

# Improvements of database system and analysis suite in VEST

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### **1. Introduction**

#### **1.1. Introduction and Motivation**

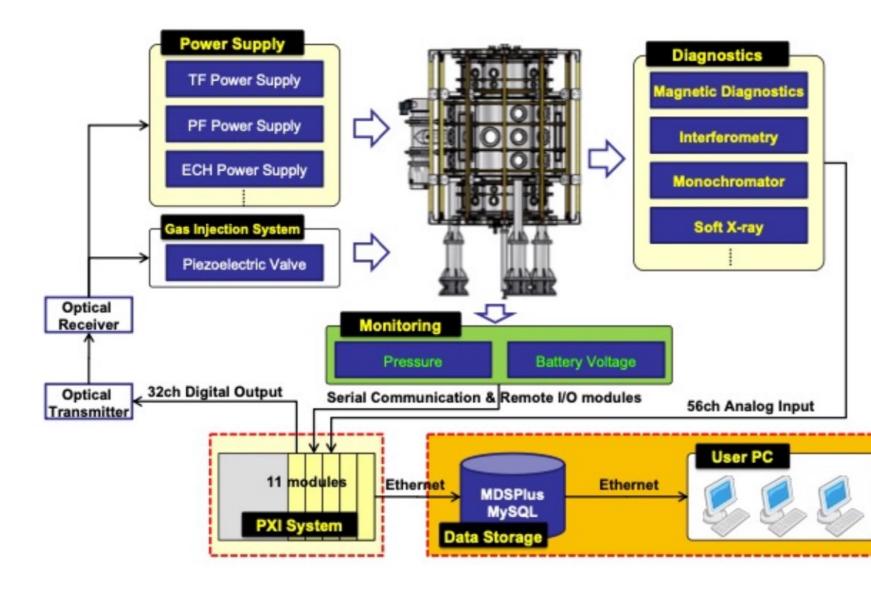


Fig. 1 Current database system of VEST.

**VEST (Versatile Experiment spherical** 

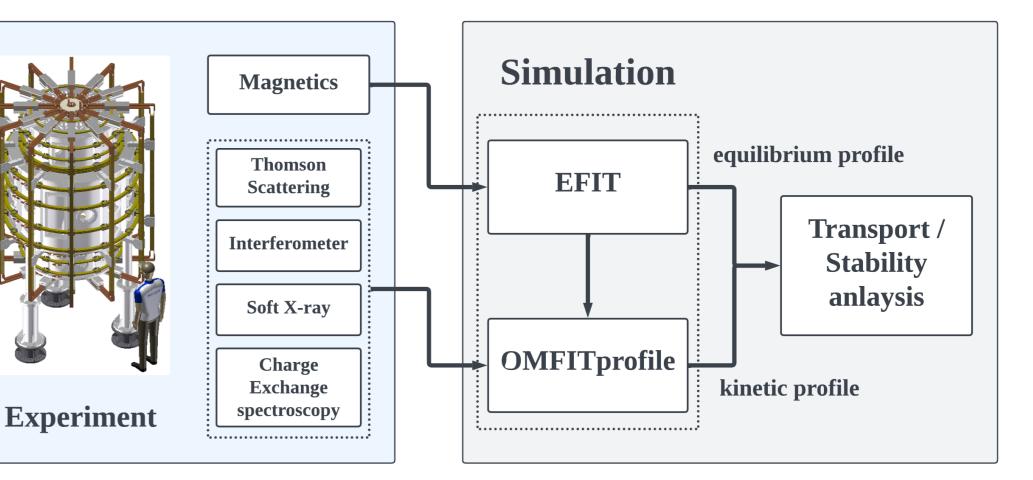
#### tokamak)

- Currently, experiment data from VEST mainly stored in MySQL, but some diagnostic data and simulation data is managed independently.
- Impossible to access all the data in one framework due to absence of a one integrated cooperation system
- Need centralized controllable database system and compatible analysis tool to construct integrated workflow

#### **1.2. Objective and Methods**

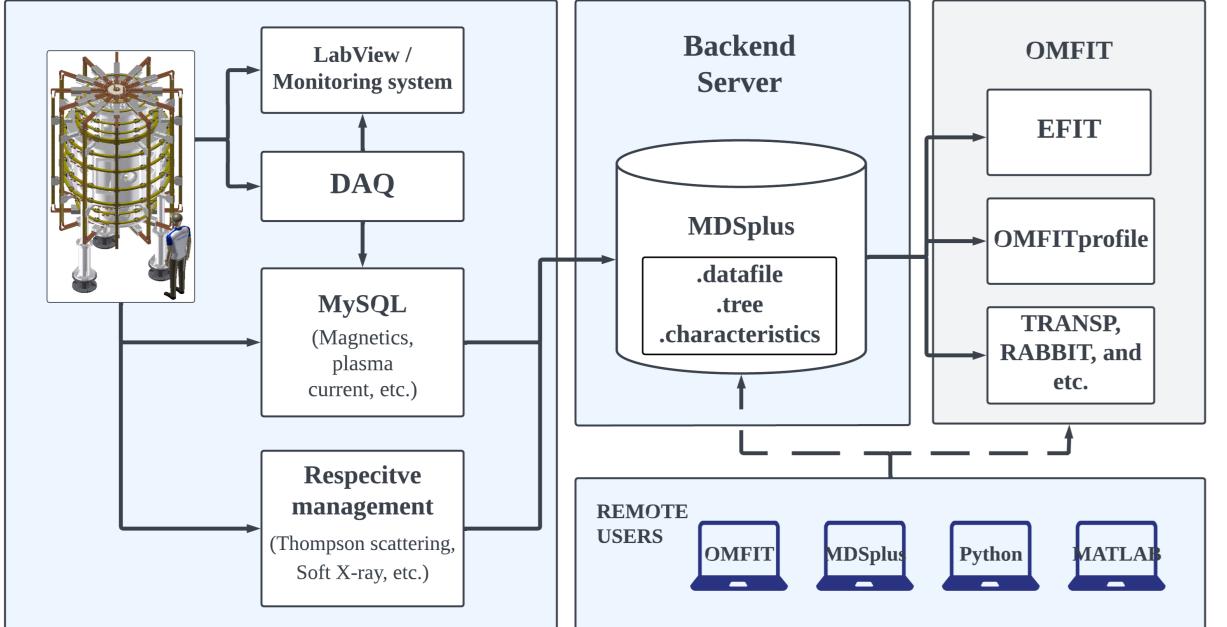
- Develop one centralized and compatible database system
- > Introducing a new data structure (ODS/IDS) and backend server (MDSplus)
- Implement integrated workflow from the experiment to simulation
- > Introducing the analysis suite (OMFIT)
- Create a feasible workflow from experimental data to simulation code (Stability, Transport)





### 2. Overall scheme

#### 2.1. Overall workflow with VEST database system



- All collected data stored in one integrated server, MDSplus with its own optimized tree structure for VEST experiment data
- Directly deal with Python, Java, Matlab and many other tools
- OMFIT, analysis suite, receive data directly from MDSplus in the form of ODS
- In addition to EFIT module, which was previously developed simulation module, constructed OMFIT profile workflow to obtain kinetic profile

Fig. 4. Overall workflow of improved VEST database system.

#### 3. Improved database system - MDSplus

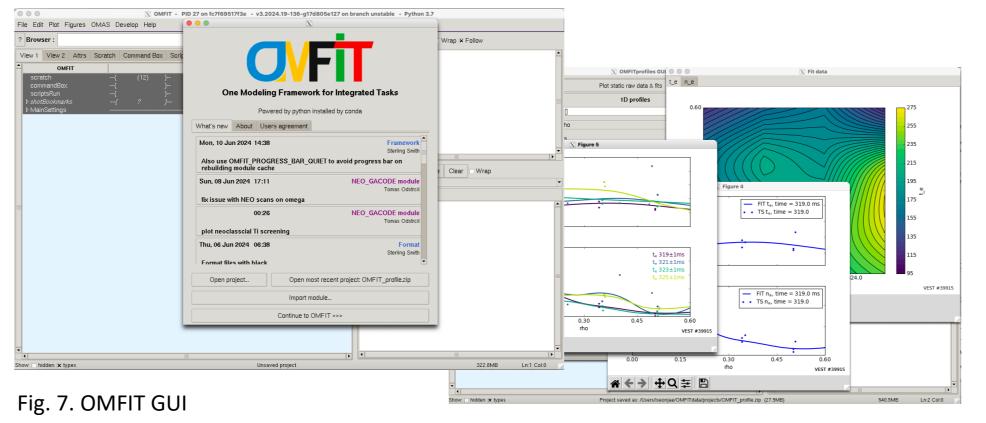
#### 3.1. MDSplus

 MDSplus : conventional database backend in fusion

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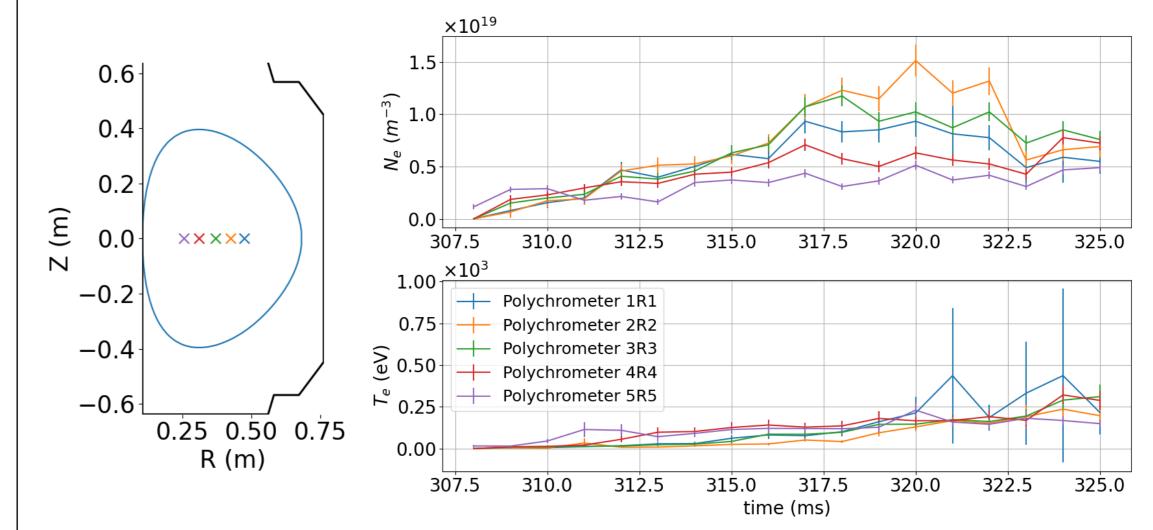
#### 4. Analysis suite - OMFIT

#### 4.1. OMFIT(One Modeling Framework for Integrated Tasks)

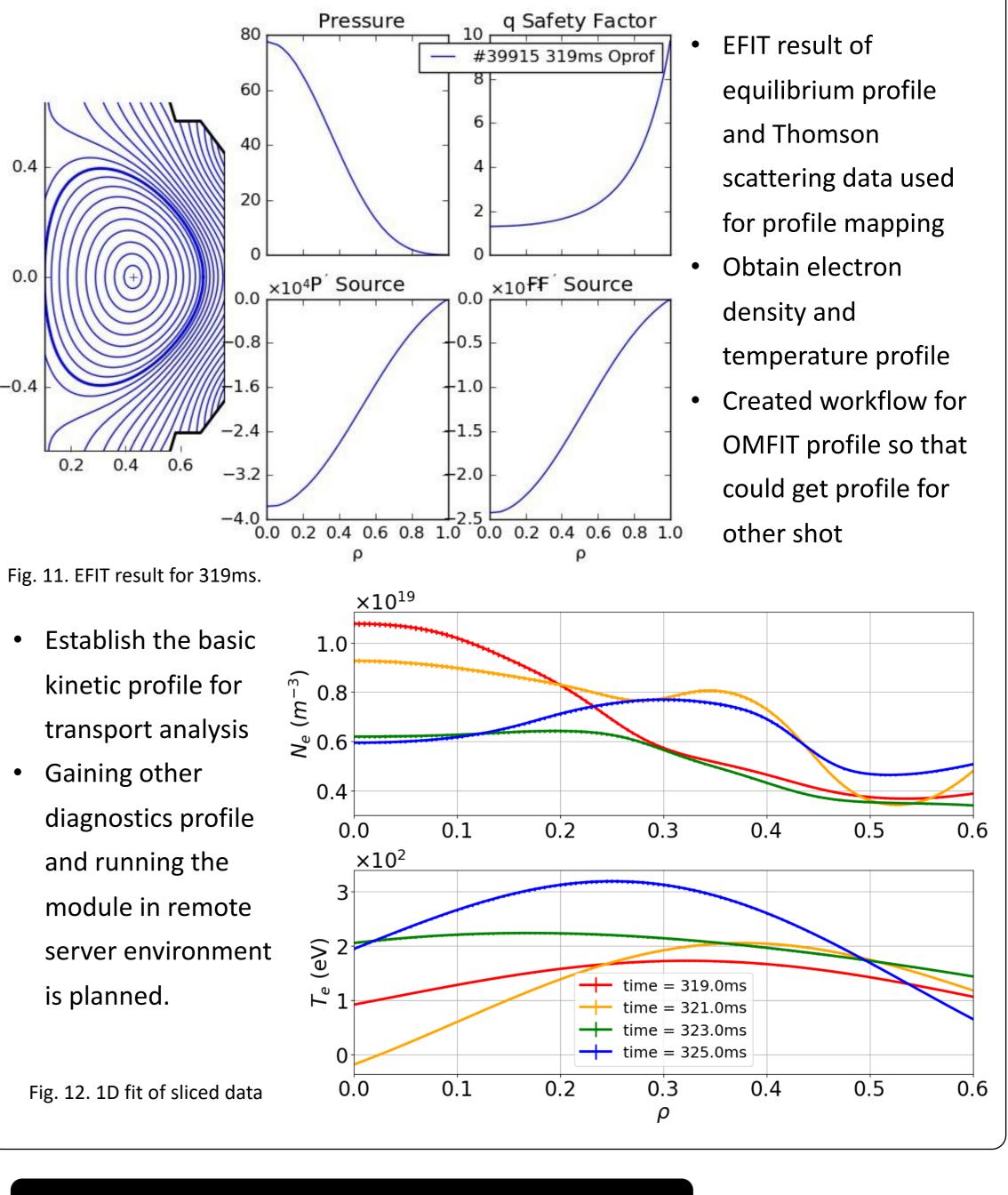


#### **5. OMFIT profile**

#### **5.2. OMFIT profile result**



#### Fig. 10. Thomson scattering location and measured data in time series.



- Enable to store all the data from a shot with optimized structure to VEST in one tree
- Standardized data structure was used to design tree structure and currently accessible in VEST server system.
- Using the previously mapped ODS data, ODS data could be stored in this tree structure. (Compatible with IMAS directly)

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Fig. 5. Shot access by jTraverser.

#### **3.2.** Application services in MDSplus

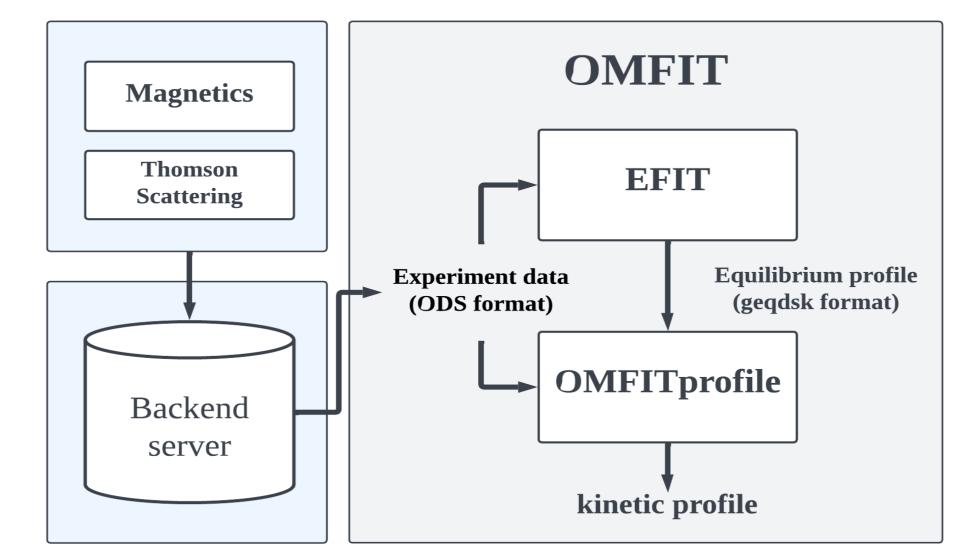
Example shot #39915 in VEST MDSplus backend server

	<pre>mdsplusadmin@vestserver:~\$ ls</pre>	[TDI> mdsconnect("localhost:8000")	command 'mdig'
Current Tree structure	[IMAS KSTAR_tokamak_simulator OMFIT-s		
Quick guide for MDSplus tree	jscope mdsip-local.log public jScope MDSplusTutorial-master simular mdsplusadmin@vestserver:~\$ module load 1		
Subtree vs Structure	[Loading IMAS/3.40.0-4.11.8		
Device	Loading requirement: java/jdk/1.11.0 m Warning: using IMAS_HOME from environmer mdsnlusadmingwestserver: _\$ mdsin _s _n &		
Editing tree structure	<pre>[sr/local/mdsplus/etc/mdsip.hosts Sat Jun 22 13:08:04 2024 (4) (pid 147267</pre>	70) Connection received from vestadmin@localhosi	
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Authority fo	est_VEST_gen.ipynb 🗳 test.py 🗙 {} 39915_eddy.json	nection received from vestadmin@localhos	
<pre> test.py &gt;</pre>			
	.Tree("ids",399150001,"readonly")	inection disconnected from vestadmin@local	
3 print(vest_tree) Using jTravers 4 em =vest_tree.getN 5 print(em)	de("EM_COUPLING")	Compiler syntax: AND_ Native puthon: True	
6 MA=em.getNode("MUT	AL ACTIV")		

- OMFIT : tools for data managing and simulations in an integrated workspace using a GUI
- Provide integrated framework for simulation and modeling compatible with ODS/IDS structure
- > Currently, equilibrium reconstruction through EFIT and Thomson scattering kinetic profile through OMFIT profile is available

#### **5. OMFIT profile**

#### 5.1. OMFIT profile



#### 6. Conclusion & Future work

- To establish the main goal, MDSplus and OMFIT connection was successfully done.
- Using the mapping function from MySQL to ODS and from ODS to MDSplus is accomplished for some data.

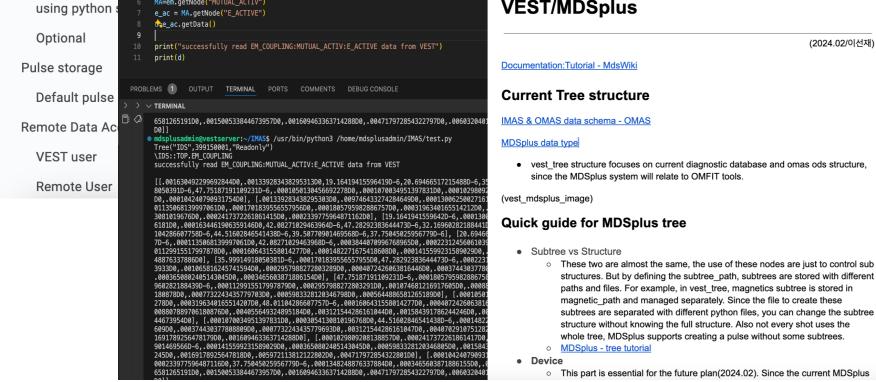


Fig. 6. Shot access by python and other languages.

- VEST MDSplus is accessible with Python, TCL, TDI, Matlab, jTraverser and etc.
- Currently, it's only open to localhost server users and will be open to remote users not in SNU
- Fig. 8. Data flow inside OMFIT.
- OMFIT profile : tools for obtaining kinetic profile, works as the input for transport analysis
- EFIT result g-file and ODS mapped from raw data fetched only with the shot number in OMIFT tool
- Support one-dimensional and two-dimensional fitting, providing timeevolution profiles
- Providing Thomson Scattering profile data that could directly interact other simulations is successfully adapted.
- Following the previously implemented module EFIT, construction of OMFIT profile was established
- Provide an optimized framework and workflow resolving the existing bottleneck due to gap in simulation and experimental data
- For the future works
- To make remote user connection without any security issue, by making python module connection for easily accessible open database
- Mapping the data no implemented in current ODS format
- Make saving routine for the simulation results from the remote users
- Connection to other simulation tools such as TRASSIC, TRANSP, and etc.
- Connection from MDSplus to remote OMFIT
- Overall code refactoring by using OOP concept



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