



Gamma-ray Spectrometry

Basic Concepts Part II

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Often a nuisance in gamma spectrometry – but can of course be very valuable!

Advantages

- Means of identification
- Sometimes the only detected radiation
- Enough with small thin Ge-detectors

Drawbacks

- Loss of counts due to summing
- Creates interferences
- Different peak shape than gamma-rays
- Difficult to quantify energies below 100 keV in gamma-ray spectrometry



Nomenclature

- We do spectrometry not just spectroscopy
- According to ICRM: Gamma-rays, alpha-particles etc.
- Thus: Gamma-ray spectrometry

ICRM = International Committee for Radionuclide Metrology



Nomenclature

- Low-level gamma-ray spectrometry – no strict definitions but usually either
 - (i) Measurement of activities found in common natural samples
 - (ii) Measurement technique in which the detector and shield are constructed using specially selected radiopure materials



Nomenclature

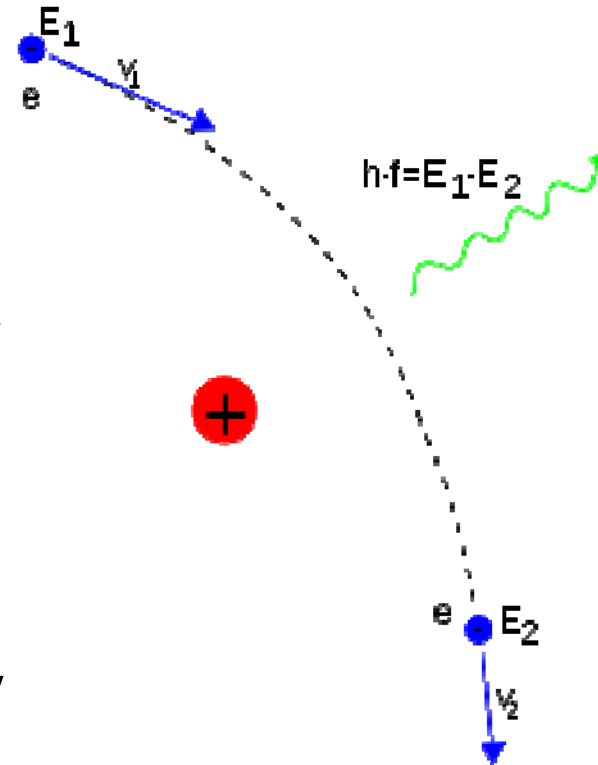
- Ultra Low-level gamma-ray spectrometry (ULGS)
no strict definitions but usually

Low-level gamma-ray spectrometry in which additional measures to reduce background have been taken such as using an active shield or placing the equipment underground (deeper than 10 m)



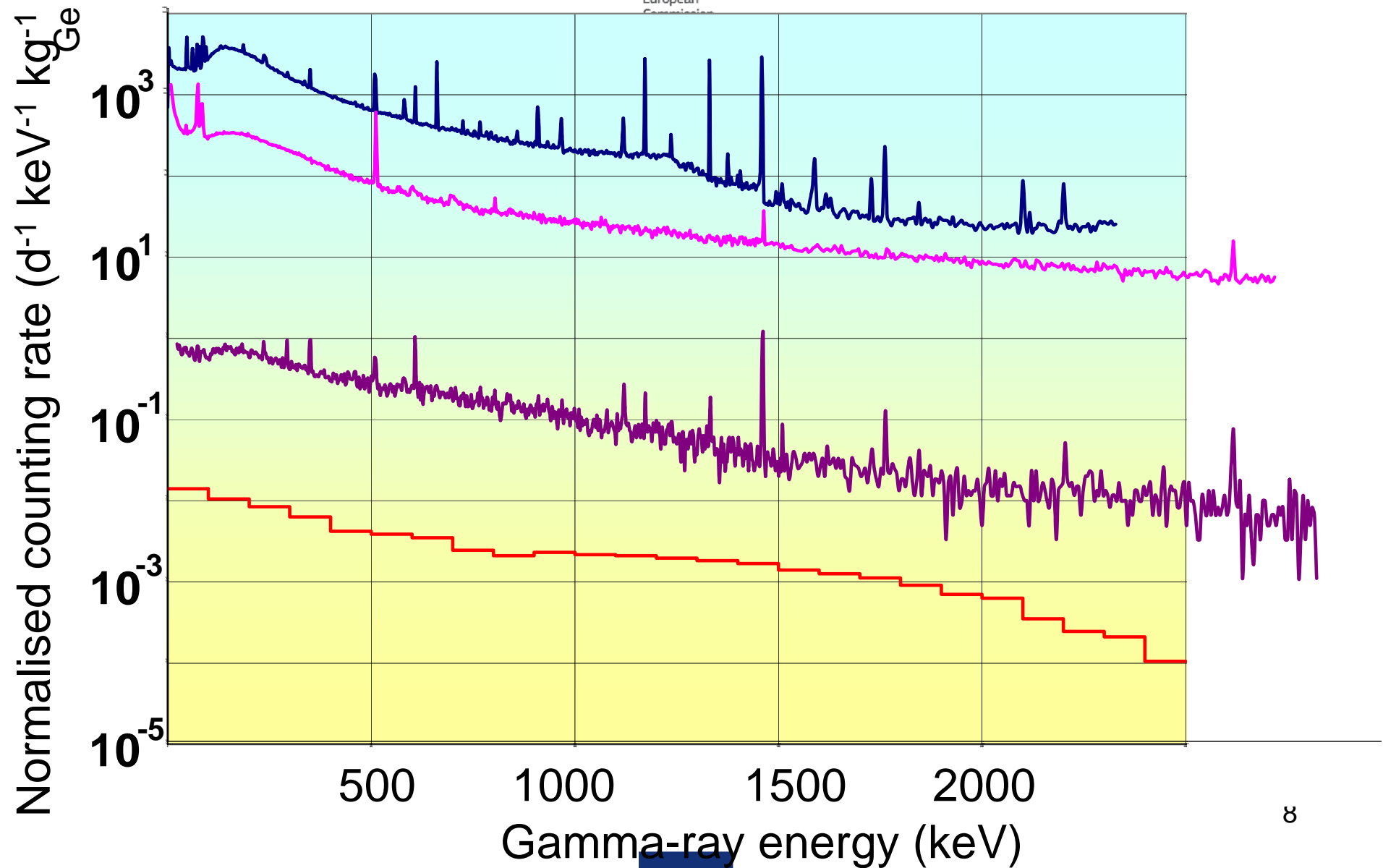
Bremsstrahlung

- from German “to brake”
- electromagnetic radiation produced by the deceleration of a charged particle when deflected by another charged particle.
- responsible for the major part of the background in gamma-ray spectrometry (see next slide)
- less for protons (comp. PIXE)



Gamma-ray background spectra

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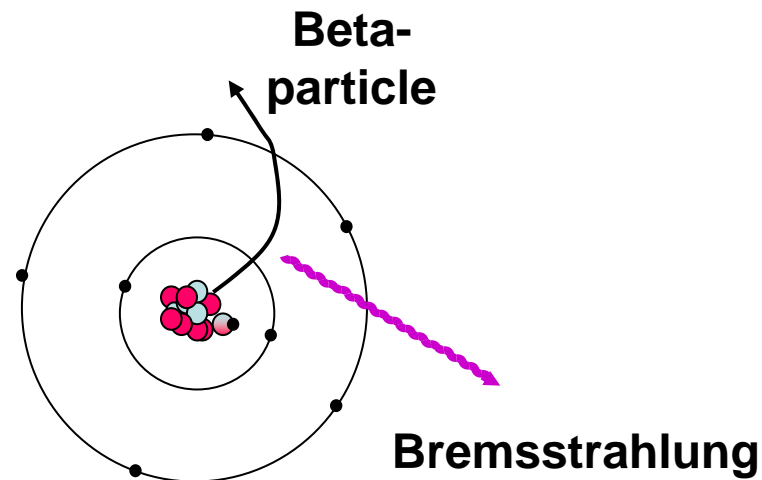




Internal (or “inner”) Bremsstrahlung

A “secondary effect of beta decay

The bremsstrahlung created in the field of the decaying atom
“normal” bremsstrahlung can be called “outer” bremsstrahlung





Other secondary effects of beta decay

- Characteristic X-rays (E.C.)
- Auger electrons (E.C.)



Nomenclature

Activity: Bq (s^{-1}) traceability to the second

Massic activity: Bq/kg

Activity per kg of the sample (dry weight or wet weight?). Traceability to the second and the kg

Activity concentration: Bq/cm³ (sometimes also Bq/kg)

Activity per volume of the sample. Traceability to the second and the m.

Specific activity: Bq/kg

Activity per kg of a specific isotope in the sample

Note that in literature (also in ISO guides) there is a great variation (confusion) regarding these entities. Therefore each author should point out what he/she uses