TPC Large Prototype (LP) Beam Tests

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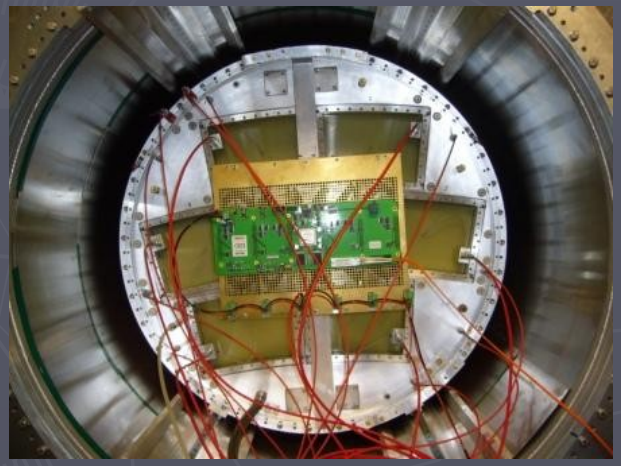
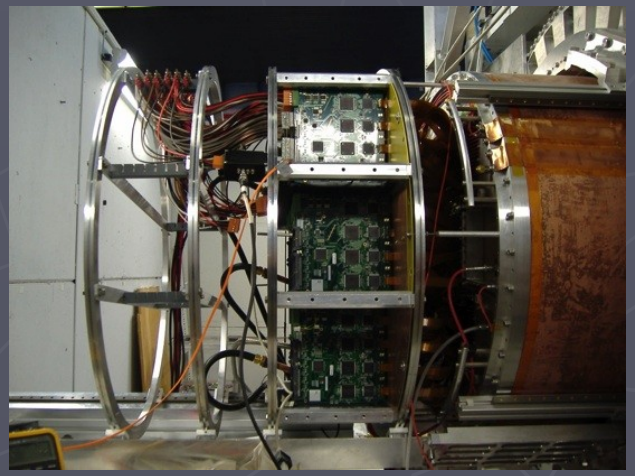
NIKHEF/DESY
(for LCTPC Collaboration)

ALCPG 2011, Eugene

TPC Large Prototype Beam Test (LP1) at DESY T24-1 Beam Line



With a MicroMEGAS module readout by T2K electronics



With three GEM modules readout by PCA16-ALTRO electronics

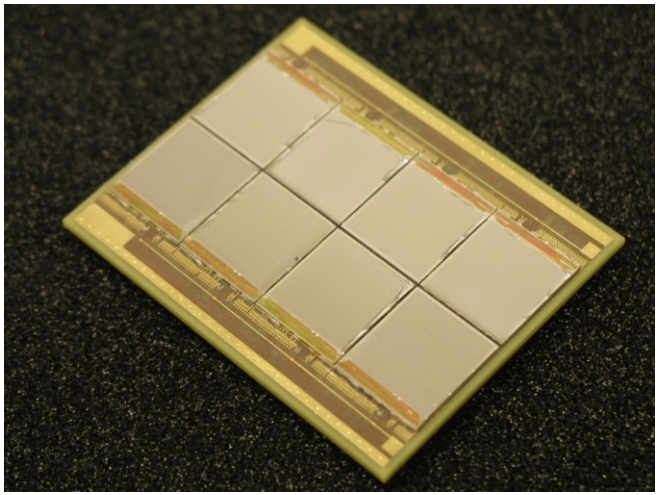
TPC Large Prototype Tests: LP1

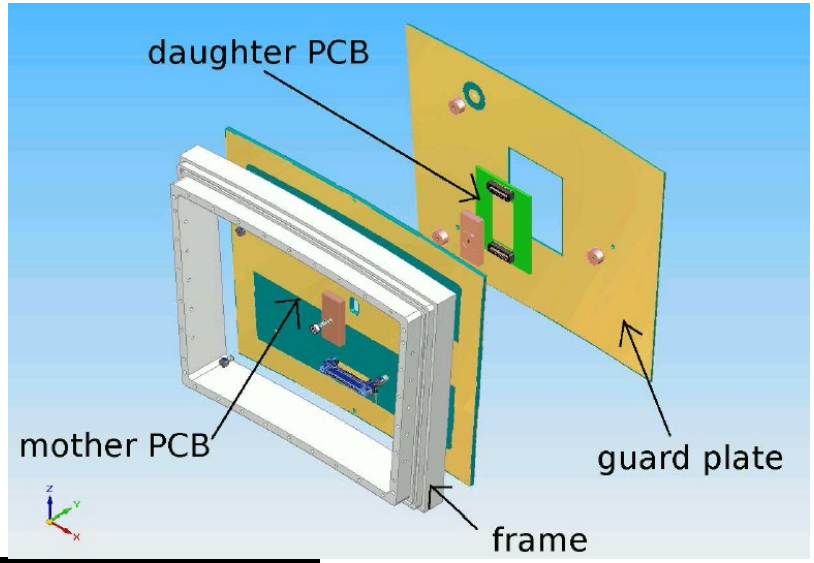
2008:	
Nov-Dec	MicroMEGAS modle w/ resistive anode (T2K electronics)
2009:	
Feb-Apr	3 Asian GEM Modules w/o Gating GEM (3,000ch ALTRO electronics)
Apr	TDC electronics with an Asian GEM Module
Apr-May	Maintenance of PCMAG
May-Jun	MicroMEGAS w/ two different resistive anodes (New T2K electronics)
	Setup and test of laser–cathode calibration
Jun	GEM+Timepix (Bonn)
Jun	Installation of PCMAG moving stage and SiTR support
July	TDC electronics with an Asian GEM module
	ALTRO electronics study w/ an Asian GEM module
July-Aug	Full installation of PCMAG moving stage
Aug	MicroMegas w/o resistive anode with laser-cathode calibration
Sept	A Bonn GEM module (A small aria GEM with ALTRO electronics)
Nov	MicroMEGAS with SiTR
2010:	
Feb	MicroMEGAS using PCMAG movable table.
March and Sept	3 Asian GEM modules w/ gating GEM or a field shaper) using the PCMAG movable table (7616ch ALTRO electronic)

Activities in fall/winter 2010/11

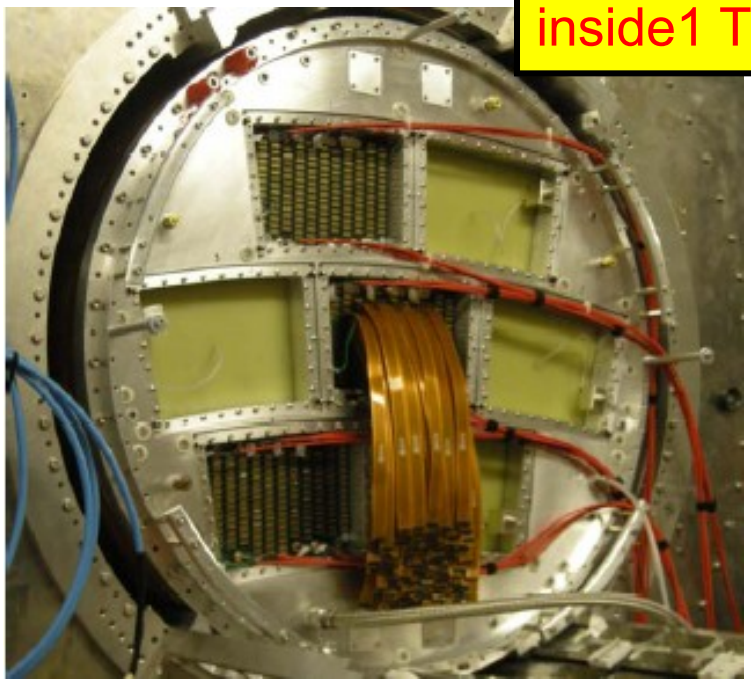
- Octopuce (= 8 Ingrids) test on LP with 1T magnet in December Saclay/Nikhef
- DESY 3-GEM module test on LP (B=0) together with Lund group
- S-Altro16 arrived; waiting for test results; Lund group preparing module layout
- New AFTER electronics for Micromegas: first card(s) operational; 1st module test at LP late April
- Continued engineering studies for new endplate (Cornell)
- Preparation cooling and power pulsing tests (Japanese groups)
- PCMAG upgrade in preparation (cryo coolers, He gas compressors, water chiller); work to be done Aug'11-Jan'12

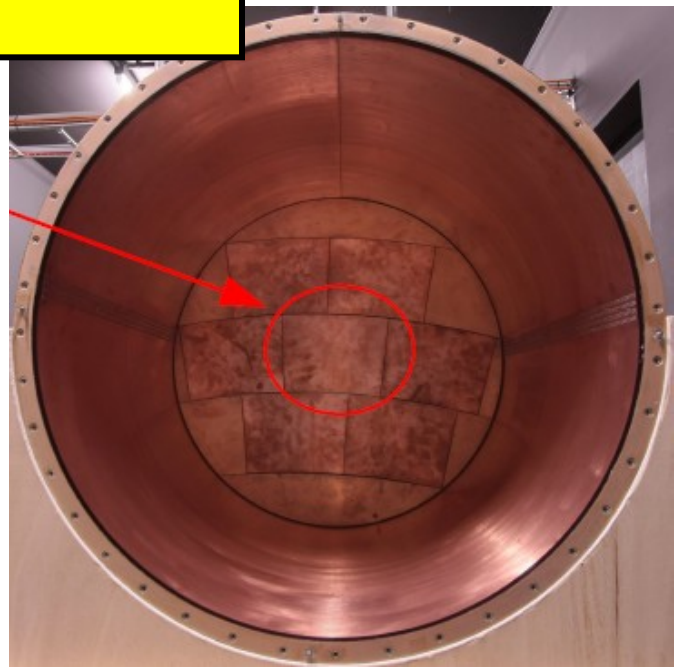
8 Ingrids on daughter board





LPTPC with 7 detector slots inside1 T solenoid

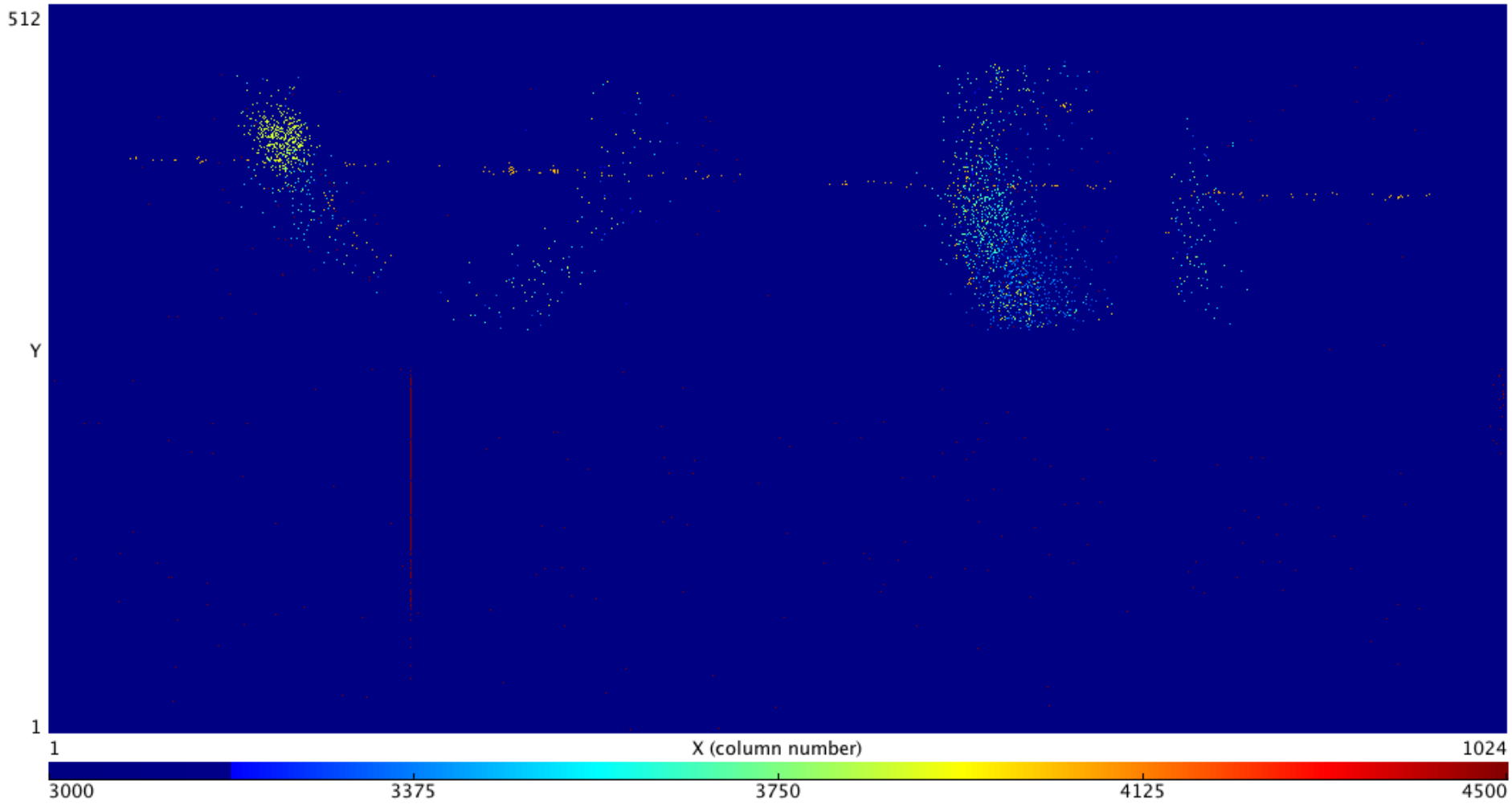




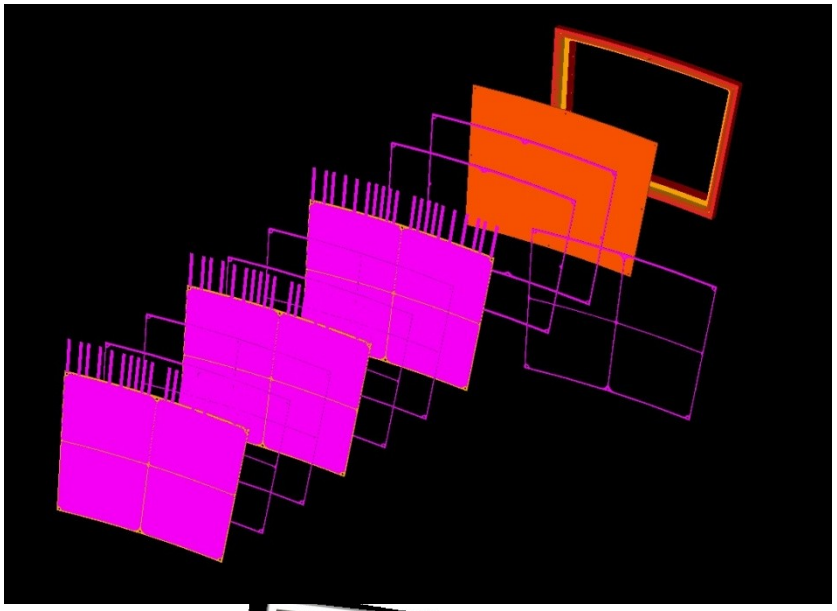
The last trigger taken: 4 Dec 2010, 11:06

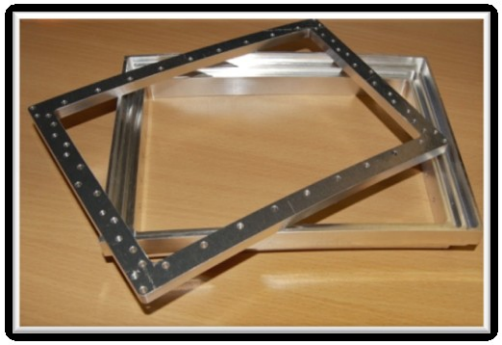
He/iC_4H_{10} 80/20 V_{grid} = -400 V B = 1 T

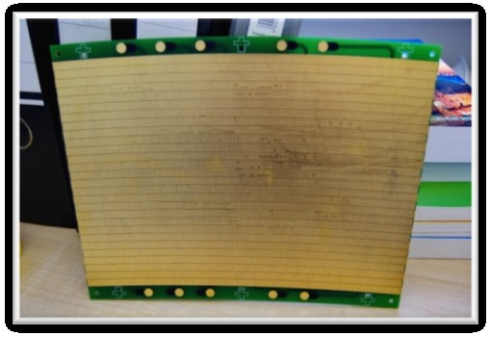
(5 GeV beam electron with two delta curlers)

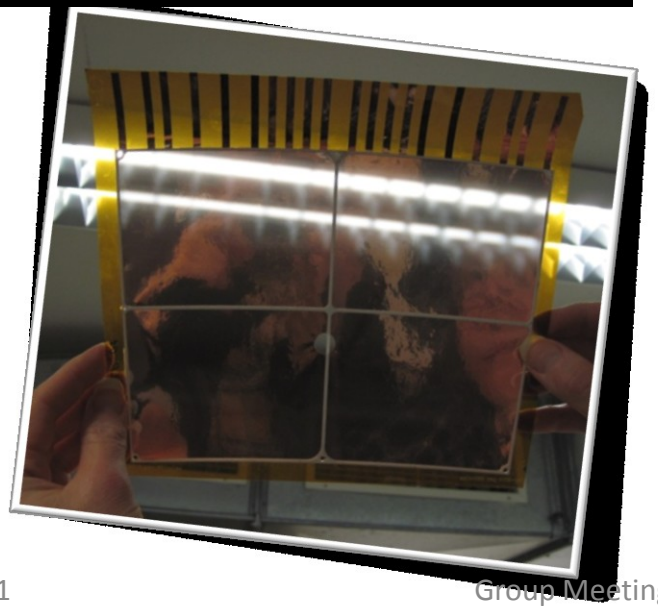


DESY GEM MODULE

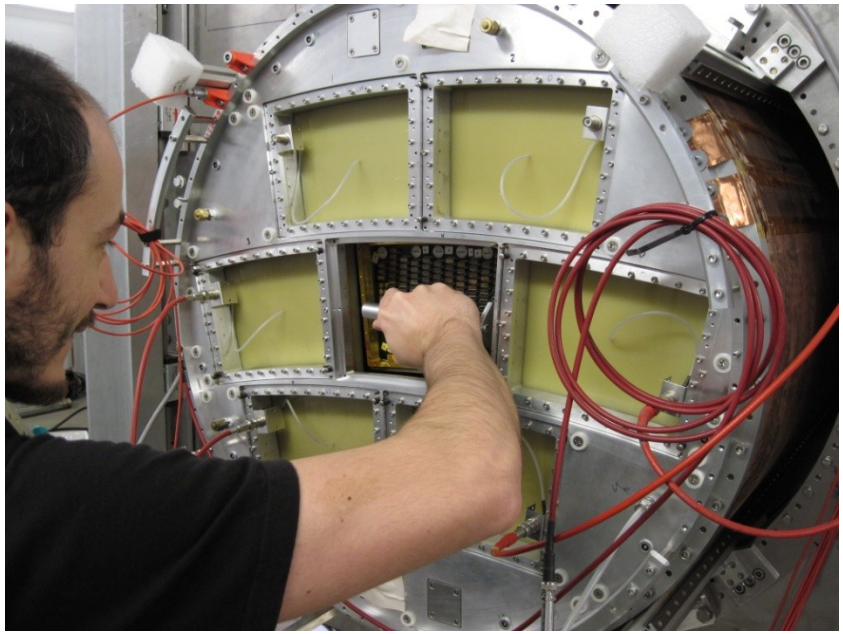




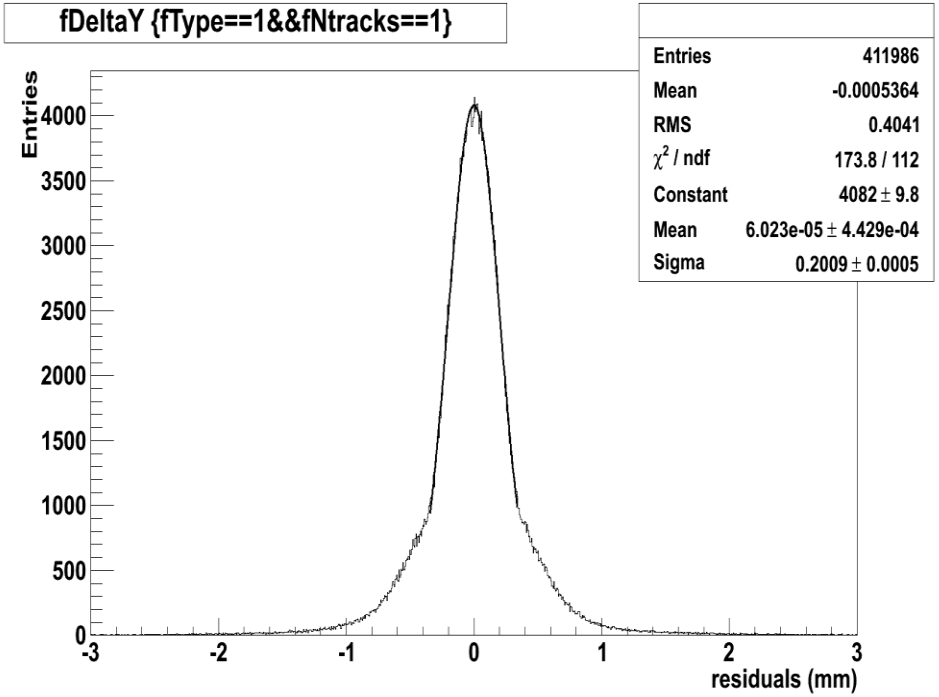


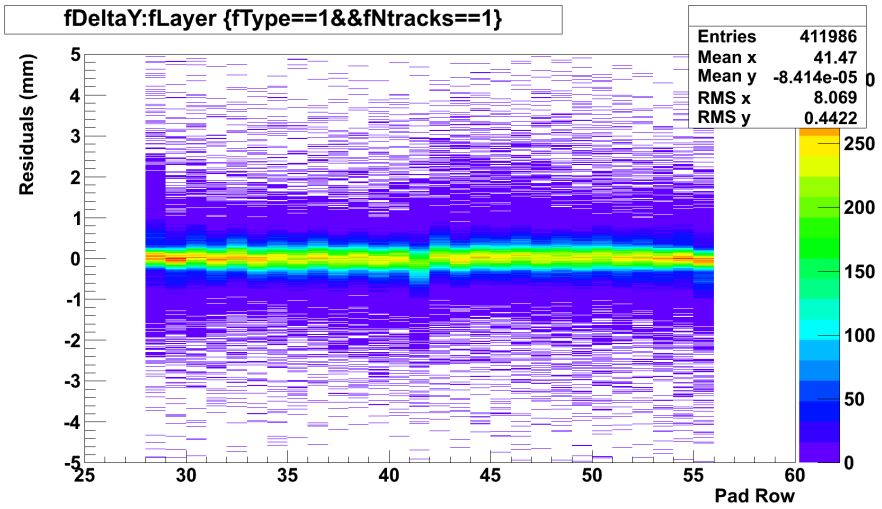


Mounting the DESY GEM module on LP



A FIRST LOOK AT THE DATA





Point resolution ~200 um at 15 cm with no magnetic field

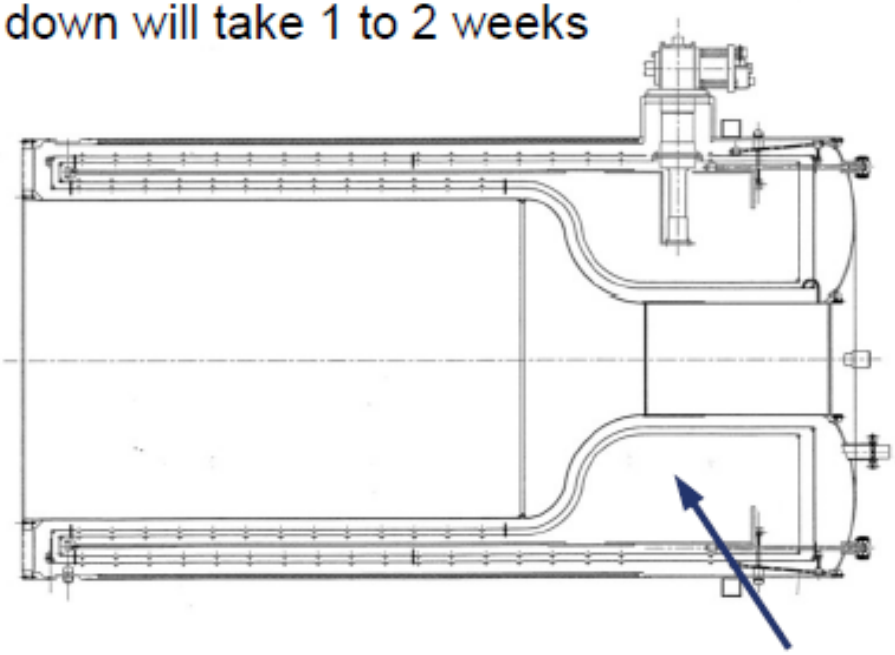
No evident track distortions

2011 beam tests with LP

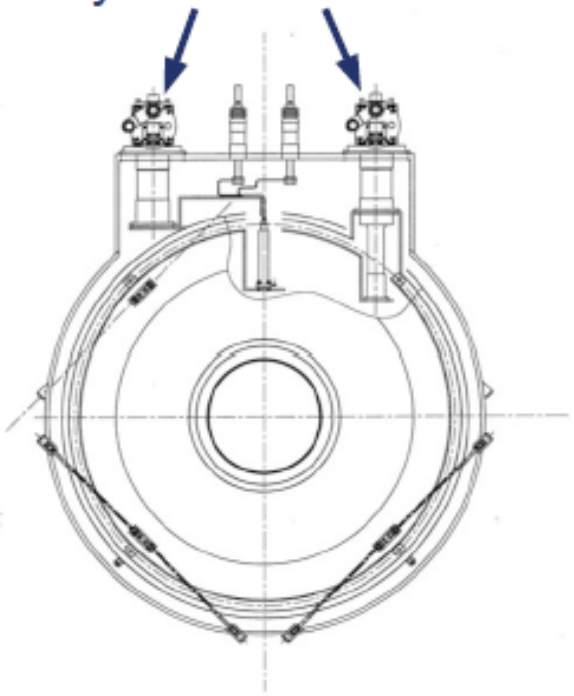
- April/May: first Micromegas module with new AFTER electronics
- April/May: DESY 3-GEM module
- June/July: Asian 2-GEM modules
- June/July (maybe): 2nd Octopuce module
- Late 2011/early 2012 (B=0): 7 Micromegas modules w. AFTER electronics
- Tests with new S-Altro16 electronics

PCMAG Upgrade Details

- Outer size of PCMAG will stay unchanged
- Two cryo modules will be added to vacuum vessel:
  - One two-stage cooler for the coil and the radiation shield (4 resp. 50 K)
  - One for the copper current leads (50 K)
- Helium gas compressors and a water chiller will be placed next to the setup
- Cool down will take 1 to 2 weeks



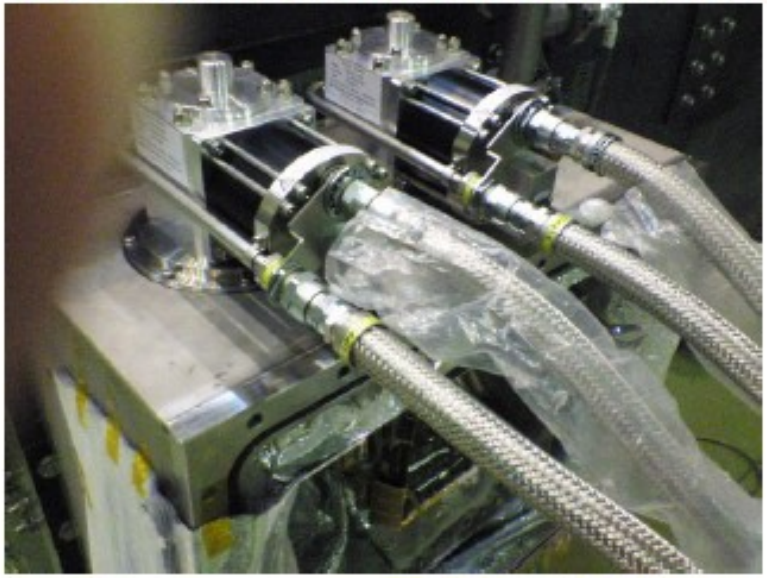
cryo modules will be installed



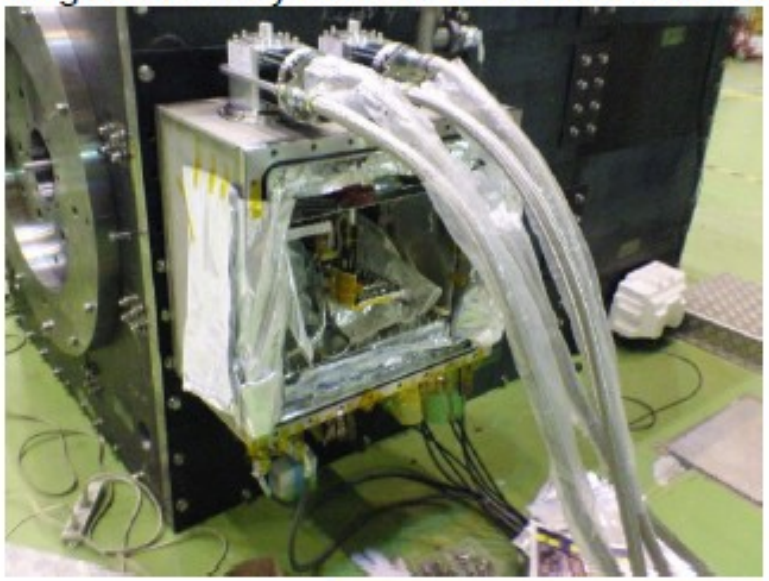
reservoir will be removed

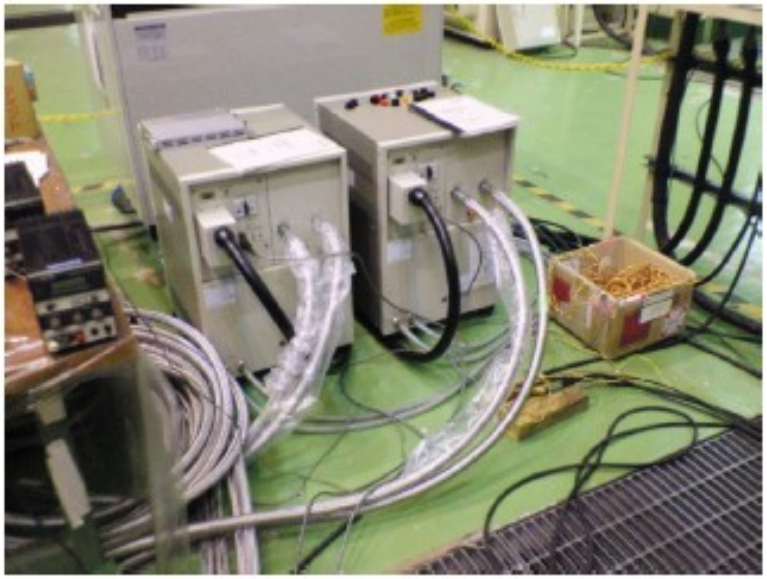
Example with PCMAG Coil

2 cryo coolers (50K, 4K) mounted on chimney



Magnet chimney with the 2 coolers on the side





Helium gas compressors
for the 2 cryo coolers

Water Chiller behind
the two compressors

TPC Large Prototype Beam Test from 2012: LP1 →LP2

Advanced endplate:

Material thickness < 25%Xo for PFA
the requirement of 15%X_0 may be relaxed to 20-30%
based on a recent PFA study of jet energy resolution.

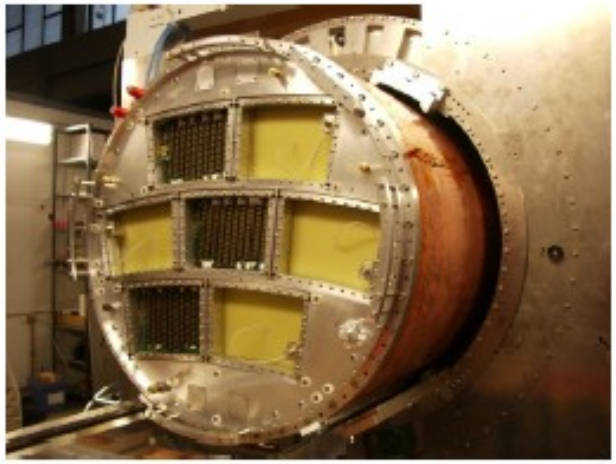
Thin endplate:
Light mechanical-structure of endplate.
LP Modules of high density, low power electronics to match with smaller pads (1 x 4mm): S-ALTRO electronics

Issue of power delivery, power pulsing, and cooling (2-phase CO2) with S-ALTRO mounted in the back of each module (iclude an option of direct mounting on the backside of the pad plane)

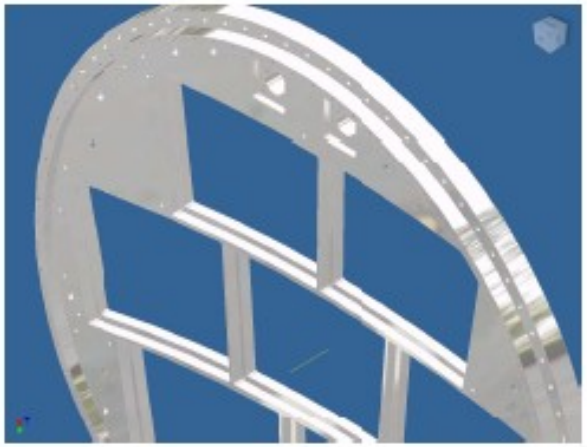
Ion Feed back and Ion disks:

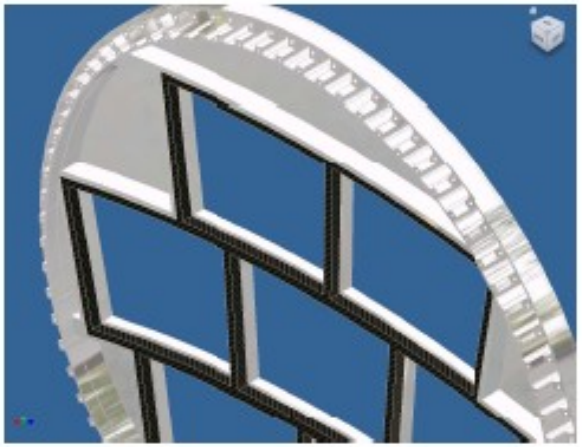
Estimate distortion due to the ion disks
→ Most probably needs a gating device
Options of gating device: Wire gating, GEM gating and others.

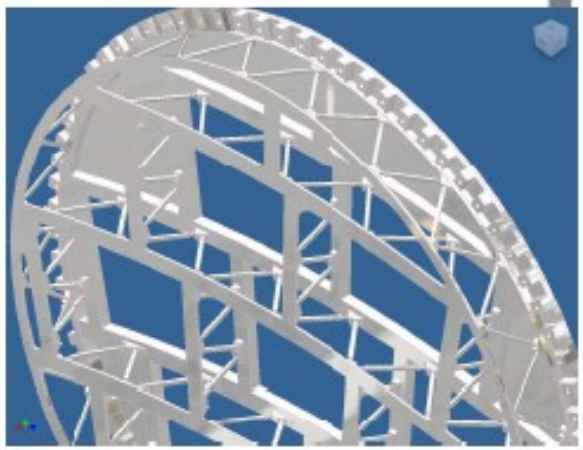
Large Prototype: from EUDET to AIDA



LP1 assembled with current and fieldcage







Current LP1 endplate mechanical structure (EUDET)

Designs for an advanced endplate for the LP: prototyping for the real thing: AIDA **Cornell**

2012 beam tests with LP1→LP2

- Continue LP1 tests (B=1T) at DESY T24 beam, while preparing LP2 with advanced endplate
- LP2 with advanced endplate tests at DESY

- Possibly go to hadron beam (10-100 GeV/c) late 2012/ early 2013 for few months.