SBS Software Review Debrief

JLab Software Review

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Charge and Agenda

- Nov 27, 9:30 – 10:00 SBS Software and Computing
  - include status of GEM tracking/reconstruction software & validation
- Main relevant charge items:
  - Are the event reconstructions and physics analysis appropriate for publication quality physics results for the foreseen experimental program over the next five years? Are the halls producing appropriate levels of simulated events?
  - Has each hall developed multi-year estimates consistent with CEBAF operations of 34 weeks/year for offline computing resources that appropriately support physics analysis and timely publication of results? Are those estimates consistent with the experience gained to date for data rates, processing time and need for simulation to support analysis

Last Review Recommendations for SBS

- Investigate whether substantially higher backgrounds in SBS than expected would alter projected computing needs or required software capabilities.

Present Projected Timeline and Milestones

	Software activities	Experiment running and analysis
	Completed – Full simulation interfaced to analysis Completed – Decoders and channel analysis	
Fall 2018	Began analysis of digitized simulated experiments	
Jan 2019	Collection of online and offline analysis and displays	
2019	Neutron FF experiment simulated analysis Goal – GMn tracking to 80% efficiency, 8 Hz	
2020	Jan - GMn, GEn ready for analysis Proton FF experiment simulated analysis Online, offline scripts finalized from commissioning	March - GMn installation begins
2021	Goal – GEp tracking to 80% efficiency, 3 Hz Jun - GEp ready for analysis Start simulated analysis of SIDIS, TDIS	Jan - GMn start of run GMn analysis begins Fall – GEn start of run
2022	Jan - SIDIS ready for analysis	Fall - GEp start of run?
2023		GEp analysis begins? SIDIS start of run?

Analysis Readiness Checklist

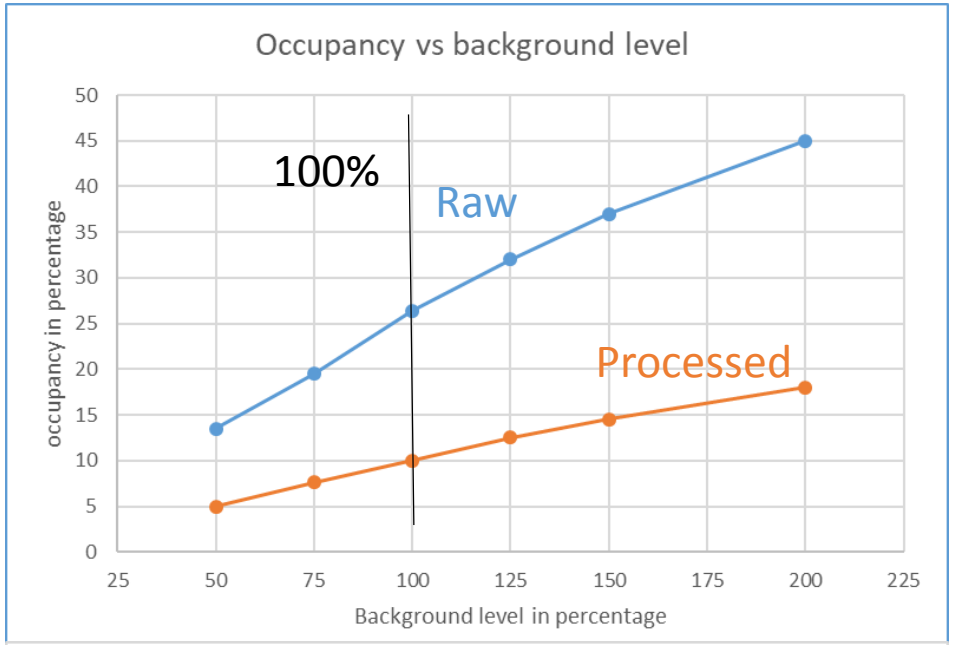
Simulation of backgrounds and analysis expected to take place on JLab farm

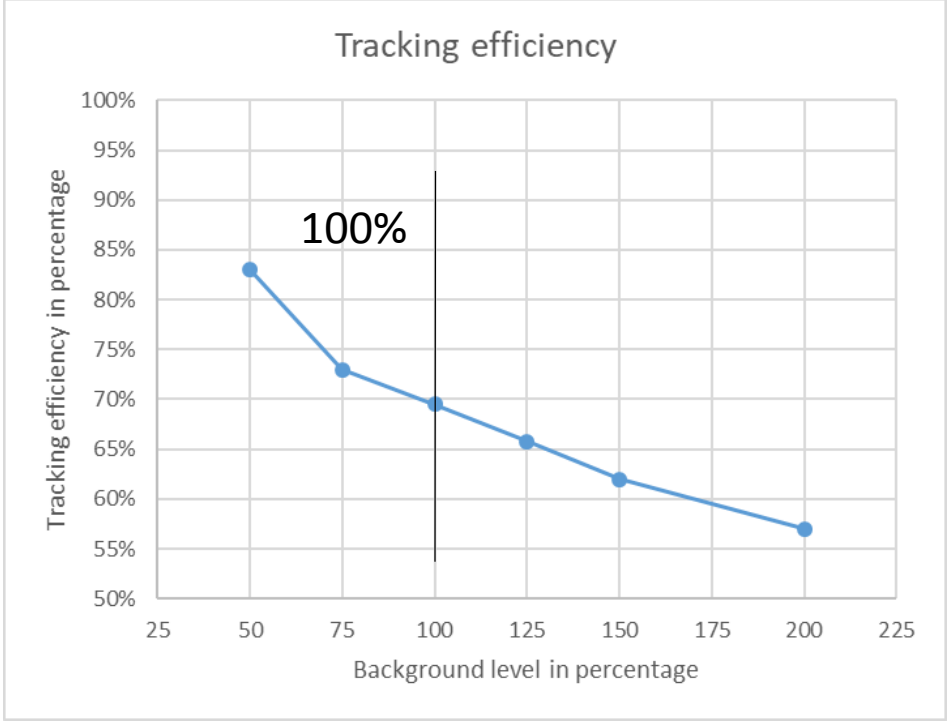
Full analysis includes

- Version controlled repository of software for each experiment
- Organized passes for
  - Pool of simulated individual background events
  - Pool of simulated digitized events with background superimposed
- Use of tracks from reconstruction under full background and +50%, +100% conditions
- Calorimeter cluster reconstruction under superimposed background
- Cherenkov cluster reconstruction
- Integration of inter-detector information for
  - Identifying good track pathways
  - Probabalistic track identification
- Full event-by-event kinematic and vertex reconstruction including optics models
- Identification of
  - Random backgrounds
  - Contamination of inelastic and radiative events

GEM Tracking – GMn

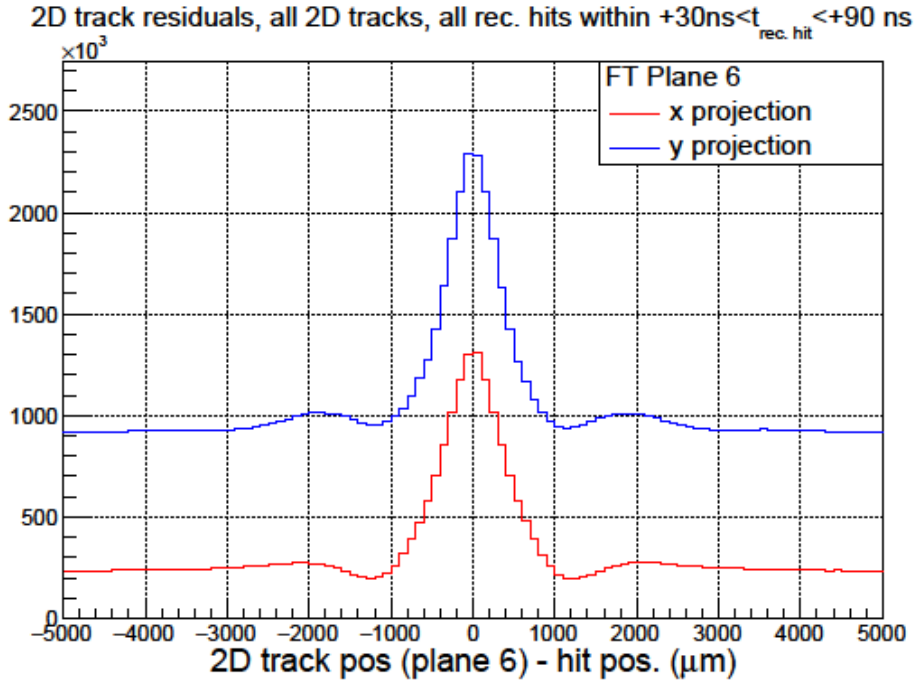
- Since 2016
  - Improved GEM response and validation based on data from constructed GEMs
  - Observe larger and wider background response
- Event reconstruction at
  - 70% tracking efficiency (2020 goal 80%)
  - 3 Hz (2020 goal 8Hz)
- Continuing to evaluate better separation of broad ADC clusters

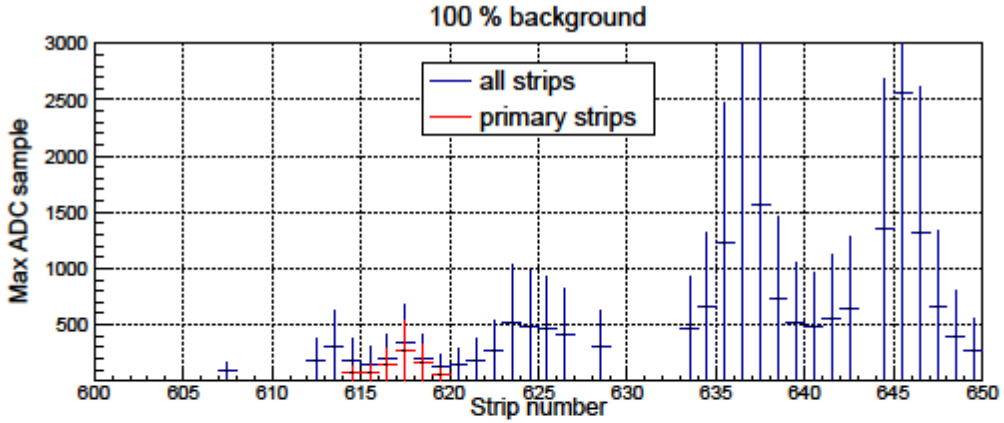


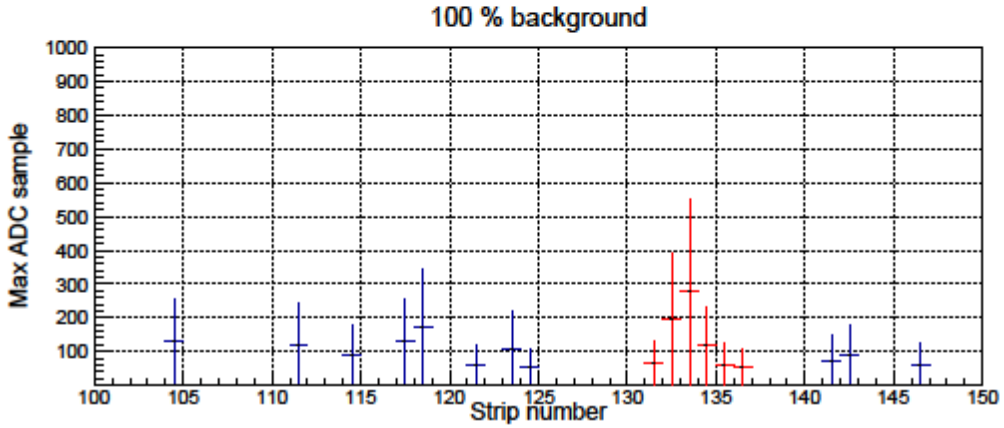


GEM Tracking – GEp (goal by mid 2021)

- GEp rates roughly factor 5 higher than GMn
  - Goal: 80% efficiency, 3 Hz by mid 2021
- Significant postprocessing will be required – Reevaluating TreeSearch
- GMn will be critical to understanding high rate data
- Have postdoc focusing on this effort







Reviewer Comments

- No major questions – satisfied with presented effort and timeline
- Favorable to doing virtual experiments beforehand
- Suggested we look at machine learning techniques for tracking problems

Observations

Hall A + C

- Onsite resources suffice now and in the mid-term future computing projections for the needs of Halls A and C
- Podd software is managed using standard tools (Github, Redmine issue tracking, Travis validation)
- Podd processing is a single pass from raw data to physics observable plots/trees
- SWIF is used to manage workflows (also in Halls B+D)
- **Hall A tritium cross-section ratio analysis is near publication**
- **Hall C F2 deuteron/proton ratio measurement has a preliminary result**
- Podd framework will depend on root 6 through the SBS era
- Both Halls project that their simulation and reconstruction needs will be met by their 5% (each) allocation of local computing resources
- SBS has tested reconstruction performance at up to 200% expected background rates in simulation
- SBS software is supported by a large but coordinated pool with a core of dedicated postdocs
- SBS GEM simulation has been tuned to prototype response measurements using cosmic rays and sources
- **Virtual experiments are planned in the near future to test SBS readiness for data**