Rezo Shanidze
I. Javakhishvili Tbilisi State University
High Energy Physics Institute

Nuclear Medicine Physics in Tbilisi State University

23 August 2018
Tbilisi, Georgia
The AMS facility for TANDEM

- The Accelerator Mass Spectrometry (AMS): Ultrasensitive analysis tool for:
  - Archeology
  - Biology, medicine and pharmacology
  - Chemistry
  - Environmental studies,
  - Physics, ...

- Modern experimental tools for scientific research and high education.
- Reasonable installation/running costs.
- Possibility to serve large scientific community in Georgia and South Caucasus region.
- Close collaboration with research groups in EU (USA, Japan,..)

TANDEM@Caucasus

Tbilisi Accelerator based Nuclear, Dating and Environmental Monitoring Regional center

R. Shanidze
University of Erlangen
and
HEPI TSU
NMP in Georgia - teaching in TSU – prospects for research

- Introduction

- Nuclear medicine in Georgia

- Nuclear medicine physics (NMP) program in TSU

- Future research projects

- Summary and Outlook
Nuclear Medicine

Radionuclide Production

Radiopharmaceuticals

As Low As Reasonably Applicable (ALARA)

Diagnostics
Nuclear medicine imaging

Gamma Camera
SPECT

PET Scanner

Therapy

Brachytherapy

Teletherapy (External Beam Radiation Therapy, EBRT)

As Low As Reasonably Applicable (ALARA)
Nuclear Medicine Centers in Georgia

Black Sea
Nuclear medicine centers in Georgia:

<table>
<thead>
<tr>
<th>MN Centers</th>
<th>Diagnostics Nucl. imaging</th>
<th>Theraphy Brachy</th>
<th>EBRT</th>
<th>Radioisotops</th>
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<tr>
<td>RICM (&quot;Todua&quot;)</td>
<td>SPECT, PET</td>
<td>Yes</td>
<td>3</td>
<td>$^{18}$F, $^{99m}$Tc, $^{131}$I, $^{192}$Ir</td>
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<tr>
<td>HTMC (&quot;Ingorokva&quot;)</td>
<td>SPECT, PET</td>
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<td>2 + 1</td>
<td>$^{18}$F, $^{99m}$Tc, $^{131}$I, $^{192}$Ir</td>
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<tr>
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<tr>
<td>Aversi</td>
<td>SPECT, -</td>
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<tr>
<td>Ewex (Kutaisi)</td>
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<td>2</td>
<td>-</td>
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<tr>
<td>Batumi</td>
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</table>

Radioisotopes for nuclear medicine in Georgia: M. Abramsivili
Nuclear Medicine Equipment in Georgia

New generation PET/CT: GE Discovery IQ was recently installed in Research Institute of Clinical Medicine (Medical Center of Acad. Todua)*

- 5 ring detector system
- Lightburst detector with enhances sensitivity for F18 labeled pharmacies by factor 2
- Highest sensitivity in the industry at up to 22 cps/kBq

* http://clinicalmedicine.ge/siaklebi/pptomografi

Brachytherapy:

In the students session:

Tea Avaliani - Brachytherapy treatment planning
Nino Batselashvili - Teletherapy treatment planning
Gamma cameras (equipments per 100 000 population)

Moldova (0.08, 2013)

Georgia (0.11, 2013)

Greece (1.39, 2013)
Tbilisi State University

- Oldest University in Georgia and Caucasus
- Largest University in Georgia: > 20,000 active students of all levels
- 7 Faculties: Economics and business, **Exact and natural sciences**, Humanities, Law, **Medicine**, Psychology and educational sciences, Social and political sciences
- 67 BS, 96 MS and 50 PhD programmes
- Largest research institution in Georgia: 16 research institutes
Nuclear Medicine Physics in TSU

Faculty of Exact and Natural Sciences

Physics Department

MS Applied Physics (120 ECTS)

Nuclear Medicine Physics

- Radiation Biology
- Medical Dosimetry
- Physical Principles of Radiation Therapy
- Physical Principles of Diagnostic Radiology and Nuclear Medicine
- Nuclear Medicine Instrumentation
- Computing in Nuclear Medicine Physics

ISU, FUT, . . .
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<th>II</th>
<th>III</th>
<th>IV</th>
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<td>Introduction in Condensed Matter Physics</td>
<td>Radiation Detectors*</td>
<td>Computing in Medical Physics</td>
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<td>Propagation of E-M Waves</td>
<td>Radiation Biology</td>
<td>Applications of Nuclear Magnetic Resonance*</td>
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<td>Medical Dosimetry</td>
<td>Diagnostic Radiology Physics*</td>
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<td>Introduction in Microelectronics</td>
<td>Medical Physics Instrumentation</td>
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<td>Selected Course 4</td>
<td>Master Project/Thesis</td>
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Nuclear Medicine Physics Program in TSU

- Physics department, MS program **Applied Physics** (120 ESCT credits)

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GGSWBS-2018, Tbilisi

R. Shanidze (TSU)
Program of nuclear medicine physics in TSU was prepared by:
B. Bochorishvili, L. Chelidze, G. Japaridze, R. Shanidze

First students of the program: T. Avaliani, N. Batselashvili
Geant4 Research Tool

a toolkit for the simulation of the passage of particles through matter


Software tool, which was developed for particle physics at CERN and found many applications in: Medicine, Space and radiation, Technology

Medical application examples:

**GAMOS:** Geant4 based Architecture for Medicine-Oriented Simulations

**GATE:** Geant4 Application for Tomographic Emission

**GHOST:** Geant4 Human Oncology Simulation Tool
Geant4 in HEPI TSU

(M. Abuladze, G. Macharashvili, G. Papalashvili, R. Shanidze)
- Applications for particle and astroparticle physics projects (ATLAS, JEDI, KM3NeT)
- G4 in nuclear medicine physics - talk of M. Abuladze
Web-application example:
Calculations for radioisotope activity, mass in sample, . . .
Summary and Outlook

- MS program in nuclear medicine physics (NMP) is active in TSU from the Winter Semester of 2017/2018.

- The program is supported by the Reserch Institute of Clinical Medicine, the leading nuclear medicine and radiation therapy institution in Georgia.

- Research directions for this program are under consideration (Geant4 tool for physics and medicine)

- Next step: internationalization of nuclear medicine program and research projects in TSU.
Vielen Dank!

დიდი მადლობა!