right).
- Beginning of helix in $TPC_1$ measured by $TPG_1$ with $\delta t^{TPC_1} \approx 100\, \text{nsec}$, $\sigma_x^{TPG_1} \approx 150\, \mu\text{m}$

- $TOF_{\text{Hodo1}}$ gives time stamp with $\delta t^{TOF} \approx 150\, \text{psec}$ while $\Delta x \sim \Delta y \sim 1\, \text{cm}$ permits to check space correlation ($\sim 800\,000$ pads in $TPC_1$, $\sim 600$ pads in $TOF_{\text{Hodo1}}$)

- Similar for $TPC_2$ and $TOF_{\text{Hodo2}}$

**Track 1:**
- no kink in $TPG_1$ helix
- $x_1 > x_2$ $\sigma_{x_2} \approx 150\, \mu\text{m}$ from $TPC_1$
- $P_{1L_1}$, $P_{2L_1}$ $\Delta P_{1}/P_{1} \approx 10^{-2}$
- $(dE/dx)^{\text{Track1}}$
- $t_{xy_1}^{\text{Track1}} < 150\, \text{psec}$ $\Rightarrow$ $TOF_{\text{Hodo1}}$

**Track 2:**
- Similar from $TPC_2$ and $TOF_{\text{Hodo2}}$
MICE prong ID with TPGs + TOF_{HOPA}

- No Decay $\leftrightarrow$ no kink in TPG$_1$ and TPG$_2$

- X-ray short track in TPG$_5$

- X-ray conversion pair $e^+, e^-$ with short tracks and high winging angle $\theta \approx 2\pi$

- $e^-$ $\frac{(dE/dx)_{e^-}}{(dE/dx)_{\mu, \pi}}$ for $p > 200$ MeV/c

- TOF !!! $\frac{(dE/dx)_{1}}{(dE/dx)_{2}} = \frac{(dE/dx)_{1of2}}{(dE/dx)_{2of2}}$

- $\mu/\pi$ TOF !!! $\frac{(dE/dx)_{1}}{(dE/dx)_{2}} = \frac{(dE/dx)_{1of2}}{(dE/dx)_{2of2}}$

... consequences ...

1) data
2) more to come
MICE-TPG chapter in MICE proposal

1 Introduction
2 TPG chamber
  2.1 Architecture
  2.2 Structure
  2.3 Design
3 TPG electronics
4 TPG read-out and DAQ
5 TPG ancillary equipment
  5.1 Low and High voltage system
  5.2 Gas system
  5.3 Calibration
6 TPG Software
  6.1 Introduction
  6.2 Pattern Recognition
  6.3 Track finding
  6.4 Momentum measurement
7 HARP-TPG test-bed
8 MICE Nightmares test
9 Cost estimates
10 Schedule
F. Sauli, NIM A 306 (1997) 531
NIM A 461 (2001) 47
E. Costa et al., Nature 411 (2001) 662
A. Calcetta, KLOE Collab., NIM A 367 (1995) 104
M. Adinolfi et al., KLOE Collab., NIM A 461 (2001) 25
S. Bachmann et al., Vienna Conf. Feb. 01
C. Altunbas et al., CERN-EP/2002-008 → NIM A
D. Karlen et al., http://www.physics.ucsb.edu/~karlen/gem