EIC-dRICH update

(annual report)

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EICpid meeting

10/Dec/2018

dRICH FY18 activities

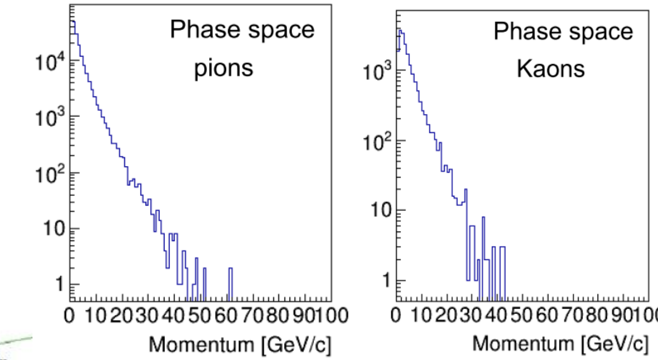
Proposed

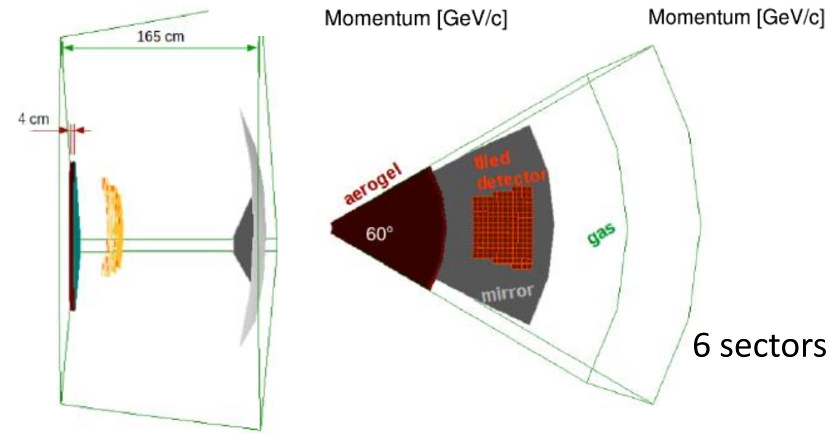
1. Study of a physics channel of interest to the EIC in the presence of physics backgrounds.
2. Evaluation of the dual-radiator RICH performance in such an extended (physics) context.
3. Adapt the dRICH for the geometry currently used in the BNL concept detectors (as well their magnetic field maps) to allow a direct comparison with the eRD6 gas RICH (ePHENIX).
4. Work on the dRICH prototype: activities can range from testing of key concepts as part of the mRICH activity, to a full realization of the dRICH prototype, which could then be tested in parallel with the mRICH (**NOT FUNDED**)

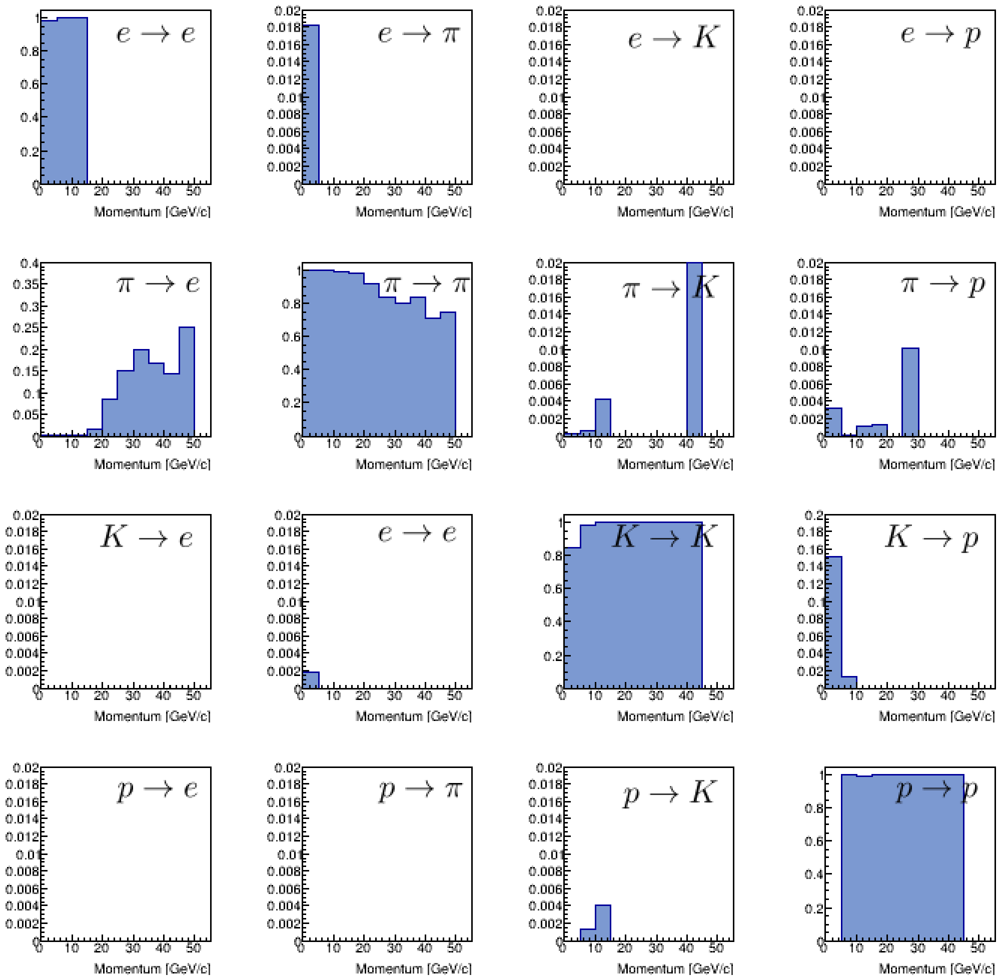
Achievements (first 5 months of 2018, mostly)

1. Baseline definition of the dRICH completed (issues on main components addressed)
2. An event based IRT reconstruction approach has been defined and implemented
3. PID performances tested in one physics channel (SIDIS) of interest for EIC
4. Shorter version of the dRICH suitable for ePHENIX implemented in GEMC
5. The dRICH analysis framework adapted to investigate the gas ePHENIX RICH
6. Developed dRICH codes in: https://github.com/EIC-eRD11/dualRICH_inMEIC

dRICH in realistic (SIDIS) physics context







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

FY19 Funding for dRICH (and mRICH)

Funding from DOE (kUSD):	**31.2**
Postdoc (shared with mRICH):	~30
Prototype components:	~1.2
Funding from INFN (keuro):	**10.2**
dRICH prototype mechanics:	3
dRICH gas & aerogel:	1.5
(m+d)RICH SiPM and cooling system:	3
(m+d)RICH electronics (opt. rdout board):	2
Travel: (m+d)RICH:	2.5

Marco Contalbrigo is coordinating the (m+d)RICH activities;
groups involved from Ferrara, Roma and Catania

(note: ITA-FY19 starts January-2019,
which rougly corresponds to DOE/BNL effective funding fruition start)

dRICH FY19 plan

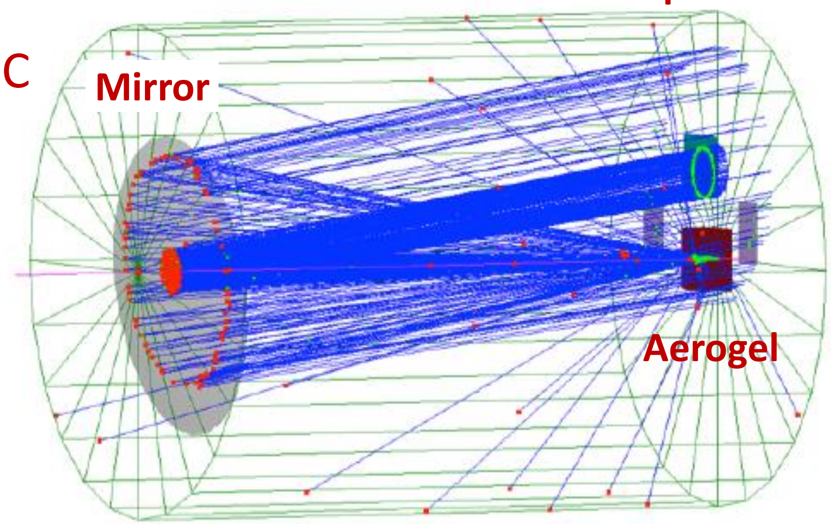
USA FY19 ↓ ITA FY19 ↓

	T1	T2	T3	T4
Finalize the event based IRT reconstruction (article!)				
Design the small scale prototype				
Implement the prototype				
Study the interface between gas and aerogel (and long term aerogel characterization, if able to get samples!)				
(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 development toward rad hard solution going on for large experiments.				
(m+d)RICH: implement Hawaii (SiREAD) + JLab/CLAS12 readout on chosen front-end; integration/test of the JLab backend and SiREAD				

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

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 proposed prototype vessel is a cylinder ~1 m long and ~0.3 m radius (with a spherical mirror of ~2 m radius); this derives from 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