

Sub-Aperture Backscatter on NIF

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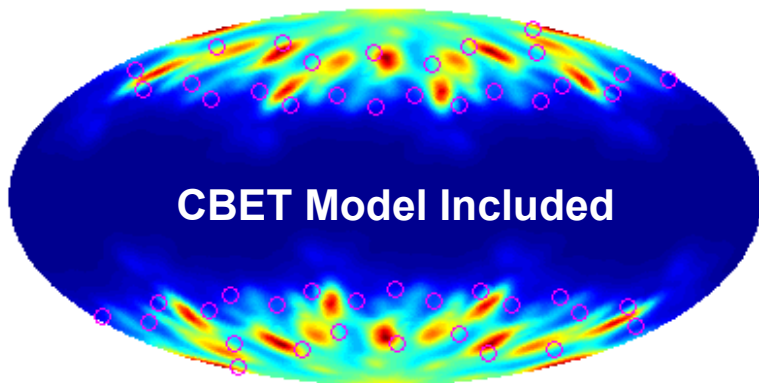
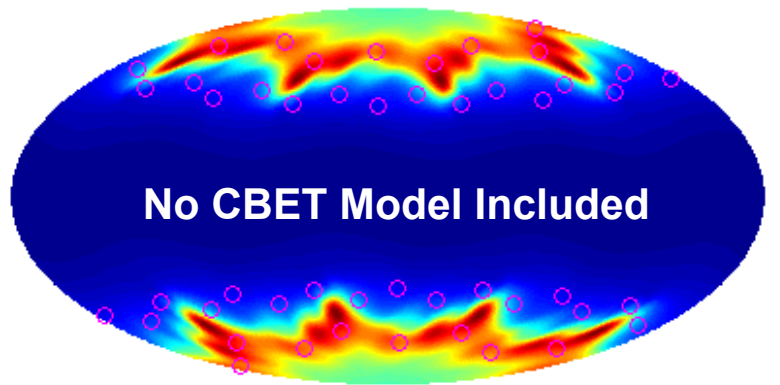


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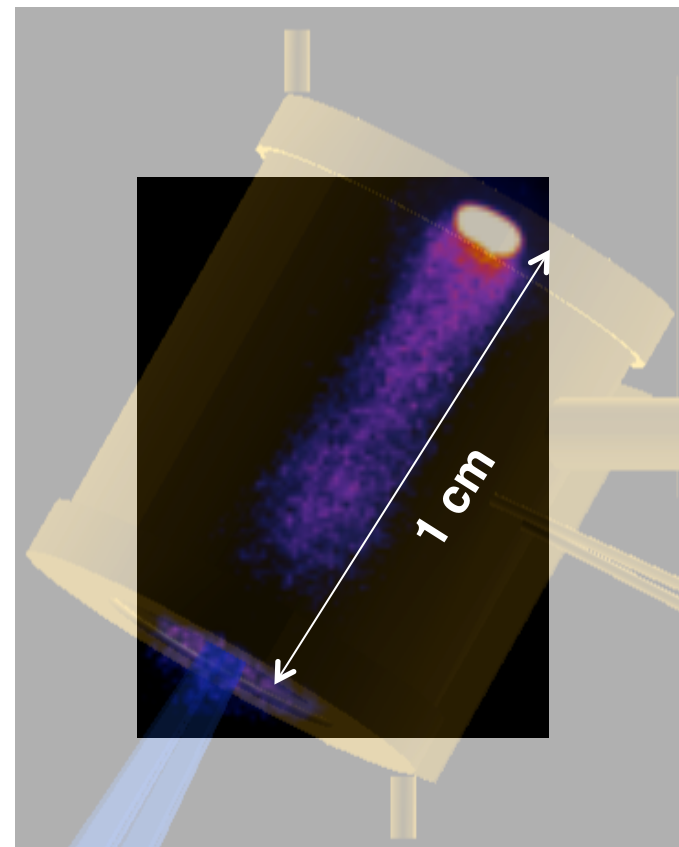
This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

Enhanced backscatter capabilities would benefit a number of experimental campaigns on the NIF

NIF Polar-Drive Scattered Light Calculations



NIF Gas-Pipe Experimental Data



LLE has made an official request for additional scattered light measurements

We have proposed enhancements to the optical diagnostics suite to cover more positions around the NIF chamber



- 1) SBS and SRS time-history measurements at positions near the equator and near the poles (i.e. not at beam ports)**

- 2) SBS and SRS time-history measurements at beam-port positions**
 - Note: DrDs are being pursued as a possible solution for SBS**

- 3) SBS and SRS streaked spectral measurements at beam-port or non-beam positions**

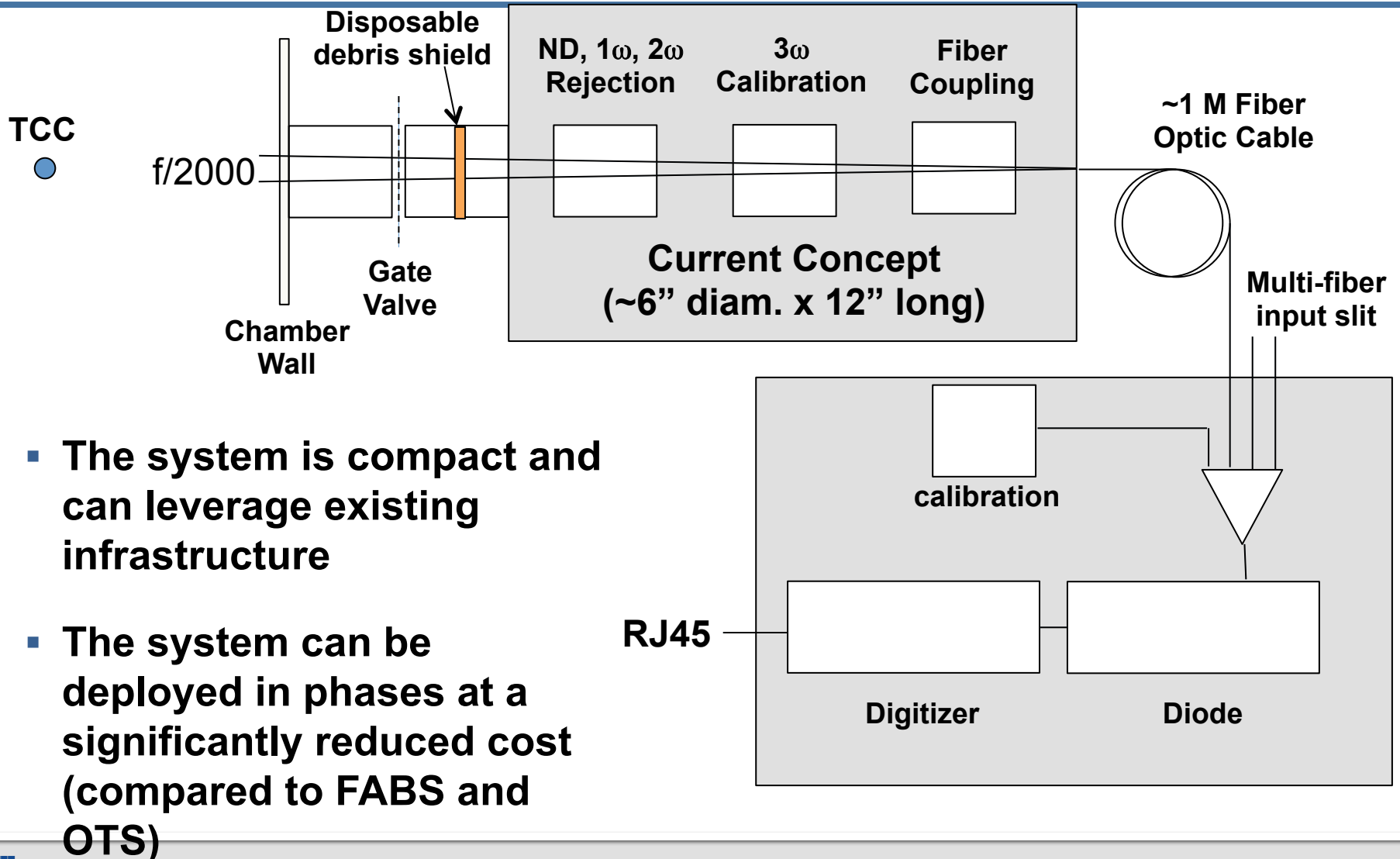
1) SBS and SRS time-history measurements at positions near the equator and near the poles (i.e. not at beam ports)



- **Expected backscattered SBS:** $\sim 2 \times 10^3 - 2 \times 10^5$ J/sr based on simulations of direct-drive implosions
- **Expected backscattered SRS:** $\sim 10^2 - 10^4$ J/sr based on $\sim 1 - 10$ J per beamline measured in FABS in planar experiments
- **Locations:** $\sim 10 - 20$, at ~ 10 different polar angles including near poles and near equator, and ~ 5 different azimuthal angles
- **Flexibility:** Should have changeable ND and bandpass filtering for either SBS or SRS (if not interchangeable b/w SBS, SRS, need more detectors)
- **Time resolution:** Near term ~ 200 ps, long term ~ 100 ps
- **Signal duration:** $\sim 5 - 25$ ns (chromatic dispersion affects record window)
- **Dynamic range:** Near term > 10 , long term > 100
- **Signal/noise and uncertainty:** Require absolute and relative uncertainty of $\pm < 10$, nice to have $\pm < 5\%$

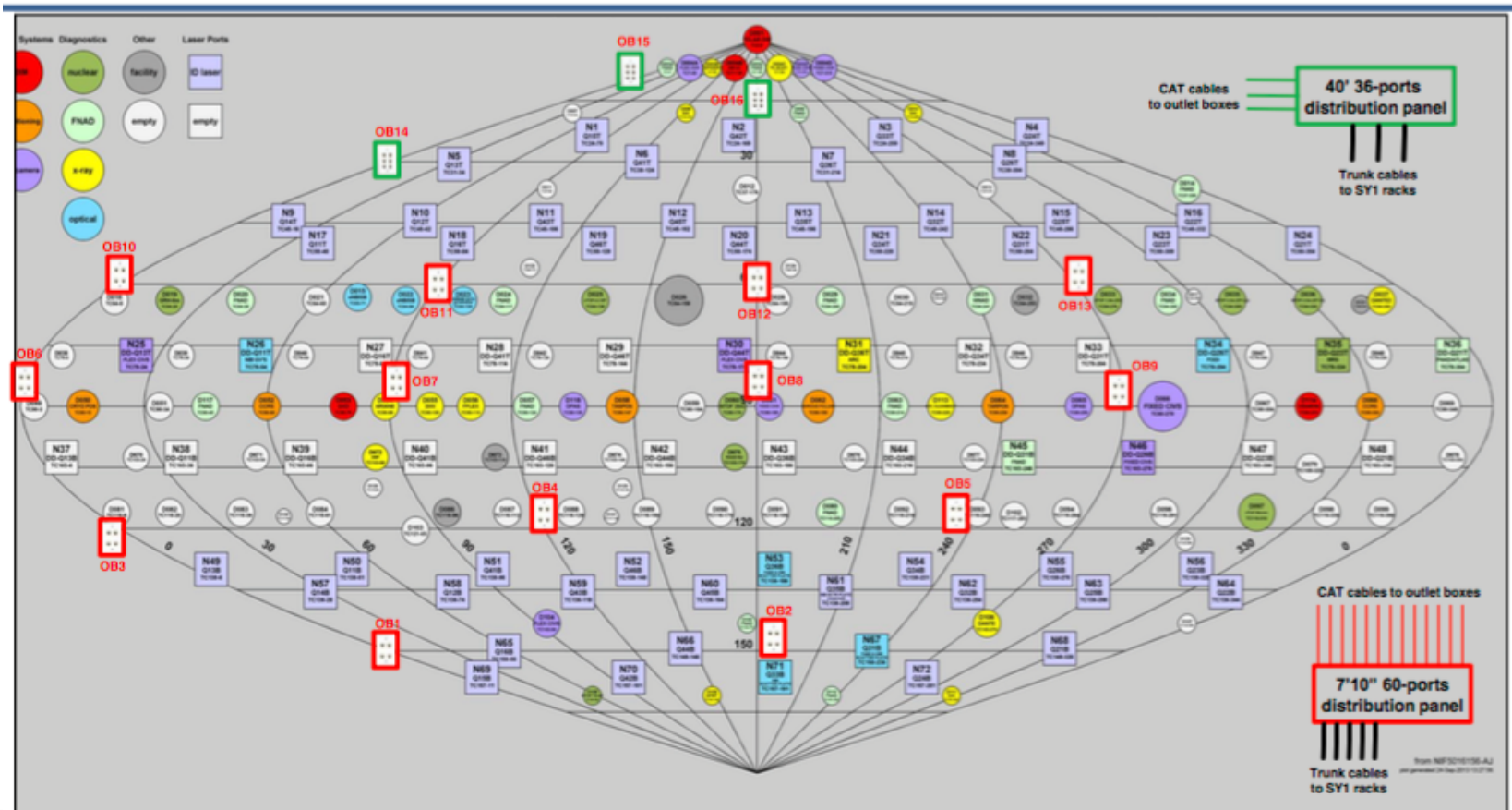
- **Other uses:** Should be designed so that next phase could introduce streaked spectrometry (i.e. item #3)

A system schematic outlines the major components for a diagnostic concept to measure scattered light



We should leverage the RJ45 infrastructure currently being deployed for RT-NADs

Propose to install RJ45 outlet boxes strategically placed around the target chamber to connect NADs to ICCS



Example of a design for supporting 48 NADs distributed through out the TB, with some capacity for future expansion.

A compact system concept is being developed to characterize scattered light at non-port locations

- The system will provide time resolved measurements of the scattered power for different wavelength bands
- This data will be beneficial for a range of experimental campaigns
- The concept is designed to be compact and inexpensive to allow rapid development and deployment

