

| Attachment 7; Table 4 - Particle Accelerators [Ref. 3] |                                                                |                                               |
|--------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------|
| Accelerator Type                                       | Particle Accelerated                                           | Energy Level                                  |
| Electrostatic Accelerators:                            |                                                                |                                               |
| Tandetron                                              | p, d, $\alpha$ , & heavy ions                                  | to 3 MV                                       |
| Cockcroft-Walton                                       | p, d, $\alpha$ , , e, & heavy ions                             | to 4 MV                                       |
| Dynamitron                                             | p, d, $\alpha$ , , e, & heavy ions                             | to 4 MV                                       |
| Tandem Van de Graaff                                   | p, d, $\alpha$ , , e, & heavy ions                             | to 20 MV                                      |
| Tandem pelletron                                       | p, d, $\alpha$ , , e, & heavy ions                             | to 26 MV                                      |
| Vivitron                                               | p, d, $\alpha$ , , e, & heavy ions                             | to 35 MV                                      |
| Time-Varying Field Accelerators:                       |                                                                |                                               |
| Microtron                                              | $e^-$                                                          | to 200 MeV                                    |
| Sector or isochronous cyclotron                        | p, d, & $\alpha$<br>heavy ions                                 | to 590 MeV (p)<br>to 90 MeV/amu               |
| Superconducting cyclotron                              | heavy ions                                                     | 200 MeV/amu                                   |
| Synchrotron (weak focusing)                            | p, e<br>heavy ions                                             | 1-6 Ge (p)<br>2 GeV/amu                       |
| Alternating-gradient synchrotron                       | p, $e^+$<br>heavy ions; mass 12-197<br>heavy ions; mass 12-208 | 10-900 GeV (p)<br>11.4 GeV/amu<br>160 GeV/amu |
| Linear Accelerators:                                   |                                                                |                                               |
| Heavy ion linear accelerator                           | p, d, $\alpha$ , & heavy ions                                  | to 30 MeV/amu                                 |
| Linear accelerator                                     | p                                                              | 50-800 MeV                                    |
| CEBAF recirculating superconducting linear accelerator | $e^-$                                                          | 0.5-4 GeV                                     |
| Electron linear accelerator                            | $e^+$ , $e^-$                                                  | 6 MeV - 50 GeV                                |
| Colliding-Beam Storage Rings:                          |                                                                |                                               |
| Electron storage ring                                  | $e^+$ , $e^-$                                                  | 0.3-100 GeV (CM)                              |
| Proton storage ring                                    | pp                                                             | 14 TeV (CM)                                   |
| Proton-antiproton storage ring collider                | (pp <sup>-1</sup> )                                            | 1.8TeV (CM)                                   |

Note:

p = proton; d = deuterium;  $\alpha$  = alpha particle;  $e^-$  = electron;  $e^+$  = positron;  
amu = atomic mass unit;  
pp = two proton beams; (pp<sup>-1</sup>) = proton & antiproton beam; CM = center of mass