From Desktop to Web:
The Evolution of Our GUIs from PyQt to React

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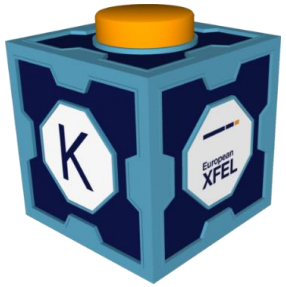
European XFEL currently uses PyQt for several of our critical applications

Controls and Data Analysis groups are now transitioning to web technologies

- Advantages:
  - Cross-platform accessibility
  - Modern and responsive interfaces
  - Centralized deployment
- Frontend: Consistent across applications
  - React (JavaScript library)
  - Redux (state management)
- Backend: Implementation varies by application
  - FastAPI (Python web framework)
  - Tailored solutions to meet specific requirements

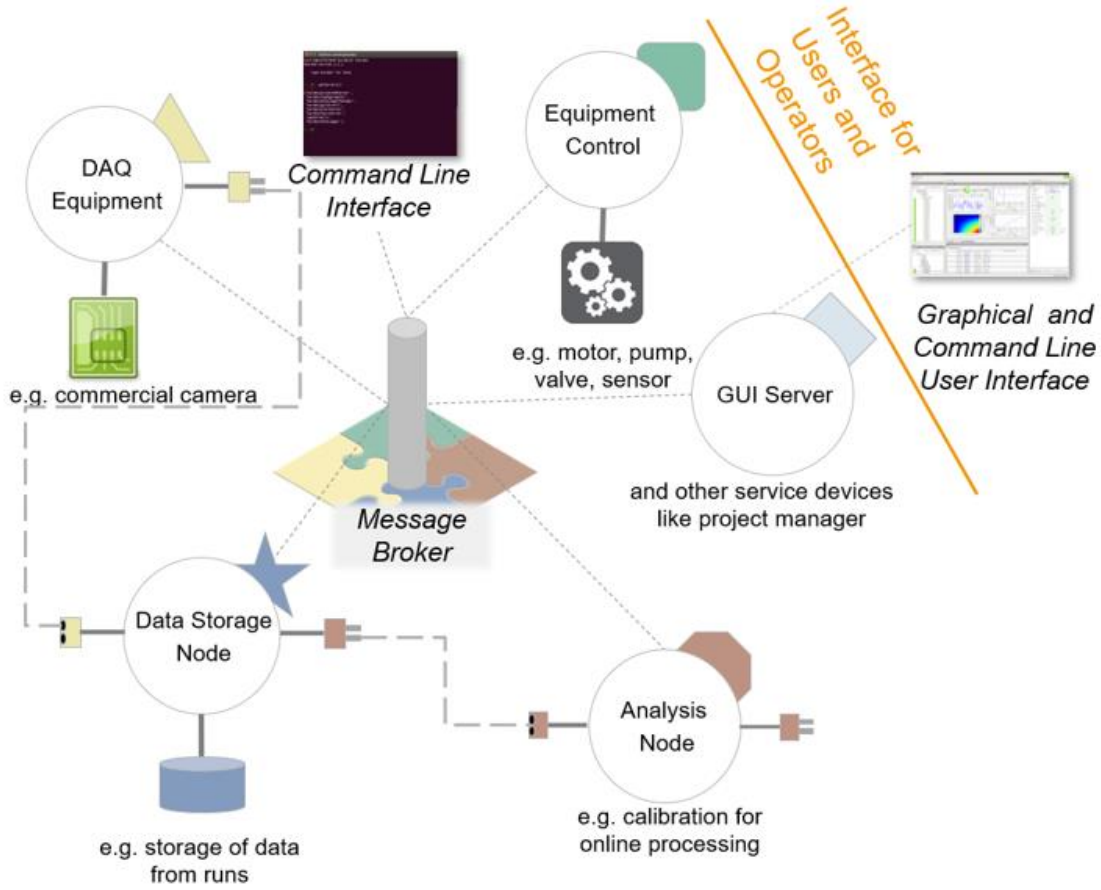


Karabo
(distributed controls system)
http://karabo.eu/

DAMNIT
(experiment data and metadata management)
https://damnit.rtfd.io/

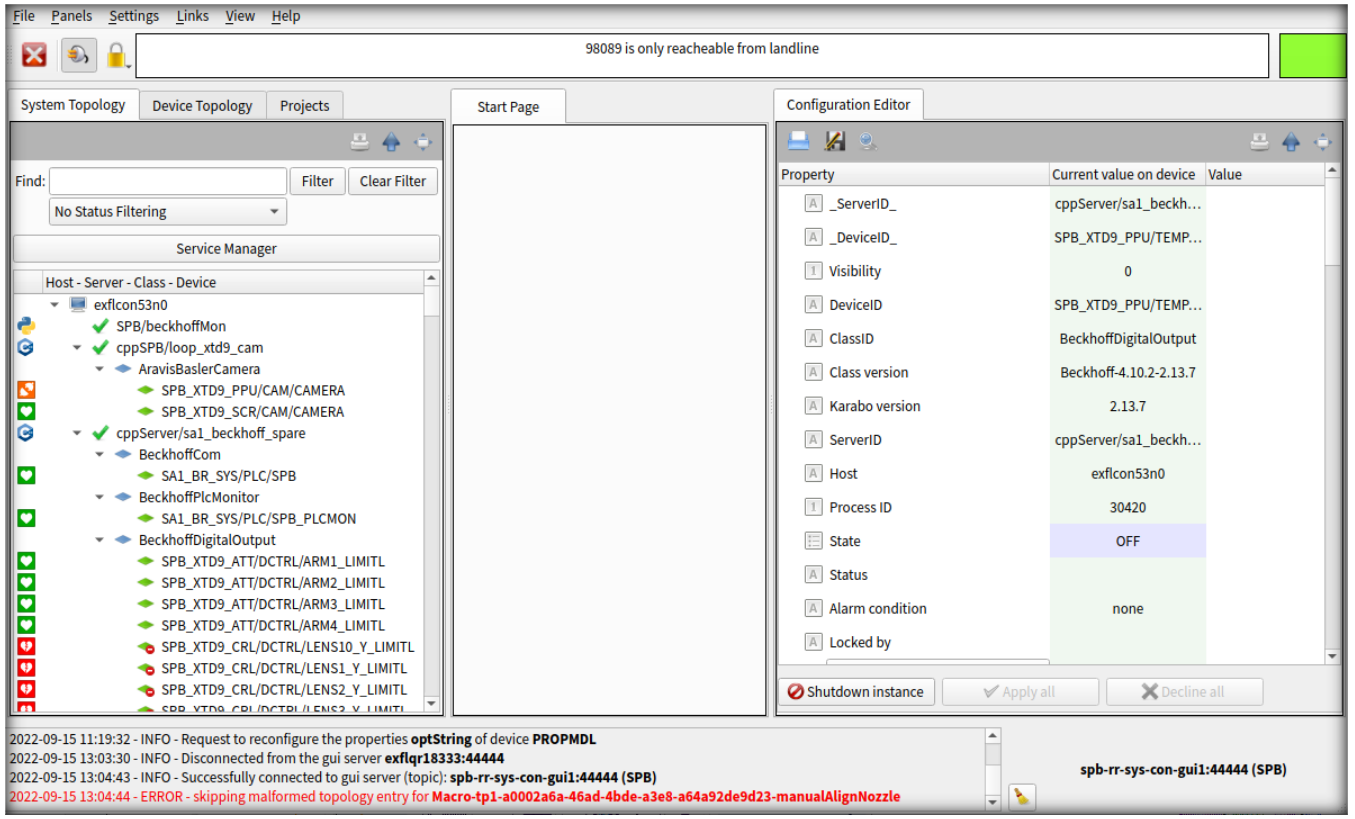
Karabo in a nut shell: Architecture

- Central Message Broker: RabbitMQ (Control data)
- Event and message driven:
  - Data propagates through the system on value change
  - Signal – Slot paradigm: publish and subscribe
- Peer-to-peer TCP connections for fast data
- GuiServer Device:
  - **Gateway** to the control system
  - TCP connection to application clients



Karabo GUI – The Cockpit

- **Python** software contained in Karabo framework
  - Separate package installation
- Technology: **Qt** Library and **Traits**
- **Core feature:**
  Scene (Panel) Designer
  Scene Model Interpreter
  - Extensible via guiextensions:
    a plugin updater for more widgets and controllers



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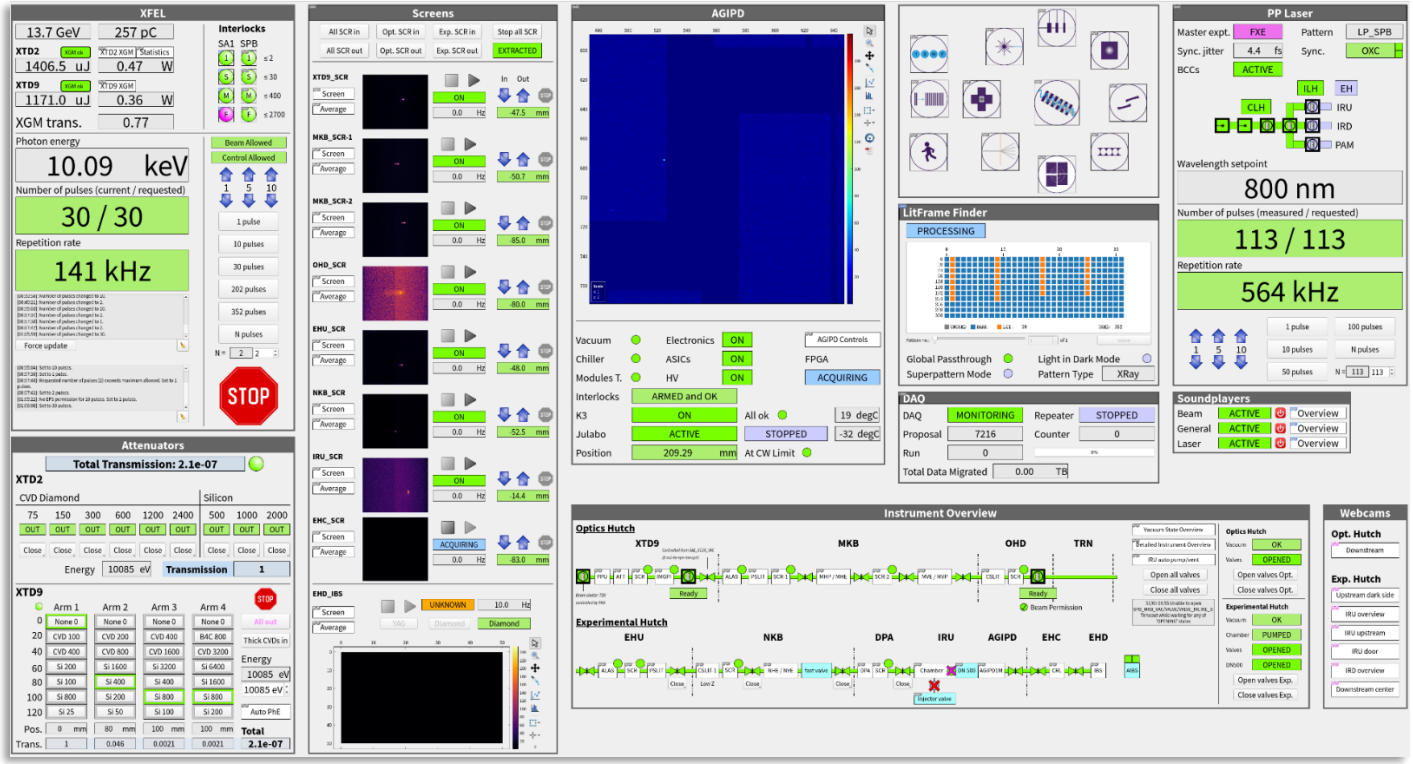
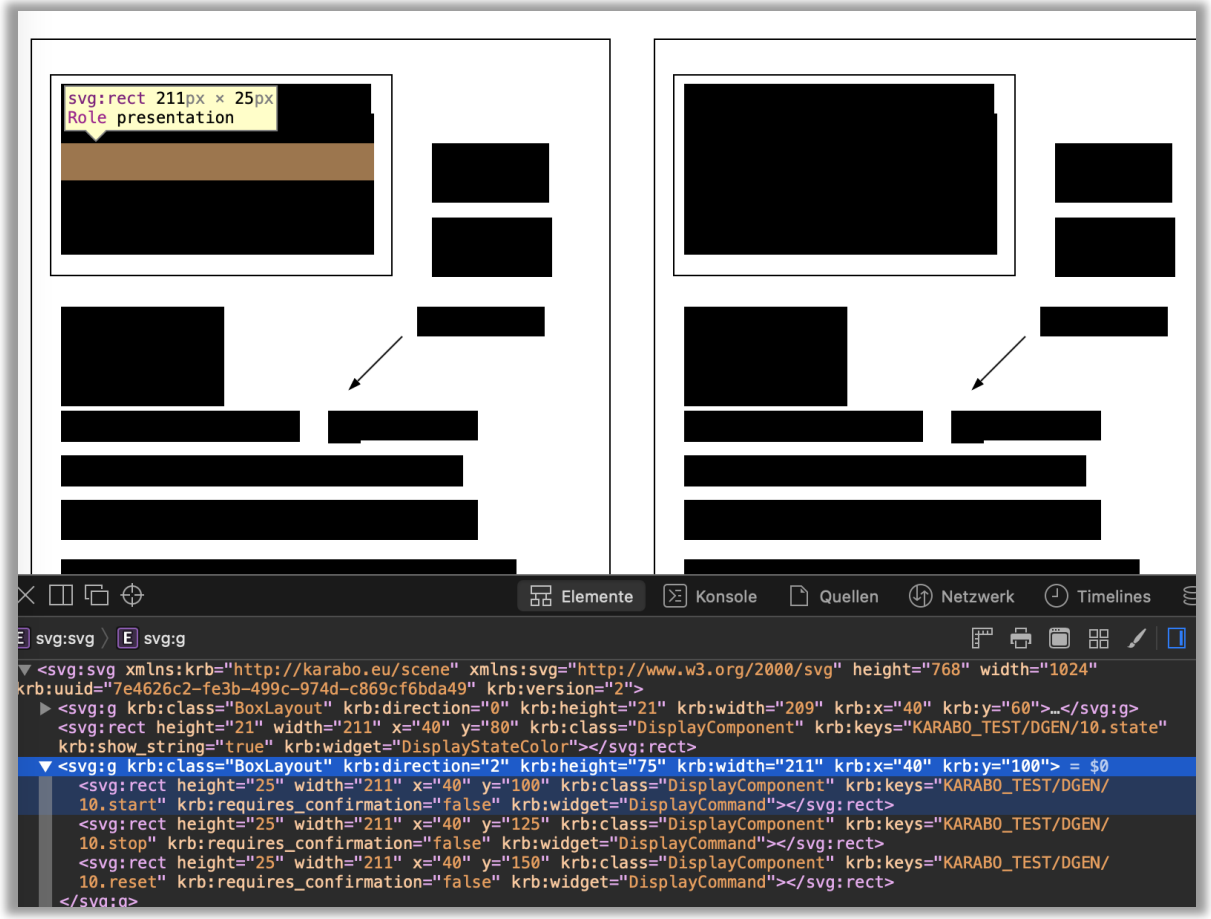


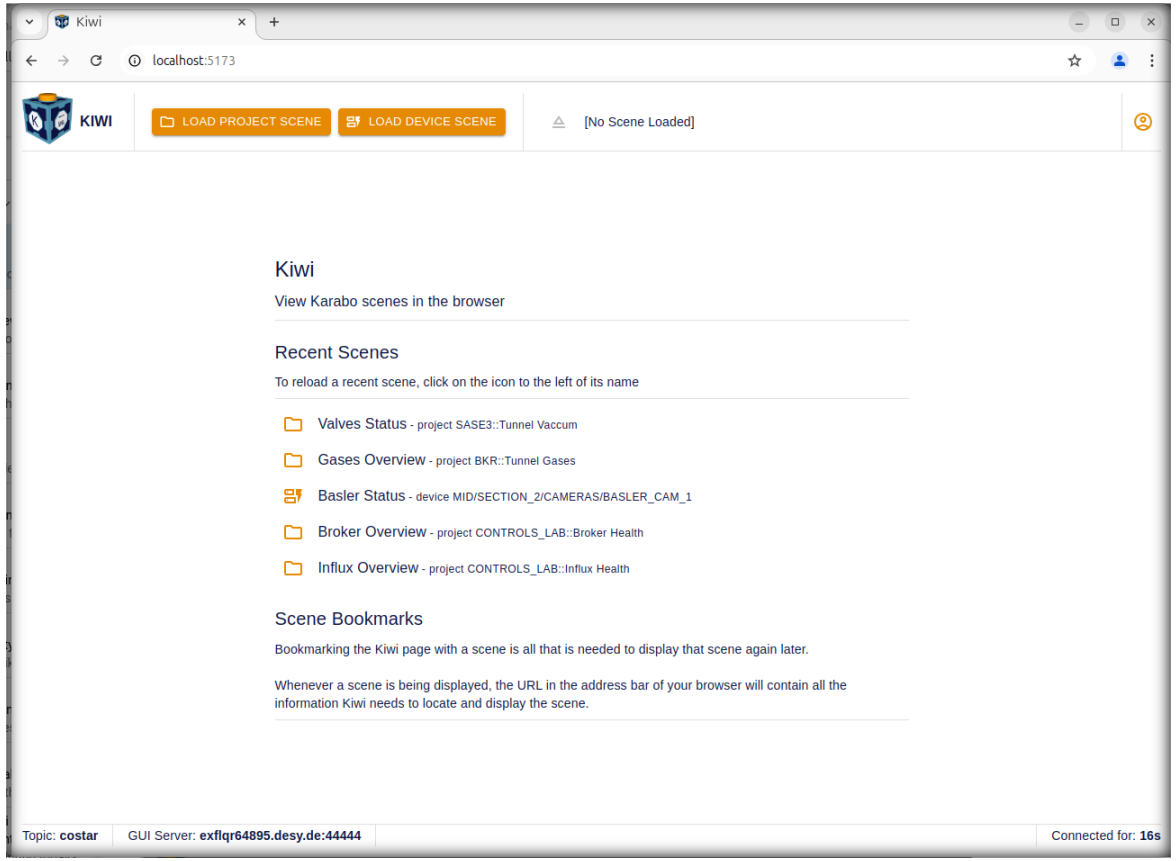
The Core Feature: The Scene

- Linked to every widget controller is a widget model
  - Separation of model and UI code facilitates external tools and applications
  - Scenes are stored as *.svg
  - The scene model is UI technology independent
- Scenes are stored in central database (ExistDB)



Motivation

- Encapsulate scenes in web form
  - To preserve integrity
  - To combine with other web services and control systems **(Synoptic View)**
- Hybrid between Qt and Web
  - Build Karabo scenes in Qt GUI Editor
  - Direct Web display
- Use of strong authentication features on the web (LDAP, KeyCloak)
- Server-side deployment instead of application deployment



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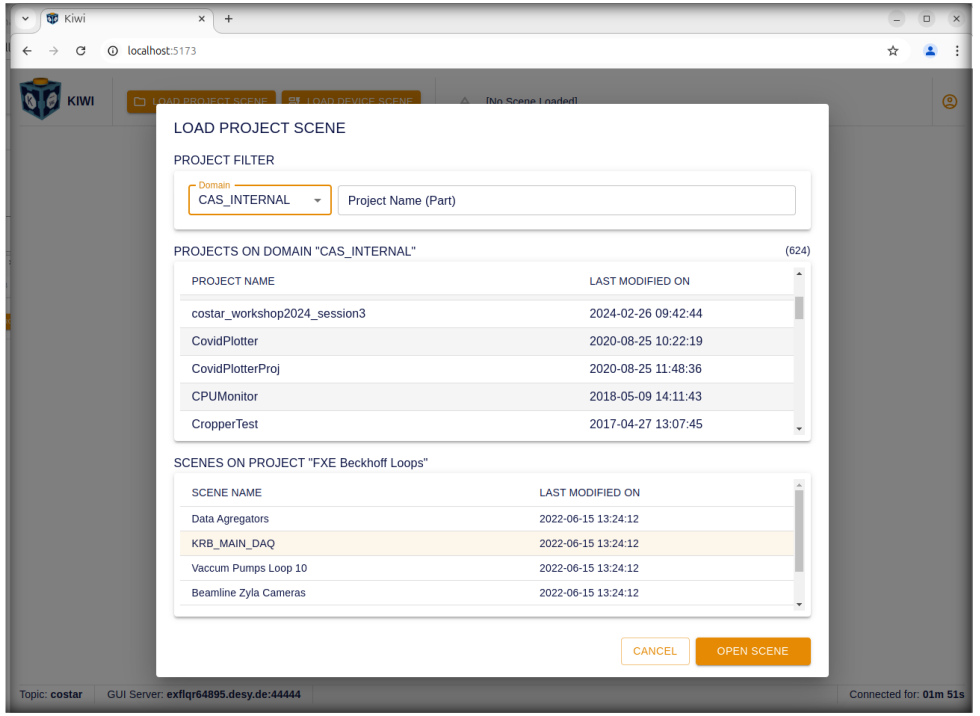
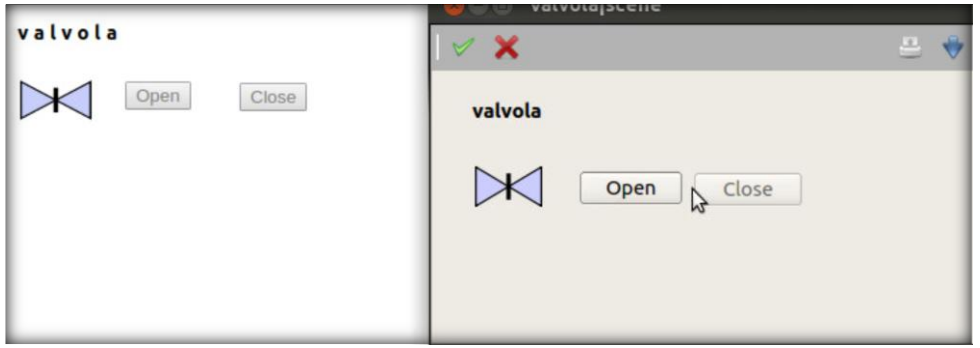




Karabo GUI - Strategy

- Backend: GuiServer device used for both Web and Qt Application (share same protocol)
  - WebSocket to TcpSocket mediator
- Technology Stack:
  - Frontend: React, Redux
  - Backend: FastAPI
- Translation of Karabo scene model to web is ongoing
  - Derive synoptic web view (read only) and concept of fast image streaming by beginning of **2026**
  - Provide plugin for widget extensions for other applications (Scantool Karabacon) by **2026**

Concept: Synoptic web view

Full user-facing experiment in a web view

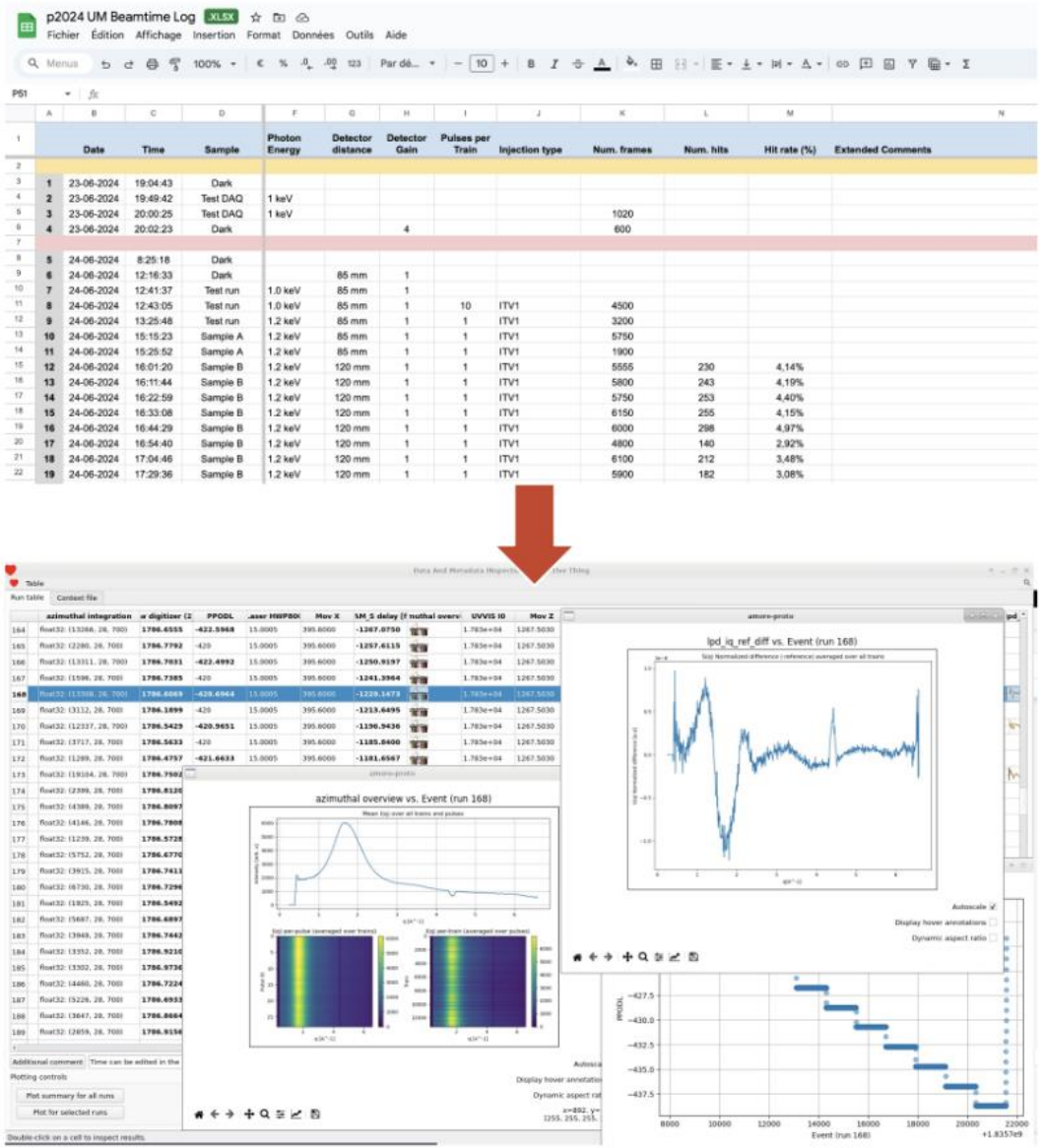
2025

Work Group (~3 personel)

2026

DAMNIT in a nutshell

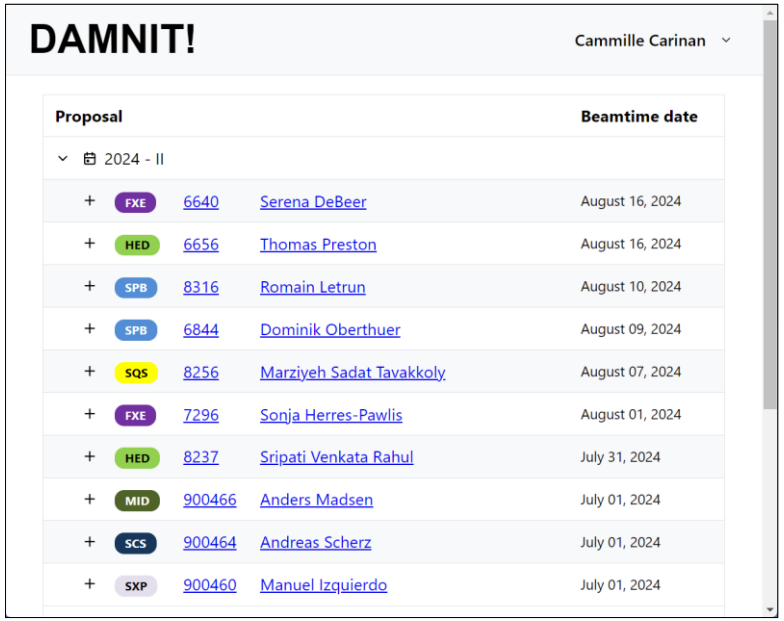
- Advanced alternative to traditional spreadsheets, specifically designed for **run tables**
- Interactive **PyQt**-based desktop application for data visualization and exploration
- Tabular format allows intuitive management of experimental data and metadata
- Automation through Python scripts for backend data processing and storage, integrated within the interface

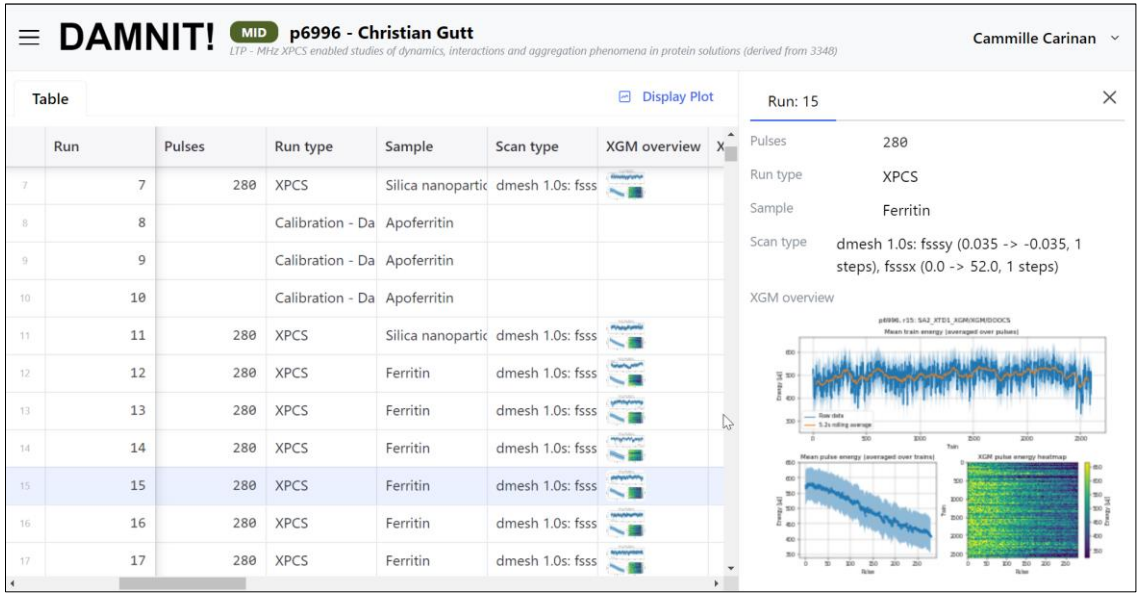


DAMNIT talk on the *data reduction session* (Thomas M.)
Wednesday, 24. September 2024, 5:10 PM

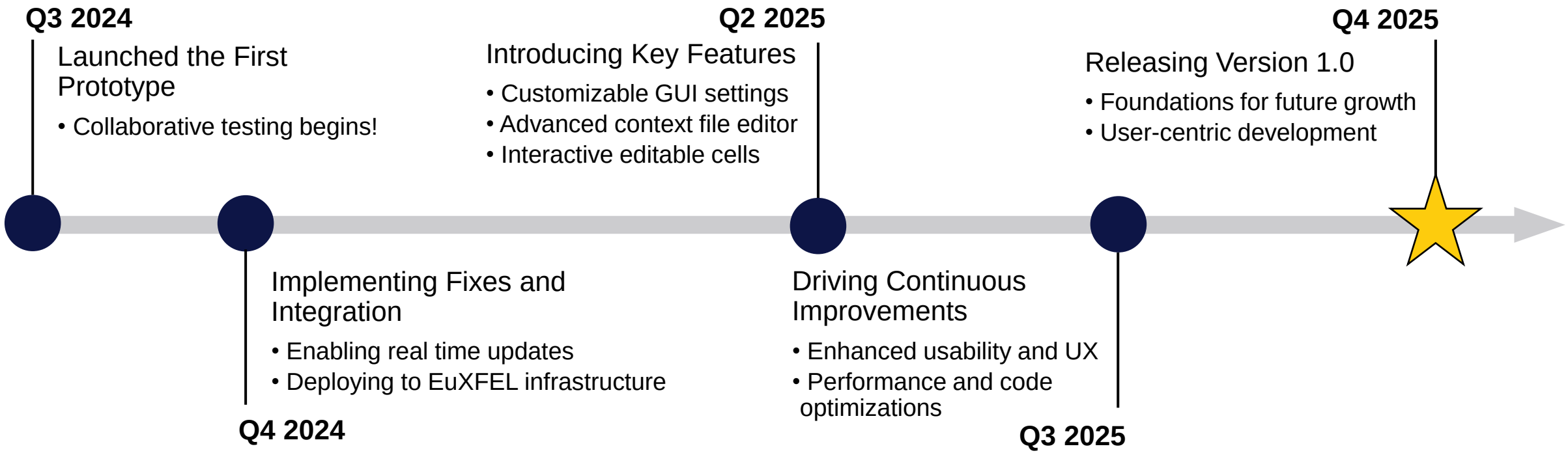
DAMNIT-web: First Prototype

- Frontend: React, Redux, Apollo GraphQL
- Backend: FastAPI, Strawberry GraphQL
  - OAUTH authentication
  - LDAP authorization
- Benefits of transitioning to web:
  - Enhanced usability with improved interface
    - ► Table pagination with infinite scrolling
    - ► Faster overview and interaction
  - Accessibility outside of the compute cluster
    - ► Web-based access
    - ► Secure external access
  - Real time updates via GraphQL subscriptions (in development)





Roadmap: From Prototype to Release



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Questions for the Community

- Transition Experiences
  - Have you undertaken a similar transition from desktop to web-based applications? If so, what were the key challenges you faced?
- Maintaining Consistency
  - What best practices have you implemented to maintain consistency across applications during a technology transition?
- Enhancing User Experience
  - What strategies have you found effective in improving user experience when redesigning application interfaces?
- Utilizing Metrics and Insights
  - Do you use metrics and other methods to gather insights that inform your design and development decisions? If so, which metrics and techniques have been most beneficial?