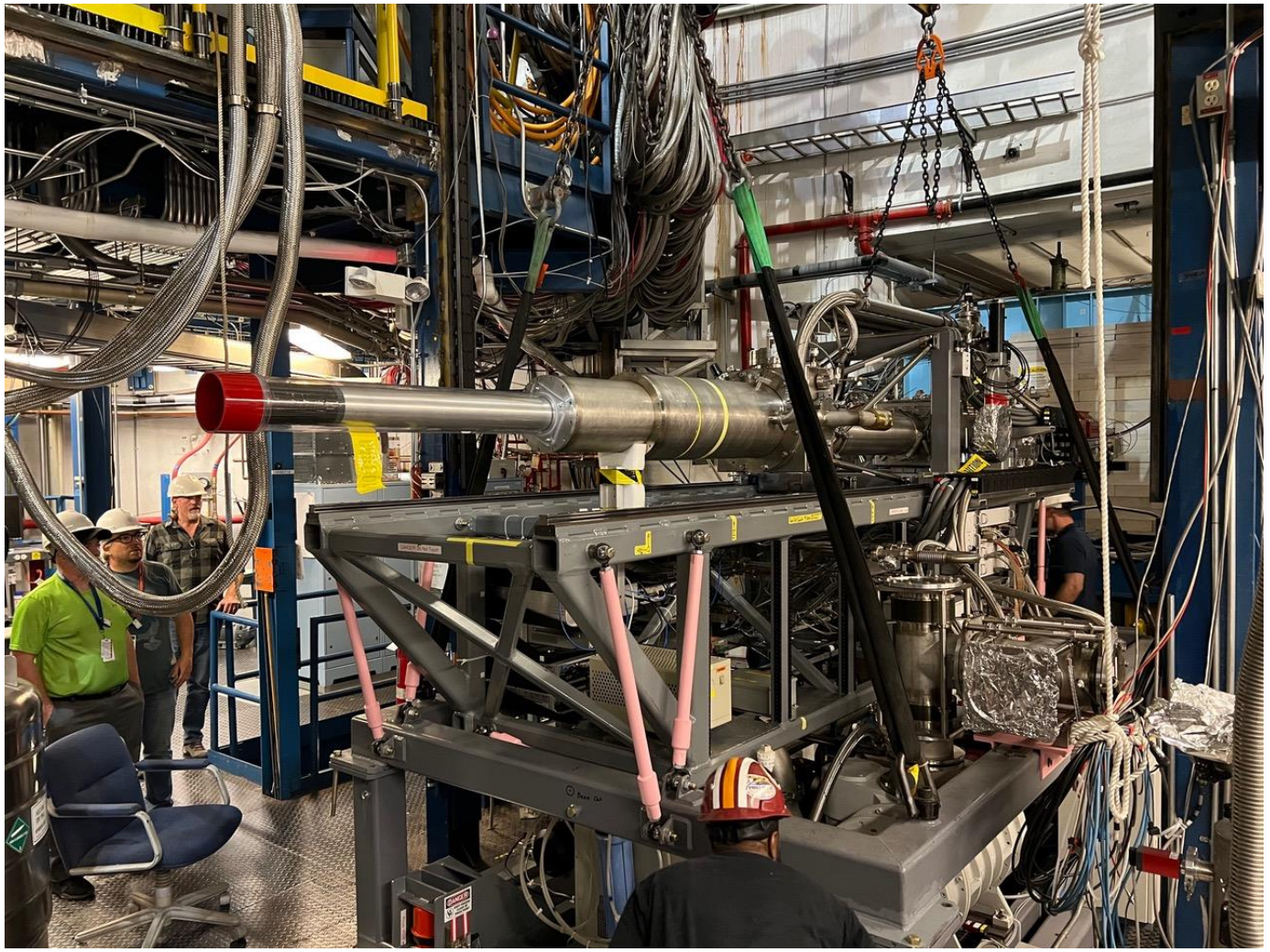
RG-C update for CalCom



S. Niccolai (RG-C analysis coordinator)
CalCom, 5/20/2022

RG-C physics program and spokespersons

« RG-C », AKA « Electroproduction on longitudinally polarized NH_3 and ND_3 with CLAS12 »

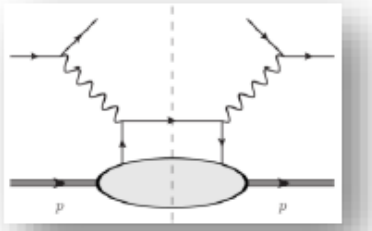
Physics goal: studying the multi-dimensional proton and neutron spin structure

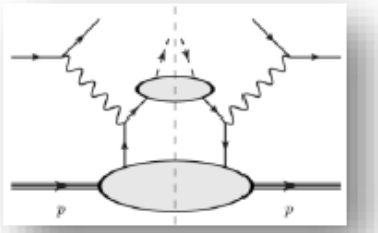
- DIS inclusive and flavor-tagged spin structure functions
- Semi-inclusive DIS (SIDIS) to access Transverse Momentum Dependent parton distributions (TMDs)
- Deeply Virtual Compton Scattering (DVCS) to access Generalized Parton Distributions (GPDs)

Proposal ID	Title	Contact Person
E12-06-109	Longitudinal Spin Structure of the Nucleon	Kuhn
E12-06-109A	DVCS on the neutron with polarized deuterium target	Niccolai
E12-06-119(b)	DVCS on longitudinally polarized proton target	Sabatie
E12-07-107	Spin-Orbit Correlations with longitudinally polarized target	Avakian
E12-09-007(b)	Study of partonic distributions using SIDIS K production	Hafidi
E12-09-009	Spin-Orbit correlations in K production with polarized targets	Avakian
E12-09-007A	Studies of Dihadron Electroproduction in DIS with Longitudinally Polarized Hydrogen and Deuterium Targets	Dilks

NEW RG ADDITION (PAC50): *Studies of Single Baryon Production in the Target Fragmentation Region with a Longitudinally Polarized Target* by T. Hayward et al.

DIS

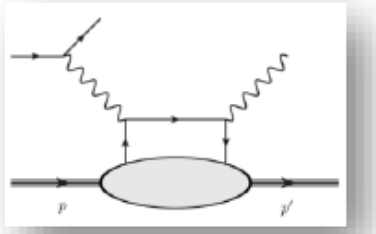




SIDIS

π, K, di-hadron

pDVCS
nDVCS



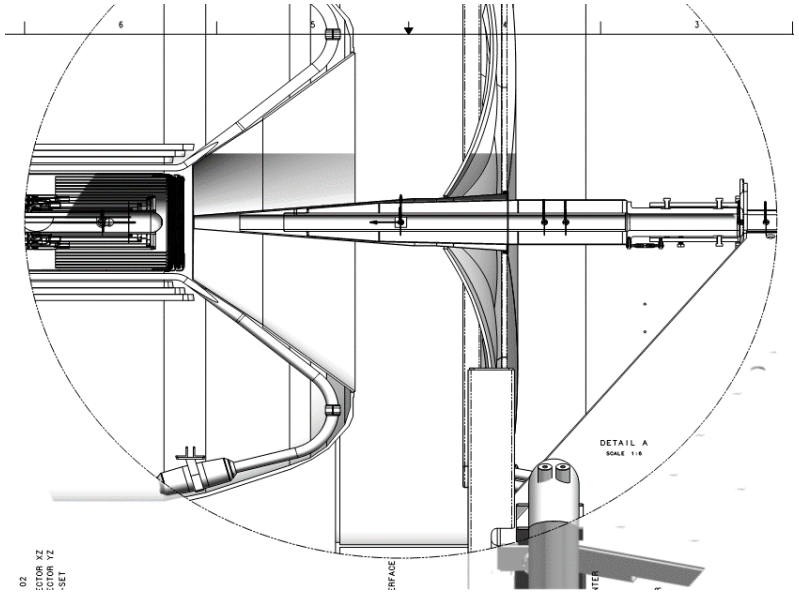
RG-C team

- Run Group Leader: Sebastian Kuhn
- Analysis coordinator: Silvia Niccolai
- Chef: Mohammad Hattawy (→Noémie Pilleux from August onwards)
- Monitoring/Timelines: Mohammad Hattawy (→Noémie Pilleux from August onwards)
- Students: Victoria Lagerquist, Pushpa Pandey, Noémie Pilleux, Kayleigh Gates, one student from W&M
- Other contributors/collaborators: Chris Keith and his team (polarized target), Maurik Holtrop (raster in CLAS12mon), John Price (raster calibration), Francesco Bossu (beam offset calibration), Daria Sokhan, Chris Dilks, Harut Avakian, Niv Ramasubramanian, Maxime Defurne, Carlos Ayerbe Gayoso
- Precious « external » support from Raffaella De Vita
- Run coordinators: https://userweb.jlab.org/~kuhn/RGC/RCschedule.pdf

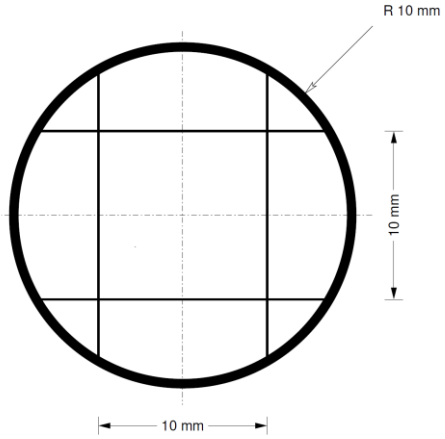
RG-C schedule and experimental configuration

RG-C run: eight-months run from June 2022 to March 2023

- Originally 185 PAC days, reduced to 120 PAC days in Jeopardy → 240 calendar days scheduled.
- Proton (NH_3) and Deuteron (ND_3) dynamically polarized targets, 5 cm long:
  - Each target will get 30 days in FTon configuration, then 90 days in FTout configuration
  - Configuration change will happen around August 10
- Beam current: 5 nA for FTon, 10 nA for FTout
- Maximum possible beam energy and polarization
- Rastered electron beam: 6 mm radius for FTon, 9 mm radius for FTout
- Torus inbending (outbending for ¼ of Ftout part), full field; solenoid full field
- Standard CLAS12 (no FMT/BAND), 2 RICH? (1+4), 2 LTCC (3+5), ELMO Moeller shield for FTout
- Standard inclusive e^- trigger and DAQ



Special runs / no-beam activities



- Commissioning:
  - Beam centering, raster parameters and calibration
  - Low-energy elastic and inelastic (e,e') to calibrate NMR, cross check with world data
- Moller runs
- Target swaps and anneals
- In-situ irradiation of ND_3
- Special runs
  - Zero field / alignment runs (to be taken early to facilitate online calibration)
  - Rate and background dependence on beam current and raster radius
  - Trigger roads validation
  - Empty target runs, ^{12}C target, CH_2/CD_2 targets runs
  - FTon: all torus inbending
  - FTout: ¾ inbending, ¼ outbending torus runs

Calibration and commissioning at 1 pass (2.2 GeV)

Running conditions:

- Torus 1/2 field, inbending polarity.
- Raster with 6 mm radius
- Standard single electron trigger without requiring road matching
- Maximum beam current ~2-5 nA

Goal of taking data at 2.2 GeV:

- study elastic, quasi-elastic and radiative elastic scattering
- measuring spin observables at low Q^2 for comparison with existing data.

Day 1:

- Establish beam on empty (raster calibration) target
- Study raster and set corresponding CCDB parameters for calibration
- Take data on fully empty target, LHe-filled target, and 12C target
- Study backgrounds and trigger rates at various beam currents for optimizing beam current
- Take series of runs with different DC HV settings to calibrate

Day 2:

- Polarize NH3 target and take data for at least 2 shifts

Day 3:

- Swap targets to ND3 and cold-irradiate sample

Day 4:

- Take data on ND3 (at least 2-3 shifts)
- If time permits, take also data on CH2 and CD2 targets.

Production running at 10.6 GeV / 5 pass with FTON (FTOUT)

At the start of each run period:

- Repeat raster centering, settings, and calibration
- Zero field run for alignment (completely empty target with foils only).
- Otherwise all runs will be with full torus field (inbending polarity) and full solenoid field.

1. (NH): Install NH3 cell, perform TE and polarize during no-beam time. Then run 6 shifts on NH3 with beam.
2. (MT): Remove NH3 cell and replace it with empty target cell. 0.25 Shifts (2 hours) on MT
3. (CH,C,CD): Replace MT target cell with one of the auxiliary cells - CH2, 12C, or CD2 (rotating on a 3-week schedule). Run 3 (CD2) to 6 (CH2, 12C) shifts
4. (ND): 6-9 Shifts on ND3, until begin of next Accelerator Studies. During no-beam, take TE, then remove ND3 cell. Series repeats.

NOTE: the number of shifts per target type is just given as an indication, it will be agreed upon in the coming days

Plan for online calibrations (according to CalCom guidelines)

• RG-C will ensure run conditions are set (trigger, DAQ, field settings), thus that the commissioning phase is over, before starting calibrations
• Alignment runs will be taken early and analyzed to fix target positions and detector offsets
• Necessary calibration runs will be taken whenever conditions change
• We will setup pass-0 monitoring to cook data and update timelines every 24- 48 hours
• Calibrate beam offset as needed (this needs to be integrated with the raster once it is calibrated, tests are ongoing)
• Provide cooked/filtered data for subsystem calibrations
• Analysis Coordinator and chef will be in place and committed to the process through the data-taking period and for 6 months after the run to finish the job

Calibrations sequence:

1) DC and beam-offset calibrations + pass-0 cooking → monitors & timelines to establish runs to process
2) FTOF calibration
3) RF calibration: run-by-run calibration after FTOF calibrations using pass-0 files + pass-0 cooking → monitors & timelines to make sure FTOF is OK before moving to the next step
4) CLAS12 subsystem calibration: DC, CND, CTOF, ECAL, FT (Hodo, Cal), HTCC (timing), RICH?
5) Pass-0 cooking → monitors & timelines; check of calibration quality vs run
6) Reiterate, if necessary (for specific run ranges and/or detector subsystems)

The number of runs to calibrate during the online phase will depend on the stability of the experiment conditions
Aware of the upcoming heavy load on calibrators, we will strive to minimize the number of runs to calibrate

Status of cooking scripts and readyness for pass-0/timelines

From Mohammad:
The cooking scripts are ready
Nathan has given Mohammad an administrative account for RG-C to have the priority when cooking data.

The production of timelines will be handled by the chef, through three stages:

1. clas12_monitoring: the first 10 files from every run are analyzed and produce hipo files with monitoring plots for every run.
2. run_based_monitoring: a set of scripts run over the hipo files from the first stage and produce a hipo file to be placed under a specific location to be visible in clas12mon0.jlab.org
3. clas12_timelines: a set of scripts read the timelines from the website and produce a new set of QA timelines and send them under a new branch in clas12mon.jlab.org

An rgc tab under clas12mon.jlab.org has been added
All the codes for the previous stages are in Mohammad’s hands under /work/clas12/mhattawy/rgc-timelines/