The system should be able to handle 48 input channels in total for safety. The BCA should implement 30 interlock circuits and 30 trip circuits to reduce failure alignment for the cyclotron. Being developed in the 1980s, the cyclotron has many components that are now outdated and that require redesign consideration.

The previous design concept of the BCA System required both a Multiplexer Card and an AutoGain Card to combine and read in low-level signals. The natural bulkiness and component-heavy nature of this causes spacing and safety replacement issues. The redesigned system, now called the Beam Current Signal Conditioner Card, transitioned from an analog system to a digital system. The previous system which relied on >15 unique and obsolete parts, now relies on only 3 parts that are repeated per channel.

This was achieved by using an ultra-low noise transimpedance amplifier capable of sensing 1nA signals. The output of the system is digitized using a 18 bit ADC and uploaded to the network. One of our main goals in this redesign project is to modernize circuit structures, not simply prioritizing high-efficiency performance. Displays output feedback at a precision of nanoamperes, previously microamperes. Overall, facility engineers approve of completed work and increased inputs. Facility engineers are satisfied with modernized circuits and increased safety.

Our group learned to highly consider environmental stress in high workload systems, not simply prioritizing high-efficiency performance.