

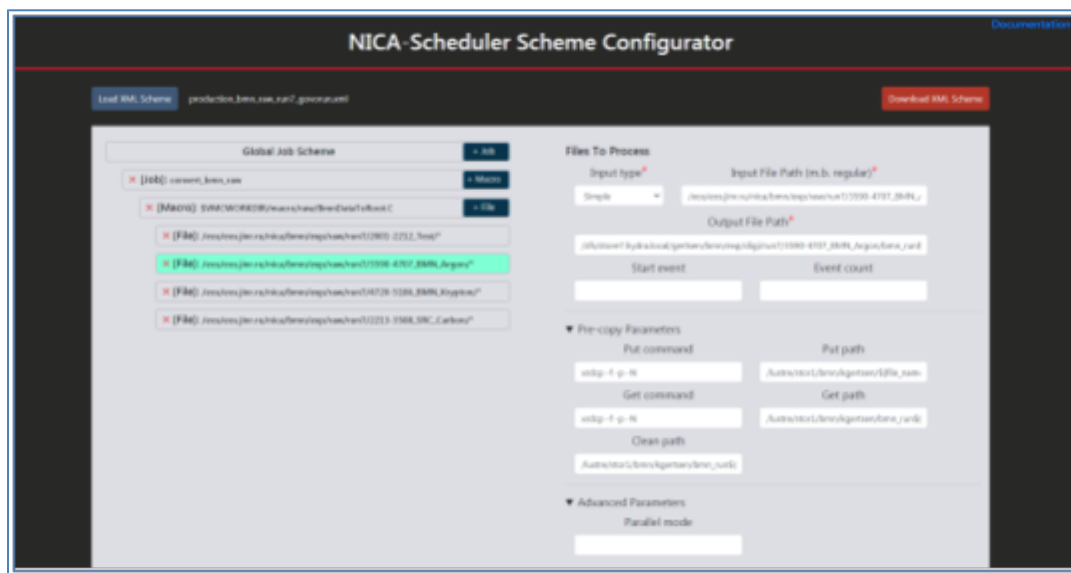
MIPT-NPM laboratory is involved in the development of software services and tools for BM@N experiment, part of the NICA megaproject.

In 2020, the following tasks were performed:

## 1. NICA-Scheduler configurator GUI development.

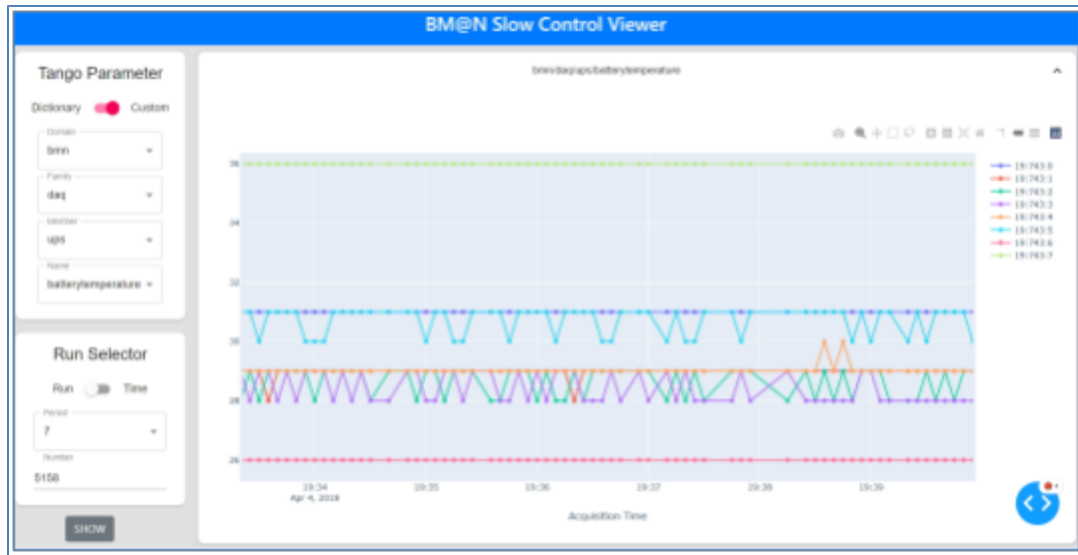
NICA-Scheduler is used to simplify running user tasks on clusters in parallel ( <https://bmn.jinr.ru/nica-scheduler/> ). NPM lab developed a GUI interface for configuring NICA Scheduler application XML schemes. The application uses Kotlin-multiplatform and can run both as Web and Desktop (JVM) versions.

Web version of NICA-Scheduler GUI is deployed at <https://bmn-scheduler.jinr.ru/>



## 2. Slow Control Viewer development.

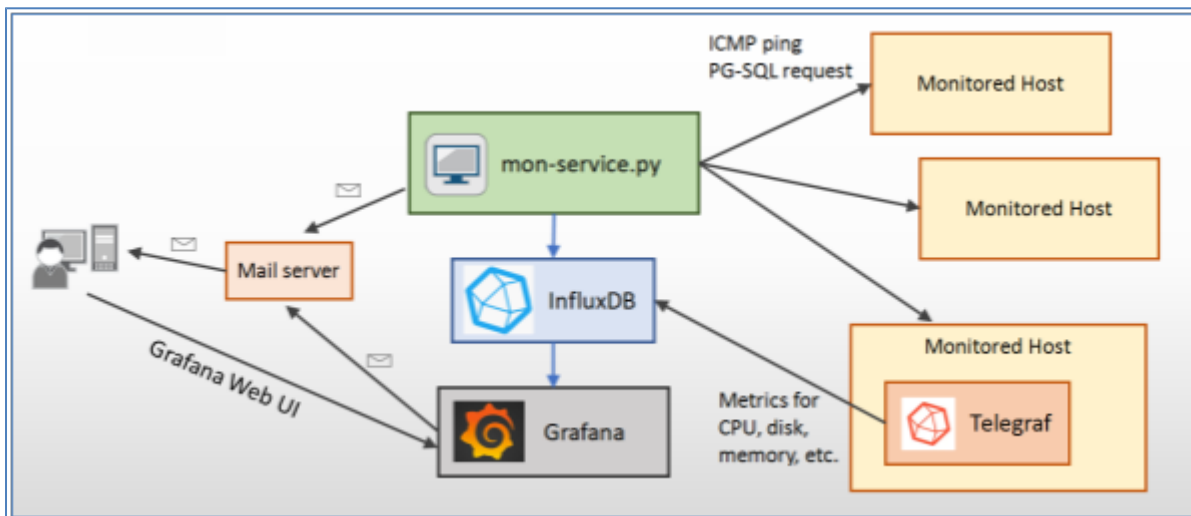
Web interface for slow control system Tango of BM@N was developed and available at <http://bmn-tango.jinr.ru/> . The tool shows sensor data graph based on user-specified run number or time interval, and parameter name.



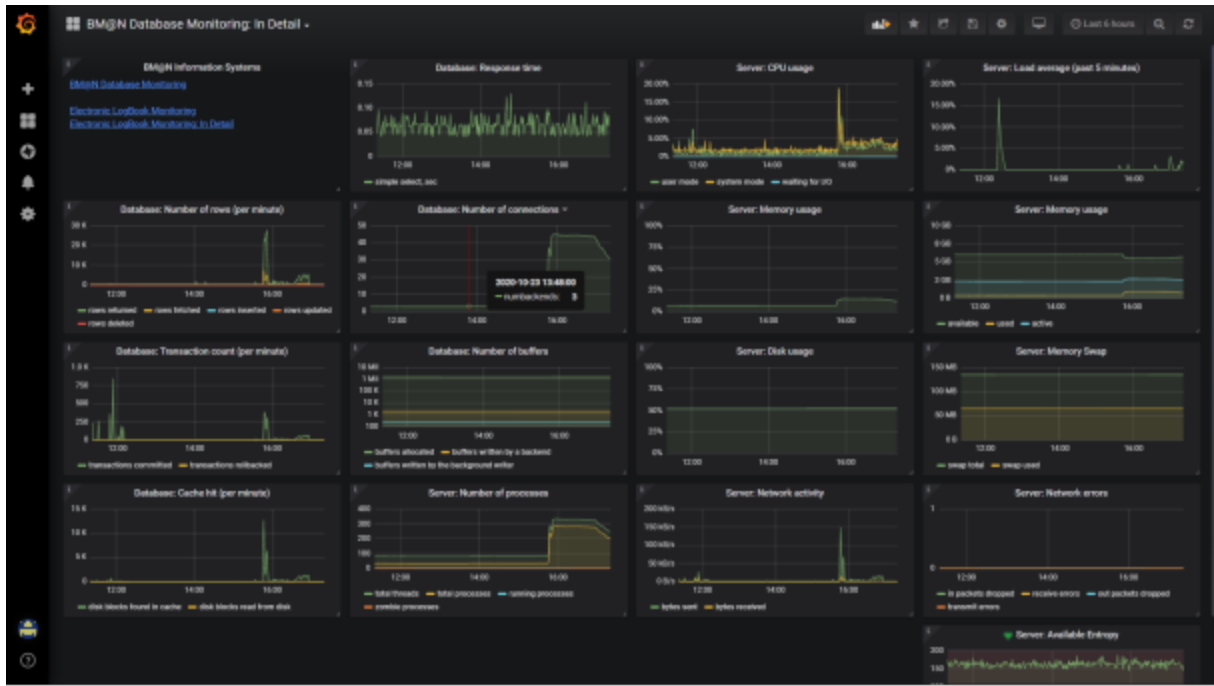
### 3. Monitoring Service development.

An important task is real-time monitoring of the existing IT infrastructure, to ensure service continuity for users. The monitoring service was developed using existing open source application stack (Telegraf, InfluxDB, Grafana) as well as custom Python scripts.

The service architecture is illustrated as follows:

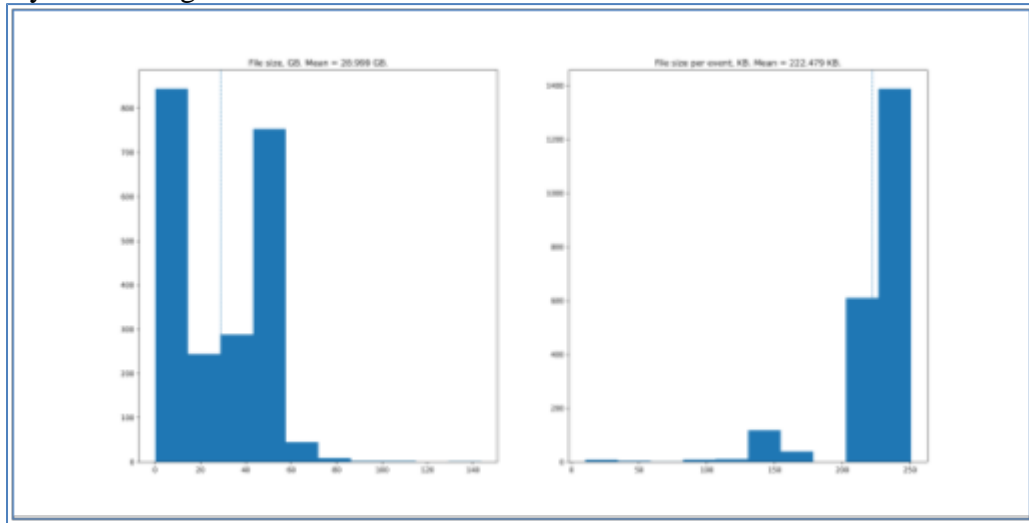


The front-end of the service (using Grafana) is available at <https://mon-service.jinr.ru> . Example view shows multiple parameters that are collected from each application server:



#### 4. Statistics collection service development.

Statistics collection service was implemented using Python language. The service collects data pertaining to processing of BmnRoot macros. The data is collected from the BM@N database, from specified directories of the file system, and extracted from the log files. The results are displayed as histograms.



#### 5. Event Metadata System (under development).

The Event Metadata System is designed to store and index events of the NICA experiments in order for the collision events required for physics analysis to be quickly searched and selected according to given parameters. The proposed design of the system is shown on the graphics. It is expected that the number of the events will increase from the current value of hundreds of million BM@N events to billions of events per year for the MPD and SPD experiments of NICA. Therefore, choosing a database management system for the Event Catalogue

implementation, which ensures efficient processing of billions of records, is one of the key points of the design. Comparison of various SQL and NoSQL DBMS is currently carried out and the performance of processing of database test records (from 500 million to billion entries) was estimated for PostgreSQL, Apache Cassandra, and Hadoop HBase.

