



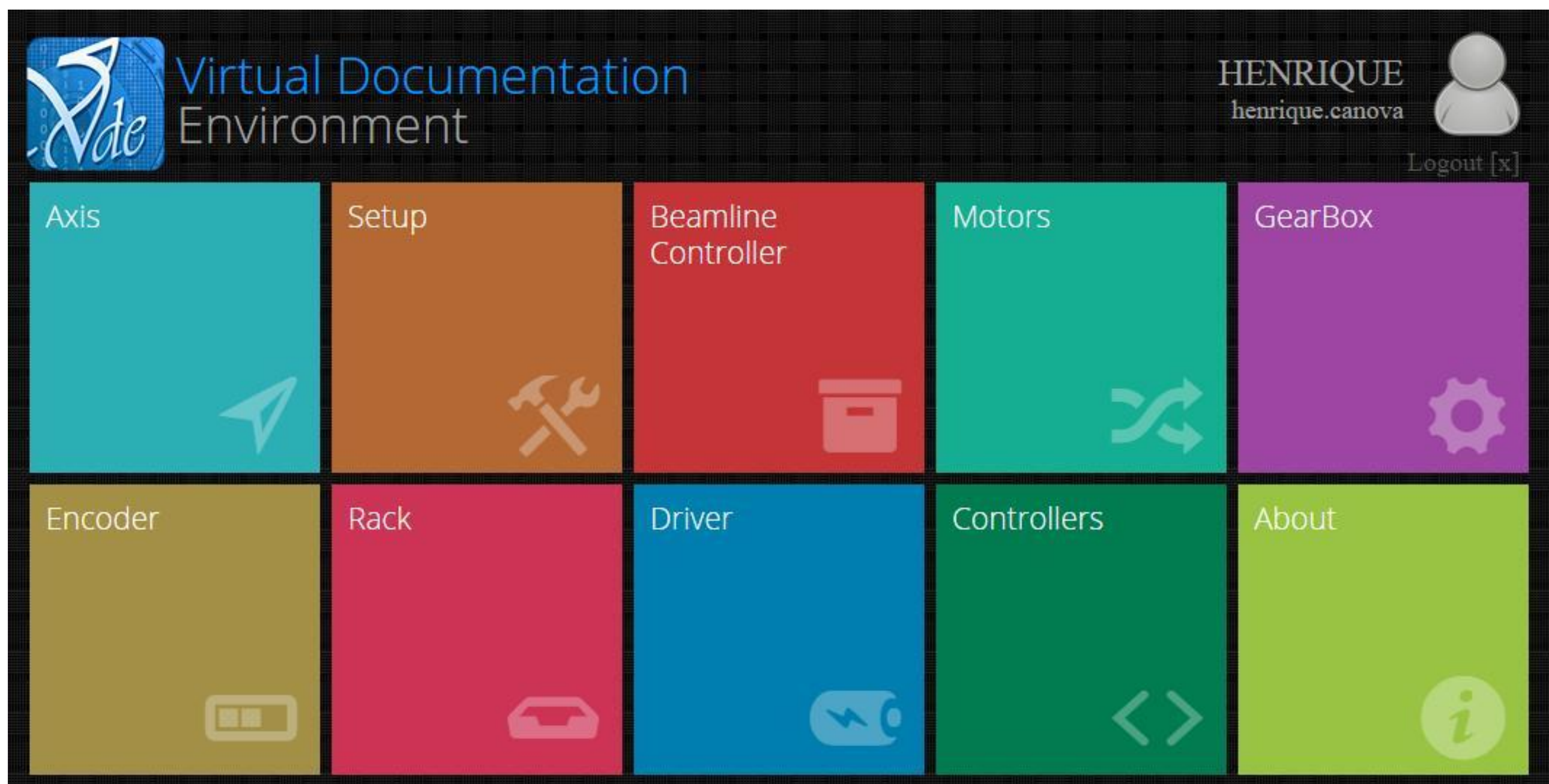
At LNLS hundreds of motors are used at the beamlines to move parts, equipment or full systems, according to different profile, synchronization and accuracy requirements. Historically, the documentation of motion axes of the LNLS beamlines was either done only at the moment of their installation and commissioning, or not properly done at all. Thus, after some time, keeping track of changes and performing maintenance could turn out to be very challenging, and there was the clear need of some solution to ensure that every change in motors would be reflected in their documentation. In 2012 the migration of the beamlines control system to the EPICS (Experimental Physics and Industrial Control System) [1] platform pushed the development of a new documentation system. In a first version, it consisted of a smart spreadsheet that generated the EPICS configuration files automatically. Later the spreadsheet evolved to a web-based system the VDE - Virtual Documentation Environment, which allows the beamlines staff to change the motion axis parameters without the need of a deep knowledge about EPICS and ensures the complete motion axis documentation intuitively. Also, changes in motors will not work in EPICS if the documentation is not updated, guaranteeing the link between documentation and the real system.

Introduction

Currently, around 700 motorized mechanisms are installed at LNLS beamlines, being used, for instance, to perform sophisticated optical alignment of mirrors and monochromators and position samples. These motorized mechanisms can be abstracted as motion axes, which are composed of motors (mostly stepper motors), gear boxes, transmission elements and encoders, when necessary. All these axes are integrated into the EPICS distributed control system of the beamlines and end stations.

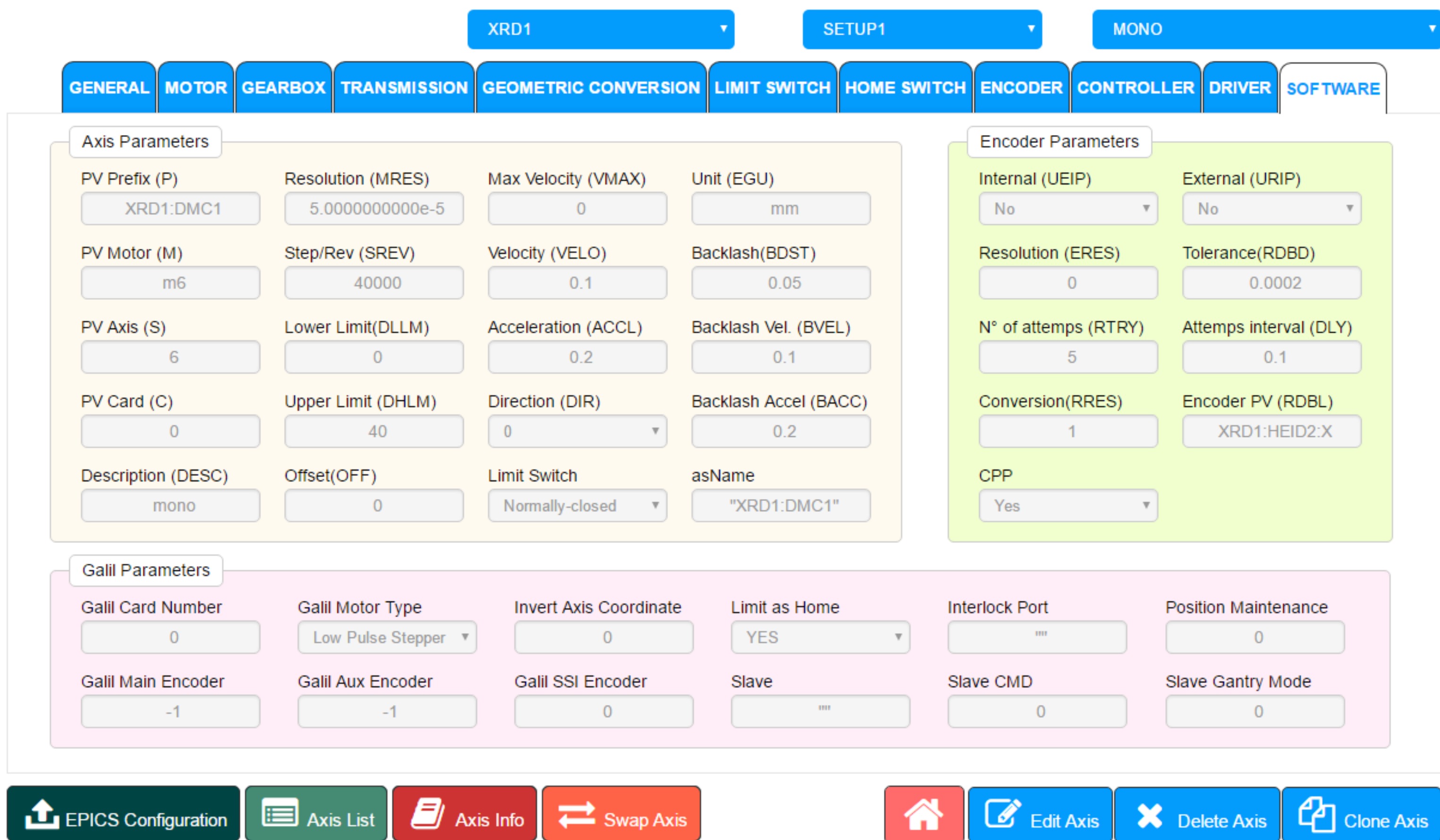
VDE Concepts

- EPICS IOCs (Input / Output Controller) run in dedicated National Instruments PXI chassis [2];
- Setups:
 - Each installation (beamline or end station) may have one or more Setups, consisting of different axes or different axes configurations (speed, acceleration levels, backlash, and so forth).
- Axis:
 - Configuration parameters are defined in specific tabs: General, Motor, Gearbox, Transmission, Geometric Conversion, Limit Switch, Home Switch, Encoder, Controller, Driver and Software;
 - EPICS records are automatically calculated using data from other tabs or edited by user.
- Configuration files:
 - IOC Motor Record substitution and command files can be automatically generated;
 - Advanced options are available to modify IOC parameters and to create extra EPICS substitutions files.



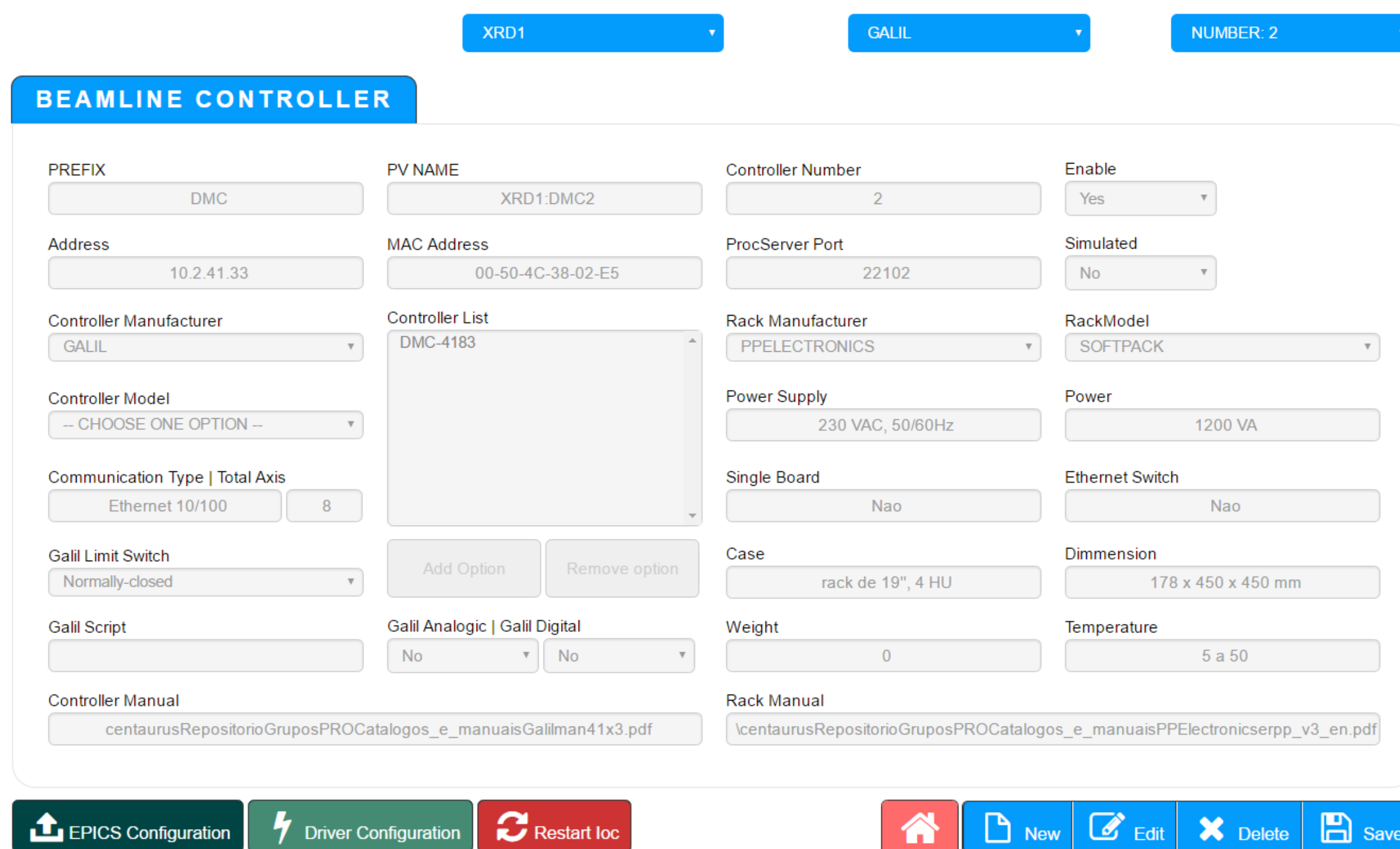
Development Tools

- Database system:
 - Apache server with relational MySQL database.
 - PHP (access and data manipulation).
- Web Interface:
 - HTML5, CSS3 and PHP/JavaScript.
- System Access:
 - LNLS Active Directory Integration (Login with institutional username and password)
 - Different user permission levels.



Files Generation

Configuration files to Galil [3], Parker [4] and IMS [5] controllers can be directly sent to the EPICS host computer by SSH - Secure Shell - protocol under Linux Currently.



Reports

- VDE currently generates two types of reports:
 - Basic lists of all registered axes in the *Setups*;
 - Detailed lists with all the information gathered from each axis in the *Setups*.



XRD1

Controller: IMS 1 Address: COM3	Controller: PARKER 1 Address: COM7
1 FENDA BRANCA SUPERIOR	5 NIVELADOR 1
2 FENDA BRANCA INFERIOR	6 NIVELADOR 2
3 FENDA BRANCA DIREITA	7 NIVELADOR 3
4 FENDA BRANCA ESQUERDA	8 CURVATURA
5 FREE	1 FREE
6 FREE	2 FREE
7 FREE	3 FREE
8 FREE	4 FREE
Controller: GALIL 1 Address: 10.2.41.34	Controller: GALIL 2 Address: 10.2.41.33
1 ROLL	1 TELA FLUORESCENTE 2
2 MCH2	2 FENDA ESPALHAMENTO SUPERIOR
3 YAW	3 FENDA ESPALHAMENTO INFERIOR
4 VERT	4 FENDA ESPALHAMENTO ESQUERDA
5 CURVATURA	5 FENDA ESPALHAMENTO DIREITA
6 MONO	6 FREE
7 MONITOR DE FIO	7 FREE
8 TELA FLUORESCENTE 1	8 FREE
Controller: GALIL 3 Address: 10.2.41.32	Controller: GALIL 4 Address: 10.2.41.31
1 CAMARA SEGMENTADA Z	1 CABECA GONIOMETRICA EIXO X
2 CAMARA SEGMENTADA X	2 CABECA GONIOMETRICA EIXO Y
3 FENDA ADC INFERIOR	3 CABECA GONIOMETRICA EIXO AX
4 FENDA ADC SUPERIOR	4 CABECA GONIOMETRICA EIXO AY
5 FENDA ADC ESQUERDA	5 FREE
6 FENDA ADC DIREITA	6 FREE
7 FREE	7 FREE
8 FREE	8 FREE



XRD1

YAW
Subset: MONOCROMADOR Mneonic: YAW PV: XRD1.DMC1.m3
Motor
Manufacturer: ARSAPE Model: AM1524-2R-V-6-35-04-0911 Current: 0.17 A Resistance: 35 OHM
Gear Box
Manufacturer: FAULHABER Model: 592.1 Reduction: 592
Transmission
Description: FUSO DE FABRICACAO PROPRIA Pitch: 0.5 MM
Geometric Conversion
Used: YES Description: - Factor: 19.6
Limit Switch
Type: MECANICO Quantity: 2 Range: 0 MRAD
Home Switch
Used: NO Type: -
Encoder
Manufacturer: _NENHUM Model: _NENHUM PV Name: -
Controller
Manufacturer: GALIL Model: DMC-4183 Axis Number: 3 Address: 10.2.41.34 MotorType: 2
Driver
Manufacturer: PHYTRON Model: ZMC+ Interpolation: 20 Current: 0.17 A
Software

DESC	MRES	SREV	LLM	ILM	OFF	VMAX
YAW	0.00003448761261261	284160	25	25	0	0
VELO	ACCL	DIR	EGU	BDST	BVEL	BACC
0.4	0.12	1	MRAD	0.1	0.4	0.12
UEIP	ERES	RTRY	RRES	RDBD	DEL	CPP
0	0	0	1	0	0	1

Administration

- Log control:
 - User login.
 - Date/Time of action.
 - Action.
- Advanced Control:
 - Server and host configurations.
 - VDE beamline management;
 - VDE library management.

Conclusion

The VDE is currently applied to all experimental stations and beamlines at LNLS and it is expected to be applied in the new accelerator, Sirius. The VDE development is ongoing and different manufacturers, as Newport and Aerotech, are expected to be integrated to the file generation system soon.

Acknowledgement

The authors would like to thank the colleagues from LNLS who contributed to valuable discussions and feedback about the VDE.

References

- EPICS, <http://www.aps.anls.gov/epics>
- J. R. Piton et al., "HYPIE: A HYPERVISORED PXI FOR PHYSICS INSTRUMENTATION UNDER EPICS", BIW 2012, Newport News, MOPG031
- Galil Motion Controllers, <http://www.galilmc.com>
- Parker Motion, <http://www.parkermotion.com>
- Intelligent Motion Systems – IMS <http://motion.schneider-electric.com>

