

Beam time request July 2010

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Necessary beamtime: (6 +1) x 24 h

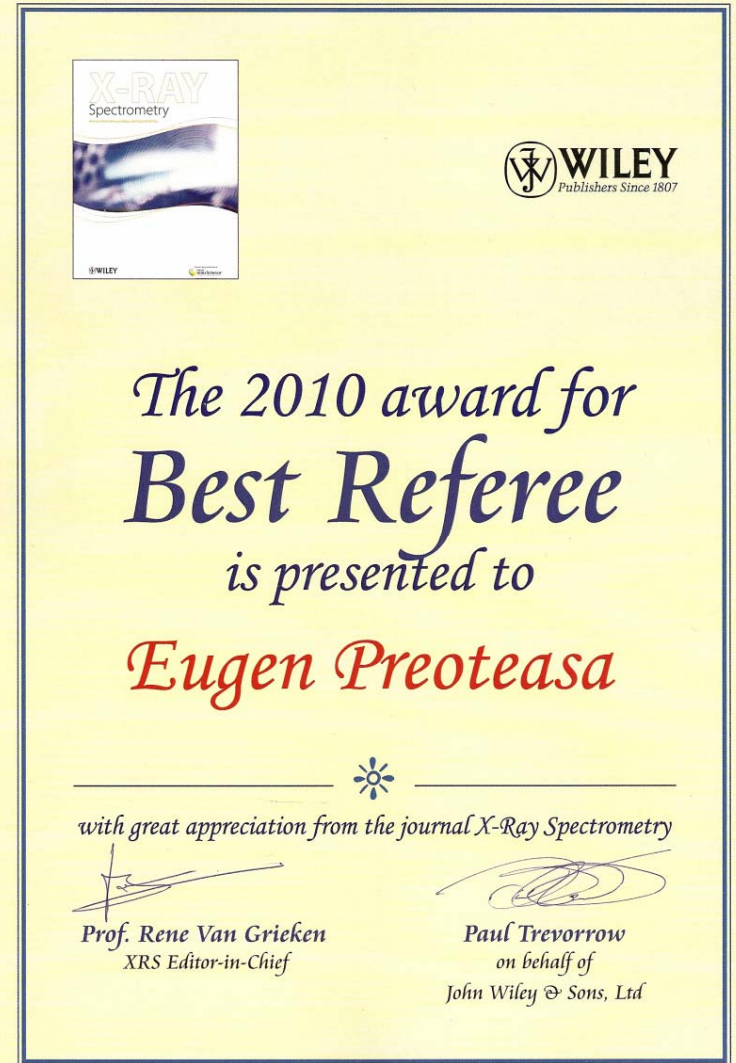
IBA studies on biomineral structures – a fertile research program

- A program of studies on: teeth, bones, dental materials.
- IBA methods: PIXE, PIGE, ERDA, μ -PIXE on thick samples. GUPIX analysis of spectra.
- Complementary methods: FTIR, AFM, optical microscopy, histochemistry, electrochemistry.
- A large diversity of topics, problems, approaches.
- Some studies require large number of measurements, long time for biological statistics.
- Planning – short, medium, long term is useful.
- The topic can be expanded further.
- Time span of this program so far: 10 'good' years + a few 'bad' months.

What was the productivity of the program in the 10 'good' years?

- The biomedical applications of the HH-NIPNE Tandem accelerator were expanded .
- 8 articles in ISI journals (*X-Ray Spectrom.*, *NIM-B*, *Rom. Rep. Phys.*, most ≥ 10 pages)
- 14 citations (ISI).
- 4 conference papers in proceedings/books.
- 2 oral conferences.
- ≥ 12 abstracts (some of them in ISI journals).
- Referee at *X-Ray Spectrometry*, *NIM-B*.

- Best Referee Award at *X-Ray Spectrometry*, presented at *ERXS 2010* (Coimbra, Portugal).
- A note stating the *HH-NIPNE* affiliation will be published in *XRS*.
- A book cheque for books from Wiley is provided.
- We wish to keep the same standard further.



Thanks to the people of DFN and everybody who helped this program!

Main drawbacks during the 10 'good' years

- *The charge integration system for PIXE* – totally inaccurate – a limit for quantitative analysis – a subject of 'acid' remarks by referees!
- *The thick Be window of the scattering chamber* (250 μm !!) – the low energy lines of light elements (usually P and lighter elements) are not seen in spectra.
- *A remote control* of the beam shutter (electric switch) is needed.
- Such problems can not be solved by the *user* alone!

“Ideal” requirements for PIXE setup

- Use of ultra pure *Al* parts of the chamber;
- An *Al* X-ray collimator aimed to eliminate X-rays generated by scattered protons;
- All surfaces visible from the detector to be lined with plastic;
- Beam collimators made of carbon, to reduce a source of intense background radiation;
- Rounded edges design of the collimators to reduce slit scattering and thus background;
- For proper beam alignment, accurate current-readable collimators;
- Etc., etc.

- To continue at the present level – even without the above ‘ideal’ conditions, some minimal requirements needed are:
 - good alignment – and control – of the beam line;
 - reliable electrical connections and electronics;
 - a simple goniometer;
- But for future development and progress, some simple improvements – a *thin Be window* of the scattering chamber, a better *charge integration* system, a *remote control* of the beam shutter – are needed.
- These improvements would not cost much as compared to the accelerator upgrading –
- But they would capitalize strongly on the already available infrastructure.
- The user alone can not solve these problems!

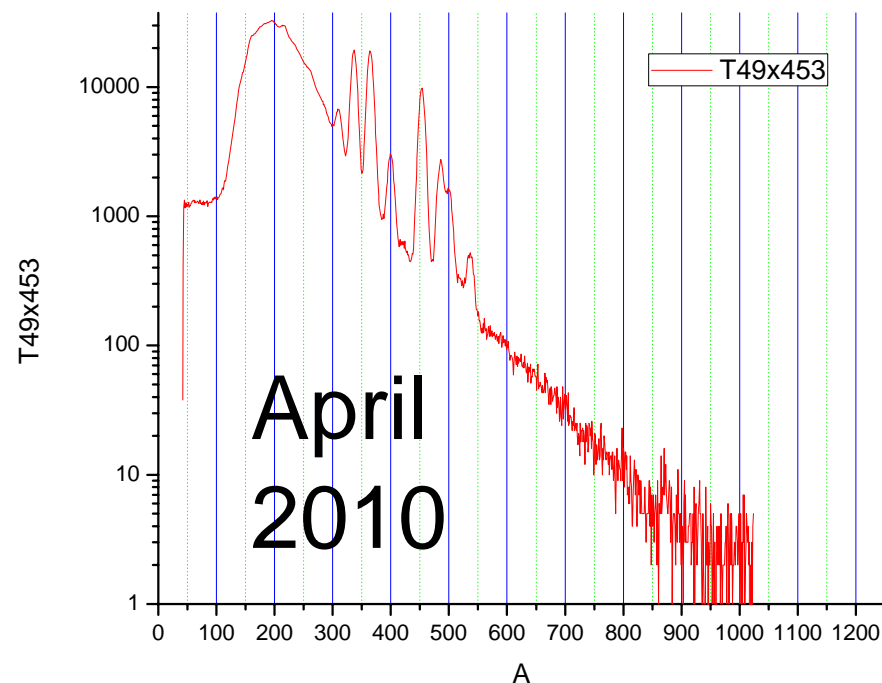
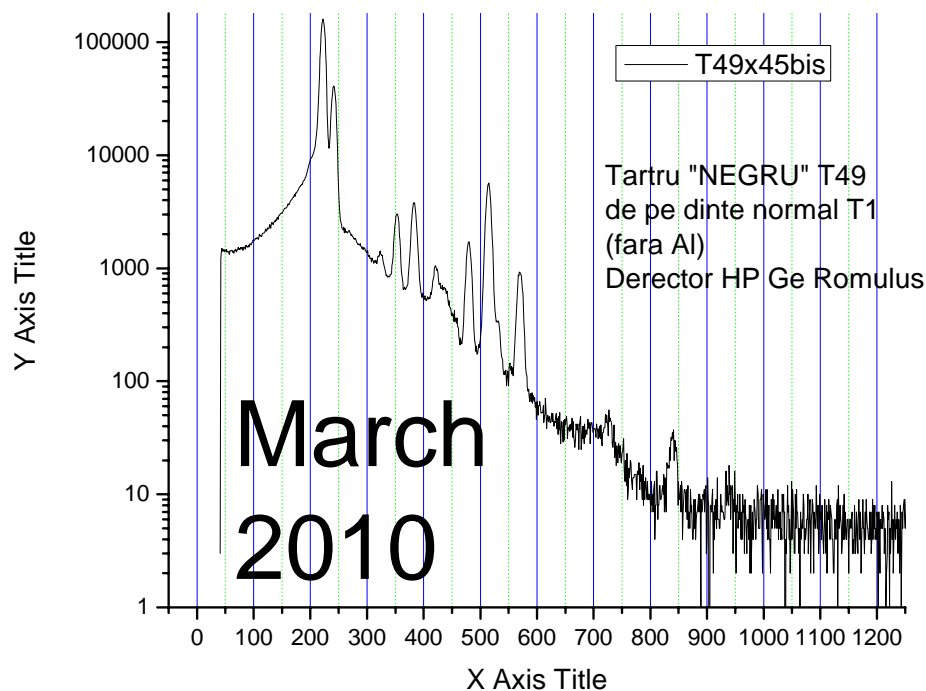
Short-term planning for the last months – to be continued also for longer term periods

- Iodine in preparations for pregnant women.
- PIXE of trace elements from dental cementum in periodontal disease and diabetes → goniometer!
- PIXE of metal contamination from dental alloys (of crowns, bridges and dowels) in calculi, cementum and enamel → goniometer!
- PIXE of dental calculi – contamination of medical, occupational and environmental origin.
- Dental alloys analysis.
- Variable angle PIXE of dental composites → goniometer!

What happened during the **last** **'bad' months?**

- **Disastrous** results, absolutely **useless!**
- Wasted beamtime and energy!
- Due to bad alignment of the beam line or bad electrical connections (?).
- Beamline alignment for **PIXE (extension 5)** is currently made by **only one man** from the host team (if not on leave).
- But one man can make mistakes! This is an **unsecure situation**.
- The user should be instructed by the host to make by **himself the beamline alignment** – and to measure the parameters of the alignment and of the electrical connections!!!

The same sample in March and April



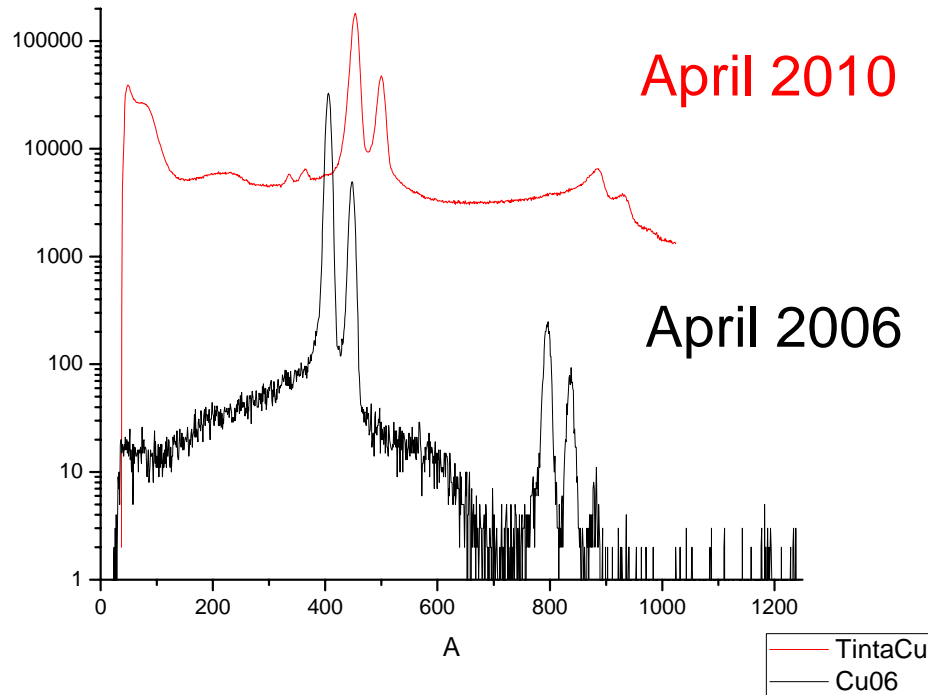
- April 2010 – huge background!
- Ca not seen in a Ca-rich sample!
- Due to misalignment -> beam hitting walls and other parts -> ejected electrons reaching target -> Bremsstrahlung -> background! Is this so?

Another example of huge background from a conductive target

Copper plate for beam check

April 2010

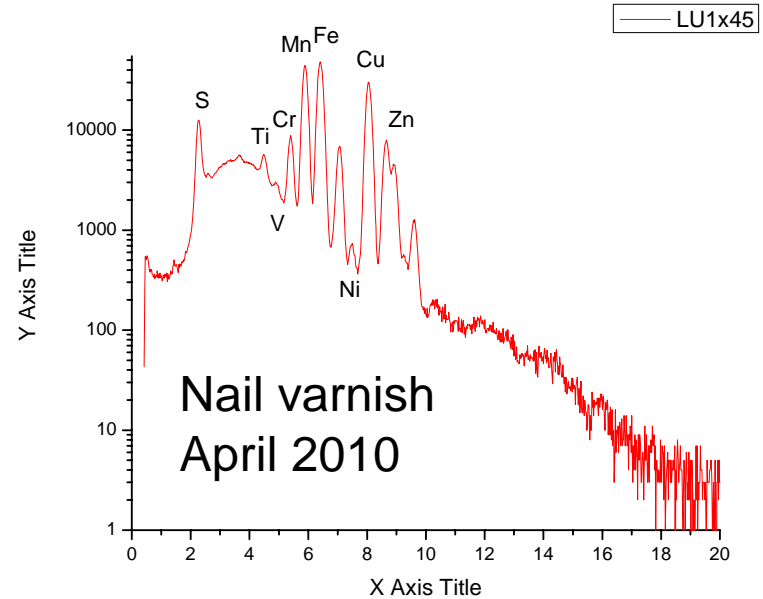
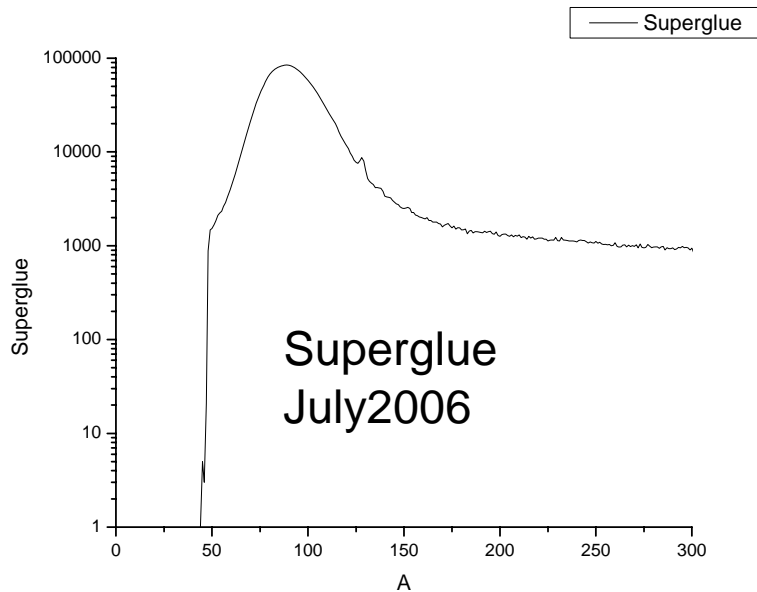
April 2006



- A **copper, conductive target** – to avoid charging.
- The **background** is equally **huge!**
- This sustains the background production

by recoil electrons extracted from walls by the proton beam in a misaligned beam line.

False lines from the parts of beamline, chamber, target support



- In **April 2010** an electroinsulating target – nail varnish polymer – shows **metals, improbable to exist in the sample (Cr, Mn, Fe, Cu, Zn)**.
- In July 2010 another electroinsulating target – Superglue polymer – showed no such metals.