ALERT/RG-L ERR Readiness Assessment
Hall B ALERT Task Force Recommendations

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On Oct. 2 from 1:30 p.m. to 4 p.m. a meeting was scheduled via bluejeans videoconference to perform an assessment on the readiness of the ALERT/RG-L leadership to call for an Experimental Readiness Review (ERR) from the Jefferson Laboratory Physics Division. The meeting wikipage containing the meeting agenda and links to the presentations is located at:

https://clasweb.jlab.org/wiki/index.php/ALERT_HallB_Meeting_Oct_2_2020.

The presentations were given to an audience consisting of the Hall B staff, along with several interested Hall B users and JLab staff. Based on the comments and discussions that came from this assessment, coupled with the specific recommendations included in the first unsuccessful ALERT/RG-L ERR review from Nov. 2019,

https://clasweb.jlab.org/wiki/images/6/6b/ERR_report.pdf,

a minimal work list of necessary tasks has been compiled that must be addressed and documented before the date of the next planned ERR. This list is organized according to the following 5 categories:

- **ATOF tasks** - TOF detector hardware
- **AHDC tasks** - HDC detector hardware
- **ALERT tasks** - higher-level detector assembly
- **Electronics tasks** - Readout electronics
- **Preparation tasks** - Documentation tasks

♢ **ATOF tasks**:

1. Present the final mechanical design of the ATOF detector.
2. Construct a single complete ATOF module to demonstrate all assembly steps and to validate the "mechanical" integrity.

3. Demonstrate from bench testing that the light output from the module meets the expectations from the design and is sufficient to meet the experiment goals. This testing should be done with the final SiPM configuration and cabling.

4. Demonstrate from bench testing that the time resolution of the module meets the 150 ps design specification. This testing should be done with the final readout electronics and cabling using an external set of reference detectors with sufficient timing resolution to demonstrate the ATOF performance.

5. Provide a realistic ATOF construction schedule based on the ATOF module prototype assembly.

6. Demonstrate that the SiPM lifetime is not an issue in the expected radiation environment of the CLAS12 solenoid at the maximal expected luminosities for the duration of the experiment. This can be done through data from dose calculations from beam tests of these devices from experiments where they have been employed previously.

♢ **AHDC tasks**:

7. Demonstrate that 8 layers of AHDC is sufficient to reach desired track reconstruction efficiency.

8. Complete simulation studies to demonstrate effect of inactive materials in the ALERT detector acceptance on forward track reconstruction (momentum resolution, vertex resolution) and the CLAS12 Forward Detector acceptance. Determine how material choices in the AHDC downstream endplate contribute to the drift chamber occupancies and the limitations on the operating luminosity.

9. Demonstrate practical tests of wire stringing procedures with the AHDC prototype. Detail complete stringing and pre-tensioning procedure with necessary force calculations.

10. Provide a realistic AHDC stringing/construction schedule based on the AHDC prototype.

11. Present the final mechanical design of the AHDC detector.

12. Demonstrate that the AHDC prototype preferably with the final dimensions and with the final design components and circuit boards is stable about the nominal design high voltage without undue leakage currents or high voltage instabilities.

♢ **ALERT tasks**:

13. Present the final mechanical design for the ALERT assembly, including the target and the gas enclosure. Details plans for gas tightness of the outer cylindrical volume layer, the upstream and downstream AHDC endplates with the wire feedthroughs, and the upstream endplate with the cabling connections (around the cable attachment points and through the cables themselves).

14. Present a final survey plan to locate all ALERT components relative to the beamline and the Hall B fiducials.

15. Demonstrate the ATOF/AHDC cabling scheme showing the full plan for connections from the detectors to the readout electronics. Detail all final cable choices.

16. Detail all magnetic materials of the ALERT detector assembly, cart, and electronics in the solenoid field volume (including fringe field). Complete eddy current force calculations and make assessment of issues.

♢ **Electronics tasks**:

17. Initially the Petiroc will run in "full digital mode" as it takes little firmware work to run in this mode and it corresponds to the specification performance values for the chip (timing <250 ps down to ∼50 ps and charge measurement resolution of ∼400 fC). The full front-end chain should begin characterized in this mode and parallel work on the firmware will proceed to allow the switch to "analog mode" for improved dead-time and improved TDC resolution (down to ∼40 ps).

18. Measure the charge resolution/noise and timing resolution of the Petiroc ASIC board as a function of the pulse charge (this is something JLab Fast Electronics group will perform) to characterize the baseline performance.

♢ **Preparation tasks**:

19. Starting from the ALERT/RG-L ERR report from the Nov. 2019 review, prepare a point-by-point reply document addressing each issue raised with brief replies that should reference more complete external reports provided as pre-brief material.