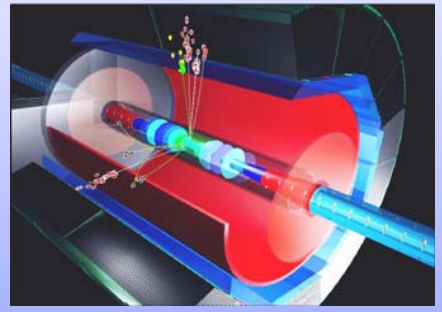
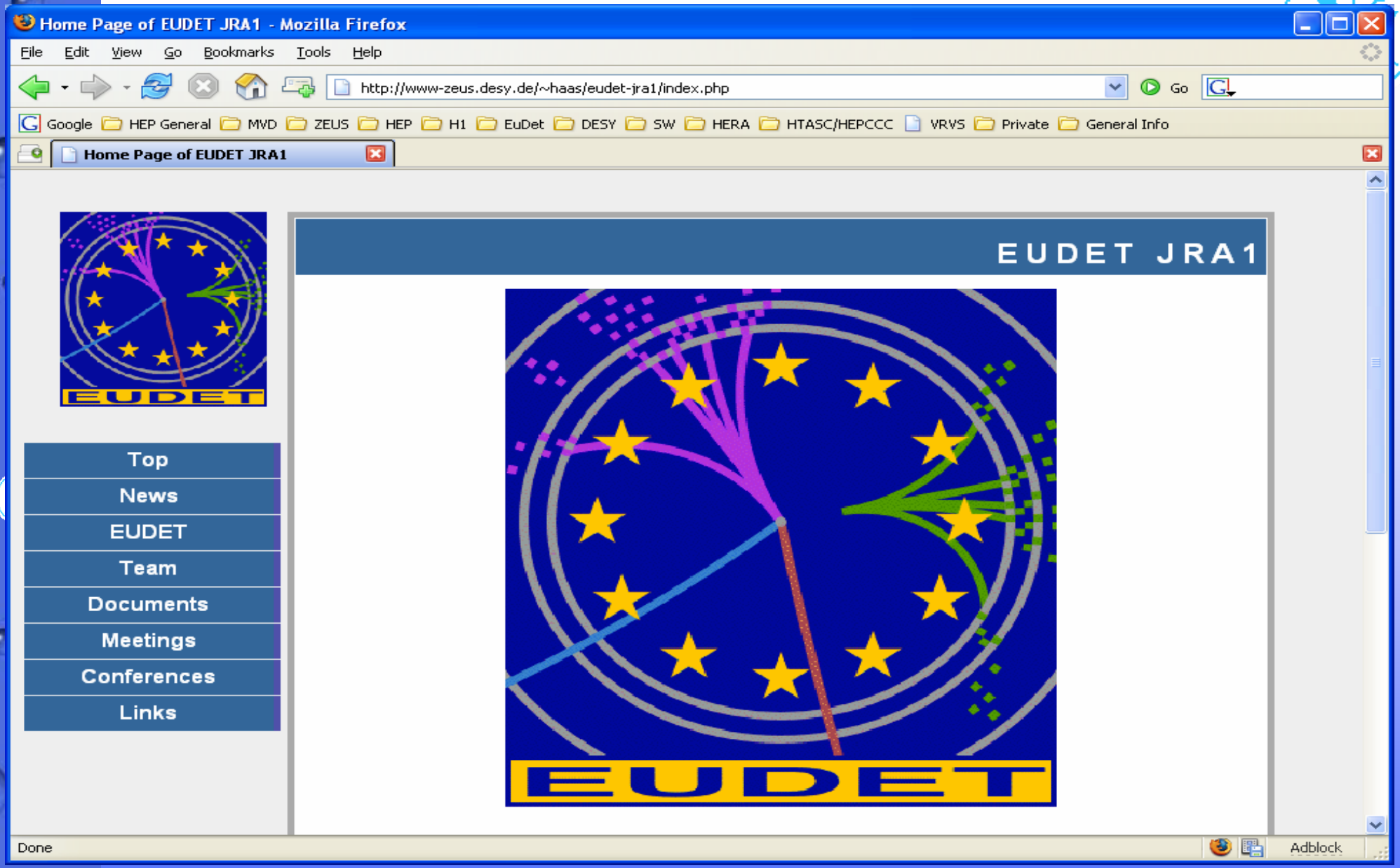
JRA1 Magnet and Test Beam Infrastructure

Tobias Haas
DESY



- Superconducting Magnet (PCMAG)
- Mechanics
- Cooling
- Telescope Simulations
- Measuring Mimostar2 @ DESY

EUDET Annual Meeting
19 October 2006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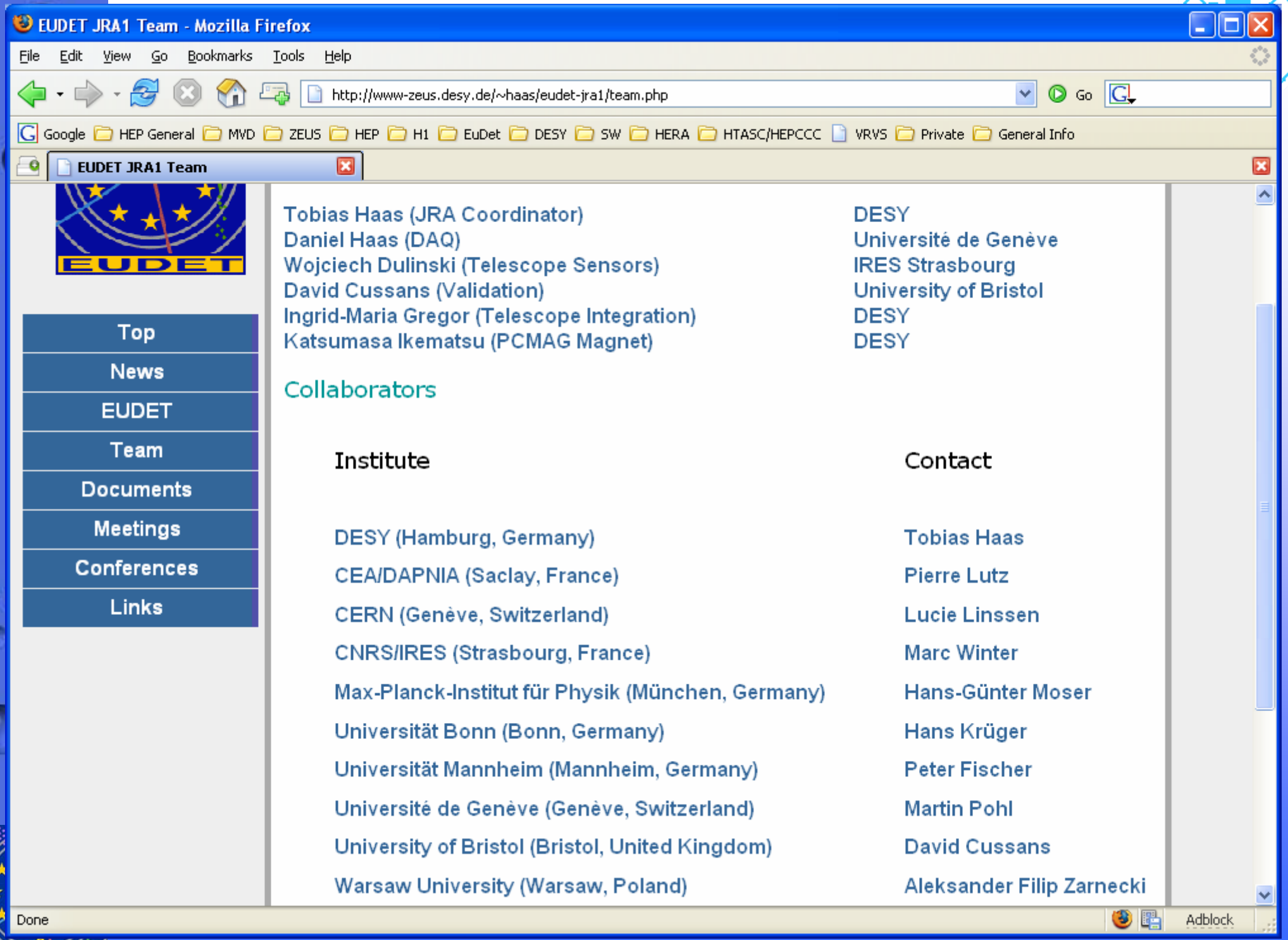
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University of Bristol (Bristol, United Kingdom) David Cussans
Warsaw University (Warsaw, Poland) Aleksander Filip Zarnecki
Done
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JRA1 Goals

- Make the DESY test beam area a user friendly general purpose facility
- Install a large bore superconducting magnet for detector R&D
- Supply a pixel-lated beam telescope for device characterization:
  - High precision ~ 1 µm
  - High R/O speed > 1 kHz frame rate
  - Reasonable fiducial area (~ 2 – 4 cm^2)
- Proceed in two steps
  - Demonstrator system available mid 2007 which is already usable for other R&D activities
  - Final system available in 2009

Milestones & Deliverables

1. Prototyping ends (now) 20 Oct 06
   1. Cleaned up SW inc. docu
2. DAQ Integration 1 starts 8 Jan 07
   1. TLU
3. DAQ Integration 2 starts 5 Mar 07
   1. MTel + Proximity b. + Auxiliary b.
   2. EURDB + Mezzanine boards 30 Apr 07
4. Overall Integration starts
   1. Telescope mechanics + cooling

Preparation of Test BeamArea 24/1 for PCMAG

Entrance of Test Beam Area 24/1

•The test beam area is rearranged and renovated by MEA (Norbert Meyners).

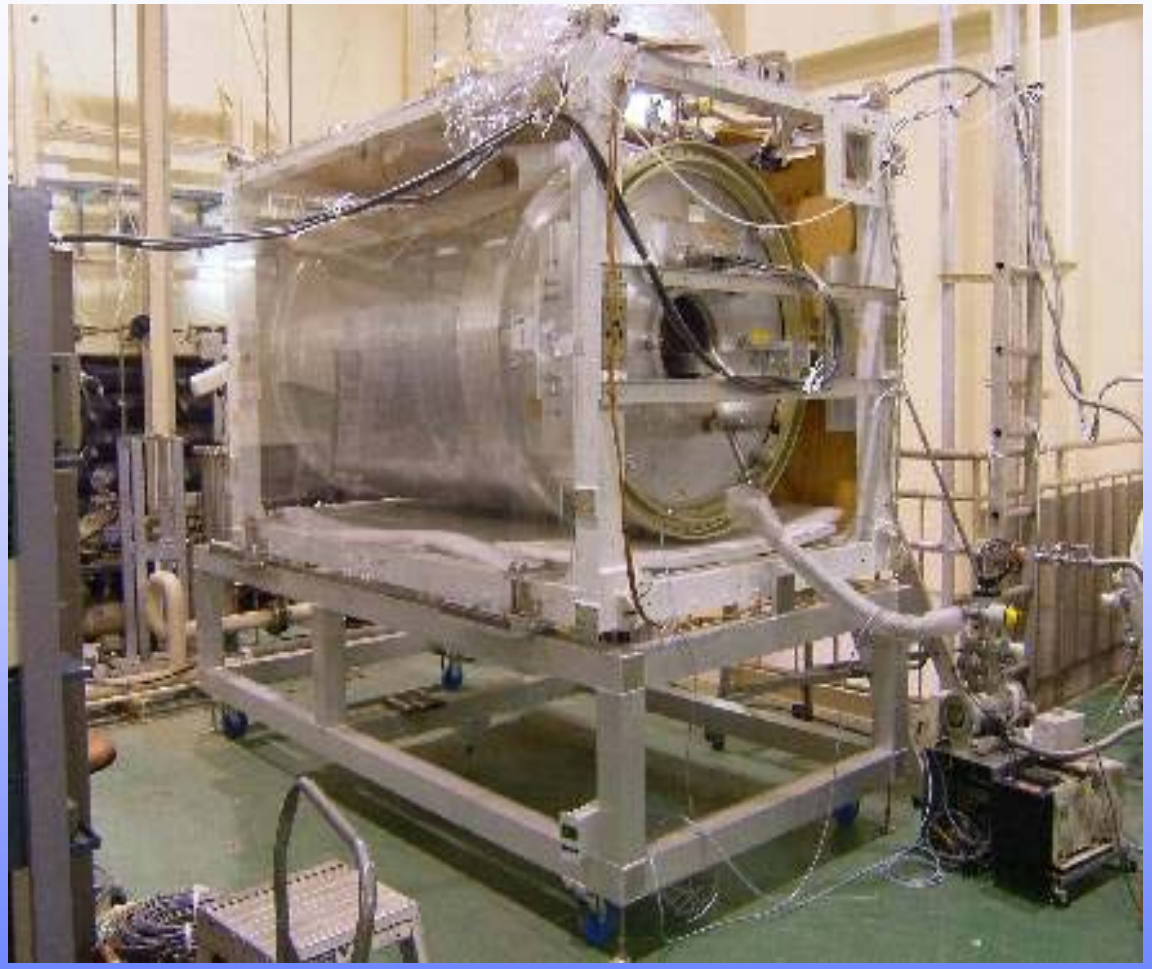
Concrete Block as Base for PCMAG

• A concrete block is placed in the area as base for the PCMAG.

• Two holes with Ø 100mm are drilled in the floor, to access the cable trays in the cave, which connected the test beam area 24/1 with the control hut.

• The helium return line is installed.

PCMAG



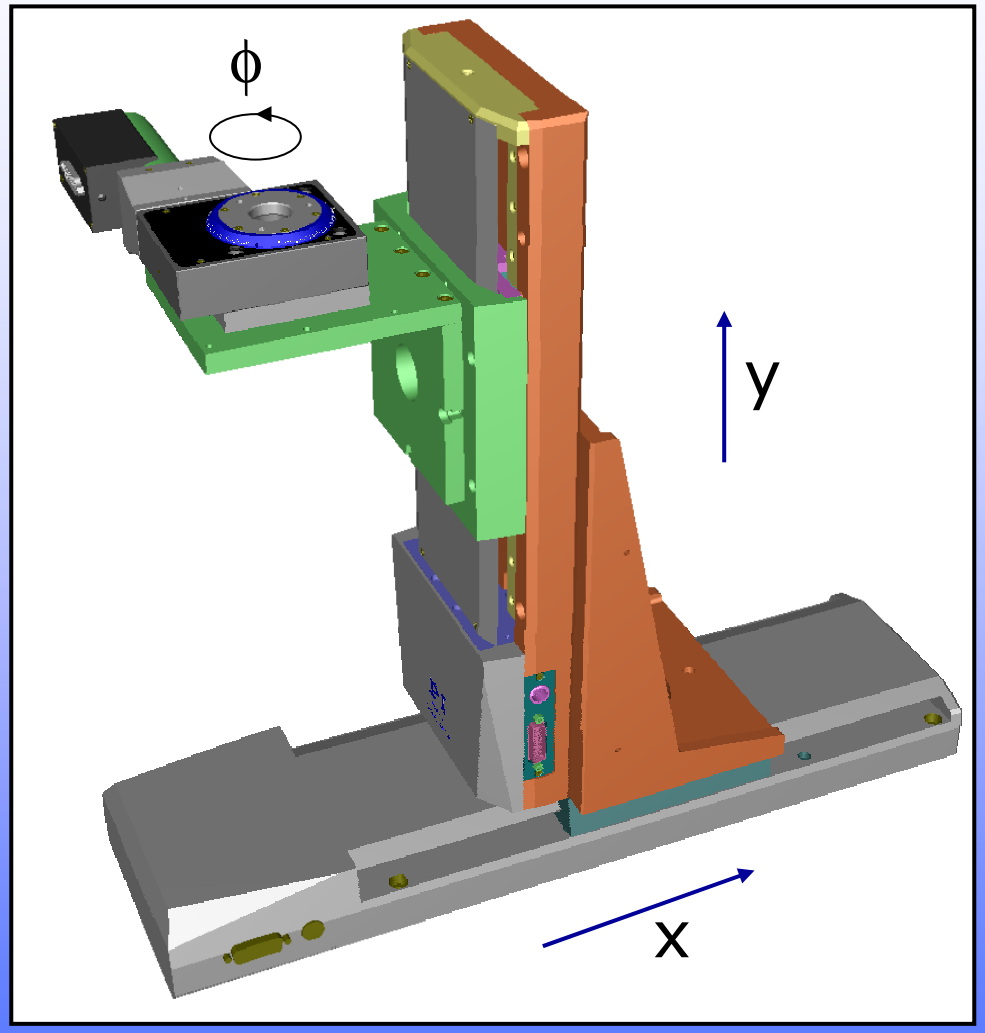
Recommissioning @ KEK

- All administrative issues about the transfer to DESY are clarified.
- Magnet arrives @ DESY in November
- Commissioning to take place @ DESY in November

Y. Makida, T. Matsuda/KEK, K. Ikematsu/DESY

Reminder: What PCMAG was designed for!

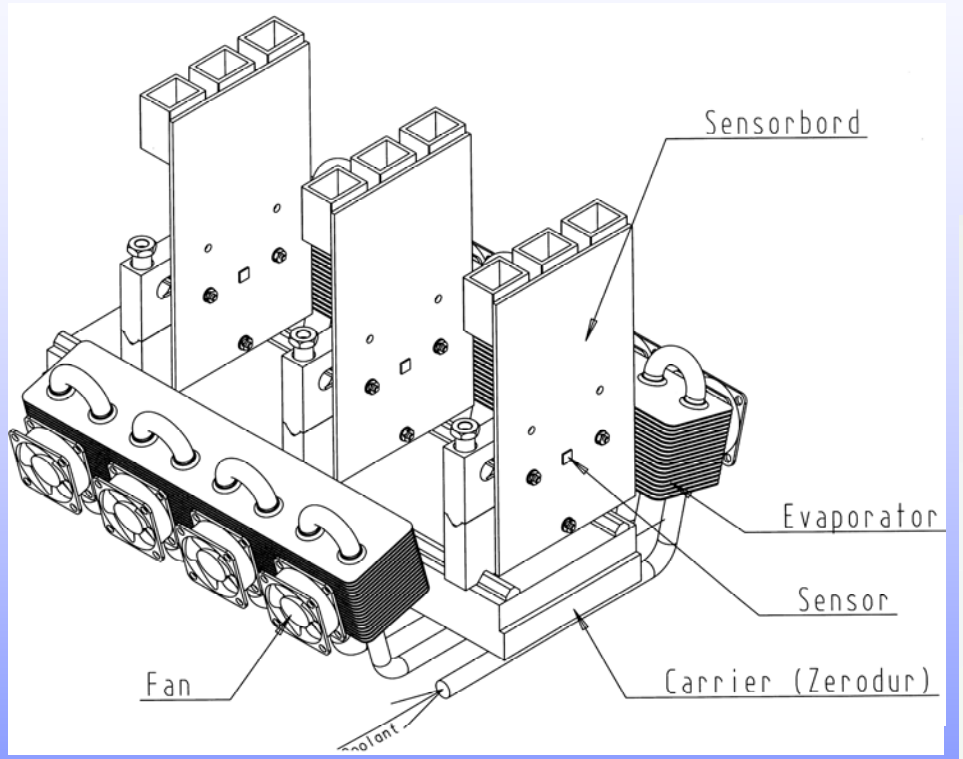
DUT Positioner

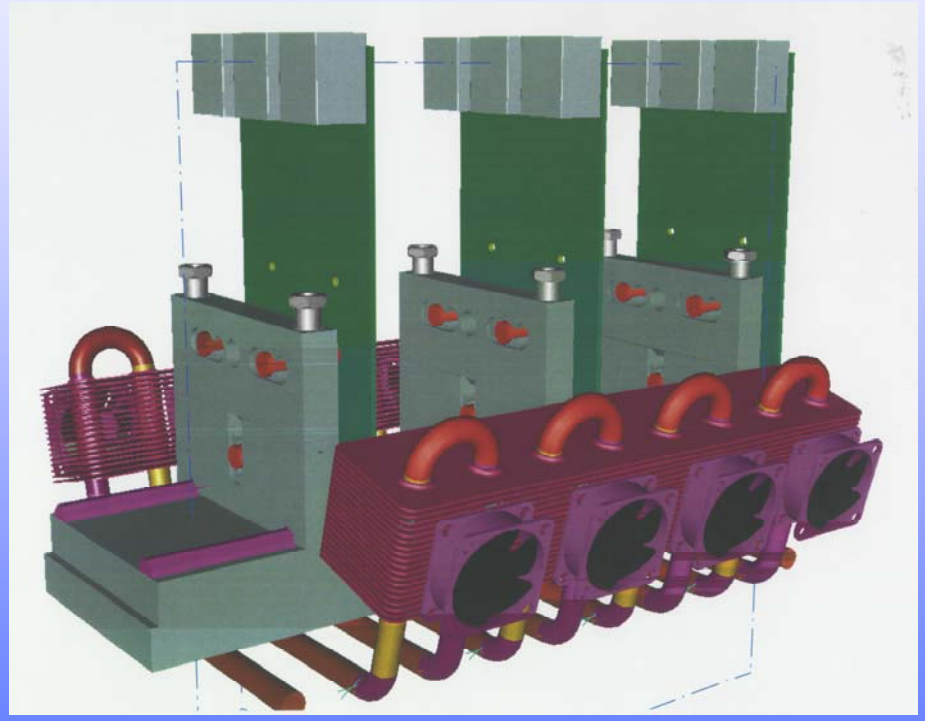


- 10 offers evaluated.
- Decision for PI-offer as best choice for price-performance ratio, with respect to our needs.
- Expected preciseness in the order of a few microns.
- Stage ordered already complete assembled and surveyed with steering components and software
- Delivered to DESY in October 2006, but had to be sent back since it came unassembled and uncalibrated.
- Will be set up in the lab for testing in November
- Ready for integration in spring 2007

Carsten Muhl/DESY

Senor Boxes are Under Development

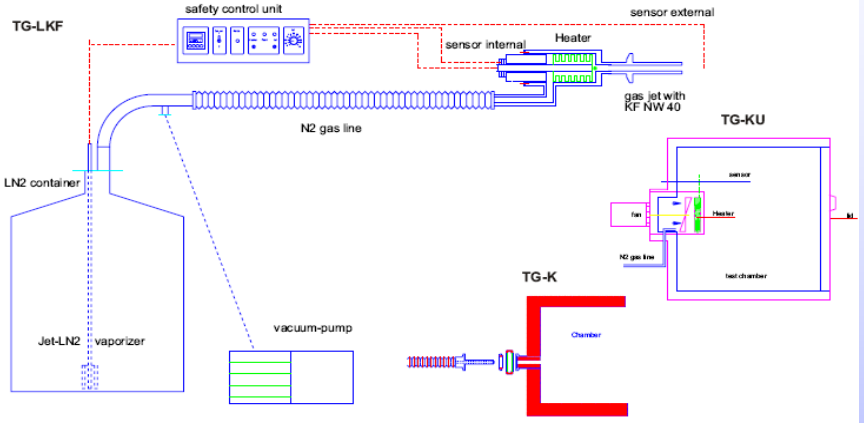




Pictures show a first design iteration. Cooling and fixations will change!

Cooling for Sensor Boxes and DUT

Regulated Cold N2 Gas System



The TG-LKF 63/50 KALTGAS system includes a standard safety control unit (a temperature controller with current value/set point display and a safety controller), a KF-NW 50 siphon with an LN2 vaporizer (Jet), a flexible, evacuable N_2 gas line with an integrated post-heating module (heater), a PT100 temperature sensor and a vacuum pump with accessories.

Cold Gas System : +170°C …-180°C

(N2-Stream Temperature Accuracy ±0,1°C)

-Expensive

-Safety regulations required

+Quick

+Precise

+Wide range of temperature

+DUT cooling possible with the same device

Evaporation Cooling Based on R404A

R404A/R507

	Kälteleistung in W						Verdampfungstemperatur in °C					
Liquefier 1	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
Liquefier 2	64	85	110	141	177	218	265	318	378	–	–	–
	–	–	–	–	–	–	265	314	377	450	528	588

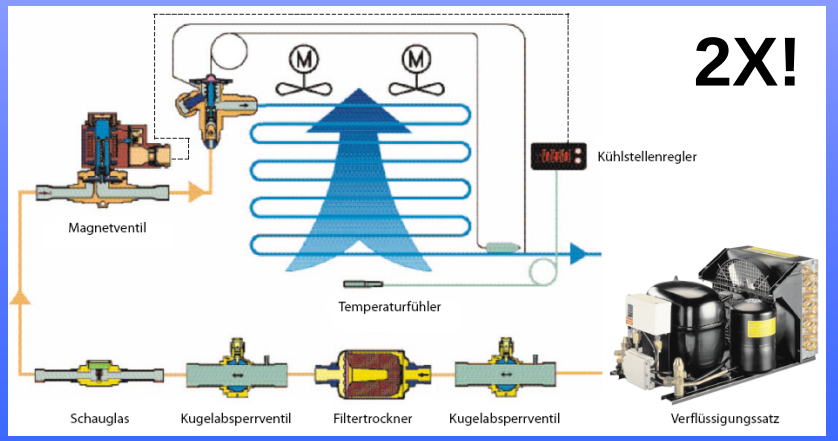
-Large area for evaporator needed → Increases Size of sensor box

-2 systems needed between -40°C and +10°C

-Slow and complex regulation

+No danger

±Standard Components except evaporator



Carsten Muhl/DESY

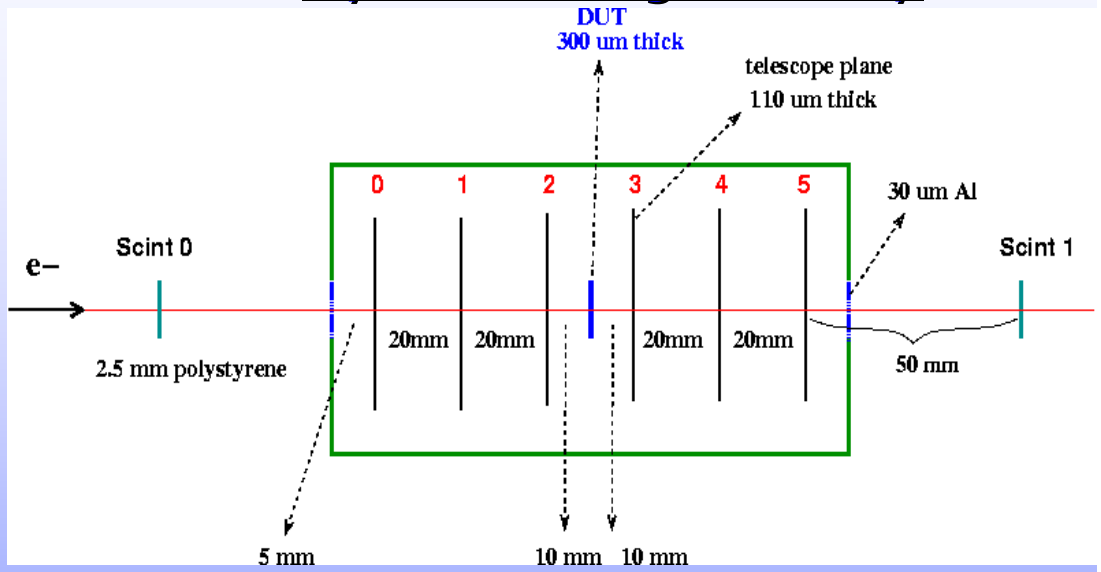
Simulations of EUDET Telescope

ILC Software Tools

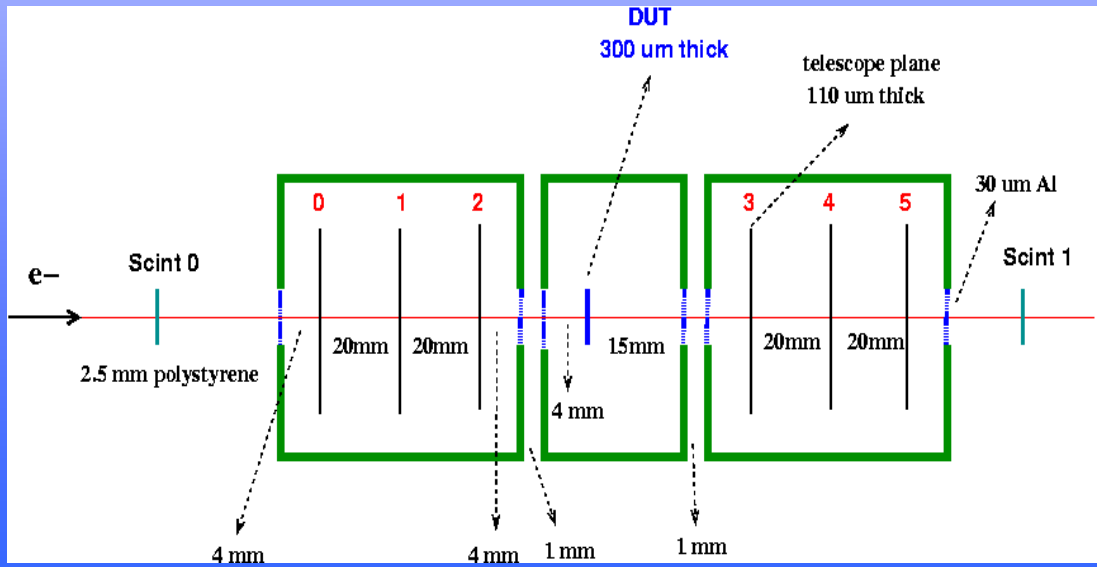
- Full simulation: Mokka (based on Geant 4) and MySQL database
- Straight line track fit
- Output: LCIO format files
- Stored information: hit position, deposited energy, ...
- Analysis: Marlin and Root
- Simulated 50000 events
- Assumed telescope plane intrinsic resolution – 3 um (hit positions are smeared)

Tatsiana Klimkovich/DESY

Symmetric geometry



Asymmetric geometry



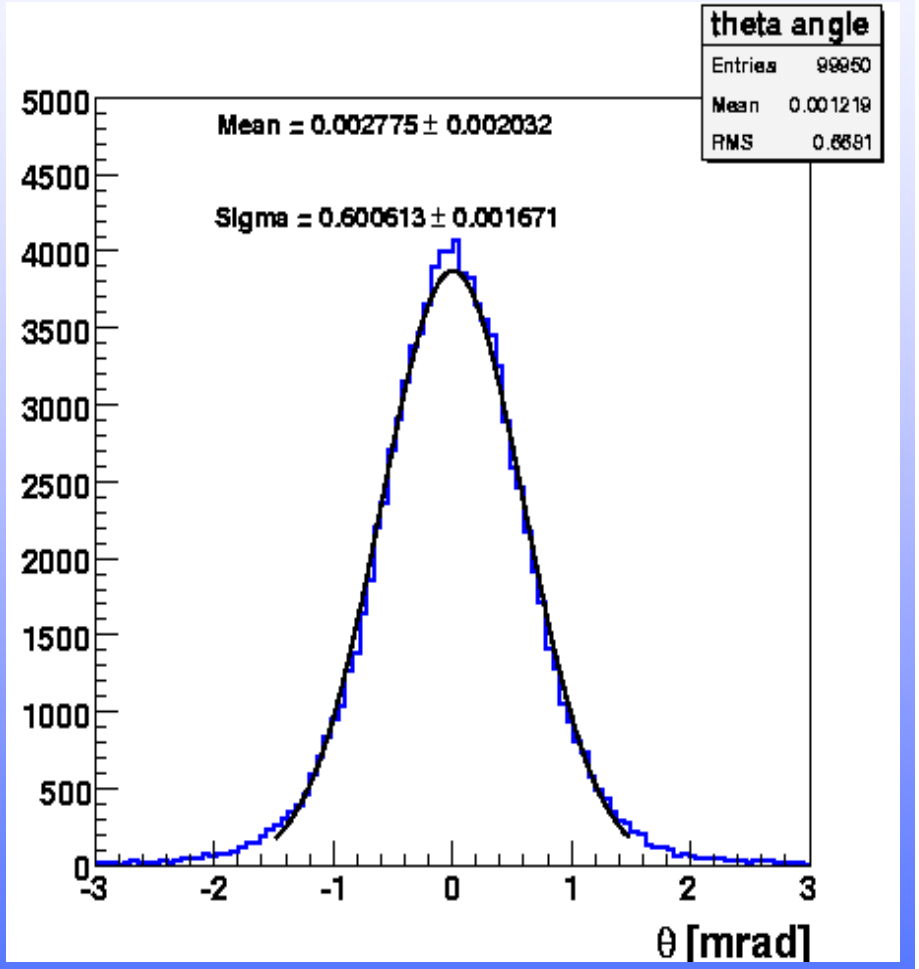
Validation of Multiple Scattering Model

- For small scattering angle Gaussian approximation is used for the width of the projected angular distribution:

$$\theta_0 = \frac{13.6MeV}{\beta cp} z \sqrt{\frac{x}{X_0}} \left[1 + 0.038 \ln\left(\frac{x}{X_0}\right) \right]$$

To check the validity of MS description

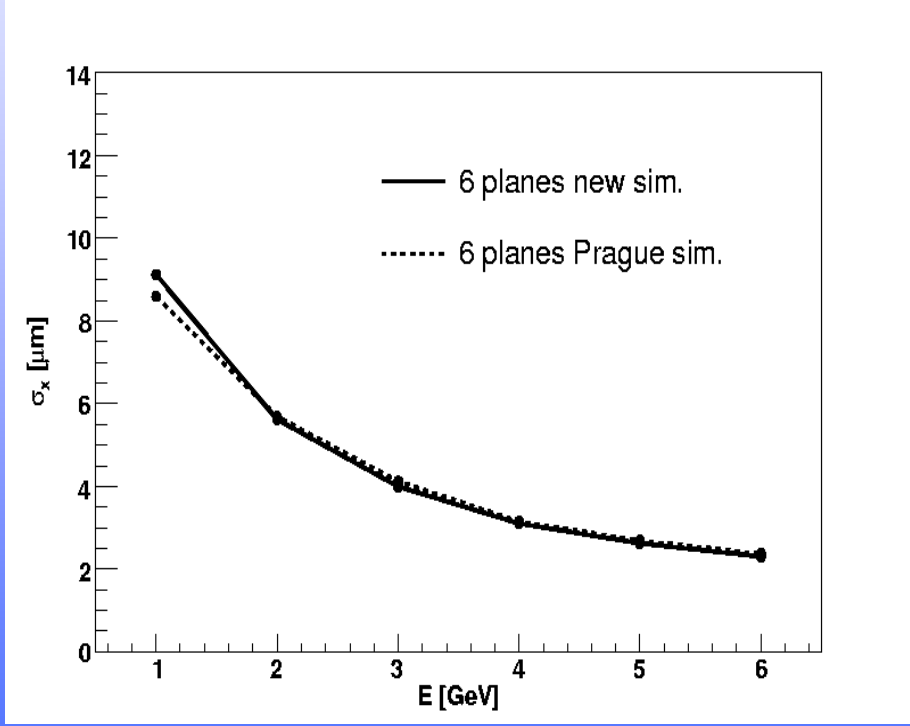
- Simulate silicon wafer of 300 um thickness
- Shoot 1 GeV electrons (100000 events)
- Look at the projection of scattering angles
- Theory prediction: 0.602 mrad



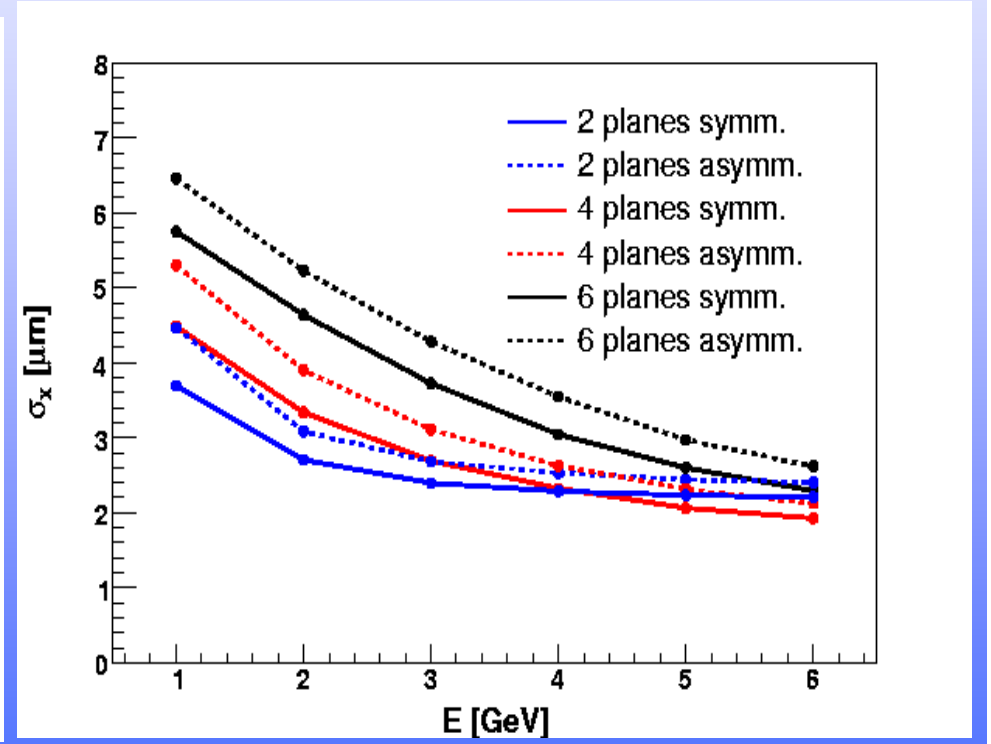
Tatsiana Klimkovich

Results

Comparison of new simulation (Mokka) with Prague simulation (Geant 4) for 6 plane symmetric geometry



Comparison of different geometries (Mokka simulation, after cuts on chi2 and track slope):



Note: Straight line track fits!

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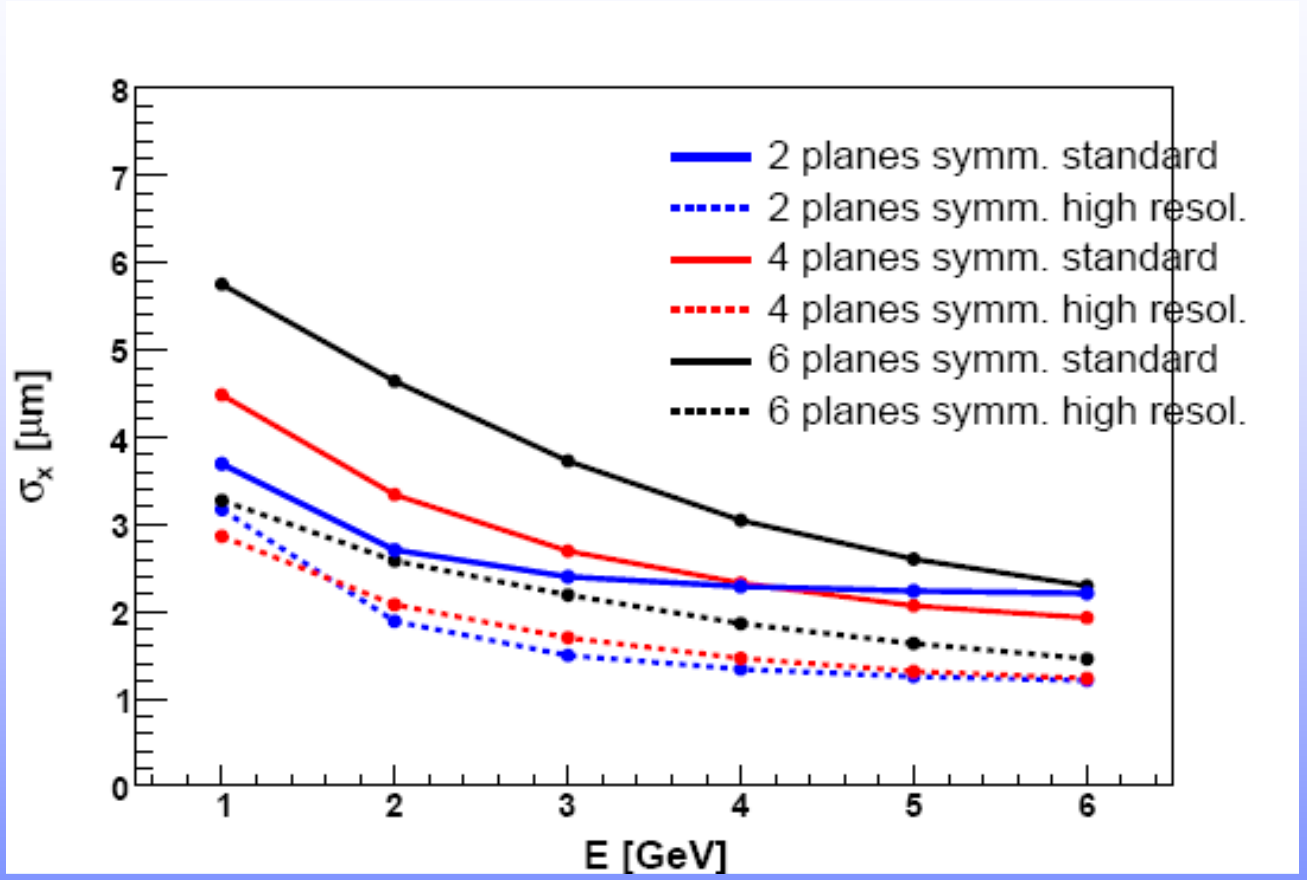
HiRes Effect



- Standard: all planes have 3 μm resolution
- HiRes: 2 planes closest to DUT have 1.5 μm resolution
- Achieve: 1.5 (2) μm on DUT at 6 (3) GeV/c

Tatsiana Klimkovich/DESY

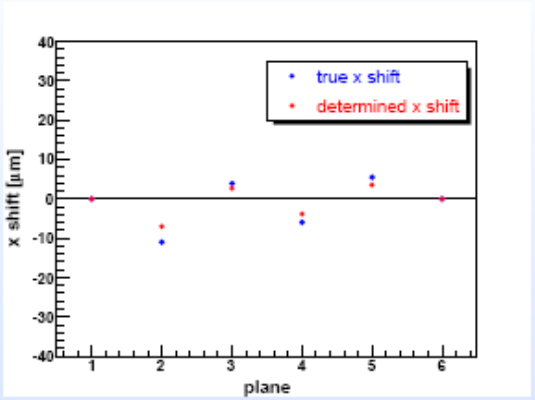
First look at Alignment

Alignment package Millepede

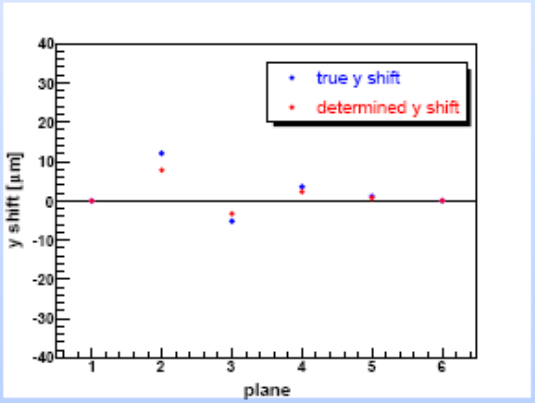
- When detector is ready a proper software alignment will be an important issue for telescope precision
- $\Longrightarrow$ Test alignment procedures with simulated data
- Alignment package Millepede is developed by Volker Blobel (Uni Hamburg)
- Used in H1, ZEUS, CMS for tracker alignment
- Aligns all planes simultaneously
- Based on linear least squares fits
- Simulated 50000 events (6 GeV electron beam) for 6-plane symmetric telescope configuration without DUT

First try to find alignment parameters

x shifts



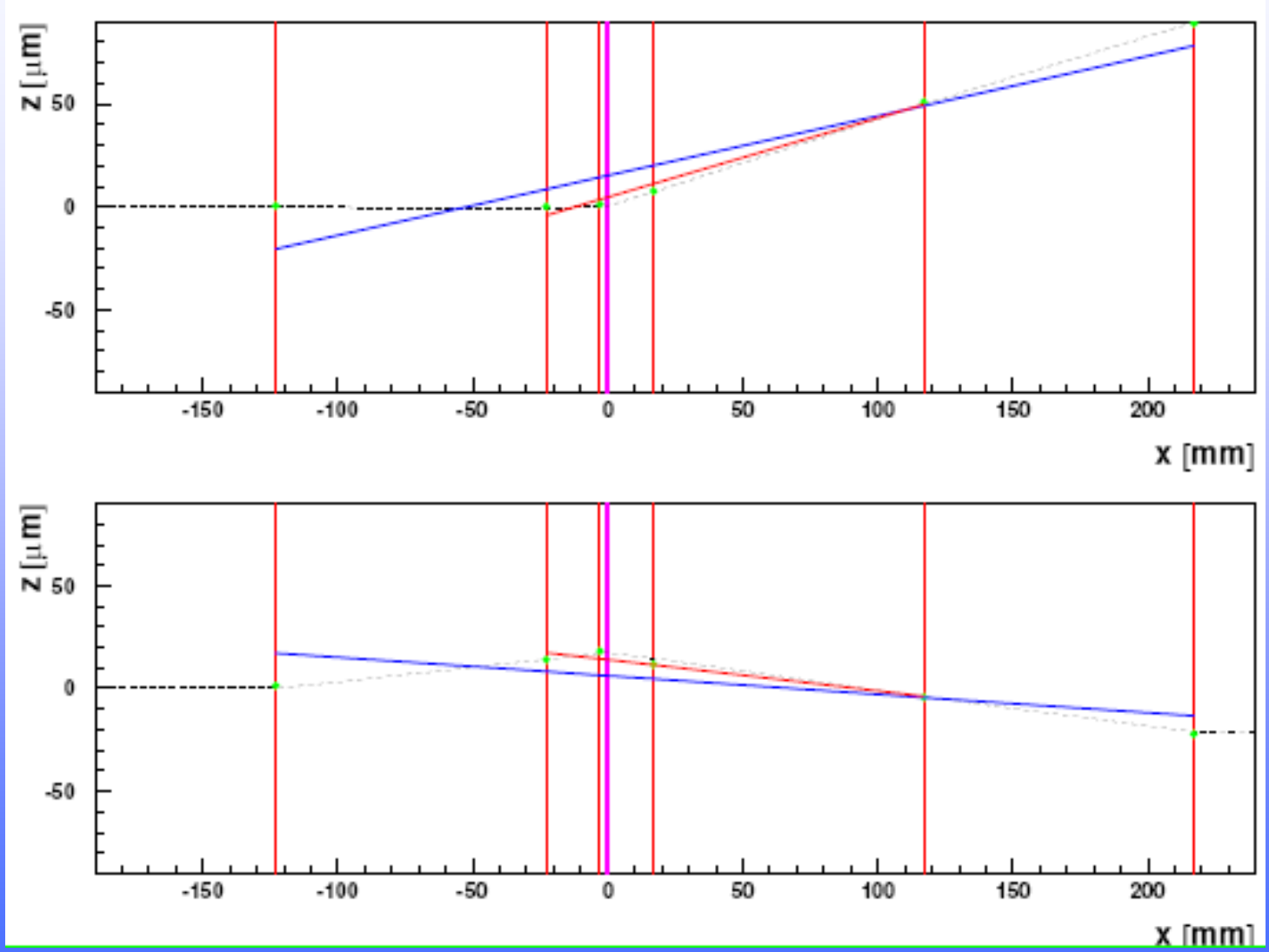
y shifts



Should investigate more, play with constraints, etc.

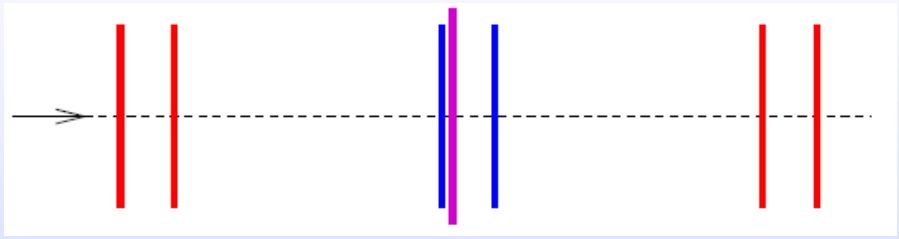
Another Study

6 GeV Electrons

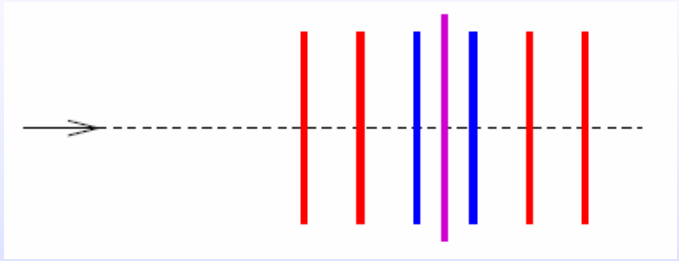


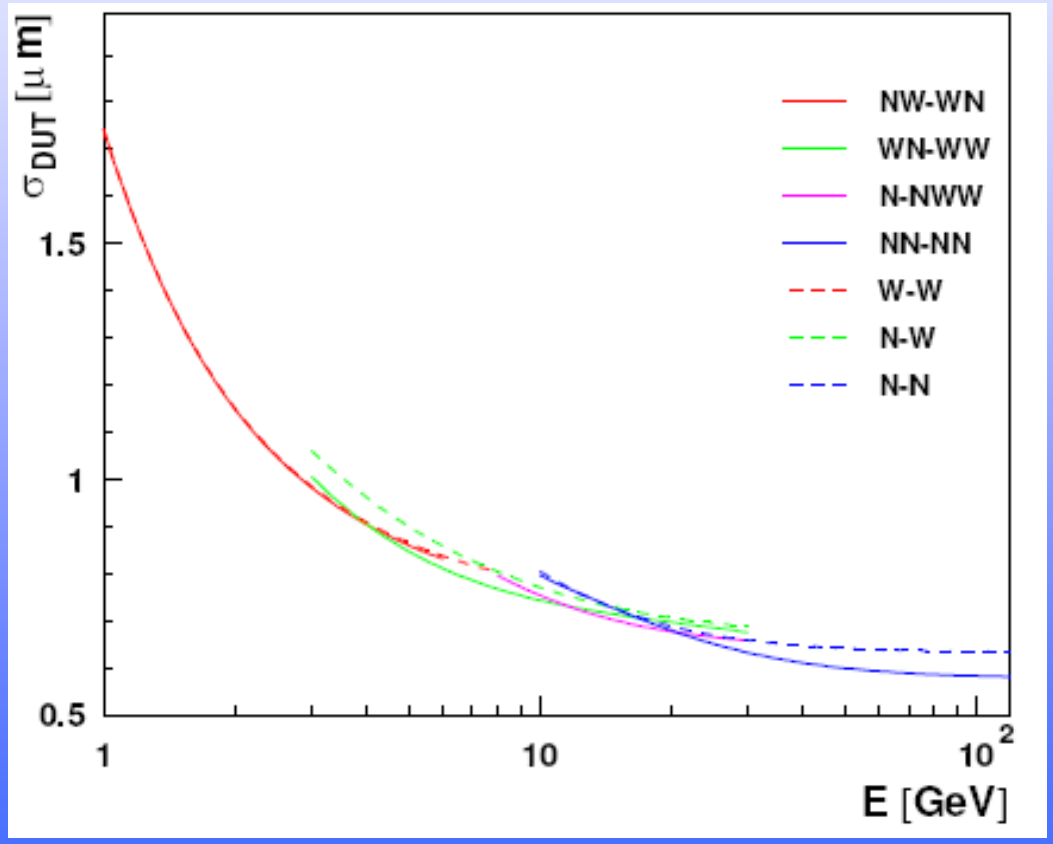
Geometries of Interest

NW-WN



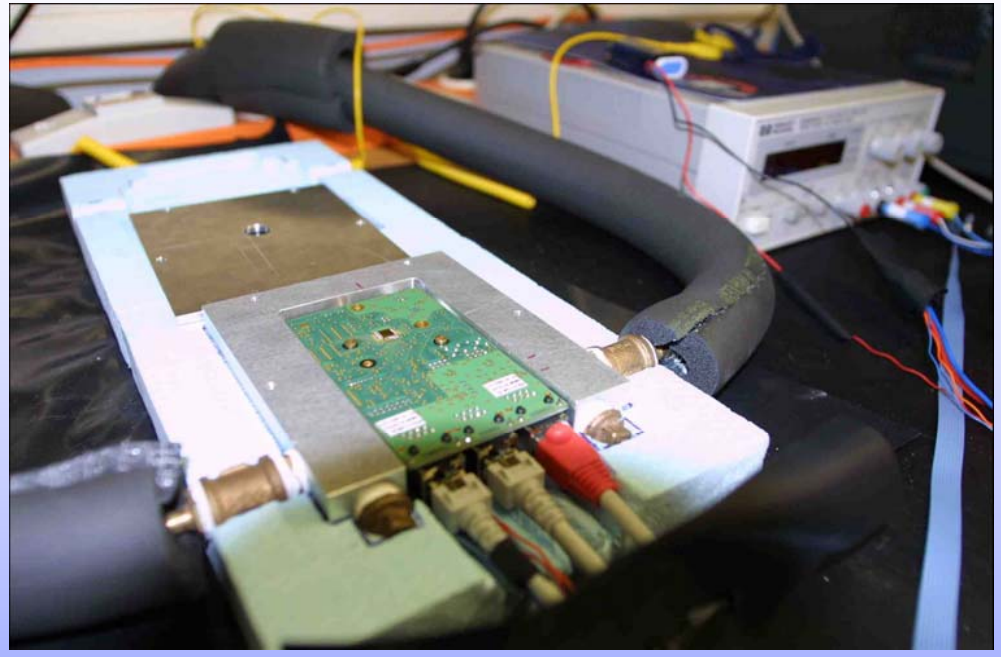
NW-WN





Flexibility for the geometrical setup is needed A. F. Zarnecki/Warsaw

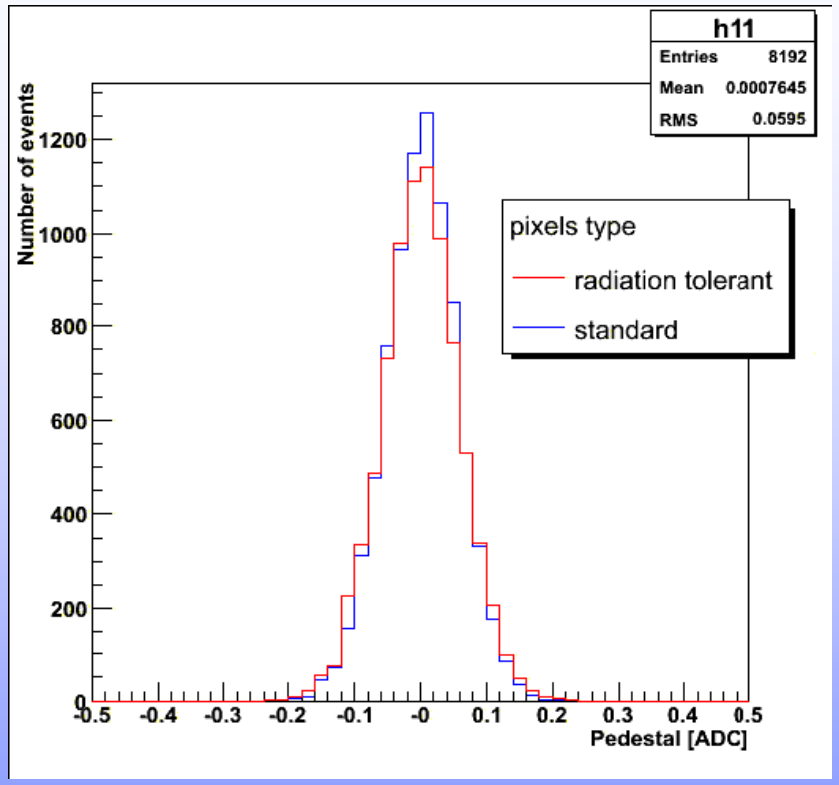
Mimostar2 – Temperature Scan

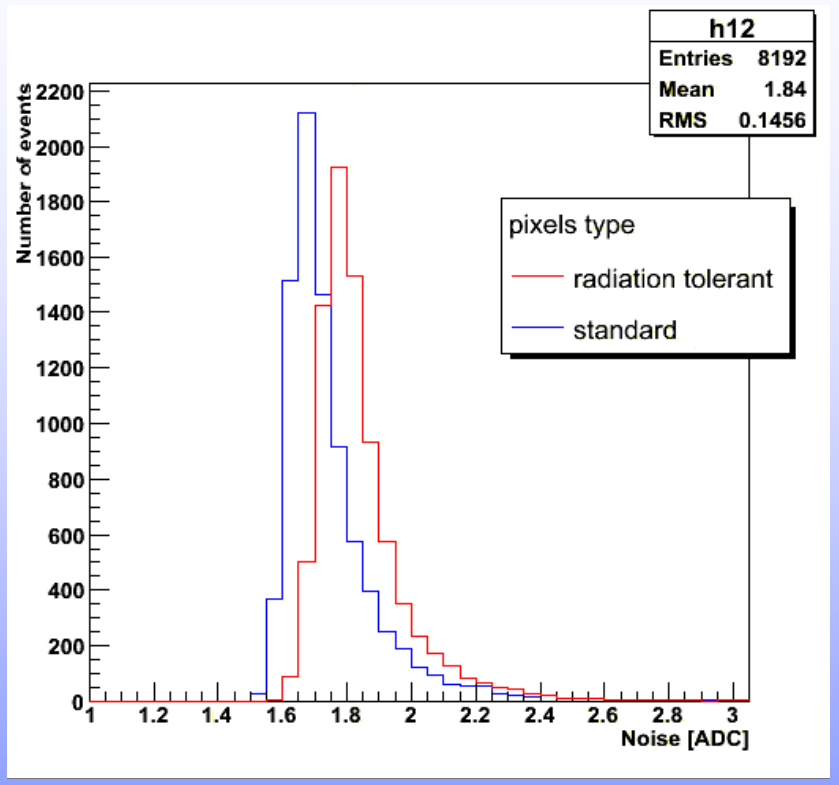


- Simple setup with Strasbourg hardware to do pedestal and source measurements
- Also source measurements were done (Fe55)
- Cooling keeps Mimostar2 at constant temperature
- Temperature Sensor inside cooling box

Lukasz Maczewski/Warsaw/DESY

Pedestal and Noise Distribution





- Measurements done at 21°C
- Pedestal is distributed around 0 ADC
- Noise in the matrix with the radiation tolerant pixels is higher than in the matrix with the standard pixels

Lukasz Maczewski/Warsaw/DESY

Summary

- Testbeam area ready for the magnet and telescope
- Magnet will arrive at DESY in November
- XYϕ table for telescope delivered in October but went back for calibration
- Mechanical setup and cooling for telescope under development
- Different Simulations are being done: First results indicate that a flexible geometrical setup is required
- Sensor technology is broadly being investigated.