Characterization of the XSS

Rotating-Anode Source (RAS)

AXAF Project Science

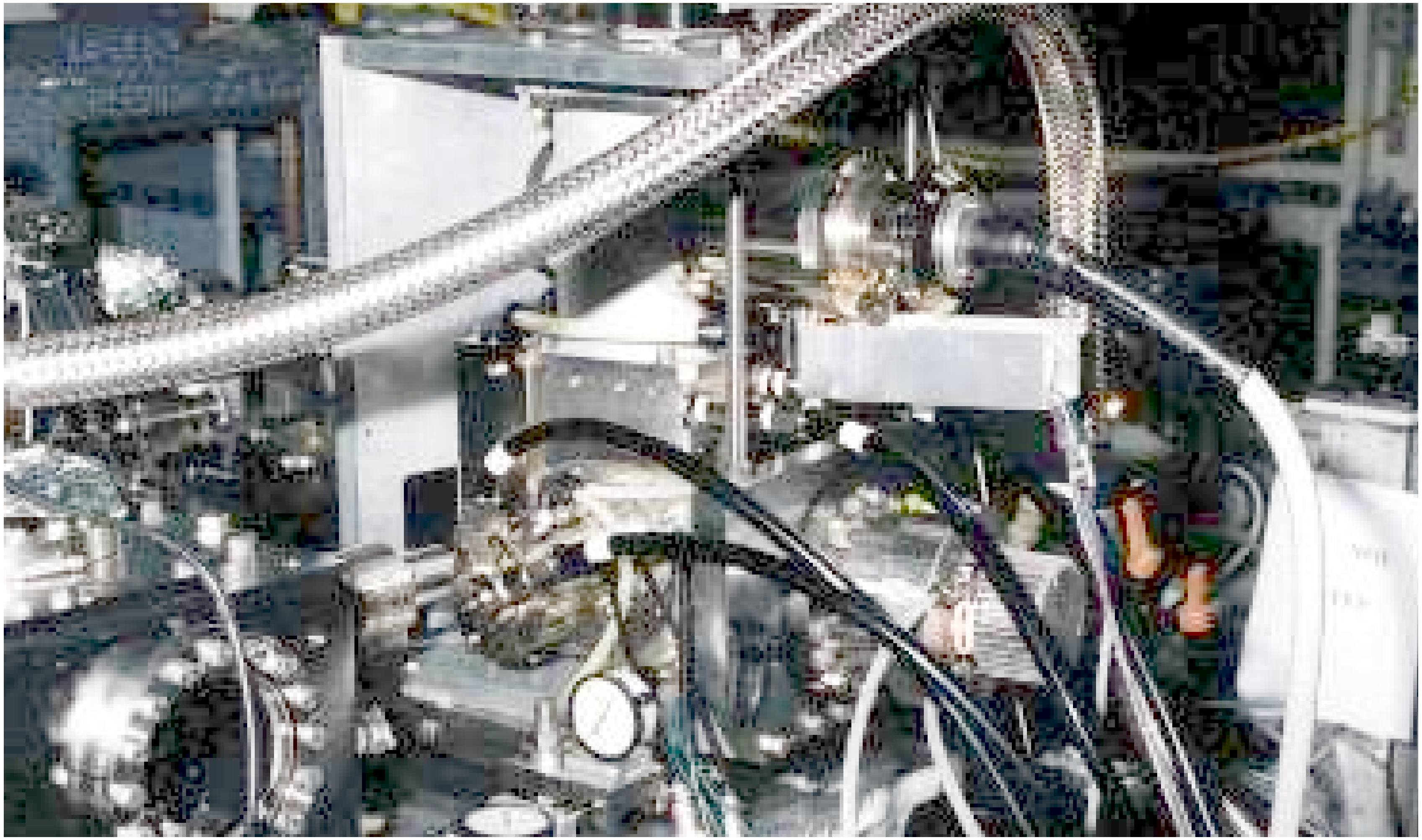
**Ron Elsner, Marshall Joy, Steve O'Dell,
Martin Sulkanen, Allyn Tennant, and Martin Weisskopf**

NASA Marshall Space Flight Center, Space Sciences Laboratory

**Robert Austin, Jeff Kolodziejczak,
Doug Swartz, and Galen Zirnstein**

USRA Marshall Space Flight Center, Space Sciences Laboratory

RAS7 photo



Purpose

Relevant features

- High anode current, effecting intense x-ray continuum
- Small focus size (0.2-mm-by-2-mm spot on anode surface)
- Interchangeable anodes of tungsten (W) and carbon (C)

Applications for AXAF calibration

- Stand-alone configuration not available
- RAS7 x-ray generator for Double-Crystal Monochromator (DCM)
  - W anode for intense continuum input to DCM
  - 7° take-off angle for 0.2-mm-by-0.25-mm spot (projected)
- RAS14 x-ray generator for HIREFS reflection-grating monochromator
  - W anode for intense continuum input to HIREFS
  - C anode for intense C-Kα input to HIREFS
  - 14° take-off angle for 0.2-mm-by-0.5-mm spot (projected)

Characterization activities

Flux

- See HIREFS and DCM sections for RAS14 and RAS7, respectively.
- Determine operating range of RAS anode current, for matrix of high-voltage and bias settings.

Spectral content

- See HIREFS and DCM sections for RAS14 and RAS7, respectively.

Spot size

- See HIREFS and DCM sections for RAS14 and RAS7, respectively.

Beam uniformity

- See HIREFS and DCM sections for RAS14 and RAS7, respectively.

Description

Rotor Flex low-voltage rotating-anode x-ray generator, by Rigaku

Electron gun

- LP2 cathode assembly
  - Spacing (from anode) for anode voltages from 5 kV to 25 kV
  - Focus dimensions 0.2 mm by 2 mm, adjusted with bias voltage
- Filament
  - 0.3-mm-diameter tungsten wire, up to 1.2-A filament current
  - 13 turns in 1.6-mm-diameter by 6.2-mm coil behind bias plate

Anode

- Water-cooled drum, rotating at 100 Hz (6000 rpm)
- Anode materials
  - Tungsten (W), for up to 2500 W anode power
  - Carbon (C), for up to 300 W anode power

Power supply and electronics, with feed-back control of anode current

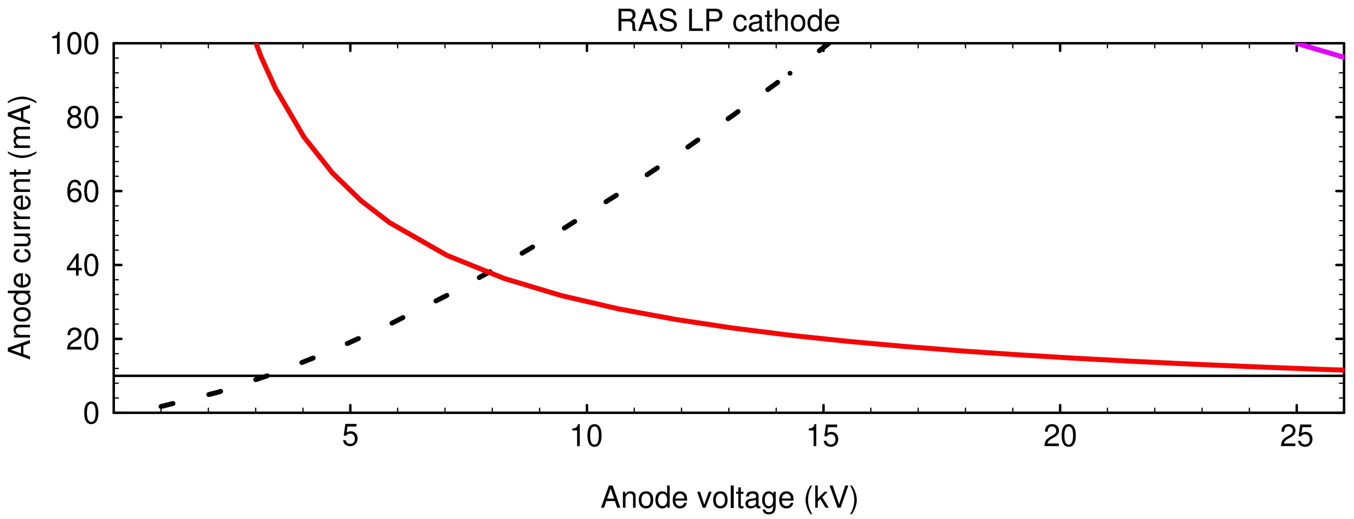
Constraints on RAS anode current

Physical constraints

- Ohmic heating of filament
- Power dissipation in anode
- Space-charge screening

Design constraints

- 10-mA minimum anode current
- Very stabile controller



RAS anode-current limits. Power limits are 300 W (C anode) and 2.5 kW (W anode). Space-charge limit (dashed line) is for a 2.0-mm-by-0.2-mm focus size and LP cathode.

Maximum operating anode current

NB: Bias unit is percent of maximum bias, which is -10% of anode voltage. E.g., 40 "percent" bias is actually 4% of the anode voltage (negated).