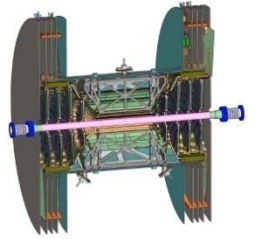


# DAQ for FVTX detector Implementation

Mark Prokop  
Los Alamos National Laboratory

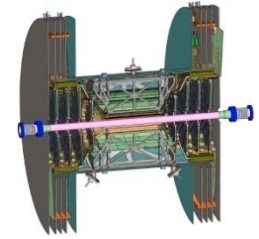


## Talk Outline

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- Overall Readout System
- ROC Pre-Production Prototype
- FEM Pre-Production Prototype
- Risk Factors
- Summary

# Technical Challenges for Readout



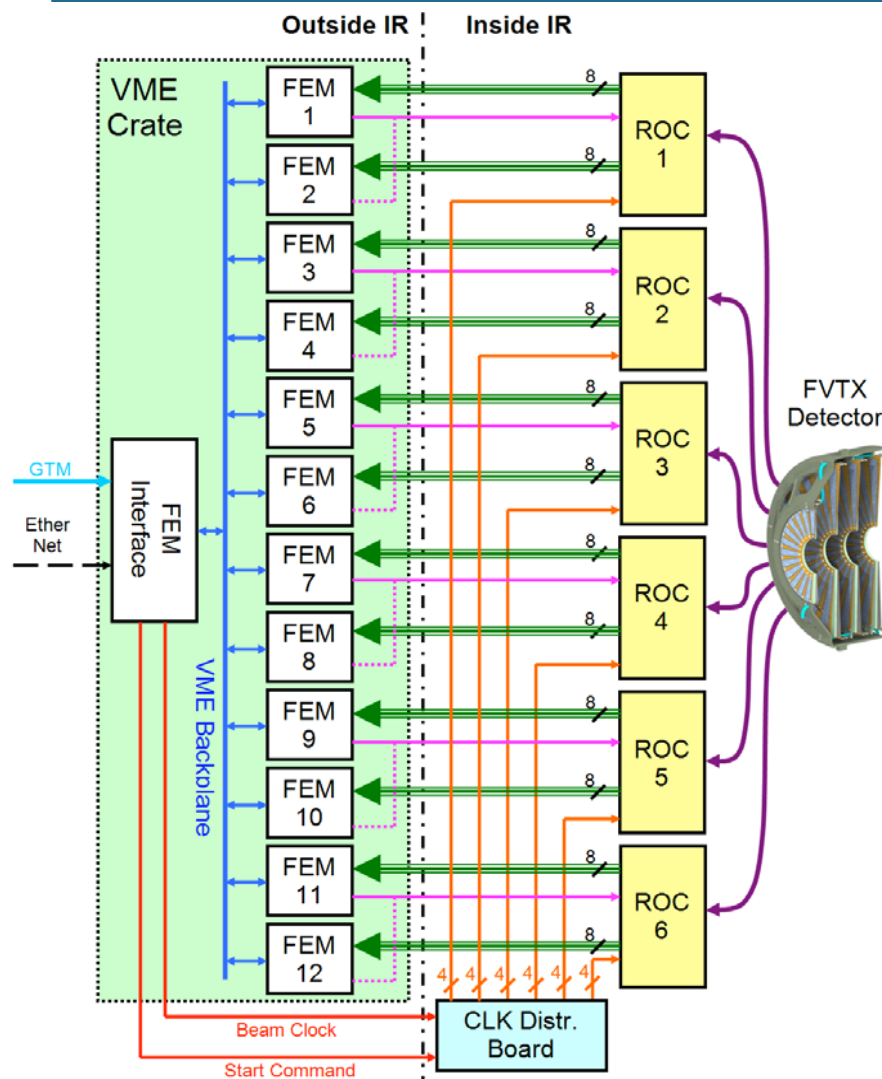
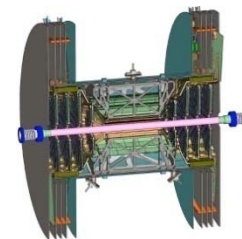
- Challenges

- Radiation environment around the detector
  - 10 year Total Integrated Dose - <200 kRad
  - Acute Radiation Effects on FPGA configuration SRAM memory
- Data Bandwidth
  - 3.38 Terabits/sec
- Number of Data I/O Lines
  - ~17k LVDS Pairs

- Solutions

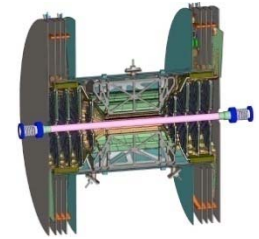
- Use Radiation Tolerant FPGAs close to the detector
  - ACTEL FLASH based FPGA
- IR Data Compression Circuitry
  - Sync word removal
- FO Data Transport to FEM
  - 16 - 2.5 Gigabit/sec FO data links

# Overall Readout Strategy

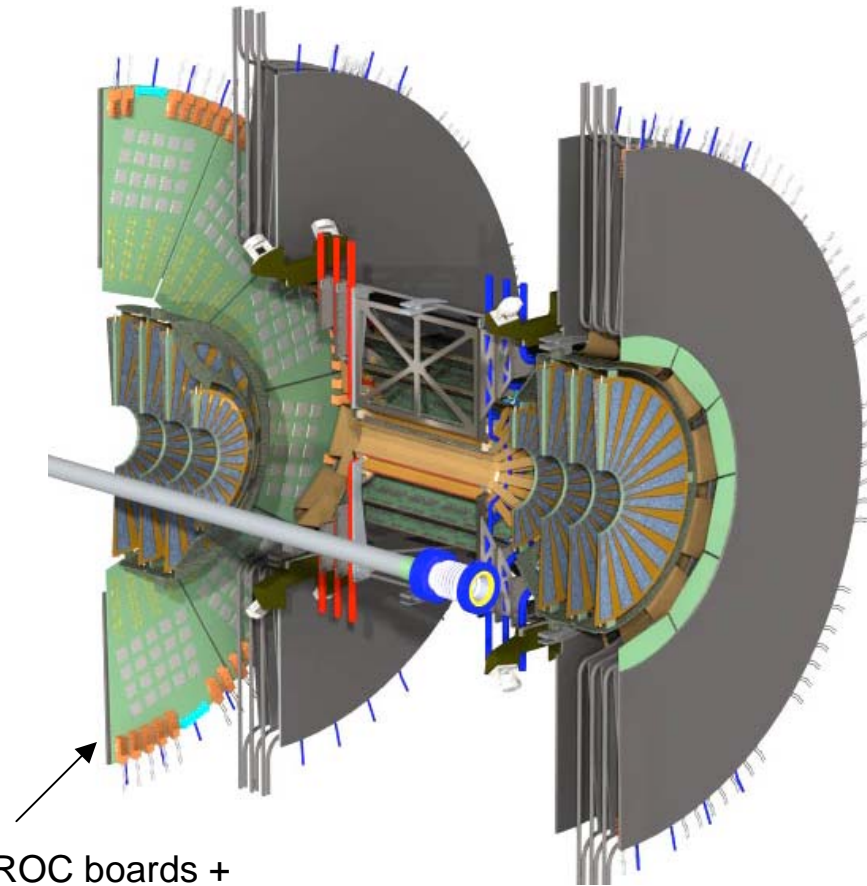


- $\frac{1}{2}$  of each detector arm is read out independently
- 6 ROC cards collect and compress the data from the detector
- Each ROC card sends fiber output to two FEM boards in the Counting House
- Slow Control fiber sends control data stream up/down the FEM $\leftrightarrow$ ROC Slow Controls link
- Clock Distribution Board distributes Beam Clock and Start signals to individual ROC boards (the signals are sent over dedicated optical fibers)

# DAQ

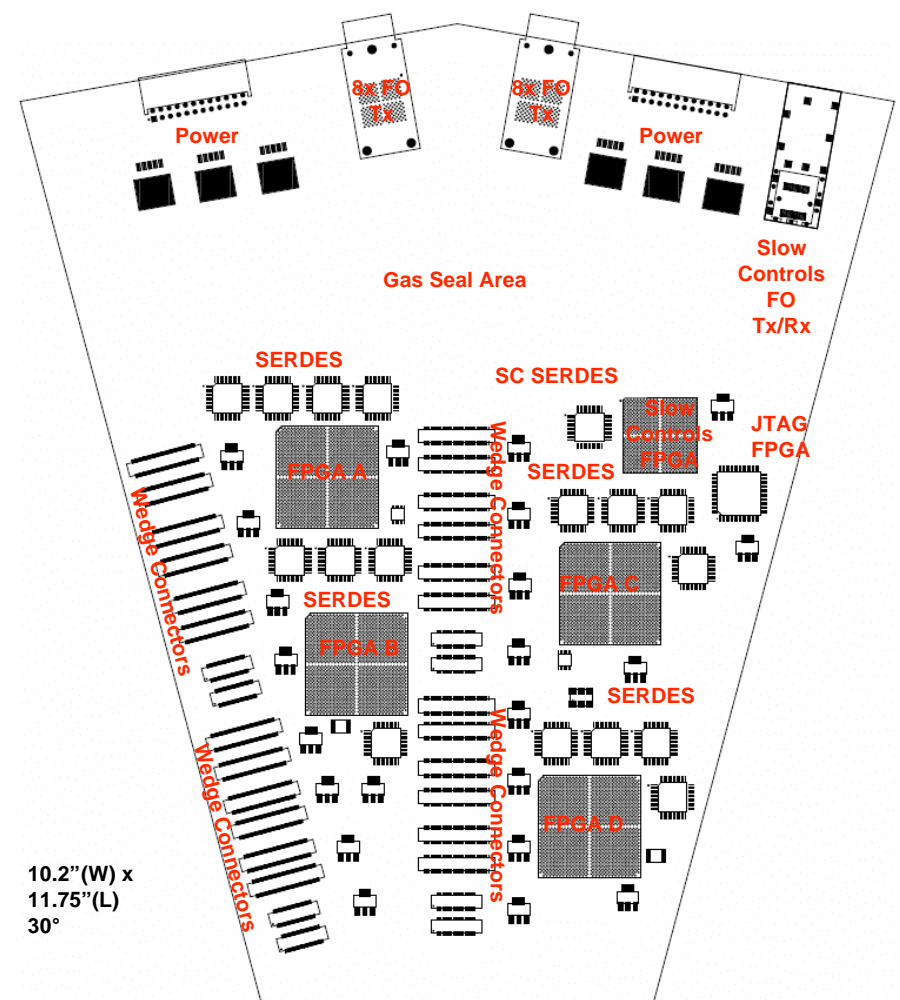
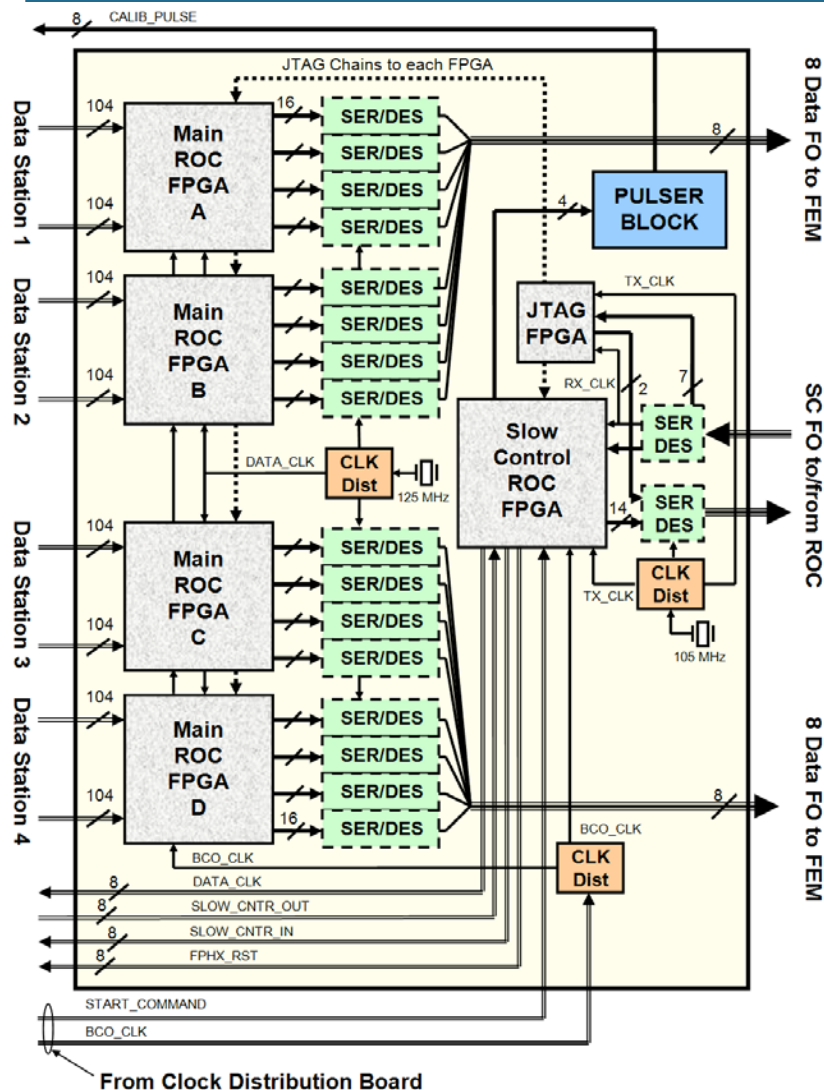
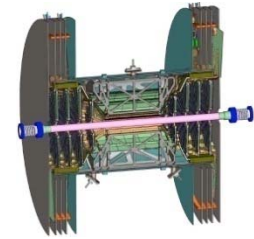


- ROC board layout started
- Clock Distribution Board layout started
- Components, cost, power consumption estimated
- Electronics supply voltages regulated on ROC
- Voltages Required:
  - 3.3V: FO Tx/Rx
  - 2.5V: SERDES, ROC I/O, Wedge
  - 1.5V: FPGA Core
- Total power per ROC board  
~ 20 W board + 18 W for V regulators  
= 38 W
- Total Power per 1/2 Arm = 228 W
- Total Power per Arm = 456 W
- Total Power for Detector = 912 W



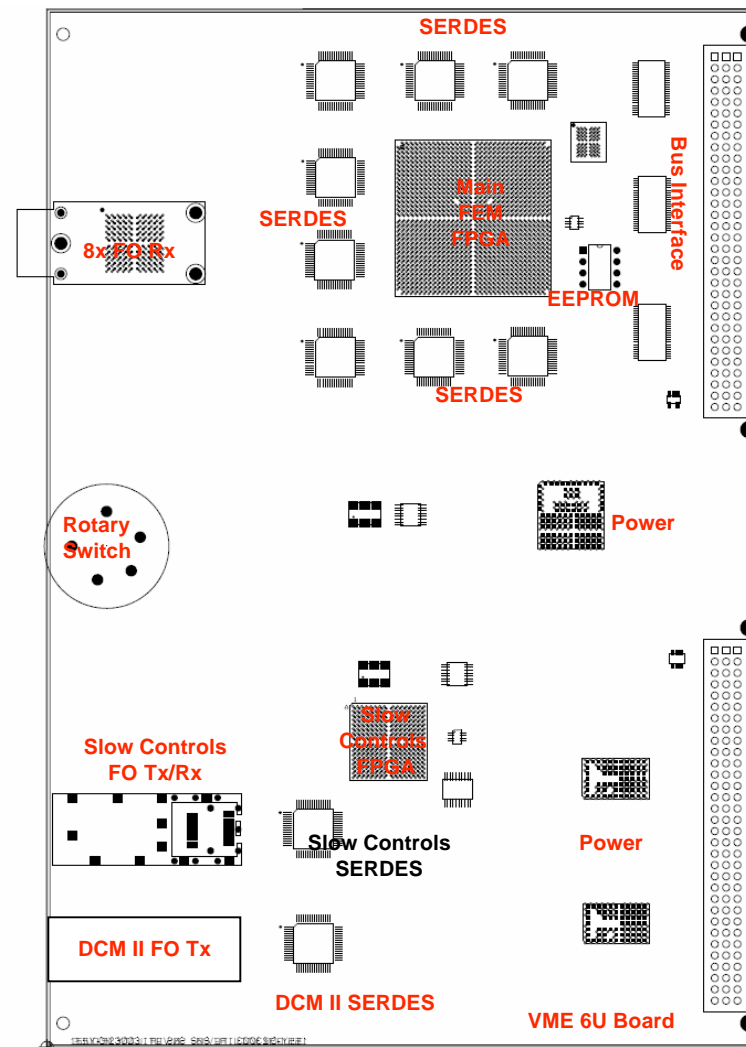
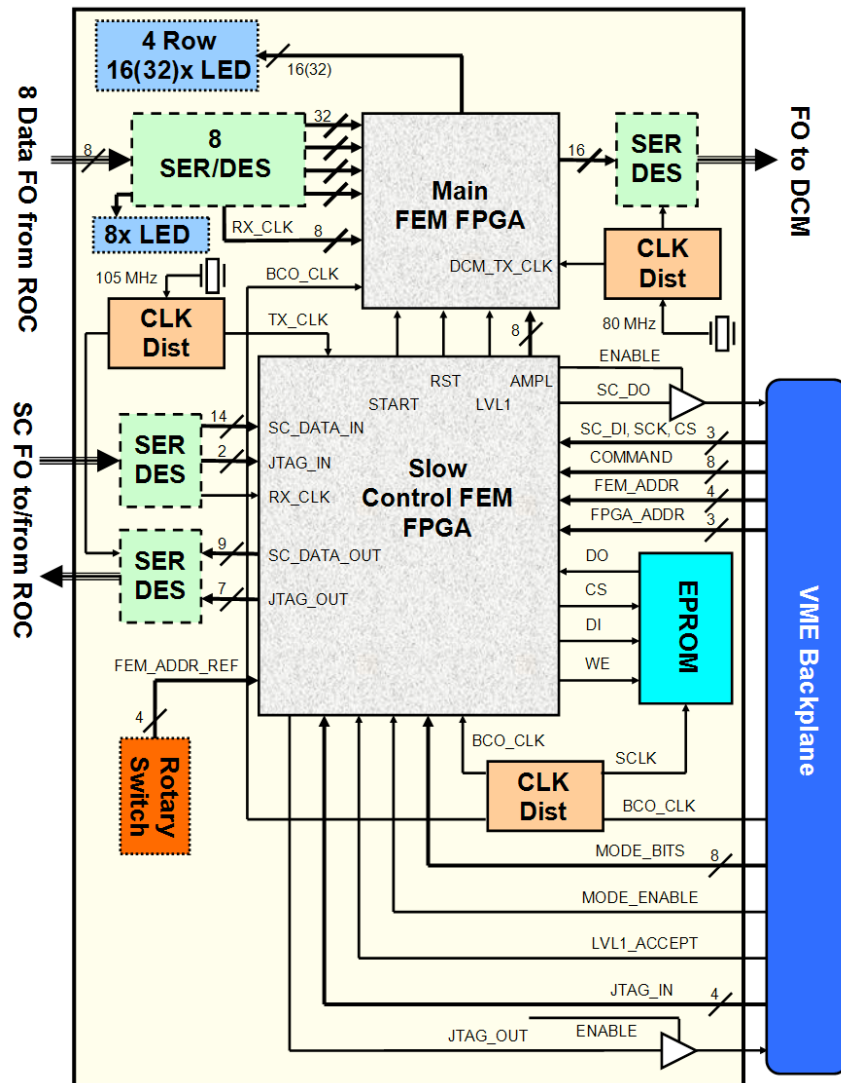
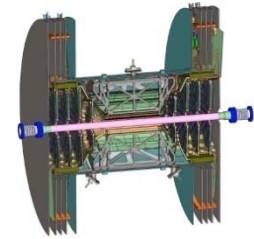
12 ROC boards +  
2 Clock Distribution  
boards in a "big  
wheel"

# ROC Board - WBS 1.5.2



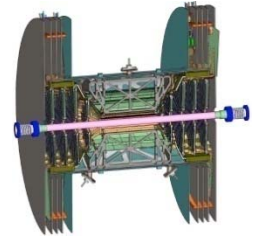


# FEM Board – WBS 1.5.3



# Risk Factors

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- FVTX DAQ design utilizes well tested, commercially available parts, nothing “state-of-the-art”.

***Risk – low***

- Design of the ROC requires a significant amount of digital signal tracing and excellent ECAD skills.

***Risk – moderate***

- FEM board is simple VME board with a few components. Moderate number of I/Os.

***Risk – low***

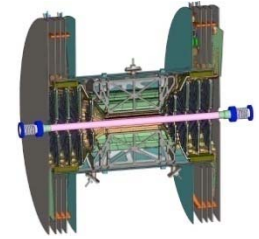
- **None of the WBS 1.5 items is on the critical path**



# Summary

## WBS 1.5 – Technical

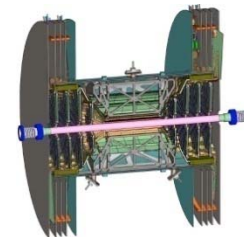
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- |                          |  |
|--------------------------|--|
| • Specification Document | TDR, DAQ overview document                             |
| • Prototype status       | ROC and FEM pre-production prototypes – started        |
| • Electronics Components | All available from distributor stock                   |
| • Production Quantities  | 24 + 4(spares) ROC boards<br>48 + 6(spares) FEM boards |
| • Heat load              | 38 W per ROC board<br>456 W per arm                    |
| • On-project Manpower    | 1 EE + 1 ECAD  |
| • Institutions Involved  | LANL   |
| • Infrastructure Defined | draft  |
| • QA procedures in place | Full QA plans for ROC and FEM                          |

# DAQ Implementation

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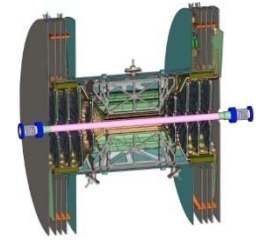


## Backup Slides

# Summary

## WBS 1.5 - Schedule

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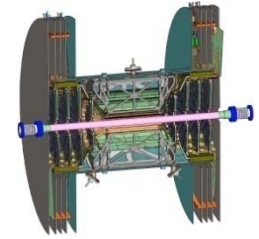


- PHENIX System Test: 1/09-3/09
- ROC Pre-prod Proto: 10/08-1/09
- FEM Pre-Prod Proto: 3/09-7/09
- ROC Production: 10/09-1/10
- FEM Production: 10/09-1/10

# Summary

## WBS 1.5 - Cost

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- ROC Pre-production: \$74k
- FEM Pre-production: \$85k
- ROC Production: \$390k
- FEM Production: \$350k
- Ancillary: \$116k
- Fibers and Lab Equipment: \$124k