

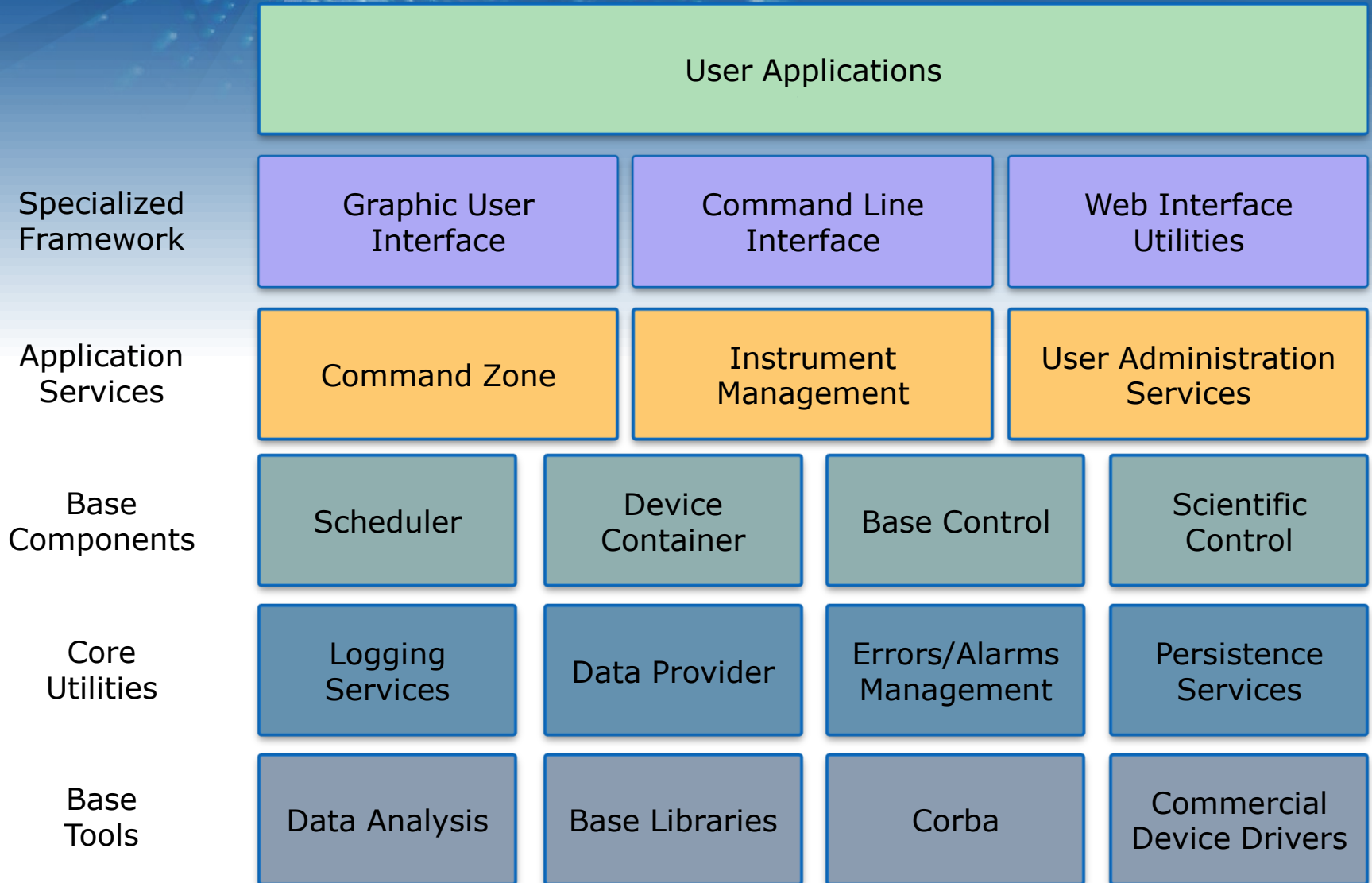


The Interactive Way To Control Experiments

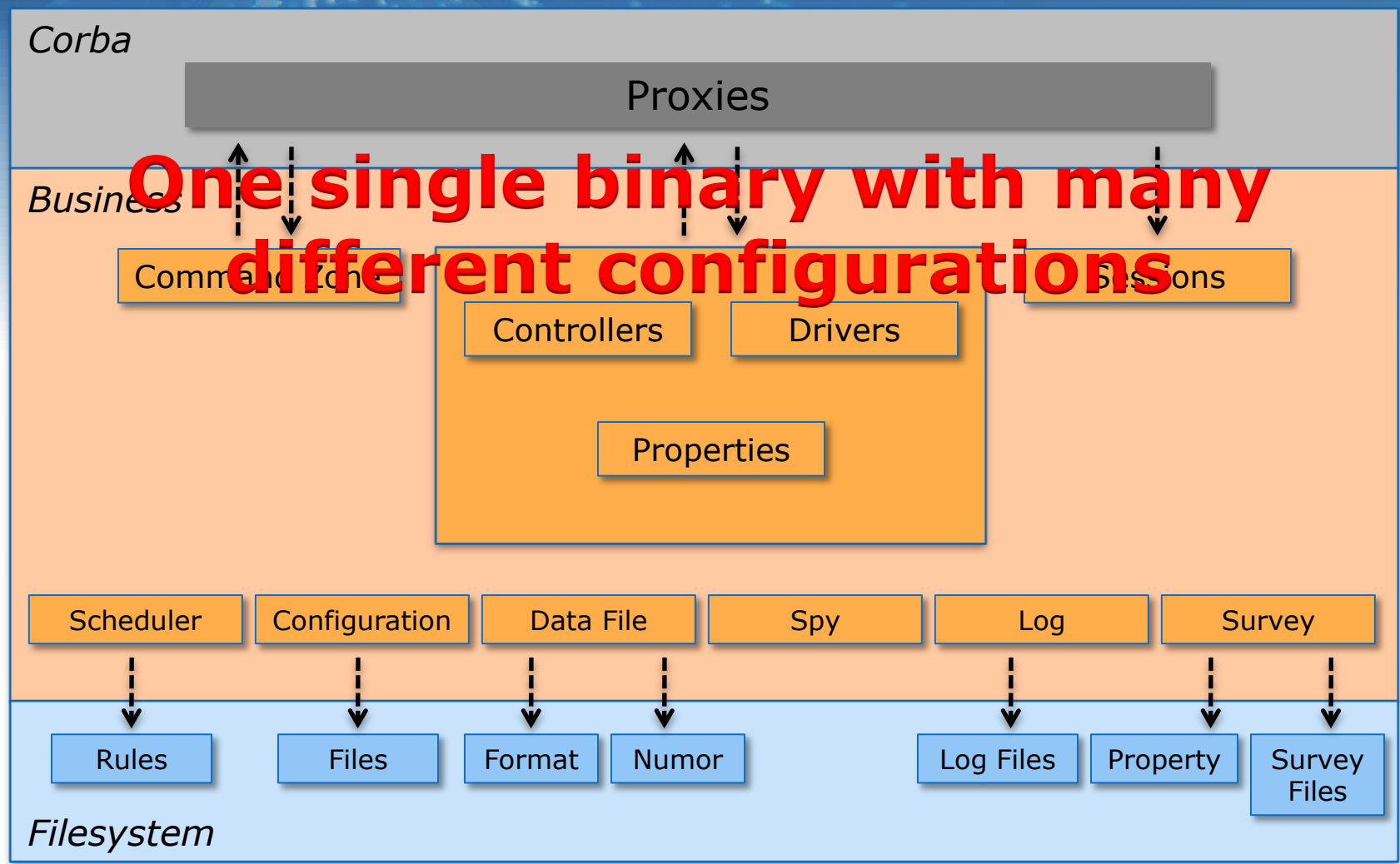
Summary

- **ARCHITECTURE PRINCIPLES**
- **DISCOVERING THE INTERFACE**
- **SCIENTIFIC CONTROLLERS**
- **HARDWARE INTEGRATION**

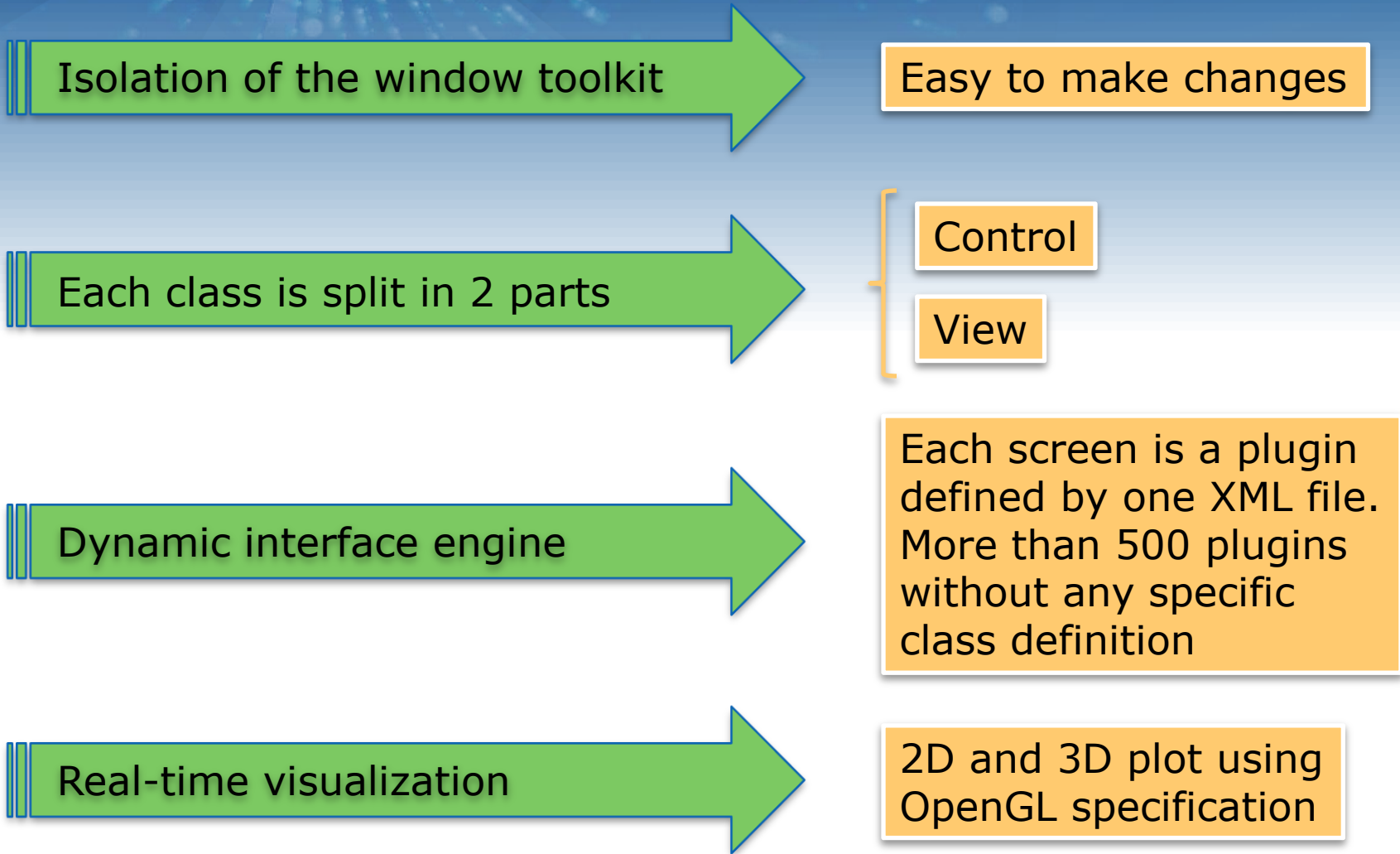
Development Framework



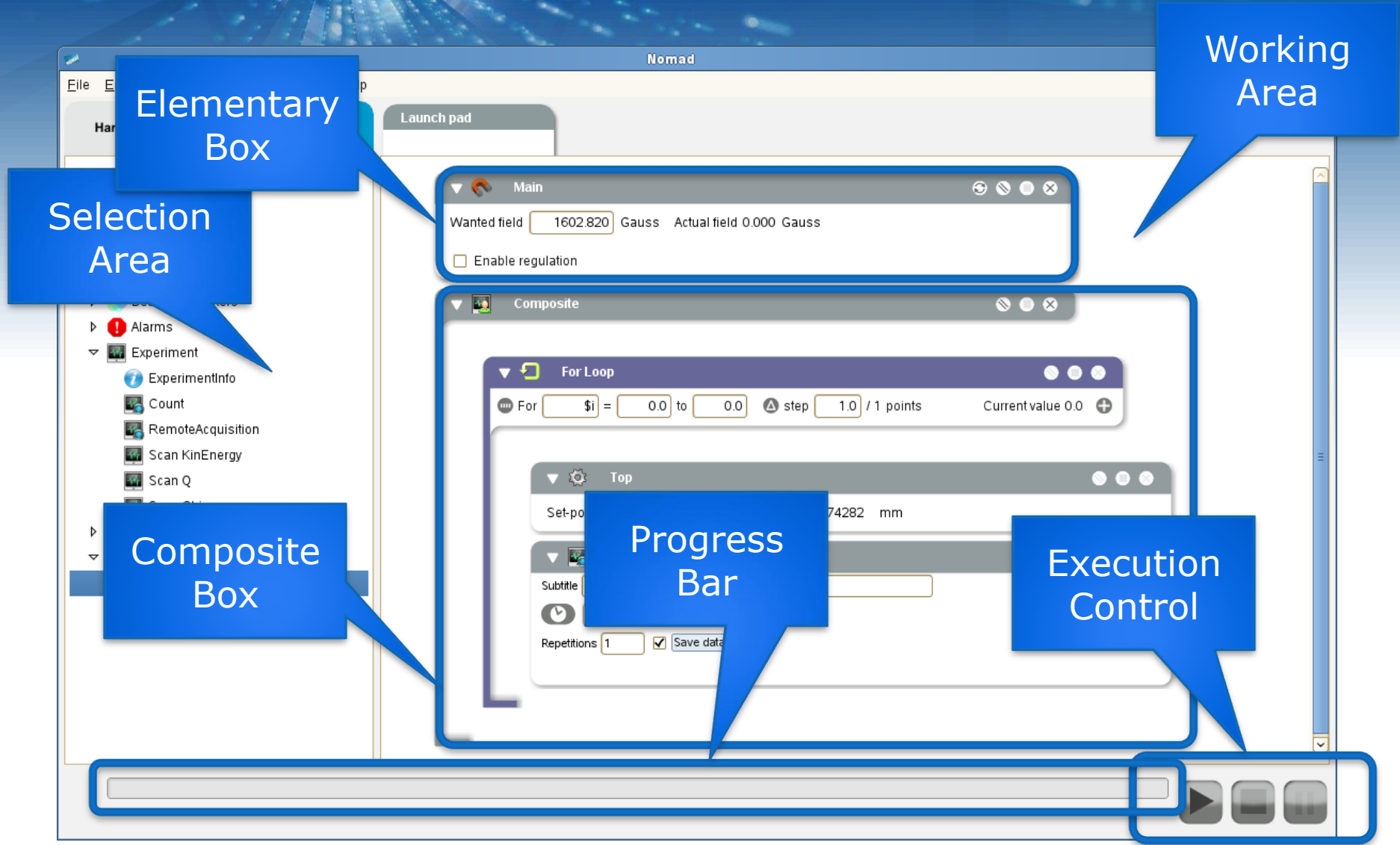
Server (C++)



Client (Java + SWT)



Discovering The Interface

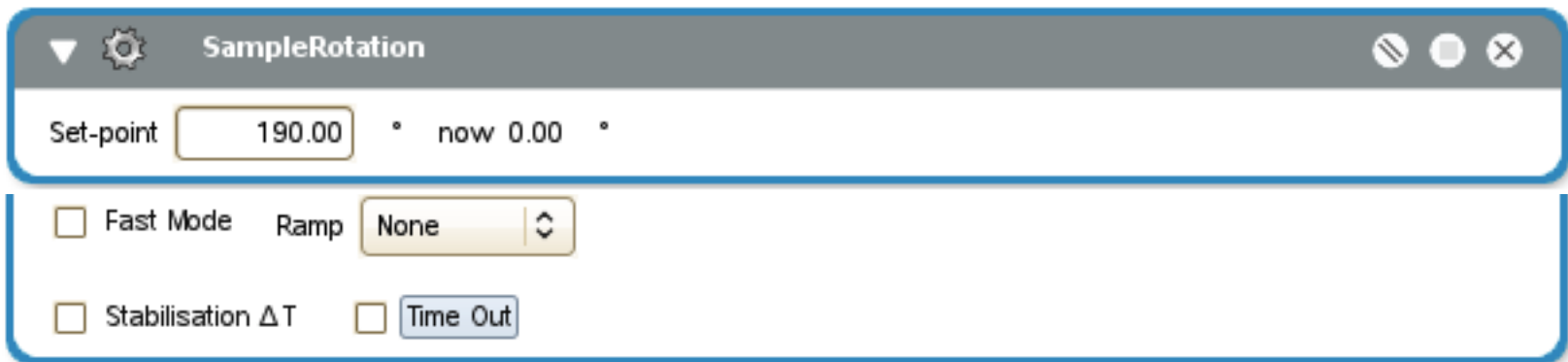


The image shows a screenshot of the Nomad software interface. The interface is titled "Nomad" and features a "Launch pad" at the top. On the left side, there is a "Selection Area" containing a tree view with items like "Alarms", "Experiment", "ExperimentInfo", "Count", "RemoteAcquisition", "Scan KinEnergy", and "Scan Q". The main "Working Area" contains several stacked windows. The top window is titled "Main" and displays "Wanted field 1602.820 Gauss" and "Actual field 0.000 Gauss", with an "Enable regulation" checkbox. Below it is a "Composite" window containing a "For Loop" window. The "For Loop" window shows "For \$i = 0.0 to 0.0 step 1.0 / 1 points" and "Current value 0.0". Below the "For Loop" is a "Top" window with "Set-po" and "74282 mm". At the bottom of the "For Loop" window, there is a "Progress Bar" and "Execution Control" elements, including a play button, a stop button, and a "Repetitions 1" field with a "Save data" checkbox. A blue callout box labeled "Elementary Box" points to a small box in the top left. A blue callout box labeled "Composite Box" points to the "For Loop" window. A blue callout box labeled "Working Area" points to the main content area. A blue callout box labeled "Progress Bar" points to the progress indicator in the "For Loop" window. A blue callout box labeled "Execution Control" points to the play and stop buttons in the "For Loop" window.

Basic Controllers

Access a single or a composition of hardware components of the instrument (e.g. axes, cryostat, power supplies, etc...)

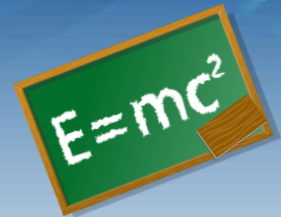
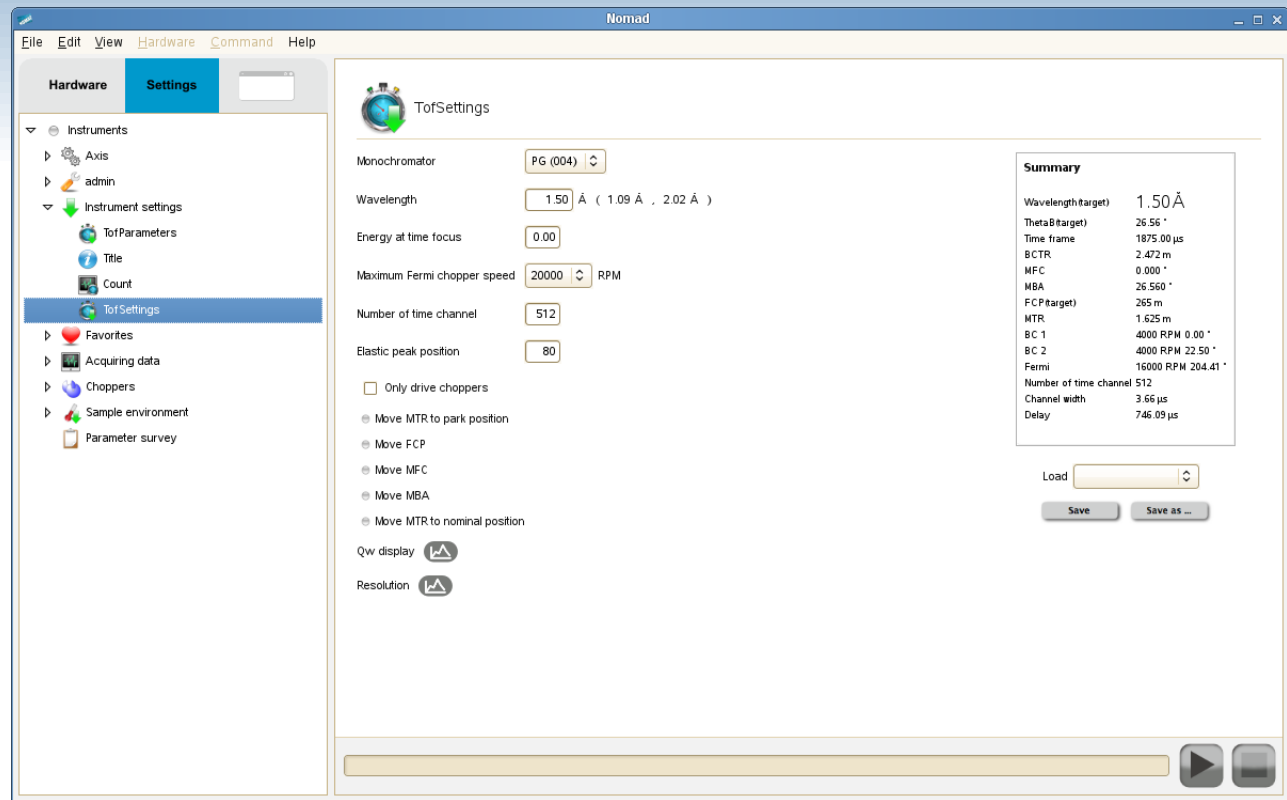
Provide a minimum level of abstraction (e.g. uses physical units, range)



The screenshot shows a control window titled "SampleRotation" with a gear icon and window controls. It features a "Set-point" input field with the value "190.00" and a status indicator "now 0.00". Below this are three control options: "Fast Mode" (checkbox), "Ramp" (dropdown menu set to "None"), and "Stabilisation ΔT" (checkbox) with a "Time Out" button.

Scientific Controllers

Allow user to work directly with the relevant physical quantities (e.g. λ , Q_{range} , K_i , Energy)

The screenshot shows the Nomad software interface with the 'ToFSettings' window open. The interface includes a menu bar (File, Edit, View, Hardware, Command, Help), a left-hand navigation tree, and a main configuration area. The 'ToFSettings' window contains the following parameters and controls:

- Monochromator:** PG (004)
- Wavelength:** 1.50 Å (range: 1.09 Å - 2.02 Å)
- Energy at time focus:** 0.00
- Maximum Fermi chopper speed:** 20000 RPM
- Number of time channel:** 512
- Elastic peak position:** 80
- Only drive choppers
- Move MTR to park position
- Move FCP
- Move MFC
- Move MBA
- Move MTR to nominal position
- Qw display:** [Icon]
- Resolution:** [Icon]

A **Summary** panel on the right provides a quick overview of the current settings:

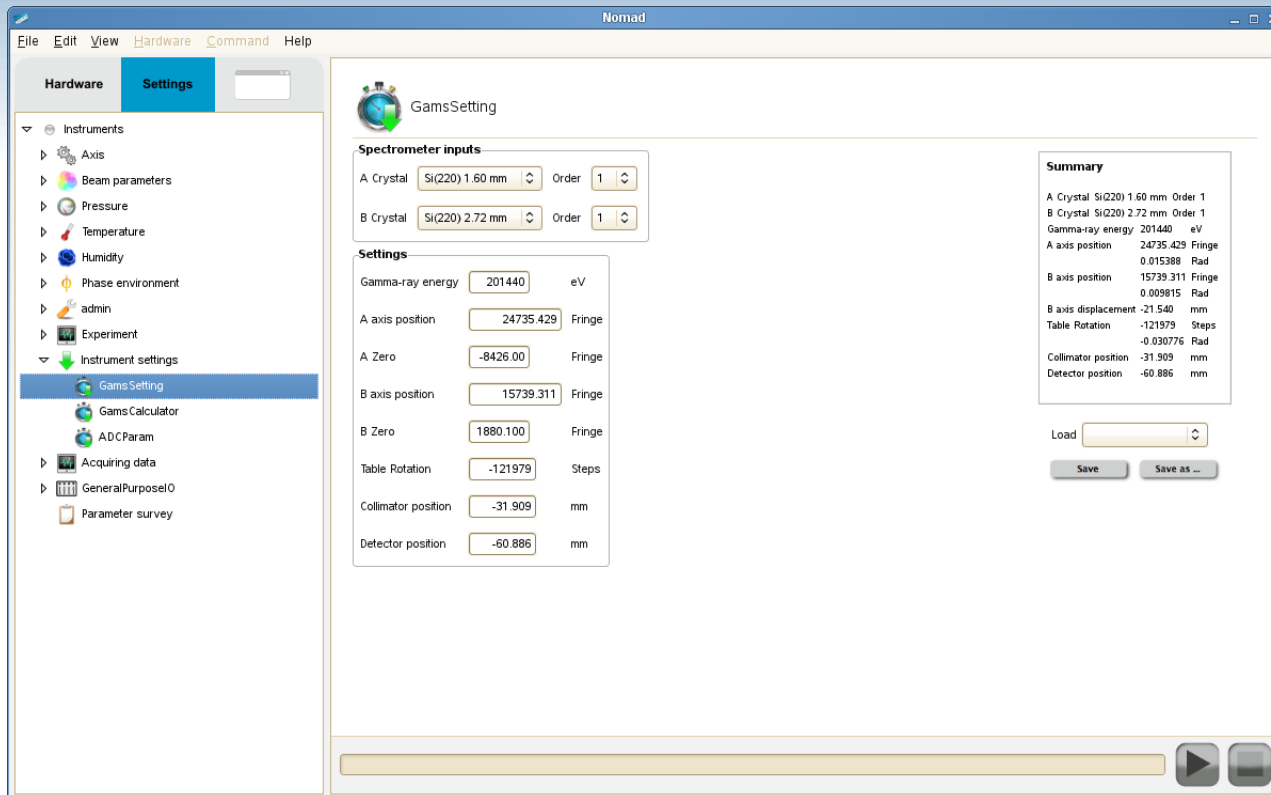
Wavelength(target)	1.50 Å
ThetaB(target)	26.56 °
Time frame	1875.00 μs
BCTR	2.472 m
MFC	0.000 °
MBA	26.560 °
FCP(target)	265 m
MTR	1.625 m
BC 1	4000 RPM 0.00 °
BC 2	4000 RPM 22.50 °
Fermi	16000 RPM 204.41 °
Number of time channel	512
Channel width	3.66 μs
Delay	746.09 μs

Additional controls include a 'Load' dropdown menu, 'Save' and 'Save as ...' buttons, and a playback/stop control bar at the bottom right.

Scientific Controllers



Act as a super calculator for the local contact to access complex instrument's configuration



The screenshot shows the Nomad software interface with the following components:

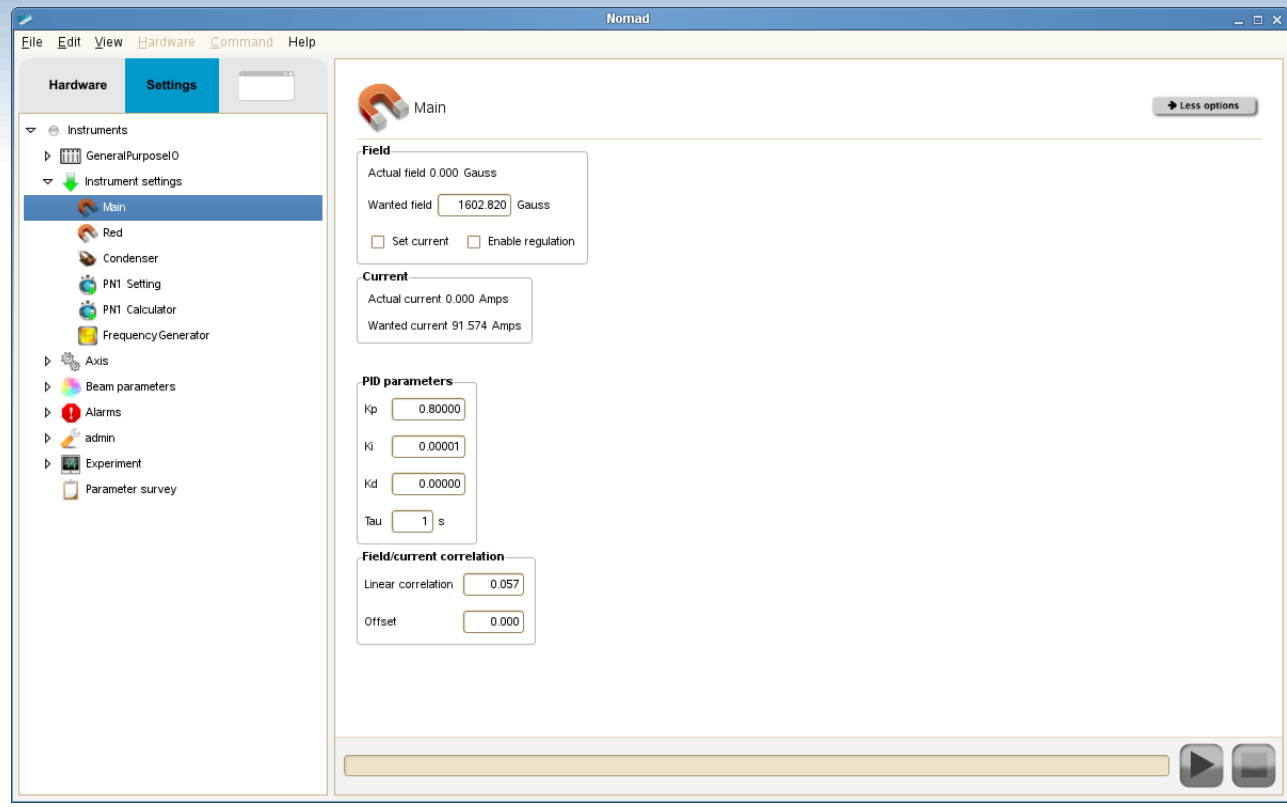
- Hardware Settings Panel:**
 - Instruments
 - Axis
 - Beam parameters
 - Pressure
 - Temperature
 - Humidity
 - Phase environment
 - admin
 - Experiment
 - Instrument settings
 - Gams Setting** (selected)
 - Gams Calculator
 - ADCParam
 - Acquiring data
 - GeneralPurposeIO
 - Parameter survey

- Main Configuration Area:**
- Spectrometer inputs:**
 - A Crystal: Si(220) 1.60 mm, Order: 1
 - B Crystal: Si(220) 2.72 mm, Order: 1
- Settings:**
 - Gamma-ray energy: 201440 eV
 - A axis position: 24735.429 Fringe
 - A Zero: -8426.00 Fringe
 - B axis position: 15739.311 Fringe
 - B Zero: 1880.100 Fringe
 - Table Rotation: -121979 Steps
 - Collimator position: -31.909 mm
 - Detector position: -60.886 mm
- Summary Panel:**
- A Crystal Si(220) 1.60 mm Order 1
- B Crystal Si(220) 2.72 mm Order 1
- Gamma-ray energy 201440 eV
- A axis position 24735.429 Fringe
- 0.015388 Rad
- B axis position 15739.311 Fringe
- 0.009815 Rad
- B axis displacement -21.540 mm
- Table Rotation -121979 Steps
- 0.030776 Rad
- Collimator position -31.909 mm
- Detector position -60.886 mm
- Controls:**
- Load: [Dropdown]
- Save
- Save as ...

Scientific Controllers



Instrument performance optimizer for fine adjustments or advanced regulations



The screenshot shows the 'Nomad' software interface. The window title is 'Nomad'. The menu bar includes 'File', 'Edit', 'View', 'Hardware', 'Command', and 'Help'. The 'Settings' tab is active, showing a tree view of instruments under 'Instrument settings'. The 'Main' instrument is selected, displaying the following parameters:

- Field:** Actual field 0.000 Gauss, Wanted field 1602.820 Gauss. Includes checkboxes for 'Set current' and 'Enable regulation'.
- Current:** Actual current 0.000 Amps, Wanted current 91.574 Amps.
- PID parameters:** Kp 0.80000, Ki 0.00001, Kd 0.00000, Tau 1 s.
- Field/current correlation:** Linear correlation 0.057, Offset 0.000.

At the bottom of the window, there is a horizontal slider and two buttons (play and stop).

Scientific Controllers



Scheduler for repetitive operations

File Edit View Hardware Command Help

Hardware Settings

- Instruments
 - Axis
 - Beam parameters
 - Favorites
 - GeneralPurposel0
 - Acquiring data
 - Instrument settings
 - admin
 - Sample environment
 - Sample Changer
 - SampleSequencer**
 - Currents
 - Parameter survey

SampleSequencer

Acquisition

Sample Changer

Changer # Changer#1 Max Slots 22

Wanted Nr. of Positions 12

Slot	Duration	Run Title		
1	10.00	Sample 1		
2	10.00	Sample 2		
3	10.00	Sample 3		
4	10.00	Sample 4		
5	10.00	Sample 5		
6	10.00	Sample 6		
7	10.00	Sample 7		
8	10.00	Sample 8		0.10
9	10.00	Sample 9	1.00	0.10
10	10.00	Sample 10	1.00	0.10
11	10.00	Sample 11	1.00	0.10
12	10.00	Sample 12	1.00	0.10

Total Time 120.00 s

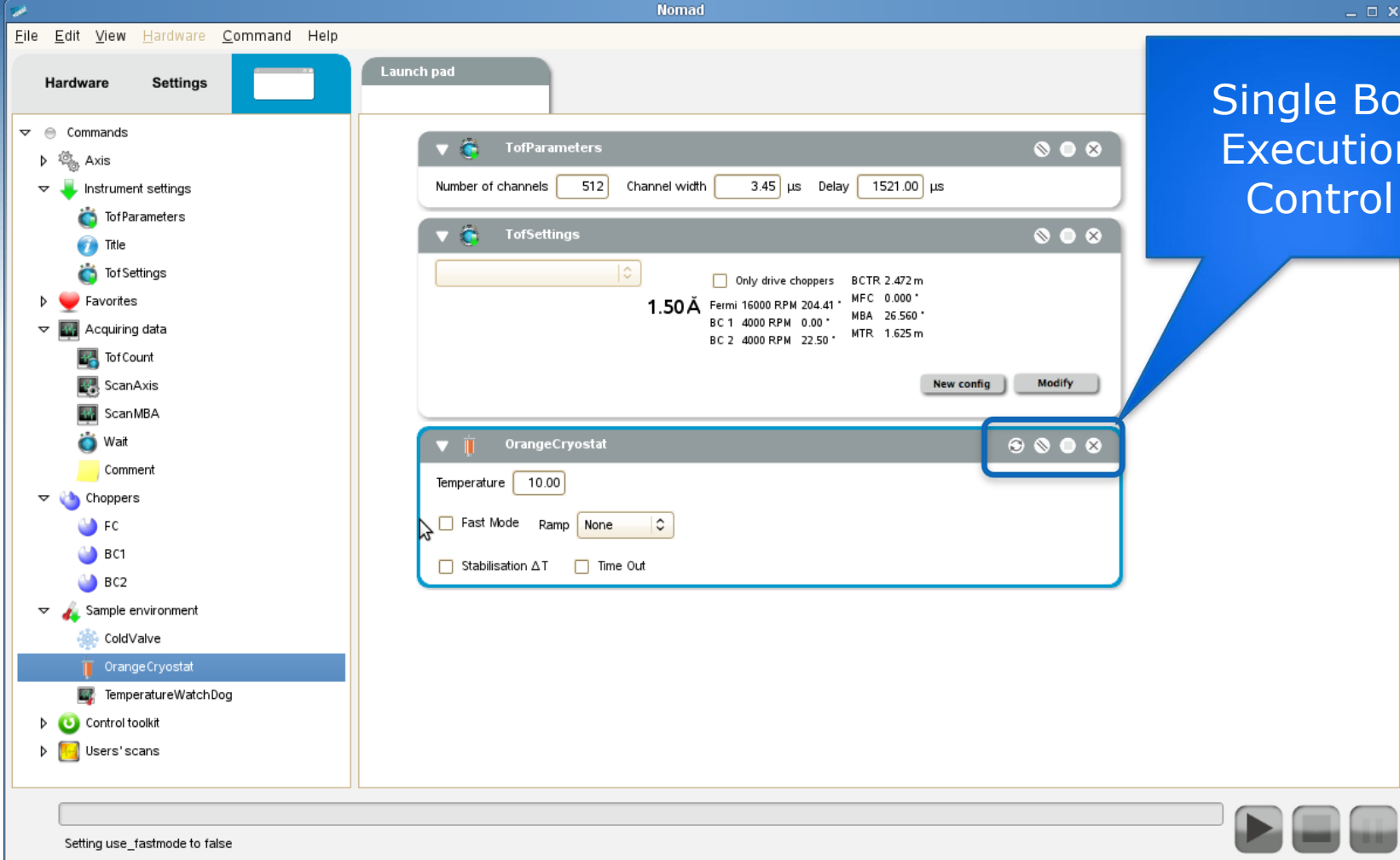
Summary

Changer #5 Used Slots 1
Slot Time Title Trans Thick
Total Time 0.00 s

Load

Save Save as ...

Drag-And-Drop



The screenshot shows the Nomad software interface with a sidebar on the left containing a tree view of hardware components. The 'OrangeCryostat' component is selected and highlighted in blue. The main window displays configuration panels for 'TofParameters', 'TofSettings', and 'OrangeCryostat'. The 'OrangeCryostat' panel includes a temperature input field set to 10.00, a 'Fast Mode' checkbox, a 'Ramp' dropdown menu set to 'None', and checkboxes for 'Stabilisation ΔT' and 'Time Out'. A blue callout box with a pointer to the window control icons of the 'OrangeCryostat' panel contains the text 'Single Box Execution Control'. At the bottom of the window, a status bar shows 'Setting use_fastmode to false' and a set of control buttons.

File Edit View Hardware Command Help

Hardware Settings

Commands

- Axis
- Instrument settings
 - TofParameters
 - Title
 - TofSettings
- Favorites
- Acquiring data
 - TofCount
 - ScanAxis
 - ScanMBA
 - Wait
 - Comment
- Choppers
 - FC
 - BC1
 - BC2
- Sample environment
 - ColdValve
 - OrangeCryostat**
 - TemperatureWatchDog
- Control toolkit
- Users' scans

Launch pad

TofParameters

Number of channels 512 Channel width 3.45 μs Delay 1521.00 μs

TofSettings

1.50 Å

Only drive choppers BCTR 2.472 m
Fermi 16000 RPM 204.41 MFC 0.000 °
BC 1 4000 RPM 0.00 MBA 26.560 °
BC 2 4000 RPM 22.50 MTR 1.625 m

New config Modify

OrangeCryostat

Temperature 10.00

Fast Mode Ramp None

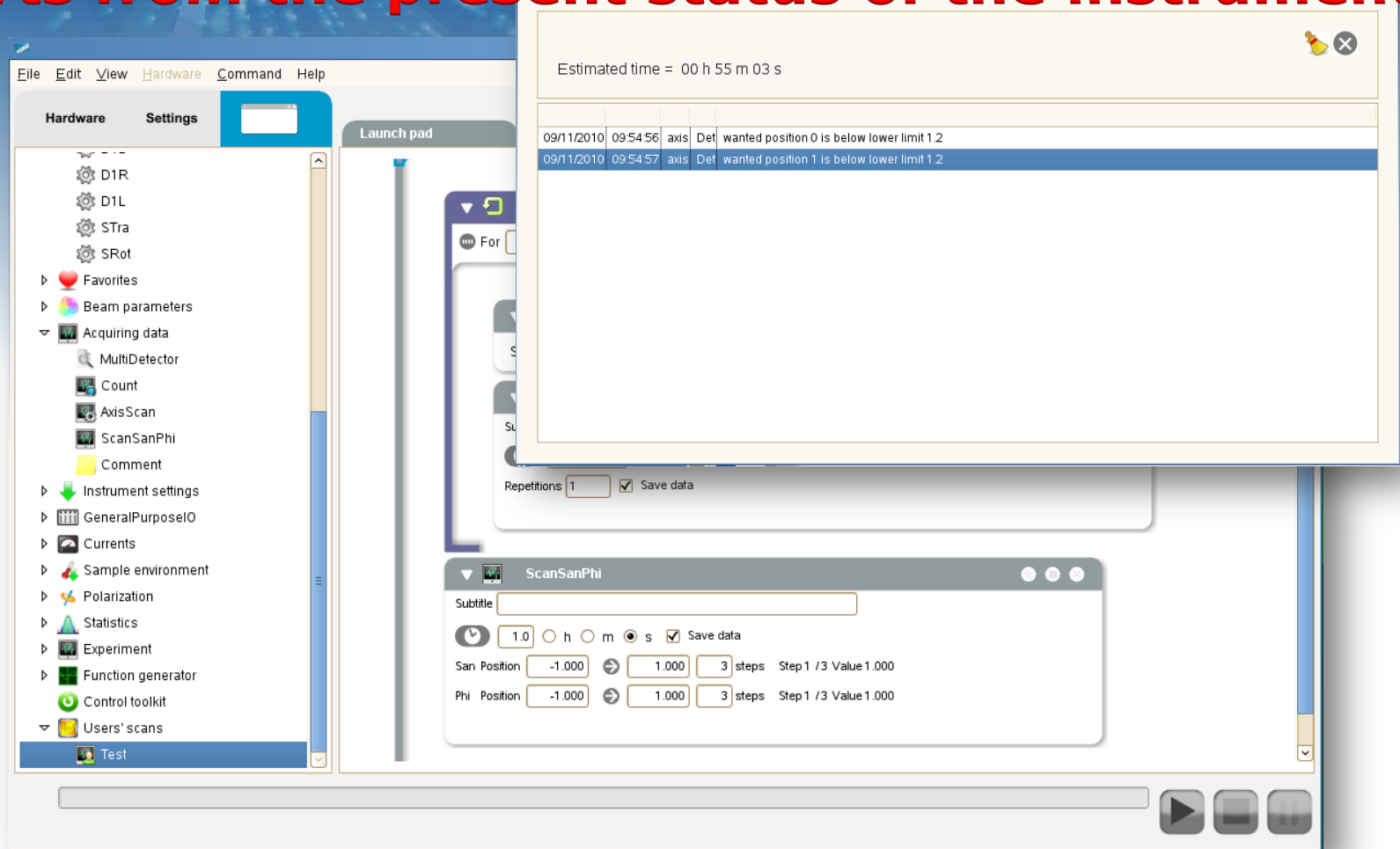
Stabilisation ΔT Time Out

Setting use_fastmode to false

Single Box Execution Control

Simulation

Starts from the present status of the instrument




The screenshot displays a software interface for instrument simulation. On the left, a 'Hardware' sidebar lists components like D1R, D1L, STra, and SRot, along with various settings categories. The main area shows a 'Launch pad' and a 'ScanSanPhi' control panel with fields for 'San Position' and 'Phi Position', both set to -1.000 to 1.000 with 3 steps. A log window in the foreground shows an estimated time of 00 h 55 m 03 s and two error messages: 'wanted position 0 is below lower limit 1.2' and 'wanted position 1 is below lower limit 1.2'. Below the log, there are controls for 'Repetitions' (set to 1) and a checked 'Save data' option.

Execution-time estimation and errors check

Keep The User In The Loop

Even at home or at the restaurant



Count

16:42
Wednesday 24

Run 46362 Finishes at 18:49

Count

Time 15.0 m
Now 459.69 s
1 over 1

Run 46362

Total 2.071 E6 (4.589E3 c/s)
Mon1 sum 1.053E7 (2.332E4 c/s)
Mon2 sum 0.000E0 (0.000E0 c/s)

Counting

Mineral stuff
On Off





D22 - 10/11/09 22:18:33

Execution

Polarizer

COUNTING

User: nonsens
hPI
user Kreyssig

Acquisition

run 42839
rate 115.18c/s
Σ mon1 7
rate mon1 45645.40c/s
Σ mon2 0
rate mon2 0c/s
Σ det 1.80 10⁵
mode: Count

1562.70s / 4500 sec - finishes at 11:08:14

Wavelength: 6.00Å

Attenuator

position 0

Collimation: 17.60m

Polarizer out

position 1

Regulation 363.21K
Sample 363.21K
Power 0W
Type Bath

Bx	-5.51 mm
By	-5.01 mm
Dan	0.01 °
Det	17.00 m
Dtr	0.01 mm
PgTrans	229.12 mm
Phi	-0.01 °
SRot	223696 °
STra	1339.65 mm
San	-0.01 °
Sdl	-24.15 mm
Sht	173.52 mm
Str	85.13 mm
StrVac	241.33 mm
Trs	0 mm

d22

A fully configurable status

Hardware Integration

● Temperature Watchdog



● Double Buffering

- Reduce the dead-time between successive acquisitions
- Allow high data throughput from acquisition electronics to the final storage
- Necessary for list-mode (up to 1Tb per day)