



**TECHNISCHE
UNIVERSITÄT
DRESDEN**

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Development of a testing method for the quantification of the filler content

Bled, 23.11.2011

Structure and Member of the Project

Advancement program:



Start up:

2009-10-01

Running time :

Task:
measuring instrument

Research Instituts:



Working group
physics of radiation

Industrial
enterprises



Filler measurement in paper industry

- 0. Introduction**
- 1. Fillers in the case of recovered paper utilization**
- 2. General methods for the identification of fillers and additives**
- 3. Specific measuring problems**
- 4. The measuring instrument**

Why it is important to measure or to analyse the filler into paper exactly?

- Rising quality requirements and purposeful, specific production developments
- increasing productivity , rising costs, resources efficiency
- Rising variety of the fillers, new additives
- new strategies of controlling



TU Dresden, 14.10.2011



Filler Measurement

Fillers influence the characteristics of the final paper.

Gloss

Opacity

Whiteness

Porosity and ink
absorption

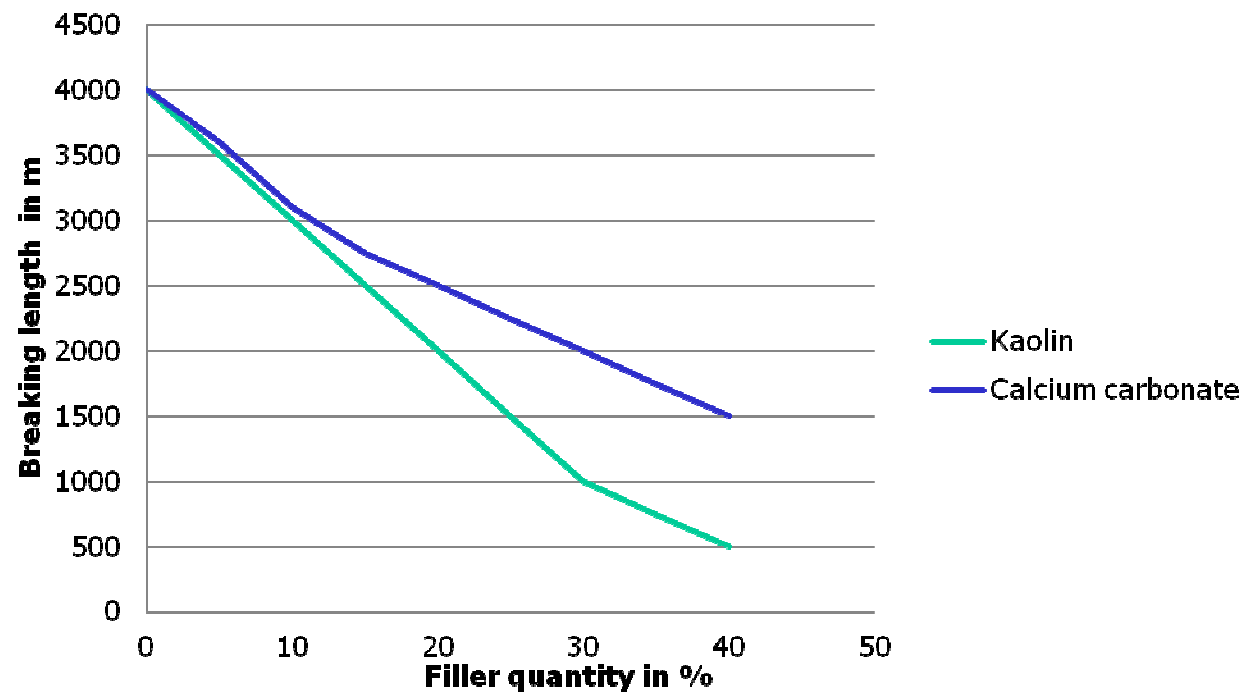
Volume

Viscosity

Strength

Drying rate

Sheet forming



Waste paper can contain - depending on sort purity - any conceivable additives in unknown quantities.

- Fillers

- Pigments

- Sizing agents, starch

- Colors

- Other additives



Within the production process the filler distribution changes

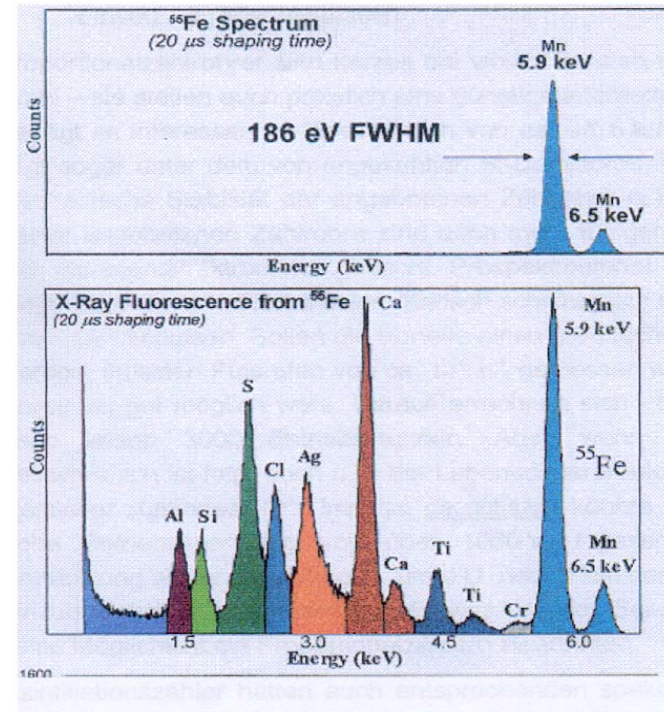
-Retention

- Accumulation and deposits

- Enrichment Processing and cleaning

General goals for the measurement

- Without destruction,
- production-accompanying,
- minimum expenditure, no sample preparation,
- **actual element analysis,**
- for advancement as on-line measurement suitably



In case of element analysis you should use Spectroscopic Methods

Spectroscopy uses the specific interaction of electromagnetic radiation (light, x-ray, radiowaves) with molecules in order to identify these.

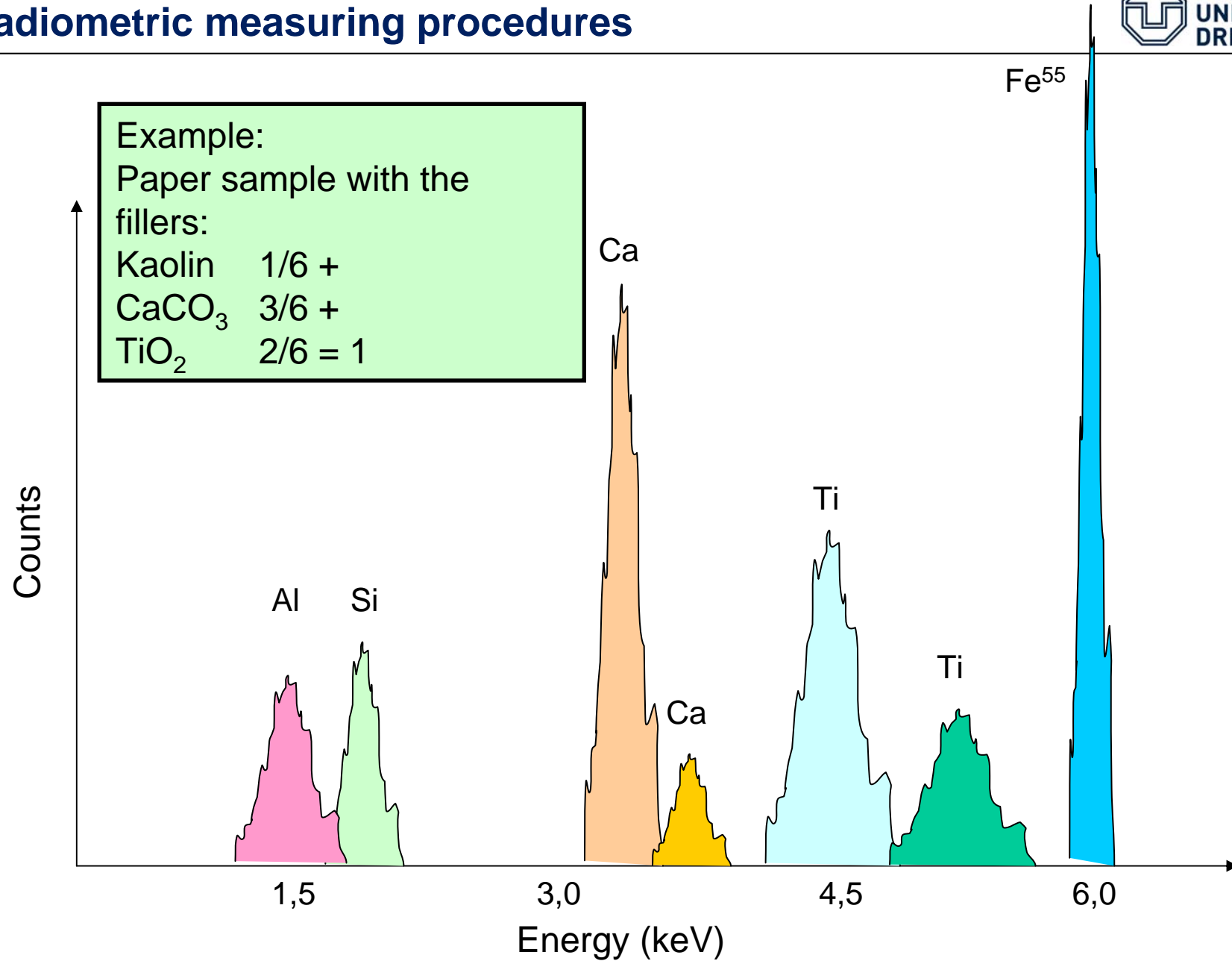
Wave number [cm ⁻¹]					
10 ⁸	10 ⁷		10 ⁴	10 ¹	10 ⁻¹
X-ray	UV	VI S	IR NIR MIR FIR	Micro wave	Radio wave
10 ⁻¹⁰	10 ⁻⁹		10 ⁻⁶	10 ⁻³	10 ⁻¹
Wave length [m]					

Also available: NIR/IR- Spectroscopy

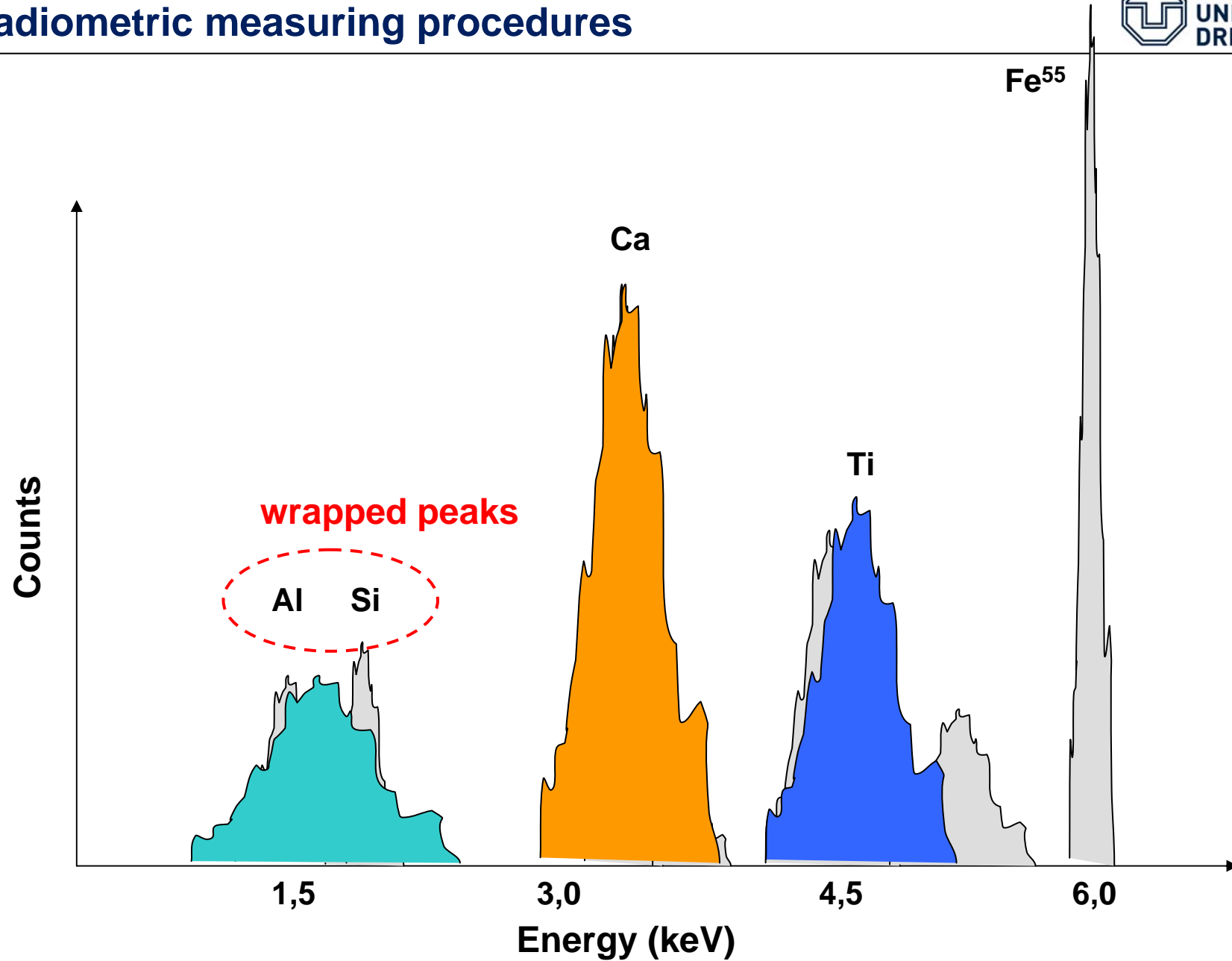
Disadvantages:

- Suggestions of the outside electron shells
- Large influence of chemical connections

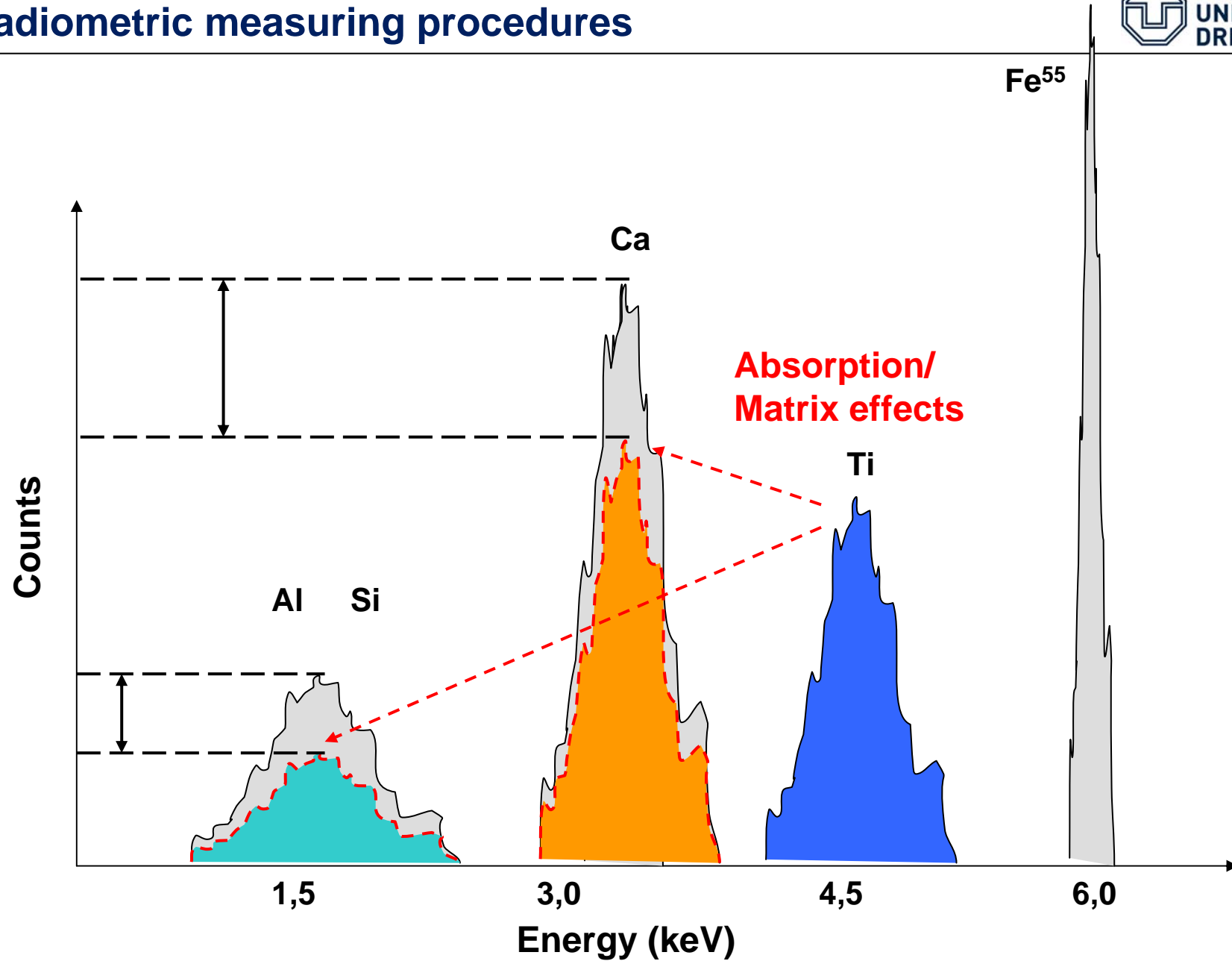
Radiometric measuring procedures



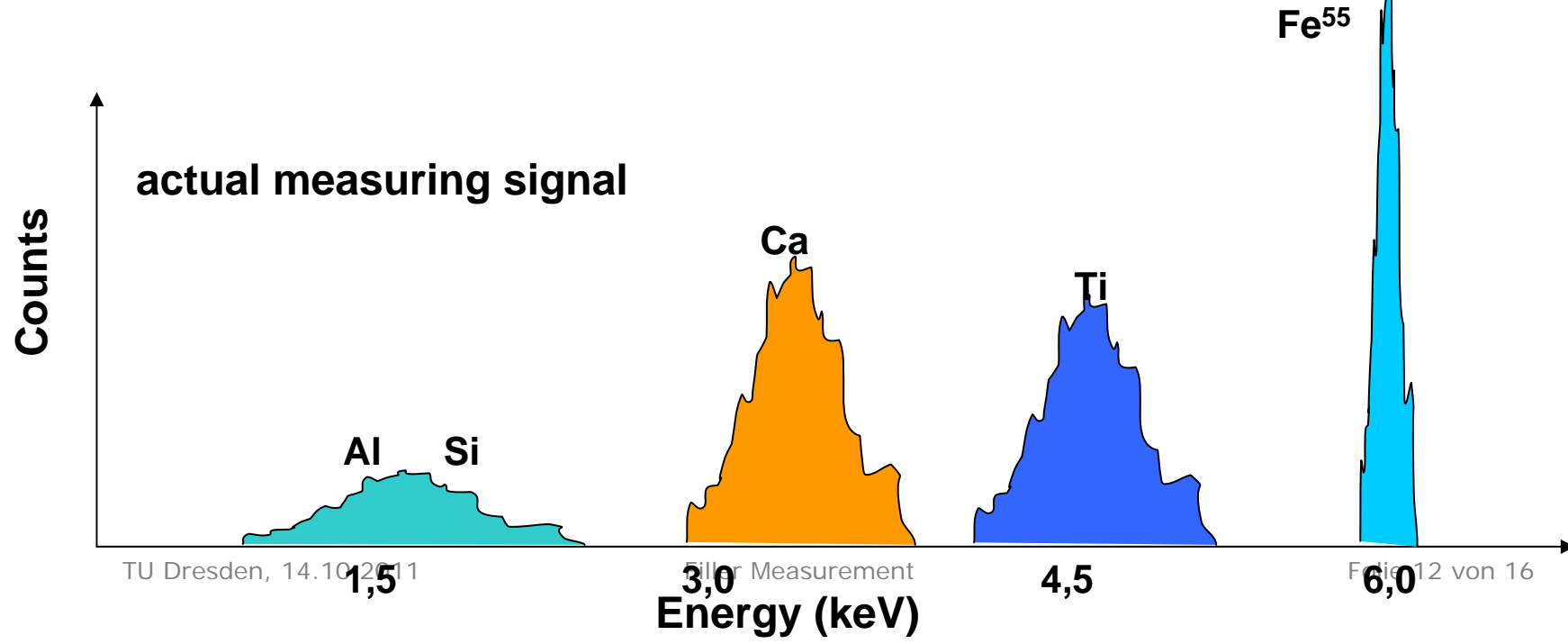
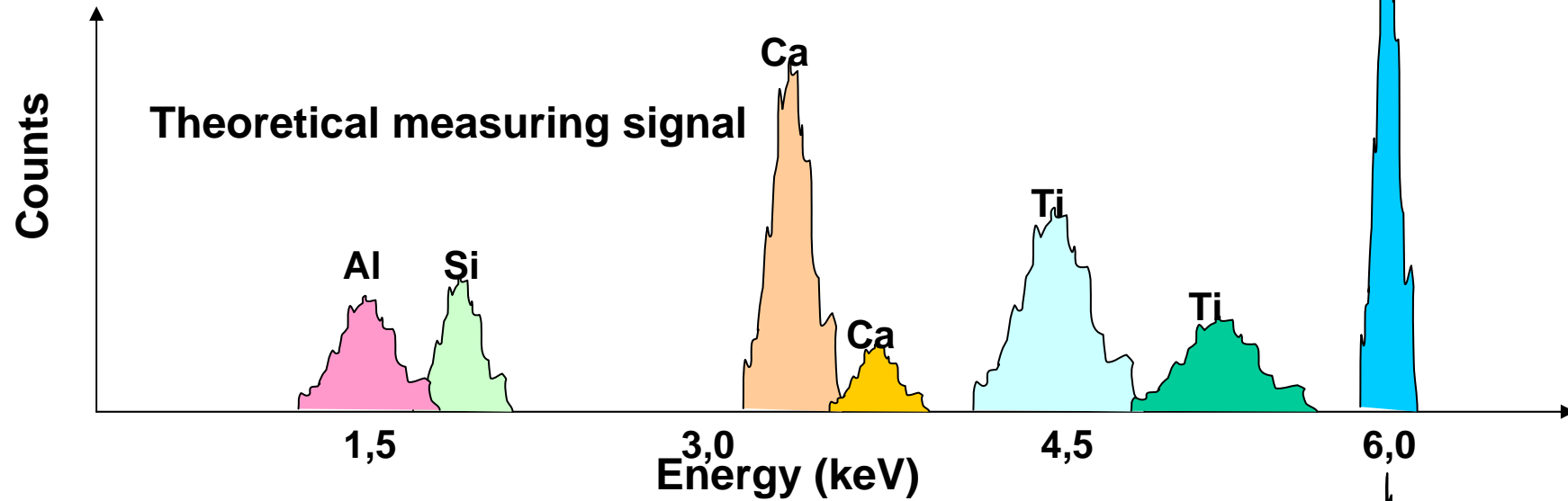
Radiometric measuring procedures



Radiometric measuring procedures



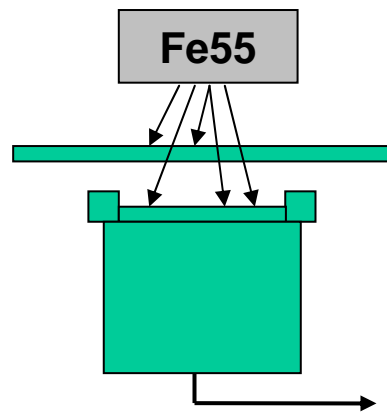
Radiometric measuring procedures



The measuring instrument

„total ash“ – measurement : a well-known way

Absorption measurement with a Fe55-source and ionization chamber

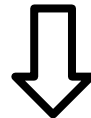


Prerequisite:

Filler components and their relative proportions are known

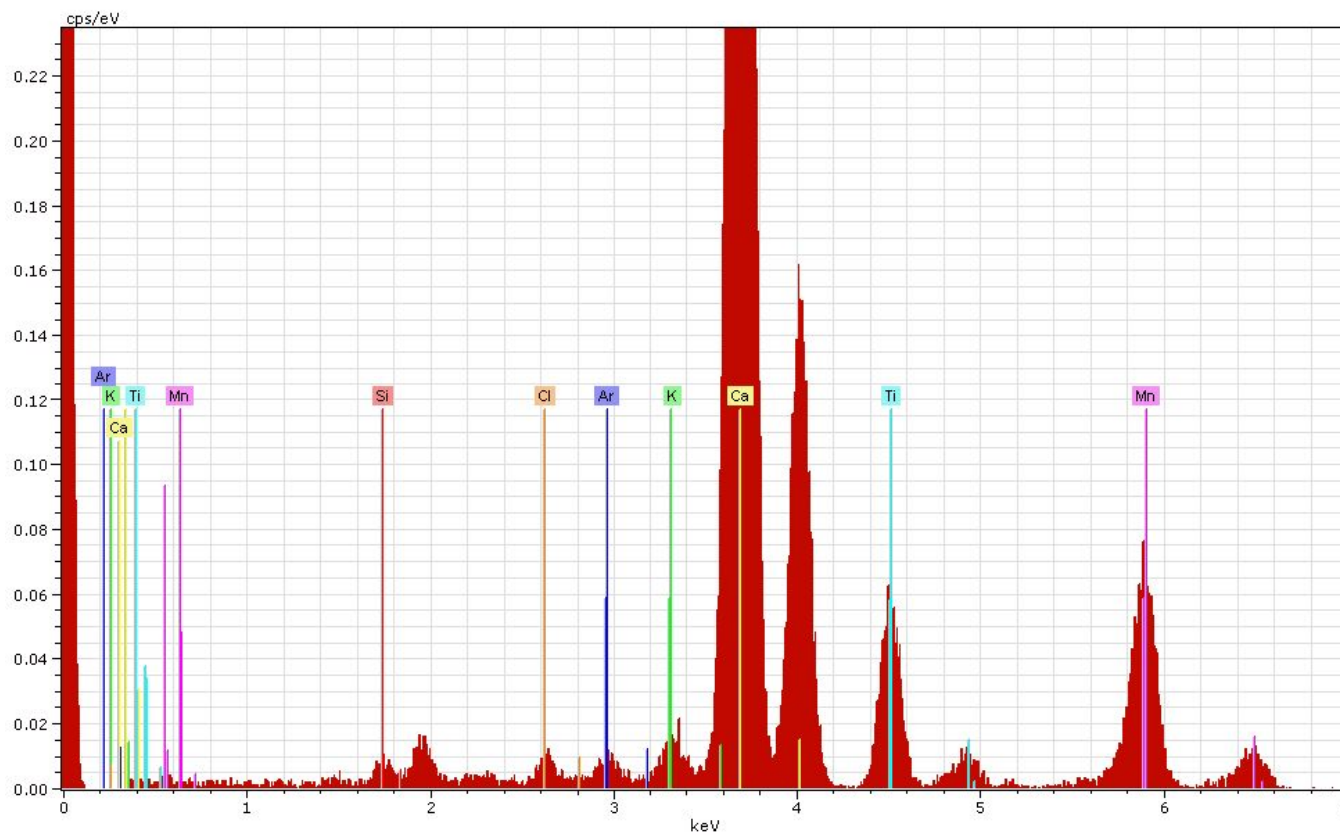
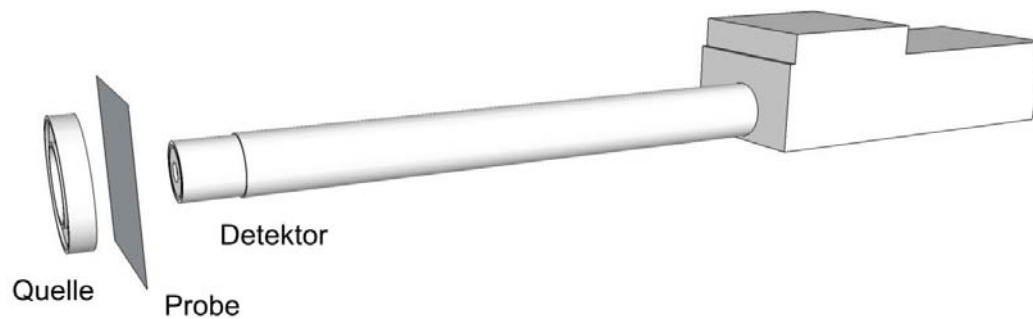
$$\left(\frac{\mu}{\rho}\right)_M = c_{K1} \cdot \left(\frac{\mu}{\rho}\right)_{K1} + c_{K2} \cdot \left(\frac{\mu}{\rho}\right)_{K2} + c_{K3} \cdot \left(\frac{\mu}{\rho}\right)_{K3} + \dots$$

$$c_{K1} + c_{K2} + c_{K3} + \dots = 1$$

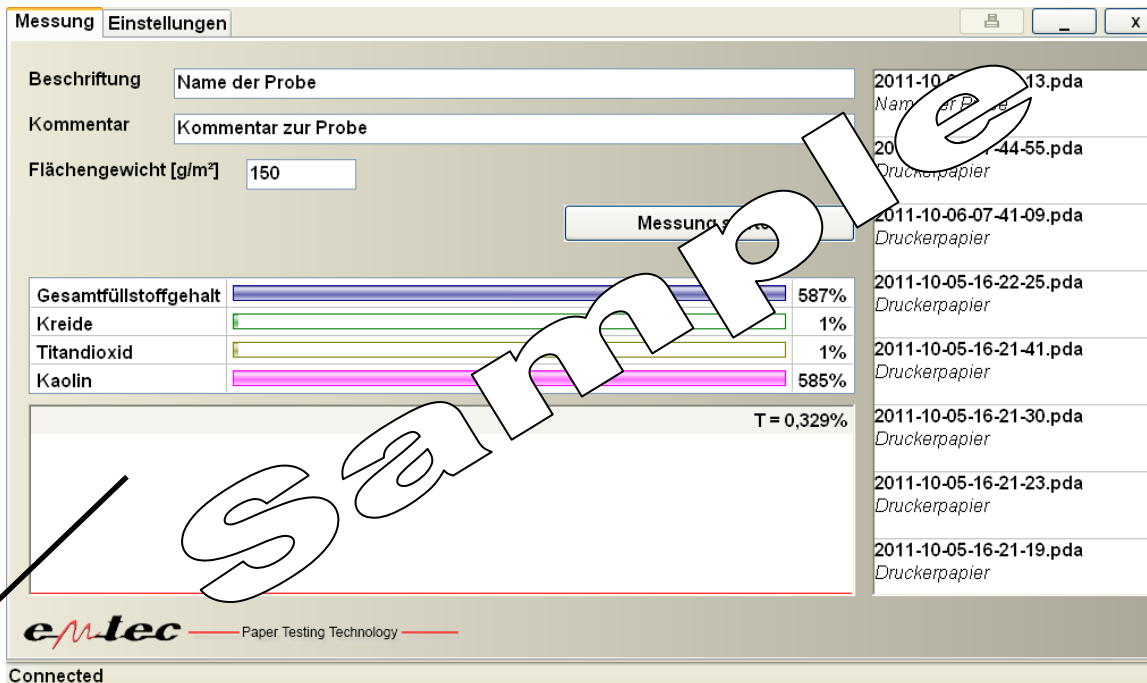


Only possible in case of fresh fiber employment and 100% admixture of the fillers, or by analysing the filler components and their concentration

The measuring instrument



The measuring instrument



Summary

It was a successful development of a measuring instrument, which fulfills the formulated development targets.

It is already tested in a paper mill and in a research institute with a lab paper making machine.

There is a good chance to develop a prototype from the operating model.