



Joint Institute for Nuclear Research



Tango software development at JINR

Part 1

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Georgy Sedykh, Tango Users Meeting Russia, Moscow, 18 may 2017

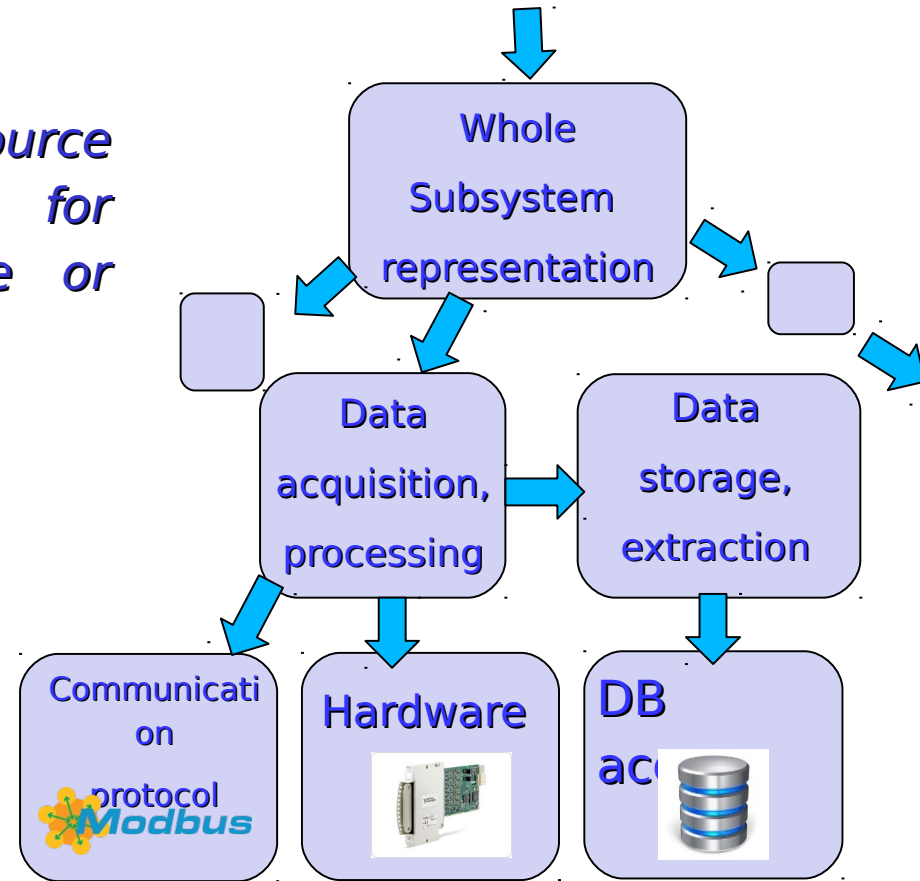
Plan

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

*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

Device Panel [booster/socketds/2]

Commands Attributes Pipe Admin

Argin value quotes needed for string with space or special char
"read 105"

CheckConnection
Init
Read
ReadIn
ReadUntil
Reconnect
State
Status
Write
WriteAndRead
WriteReadUntil

Argin Type DevString
Argout Type DevString

Show description
Execute
Plot

Argin: "read 103"
Output argument(s) :
OK 103 10

Command: booster/socketds/2/WriteAndRead
Duration: 2 msec
Argin: "read 104"
Output argument(s) :
OK 104 0

Command: booster/socketds/2/WriteAndRead
Duration: 2 msec
Argin: "read 105"
Output argument(s) :
OK 105 0

Clear history Dismiss

Jive 6.9 [nuclotango.jinr.ru:10000]

File Edit Tools Filter

Server/SocketDS/rf1/SocketDS/booster/socketds/2/Properties

Server Device Class Alias Att. Alias Property

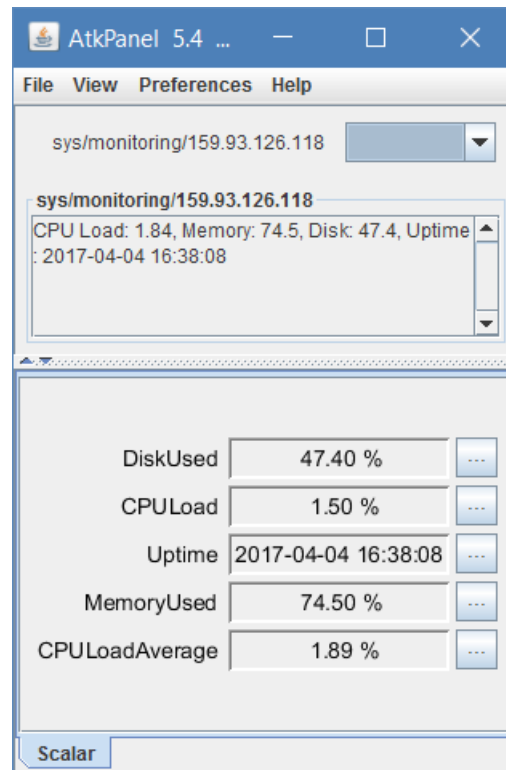
- ResLenses
- RestDS
- RestDS2
- RFAMP
- RFStationDS
- RTS
- SeptumDS
- SlowExtrServer-ds
- Socket
- SocketDS
 - 1
 - SocketDS
 - training/socket/mks647c
 - rf1
 - SocketDS
 - booster/socketds/2
 - Properties
 - Polling
 - Event
 - Attribute config
 - Pipe config
 - Attribute properties
 - Logging
- SPAN
- Starter
- TangoAccessControl

Property name	Value
AutoReconnect	true
DisabledStrings	> ^r ^n
Hostname	localhost
Port	1212
Readtimeout	1000

Refresh Apply New property Copy Delete

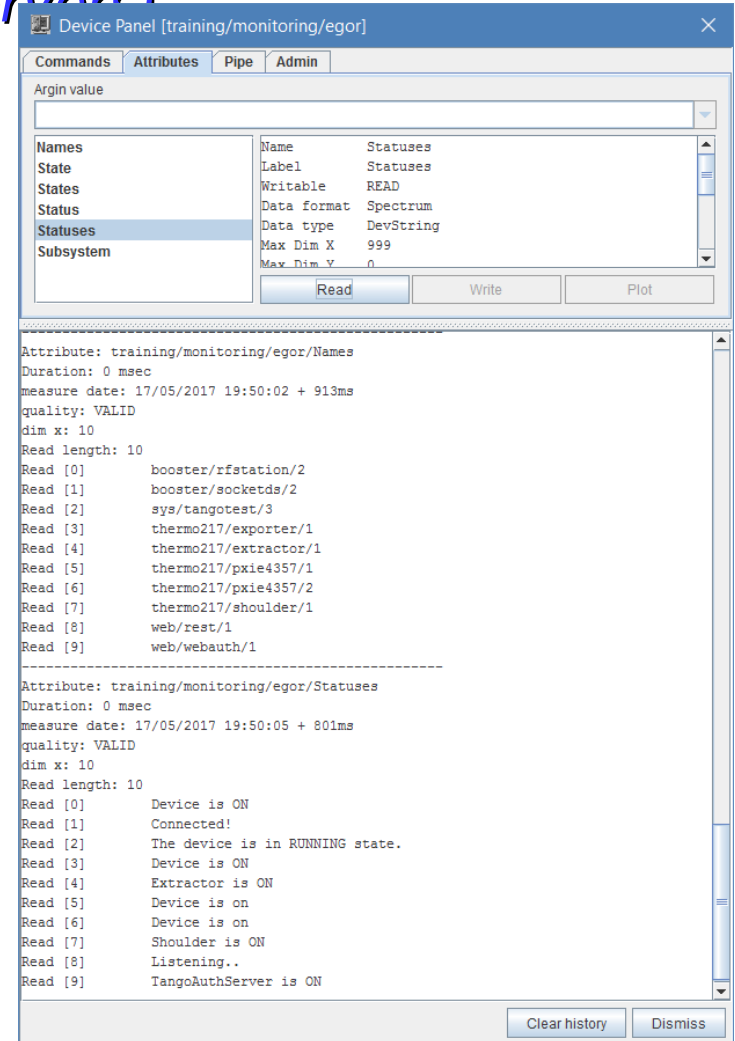
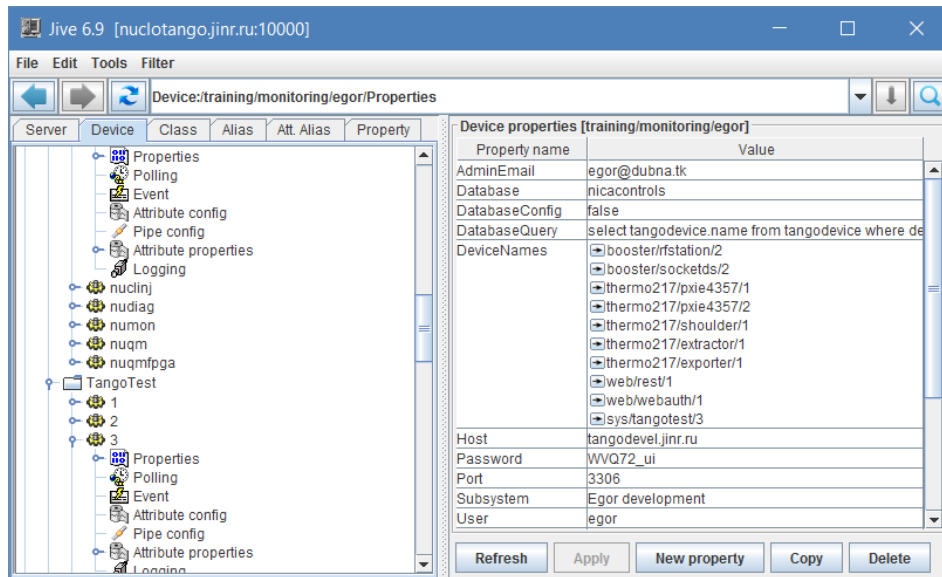
Tango Monitoring :: PCMonitoring

*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)

The screenshot displays the Jive 6.9 interface for monitoring a control system. The main window shows the 'Device: training/monitoring/csmonitoring/Properties' configuration. The left sidebar contains a tree view of the system hierarchy, with 'csmonitoring' expanded to show its sub-properties like 'Polling', 'Event', and 'Logging'. The main panel shows the 'Device properties' for 'training/monitoring/csmonitoring', listing 'DSMonitoringNames' and '_SubDevices' with their respective values.

Overlaid on the main window is the 'Device Panel [training/monitoring/csmonitoring]' dialog. It features tabs for 'Commands', 'Attributes', 'Pipe', and 'Admin'. The 'Commands' tab is active, showing a list of commands: 'GetData', 'Init', 'Off', 'On', 'State', and 'Status'. The 'GetData' command is selected, and its 'Argin Type' is 'DevVoid' and 'Argout Type' is 'DevString'. Below the command list are buttons for 'Show description', 'Execute', and 'Plot'. The 'Execute' button has been pressed, and the output is displayed in a text area at the bottom of the panel.

```
Command: training/monitoring/csmonitoring/GetData
Duration: 1029 msec
Output argument(s) :
[{"device": "training/monitoring/egor", "name": "Egor development", "state": "ON", "type": "subsystem", "devices": [{"
```

Buttons at the bottom of the Device Panel include 'Clear history' and 'Dismiss'.

Tango Monitoring :: Web client

Мониторинг Tango-устройств системы управления Нуклотрона

Name	Status	State
sys/monitoring/nucleon		
sys/dbstorageds/dbds1	DB connection succeed. Device is fully operational.	ON
extraction/daqmxaisofretsig/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_status	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/nucleon		
sys/monitoring/numan		
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/daqmpulseout/1	ON: PXI-6733 initialized	ON
qmeter/niscopeds/bpm	UNKNOWN	UNKNOWN
qmeter/nivisa/fungen1	Device is OFF	OFF
qmeter/nivisa/lfamp1	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 acquisition 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.

Device properties [satellites/opc/3]

Property name	Value
Attributes	
V3,Valve3RM	
V6,Valve6RM	
V6_Valve6_RM	
V9,Valve9RM	
V9_Valve9_RM	
V19,Valve19RM	
V26,Valve26RM	
V27,Valve27RM	
V28,Valve28BarM	
V1,V1_m_open	
V2,V2_m_open	
V4,V4_m_open	
V7,V7_m_open	
V10,V10_m_open	
V14,V14_m_open	
T1,TSens1K	
T2,TSens2K	
T3,TSens3K	
T4,TSens4K	
T5,TSens5K	
T6,TSens6K	
T7,TSens7K	
T8,TSens8K	
T9,TSens9K	
T10,TSens10K	
T11,TSens11K	
T12,TSens12K	
P1,PSens1Bar	
P2,PSens2Bar	
P3,PSens3Bar	
P4,PSens4Bar	
P8,PSens8Bar	
P9,PSens9Bar	
P13,PSens13Bar	
P14,PSens14Bar	
P17,PSens17Bar	
P18,PSens18Bar	
P19,PSens19Bar	
Pvac,PSensLogVac	
LHe,LSens1LHe	
LN2,LSens2LN2	
m1,mSensVenturi	

Host: _____
Name: OMRON.OpenDataServer.1

Buttons: Refresh, Apply, New property, Copy, Delete

AtkPanel 4.8 : satellites/opc/3

satellites/opc/3

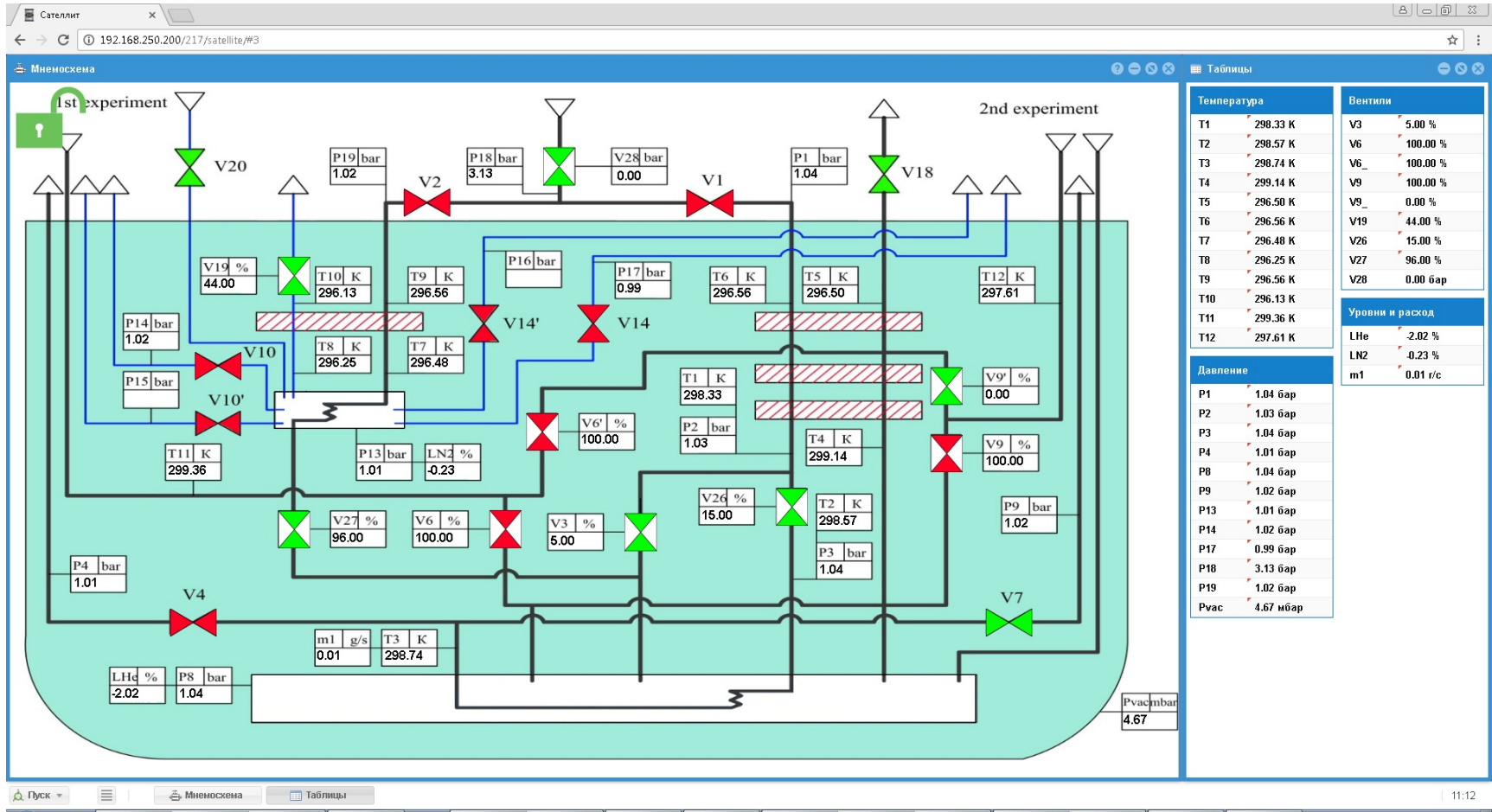
Device is ON

V3	5.00	0095.00	...
V6	100.00	0000.00	...
V6_	100.00	0000.00	...
V9	100.00	0000.00	...
V9_	100.00	0000.00	...
V19	0.00	0000.00	...
V26	5.00	0000.00	...
V27	99.00	0099.00	...
V28	0.00	0000.00	...
V1	<input type="checkbox"/>	False	...
V2	<input type="checkbox"/>	False	...
V4	<input type="checkbox"/>	True	...
V7	<input type="checkbox"/>	True	...
V10	<input type="checkbox"/>	True	...
V14	<input type="checkbox"/>	True	...
T1	155,12	0000.00	...
T2	161,05	0000.00	...
T3	193,10	0000.00	...

Scalar

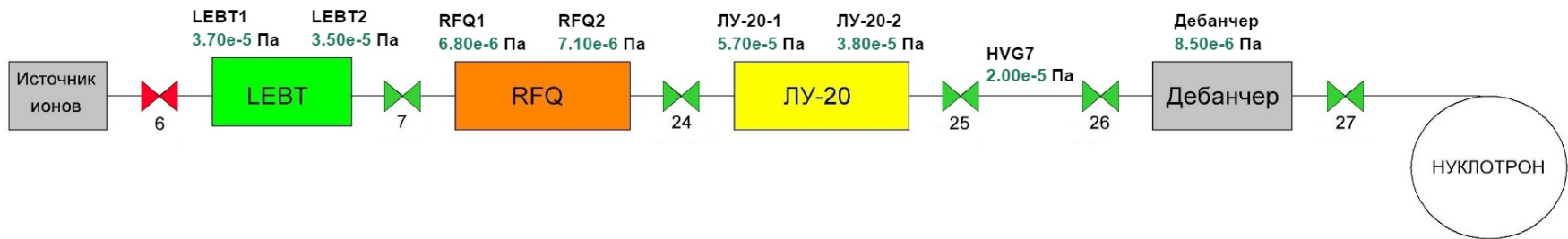
OPCDADS :: Web client

Satellite refrigerator control system.



OPCDADS :: Web client

Injection complex vacuum system client.



Вакуум		Шиберы	
Название	Значение	Название	Значение
LEBT1	3.70e-5 Па	6	ЗАКРЫТ
LEBT2	3.50e-5 Па	7	ОТКРЫТ
RFQ1	6.80e-6 Па	24	ОТКРЫТ
RFQ2	7.10e-6 Па	25	ОТКРЫТ
ЛУ-20-1	5.70e-5 Па	26	ОТКРЫТ
ЛУ-20-2	3.80e-5 Па	27	ОТКРЫТ
HVG7	2.00e-5 Па		
Дебанчер	8.50e-6 Па		

Последнее обновление: 16:47:51

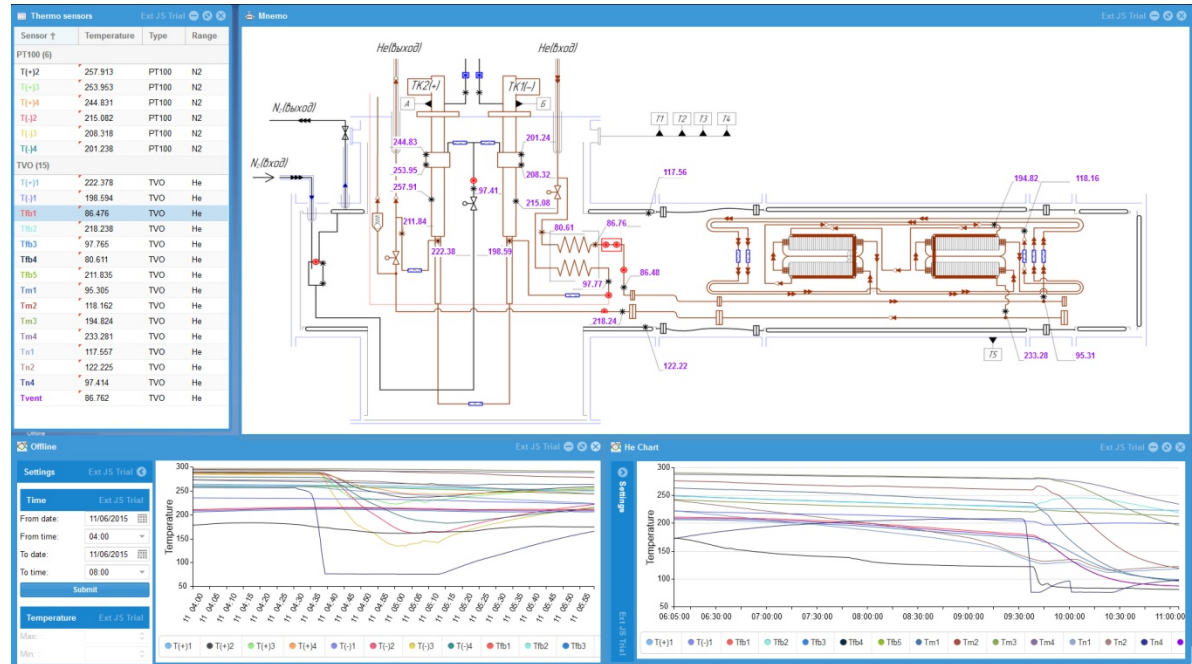
Web clients

1. Web technologies



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://rango-dev-1.jmfr-0000/rango/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..

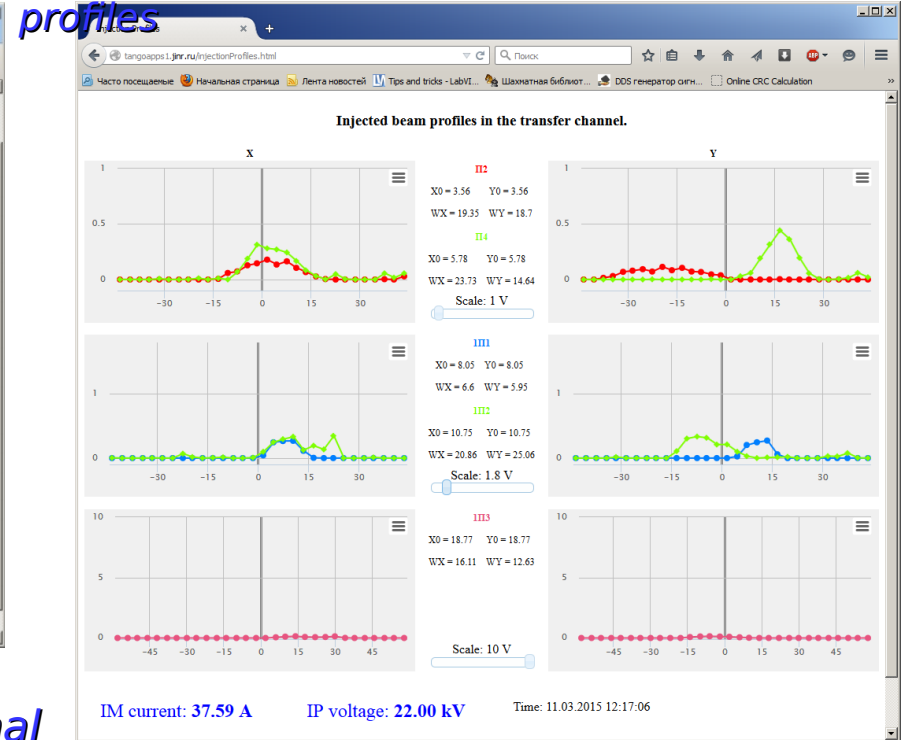
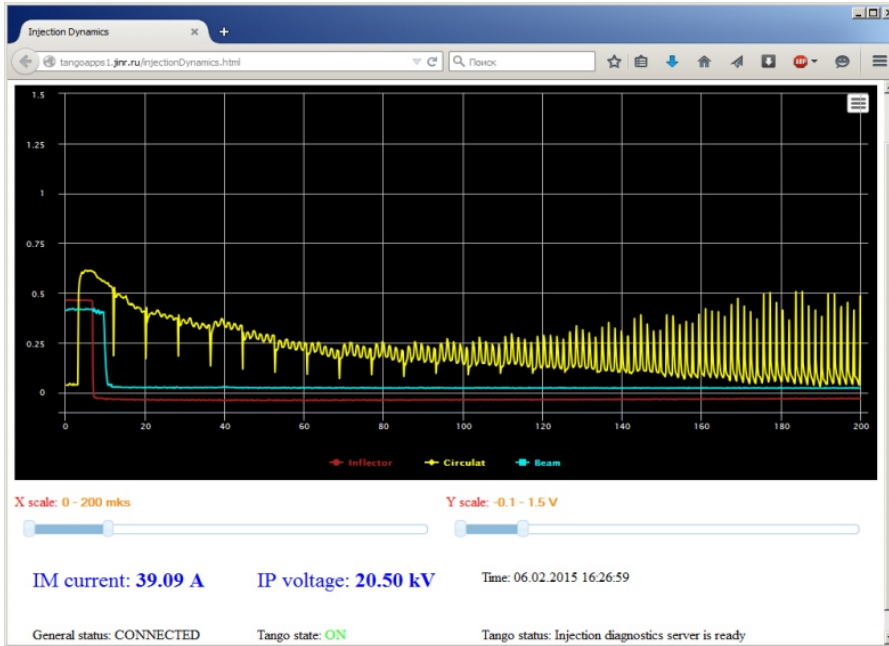
400 - Bad request
401 - Unauthorized

403 - Forbidden
404 - Not found

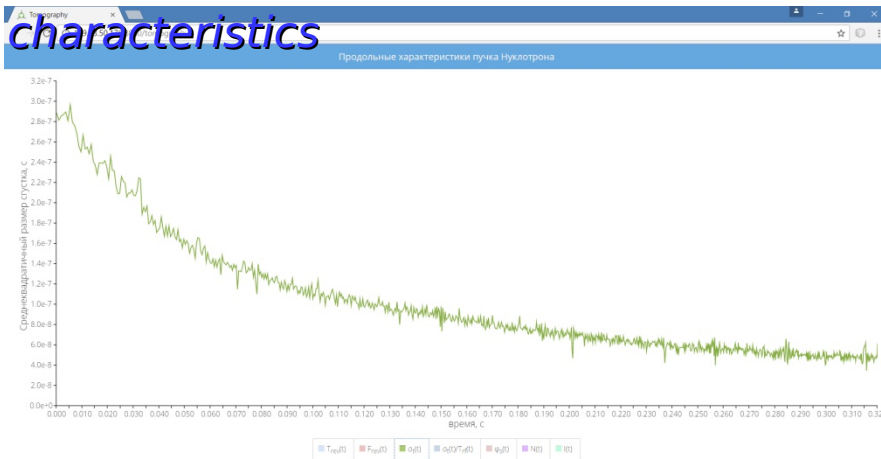
Web clients :: Beam diagnostics

Nuclotron injected beam dynamics

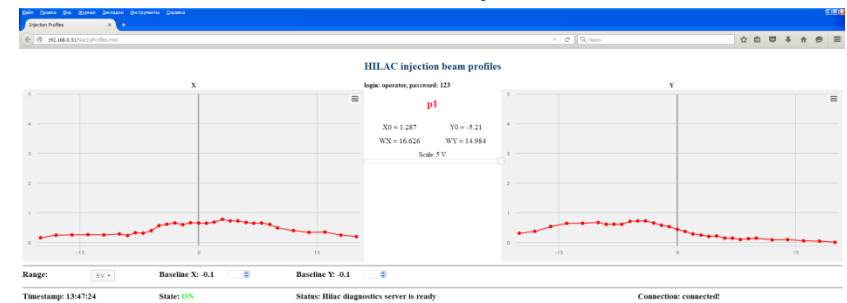
Injector-Nuclotron transfer channel beam profiles



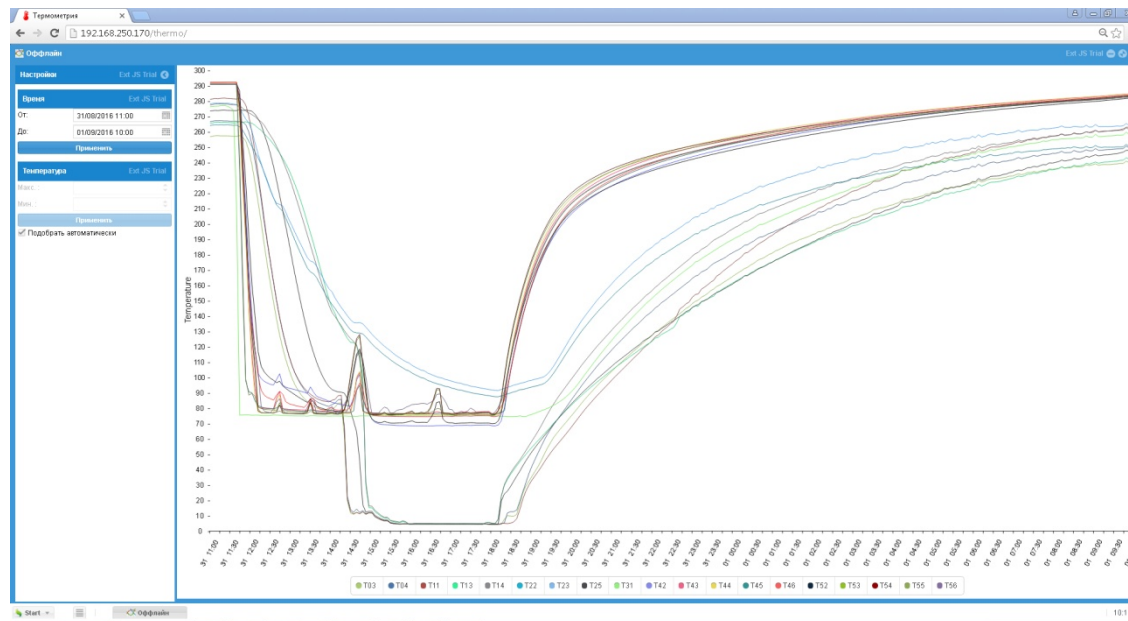
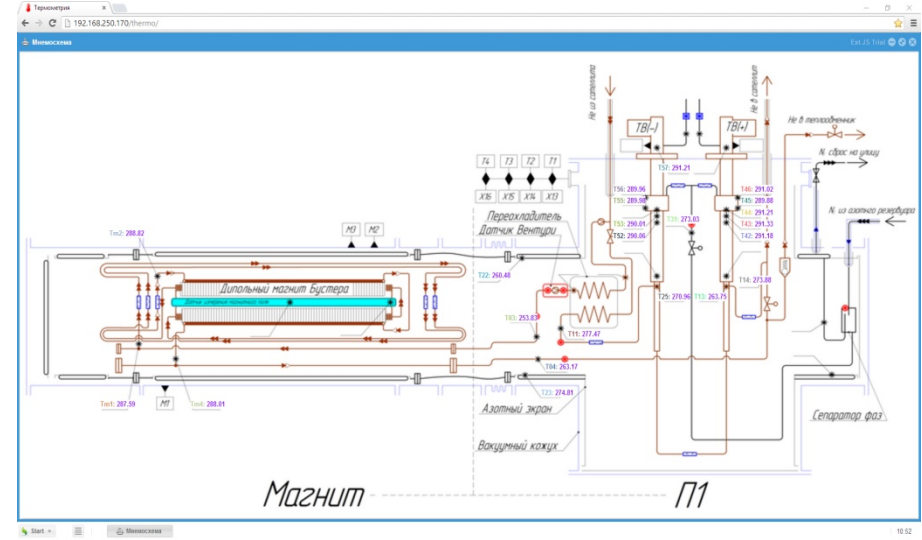
Nuclotron beam longitudinal characteristics



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;