

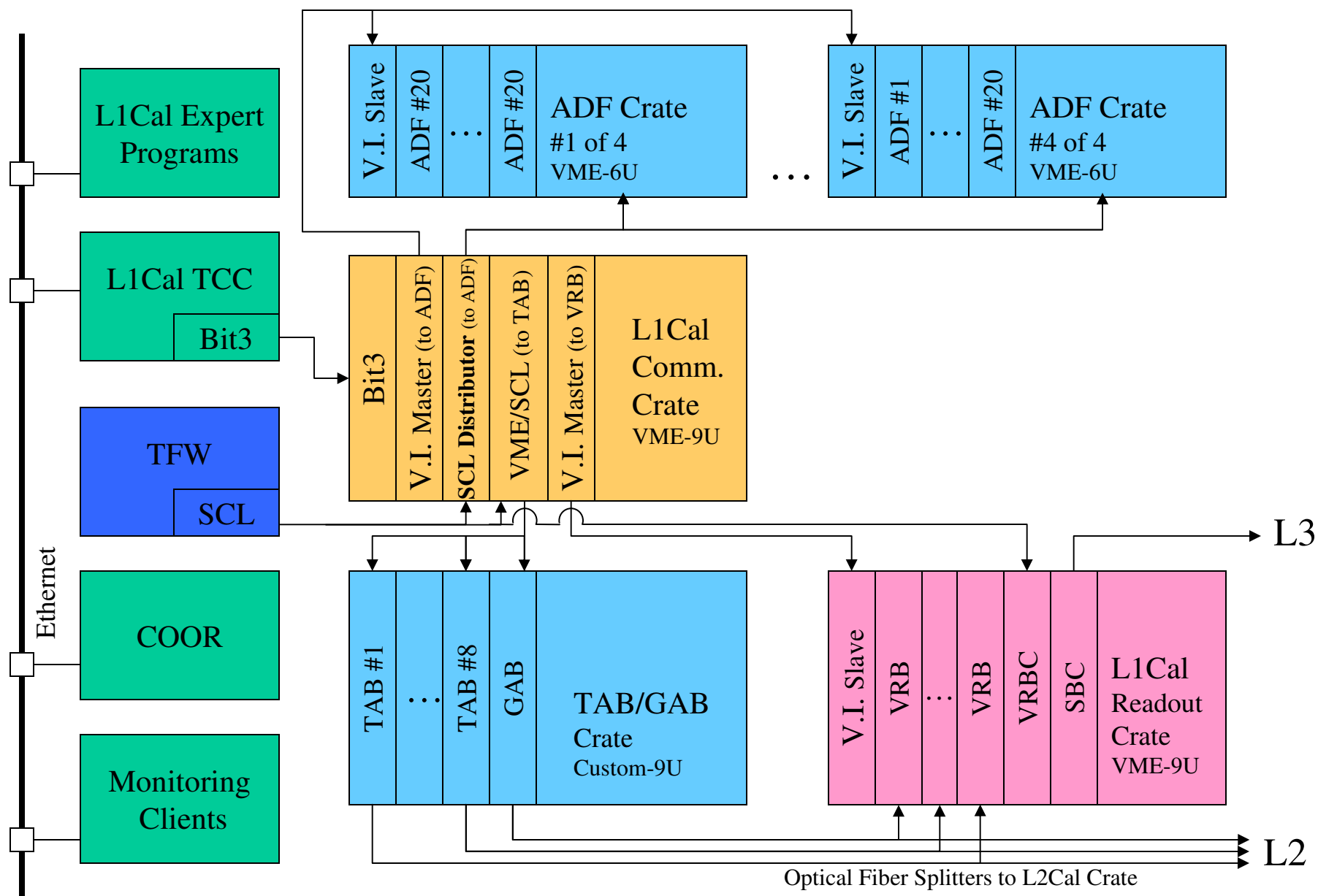
L1CAL

Online Control System

Philippe Laurens

26-Aug-2005

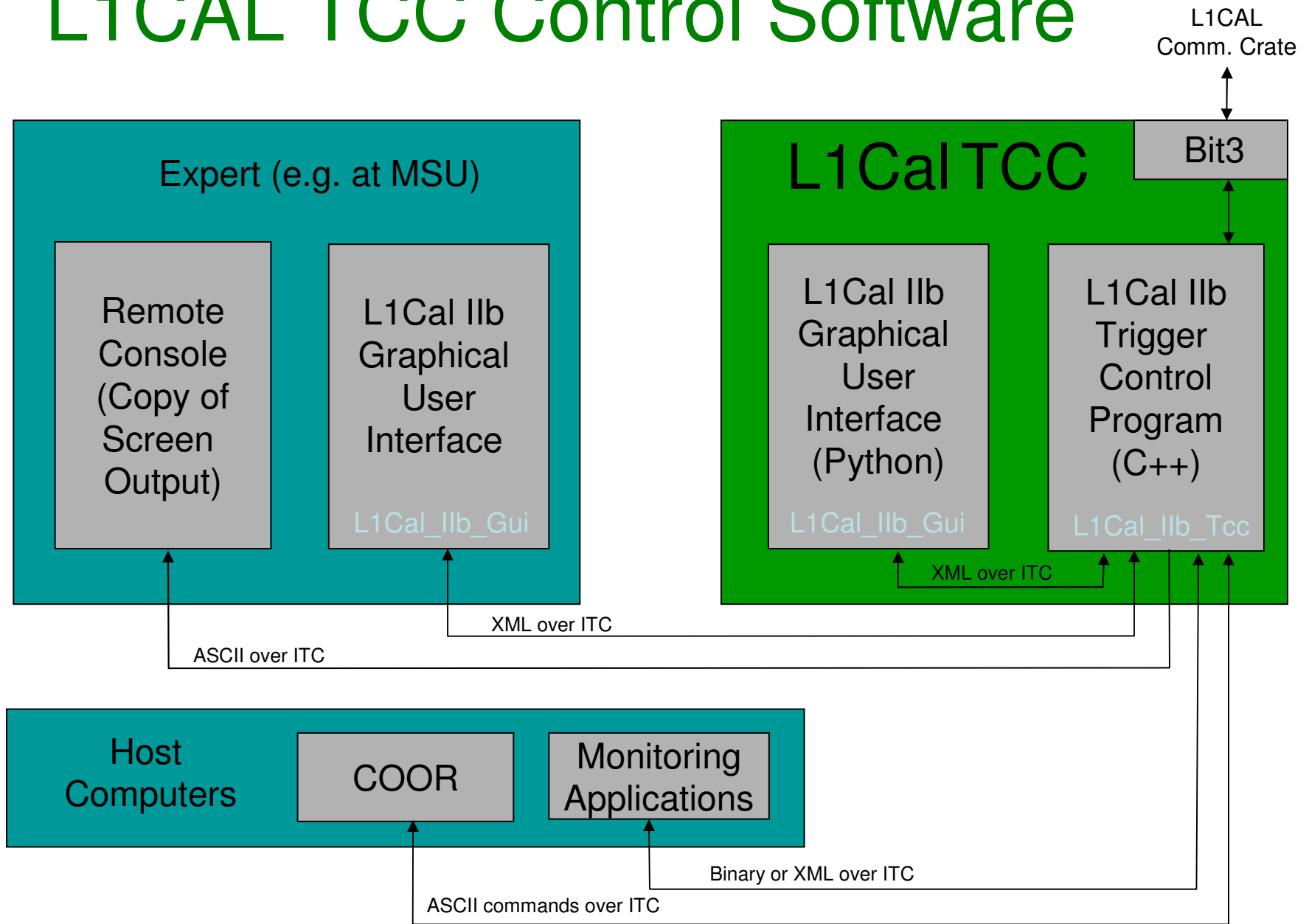
Run Iib L1 Calorimeter Trigger Control Path



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)

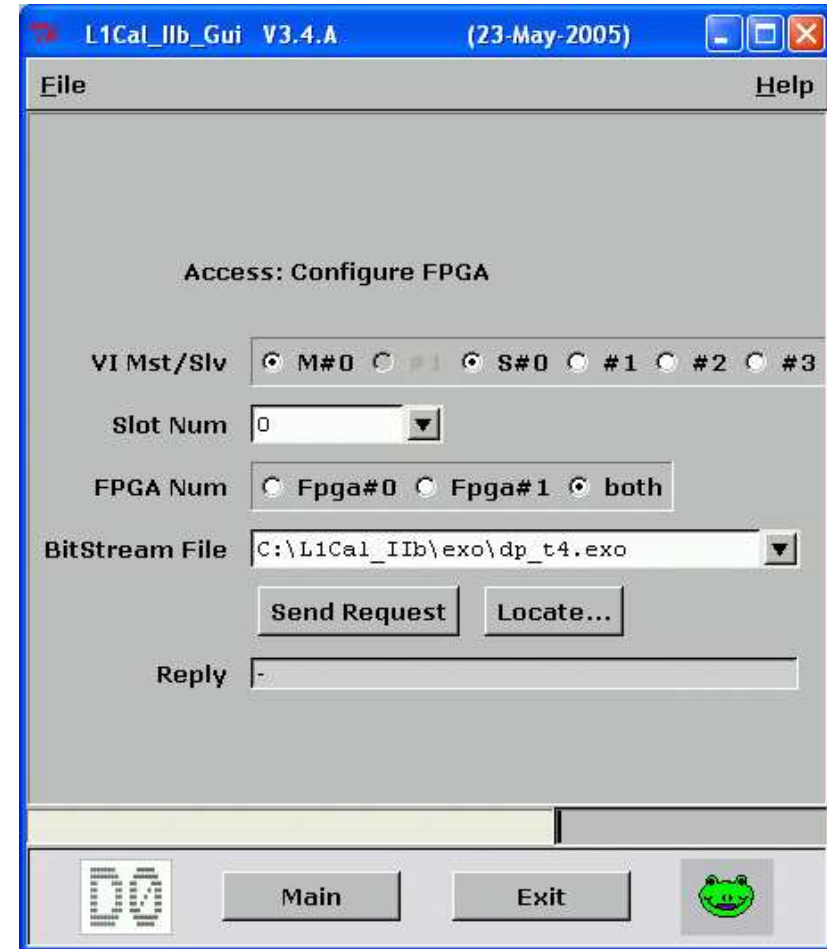
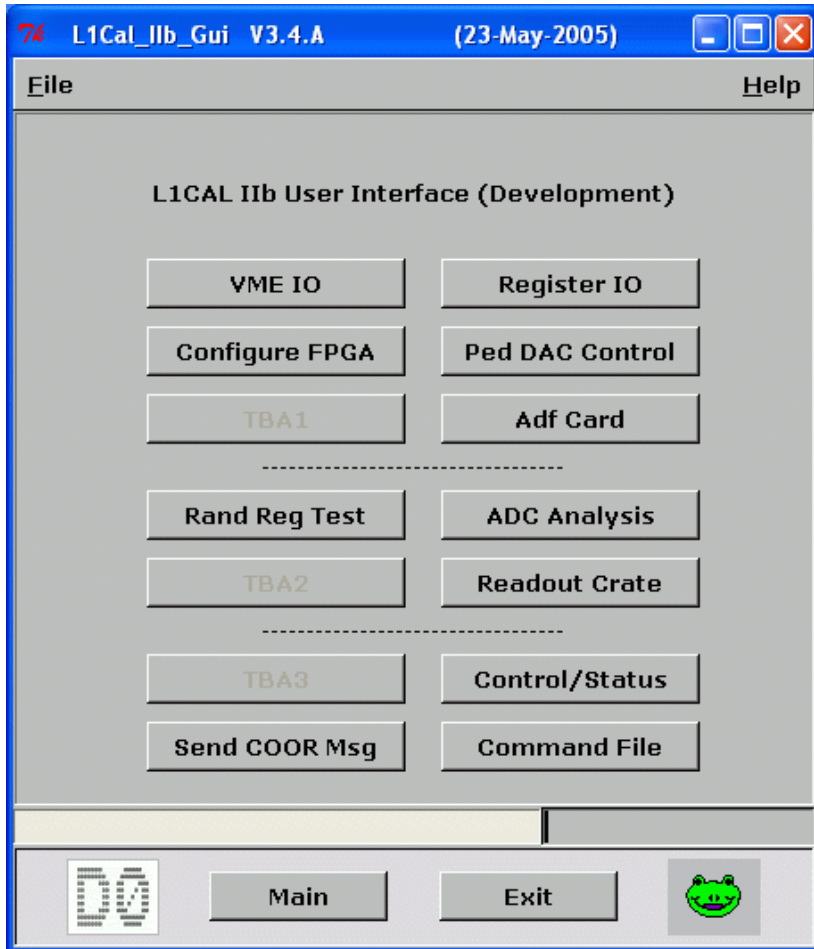
L1CAL TCC Control Software



L1Cal Ilb 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 Ilb
 - 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



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

Reference: Example GUI command file code excerpt

```
...
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 TNum in range(16) :

        FpgaThisTNum = TNum / 8
        TNumThisFpga = TNum % 8

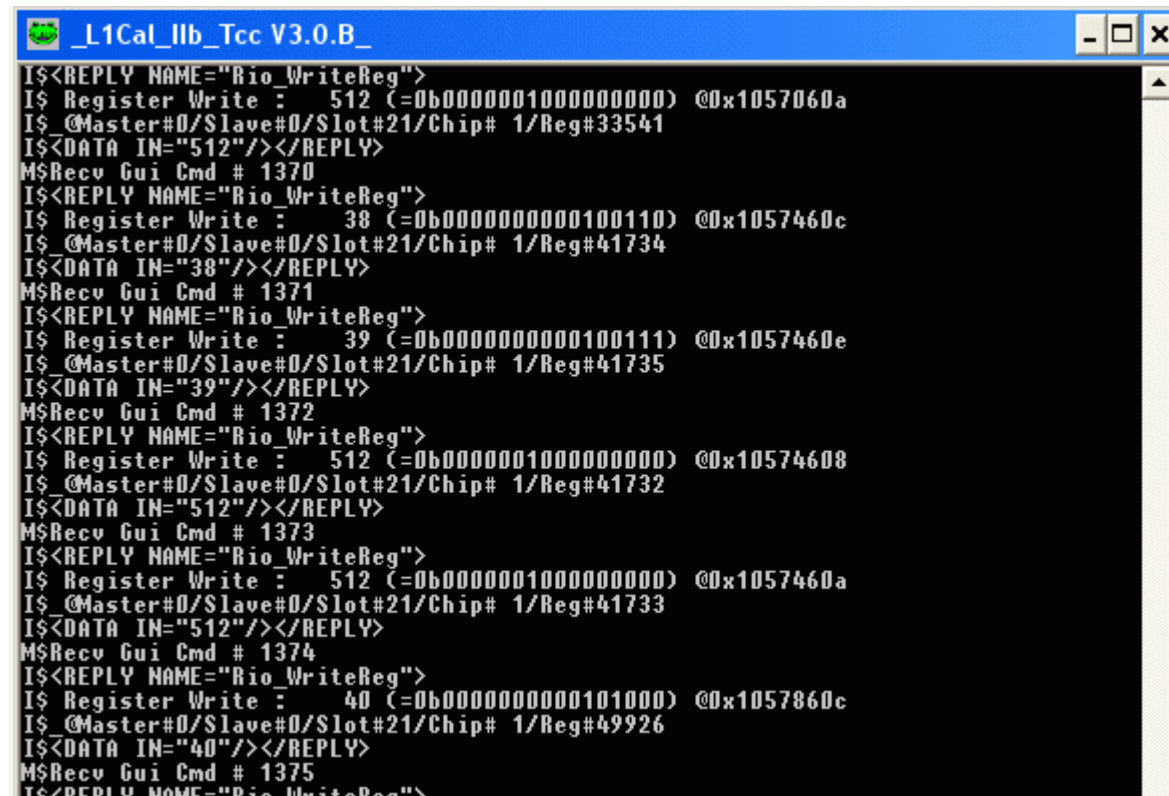
        # load the PRN seed for this EM channel
        EMSeedRegAddr = 0x2000 * TNum + 0x300 + 6
        Rio_Write( MasterNum = MasterNum,
                  SlaveNum  = SlaveNum,
                  SlotNum   = SlotNum,
                  ChipNum   = FpgaThisTNum,
                  RegAddr   = EMSeedRegAddr,
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

    ...
```

L1Cal IIb Control Software

- L1Cal_IIb_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 IIa)
 - Keeps a Logfile of all actions

Reference: Example L1Cal TCC Console/LogFile



```
_L1Cal_IIb_Tcc V3.0.B_
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 512 (=0b0000001000000000) @0x1057060a
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#33541
I$<DATA IN="512"/></REPLY>
M$Recv Gui Cmd # 1370
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 38 (=0b0000000000100110) @0x1057460c
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#41734
I$<DATA IN="38"/></REPLY>
M$Recv Gui Cmd # 1371
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 39 (=0b0000000000100111) @0x1057460e
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#41735
I$<DATA IN="39"/></REPLY>
M$Recv Gui Cmd # 1372
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 512 (=0b0000001000000000) @0x10574608
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#41732
I$<DATA IN="512"/></REPLY>
M$Recv Gui Cmd # 1373
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 512 (=0b0000001000000000) @0x1057460a
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#41733
I$<DATA IN="512"/></REPLY>
M$Recv Gui Cmd # 1374
I$<REPLY NAME="Rio_WriteReg">
I$ Register Write : 40 (=0b0000000000101000) @0x1057860c
I$ @Master#0/Slave#0/Slot#21/Chip# 1/Reg#49926
I$<DATA IN="40"/></REPLY>
M$Recv Gui Cmd # 1375
I$<REPLY NAME="Rio_WriteReg">
```

Interface with TAB/GAB Hardware/Software

- Commissioning/Tests
 - Current and future Nevis Test programs can be used for tests or diagnostics
- Physics Running = L1Cal_Ilb_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

L1 Cal IIb Control Software

- L1Cal_IIb_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 Ila 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_l1ct_message_syntax.txt
- Ref: L1Cal IIb resources
http://www.nevis.columbia.edu/~evans/l1cal/algos/trig_terms/coor_params.html

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 Ila