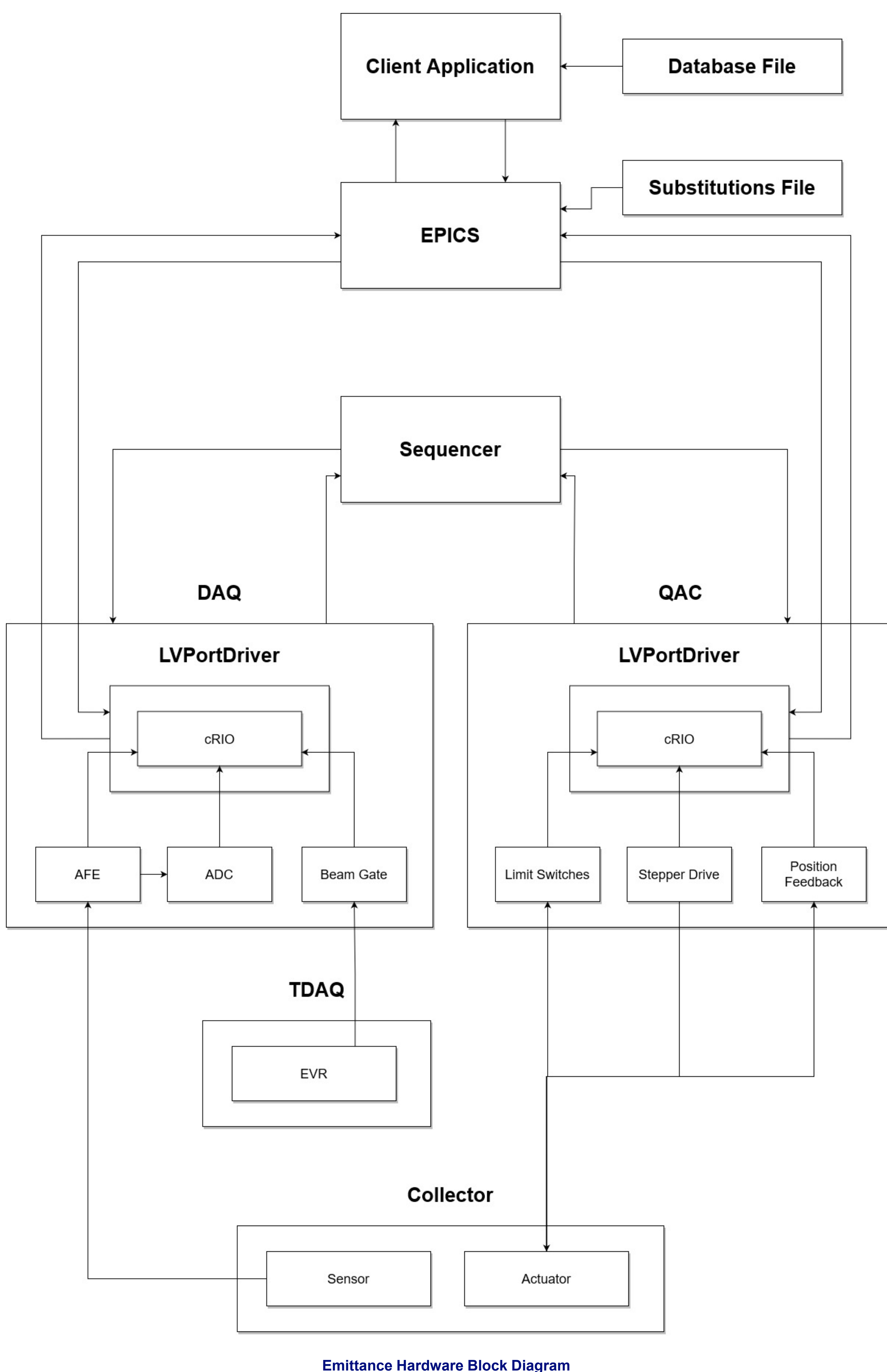


# LANSCCE High Density Emittance Instrumentation System\*

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## Abstract

The Los Alamos Neutron Science Center (LANSCCE) is currently upgrading the existing emittance stations with a high-density instrumentation system for emittance measurements in the low energy beam transport region. Emittance measurements were obtained using obsolete legacy equipment. For motion control a switching station with a mechanical mux to switch actuators was used. This caused a single point of failure for all emittance stations and is becoming increasingly unreliable. For data acquisition, two sets of signal conditioning and digitizers were employed and had to be shared between 7 emittance stations. Physical cable swapping was necessary when taking measurements from station to station. A system was developed using dedicated Quad Actuator Controller (QAC) chassis, capable of driving four (4) actuators, and dedicated data acquisition (DAQ) chassis capable of signal conditioning and digitizing up to 80 channels simultaneously. Details of the system development are presented.

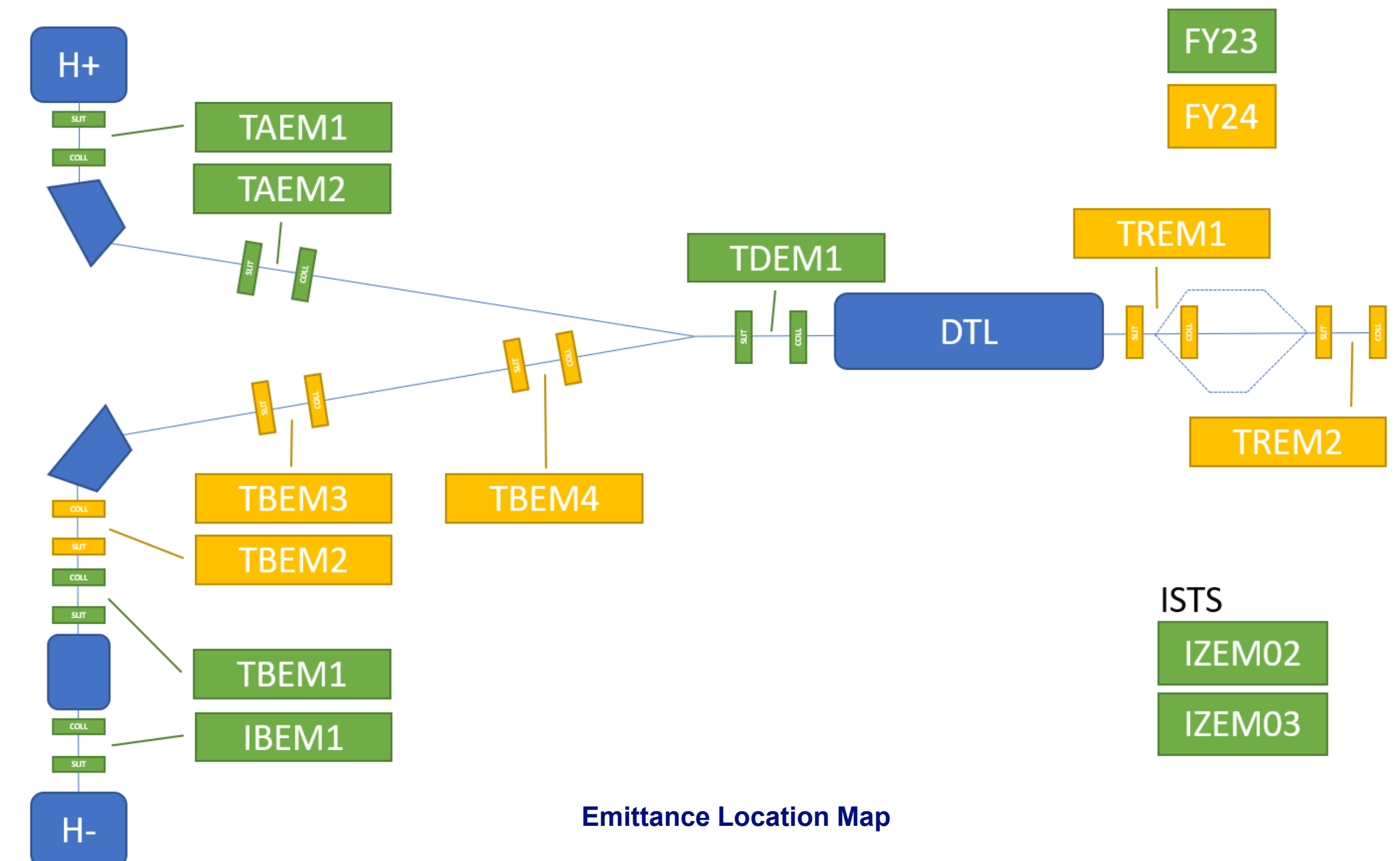


Emittance Hardware Block Diagram

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## System Location and Overview

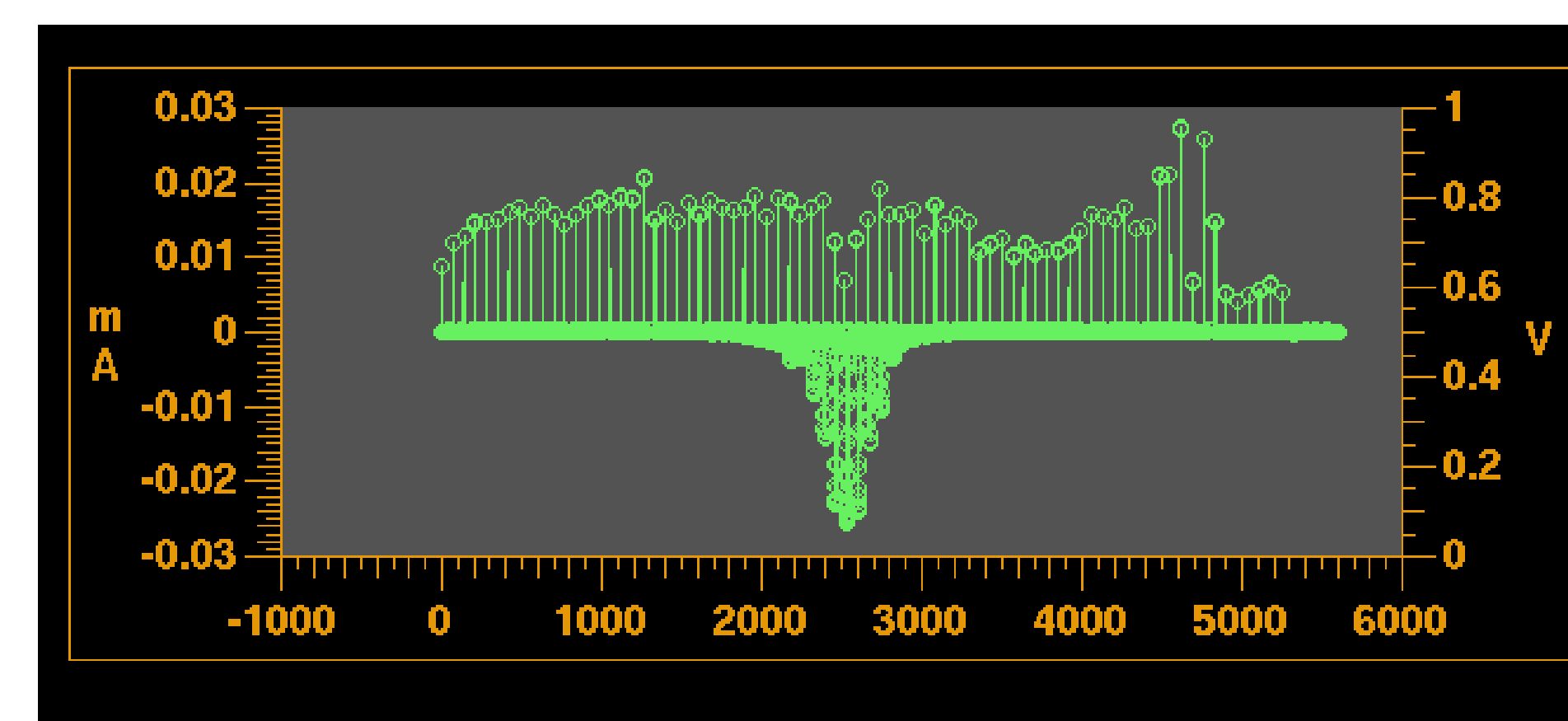
Locations upgraded during the 2023 outage are shown in green, and planned upgrades to be completed during the 2024 outage are shown in yellow. Emittance measurements provide necessary information to tune the beam by providing beam parameters such as beam position, shape, angle, and intensity in both transverse and longitudinal planes through the beam pulse.



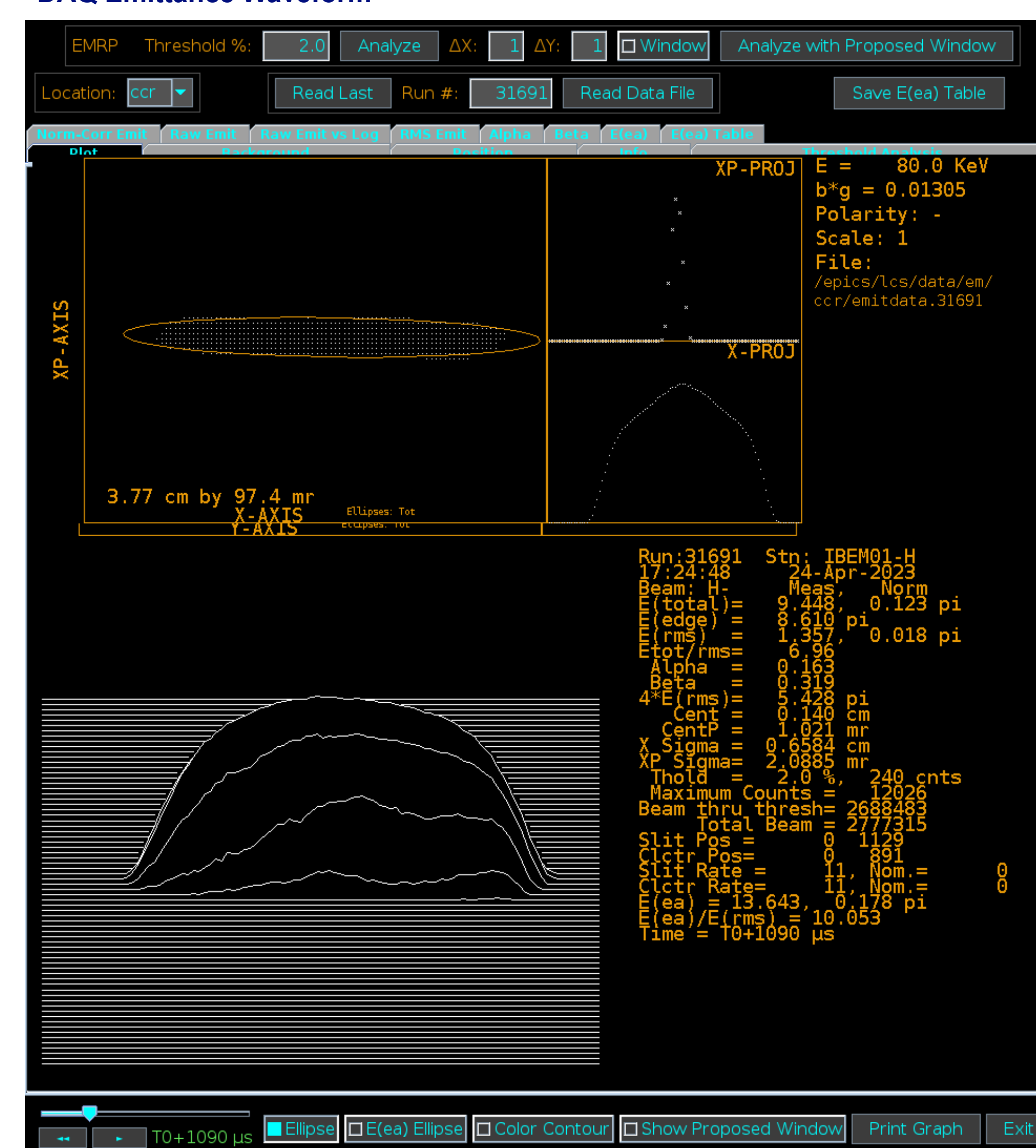
Emittance Location Map

## Controller Hardware

Using recently developed Quad Actuator Controllers (QAC) and Data Acquisition (DAQ) instrumentation chassis, the existing system is to be completely replaced and condensed with increased density of electronics. The hardware diagram of the emittance system is shown. QAC chassis will provide actuator control for a single emittance station, driving vertical and horizontal slits and collectors. The DAQ maintains acquisition capabilities as developed. Live waveform data can be observed where a collector can effectively be utilized as a harp device.



DAQ Emittance Waveform



IBEM01 Horizontal Emittance Scan

## Results

Emittance measurements were taken using chopped and un-chopped beam in the LEBT using both H+ and H- beams. IBEM01 horizontal emittance scan on the cRIO system with similar measurements being produced from previous years confirming the viability of the system and allowing for a total replacement of all legacy hardware. Successful commissioning of the emittance stations has prompted work to be planned to complete the remaining emittance stations and upgrade harp devices using the QAC and DAQ platform. With all LANSCCE beam interceptive devices on the same platform, diagnostics will become easier to maintain with fewer hardware types to learn and have spares more readily available.