

Slow Control Software

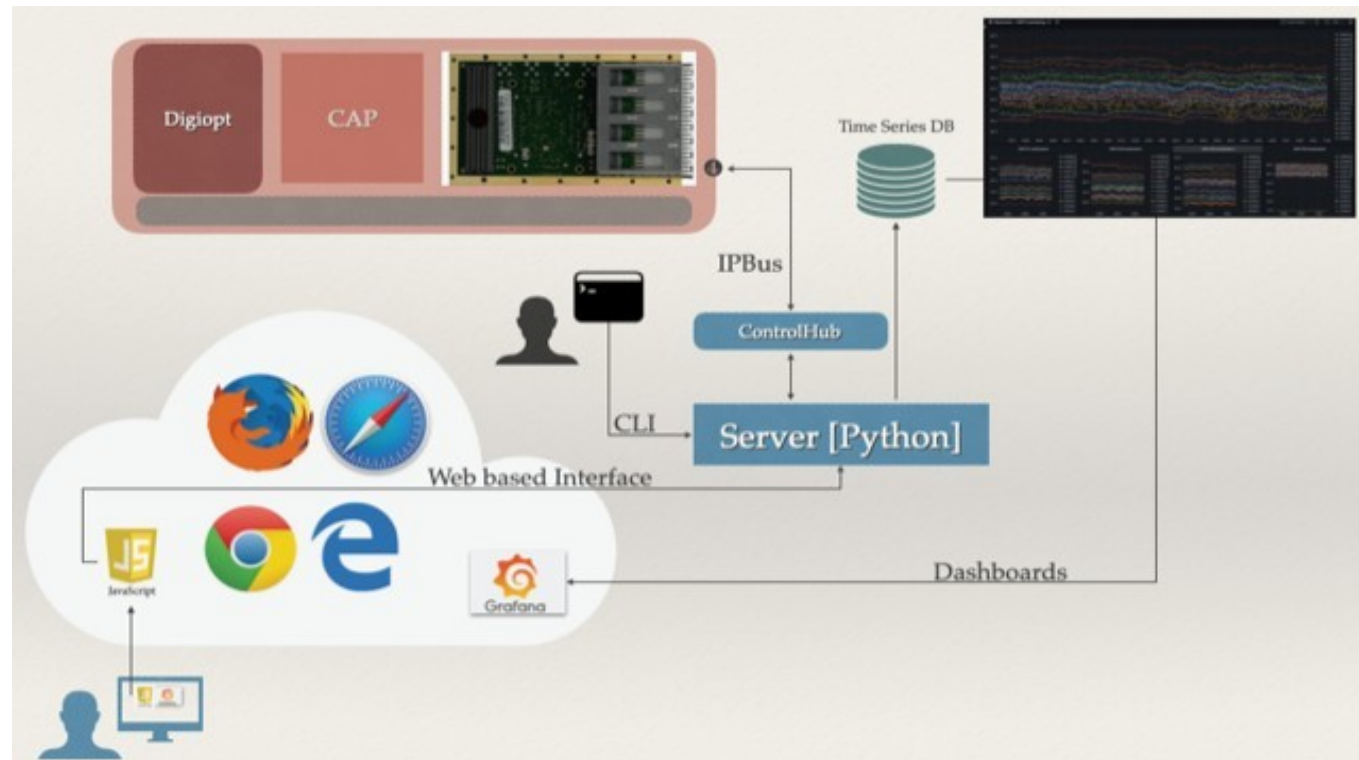
AGATA Week 2023

Summary

- Software Architecture
- Web site main page and crystal views
- Interface with TopologyManager
- Functionalities
 - Crystals selection
 - Parameter values management
 - Actions on cards
 - Interoperability
 - Administration
- Data model used by the software
- Docker container containing the installation

Software Architecture

- Python 3 server
- Django framework
- GUI in a browser
- Console in a CLI
- Database InfluxDB
- REST API
- Connection to cards using IPBus & Controlhub
- Use of existant CMD_Test scripts (from Gustav Vinther-Jørgensen)



Main page

- 1) Menu
- 2) Submenu
- 3) Totals
- 4) Crystals

Slow Control

[Crystals view](#)
[Selection](#)
[Configuration](#)
[Action](#)
[Profile](#)
[Logout](#)

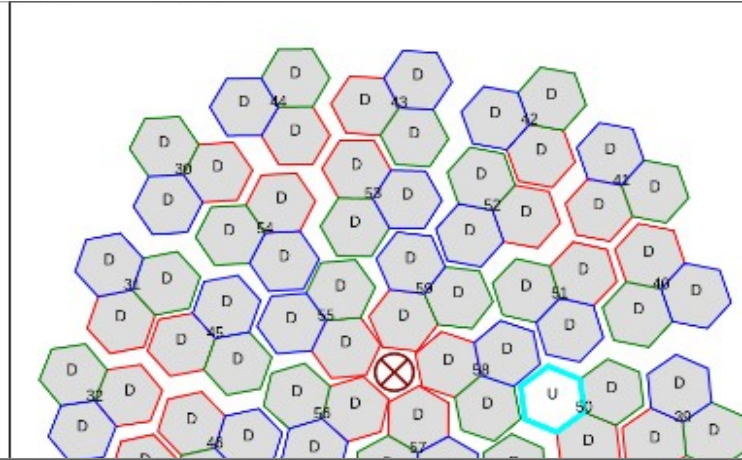
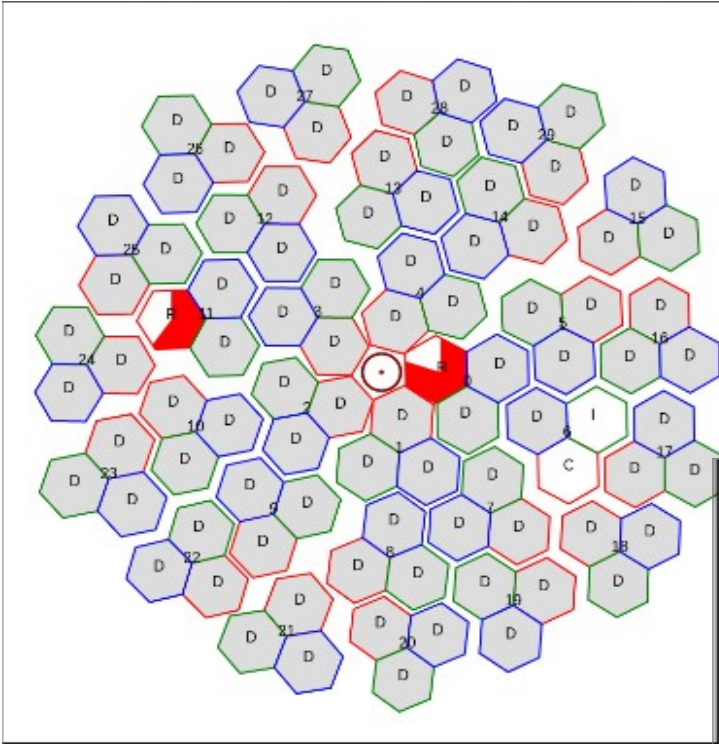
List Circles Planisphere

Status: Up: 1, Configured: 2, Idle: 1, Running: 2, Warning/Error(1, 1)

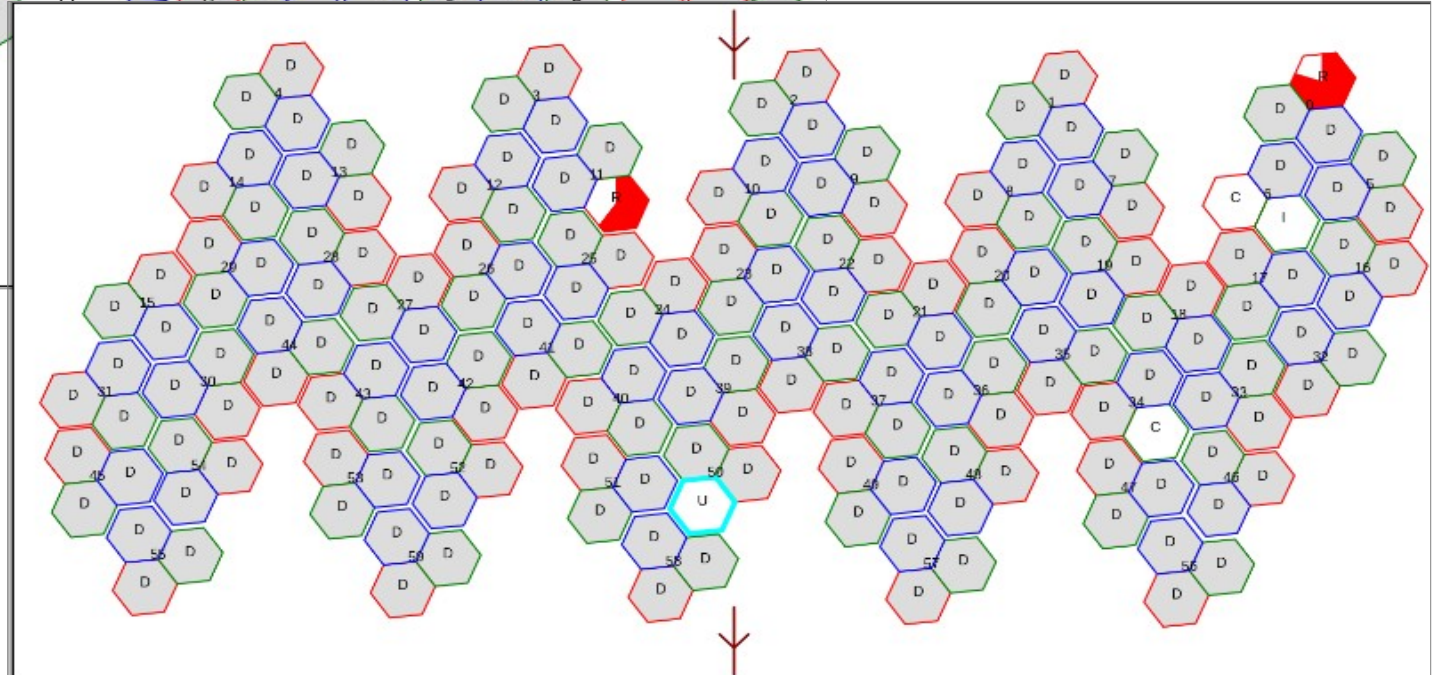
ATC00 (0)	R	D	D	(15)	D	D	D	(30)	D	D	D	(45)	D	D	D
(1)	D	D	D	(16)	D	D	D	(31)	D	D	D	(46)	D	D	D
(2)	D	D	D	(17)	D	D	D	(32)	D	D	D	(47)	D	D	D
(3)	D	D	D	(18)	D	D	D	(33)	D	D	D	(48)	D	D	D
(4)	D	D	D	(19)	D	D	D	ATC03 (34)	D	C	D	(49)	D	D	D
(5)	D	D	D	(20)	D	D	D	(35)	D	D	D	ATC50 (50)	D	D	U
ATC06 (6)	C	I	D	(21)	D	D	D	(36)	D	D	D	(51)	D	D	D
(7)	D	D	D	(22)	D	D	D	(37)	D	D	D	(52)	D	D	D
(8)	D	D	D	(23)	D	D	D	(38)	D	D	D	(53)	D	D	D
(9)	D	D	D	(24)	D	D	D	(39)	D	D	D	(54)	D	D	D
(10)	D	D	D	(25)	D	D	D	(40)	D	D	D	(55)	D	D	D
ATC01 (11)	R	D	D	(26)	D	D	D	(41)	D	D	D	(56)	D	D	D
(12)	D	D	D	(27)	D	D	D	(42)	D	D	D	(57)	D	D	D
(13)	D	D	D	(28)	D	D	D	(43)	D	D	D	(58)	D	D	D
(14)	D	D	D	(29)	D	D	D	(44)	D	D	D	(59)	D	D	D

Other crystal views

Circles



Planisphere



2D projection

- AGATA polyhedron : [Icosahedral Goldberg w3D](#)

- 180 hexagons, 12 pentagons

- [Dual Geodesic Icosahedron Pattern 8](#)

- Coordinates of centers of Agata Triple Clusters

- [Mollweide projection](#)

- λ = longitude, Φ =latitude

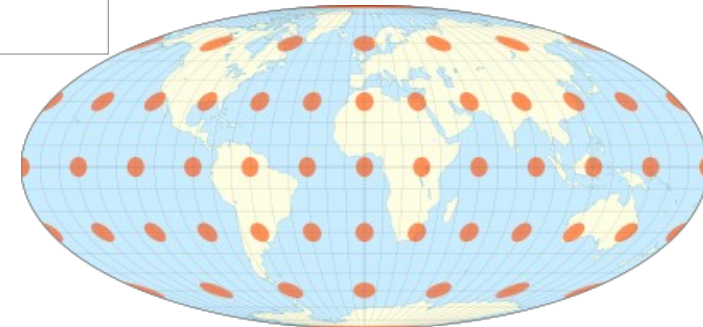
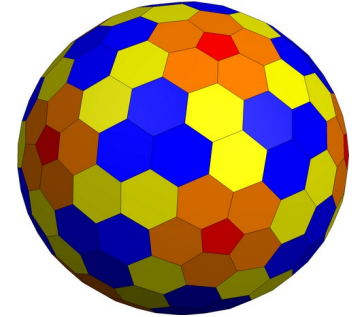
- θ given by equation: $2\theta + \sin 2\theta = \pi \sin \varphi$

- Limit of convergent sequence:

$$\theta_0 = \varphi,$$

$$\theta_{n+1} = \theta_n - \frac{2\theta_n + \sin 2\theta_n - \pi \sin \varphi}{2 + 2 \cos 2\theta_n}.$$

- The 3 hexagons of each ATC stay together



Interface with TopologyManager

- TM gives information about available STARE cards

```

{"connections":[
  {
    "id":"stare.0",
    "uri":"chtcp-2.0://10.81.17.221:10203?target=10.81.17.157:50001",
    "address_table":"file:///... /Stare_Utility/STARE.xml",
    "cluster":"ATC01",
    "position":11,
    "crystal":"A", ...
  },
  ...
}]
  
```

controlhub IP → 10.81.17.221:10203
 card IP → 10.81.17.157:50001

Functionalities

- Crystals views (List, Circles, Planisphere)
- Crystal selections functions (Clear, Load from a list, Save, Delete)
- Configuration functions (Display from base, Read from cards, Write, Ipbus Parameters tree)
- Actions on crystal sets or individual crystals (FSM transitions, launch CMD_Test functions)
- User profile modification (username, email, first name, last name, password)
- Administrator functions on
 - Users, user groups, permissions
 - database objects : Card selections, Cards, Configurations, Monitor periods, Parameter groups, Parameter selections, Parameters, Values

Crystals selection

- Each user has his own selections
- Can be stored in a list
- Current selection stored
- Selections kept when switching view and after logout
- Crystal description in a tooltip



Parameter values

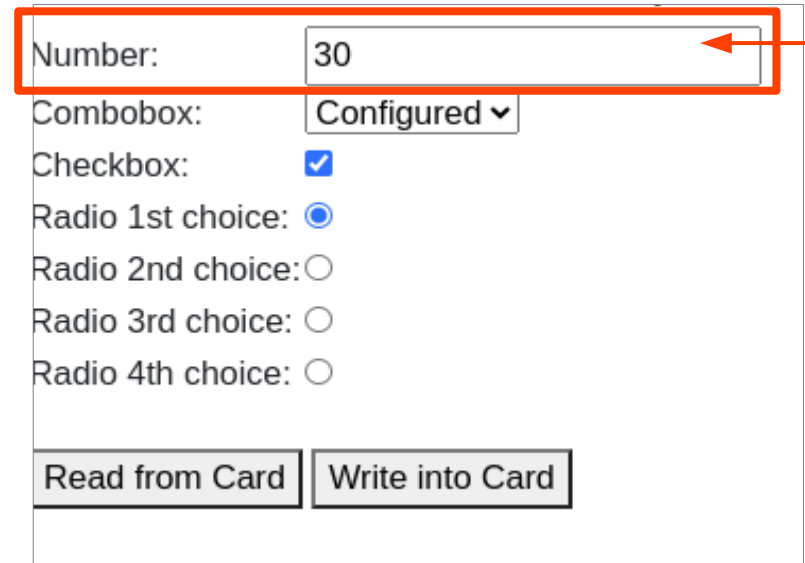
- Parameter configurations can be:

- Displayed from base
 - In a tree view
 - In HTML forms
- Written into cards
- Read from cards
- Imported from file
- Exported to file
- Monitored
 - Read periodically
 - Stored into InfluxDB database

Parameters	Address	Mask	Value			
▶ udp_0	-	-	-			
▶ aurora_a	-	-	-			
▶ data_manager_0	-	-	-			
▼ reset_controller	-	-	-			
soft_reset	0x00000C00	0x00000001	0x0	<input type="text"/>	Write	Read
▶ reset_monitor	0x00000C08	0xFFFFFFFF	0x0	<input type="text"/>	Write	Read
▼ done	0x00000C09	0xFFFFFFFF	0x0	<input type="text"/>	Write	Read
network_reset_done	0x00000C09	0x00000001	0x0	<input type="text"/>	Write	Read
aurora_reset_done	0x00000C09	0x00000002	0x0	<input type="text"/>	Write	Read
▶ eeprom_stare	-	-	-			
▶ udp_1	-	-	-			
▶ data_manager_1	-	-	-			
▶ udp_2	-	-	-			
▶ data_manager_2	-	-	-			
▶ sys_manag	-	-	-			
▶ N_SLV_aC_P0_calibration	-	-	-			
▶ N_SLV_aC_P2_COMM	-	-	-			
▶ N_SLV_aC_P1_JESD	-	-	-			
▶ N_SLV_aC_P6_DPTH	-	-	-			
▶ N_SLV_aC_PAG	-	-	-			
▶ N_SLV_PACE_HBRD	-	-	-			
▶ N_SLV_PACE_TDC	-	-	-			
▶ TEST	-	-	-			

HTML Forms

- Parameter selection ↔ HTML template file
- Subsets of parameters
- Allows to:
 - Display, Read, Write
- Available HTML controls:
 - Numerical edit zones
 - ▼ combo boxes
 - ☑ Checkboxes
 - Radio buttons



• `<input id="idRate" type="number" name="N_SLV_HLTH.liveRate.rate" value="{{N_SLV_HLTH.liveRate.rate}}" size="4">`

Actions

Configure

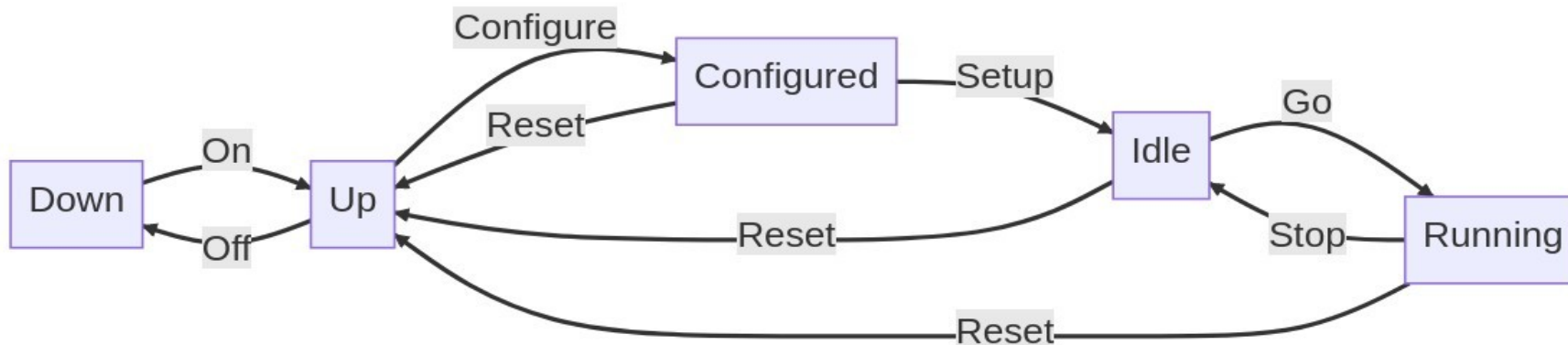
Setup

Go

Stop

Reset

- Can be launched on selections of cards
- Finite State Machine transitions



- Total counts are refreshed

CMD_Test actions

- 140 python functions in CMD_Test.py
- Descriptions provided in tooltips
- Output is displayed with colors
- History of action results

Action results of all cards

Date	Time	Card	Action	Result
2023-09-05	14:37:52	stare.152(152)	PACE_GTS_stat	GTS status - Crystal 0 -----
2023-08-31	15:40:05	stare.152(152)	read_idbitstream	[GTS enabled]
2023-08-31	15:38:30	stare.152(152)	read_idbitstream	IDLE period disabled Comma period disabled
2023-08-31	15:06:33	stare.152(152)	PACE_QuadLink_runOne	Led duration: 0 - Rate duration: 0 Trigger to capture time: 0 ns
2023-08-31	15:06:26	stare.152(152)	PACE_HLTH_live	

Interoperability

- Console mode
 - Choose card by position
 - `csi.launchActionCard(<position 0-59>, <crystal 'A' or 'B' or 'C'>, <action>, <args>)`
 - Stores action result in history
- REST Application Programming Interface
 - Parameters tree in JSON format
 - Read / Write values from parameter path
 - Can be tested in the web browser

Administration

- Uses Django administration GUI
- More user friendly than PHPMyAdmin
- Allows data Importation / Exportation
- Accessed only by administrator privileged users

Django administration

Site administration

AUTHENTICATION AND AUTHORIZATION

- Groups [+ Add](#) [Change](#)
- Permissions [+ Add](#) [Change](#)
- Users [+ Add](#) [Change](#)

SLOWCONTROL

- Card selections [+ Add](#) [Change](#)
- Cards [+ Add](#) [Change](#)
- Configurations [+ Add](#) [Change](#)
- History results [+ Add](#) [Change](#)
- Monitor periods [+ Add](#) [Change](#)
- Parameter groups [+ Add](#) [Change](#)
- Parameter selections [+ Add](#) [Change](#)
- Parameters [+ Add](#) [Change](#)
- Values [+ Add](#) [Change](#)

Django administration

WELCOME, ADMIN. [VIEW SITE](#) / [CHANGE PASSWORD](#) / [LOG OUT](#)

Home > Slowcontrol > History results

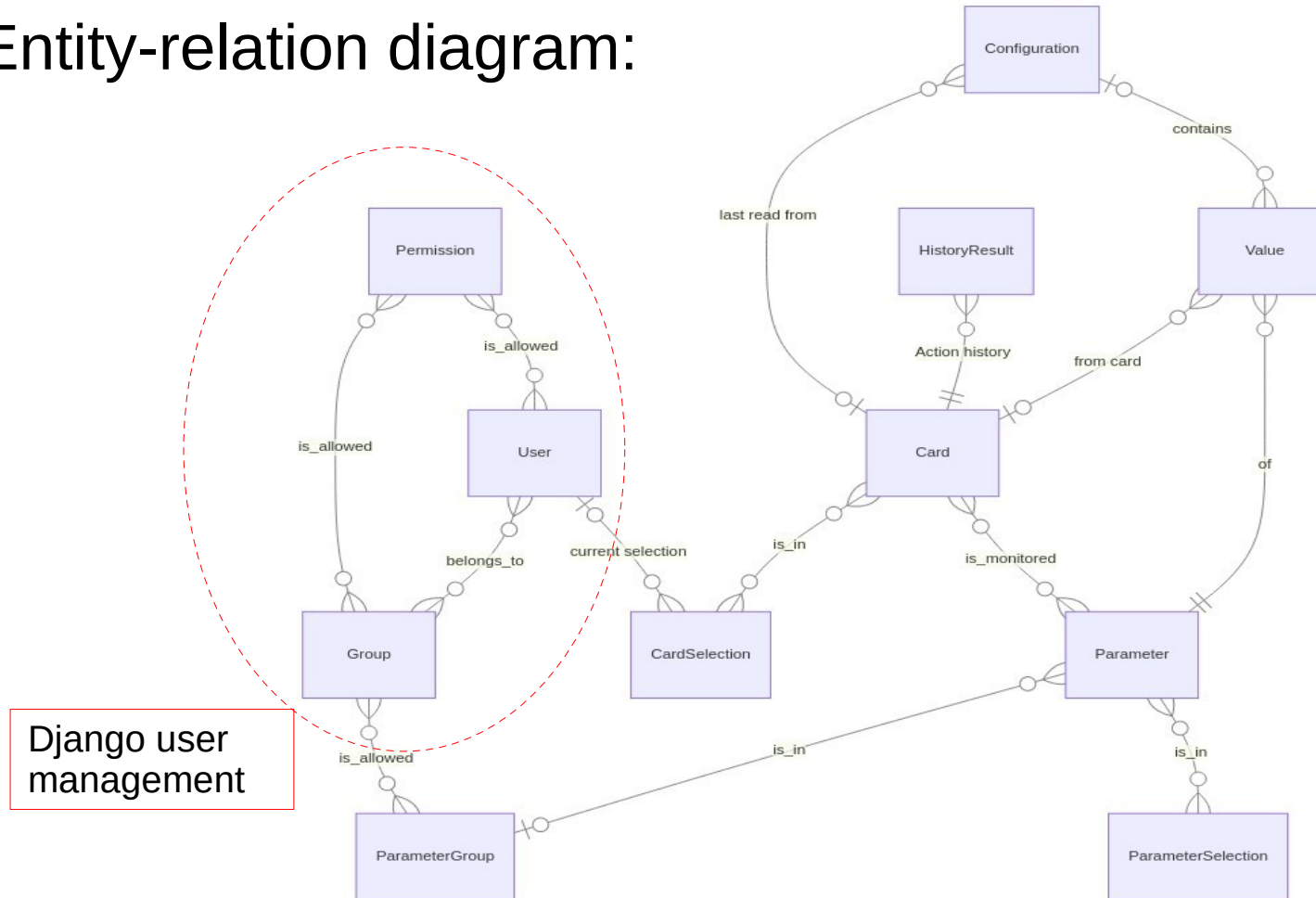
Select history result to change [IMPORT](#) [EXPORT](#) [ADD HISTORY RESULT +](#)

Action: 0 of 11 selected

<input type="checkbox"/>	ACTION	CARD	DATETIME
<input type="checkbox"/>	PACE_GTS_stat	stare.152(152)	Sept. 5, 2023, 2:37 p.m.
<input type="checkbox"/>	read_idbitstream	stare.152(152)	Aug. 31, 2023, 3:40 p.m.
<input type="checkbox"/>	read_idbitstream	stare.152(152)	Aug. 31, 2023, 3:38 p.m.
<input type="checkbox"/>	PACE_QuadLink_runOne	stare.152(152)	Aug. 31, 2023, 3:06 p.m.
<input type="checkbox"/>	PACE_HLTH_live	stare.152(152)	Aug. 31, 2023, 3:06 p.m.
<input type="checkbox"/>	PACE_GTS_stat	stare.152(152)	Aug. 31, 2023, 3:06 p.m.

Data model

Entity-relation diagram:



11 entities, 17 tables

Docker container

- Base on Debian 10 (buster)
- Databases
 - Connection to external MySQL
 - Connection to external InfluxDB
- IPBus v2.8.3 compiled from source
- Python 3.7
- Django 2.2.28 with modules:
 - mysql-connector-python, python-statemachine, django-simple-menu, influxdb-client, djangorestframework, django-import-export

Links

- Sources: [IN2P3 Gitlab repository](#)
 - [Technical specifications](#)
 - [Demonstration instance at IPHC](#)
- [Included python scripts and address file](#) repository (needs Github login)
- IPBus software
 - CERN [web site](#)
 - [IPBus software sources](#)

Thank you for your attention