

# SoLID Simulation Overview

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# magnet with longer endcap

longer endcap gives room for FAEC cables, Cherenkov tank and window  
 Prepare for next iteration of design and verify basic performance  
 Not update everything for science review

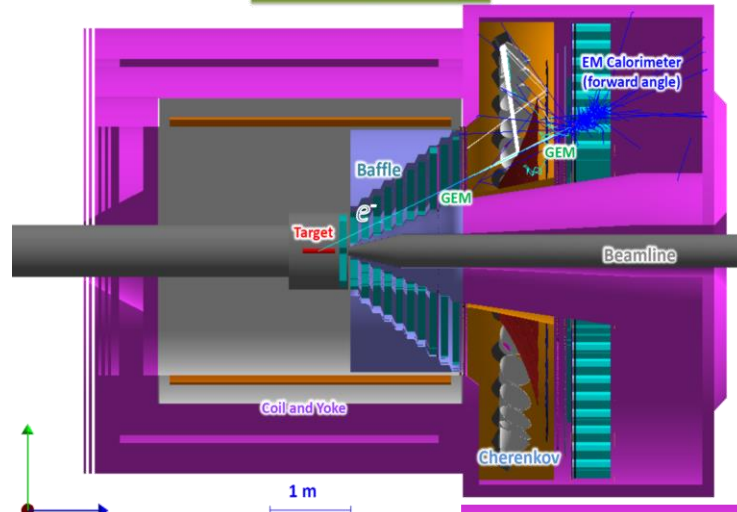
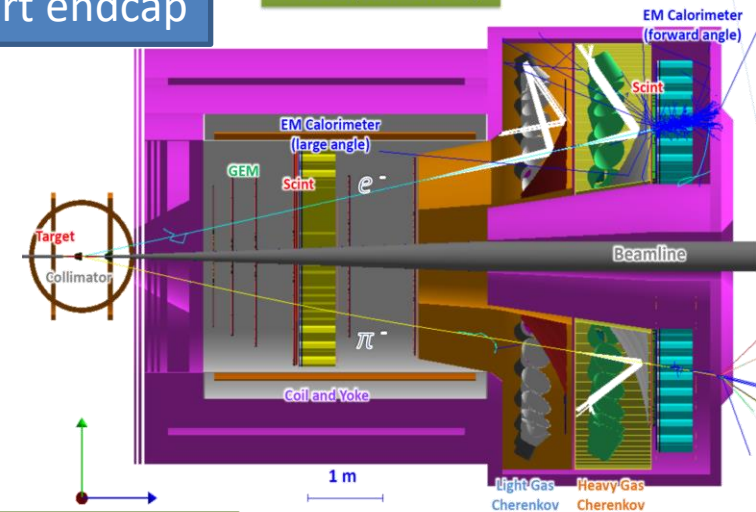
- Layout change
  - enlarge endcap space in Z by 45cm=(530-485)
  - Move downstream of FASPD, MRPC, GEM 4 5 of PVDIS, and FAEC
  - Adjust LGC, HGC position in Z and optics
  - SIDIS forward angle from 8 to 7 deg

- Other change
  - Magnet geometry is from CAD model directly
  - Magnet field map 3D with 4fold rotation symmetry from TOSCA

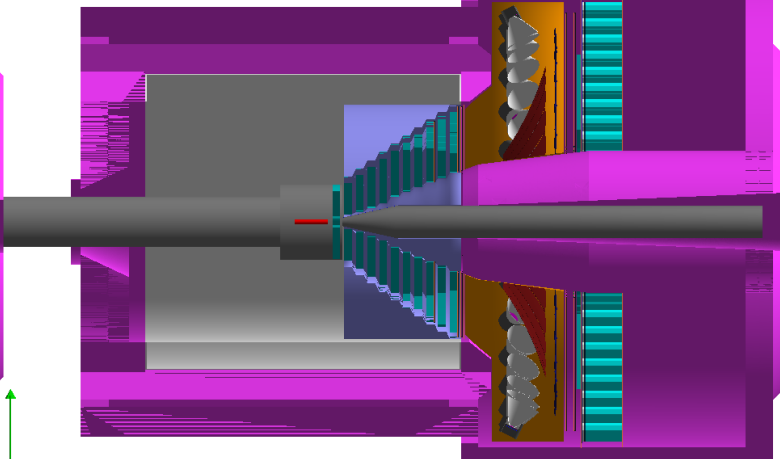
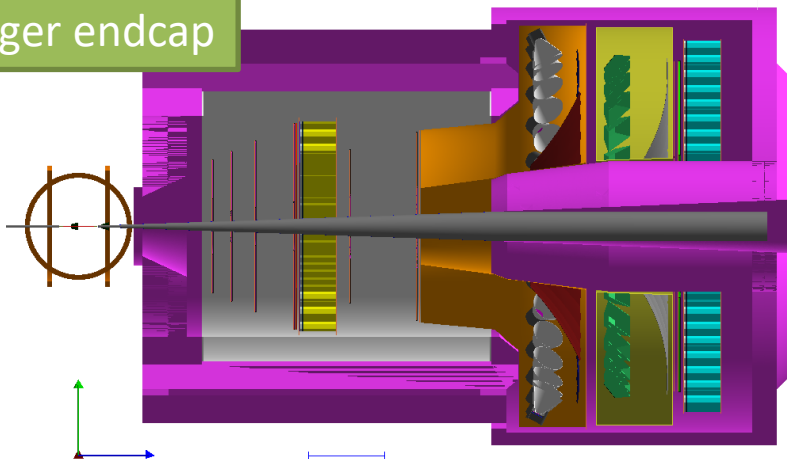
Short endcap

SoLID (SIDIS He3)

SoLID (PVDIS)



Longer endcap



Longer endcap field map and magnet from CAD matches as 2020 design

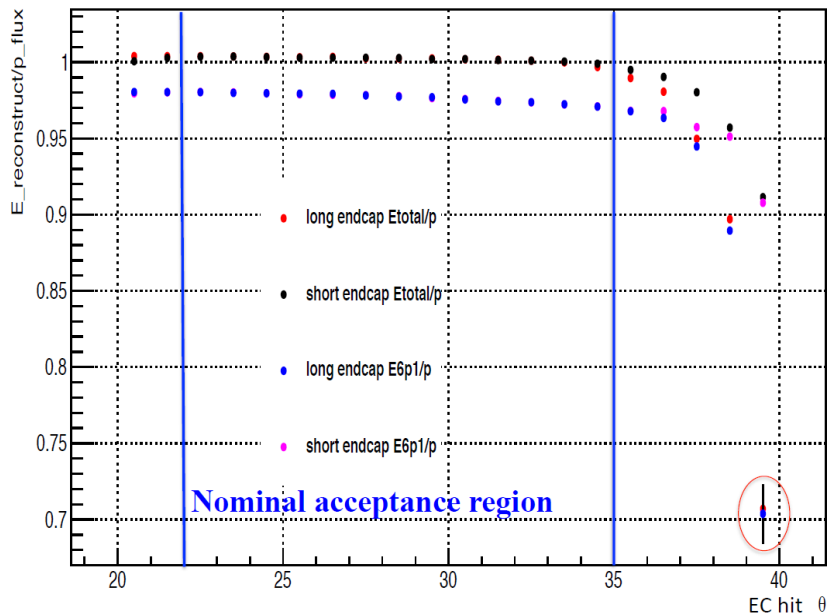
# Longer endcap EC edge effect

- Energy absorption ratio in FAEC for all modules (offline) and 6+1 modules (trigger) are similar between shorter and longer endcap
- No new modules are needed

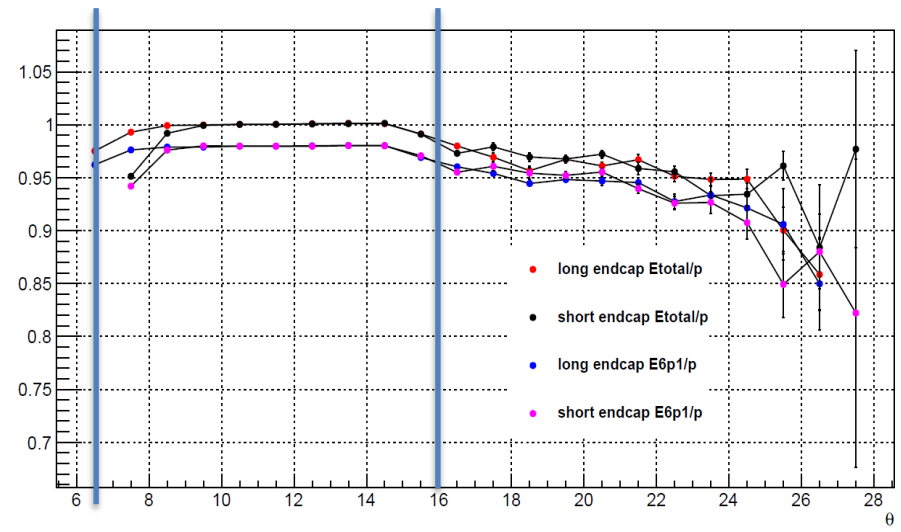
PVDIS

Edge Effect comparison

PVDIS LD2



SIDIS\_He3



# Sim Tasks before Science Review

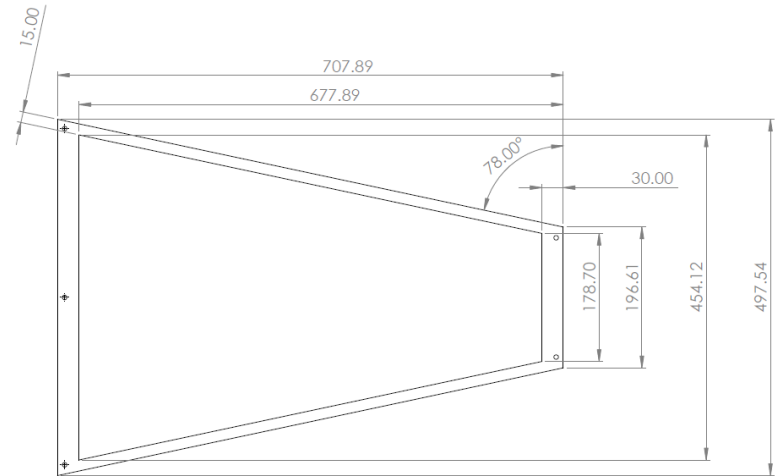
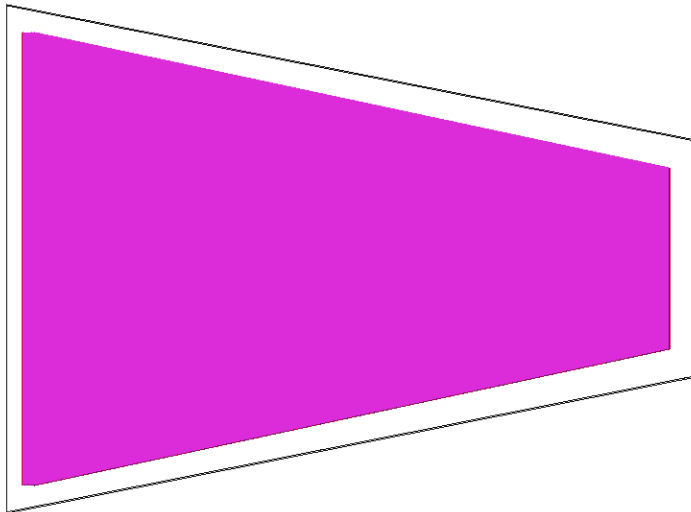
- Defend preCDR as it is but include new progress (longer endcap setup)
- Improve some physics studies (Jpsi and SIDIS\_NH3) to the same level of other studies.
- support preRD

	description	who	status	exp
1	Cherenkov simulation for preRD to support test	Zhiwen, Michael	ongoing	spring
2.1	GEM digitization with VMM and update tracking	Jinlong, Weizhi	Fine tuning	
2.2	GEM frame,dead area,layout in the simulation and update tracking for initial study	Weizhi, Zhiwen	ongoing	Feb/M ar
2.3	SIDIS_NH3 electron tracking, SIDIS_He3 hadron tracking	Weizhi	finished	
2.4	Initial tracking for multiple particles	Weizhi	finished	
3.1	check longer endcap setup: acceptance	Zhiwen	Fine tuning	Feb
3.2	check longer endcap setup: EC edge effect	Ye Tian	finished	
3.3	check longer endcap setup: background and trigger with existing method (PVDIS, SIDIS_He3)	Ye Tian	ongoing with updated generators	Feb/M ar
4	JPsi, background and trigger	Sylveste r	Ongoing	?
5	SIDIS_NH3, background and trigger	Vlad	finished	
6	evaluate e- generators and compare generators to Geant4	Ye Tian	Fine tuning	Feb <sub>4</sub>

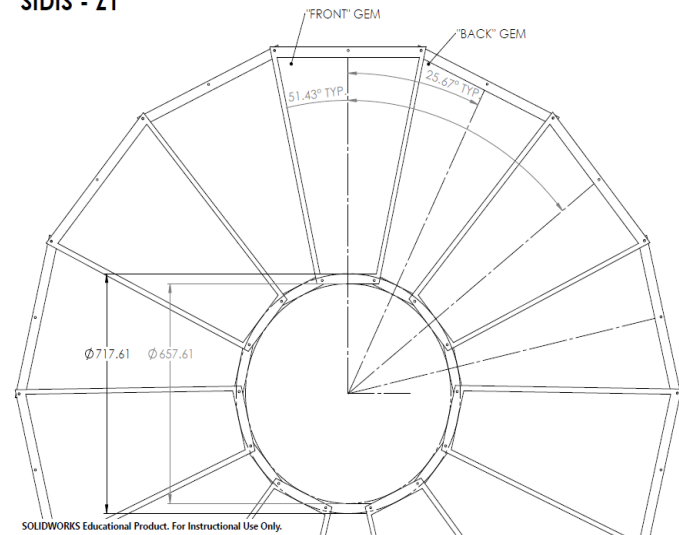
backup

# GEM geometry with frame,dead area,layout

putting design into simulation is ongoing



SIDIS - Z1



# How to move forward with general software

Is DD4hep the solution for detector definition?

- Need instruction to test solid in DD4hep
- Need some comparison studies between DD4hep and current simulation

Simulation software

- How good is the geant4 interface in DD4hep?
- Can gemc/solid\_gemc work with DD4hep?

ANL software ready for test?

Digitization, reconstruction and analysis software

- Need some framework to combine information from different subdetectors for high level analysis like PID and trigger
- Need some consistent data format or model

# Simulation Software Status

- solid\_gemc
  - for preCDR, using production version based on modified gemc 2.3 and geant4.10.1.p03 and physcis list “QGSP\_BERT\_HP”
  - For longer endcap setup, testing devel version based on latest gemc 2.x and geant4.10.06 and and physcis list “QGSP\_BERT\_HP”
    - This geant4 has fix of correct treatment for the recoiled nucleon with Deuterium, but not Tritium or Helium3 yet
- Digitization
  - MRPC, standalone code
  - GEM, standalone code using Analyzer
  - Others, simple optical photons and energy deposition
- Reconstruction and analysis
  - MRPC, standalone code
  - Tracking, standalone code using Analyzer
  - Root scripts with some structures



# Tasks in mid term before FY22

## Simulation goal

- Study figure-of-merit for experiments
- Optimize detector designs
- Understand experimental conditions and mitigate technical risks.

Item	Curr.per.(FTE)	Req.per. Y1(FTE)	Req.Per. hY2(FTE)
GEM	0.2 (Duke) 0.3 (SBU)	0.5 (UVa Liyanage)	0.25 (UVa Liyanage)
Other detector	0.3 (SBU) 0.1 (Temple) 0.1 (Duke)	0.3 (UVa Zheng) 0.1 (Temple Sparv.) 0.1 (Duke)	0.15 (UVa Zheng) 0.05 (Temple Sparv.) 0.05 (Duke)
physics	1.0 (Syracuse) 0.5 (Duke)	0.5 (Duke) 0.5 (Temple Sparv.)	0.4 (Duke) 0.4 (Temple Sparv.)
General software		0.5 (JLab*)	0.25 (JLab*)
reconstruction	0.3 (Syracuse)		
Total	2.8	2.5	1.55

- With existing effort only, we can cover different aspects, but with **less** deliverables. We don't have **general software** covered
  - GEM has no UVa part and simulation can't be connected to hardware well
  - EC simulation and reconstruction conflict. EC need to study edge effect for longer endcap. Reconstruction needs improvement to do better high level study combining different sub-detectors
  - We need to move forward with general software
- To ramp up effort, we need more people
  - Some standalone efforts in detector study and software can be a few months efforts. But overall performance and physic studies are constantly involving. There is a learning curve for any work.
  - It's ideal to have long term commitment from new contributors
  - How to get new contributors?

# Idea of SoLID software ecosystem

arrows with different colors mean different interfaces

