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MSFC Solar Wind Facility

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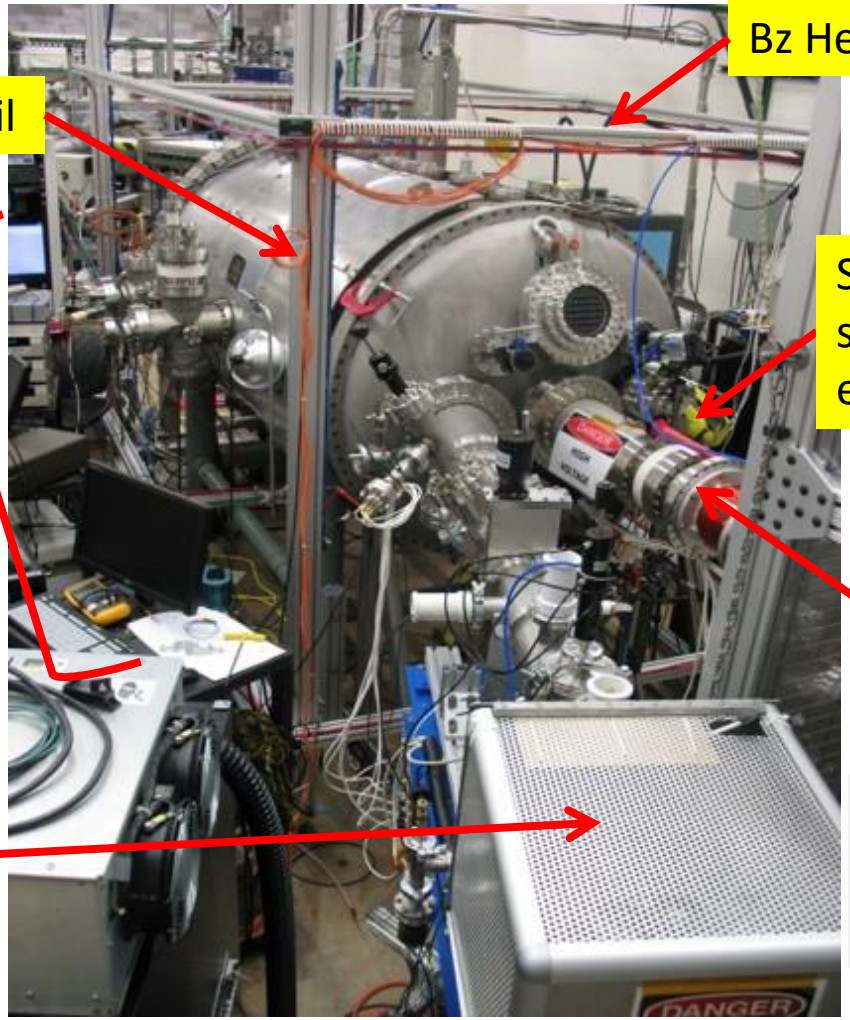
Solar Wind Facility (SWF) Layout



Bz Helmholtz coil

Bx Helmholtz coil

Skevington 5000 electron source for broadbeam electrons

EGSE

Kaufman ion source for broadbeam ions

Peabody Source for Pencil Beam

- Vacuum chamber axis is aligned E-W
- Oil-free pumping

SWF Attributes

Vacuum chamber: 4 ft diameter x 8 ft long cylinder; LN_2 cold shroud; quartz windows for solar photon input; base pressure at low 10^{-7} Torr with oil-free pumping

Ion source: Modified Kaufman-type with 10 cm diameter, collimating, matched grid set; housing electrically isolated from chamber; energy and flux computer controlled

Electron source: biased filament accelerates electrons through grounded anode screen; energy and flux computer controlled

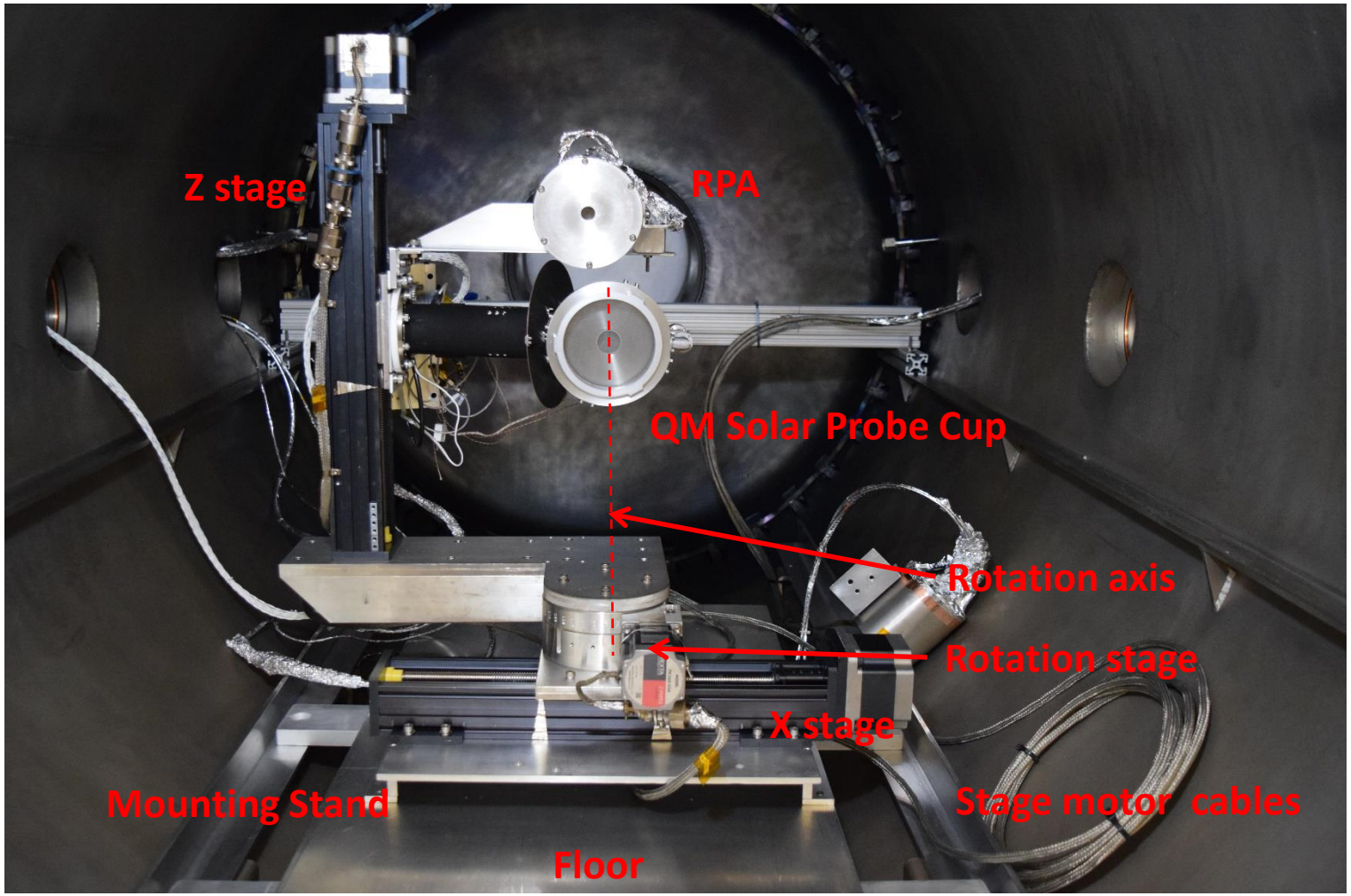
Peabody Scientific ion source: water cooled Duo-plasmatron source with steering and focusing in drift tube; pin-hole aperture can be installed in chamber for pencil beam; energy computer controlled

Translation and Rotation Stages: X- and Z- motion at 4000 steps/inch; rotation at 40 steps/degree; all motion computer controlled

Helmholtz Horizontal Coils: Octagon shaped at 11 ft by 11 ft dimension with 9 turns of 12 gauge wire; computer controlled wire current

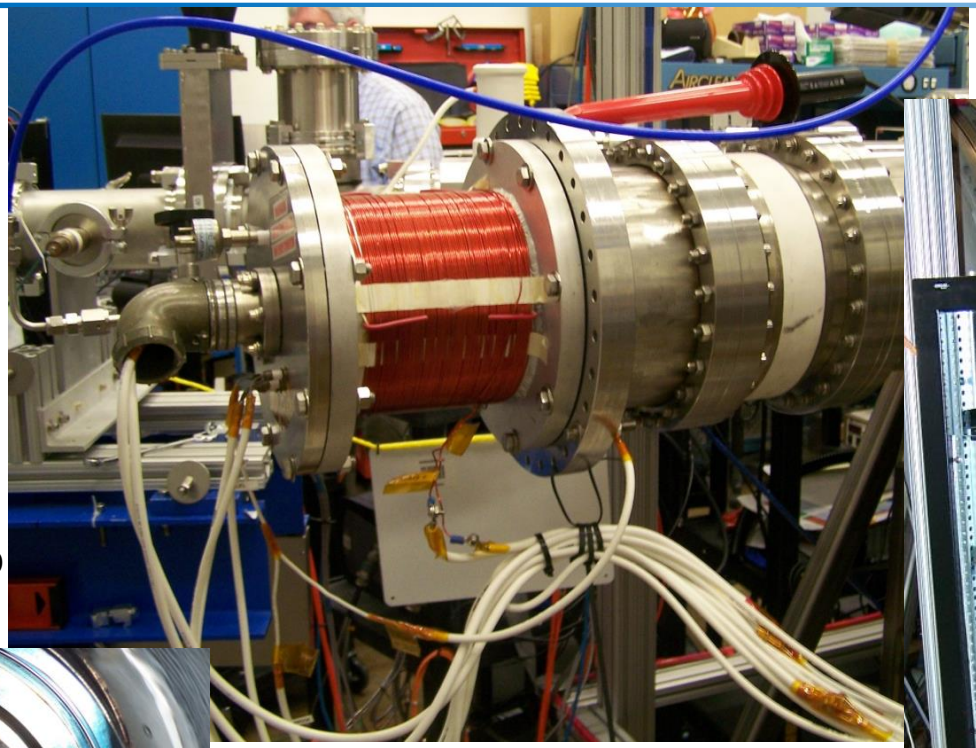
Helmholtz Vertical Coils: Square shaped at 6 ft by 6 ft dimension with 8 turns of 12 gauge wire; computer controlled wire current

SWF Internal Layout for Solar Probe Cup Test



Note: LN_2 shroud removed to allow for rotational clearance of electronics box

SWF Kaufman Source: Broadbeam Ions

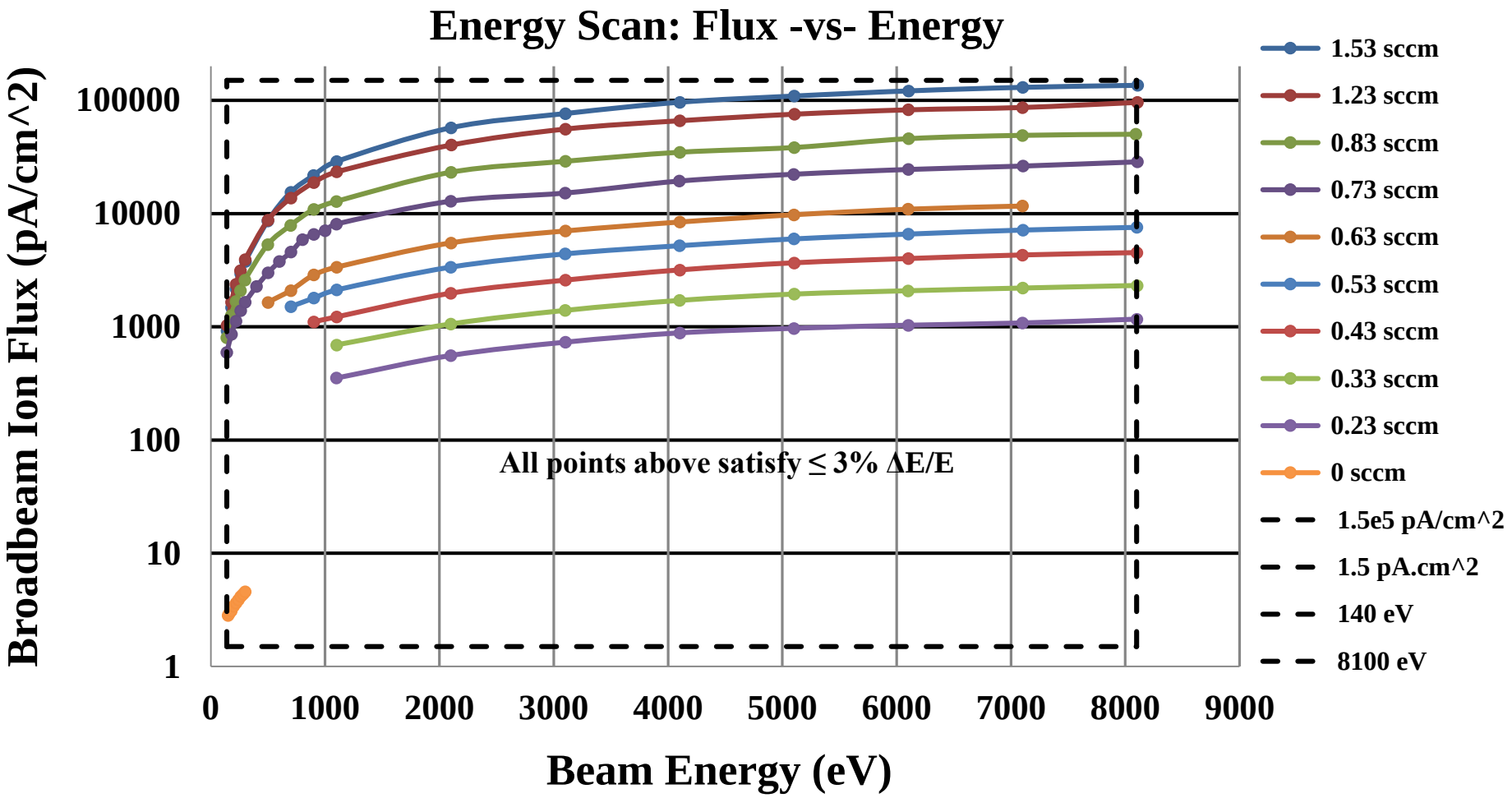


Matched, high transparency, two grid set

Beam Energy ≈ Anode voltage + commanded floating voltage

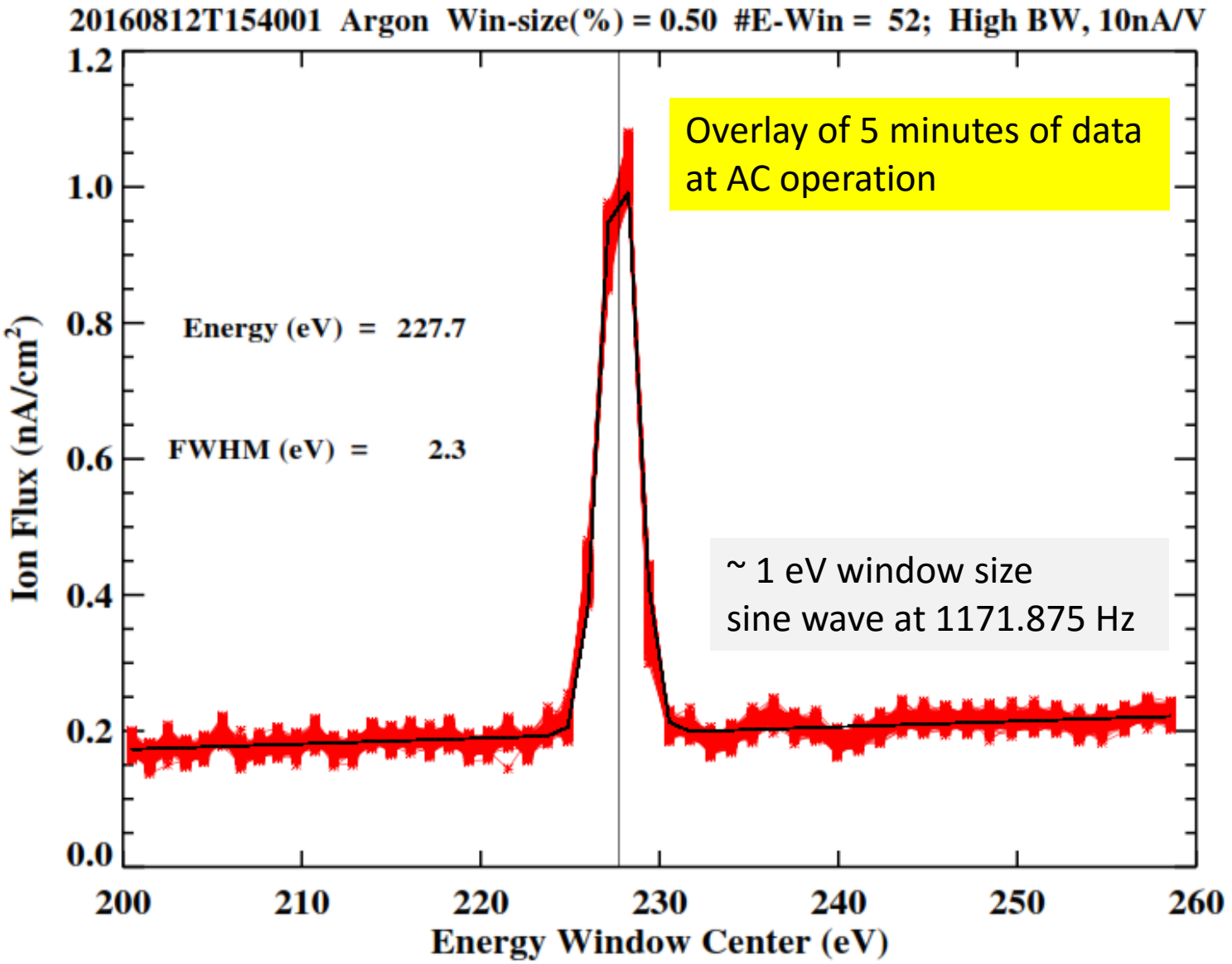
Broadbeam Ions

Source operated in constant voltage mode



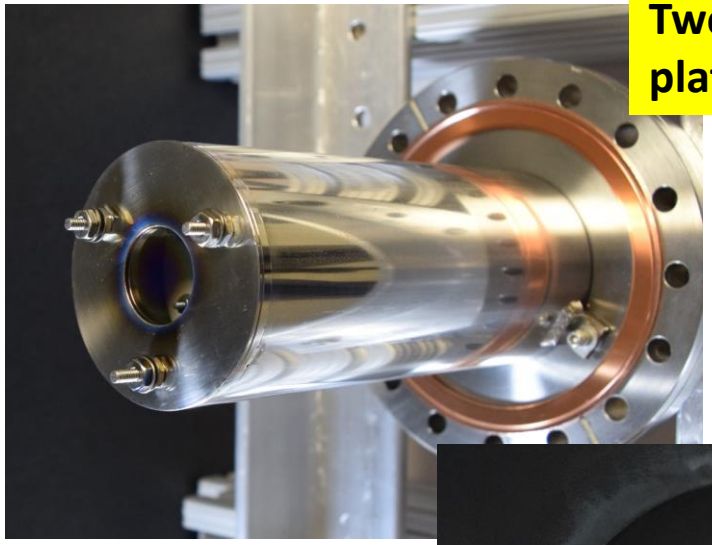
Beam uniformity at 80 mm diameter: > 90% for 140 eV to ~ 80% at 8100 eV

Broadbeam Ions - Stability

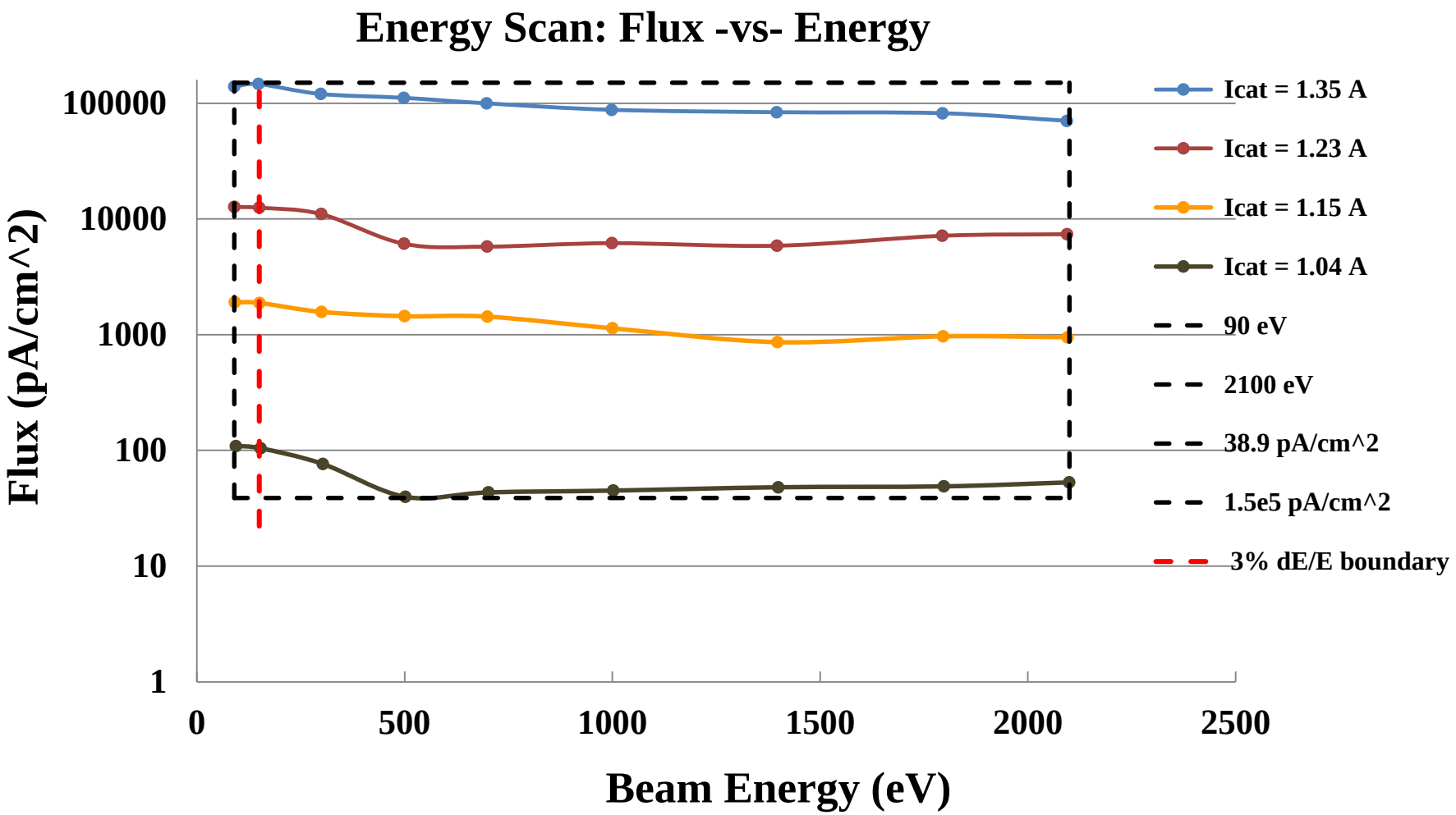


SWF Broadbeam Electron Source

Two independent filaments mounting on Macor plate surrounded by grounded anode.

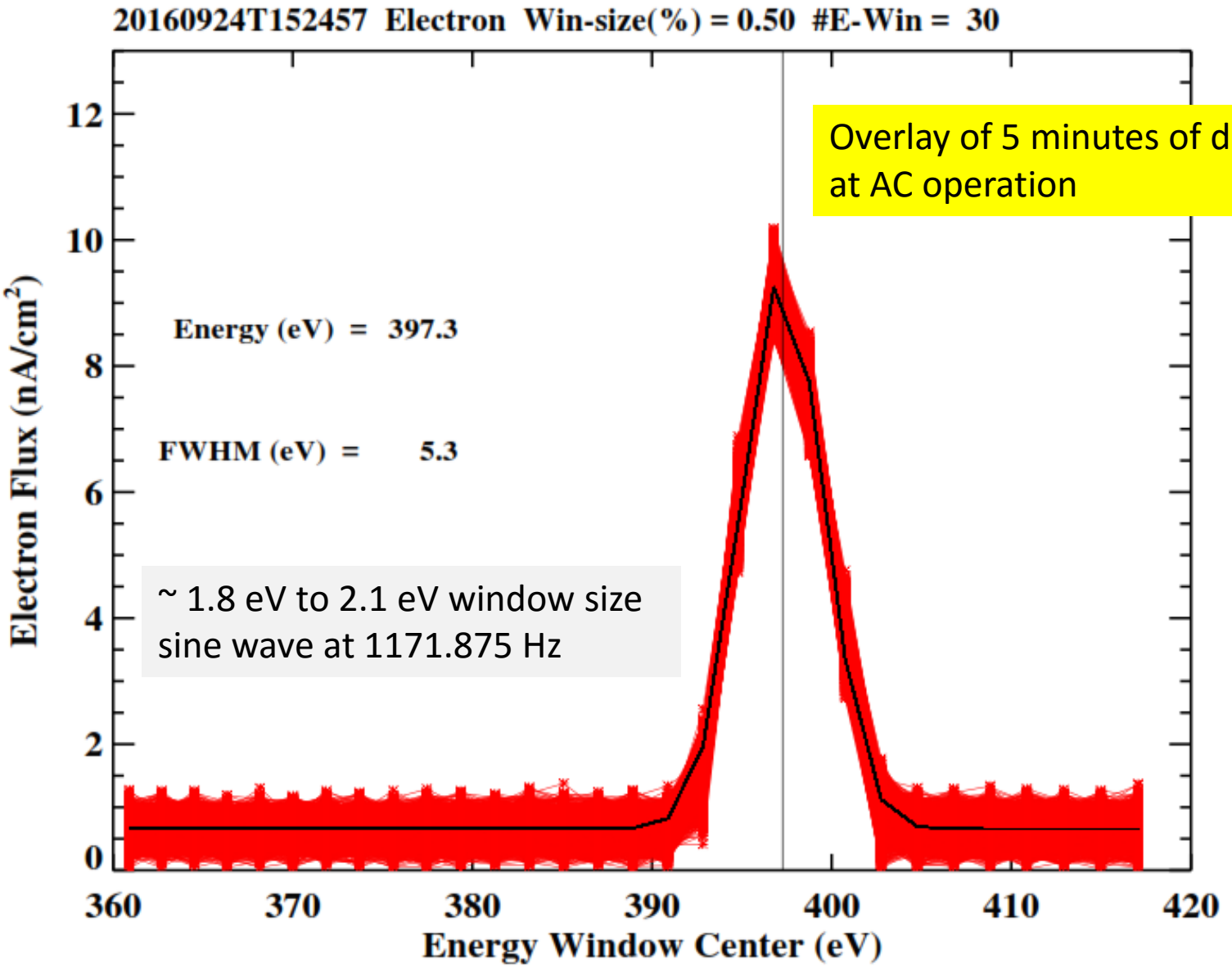


Broadbeam Electrons



Beam uniformity at 80 mm diameter: > 90% for 90 eV to ~ 80% at 2100 eV
Vertical Coil current adjusted inconcert with Energy changes between 90 to 1500 eV
Horizontal Coil current fixed for all energies.

Broadbeam Electrons - Stability

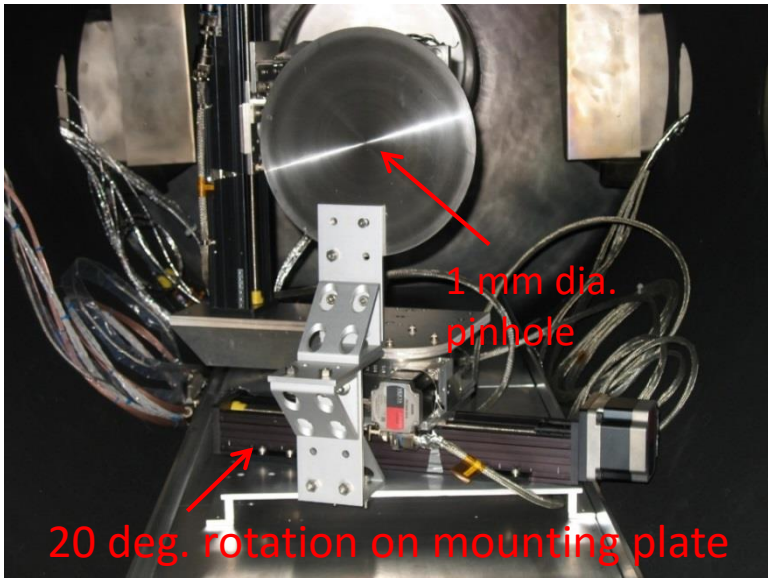


Overlay of 5 minutes of data at AC operation

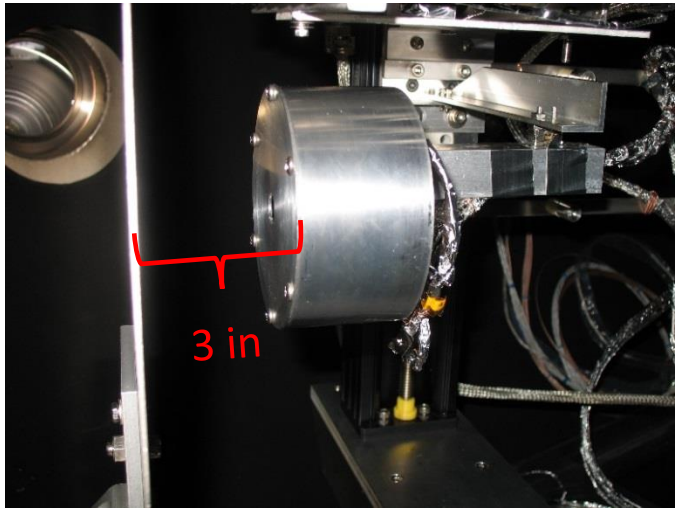
~ 1.8 eV to 2.1 eV window size sine wave at 1171.875 Hz

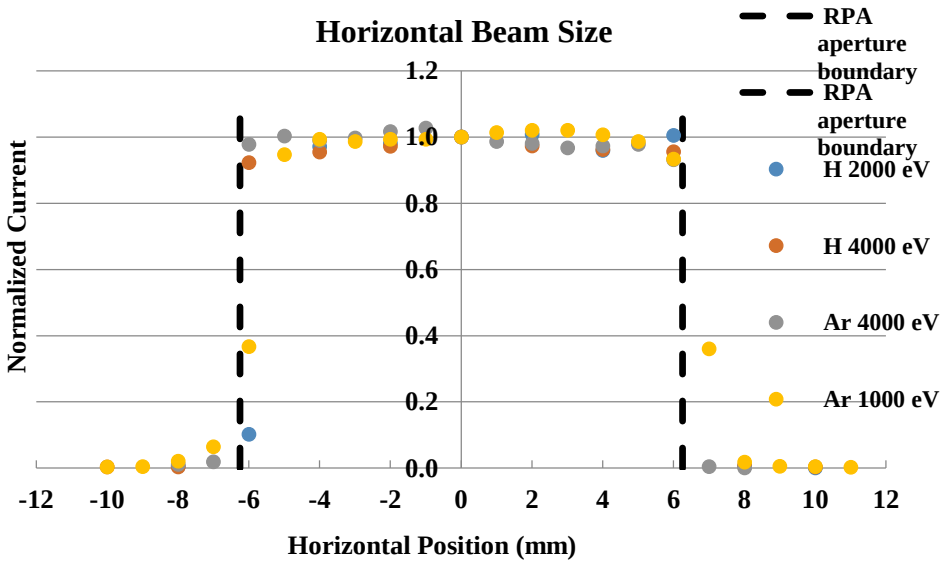
Pencil Beam Ions

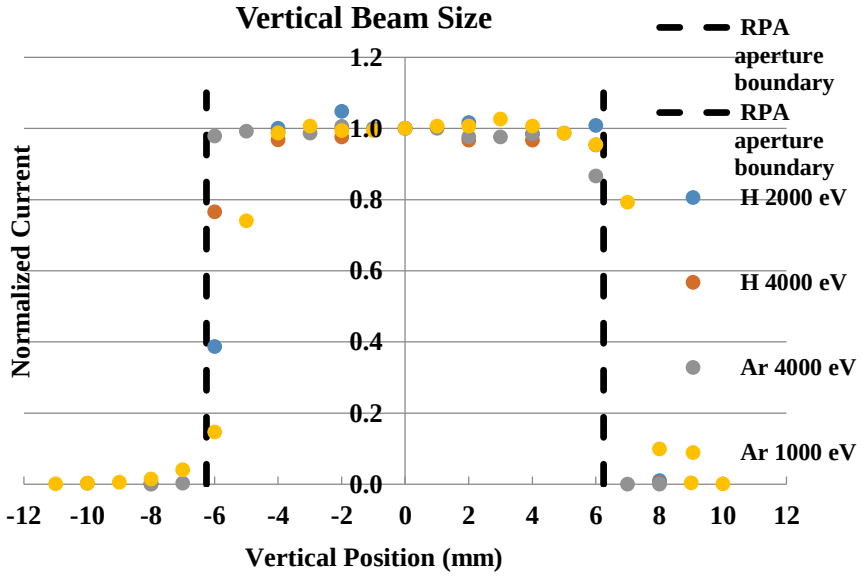
Front View



Side View







Summary

- MSFC's Solar Wind Facility has been upgraded
  - ✓ Historical capability includes long term, high fluence material exposures
  - ✓ New capability includes high fidelity particle beams for space flight instrument calibration
  - ✓ Capability also exists to add solar photon radiation if required
- Both broadbeam ion and electron beams have flux control over several orders of magnitude
- Computer control allows either energy and flux scans with user control of start value, stop value, step size, and dwell time per step