The PHENIX
Multiplicity Vertex Detector

Jehanne Simon-Gillo
Los Alamos National Laboratory

PHENIX Collaboration Meeting
Santa Fe, NM
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Physics Goals

Design Criteria

MVDSchematic

Silicon Detector Design

Prototype electronics & Beamtest

Mechanical Progress

Prototyping

Milestones

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PHENIX

Physics Goals

* Charged particle multiplicity

* $d^2N/d\eta d\phi$

* Centrality trigger at LVL-1

* Collision vertex position (σ < 2mm)

Design Goals

* Large rapidity coverage ($\Delta\eta$ = 5)

* Good azimuthal coverage & granularity

* Minimum material in electron arm acceptance

* Minimize cost

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MVD Collaboration

J. Boissevain, D. Clark, R. Conway,
R. Cunningham, B. Jacak, J. Kapustinsky,
L. Marek, J. Simon-Gillo, J. Sullivan,
H. van Hecke, N. Xu
Los Alamos National Laboratory

E. Bosze, J. Chang, D. Jaffe, S.Y. Fung, R. Seto
U.C. Riverside

M. Allen, C. Britton, N. Ericson,
M. Simpson, R. Smith, J. Walker
Oak Ridge National Laboratory

Y. Takahashi
University of Alabama, Huntsville

Clamshell design - mounts to magnet pole faces
Inner and Outer barrels of silicon strip detectors
200um, 64cm long
Silicon pad endcaps +/- 35cm

Strip electronics at bottom
256 ch/ Si detector
Channel count = 34,816

"C" shaped detector assemblies
Support Structure - Rohacell foam
50μm kapton cables: Si to MCM

6 MCM per Air-cooling plenum section
Rohacell plenum
Power & Communication Bus exit base of plenum

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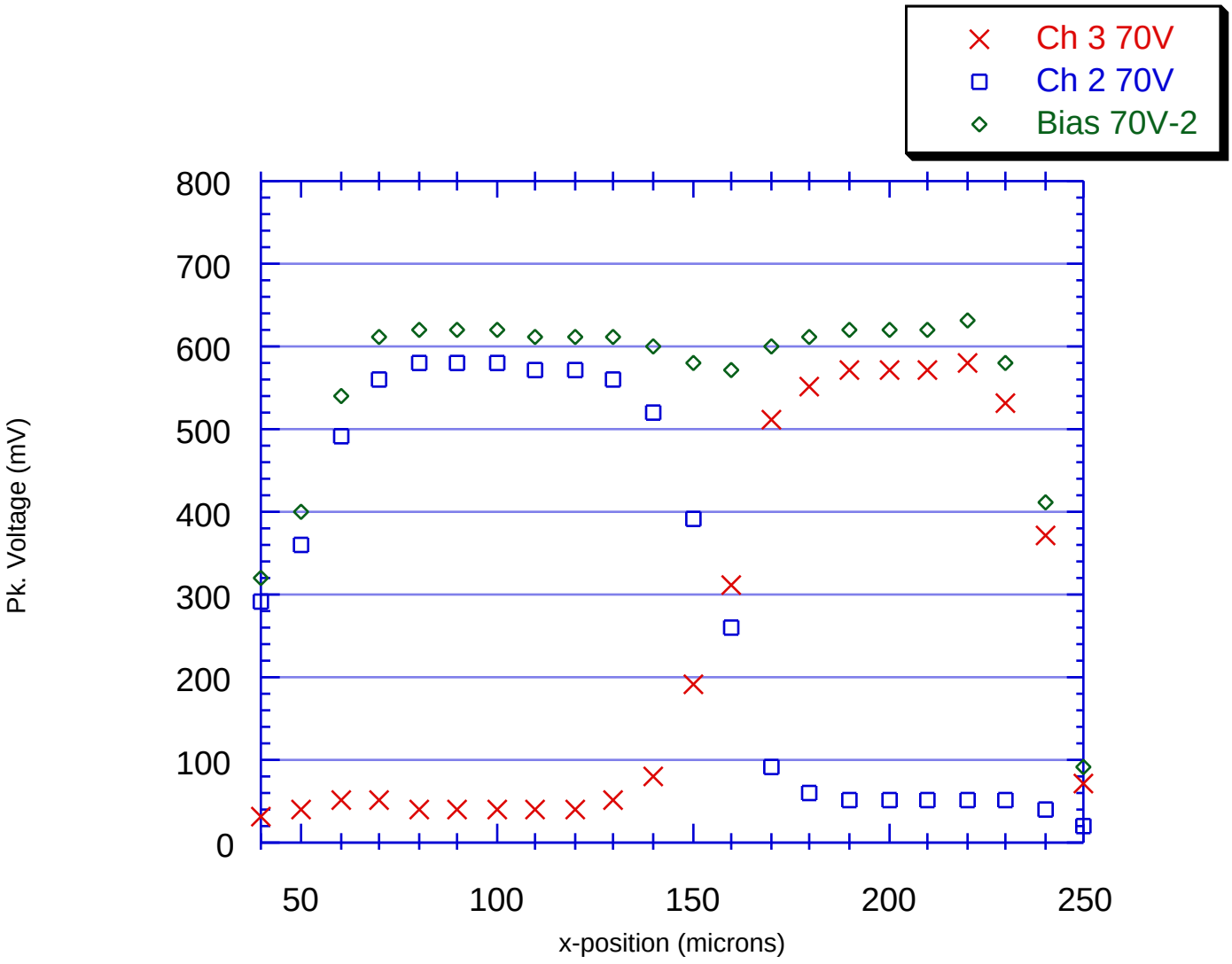
Silicon Strip Detector

* Designed & prototyped-MicronSemiconductor
  200µm pitch, 300µm thick
* Evaluated in lab- probe, laser station
* Tested in beam



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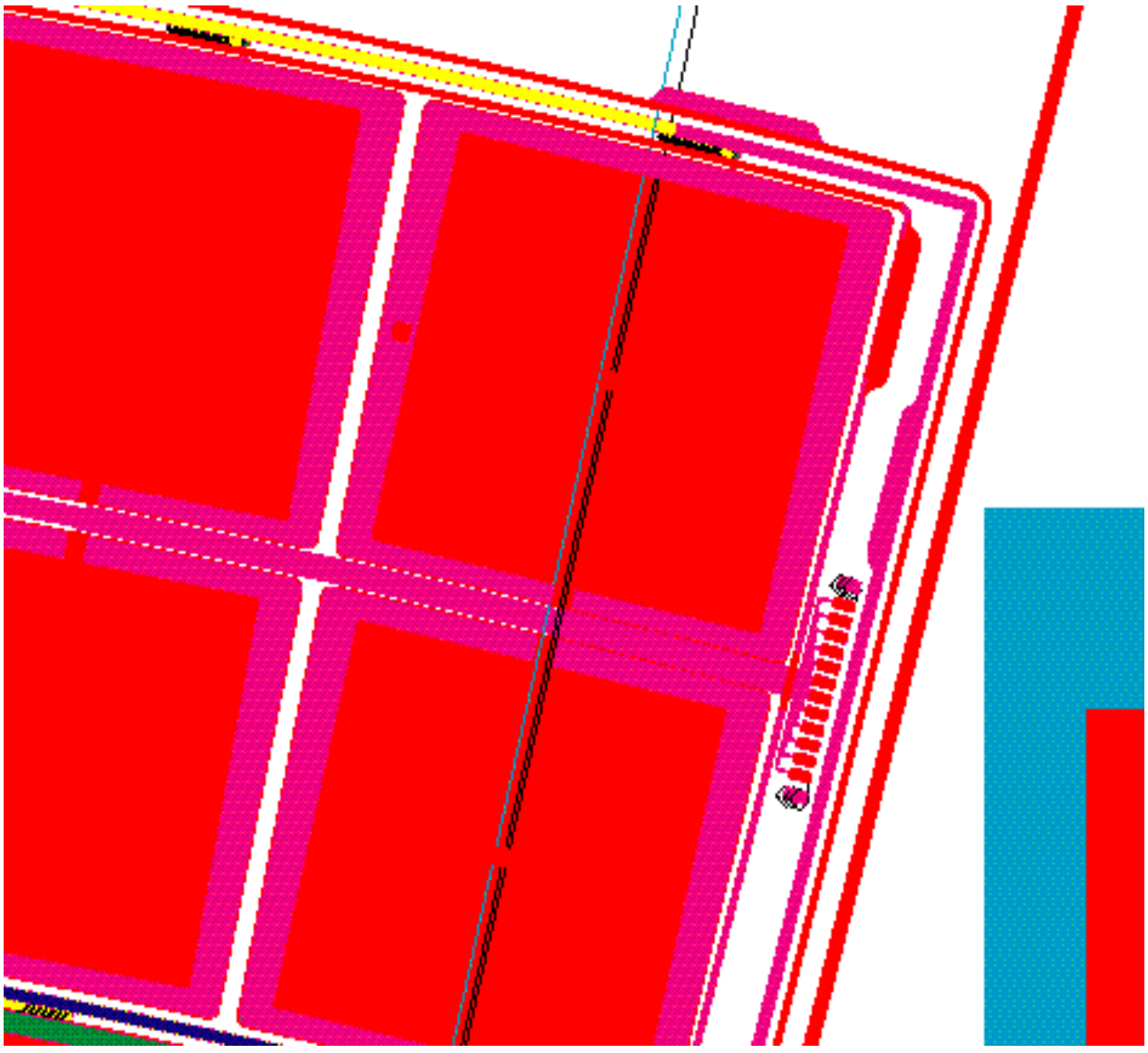
Single Metal Pad Detector



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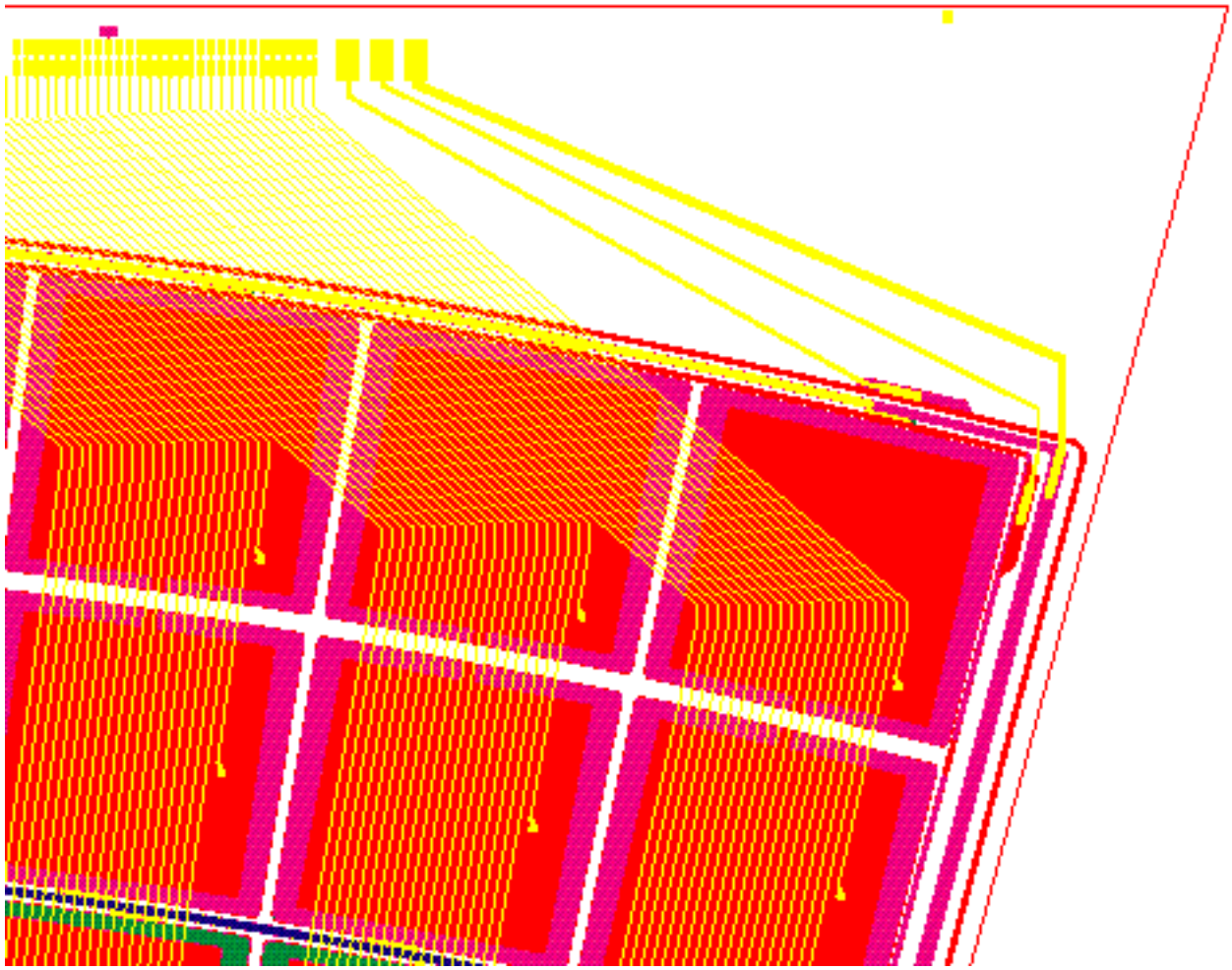
Double Metal Pad Detector



* Eliminates specialized kapton cable
* Reduces wirebonding
* Facilitates detector probing
* Facilitates assembly, handling
* Increases yield
* Sequential readout

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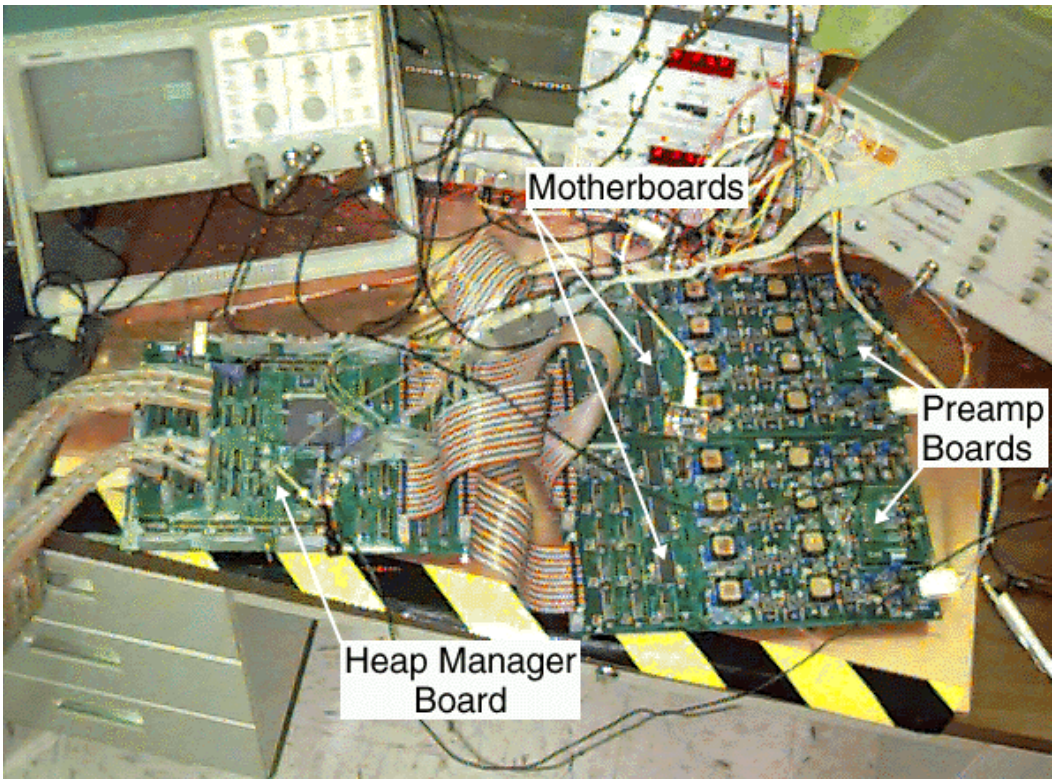
Front-end Electronics



Basic components:
8ch preamp, AMU, ADC,
Heap Manager (1/4 Phenix clock)

ADC - Nonlinearity of response - worsening of resolution in low range

3-Board set used in Beam test

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MCM Pre-Prototype Development

32 channel MCM
8 channel die
Preamp, AMU, ADC, FPGA

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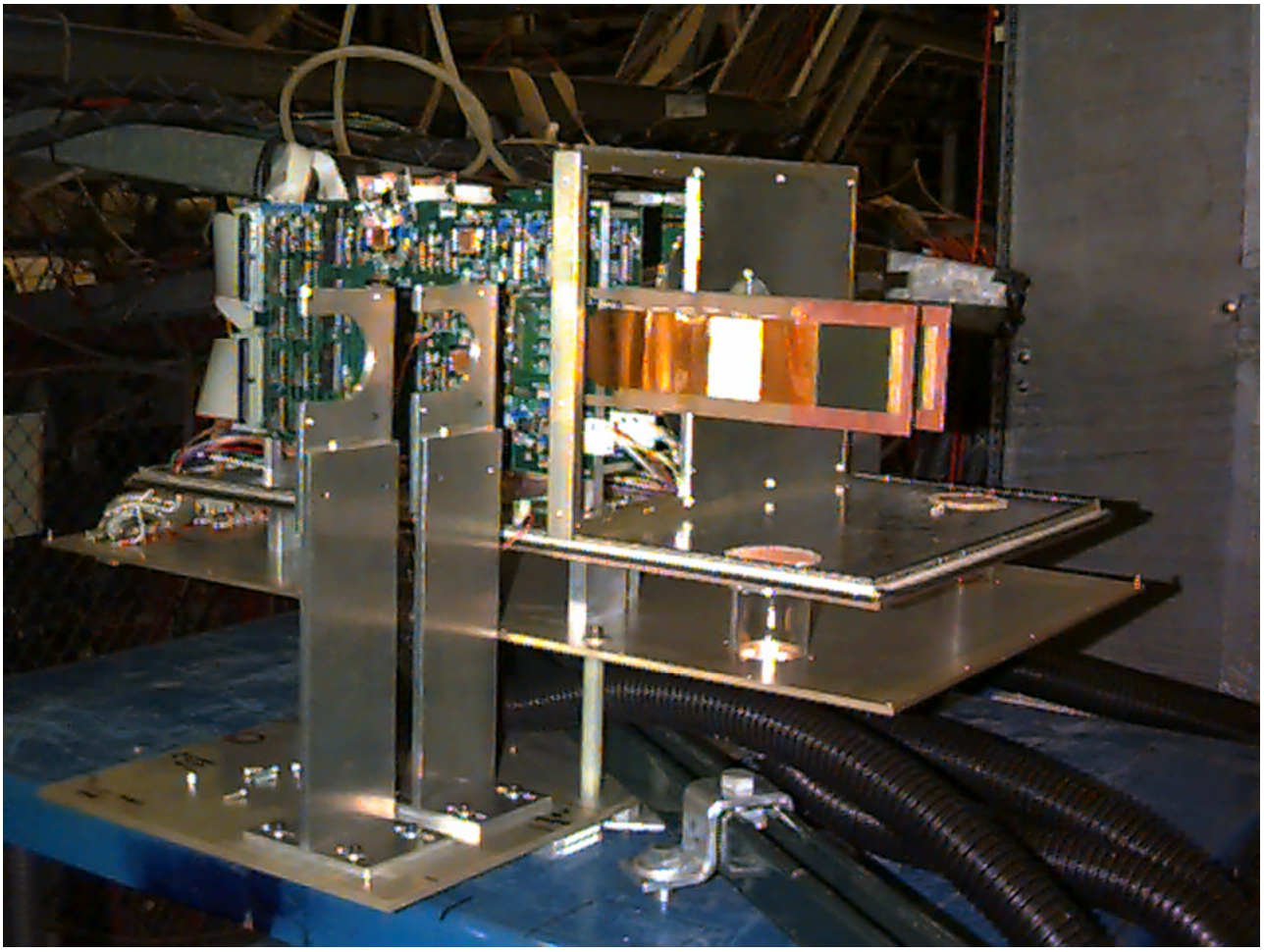
AGS Beam Test



Prototype electronics, DAQ
PrototypeSi strip detectors, kapton cables
Prototype RF enclosure

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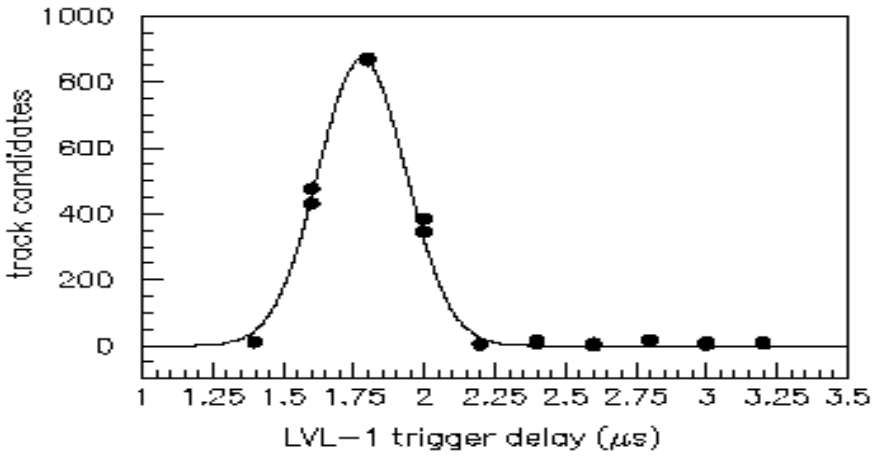
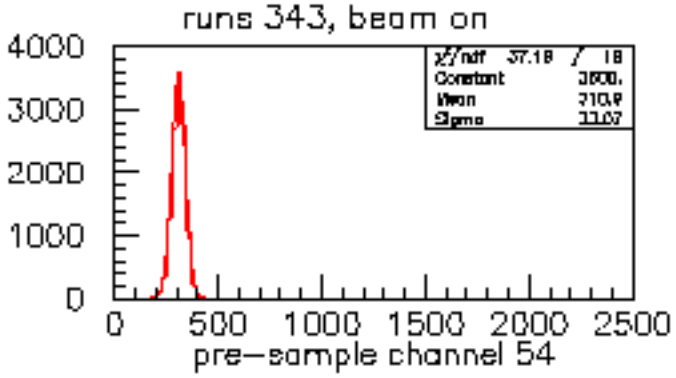
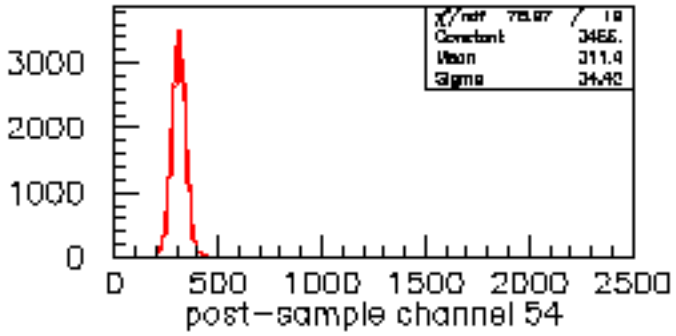
Beam Test Data



Beam Test Data



Presample:
ADC values before event
Includes high & low freq noise



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ADC values after event
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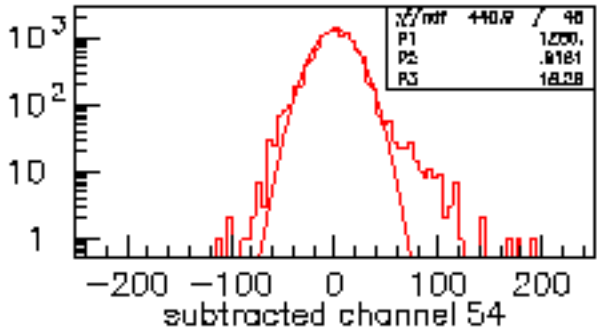
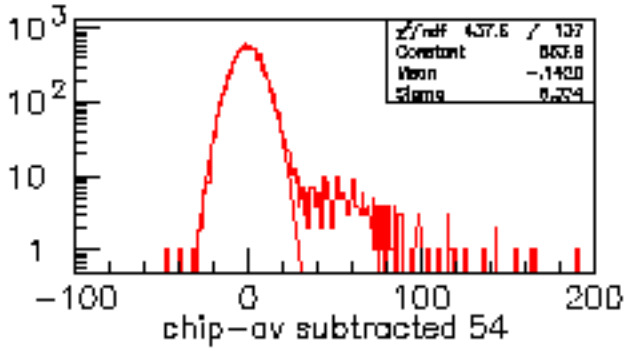


Post-pre:
Subtract ped and low freq noise
High freq noise remains



<Chip> subtraction:
Removes high freq noise
Remaining width due to ADC rresolution

Mechanical Progress

All mechanical components designed
(Pre Mechanical Design Review July 30)
Mounting, Truss, Detector supports, Enclosure, Cables, Motherboard, Connector ID, Cooling systems....

Engineering analysis - MCM Cooling, Detector Support Deflection, Foam Environmental

Truss Structure Deflection studies
Detector Support Deflection studies
Rohacell Cage Environmental
Rohacell Cage Mechanical Stability
Thermal and Electrical Studies of Enclosure
Enclosure formation and assembly procedure
MCM Air Cooling Studies
Air-induced Vibrational Studies
Motherboard water cooling system

Extensive prototyping

MCM Cooling System:

Air Cooling (10^{o}C min)
10mW/chan
2x safety margin

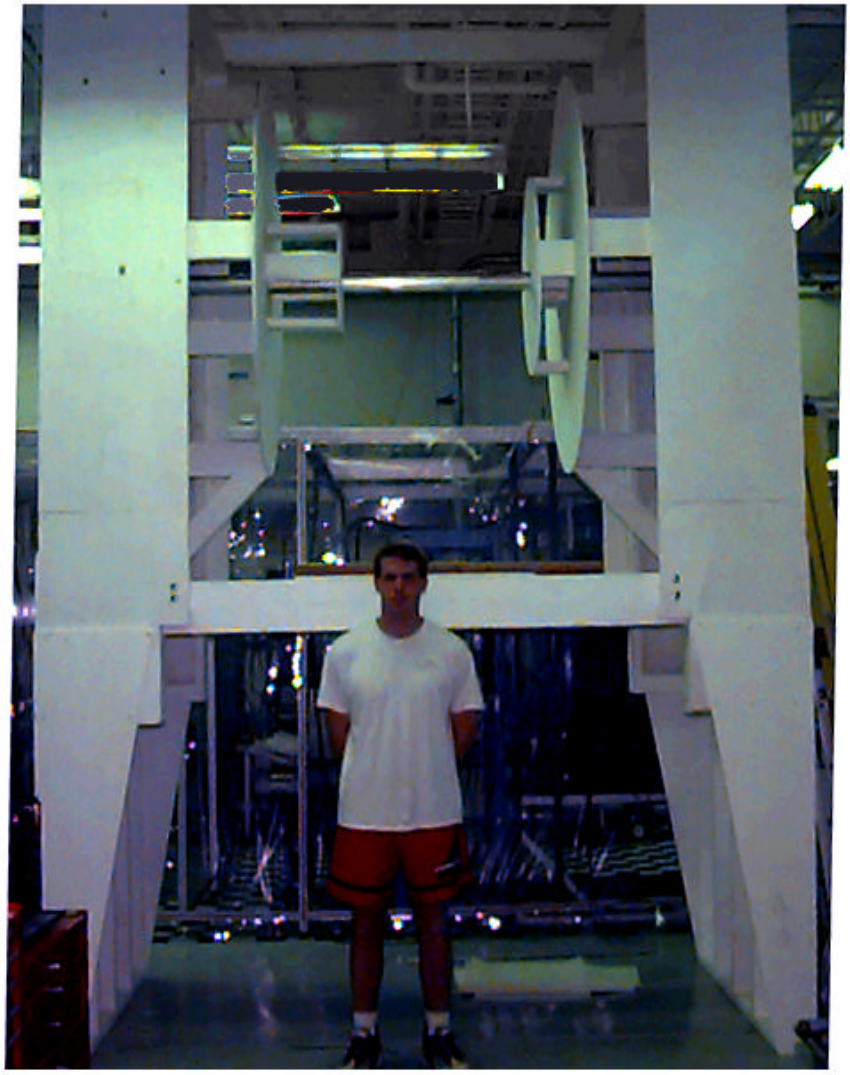
Motherboard Cooling System

Water : 10-25^{o}C

Sllicon Detector Cooling System

Air: 10-25^{o}C

Prototyping



Fullscale!
Represent all mechanical components
Mechanical studies
Assembly issues, jigs
Cables, connectors
Integration
Asembly procedure

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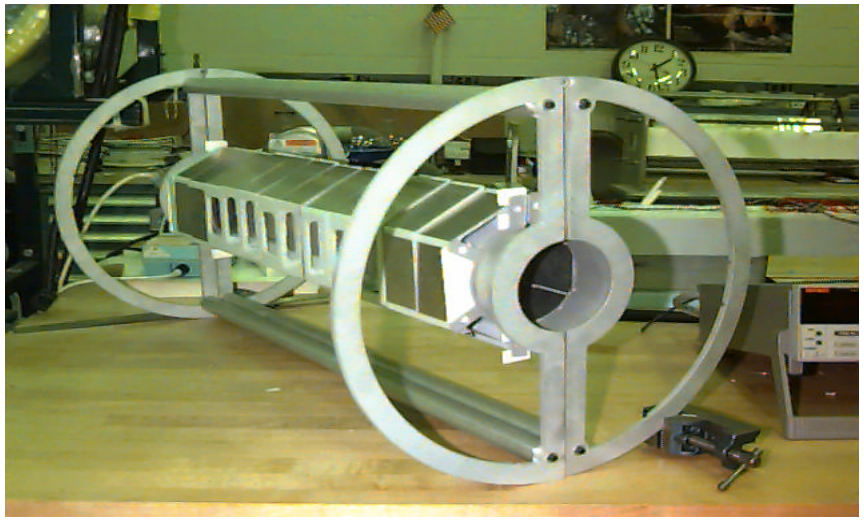

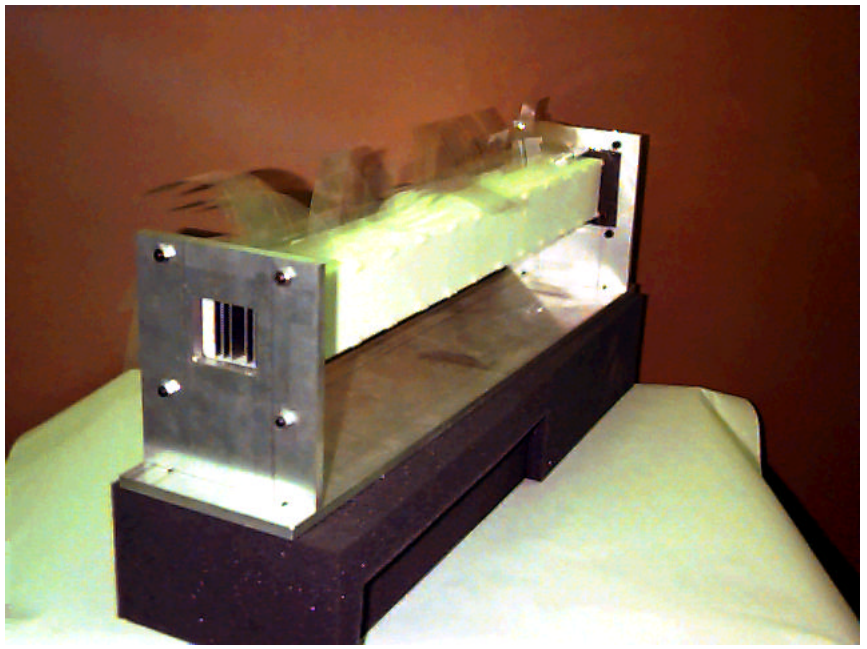

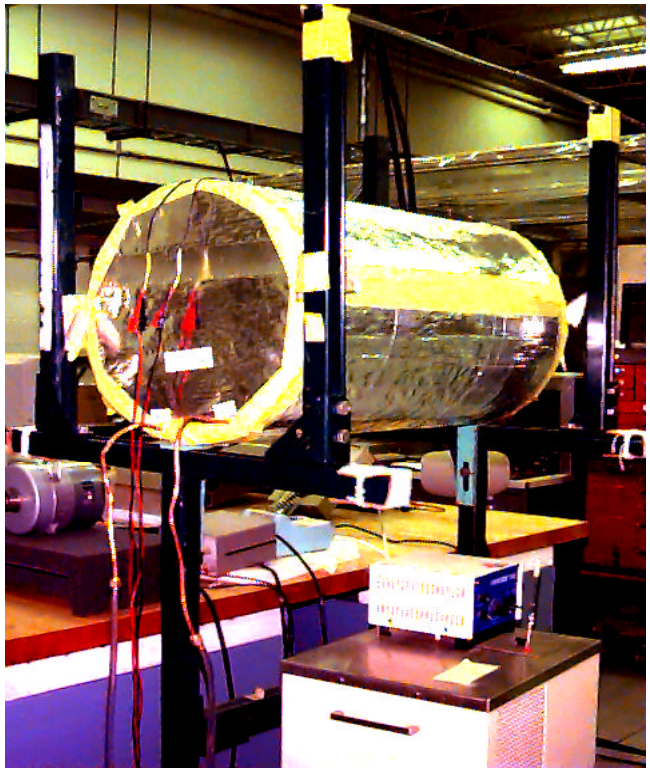

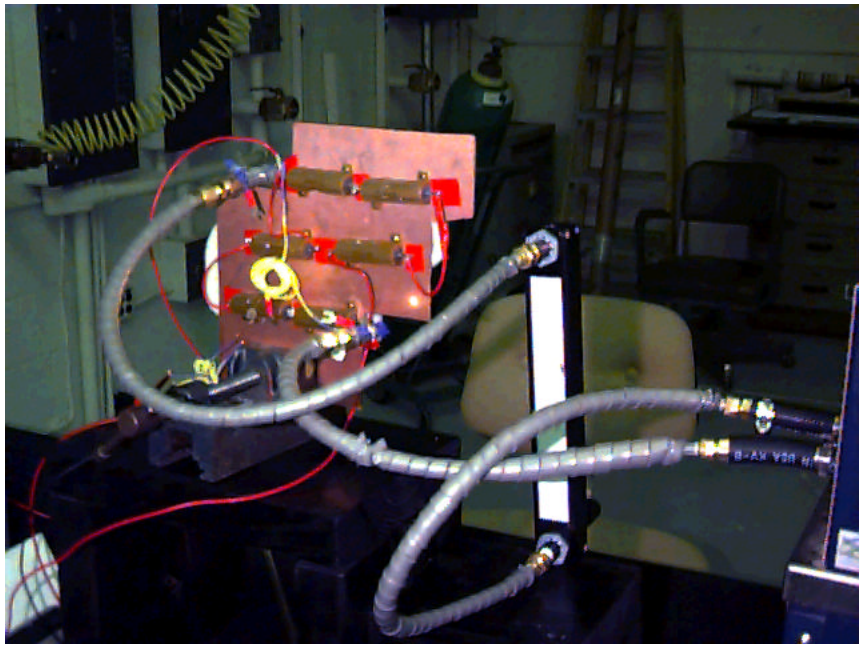

Milestones

Mechanical:

Vertex detector design complete	Mar-96
Pad detector design complete	May-96
MVD Chain Test	Apr-96
Mechanical design -prelim	Jul-96
Cooling design -prelim	Jul-96
All detectors received	Apr-97
Final Mech design review	Dec-96
Subassemblies complete	Mar-98
Assembly complete	Oct-98

Front-end Electronics:

Review TGV R2	Nov-95
Review AMU/ADC R1	Mar-96
FEE Prelim design review	Aug-96
Review AMU/ADC R2	Oct-96
Review TGV R3	Oct-96
Review Prot MCM w/vendor	Nov-96
MCM Design Complete	Jun-97
Chip Fab Complete	Jun-97
MCMs complete	Feb 98