

Simulation Overview

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Simulation Software status

- Study for preCDR 2018
 - with jlabce 1.3 including Geant4.10.01.p03 and GEMC 2.3
- Try new setup with enlarged magnet endcap
 - with jlabce 2.2 including Geant4.10.03.p02 and GEMC latest
 - CAD import
 - Fast MC mode
 - FADC output
 - Background merging
 - 3D map in cartesian coordinates with 4 fold symmetry
 - <https://gemc.jlab.org/gemc/html/documentation/releases/changelog.html>
- Test GEMC 3.0.beta1
 - multithreading at event level
 - Hit process as plugin
 - Direct root output
 - <https://gemc.jlab.org/gemc/html/documentation/releases/roadmap.html>

Code on github

Codes are converted from svn to github with history preserved

github https://github.com/JeffersonLab/solid_gemc (alive)

svn <https://jlabsvn.jlab.org/svnroot/solid/> (frozen)

Codes are also reorganized with the following structure

- "geometry", detector definition
- "field" field definition
- "script" example script to run simulation
- "digitization" code to digitize simulation output
- "analysis" code to analyze results and do some studies
- "source" source code of solid_gemc which add solid specific hit process routine and load gemc as library
- "mod" some modification of original gemc code to fit solid need

Development rule

- Use "master" branch as devel version and github release as production version
- most small development will be done by "fork->modify->submit pull request" mode.
- some major collaborative development can be done with "branch->modify->submit pull request" mode as needed

event generator will have individual repo (ongoing)

for example "evgen_BHphoton" converted from svn "evgen/genTCS"

Release in Container

- release all software in container
 - Like virtual machine but with no overhead, run farm job, no installation, one image for any machine, **reproducible results**
 - Build docker image and both docker and singularity
- SoLID dockerfiles are at https://github.com/JeffersonLab/solid_release
- Docker images are at jeffersonlab/solid:[tag]
 - tag 1.0.0 (GEMC 2.3 + solid_gemc 1.0.0)
 - tag 1.devel (GEMC 2.3 + solid_gemc latest)
 - tag 2.devel (GEMC latest + solid_gemc latest)
- Running it on jlab farm is working (instruction soon)
- Running it on open science grid is feasible (instruction in near future)

Event generator

- done
 - hadron generator “solid_bggen” (halld “bggen” based) code improvement and bug fix (Ye Tian, Jixie Zhang)
 - Comparing solid_bggen and pi- rates from MARATHON pi0 rates (DVCS?)
 - SIDIS generator (Tianbo,Zhihong)
- Todo
 - Comparing solid_bggen and pi0 rates from DVCS (Ye Tian from Shandong Univ.)
 - Internal and external radiative effects
 - check and compare inclusive ele generator “solid_inclusive_e” (Christy/Bosted+LHAPDF6) and “eicrate” (Seamus)
 - Finalize jpsi generator (Sylvester)

Magnet

- done
 - New magnet 3D field map (Jay)
 - NH3 target magnet field map fixed (Chao Gu)
 - Read new magnet 3D field map in simulation (Zhiwen)
- todo
 - Study how map grid size and precision affects tracking resolution to understand tracking requirement on map (Jinlong?)

Baffle

- done
 - Optimization study (Rich)
 - Recheck with new magnet (Rich)
- todo
 - 32 instead of 30 sectors (?)

Target

- done
 - Detailed NH₃ target in simulation (Chao Gu)
- todo
 - He³ window collimator optimization (Zhiwen)

EC

- done
 - add scintillation (Birk) and fiber attenuation effect for shower and preshower (Zhiwen Zhao, Ye Tian)
 - Trigger function (Ye Tian)
 - Simulation for beam test (Ye Tian)
 - Study combine 3 readout into 1 (Ye Tian)
- todo
 - comparing to test result (Ye Tian from Shandong Univ.)
 - new FAEC layout for new magnet, LAEC layout (ANL)

GEM and tracking

- Done
 - digitization and tracking tested for 160ns time window of SAMPA chip for SIDIS He3 (Weizhi)
 - digitization and tracking note in docdb (Weizhi)
 - digitization for PVDIS with strip cut (Rich)
 - Study one plane removed (Jinlong)
- Todo
 - Add layout and dead area (UVa?)
 - Test SAMPA chip with 80ns for SIDIS He3 (Jinlong)
 - Recheck PVDIS tracking with strip cut (Jinlong)
 - Test SAMPA chip for other setup
 - Optimize SIDIS and JPsi setup
 - Optimize digitization code
 - SIDIS NH3 tracking
 - Get Resolution with background for all setup with better description

MRPC

- Done
 - digitization improved
- todo
 - Comparing to data
 - Finish occupancy and rate study
 - Study trigger condition and trigger response

Sanghwa

SPD

- Done
 - More detailed digitization including light collection
 - add scintillation (Birk) effect
- todo
 - Comparing to data
 - Finish occupancy and rate study
 - Study combined trigger response with MRPC

HGC

- done
 - redesign optics for new magnet (Bo Yu,Zhiwen)
- todo
 - Study field effect
 - Background and window study
 - Study small flat mirror

LGC

- Done
 - Optimize more forward angle for SIDIS
 - Study small flat mirror
- Todo
 - More optimization for new magnet

Overall simulation

- Done
 - NH3 acceptance file with correct field map (Zhiwen)
 - Trigger and background with new hadron generator output for SIDIS He3 (Ye Tian)
- Todo
 - DAQ deadtime simulation
 - Trigger and background with new hadron generator output for other setup
 - Background merging and pileup for all detector
 - End-to-end simulation with all digitization

Digitization and reconstruction

- Digitization (keep it independent of simulation)
 - MRPC and GEM digitization are most advanced, they are after simulation. For other detectors, we could do the same
 - In simulation, Cerenkov record photons, SPD and EC record energy deposition, then in digitization, convert Cerenkov,SPD,EC to number of p.e., unless it can't be separated
 - This would save a lot of simulation time
- Reconstruction
 - Tracking code is independent
 - We have simple root script to read simulation output and combined information from many sub-detectors to study acceptance,efficiency,trigger etc and produce some plots and numbers
 - Simple code can't go too far
- Next step
 - Maybe try to use art with a data model and input plugin to read GEMC output, then code can still be reused even for next stage of simulation.
 - Do GEM digitization in art to test drive data model,input plugin, etc (?)

Priority

- Before jlab internal review
 - Refine current study
- Before DOE review
 - Comparing solid_bggen and pi0 rates from DVCS (Ye Tian from Shandong Univ)
 - SAMPA chip and tracking (Jinlong)
 - MRPC and SPD rate study (Sanghwa)
- Beyond
 - Set up all sub-detectors with enlarged magnet endcap to start another round of overall simulation