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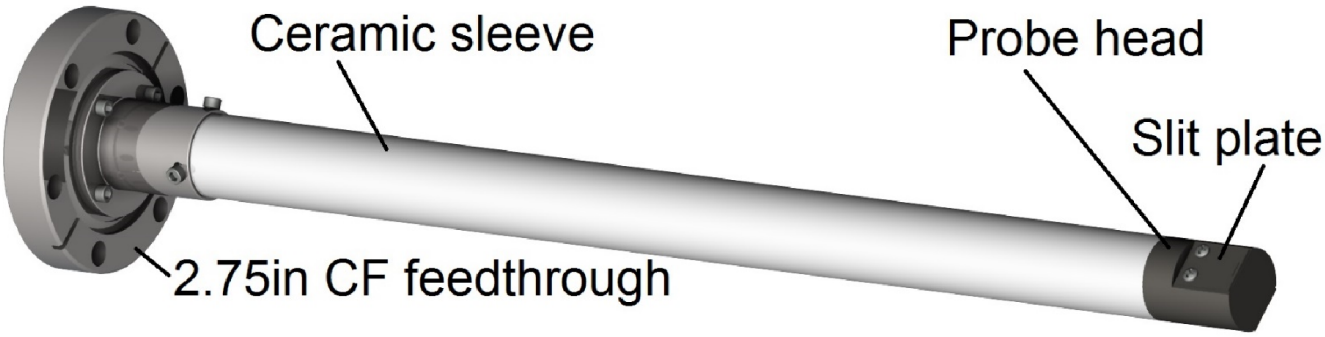
Woodruff Scientific Inc
4000 Aurora Ave N,
Suites 5 & 6, Seattle, WA 98103
(206) 905 9477 8am to 5pm Pacific
sales@woodruffscientific.com
http://www.woodruffscientific.com

Model number(s): E1-RFA-U / E1-RFA-B / E1-RFA-A
Descriptive name: Retarding Field Analyzer – Unidirectional / Bidirectional / Axial



Features:
- Measures ion and electron energy distributions in accessible plasma region
- Unidirectional, bidirectional (shown), and axial (see last page) options available
- Custom sizing and materials based on Debye length and heat flux
- Wedge slit and 2-grid design provides low perturbation sampling and includes secondary electron suppression
- Fast, swept electronics for time-resolved measurement during a single shot
- Mounts to many standard vacuum electrical feedthrough
- Can be angled to align with magnetic field
- Design for ultra-high vacuum (UHV) compatibility
- Can be used on a reciprocating drive

Operational ratings:
Debye length (λ_D): ≥ 16 μm
Heat flux: ≤ 10 MW/m^2

Options:
- Orientations: Unidirectional / Bidirectional / Axial
  Unidirectional and bidirectional orientations allow for better alignment with the magnetic field in toroidal plasmas; axial orientation allows measurement perpendicular to the magnetic field and may be better suited for non-toroidal plasmas
- Electronics: Static / Swept
  Static electronics provide a high temporal resolution measurement of the ion current during an experimental shot; swept electronics provide a high energy resolution measurement of the entire energy distribution during a single shot

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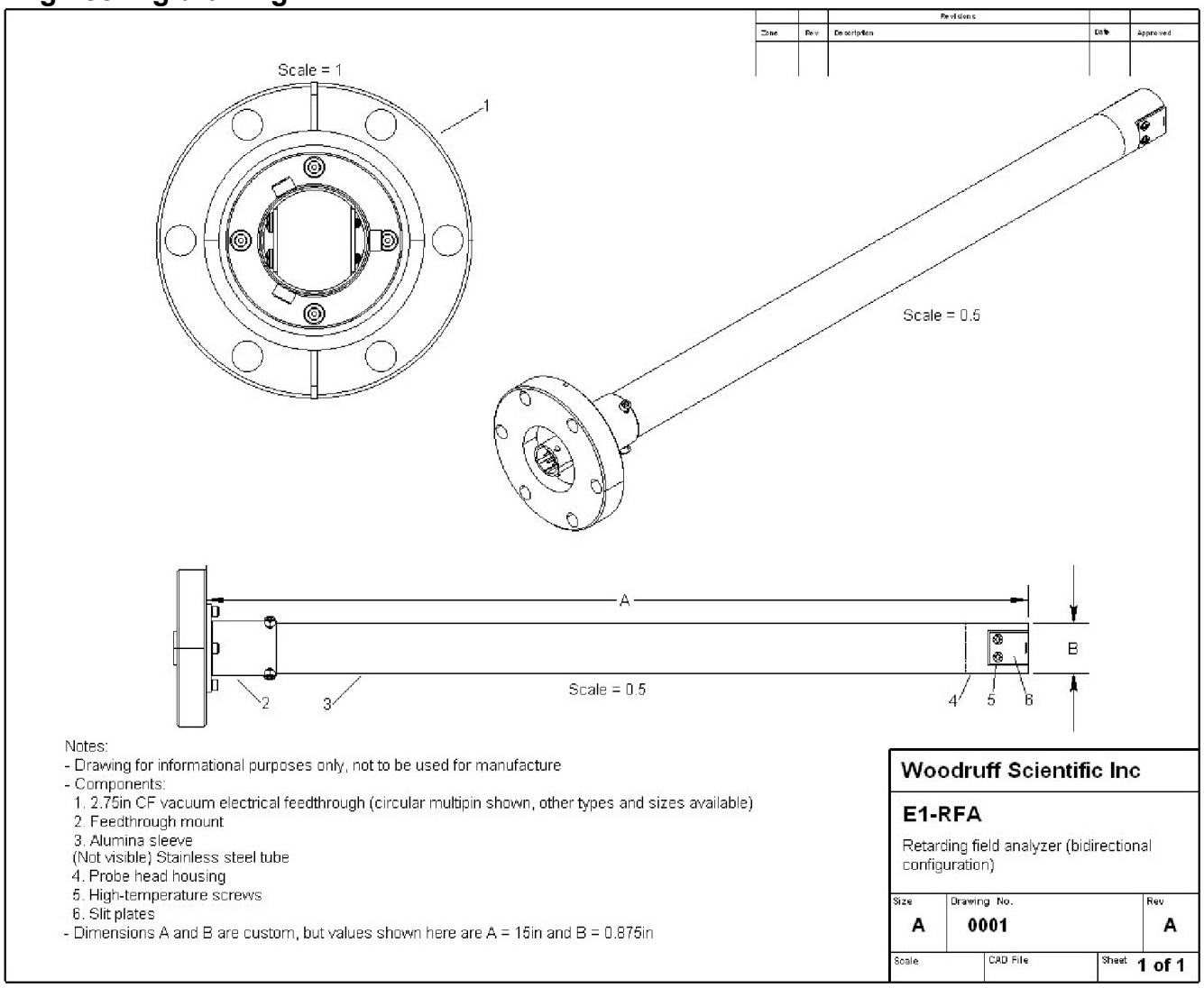
Engineering drawing:



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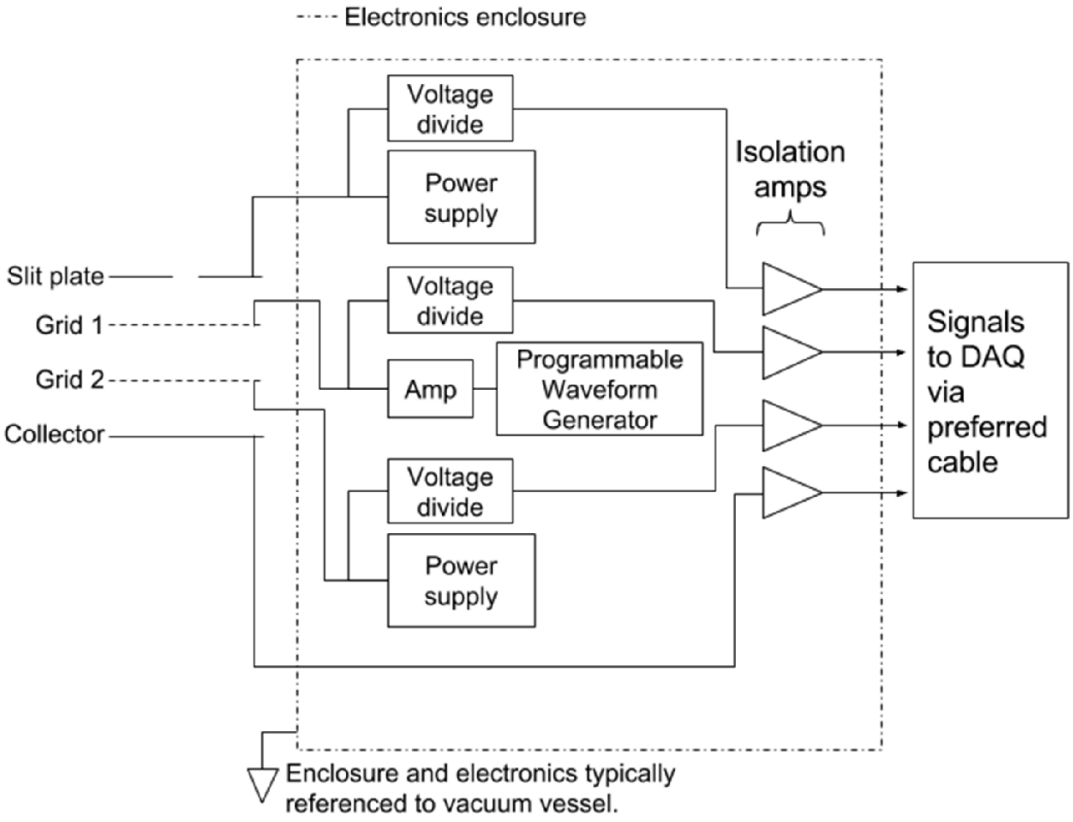
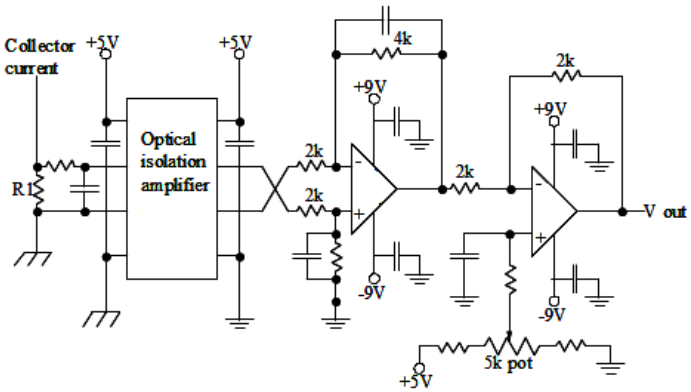
Electronics schematic:



The electronics schematic is shown above for the unidirectional and axial variations; the bidirectional electronics include additional collector and slit plate circuits. The sweep frequency and grid/slit plate potentials are remotely controlled. Potential divides on the grid/slit plate circuits and isolation amplifiers (circuit shown on right) on all circuits ensure that the data acquisition system is protected.



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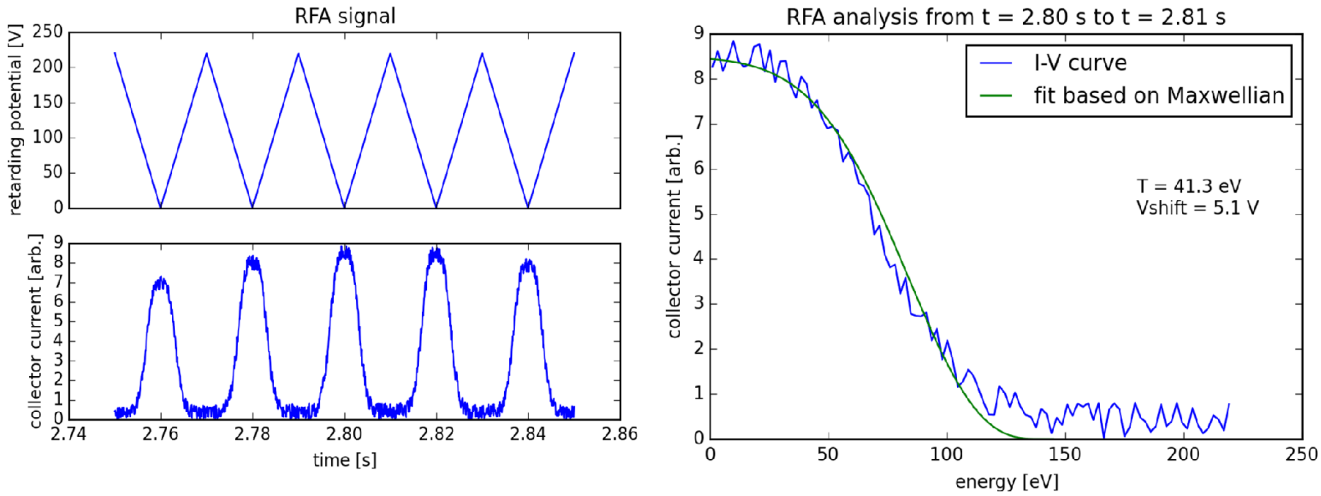
Example post-processing:



Post-processing of RFA data can be integrated with the experiment monitoring software to provide real-time results, like those shown above. On the left is an example of an RFA signal for a given experimental shot, showing both the retarding potential and collector current. On the right is the signal from one half-period of the retarding potential waveform, with a fit based on a Maxwellian distribution that provides the ion temperature and energy shift. The RFA post-processing software allows the user to select multiple time intervals during which to calculate the energy distribution.

Customization:

In addition to the options listed previously, the RFA is highly customizable. For example, the axial orientation shown on the right includes an aperture with multiple entrances for high-flux applications and can be designed to mount on any vacuum electrical feedthrough.