SYSTEM OF PROGRAMS FOR ACTIVATION ANALYSIS CALCULATIONS: (SPAAC)

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A system of programs performing calculations for relative instrumental neutron activation analysis with germanium detectors was developed. It can be used if standards and unknowns are irradiated together and measured at the same counting geometry. Experimental and library data are evaluated by five programs. The final result is a table of concentrations. The whole system works automatically, without the intervention of an operator and runs on an IBM-PC.

Routine multielement neutron activation analysis needs to perform many calculations, which are often the most labour-consuming stages of the analysis. The SPAAC makes these stages easier and faster. It consists of 5 programs (Fig. 1) which perform the following stages of data processing:

- gamma-spectra analysis (OPWID.EXE);
- nuclide identification and overlapping peak correction (KORPIK.EXE);
- blank correction (FOLKOR.EXE);
- calibration with the use of prepared standards or reference materials (PCKAL.EXE);
- concentration calculation (PIKCOW.EXE).

Gamma-spectrum analysis

The input data for this program consist of data on the samples (Fig. 2) and spectra written in the Canberra S100 format. In the first step the program searches for peaks.\(^1\) It makes use of the well-known STERLINSKI's algorithm,\(^2\) developed for the determination of value \(L\) proportional to the peak area and the variance \(V\) of this value:

\[
L = n \cdot N_k + \sum_{i=1}^{n-1} \left[ (n - 2i + 0.5) \cdot (N_{k-i} + N_{k+i}) \right] - (n - 0.5) \cdot (N_{k-n} + N_{k+n})
\]

\[
V = n^2 \cdot N_k + \sum_{i=1}^{n-1} \left[ (n - 2i + 0.5)^2 \cdot (N_{k-i} + N_{k+i}) \right] - (n - 0.5)^2 \cdot (N_{k-n} + N_{k+n})
\]

\(1\)


where $N_k$ is the number of counts in the $k$-th channel, and $n$ is a window, which should include expected peak (number of channels).

For each $k$-th channel of spectrum, if $N_{k-1} \leq N_k \leq N_{k+1}$ or $N_{k-1} < N_k \leq N_{k+1}$ then $L$ and $V$ values are calculated. A peak is found when the relative standard deviation $B = (\sqrt{V/L}) \cdot 100\%$ is smaller than a certain critical value (usually 25%).

**INPUT DATA**
- Spectra of blank, standards and unknowns
- Data on samples
- Element Identification Library
- Interference Correction Library
- Half-Life Library
- Standard Concentration Library
- List of elements

**PROGRAM RESULTS**
- OPWID.EXE
  - Peak areas
- KORPIK.EXE
  - Analytical peak areas
- FOLKOR.EXE
  - Analytical peak areas after blank correction
- PCKAL.EXE
  - Calibration report
  - Sensitivities
  - Final results: concentrations

Fig. 1. Flowchart of data in the system of programs