

# Beam Modulation Control and Hardware

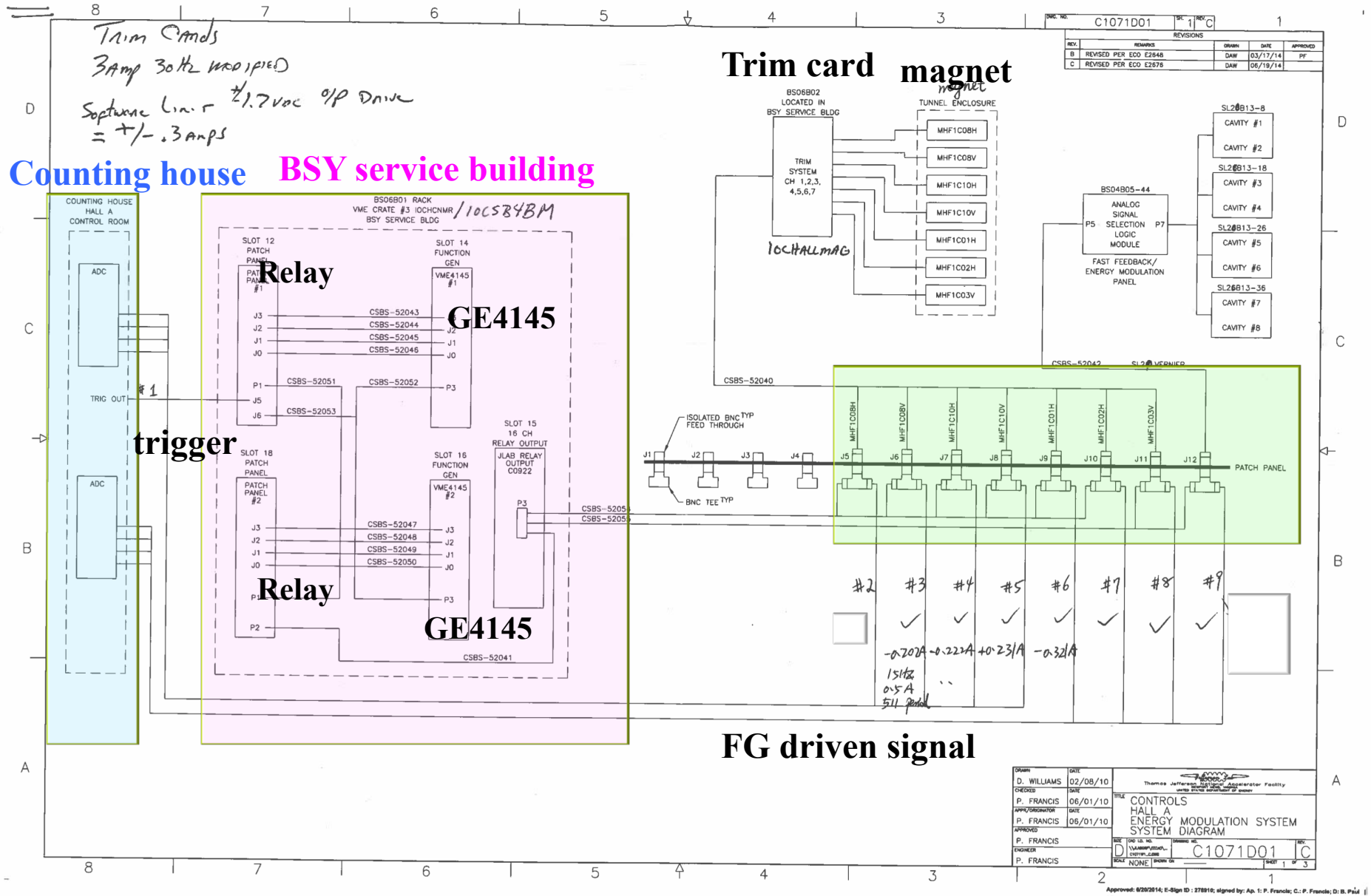
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02/16/2019

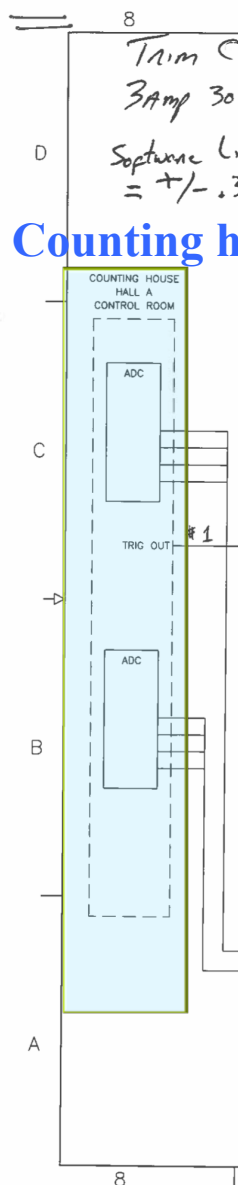
# Beam Modulation Updates

- ✓ BSY service building Hall A beam modulation cables that are connected to the counting house and have been labeled. (with help from Pete)
- ✓ Trim card and corresponding wires are rechecked and the issues were solved by Pete.
- ✓ The trim card controlled modulation magnet and the corresponding feedback singles were checked with the software trigger and external trigger.
- ✓ Beam modulation CODA (run but not as expected)

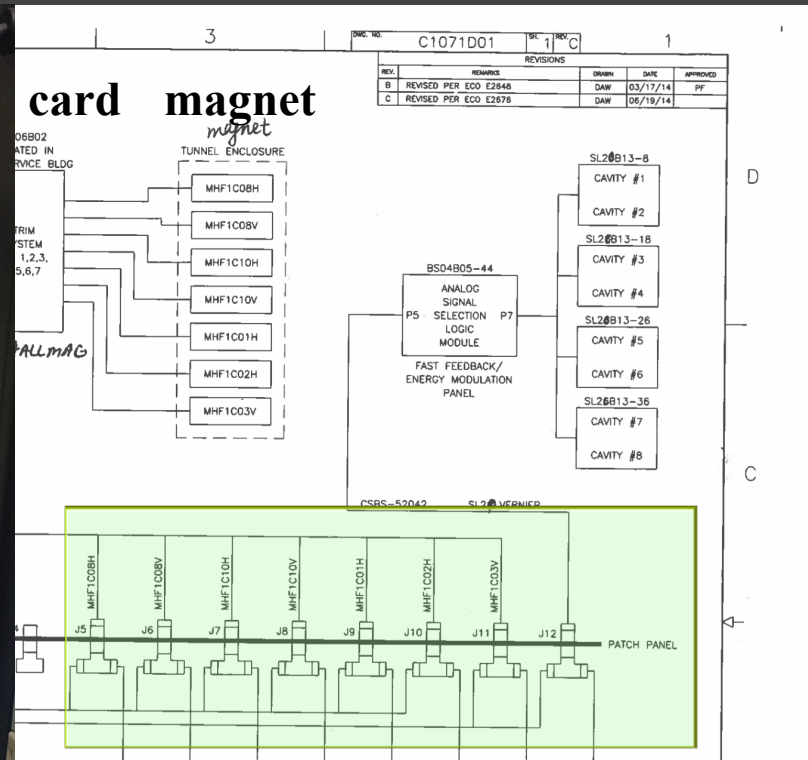
# HallA Beam Modulation Hardware and Cables



# HallA Beam Modulation Hardware and Cables



**Cables are Labeled**  
**1 trigger cable**  
**8 FG driven signal**  
**2 spares**



Channel 0 MHF1C08H

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

16.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

☐ Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 0 Status

Channel 1 MHF1C08V

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

☐ Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 1 Status

Channel 2 MHF1C10H

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

☐ Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 2 Status

Channel 3 MHF1C10V

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

☐ Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 3 Status

Channel 0 MHF1C01H

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 0 Status

Channel 1 MHF1C02H

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

10.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 1 Status

Channel 2 MHF1C03V

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.500 Amplitude (Amps)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 2 Status

Channel 3 SL20VERNIER

## Load Waveform Data

0.000 Amplitude (Volts)

Load Test Waveform

15.000 Frequency (Hz)

0.178 Amplitude (MeV)

511 No. Periods

Load Sine Waveform

2046 Number Waveform Words Loaded

## Waveform Controls

Enter Trigger State

Software Trigger

Leave Trigger State

Expert Config

## Waveform Status

MODULATION OFF

OFF STATE Wave State

0x0 VCR Register

0.000 Trigger Peak Volts Out

Update Engine Status

Channel 3 Status

# FG Board Operation

## States:

- **Modulation OFF** the Relays to the Trim cards will be set to ground.
- **CONFIG** can set amplitude, N periods, frequency. Relays are open.
- **Trigger** with initiate function on front panel trigger. The relay for the FG to Trim card is connected.
- **Test States**

# Counting House Trigger Signal

## 3.7.3 External Trigger

Each channel has an external input for a user-supplied trigger. If the user decides on using an external trigger instead of a software trigger, the user must guarantee this trigger is within the specifications of voltage and period. It must also meet the setup and hold times specified below. See Figure 3.7.3-1.

### External Trigger:

**Voltage:** CMOS TTL Compatible (Low <0.8 VDC, High >3.15 VDC)  
**tp Trigger Period:** 500 nanosecond period (minimum)  
**ts Setup Time:** >50 nanoseconds  
**th Hold Time:** >100 nanoseconds  
**Trigger Latency:** 300 nanoseconds  
**ta Clock edge to Analog value change:** 200 nanoseconds (maximum)

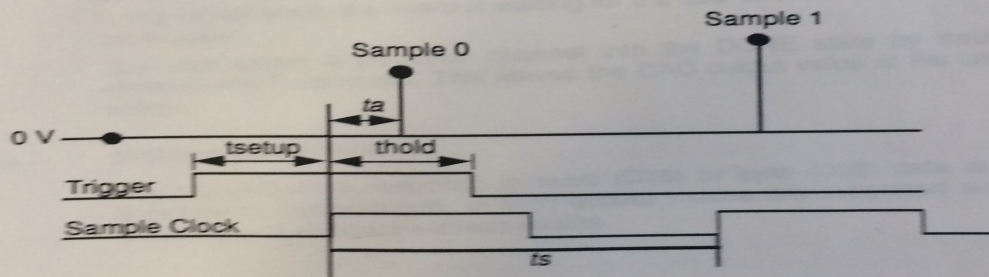


Figure 3.7.3-1 External Trigger

Trigger signal  
specification

Voltage: TTL

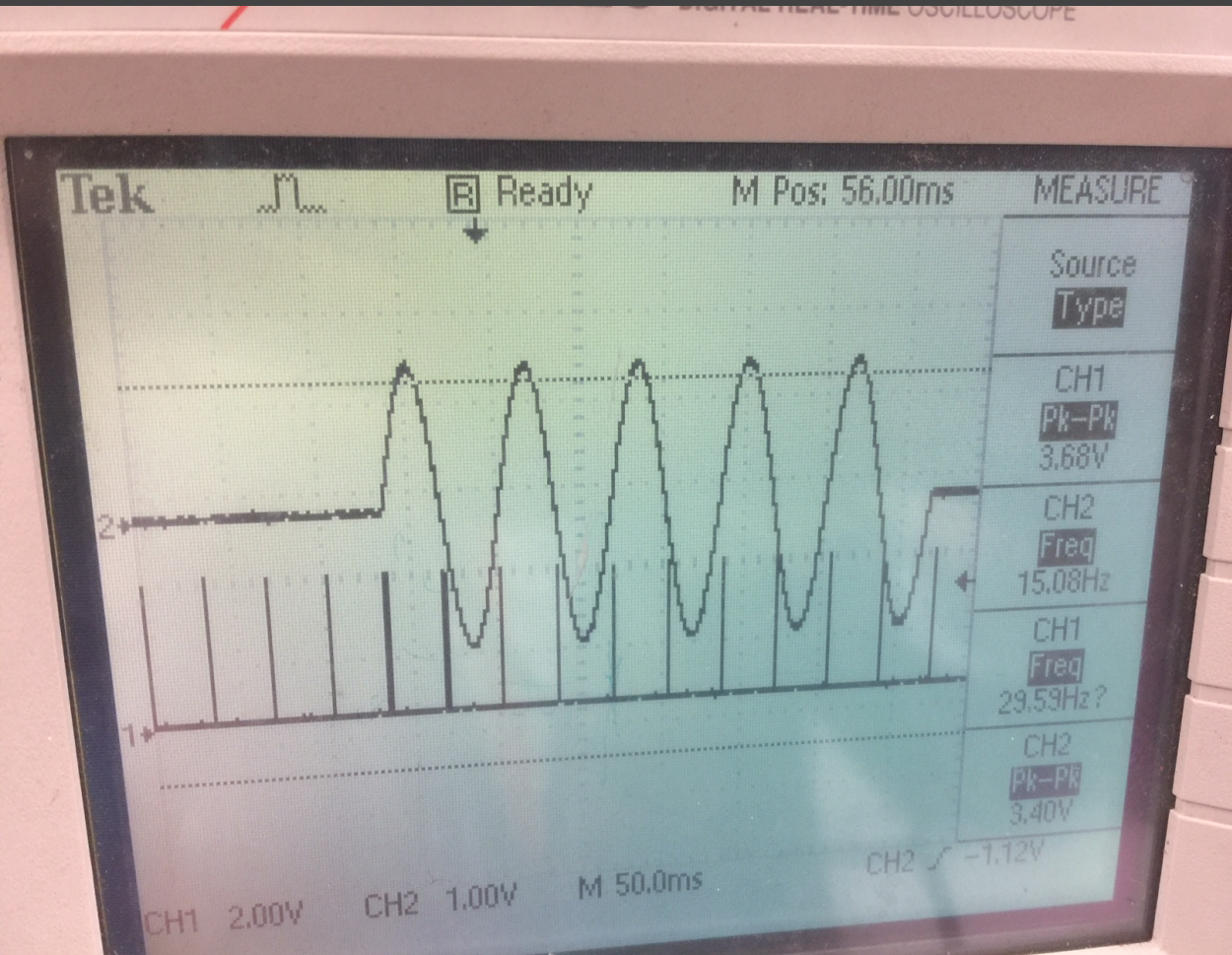
low < 0.8 VDC

High > 3.15 VDC

Trigger Period: 500 ns

Test TTL trigger signal: trigger formed in CH by coincidence of MPS and FlexIO signal

# Feedback Signal with External Trigger



Sine Waveform:

Frequency: 15 Hz

Number of period: 5

External Trigger works !

# BMW Control Code Debugging

## **Vxworks Script**

Start supercycle ----- complete unit of dithering: a series of up to 8 sequences

Pause FFB

Loop over “sequence”-----single step of dithering, composed of 1 or 2 magnets

    configure first sequence

    set FG to Trigger

    request trigger

    count sequence+buffer time

    set FG to CONFIG

End loop

Count till next supercycle

## **Words in data stream**

- 8 channels of FG readout
- Bmw\_cycle (arbitrary cycle count, usefu for indexing)
- Bmw\_object (which sequence number is running)
- Bmw\_active (Vxwork script thinks this sequence is stll active)

# CODA Status for the Beam Modulation

**Xcefdmp**

Data Source: /ata1/apar/parity\_CH\_1112.dat

Dictionary: /adaqfs/coda/2.6.2/common/lib.

Tag Name:

Event Number: 16

1

Event Number Slider

Decimal Dump   Hex Dump

Enable Dictionary   Disable Dictionary

Click to disable dictionary

View File   Spy Event

View Next   View Previous

Reserved   Quit

Info -> To start, enter an object name and a tag name (value)  
 Info -> Load file  
 \$CODA/common/lib/evTags as a dictionary.  
 Info -> To start, enter a file name  
 Info -> Number of events is at least 2000  
 Info -> Data source name is  
 /adaq2/data1/apar/parity\_CH\_1112.dat  
 Info -> Number of events is at least 2000

Xcefdmp

Test Run 1112

Data Source   Dictionary   View   Options

```

graph LR
    type1[type_1_physics_event] --> header[header]
    type1 --> ROC23[ROC23]
    ROC23 --> 0x1[0x1]
    ROC23 --> 0x2[0x2]
    ROC23 --> 0x3[0x3]
    ROC23 --> 0x4[0x4]
    ROC23 --> 0x5[0x5]
                    
```

```

/*rol->dabufp++ = 0xffffbd000; /* Header for timing board info */
*rol->dabufp++ = getDataHAPTBO;
*rol->dabufp++ = getRampDelayHAPTBO;
*rol->dabufp++ = getIntTimeHAPTBO;
*rol->dabufp++ = (getOverSampleCurrentHAPTBO << 8) +
getOverSampleHAPTBO;
*rol->dabufp++ = getDACHAPTBO(2); /* DAC16 */
*rol->dabufp++ = getDACHAPTBO(1); /* DAC12 */
                    
```

0x4:

0xffffbd000	0x00000000	0x00000028	0x00003390	0x00000000	0x00000000
0x00000bb3	0xfdacf000	0x0126aff0	0x00114044	0x00000000	0x0126afb0
0x00000005	0x00000000	0x00000000	0x00000000	0x0002c8e2	0x0126afb0

```

if(bmwscan==1) {
*rol->dabufp++ = 0xfdacf000; // Header for daqflags
*rol->dabufp++ = localBMWphase; //record where we are in a sinewave
*rol->dabufp++ = localBMWperiod; //record where we are in a sinewave
*rol->dabufp++ = localBMWobj; //record the last-moved object
*rol->dabufp++ = localBMWfreq; // record the value of the last-moved object
*rol->dabufp++ = localBMWcycnum; // record the number of this supercycle

/* Scan words next */
*rol->dabufp++ = getCleanSCAN();
*rol->dabufp++ = getDataSCAN(1);
*rol->dabufp++ = getDataSCAN(2);

/* Now the vxWorks Clock and software event increment*/
*rol->dabufp++ = iocTime;
*rol->dabufp++ = ncnt;
                    
```

Run but no as expected

iocLogClient: EPICS environment variable  
 "EPICS\_IOC\_LOG\_INET" undefined  
 iocLogClient: logging disabled

# To-do List

- Connect the FG feedback signals to V2F/scalars.
- Debug `bmwClient.C`
- Run CODA to test BMW process during the APEX is safe

Any comments and suggestions ?

Back Up

# HallA Beam Modulation Software Trigger Test

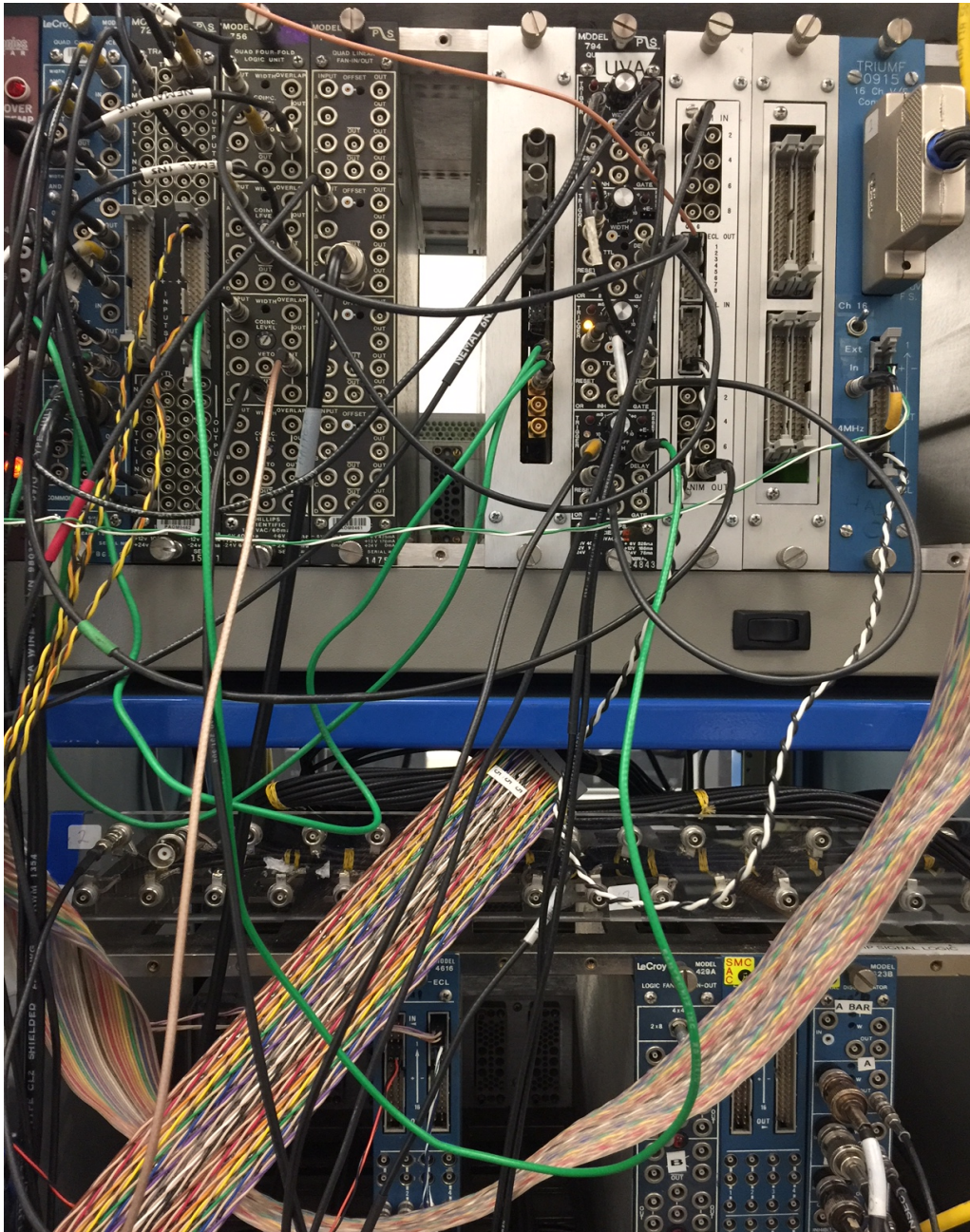
Call MCC to access I0CSB4BM and I0CHCNmR

The screenshot displays the JMenu-2.5 software interface. The main menu on the left includes: Operations, Injector, System Expert (highlighted), Beam Setup, StartOfShift, Plots, DT Manager, JELI, Utilities, Standalone Menus, and Help Menu. The System Expert sub-menu is open, showing: Beam Dumps, Control System, Cryogenics, BPM, Current Monitors, Global Diagnostics, Viewers, Harps, Modulation (highlighted), Hall A, EES Diag Tools, and Facilities. The Modulation sub-menu is also open, showing: Fast Feedback and Position/Energy Modulation Controls (highlighted). The Position/Energy Modulation Controls window is visible, showing a MODULATION OFF button and a table of modulation parameters.

Parameter	Value	Unit
MHF1C01H	0.000	Amps
MHF1C02H	-0.001	Amps
MHF1C03V	-0.000	Amps
MHF1C08H	-0.000	Amps
MHF1C08V	0.000	Amps
MHF1C10H	-0.000	Amps
MHF1C10V	0.000	Amps
SL Zone 20	0.000	

At the bottom of the Modulation Menu, the Screens section lists: Fast Feedback and Position/Energy Modulation Controls.

# Counting House BMW Trigger Setting



trigger formed in CH by coincidence  
of MPS and FlexIO signal

