

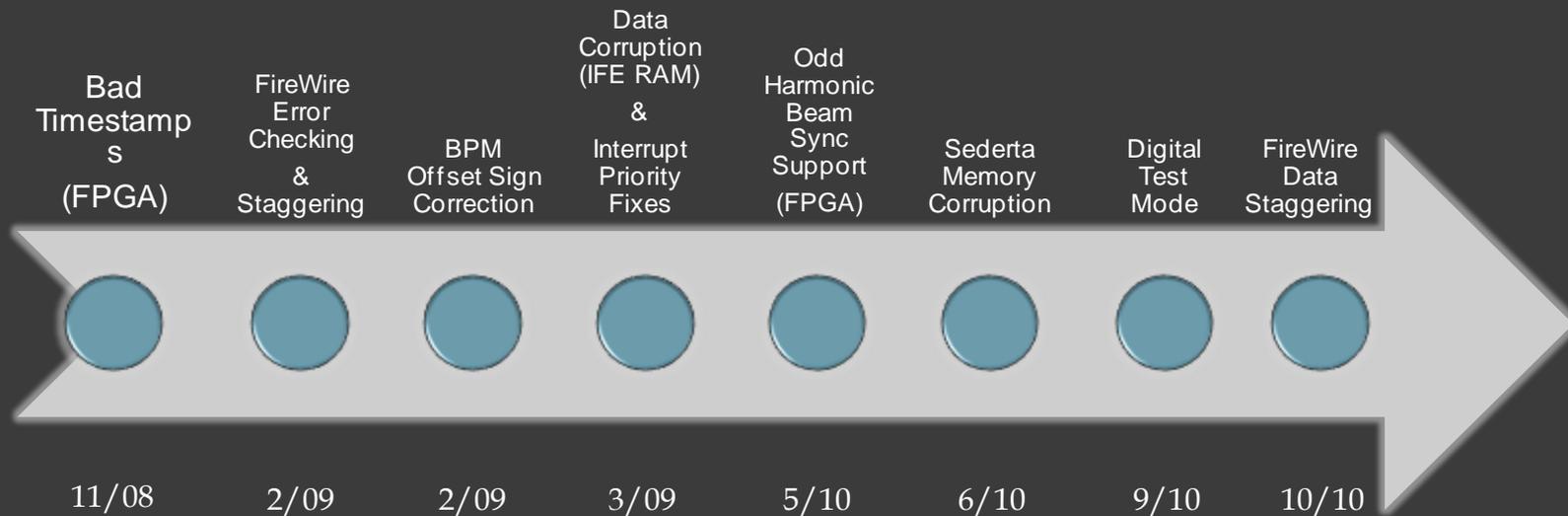
RHIC BPM SYSTEM APEX WORKSHOP 2010

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BPM System Improvements

Data Delivery and Integrity



Digital Test Mode

- ⦿ In this new mode, sequential test data patterns are filled into the TBT data array on each 'turn' along with other diagnostics
- ⦿ All datapaths used for real measurement data are followed – data injected at the ADC ISR
- ⦿ Code to collect and analyze data
- ⦿ This performs a full end to end data delivery test

Test Results

- ⦿ After 9000 TBT events (triggered every 4s) some data corruption occurred in the middle of a data set
- ⦿ 1 string of BPM's with common FireWire card all had 'shifted' sequential data at the same time (about 14)
- ⦿ This could be explained by a part of a FireWire packet being lost and not saved to memory – stale data from the circular buffer is read back instead
- ⦿ It seems the Sederta card 'chokes' and loses a portion of a dataset with too much traffic

FireWire Staggering v2.0

- ⦿ Some staggering in the TBT data delivery was implemented in 2009, using software loop delays
- ⦿ At that time, only timestamps were being correlated and these issues and other bus errors were corrected
- ⦿ It seems likely the FireWire card is still choking on the data, so we slowed things down some more
- ⦿ Delays are now based on beam sync link turn counter
- ⦿ Staggering verified using bus analyzer

Preliminary Results

- ⦿ Test code loaded into all BPM IFE's which implements improved data delivery routine
- ⦿ After days of constant TBT events every 4s, over 100,000 datasets of 1024 turn simulated data was correlated for all 300+ yellow BPM's. 1 error!
- ⦿ Release code being loaded this week, then another test run will be taken with simulated data

Vanishing FireWire Hangs?

- ⦿ The rate of FireWire card 'hangs' which puts 7-14 IFEs out of communication sharply increased when we ran the first test and triggered the TBT event every 4s
- ⦿ There was a marked decrease (almost to 0) of FireWire card 'hangs' after the test code was loaded and events were triggered every 4s for almost 5 days
- ⦿ Although TBT events are not normally triggered at this rate during operations, we hope this will help reduce this failure mode significantly

Diagnose Mode

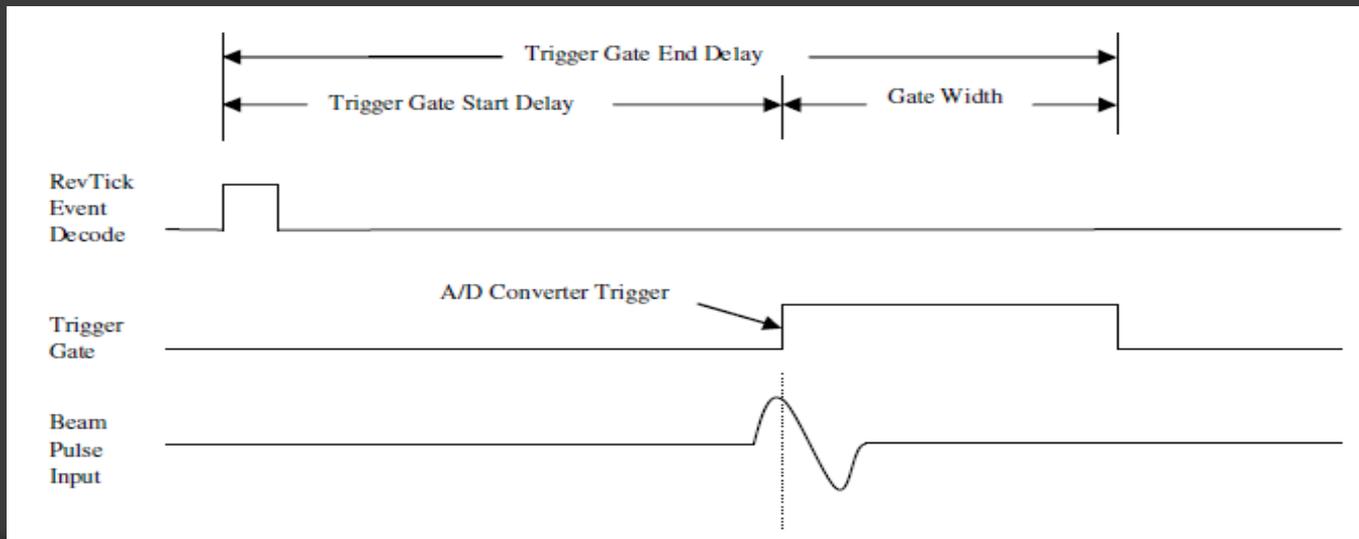
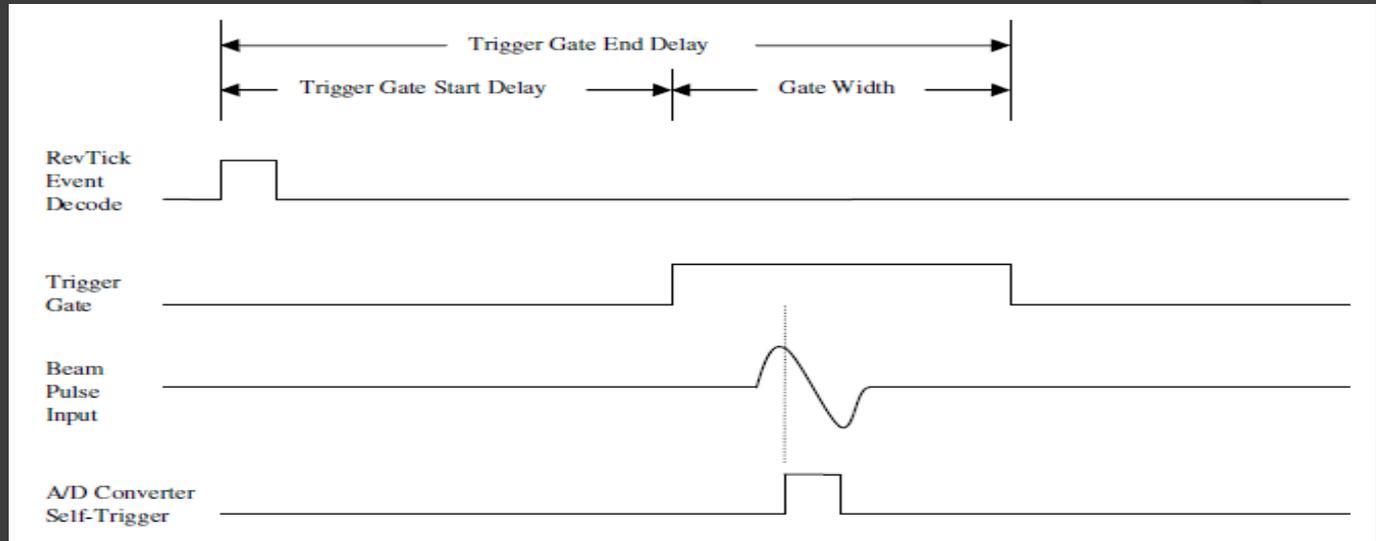
- A new parameter has been added to the BPM ADO – “Diagnose Mode” – On/Off
- Turning this on will set a status bit in the data record and flag the data as bad to the manager
- This should be used instead of ‘Service’ mode which should be reserved for known hardware failures or feedthrough failures
- Data is still delivered so we can then take a closer look at calibration or hardware issues

Calibration and Timing

- ◉ With reliable data delivery, we can focus on improving the timing calibration of the system
- ◉ Fixed trigger timing is the coarse adjustment which applies to both ADC's
- ◉ Very Fine Delay (VFDG) can be adjusted in 20ps steps for each PUE channel independently

Self vs. Fixed Trigger Timing

Self
Trigger
Mode



Fixed
Trigger
Mode

Profile Mode Enhancements

- ⦿ Record size doubled to 2048 elements to display both 'forward' and 'reverse' profiles
- ⦿ Profile generated fixed trigger position can now be visually verified much easier than before
- ⦿ Software tools are being developed to automate this timing adjustment process
- ⦿ Position-from-profile may be useful for calibration

Automatic Fixed Timing in DSP

Temp A...

Page PPM Device Data Tools Buffer

Heartbeat		170
bucket	1	65522
triggerSource	3	3
triggerThreshold	1948	1948

	Timestamp	Position	Status
Avg	[1258051852 52788]		-4
Cavg			-4
tbt	[1258083940 46843]	[-21 -8 -10 -1 24. [1026 1026 1026 1	
Profile		[-58 -58 -59 -60.. [0 0 0 0 0 0 0 0	
Cal		[]	[]

	BuffPtr	BuffPtrAtSync	BuffStart
Avg	0xc0000	0xc0000	0xc
tbt	0x4720	0x2710	0

	Geo Delay	picoDelayAtInj	picoDelay
Setting	11	84900	
Readback	11		8

(26,4) rbpm.919a-bpm1.0d7:picoDelayAtInjS

Thu Nov 12 22:45:15 2009: Get and Async requests complete.
Thu Nov 12 22:45:41 2009: Value sent for (26,4)

Stop

File PPM Setup Logging Diagnostics

Thu Nov 12 22:42:29 2009, cycle 1258083745

picoDelayAtInj = 50000

Legend: rbpm.919a-bpm1.0d7:prof0rbBCorrM:value[*] (black), rbpm.919a-bpm1.0d7:prof0rbBCorrM:value[*] (red)

tmp/rbpm.919a-bpm1.0d7.ado

Page PPM Device Data Tools Buffer Help

profileMaxValueM	16483
profileMaxIndexM	1
picoDelayFromProfileM	84900

(136,2) "text" Nudge: 0 366

entry ID specified
Thu Nov 12 22:45:15 2009: Get and Async requests complete.

Terminal

File Edit View Terminal Tabs Help

```
[1] + Done labview
acnuser01.pbn.bnl.gov 216:adoIf bsy-tbtstart triggerChannel
Trigger
adoIf bsy-tbtstart triggerChannel Trigger
adoIf bsy-tbtstart triggerChannel Trigger
acnuser01.pbn.bnl.gov 217:adoIf bsy-tbtstart triggerChannel Trigger
adoIf bsy-tbtstart triggerChannel Trigger
adoIf bsy-tbtstart triggerChannel Trigger
acnuser01.pbn.bnl.gov 218:[]
```

File PPM Setup Logging Diagnostics

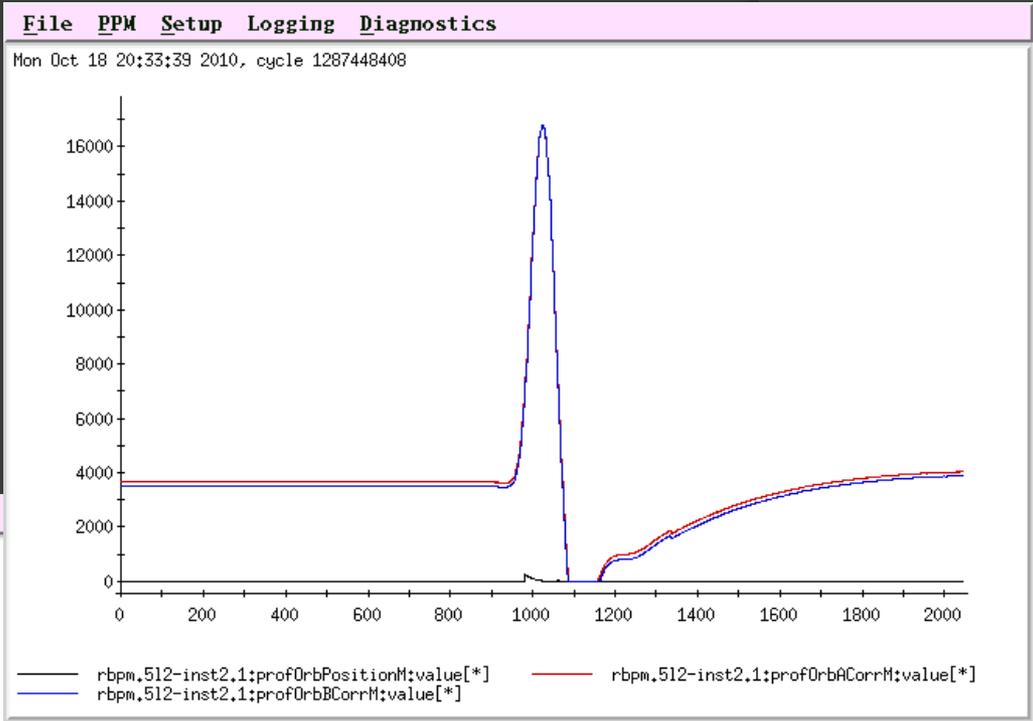
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picoDelayAtInj = 84900

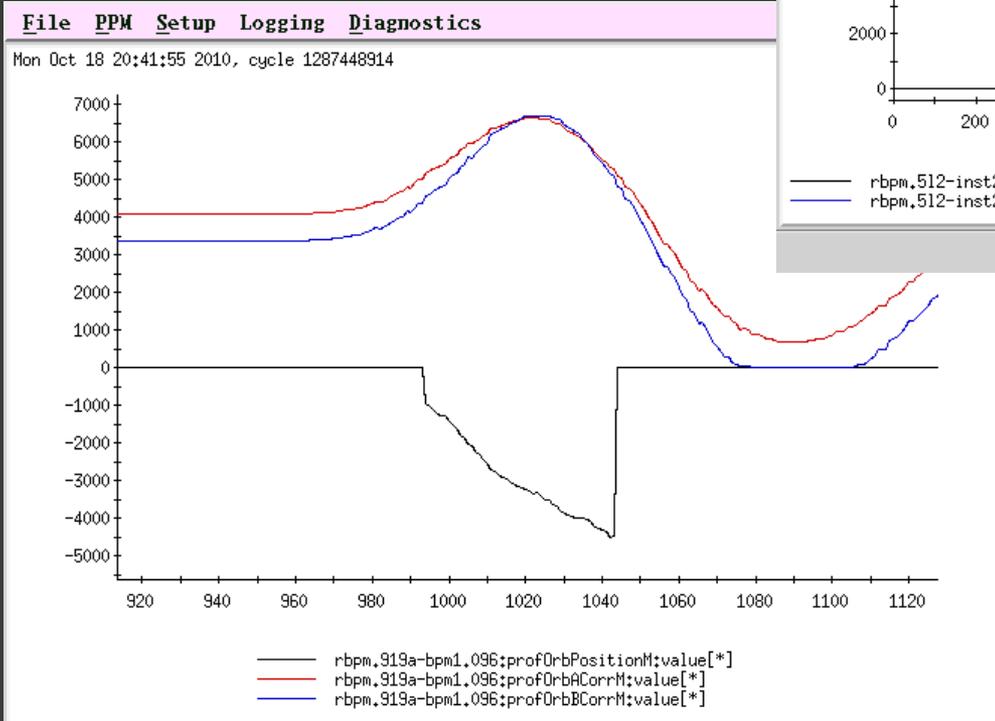
Legend: rbpm.919a-bpm1.0d7:prof0rbBCorrM:value[*] (black), rbpm.919a-bpm1.0d7:prof0rbBCorrM:value[*] (red)

2048 Element Profile

Trigger position in center



Stop

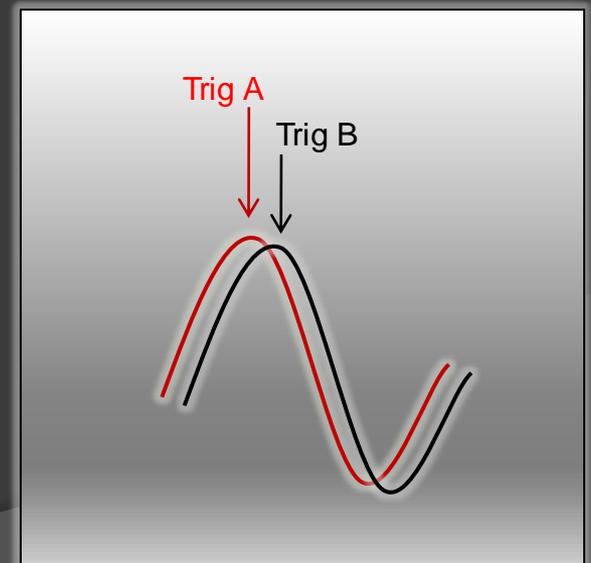


Stop

Position from Profile

VFDG Calibration

- 20 picosecond / step adjustment of A vs. B sampling
- IFE can internally scan and report these curves
- Software tools are needed to process 660+ datasets and perform exception handling
- Scripts will be tested in run-11 to automate this process



Hardware Status

- ⦿ 27 IFE module replacements during run-10 and summer shutdown
- ⦿ There is a pattern of precision resistors drifting out of range
- ⦿ Most problems due to component failure, some spare components are still on hand but getting harder to procure

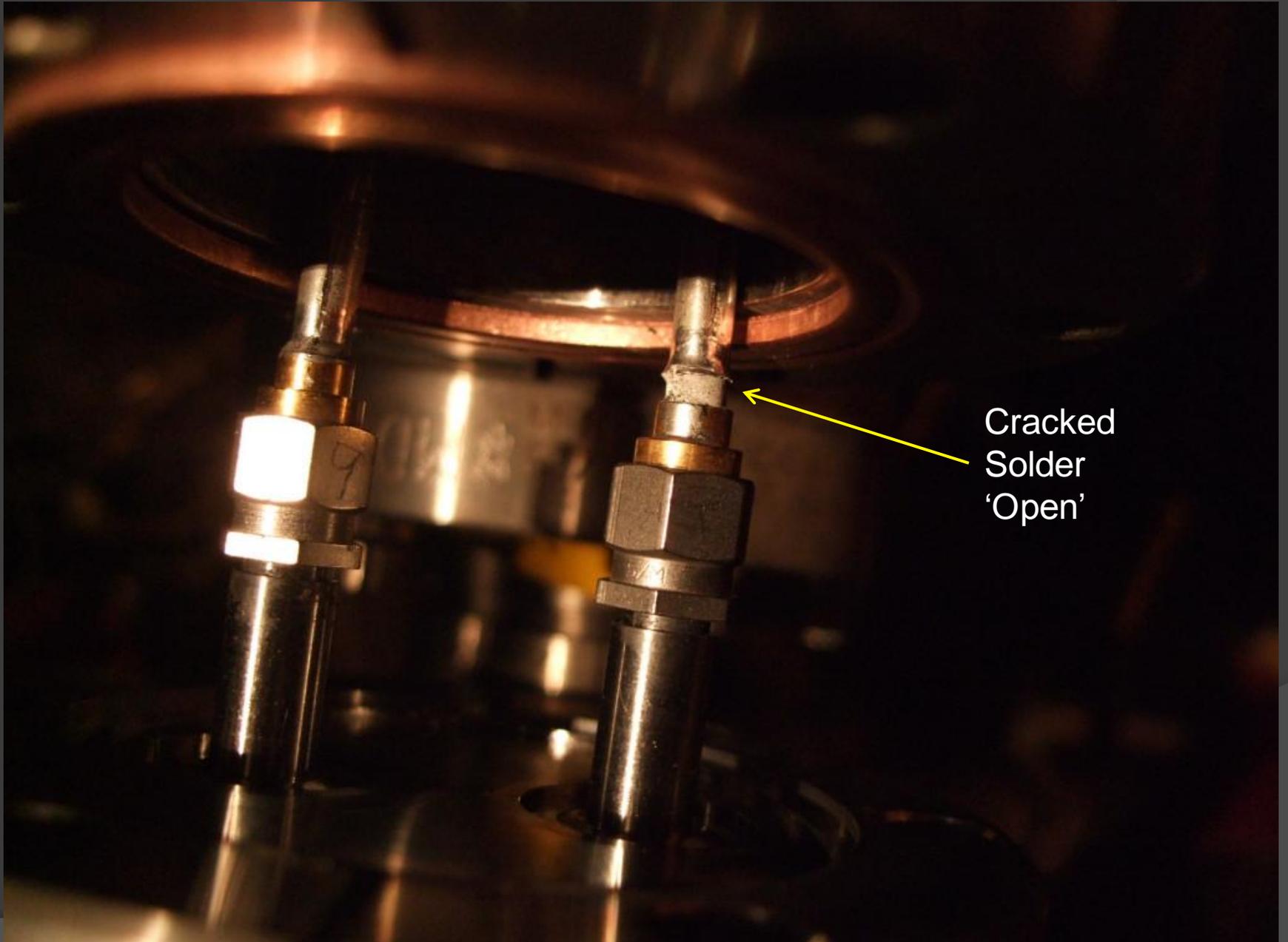
Spares

- ⦿ Thanks to Joe DeCicco, we have about 25 spares
 - (In addition to those already replaced in 2010)
- ⦿ Another dozen older boards are being upgraded to the current revision

Feedthrough Replacement

- ⦿ All 11 problem feedthroughs have been serviced
- ⦿ 'Open' Failure Mode
 - Most are old-style feedthrough
 - Those examined had 'cracked solder' – known problem
- ⦿ 'Shorted' Failure Mode
 - New-style feedthroughs affected
 - Solder overflow into connector caused short
 - Failure does not appear to be related to new style feedthrough

yo9-bh3



Cracked
Solder
'Open'

yi11-bh3

solder short
inside SMA connector

