Application of LHD Post Data Analysis Systems to the KSTAR Project

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Introduction

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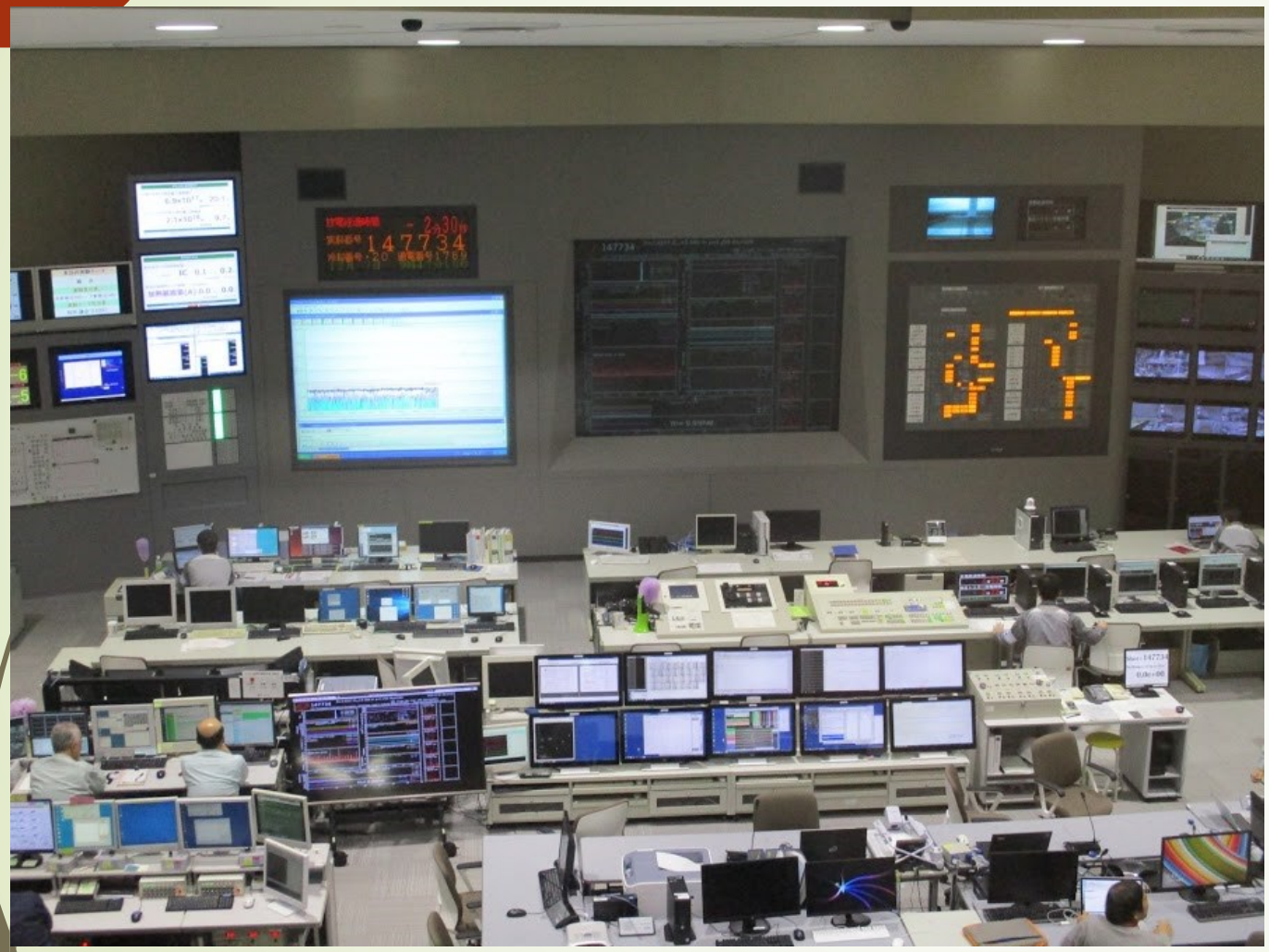
LHD plasma discharge experiments are executed every three minutes. In order to grasp the last results of the ongoing experiment as soon as possible, the following systems are working.

- AutoAna
- myView2

They are expected to be useful for other plasma experiments, and the authors have been porting these systems to other experiments.



Here is the picture of the central control room. During experiments, MyView2 displays the last results calculated by AutoAna during the repetitive plasma experiments, and it provides the experiment coordinator important information for the following experiment schedule.

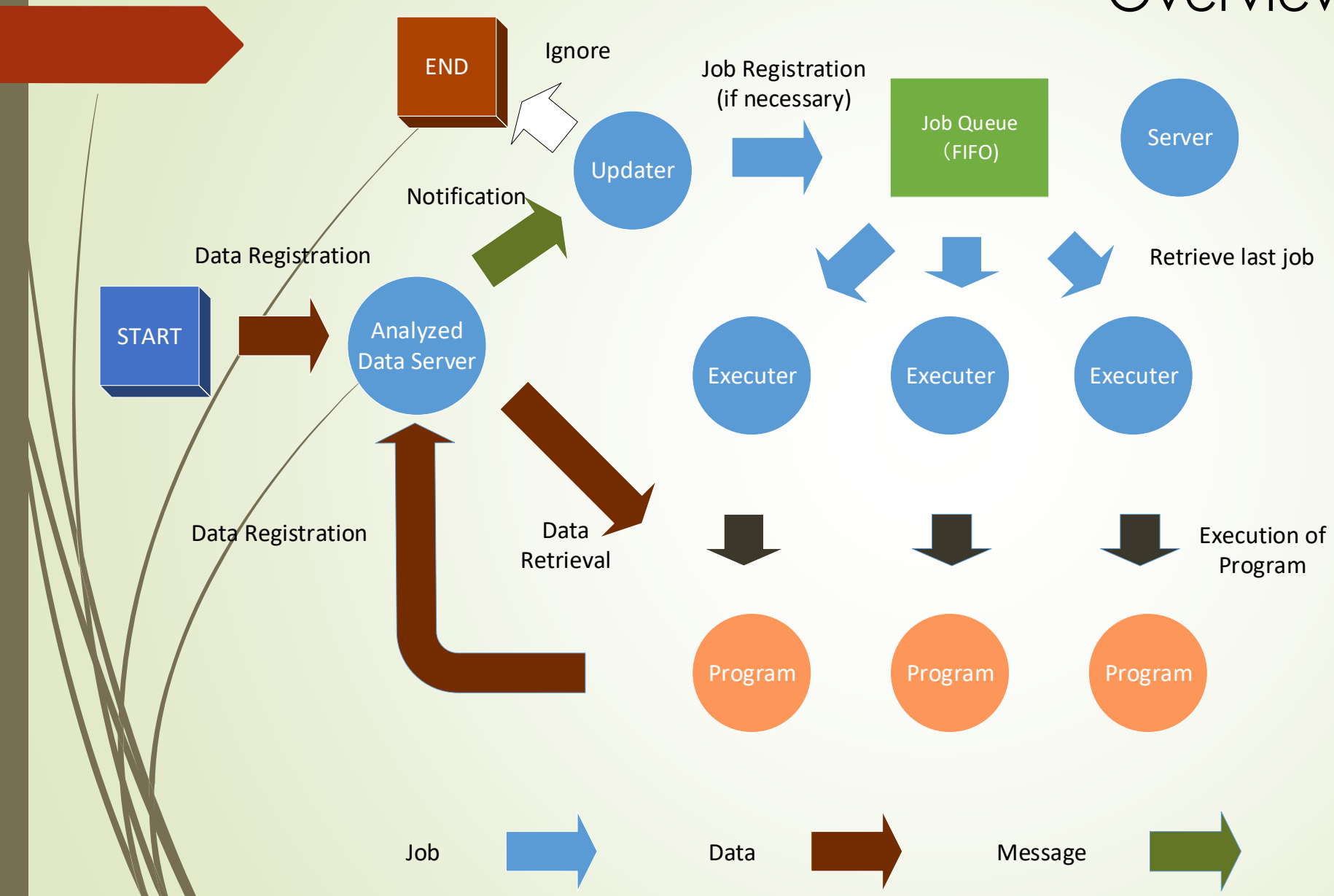
AutoAna

AutoAna

All the physical data is stored in the Kaiseki Server. AutoAna automatically executes the analysis programs as soon as the source physical data registers into the Kaiseki Server.

- AutoAna maintains the dependency among the physical data in the Kaiseki Server
- It also provides the last results of the plasma discharge experiment

Overview of AutoAna



AutoAna consists of 3 components, **Server**, **Updater**, and **Executer**.

Server controls job queue, **Updater** submit job request to **Server**. The jobs is executed by multiple **Executers**

Depmap.json

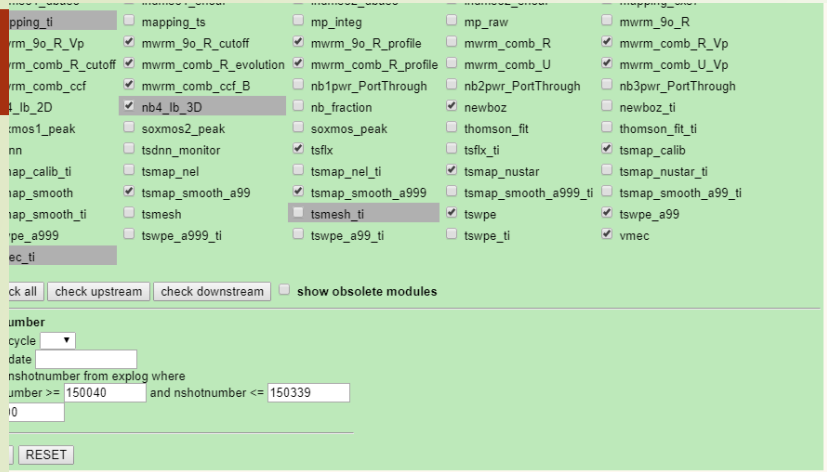
The analysis programs run from AutoAna is defined in a single JSON file named depmap.json.

```
{
  "tswpe_a999": {
…
  },
  "mapping_ts": {
    "email": "csuzuki@lhd.nifs.ac.jp",
    "output": [
      "mapping_ts",
      "tsmap_reff",
      "tsmap_reff_fir"
    ],
    "enabled": true,
    "author": "C.Suzuki",
    "module": "mapping_ts",
    "command": "$TOP/tsmap/mapping_ts.sh %d",
    "concurrency": 1,
    "depend": [
      "ip",
      "thomson",
      "heating_flg"
    ]
  },
```

Latest Enhancement of AutoAna

- Web Interface
  - Dependency diagram
  - Enabling / disabling modules
  - Submit / cancel jobs from the web page
- Job Management
  - Manual Execution
  - Limitation of concurrent task

Web interface of AutoAna



SHOT#	cxs3_nb	cxs6_Er	cxs6_flow_2D	cxs7_Er	cxs7_flow_2D	cxs7_flow_2D_ti	cxscti6	cxscti7	cxscti9	cxsmap3	SHOT#	cxsmap3_density	cxsmap3_smooth	cxsmap6	cxsmap6_nustar	cxsmap7	cxsmap7_nustar	cxsmap8	cxsma
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SHOT#	cxs3_nb	cxs6_Er	cxs6_flow_2D	cxs7_Er	cxs7_flow_2D	cxs7_flow_2D_ti	cxscti6	cxscti7	cxscti9	cxsmap3	SHOT#	cxsmap3_density	cxsmap3_smooth	cxsmap6	cxsmap6_nustar	cxsmap7	cxsmap7_nustar	cxsmap8	cxsma
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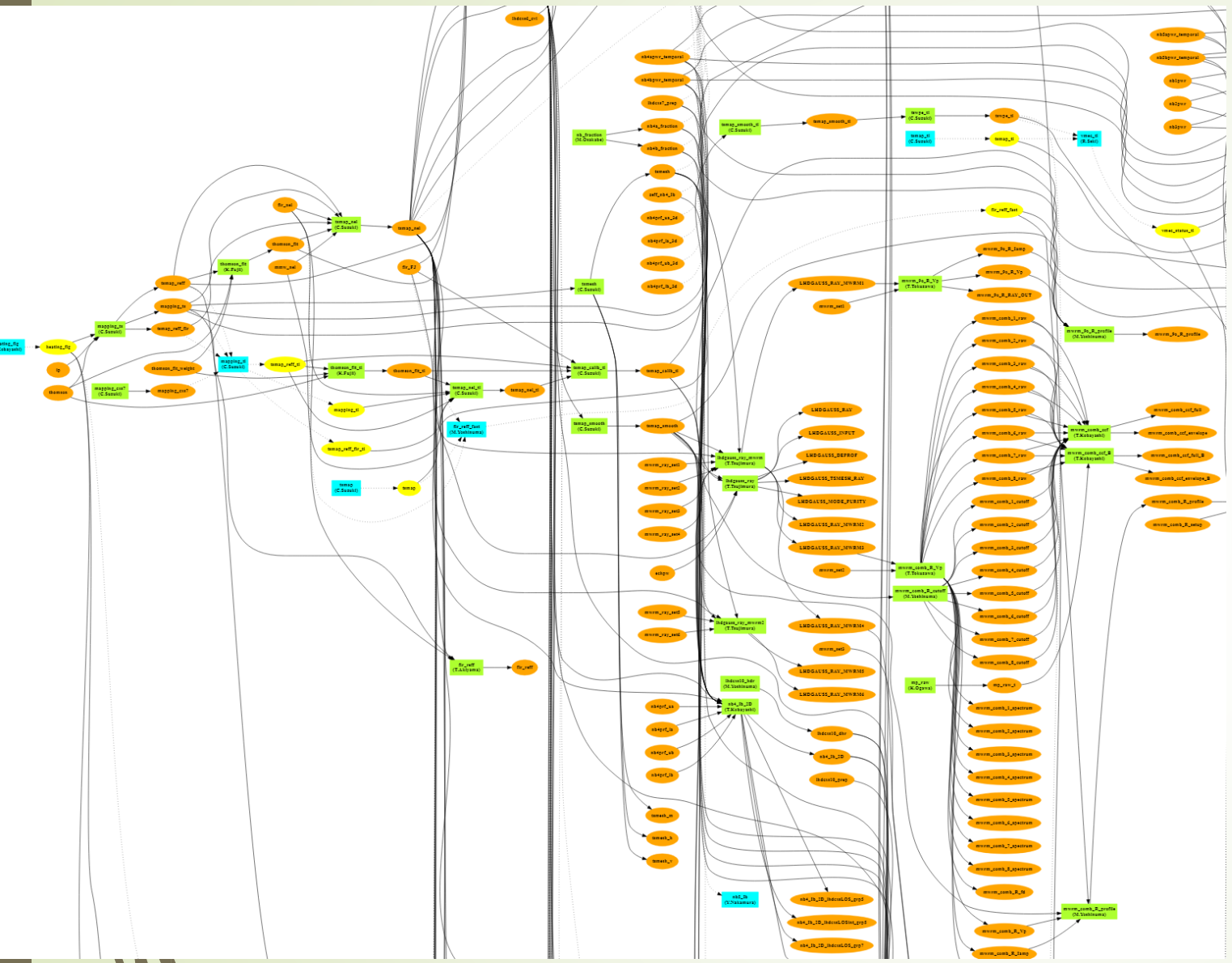
This table shows the status of jobs.
The job can be submitted from this page manually.



This is dependency diagram of physical data and analysis modules.
The diagram is created by the previous Web page.

module (enabled)

module (disabled)

physical data (enabled)

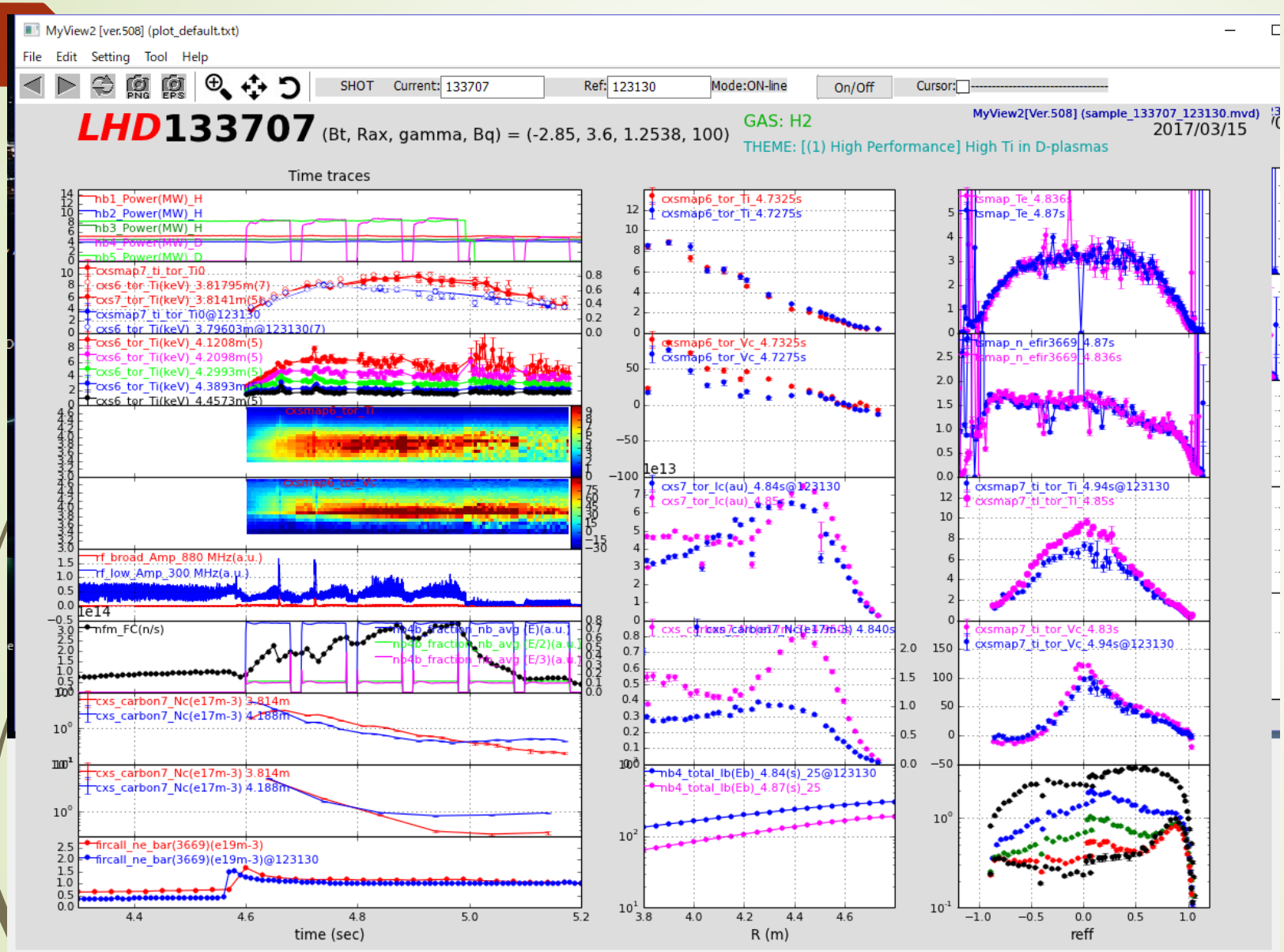
physical data (disabled)

MyView2

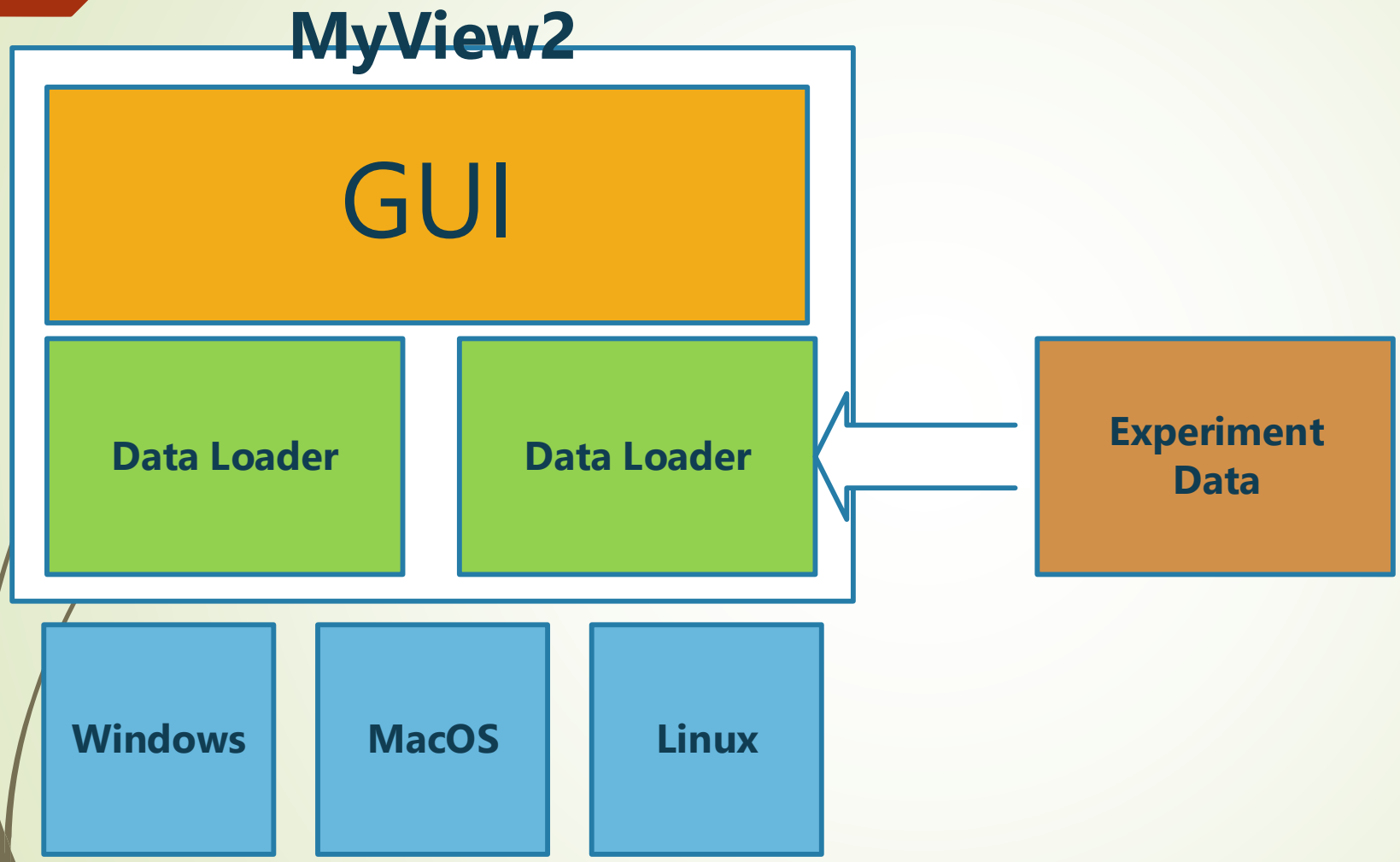
MyView2

MyView2 is a visualization tool developed especially for the visitors so that they can view the necessary data soon after they visit NIFS.

- MyView2 is written in **Python**, and it currently run under Windows, MacOS, and Linux
- The display layout is flexibly customizable. The layout file can be available in advance, and the visitors can see the necessary data soon.
- It supports offline mode as well as online mode, and the researchers can see the data after they go back to their office.
- MyView2 has a real-time mode, it updates the graph synchronized with the LHD experiment sequence.



This is the main window of MyView2.


MyView2
GUI
Data Loader
Data Loader
Experiment Data
Windows
MacOS
Linux

Porting to other experiments

Migration of Post analysis tools to other experiment

AutoAna and **MyView2** are developed so that they can be used for generic experiments and because they do not depend heavily on the LHD experiment too much, these systems can be relatively easy to use for other experiments. Currently, the authors are working for the following experiments.

- KSTAR (Developing and testing as a J-K collaboration)
- J-TEXT (scheduled to install in next month)

Proposal of FY 2019 JK Collaboration

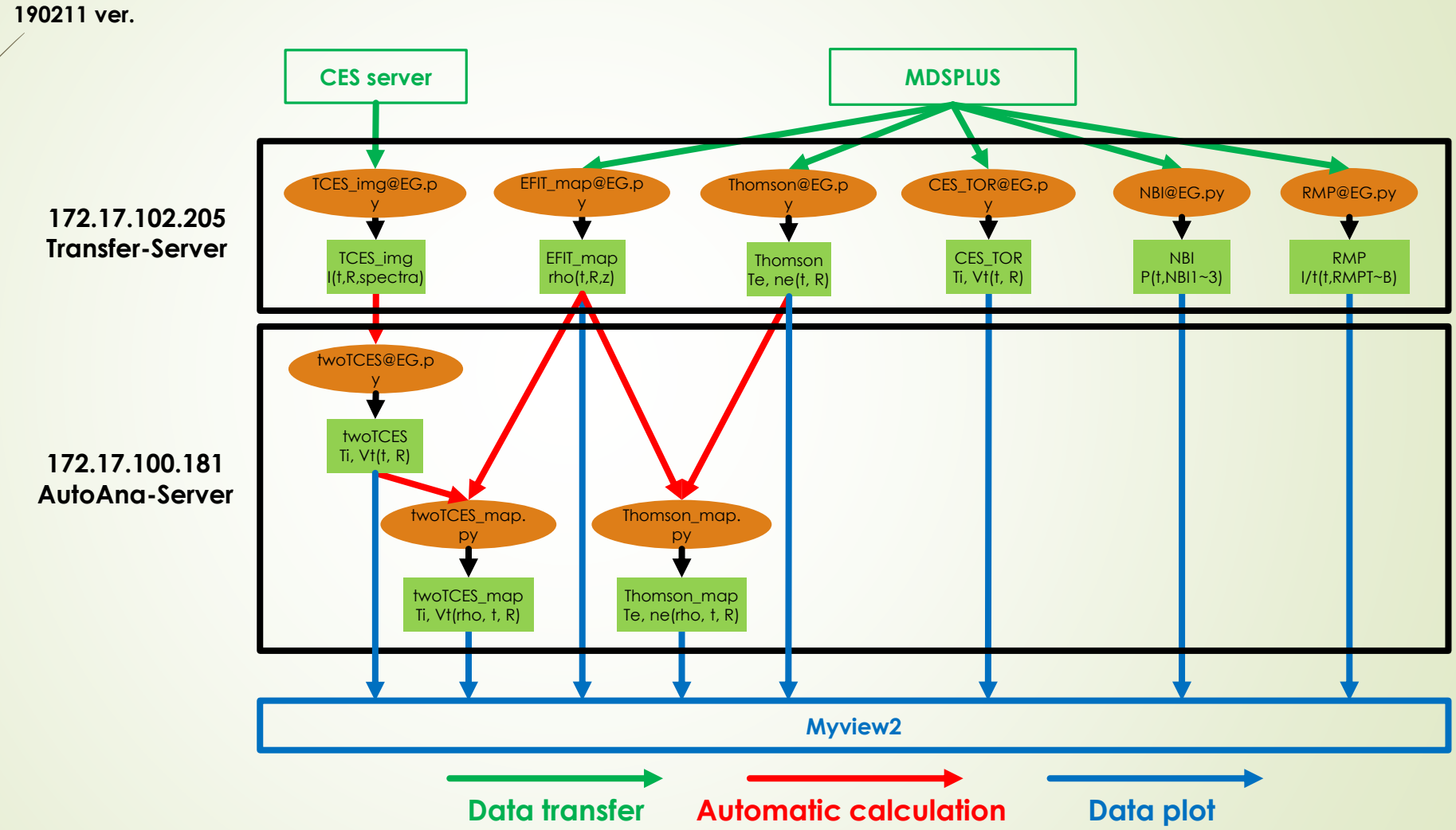
- ITER Technical Collaboration
  - FW and Blanket
  - Tritium Plant
  - Diagnostics
- KSTAR Collaboration
  - Plasma Heating Systems
  - **Diagnostic Systems**
  - SC Toroidal Device Experiments
- Human Resource Development

Modification for the KSTAR

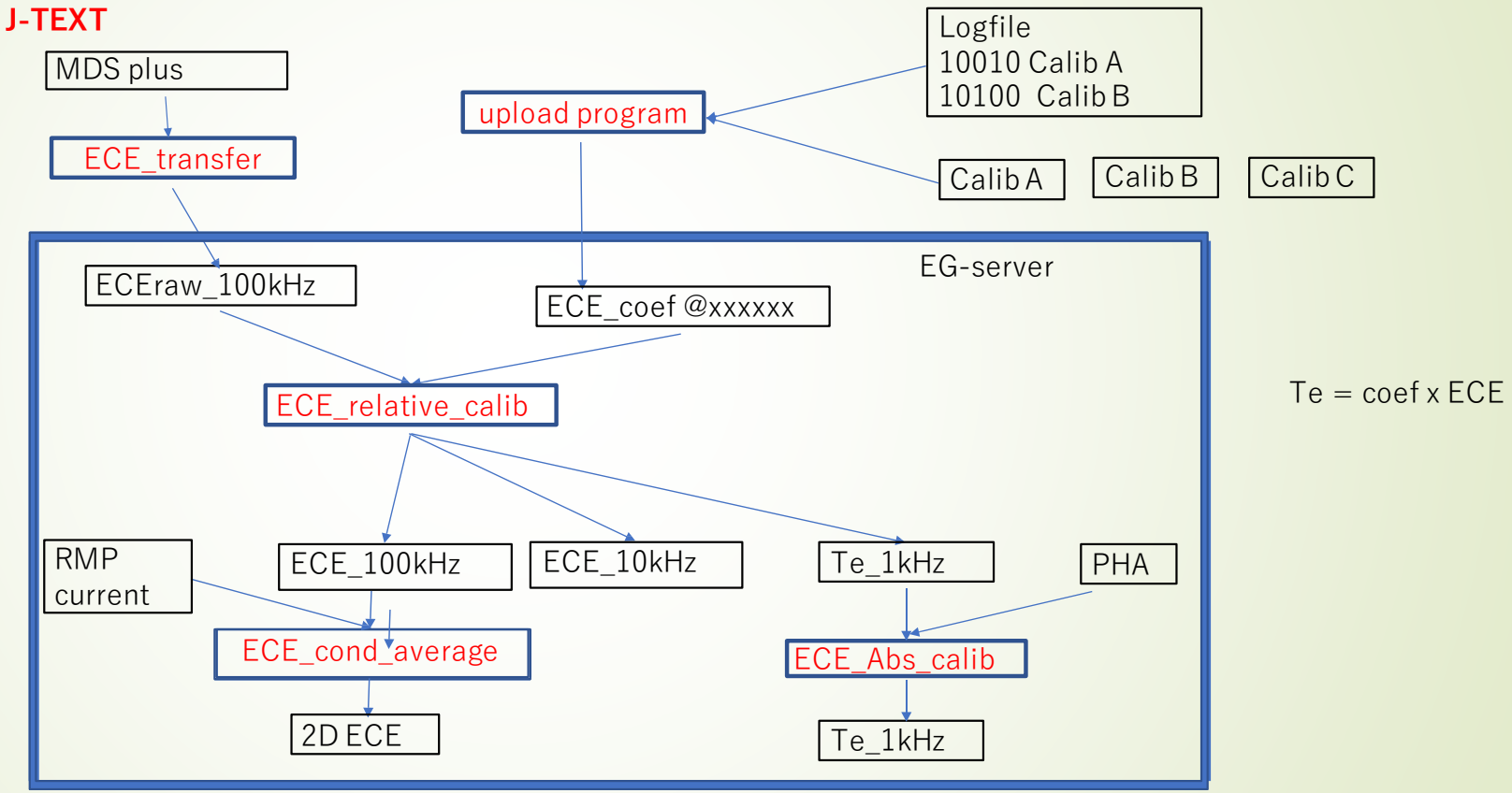
In order to port AutoAna and MyView2, and collaborate, the following modifications are applied.

- IP Multicast => UDP Unicast
- isolate server configuration (server-name, IP port, etc.)
- CentOS 6 => CentOS 7
- Subversion => git (bitbucket.org)

AutoAna for the KSTAR Project



AutoAna for the J-TEXT Project



Independent of the Kaiseki Server

AutoAna and **MyView2** depend on the Kaiseki Server System. In order to use them widely for other systems, they should be independent of the Kaiseki Server, and the following function must be replaced by others.

- AutoAna (Updater)
  - Updater checks the Kaiseki Server if source data is available.
  - new data registration is notified by a UDP packet from the Kaiseki Server
- MyView2
  - For real-mode, MyView2 asks the shot number server to know the current shot number.

Summary

Summary

- AutoAna and MyView2 are useful systems especially for inter-shot analysis.
- In order to show the usefulness of both systems, the authors have been poring both systems to the KSTAR experiment, and plan to port to J-TEXT
- To use them for other systems, it is required to be independent of the Kaiseki Server.