Beam time request
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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, $\mu$-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.
- 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?

- Disastruos 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

- 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.

Copper plate for beam check

April 2010

April 2006
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.