MAX IV - Control System Operational Support

Agenda

- Introduction
- Problem
- Organization
- Workflow
- Follow-up
- Report
- Conclusion

Introduction: Why operational support is critical for Control Systems?

⚙️ **The glue of the Synchrotron facility: Control System**

- Every subsystem — from beam diagnostics to vacuum and RF — relies on robust control.
- Control Group ensures **system integration**, **device communication**, **interconnection** and **data acquisition**.

🧩 **Complexity & Interdependence**

- A synchrotron consists of **hundreds of interconnected components**.
- Operational support maintains **synchronization, automation, interconnection and stability** across these systems.

🔧 **Why Operational Support?**

- **Reliability** is non-negotiable for experiments and beam delivery.
- Enable rapid **troubleshooting, tuning, and reconfiguration**.
- Reduce downtime and increases **user beamtime availability**.

🚨 **Without Support?**

- Failures in controls may ripple across the entire machine and beamlines:
  ➤ Beam instability
  ➤ Data loss
  ➤ Delayed experiments

Problem

From Day One (2016-2022):

- Only **one person** carried the support phone during weekdays.
- **Primitive rotation**, no formal structure → inconsistent and stressful.
- Clients experienced **delays**, **frustration**, and **unclear expectations**.

Support Coverage Gaps:

- Weekdays (08:00–17:00): Daytime support for all former KITS groups: **Controls, Infrastructure, Electronics, Detectors and Scientific Data & Infrastructure**.
- One on-call person during off-hours:
  - Weekdays: 17:00–23:00
  - Weekends: 08:00–20:00
- **Same person handled everything**, regardless of domain.
- Single point of failure.

Facility Growth Outpaced the Model:

- As the facility scaled, the **lack of structure became a bottleneck**.
- Reactive support → led to operational risks and inefficiencies.
- Frustration from clients and users

Need for Change:

- Inspired by **DOC (Data department Operation Centre)** at **European XFEL**.
- Vision: Create **KITOS** — Controls & IT **Operational Support**:
  A structured, sustainable, and domain-aware support framework.

Organization – KITOS: 2022-present

Collaborative Taskforce Formation

- Joint effort across all major groups: **Software**, **Electronics**, **Infrastructure**, **Detectors & Scientific Data**
- Goal: Develop a sustainable, shared operational support structure (KITOS)

Taskforce Coordinator – Unofficial role

- Responsibilities:
  - Organize meetings
  - Structure and documentation
  - Schedule coordination and follow-ups
  - Serve as central point of contact

Taskforce Members

- **1–2 representatives from each group**
- Support the coordinator and help implement KITOS duties
- Serve as **weekly KITOS shift coordinators** on a rotation basis

Group-Wide Participation

- **All members** of each group contribute to **daytime KITOS shifts (08:00–17:00)**
- Promotes shared responsibility, knowledge exchange, and team resilience
- ~2 shifts per year

Workflow

🕘 **Shift Structure**

🟦 **Daytime Crew** (Weekdays 08:00–20:00)

- **2 people per shift**, randomly selected from a shared pool (all group members)
- Shift members are **exempt from regular duties** during this time
- Focused solely on operational support and incident response

🟥 **On-Call Crew**

- **One person per group** covers:
  - **Weekdays:** 17:00–23:00
  - **Weekends:** 08:00–20:00
- Provides domain-specific support during off-hours
- Certain groups may not cover all weeks but one per month

🚹 **Escalation Pathway (Daytime)**

→ **Expert support** (in-groups)

→ **Shift coordinator**

→ **Group manager**

→ **Technical Division Director**

🔧 **Daytime Crew Responsibilities**

Start of Shift

- Review KITOS documentation & support logs
- Check **accelerator status** and **operator messages**
- Review **support tickets** and handle as per guidelines

During Shift

- Monitor system health (CPU load, network, temps, etc.)
- Investigate and **proactively resolve anomalies**
- Work on **service development tasks**
- Engage in **peer learning** and **knowledge sharing**

End of Shift

- Assess unresolved issues; **escalate urgent problems**
- Brief on-call crew about any **ongoing or critical issues**

🕵 **Role of the Shift Coordinator**

- Schedule and oversee shift assignments
- Manage login/logout for the shared support phone
- Arrange replacements for absences
- Provide prioritization and expert guidance to shift crew
- Lead Monday morning **handover meetings**
- Represent KITOS in **Beamline Operations (BLOPS)** meetings

🔁 **Weekly Handover Process**

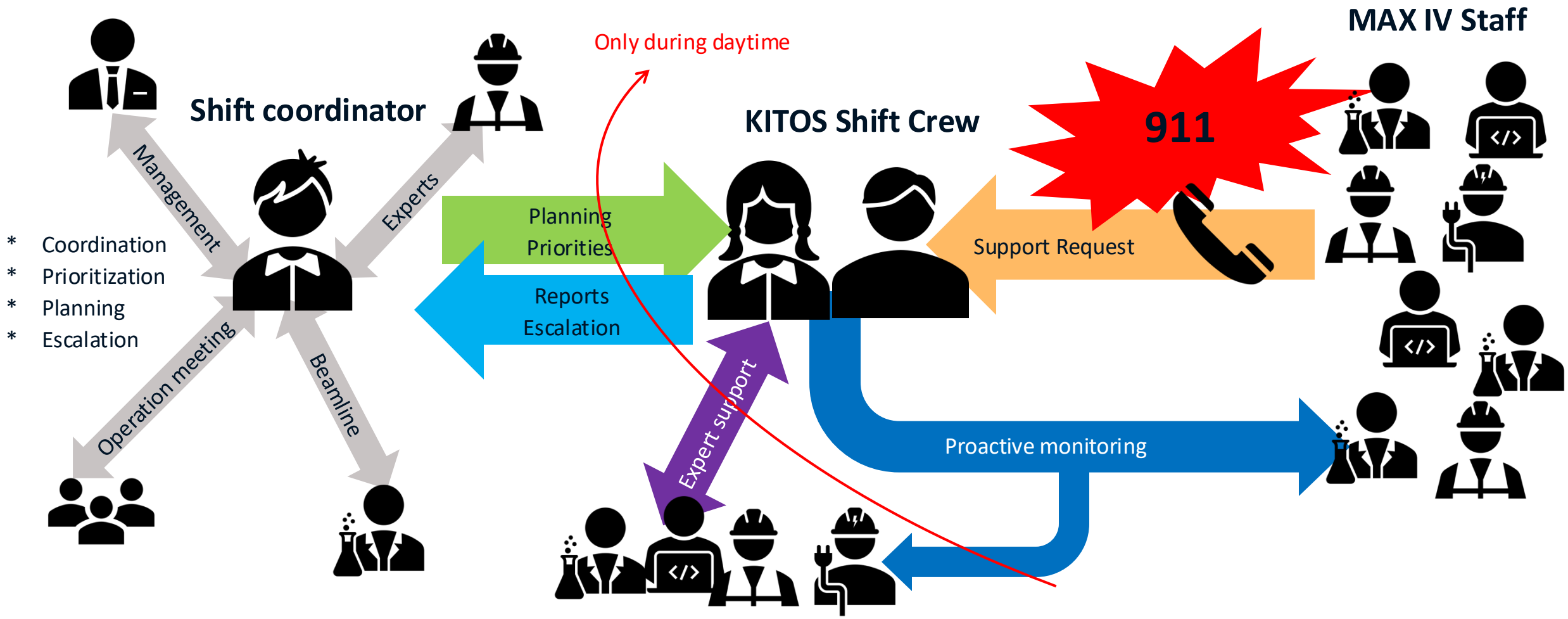
Every Monday at 09:00

Outgoing crew briefs the incoming team on:

- Active tickets/issues
- Ongoing investigations
- Critical or upcoming interventions

Workflow - Schema

* Image inspired by DOC EuXFEL presentation



Workflow – Example of shift scheduling

2025

Week	Daytime	Evening/Weekend Software	Evening/Weekend Electronics	Evening/Weekend SciSWDet	Evening/Weekend Infra	Coordinator
01 [1]	-	Mirjam Lindberg	Peter Sjöblom	-	-	-
02 [2]	-	Dmitry Egorov	-	-	Jonas Rahmberg	-
03 [3]	-	Carla Takahashi	-	-	-	-
04 [4]	Julio Lidón-Simón, Anton Joubert, Zdenek Matej	Anton Joubert	-	-	-	Dmitrii Ermakov
05	Meghdad Yazdi, Thomas Eriksson	Vanessa Silva	Julio Lidón-Simón	Stuart Ansell	-	Dmitrii Ermakov
06	Dmitry Egorov, Stuart Ansell	Benjamin Bertrand	-	-	Jonas Rahmberg	Dmitrii Ermakov
07	Vanessa Silva, Aleko Lilius	Henrique Silva	-	-	-	Dmitrii Ermakov
08	Carla Takahashi, Mirjam Lindberg	Lin Zhu	-	-	-	Johan Forsberg
09	Anton Joubert, Henrique Silva	Dmitry Egorov	Marcelo Alcocer	—	-	Johan Forsberg
10	Marcelo Alcocer, Oliver Grimm	Áureo Freitas	-	-	Jonas Rahmberg	Johan Forsberg
11	Benjamin Bertrand, Shoresh Soltani	Carla Takahashi	-	-	-	Johan Forsberg

Follow-up - Entries

KITOS Log

New Follow-up New Entry

2025 W25 (2025.06.16 - 2025.06.22)

Reveal Collapse

▼Wed 2025.06.18 09.00 - Species Sardana master file names incorrect: scan-<number>.h5 instead of specified name Edit Link Download

09:03:16, Wed Jun 18 2025 09:32:17, Thu Jun 26 2025

Fabien Coronis, Anton Joubert

Status Closed | System Species | Caller Conny Såthe | Tags Sardana, Monday updates, Prodigy | Classification Configuration

Description

- Technical details:
  - getting incorrect names for data from Sardana scans. Names like scan-1234.h5 instead name set in experiment config.
- Effect on operations: do not want to continue with incorrect names.
- Last seen working. Didn't ask (probably before Monday)

Investigation

Suspected MAX IV's custom hdf5 recorder was being used, instead of Sardana's standard recorder. Checked Sardana environment variables via spock:

```
Door_B108A [1]: lsenv
                Name                                                    Value   Type
------------------- ------------------------------------------------------- ------
       _GeneralHooks  [('check_panda_schema', ['pre-scan']), ('configure_tri [...]   list
        _ViewOptions  {'OutputBlock': False, 'ShowCtrlAxis': False, 'Descrip [...]   dict
        ActiveMntGrp                                                RIXSAlba    str
DataCompressionRank                                                        1    int
        JsonRecorder                                                    True   bool
     PreScanSnapshot  [('tango://b-v-species-csdb-0.maxiv.lu.se:10000/b108a- [...]   list
       ProdigyDevice                                          b108a/ctl/prodigy-01    str
             ScanDir                  /data/visitors/species/20241608/2025061808/raw    str
            ScanFile                                        ['startup-2025-06-18.h5']   list
         ScanHistory  [{'startts': 1749553001.5674944, 'endts': 1749553094.4 [...]   list
              ScanID                                                    19652    int
           scanstats                                                    True   bool
           ScanStats  {'Stats': {'dummy_motor_1': {'aem_o04_01_timer': {'min [...]   dict
       TriggerDomain                                                     TIME    str
```

The Sardana recorder env var, `ScanRecorder`, was not set.

Checked MacroServer log file, see last recorder used was the custom MAX IV recorder, `H5Recorder`.

ThreadPool.W001 INFO 2025-06-18 08:59:32,836 B108A/DOOR/01.Macro[ascan]: Operation will be saved in None (HDF5::NXscan from H5Recorder)

Manually set enviroment variable for the standard Sardana recorder: `senv ScanRecorder NXscanH5_FileRecorder`.

```
Door_B108A [1]: senv ScanRecorder NXscanH5_FileRecorder
ScanRecorder = NXscanH5_FileRecorder
```

Asked beamline to run another scan. This worked, as expected.

Files created today:

```
[species-user@b-v-species-ec-4]/% ll /data/visitors/species/20241608/2025061808/raw/
total 976
-rw-r--r-- 1 species-service 20241608-group 115960 Jun 18 08:35 scan-19647.h5
-rw-r--r-- 1 species-service 20241608-group 115960 Jun 18 08:44 scan-19648.h5
-rw-r--r-- 1 species-service 20241608-group 115960 Jun 18 08:46 scan-19649.h5
-rw-r--r-- 1 species-service 20241608-group 115960 Jun 18 08:55 scan-19650.h5
-rw-r--r-- 1 species-service 20241608-group  45392 Jun 18 08:58 scan-19651.h5
-rw-r--r-- 1 species-service 20241608-group 115960 Jun 18 08:59 scan-19652.h5
-rw-r--r-- 1 species-service 20241608-group 292684 Jun 18 09:12 startup-2025-06-18.h5
```

The new recorder was added as part of the Monday deployment: https://gitlab.maxiv.lu.se/kits-maxiv/ansible-galaxy/cfg-maxiv-ansible/-/merge_requests/7312

Now Sardana has two hdf5 recorders to choose from, and it ended up choosing the new one. Using the environment variable, we can force it to use the old one.

Note: The recorder was added for Prodigy scans, so those won't work as expected. @hensil will have to fix this. E.g., set the recorder based on the measurement group using a pre-scan hook. Similar to what PEAK does.

-- Follow-up (hensil): Fix implemented on https://gitlab.maxiv.lu.se/kits-maxiv/sardana-prodigy/-/merge_requests/10

Resolution

Set Sardana enviroment variable from Spock: `senv ScanRecorder NXscanH5_FileRecorder`

Avoidance of recurrence: implement an automatic change via a hook. @hensil has been informed.

- Log book develpoed in house where all calls are logged: Elogy
- Keys for: **Status**, **System**, **Caller**, **Tags** and **Classification**
- Composed by:
  - Title with timestamp describing problem
  - Description:
    - Technical details
    - Effect on Operations
    - Last seen working
  - Investigation: To describe all steps taken to identify the problem
  - Resolution:
    - Describe resolution proceedure
    - How to avoid this happen in future

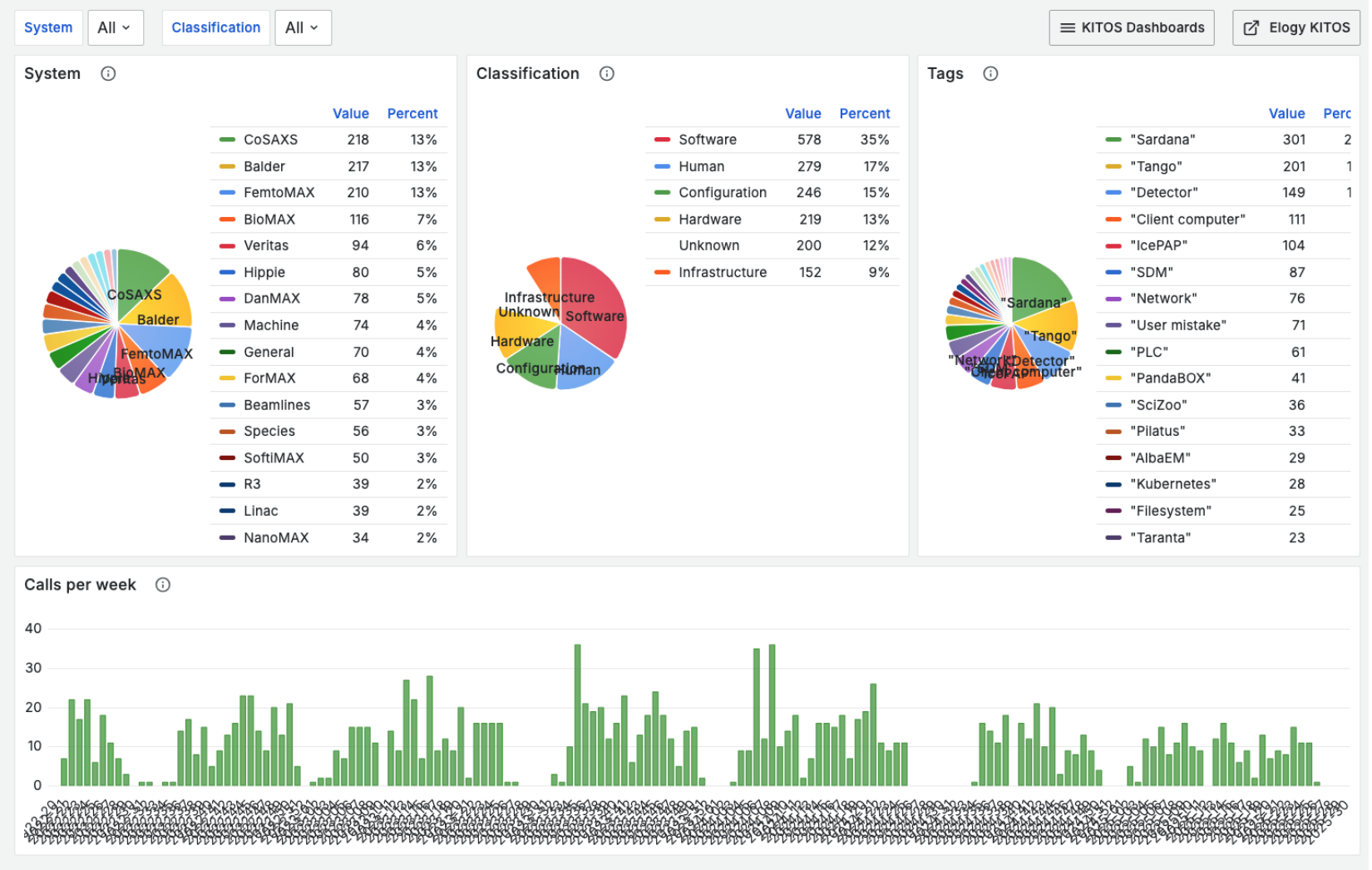
Follow-up: Metrics

By implementing a **standard tagging system** in each support entry, we enable **Grafana dashboards** to visualize key operational metrics.

These metrics can be **filtered and correlated** by system, classification, tags, time range, and more.

This structured data allows us to:

- Identify and **prioritize systems** needing improvement
- **Allocate resources** based on real support load
- Detect **anomalies** and recurring patterns
- Correlate issues with **user run activities**
- Generate actionable **reports**
- Track **system maturity** and monitor **evolution over time**



Follow-up

📁 Review & Handover

- All support entries are **reviewed during the weekly handover meeting**
- Each item is expected to be either:
  - **Resolved**, or
  - Assigned a **follow-up path** for further action

👥 Group-Level Follow-Ups

- Follow-ups may be handled by **individual groups**
  - For example: tasks added to group **backlogs** for future sprints, planning meeting
- Ensures continuity and accountability across technical domains

🔎 Post–User Run Reviews (System-Wide)

- The KITOS taskforce now conducts **system-wide evaluations** after each user run
  - Identify **recurring calls/issues** linked to specific beamlines
  - Collaborate with **beamline staff and system contacts**
  - Build a **backlog of improvements** to enhance system stability for future runs

🧑‍🚀 Collaboration with Floor Coordinators

- **Floor Coordinators** support users during 24/7 shifts — often covering KITOS-like issues during off-hours
- A joint **post–user run review** is being planned with them:
  - Gather insights from their experience
  - Identify **documentation gaps**
  - Feed findings back into system and process improvements

Report

1. Direct Feedback to Requestors

- **KITOS crew** follows up with the **original caller/requestor** to report on:
  - Issue resolution
  - Troubleshooting steps taken
  - Any next actions or escalation
- Ensures transparency and closes the support loop.

2. Weekly Global Report (BLOPS Meeting)

- **Shift Coordinator** presents a **weekly summary** at the **Beamline Operations (BLOPS) meeting**
  - Audience includes group representatives, accelerator staff, beamline staff, and directors
  - Covers **general trends**, **significant issues**, and any **critical incidents**
  - Opportunity to raise cross-group concerns and system-wide insights

3. Accelerator Operation Reporting

- Only **beam dump events** and **major instabilities** are reported in this forum
  - Each event is **tracked**, **discussed**, and **analysed**
  - Purpose: prevent recurrence and improve machine stability
- This reporting is done by **group representatives**, not the KITOS coordinator

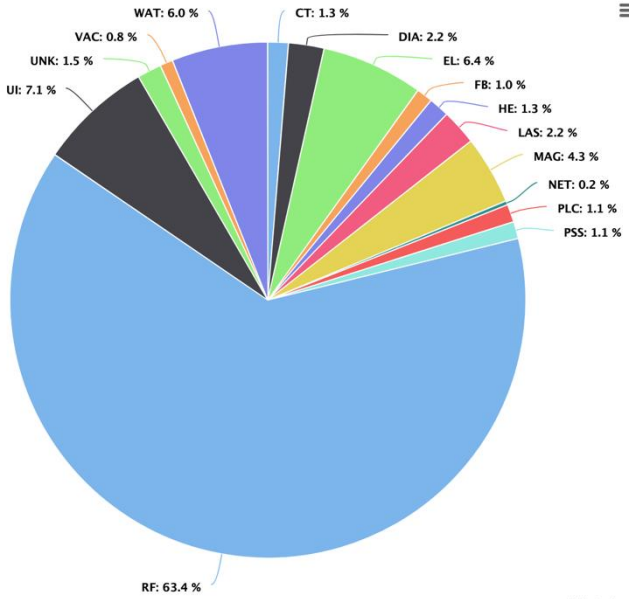
Machine	Planned delivery (h)	total downtime (h)	uptime (%)	MTTR (h)	MTBF (h)
R1	2808	33.05	98.82	1.84	156.00
R3	2808	72.12	97.43	2.58	100.29
SPF	2520	78.28	96.89	0.28	9.03

R3 CT ~ 0.5%

R1 CT ~ 0%

SPF CT ~ 2.6%

TOTAL CT ~ 1.3%



Conclusion

🧠 Why KITOS Exists

- As systems grow, **reliable, coordinated operational support** becomes essential
- KITOS provides a **centralized, structured model** to address issues efficiently and sustainably

⚙️ How KITOS Works

- Cross-group **collaboration and rotation-based shifts** ensure wide knowledge coverage
- Clear **workflow**, defined **roles**, and **escalation paths** support operational continuity
- **Standardized tagging and dashboards** help analyse trends and prioritize improvements

🔄 Beyond Reactive Support

• KITOS enables **proactive monitoring**, **system evaluations**, and **post–user run reviews**
• Feedback from **floor coordinators** and **beamline staff** feeds into continuous system improvement
• Integrated reporting at both **team** and **facility-wide** levels fosters transparency and accountability

🚀 Outcome

• KITOS enhances system stability, improves user experience, and enables **data-driven decisions**
• It is a critical step toward a **mature, responsive, and resilient operations framework**

MAX TV