

# Cosmics Test Stand

- From the Progress Report, Dec. 2003
- Purpose
- Scintillator option
- Status
- Work underway
- Areas that need HELP

# From the Progress Report, Dec. 2003

- We plan to conduct a test with a prototype detector to check this (background) calculation
- If the backgrounds from cosmic rays turn out to be more serious than above estimates indicate, a passive overburden could be added to the detector
- The neutron flux would be reduced a factor of 100 by a dirt or rock overburden of  $500 \text{ g/cm}^2$ , about 2 to 2.5 m
- Neutrons produced in the overburden will be accompanied by muons, which would be detected in the active shield

# Purpose

- How large is that test ?
- Run long enough to look for fake nu-e events
- Put a hardware system together
- Put a readout and trigger system together
- Put an analysis system together
- Same goals for Scintillator option ?

# How large is that Test?

- A 20 ton test is 1/ 2500 of the 50 kton detector.
- Assume you are going to row across the Atlantic ocean in a small boat. This test would be equivalent to rowing one mile for practice
- Assume you will climb Mount Everest. You practice by climbing one flight of stairs
- (Not terribly conservative ?)

# Fake Nu-e Events

- One example of a fake Nu-e Event:
- Cosmic ray at right angle to Nu beam
- Travels invisibly inside absorber
- Makes a DI event with secondaries that look like an electron
- Neutrons are another possible source

# Run long enough to look for fake nu-e events

- Match (mass x lifetime) of the real detector
  - ◆ Mass = 50 kton
  - ◆ Lifetime = 10 us every 2 sec
    - ★  $158 \text{ sec/yr} * 5 \text{ yr} = 800\text{s}$
  - ◆ For a 20 ton test must run about 15 days live.
- Possible, but hard!
- There are several factors increasing the run time (fiducial volume fraction; veto dead time; readout dead time)

# Put a hardware system together

- Make a mountain of wood
- Learn to operate RPC's
- Make a gas system
- Make a HV system
- Make a readout system into VME

# Put a readout and trigger system together

- Read out from VME into some computer
  - ◆ Triggered readout
  - ◆ Continuously live readout
- Triggers:
  - ◆ Scintillator trigger
    - ★ Large counters
    - ★ Shower vetos
    - ★ Integrate into readout
  - ◆ Self trigger
    - ★ How ?
- Needs someone to take it on if it is to happen

# Put an analysis system together

- Data unpacking
- Huge amounts of data
- Time sorting
- Fluff filtering / summary file
- Track finding
- Event finding
- Needs someone to take it on if it is to happen

# Run long enough to look for fake nu-e events

- Run for a month or two—maybe longer
- Develop analysis algorithm
  - ◆ Fast
  - ◆ Smart
- Analyze mountains of data
- Find nu-e like events
- Find ways to suppress fake ones (they are all fake)
- Needs someone to take it on if it is to happen

# Scintillator option –Purpose ?

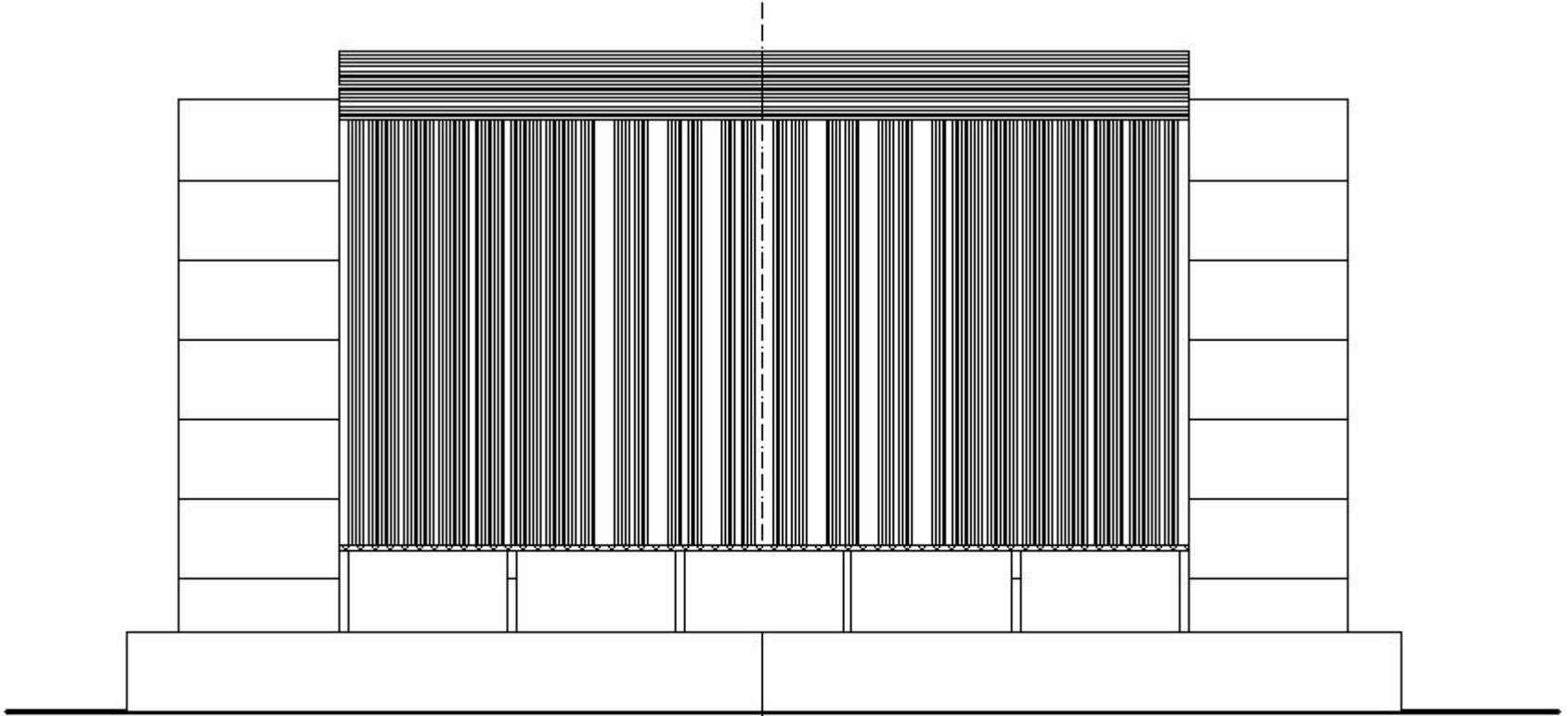
- Same as RPC Motivation
  - ◆ background
  - ◆ Reality check
- Need many planes to look for fake nu-e events
- Scintillator planes can be interleaved with RPC / absorbers at Lab F
- Comparing the identical events in both technologies could be revealing
- Needs someone to take it on if it is to happen

# Scintillator option

- MINOS Calibration calorimeter (CALDET) from CERN may be available
- 60 (?) planes of 1 m x 1m—just about right
- 64 anode PMT's may be available
- Choice of scintillator
  - ◆ CERN
  - ◆ Solid a la Minos
  - ◆ Liquid filled tubes

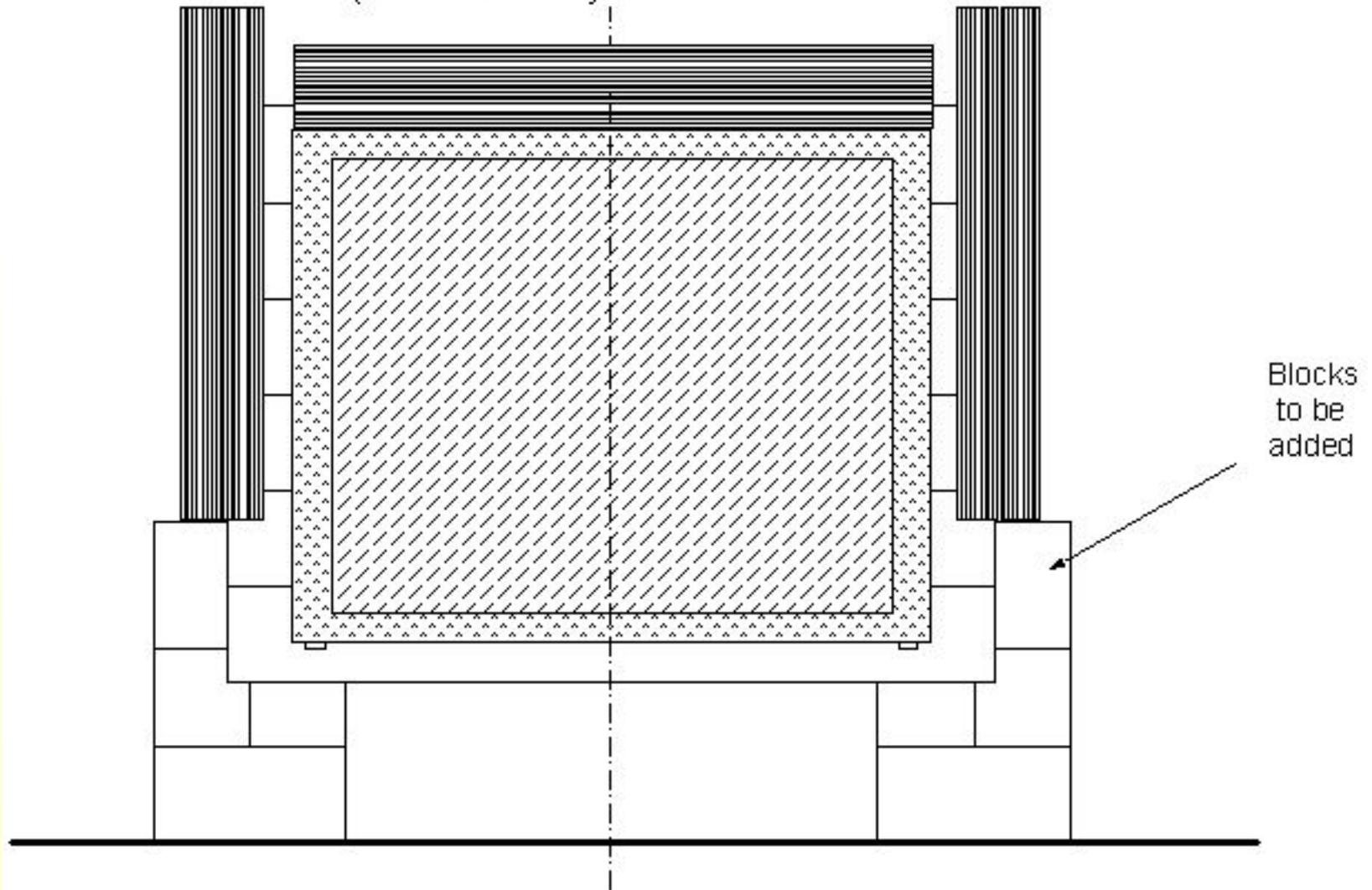
# What exists ?

20 vertical chamber modules  
Seven 4 " gaps for scintillator



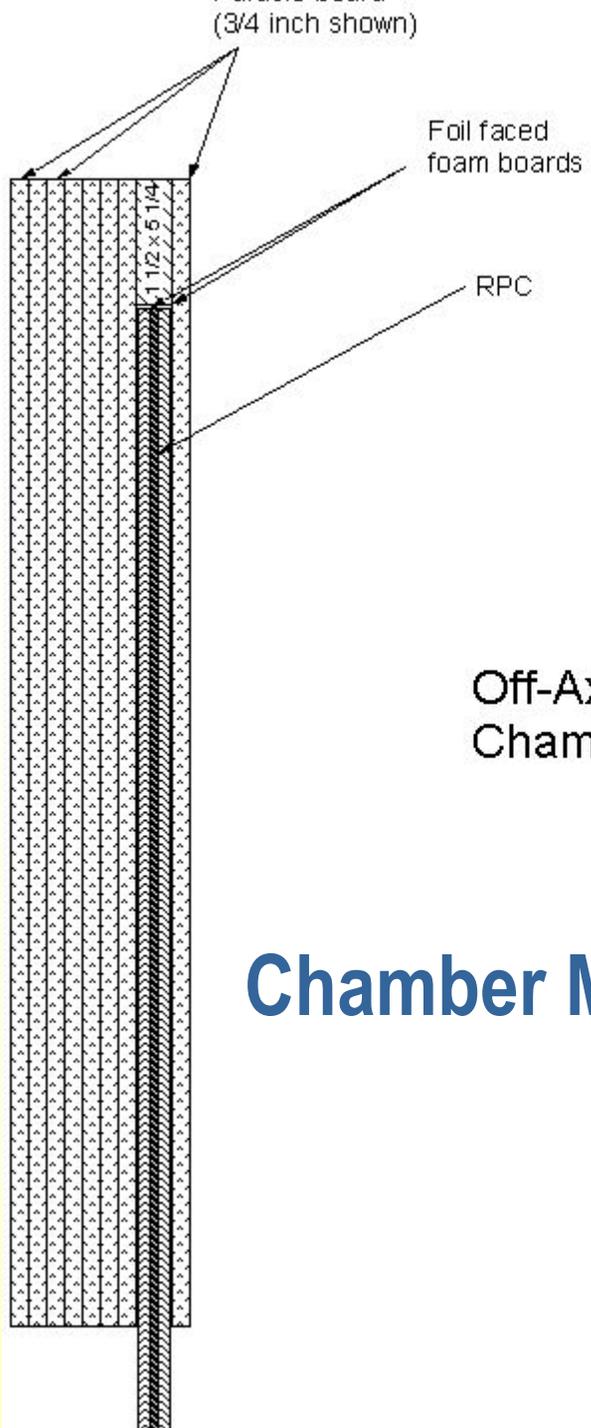
Off-Axis Cosmic Ray Test Stand  
Side View  
(Side vetos not shown)

2 Layers of Cosmic Shield Chambers  
(Do we need 3 layers ?)



Blocks  
to be  
added

Off-Axis Cosmic Ray Test Stand  
End View



Off-Axis Cosmic Ray Test Stand Chamber Module Detail

## Chamber Module Detail

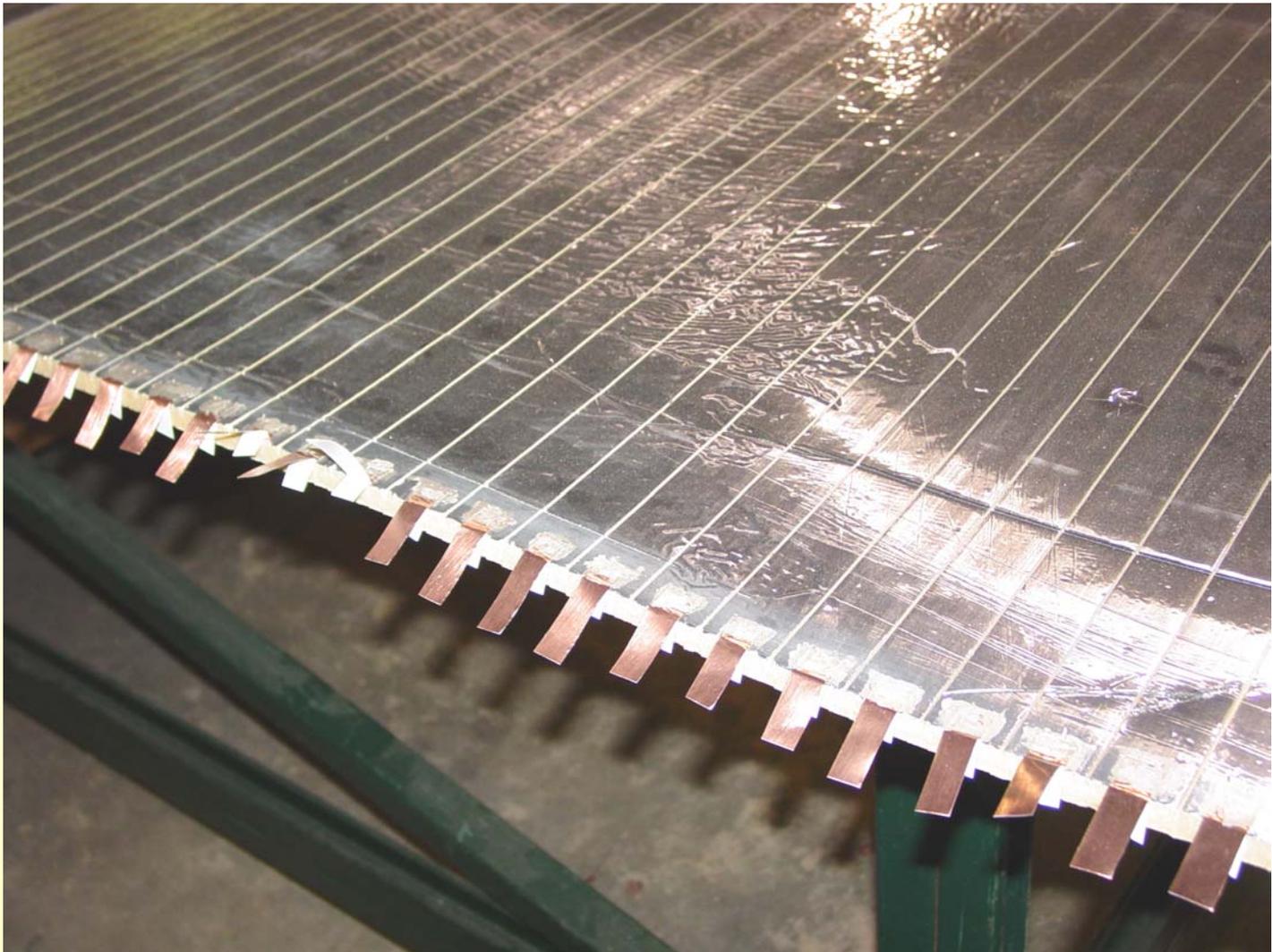
# Concrete Base



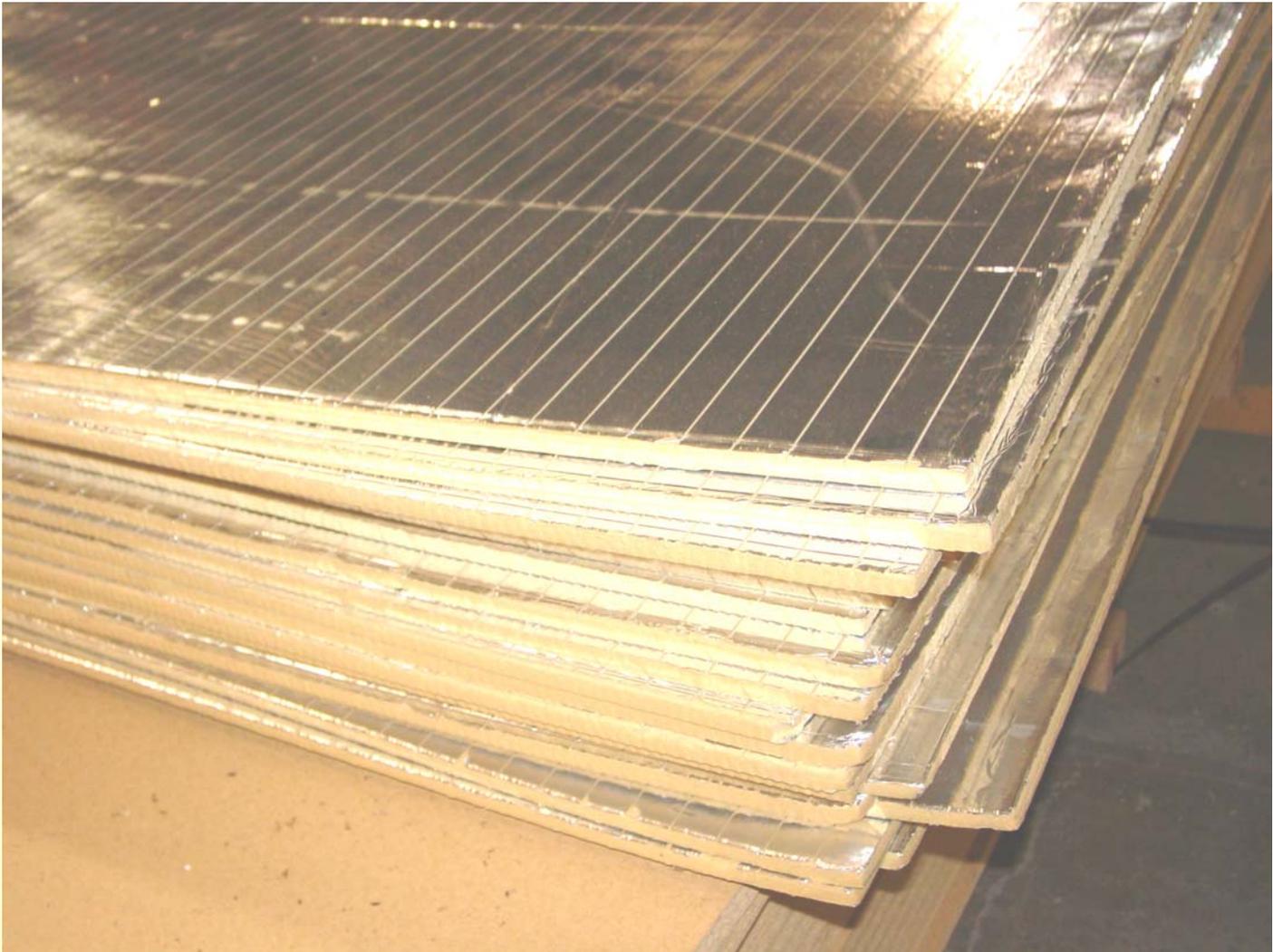
# Belle Chambers



## Readout foam board



## A whole bunch of foam boards



## A complete absorber stack



# Stacking Table



# Cockroft Walton HV supply and Readout Board

- We have the first crate and control unit in hand – great!
- The first readout Board is Imminent !

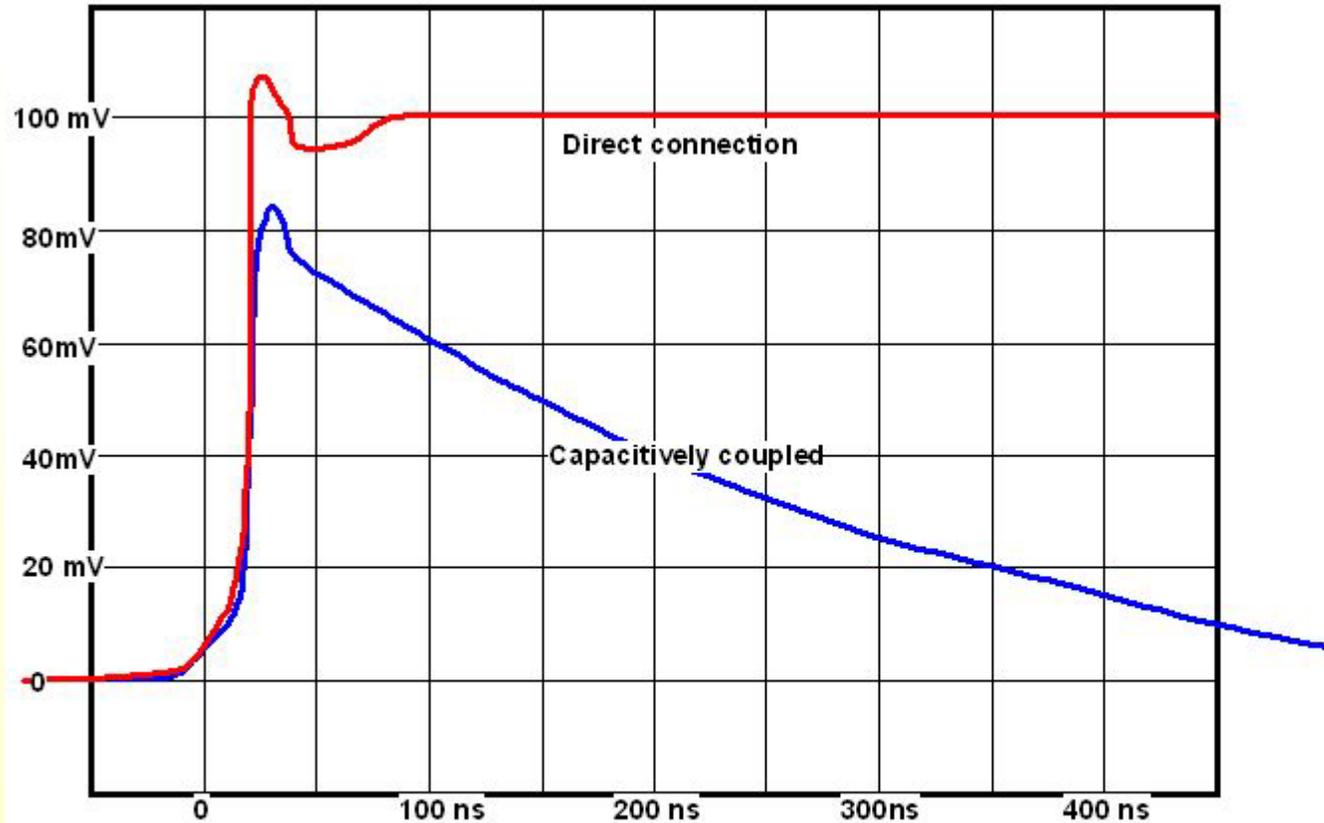
# Gas distribution rack



# 4-Gas Mixing System

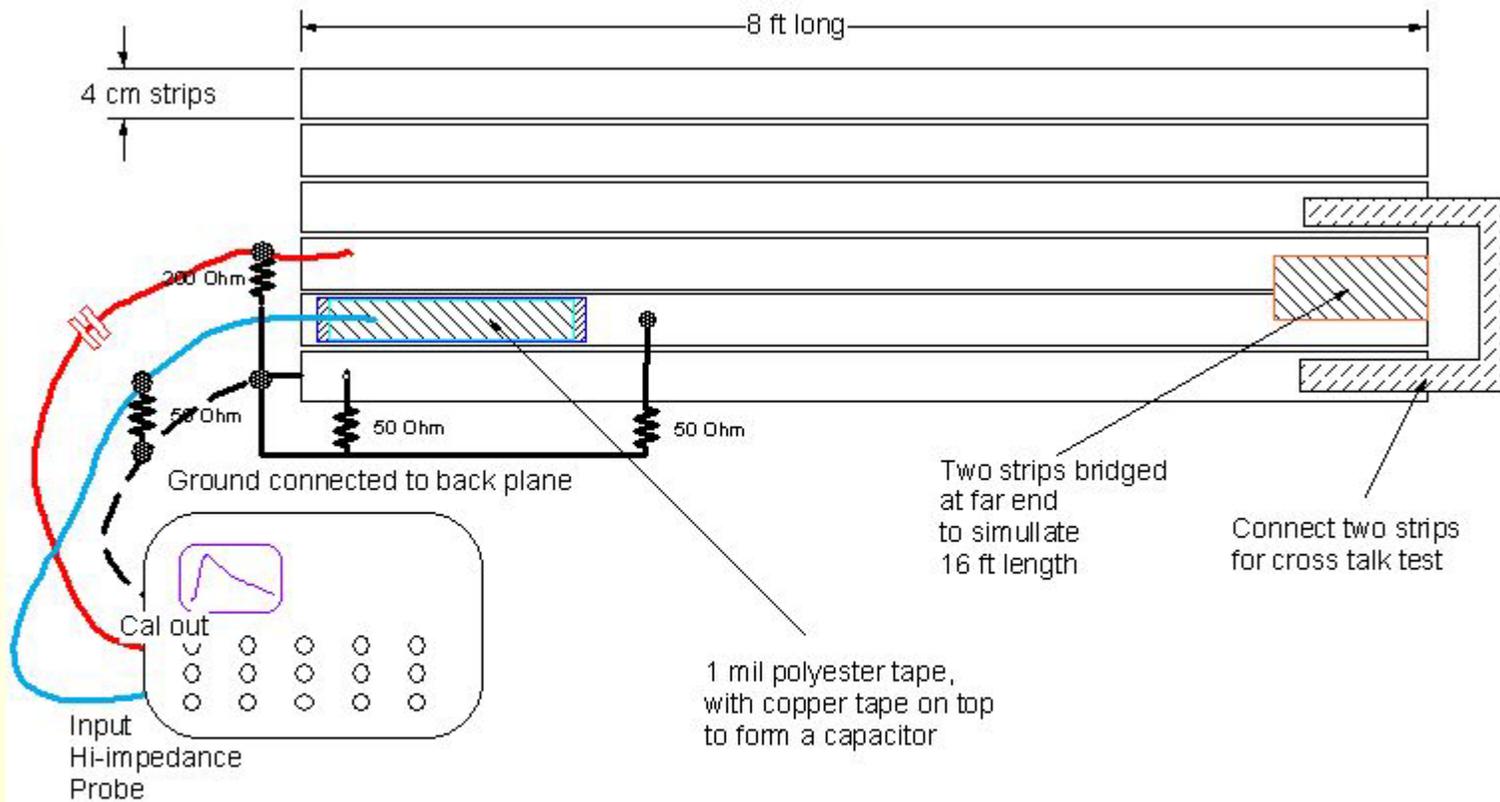


# Using step function input



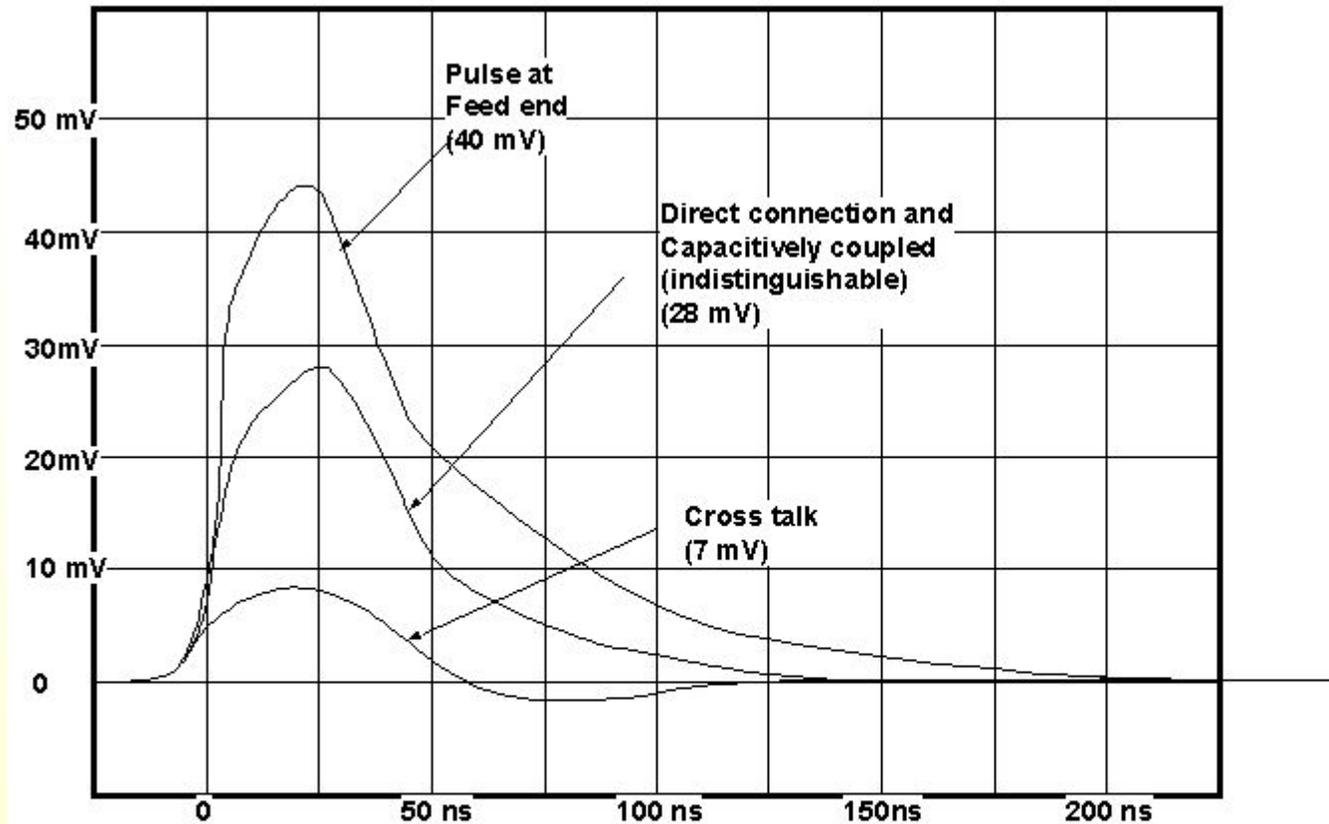
Strip pulse shapes for directly coupled and for capacitively coupled readout

# Capacitive coupling with short pulses



Test for Capacitive Foil Coupling  
and for Cross Talk

# Pulse shapes and sizes

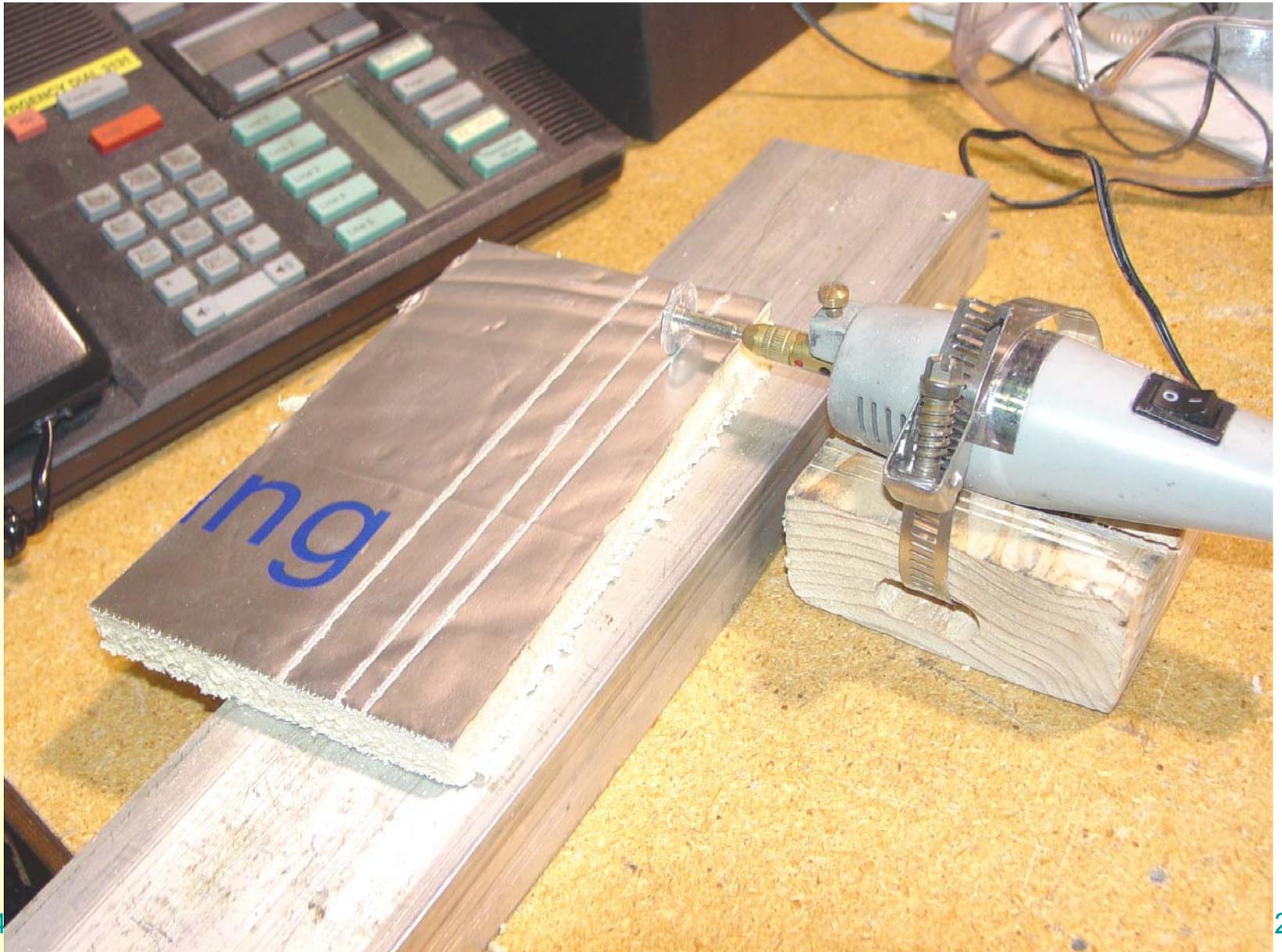


Strip pulse shapes for directly coupled  
and for capacitively coupled readout,  
and for Cross Talk

# Test of Capacitive Coupling



# Grooving of Foam Board



# Summary

- The cosmic test setup has been initiated (due to the effort of many, many people !)
- Importance ?
- A long way to go