

BENEFITS OF LOW CODE DEVELOPMENT ENVIRONMENTS ON LARGE SCALE CONTROL SYSTEMS

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Academia Employment

Contracts, Trends and Turnover

Typical Academia Contracts

- Students, Postdoc, Phd Students
 - Short Terms Contracts
- Very limited amount of permanent positions
 - High Turnover rate

Software Engineering Consequences

Habits, Quality and Maintainability

Consequences on Habits

- Competitive environment
 - Result driven developers
 - Non IT experts have to develop
- “I need to develop a driver that controls this hardware so I can start doing science with it”

Quick
and
Dirty

Consequences on Quality

- Quality and productivity are competing objectives
 - Too little considerations about the fact that it has to be (re)used and maintained by others.

Consequences on Maintainability

- Proliferation of not maintainable piece of software
- Everyday life of the corresponding developers / users is affected

Limiting the number of lines of code

Low-Code, No-code, CERN Inspector

Low-code development platforms (LCDP)

- Create applications Graphically
- Billion dollars market
- Market is growing by 50% every year

No-code development platforms

- Widely used already
- Not generic, for specific application
 - Start Acquisition → Display data
- Important to keep the ability to let the user insert custom code when needed

CERN Inspector : No-Code

The screenshot shows the CERN Inspector No-Code interface. The window title is '*untitled - Inspector DEV'. The interface includes a toolbar with icons for search, settings, and help. Below the toolbar, there are filters for 'Working Set', 'Search', and 'Synthetic'. The 'Provider' is set to 'CCDB', 'Accelerator' to 'ELENA', and 'Class' to 'All'. The 'Name' field contains 'RPAA'. A list of results is displayed, with 'RPAAN.193.LNR.RCH.0105' selected. Below this list, there is a section for 'MEAS.I.VALUE#value' and other measurement-related items. At the bottom left, there is a 'LOGIN' button, and at the bottom right, it says 'No Selector PLS'.

Working Set Search Synthetic

Provider: CCDB

Accelerator: ELENA

Class: All

Name: RPAA

- RPAAN.193.LNI.RCV.0070
- RPAAN.193.LNI.RQD.0040
- RPAAN.193.LNI.RQF.0020
- RPAAN.193.LNI.RQF.0045
- RPAAN.193.LNR.RCH.0105
- RPAAN.193.LNR.RCH.0130
- RPAAN.193.LNR.RCH.0230
- RPAAN.193.LNR.RCH.0330
- RPAAN.193.LNR.RCH.0405
- RPAAN.193.LNR.RCH.0470

- MEAS.I.EARTH_PCNT#value
- MEAS.I.ERR_MA#value
- MEAS.I.FIR_LENGTHS#value
- MEAS.I.MAX_ABS_ERR#value
- MEAS.I.REF#value
- MEAS.I.RMS#value
- MEAS.I.RMS_ERR#value
- MEAS.I.RMS_LOAD#value
- MEAS.I.VALUE#value
- MEAS.MAX#I_EARTH
- MEAS.MAX.I_EARTH#value
- ⊕ MEAS.PULSE
- MEAS.PULSE.VALUE#value
- MEAS.PULSE.VALUE_UNITS#value
- MEAS.SIM#value

LOGIN No Selector PLS



CERN Inspector : Low-code

The screenshot displays the CERN Inspector application interface. The window title is "*untitled_copy - Inspector DEV". The interface is divided into several sections:

- Top Bar:** Contains window management icons (back, forward, search, etc.) and a "+" icon for additional actions.
- Left Panel (Configuration):**
 - Working Set: Search, Synthetic
 - Provider: CCDB
 - Accelerator: ELENA
 - Class: All
 - Name: RPAA
 - A list of RPAAN identifiers, with "RPAAN.193.LNR.RCH.0105" selected.
 - A list of MEAS identifiers, with "MEAS.I.VALUE#value" selected.
- Center Panel (My App):**
 - A line graph showing data over time from 18:50:30 to 18:51:45. The y-axis ranges from -12 to 0. A blue line shows high-frequency oscillations, while a red line shows a lower-frequency signal.
 - Below the graph are four status buttons: ON (highlighted in green), OFF, FAULT, and BLOCKING.
- Bottom Bar:** Includes a "LOGIN" button and the text "No Selector PLS" with a pencil icon.



Observed benefits of using Low-code development platform

Operators, Scientists and Automation Specialists

Accelerator Operators

- Rough display to correlate multiple data.
- Short term monitoring.
- Machine Development application can be designed on-the-fly.
- Everyone can improve Operational application in a collaborative way.

Accelerator Physicists

- Use Blueprints to run Python simulation code against hardware with very little modification.

Hardware Specialists

- They develop their own engineering interfaces.
- They provide testing interface.

Automation Specialists

- PLCs usually have a long integration process.
- Direct connection to PLCs allows specialists to develop GUI to test PLCs **BEFORE** integrating them into the control system.

Conclusion

Project & Users Survey

Inspector Project

- 6 man-year of development for a fully tailored solution.
- No proprietary libraries.
- Support & New development : 0.2 man-year
- \approx 600 mission-critical applications.
- Improves security, global code Quality and maintainability.

Users Survey

- It is fast and simple, look and feel is consistent.
- Almost no maintenance.
- Embedded maintenance tools.
- Cost effective way to develop control system.
- 60% of the Inspector users come from non-IT disciplines.

QUESTIONS ?

Inspector 3.3.10 - Main Coupler

Main Coupler Module 1 Beam 1

Main Coupler Window Heaters

ACSLine1B1	ACSLine2B1	ACSLine3B1	ACSLine4B1
Last Fault Time			
1999/11/30 00:00:00	No Fault	No Fault	No Fault
Status MC 1	Status MC 2	Status MC 3	Status MC 4
PT100 Probe A1	PT100 Probe A1	PT100 Probe A1	PT100 Probe A1
PT100 Probe A2	PT100 Probe A2	PT100 Probe A2	PT100 Probe A2
PT Probes	PT Probes	PT Probes	PT Probes
Reg. Activated	Reg. Activated	Reg. Activated	Reg. Activated
Temp < Min	Temp < Min	Temp < Min	Temp < Min
Temp > Max	Temp > Max	Temp > Max	Temp > Max
Manual Control	Manual Control	Manual Control	Manual Control
OFF ON	OFF ON	OFF ON	OFF ON
Auto Control	Auto Control	Auto Control	Auto Control
Probe A MC 1	Probe A MC 2	Probe A MC 3	Probe A MC 4
33.8 C	32.3 C	32.6 C	33.7 C
HRT Time MC 1	HRT Time MC 1	HRT Time MC 1	HRT Time MC 1
0.00	0.00	0.00	0.00
HTR Time MC 1	HTR Time MC 1	HTR Time MC 1	HTR Time MC 1
0.00	0.00	0.00	0.00

Main Coupler & Tuner Position

ACSLine1B1	ACSLine2B1	ACSLine3B1	ACSLine4B1
Coupler Vacuum	Coupler Vacuum	Coupler Vacuum	Coupler Vacuum
0.00 mbar	0.00 mbar	0.00 mbar	0.00 mbar
MC Vacuum OK	MC Vacuum OK	MC Vacuum OK	MC Vacuum OK
Coupler Position	Coupler Position	Coupler Position	Coupler Position
23.111 mm	20.643 mm	14.714 mm	15.691 mm
Tuner Position	Tuner Position	Tuner Position	Tuner Position
57.49 %	50.47 %	59.92 %	50.76 %
Coupler Blower	Coupler Blower	Coupler Blower	Coupler Blower
MC Blower ON	MC Blower ON	MC Blower ON	MC Blower ON
MC Air OK	MC Air OK	MC Air OK	MC Air OK
Sw 1 Sw 2	Sw 1 Sw 2	Sw 1 Sw 2	Sw 1 Sw 2
ON - OFF	ON - OFF	ON - OFF	ON - OFF

Main Coupler Bias

Voltage: 4.59 kV
Current: 1.18 mA

MC Bias ON
MC Bias I OK
MC Bias V OK

MC Blower Control: Remote Local
Toggle MC Blower ON/OFF

verter

RF Veto

Line Chain Viewer

*ADT Ma

Main Coupler

General Se

- Modulator Ma
- Modulator Ma
- Stabilizer Mail
- Stabilizer Mail
- Klystron Blow
- Focus PS
- Crowbar Read
- Crowbar Main
- Crowbar Main
- Crowbar Stab
- Crowbar Stab
- Bunker Flashe
- Bunker Water
- Mains 380V P
- Bunker Temp

HV Interlo

- Sum of PLC Li
- Filament Heat
- Focus Current
- Focus Voltage
- Klystron Vacu
- Klystron Vacu
- Stab 1
- Stab 2
- Grid HV
- Grid LV
- Crowbar
- Bunker Door
- GND Plug
- Sum of PLC M
- Emergency Sw
- Access
- He Press L2
- Cavities Vac P

L3

L2

L1

OFF

L3

L2

L1

OFF

