Universiteit Utrecht

380 YEARS

Bright minds, better future

Faculty of Sciences
Freudenthal Institute

Ionizing Radiation Experiments as a Mobile Lab

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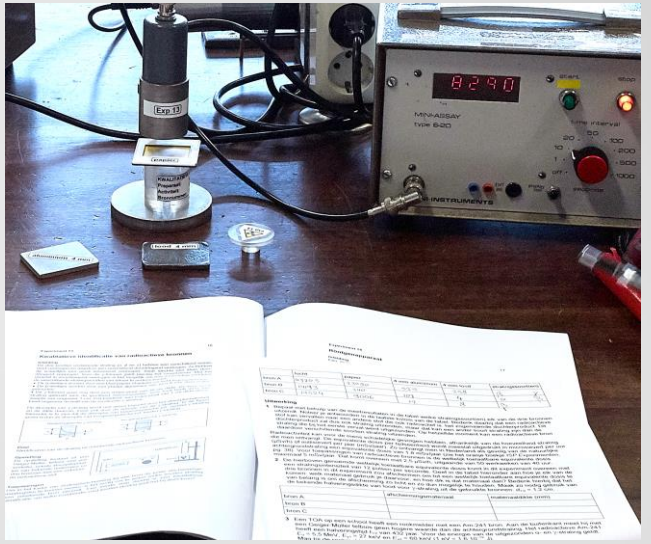
Why mobile labs?

- Initiated about 45 years ago by the Dutch Ministry of Education, Culture and Science with increasing:
  - emphasis on radionuclides in the physics curriculum, and
  - stricter regulations on the use and storage of isotopes at schools.
- Outreach to **350+ high schools** and over **18,000 students** throughout the Netherlands.
- Mobile lab instructors certified for safe handling of radionuclides and expertise about radio-activity.
- Use of robust, high-quality equipment.
- Safe storage and transportation of low activity radio-isotopes.
- Students are limited to an extra exposure of maximum 0.2 µSv/hour.

The Activities

- Closed activity instruction or open activity guidance

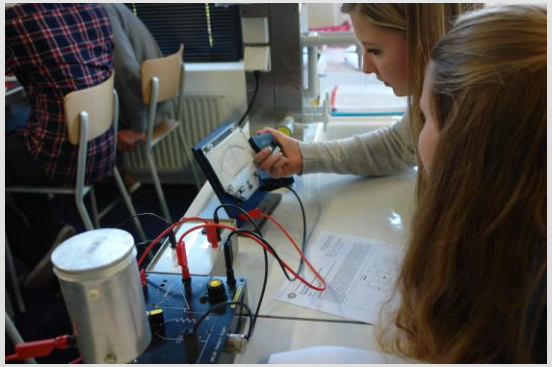
- Each activity consists of:
  - a set of student instructions or a guidance
  - background and procedural information
  - required tasks and questions
  - student interaction with: equipment and
    radio-isotopes and their safe handling



- Some activities ask for physics knowledge about:
  - the electrical force in a magnetic field
  - interference of waves

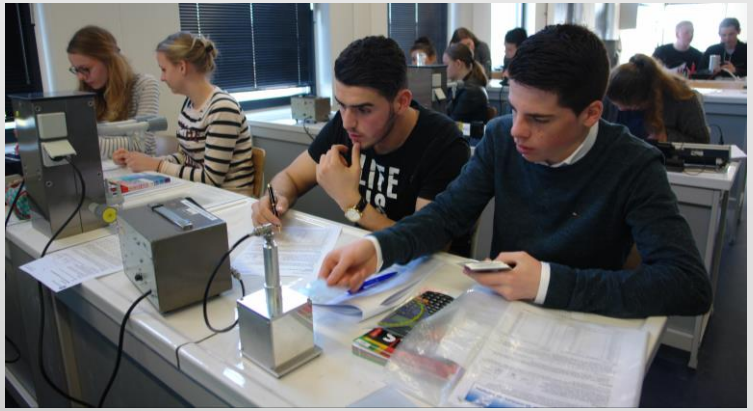
The Activities

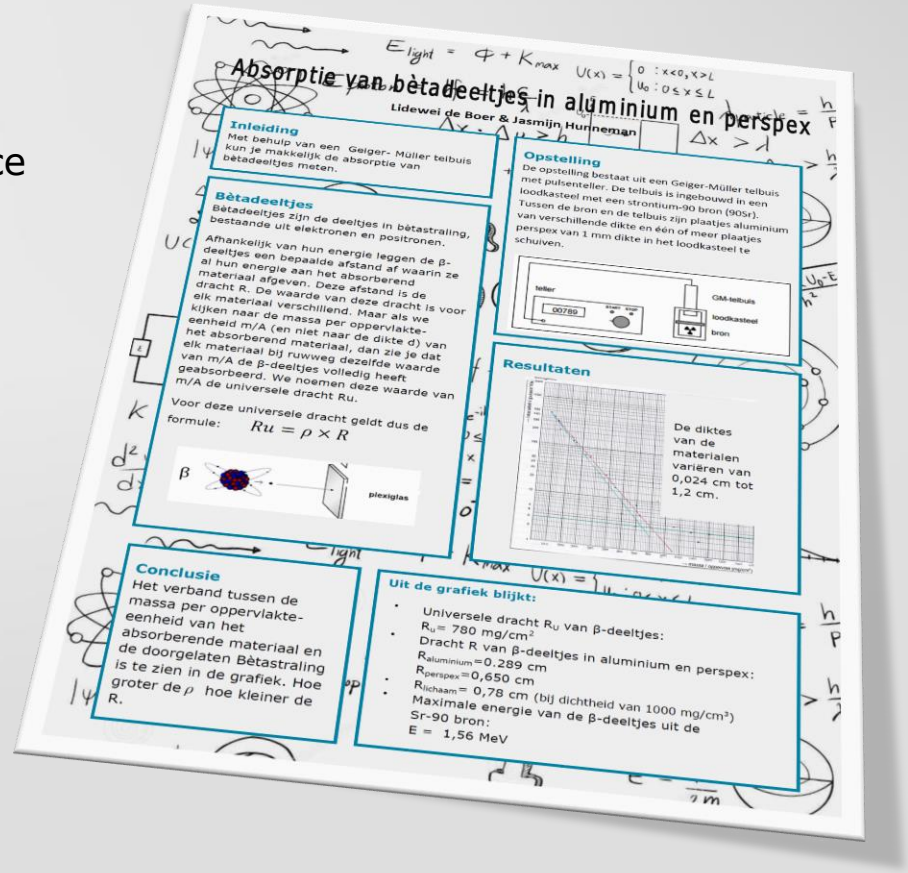
- The **22 different activities** include:
  - half-life with e.g. age of an isotope, parent-daughter system
  - absorption with e.g. detection of lead, identifying isotopes, thicknesses of a rubber band
  - X-rays with e.g. ionization of air, Bragg reflection
  - diverse other with e.g. working of a GM-tube, backscattering, distance vs intensity, cloud chamber



The Activities

- Depending on mandated results, students may be required to
  - become familiar with background and instructions in advance
  - present outcomes of one or more experiment using a
    - slide presentation
    - lab report
    - poster presentation





The logistics during a Typical Day

6:30 am
- off to a school

8:00 am
- unload the car
- move crates to lab(s)
- set up the experiments

9:00 am
- start of the first lab session
- each lab session starts with a 10-15 minute intro
- max 30 students per session accomplish 2-4 experiments

3:00 pm
- crate the experiments
- load the car
- evaluation with teacher(s)

4:00 pm
- head home

The logistics during an Academic Year

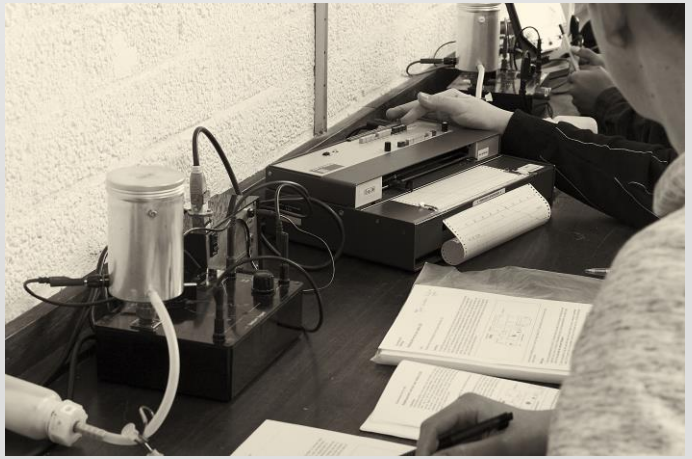
Sept
- schools sign up
- dates and times are finalized
- a few school visits begin

Nov
- all three cars permanently on the road now: each ten workdays consists of nine school visits and one day at the office

May
- number of school visits start to decrease

July
- maintenance of equipment
- checks of radio-isotopes
- administration and updates

Sept



Evaluations

- A 2001 survey among teachers and school managements proves:
  - the vast majority of schools supported the significant importance of this unique lab
  - schools find it worthwhile to pay a small fee per student to keep the ISP on the road

- A 2016 pilot survey among students suggests that the lab:
  - is well received by students for use with the subject
  - provides students with necessary knowledge about radioactivity

Still today teachers regularly voice their sincere gratitude.

It is often that some students individually or by group express their appreciation.

Current Status

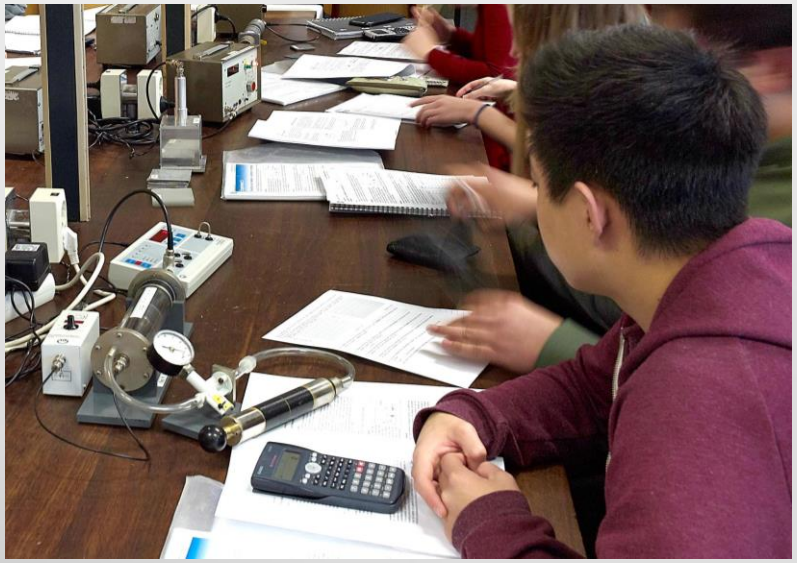
- After 45 years the project development continues, but has slowed down since:
  - the variety of the 22 experiments give students lots of choices to get familiar with the subject
  - all experiments are proving their usefulness to students
  - the experiments are simple in their set-up and easy to trouble shoot
  - small changes get initiated by changing social relevance

Future Plans

- Plans include:
  - larger scale research on motivation and learning outcomes by the Freudenthal Institute
  - experiments which make use of tablets or smartphones
  - collaboration with the:
    - COVRA (Nuclear Waste Facility) – Nieuwdorp – NL
    - URENCO (Uranium Enrichment and Stable Isotopes) – Almelo – NL
    - Reactor Institute Delft – Delft University of Technology – Delft – NL

Just one concern

- Insecurities of annual funding are:
  - the Ministry of Education, Culture and Science's budget
  - a required fee per student



Thank You …

… for your interest.

- Feel free to ask questions.

www.isp.sites.uu.nl/english-information