June-2010 Model of ILC (ILD) TPC

A Proposal

1. For our own conceptual "engineering" design of LC (ILD) TPC

2. Inputs to ILD physics simulation: space and material
3. Feedback to ILD detector integration: cables & pipes

LC TPC WP meeting
WP5 Discussion
8 April 2010

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DESY/FLC & KEK/IPNS

June-2010 Model of LC (ILD) TPC

(A) **Analog TPC:**
- (1) Multi layer GEM + Narrow (1mm wide) pad readout
- (2) MicroMEGAS + Resistive anode pad
- (3) Multilayer GEM + Timepix

(B) **Digital TPC**
- (4) Ingrid-MicroMEGAS + Timepix

For these practical purposes

(I) Pad readout TPC using S-ALTRO electronics: Immediate options with a common pad size:
- (1) Multi layer GEM
- (2) MicroMEGAS + Resistive anode pad

(II) Pixel readout TPC using TimePix:
- (3) Multilayer GEM + Timepix
- (4) Ingrid-MicroMEGAS + Timepix

Make one "common model" for each of (I) and (II) , at least for (I) in time, though for (3) and (4) quite different ?

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Hardware

1. A model of **Endplate based on the Advanced Endplate**:
   - **Mechanics**: The current design with Dan's proposal (A)
   - **Detector module**: Pad readout by S-ALTRO
     with the common pad size of 1mm x 4mm
     with a wire gate
     both for GEM and Micromegas/resistive-anode
     assuming a module structure ala Saclay (DESY) module
   - **Cooling**: The model by Bart but with $\Delta T = 0.1C$

2. A model of **Field cage (FC) ala LP :**
   with a central cathode, gas circulation, FC HV cable
   and cooling of FC resistors (if necessary)
   with TPC support

3. A model of **Electronics**:
   - S-ALTRO: a scheme of **low voltage supply**
   - **Module HV**: DC converters or HV cables?
   - DAQ: No extra DAQ component except those on the endplate?
     Any intermediate connection of cables?

4. Interface to Si trackers:

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Performance-Pad readout

5. A model of TPC operation:

Gas: T2K gas/Circulation
Pressure: 2mb (goal) – 6mb (max)-10mb (safety)
Contamination: O2/H2O
Drift filed: up to 230V/cm
Temperature (gas volume): 20.0C +- 0.1C
……

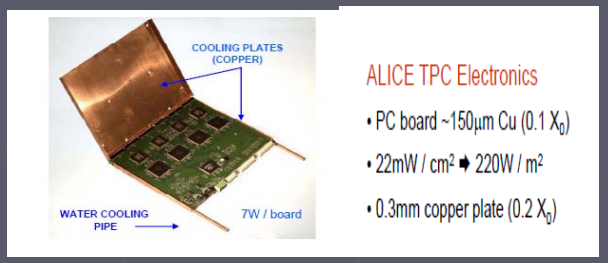
6. A model of TPC performance:

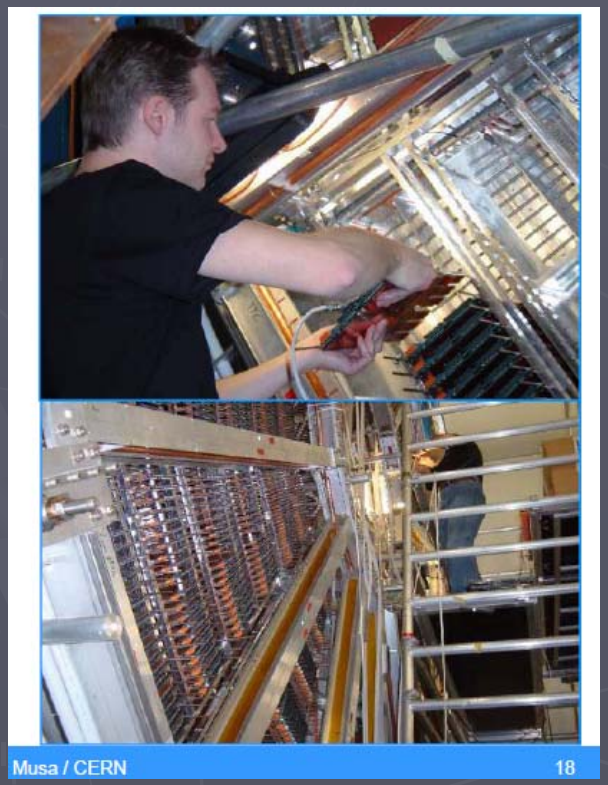
Z-dependent r-φ/z resolution:
Extrapolations based on LP results (Neff, σ(0), and with no-hodoscopes effect (ala Micromegas)
Z-dependent r-φ/z double track separation (*1) :
Based on the Z-dependent pad response for 1mm wide pads.
Dead area:
Based on the endplate/module model. Take the example of the Saclay/DESY module(*2)

Advanced Endplate: S-ALTRO

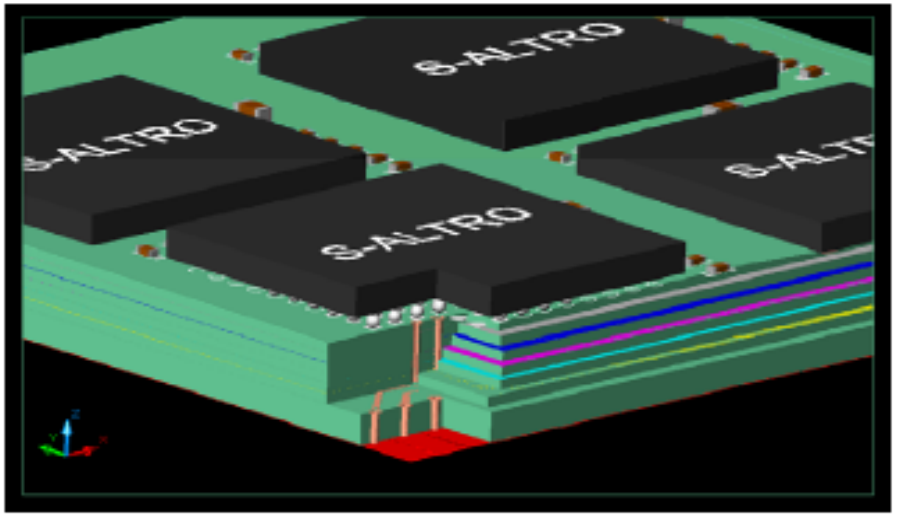
S-ALTRO Team
LC TPC collbaoration

High density, low power , low material electronics for TPC





ALICE TPC



The S-ALTRO team at CERN

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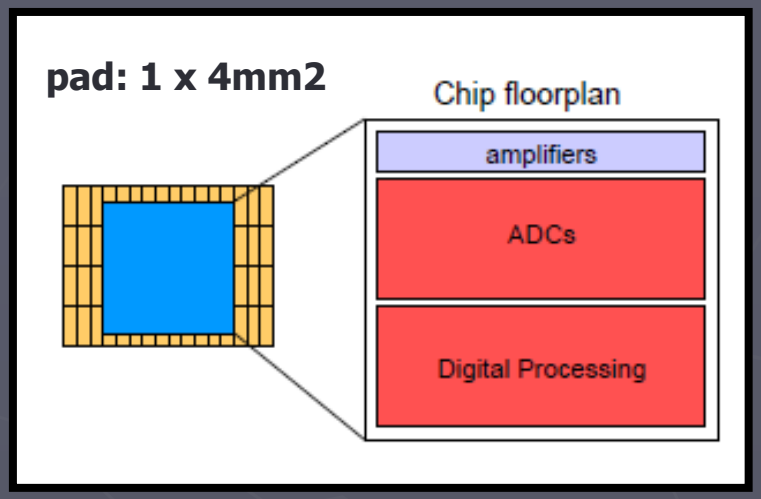
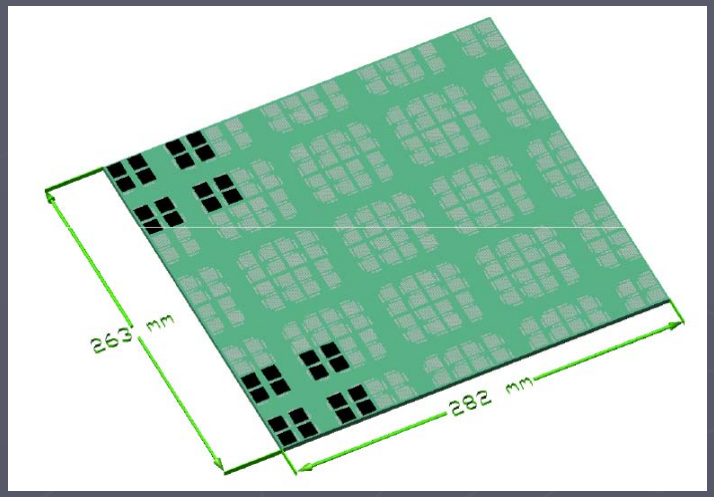
A. Junique, M. Mager, C. Patauner,
A. Ur Rehman, L. Musa

ILC (ILD) TPC

Concept of Advanced Endplate with S-ALTRO
LC (ILD) TPC with Pad Readout

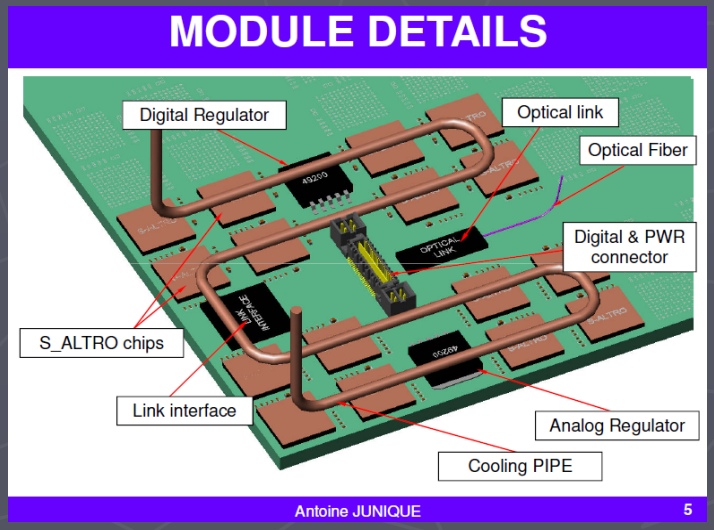




LAYER STACKUP

18 layer PAD PCB

MODULE DETAILS

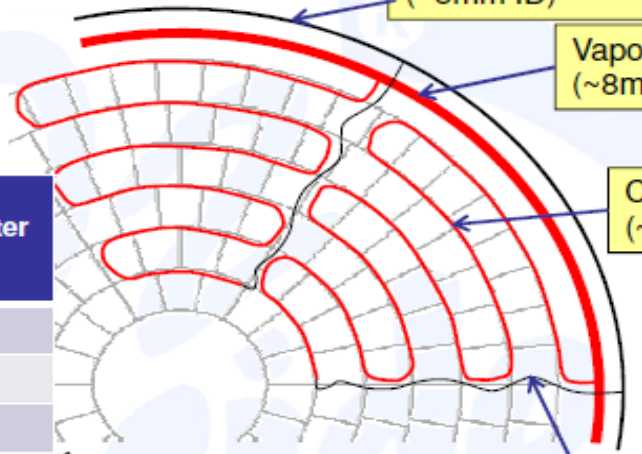


With 2-phase CO2 cooling

Concept of Endplate Cooling
2PHCO2 Cooling

TPC end plate cooling tube routing

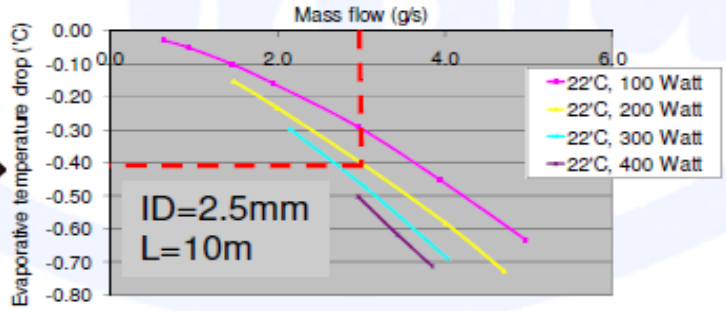
Possible layout of the 6 loops option



	Qty Frames / loop	Heat load per loop (W)	Tube length (m)	Inner diameter (mm)
1 loop	200	1000	48m	6.2
2 loops	100	500	24m	4.3
4 loops	50	250	12m	3
6 loops	34	171	8m	2.2

Similar to AMS-TTCS

AMS test data (2001)
0.4ºC temperature gradient



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