

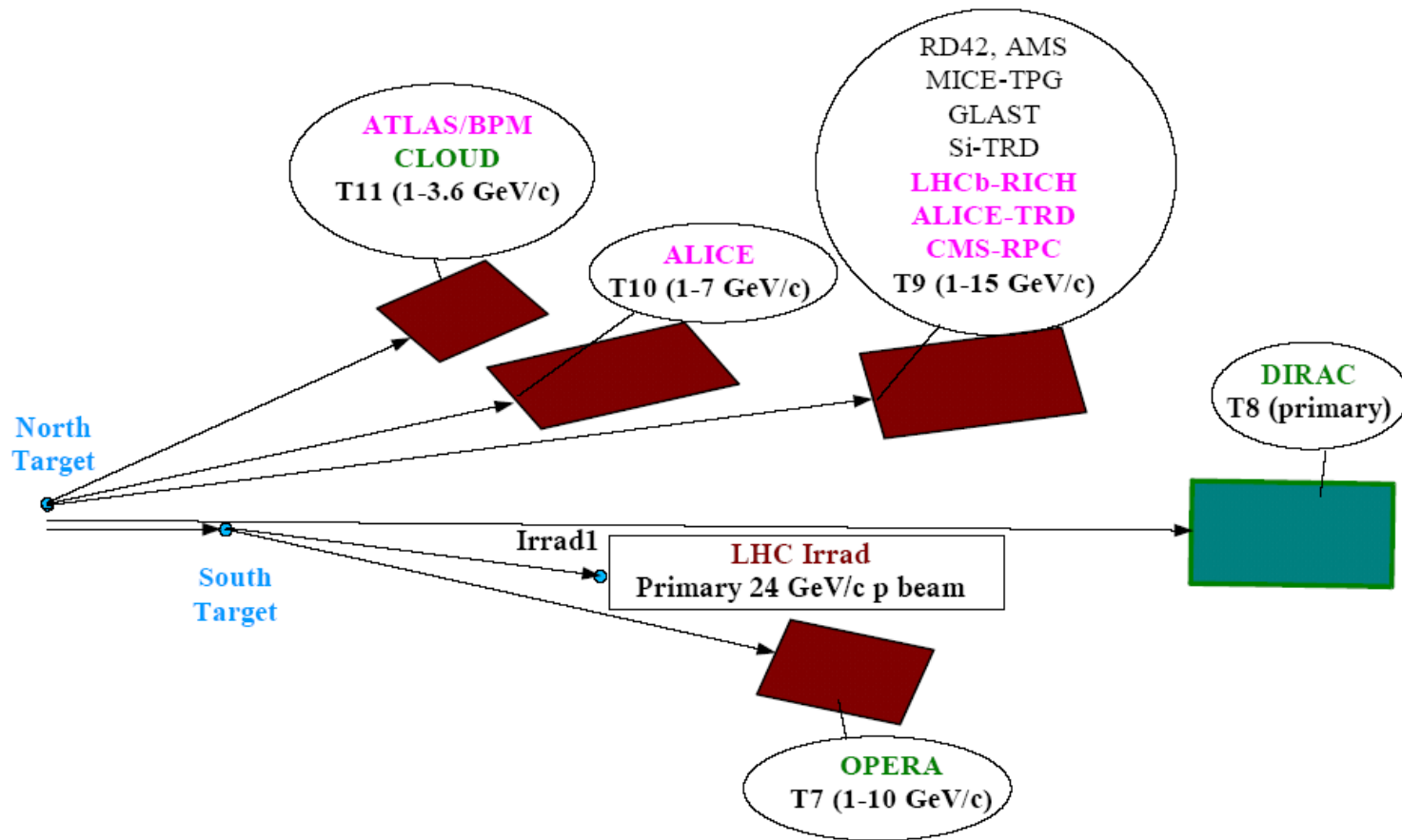
# CERN and DESY Test Beam Facilities

Presented by Erik Ramberg on behalf of  
CERN (Horst Breuker) (and DESY (Ingrid  
Gregor))

ALCPG09

30 September, 2009

# The PS East Area



**EAST AREA LAYOUT**  
(2006 Situation)

# Beam Characteristics

The PS East Area

<b>T7</b>	The T7 beam is a secondary beam that delivers secondary particles up to 10 GeV/c at a production angle of 0 degrees.
<b>T8</b>	The T8 beam is a primary beam that delivers primary protons to the <a href="#">DIRAC</a> experiment. Normally the beam momentum is 24 GeV/c.
<b>T9</b>	The T9 beam is a secondary beam that delivers secondary particles up to 15 GeV/c at a production angle of 0 degrees.
<b>T10</b>	The T10 beam is a secondary beam that delivers secondary particles up to 7 GeV/c at a production angle of 61.6 milliradians.
<b>T11</b>	The T11 beam is a secondary beam that delivers secondary particles up to 3.5 GeV/c at a production angle of 149.2 milliradians.

# PS Physics since April 30 th

- **PS Experiments :**

DIRAC (T8), start May 14 th, # exotic Atoms  
observed today is as in 2008

CLOUD (T11), Facility / Infrastructure ready mid Oct.

nTOF (since May 26), Target commissioned; Beam  
characterized; now on capture XSECT 56 Fe

ATRAP, ASACUSA, ALPHA smooth start-up June 8

- **PS Testbeams :**

Irradiation (T7);

T9, T10 going through the users as planned

14-August-2009

# 2009 PS Fixed Target Programme

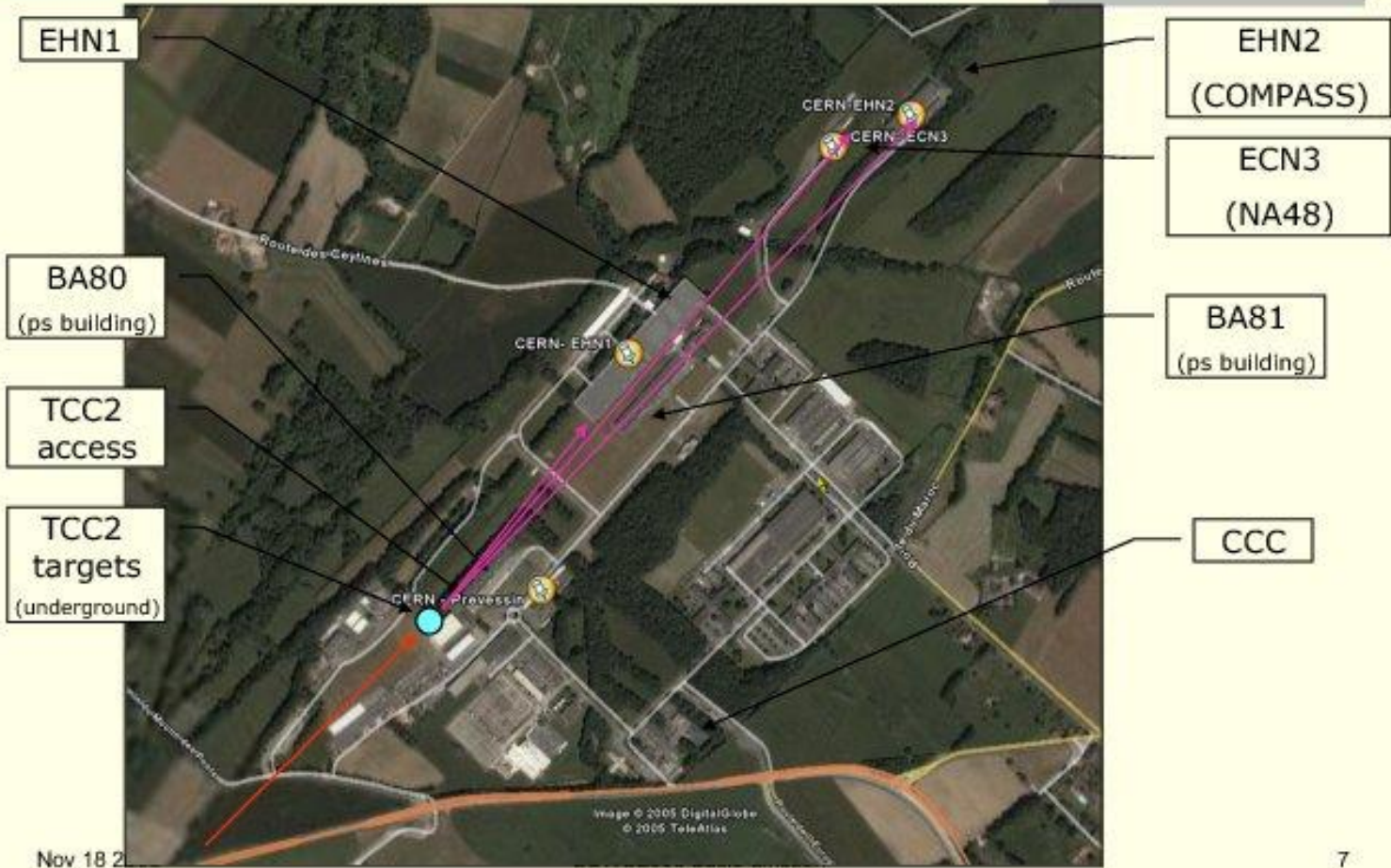
Version 3.0

Colour code: green = PS/SPS-exp ; purple = LHC-exp ; dark blue = Outside exp ; yellow = not allocatable or Machine Development

		P1	P2	P3	P4	P5	P6											
		35 30 Apr 4 Jun	35 4 Jun 9 Jul	35 9 Jul 13 Aug	35 13 Aug 17 Sep	35 17 Sep 22 Oct	32 22 Oct 23 Nov											
T7	Setup 7	Irradiation 35	35	30	5 Irradiation 35	Irradiation 35	Irradiation 32											
T8	Setup 21	DIRAC 21	DIRAC 35	DIRAC 35	DIRAC 35	DIRAC 35	DIRAC 32											
T9	Setup 7	T2K-ECAL 35	T2K-ECAL 14	CALICE RPC 17	4 2 COMPASS CALO 16	MICE EMR 14	MICE EMR 7	MICE EMR 7	3 OPERA Bricks 13	8 COMPASS ECAL 11	15 VIPIX 9	15 NA62	17 PEBS					
T10	Setup 7	ALICE PMD 18	2 CALICE MMEGAS 15	ALICE TOF 14	ALICE VHMPID 13	CMS BCM 8	ALICE TOF 15	RD51 CALICE 10	MICE EMR-ADS 10	MICE EMR-CAL 14	11	ATLAS GOSSIP 10	5 CALICE MMEGAS 15	ALICE VHMPID 7	ALICE TOF 8	ALICE TOF 7	ALICE HPTD 16	ALICE VHMPID 9
T11	Setup 7	35	18	CLOUD 17	CLOUD 35	35	CLOUD 35	CLOUD 32										

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# The SPS North Area



Nov 18 2

7

# The EHN1 beams

Target	Beam	Characteristics
T2	H2	High-energy, high-resolution secondary beam. Alternatively can be used to transport: attenuated primary beam of protons, electrons from $\gamma$ -conversion, polarized protons for $\Lambda^0$ decay, enriched low-intensity beam of anti-protons, or $K^+$ <u>Main parameters:</u> $P_{\max} = 400$ (450) GeV/c, Acc.=1.5 $\mu$ Sr, $\Delta p/p_{\max} = \pm 2.0$ %
	H4	High-energy, high-resolution secondary beam. Alternatively can be used to transport: primary protons, electrons from $\gamma$ -conversion, polarized protons for $\Lambda^0$ decay, enriched low-intensity beam of anti-protons, or $K^+$ <u>Main parameters:</u> $P_{\max} = 330$ (450) GeV/c, Acc.=1.5 $\mu$ Sr, $\Delta p/p_{\max} = \pm 1.4$ %
T4	H6	High-energy secondary beam. <u>Main parameters:</u> $P_{\max} = 203$ GeV/c, Acc.= 2.0 $\mu$ Sr, $\Delta p/p_{\max} = \pm 1.5$ %
	H8	High-energy, high-resolution secondary beam. Alternatively can be used to transport an attenuated primary proton beam <u>Main parameters:</u> $P_{\max} = 400$ (450) GeV/c, Acc.= 2.5 $\mu$ Sr, $\Delta p/p_{\max} = \pm 1.5$ %

# SPS Physics since May 11 th

- **SPS Experiments :**

COMPASS (M2) May 11 th;  $\pi^-$ ,  $\pi^+$ , p;

planned muon and Drell-Yan tests

NA61 (SHINE) (H2) testrun June; now high statistics  
for “T2K” and Pierre Auger Obs.; then p-p e-scan

NA62 (P0) : Commission RICH400, LeadGlass, MUV;  
tests for STRAW and GTK to come

NA63 (crystal) (H4) : Rad. Int. thin foils done, pub.;  
spin-flip in crystalline fields to come

OPERA (CNGS) since May 27 th, running smooth  
(ICARUS later this year)

- **SPS Testbeams :** switch between the users as planned



24-August-2009

# 2009 SPS Fixed Target Programme

Version 3.0

Colour code: green = SPS-exp ; purple = LHC-exp ; dark blue = Outside exp ; yellow = not allocatable or Machine Development

	P1	P2	P3	P4	P5	P6
	35 30 Apr 4 Jun	35 4 Jun 9 Jul	35 9 Jul 13 Aug	35 13 Aug 17 Sep	35 17 Sep 22 Oct	32 22 Oct 23 Nov
T2 -H2	NA CMS CASTOR 3 CMS 7 CREAM 7 FR TR 3 CMS HCAL 4 WALDO 10 WALDO 11 CMS HCAL 10 CMS HCAL 4 CMS HCAL 14 NA61 17 NA61 35 NA61 11 CREAM 7 NA61 17 NA61 24 NUCLEON 8					
T2 -H4	NA CMS BCM 3 CMS 7 CMS 6 CMS 4 SITRD 4 SITRD 8 RD51 14 CMS ECAL 3 DREAM 7 DREAM 15 CALICE RPC 10 COMPASS CALO 3 CALETTI 8 INSURAD 7 CMS ECAL 3 CMS ECAL 11 NA63 20 UA9 10 RD51 10 CMS ECAL 9 LHCf 13					
T4 -H6	CERF 0 CMS 5 CMS 5 MAGAS 7 MAGAS 3 MAGAS 7 ATLAS BCM 7 RD42 7 ATLAS BCM 7 ATLAS LUCID 7 ATLAS LUCID 7 ATLAS STRAW 6 EUDET 14 DEPFET 6 LFCI 6 SILC 12 EUDET 7 ATLAS 8 MIMOSA 2 RD42 7 ATLAS BCM 7 ATLAS LUCID 13 ATLAS FP420 8 ATLAS 3DSI-Si 14 MAGAS 8 MAGAS 7 MAGAS 3					
T4 -H8	NA 3 3DSi 16 ATLAS 5 ATLAS 9 ATLAS 8 MDT Roma 3 MDT Roma 9 GOSSIP 4 GOSSIP 13 UA9 3 UA9 9 ATLAS RP 6 ATLAS RP-MDT-MPI 14 AMS 2 MDT Roma 4 MDT Roma 15 UA9 28 ATLAS RP 4 ATLAS RP 3 AMS 7 AMS 3 AMS 22					
T4 -P0	NA Setup 10 NA62 10 NA62 7 NA62 7 NA62 9 19 28 35 29 NA62 6 NA62 10 22					
T6 -M2	NA 3 COMPASS 17 COMPASS 35 COMPASS 35 COMPASS 35 COMPASS 35 COMPASS 32					
CNGS	NA 3 CNGS 17 CNGS 35 CNGS 35 CNGS 35 CNGS 35 CNGS 32					

SPS/PS-Coordinator: Horst Bruker

Comments:

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- no comments

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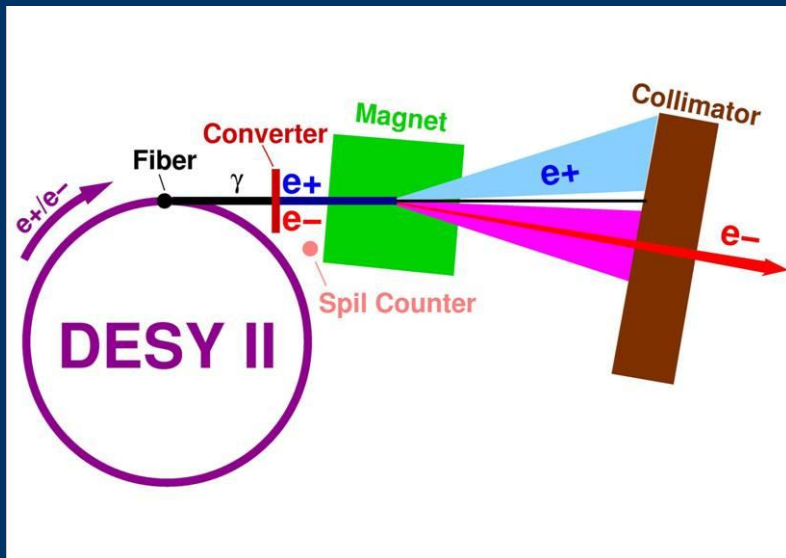
mobile: 164212 (ext. +41 76 487 4212)

# PS / SPS Test Beam Users

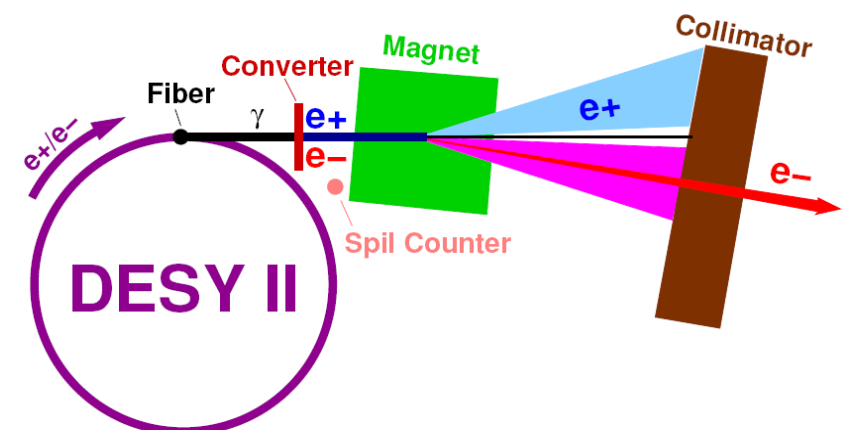
**(list of Projects finished by now;  
ALL initial goals achieved)**

- T9 : T2K ECAL, CALICE, MICE-AD3
- T10 : ALICE PMD, MMEGAS, TOF, VHMPID, MICE-CAL
- H2 : CMS CASTOR, CREAM, CMS HCAL
- H4 : CMS BCM, ECAL, SITRD, RD51, DREAM, CALET
- H6 : CERF, MonoPix, MediPix, ATLAS MMEGAS and BCM, RD42, LUCID, STRAW, EUDET
- H8 : ATLAS 3DSi, GOSSIP, TOTEM, ATLAS TGC, MDT-MPI

# DESY Test Beam Facilities - Status and Plan



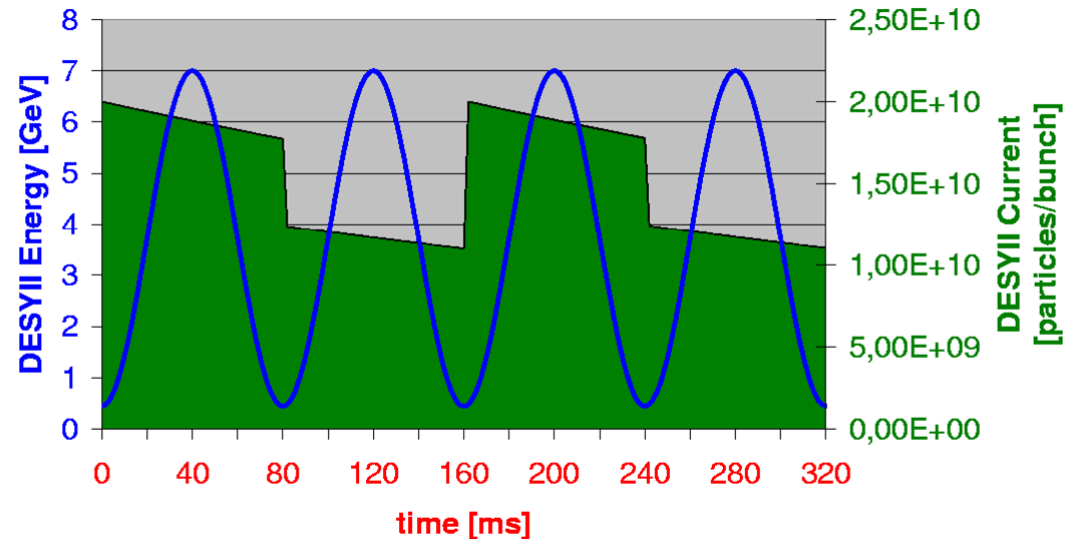
# DESY Test Beam

- DESY provides three test beam lines with 1-6 GeV/c electrons
  - Very simple system, no beam optics, only momentum selection via magnet.
  - Bremsstrahlung beam generated by a carbon fibre in the circulating beam of the electron/positron synchrotron DESY II.
- 
- Photons are converted to electron/positron pairs with a metal plate.
  - Beam is spread out into a horizontal fan with a dipole magnet. Collimator cuts out final beam.
- **DESYII:** Mainly injector for DORIS and PETRA (synchrotron sources).
    - For DORIS: DESYII delivers every second cycle (160ms) single bunches with about  $1 \cdot 10^9$  electrons ( $3 \cdot 10^9$  positrons) at 4.5GeV
    - For PETRA: DESYII delivers every fourth cycle (320ms) single bunches with  $3 \cdot 10^{10}$  electrons ( $1 \cdot 10^{10}$  positrons) at 7GeV
    - Test beam runs in PETRA mode
  - The revolution frequency is 1 MHz, the RF frequency 500 MHz, and the bunch length around 30 ps. The average radius is 46.6 m

# DESY Test Beam

- Ideal DESY II Cycle (no extraction)

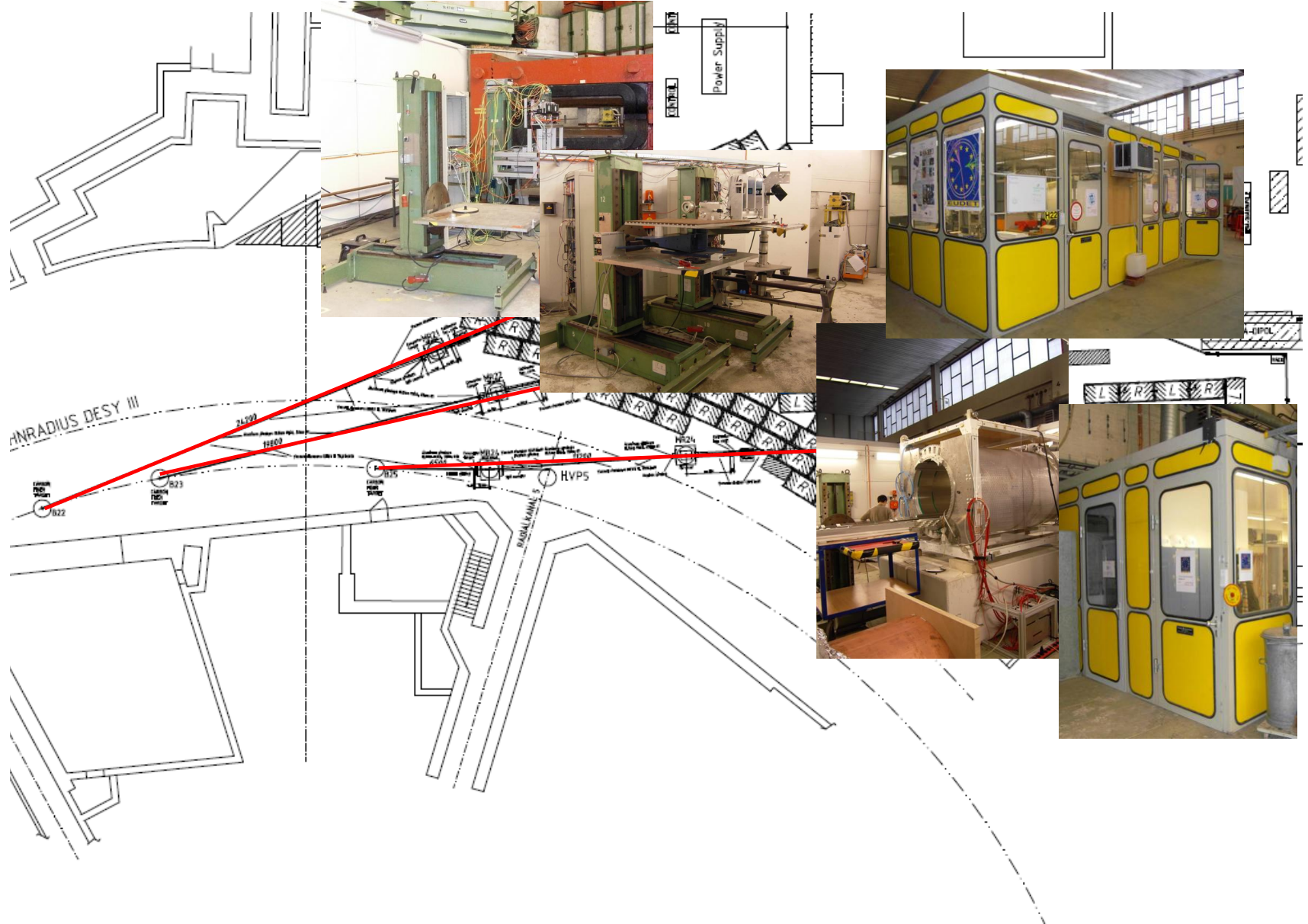
Rates	Target	
	3mm Cu	1mm Cu
Energy		
1 GeV	~2.2 kHz	~ 0.5 kHz
2 GeV	~4.6 kHz	~1.1 kHz
3 GeV	~5.2 kHz	~1.3 kHz
4 GeV	~4.4 kHz	~1.1 kHz
5 GeV	~2.8 kHz	~0.5 kHz
6 GeV	~1.5 kHz	~0.2 kHz



- The rates are influenced by many parameters.
- Ideally, the maximum rate around 1 kHz (3 GeV, 3mm Cu convert, Collimator ca. 5mm x 5mm, DESY II maximum energy at 7 GeV, no beam extraction, no DESY III ramp).
- Few hundred Hertz are realistic

In practice is the maximal event rate around 2 kHz.  
(3 GeV, 3mm Cu convert, Collimator ca. 5mm x 5mm)

# Testbeam Layout



# Facilities for Test Beam User

- All three testbeam lines have
  - Interlock systems
  - Magnet control
  - Patch panels with preinstalled cables
  - Gas warning systems
  - Fast internet connection (DHCP)
  - Trigger scintillators
- The user can ask for:
  - Translation stages
  - Premixed gases
  - Superconducting Magnet (1T)
  - Beam Telescopes:
    - MVD Telescope
    - EUDET Telescope
- The users typically bring:
  - Your Data Acquisition incl. computers
  - Trigger scintillators



# Test Beam Area 21

- Recently refurbished -> New home of EUDET telescope



- Pixel beam telescope:
  - 6 layers of Monolithic Active Pixel Sensor (MAPS) detectors
  - DEPFET and ISIS pixel detectors for validation
  - DAQ system
  - Demonstrator telescope in use since summer 2007

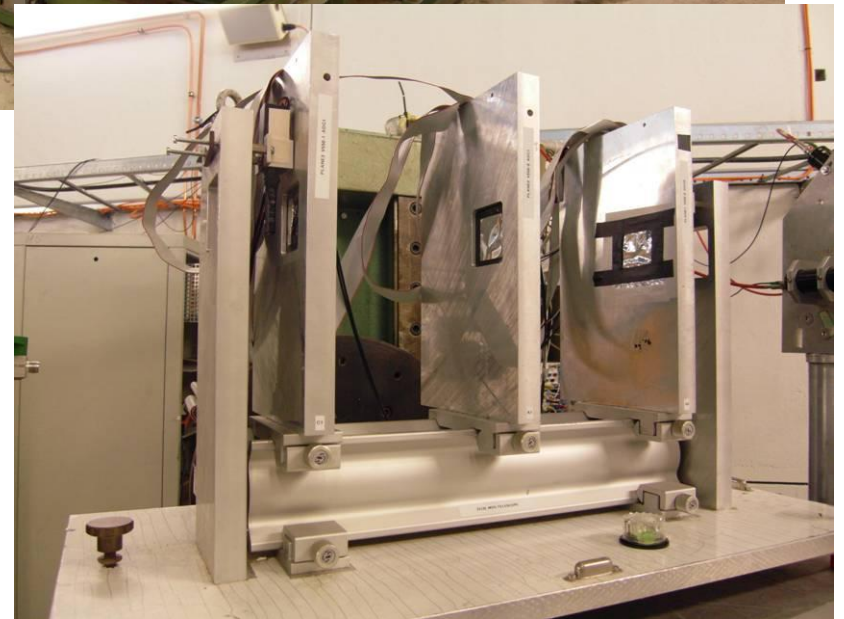
More information

**[WWW.EUDET.ORG](http://WWW.EUDET.ORG)**



# Testbeam 22: ZEUS Telescope

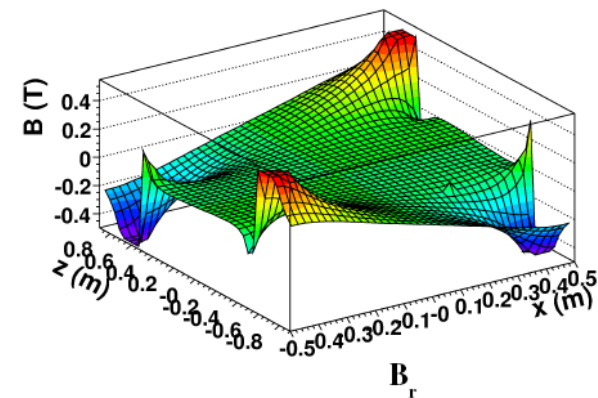
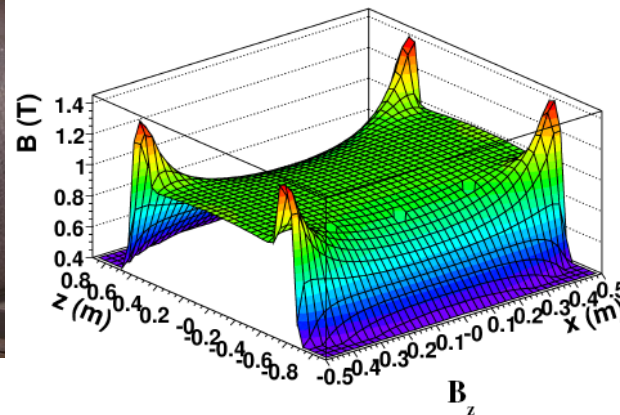
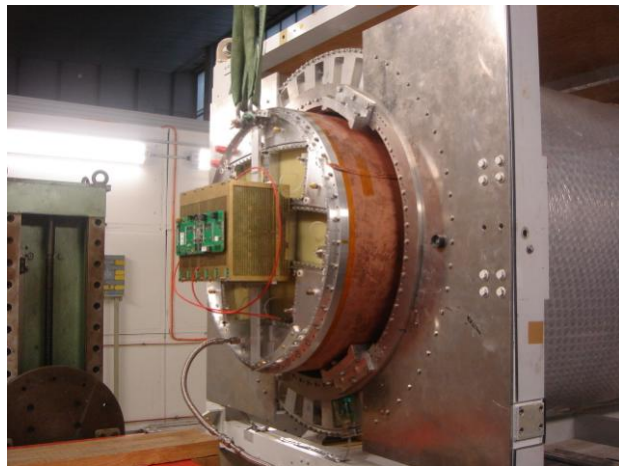
- Location of ZEUS MVD telescope (build in 1998)
- Telescope parameters:
  - 300  $\mu\text{m}$  thick single-sided Si strip sensors
  - Each plane with 2 sensors perpendicular to each other
  - Strip pitch: 25 $\mu\text{m}$
  - Readout pitch: 50 $\mu\text{m}$
  - Active area: 32x32 mm<sup>2</sup>
  - Trigger window: 8x8 mm<sup>2</sup>
  - DAQ was upgraded to EUDET like system
- Plans for next years:
  - keep telescope running
  - improve software



# Testbeam 24: EUDET



- Large bore magnet:
  - 1Tesla,  $\varnothing \approx 85$  cm, stand-alone He cooling, supplied by KEK
  - infrastructure(control, fieldmapping, etc.) through EUDET
  - Magnet fully instrumented at DESY and ready for use



# Users in the Last 5 years

- HERA Upgrades:
  - ZEUS-MVD,
  - Hermes-Recoil Detector (Silicon and SiFi)
- ILC R&D groups:
  - CALICE (HCAL, ECAL, DigiHCAL, BeamCAL)
  - ILC-TPC, SiTRA, SiTPC
  - Mimoso, ISIS, DEPFET
  - Polarimeter
- LHC R&D groups:
  - LHCb
  - ATLAS LUCID, ATLAS ALFA
- Medipix
- OPERA

# Availability and Summary

- DESY test beam is running throughout 2009 and 2010 except January
- Machine study weeks every 6 weeks planned -> detailed schedule available
- Users can apply for beam time through DESY test beam coordinators -> up to three weeks possible, longer terms negotiable

You can apply for test beam time at DESY

***[testbeam.desy.de](http://testbeam.desy.de)***

Or contact: [testbeam-coor@desy.de](mailto:testbeam-coor@desy.de)

- DESY provides three test beam lines with 1-6GeV/c electrons
- Very simple system, no beam optics, only momentum selection via magnet
- Perfect facility for proof of principle studies, efficiency studies and also resolution studies
- Infrastructure simple and flexible