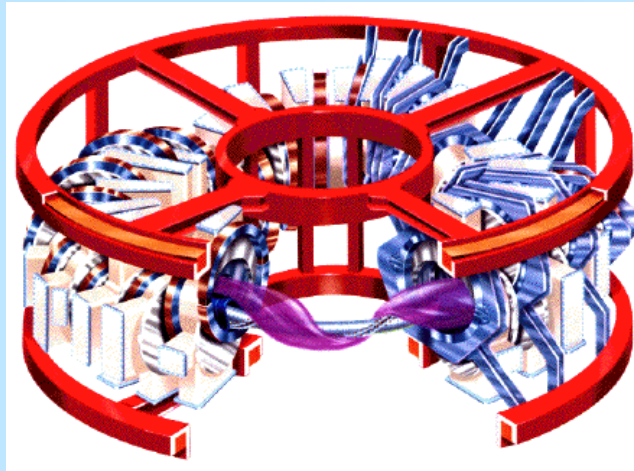


Remote operation in the TJ-II fusion device



J. Vega, E. Sánchez, A. López, A. Portas, M. Ochando

Asociación EURATOM/CIEMAT para Fusión. Madrid, Spain.

A. Mollinedo, A. Sánchez

CIEMAT. Computing Center. Madrid, Spain.

M. Ruiz, S. López, E. Barrera

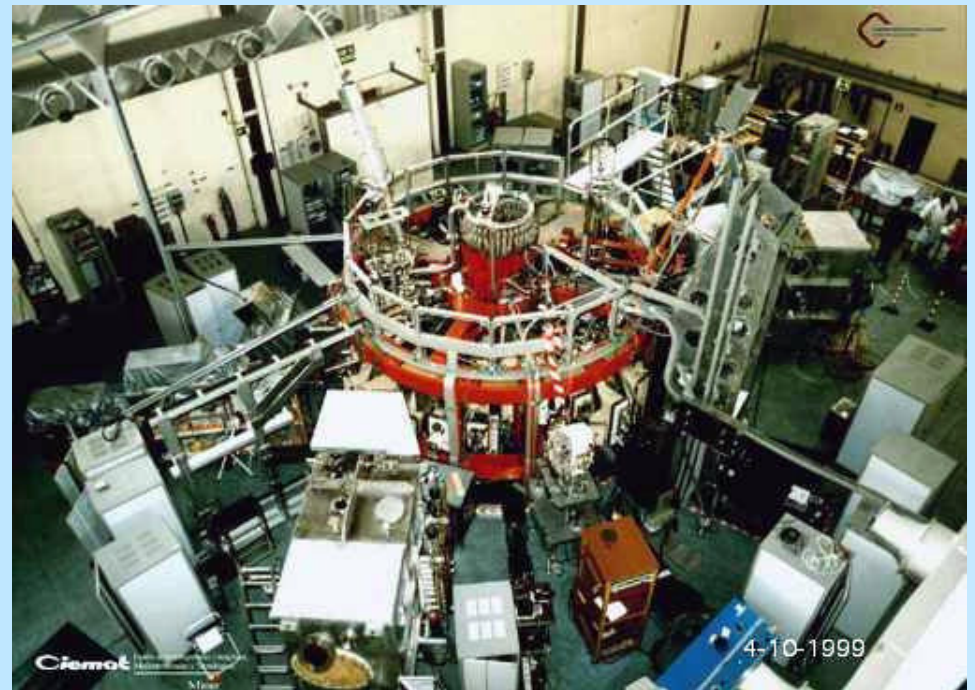
Universidad Politécnica de Madrid. Dpto. Sistemas Electrónicos y de Control. Madrid. Spain.

R. Castro, C. Fuentes, D. López

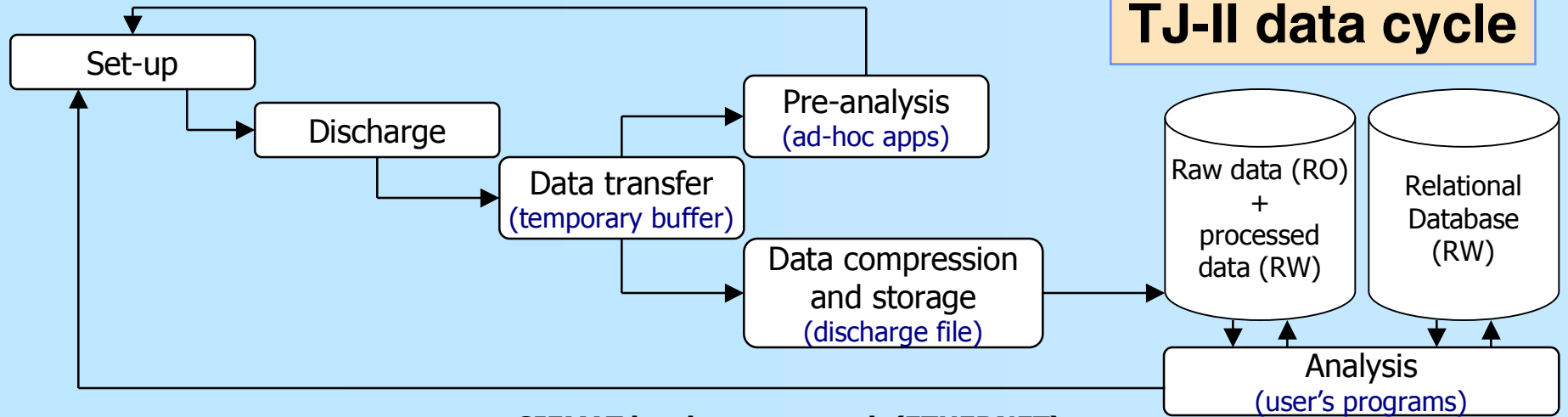
CSIC-RedIRIS. Madrid, Spain

The TJ-II fusion device

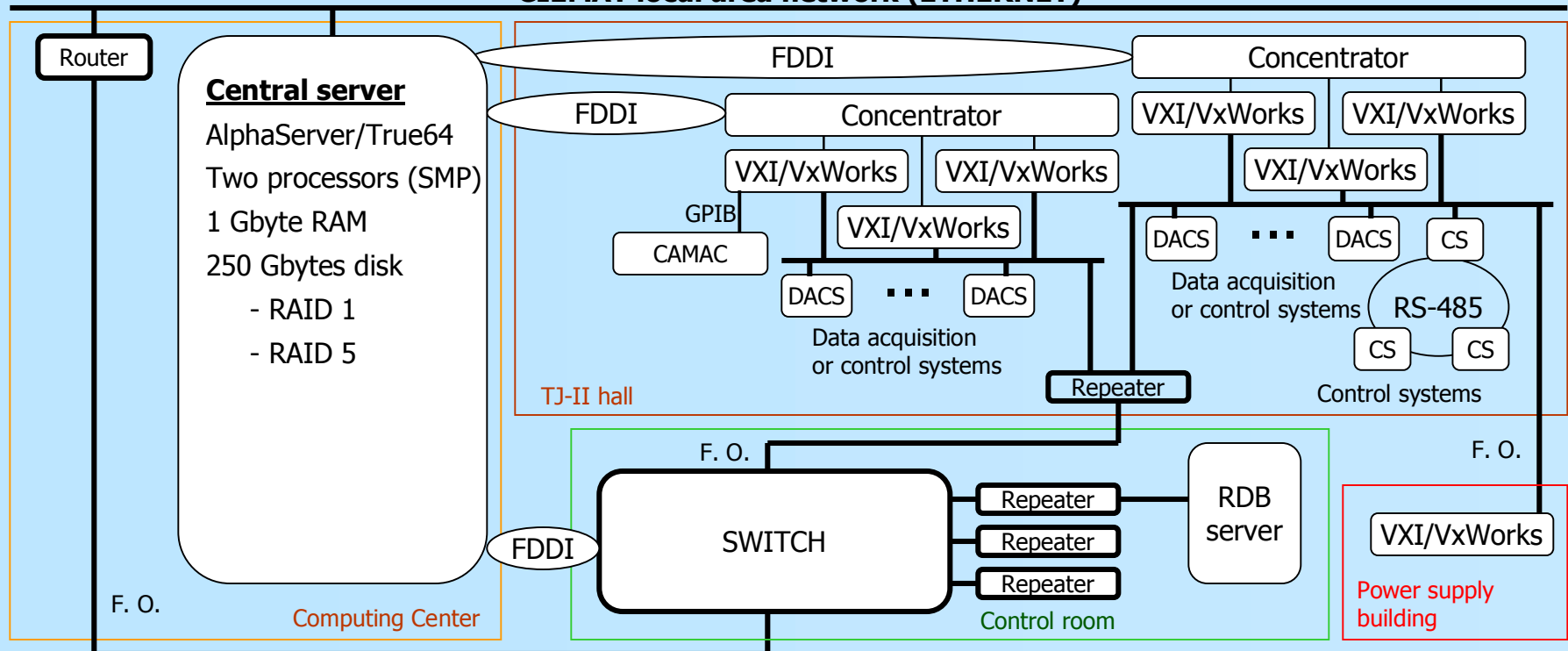
- The TJ-II heliac is a medium size helical axis stellarator located at CIEMAT (Madrid, Spain)
- Parameters
 - Major radius: 1.5 m
 - Plasma radius: 0.1-0.2 m
 - Toroidal field < 1.2 T
 - $n_e < 1.2 \cdot 10^{19} \text{ m}^{-3}$
 - $T_e < 1.5 \text{ keV}$
 - ECRH heating: < 600 kW
 - NBI heating: 2 MW (in preparation)
- It has been designed to study the effect of the helicoidal magnetic axis on plasma confinement for different values of rotational transform
- Discharges are 0.5 s long



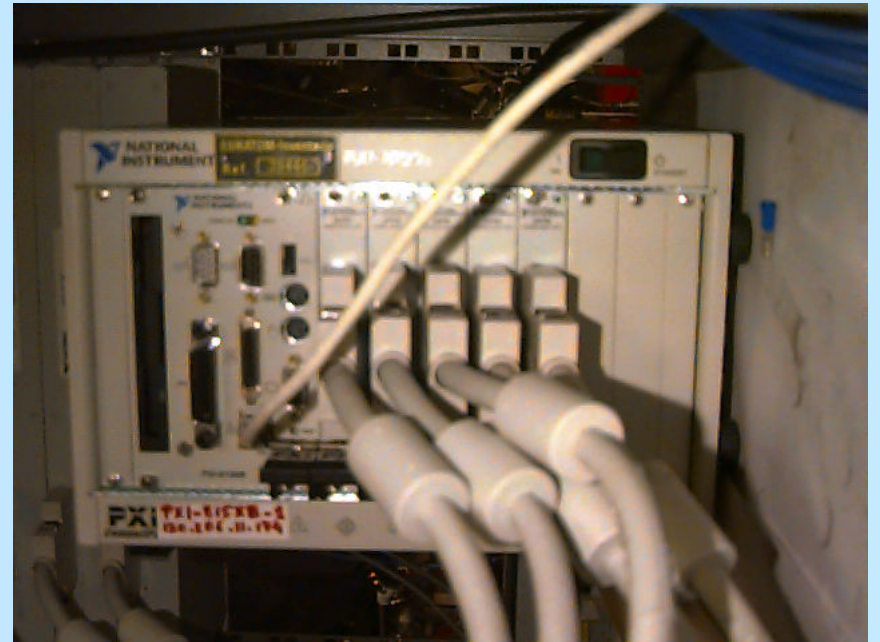
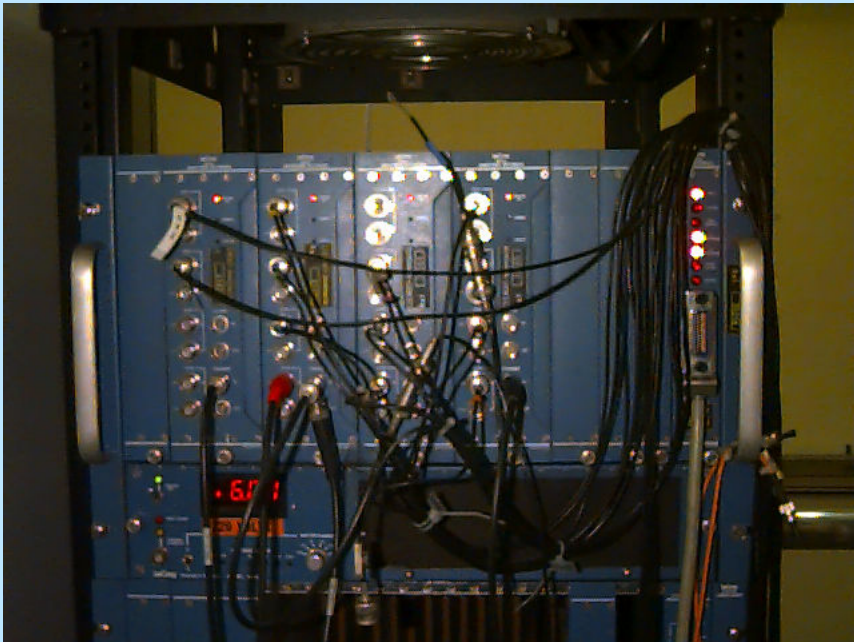
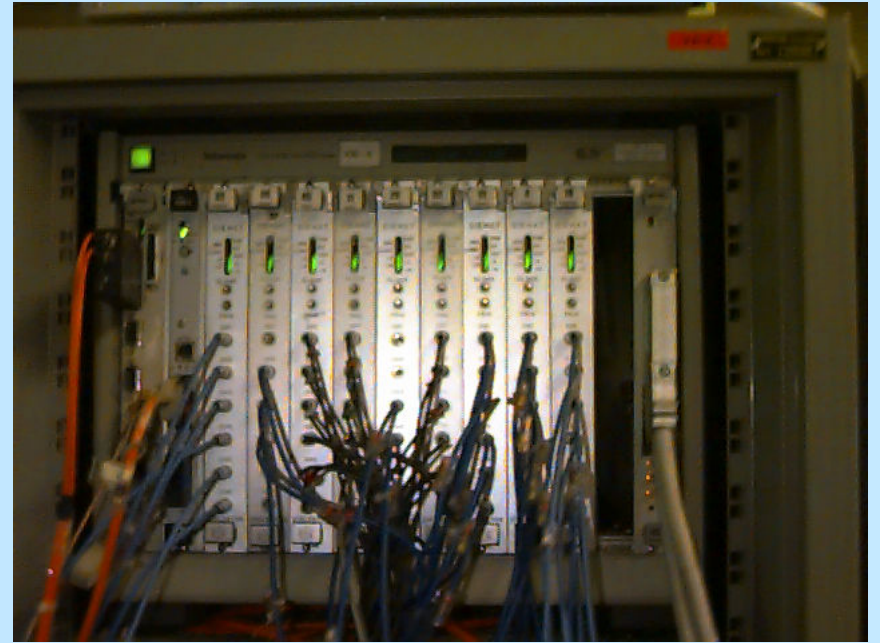
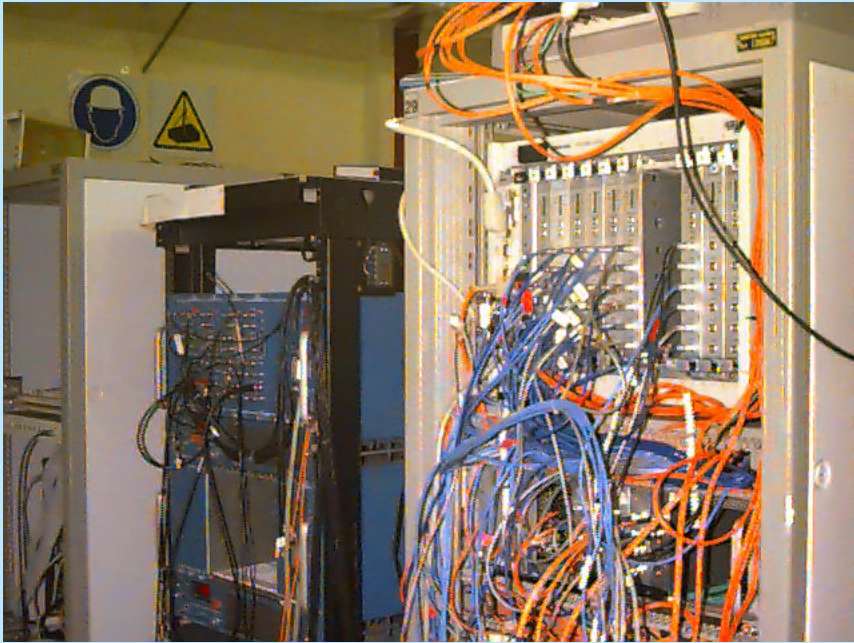
TJ-II data cycle



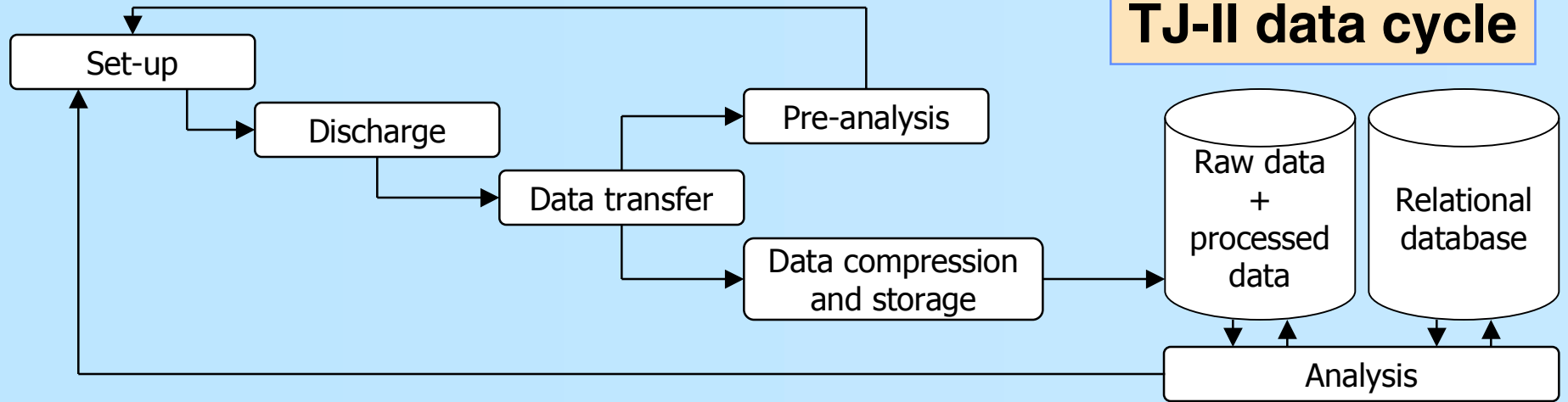
CIEMAT local area network (ETHERNET)



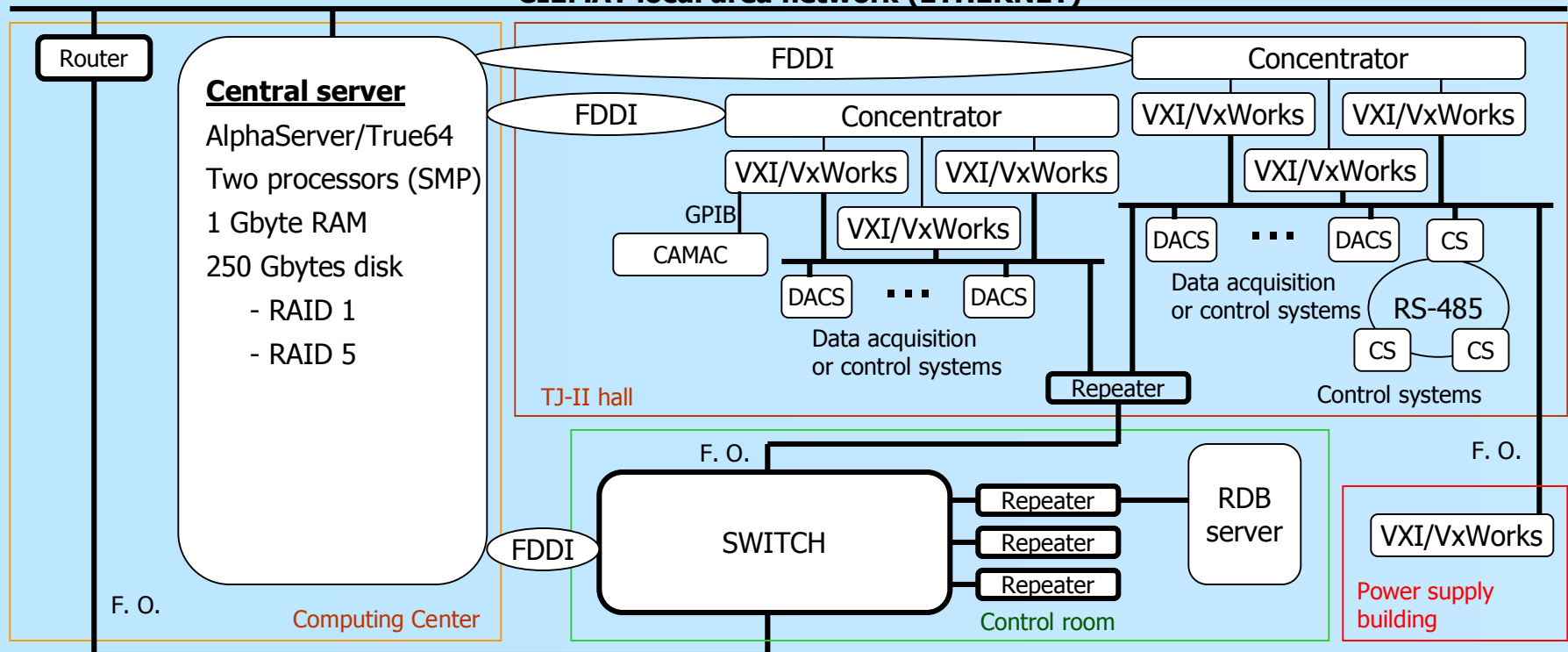
- **Data acquisition: 928 measurement channels**
 - VXI, CAMAC, PXI and PCI based
- **Diagnostic control systems: 11 systems**
 - PLC and Field Point based



TJ-II data cycle



CIEMAT local area network (ETHERNET)



- **Data acquisition: 928 measurement channels**
 - VXI, CAMAC, PXI and PCI based
- **Diagnostic control systems: 11 systems**
 - PLC and Field Point based

FJ-II operation logbook

Archivo Ayuda

Last shot
 Number: 9641
 10-4-2003 16:55

Shot to process
 Number: 9574
 9-4-2003 11:20 Validation:

Record Cancel Differences

150 ms de ECH empezando en 1020 ms. Puffing de He 5 ms despues del fin del girtron.
 HXR, muy baja densidad. Subimos el puffing

Last validation: 9641

Experiment
 Racionales y campos electricos: perfiles de potencial Racional 4/2 en el borde

Respons: CARLOS HIDALGO, M ANGELES PEDROSA Resp
 Pilots: KIERAN MCCARTHY, ROSA BALBIN Pilots
 Id: INFLUENCIA RACIONALES, PERFILES DE POTENC Descriptors

Wall: Boronizada el 24 de febrero de 2003 Gas/Valve: HELIUM-B, HYDROGEN-A Gas/Valv

Parameters
 Config: 059 085 62 Base press.(10⁻⁸-8) mbar: 11.0
 Z_Limiter_A (m): -353 Z_Limiter_C (m): -353 cut_ne (Y/N): Y

ECRH QTL1	ECRH QTL2	NBI 1
Power (kW): 300	Power (kW): 300	Power (kW):
Angle 1: 2.8	Angle 1: 3.0	V acel. (kV):
Angle 2: 29.2	Angle 2: 29.0	NBI 2
N paral.: 00	N paral.: 00	Power (kW):
		V acel. (kV):

Credits (A)
 ITF: 27616 ICC: 5920 Hc: 8458 VF: 6240

Experiment descriptors

Shot number: 9574

Recorded data: INFLUENCIA RACIONALES, PERFILES DE POTENCIAL

Defined names

- CONFINAMIENTO
- CONTROL DE DENSIDAD
- HIBP
- IMPUREZAS
- LIMITADORES
- OH
- POLARIZACION
- PRUEBAS
- PUFFING

Data for current discharge

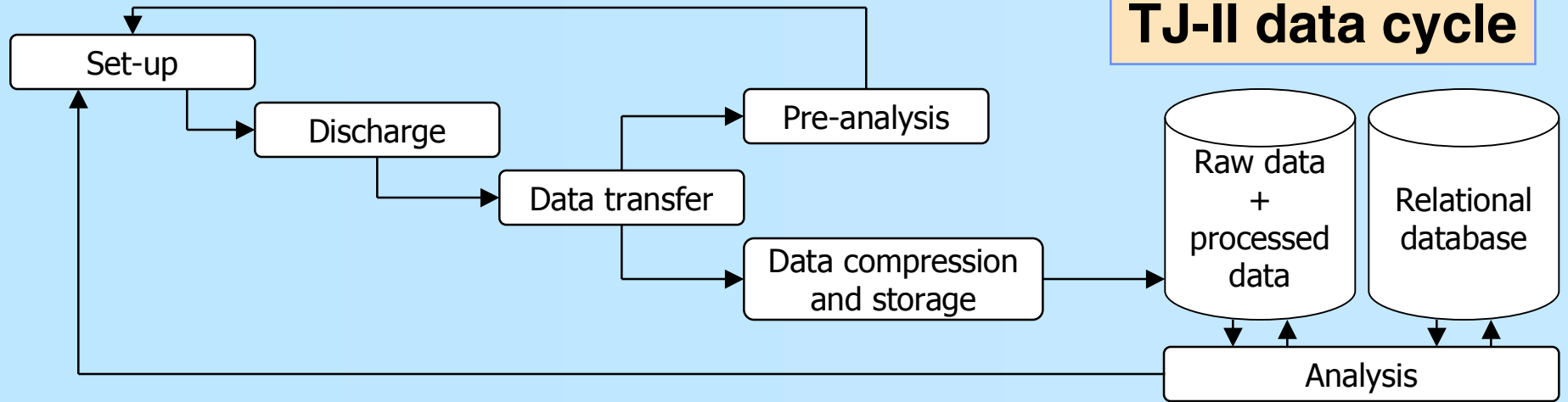
INFLUENCIA RACIONALES
 PERFILES DE POTENCIAL

New name

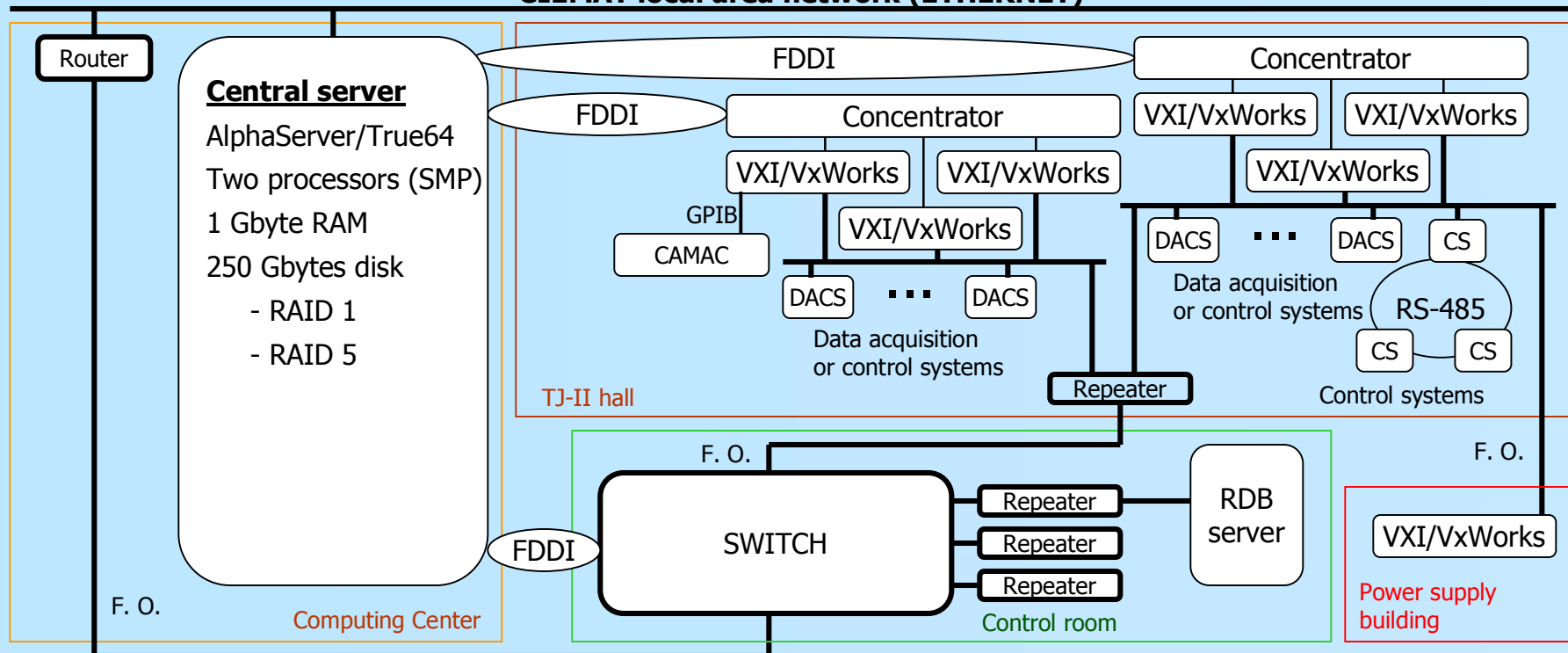
Define Give up Add

Save data Cancel

TJ-II data cycle



CIEMAT local area network (ETHERNET)




- **Data acquisition: 928 measurement channels**
 - VXI, CAMAC, PXI and PCI based
- **Diagnostic control systems: 11 systems**
 - PLC and Field Point based

Exceed

TJ-II DAS: Channel Configuration Window

STANDARD VXI SYSTEMS



VXI - 0 VXI - 5

VXI - 1 VXI - 4

VXI - 2 VXI - 3

VXI module ID

VME - CAMAC

CAMAC-0

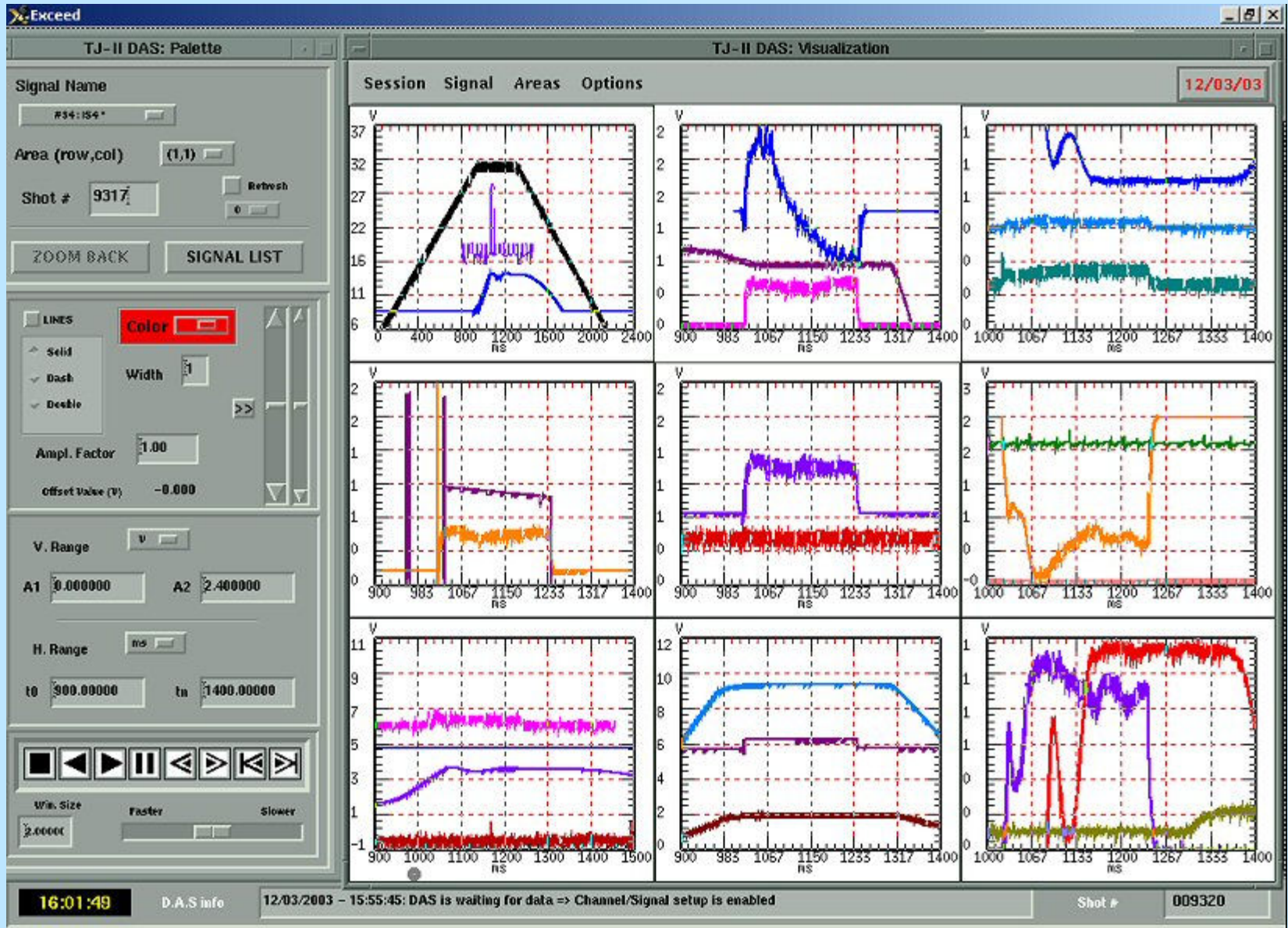
SIGNAL LIST

- ABOL1
- ABOL10
- ABOL11
- ABOL12
- ABOL13
- ABOL14
- ABOL15
- ABOL16
- ABOL2
- ABOL3
- ABOL4
- ABOL5
- ABOL6
- ABOL7
- ABOL8
- ABOL9
- ACTON275
- ADISP
- AMPCZT
- AMPGE
- AMPSI
- AMPSILI
- Alimiter0
- Alimiter1
- Alimiter2

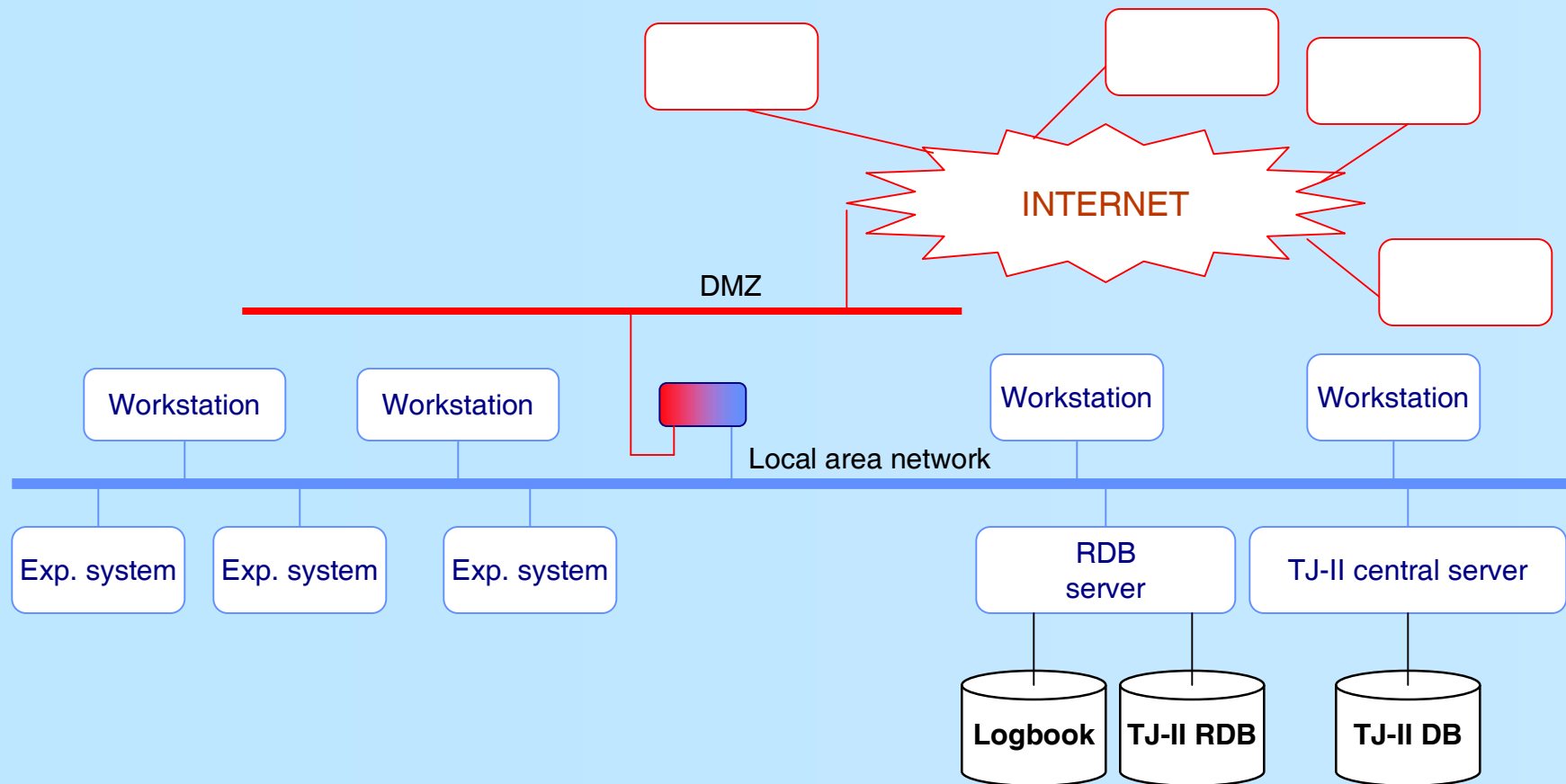
SYNOPTIC EDIT

CONFIG QUIT

15:05:23 D.A.S info Shot # 009315



TJ-II remote participation system

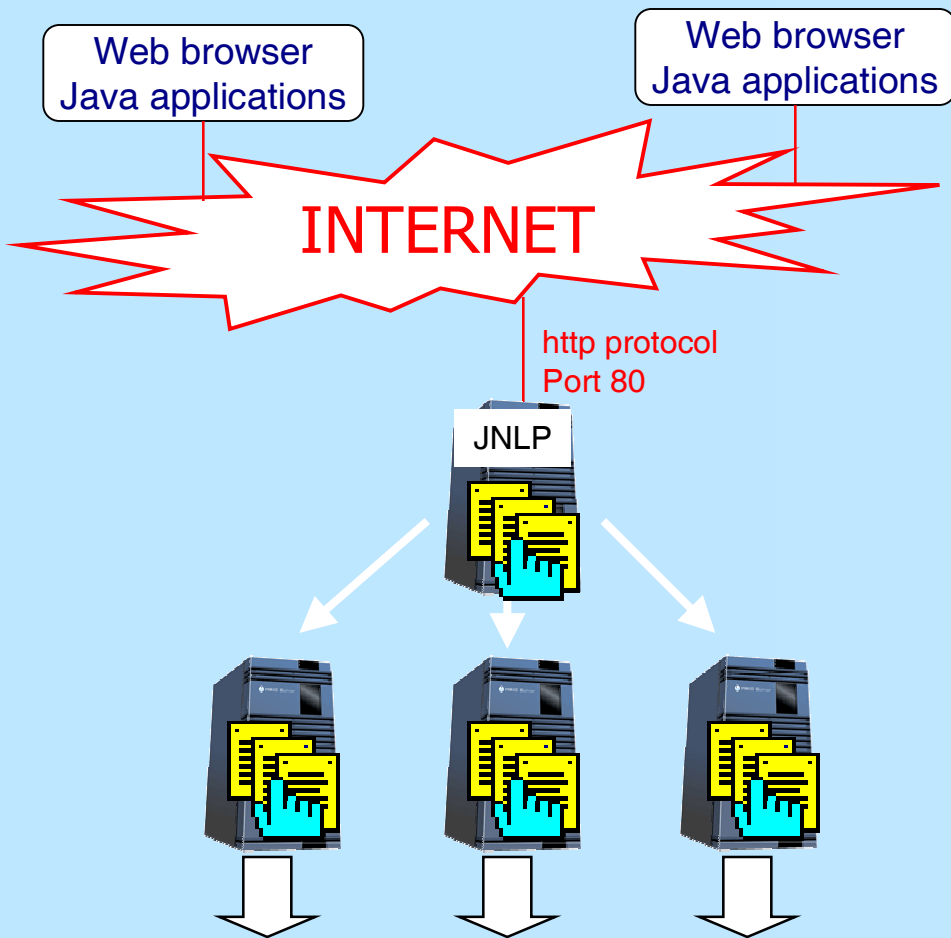


Capabilities to provide

- **Methods for remote access**
 - **Following discharge production**
 - » **Programming signal conditioning instrumentation**
 - » **Programming digitiser channels**
 - » **Monitoring programming of diagnostic control systems**
 - » **Accessing logbook (read/write)**
 - » **Audio/video system**
 - **Accessing databases (read/write)**
- **Resources for work-group tools**
 - **Videoconference**
 - **Interactive shared applications**
 - **Chat**
 - **...**

Critical aspects of the system

- **Growth capabilities**
 - Flexible enough system architecture
- **It must be an “open” system**
 - Multi-platform access
 - Products and licenses for remote users: availability and cost
- **The “working environment” is INTERNET**
 - Security
 - Software distribution and control of versions
 - Easy system administration



Data acquisition systems

- 928 measurement channels

Diagnostic control systems

- 11 control systems

TJ-II databases (R/W capabilities)

- Relational and non relational

TJ-II operation logbook

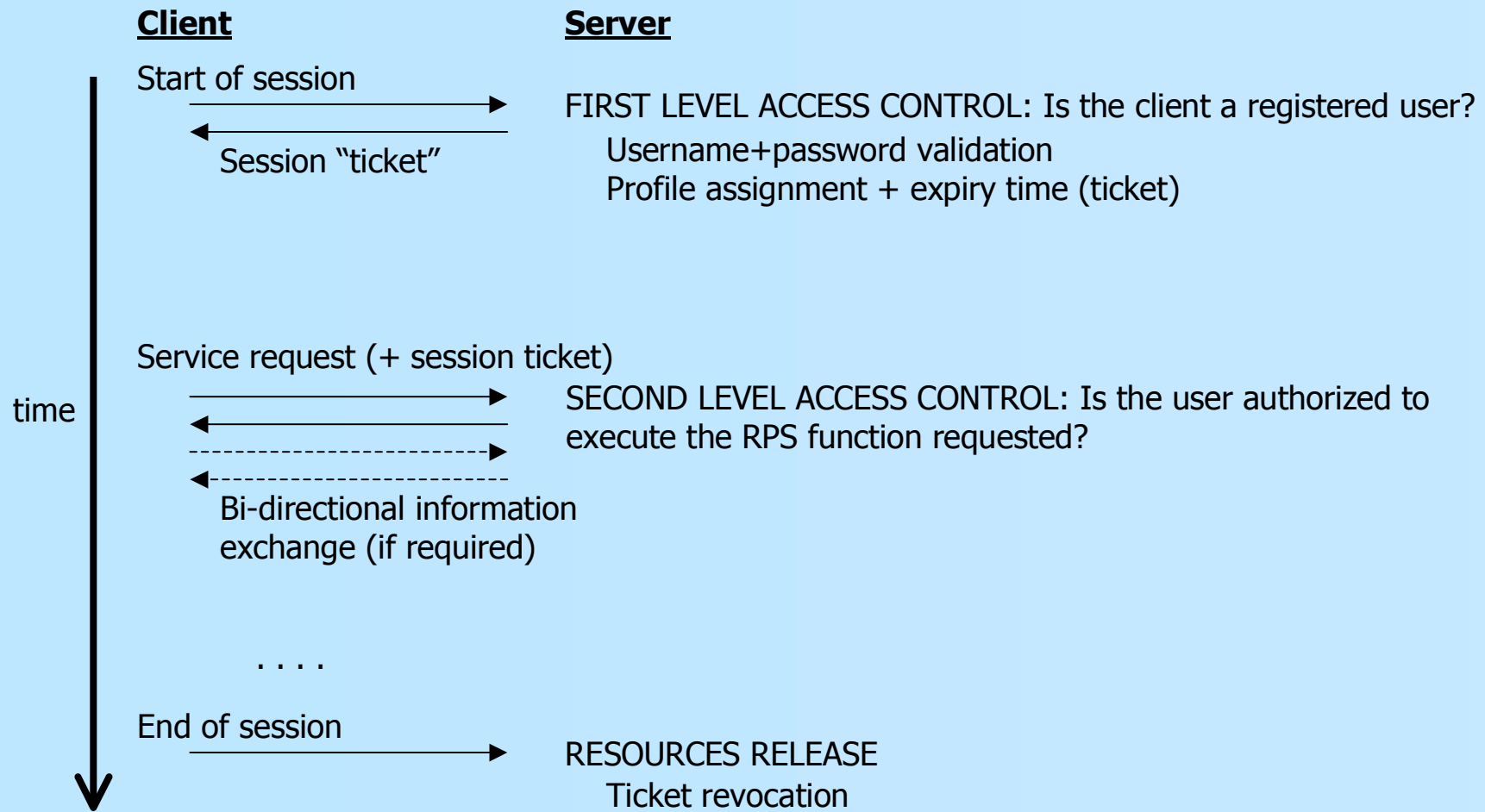
- R/W capabilities

- **The TJ-II remote participation system is based on **web technologies****
 - A web server is the most standard platform acting as a communication front-end
 - A very scalable and flexible system architecture can be developed
 - All external access depends on a single protocol and a well known communication port
- **User/Remote participation system interplay has been founded on **Java technology****
 - Network services will be provided by means of resources supplied by JSP pages
 - Client tools will be web browsers and Java applications
 - Deployment of Java software: there are ready-to-use solutions based on JNLP technology
 - » JNLP server
 - » JNLP client (Web Start)
- **Distributed authorization and authentication system**
 - **PAPI system**

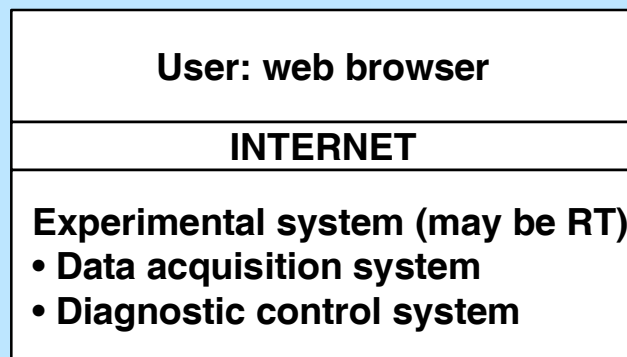
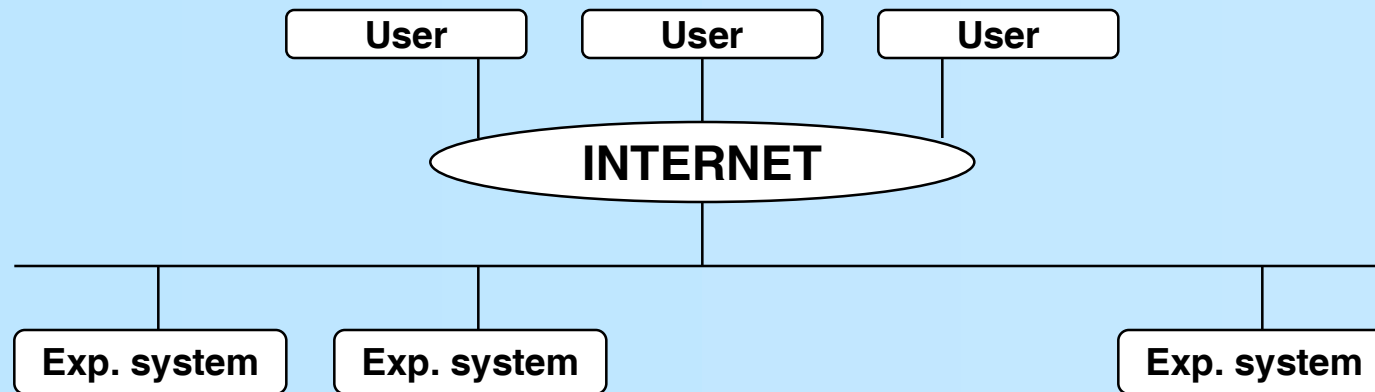
Entities and Services

- TJ-II remote participation system: a **set of software resources** for providing access to **RPEs**
- The term “remote participation service” (**RPS**) describes the set of software resources for having access to a particular TJ-II RPE
- The resources provided by a RPS can be divided into smaller parts (**functions**)

Sessions

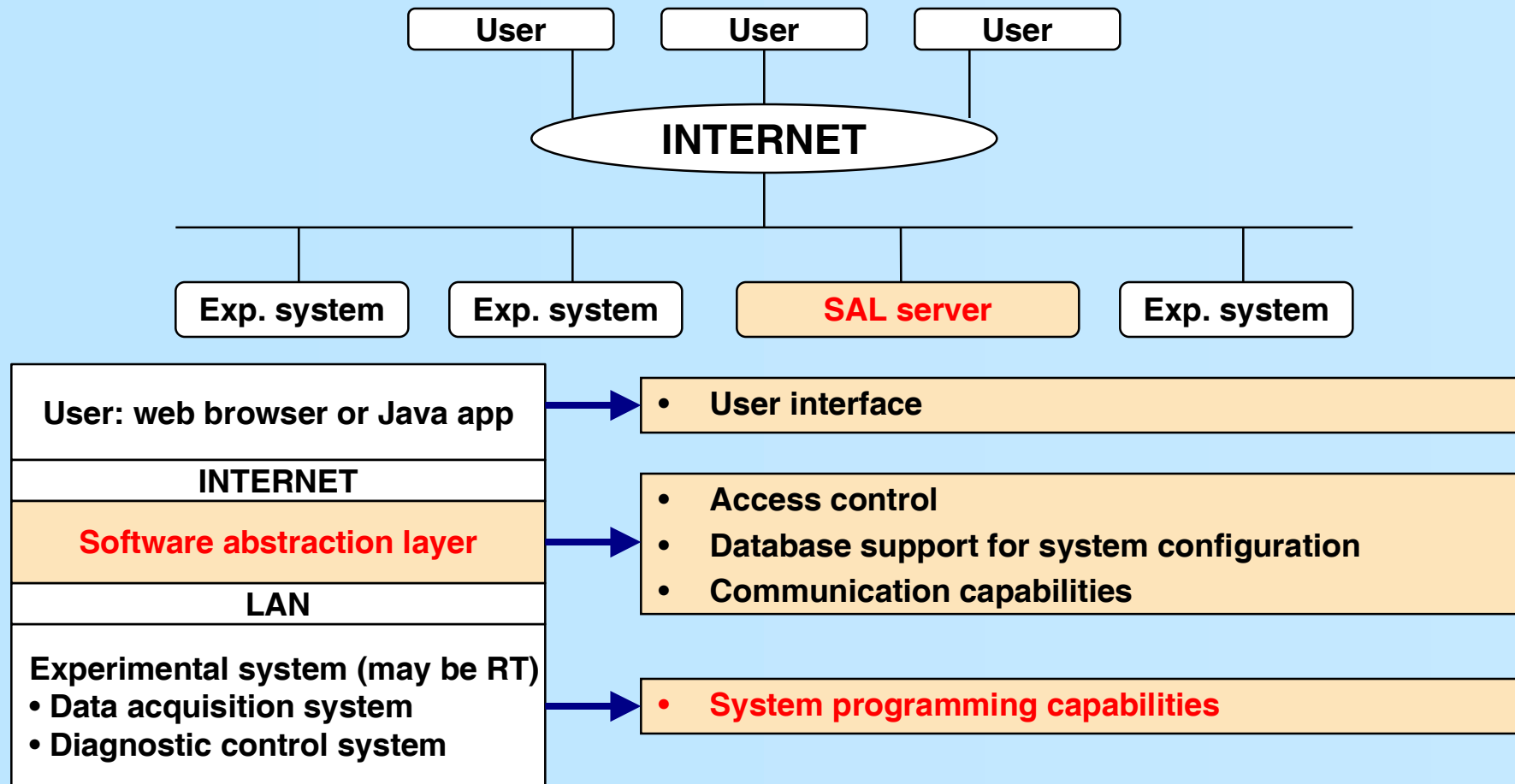


Software resources for system access

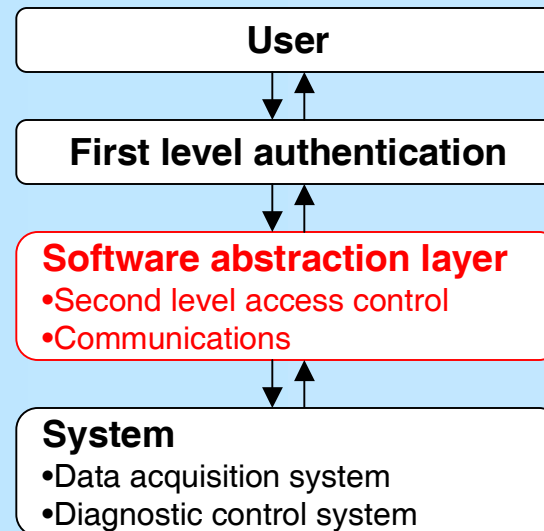


- **System programming capabilities**
- GUI (VNC server)
- Access control (permissions)
- Database support for system configuration

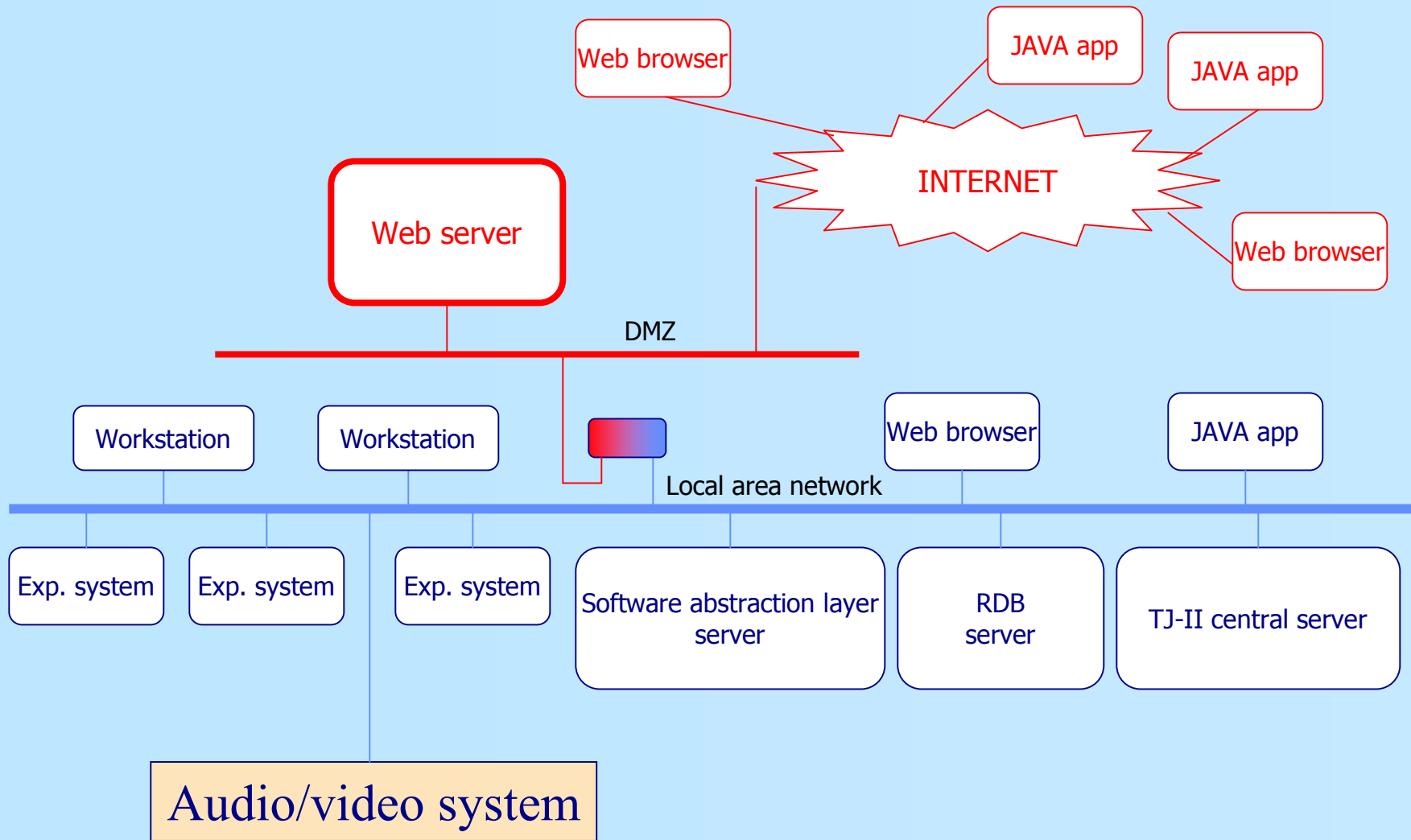
Software resources for system access



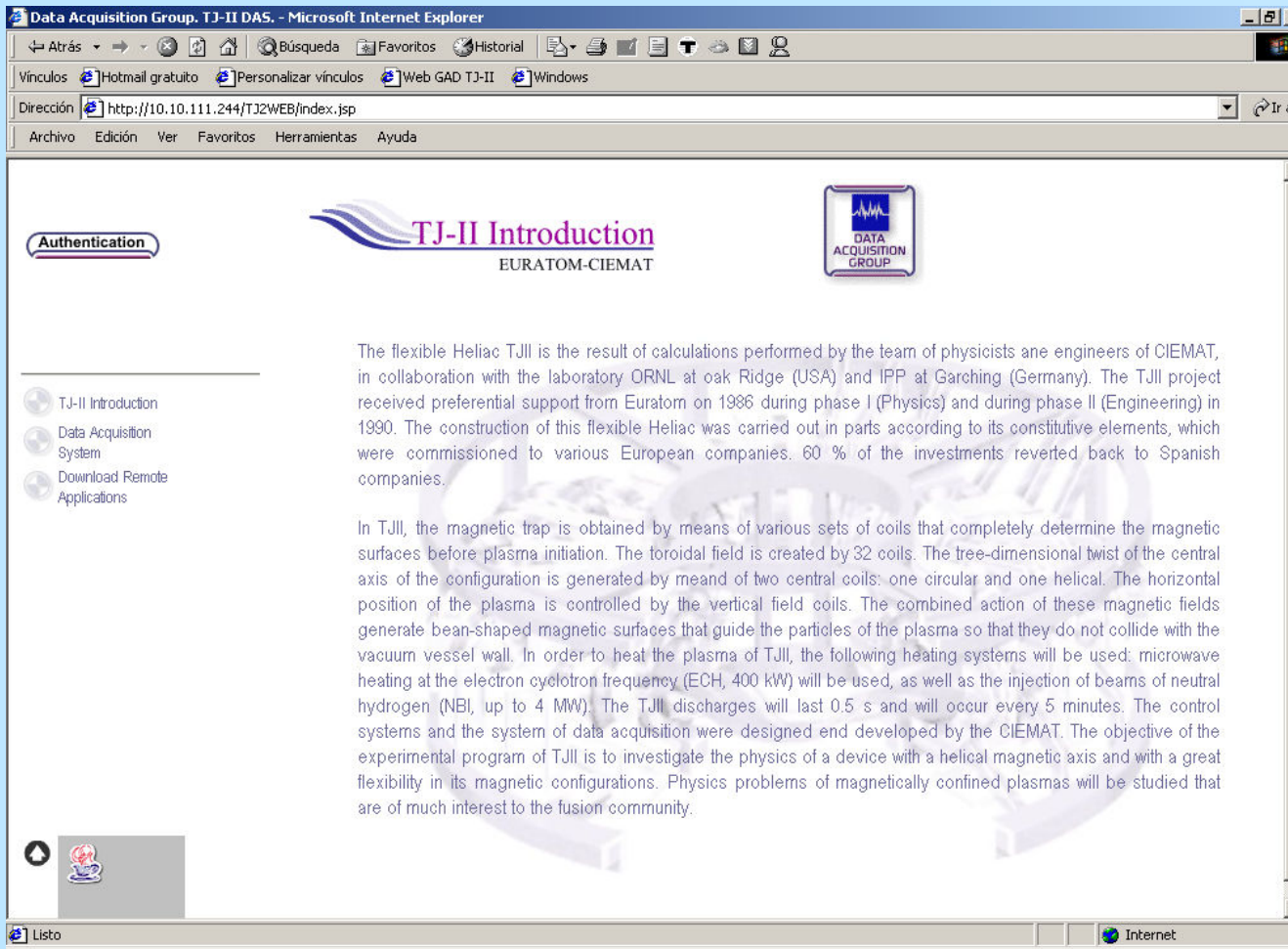
User/system interaction



- ◆ Many experimental systems can be supported from a single server application
- ◆ Very modular developments
- ◆ The experimental systems do not provide
 - ◆ Authentication
 - ◆ User interface resources for remote display
- ◆ Minimum overhead over experimental systems
- ◆ High degree of security: filters are external to systems

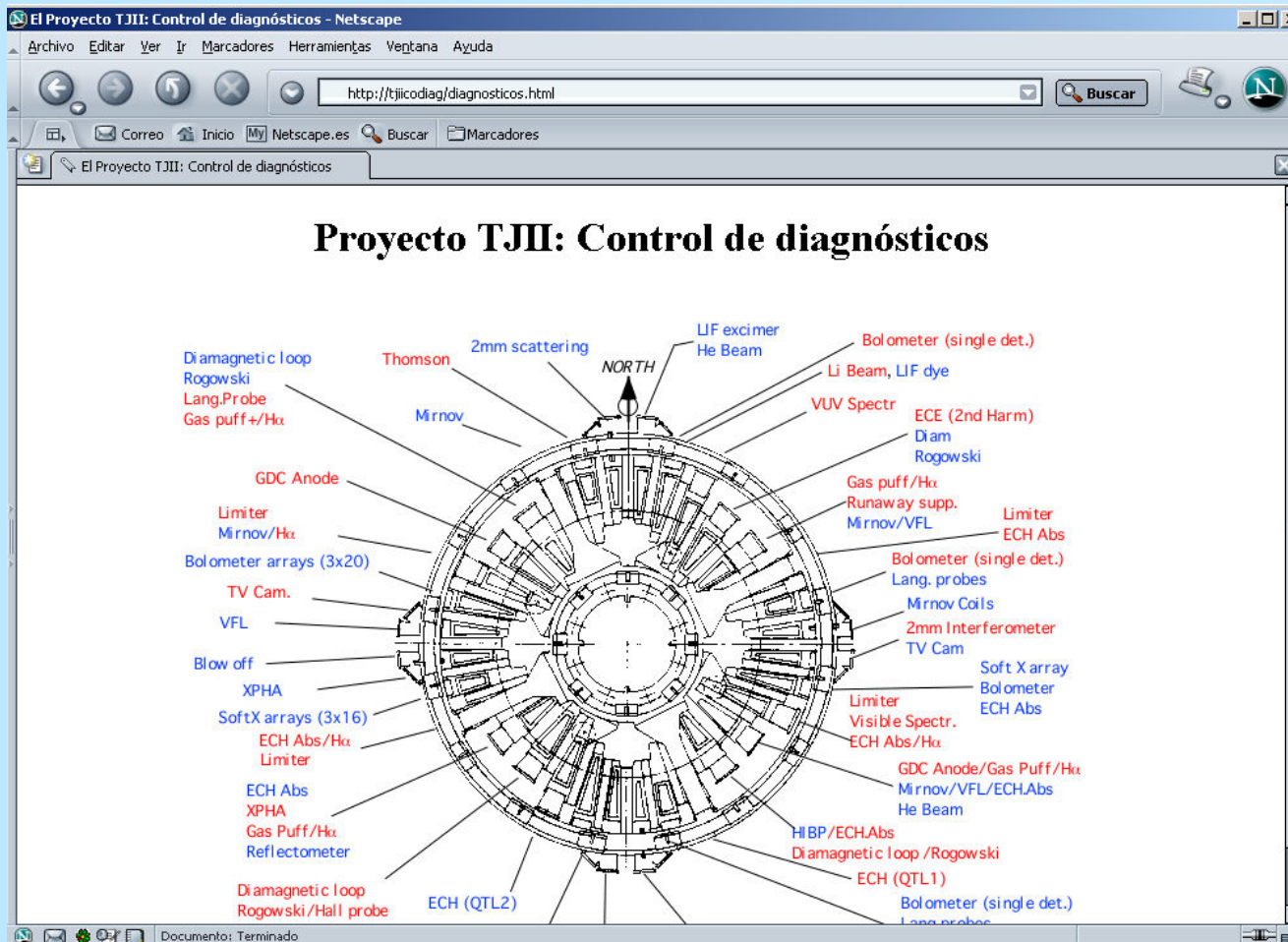


Present status



- **First developments: following experimental sessions**
 - Diagnostic control systems
 - Operation logbook
 - Data acquisition card programming
 - INTERNET connection upgrading
 - System security
- **Second phase**
 - Visual data analysis tools
 - Data access (R/W)

Diagnostic control systems



Control de diagnósticos - Netscape

Archivo Editar Ver Ir Marcadores Herramientas Ventana Ayuda

http://tjicodiag/comandos-Thomson.html

Control de diagnósticos

A.G. P-Tj-II(mbar)
 Aire **7.2E-3**
 Red
 Inhb.
Alarmas

Vacío

E-W N-S

Alinear **Espejo** **Láser**

Dentro
 Fuera

GPIB **Estructura**

Posición mm Desplazar mm

Alinear Man/Aut OK
L. a. Interlock OK
Shut Carga
D3 Disparo

[D3](#)

[Man-Aut](#)

[Marcha](#)

[Descarga](#)

[Carga](#)

[Disparo](#)

[GPIB](#)

[Sentido](#)

"Desplazar (mm)": Mover

Seleccione el movimiento
 Mover

[CERRAR](#)
[\[Volver a la página principal\]](#)

Transfiriendo datos desde tjicodiag...

Inicio

TJ... Ca... Co... Mi... Im... W Mi... Co... Di... Mi... ES

11:54

Operation logbook

The screenshot displays the EBoard - Data Acquisition Group software interface. The main window is titled "EBoard - Data Acquisition Group" and contains several sections for data entry and configuration.

Top Section:

- Shot number: 9148
- Shot #: 9101
- Date/Time: 26-02-2003 18:01
- Date/Time: 25-02-2003 15:04
- Validation:
- Last validation: 9147
- Buttons: Record, Cancel, Differences

Experiment Section:

Pruebas configuracion divertor. Superficie racional 4/2 en el borde del plasma.

Personnel Section:

- Respons: ROSA BALBIN, ANTONIO LÓPEZ FRAGUAS
- Pilots: TERESA ESTRADA, JOAQUIN SANCHEZ
- Id: CONFIGURACIONES DIVERTOR
- Gas/Valve: HELIUM-B, HYDROGEN-A

Currents (A) Section:

- TF: 27616
- ICC: 5920
- HX: 8458
- VF: 6240

agnostics Section:

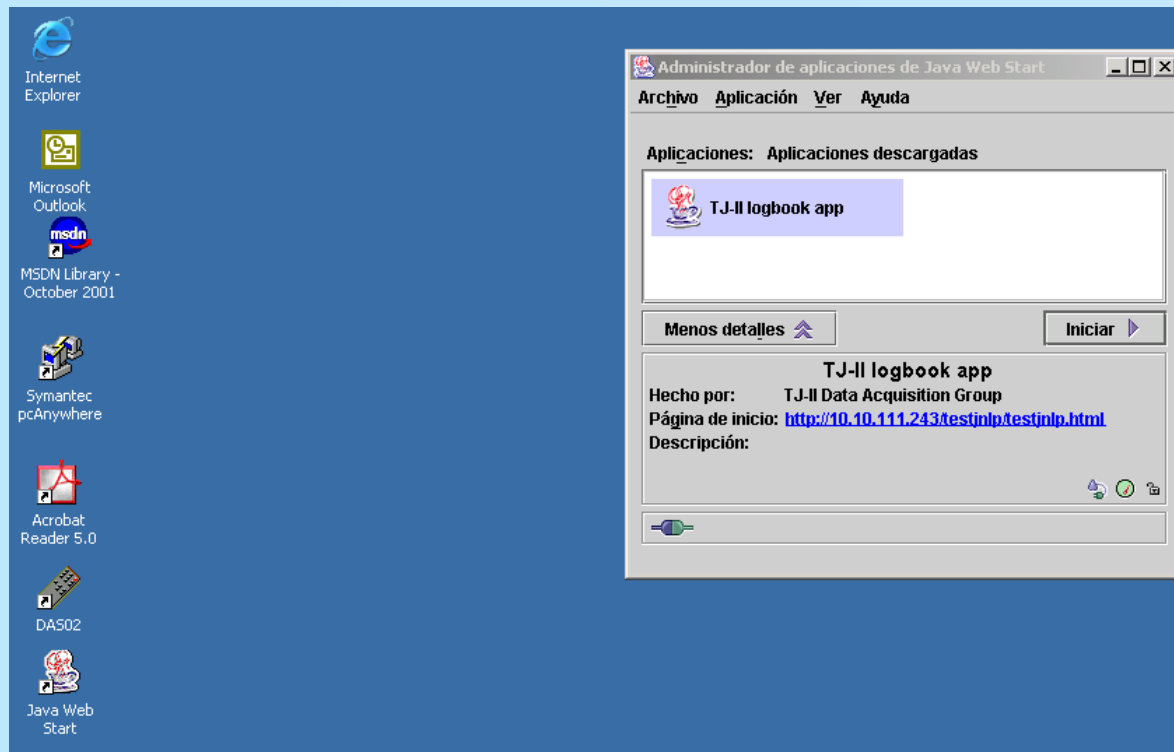
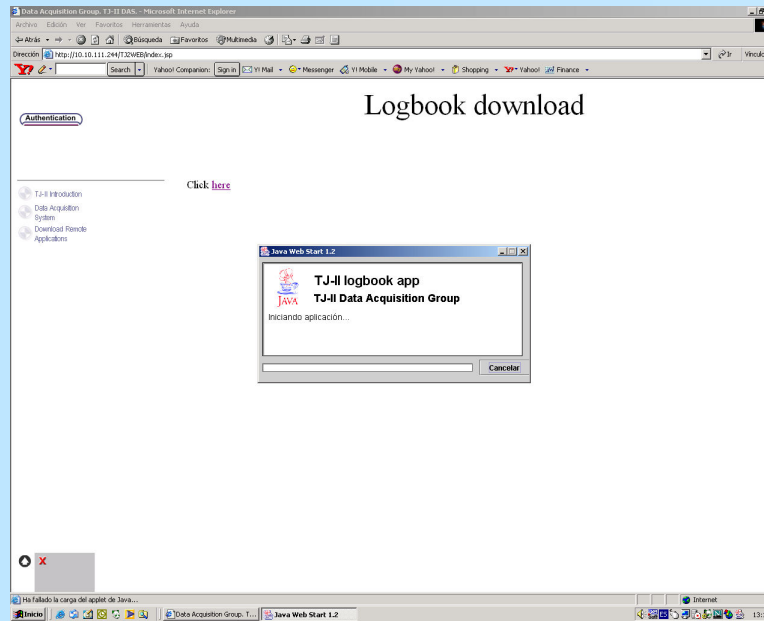
- al HE puff. ...
- Probe input (m...)
- urity input (ms):
- urity type:
- Copy Data button

Define new gas / Define new valve / Data to store:

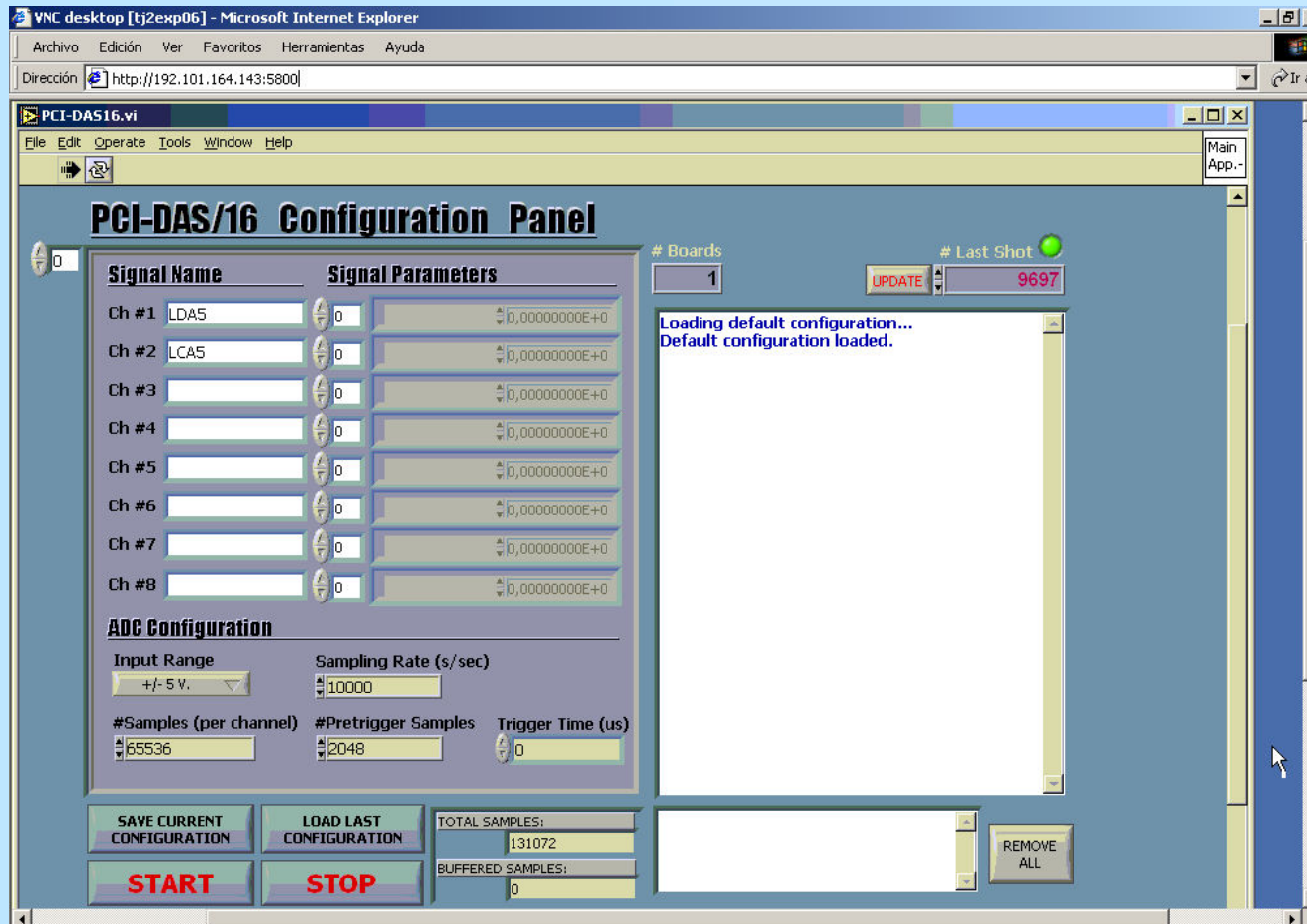
- Define new gas: New Gas, Erase, Write
- Define new valve: New Valve, Erase, Write
- Data to store: HELIUM-B, HYDROGEN-A

Defined names:

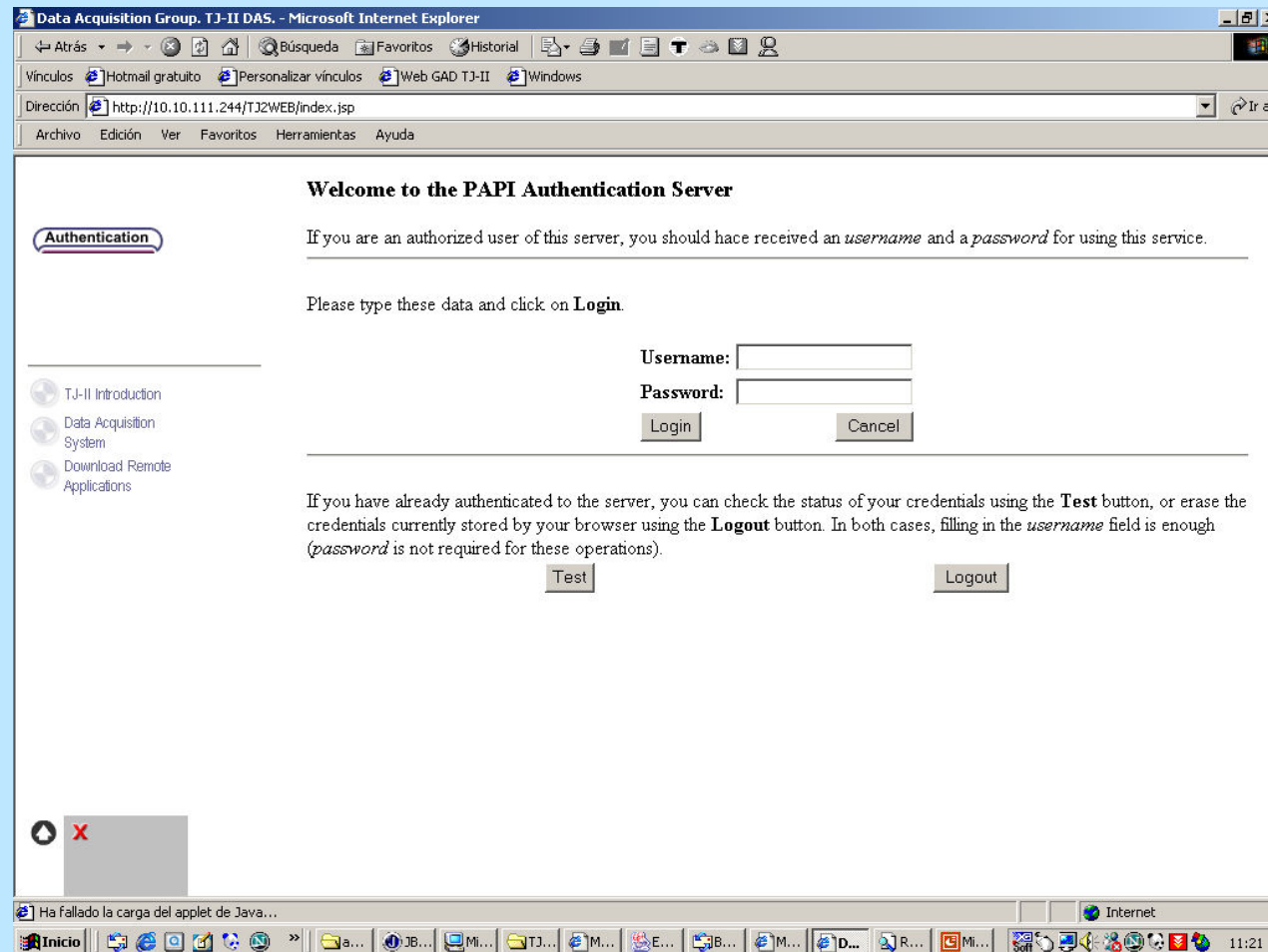
- Left list: HYDROGEN, HELIUM
- Right list: A, B, C, D
- Buttons: Record, Cancel, Save, Quit



Data acquisition systems



PAPI system



Audio/video resources

- **The connection to Internet of the Lab has been upgraded with a higher bandwidth to support videoconference by means of VRVS**
 - 100 Mb/s full duplex line

Pending tasks

- **Finishing PAPI system adaptation**
- **Developing the SAL to integrate data acquisition systems**
- **Providing software resources to remotely**
 - perform fast visual data analysis
 - download TJ-II data for analysis purposes
 - upload data to the databases
- **Videoconference system for following the TJ-II operation**

Acknowledgments

- This work is partially funded by the Spanish Ministry of Science and Technology under the Project No. FTN2001-1587-C02-01