
# Visualization and auxiliary tools development in BM@N experiment

Peter Klimai

# MIPT-NPM Projects for BM@N

MIPT-NPM projects for BM@N:

- Visualization service event display
- Monitoring service
- NICA-Scheduler multiplatform GUI
- Slow control viewer

The work is supervised by **Tagir Aushev** from MIPT-HEP laboratory.

About MIPT-NPM:

- http://npm.mipt.ru/ru/
- https://research.jetbrains.org/groups/npm


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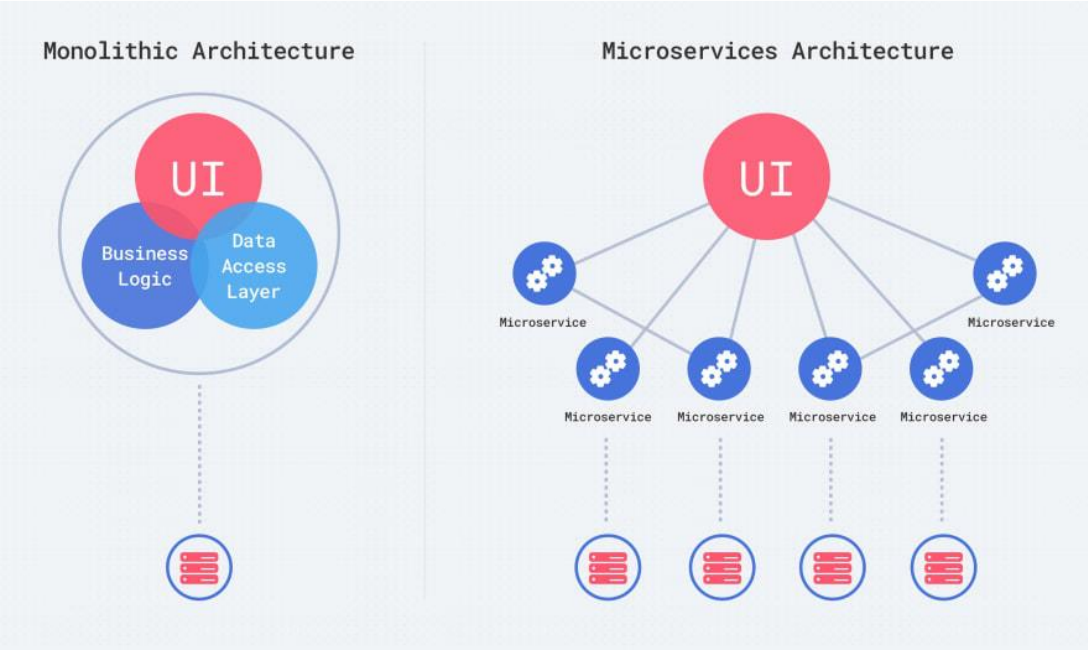
# Visualization – Event Display Next-Gen

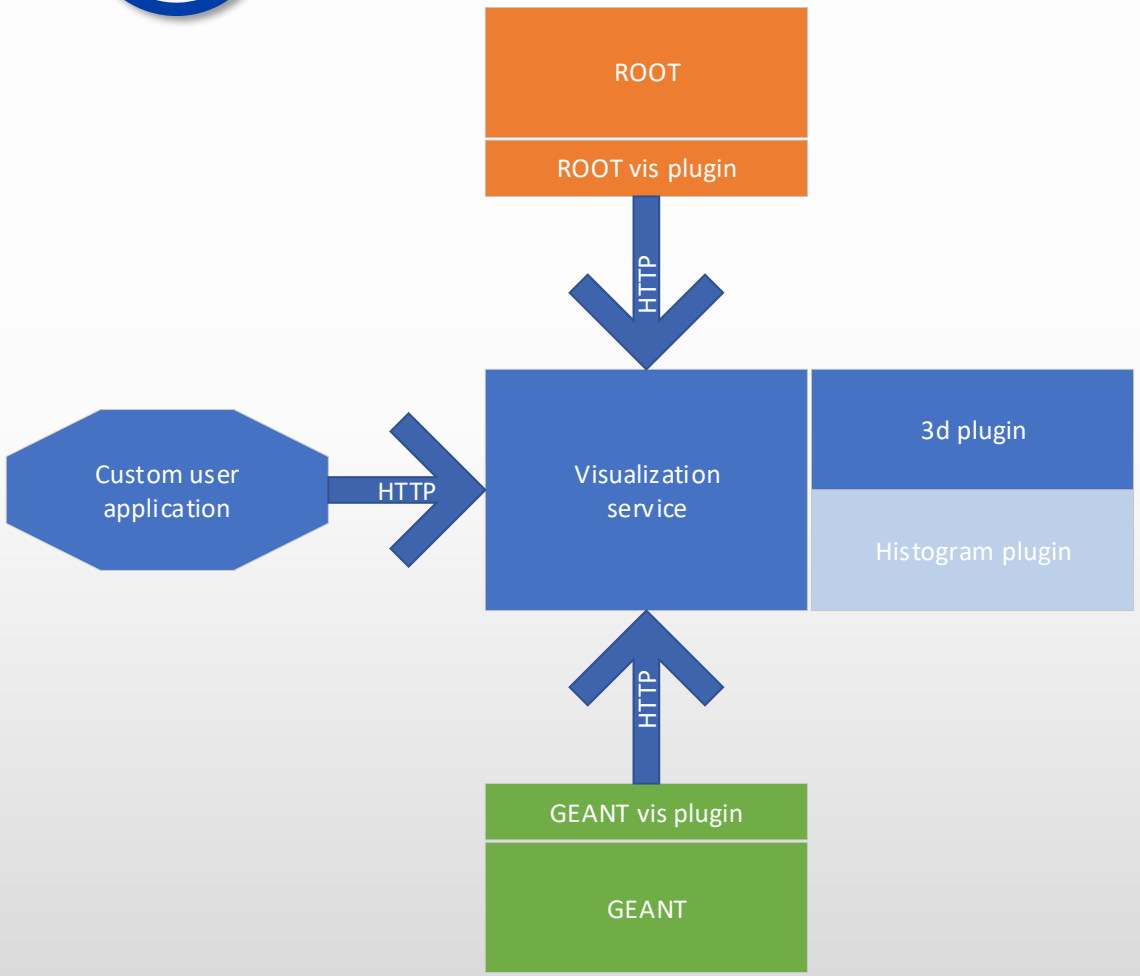
# Service-based architecture




https://dev.to/alex_barashkov/microservices-vs-monolith-architecture-4l1m

- Harder to implement, but much easier to maintain
- Services could be developed or replaced without changing core functionality
- Fast service development cycle
- Easy to move to new infrastructure or scale

# Visualization as a service

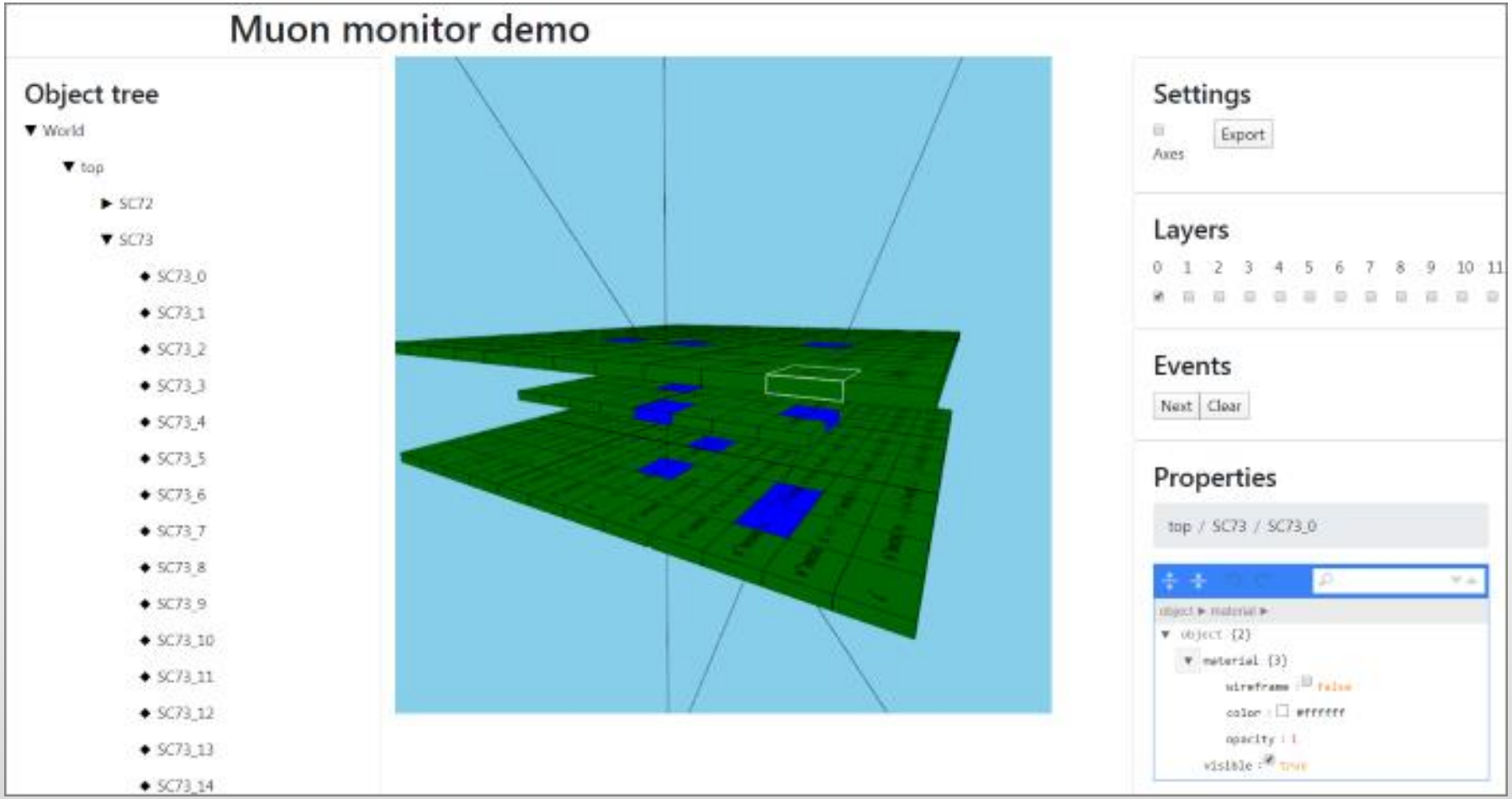



- Visualization runs as a stand-alone service
- It communicates with other services via HTTP
- The service itself uses plugin system to include new visualization types
- Adapters are made to convert ROOT/GEANT/whatever format into visualization tree

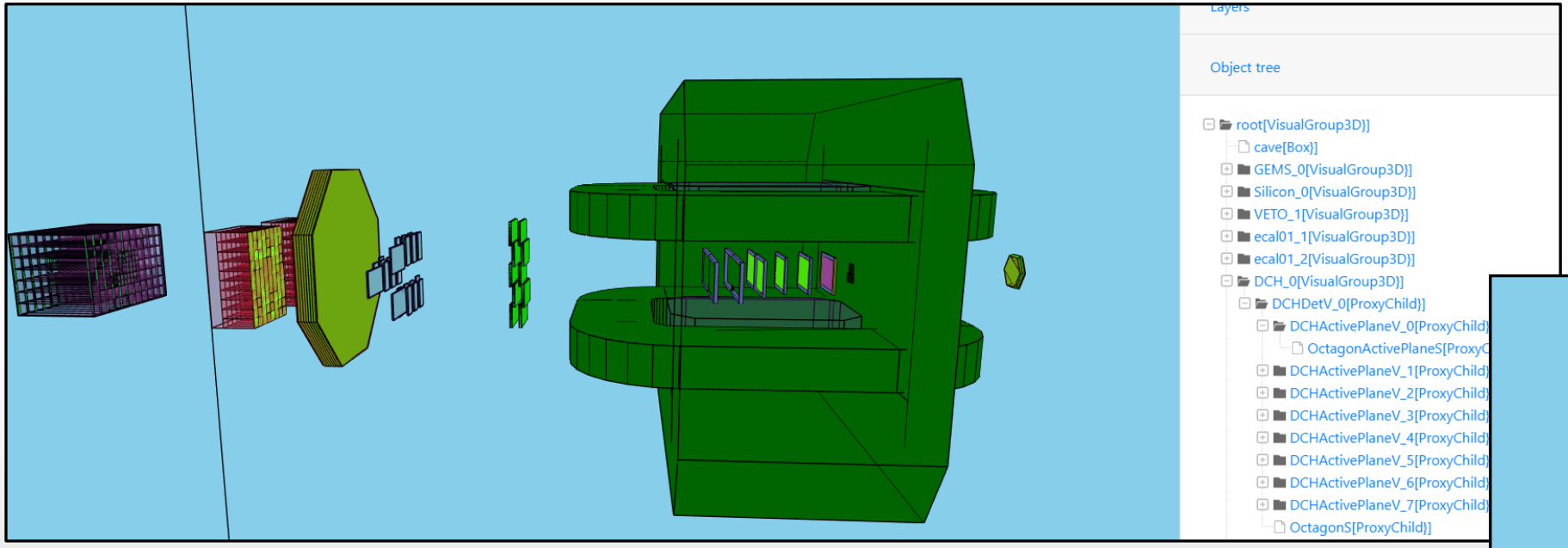
# Introducing DataForge-VIS

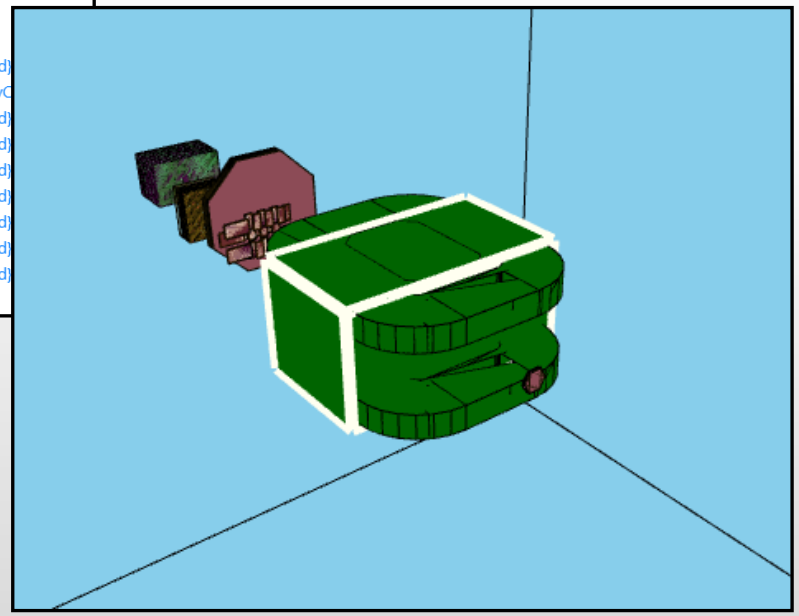
- Developed as Kotlin multiplatform application
- Available at https://github.com/mipt-npm/dataforge-vis
- DataForge-VIS features
  - Working Three-JS rendering engine
  - Caching and template usage for performance optimization
  - Styling capabilities
  - Layering
  - Implementation for all primitives needed for BM@N geometry
  - Basic online object manipulation capabilities
  - Complete reader for GDML format

# Muon Monitor Demo



# BM@N Geometry



# Current work and plans

- Finalization of ROOT plugin to convert TGeoManager to JSON
  - https://github.com/Unrealf1/RootExtraction
- VR via Three-JS
- OpenGL backend
- Non-3D plugins
- jupyter-kotlin integration (JetBrains internships, summer 2020)

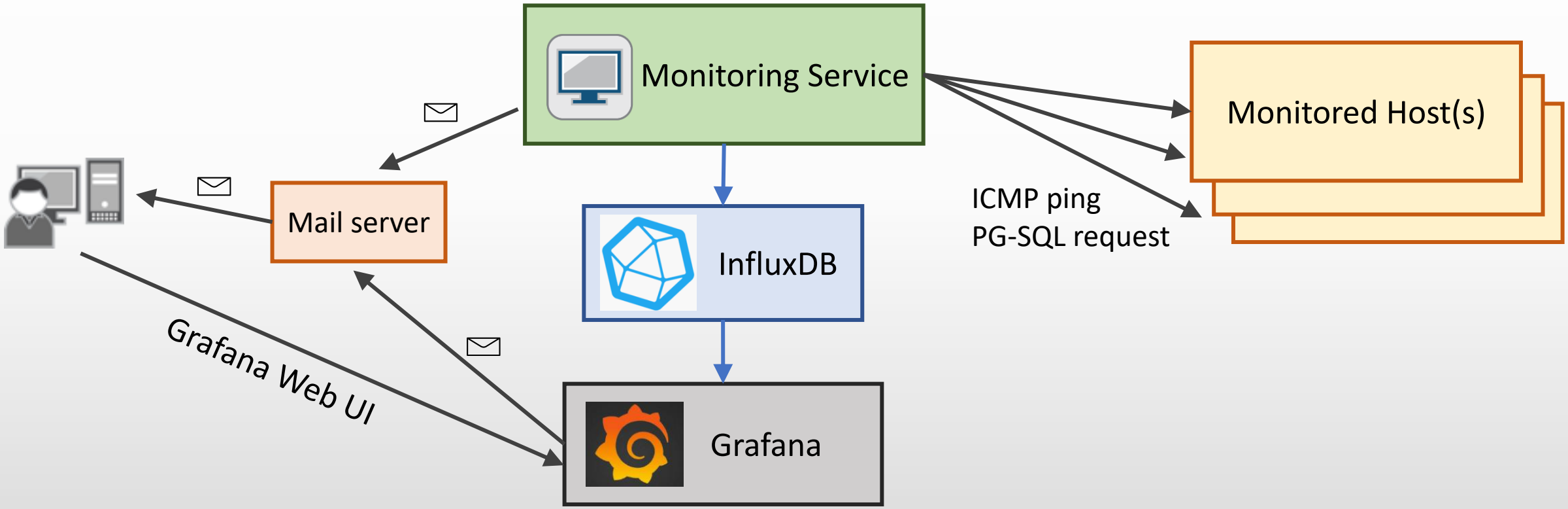

# Monitoring Service

# Monitoring Service - Task

- Monitoring Service Features
  - Ping and PG-SQL request to check database status
  - Configurable via JSON file
  - Email notifications
  - Response time stored in InfluxDB
  - Use Grafana for visualization and additional alerting
- Sources:

  https://git.jinr.ru/nica/bmnroot/-/tree/dev/uni_db/services/monitoring

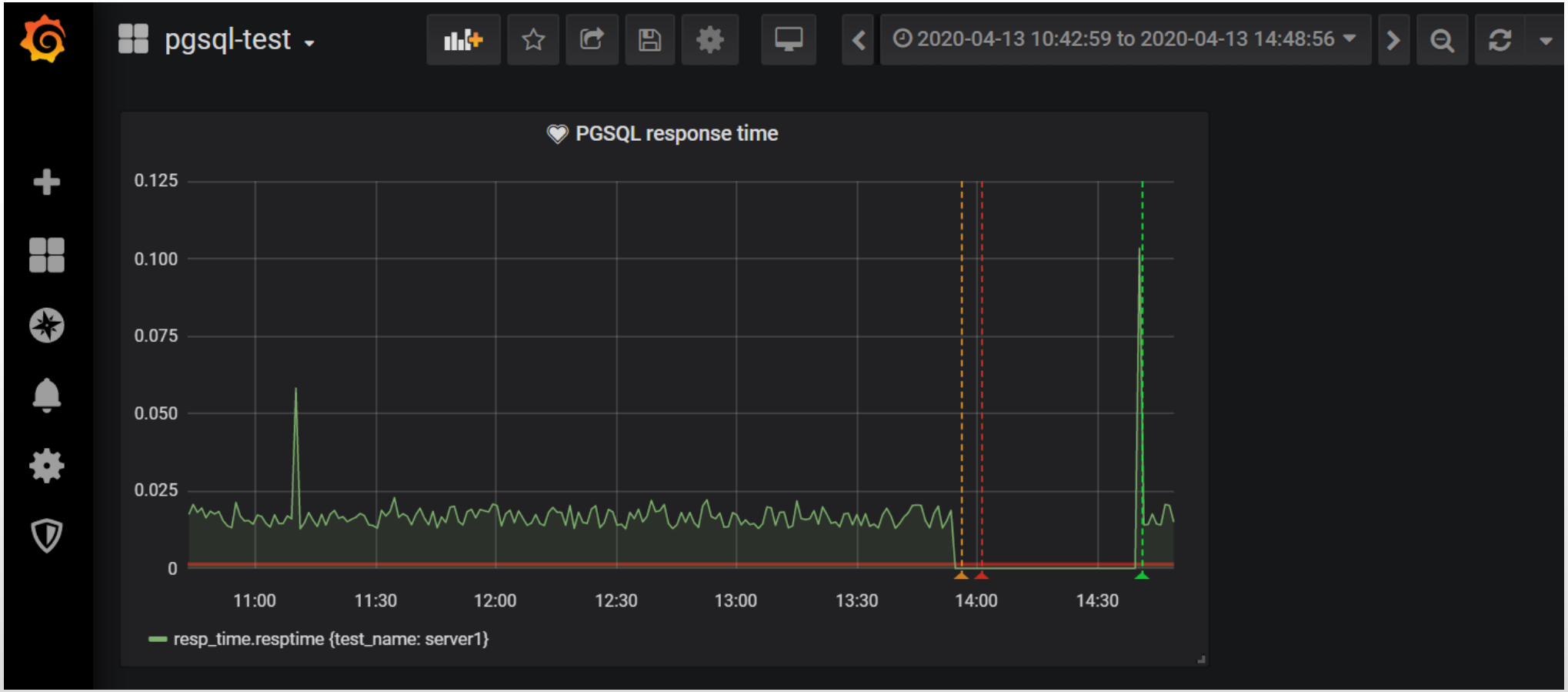
# Monitoring Service - Components



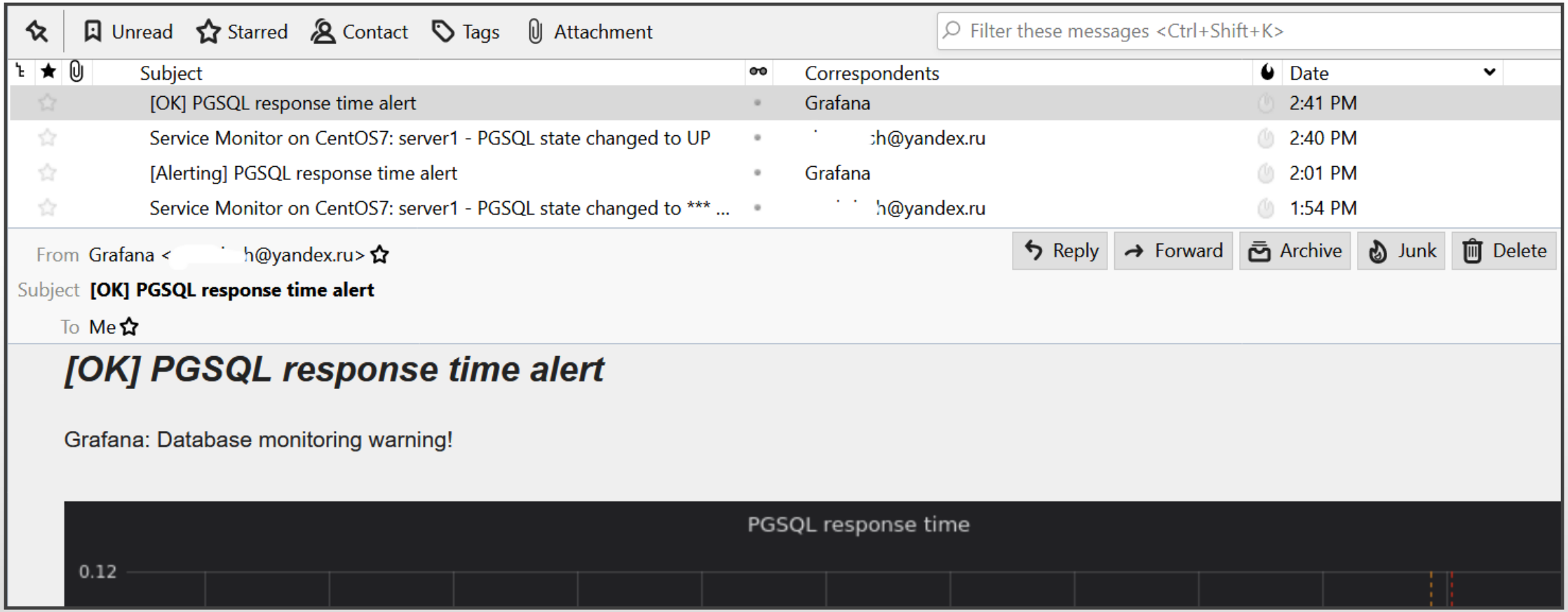
# Configuration File Example

```
{
  "PING": {
    "server1": {
      "IP": "192.168.65.116",
      "NOTIFY": "mail1.jinr.ru"
    },
    "router1": {
      "IP": "10.254.0.41",
      "NOTIFY": "mail2.jinr.ru"
    }
  },
  "DATABASE": {
    "server1": {
      "SERVER": "192.168.65.116",
      "DBMS": "PGSQL",
      "PORT": 5432,
      "DBNAME": "testdb",
      "USER": "testuser",
      "PASS": "***",
      "NOTIFY": "mail3.jinr.ru"
    },
    "server-centos2": {
      "SERVER": "192.168.65.62",
      "DBMS": "PGSQL",
      "PORT": 5432,
      "DBNAME": "books_store",
      "USER": "bookuser",
      "PASS": "***",
      "NOTIFY":
"mail5.jinr.ru,mail6.jinr.ru"
    }
  },

  "OUTPUT": {
    "DBMS": "INFLUXDB",
    "SERVER": "192.168.65.52",
    "PORT": 8086,
    "DBNAME": "pgsqltest",
    "USER": "influx",
    "PASS": "***",
    "NOTIFY":
"mail1.jinr.ru,mail2.jinr.ru"
  },

  "INTERVAL_SEC": 60,

  "MAIL": {
    "SERVER": "smtp.yandex.ru",
    "PORT": 587,
    "USER": "***",
    "PASS": "***"
  },

  "LOG": "mail1.jinr.ru,mail2.jinr.ru",
  "NAME": "Monitoring Service"
}
```

# Grafana View



# Email Examples

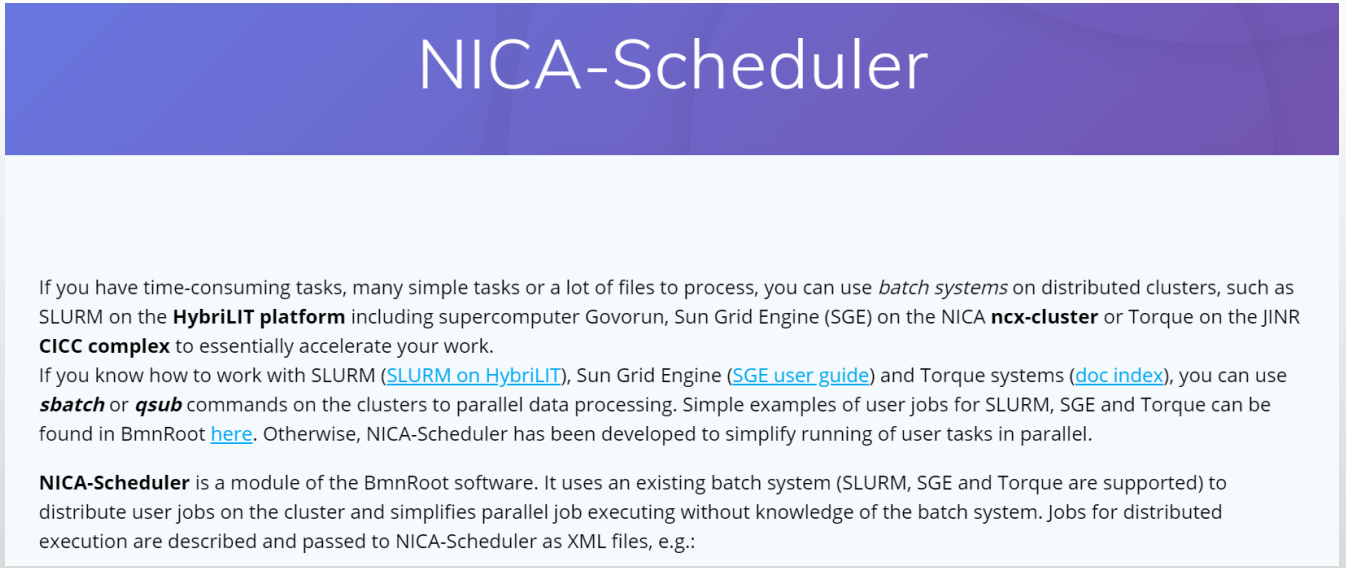


# Scheduler-GUI

# NICA Scheduler Configurator: Task

NICA-Scheduler is a module of BmnRoot software

- Uses existing batch system (SLURM, SGE, Torque) to distribute user jobs on the cluster
- Jobs for distributed execution are described and passed as XML file:
  `$ nica-scheduler my_job.xml`
- Details: http://bmn.jinr.ru/nica-scheduler/
- Task: Create a GUI editor for scheduler XML files



NICA-Scheduler

If you have time-consuming tasks, many simple tasks or a lot of files to process, you can use *batch systems* on distributed clusters, such as SLURM on the **HybriLIT platform** including supercomputer Govorun, Sun Grid Engine (SGE) on the NICA **ncx-cluster** or Torque on the JINR **CICC complex** to essentially accelerate your work.
If you know how to work with SLURM (SLURM on HybriLIT), Sun Grid Engine (SGE user guide) and Torque systems (doc index), you can use ***sbatch*** or ***qsub*** commands on the clusters to parallel data processing. Simple examples of user jobs for SLURM, SGE and Torque can be found in BmnRoot here. Otherwise, NICA-Scheduler has been developed to simplify running of user tasks in parallel.

**NICA-Scheduler** is a module of the BmnRoot software. It uses an existing batch system (SLURM, SGE and Torque are supported) to distribute user jobs on the cluster and simplifies parallel job executing without knowledge of the batch system. Jobs for distributed execution are described and passed to NICA-Scheduler as XML files, e.g.:

# Example of NICA-Scheduler Job

```
<job name="reco_job">
  <macro path="$VMCWORKDIR/macro/mpd/reco.C" start_event="0" event_count="1000" add_args="local">
    <file input="$VMCWORKDIR/macro/mpd/evetest1.root" output="$VMCWORKDIR/macro/mpd/mpddst1.root"/>
    <file input="$VMCWORKDIR/macro/mpd/evetest2.root" output="$VMCWORKDIR/macro/mpd/mpddst2.root"/>
    <file sim_input="energy=3,gen=urqmd" output="~/mpdroot/macro/mpd/evetest_${counter}.root"/>
  </macro>
  <run mode="global" count="25" config="~/mpdroot/build/config.sh"/>
</job>
```

It is perfectly fine to create such a file using a text editor.

You have to remember or look up XML tag and attribute names and make sure XML syntax is valid.

# NICA-Scheduler-GUI Details

- Written as a Kotlin Multiplatform application
  - Runs as JavaScript in browser, or in JVM
    - Using the same data model defined in Common part
  - Libraries used:
    - xmlutil (https://github.com/pdvrieze/xmlutil)
    - Kotlinx-HTML (https://github.com/Kotlin/kotlinx.html)
    - Bootstrap (https://getbootstrap.com/)
    - TornadoFX (https://github.com/edvin/tornadofx)
- Available at https://git.jinr.ru/nica_modules/mpd-scheduler-gui

# Going multiplatform

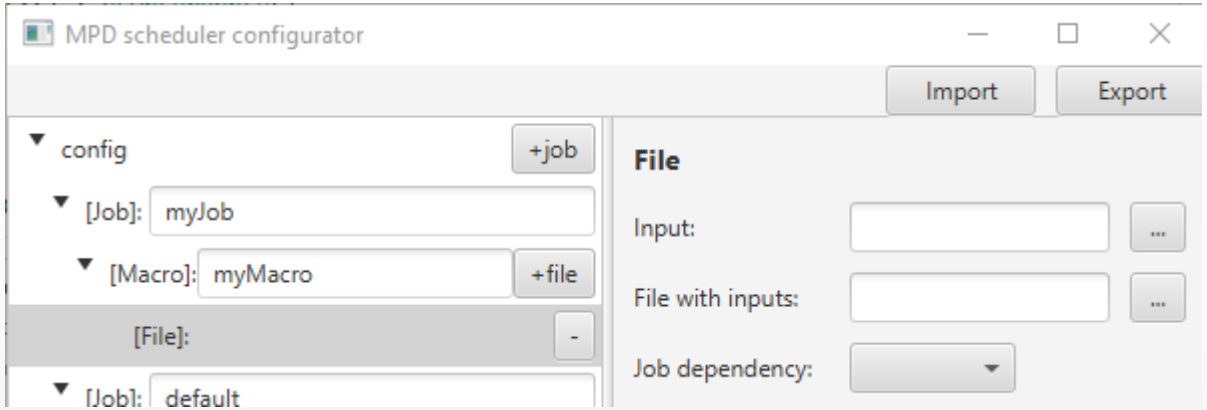
JVM

- Cross-platform on desktops
- Easier to develop and maintain
- In future can support: Full execution control
- Problems with deployment on systems without JVM

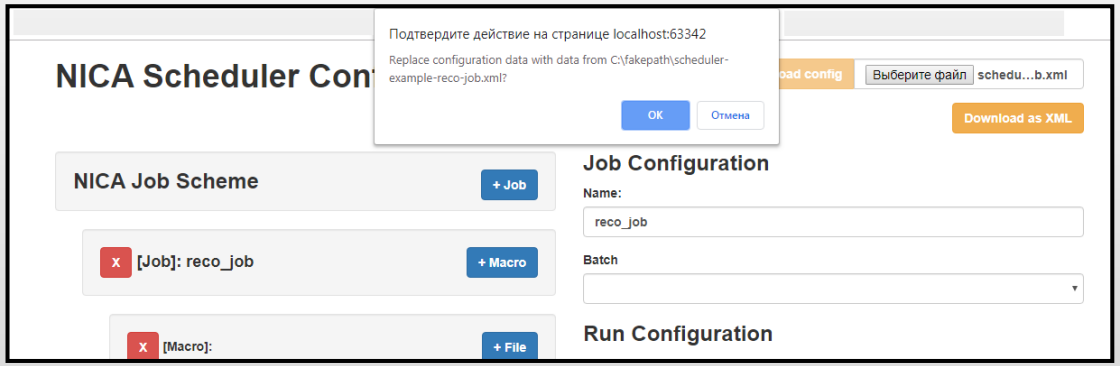
JavaScript GUI using the same model

- Does not require installation. Could be run from Web site or from local file
- Shares model with desktop via Kotlin-multiplatform technology
- Has almost the same functionality

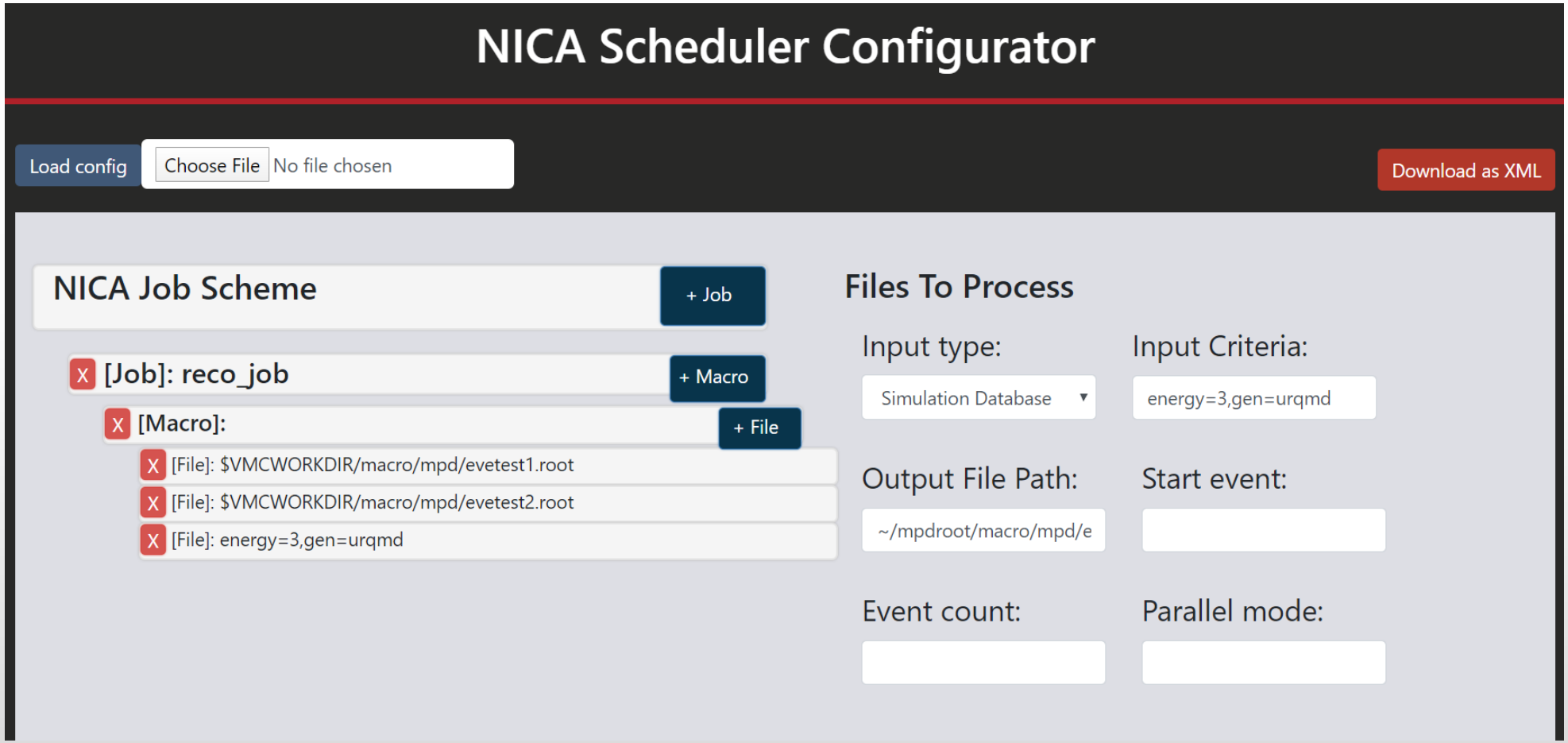
JVM




JS

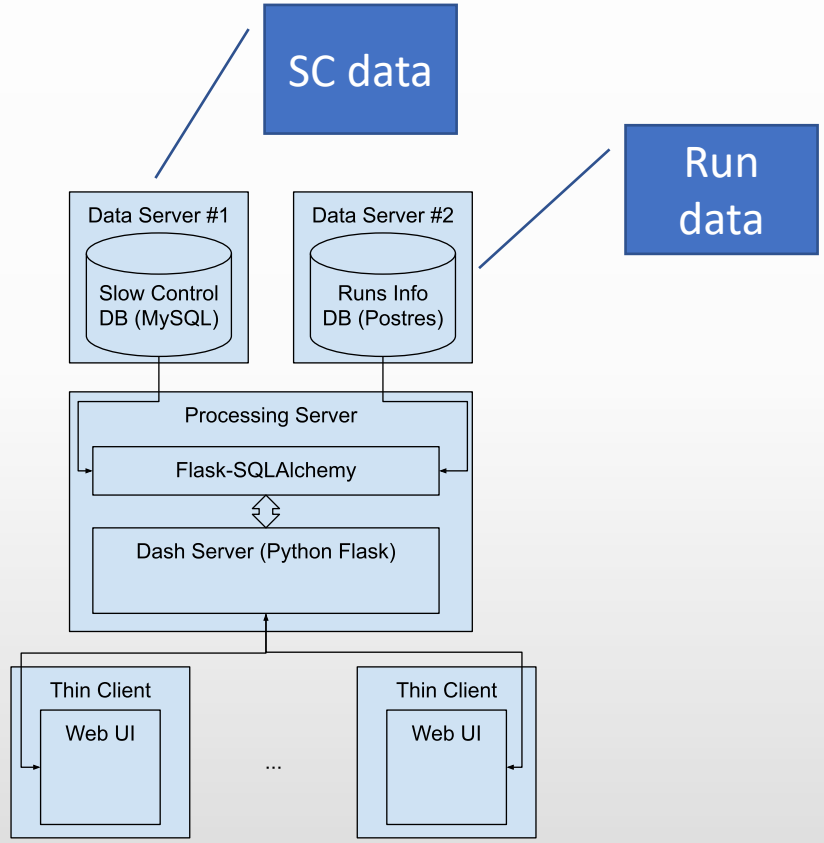


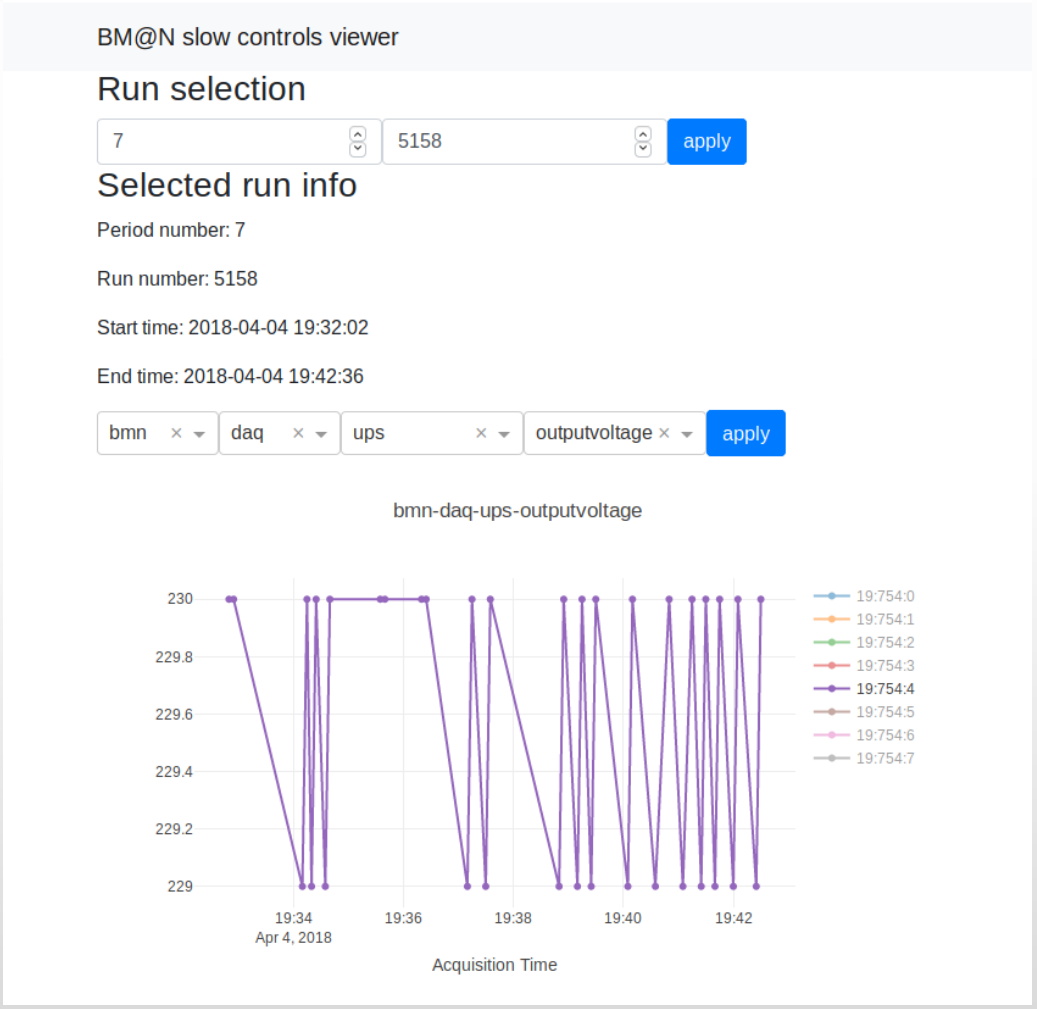
# New design for JS version



# Slow Control Viewer

# Slow control viewer example



# Slow control viewer status

- All components prepared and tested
- Repository available at https://git.jinr.ru/vchernov/bmn-visualisation


# Thank You!