

Progress in the Development of an Integrated Modeling Tool to Support DIII-D and EAST

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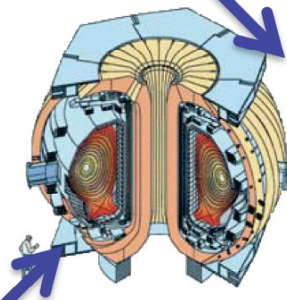
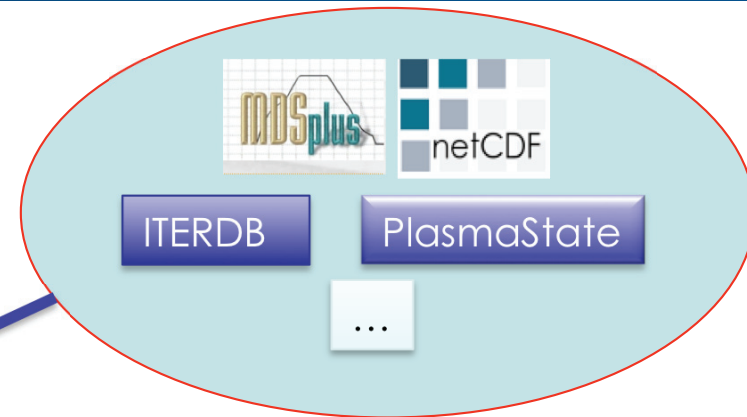
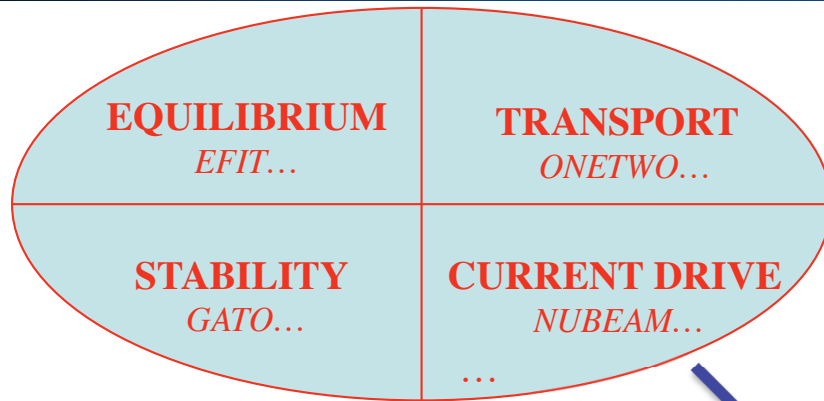
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OUTLINE

- **IMFIT** is developed to provide an efficient integration platform to support tokamak research and operation
- Current version employs a **PYTHON-based** framework to manage tasks with a **TASK-FLOW** based execution model
- Analysis codes and tools are integrated into **IMFIT** through different **PHYSICS** and **SERVICE MANAGERS**
- Extensive GUI and web-based support are developed for ease of use
- **IMFIT** is being released for DIII-D and EAST

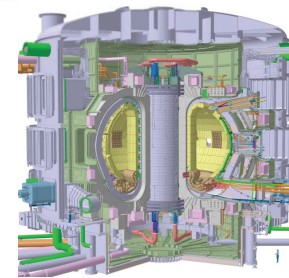
IMFIT Is Designed To Efficiently Integrate Different Physics Modules To Support Multiple Devices For Data Analysis And Modeling



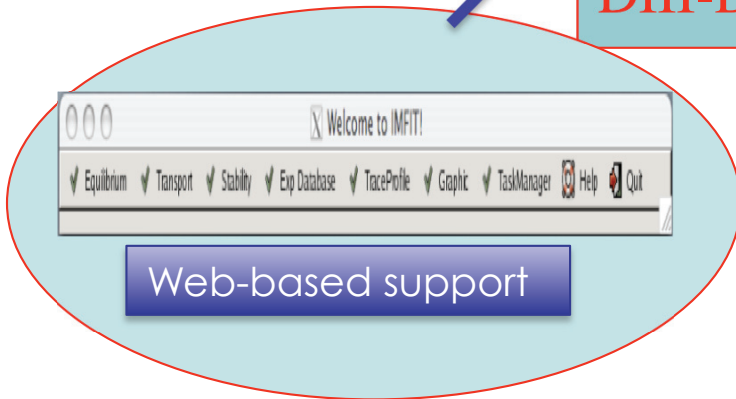
DIII-D



EAST



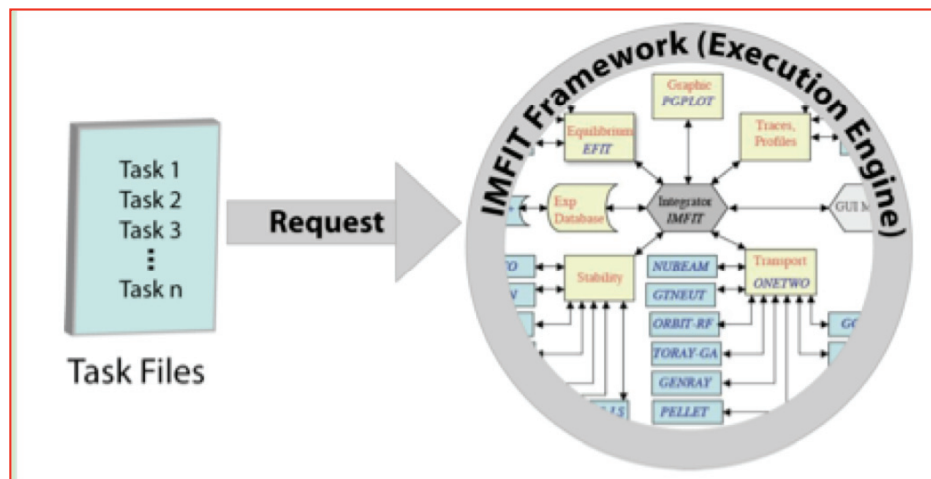
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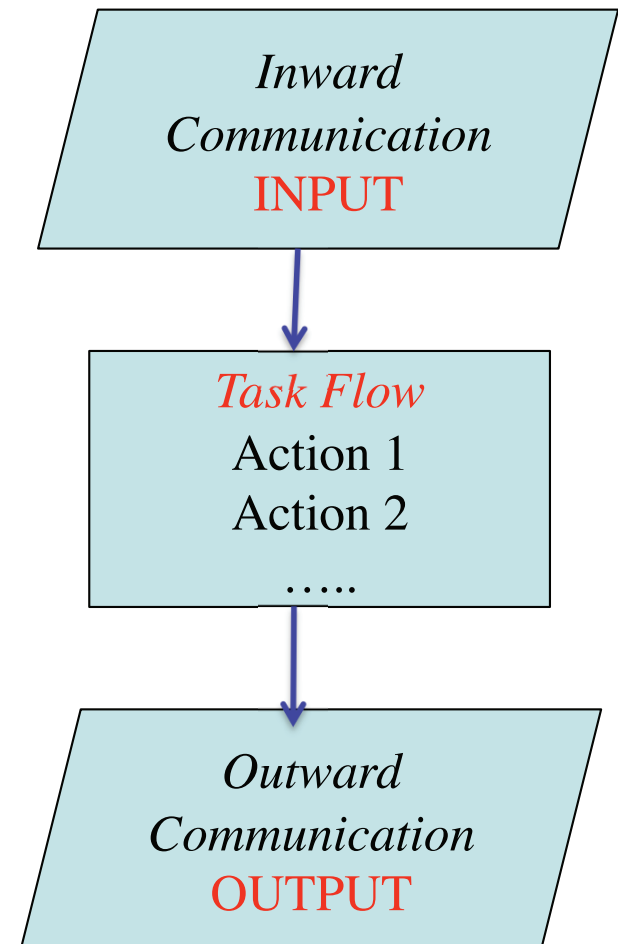
Efficient Integration Platform to Support Tokamak Research and Operation

IMFIT Manages Tasks Using PYTHON Task-Flow Based Framework and Task File

- **Framework is such an architecture that:**
 - provides standard logic for managing various physics codes
 - provides certain rules for development of components
- **Tasks are generally defined in terms of *Task Flow, Communication* in Task File**
 - *Compound Task*: combination of simple tasks
- **Framework reads in *Task File* and dynamically generate a sequence of actions**

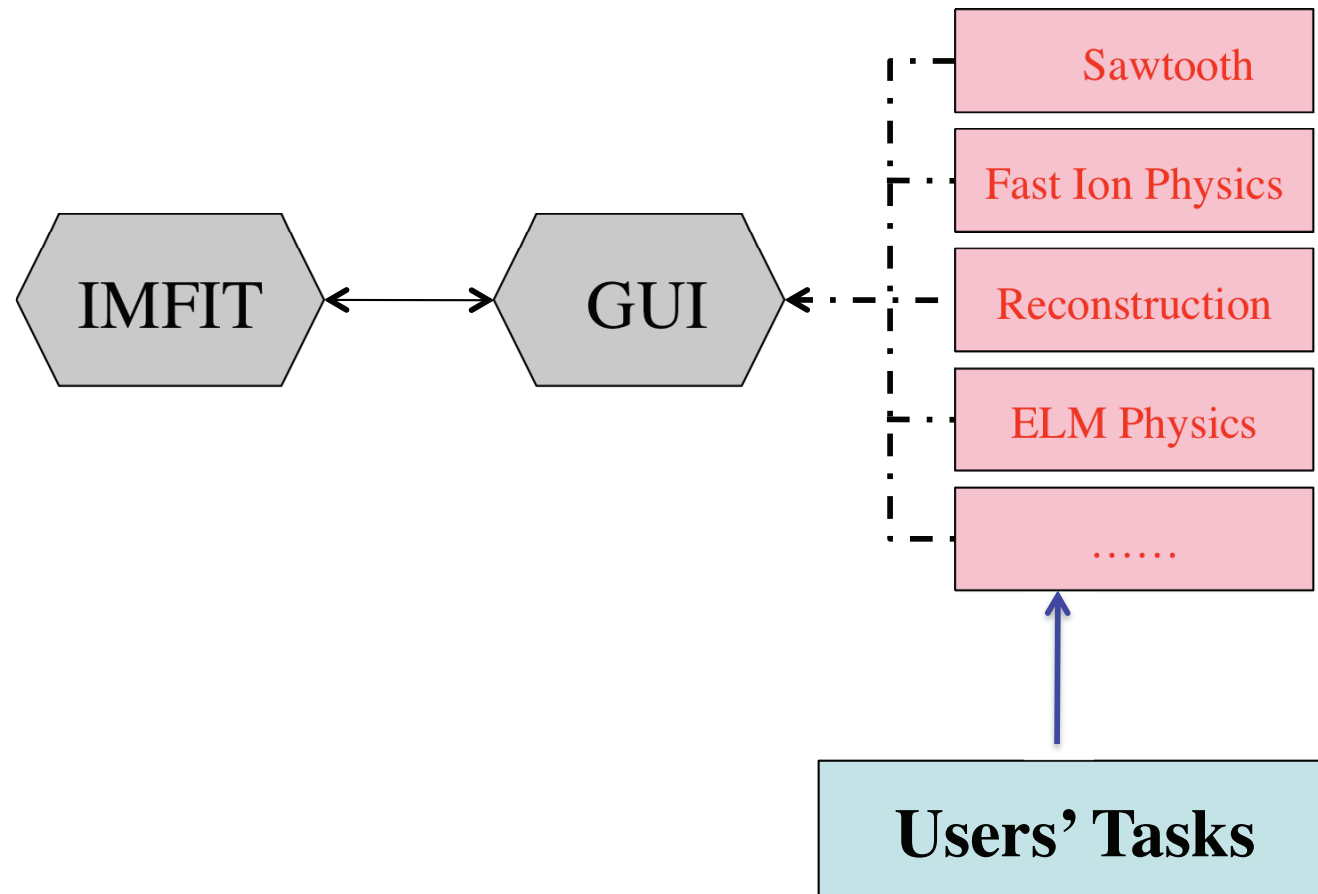


Simple Task Description



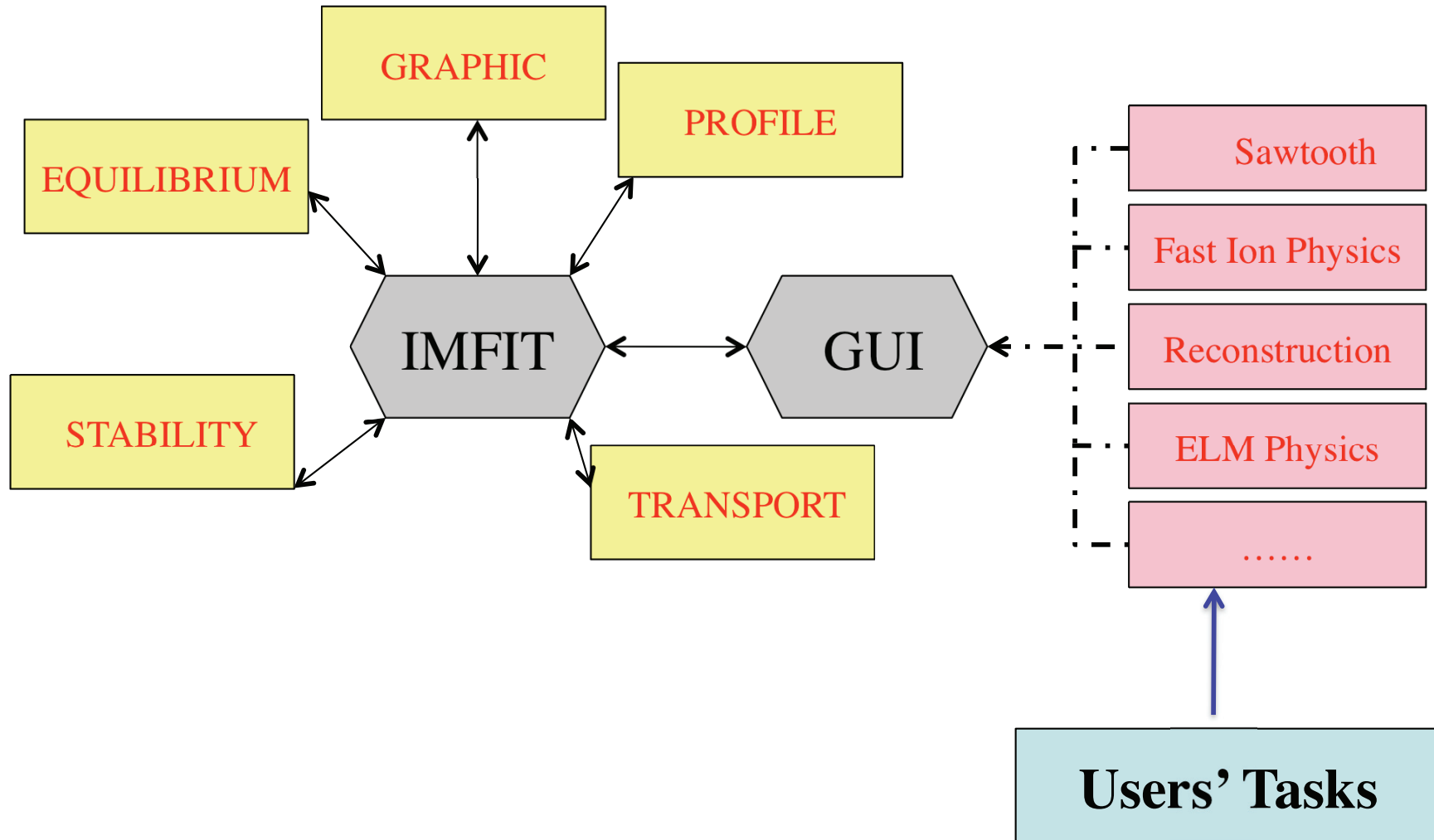
Users Interact With IMFIT Framework Through GUI Manager and Task File

- GUI manager receives the Task and its Task File information
- Task file information is sent to IMFIT Framework for processing and further action



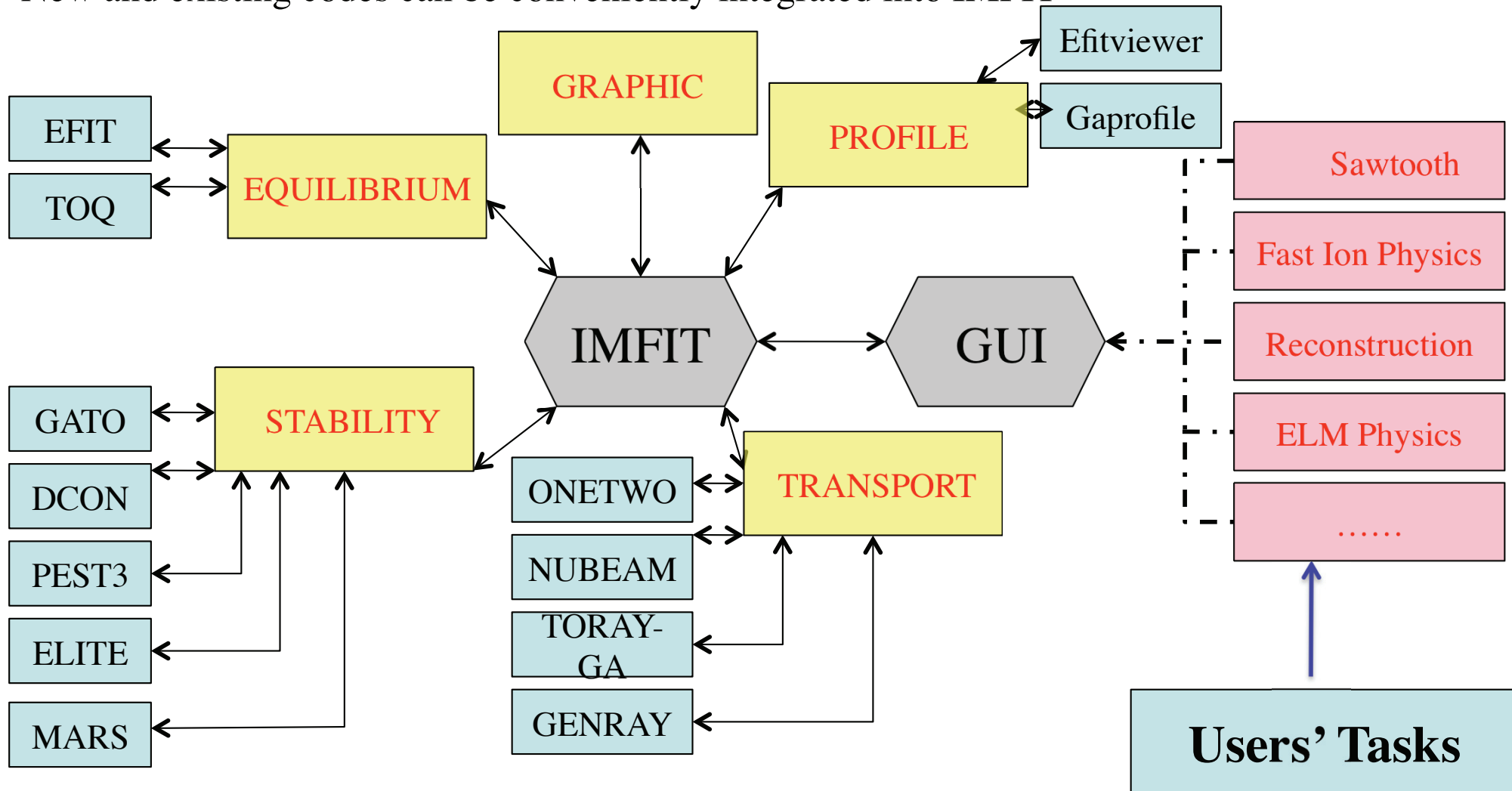
IMFIT Assigns Tasks To Responsible Managers Based on Task File Received

- Each Manager maintains its own Task List and can interact with each other



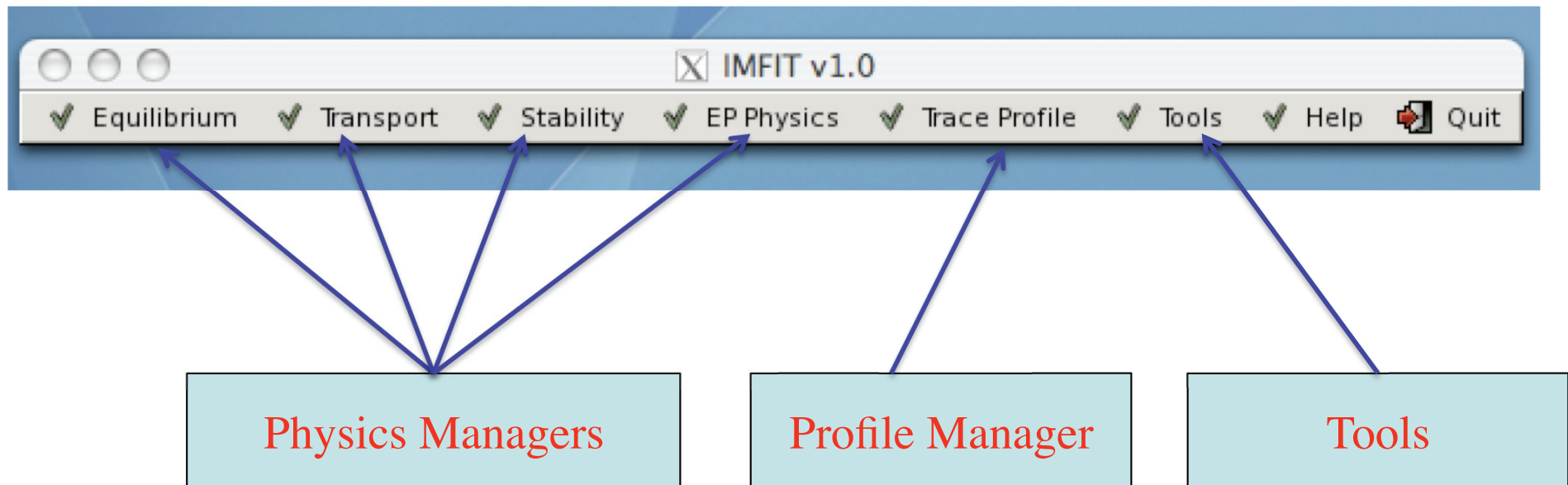
Managers Carry Out Assigned Tasks By Calling Corresponding Component

- New and existing codes can be conveniently integrated into IMFIT



Extensive GUI Support Is Developed For Ease Of USE

Based on PYGTK, open source graphic user interface toolkit for PYTHON



**See IMFIT JP8.00086 Poster for more details
On Tuesday Afternoon**

Extensive GUI Support: Kinetic Reconstruction Example

The screenshot displays the IMFIT v1.0 application window. The main menu bar includes: Equilibrium, Transport, Stability, EP Physics, Trace Profile, Tools, Help, and Quit. A secondary menu bar shows the EFIT option. The Equilibrium Fitting window is open, showing the following configuration:

- Work Directory: /task/imd/renq/equil_demo
- Tokamak Type: DIII-D
- EFIT Version: 65x65
- EFIT Mode: INPUT --- 5
- Shot Number: 133221
- Start Time: 2500
- Time Step: 1
- Time Slice: 1
- Input:SNAP FILE: /task/imd/renq/equil_demo/efit_snap.dat

The window also features a Kinetic/Stability toggle, a toolbar with Generate, Execute, Check, Comment, View Results, and Quit buttons, and a terminal window with the following output:

```
[1] You chose EFIT mode 2: File
    INPUT: KFILE
    OUTPUT: equilibrium a,g, and m files
[2] You are gonna run kinetic reconstruction
[3] You chose EFIT mode 5: INPUT
    INPUT: measured data, efit_snap.dat file
    OUTPUT: KFILE for EFIT mode 2
[4] You chose /task/imd/renq/equil_demo/efit_snap.dat as the input file
```

Extensive GUI Support: Kinetic Reconstruction Example

The image displays the IMFIT v1.0 software interface. The main window has a menu bar with options: Equilibrium, Transport, Stability, EP Physics, Trace Profile, Tools, Help, and Quit. A sub-menu for 'EFIT' is open, showing a list of options. The 'Kinetic Reconstruction' window is active, showing the following settings:

- Work Directory: /task/imd/renq/equil_
- Tokamak Type: DIII-D
- EFIT Version: 65x65
- EFIT Mode: INPUT --- 5
- Shot Number: 133221
- Start Time: 2500
- Time Step: 1
- Time Slice: 1
- Input: SNAP FILE /task/imd/renq/equil_

The 'Kinetic Reconstruction' window has a title bar and a menu bar. The main area contains the following options:

- Profile Fitting
- ONETWO RUN
- Make Kinetic Kfile

Below these options are three buttons: Profile Fitting, ONETWO Run, and Make Kinetic Kfile. The Work Directory field is set to /task/imd/renq/equil_demo, with a 'Select' button next to it. At the bottom of the window are two buttons: GAPROFILES and MDS+ Fetching.

The bottom of the IMFIT v1.0 window shows a status bar with 'Kinetic' and 'Stability' tabs. Below the status bar are buttons for 'Generate', 'Execute', 'Check', 'Comment', 'View Results', and 'Quit'. A text area displays the following log output:

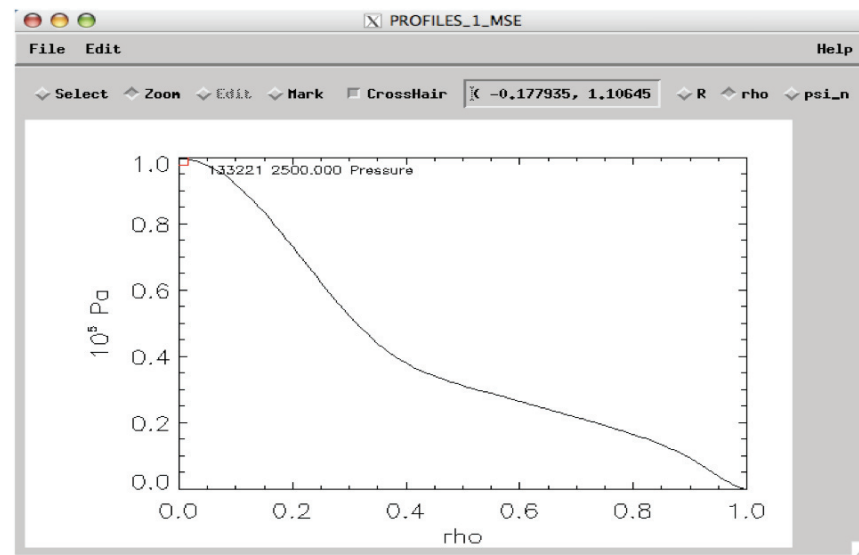
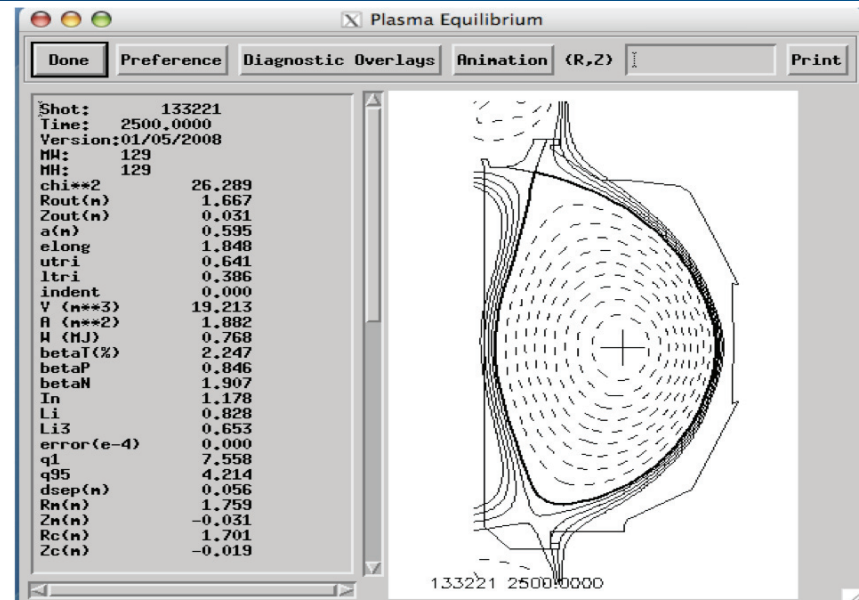
```
[1] You chose EFIT mode 2: File
    INPUT: KFILE
    OUTPUT: equilibrium a,g, and m files
[2] You are gonna run kinetic reconstruction
[3] You chose EFIT mode 5: INPUT
    INPUT: measured data, efit_snap.dat file
    OUTPUT: KFILE for EFIT mode 2
[4] You chose /task/imd/renq/equil_demo/efit_snap.dat as the input file
```

Extensive GUI Support: View Results Using Efitviewer

The Efit Viewer GUI window shows the following interface elements:

- File** menu and **Help** button.
- Select EFIT from:** File, MDSplus, and a dropdown menu showing 'DIII-D'.
- Selected:** 133221 t = 2500.000
- Path:** -data/task/ind/renq/equil_dend [Update]
- Selected:** ...ta/task/ind/renq/equil_demo
- Select times with:** a, g, t, n OR Any File
- Table:**

Path	Shot	Time (ns)
..	133221	02500
k1	122831	
onetwo		
tmp		
- Buttons:** 133221, 02500, Update list of shots/directories
- Select Plots:**
 - plasma_equilibrium
 - fitting_quality
 - profiles_1_mse
 - ne_te_ti_vrot
 - profiles_2
 - pointnames_vs_time
 - kinetic_pressure
- Slices Overlay:** on, off, Set as ref, Run EFIT

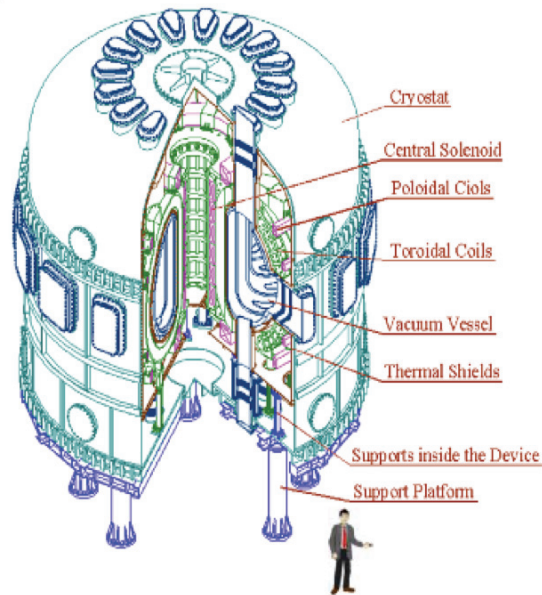


IMFIT Is Applied On EAST For Advanced Tokamak Scenario Development

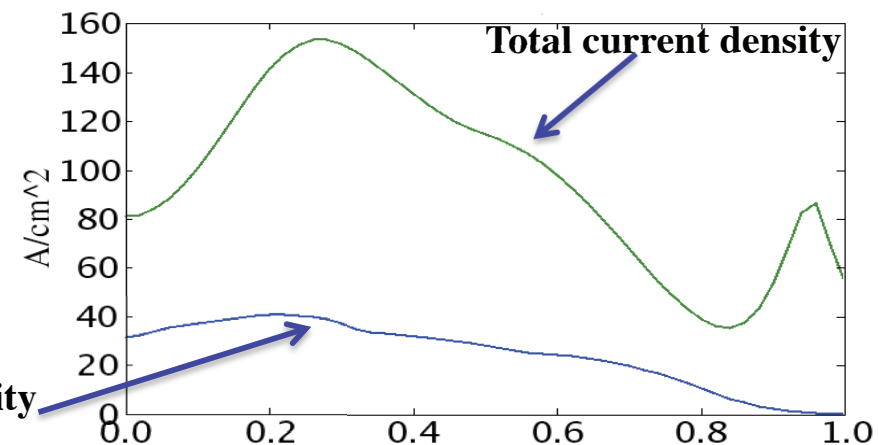
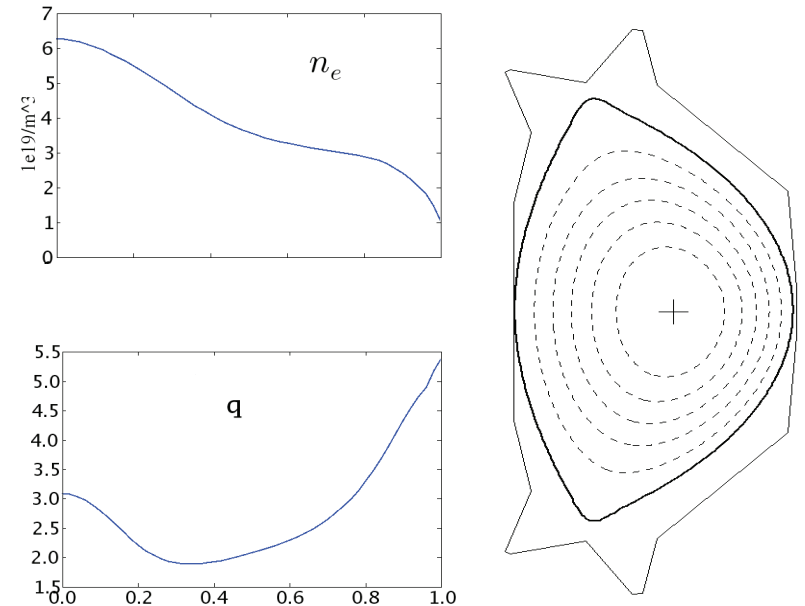
Main Parameters of the EAST

	Nominal	Upgrade
B_0	3.5 T	4.0 T
I_P	1 MA	1.5 MA
R_0	1.7 m	1.7 m
a	0.4 m	0.4 m
R/a	4.25	4.25
K_x	1.2-1.5	1.5-2
δ_x	0.2-0.3	0.3-0.5

Pulse length: 1000 s
 Configuration: Double-null divertor
 Single-null divertor



NBI Simulation Using IMFIT



- EAST is moving forward towards research phase
- See Professor Li's invited talk poster BI3.0003 Monday afternoon for more details
- IMFIT is being released for DIII-D and EAST

Beam-driven current density

SUMMARY/FUTURE WORK

An Integrated Modeling and Fitting Tool *IMFIT* Based on Python Is Being Developed to Support DIII-D and EAST Research

Primary Goal:

- To increase experimental data analysis productivity and streamline analysis
- To allow new physics modules to be conveniently integrated to ease theory-experiment comparison

Future Work:

- Development of compound tasks
- Improvement of branching and error handling of Framework
- Improvement of physics codes as well as development of tools to facilitate analysis