

Project
‘VIRTUAL LABORATORY’
as a learning tool for nuclear
experiment preparation

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**International Sakharov Environmental Institute of
Belarusian State University**



JINR Lab: Virtual Laboratory

Project supervisors

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- Alexander Strelalovsky
- Pavel Semchukov
- Kseniya klygina

The Aim of the project

- To support the theoretical part of learning with experimental learning
- To learn about different equipment's in Nuclear experiment through,
 - firstly Virtual laboratory software (both theoretical background and Virtual equipment)
 - Then practical work with the real equipment's
- Final use what we learned practice with equipment in the main goal of lab which is ,
- **Measuring the thickness of the Foil through Energy loss Spectrum.**

Software 'Virtual Laboratory'

- About
- Part 1 'Some Concepts of Nuclear Physics'
- Part 2 'How to Measure Radioactivity'
- Part 3 'Theoretical Models of the Atomic Nucleus'
- Part 4 'Nuclear Fission Experiment'
- Part 5 'Light Ions Spectrometer – Measurements'
- Part 6 'Light Ions Spectrometer – Data Analysis'
- Part 7 'Interactive environment for nuclear experiment modeling'

Virtual Laboratory of Nuclear Fission

The goal of the project is to include current scientific data into the educational process, to conduct virtual and online laboratory research based on information and communication technologies using modern scientific equipment and data obtained from the existing physical facilities.

1. Welcome Words
2. About the Project
3. Manual
4. Developers



About

Part 1

Part 2

Part 3

Part 4

Part 5

Part 6

Part 7

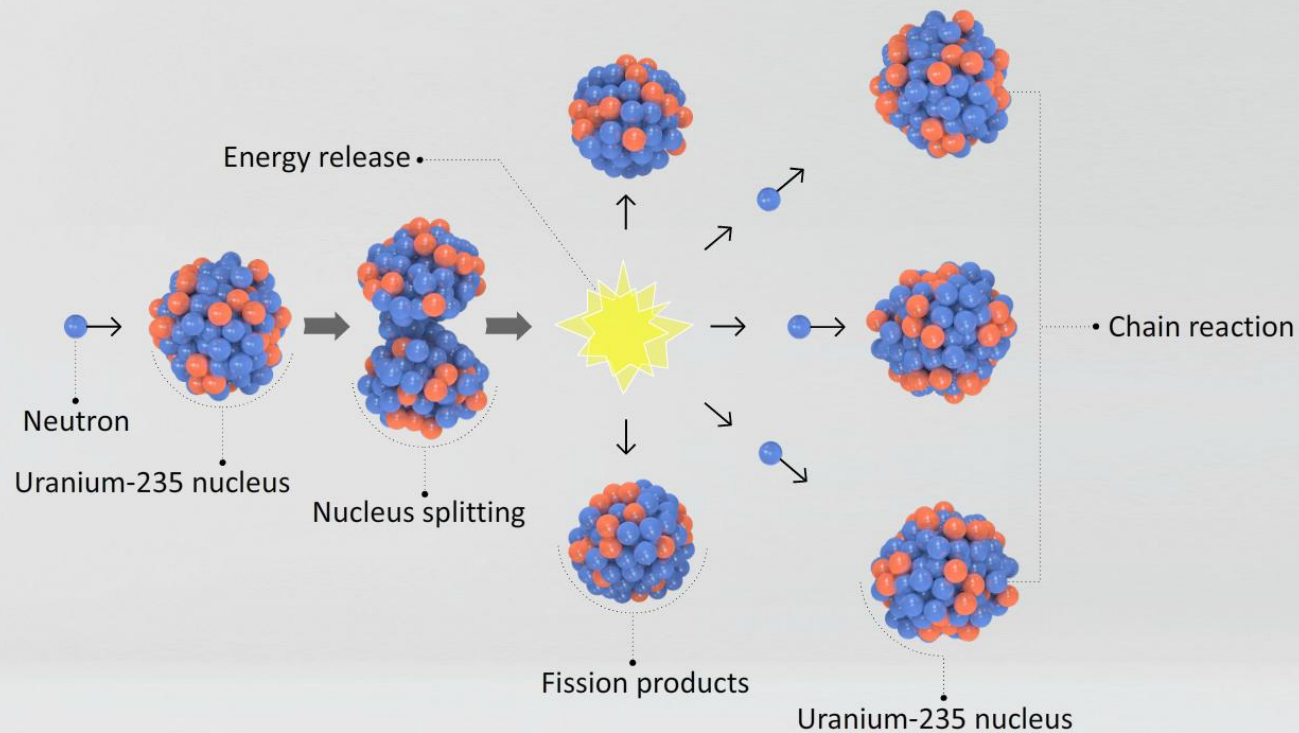
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Theoretical basis

Some Concepts of Nuclear Physics

 Virtual Laboratory



1. World of the Atom
2. Atomic Nucleus
3. Mass and Energy
- 4. Fusion and Fission**
5. Radioactivity:
 - Alpha Decay
 - Beta Decay
 - Gamma Decay
 - Spontaneous Fission
6. Radioactive Decay Laws
7. Quiz
8. Exercises

About

Part 1

Part 2

Part 3

Part 4

Part 5

Part 6

Part 7

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7/20. Choose 6 elements whose names are connected with Russia.

The Periodic Table of the Elements

													13	14	15	16	17	18
1 H hydrogen (1.007, 1.009)													5 B boron (10.80, 10.83)	6 C carbon (12.00, 12.02)	7 N nitrogen (14.00, 14.01)	8 O oxygen (15.99, 16.00)	9 F fluorine 19.00	10 Ne neon 20.18
3 Li lithium (6.938, 6.997)	4 Be beryllium 9.012	Key: atomic number Symbol name standard atomic weight										13 Al aluminium 26.98	14 Si silicon (28.08, 28.09)	15 P phosphorus 30.97	16 S sulfur (32.05, 32.08)	17 Cl chlorine (35.44, 35.46)	18 Ar argon 39.95	
11 Na sodium 22.99	12 Mg magnesium (24.30, 24.31)	3	4	5	6	7	8	9	10	11	12	31 Ga gallium 69.72	32 Ge germanium 72.63	33 As arsenic 74.92	34 Se selenium 78.96(3)	35 Br bromine (79.90, 79.91)	36 Kr krypton 83.80	
19 K potassium 39.10	20 Ca calcium 40.08	21 Sc scandium 44.96	22 Ti titanium 47.87	23 V vanadium 50.94	24 Cr chromium 52.00	25 Mn manganese 54.94	26 Fe iron 55.85	27 Co cobalt 58.93	28 Ni nickel 58.69	29 Cu copper 63.55	30 Zn zinc 65.38(2)	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3	
37 Rb rubidium 85.47	38 Sr strontium 87.62	39 Y yttrium 88.91	40 Zr zirconium 91.22	41 Nb niobium 92.91	42 Mo molybdenum 95.96(2)	43 Tc technetium	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	81 Tl thallium (204.3, 204.4)	82 Pb lead 207.2	83 Bi bismuth 208.9	84 Po polonium (209)	85 At astatine (210)	86 Rn radon (222)	
55 Cs caesium 132.9	56 Ba barium 137.3	57-71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	113 Nh nihonium [286]	114 Fl flerovium [289]	115 Mc moscovium [290]	116 Lv livermorium [293]	117 Ts tennessine [294]	118 Og oganeson [294]	
87 Fr francium [223]	88 Ra radium [226]	89-103 actinoids	104 Rf rutherfordium [261]	105 Db dubnium [262]	106 Sg seaborgium [266]	107 Bh bohrium [262]	108 Hs hassium [269]	109 Mt meitnerium [268]	110 Ds darmstadtium [272]	111 Rg roentgenium [272]	112 Cn copernicium [285]	113 Nh nihonium [286]	114 Fl flerovium [289]	115 Mc moscovium [290]	116 Lv livermorium [293]	117 Ts tennessine [294]	118 Og oganeson [294]	
57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium [145]	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.1	71 Lu lutetium 175.0				
87 Ac actinium [227]	90 Th thorium 232.0	91 Pa protactinium 231.0	92 U uranium 238.0	93 Np neptunium [237]	94 Pu plutonium [244]	95 Am americium [243]	96 Cm curium [247]	97 Bk berkelium [247]	98 Cf californium [251]	99 Es einsteinium [252]	100 Fm fermium [257]	101 Md mendelevium [258]	102 No nobelium [259]	103 Lr lawrencium [262]				



Study of signals from a pulse generator

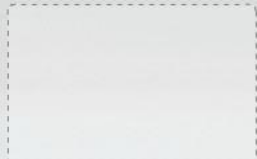
Now you see 2 signals from the pulse generator on the oscilloscope screen. These signals accurately coincide with each other because we used identical cables of the same length. To prove this fact superimpose one signal on another.



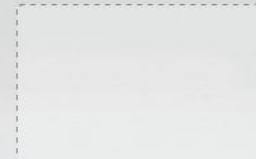
LEMO-LEMO (1 m)



LEMO-LEMO (1 m)



LEMO-BNC (1 m)

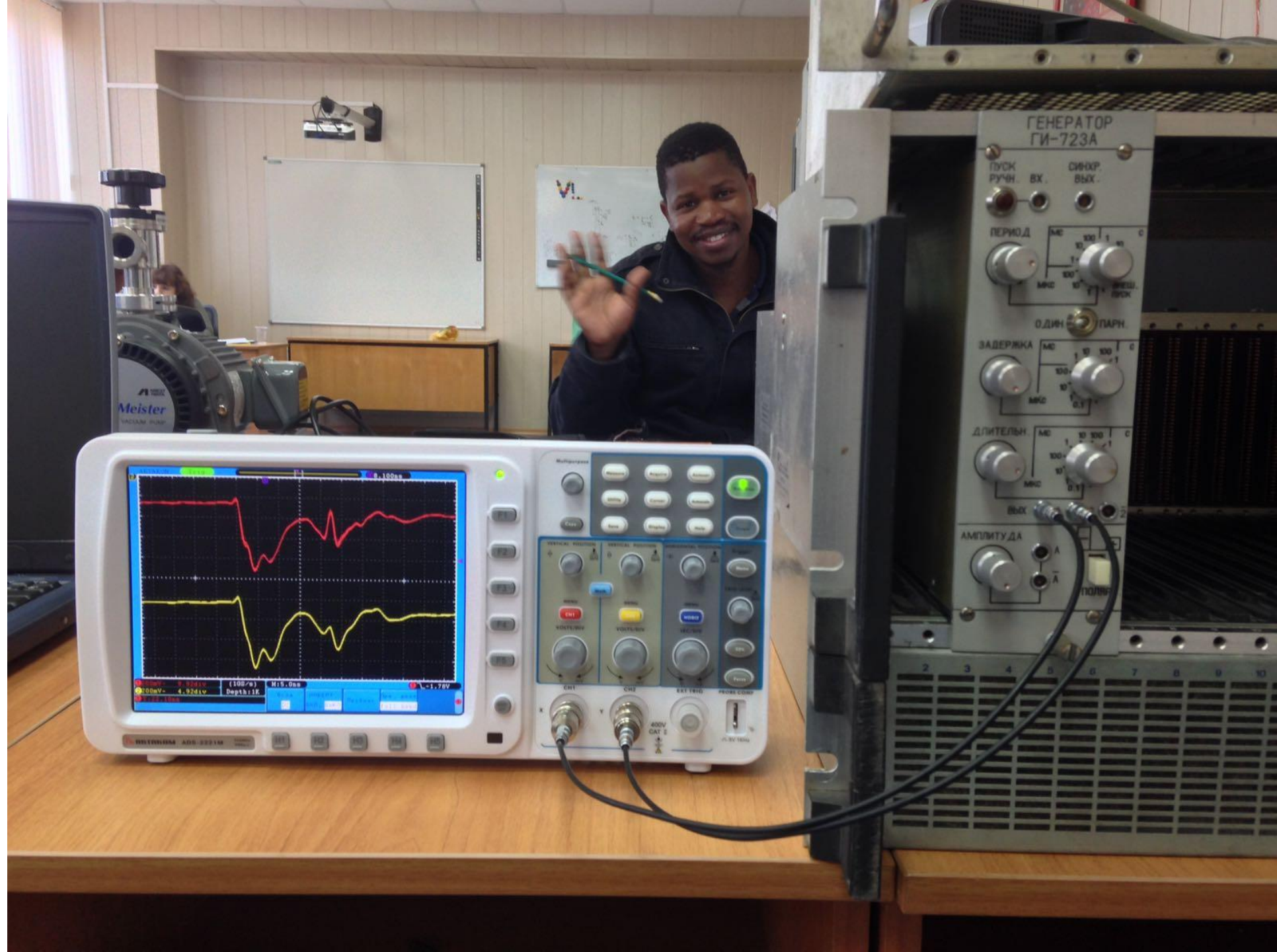


LEMO-BNC (1 m)

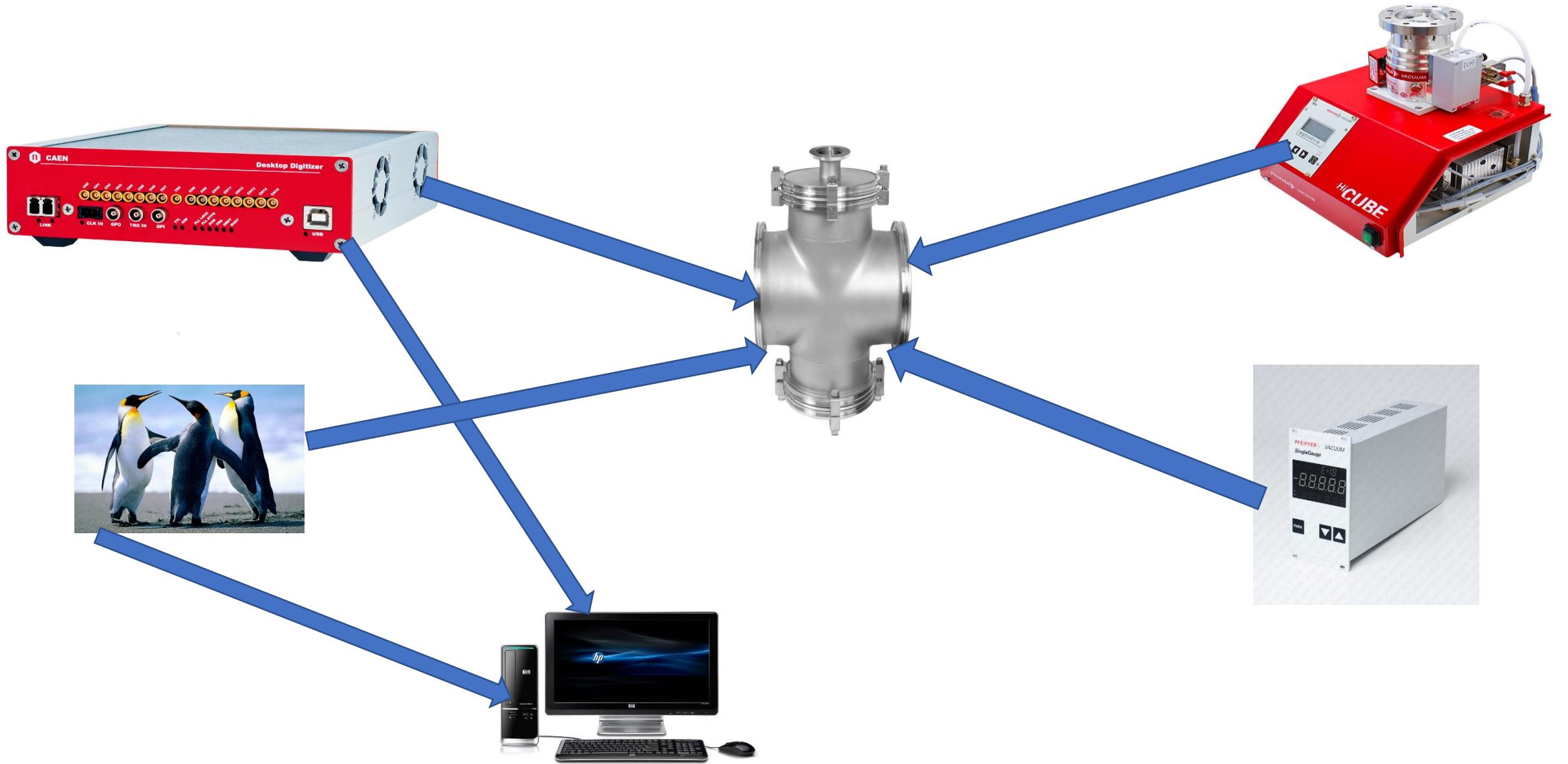
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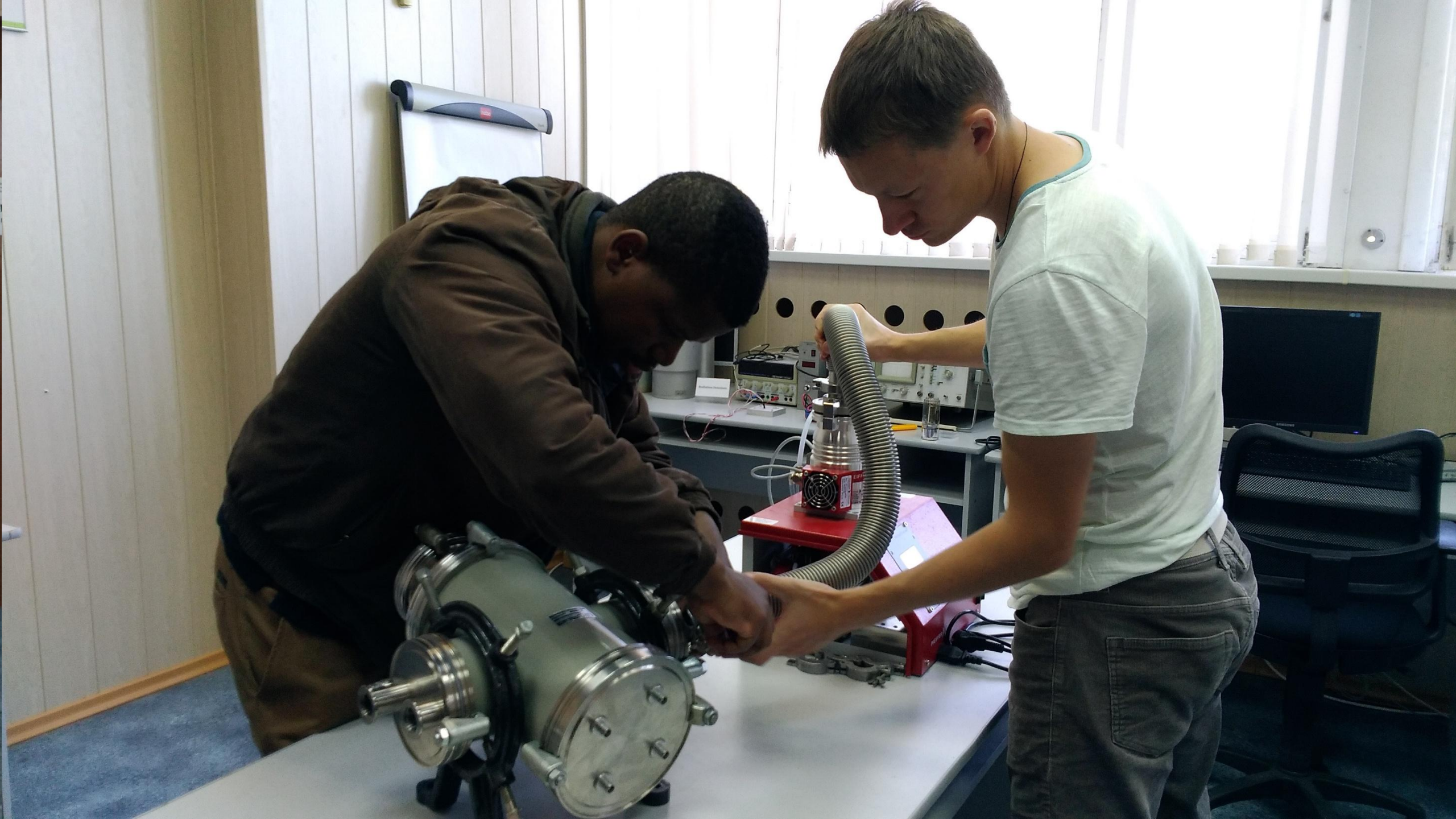
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In real life



The main Project Methodology





- Data Processing building the spectra's



- Calculation with Excel and Data Processing building the spectra's for the most probable energies of our spectra's



- Calculating the difference between the Initial Energy and the final Energy and using Trim tables to find approximate
- Thickness of the Foil.





Results and Discussion

Conclusion

ACKNOWLEDGEMENTS



science
& technology

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REPUBLIC OF SOUTH AFRICA



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Belarusian State University



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LABS

Laboratory for Accelerator
Based Sciences

