Simulation Parameters Update with 2023/09 Geometry Table

Physics and Detector Simulation Working Group, ePIC Collaboration

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Recent Release of the Geometry Parameters

- New Detector Parameter Table released 2023/09/27
  - Many updates compared to 2023/01 table
  - Need to implement them in the simulation (easier for frequent and smaller updates)
  - https://eic.jlab.org/Geometry/Detector/Detector-20230929162408.html

EIC GEOMETRY FRI, 29 SEP 2023 16:24:08

EIC DETECTOR GEOMETRY

INTERACTION POINT 6

Region	Component	Sub-Component	WBS	Length (cm)	Inner Radius (cm)	Outer Radius (cm)	Offset from Center (cm)	Physical Start (cm)	Physical End (cm)	Volume (m^3)	Weight (kg)	Technology	Notes
HADRON DIRECTION END CAP	HD Flux Return (Collar)			170	269	324	414.6	329.6	499.6	17.42	136,685	Iron	Offset: measured from center. Weight estimated as 100% iron.
	Hadron Calorimeter		6.10.06	140	17.5	267	359.6	359.6	499.6	31.22	199,896	FeSc, WSc last segment	Tower size: 5cm x 5cm x 140cm including 10cm readout Offset: measured from face nearest to interaction point Weight: estimated as 79% iron and 21% plastic
	HD Flux Return (Oculus)			22.2	195	267	340.7	329.6	351.8	2.32	18,205	Iron	Offset: measured from center. Weight estimated as 100% iron.
	Electromagnetic Calorimeter		6.10.05	30	14.0	195	329.6	329.6	359.6	3.57	23,048	Pb/Sc	Tower size: 2.5 cm x 2.5 cm x 30 cm including readout 10cm Offset: measured from face nearest to interaction point Weight: estimated as 85% lead glass and 15% steel
	Service Gap			13.6			316	316	329.6				Offset: measured from location nearest to interaction point
			6.10.04	120	14.0	180	320	200	320	10.47	1,946	Aerogel/Gas	Offset: measured from face farthest from the interaction point

Simulation Parameters and the Comparison

- Software WG has compared the new geometry table with the simulation
  - A Template to extract simulation constants
  - Not all parameters are implemented
  - https://eic.github.io/epic/artifacts/DetectorParameterTable/epic_craterlake.html

HADRON DIRECTION END CAP	HD Flux Return (Collar)							
HADRON DIRECTION END CAP	Hadron Calorimeter		140.0	0	270.0		363.2	503.2
HADRON DIRECTION END CAP	HD Flux Return (Oculus)							
HADRON DIRECTION END CAP	Electromagnetic Calorimeter		30.0	20.0	174.0		333.2	363.2
HADRON DIRECTION END CAP	Service Gap		13.6				319.6	333.2
CENTRAL DETECTOR	Dual RICH		120.0	8.49	185.0		195.0	315.0
CENTRAL DETECTOR	Dual RICH	Detector Section		8.49				
CENTRAL DETECTOR	Dual RICH	Aerogel Section		8.49				
CENTRAL DETECTOR	HD Time of Flight/Tracker							
CENTRAL DETECTOR	Barrel Flux Return							
CENTRAL DETECTOR	Barrel Hadron Calorimeter		635.6	177.0	270.0		-316.0	319.6
CENTRAL DETECTOR	Barrel Hadron Calorimeter	HD Section						
CENTRAL DETECTOR	Barrel Hadron Calorimeter	Central Section						
CENTRAL DETECTOR	Barrel Hadron Calorimeter	LD Section						
CENTRAL DETECTOR	Solenoid Magnet		384.0	142.0	177.0		-202.0	182.0
CENTRAL DETECTOR	Barrel HD EMCal Support							

Ongoing and Planned Updates

- A detailed comparison report can be found in issue #552 in epic repository
  - New geometry (det) vs simulation (sim), and constant name (template_var)
  - Many simulation constants need to be updated, most of the detectors are affected

CENTRAL DETECTOR, Barrel EMCal, :

	det	sim	template_var	stat
Length (cm)	470.0	635.0	{{EcalBarrel_length}}	Mismatched
Inner Radius (cm)	81.0	78.5	{{EcalBarrel_rmin}}	Mismatched
Outer Radius (cm)	116.0	140.0	{{EcalBarrel_rmax}}	Mismatched
Offset from Center (cm)	-38.75	NaN	Empty	Missing
Physical Start (cm)	-273.75	-440.0	-{{EcalBarrelBackward_zmax}}	Mismatched
Physical End (cm)	196.25	195.0	{{EcalBarrelForward_zmax}}	Mismatched

CENTRAL DETECTOR, Barrel EMCal, Exterior Cover:

	det	sim	template_var	stat
Length (cm)	460.0	NaN	Empty	Missing
Inner Radius (cm)	114.0	NaN	Empty	Missing
Outer Radius (cm)	116.0	NaN	Empty	Missing
Offset from Center (cm)	-38.75	NaN	Empty	Missing
Physical Start (cm)	-268.75	NaN	Empty	Missing
Physical End (cm)	191.25	NaN	Empty	Missing

CENTRAL DETECTOR, LD EMCal, :

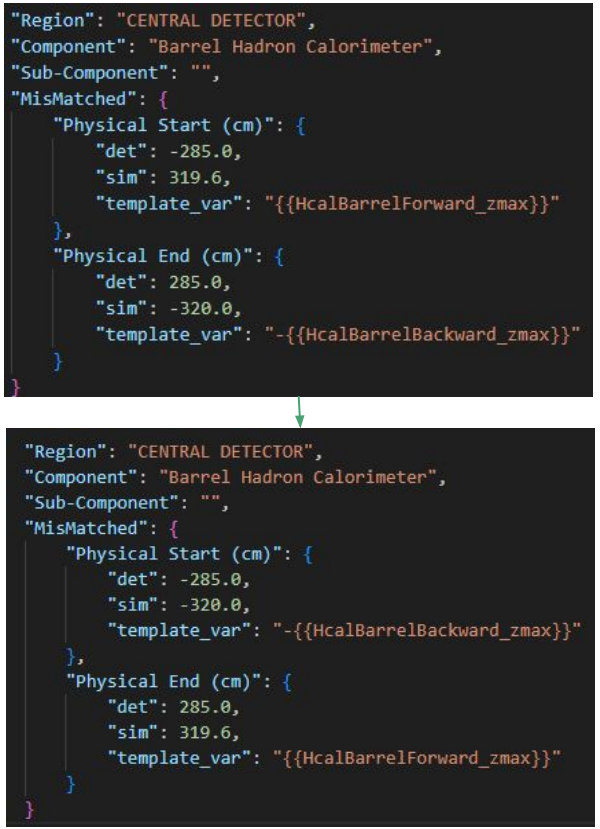
	det	sim	template_var	stat
Length (cm)	60.0	60.0	{{EcalEndcapN_length}}	Correct
Inner Radius (cm)	9.0	9.0	{{EcalEndcapN_rmin}}	Correct
Outer Radius (cm)	63.0	63.0	{{EcalEndcapN_rmax}}	Correct
Offset from Center (cm)	-175.0	NaN	Empty	Missing
Physical Start (cm)	-235.0	-235.0	-{{EcalEndcapN_zmax}}	Correct
Physical End (cm)	-175.0	-175.0	-{{EcalEndcapN_zmin}}	Correct

CENTRAL DETECTOR, Solenoid Magnet, :

	det	sim	template_var	stat
Length (cm)	384.0	384.0	{{Solenoid_length}}	Correct
Inner Radius (cm)	142.0	142.0	{{Solenoid_rmin}}	Correct
Outer Radius (cm)	177.0	177.0	{{Solenoid_rmax}}	Correct
Offset from Center (cm)	-10.0	NaN	Empty	Missing
Physical Start (cm)	-202.0	-202.0	-{{SolenoidBackward_zmax}}	Correct
Physical End (cm)	182.0	182.0	{{SolenoidForward_zmax}}	Correct

Implementation of New Parameters

- Update the table template
  - First update in PR #553
  - Format updated, fixed several known issues, added many constants
- Update the compact files
  - Break the issue #552 into smaller ones
  - Coordinated work with DSC's
  - Start to assign issues to DSC's point of contact for simulation
- Update the geometry plugin
  - Mostly related to the new support structure
  - Coordinated work with relevant DSC's

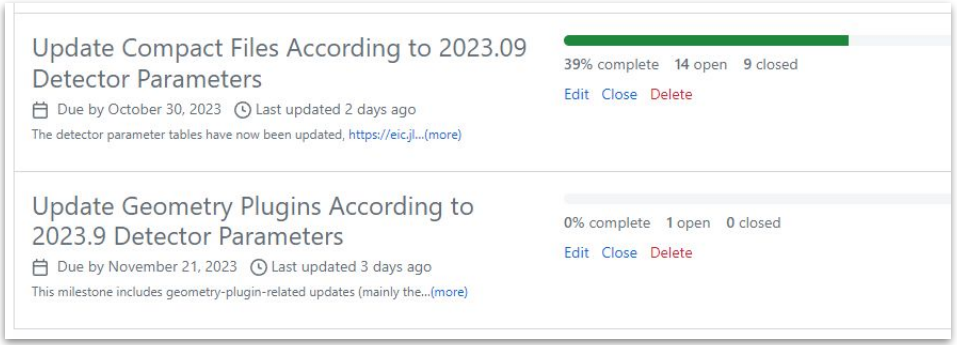


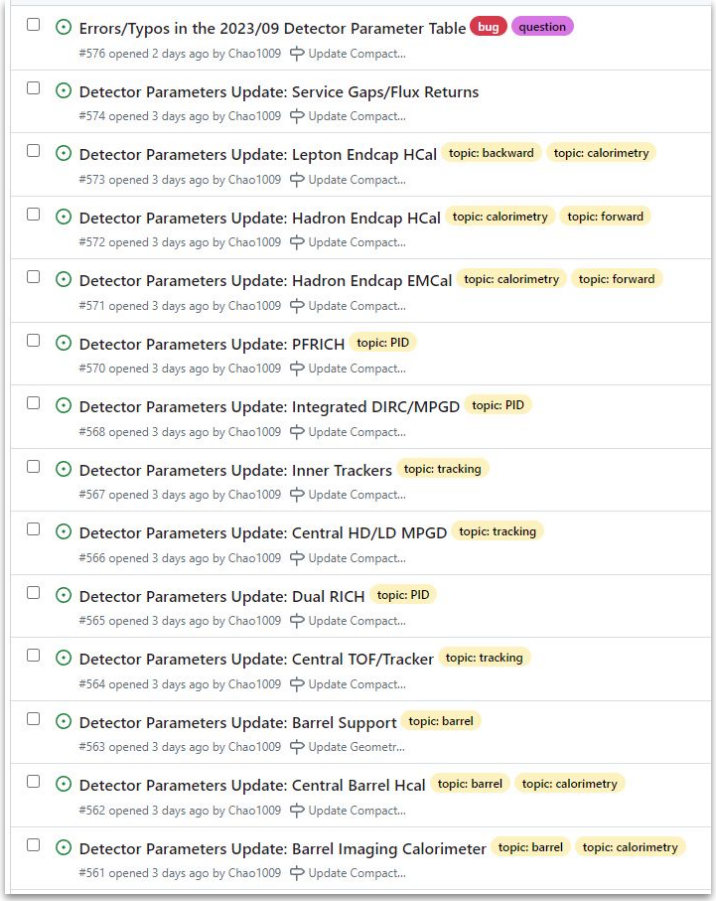
What the Simulation WG Needs from DSC's

- Update the parameters for your own detector subsystem
  - Simulation team is willing to help
  - Helpdesk channel on mattermost, or tag us (Chao, Wouter, ...) on github
- Study and validate the parameter changes
  - Expect simulation output changes in the following simulation campaigns
  - Report issues/bugs
  - Simulation team is the messenger, we do not own the geometry parameter table
- Help us improve the simulation parameter table template
  - Let us know if we're looking at wrong constants
  - Fill out the missing ones

Issues, PRs, and Milestones

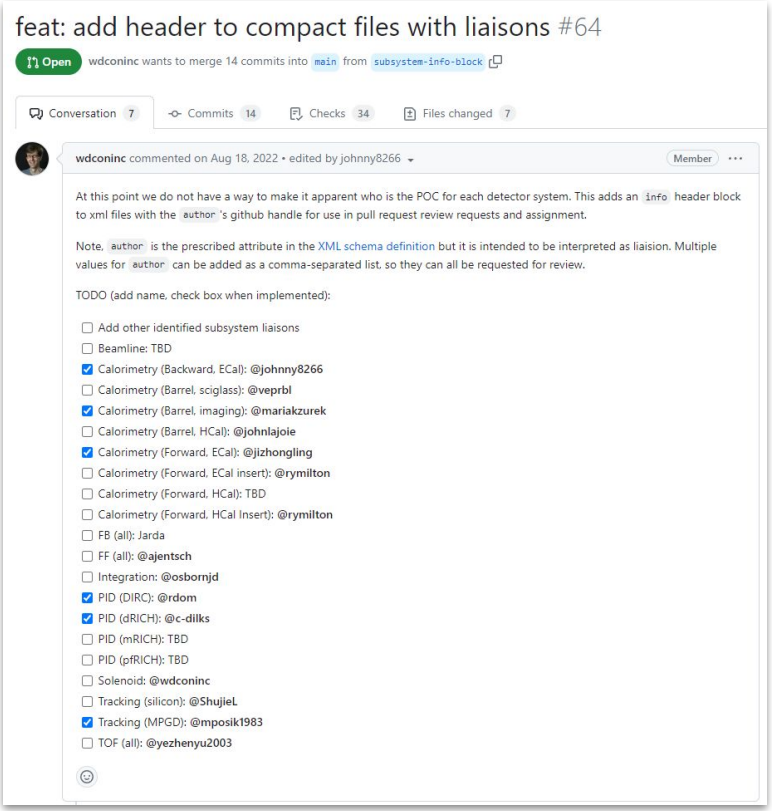
- A series of issues created in the eic/epic repository
  - Grouped by detector subsystems
  - Contains a relevant report for the parameters comparison
- Two milestones for the update





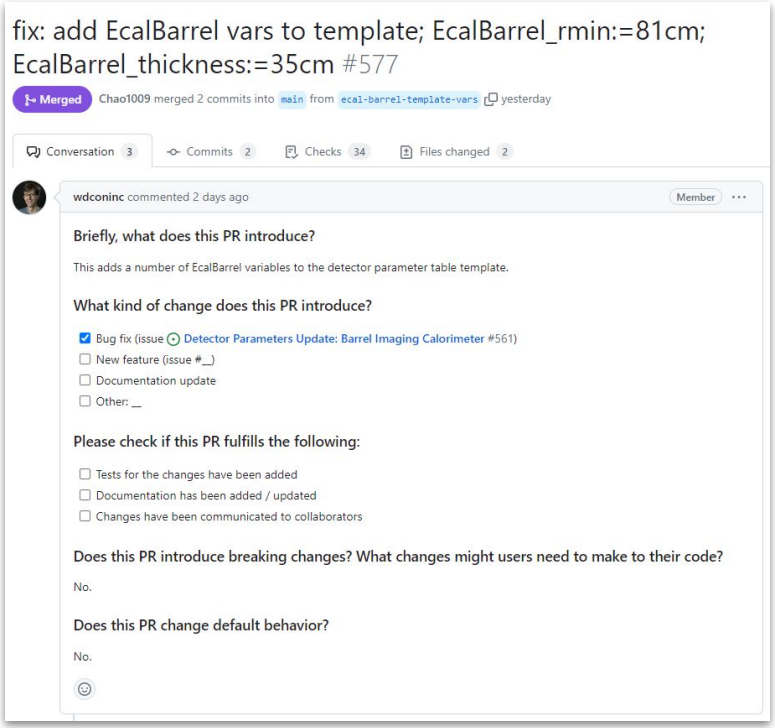
DSC's Points of Contact for Simulation and Reconstruction

- Issues about the parameter update will be assigned to DSC's POC
  - One person with an active github account
- POCs will also be contacted for inputs to detector's digitization threshold
- PR #64 for identifying geometry code owners
  - Get notified for code changes
  - Some are still missing



An Example of the Update

- Can be small PRs with changes for 1 or 2 parameters
  - Link to the issue
- Changes within the subsystem's own regime
  - Central detector's physical start point may depend on backward detector lengths/gaps



Summary

- 2023/09 geometry updates will affect most of the detector subsystems
  - Coordinated work between DSC's and software WGs
- Update the DSC's point of contact for simulation and reconstruction
  - Geometry parameters update
  - Detector digitization threshold
  - Code owners of the relevant geometry/digitization/reconstruction
- Expect ...
  - Simulation output changes in the following campaigns because of geometry update
  - Communications from software side regarding the geometry update and digitization thresholds