#### **Data Concentrator**

Preparations and plans for the Vienna test in June and preliminary ROI extrapolation results

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June 15th, 2013



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# AMC v2



- Board from Beijing received in May 2013
- JTAG control ok
- FPGA flashing ok
- Four SFP 1.5 Gbit/s ok

- Gbit Ethernet ok
- Backplane testing
- DDR2 Memory in progress
- PowerPC Core not tested

# Finesse Transmitter Board (FTB)



- Received from Cracow in May 2013
- JTAG control ok

- FPGA flashing ok
- Two SFP 1.3 Gbit/s ok

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3 ROI Central Point Extrapolation with Hough Transformation

4 ROI Central Point Extrapolation with Genfit (Stephan Duell)

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#### Testsetup in Vienna

Digital SVD and DATCON readout test from 26 to 28 of June 2013



### Trigger Path

 Trigger Source: Agilent pulse generator connected to FTB over FADC



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#### Data Path

 FADC sends 15 Mbit event data (stored in block mem) to FTB over LVDS



#### Data Path

 FTB transfers data over two optical links to DATCON and COPPER with clock provided by the FTSW



#### Data Path

DATCON decodes, temporaly stores and sends the data to a readout PC for crosscheck



# **Basic Protocol for FTB-DATCON Connection**



# FADC protocol: Zero suppressed + hit time finding



- APV# [0..47]: APV identification
- Sp# [0..127]: Strip identification
- N [0..1]: Next sample:  $0 \rightarrow$  found hit time
  - $1 \rightarrow six$  sample mode
- Hit time mode: Peak sample (Peak [0..5]) + Time and Quality (T&Q [0..255]) + Peak sample (Data [0..255])
- Sample mode: Six consecutive samples D#0 .. D#5 [0..255]

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#### 3 ROI Central Point Extrapolation with Hough Transformation

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# Simulation Setup

- basf2 simulation with full detector geometry, no background, uniform distribution of phi and theta (limited between 50 and 120 deg)
- Generating  $e^+$ ,  $e^-$  with momentum from 0.1 to 3 GeV
- Tracking: Hough transformation with 8 iterations in (x,y) and (y,z)
- Extrapolation to PXD ladder with angle/track radius lookup table New
- Precise hit-finding by track extrapolation over sampling and point of closest approach <sup>New</sup>

# Visualization



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# Visualization



# Visualization



# Performance of ROI size

- Table shows difference between real and extrapolated hit
- 10 Events for each momentum, taken worst value
- Layer 1 pixel pitch = 50x60 um ; Layer 2 pixel pitch = 50x85 um

Layer 1				
p [GeV]	∆x [px]	∆z [px]		
3	0.65	0.88		
1	0.51	0.43		
0.6	5.41	0.88		
0.3	7.72	0.43		
0.1	29.28	17.29		

Layer 2				
p [GeV]	∆x [px]	∆z [px]		
3	1.11	0.96		
1	0.76	0.47		
0.6	7.51	0.98		
0.3	10.95	0.42		
0.1	42.49	17.84		

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3 ROI Central Point Extrapolation with Hough Transformation



Image: A matrix and a matrix

# Genfit Results: Layer 1

- Tracking with the basf2 genfit module
- Track extrapolation and hit point estimation over genfit with GFRectFinitePlane(), GFDetPlane() and getPosMomCov()

Layer 1				
p [MeV]	∆ <i>x</i> [px]	Δ <i>z</i> [px]		
2000	22	22		
1000	20	21		
500	25	21		
300	26	22		
200	40	24		
150	43	32		
100	68	52		
80	84	70		

Layer 2				
p [MeV]	∆ <i>x</i> [px]	Δ <i>z</i> [px]		
2000	19	23		
1000	20	23		
500	21	22		
300	23	23		
200	24	22		
150	27	24		
100	39	40		
80	55	61		

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# **Genfit ROI Performance**



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## Hough Transformation ROI Performance



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#### Thank you for your attention!

#### Backup

#### Internal Protocol



- Type: 2 Bit
  - 00: Command (CMD)
  - 01: User Data (DATA)
- Flags: 14 Bit
  - (0000)<sub>16</sub>: Normal operation
  - (0001)<sub>16</sub>: Test the connection, waiting for reply (only command)
  - (0002)<sub>16</sub>: Test the connection, reply (only command)
  - (1XXX)<sub>16</sub>: Error, kind of error indicated by XXX

# Real Topology Layout



- 3 carrier boards with 4 AMCs
  - $\rightarrow$  4:1 / 3:1 Multiplexer in each AMC card
  - → Use one SFP+ transceiver for inter-carrier board transmission
  - → AMC card interconnection over high-speed RocketIOs
- 1 AMC as data collector
  - → 3:1 Multiplexer with track reconstruction algorithm
  - → Ethernet connection for transmission of tracks to ATCA

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# **Testbeam Simulation Setup**



- Set up two layers with one PXD half ladder each.
- And four layers of the SVD in the suggested distance as in the final design
- Run simulation with electrons with energies between 0.5 and 2 GeV, 1 T magnet field

### **Testbeam Visualization**



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# **Testbeam Visualization**



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