



# NSLS-II Commissioning with CS-Studio

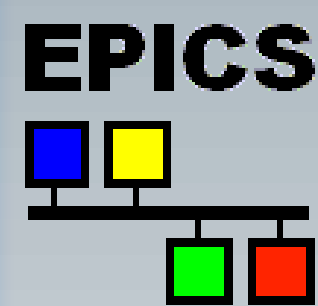


Tasha Summers, Reid Smith, Kunal Shroff  
Photon Sciences Directorate, Brookhaven National Laboratory, Upton, NY 11973

The NSLS-II started commissioning the storage ring in March 2014. By July 2014 the initial goal of storing 50 mA in the storage ring had been achieved. While the ring and equipment was being commissioned, we were also building the software interfaces for operating and monitoring the accelerator complex.

The primary tool at NSLS-II for interacting with the EPICS-based control system is Control System Studio (or CS-Studio). CS-Studio is an integrated set of tools built on Eclipse which combines operator interface (runtime and development), data trending and archive viewing, alarm handling and logbook services. Presented below are the current status and operations experience gained while learning and using CS-Studio as the new lightsource was commissioned.

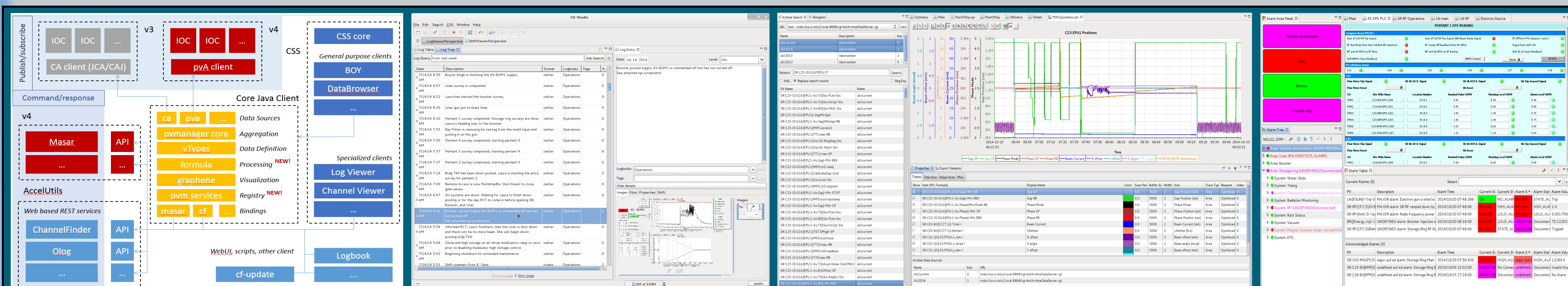
## EPICS and CS-STUDIO



EPICS (Experimental Physics and Industrial Control System): A toolkit for distributed control systems.

CS-Studio: An Integrated platform for controls and physics applications.

The collaboration is actively developing new tools and adding features—go to [github.com/ControlSystemStudio](https://github.com/ControlSystemStudio)



Integrated applications include: BOY - OPI pages (edit and runtime), BEAST - Alarm handler, DataBrowser - Live and Archived, Logbook, ChannelFinder...

## OPI SCREENS

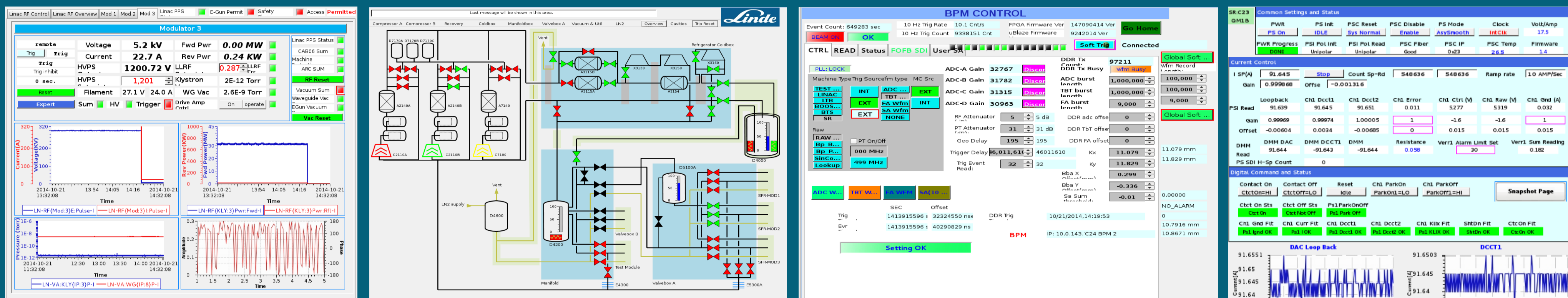
Interface design with CSS came in three steps, with a different focus and authors/users for each type:

**Engineering:** Developed by the controls engineers alongside device IOCs. Designed for system expert-level device control and troubleshooting.

**Physics:** Created by a small number of physicists from an AP committee list of required interfaces. These pages tend to consolidate individual elements into systems, and include rules and external python scripts for complex calculations and displays. These pages are well-suited for local studies & tuning, and performing single tasks.

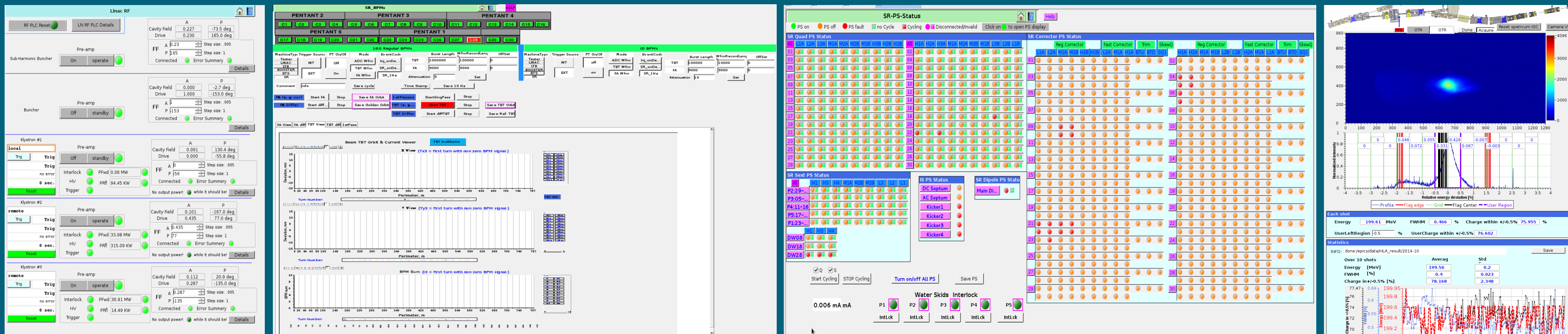
**Operator:** Created by two machine operators. Pages combine and summarize large amounts of information from to give a “big picture” view of the accelerator, suited for machine tasks like startup, shutdown, tuning, and troubleshooting. They use a single design standard to be as consistent as possible. This consolidation of info and controls makes operation and troubleshooting more efficient.

### Engineering Screens



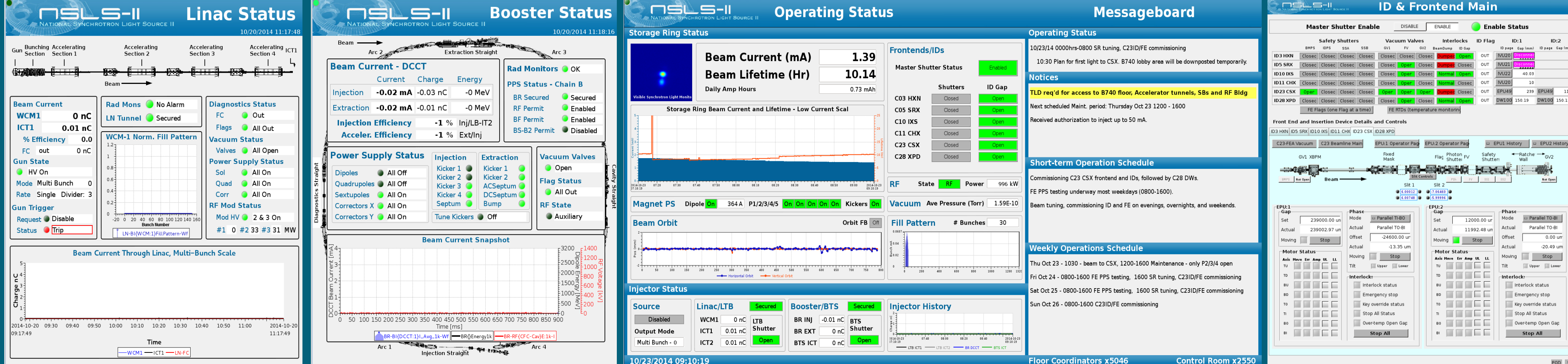
Sample of ENG control pages: (From left to right) Gun RF modulator 3, Cryogenic He cooler, Storage Ring BPM 23-2, and a Ring quadrupole power supply. Due to the absence of BOY screen standards, there is little visual or functional cohesion between systems.

### Physics Screens



A Sample of PHYS pages: (From left to right) Linac RF overview, LTB flag Spectrum Analyzer, Ring BPM/Orbit monitor, and Ring Magnet power supply summary. The Spectrum Analyzer and BPM Orbit viewer both call python scripts.

### Operator Screens



Operator Status Panels that convey the state of each machine and the presence/location of any faults at a glance, including a main status page that is available to beamlines and for remote viewing. Operator control pages combine controls for many components of a system without requiring extra navigation.

## CURRENT STATE OF CS-STUDIO

### Creating Pages

Dozens of “developers”

- Controls/engineers/operators/physicists/vendors/beamline Scientists/technicians...
- Different styles, backgrounds, training, requirements
- Layers of OPIs: Op pages summarize engineer pages

OPI Version control - Mercurial

- Everyone works on main branch
- Recently set up Hg in CSS – more visual and less error prone

Controls network available from MCR and gateway machines

- ssh to BNL network, log in with unix credentials (NX is popular)
- IOCs have access security – MCR can permit or restrict remote write to PVs

CSS version – currently using v3.2.15a

- Newer version (3.3.10a) available and tested by a few lucky people
- Early experience with regressions... hard to convince users to move forward

### Performance Issues

Frequent crashes – out of memory

- Watch CPU, heap status - running garbage collection when it gets too high
- Closing huge pages does not free memory quickly
- Newer operators have the most trouble – leaving all pages open as substitute for knowing where to look (multiple desktops/windows/many tabs)
- Files in inactive tabs still actively consume memory?
- Setting a refresh cycle for GUIs to slow memory consumption – hardly any affect
- Not everyone knows about (or uses) best practices
  - ie. minimal rules and scripts, using lines rather than points for large plots, etc

### Human Factors

Most of us have minimal training

- Commonly copying page with similar functions (with bad practices!)
- Documentation minimal / incomplete / non-existent for new features
- Habits from GUI building in Matlab/LabView – including calculations and scripts

Limited time!

- Using quickest method (rules) even in cases where they are overly memory intensive (We'll go back and redo pages and IOCs properly ... someday when we have free time)
- Don't wanting to learn new tricks when old methods will roughly work (some engineer pages are memory intensive – ok when only pages open)

Style guide was attempted – practices sometimes followed

Few people know new tools yet

## SR COMMISSIONING HIGHLIGHTS

26 Mar 2014	Commissioning authorized for Storage Ring
30 Mar 2014	First Storage Ring injection & First turn
02 Apr 2014	Visible light monitor shows first light
03 Apr 2014	Kicker found with wrong polarity; fixed
11 Apr 2014	Tune measurement system working
18 Apr 2014	5 mA limit reached!
25 Apr 2014	Vacuum opened—RF contact spring found hanging in beam path!
29 Apr 2014	Filled to 25 mA! Administrative limit reached
03 May 2014	92% Injector efficiency reached
07 May 2014	25 mA filled uniformly over 80% of the machine
11 May 2014	Commissioning at 25 mA complete.
02 July 2014	Shutdown for installation of superconducting RF cavity reached 25 mA with new RF cavity
11 July 2014	50 mA approved and achieved!
14 July 2014	Shutdown for installation of ID and beamline front ends
03 Oct 2014	Restart for ID commissioning
23 Oct 2014	First light seen on beamline flag!

