

COVER PAGE

Sent: 16/09/2015 14:42 **Project Code:** 15T-1C113

1. Project Title: Radiation phenomena in 18 MeV proton irradiated silicon single crystals
2. Field of Science: Natural Sciences - Physics and Astronomy
3. Type of Research: Experimental
4. Principal Investigator: Harutyunyan Vachagan Viktor
5. Organization: Ministry of Education and Science of RA - "A.Alikhanyan National Laboratory (Yerevan Physics Institute)" Foundation of MES RA
6. Duration: 24 months
7. Research group structure: Principal Investigator, 4 Members
8. Total Requested Budget: 15000.0 thousand drams
- Total Individual Financial Support: 9120.0 thousand drams
- Overhead: 375.0 thousand drams

Project Annotation

The development of new research trends such as micro-, nano- and optoelectronics, has demonstrated some limitation of the currently used doping techniques and has demanded a search and introduction of new methods. One of the most promising is the radiation modification - controlled change of physical properties of materials under the impact of various types of radiation, in particular - high energy protons, ions etc. Interesting phenomena can be observed in proton irradiated silicon single crystals, which can be basis for discovery of mechanisms and origin of radiation defect creation in semiconductors as well as for creation of functional elements based on structural defects used in various equipment. The aim of the present work is In-situ investigation of high-energy proton irradiation influence on silicon single crystals, the origin and dimensions of created defects, their dependence on irradiation dose and temperature as well as measurement of Hall electrophysical parameters.

Keywords: Silicon; radiation defects; disordered regions; effective Hall mobility; proton irradiation

INFORMATION ON THE PROJECT PRINCIPAL INVESTIGATOR

Harutyunyan Vachagan Viktor	
Date of Birth:	1954 November 16
Education:	1. Karakol State University, DSc Program, 1971-1976, Doctor of Science
Degree:	Doctor of Physico-Mathematical Sciences
Title of the last thesis, Specialty Code, year and place of defense:	Synchrotron radiation application in wide gap oxide single crystals - investigation of optical properties of irradiation-induced defects, U.04.07, 2000, Institute of Applied Problems of Physics, NAS, RA, 021
Affiliation and Position:	Ministry of Education and Science of RA - "A.Alikhanyan National Laboratory (Yerevan Physics Institute)" Foundation of MES RA, Head of Department
E-mail:	vharut@mail.yerphi.am
Number of publications registered in the System:	19
Total number of monographs and publications in Compendiums registered in the System:	2
Number of meeting's materials in proceedings including abstracts registered in the System:	15
Number of Grants from RA MES SCS and other sources registered in the System:	5

Publications published during the last 5 years (2010-2015) and meeting's materials during the last 3 years (2012-2015)

Articles in scientific journals, published in 2010-2015

1. Yeritsyan, H.N., Sahakyan, A.A., Grigoryan, N.E., Harutyunyan, V.V., Sahakyan, V.A., Khachatryan, A.A. // Clusters of Radiation Defects in Silicon Crystals / Journal of Modern Physics, 2015, 6, pp. 1270-1276.
2. E.Aleksanyan, V. Harutyunyan, M. Kink, M. Kirm, Yu. Maksimov, V. Makhov, T. Ouvarova // Upconverted 5d-4f luminescence from Er³⁺ and Nd³⁺ ions doped into fluoride hosts excited by ArF and KrF excimer lasers / Optics Communications, 2010, 283, pp. 49-53.
3. Sergey K. Nikoghosyan, Aram A. Sahakyan, Vasak B. Gavalyan, Vachagan V. Harutyunyan, Aghasi S. Hovanisyan, Hrant. N. Yeritsyan, Vovik A. Atoyanyan, Konstantin. I. Puskulyan, Mark Gerchikov, Narek A. Hakobyan, Artur V. Hovannisyan // Electro-physical properties of super-thin basalt fiber chemically modified by sulfuric acid / Journal of Modern Physics, 2011, N12, pp. 1450-1454.
4. Zh. R. Panosyan, S. S. Voskanyan, Ye. V. Yengibaryan, M. G. Azaryan, A. A. Sahakyan, H. N. Yeritsyan, V. V. Harutyunyan // Physical Properties of Conducting Diamond Like Carbon Nanostructure Films Transparent in the Visible Range of Light, Deposited on Silicon / Nano Studies, 2014, 10, pp. 67-76.

5. S. K. Nikoghosyan, A. A. Sahakyan, V. B. Gavalyan, V. V. Harutyunyan, A. S. Hovanisyan, V. A. Atoyan, K. I. Puskulyan, M. Gerchikov, N. Hakobyan // The influence of hydrochloric acid treatment and temperature on the electro-physical properties of super-thin basalt fibers / Central European Journal of Physics, 2011, V.9, N6, pp. 1482-1487.
6. H. N. Yeritsyan; A. A. Sahakyan; S. K. Nikoghosyan; V. V. Harutyunyan; S. Ohanyan; V. S. Avagyan; V. A. Sahakyan; K. A. Movsisyan // Effect of Electron and Ultraviolet Radiations and Temperature on n-Si Conductivity / Journal of Spacecraft and Rockets, 2011, Vol.48, No.1, pp.34-37.
7. Hrant N. Yeritsyan, Aram A. Sahakyan, Sergey K. Nikoghosyan, Vachagan V. Harutyunyan, Karen Sh. Ohanyan, Norair E. Grigoryan, Eleonora A. Hakhverdyan, Aghasi S. Hovhannisyan, Vahan A. Sahakyan, Kamo A. Movsisyan, Artur V. Hovhannisyan // In-Situ Study of Silicon Single Crystals Conductivity under Electron Irradiation / Journal of Modern Physics, 2012, vol. 3, no5, pp. 381-385.
8. E. Aleksanyan, M. Kirm, S. Vielhauer, V. Harutyunyan // Investigation of luminescence processes in YAG single crystals irradiated by 50 MeV electron beam / Radiation Measurements, 2013, 56, pp.54-57.
9. S. Nikoghosyan, V. Harutyunyan, V. Baghdasaryan, E. Mughnetsyan, E. Zargaryan and A. Sarkisyan // Effect of Direct Transport Current and Heat Treatment on Resistive Properties of Bismuth-based Ceramic High-temperature Superconducting Oxides of Various Compositions / Solid State Phenomena, 2013, Vol. 200, pp. 267-271.
10. Hrant Yeritsyan, Aram Sahakyan, Vachagan Harutyunyan, Sergey Nikoghosyan, Eleonora Hakhverdyan, Norair Grigoryan, Aghasi Hovhannisyan, Vovik Atoyan, Yeghis Keheyan & Christopher Rhodes // Radiation-modified natural zeolites for cleaning liquid nuclear waste (irradiation against radioactivity) / Nature: Scientific Reports, 2013, Scientific Reports 3, Article number, online.
11. H. Yeritsyan, N. Grigoryan, V. Harutyunyan, E. Hakhverdyan, V. Baghdasaryan // Long-Time Relaxation and Residual Conductivity in GaP Irradiated by High-Energy Electrons / Journal of Modern Physics, 2014, vol.5, pp.51-54.
12. V.V. Harutyunyan, N.A. Hakobyan, E.M. Aleksanyan, E.A. Akhverdyan, V.A. Atoyan, V.B. Gavalyan, V.S. Baghdasaryan, M.G. Vardanyan, K.I. Pyuskyulyan // Physical Properties of Modified High-Efficiency Systems on The Basis of Super-Thin Basalt Nanostructures / Armenian Journal of Physics, 2015, vol. 8, issue 2, pp. 91-101.
13. V.V. Harutyunyan, E.M. Aleksanyan, N.E. Grigoryan, V.S. Baghdasaryan, V.Jh. Yeghiazaryan // Radiation-Induced Effects in Corundum Single Crystals / Armenian Journal of Physics, 2015, vol. 8, issue 3, pp. 129-139.
14. S.K. Nikoghosyan, V.V. Harutyunyan, V.S. Baghdasaryan, E.A. Mughnetsyan, E.G. Zargaryan, A.G. Sarkisyan // Appearance Of Semiconducting (Dielectric) Conduction in Polycrystalline High-Temperature Superconducting Cuprates after Heat Treatment / Armenian Journal of Physics, 2015, vol. 8, issue 1, pp. 1-6.
15. H. N. Yeritsyan, A. A. Sahakyan, V. V. Harutyunyan, N. E. Grigoryan, V. A. Sahakyan // Irradiation Enhancement of Electrical Properties of Passive Impurities in Silicon Crystals / Physical Science International Journal, 2014, 4(9), pp. 1225-1234.

Monographs, textbooks, etc., published in 2010-2015

1. V.V Harutyunyan // Synchrotron Radiation: Theory and application / Synchrotron Radiation: Theory and application, 2012, 1-59.
2. V.V Harutyunyan // Physical Fundamentals of Interaction of Ionizing Radiation with Condensed Matter: Theory and application / Physical Fundamentals of Interaction of Ionizing Radiation with Condensed Matter: Theory and application, 2015, 1-102.

Meeting's proceedings, published in 2012-2015

1. Harutyunyan V.V., Hakobyan N.A, Hakhverdyan E.A., Baghdasaryan V.S., Sahakian A.A, Oganesyanyan A.S., Atoyan V.A., Avakian A.N. // The Functional Properties of Diamond Elements and Their Use in Extreme Conditions / 2013
2. Harutyunyan V.V., Hakobyan N.V., Hakhverdyan E.A., Yeritsyan H.N., Grigoryan N.E., Sahakyan A.A., Nikoghosyan S.K., Atoyan V.A., Hovhannisyanyan A.V., Gevorgyan A.A. // Radiation-Modified Natural Zeolites for Radionuclide Utilization / 2013
3. Harutyunyan V.V., Hakobyan N.A, Hakhverdyan E.A., Baghdasaryan V.S., Saakyan A.A., Hovhanissyan A.S., Dallakyan R.K., Atoyan V.A., Avagyan A.N., Gevorgyan A.A. // DIAMOND ELEMENTS AND THEIR USE IN HIGH-RADIATION AREAS / 2013
4. N. A. Hakobyan, V. V. Harutyunyan, E. A. Hakhverdyan, V. B. Gavalyan, A.V. Sahakyan, A.S. Hovhannisyanyan, V.A. Atoyan, K.I. Pyuskyulyan, A.V. Hovhannisyanyan // High-efficiency filtering systems for highly radioactive aerosol cleaning / 2012
5. Harutyunyan, V., Aleksanyan, E., Hakhverdyan, E., Grigoryan, N., Baghdasaryan, V., Makhov, V., Kirm, M. // Luminescence and radiation defects in irradiated ruby / 2012, pp. 172-173
6. S. Nikoghosyan, V. Harutyunyan, V. Baghdasaryan, E. Mughnetsyan, E. Zargaryan, A. Sarkisyan // Fast and slow aging processes induced in superconducting Y-Ba-Cu-O ceramics after high temperature treatment / 2013 / Proceedings of the Ninth International Conference
7. S. Nikogosyan V. Harutyunyan, V. Baghdasaryan, E. Mughnetsyan, E. Zargaryan A. Sarkisyan // The effect of aging on the superconducting transition temperature and resistivity of Y-Ba-Cu-O ceramics after high temperature treatment / 2013 / IOP Conf. Series: Materials Science and Engineering
8. H. N. Yeritsyan, A. A. Sahakyan, V.V. Harutyunyan, V. A. Sahakyan // Experimental Facility for Study of Nano-materials Including the Influence of Irradiation / 2014, pp. 113-114
9. E. Aleksanyan, M. Kirm, S. Vielhauer, V. Harutyunyan // Investigation of Luminescence Processes in YAG Single Crystals Irradiated by 50 MeV Electron Beam / 2012
10. Vachagan Harutyunyan, Vladimir Makhov, Eduard Aleksanyan // X-ray Excited Emission of YAG and YAG:Nd³⁺ Single Crystals / 2013
11. V. Harutyunyan, E. Aleksanyan, M. Kirm, G. Yeritsyan, S. Nikoghosyan, A. Sahakyan, N. Grigoryan, V. Makhov // Luminescence Spectroscopy of Electron and Neutron Irradiated α -Al₂O₃ Single Crystals / 2014
12. V.V. Harutyunyan, E.M. Aleksanyan, V.S. Baghdasaryan, V.V. Bagramyan // New technology of radiation-resistant temperature-regulating coatings for space vehicles / 2015 / Proceeding Novel Materials, Technologies and Devices for Development

INFORMATION ON THE TEAM MEMBER

Grigoryan Norik Enok	
Date of Birth:	1946 May 22
Education:	1. Yerevan State University, 1963-1968
Degree:	Candidate of Physico-Mathematical Sciences
Title of the last thesis, Specialty Code, year and place of defense:	
Affiliation and Position:	Ministry of Education and Science of RA - "A. Alikhanyan National Laboratory (Yerevan Physics Institute)" Foundation of MES RA, Optical and spectroscopy group leader

E-mail:	norair@mail.yerphi.am
Number of publications registered in the System:	5
Total number of monographs and publications in Compendiums registered in the System:	0
Number of meeting's materials in proceedings including abstracts registered in the System:	0
Number of Grants from RA MES SCS and other sources registered in the System:	0

Publications in line with the current project objectives (up to 5)

Articles in scientific journals

1. Yeritsyan, H.N., Sahakyan, A.A., Grigoryan, N.E., Harutyunyan, V.V., Sahakyan, V.A., Khachatryan, A.A. // Clusters of Radiation Defects in Silicon Crystals / Journal of Modern Physics, 2015, vol. 6, pp. 1270-1276.
2. H. N. Yeritsyan, A. A. Sahakyan, V. V. Harutyunyan, N. E. Grigoryan, V. A. Sahakyan // Irradiation Enhancement of Electrical Properties of Passive Impurities in Silicon Crystals / Physical Science International Journal, 2014, 4(9), pp. 1225-1234.
3. H. Yeritsyan, N. Grigoryan, V. Harutyunyan, E. Hakhverdyan, V. Baghdasaryan // Long-Time Relaxation and Residual Conductivity in GaP Irradiated by High-Energy Electrons / Journal of Modern Physics, 2014, vol. 4, pp.51-54.
4. Hrant Yeritsyan, Aram Sahakyan, Vachagan Harutyunyan, Sergey Nikoghosyan, Eleonora Hakhverdyan, Norair Grigoryan, Aghasi Hovhannisyanyan, Vovik Atoyanyan, Yeghis Keheyan, Christopher Rhodes // Radiation-modified natural zeolites for cleaning liquid nuclear waste (irradiation against radioactivity) / Nature: Scientific Reports, 2013, Scientific Reports 3, Article number: 2900.
5. Hrant N. Yeritsyan, Aram A. Sahakyan, Sergey K. Nikoghosyan, Vachagan V. Harutyunyan, Karen Sh. Ohanyan, Norair E. Grigoryan, Eleonora A. Hakhverdyan, Aghasi S. Hovhannisyanyan, Vahan A. Sahakyan, Kamo A. Movsisyan, Artur V. Hovhannisyanyan // In-Situ Study of Silicon Single Crystals Conductivity under Electron Irradiation / Journal of Modern Physics, 2012, vol. 3, no5, pp. 381-385.

INFORMATION ON THE TEAM MEMBER

Aleksanyan Eduard Mnacakan	
Date of Birth:	1983 July 28
Education:	1. Yerevan State University, 2000-2004 2. Yerevan State University, 2004-2006 3. Yerevan Physics Institute, 2006-2009
Degree:	Candidate of Physico-Mathematical Sciences
Title of the last thesis, Specialty Code, year and place of defense:	
Affiliation and Position:	Ministry of Education and Science of RA - "A.Alikhanyan National Laboratory (Yerevan Physics Institute)" Foundation of MES RA,

	Researcher
E-mail:	aeduard@mail.yerphi.am
Number of publications registered in the System:	11
Total number of monographs and publications in Compendiums registered in the System:	0
Number of meeting's materials in proceedings including abstracts registered in the System:	9
Number of Grants from RA MES SCS and other sources registered in the System:	0

Publications in line with the current project objectives (up to 5)

Articles in scientific journals

1. Eduard Aleksanyan, Vachagan Harutunyan, Radik Kostanyan, Eduard Feldbach, Marco Kirm, Peeter Liblik, Vladimir N. Makhov, Sebastian Vielhauer // / Optical Materials, 0, 31/6, 1038-1041.
2. Eduard Aleksanyan, Vachagan Harutunyan, Margarita Kink, Rein Kink, Marco Kirma, Yuri Maksimov, Vladimir N. Makhov, Tatiana V. Ouvarova // / Optics Communications, 0, 283/1, 49-53.
3. Eduard Aleksanyan, Marco Kirm, Sebastian Vielhauer, Vachagan Harutyunyan // / Radiation Measurements, 0, 56, 54-57.
4. N.V. Vasil'eva, D.A. Spassky, I.V. Randoshkin, E.M. Aleksanyan, S. Vielhauer, V.O. Sokolov, V.G. Plotnichenko, V.N. Kolobanov, A.V. Khakhalin // / Materials Research Bulletin, 0, 48, 4687-4692.
5. D.A. Spassky, V. Nagirnyi, A.E. Savon, I.A. Kamenskikh, O.P. Barinova, S.V. Kirsanova, V.D. Grigorieva, N.V. Ivannikova, V.N. Shlegel, E. Aleksanyan, A.P. Yelisseyev, A. Belsky // / Journal of Luminescence, 2015, 166, 195-202.

INFORMATION ON THE TEAM MEMBER

Hakobyan Narek Areg	
Date of Birth:	1987 February 12
Education:	1. Yerevan State University, 2004-2014
Degree:	None
Title of the last thesis, Specialty Code, year and place of defense:	
Affiliation and Position:	Ministry of Education and Science of RA - "A.Alikhanyan National Laboratory (Yerevan Physics Institute)" Foundation of MES RA, researcher/physicist
E-mail:	h.narek@yerphi.am
Number of publications registered in the System:	5
Total number of monographs and publications in Compendiums registered in the System:	0
Number of meeting's materials in proceedings	5

including abstracts registered in the System:	
Number of Grants from RA MES SCS and other sources registered in the System:	0

Publications in line with the current project objectives (up to 5)

Articles in scientific journals

1. N.A. Hakobyan // Introduction to Basics of Submicron Aerosol Particles Filtration Theory via Ultrafine Fiber Media / Armenian Journal of Physics, 2015, vol. 8, issue 3, pp. 140-151.
2. V.V. Harutyunyan, N.A. Hakobyan, E.M. Aleksanyan, E.A. Akhverdyan, V.A. Atoyan, V.B. Gavalyan, V.S. Baghdasaryan, M.G. Vardanyan // Physical Properties of Modified High-Efficiency Systems on the Basis Of Super-Thin Basalt / Armenian Journal of Physics, 2015, vol. 8, issue 2, pp. 91-101.
3. Hrant N. Yeritsyan, Vachagan V. Harutyunyan, Aram A. Sahakyan, Sergej K. Nikoghosyan, Agasi S. Hovhannisyanyan, Norair E. Grigoryan, Karen Sh. Ohanyan, Eleonora A. Hakhverdyan, Narek A. Hakobyan, Vahan A. Sahakyan // Space Environment Simulator for Testing of Materials and Devices / Journal of Modern Physics, 2013, vol. 4, pp. 180-184.
4. S.K. Nikoghosyan, A.A. Sahakyan, V.B. Gavalyan, V.V. Harutyunyan, A.S. Hovanisyan, H.N. Yeritsyan, V.A. Atoyan, K.I. Puskulyan, M. Gerchikov, N.A. Hakobyan, A. V. Hovhannisyanyan // Electro-physical Properties of Super-thin Basalt Fiber Chemically Modified by Hydrochloric or Sulphuric Acid / Journal of Modern Physics, 2011, vol. 2, pp. 1450-1454.
5. S.K. Nikoghosyan, A.A. Sahakyan, V.B. Gavalyan, V.V. Harutyunyan, A.S. Hovanisyan, H.N. Yeritsyan, V. A. Atoyan, K.I. Puskulyan, M. Gerchikov, N.A. Hakobyan // The Influence of Hydrochloric Acid Treatment and Temperature on the Electro-Physical Properties of Super-Thin Basalt Fibers / Central European Journal of Physics, 2011, 9(6), pp. 1482-1487.

INFORMATION ON THE TEAM MEMBER

Khachatryan Armenuhi Ashot	
Date of Birth:	1992 February 5
Education:	
Degree:	None
Title of the last thesis, Specialty Code, year and place of defense:	
Affiliation and Position:	Ministry of Economy of RA - CJSC "National Institute of Metrology (Armenia)", Specialist
E-mail:	arminkhach1959@bk.ru
Number of publications registered in the System:	1
Total number of monographs and publications in Compendiums registered in the System:	0
Number of meeting's materials in proceedings including abstracts registered in the System:	0
Number of Grants from RA MES SCS and other	0

sources registered in the System:	
-----------------------------------	--

Publications in line with the current project objectives (up to 5)

Articles in scientific journals

1. Yeritsyan, H.N., Sahakyan, A.A., Grigoryan, N.E., Harutunyan, V.V., Sahakyan, V.A. and Khachatryan A.A // Clusters of Radiation Defects in Silicon Crystals / Journal of Modern Physics, 2015, 6, pp.1270-1276.

PROJECT BUDGET

Project Code: 15T-1C113

Individual Financial Support (full-time)(including taxes, AMD)									
	2015 - 3 months			2016			2017 - 9 months		
Full Name (First, Family, Patronymic)	Mothly Rate	Number of Months	Requested	Mothly Rate	Number of Months	Requested	Mothly Rate	Number of Months	Requested
Harutyunyan Vachagan Viktor Principal Investigator - U00363RZYA7J	90.0	3	270.0	90.0	12	1080.0	90.0	9	810.0
Grigoryan Norik Enok U02366D4AEZA	80.0	3	240.0	80.0	12	960.0	80.0	9	720.0
Aleksanyan Eduard Mnacakan U02232FZI3SE	80.0	3	240.0	80.0	12	960.0	80.0	9	720.0
Hakobyan Narek Areg U023670EC00Y	70.0	3	210.0	70.0	12	840.0	70.0	9	630.0
Khachatryan Armenuhi Ashot U02399BW06C6	60.0	3	180.0	60.0	12	720.0	60.0	9	540.0
TOTAL INDIVIDUAL FINANCIAL SUPPORT:			1140.0			4560.0			3420.0
OTHER, including									
1. Equipments and Materials (Please list. All items over 100000 AMD must be justified in the Budget Narrative.)						2015 - 3 months	2016	2017 - 9 months	
Համակարգիչ Dell Optiplex 7010DT + Մոնիտորը Dell E2314H + սպիչ						0.0	0.0	670.0	
Ջերմաստիճանի կարգավորիչ (Lakeshore)						0.0	800.0	0.0	
Ջերմային սվիչներ (NI SCC-RTD01)						0.0	300.0	300.0	
Վակուումային պոմպ (Edwards RV-5)						585.0	0.0	0.0	
Վակուումի ցուցիչ (Pfeiffer)						0.0	250.0	0.0	
Վակուումային փականներ (SMC XLH-50)						0.0	250.0	0.0	
Դոզաչափ (Terra MKS-05 Geiger Counter)						0.0	200.0	0.0	
Հեղուկ ազոտ - 200լ						0.0	100.0	0.0	
Նյութեր և այլ սարքավորումներ						100.0	100.0	350.0	
TOTAL EQUIPMENTS AND MATERIALS:						685.0	2000.0	1320.0	
2. Travel (Please describe in Budget Narrative.)						2015 - 3 months	2016	2017 - 9 months	
1) Domestic Transportation						0.0	0.0	0.0	
2) Domestic Per Diem						0.0	0.0	0.0	
3) Domestic Accommodation						0.0	0.0	0.0	
4) International Transportation						0.0	260.0	525.0	
5) International Per Diem						0.0	190.0	70.0	
6) International Accommodation						0.0	300.0	155.0	

7) Other Travel Expenses (visa fees, conference registration fees, etc)	0.0	0.0	0.0						
TOTAL TRAVEL:	0.0	750.0	750.0						
3. SECONDARY COLLABORATION (All secondary collaborating institutions and individuals must be identified and secondary collaborators described in detail in the Budget Narrative.) Secondary Collaboration Individual Financial Support									
	2015 - 3 months			2016			2017 - 9 months		
Full Name (First, Family, Patronymic)	Daily Rate	Number of Day	Requested	Daily Rate	Number of Day	Requested	Daily Rate	Number of Day	Requested
TOTAL SECONDARY COLLABORATION INDIVIDUAL FINANCIAL SUPPORT:			0.0			0.0			0.0
Secondary Collaboration: Materials and Services (Please list. All items over50000 AMD must be justified in the Budget Narrative.)									

	2015 - 3 months	2016	2017 - 9 months
TOTAL SECONDARY COLLABORATION MATERIALS AND SERVICES:	0.0	0.0	0.0

OVERHEAD CHARGES:	50.0	190.0	135.0
TOTAL REQUESTED:	1875.0	7500.0	5625.0

Budget Narrative
<p>1. PC+Monitor+Printer - is necessary Remote control and in-situ monitoring of the experimental parameters and process of their changing via special computer software (temperature, vacuum, beam intensity, step motor parameters) as well as for processing the experiment results. 2. Temperature controller - necessary to make measurement at different temperatures 3. Temperature sensors - To perform measurements at 100-400 K range it is necessary to precisely control and record the sample temperature 4. Forevacuum pump - Forevacuum system is required to perform measurements in vacuum conditions. 5. Vacuum gauge - To have complete information on experiments, the vacuum level is necessary to know 6. Vacuum valves - To provide unhampered work of the beamline, it is necessary to separate it from measurement chamber 7. Dozimeter - As the measurement will be performed in irradiated conditions, for staff safety reasons it is necessary to control the irradiation dose. 8. Liquid nitrogen - necessary during proton beam irradiation and to perform measurements at low temperatures (77-300 K) 9. Materials - Different materials will be necessary for project implementation, including construction materials for portable table for chamber, wires, stepper motors, controllers etc.</p>