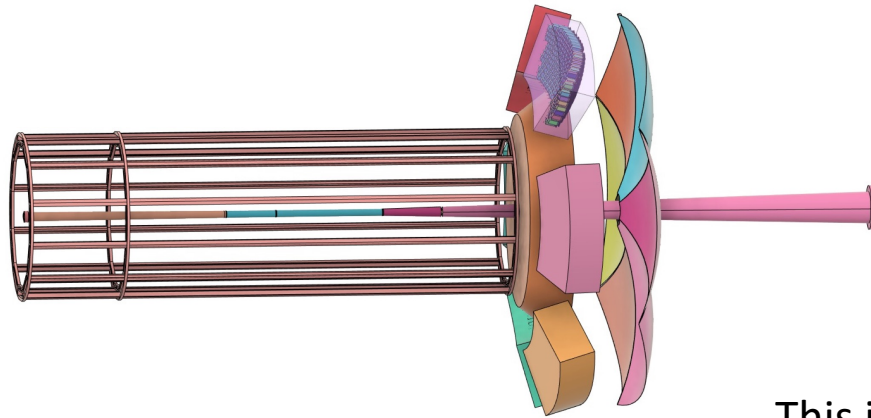
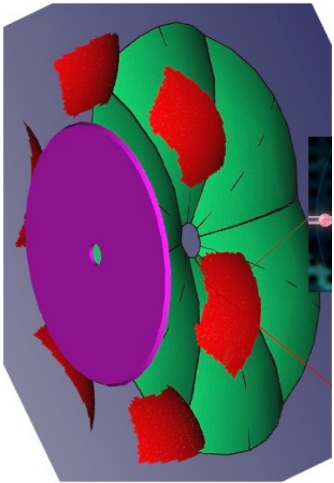


## dRICH DAQ scenarios: interaction tagger?

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on behalf of the dRICH group



This is a follow-up of the [talk](#) given at DAQ WG 16/02/2023

## dRICH DAQ scenarios: a re-cap

Scenario	DCR rate	RDO	Fibers	DAM	Link/DAM	DAQ link throughput	Total throughput	Notes
A	270	310	310	14	24	5.8 Gbps	1830 Gbps	timing reduction factor = 3
B	500	310	310	14	24	2.94 Gbps	935 Gbps	Timing reduction factor – 10 / machine cycle accounted
C	500	1240	1240	56	24	0.75 Gbps	935 Gbps	<b>Costs up:</b> more fibers, more PCB, more FPGA, more DAM
D	500	1240	1240	28	48	0.75 Gbps	935 Gbps	Assuming FELIX2 can reach 48 links per DAM
E	500	1240	1240 → 62	2	48	75 Mbps	4.65 Gbps	<b>Costs up:</b> minicrates, cards, fibers, FPGA... <b>Costs down:</b> from 28 to 2 FELIX2 <b>Throughput down</b>
F	500	1240	1240	28	48	3.75 Mbps	4.65 Gbps	<b>Requires an external trigger</b> (latency 10 $\mu$ s to say). <b>Costs up but how much?</b> Internal buffers implemented at ALCORv3 level or at RDO level
F+	500	1240	1240 → 62	2	48	75 Mbps	4.65 Gbps	Internal buffers implemented at intermediate aggregator

A: ATHENA baseline

B..: with improved shutter and more solid numbers based on radiation studies

C..: x4 factor in links (still to be discussed within dRICH it is very much linked to detector geometry modularity)

D..: 48 links DAM

E-F+: assumes a private aggregator (**pDAM**) for dRICH

F: assumes an **interaction tagger** (“external trigger”)

420 k\$ in DAM +  
14 high-end servers

pDAM cost (financial/human) not  
negligible. DAM saving would be 390 k\$  
+ 13 high-end servers

# Intermezzo: remember dRICH@startup/commissioning

Scenario	DCR rate	RDO	Fibers	DAM	Link/ DAM	DAQ link throughput	Total throughput	Notes
F	2	1240	310	28	48	3 Mbps	3.7 Gbps	Timing reduction factor – 10 / machine cycle accounted “no interaction tagger”

During first years, and especially during commissioning in 2030-2031 dRICH throughput will be "easy" allowing for calibration, optimization of shutter etc.

# Why an interaction tagger for dRICH?

- With an increasing high DCR and throughput it doesn't make sense "read always everything" (→ "streaming with care readout")
- Physics tells us that we have 100 MHz bunch crossing and 500 kHz (at max center of mass energy) interaction rate (only in ep, even less in eA)  
→ a factor 200 reduction could be achievable
- An interaction tagger is not a full-fledged physics trigger. An interaction tagger for dRICH means **"something interesting, may be, is happening close to the dRICH at this BC, I'm not sure, but please keep the data"**

## 16/02 Summary + input collected at DAQwg + GDIwg + chat with Jeff/Tonko/Davide

DAQ design is now starting to be impacted by the usual boundaries designing a real detector: sensor specs, front-end, mechanics, dimensions, etc.

Scenarios presented here are part of the work we will undertake this year (towards draft-TDR, with serious costing etc). They are brainstorming scenarios. Please comment on them.

Intermediate scenarios of course exist: we might have some “private” concentrators close to the Front-End and having then 6 sectors routed in 6 DAM/FELIX2. In 1 DAM=dRICH sector we might then implement scenario E... (not paying for a  $\mu$ TCA crate ecc.) or even go just to one DAM/FELIX2 (Scenario F+)

### Questions:

- Is an increase of fibers / DAM a problem? **NO [ input got by Jeff/Tonko]**
- When we need to decide if having a private dRICH-DAM ? (space in crates close to the detector)
- DAM cost? (FELIX2) (needed for assess trade off). **15000 \$/DAM + 1000 \$ ("half server")**
- When you can confirm 48 links will be a reality? **CONFIRMED by Jeff**
- Should we assume 14 Gbps /DAQ link? **CONFIRMED by Jeff**
- Detectors able to provide a trigger? → discuss with GDI/opinion from DAQ group → **let's engage with MPGD and LGAD-TOF**
- Could the trigger fly over RDO-DAM link? → I would add this to spec, but latencies are also critical --> **not preferred option, preferred option is to make data reduction on DAM (use additional inputs on DAM)**

# Supercaveat

Given WG → DSS transition things are happening faster in this WG than on the detector side. All this is still brainstorming thinking **they are not at all dRICH-rubber stamped requests.**



# ePIC candidates? (before thinking to a devoted interaction tagger like a scint disk in front of dRICH aerogel ....)

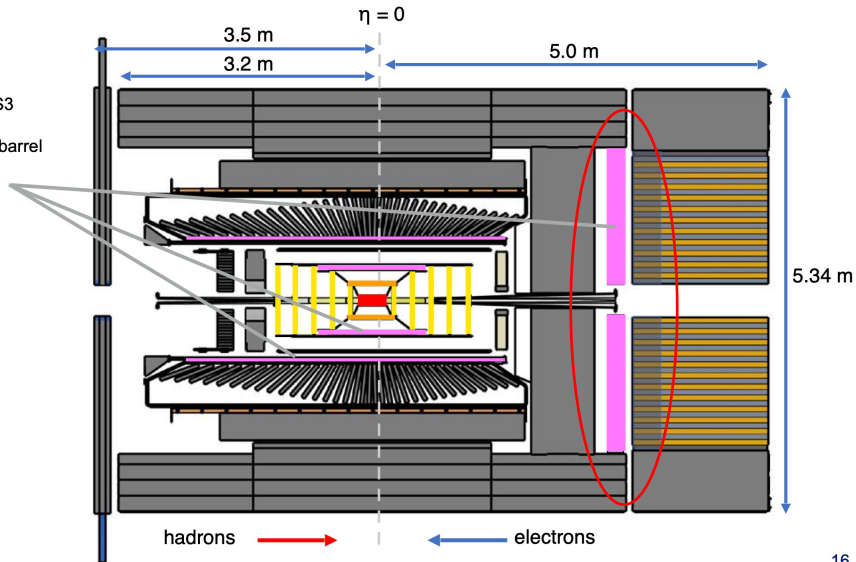
## EPIC - Baseline Design

### Magnet

- New 1.7 T SC solenoid

### Tracking

- Si Vertex Tracker MAPS/ITS3 wafer-level stitched sensors
- Si Tracker MAPS/ITS3/EIC barrel and disks
- MPGDs ( $\mu$ RWELL/MMG) cylindrical and planar



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From T. Ulrich presentation at CPAD

**But.. is the MPGD really there? Not in ePIC geometry db!  
Or the barrel MPGD? But acceptance....**

## EPIC - Baseline Design

### Magnet

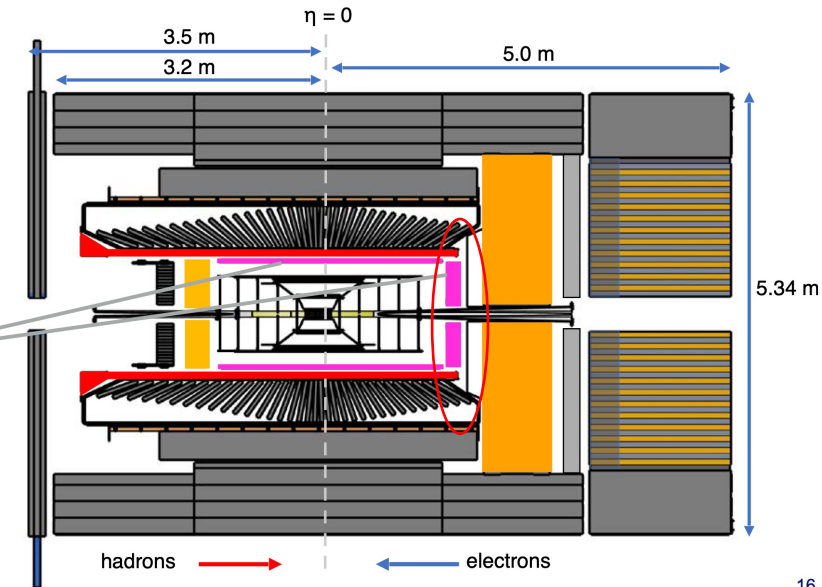
- New 1.7 T SC solenoid

### Tracking

- Si Vertex Tracker MAPS/ITS3 wafer-level stitched sensors
- Si Tracker MAPS/ITS3/EIC barrel and disks
- MPGDs ( $\mu$ RWELL/MMG) cylindrical and planar

### PID

- high performance DIRC (hpDIRC)
- dual RICH (aerogel + gaseous)
- aerogel RICH/modular w/ Fresnel
- proximity focussing RICH
- ToF using AC-LGAD

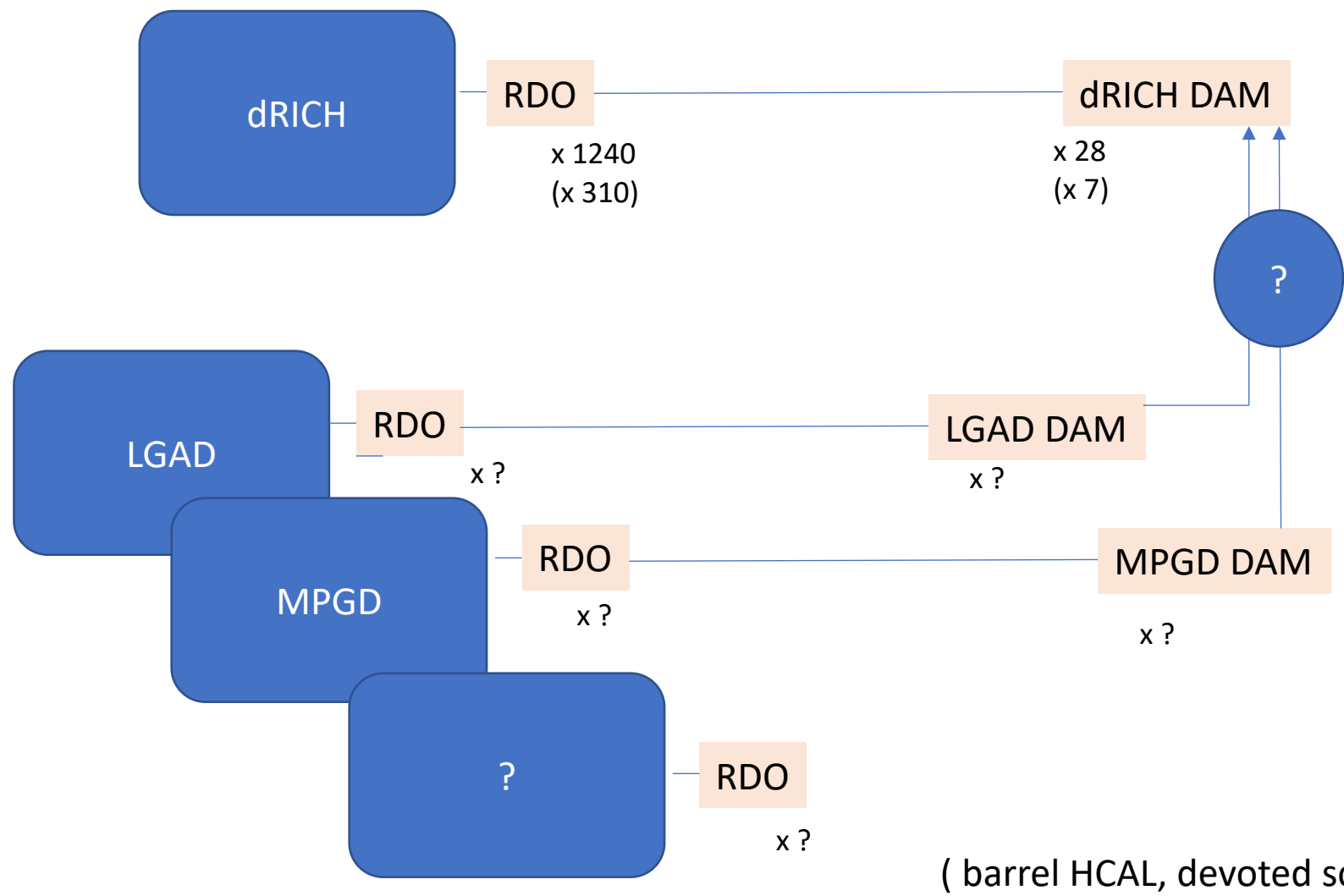


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From T. Ulrich presentation at CPAD

**LGAD-TOF**

Per se we shouldn't limit this just to MPGD / LGAD.... Others?



**Points for discussion:**

- DAM/detector modularity not trivial to elaborate then "trigger logic"
- The same on receiving dRICH DAM
- Latency!!!! (10 usec?)
- RAM resources for BC pipelines (à la ZEUS First Level Trigger) in DAM become important

( barrel HCAL, devoted scint ring... ?)



## 9/03 Summary

DAQ WG input is to invest in DAM (and fibers) not on intermediate aggregators

We need some joint work if we want to explore seriously this interaction tagger option for dRICH.

To start with we should clarify if some of the “interested” detectors could elaborate some signal or there is not such a possibility (linked to FEE, fast-OR signals, what DAM firmware can do, etc.)

### Questions:

- Can named detectors elaborate at DAM level some interaction tagger signal?
- Rates? How much background?
- Latency?
- Do we need an intermediate “trigger box” before sending signal to dRICH DAM?
- Which memory resources we would need at DAM level