The Implementation of the Software Framework in J-PARC/MLF

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Neutron instruments in J-PARC/MLF

MLF: Materials and Life science experimental Facility

Super HRPD (KEK)

NNRI (Tokyo Tech, JAEA, Hokkaido Univ.)

PLANET (Univ. of Tokyo, JAEA)

NOP (KEK)

iBIX (Ibaraki pref.)

NOBORU (JAEA)

1st Experimental Hall

HRC (KEK)

DNA(JAEA)

4 Instruments in commissioning
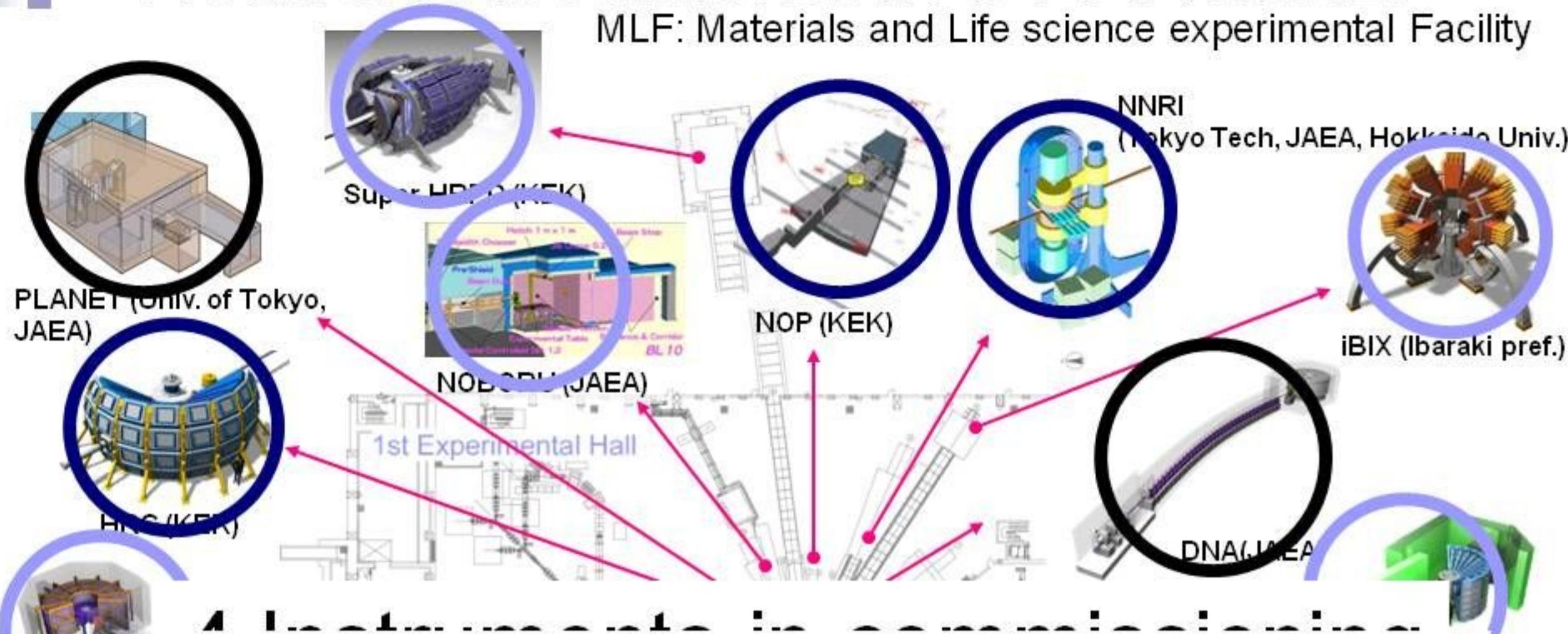
3 Instruments under construction

AMATERAS (JAEA)

Univ.)

TAIKAN (JAEA)

ARISA-II (KEK)

TAKUMI (JAEA)

iMATERIA (Ibaraki pref.)

NOVA (NEDO, KEK)
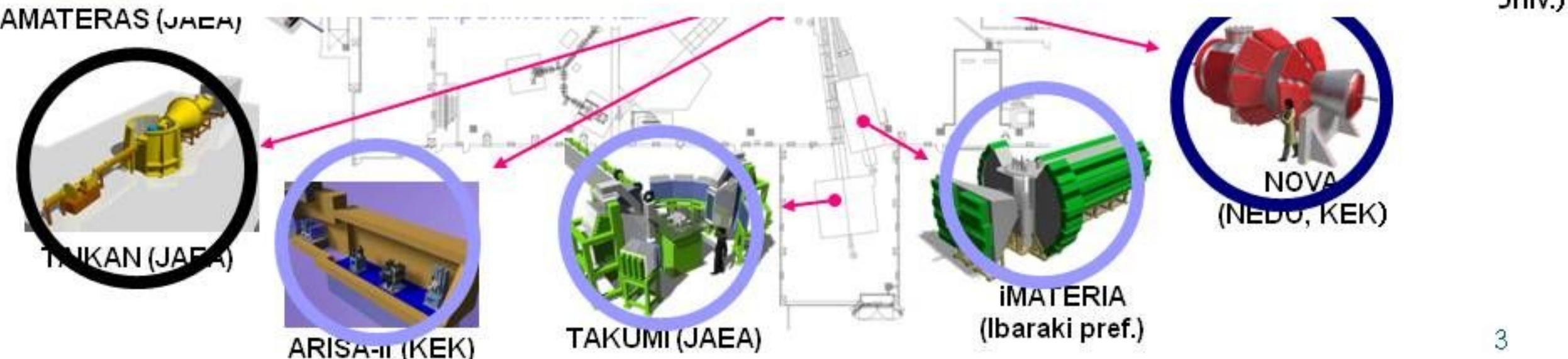
Computing requirements at MLF

- **High throughput of large data analysis**
  - ☐ On-line analysis of GB order data during an experiment
  - ☐ Interpretation software (simulation) will be used on an experiment
  - ☐ Data analysis affect on effective flux of neutron (muon)
    - Fast and reliable data analysis and experiment systems are required

- **Variety of experimental approaches**
  - ☐ Extreme experiments will become conventional
    - Flexible instrument control

- **Large number of user**
  - ☐ Several ten thousands of cumulative users / year
    - Database for user program should be implemented
    - Computing environment should be user-friendly

  - ☐ Security
    - User identification and authorization are essential to enable flexible access to J-PARC/MLF

- **Collaboratory system will open new style of experiment**

MLF Computing Environment

Visualization

Common Int...

2D

>3D

Remote Access

Software Framework

Python

Analysis Control Server

Data base

Common Interface

Device monitoring

DAQ log

Analysis log

Simulation

Common Inter...

Simulator

ab initio
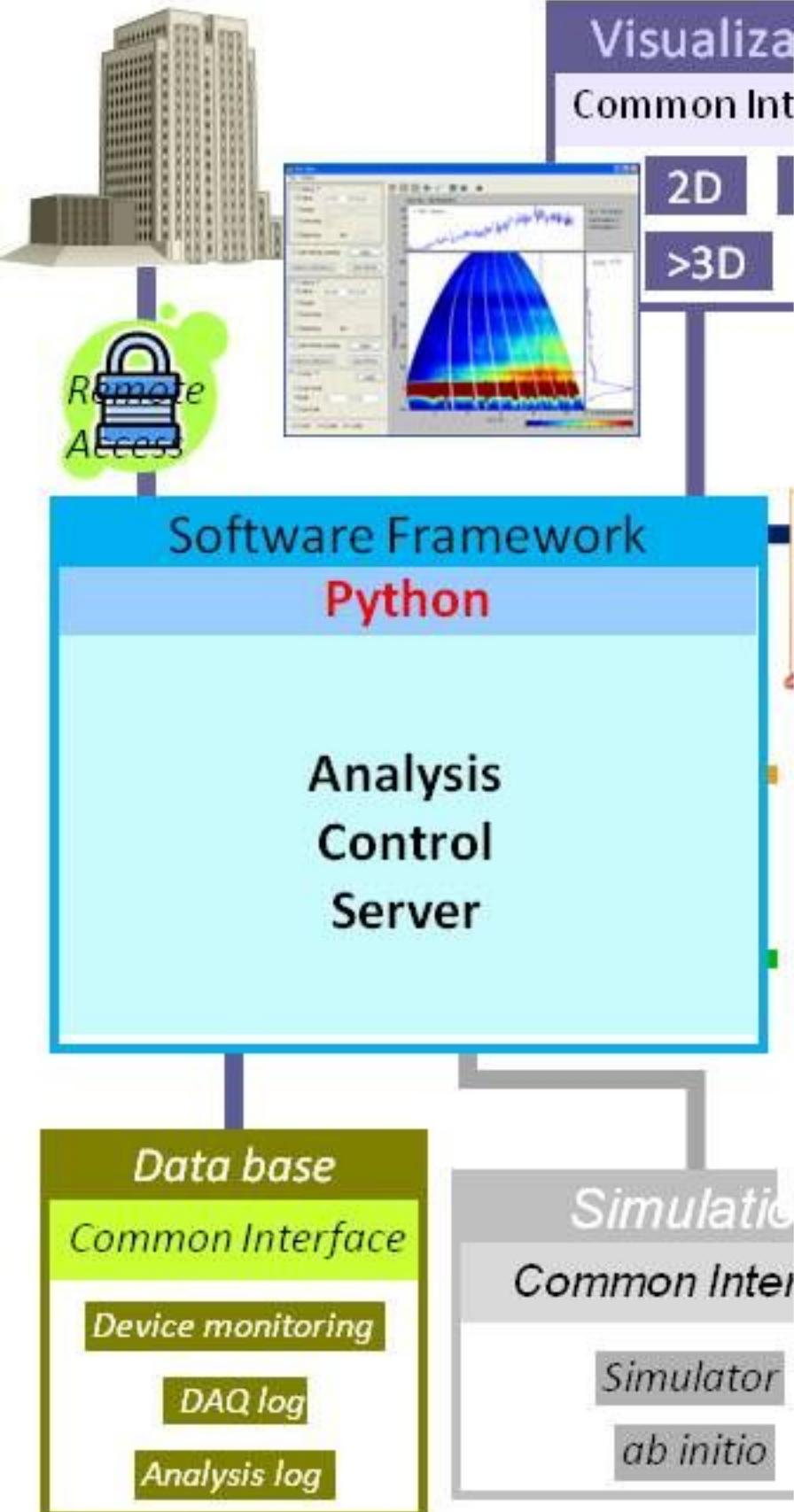
- **Analysis "Manyo-lib"**
  - Mainly data reduction; it can work as an application
  - Implemented by C++
  - Wrapped into Python with SWIG
  - Standardized units and coordinate system
  - Hieratical data structure

Software framework supports network distributed environment.

- Network-based device control middleware
- Event mode DAQ
- Absorb differences between detectors (He3 gas, scintilator…)
- Automatic measurements combining DAQ and equipments
  - Generate XML and send/receive with HTTP

XML messages between Working Desktop and DAQ Middleware (1)

URI : http://DAQContSv/daq/Params
HTTP POST
MINE : text/xml
Parameter :
<params>config.xml</params>

DAQ.params("config.xml")

Working Desktop/IMS

DAQ Middleware

HTTP/1.1
<status>OK</status>

XML messages between Working Desktop and DAQ Middleware (2)

DAQ.status()

URI : http://DAQContSv/daq/Status
HTTP GET
MINE : text/xml

HTTP/1.1
<status>OK</status>
<devStatus>Ready</devStatus>
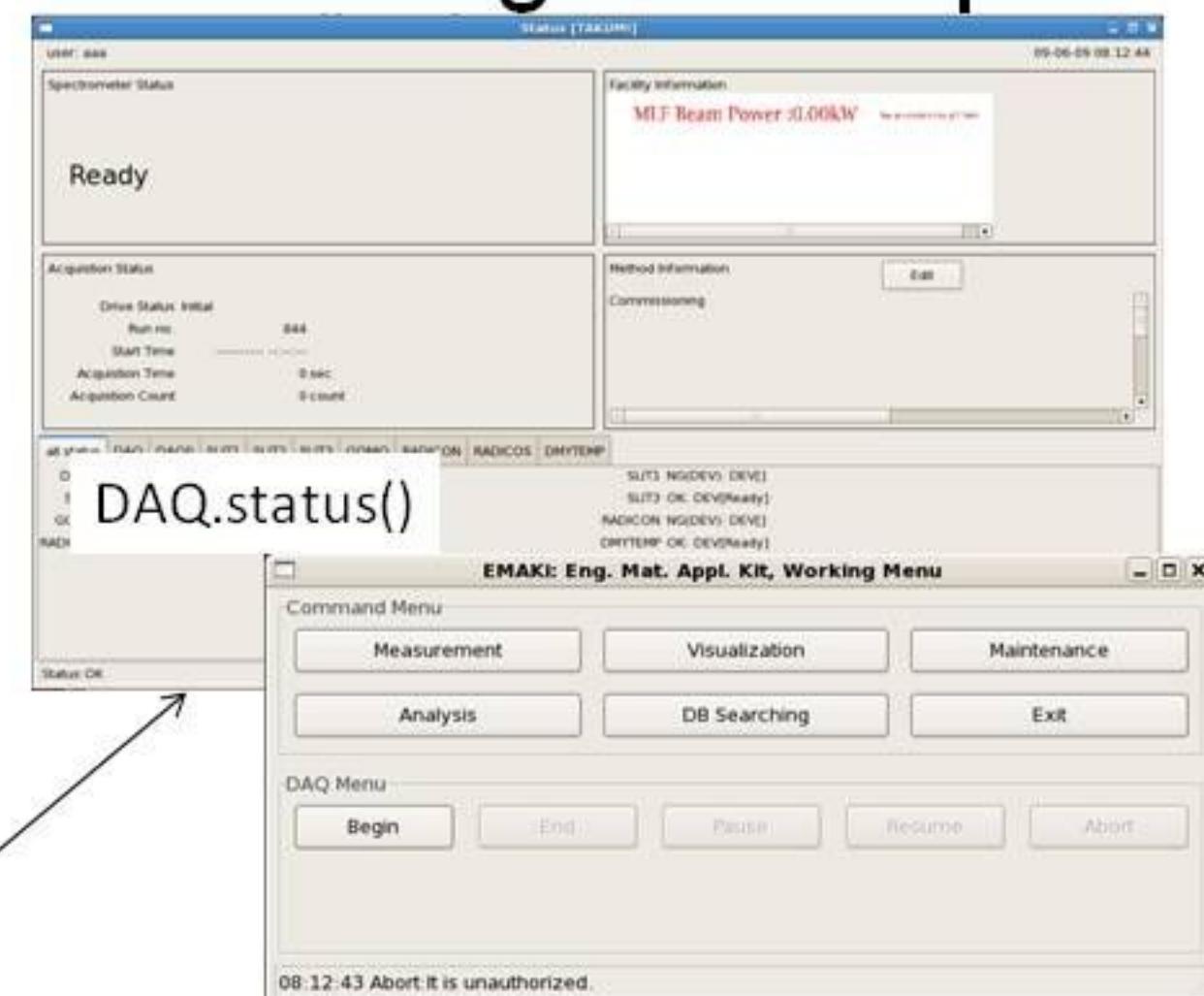
DAQ Middleware

Working Desktop/IMS

Measurement procedure

UI

Instrument manager

Equipment control

Measurement condition script

Working Desktop (WD)

Equipment condition

Server process

User made

DAQ Middleware (DAQ-MW)
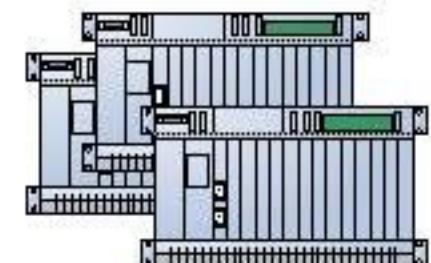
DAQ electronics

Equipment control server (ECS)

Equipment controllers

Users make measurement condition is thread
DAQ command to DAQ-MW
conditions to Equipment controllers through ECS

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Analysis procedure (network)

UI

Analysis control

Analysis server

Server process

User made

System made

Analysis condition

Analysis module

Working Desktop (WD)

Analysis module startup script

Analysis server startup script
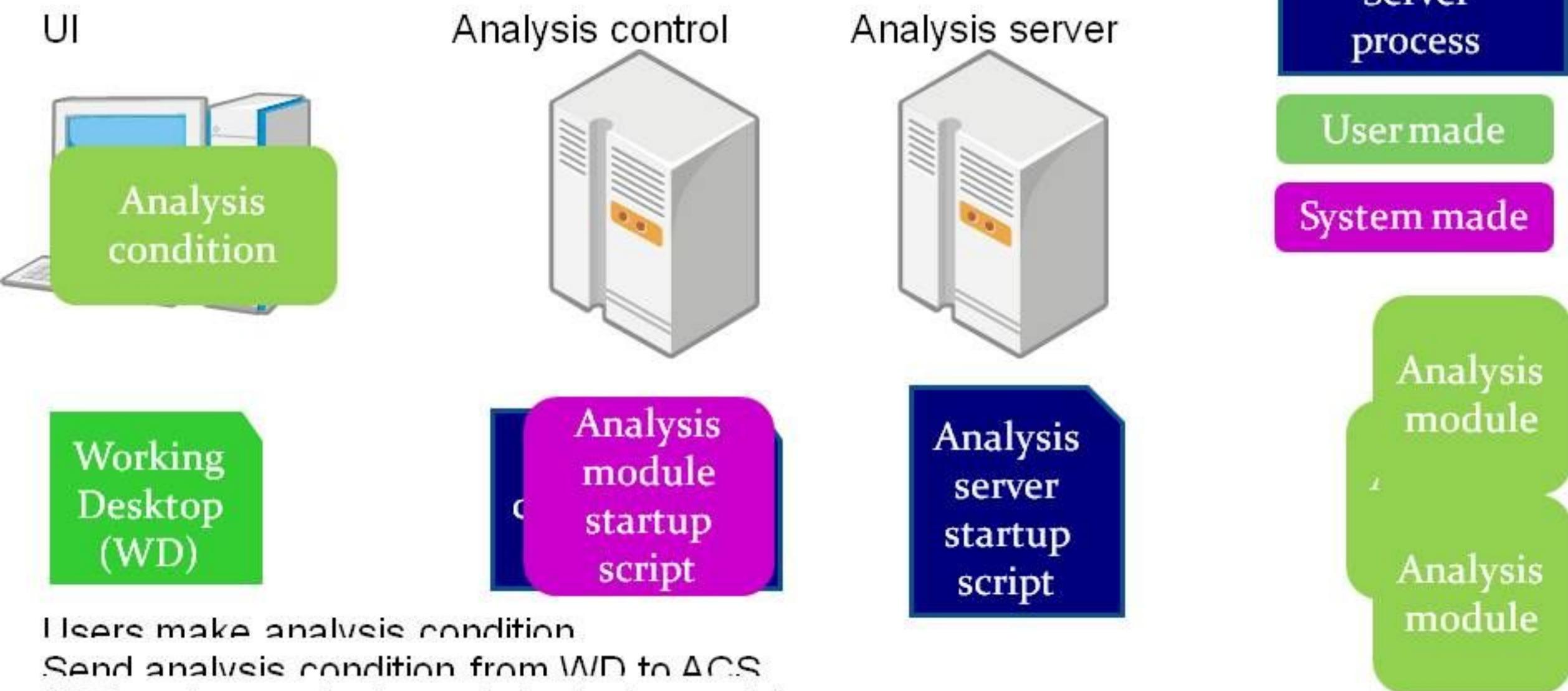
Analysis module

Users make analysis condition
Send analysis condition from WD to ACS
ACS makes analysis module startup script

On parallel processing, ACS make several analysis module startup scripts
send to analysis server startup scripts and analysis modules are executed

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Analysis procedure (stand alone)

UI

Server process

User made

Analysis condition

Working Desktop (WD)

Analysis control server (ACS)

Analysis module

Users make analysis condition
Users can use same analysis modules at their home laboratories.
ACS executes analysis module

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Summary

- We have developed the software framework for DAQ, equipment control, analysis and visualization of the neutron experimental instruments in J-PARC/MLF.

- The software framework is scalable and flexible by Python and the distributed network processing with XML over HTTP.