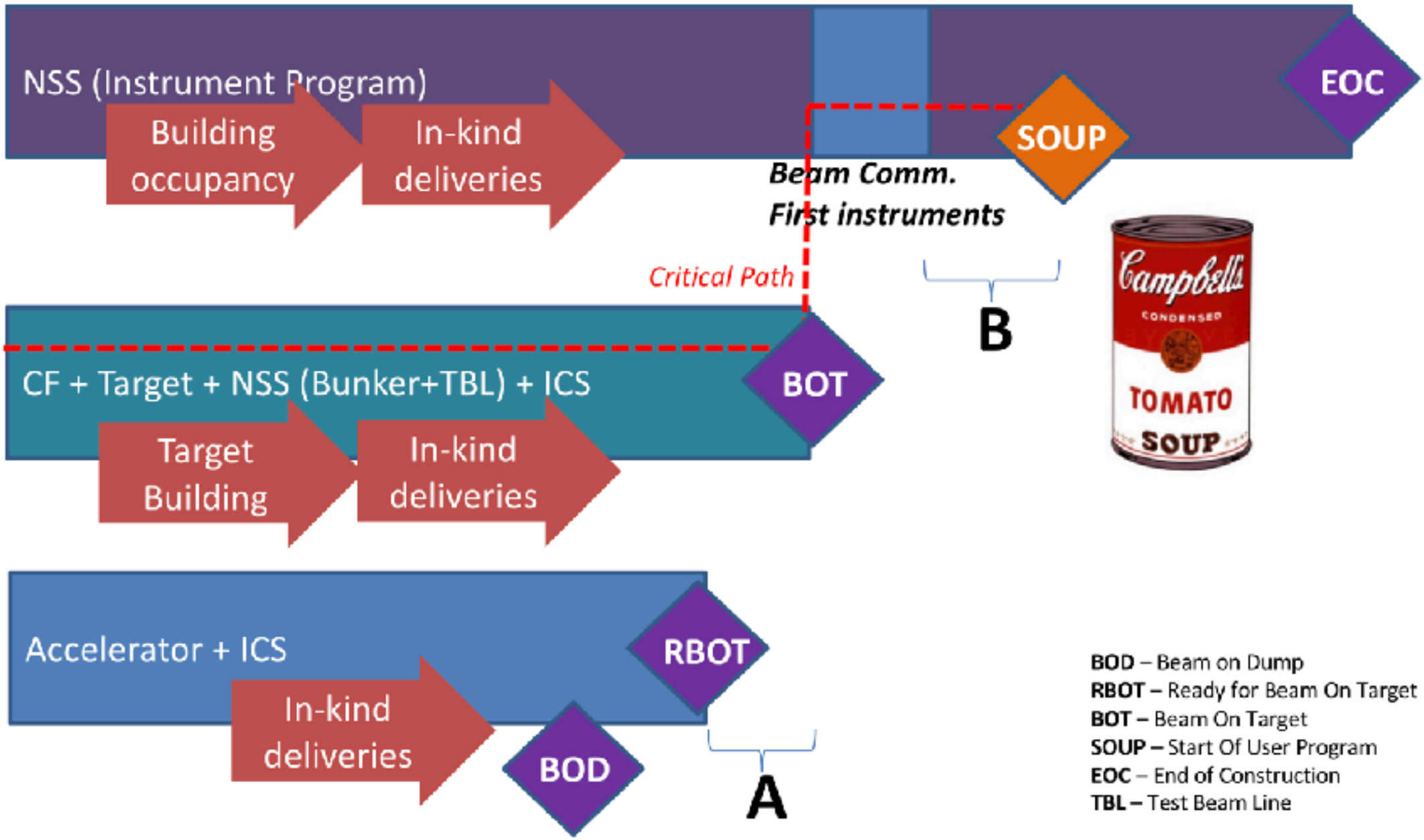
IKON 14 ICS and DMSC Session

Jon Taylor

13 Feb 2018

High level schedule

Commissioning with neutrons is *quite* compressed



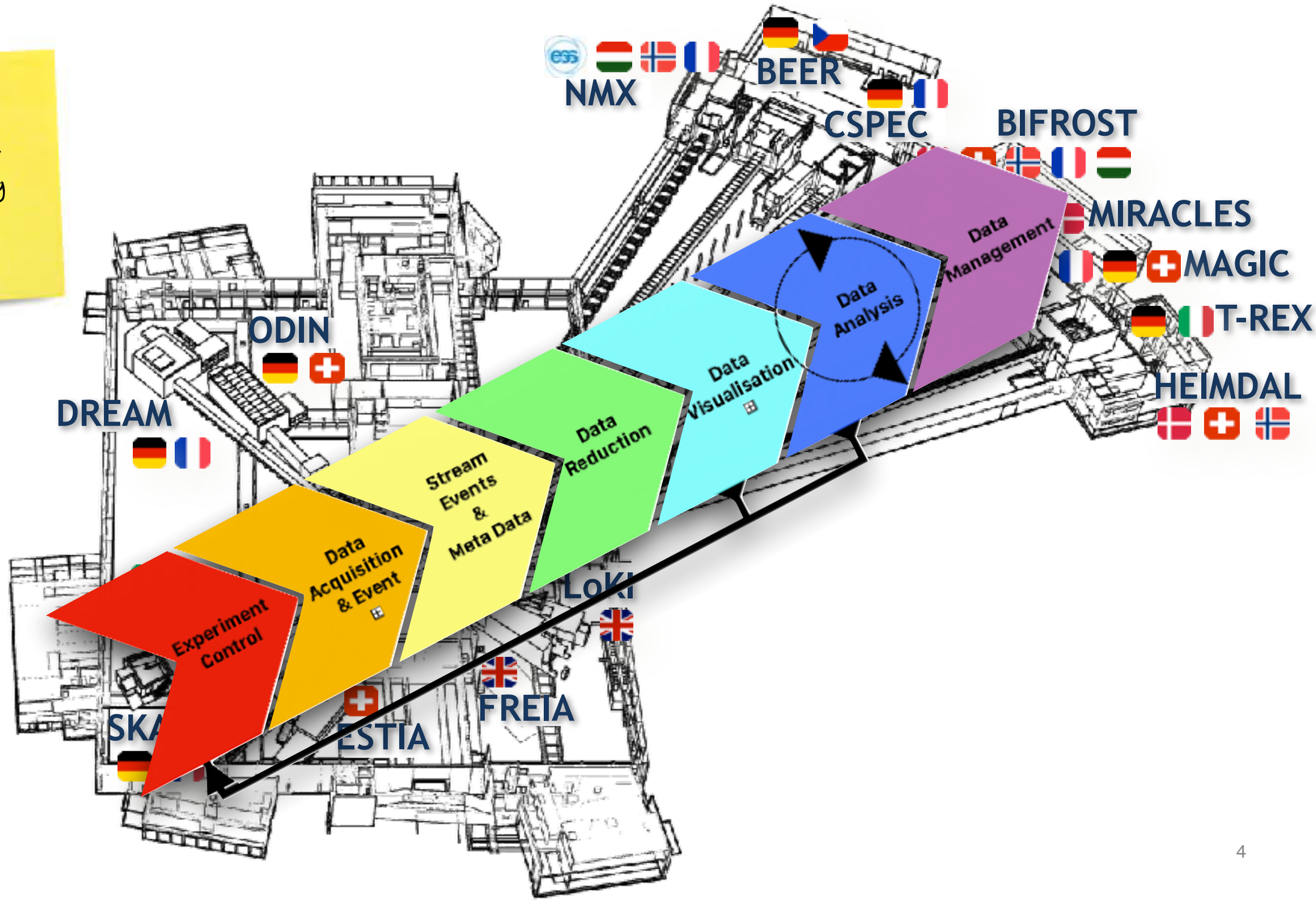
BOD – Beam on Dump
RBOT – Ready for Beam On Target
BOT – Beam On Target
SOUP – Start Of User Program
EOC – End of Construction
TBL – Test Beam Line

Outline

- Integration update
- TG3
- Installation and Commissioning

DMSC

TO DO:
Scientific computing for this



Data Management and Software Centre

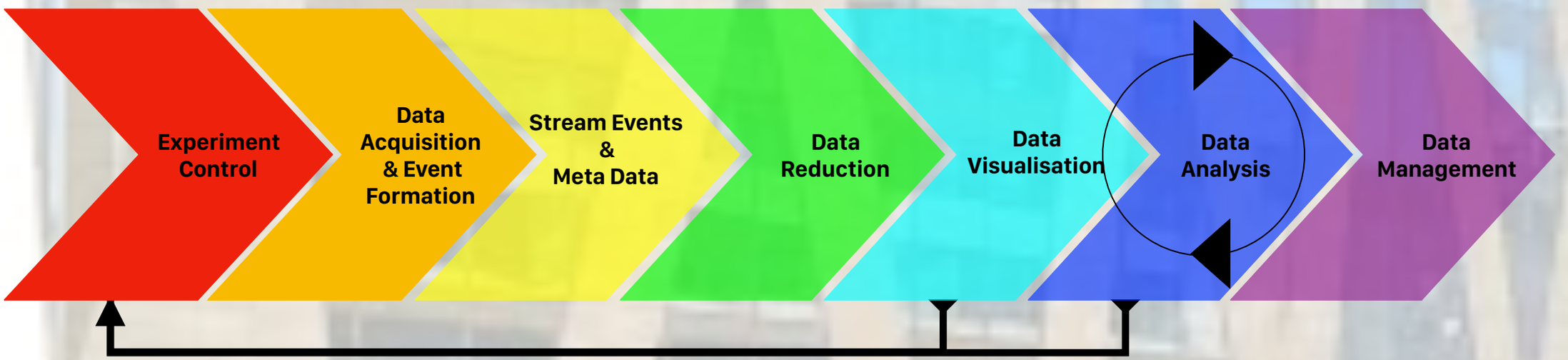
Provide world leading scientific software and scientific computing support for neutron scattering at ESS

- Construction budget 20M euro
- Staff 2018 27 + 8
- Staff 2028 60

Scientific Software development.
- Experiment control
- Data acquisition system
- Data reduction, analysis & modelling

Data centre operations.
- Dual location - Lund & Copenhagen
- Data management and curation

User programme support
- Instrument Data scientists
- User office software
- Remote access to data and software tools



Architecture strategy

- Centralised scientific computing
- Maximise common features
- Promote ease of maintenance
- Ensure quality
- Standard approach across facilities

Instrument specific Data analysis Data reduction Instrument control	LOKI	Skadi	CSpec	TREX	BiFrost	MIRECLE	Vespa	DREAM	HIEMDAL	NMX	MAGIC	FRIEA	ESTIA	ODIN	BEER
Data analysis Data reduction	SANS		Direct geometry		Indirect geometry			Diffraction Powder		Diffraction XTAL		Reflectometry		Imaging	Engineering diffraction

Live data reduction Framework and visualisation

Experiment control Framework

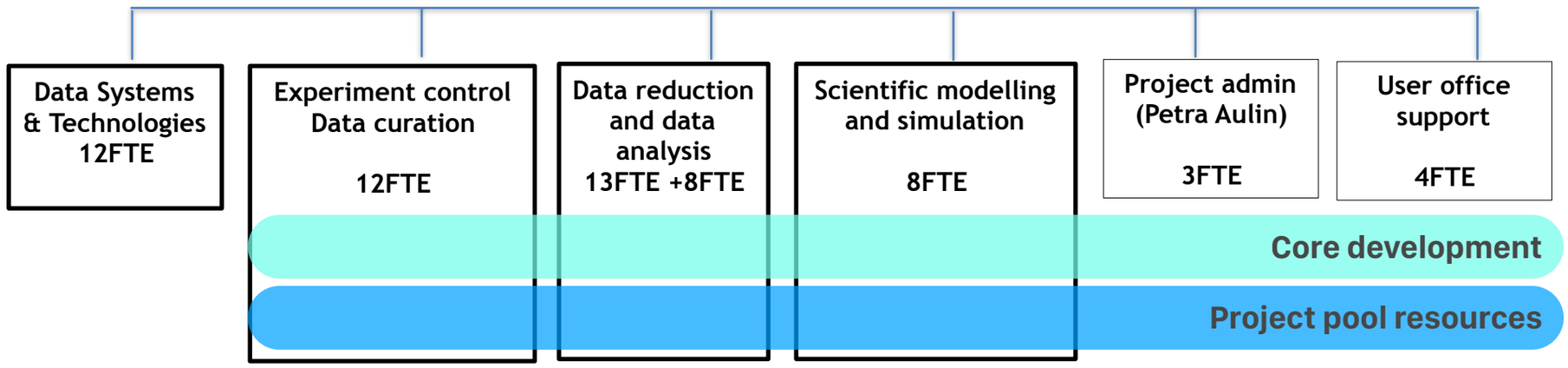
DAQ, Data Management and Data curation

Detector readout

User office

Compute & storage

What can DMSC realistically deliver



- SL 0 - Control of instruments and acquisition of data, archive and curation of collected data
- SL 1 - Framework for manual data reduction, Data analysis packages manual operation
- SL 2 - Automated reduction workflows, automated analysis – experiment control feedback
- SL 3 - Support for advanced analysis and simulation

TG3

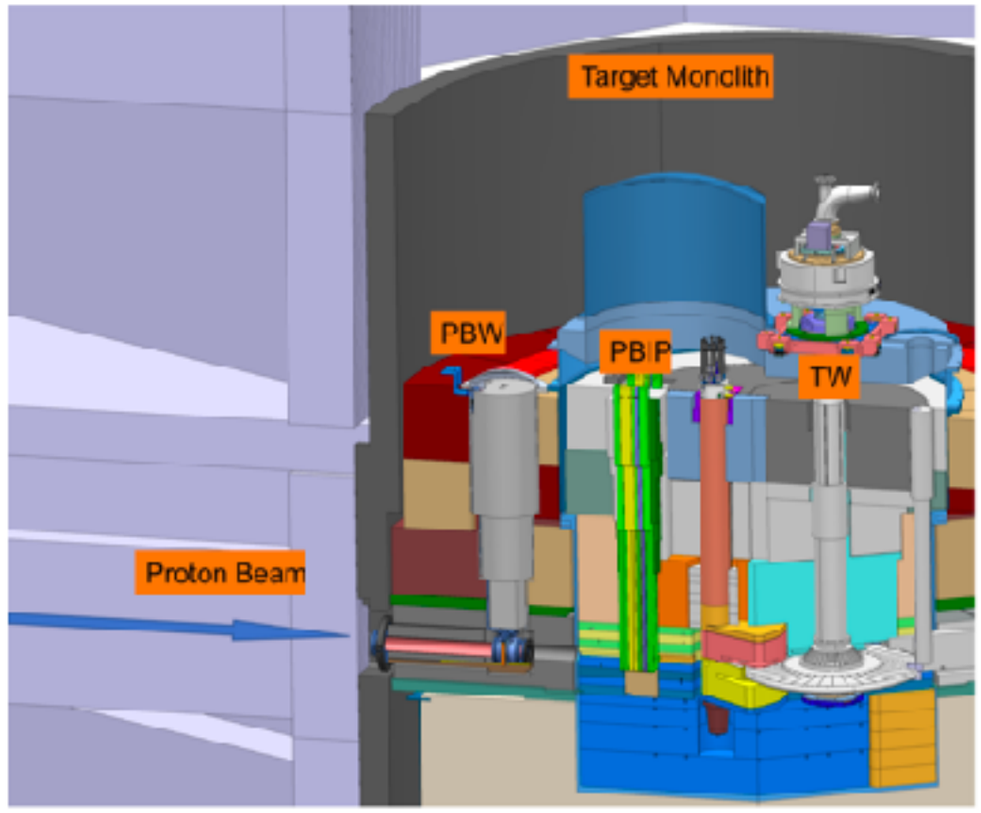
- DMSC will be a TG3 reviewer
- Data chain shall be defined and agreed
- Excursions from standards will be highlighted
- Commissioning and operations

TG3 continued

- detectors and detector readout
  * expected rates (simulation or sensible estimation)
  * technology
  * integration model
- beam monitors
  * types, rates and uses
- standard data acquisition operations
- expected calibration procedures
- commissioning plan

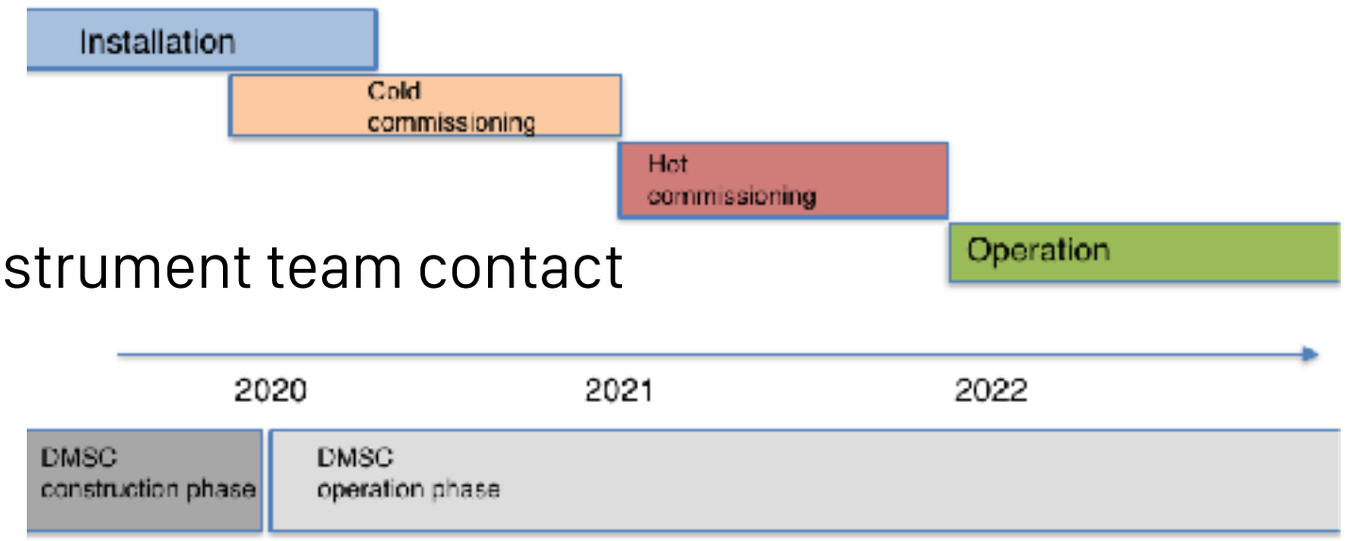
Synchronisation and Monitors

- Accelerator provide at any given rep rate
  - Start of cycle signal
    - Beam On Target - 10microS
  - T_0 rising edge from grid monitor at PBIP
    - Timing system event - low latency
- Definition of Time = 0 may need to sync to a known monitor position



Instrument Software projects

- Summary document for 2017 workshops at ESS-0148155
- Scientific software Scope will be delivered with project management
- 1 instrument 1 project
- PM at DMSC
- Sponsor NSS project team
- Customer Lead scientist
- Project scientist - Lead scientist or Instrument team contact
- Start date
  - Instrument schedule is needed
  - After ESS re-baseline
- End date: instrument in UP



Requirements

- High level requirements capture
- Abstraction to
  - Crystallography
  - LSS – (Need sans)
  - Spectroscopy
  - Imaging & engineering
- Instrument schedule milestones

Software requirements for diffraction (DREAM, MAGIC, BEER, HEIMDAL)

Data Reduction and Visualization

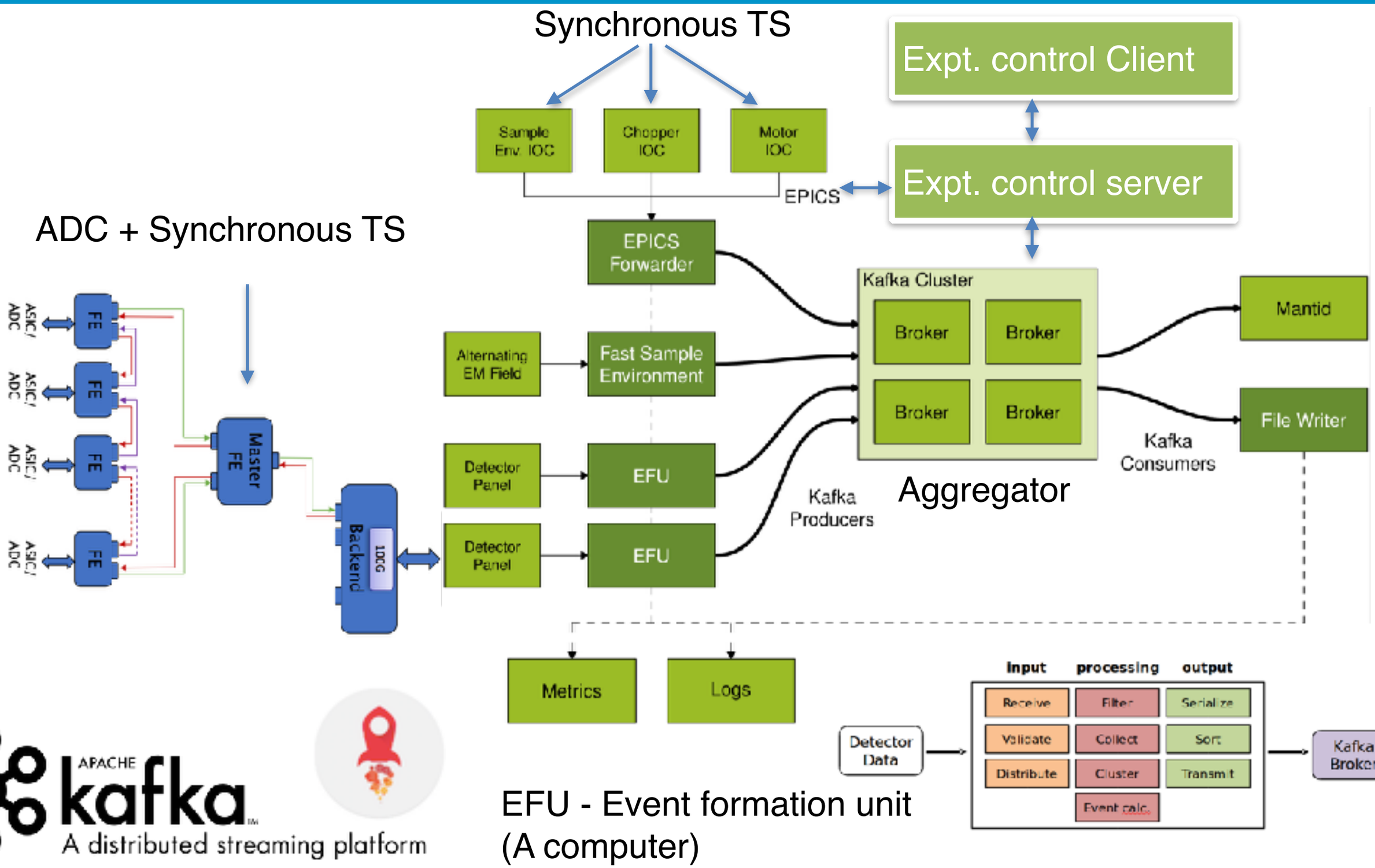
	DREAM			HEIMDAL			MAGIC			BEER		
M = Must, S = Should, N = Nice	M	S	N	M	S	N	M	S	N	M	S	N
Reduction algorithms							X					
Normalize for detector efficiency	X			X			X					
Normalize for incident beam spectrum	X			X			X					
Correct for the Lorentz factor							X					
Convert each event to Q-space, intensity, weight	X			X			X					
Find peaks		X			X·		X					
Find the best orientation matrices		X			X·		X					
Find possible propagation vectors (user input required to constrain lattice parameters)		X					X					
Predict position of all relevant peaks		X			X·		X					
Integrate intensity (spherical, ellipse, cylindrical) for each polarization channels (up to 6)		X					X					
Export to hkl, intensity, error, ASCII file		X					X					
Automatic reduction to 1D Rietveld in GSAS, TOPAS and FULLPROF formats	X			X								
Reduction to PDF format	X			X								
CLI & GUI Interfaces												
Fully python scriptable, including SH	X			X			X					
Advanced user GUI with all parameters available		X			X		X					
Simple GUI with minimal input from	X			X			X					

Edge Cases and 2018 workshops

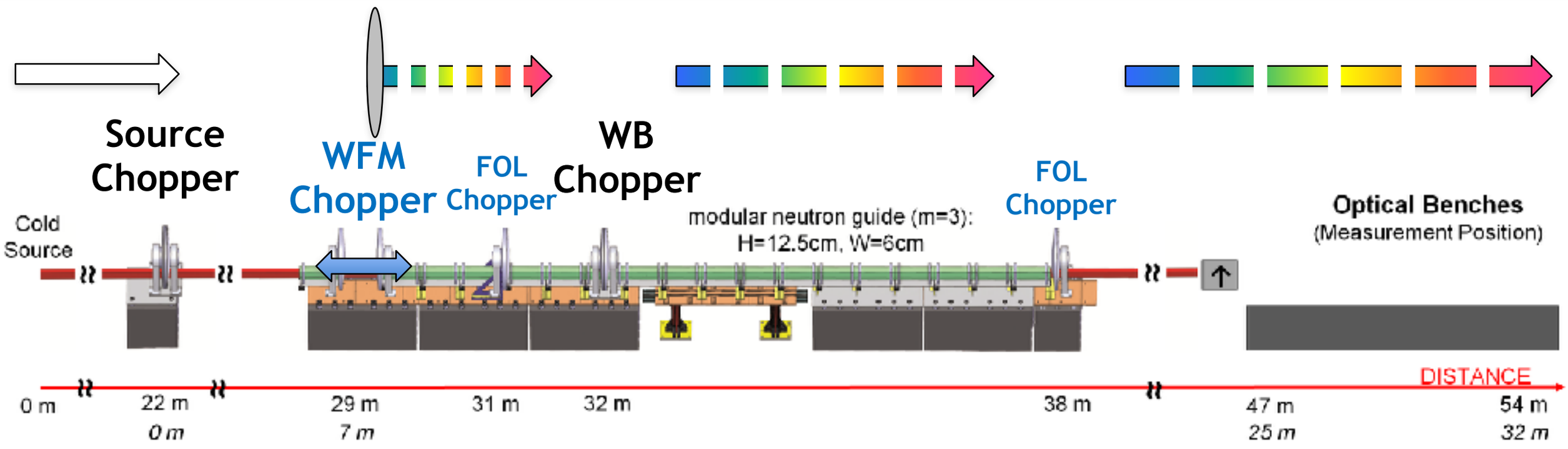
- Coordination meeting 12th September ESS-0148156
- Instrument Class Coordinators & DMSC management team

Mtg Nr.	Point Nr. & Action	By
#1	Instrument teams to complete requirements matrix	Class coordinators to coordinate collection
#2	Organise NMX software workshop	Esko
#3	Organise engineering diffraction workshop	Robin & Thomas
#4	Discuss / document standardisation requirements for treatment of polarised neutrons at ESS	Jon & Werner
#5	WFM processing & lessons learned presentation	Robin
#6	Document proposing a Software development project governance structure for inkind	Jon
#7	Workshop on user experience and remote access	Sune
#8	Proposal for how to communicate current Mantid functionality	Jon
#9	Organise Data management and curation meeting	Tobias
#10	Single crystal strategy meeting	Jon, Werner, Thomas , Esko
#11	Setup Nicos demo environment for ESS building 205	Jon / ID group

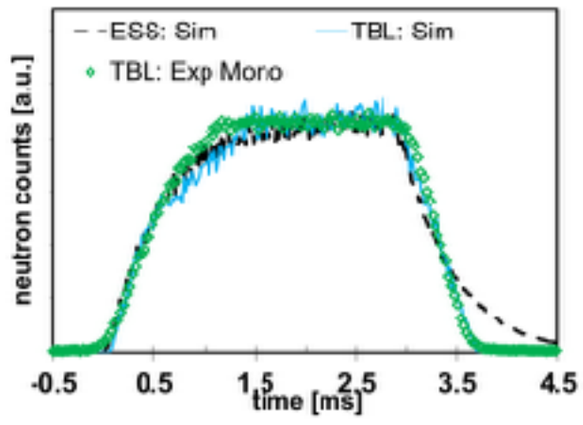
ESS DAQ architecture & update

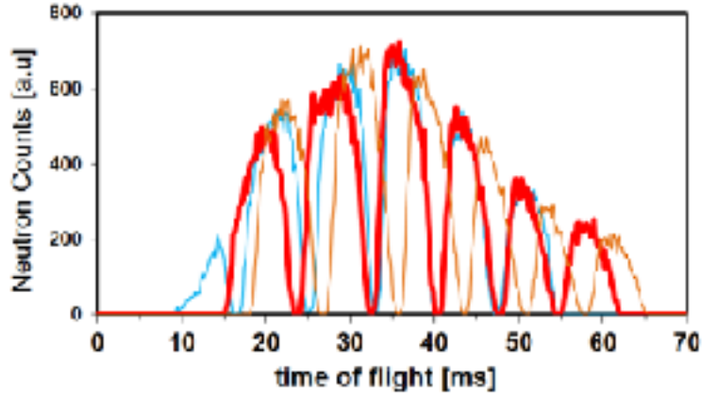


ESSIIP on V20 Test beam line



- Full scale prototype
- Tests controls and DAQ architecture
- Prototypes WFM mode data processing





brightness Full Integration Tests at HZB V20

EUROPEAN SPALLATION SOURCE

ICS Chopper Group
Detector Group DMSC

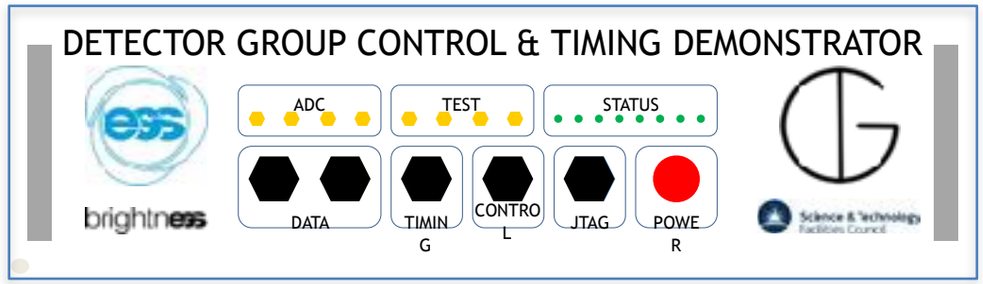
First Session – November:

- Demonstration of Timing
- Chopper low level control and operations
- Readout of TDC values and beamline metadata

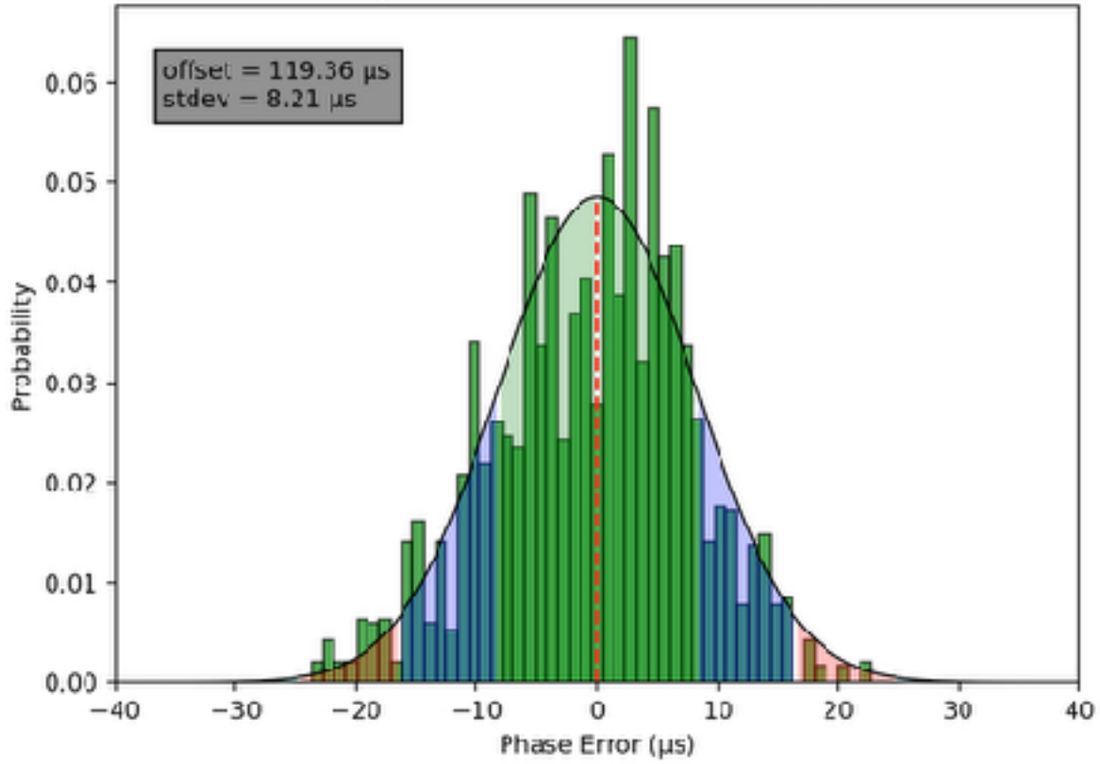
Second Session – January:

- EPICS and NICOS control of chopper and beamline
- Readout of monitors through DG system
- Processing and storing of event data

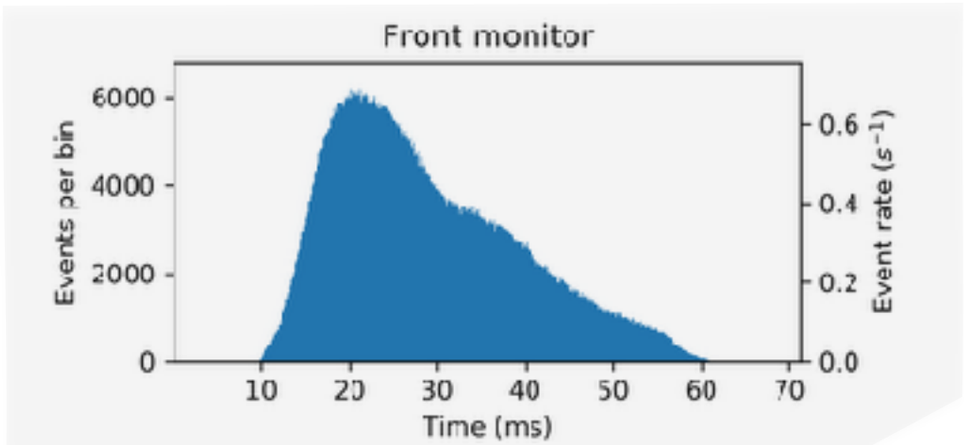
Future: Wavelength Frame Multiplication, Sample Environment, Motion Control

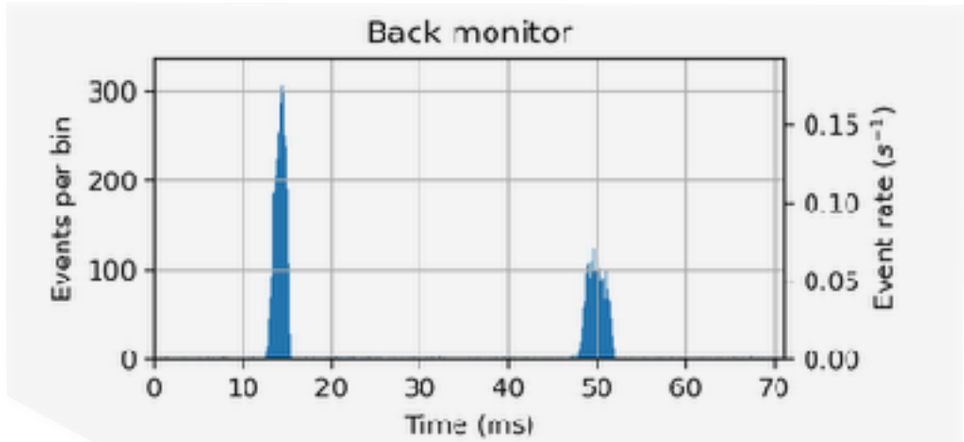


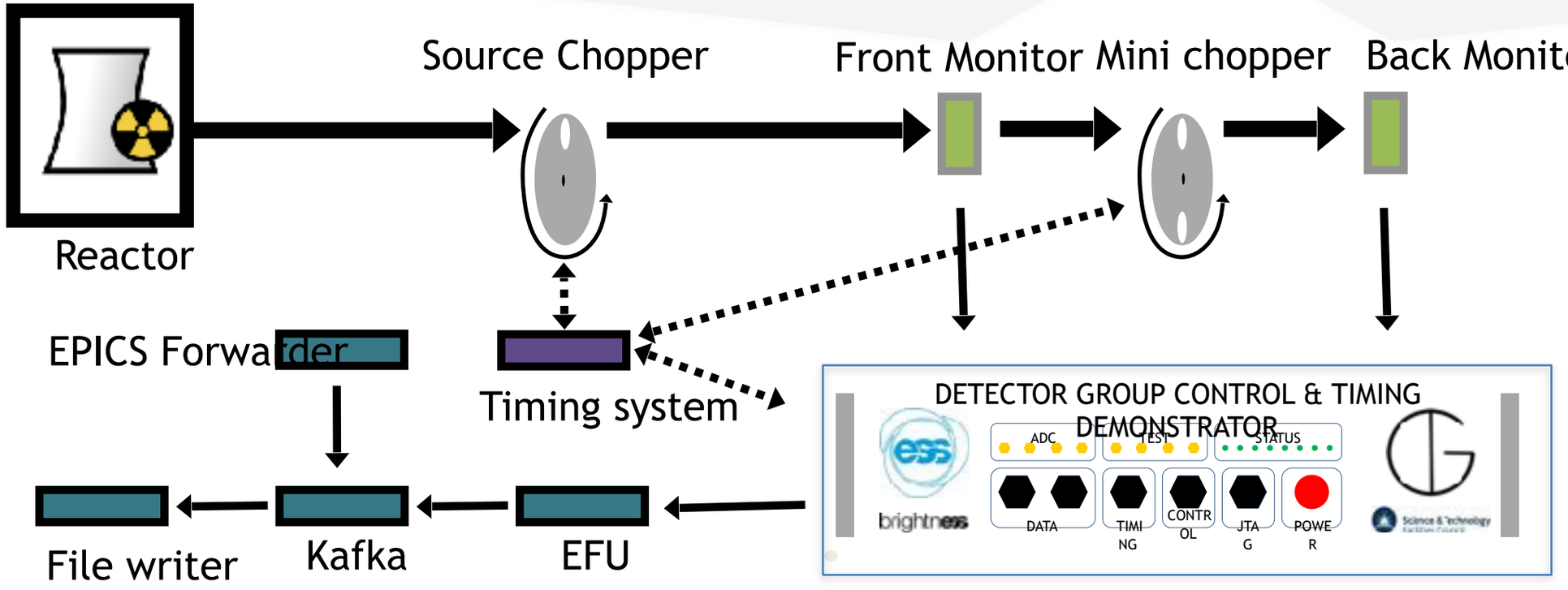
Histogram of Phase Error (Mini Chopper)



Control and Readout



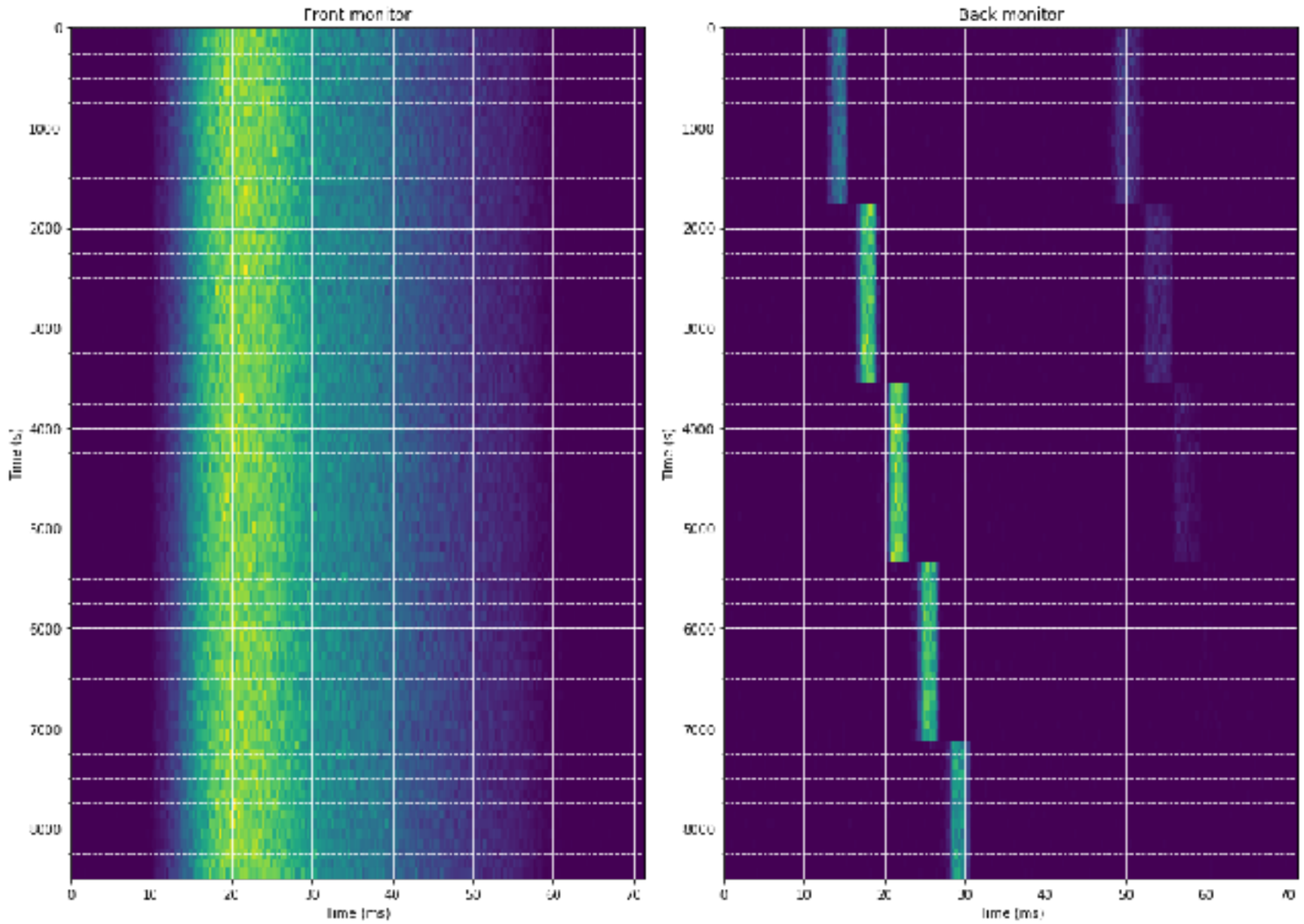




Networked Instrument COntrol System

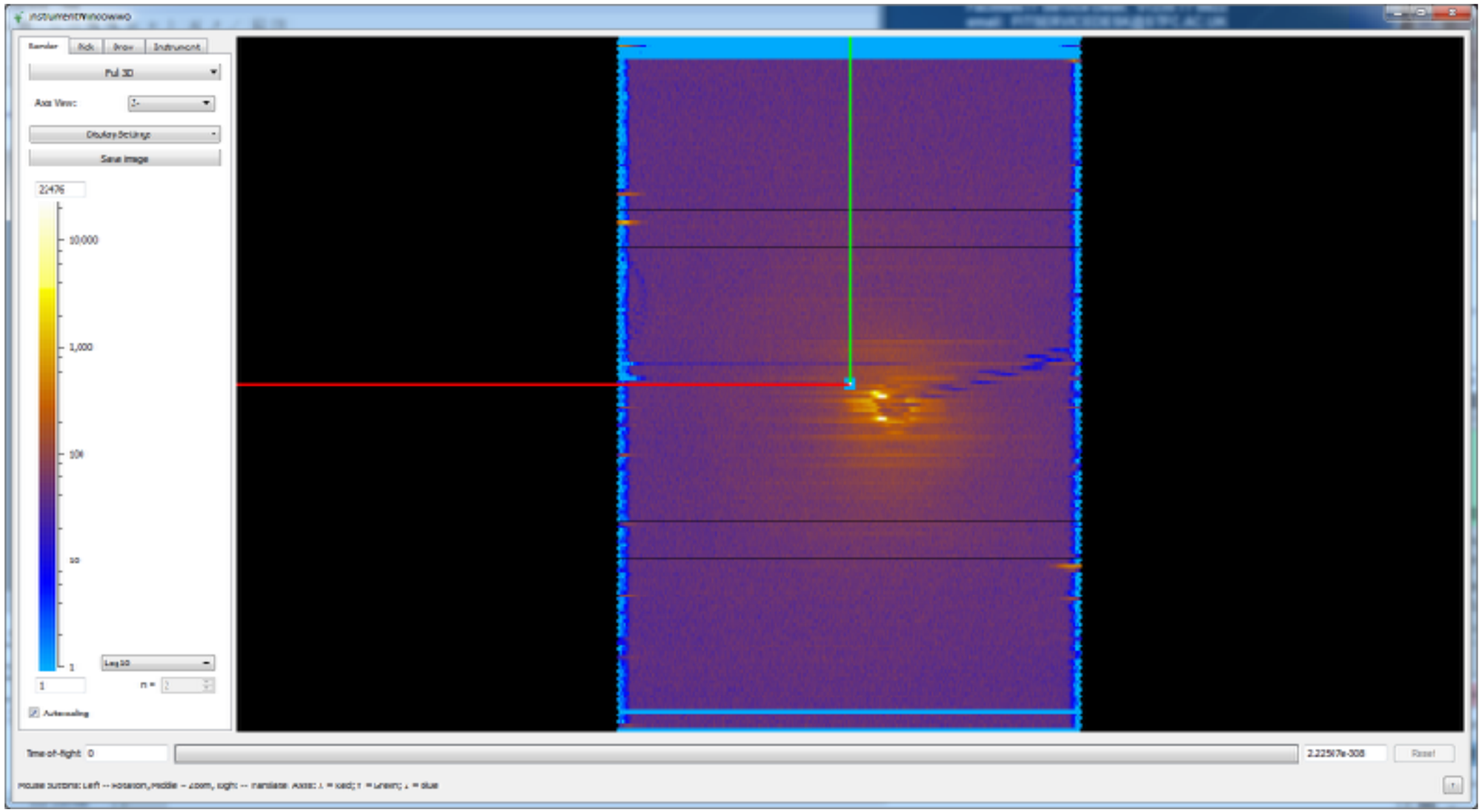
V20 Summary

- Chopper and its control (CHIC) are performing as expected
- NICOS has high level control of the chopper and most V20 equipment
- Monitors acquire useful data
- DG readout electronics capture the signals correctly
- EFU can process the data sensibly
- Data Streaming with Kafka and
- HDF5/NeXus file writing works
- We have gained better understanding of the devices from the data captured
- Timing works in principle
- Better idea of priorities for future tasks



Data streaming update

- DMSC Technology deployed at ISIS
- Running on Zoom



Installation and commissioning

- SNS commissioning plan documentation taken as a guide.
- We assume instrument team consists of 2 scientists. + 0.5 Instrument data scientist

- **Phase 1 commission and verify beam-line components**

  5 key staff - 1 ICS 1 DMSC ECDC 0.5 FTE DST

  32 days BOT

- **Phase 2 verification of source and beam-line performance**

  20 - 30 days (BoT)

  5 staff — 1 ECDC 1 - DRAM 0.5 Instrument Data Scientist

- **Phase 3 Commissioning experiments**

  50 days (BoT)

  1 - DRAM 0.5 Instrument Data Scientist

Phase 1

Timing system verification

Time-stamping accuracy and jitter

Delay compensation accuracy

Machine synchronisation

Target and moderator data verification

Moderator state

Moderator temperature

shutter verification

Chopper axis verification

Beam-line mechanical components commissioning and verification

Vacuum system verification

Monitor commissioning and verification

Detectors commissioning and verification

Fibre connection test - instrument positions —>CUB

DAQ

Verification that DAQ receives data from all sources

start / stop of DAQ

Verification of EFU process

data file verification Lund

Data file verification Cph

verification of DAQ operating modes - counting in 1st -2nd -3rd and so forth frames

Efficacy of soft vetos from time-stamped data

Detector evaluation and calibration

Phase 2 & 3

Measurement and verification of source spectrum

Measurement and verification of incident flux

Measurement and verification of guide divergence and beam profile at sample position

Calibration and alignment of guides and beam-line components

Measurement and calibration of beam-line operating modes

Verification of chopper cascade

- Bandwidth
- Resolution
- operating mode WFM / RRM

Verification of source performance

- Normalisation by current
- Normalisation by monitor
- Check of beam raster characteristics
- Ion sorce fluctuation evaluation
- Moderator performance check
- Performance verification for each target segment

Phase 3 Commissioning experiments

Any questions?