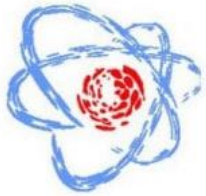
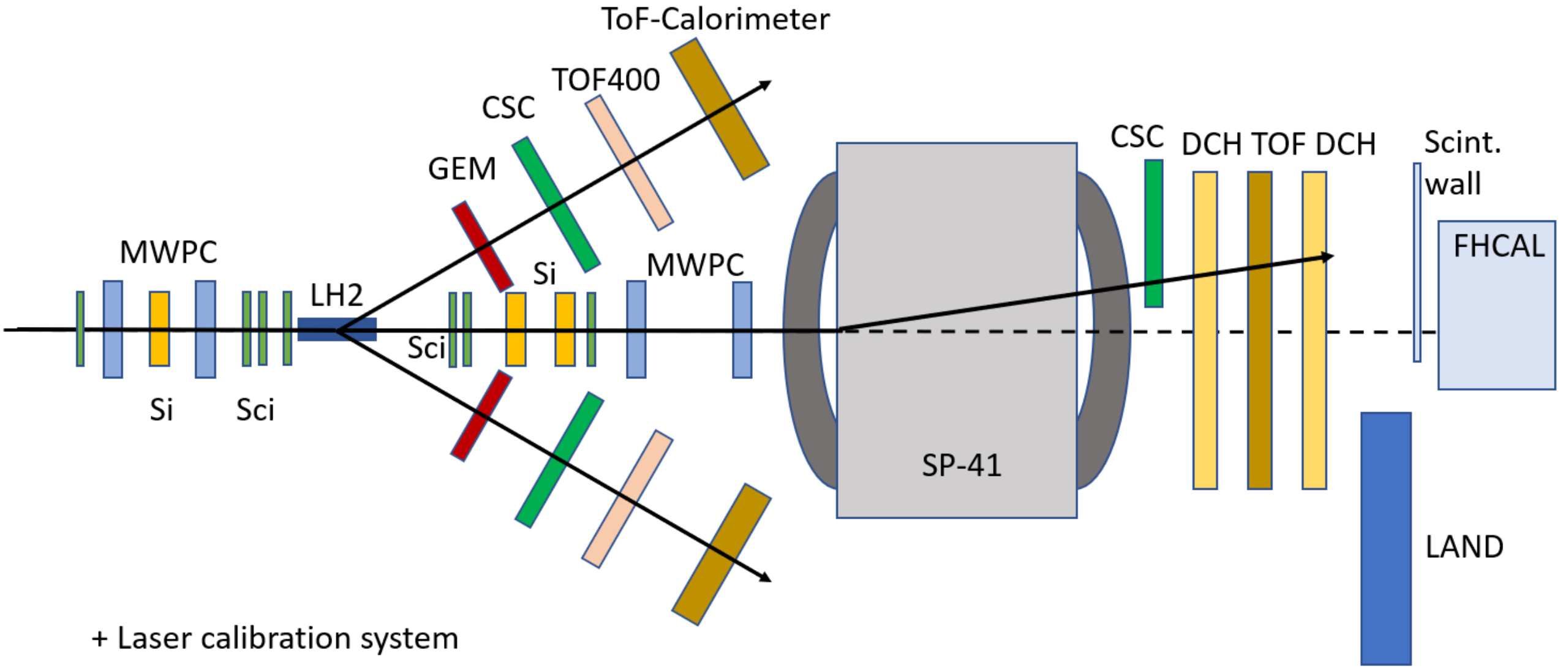
Control and monitoring system for the SRC experiment at BM@N

V.Shutov
D. Egorov
R. Nagdasev
T. Smolyanin

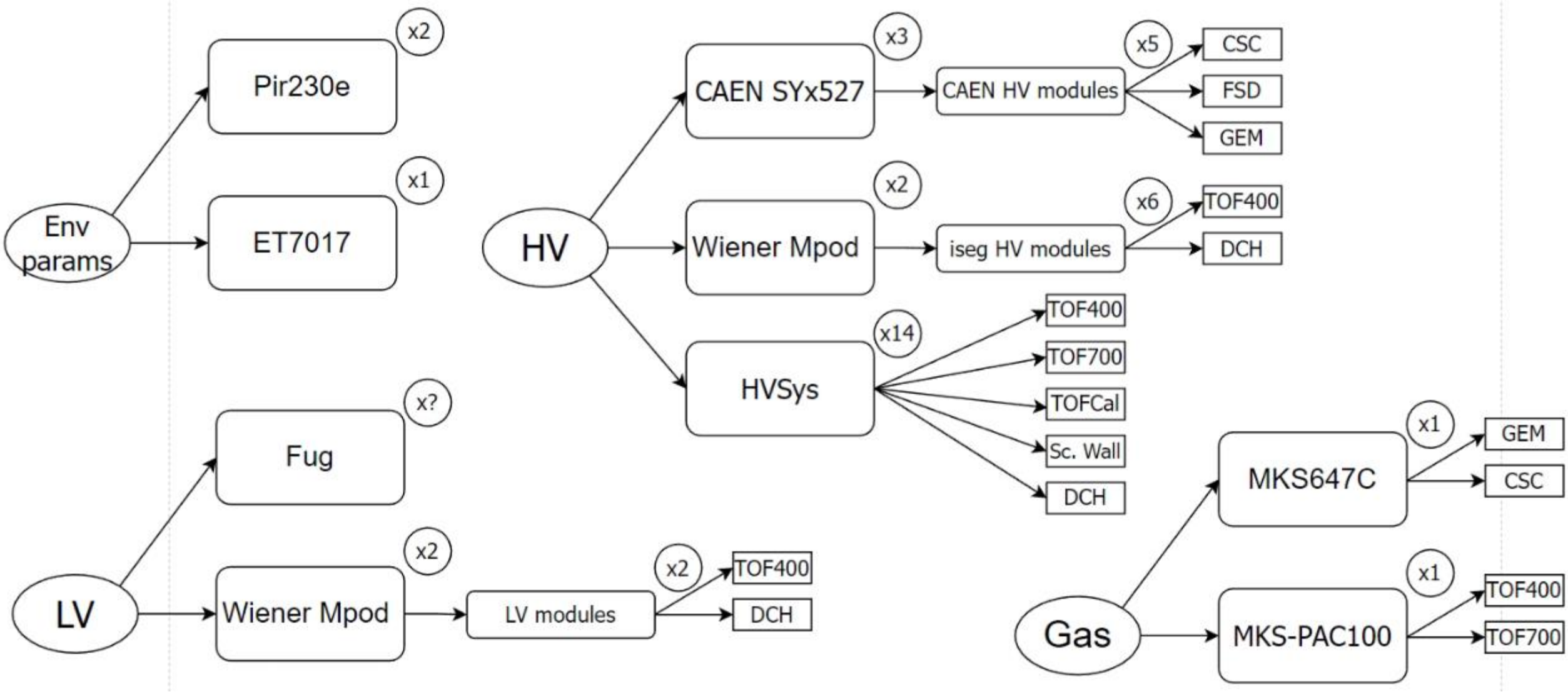


ASSOCIATION OF YOUNG SCIENTISTS AND SPECIALISTS OF JINR

SRC setup BM@N facility



Hardware of SRC setup



What is Slow Control System?

- Monitoring of the experimental hardware;
- Centralized control of the Slow Control equipment (LV, HV, gas flow etc.);
- Archiving Slow Control data;
- Alarm system.

Not a Slow Control:

- Main data stream (data taking);
- Event builder (reconstruction)/event display;
- Data quality;
- Run control.

How we can build SC?

TANGO controls

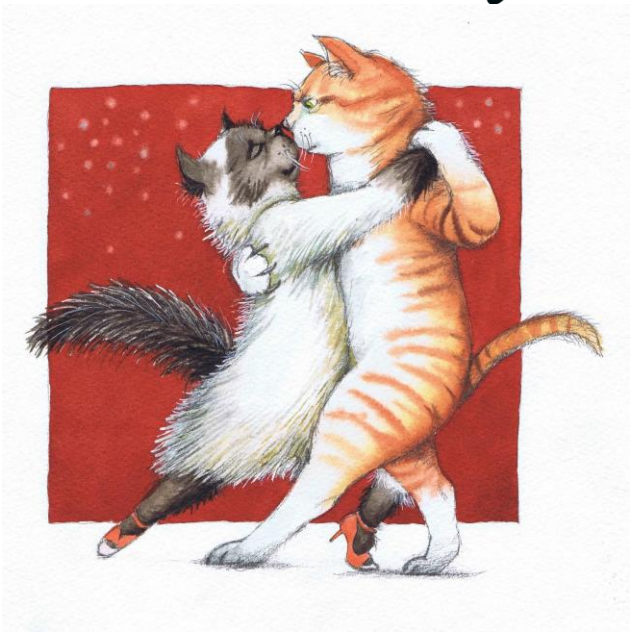
WinCC® Professional

EPICS

Tango Controls

Tango Controls is an object oriented, distributed control system. It is a framework for building custom SCADA systems. Tango defines communication protocol and API. It provides libraries, set of GUI tools and drivers (so called Device Servers) for variety of standard and specific control equipment. For more information see: http://www.tango-controls.org/what-tango-controls/

- Multiplatform
- Archiving service
- Access control service
- Logging service
- Alarm service
- Configuration tool
- Administration tool



Who use Tango Controls

SKA SQUARE KILOMETRE ARRAY

NATIONAL RESEARCH CENTER «KURCHATOV INSTITUTE»

ALBA

TANGO controls

Институт ядерной физики имени Г. И. Будкера СО РАН

MAX IV

Elettra Sincrotrone Trieste

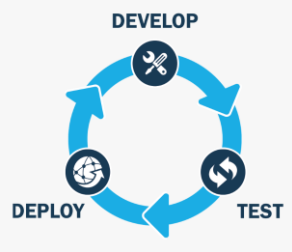
DESY.

SOLEIL SYNCHROTRON

ESRI

eli beamlines

What is Tango Controls



TANGO is based on the 21 century technologies :

- CORBA and ZMQ to communicate between device server and clients
- C++, Python and Java as reference programming languages
- Linux and Windows as operating systems
- Modern object oriented design patterns
- Naturally implements a microservices architecture
- Unit tested, continuous integration enabled
- Hosted on Github (https://github.com/tango-controls)
- Extensive documentation + tools, large community

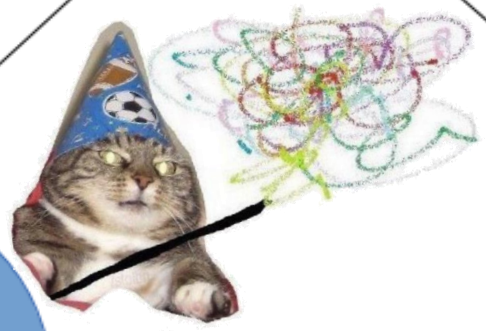
What is Tango Controls

Data visualization for users

Client Application

What and how read from server?

Data and command exchange



Read and control methods between devices

Device configuration description

Database

How to connect? (IP, port, ID, protocol, etc.)

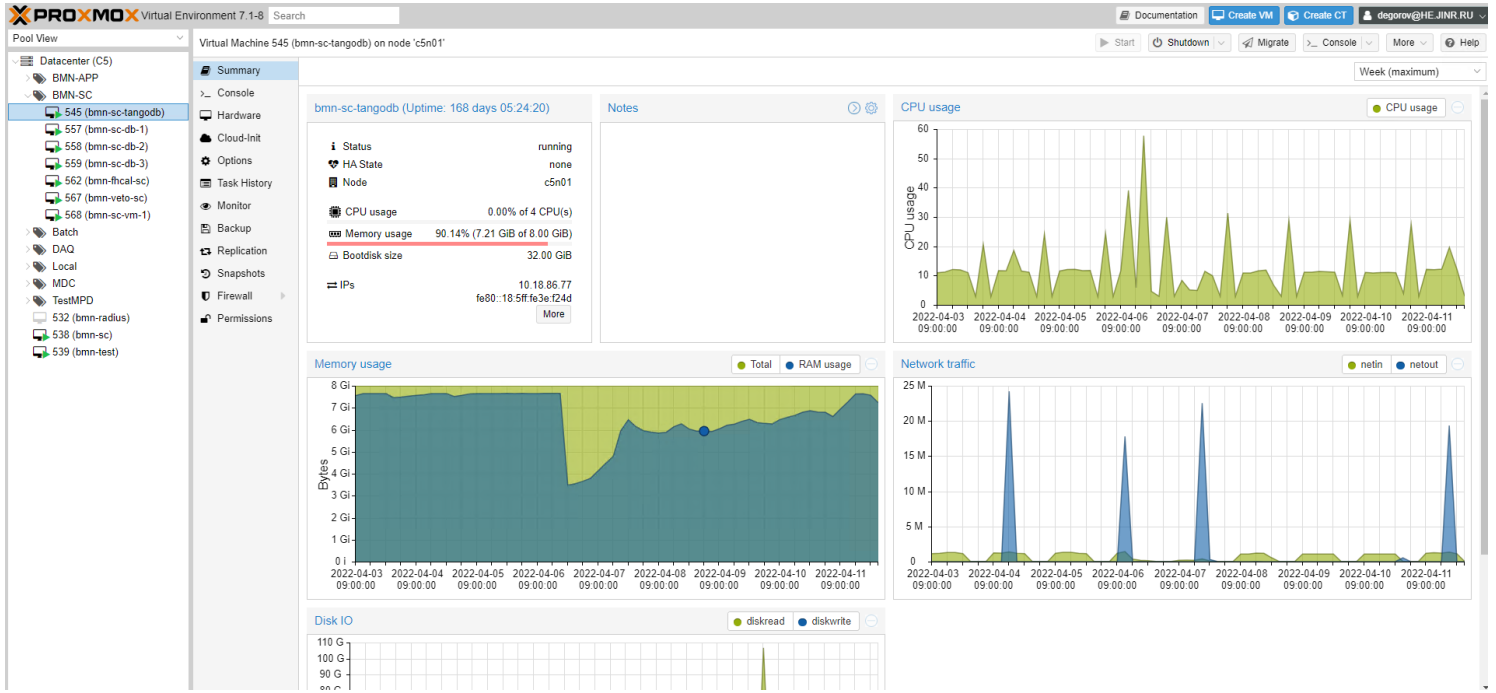
Device Server

Infrastructure – computing, devices, interfaces…

At present time the service layer tasks uses existing MPD/BM@N computing farm. Virtualization is done using PROXMOX Virtual Environment.

All centralized services are running on dedicated VM’s

Front-end layer includes a wide variety of devices which are uses different buses and protocols, such as PXI, Ethernet, RS-485, RS232 etc.



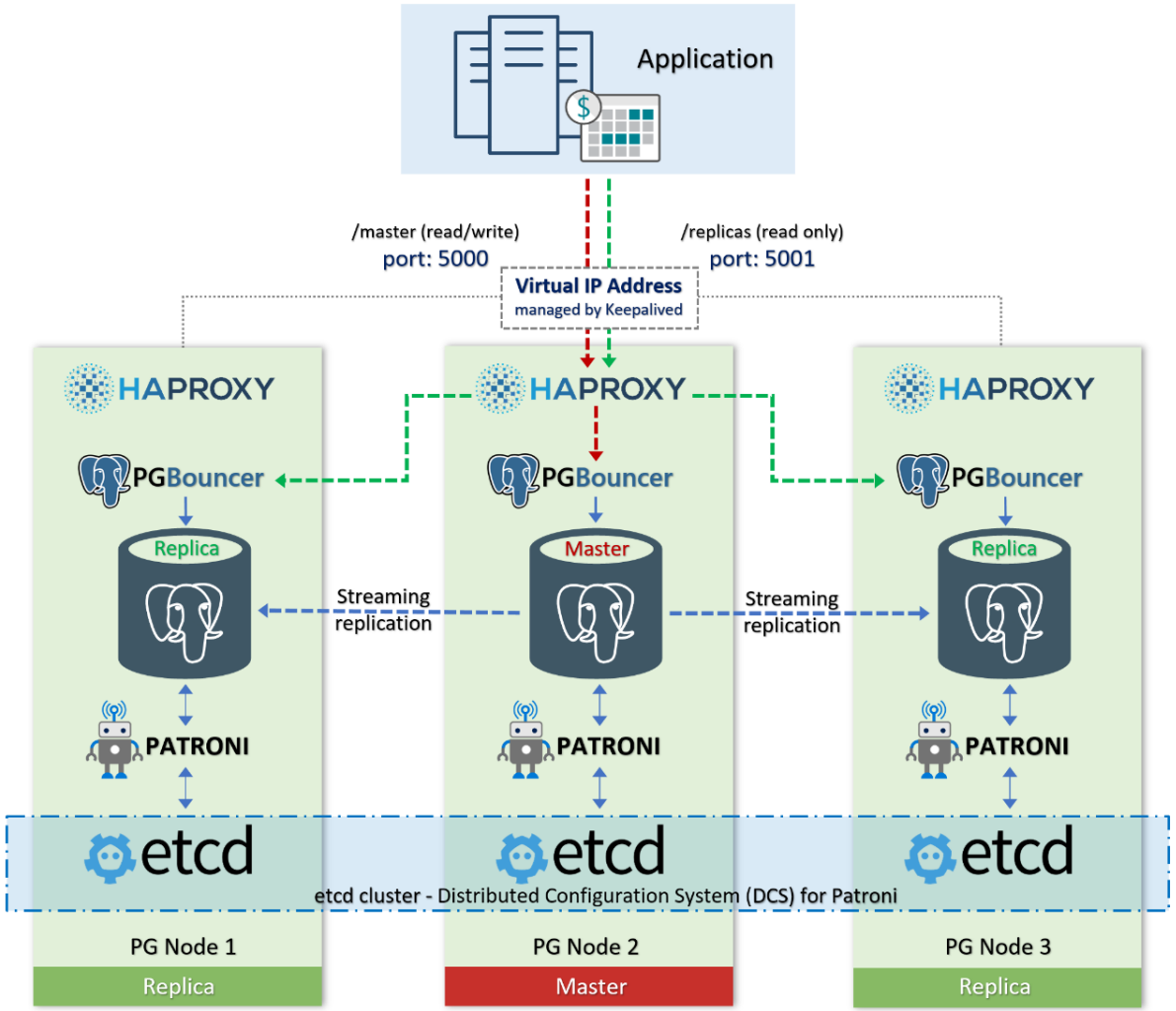
Ansible

Ansible is a software solution for remote configuration management. It allows you to configure remote machines.

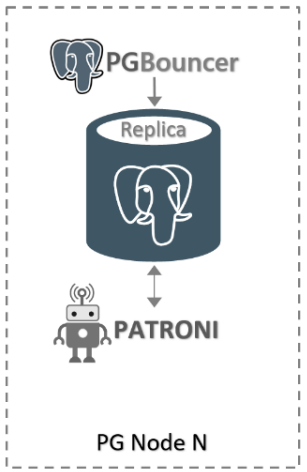
- System configuration;
- Tango installation;
- Libraries installation and database configuration;
- Libraries installation and configuration of the Python development environment.

```yaml
- name: deploy_tango
  hosts: bmn
  vars_files:
    - vars/main.yml
  become: yes
  roles:
    - system
    - tango
    - hdb
    - pytango
```

Database cluster(PostgreSQL)



Scale-Out
PostgreSQL
with read
replicas

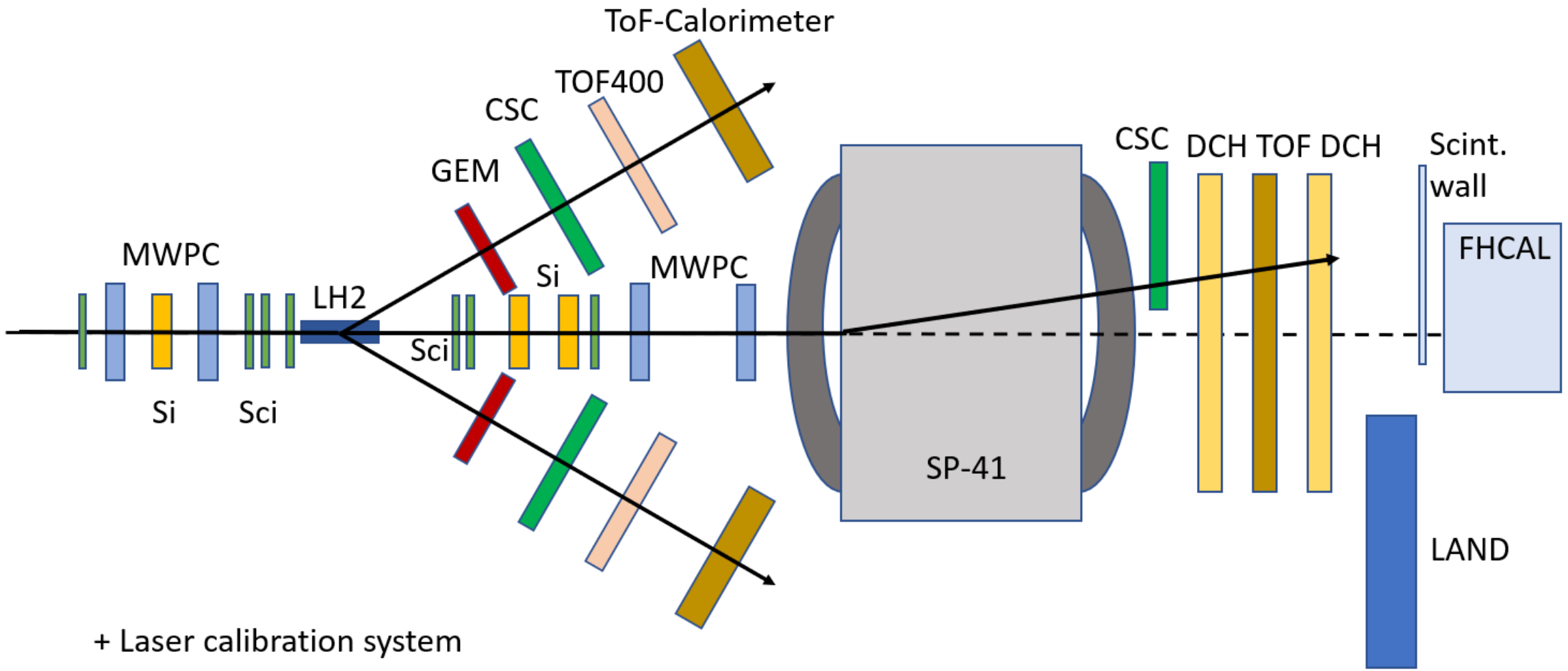


https://github.com/vitabaks/postgresql_cluster

Data visualization

Grafana is a free software data visualization system focused on IT monitoring systems data. It is implemented as a "dashboard" style web application with charts, graphs, tables, alerts.

SRC BM@N (Baryonic Matter at Nuclotron)



HV system of MWPC, GEM, CSC, FSD

TCP/IP

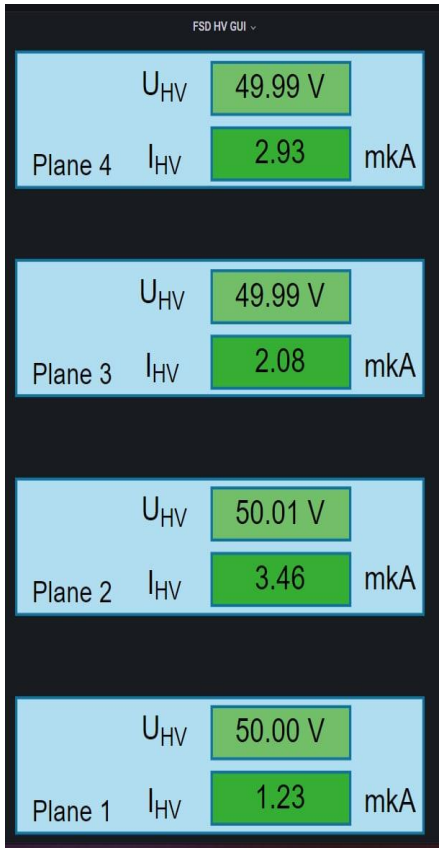
CAEN HV Wrapper

CAEN HV Wrapper Library

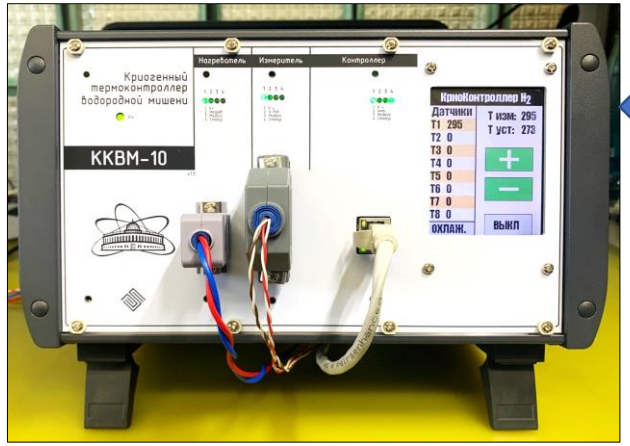
Device Server

Properties
Attributes
Commands

HDB



LH2 Target



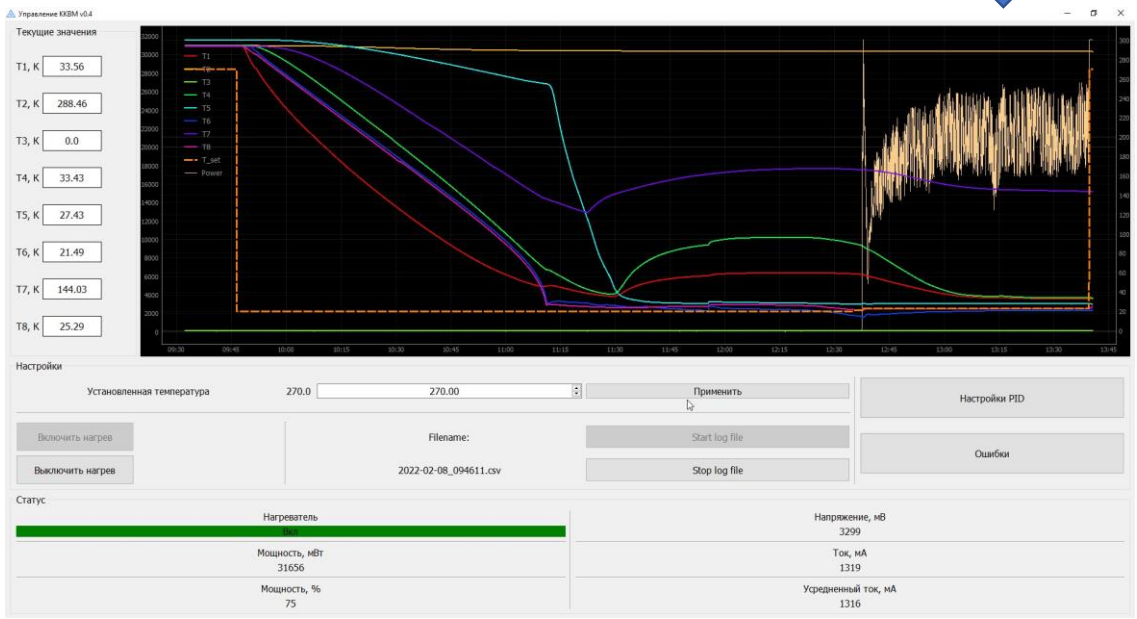
TCP/IP

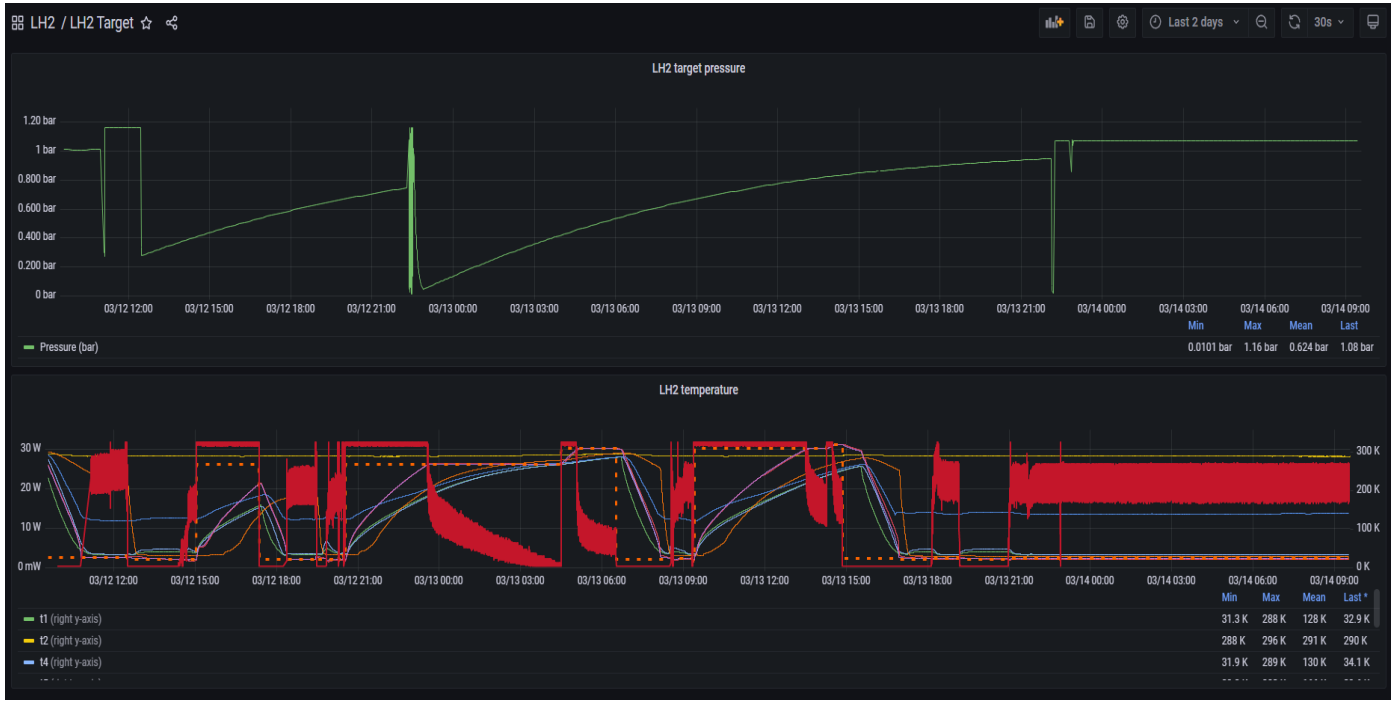
Modbus

Device Server

Properties
Attributes
Commands

HDB





Gas system of GEM/CSC

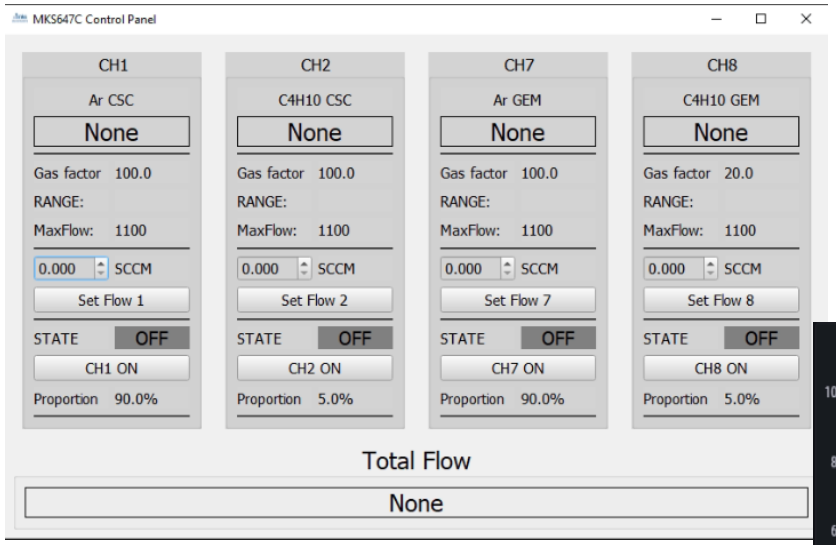
TCP/IP

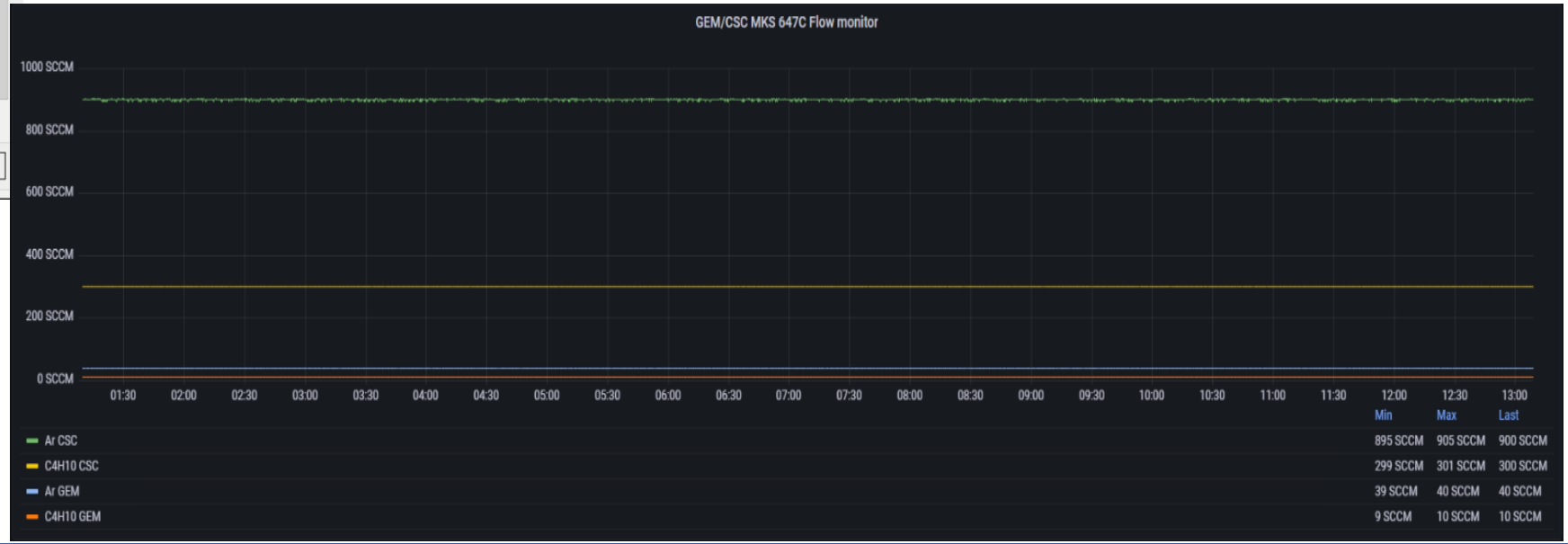
Socket

Device Server

Properties
Attributes
Commands

HDB





HV/LV system of TOF(Left), DCH

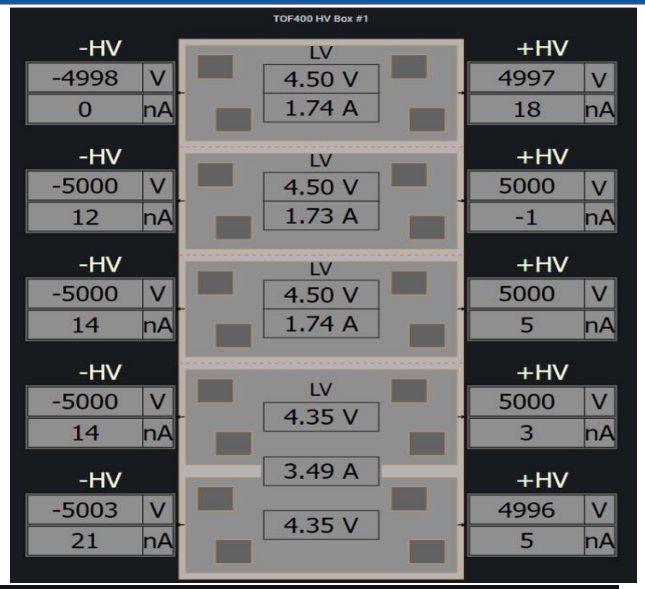
TCP/IP

SNMP
Simple Network Management Protocol

Device Server

Properties
Attributes
Commands

HDB



HV system of TOF(Right) BM@N

TCP/IP
Socket

Socket Manager

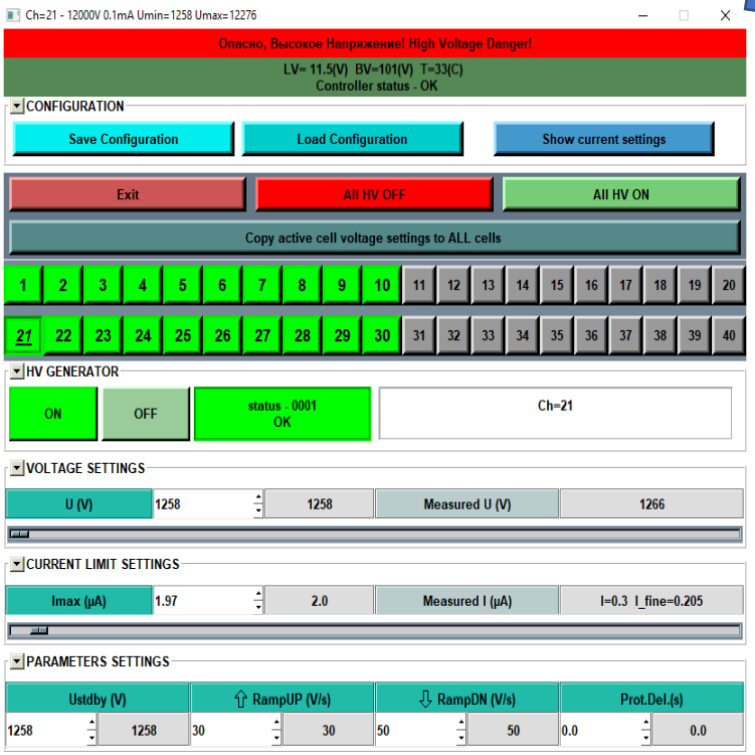
TCP/IP
Socket

Device Server

Properties
Attributes
Commands

HDB

TCP/IP
Socket



Gas system of TOF400/TOF700 BM@N

TCP/IP

Modbus

Device Server

Properties
Attributes
Commands

HDB

Device Server

Properties
Attributes
Commands

TCP/IP

TCP/IP

Socket

Gas system of TOF BM@N

HV system of TOF700, TOFCal

RS-485

TCP/IP

Socket

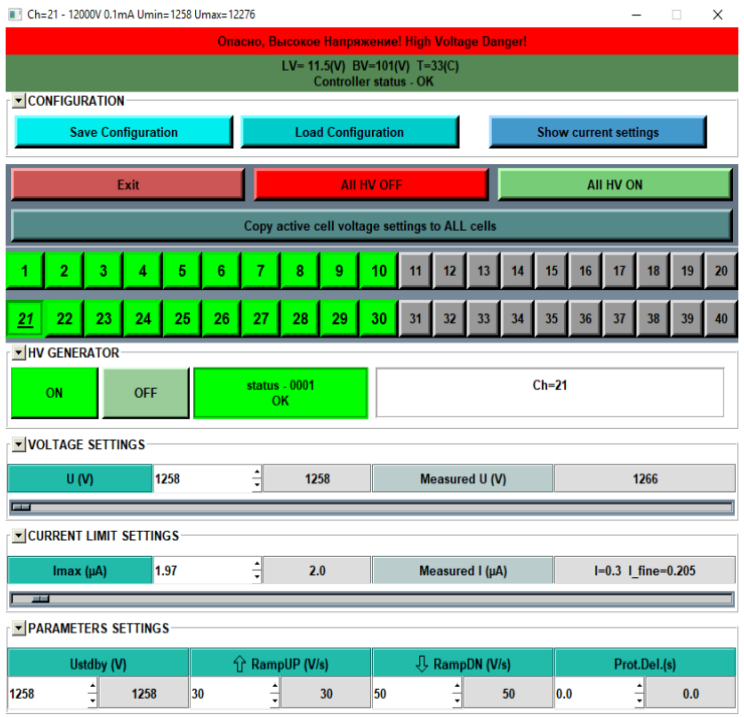
Device Server

Properties
Attributes
Commands

HDB

TCP/IP

Socket



FSD FEE chip temperature

TCP/IP

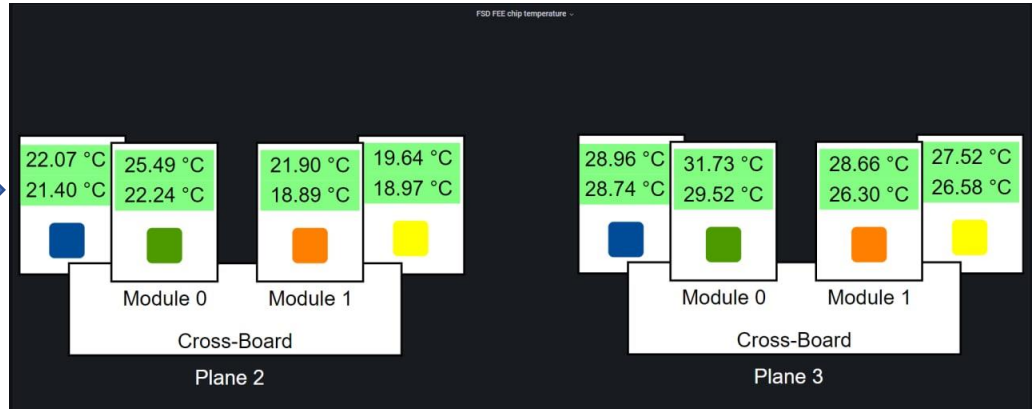
Modbus

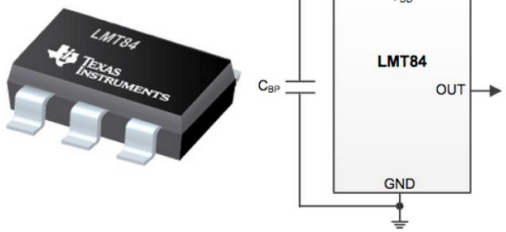
Device Server

Properties
Attributes
Commands

TCP/IP

HDB





SP-41 BM@N

TCP/IP

Modbus

Device Server

Properties
Attributes
Commands

TCP/IP

HDB

HV system of Scint. Wall

TCP/IP
Socket

Socket Manager

TCP/IP
Socket

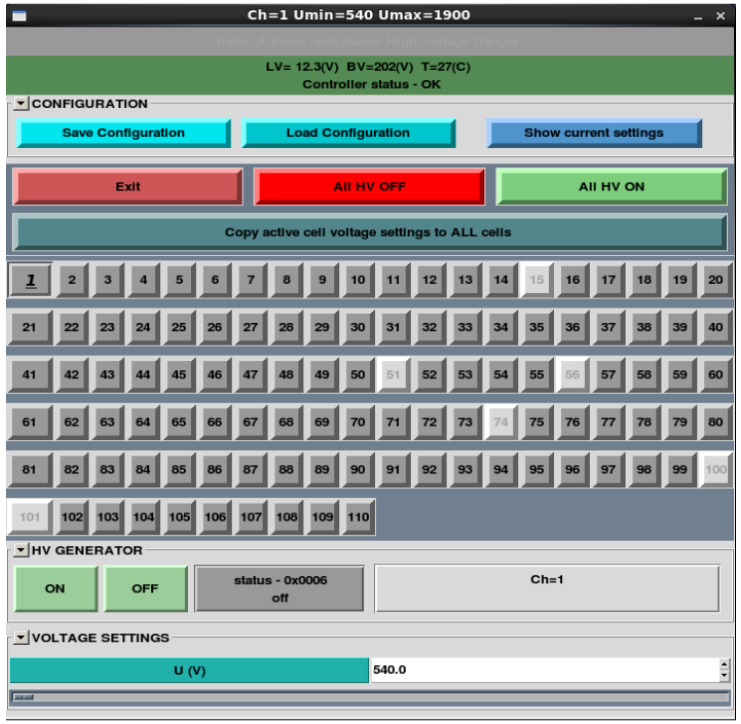
Device Server

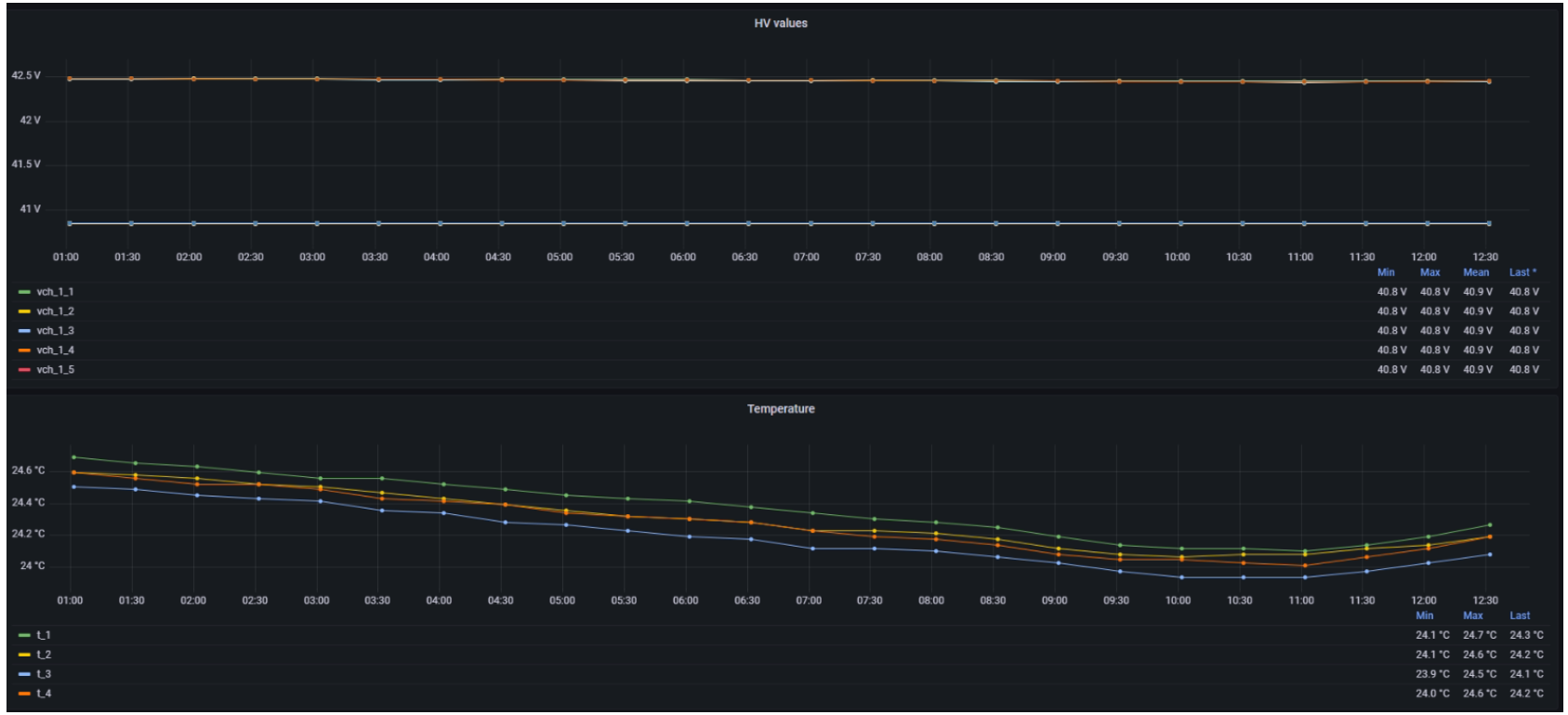
Properties
Attributes
Commands

TCP/IP

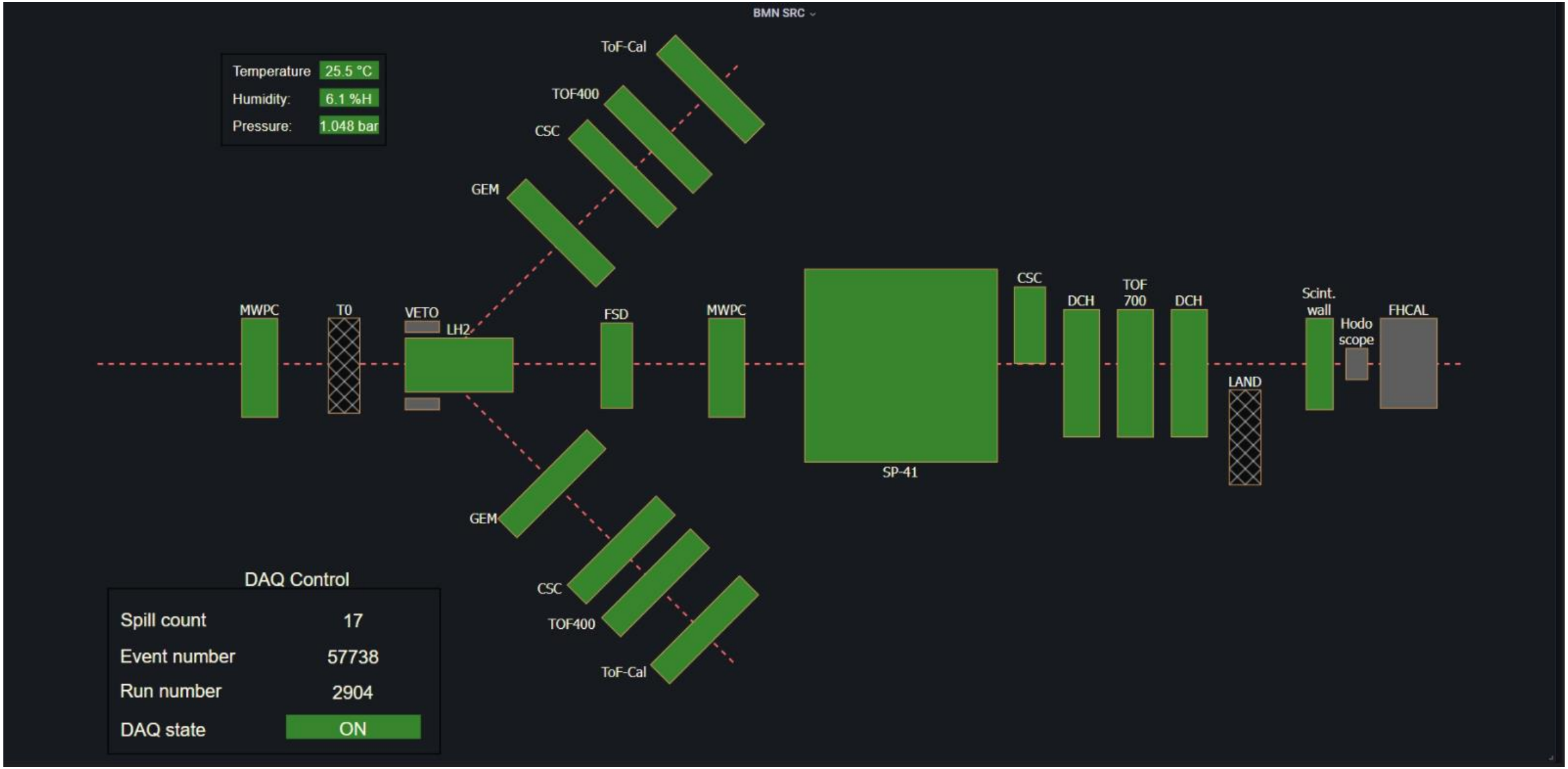
HDB

TCP/IP
Socket

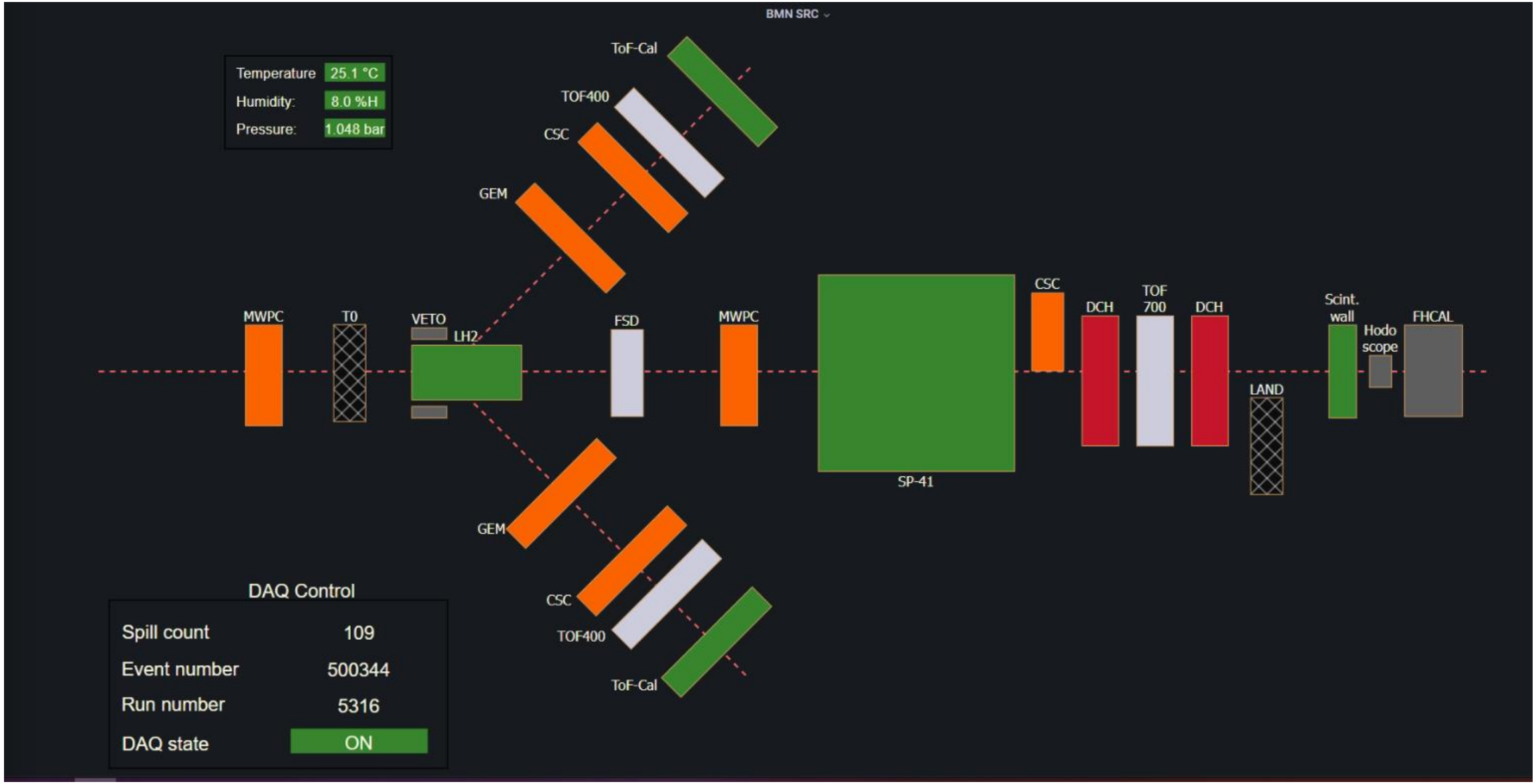




SRC Slow Control



SRC Slow Control



Conclusions

- This slow control system successfully worked the entire session of the SRC;
- This system will also work for the upcoming BM@N session. At this point, additional devices are being implemented that were not present in the SRC session