# Troubleshooting Guide for BPMs

In the Accelerator housing their exists 3 different type of BPMs, they are as follows:
ATCA Based Stripline BPMs, VME Based Stripline BPMs, and ATCA Based Cavity BPMs. (Check)
This confluence page (**under development)** will serve as a source for diagnosing many BPM related issues as well as general information about overall hardware in the BPM diagnostic system.

VME Based Stripline BPMs

The setup for the VME based Stripline BPMs can be found in Figure 1.
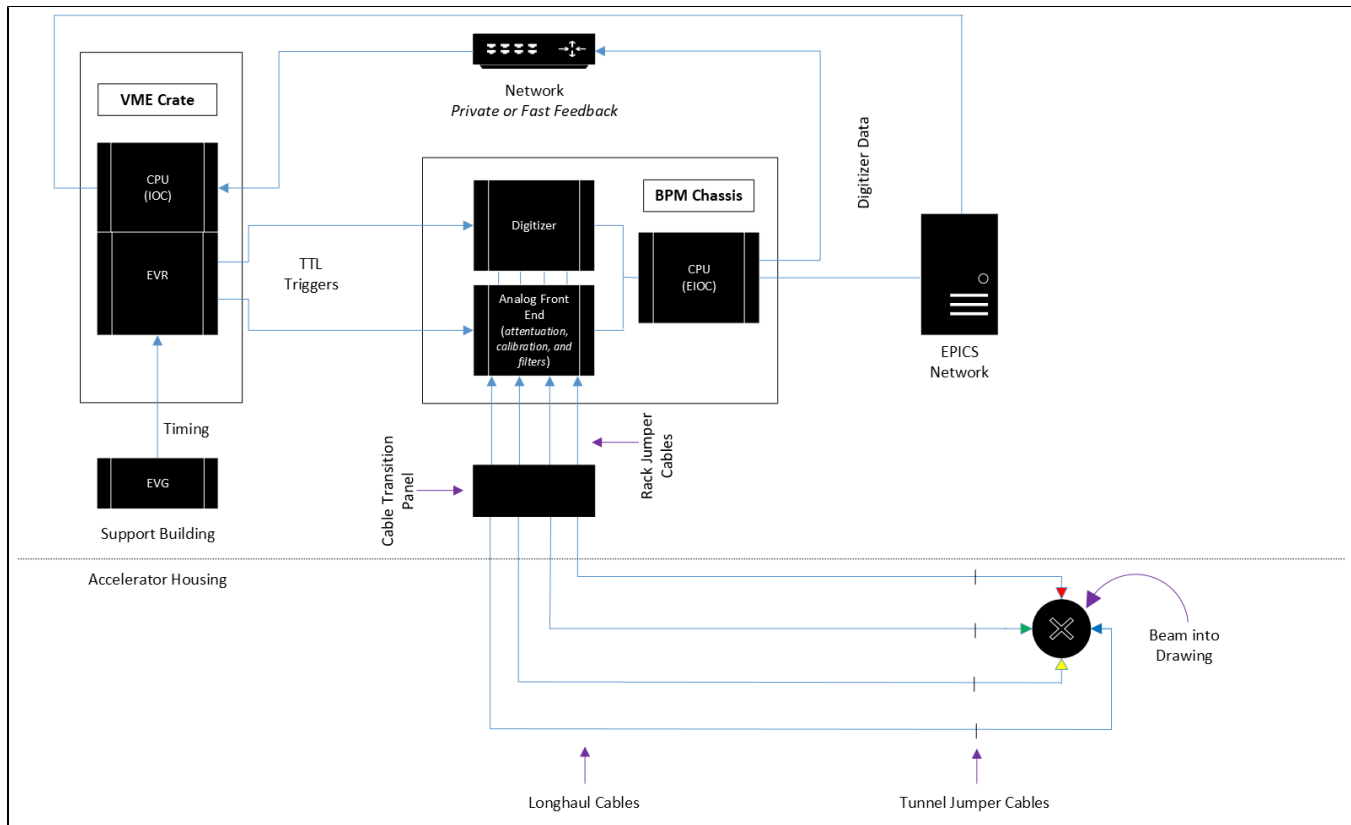
(Figure 1- Setup for VME based BPMs, note that the VME crate sends forward communication to the BPM chassis through the use of TTL triggers. The AFE (Analog Front End) of BPM chassis receives raw beam
data from the BPM living inside the accelerator housing and performs a series of tasks on the data before sending it to the digitizer * responsible for converting raw waveform data to digital signals* and the EIOC *Embedded IOC* living in side the BPM Chassis)

An Example of a Healthy Stripline BPM:

Stripline BPM Diagnostic Display

SLAC

Legend

— Display info

— BPM Health

— BPM Health (with beam)

Beam X,Y,TMIT

Healthy Status Summary

Beam Position

Adjust AFE attenuators if needed

Set BPM offline or online

Raw beam waveforms

Configure:
- Position offsets
- Beam scale factor (~radius)
- BPM rotation angle
- Angle between BPM striplines (typically 90)
- TMIT scale factor (set to force TMIT to read known charge)

Adjust calibrator amplitude if needed

Calibration waveforms are populated

No fault states in hardware status summary

Calibration waveforms
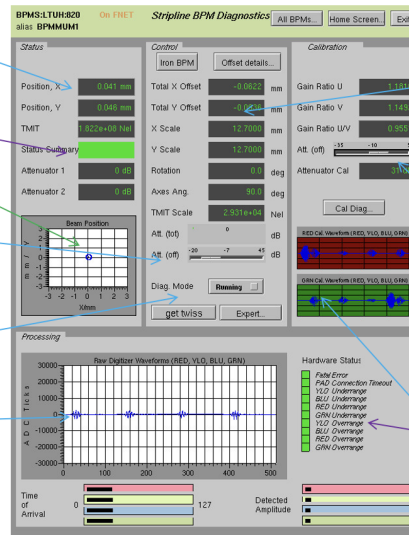
(Figure 2- An example of a healthy Stripline BPM with comments, blue comments in this figure are to provide the user with information about the display itself, purple comments are to provide information on what a healthy BPM _can_ look like when there is no beamrate,

and finally green comments are to provide additional information on what BPM health looks like with beam after reviewing the purple comments.)

Examples of some common issues(VME Stripline BPMs, ATCA Stripline, and Cavity:

The figures below are examples of some common issues that can occur with the different BPMs.

Status

Any

Position, X | 0.0000 mm
Position, Y | 0.0000 mm
TMIT | 0.000e+00 Nel
CHRG NonBSA | 0.0 pC
Status Summary | [red]
Attenuator 1 | 0 dB
Attenuator 2 | 0 dB

Beam Position

Y mm / mm — X/mm
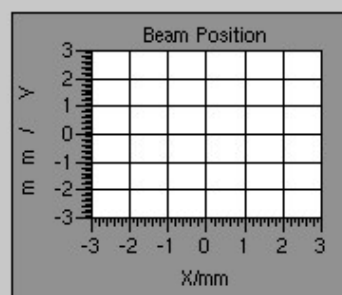
Control

Offset details...

Total X Offset | 0.3355 | mm
Total Y Offset | 0.0160 | mm
X Scale | 36.3000 | mm
Y Scale | 36.3000 | mm
Rotation | 0.0 | deg
Axes Ang. | 90.0 | deg
TMIT Scale | 2.3260e+03 | Nel
Att. (tot) | 0 | dB
Att. (off) | | dB

Diag. Mode | **Running**

Expert...

Calibration

Red Gain Ratio U or V usually means
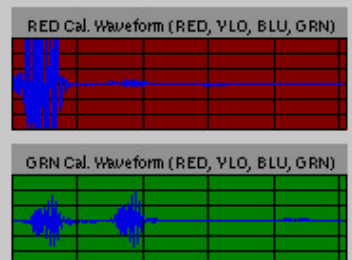missing or low cal waveforms

Gain Ratio U | 1.0000
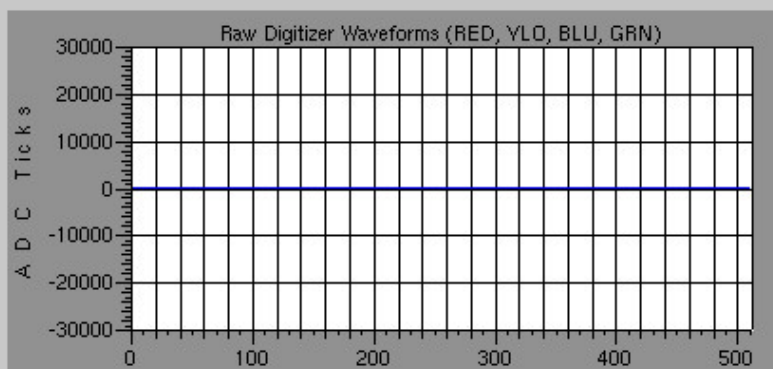Gain Ratio V | 0.9012
Gain Ratio U/V | 1.0000
Att. (off) | -60 -45 -10
Attenuator Cal | 17 dB

Cal Diag...

RED Cal. Waveform (RED, YLO, BLU, GRN)

GRN Cal. Waveform (RED, YLO, BLU, GRN)

Processing

Raw Digitizer Waveforms (RED, YLO, BLU, GRN)

ADC Ticks

Hardware Status

Fatal Error
ADC Timeout (Connection/Trig.)
Y Reading Invalid
X Reading Invalid
TMIT Below Threshold
TMIT Reading Invalid

Time of Arrival | 0 | 127

Detected Amplitude

BPMS:LTUH:820   On FNET   *Stripline BPM Diagnostics*

alias **BPMMUM1**

[All BPMs...] [Home Screen...] [Exit]

Status

Position, X	0.041 mm
Position, Y	0.046 mm
TMIT	1.822e+08 Nel
Status Summary	
Attenuator 1	0 dB
Attenuator 2	0 dB

Beam Position
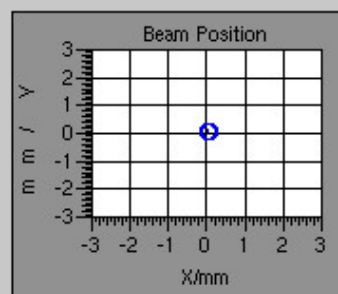
Control

[Iron BPM]   [Offset details...]

Total X Offset	-0.0622	mm
Total Y Offset	-0.0936	mm
X Scale	12.7000	mm
Y Scale	12.7000	mm
Rotation	0.0	deg
Axes Ang.	90.0	deg
TMIT Scale	2.931e+04	Nel
Att. (tot)	0	dB
Att. (off)	-20 -7 45	dB

Diag. Mode   [**Running** ☐]

[get twiss]   [Expert...]

Calibration

Gain Ratio U	1.1810
Gain Ratio V	1.1492
Gain Ratio U/V	0.9551
Att. (off)	-35 -10 5
Attenuator Cal	31 dB

[Cal Diag...]

RED Cal. Waveform (RED, YLO, BLU, GRN)

GRN Cal. Waveform (RED, YLO, BLU, GRN)

Processing

Raw Digitizer Waveforms (RED, YLO, BLU, GRN)

Hardware Status

- Fatal Error
- PAD Connection Timeout
- YLO Underrange
- BLU Underrange
- RED Underrange
- GRN Underrange
- YLO Overrange
- BLU Overrange
- RED Overrange
- GRN Overrange

Time of Arrival   0   127

Detected Amplitude

Status

Position, X	nan mm
Position, Y	nan mm
TMIT	nan Nel
Status Summary	
Attenuator 1	0 dB
Attenuator 2	0 dB

Beam Position
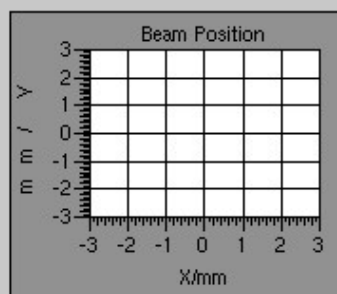
Control

[Iron BPM]   [Offset details...]

Total X Offset	0.0000	mm
Total Y Offset	0.0000	mm
X Scale	10.0000	mm
Y Scale	10.0000	mm
Rotation	0.0	deg
Axes Ang.	90.0	deg
TMIT Scale	3.370e+04	Nel
Att. (tot)	0	dB
Att. (off)	-20 -10 45	dB

Diag. Mode   [**Running** □]

[get twiss]   [Expert...]

Calibration

Gain Ratio U	0.9995
Gain Ratio V	0.9329
Gain Ratio U/V	1.0068
Att. (off)	-35 -28 5
Attenuator Cal	18 dB

[Cal Diag...]
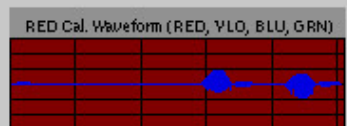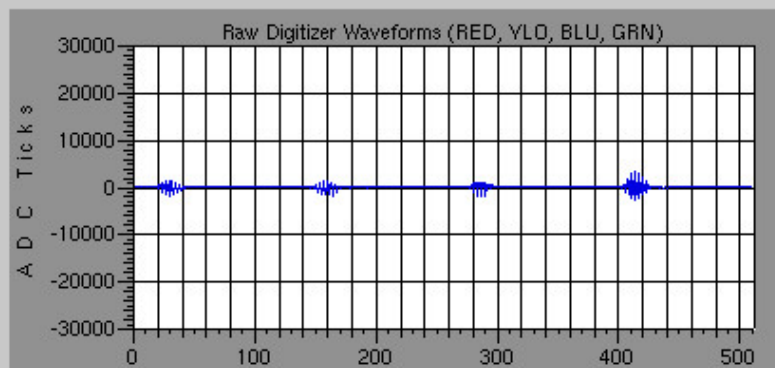
RED Cal. Waveform (RED, YLO, BLU, GRN)

GRN Cal. Waveform (RED, YLO, BLU, GRN)

Processing

Raw Digitizer Waveforms (RED, YLO, BLU, GRN)
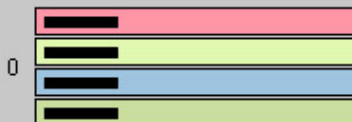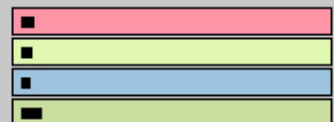

Hardware Status

- Fatal Error
- PAD Connection Timeout
- YLO Underrange
- BLU Underrange
- RED Underrange
- GRN Underrange
- YLO Overrange
- BLU Overrange
- RED Overrange
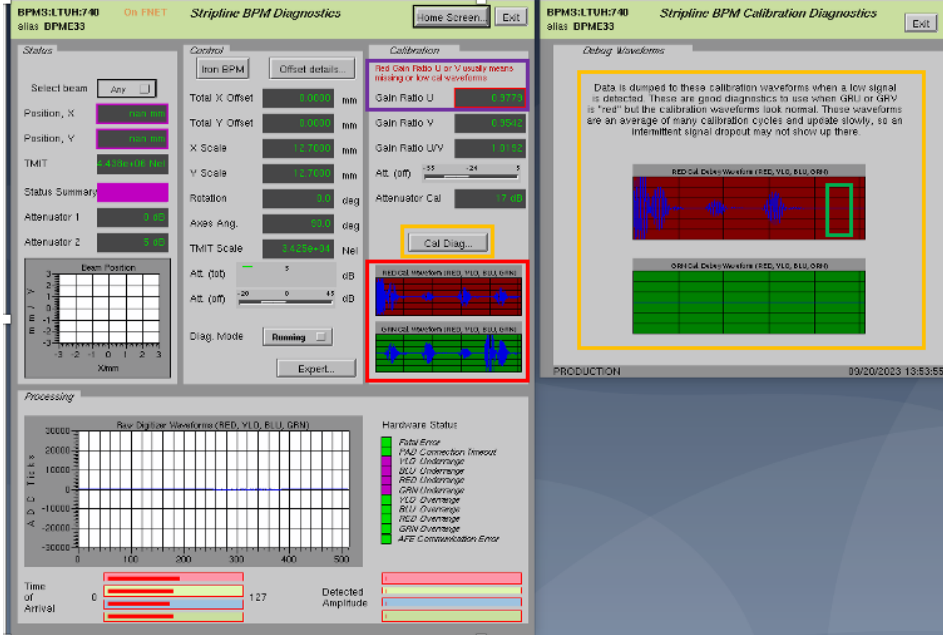- GRN Overrange

Time of Arrival   0   127

Detected Amplitude

Intermittent Failures : Example 1

1.) Observe that gain ratio U is at Major Severity. Usually corresponds to missing or low cal waveforms.

2.) Observe that the Waveform plot does not appear to have missing or low cal waveforms, since the PV for this plot updates at 1Hz this is an indicator the problem is intermittent at may not always visible on these plots alone.

3.) By clicking the "Cal Diag" related display button a new display will appear with debug information. The data is scanned at the full 120 Hz beam rate but only dumped when to the PV a low signal is detected, it then freezes at that value until another low signal event happens.

4.) This failure is likely caused by faulty switches which intermittently block the transport of the signal (hardware issue).