

12th Workshop on European Collaboration for Higher
Education and Research in Nuclear Engineering and
Radiological Protection

30 May - 1 June 2016 Cervia



„RADAM“

A laboratory Course on Radiation Detection and Measurement

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Scope



- Familiarize the participants with standard nuclear measurement techniques
- Give the possibility to perform hands-on experiments
- Introduce data analysis techniques
- Experience of working in a foreign environment
- Foster communication skills in English

Schedule



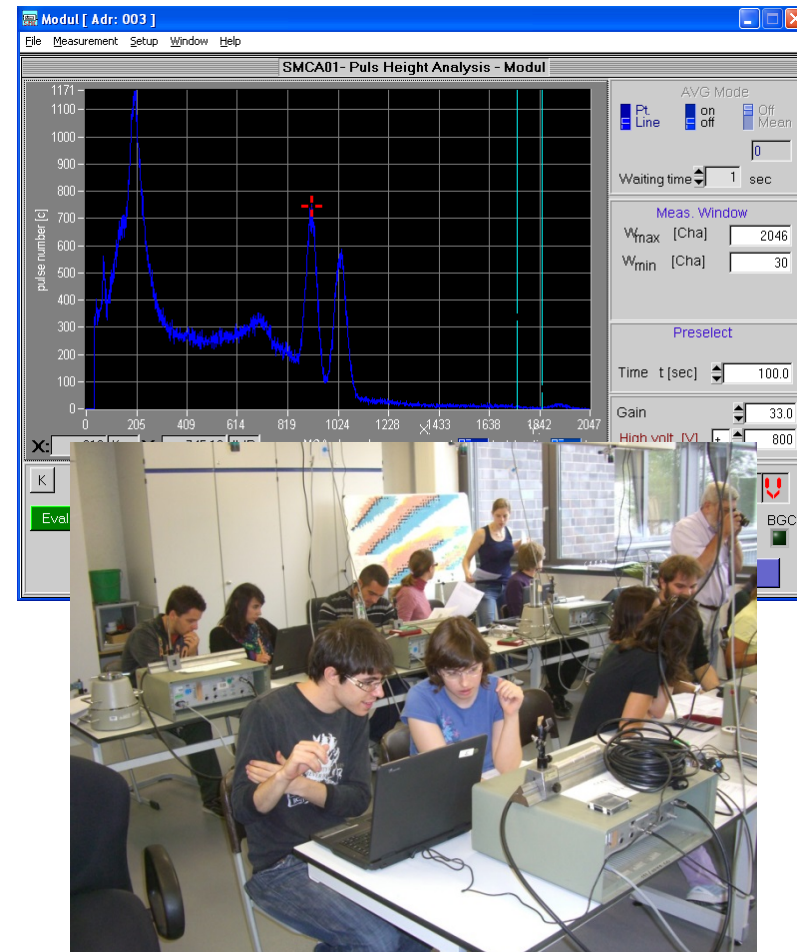
- Sunday September 4, arrival in Jülich
- *Day 1 and 2*: basic experiments for all participants in parallel
- *3 and 4*: small teams of 2 (max. 3) participants work on individual experiments (max. 6 different experiments at a time)
- *Day 5*: Preparation of final presentations and written examination (multiple choice questions covering content of first 2 days)
- Saturday September

Max. 12 participants

Basic Experiments in „plenum“

First 2 days of course

- Characterize a GM counter
- Dead-time with a GM counter
- Counting statistics
- Calibration of a proportional counter
- Energy calibration in γ -spectrometry
- Efficiency calibration in γ -spectrometry



Examples of experiments

„Rabbit“ System for Lifetime measurements after neutron activation

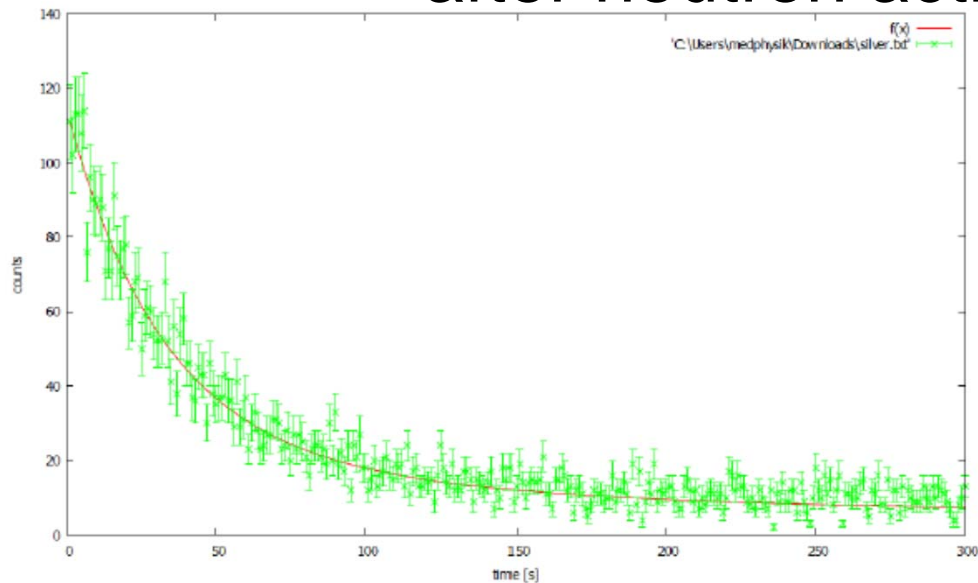
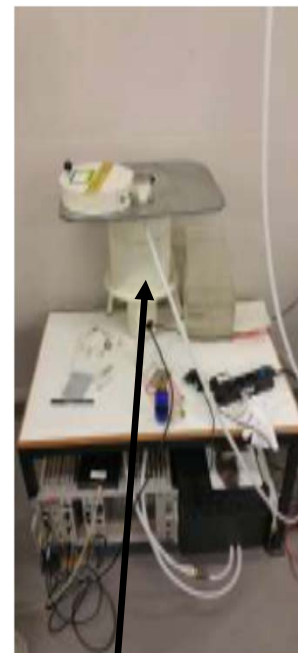
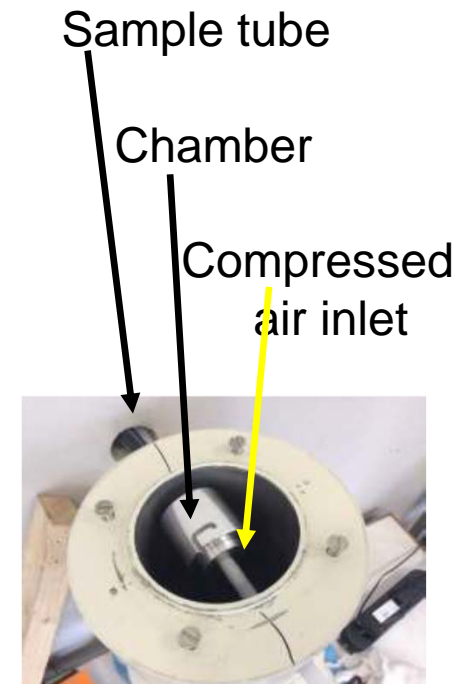


Figure 4.2: Measured decay curve of activated silver with errorbars

Lifetimes down to 2s have been be measured

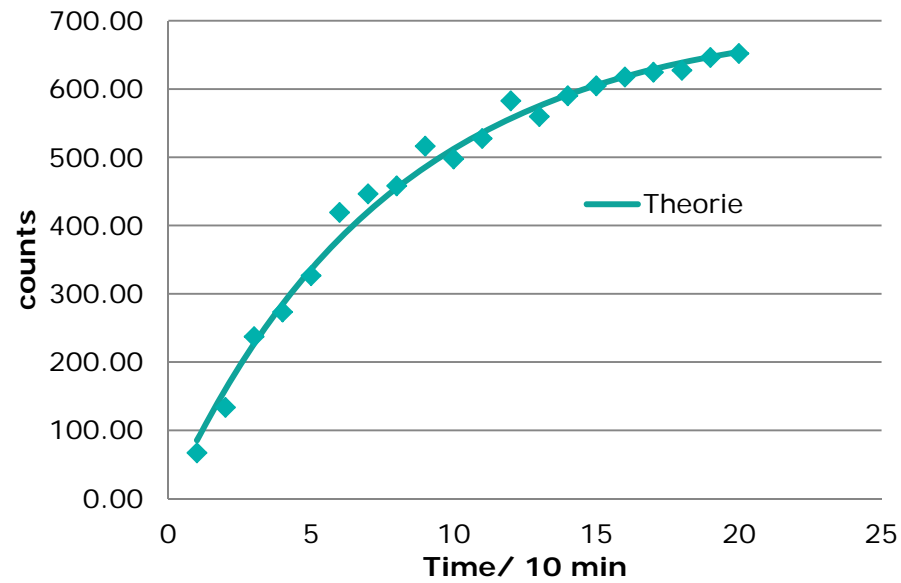


Lead shield with NaI-Detector





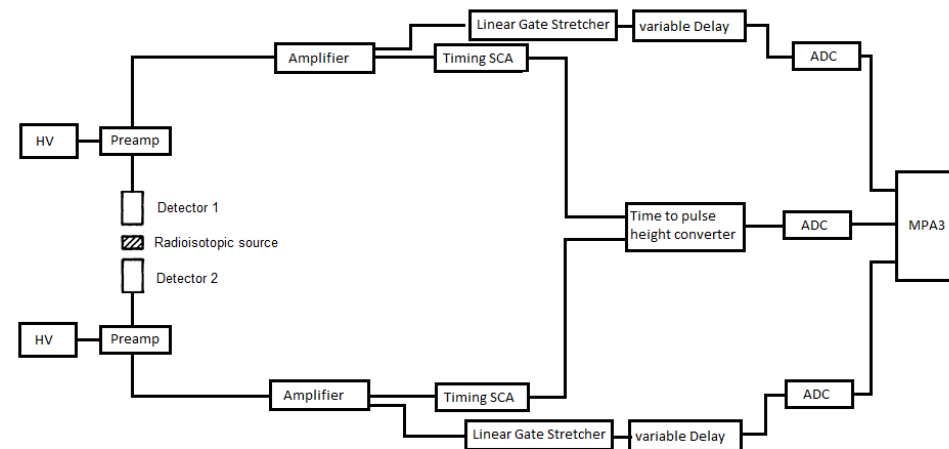
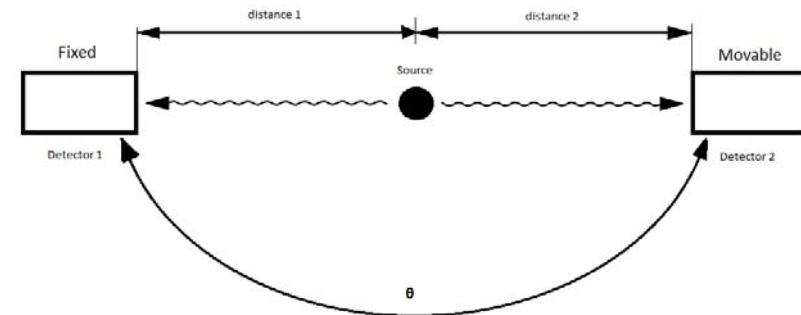
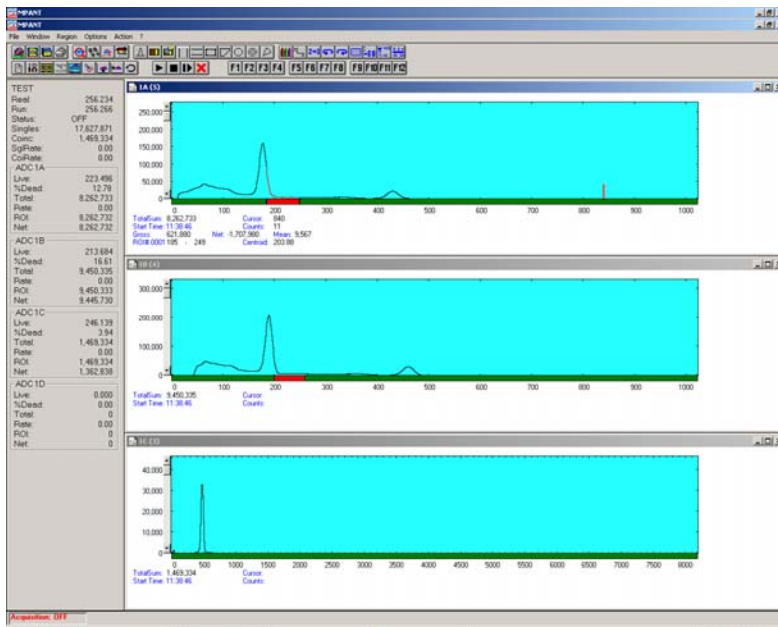
Activation curve for Indium



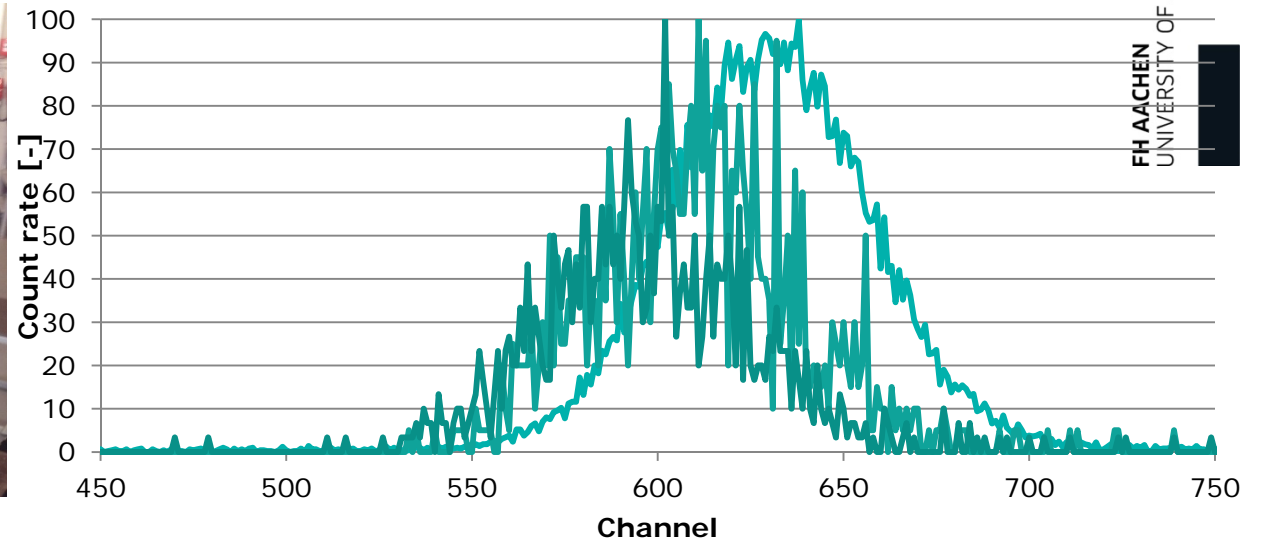
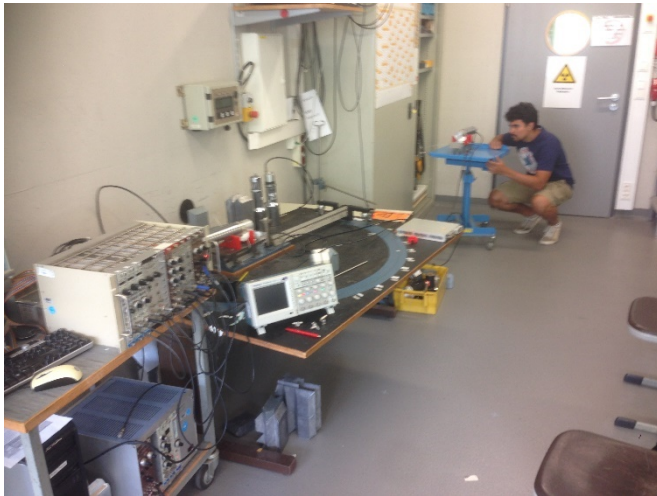
Sample is periodically irradiated (here 10 min. irradiation)

Examples of possible experiments

„Fast-slow“-coincidence and angular correlation



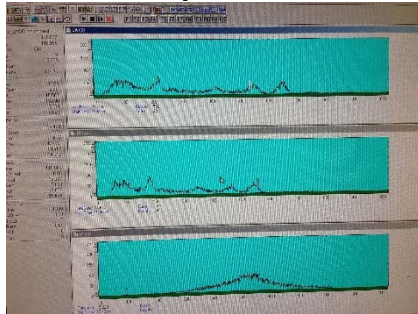
Measure the speed of light



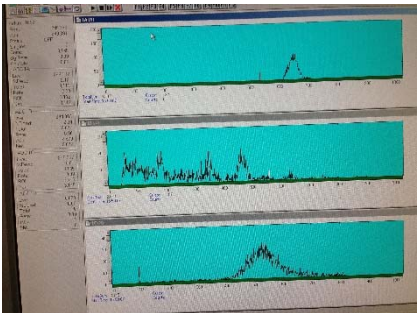
distance [m]	delay [channel]	time [s]	v [m/s]
0,3	6	1,32E-09	2,27E+08
1,5	22	4,84E-09	3,09E+08
2,2	33	7,27E-09	3,03E+08
1,5	24	5,28E-09	2,84E+08

Example – Coincidences ^{116m}In

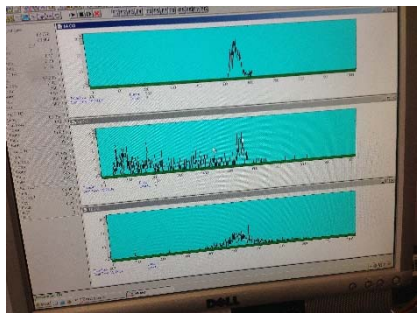
3 Spectra – Detector 1 / 2 and time between Detector1 and Detector 2



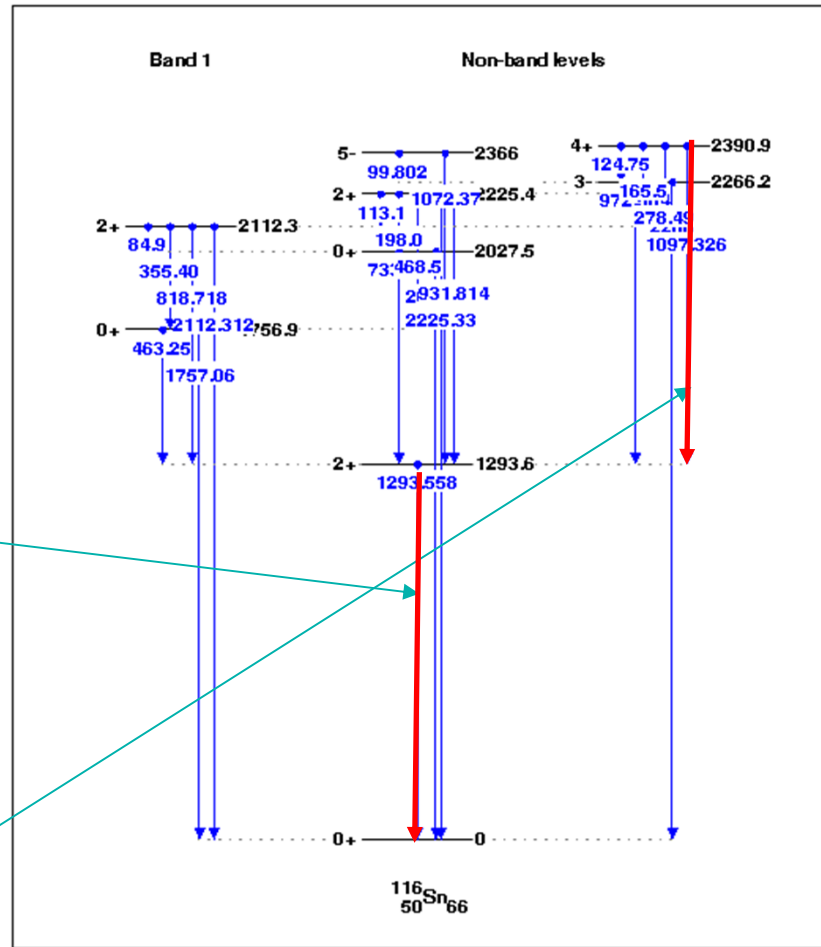
Singles



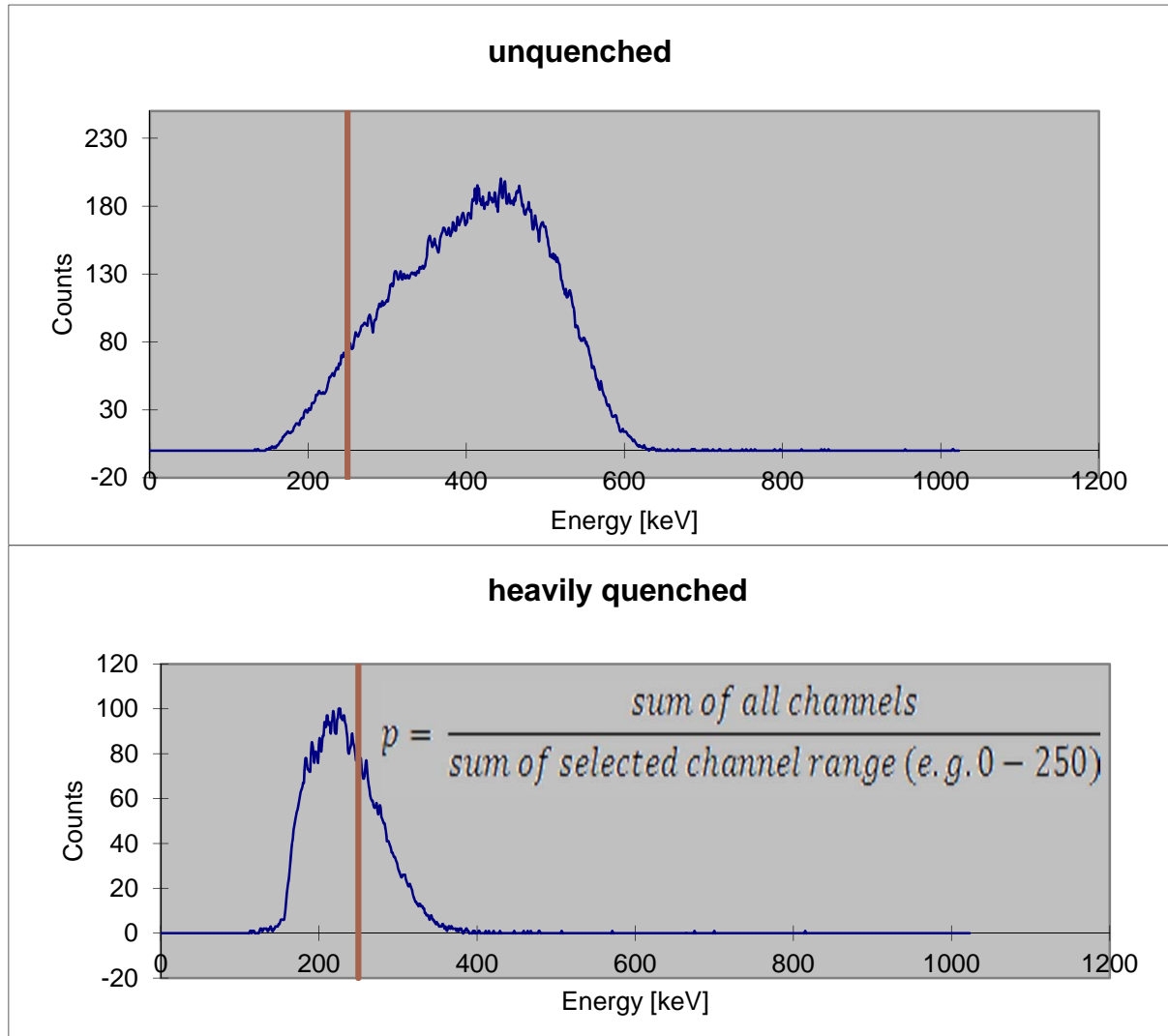
Gate
1294keV



Gate
1097 keV



LSC- Counting (example quench correction)



Quench-correction:
Using ratio between
2 windows as
parameter p
Quench Series with
increasing quench,
but constant activity

Examples of possible experiments

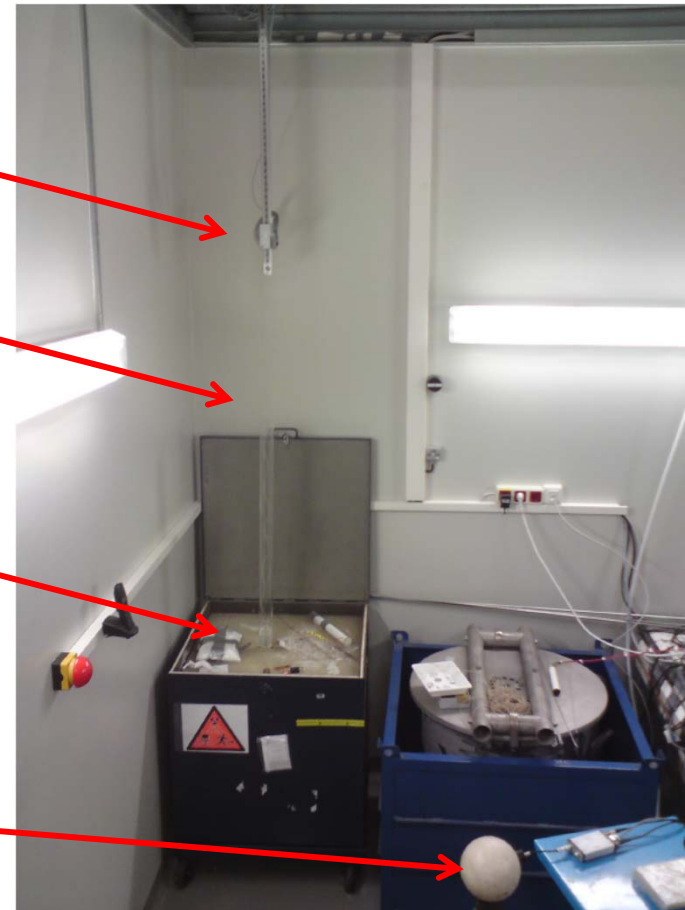
Neutron-Spectrometry using Bonner-spheres

Linear guide to lift the source

plastic tube to safely guide
the source

Source container (parafin)

Bonner-sphere with SP9-
spherical detector



Cost estimate

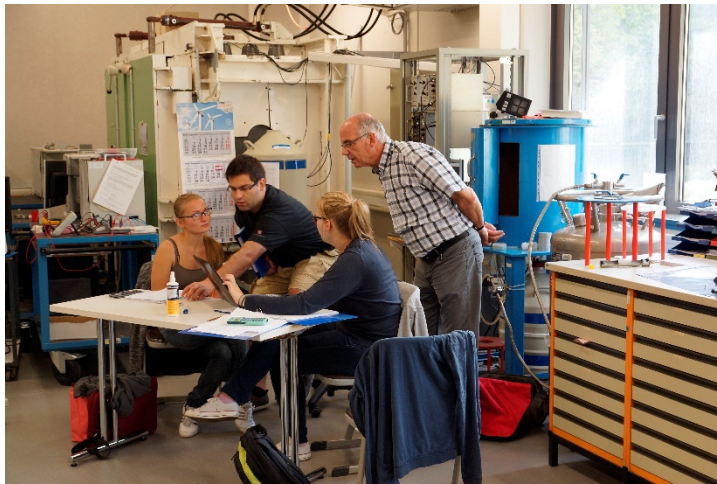
- Travel
 - Cologne or Düsseldorf airports are close. Train to Jülich is about 13€
- Accomodation
 - Camping on site (0€)
 - Appartments for 3 to 4 students (appr. 150€)
 - Hotel (double 240€, single 420€)
- Meals
 - Breakfast, Lunch in FH Aachen cantine (<5€/meal depending on choice.)



The RADAM1015 group



Some impressions from our lab



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