

# CONTENTS

<b>S.No.</b>	<b>Chapter Particulars</b>	<b>Page No.</b>
<b>1.</b>	<b>ACCELERATOR</b>	<b>1</b>
<b>1.1</b>	<b>PELLETRON</b>	<b>1</b>
1.1.1	Operational Summary	1
1.1.2	Maintenance and Development Activities	3
1.1.3	Ion Source Activities	7
1.1.4	Beam Pulsing System	7
1.1.5	Development Activities	8
<b>1.2</b>	<b>LOW ENERGY ION BEAM FACILITY (LEIBF)</b>	<b>9</b>
1.2.1	Operation	9
1.2.2	Maintenance	11
1.2.3	Development	11
<b>1.3</b>	<b>PELLETRON ACCELERATOR RBS-AMS SYSTEMS (PARAS)</b>	<b>12</b>
1.3.1	Operation	12
1.3.2	Maintenance and Development	12
<b>1.4</b>	<b>DEVELOPMENT OF 50 KEV ION ACCELERATOR</b>	<b>13</b>
<b>2.</b>	<b>ACCELERATOR AUGMENTATION PROGRAM</b>	<b>16</b>
<b>2.1</b>	<b>LINAC</b>	<b>16</b>
2.1.1	Operation of All Five Cryostats of Superconducting Linac and Delivery of Energised Beam for Scheduled Experiments	16
2.1.2	Activities Related to Improvement of the Performance of the Resonator and Automation of Linac Operation	17
2.1.3	Superconducting Niobium Resonators	18
2.1.3.1	Single Spoke Resonators	18
2.1.3.2	TESLA-type 5-Cell, 1.3 GHz Cavity	19
2.1.3.3	650 MHz, $\beta=0.9$ Cavity	20

<b>2.2</b>	<b>HCI</b>	<b>20</b>
2.2.1	High Temperature Superconducting ECRIS -PKDELIS and Low Energy Beam Transport (LEBT)	20
2.2.2	Design of the 100 kV High Voltage Platform for the High Current Injector Programme	26
2.2.3	Radio Frequency Quadrupole Accelerator	28
2.2.4	Fabrication of First DTL Cavity and Development of Prototype Cavity	30
2.2.5	Beam Transport System for HCI	31
2.2.5.1	Beam Optics of High Current Injector	31
2.2.5.2	Fabrication of Magnetic Quadrupoles for LEBT Section of HCI	33
<b>2.3</b>	<b>CRYOGENICS</b>	<b>34</b>
<b>3.</b>	<b>RESEARCH SUPPORT FACILITIES</b>	<b>37</b>
<b>3.1</b>	<b>SUPPORT LABORATORIES</b>	<b>37</b>
3.1.1	High Vacuum Laboratory	37
3.1.1.1	GP Tube Shorting Problem in the Low Energy Ion Beam Facility	37
3.1.1.2	Design, Fabrication and Installation of HCI High Voltage Deck	37
3.1.1.3	Fabrication and Installation of the New Control Crate (IMACS) for LEIBF High Voltage Deck	38
3.1.1.4	Installation of the Dedicated Vacuum Gauges for Interlocking the Beam Line Valves in the LINAC Beam Line	39
3.1.1.5	Installation of 2.45 MHz ECR Source Testing Set –up	39
3.1.1.6	Design, Fabrication and Installation of a Vacuum Interlocking System for New LEIBF HV Deck	40
3.1.2	Beam Transport System	40
3.1.2.1	Power Supply for HCI Steerer and Low Power Quadrupole Magnets	40
3.1.2.2	Development of Magnet and Associated Power Supply System for g – factor Measurement Set-up of Nuclei	40
3.1.2.3	Feedback Controller for Piezoelectric Actuator Based Phase Locking of SCQWR	41

3.1.2.4	Development of Multi Harmonic Buncher (MHB) Electronics	41
3.1.2.5	Temperature Controller for Thermoelectric Cooler (TEC) Module for Atomic Physics Beamline	42
3.1.2.6	Development of Vacuum Tube Based 10kW, 97MHz RF Amplifier for Drift Tube Linac (DTL) Cavities.	42
3.1.2.7	24-Channel High Voltage (-2kV/2.5mA) Power Supply for NAND Facility.	42
3.1.2.8	Maintenance Activities	43
3.1.2.8.1	Beam Transport System Maintenance	43
3.1.2.8.2	Maintenance of Power Supplies/Instruments other than BTS	43
3.1.3	Detector Laboratory	44
3.1.3.1	Detector System for Quasi-elastic Scattering Studies in GPSC/NAND	44
3.1.3.2	Detector System for Charge Particle Multiplicities in Fission Experiments	44
3.1.3.3	Upgradation of MWPC in NAND/GPSC	44
3.1.3.4	Annular PPAC for Experiments in GDA & NAND	44
3.1.3.5	Installation of Resistive Anode Detector at HYRA Focal Plane	45
3.1.3.6	Differential Drivers for Multichannel Preamplifier	45
3.1.3.7	Preamplifier Development	45
3.1.4	Target Development Laboratory	45
3.1.5	RF & Electronics Laboratory	49
3.1.5.1	Front End and PSD Electronics for NAND Array at IUAC	49
3.1.5.2	High Power Solid State Power Amplifier Development	49
3.1.5.3	Status Report of the Multi-harmonic Buncher and Associated Jobs	49
3.1.5.4	Development of the Multi-harmonic Buncher (MHB) for High Current Injector (HCI)	49
3.1.5.5	Shaping Amplifier for HPGe Detectors	50
3.1.5.6	Improvements in the Control Scheme for Linac	50
3.1.6	Computer and Communications	51
3.1.6.1	High Performance Computing Facility	51
3.1.6.2	IUAC LAN and Servers	51
3.1.6.3	NIAS Time Stamp Unification Module (TsuM)	52

3.1.7	Health Physics Laboratory	52
3.1.7.1	Thermo-luminescence Kinetic Parameters of $\gamma$ -irradiated $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu}^{2+}, \text{Dy}^{3+}$ Phosphors	52
3.1.7.2	Opto-structural and Dielectric Properties of 80 MeV Oxygen Ion Irradiated Natural Phlogopite Mica	53
3.1.7.3	Thermoluminescence Studies of Tissue Equivalent Lithium Fluoride Nanophosphors	53
3.1.7.4	Swift Heavy Ion Induced Structural and Optical Properties of $\text{Y}_2\text{O}_3:\text{Eu}^{3+}$ Nanophosphor	54
3.1.7.5	Pre-gamma Dose Thermoluminescence Characteristics of Muscovite Mica	54
3.1.7.6	Luminescence Characteristics of Eu and Ti Doped $\text{LiNaF}_2$ Phosphor	54
3.1.7.7	Studies on Luminescence Properties and Energy Transfer in Ce/Dy Co-doped CaS Nano-phosphors	55
3.1.7.8	Thermoluminescence of Eu Activated LiF Nanophosphors	55
3.1.7.9	Pure LiF Nanophosphors for High Exposures of Gamma Rays	55
3.1.8	Data Support Laboratory	56
3.1.8.1	Development of NIM Modules for NAND Experimental Facility	56
3.1.8.2	Freedom DAS with CMC100 CAMAC Crate Controller	56
<b>3.2</b>	<b>UTILITY SYSTEMS</b>	<b>57</b>
3.2.1	Electrical Group Activities	57
3.2.1.1	Captive Power Installations	57
3.2.1.2	Voltage Stabilisers	57
3.2.1.3	UPS Installations	57
3.2.1.4	Power Factor Compensation	57
3.2.1.5	Communication Equipments	58
3.2.1.6	Maintenance of Substation, Power and Lighting Installations of Office Complex and Residential Colony	58
3.2.1.7	Energy Saving	58
3.2.1.8	UPS Systems for 15UD Pelletron	58
3.2.1.9	Backup Power to 15UD Pelletron ana Power to HPC Centre	58
3.2.1.10	Electrical Energy Management Network	59
3.2.1.11	Special Electrical Earthing	59

3.2.1.12	Works for Beam Hall-III	59
3.2.2	Air Conditioning, Water System and Cooling Equipments	59
3.2.3	Mechanical Workshop (MG-III)	60
3.2.4	Civil Works	61
3.2.5	Compressed Air System and Material Handling Equipments (MG-I )	62
<b>4.</b>	<b>EXPERIMENTAL FACILITIES IN BEAM HALL</b>	<b>64</b>
<b>4.1</b>	<b>NEUTRON DETECTOR ARRAY PROJECT FACILITY</b>	<b>64</b>
<b>4.2</b>	<b>GAMMA DETECTOR ARRAY FACILITY</b>	<b>65</b>
4.2.1	Experiments and Detector Maintenance	65
<b>4.3</b>	<b>HEAVY ION REACTION ANALYZER AND HYBRID RECOIL MASS ANALYZER FACILITY</b>	<b>66</b>
<b>4.4</b>	<b>MATERIALS SCIENCE FACILITY</b>	<b>68</b>
4.4.1	Irradiation Chamber Maintenance	69
4.4.2	Scanning Probe Microscope	69
4.4.3	In-situ X-ray Diffractometer	69
4.4.3.1	Testing of In-situ X-ray Reflectivity using XRD System	70
4.4.3.2	Testing of Closed Cycle Refrigerator CCR with Beam	70
4.4.4	Fabrication and Installation of High Temperature Target Ladder	70
4.4.5	Plasma Based Systems for Thin Film Deposition.	71
4.4.6	Field Emission Scanning Electron Microscope	72
4.4.6.1	Cross Sectional SEM	72
4.4.6.2	Spectroscopy Facilities	73
4.4.7	Materials Synthesis	73
4.4.8	Low Temperature and Transport Measurement Facilities	73
<b>4.5</b>	<b>RADIATION BIOLOGY FACILITY</b>	<b>74</b>
<b>4.6</b>	<b>ATOMIC PHYSICS FACILITY</b>	<b>74</b>
4.6.1	Noise Reduction Technique	74
<b>4.7</b>	<b>ACCELERATOR MASS SPECTROMETRY</b>	<b>76</b>

<b>5</b>	<b>RESEARCH ACTIVITIES</b>	<b>78</b>
<b>5.1</b>	<b>NUCLEAR PHYSICS</b>	<b>78</b>
5.1.1	Fission Cross Section Measurements for $^{16,18}\text{O}+^{194,198}\text{Pt}$ Systems	78
5.1.2	Evaporation Residue Excitation Function Measurements for the $^{16,18}\text{O}+^{194,198}\text{Pt}$ Reactions	80
5.1.3	Evaporation Residue Excitation Function for $^{18}\text{O}+^{194}\text{Pt}$ Reaction	82
5.1.4	An Exploratory Experiment to Measure Evaporation Residue Cross Sections for $^{48}\text{Ti}+^{140,142}\text{Ce}$ Systems	84
5.1.5	Measurement of Evaporation Residue Cross Section and Spin Distributions in $^{28}\text{Si}+^{176}\text{Yb}$ Reaction	85
5.1.6	Spin Distribution Measurements for $^{16}\text{O}+^{64}\text{Zn}$ and $^{32}\text{S}+^{48}\text{Ti}$ Reactions	87
5.1.7	Study of Isomer Decay in Bi Nuclei at the Focal Plane of HYRA	89
5.1.8	Search for High-spin Isomer in $^{188}\text{Tl}$ at the Focal Plane of HYRA	91
5.1.9	Giant Dipole Resonance in $^{144}\text{Sm}$	93
5.1.10	g-factor of $9/2^-$ and $23/2^+$ Isomeric States in $^{129}\text{Ba}$	94
5.1.11	Facility Test for g-factor Measurement Using Transient Field Method	95
5.1.12	Study of Structure and Reaction Mechanism near Proton Drip-line	96
<b>5.2</b>	<b>MATERIALS SCIENCE</b>	<b>98</b>
5.2.1	Swift Heavy Ion Induced Structural Modifications In $\text{BaTiO}_3$ : Low Temperature In-Situ XRD Study	99
5.2.2	In-Situ Current Voltage (I-V) Measurements of Quantum Dots Hetero-Junction Photodiode Under 120 MeV $\text{Au}^{9+}$ Ions Irradiation	100
5.2.3	In-Situ Electrical Transport Measurements of Schottky Barrier Junctions at Low Energy Ion Beam Facility	101
5.2.4	Re-calculation of Sputtering Yield of Thickness Dependence in $\text{LiF}$ Thin Films	102
5.2.5	Ion Beam Induced Modifications in Properties of Zn Nanowires	103
5.2.6	High Density Co Nanostructures by Ion Beam Induced Dewetting	104
5.2.7	Swift Heavy Ion Irradiation Induced Defects for Tailoring the Ferromagnetic Response of Palladium Nanoparticle Embedded in Silica Matrix	105

5.2.8	Swift Heavy Ion Irradiation Induced Formation of Nanostructures in Si-rich A-Si <sub>x</sub> Thin Films	106
5.2.9	Purification/Annealing of Graphene with 100 MeV Ag Ion Irradiation	107
5.2.10	Free Radical Scavenging Activity of Polypyrrole Nanotubes Irradiated with 100 MeV Si <sup>9+</sup> Ion Beam	108
5.2.11	Energy Dependence Studies of Nanostructures on Inp(100) Using Energetic Ion Bombardment	109
5.2.12	Engineering of Ripple Patterns on Si (100) Surface Using Low Energy Ion Beam Irradiation	110
5.2.13	The Effect of Ion Beam Irradiation on Transport Studies in Polymer Nano-Composite Electrolytes	111
5.2.14	Disorder Induced Semiconductor to Metal Transition and Modifications of Grain Boundaries in Nanocrystalline Zinc Oxide Thin Film	112
5.2.15	Structural and Optical Properties of Teflon-Impregnated TiO <sub>2</sub> Nanoparticles Irradiated by 80 KeV Xe <sup>+</sup> Ion	114
5.2.16	Fluence Dependent Bandgap Engineering of Rutile TiO <sub>2</sub> (110) Single Crystal	115
5.2.17	Study of Amorphization of Ge Using 100 KeV Ar Ions	116
5.2.18	Layer Transfer and Blistering Studies of H-implanted Semiconductors	117
5.2.19	Role of Swift Heavy Ion Irradiation for the Development of Zn <sub>1-x</sub> In <sub>x</sub> O as Transparent Conducting Oxide	118
5.2.20	100 MeV O <sup>7+</sup> Ion Irradiation Induced Effect on Multiferroic GdMnO <sub>3</sub> Nanoparticles	119
5.2.21	Effect of Irradiation of 100 MeV O <sup>7+</sup> Beam on the Cobalt Ferrite Nanoparticles	120
5.2.22	Effect of 100 MeV Oxygen Ion Beam Irradiation on Dysprosium Doped Cobalt Ferrite Nanoparticles	122
5.2.23	Effect of Gamma and Heavy Ion Irradiations on Structural, Optical, Electrical and Dielectric Properties of Micaceous Minerals	123
5.2.24	Swift Heavy Ion Induced Structural and Luminescence Studies of Rare Earth Doped Yttrium Oxide Nanophosphors	123
5.2.25	Effect of 200 MeV Ag Ions on the Transport Property of YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-Δ</sub> Thick Films	124

5.2.26	Ion-induced Optical Treatment of Amorphous Chalcogenide Thin Films for Next Generation Photonic/Optical Components	125
5.2.27	Effect of Irradiation of Si <sup>5+</sup> Ion on Fe Doped Hydroxyapatite	126
5.2.28	Investigations of Physical and Biological Performance of Swift Heavy Ion Irradiation on Calcium Phosphate Based Bioceramics and its Polymer Composites	128
5.2.29	Ac Conductivity Studies of 160 MeV Ni <sup>12+</sup> Ion Irradiated Polyaniline Nanofibers	129
5.2.30	Effect of Low Energy Irradiation on The Transport Properties of Mixed Conducting Solid Polymer Electrolytes	130
5.2.31	Investigation of Thermally Stimulated Depolarization Current in Pristine and Irradiated Polyetheretherketone	131
<b>5.3</b>	<b>RADIATION BIOLOGY RESEARCH</b>	<b>133</b>
5.3.1	Role of PARP-1 in Programmed Cell Death Induced by heavy Ion Radiation in Human Cervical Epithelial Carcinoma (HeLa) Cells	133
5.3.2	Synthesis of Au Nanoparticles and its Conjugation with Anti EGFR to Target A549 Lung Cancer Cell	134
<b>5.4</b>	<b>ATOMIC &amp; MOLECULAR PHYSICS RESEARCH</b>	<b>135</b>
5.4.1	Fast Ion Surface Energy Loss in the Surface Wake Fields	135
5.4.2	Energy Loss Stragglng Due to SELF	137
5.4.3	Radiative Resonant Energy Transfer Process in Projectile-like Ion Formed in Beam-foil Interaction	138
5.4.4	Resonances in the Population of Circular Rydberg States Formed in the Beam-foil Excitations	139
<b>5.5</b>	<b>ACCELERATOR MASS SPECTROMETRY RESEARCH</b>	<b>139</b>
5.5.1	Stripping of a Molecular Beam to a Higher Charge State by Means of Two Successive Stripper Foils in the Tandem Accelerator	139
5.5.2	Application of <sup>10</sup> Be to Estimate the Rate of Glacial Retreat in Ladakh Region of Himalaya	140
5.5.3	An Environmental Magnetic Study & Elemental Composition of a Marine Sediment Core from the Central Western Bay of Bengal: Implications for Paleo-oceanographic Studies	141

<b>6.</b>	<b>ACADEMIC ACTIVITIES</b>	<b>142</b>
<b>6.1</b>	<b>PELLETRON BEAM UTILIZATION BY USERS</b>	<b>142</b>
6.1.1	Pelletron Beam Time Utilization and Experiments Performed (April, 2012 to March, 2013)	142
6.1.2	List of Users Family	143
<b>6.2</b>	<b>STUDENTS' PROGRAMME</b>	<b>149</b>
6.2.1	B. Sc. Summer Programme	149
6.2.2	M. Sc. Orientation Programme	149
6.2.3	PhD Teaching Programme	149
6.2.4	Teaching Laboratory Activities	150
<b>6.3</b>	<b>LIBRARY</b>	<b>150</b>
<b>6.4</b>	<b>ACADEMIC ACTIVITIES HELD IN 2012-13</b>	<b>151</b>
<b>6.5</b>	<b>FORTHCOMING EVENTS: 2013</b>	<b>152</b>
<b>6.6</b>	<b>LIST OF PH.D. AWARDEES</b>	<b>153</b>
<b>6.7</b>	<b>LIST OF PUBLICATIONS IN THE YEAR 2012-13</b>	<b>153</b>
<b>6.8</b>	<b>LIST OF SEMINARS CONDUCTED IN THE YEAR 2012-13</b>	<b>159</b>
<b>6.9</b>	<b>LIST OF TECHNICAL REPORTS /MEMOS (2012-13)</b>	<b>161</b>
	<b>APPENDIX I</b>	<b>164</b>
	<b>APPENDIX II</b>	<b>169</b>
	<b>APPENDIX III</b>	<b>172</b>