WARWICK
THE UNIVERSITY OF WARWICK

WCTE DAQ

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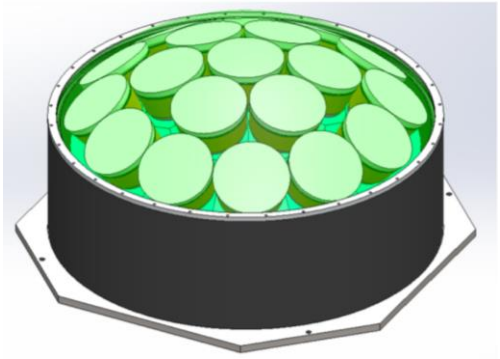
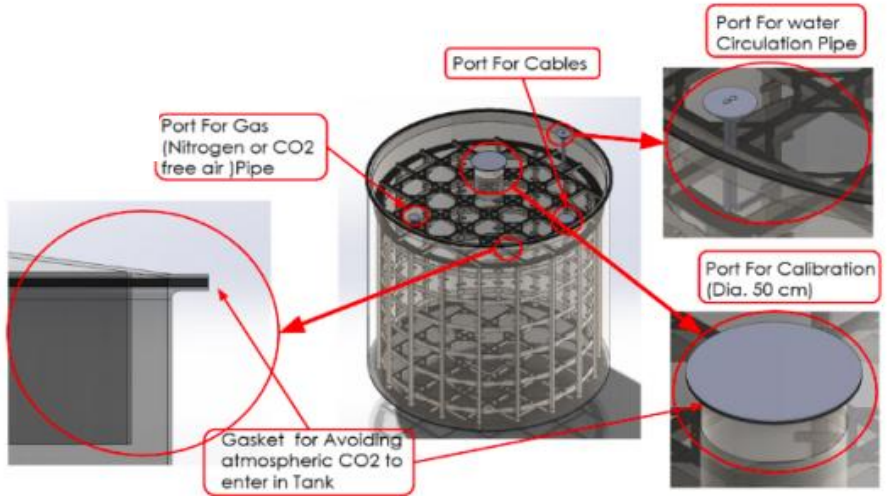
WCTE Detector

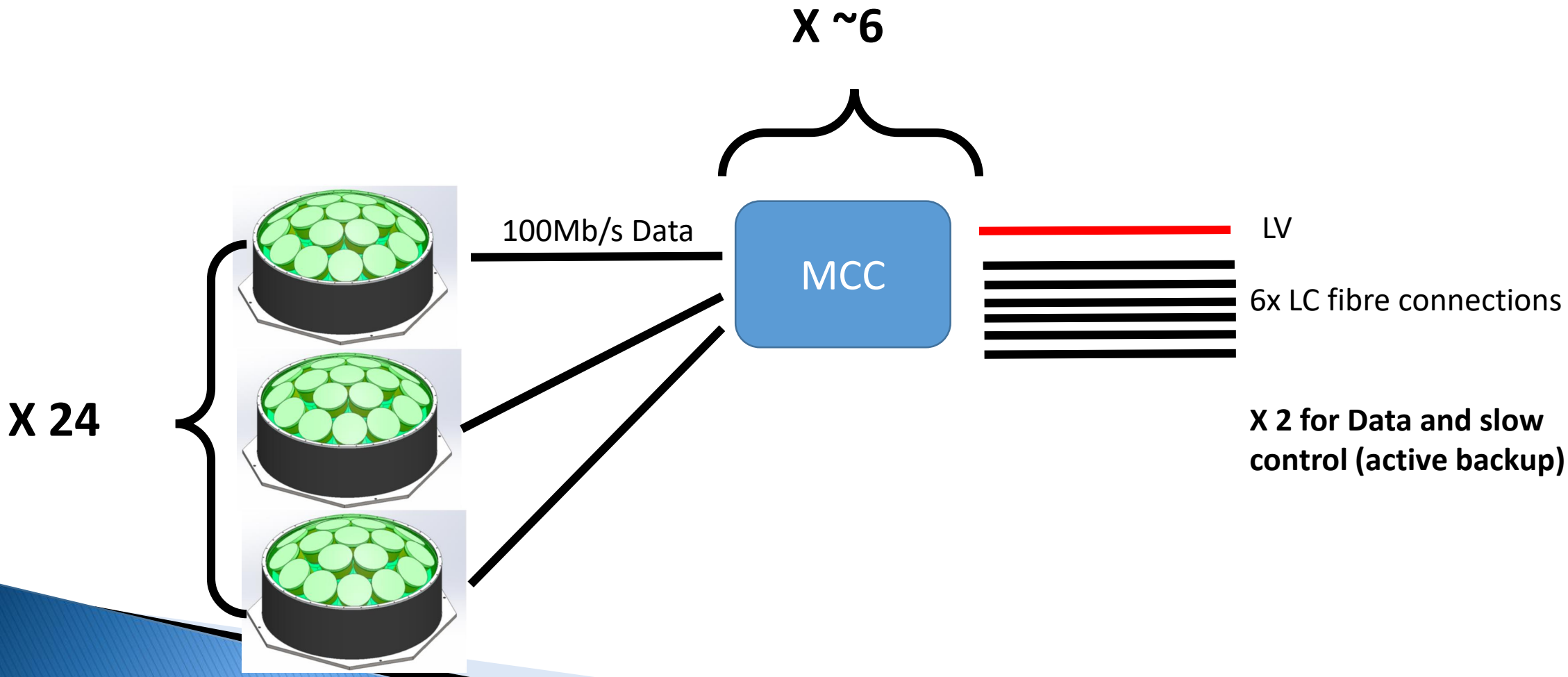
- ~4m X ~4m
- Stainless steel tank



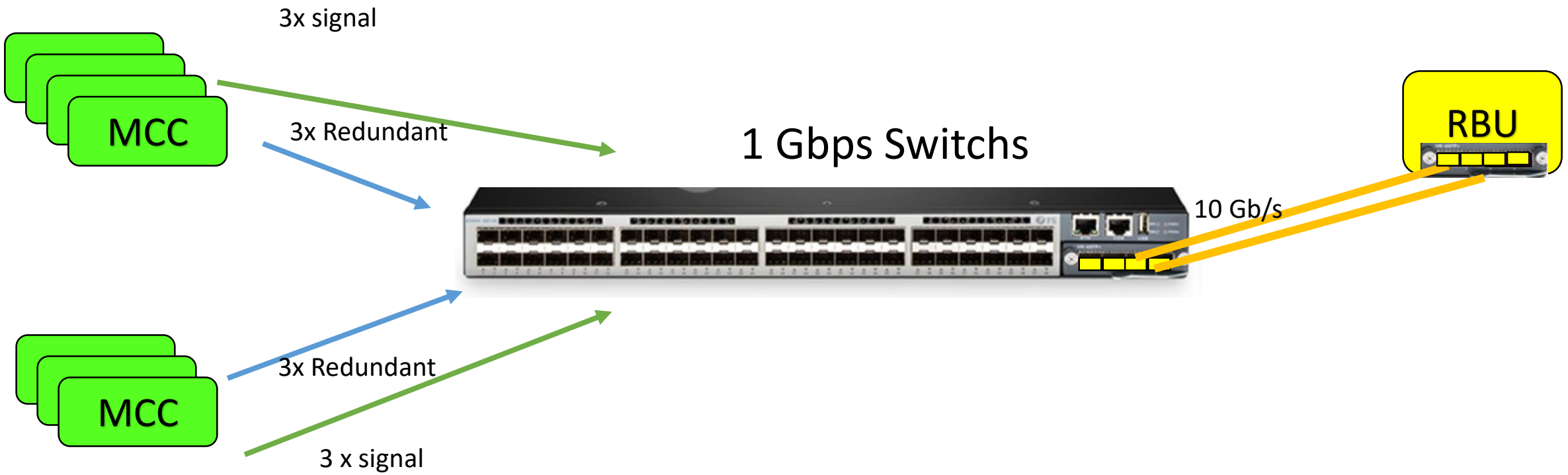


- 2432 channels / 3”PMTs
- 128 mPMTs
- MCC 6
- 36 fibres
- 12 dual fibre bi directional data connections

MPMT Readout



WCTE Data Network



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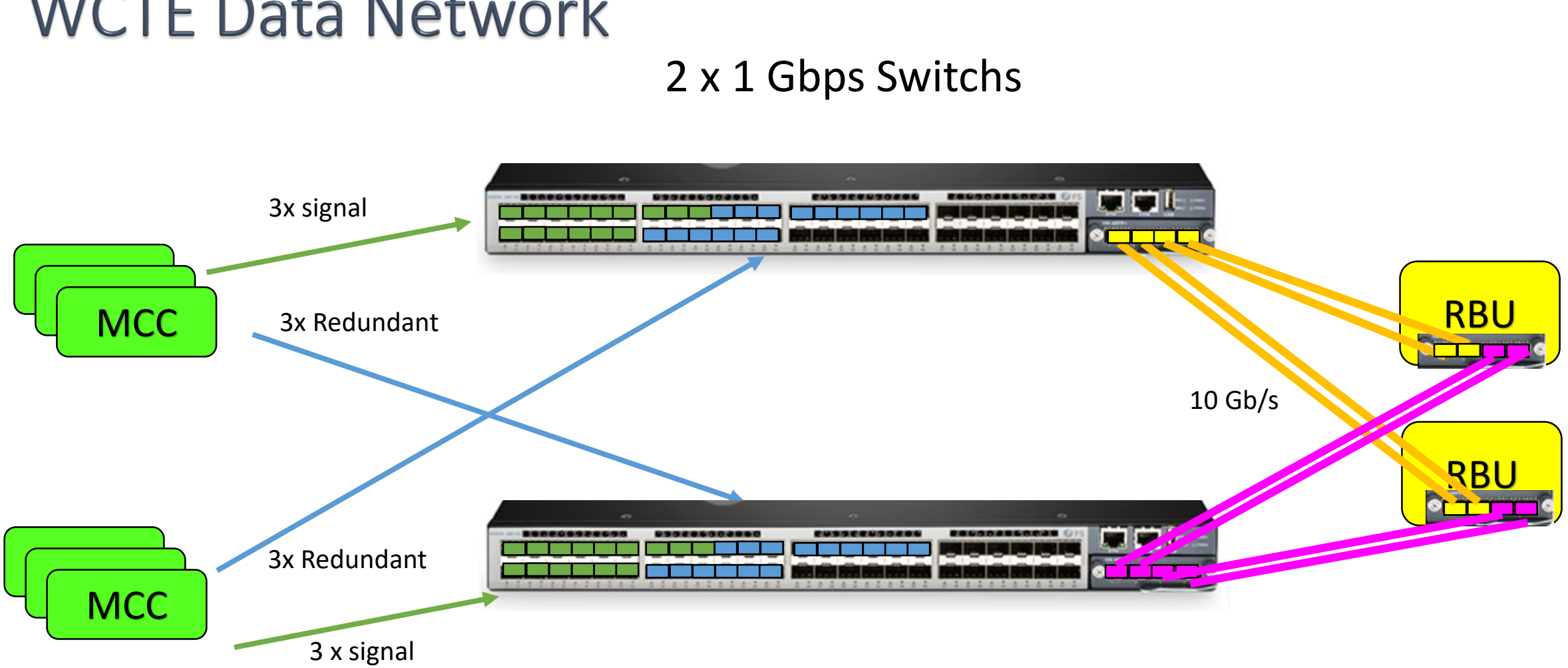
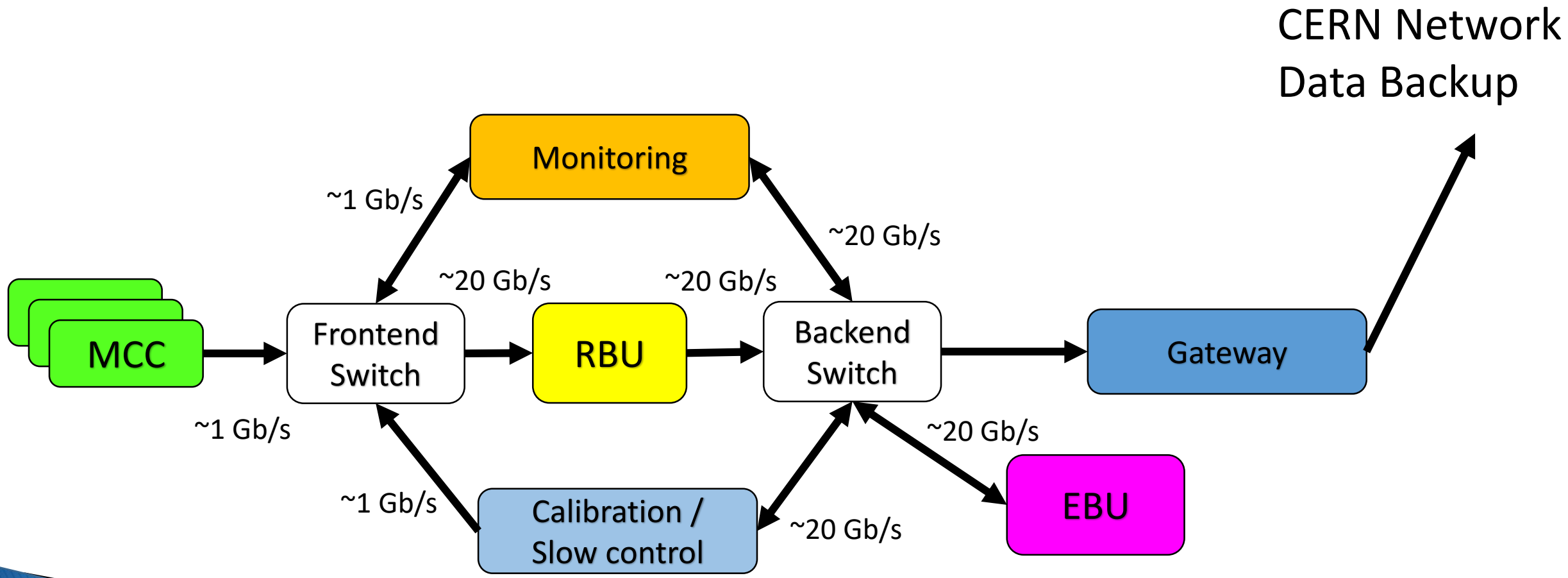


WCTE DAQ Design



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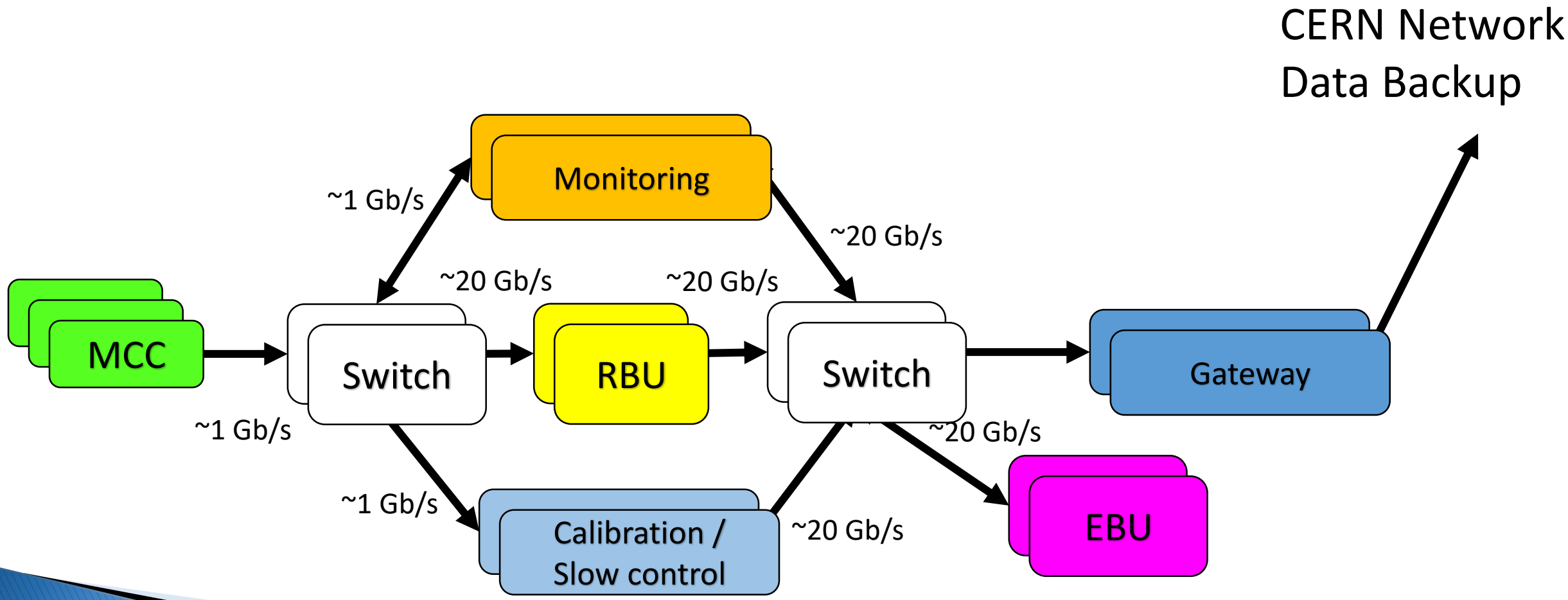
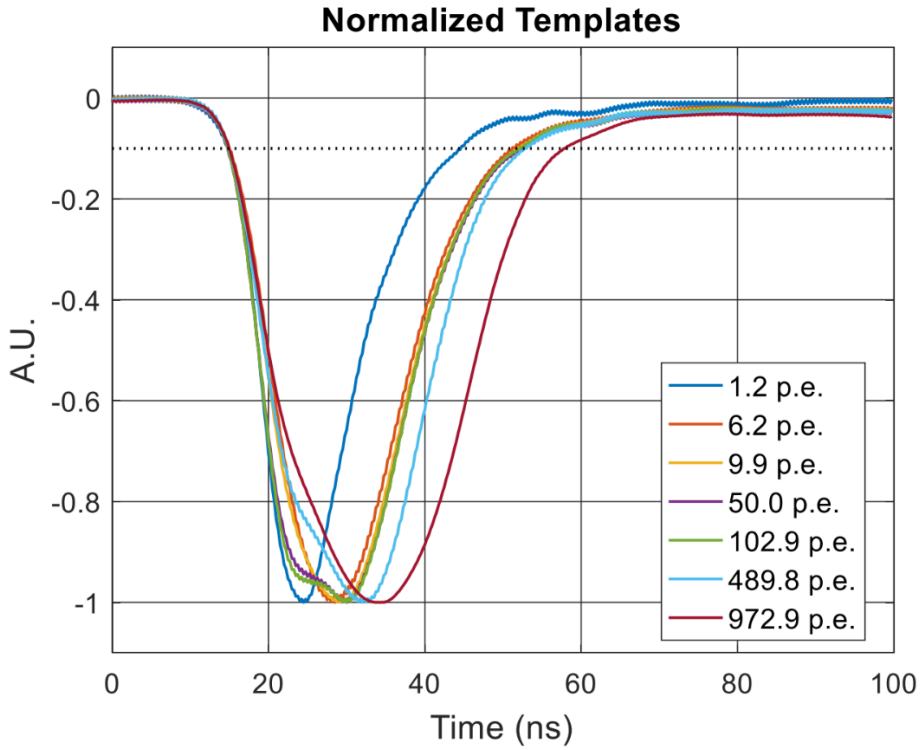


Hit size

Time and Charge

- 31 bit Time
- 8 bit Charge
- 14 bit ID
- 8 bit Quality factor
- **Total: ~8 B**



Waveform

- Waveform duration: 10-80ns
- Digitisation rate: 1GHz – 125 MHz
- Wave from samples: ~10
- Sampling depth: 14 bit
- **Total: 24 B**

- If we use the assumption that only 5% of hits require waveform data

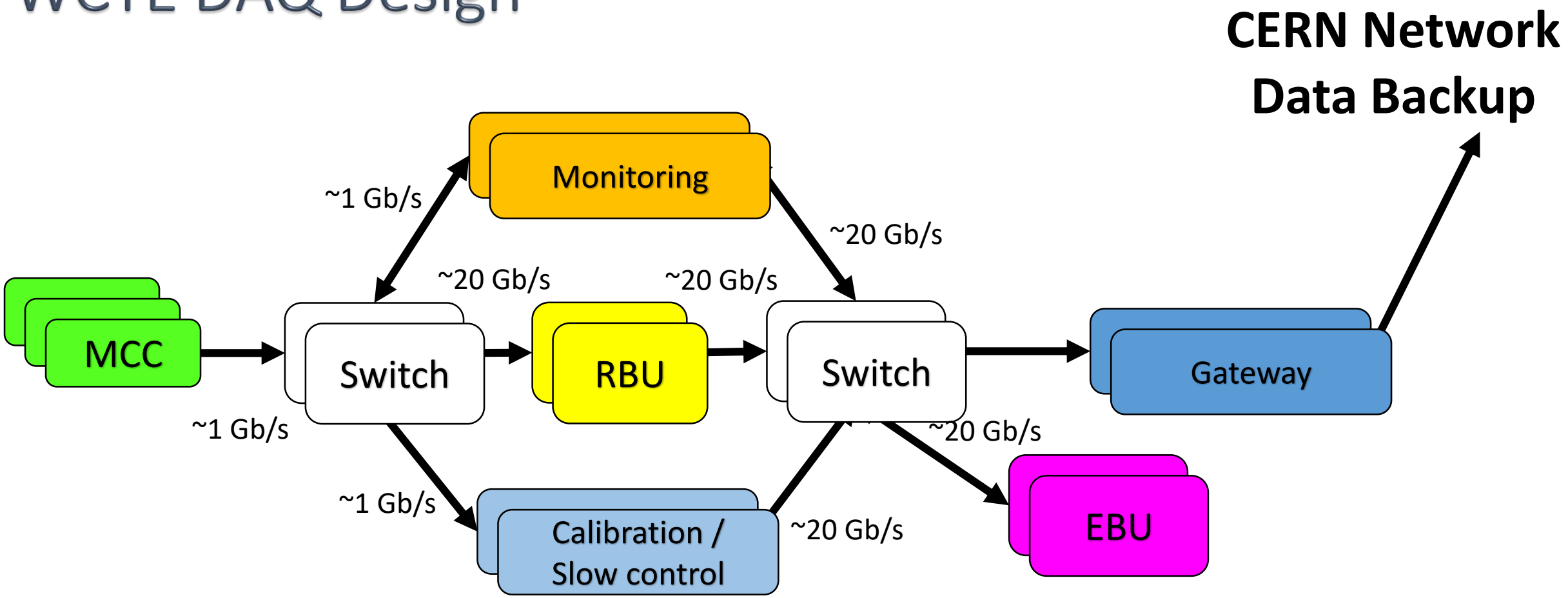
Data Rate 5% Waveform IWCD & Test Experiment

	data rate Avg MB/s IWCD	data rate Avg MB/s WCTE	Max data rate per MPMT MB/s
Cosmics	290	44	2.3
Beam	0.01	small	1.344E-04
Darknoise	34.4	6.6	0.1
Total	324.6	50.6	2.5
Connection speed Gb/s	2.6	0.4	0.02
	3 Gb/s	400 Mb/s	20 Mb/s

- 51 MB/s Total detector output -> 0.4 Gb/s
- 4.4 TB per day (or 180 GB/hr)

Caveat need new simulations

WCTE DAQ Design



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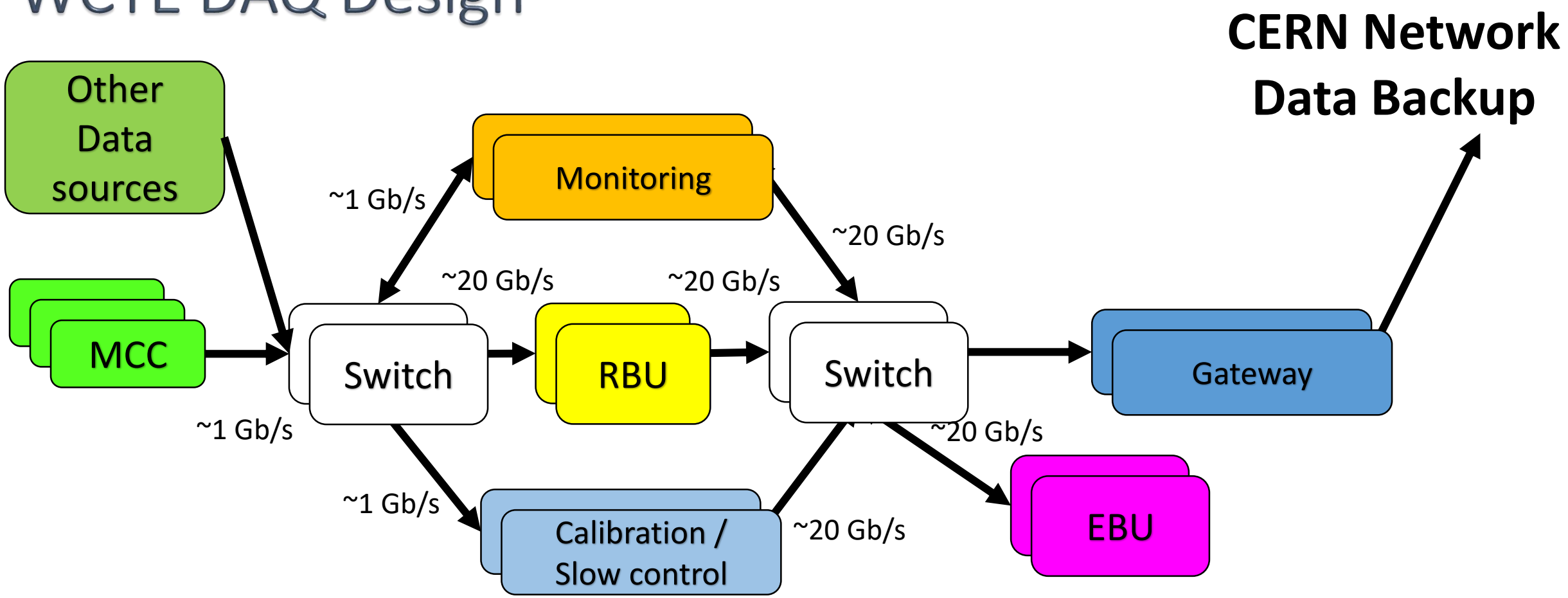

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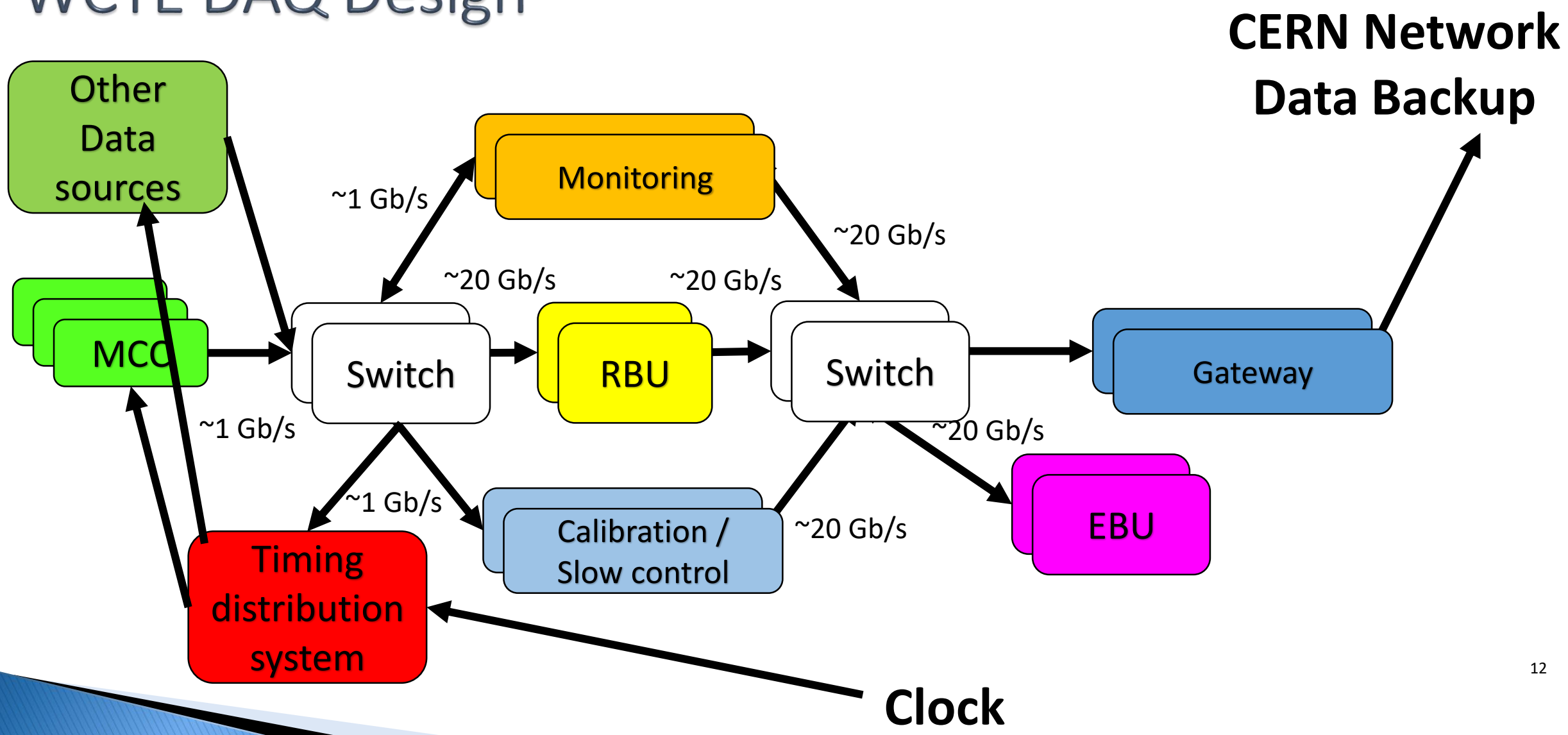
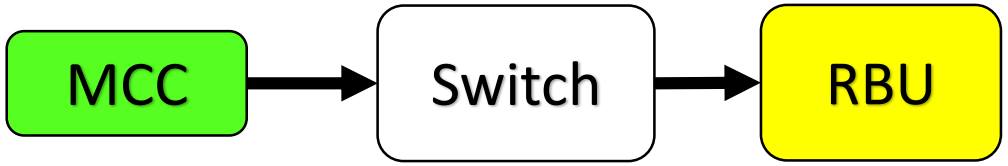
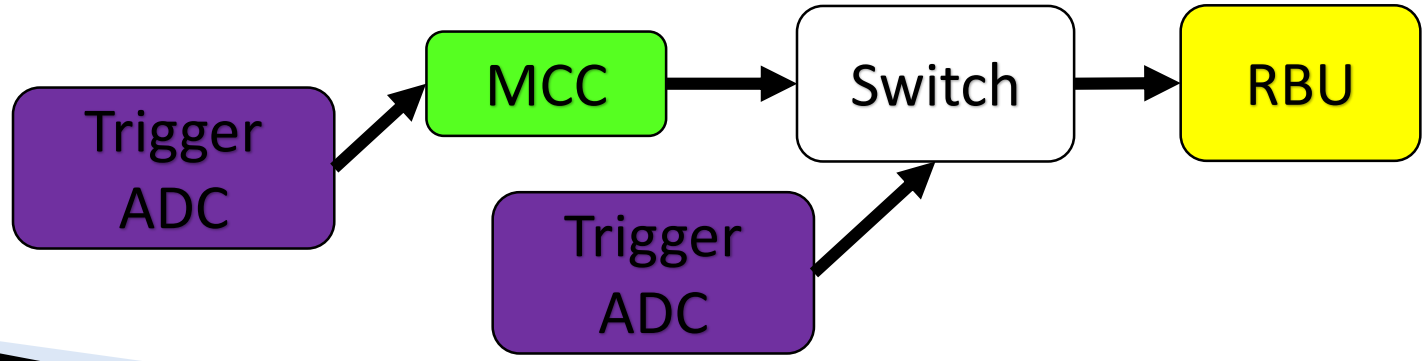


Triggering

- Stream all hits in the detector to the RBUs
- Triggering will then be undertaken on the RBU

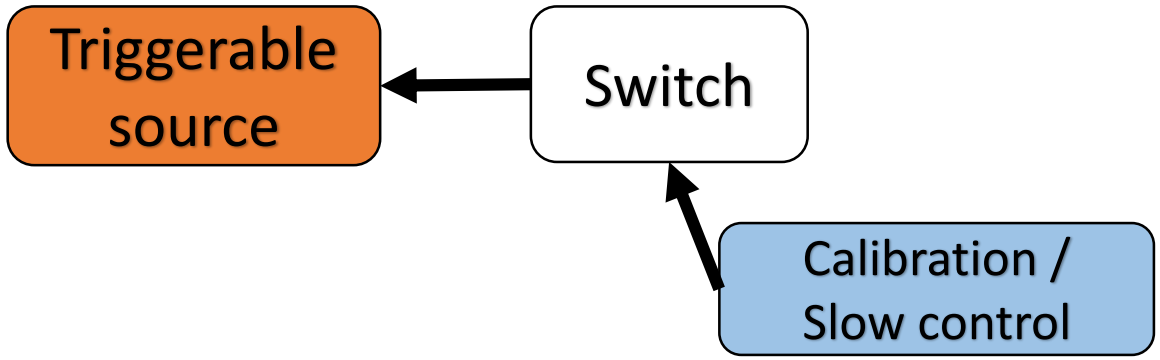


- Calibration, beam and cosmic triggers need digitisation (hardware needed)



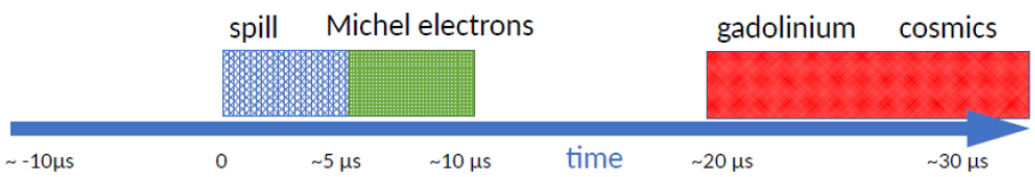
Triggering 2

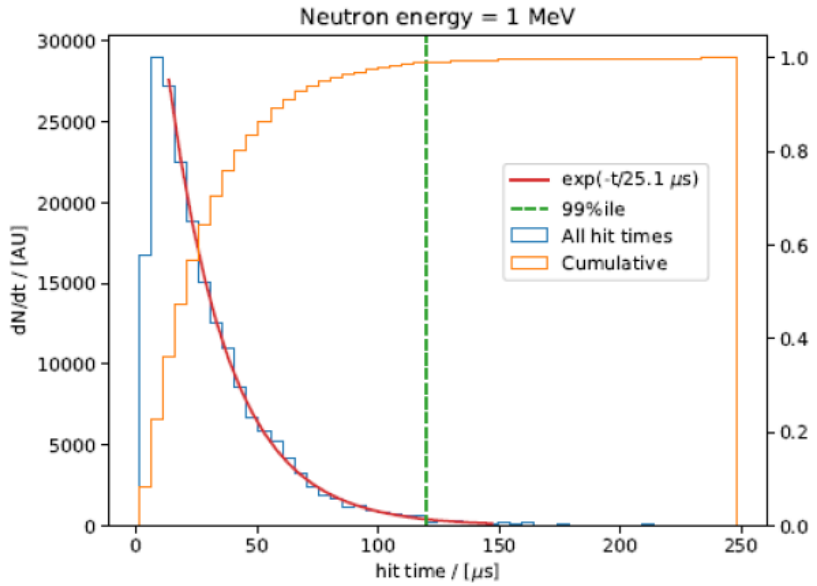
- Triggerable sources can be controlled via slow control / calibration server

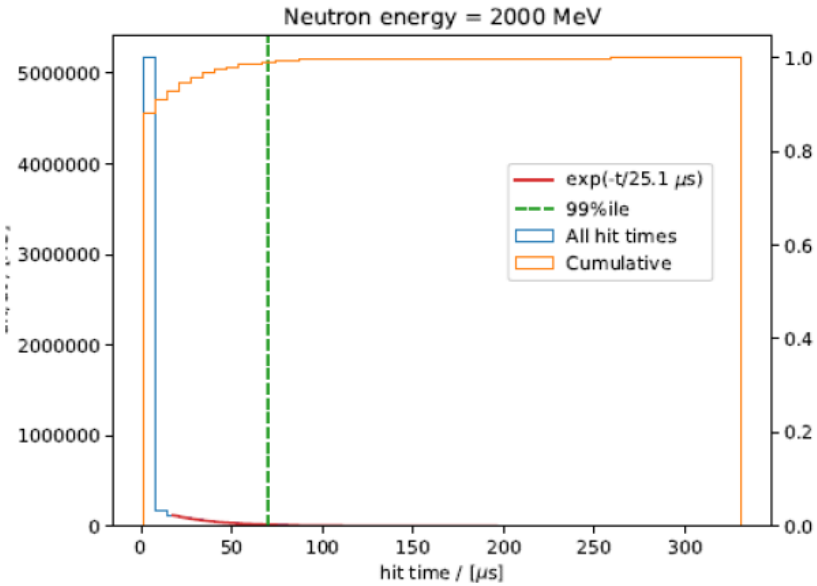


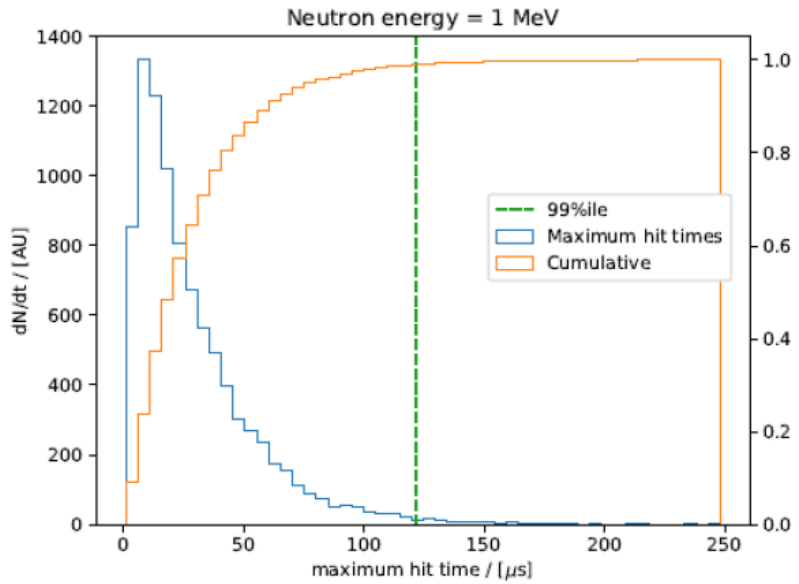
Readout window

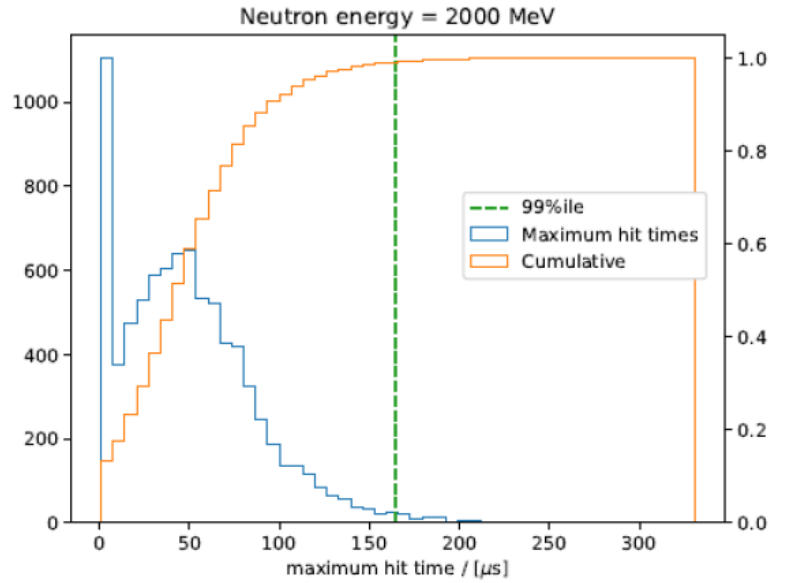
- 130 µs window record 99% of all neutron hits
- 200 µs window record all neutron hits from 99% of events
- 0.2 ms therefore sufficient











Saved Data Rates

- 50 MB/s or 4.4 TB /day Input Data Rate

- 10 x 0.2ms windows per second
  - Open around nhits tirggers
  - And some min Bias
  - Guaranteed cosmics in each window

- 100KB/s or 8.7 GB /day
- 3.2 TB/year

- Could open for whole 0.4s beam spill
- Then add a few random cosmics windows and min bias

- 50 600KB/s or 52.2 GB /day
- 19.2 TB/year

Connections to Cern

- Network connection
  - Long term data storage
  - Internet access
- Timing (GPS, clock white rabbit)?
- Power
- Simple control room

Summary

- Very low data rates
- Design for mPMT readout (other systems need defining/integrating)
- Timing and clock distribution need defining
- Simple trigger scheme for data readout