Status update of IRT 2.1 code adaptation to ePIC software stack

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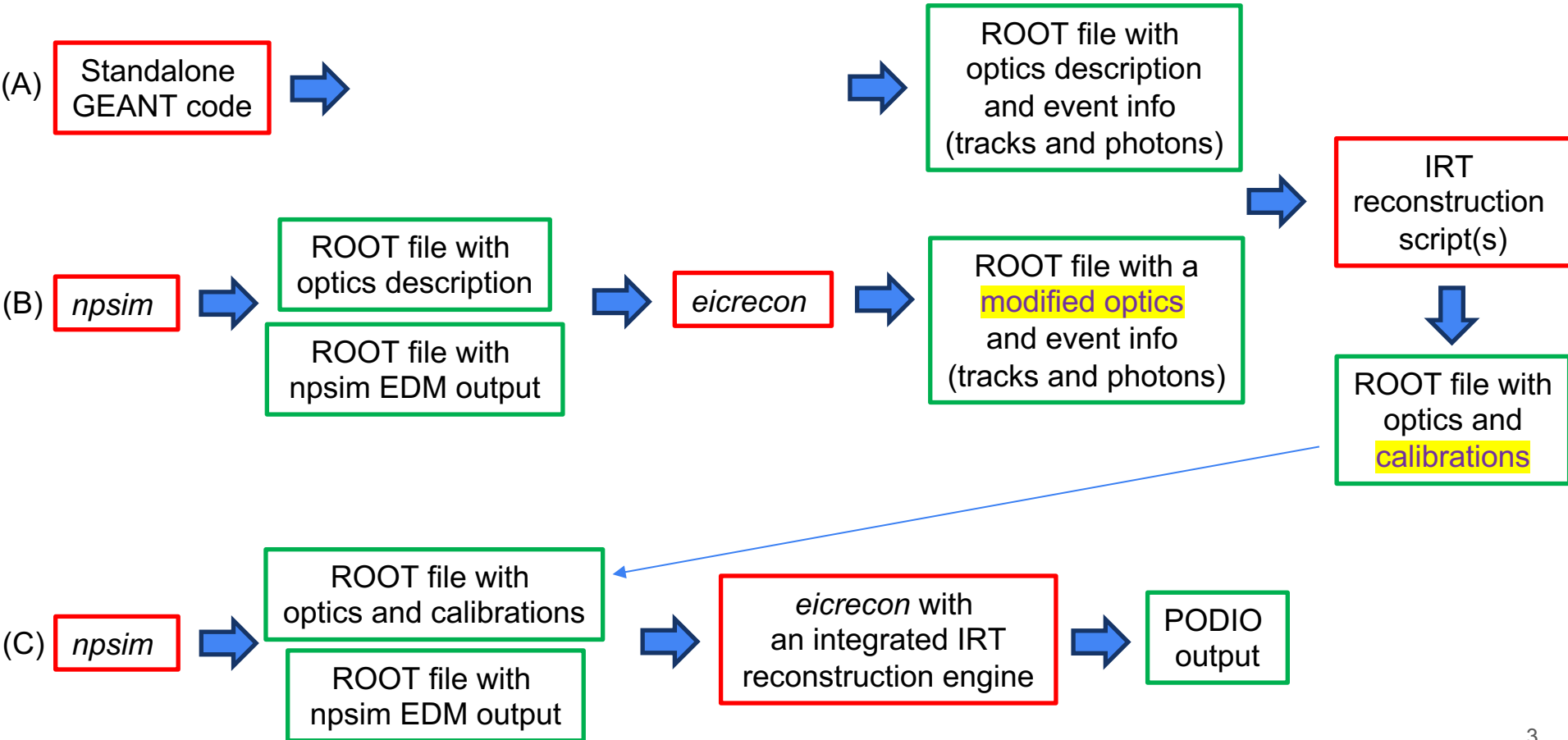
Progress since the JLab meeting

➢ IRT 2.0 -> 2.1a (08/06/25) -> 2.1b (09/22/25)

- ➢ Codes "re-based" against *EDM4eic*, *epic* and *EICrecon* repositories by hand
- ➢ Shown to work with a 25.07.0-stable (Aug) and a 09/22/25 nightly (now) Docker images

➢ Codes generalization in all places - *no pfRICH(/dRICH)/FRICH/BRICH specifics*

- ➢ ACTS tracking interface has been re-worked, in particular

➢ Calibration data made persistent *in the IRT optics ROOT file*

➢ Functionality without a standalone .C script at the end of the chain demonstrated

- ➢ IRT reconstruction engine called within a generic EICrecon *IrtInterface* plugin, …
- ➢ … with a fully functional detector-specific JSON config parser

➢ A unified "gas + aerogel" case confirmed to work (for a FRICH mockup detector)

IRT-2.0(1) sandbox setup evolution

(A) Standalone GEANT code → → ROOT file with optics description and event info (tracks and photons)

(B) *npsim* → ROOT file with optics description / ROOT file with npsim EDM output → *eicrecon* → ROOT file with a **modified optics** and event info (tracks and photons)

IRT reconstruction script(s) → ROOT file with optics and **calibrations**

(C) *npsim* → ROOT file with optics and calibrations / ROOT file with npsim EDM output → *eicrecon* with an integrated IRT reconstruction engine → PODIO output

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Modifications stats [*irt-2.1b* branches vs *main* ones]

|	Modified files	Comments	Deleted files	Comments	New files	Comments
EDM4eic	1	edm4eic.yaml (IRT output tables)	0		0	
epic	5(7)	CMakeLists.txt, Optical materials, pfRICH geometry	0		12	.xml config files F(B)RICH geometry
EICrecon	8	CMakeLists.txt, IRT-1.0 stuff commented out	2 2 6	pfRICH plugin (dRICH plugin) RICH geo service	10 6 2	irt-sandbox scripts IRT-2.0 interface RICH-IRT plugin

➢ Contrary to a similar exercise done in August, this time the re-basing took few hours only

➢ CMakeLists.txt file in the *epic* repository: IRT-related linkage is made optional

➢ As expected, modifications outside of the IRT/(pf/d/F/B)RICH codes are minimal

  ➢ Which means a migration into main should be rather straightforward, right?
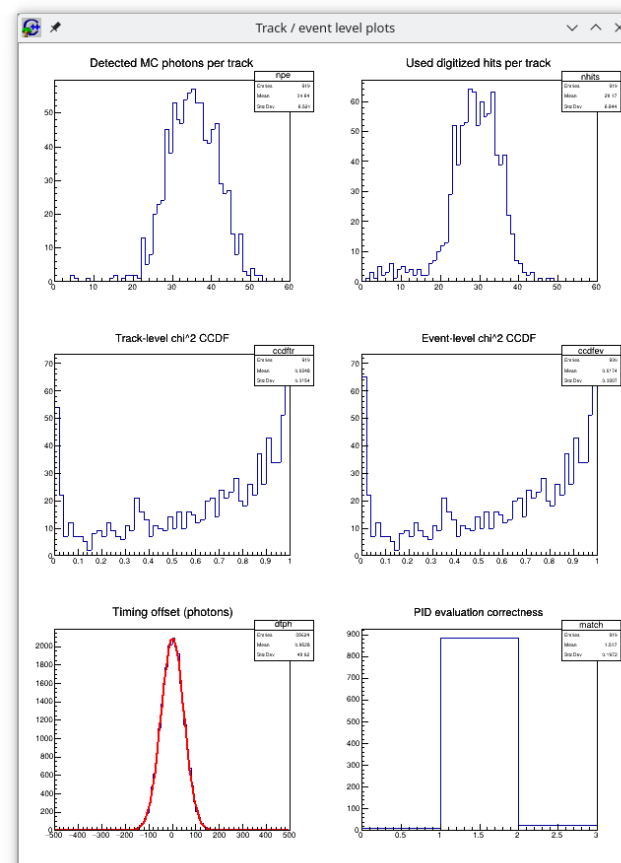
FRICH mockup implementation

- ➤ A dRICH-like geometry
  - ➤ Spherical mirror
  - ➤ SiPM QE (yet HRPPD geometry)
  - ➤ Aerogel with <n> ~ 1.019
  - ➤ C_2F_6 gas radiator
  - ➤ Tuned to produce focused rings
- ➤ Optics description

- ➤ IRT reconstruction shown to work *in a combined aerogel+gas configuration*
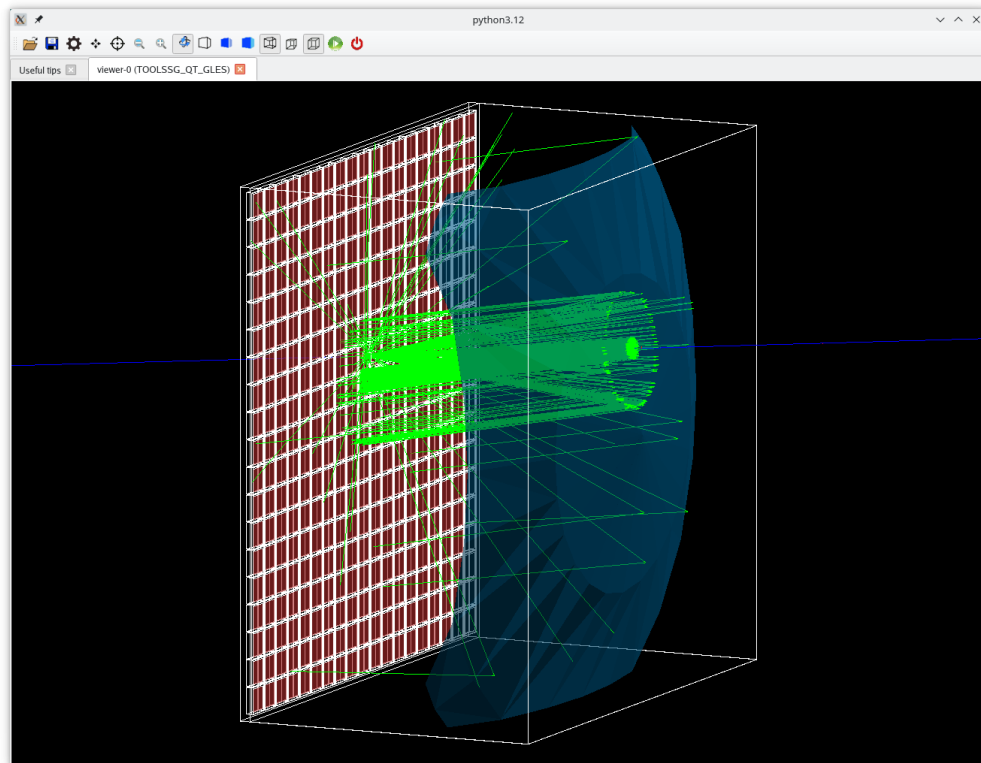
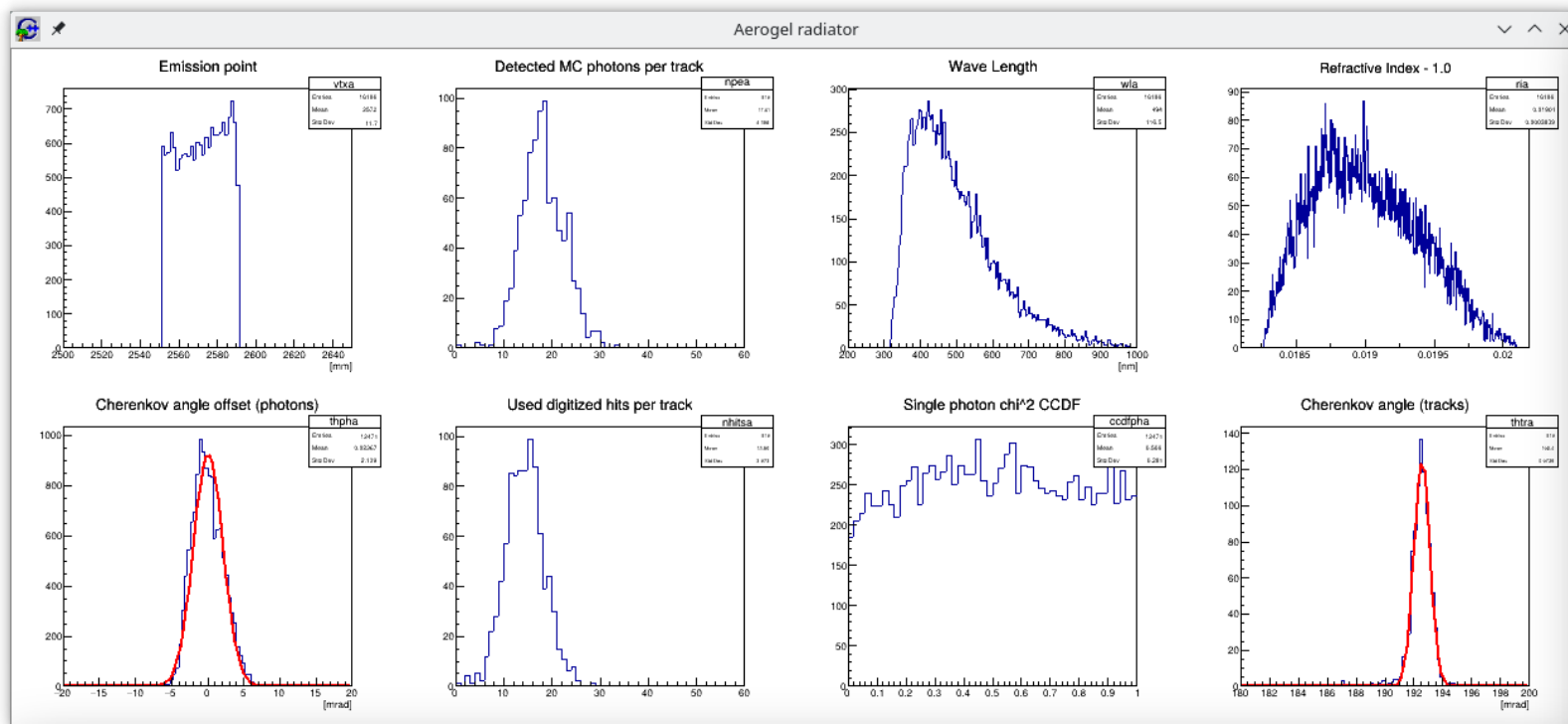# FRICH mockup implementation
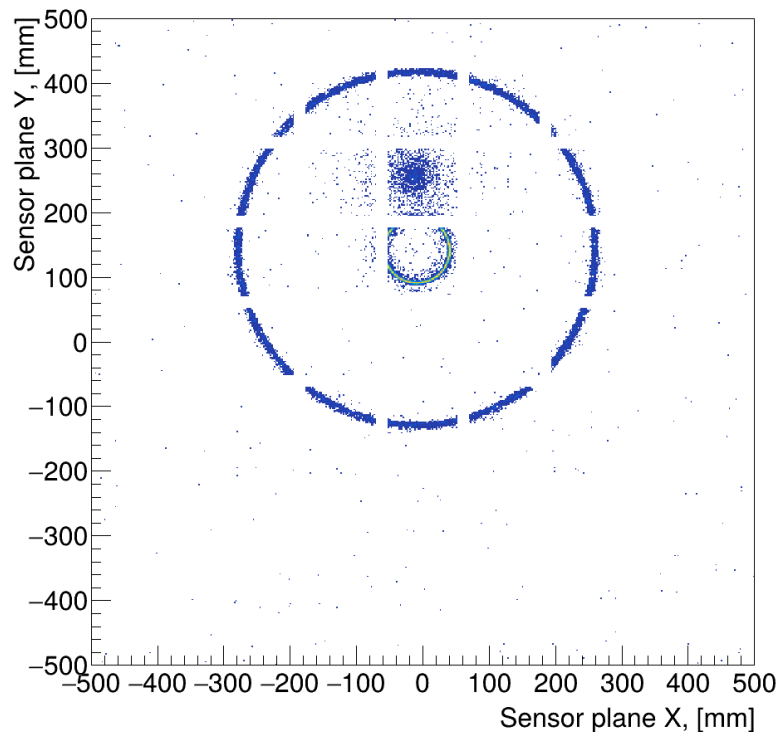
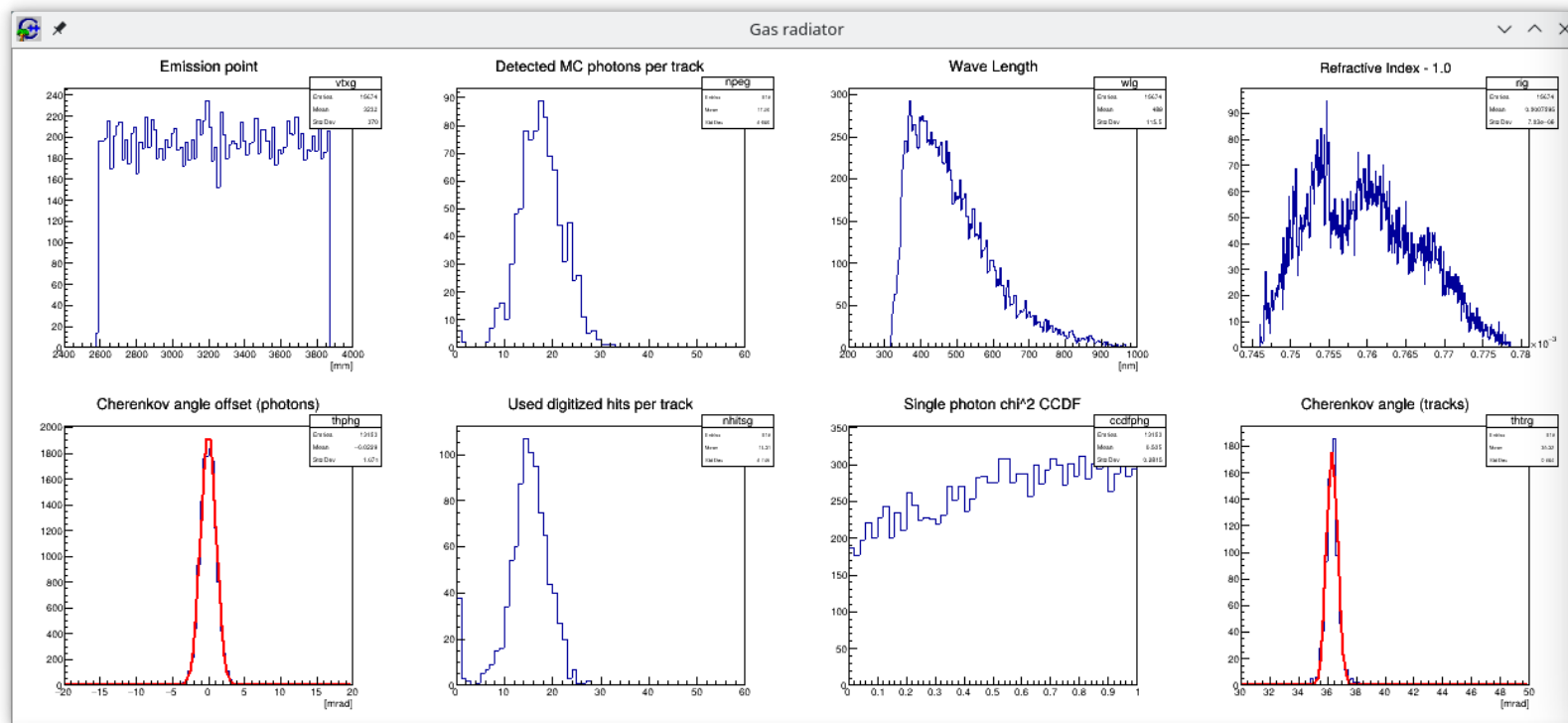Digitized hit map: direct hits, gas, aerogel

Combined IRT pass plots

FRICH mockup implementation

Aerogel radiator portion of the evaluation plots

FRICH mockup implementation

Gas radiator portion of the evaluation plots

A unified aerogel/gas/tof PID engine, yet with a per-radiator stat info available

Next steps

Activity	Workforce	Start	Finish
Merge irt-2.1b branches into the main ones	Deepak [, Chandra]	Now	?
dRICH geometry adaptation to IRT-2.1	Alexander (a first shot, then others take over)	Now	This week (assuming it all works in general)
pfRICH geometry clean up	Alexander		Beginning of October
Benchmarks	Brian, ..?		
Digitization as a separate step	Alexander	Later?	
IRT-2.0 algorithm debugging (memory leaks, etc)	Alexander, Chandra, ..?		Need few weeks or so
Debugging on (SI)DIS file input (+ background)		?	?

➤ Should be able to reproduce single particle performance plots in EICrecon

  ➤ Whether it is done using *irt-2.1b* or *main* branches, does not matter?

➤ Do not really need official productions to reproduce EmCal- & SIDIS-related plots either?

➤ Whether at least pfRICH+IRT2.1 can make it into the October production is yet to be seen

  ➤ Most likely not; depends on the *irt-2.1b -> main* migration progress and (SI)DIS input debugging