CERN Controls Configuration Service
a challenge in usability

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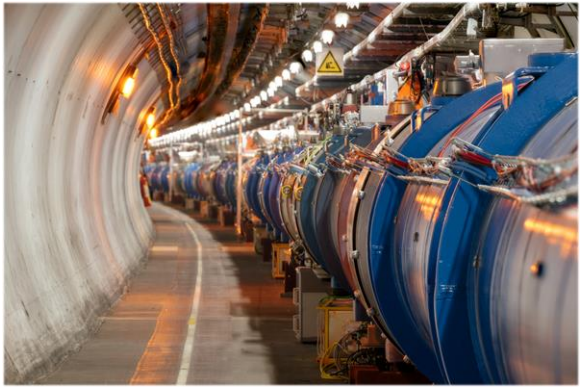
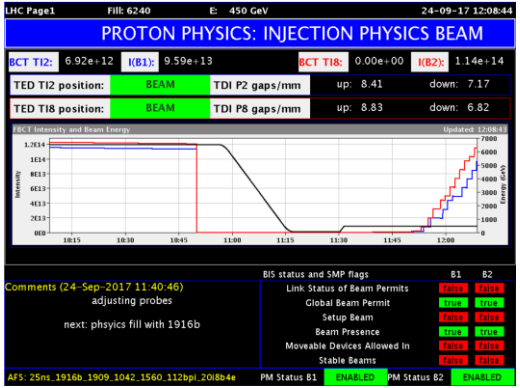
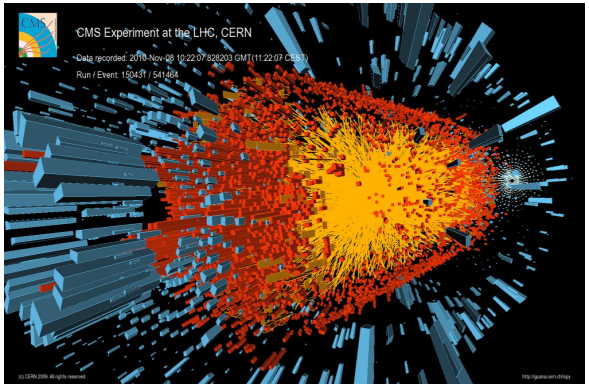
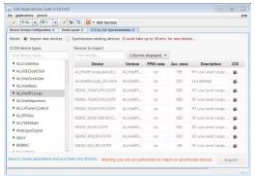
Control system applications







Critical, robust, performant, tailored - prerogatives of control system software applications.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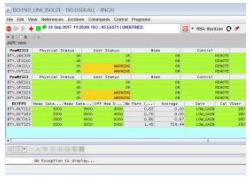
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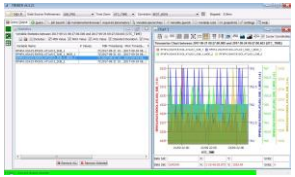
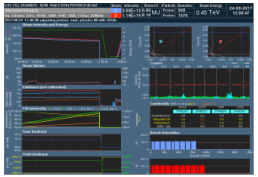
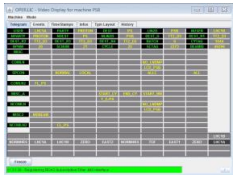
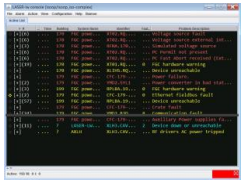

Acquisition


Monitoring

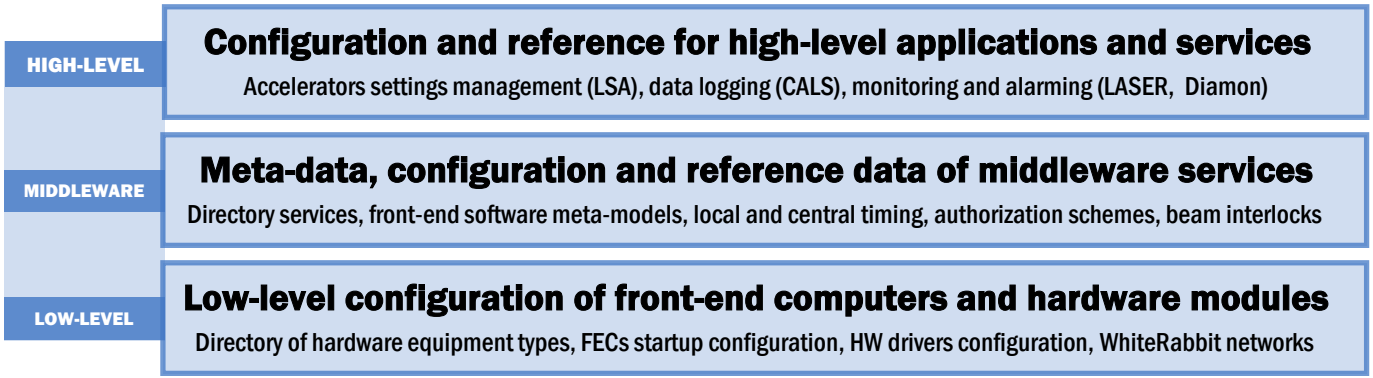

Diagnostics


Safety

Easy to use? Intuitive and usable? Ergonomic and delivering good user experience?
Usability is not the main goal for controls applications,
yet it should not be left unconsidered.

Controls Configuration Service at CERN

The main purpose of the CCS: centralize all the information relevant to the Control systems.



The challenge:

- 25 years of history
- 1500 DB session per day
- 80 $^{calls}/_{sec}$ on Java API(s)
- 700 domain tables
- over 40k DML operations per day
- 500 distinct users of GUIs
- variety of users
- operations-critical components

The CCS provides database, tools and services enabling access to the Control systems configuration data.

One of the key challenges of the CCS: diversified and vast groups of users, functions and a multitude of domains and sub-system-specific extensions.

In order to improve usability and ergonomics of the CERN Control system configuration, a new tool, the Controls Configuration Data Editor (CCDE) has been designed with the goal of providing a single and user-oriented view of all Control System configuration data.

Usability in control system applications

Qualities of usable software applications:

low learning curve, intuitive, context-oriented, tailored to user role and situation, reliable.

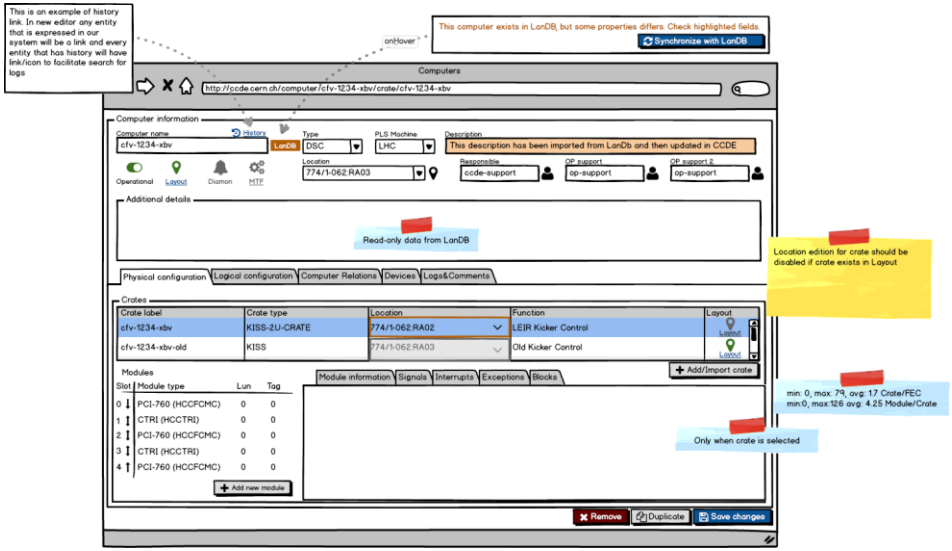
Aspects to be considered when aiming at high usability:

attention to visual consistency, context-oriented workflows, concise behaviour reflecting real-life situations, encapsulation of system complexity.

The subject of usability is formalised by dedicated ISO standards:

- ISO/TR 16982:2002 Ergonomics of human-system interaction: Usability methods supporting human-centred design.
- ISO 9241-210:2010 Ergonomics of human-system interaction: Part 210: Human-centred design for interactive systems.

User interfaces: design challenge

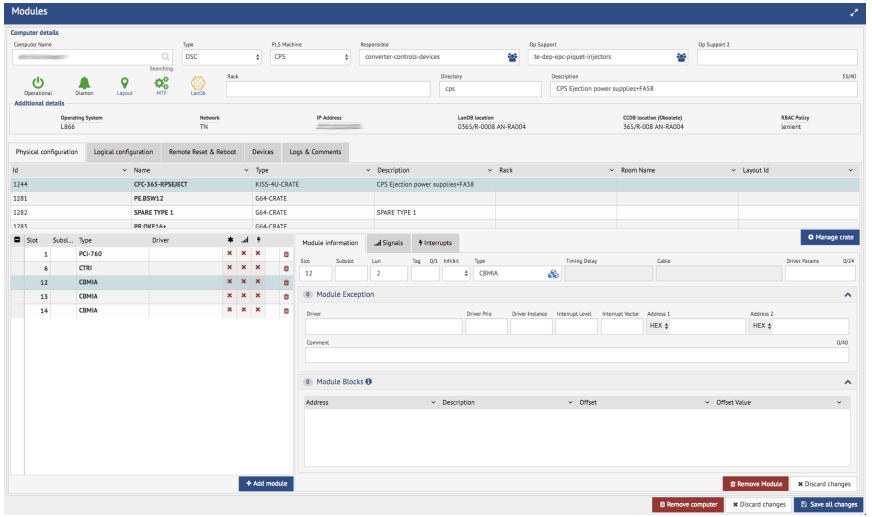


Wireframes based design and screen mockups are an indispensable tool to gather users feedback.

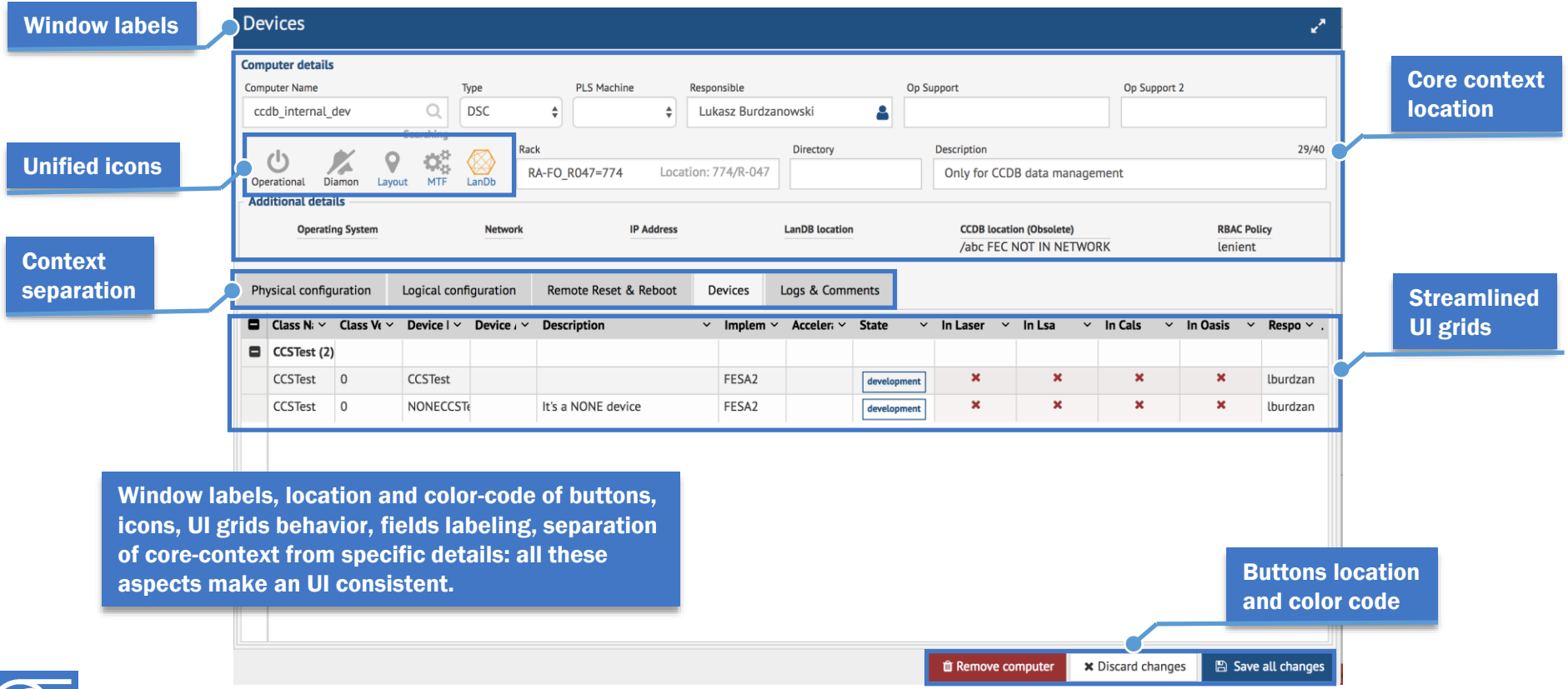
The mockups can help to describe complete real-life workflows and scenarios thus greatly reduce overall development time.

When designing and developing interfaces, not only graphical ones, the biggest challenge is always the same:

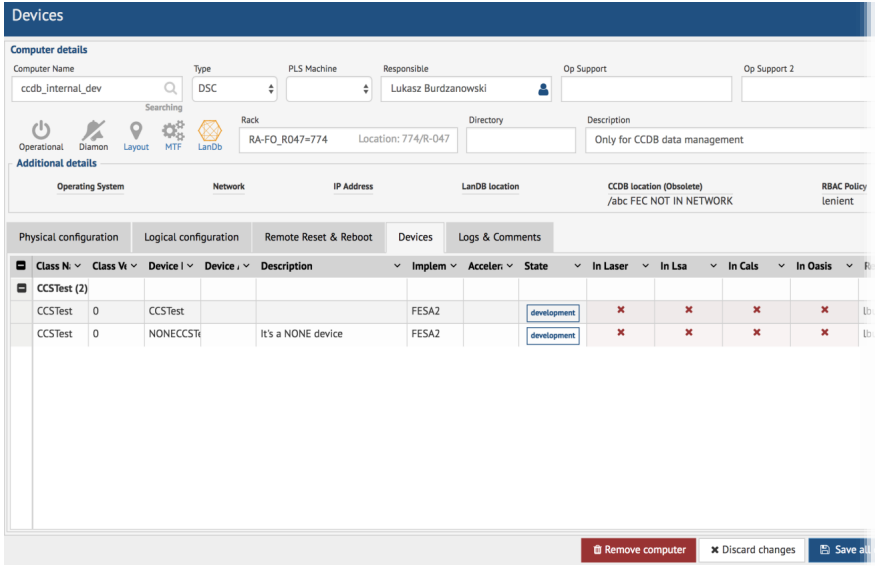
how to satisfy real needs of our users?

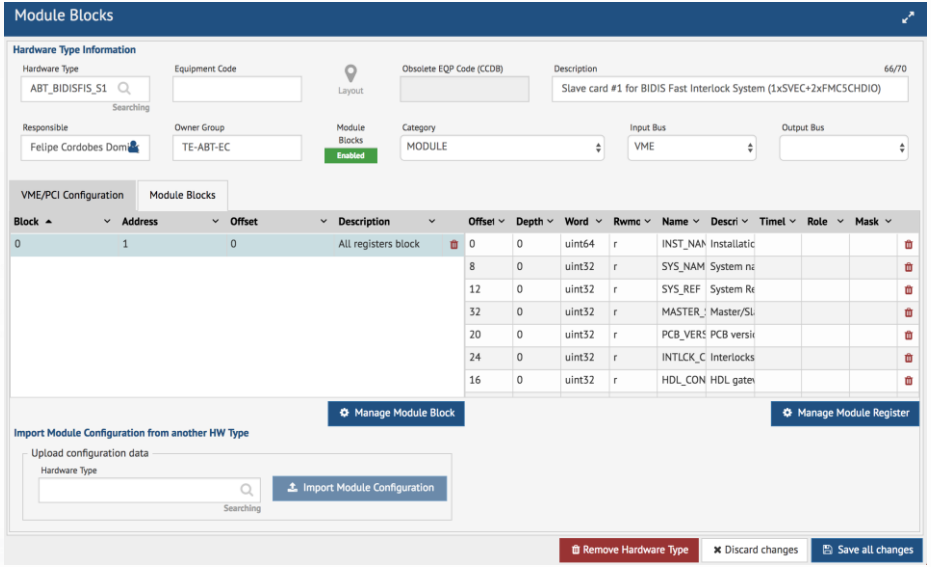


User interfaces: visual consistency



User interfaces: visual consistency





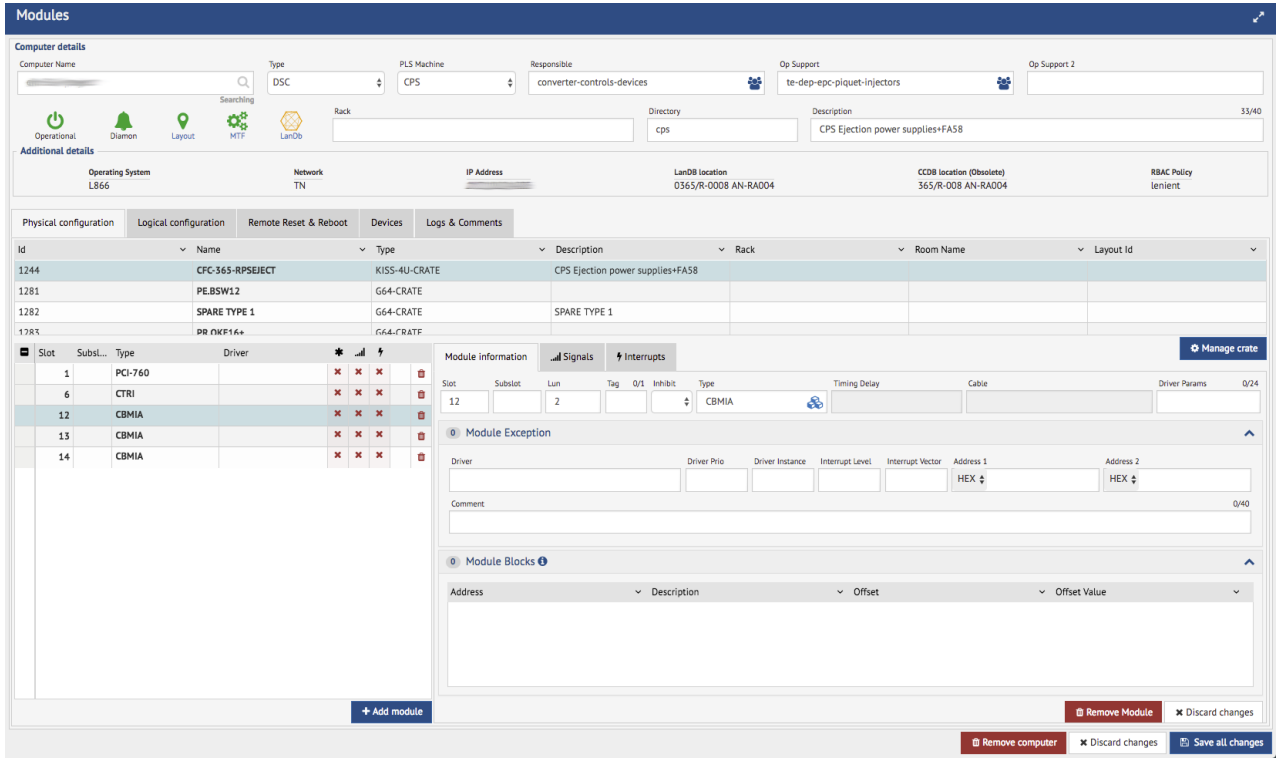
Commonly accessed configuration data

Expert-level configuration

Within a single tool, the CCDE, two different groups of users:
FECs users and HW experts defining dictionary of equipment types benefit from the unified UI.

Core concepts of the UI remain consistent across different views and domains.

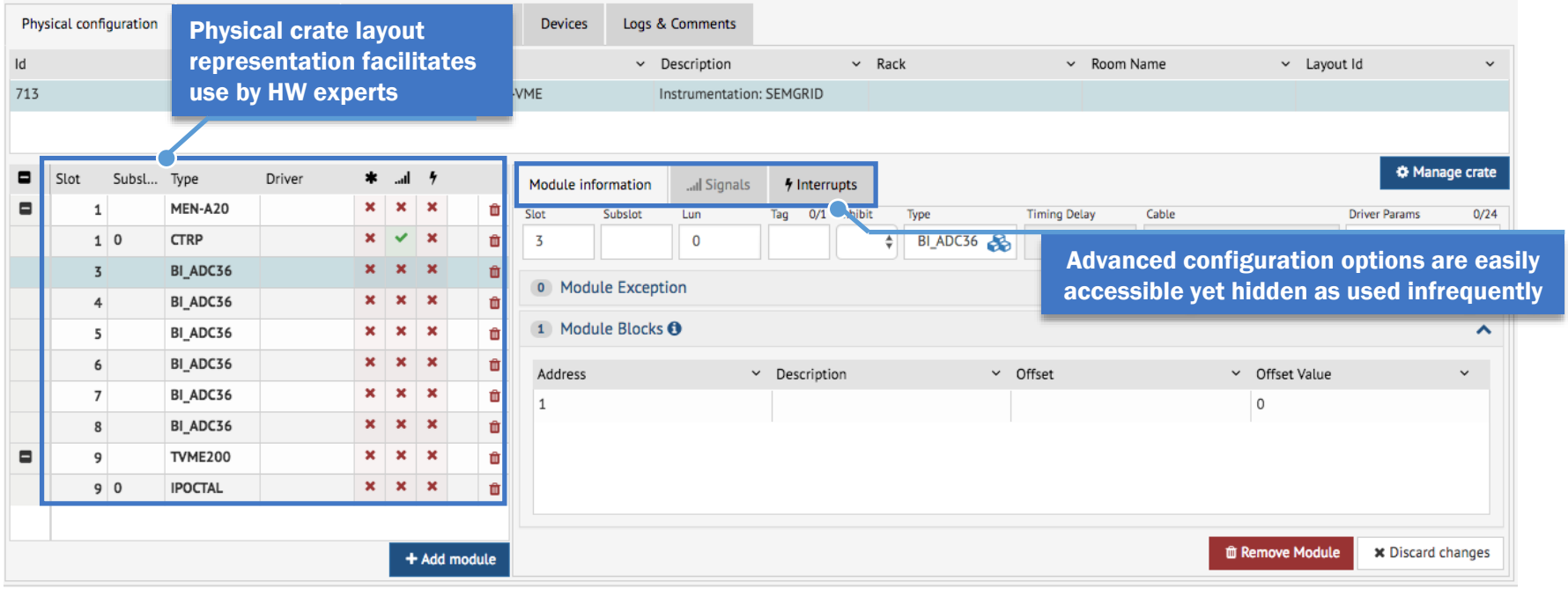
Context oriented workflow: expert vs common UIs



Immediate access to advanced information is essential for expert users.

The UI design represents the natural flow: FEC HW configuration > startup sequence > operations..

Context oriented workflow: expert vs common UIs



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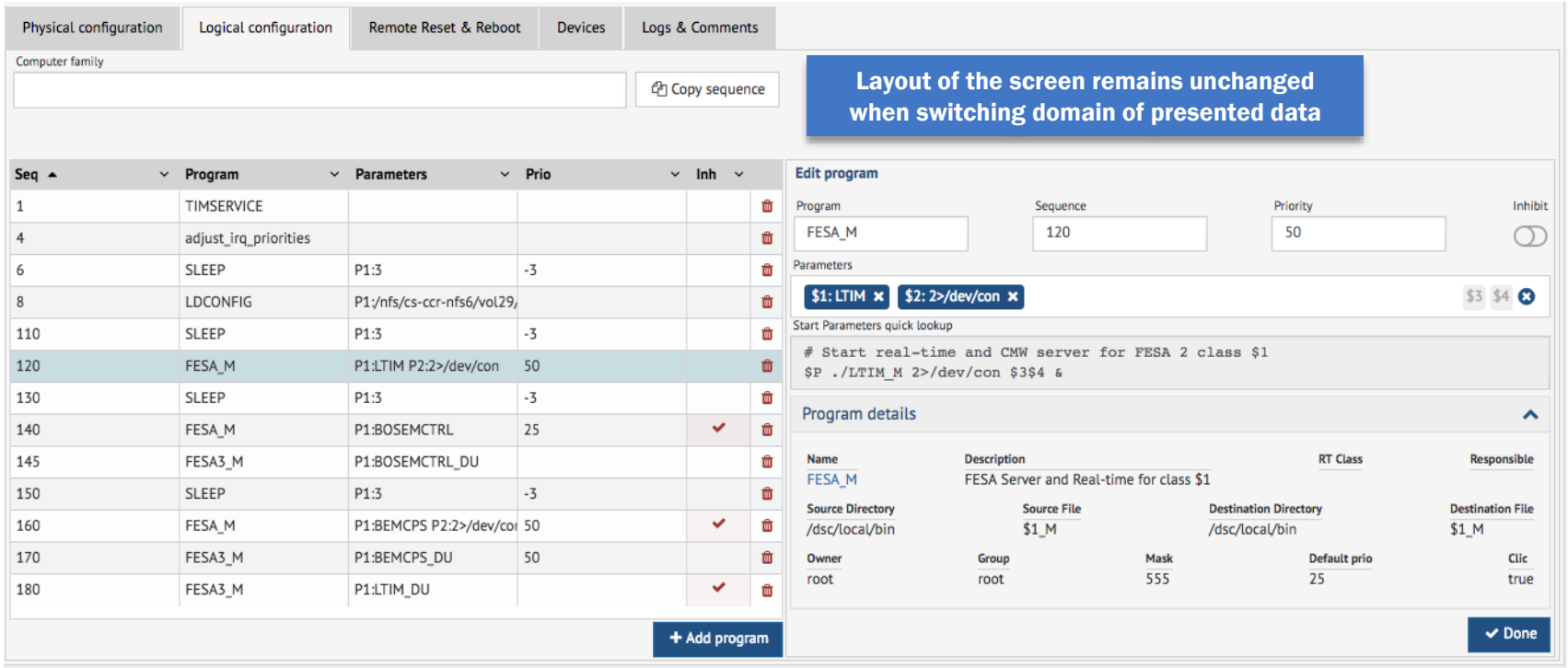

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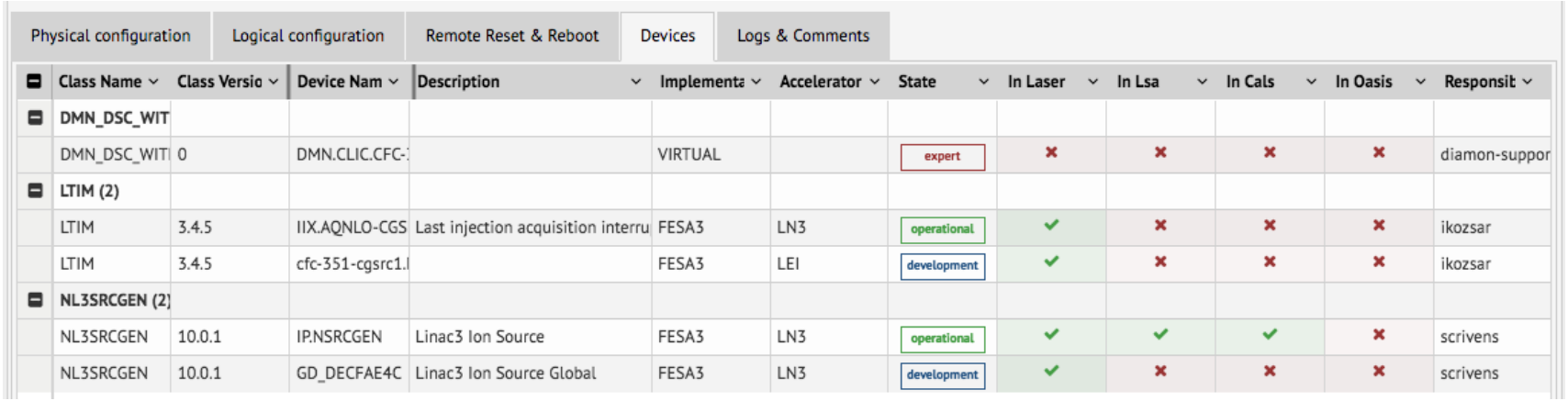


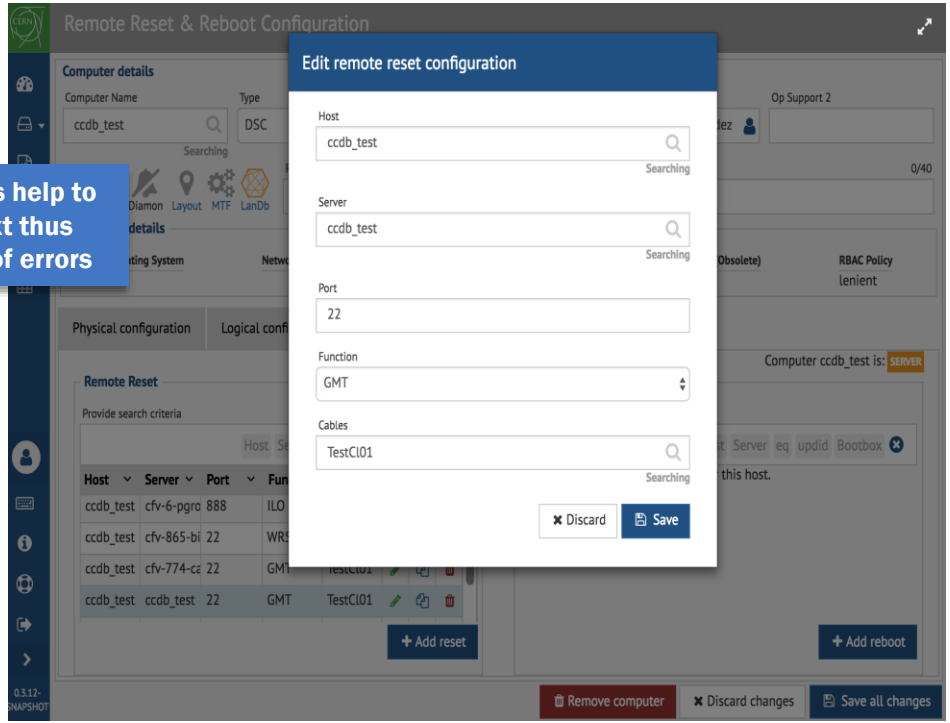
Class Name	Class Versio	Device Nam	Description	Implementa	Accelerator	State	In Laser	In Lsa	In Cals	In Oasis	Responsit
DMN_DSC_WIT											
DMN_DSC_WIT	0	DMN.CLIC.CFC-		VIRTUAL		expert	✗	✗	✗	✗	diamon-suppor
LTIM (2)											
LTIM	3.4.5	IIX.AQNLO-CGS	Last injection acquisition interru	FESA3	LN3	operational	✓	✗	✗	✗	ikozsar
LTIM	3.4.5	cfc-351-cgsrc1.l		FESA3	LEI	development	✓	✗	✗	✗	ikozsar
NL3SRCGEN (2)											
NL3SRCGEN	10.0.1	IP.NSRCGEN	Linac3 Ion Source	FESA3	LN3	operational	✓	✓	✓	✗	scrivens
NL3SRCGEN	10.0.1	GD_DECFAE4C	Linac3 Ion Source Global	FESA3	LN3	development	✓	✗	✗	✗	scrivens

Easily accessible overview of devices is commonly used by all users and serves as an entry point to domain of "Devices"

Immediate access to advanced information is essential for expert users.
The UI design represents the natural flow: FEC HW configuration > startup sequence > operations..

Context oriented workflow: expert vs common UIs

Modal windows and dialogues help to focus on a particular context thus helping to reduce likelihood of errors



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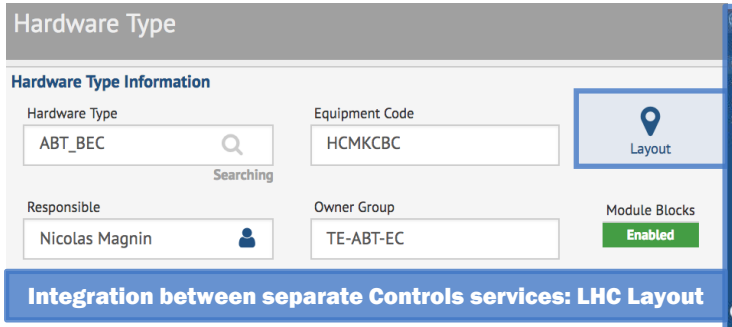
CCS: taming system complexity

Device Name	Accelera	State	In Laser	In Lsa	In Cals	In Oasis
DMN.CLIC.CFC-351-CGSRC1		expert	✗	✗	✗	✗
IIX.AQNLO-CGSRC1	LN3	operational	✓	✗	✗	✗
cfc-351-cgsrc1.LTIM	LEI	development	✓	✗	✗	✗
IP.NSRCGEN	LN3	operational	✓	✓	✓	✗
GD_DECFAE4C	LN3	development	✓	✗	✗	✗

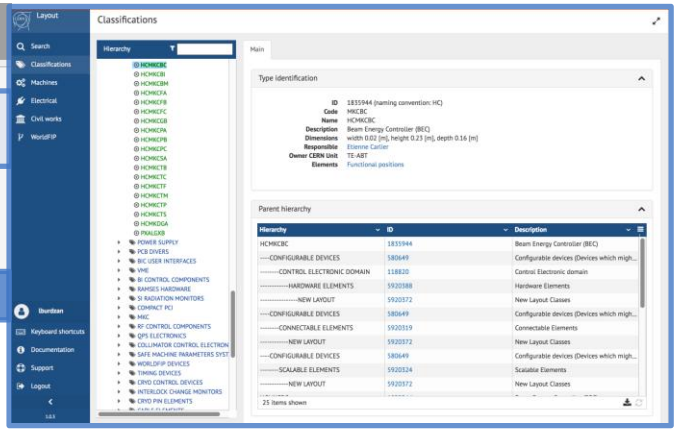
Configuration and reference for high-level applications and services

- State of a device in control system
- Relation to alarms system (LASER)
- Presence in accelerator settings management system (LSA)
- Source of data acquisition for data logging service (CALS)
- Part of Open Analogue Signal Information System (OASIS)

End-users benefit from integration between control system components but are not exposed to its complexity.



Integration between separate Controls services: LHC Layout



Conclusions

Increased user satisfaction, less stress at work, higher work efficiency, lowered user support...

... Is what easy to use, intuitive and ergonomic UIs can bring.
Design and development of ergonomic user interfaces is a challenge and an opportunity.

Reliable, efficient and easy to learn: ergonomic user interfaces.