Introduction to Vulcan 20-20 Laser

Rebecca Harding

Vulcan

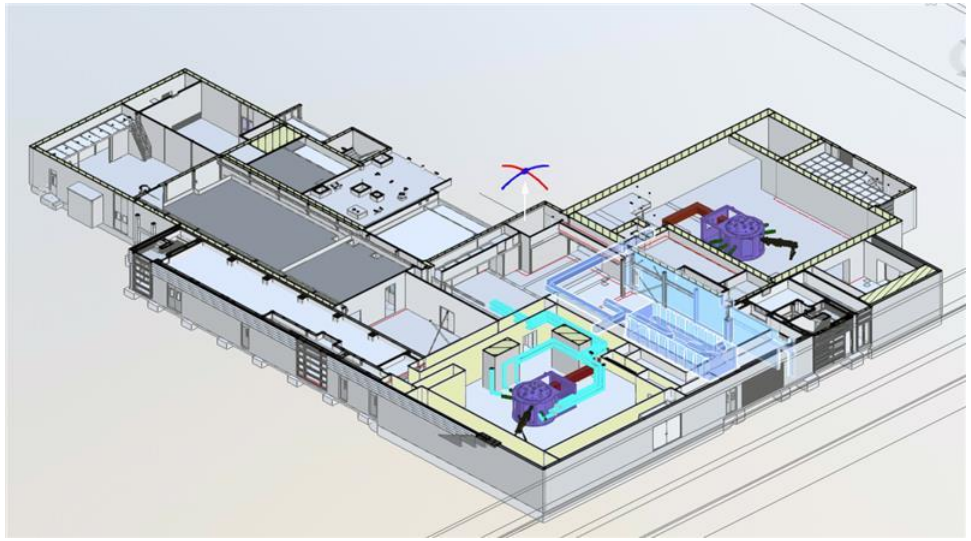
- High powered Nd:glass amplifier, CPA laser system
- Built late 1970s, numerous upgrades
- 8 beam lines:
  - 6 Long pulse beams (nano seconds)
    - 50 to 300J per beam
  - 2 Short pulse beams (femto seconds)
    - 1PW beam, 500J in 500fs
- 2 target areas
- Guinness Book of World Records 2005 highest-intensity focussed laser in world

Existing Vulcan facility layout

Science and Technology Facilities Council

Vulcan 20-20

- Exciting new £82M upgrade of Vulcan
- Deliver 20PW, 400J in 20fs (20x peak power)
- OPCPA technology
- Improve shot rate from 20 to 5 min
- Set to be the most powerful laser in the world again
- Science:
  - Replicate interstellar conditions
  - Research fusion energy
  - Plasma physics
  - …and more



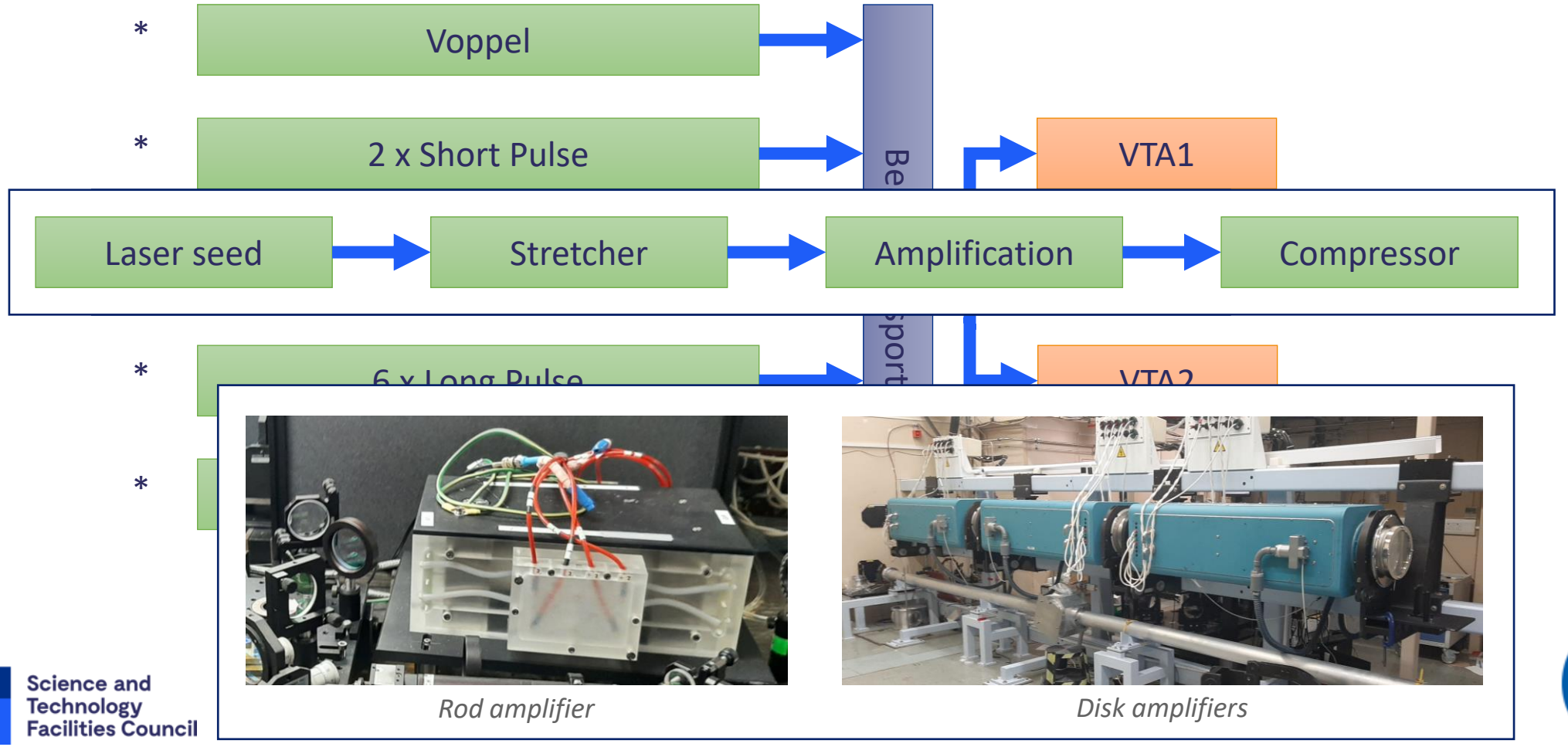
Vulcan 20-20 proposed layout

https://www.clf.stfc.ac.uk/Pages/Vulcan-2020.aspx

Science and Technology Facilities Council

central laser facility

Vulcan 20-20



Rod amplifier

Disk amplifiers

Science and Technology Facilities Council

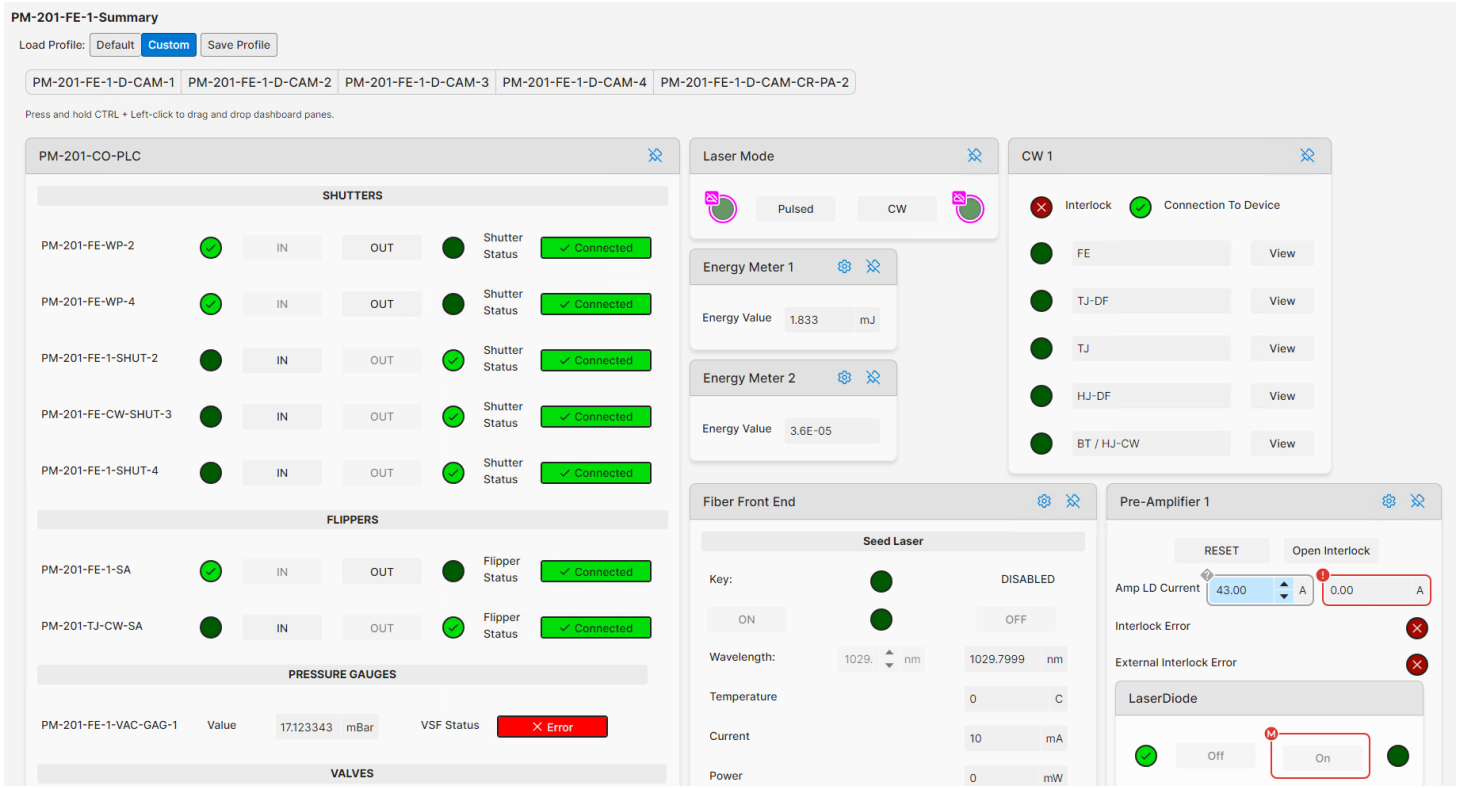
central laser facility

Architecture Overview

- EPICS-based control system
- PV Access over Channel Access where possible
- PVA Gateway
- EPICS IOCs Functionality:
  - Device status/control
  - Soft IOCs
  - PLC Interface using OPC UA (status and control)
  - Motion Control
  - Area Detector (cameras)
  - DAQ Modules (data capture)

Architecture Overview

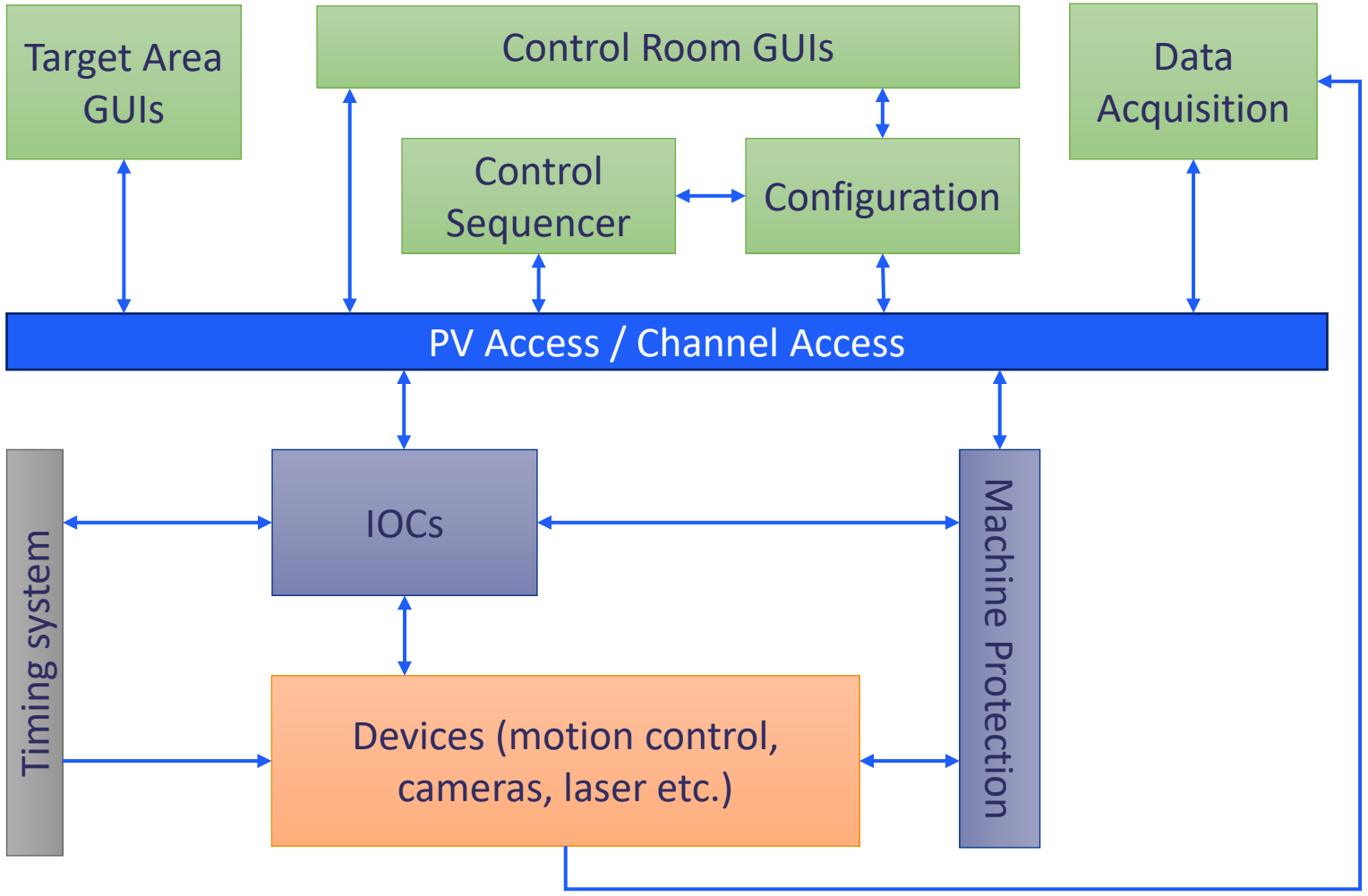
- User interfaces will be a combination of Phoebus and Blazor
- Automated control/data capture whenever possible
- Data Management
  - Adopt tools & architecture (where suitable) from EPAC



Example Blazor screen

Science and Technology Facilities Council

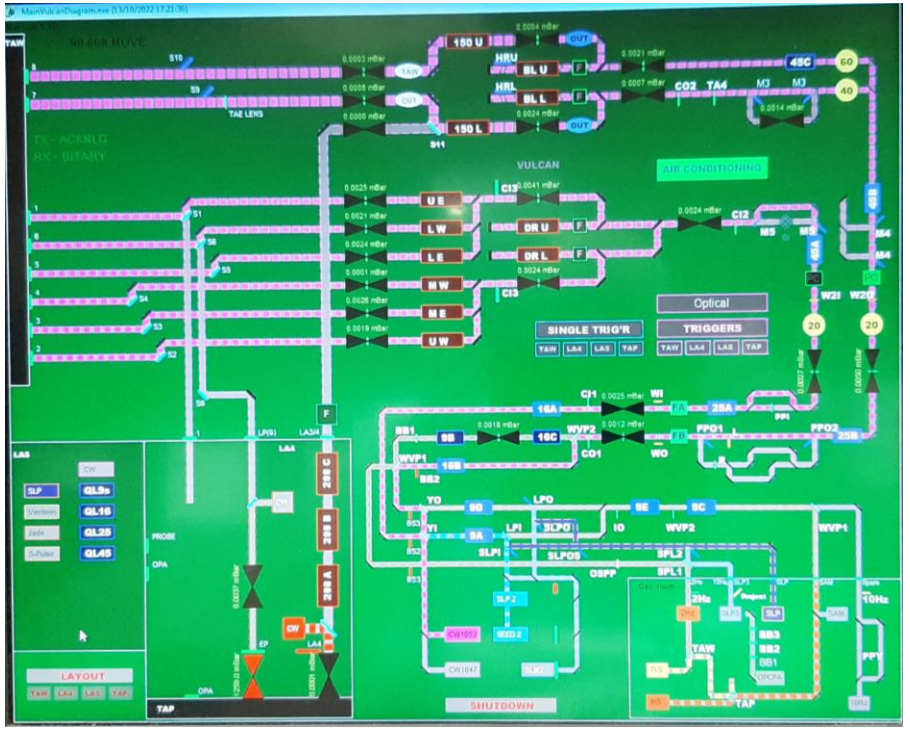
Architecture Diagram



Science and Technology Facilities Council

Software Controls - Challenges

- Increased repetition – increased automation
- Instrumentation platform
- Highly configurable system – more machine safety tasks
- Network and security
- Deployment



Control screen

Science and Technology Facilities Council

central laser facility

Software Controls - Strategy

- Consider new technologies
- Reuse IOCs, drivers etc. where possible
- Learn lessons from CLF EPAC project
- Learn lessons and experience from the community

EPAC (Extreme Photonics Application Centre)

Science and Technology Facilities Council

central laser facility

Science and Technology Facilities Council

Thank you

Facebook: Science and Technology Facilities Council

Twitter:@STFC_matters

YouTube: Science and Technology Facilities Council

CLF central laser facility