# Technical Proposal

Compact Automated Rutherford
Backscattering Spectrometry (CARBS)

# System Specifications

## Primary Components:

| | |
|---|---|
| Beamline height | 1.25 m |
| Pumps | Turbo molecular pumps, rough backing pumps |
| Vacuum system base | 5e-7 Torr, or better (without beam) |
| Ion source(s) / Injector: | Injection voltage, ~30 keV<br>Positive RF Source (light ions: H / He) |

## Pelletron:

| | |
|---|---|
| Voltage Range: | Model 1.5SH-1: 50 kV to 0.500 MV<br>Model 3SH-1: 100 kV to 1.0 MV<br>Model 7.5SH-1: 250 kV to 2.5 MV |
| Singly Charged Energy Range: | Model 1.5SH-1: 50 keV to 0.500 MeV<br>Model 3SH-1: 100 keV to 1.0 MeV<br>Model 7.5SH-1: 250 keV to 2.5 MeV |
| Voltage Stability | Better than 1 kV |
| Voltage Ripple | <=50 V RMS |

**SF6 System:** Dilo Mini Series (or equivalent)

| | |
|---|---|
| **Analyzing Magnet:** | 90 degree magnet<br>MEP = 5 @90 degrees |
| **Beamline #1** | IBA chamber |

***The following will be included with the system:***

| | |
|---|---|
| Spare Parts Lists | 2QL030101 – Alphatross<br>2QL020170 – Model 1.5SH-1<br>2QL020200 – Model 3SH-1<br>2QL020180 – Model 7.5SH-1 |

Specialized tools, when applicable.

All necessary source and beamline alignment fixtures.

Service Manuals and Drawings - The parts lists, wire lists, drawings, and process control lists for components and systems manufactured by National Electrostatics are provided on CD-ROM and USB drives. This documentation will be made available to the buyer at the time of installation. All available manuals and drawings of items purchased by NEC for use in the accelerator system will be provided to the buyer.

# Facility Requirements

Values listed below are estimates for single source configuration. NEC will provide adapters for cooling water and air/gas as necessary.

## Electric Power

| | |
|---|---|
| System total: | 7 kVA, 3 phase, 5 wire, WYE connected, grounded neutral |
| Main Breaker | 50 A (120/208 VAC); 45 A (230/400 VAC) |
| Required location: | ACPC |

One (1) AC Power Center (ACPC) is provided from which all electrical power for the system will be distributed. 120/208 VAC or 230/400 VAC, 50/60 Hz input power configurations are available for all systems. Other voltage options are available upon request; please contact NEC for additional information. Voltage and frequency must be specified upon ordering.

## Cooling Water

| | |
|---|---|
| System total: | 2.0 gpm (7.5 l/min), 20 deg C or less |
| Required location: | Near High Energy Magnet |

Connection type: 1/2" FNPT fitting

Cooling water pressure drop <60 psi (4 kg/cm^2). Maximum pressure 100 psig (7.8 kg/cm^2). Maximum temperature rise = 5 deg C. The water is to be filtered to remove particulates greater than 10 microns. The water must be clean and chemically neutral to avoid corrosion of the copper heat exchangers. Closed loop systems should utilize a biocide to prevent buildup of organics.

## Air/Gas

| | |
|---|---|
| Compressed air: | 80 psig (5.5 bar) estimated flow rate of 1 CFM (1.7 cubic m per hour) |
| Argon: | 5 psig (0.34 bar) for venting of ion source and beamline |
| Required location: | Near High Energy Magnet |
| Connection type: | 1/4" tube fitting |

$SF_6$:

| | |
|---|---|
| Model 1.5SH-1: | 125 lbs (57 kg) |
| Model 3SH-1: | 170 lbs (77 kg) |
| Model 7.5SH-1: | 535 lbs (243 kg) |

Note: Above $SF_6$ values are for normal operation. Extra is recommended for maintenance.

## Heat Dissipation

| | |
|---|---|
| Estimated heat dissipation to air: | 3.0 kW |
| Estimated heat dissipation to water: | 3.5 kW |

## Additional Notes

In the area of the accelerator and ion source(s), care is to be taken in limiting dust, such as sealing all walls, floors, and ceiling surfaces. Ambient air temperature to be maintained at 20 deg C +/- 2 deg C with no more than 1 deg C change per hour. The relative humidity is to be maintained between 30% and 55%.

# Accelerator Physical Dimensions

Values listed below are estimates for single source configurations:

| Model | | 1.5SH-1 | 3SH-1 | 7.5SH-1 |
|---|---|---|---|---|
| System Total: | Length | 13.1 ft (4.0 m) | 14.7 ft (4.5 m) | 18.0 ft (5.5 m) |
| | Width | 11.1 ft (3.4 m) | 11.8 ft (3.6 m) | 11.8 ft (3.6 m) |
| | Height | 5.9 ft (1.8 m) | 5.9 ft (1.8 m) | 5.9 ft (1.8 m) |
| Accelerator Tank | Length | 6.1 ft (2.0 m) | 7.1 ft (2.2 m) | 12.3 ft (3.7 m) |
| | Diameter | 2.9 ft (0.9 m) | 3.1 ft (0.9 m) | 4.5 ft (1.4 m) |
| | Volume | 40 ft ^3(1.1 m ^3) | 53 ft^3(1.5 m^3) | 195 ft^3(5.5 m^3) |
| | Maximum Operating Pressure | 125 psig (7.0 bar) | | |
| | Total Weight | 4500 lbs (2040 kg) | 5000 lbs (2270 kg) | 9220 lbs (4180 kg) |
| Terminal Dimensions | Length | 26.5 in (67.3 cm) | 26.5 in (67.3 cm) | 48.7 in (123.7 cm) |
| | Diameter | 25.5 in (64.8 cm) | 25.5 in (64.8 cm) | 31.2 in (79.2 cm) |