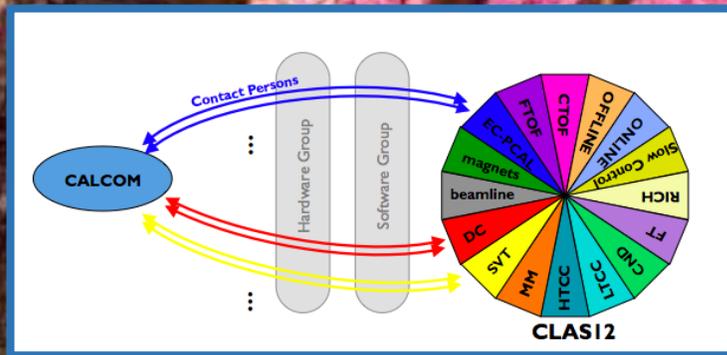


# CALCOM Status and Plans



## Topics:

- Calibration activities: RG-E, K, L
- Calibration updates
- Pass-3:
  - Archaeology
  - Considerations
- Summary

# Active Run Groups in Calibration Mode - March 2026

#	Run Group	Dataset	Conditions	Run Range	Stage
	RG-D	F23	LD2, C, Cu, Sn 10.6 GeV inbending+outbending	18329 - 19130	Cooking
	RG-E	Spr24	LD2, C, Cu, Al, Sn, Pb 10.5 GeV	20015 - 20525	Cooking upcoming
	RG-K	Spr24	LH2 6.4, 8.5 GeV outbending	19200 - 19893	Cooking upcoming
1	<b>RG-L</b>	<b>Spr25</b>	<b>D2, 4He 2.2 GeV, 10.7 GeV</b>	<b>21310 - 23065</b>	<b>Calibrating</b>

A single dataset now being calibrated

	Analysis Coordinator	Chef
<b>RG-L</b>	<b>Mohammad Hattawy</b>	<b>Mathieu Ouillon, Noémie Pilleux</b>



- **RG-A Spr18 Cooking: Apr. 1 - Oct. 1, 2025** **DONE**
- **RG-D F23 Cooking: Jun. 6 - XXX, 2025 (~87% done)**

# RG-K Spr24 - Status

[3] RG-K Spr24 - Pass-1 calibration  
review Oct. 11, 2024

## Current Status:

- Now defining trains
- Awaiting resources for cooking ...



Thursday, Dec 18, 2025

### Report

Readiness Review for Pass1 processing of the  
Hall-B/CLAS12 RG-K Fall 2023/Spring 2024 data set

**Review committee:**  
 Nathan Baltzell  
 Marco Battaglieri (chair)  
 Larry Weinstein  
 Marco Mirazita  
 Cole Smith

A review of RG-K's readiness to process a first pass of the Fall 2023 and Spring 2024 datasets using the latest available reconstruction software took place on December 12 via Zoom. The meeting agenda and presentation materials are available on the [review page](https://clasweb.jlab.org/wiki/index.php/Run_Group_K#Fall_2023_and_Spring_2024_Pass_1_Readiness_Review):  
[https://clasweb.jlab.org/wiki/index.php/Run\\_Group\\_K#Fall\\_2023\\_and\\_Spring\\_2024\\_Pass\\_1\\_Readiness\\_Review](https://clasweb.jlab.org/wiki/index.php/Run_Group_K#Fall_2023_and_Spring_2024_Pass_1_Readiness_Review)

The review committee would like to thank the RG-K team for the thorough preparation of the presentations and for clearly addressing all questions raised during the review.

The RG-K run was conducted at lower beam energies than usual (6.4 GeV and 8.5 GeV) in the FT-OFF configuration to increase luminosity. This operating mode resulted in a clean, well-calibrated dataset, with no major experimental issues identified.

The RG-K team successfully addressed all charges of the review. The committee therefore recommends initiating the data cooking process as soon as a revised skimming scheme is proposed and approved by the Software Group.

Given that another run group is currently processing data and that this review was conducted to schedule

**RECOMMENDATIONS:**

We recommend defining and discussing with the Software Group an efficient skimming scheme before starting with the Pass1.

The vertexing service has been sped up significantly since the time of this review, so a new coatjva version will need to be used to get the improvements.

**Assumptions and Estimates:**

- Average Processing Speed = 800 MEv/day (~ 8 full runs/day)
- Milestones at each pass0 monitors & timelines
- Calibration needs are announced 5 days in advance to calibrators to maximize calibration time performances
- Calibration progress reported at CALCOM weekly meetings

Maximum Calibration runs cooking → 20 runs → 3 days processing time  
 Pass 0 cooking time + monitoring & timelines including monitoring checks and quality assessment with calibrators → 7 days

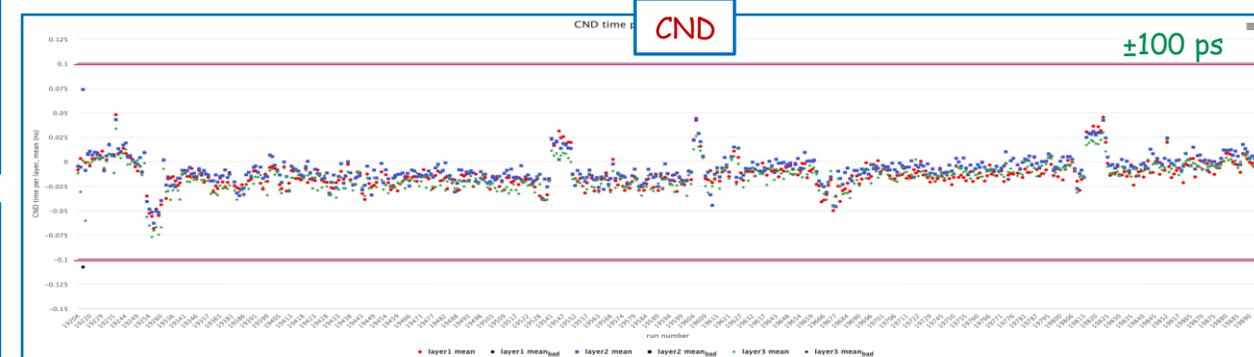
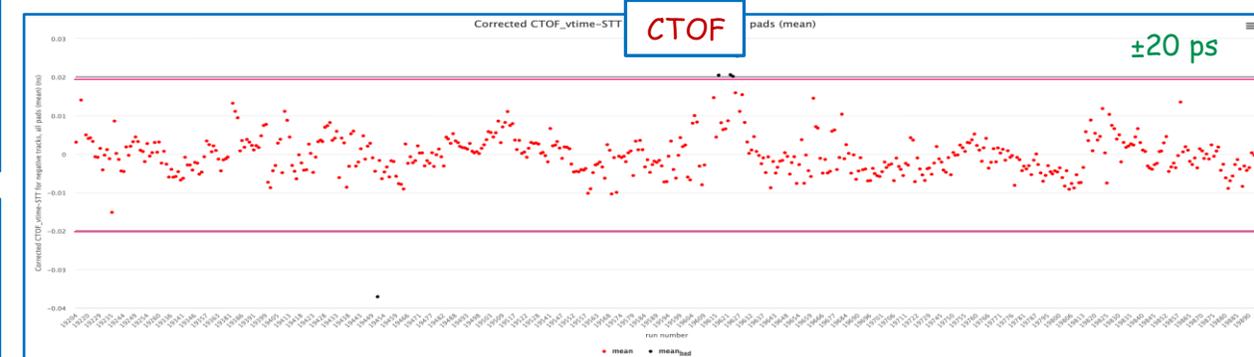
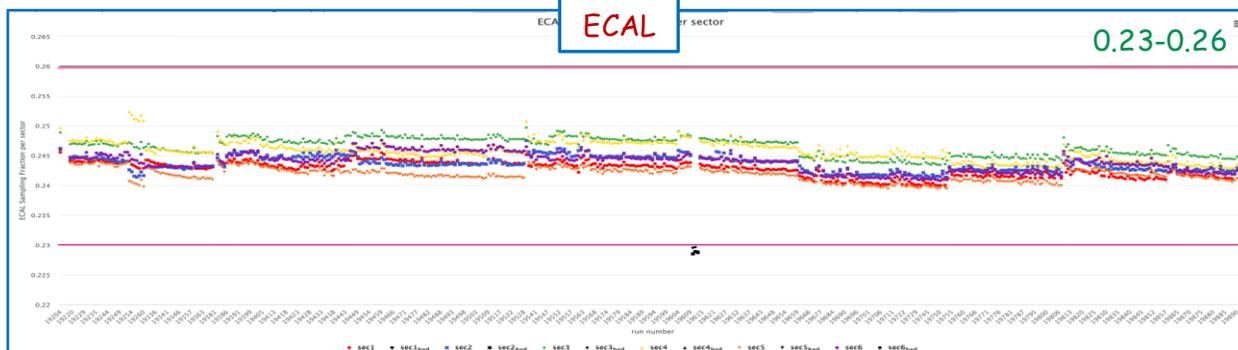
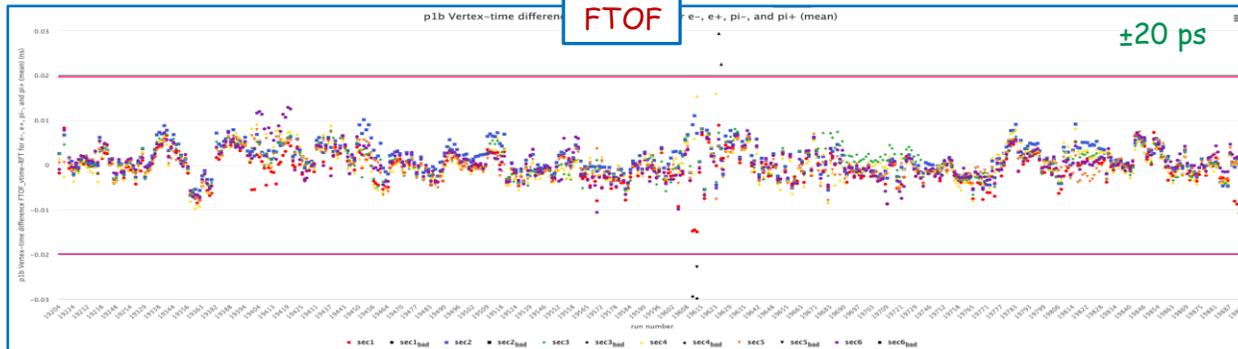
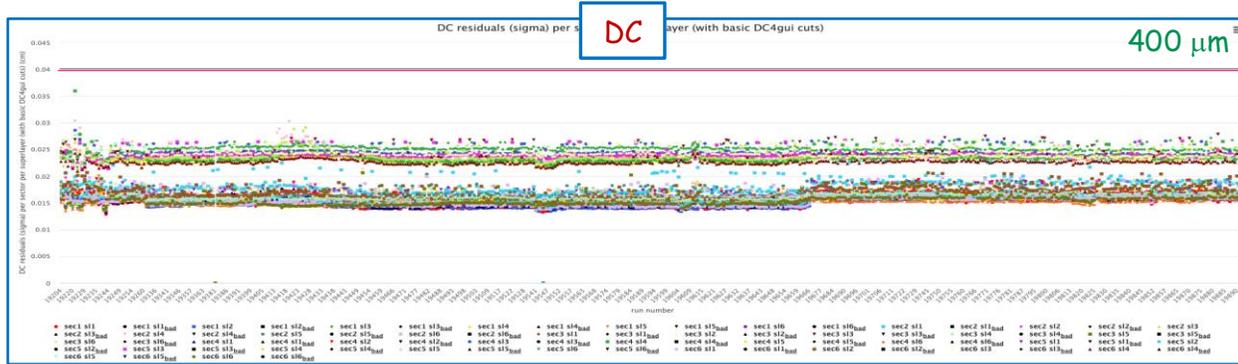
**Re-Calibration Timeline:**

1) Beam-Offset Calibrations:	Started by Mariana – goes in parallel with other calibrations	
2) FTOF calibration:	week 1	Cook 20 calibration runs for FTOF calibration
	week 2	pass 0 & timelines
	week 3	FTOF calibration iteration
	week 4	pass 0 & timelines <span style="float: right;">Milestone 1</span>
3) RF calibration:	week 5	RF calibration using pass 0
	week 6	pass 0 & timelines with RF calibration <span style="float: right;">Milestone 2</span>
4) CLAS12 subsystem calibration:	week 7:	Cook specific calibration runs for subsystems calibration(DC, ECAL, FT, HTCC,...)
	week 8 :	Subsystem calibration (done in parallel), test of high-level QA on fully cooked runs
	week 9 :	Pass 0 & timelines with subsystem calibrations, cook of ~4 full runs to check high-leve physics
	week 10:	Final check of specs, investigation of full runs <span style="float: right;">Milestone 3</span>
5) AI and denoising studies, final validations :	week 11-12	AI training for tracking detectors and denoising studies
	week 13:	Hardware status table, cable swaps, efficiency versus beam current studies, Final validation

## Timeline:

- Original calibration window:
  - Oct. 15, 2024 - Feb. 7, 2025
  - 5 month delay to complete DC work
  - 3 month delay on final validations
- Pass-1 review: Dec. 12, 2025
- Cooking: TBD

# RG-K Spr24 - Calibration Timelines



Final key timelines after completion of all subsystem calibrations

# RG-E Spr24 - Status

[4] RG-E Spr24 - Pass-1 Calibration review Jan. 31, 2025

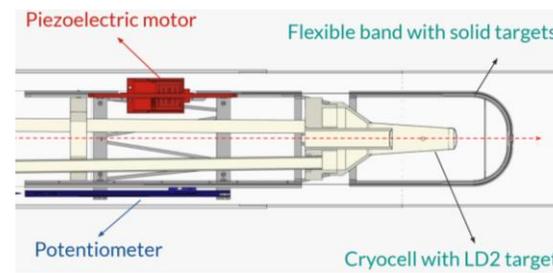
## Calibration estimated timeline:

- Beam offset -> Completed ✓
- DC/FTOF ~10 runs
  - Cook calibration runs + pass 0 and timelines checks -> 2 weeks
  - Reiterate calibration -> 2 weeks (milestone 1)
- RF -> calibration using pass 0 + new pass0 and timelines -> 2 weeks (milestone 2)
- CLAS12 Subsystem Calibration -> CND, CTOF, ECAL, HTCC, LTCC, RICH ~10 runs
  - Cook calibration runs for subsystems -> 1 week
  - Subsystem calibrations -> 1 week?
  - Pass0 and timelines with new calibrations -> 1 week
  - Checks of specs -> 1 week
  - Recook and recalibrate necessary runs -> 1-2 weeks
- Extra week of unforeseen problems and cooking delays related to resource limitations

Total **12-13 weeks.**

## Timeline:

- Original calibration window:
  - Feb. 1 - May 10, 2025
  - 2 month delay for DC calibrations
  - 1 month delay for subsystem calibrations
  - 2 month delay on final validations
- Pass-1 review: Dec. 12, 2025
- Cooking: TBD



## Current Status:

- Awaiting resources for cooking ...



Thursday, Dec 18, 2025

### Report

Readiness Review for Pass1 processing of the Hall-B/CLAS12 RG-E Spring 2024 data set

**Review committee:**  
 Nathan Baltzell  
 Marco Battaglieri (chair)  
 Larry Weinstein  
 Marco Mirazita  
 Cole Smith

A review of RG-E's readiness to process a first pass of the Spring 2024 datasets using the latest available reconstruction software took place on December 12 via Zoom. The meeting agenda and presentation materials are available on the review page: [https://clasweb.jlab.org/wiki/Index.php/Run\\_Group\\_E#tab=Pass1\\_Review](https://clasweb.jlab.org/wiki/Index.php/Run_Group_E#tab=Pass1_Review)

The review committee would like to thank the RG-E team for the thorough preparation of the presentations and for clearly addressing all questions raised during the review.

The RG-E run was conducted at the maximum available beam energy (10.547 GeV) on a special dual target arrangement that included a cryogenic liquid deuterium target and a variety of solid nuclear targets (C, Al, Cu, Sn and Pb). The presence of a high level of background resulted in scattered calibration parameters, although residuals and physics observables were correctly obtained.

The RG-E team successfully addressed all charges of the review. The committee therefore recommends a skimming scheme is given that another review is conducted concurrently to schedule and priorities.

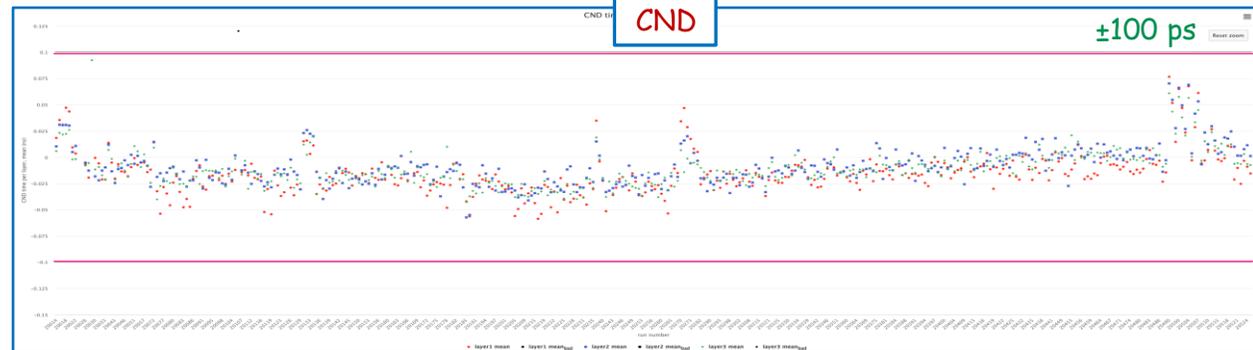
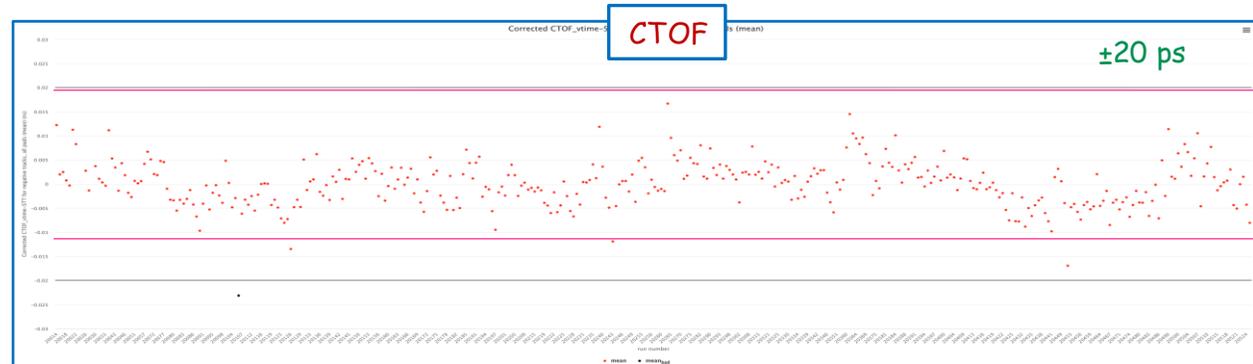
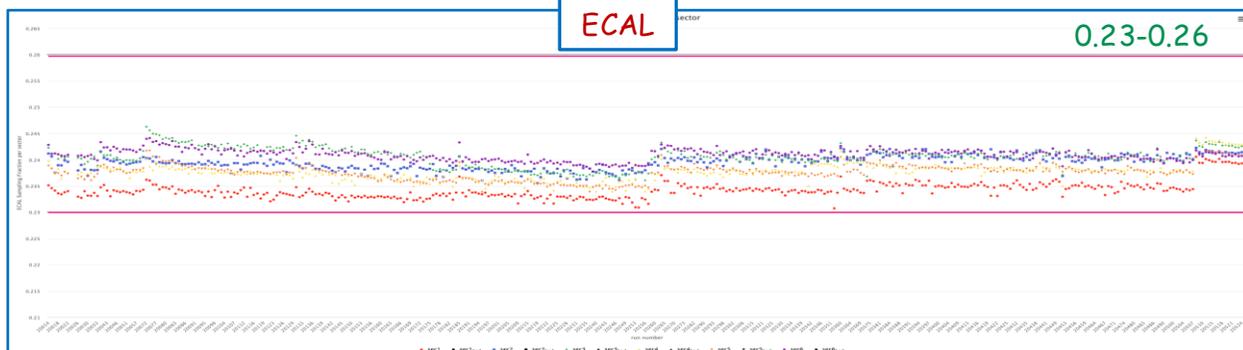
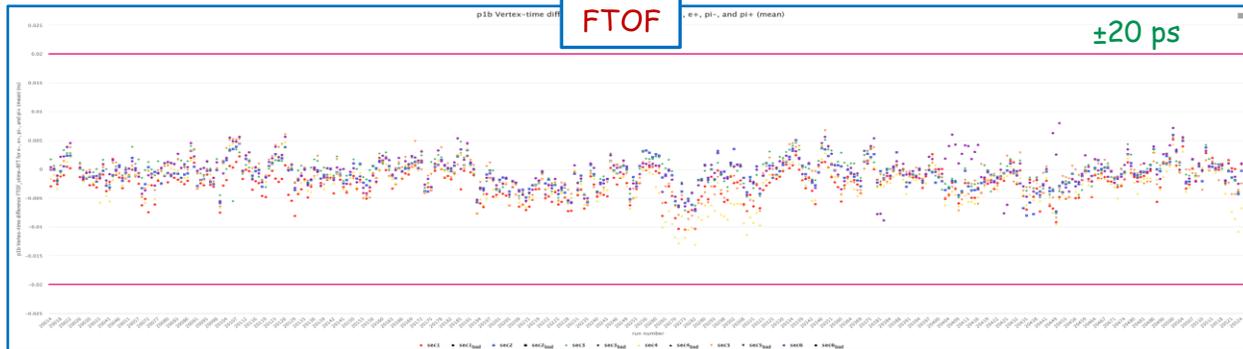
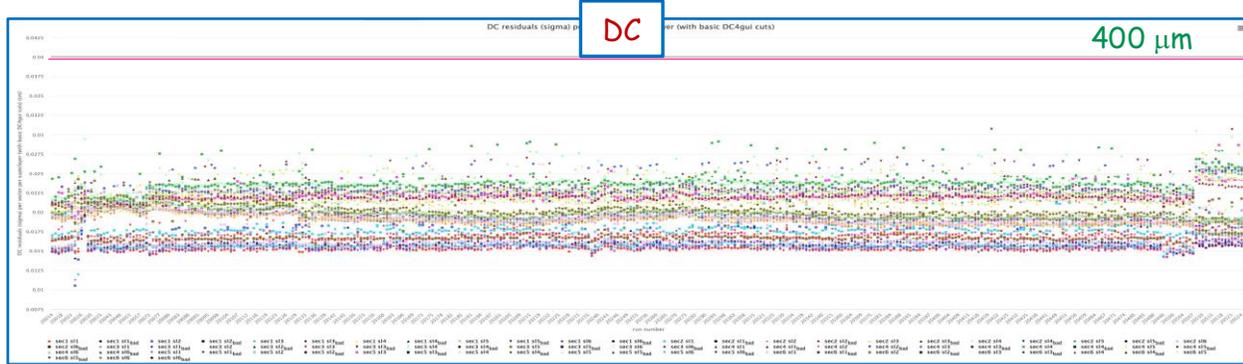
**RECOMMENDATIONS:**

We recommend defining and discussing with the Software Group an efficient skimming scheme before starting with the Pass1.

The vertexing service has been sped up significantly since the time of this review, so a new coatjava version will need to be used to get the improvements.

Charge #1: Is the quality of detector calibration and alignment adequate to achieve the performance specifications foreseen for CLAS12 or achievable at the

# RG-E Spr24 - Calibration Timelines



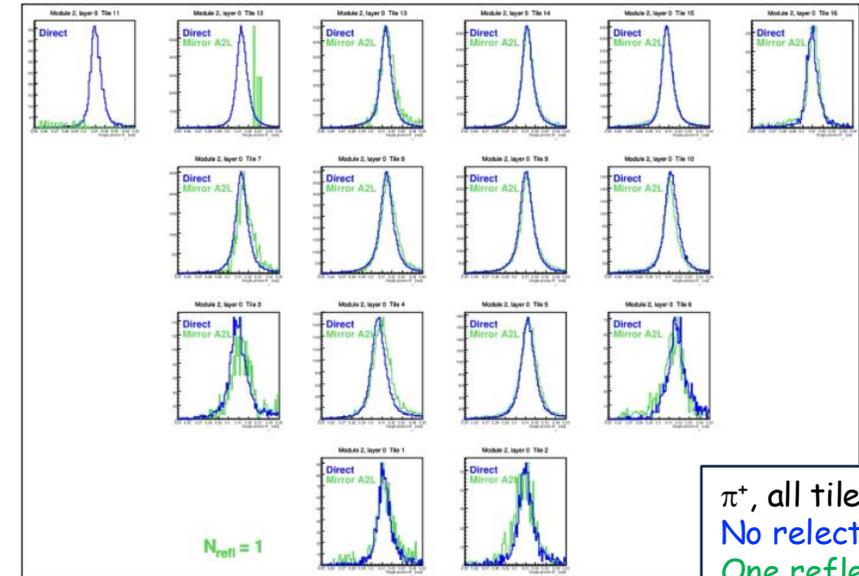
Final key timelines after completion of all subsystem calibrations

# RICH Alignment

Measured Cherenkov Angle

- New alignment software developed by Connor Pecar (Duke) and Marco Mirazita (Frascati)

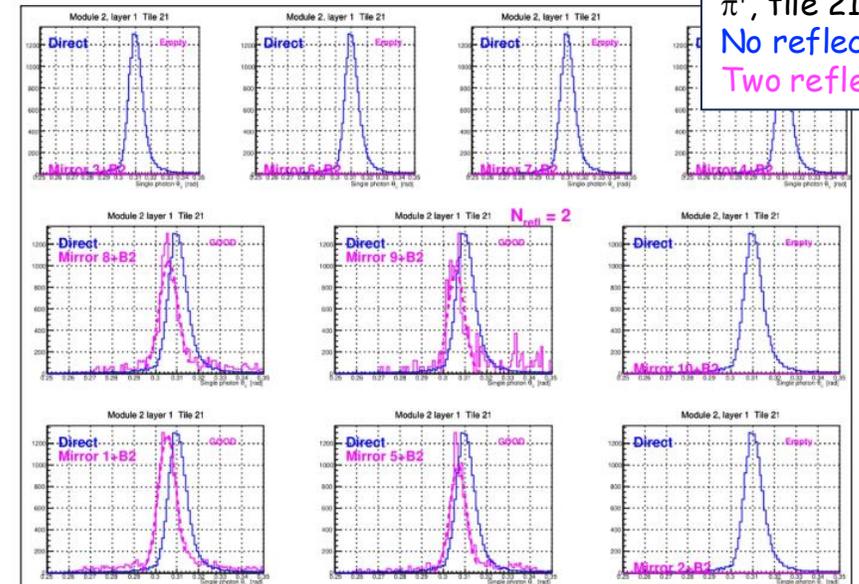
- Determine the position of a RICH module (i.e. the photodetector plane) with respect to the tracking system
  - 3 angles and 3 shifts per module
  - Use charged track clusters on the MAPMT
- Determine the position of each optical element inside a RICH module
  - 3 aerogel layers, 10 spherical mirrors, 7 planar mirrors
  - 3 angles and 3 shifts per element, but  $\theta_z$ ,  $dx$ ,  $dy$  can be neglected in first approximation
  - 60 alignment parameters per module highly correlated
  - Use traced photons with 0, 1, 2 reflections



$\pi^+$ , all tiles layer 0  
No reflections  
One reflection

## What's new:

- Better selection of the event
  - electrons or pions
- "Intelligent" search in the multi-D parameter space
  - utilize TuRBO: Bayesian optimization algorithm designed for high-dim. problems
- Better definition of the alignment objective function
  - based on the Cherenkov angle distribution shape (no fits)
  - no need for apriori knowledge of the refractive index
- Simultaneous determination of all the alignment parameters
  - correlations among parameters of different elements properly taken into account



$\pi^+$ , tile 21 layer 1  
No reflections  
Two reflections

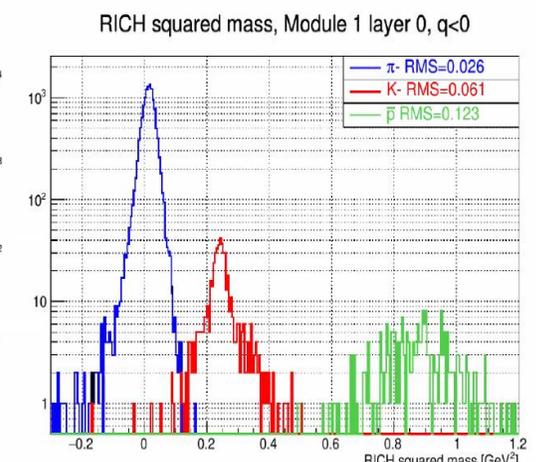
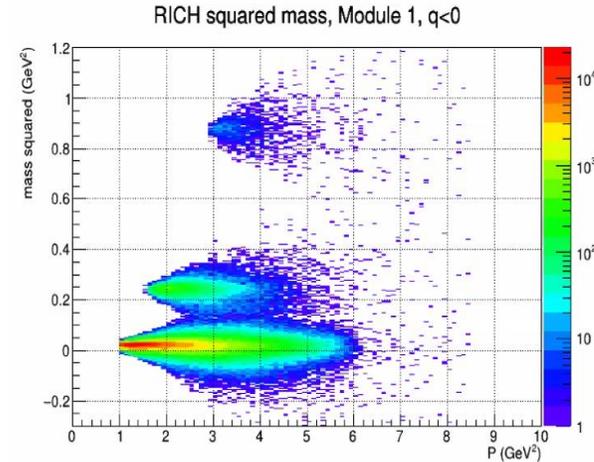
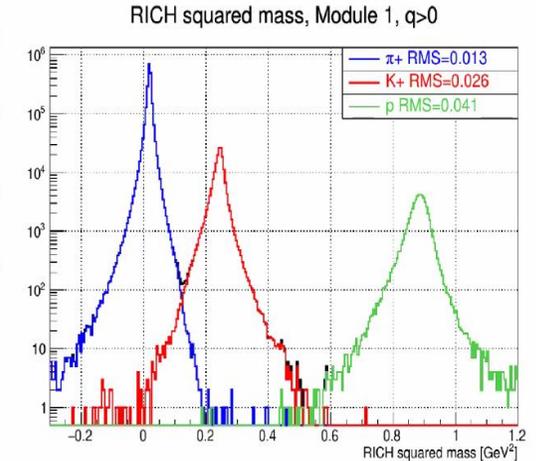
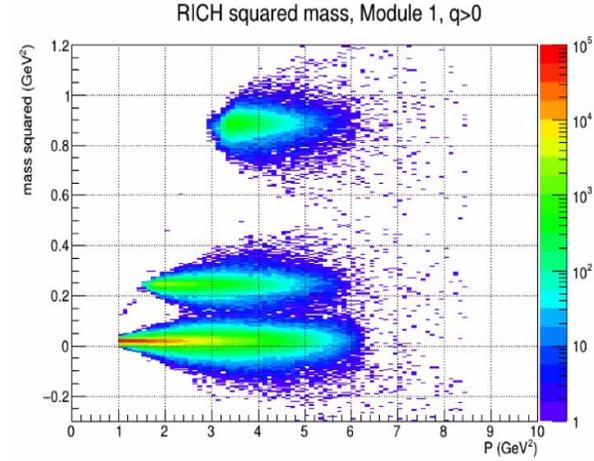
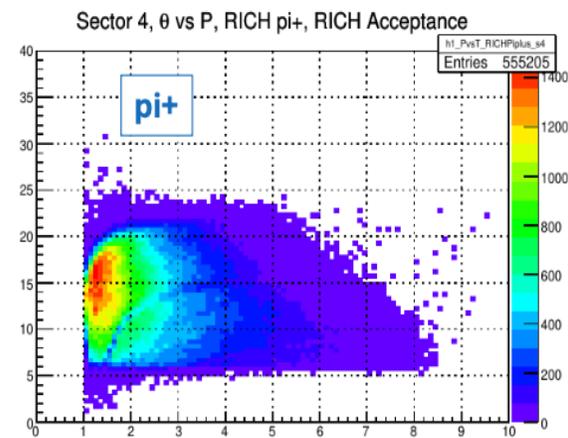
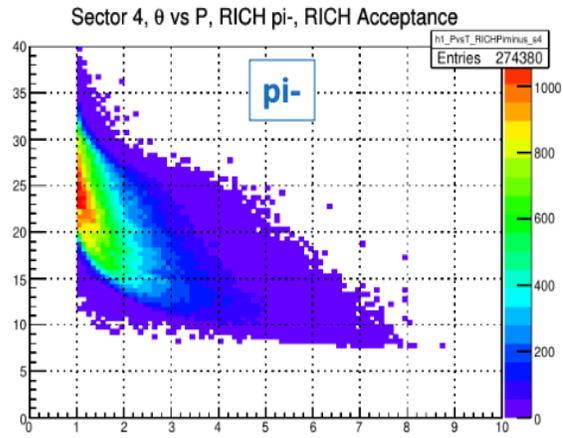
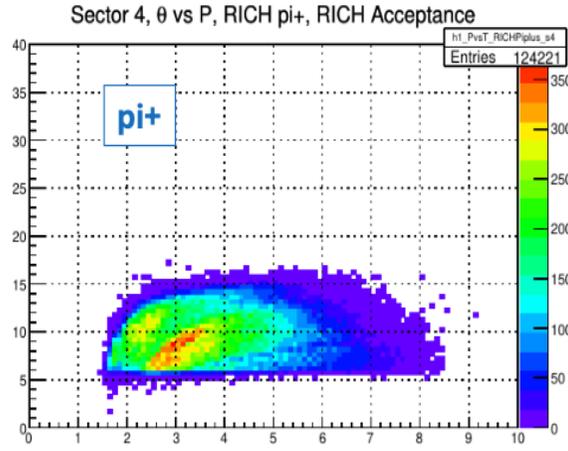
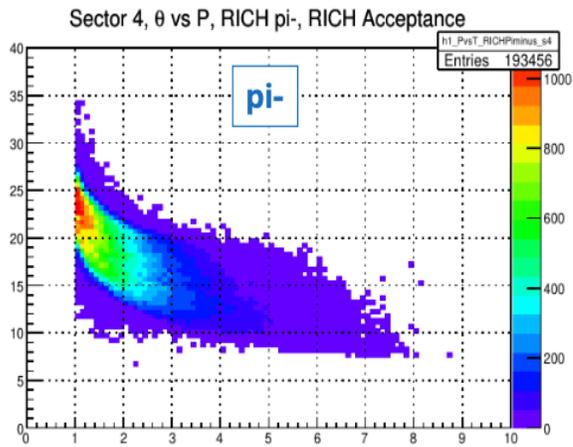
# RICH Alignment

RG-A F18 inbending data

RG-K Spr24 outbending data

Pass-2 cooking

New alignment

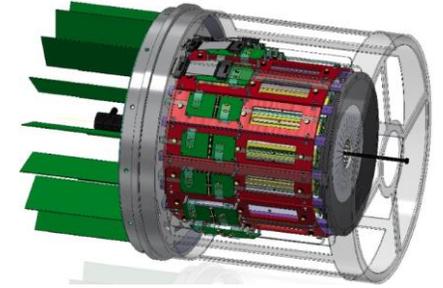


\* See presentation by Connor Pecar

Marco Mirazita

# RG-L Spr/Sum25 - Status

[5] RG-L - Pass-1 Calibration  
Review Nov. 14, 2025



## Where do things stand?

- FD calibration of 3 reference runs completed as part of online calibrations
- Beam offset calibration for FD complete
- FTOF calibration complete
- RF calibration complete



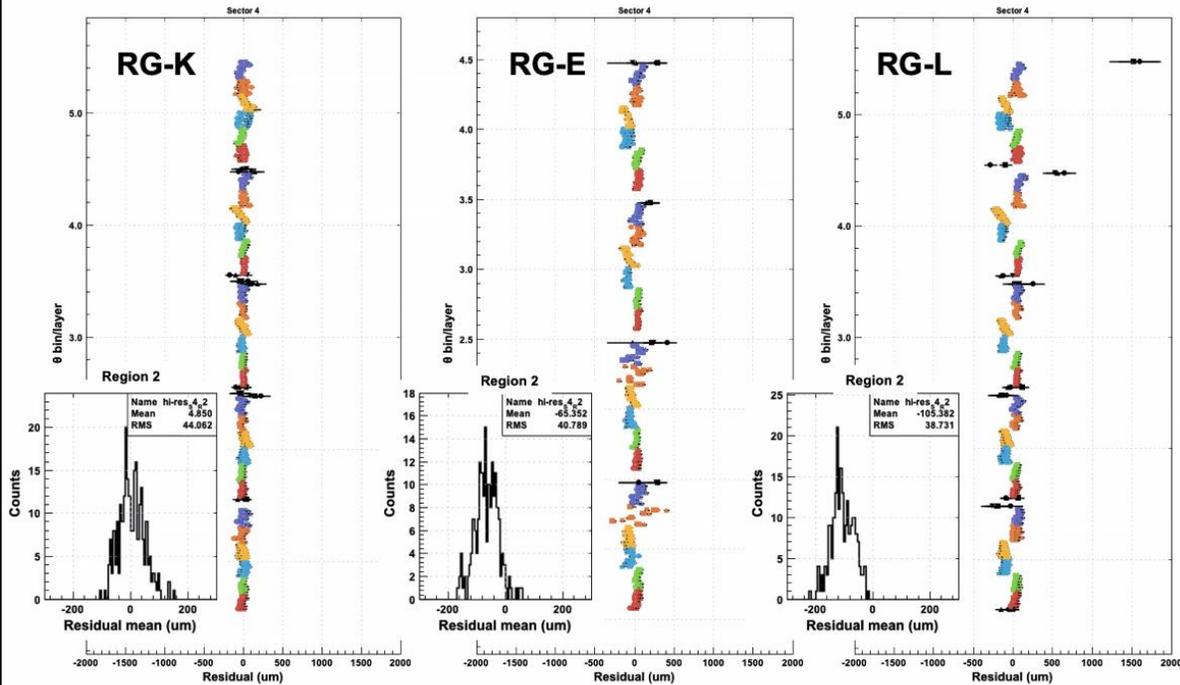
- DC alignment checks showed need to revisit geometry constants from RG-K/RG-E
- Redid DC alignment
- DC calibration started - step #1 global timing
- Ready to jump back into FD calibration
- Develop AHDC and ATOF calibration suites using beam data and MC

## Next steps:

- Complete full DC and FD calibrations
- Complete development/validation:
  - AHDC calibration suite
  - ATOF calibration suite
- Complete ALERT alignment procedure
- Calibrate AHDC and ATOF
- Calibration CTOF and CND (process to be determined)
- Too soon to predict when cooking of dataset will begin

# RG-L DC Alignment Status

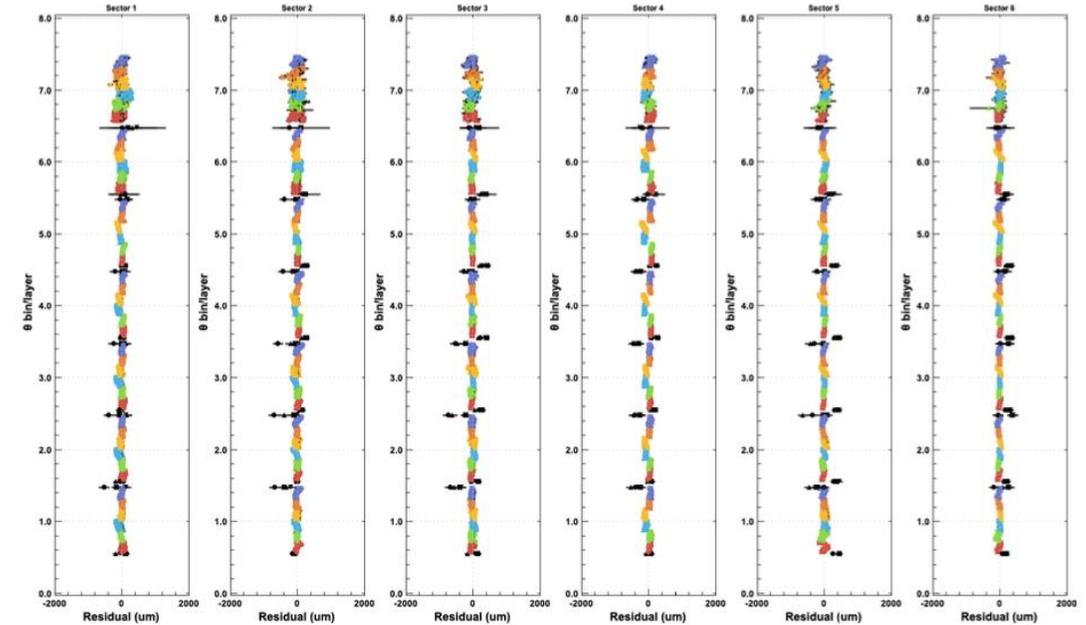
## Sector 4 in RG-K, E, and L



1



## With current alignment



2



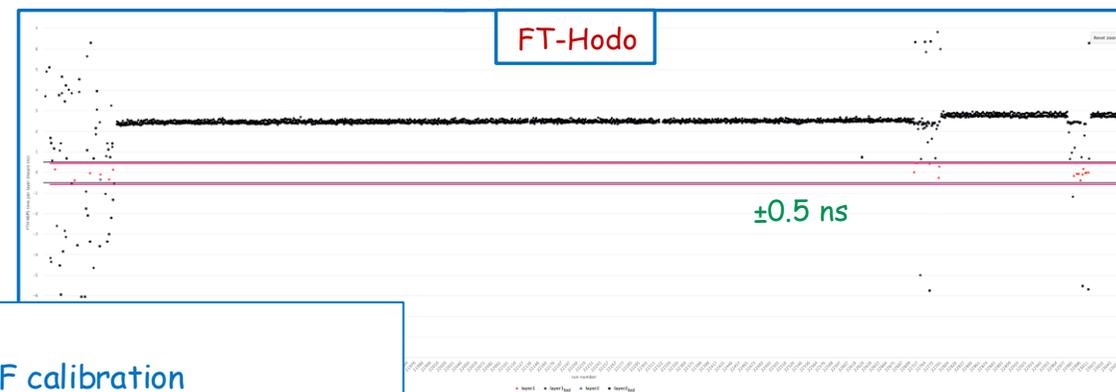
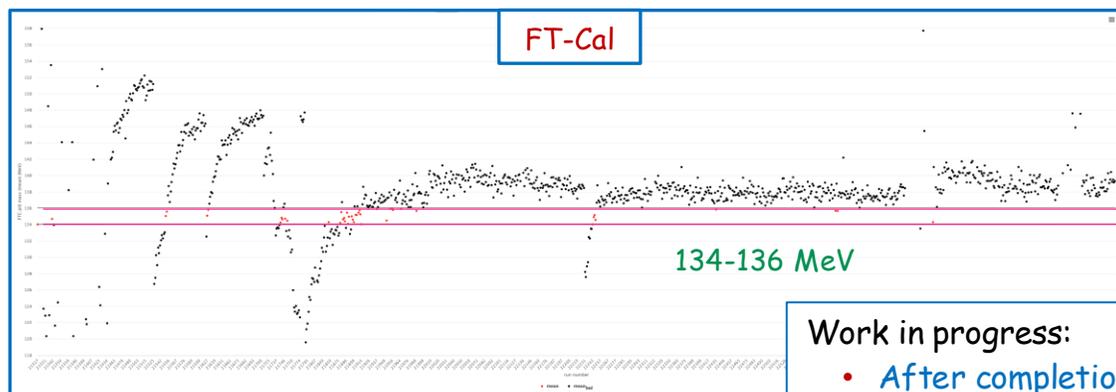
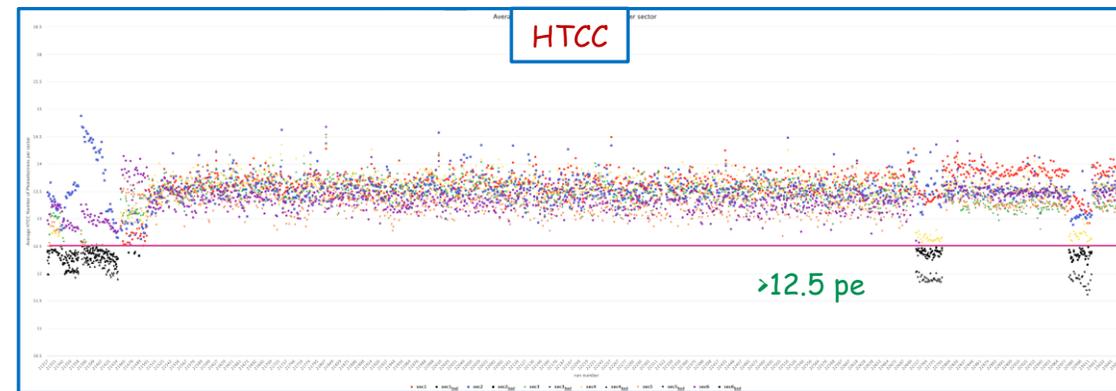
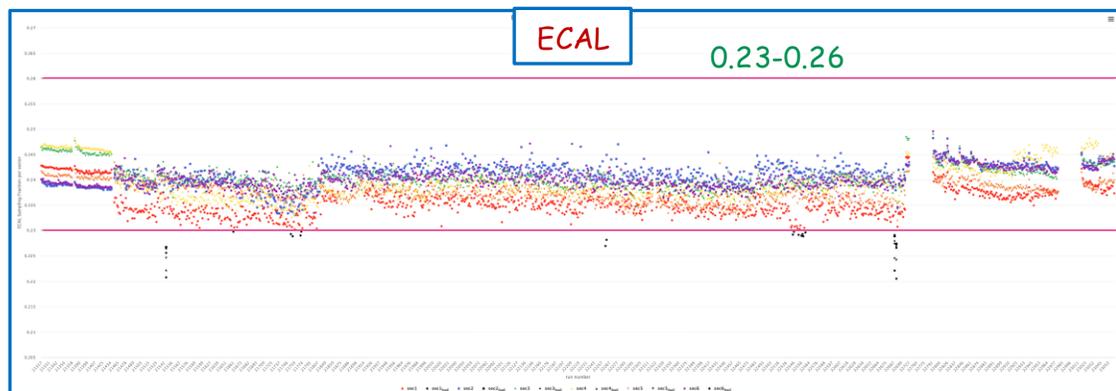
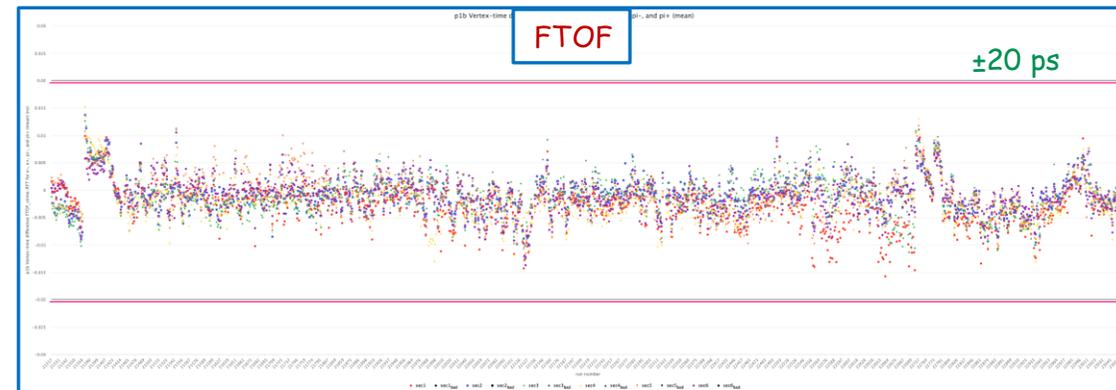
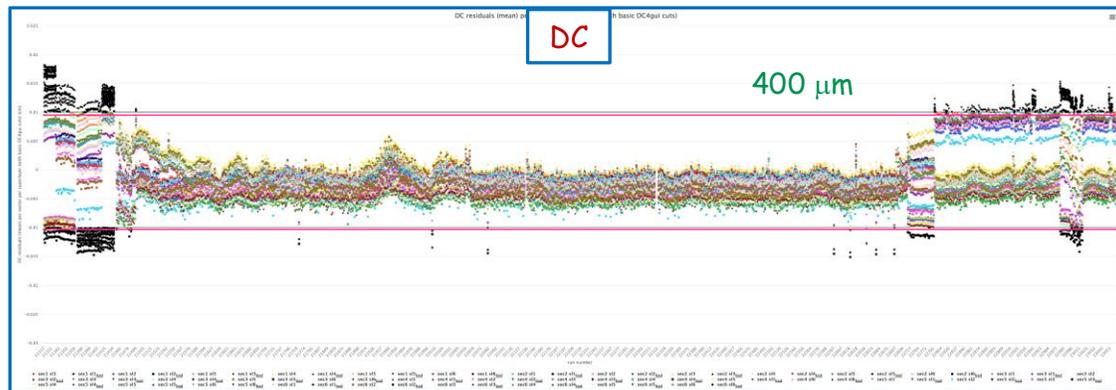
Note:

- No DC service done between RG-K/E/L
- Alignment runs at end (must/should/like)

- Survey check led by Bob Miller with JLab Alignment Group
- Fix software bugs/issues

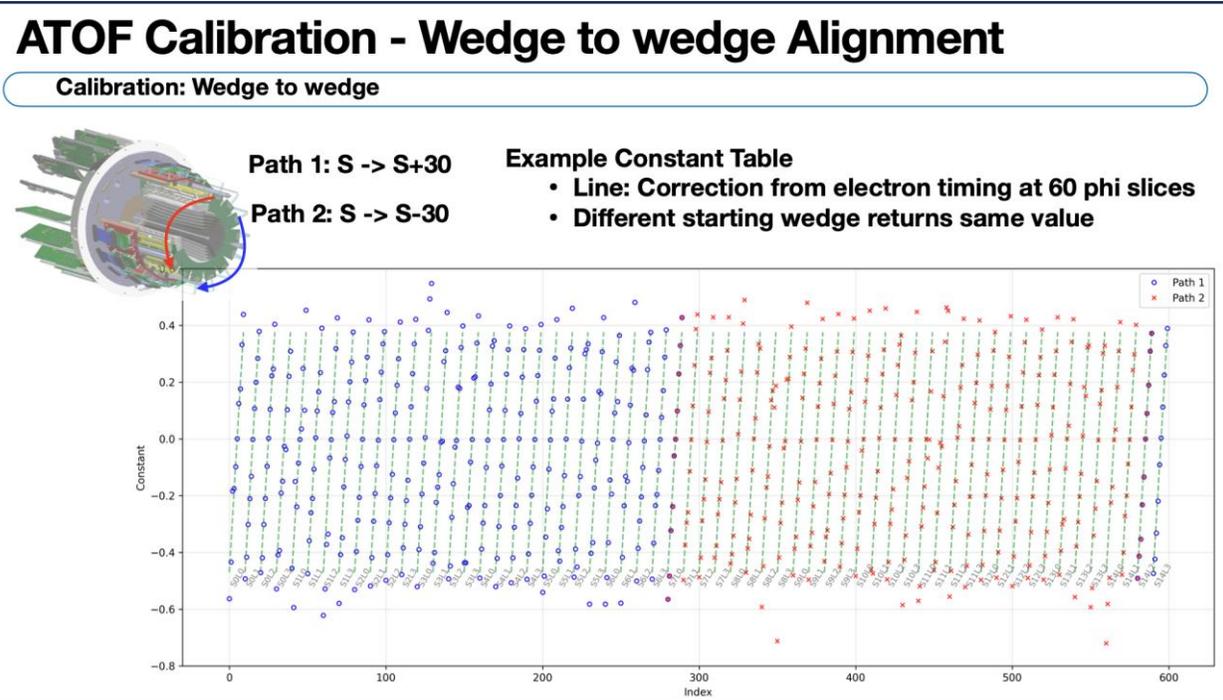
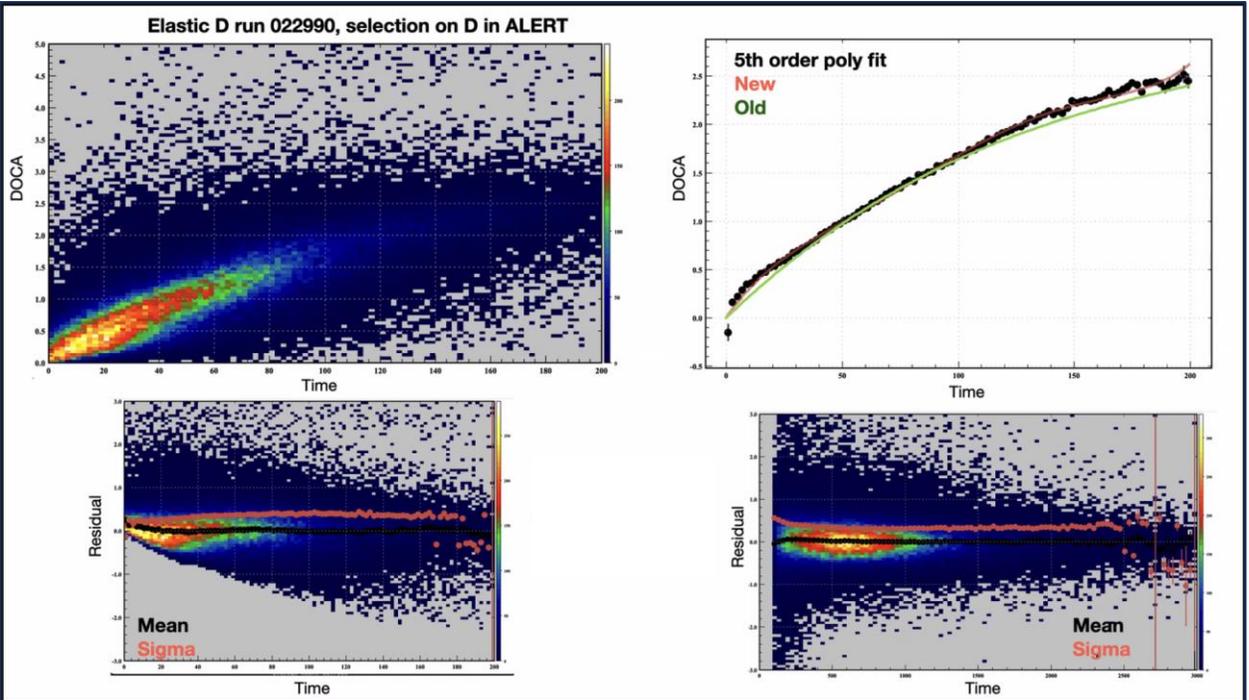
Raffaella De Vita

# RG-L Spr25 - Calibration Timelines

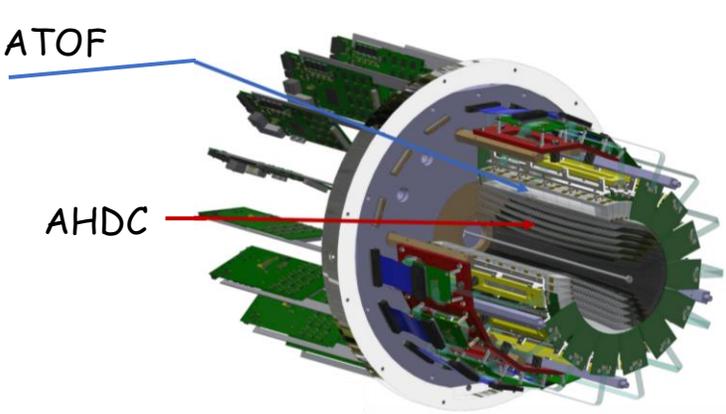
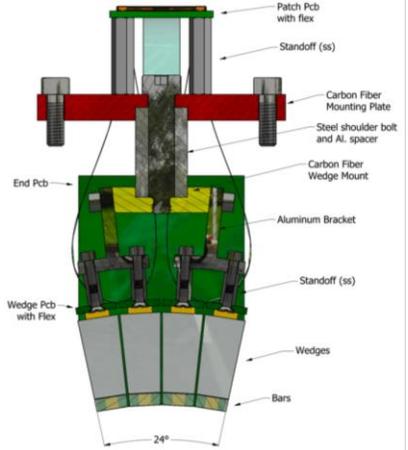


Work in progress:

- After completion of FTOF calibration
- All other subsystems based on online calibrations



- Time offsets
- Time-to-distance function
- Gain calibrations
- Link to ATOF (upcoming)



- Global timing (bars, wedges)
- Energy loss (upcoming)

Michael Paolone

Zhiwan Xu

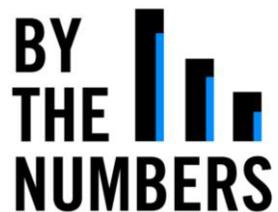
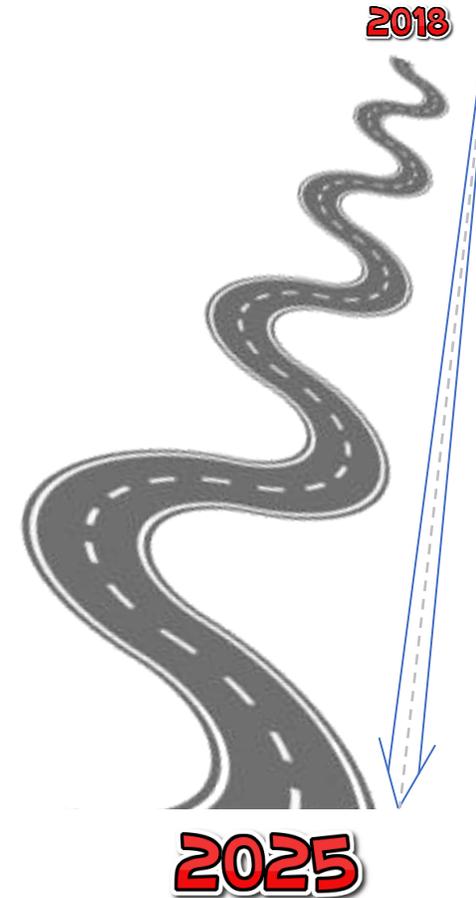
\* See presentations in Nuclear Physics WG session

# CLAS12 Dataset Collection History



#	CLAS12 Dataset	Run Range
1	RG-A Spr18	r3029-4326
2	RG-A F18	r4763-5666
3	RG-K W18	r5674-6000
4	RG-B Spr19	r6150-6603
5	RG-A Spr19	r6608-6783
6	RG-B F19/Spr20	r11093-11571
7	RG-F Spr/Sum20	r11620-12951
8	RG-M F21/Spr22	r15016-15884

#	CLAS12 Dataset	Run Range
9	RG-C Sum22	r16043-16772
10	RG-C F22	r16843-17408
11	RG-C Spr23	r17471-17811
12	RG-D F23	r18305-19131
13	RG-K Spr24	r19200-19893
14	RG-E Spr24	r20000-20525
15	RG-L Spr/Sum25	r21310-23065



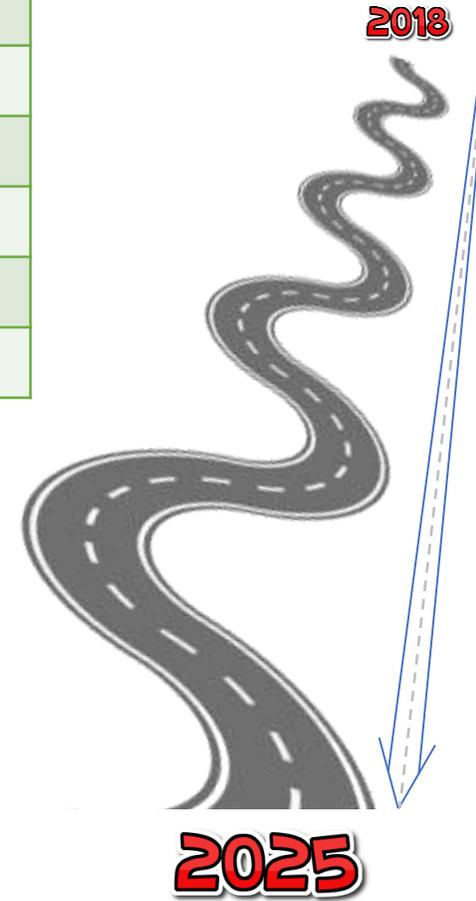
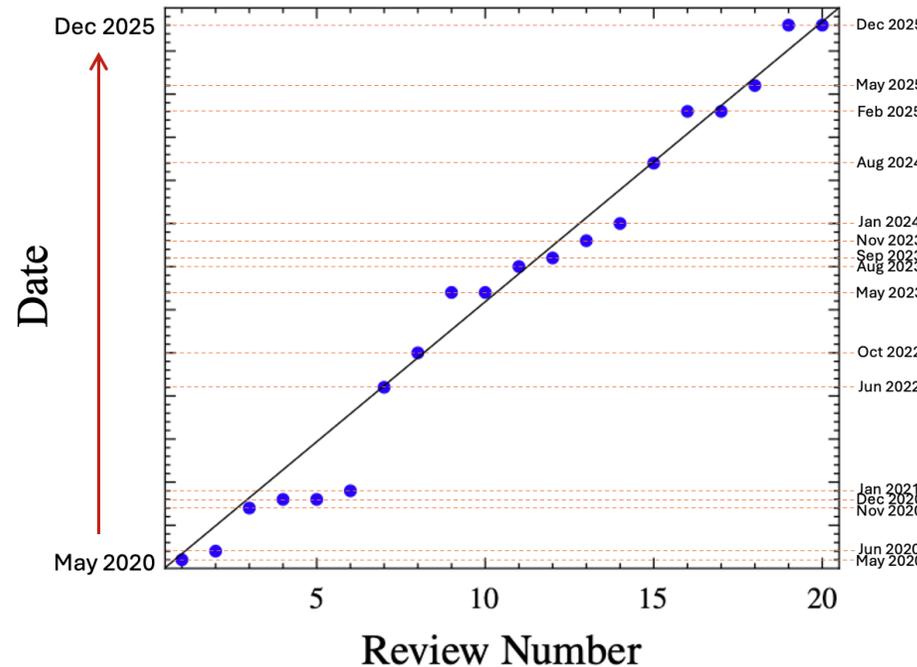
- 14 pass-1 dataset calibrations + cooking reviews
- 6 pass-2 dataset calibrations + cooking reviews

# Dataset Cooking Reviews

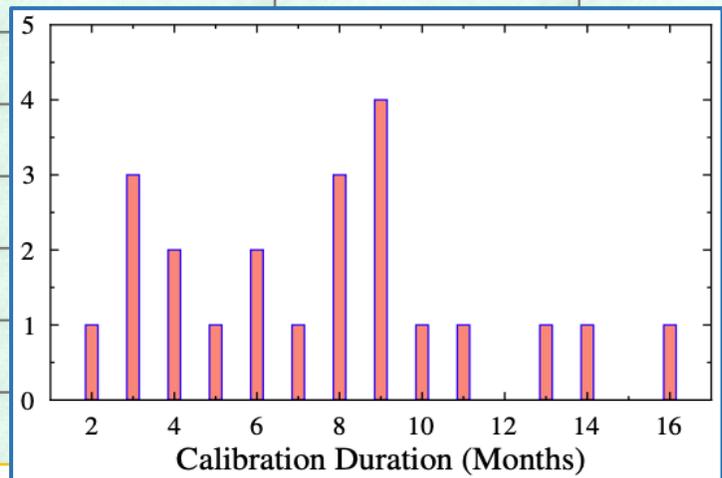
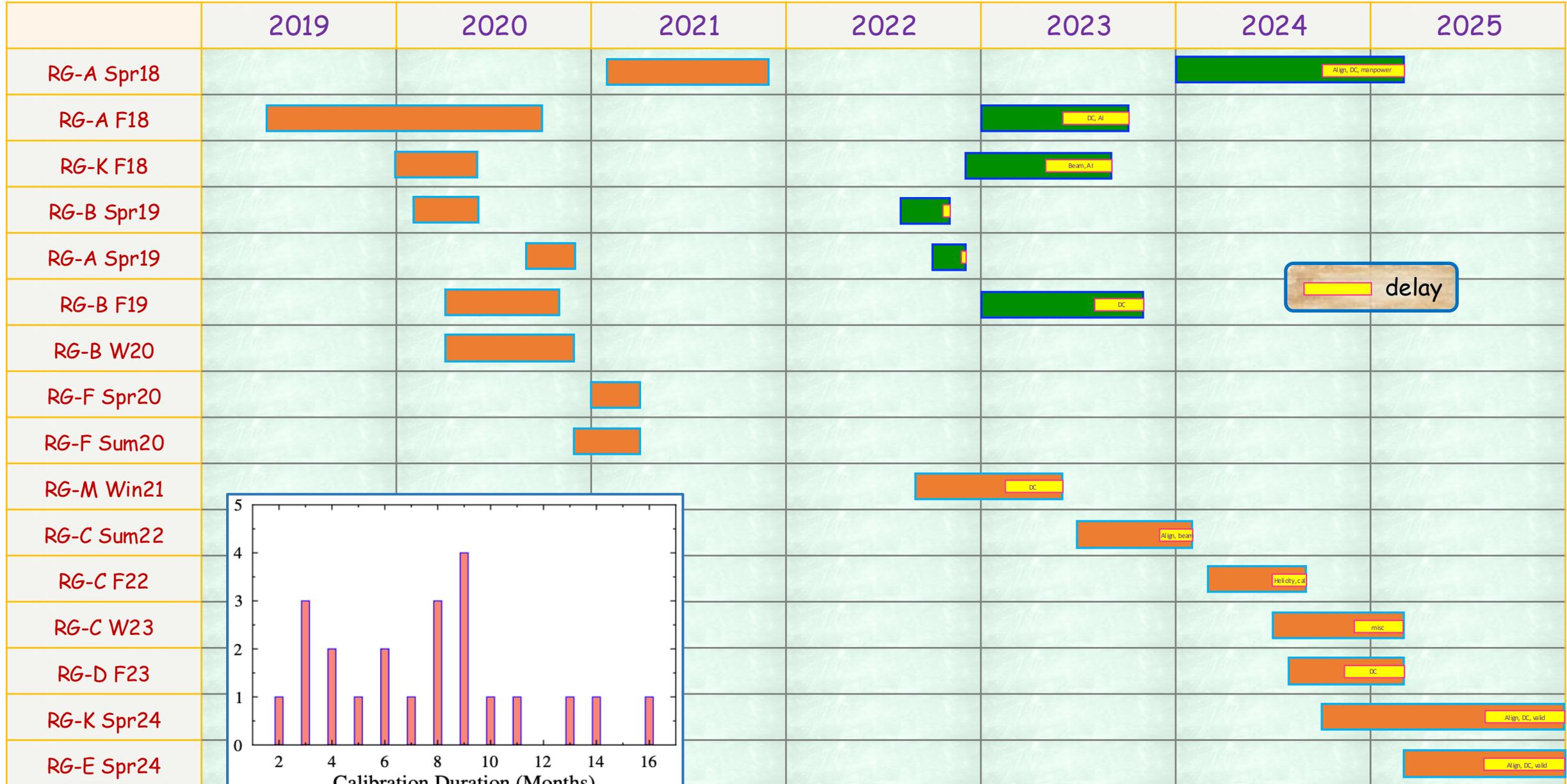


Pass-1 Reviews		
#	CLAS12 Dataset	Date
1	RG-A Spr18	-----
2	RG-A F18	Dec. 2020
3	RG-K W18	Jun. 2020
4	RG-B Spr19	May 2020
5	RG-A Spr19	Dec. 2020
6	RG-B F19	Nov. 2020
7	RG-B Spr20	Jan. 2021
8	RG-F Spr/Sum20	Jun. 2022
9	RG-M F21/Spr22	May 2023
10	RG-C Sum22	Jan. 2024
11	RG-C F22	Aug. 2024
12	RG-C W23	Feb. 2025
13	RG-D	May 2025
14	RG-K Spr24	Dec. 2025
15	RG-E	Dec. 2025

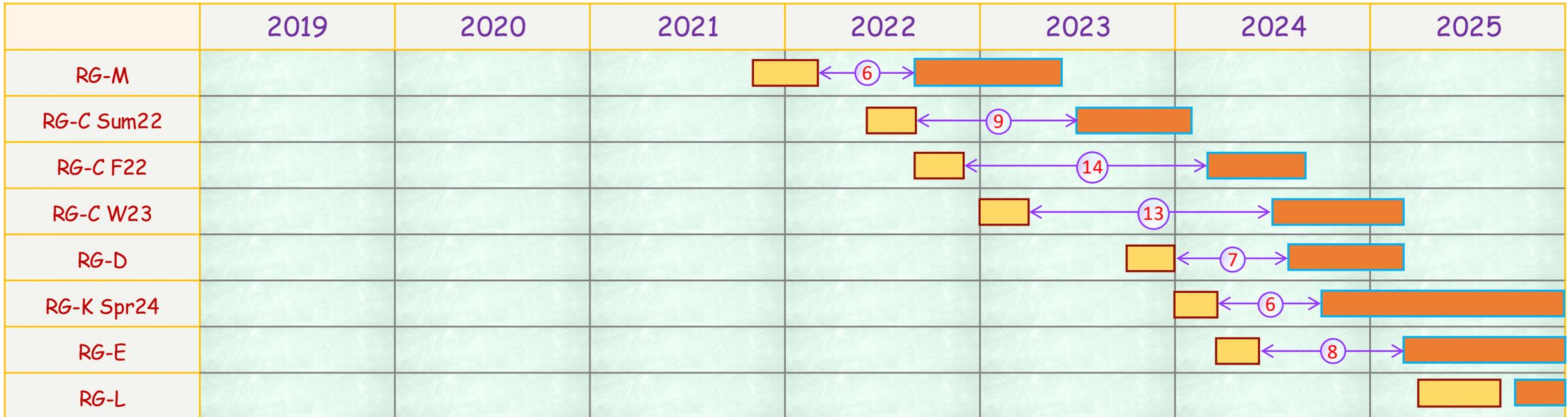
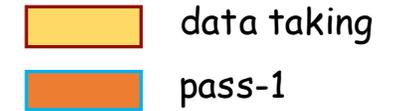
Pass-2 Reviews		
#	CLAS12 Dataset	Date
1	RG-A Spr18	Feb. 2025
2	RG-A F18	Sep. 2023
3	RG-K W18	Aug. 2023
4	RG-B Spr19	Oct. 2022
5	RG-A Spr19	May 2023
6	RG-B F19/W20	Nov. 2023



# Data Calibration Periods



# Delay to Start of Calibration Periods

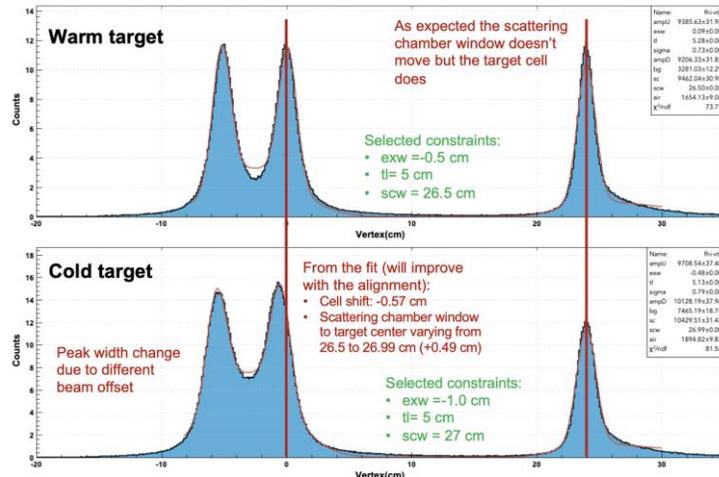


- 1) RG-M: DC+CVT alignment, manpower
- 2) RG-C: Lack of run group support
- 3) RG-D: Moller cone sagging issue

- 4) RG-K: DC alignment - thermal contraction studies
- 5) RG-E: DC alignment - thermal contraction studies
- 6) RG-L: DC alignment - S4 shift

# Pass-3 Considerations I

## 1) DC realignment efforts to account for the thermal contraction of the cryotarget



- This was only understood from the RG-K 2024 data and applied to alignment for datasets starting with RG-D 2023
- New B=0 code now available with bug fixes and essential improvements starting with RG-L 2025

## 2) Application of new protocols for DC time offsets and time-to-distance calibration

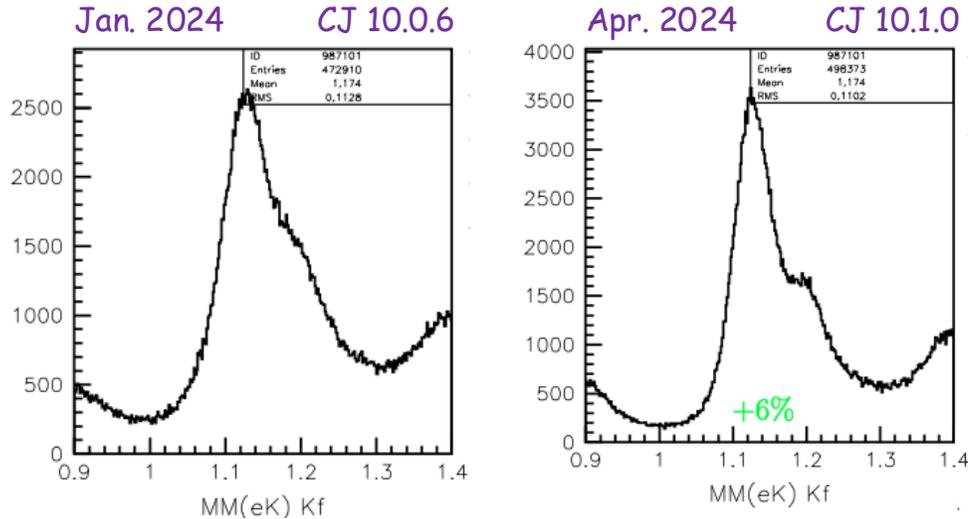
### New DC calibration suite:

- 1) Improve algorithmic approach to account for time-walk correction
- 2) Improve B-field dependent parameterization for R2
- 3) Add improved metrics for calibration convergence
- 4) Improve event selection + fitting approach
- 5) Implementation of TDC cuts for R1, R2, R3

- New DC suite available starting with RG-K 2024
- COATJAVA not backward compatible with old DC calibration constants starting with RG-D 2023

# Pass-3 Considerations II

3) With new reconstruction code what subsystem recalibrations must be done?



- Pass-0/timelines should be re-run before any re-cooking
- Before RG-D the calibration procedure mixed FTOF and RF calibrations
  - This issue propagated across all timing calibrations
  - Any recalibration work, in principle, should be properly redone across all subsystems

4) What impact can be expected for improved CVT tracking algorithms?

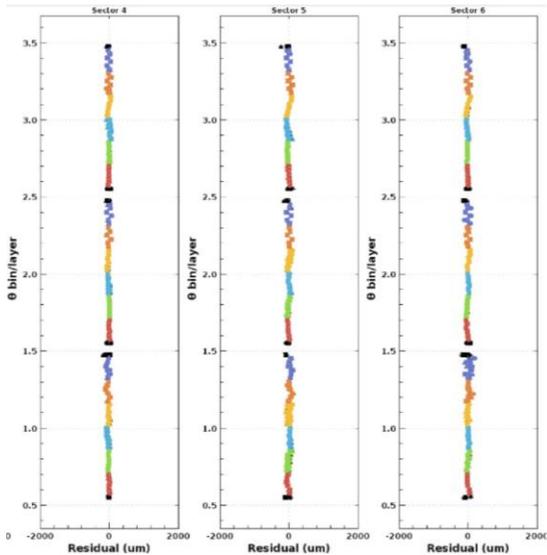
- Are substantive gains in efficiency and resolution possible?
- Work is in progress on improvements to the conventional algorithms (tracking seeding)
- Work is in progress on implementing AI/ML methods

5) Are there expected improvements or planned investigations of the torus and/or solenoid field maps?

- Such work should be completed/implemented before starting any recalibration efforts

# Pass-3 Considerations III

## 6) What are the effects of geometry changes made to DC?



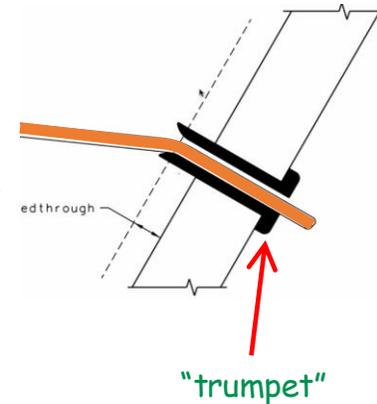
### Issue #1: R3 S5 and S6 "zigzag":

- Found that reference guard wires did not include a  $\pm 300 \mu\text{m}$  "mini-stagger"
- Possible effect of distorted electric field - compensated for with increased effective mini-stagger  $\pm 350 \mu\text{m}$

### Issue #2: Model of wire positions at endplate:

- Geometry model assumes wire is located at center of hole in endplate - but wires actually shifted due to bending at "trumpet"
- Effect causes wire-length-dependent shift at the level of  $200 \mu\text{m}$

\*Implemented in CJ 11.0.0 - Aug. 2024



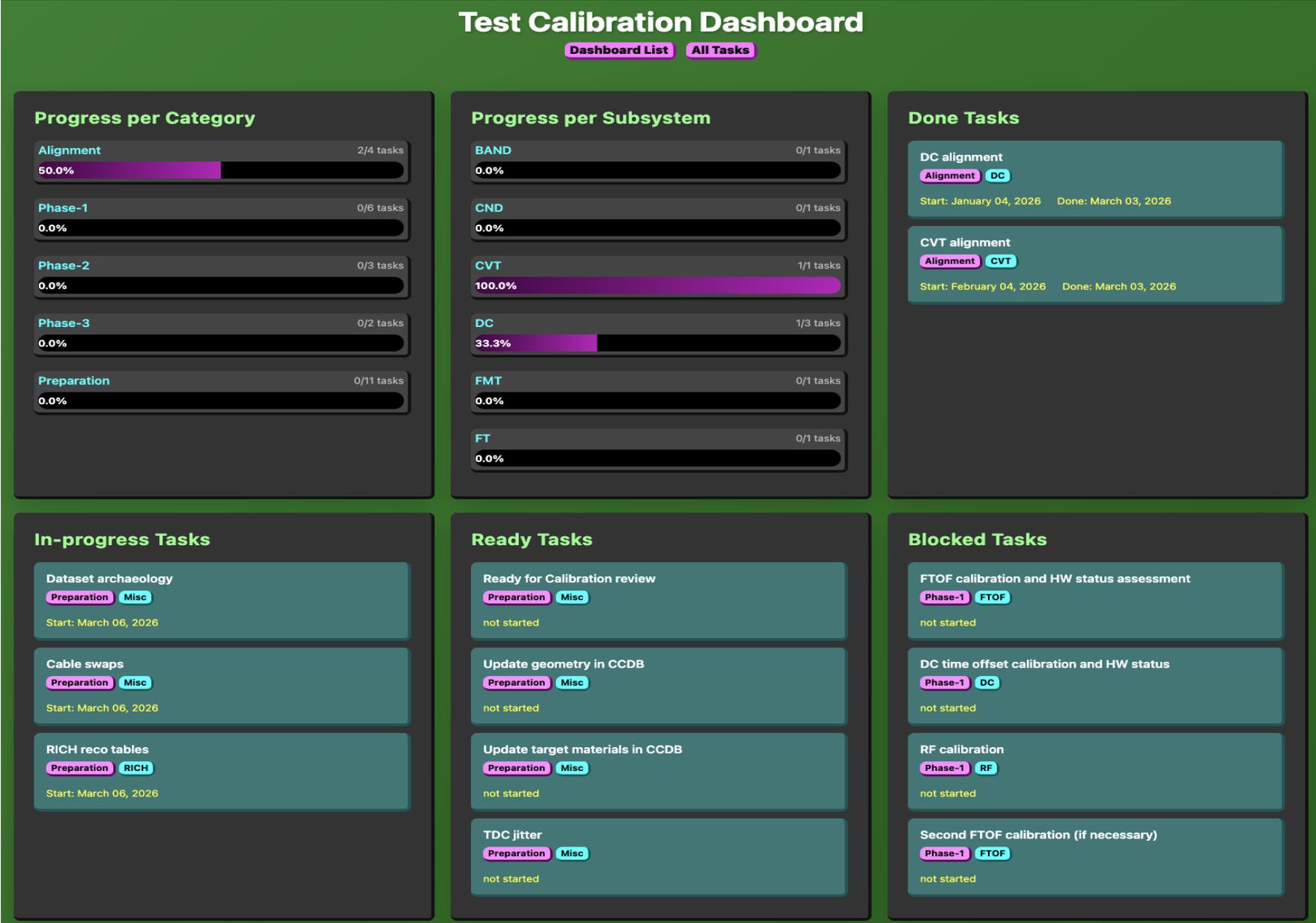
## 7) Other considerations:

- Need to study the impact of the new software on the subsystem QA calibration quantities
- Implement run-by-run hardware status tables - started with RG-C Sum22
- New DC time jitter correction and to reduce multiple TDC hits - data need to be decoded - RG-D F23
- New RICH alignment procedures - implemented starting with RG-K Spr24
- Matching MC to data with pass-3 software/calibrations



# Calibration Workflow/Checklist

Christopher Dilks



# Summary

- CALCOM has been overseeing the detector calibrations of the different CLAS12 datasets:
  - Completed calibrations: RG-D - cooking in progress
  - Current focus:
    - RG-E, RG-K: completed reviews - waiting for resources
    - RG-L: final calibrations for FD in progress; developing ALERT calibration suites/protocols
- Laying the groundwork for "pass-3" recalibrations/recooking:
  - Getting organized for the work ahead
  - Updating code suites for improved speed and automation
  - New software development (DC, CVT efficiency/purity, speed)
  - Improving DC calibration "turn-around"
  - Improving/streamlining calibration protocols
  - Implementing active/online calibration checklist
- CALCOM is a critical service-work committee for the CLAS Collaboration:
  - Lots of folks are part of this work: CALCOM, coordinators, chefs, timeline crew, subsystem leaders, calibrators, alignment team, Software Group, data validators, ...



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