The Virtual European XFEL Accelerator

Development, test and integration of high level software at the European XFEL

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Introduction

Can **not** talk about:

- the European XFEL
  (see MOA3O02, MOPGF101, …)
- the FLASH facility
  (see MOC3O07, ICALEPCS2007 TOAA04, …)
- the control system
  (see ICALEPCS2009 MOD004, …)

Introduction

Outline

- **The Idea** - Motivation
- **Where we've grown up** - From FLASH to XFEL
- **The core of the Control System Architecture** - The DAQ (Data Acquisition System)
- **The Virtual XFEL** - damned let's have a look

The Idea / Motivation

- The European XFEL is a **large scale** machine
- **Tight time schedule** for commissioning and time up to first lasing
- **Lessons learned** at other facilities:

Need to have **all** software **ready** for the **commissioning**

Set up **interdisciplinary team** from multiple DESY groups to **provide high level software**

Test and thereby **approve** foreseen **control system architecture works**

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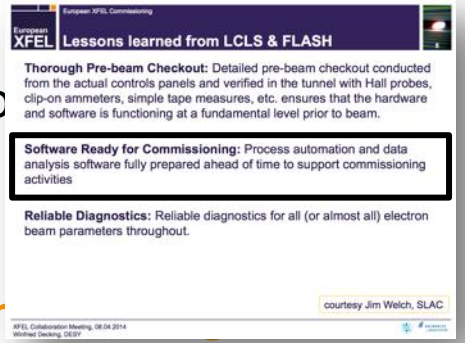

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↓

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From FLASH to XFEL

- **FLASH is the *little brother* of XFEL**
  - Control System: DOOCS/TINE
  - Front-end Hardware: VME, µTCA
  - Timing System
  - Machine Protection System
  - Multi-Beam-Line Operation
  - …

- FLASH is **the test bed** for software to be used at XFEL

but …

XFEL is 10 times as big!

From FLASH to XFEL

FLASH ~ 30 crates producing < 100 Mbyte/s

XFEL ~ 200 crates producing >> 100 Mbyte/s

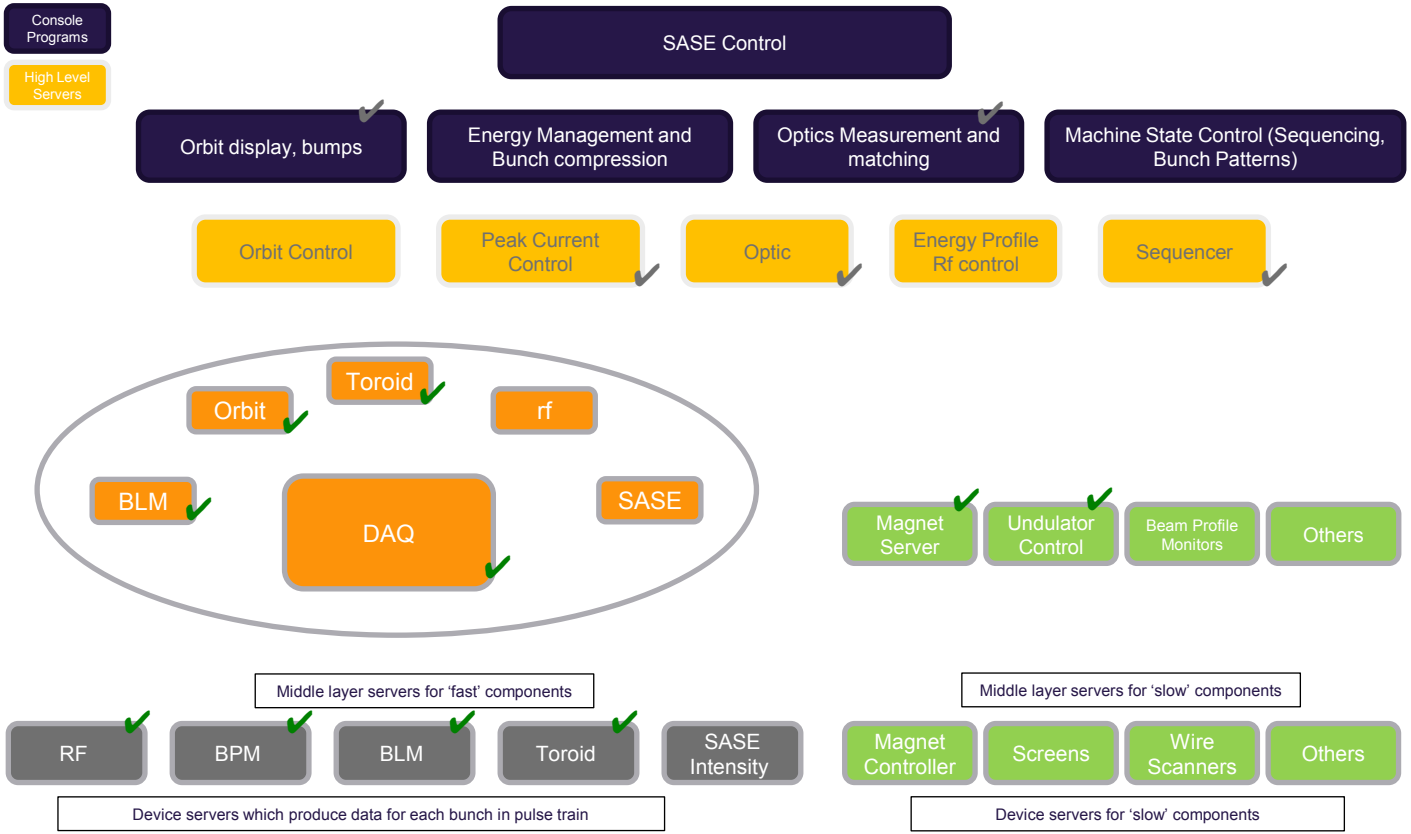
➔ High data rates **require data reduction**

➔ **Synchronize data** from various sources

➔ Have to think more in **physics entities**

➔ **The Data Acquisition System (DAQ)**

The Data Acquisition System



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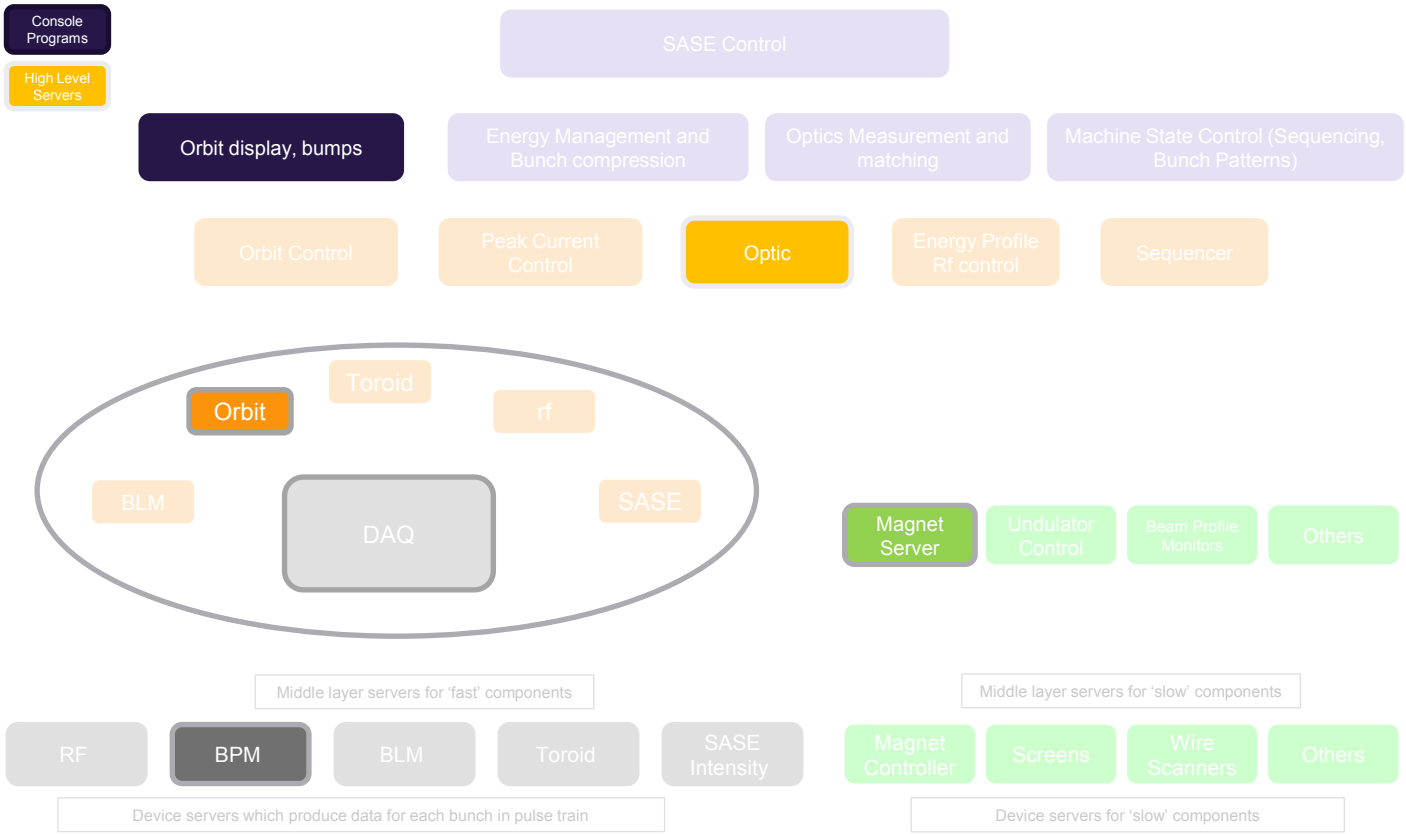

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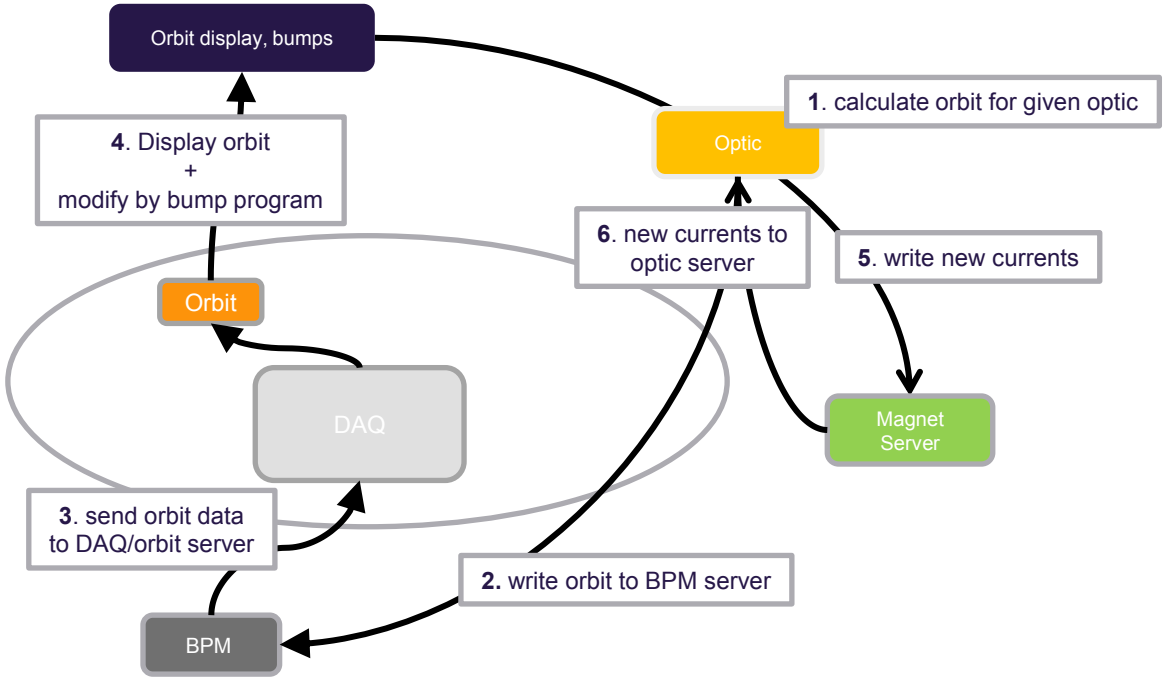
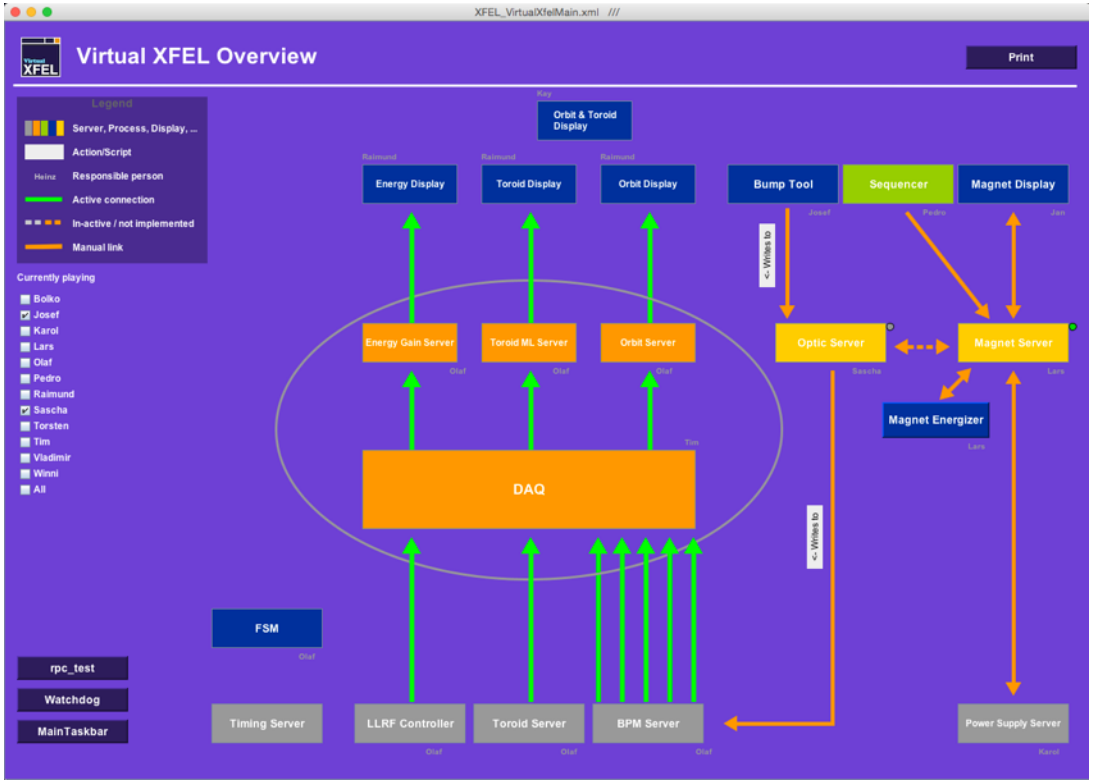


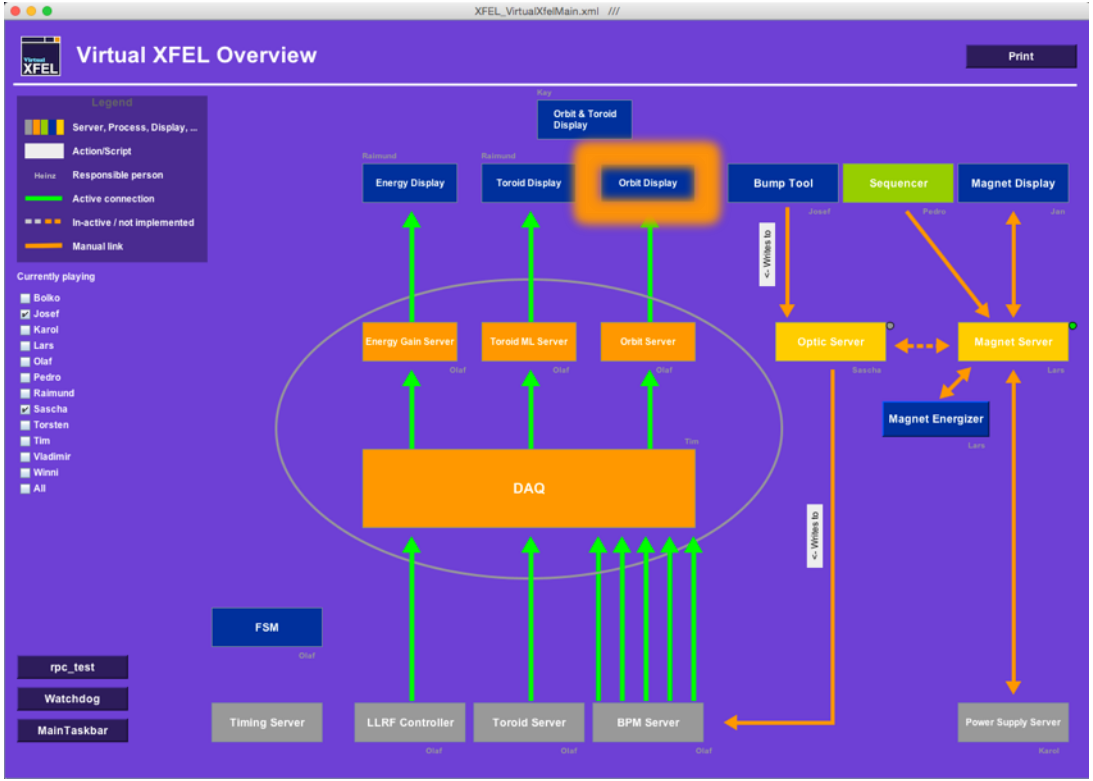
European XFEL

The virtual XFEL



European XFEL

The virtual XFEL – Orbit



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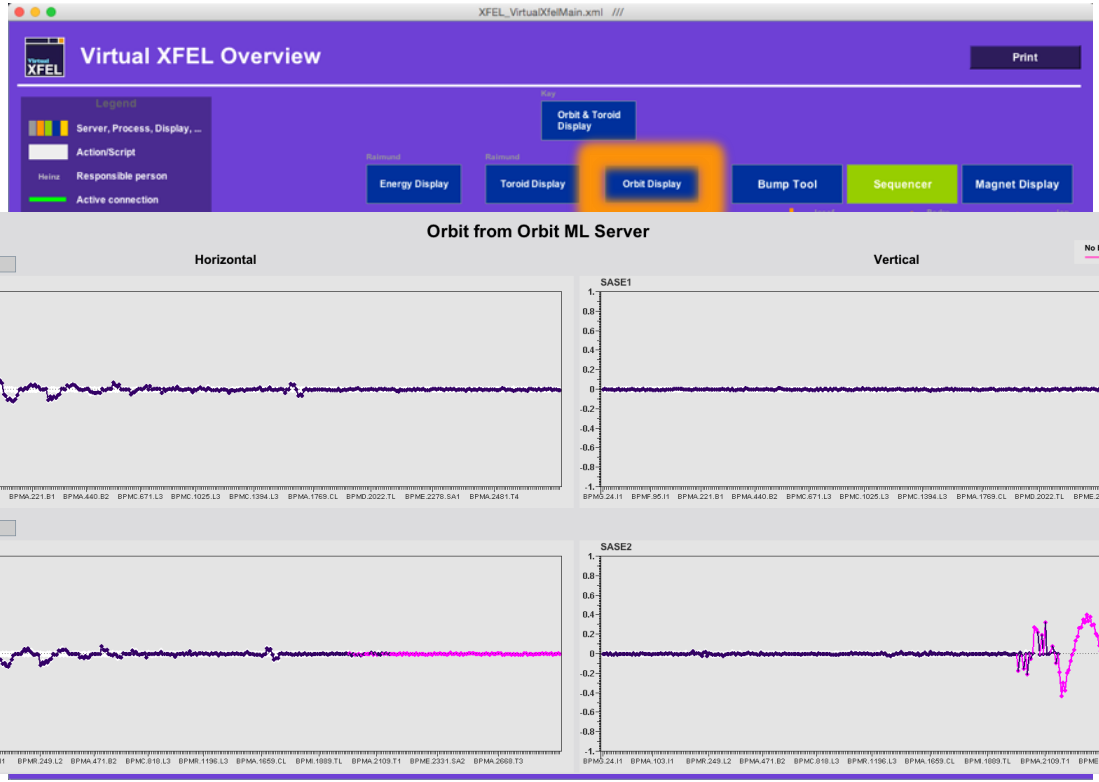

European XFEL

The virtual XFEL – Orbit

DESY

HELMHOLTZ ASSOCIATION

European XFEL

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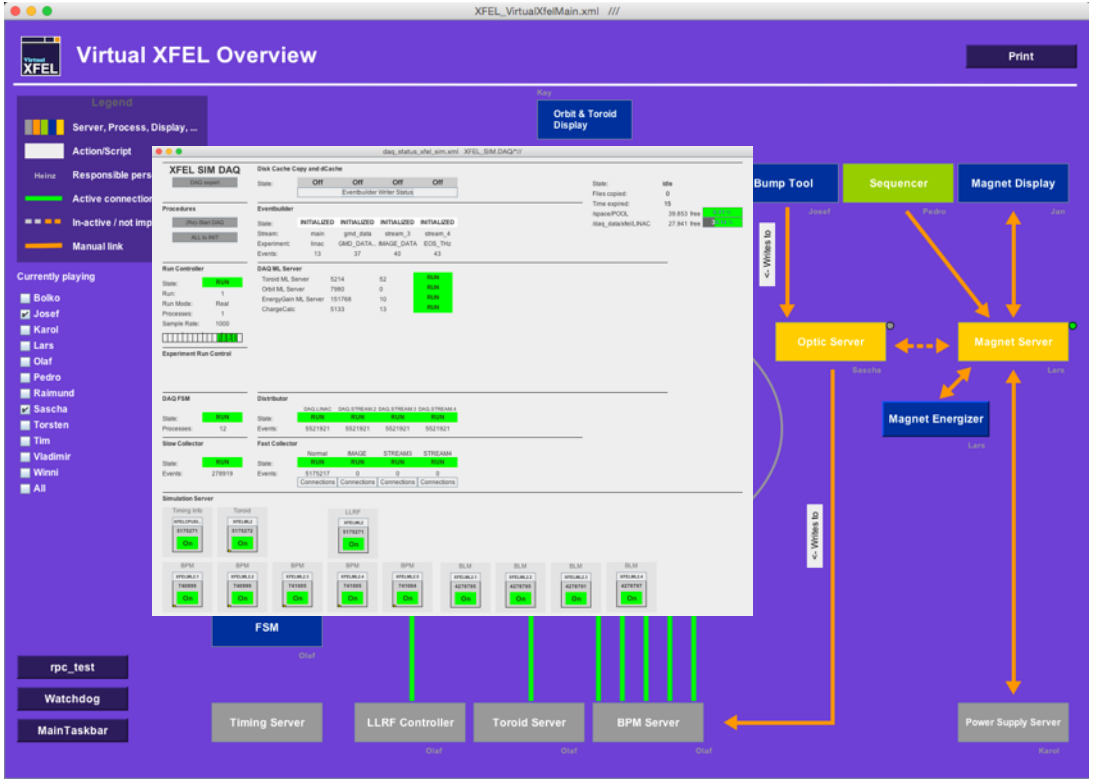
The virtual XFEL – Data throughput



European XFEL

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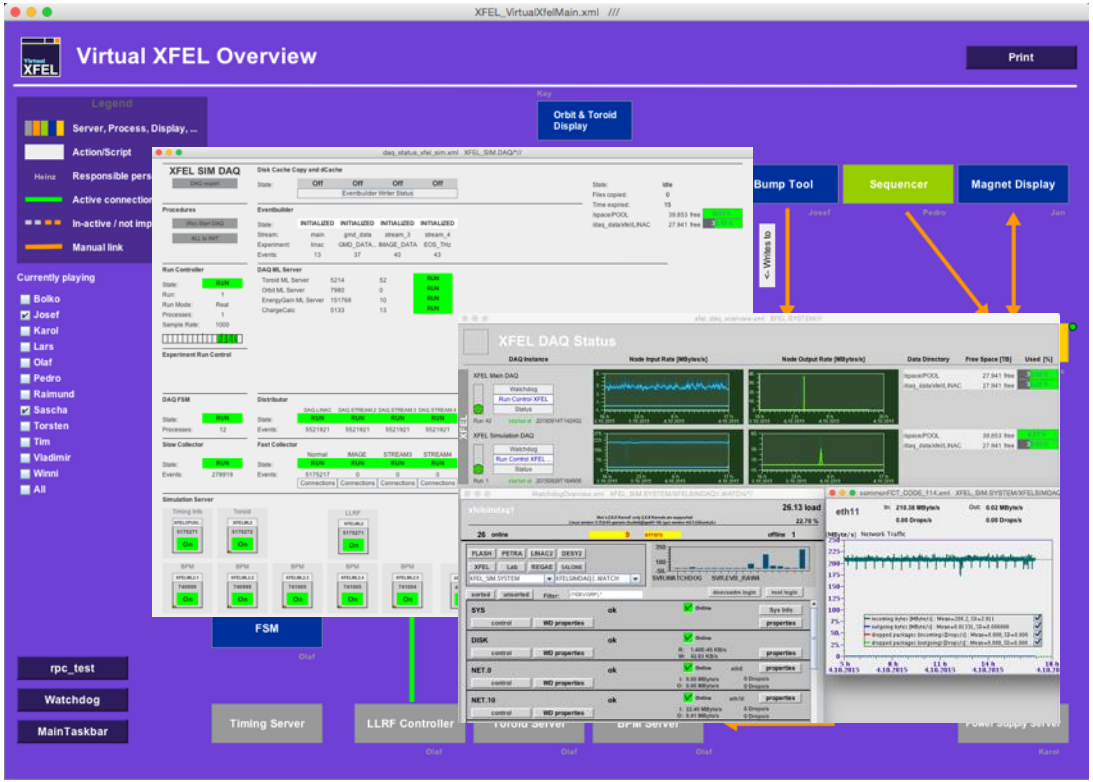

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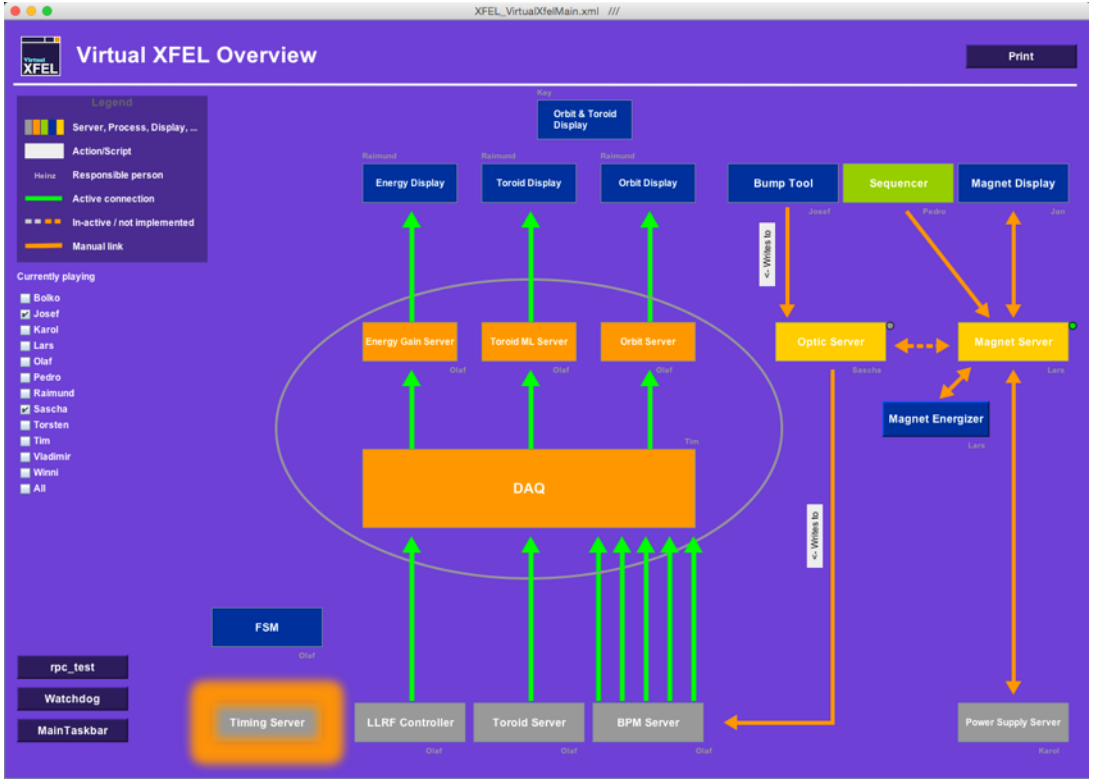
The virtual XFEL – Timing



European XFEL

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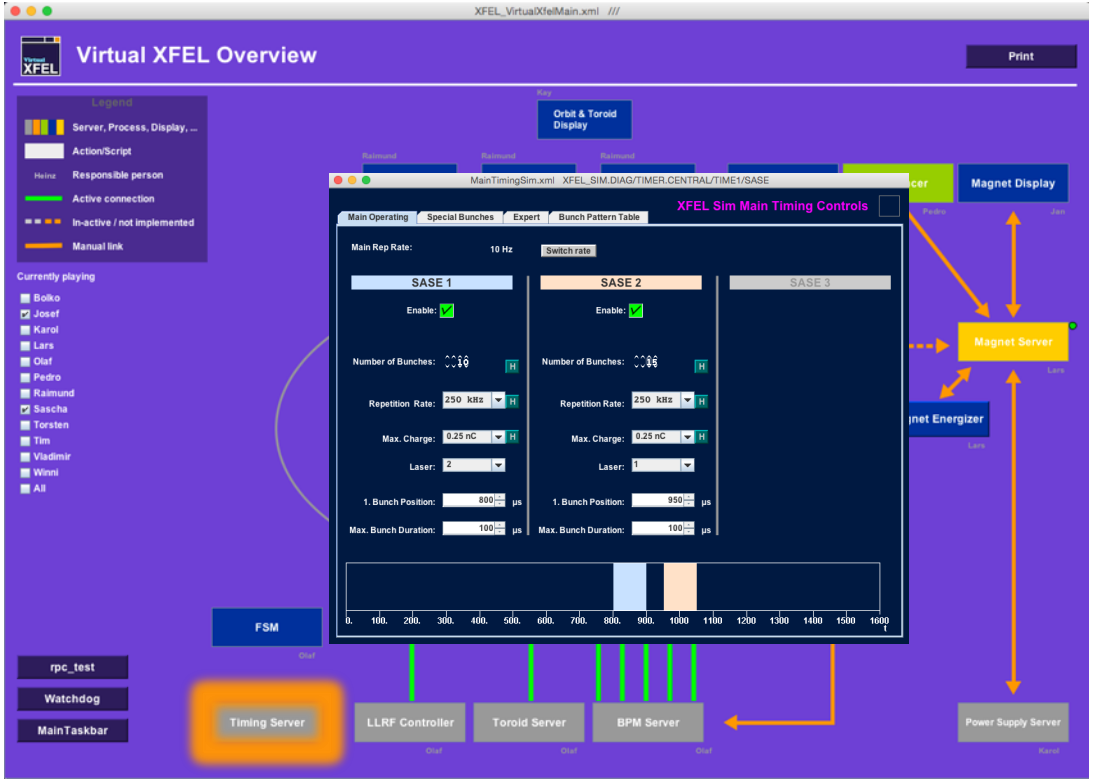
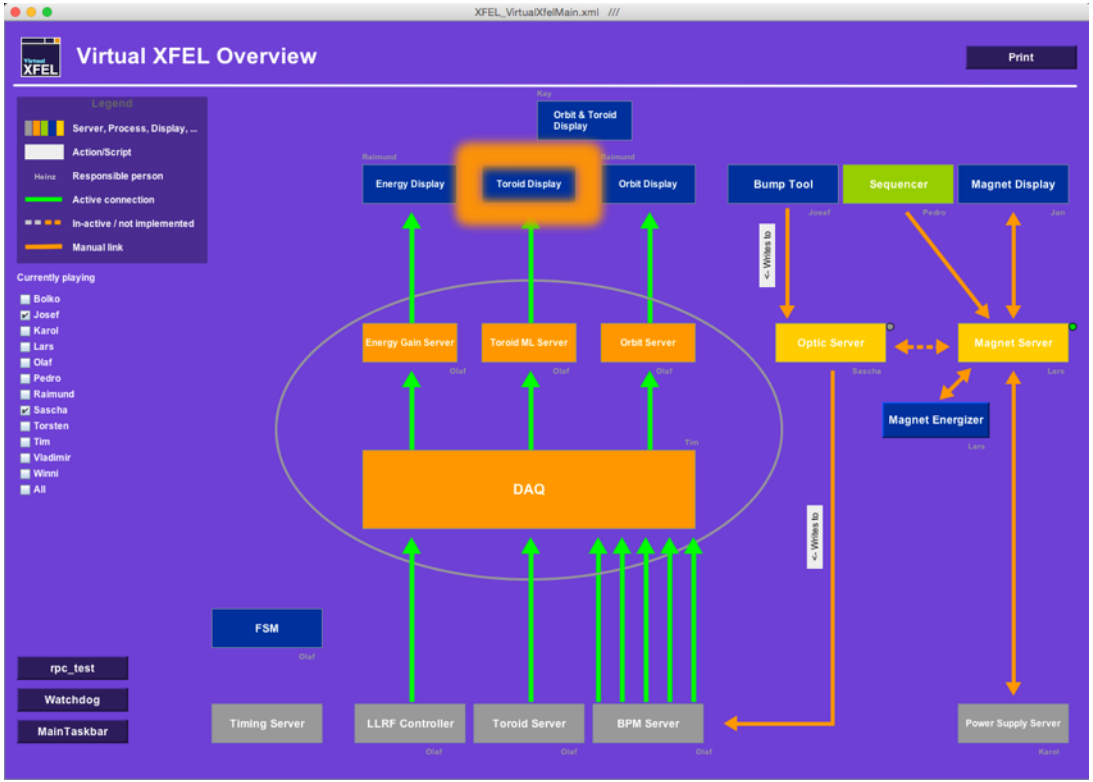


European XFEL

The virtual XFEL – Bunch pattern handling



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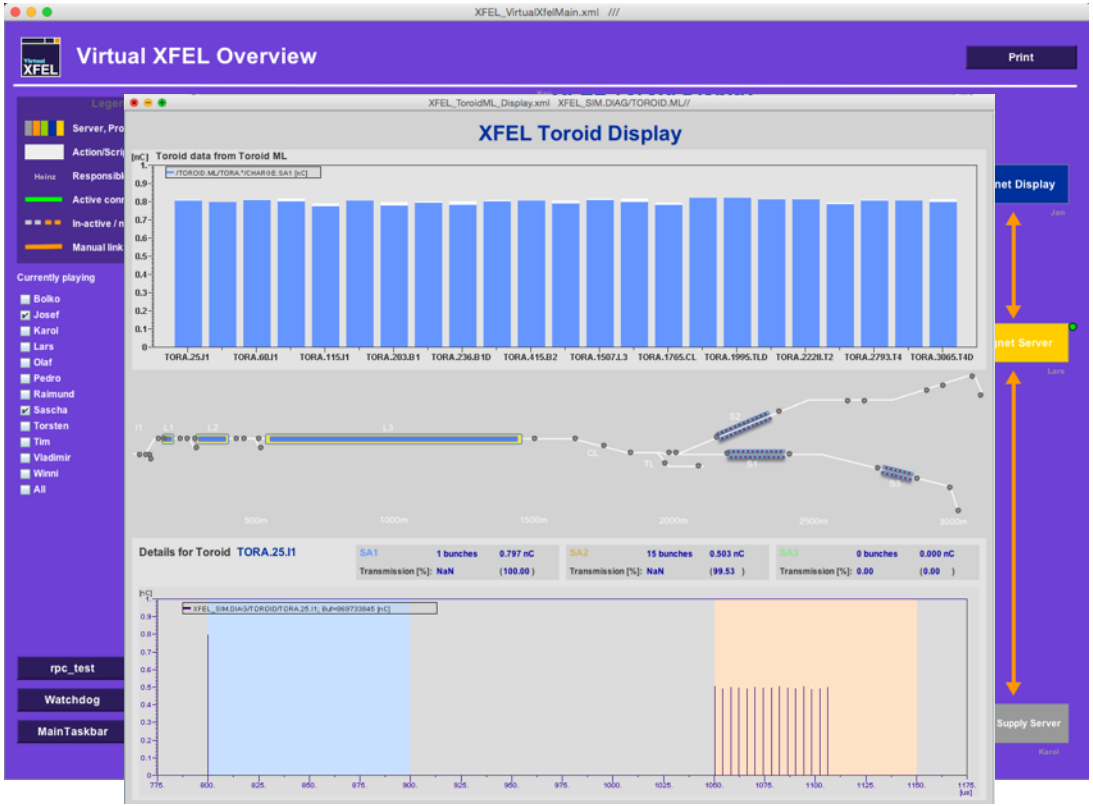

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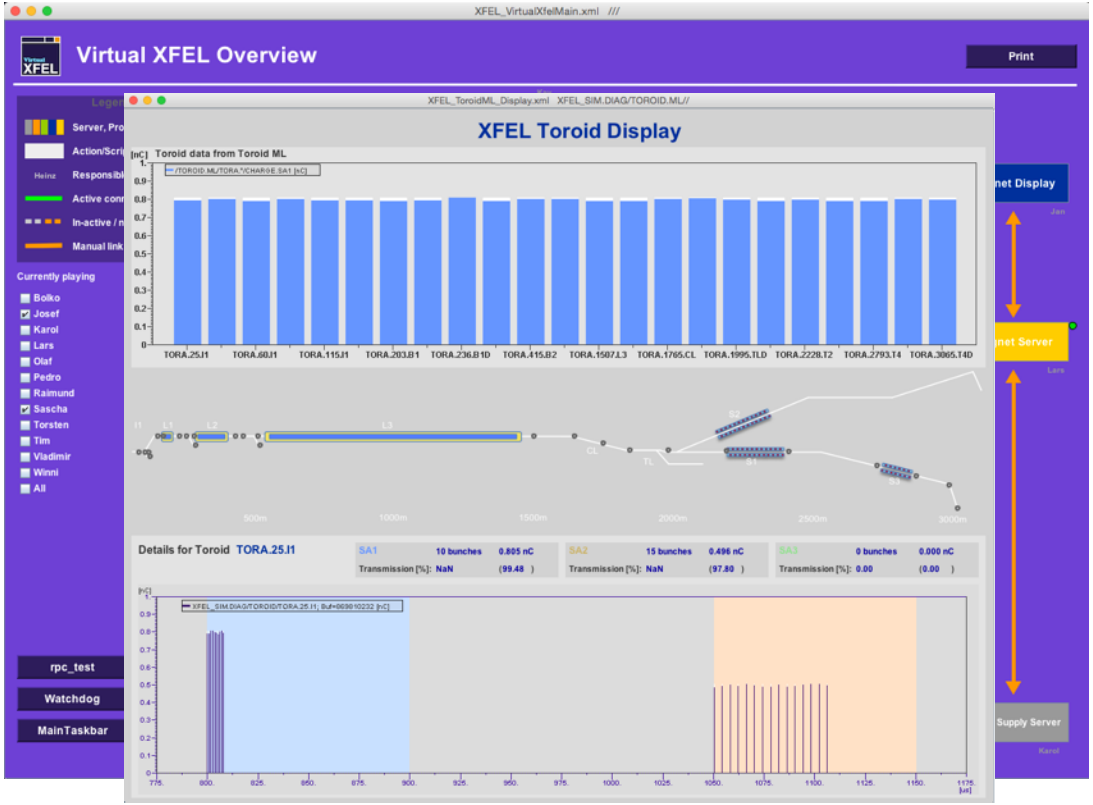

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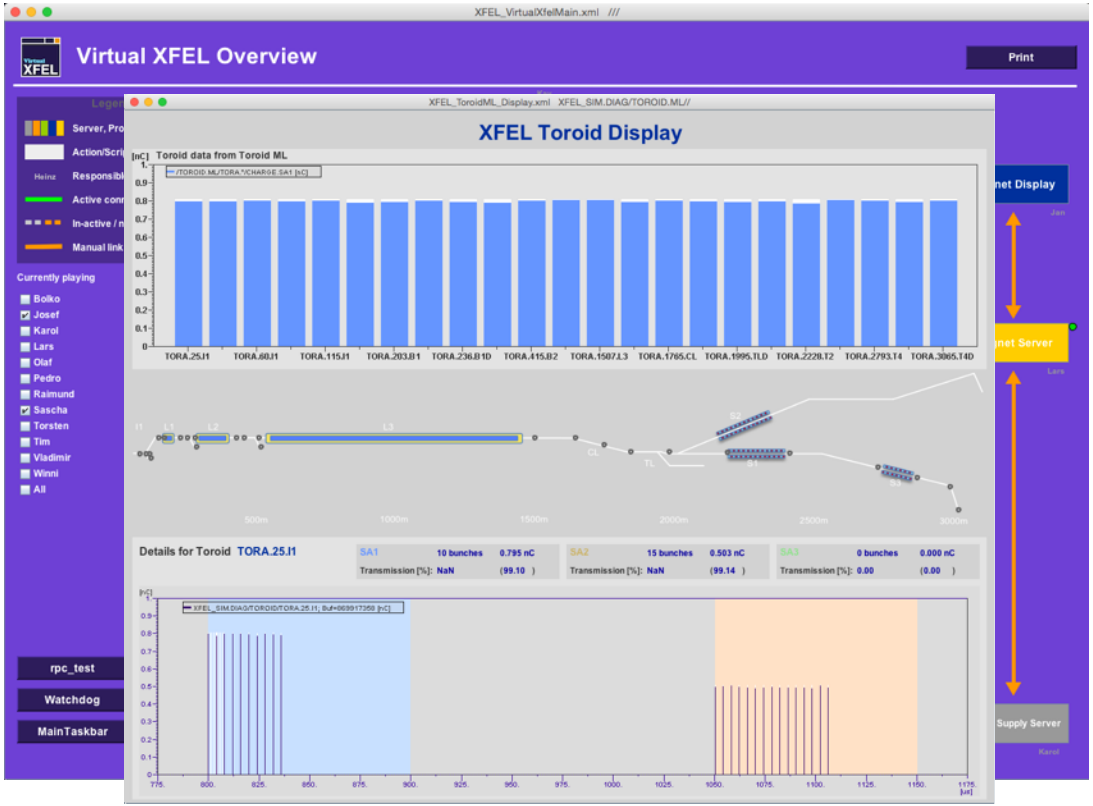

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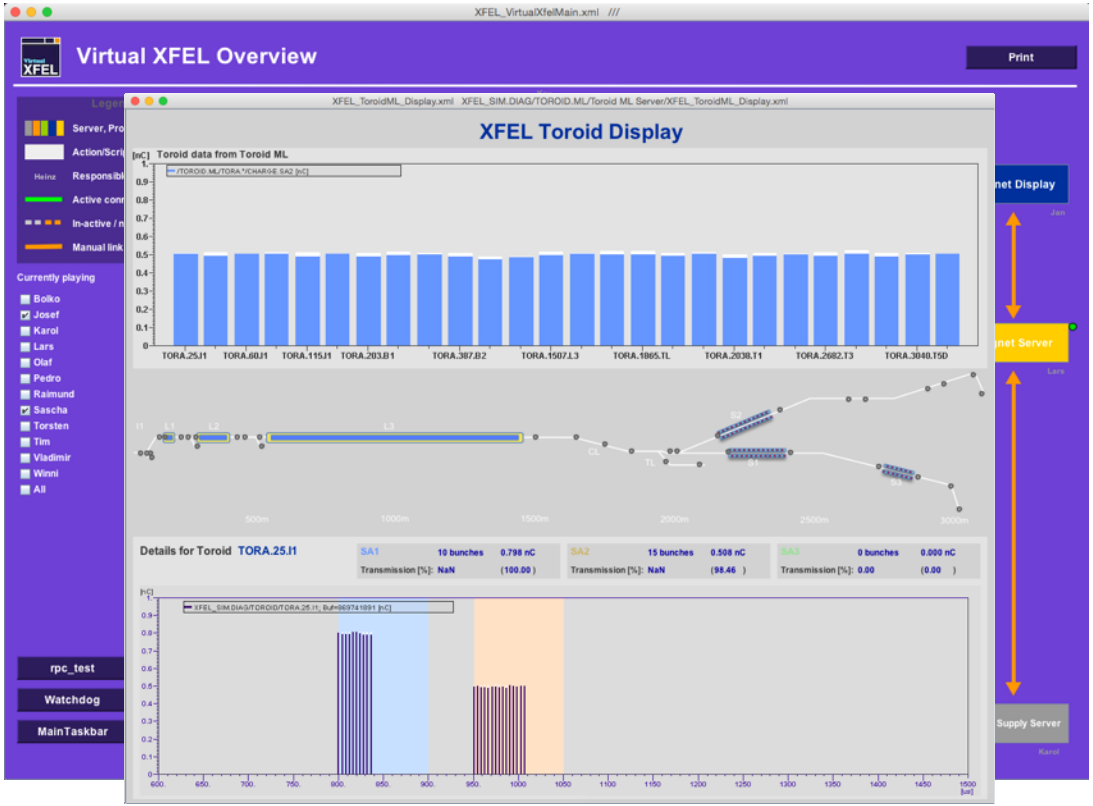
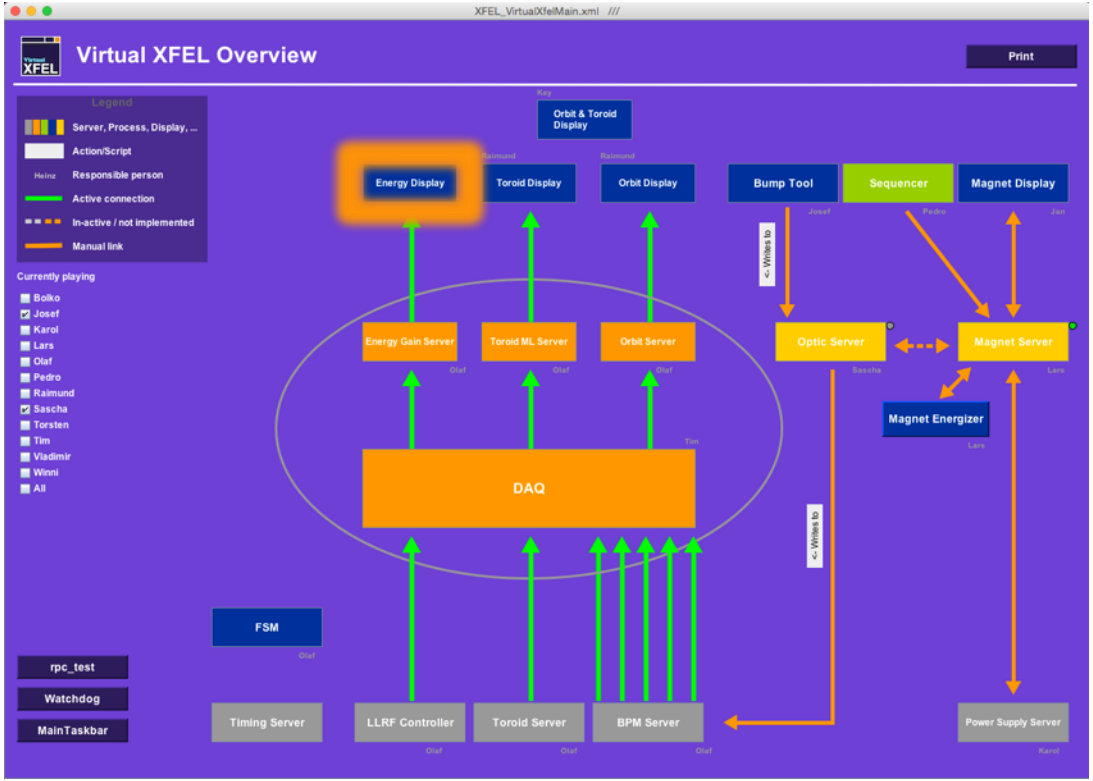


European XFEL

The virtual XFEL – LLRF



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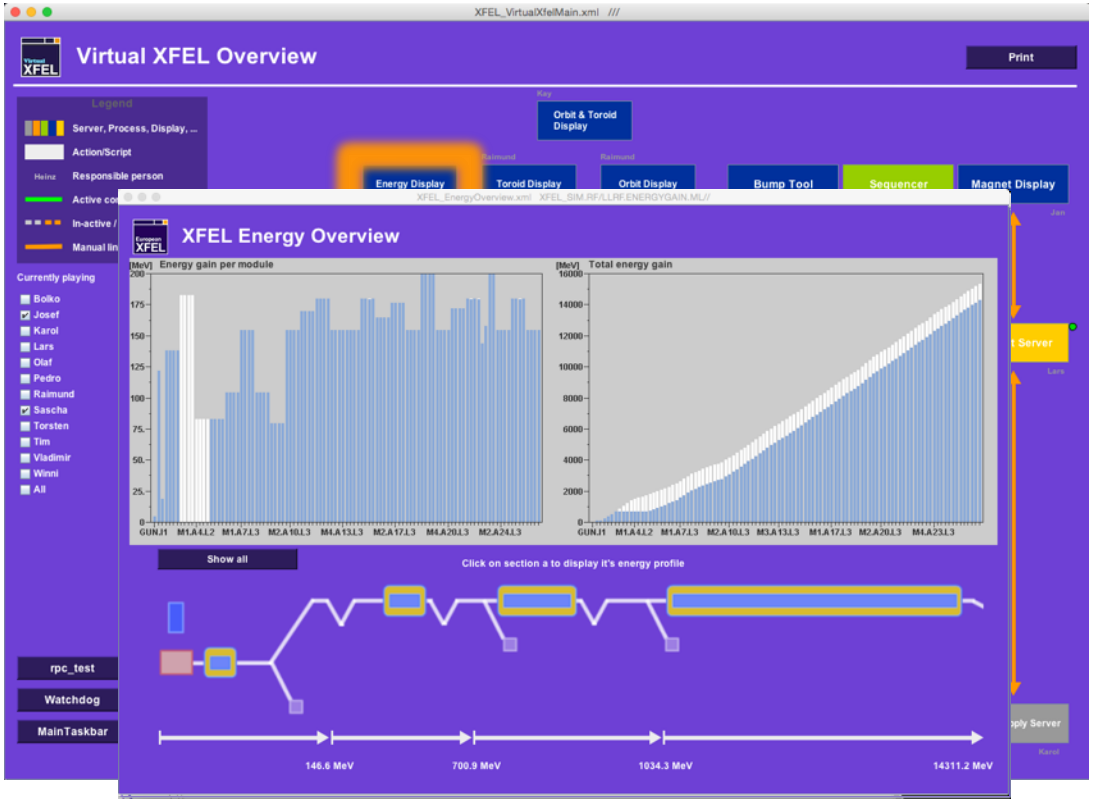

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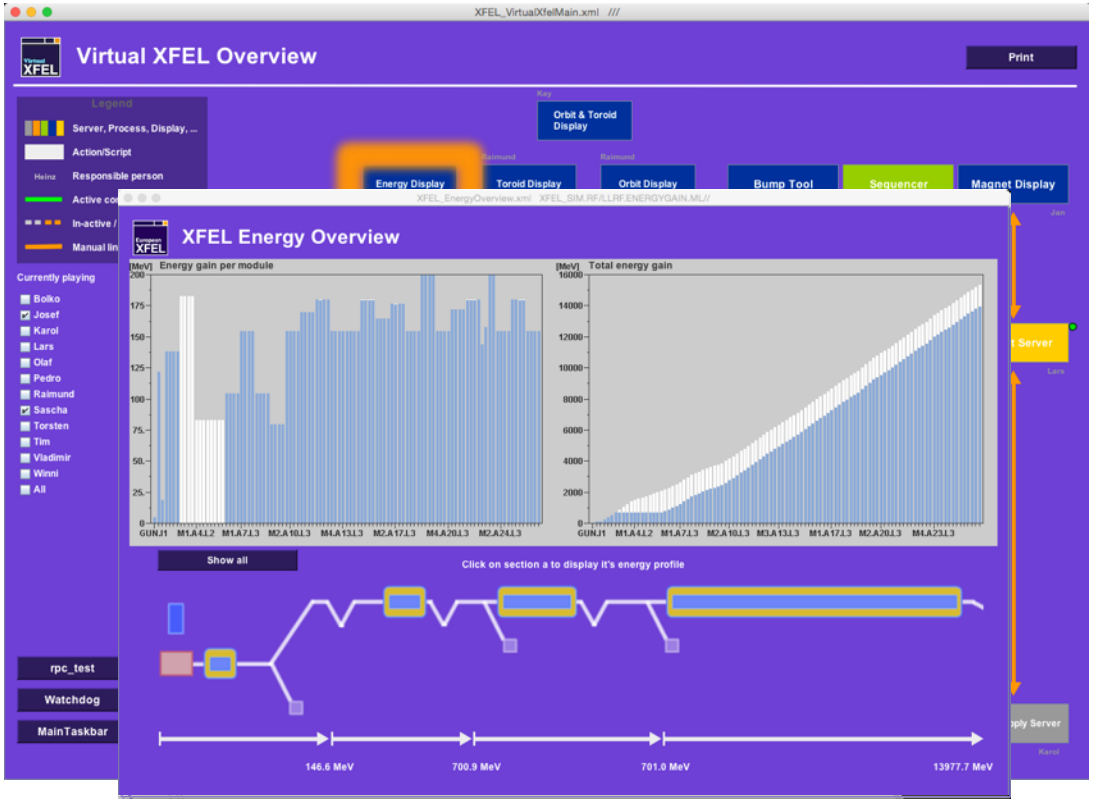

Summary

- The VXFEL **allowed** us to:
  - Test the **network** and **data throughput**
  - Tests of the **Timing System** and **Bunch Pattern Handling**
  - Is a test bed for all **High Level Software**
  - Test **naming conventions** and prepare server **configurations**
  - **Port** software from the VXFEL **1:1** to the XFEL
  - Develop and test **display concepts and displays**
  - ...

- The VXFEL **does not** or only partly allow to:
  - Test **hardware**
  - Do **physical simulations**

Summary

- **Started as** pure **test** for data throughput
- **Turned out to be vital tool** for testing much more aspects of the software
- Even further proved to be an essential tool for **development** of **GUIs**
- Allows to some extend **physics experiments**

➔ **VXFEL got it's dedicated hardware and will be kept running!**

Thank you for your attention!