



DAQ requirements, proposal G22-073

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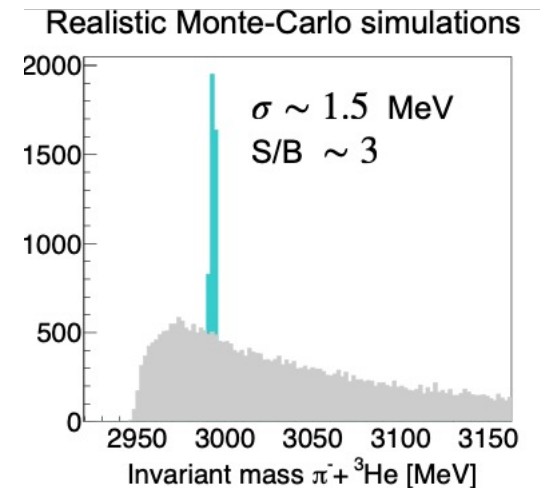
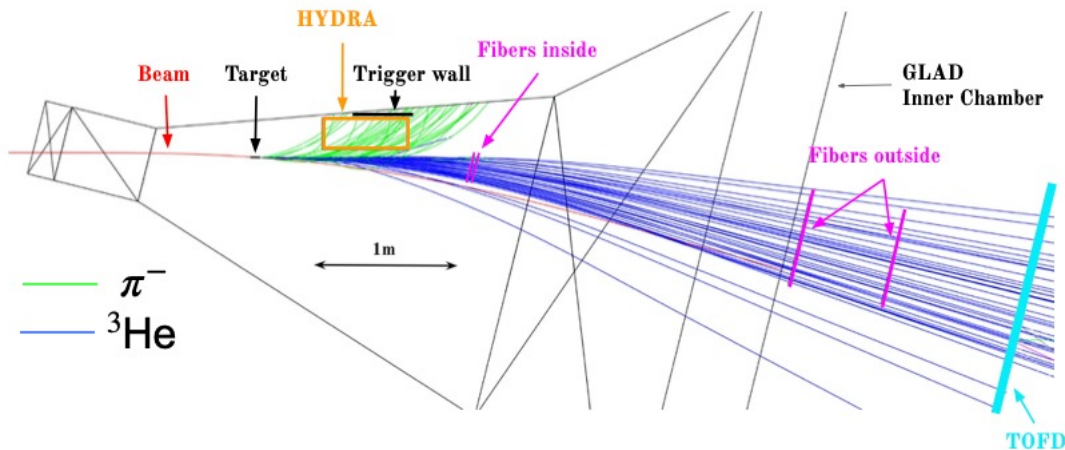
R3B Collaboration Meeting
November 15, 2022

The experiment in a nutshell

- ^{12}C stable beam at 18 Tm at $1 \cdot 10^6$ - $5 \cdot 10^6$ pps
- slow extraction (7 seconds+3 seconds)
- ^{12}C targets inside GLAD: 1cm and 6 cm

Measurement:

- production of hypertriton from **invariant mass spectrum (pion+ ^3He)**
- TPC for decay pion, R3B tracking for ^3He (+2 small x,y fiber det.)



- (proposal) MWPCs from beam tuning at lower intensity (10^4 pps)
- Fiber detectors for beam tracking **under consideration** (suggestion from M. Heil)
0.5 mm fibers, 20x20 mm²; **non existing**
- HYDRA TPC prototype: 5k channels; **under construction**
- TPC plastic wall (PW): 32 „bars“, 2 SiPM each
- 2 new small x,y fiber detectors (1 mm fibers, 15x15 cm², 4 planes); **to be built**
- 2 x,y fibers (50 cm) from R3B
- TOFD
- RPC **under consideration**

Rates

Rate in detectors from MC simulations for 6cm target and 10^6 pps beam:

- TPC: 220 kHz (mostly $Z=1$)
- Plastic wall (TPC): 100 kHz
- Fiber detectors and TODF: 200 kHz

Trigger request (TOFD + PW): 30 kHz

Assuming 50% of triggers accepted

Accepted triggers: 15 kHz

Readout features:

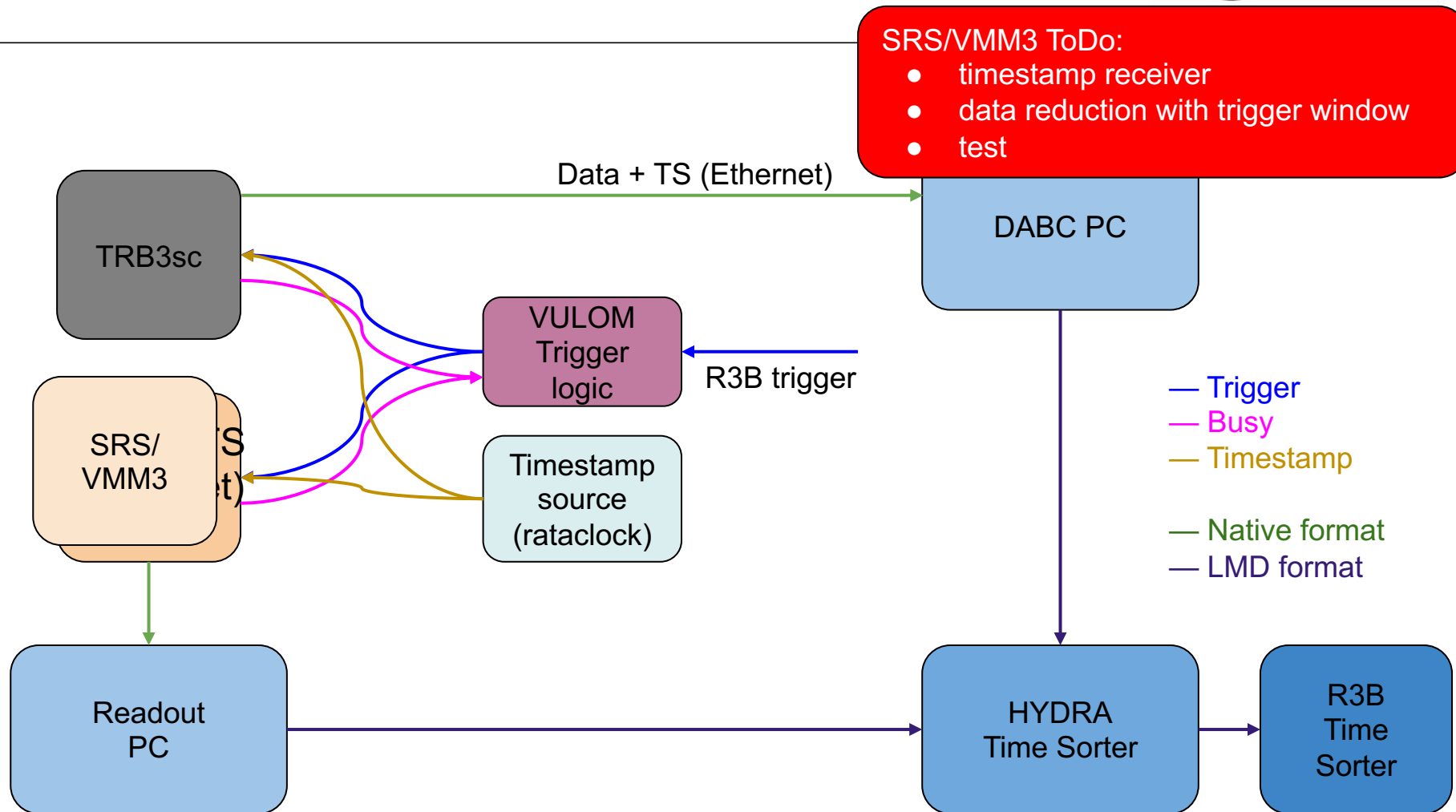
- VMM3 + SRS for TPC / continuous
- TRB3 for PW
- TAMEX3 for TOFD
- kilom2 for existing fibers: 1 PC / plane
- new fibers: to be decided

	${}^3_{\Lambda}\text{H}$	${}^4_{\Lambda}\text{H}$
Production cross section ($\sigma_{\Lambda X}^A$)	1.8 μb	2.9 μb
Interaction cross sections ($\sigma_{R,\Lambda X}^A$)	861 mb	645 mb
Decay channel	$\pi^- + {}^3\text{He}$	$\pi^- + {}^4\text{He}$
π^- decay branching ratio	26 % [64]	49 % [76]
Pion detection efficiency	29 %	
Recoil detection efficiency	60 %	63 %
Accelerator duty cycle	76 %	
Acquired events (dead time, spill structure)	50 %	
First measurement ($d_1 = 1$ cm)		
Measurement time	6 shifts	
${}^{12}\text{C}$ primary-beam intensity	$4.5 \cdot 10^6$ pps	
Statistics ($N(d_1)$) (counts)	1777(42)	2461(50)
Second measurement ($d_2 = 6$ cm)		
Measurement time	18 shifts	
${}^{12}\text{C}$ primary-beam intensity	$1 \cdot 10^6$ pps	
Statistics ($N(d_2)$) (counts)	3817(62)	5545(75)
Beam tuning time	2 shifts	
Setup tuning time	3 shifts	
Empty target and beam-position checks	1 shift	
Total beam time requested	30 shifts	

HYDRA SRS/VMM3 – R3B DAQ integration



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Slide from Bastian (GLAD TPC session, tomorrow)