



Science and  
Technology  
Facilities Council

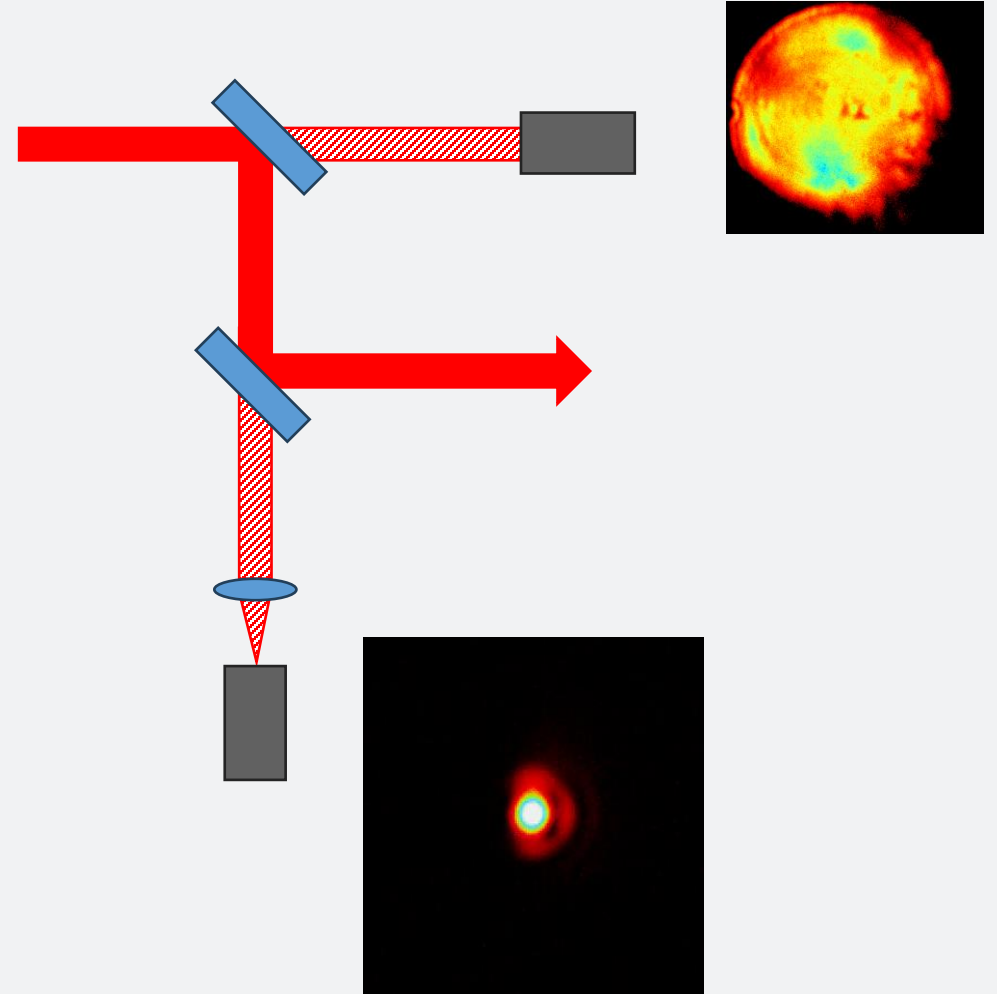
Central Laser Facility

# The EPAC camera system

EPICS collaboration meeting April 2025

# Use of cameras in EPAC

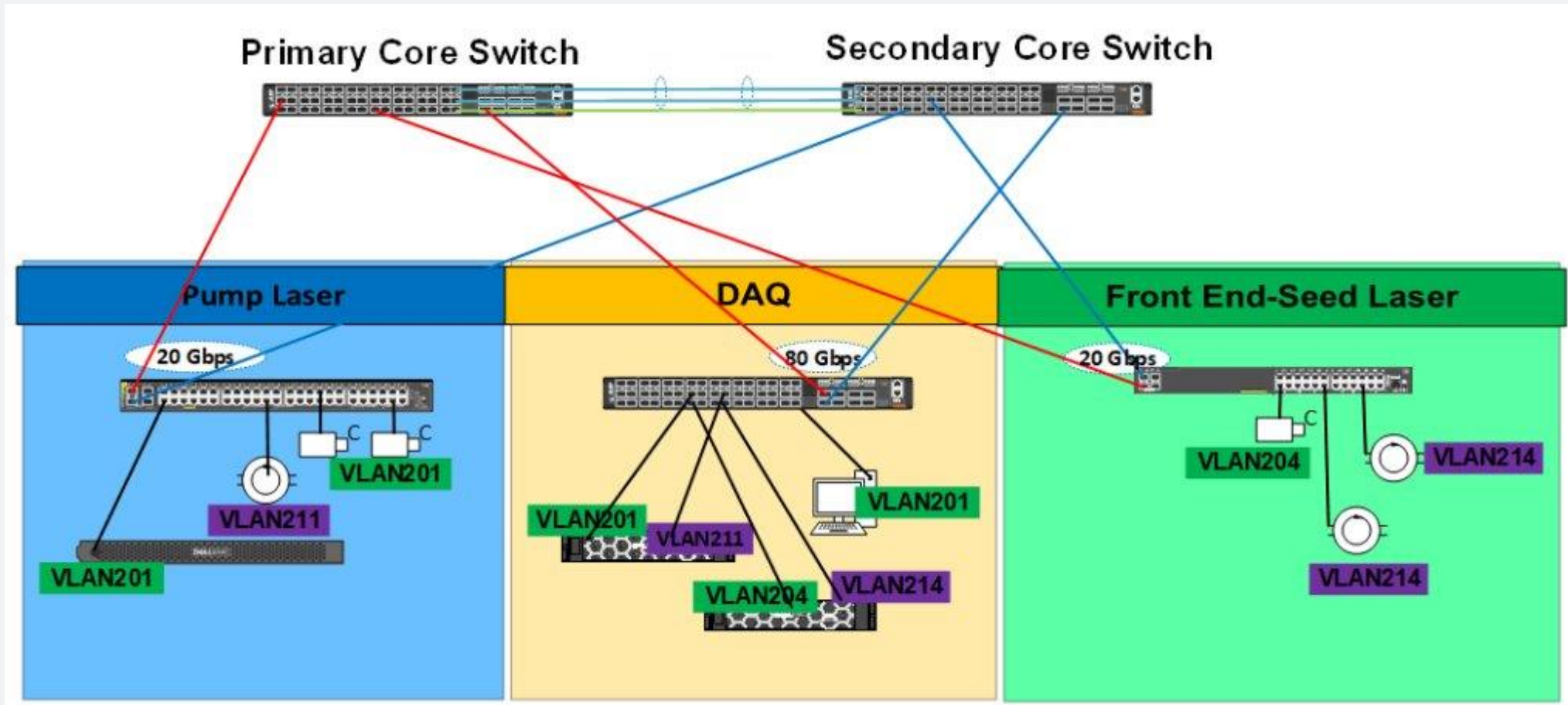
- Detect the position of the laser and direction of travel by operators and automated systems
- Calculate the energy in the beam (integration + calibration)
- Monitor beam quality and optical damage on key components



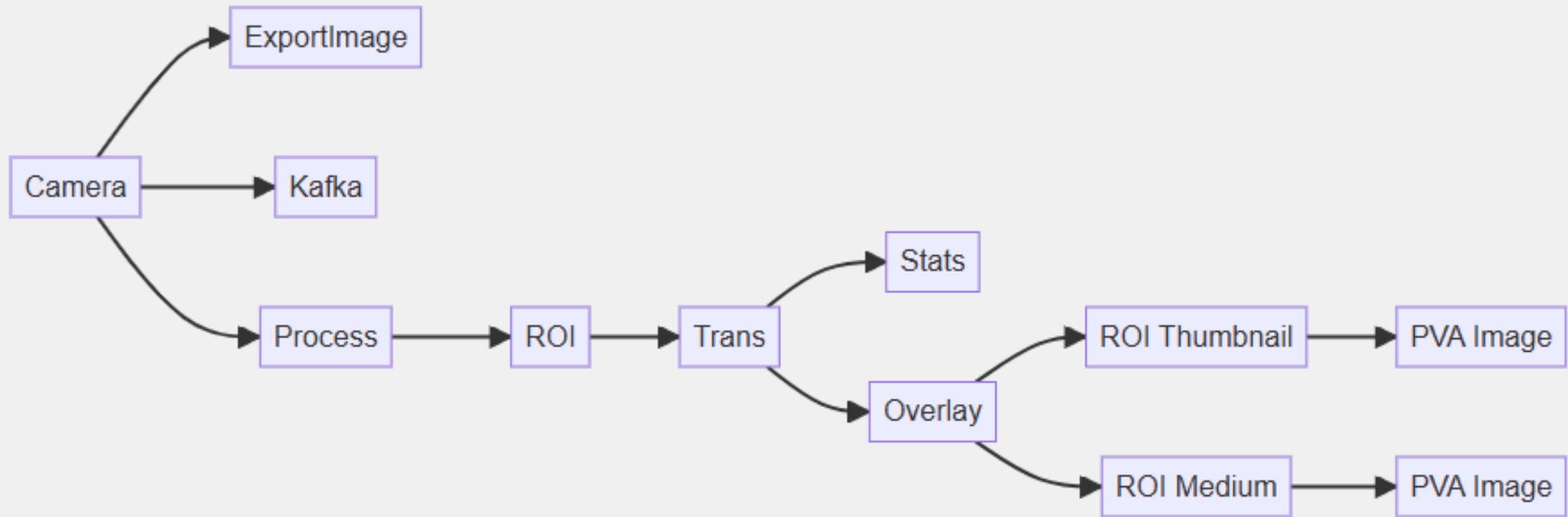
# Requirements (worst case)

- System designed for 2.3 Mp, 16-bit, 10Hz => approx. 400 Mbps
- Each area has up to 40 cameras => approx. 15Gbps
- Central control room up to 200 cameras => approx. 75 Gbps
- Centroid, integration, cross-sections, (FWHM, other beam metrics)
- Full resolution images available for saving

# Network Layout



# areaDetector plugin chain



# Camera distribution

- Up to 20 Camera IOCs per server in production
- Servers have a 10G network interface card
- CPU usage of 45-50 % and network utilization of approx. 3.5G
- Moving to deploying into VMs – current limit 8 cameras per VM

# NDStdArray Vs NDPVA

Camera Dimension = 1936 x 1216 @10Hz

| Description      |            | Server  |          |          | Client (CSS) PC |             |
|------------------|------------|---------|----------|----------|-----------------|-------------|
|                  |            | CPU (%) | Network  |          | CPU (%)         | Network(/s) |
|                  |            |         | Incoming | Outgoing |                 |             |
| NDStdArray + CSS | 1 Camera   | 2.2     | 180M     | 180M     | 16              | 202M        |
|                  | 16 Cameras | 34.6    | 2.88G    | 2.8G     | 44              | 2.8G        |
|                  |            |         |          |          |                 |             |
| NDPVA + CSS      | 1 Camera   | 2.2     | 180M     | 180M     | 10              | 190M        |
|                  | 16 Cameras | 31      | 2.7G     | 2.8G     | 30              | 3G          |

# Binning

| Description   |            | Client (CSS) PC |             |
|---------------|------------|-----------------|-------------|
|               |            | CPU (%)         | Network(/s) |
| 2x2 binning   | 1 Camera   | 31              | 345Mbps     |
|               | 16 Cameras | 58              | 2.8G        |
|               |            |                 |             |
| 5 x 5 binning | 1 Camera   | 30              | 165Mbps     |
|               | 16 Cameras | 45              | 270Mbps     |

# Operational considerations

- Triggering multiple cameras simultaneously can cause frame drops.
- Memory buffers may become a bottleneck, especially with concurrent data streams from multiple detectors.
- The Camera IOC needs re-start because the IOC gets frozen after 4/5 days of acquiring the image.

# Next steps

- Integrate EPICS gateway in EPAC
- areaDetector plugin for beam metrology (FWHM,  $1/e^2$ , beam circularity, kurtosis...)?



Science and  
Technology  
Facilities Council

Central Laser Facility

# Thank you