Joint Institute for Nuclear Research

Tango software development at JINR

Part 1

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Plan

1. SocketDS;
2. Tango monitoring;
3. OPCDADS;
4. RestDS;
5. Tango Web clients

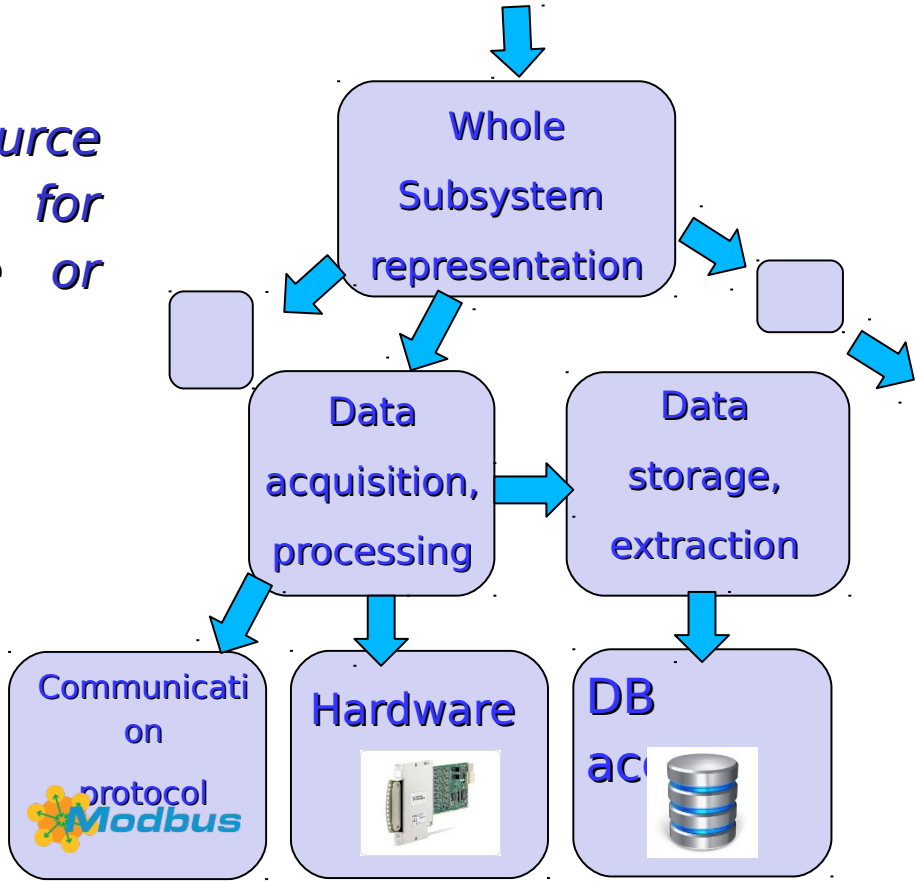
TANGO - NICA middleware standard*

Connecting things together

*Tango Controls** – is a free open source device-oriented controls toolkit for controlling any kind of hardware or software.*

Tango Device

- **State**
- **Status**
- **Properties**
- **Attributes**
- **Commands**

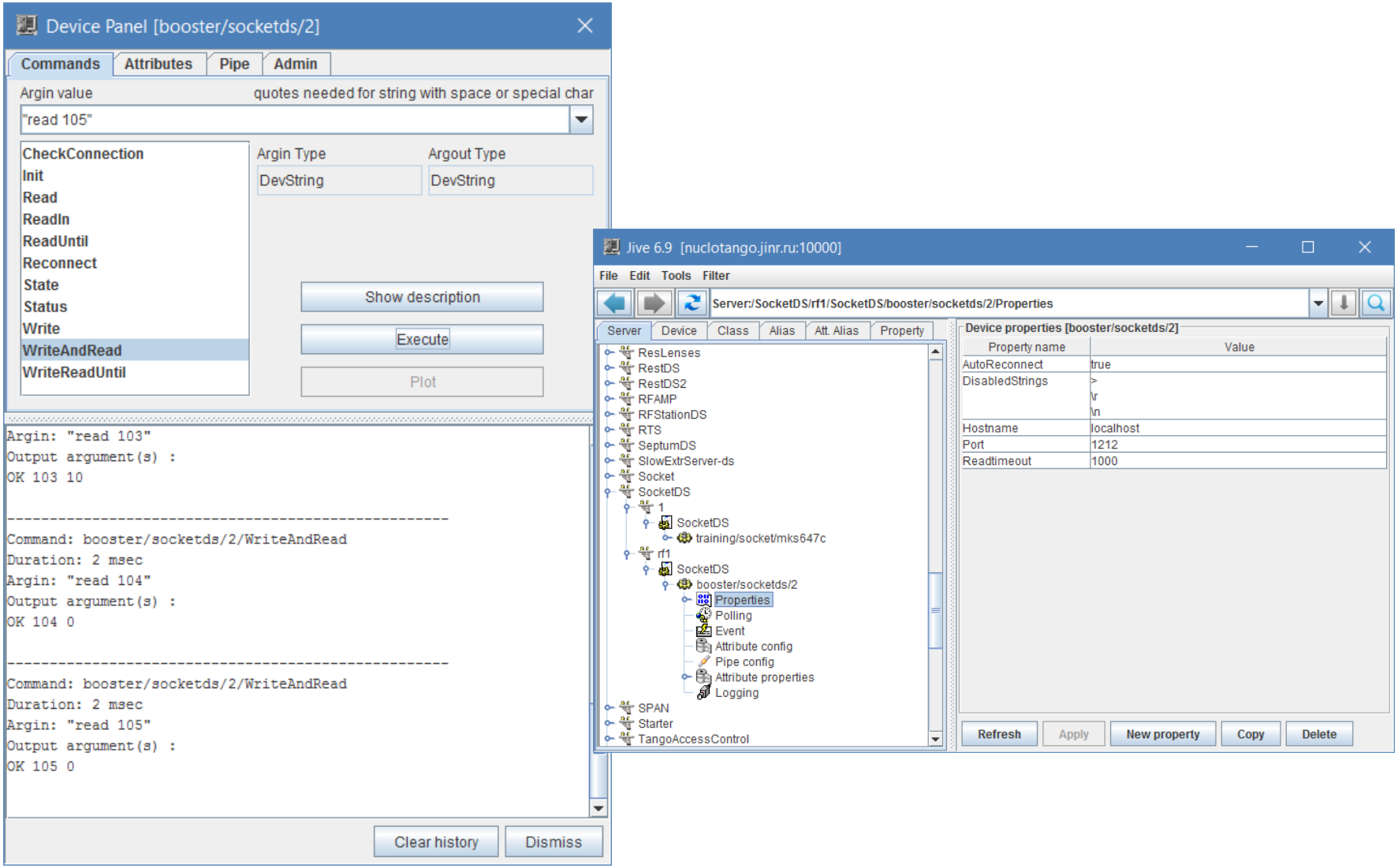


ID: tango://[host:port/]domain/family/member[/attribute
/command
/property]

* - NICA Technical Design Report - 2015, Volume 4, section 8.3.4, pages 36-38
** - http://www.tango-controls.org/

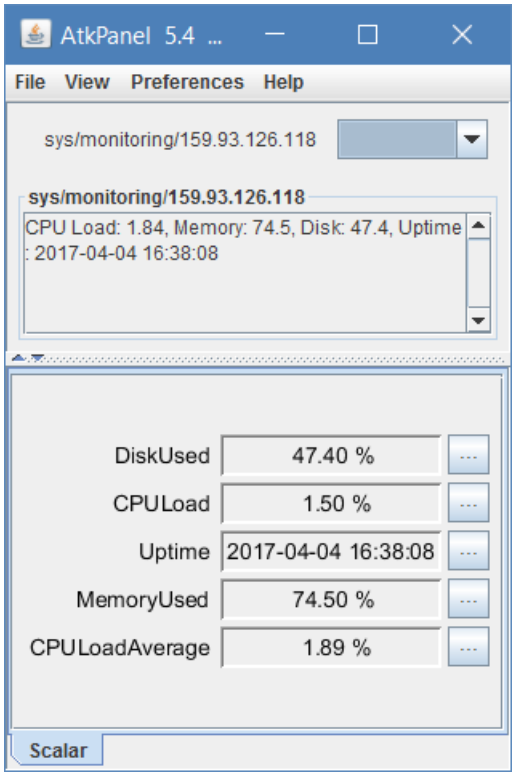
SocketDS

Crossplatform alternative to Tango Socket device-server



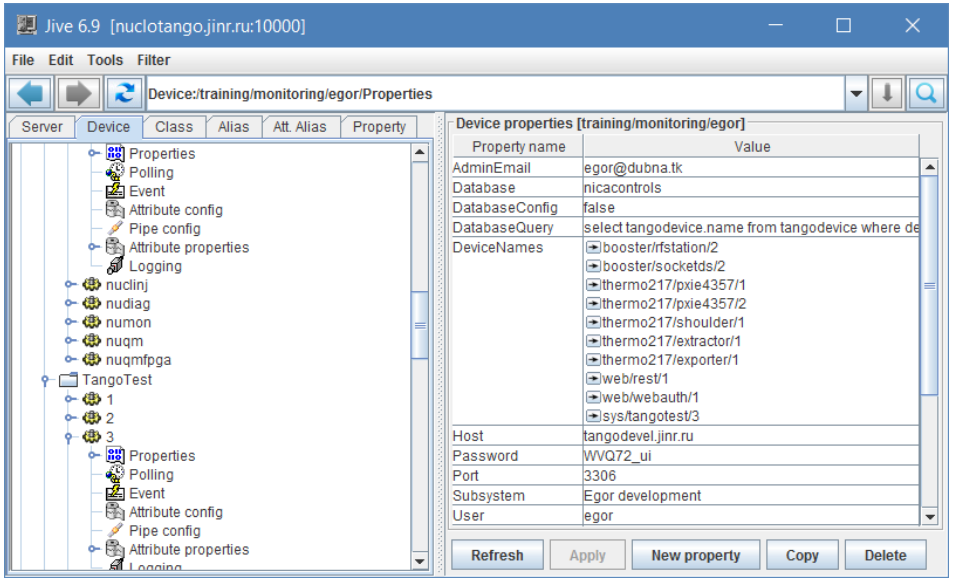
Tango Monitoring :: PCMonitoring

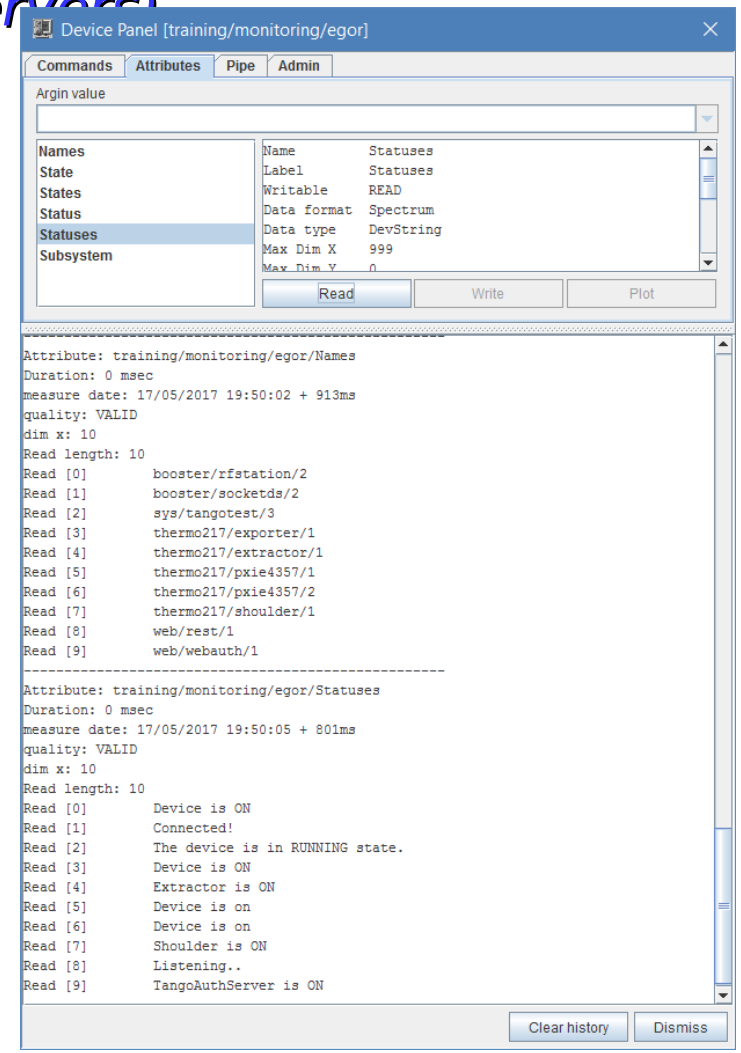
Broadcasts PC operational parameters to Tango (CPU load, memory usage, disk usage)



Tango Monitoring :: DSMonitoring

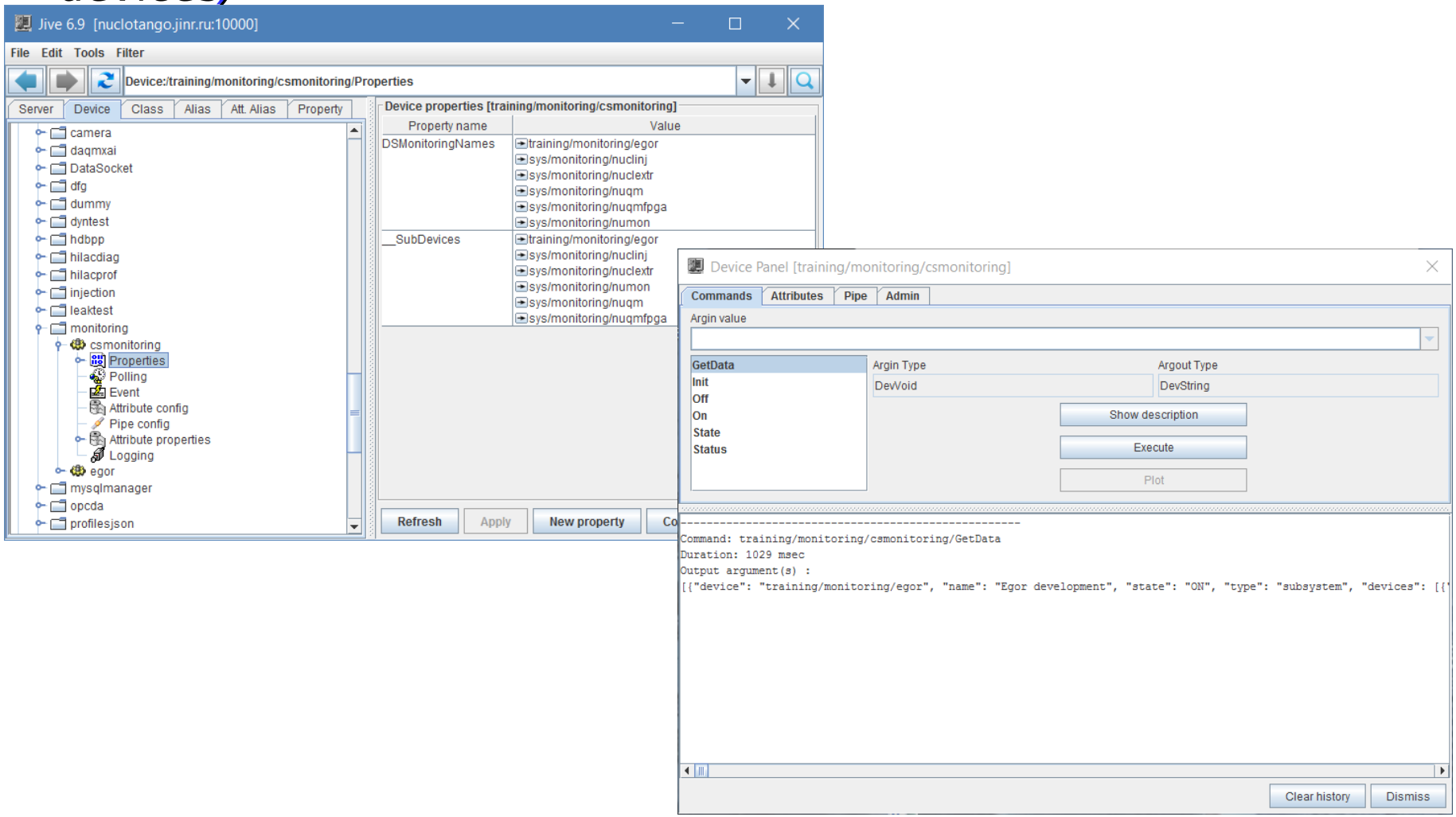
Monitors state and status changes in control subsystem (a set of logically connected Tango device-servers)



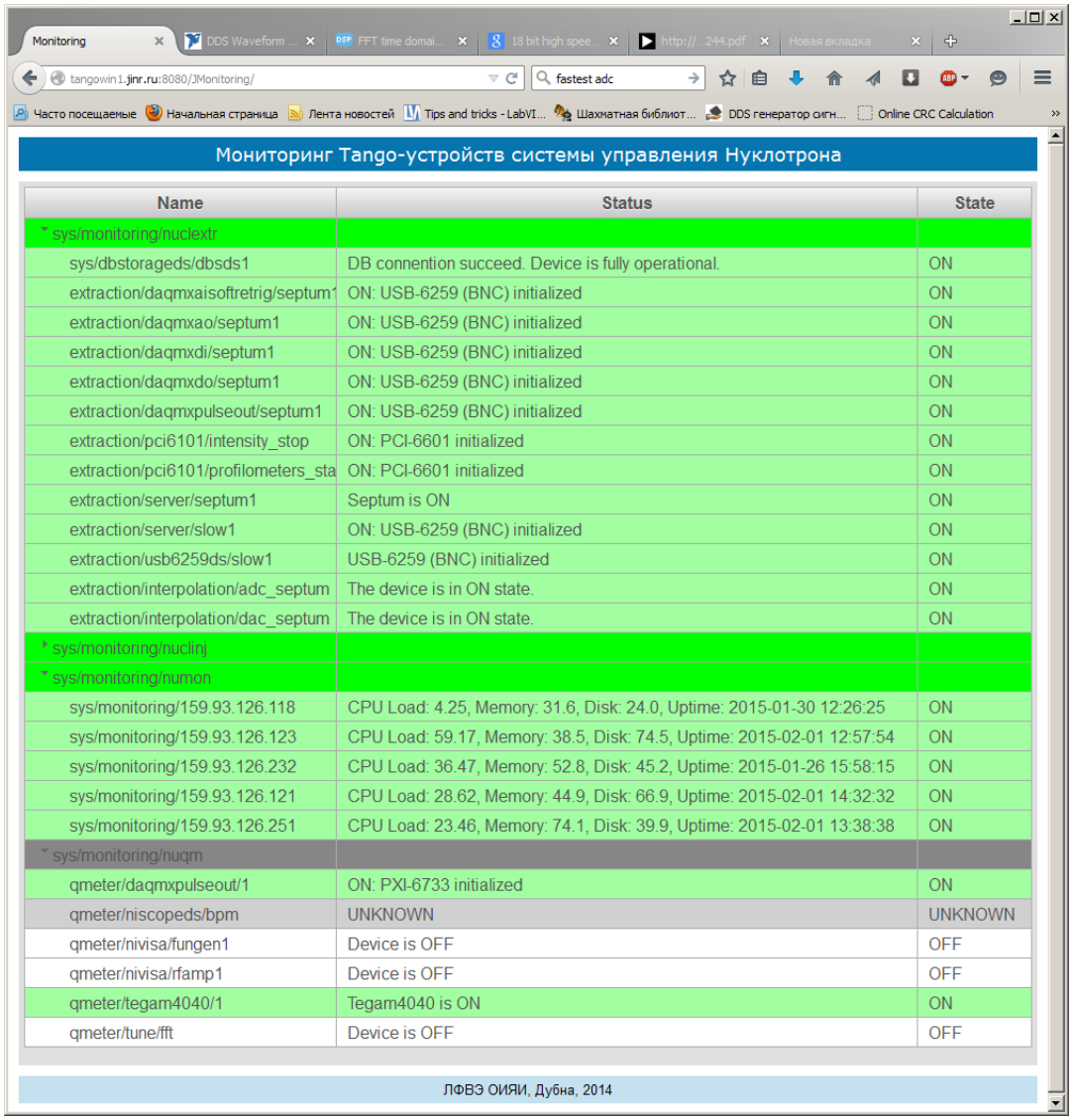


Tango Monitoring :: CSMonitoring

Monitors the whole Control System (several DSMonitoring devices)



Tango Monitoring :: Web client



Мониторинг Tango-устройств системы управления Нуклотрона

Name	Status	State
sys/monitoring/nuclextr		
sys/dbstorageds/dbsds1	DB connention succeed. Device is fully operational.	ON
extraction/daqmxaisoftretrig/septum1	ON: USB-6259 (BNC) initialized	ON
extraction/daqmxao/septum1	ON: USB-6259 (BNC) initialized	ON
extraction/daqmxdi/septum1	ON: USB-6259 (BNC) initialized	ON
extraction/daqmxdo/septum1	ON: USB-6259 (BNC) initialized	ON
extraction/daqmxpulseout/septum1	ON: USB-6259 (BNC) initialized	ON
extraction/pci6101/intensity_stop	ON: PCI-6601 initialized	ON
extraction/pci6101/profilometers_sta	ON: PCI-6601 initialized	ON
extraction/server/septum1	Septum is ON	ON
extraction/server/slow1	ON: USB-6259 (BNC) initialized	ON
extraction/usb6259ds/slow1	USB-6259 (BNC) initialized	ON
extraction/interpolation/adc_septum	The device is in ON state.	ON
extraction/interpolation/dac_septum	The device is in ON state.	ON
sys/monitoring/nuclinj		
sys/monitoring/numon		
sys/monitoring/159.93.126.118	CPU Load: 4.25, Memory: 31.6, Disk: 24.0, Uptime: 2015-01-30 12:26:25	ON
sys/monitoring/159.93.126.123	CPU Load: 59.17, Memory: 38.5, Disk: 74.5, Uptime: 2015-02-01 12:57:54	ON
sys/monitoring/159.93.126.232	CPU Load: 36.47, Memory: 52.8, Disk: 45.2, Uptime: 2015-01-26 15:58:15	ON
sys/monitoring/159.93.126.121	CPU Load: 28.62, Memory: 44.9, Disk: 66.9, Uptime: 2015-02-01 14:32:32	ON
sys/monitoring/159.93.126.251	CPU Load: 23.46, Memory: 74.1, Disk: 39.9, Uptime: 2015-02-01 13:38:38	ON
sys/monitoring/nuqm		
qmeter/daqmxpulseout/1	ON: PXI-6733 initialized	ON
qmeter/niscopeds/bpm	UNKNOWN	UNKNOWN
qmeter/nivisa/fungen1	Device is OFF	OFF
qmeter/nivisa/rfamp1	Device is OFF	OFF
qmeter/tegam4040/1	Tegam4040 is ON	ON
qmeter/tune/fft	Device is OFF	OFF

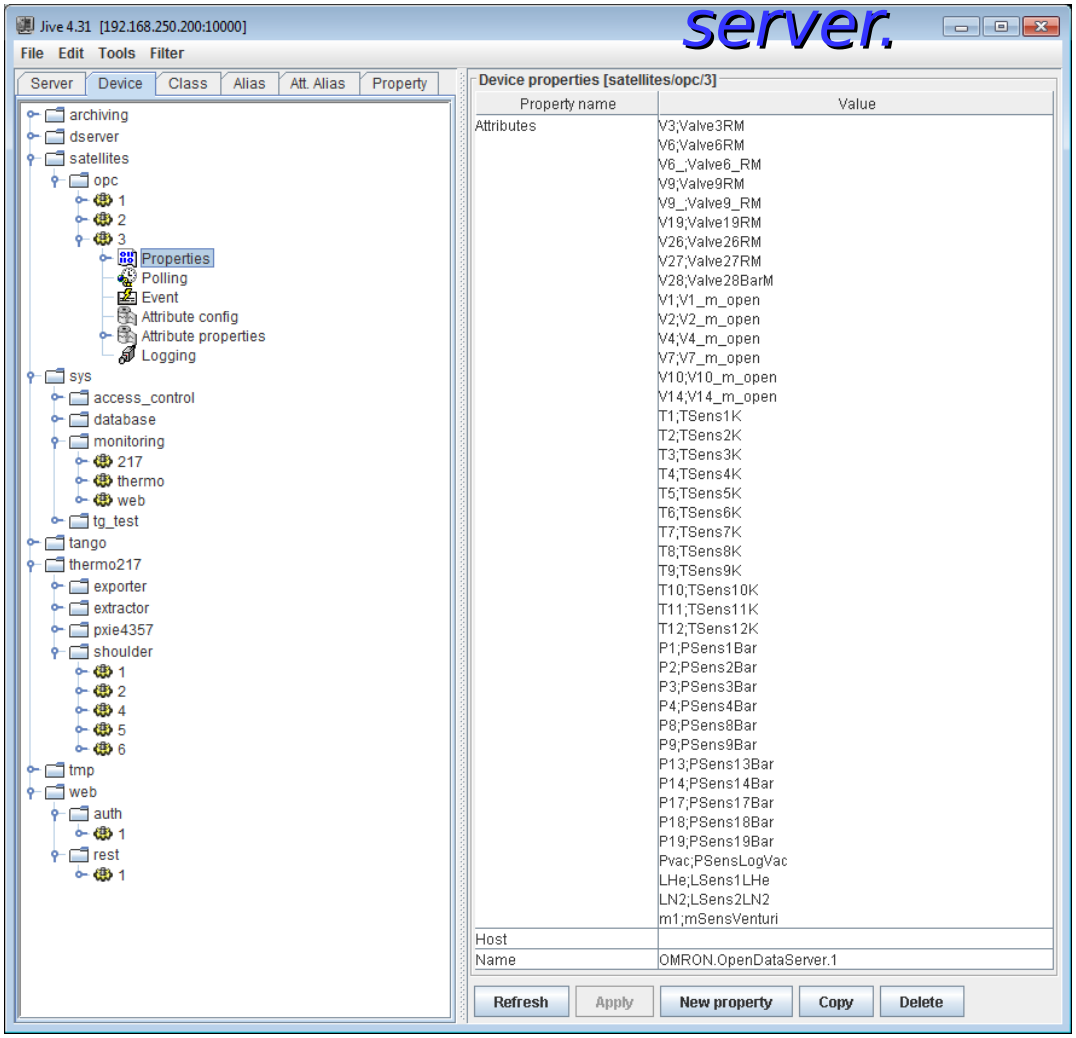
ЛФВЭ ОИЯИ, Дубна, 2014

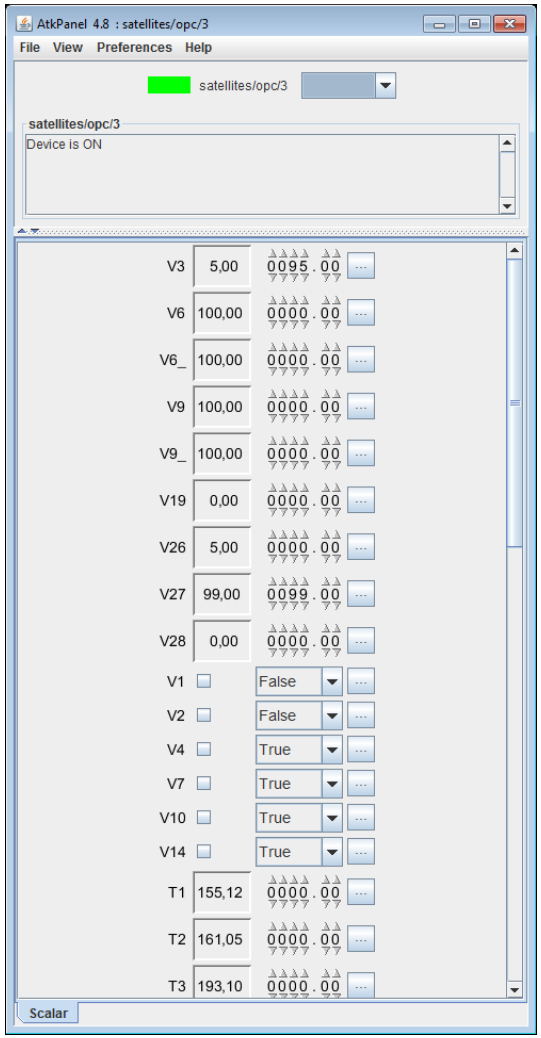
OPCDADS :: OPC DA server

OPC Data Access *is a group of client-server standards that provides specifications for communicating real-time data from data acquisiton devices such as PLCs to display and interface devices like Human-Machine interfaces (HMI), SCADA systems and also ERP/MES systems.*
The specifications focus on the continuous communication of data.

OPCDADS :: OPCDADS

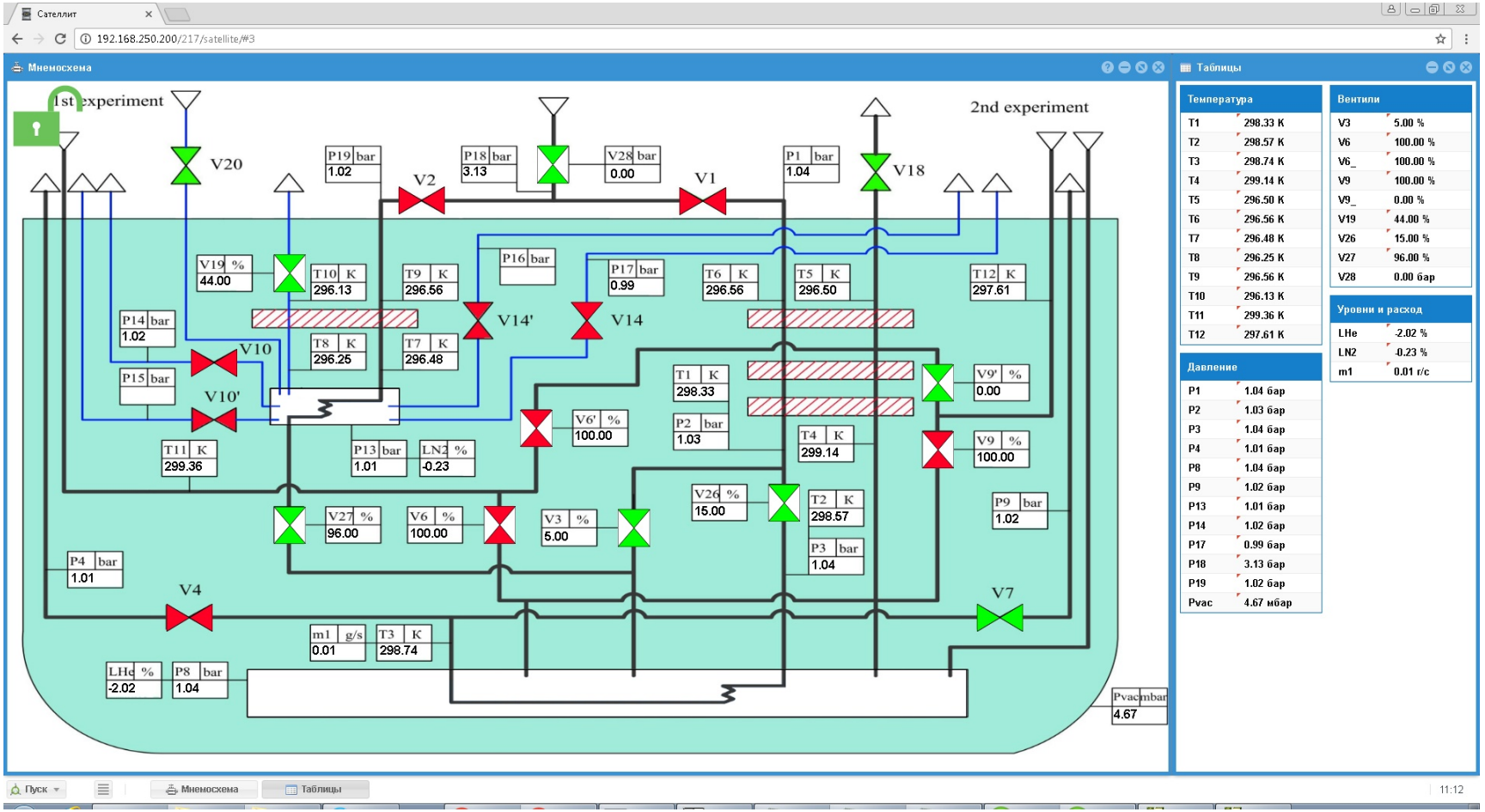
Device-server to interact with the OPC DA server.





OPCDADS :: Web client

Satellite refrigerator control system.



OPCDADS :: Web client

Injection complex vacuum system client.

Вакуум	
Название	Значение
LEBT1	3.70e-5 Па
LEBT2	3.50e-5 Па
RFQ1	6.80e-6 Па
RFQ2	7.10e-6 Па
ЛУ-20-1	5.70e-5 Па
ЛУ-20-2	3.80e-5 Па
HVG7	2.00e-5 Па
Дебанчер	8.50e-6 Па

Шиберы	
Название	Значение
6	ЗАКРЫТ
7	ОТКРЫТ
24	ОТКРЫТ
25	ОТКРЫТ
26	ОТКРЫТ
27	ОТКРЫТ

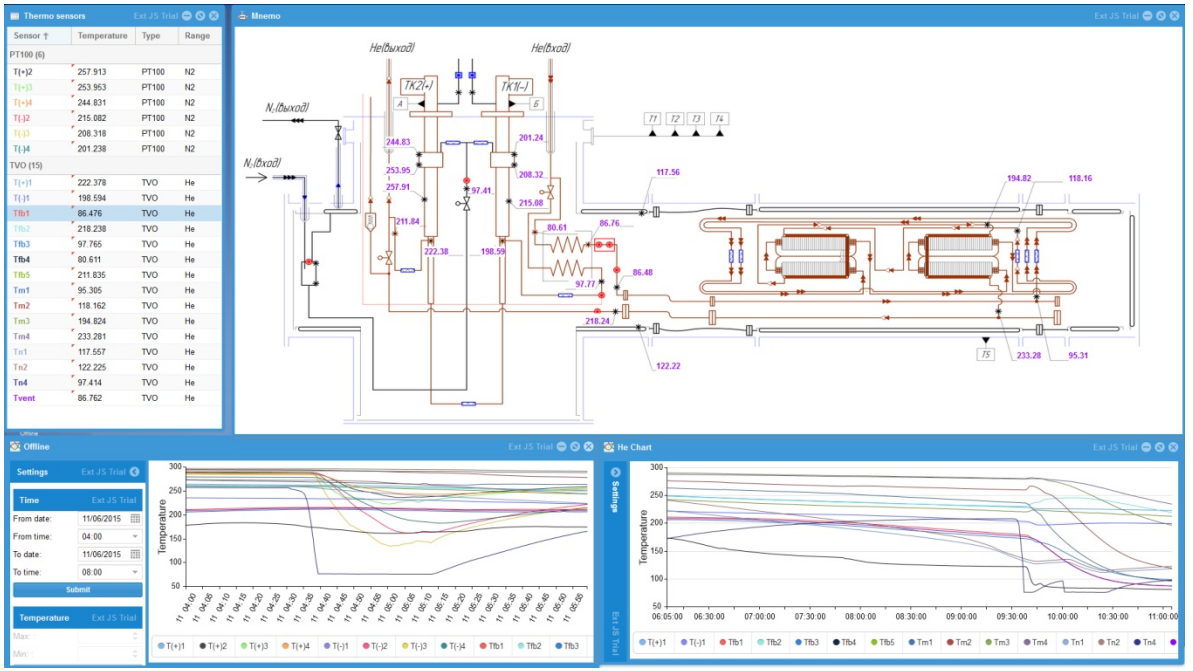
Последнее обновление: 16:47:51

Web clients

1. Web technologies progress

2. Advantages:

- Universal
- Flixible
- Well-looking
- Convenient



Universal tools for communication between Tango-based control system and Web clients are required

RestDS :: REST

(***Representational State Transfer) – architectural principles to design web services that focus on system's resources.***

- Global identification of resources (URL);
- Manipulation of resources through the standard protocol (HTTP);
- Stateless;

RestDS :: RestDS

Tango module, designed to provide access to Tango control system through http requests;

- Developed in C++ with Boost;
- Lightweight;
- Tango module;
- Both http and https protocols supported;
- Basic http authentication supported;

RestDS :: API

To read attribute:

GET

http(s)://host:port/tango/devices/domain/family/member/attributes/name

To write attribute:

POST

http(s)://host:port/tango/devices/domain/family/member/attributes/name

+ value as POST parameter

To execute command:

POST

http(s)://host:port/tango/devices/domain/family/member/commands/name

+ arguments as POST parameters (if needed).

RestDS :: Request example

http://tangodevel.jinr.ru:8080/tango/devices/thermo217/shoulder/1/attributes/T56

Web Client

HTTP code 200 - OK

Response as JSON object if success

```
{
 “name”: “T56”,
 “value”: “273.12”,
 “quality”: “VALID”,
 “timestamp”:
1473348563
 }
```

RestDS

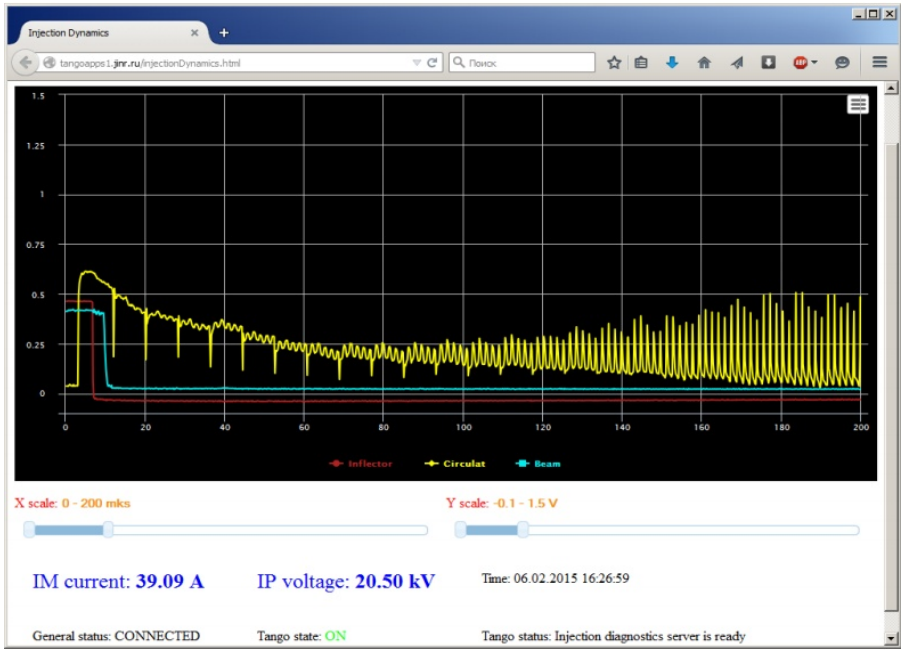
- Host:port
- Threads number
- Authentication
- Security (SSL)

Or http error code if failed..

400 – Bad request
401 – Unauthorized
403 – Forbidden
404 – Not found

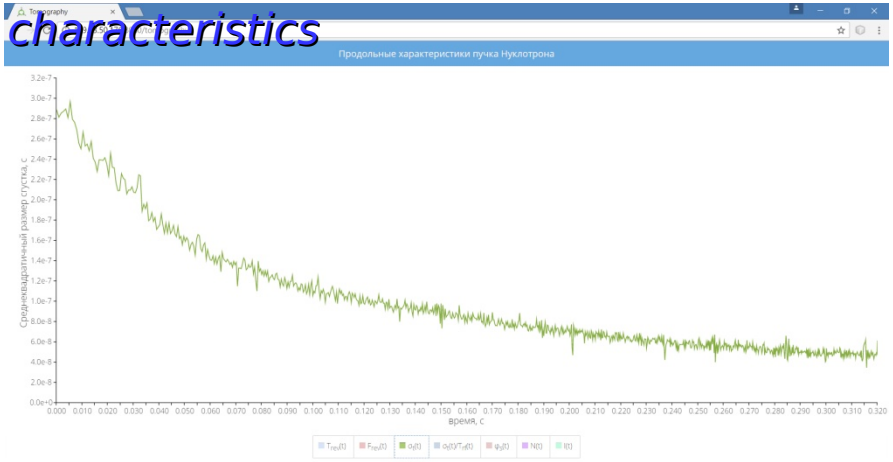
Web clients :: Beam diagnostics

Nuclotron injected beam dynamics

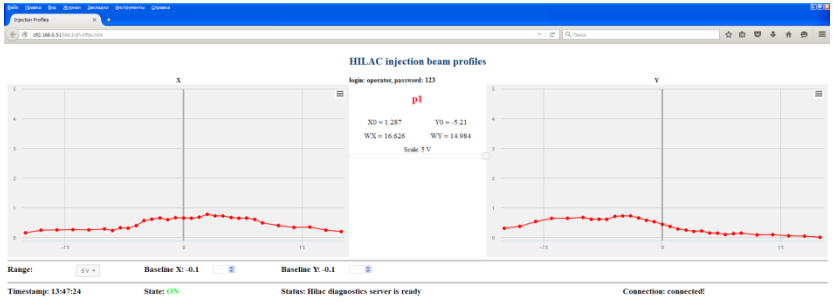


Injector–Nuclotron transfer channel beam profiles

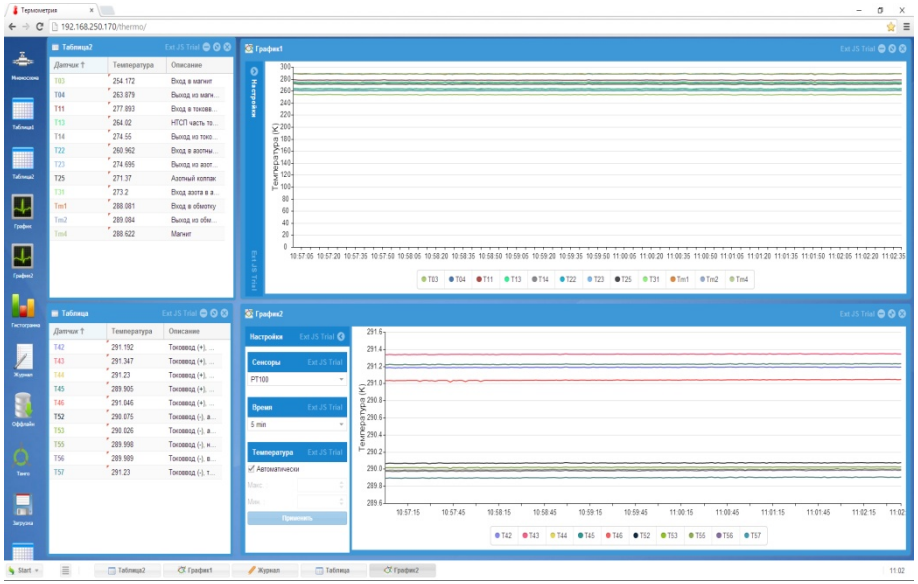
Nuclotron beam longitudinal characteristics

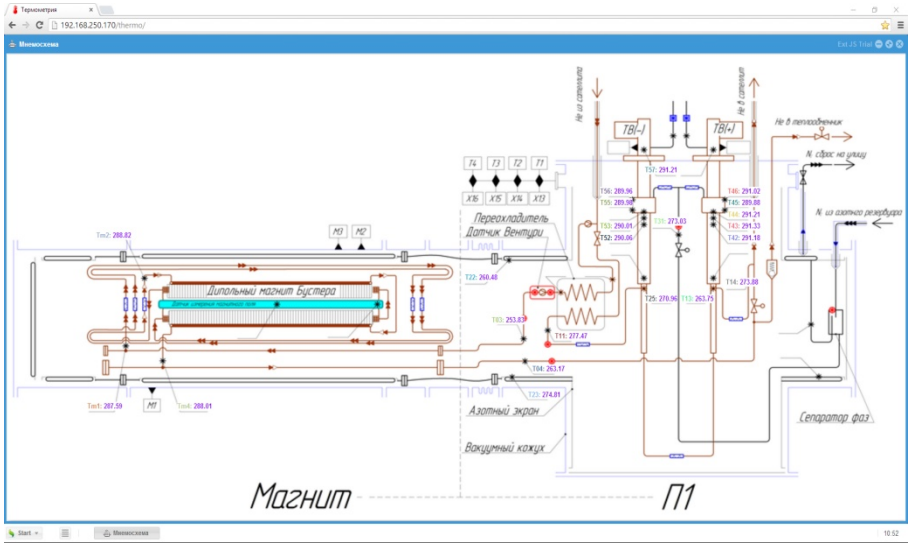


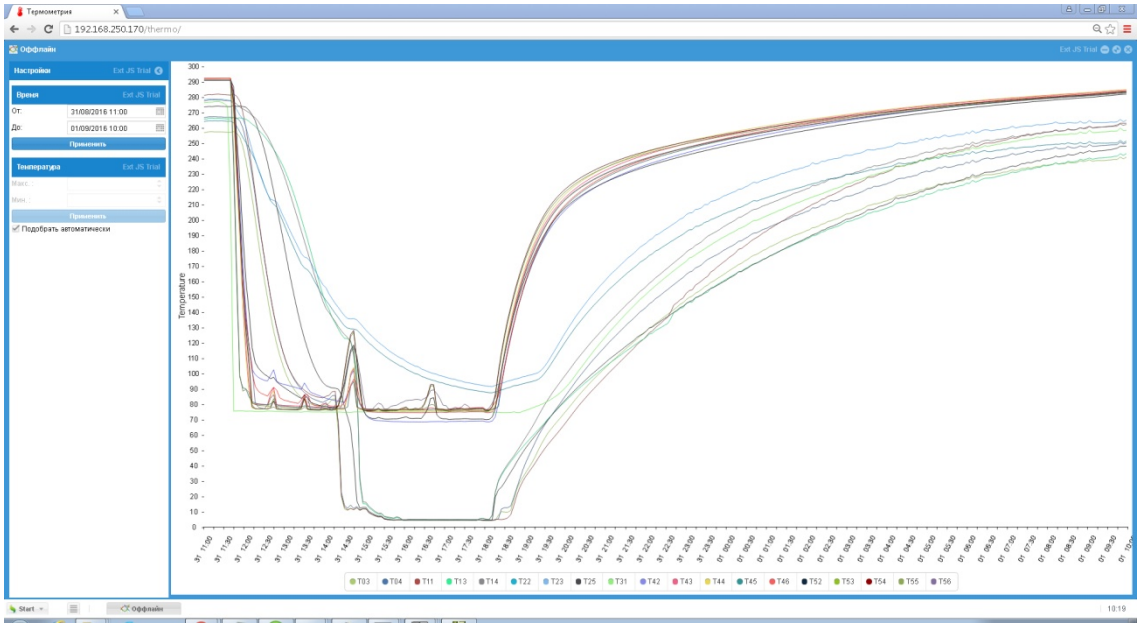
HILAC beam profiles



Web clients :: Thermometry







Future plans:

- To implement fully support of Tango REST API to RestDS;
- To write complete documentation;
- To put in order our Tango modules in http://tangodevel.jinr.ru/git
- To contribute these modules to Tango Controls community;