A Summary of Backend Electronics at <u>SINP</u> For HCAL Upgrade

Presented by:

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Outline of the talk:

✓ Why this upgrade

✓ Role of <u>SINP</u>

✓ Brief Description of HCAL BackEnd Part

✓ µTCA and AMC Card

✓ Fabrication

✓ Testing

✓ Installation at P5

✓ Official Database

✓ Future Plan

Why this Upgrade?

- With the increase of energy and luminosity in LHC large amount of data has to be processed.

•Number of channels recorded will also be increased by a factor of 2.

   Very high speed data(upto 10Gbps) acquisition system is needed.

➤This upgrade allows to tackle this problem(takes advantage of new technologies, earlier not available).

Role of SINP:

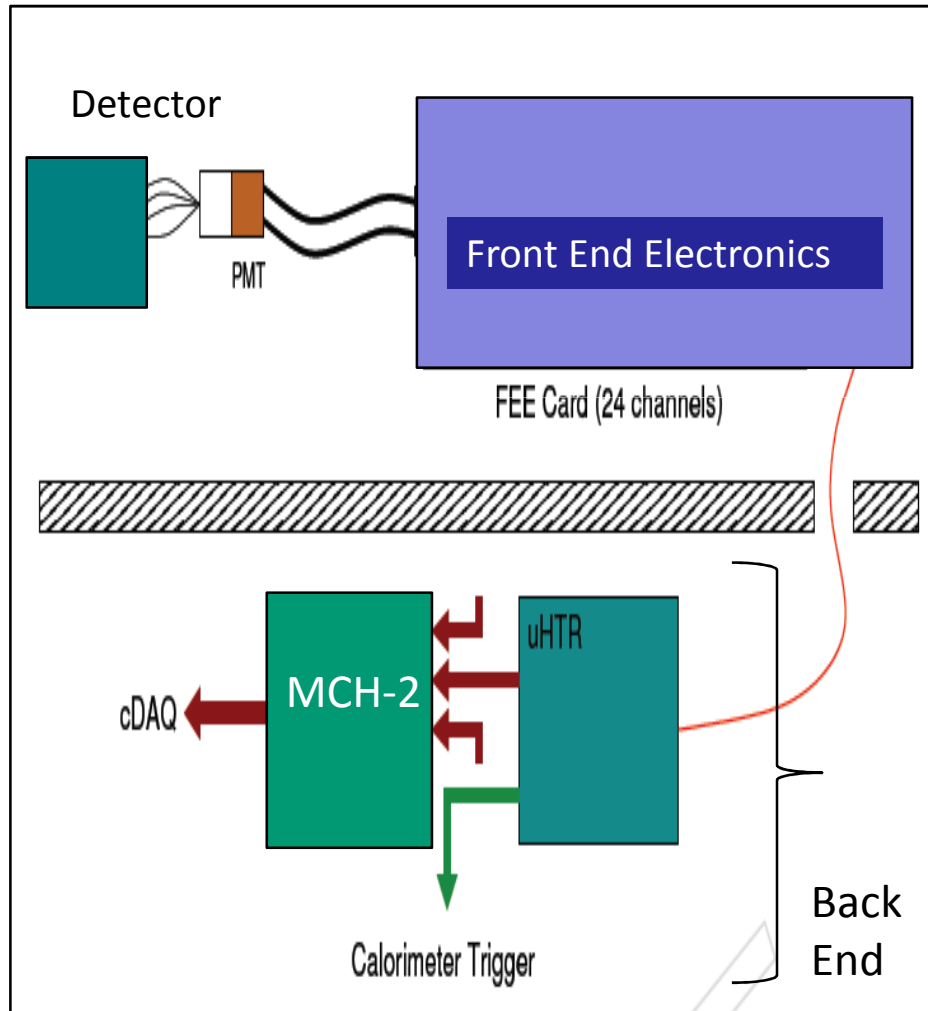•SINP is taking part in the upgrade of the Back–End Electronics from Jan.2012.

•Key Players :

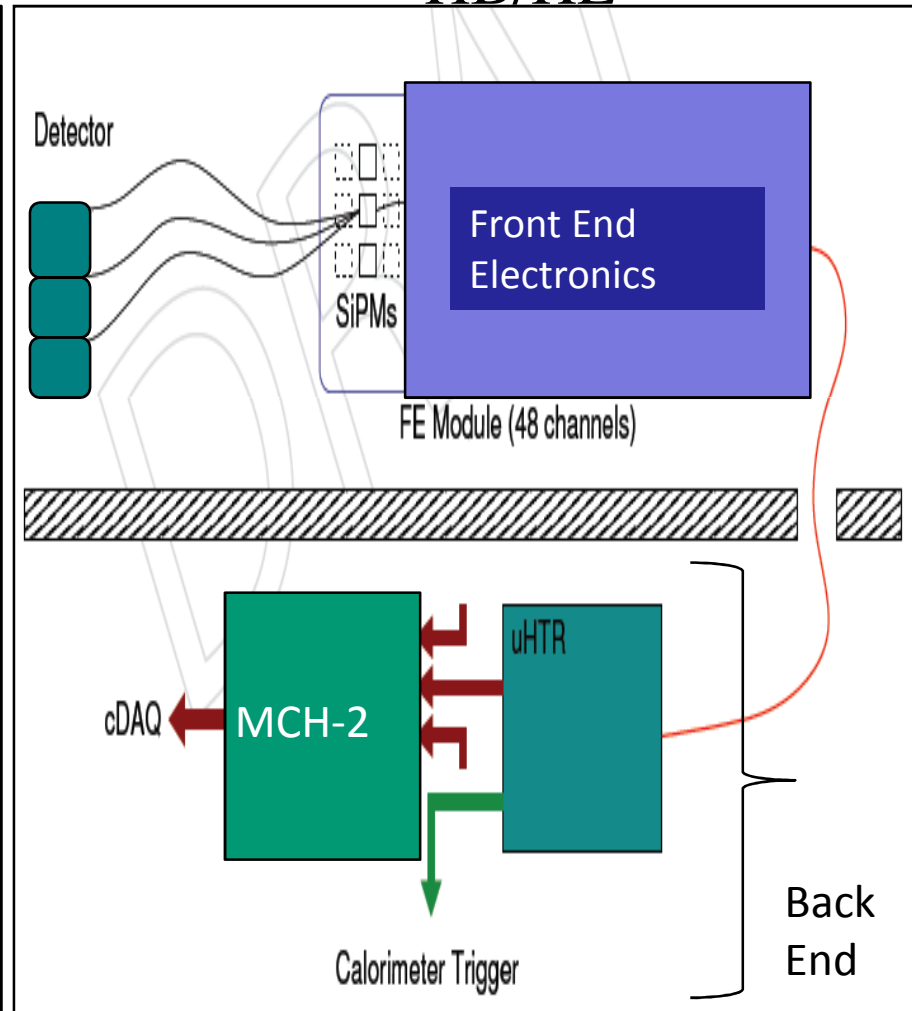 S.Banerjee, ,R.Khurana , S.Mukherjee, P.Saxena, M.Sharan, D.Roy .

- Task :

 Current VME system of the HCAL Back–End part will be replaced by μTCA for high speed data acquisition.
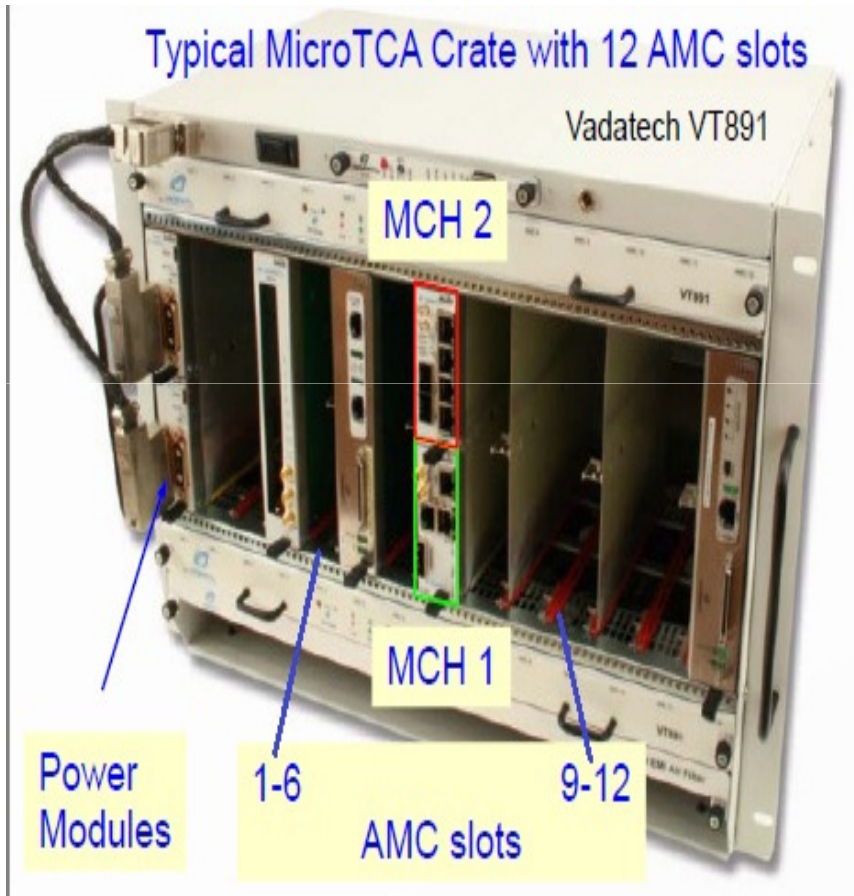
Where is The BackEnd ?

μTCA
(developed firstly by telecommunications industry)

Typical MicroTCA Crate with 12 AMC slots

Vadatech VT891

MCH 2

MCH 1

Power Modules

1-6

9-12

AMC slots

- Consists of

  a. 12 AMC (μHTR) cards

    Receive the data from the front–ends.

(Later will calculate and transmit the trigger primitives ,will hold the Level1 readout pipeline)

μTCA

b. 2 MCH modules.

MCH–1 (the commercial one)is there to control the power to all AMC modules (general house-keeping of the crate).

MCH–2 (AMC13/Custom one) is added in the upgrade (firstly made by Boston University).

is <u>responsible</u> for data acquisition as well as distribution of the LHC clock and fast control signals(capable of receiving data at the rate 4.8 Gbps).

AMC Card

Right now each AMC card has one MMC (Mezanine Management Controller) card.

MMC of each card has different MMC ID.

MMC is attached horizontally wrt the AMC surface.

When an AMC is inserted in the crate MCH communicates with the AMC via this subcomponent called MMC.

There exists one FPGA

There are two PPODs (for CTR2d):

PPOD Receiver

PPOD Transmitter

Fabrication

- SINP Made 10 AMC cards at Bangalore (under the supervision of M.Sharan) with UMN collaboration.

  1 CTR2c card

  9 CTR2d cards

- C and d series have different optical receiver.

  Snap12 used in c series

  PPOD   used in d series (more sensitive to digital signal, can receive data at the rate 10Gbps)

  Thus CTR2d card is the recommended one.

Testing

- Card testing was carried out at SINP.

- Done the following tests:

  ✓   Blinking Test

  ✓   Loading   Firmware

  ✓   Assigning IP Address

  ✓   Assigning MAC Address

- All cards were tested successfully and all CTR2d cards carried to CERN.

Installation at P5

- Kevin(from UMN) and I maintain an official database having the final status of each card (located at P5(CERN), 904(CERN),SINP(INDIA),UMN(USA).

- Cards were again assigned particular IP and MAC address (according to the database) before their installation at P5.

- Proper PPODs were attached to each AMC before the final installation at P5.

Snapshot of our Official Database

miniCTR2d series

MAC Addr: 00-80-55-CE-C0-0C ~ 14 for N77850
IP Addr: 192.168.xxx.xxx

| Type	Serial #	FPGA	EPROM	SFP0/1 (Gbps)	MAC Addr.	IP 192.168.**.**	Slot No.	Fiber No.	PPOD_TX	PPOD_RX	MMC DI1111***	Test Status	Location	Comments
mCTR2d	0001	XC5VFX70T-1FFG1136C	M25P128	8.5	0C	30.04	1	1					P5,CERN	Firmware 4.02
mCTR2d	0002	XC5VFX70T-1FFG1136C	M25P128	8.5							549		904,CERN	Default IP/MAC address MMC problem sorted out.
mCTR2d	0003	XC5VFX70T-1FFG1136C	M25P128	8.5	0E	30.12	3	2			543		P5, CERN	Firmware 4.02
mCTR2d	0004	XC5VFX70T-1FFG1136C	M25P128	8.5	0F	30.16	4	3			551		P5, CERN	Firmware 4.02
mCTR2d	0005	XC5VFX70T-1FFG1136C	M25P128	8.5	10	30.20	5	9			559		P5, CERN	Firmware 4.02
mCTR2d	0006	XC5VFX70T-1FFG1136C	M25P128	8.5	11	30.24					560		904,CERN	Firmware 4.02
mCTR2d	0007	XC5VFX70T-1FFG1136C	M25P128	8.5	12	30.28	7	10			561		P5,CERN	Firmware 4.02
mCTR2d	0008	XC5VFX70T-1FFG1136C	M25P128	8.5	13	30.32	8	11			557		P5,CERN	Firmware 4.02
mCTR2d	0009	XC5VFX70T-1FFG1136C	M25P128	8.5	14	30.36					558		KOLKATA	Firmware 4.02

Final Installation at P5
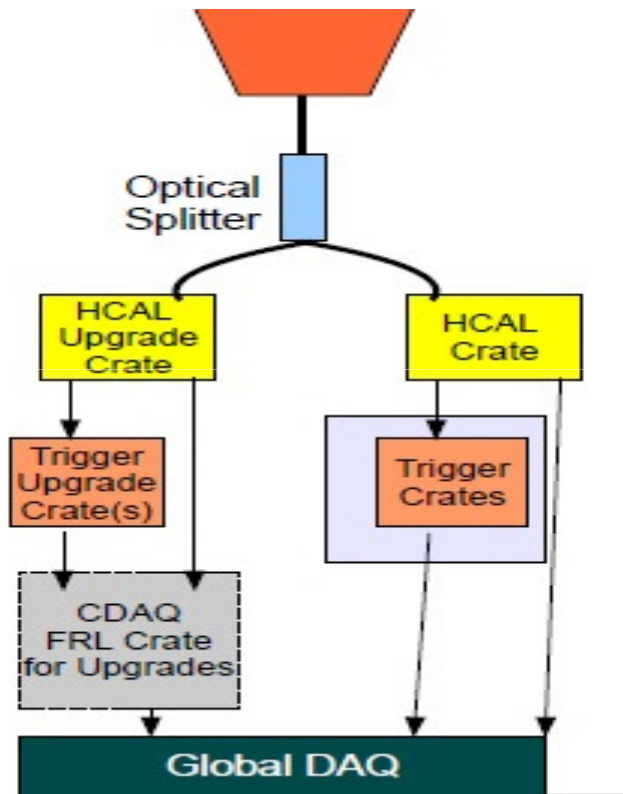
- A µTCA crate (Vadatech) has been installed at P5.

- It is operating for the HB,HE and HF in parallel with the existing VME electronics using Optical splitter.

- It reduces the optical power to a receiver by 5 to 7dB).

- A portion of 40 degree sector of HCAL was split up.

Current status of uTCA crate at P5

µTCA Vadatech Crate at SINP

µTCA Mini Crate at SINP

At P5:
- Right now 6 cards are working fine
- 36 channels information goes to one AMC Card
- We are monitoring the card performance regularly
(Detailed information in Pooja's talk)
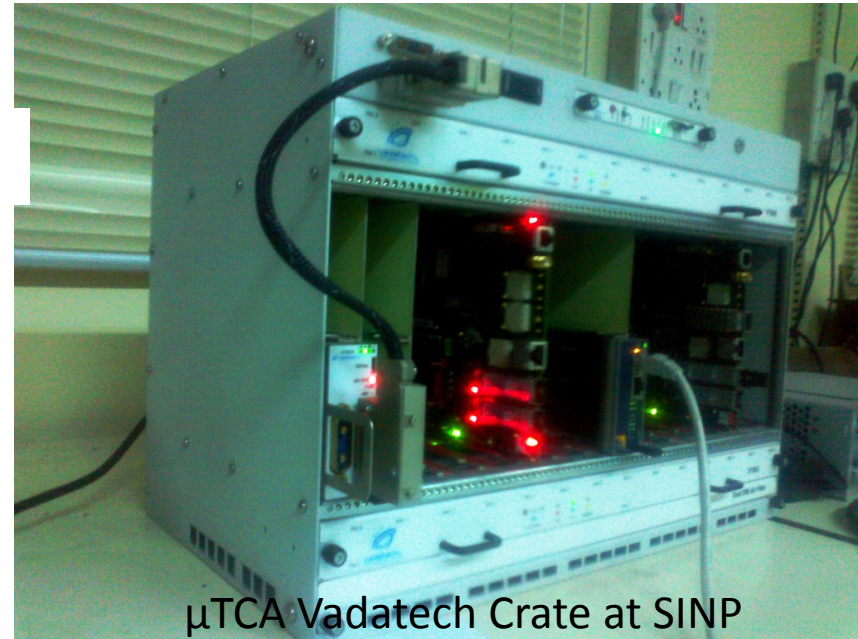
Future Plan

- The database structure will be modified. More detailed information will be put (starting from the η,φ details of a wedge from which the read-out fiber is coming out) as per suggestion by Umesh. All test information will have to be included in the database as well.

- In all AMCs there will be 2 FPGA's .

- MMC will be placed vertically for proper contact and less usage of space.

- The trigger part has to be included.

- Most of the AMC cards (for HF,HB,HE)will be fabricated and tested by SINP.

Thanku for Listening!!