# ELI Beamlines

## Control System Overview

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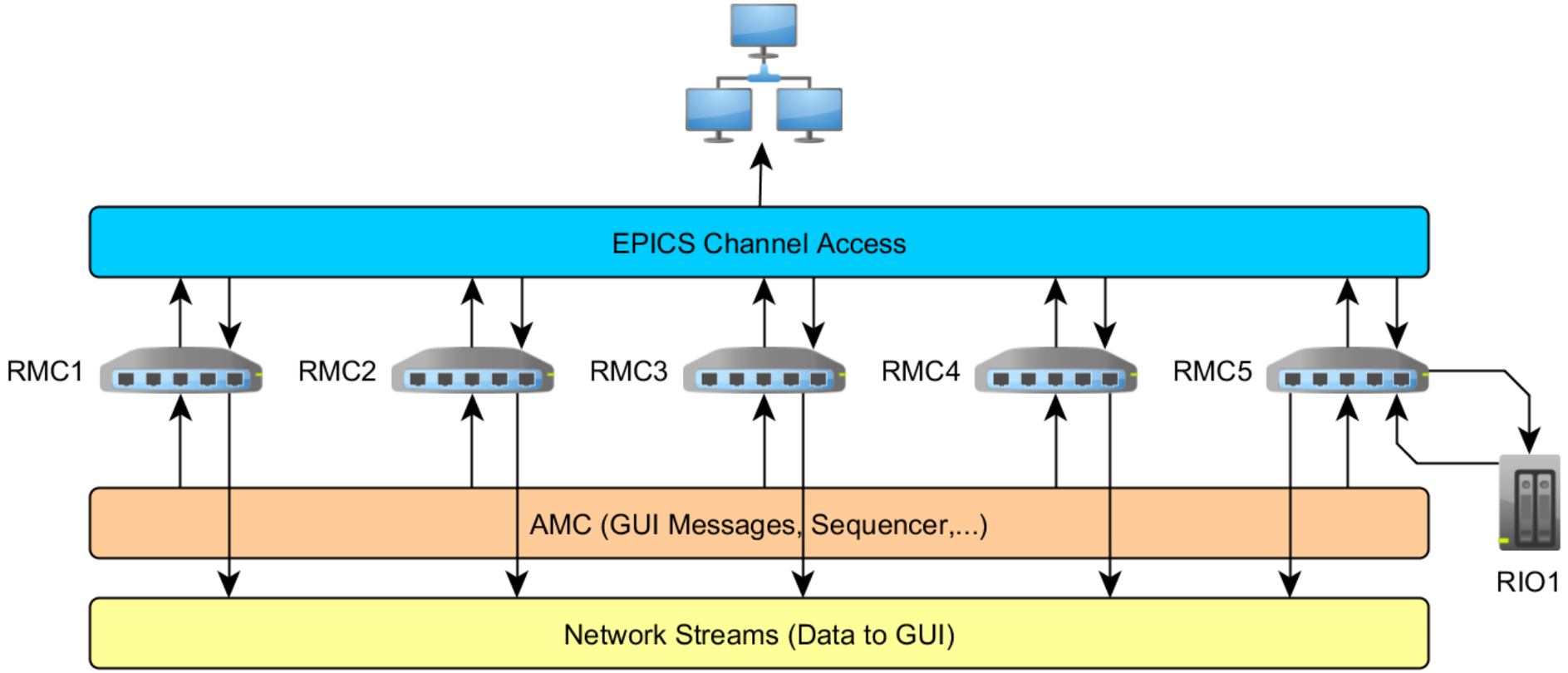
# Contents

# Introduction

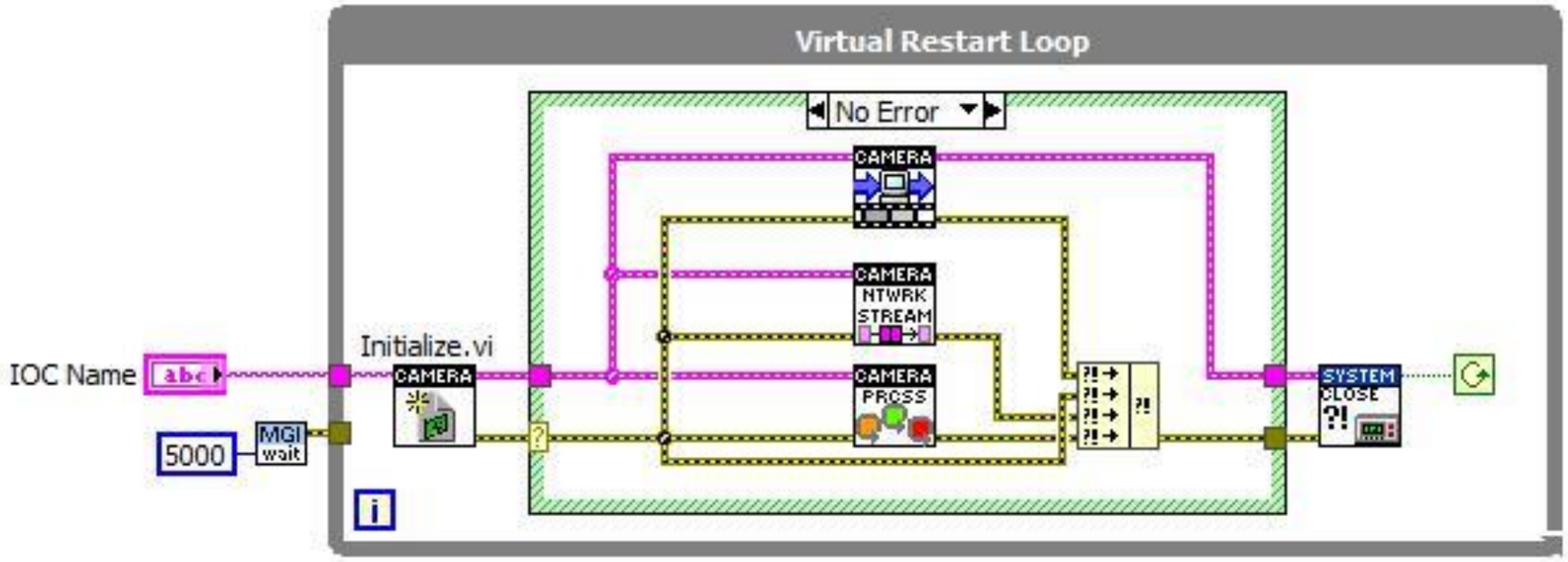
- Templates and source code versioning ensure fast deployment of new solutions in the lab
  - MySQL, P4V Helix
  - ELI Controls and ELI.lib (developed in LabVIEW)
- EPICS commands and data are supported

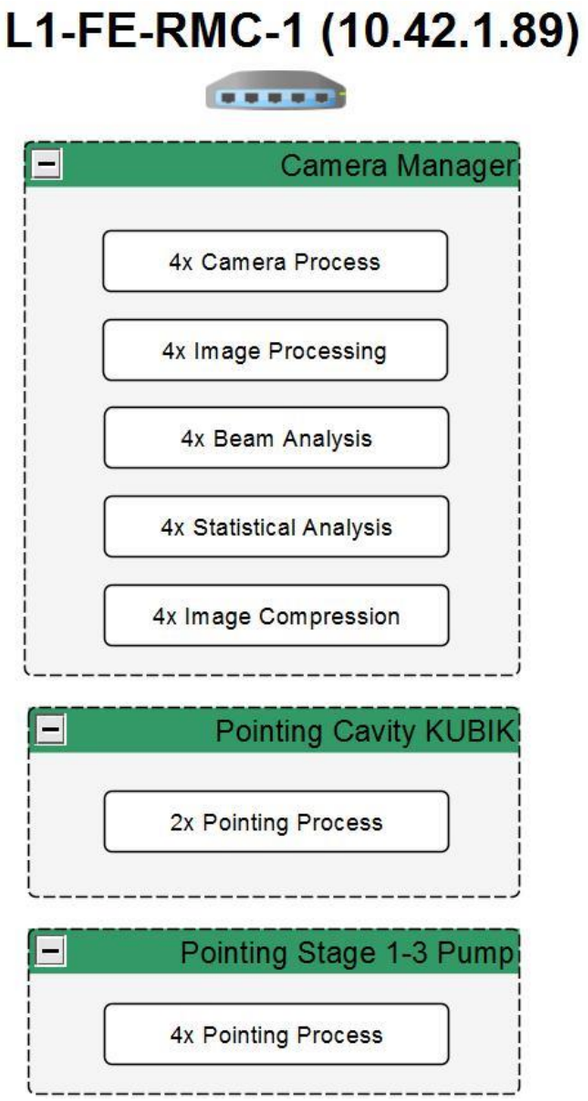
# Scope of the Architecture (I)



# Scope orf the Architecture (II)

- Each RMC contains several Input-Output Controllers (IOC)
- Each IOC contains processes



# Communication Protocols - AMC

**AMC (Asynchronous Message Communication)**

- UDP based
- Sending commands from Developer GUIs to IOCs

**Network Streams**

- Handle reliable transfers on top of modified TCP/IP
- Used for developer GUIs
- Streams are wrapped into the architecture

**CA (Channel Access)**

- Used by EPICS 3.14
- Enables transfer of data using TCP/IP with additional features

# HW Needs

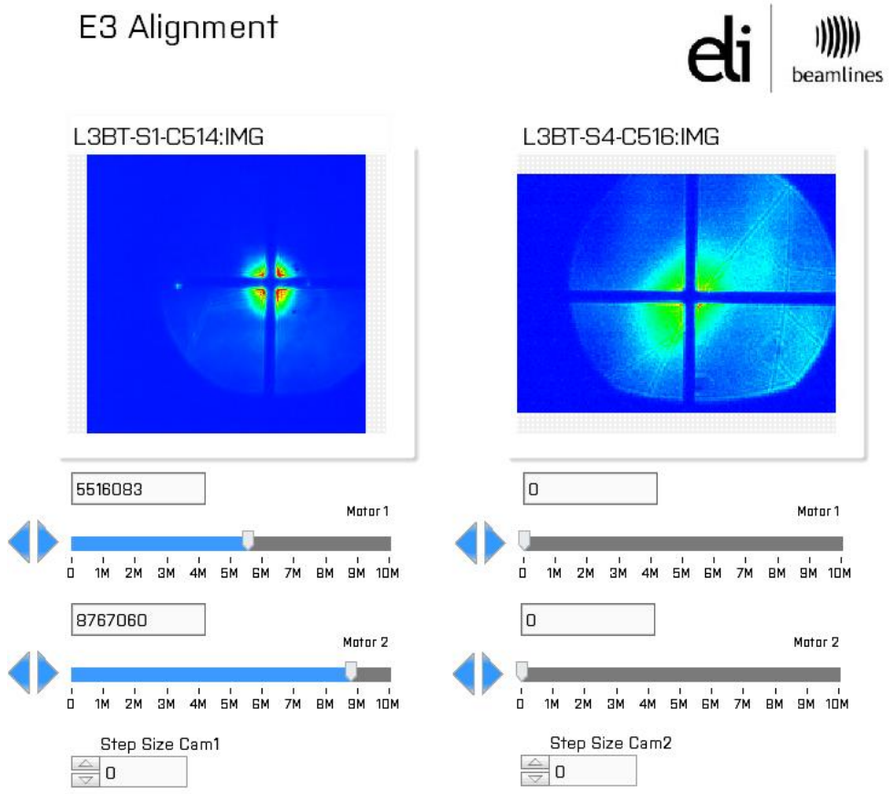
- Supported OS: ETS PharLap, NI RT Linux, Win10
- RMC 8354 (matured)
- KISS 1U Short V3 CFL
  - Intel i7-9700E (8Core/2,6GHz)
  - 8GB DIMM DDR4 2666
- NI cRIO (different types)
- Real-time controllers can be virtualized

# RIO Utilization

- NI 9149 is the most common type (Ethernet RIO)
- Programmatic interaction with FPGA front panel for slow data
- FIFOs for fast data
- Both DAQ and state machine control are applicable on FPGA

# Integration (I)

- Process data -> IOC -> EPICS
- EPICS GUIs allow access to multiple IOCs through EPICS layer

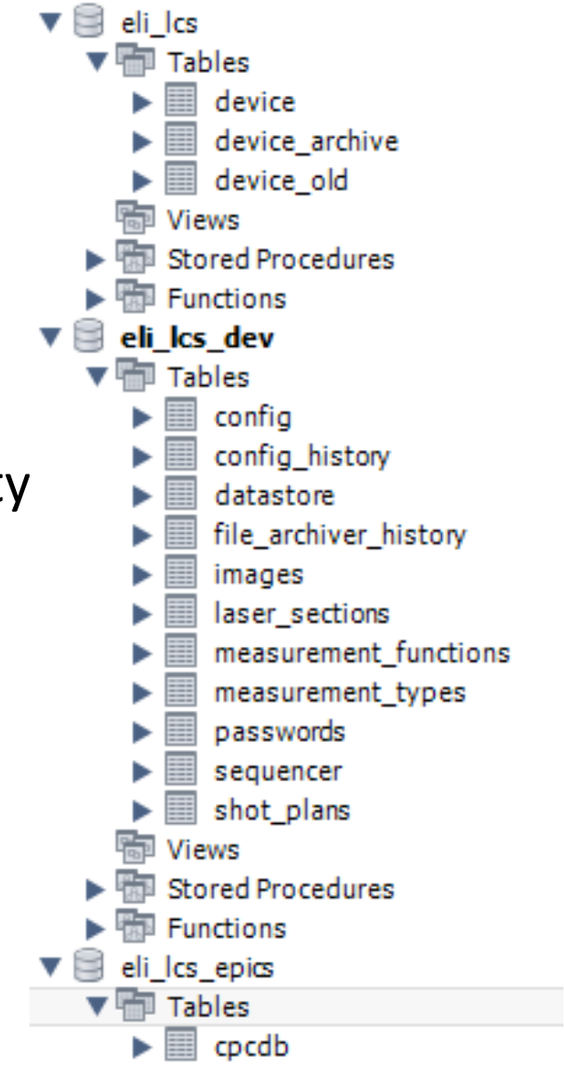


# Integration (II)

- Database contains information about all the PVs and IOCs

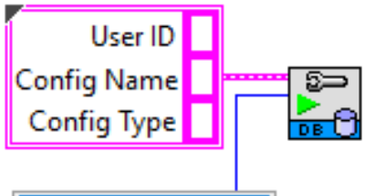
| id | pv_name | cp_ta | gr | device_id | ioc_id | datastore_id | pv_t | ds_type | nelm | pv_class |
|---|---|---|---|---|---|---|---|---|---|---|
| 802 | L1-FE-PM01:VAL_CAL | NULL | NULL | RMC123 | EDS | EDS-Zone 0:CH1 Data | AI | DBL | NULL | LABIOC_AI |
| 803 | L1-FE-PM24:VAL_CAL | NULL | NULL | RMC123 | EDS | EDS-Zone 0:CH2 Data | AI | DBL | NULL | LABIOC_AI |
| 804 | L1-FE-PM04:VAL_CAL | NULL | NULL | RMC123 | EDS | EDS-Zone 0:CH3 Data | AI | DBL | NULL | LABIOC_AI |

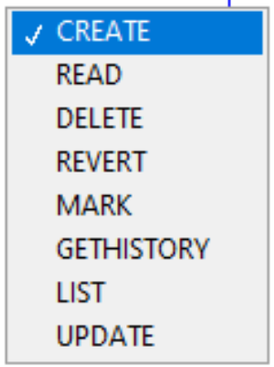
- PVs require server information
- IOCs require INI and CFG configurations that define their functionality



# Integration (III)

- Database access is provided using DB Config Access.vi

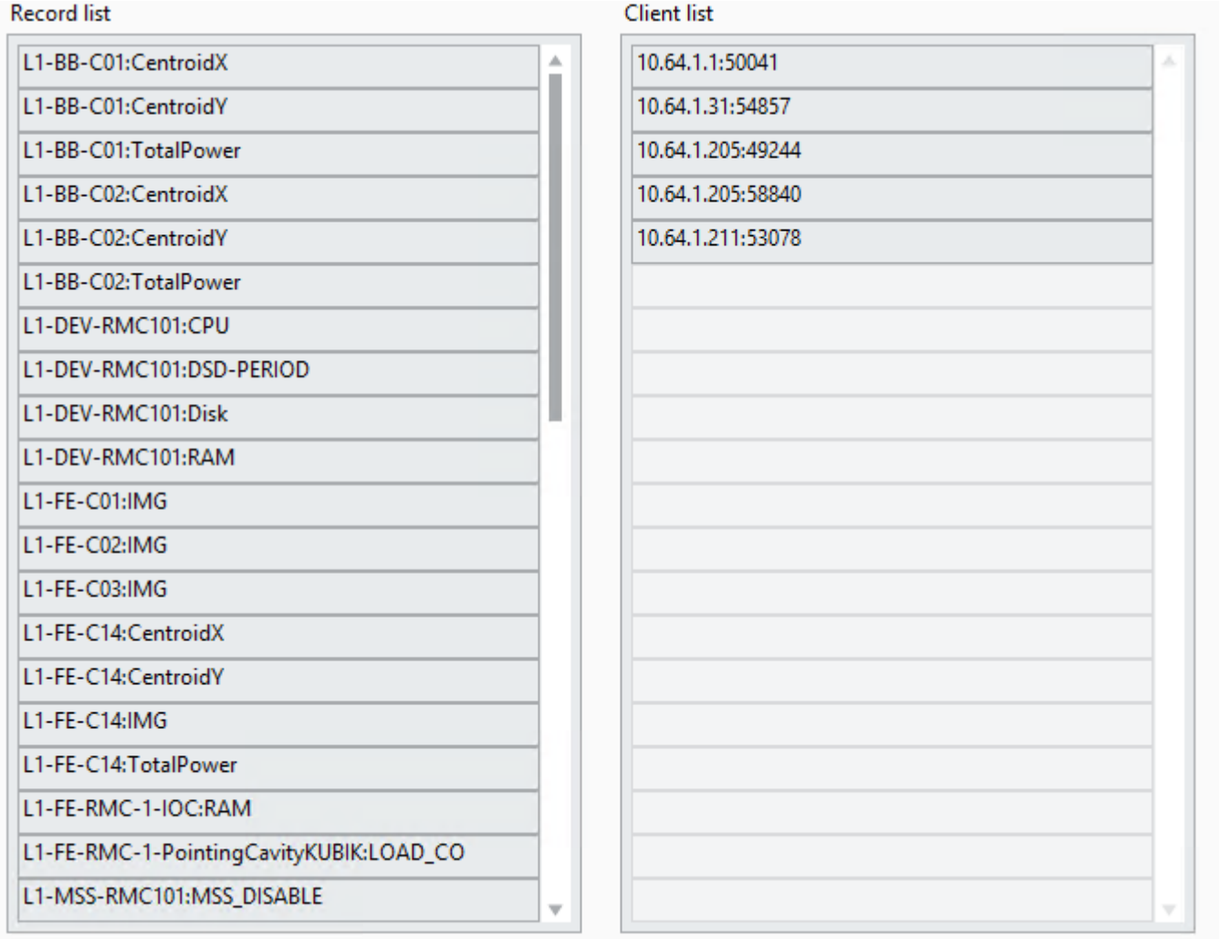



- Configuration history can then be used to backtrack in time what changes might have had an effect on the system

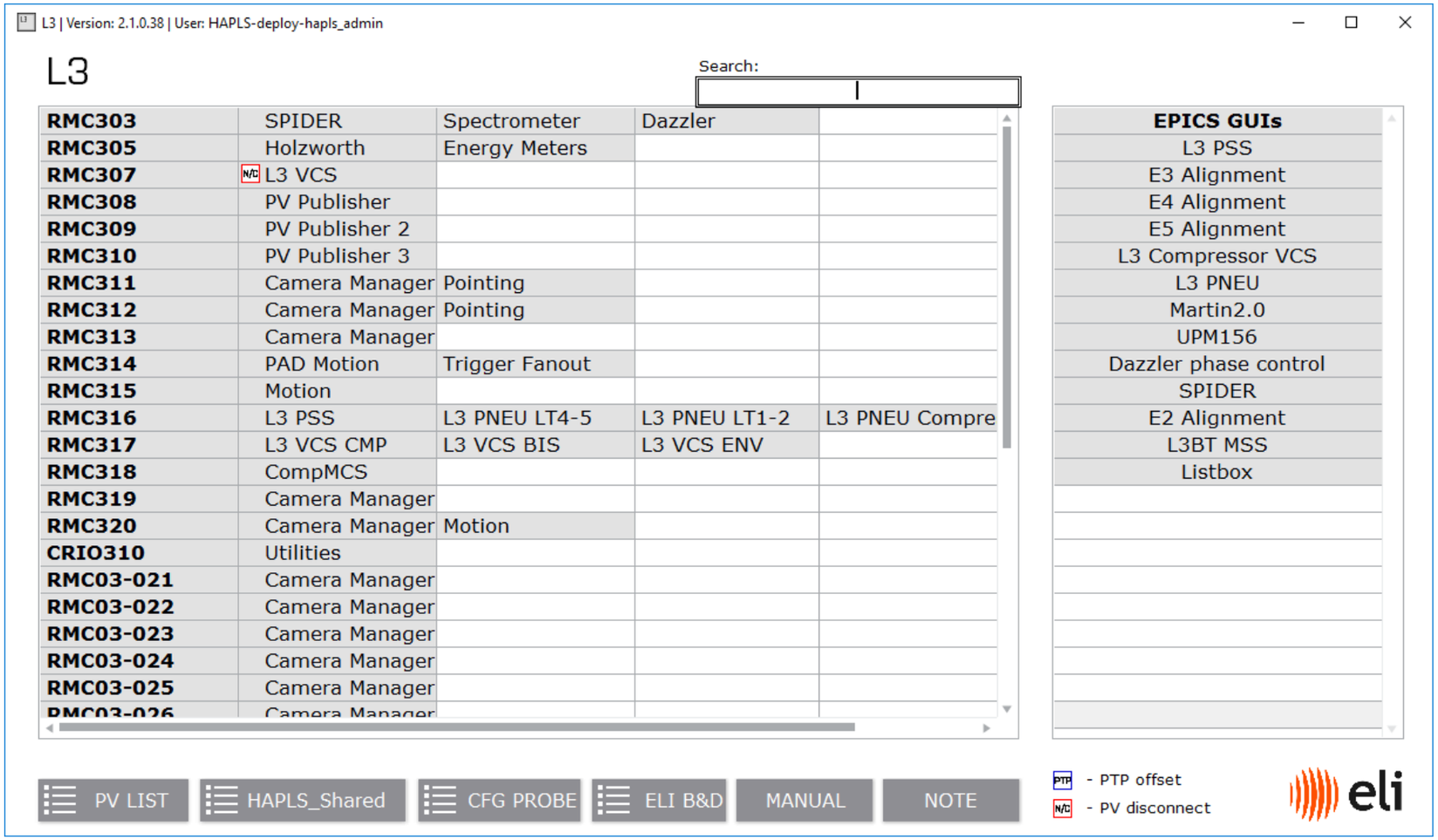
# Integration (IV)

- Data is published using a LabIOC server which is present on all machines

# GUIs (I)

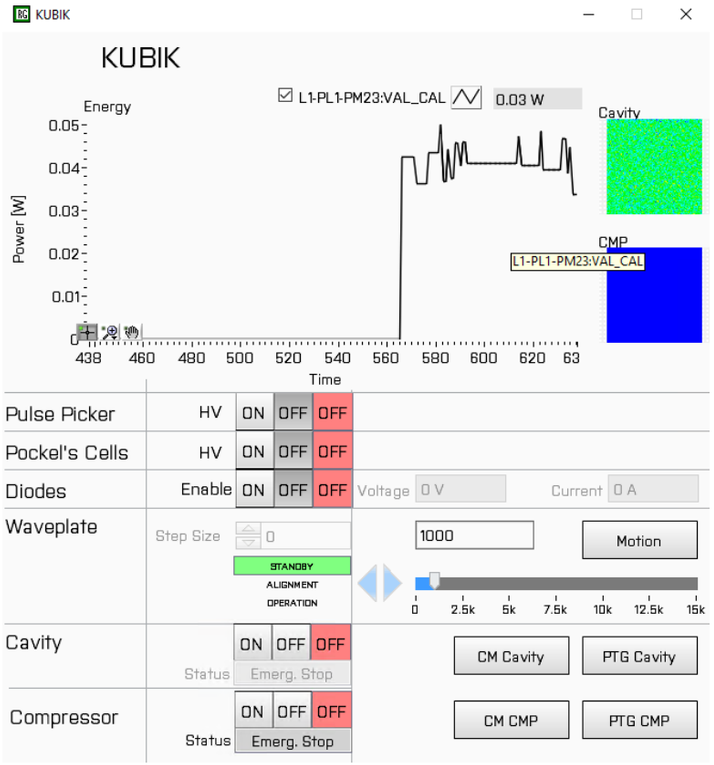
- A central launcher is used to access developer GUIs



# GUIs (II)

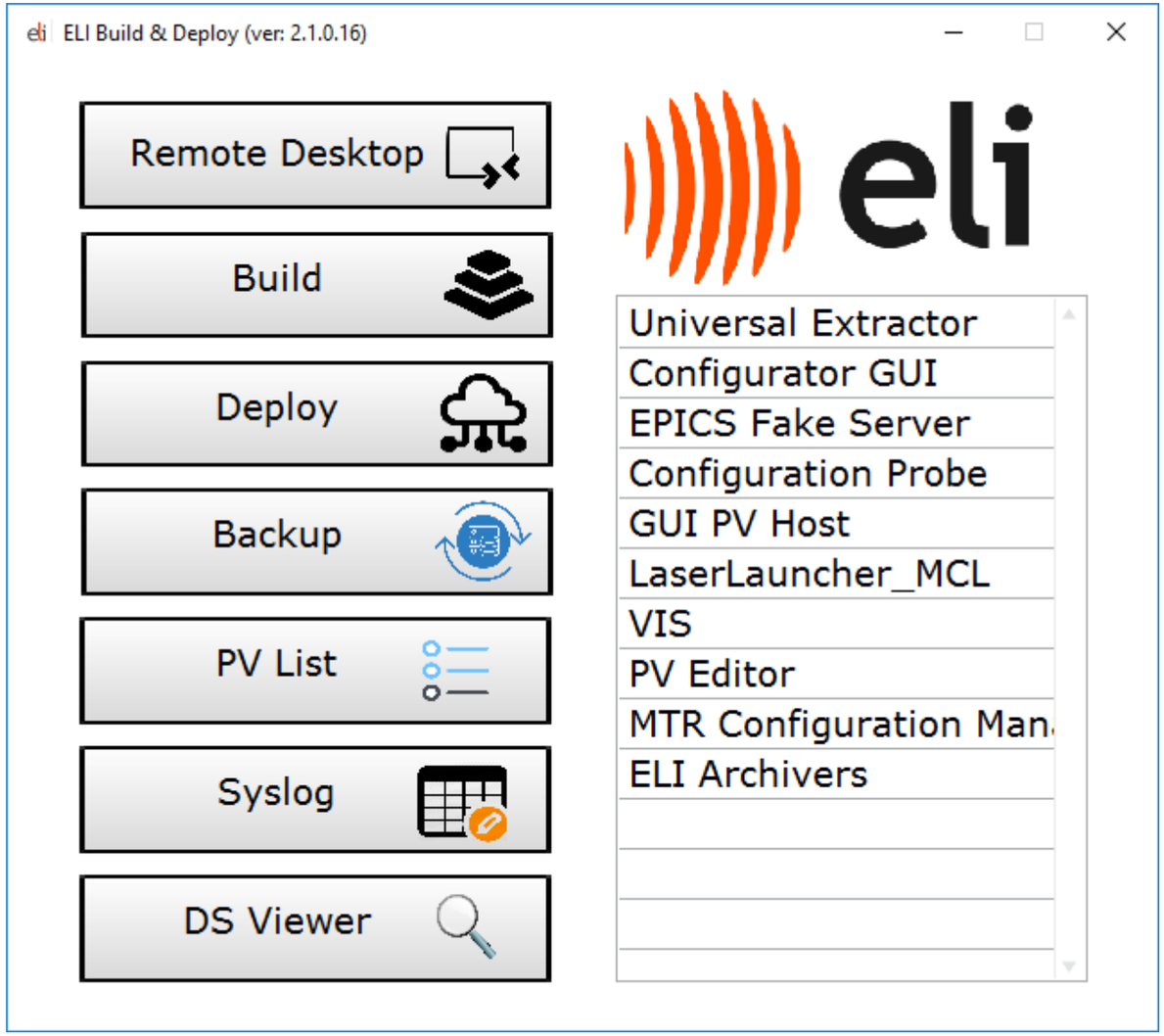
- EPICS GUIs use a special template that defines their appearance but allows various PVs to be added as data sources
- This is stored in the database and it is modifiable using an editor

| Control Name | PV linked |
|---|---|
| Fundamental Spectrum | L1-PL1-PM23:VAL_CAL |
| GUI Name | |
| PC Status | L1-FE-L1_1-BB-PL1-RA-PC-HV:HV-on_RBV |
| PC Off | L1-FE-L1_1-BB-PL1-RA-PC-HV:HV-on |
| PC On | L1-FE-L1_1-BB-PL1-RA-PC-HV:HV-on |
| Diodes | L1-FE-L1_1-BB-PL1-RA-LH-PL-PS:Out_Enable_RBV |
| Diodes OFF | L1-FE-L1_1-BB-PL1-RA-LH-PL-PS:Out_Enable |
| Diodes ON | L1-FE-L1_1-BB-PL1-RA-LH-PL-PS:Out_Enable |

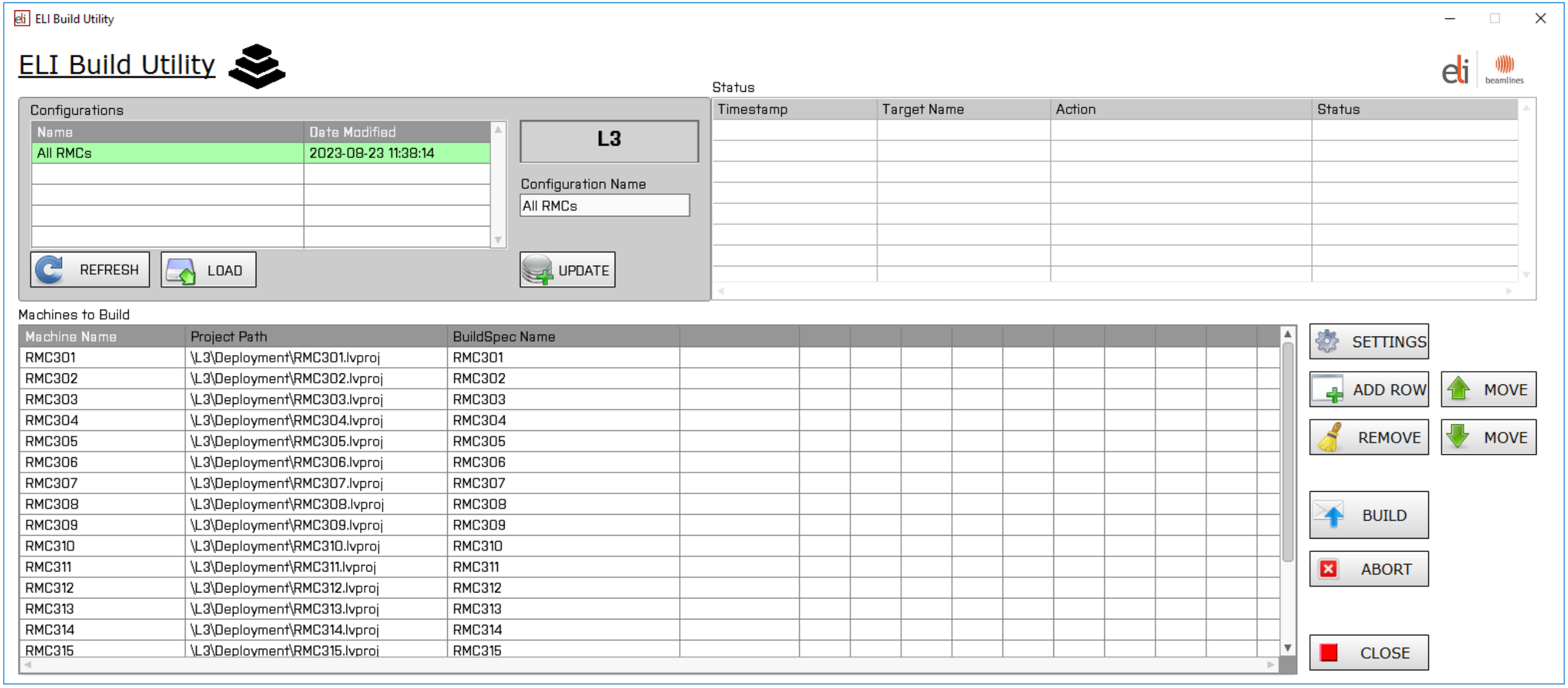


# Build & Deploy

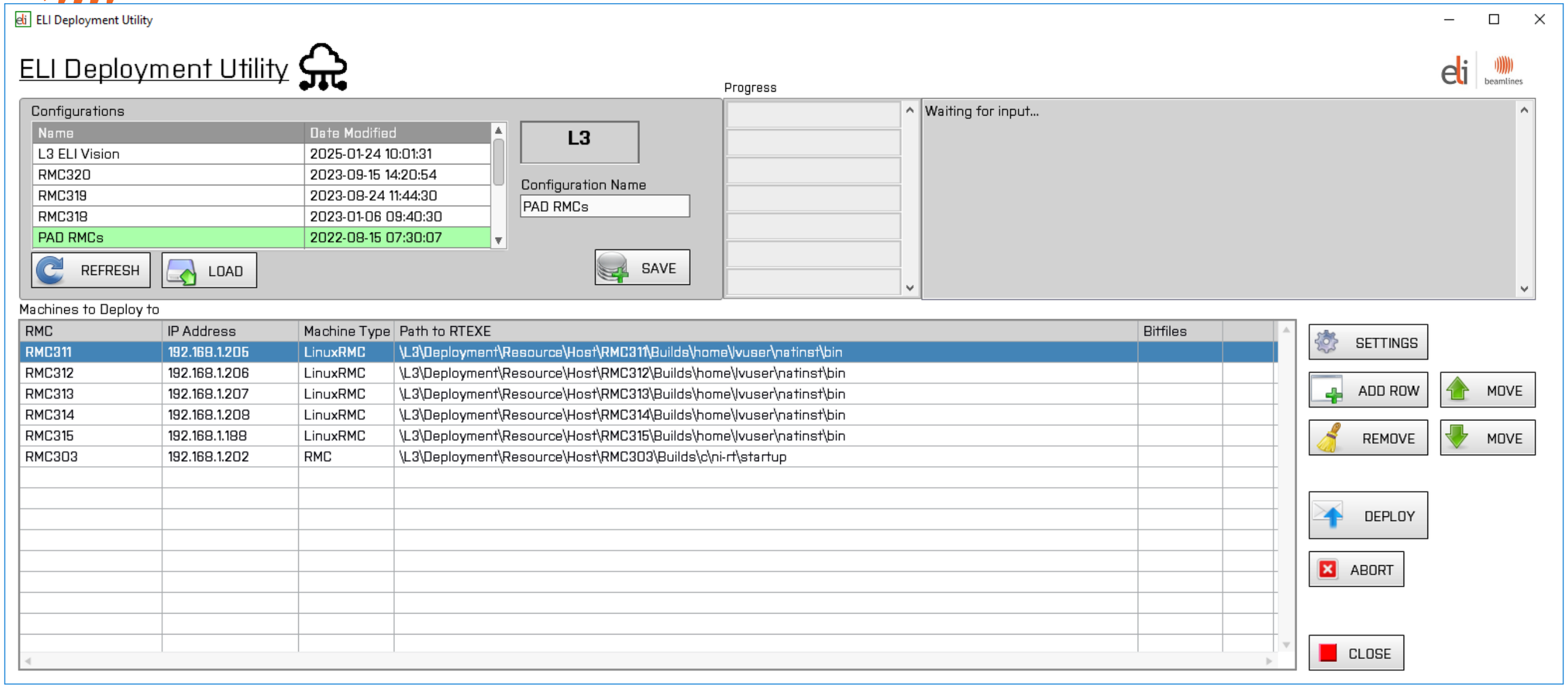
- Central app allows access to various tasks



# Build & Deploy (Build)

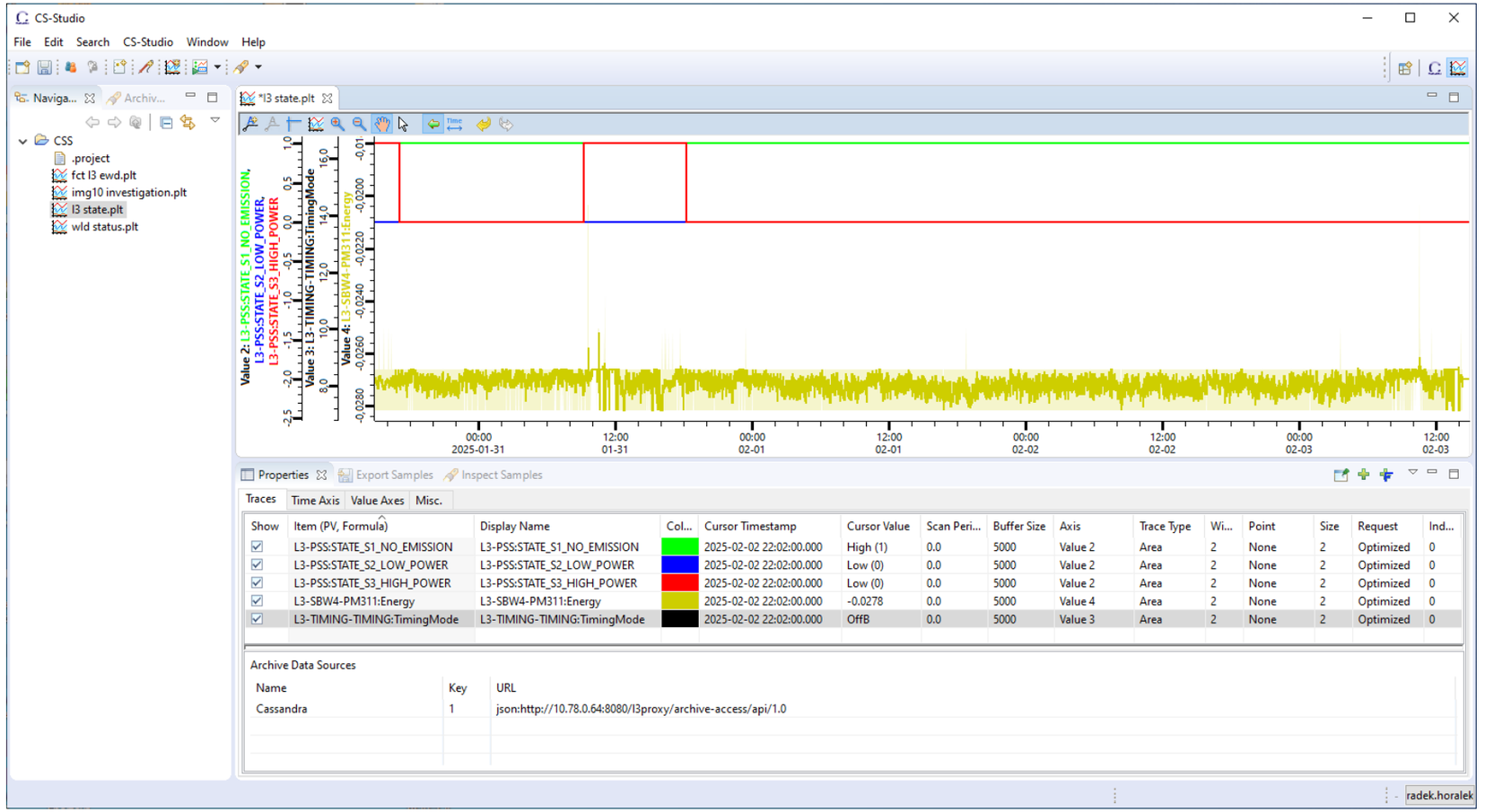


# Build & Deploy (Deploy)



# Archiving

- Raw archived data are stored centrally for all lasers



Thank you
for your attention!

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