Fun4All and EicRoot TPC

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Fun4All TPC Digitization

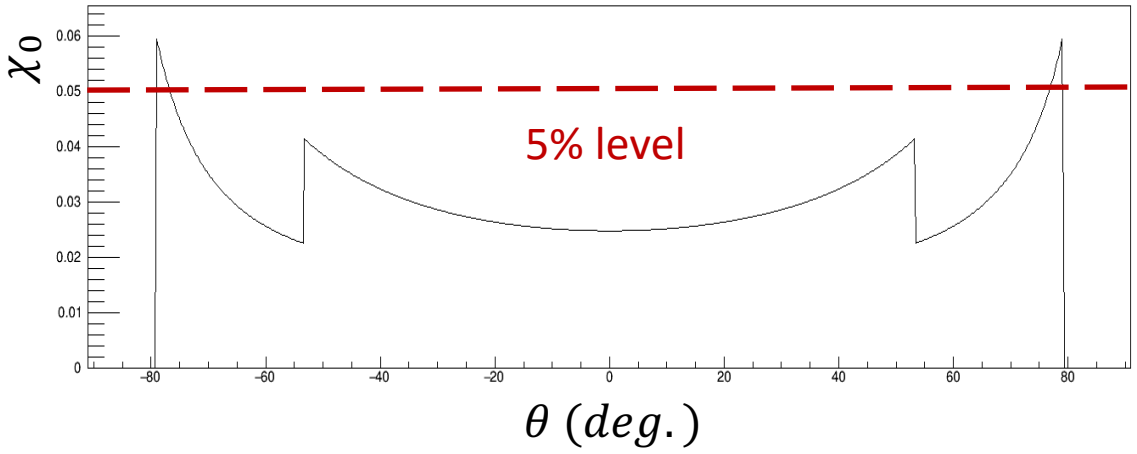
- Fun4All TPC: https://github.com/sPHENIX-Collaboration/macros/macros/G4_Svtx_maps_ladder_....C
- Slow simulation mode carries out full TPC simulation
  - Gas volume
  - Ionization energy loss
  - Generate initial ionizations
  - Parameterization drift for each ionizing electron
  - GEM amplification simulation
  - readout mapping
  - Signal shaping/noise… (based on SAMPA)
  - Cauterization, truth association and performance evaluation
  - Full pattern recognition and fitting

➢ *"Fast Tracking Simulation"* uses resolutions
  - **Radial resolution = 1 cm, phi-res = 200 μm, long-res = 500 μm**

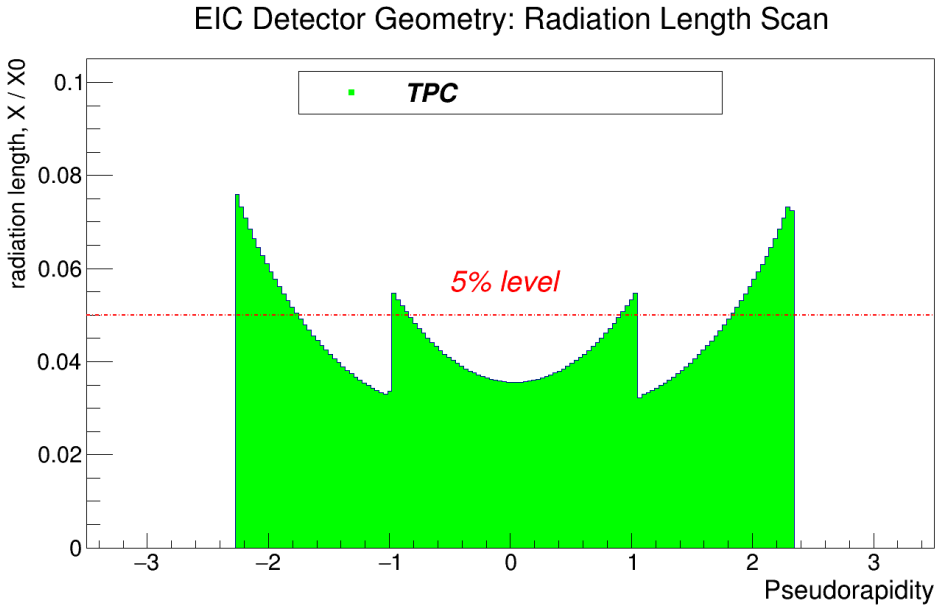
Fun4All TPC Material

- *"Fast Simulation"* TPC material scan ($\theta = 0^0 \rightarrow 90^0$ to beamline)
- Differences in materials are understood

Fun4All TPC



EicRoot



* Endcap material not included

Fun4All TPC Materials

- Active Gas layers (Fun4All)
  - 16 layers per section, each layer 1.25 cm thick
  - Inner: 20-40 cm
  - Mid: 40-60 cm
  - Outer: 60 – 78 cm
  - Gas *sPHENIX_TPC_Gas* : Ne(90%) CF4(10%) - defined in g4main/PHG4Reco.cc
- Support material (Fun4All)
  - Inner/outer cage: $L = 211\ cm$, $\chi_0 = 1.13\%$ (Kapton + carbon fiber structure)
  - Inner field cage R = 20 cm, Outer field cage R = 78 cm

Fun4All vs. EicRoot TPC Material

	Fun4All	EicRoot
Inner Field Cage	χ_0 = 1.13% (3.23 mm Kapton)	Carbon Fiber (3.4 mm) + Kapton (0.150 mm) + Al (0.050 mm) ($\chi_0 = 1.52\%$)
Outer Field Cage	χ_0 = 1.13% (3.23 mm Kapton)	Carbon Fiber (3.4 mm) + Kapton (0.150 mm) + Al (0.050 mm) ($\chi_0 = 1.52\%$)
Central Membrane	X	Kapton (0.100 mm) ($\chi_0 = 0.035\%$)
Endcap	X	13.4 mm ($\chi_0 = 15.3\%$)
Gas	NeCF4 90-10 ($\chi_0 = 207\ m$)	ArCF4iC4H10 (χ_0 =105 m)
Total	$\chi_0 \approx 2.5\%$	$\chi_0 \approx 3.6\%$ (endcap not included)

- Fun4All
  - Kapton: χ_0 = 286 mm
- EicRoot Materials
  - Carbon Fiber: χ_0 = 241.5 mm
  - Kapton: χ_0 = 284 mm
  - Al: χ_0 = 87.5 mm

- Totals are consistent with minimum seen in material scans

Fun4All Next Steps

- Define realistic TPC parameters for EIC
  - Meeting with TPC experts on Monday to start discussion
  - Including support materials
- Are there any studies available on backgrounds, in particular neutrons?
- Implement track extrapolations to various surfaces in fast track simulation evaluation