Introduction

Vibration mitigation

- Vibration: add extra phase, 1μm ± 1° (n_e, r_e = 1.4 × 10^9 m^-3)
- Solutions: mechanical amelioration; optical optimization

Method: Rearrange reference chord
- Plasma section: [27cm, 27cm]
- Beam coverage area: [12cm, 33cm]
- 12 probe chords: [9cm, 24cm]
- Spacing: 3cm
- New reference chord: 31.5cm
- Result: <0.1° on electron density signal

Schematic of optical optimization

- Electron density from old reference
- Electron density from new reference
- Vibration been reduced after optical optimization
- Faraday angle from old reference
- Faraday angle from new reference
- Vibration been reduced after optical optimization

Collinearity optimization

- Without Polaroid
  \[ \Delta \phi = 2.82 \times 10^{-12} \text{V/m} \]
  \[ \phi = \frac{\Delta \phi}{2} \]
- With Polaroid
  \[ \Delta \phi = 2.82 \times 10^{-12} \text{V/m} \]
  \[ \phi = \frac{\Delta \phi}{2} - \frac{1.44 \times 10^{-12} \text{V/m}}{2} \]

\( \Delta \phi \) is the Faraday angle. \( \phi \) is the actual measurement we get and \( \phi \text{ collinear error} \) is the systematic error caused by misalignment of collinearity.

Method: Measure collinear error and optimize it during repeated plasma discharges

Result: collinear error of most the 12 chords is less than 0.2°

Experiment results

Future works:
1. Increase the beam covered region of plasma;
2. Reduce systematic error on Faraday angle to a lower level.

References:
2. G. Dodel and W. Kuri, Infrared Phys. 18 (1978) 773