

General Assembly Meeting 2016

WORK PACKAGE 5

Real-Time Data Management of ESS Data

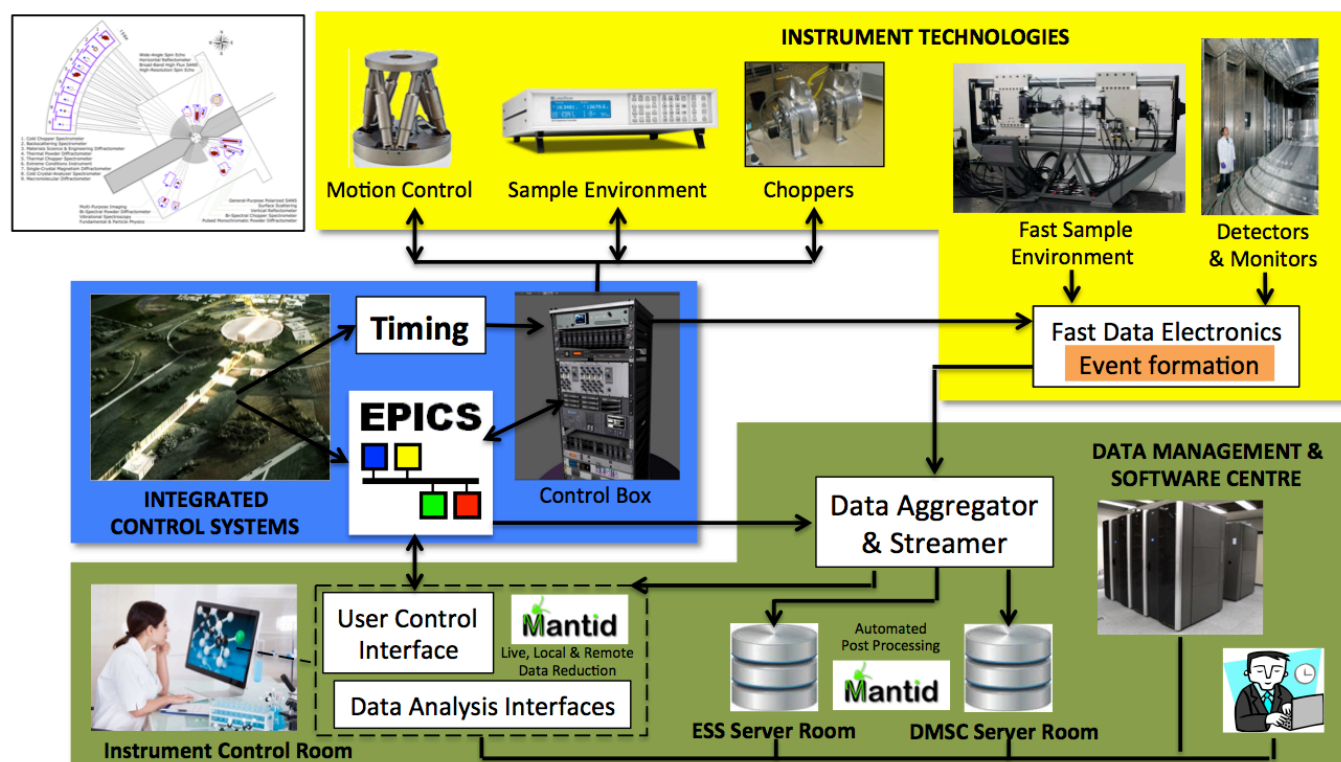
Tobias Richter



WP5 – Real time Management of ESS Data

- Captures technical scope that was not in the ESS TDR
- Offers new options for capturing data not available elsewhere
- Reduces risk in the ESS construction phase through collaboration with existing facilities, offering expertise and the ability to test under real conditions
- Fits into the Data Management Group of the Data Management and Software Centre (Copenhagen)

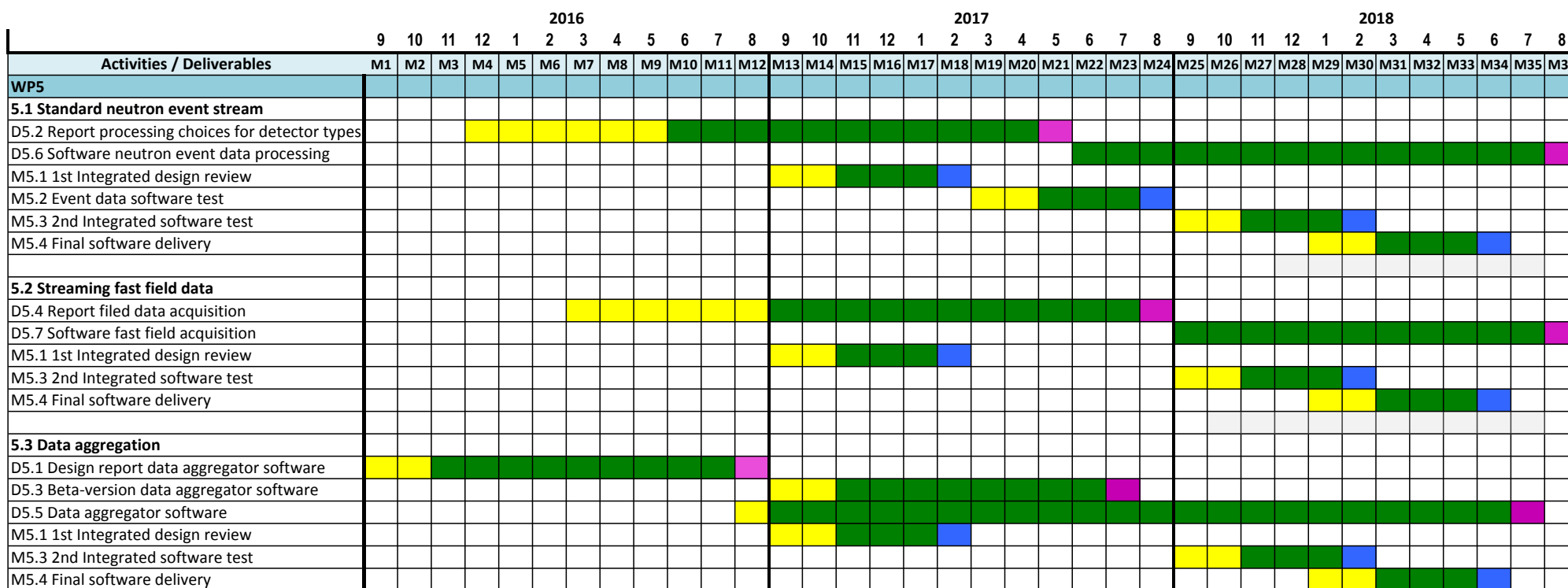
Overview of ESS Data Pipelines



Overview of WP5

Task 5.1	Creating a standard neutron event data stream for different detector types	ESS, KU
Task 5.2	Creating a standard method for streaming meta-data for fast applied fields	ESS, PSI
Task 5.3	Software to aggregate and make available neutron event data and sample meta-data	ESS, PSI, Elettra

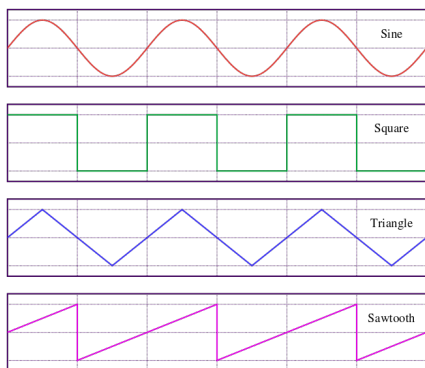
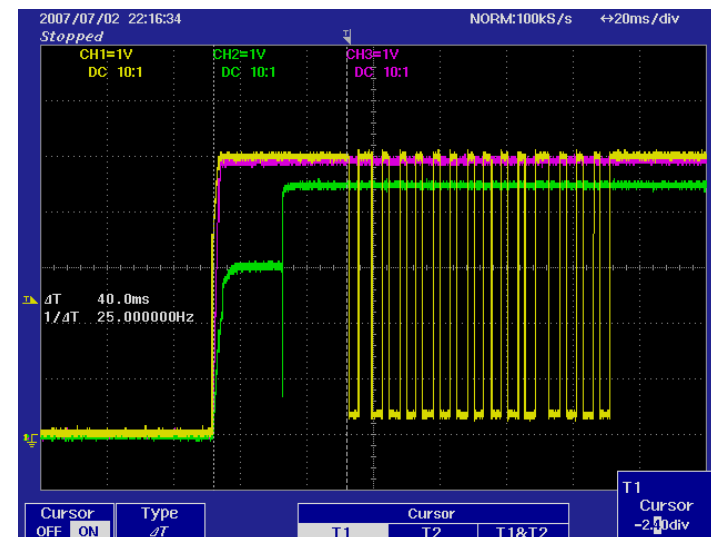
Milestones and Deliverables



Joint Task with PSI.

DMSC/ESS staff on board
since this September

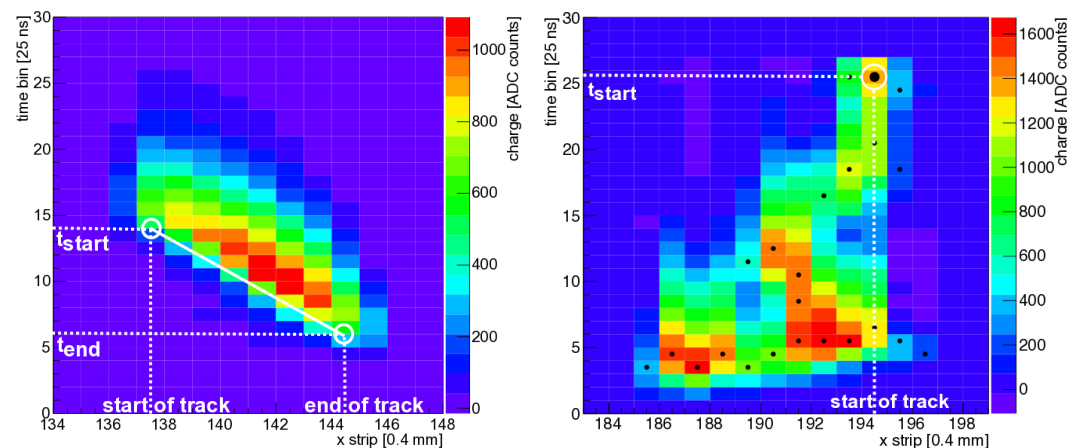
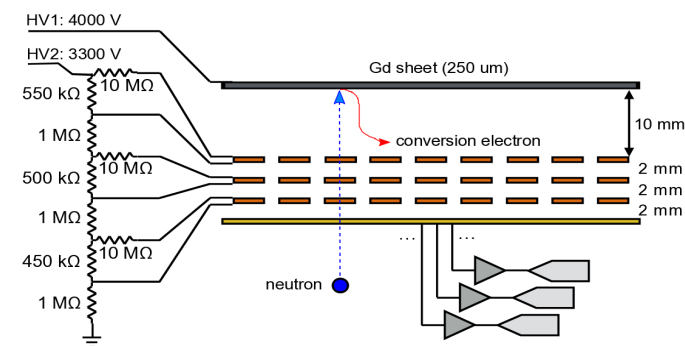
- Collecting Metadata from fast Sample Environments
- High Speed – up to MHz
- Lots of data, close to neutron events
- No turn key solution available that includes accurate timing
- Evaluating partial technical solutions that can be combined
- Integration into data stream



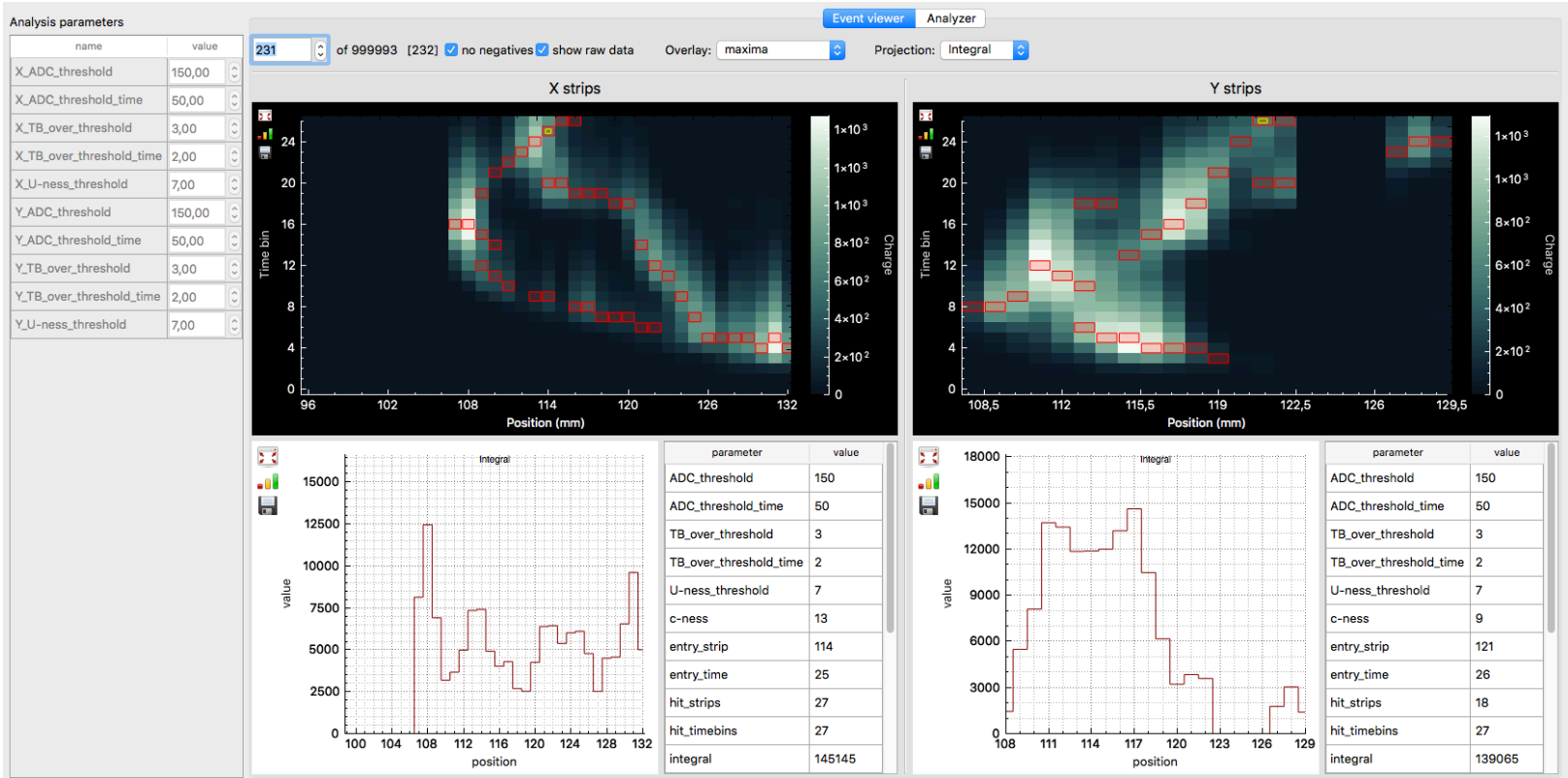
Task 5.1 – Standard Neutron Events

Joint task with NBI (Copenhagen University)

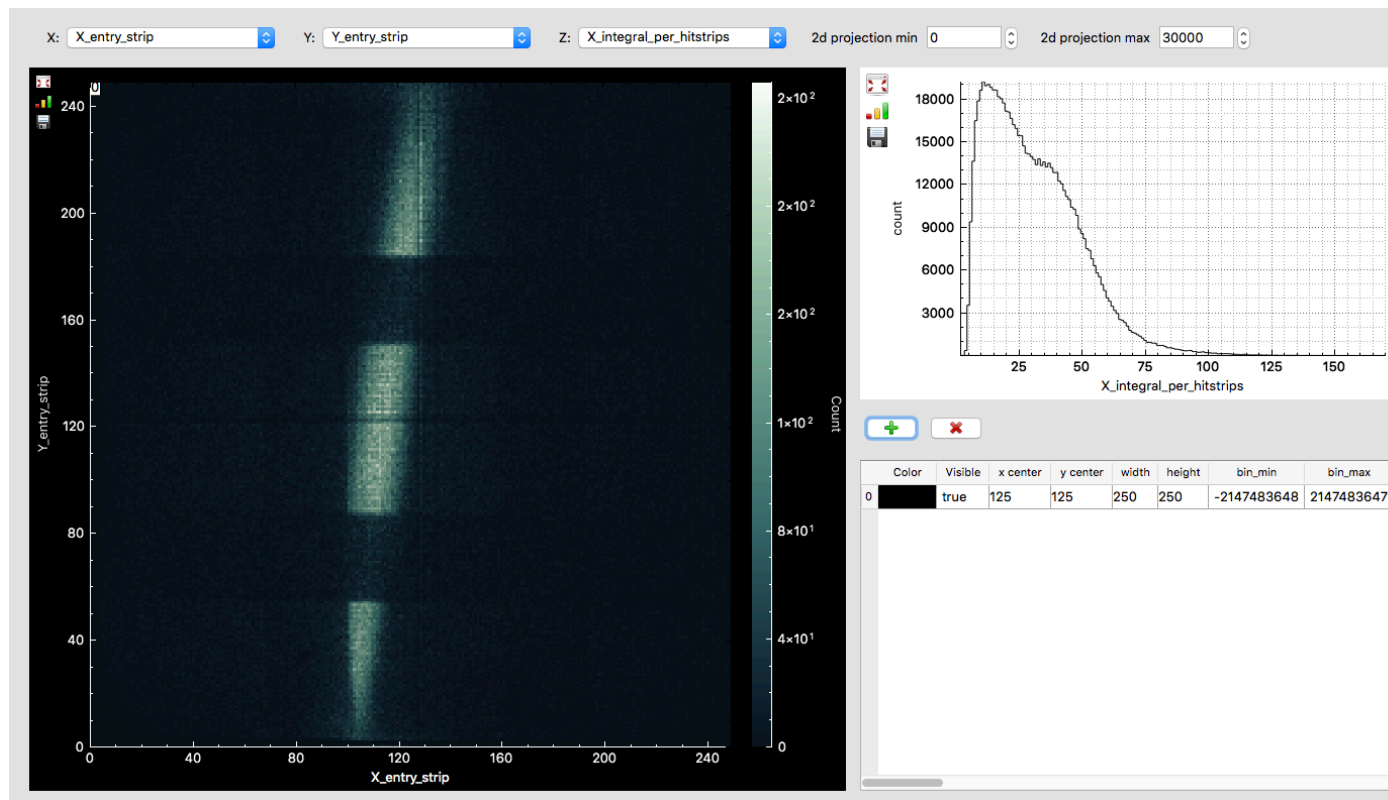
- To support novel detector types (e.g. WP4) despite the lack of associated electronics effort
- Software processing of digitised signals that would traditionally happen in analogue or digital electronics
- Detectors emit raw time stamped information that needs refinement
- Initial assignment was to gather and analyse existing test data and establish specifications for the way data will be presented in the future



Event Classification



Event Classification



Task 5.1 Outcome

- Contributed to and created software packages to read, convert, analyse, and classify existing trial data
- Results will be disseminated at a joint WP4 and WP5 workshop in November
- Documented current status of data and best
- First Deliverable due in May

ESS/DMSC internal note
August 2016
Carsten Sogaard

Asumptions and the Road Forward for the DMSC–NBI collaboration in Relation to the Processing of NMX Data

(v. 1.0)

uction

aims at documenting the assumptions upon which the DMSC/NBI
e developing algorithms and software to process the raw data
MX detector.
nt that this document is revised continuously as new decisions
v knowledge is gained.

ntions

Learnings from the IFE beam tests of the NMX Gd–GEM modules v. 1.0

1 Introduction

The NMX detector to be installed at ESS, will eventually consist of three
60 cm x 60 cm panels. The cathode, bounding the drift gas at the top
of the module. has been coated with Gadolinium (Gd). which has a high

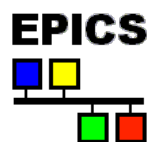
Task 5.3 – Data Aggregation

- Task with PSI and our ISIS/STFC in kind collaborators
- Target goal: Software Framework to support neutron and metadata data stream
- Problem includes the “Big Data” 3 Vs:
 - Volume
 - Velocity
 - Variety
- Initial objective:
Agree on technology platform
based on common criteria
- Prototyping and Testing
- Formalise Testing



Technology Choice

Options investigated:



V4

Facility Control System

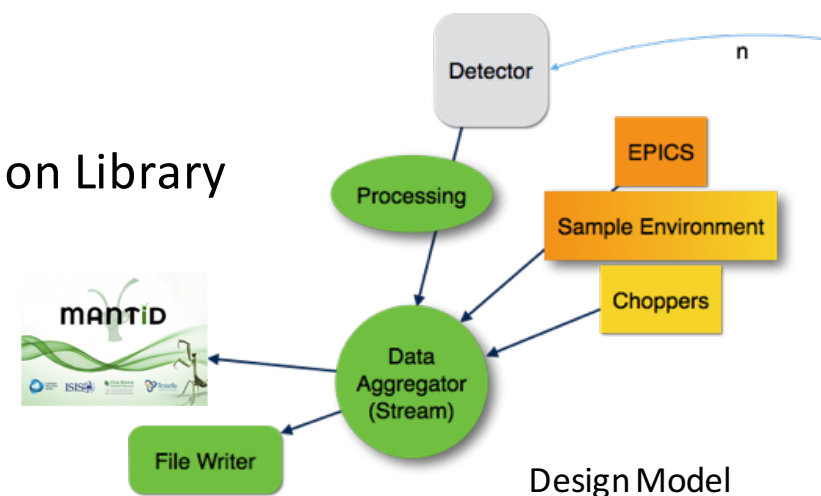
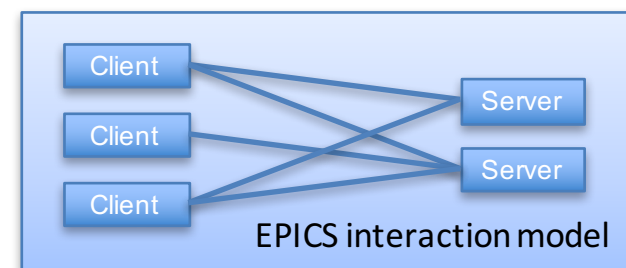


General Purpose Communication Library



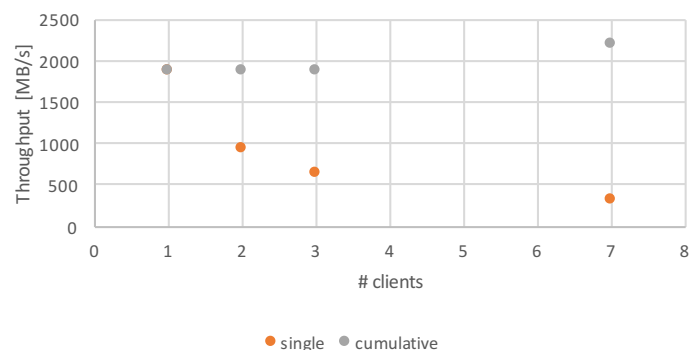
Apache Kafka

“Big Data” Data Broker

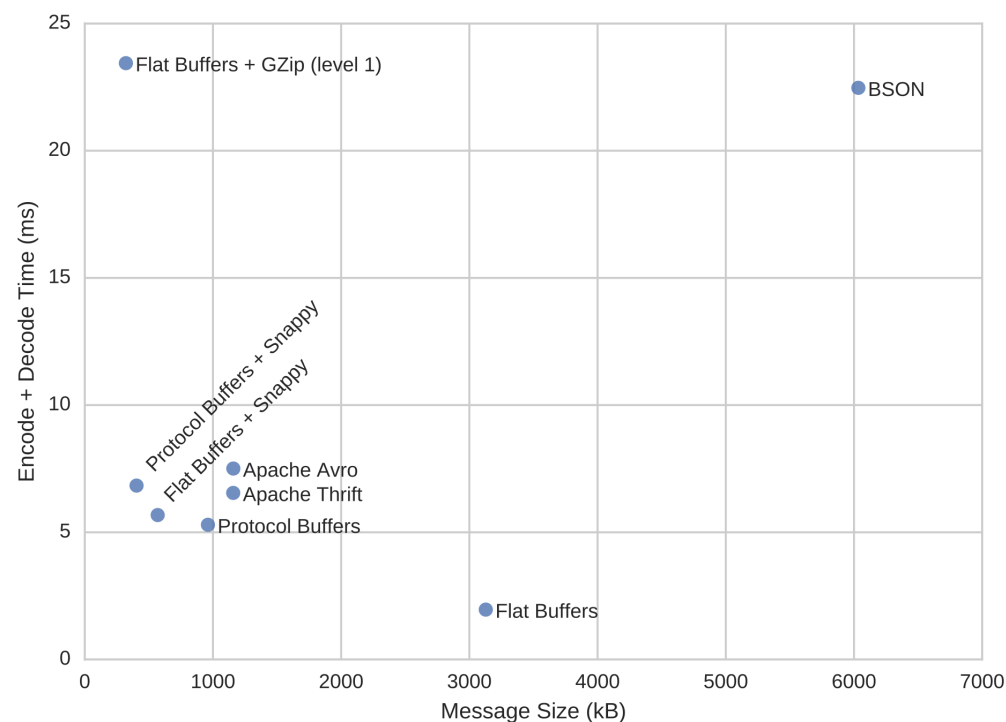
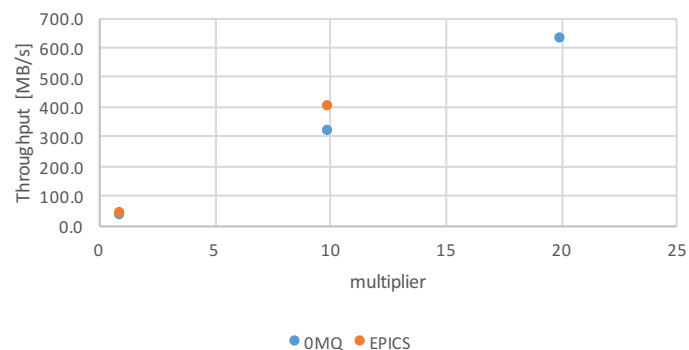


Performance and Efficiency Tests

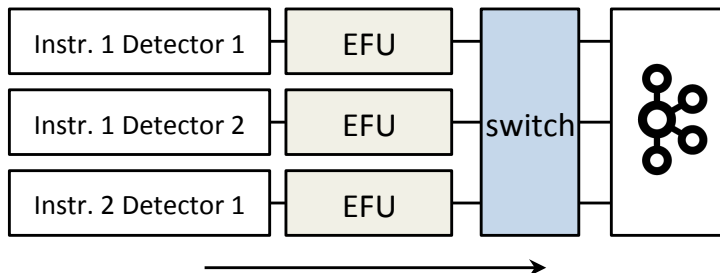
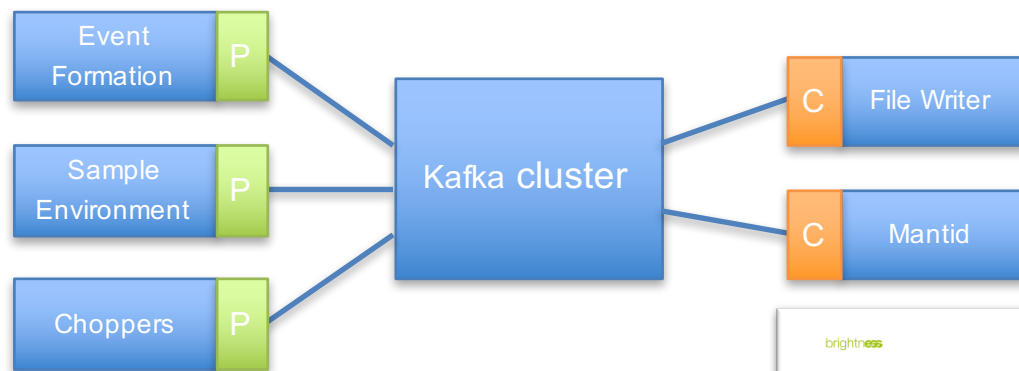
OMQ multiple clients



OMQ vs EPICS



Choice and Architecture



Deliverable



Technology evaluation - DMSC x

<https://ess-ics.atlassian.net/wiki/display/DMSC/Technol...>

Pages / ...

/ Data Aggregation and Streaming

Technology evaluation

Created by Tobias Richter, last modified by Afonso Mukai on Aug 01, 2016 11:25

Data streaming technology evaluation

Apache Kafka was chosen as the technology for aggregation and streaming, after evaluating it against ZeroMQ and EPICS v4. The criteria used for the decision are listed below, followed by the results matrix.

Criteria

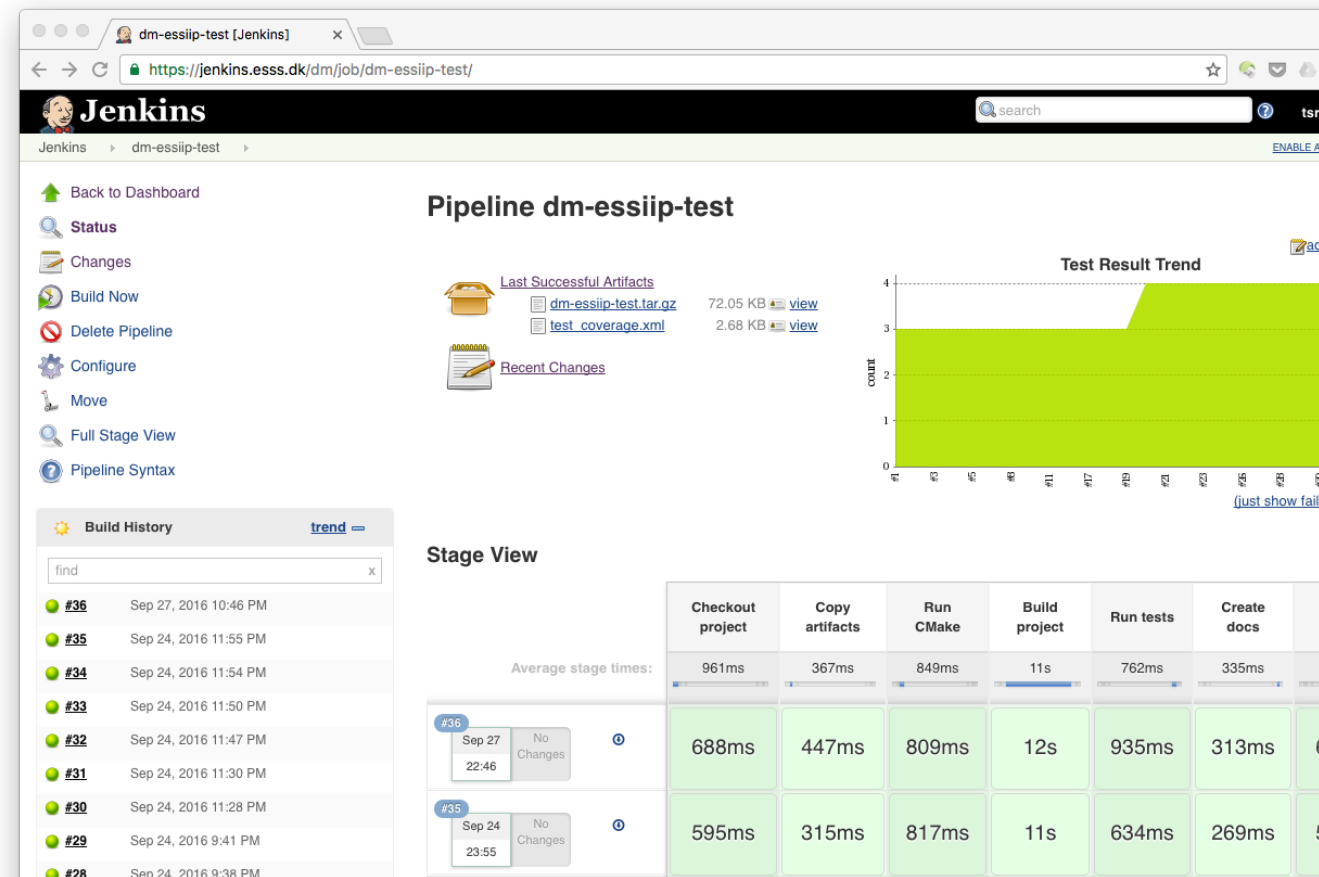
A list of the criteria for evaluating the technologies against, ordered by priority. Examples of the type of issues to consider have also been included.

1. Maintainability (Man):
 - Level of ongoing development
 - Indication of future direction
 - Longevity
 - Backward compatibility of version upgrade
 - Dependencies
 - Which other packages does the solution spend upon?
 - What is the maintenance state of those other packages?
 - Code readability and quality
 - Can we fix the code ourselves when the community fails us?
2. Technical (Tech):
 - Support for complex or custom data structures
 - Does it provide a protocol?
 - Does the protocol suit the needs of the project?



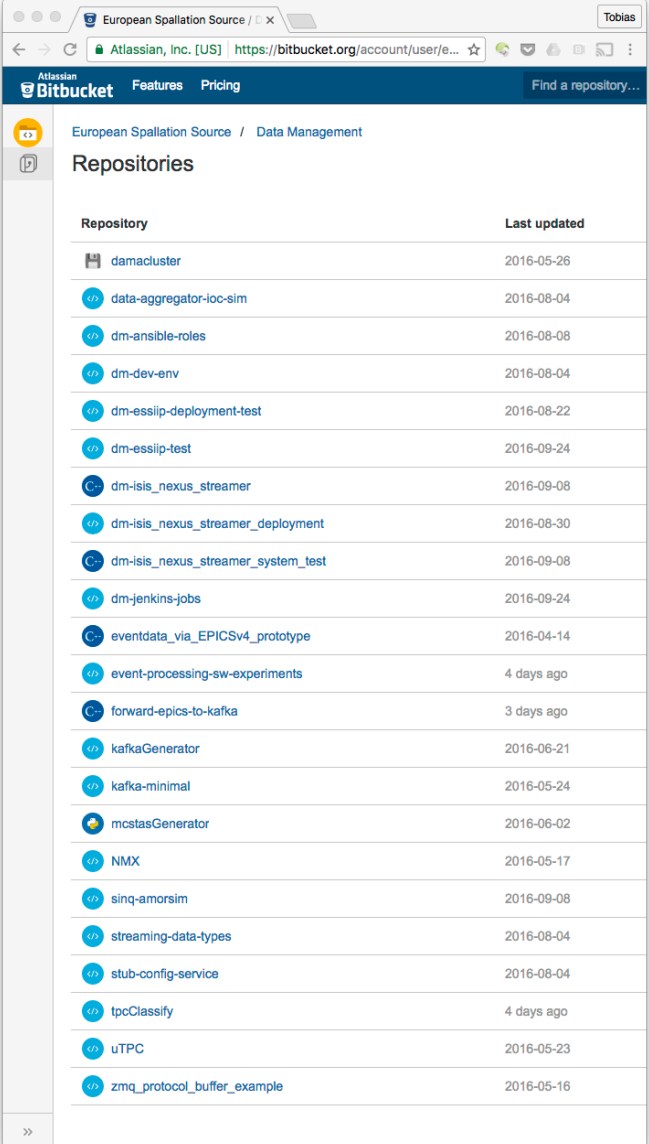
Software Testing

- Our data stream will be the one and only scientific record of ESS experiments
- Software needs to function correctly, reliable, and in real time
- Going forward software testing will be as important as implementing new features
- Integration and testing facility is set up in the ESSiP lab (Lund)
- Test will be run by partners in their facilities
- Automated test are implemented on virtual hardware for now



Some WP5 Results

- Deliverable D5.1 accepted
- Kafka and Flat Buffers chosen as core technology
- Better understanding of detector processes, design, output (current and future)
- Classification of event data makes tasks quantifiable
- Initial Prototypes implemented and Designs verified
- Repositories and Development Workflows established
- Testing of various replacements for face to face collaboration (Jira, Slack, Skype, ...)
- Agreed on Roadmap



Repository	Last updated
damacluster	2016-05-26
data-aggregator-ioc-sim	2016-08-04
dm-ansible-roles	2016-08-08
dm-dev-env	2016-08-04
dm-esslip-deployment-test	2016-08-22
dm-esslip-test	2016-09-24
dm-isis_nexus_streamer	2016-09-08
dm-isis_nexus_streamer_deployment	2016-08-30
dm-isis_nexus_streamer_system_test	2016-09-08
dm-jenkins-jobs	2016-09-24
eventdata_via_EPICsv4_prototype	2016-04-14
event-processing-sw-experiments	4 days ago
forward-epics-to-kafka	3 days ago
kafkaGenerator	2016-06-21
kafka-minimal	2016-05-24
mcstasGenerator	2016-06-02
NMX	2016-05-17
sinq-amorsim	2016-09-08
streaming-data-types	2016-08-04
stub-config-service	2016-08-04
tpcClassify	4 days ago
uTPC	2016-05-23
zmq_protocol_buffer_example	2016-05-16

Upcoming Events

- NOBUGS conference
Mid October
- Joint meeting with WP4 (Jamboree)
Early November
- Readout Electronics and Output Meeting
December?
- Integrated Design Review of all WP5 tasks
February



<https://nobugs.esss.se>

Joint BrightnESS WP4 and WP5 Jamboree

from Wednesday, 9 November 2016 at **09:30** to Thursday, 10 November 2016 at **17:00** (Europe/Stockholm)
at DMSC COBIS (M10A)
Ole Maaløes Vej 3 2200 Copenhagen NDenmark

Manage

Description We start with short presentations of what we've been doing for ESS detectors so far and enter a workshop on some current topics to develop ideas, gather requirements, etc.

Participants Morten Christensen; Tobias Richter; Carsten Seggaard

Registration Want to participate? [Apply here](#)

Go to day

Wednesday, 9 November 2016

09:30 - 10:45	Presentations	▼
10:45 - 11:00	Coffee	
11:00 - 12:15	Presentations	▼
12:15 - 13:00	Lunch	
13:00 - 17:00	Workshop	▼

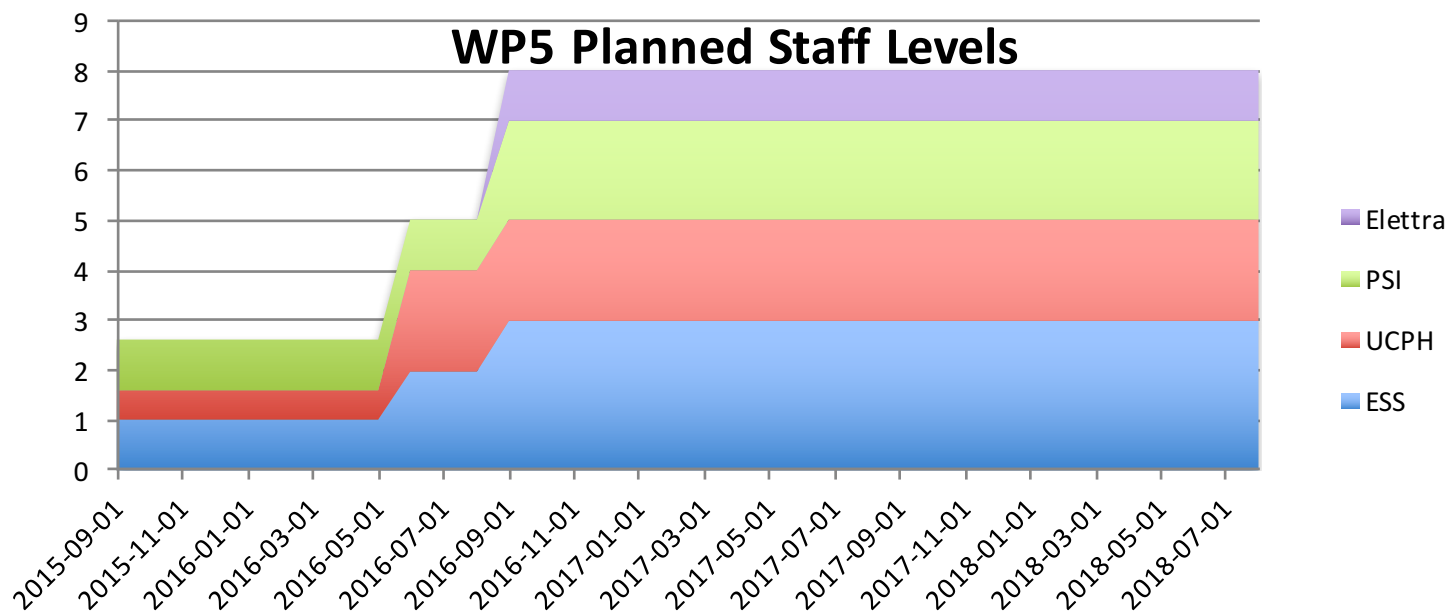
Thursday, 10 November 2016

09:30 - 10:00	Presentations	▼
10:00 - 12:15	Workshop	▼
12:15 - 13:00	Lunch	
13:00 - 15:00	Workshop	▼
15:00 - 15:30	Presentations	▼
15:30 - 16:30	Discussions	▼



BrightnESS is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 676548

Costs



Summary

- The work package has met all deadlines so far
- We've successfully jump started efforts for both BrightnESS and ESS
 - Gathered crucial information for the project and operations
 - Established working relationships across multiple sites and including in kind
 - Started collaborative work on new common software packages
 - Agreed on direction for further development
- Not all requirements are established and understood as well as they would be in an ideal setting
- Hiring staff takes time,
so does starting a larger project at a green field site

brightness



Thank you!



BrightnESS is funded by the European Union Framework Programme for Research and Innovation Horizon 2020, under grant agreement 676548

Backup Slides



Costs

