# Electric field profile using beam test data

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# Outline

- Motivation
- How-to: the grazing angle technique
- Tools: beamline, telescope, etc
- Samples to be measured: let's talk about it :-)
- Practical details: when, where, how, what we need to do, what you need to do
- Conclusions & Outlook

# Motivations

- Need to parameterize the electric field as a function of several variables and conditions:

A. Fluence

B. Radiation type

C. Bulk material

D. Temperature

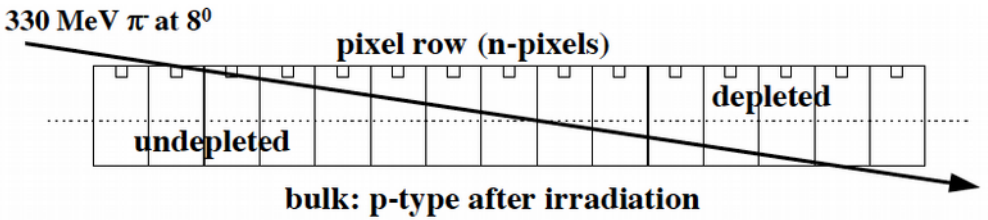
E. Annealing

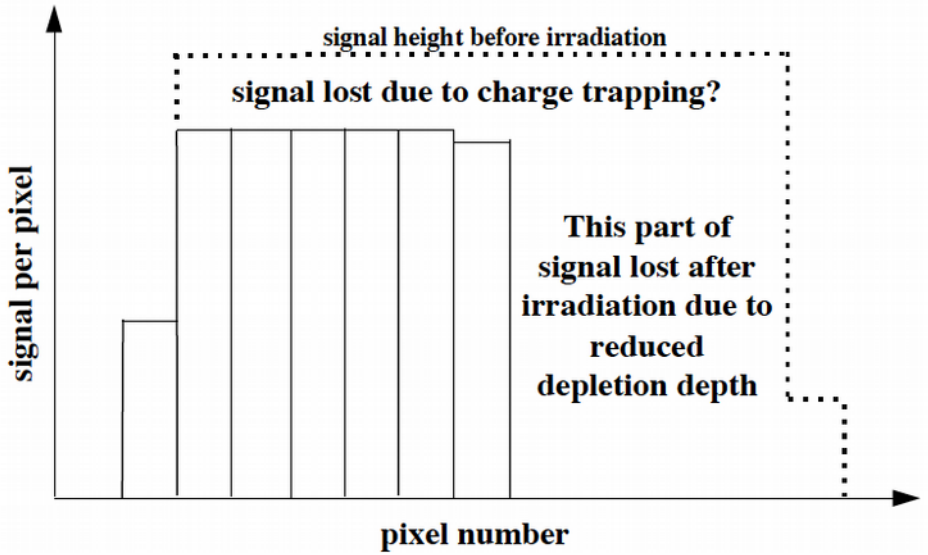
e.g. needed for detector simulation (digitization)

- Done with Edge TCT measurements
- Possible with test beam data too

# Grazing angle technique

- Technique developed by Henrich, Bertl, Gabathuler & Horisberger (CMS note 1997/021)




- Tracks enter at shallow angle wrt to the detector surface
- Charge collection efficiency as a function of the bulk depth

# Exploiting the grazing angle technique

"Simulation of Heavily Irradiated Silicon Pixel Sensors and Comparison with Test Beam Measurements"
V. Chiochia et al., Nuclear Science, IEEE Transactions on , vol.52, no.4, pp. 1067- 1075, Aug. 2005

- Use this technique to perform ~ 1 µm resolved charge collection profiles

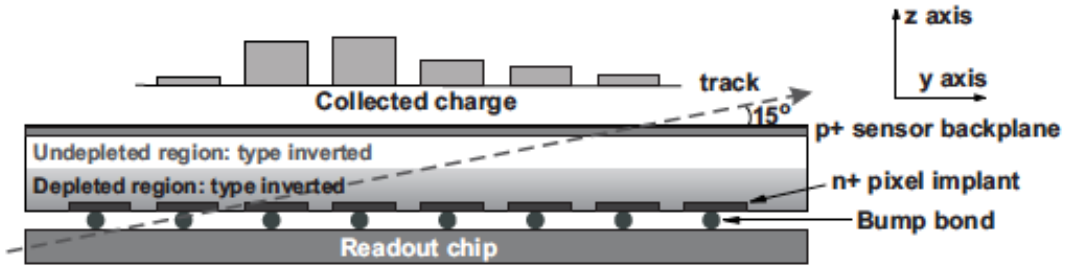



Fig. 2
THE GRAZING ANGLE TECHNIQUE FOR DETERMINING CHARGE COLLECTION PROFILES. THE CLUSTER LENGTH IS PROPORTIONAL TO THE DEPTH OVER WHICH CHARGE IS COLLECTED.

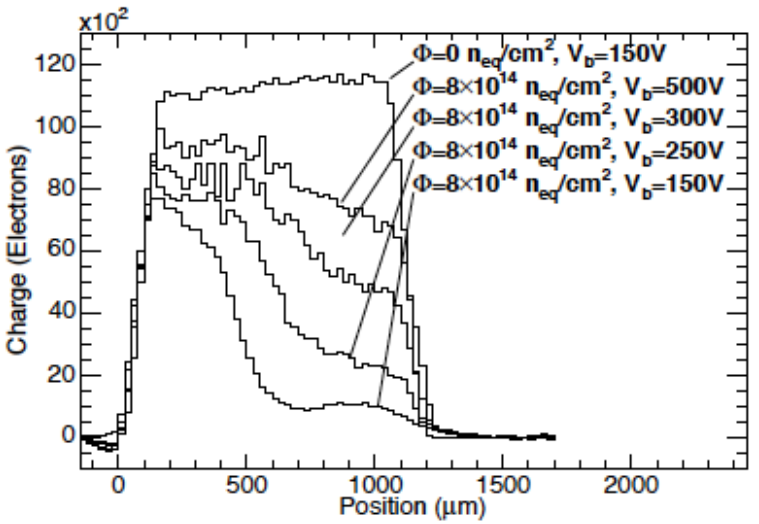



Fig. 3
CHARGE COLLECTION PROFILES FOR AN IRRADIATED ($\Phi = 8 \times 10^{14}$ $N_{eq}/cm^2$) AND AN UNIRRADIATED SENSOR ($\Phi = 0$ $N_{eq}/cm^2$) OPERATED AT SEVERAL BIAS VOLTAGES.

- Parameterization of the Electric Field in simulations
- Comparison data/simulation (next slides)

# Chiochia 2005/06 results

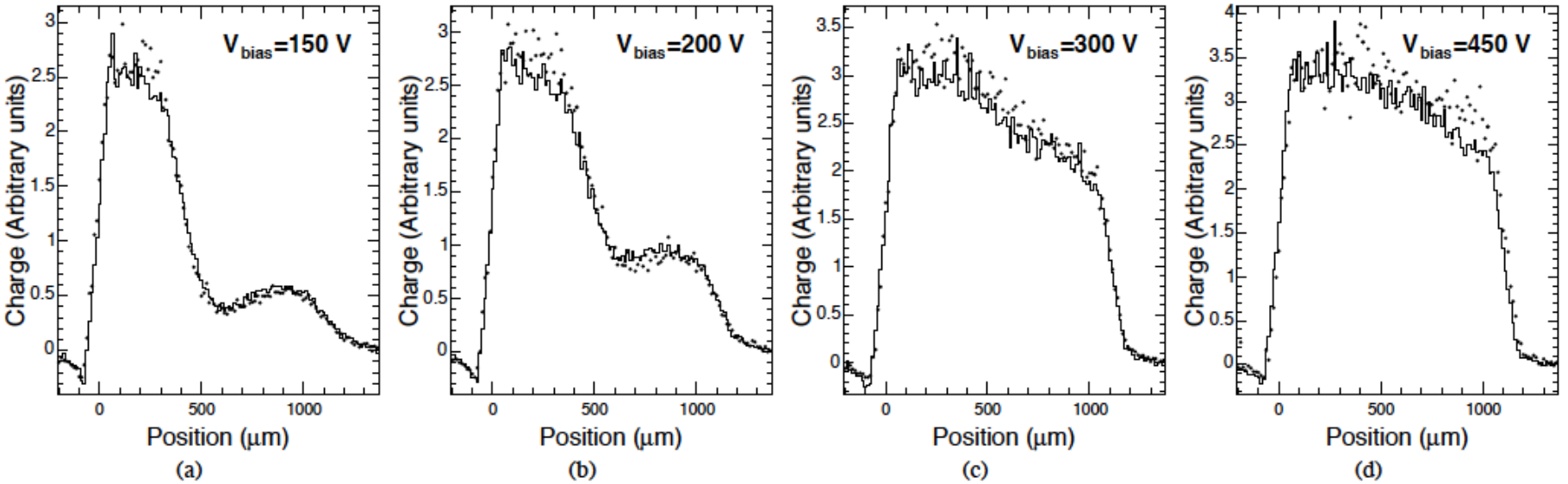



Fig. 10

THE MEASURED CHARGE COLLECTION PROFILES AT BIAS VOLTAGES OF 150 V, 200 V, 300 V, AND 450 V ARE SHOWN AS SOLID DOTS FOR FLUENCES OF $6 \times 10^{14}$ $N_{eq}/CM^2$. THE BF SIMULATION IS SHOWN AS THE SOLID HISTOGRAM IN EACH PLOT.

- ✓Excellent agreement
- ✓Down to the details of wiggle between 500 and 1000 μm
- ✓All effects understood

# Tools

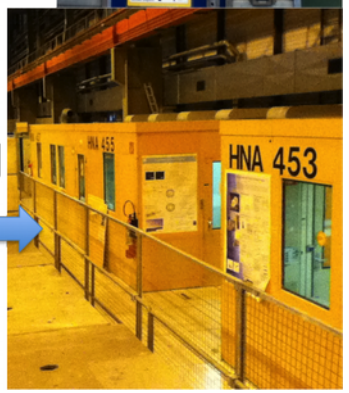
- A beamline: high energy particles preferred to minimize multiple scattering (NB very large thickness to be transversed)
- A telescope with a high pointing resolution ( O(μm))
- All the necessary infrastructure to precisely mount the sample, bias them, power the R.O.C.s, a DAQ system, etc.
- Samples to be measured
- Simulations to be run for selected samples

# Beamline – North Area

Where we are

BUILDING 887 IN PREVESSIN

HUT HNA 455

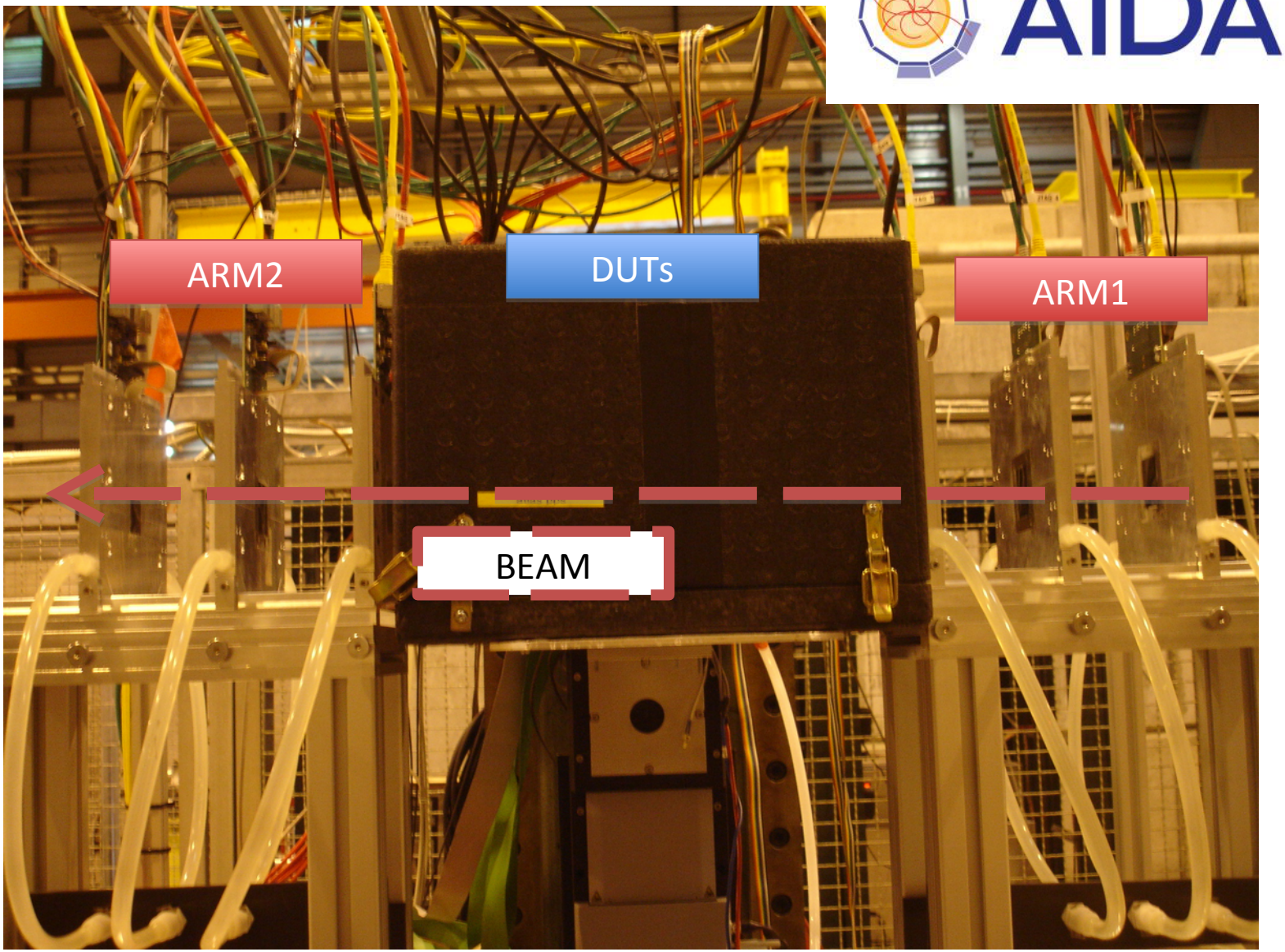

**H6B:**

**120 GeV/c π**

**0.6 Mparticles/spill**

**Spill ~ 10 s; supercycle ~ 50 s**

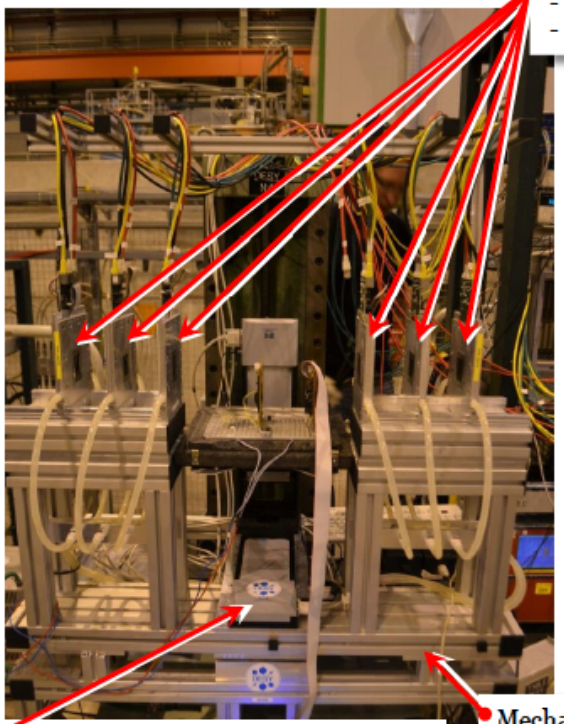
# Telescope



# Telescope characteristics

EUDET telescope @DESY ⇔ CERN
(EUropean DETectors, FP6 project)

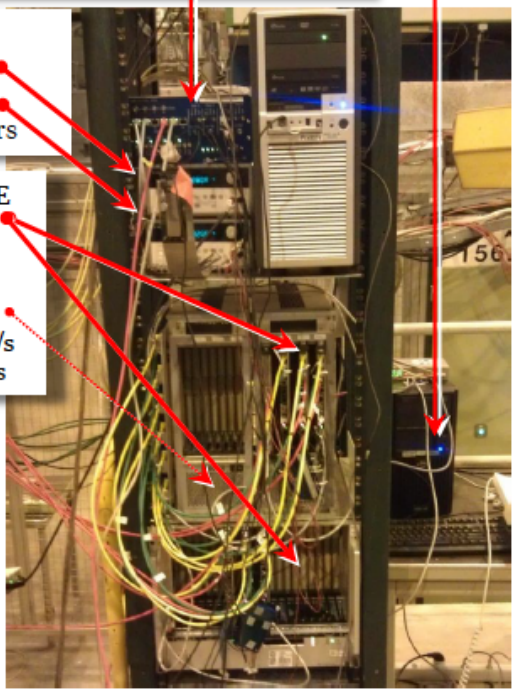
6 MAPS sensors (IPHC Strasbourg)
- Mimosa26
- 18.4 x 18.4 μm²
- 1152 columns x 576 rows (2x1 cm²)
- 50 μm thickness
- rolling shutter = continuous readout = deadtime free
- 115.2 μs integration time/frame (8.68 kFrames in 1 second)



Trigger Logic Unit (TLU)
- 4 inputs from PMTs
- 6 RJ45 (+ 2 NIM, 2 TTL) sockets to communicate with the readout systems by exchange trigger/busy signals
- +15V to power 4 PMTs
- control via linux PC (USB)

Power supplies
+8V: power the sensors
+6V: JTAG boards to configure Mimosa sensors

Sensors readout with a 64bit VME based boards
- EUDRB = "EUdet Data Reduction Board"
- 2 crates (+1 spare)
- if 6 EUDRBs/1 VME = 500 Ev/s
- if 3 EUDRB/2 VME = 850 Ev/s

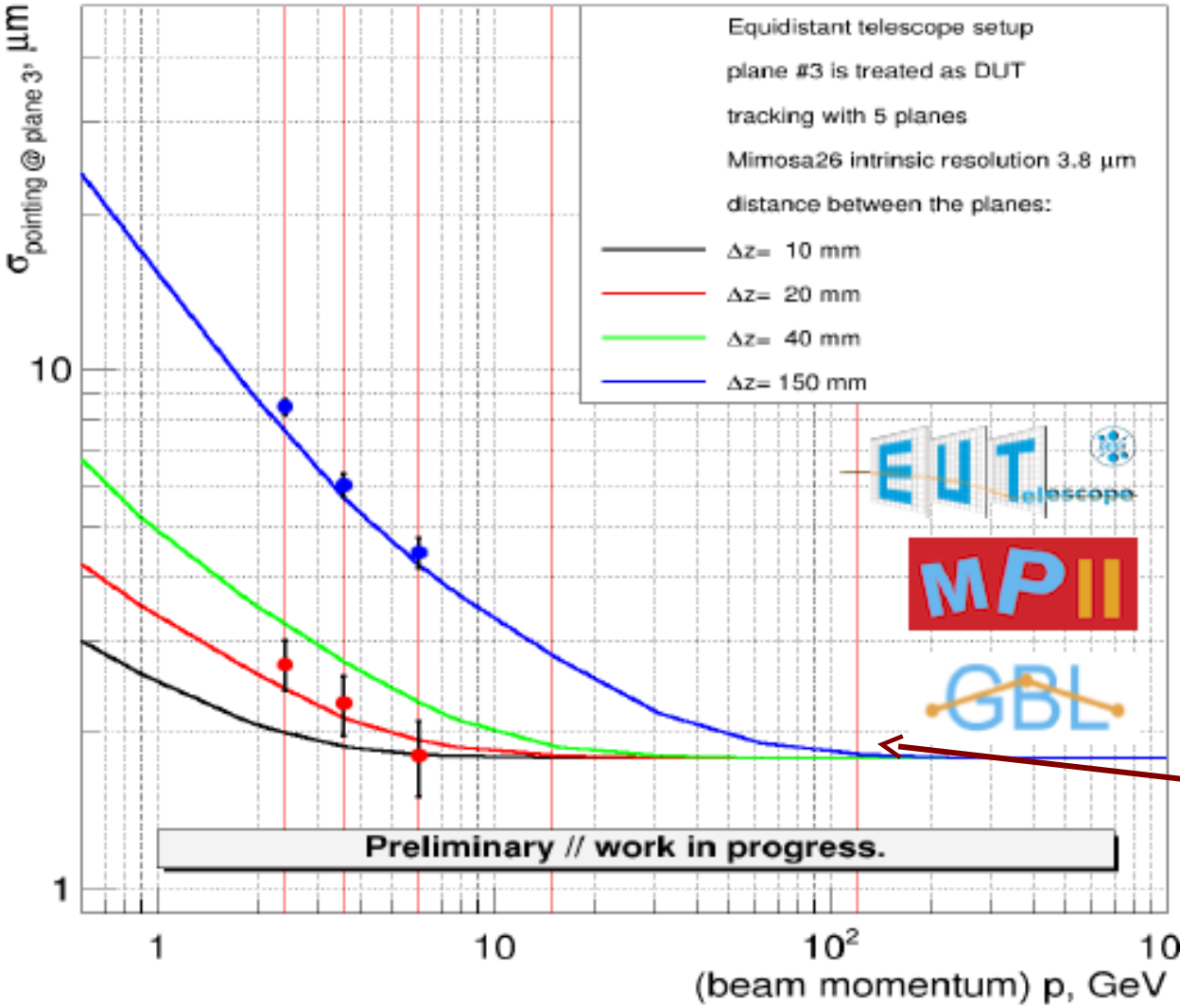


Device Under Test (DUT) positioning
- by Physikalische Instrumente
- precision positioning XY stage
  - 0.1 μm precision
- 1 rotation stage in the setup
  - 32 μrad precision
- few kg of weight possible
- control over Windows PC

Mechanical support
- based on Al profiles
- very rigid
- ~1 μm precision rotation in horisontal plane
- 350 mm gap between the arms for XY stage + DUT platform

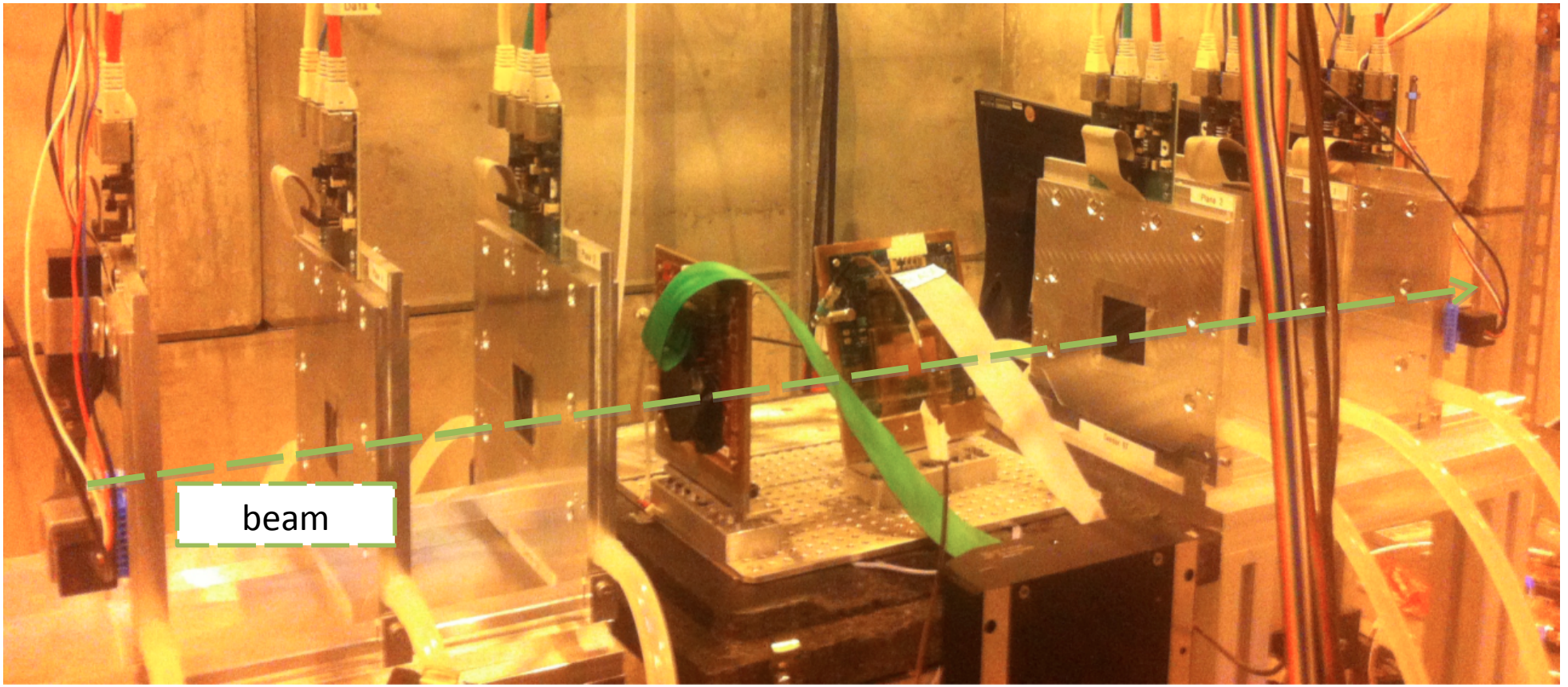
Igor Rubinskiy 31.05.2012 - High resolution EUDET telescope (status and development plans) page 2

# Telescope pointing resolution

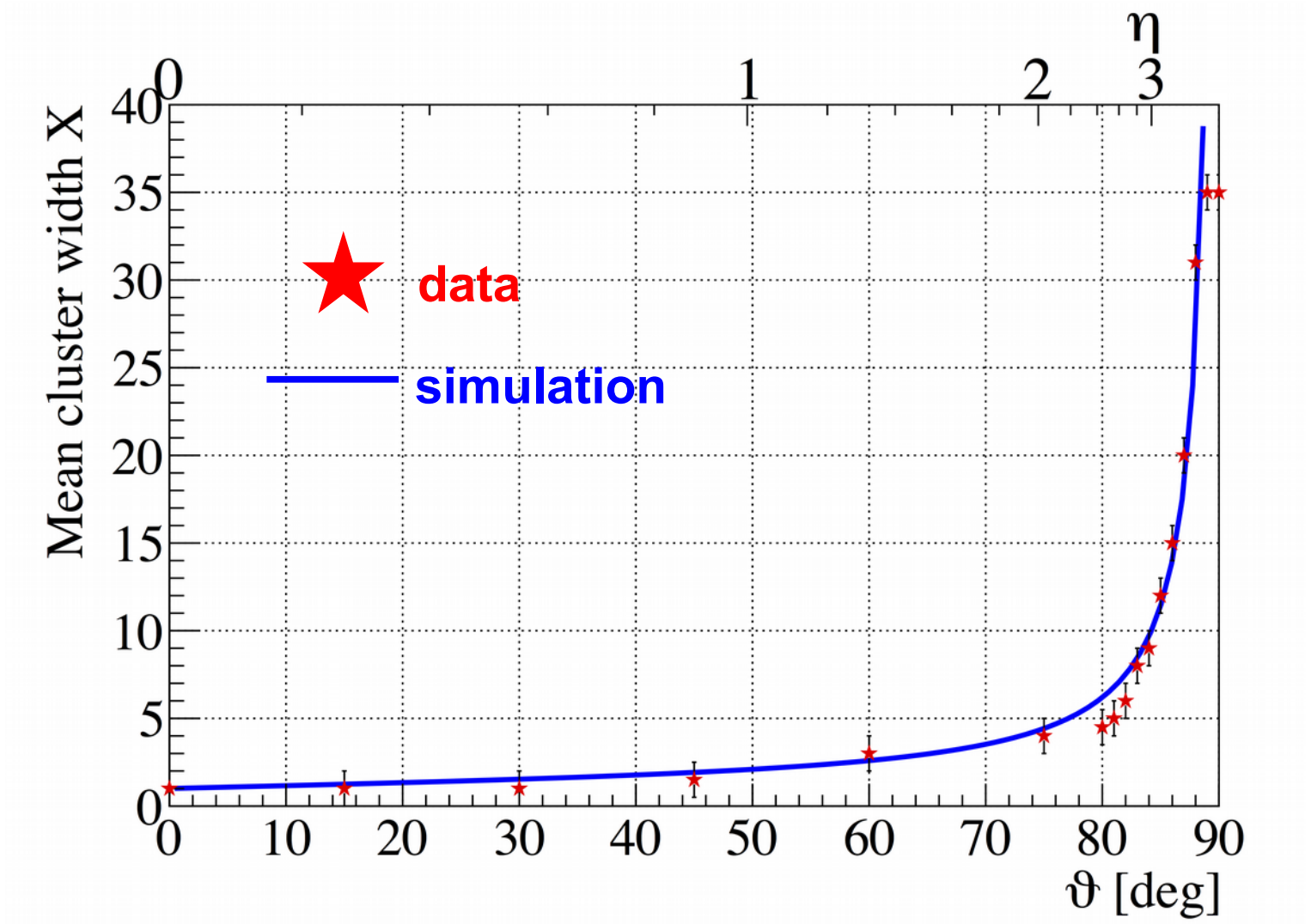



pointing resolution <2µm !!!

# Hi-η configuration



# Cluster size vs impinging angle



# Groups interested

- Several configurations can be investigated
  - Bulk material, type
  - Irradiation type, fluence
  - Etc.
- Please express your interest and prepare a list of samples you would like to measure

➔ Send it to Igor and myself by July 1st

- We will try to make a list of measurements with different priorities
- Then we can start to simulate the selected samples

# Practical details

- When: 1 week starting from Monday 20/10
- Where: H6B beamline at NA, CERN
- How: using 120 GeV π with the EUDET/AIDA telescope
- What you need to do:
  - Take the RP class (online at sir.cern.ch)
  - Get a personal dosimeter (DIS)
  - Ask for access authorization via EDH (North Area, building 887)

# RP online course

https://sir.cern.ch

Apps | Wikipedia | BBC | Iphne mail | LPNHE - UMR 7585 | ATLAS Experiment | Google Scholar | Annuaire LDAP - LP | Imported From Firef | Other Bookmarks

**SIR - Safety Information Registration**

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This application allows you to access CERN safety self-training modules. Click on any of the training proposed below.

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Please note that successfuly passing a course doesn't give you any access rights to controlled zones but, on the opposite, safety courses may be required to validate your existing access authorizations. You can control the validity of your access authorizations on Adams and request new access authorizations on EDH.

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| Go | CMS Safety (Level 4C) | ✘ |
| Go | ALICE Safety (Level 4I) | ✘ |
| Go | Electrical Safety Awareness | ✘ |
| Go | ATLAS Run Control | ✘ |
| Go | PS Complex (Level 4 PS) | ✘ |
| Go | ISOLDE Primary | ✘ |
| Go | TREC: Traceability of Radioactive Equipment | ✔ |
| Go | GLIMOS training | ✘ |
| Go | ATLAS Muon Shifters | ✘ |
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| Go | Chemical Risk Awareness | ✘ |

**Course description**

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| TSO (Bdg 40) | Kate RICHARDSON |
| GLIMOS (Exp ATLAS) | Olga BELTRAMELLO |
| First Aiders (Bdg 40) | Wim BEAUMONT |
| | Dave COCKERILL |
| | Loukas GOUSKOS |
| | Lucie AGUIRRE |
| | Wolfram ZEUNER |
| | Claudia WULZ |
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| | Krzysztof Zdzislaw KIERZKOWSKI |
| | Austin BALL |

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ADaMS

Click on the image above to check all your access rights on the ADaMS system.

**News**

***Messages from AdAMS***

If you have received a message from AdAMS access control system claiming your level 1, 2 or 3 course is soon to expire, please note that these courses are no more available and have been replaced by:

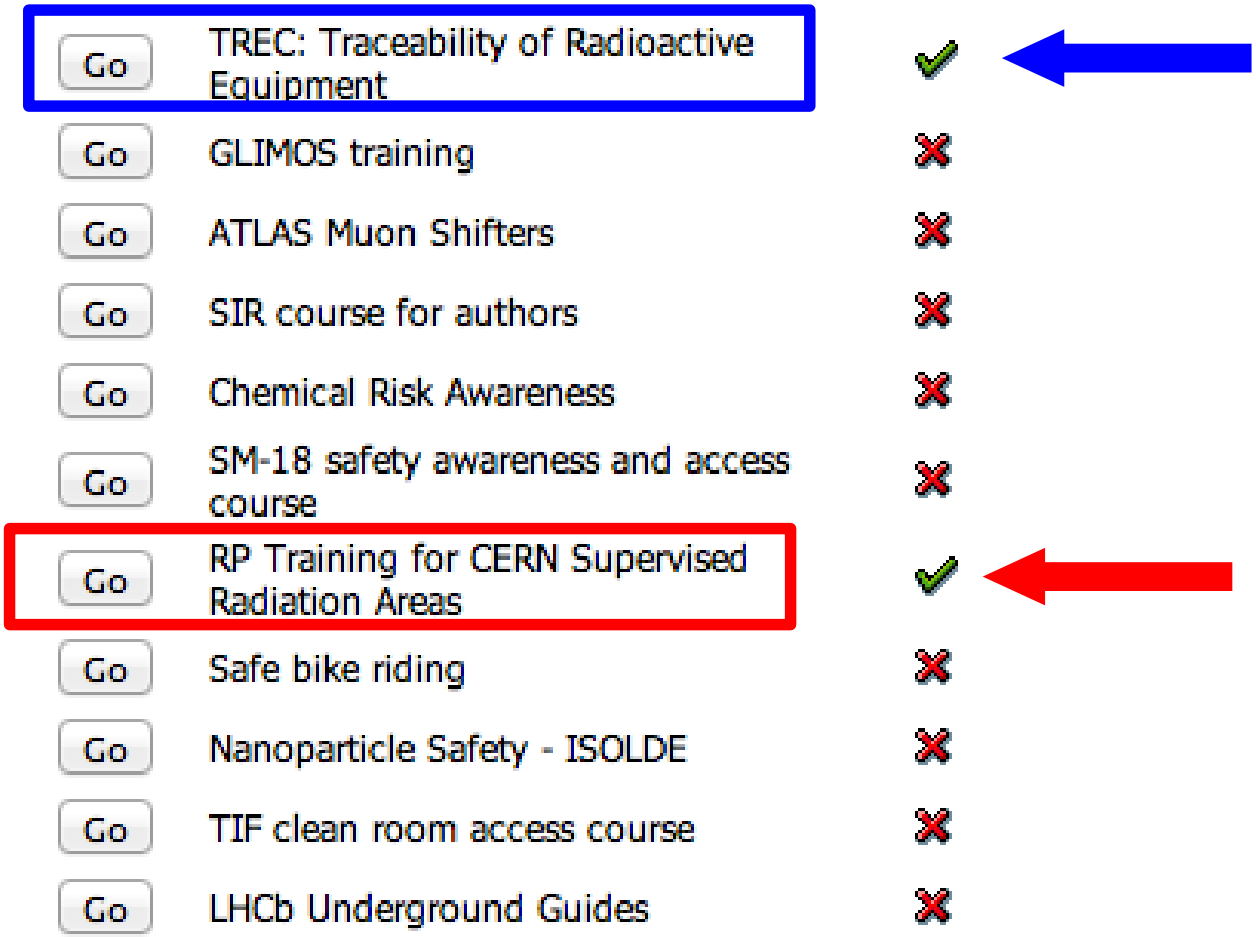
- "CERN Safety Introduction" to be followed by any person at CERN
- "Safety during LS1" to be followed by any person accessing machines and underground zones

If you have taken the 2 courses above, you can ignore any message regarding Level 1, 2 and 3.

# Classes to take

**Optional**

**Mandatory**



# Dosimeter

https://dosimetry.web.cern.ch

CERN Accelerating science

Sign in Directory

HSE

## Dosimetry Service

Occupational Health & Safety and Environmental Protection Unit

Français English

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## Welcome!


QUICK LINKS

- How to obtain a dosimeter
- Dosimeter reader stations
- Medical certificate
- Radiation Protection Training
- Dosimetry results
- Frequently Asked Questions

CONTACT AND OPENING HOURS

Office: 55 R-004

# Short term dosimeter

CERN associated members

***Short-term dosimeter for associated members of the personnel***

If you are an Associated Member of the personnel, you will work in *Supervised Radiation Areas* only and you will stay less than 2 consecutive months at CERN in one calendar year, you may request a short-term dosimeter without the need to provide a medical certificate. In this case your maximum allowed personal dose is limited to 1 mSv per year. *Please note that you are entitled to only one short-term dosimeter per calendar year.*

CERN personnel

Employed members of the personnel (Staff, Fellows, Apprentices) are generally considered to be at CERN full-time and hence are not entitled to obtain a short-term dosimeter. Contractors' personnel are not entitled to short-term dosimeters.

# Personal dosimeter: requirements

## Personal dosimeter for employed or associated members of the personnel

You can obtain a personal dosimeter if you meet the following conditions:

- You will work in a *Radiation Area*.
- You have a **valid contract** with CERN.
- You have a **valid** medical certificate or you had a medical and hematological examination by the CERN Medical Service.
- You have followed the relevant radiation protection course at CERN.
- You have **read and signed the** 'Rules of use' form (pdf). This is only needed for your first dosimeter.

# Medical certificate forms

**Forms**

| Document | Type |
|---|---|
| CERN Personal Dosimeter - reception form and fact sheet<br>* to be signed before receiving a dosimeter * | pdf |
| Lost or damaged Dosimeter declaration | pdf |
| Medical certificate template - Users | |
| ENGLISH | pdf |
| FRENCH | pdf |
| BULGARIAN | pdf |
| CHINESE | pdf |
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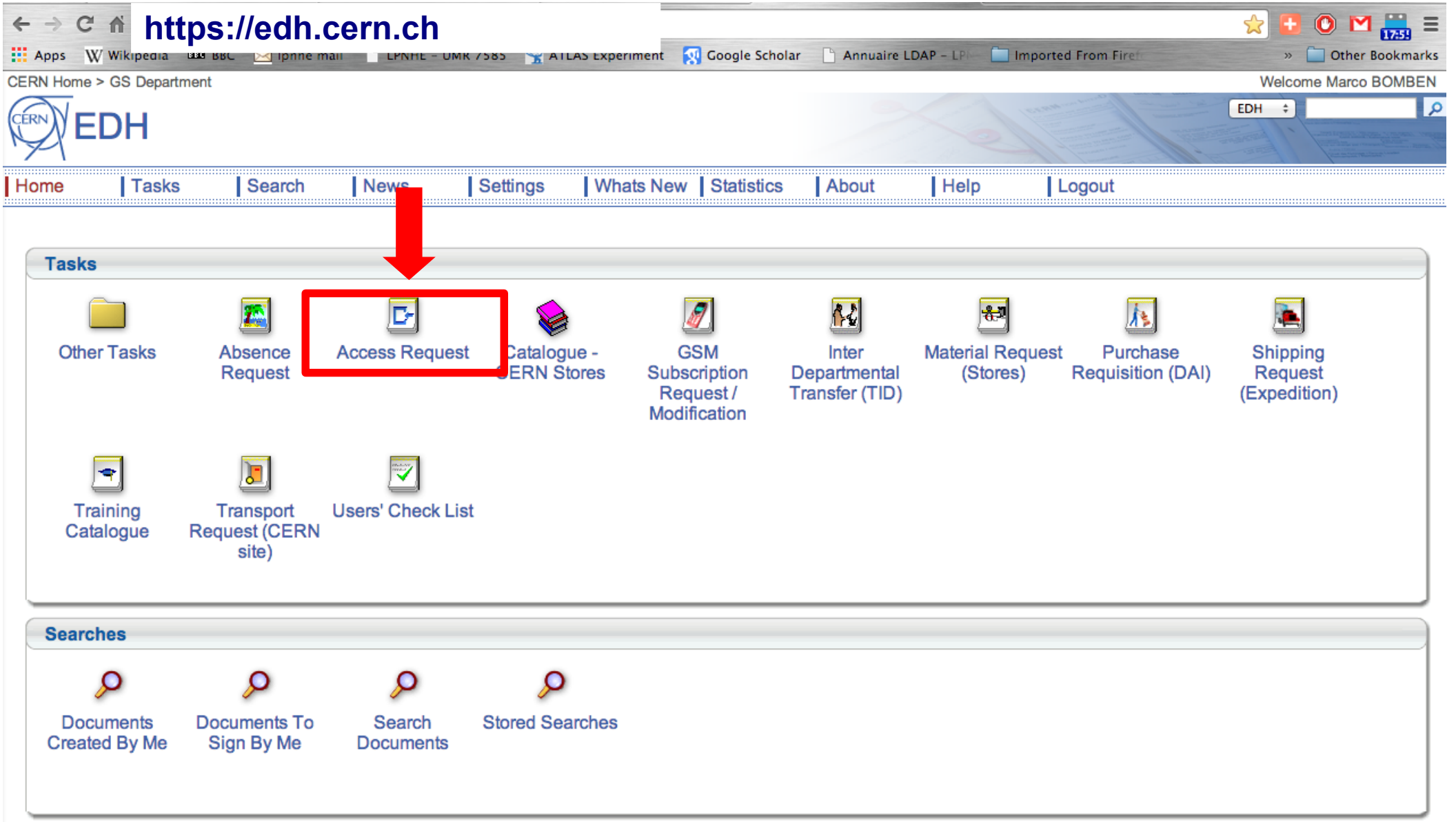
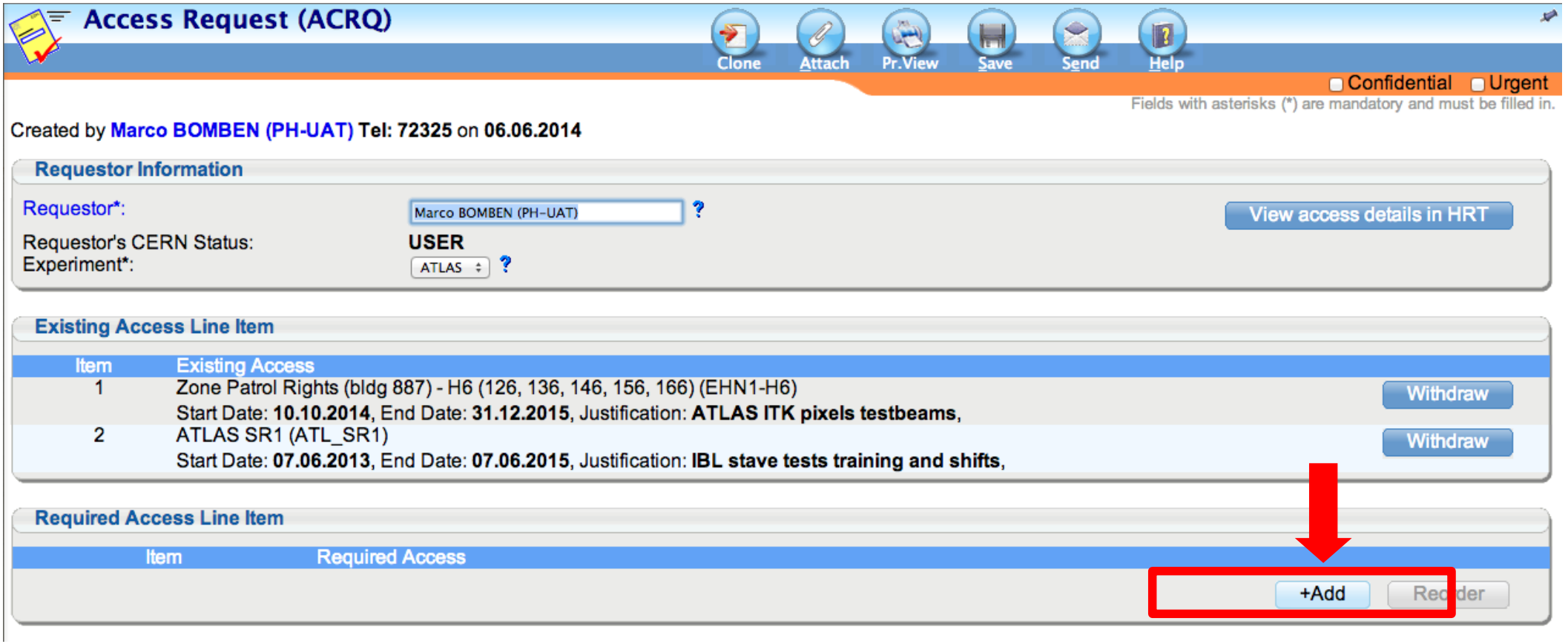
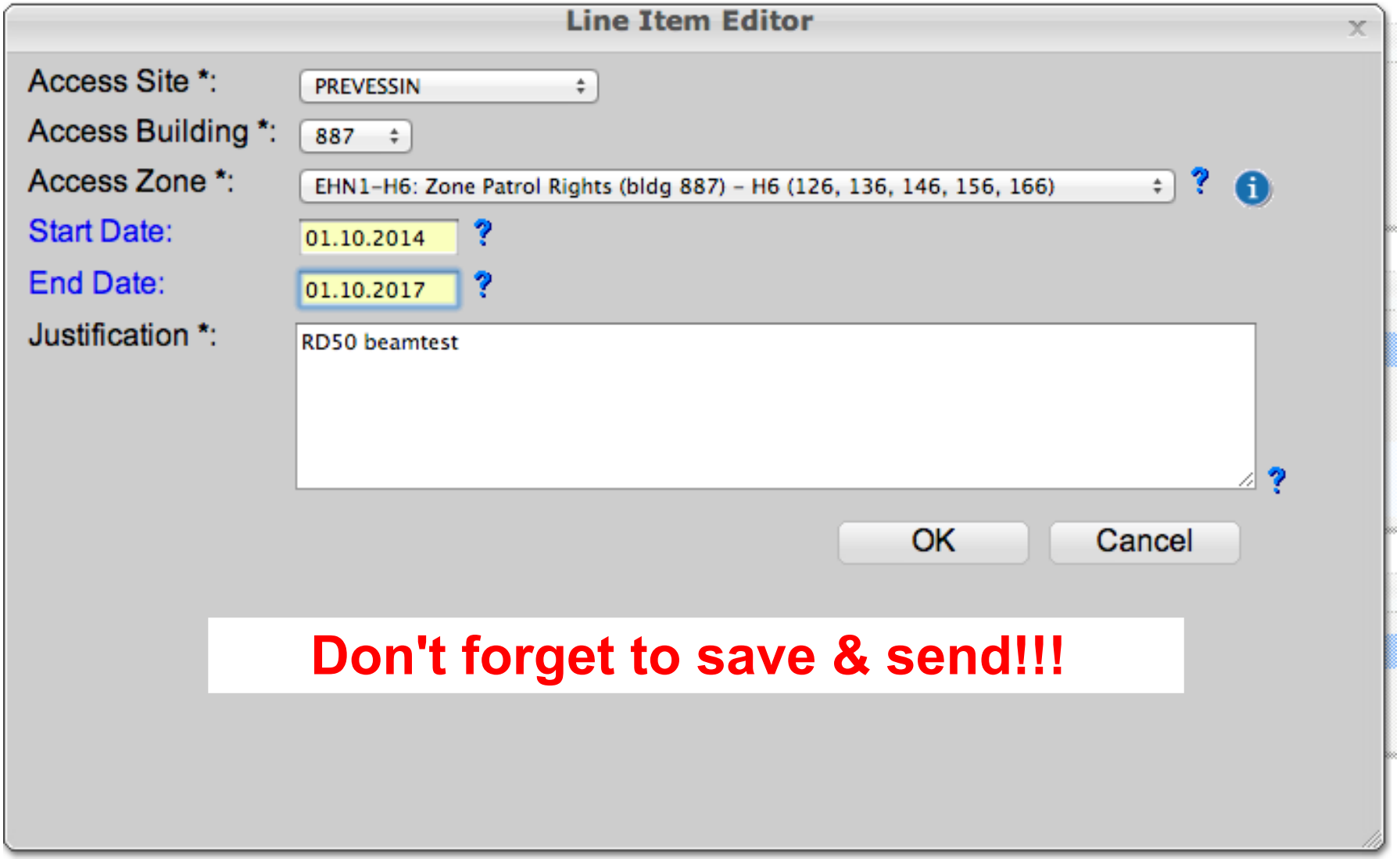
# North Area access authorization



# Requiring new access



# Access to beam line H6




**Don't forget to save & send!!!**

# What we need to do

- Find shifters
- Complete the setup:
  - LV PSs needed – electronic pool?
  - DAQ PCs: one more might be needed
- Find a place to store data accessible to everyone:
  - Afs? Eos?
- A place accessible to everybody to collect information
  - Instructions, log files, spreadsheets, etc

# Conclusions & Outlook

- Combining simulations and beamtest measurements could give access to the electric field profile
- To achieve excellent precision high energy particle beam and high pointing resolution telescope is needed
- We have all the above ingredients
- We are looking forward to measure your samples
- ... and for your best shifters :-)

# Contacts

- Marco: marco.bomben@cern.ch
- Igor: rubinsky@mail.desy.de