Web Interfaces to Fusion Codes

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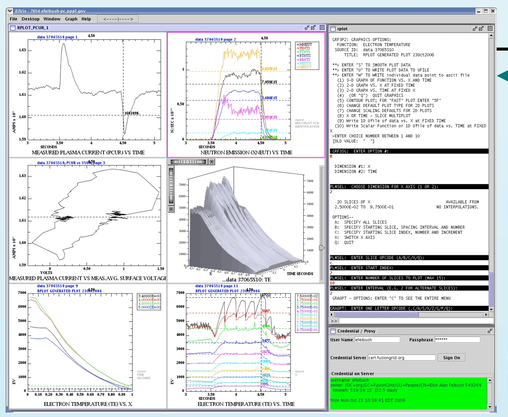
1. Visualization Clients

1a. TRANSP Results

Interactive scientific graphics. Multiple graph windows.

Requests data from server with TRANSP run in RPLOT.

Java applet: ElVis runs in browser. No software installed.



1b. Reflectometry Visualization

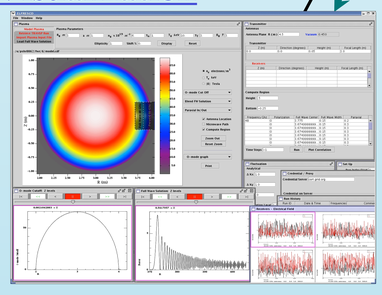
Prepare input, submit run & monitor results.

Display simulated waves downloaded from URL.

Added interactive graphics & visualization without changing existing Fortran simulation programs.

Java applet, runs in browser.

Portable, no software installed.



Requests

Graph Objects

Explore Data Interactively

Security Panel

2. HTTP Web Server

Access from anywhere on Internet.

Receives requests from visualization clients. Forwards servlet requests through PPL firewall. Returns graph objects.

Multi-Tier Architecture Distributes Functionality

Firewall

3. Portal Server

Register sessions.
Manage credentials.

Create graphs.

Collaboration among clients.

Run history.

Visualization Servlet

Credentials

Globus job-submit

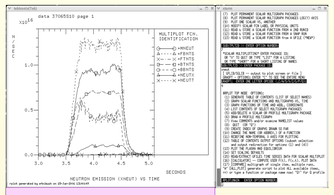
4. myProxy Server

X.509 Certificates

Certificates stored on remote myProxy server.

Convenient for user:
Enter name and password in security panel instead of managing files.

5. Compute Services



5a. TRANSP - RPLOT

Used at several institutes world-wide.

New physics models being added but still using legacy plotting code.

Access analysis runs stored in MDSplus.

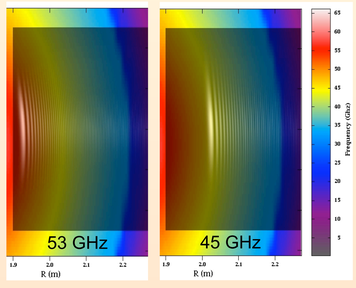
Scripted to formulate graphs of fusion data.

ElVis API sends data to visualization client with minimal changes to Fortran code.

ElVis API

User Files

5b. Full Wave Simulation



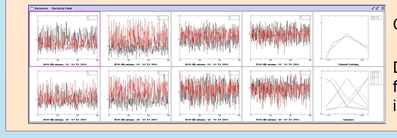
Blending simulated reflection with predicted reflection locations.

Simulated 53 Ghz wave propagates farther than 45 Ghz wave for O-mode cut-off:

$$f_o = \sqrt{\frac{n_e}{1.24x10^{16}}}$$

$$n_e = \text{electrons}/m^3$$

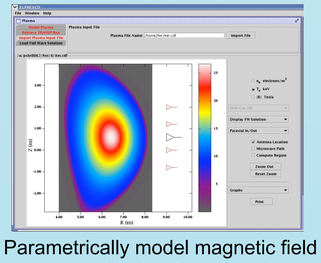
Correlation Graphs



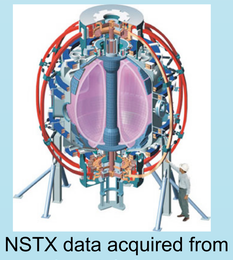
Correlation of 4 frequencies at 2 receivers.

Decreasing correlation indicates fluctuation and turbulence areas in the plasma.

Input Plasma Data Sources

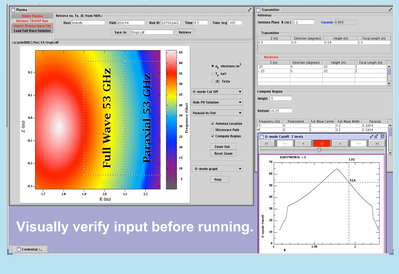


Parametrically model magnetic field geometry, density, & temperature. Or programmatically simulate new designs, such as ITER.



NSTX data acquired from experimental shots, processed & stored in MDSplus database.

Graphical Input



User positions transmitter & receivers outside of plasma.

Interactive crosshair to find reflection layer predicted in O-mode cut-off graph.

Guides user in specifying frequency to simulate.

Elfresco – **The Full Wave Reflectometer Simulation Code – w3.pppl.gov/fwr**

ElVis Scientific Graphics – w3.pppl.gov/elvis