
TP2 Encircled Flux Measurement Results

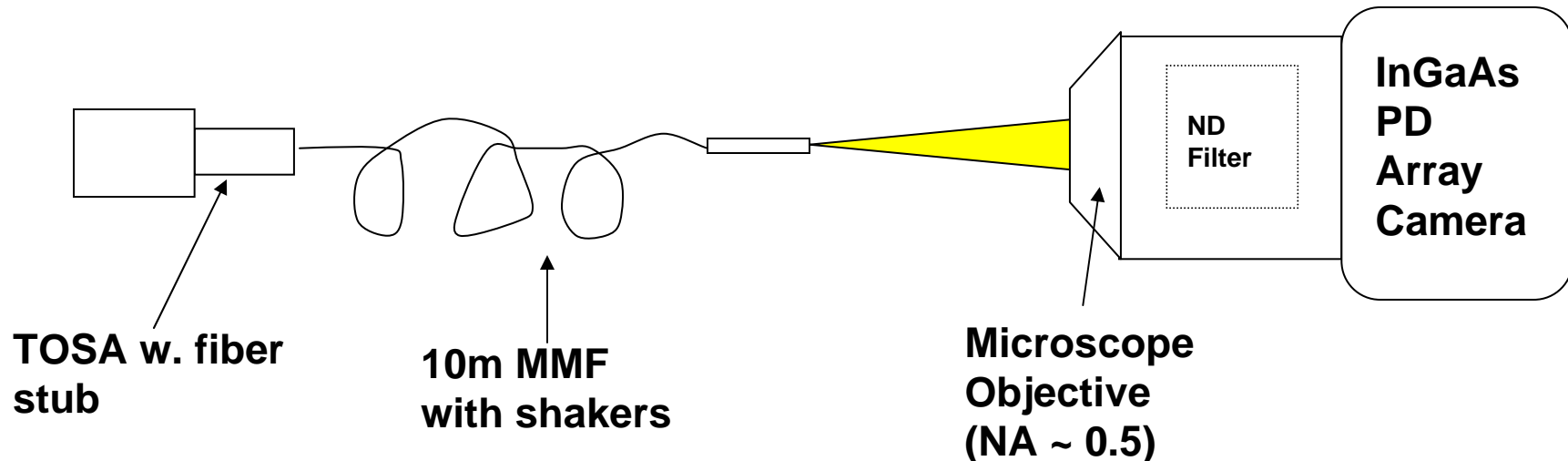
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Introduction

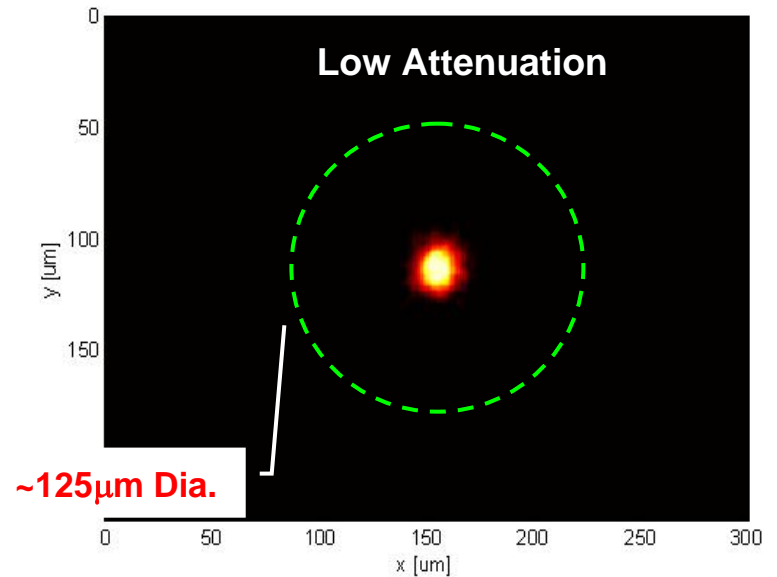
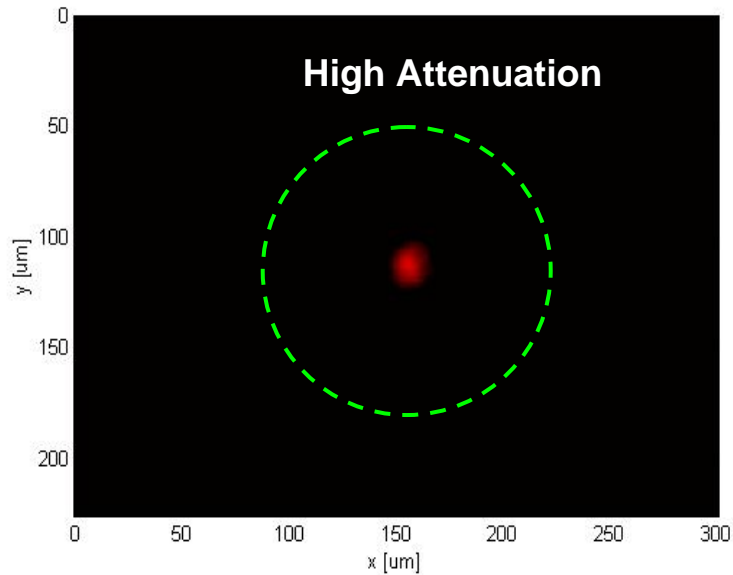
- D2.2 TP2 Requirements include Encircled Flux limits for direct launch into MMF:
 - **>30% within 5um radius**
 - **>86% within 11um radius**
- Pepeljugoski results indicated that even EF from a pure SMF launch violates the current spec:
 - **~35% within 5um radius**
 - **~75% within 11um radius**
- Finisar presented EF data at the July meeting measured at the TOSA fiber stop.
 - **Easily met EF Spec, But Not Measured Per Referenced IEC 61280-1-4**
- New measurements carried out per IEC 61280-1-4 are reported:
 - **Measurements carried out after 10m fiber (both 62/125 and 50/125) through a fiber shaker.**
 - **Images averaged 100 times.**
- EF Measurements Reported:
 - **Limiting case of EF with SMF launch (after SMF patchcord)**
 - **Meets current spec (~40-45% within 5um, and ~92-94% within 11um)**
 - **EF with direct TOSA launch for 4 parts over range of alignment qualities**
 - **Results are Marginal to Failing with Current Spec**
- A relaxation of the EF spec is proposed to ensure high TOSA yield

Measurement Setup



- TOSA with fiber stub, with and without a 2-meter SMF for launch test.
- 10 meters of 62/125 or 50/125 MMF with three shakers per IEC 61280-1-4
- InGaAs IR PD array camera + frame grabber + PC
- 100 images each, captured at two attenuation levels.
- Special processing routine to expand dynamic range of camera and include low intensity light outside the main central spot.

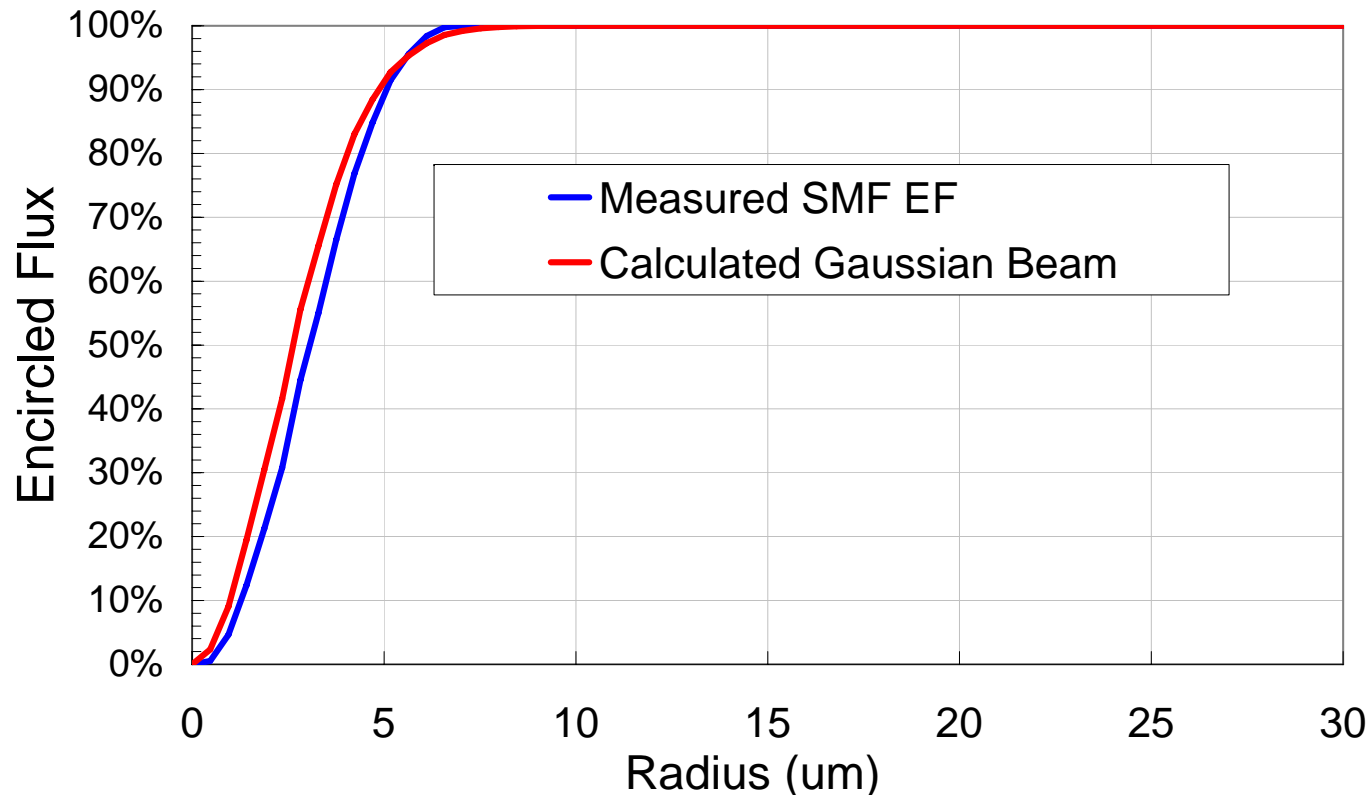
Captured Images



- TOSA launch into 10 meters of MMF with three-motor shaker. (62/125 case shown)
- Single typical drive condition (40 mA bias) used.
- Average of 100 images captured at two attenuation levels
 - Individual image varies as fiber shaker moves.
- Averaged images at each attenuation combined to calculate encircled flux (EF).

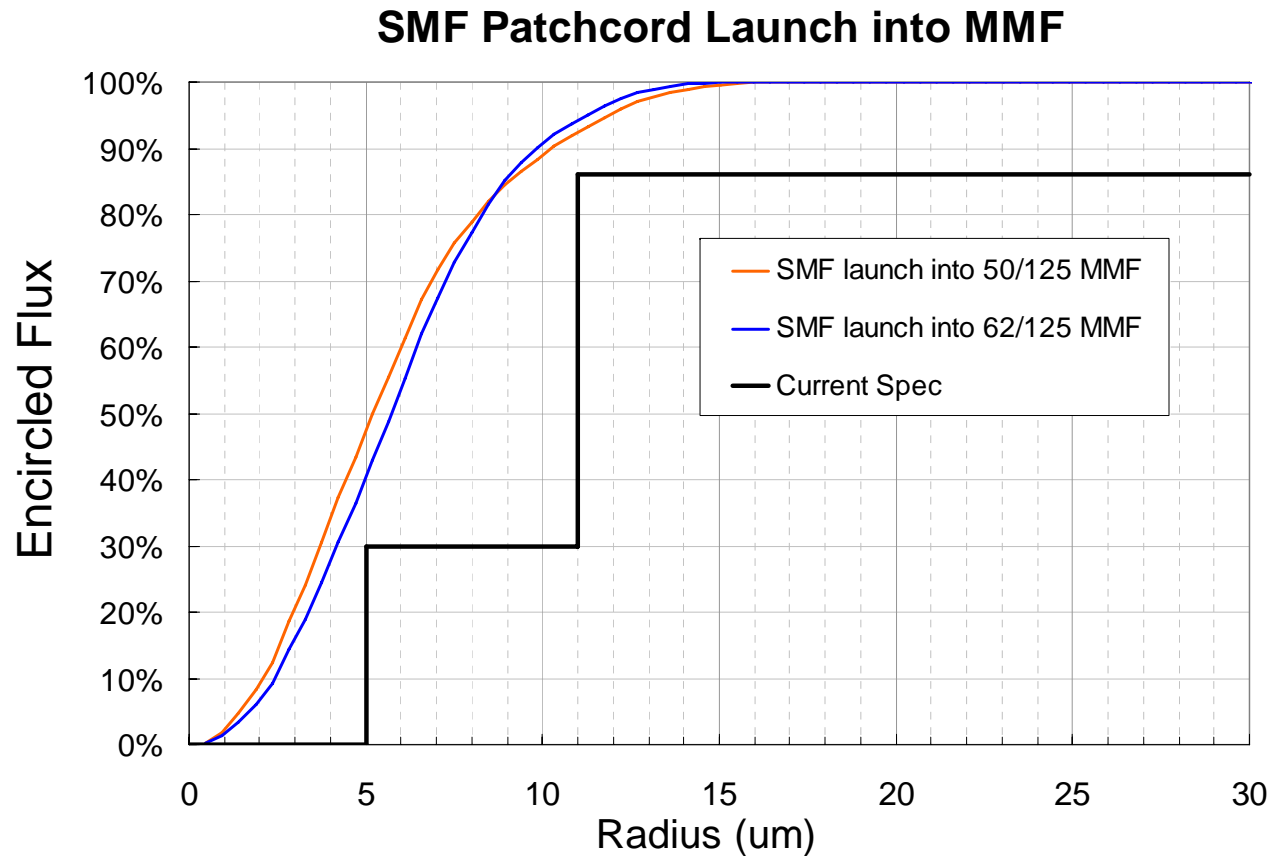
SMF Output Encircled Flux Measurement and Calculation (setup validation)

Comparison of Measured and Calculated SMF EF



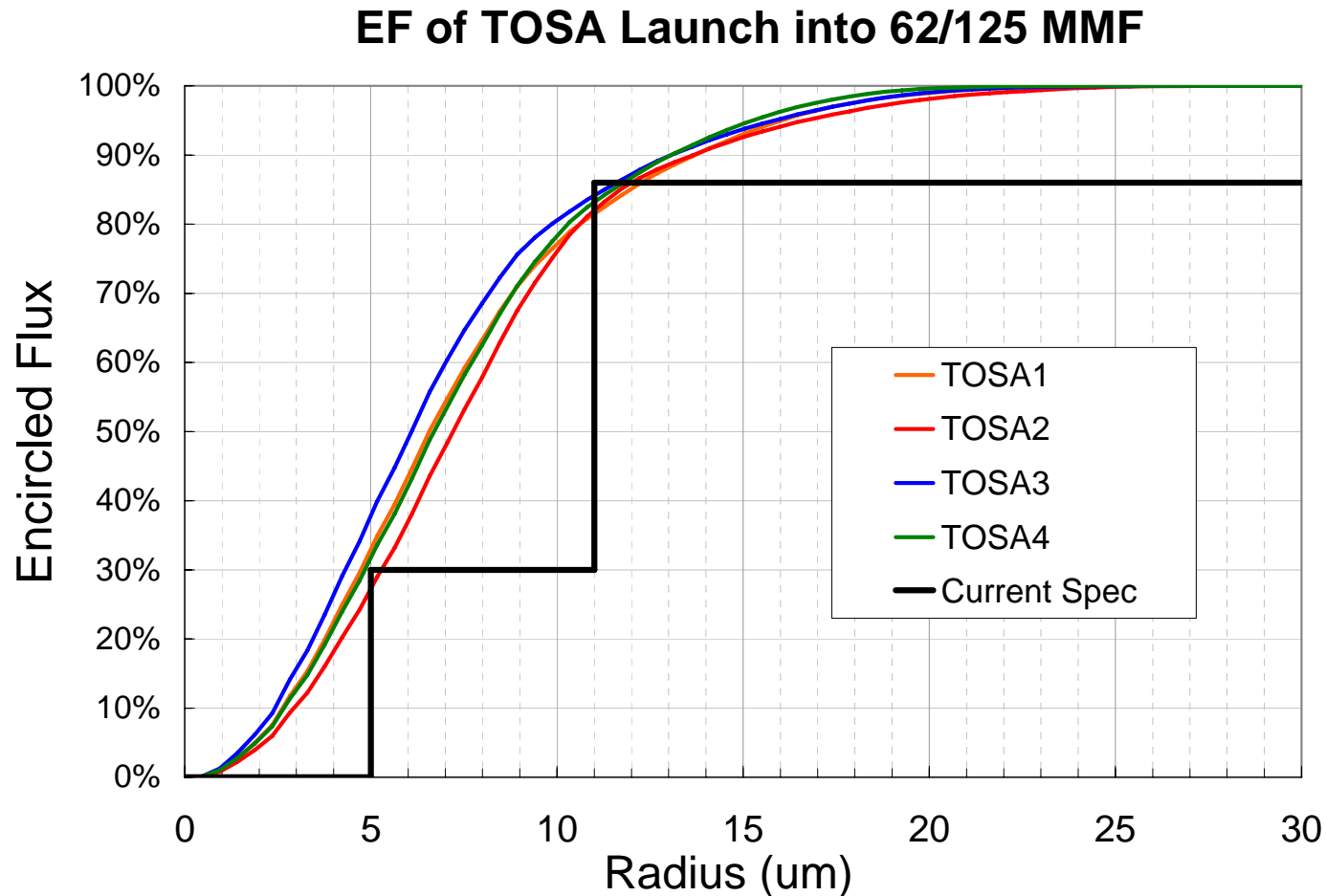
- Measurement of EF from a SMF output, and comparison with calculation assuming Gaussian distribution with 9.2um beam waist.
- Measurement is slightly larger than calculated Gaussian mode.
- Deviation is less than 1um.

Encircled Flux under Ideal Launch Condition



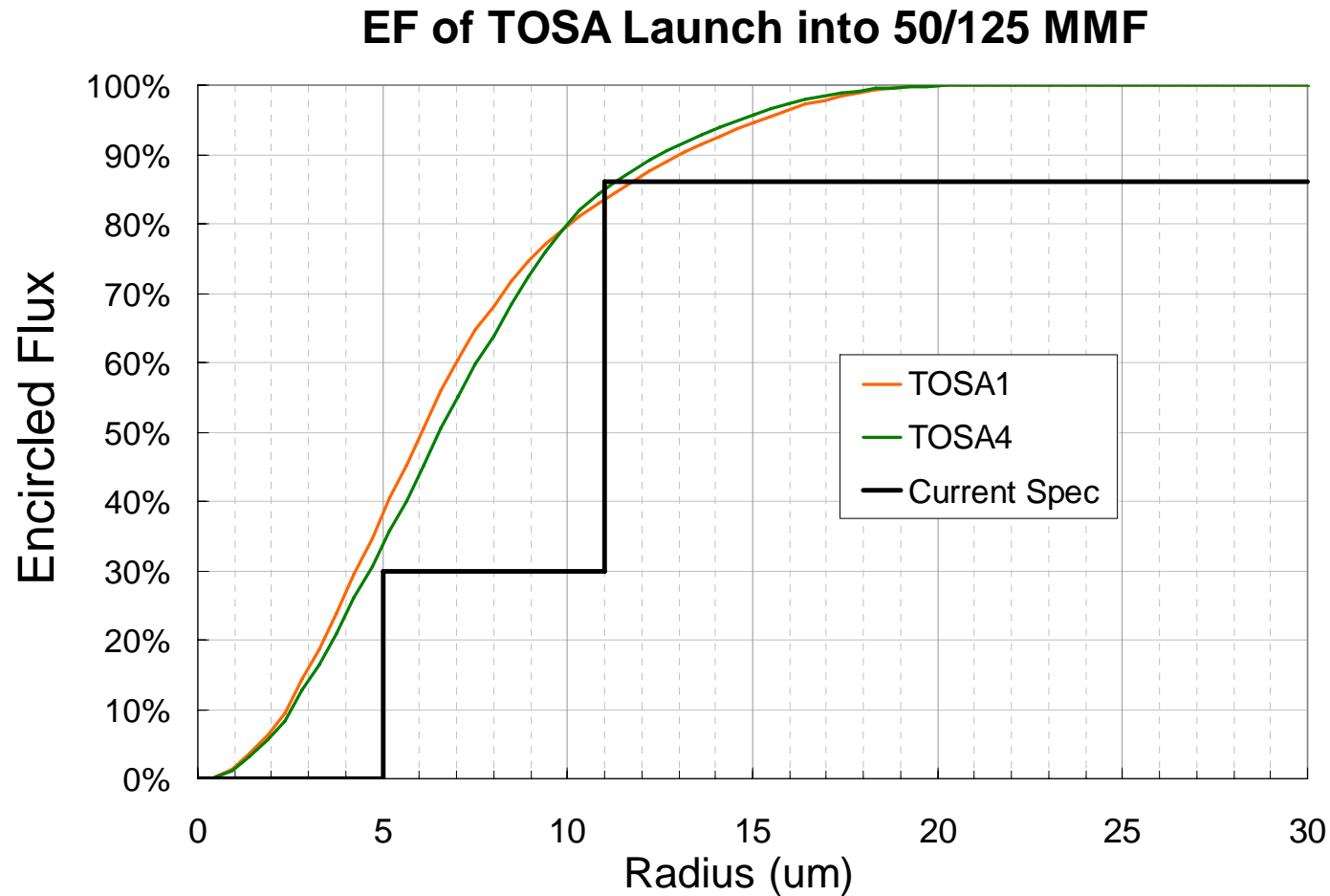
- SMF Patchcord Launch into 50/125, 62/125 Test Setups
- Represents Ideal Launch Case
- Meets current spec:
 - 40 - 45% at 5um
 - 92 - 94% at 11um

Encircled Flux with Direct 62/125MMF Launch



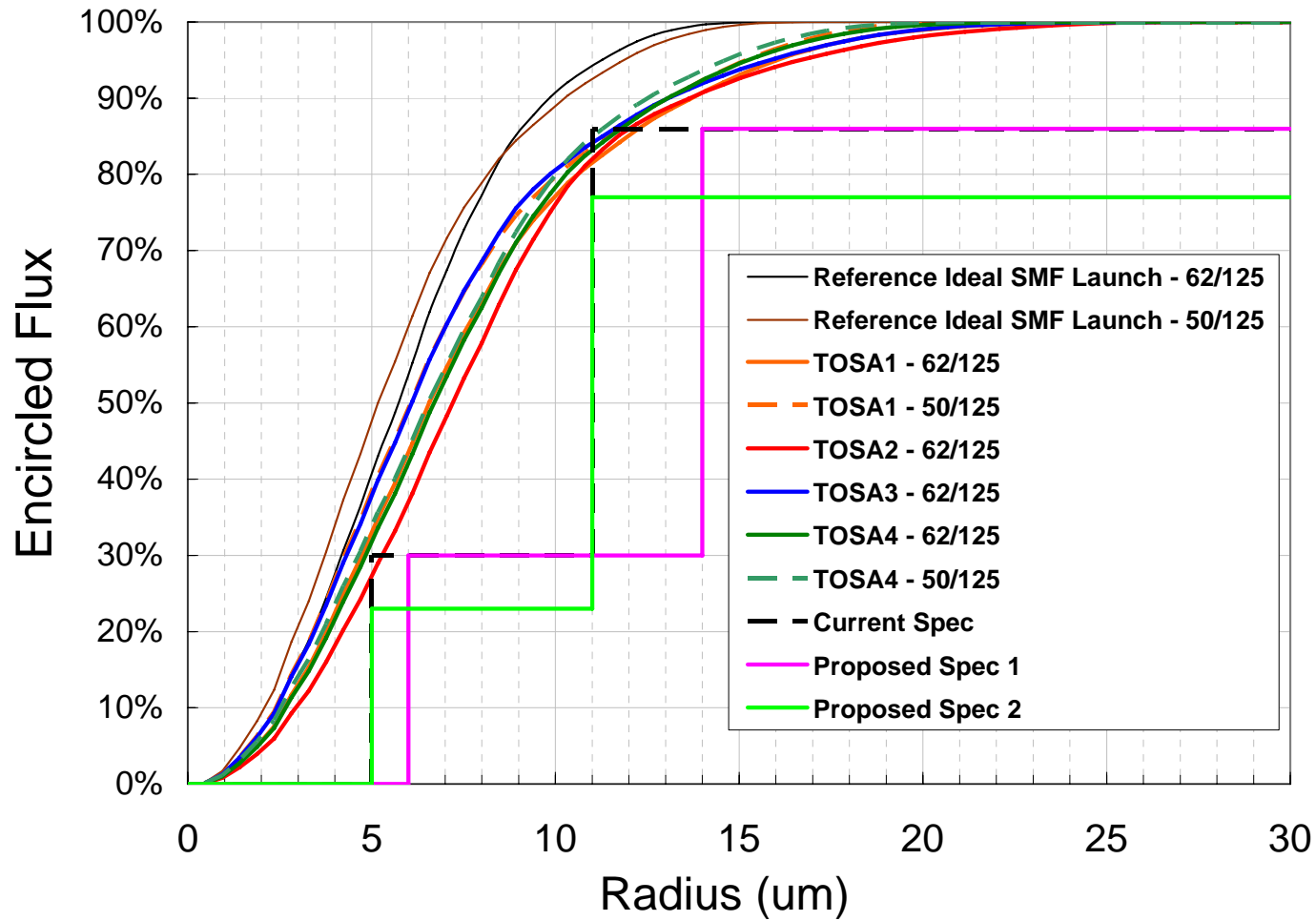
- TOSAs represent a range of alignment qualities.
- Failures at 11 um (81 – 84%), some fail, all marginal at 5 um.

Encircled Flux with Direct 50/125MMF Launch



- Very similar results to 62/125 launch with same TOSAs

Proposed New Encircled Flux Spec (For Both 50/125 and 62/125 Fiber)



- Proposed New EF Limits - Option 1 (preferred):
 - >30% within 6 um Radius / >86% within 14 um Radius
- Proposed New EF Limits - Option 2:
 - >23% within 5 um Radius / >77% within 11 um Radius

Summary and Proposed New EF Limits

- Measurements Made per Referenced IEC procedure on OM1 and OM2
- SMF Measurements Show Spec is Not Impossible, But TOSA Measurements Show Compliance in Direct Launch Would Be Difficult
- Proposed New Encircled Flux Limits:
 - >30% within 6 um Radius (or > 23% within 5um)
 - >86% within 14 um Radius (or > 77% within 11um)
 - From TOSA Yield View, Spec Is Appropriate for Both 50/125 and 62/125 Fiber
- Remaining Questions
 - Does Proposed Relaxation Reasonably Maintain Current Link Model.