The multi-spectral line polarization (MSE-MSLP) technique has been developed on Alcator C-Mod using a high-endty polarimeter to measure the polarization at multiple wavelengths on the same sightline. The prototype demonstrated key technologies and tested assumptions with favorable results. A full implementation is under construction for FT51 on C-Mod using advanced filters, a mixed imaging polarization and new detectors and will enable improved MSE measurements in FT51.

MSE filter width and detector are about 1/3. For small angles of incidence (3°) required to photon efficient, a wide filter range free of impurities is needed. Works over large wavelength range free of impurities. MSE-MSLP works well with the existing single wavelength detectors. MSE-MSLP prototype developed with 3D stokes vector simulation code. MSE-MSLP prototype incorporated into rack system, beam dump system, control hardware, simplified cabling, remote control, eliminates CAMAC. Revised mechanical design for easier assembly/calibration in early November: ready for C-Mod’ s FY15 campaign.

**Future prospects for the approach**

- High-throughput imaging polarimeter optical layout developed for MSE-MSLP is useful for other projects.
- MSE-MSLP will resolve field of view problems.
- MSE-MSLP works well with high throughput lasers with large diameter beams.
- MSE-MSLP prototypes for MSE-MSLP.

**Motivation for and design and construction of a multi-spectral line polarization MSE system for Alcator C-Mod**

- Photon collection for each MSE sightline, each with four wavelengths
- Beam dump system replaces existing single wavelength detectors
- Replaces complex matching MSE optical systems (1/32 stop)
- Modular for use on other tokamaks with a change of filters.
- Advanced actively controlled filter system to increase data with better than shot analysis.
- Control system literature (high rate more expensive than existing MSE-MSLP systems, 350 per sightline).

- Magnetic field integration of full implementation.
- Single sightline system targeted.
- High sensitivity filters, 100x filter rejection, 50x range simply by changing the wavelength.
- Survey with visible spectroscopy to determine optimal filter wavelengths.
- Custom filter design for each wavelength MSE-MLP imaging, 16 filter slots of 20 wavelengths per sightline.

**Identifying optimal wavelength regions for polychromator**

- MSE-MSLP system works well with existing single wavelength systems for the wider spectrum, hence collecting more photons.
- Replaces existing high- and low-throughput detectors.
- Imaging with high-throughput detectors.
- In red we use orthogonally polarized (i.e., YH) aperture as polariisation angle of all diffraction orders.
- Key requirements to background suppression produced a chromatic error for offset toroidal fields.<ref>

<table>
<thead>
<tr>
<th>MSE Wavelengths</th>
<th>MSE Filter Width</th>
<th>MSE Filter Number</th>
<th>MSE Filter Intensity</th>
<th>MSE Filter Transmission</th>
<th>MSE Filter Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 nm</td>
<td>20 nm</td>
<td>20</td>
<td>100</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>440 nm</td>
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<td>100</td>
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<td>20%</td>
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<tr>
<td>560 nm</td>
<td>20 nm</td>
<td>20</td>
<td>100</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Full 10-sightline system designed, now under construction**

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