

dRICH data throughput model update

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What's new and what's missing?

- Background estimates included (see Misha's talk)
- Signal estimates included (see Misha's talk)
- Data format + protocols overhead more precisely taken into account



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- Scaling up to 18x275 GeV (minor)
- Checks on electron generated hits (not crucial but...)
- Some data overhead (head/trailers/etc.) not yet included
- radial dependency (minor)
- Peak throughput analysis

The ingredients (I): hit rate (per channel)

dRICH hit rate sources per channel	[kHz]	Full dRICH [Mhz]	
DIS signal ($Q^2 > 1 \text{ GeV}^2$)	1,10E-03	0,35	Numbers estimated with 10x100 GeV configuration
SIDIS signal ($Q^2 < 1 \text{ GeV}^2$)	4,30E-02	13,75	
SR Background	0,00E+00	0	
Beam-gas background	9,86E-03	3,15	
Other background	4,32E-03	1,38	
DCR SiPM noise	300,00 ▼		
Total hit rate	300,06		

- 18x275 GeV will not change the pattern
- We include photons from electrons... TBC

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DCR SiPM noise	3,00 ▼		
Total hit rate	3,06		

When we will start....

The ingredients (II): ALCOR

ALCOR parameters		Notes
Front end limit [kHz]	4000	
ALCOR Clock [MHz]	394,08 ▼	CDR x 5
Channels/serializer	8	
Bits per hit	64	2 32-bit words per hit (also TOT or time slewing)
Bits per hit with encoding	80	8b/10b encoding
Serializer band limit [Mb/s]	788,16	DDR sampling
Theoretical Serializer limit/ single ch [kHz]	1231,5	(his would be with 0 control words)
Serializer limit single ch [kHz]	985,2	extrapolated from ALCOR32@320 MHz
Number of serializer per chip	8	
Maximum hit rate capability (x ALCOR) (MHz)	78,816	not including frame words
Channel/chip	64	
Shutter Acceptance width (ns)	7 ▼	(with 10 ns == no shutter)

The ingredients (III): DAQ front-end/back-end

EIC parameters	
EIC Clock [MHz]	98,522
Orbit efficiency (takes into account gap)	0,92

dRICH DAQ parameters	
RDO boards	1248
ALCOR64 read by RDO	4
dRICH channels (total)	319488
Number of DAM	30
Input link in DAM	42
Output links from DAM to TP	1
Number of DAM Trigger Processor	1
Input link to DAM Trigger Processor	30
RDO to DAM link bandwidth [Gb/s]	10,24
DAM to Echelon-0 Switch Bandwidth [Gb/s]	100 ▼
External Trigger reduction factor	5 ▼
External trigger latency [s]	1,00E-04

dRICH data stream analysis		Limit	Comments
Hit rate per channel [kHz]	300,06	4.000,00	300 kHz is at max. damage
Rate post-shutter [kHz]	193,24	4.000,00	includes also orbit efficiency
Throughput to 1 ALCOR64 serializer [Mb/s] (8 channels)	120,77	788,16	here we add encoding
Throughput from all FEBs to RDO [Mb/s]	3.864,75	25.221,12	limit based on 32 diff. pair. input @ 4 x EICclock x 2
Throughput after RDO deserialization [Mb/s]	3.091,80		80/64 bit decoding
Throughput after RDO payload optimization [Mb/s]	2.463,78		51/64 bit reduction
RDO serialization + DCS payload	1,29		64/66 + 13 bit or 204/256 + 20 bit
Data Throughput from RDO [Gb/s]	3,11	10,24	
Input at each DAM [Gbps]	130,78	430,08	we have 42 links operated at 10 Gbps
Buffering capacity at DAM [Mb]	13,39		to be checked but seems manageable
Output from each DAM [Gbps]	26,16	100,00	DCS payload should be stripped

Aggregated dRICH data throughput		Comments
Total input at all DAM [Gb/s]	3.923,25	This is only "inside" DAM, not to be transferred on PCI (still includes encoding)
Total output from DAM [Gb/s] to Echelon	784,65	Reduction from external trigger (NN on DAMs or det. based)

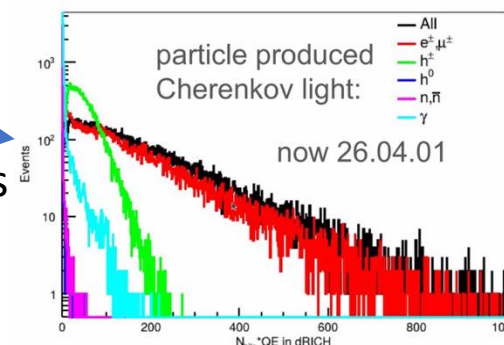
We might relax current reduction factor requested by tagger/ML algorithms by a factor 2 perhaps

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Now possible sampling from distributions provided by MishaO (some rescaling needed) + int. rate.

None of the points above seems particularly troubling, I'm more worried by... making things done (ALCOR64, packing & ordering on RDO, merging streams on DAM etc.).



- Need to translate these numbers in general Electronics & DAQ Excel shared by Jeff (not trivial but working on it) → check at next DAQ meeting on Friday 2 Oct.
- Short answer to TIC: background sources are negligible with respect to dRICH detector throughput
- Impact on event reconstruction + refining ML algorithm → INFN FE-RM1

Credits: M. Osipenko, M. Contalbrigo, S. Geminiani