## §3. Error Estimation for the Polychromator of the Multipulse Thomson Scattering Diagnostic on LHD

Minami, T., Narihara, K., Yamada, I.

To analyze the spectral of the scattered light, we are developing five channel filter polychromators which are similar to that used on DIII-D Tokamak. [1)]

For the selection of the filter sets, we must consider the range of the electron temperature. The expected maximum temperature on the LHD is 10 keV. It is important to measure the edge temperature to understand physics of several processes, such as L-H transitions. The edge temperature is expected as low as 5 eV. It is difficult to measure this wide range of temperature using only one filter set of five filters, because the low temperature measurement requires the narrow band filter as close to laser line, but the high temperature measurement requires the wide band filter as far to it. Thus we selected four filter sets for next four ranges of temperature. (1) High temperature range (10keV-0.2keV). (2) Middle high temperature range (5keV-0.05keV). (3) Middle low temperature range (1 keV-0.01keV). (4) Low temperature range (0.5keV-0.005keV).

We selected filter sets using a simulation code that modeled our polychromator [1)]. The statistical fluctuation of the photons is a main noise source. We calculated this level of the scattered photons plus the bremsstrahlung photons. In this code the filter transmission, the detector quantum efficiency was considered. The Seldem model 2) is used to calculate the Thomson scattering spectrum, which takes into account the relativistic blue shift.

Figure.1 shows the calculated relative error of Te for the selected four filter sets. We calculated with parameters, the laser energy is 500 mJ, ne=1x$10^{19}$$m^{-3}$,the solid angle is 30 mstr, the scattering length is 1 cm, and the scattering angle is 170 deg.. The relative error increases with decrease in Te, because the bremsstrahlung light mainly affects the low temperature range. The error is less than 3% in the all range of the temperature. Figure.2 shows the relative error of ne. The tendency is similar to the case of the Te, but the value of the relative error is about two times as large as that of Te. These calculation shows that our polychromator will cover the all required range of the temperature.

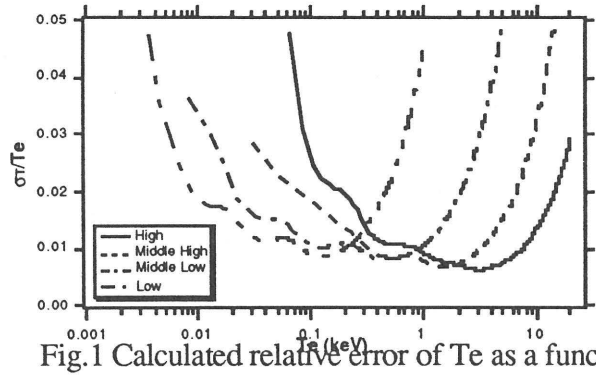


Fig.1 Calculated relative error of Te as a function of Te for four filter sets

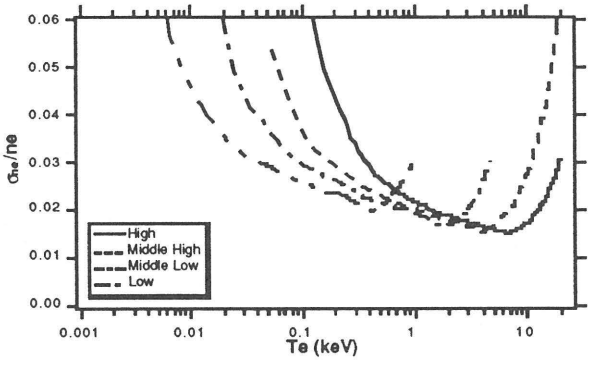


Fig.2 Calculated relative error of ne as a function of Te for four filter sets

References
1)T.N.Carlstorm,J.C.DeBoo et. al. Rev.Sci.Inst. **61** No.10 2858 (1990)
2) A.C.Selden,Phy.Lett.A **79**,6 (1980)