Gaseous Detectors Group

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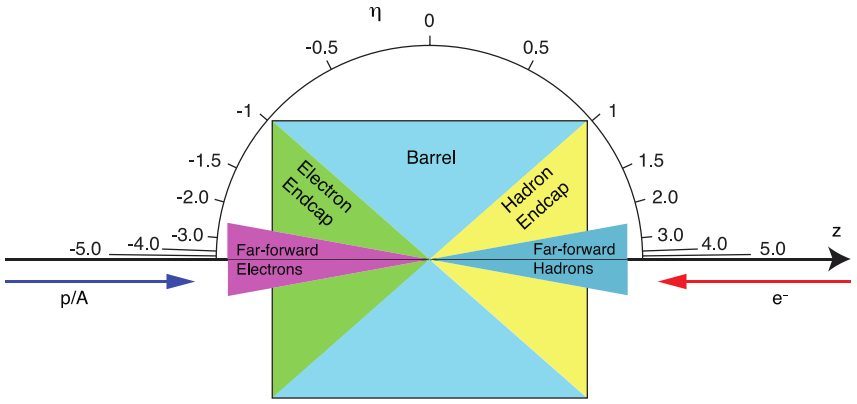
Gaseous Detector Group: EIC Requirements for Central Tracker

Barrel Main Tracker

- ❑ Hermetic coverage, close to 4π acceptance
  - ⇨ pseudo-rapidity range up to +/-1)
  - ⇨ Large area detectors
- ❑ Low material budget on the level of 3-5% of X_0/X for the central tracker region
  - ⇨ Gaseous detectors
- ❑ Tracking momentum resolution in few % range



http://eicug.org/web/sites/default/files/EIC_HANDBOOK_v1.1.pdf

Forward and Backward Trackers

- ❑ Coverage in the end cap
  - ⇨ pseudo-rapidity range up to +/-1 to +/-2.5
  - ⇨ Large area detectors
- ❑ Low material budget specially for the electron endcap
  - ⇨ Gaseous detectors
- ❑ Tracking momentum resolution in few % range
  - ⇨ 50 μm space point resolution **desirable** for high P (> 50 GeV) in the hadron end cap

EIC Detector Requirements

η	Nomenclature			Tracking			Electrons		π/K/p PID		HCAL	Muons
				Resolution	Allowed X/X_0	Si-Vertex	Resolution σ_E/E	PID	p-Range (GeV/c)	Separation	Resolution σ_E/E	
-6.9 — -5.8	↓ p/A	Auxiliary Detectors	low-Q^2 tagger	$\delta\theta/\theta < 1.5\%$; $10^{-6} < Q^2 < 10^{-2}$ GeV^2								
…												
-4.5 — -4.0			Instrumentation to separate charged particles from photons				2%/√E					
-4.0 — -3.5												
-3.5 — -3.0		Central Detector	Backwards Detectors	$\sigma_p/p \sim 0.1\%\times p + 2.0\%$	~5% or less	TBD		π suppression up to 1:10^4	≤ 7 GeV/c	≥ 3σ	~50%/√E	
-3.0 — -2.5												
-2.5 — -2.0				$\sigma_p/p \sim 0.05\%\times p + 1.0\%$								
-2.0 — -1.5							7%/√E					
-1.5 — -1.0												
-1.0 — -0.5			Barrel	$\sigma_p/p \sim 0.05\%\times p + 0.5\%$		$\sigma_{xy} \sim 20$ μm, $d_0(z) \sim d_0(r\phi) \sim 20/p_T$ GeV μm + 5 μm	(10-12)%/√E		≤ 5 GeV/c		TBD	TBD
-0.5 — 0.0												
0.0 — 0.5												
0.5 — 1.0												
1.0 — 1.5			Forward Detectors	$\sigma_p/p \sim 0.05\%\times p + 1.0\%$		TBD			≤ 8 GeV/c		~50%/√E	
1.5 — 2.0												
2.0 — 2.5									≤ 20 GeV/c			
2.5 — 3.0				$\sigma_p/p \sim 0.1\%\times p + 2.0\%$								
3.0 — 3.5									≤ 45 GeV/c			
3.5 — 4.0	↑ e	Auxiliary Detectors	Instrumentation to separate charged particles from photons									
4.0 — 4.5												
…												
> 6.2			Proton Spectrometer	$\sigma_{intrinsic}(|\vec{u}|)/|\vec{u}| < 1\%$; Acceptance: $0.2 < p_T < 1.2$ GeV/c								

Gaseous Detector Group: Needs, Goals & Deliverables

Rich and diverse field Gaseous Detectors technologies will satisfy the requirements for the central tracking in the central and forward regions of an EIC detector as rate is not a limiting factor, large area capabilities and low material with requirements such as space point resolution and efficiency are possible with these technologies

Review of available Technologies for EIC

- ❑ State of the art of gaseous detector technologies
- ❑ Investigate alternative technologies beyond those currently under consideration within EIC detector R&D program
- ❑ Encourage groups to join and participate to the Tracking-WG
- ❑ Broad range of gaseous detectors technologies suitable for complementarity between two general purposed EIC detectors
  - ⇨ scope of program like eRD6

Physics input & Simulation Need

- ❑ Detector requirements input from the Physics WGs
- ❑ Integration of tracking detector into EIC simulation frameworks **(Annalisa slides)**
  - ⇨ **Input:** Coordinate with and provide input to the simulation group
  - ⇨ **Output:** Study detector response and derive key performances to optimize the detectors design

Detector R&D (Targeted vs. Generic)

- ❑ Evaluate maturity for gaseous detectors to satisfy EIC requirements
- ❑ **Targeted R&D:** Status and timescale for completion for a day-1 EIC
  - ⇨ scope of program like eRD6
- ❑ **Generic R&D:** Identify areas to benefit EIC sciences in the future
  - ⇨ scope of program like CERN RD51 for MPGDs

Gaseous Detector Group: To Do List

- Define list of tasks and timeline for completion
  - Detector Technologies (R&D, Integration, services …)
  - Simulation needs and outputs
- Identify areas of interest for groups and assign tasks
  - Start the discussion at next week meeting on people's interest and commitment to contribute to a successful Yellow Report.
- Coordinate the effort between different task and groups
  - Tracking Group weekly meeting, Google groups, Workshop …

Tracking WG needs your enthusiastic contributions and your expertise.

So please join and spread the word around to help enlarge the community for a successful outcome for the Yellow Report in a year from now