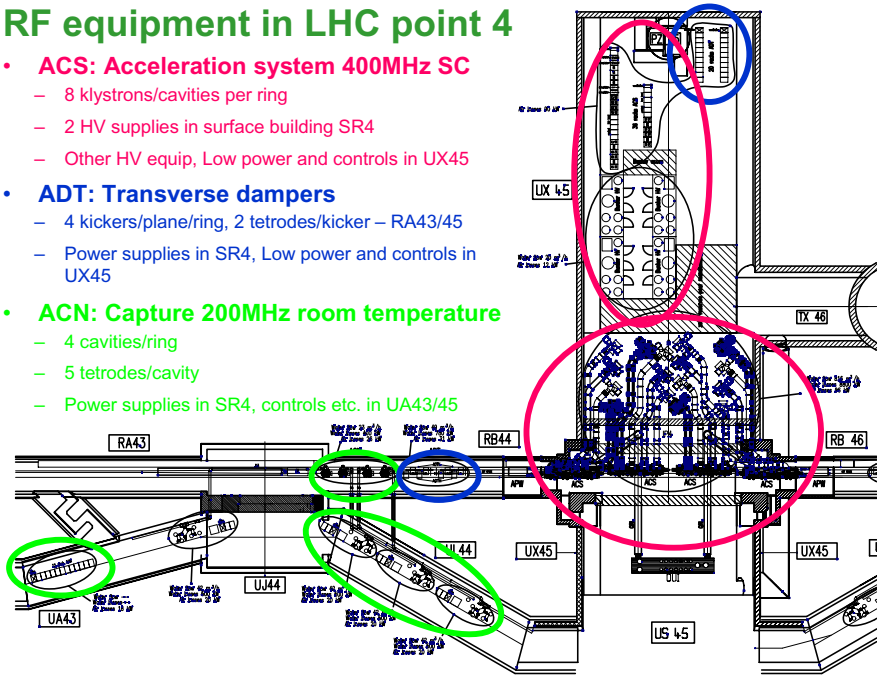
LHC RF Controls

- Overview
  - LHC machine
  - Test stands
- RF controls requirements for the LHC machine
- Architecture choices
  - Industrial components in RF controls –
    What has been done
    What can be done, what might, what cannot
  - How far should we go with industrial controls?
- Conclusions

RF equipment in LHC point 4

- **ACS: Acceleration system 400MHz SC**
  - 8 klystrons/cavities per ring
  - 2 HV supplies in surface building SR4
  - Other HV equip, Low power and controls in UX45
- **ADT: Transverse dampers**
  - 4 kickers/plane/ring, 2 tetrodes/kicker – RA43/45
  - Power supplies in SR4, Low power and controls in UX45
- **ACN: Capture 200MHz room temperature**
  - 4 cavities/ring
  - 5 tetrodes/cavity
  - Power supplies in SR4, controls etc. in UA43/45



LHC RF controls in development

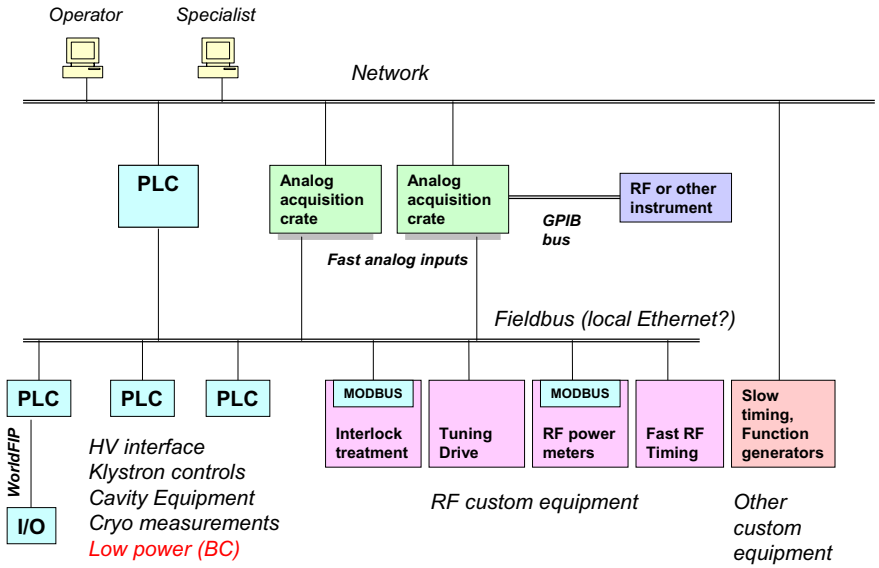
- Hall 112 klystron test and reception (Ready)
  - control of whole high power line with Schneider Premium PLCs
    HV, klystron focus & drive, temperatures, power meters
    measurements of efficiency, performance
  - Schneider applets for direct Web access to individual PLCs
  - Schneider OPC server + CMW gateway for access from Java clients
- Test stands SM18 (SC Cavities)
  - same as klystron tests but with cavity and low level equipment
  - currently LabView with PLCs
  - in future will re-use same controls as klystron tests
- Hall 867 Damper Tetrodes and kicker (new)
- Hall 867 ACN tetrodes and cavity (new)
  - will use same solution as klystron test stand

RF controls for the LHC machine

- Remote access to ALL control points
  - much of the equipment will be inaccessible during operation
  - minimise manual adjustments needed
- Autonomous operation
  - automatic surveillance
  - alarms
  - logging
- Fast monitoring diagnostics
  - analogue signals for observation and Post Mortem
  - dedicated analogue acquisition crates

- Make maximum use of COTS equipment (PLCs as “ECAs”)
  - robust, easy to integrate
  - sufficient performance for most applications

Controls architecture...?



Which parts can we do with PLCs?

- What can be done:
  - All cavity controls and measurements, except a few
- What might be done:
  - Low Level RF "slow" controls items:
    - phase shifters
    - delays
    - loop switches
- What cannot be done:
  - Acquisition for T < 10ms sampling
  - Function Generator
  - Slow timing
  - Fast timing

How far do we go with industrial controls?

- Can integrate PLCs and all RF equipment using COTS or CERN standard components
  - OPC, CMW
  - DataViewer, standard operation GUIs
  - Direct interface to Alarm System
  - Can provide all facilities for the operator and specialist using these
- But, SCADA system could still be useful for diagnostic applications
  - synoptics, fixed displays
  - trending (linked to central logging DB?)
- UNICOS:
  - seems difficult to integrate custom equipment into UNICOS PLC framework
  - but PVSS tools could be useful
- Open questions:
  - How far should we go in giving non-PLC equipment PLC-type interface to facilitate use of SCADA systems?
  - What SCADA features can we use?
  - Is there really an interest in taking a full industrial software environment simply because we have used PLCs for part of the interface?

Conclusions

- Already investing in industrial controls solutions for LHC RF
- Will have a mixture of PLCs and custom equipment
- Not clear how far we can go with SCADA/UNICOS
- But some supervision layer tools may be useful
- More discussion necessary...