## **CBC** calibration

#### 16.04.2014 Electronics for 2S and PS-Pt modules meeting Kirika Uchida

## **CBC2** calibration

- Current situation (for beamtest)
  - Done in the IC lab downstairs with VME & LabVIEW by M. Raymond.
- New method
  - In the similar hardware setup as the beamtest.
  - Software in a linux machine with the beamtest setup (2CBC2 on 1FMC on GLIB). Coded in C++.

#### **Calibration sequence**

- Goal
  - Get all pedestals (254 channels) to have same level of inputs to the comparator wrt the global comparator threshold with a reasonable range of parameters, VCTH (global), VPLUS (global), offsets (one for each channel). All parameters are set by 8 bit registers range 0-255.
- Procedure
  - Obtain VPLUS value with all offsets at 80(0x50) which gives pedestal S-curve VCTH middle point at 120(0x78).
  - Optimise offsets with the VPLUS to have all pedestal S-curve VCTH middle points at 120(0x78).



## Some technical caveats

- Number of channels to pass the comparator threshold should be small.
  - The test pulse grouping (8 x 32 channels) is used in the study (Arbitrary grouping is also implemented.)
  - The sequence is applied to each grouping one after another.
  - The offsets of all channels which are not of interest are set to 0x00 (0xFF) for hole (electron) mode.

## Software Interface

Input : Setting file (Electron mode)

• The sequence is implemented in DAQController class.

#### Most simple main function to do calibration using DAQController

```
int main( int argc, char *argv[] ){
                                                                                                                     : /opt/testing/trackerDAQ-3.2/CBCDAQ/GlibSupervisor/xml/connections.xml
                                                                                              GlibConfigurationFile
                                                                                              GlibBoardId
                                                                                                                     : board
   std::string cConfigFileName = "settings/CbcCalibElectron.txt";
                                                                                              GlibReg_CBC_expected
                                                                                                                                                                   : 3
   if( argc >= 2 ){
                                                                                              GlibReg COMMISSIONNING MODE CBC TEST PULSE VALID
                                                                                                                                                                   : 1
       if( !strcmp( argv[1], "hole" ) ){
                                                                                              GlibReg COMMISSIONNING MODE DELAY AFTER FAST RESET
                                                                                                                                                                       50
           cConfigFileName = "settings/CbcCalibHole.txt";
                                                                                              GlibReg COMMISSIONNING MODE DELAY AFTER L1A
                                                                                                                                                                  : 400
                                                                                              GlibReg_COMMISSIONNING_MODE_DELAY_AFTER_TEST_PULSE
       }
                                                                                                                                                                   : 201
                                                                                              GlibReg COMMISSIONNING MODE RQ
                                                                                                                                                                        1
   CbcDaq::DAQController daq( cConfigFileName.c_str() );
                                                                                              GlibReg_FE_expected
                                                                                                                                                                        1
                                                                                              GlibReg cbc stubdata latency adjust fe1
                                                                                                                                                                        1
   TQObject::Connect( &daq, "Message( const char * )", 0, 0, "PrintLog( const char * )" );
                                                                                              GlibReg cbc stubdata latency adjust fe2
                                                                                                                                                                        1
                                                                                              GlibReg_user_wb_ttc_fmc_regs.pc_commands.ACQ_MODE
                                                                                                                                                                        1
   daq.ConfigureGlib();
                                                                                              GlibReg_user_wb_ttc_fmc_regs.pc_commands.CBC_DATA_GENE
                                                                                                                                                                        1
   daq.ConfigureCbc();
                                                                                              GlibReg user wb ttc fmc regs.pc commands.CBC DATA PACKET NUMBER: 100
   daq.ConfigureCalibration();
                                                                                              GlibReg user wb ttc fmc regs.pc commands.INT TRIGGER FREQ
                                                                                                                                                                        4
                                                                                                                                                                  :
   daq.Calibrate();
                                                                                              GlibReg user wb ttc fmc regs.pc commands.TRIGGER SEL
                                                                                                                                                                  :
                                                                                                                                                                        0
                                                                                              GlibReg_user_wb_ttc_fmc_regs.pc_commands2.clock_shift
                                                                                                                                                                  :
                                                                                                                                                                        0
                                                                                              GlibReg_user_wb_ttc_fmc_regs.pc_commands2.negative_logic_CBC
                                                                                                                                                                  :
                                                                                                                                                                       1
                                                                                              GlibReg user wb ttc fmc regs.pc commands2.negative logic sTTS
                                                                                                                                                                  :
                                                                                                                                                                        0
                                                                                              GlibReg user wb ttc fmc regs.pc commands2.polarity tlu
                                                                                                                                                                   :
                                                                                                                                                                        0
                                                                                              CbcConfig_FE0CBC0
                                                                                                                     : settings/FE0CBC0.txt
                                                                                              CbcConfig_FE0CBC1
                                                                                                                     : settings/FE0CBC1.txt
                                                                                              Calib InitialOffset
                                                                                                                     : 0x00
Outputs
                                                                                              Calib_TargetOffset
                                                                                                                     : 0x50
                                                                                              Calib TargetVCth
                                                                                                                     : 0x78
Directory Neg1Off50VCth78 contains
                                                                                              Calib VplusMax.
                                                                                                                     : 0x90
  Root files contain scurve histograms, Vplus vs. VCth graphs,
                                                                                              Calib_VplusMin.
                                                                                                                     : 0x60
  FEOCBC0.txt and FEOCBC1.txt with the calibration result.
                                                                                              Calib_VplusStep
                                                                                                                     : 0x10
```

#### On-the-fly configurations are also implemented and used in GUI version.

#### **GUI** interface

## **Class diagram**





15/04/2014

BeController and Data are for strusburg's firmware (BE) on GLIB

#### VPLUS vs. VCTH middle point

• VCTH scan with all offsets at 80(0x50) for 4 value of VPLUS, 96, 112, 128, 144.





# Offset optimization



- Optimise offsets with the VPLUS at 110(0x6E) to have all pedestal Scurve VCTH middle points at 120(0x78)
  - Set offsets to 0.
  - Set bit[i] to 1 and check vстн middle points, if it is greater than 120, set bit[i] to 0. Loop over i = 7 to 0.



## Pedestal and Test pulse



## Summary

- A proposal of CBC2 calibration sequence from M. Raymond is implemented in linux system for electron and hole modes.
- Current software is designed for a single GLIB with one or two FMC with also one or two CBC2. It is possible to extend to multiple GLIBs with some modifications (root histogram namings, etc.)
- The software is tested with strasburg's firmware on GLIB with one FMC with 2CBC2.
- It would be easy to use and integrate calibration sequence itself in beamtest setup.
- GUI is build by ROOT. This is useful to do many kinds of test changing the setup including CBC register on-the-fly.

## backup

#### Pedestal and Test pulse



#### Test pulse noise (S-curve width/Gain)

