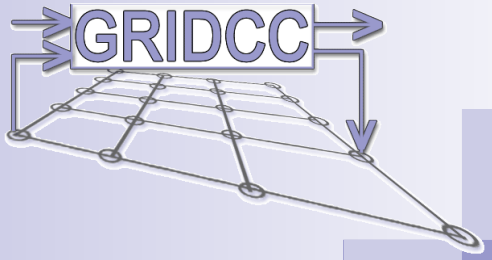


Remote Operations of an Accelerator Using the Grid

Milan Prica
ELETTRA Sincrotrone Trieste

GRIDCC Project: www.gridcc.org

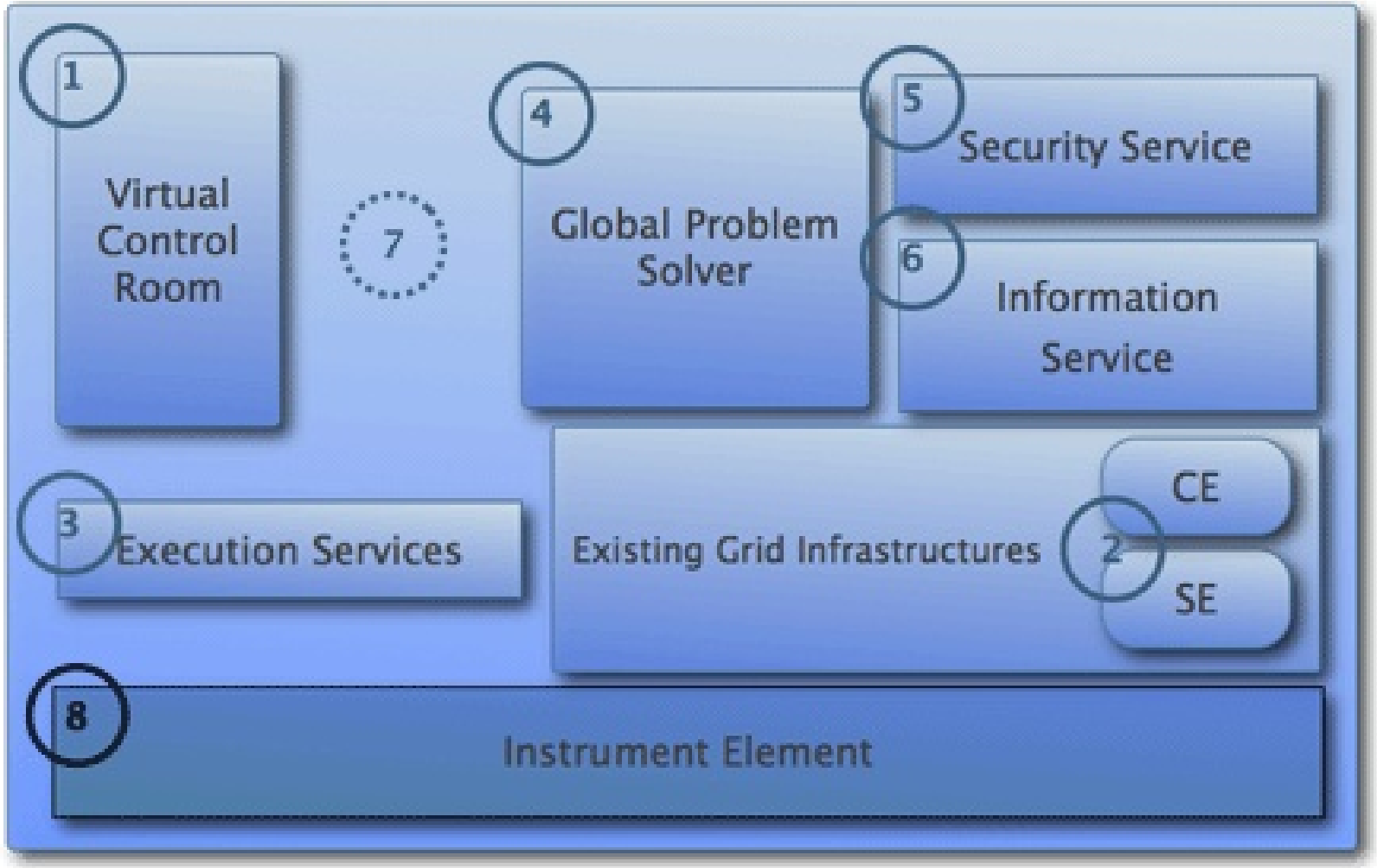
***G**rid Enabled **R**emote **I**nstrumentation with **D**istributed **C**ontrol and **C**omputation*

The goal of the GRIDCC project was to build **a widely distributed system** that is able to **remotely control and monitor complex instrumentation**

Partners:

- INFN – Instituto Nazionale di Fisica Nucleare (Italy)
- IASA – Institute of Accelerating Systems and Applications (Greece)
- Brunel University (UK)
- CNIT – Consorzio Interuniversitario per Telecomunicazioni (Italy)
- ELETTRA Sincrotrone Trieste (Italy)
- IBM – Haifa Research Labs (Israel)
- Imperial College of Science, Technobgy and Medicine (UK)
- Istituto di Metodologie per l'Analisi Ambientale, CNR (Italy)
- University of Udine, HCI Lab (Italy)
- GRNET Greek Research and Technology Network (Greece)

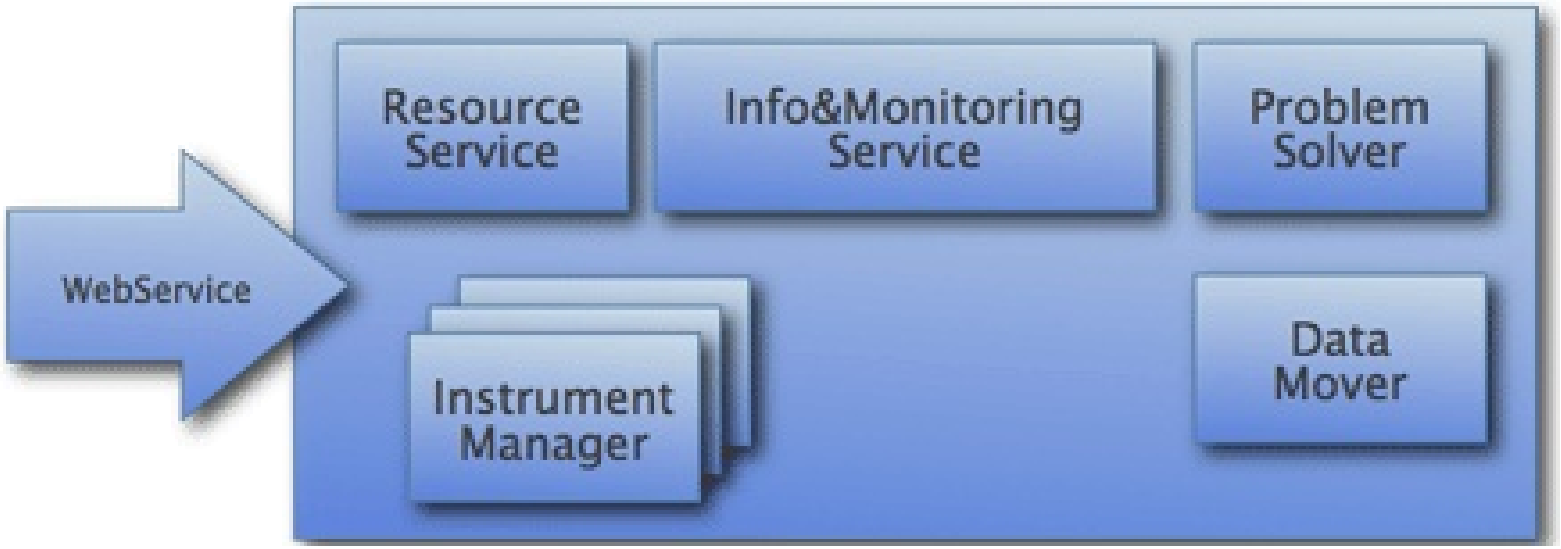
GRIDCC Components



Virtual Control Room

- The VCR provides a web-based collaborative environment where users:
  - **Meet and collaborate** by means of groupware tools (e.g. chat, shared calendar, logbook, video conference tools)
  - **Browse resources** such as people, instruments and other Grid resources (e.g. computing and storage ones)
  - **Transparently operate with remote Grid / non Grid resources,** including the GRIDCC instruments and services

Instrument Element



- **Instrument Element** describes a set of services that provide the needed interface and implementation that enables the remote control and monitoring of physical instruments.

- **Instrument Managers** are the parts of the instrument element that perform the actual communication with the instruments. (Protocol Adapters.)

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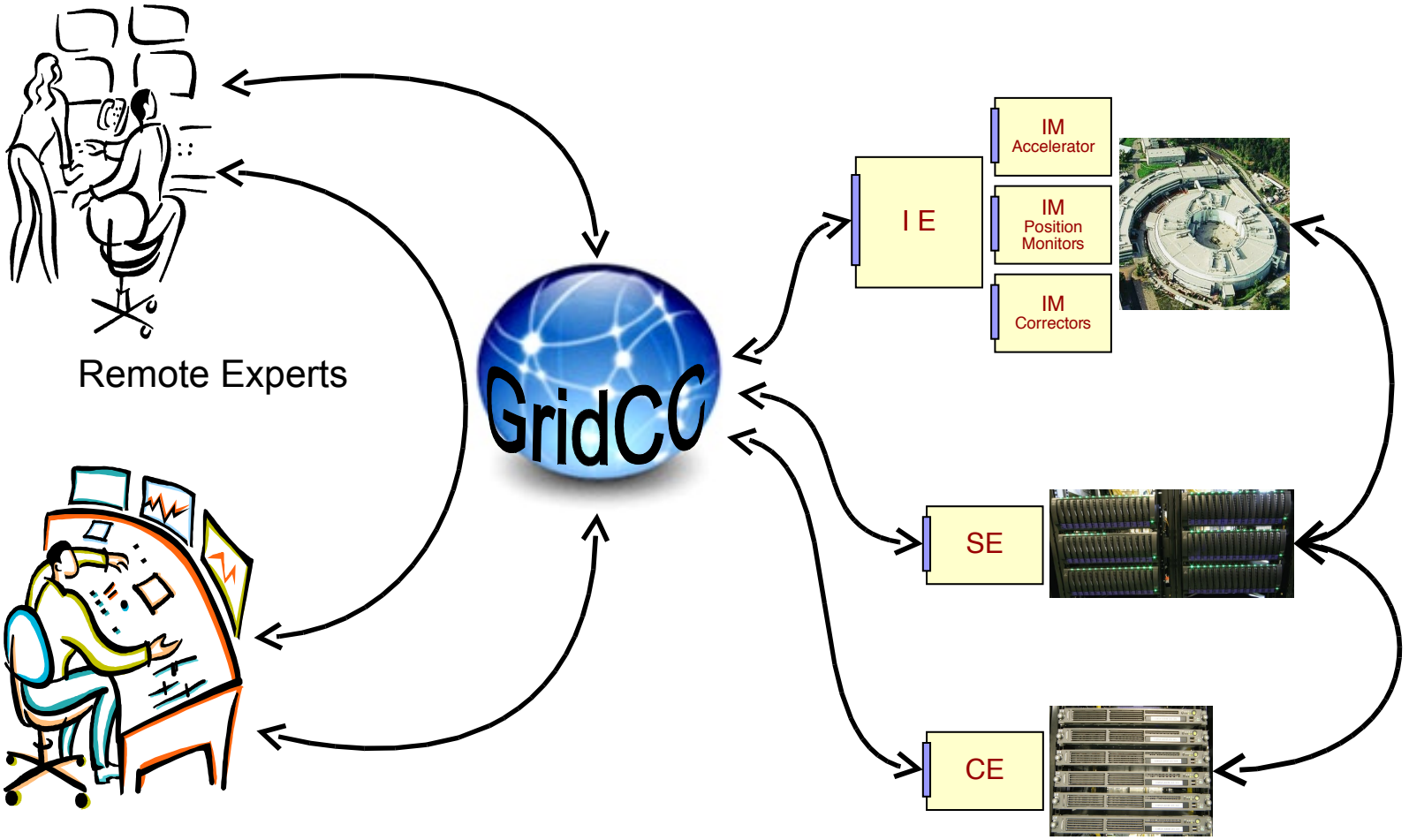
Remote Operations

- Remote operations of an accelerator involve:
  - maintenance and troubleshooting of the accelerator
  - repair of delicate equipment
  - understanding and pushing performance limitations
  - performing commissioning and set ups
  - routine operations
- Grid technologies enable integration with computing farms where complex machine physics models can run.

Remote Operations

- All the High Level Software (HLS) of ELETTRA is suitable to be implemented using the GRIDCC testbed.
- Elettra HLS for Remote Operations consists of
  - workflows like OneBM & OrbitFB
  - a set of data files describing the accelerator from the machine physics point of view, parameters and calibration files
  - utility functions to access the control system and the machine simulator

Remote Operations of Elettra using GridCC

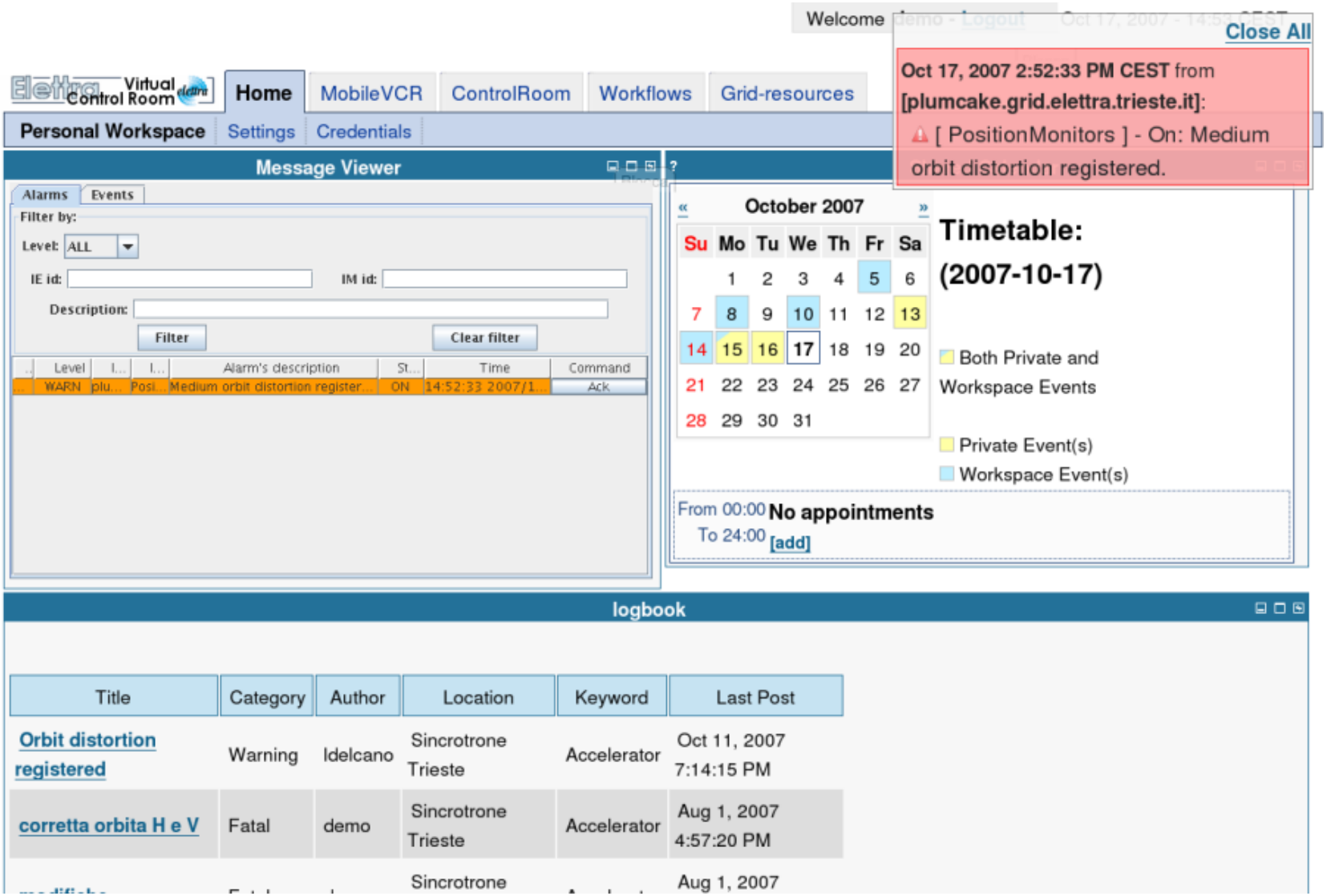


Troubleshooting Scenario

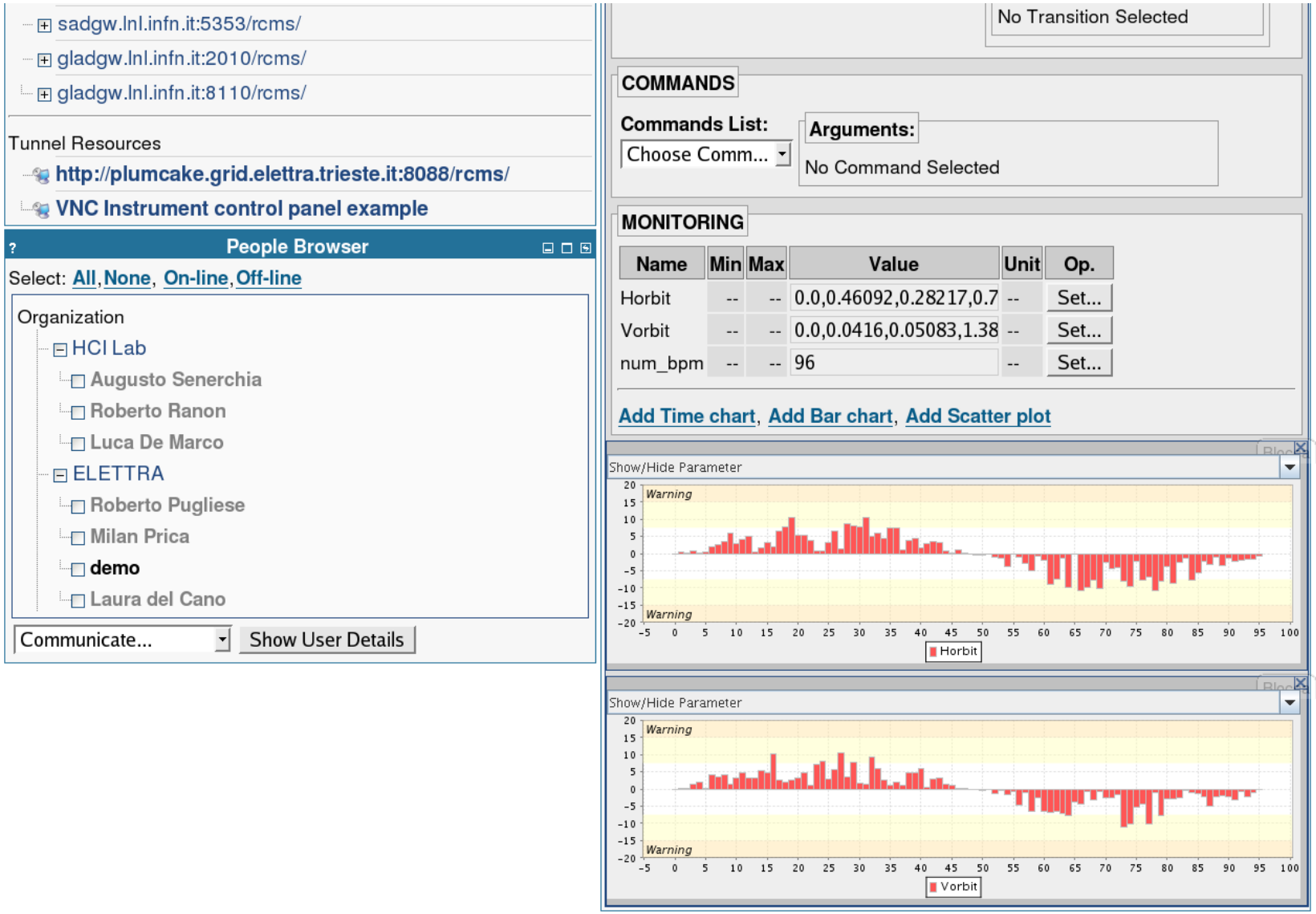
Orbit distortion occurs...

- The Problem Solver rises an alarm, visualized by the VCR Notifier
  - The operator sees the alarm and acknowledges it in the *Alarm Viewer*
- The operator seeks expert advice
  - Starts a Skype session with an expert selected from the *People Browser*
  - Verifies the distortion with the *Position Moniotors*
  - Launches the *OrbitFB* workflow and monitors its progress
  - (IE, CE, SE, glite security)
  - Checks the orbit after the correction in the *Instrument* workspace
- The Operator returns to the Alarm Viewer
  - Verifies that the alarm has been turned off.
  - Deletes the entries from the alarms table with the *ACK* button
  - Registers the distortion and its correction events in the *Logbook*

VCR Snapshots – Alarm ON

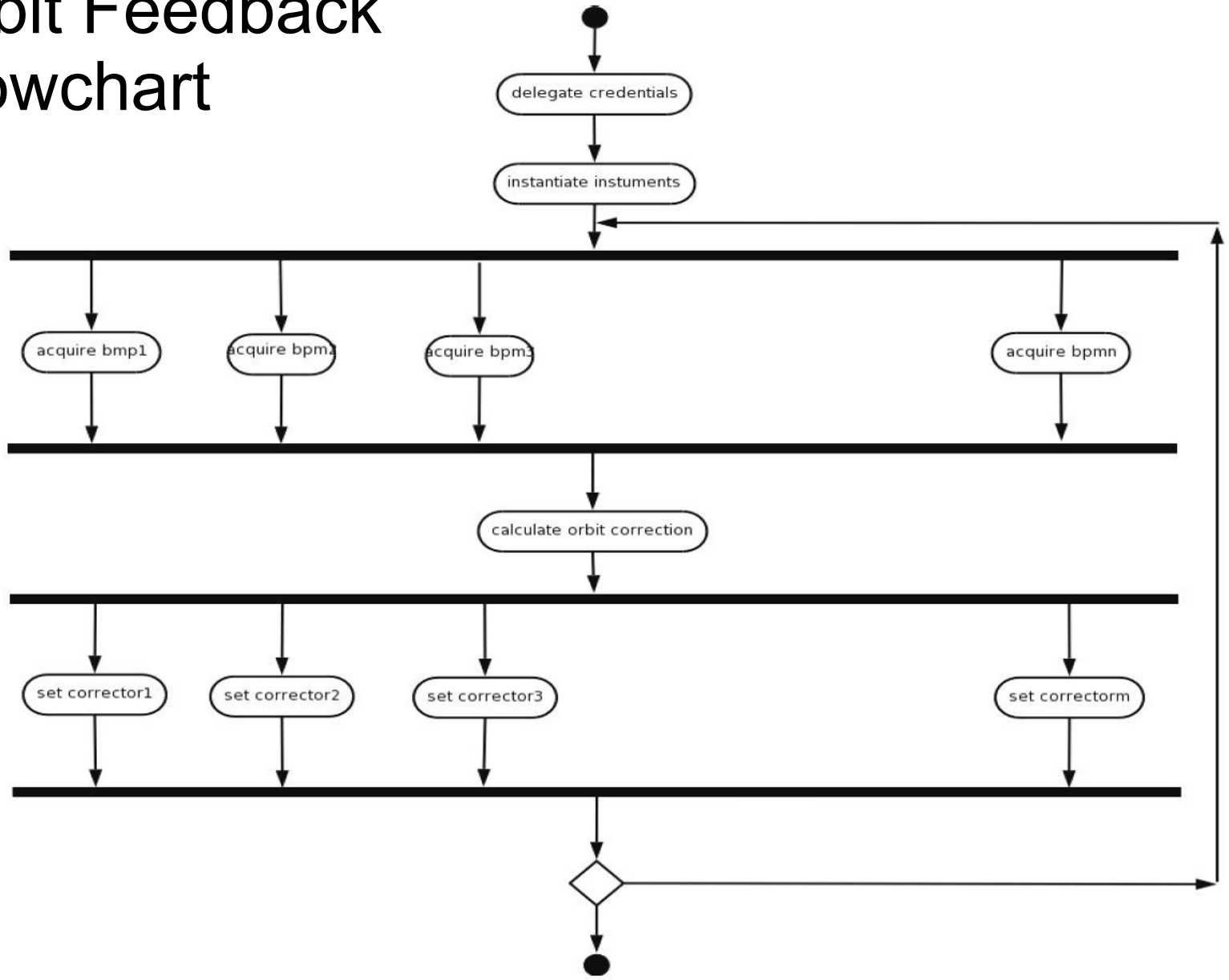


VCR Snapshots – Orbit distorted

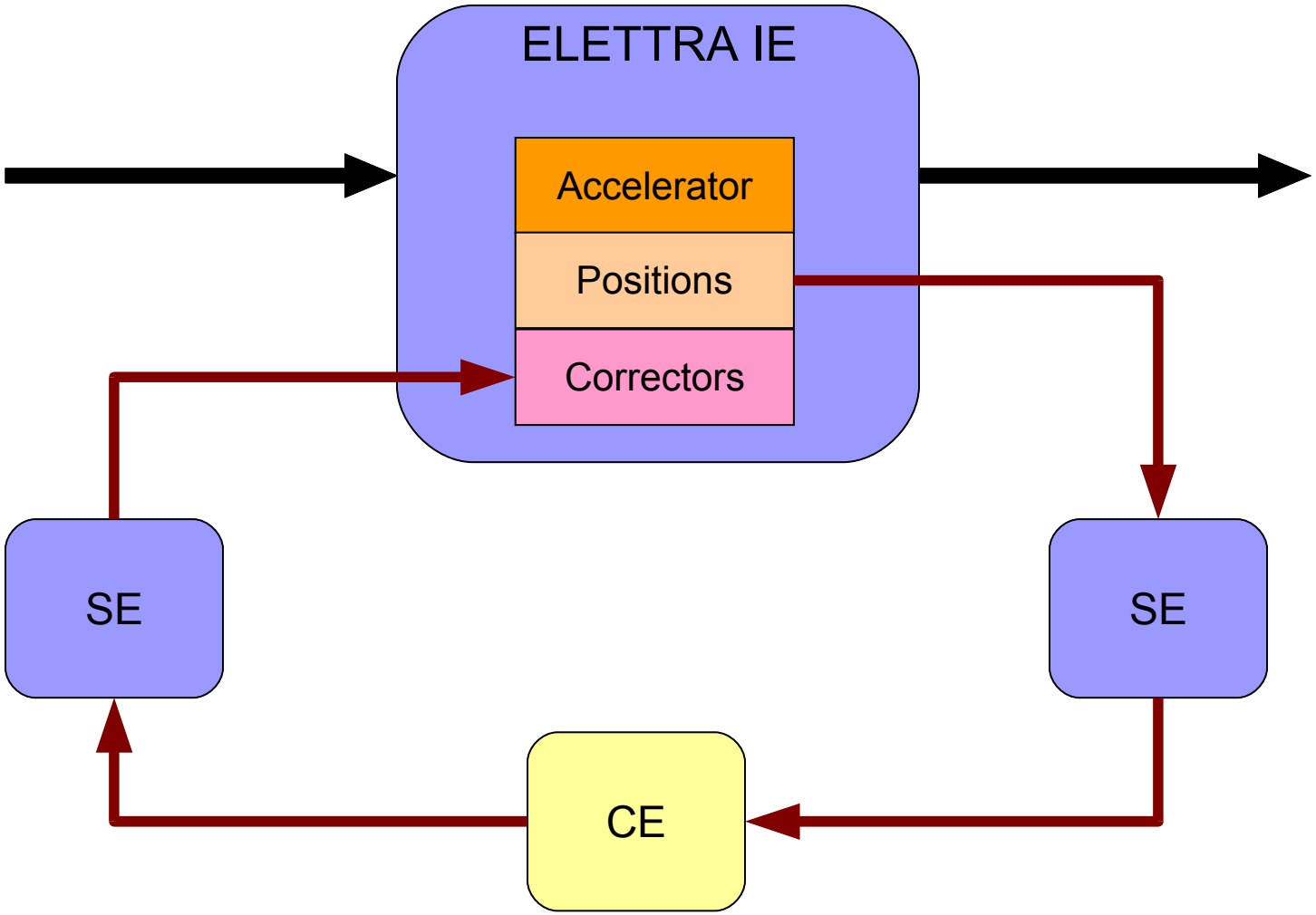


VCR Snapshots – Workflow submission and monitoring

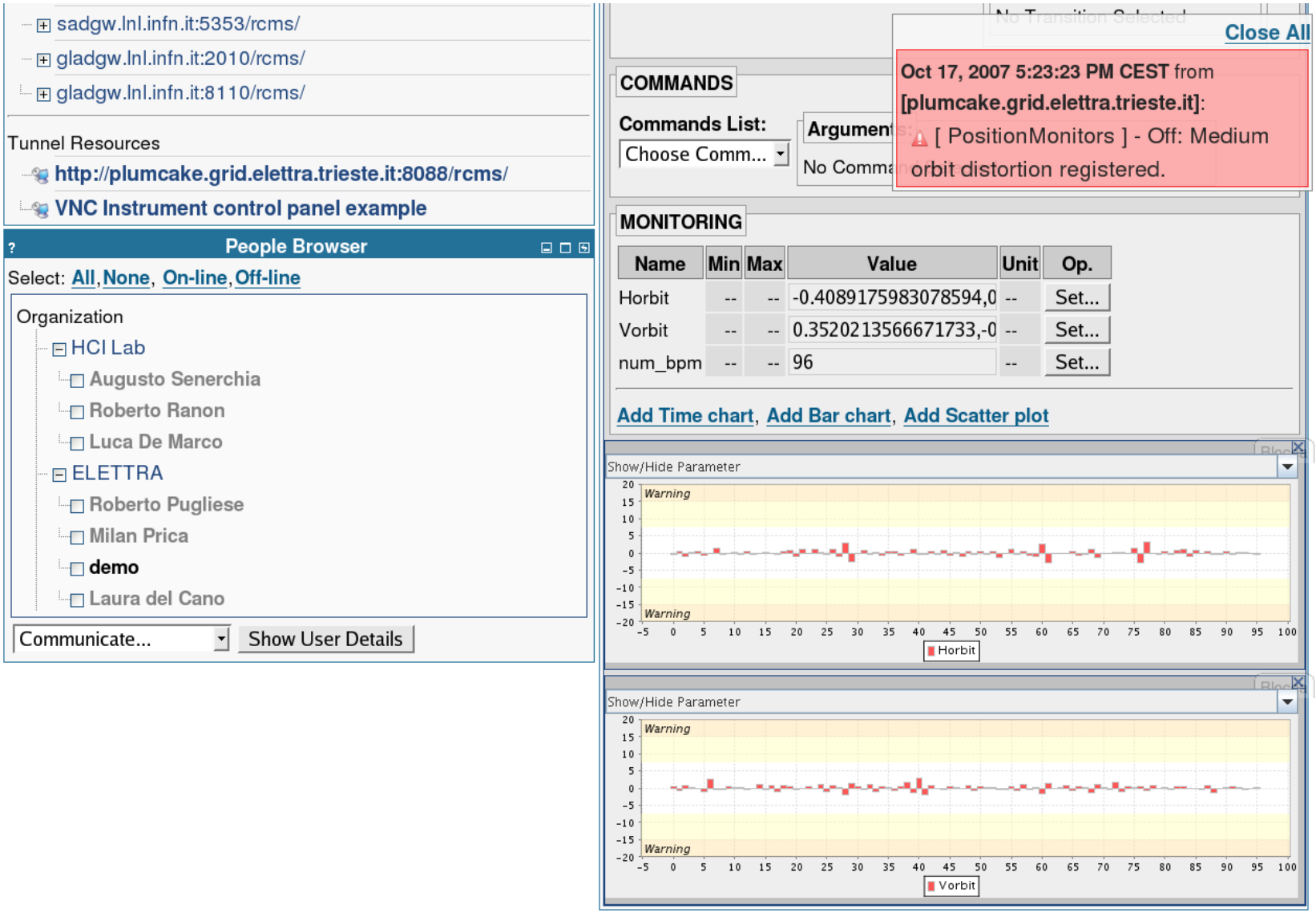
Orbit Feedback Flowchart



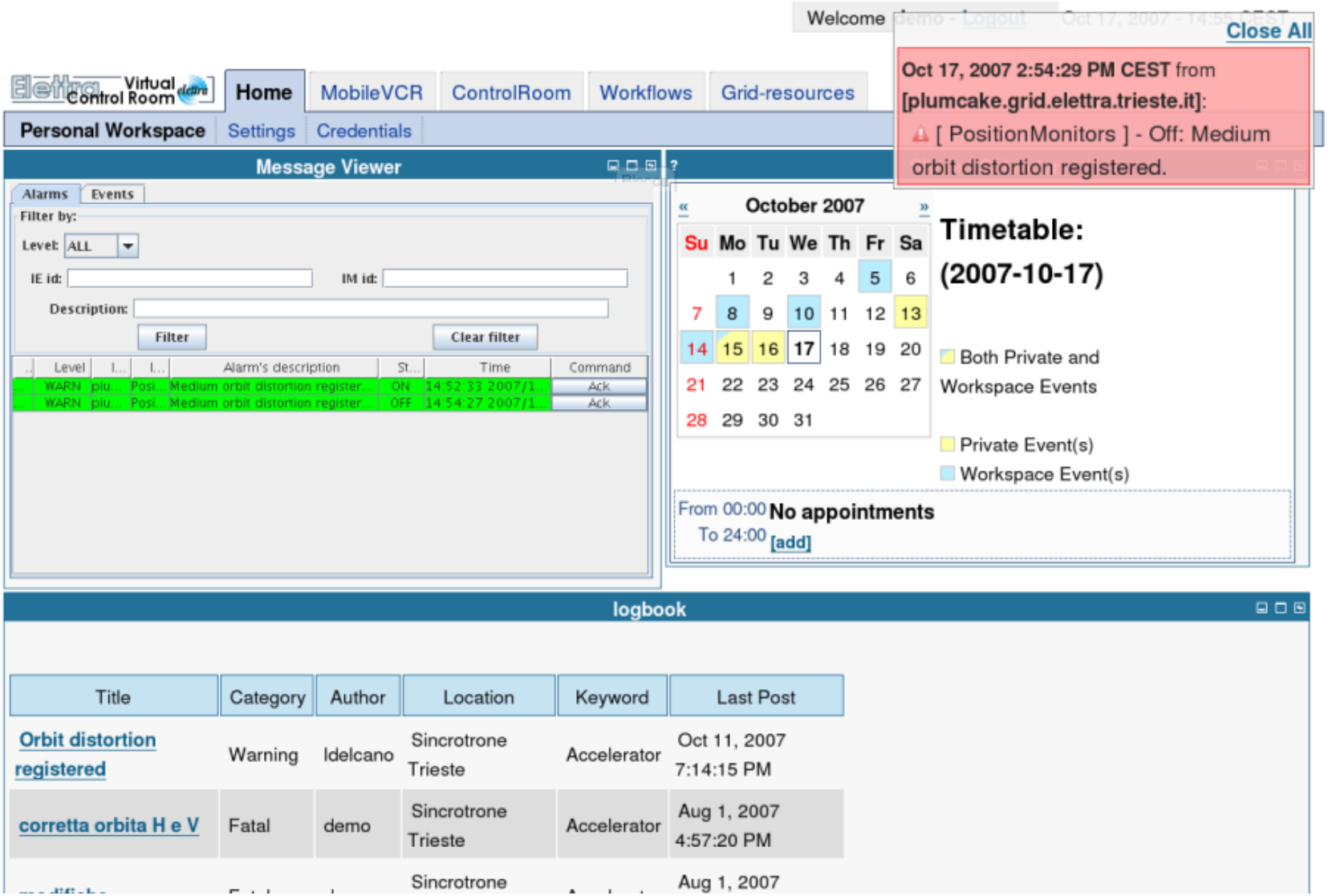
Orbit feedback correction via GRID



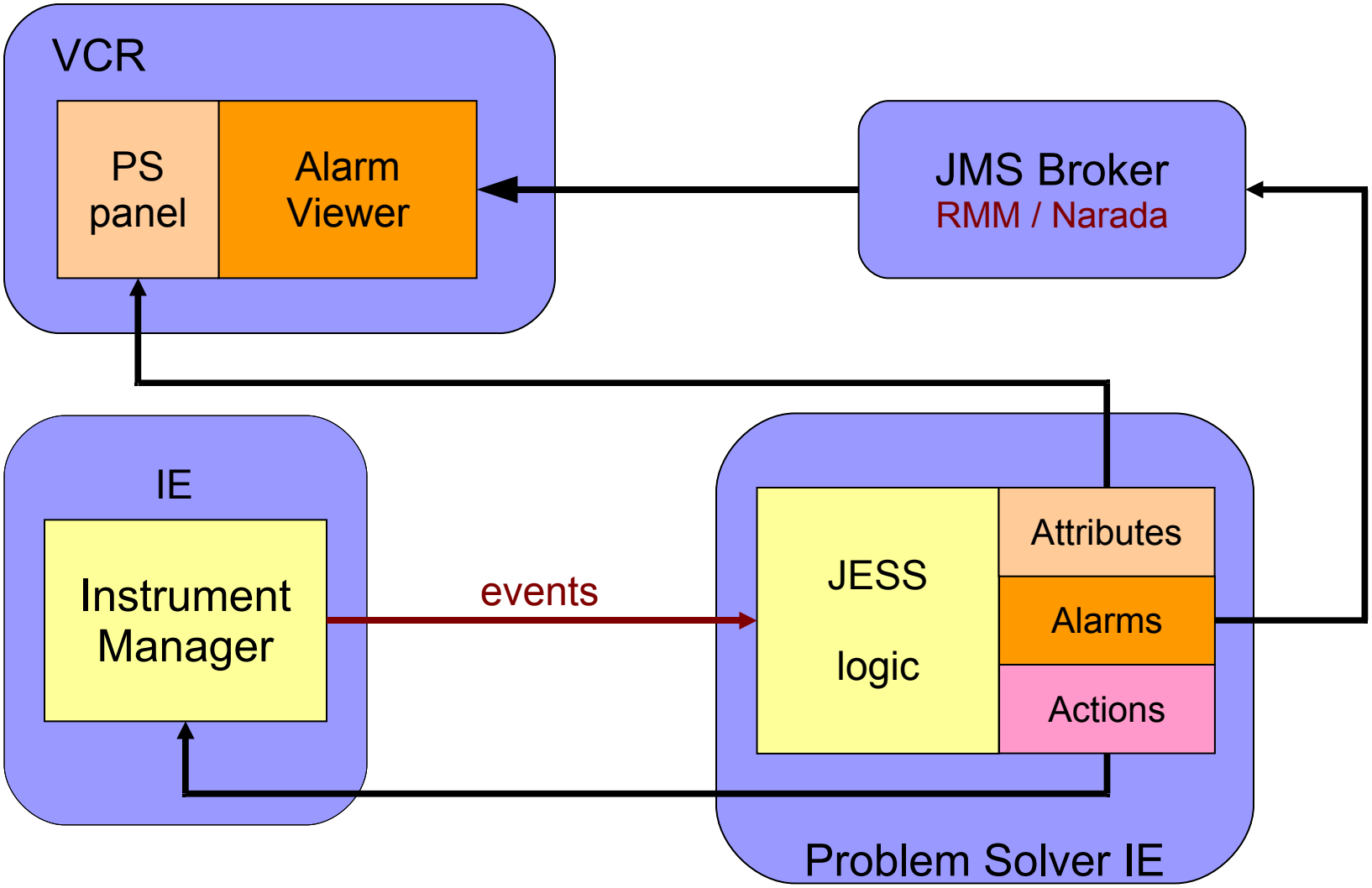
VCR Snapshots – Orbit corrected



VCR Snapshots – Alarm OFF

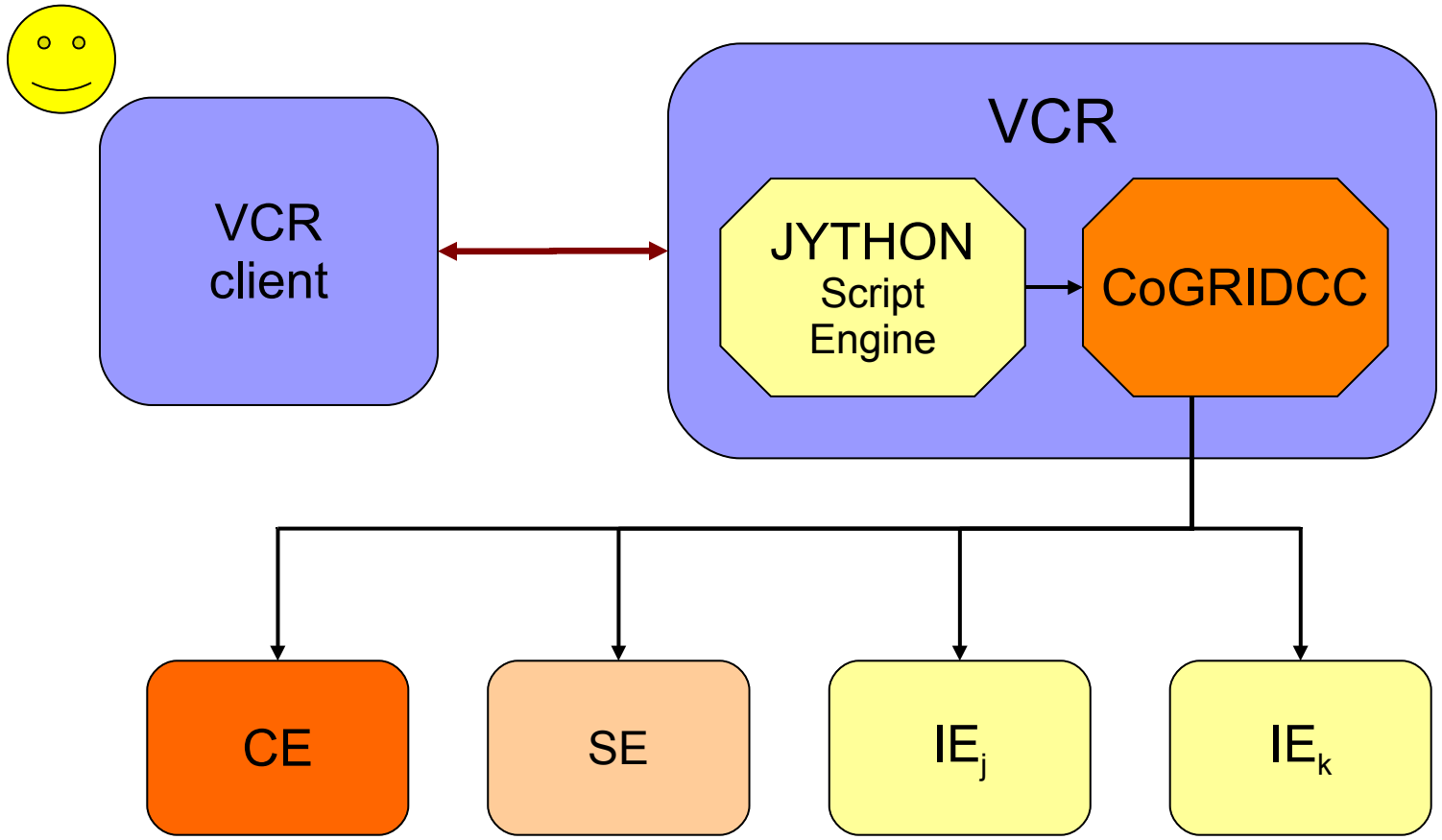


Event handling with the Problem Solver

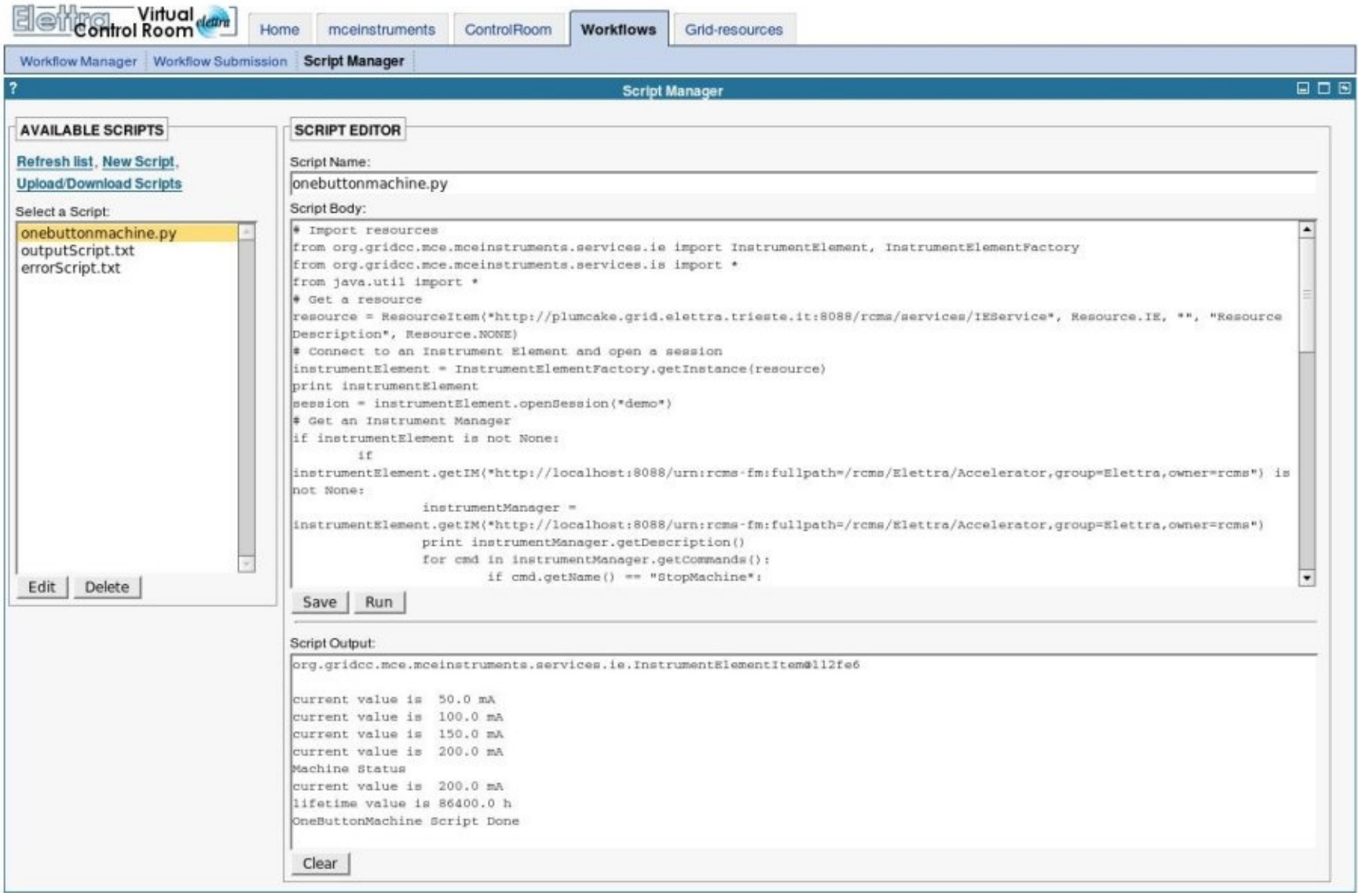


VCR CoGRIDCC

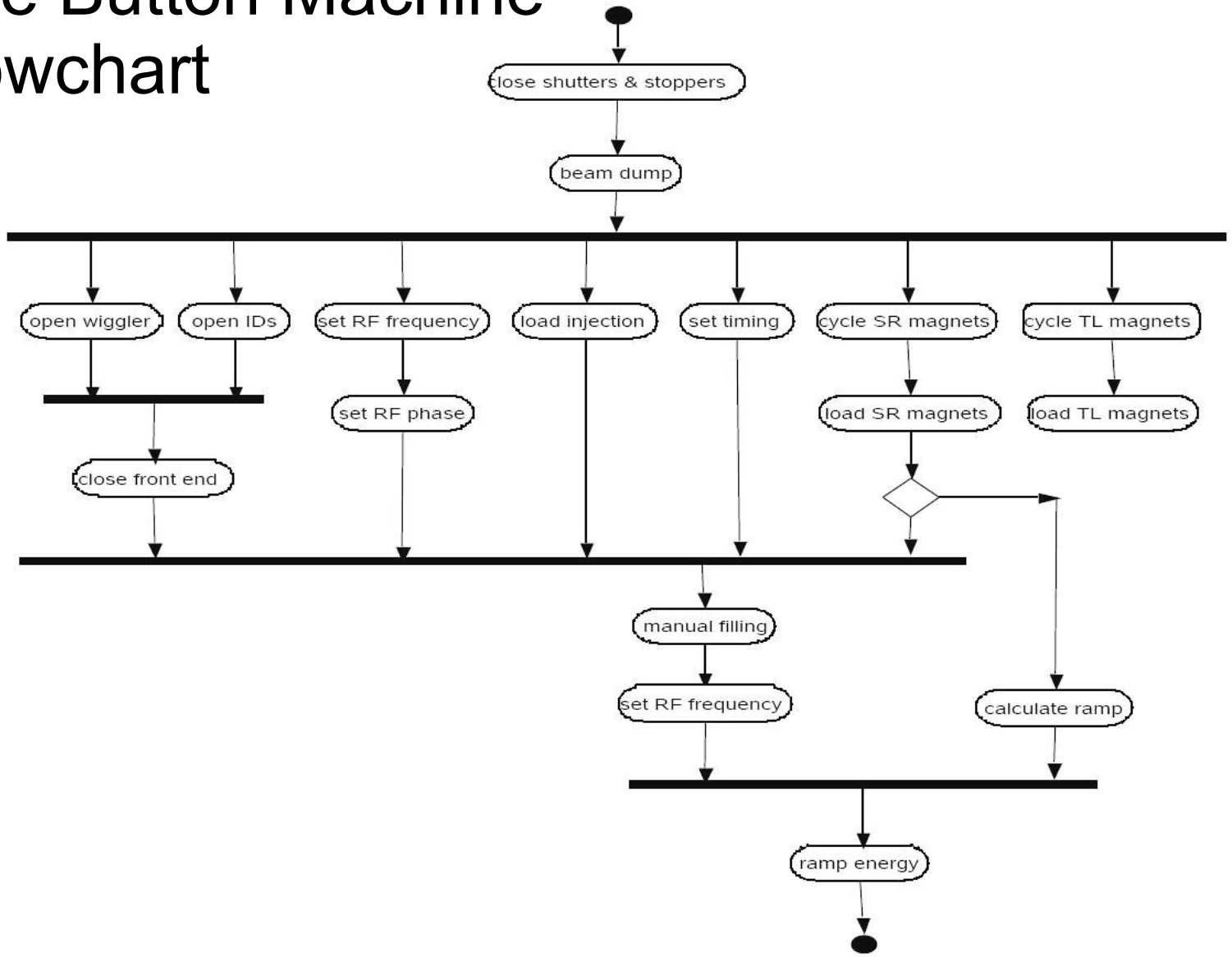
Alternative approach: Integrated scripting environment offers a simple tool for building workflows



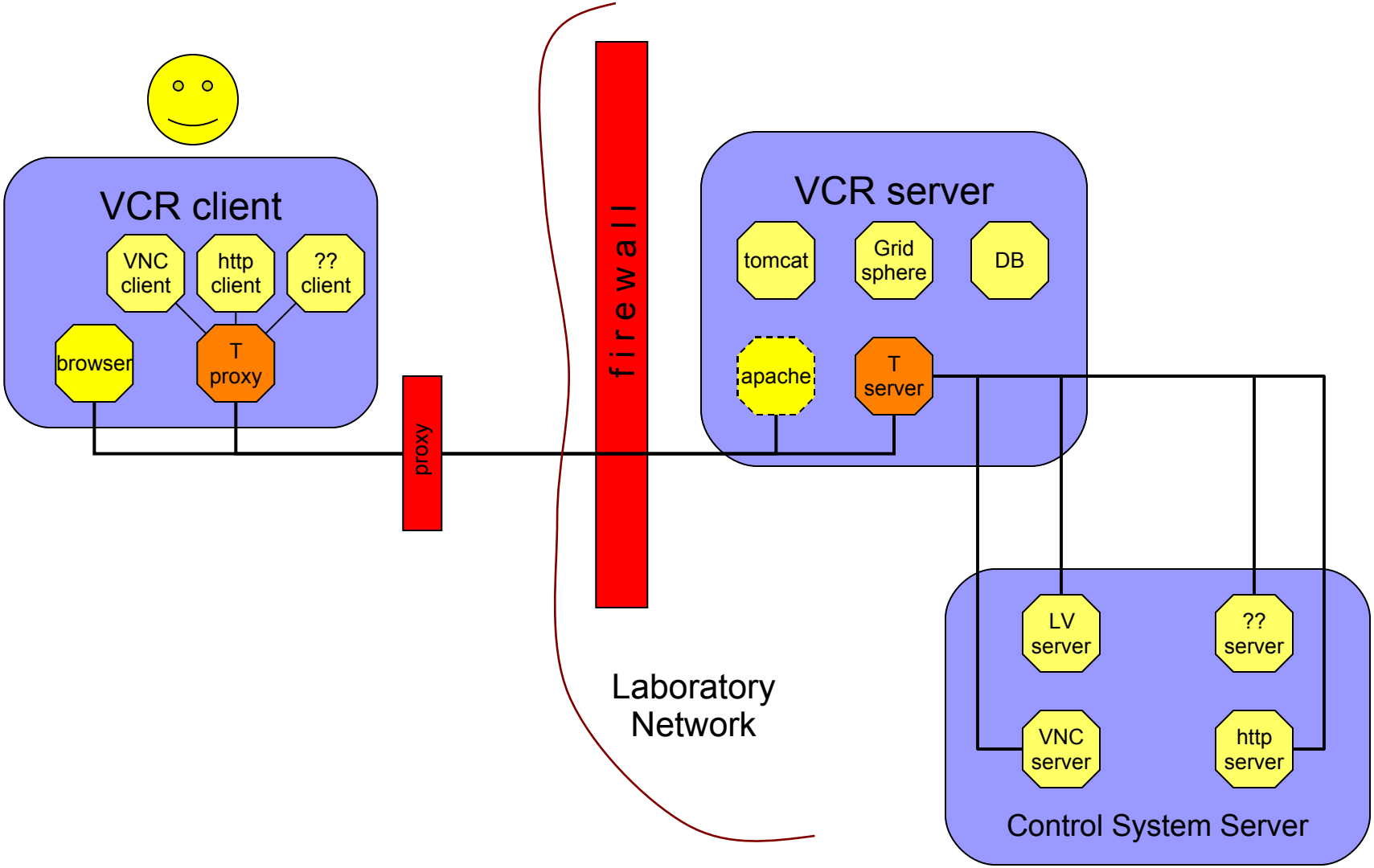
VCR Script Manager – OneBM workflow



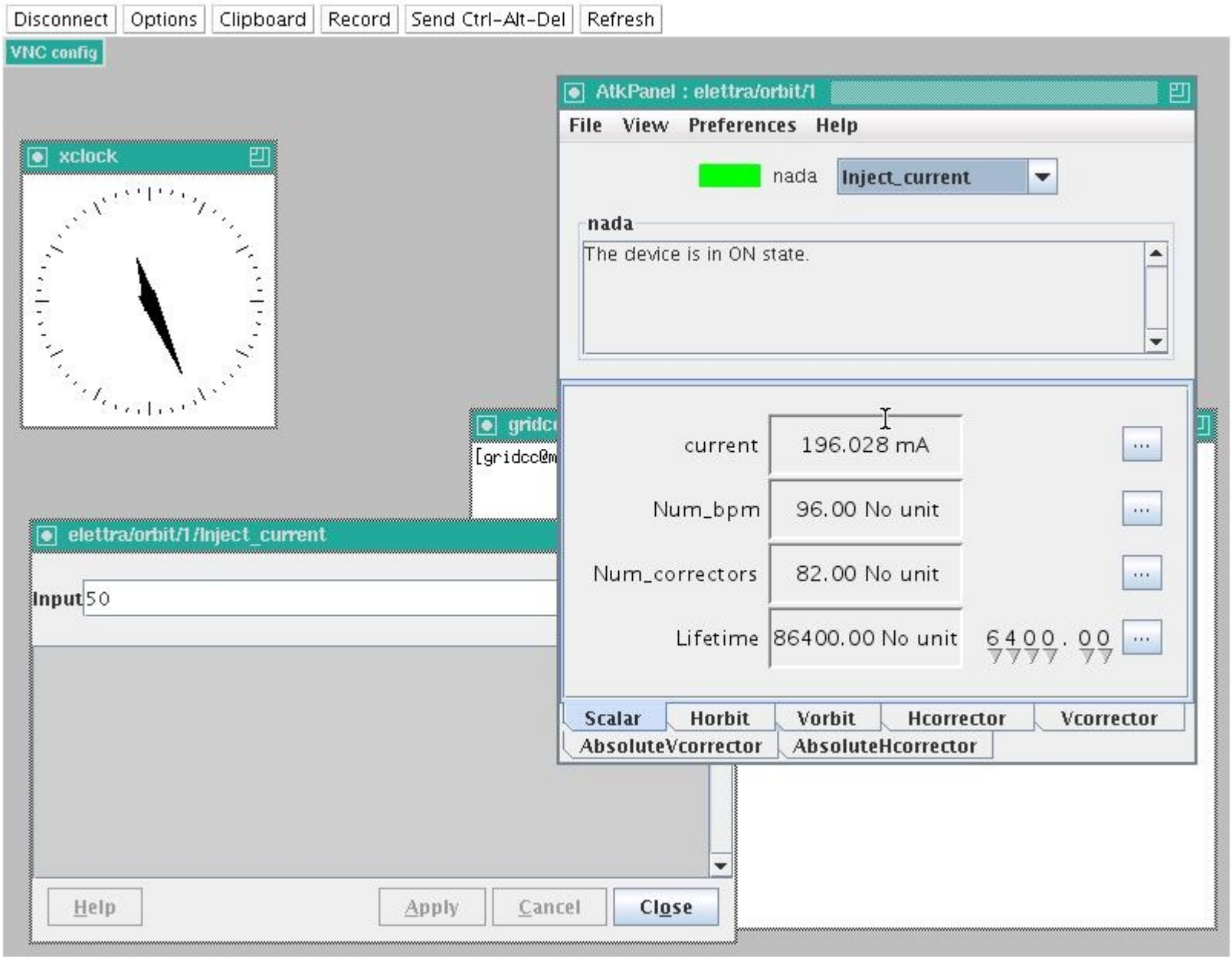
One Button Machine Flowchart



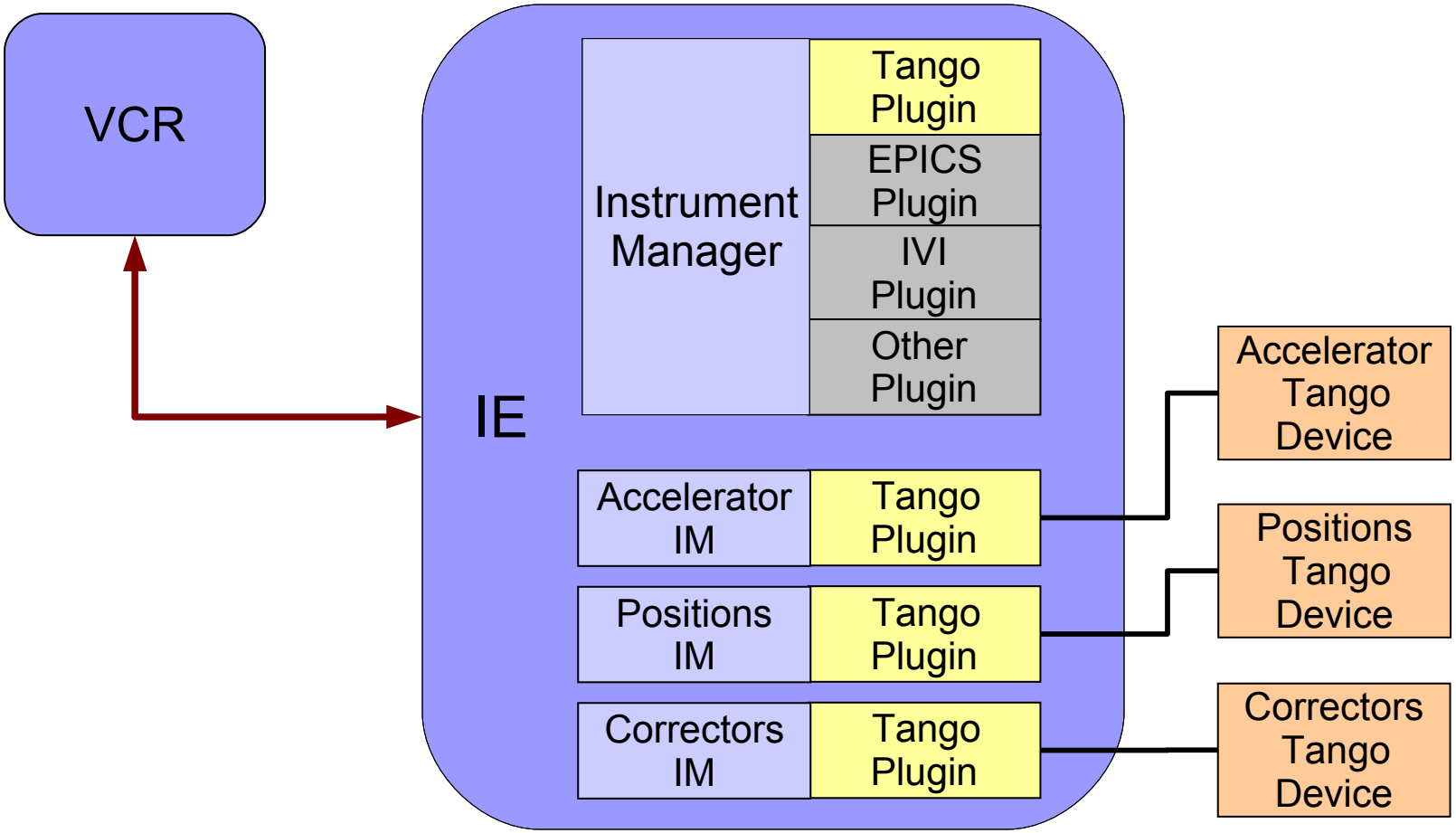
Remote Desktop (tunneling)



VNC Remote desktop



Control Systems Plugins: Tango Plugin

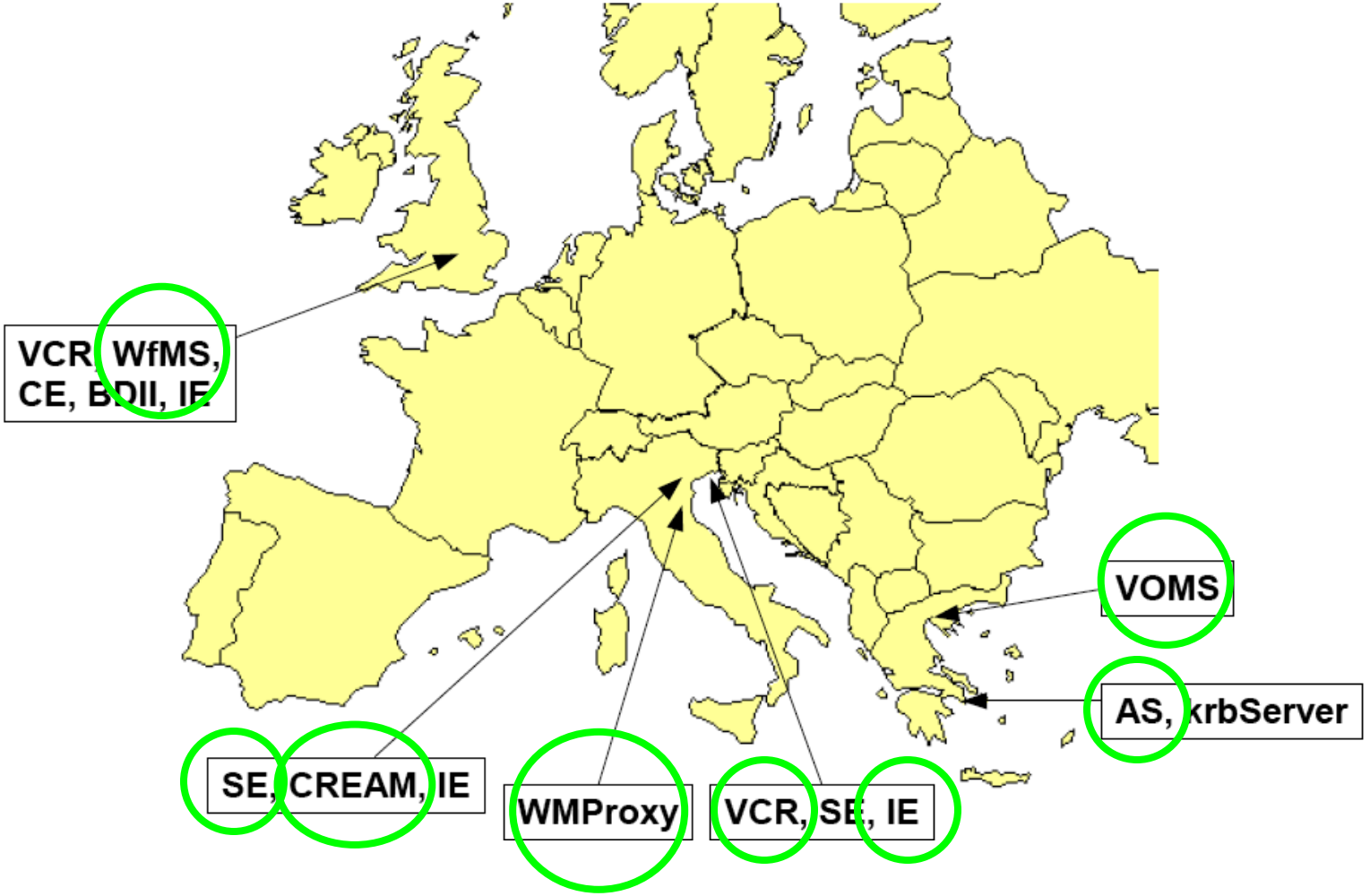


Deployment in the ELETTRA Control Room

Conclusions

- GRIDCC testbed pilot application
- The demo shows the capabilities of the GRIDCC middleware in accessing and controlling of distributed instrumentation in a large experimental physics facility.
- Grid technologies can be used to integrate operations with computing farms where complex machine physics models can run.
- The VCR provides a set of tools that allows for collaborative efforts in coping both with everyday tasks and exceptional events.
- Shows the use of VCR, IE, WfMS, PS, AS, VOMS (+ CE, SE)

GRIDCC Testbed used in the Demo



Thank you kindly for your attention!

Questions?