AUTOMATION OF INAA OF BIOLOGICAL OBJECTS IN RADIOANALYTICAL CENTER OF INP AS RU

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ABSTRACT

User's "Biological objects Application" software for comparator technique of INAA some biological objects for automation process of INAA by using Canberra Genie 2000 Spectroscopy System has been developed. This Application works in interactive environment as a dialogue system with user and allows calculating required nuclides concentration in analyzed samples, separately for long-lived, middle-lived and short-lived nuclides.

1. INTRODUCTION

In the Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan in frames of the "Enhanced nuclear techniques for materials identification", "Cooperative International Study of Contamination in Transboundary Rivers of Central Asia, Advanced" and "Mobile Laboratory (MOBLAB)" STCU projects, the Radioanalytical Center (RAC) was created and in October 2004 has been opened. RAC was equipped in frames of the projects with unique: HP Ge-detector with high resolution gamma-spectrometers; Si(Li)-detector with high resolution XRF-spectrometer, including DSA-1000 analyzers and Alpha-beta counter "Solo" of Canberra Industries, Inc.

For analysis such objects as metals and alloys, minerals and ores, hydrogeological samples, technological products, soils, fertilizers, biological samples, foodstuffs, water, sediments, construction materials, as well as materials of unknown composition the following major analytical method were selected:
Neutron activation analysis (instrumental and radiochemical);

X-ray fluorescence analysis (XRF);

Radiometric method with registration of natural (γ, α, and β) activity of samples.
Genie-2000 Spectroscopy System of Canberra spectrometers, represents the true state of the art in spectroscopy software platforms. Genie 2000 is a comprehensive set of capabilities for acquiring and analyzing spectra from Multichannel Analyzers (MCA). Its functions include MCA control, spectral display and manipulation, basic spectrum analysis and reporting. Genie 2000 software is available in several variations and with several layered optional packages. Genie 2000 Basic Spectroscopy and Gamma Analysis Software, which available in RAC permitting us automatically obtain nuclide identification report with all needed parameters. Any applications of Genie 2000 software have not possibility to calculate analyzed elements concentration. For automation this step of INAA by using Canberra Genie 2000 Spectroscopy System we developed user's "Biological objects Application" software for comparator technique of INAA some biological objects.

2. TOOLS OF GENIE 2000 FOR CREATION USERS APPLICATION PROGRAMS

In GENIE-2000 system the block of special user parameters is provided which contains both common parameters, and record parameters. This block is used by Canberra for the user batch programs, and also for use by the user. A symbolic name for this class is CAM_CLS_SPECIAL. We had used this class of parameters.

GENIE-2000 Batch Programming Support provides REXX script language environment for advanced automated procedure development. Besides, it is desirable to conduct dialogue with the operator through the graphic user interface (GUI), instead of questions and answers offered by environment REXX. For this purpose serves the library Graphical Batch Tools, delivered together with GENIE-2000. This tool allows creating the user menus, numbered lists, parameters input window, messages window etc. in GUI style, and the management can be carried out as the mouse, and from the keyboard.

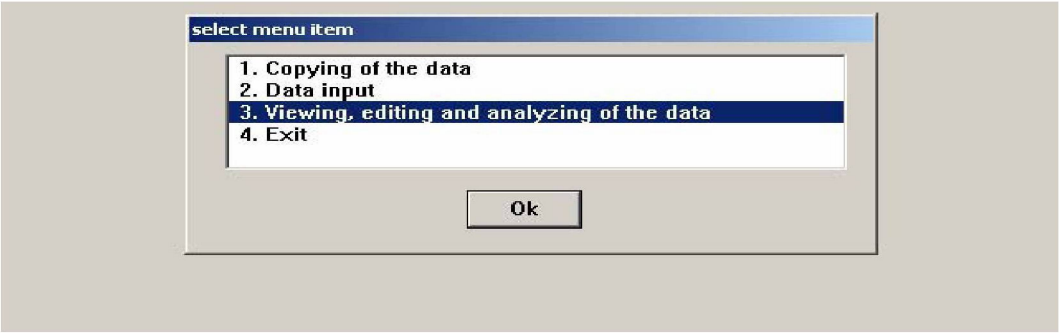
The library GENIE-2000 Graphical Batch Tools is programming expansion of system tasks performance environment and of REXX command language environment. This tools allows the user to develop own batch procedures with the graphic user interface similar to interactive environment GENIE-2000. Among functions Graphical Batch Tools, there are such, which as an argument use specific Form Design Specification so-

called FDS files. FDS files are ASCII files, which determine appearance and contents of graphic dialogue appearing on the screen.

3. DESCRIPTION OF "BIOLOGICAL OBJECTS APPLICATION" SOFTWARE FOR GENIE 2000

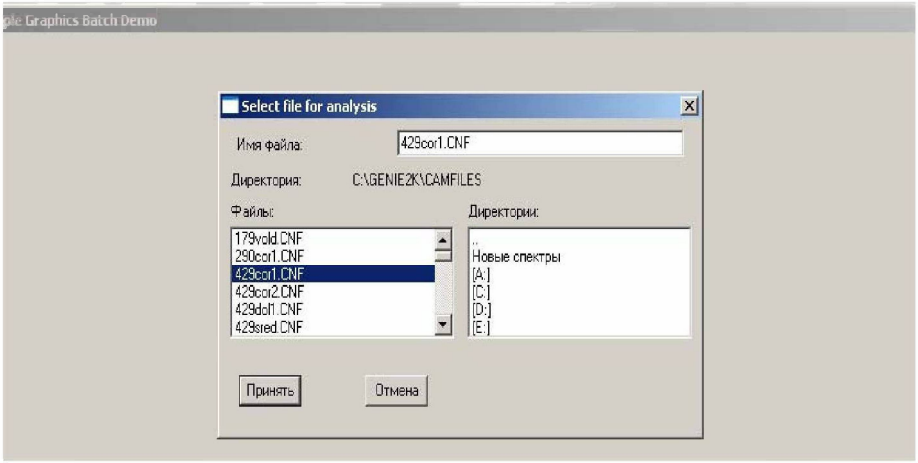
All measurement operations of examined samples analyst carry out on the base of Genie 2000 which allows to analyzing spectra from Multichannel Analyzers, including MCA control, spectral display and manipulation, basic spectrum analysis and reporting. Concentration of determined element for long-lived middle-lived and shot-lived nuclides is defined by the appropriate formulas in sufficient modules. The work with the developed Application for GENIE-2000 begins with the menu, which contains four items. Using the Nuclide Library Editor and comprehensive standard libraries of Genie package we created three custom libraries, accordingly for long-, middle- and short-lived nuclides. After processing of the next data source the Application returns the user to the menu. From here he can continue data processing, having chosen the following data source, or through menu item EXIT to leave from the Application. Thus, the user has opportunity to calculate various type required nuclides concentration (with sufficient algorithm for long-, middle- and short-lived nuclides) any number of data sources not leaving from the application.

Dialogue with operator on the screen for choose menu item for next processing



The item "Copying of the data" makes copying the entered values of special user parameters of the above described class CAM_CLS_SPECIAL from one data source into another. It is very user-friendly. It is enough to him once in one data source to enter values of necessary parameters (nuclides name, γ-lines value, factors of transformation for various times of an irradiation and cooling). Further, with the help of procedure "Copying of the data" he can transfer them to any other data source. The item "Data input" is carried out with the help of Graphical Batch Tools function GBT_PARS and specially developed set of Form Design Specification (FDS) files for this function

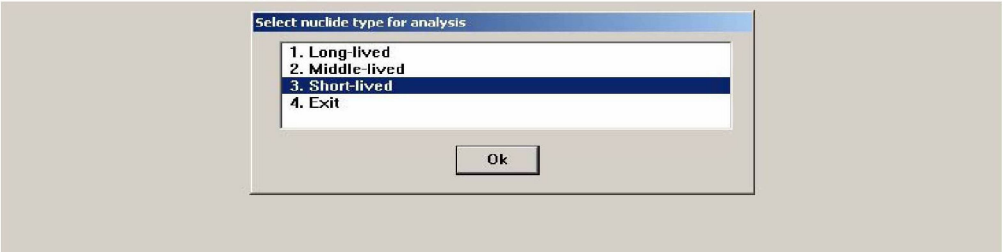
Dialogue with operator for choose data source for input



Each time when it is necessary program requests the user (operator) to specify type of processing nuclide as on next fig. Moreover there is one peculiarity. For short-lived nuclides at concentration calculation conversion factor of EXP (λ·t) is used. Therefore, in the block of data input for short-lived nuclides the small calculations block is stipulated which calculates a difference between of a sample and standard cooling

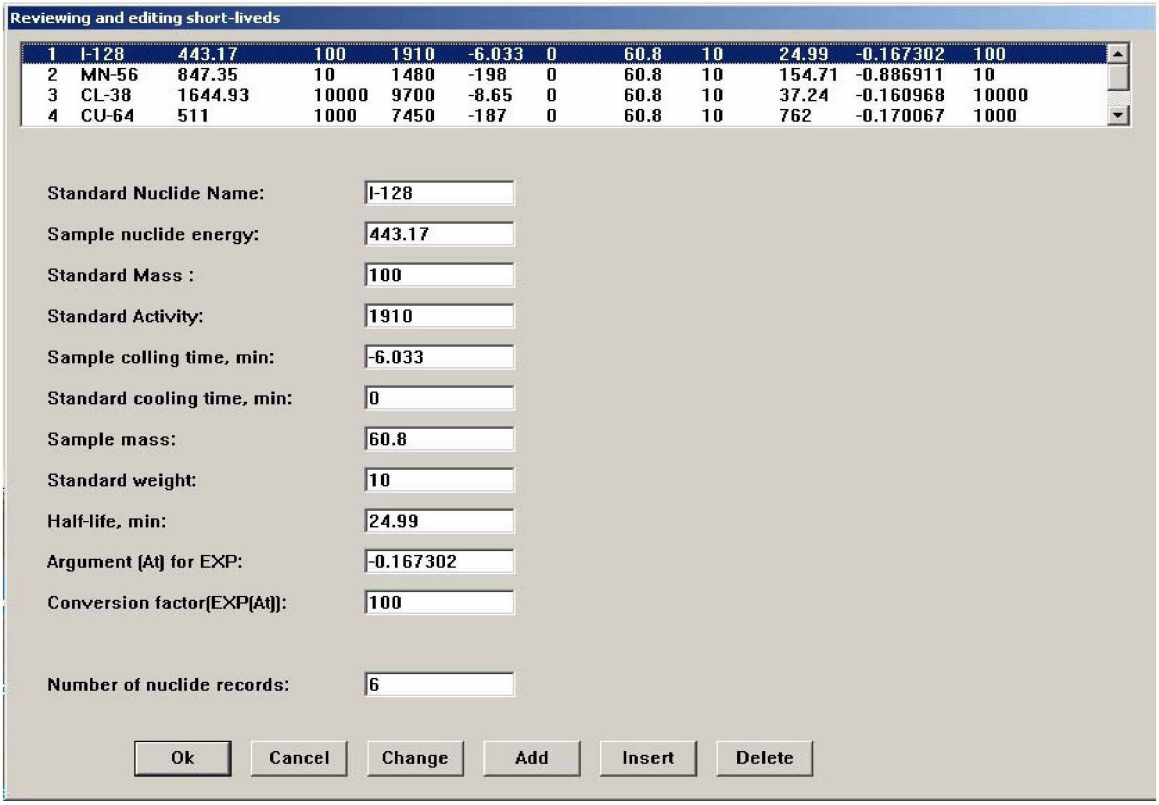
time's t, decay constant λ=0.693/T1/2. For this reason in heading of the input window "input and calculation for short-lived nuclides data " is written.

Dialogue with operator for choose type of processing nuclide



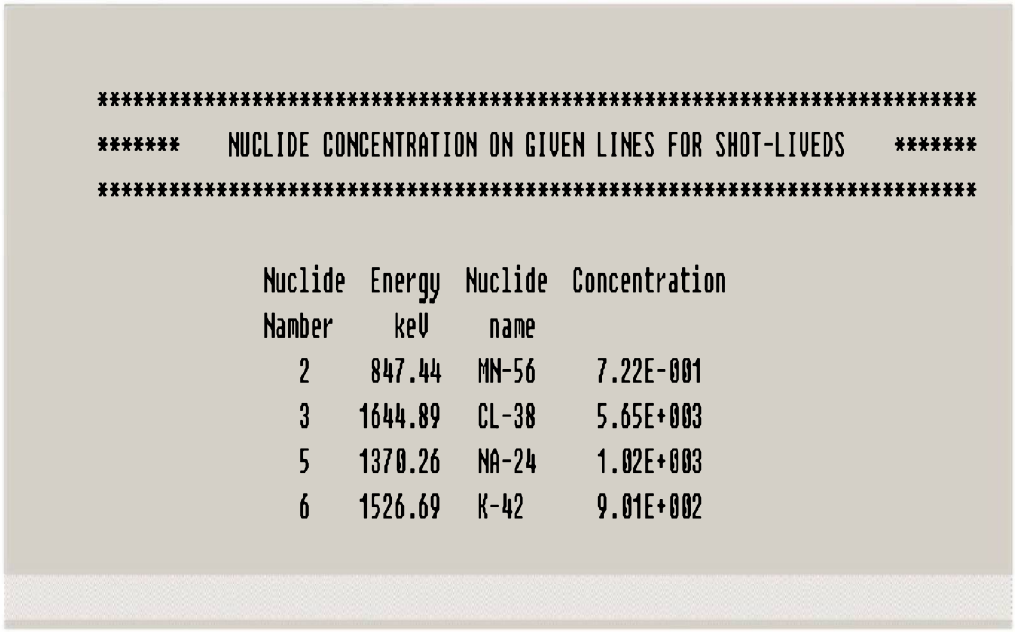
The viewing and editing before beginning the data analysis is made similarly to data input. For transition to the data analysis it is necessary to generate the appropriate files of analysis sequence. For researches convenience three different nuclide libraries, separately for short-lived, middle-lived and long-lived nuclides are generated. For long-lived and middle-lived nuclides the same steps of the analysis sequence, but with different nuclides libraries are used. Therefore for them two files of analysis sequence NID_COMPRD and NID_COMPRS were generated. These files of analysis sequence are consisting from the following steps: Report - Header, Peak Search, Peak Analysis, Peak Analysis Report, Preliminary Identification and Preliminary Identification Report.

Dialogue with operator for input data of short-lived nuclides



In an internal cycle the energy of the next processing peak from an external cycle is compared with the given values of reference energy lines of required nuclides. If the module of compared energy difference does not exceed the given admission on energy, for the given line and given nuclide name to be made calculation of concentration under the given formulas with use of conversion factor EXP (λ·t), taking into account a difference between of sample and standard cooling times. On the screen by the line are put out: required nuclide number, energy value, nuclide name, nuclide concentration on this energy line.

Nuclide concentration on given lines



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******* NUCLIDE CONCENTRATION ON GIVEN LINES FOR SHOT-LIVEDS *******

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Nuclide Number	Energy keV	Nuclide name	Concentration
2	847.44	MN-56	7.22E-001
3	1644.89	CL-38	5.65E+003
5	1370.26	NA-24	1.02E+003
6	1526.69	K-42	9.01E+002

4. CONCLUSION

This is the first Application, developed in the Institute of Nuclear Physics AS RU for automation of data processing to Genie-2000 spectroscopic system, which allows the user to calculate required nuclides concentration in analyzed samples for one of INAA techniques. Its application in practice show the efficiency of automation methods use and expediency of the new Applications development for other applied techniques