LabIOC

EPICS Channel Access server and client implemented in LabVIEW

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Features:

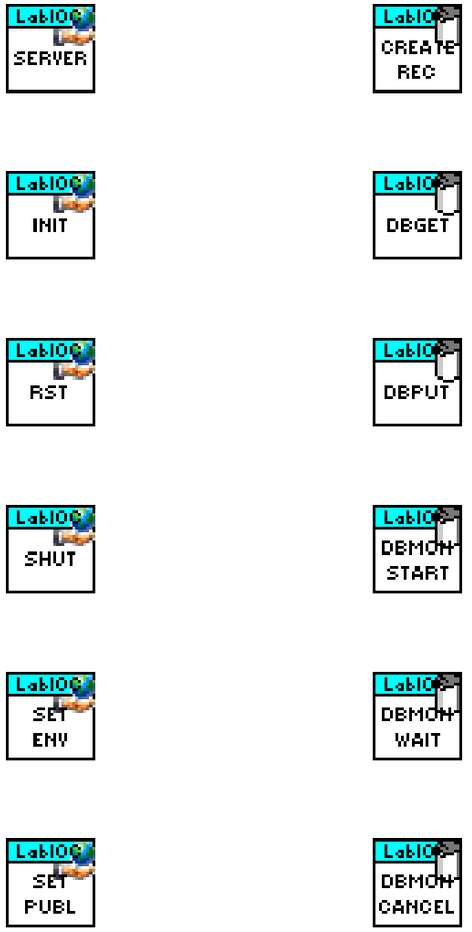
- Implemented purely in LabVIEW (not depending on EPICS base)
- LabIOC server publishes data stored in record database into Channel Access
- LabIOC client can read/write using Channel Access
  - Tested with EPICS 3.14 and EPICS 7
  - caget, caput, camonitor
  - Automatic monitoring, channel reconnection in background, batch connect/read/write

Not implemented:

- Many record types needed for processing inside EPICS database (only AI, AO, BI, BO, LONGIN, LONGOUT, MBBI, MBBO, STRINGIN, STRINGOUT implemented, no record links)
- Some fields of records (e.g. SCAN, all records behave as configured with SCAN=Passive)
- Reading .db files of EPICS base

LabIOC server

- Server VI placed parallel to other loops (we had terrible results with asynchronously called server on cRIO), methods for starting/stopping the server
- Database methods for creating records, dbGet, dbPut
- Database can exist without Channel Access server for sharing data between parts of an application

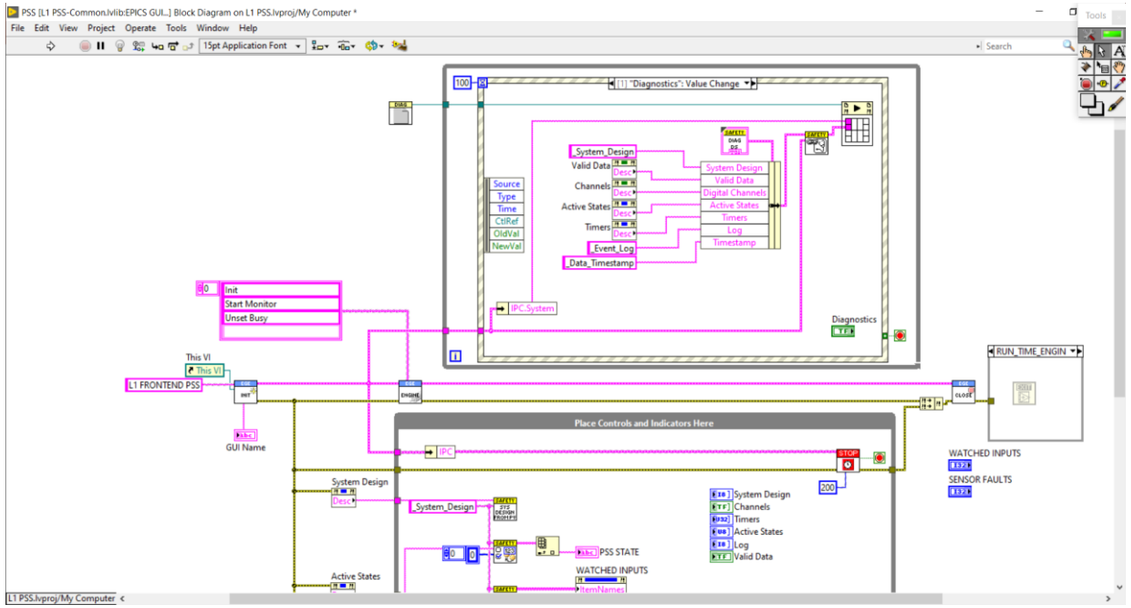


LabIOC client

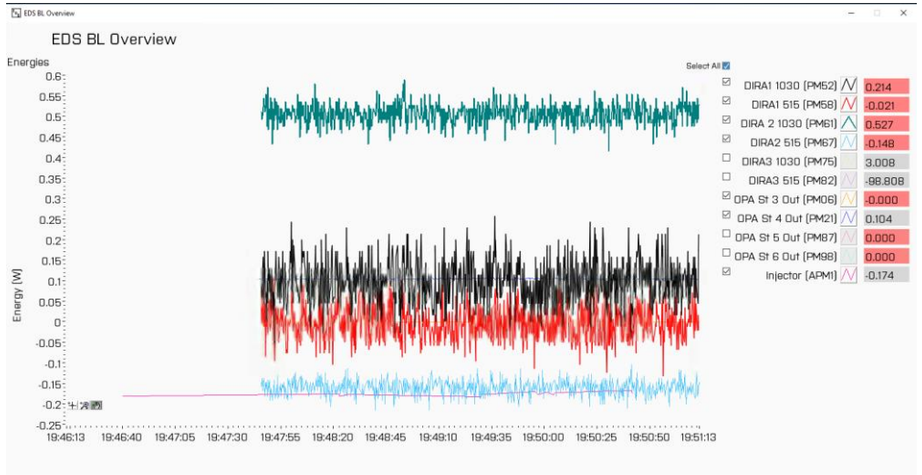
- Interface for PV names (caget, caput) or channel references which are returned by PV search
- Data returned as variant or typecasted automatically (.vim functions), optional status, severity and time fields
- Functions for single PV and batch processing
- Cache of open TCP connections and channels
- Search and reconnect engine running in background

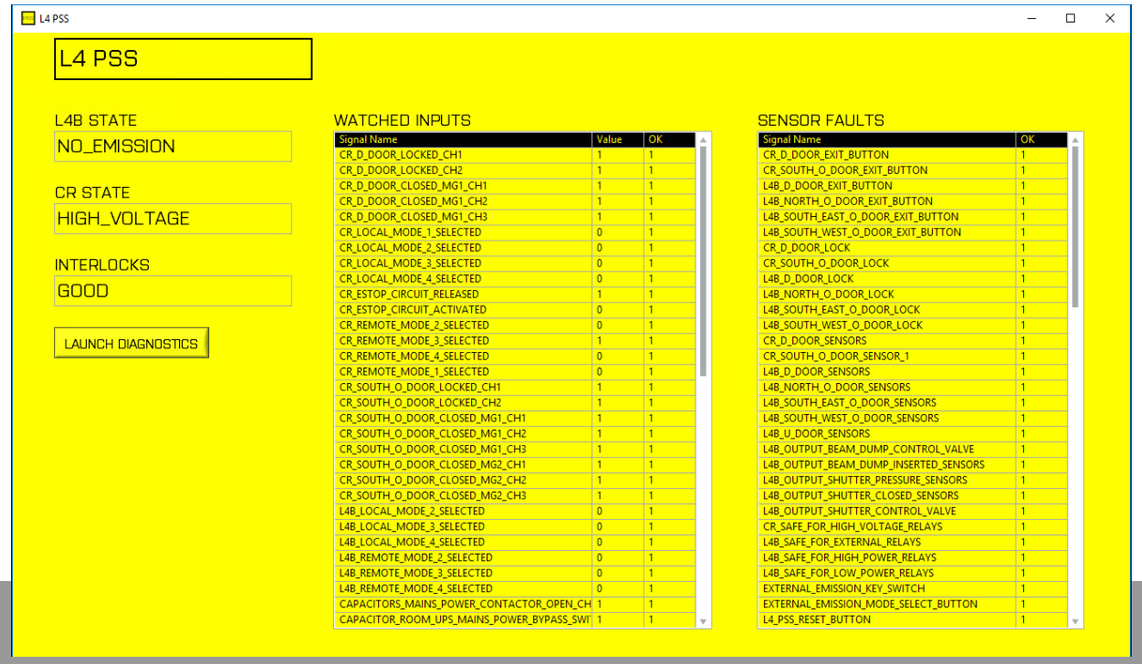
EPICS GUIs

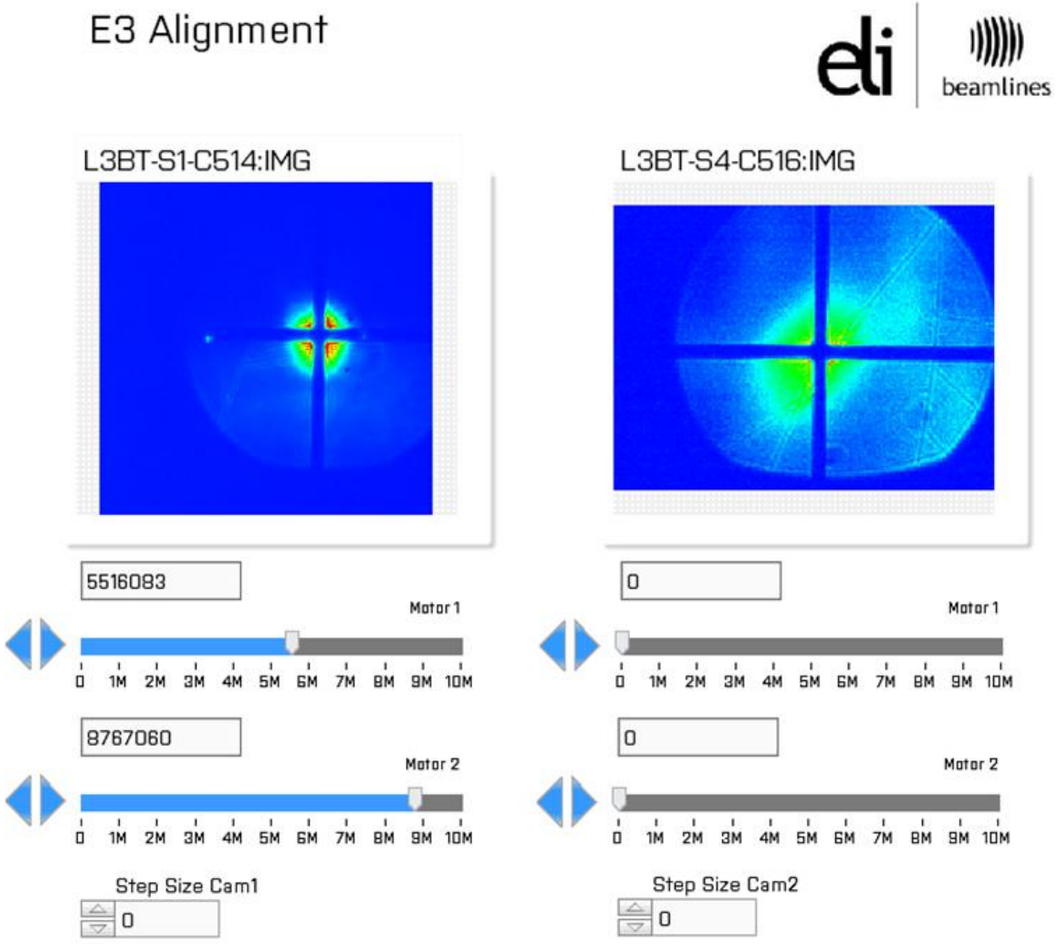
- Framework for building user interfaces on top of LabIOC client
- Automatic binding of an indicator to PV name specified in its description
- Descriptions can be hardcoded or read from configuration database -> easy-to-make, reusable GUIs
- Sometimes simple value display is not enough – GUIs are normal VIs and can be fully customized



Examples


EDS BL Overview
Energies
Energy (W)
Select All
DIRA1 1030 (PM52) 0.214
DIRA1 515 (PM58) -0.021
DIRA 2 1030 (PM61) 0.527
DIRA2 515 (PM67) -0.148
DIRA3 1030 (PM75) 3.008
DIRA3 515 (PM82) -98.808
OPA St 3 Out (PM06) -0.000
OPA St 4 Out (PM21) 0.104
OPA St 5 Out (PM87) 0.000
OPA St 6 Out (PM98) 0.000
Injector (APM1) -0.174

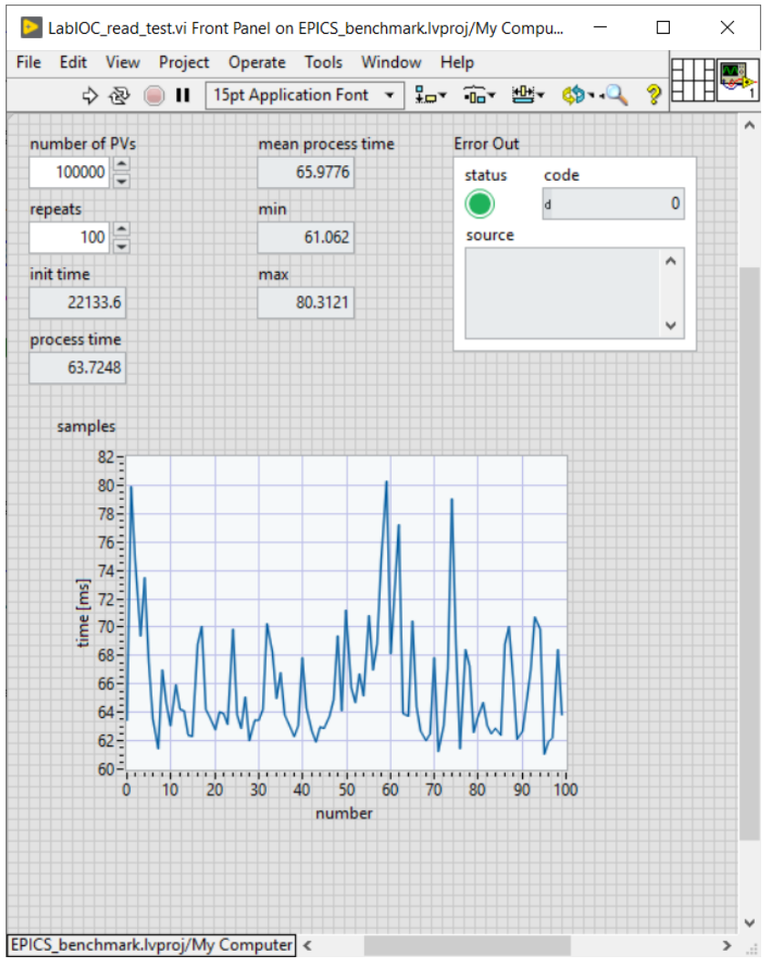

L4 PSS
L4 PSS
L4B STATE
NO_EMISSION
CR STATE
HIGH_VOLTAGE
INTERLOCKS
GOOD
LAUNCH DIAGNOSTICS
WATCHED INPUTS
Signal Name | Value | OK
CR_D_DOOR_LOCKED_CH1 | 1 | 1
CR_D_DOOR_LOCKED_CH2 | 1 | 1
CR_D_DOOR_CLOSED_MG1_CH1 | 1 | 1
CR_D_DOOR_CLOSED_MG1_CH2 | 1 | 1
CR_D_DOOR_CLOSED_MG1_CH3 | 1 | 1
CR_LOCAL_MODE_1_SELECTED | 0 | 1
CR_LOCAL_MODE_2_SELECTED | 0 | 1
CR_LOCAL_MODE_3_SELECTED | 0 | 1
CR_LOCAL_MODE_4_SELECTED | 0 | 1
CR_ESTOP_CIRCUIT_RELEASED | 1 | 1
CR_ESTOP_CIRCUIT_ACTIVATED | 0 | 1
CR_REMOTE_MODE_2_SELECTED | 0 | 1
CR_REMOTE_MODE_3_SELECTED | 1 | 1
CR_REMOTE_MODE_4_SELECTED | 0 | 1
CR_REMOTE_MODE_1_SELECTED | 0 | 1
CR_SOUTH_O_DOOR_LOCKED_CH1 | 1 | 1
CR_SOUTH_O_DOOR_LOCKED_CH2 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG1_CH1 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG1_CH2 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG1_CH3 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG2_CH1 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG2_CH2 | 1 | 1
CR_SOUTH_O_DOOR_CLOSED_MG2_CH3 | 1 | 1
L4B_LOCAL_MODE_2_SELECTED | 0 | 1
L4B_LOCAL_MODE_3_SELECTED | 0 | 1
L4B_LOCAL_MODE_4_SELECTED | 0 | 1
L4B_REMOTE_MODE_2_SELECTED | 0 | 1
L4B_REMOTE_MODE_3_SELECTED | 0 | 1
L4B_REMOTE_MODE_4_SELECTED | 0 | 1
CAPACITORS_MAINS_POWER_CONTACTOR_OPEN_CH | 1 | 1
CAPACITOR_ROOM_UPS_MAINS_POWER_BYPASS_SWI | 1 | 1
SENSOR FAULTS
Signal Name | OK
CR_D_DOOR_EXIT_BUTTON | 1
CR_SOUTH_O_DOOR_EXIT_BUTTON | 1
L4B_D_DOOR_EXIT_BUTTON | 1
L4B_NORTH_O_DOOR_EXIT_BUTTON | 1
L4B_SOUTH_EAST_O_DOOR_EXIT_BUTTON | 1
L4B_SOUTH_WEST_O_DOOR_EXIT_BUTTON | 1
CR_D_DOOR_LOCK | 1
CR_SOUTH_O_DOOR_LOCK | 1
L4B_D_DOOR_LOCK | 1
L4B_NORTH_O_DOOR_LOCK | 1
L4B_SOUTH_EAST_O_DOOR_LOCK | 1
L4B_SOUTH_WEST_O_DOOR_LOCK | 1
CR_D_DOOR_SENSORS | 1
CR_SOUTH_O_DOOR_SENSOR_1 | 1
L4B_D_DOOR_SENSORS | 1
L4B_NORTH_O_DOOR_SENSORS | 1
L4B_SOUTH_EAST_O_DOOR_SENSORS | 1
L4B_SOUTH_WEST_O_DOOR_SENSORS | 1
L4B_U_DOOR_SENSORS | 1
L4B_OUTPUT_BEAM_DUMP_CONTROL_VALVE | 1
L4B_OUTPUT_BEAM_DUMP_INSERTED_SENSORS | 1
L4B_OUTPUT_SHUTTER_PRESSURE_SENSORS | 1
L4B_OUTPUT_SHUTTER_CLOSED_SENSORS | 1
L4B_OUTPUT_SHUTTER_CONTROL_VALVE | 1
CR_SAFE_FOR_HIGH_VOLTAGE_RELAYS | 1
L4B_SAFE_FOR_EXTERNAL_RELAYS | 1
L4B_SAFE_FOR_HIGH_POWER_RELAYS | 1
L4B_SAFE_FOR_LOW_POWER_RELAYS | 1
EXTERNAL_EMISSION_KEY_SWITCH | 1
EXTERNAL_EMISSION_MODE_SELECT_BUTTON | 1
L4_PSS_RESET_BUTTON | 1

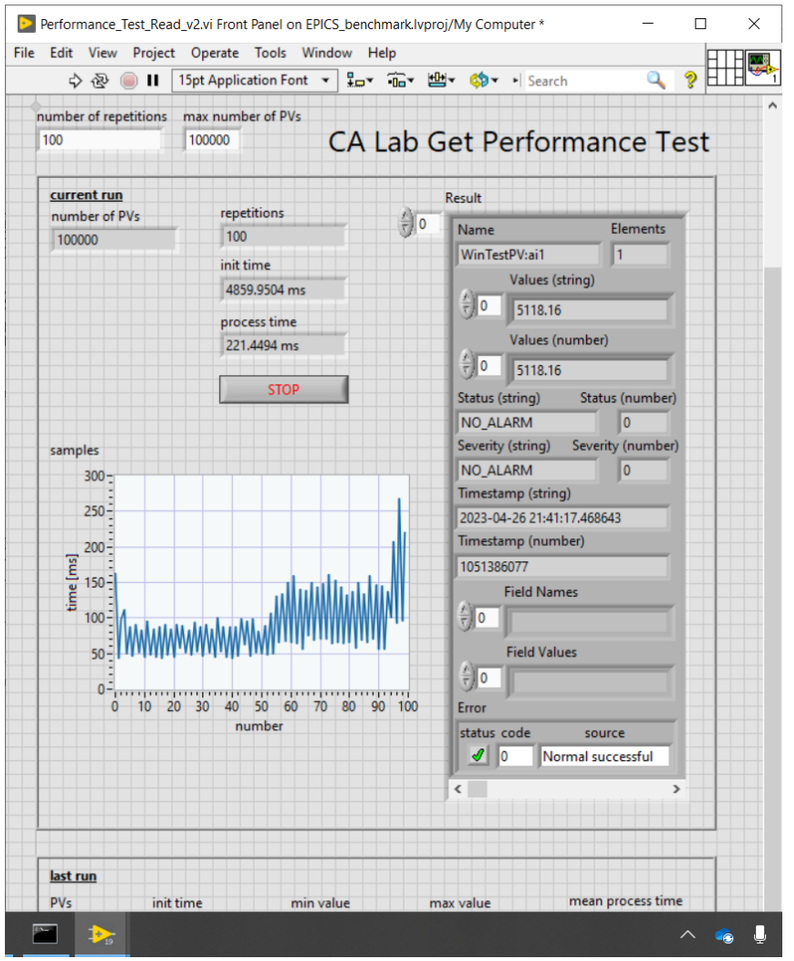

E3 Alignment
L3BT-S1-C514:IMG
L3BT-S4-C516:IMG
5516083
Motor 1
8767060
Motor 2
Step Size Cam1
0
0
Motor 1
0
Motor 2
Step Size Cam2
0
0 1M 2M 3M 4M 5M 6M 7M 8M 9M 10M

Performance

- LabIOC server
  - Publishing 4 camera images (.png ~ 300kB each) @ 10 Hz + hundreds of scalar variables
- LabIOC client
  - Benchmarked at HZB together with CALab
  - Both libraries optimized based on benchmarks, very similar results of latest versions

Performance





Thank you for attention

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