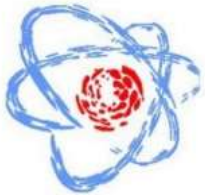




Distributed control system for the BM@N experiment

Alushta-2025



ASSOCIATION OF YOUNG
SCIENTISTS AND SPECIALISTS OF JINR

I. Osokin

on behalf of Slow Control group:

V. Dronik, V. Shutov, R. Nagdasev, D. Egorov

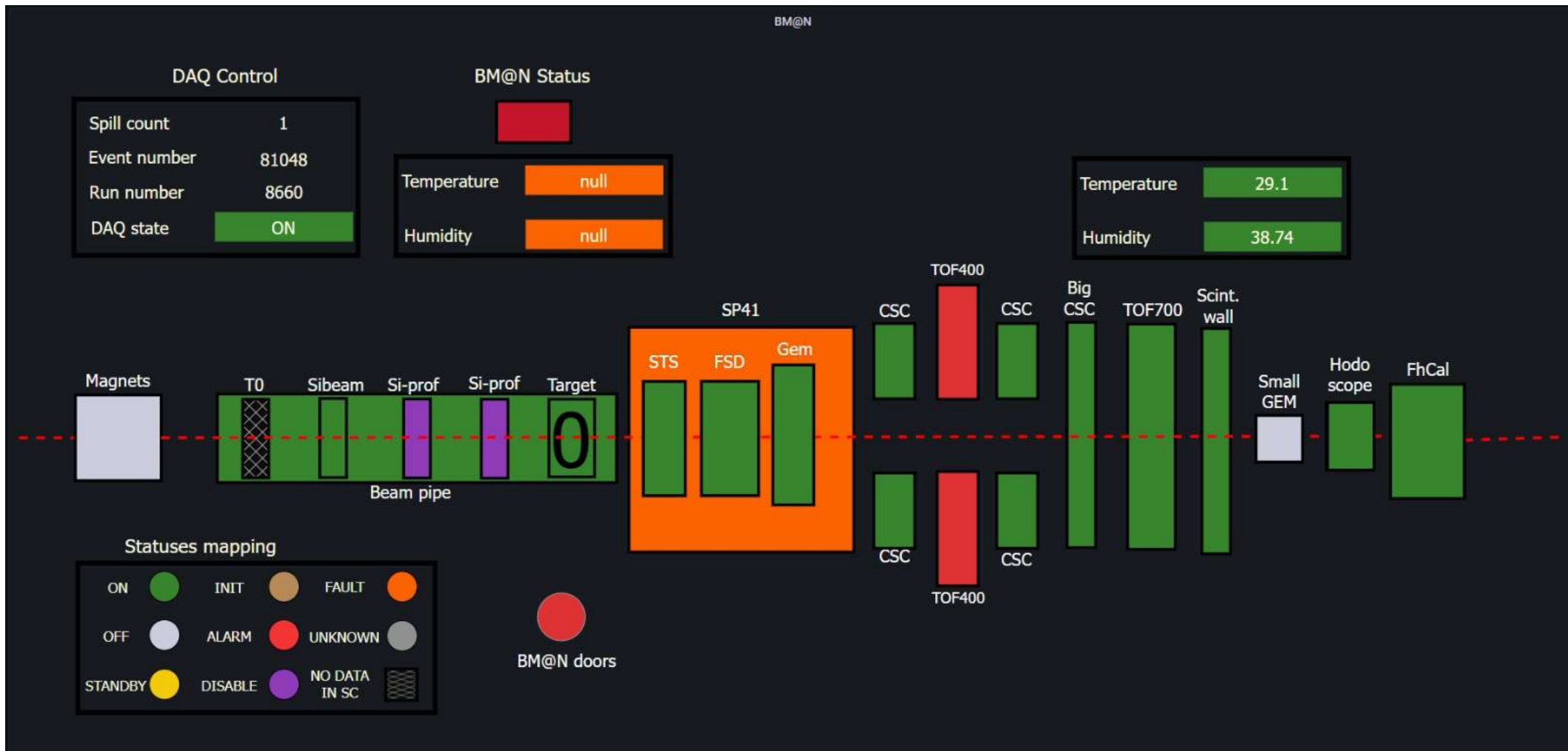
10.06.2025



BM@N building in NICA complex

BM@N experiential hall:





What is Slow Control?

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

Not a Slow Control:

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

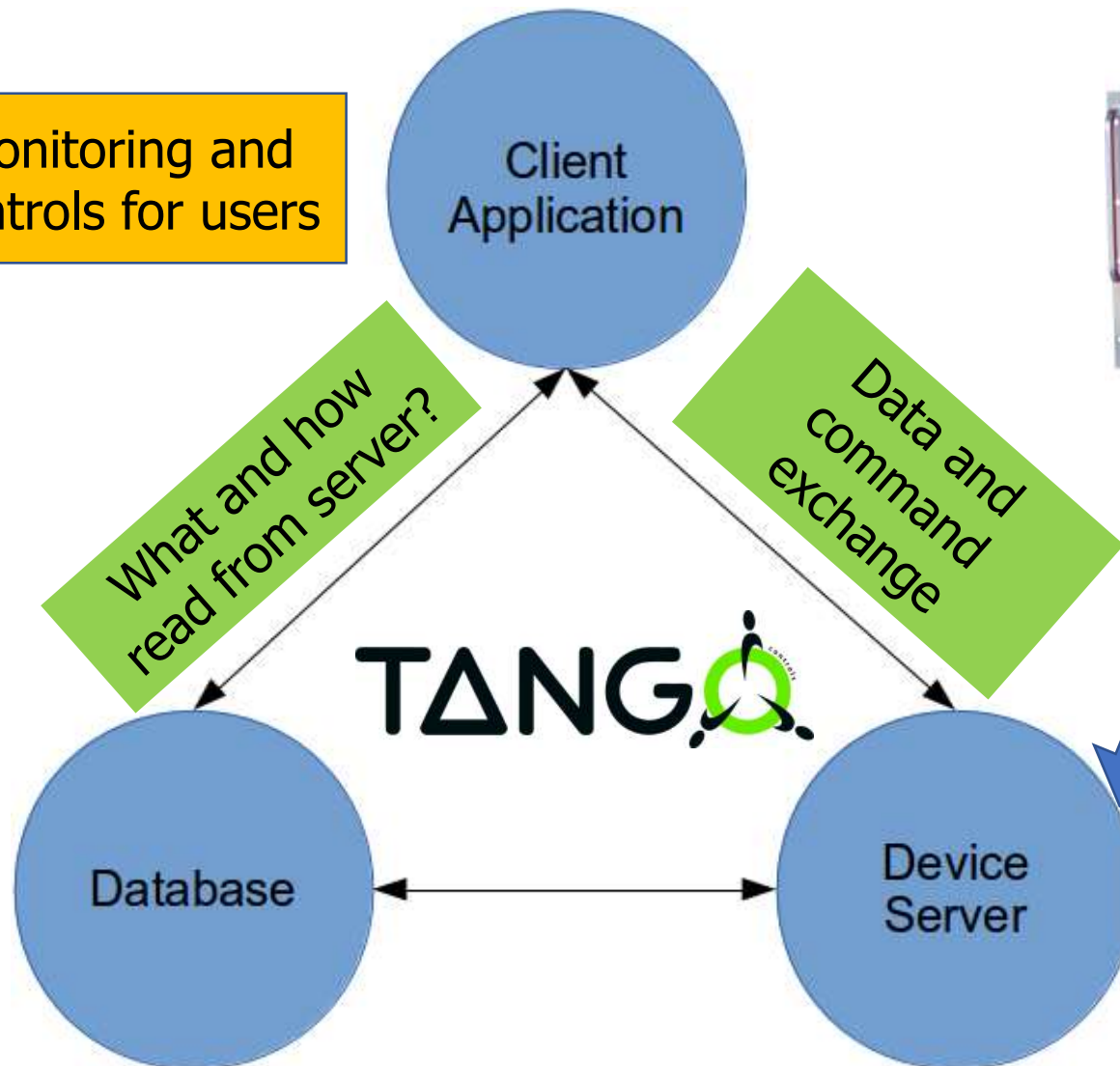


What is Slow Control?

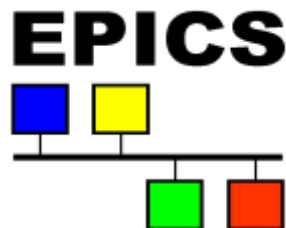


Monitoring and controls for users

Tango-based Slow Control System has performed well in previous runs and will be used in the forthcoming run



DCS analogs:

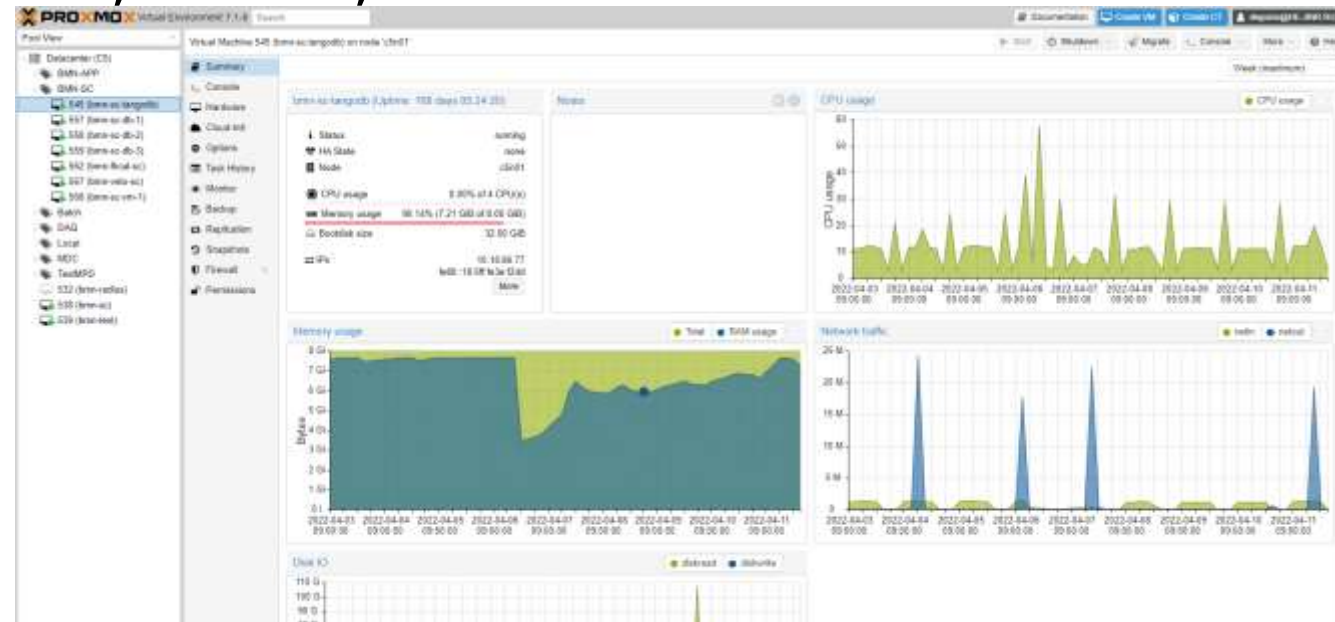


Infrastructure – computing, devices, interfaces

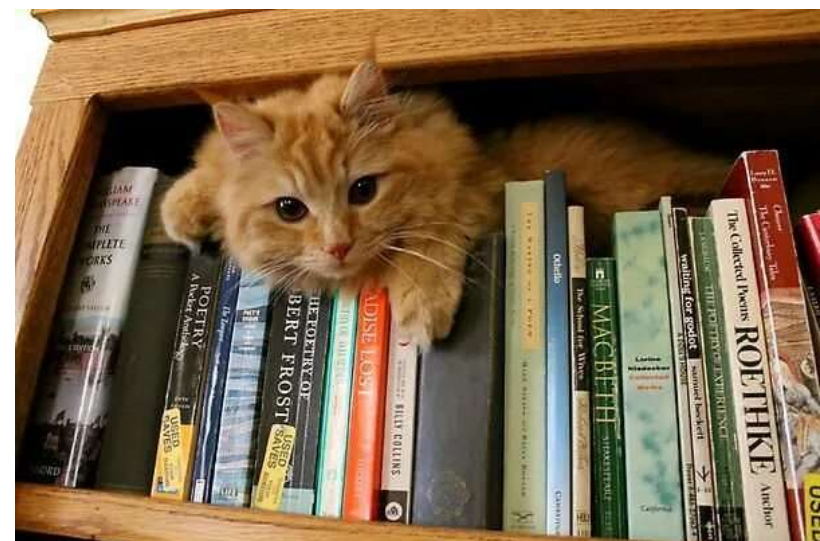
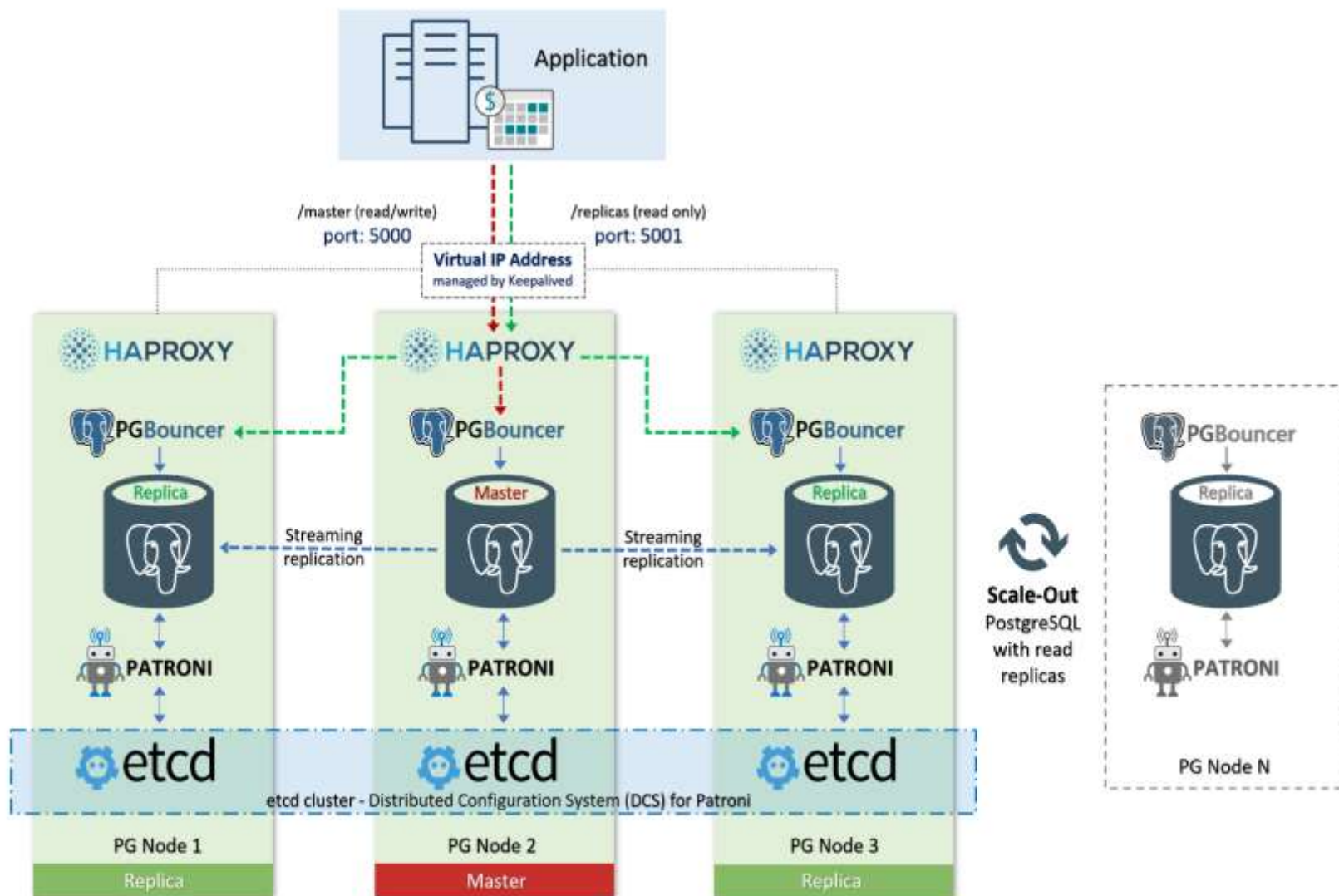
At present time the service layer tasks uses existing MPD/BM@N computing farm
Virtualization is done using PROXMOX Virtual Environment.

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.



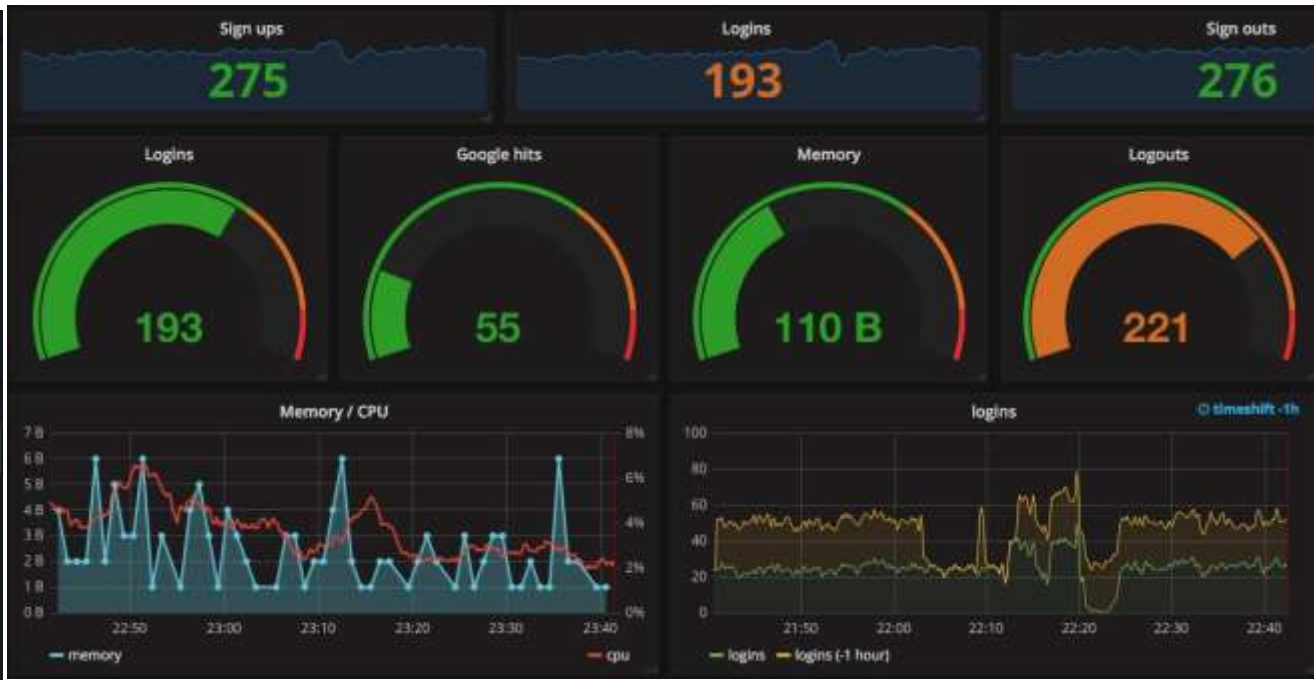
Database cluster

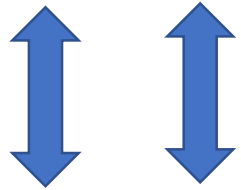


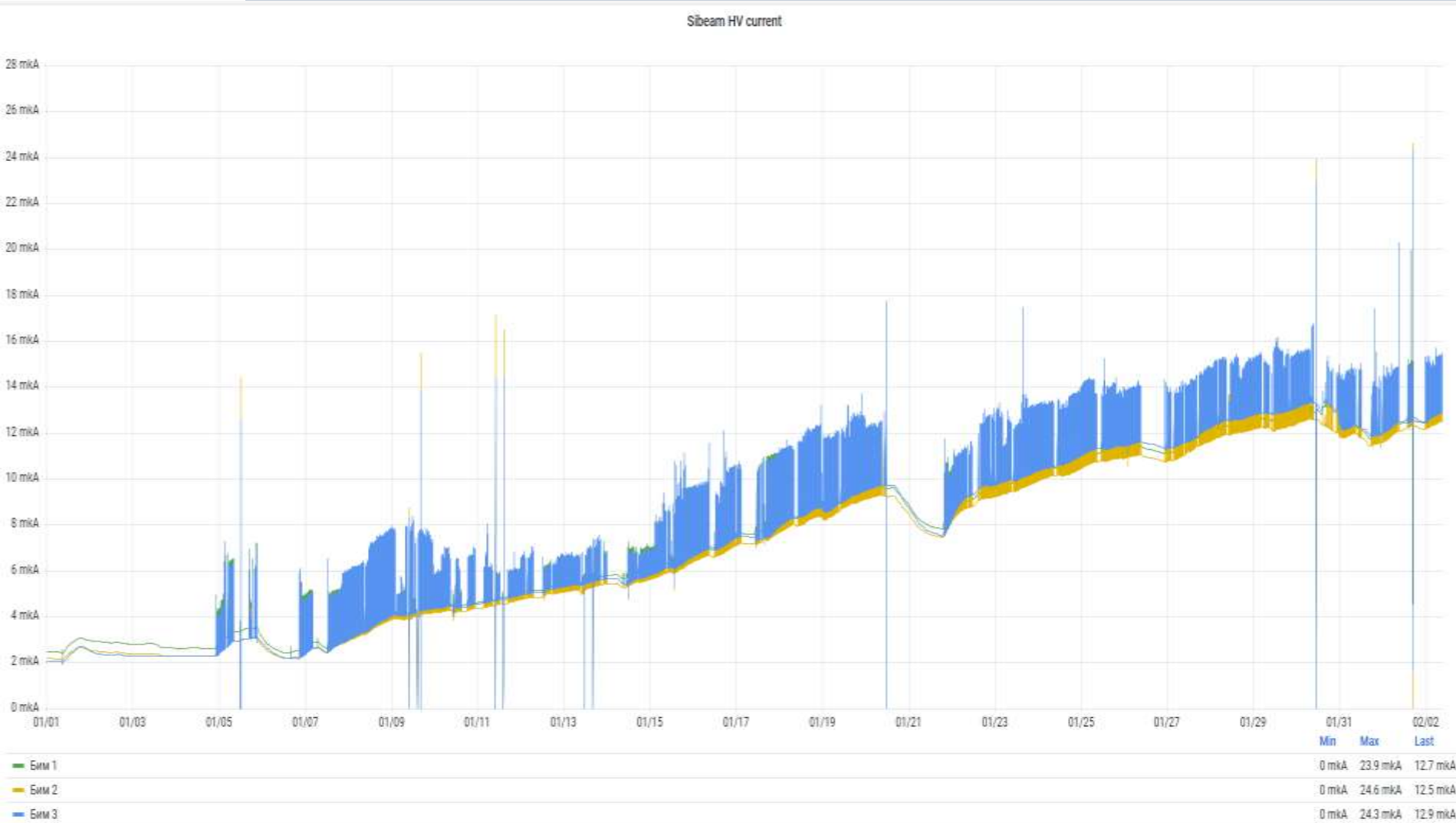


Grafana

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.







The average value of the dark current at the beginning of the session is $0.761 \mu\text{A}$, measured at a temperature of $+22.5^\circ\text{C}$; the average value of the dark current at the end of the session, for a reason radiation damage, is $12.7 \mu\text{A}$,

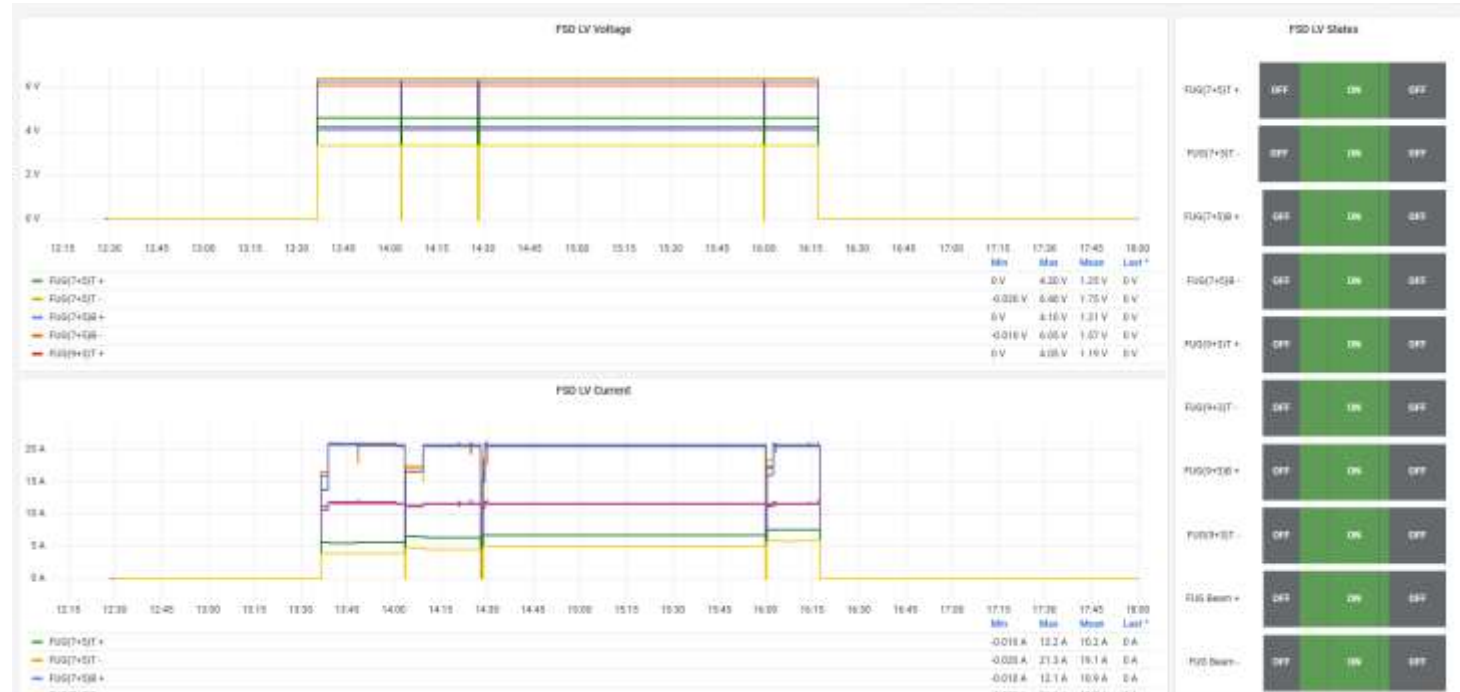
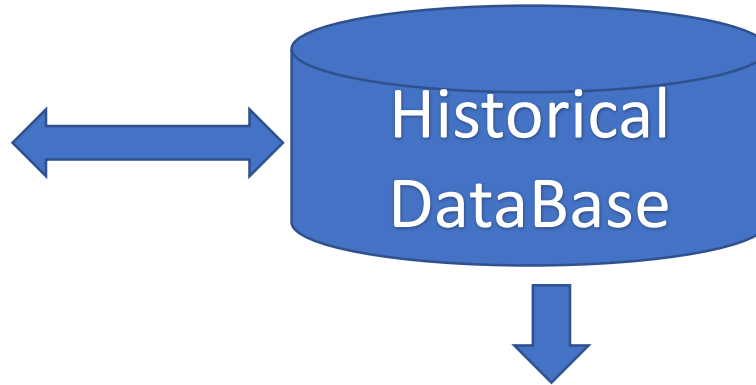
The change in detector currents at three beam tracker stations during the 2022-2023 session is shown.

LV system of FSD, GEM, BT

TANGO

TANGO device
server

TCP/IP



FSD FEE temperature



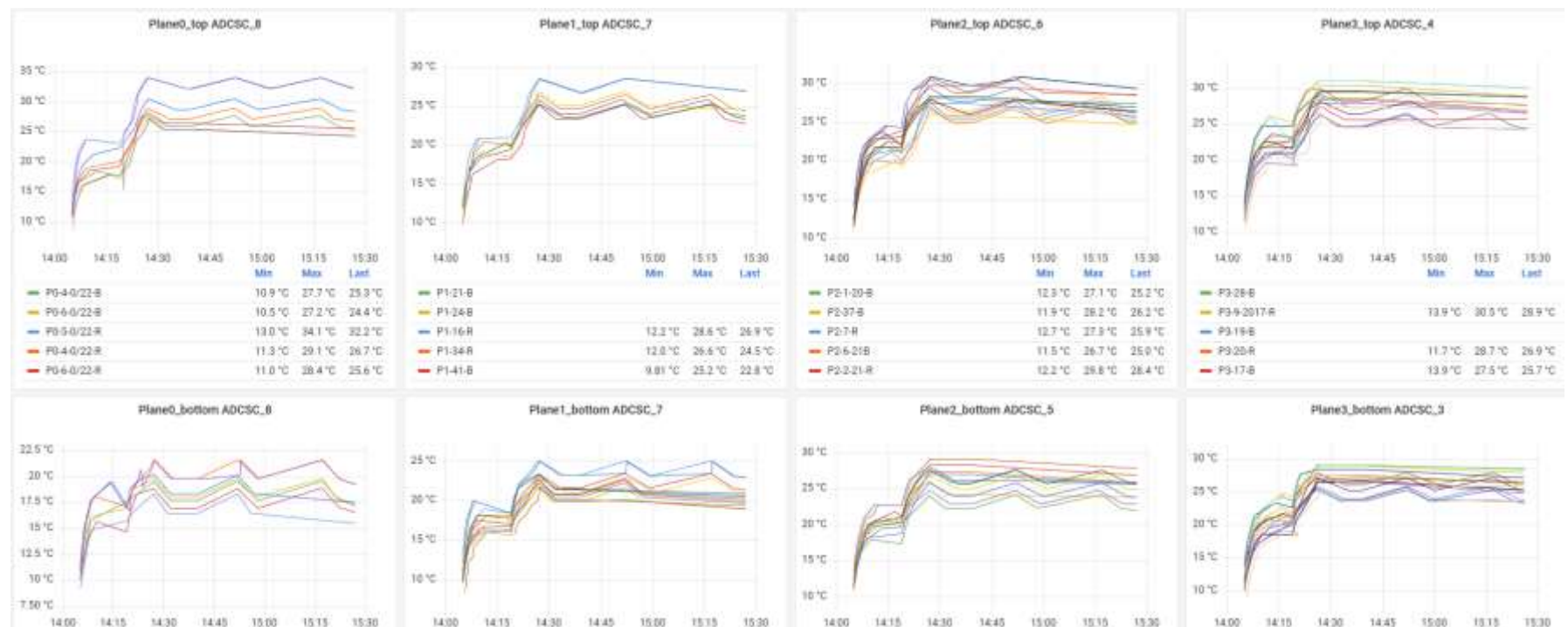
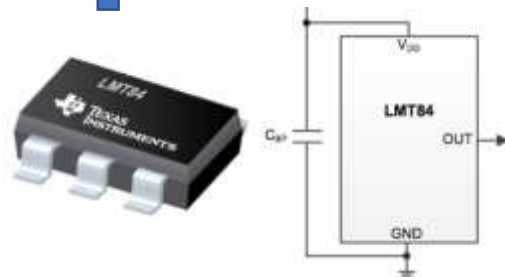
TCP/IP

Modbus



TCP/IP

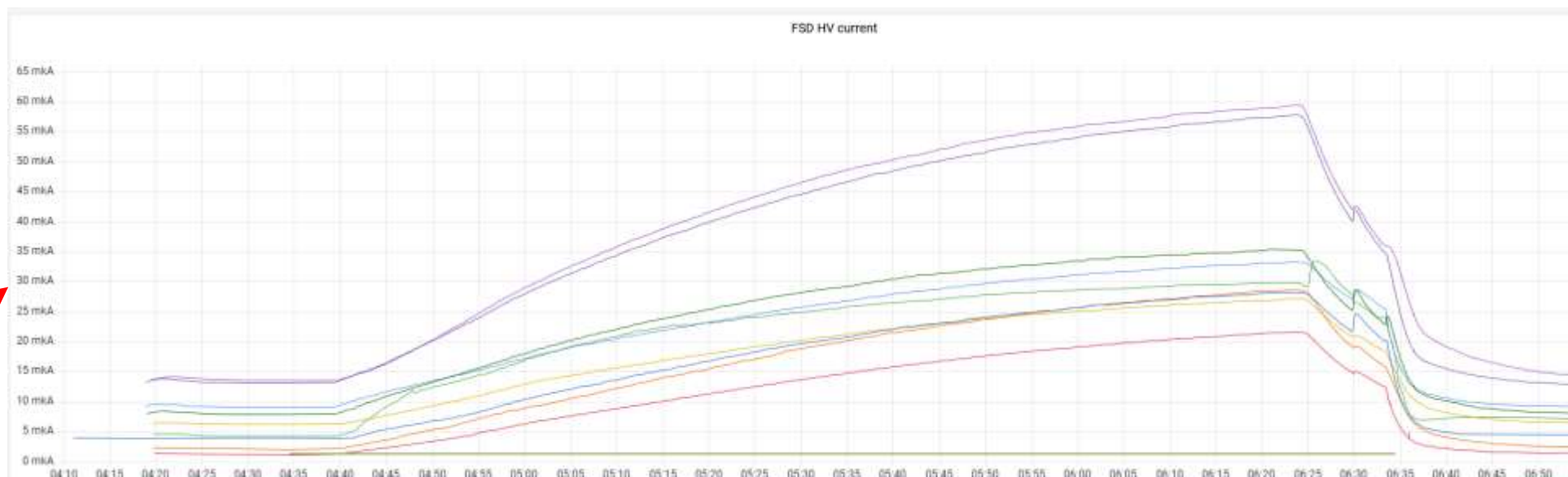
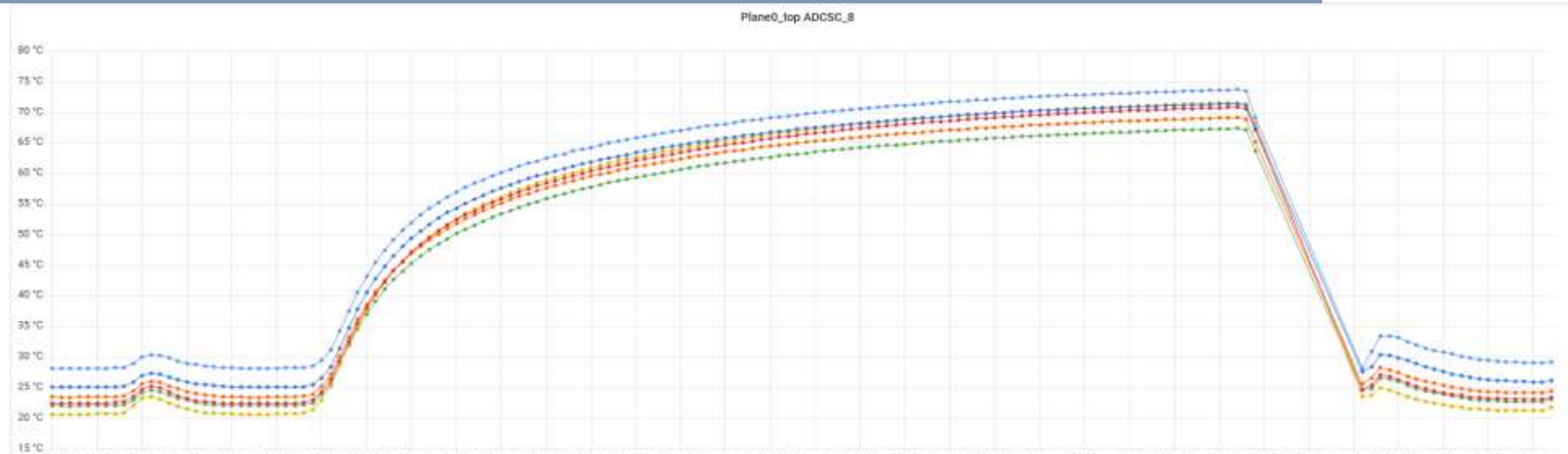
HDB



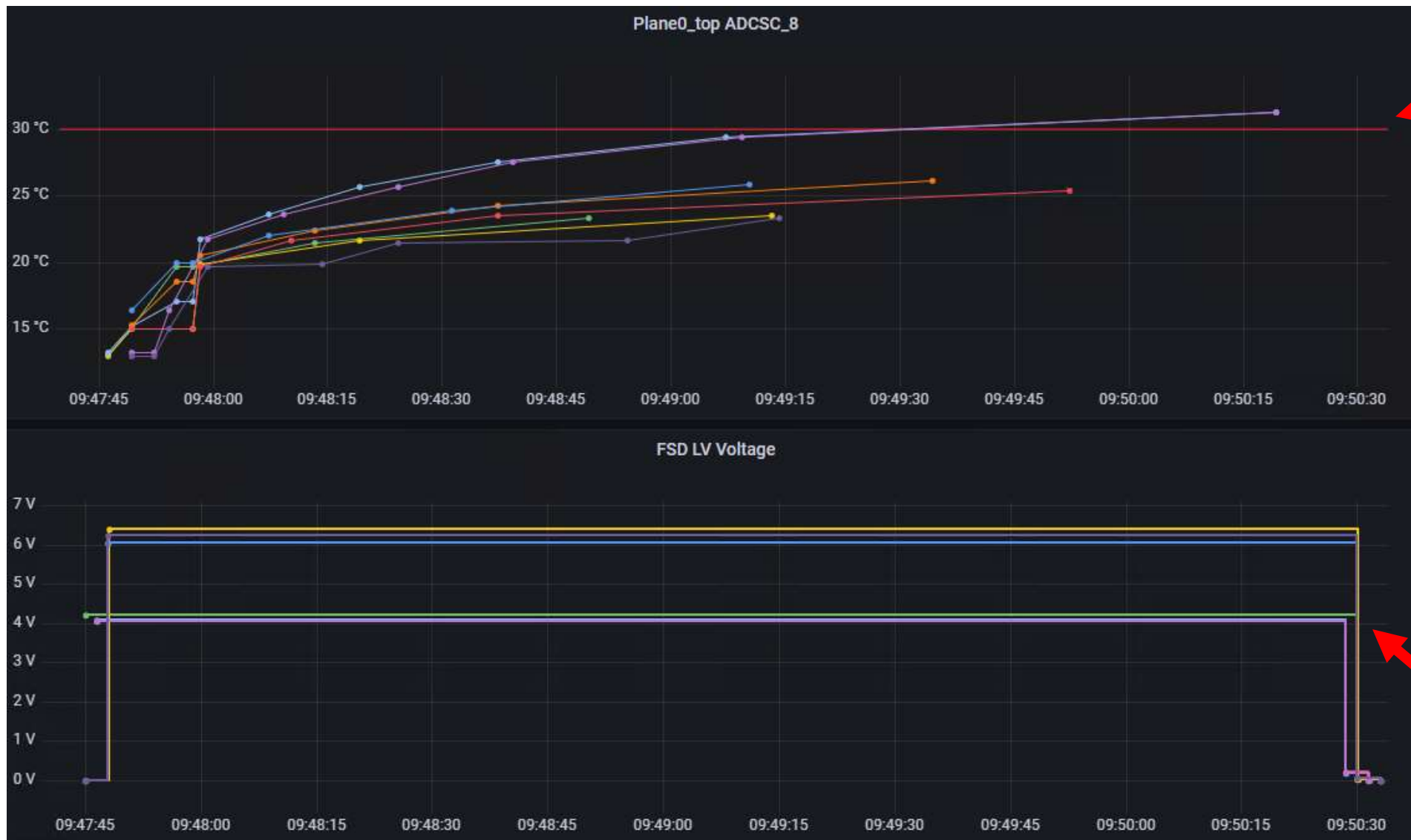
Temperature
heating over
 80°C



Increasing dark
currents of
silicon detectors



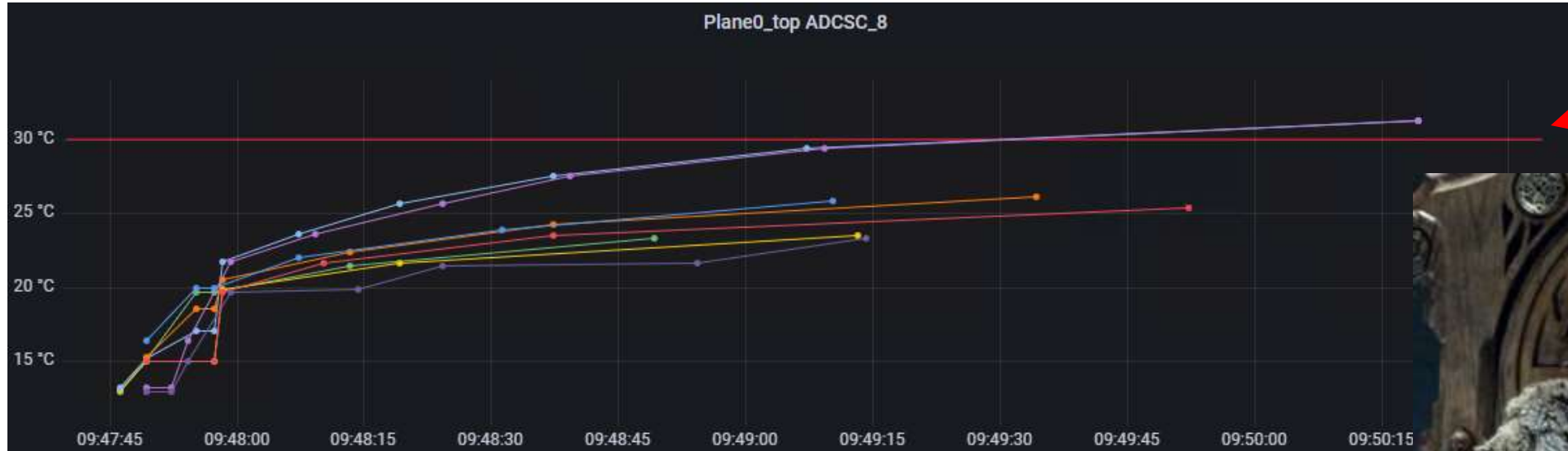
FSD Autoswitch system



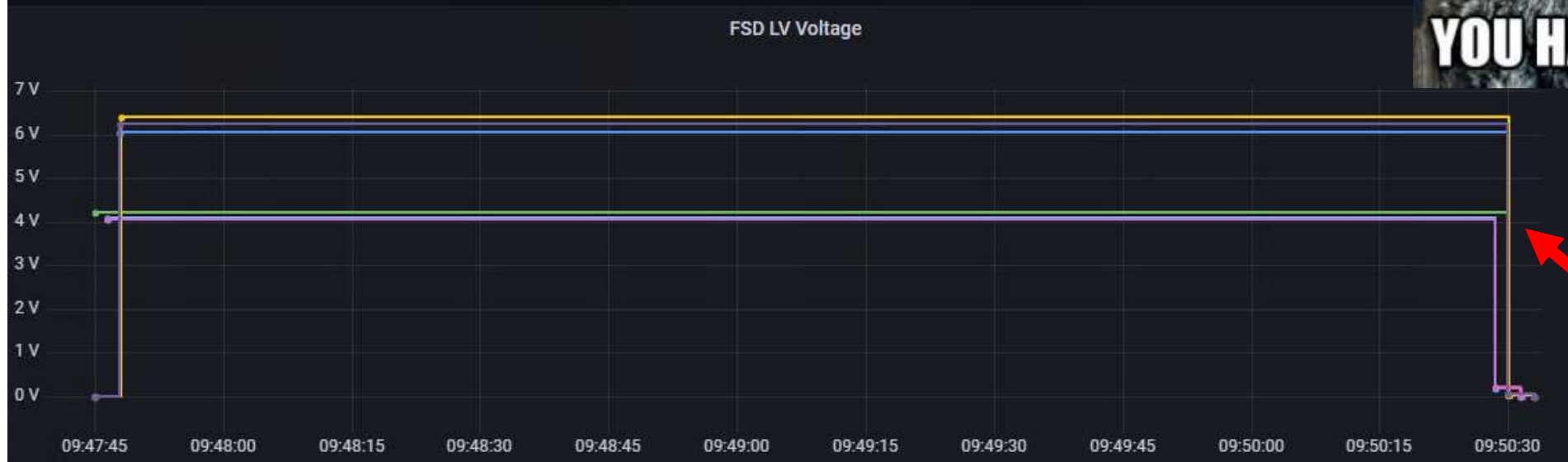
Temperature
threshold

Delayed
automatic
LV shutdown

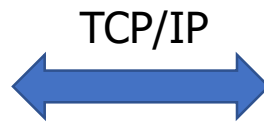
FSD Autoswitch system



Temperature
threshold



Delayed
automatic
LV shutdown



TANGO device
server

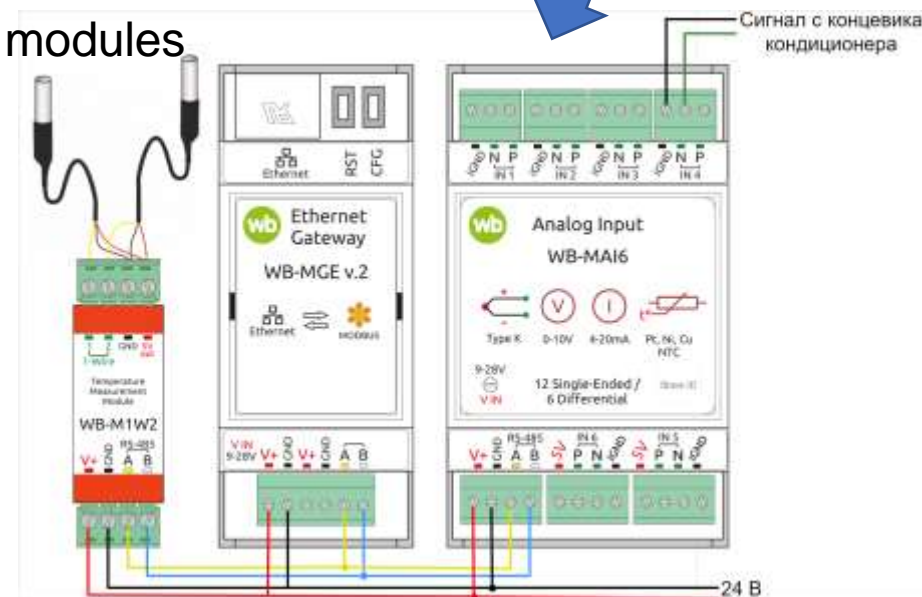


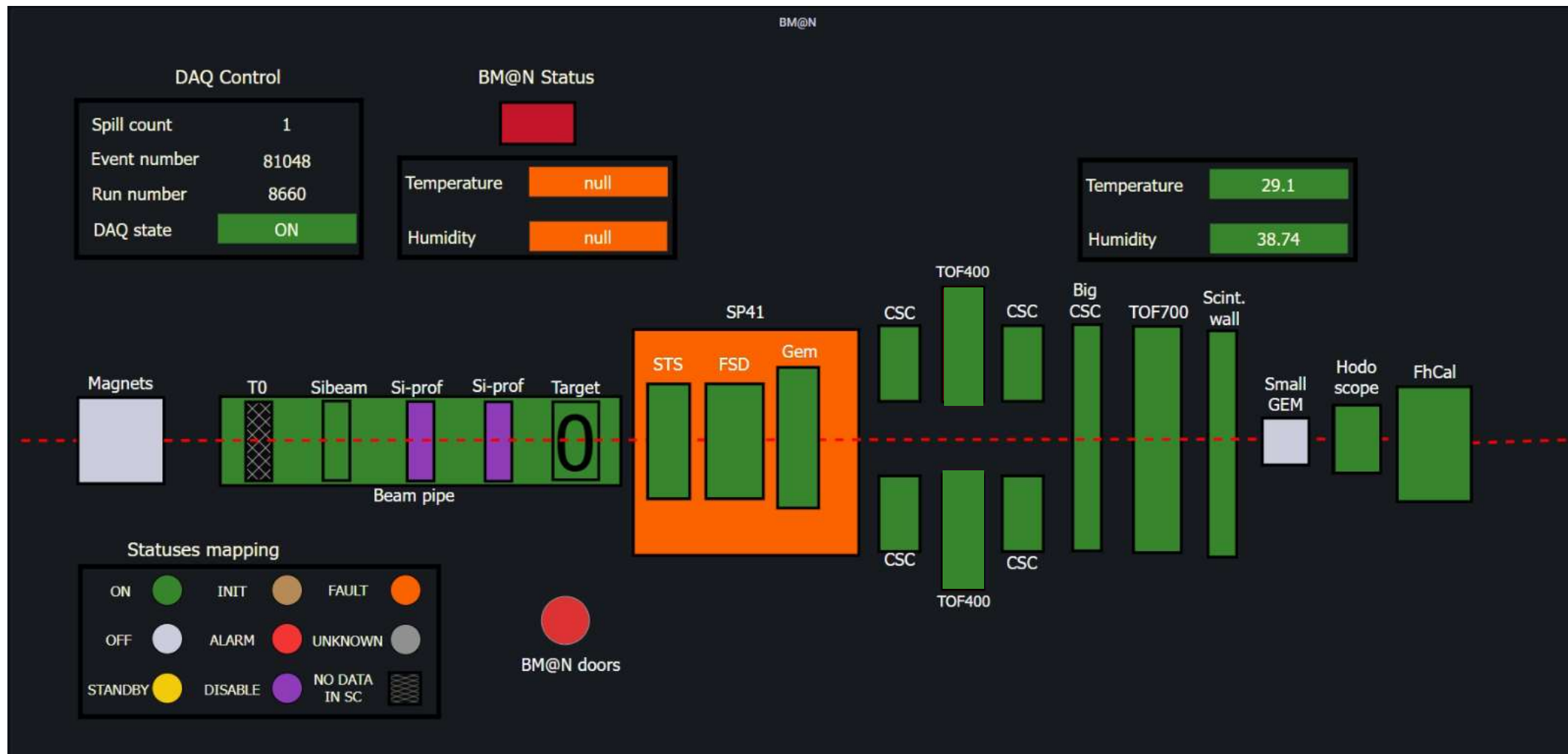
MAI6 & WB M1W2
Measurement
modules

Modbus RTU



Сигнал с концевика
кондиционера





Thank You for attention!

