NSTX divertor bolometry: physics needs and options

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Divertor Bolometry Topical Group Discussion

Overview

- Physics needs and diagnostic objectives
- NSTX divertor diagnostics
- NSTX divertor bolometry hardware options
- CDX-U AXUV diode bolometer array (JHU - PPPL collaboration)
- Proposed solution for NSTX

Physics needs & diagnostics objectives

Radiated power measurement
Radiated power distribution measurement
Spatial resolution (mm, cm, 10 cm scale)
Time response (ms, μs scale)

Levels of bolometer system complexity and physics results accessible with each level

- Crude power balance: P_{rad} measurements in the core and edge
- Power balance: P_{rad} measurements in the core, edge, divertor, SOL
- Power balance in divertor region (in / out ratios)
- 2D radiated power profile
- 2D radiated power profile with high temporal resolution

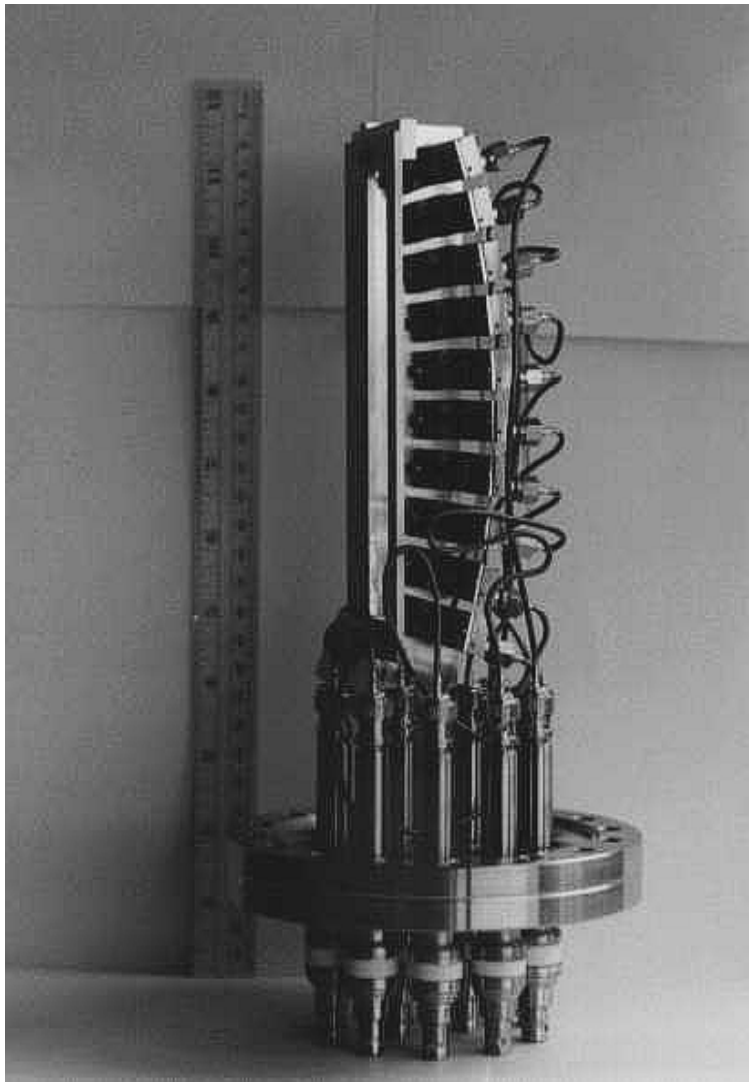
Divertor diagnostics

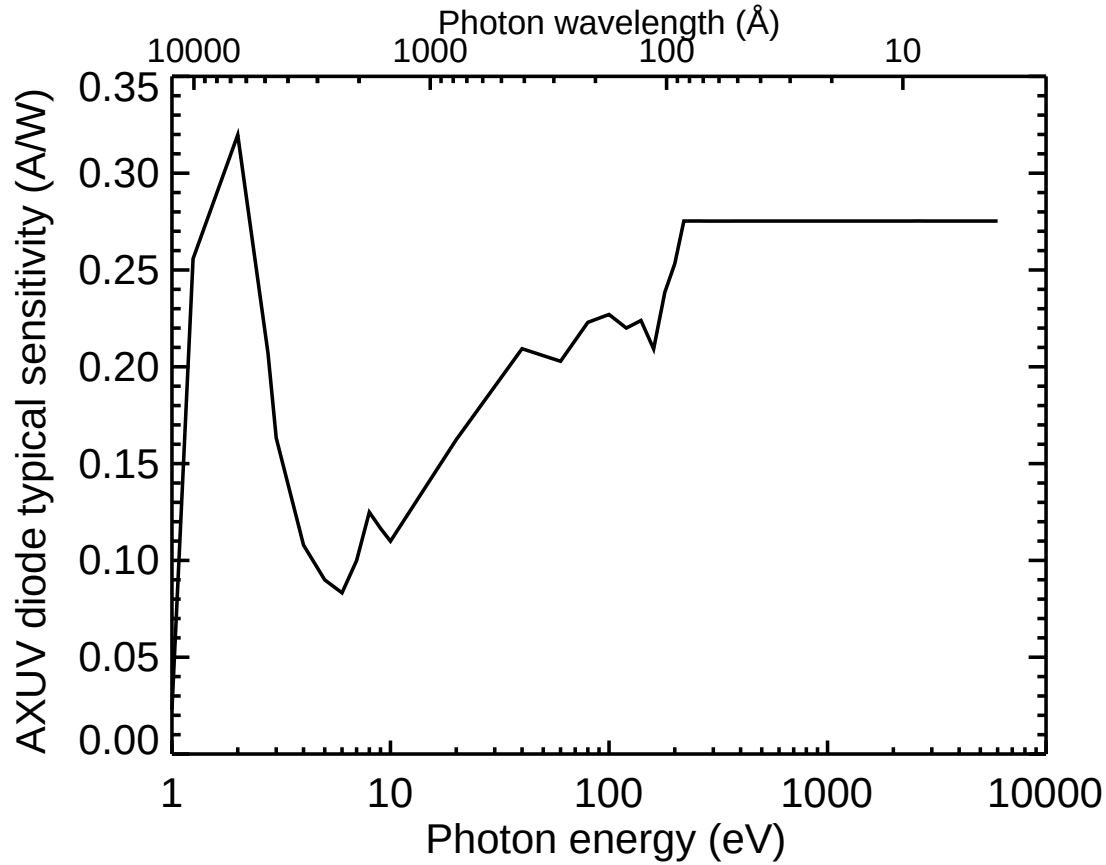
- Edge Thomson scattering
- Reciprocating probe
- Langmuir probes
- X-point probe
- Visible spectroscopy (VIPS-2, filterscopes)
- USXR top array
- Tangential core / edge bolometry
- Visible (filtered?) CCD cameras
- Infrared cameras
- 1D top CCD array
- Magnetics / EFIT equilibrium reconstruction

Hardware options for divertor bolometry

- Conventional foil bolometers
- AXUV diode radiometers
- IR cameras, imaging bolometry

CDX-U tangential FFR array





Details: Review of Sci. Instruments 72, 737 (2001)

Possible solution for NSTX

- Several chords of foil bolometers for absolute rad. power measurement and subsequent AXUV diode "calibration"
- Filtered AXUV diode array (s)
  - 200 A bandpass filter centered at 1550 A for C IV distribution measurements
  - narrow bandpass filter centered at 1216 A for D (H) distribution measurements

  Filters available off-shelf from Acton Research Corp.

- Possible utilization of USXR top arrays in radiometer or filtered (e.g. for C IV) mode (need amplifiers, spatial resolution 5 cm in lower divertor)