

FLAT-TOP FIBERS FOR POWER/BEAM DELIVERY APPLICATIONS

Performances summary

FY18

FLAT-TOP FIBER (FTF) TECHNOLOGY

- Flat-Top fiber technology has been developed since 2014
- First public presentation of the concepts and performances at PW 16 (see references below)
- Near term product launches:

	POWER DELIVERY	BEAM DELIVERY
Core/clad diameters	105/125 → 800/840	300/360 → 600/720
Products available	105/125	Not Available
Products in the pipeline	400/440	TBD

- Key optical performances are summarized
- Technology can be customized for specific application needs

C. Jollivet *et al.*, "Specialty flat-top beam delivery fibers with controlled beam parameter product," SPIE Photonics West 9727-28 (2016)

C. Jollivet *et al.*, "Novel beam delivery fibers for delivering flat-top beams with controlled BPP for high power CW and pulsed laser applications," SPIE Photonics West 9728-74 (2016)

NEW MMF-S105/125-22A (“F” STANDS FOR FLAT-TOP)



Parameters	Min	Max	Nom	Unit	Compliance
Core NA	0.2	0.24	0.22		Measured
Core Diameter	102	108	105	μm	Measured
Clad Diameter	123	127	125	μm	Measured
Core/Clad Offset	0	3		μm	Measured
Coating Diameter	230	260	245	μm	Measured
Long Term Bend Radius	25			mm	Design
Short Term Bend Radius	12			mm	Design
Proof test Level	100	120		kpsi	Measured
Operating Wavelength	700	2200		nm	Design
Flat-Top Technology Verified	1	1			Measured

Comments

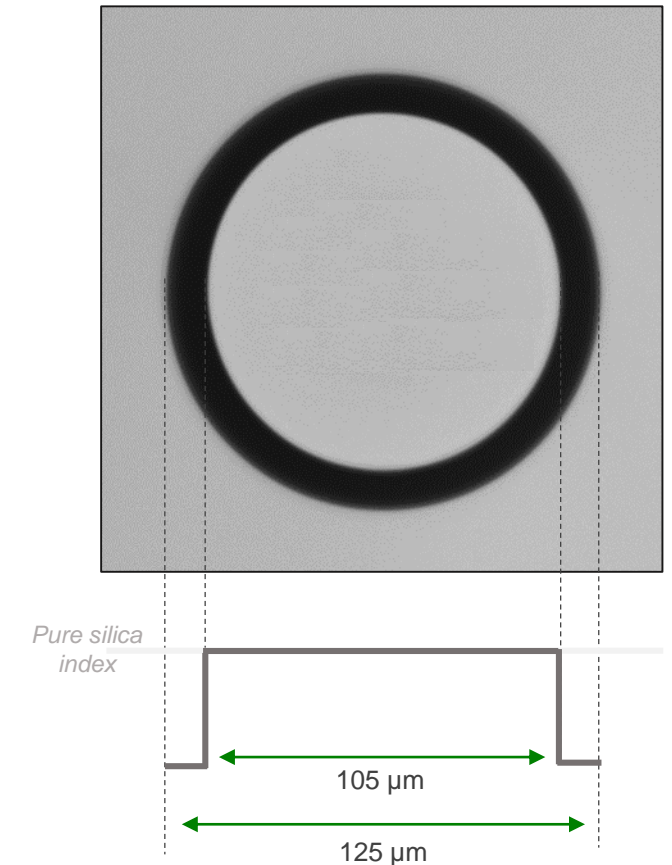
Customer Comments: Core designed with the Flat-Top Technology
Low or High -OH Core: Low
Coating Requirements: UV Cured, Dual Acrylate

Specifications identical to standard MM-S105/125 fibers available today

SPECIFICATION SUMMARY

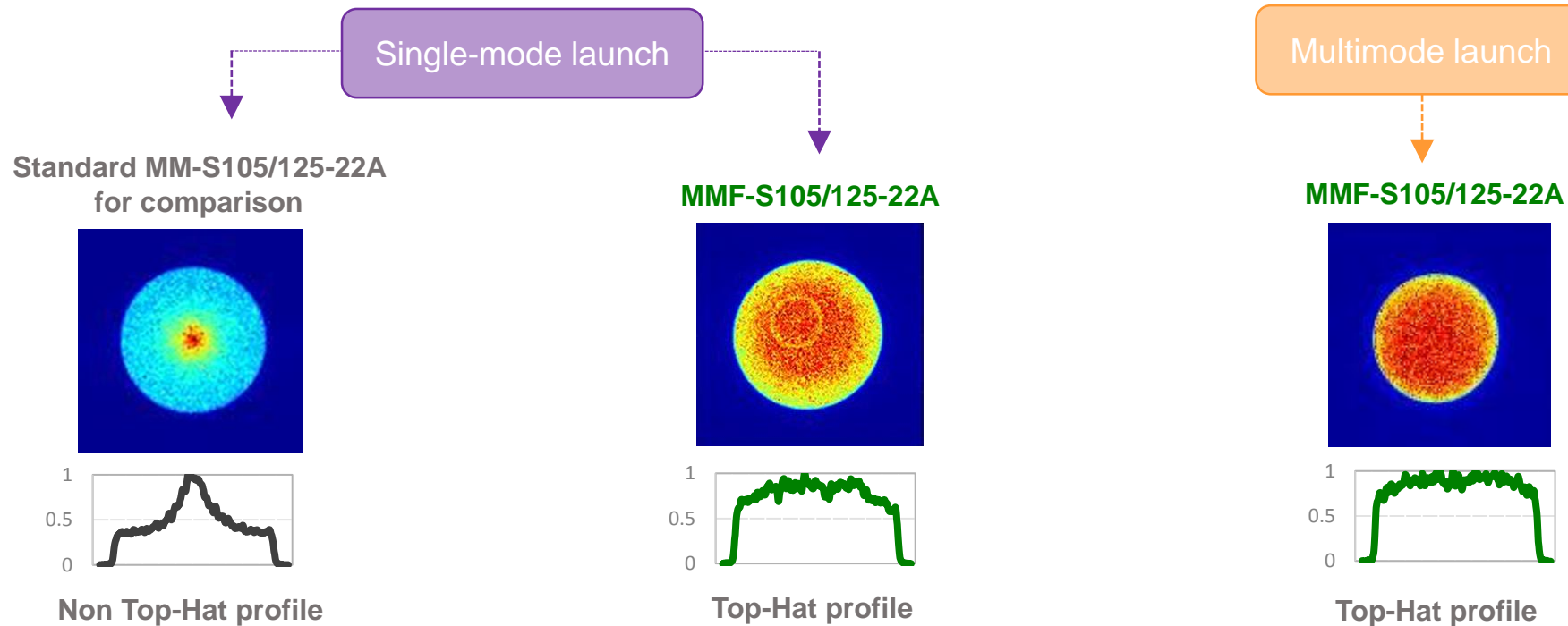
Specifications (nominal)	Current MM-S105/125-22A	NEW MMF-S105/125-22A
Core diameter (μm)	105	105
Core NA	0.22	0.22
Cladding diameter (μm)	125	125
Coating diameter (μm)	245	245
Core design	Pure Silica	Pure Silica + flat-top technology

MMF-S105/125-22A
Facet image



BEAM SHAPING PERFORMANCES (1)

- Effect of the launch conditions: singlemode or multimode beam
 - Measured beam imaged from the output of MMF-S105/125-22A ($\lambda = 1.06 \mu\text{m}$)

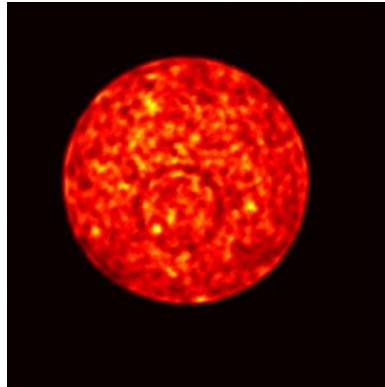


→ The FTF converts both single and multimode launch beams in a homogeneous top-hat beam profile

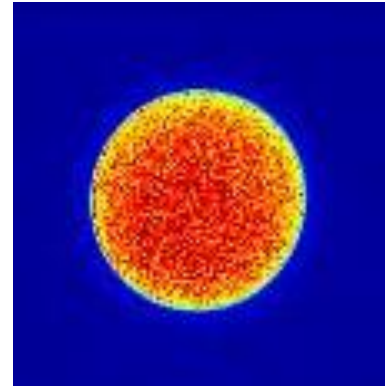
BEAM SHAPING PERFORMANCES (2)

- Effect of the wavelength on the beam
 - Measured beam imaged from the output of MMF-S105/125-22A when using light sources of different wavelengths

$\lambda = 793 \text{ nm}$



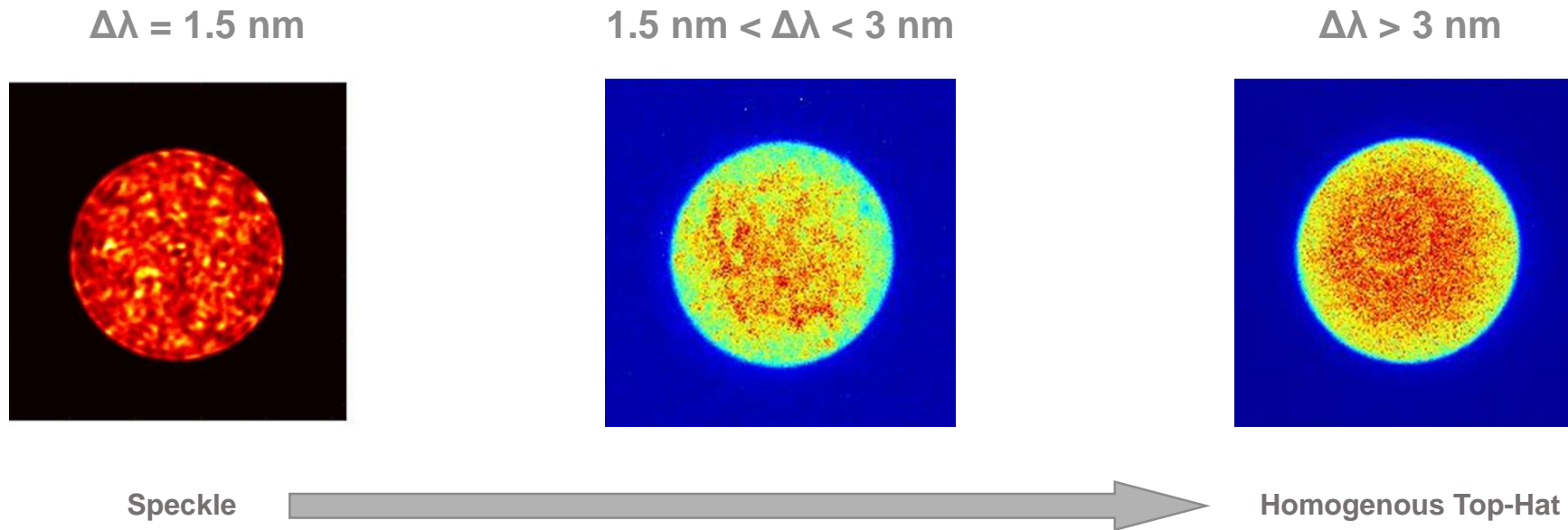
$\lambda = 1.06 \mu\text{m}$



→ The homogeneous top-hat beam profile is obtained for any launch wavelength

BEAM SHAPING PERFORMANCES (3)

- Effect of the light source linewidth:
 - Measured beam imaged from the output of MMF-S105/125-22A when using light sources of different linewidth



→ The homogeneity of the top-hat beam reduces as the linewidth of the light source decreases

SUMMARY

- Flat-top technology has been demonstrated. Product designs and processes have been optimized for commercialization.
- MMF-S105/125 is the first of a series of products to be launched in the coming months.
- These unique fibers have the ability to convert SM & MM inputs to top-hat outputs.
 - Technology is applicable to a broad range of wavelengths
 - Top-hat doesn't mean speckle free
 - Broader linewidths reduce speckle
- Performances can be application dependent. Our technical team is glad to provide application support.