L1CAL
Online Control System

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L1Cal IIb Control Software

- Take L1CAL control out of L1 TCC
  - Based on Run IIa code
  - OS Independent: Windows -> Linux
- Split: Control Code vs. GUI
  - Python (GUI) & C++ (Control)
  - Re-use much of IIa infrastructure
  - New code for ADF
  - Use Nevis source code for TAB/GAB
  - Use ITC, Thread_Util, +now Xerces (XML)
L1CAL TCC Control Software

**Expert (e.g. at MSU)**
- Remote Console (Copy of Screen Output)
- L1Cal IIb Graphical User Interface
  - L1Cal_Iib_Gui

**L1Cal TCC**
- L1Cal IIb Graphical User Interface (Python)
  - L1Cal_Iib_Gui
- L1Cal IIb Trigger Control Program (C++)
  - L1Cal_Iib_Tcc

**Host Computers**
- COOR
- Monitoring Applications

**ASCII over ITC**
- Binary or XML over ITC
- ASCII commands over ITC

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L1Cal IIb Control Software

- L1Cal_Ilb_Gui (Graphical Interface)
  - GUI on L1Cal TCC and/or remote computer
  - Zero, One, or more GUI connected at a given time
  - Not in the path of data taking, COOR control, etc
  - Not in the path of monitoring operation
  - All new code for run IIb
  - Use Python with Tkinter plus C++ extension for ITC
  - GUI is extended with external python command files (arbitrary complex, e.g. ADF-2 production test)
Reference: Example
L1Cal GUI dialogs
Reference: Example
L1Cal GUI Console/LogFile
L1Cal IIb Control Software

- GUI extensions with Python Command Files
  - Call functions to perform any action the GUI supports:
    VME R/W, Config FPGA, program resources,...
  - Receive reply from Control Program (e.g. value read)
  - Recursive call to lower level command files while passing parameters (e.g. card address)
  - Also allow Control Waveform Generator and Multiplexer (for ADF initial tests and cabling sidewalk tests)
  - Allow interactive user input (e.g. enter card S/N)
  - Write test logfiles, or any other files e.g. plot files
  - Execute OS commands, e.g. view plots
  - In some sense: a python interface to L1Cal, and more
for SlotNum in range(2,SlotNumMax+1) : # i.e. slots 2,...21

    # Load T7 Firmware
    Config_Fpga ( MasterNum = MasterNum,
                  SlaveNum = SlaveNum,
                  SlotNum = SlotNum,
                  FpgaMask = 0x3, # 1: fpga#0, 2: fpga#1, 3: both
                  BitStream = BitStreamDir + T7_FirmwareName )

    # Initialize Card
    Adf_InitCard ( MasterNum = MasterNum,
                   SlaveNum = SlaveNum,
                   SlotNum = SlotNum )

    # park the shifters
    Exec_ComFile ( ComFile = CommandFileDir+'Setup_Stop_PRN_Shifters.cmd',  ArgDict = ArgDict )

    # Load the pseudorandom seeds
    for TTNum in range(16) :

        FpgaThisTTNum = TTNum / 8
        TTNumThisFpga = TTNum % 8

        # load the PRN seed for this EM channel
        EMSeedRegAddr = 0x2000 * TTNum + 0x300 + 6
        Rio_Write( MasterNum = MasterNum,
                   SlaveNum = SlaveNum,
                   SlotNum = SlotNum,
                   ChipNum = FpgaThisTTNum,
                   RegAddr = EMSeedRegAddr,
                   DataOut = PseudoRandomSeeds[2*TTNum+0] )

    ...
L1Cal Ilb Control Software

- L1Cal_Ilbb_TCC (Control Code)
  - Leveraged current L1 TCC code
  - Use C++ for robustness and execution speed
  - Software actually performing the VME IOs
  - Control and monitor both ADF and TAB/GAB
  - Interface presenting one L1CAL to COOR, Monitoring
  - Support local command files (like Run Ilb)
  - Keeps a Logfile of all actions
Reference: Example
L1Cal TCC Console/LogFile
Interface with TAB/GAB Hardware/Software

• Commissioning/Tests
  – Current and future Nevis Test programs can be used for tests or diagnostics

• Physics Running = L1Cal_IIb_TCC (only)
  – Call Nevis C code (common with Tests) to configure, initialize, program the TAB/GAB
  – Only tried with trivial case so far, more shortly
L1Cal Ilb Control Software

• **L1Cal_Ilb_TCC main functions**
  – Control
    • Configuration
      – After power up
    • Initialization
      – Defined initial state for COOR
    • Programming
      – Run-dependent requirements from COOR
  – Monitoring
  – Tests/Diagnostics
Interface to COOR

- Current highest priority is defining the syntax for COOR to program run dependent resources (references, parameters, thresholds, etc)
  e.g. “L1CAL_Ref_Set Jet_Et_Ref_Set 0 TT_Eta(-20:20) TT_Phi(1:32) Energy_Threshold 10.0”
- Most programmable resources are in TAB/GAB
- Philippe is working with Hal and Mike to produce a document defining the outside view of the system to COOR/Scott
- Implementation will leverage syntax parsing from IIa and call TAB/GAB code provided by Mike(&Philippe)
Reference: Interface to COOR

- Ref. L1Cal IIa programming
  [http://www.pa.msu.edu/hep/d0/ftp/tcc/coor/coor_to_tcc_I1ct_message_syntax.txt](http://www.pa.msu.edu/hep/d0/ftp/tcc/coor/coor_to_tcc_I1ct_message_syntax.txt)

- Ref: L1Cal IIb resources
L1Cal Monitoring (Control aspect of)

- **Serve L1Cal Monitoring Data**
  - Subset of events tagged for monitoring (~1 per 5s)
    - Hardware programmed to capture snapshot
    - Capture not just triggered crossing (whole turn for ADF-2)
  - L1Cal TCC reads data from hardware
    - e.g. TT ADC counts (ADF-2 Outputs, TAB inputs)
  - Oversampled data
    - ADF-2 raw 4x oversampled data
    - For calibration/verification
    - Special mode: set TT threshold to wait/capture bigger pulse
  - Server Infrastructure ported from IIa