

Proposal for the Power Supply Control System of Hall A Dipoles

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This note presents the rationale for selecting the Allen-Bradley CompactLogix series for use with the Hall A dipole power supplies.

The left and right dipole magnets of the Hall A High Resolution Spectrometer uses Dynapower Corporation's power supplies, Fig. 1. An Allen-Bradley SLC 500 series PLC system, Fig. 2, monitors the power supply safety interlock circuits and performs control functions of the power supply.

As of January 2017, Allen-Bradley discontinued support of the implemented controllers, model #1747-L51 [1]. Additionally, these controllers had booting problems [2] that required hall access to recover (via serial port). Hence, a new system that is in active service and provides better communications capability was proposed.

Three different systems were considered: Allen-Bradley CompactLogix series, National Instruments CompactRIO (cRIO), and Allen-Bradley ControlLogix series. These systems are in use in the Physics Division. CompactLogix series are used for Hall D detectors, cRIOs are used for the Hall B Gas System, and the ControlLogix series are used for the Hall C magnets.

The pricing for a single chassis (as of March 2019, rounded to hundreds) was as follows: CompactLogix at \$4,300, cRIO at \$6,000, and ControlLogix at \$14,400.

While the performance in the ControlLogix series is better than that of the CompactLogix series, the cost for the ControlLogix series removed it from consideration.

While the cRIO offers higher performance (higher CPU and RAM) and capabilities (faster I/O) than the CompactLogix, the offered modules did not always match the existing system's needs, e.g. for a sourcing DC input module, cRIO offers 4, 8, or 32-channel modules, while the present system uses 16-channel modules. Though not a show-stopper, this difference requires rewiring of the existing power supply, and additional adapters and documentation. However, the main reason the cRIO was eliminated was that its implementation would need a complete rewrite of the code that is presently deployed; the two systems use different programming paradigms, National Instruments cRIO uses LabVIEW, Allen-Bradley CompactLogix uses ladder logic. Rewriting the code would increase development and testing time.

The Allen-Bradley CompactLogix system was selected because it uses the same programming environment as the current system and has direct module replacements [3]. Also, because of its network capability, it facilitates monitoring by EPICS. Further, this choice standardizes the magnet control and monitoring systems across the Physics Division. Being the lowest cost was an unexpected plus.



FIG 1. Dynapower magnet power supply.

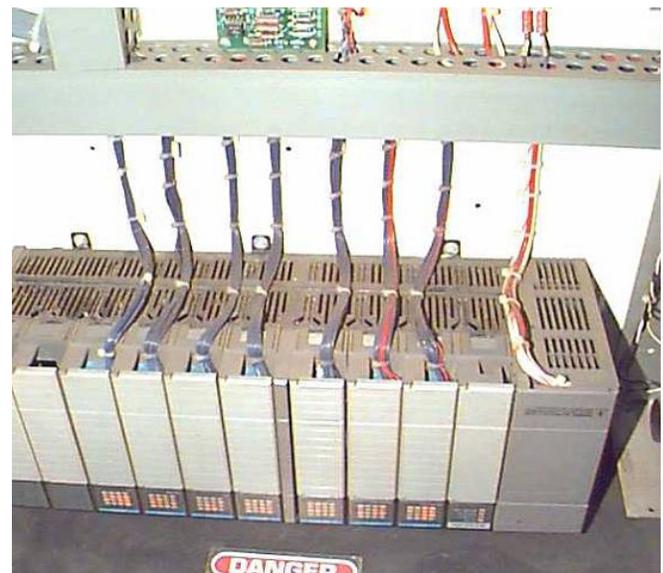


FIG. 2. Existing SLC 500 PLC control system.

- [1] <https://www.rockwellautomation.com/global/support/product-compatibility-migration/lifecycle-status/overview.page>
- [2] A sample of logbook entries: <https://logbooks.jlab.org/entry/3433529> <https://logbooks.jlab.org/entry/3519290>, <https://logbooks.jlab.org/entry/3659482>
- [3] Rockwell Automation Publication 1746-RM003C-EN-E