# MDSplus Integration at TCABR Tokamak: Current Status

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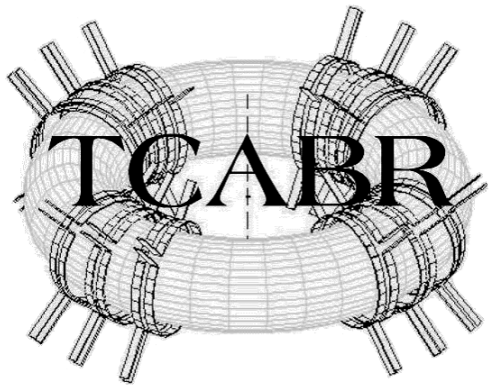


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# Outline

# Introduction

## Scientific experiments

- Heavily focused on collaborations
- Remote access to data
- Remotely controlling the experiments

## Standardized computational tools are becoming extremely important

- MDSplus

## Each laboratory of plasma physics

- Proprietary scheme to control and data acquisition system

## Tokamak TCABR

- Distributed system scheme
- Use of modern browser technology
- MDSplus + LabVIEW + WebServer + HTML5 + JavaScript

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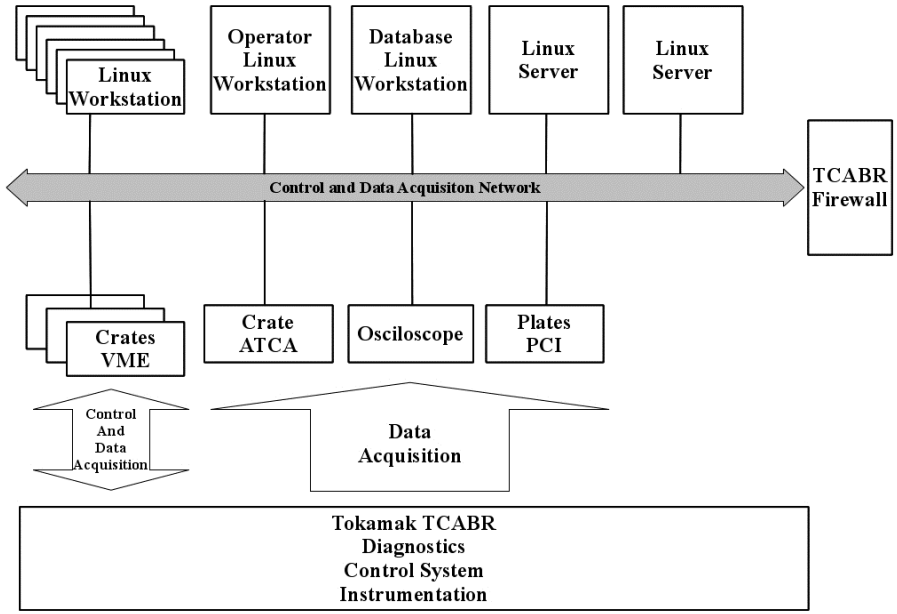
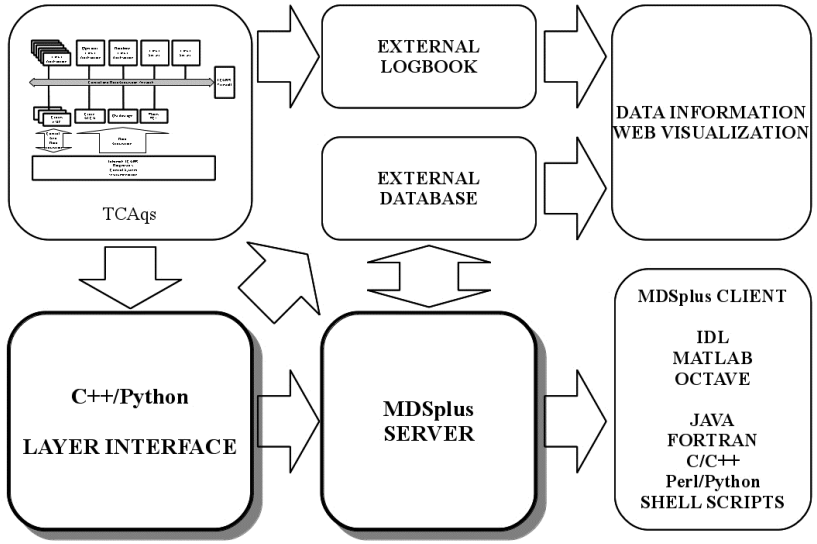
# Former CODAS

1. Legacy Proprietary System
   - Until the year 2010
   - VME, ATCA, Intel CPU
   - Mainly Linux OS
   - ADCs modules of 12-bit
   - Software: C, C++, Perl
   - All system behind a firewall

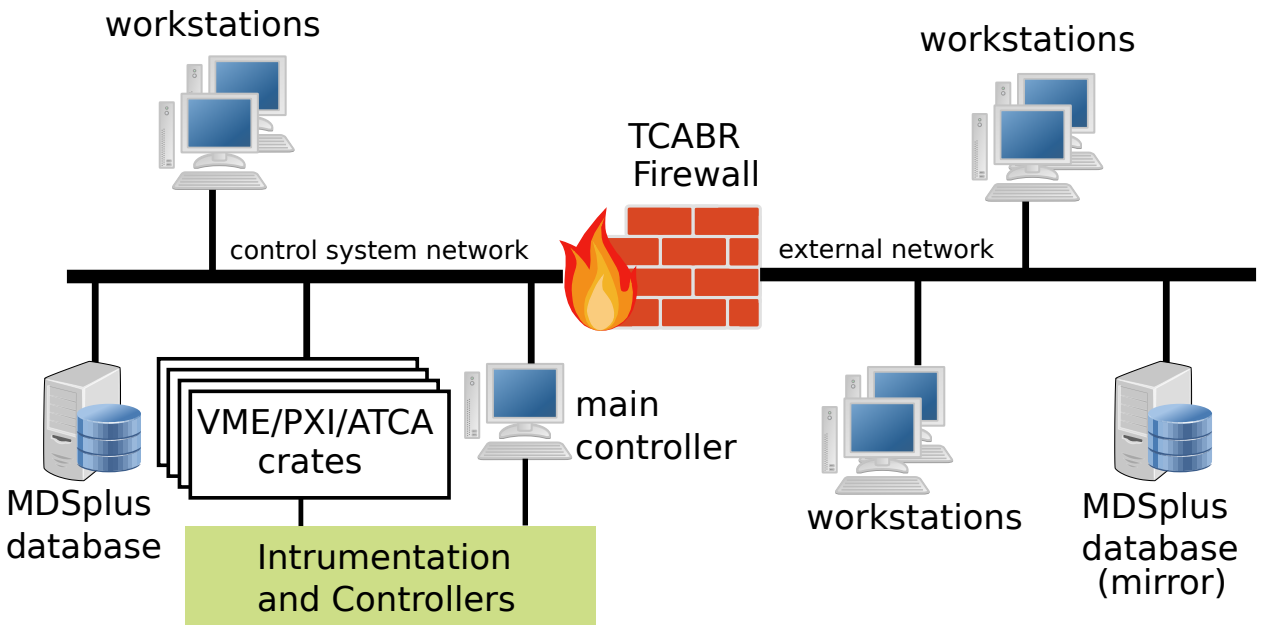



1. CODAS Update First Phase
   - MDSplus
   - Framework
2. CODAS Update Second Phase
   - MDSplus
   - Distributed work
   - Data Visualization



# Current System

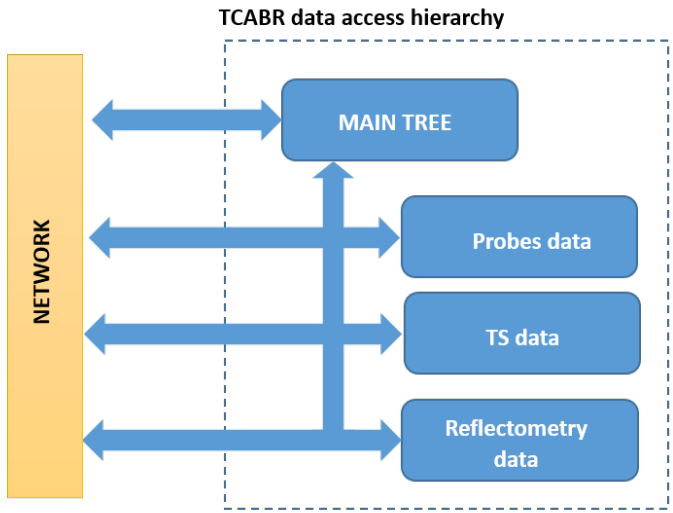
1. Simplified current CODAS system




2. Biggest challenge
   - New features and new technologies + Legacy drivers
   - Tokamak TCABR - How to handle this?
     - Centralized and Serialized CODAS –> Distributed System
     - Each/System diagnostic –> responsible for it's own MDSplus tree

# Current System: MDSplus and Distributed work

1. Simplified structure of the new TCABR data access hierarchy.




2. Each rectangle represents a whole MDSplus Tree populated with all data and configuration of the tokamak diagnostic. The data can be accessed direct from the main MDSplus tree, by means of nodes full path or aliases, or individually

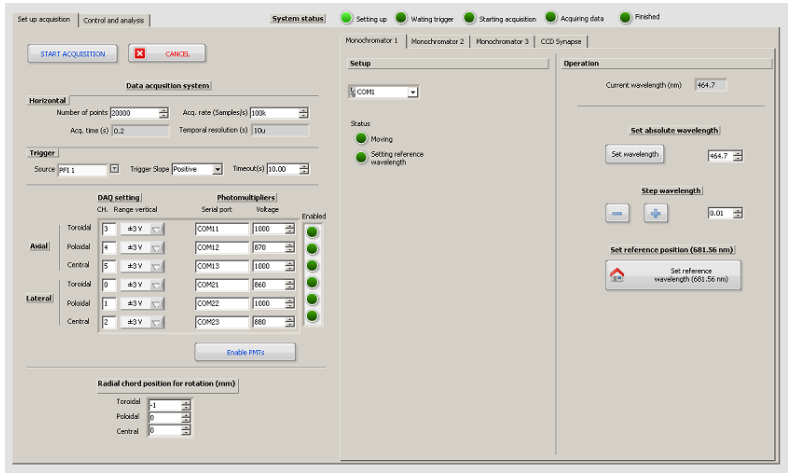
# Current System: LabVIEW

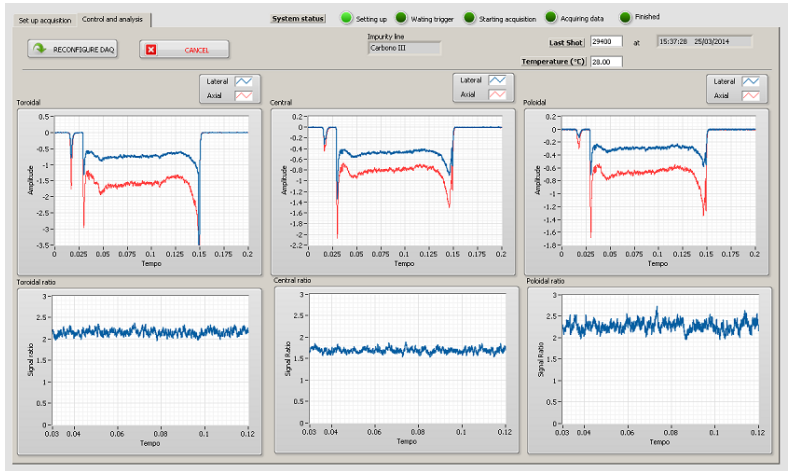
1. LabVIEW is graphical programming that has been used for wide applications in a multitude of instruments field like optics, and plasma physics as well.
2. The advantage of the LabVIEW platform over textual programming remains in its fast programming, readable source code, and instrumentation oriented interface due to its focus on instrument control.
3. Moreover, the MDSplus was integrate with LabVIEW by means of LabVIEW Object Oriented programming interface (VLOOP) [1]

[1] G. Manduchi and E. De Marchi and A. Mandelli, Stillerman, Fusion Eng. Des. 89, pp. 775 - 779

# Current System: LabVIEW

1. LabVIEW allow both setting up the diagnostics as well and from a first glance of que acquired data to a complex post-analysis.
2. The setting up can be interfaced by TCP/IP messages from an remote computer.
3. Just after the data acquisition and post-processing, the LabVIEW create a populate the diagnostic specific MDSplus tree that is structured to reflect the diagnostic own characteristics. Then the database is exported to the main MDSplus database where it become available to others scientists.



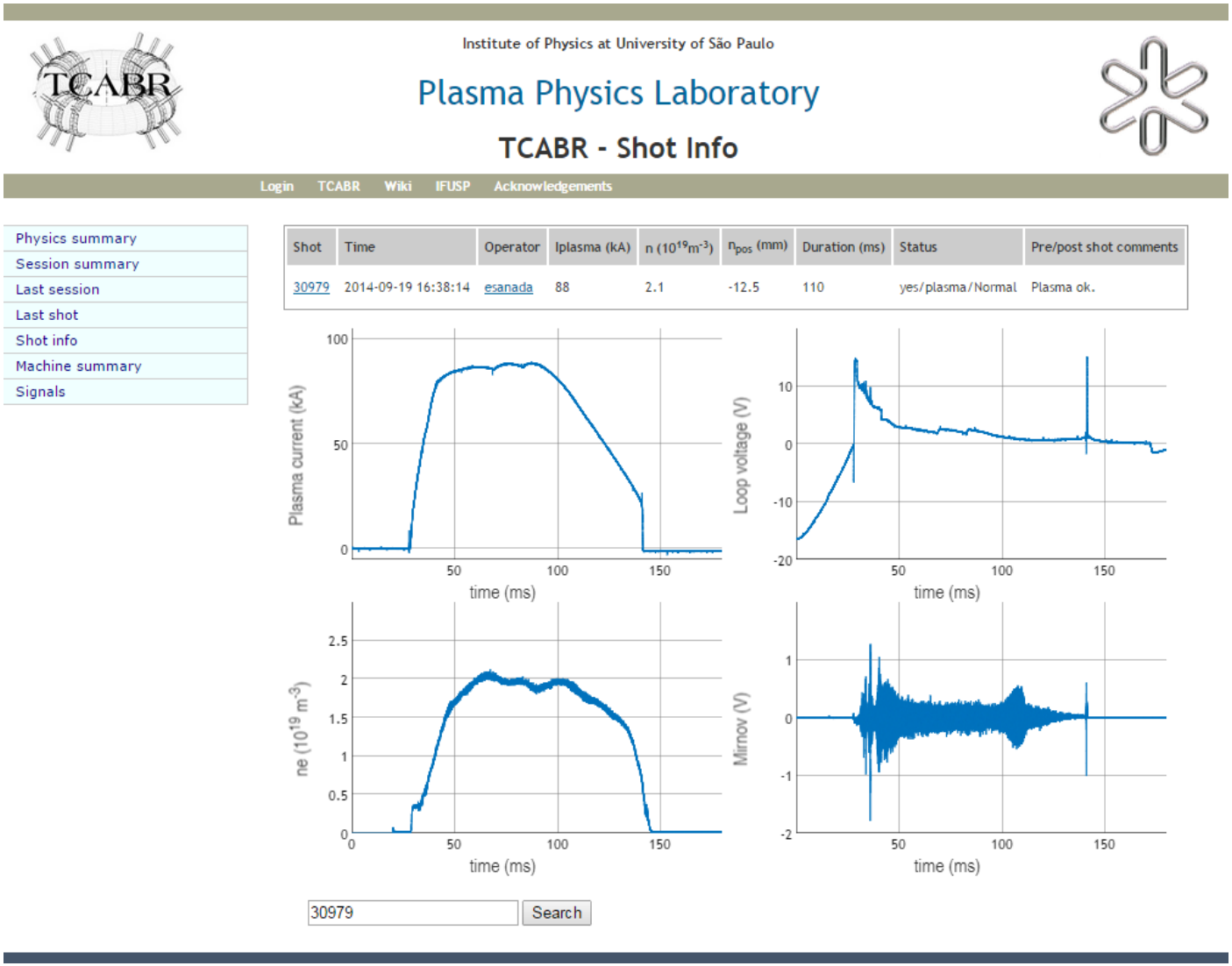
# Current System: Data Visualization

1. Traditional usage:
   - Locally: jScope (java), python, MATLAB, Mathematica, etc.
2. The new WSGI developed (python-apache Gateway interface), allows recover discharge information XMLHttpRequest in JavaScript (AJAX)
   - WebScope[2] (alternative to jScope) in web browser + JavaScript
   - Others dedicated solution.

[2] G. Manduchi, T. Fredian, J. Stillerman, Fusion Eng. Des. 85, pp. 780-783

# Current System: Data Visualization

Case example: TCABR logbook.



# Current System: Data Visualization

1. Advantages
   - Simple fast implementation
   - Non-static Graphics: zoom, toggle, panning.
   - Client require just a modern web browser (HTML5).
2. Drawbacks
   - Higher network throughput, since data is not cacheable
   - All data processed in the client side (may be a problem for slow connections).
3. Depends on the amount of data, the rendering may take a few hundred of milliseconds (like our logbook signals) to a few seconds.

# Future development

1. Unified Protocol
   - Via HTTP
   - Reflectometry Diagnostic.
     - Linux
     - Python + MDSplus
     - Python control the acquisition and configuration
   - Electrostatic Probes.
     - NI Real Time DAC
     - LabVIEW + MDSplus
     - LabVIEW control the acquisition and configuration
2. HTTP Protocol
   - Web server
   - HTTP -> Python + MDSplus
   - HTTP -> LabVIEW + MDSplus

# Summary

1. Remote participation and remote access to experimental data is the main factor in the collaborative work between scientists in different laboratories around the world.
2. The implementation of MDSplus tools system has become in physics of plasmas and nuclear fusion a standard.
3. Reducing significantly development tools for Control, Data Acquisition and Data Analysis and Remote Access.
4. Tokamak TCABR
   - MDSplus system
   - Distributed System
   - Simple, fast and power Web visualization
   - Easily to improve and update