



# Hardware, Design and Standards Issues for ILC Controls

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# My Motherhood Bullets

- Control system impacts every (almost) system in the ILC
- Need to have design criteria in place up front
- Important to educate designers quickly or incompatibilities will occur
- Need design and test system feedback as soon as possible and update specifications as required
- Large scale building without hard specs will lead to chaos!



# Topics to Address

- R & D projects
- Tests needed
- Module design standards (at least preliminary)
- Associated hardware (non-ATCA) requirements for interfacing to controls
- Test stands (racks not covered)
- Design checking
- Education/Monitoring
- Interface with detector electronics?



# R&D Projects

- How to monitor?
  - **Since money is short need to try and eliminate overlap**
  - **Need help from software to establish data base**
    - Try to think ahead of data needed for operation and get it in early
  - **Establish mandatory ID number system**
    - This can help keep track since all have to get one and provide some level of details
  - **Link test stands via internet**
    - Discuss later
    - How??



# ATCA Testing for DAQ

- Backplane Noise - design guidance
  - **Need measurements of noise induced from backplane operations**
    - Magnitude and frequency
    - Suggest remediation schemes
      - Filters
      - Shielding
      - Isolation
    - Will some systems require backplane “pause”?
  - **Module noise**
    - Processor power variations for example:
      - Intel data shows 20A to 90A changes in a few ns
        - » Filter design
        - » Resonance issues
  - **External noise from machine**
    - What can be expected????



# ATCA Design Standards - SM

- The Shelf Manager is one of the keys to ATCA five 9's availability
- What should the Shelf Manager requirements be?
  - **Module power control**
    - Power up test
    - Hot swap
  - **Power monitoring - V, I**
  - **State monitoring**
    - Operation data
    - Externals (more later)
  - **Module information conduit**
    - ID and Serial number
    - Features
      - ADC, DAC, processor, network
      - Operational manual in prom
      - Service record in prom



# ATCA Module Design

- Requirements and Specification Documents
- Standard protocol in Zone 2?
  - **E-net dominate ATCA protocol - +80%**
- Zone 3 Issues
  - **Connector suggestions**
    - Copper
    - Fiber
  - **Rear Transition Module**
    - Impact on MTTR
    - Are active components allowed?
    - Only a “form factor changer”?
- Front Panel
  - **No I/O**
  - **Only test points and visual displays**



# Associated Hardware

- What specifications need to be applied to non-ATCA hardware attached to Controls?
  - **Monitor and control of attached sensors**
    - ID and Serial number
    - Type, function, etc
  - **I/O physical and protocol**
    - I<sup>2</sup>C to Shelf Manager
    - Analog signals
      - Uni-polar/bipolar
      - Maximum voltage
      - impedance
    - Digital signals
      - Differential LVDS
      - Supported protocols (also software issue)





# AMC and/or $\mu$ TCA

- Note:  $\mu$ TCA is missing some ATCA features for five 9's
  - Is there an appropriate place for it?
  - Front panel cabling issue?
  - What should Controls recommend?
  - What is the availability?
- AMC modules
  - Shelf Manager compatibility
  - Power management
  - ID's
  - Hot Swap
  - I/O issues



# Virtual “Test Stand”

- Designers simulate their design against this “Test Stand”
  - **Idea used for Fastbus**
  - **VME had some commercial software**
- High level model of ATCA requirements
  - **VHDL**
  - **C++**
  - **Other?**
- What is available from industry for ATCA?



# Real Hardware and Software

- Need to disseminate current “hands on” knowledge to wider group
- Recommended hardware set - starter kit
  - **U of I experience**
  - **Other user feedback**
- Recommended software - starter kit
  - **Argonne**
  - **Other user feedback**



# Design Checking

- Specify test stand on the Internet
  - **Compliance testing**
    - Only check system issues
      - Compliance to standard feature set
        - » See slide 6
      - Not tested, for example:
        - » ADC linearity
        - » Amplifier sensitivity
  - **System testing**
    - Connection of modules at remote sites that need to communicate
      - Functional tests for operational compatibility
      - Probably no speed testing due to latency
  - **Lots of software help needed!!**
  - **Internet test facility (funding???)**



# How to Proceed

- Distill meat of ATCA document for ILC use
- Modify existing design documents as required
- Use existing lab equipment safety practices where possible
- Set up ID system ASAP
- Communication between hardware and software developers necessary
- Interface with non-controls hardware to prevent incompatibilities up front
- Judicious plagiarism (with acknowledgements) acceptable
- Do we need some help from upper management since this has an ILC wide impact?



# Psychology to Remember

- We need to remind designers that they can be as creative as they can be inside the device.
- We only want to insure that the edges of their design fits the rest of the system.