VFCAL Report

W. Lohmann, DESY

Laser alignment system

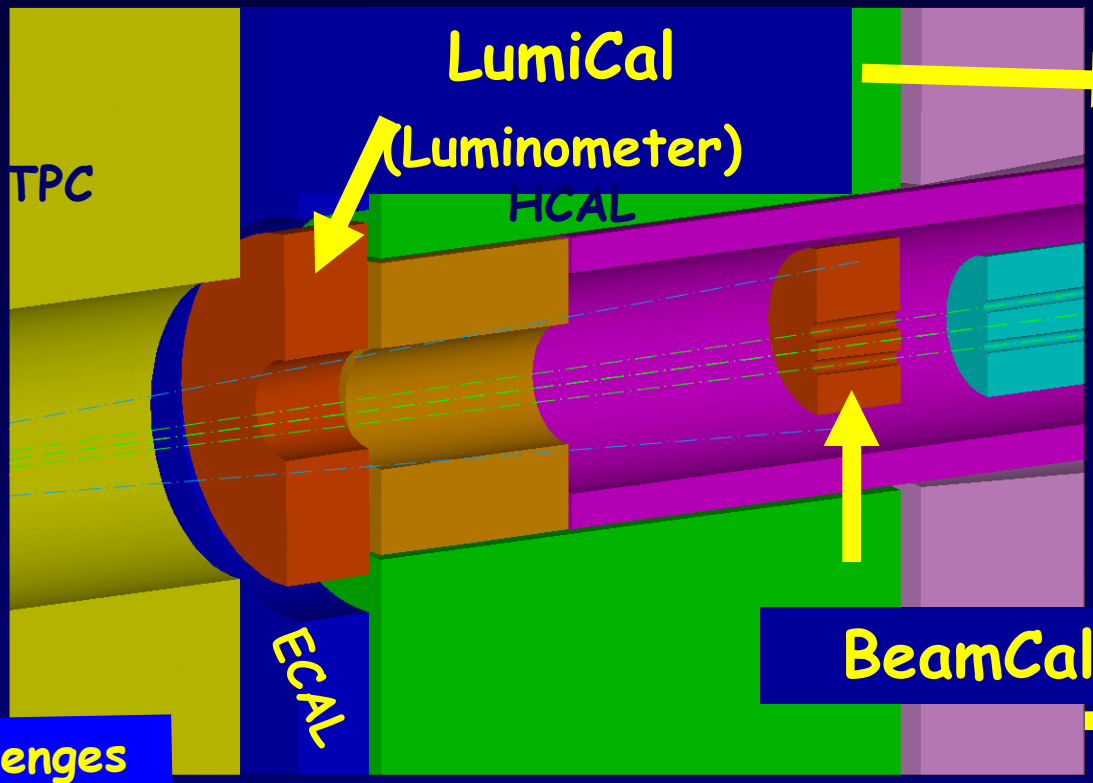
Infrastructure for sensor diagnostics

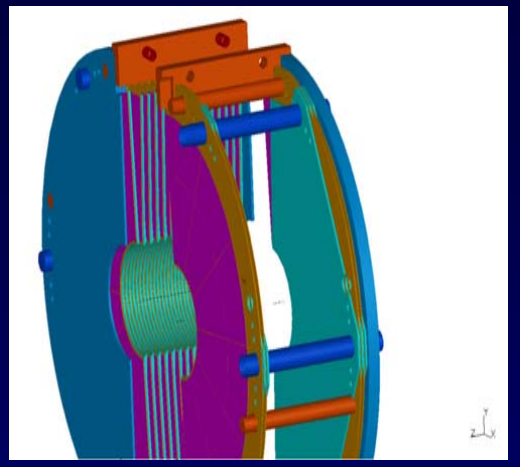
Sensor test facilities

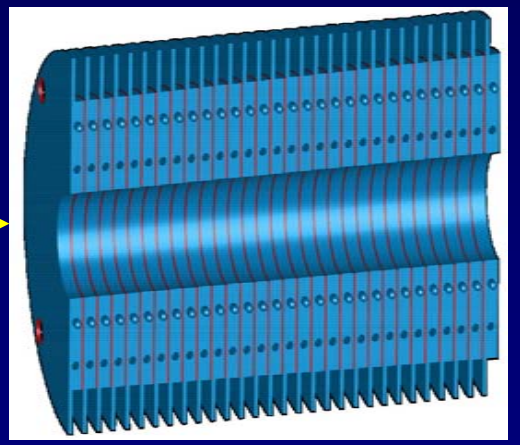
FE design

Labs involved: Cracow UST, Cracow INP,
Prague (AS), Tel Aviv Univ.
DESY (Z.)

Current design (Example LDC, 14 mrad):







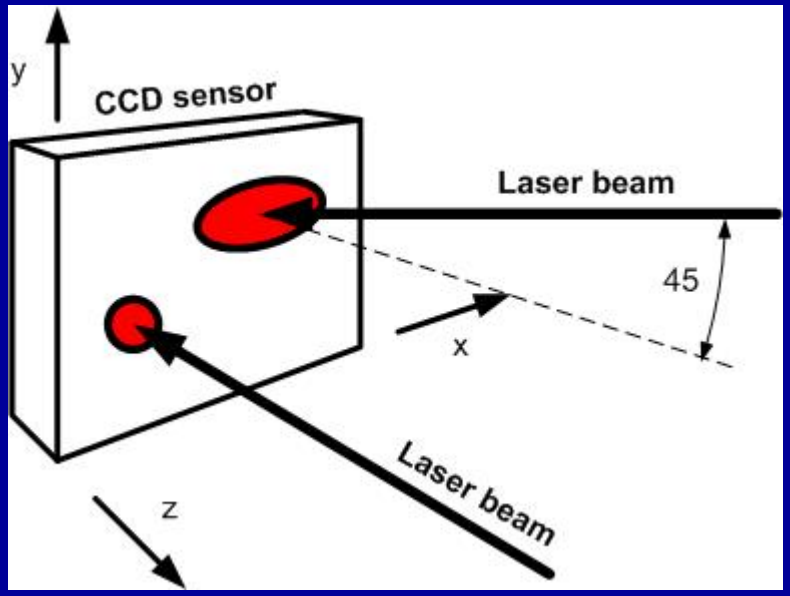
Challenges

LumiCal: -control of position on ~10 μm level
-control of the inner acceptance radius on ~μm level

BeamCal: -radiation hard sensors (~10 MGy/year)

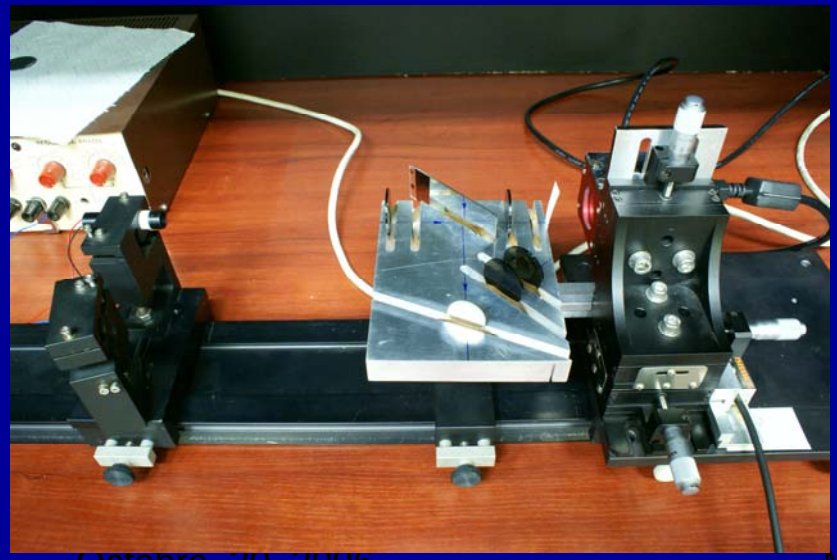
Both: -compact (smallest possible Moliere radius)
-readout after each BX

Laser alignment system

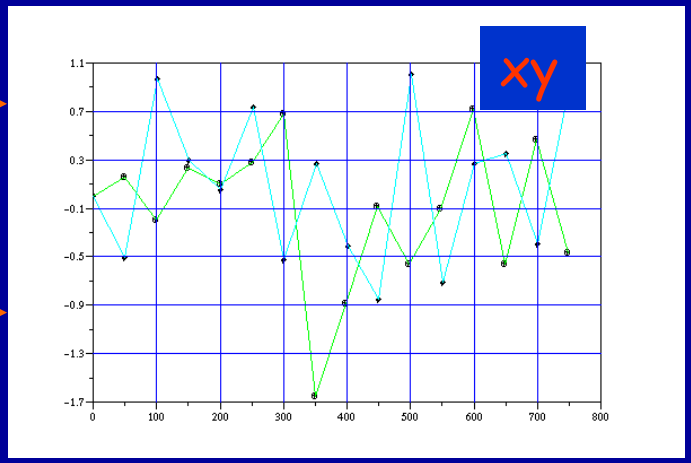


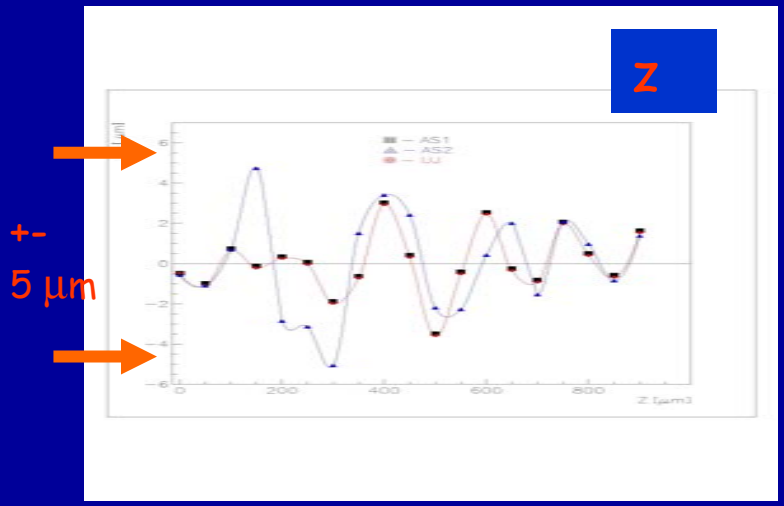
Wojciech Wierba et al., INP Cracow

Two laser beams (one perpendicular, second with 45˚ angle to the
sensor plane) allows to measure XYZ translation in one sensor



Results and Status





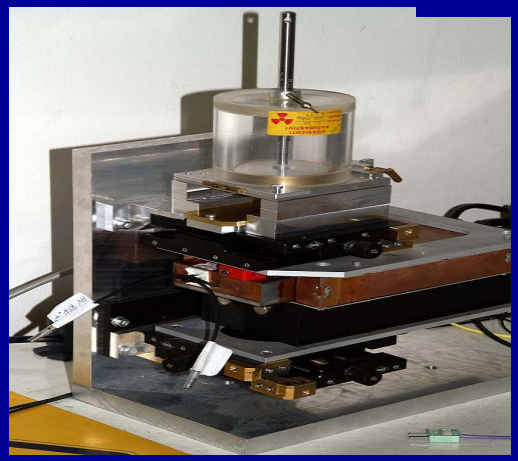
- New lasers with aspherical lenses – better spot.
- Setup with two lasers – avoid beam splitting
- Compact prototype – in progress (new person involved)
- Reference measurement of XYZ translations – Renishaw industrial system (0.1 µm resolution)
- Stability tests

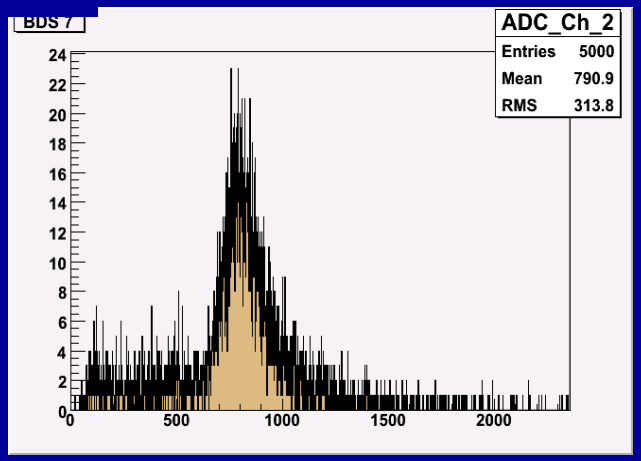
Infrastructure for Sensor Tests

How can we characterize a sensor?

- I/V measurement with both polarities
- C/V measurement (semiconductor (V_{dep} ?) or insulator?)
- spectrum for MIPs (charge collection efficiency)
- charge collection, leakage current etc. vs. irradiation dose
- …
- Always check calibration, data integrity, repeatability
- Bookkeeping of data: from files to a data base

Measurement of mip spectra





Infrastructure for Sensor Tests

Rooms (Cracow, DESY):

two rooms with filtered air (10k), stabilized temperature

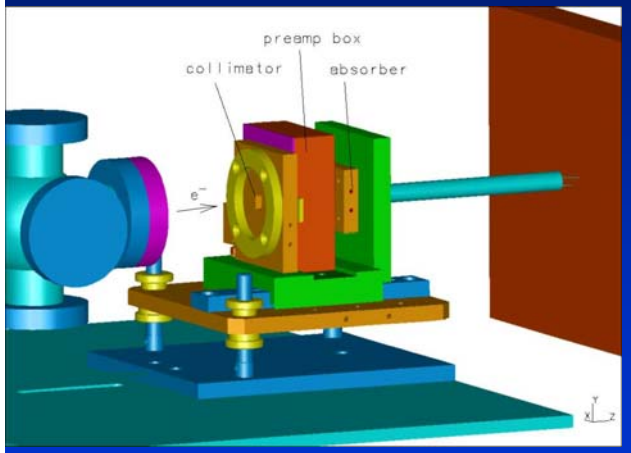
- room 1: bonding and assembly
- room 2: all measurements without radioactive source

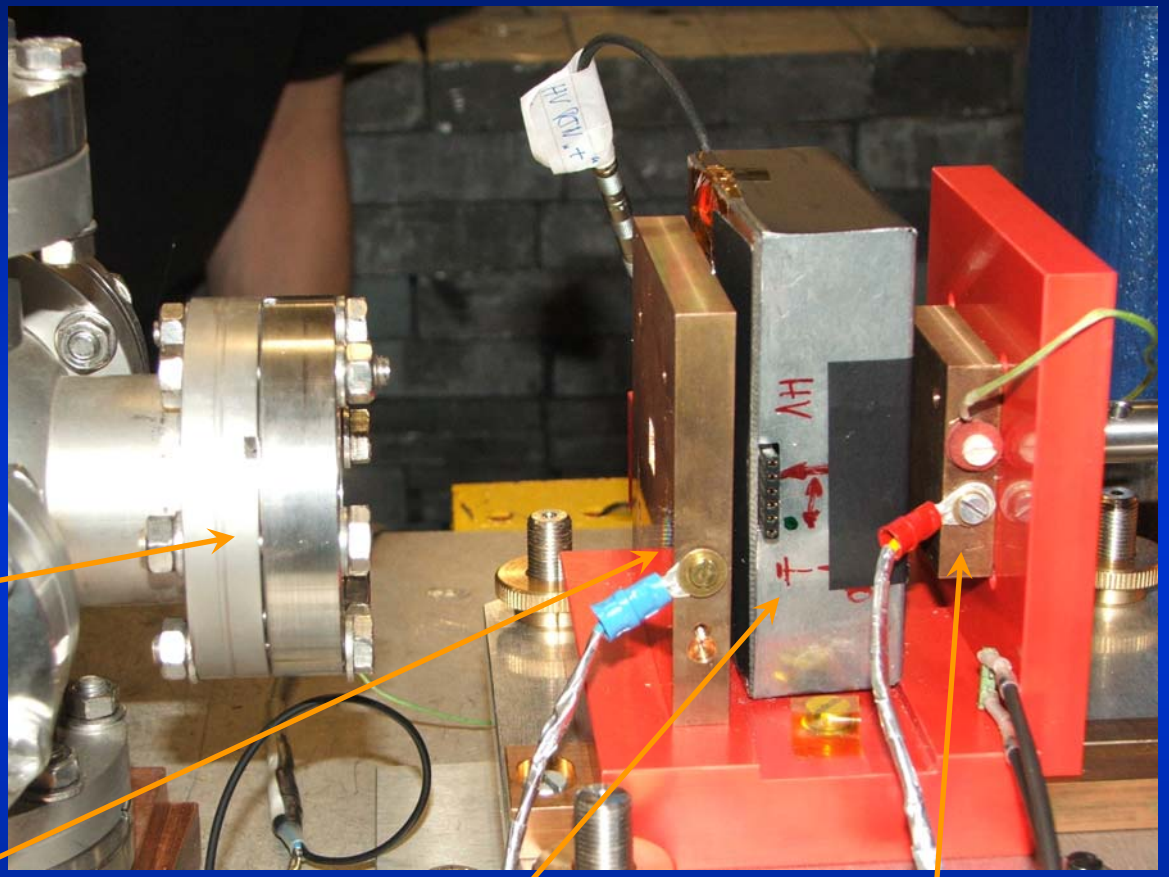
Instruments:

- manual prober in a shielded box (light, electrical screening)
- manual prober for probe cards (chip testing)
- microscopes with a large object distance
- manual bonding machine with x-y computer control
- glueing tools, oven etc.
- computer controlled instruments (I, C, V, V and I

Prob Station in TA

Test Beam Equipment





exit window of beam line

collimator (I_{Coll})

sensor box (I_{Dia}, T_{Dia}, HV)

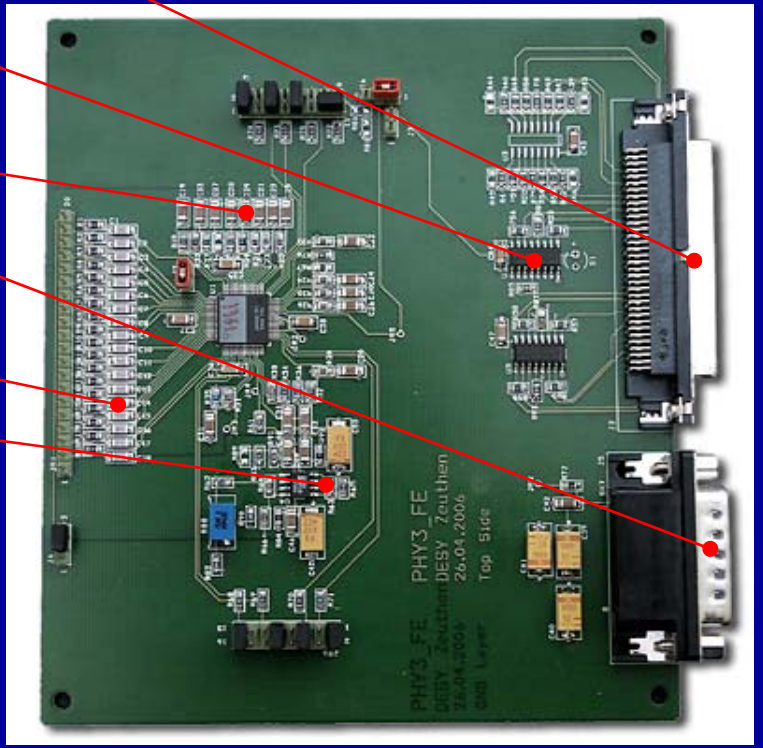
Faraday cup (I_{FC}, T_{FC})

FE design and studies

H. Henschel, M. Idzik et al.,
Cracow Univ., DESY

Readout board for PHY3 chip with

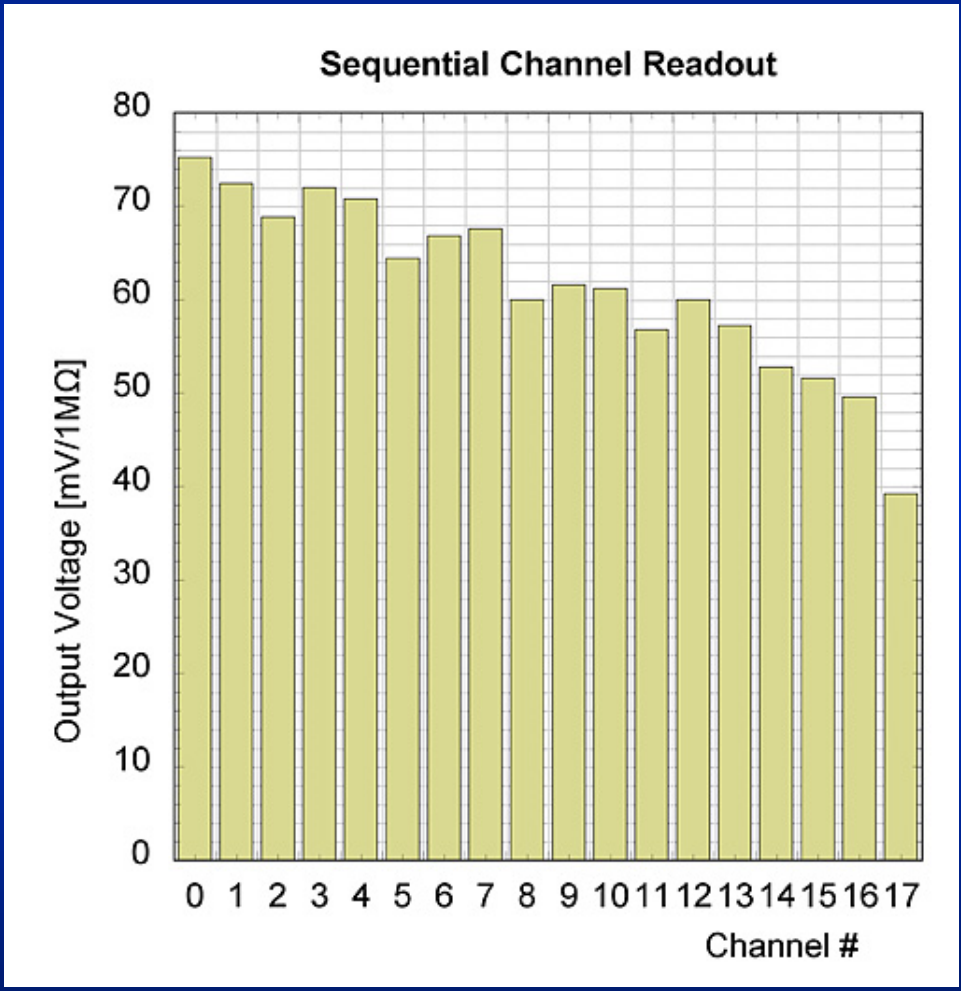
- control input/output
- level shifters
- biasing switches & networks
- power connector
- 18 FE inputs
- Amplifier



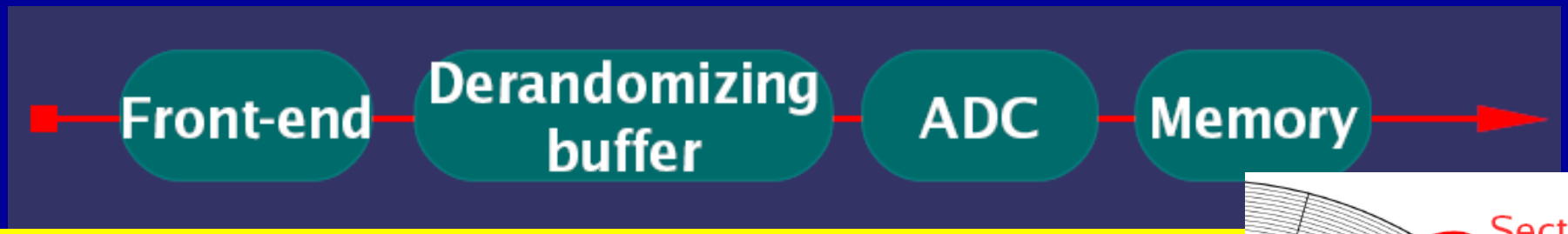
Testmeasurements with Phy3

Sequential Readout

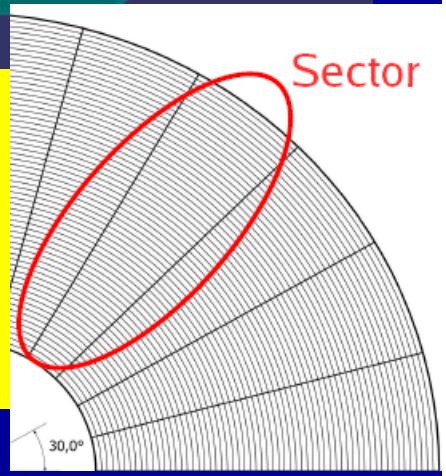
- definite charge of 0.33pC injected into one channel after the other
- readout with (slow) clock, hence considerable decay of captured charge is observed

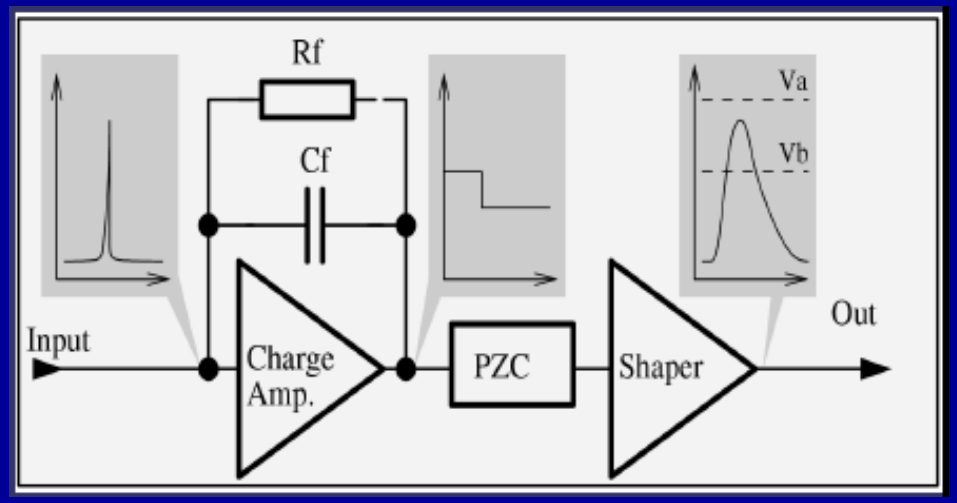


Future Design



- signal from 4 fC (mip) to 6 pC
- high occupancy – no multiplexing
- DC coupled sensors, Cdet 20 -120 pf + fanout (~1pF/cm)
- 300 (150) ns between bunches
- limited power dissipation (~10 mW/ch)





- Charge sensitive
- test and physics mode variable gain
- test mode: S/N ~ 10
  physics mode: > 11 bit
- Tpeak: 50-70 ns

Plans and Summary

- First prototype submission in 2-3 months
- Testbeam application planned
- More studies on general readout architecture necessary
- Compatibility with mechanics/cooling

First steps are done:

- Test beam equipment partially available and running, completion is ongoing
- Laser alignment 'proof of principle experiment' under construction
- Test facilities for sensors in Zeuthen and Tel Aviv; Zeuthen will be upgraded, Tel Aviv started to collect equipment
- FE electronics development started