

MAX IV Control System

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Agenda

- Introduction
- Control System Overview
- Tango
- Architecture
- Workflow
- Conclusion

Introduction

3 accelerators:

- Full energy injector Linac with SPF
- 1.5 GeV storage ring
- 3 GeV storage ring
- 4 Diagnostic beamlines (TDC, B105, B302 and B320)

16 beamlines in operation:

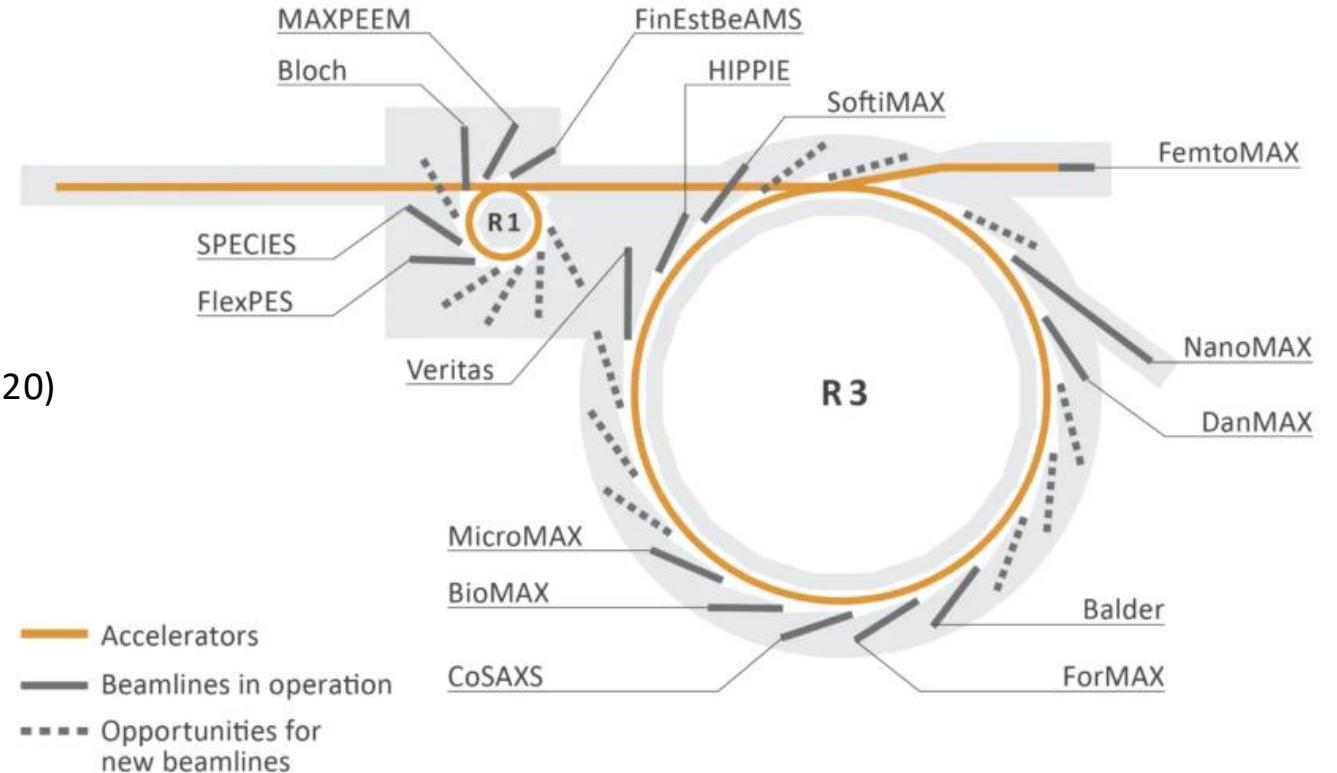
- 24 branches
- 1 in construction – [SinCrys](#) at [DanMAX](#)

1 beamline in construction:

- [TomoWISE](#) – founded by [WISE](#)
- Full-field tomography, 20 to 65 keV
- 10^{12} ph/s and 45 mm x 4.5 mm beam

10 support labs/systems:

- KITSLAB, MagLab, LaserLab, Cryo, GunLaser, SEDSMAX, OpticsLab, SPM, NoMad and DummyMAX



Control System Overview

[Tango](#) toolkit for SCADA

98% of devices servers are written in Python

On accelerators we have:

- ~15,100 devices servers -> equivalent to EPICS IOC
- ~36,500 configuration properties -> similar parts of EPICS .db
- ~61,000 commands -> equivalent to EPICS PV
- ~105.300 attributes -> equivalent to EPICS PV

[Sardana](#) for scanning and data acquisition

See flyscan sessions for Sardana details.



Tango



SOLARIS
NATIONAL SYNCHROTRON
RADIATION CENTRE



Elettra Sincrotrone Trieste



ESRF
The European Synchrotron



Origins & Architecture

- Developed at ESRF in 1999
- Based on a **central configuration database**

Devices

- **Devices** act as microservices — software or hardware components
- Devices belong to a **Device Class** and have a **unique 3-part name**: Domain/Family/Member (D/F/M)
- Devices are **stateful** and accessed via a **standard API**
- Devices can be **composed** from other devices (hierarchical architecture)

Attributes

- Represent **data fields** clients can **Read / Write / Subscribe to**
- Support **event-driven updates** (via ZeroMQ)
- Attributes can be **memorized** in the database



Tango

Commands

- Represent **actions**: e.g., On, Off, Move, Calibrate
- Support **typed arguments and results**
- Executed by clients to control device behaviour

Properties

- Stored in the database to **configure devices at startup**
- Can be set at **attribute, device, class, or global** level
- Accept **any Tango data type**

States & State Machine

- Every device has a **State** (14 predefined discrete values); Colour coded
- Each device class includes a **State Machine** to manage transitions
- Possible states: **ON, OFF, CLOSE, OPEN, INSERT, EXTRACT, MOVING, STANDBY, FAULT, INIT, RUNNING, ALARM, DISABLE** and **UNKNOWN**



Architecture - Network

Color-Coded Segmentation

Blue – Beamlines

- ▶ Each beamline is **isolated** from others

Green – Accelerator Systems

- ▶ Includes **PSS** (Personnel Safety System) and **MPS** (Machine Protection System)

Purple – High Data Throughput Zone

- ▶ Covers **detectors, BPMs, storage, and compute** resources

White – Office Network

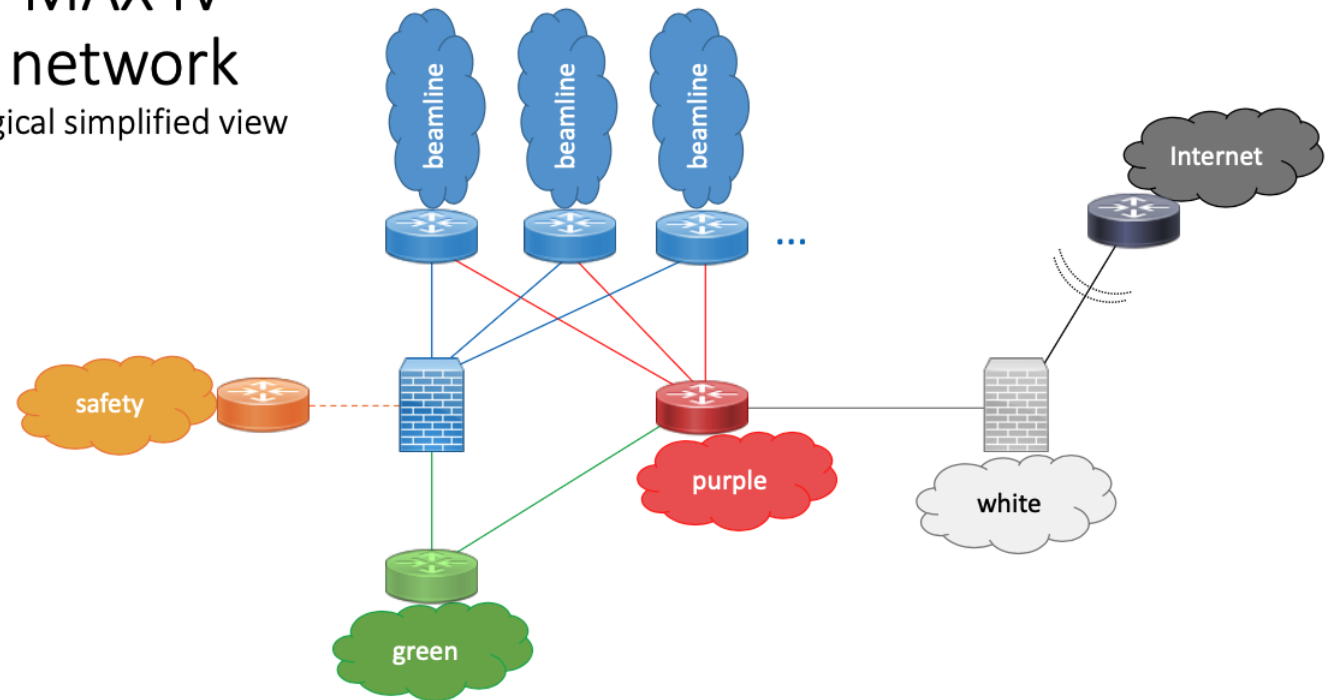
- ▶ General-purpose **servers, desktops, user services**

Safety – Dedicated to Gas Systems

Controlled Access & Security

- **Jump Hosts, VPN, and Firewalls** control traffic between segments
 - ▶ Example: **Beamline** → **Accelerator** access is strictly regulated

MAX IV
network
logical simplified view



Architecture - Technologies



Control System Toolkit

TANGO – one control system instance per system



Operating System

[Rocky Linux](#) (Enterprise-grade Linux distribution)



Virtualization Platform

VMware for infrastructure and system isolation



Programming Languages

Python, C++, and Java



Device Configuration Database

MariaDB for storing TANGO device and property definitions



Archiving System

[hdb++](#) on **TimescaleDB**

Custom-built data viewer: [Archviewer](#)



Alarm System

[Achtung](#) – in-house system, inspired by [PANIC!](#)



Alarm Notifications

[Notify](#) – developed in collaboration with [ESS](#)

Architecture - Technologies

Graphical User Interfaces

[Taurus](#) (based on PyQt)

[Taranta](#) (Web-based interface)

Timing System

[MRF](#) – Micro-Research Finland timing hardware

Communication Protocol

Ethernet-based across systems

Configuration Management

Ansible for system provisioning and automation

Source Code Management

Primarily **internal GitLab**

Gradual migration to [public gitlab](#) for selected projects

CI/CD Pipeline

GitLab CI integrated with **Ansible** for deployment

Monitoring & Alerts

Grafana for metrics dashboards

Graylog for centralized logging and log analysis

Scanning & Data Acquisition

[Sardana](#) – flexible framework built on TANGO

Architecture

Accelerator Network

Clients

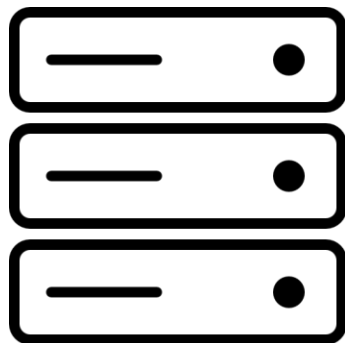


EVG

A



VM at VMWare cluster



DAQ cluster

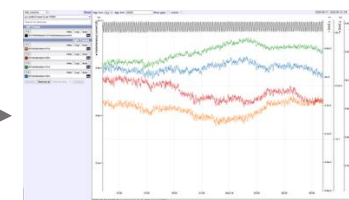


Archiver DB



Timescale

Archviewer



Client on any internal network



graylog



VICTORIA
METRICS

Grafana

Notify Adapter



Client on internet



Archviewer



Main Features

Attribute Search:

- Locate attributes by full name or wildcard (e.g., */pressure).
- Add attributes to left/right Y axes or create new ones.

Attribute Controls:

- Customize colour, style, and aggregation function.
- Download data in TSV or JSON format.

Y-Axis Management:

- Each axis has individual settings: Log scale, Auto scale, visibility toggle, and manual limits.
- Shared attributes on an axis use the same scale.

Time Range Control:

- Adjustable via calendar, presets, or mouse interaction.
- Supports **Live Mode** (auto-updating latest data view).



Advanced Functionality

Aggregation:

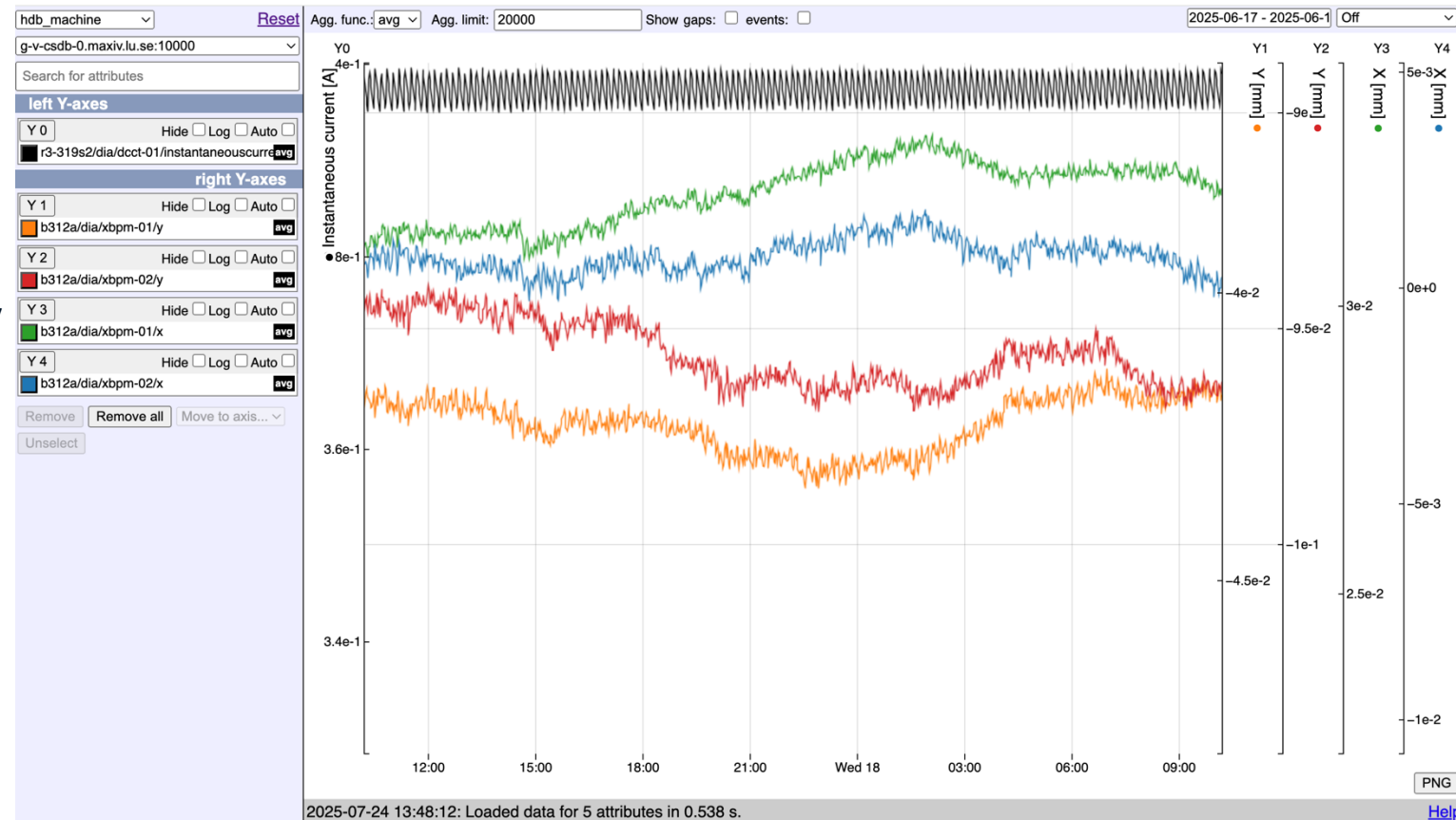
- Reduces data volume by using functions like avg, min, max.
- Automatically triggered for large datasets; customizable via aggregation limit.

Multiple Databases:

- Attributes from different databases can be plotted together.

Data & Plot Export:

- Download plot as PNG.
- Use URL to save/share specific views



Taranta

2.16.7 Not logged in. [Log In](#)

Widgets

Dashboards

Layers

>

Alarm Indicator

Attribute Dial

Attribute Display

Device/Attribute: 100

AttributeHeatMap

device/attribute

0

1

2

10

20

30

Attribute LED Display

Device/Attribute

Attribute Logger

Recent Attribute to log

12345

Log Message

12345

Attribute Plot

attribute 1

attribute 2

0

50

100

Time (s)

Attribute Scatter

attribute 2

attribute 1

-5

0

5

0

5

2.16.7 Not logged in. [Log In](#)

Attribute Writer

Device/Attribute:

unit

Attribute Writer Dropdown

Attribute:

Dropdown

Submit

Boolean Display

Attribute

Box

Command

Device/Command:

DevStr

Submit

Command File

Upload File

No file selected

Send

Command Switch

Device/Command

Dashboard Link

Dashboard 1

OPEN

Device Status

Device STATE

Embed Page

EMBED A PAGE HERE

Image Display

ImageTable

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

taranta.maxiv.lu.se/machine/dashboard?id=66b0cc31437e010012321e03&mode=run

2.16.7 aurfe Log Out

Devices

Dashboards

Synoptics

FE - main v1.2

| R3 | null | Reset Alarms | PLC | VGMB4 | VGC | IPN7 | BS | IPO6 | VGMB3 | FS | MM2 | IPO5 | MM1 | VGMB2 | IPO4 | VGC-a | VGFA | HA | HA DIA | FM3 | FM2 | IPQ3 | XBPM2 | XBPM1 | IPQ2 | FM1 | IPFE1 | IPFB1 | WAT | Ring Valve | ID Gap [mm] | |
|---------------|------|--------------|-----|-------|-----|------|----|------|-------|----|-----|------|-----|-------|------|-------|------|----|--------|-----|-----|------|-------|-------|------|-----|-------|-------|-----|------------|---------------|--|
| R303 NanoMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 37.00 | R303 NanoMAX | |
| R304 DanMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 48.00 | R304 DanMAX | |
| R308 Balder | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 47.00 | R308 Balder | |
| R309 ForMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 47.00 | R309 ForMAX | |
| R310 COSAXS | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 49.00 | R310 COSAXS | |
| R311 BioMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 37.00 | R311 BioMAX | |
| R312 MicroMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 48.00 | R312 MicroMAX | |
| R316 Veritas | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 150.00 | R316 Veritas | |
| R317 HIPPIE | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 150.00 | R317 HIPPIE | |
| R318 SoftiMAX | | Submit | | | | | | | | | | | | | | | | | | | | | | | | | | | | 150.00 | R318 SoftiMAX | |

| R1 | null | Reset Alarms | PLC | VGMB4 | VGC | IPN6 | BS | IPO5 | VGMB3 | FS | MM2 | IPO4 | MM1 | VGFA2 | IPQ3 | VGMB1 | HA DIA | HA | IPO2 | FM1 | IPE1 | WAT | Ring Valve | ID Gap [mm] | |
|--------------|------|--------------|-----|-------|-----|------|----|------|-------|----|-----|------|-----|-------|------|-------|--------|----|------|-----|------|-----|------------|-------------|---------------|
| R107 FlexPES | | Submit | | | | | | | | | | | | | | | | | | | | | | 150.00 | R107 FlexPES1 |
| R108 SPECIES | | Submit | | | | | | | | | | | | | | | | | | | | | | 150.00 | R108 SPECIES |
| R110 Bloch | | Submit | | | | | | | | | | | | | | | | | | | | | | 150.00 | R110 Bloch |
| R111 MAXPEEM | | Submit | | | | | | | | | | | | | | | | | | | | | | 150.00 | R111 MAXPEEM |
| R112 Finest | | Submit | | | | | | | | | | | | | | | | | | | | | | 150.00 | R112 Finest |

2.16.7 Not logged in. [Log In](#)

g-3061/vac/vna-01

CLOSE

Open

Close

Device

state

statusopen

statusclosed

alarms_list

moving

enabled

conflict

bypassed

g-3061/vac/vna-02

CLOSE

Open

Close

g-3061/vac/vna-05

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-03

CLOSE

Open

Close

g-3061/vac/vna-06

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-04

CLOSE

Open

Close

g-3061/vac/vna-07

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-05

CLOSE

Open

Close

g-3061/vac/vna-01

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-06

CLOSE

Open

Close

g-3061/vac/vna-02

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-07

CLOSE

Open

Close

g-3061/vac/vna-03

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-08

CLOSE

Open

Close

g-3061/vac/vna-04

CLOSE

false

true

false

true

false

false

g-3061/vac/vna-09

ALARM

Open

Close

g-3061/vac/vna-01

ALARM

false

true

g-3061/vac/vna-01_a01_ad_inalarm: Valve indication fault

false

true

false

false

g-3061/vac/vna-10

ALARM

Open

Close

g-3061/vac/vna-02

ALARM

false

true

false

true

false

false

g-3061/vac/vna-11

ALARM

Open

Close

g-3061/vac/vna-03

ALARM

false

true

false

true

false

false

g-3061/vac/vna-12

ALARM

Open

Close

g-3061/vac/vna-04

ALARM

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g-3061/vac/vna-13

ALARM

Open

Close

g-3061/vac/vna-05

ALARM

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g-3061/vac/vna-14

ALARM

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g-3061/vac/vna-06

ALARM

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g-3061/vac/vna-15

ALARM

Open

Close

g-3061/vac/vna-07

ALARM

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g-3061/vac/vna-16

ALARM

Open

Close

g-3061/vac/vna-08

ALARM

false

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true

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false

g-3061/vac/vna-17

ALARM

Open

Close

g-3061/vac/vna-09

ALARM

false

true

false

true

false

false

g-3061/vac/vna-18

ALARM

Open

Close

g-3061/vac/vna-10

ALARM

false

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false

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g-3061/vac/vna-19

ALARM

Open

Close

g-3061/vac/vna-11

ALARM

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g-3061/vac/vna-20

ALARM

Open

Close

g-3061/vac/vna-12

ALARM

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g-3061/vac/vna-21

ALARM

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g-3061/vac/vna-13

ALARM

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g-3061/vac/vna-22

ALARM

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g-3061/vac/vna-14

ALARM

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g-3061/vac/vna-23

ALARM

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g-3061/vac/vna-15

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g-3061/vac/vna-24

ALARM

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g-3061/vac/vna-16

ALARM

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g-3061/vac/vna-25

ALARM

Open

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g-3061/vac/vna-17

ALARM

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g-3061/vac/vna-26

ALARM

Open

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g-3061/vac/vna-18

ALARM

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g-3061/vac/vna-27

ALARM

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g-3061/vac/vna-19

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g-3061/vac/vna-28

ALARM

Open

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g-3061/vac/vna-20

ALARM

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g-3061/vac/vna-29

ALARM

Open

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g-3061/vac/vna-21

ALARM

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g-3061/vac/vna-30

ALARM

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g-3061/vac/vna-22

ALARM

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g-3061/vac/vna-31

ALARM

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g-3061/vac/vna-23

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g-3061/vac/vna-32

ALARM

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g-3061/vac/vna-24

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g-3061/vac/vna-33

ALARM

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g-3061/vac/vna-25

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g-3061/vac/vna-34

ALARM

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g-3061/vac/vna-26

ALARM

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g-3061/vac/vna-35

ALARM

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g-3061/vac/vna-27

ALARM

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g-3061/vac/vna-36

ALARM

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g-3061/vac/vna-28

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g-3061/vac/vna-37

ALARM

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g-3061/vac/vna-29

ALARM

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g-3061/vac/vna-38

ALARM

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g-3061/vac/vna-30

ALARM

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g-3061/vac/vna-39

ALARM

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g-3061/vac/vna-31

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g-3061/vac/vna-40

ALARM

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g-3061/vac/vna-32

ALARM

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g-3061/vac/vna-41

ALARM

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g-3061/vac/vna-33

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g-3061/vac/vna-42

ALARM

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g-3061/vac/vna-34

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g-3061/vac/vna-43

ALARM

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g-3061/vac/vna-35

ALARM

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g-3061/vac/vna-44

ALARM

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g-3061/vac/vna-36

ALARM

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g-3061/vac/vna-45

ALARM

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g-3061/vac/vna-37

ALARM

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g-3061/vac/vna-46

ALARM

Open

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g-3061/vac/vna-38

ALARM

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g-3061/vac/vna-47

ALARM

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g-3061/vac/vna-39

ALARM

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g-3061/vac/vna-48

ALARM

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g-3061/vac/vna-40

ALARM

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g-3061/vac/vna-49

ALARM

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Close

g-3061/vac/vna-41

ALARM

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g-3061/vac/vna-50

ALARM

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Close

g-3061/vac/vna-42

ALARM

false

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false

false

g-3061/vac/vna-51

ALARM

Open

Close

g-3061/vac/vna-43

ALARM

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g-3061/vac/vna-52

ALARM

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g-3061/vac/vna-44

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g-3061/vac/vna-53

ALARM

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g-3061/vac/vna-45

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g-3061/vac/vna-54

ALARM

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g-3061/vac/vna-46

ALARM

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g-3061/vac/vna-55

ALARM

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g-3061/vac/vna-47

ALARM

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g-3061/vac/vna-56

ALARM

Open

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g-3061/vac/vna-48

ALARM

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g-3061/vac/vna-57

ALARM

Open

Close

g-3061/vac/vna-49

ALARM

false

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false

g-3061/vac/vna-58

ALARM

Open

Close

g-3061/vac/vna-50

ALARM

false

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g-3061/vac/vna-59

ALARM

Open

Close

g-3061/vac/vna-51

ALARM

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g-3061/vac/vna-60

ALARM

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g-3061/vac/vna-52

ALARM

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g-3061/vac/vna-61

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g-3061/vac/vna-53

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g-3061/vac/vna-54

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g-3061/vac/vna-63

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g-3061/vac/vna-55

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g-3061/vac/vna-64

ALARM

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g-3061/vac/vna-56

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g-3061/vac/vna-65

ALARM

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g-3061/vac/vna-57

ALARM

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g-3061/vac/vna-66

ALARM

Open

Close

g-3061/vac/vna-58

ALARM

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false

false

g-3061/vac/vna-67

ALARM

Open

Close

g-3061/vac/vna-59

ALARM

false

true

false

true

false

false

g-3061/vac/vna-68

ALARM

Open

Close

g-3061/vac/vna-60

ALARM

false

true

false

true

false

false

g-3061/vac/vna-69

ALARM

Open

Close

g-3061/vac/vna-61

ALARM

false

true

false

true

false

false

g-3061/vac/vna-70

ALARM

Open

Close

g-3061/vac/vna-62

ALARM

false

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true

false

false

g-3061/vac/vna-71

ALARM

Open

Close

g-3061/vac/vna-63

ALARM

false

true

false

true

false

false

g-3061/vac/vna-72

ALARM

Open

Close

g-3061/vac/vna-64

ALARM

false

true

false

true

false

false

g-3061/vac/vna-73

ALARM

Open

Close

g-3061/vac/vna-65

ALARM

false

true

false

true

false

false

g-3061/vac/vna-74

ALARM

Open

Close

g-3061/vac/vna-66

ALARM

false

true

false

true

false

false

g-3061/vac/vna-75

ALARM

Open

Close

g-3061/vac/vna-67

ALARM

false

true

false

true

false

false

g-3061/vac/vna-76

ALARM

Open

Close

g-3061/vac/vna-68

ALARM

false

true

false

true

false

false

g-3061/vac/vna-77

ALARM

Open

Close

g-3061/vac/vna-69

ALARM

false

true

false

true

false

false

g-3061/vac/vna-78

ALARM

Open

Close

g-3061/vac/vna-70

ALARM

false

true

false

true

false

false

g-3061/vac/vna-79

ALARM

Open

Close

g-3061/vac/vna-71

ALARM

false

true

false

true

false

false

g-3061/vac/vna-80

ALARM

Open

Close

g-3061/vac/vna-72

ALARM

false

true

false

true

false

false

g-3061/vac/vna-81

ALARM

Open

Close

g-3061/vac/vna-73

ALARM

false

true

false

true

false

false

g-3061/vac/vna-82

ALARM

Open

Close

g-3061/vac/vna-74

ALARM

false

true

false

true

false

false

g-3061/vac/vna-83

ALARM

Open

Close

g-3061/vac/vna-75

ALARM

false

true

false

true

false

false

g-3061/vac/vna-84

ALARM

Open

Close

g-3061/vac/vna-76

ALARM

false

true

false

true

false

false

g-3061/vac/vna-85

ALARM

Open

Close

g-3061/vac/vna-77

ALARM

false

true

false

true

false

false

g-3061/vac/vna-86

ALARM


Open

Close

<





PLC2Tango

plc2tango_auto_commit

 PLC2TANGO deployment by johgru on danmax-1
plc2tango-okd authored 4 days ago

c6edc848

History

| Name | Last commit | Last update |
|--|--|--------------|
| .. | | |
|  .gitkeep | Add new directory | 4 years ago |
|  balder-1.csv | PLC2TANGO deployment by johgru on balder-1 | 3 months ago |
|  biomax-1.csv | Big clean up update for most beamlines | 1 year ago |
|  bloch-1.csv | PLC2TANGO deployment by johgru on bloch-1 | 8 months ago |
|  cosaxs-1.csv | PLC2TANGO deployment by jonlin on cosaxs-1 | 7 months ago |
|  cryo-1.csv | PLC2TANGO deployment by mirlin on cryo-1 | 3 years ago |
|  danmax-1.csv | PLC2TANGO deployment by johgru on danmax-1 | 4 days ago |

Added

R3-A101311/WAT/FSW-01

| | |
|-----------------------|---|
| Server | FlowSwitch/R3-A111212-CAB02-WAT-PLC-02-WAT |
| Class | FlowSwitch |
| Property | Value |
| AlarmsDesc | R3_A101311_WAT_FSW01_A01_AD_InAlarm:CIRCULATOR |
| AlarmsList | R3-A111212-CAB02/WAT/PLC-02/R3_A101311_WAT_FSW01_A01_AD_InAlarm |
| AlarmsReset | False |
| ByPassedAttribute | R3-A111212-CAB02/WAT/PLC-02/R3_A101311_WAT_FSW01_BP |
| StatusClosedAttribute | False |
| StatusOpenAttribute | False |

Updated

R3-A111212-CAB02-WAT-PLC-02/WAT/ALARM-01

| | |
|----------|--|
| Property | Value |
| AlarmD | R3_A101311_WAT_FSW01_A01_AD_InAlarm:CIRCULATOR |

AtkPanel 5.11 : R3-312S2/WAT/TSE-01

File View Preferences Help

R3-312S2/WAT/TSE-01

This equipment seems to work fine.

Bypassed

Temperature

HighWarningLevel

LowWarningLevel

HighAlarmLevel

LowAlarmLevel

HighWarning

LowWarning

HighAlarm

LowAlarm

41.70 degC

65.00

0.00

70.00

20.00

True

...

...

...

...

...

...

...

...

...

Scalar alarms_list

PLC2TANGO

| | |
|-----------------------------|-------|
| Web service | 2.1.5 |
| PLC2Tango (config tool) | 4.7.6 |
| Object Tag Definition (OTD) | 3.8 |

Upload your CSV file

System

Select a system

Equipment classes (High Level Devices) - All / None

Beamshutter

Conductivity Sensor

Fast Acting Valve

Flow Switch

Gas Sensor

Humidifier

Kill Switch

Linear Actuator

Mass Flow Controller

Movable Lid

PID Slave

Pneumatic Valve

Pressure Sensor

ServoMotorAxis

Tehus Temperature Sensor

Thermocouple

Turbo Pump B

Vacuum Gauge HVA

Circulation Fan

Control Valve

Filter Actuator

Fore Vacuum Pump

Halogen Heater

Humidity Sensor

Laser Shutter

Limit Switch

Mass Flow Regulator

Photon Beamshutter

Multistage Roots Vacuum Pump

Power Interlock Panel

Proximity Sensor

ServoMotorSystem

Temperature Sensor

Tilt Sensor

Uninterruptible Power Supply

Water Pump

Compressor

Differential Pressure Sensor

Flow Gauge

Fore Vacuum Pump Kashiyama

Heat Absorber

Ion Pump

Lens Actuator

Manual Valve

Mass Flow Regulator Bronkhorst

PID Master

PLC Macro

Pressure Control Valve

Screen

Tehus Humidity Sensor

Temperature Switch

Turbo Pump (A)

Vacuum Gauge

Equipment classes (General devices)

EIP (AllenBradley device)

Alarm

Tag list file

Choose file No file chosen

The CSV tag dump file from the PLC.

Validate

Validates the taglist against the rules specified by the Object Tag Definition.

Simulate deploy

Runs a simulated deploy to the Tango Database (non destructive). The result describes the diff in configuration.

Deploy

Deploys the configuration to the Tango Database. The result describes the diff in configuration.

You must login to deploy. [Log in](#)

Workflow

Controls Team

- Responsible for the **software layer** of the Control System
- Collaborates closely with other technical groups

Team Composition

- **10** permanent staff
- **4** consultants

Distribution

- Each Controls team member acts as the **Contact Person** for **2–3 system** (↔ responsible for follow-up, coordination, and support)

Evolving Workflow

- Transitioning toward a **team-based structure**
- Exploring **Kanban** for planning and tracking work

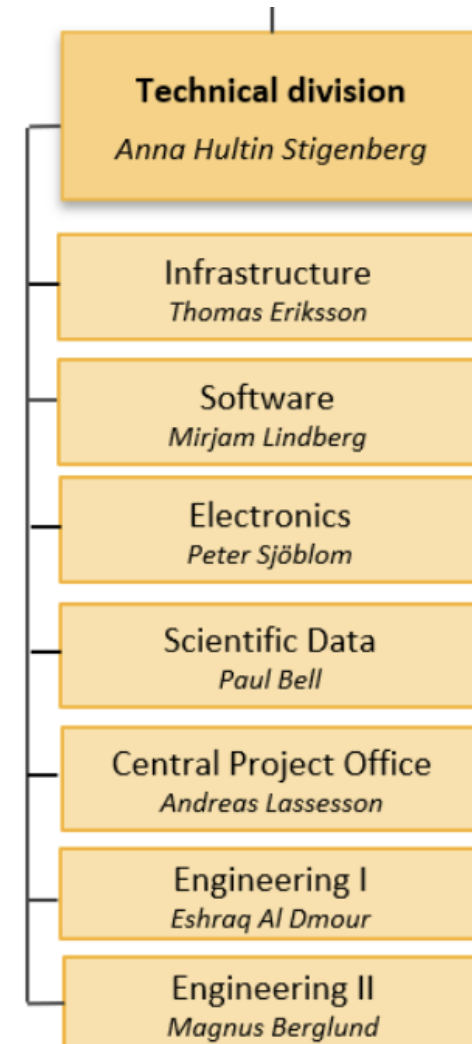
Software Group

| MX | Controls | Applications |
|---|--|---|
| <ul style="list-style-type: none">• Mirjam• Alberto 50%• Elmir• Fabien• Matheus (July 2nd)• Recruitment• Dominika• Pawel | <ul style="list-style-type: none">• Áureo• Benjamin• Anton• Ben• Dmitry• Henrique• Johan• Lin• Vanessa• Yimeng• Recruitment• Recruitment• Hanno• Juanzi• Lukas• Wojtek• Consultant | <ul style="list-style-type: none">• Carla• Alberto 50%• Angshuman• Emil• Martin• Moa• Recruitment• Recruitment (DUO)• Jonatan |

Workflow

👤 Shared Responsibilities

- **Infrastructure Group**
 - Manages clusters, storage, virtualization, and networking
- **Electronics Group**
 - Handles hardware installation, schematics, motion systems, and timing
- **Detectors & Scientific Data Group**
 - Manages detector interfaces, live view tools, and analysis pipelines
- **MX Team – Software Group**
 - Responsible for Crystallography beamlines: **BioMAX & MicroMAX**
- **Applications Team – Software Group**
 - Develops web-based user interfaces (e.g., **Taranta**), **data management systems** and **Digital User Office**



Workflow

 **Development Cycle:** Operates on a 2-week sprint cycle

 **Work Backlog Categories**

Projects

- ▶ Long-term, externally or internally funded
- ▶ Managed by the **Central Project Office (CPO)**
- ▶ Sometimes grouped into **Programs**

Operation Projects

- ▶ Short-term tasks (~2–3 weeks)
- ▶ Managed by the **Beamline Office (BO)**

Operations

- ▶ Day-to-day tasks:
- ▶ Maintenance, issue resolution, user support, and small feature requests

 **Regular Meetings**

Weekly Beamline Operations Meeting

Weekly Accelerator Operations Meeting

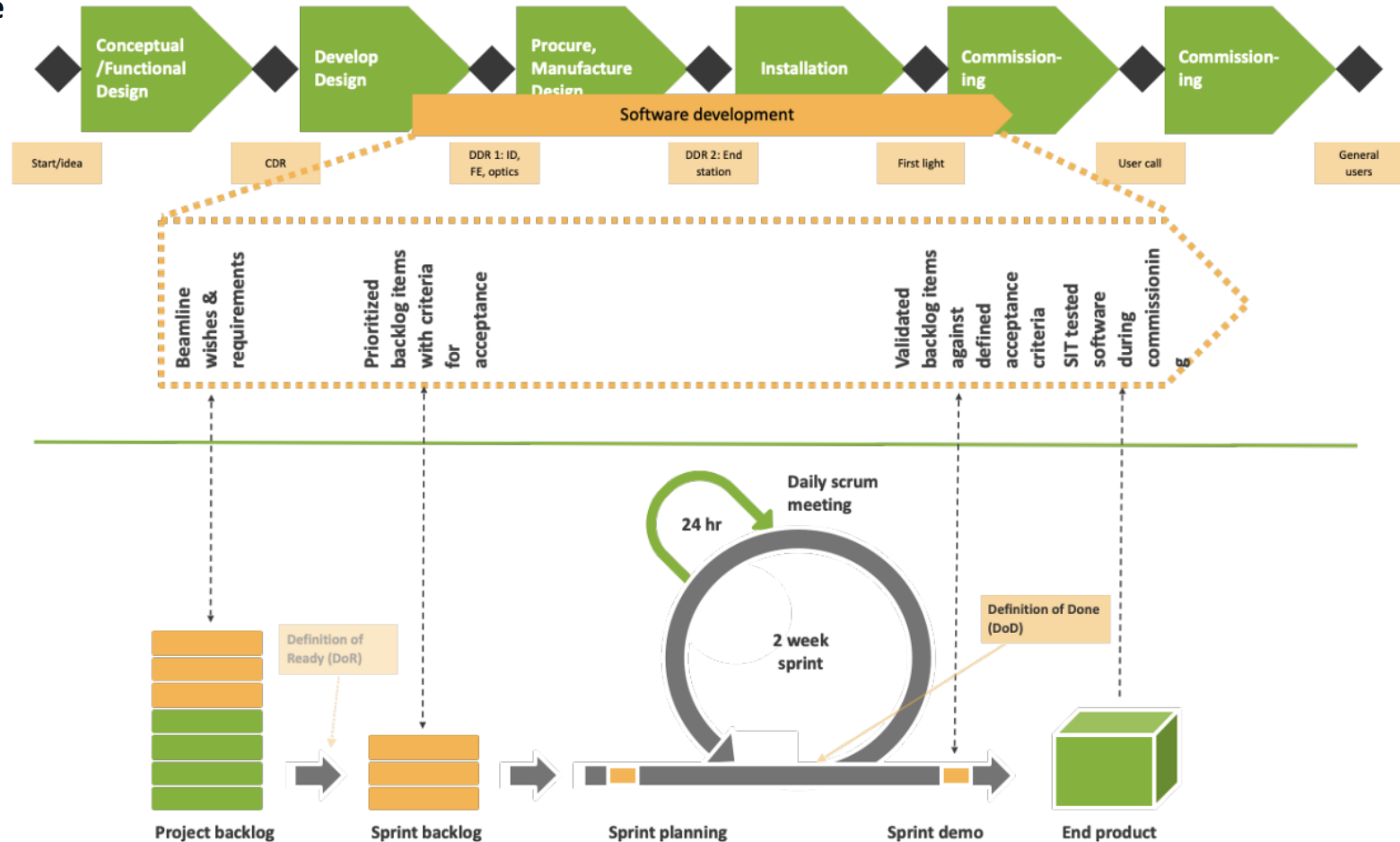
 **Prioritization**

Not owned by the Controls team

- ▶ Priorities are driven by external stakeholders and coordinating groups

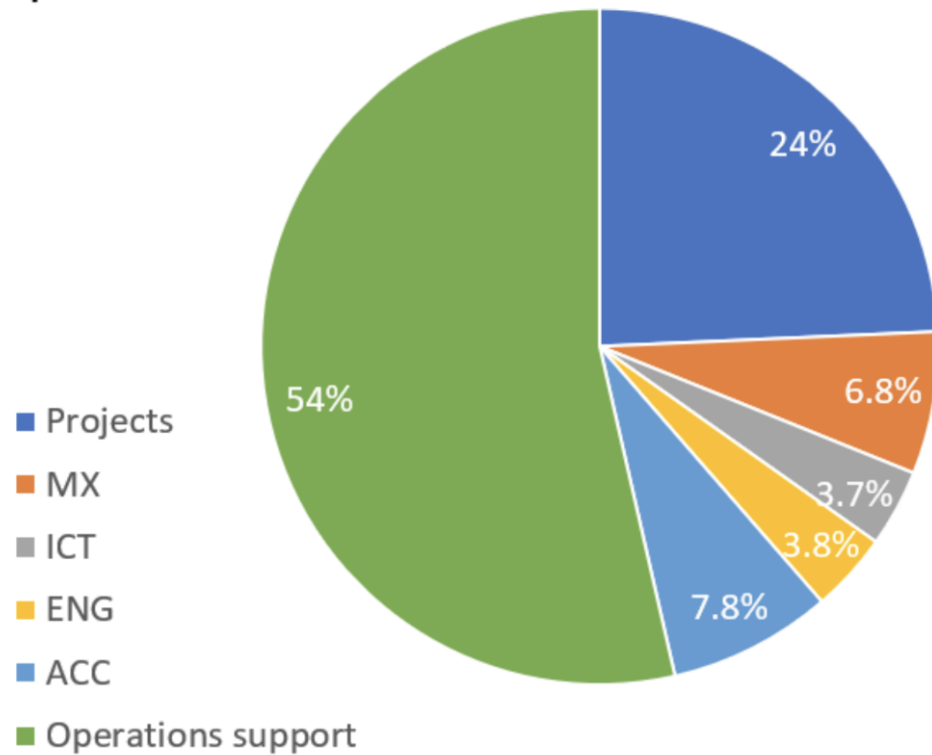
 **Tooling**

Taiga – used for user story tracking and task management

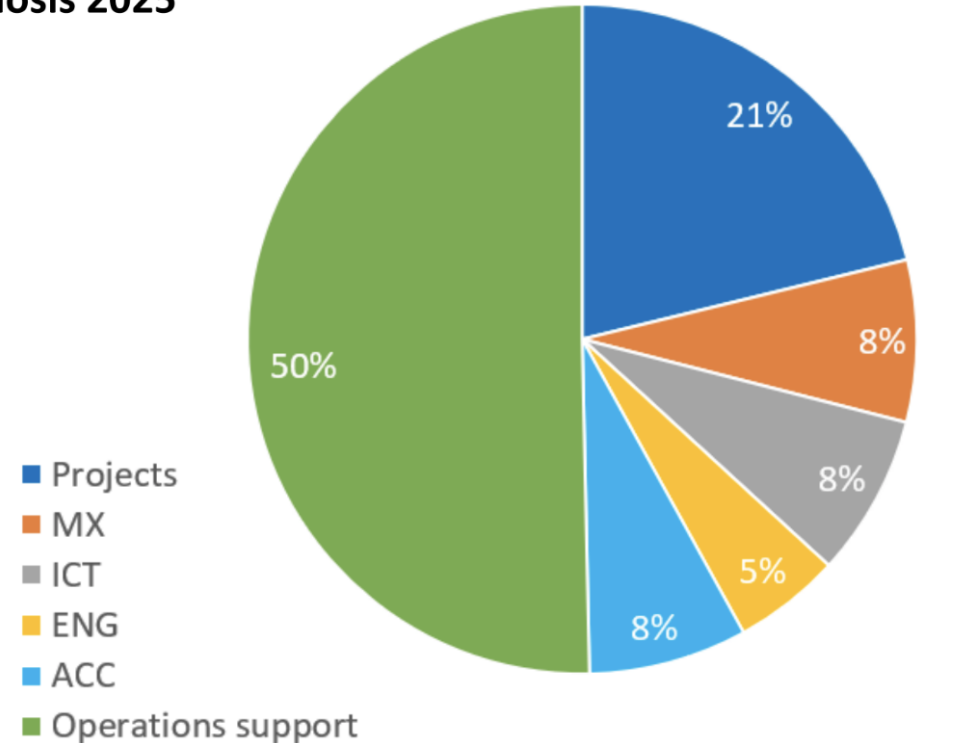


Workflow - Ressource distribution

Reported to date 2024



Prognosis 2025



Workflow

From Backlog to Plan

- **Beamline Contacts** and **Project Groups** propose items for the upcoming sprint
- Discussed during the **Planning Meeting**

Estimation & Planning

- **Team Estimation Meeting**: effort and feasibility assessment
- **Group Manager (GM)** and **Team Leads (TLs)** review and clean up the sprint plan
- Priorities aligned with **CPO** and **BLOPS** (Beamline Operations)

Task Execution

- Team members **self-assign tasks**
- Task lifecycle:
In Progress → In Review → In Validation → In Deployment → Done
- **Ad-hoc tasks** allowed for **urgent/emergency issues**

Deployment Routines:

Beamlines

- **Monday deployment** window
- Major deployments discussed in the **Beamline Operations Meeting**
- **Changelog** shared via mailing list (based on GitLab milestone)
- Deployed using **Ansible** with a **scheduled deployment crew**

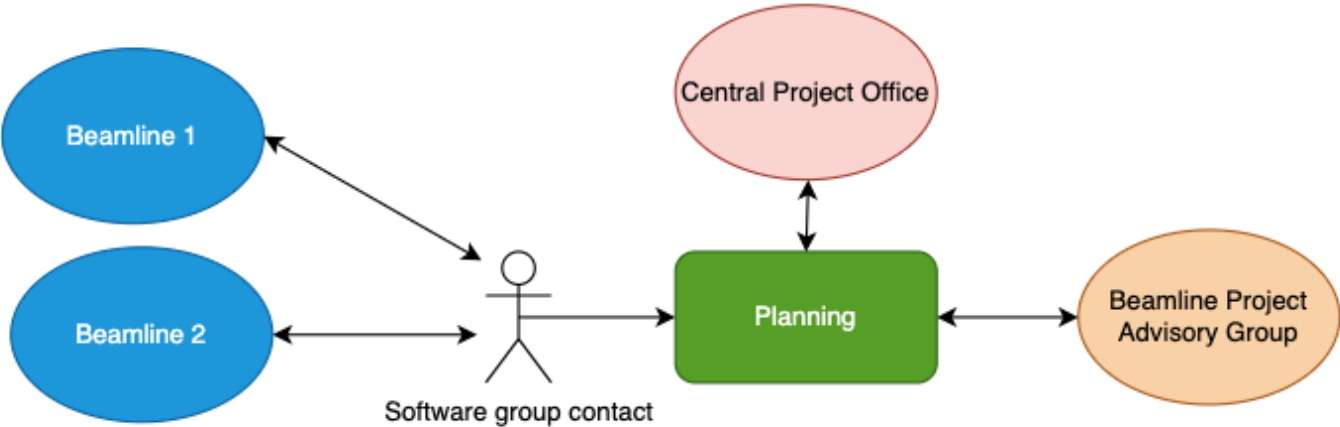
Accelerators

- Deployments planned during **Accelerator Operations Meeting**
- Evaluated in coordination with other activities
- Uses [J5](#) stack for scheduling and tracking maintenance

More Info

See **Operational Support** session for further details

Planning workflow:



Technology Readiness Level TRL:

| TRL Level | TRL 1 | TRL 2 | TRL 3 | TRL 4 | TRL 5 | TRL 6 | TRL 7 | TRL 8 | TRL 9 |
|-------------------|------------------------|--|---|--------------------------------------|---|---|---|--|---|
| Color code | | | | | | | | | |
| MAX IV definition | | Basic simulation / calculation completed | Demonstrated in a laboratory / workshop that elements of the concept are feasible | Sub system test | System test | Technology fully implemented and fully verified | Technology validated with (experts, stakeholders) | Technology operational with intended users | Technology operationally in multiple environments or standard operation with bread and butter users |
| Test env. | | Theoretical | Laboratory | Component test rig | Test rig with critical interfaces | Solution tested in operational environment | Operational environment | Operational environment | Operational environment |
| Involvement | | Formulate project | Formulate Project | BL/ACC/Orderer- no end users | BL/ACC/Orderer- no end users | BL/ACC/Orderer- no external users | "Friendly/Expert users" | "End user/s" | "End users" |
| Support | | Project team | Project team | Project team | Project team | Project team | Project team | KITOS & on call | KITOS & on call |
| TRL | TRL 1->2 | TRL 2->3 | TRL 3->4 | TRL 4->5 | TRL 5->6 | TRL 6->7 | TRL 7->8 | TRL 8->9 | |
| Level Criteria | | Discuss with other subject matter expert if concept applies to real use case | core part of component developed and tested | component developed and tested | Verified by BL/ACC/Orderer | Validated with an expert or friendly end user | Acceptance after X beamtime with end-user | Proven Performance | |
| Operation | No Impact on operation | | | | Removable from operation modes | Lower the overall level of operation mode | | | |
| Time Frame | | | | | Transition should be minimal in time e.g criteria evaluation have to be prepared in | | | | |
| Feature | | | core feature | component implemented | System fully implemented | | | | |
| Example | | | Software Library developed | Tango device with standard interface | Complete software and hardware suite | | | | |
| Test | | | Unit tests | Integration tests | Verification | | | User feedback has been positive | |

Milestone example:

ClosedMilestone expired on Apr 28, 2025Reopen milestone

release-2025-04-28

Issues0Merge requests11Participants0Labels0

Work in progress (open and unassigned)0

Waiting for merge (open and assigned)0

Rejected (closed)0

Merged11

cfg-maxiv-ansible · Add new HEAT3 to SPECIES
I7105

cfg-maxiv-ansible · Update sardana-softimax to dev version
I7096

cfg-maxiv-ansible · Update sardana to 3.5.2post1+maxiv
I7093

cfg-maxiv-ansible · Add package qrcode to sardana_conda_plugins for Danmax
I7076

cfg-maxiv-ansible · MXCuBE: deploy SciCat Kafka certificates
I7075

cfg-maxiv-ansible · use dev version for tangods-balderpandabox in b-v-balder-ec-1.yml
I7064

cfg-maxiv-ansible · MicroMAX: add MXCuBE staging host
I7055

cfg-maxiv-ansible · Update tangods-cosaxspandabox to 3.5.0
I7053

cfg-maxiv-ansible · Update sardana-cosaxspandabox to 3.3.0
I7050

cfg-maxiv-ansible · Update tangods-nanomaxfacade to 1.0.1
I7044

cfg-maxiv-ansible · Test sardana 3.5.2post0+maxiv at finest and dummymax
I7038

Sprint example:

| Sprint 2652025-06-13 - 2025-06-27 | | | | | | |
|-----------------------------------|---|------------|--------|-----------------|----------------------|--|
| My tasks | | | | | | |
| ID | Title | Sprint | Points | Status | Assigned to | |
| + 7940 | [Issue] Finest: Timeout when changing EPU config | Sprint 265 | 2 | ● Novo | | |
| + 7937 | Cont scans: study flexpes ID energy for trajectory preparation | Sprint 265 | 3 | ● In validation | Lin Zhu | |
| + 7936 | Cont scans: make velocity restoration method more robust | Sprint 265 | 3 | ● In validation | Wojciech Kitka | |
| + 7932 | Species GAS: mass flow regulator update for new OTD | Sprint 265 | 2 | ● Terminado | Áureo Freitas | |
| + 7945 | PEAK: improvements from integration testing at HIPPIE - 35 | Sprint 265 | 5 | ● Terminado | Anton Joubert | |
| + 7946 | Eng Prog: VAC: continue VACCA updates | Sprint 265 | 2 | ● In validation | Hanno Perrey | |
| + 7869 | Balder (DAQ 2): configure Eiger for either SPM or TotalTriggers | Sprint 265 | 5 | ● Em andamento | Dmitry Egorov | |
| + 7956 | BioSAXS: Manager DS prototype | Sprint 265 | 5 | ● Em andamento | Lukas Wittenbecher | |
| + 7934 | [DUO keep alive]:Matabase:Review all the reports and fix the broken ones [Part 7] | Sprint 265 | 3 | ● Novo | Angshuman Chatterjee | |
| + 7942 | DUO: Move all the blob data to the filesystem from the EXPREPATT table | Sprint 265 | 5 | ● Terminado | Alberto Nardella | |
| + 7933 | [MACH4] - fix trajectory motor ALARM state and add close traj point position function | Sprint 265 | 8 | ● Terminado | Vanessa Silva | |
| + 7935 | [SOS] Tango 10 upgrade: tango-db and os upgrade (minor version) | Sprint 265 | 1 | ● Terminado | Áureo Freitas | |
| + 7938 | [BPAG] Make wrapper for sequencer energy scan macro | Sprint 265 | 5 | ● Terminado | Áureo Freitas | |
| + 7943 | DanMAX - Add rotary min value to pcap | Sprint 265 | 2 | ● Terminado | ext-juashi | |
| + 7944 | Acc Ops: Investigate line positions not being stored in Basler camera | Sprint 265 | 3 | ● In validation | Hanno Perrey | |
| + 7947 | Elogy: update elogy2 | Sprint 265 | 1 | ● Em andamento | Johan Forsberg | |
| + 7948 | Veritas: memory leak in sampletracker GUI | Sprint 265 | 2 | ● In review | Johan Forsberg | |
| + 7955 | [scicat] update certificates | Sprint 265 | 1 | ● Em andamento | Emil Gunnarsson | |
| + 7959 | [Unplanned] plc2tango: Unable to create facade devices for subsystem DIA on machine | Sprint 265 | 1 | ● Terminado | Emil Gunnarsson | |
| + 7960 | [Unplanned]: MicroMAX: mono pid for optical hutch | Sprint 265 | 2 | ● Terminado | Áureo Freitas | |
| + 7961 | Eng Prog: Neg-coating 2: update PLC stack and user interfaces | Sprint 265 | 3 | ● Terminado | Áureo Freitas | |
| | | | 64 | | | |



Conclusion



Project Handover to Operations

- Formal **handover process still to be defined**
- Using **Technology Readiness Levels (TRL)** as a potential framework for transition



Maintenance Process

- Opportunity for improvement in:
 - **Validation scheduling**
 - **Planning and resource coordination**
 - **Follow-up and accountability**



Operations Classification & Tracking

Need to **categorize operational activities** to better understand resource usage

Important to distinguish between:

- **Unplanned work**
- **Work caused by poor planning**



Upcoming Project Challenges

SXL (Soft X-ray free electron laser)

MAX 4U – next major expansion at R3

TomoWise – Full-field tomography beamline

PLC on OPCUA – improve communication bandwidth for timestamp resolution

MAXIV