Status of the Cornell/Purdue Program: first events with wire readout

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Information available at the web site: http://w4.lns.cornell.edu/~dpp/tpc_test_lab_info.html

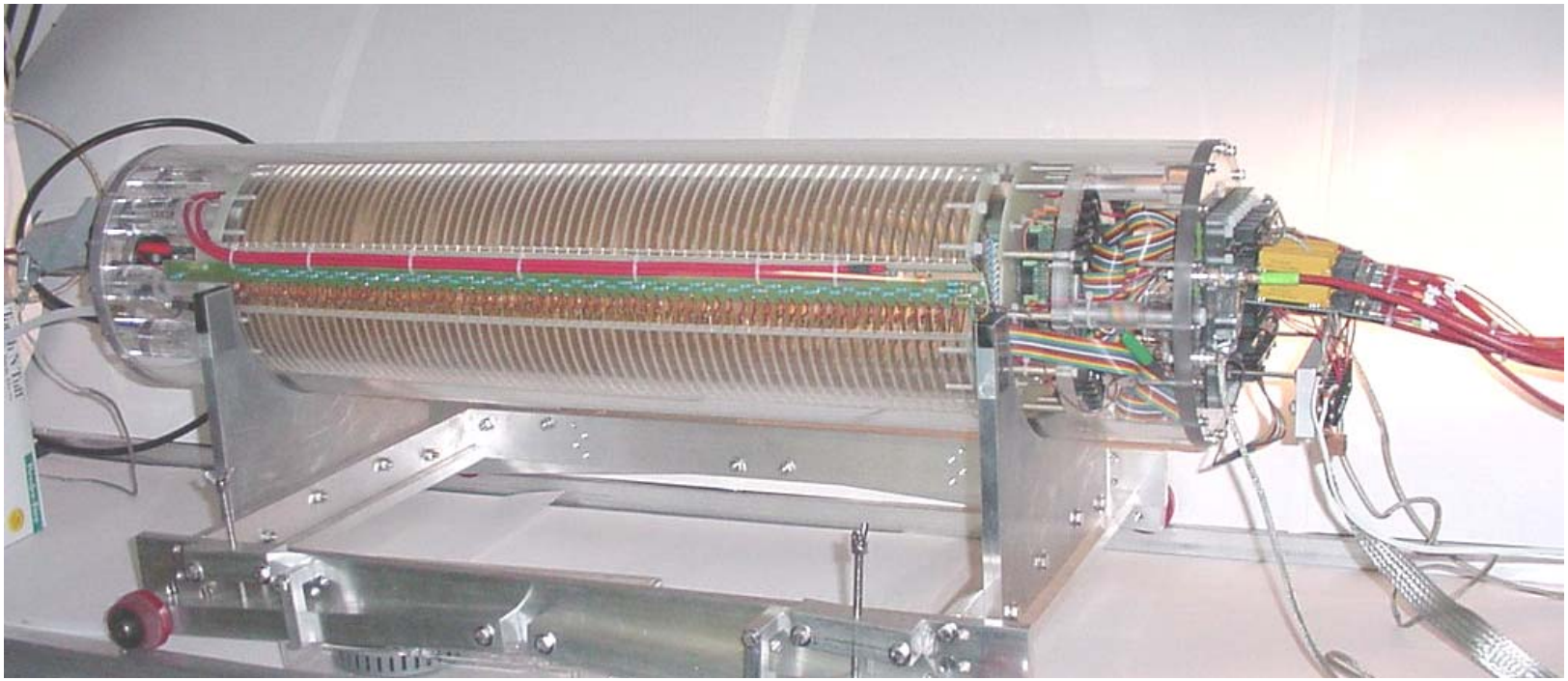
* this presentation, Orsay, 12-January-2005,
* presentation to ALCPG at Victoria, 28-July-2004,
* presentation to ALCPG meeting at SLAC, 07-January-2004,
* presentation to TPC meeting at Berkeley, 18-October-2003,
* presentation to UCLC meeting at Santa Cruz, 30-June-2002,
* project description from the NSF proposal, 29-August-2002

This project is supported by the US National Science Foundation (LEPP cooperative agreement) and by the US Department of Energy

TPC

we have completed construction of our first TPC device
(inspired by the Victoria design)

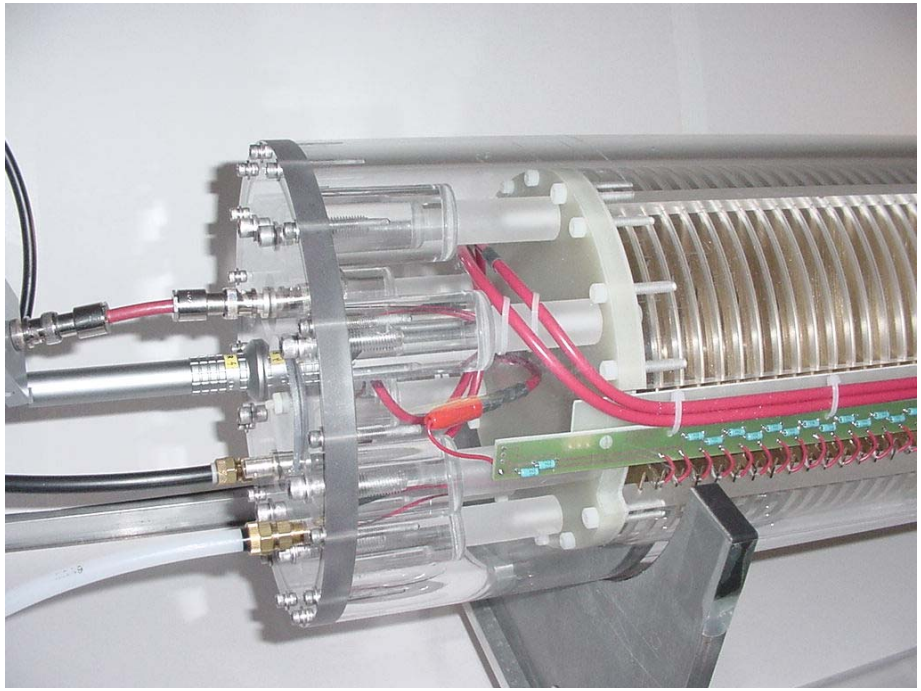
14.6 cm ID field cage accommodates a 10 cm GEM
64 cm drift field length
22.2 cm OD outer structure (8.75 inch)

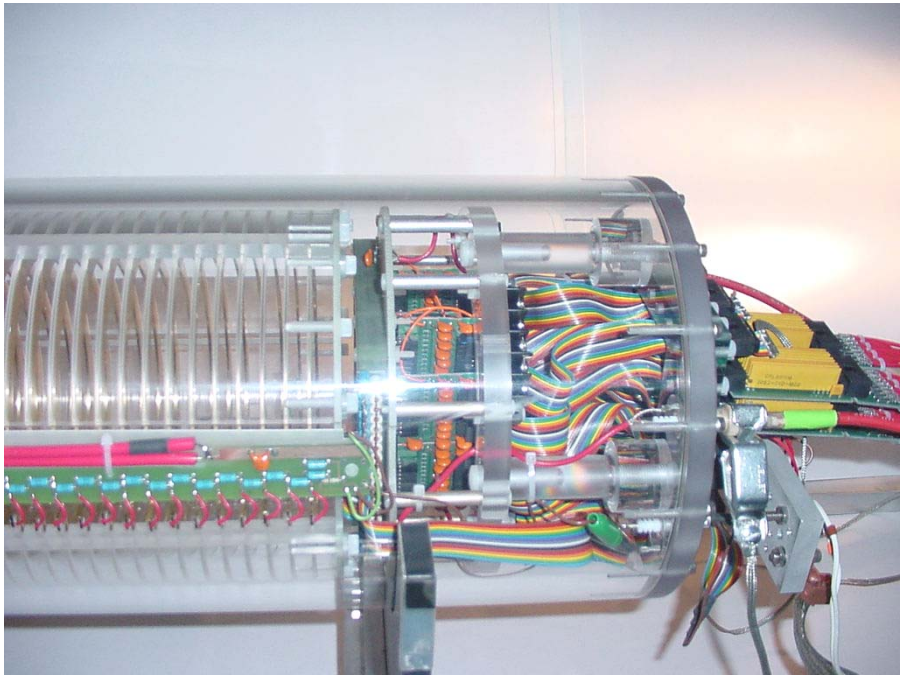


TPC details

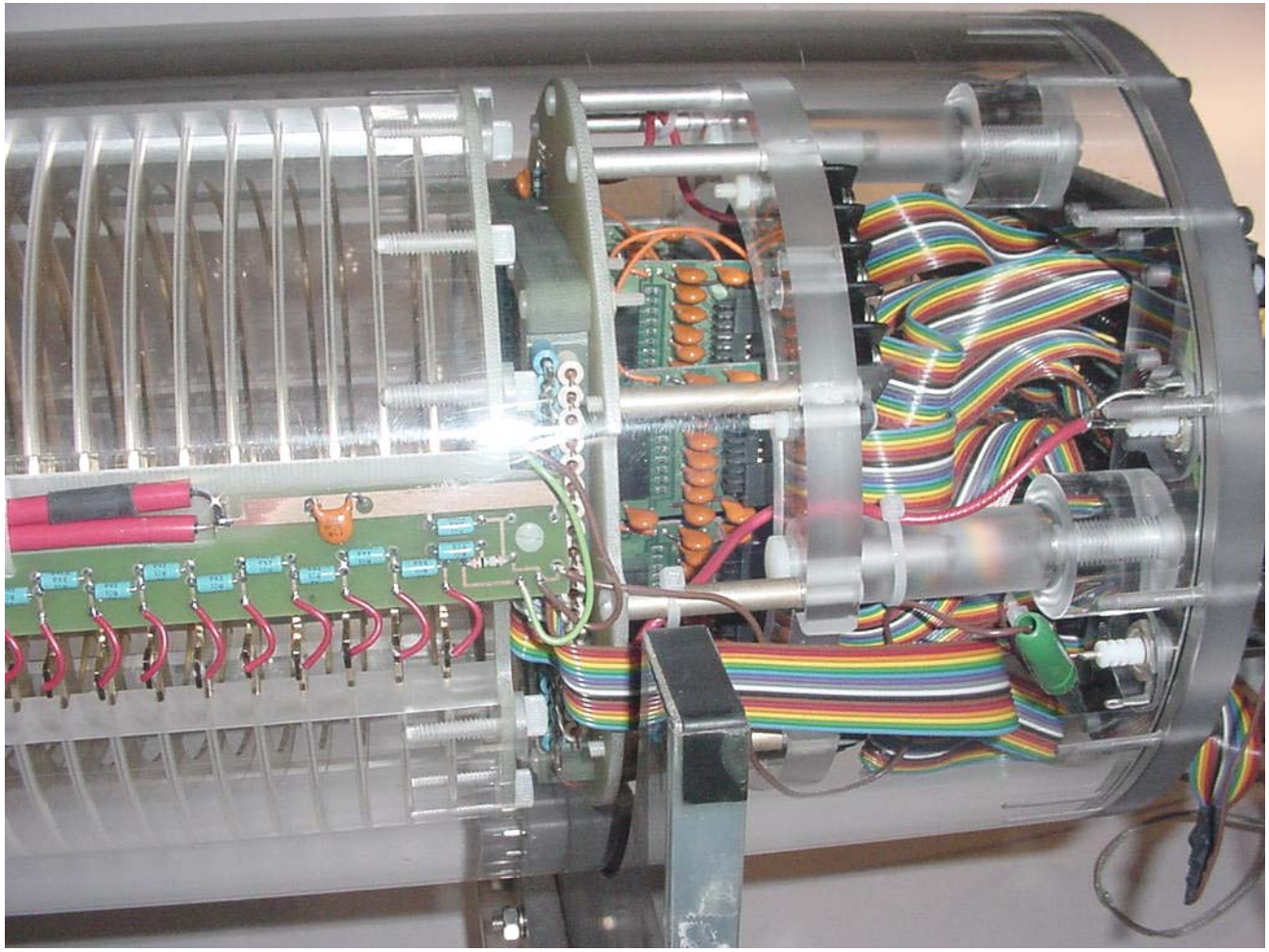
High Voltage end:
- LEMO HV connectors
- SHV bias trimming connectors
- gas connections
- field cage HV distribution

Read-out end:
provides for interchangeable readout modules
shown: field cage HV distribution
- field cage termination
- wire gas-amplification readout
- front end electronics
- CLEO II cathode preamps





TPC Readout End details



Visible:

field cage HV distribution
field cage termination
wire gas-amplification
pad board
pad biasing boards
signal ribbon cable

Biasing:

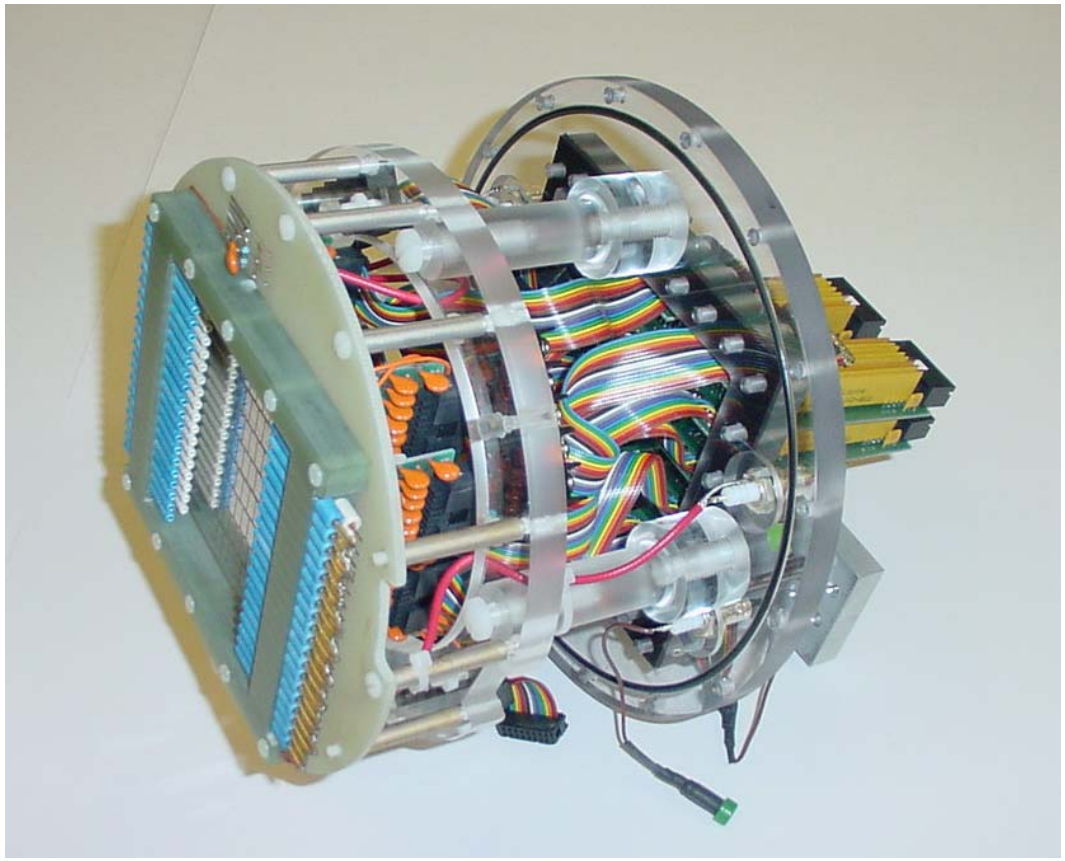
drift: 300V/cm
@ termination: -900V

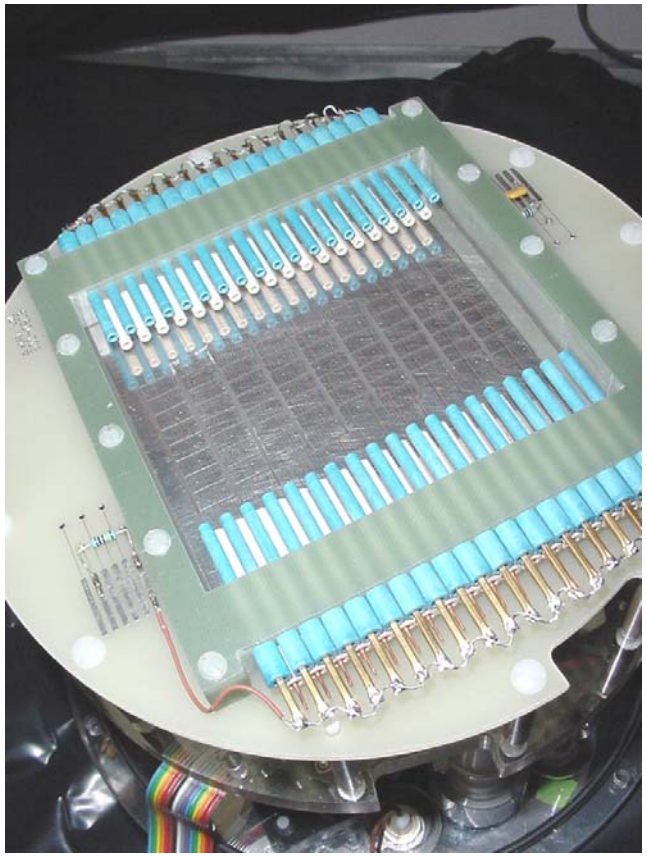
grid: -600V
anode: +550V
pads: -2000V

TPC Wire Gas-Amplification

18 anode wires: 5mm spacing
anode-pad: 5mm
19 grid layer wires:
grid-anode: 5mm

field cage termination - grid: 10mm



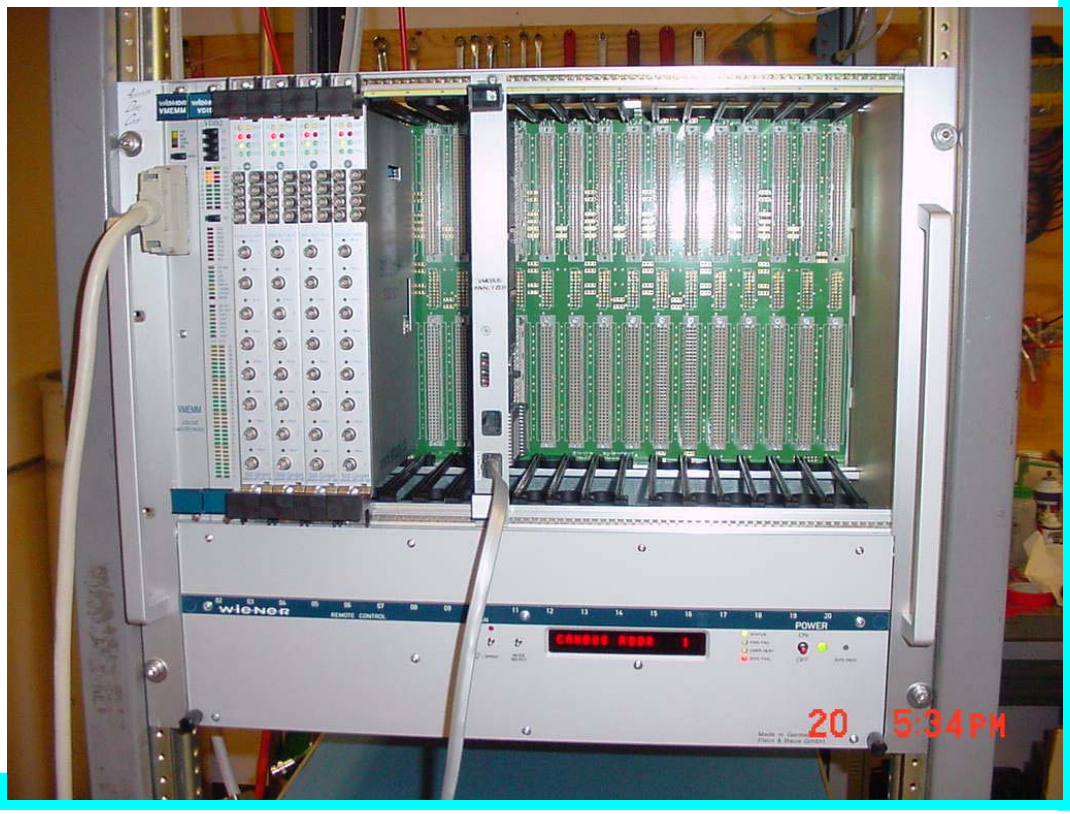


Electronics purchases

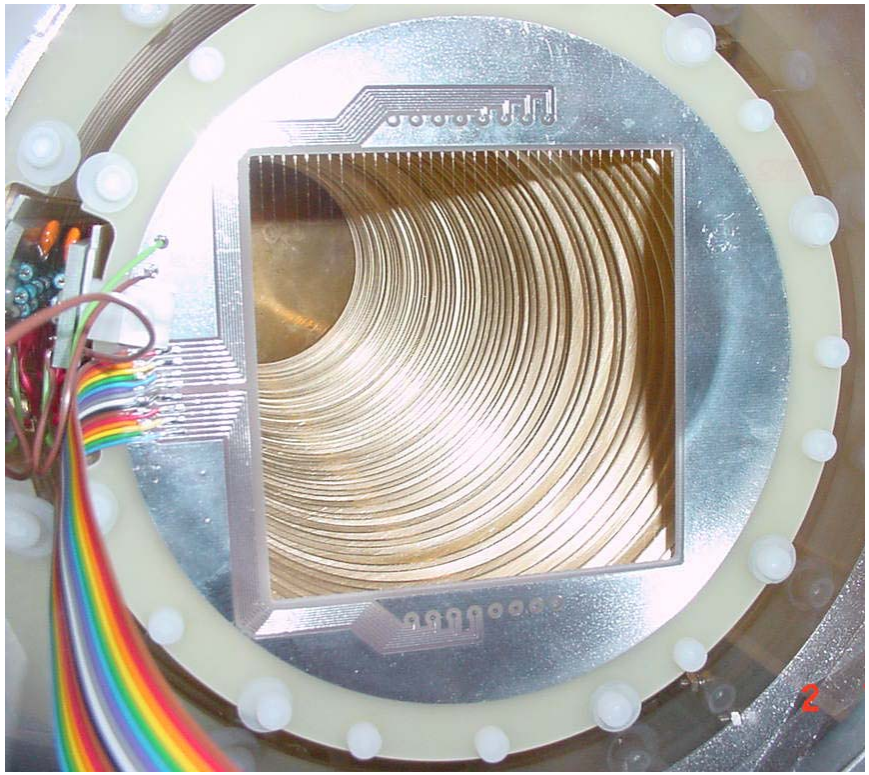
High voltage system:
-20 kV module, 2 channels
-2 kV module, 4 channels

Readout:
VME crate
PC interface card
LabView

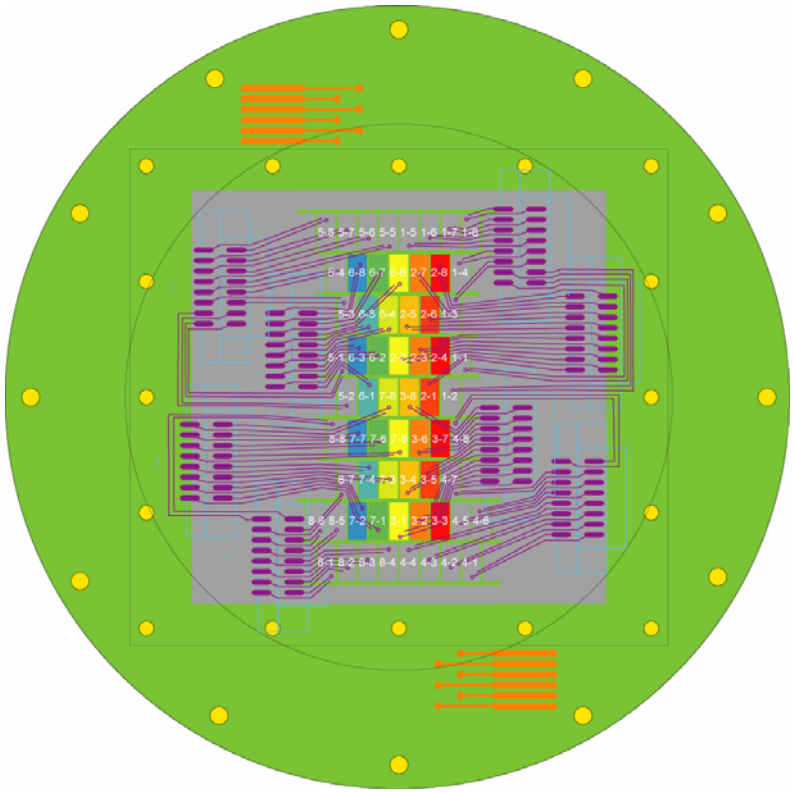
Struck FADC
32 channels (room for expansion)
105 M Hz
14 bit
+/- 200 mV input range
NIM external trigger input
circular memory buffer



Readout size



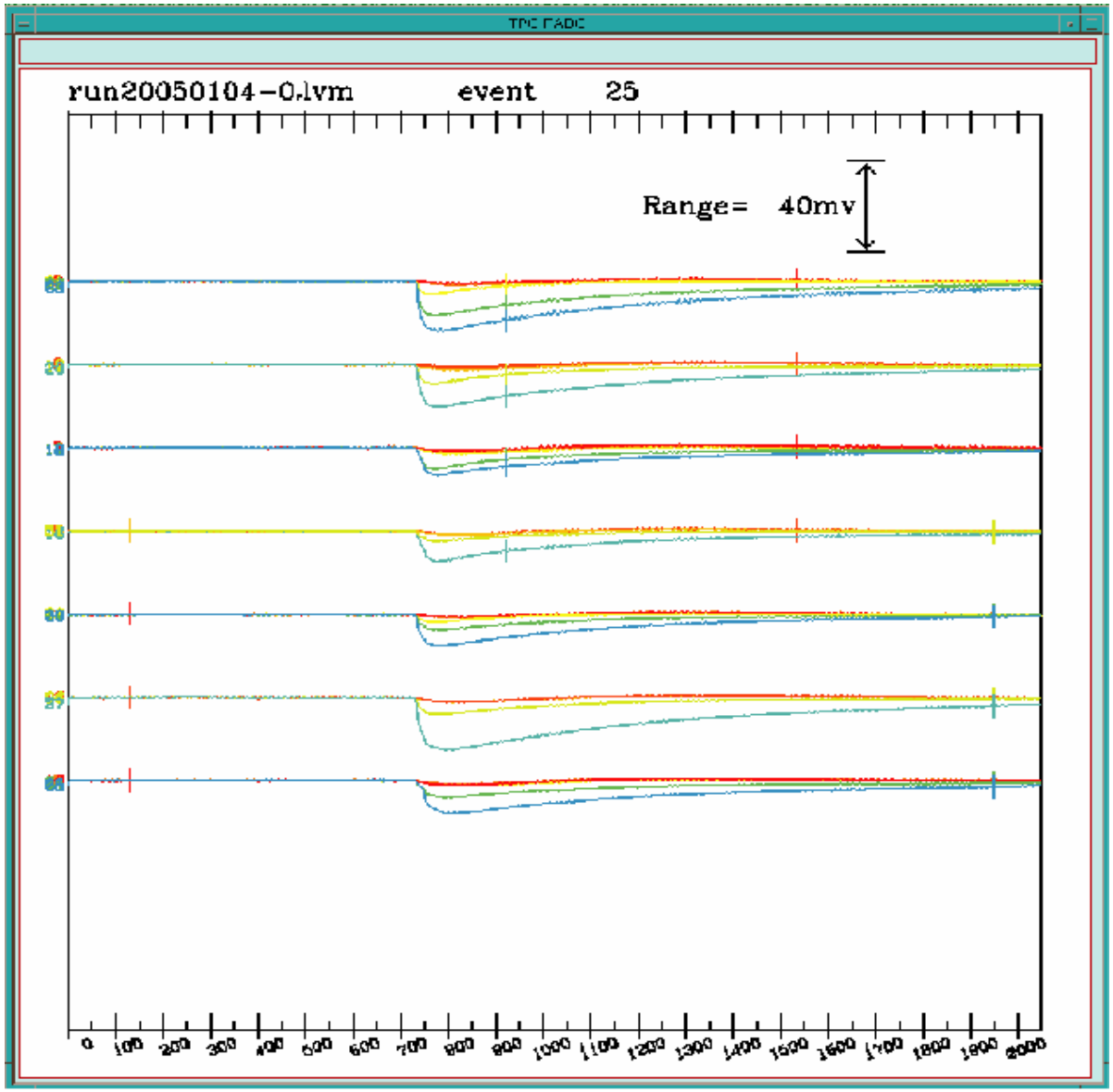
10 cm



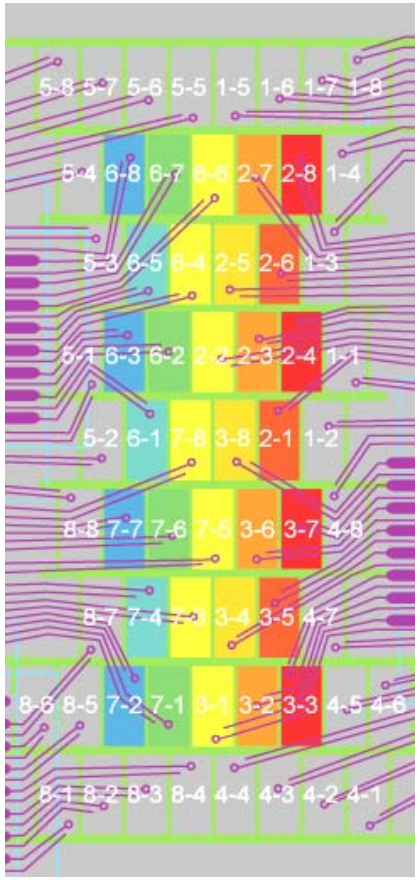
readout area is ~2cm x7 cm , 32 pads

(This pad board allows ~3 x 9 cm , 64 pads.)

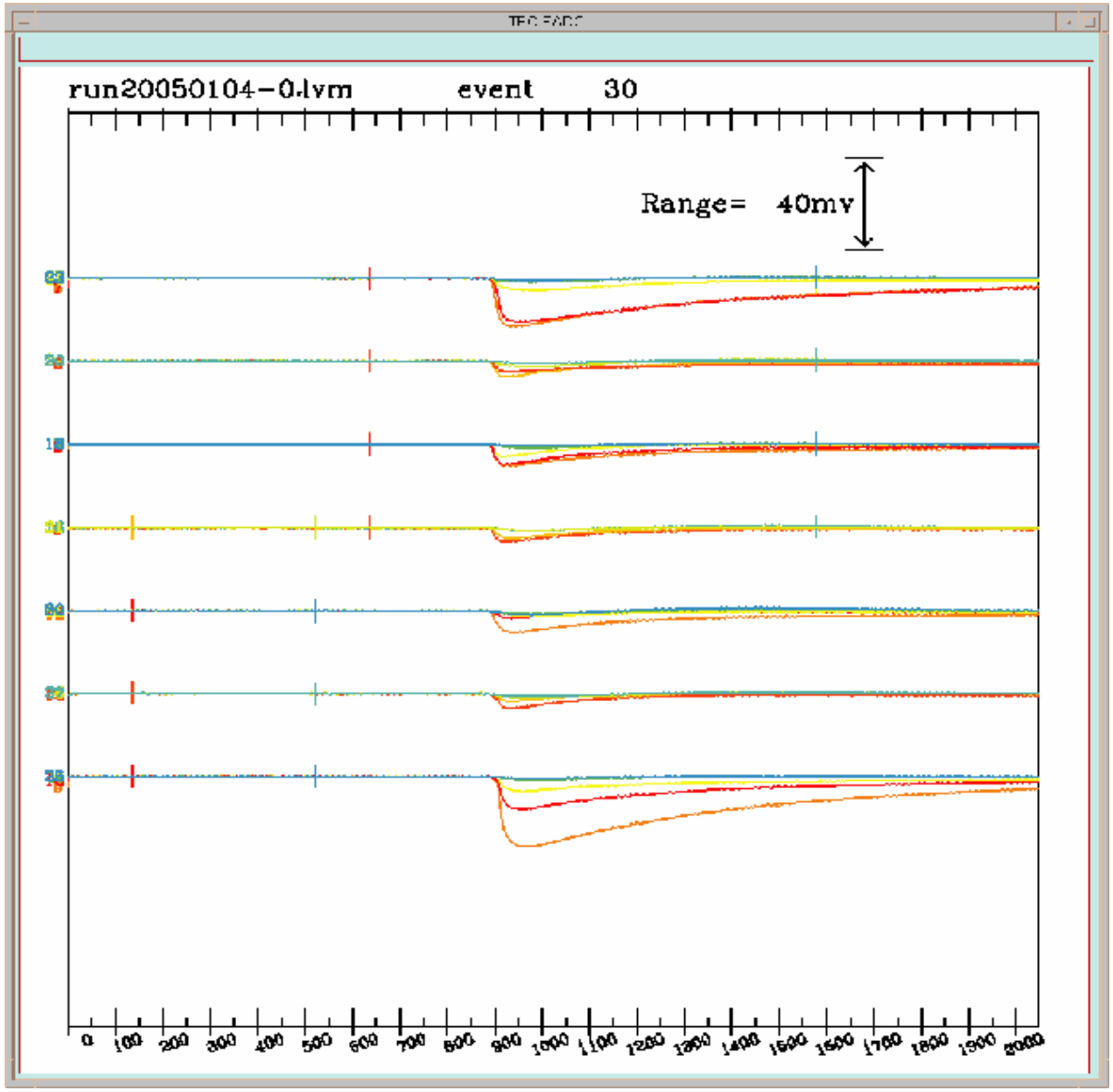
track through the blue/green pads



ArCO2 (10%) , 300V/cm
100 MHz , 10 ns
2048 time buckets (20.48 μs)



track through the red/orange pads



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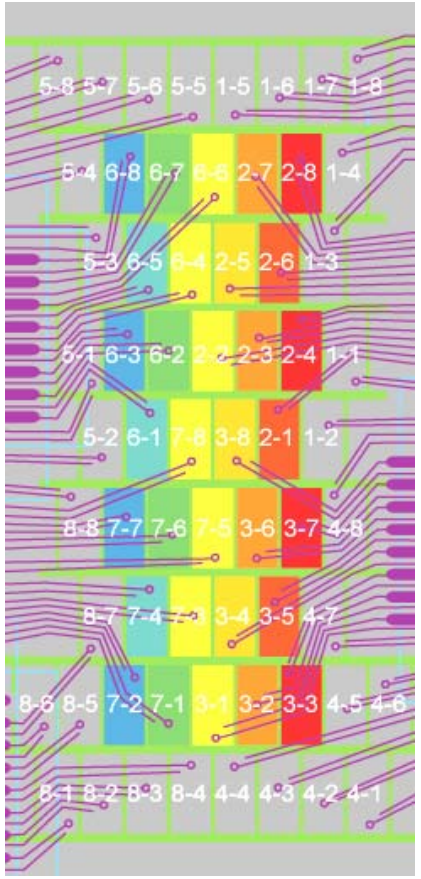
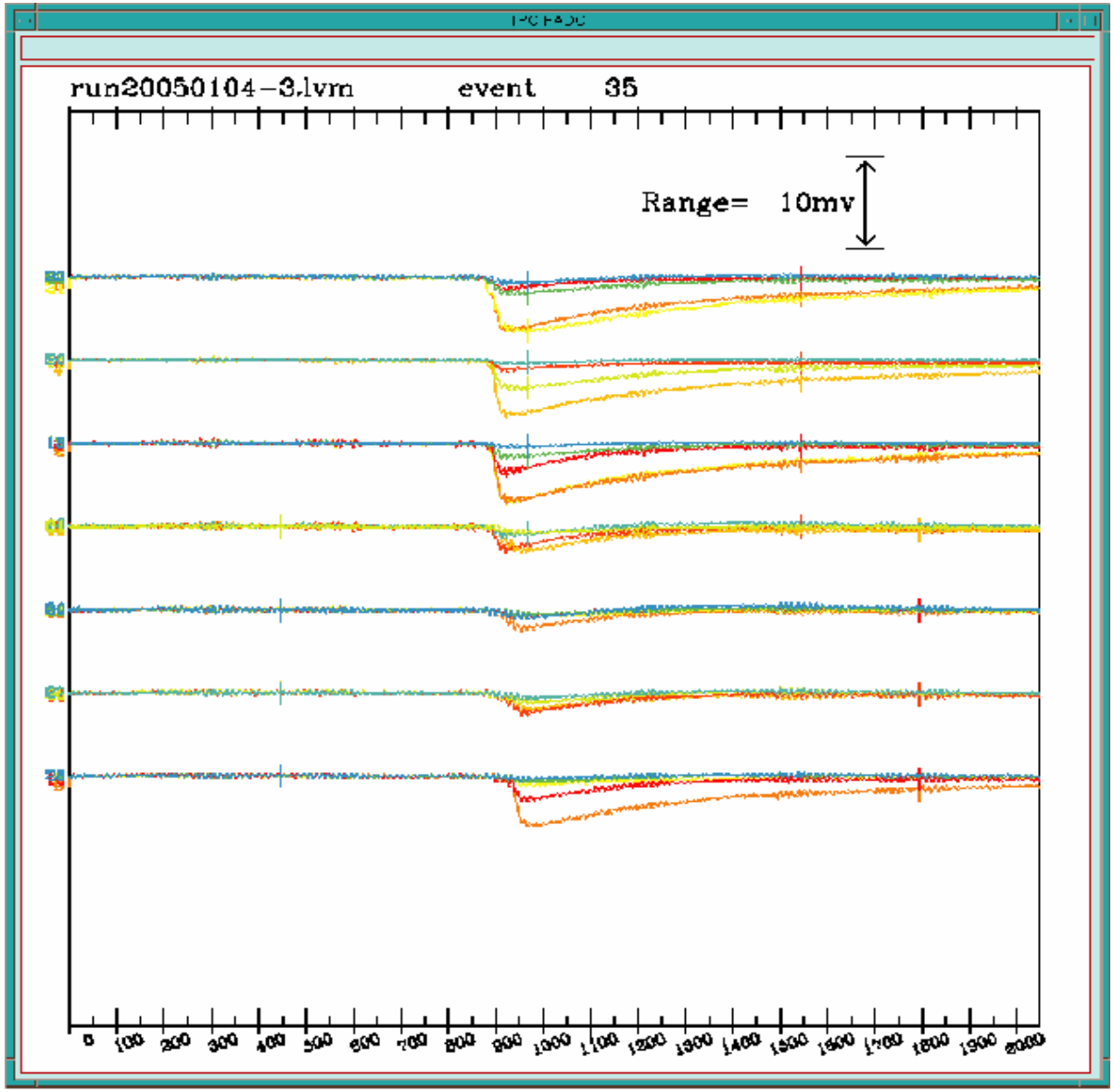


track through the yellow/orange pads



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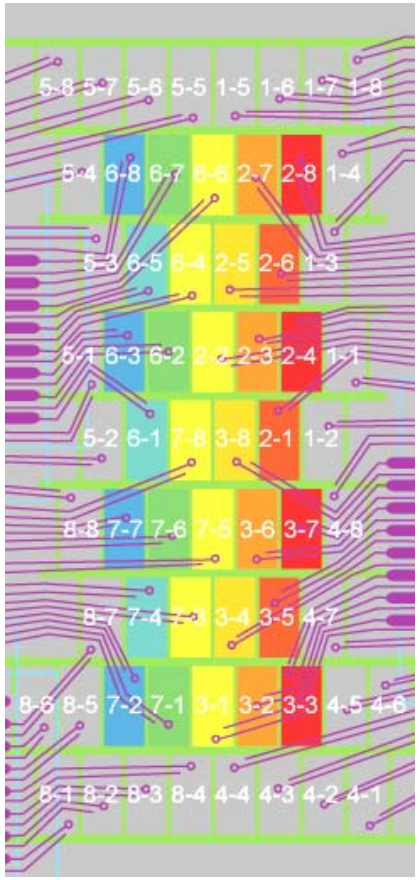
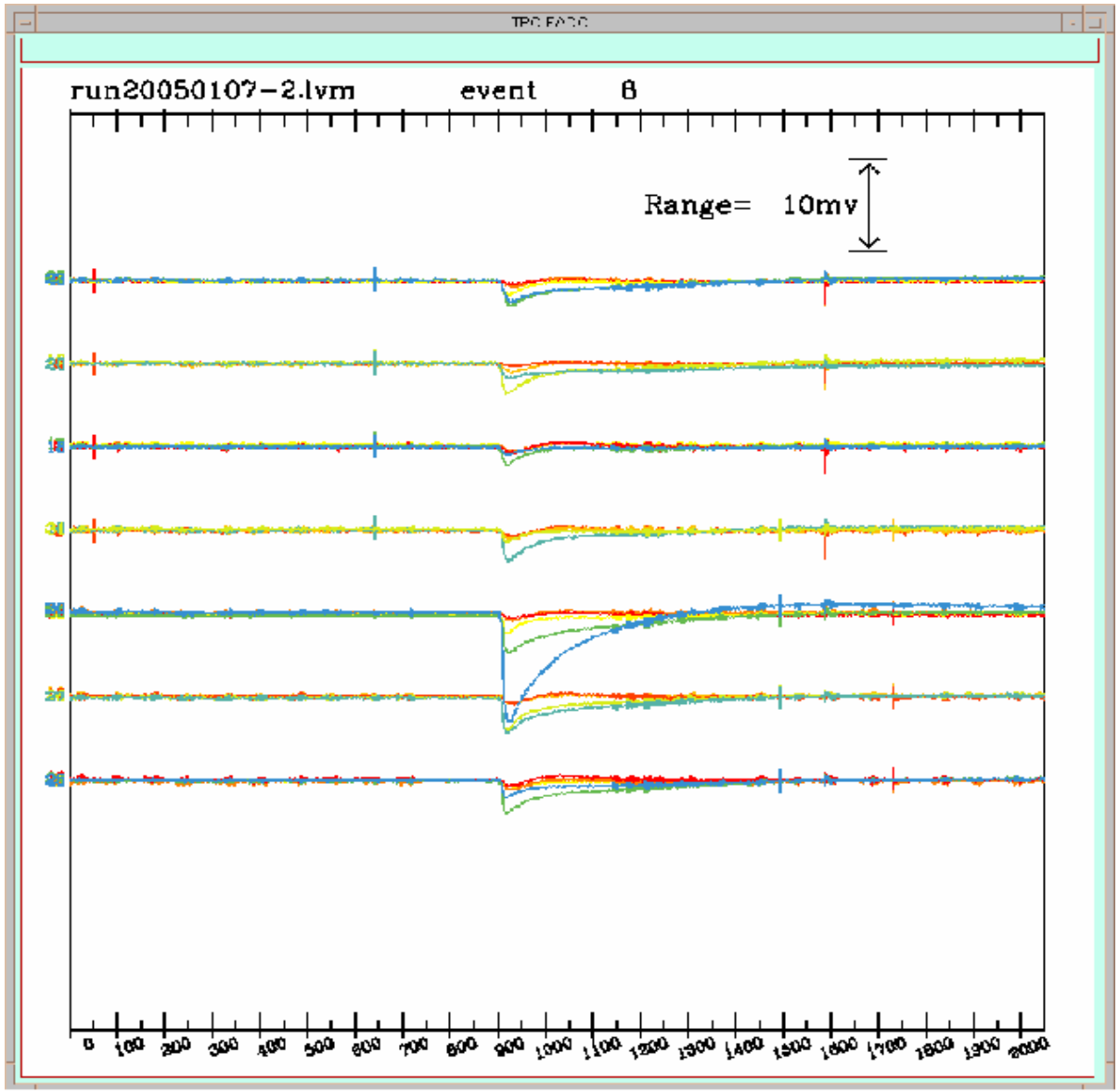
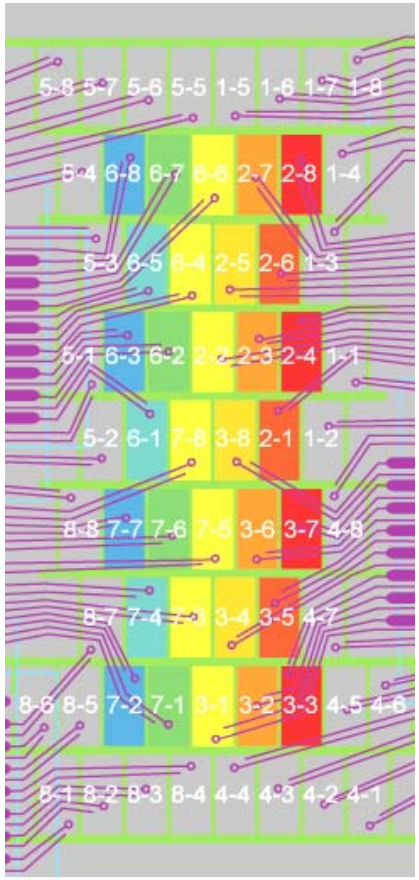


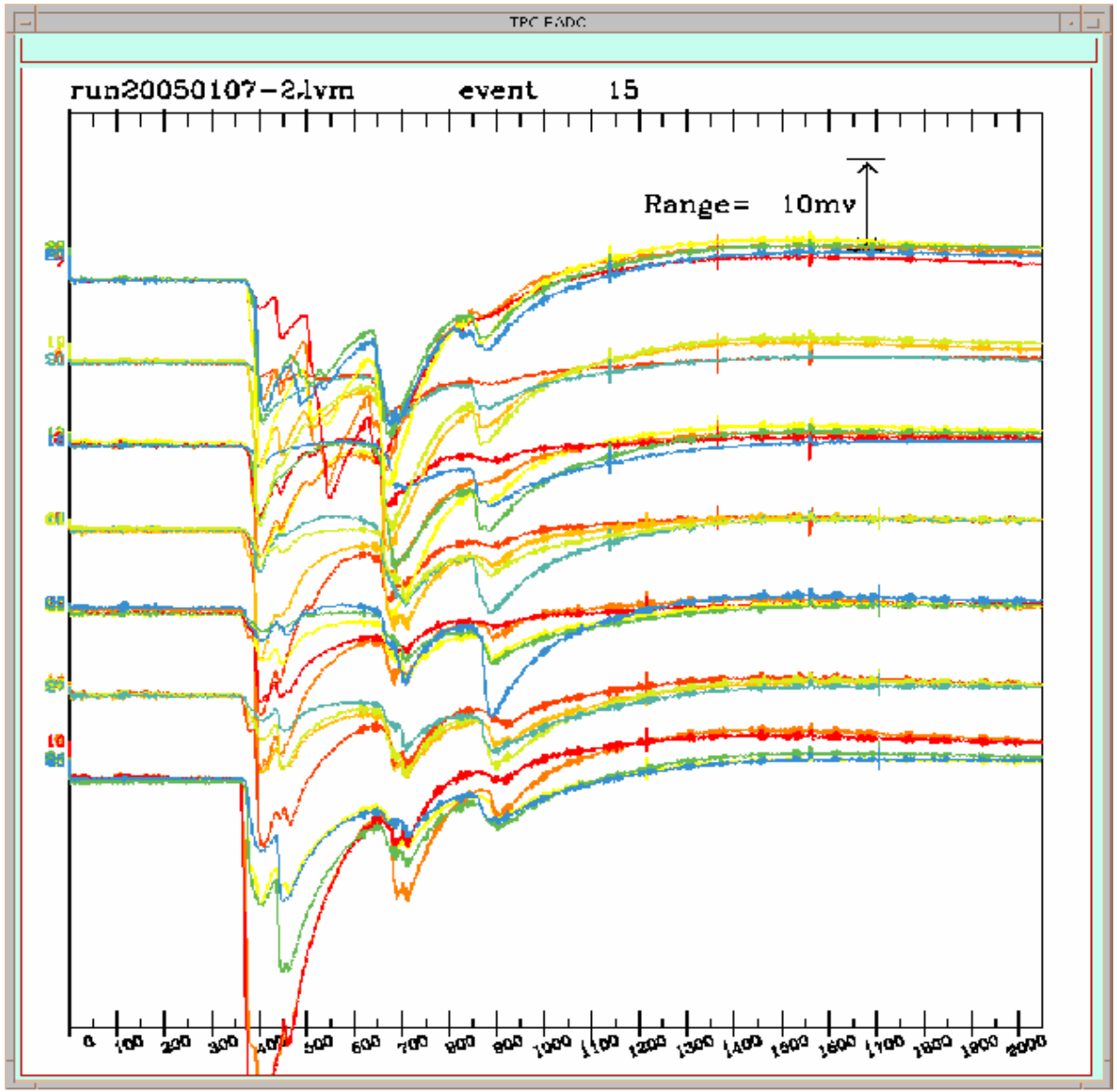
track at 54 cm drift



ArCO2 (10%) , 300V/cm
25 MHz , 40 ns
2048 time buckets (82 μs)



shower



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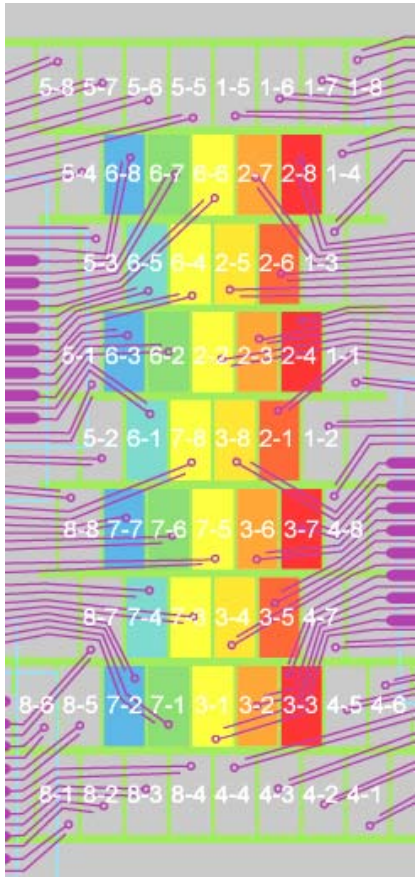

Next (1 year term)

Cornell:

noise: ~ +/- 0.5 mV with the first attempt at grounding,
input range is +/- 200 mV with +/- 8K counts, noise is +/- 20 counts
we can do better

wire gas-amplification: 20 μm wire, 2550V, 5mm anode-to-pad
we can construct a new wire stage, 8 μm wire, 3mm anode-to-pad, lower voltage

expand the readout system

measure resolution vs. drift distance, grid voltage, gas, (location on pad)

compare GEM, MicroMegas, Wires on within the same TPC
compare multiple assemblies of "identical" gas-amplification stages

measure ion feedback

Purdue:

mount *and test* single, double, triple GEM on standard pad boards
We will probably start with 3M MicroMegas.

Linear Collider Detector R&D Proposal

The next round of joint DOE/NSF Linear Collider detector R&D funding has a project proposal due date: 21-January-2005.

Funding will be modest but there is optimism for increased funding.

Cornell: first year

- expanded readout
- new preamps
- positive HV supply
- instrumentation for ion feedback measurements
- gas

Purdue:

- student support

Future: 3 year term

Expand the readout system to allow resolution measurements on a much smaller pad size.

We will consider a magnet / test beam run if this is useful.

We have experience in building and commissioning large detectors that must be reliable.

We will use this experience to study reliability issues with our TPC.

We can study issues related to building an assembly/array of MPGD gas-amplification devices in a mid-sized test chamber.

We have experience evaluating and training vendors for large construction projects.
We have experience working with vendors to build precision parts.
We have experience building light-weight composite parts.

We are prepared to participate in building a component in the next phase of prototyping.

We must include funding for this participation in the upcoming request.