

CONTROLS INTERFACE INTO THE LOW-LEVEL RF SYSTEM IN THE ARIEL E-LINAC AT TRIUMF

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ABSTRACT

Phase 1 of TRIUMF Advanced Rare Isotope Laboratory (ARIEL) was completed in September 2014. At phase 1, the Low-Level RF (LLRF) system of ARIEL's electron linear accelerator (e-Linac) consists of a buncher and a deflector, one single-cavity injector cryomodule and the first cavity of two dual-cavity accelerating cryomodules. The model for the e-Linac LLRF system is largely based on the experience gained from the fully-commissioned TRIUMF ISAC-II linear accelerator (linac). Similarly, the EPICS-based Controls for the e-Linac LLRF builds on the lessons learned with the linac LLRF Controls. This paper describes the interface between the ARIEL Control System (ACS) and the e-Linac LLRF using EPICS ASYN/StreamDevice and a SCPI-like protocol. Also discussed are the ACS EDM displays and future plans for LLRF Controls.

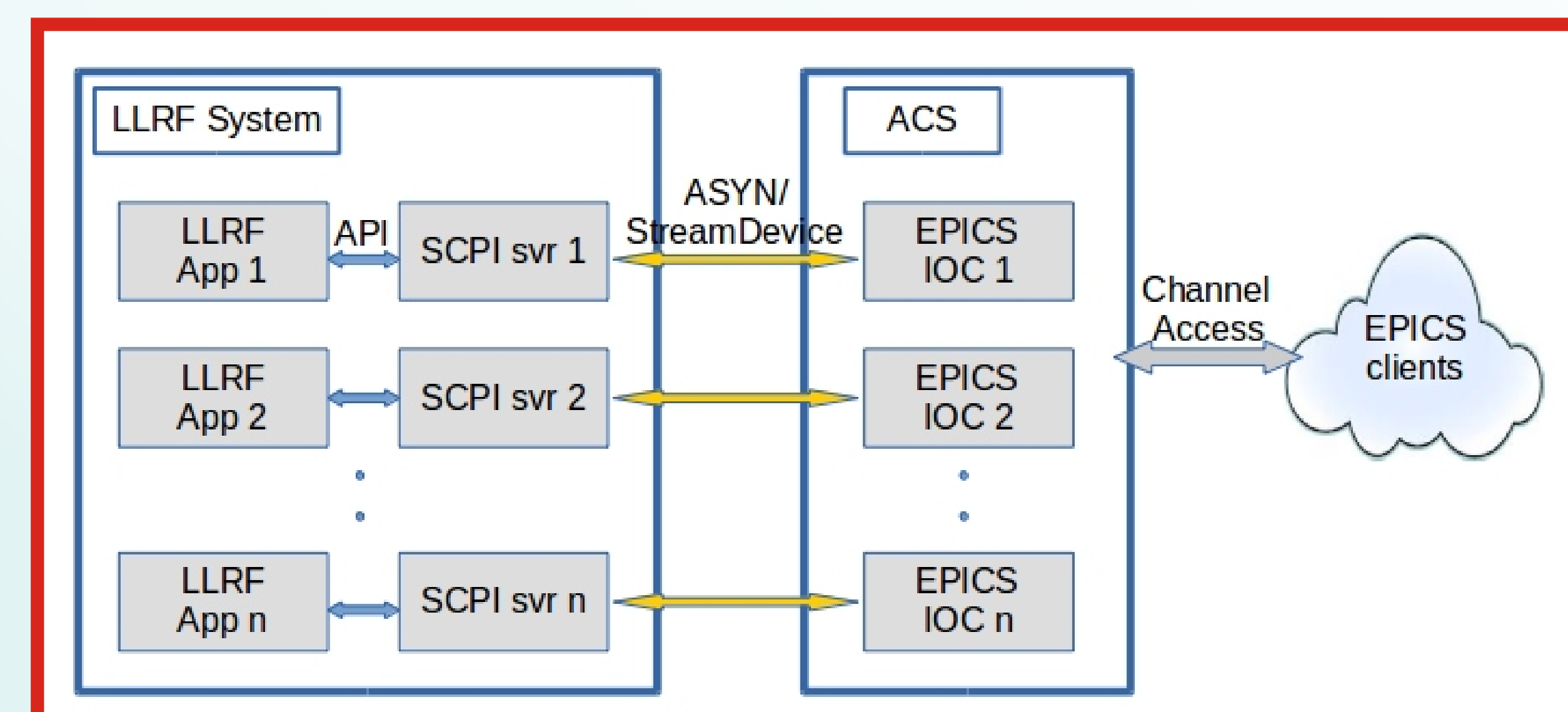
LLRF-ACS INTERFACE

- Lessons learned from ISAC-II linac Controls:

- The LLRF and EPICS IOC used shared memory for inter-process communication
- The IOC needed to run in the same computer as the LLRF System
- IOC was difficult to maintain due to limited experience: IOC was built to run on Windows and was developed in Visual Studio using WIN32 DLL's
- Host machine is owned and maintained by the LLRF group: LLRF personnel were often inconvenienced whenever Controls staff needed access to the machine
- Updates to the IOC database were done by LLRF personnel

- Applied Improvements:

- The ACS IOC communicates via the commonly used EPICS ASYN/StreamDevice method
- The LLRF developed a simple SCPI-like server to respond to requests from ACS IOC
- Separate responsibilities: Move the EPICS IOC out of the LLRF System
- IOC runs on a linux machine in the ACS domain: Controls have freer access and ample linux experience diagnosing and maintaining the IOC
- Updates to the IOC database are done by Controls personnel



LLRF-ACS Interface

INTRODUCTION

- ARIEL is the latest project in the Rare Isotope Beam (RIB) program at TRIUMF

- In conjunction with ISAC and ISAC-II, ARIEL will triple RIB production and expand the range of exotic isotopes for nuclear physics and astrophysics, nuclear medicine, and material science

- ARIEL's e-Linac consists of:

- A 300KeV DC thermionic gun,
- A buncher and a deflector,
- A Single-cavity injector cryomodule (ICM),
- Two dual-cavity accelerating cryomodules (ACM),
- Five cavities in three superconducting cryomodules in total

- Controls of the e-Linac's Low-Level RF followed the same model as in ISAC-II's linac plus some improvements

FUTURE PLANS

- Backfit the improvements as time and resources permit
- First retrofit is being commissioned in ISAC-II LLRF Controls
- ISAC-I LLRF Controls will be next
- Laser and Beam Diagnostics will follow

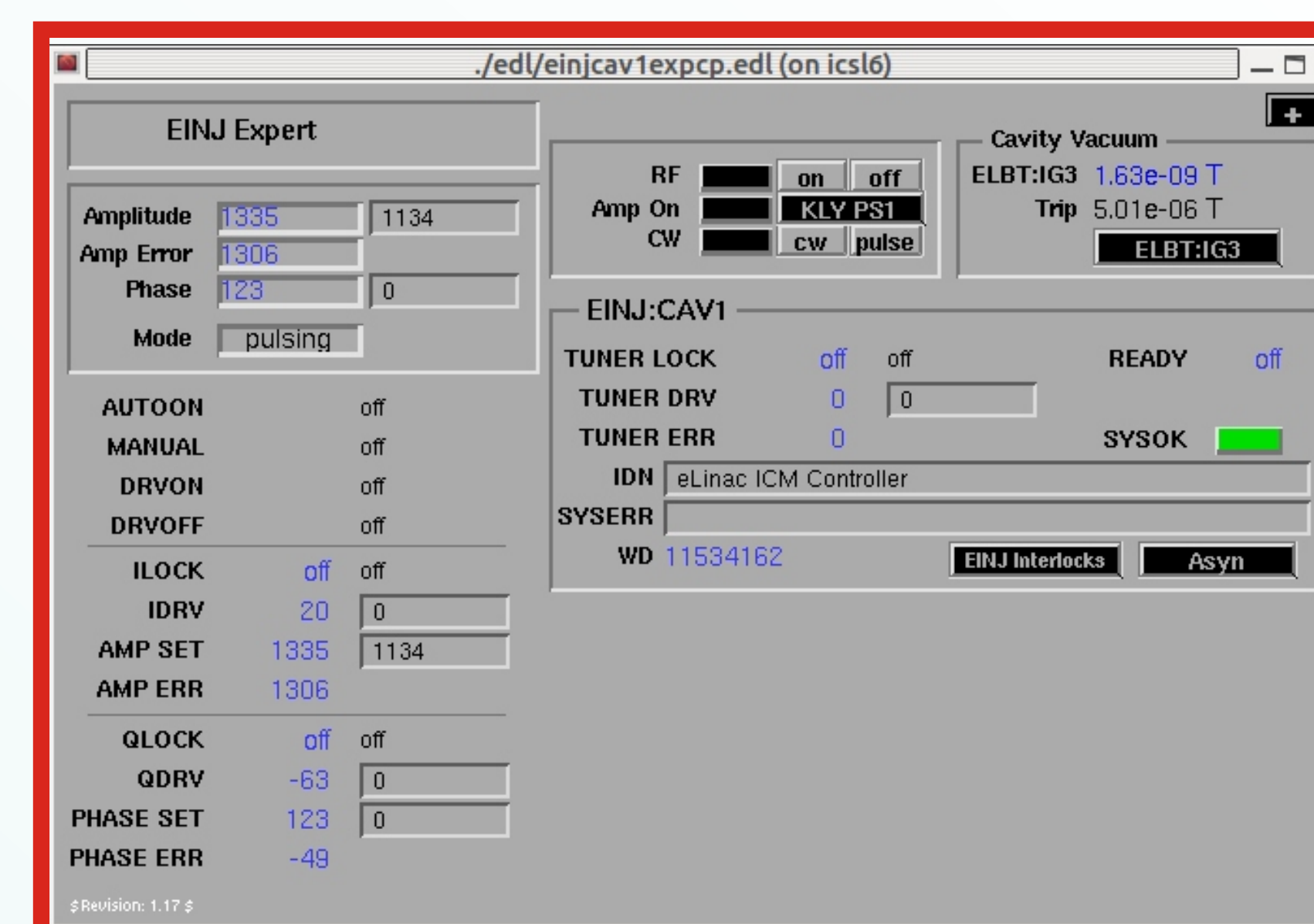
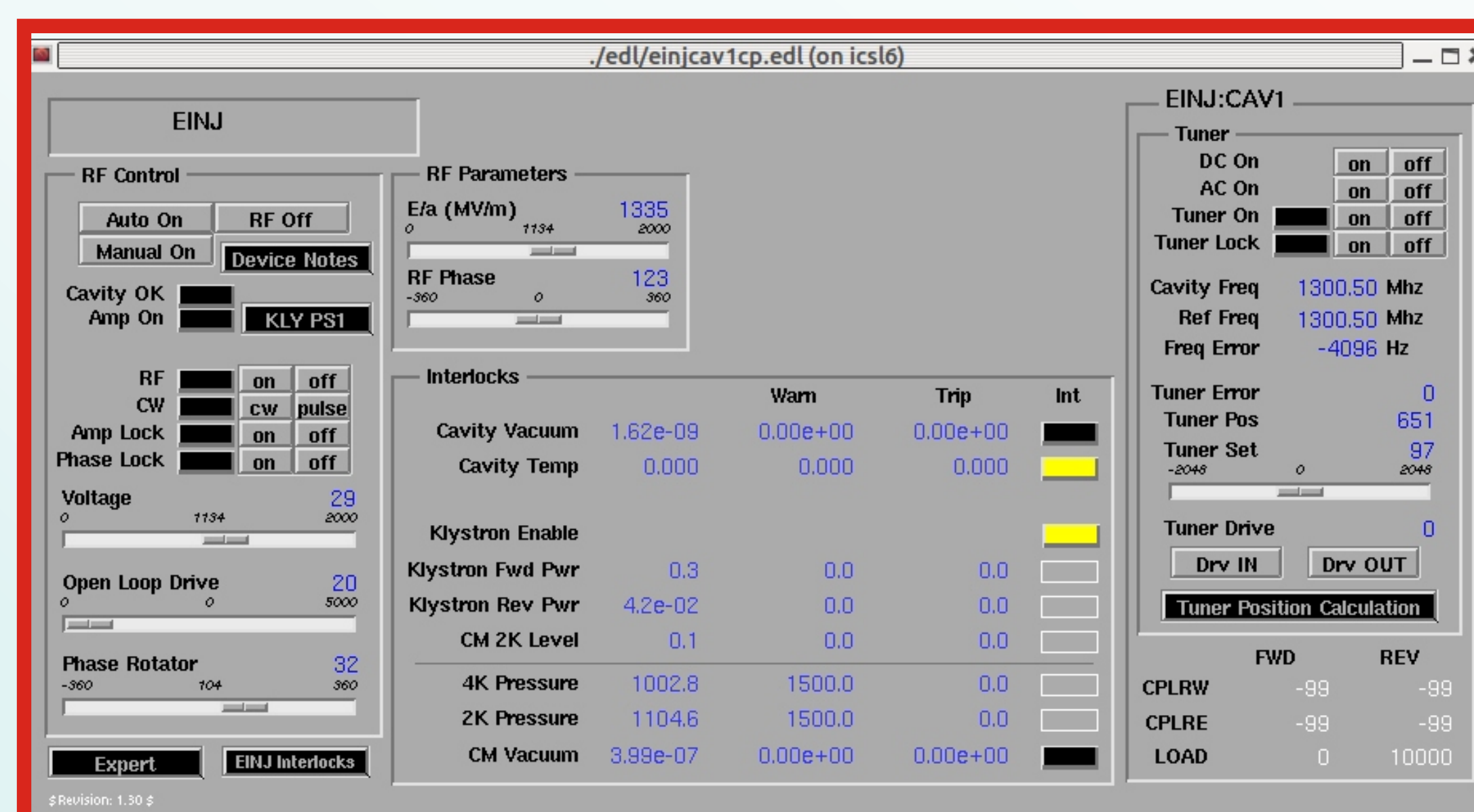
CONTROLS GUI

- Use EPICS EDM for ACS displays

- Follow the same guidelines as ISAC-I and ISAC-II Controls

- Apply the same look and feel as ISAC-I and ISAC-II displays

- Introduce a delay on fast, successive commands to the IOC (i.e., Operating a slider) so as not overwhelm the LLRF SCPI server



Sample EDM LLRF Controls Displays

SUMMARY

- Phase 1 of TRIUMF's ARIEL project has been completed
- Phase 2 is currently underway
- The design of ARIEL LLRF Controls borrowed heavily from the ISAC-II model
- Introduced some improvements to ACS to address limitations learned from ISAC-II Controls
- ACS uses SCPI-like commands over ASYN/StreamDevice to communicate with LLRF System
- ACS EDM displays are very similar to ISAC-I AND ISAC-II displays
- Improved design of LLRF-ACS is working well so far
- There are plans to retrofit LLRF-ACS model to ISAC-II, ISAC-I, Laser, and Beam Diagnostics