

Overview of motion control at the Spallation Neutron Source



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H- ions



Accelerate
Protons to
1 GeV in linac



Accumulator
ring bunches
protons.

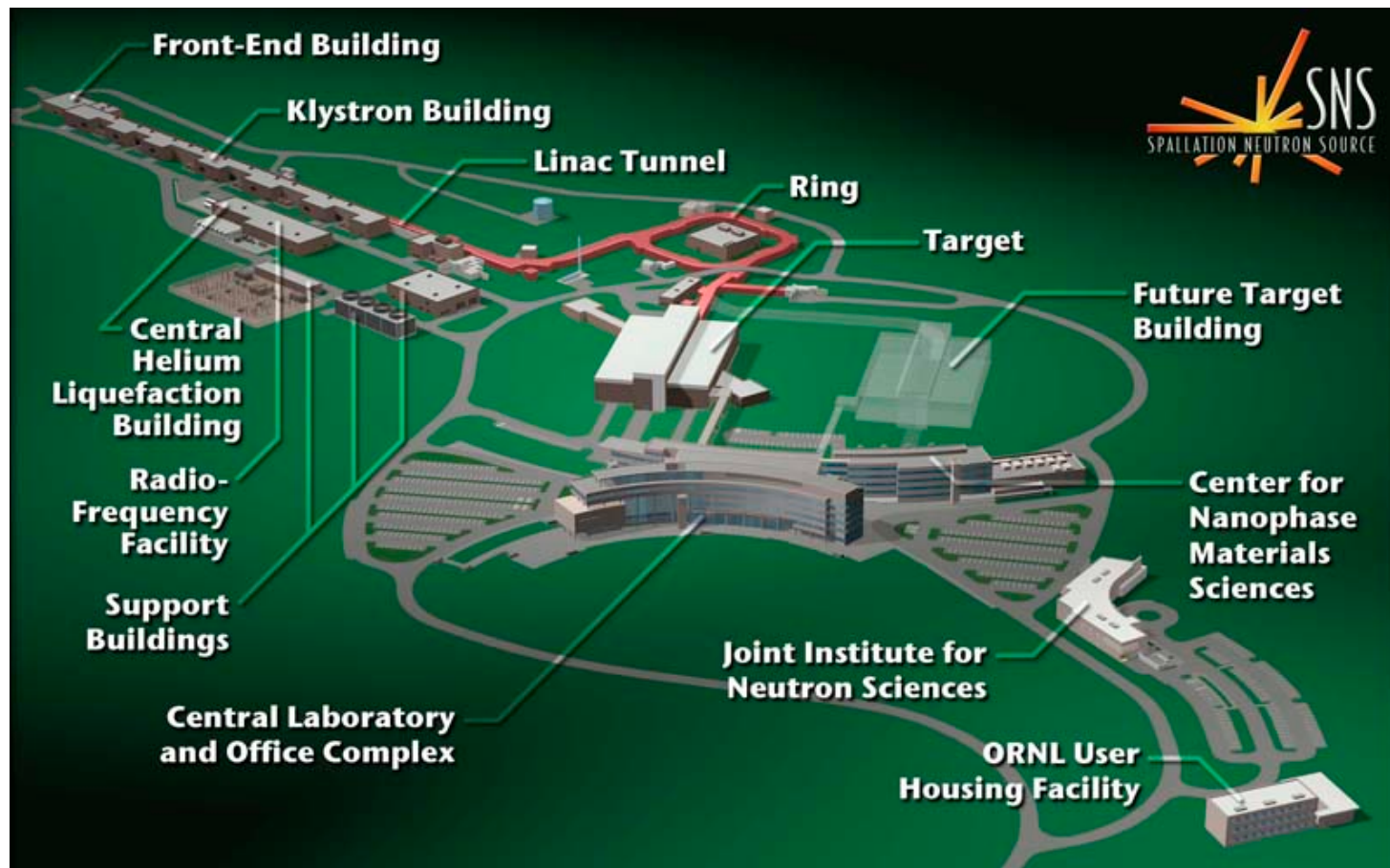


Liquid mercury
Target. 60Hz.



Moderate
produced
neutrons.

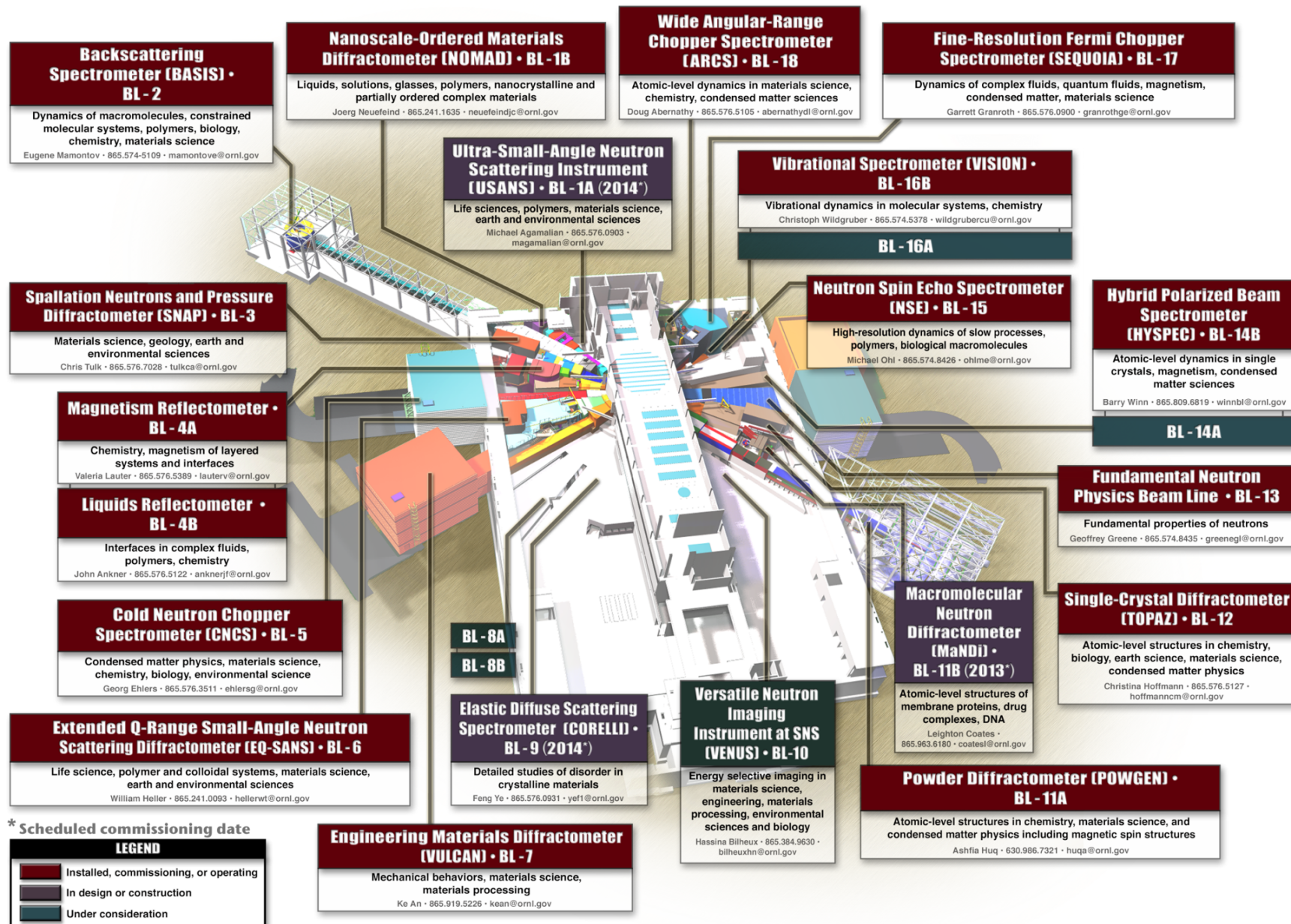
→ Neutron scattering on beamlines



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Instrument / Target Building



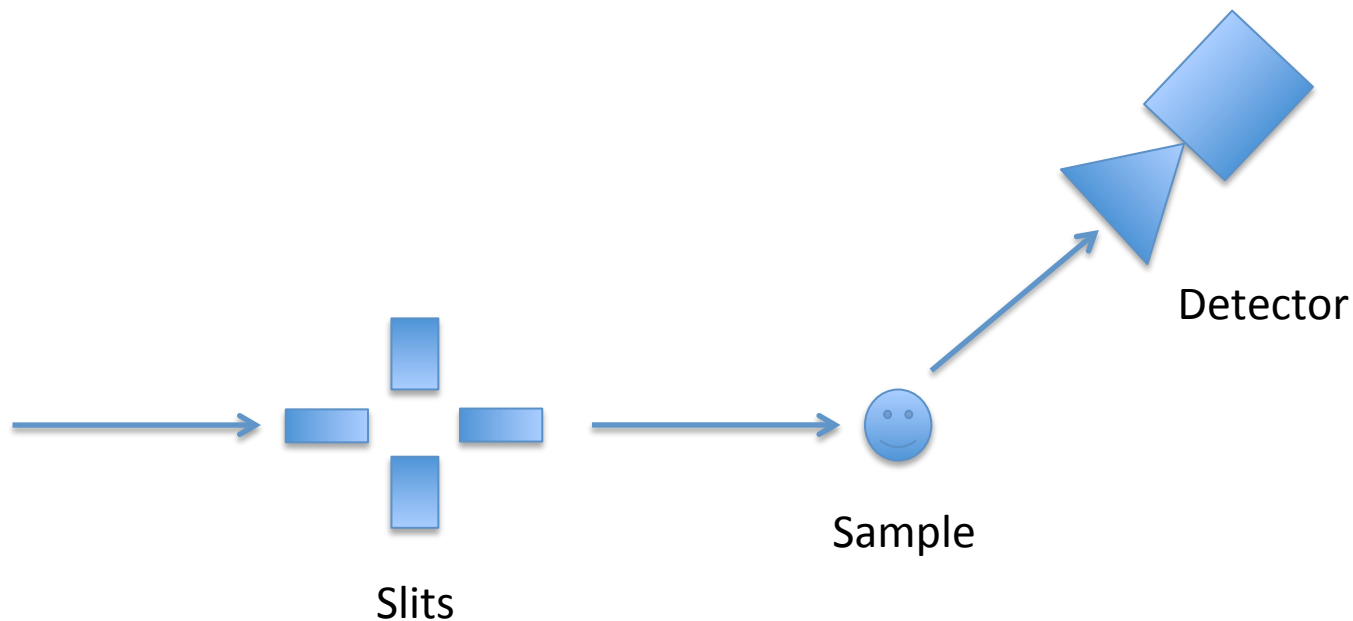


Motion Control on SNS Instruments (1)

Simplified beamline

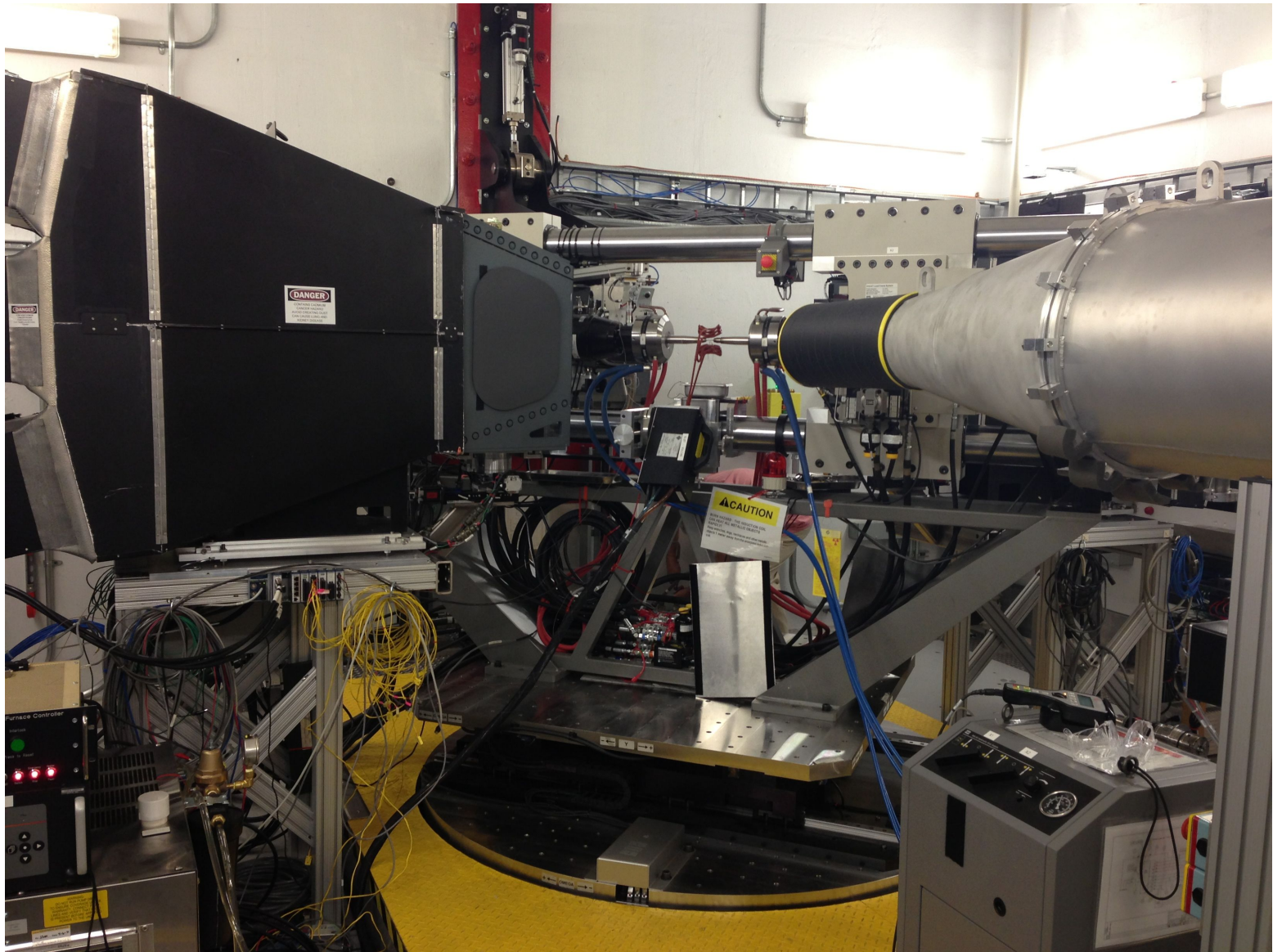


T0 Chopper



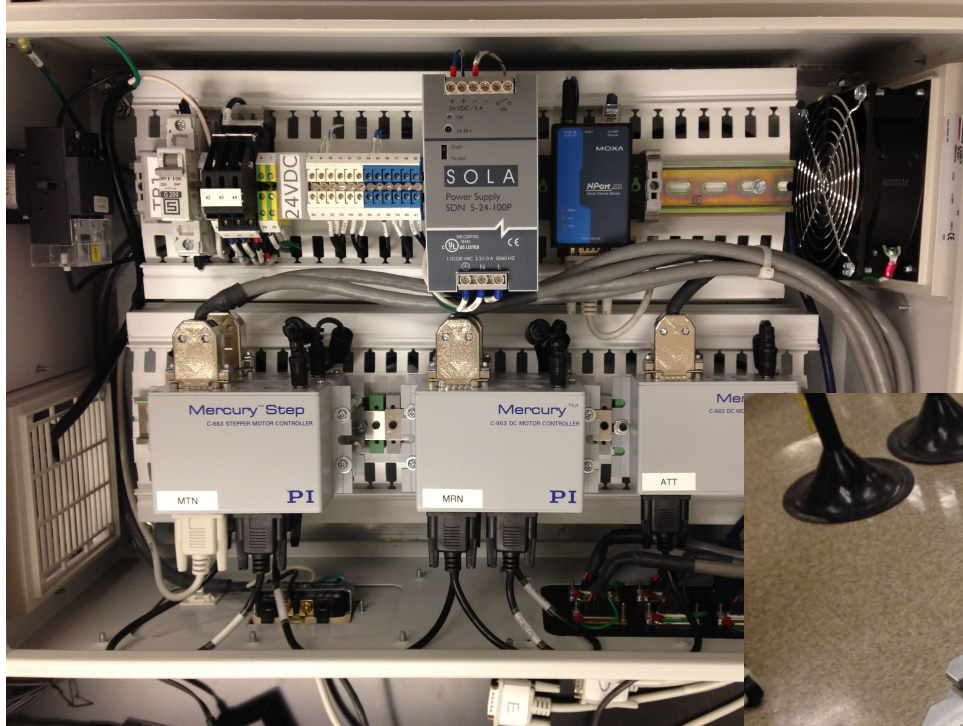
*Controls
Server*

VULCAN beamline sample/detector area. Large Newport sample stages.

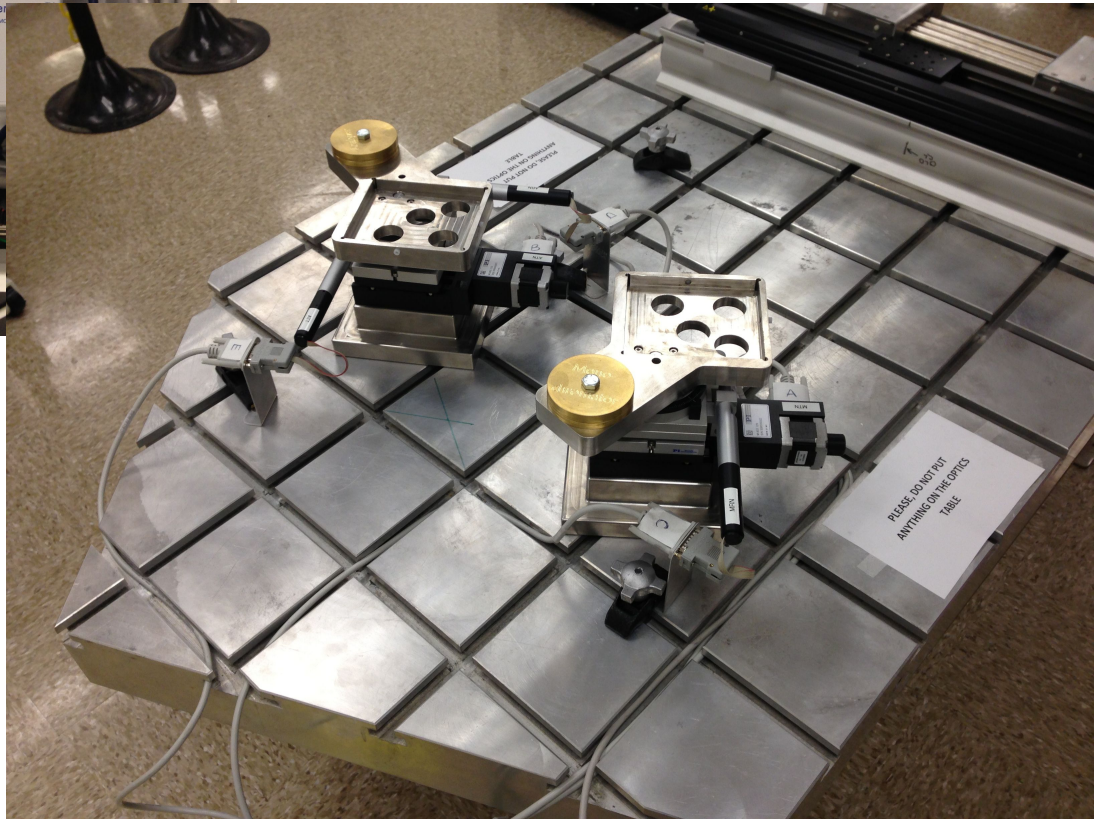


USANS beamline

PI positioners for neutron energy selection.



PI C-663 and C-863 controllers. Daisy chained together on RS232 bus.



Standard Parker 6K control box



Control Hardware / Software

Typical motion control rack:

- Parker 6K Controller
- E-AC / E-DC stepper amplifiers
- Moxa serial device server
- ICP (digital I/O – used to control amplifier power, via Moxa)

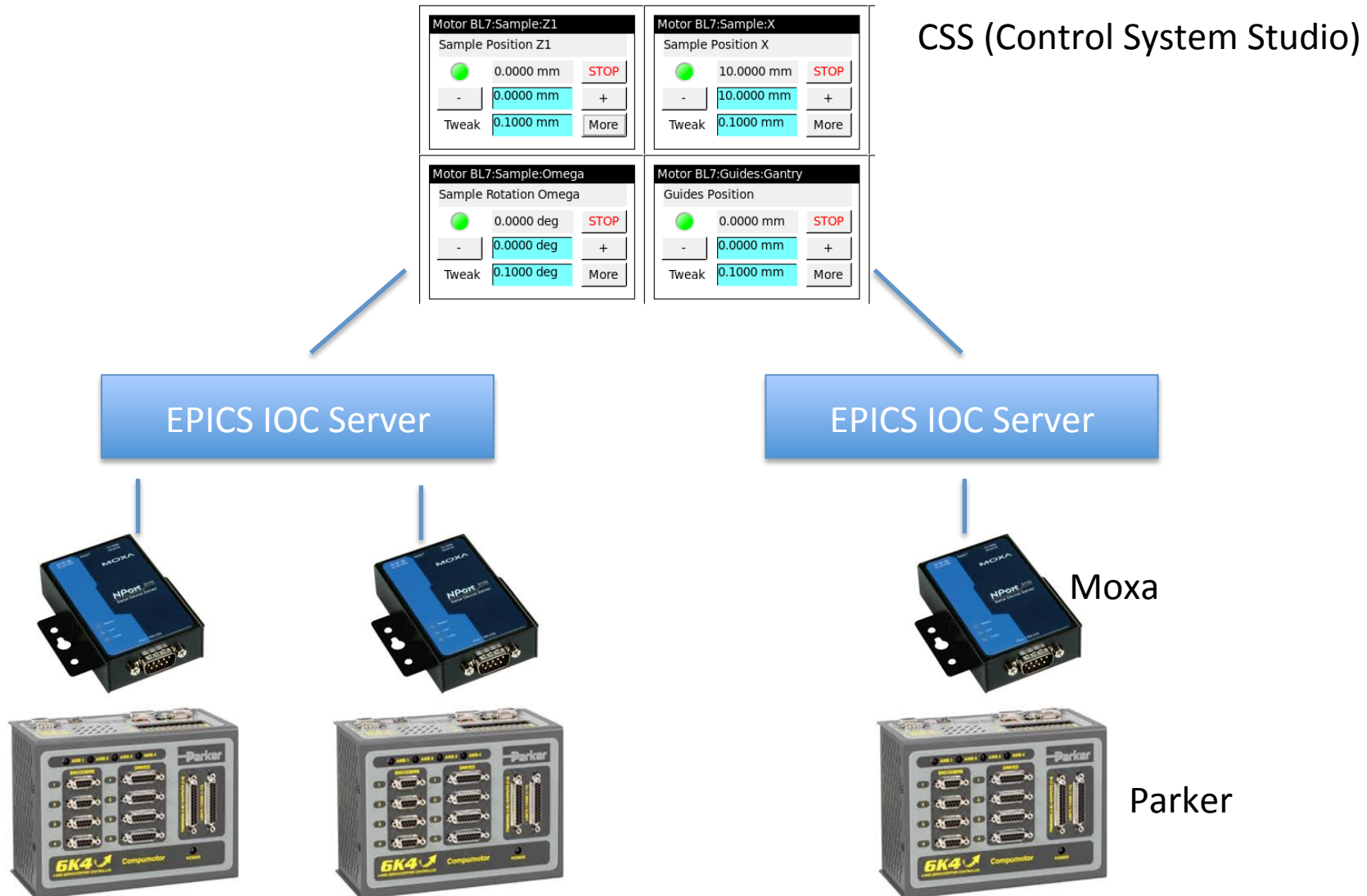
Also have:

- Several Newport XPS controllers (bespoke end station stages).
- PI controllers (C-663 / C-863)
- Bespoke chopper control rack (timing/PLC control/drives/Windows XP UI)

Most motion control software is custom C++ applications & Labview running on Windows XP.

- Migrating to EPICS running on Linux.
- Chopper control is migrating to EPICS running on Windows XP.

Control Software Architecture



CSS Motor Control Screens

Motor BL7:Sample:Z1 Sample Position Z1  0.0000 mm STOP - 0.0000 mm + Tweak 0.1000 mm More	Motor BL7:Sample:X Sample Position X  10.0000 mm STOP - 10.0000 mm + Tweak 0.1000 mm More
Motor BL7:Sample:Omega Sample Rotation Omega  0.0000 deg STOP - 0.0000 deg + Tweak 0.1000 deg More	Motor BL7:Guides:Gantry Guides Position  0.0000 mm STOP - 0.0000 mm + Tweak 0.1000 mm More

Motor Detail BL7:Guides:Gantry
 Guides Position

Readback 0.0000 mm
 DMOV 

Demand 0.0000 mm
 MOVN 

Tweak Size 0.1000 mm
 ATHM 

SYNC - +
 Homed 

STOP
 Missed 

HOME
 LVIO 

Direction Pos
 HLS 

Use Encoder No
 LLS 

Set/Use Mode Use
 SPMG Go

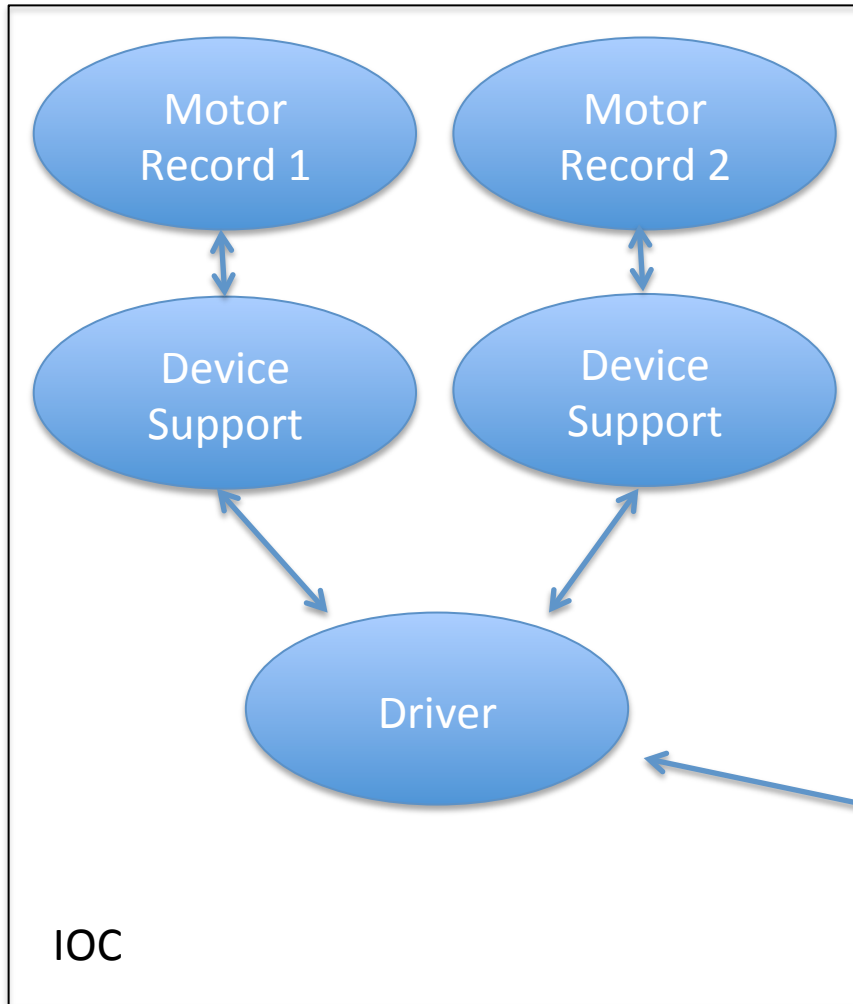
Frozen Offset Variable
 DVAL 0.0000

Alarm
Calibration
Command
 OFF 0.0000

Limit
Link/Misc
Motion

Resolution
Servo
Status

EPICS IOC Details



- Motor record for each axis.
- Device support layer for each record (driver abstraction layer)
- Parker/XPS/PI/... driver. Based on the ASYN framework (see Talk by Mark Rivers).

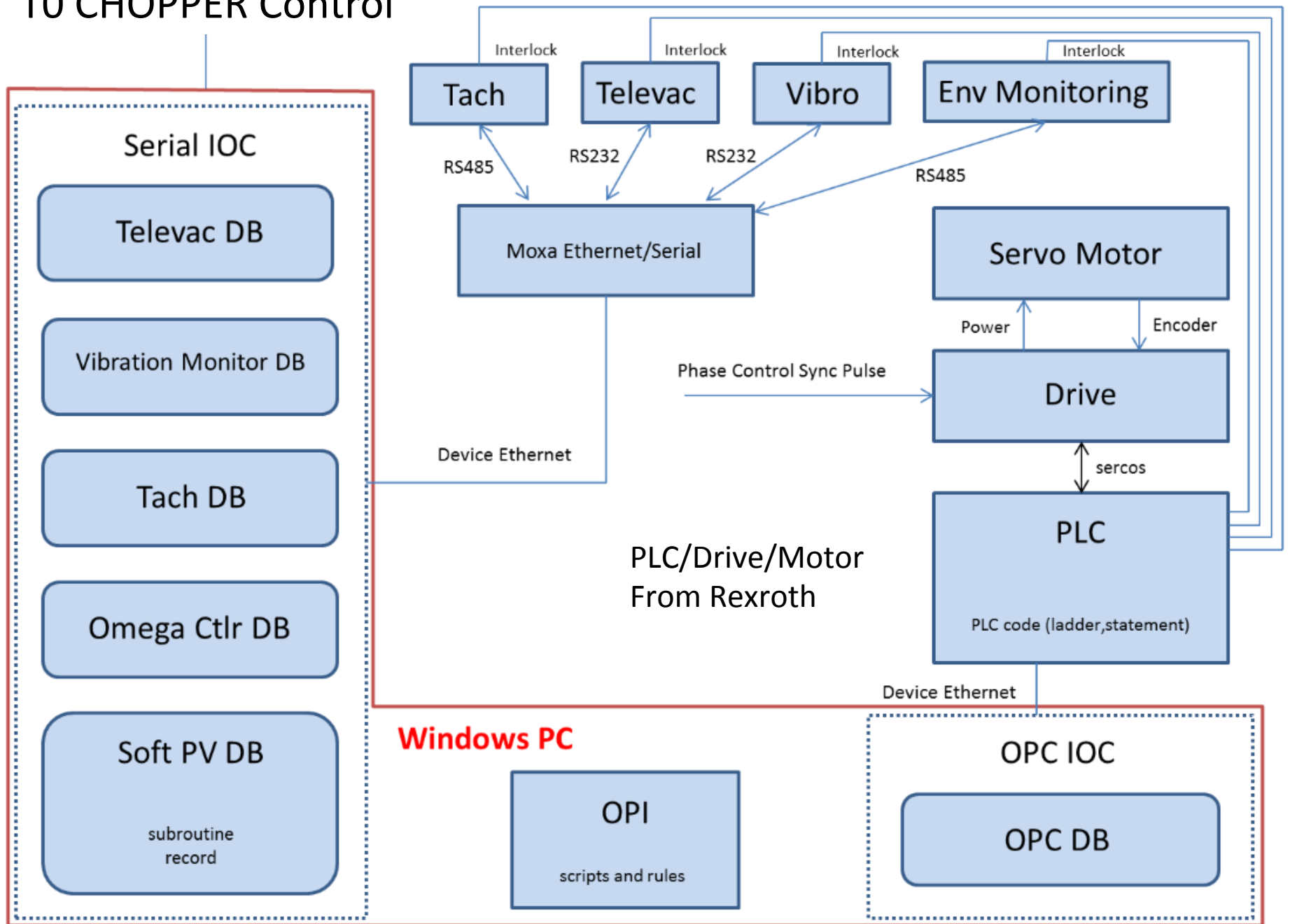
Driver typically has threads for:

- Command/response
- Position polling
- Misc long operations

TCP/IP



T0 CHOPPER Control



Motion Control Plans (software point of view)

- Roll out EPICS support for more beamlines. 3 beamlines in progress.
- Port EPICS Parker driver to new ASYN C++ framework (Mark Rivers).
- Develop more comprehensive motor control software for Parker (tuning, configuration, data gathering).
- Use virtual machines for Windows XP support.
- Support robotic sample changer in EPICS.

Motion Control Plans (hardware point of view)

Most beamlines are near completion. Possible future requirements:

- More use of positioning at the sub-micron scale.
- Support for continuous motor scanning/triggering.
- Update of chopper control hardware.