Joint Research Centre (JRC)

Calculation of correction factors for effects of true coincidence summing (TCS)

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1. GEANT 3.21 was used to calculate the full-energy-peak (FEP) efficiencies at the reference source position
2. The detector model was optimized to match the respective measured values
3. With the optimized detector model the FEP and total efficiencies were calculated for other source positions
4. The calculated efficiencies were used as input to a recently developed algorithm for the calculation of TCS correction factors
5. The KORDATEN decay scheme data were used in the calculation
6. The 40 keV X-ray of Eu-152 was taken into account
The DETECTOR MODEL

- Manufacturer’s data and the drawing were initially used, but not trusted
- The shield and the source holder were modeled according to the photos – important for total efficiency
- The radiograph data were considered the most reliable ones
- The rounding of the crystal edge was modeled as a straight cut
- Holder was not modeled, the thickness of the housing was increased instead
- The parameters adapted to match the measured efficiencies were the crystal diameter (49.3 mm), the core dimensions and the rounding
The DETECTOR MODEL

Difference between the calculated and measured reference FEP efficiency
The TCS ALGORITHM

- Deterministic algorithm
- Recursive descent through the decay scheme
- Multiplication of FEP registration probabilities
- No symbolic manipulation
- Easy inclusion of X-rays
- Compact code
- Equivalent to other established algorithms, only better 😊
- Two publications submitted to ARI
UNCERTAINTIES

Alternative approaches were tried:

- Calculation with the experimental efficiency curve (polynomial) for the reference geometry
- Efficiency transfer (ET) with non-optimized detector model to other geometries
- Total efficiencies from the EFFTRAN ET code
PROBLEMS

• Reproducing the measured total efficiencies
• Proper uncertainty estimation (decay data)
• Finite spectrum resolution (e.g., Eu-152 1085 keV line)
Thank you.