CMX-Topo path: CRC error investigation

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with help and inputs of Topo and CMX crews

L1Calo weekly

1/02/2016

Christian's tests

- CRC errors identified in P1 in both data-taking and playback
- Playback pattern: CMX playback with 1/256 events filled with 1TOB per fiber

```
decodedAndRealignedRawData128:        0x10000040_0000c0bc_06600006_000008e2
decodedAndRealignedRawDataCharIsK16:  0 0 0 0  0 0 0 1  0 0 0 0  0 0 0 0        GOOD EVENT
emWord is valid
clusterTOB(0): CPM_Number= 1    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(1): CPM_Number= 2    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(2): CPM_Number= 3    Chip= 0 LocalCoordinates= 0
BCID= 0x66
clusterTOB(3):                          LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(4): CPM_Number= 6    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
Software CRC check okay
Firmware CRC check was error-free
```

```
decodedAndRealignedRawData128:        0x10000040_000080bc_06700006_00000942
decodedAndRealignedRawDataCharIsK16:  0 0 0 0  0 0 0 1  0 0 0 0  0 0 0 0        CRC ERROR
emWord is valid
clusterTOB(0): CPM_Number= 1    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(1): CPM_Number= 2    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(2): CPM_Number= 2    Chip= 0 LocalCoordinates= 0
BCID= 0x67
clusterTOB(3):                          LocalCoordinates= 0      IsolationMask= 0      Energy=   0
clusterTOB(4): CPM_Number= 6    Chip= 0 LocalCoordinates= 0      IsolationMask= 0      Energy=   0
Error in software CRC check
Firmware CRC check found error
```

Similar one for BCID as well

Cristian's additional findings

- Special FW analysed data after alignment and before/after 10b-8b encoding. **not the problem**

- The occurrence of the bit flip is "rare", it require to trigger on it to be observed **not likely to be systematic logic problem**

- Few / 68 channels affected, they are different after start of a new run

- CMX reconfig changes affected channel, Topo reconfig does not. **not likely to be logic bug**

Indication of the problem being located non only from the data encode at CMX

- On a very few channels it has been observed that on the (in)elastic buffer memory over/underruns can occur.

- Along with that misbehaviour we see that our detection circuity for comma characters finds a change in comma character postion and starts a re-alignment cycle (which is not surprising in such a case).

Test-rig setup

Set1 FIBER x 12

Set2 FIBER x12

FAN OUT 48 in 4 x 12
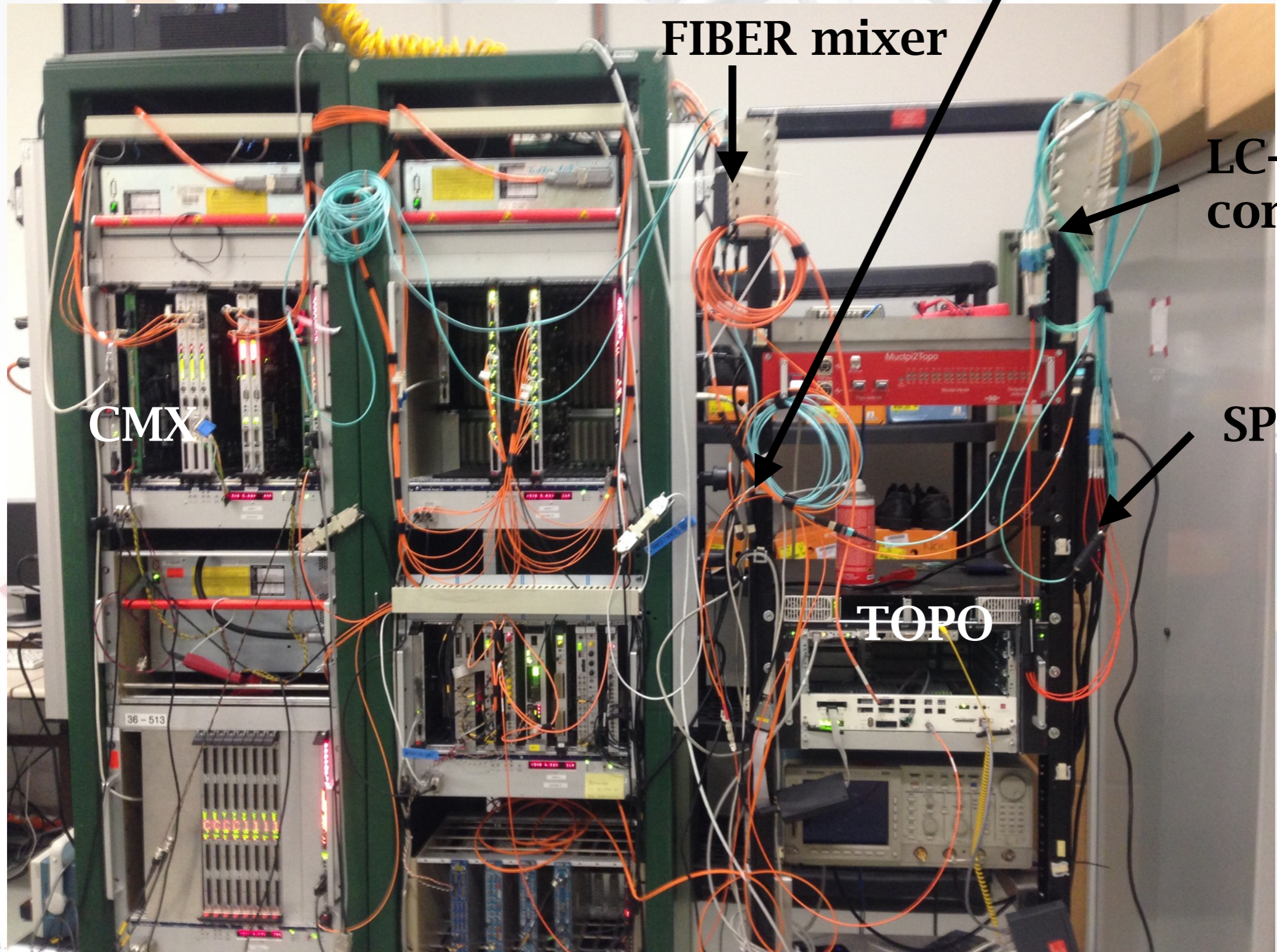
FIBER mixer

LC-LC connections

SPLITTER

CMX

TOPO

- CMX: loaded with CP crate FW (both)

Topo-week tests

Test-rig

- 256/256 events with saturated fibres -> **CRC err** (but we believe due to lack of comma character for alignment)

- 256/256 events w 1 TOB x fiber **-> NO CRC / 1 night** - no P1 emulation of fiber plant

- todo: 1/256 or random sparse

Point-1

- random sparse data (from PPM) ~ **1h CRC free**

- random sparse data after run restart x 2: **~250 CRC / few minutes** *elog 290217*

- bit flip 0->1 and 1->0

- 1/256 events w 1 TOB x fiber: **~ 100 CRC / all night** *elog 290259*

- *256/256 events w 1 TOB x fiber: **~few / few min***

Details (elogs: 290217-290259)

- sparse random PPM

- Most of events empty: expected to see the flip around the module and BCID number

- both 1 and 2 bit flips observed.
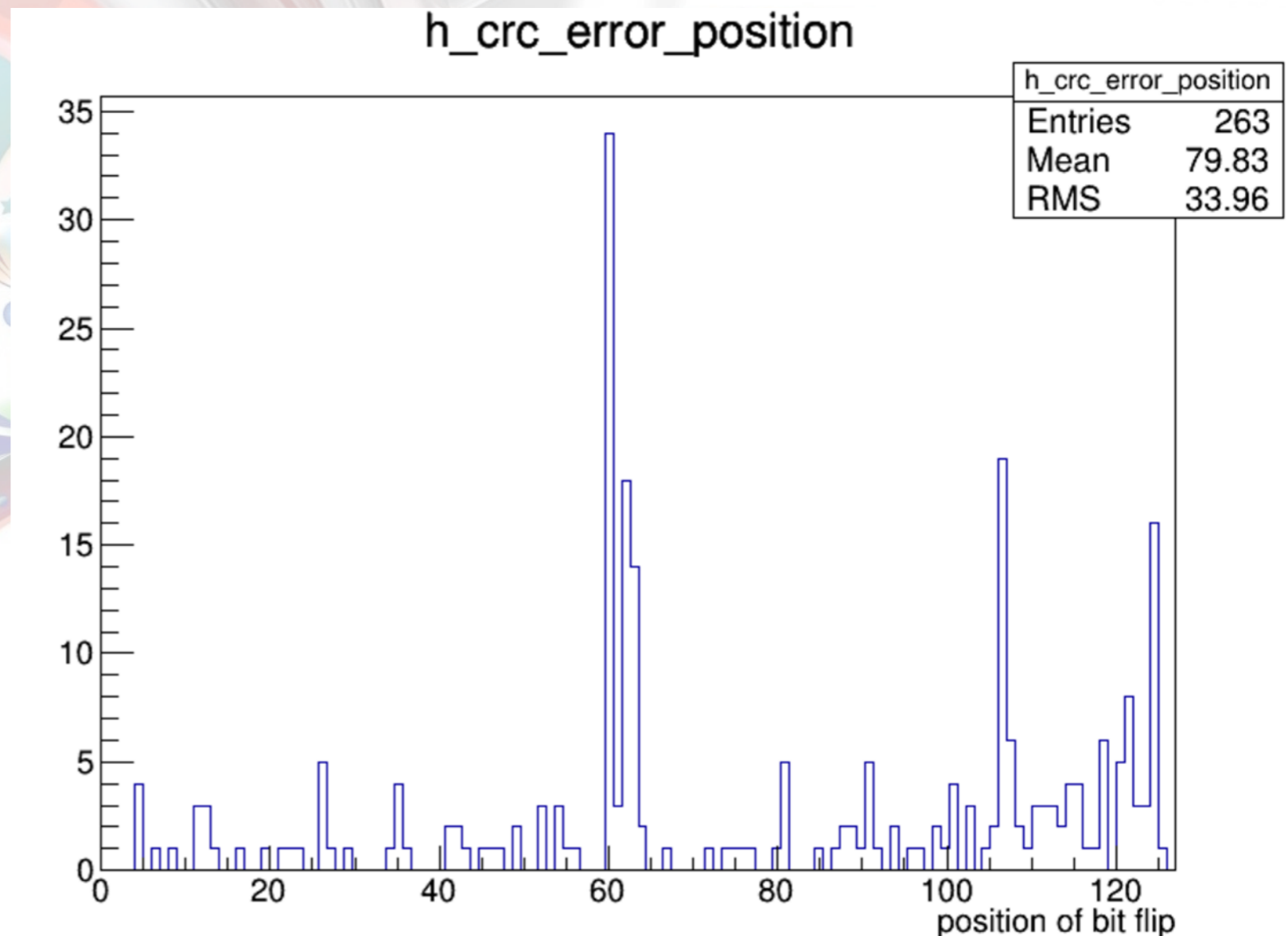
Details (elogs: 290335)

- ~50 errors per hour

- no luck on identify a CRC on a splitter finer

- Errors occurred only on L1Topo00 despite many reset

- Since L1Topo01 appear to be error free, we can swap the RTM between the two blades to verify if this might have anything to do with the module itself.

Priscilla Pani

Further discussion this afternoon to define the next steps

thank you