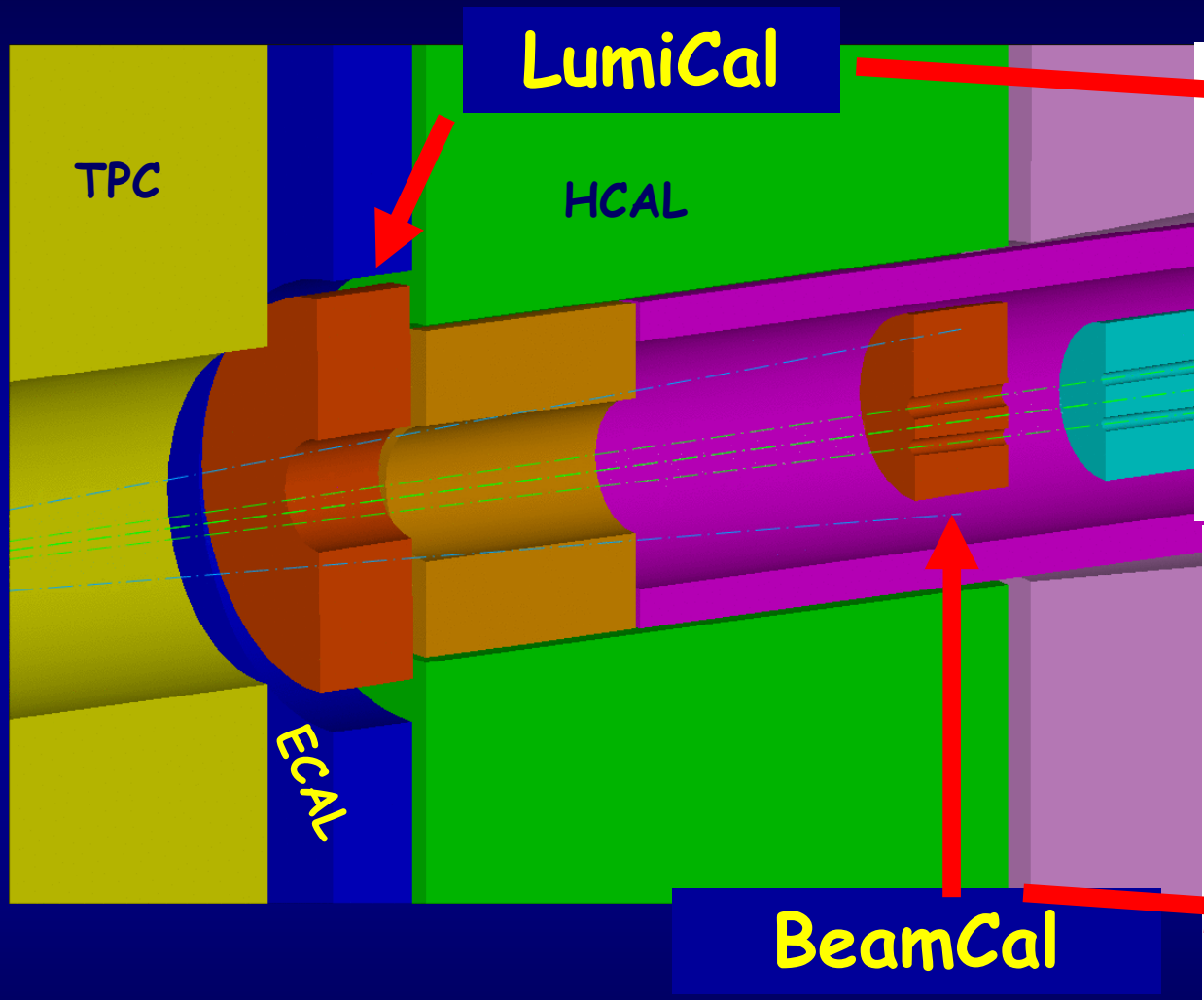
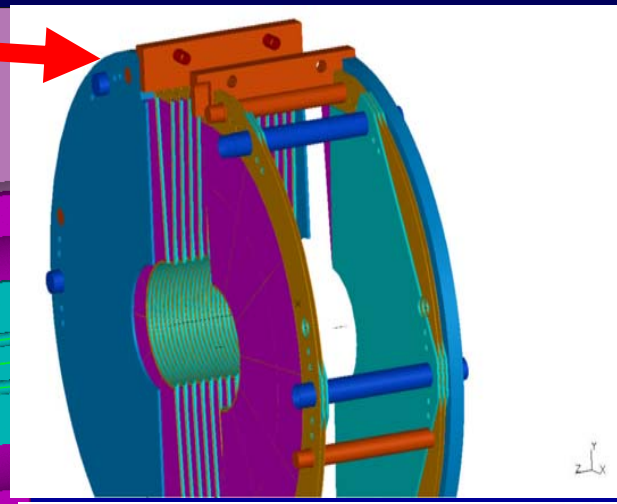
Testbeam plans for very forward detectors

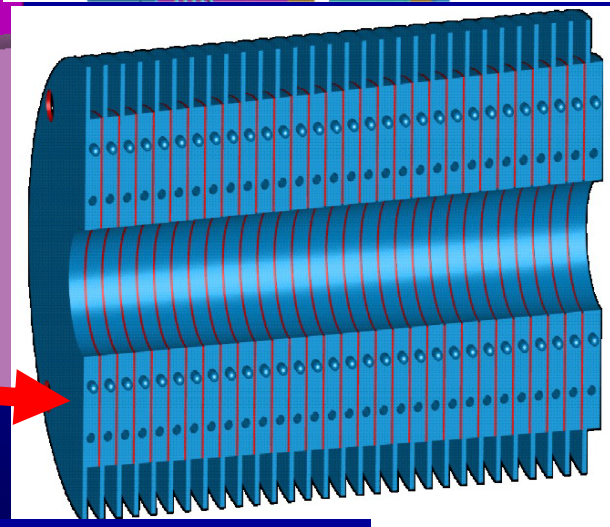
Wolfgang Lohmann, DESY

BeamCal, GamCal and LumiCal

Current design (Example LDC, 20 mrad):





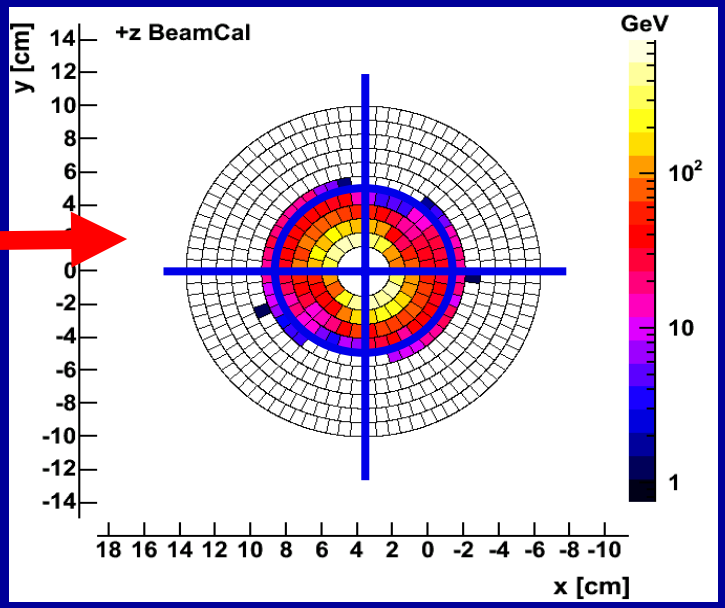


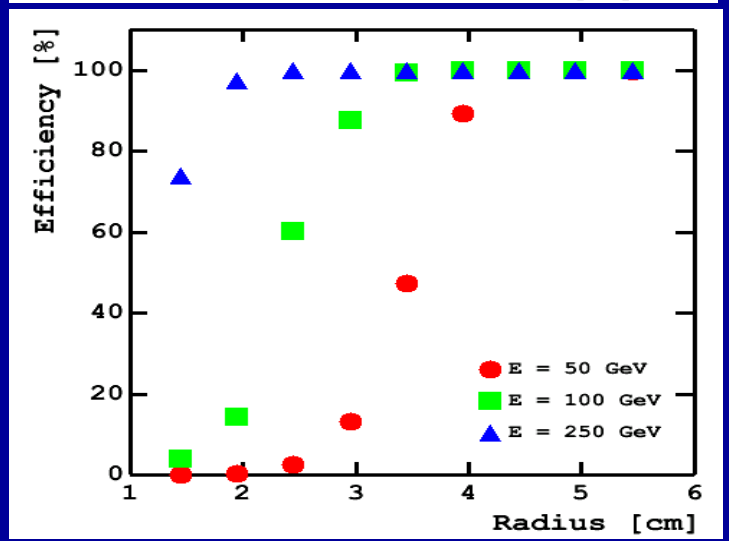
Technology: Tungsten/sensor sandwich

BeamCal

Challenge: BeamCal

- 15000 e^+e^- per BX, MeV range, total 10 – 20 TeV
- ~10 MGy dose per year
- single electron detection capability



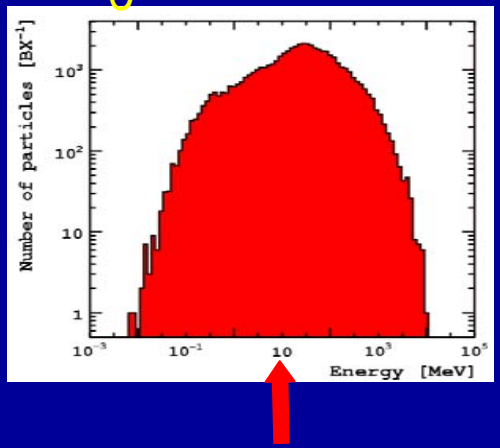


-Radiation hard sensors
-Linearity and dynamic range
- Readout speed (design stage)
-Compactness and granularity

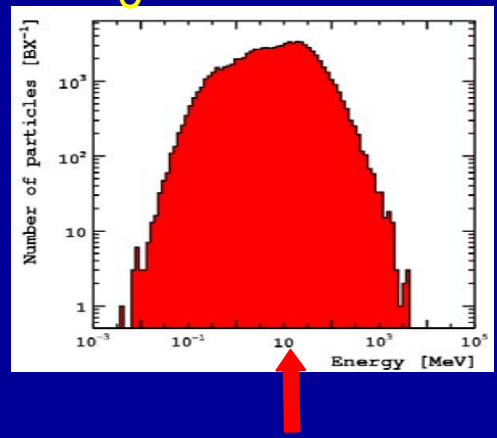
Radiation hardness

Energy of shower electrons inside the sensor:

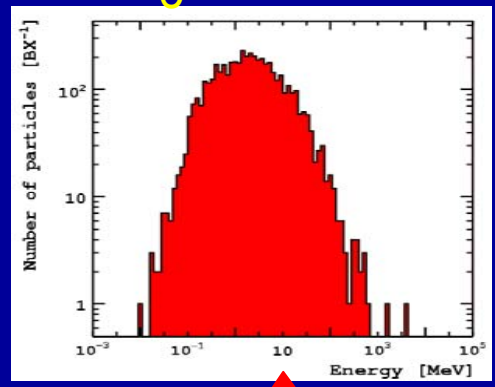
$2X_0$



$6X_0$



$20X_0$



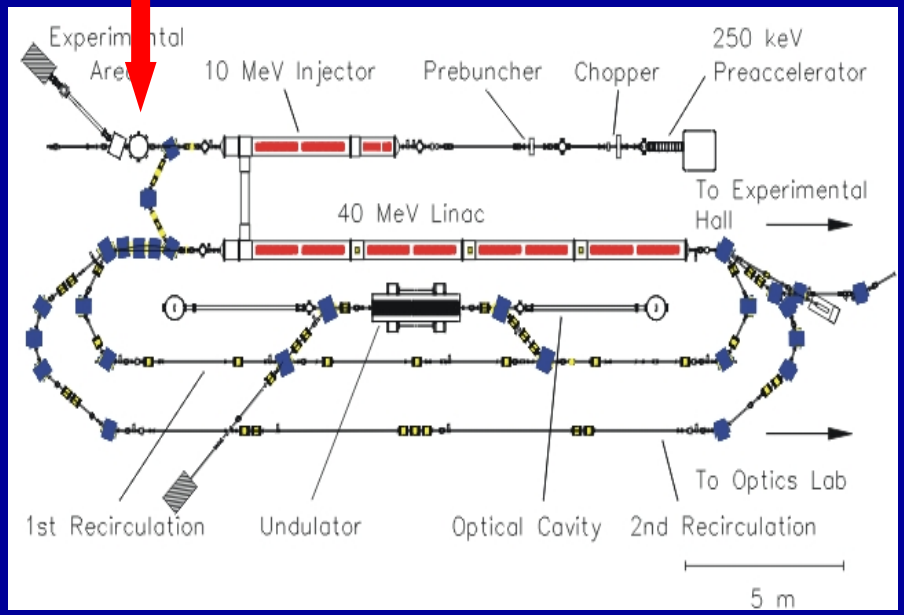
Radiation hard against electromagnetic radiation in the ~ 10 MeV range !

Radiation hardness

Beams available:

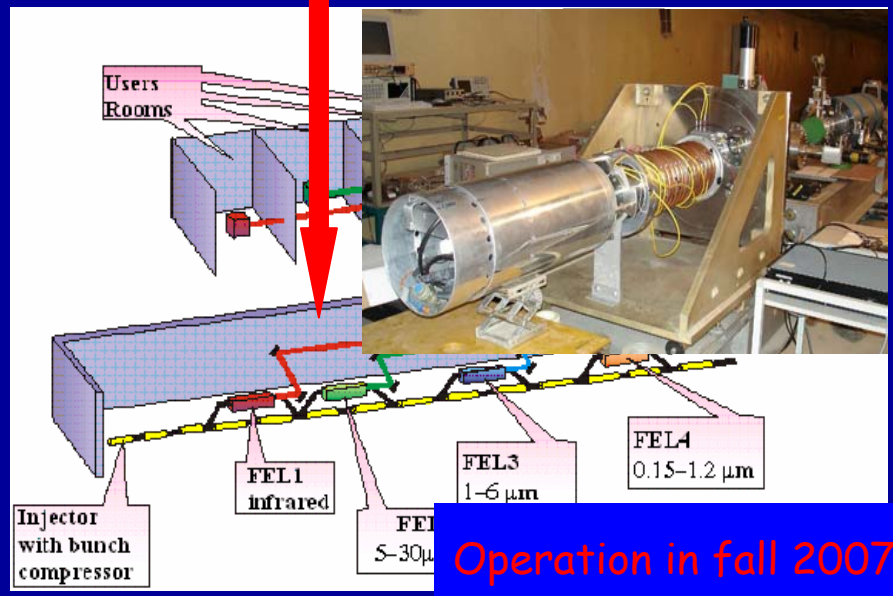
SDALINAC (TU Darmstadt)

10 MeV



JINR LINAC 800

20-40 MeV

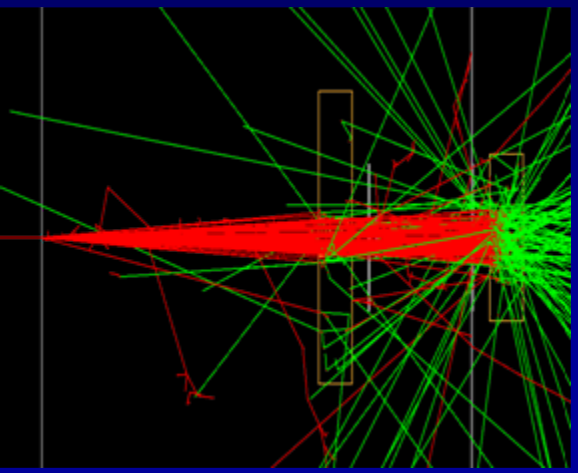


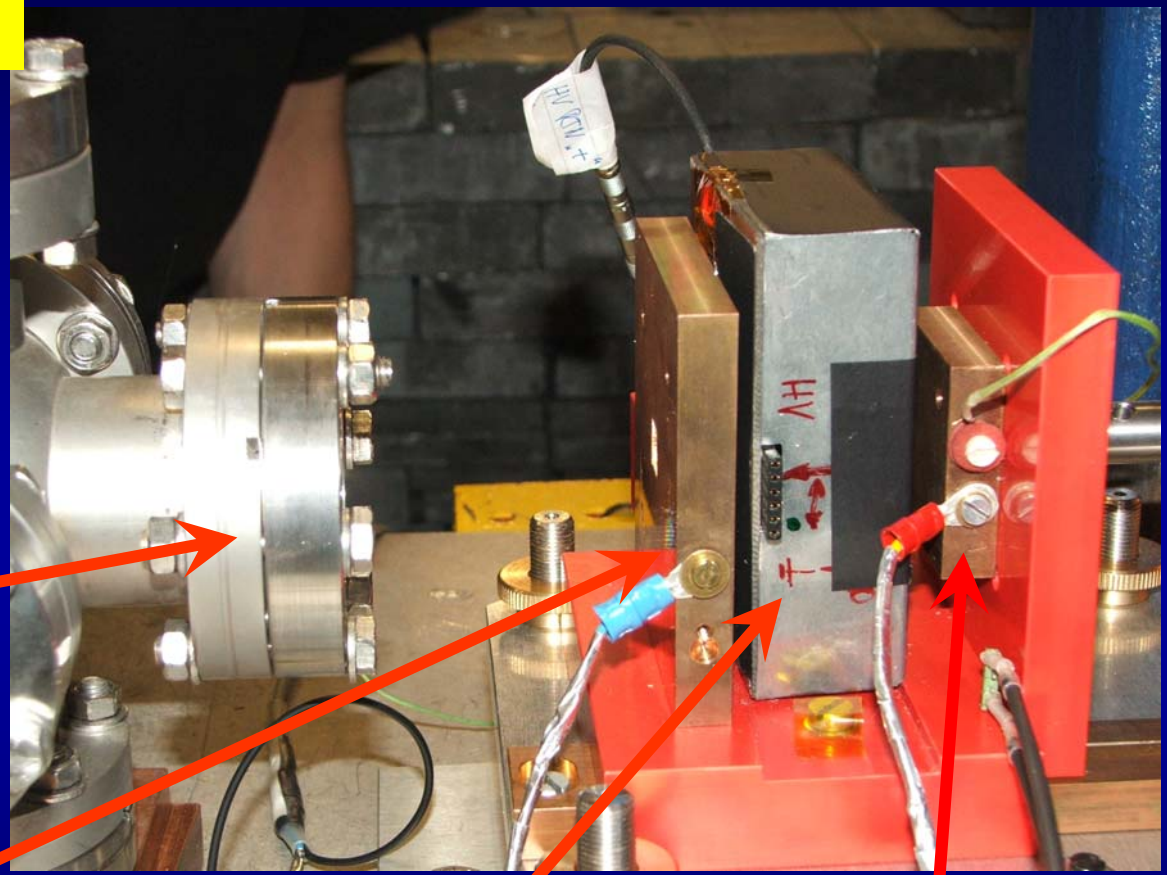
Operation in fall 2007

beam currents from 1 to 100 nA (10 nA ≈ 50 kGy/h)

Radiation hardness

The testbeam setup





exit window of beam line

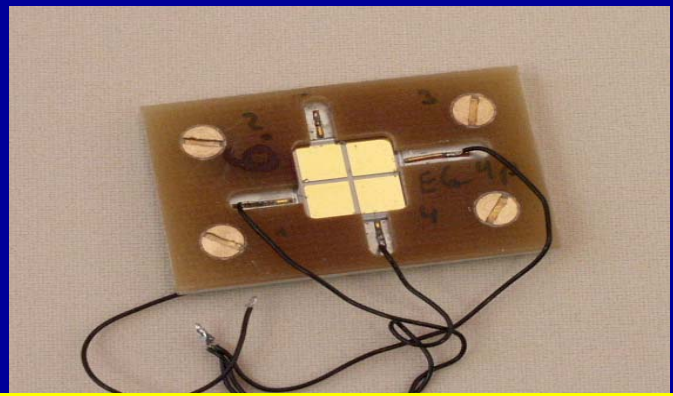
collimator (I_{Coll})

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

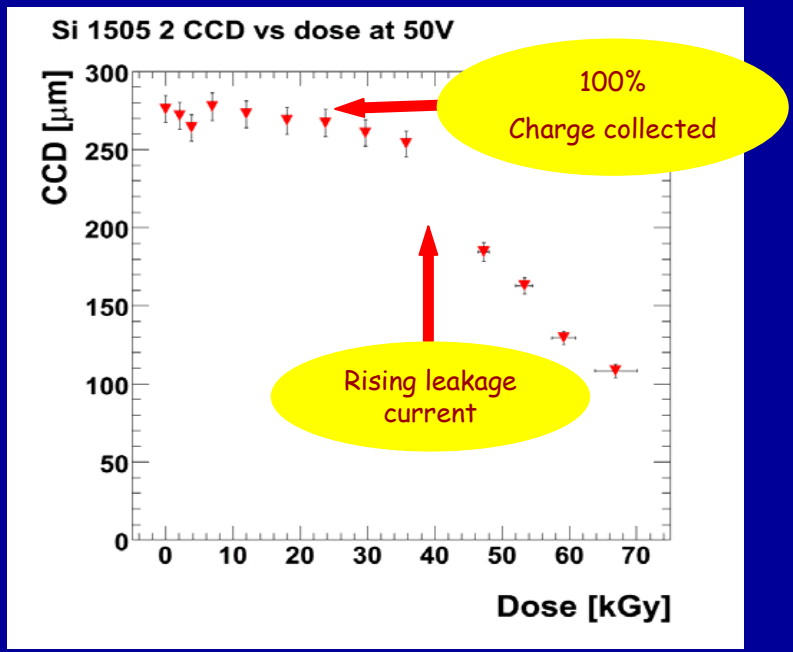
Faraday cup (I_{FC}, T_{FC})

Radiation hardness

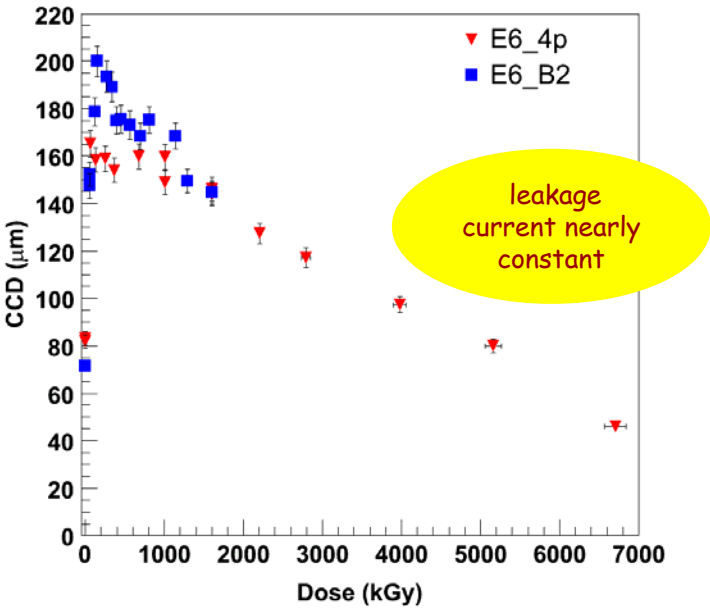
Results from 2006 (DALINAC)
Si and diamond sensors:



Si pad sensor



Diamond sensor after ~7 MGy

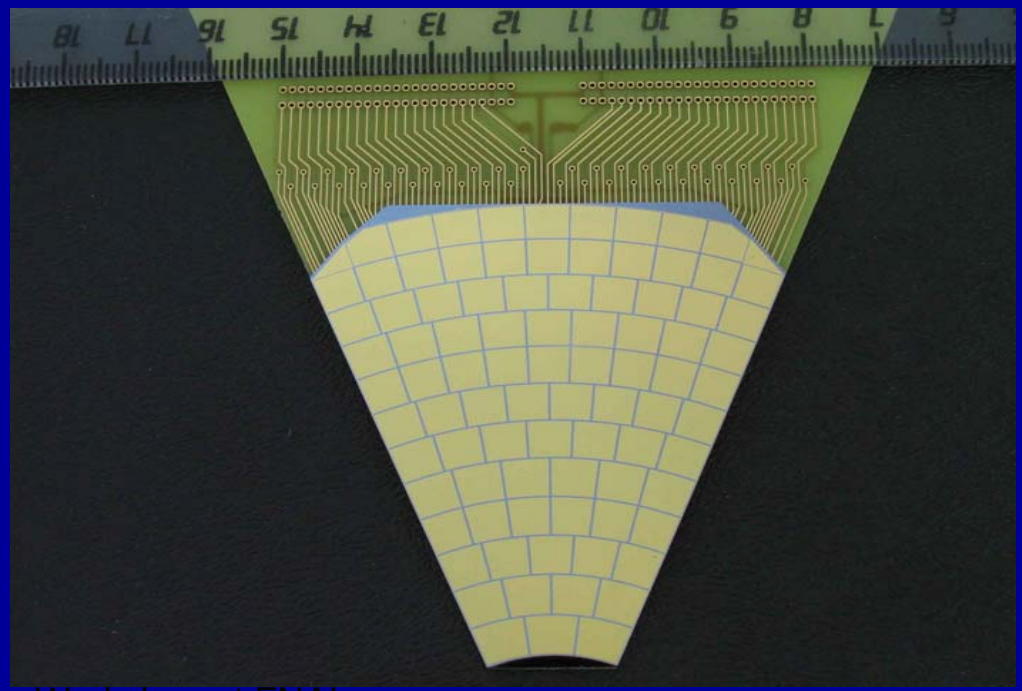


Radiation hardness

Plans for 2007/2008

- Repeat measurements with new diamond samples
- Measurements with lower dose rates
- Test alternative sensor materials
  - GaAs (produced by Russian Collaborators)
  - SiC (collaboration with BTU, Cottbus)
  - Rad. hard Si (BNL?)

GaAs Segment prepared for tests



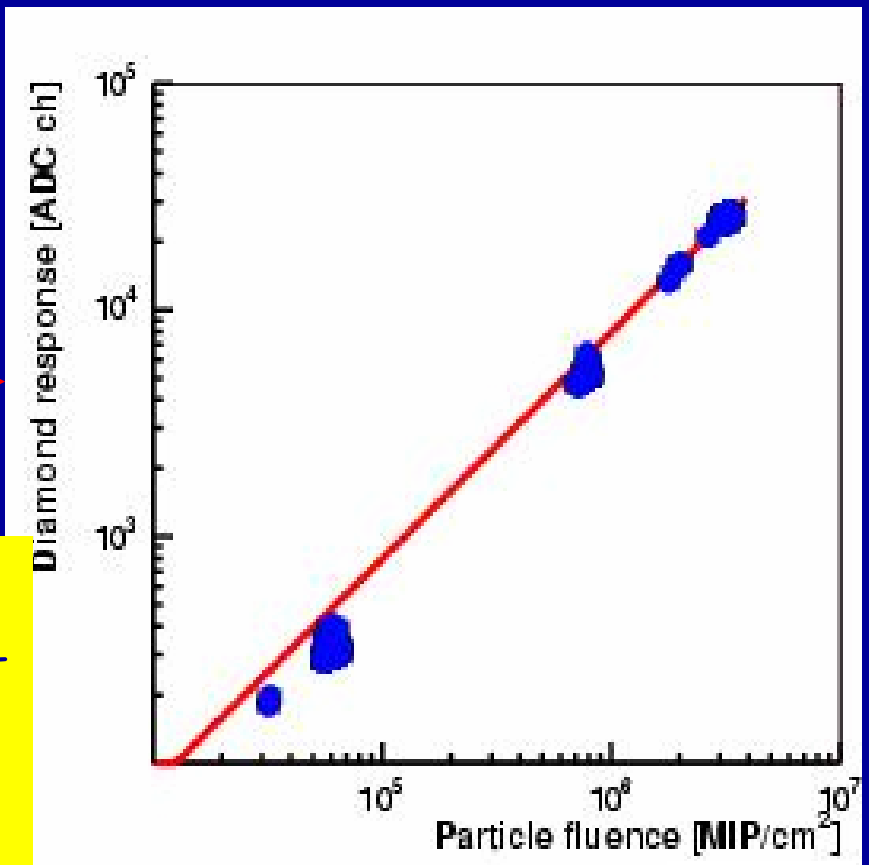
Linearity and dynamic range

CERN PS (CMS)

Energy (mixed beam): few GeV
10^3 - 10^6 particles in ~10 ns

Test of several diamond sensors,
1 cm^2 area, 500 µm thick,

Results reasonable



Plans 2009/10

-Repeat and refine previous measure-
ments (better flux calibration)

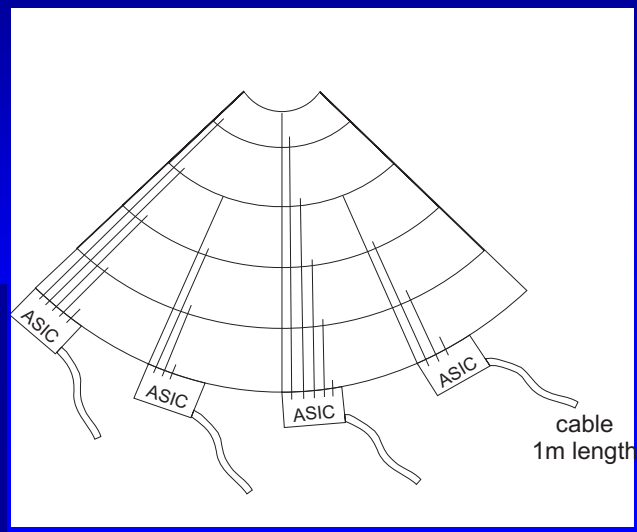
-Study new sensor materials

Compactness

Goal:

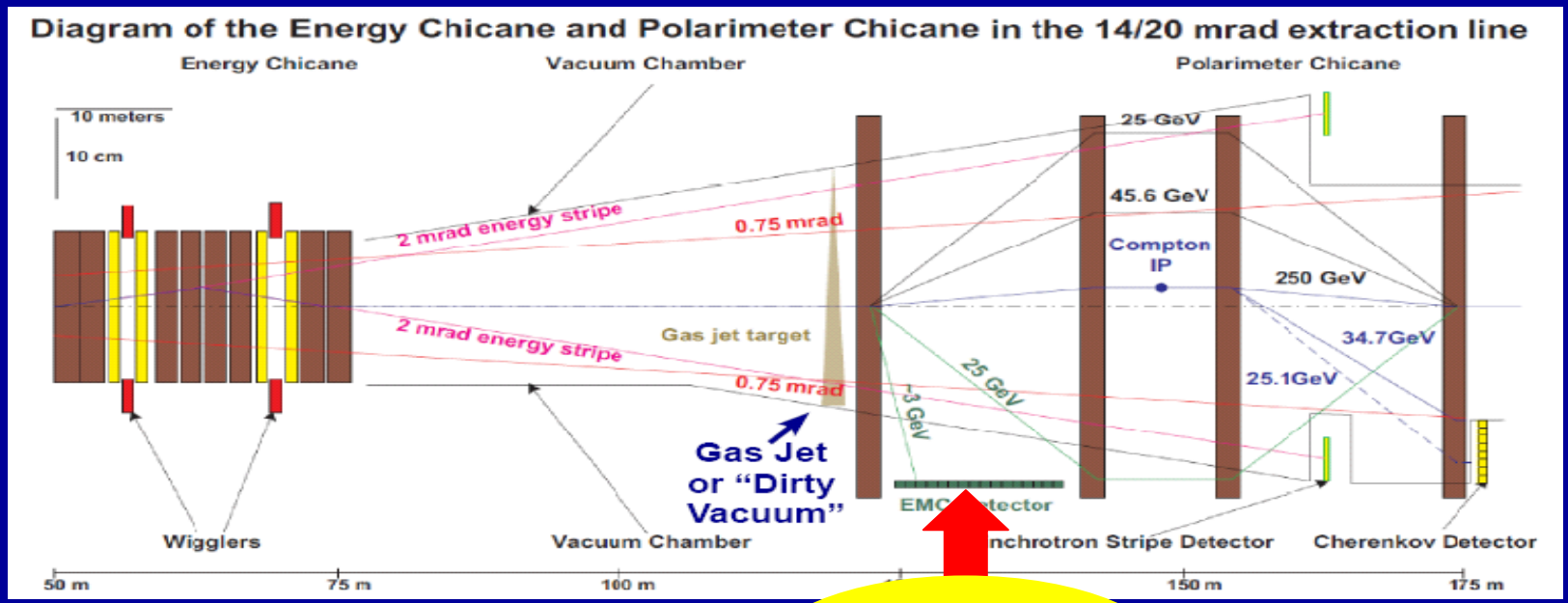
Thin instrumented sensor plane prototypes

- Function test of assembled sensor planes,
- Channel-to-channel homogeneity,
- Cross talk,
- Performance at the edges.



Plan 2007/2009
Use a few GeV electron beam at DESY, EUDET infrastructure

GamCal



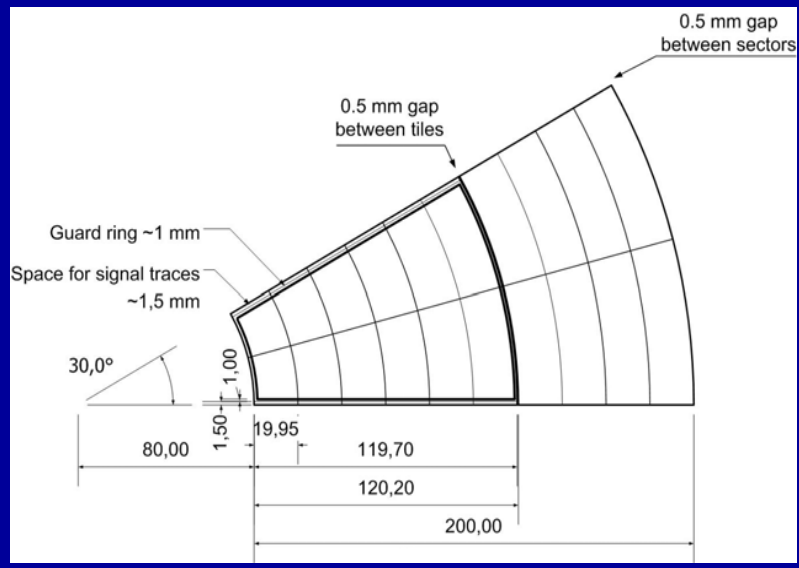
EM Calorimeter

- design work ongoing
- prototype for beamtests planned

Plan: ~2009
1-20 GeV electron beam, SLAC?
High (100 GeV) beam for background studies

LumiCal

- Function test of assembled Si sensor planes,
- channel homogeneity,
- cross talk,
- performance at the edges.
- operate a 'few layer prototype'



Plan 2008/2009
Use a few GeV electron beam at DESY, EUDET infrastructure

Prototype Calorimeter Tests

Finally prototypes of BeamCal and LumiCal must be tested in a beam to proove the performance of the full system

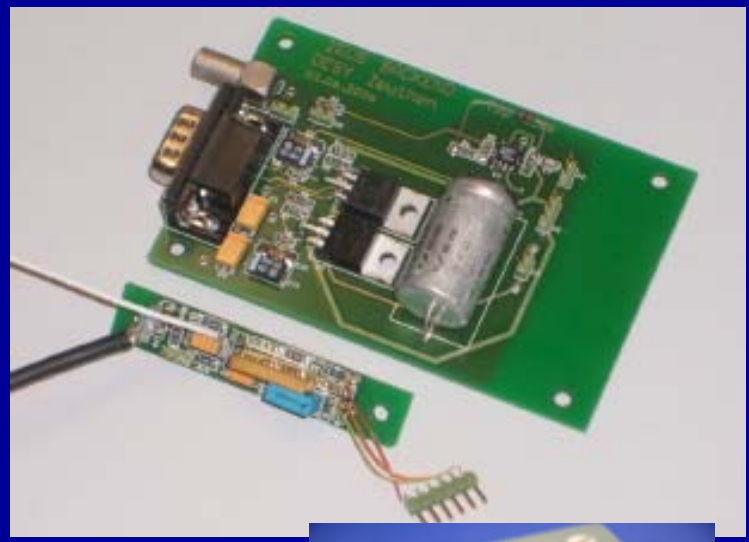
Plan, not before 2010:
Test in an electron beam of ~100 GeV at CERN or Fermilab

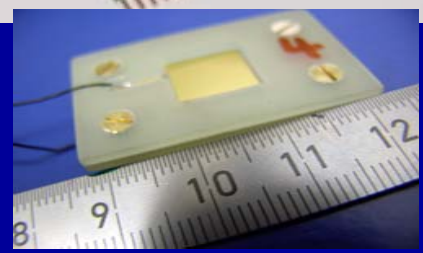
Plan with FONT (ATF)

We operate just now a single crystal diamond of 5x2 mm2 size near the ZEUS beam.

-long term stability under harsch radiation conditions

If successful, we plan to use it for the fast feedback system FONT to fake the input from the beamstrahlung pairs.





Plan 2008/09 (preliminary, not yet worked out in detail)