Report of the Readiness Review for a large-scale processing of the HallB/CLAS12 RG-A data (Fall2018)

Monday, March 2, 2020

Review committee:
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The review took place on February 27 at JLAB. For the agenda and presentation refer to the review page:
https://clas12-docdb.jlab.org/cgi-bin/DocDB/private/DisplayMeeting?sessionid=361

The Hall-B/CLAS12 RG-A is getting ready to process a significant fraction of their data to provide enough statistics for the first publication(s) of physics results from CLAS12 in FY20. The data set presented for the review has been acquired during fall 2018 run with both polarities of the CLAS12 torus magnet almost in equal amount. About 15% of this data set has been processed in the past and various physics analyses of that data showed encouraging signs for possibly producing publishable results in a short time if enough well-calibrated data is available. It has been recognized that while publications are expected from this processed data set, this will not be the final processing of the fall 2018 data, as certain aspects of the software, alignment and calibrations are not yet final, e.g. CVT alignment and the tracking algorithm for the central tracker.

In the past several months, there has been significant progress made in the development of the CLAS12 reconstruction software and the data processing workflow, calibration tools and the monitoring applications. Run Group A, working together with the calcom and software groups, made good progress in calibrating the fall 2018 data. However, as pointed out during the review presentations, work is not finished yet and the data are not ready for processing. RG-A estimates that there are still two weeks of work remaining before data processing can start. Moreover, as was discussed in the short closeout session, the review committee will reconvene to check the progress of the work on Monday, March 9. The review on March 9 may have to verify the readiness of only the negative torus polarity ("inbending" electron) part of the run period. If approved, processing of this data can start, hopefully not later than March 13. It will take a month to process the whole set of "inbending" data. During that time RG-A can finish tweaking the calibration for the positive torus polarity ("outbending" electron) part of the run period. The review committee can review the readiness of that data set some time in late March or early April.

The review committee wants to thank RG-A for preparing the presentations, providing ancillary information, and for patiently answering our questions during the review meeting. Below are our answers to the Review Charge questions in the form of comments and recommendations. Most of the Charge items composed of more than one question, so we present our comments for each question marking then as (a), (b) ...

Review Charge:

Charge #1: *Is the quality of detector calibration and alignment adequate to achieve the performance specifications foreseen for CLAS12 or achievable at the current time, given the "state of the art" calibration, alignment and reconstruction algorithms?*

(a) Yes – The current algorithms and methods used for calibration, alignment and the reconstruction of data are adequate to achieve performance specifications foreseen for CLAS12.

(b) No – The demonstrated performance was not based on the calibration and alignment directly related to the presented RG-A data. The CLAS12 performance has been demonstrated using plots made for the CLAS12 NIM article, for some specific runs, calibrated and processed separately from the ongoing RG-A efforts using different software releases.

Charge #2: *Is data quality as a function of run number or time for the data set that is proposed for pass1 cooking stable and understood? Is reconstruction efficiency consistent with expectations and reproducible by appropriate MC simulations?*

(a) No – timelines for most of the parameters have not been shown or discussed. There is still some calibration work that has to be done and another pass0 processing should happen before the monitoring DB will be ready to check for the run dependent quality of detector calibration.

(b) No – there have been no discussions or presentations on the reconstruction efficiencies or MC simulations. Although reconstruction efficiency from the data has been studied.

Recommendation:

(a) After recalibration and pass0, RG-A should pass along links to the new monitoring timelines to the review committee and be ready to discuss them at the follow-up meeting. Besides the timelines, the group should present performance plots for the calibrated run and the last run in time for which that calibration constants are used. For example, DC residuals (slide 4 of D. Carman's talk), FTOF resolution (slide 6), 1D beta distribution for small bins in momenta of charged hadrons to demonstrate 4s separation as stated on slide 7, ECal sampling fraction, FT pi0 mass and any other quantities that are important for RG-A physics analysis.

(b) Robust methods for understanding the detector efficiency must be developed together with a method of the beam background merging with simulations to account for these inefficiencies. While the claim is that the physics publications from the reviewed data processing are beam spin asymmetries and the detector acceptance effects are expected to be small in asymmetry ratios, it is not a case for evaluation of backgrounds and depending on the background contamination some azimuthal dependences will be polluted with false asymmetries.

Charge #3: *Are analysis plans for the data set developed at adequate levels? Is the list of planned skims defined and tested running analysis trains on preliminary data? Are preliminary analysis results for the main reaction channels and observable available and consistent with expectations? Is all ancillary information (helicity, Faraday Cup, …) available and understood?*

    (a) Yes – There seems no question that analysis plans for the leading candidates for the first publication are well developed and prepared for new data. In fact, these studies have exhausted the statistics in the DNP dataset and are waiting for the full cooking to finalize their systematics and background studies.

    (b) Yes - The skim list has been in place for months although it may be worth considering consolidate or limit the production or remove trains with large outputs.

    (c) Yes - From the available studies on the review page and the analysis notes for previous DNP presentations, this looks to be true for the FD based data.

    (d) No - From the presentations the issue of what ancillary information is 'available' is clear, but what is 'understood' is not so clear.

Comments:

    (c) FX's analysis of FD/CD elastic correlations shows departures from MC expectations for all but the 'S5' correlated portion.

    For physics analyses requiring either pizero selection, estimation of pizero contamination or subtraction of pizero sideband asymmetries, considerations of pizero detection efficiency/reconstruction are relevant and not currently known independently of MC. For example, the low energy peak in the diphoton mass plots in the di-hadron analysis note are claimed to be correlated with low photon opening angles of 2-4 deg. If these are actually mis-reconstruction pizeros then they have lost 1/2 of their pizero yield (below).

    (d) The QA tools look very powerful but more clarity is needed on how to programmatically 'mine' these plots for relevant information in the workflow.

Recommendations:

    (d) From Chris Dilks talk: "We need to look at every plot" is not an option. Automated algorithms must be implemented and used taking into account also the statistical uncertainties on the monitored quantities.

Charge #4: *are data processing tools that will be used adequate for the proposed processing task? Is the data management plan (staging area, tape destination, directory structure, logs, …) defined and appropriate given the available resources? Is the estimate of resources needed to complete the task sound?*

    Yes – Data processing tools, the data management plan, and the required resources are adequate for processing of this data set.

Comment:

    The processing will start with the 64 runs that have been processed for the last DNP meeting. These runs will take 9 days to complete.

Charge #5: *What are the plans for monitoring the quality of the cooking output and identify/correct failures?*

    Yes – Monitoring tools are available and are quite advanced. But still some work needs to be done for high-level monitoring and for identifying failed calibrations.

Comment:

It has been advertised the monitoring will be fully incorporated into the standard data processing workflow tools. From the software group point of view, that may not be feasible in time, given the information received so far. But that should not be too important, given that in #4 the full DSTs will be resident and pinned on /cache, so RG-A should be able and prepared to run their monitoring software manually.

Charge #6: *Is the manpower adequate for the proposed data processing?*

Yes – the available manpower is adequate for completing the calibration and processing of the RG-A fall 2018 data set.
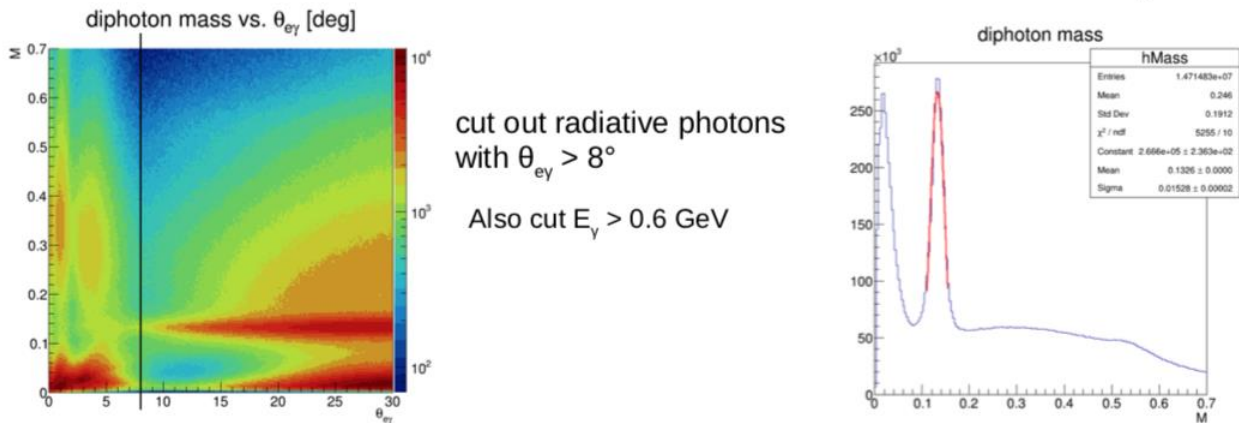
Neutral Pions

Figure 1 Pizero mis-reconstruction and contamination, Charge 3c.