

SRO WG meeting

Apr 14, 2026

Calibration Workflow

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SRO calibration workflow

- Phase I - Conceptual design
- Phase II - Requirements implementation
- Use cases (EEECal calorimeter)

Workflow Conceptual Design

1. Classification of calibration tasks
 - Standalone (between fills, laser, pulser)
 - Physics-driven (tracks, vertex, PID dependent)
 - Iterative (requires previous constants or reco-calib loops)
2. Data and detector dependencies
 - Identify required inputs (tracks, PID, other calibrated detectors)
 - Build a dependency matrix / graph
 - Explicitly identify circular dependencies and iteration needs
3. Latency classes
 - Seconds (prompt feedback)
 - Minutes (run-by-run updates)
 - Hours (delayed / quasi-online)

Requirements implementations

1. Interface specifications (E0–E1 / E1–E2)
 - What data is produced and consumed?
 - Calibration object format, metadata, versioning, validity intervals
2. Infrastructure requirements
 - Conditions database
 - Orchestration layer
 - Dedicated compute queues?
 - Monitoring and control interfaces
3. Workflow placement
 - At which stage of the data acquisition does each calibration run?
 - Synchronous vs asynchronous execution?
4. Resource profiles
 - CPU intensity
 - Acceleration using GPU and AI
 - Data fraction needed

Actions taken

1. ePIC SRO calibration table update
2. Individual messages to contact person(s)
3. Identified contact points for each sub detector
4. Verify completeness and accuracy

Dear Yulia,

You are receiving this message because you are listed as the contact person for the ePIC subdetector **Direct Photon calorimeter** Insert regarding calibration and alignment procedures within the Streaming Readout DAQ framework. If you are not covering this role, please refer to your DSC to identify the correct person and provide us with their name as soon as possible.

Following previous messages sent in December '25 and January '26, and the discussions during the December 1 TIC meeting and January ePIC Collaboration meeting, we are consolidating information related to detector-specific calibration needs and their inter-dependencies for the EIC Streaming DAQ. All information collected so far is documented in the table available at the following link (please note that this is a living document, continuously updated as the subdetector design and deployment progress):

<https://docs.google.com/spreadsheets/d/1Rb5Cdjthkfh4IWWxFwHgiHNtMs5cDxcahTTUN394cJ8/edit>

We kindly ask you to:

- Review and, if necessary, update the entries relevant to your subdetector (detector-internal items).
- Check for missing dependencies on other detectors or reconstruction objects and add them as needed.

The information we are gathering includes:

- **Organization:** Verify that the contact person listed in the table is correct.
- **Calibration/alignment items:** Which quantities need calibration or alignment? Which must be calibrated before prompt reconstruction or full reconstruction?
- **Timescale:** Typical update frequency (per run, per fill, hourly, daily, etc.)
- **Data requirements:** Event selections, triggers, statistics needed; estimate of the required fraction of the data stream
- **Inter-detector dependencies (very important):**
 - Does this calibration require reconstructed tracks, vertex information, or PID information from other detectors?
 - Does it assume that other detectors must already be calibrated? If yes, which ones and at what level of precision?

We will discuss the table in a Streaming Readout Working Group meeting during the first or 2nd week of April and present the outcome at the earliest available TIC meeting. Given this timeline, we kindly ask you to review and update the table by **March 31**. Even if current entries are still valid, please indicate that in the spreadsheet. That is helpful for us to judge that the entries are up to date.

Please feel free to forward this message to other relevant experts in your detector group, and do not hesitate to contact us if you would like to discuss specific calibration workflows or dependencies in more detail.

Cheers,

Taku and Marco

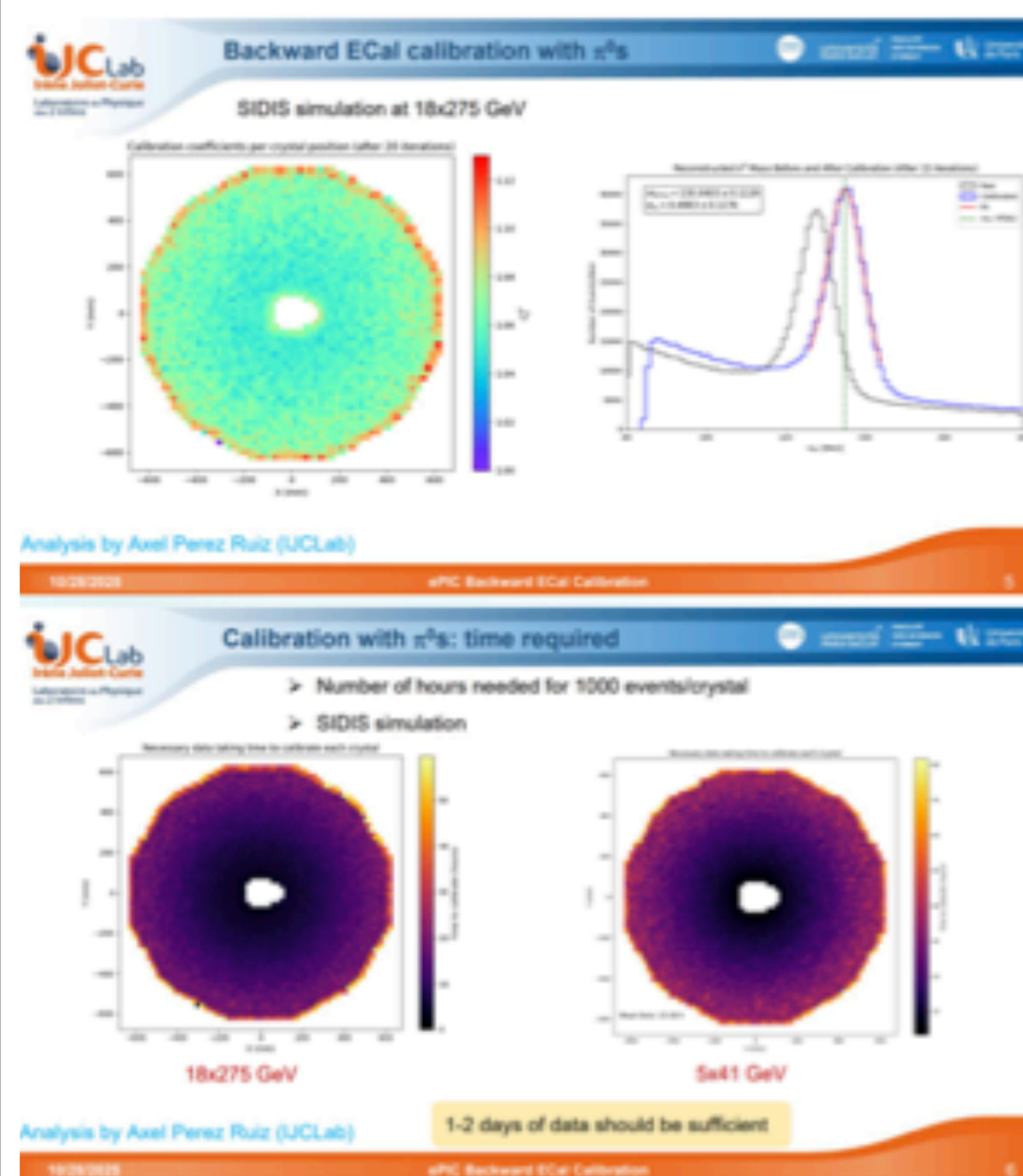
Actions taken

5. Interviewed bECAL (Carlos - Tanja) as prototype of SRO calibration workflow implementation

Prototyping

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Carlos (Muñoz Camacho) presented on Oct. 28 on the **Backward ECal (EEEMCal) Calibration**.
The EEEMCal is a good example to start with. <https://indico.bnl.gov/event/30349/>



This prototype addresses reconstruction-level calibrations and physics-based calibration using high-statistics events.

1. **Script Integration:** Carlos provides calibration scripts and integrates them into JANA2/EICrecon, defining data flow and required inputs.
2. **Workflow Implementation:** Implement file-based workflow first; then prepare for stream-based workflow
3. **AI-Driven Components:** Stepwise integration of calibration detection logic, automated validation, and selective human-in-the-loop checkpoints.
4. **Workflow Orchestration:** Proven workflows are then incorporated into the overall orchestration framework for automated operations.
5. **Milestones & Deliverables:** Prototype workflow (manual \rightarrow semi-automated \rightarrow AI-assisted), validated Conditions DB, documentation of APIs, state machine, ownership, and operational cycle; plan for scaling to full EIC detectors.

Other systems are welcome to join the prototype

EEEMCal as use case for SRO calibration

- ALLEN framework
- Simulations
- Test beam

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4. Verify completeness and accuracy
5. Interviewed bECAL (Carlos - Tanja) as prototype of SRO calibration workflow implementation

Future actions

- Review the table, understand dependencies between subsystem calibrations, and develop concrete, easy-to-implement example workflows
- Invite detector's report at Tuesday's meeting (2x) to discuss with link person details of the table and keep it updated
- define other sub-systems to verify the calibration workflow

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Taku and Marco

SRO sub-detector calibration tables

Subsystem	Region	contact	Contact person	up to date? (March 2026)
MAPS	Barrel+Disk	Taku	"Schambach, Jo" <schambachjj@ornl.gov>	Yes
MPGD	Barrel+Disk	updated	Kondo Gnanvo <kagnanvo@jlab.org>, BOSSU Francesco <francesco.bossu@cea.fr>, Annalisa D'Angelo <annalisa.dangelo@roma2.infn.it>	Yes
bTOF, eTOF (ac-Igad)	Barrel/Forward	Taku	tonko.ljubicic@gmail.com	Yes
Central Detector Tracker Alignment		Taku	Ernst Sichtermann <epsichtermann@lbl.gov>	
pfRICH	Backward	Marco	ayk@bnl.gov	
DIRC	Barrel	Marco	ayk@bnl.gov	
dRICH	Forward	updated	francesco.noferini@bo.infn.it, roberto.preghenella@bo.infn.it	Yes

Subsystem	Region	contact	Contact person	up to date? (March 2026)
bEMC	Backward		munoz@jlab.org, hornt@cua.edu	Yes
AstroPix	Barrel		sjoosten@anl.gov	
ScifiPb	Barrel			
fEMC	Forward		tsai@physics.ucla.edu	Yes
bHCAL	Backward		akio@bnl.gov	Yes
cHCAL	Barrel		NOVITZKYN@ORNL.GOV	
fHCAL	Forward		NOVITZKYN@ORNL.GOV	
fHCAL insert	Forward		NOVITZKYN@ORNL.GOV	
Hadronic energy scale calibration			NOVITZKYN@ORNL.GOV	
low Q2 Tagger	Far Backward		Simon.Gardner@glasgow.ac.uk, k.livingston@physics.gla.ac.uk	
low Q2 Tagger (CAL)	Far Backward		Simon.Gardner@glasgow.ac.uk, k.livingston@physics.gla.ac.uk	
Pair Spec Tracker	Far Backward		stephen.kay@york.ac.uk	
Par Spec Cal	Far Backward		stephen.kay@york.ac.uk	
Direct Photon Cal	Far Backward		stephen.kay@york.ac.uk, mariusz.przybycien@agh.edu.pl	
B0 Tracking	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
B0 PbWO4	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
Roman (Pots)	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
Off Momentum	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
ZDC PbWO4	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
ZDC Sampling	Far Forward		"Jentsch, Alexander" <ajentsch@bnl.gov>	
Polarimetr			frathmann@bnl.gov	

Opportunities within GENESIS

Streaming Trigger and REAL-TIME IntelligentData Engine (STRIDE)

- CanisiusU (NY) + FIU + JLab [+ INFN + TokyoU]
- M.Wood (PI) + H.Szumila-Vancem + M.Battaglieri + M.Bondì + T.Gunji
- RFA: I4-A Unifying Physics from Quarks to the Cosmos | Foundation Models of Particle Interactions and Cosmic Physics (HEP, NP)
- Project objectives: to develop and validate an artificial intelligence–driven, real-time data acquisition and analysis pipeline for next-generation nuclear and particle physics experiments
- JLab BDX-MINI data + GEANT4 simulation to validate the full SRO pipeline (from FEE to BSM pphysics search) using AI-supported algorithms in different phases

		Leading Inst.	M1	M2	M3	M4	M5	M6	M7	M8	M9
WP1	Virtual generator (FEE emulator)	JLAB									
	Task 1.1	BDX-MINI data time-stamped	█								
	Task 1.2	GEANT4 pseudodata time-stamped	█								
	Task 1.3	Data/pseudodata virtual generator			█						
WP2	SRO workflow	FIU									
	Task 2.1	Data reduction	█								
	Task 2.2	Time frames and routing	█								
WP3	Data reconstruction	Canisius									
	Task 3.1	Level-1 data selection	█								
	Task 3.2	Level-2 data selection			█						
	Task 3.3	Anomaly detection						█			
WP4	Autonomous calibrations	Canisius									
	Task 4.1	Energy calibration					█				

WP4: autonomous detector calibrations [Canisius, FIU, TokyoU]

Cosmic muon candidates will be used for continuous calibration, detector stability monitoring, and autonomous correction of time-dependent drifts. Energy deposited by cosmic muons on crystals and plastic scintillators will be used to calibrate in energy the detector response.