SoLID Simulation Organization and Status

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Outline

- Pre R&D Goals and Request
- Progress to Goals
- Acceptance Studies

Director's Review Issues

11 Recommendations:

- End-to-end simulations with realistic subsystem responses and material budgets, and complete track finding and reconstruction should be developed.
- Acceptances, efficiencies, and systematic uncertainties should be simulated for each of the core measurements.
- For the PVDIS measurements, the viability of the elastic scattering calibration procedure, to determine absolute Q^2 should be demonstrated by simulations for similar scattering angles to those probed in DIS, and with realistic misalignments.
- Bin migration effects should be simulated for the measurements of the sharply rising J/ψ production cross section near threshold.
- The signal and background trigger rates should be simulated for the J/ψ measurements.

Director's Review Issues II

- The dead-time(s) in the DAQ chain should be modeled.
- The development of a simulation framework with realistic reconstruction and analysis should be pursued with high priority and increased resources.
- The development of a simulation framework with realistic reconstruction and analysis should be pursued with high priority and increased resources.
- Having a functional simulation and reconstruction routines as soon as possible should be a high priority in the software effort. Such software will pay off many times over in experimental design and avoiding pitfalls.

Director's Review Issues III

- Complete radiation calculations to determine activation and absorbed dose on components of concern and mitigate as appropriate
- It should be confirmed that the baffle design, including the support structure, is optimized for background rejection and signal acceptance. Furthermore the baffle design should minimize generation of secondary backgrounds.

Director's Review Issues Summary and Response

- Overall - Restarted dedicated bi-weekly simulation meetings
  - Interleved with SIDIS-specific meeting
  - Has been well attended by working groups
  - Complementary to Ole's bi-weekly software meeting
- End-to-end Simulations
  - Starting with existing GEMC/libsolgemc framework
  - INFN GEM digitization was integrated with general post-processing library years ago
  - Incidentally: Evaristo did some neutral-network GEM tracking code which may be useful
  - Long term simulation needs being explored by software WG and has been put in pre R&D request

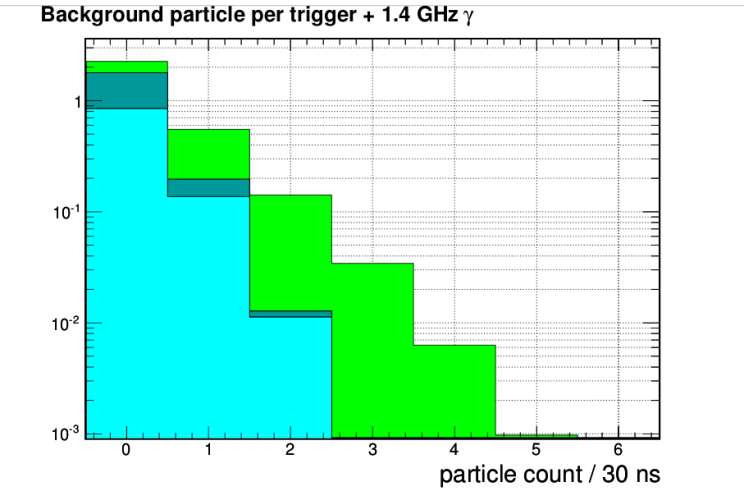
Short Term $\sim$ year

Timeline/Milestones

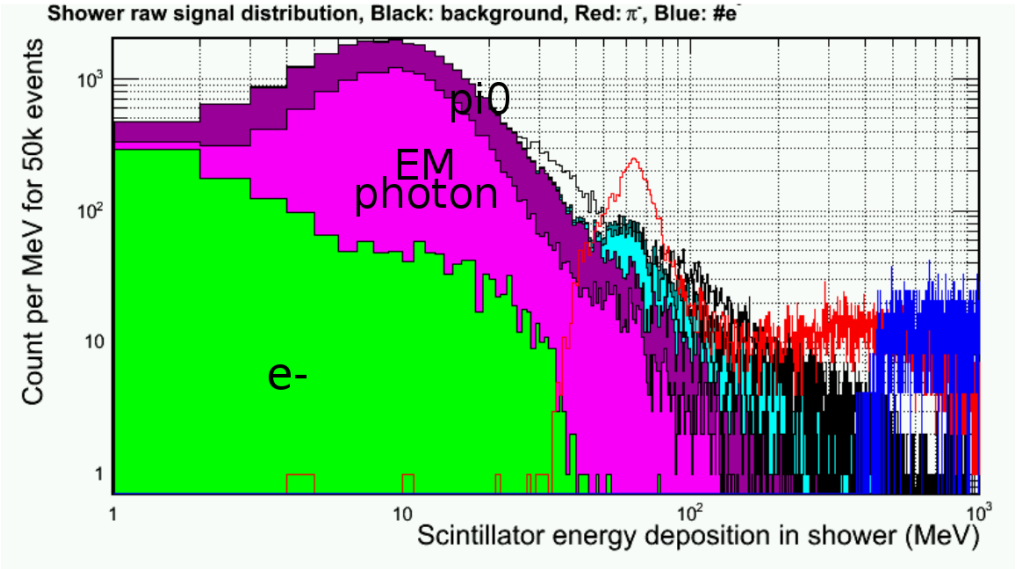
Acceptances for 3 experiments	May	Zhiwen and Kalyan	
PVDIS Q2	May?	Bob Michaels	
SIDIS impact	Aug?	Tianbo,Zhihong,Kalyan	
J/psi bin migration and signal/background	May?	Temple	
Magnet optimization	Aug?	ANL?	
Hadron generators	April	Rakitha	
EC old response function wrapper	March	Yuxiang	Done
EC new response (PVDIS)	March	Rakitha	Done
EC new response (SIDIS)	April	Rakitha	
LGC trigger response	March	Michael	
SPD and MRPC trigger response	April	Yuxiang	
PVDIS e trigger	April	Michael,Yuxiang,Sangwha	
SIDIS e trigger	May	Michael,Yuxiang	
SIDIS hadron trigger	May	Michael,Yuxiang	
DAQ deadtime	Aug?	Alex,Bob,Yuxiang?	
GEM response parameterization	May?	UVa group	
GEM Digitization and Occupancy	May	Weizhi	
Tracking	Aug	Weizhi	
Baffles optimization	May	Rich	

Trigger Concerns

- Major issue: Formalizing how to handle
  - Correlations between detectors
  - Folding in backgrounds over signal responsibly
  - Minimally (as possible) biased event generation



(a) Stacked probability to find the number of background π^- (light blue), π^+ (dark blue) and electrons (green) at the front of the preshower. The photon rate is as high as $\sim$ 1.4 GHz,



Pre R&D Request

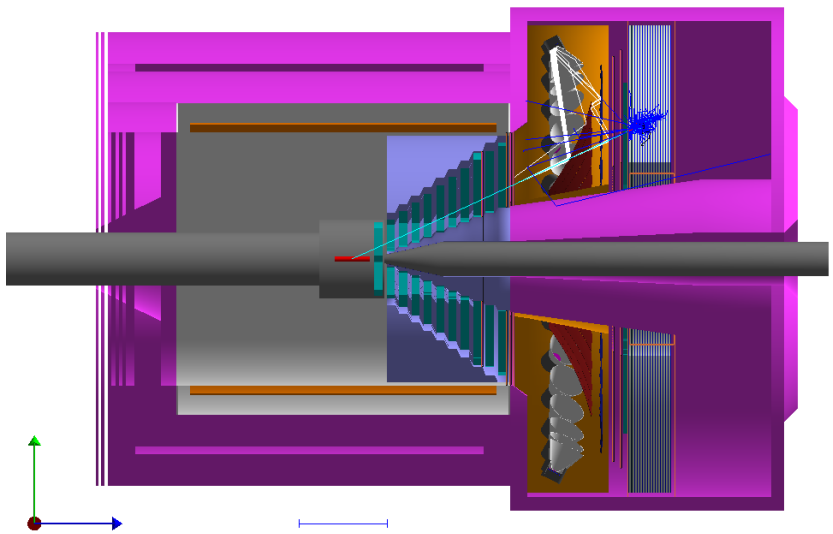
Lots of big tasks ahead which require new dedicated workforce

- Envisioned 4 postdoc FTEs - scaled back to 3
- Strong tie-in with general software efforts
  - Coherent simulation and software development - particularly end-to-end and simulation/analysis framework interface
  - Algorithms and tracking - development and testing with simulation
  - Immediate needs for background evaluation, configuration optimzation, code maintenance
  - Simulation directly relating to DAQ, analysis framework
- Institutions making the requests:
  Stony Brook (1.5), Duke (1), Temple (0.5)
- Need more detail and repropose?

Short Term $\sim$ year

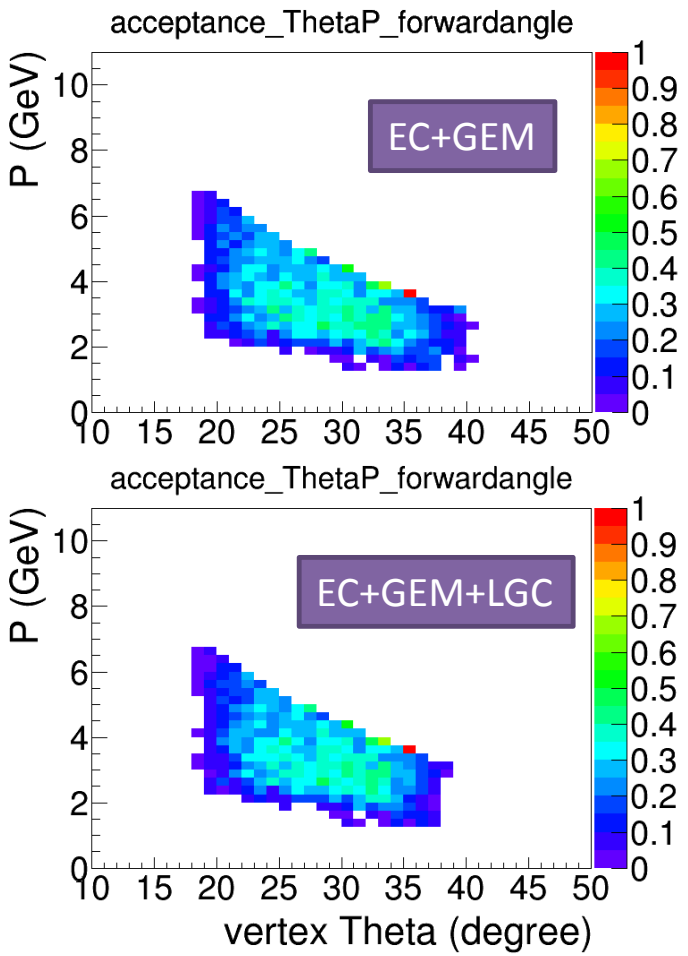
Full Simulation and file sharing

- We run full simulation in “solid_gemc” with all subsystems and generate various files at a shared central location
- They can used for studies like acceptance, trigger, background, GEM etc and ensure consistent results

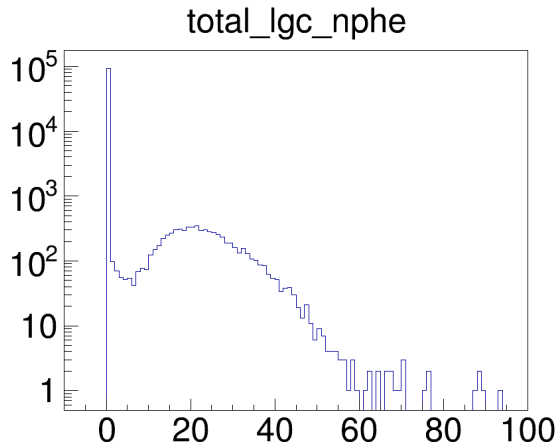


location
/home/zwzhao/background
dir
PVDIS_LD2_JLAB_VERSION_1.2
PVDIS_LD2_JLAB_VERSION_1.3
SIDIS_He3_JLAB_VERSION_1.2
SIDIS_NH3_JLAB_VERSION_1.2
JPsi_LH2_JLAB_VERSION_1.2
subdir
pass1
pass2
pass3
log
/home/zwzhao/background/log_PVDIS_LD2
/home/zwzhao/background/log_SIDIS_He3
/home/zwzhao/background/log_SIDIS_NH3
/home/zwzhao/background/log_JPsi_LH2

Example: PVDIS acceptance

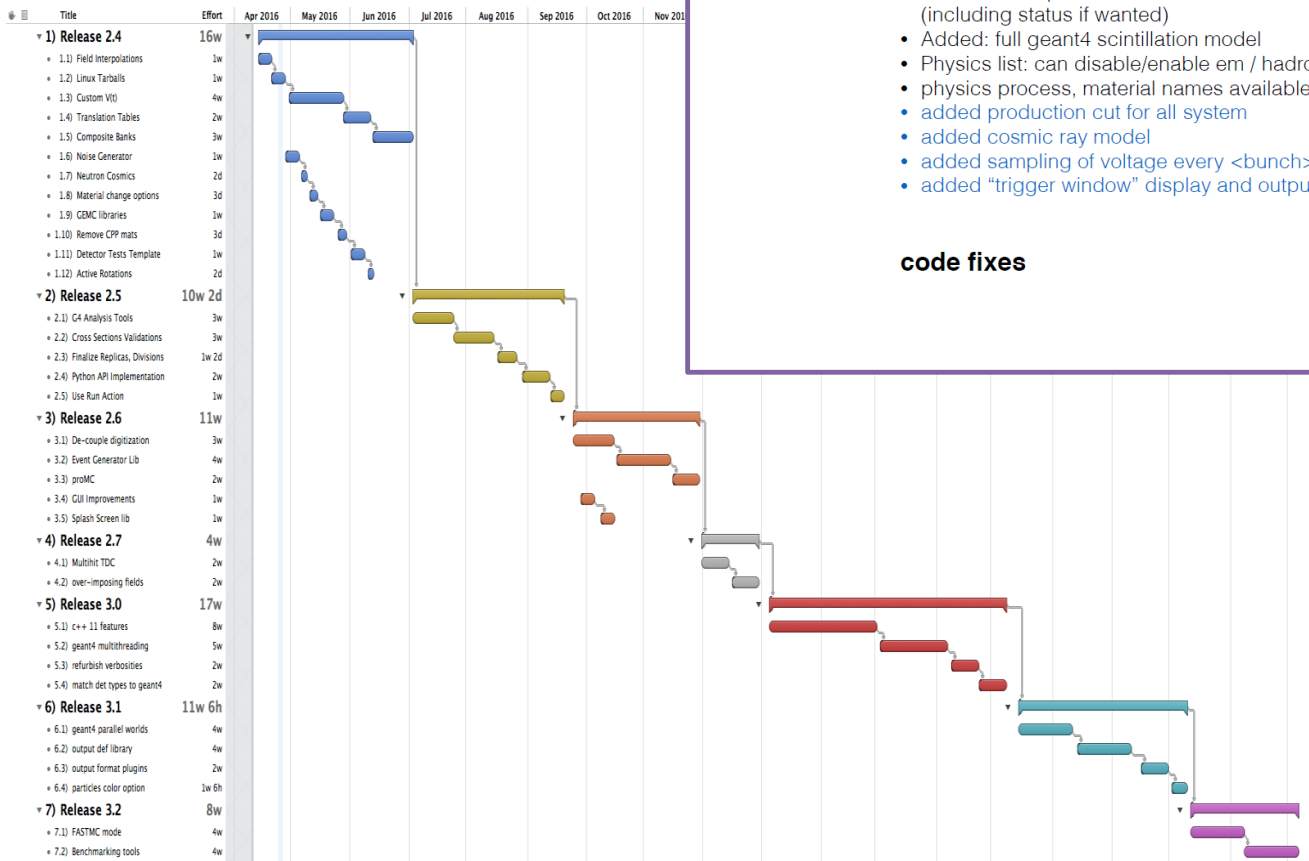


- A simple test, not complete study
- Throw eDIS into PVDIS full simulation, consider it's accepted when
  - it passes all GEM planes and entering EC
  - In addtion, LGC has number of total photons > 10
- Essentially it will need to involve from a simple into a full reconstruction code



GEMC Update

Roadmap



gemc version 2.3

What's new:

- parameters from CCDB
- template: initialize hit process routine with those pars (example: FTOF)
- added run dependent calibration - will re-initialize pars (including status if wanted)
- Added: full geant4 scintillation model
- Physics list: can disable/enable em / hadronic / optical physics
- physics process, material names available in the hit process
- added production cut for all system
- added cosmic ray model
- added sampling of voltage every <bunch> ns (FADC mode 1)
- added "trigger window" display and output

code fixes

BACKUP

Director's Review Issues Summary and Response II

- Systematics for all experiments
  - Individual experiment spokespeople have been contacted for dedicated manpower
  - Short-term systematics assignment
    - SIDIS (with CLAS and SBS comps) - Tianbo, Zhihong, Kalyan (Aug?)
    - PVDIS - Rakitha (backgrounds), Rich (calibration, baffles), Rob Michaels (calibration)
    - J/ψ - Zein-Eddine and Student
- Background generators are high priority being explored with Rakitha
- Radiation/activation addressed by simulations with Lorenzo
- Detector and baffle optimization need to be demonstrated
- Continuing algorithm development - Ole and Weizhi with pre R&D request
- Simulating to DAQ - Yuxiang at SBU with preR&D request

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