α β γ **ISuS** Institute for Spectrometry and Radiation Protection

Logistik, Consulting & Management für α·β·γ-Spektrometrie und für Strahlenschutz
Referenz-Systeme und Software-Produkte für *In Vivo*, *In Vitro* und *In Situ* Applikationen
Virtuelle Modelierungen und Simulationen von realen Szenarios

Beta (Photon) Spectrometry Systems

„Detector to the unequivocal Detection of Beta-Emitters“

- Selective detection and spectrometry of beta-particle
- Simultaneously detection and spectrometry of photons and beta-particle

Based on a new detector developed from ISuS:

„Transmission-Detector for Beta-Particle“

The new development! ➔

In order to suppress alpha or beta particles in the gamma spectrometry (e.g. with HPGe or NaI detectors), one takes simply an absorber if a thin entrance contact and a thin window is in use (e.g. 10 mm Plastic for about 2 MeV Beta's). In order, however, when we would like to be able to eliminate photons within beta spectrometry, already very many more knowledge have to be taken into account.

Therefore we developed for you the worldwide first detector, in order to be able to eliminate finally disturbing photon events within beta and particle measurements.
Beta measurements with this new detector system require - only to the achievement of smallest LLD - chemical sample preparations. It is together usable for counting and for screening as well as spectrometric measurements of beta particles.

It closes a gap in the measuring technique!

Photon spectra can be determined with the help of this new detector freely by any beta underground. This is importantly e.g. with n-type, inverted and planar HPGe or NaI detectors with thin entrance windows.

Best LLD

Beta and gamma spectra can be taken up by a sample simultaneously and without mutual disturbance

High time and cost saving, minimum preparation expenditure, best LLD.

Pure beta spectrometry with the possibility of the selective proof of individual beta emitters is realizable.
Best LLD, counting and spectrometry, cost saving and minimum preparation expenditure.

Where do the field of application of this detector lie?

- To detect pure beta rays for Activation- and fission products such as ^{90}Sr/^{90}Y, ^{89}Sr, ^{85}Kr, ^{99}Tc, ... and with a specific set-up also ^{63}Ni as well as additional beta-emitter in the field of nuclear medicine ^{32}P, ^{32}Si, ^{35}S, ^{45}Ca, ... and the natural radio-nuclides as ^{234}Pa, ^{210}Bi and others.
- To the simultaneously detection of photons and beta particles without disturbing mutual overlays This depends enormously with the detection on ^{210}Pb/^{210}Bi in addition, with ^{234}Th/^{234m}Pa as soon as ^{212}Bi and ^{231}Th, ^{211}Pb and many further combinations and overlays on the radionuclide matrix in the sample.

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System Application

- As a pure beta counter. The beta sensitive detector count betas from a sample or from the air activity without disturbances by photons.
- In combination with an HPGe-Detector as selective Beta/Gamma-spectrometer.
- In combination with a plastic scintillator (E-Detector) as high sensitive direct beta-spectrometer.

Important Highlights:

- **Selectivity**
  Beta particles can be separated almost perfectly of photons. Separation factors of more than 3000 are realizable
- **Efficiency**
  It is related to a 2π-source emission and a Sr/Y-90 source in equilibrium with > 58 %.
- **Lower Limit of Detection (LLD)**
  It depends naturally on the selected detection system, the source geometry and/or their thickness, partly also of the sample preparation and in this connection of the nuclide matrix in the sample. LLD's of smaller 3 mBq/g sample weight are attainable.

Detector Data:

- Gas flow -detector (standard: Methane, or other Gas)
- Geometry: about 16 mm thick, ~ 70 or 120 mm sensitive inner diameter, Outer diameter: 98 as well as 160 mm
- Type: Transmission-Detector
- Beta-sensitivity: down to about 50 keV
- Beta/Gamma Separation Power: >> 10^3
- HV/Signal-Connection: SHV-NIM Connector

Substantial Advantages

From samples with not to high self-absorption (e.g. point sources, filter samples or thin Petrie-shells), i.e.:

- without chemical sample preparation,
- with filters mostly direct on the covert sample,
- with liquids mostly evaporation it is enough

the Photon- and/or beta spectra but also the count rate could be determined direct in one measurement action.

Beta particles and photons are separately and simultaneously detectable; minimum sample preparation; enormous time and cost saving as well as smallest LLD!

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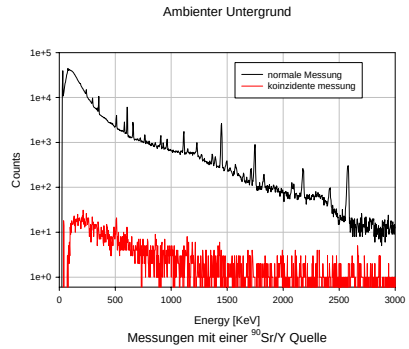
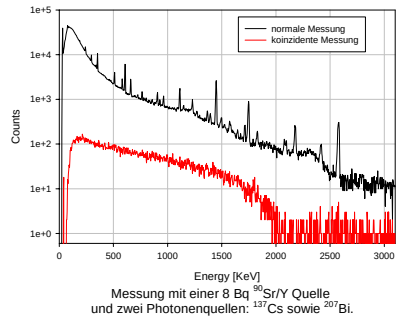
Examples for Applications

"State-of the-Art Beta-Counting and Spectrometry"

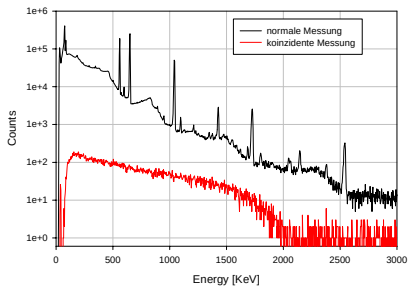
In Combination with an HPGe-Detector (Semi β-Spectrometry)



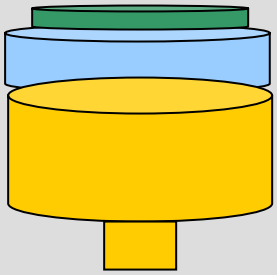
Messungen mit einer ^{90}Sr/Y Quelle



Messung mit einer 8 Bq ^{90}Sr/Y Quelle und zwei Photonenquellen: ^{137}Cs sowie ^{207}Bi.



Scheme: Beta- and HPGe -Detector



← Sample

← New Beta-Sensitive Transmis-sion - Detector

← HPGe- or NaI-Detector

Left you see 3 typical spectra each taken up with an HPGe n-type detector: black distributions without coincidence and red in coincidence with the beta detector.

Without Coincidence:

The upper and middle black distributions show in each case the background without lead shield. The lower with two addi-tional photon emitters in front of the detectors: ^{137}Cs and ^{207}Bi.

In Coincidence with the Beta-Detector:

The red distributions show the pure beta Components

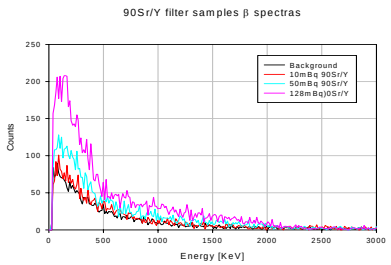
Above: without sample, i.e. random decays of beta-emitters from the air activity, as e.g. Bi/Pb-214. Photons are sup-pressed around far more than a factor 10^3.

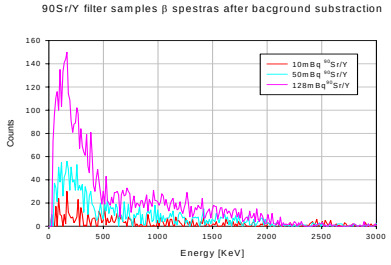
Next: with a Sr/Y-90 sample in front of the beta-detector.

Down: with additional photon emitters in front the detector

➔ In coincidence with the beta detector, the pure beta-ray spectrum can be taken up without disturbances of photons from the sample or the environment with the HPGe detector. Simultaneously the photon spectrum is naturally taken up.

In Combination with a Plastic Scintillation Detector (True β-Spectrometry)





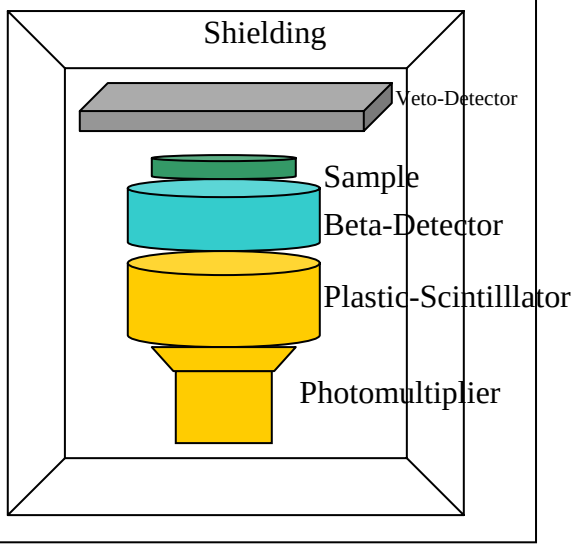
Both spectra show the perfect beta distribu-tions of 3 Sr/Y-90 filter samples with the plas-tic scintillation detector system (see pattern left)

above:

- Pink: 128 mBq
- Magenta 50 mBq
- red: 10 mBq
- black: Bkg.

down:

with Bkg. Subtraction



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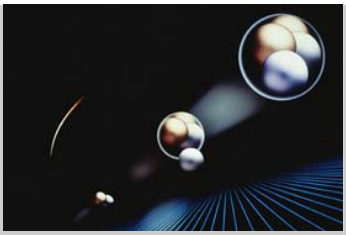
Time is Money!

Today more than ever

Determine the lowest level Beta/Gamma-Activities
with minimum of sample preparation
“simultaneously”
by Beta- and Photon-Spectrometry

ISuS saves your time and current costs!



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Advanced Innovative Technologies for Spectrometry

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