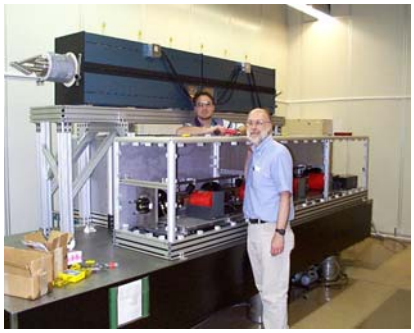
ORNL Has Developed a CO_2 Laser Collective Thomson Scattering Diagnostic for High-Energy Ion Measurements in Fusion Plasmas

A sensor for the measurement of confined fusion-product alpha particles

A collective Thomson scattering (CTS) system based on a pulsed CO_2 laser is being developed for in-situ measurements of fusion-product alpha particles. The difficulty in this measurement arises due to the high velocity and low density of these particles in the environment of a fusion plasma. Tests on this diagnostic system have been conducted on the Advanced Toroidal Facility (ATF) at ORNL and are currently underway on the JT-60U tokamak in Naka, Japan. The system consists of a pulsed laser (15J in 1 : s at 10.6 : m) and a wideband (~ 10GHz) heterodyne receiver with a quantum-well infrared photodetector (QWIP). Stray light is reduced by a notch filter containing hot CO_2 gas. The heterodyne receiver is absolutely calibrated using a blackbody radiation source.

The CTS Characteristics

- Based on high power (>10MW) pulsed CO_2 laser technology
- Small angle scattering – less than 1E
- Small signals (1nW) with high power input (10MW)
- Heterodyne detection covering 10GHz
- Notch filter to remove stray laser light



CTS System under construction.

Point of Contact:
Dr. Roger K. Richards
ALOTD Group
Engineering Science and Technology Division
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831
Phone: 865-576-2582
FAX: 865-574-1249
E-mail: richardsrk@ornl.gov
http://www.ornl.gov/lod