

Building a Transient Recorder System for the Large Hadron Collider

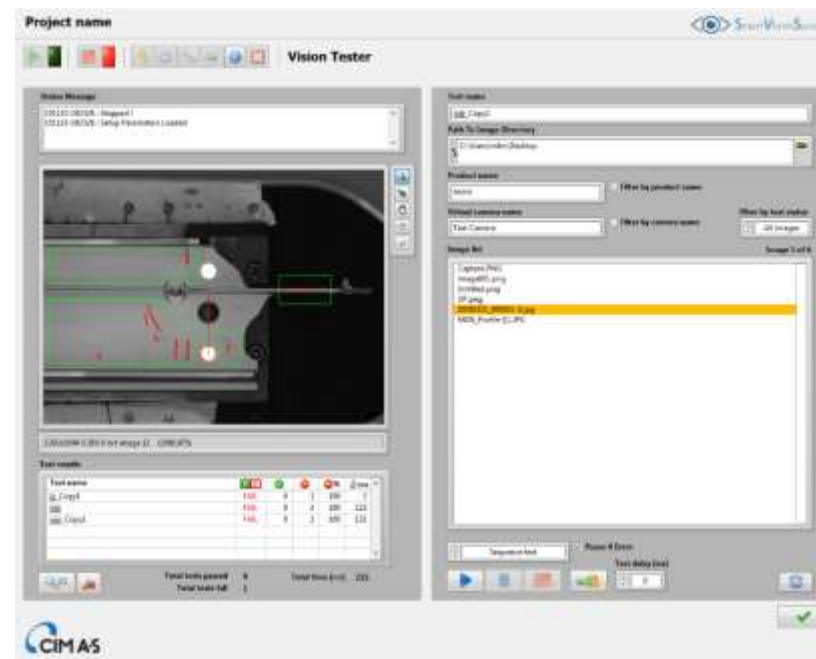
Anders Meister, Director



6TL-24 Combinational Tester

- supporting both ICT & FCT

- FLEXSTAND OI
- FLEXSTAND Diversity DB
- CIM SPC



- Part of CIM Group
Est. in 1998
60 employees in 3 Divisions

Consultancy
Test Solutions
Logger solutions
Vision Solutions
Medico (GMP, CFR 21 Part 11)
Green Engineering

16:25-16:55 Track D
How to Use NI Vision in Practice

Agenda

- CERN
- The Project
- System Requirements
- Challenges
- Working with CERN



- European Organization for Nuclear Research
- Geneva (Swiss-French Border)
- Used by +10.000 physicists WW
- Home of the Large Hadron Collider
- Not just Nuclear Research



- Annual Usage 1.3 Terawatt/h
- Power vs electrical resistance vs heat
- Cobber vs Niobiumtitanium (NbTi)

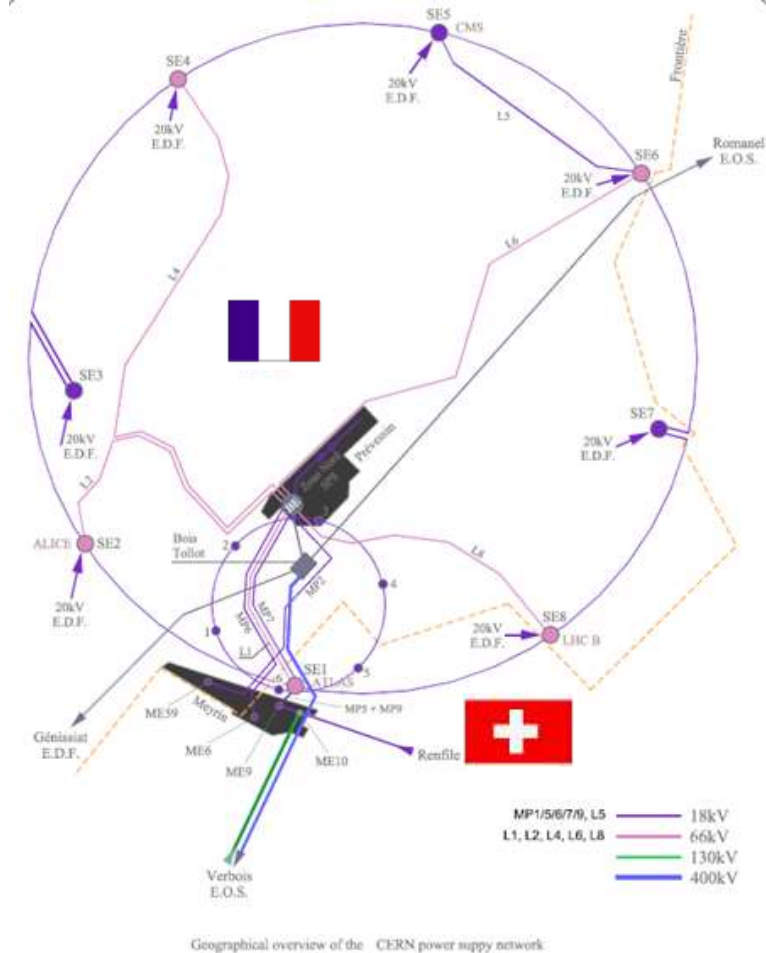
- Objective:

To make sure it is safe to repower the LHC and the Cooling (Cryo) System



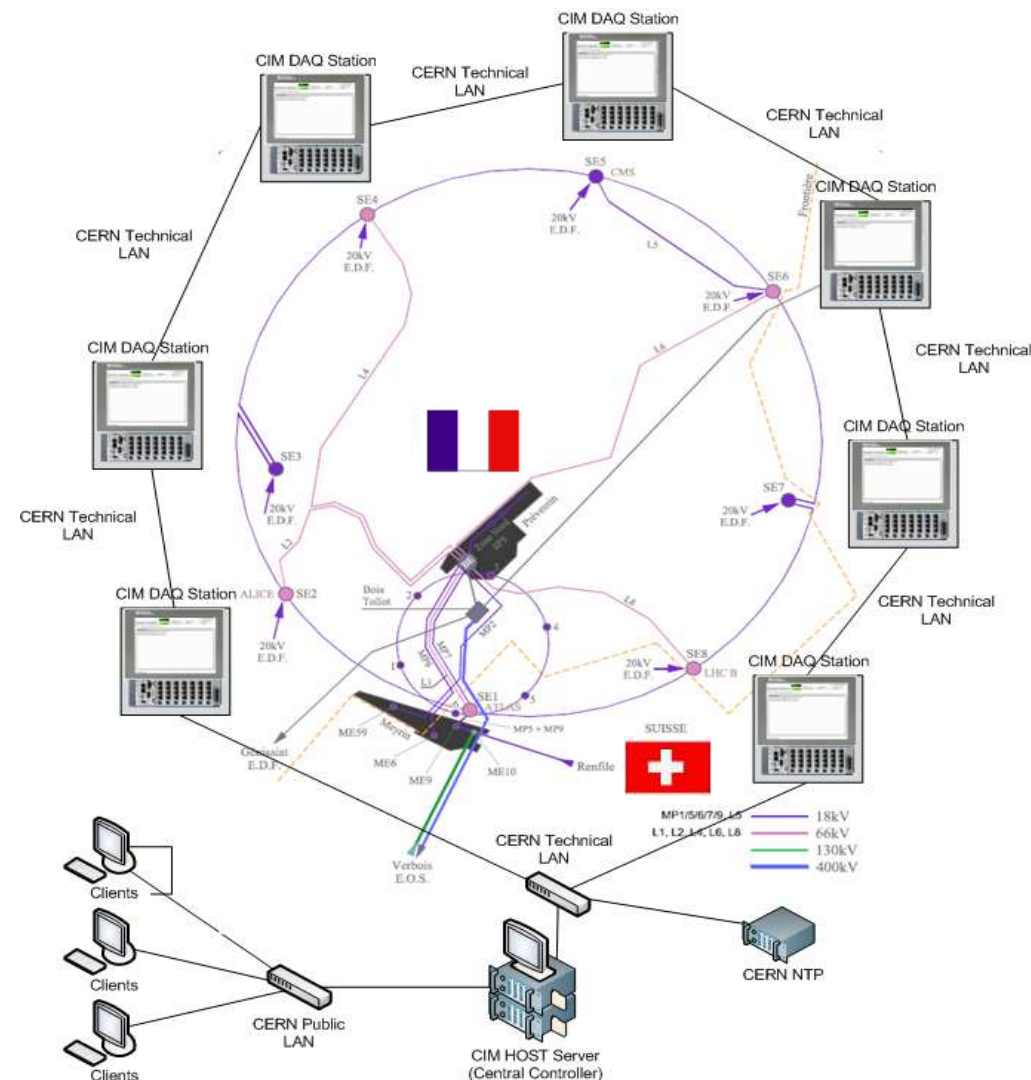
LHC TRIVIA

- 27 km Ring, Mean Depth 100m
- Two Particle Beams
- 9600 different Magnets
- -271,3 C using Liquid Helium
- 7 Power Stations
- 3 Billion Euro
- A Greater Understanding of How the Universe evolved



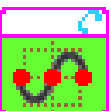
cRIO Based Transient Recorder

- Distributed Continuous Measurements
- 64 AI, 96 DI per DAQStation
- Sub Millisecond Synchronization
- Triggered Data Collection
- Redundancy (System Disconnect Handling)
- Data Stored on Server (Central Controller)
- Clients for Configuration and Analysis
- cRIO versus Commercial Solutions





Absolute



Zerocrossing



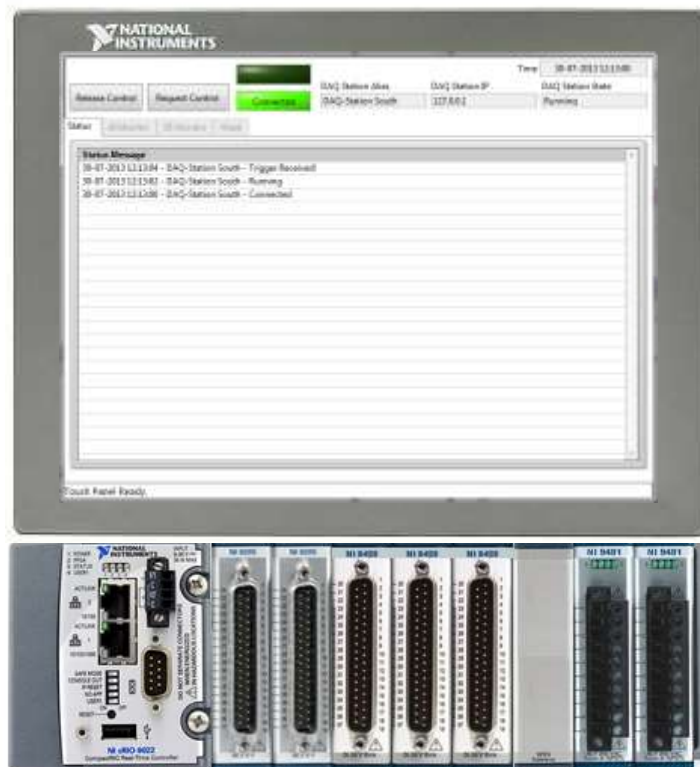
Delta-Peak



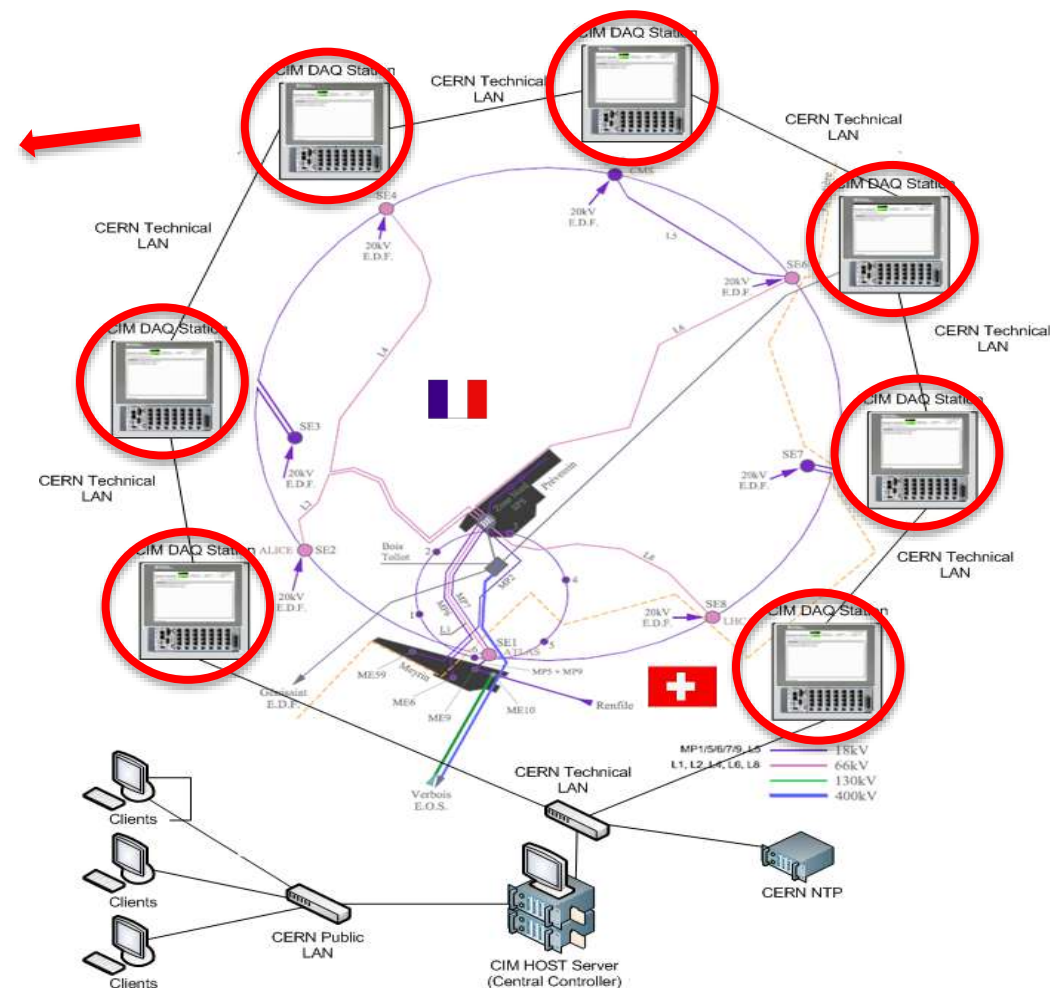
Peak-to-Peak



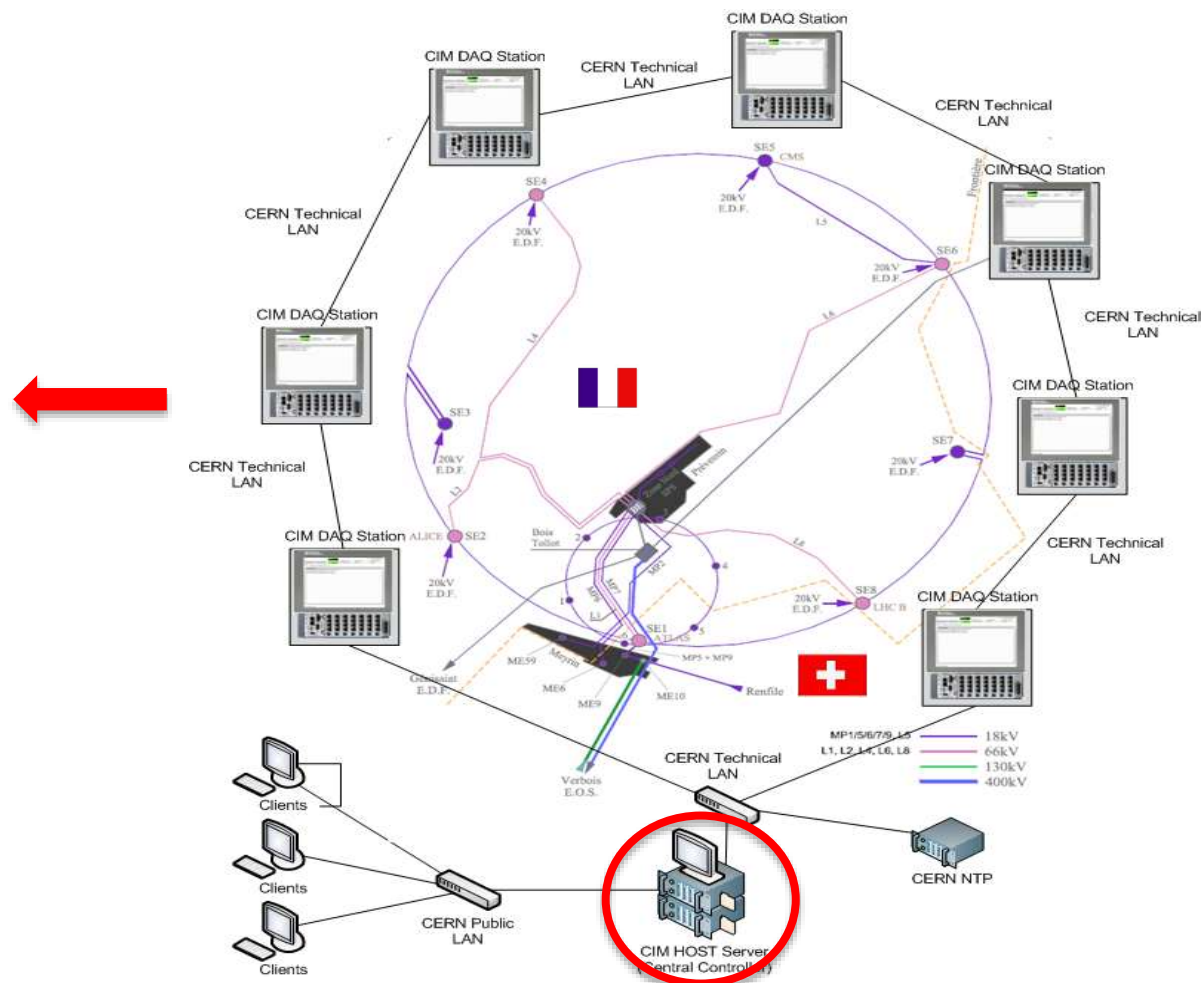
FFT (Co-processor)

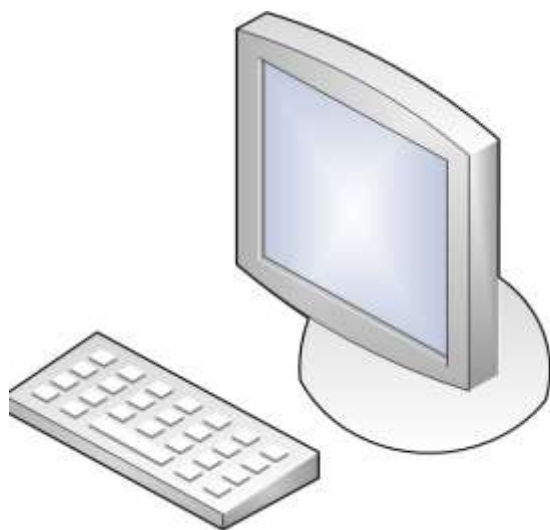


- Transient Recorder Acquisition System
- Analysis, Triggers, Communication
- Touch Panel IO, Trigger Masking

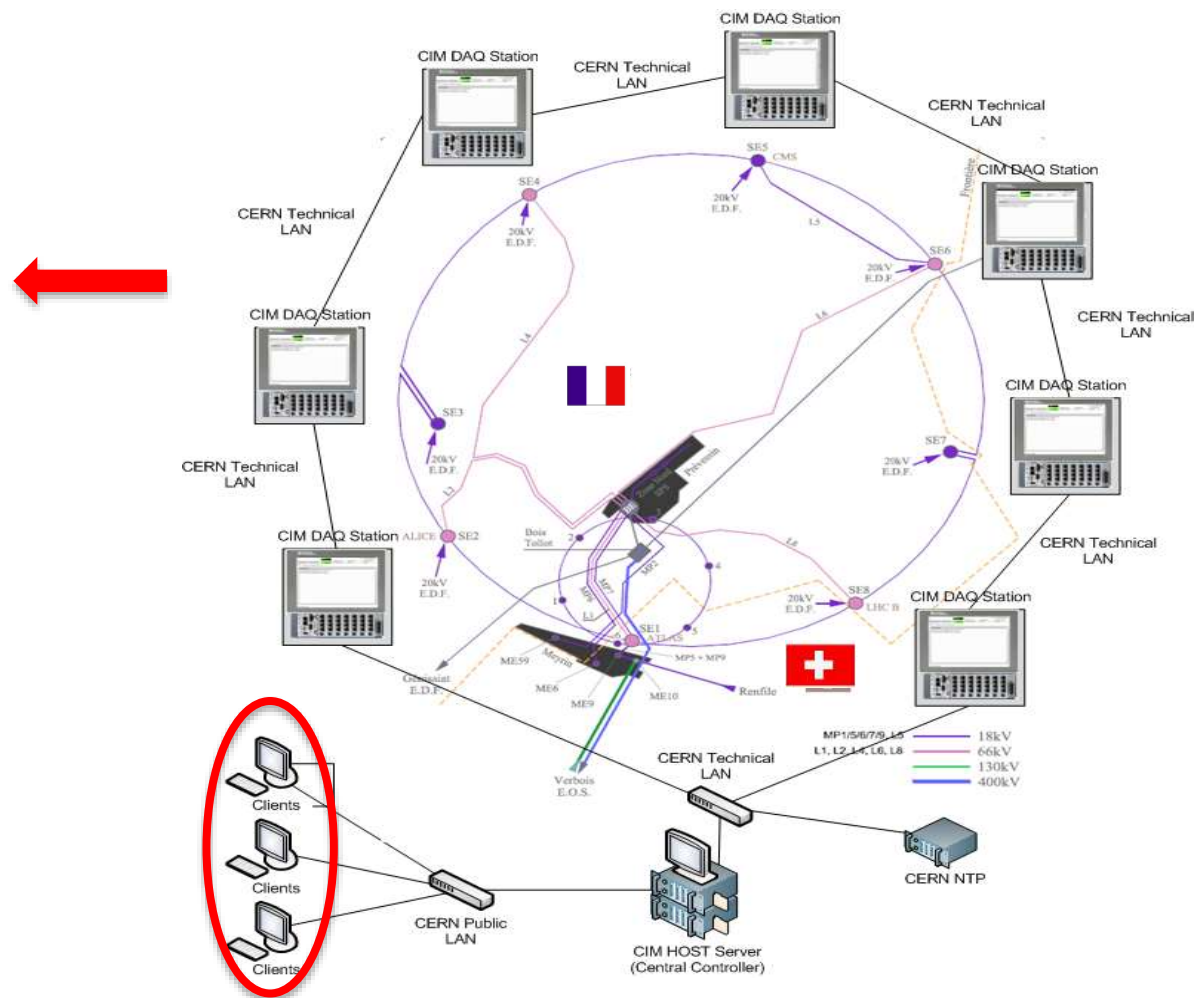


- Data Traffic Controller Manager
- Settings, Monitoring, Data Retrieval

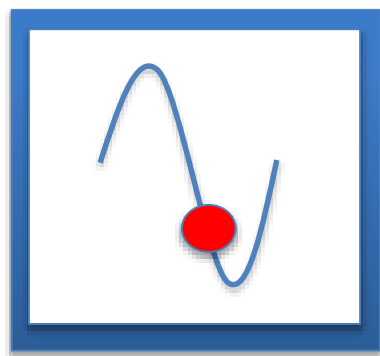




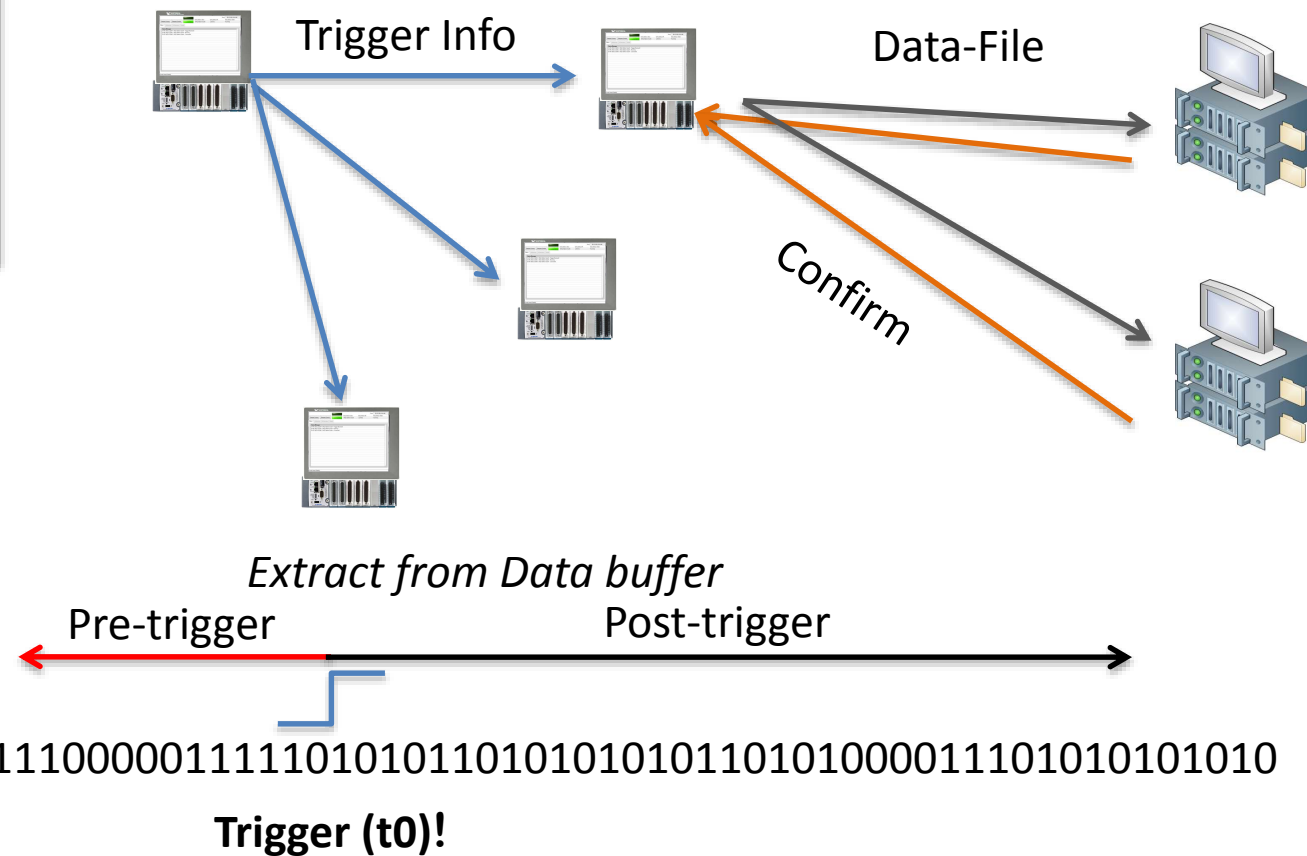
- Systems Configuration Tool
- Data View and Analysis



Transient Recording



Trigger (t0)!



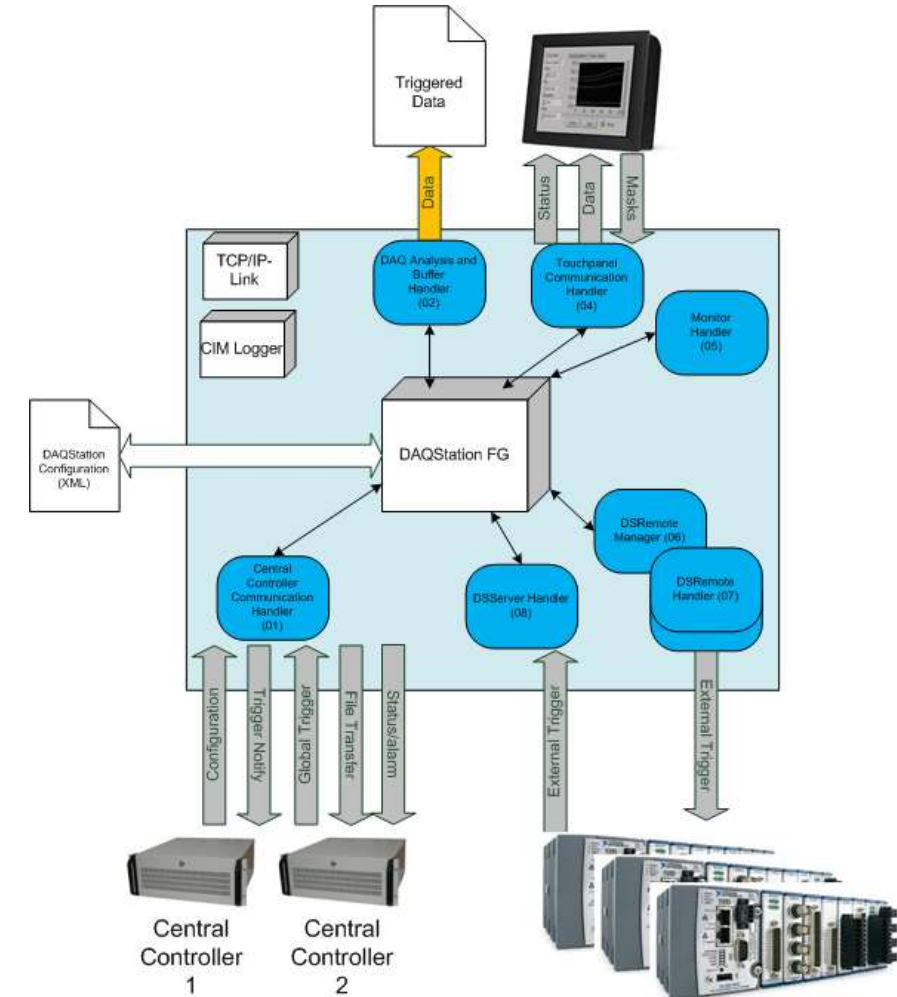
Challenges

- Distributed Systems
- Multiple Platforms (Linux, Windows, RT, FPGA)
- Synchronization
- High Load Application
 - 8000 Hz Measurement and Realtime Analysis on 160 Channels Per DaqStation
- Bookkeeping
- Redundancy



Working with CERN

- The Risk?
- Why CIM?
- Design vs Implementation
- Product vs Framework
- CERN Capabilities



- 7 Units installed, running and recording on the Sub-stations and Main Inlet– 18/400kVolt
- New features Implemented by CERN:
 - WebDAV for File transfers
 - Report logging

Next year:

- 10 new systems, including 8 installed on LHC
- Power Recording

The End