Neutron Activation Analysis NAA for Life sciences.

Frank laboratory of Neutron Physics

Phathizwe Gwebu.

Bsc Biology-Chemistry.

Honors Applied radiation science.

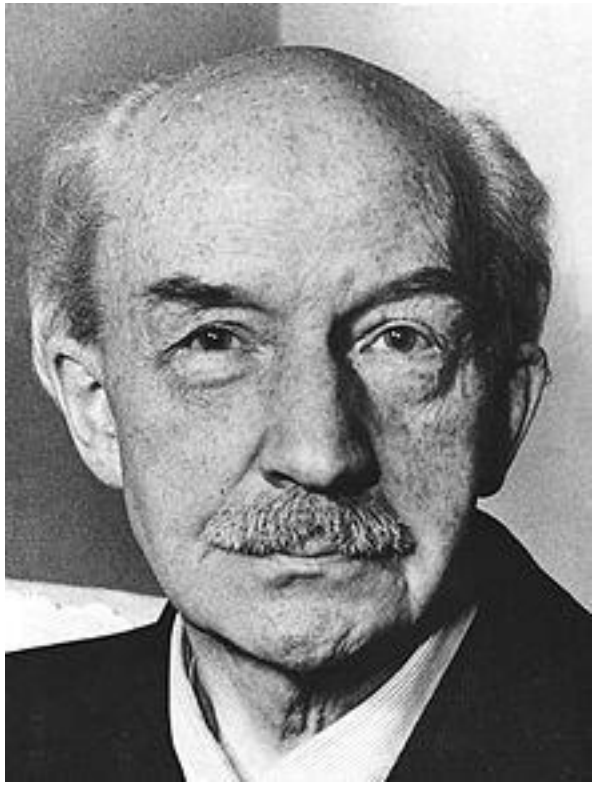
Supervision;
Prof. Marina Frontasyeva
Dr. Wael Badawy.

Outline.

- History and discovery of Neutrons
- Definition of NAA
- Types of NAA
- Detection/Measurement.
- Application of NAA.
- Comparison of NAA with other techniques.
- Advantages and limitations of NAA.
- Joint projects JINR-RSA.

History and Discovery.

- **1930** Walter Bothe and Herbert Berker found that the alpha radiation from polonium produced high penetrating radiation when directed to light atoms like Beryllium.
- The radiation was uncharged so they thought it was gamma radiation.



Walter Bothe

Continued.

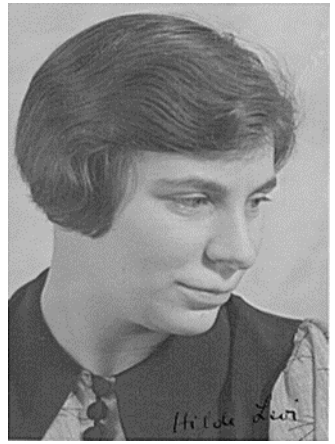
- **1932** Irene and Fredric Joliot-curie showed that if this new penetrating radiation fell on hydrogen rich materials it emitted protons.
- The observation was not inconsistent with the nature of gamma radiation(Compton scattering)
- But the problem is that the ‘gamma ray’ would have to have impossible high energy to scatter the proton.

Cont

.

James Chadwick

George Charles de Hevesy

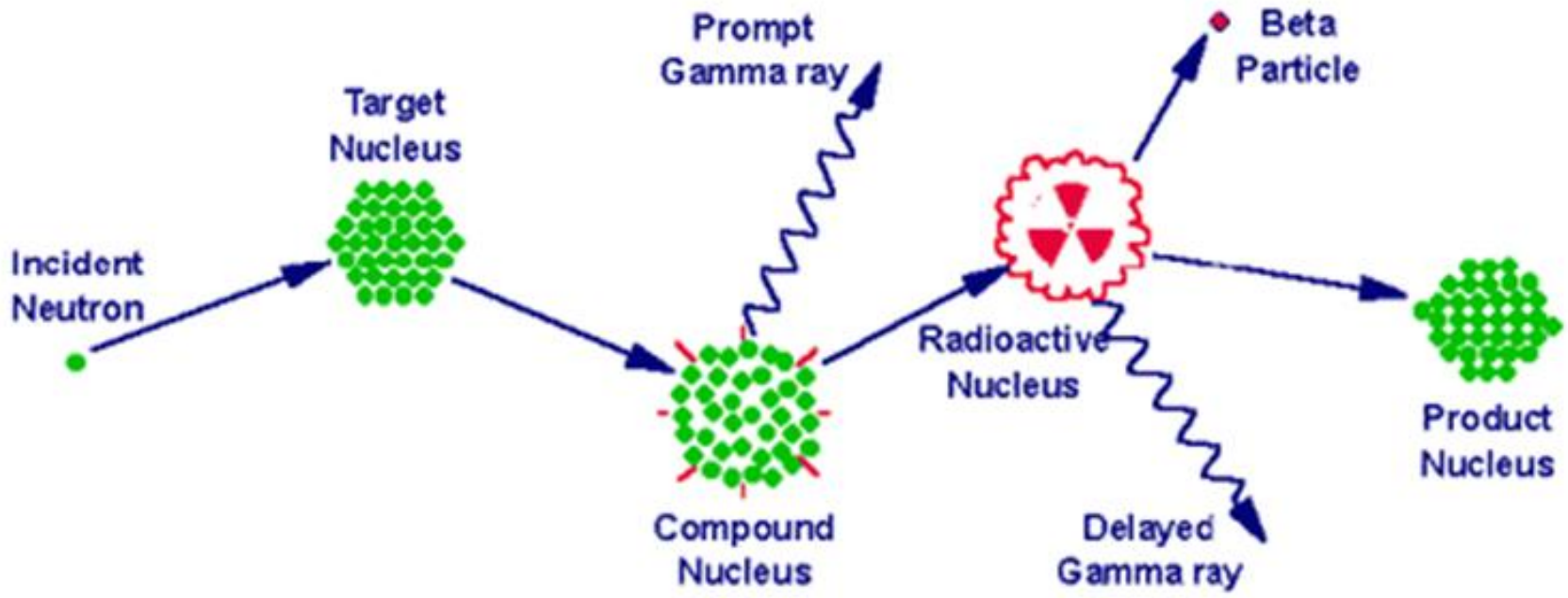


Hilde Levi

- **1932** James Chadwick then used Beryllium to produce this new radiation and he aimed the radiation at paraffin wax and protons were ejected.
- He measured the range of the protons found that the new radiation consisted of not gamma rays, but uncharged particles with about the same mass as the proton
- **1934** Hilde Levi exposed dysprosium to neutrons but the GM, indicated no activity. This was explained by the dead time 100%.
- She put away the tray and later when she needed it she observed that GM counter start to register some pulses.

NA
A

- Neutron activation analysis is a method for the qualitative and quantitative determination of elements based on the measurement of characteristic radiation from radionuclides formed by irradiating materials by neutrons.



Types of NAA

- **Destructive**

(radiochemical) – the resulting radioactive sample is chemically decomposed and the elements are chemically separated.

Non-destructive

(instrumental) – sample is kept intact and the radionuclides are determined, taking advantage of the differences in decay rates via measurements at different decay intervals

Sample collection.

Soil

Moss

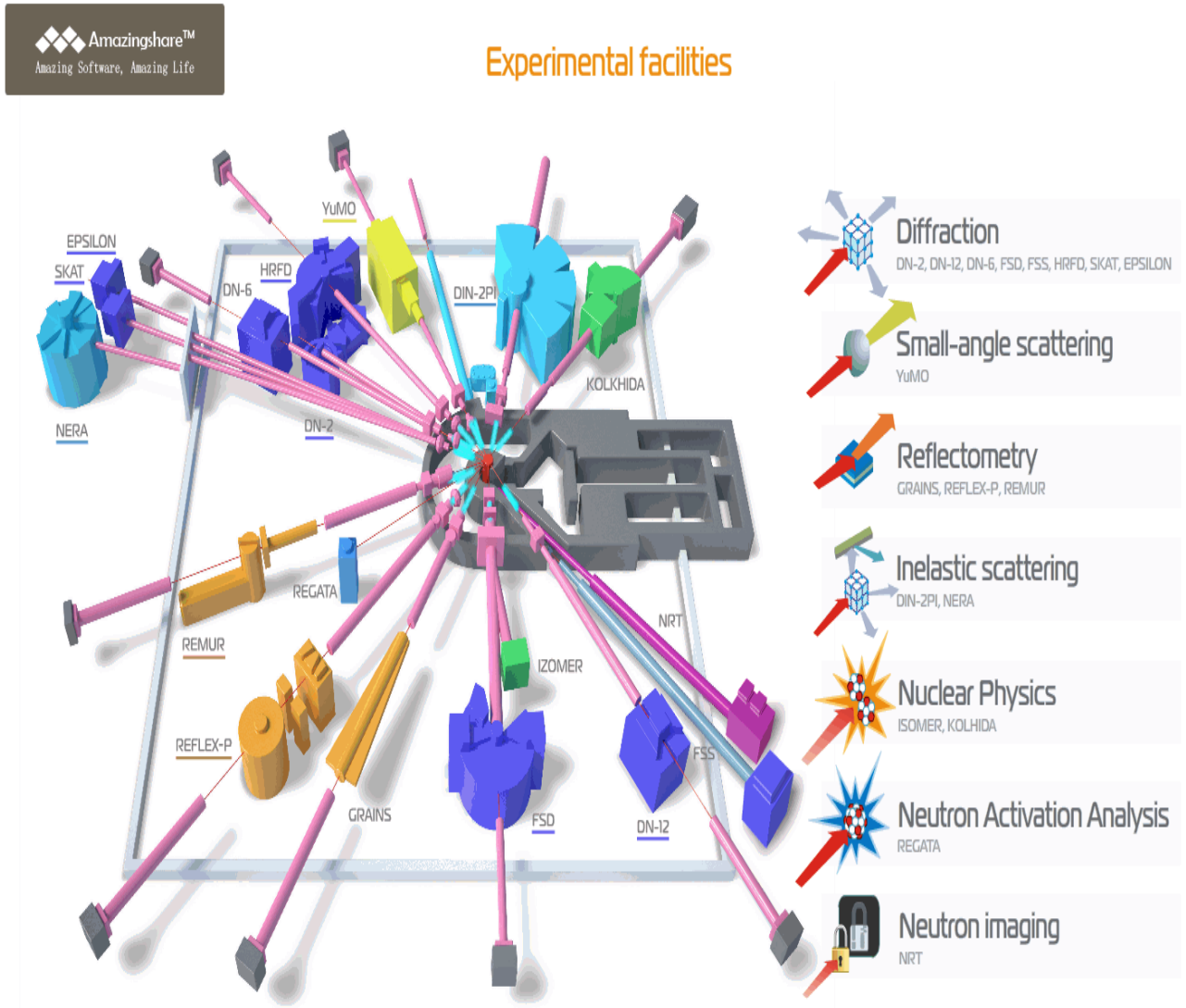
Sediments

Sample preparation

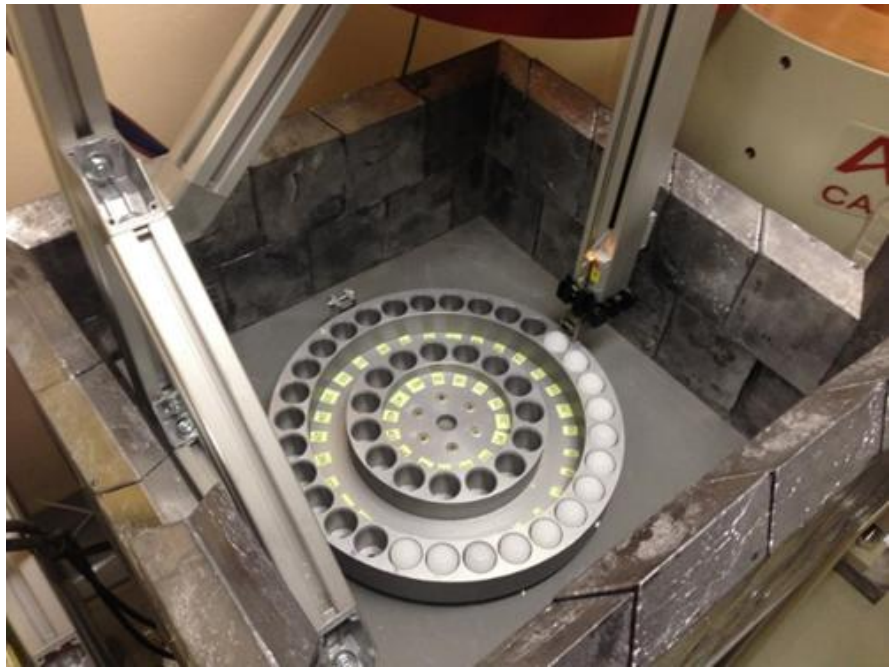
Sample Irradiation

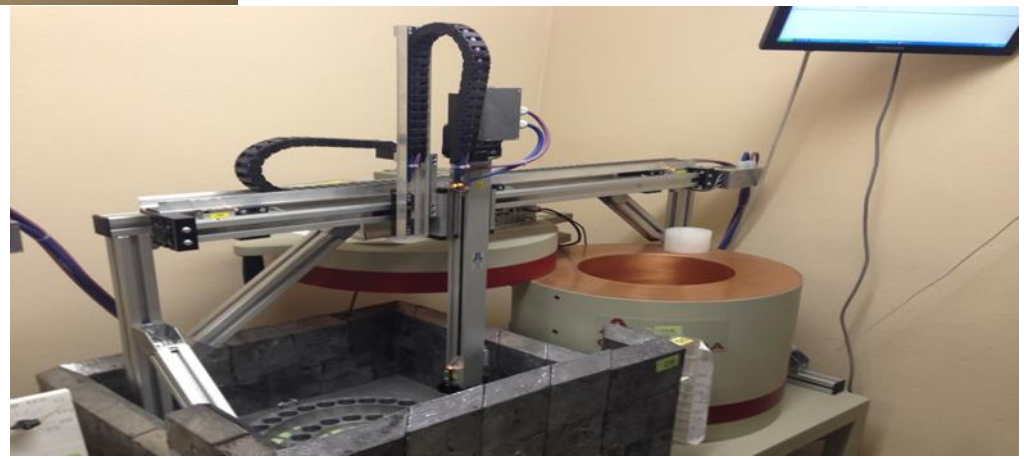
IBR-2

REGATA

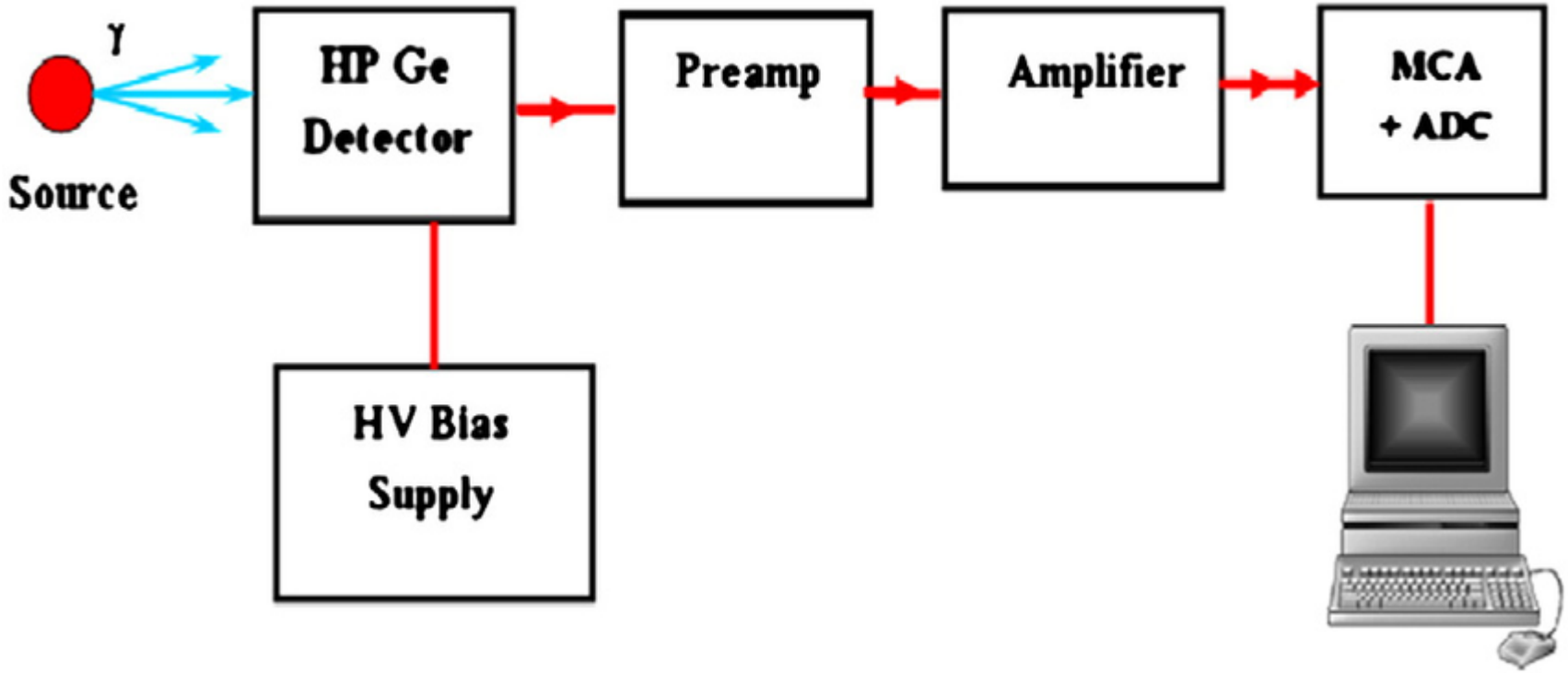


Post Irradiation.

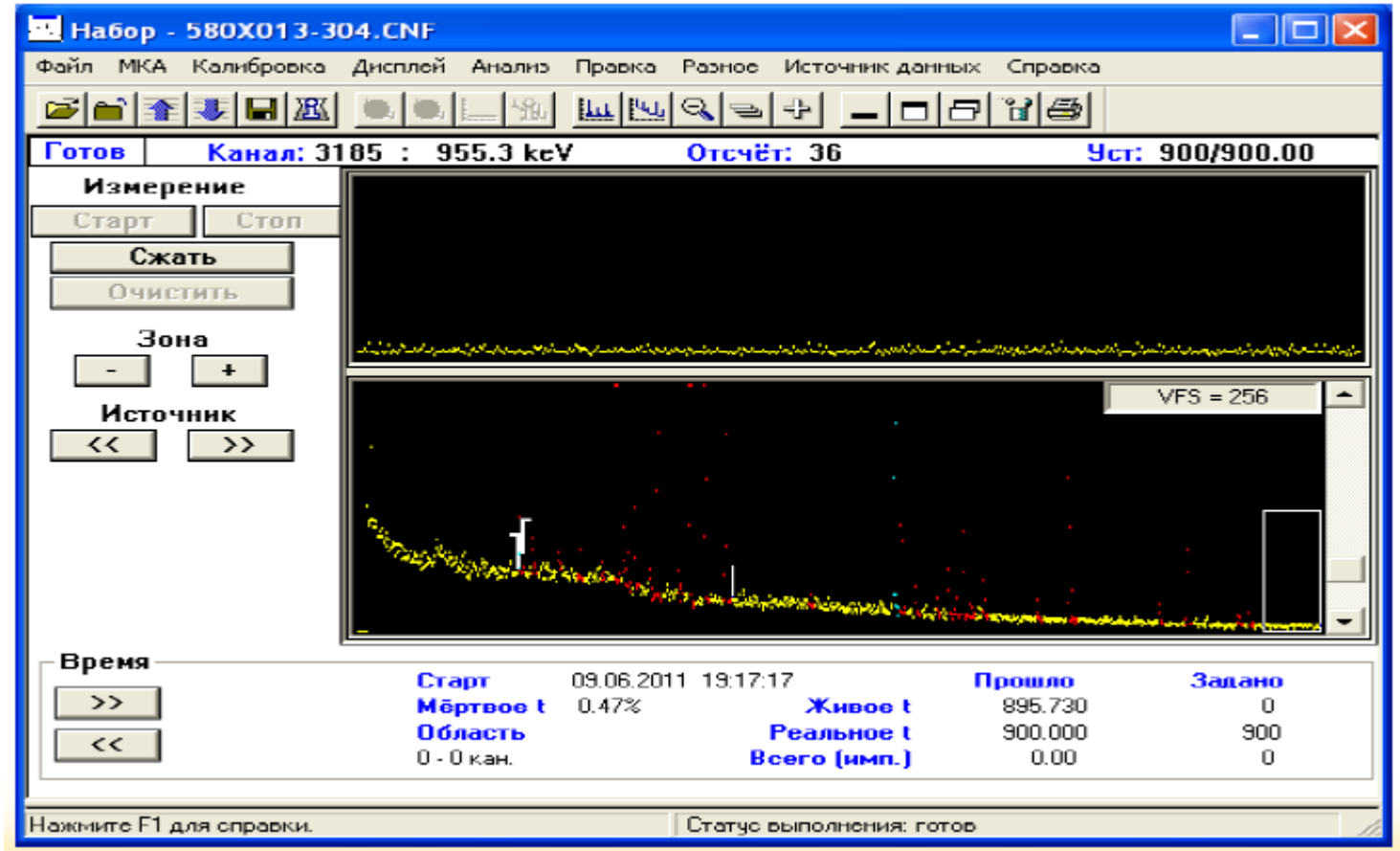




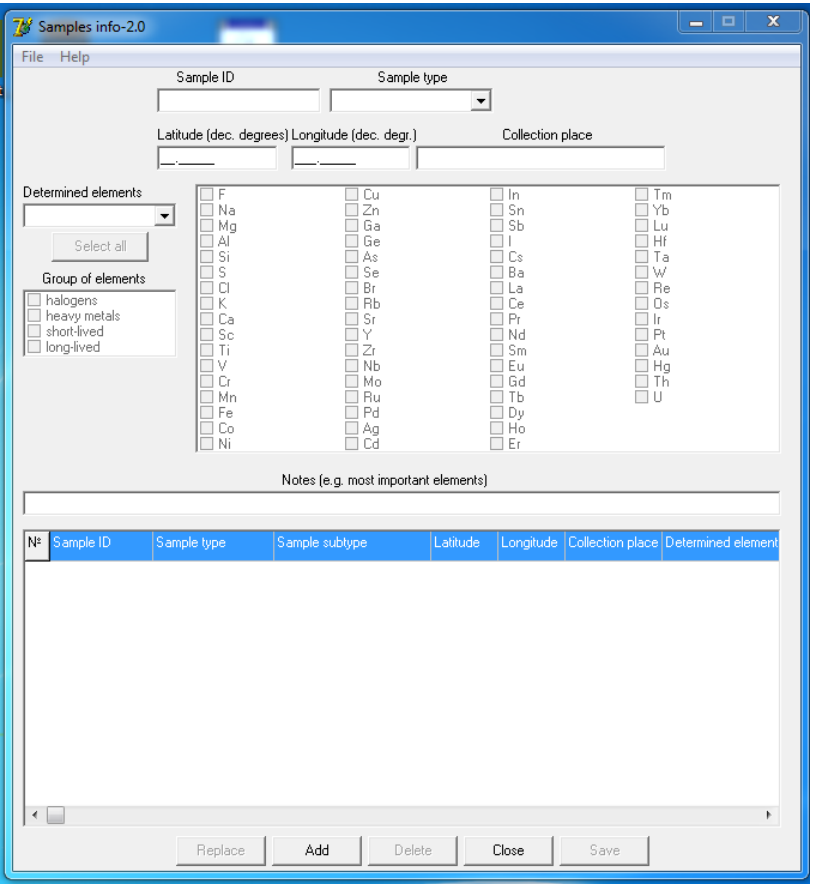
Detection/Measurement

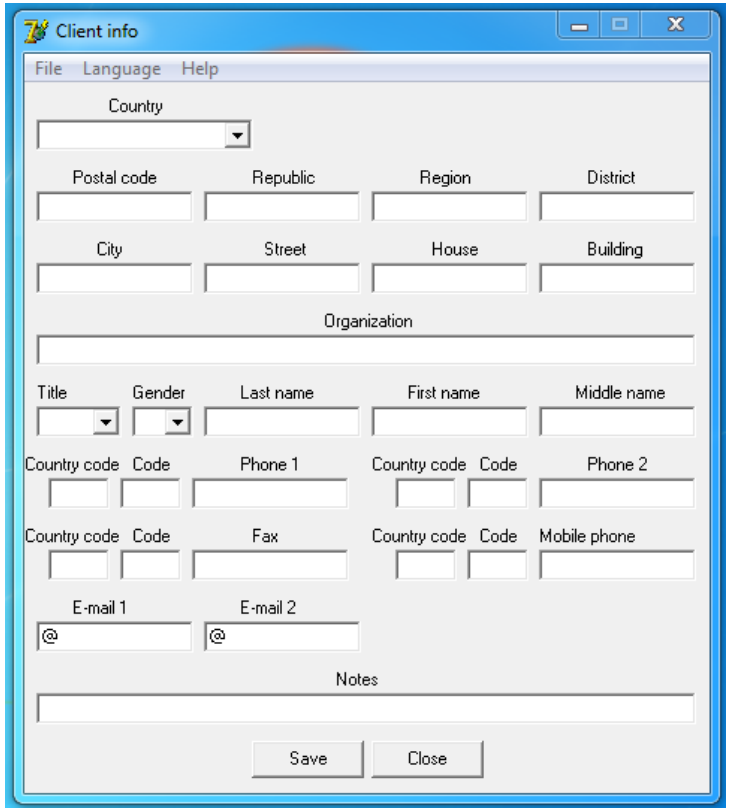


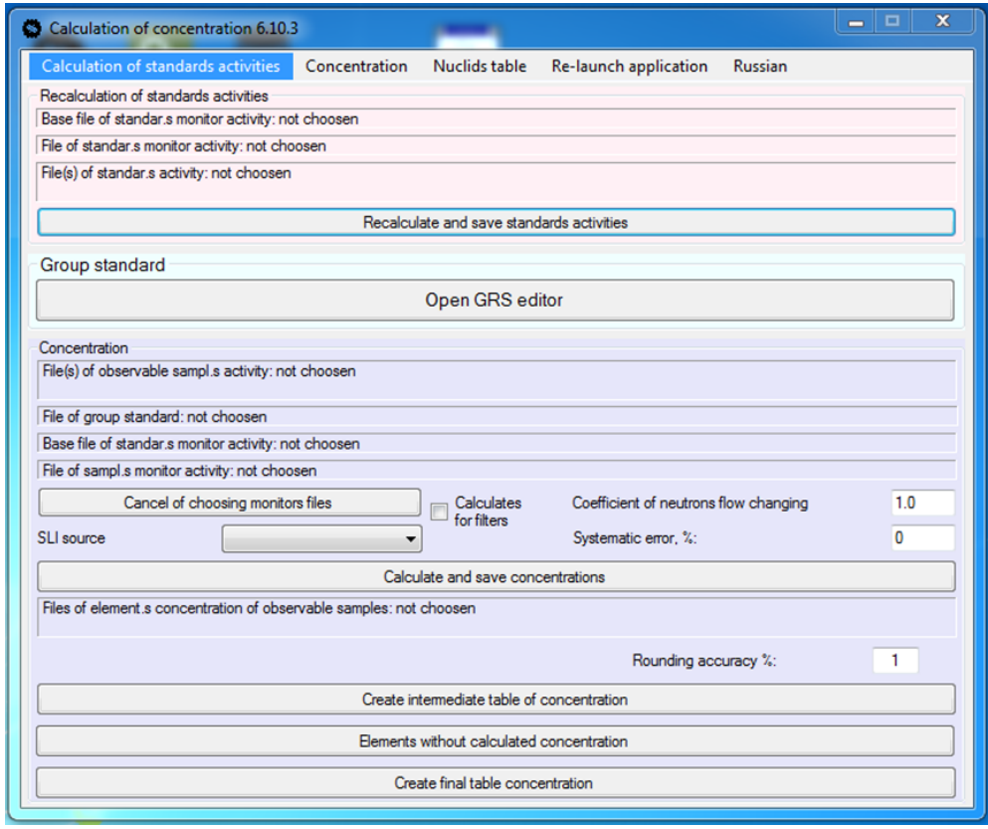
Genie 2000


Набор - 580X013-304.CNF
Файл МКА Калибровка Дисплей Анализ Правка Разное Источник данных Справка
Готов
Канал: 3185 : 955.3 keV
Отсчёт: 36
Уст: 900/900.00
Измерение
Старт
Стоп
Сжать
Очистить
Зона
-
+
Источник
<<
>>
VFS = 256
Время
>>
<<
Старт 09.06.2011 19:17:17
Мёртвое t 0.47%
Область
0 - 0 кан.
Прошло
Задано
Живое t 895.730 0
Реальное t 900.000 900
Всего (имп.) 0.00 0
Нажмите F1 для справки.
Статус выполнения: готов

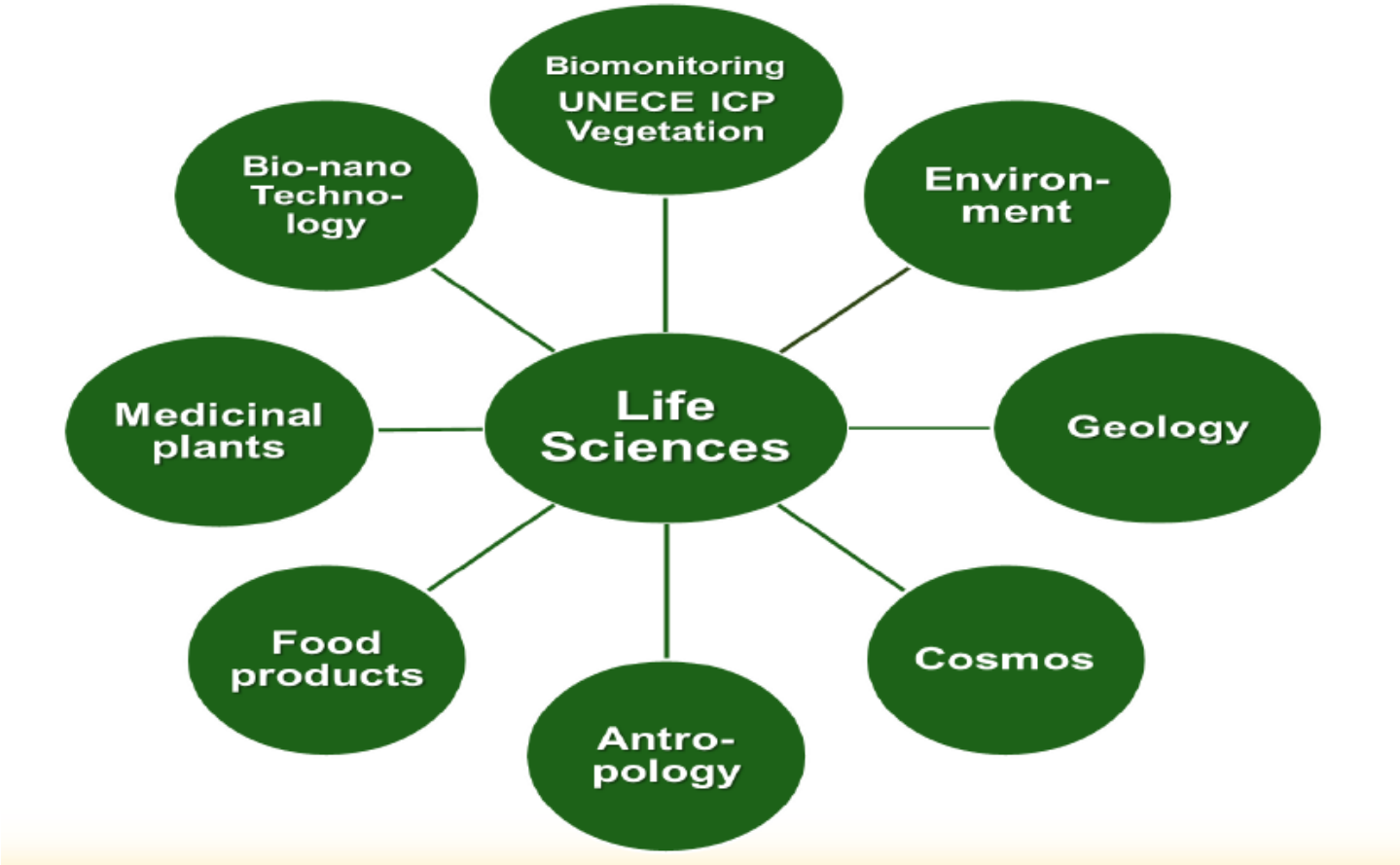
Supporting programs.



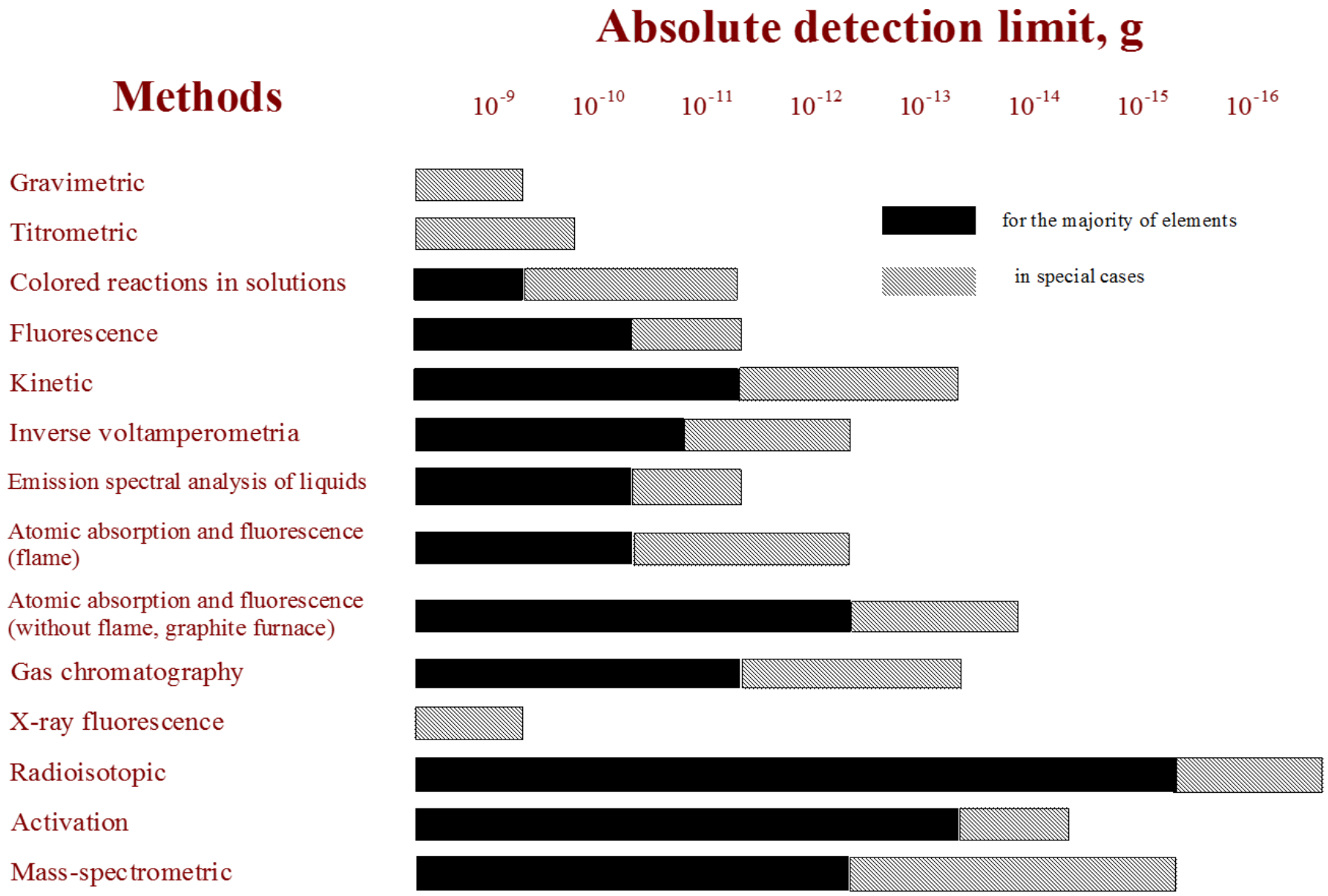




Applications



Comparison of NAA with other techniques.



Advantages

- Wide possibilities of applications
- Non destructive analysis
- Multi-element analysis
- Sensitivity to parts-per-billion for specific elements

Limitations.

- Need for nuclear reactor
- Work with radioactive materials
- Time of analysis
- Sample preference

Joint projects JINR-RSA.

Nuclear and related analytical techniques for environmental studies using aquatic biomonitors around the Southern African coastline. ACRONYM: Mussel Watch.

- 31 major and trace elements were found in the mussels.
- Seasonal accumulation of heavy metals was also studied. During winter accumulation was high compared to summer.
- Comparison between farmed and naturally occurring mussels—farmed mussels showed low accumulation of heavy metals than naturally growing.

Fig. 1. A Google Earth image indicating the positions of the four sampling sites. The map insert shows the position of Saldanha Bay with relation to South Africa

Acknowledgements.

- Prof Marina Frontasyeva.
- Dr Wael Badawy.
- Nikita Yushin.
- Anita.