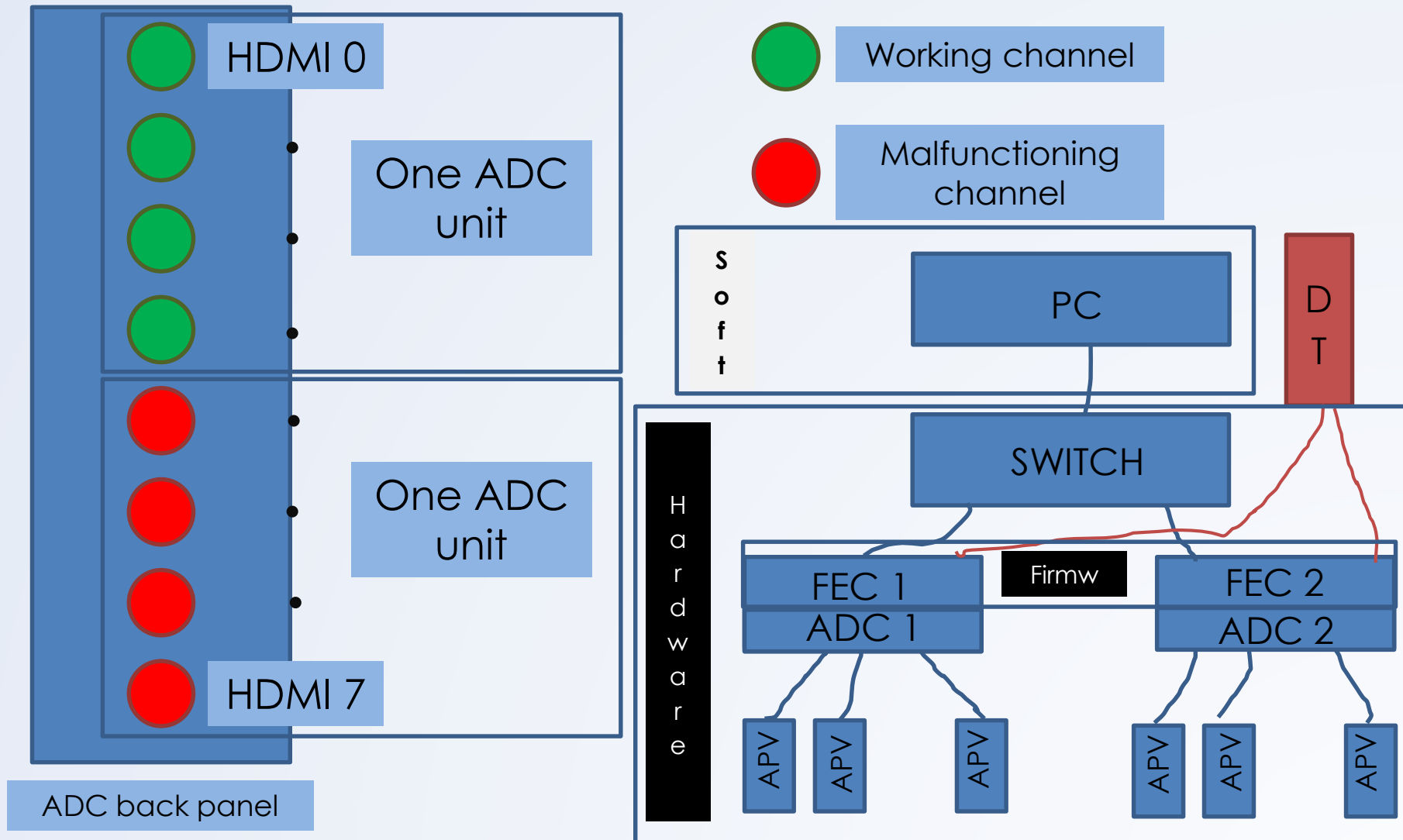


FEC v6 based SRS system status

Marek Gruchala

- Setup description
- Debugging strategy
- General problem with the raw files
 - Too many ADC words
 - Empty events
 - Events full of meaningless data (data overload)
- Hardware modifications.
- Results comparison.

Setup description



ISSUE: NOT WORKING SRS SYTEM

HARDWARE

Black box

Replaced four capacitors
C141, C142, C187, C188
form 33pF to 18 pF
capacitacne.
Adding two 0 ohm resistors
in R90 and R92 positions.

FIRMWARE

Black box





In order to determine if
the problem is firmware
related we are
establishing a machine
with RD51LabView
software . Problem
occurs no matter the
firmware version.

SOFTWARE

Full control

- The FEC v6 were tested using two firmwares: ZS one and non_ZS one (default).
- ZS test performed, using the SRS chain with different number of ADC channels in use.
- Non ZS test performed, using the LabView based software from the RD51 community, one channel at the time.

Test results

FEC v1.3		FEC v6	
nonZS firmware	ZS firmware	nonZS firmware	ZS firmware
			



nonZS: In case of the LabView dedicated Vis, the signal was observed only for first 8 channels (4HDMI ports).
 ZS: Reasonable data coming only when using first 8 channels.







nonZS: Signal seen in any of 16 channels.
 ZS: Proper initialization, reasonable data from all channels.

31 ADC words example

```

.....
Size:216 (header:80) version:0x0003000e Type:PhysicsEvent
RunNb:145 nbInRun:28 burstNb:0 nbInBurst:0 ldcId:1 gdcId:VOID time:Fri May 26
17:43:18 2017 +479044usec Attributes:noAttr(00000000.00000000.00000000)
triggerPattern: 0)00000002 1)00000000 2)00000000 3)80000000
detectorPattern:00000000[invalid]
 0) 00000088 00000016 00000003 00000000 | ..... |
16) 00000000 00000000 00000004 00000000 | ..... |
32) 41505a06 aabb0fa0 0100001e 00000000 | .ZPA ..... |
48) 5a000b00 f0ffecff eaffeeff f7fff5ff | ...Z ..... |
64) f6ffffff 07000400 0100f2ff 04000200 | ..... |
80) f9fff2ff e4ffefff faffebff eeffecff | ..... |
96) f3fff3ff 0400f7ff edffebff f9fff9d | ..... |
112) 00000001 41505a07 aabb0fa0 0000001e | .....ZPA ..... |
128) 00000000 fafafafa | ..... |

```

-  HEADER
-  #hits & #bins
-  Channel #
-  Time bins val.

Empty words

```

.....
Size:272 (header:80) Version:0x0003000e Type:PhysicsEvent
RunNb:136 nbInRun:1 burstNb:0 nbInBurst:0 ldcId:1 gdcId:VOID time:Fri May 26 15:02:20 2017 +717344usec Attributes:noAttr(00000000.00000000.00000000)
triggerPattern: 0)00000002 1)00000000 2)00000000 3)80000000 detectorPattern:00000000[invalid]

```

```

 0) 000000c0 00000016 00000003 00000000 | .... |
 16) 00000000 00000000 00000004 00000000 | .... |
 32) 41505a00 aabb0fa0 0000001e 00000000 | .ZPA .... |
 48) 00000001 41505a01 aabb0fa0 0000001e | .... .ZPA .... |
 64) 00000000 00000002 41505a02 aabb0fa0 | .... .ZPA .... |
 80) 0000001e 00000000 00000003 41505a03 | .... .ZPA |
 96) aabb0fa0 0000001e 00000000 00000004 | .... |
112) 41505a04 aabb0fa0 0000001e 00000000 | .ZPA .... |
128) 00000005 41505a05 aabb0fa0 0000001e | .... .ZPA .... |
144) 00000000 00000006 41505a06 aabb0fa0 | .... .ZPA .... |
160) 0000001e 00000000 00000007 41505a07 | .... .ZPA |
176) aabb0fa0 0000001e 00000000 fafafa | .... |

```

```

.....
Size:272 (header:80) Version:0x0003000e Type:PhysicsEvent
RunNb:136 nbInRun:2 burstNb:0 nbInBurst:0 ldcId:1 gdcId:VOID time:Fri May 26 15:02:20 2017 +718450usec Attributes:noAttr(00000000.00000000.00000000)
triggerPattern: 0)00000002 1)00000000 2)00000000 3)80000000 detectorPattern:00000000[invalid]

```

```

 0) 000000c0 00000016 00000003 00000000 | .... |
 16) 00000000 00000000 00000004 00000000 | .... |
 32) 41505a00 aabb0fa0 0000001e 00000000 | .ZPA .... |
 48) 00000001 41505a01 aabb0fa0 0000001e | .... .ZPA .... |
 64) 00000000 00000002 41505a02 aabb0fa0 | .... .ZPA .... |
 80) 0000001e 00000000 00000003 41505a03 | .... .ZPA |
 96) aabb0fa0 0000001e 00000000 00000004 | .... |
112) 41505a04 aabb0fa0 0000001e 00000000 | .ZPA .... |
128) 00000005 41505a05 aabb0fa0 0000001e | .... .ZPA .... |
144) 00000000 00000006 41505a06 aabb0fa0 | .... .ZPA .... |
160) 0000001e 00000000 00000007 41505a07 | .... .ZPA |
176) aabb0fa0 0000001e 00000000 fafafa | .... |

```


Data overload

Size:16184 (header:80) Version:0x0003000e Type:PhysicsEvent
 RunNb:160 nblnRun:1 burstNb:0 nblnBurst:0 ldcl:1 gdcl:VOID time:Fri Jun 2 14:30:46
 2017 +501582usec A

ttributes:noAttr(00000000.00000000.00000000)
 triggerPattern: 0)00000002 1)00000000 2)00000000 3)80000000
 detectorPattern:00000000[invalid]

```

0) 00003ee8 00000016 00000001 00000000 | .>.. .... .... |
16) 00000000 00000000 00000004 00000000 | .... .... .... |
32) 41505a00 aabb0fa0 0000001e 00000000 | .ZPA .... .... |
48) 00000001 41505a01 aabb0fa0 0000001e | .... .ZPA .... |
64) 00000000 00000002 41505a02 aabb0fa0 | .... .... .ZPA .... |
80) 0000001e 00000000 00000003 41505a03 | .... .... .ZPA |
96) aabb0fa0 0000001e 00000000 00000004 | .... .... .... |
112) 41505a04 aabb0fa0 0000001e 00000000 | .ZPA .... .... |
128) 00000005 41505a05 aabb0fa0 0000001e | .... .ZPA .... |
144) 00000000 00000006 41505a06 aabb0fa0 | .... .... .ZPA .... |
160) 0000001e 00000000 00000007 41505a07 | .... .... .ZPA |
176) aabb0fa0 0000001e 00000000 cacacaca | .... .... .... |
192) cacacaca cacacaca cacacaca cacacaca | .... .... .... |
208) cacacaca cacacaca cacacaca cacacaca | .... .... .... |
224) cacacaca cacacaca cacacaca cacacaca | .... .... .... |
.
.
.
16080) cacacaca cacacaca cacacaca cacacaca | .... .... .... |
16096) cacacaca fafafafa
  
```

Data overload (zeros)

Size:48008 (header:80) Version:0x0003000e Type:PhysicsEvent
 RunNb:157 nbInRun:1 burstNb:0 nbInBurst:0 ldcl:1 gdcl:VOID time:Fri Jun 2 11:06:41 2017 +404759usec A
 ttributes:noAttr(00000000.00000000.00000000)
 triggerPattern: 0)00000002 1)00000000 2)00000000 3)80000000 detectorPattern:00000000[invalid]

```

192) 41505a0a aabb0fa0 8000001e 00000000 | .ZPA ..... |
208) 00000000 00000000 00000000 00000000 | ..... |
224) 00000000 00000000 00000000 00000000 | ..... |
240) 00000000 00000000 00000000 00000000 | ..... |
256) 00000000 00000000 00000000 0000100 | ..... |
272) 00000000 00000000 00000000 00000000 | ..... |
288) 00000000 00000000 00000000 00000000 | ..... |
304) 00000000 00000000 00000000 00000000 | ..... |
320) 00000000 00000000 00000000 02000000 | ..... |

```

$$80_{\text{HEX}} = 128_{\text{DEC}}$$

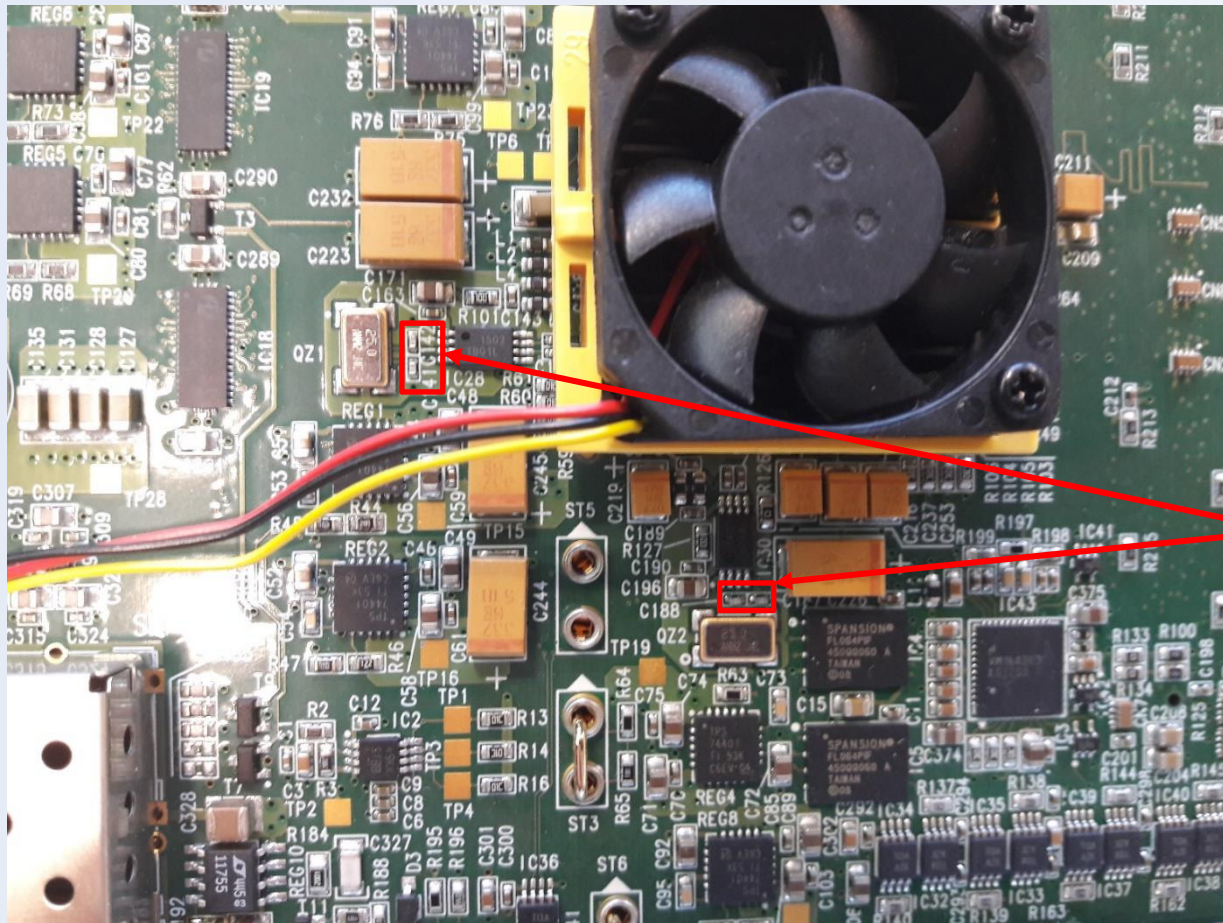
```

8080) 00007f00 00000000 00000000 00000000 | ..... |
8096) 00000000 00000000 00000000 00000000 | ..... |
8112) 00000000 00000000 00000000 00000000 | ..... |
8128) 00000000 00000000 00000000 00000000 | ..... |
8144) 00000009 41505a0b aabb0fa0 8000001e | .... .ZPA ..... |

```

Hardware issues

Capacitors?









RESULT

No change

Capacitors: C141, C142, C187 and C188 replaced from the nominal 33pV capacitance to 18 pF one. (company instruction)

- After successful replacing the capacitors ADC scan performed again.
- Only The FEC with changed capacitors was in use.

FEC mask	Result
0x001 - 0x00FF	Correct data
0x03FF	ZEROS
0x0FFF	ZEROS
0x3FFF	ZEROS
0xFFFF	ZEROS
0xF3FF	ZEROS
0xC0FF	CACA....
0x3CFF	ZEROS
0xF0FF	ZEROS

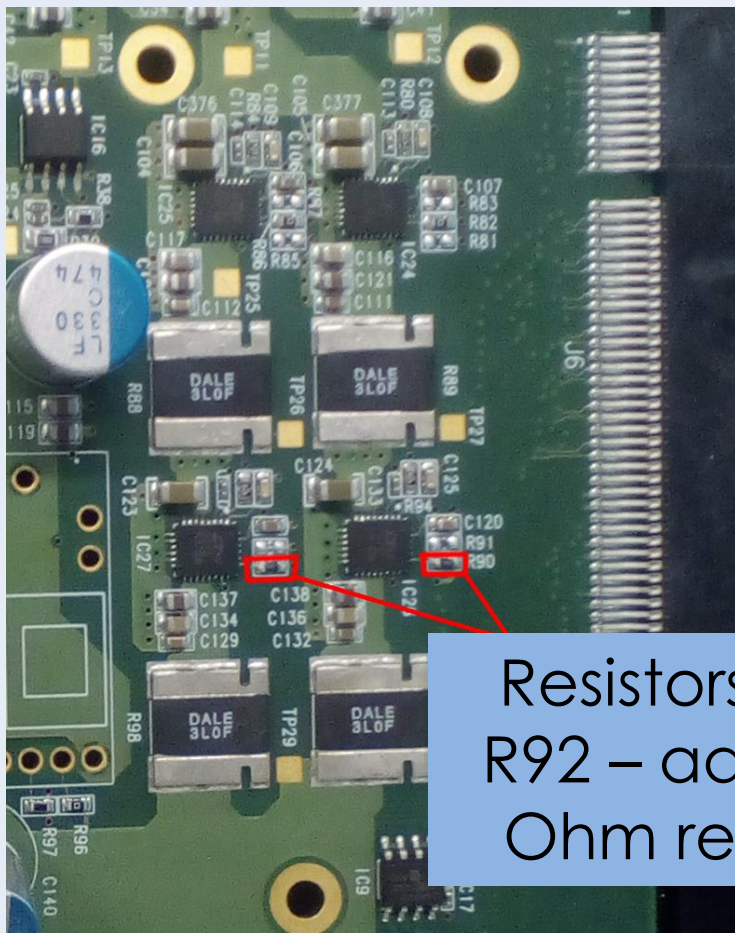
Action	FEC v1.3		FEC v6	
	nonZS firmware	ZS firmware	nonZS firmware	ZS firmware
FECs off the box				
Capacitor exchange	X	X		

X

No action performed, modification not applicable to the listed card.

Hardware issues

Resistors?











Resistors: R90,
R92 – added 0
Ohm resistors

Change

Two 0 ohm resistors increase FPGA core voltage by 50 mV.

Result

- Proper initialization of the second ADC unit.
 - No problem in the data observed.
- Success?

Action	FEC v1.3		FEC v6	
	nonZS firmware	ZS firmware	nonZS firmware	ZS firmware
FECs off the box				
Capacitor exchange	X	X		
			Old capacitors.	Old capacitors.
Resistors added	X	X		



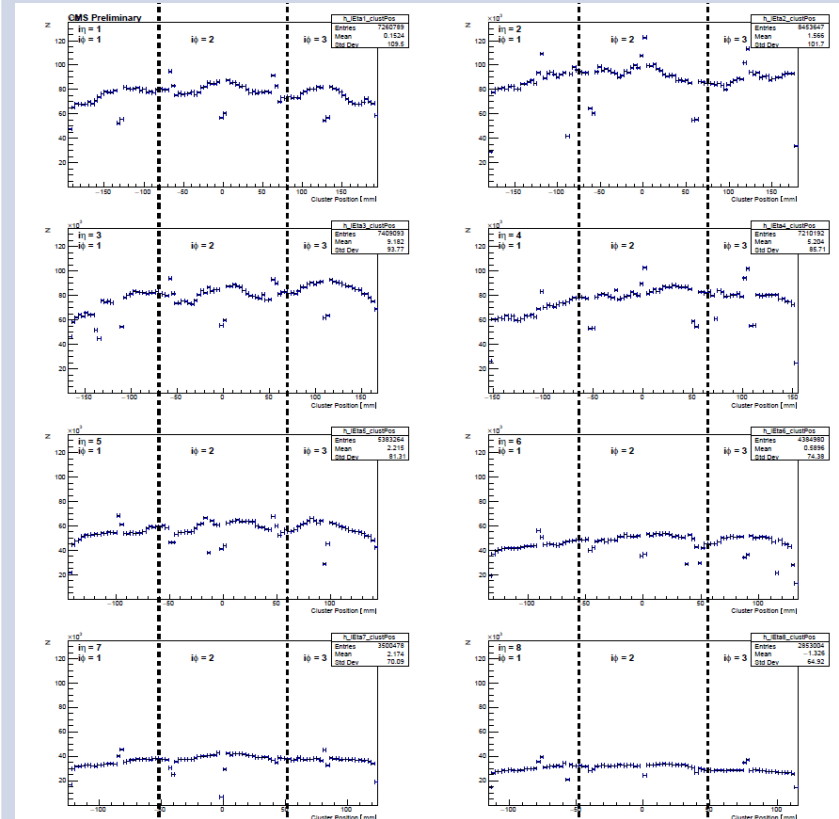
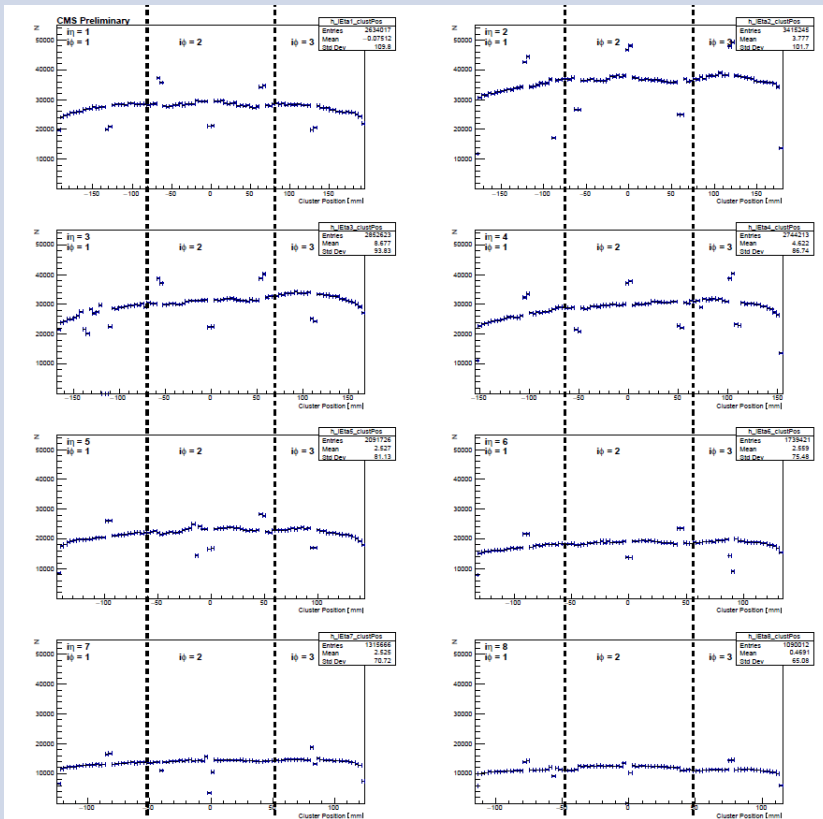
Modification seems to be successful, but we need to confirm it is „regular“. In case of one pair of v6 FECs improvement is observed.

- Tests performed, using the same chamber GE1/1-X-S-CERN-0002.
- The same X-Ray gun settings.
- Very similar ambient conditions.
- Same PC (same software).
- Only difference in the SRS chain - FECs

ClusterPos

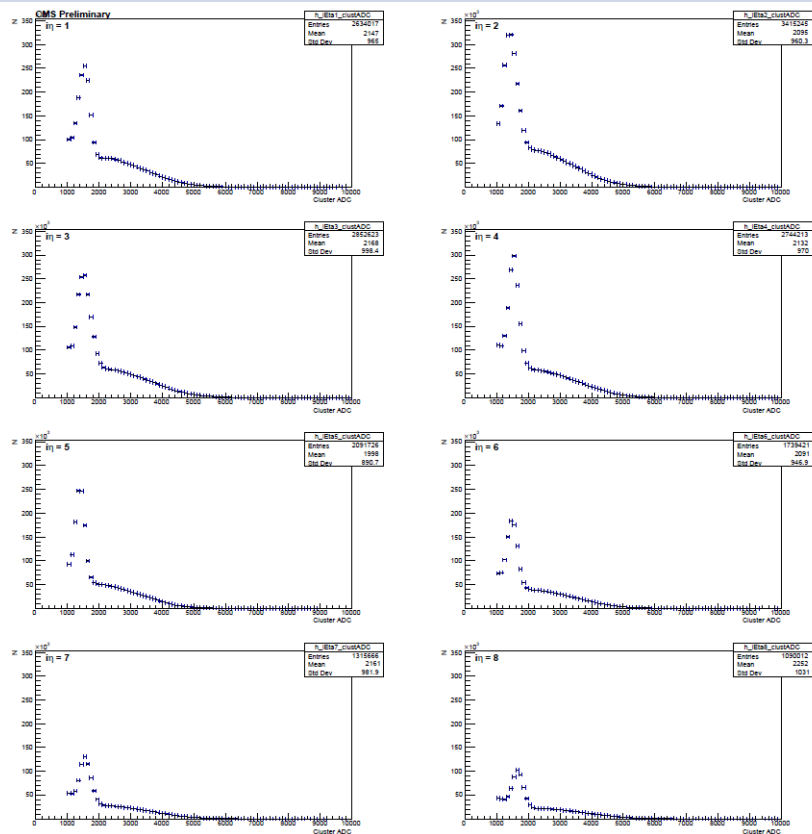
v1.3

v6

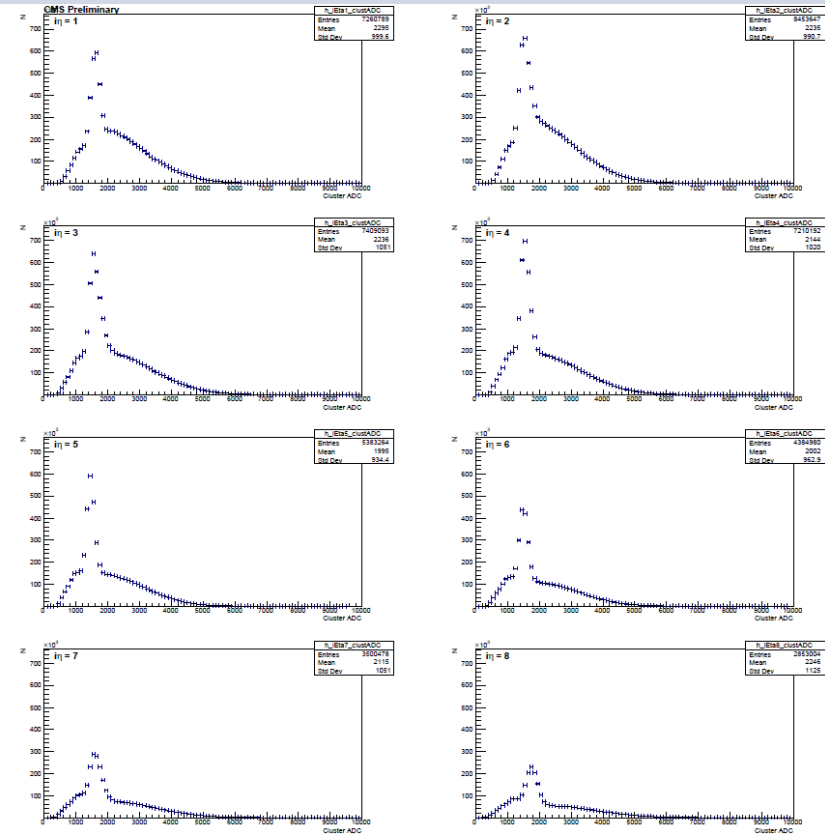


Fluorescence peak pos.

v1.3



v6

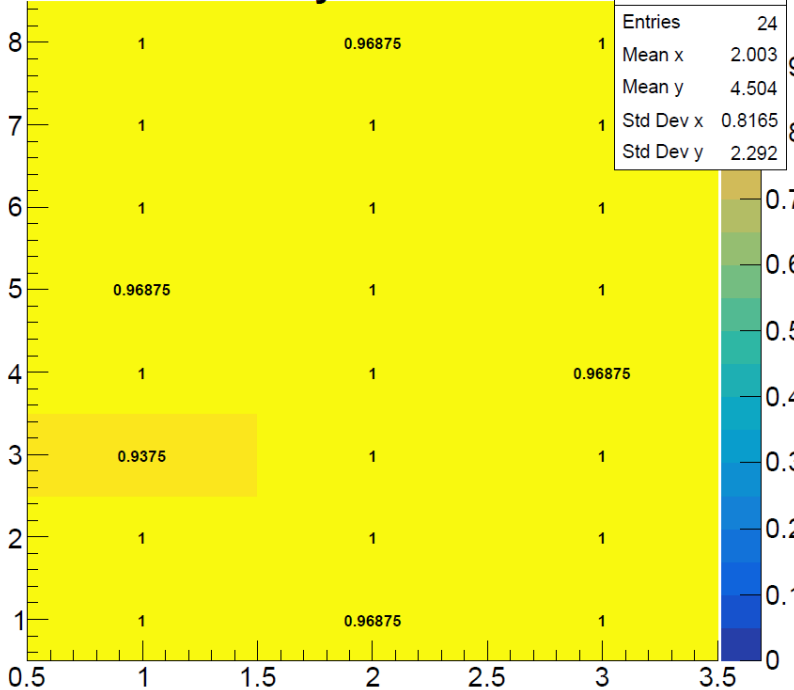


Fit Success

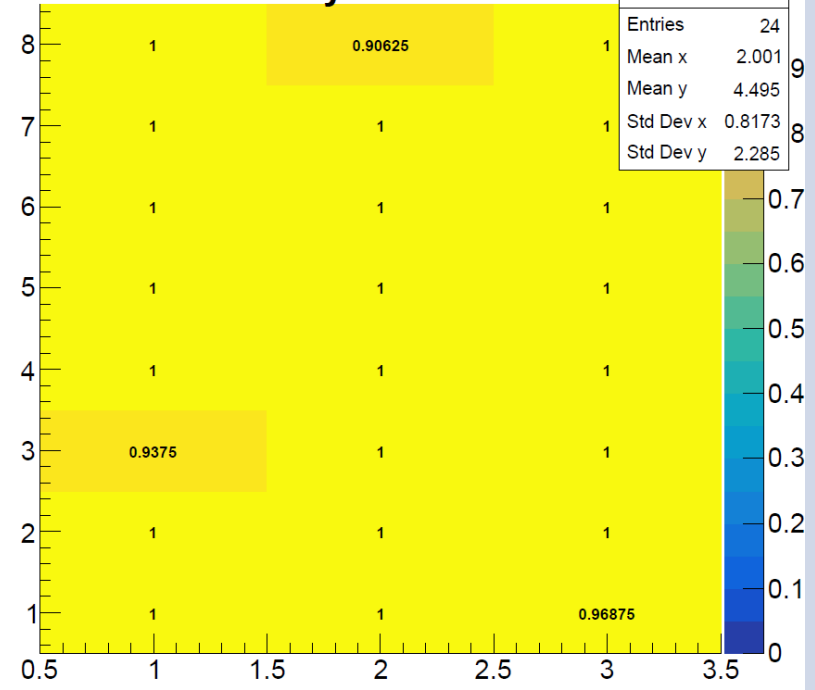
v1.3

v6

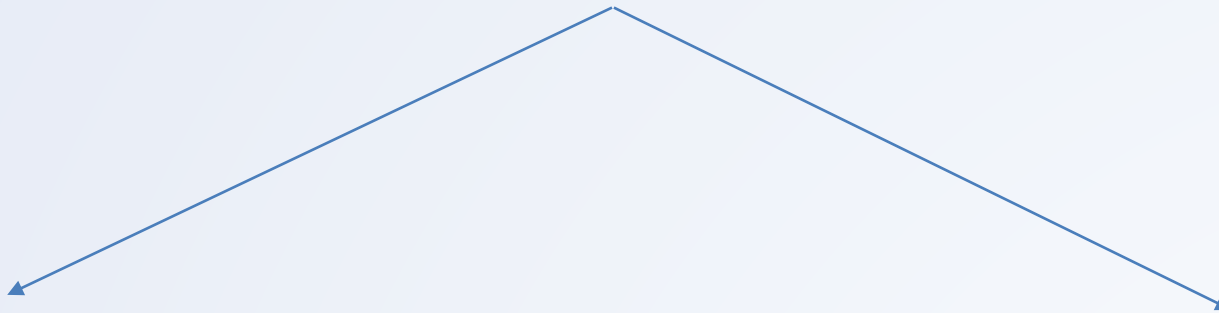
CMS Preliminary



CMS Preliminary



- Applying the solution to two spare FECs in the GEM lab.



Success

- Propagating the solution to all available FEC v6 in the GEM community.
- V6 exchange for v1.3 upon the request of the interested site.

Failure

- Further debugging the FEC cards.