

LAB ACTIVITIES @ LNF

STATUS REPORT

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XV SUPERB GENERAL MEETING
DCH-II PARALLEL SESSION

CALTECH, 14 DEC 2010

OUTLINE

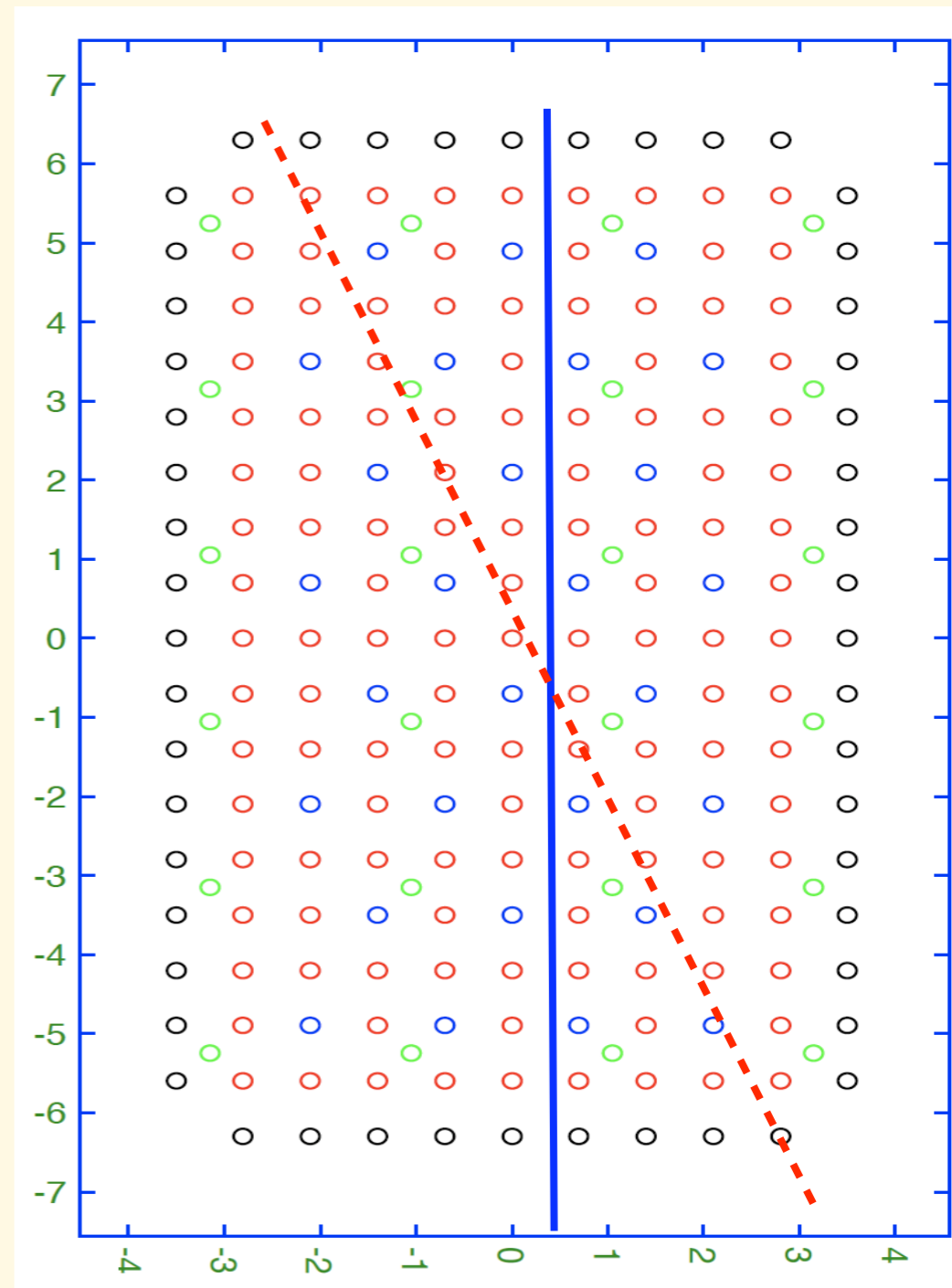
- **DESIGN OF PROTOTYPE 2**
- **LOCAL DERIVATIVE METHOD FOR CLUSTER COUNTING: PRELIMINARY RESULTS**

PROTOTYPE 2 - GENERALITIES

- **2.7M LONG, SQUARE-CELL PROTOTYPE TO STUDY DCH RESPONSE FROM SINGLE CLUSTERS IN A REALISTIC ENVIRONMENT, AND SERVE AS A TEST BENCH FOR THE FINAL FEE**
- **ENOUGH CELLS PER LAYER TO ALLOW $\pm 20^\circ$ TRACKS**
- **KEEP DIMENSIONS LIMITED, TO MAXIMIZE USE OF OFF-THE-SHELF PARTS**
- **8 LAYERS OF SQUARE CELLS, 14MM SIDE (28 CELLS TOTAL)**

PROTOTYPE 2 - CELL LAYOUT

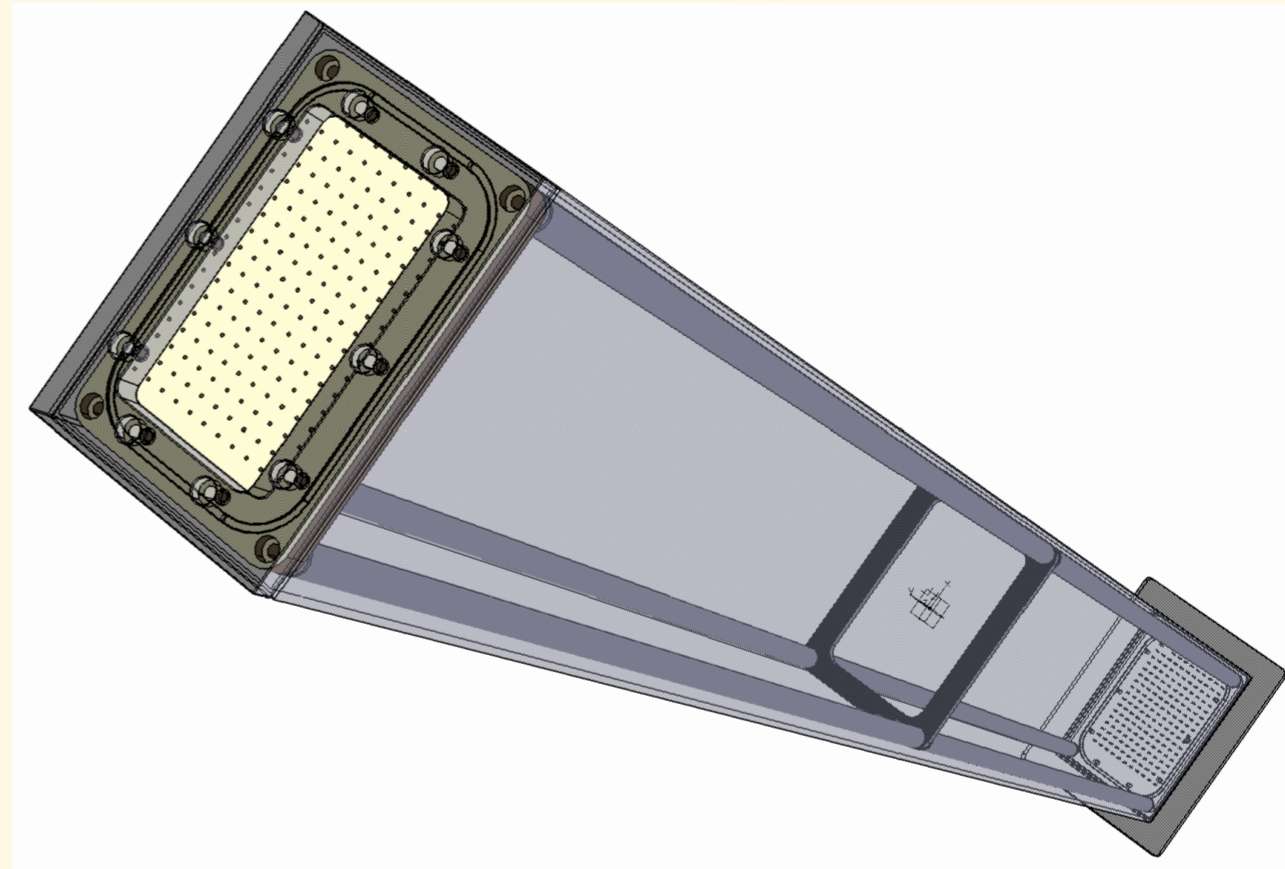
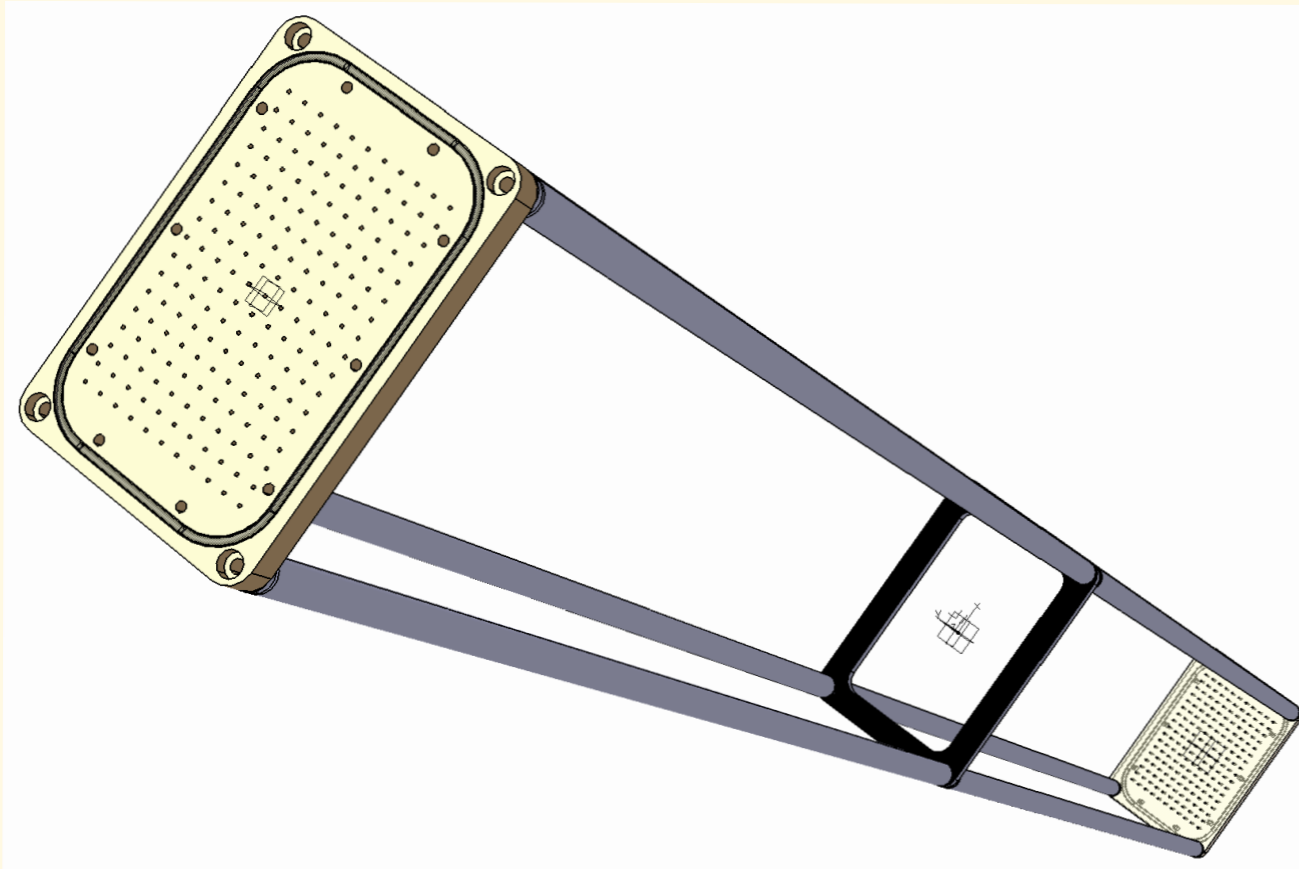
- **BLUE CIRCLES: 28 SENSE WIRES
ARRANGED IN 8 LAYERS
(3-4-3-4-3-4-3-4)**
- **RED CIRCLES: FIELD WIRES**
- **BLACK CIRCLES: EXTERNAL LAYER OF
GUARD WIRES TO MAKE CELL
RESPONSE HOMOGENEOUS**
- ✓ **OPTIMIZATION OF WIRE POSITIONS
AND HV DISCUSSED IN CHRIS' TALK**
- **GREEN CIRCLES: BLIND THREADED
HOLES FOR SUPPORT OF FEE BOARDS**



TECHNICAL DESIGN

E. CAPITOLO
A. CECCHETTI
LNF

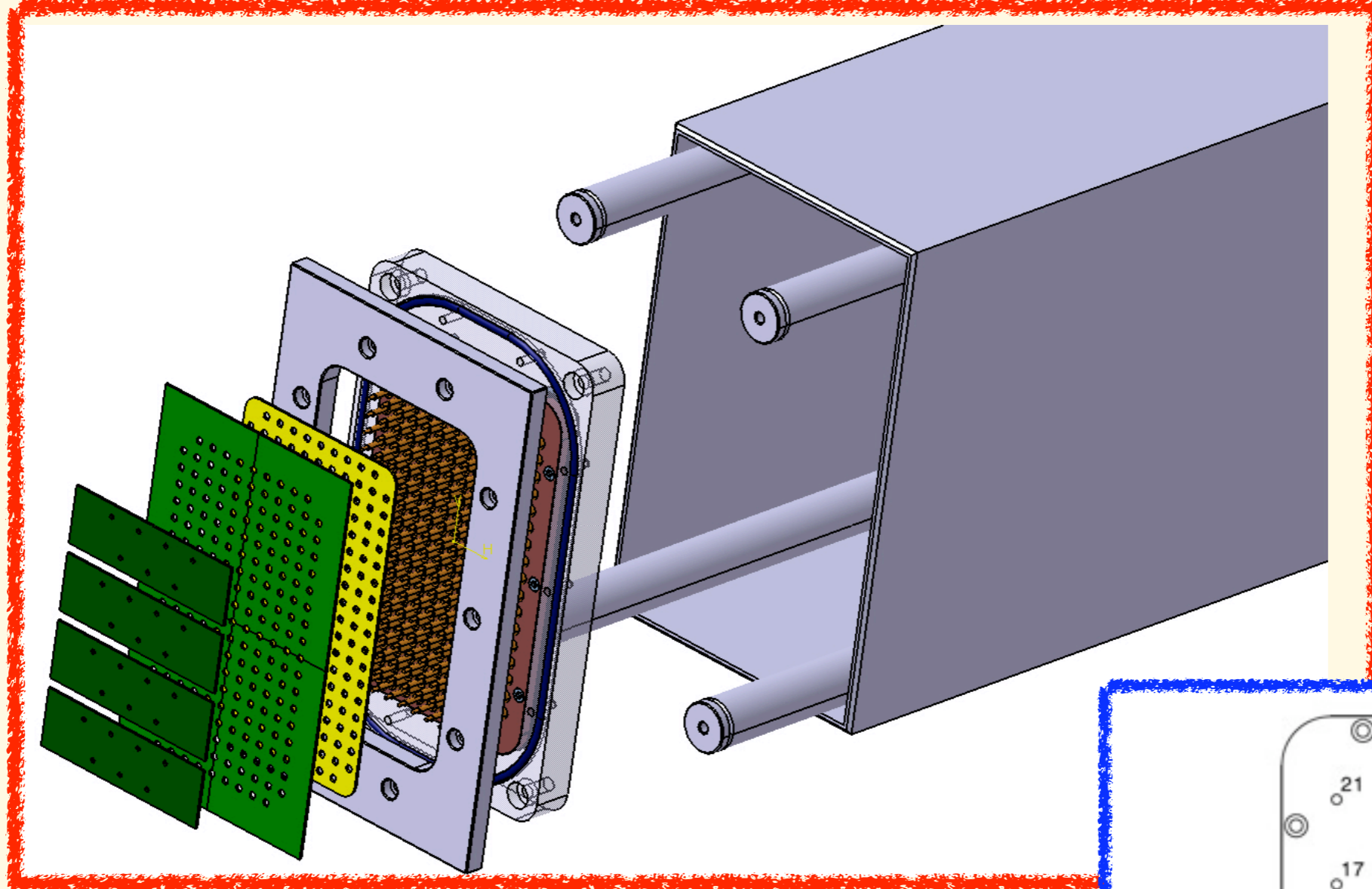
- ✓ **2.7M LONG, LIGHT STRUCTURE WITH ENDPLATE FRAMES SEPARATED BY 4 ALUMINUM ROD STRUTS**



- ✓ **AFTER STRINGING, STRUCTURE SLID INTO 3 MM THICK METAL CASE FOR GAS TIGHTNESS**

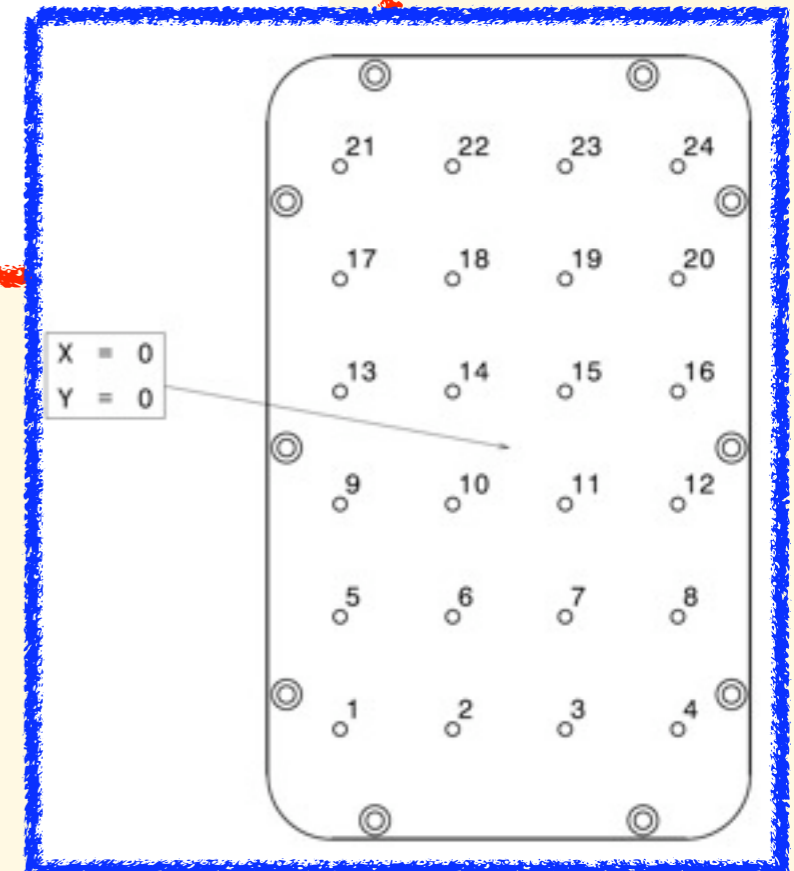
- **ALUMINIZED MYLAR WINDOWS TO MINIMIZE MATERIAL SEEN BY TRACKS AT VARIOUS LONGITUDINAL POSITIONS**

TECHNICAL DESIGN



SOLUTIONS NOW FINALIZED FOR:

- GAS TIGHTNESS (GASKETS, GROOVES)
- FIXTURE OF FEE BOARDS
- ➔ MORE DETAILS ON FEE BOARDS IN G. FELICI'S TALK



WIRES



- Field/Guard wires: **80/120 μm** bare Al-5056 (as in Proto1)
- Sense wires:
 - ✓ Gold-plated W-Rh (\varnothing **25 μm**) used in Proto 1 (and in the KLOE DC)
 - ✓ Gold-plated Molybdenum has lower resistivity (less signal losses), possibly beneficial for cluster counting

Properties of tungsten wire alloyed with 3% Rhenium	
Purity of tungsten before rhenium addition	99.95% W
Melting point	3380 °C
Density	19.22 g/cm ³
Specific electrical resistance at 20 °C	0.092 Ohm x mm ² /m
Modulus of elasticity at 20 °C	430 kN/mm ²

Properties of bare Molybdenum wire	
Purity	99.9% Mo
Melting point	2620 °C
Density	10.14 g/cm ³
Specific electrical resistance at 20 °C	0.052 Ohm x mm ² /m
Modulus of elasticity at 20 °C	320 kN/mm ²

- ❖ **~200KG LESS TENSION ON DCH ENDPLATES FOR 10,000 WIRES**
- ❖ **NEGLIGIBLE DECREASE OF OVERALL MATERIAL DENSITY**

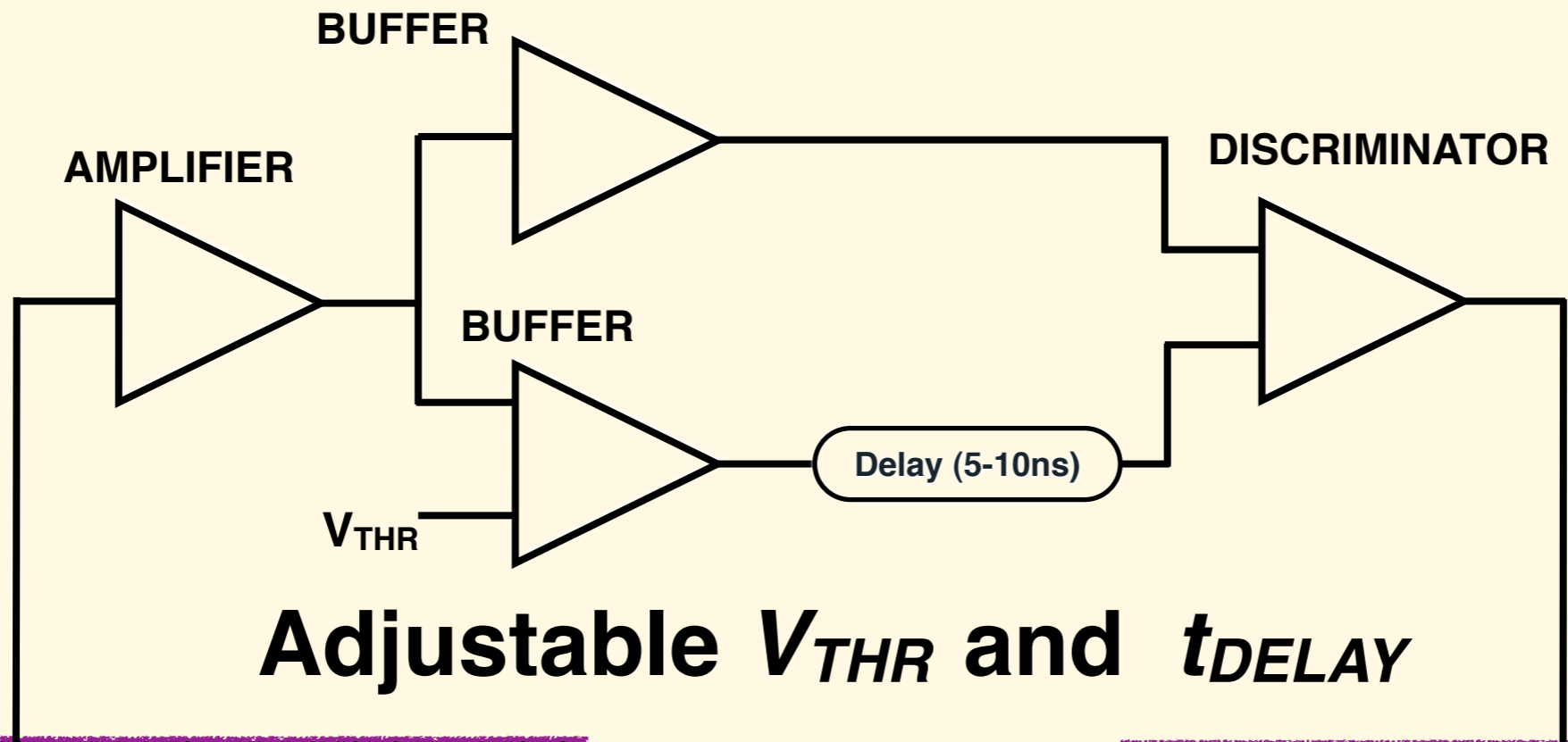
➔ 400m spool (\varnothing **20 μm**) purchased from Luma Metall

- $T_{\text{break}} = (60 \pm 6)\text{g}$ - [three tests]
- $R_{\text{W-Rh}} = 180\Omega$; $R_{\text{Mo}} = 170\Omega$ (corresponding to 110Ω for **25 μm** \varnothing)
 - consistent with factory specifications

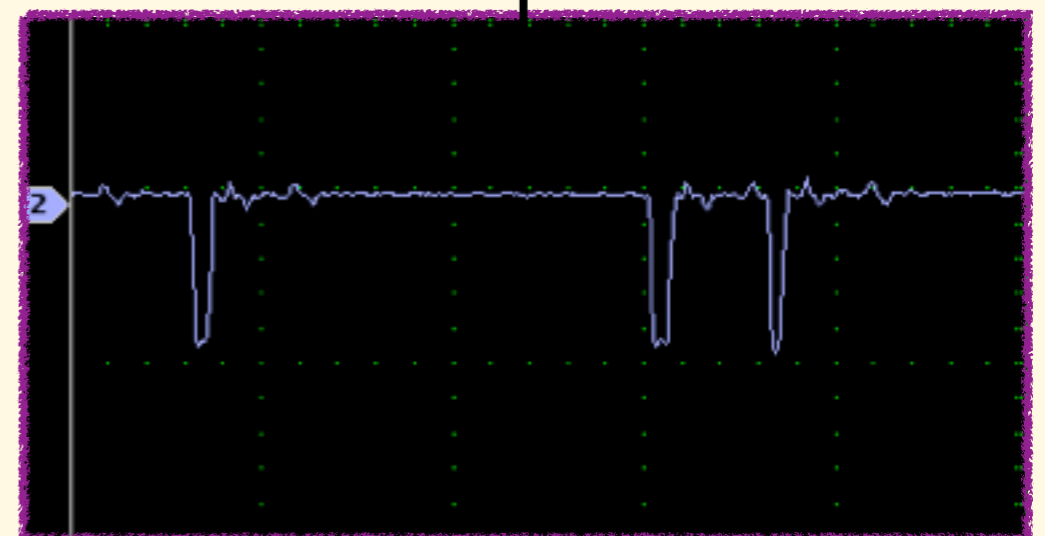
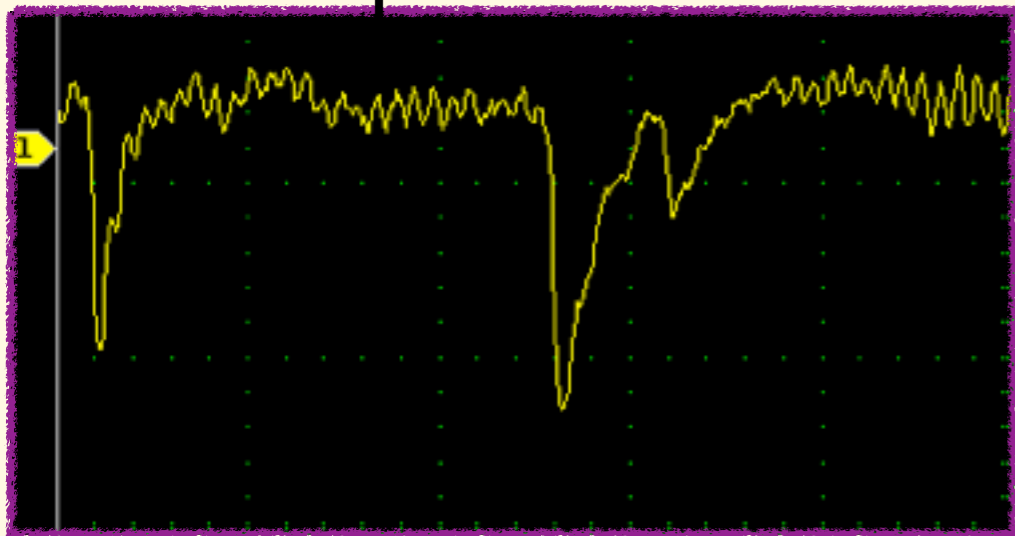
PROTO2 SUMMARY

- Permaglass endplates to be machined next weeks
- Mechanical structure to be built and assembled at LNF starting January 2011
- Then stringing...
 - plan to use Molybdenum wire

CLUSTER COUNTING: ANALOGIC DERIVATIVE



Adjustable V_{THR} and t_{DELAY}



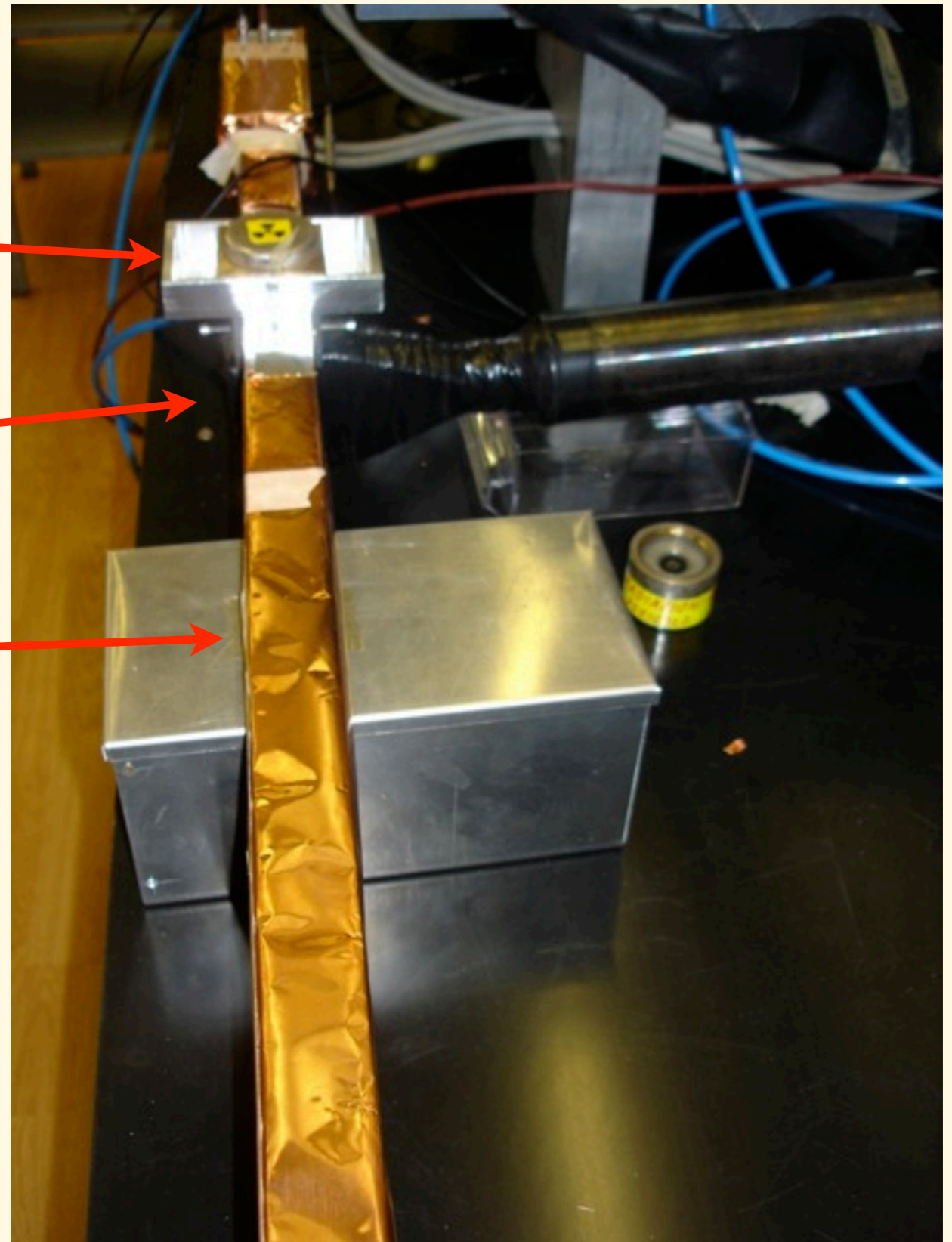
Width of comparator output depends on *both* signal shape and cluster spacing

TESTS

^{90}Sr source

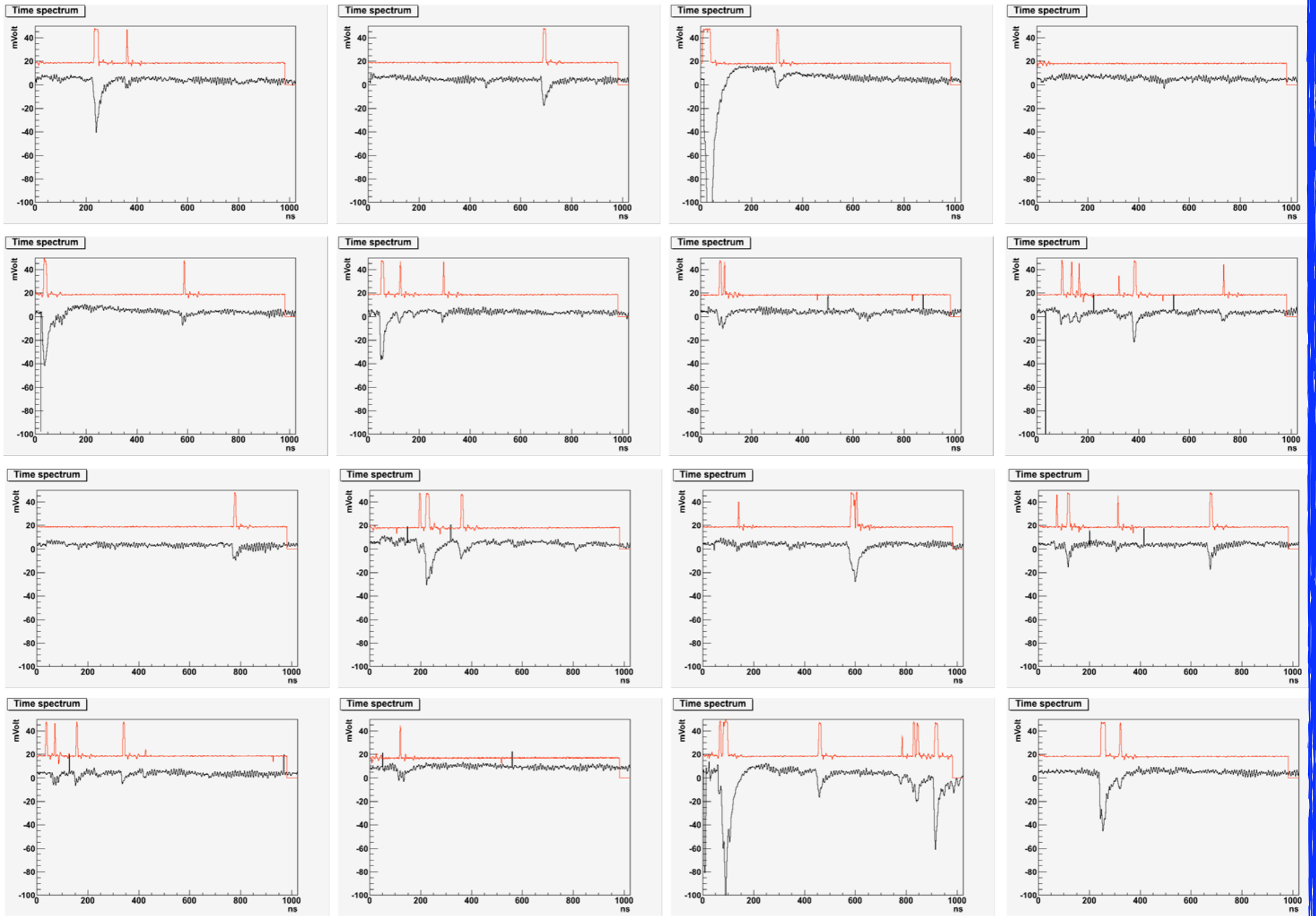
Trigger scintillator

Drift tube



- ▶ Square tube (2.5m long, 2.6cm side)
- ▶ Tested gas mixture is 80%He-20%CH₄
- ▶ 9.1cluster/cm for a MIP at NTP (24 clusters for a straight e⁻)

A COLLECTION OF SIGNALS



COMMENTS

- ✓ Very preliminary results shown indicate features (and limits) of the methods
 - ➔ No fake peaks
 - ➔ Inefficiency for cluster spacing $\leq t_{\text{DELAY}}$
 - Margins to optimize threshold and time delay
- ✓ Observed no. of clusters *not* consistent with straight M.I. tracks. Possible improvements:
 - ➔ Optimize collimator (?)
 - ➔ Use cosmic ray tracks instead of β source
- ✓ Plan to study cluster counting efficiency as a function of impact parameter, gas mixture, distance from preamplifier