

Time Projection Chamber

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TPC task in EUDET:

- development and building of a field cage (DESY)
- HV and slow controls facility (DESY, Rostock)
- prototyping of a compact new readout electronics (Lund, Rostock, CERN)

Time scale:

month 12: pre-amplifier

month 18: field cage available

month 24: DAQ prototype available

month 48: compact readout system prototype available

Goal

Develop and set-up a facility to enable efficient R&D towards
a ILC-TPC

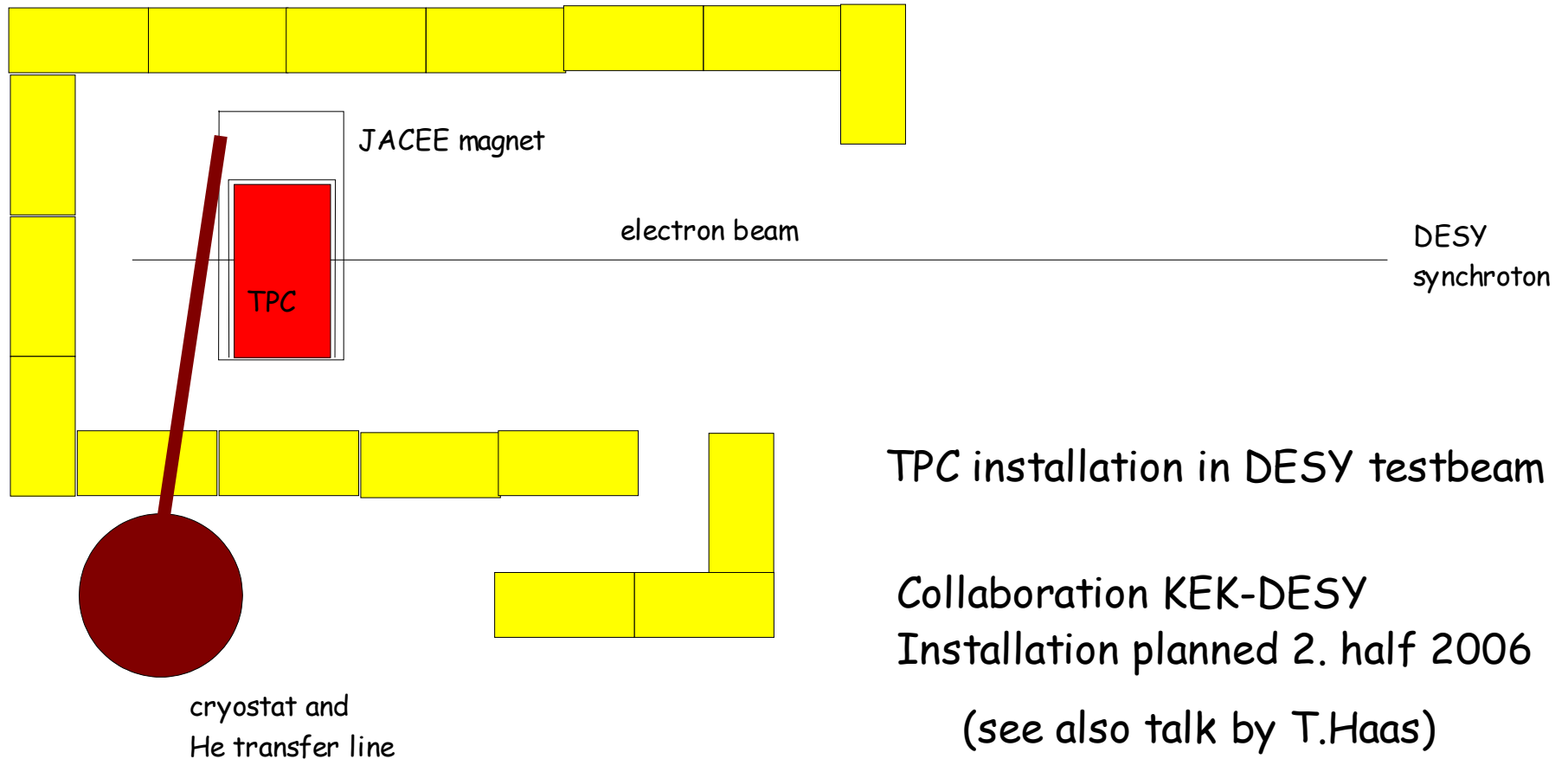
Generic Field Cage

Infrastructure (HV, Gas)

Electronics

R&D groups from the community: utilize the infrastructure for endcap
and performance studies and tests

The TPC facility: Phase 1



TPC installation in DESY testbeam

Collaboration KEK-DESY
Installation planned 2. half 2006

(see also talk by T.Haas)

Fieldcage Plans

Main parameters:

should fit into the magnet (part of the JRA1 package)
(inner bore 85cm, length of field (1.2 T) 1m)

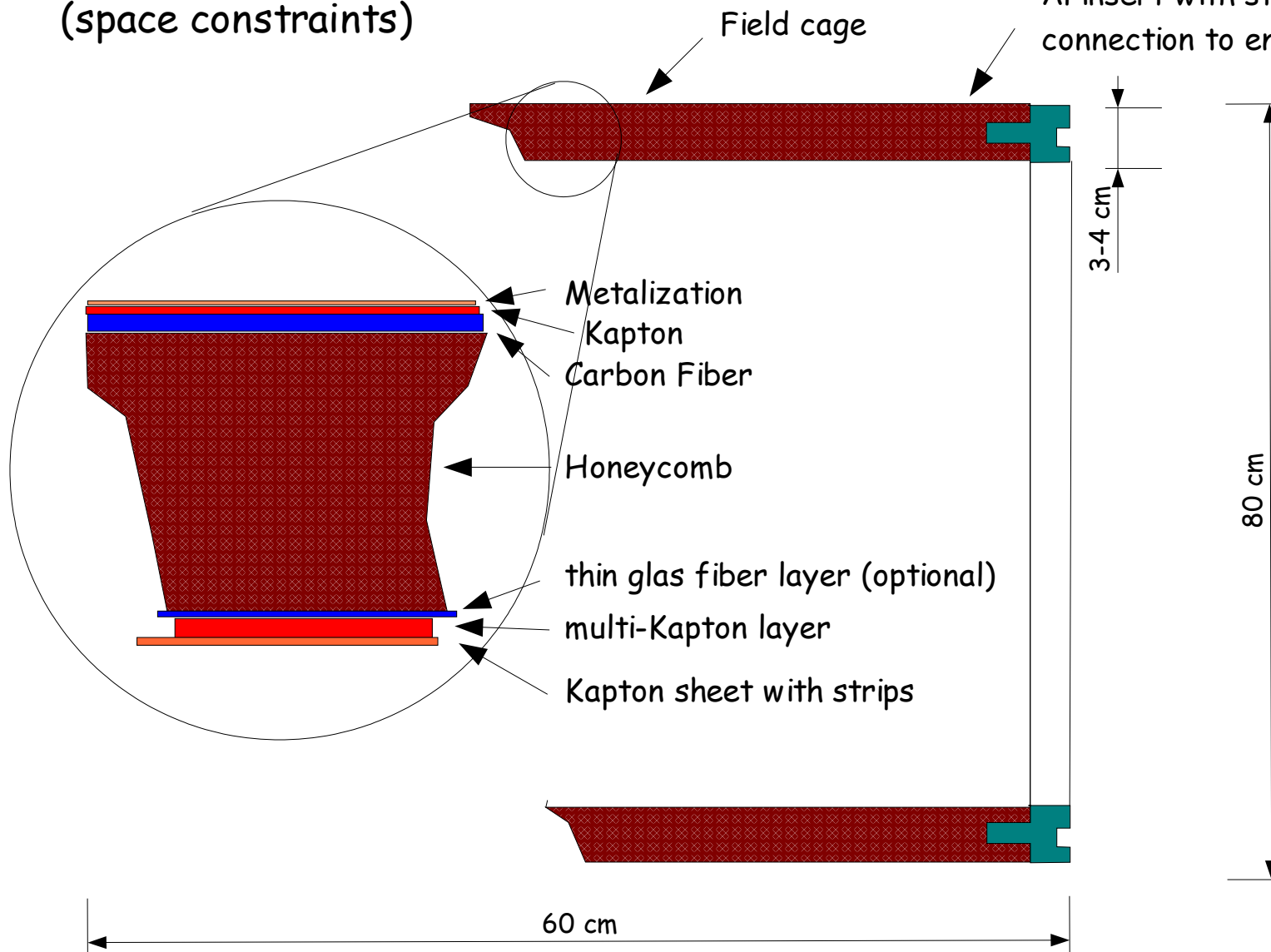
„generic“ fieldcage to be used for different end-cap technologies

field cage realistic to test structure and HV behaviour
end plate as realistic as possible to test MPGD behaviour
cathode not realistic in first iteration,
but possibility to make a realistic version should exist

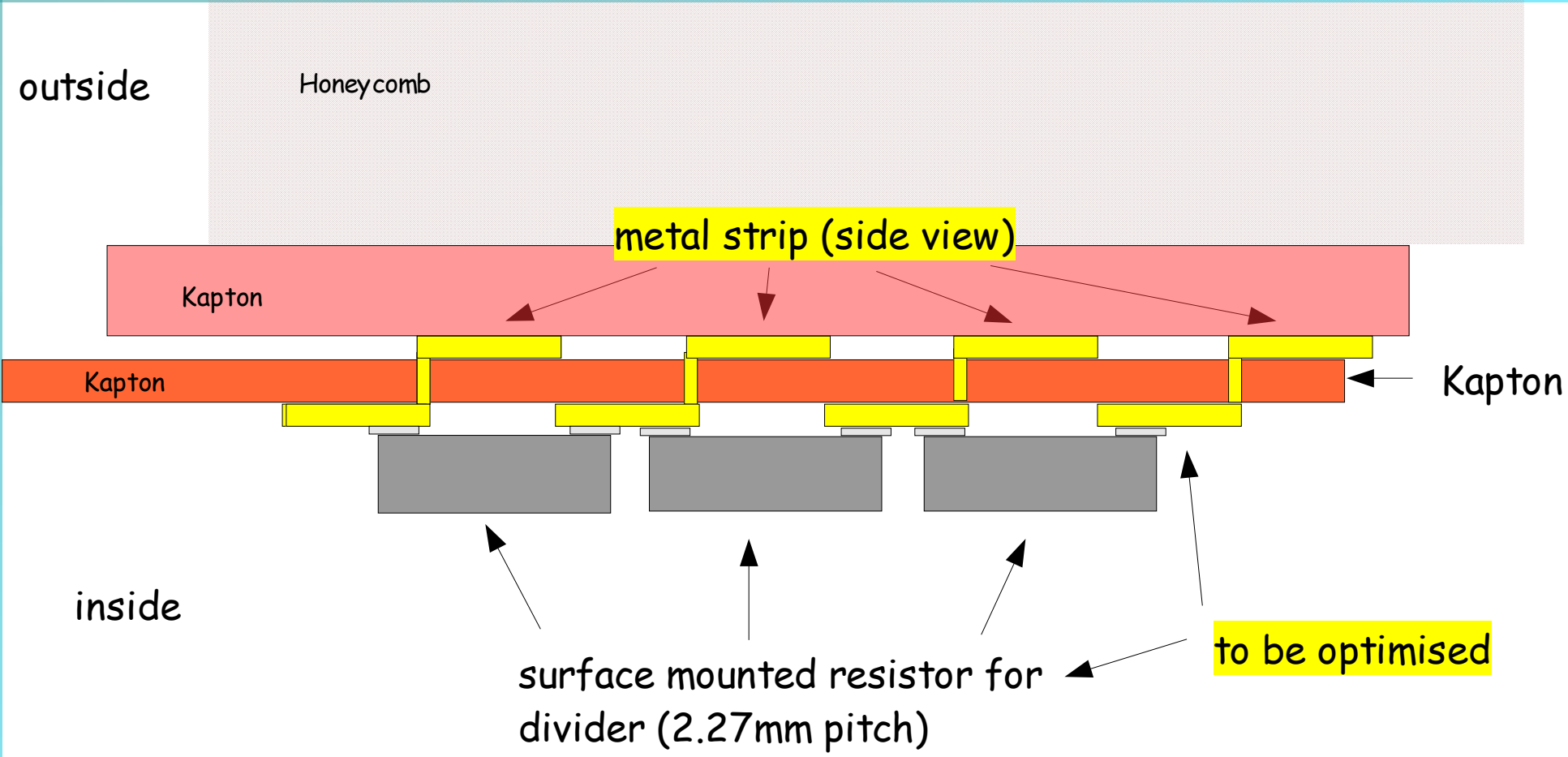
Field Cage design

Basic design: solid wall fieldcage
(space constraints)

Al insert with standardized
connection to endplate



Field Strips



Field divider through surface mount resistor chain (no external feedthroughs needed)
(needs rather fine grid - to be discussed)

based on DESY MediTPC field cage design

Work Plan

First half 2006: design field cage, iterate with EUDET and LC-TPC on the design and the parameters

do some calculations to estimate the mechanical strength

do some tests on the field cage structures (HV stability, mechanical stability)

Second half 2006: develop „production“ facility at DESY to wind the fieldcage

First half 2007: build the field cage, commission it

Summer 2007: field cage ready to be used

The Team

DESY TPC group is committed to design and build this field cage:

one PhD just started who will concentrate on this work

plan to hire one postdoc during 2006 to take a leading role in this work

Explore possibility to collaborate with other groups:

University Siegen (not yet an EUDET participant)

St Petersburg

Obninsk

Utilise experience from DESY and Aachen on small field cage production

Electronics

Readout electronics:

need to be able to measure the arrival time of electrons on the pads

need to be able to measure the charge per „hit“ (clutser?)

Traditional approach: (Lund/ CERN)

→ FADC readout for timing and charge information

Alternative approach: (Rostock)

→ TDC based system (measure charge through timing system)

The FADC approach

Proposal (preliminary):

pre-amp-shaper chips: programmable ASIC developed at CERN

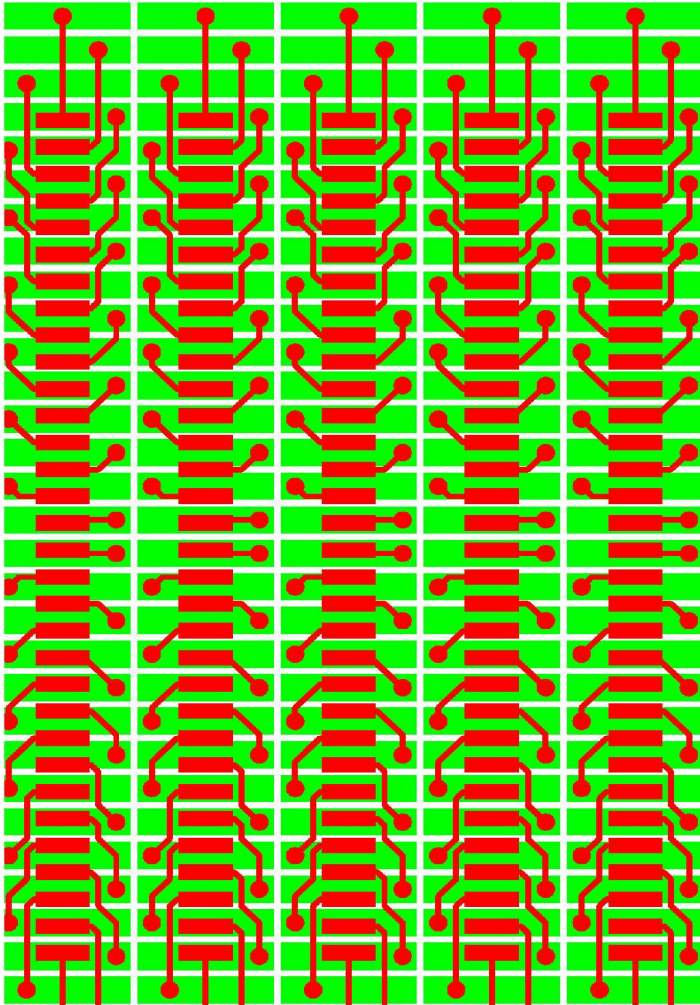
digitizes: modified version of the ALTRO chip (40 Mhz sampling rate)

Proposed footprint:

2x4 mm² pitch for the pads (0.1mm separation between neighbours)

instrument 2046 channels (= 9x9 cm²)

The endplate layout



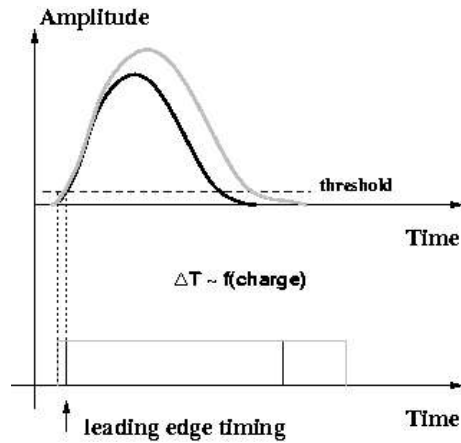
pads are connected to high density connectors

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interface to the outside world

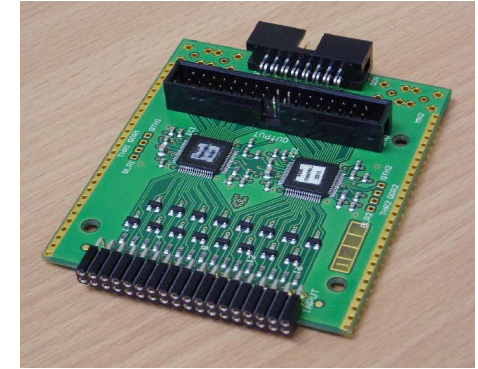
need careful specification of the pad plane and of the mechanical constraints.

The TDC approach

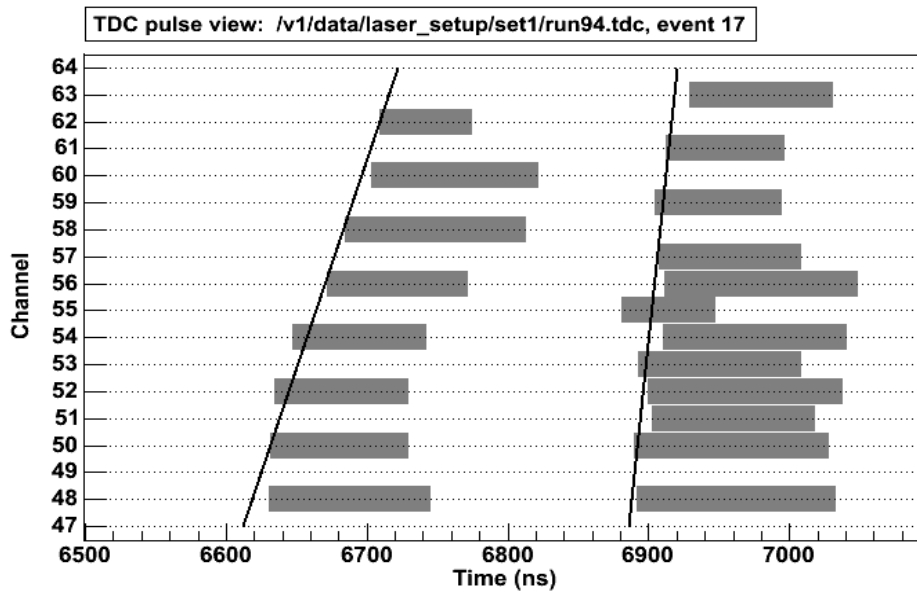


The time of arrival is derived using the leading edge discriminator.

The charge of the input signal is encoded into the width of output digital pulse.

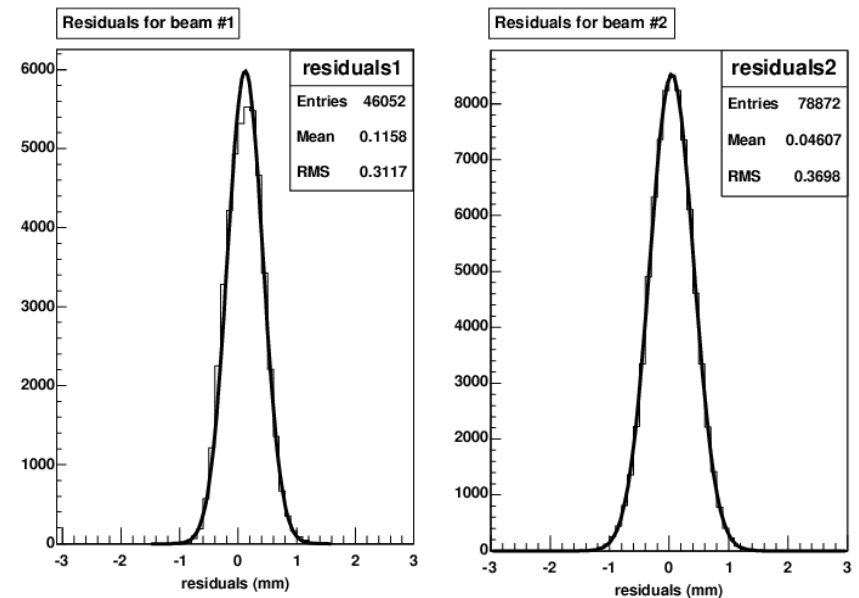


16 channel ASDQ board: preamplifier and charge-to-time converter



Event display.

Two tracks (from wedge) induced by laser. Arrival times are corrected on the *time walk* of discriminator.



Calculated residuals for all hits.
RMS ~0.3 mm (in drift direction)

Summary

- The EUDET TPC facility aims to provide an infrastructure to ease TPC R&D for the ILC
- A central part is the field cage, which is under development
- Electronics is being designed in collaboration between Lund and CERN
- An alternative Ansatz is being followed by Rostock

Close cooperation with JRA1 and with LC-TPC is essential!