## Micromegas Panels LP electronics

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## Foreword

We aim at 1 single system

- Same DAQ : easier comparison, less duplicate work We have to keep in mind the evolution toward ILC electronics
We need flexibility (possibility to vary parameters) and backup solutions
The panel design (pad-to-channel matching) depends on the electronics (number of channels per chip, or per FEE card)


The technology retained is bulk + resistive foil with about 2000 channels per panel.

Needs :

- HV lead
- Grounding of the edge of the res.foil
- Routing to connectors


Manpower at Saclay
-Franck Senée (engineer)
-Marc Riallot (drawer)
-Christophe Coquelet (PCB designer)

## An alternative to ALTRO : AFTER

- AFTER: Asic For TPC Electronic Readout
- See D. Calvet's talk (Endplate meeting Paris Sept. 2006)
- Now fully tested on a detector with source
- Will be fully operational for a cosmic test in magnetic field with 1728 channels in the HARP magnet in Sept. 2007, with DAQ, zero suppression


## Context

- Designed for T2K experiment, with the aim to be extendable to ILC TPC
- T2K has to be fully operational in 2009, with DAQ, cooling, etc... for 80000 channels
- EUDET contracts does not mention any particular chip to be used for the LP
- Dave Nygren's 'notion' (March 5, 2007), about solving the power consumption problem:
...An ASIC with some of these features has been designed at SACLAY for the T2K TPC, as the duty cycle for a neutrino burst experiment has similarities to our problem. Finally, I note that, while this scheme may appear now as infeasible and/or unattractive for various reasons, it is still appropriate to explore alternatives to ensure that no potentially valuable options have been discarded prematurely.


## AFTER




## AFTER

It has been tested on a detector to be at least as good in performances as the ALTRO. It uses an 'off the shelf" 10 bits digitizer and FPGA. The sampling rate can be chosen from 1 MHz to 50 MHz and has even been tested up to 100 MHz .
Here are some details for the 2000 channel scheme, 10000 channel scheme and 50000 channel scheme.
2000 channel step
The modularity is by 1728 channels ( 6 cards $\times 4$ ASICs $\times 72$ channels) and the ASICs for such a card have already been produced and cost 200 euro each, that is 4800 euro for the 24 needed (compared with the 56000 of the corresponding ALTRO solution). This will be ready by September for a T2K test and additional cards can be made by the same company together. The precise costing for the whole chain is currently being done.
Some work is needed to adapt to our connectors and we have to choose between several solutions for this. The software work is the same as for the ALTRO solution, but here synergy with T2K might only help both sides.
10000 channels or more
The T2K experiment has to start in 2009, so the chip production shall be finished by the end of 2008. A whole production run costs 90000 euro for about 200000 channels. We can get 10000 channels for less than 10000 euros, one ordre of magnitude less than the corresponding ALTRO solution. We can event think of 50000 channels, with more packing and with an adapted cooling, but here also the synergy with T2K would help as state-of the art solutions are just being designed now.

## The ideal enplate (dreams...)

Electronics side
Detector side

Resistive bulk

1000 I.p.i.
Nanocrystalline copper mesh, or gold mesh


Res. foil grounding on the side
Each yellow item is a R\&D topic

## Cathode ancillaries

- ${ }^{55}$ Fe Source
- Separate supply for the cathode for current measurement
- UV light illumination to simulate the beam structure and the ion foil (Xe lamp)
- Dots or lines of low work-function material and suitable light for studying distortions (see Dean Karlen's talk)


## Conclusion

- Now that the panel size is fixed, we start the drawing of the pads, routing, connections
- Proposal (if electronic specialists agree that both solutions are viable) : Draw 2 models : 1 at Carleton for 2048 ALTRO channels, 1 at Saclay for 1728 AFTER channels.

