

Developing a new instrument control system for ISIS: lessons learned

Matt Clarke

Sample Environment Control Interface (SECI)

Sample Environment Control Interface (Version 1.0.10.17085)

File Manager

WISH is SETUP Next Run 78

Time: 14:55 23 October 2008
User(s): John Smith et al.
Title: Long title name; change by typing here!

Current Run Time: 1 12:30:25	Monitor Counts: 5100045
Good/Raw Frames: 499985 / 499985	Current/Total μ A: 165.2 / 500.2
Current Period: 1 of 5	Shutter Status: OPEN

Beam Status

TS2_current: 0 uA
VAT_valve: OPEN
DecoupledCH4: 302 K
Nb_Time_Ch: 0
Nb_Spectra: 0

ORC

ORC_STATUS: Stopped
ORC_cycle: 0.000

Pressure

G1_TK_PEN: 0.010 mbar
G2_TK_PIR: 870.000 mbar
G3_TURBO_PEN: 0.010 mbar
G4_TURBO_PIR: 0.073 mbar
G5_RP1_PIR: 810.000 mbar
G7_GUIDE_TGT: 0.059 mbar
G8_GUIDE_BCKH: 0.049 mbar

Eurotherms

Sample_Temp: 0.000 K
cell_top: 0.000 K
cell_bottom: 0.000 K
Orange_cryo: 0.000 K
Low_T_Furnace: 0.000 C

Experiment Details
LabVIEW VIs
[Add VI](#)
[Remove VI](#)
[Configure VIs](#)
[Edit Tabs](#)
[Configure Blocks](#)
[Display Blocks Status](#)
Open Genie (Scripting)
DAE
Journal Viewer
System Messages
Beam Status
ISIS News
Report a Problem
Help

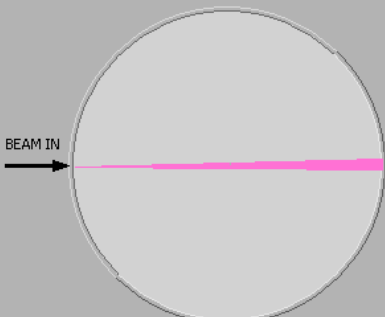
Eurotherms | Beam-Logger | Choppers | Jaws | Jaws - Top | ORC | Pressure

WISH ORC - Front Panel.vi

WISH Oscillating Radial Collimator

ISIS

Version 1.0.0



Mode:

Swept Angle: deg

Operating Frequency: Hz

Current Cycle:

Cycles per Maintenance Rotation:

Estimated Time to Maintenance Rotation: hh:mm:ss

Current Position: deg

Activity

Configuration: WISH Base + Orange Cryostat.conf

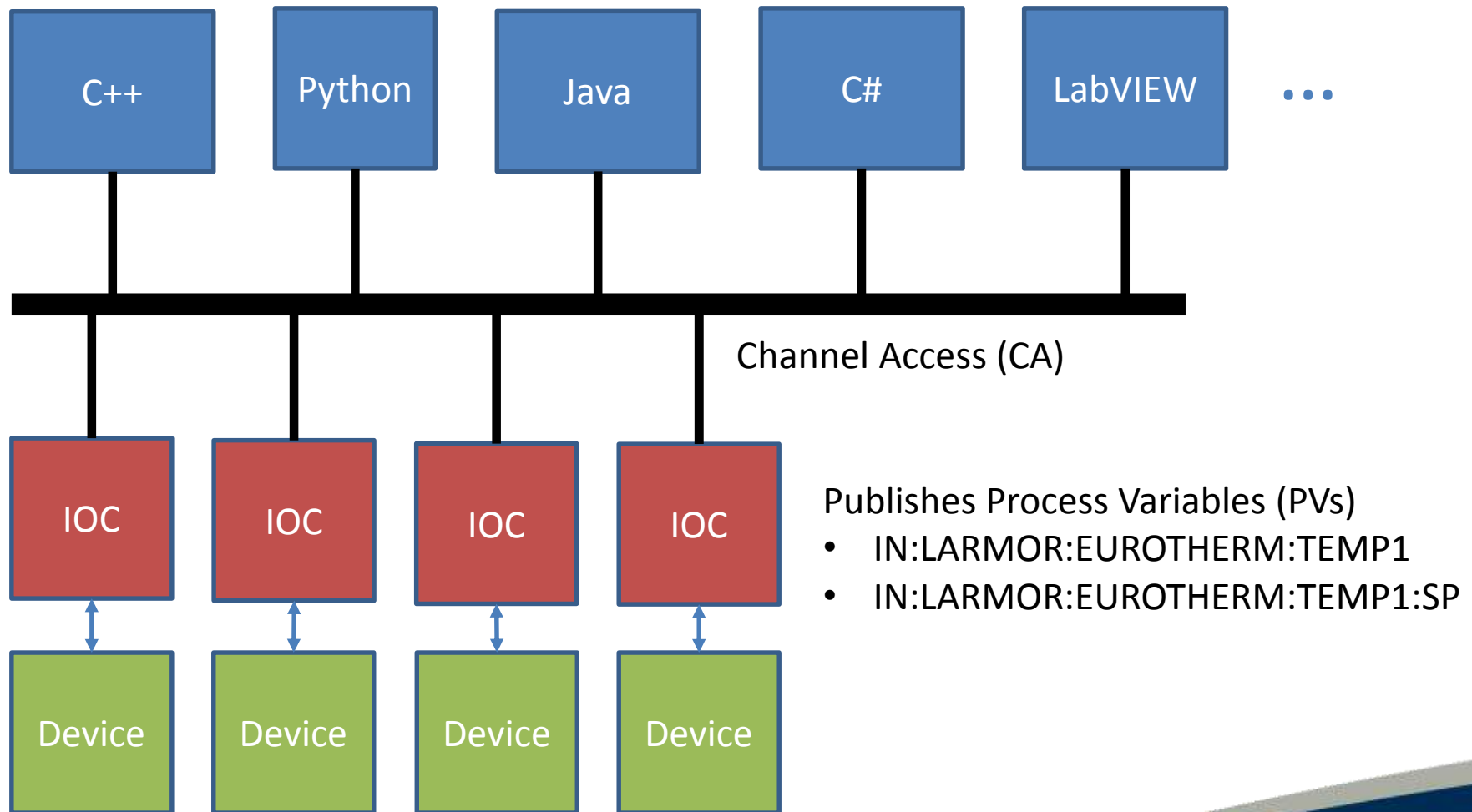
Reasons for replacing

- Increasingly complex instruments
 - Motion control
 - Cameras, robots etc.
- Difficult to extend or modify
 - Close-coupled
 - Multiple responsibilities
- Limited opportunities for collaboration
 - Dependent on LabVIEW
 - Windows only
- Mantid integration

The new system

- EPICS-based
 - Well established and defined framework
 - Client/server model
 - Used at Diamond and the SNS
- Will replace the existing control system
 - ~30 instruments
- Initially targeted for LARMOR and CHIPIR
- SECI++

EPICS – a one slide introduction

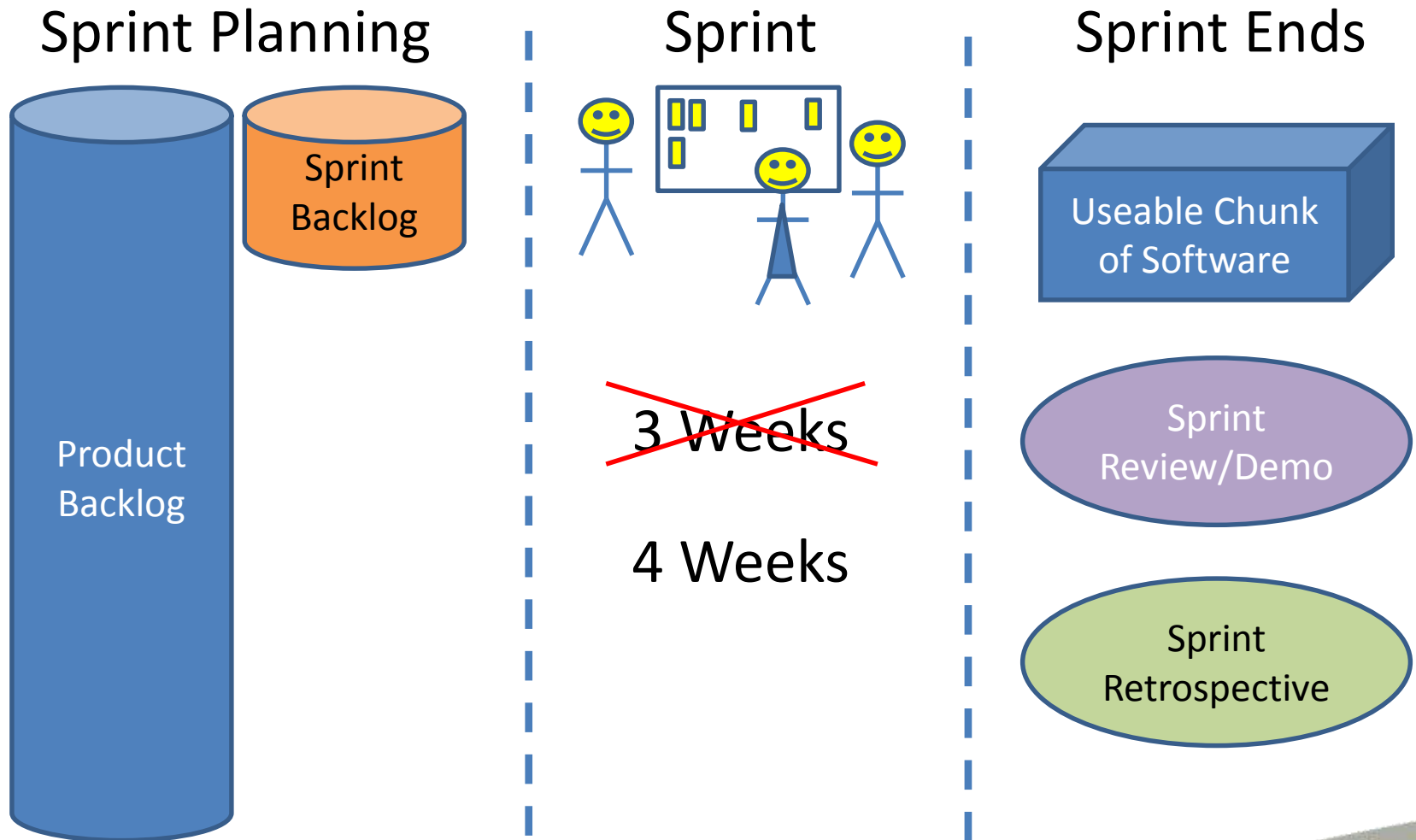


The project

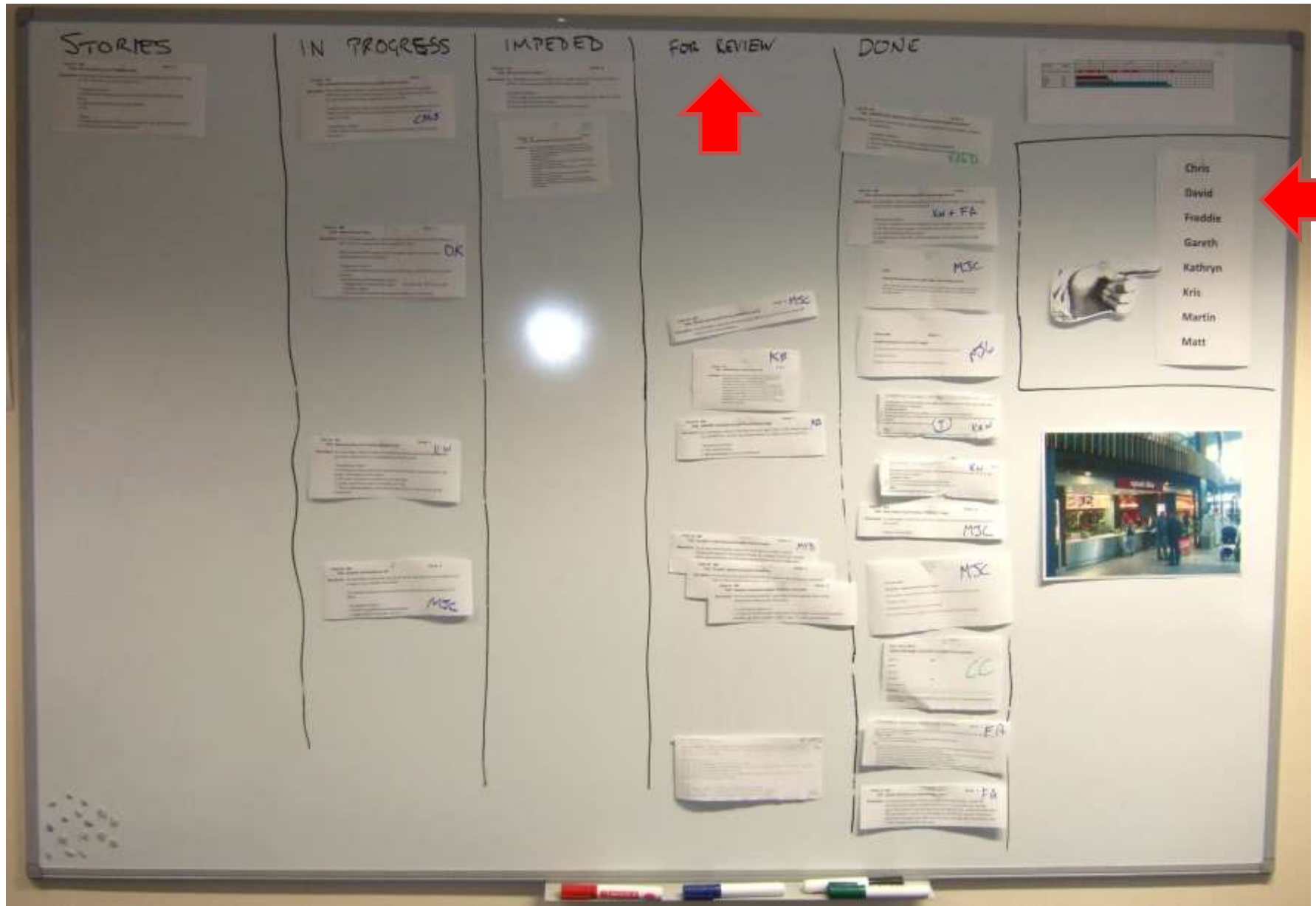
- Large scale software project
- Hired an external project manager from Tessella
- Initial “pilot project”
- Project officially started in December 2012
- Developing while maintaining old system!
- 2 contractors



Scrum - how it works



The white board (current version)

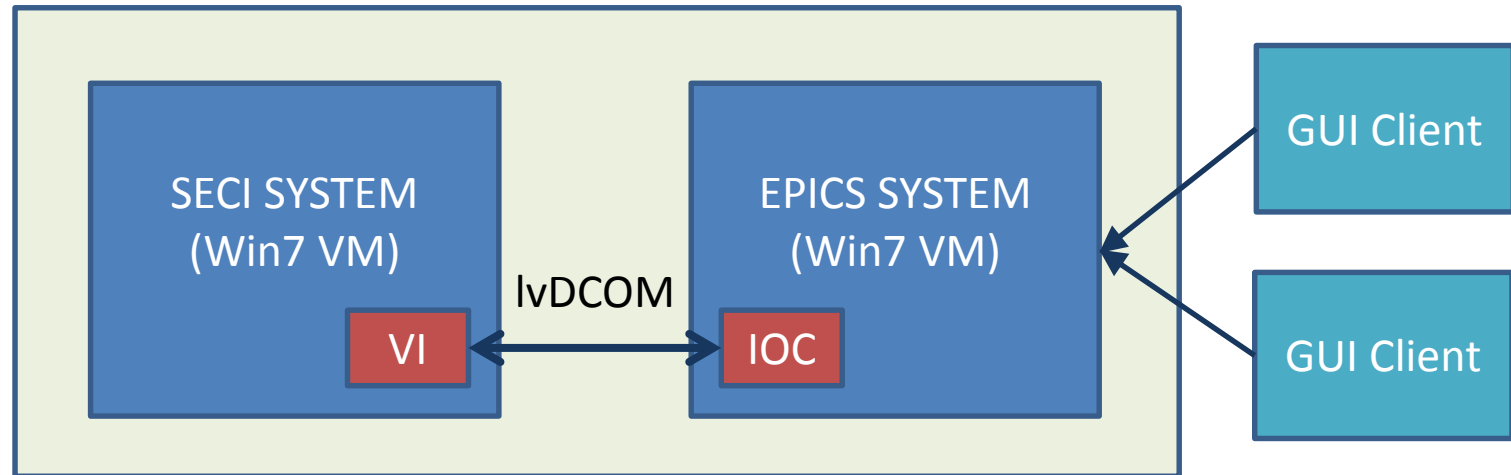


The approach

- Two instruments = two different methods
 - CHIPIR = EPICS and SECI in parallel
 - Relatively simple instrument
 - Basic read-only GUI required
 - Integrating LabVIEW
 - LARMOR = full EPICS system



CHIPIR



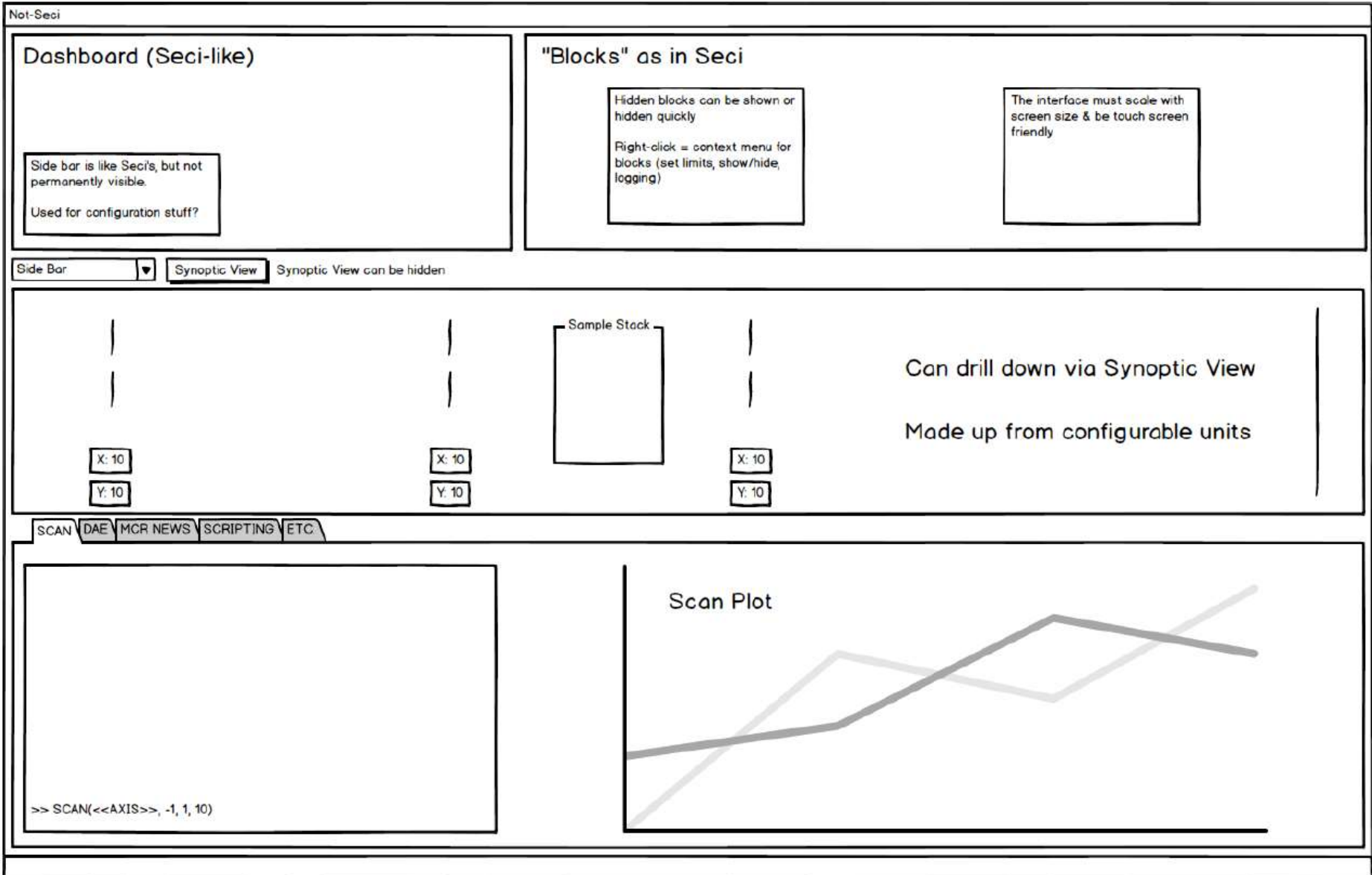
- IvDCOM
 - VIs requires no alteration
 - Configuration files for the IOCs are auto-generated
 - Quick to do

LARMOR



- 40+ motors
- No LabVIEW
- New GUI

GUI mock-up



Control System Studio + BOY

The screenshot displays the Control System Studio (CSS) interface for the 'ISIS Mk3 Chopper' project. The main workspace contains a control panel with a graph and several input fields.

Graph: The graph plots Frequency (Hz) on the left y-axis (0 to 50) and Phase Error (μs) on the right y-axis (0 to 100) against Time (01:00 to 01:00). Two data series are shown: Frequency (blue line) and Phase (red line).

Control Panel:

- FREQUENCY (Hz): ##### [input field]
- PHASE (μs): ##### [input field: 0.0]
- PHASE ERROR (μs): ##### [input field: 0.0]
- DIRECTION: ##### [input field]
- VETO: [red indicator light]
- READY: [green indicator light]
- IN SYNC: [green indicator light]

Properties Panel: The Properties panel on the right shows the configuration for the selected 'bitSetpoint' widget.

Property	Value
Basic	
Name	bitSetpoint
PV Name	\$(PV_ROOT)/\$(CHOP1)/PHAS_ERR:\$(
Widget Type	Text Input
Behavior	
Actions	no action
Confirm Message	
Enabled	<input type="checkbox"/> no
Limits From PV	<input type="checkbox"/> no
Maximum	1.7976931348623157E308
Minimum	-1.7976931348623157E308
Multi-Line Input	<input type="checkbox"/> no
Rules	no rule attached
Scripts	no script attached
Visible	<input checked="" type="checkbox"/> yes
Border	
Alarm Sensitive	<input type="checkbox"/> no
Border Color	(0,128,255)
Border Style	Lowered Style
Border Width	1
Display	
Auto Size	<input type="checkbox"/> no
BackColor Alarm Sensitive	<input type="checkbox"/> no
BackgroundColor	ISIS_Textbox_Background
Font	ISIS_Value
ForeColor Alarm Sensitive	<input type="checkbox"/> no
ForegroundColor	ISIS_Standard_Text
Horizontal Alignment	Center
Rotation Angle	0.0
Selector Type	Name
Text	0.0
Tooltip	\$(pv_name) / \$(pv_value)
Transparent	<input type="checkbox"/> no
Vertical Alignment	Middle
Format	
Format Type	Default
Precision	0
Precision from PV	<input checked="" type="checkbox"/> yes
Show Units	<input checked="" type="checkbox"/> yes
Position	
Height	30
Scale Options	true true False
Width	69
X	300
Y	96

Version 1

Beam
Shutter DEACT
Run State SETUP

Update selected group Load... Save Group Overview Add a Beam block... < Change device... Remove block... Clear group Load/Save Defaults... Delete a group

Overview (server)
Beam Current: 0.000 uA
Run number: 00024187
Status: SETUP
Sample: Disconnected
Phase: Disconnected

Slit 1 (server)
H Gap 1: 10.000
V Gap 1: 45.000
North 1: 50.000
South 1: 5.000
East 1: 5.000
West 1: -5.000

Slit 2 (server)
H Gap 2: 0.000
V Gap 2: 0.000
North 2: 0.000
South 2: -0.000
East 2: 0.000
West 2: -0.000

Slit 3 (server)
H Gap 3: 0.000
V Gap 3: 0.000
North 3: 0.000
South 3: -0.000
East 3: 0.000
West 3: -0.000

Slit 4 (server)
H Gap 4: -0.017
V Gap 4: 0.000
North 4: 80.250
South 4: 80.250
East 4: 80.188
West 4: 80.205

Home All Pages... Pages... Beamline Pages... All Motion STOP

Larmor
Neutrons

pressure A1 Disconnect Vacuum 1 Vacuum 2 pressure A1 Disconnect

Chopper Freq Disconnect Disconnect Disconnect Disconnect Error Disconnect
Monitor 1 Counts 100 furlong
Slit 1 HGap 10.000 VGap 45.000
Monitor 2 Counts 200 furlong
Polywall
Slit 2 HGap 0.000 VGap 0.000
Slit 3 HGap 0.000 VGap 0.000
Monitor 3 Monitor In Out Counts 300 furlong
Sample Stack Sample Post Phi/Theta 0.00000 mm Psi 0.00000 mm Rotation 0.00000 mm
Moving Bench Slit 4 HGap -0.017 VGap -0.017
Monitor 4 Monitor In Out Counts 400 furlong
DAE

Run Info ISS Status MCF News Beam Status Graphs Bug Reporting
LARMOR is SETUP
Run: 00024187
Time: 2014/03/19 11:45:24
User(s):
Title: 40, 68, 65, 69, 32, 83, 73, 77, 85, 76, 65, 84, 73, 79, 78
Current run time: 0
Monitor counts: 0
Shutter status: DEACT
Good/raw frames: 0 / 0
Current/total: 14,695,867 / 14,695,90
Current period: 1 of 1

File Edit CSS Window Help
 Update selected group Load... Save Group Name Overview Add a Beam block... < Change device... Remove block... Clear group Load/Save Defaults... Delete a group

Beam Shutter DEACT Run State SETUP	Overview (server) Beam Current: 0.000 uA Run number: 00024187 Status: SETUP Sample: Phase: XXXXXXXXXX	Slit 1 (server) H Gap 1: 150.000 V Gap 1: 45.000 North 1: 50.000 South 1: 5.000 East 1: 75.000 West 1: -75.000	Slit 2 (server) H Gap 2: 0.000 V Gap 2: 0.000 North 2: 0.000 South 2: -0.000 East 2: 0.000 West 2: -0.000	Slit 3 (server) H Gap 3: 0.000 V Gap 3: 0.000 North 3: 0.000 South 3: -0.000 East 3: 0.000 West 3: -0.000	Slit 4 (server) H Gap 4: -0.017 V Gap 4: 0.000 North 4: 80.250 South 4: 80.250 East 4: 80.188 West 4: 80.205
---	---	---	--	--	---

Vacuum 1 Home Larmor Vacuum 2 All Motion STOP

Slit 1 All Pages... Beamline Pages... View Motors

JAW SET MOT: JAWS1

H CENT:	0.000	0.000
V CENT:	27.500	27.500
H GAP:	150.000	150.000
V GAP:	45.000	45.000
NORTH:	50.000	50.000
SOUTH:	5.000	5.000
EAST:	75.000	75.000
WEST:	-75.000	-75.000

Run Info ISS Status MCR News Beam Status Graphs Bug Reporting

LARMOR is SETUP

Run: 00024187

Time: 2014/03/19 11:49:59

User(s):

Title:
40, 68, 65, 69, 32, 83, 73, 77, 85, 76, 65, 84, 73, 79, 78

Current run time: 0

Monitor counts: 0

Shutter status: DEACT

Good/raw frames: 0 / 0

Current/total: 14,695,867 / 14,695,90

Current period: 1 of 1

File Edit CSS Window Help

100%

master.epi 4motor_form master.epi

Beam

Update selected group Load... Save Group Name Overview Add a Beam block... < Change device... Remove block... Clear group Load/Save Defaults... Delete a group

Shutter DEACT Run State SETUP

Overview (server)

Beam Current: 0.000 uA
 Run number: 00024187
 Status: SETUP
 Sample:
 Phase: Dispersed

Slit 1 (server)

H Gap 1	150.000
V Gap 1	45.000
North 1	50.000
South 1	5.000
East 1	75.000
West 1	-75.000

Slit 2 (server)

H Gap 2	0.000
V Gap 2	0.000
North 2	0.000
South 2	-0.000
East 2	0.000
West 2	-0.000

Slit 3 (server)

H Gap 3	0.000
V Gap 3	0.000
North 3	0.000
South 3	-0.000
East 3	0.000
West 3	-0.000

Slit 4 (server)

H Gap 4	-0.017
V Gap 4	0.000
North 4	80.250
South 4	80.250
East 4	80.188
West 4	80.205

Vacuum 1 Home Larmor Vacuum 2 All Motion STOP

Slit 1 All Pages... Beamline Pages...

Name: motor High Limit: 100.00000 Current Posn: 50.00000 Low Limit: -100.00000 Target Posn: 50.00000 At Home Tweek Home Jog STOP

Name: 847:faa59:MOT:MTR High Limit: 42.273.30000 Current Posn: -5.00000 Low Limit: 42.273.30000 Target Posn: -5.00000 At Home Tweek Home Jog STOP

Name: 847:faa59:MOT:MTR High Limit: 42.273.30000 Current Posn: 75.00000 Low Limit: 42.273.30000 Target Posn: 75.00000 Tweek Home Jog STOP

Name: 847:faa59:MOT:MTR High Limit: 42.273.30000 Current Posn: 75.00000 Low Limit: 42.273.30000 Target Posn: 75.00000 Tweek Home Jog STOP

Run Info: [SES Status] [MCR News] [Beam Status Graphs] [Bug Reporting]

LARMOR is SETUP

Run: 00024187
 Time: 2014/03/19 11:51:03
 User(s):
 Title:
 40, 68, 65, 69, 32, 83, 73, 77, 85, 76, 65, 84, 73, 79, 78
 Current run time: 0
 Monitor counts: 0
 Shutter status: DEACT
 Good/raw frames: 0 / 0
 Current/total: 14,695,867 / 14,695,90
 Current period: 1 of 1

Version 2

css_3515
Preferences Help Configuration IOC Console Search

LARMOR is RUNNING

Run: 00002040 Shutter: OPEN

Title: Blend 1.3 DF Grating Separation- .J8 TRANS After further alignment		Users: Larmor Team	
Good / Raw Frames: 964 / 964	Time Now: 12:52 PM Wed, Aug 20		
Current / Total μ A: 1.066 / 1.025	Run Time: 1 min 31 s		
Monitor Counts: 132273	Period: 1 / 1		

JAW GAPS	
A1HGap	20.001
A1VGap	20.000
S2HGap	21.000
S2VGap	21.000
S1VGap	16.000
S1HGap	16.000

BENCH	
Bench_Rot	-0.100
Mon4InCut	
M4Trans	0.01440
BenchStatus	LOWERED
BenchLift	LOWER
BSZ	0.00025
BSY	200.00175

Sample	
Translation	5.15100 mm
Phi	0.10927 deg
SampleK	0.00000 mm
FineHeight	0.01500 mm
CoarseHeight	-118.00000

Detector	
DetectorPack3	On
DetectorPack4	On
DetectorPack1	On
DetectorPack2	On

Optics	
Pol_Arc	-0.10000 mm
An_Trans	1.30012 mm
BlockhouseV...	0.810
Pol_Trans	0.00005 mm
An_Arc	-6.50000 mm

Alarm
Beam Status
DAE
Log
Motors
Synoptic

Home
All Pages...
Pages
Beamline Pages...

Neutrons →

pressure A2: 0.002

pressure B1: 0.810

All Motion

Motors are stationary

STOP

Current status

LARMOR is SETUP
 Run: 00002217 Shutter: CLOSED

Title: (DAE SIMULATION MODE) Solvent C TRANS
 Users: Larmor Team

Good / Raw Frames: 0 / 0 Time Now: 2:55 PM Thu, Sep 11
 Current / Total μ A: 0.000 / 0.000 Run Time: 6 min 3 s
 Monitor Counts: 0 Period: 1 / 1

JAW GAPS	BENCH	Sample	Detector	Optics
A1HGap 0.000	Bench_Rot 0.000	Translation 0.00000 mm	DetectorPack3 initialising	Pol_Arc 0.00000 mm
A1VGap 0.000	Mon4InOut	Phi 0.00000 mm	DetectorPack4 initialising	An_Trans 0.00000 mm
S2HGap 0.000	M4Trans 0.00000 mm	SampleX 0.00000 mm	DetectorPack1 initialising	BlockhouseV... 140.000
S2VGap 0.000	BenchStatus LOWERED	FineHeight 0.00000 mm	DetectorPack2 initialising	Pol_Trans 0.00000 mm
S1VGap 0.000	BenchLit LOWER	CoarseHeight 0.00000 mm		An_Arc 0.00000 mm
S1HGap 0.000	BSZ 0.00000 mm			
	BSY 0.00000 mm			

Add Block Remove Block Edit Group Add Group Remove Group Show hidden blocks

IOC Log Motors Beam Status Alarm DAE Synoptic Synoptic Editor

Go to: Vacuum 1 Current Location: Larmor Motors are stationary Stop All

Pressure A2: 0.002 Pressure B1: 140.000

Vacuum 1 **Vacuum 2** **Sample Stack** **Moving Bench**

Chopper Monitor 1 Slit 1 Monitor 2 Slit 2 Slit 3 Monitor 3 Sample Position Slit 4 Monitor 4 DAE CAEN Moving Beamstop

Chopper: Frequency 0, Phase 0, Error 0
 Monitor 1: Counts 0 counts
 Slit 1: HGap 0.000, VGap 0.000
 Monitor 2: Counts 0 counts
 Slit 2: HGap 0.000, VGap 0.000
 Slit 3: HGap 0.000, VGap 0.000
 Monitor 3: Counts 0 counts
 Sample Position: Phi/Theta 0.00000 mm, Psi 0.00000 mm, Rotation 0.00000 mm
 Slit 4: HGap 0.000, VGap 0.000
 Monitor 4: Counts 0 counts
 DAE: Power Not All On, Error Error
 CAEN: Error Error
 Moving Beamstop: Counts 0 counts, Z 0.00000 mm, Y 0.00000 mm

Mantid

The screenshot displays the Mantid software interface. At the top, there is a menu bar (File, Edit, View, Windows, Catalog, Interfaces, Help) and a toolbar. Below the toolbar is a Results Log window with the text: "Welcome to Mantid version 3.2.0 - Manipulation and Analysis Toolkit for Instrument Data. Please cite Mantid in your publications using: <http://dx.doi.org/10.5286/Software/Mantid3.2>".

The central part of the interface features a plot window titled "Figure 1". The plot shows "Normalised Neutron counts" on the y-axis (ranging from 0.0 to 3.5) and "translation" on the x-axis (ranging from -105 to -120). The data points are as follows:

translation	Normalised Neutron counts
-105	0.2
-108	1.0
-110	1.8
-112	2.6
-113	3.3
-115	2.7
-117	1.9
-120	1.1
-122	0.3

On the right side, there is a "Workspaces" panel with buttons for "Load", "Delete", "Group", and "Sort". Below it is an "Algorithms" panel with an "Execute" button and a list of algorithm categories: Arithmetic, CorrectionFunctions, Crystal, DataHandling, Diagnostics, Diffraction, Events, ISIS, Inelastic, MDAlgorithms, Muon, Optimization, and PythonAlgorithms.

At the bottom, there is a "Script Interpreter" window showing the following code and output:

```
IPython 1.1.0 -- An enhanced interactive Python.
?          -> Introduction and overview of IPython's features.
Quickref  -> Quick reference.
help      -> Python's own help system.
object?   -> Details about 'object', use 'object??' for extra details.
?quickref -> A brief reference about the graphical user interface.

In [1]: from genie_python.genie import *
no instrument specified - to set the instrument use the 'set_instrument' command

In [2]: set_instrument("IN:LAKHOR")
THIS IS LAKHOR!

In [3]: import Simple_scan as ss

In [4]: ss.scan_axis_mantid("translation",-105.0,-122.0,11,50,"translation scan of sample rack",useM=1)
setup_larmor_scanning
```

What went well

- External project manager
 - Different perspective
 - Greater expertise
 - Developers developing
- Scrum
- Pilot project
- IvDCOM
- Incorporating code from outside (mostly)
- Support from other institutes
- Being able to test on a real instrument

What did not go well

- Not enough customer involvement, especially at the beginning
- Sprint demos
- Not everyone comfortable with Scrum
 - Lack of a detailed long term plan can be unsettling
 - Hard to plan your objectives for the year
- Eclipse RCP
 - A steep learning curve
- Too many tickets in a sprint – FIXED!
 - Dodging tickets
- Three week sprints – FIXED!
- Tickets not being reviewed – FIXED?

Thank you