

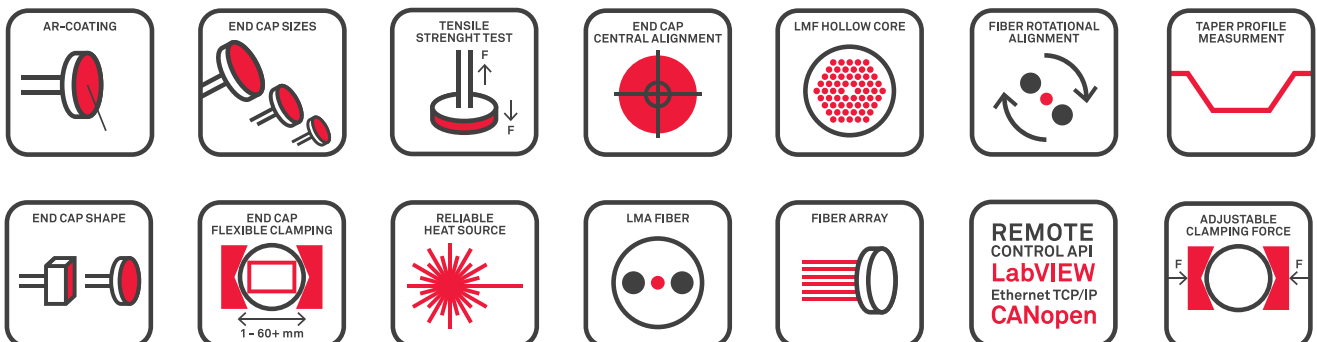
SMARTSPLICER™

SMARTSPLICER™

CO₂ laser system for fiber splicing and glass processing

- For cladding diameters up to 2.5 mm
- User friendly design with intelligent tool holders
- New viewing window to watch during processing
- Autofocus cameras reduces operator involvement
- Patent pending Axicon Splicing™ optical beam shaping technology for uniform and highly precise annular laser power distribution
- Vertical operation for Gravity Splicing™
- No consumables such as process gas, filaments or electrodes needed
- Run camera views separately allowing one monitor to control process and the other to watch the process
- Contamination-free and reliable splicing
- High process reproducibility, real-time process control
- High mechanical strength of splice connections
- No maintenance and calibration of heat source (advantage against electrodes and filaments)
- No gases or compressed air needed
- Splicing single or multiple fiber to end caps up to 60+ mm diameter
- End cap splice of a large variety of diameters (1- 60+ mm)
- For fiber to fiber splicing cladding diameters from 125µm to 2.5 mm
- Splicing of fiber arrays
- End caps for beam delivery
- Manufacturing of ball lenses
- Splicing of thin fibers with large end caps
- Splicing of AR-coated end caps
- PC-based real-time controller with windows interface
- Recording and control of process data
- Easy export and evaluation of process data, pictures and videos

SPECIFIC AREAS OF USAGE:



SMARTSPLICER™

CO₂ laser system for fiber splicing and glass processing



APPLICATION

- PCF, Hollow core, Multi core fibers, LMA
- AR-coated fibers and end caps
- Beam delivery splicing / coupling
- High power applications
- Fiber lasers and amplifier manufacturing
- Diode lasers
- Industrial, R&D, Scientific, Astronomy, Optical metrology, Photonics, Medical, Telecom
- Quantum technology, Directed Energy
- Laser material processing

The SMARTSPLICER™ is an advanced laser fusion splicing and glass processing system designed for the production of high power and sensitive photonics components of various kinds. It features a powerful and clean laser heat source which enables completely contamination free and localised glass melting and shaping with low maintenance requirements and no need for consumables such as process gas, filaments or electrodes.

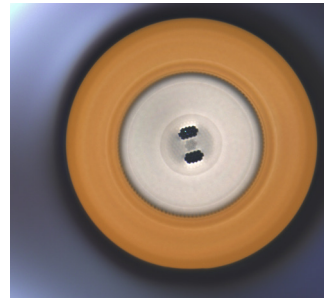
Precision beam shaping optics – based on the patent pending Axicon Splicing™ technology – converts the CO₂ laser beam into an annular shape that spans the geometry of the fiber or optical component under processing. This way optical power is distributed symmetrically and evenly to the defined processing area.

The diameter of the laser ring can be controlled by software along with other vital process parameters. This makes the SMARTSPLICER™ easy to configure and optimise for different fiber diameters and glass processing operations. These include splicing of single and multimode fibers as well as gradient index and photonic crystal fiber, fiber to end-cap splicing, tapering and the manufacturing of high power fiber laser components such as mode field adapters and pump combiners.

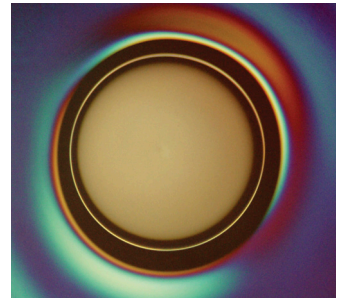
A highly stable fiber translation and alignment system, along with precision optics and mechanics, ensures consistency and reproducibility of production results and gives the user the capability to undertake the most challenging glass processing operations.

The system can be operated in either horizontal or vertical orientation. In vertical orientation the force of gravity facilitates processes such as tapering and lensing. Intelligent tool holders allow the machine to be customised for user specific applications.

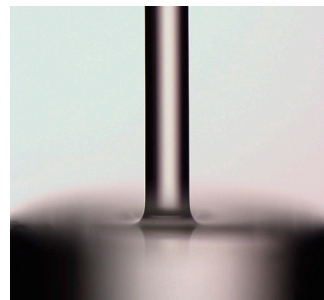
The optical system of the SMARTSPLICER™ has been designed by Fraunhofer IOF of Jena, Germany. This cooperation with a leading research institute that has a broad expertise in optics and precision mechanics has enabled the industrial realisation of splicing and glass processing methods that are at the international forefront of technology.



PCF / END CAP SPLICING



END CAP SPLICING

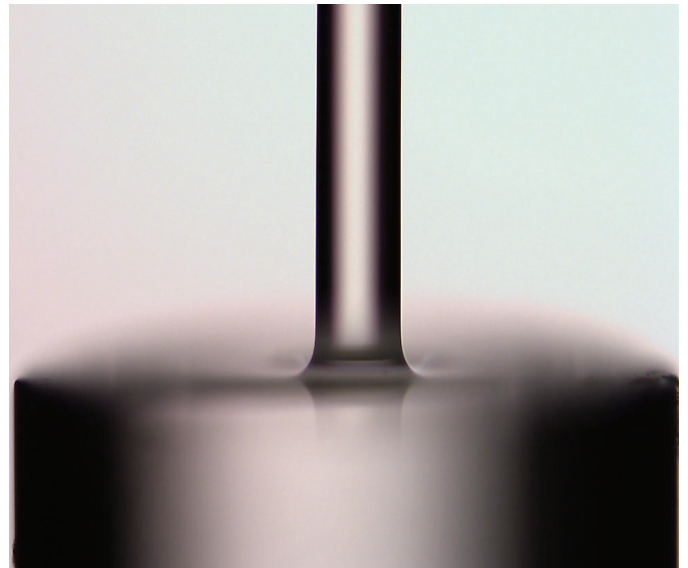
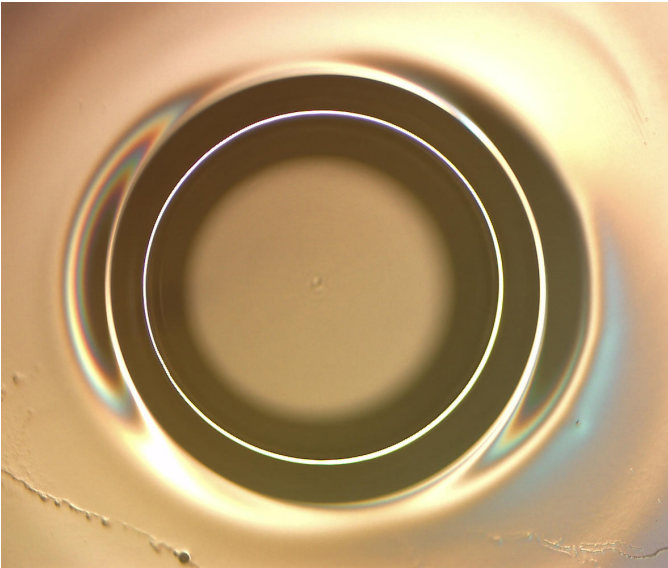


END CAP SPLICING


MULTI FIBER END CAP SPLICING
to end caps for Directed Energy &
Fiber Array splicing


SPECIFICATIONS FOR SMARTSPLICER

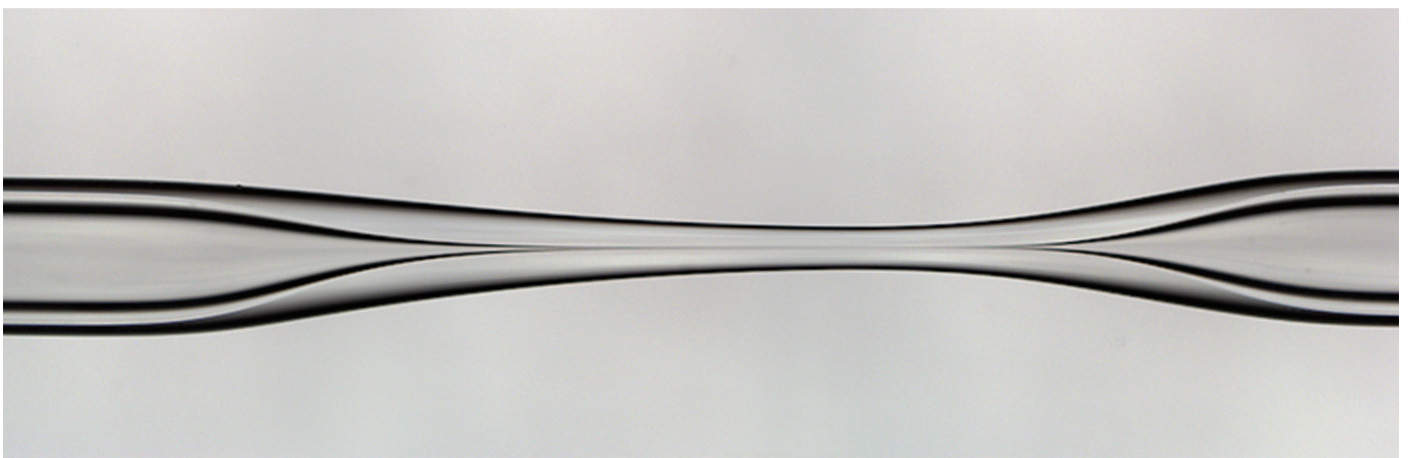
Heating Source	Ring formed CO ₂ laser beam
Laser Safety	Emergency laser cut off Class 1 laser system Optional configured to Class 4
Laser Beam Shaping	Laser ring focus and diameter directly controllable by operator
Laser Beam Control	High power stability Optional feedback system can be equipped
Applicable Fiber Diameter	80 µm to 2500µm
Typical Splice Loss	<0.1 dB
Typical Splice Strength	Same as original material
Applicable End Cap Diameter	1 to 60+mm
Cameras	Two side view cameras for aligning processes Field of view: 2.68 mm horizontal & 3.56 mm vertical Optional bottom view camera for end cap alignment Optional end view camera for PM and PCF fiber alignment
Measurement capabilities	Measurement of processes and final component with cameras Force sensors for process control Optional additional measurement equipment
Tool Holders	NYFORS fiber holders (optional) End cap holders (optional) Rotators for PM or PCF fibers (optional)
X/Y stage resolution	0,02 µm
Maximum Z travel Length	180+ mm
Z Travel resolution	0,4 µm (optional 0,025µm)
Maximum Taper Ratio	1:10
Taper speed	Typically 2 mm/sec
Device Control	Complete control with built in computer and specialized software USB connection Optional Network capabilities Optional PCI-express cards
Electric Power	100 - 240 VAC



End-cap splicing

The SMARTSPLICER™ is a versatile tool for end-cap splicing. The picture to the right above shows a high resolution photograph showing a typical multimode fiber to end-cap

splice done with Axicon Splicing™ technology. To the left is a microscopic view of a fiber to end-cap splice. The closed double ring shows a closed fillet weld implying a high mechanical strength. *Photo courtesy of Fraunhofer IOF.*



Tapering, glass processing

The photograph shows a tapered capillary with collapsed center. Tapering of capillaries is important for making fiber bundles and different fiber combiners. *Photo courtesy of Fraunhofer IOF.*

Accessories for SMARTSPLICER					
Fiber holder	Type	Cladding diameter	Article number	Article description	
	Mini-holder	80µm		Fiber holder, 80µm	• •
	Mini-holder	125µm		Fiber holder, 125µm	• •
	Mini-holder	155µm		Fiber holder, 155µm	• •
	Mini-holder	180µm		Fiber holder, 180µm	• •
	LD-holder	250µm		Fiber holder, 250µm, LD	• •
	LD-holder	300µm		Fiber holder, 300µm, LD	• •
	LD-holder	350µm		Fiber holder, 350µm, LD	• •
	LD-holder	400µm		Fiber holder, 400µm, LD	• •
	LD-holder	480µm		Fiber holder, 480µm, LD	• •
	LD-holder	550µm		Fiber holder, 550µm, LD	• •
	LD-holder	660µm		Fiber holder, 660µm, LD	• •
	LD-holder	770µm		Fiber holder, 770µm, LD	• •
	LD-holder	800µm		Fiber holder, 800µm, LD	• •
	LD-holder	850µm		Fiber holder, 850µm, LD	• •
	LD-holder	900µm		Fiber holder, 900µm, LD	• •
	LD-holder	1000µm		Fiber holder, 1000µm, LD	• •
	LD-holder	1100µm		Fiber holder, 1100µm, LD	• •
	LD-holder	1200µm		Fiber holder, 1200µm, LD	• •
	LD-holder	1550µm		Fiber holder, 1550µm, LD	• •
	LD-holder	1850µm		Fiber holder, 1850µm, LD	• •
	LD-holder	2100µm		Fiber holder, 2100µm, LD	• •
	LD-holder	2500µm		Fiber holder, 2500µm, LD	• •

Endcap holder	Type	Endcap diameter	Article number	Article description	
	Endcap	1mm		Endcap holder, 1mm	• •
	Endcap	1,8mm		Endcap holder, 1,8mm	• •
	Endcap	2mm		Endcap holder, 2mm	• •
	Endcap	3mm		Endcap holder, 3mm	• •
	Endcap	4mm		Endcap holder, 4mm	• •
	Endcap	5mm		Endcap holder, 5mm	• •
	Endcap	6mm		Endcap holder, 6mm	• •
	Endcap	8mm		Endcap holder, 8mm	• •
	Endcap	10mm		Endcap holder, 10mm	• •
	Endcap	12mm		Endcap holder, 12mm	• •
	Endcap	15mm		Endcap holder, 15mm	• •
	Endcap	16mm		Endcap holder, 16mm	• •
	Endcap	20mm		Endcap holder, 20mm	• •
	Endcap	0,25in		Endcap holder, 0,25in	• •
	Endcap	0,5in		Endcap holder, 0,5in	• •
	Endcap	1,8-65mm		Chuck 1,8-65mm	• •
	Endcap	1in		Special Endcap holder, 1in	• •
	Endcap	2in		Special Endcap holder, 2in	• •

Fiber end-face alignment	Type	Article number	Article description	
	Rotational unit top		Fiber rotator for the top holder	• •
	Rotational unit bottom		Fiber rotator for the bottom holder	• •
	Extendable end-face mirror arm		Mirror arm for fiber end-face inspection	• •
	Prealignment rotator		External pre-alignment unit for fiber rotational alignment	• •

Accessories	Type	Article number	Article description		
	Water chiller (EU)		Recirculating water chiller for cooling the laser, for EU	•	•
	Water chiller (US)		Recirculating water chiller for cooling the laser, for USA	•	•
	End view camera		Camera for bottom view (view through Endcap)	•	•
	Endcap tool holder		For holding the Endcap stages and the Chuck	•	•
	Top tool holder		For holding the top fiber holder	•	•
	Bottom fiber holder		Fiber holder stage bottom	•	•
	Small Endcap stage		Stage for Endcap holders between 1-12mm	•	•
	Large Endcap stage		Stage for Endcap holders between 12-20mm	•	•
	Multi fiber endcap stage		Endcap holder for multi-fiber splicing	•	•
	Combiner speed loader		For preparing combiners / fiber bundles	•	•
	Absolute positioning mirror mounts		Stable mirror positions for laser beam alignment	•	•
	Fiber cleaving unit		Integrated fiber cleaving	•	•