EIC-dRICH

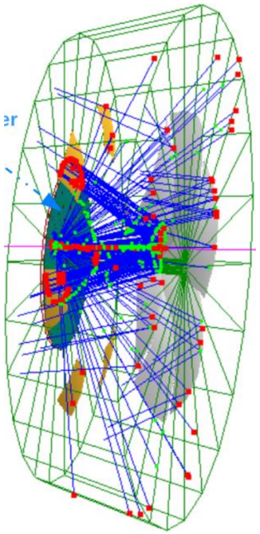
A. Del Dotto, E. Cisbani, M. Contalbrigo, Zhiwen Zhao

EICpid meeting

07/Jan/2019

Outline

- **Few highlights from FY18 activities:**
  - **Global pID in dRICH**
  - **Performance in «realistic physics» case**
  - **Toward a prototype implementation**
- **FY19 plan and funding**



Inverse Ray-Tracing

IRT based global reconstruction

Nt : tracks (+ background «dummy track»)
Nh : photon hits

Nr : radiators (aerogel and gas)
Np : potential particle types (e,pi,K,p)

PID problem:
associate to each track a particle type (based on some sort of Likelihood)

Global «brute force» approach: explore all possible combinations of:

Track ∈ Particle type : Np^Nt

Photon hits ∈ (Track ⊗ Radiator + Background) : **(Nt*Nr+1)^Nh**

Each combination has a Likelihood; take the one that maximize the Likelihood

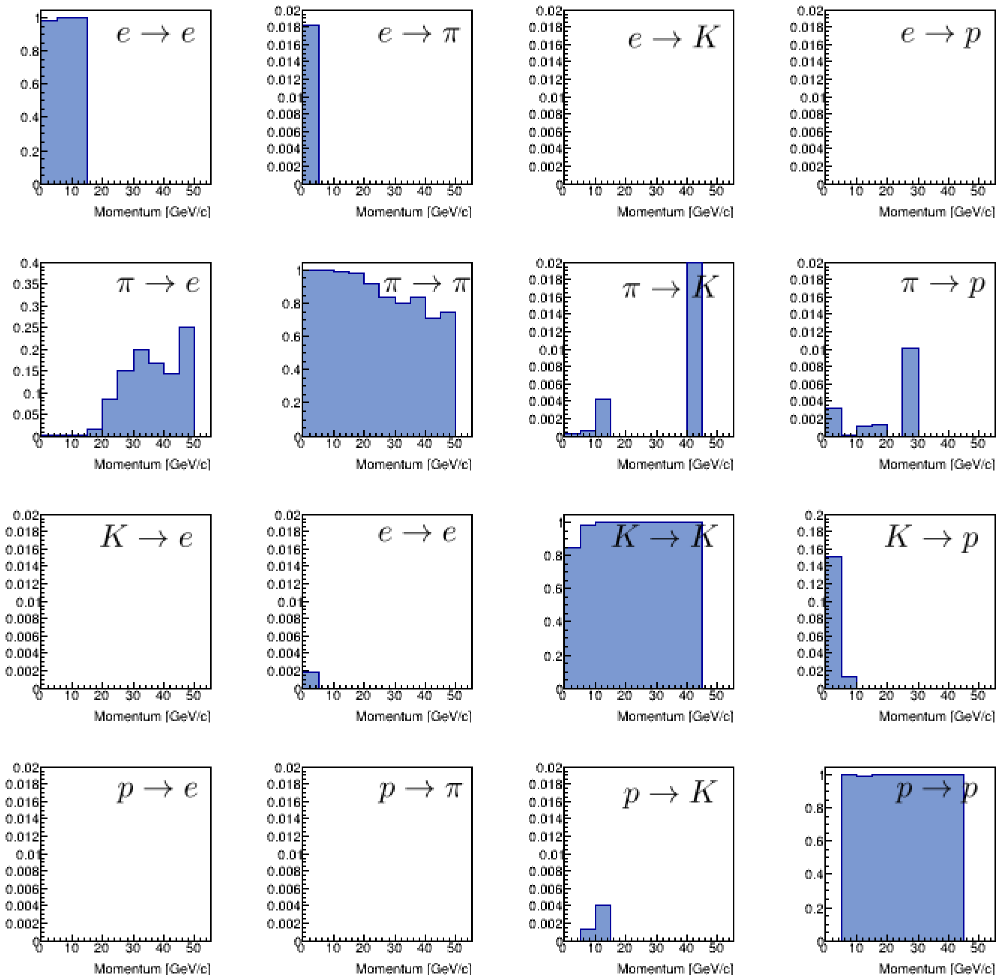
Example: 2 tracks, 15 hits → up to ~488 billion combinations ! … *need a reduction strategy*

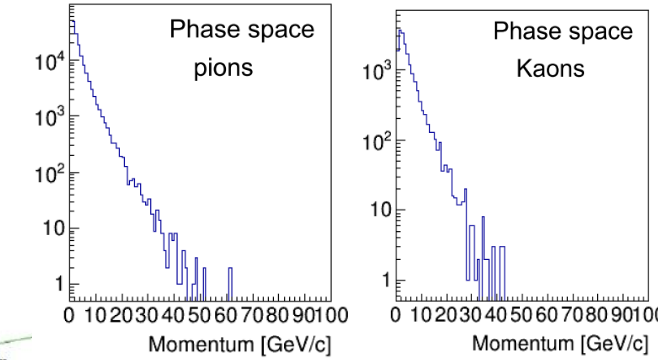
Our approach (on each event):

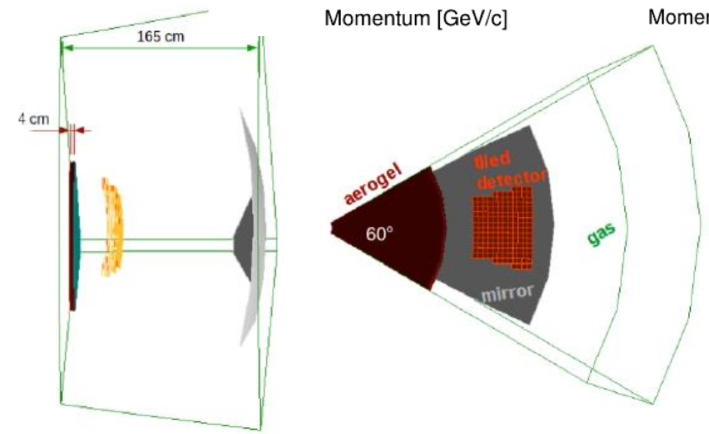
1) Determine (by IRT) the possible emission angles corresponding to each photon hit
2) Sequential association of photon hits to (tracks ⊗ radiator) based on Likelihood (L1) on emission angle and with a-priori probability (depending on previous associations); number of combinations drops to **(Nt*Nr+1)*Nh**
3) Once all hits are associated, estimate a global Likelihood (L2) for each (track ∈ particle) combination; choose the combination with max L2

(in the above example we need to evaluate 1200 combinations)

dRICH in realistic (SIDIS) physics context & global PID







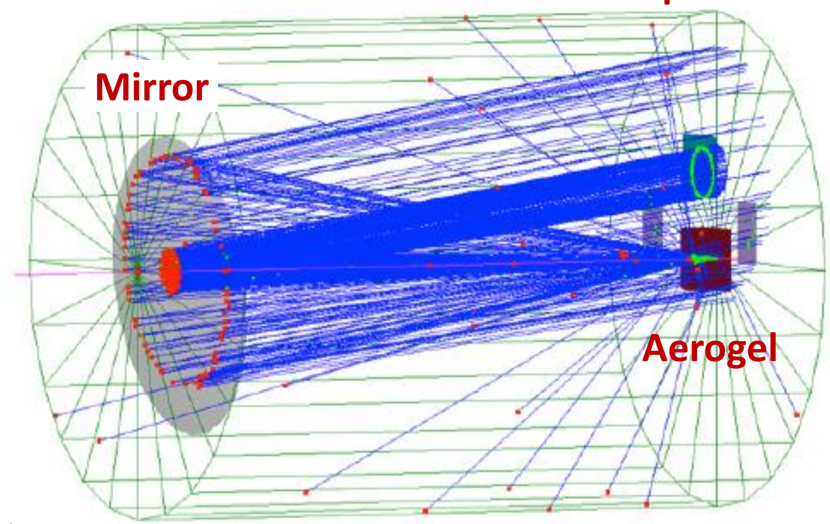
one of the six dRICH sectors

Momentum Threshold (GeV/c)		
Particle	Aerogel (1.02)	C2F6 (1.0008)
e	0.003	0.013
pi	0.694	3.49
K	2.46	12.3
p	4.67	23.5

The PID capability fulfill the design goal in realistic multiplicity

dRICH Prototype

Why: **evaluate critical aspects of the proposed solutions; tune relevant parameters used in MC and consolidate the estimated performances**



The prototype must:

- mimic the performances of the proposed dRICH components, minimizing modeling and assumptions
- be cost effective (trade-off between small scale, versatility and measurable quantities)

The preliminary prototype vessel is a cylinder ~1 m long and ~0.3 m radius (with a spherical mirror of ~2 m radius); driven by two main considerations:

1. **reasonable (order of 10) photoelectrons for the gas** ring per particle; this number depends almost linearly on the thickness (**length**) of the gas and therefore of the vessel.
2. **catch the aerogel ring (20 cm radius)** in order to estimate its angular resolution; this constraints the **transverse size** of the vessel.

At the same time we need to minimize vessel volume, sensor area…

… going to start the detailed definition

(m+)dRICH FY19 plan & funding

	T1	T2	T3	T4	Funding (USA+ITA) kUSD (1€ ~ 1USD)		
Finalize the event based (global) IRT reconstruction (article!)					Post Doc	Mat erial	Travel
Design the small scale prototype							
Implement the prototype						4.2	
Study the interface between gas and aerogel (and long term aerogel characterization, if able to get samples!)						1.5	
(m+d)RICH: consolidate design and test SiPM sensor matrix with proper cooling and thermal stability; setting up the lab laser test bench for characterization (also for irradiation campaigns); follow SiPM ongoing development toward rad hard solutions					30*	3*	2.5*
(m+d)RICH: implement Hawaii (SiREAD) + JLab/CLAS12 readout on chosen front-end; integration/test of the JLab backend and SiREAD						2*	

* (m+d)RICH

Important components (electronics and sensors) of the dRICH prototype MUST be shared with the mRICH development
CLAS12 infrastructures available in Ferrara will be used for aerogel-gas studies