

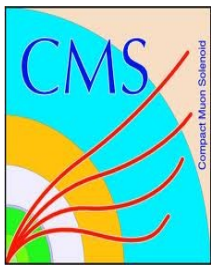
# Progress on BackEnd Tests at P5

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S. Bhattacharya\*, K. Ranjan, S. Banerjee\*

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03<sup>rd</sup> August 2012

\*- SINP

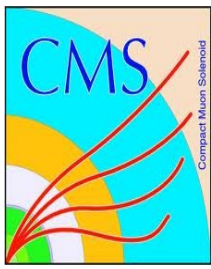
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# Outline



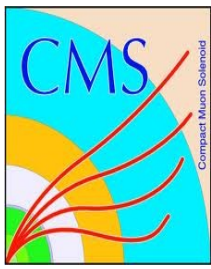
- Goal
- Plan description
- Issues
- Result/Plot
- Summary



# Goal

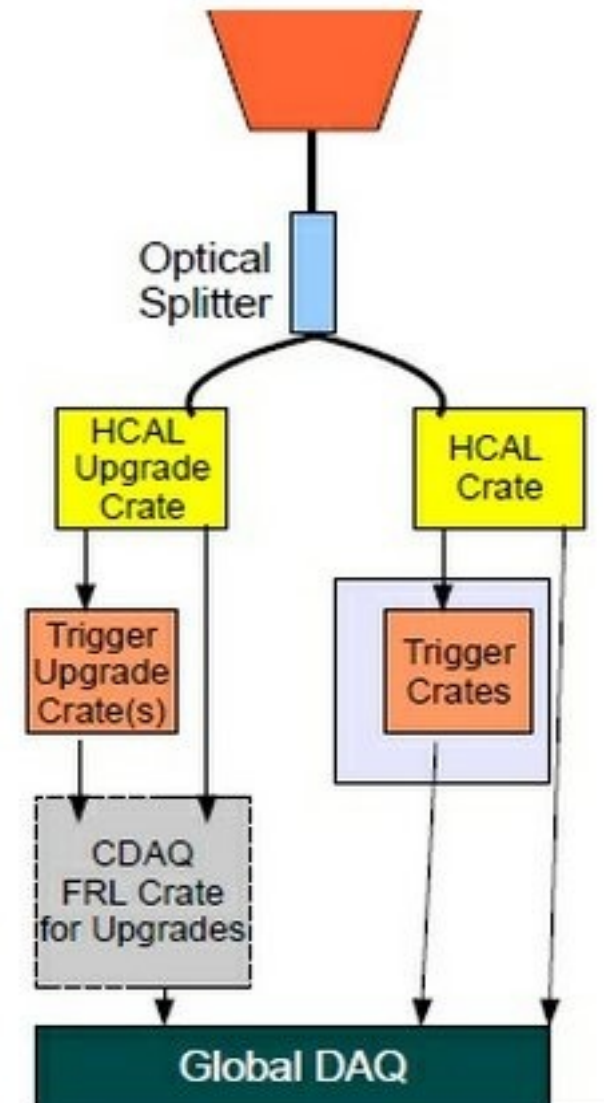
Testing of the cards by monitoring the HF/HB readout via uTCA in realistic operational condition at P5

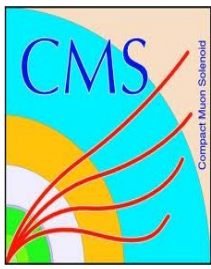
- BER (Bit Error Rate) test
- Data synchronization validation



# Card Setup

- HF slice
  - 40 deg slice in Q4 on the minus side (iphi 59-66) occupying
    - 1/3 of HFM10
    - all of HFM11
  - 32 Fibers, 3 Ribbons
  - Occupied slot no 9, 10, 11
- HBHE slice
  - 36 fibers, 3 Ribbons
  - Occupied slot no 1, 3, 4

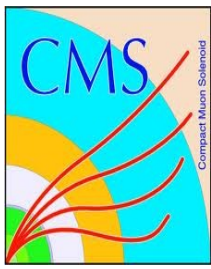




# Plan

Using AMC13 and mCTR software:

- At 904 (8 cards)
  - Initial testing
  - IP/mac assignment
  - PPOD fixing
- Installation at P5 uTCA crate (6 cards)
- Crucial step
  - BER test
  - Validate link synchronization
- Maintenance of database.



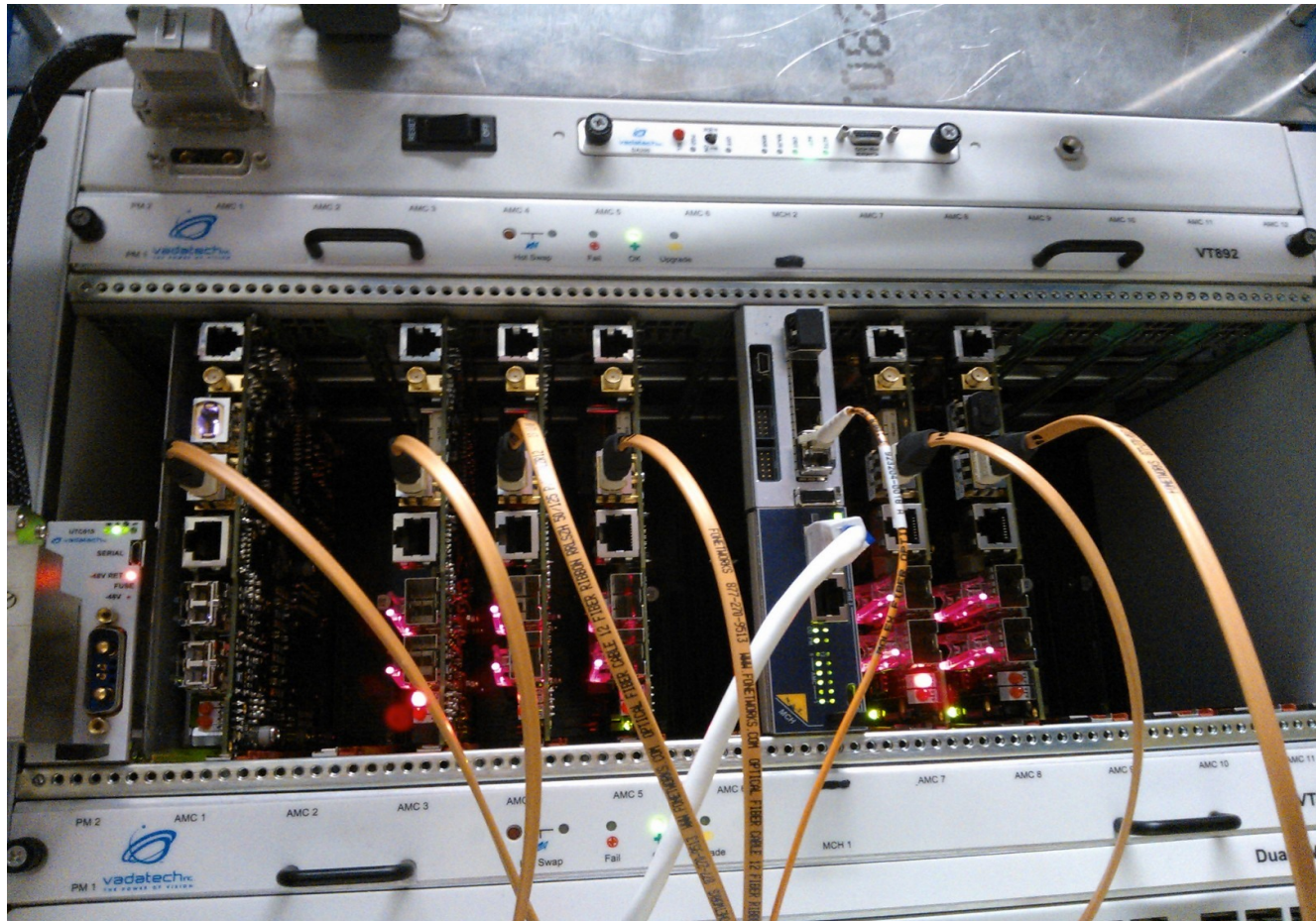
## Issues faced

After the initial testing at 904, six cards were installed at P5.

- First check
  - card no/slot no thread was not as planned.
  - card/slot scheme changed as needed.
- Second check
  - few cards still failed to respond.
  - brought to 904 for testing, air blower was used.
  - inserted back at P5, failed to access.
- Third check
  - were not properly “clicked in” the slots
  - fixed again.
- Finally six cards were successfully installed at P5 and 2 were kept at 904.

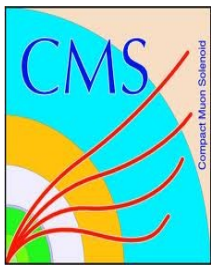


# Hardware status at P5



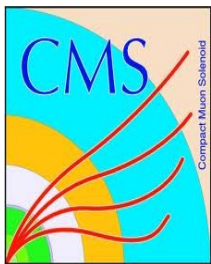
- Two mCTR2d cards are at 904
- One has assigned IP/mac and second is with default ip/mac

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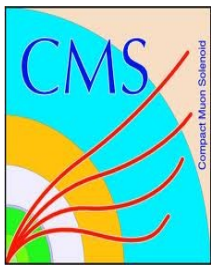
# Monitoring of 40deg slice readout for one week of LHC fill





# Fill Snap Shot

| Sl. no. | Fill No | Orbits         | No of time slices |
|---------|---------|----------------|-------------------|
| 1.      | 2729    | 10k, 100k      | 2                 |
| 2.      | 2732    | 10k            | 1                 |
| 3.      | 2733    | 10k            | 2                 |
| 4.      | 2734    | 10k, 50k, 100k | 4                 |
| 5.      | 2736    | 10k            | 4                 |
| 6.      | 2737    | 10k            | 2                 |



# BER test

Features of software :

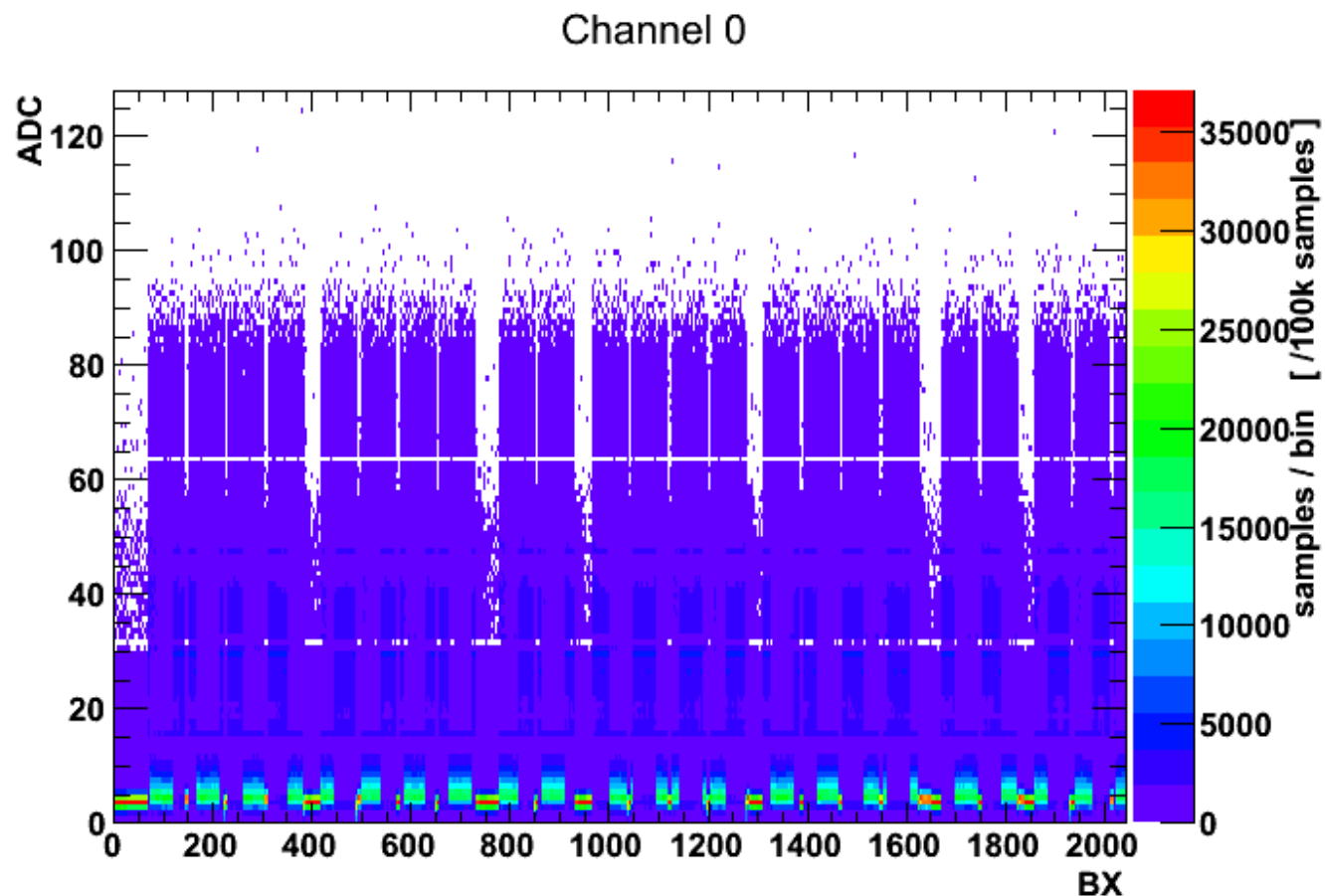
- Data lose monitoring
- Histograming

For HF/HB, the error rate is 0 integrating over 1, 2 minutes.

| Link            | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |       |       |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Bad Data</b> |       | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |       |
| AutoReset       | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 | 65535 |
| AlignStatus     | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    | 3c    |       |
| AlignOcc        | 5     | 5     | 5     | 5     | 5     | 5     | 5     | 5     | 5     | 5     | 5     | 6     |       |       |
| Orbit Rate      | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   |       |

Snapshot for one of the ribbon  
Initialized at orbit delay - 30

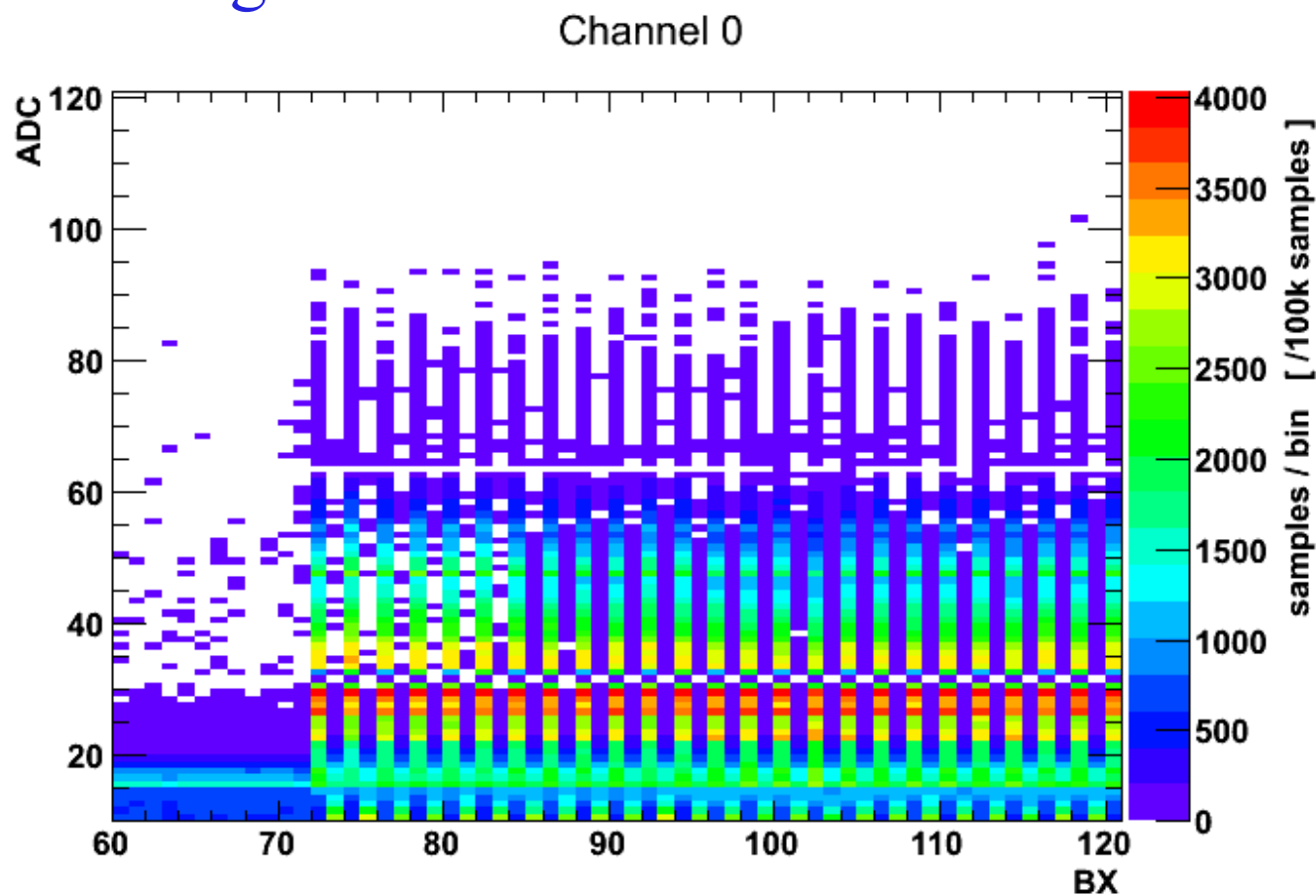
# Single fill Study



– HF ribbon 9, fill 2734, 100k orbits

# Single fill Study

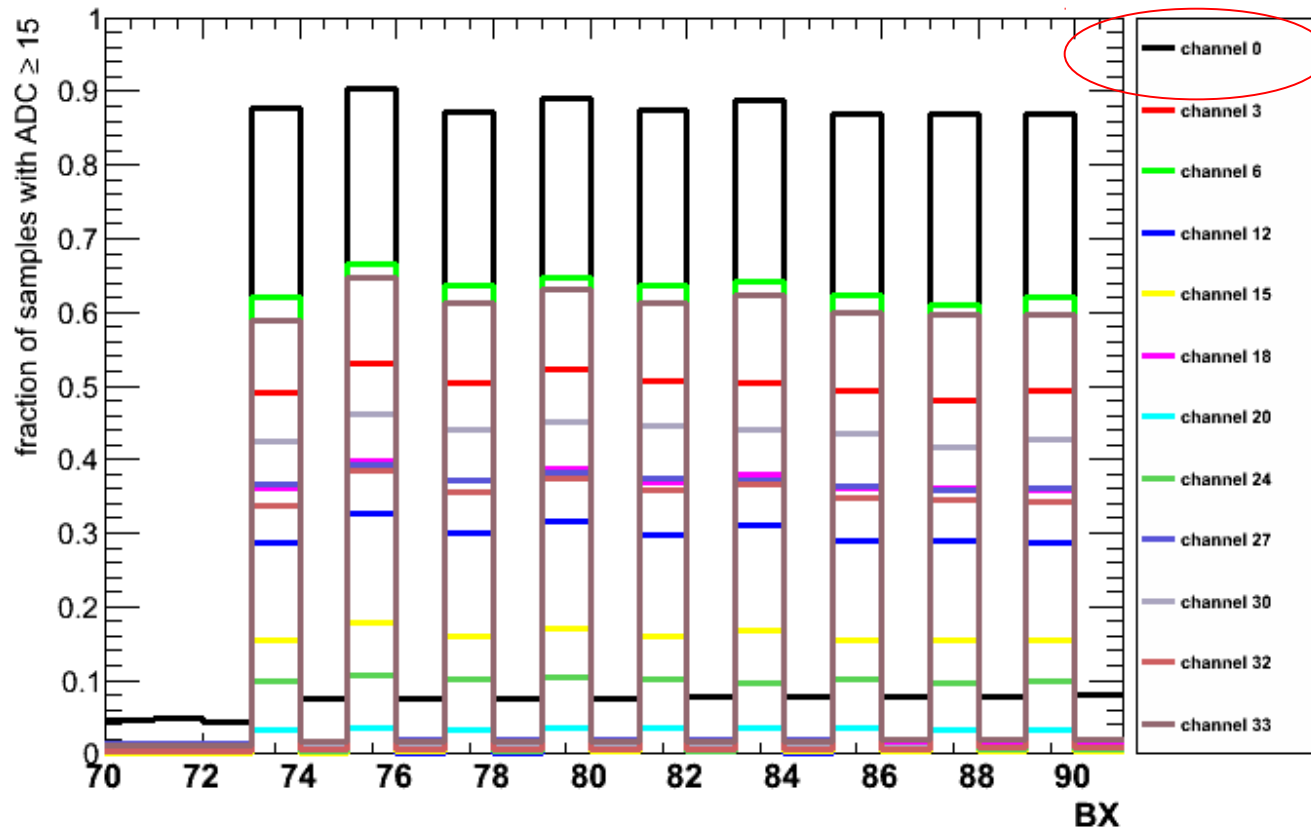
## Big BreakThrough



- Visible 50ns spacing with HF signal (ribbon 9, fill 2734)

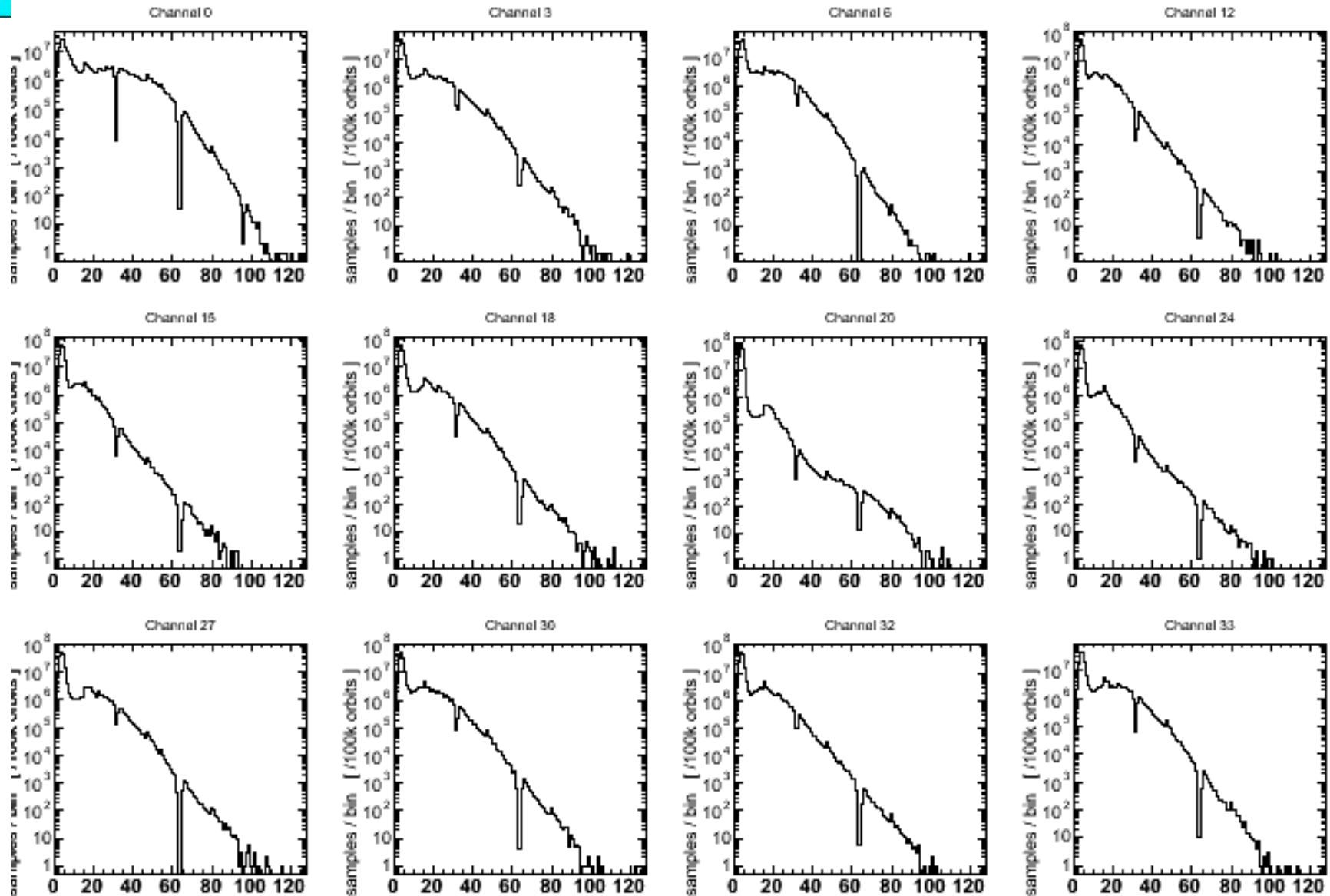
# Single fill Study

HF Ribbon 9, fill 2734, 100k orbits



- Fibers are aligned in time
- Channel 0 has maximum signal occupancy

# Single fill Study

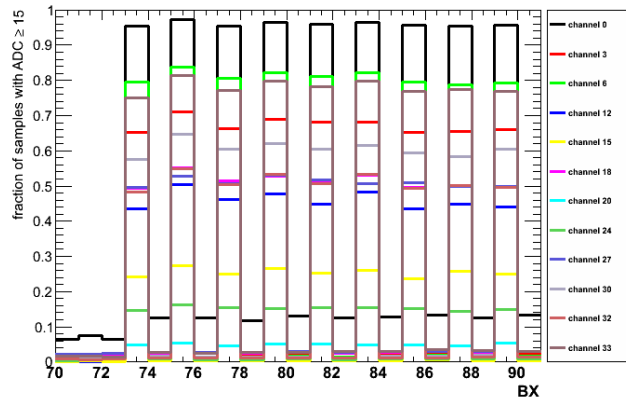


fill 2734, 100k orbits

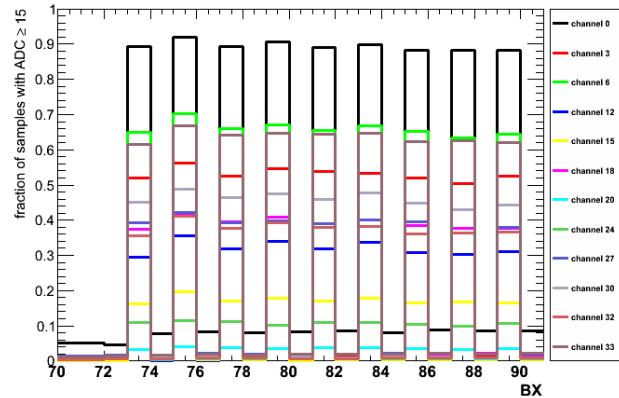
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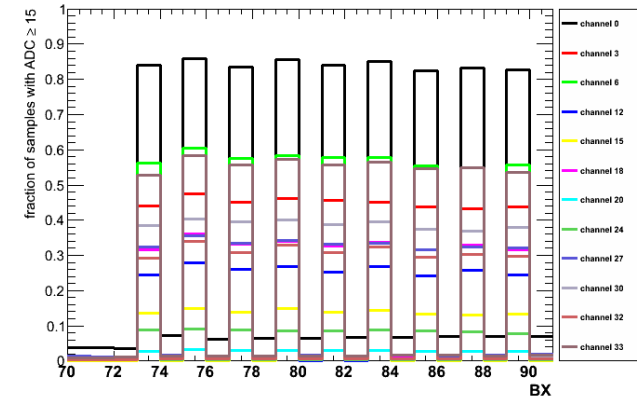
# Time Slicing (10k events)



t0



t1



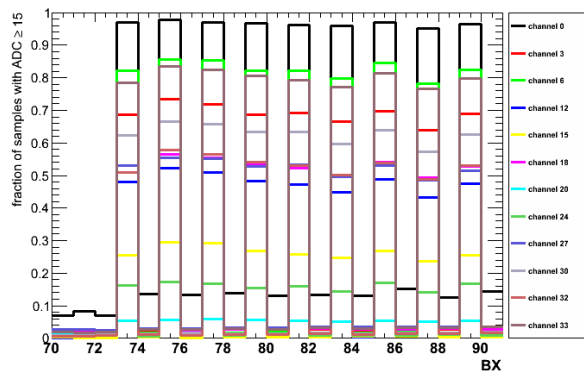
t2

- t0: time at start of the fill
- $t2 > t1 > t0$
- With decrease in the instantaneous luminosity, the decrease in signal occupancy is visible.

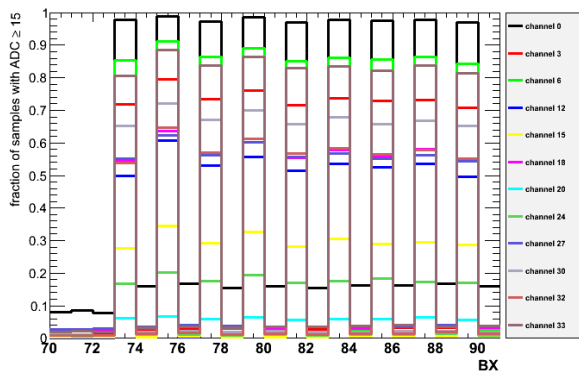
Fill 2734, HF ribbon9

# Various Fill Study

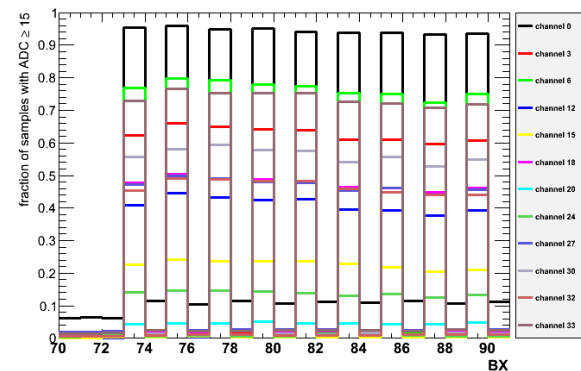
Fill 2729



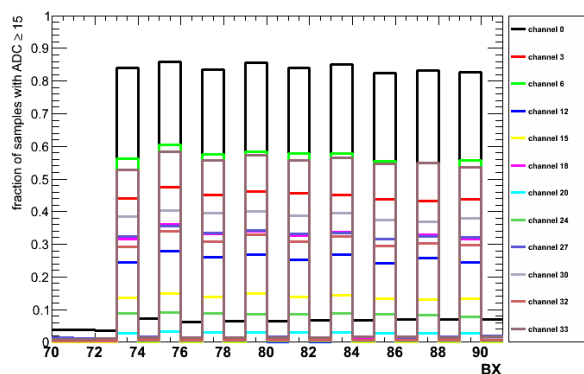
Fill 2732



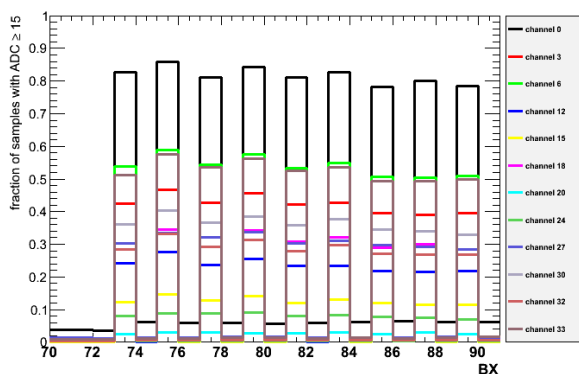
Fill 2733



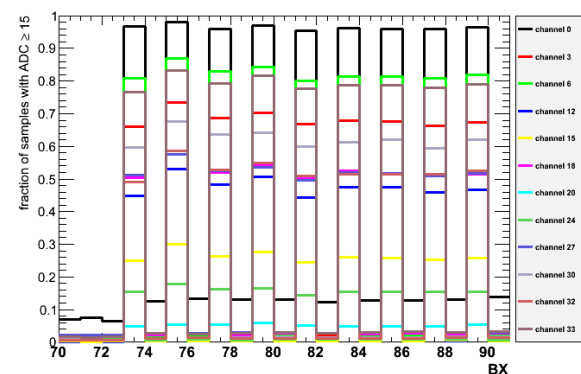
Fill 2734



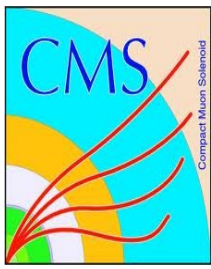
Fill 2736



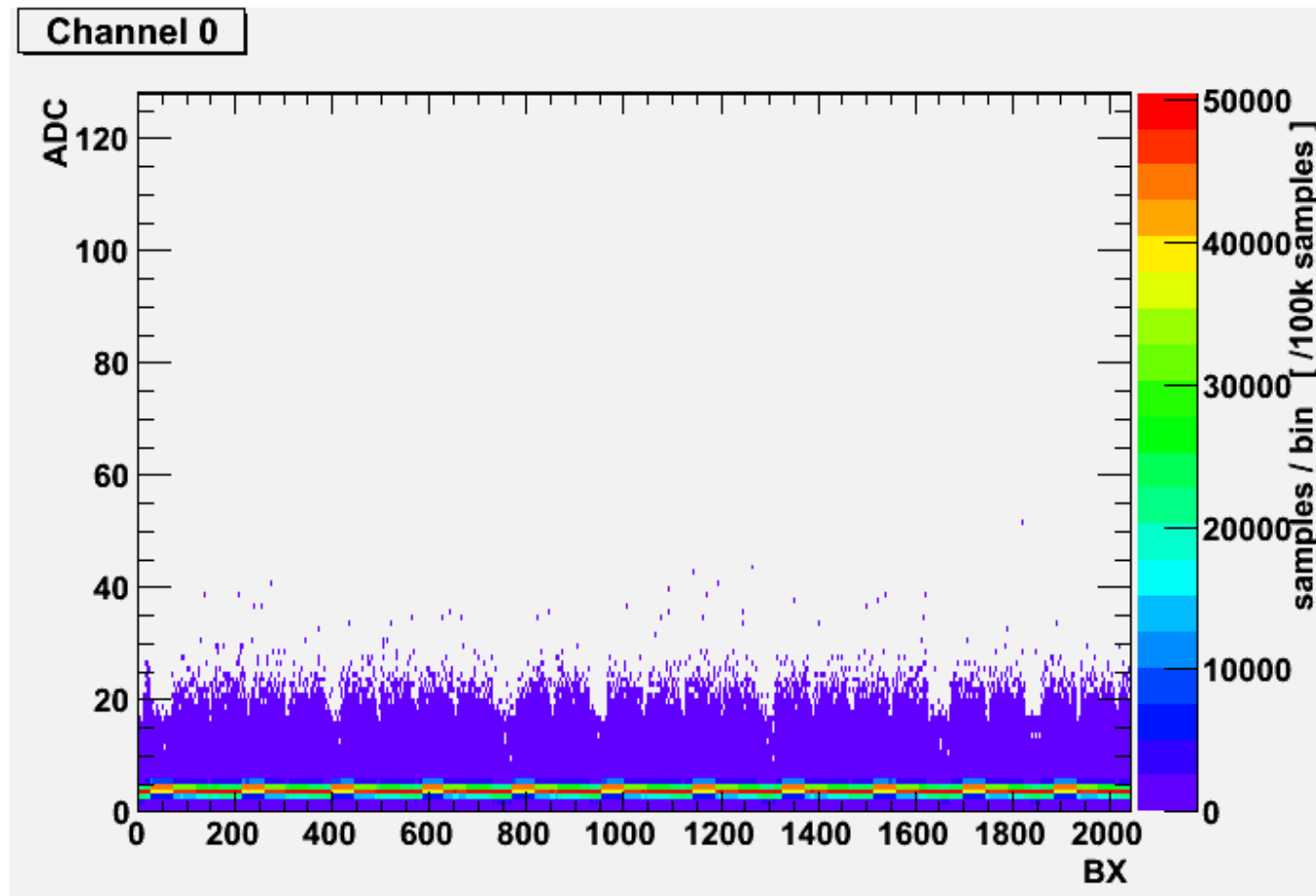
Fill 2737



— Signal occupancy found to be consistent for all fills

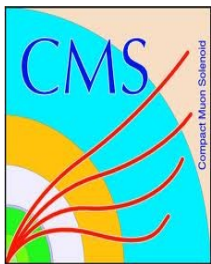


# HB readout



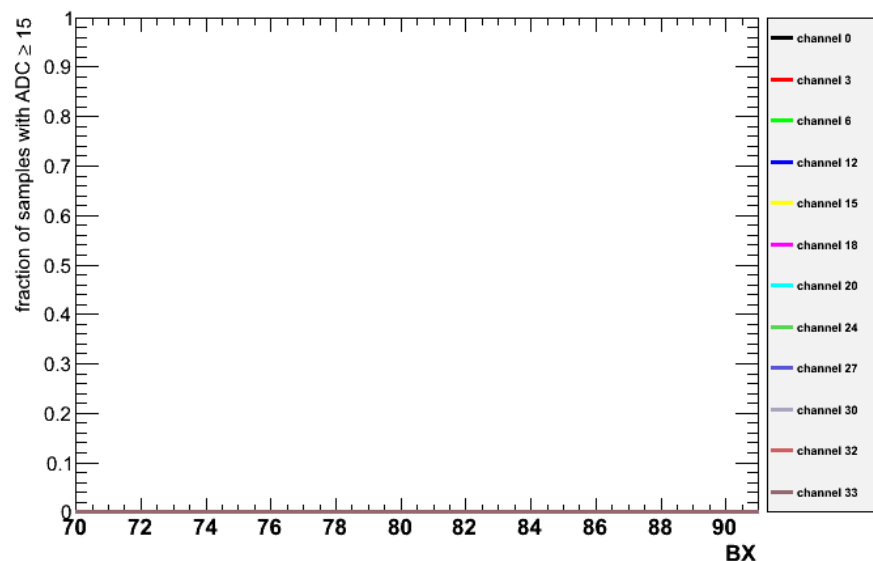
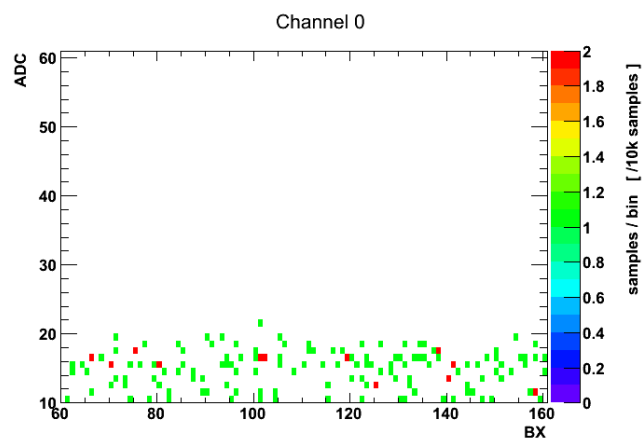
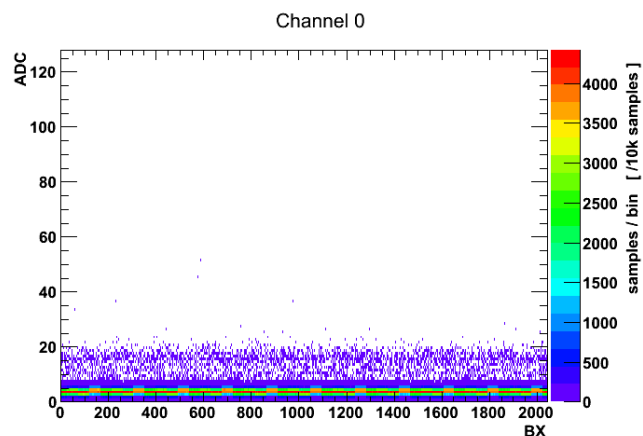
Fill 2729, HB ribbon1

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# Circulating Beam

Fill 2737, ribbon 9



— When beam were circulating not colliding.

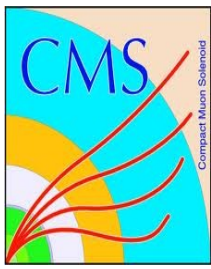
# SINP hardware Status



- Vedatech crate
- Can occupy 12 cards
  - Same as P5/904 crate



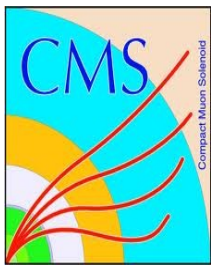
- Mini crate
- can occupy 1 card



# Summary

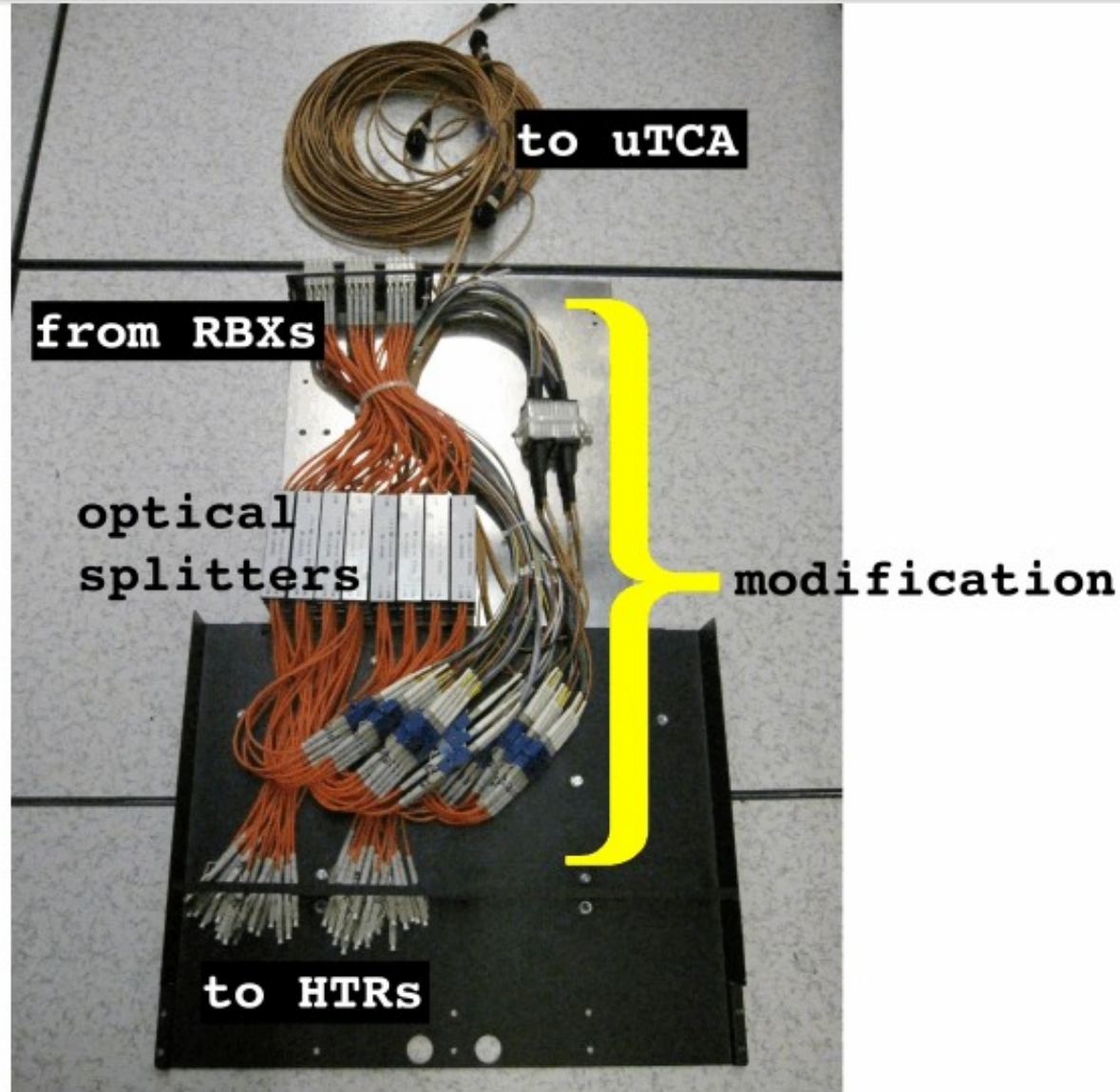
- SINP has delivered eight mCTR2d cards at CERN.
- Six of them are successfully installed at P5 and two are kept at 904, PPOD reception of split bers tested.
- For one week, the link validation and BER test were performed.
- Data received on all ribbons, Error rate = 0 integrating over 1, 2 minutes/ber.
- Big milestone was achieved with visibility of 50 ns spacing in data.
- Data was found to be synchronized over time and consistent over different fills.
- Continue AMC13 software development
- Local readout with sparse L1AS during global run is the step next in the uTCA journey.





# BACKUP

# Optical Splitters



# Source of Anomalous Events

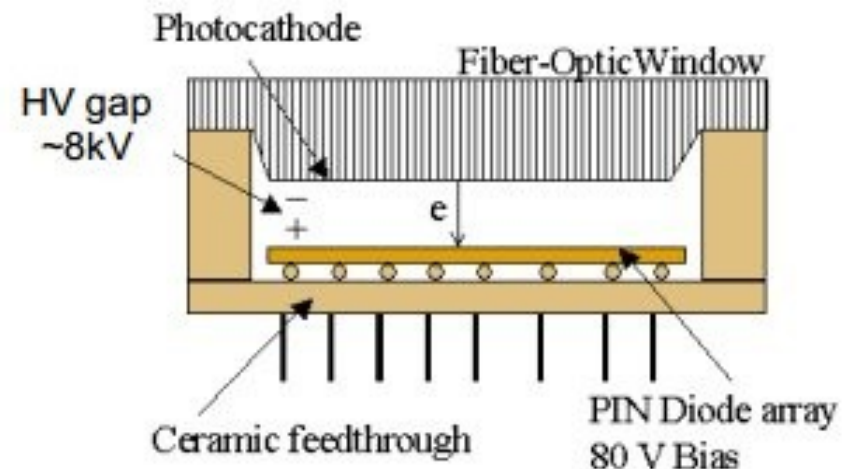
1) Cherenkov light produced by interactions in the window of the Forward Calorimeter PMTs

Glass window thickness in the center is  $\sim 1\text{mm}$  increasing to  $\sim 6.1\text{mm}$  on the edges

2) Scintillation light produced in part of the reflective material of the light guide

3) Electronics noise from the Hybrid Photo Diode (HPD) and Readout BoX (RBX) used for the Hadronic Barrel (HB), Outer (HO), and EndCap (HE) calorimeters

The HPD has 18 channels/device  
There are 4 HPDs in a RBX





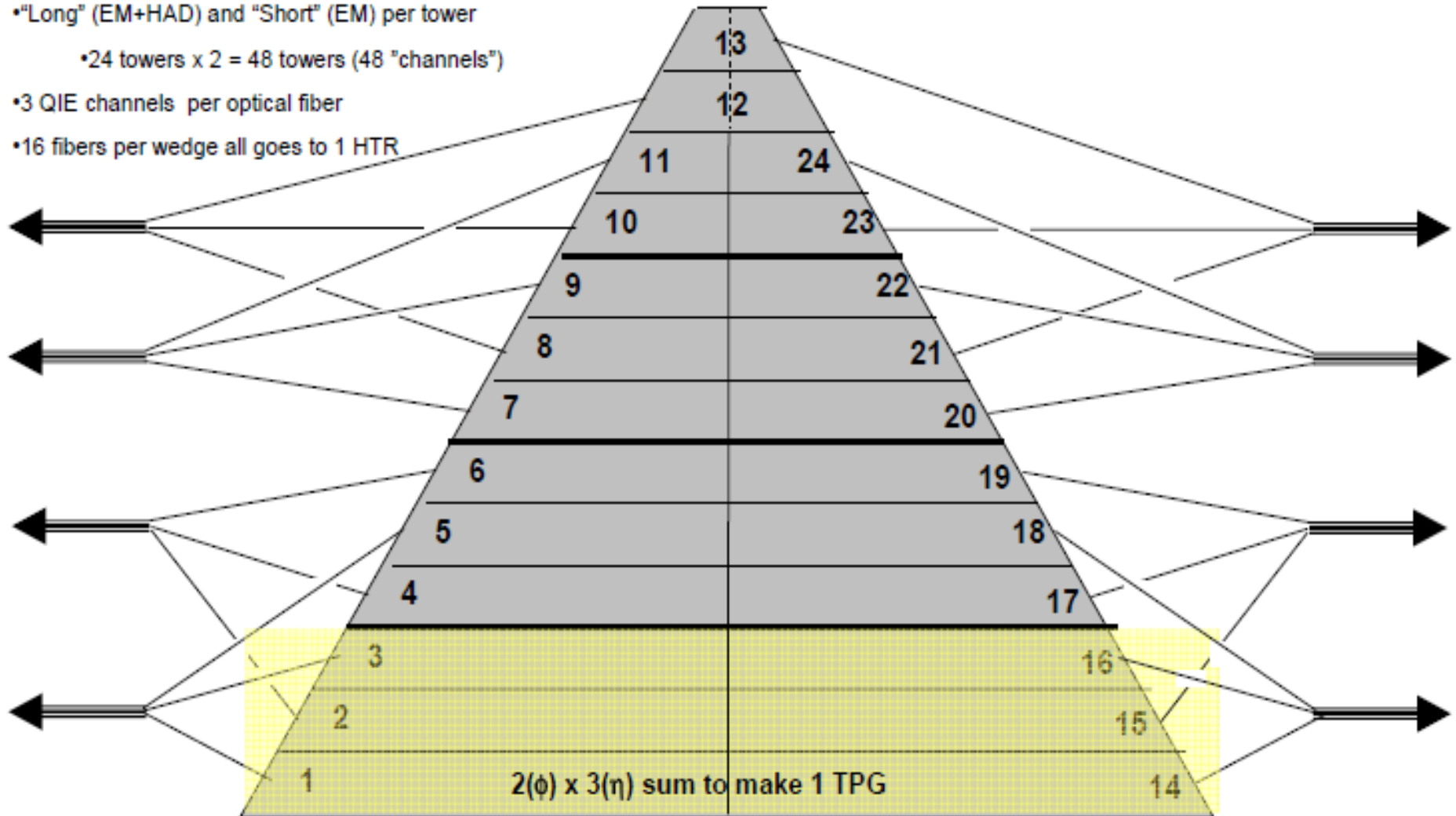
# HF "Wedge"

• "Long" (EM+HAD) and "Short" (EM) per tower

• 24 towers x 2 = 48 towers (48 "channels")

• 3 QIE channels per optical fiber

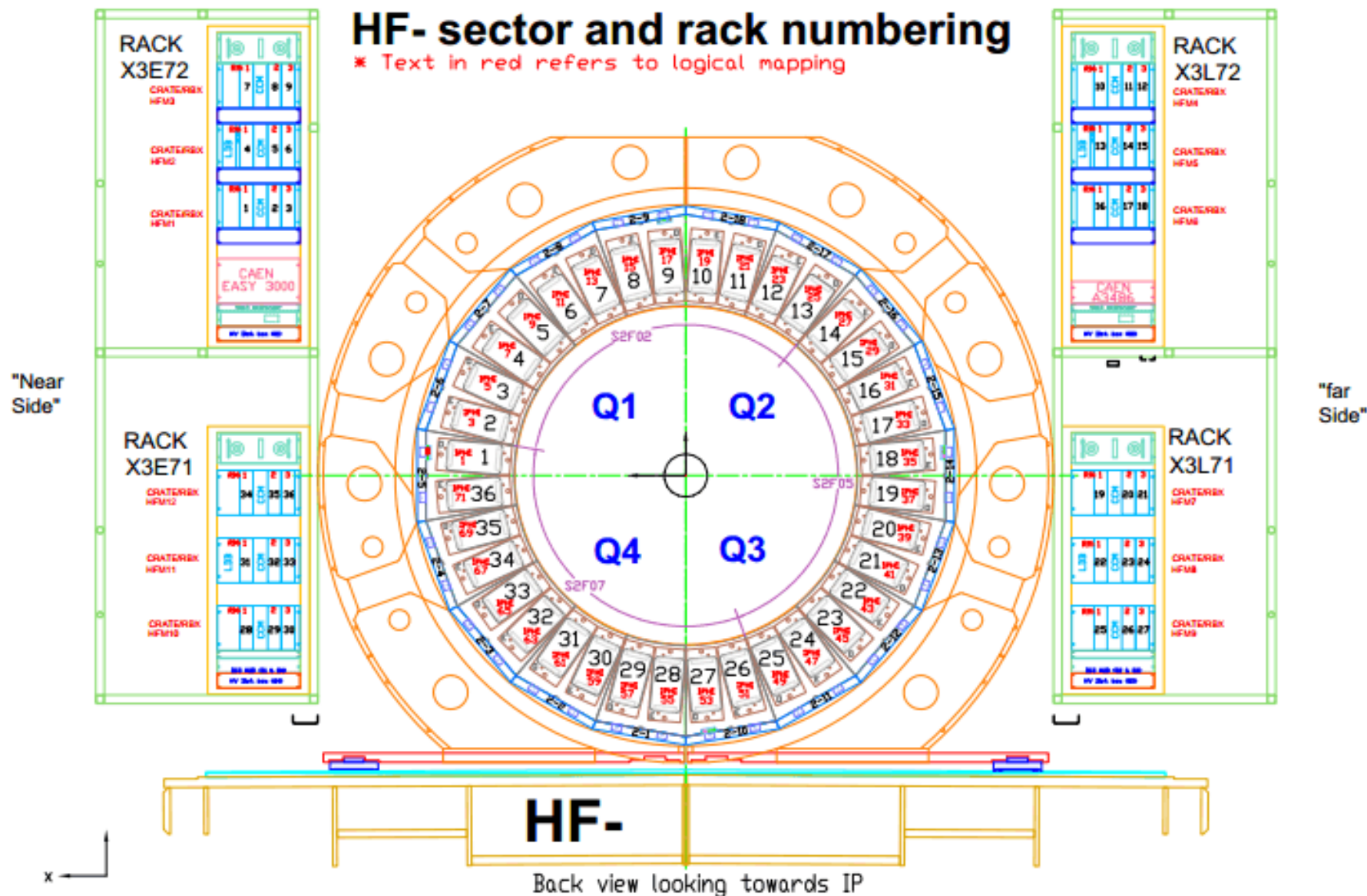
• 16 fibers per wedge all goes to 1 HTR



# LHC orbit structure

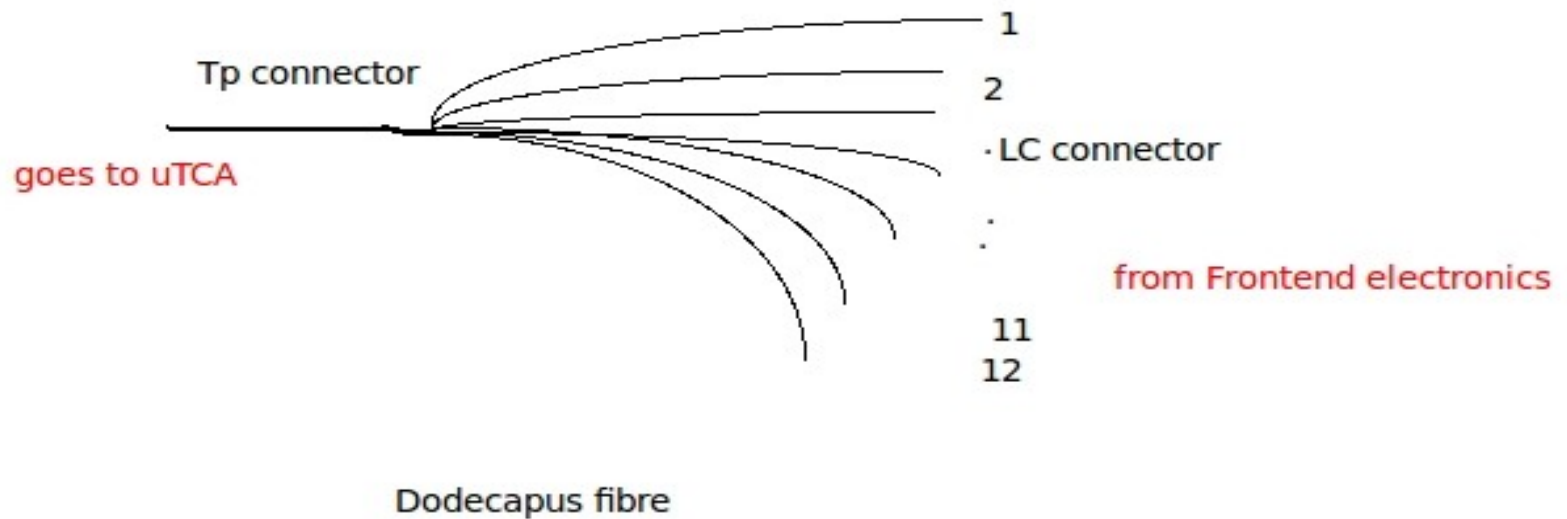


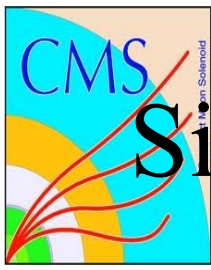
Figure 4: LHC orbit structure





# Dodecapus Fiber





# Single fill Study Fill : 2734 (100k orbits)

