



Changing the technology, one fiber at a time...



Over 20 years of service to the Photonics Industry

LaseOptics: Laser Applications in Science & Engineering with Fiber Optics



Lensed & Tapered Fibers Production Capabilities

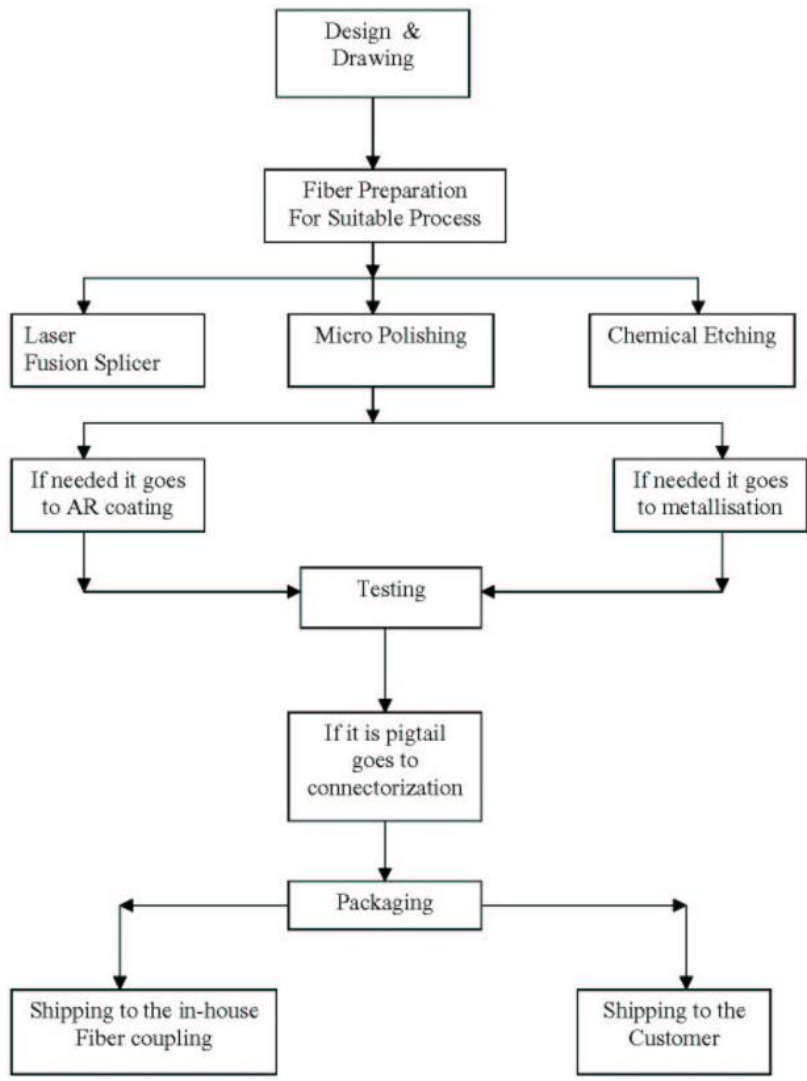
Papers Published using by Our Lensed Fibers

Presentation

We make Custom Lensed Fibers Assemblies



LaseOptics Lensed Fibers- Flow Chart



Types of Fibers:
 Corning, Nufern, and Fiber Core Fibers. Custom Fiber

Single Mode: SMF-28, 405-HP; 460-HP; 630-HP; 780-HP, 980-HP, 1060-HP; & SM 2000

Multi Mode: GI 50/125; 62.5/125; SI 105/125; 200/240; 300/330; 400/440/; 600/630

Polarization Maintaining (PM) Fibers: PM-1550, PM-980; PM780-HP; PM630-HP; PM405-HP

Plastic Optical Fibers:



LaseOptics Lensed Fibers Used by Different Institutes and Scientists and Engineers in Worldwide and Published Papers.

[Paper-LaseOptics-Lensed-Fiber-Used-Soton-UK-Highlighted-3P.pdf](#)

<https://eprints.soton.ac.uk/363177/1/6120.pdf> (3.1-Line 4)

[Paper-LaseOptics-Lensed-Fiber-Used-CalTech-Paper-Thesis-Highlighted-149P.pdf](#)

https://thesis.library.caltech.edu/10087/57/20170529_KRF_Thesis_Ch7.pdf (7.3.2; 7.4 Fig Line 2)

[Paper-LaseOptics-Lensed-Fiber-Used-By-Masdar-Institute-2016-Highlighted-14P-15P.pdf](#)

<https://opg.optica.org/oe/fulltext.cfm?uri=oe-24-11-11611&id=340803> (4.3. Line 4)

[Paper-LaseOptics-Lensed-Fiber-Used-By-NIH-Goverment-2020-Highlighted-14P.pdf](#)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7532020/>

[Paper-LaseOptics-Lensed-Fiber-Used-By-OSTI-Goverment-2019-Highlighted-7P.pdf](#)

[Paper-Thesis-LaseOptics-Lensed-Fiber-Used-By-MiddleEast-Uni-Tech-2019-30P-77P.pdf](#)

[Paper-LaseOptics-Lens-fio-2016-jth2a-63-HighLighted.pdf](#)

[Paper-LaseOptics-MM-Conical-Lensed-Fiber-Used-By-B-PhoT-2018.pdf](#)



LaseOptics Lensed Fibers Used by Different Institutes and Scientists and Engineers in Worldwide and Published Papers.

DESIGN AND DEVELOPMENT OF FIBER OPTIC MEMS MICROPHONE MEASUREMENT SYSTEM

<https://etd.lib.metu.edu.tr/upload/12623979/index.pdf>

[Optical Fiber Sensors for Biomedical Applications \(yumpu.com\)](https://www.yumpu.com)

In-Hand Object Recognition with Innervated Fiber Optic Spectroscopy for Soft Grippers (nsf.gov)

[https://par.nsf.gov/servlets/purl/10374030.](https://par.nsf.gov/servlets/purl/10374030)

Down-scaling grating couplers and waveguides in single-crystal diamond for VIS-UV operation

<https://iopscience.iop.org/article/10.1088/2515-7647/aaea7d/pdf>

Bragg-grating-stabilised external cavity lasers in optical fiber and integrated planar silica-on-silicon circuits

<https://eprints.soton.ac.uk/363177/1/6120.pdf>

A microfluidic flow analyzer with integrated lensed optical fibers

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7532020/>

MICROANGELO SCULPTING: WAVEGUIDE FABRICATION

https://thesis.library.caltech.edu/10087/57/20170529_KRF_Thesis_Ch7.pdf

LaseOptics Lensed Fibers Used by Different Institutes and Scientists and Engineers in Worldwide and Published Papers.



Fabrication of a phase photon sieve on an optical fiber tip by focused ion beam nanomachining for improved fiber to silicon photonics waveguide light coupling

[\(PDF\) Fabrication of a phase photon sieve on an optical fiber tip by focused ion beam nanomachining for improved fiber to silicon photonics waveguide light coupling \(researchgate.net\)](#)

Fiber-based interferometer for optical field reconstruction

<https://www.osti.gov/servlets/purl/1765530>

https://books.google.com/books?id=ZjhGDgAAQBAJ&pg=PA194&lpg=PA194&dq=LaseOptics+lensed+fibers&source=bl&ots=KZ0kWF04IR&sig=ACfU3U2Ix_Mf-wZOov_9zIBHMeeHxmyZ9A&hl=en&sa=X&ved=2ahUKEwjBypD0m4eFAxVYFFkFHV-xBdI4MhDoAXoECAUQA#w=onepage&q=LaseOptics%20lensed%20fibers&f=false

Micro-hyperboloid lensed fibers for efficient coupling from laser chips

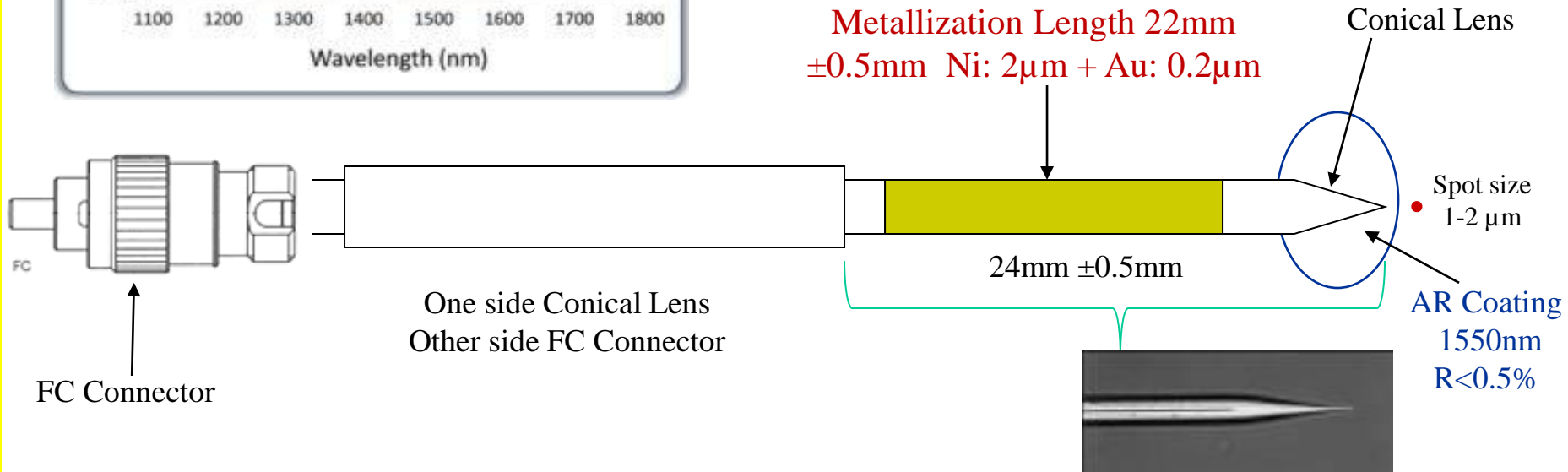
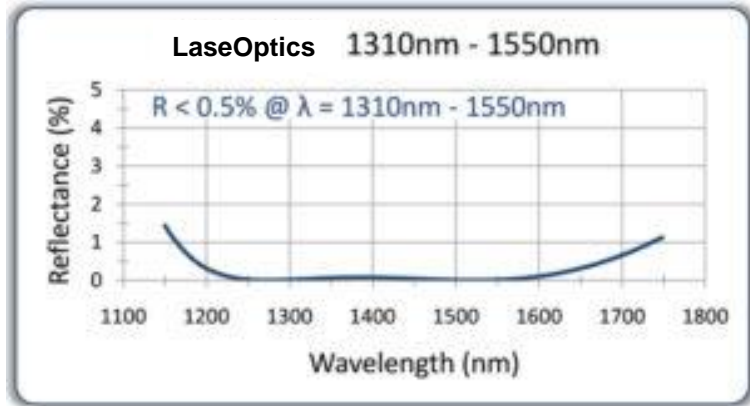
<https://opg.optica.org/oe/fulltext.cfm?uri=oe-25-20-24480&id=373719>

Evaluation of lensed fibers used in photodynamic therapy (PDT)

<https://www.sciencedirect.com/science/article/abs/pii/S1572100020302787>

[POSSIBLE LENSING SCHEMES FOR FIBER-OPTIC COUPLING IMPROVEMENT 8Vol96No9.pdf \(jatit.org\)](#)

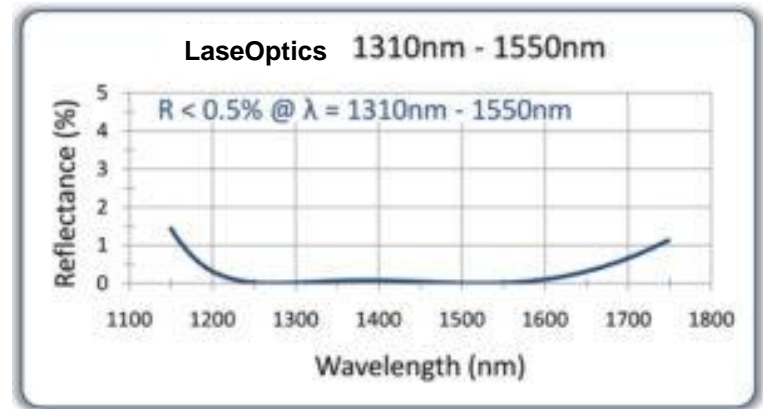
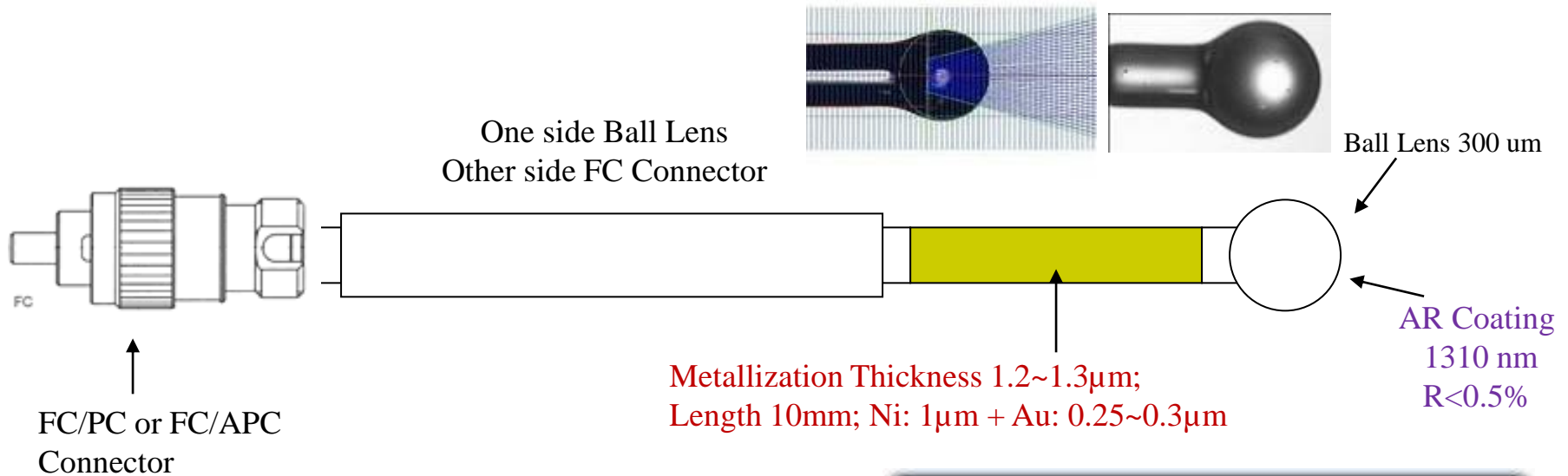
Conical Lensed Fibers SMF-28 Fiber for Metallization & 1550nm AR Coating



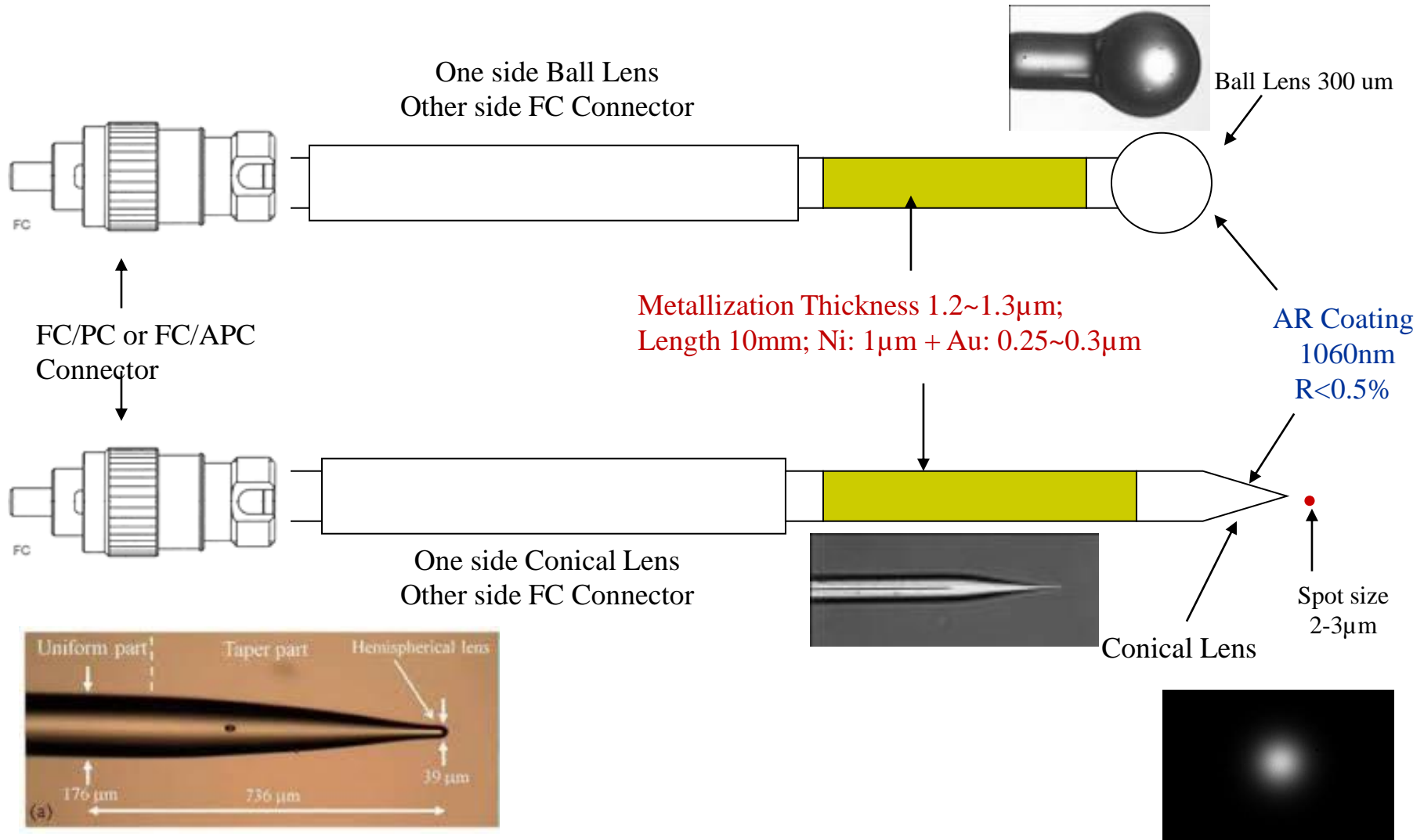
- Option 1: We can make lens on **bare fiber** like 9/125/250 fiber without connector
- Option 2: We can make 9/125/900 μm **tight buffer** without connector
- Option 3: We can make above any options with **any connector** FC/PC or FC/APC



Ball Lensed Fibers SMF-28 with 1310nm AR coating and Metallization

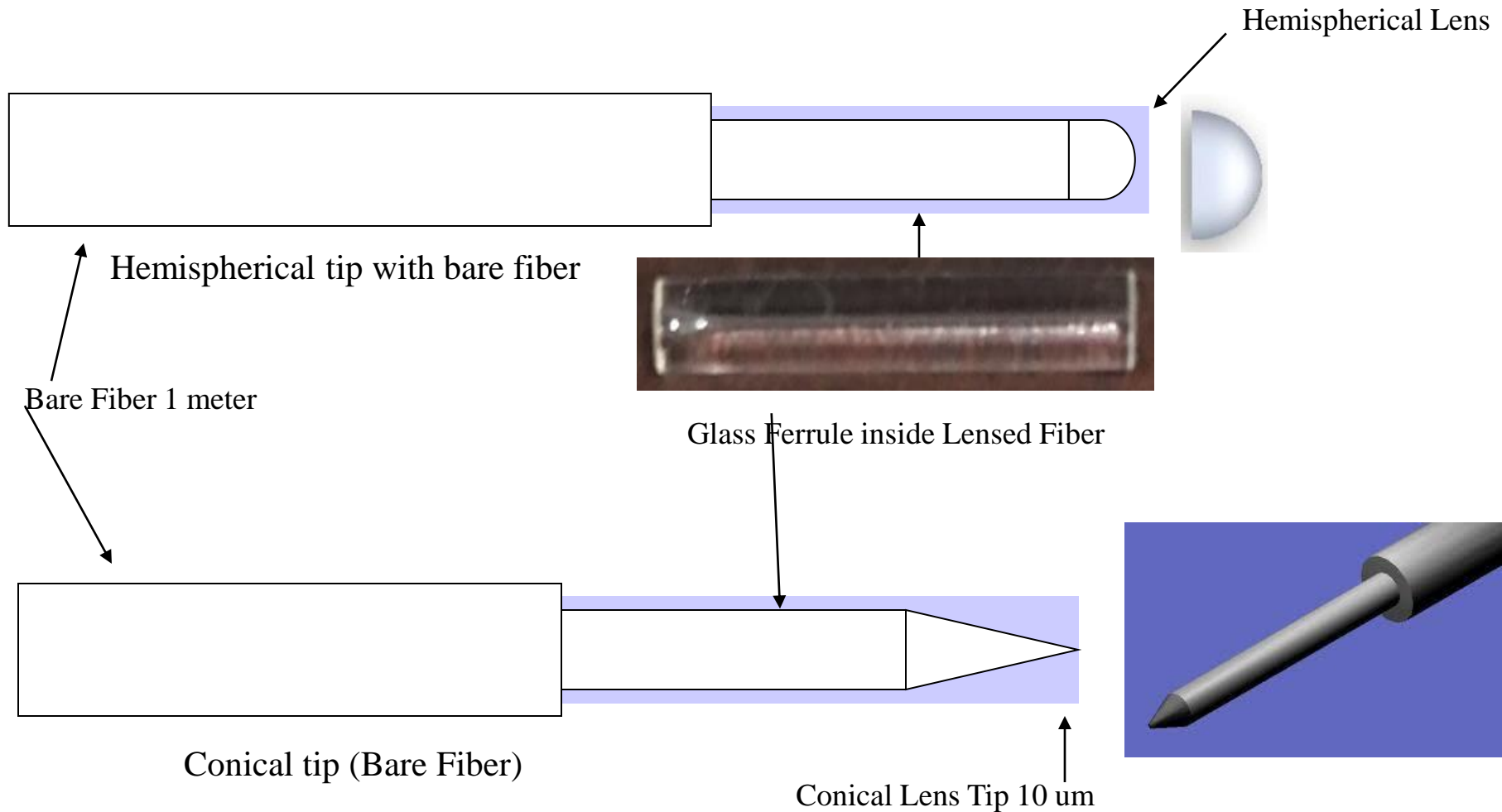


Ball & Conical Lensed Fibers of 1060-XP with AR coating and Metallization





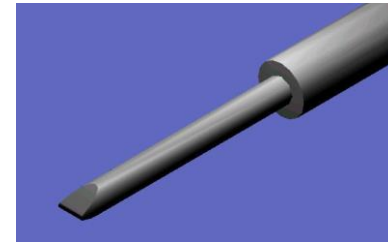
Hemispherical & Conical Lensed Fibers of 780-HP Fiber with Glass Ferrule 1.8mm OD & 13mm Long for Water Application



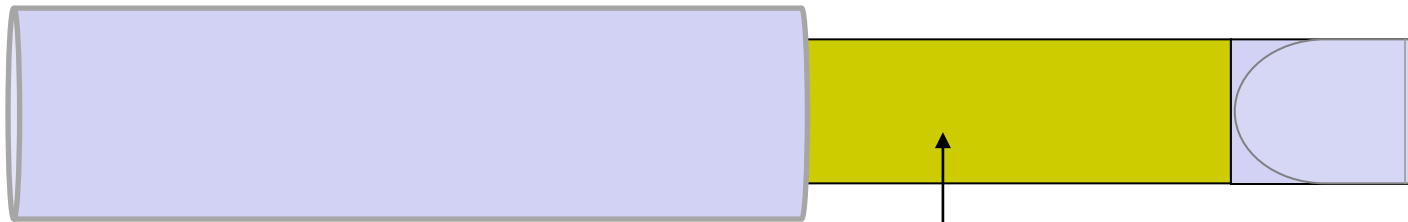


Wedged/Chisel Lensed Fibers with Metallization

Wedged/Chisel (**Screwdriver**) Lensed Fiber
(Bare Fiber) SMF-28: 9/125/250

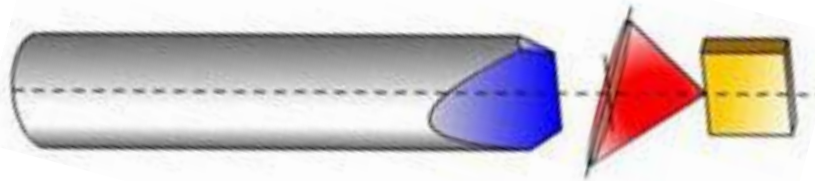


Lens Tip
thickness $2\mu\text{m}$

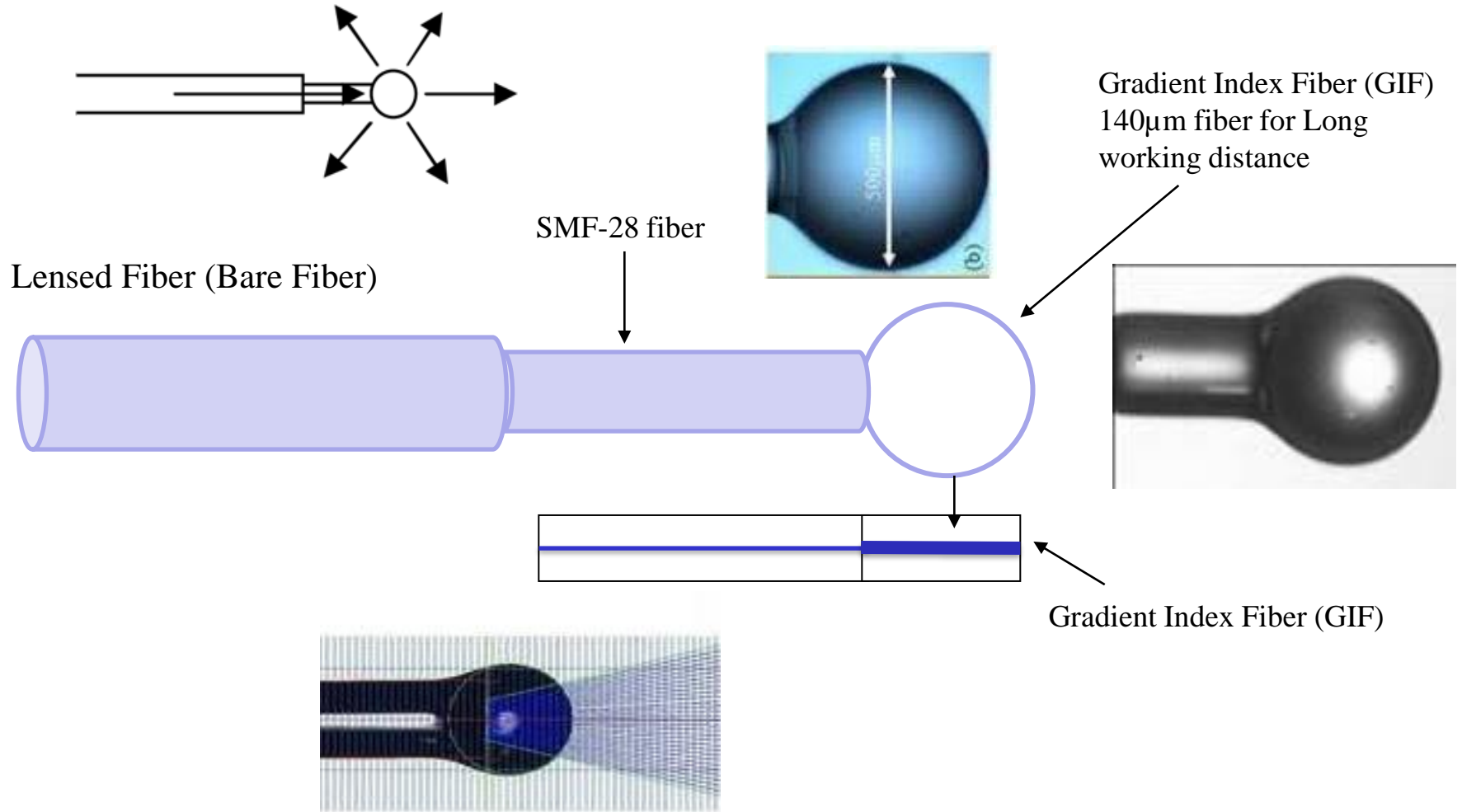


Metallization: Ni: $2\sim 3\mu\text{m}$ + Au: $0.1\sim 0.2\mu\text{m}$
7mm length

Bare Fiber
1 meter length

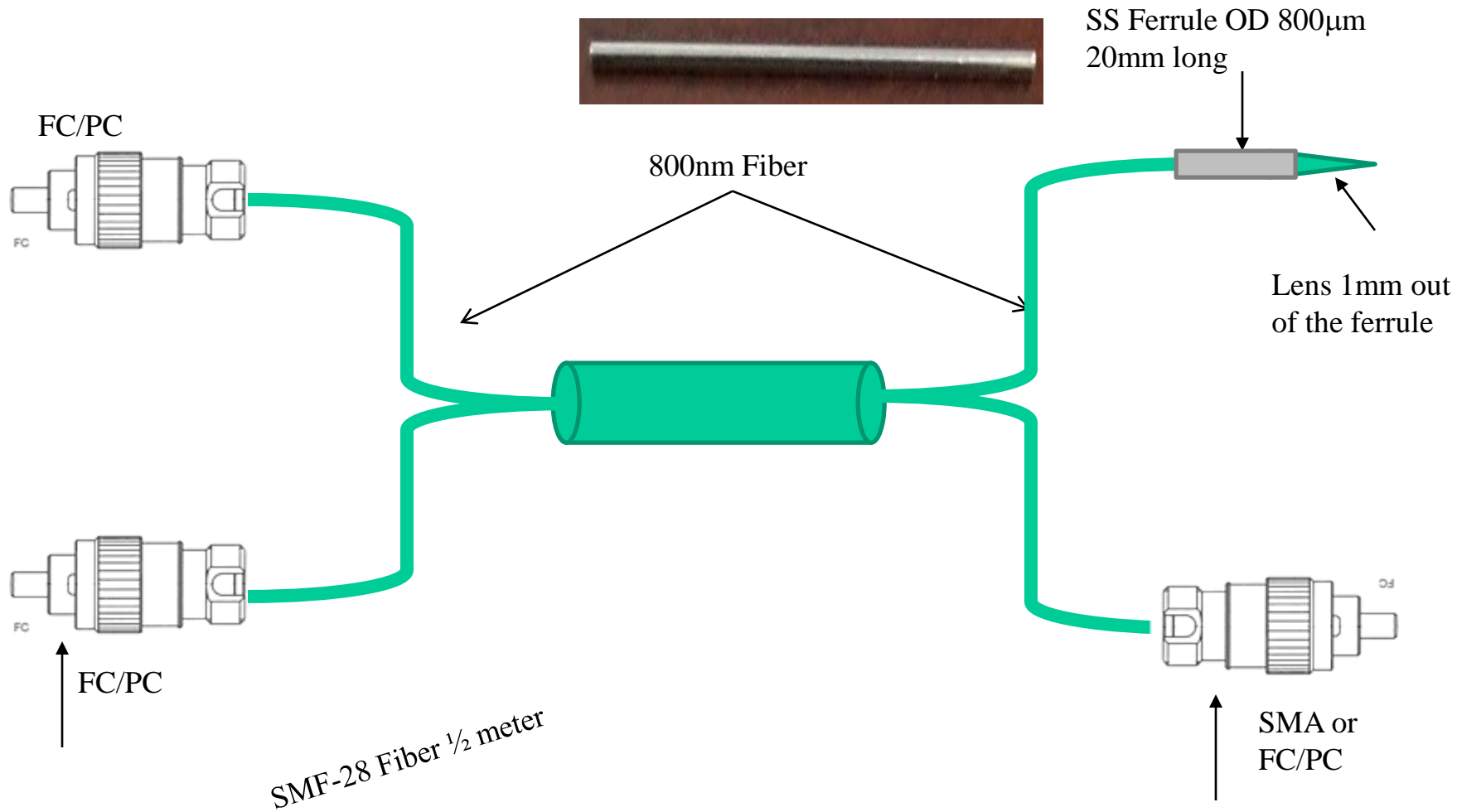


SMF-28 fiber with GIF Fiber tip with Ball Lens for Long Working Distance



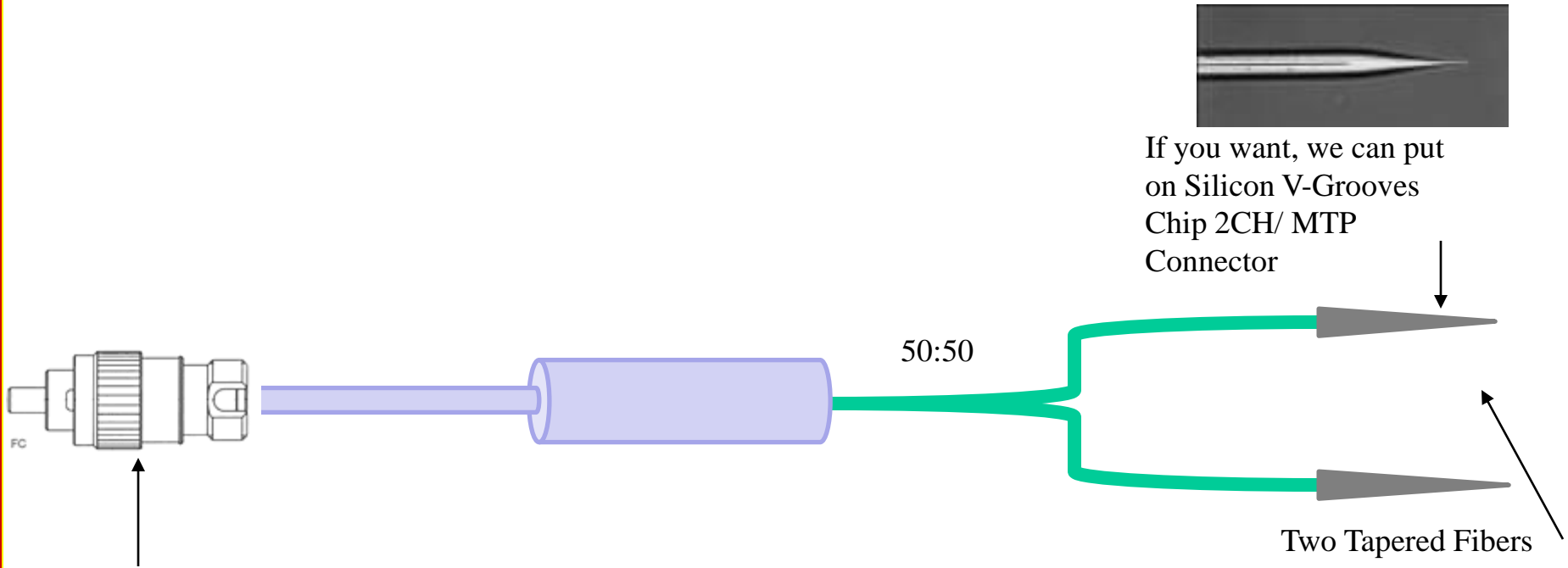


800nm 2x2 couple with One Terminal Lensed fiber with Ferrule

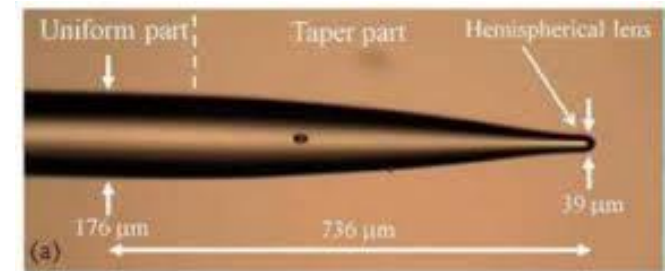




Single Mode Lensed Fiber Coupler (1 x 2) FC/PC

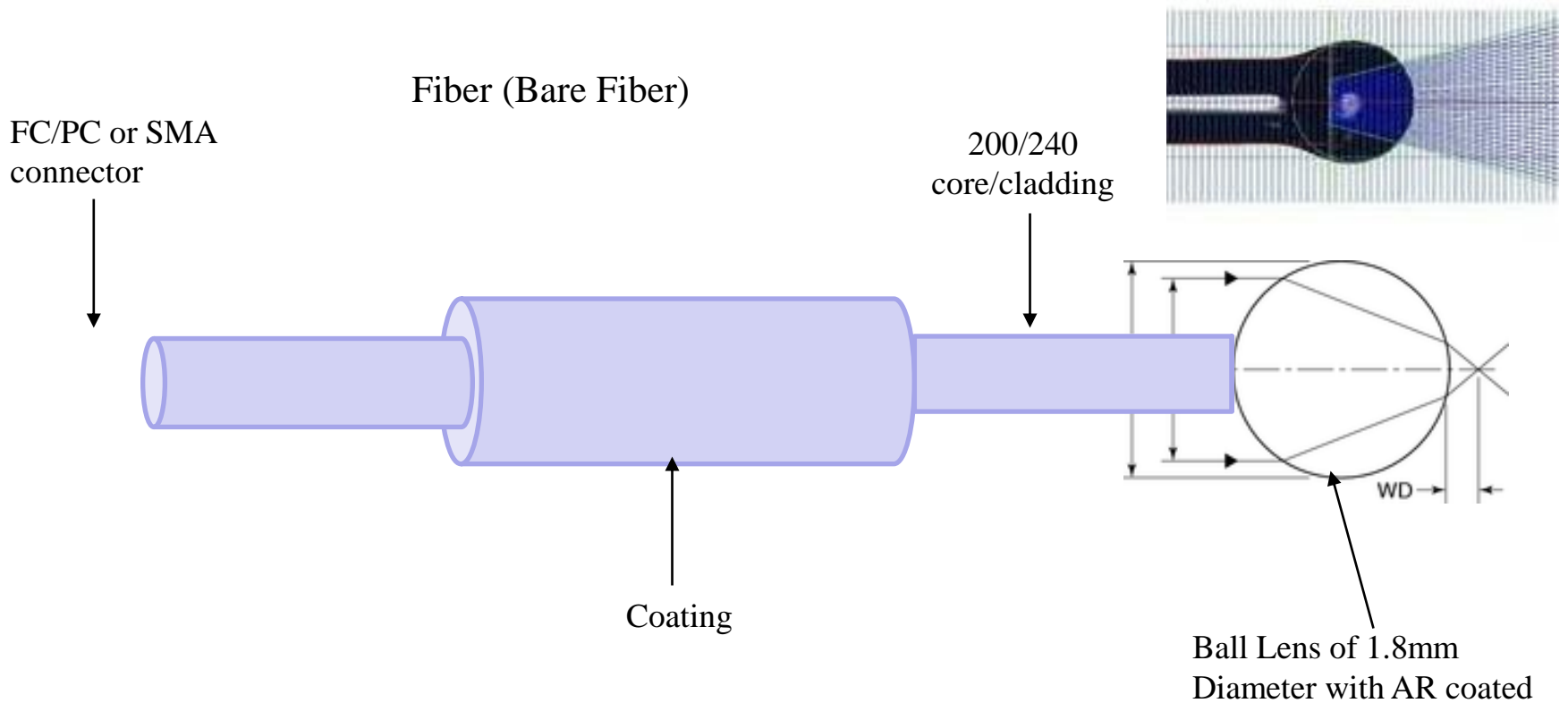


One Input with FC/PC

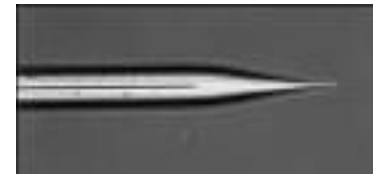
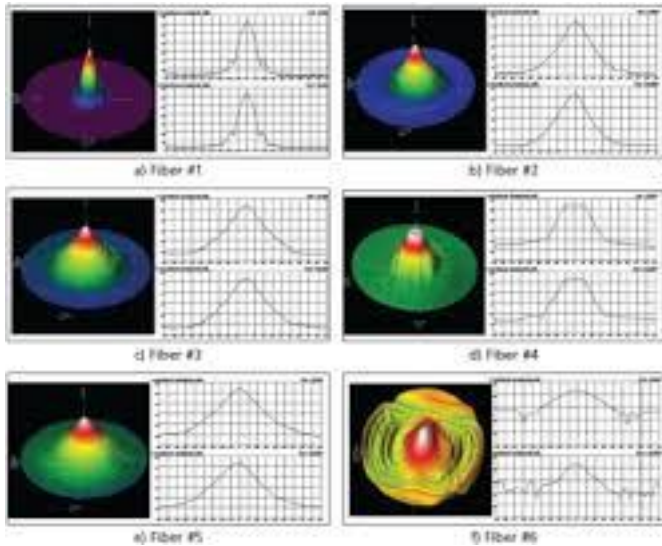
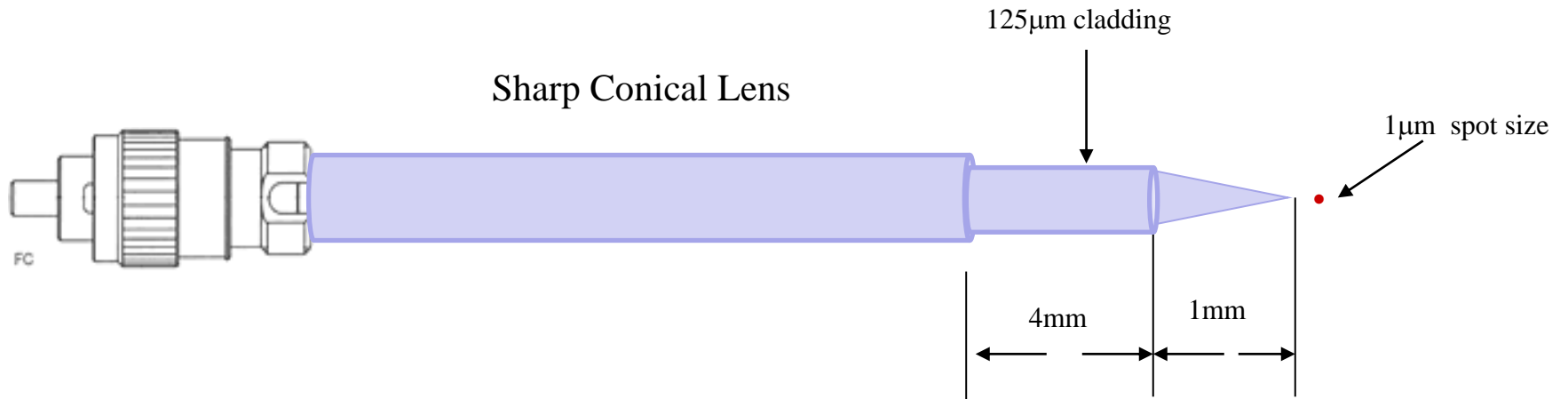




LaseOptics Multi Mode fiber of 200 core one end with 1.8mm Ball Lens on other side plain cleaved or connector

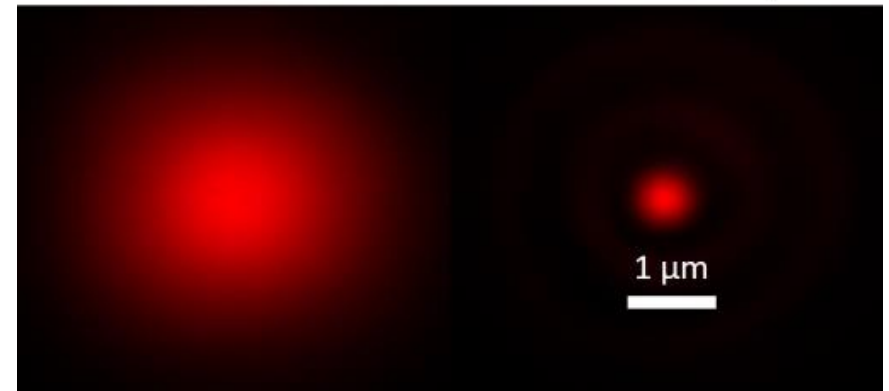


SMF-28 Fiber with Sharp Conical Tip with FC Connector

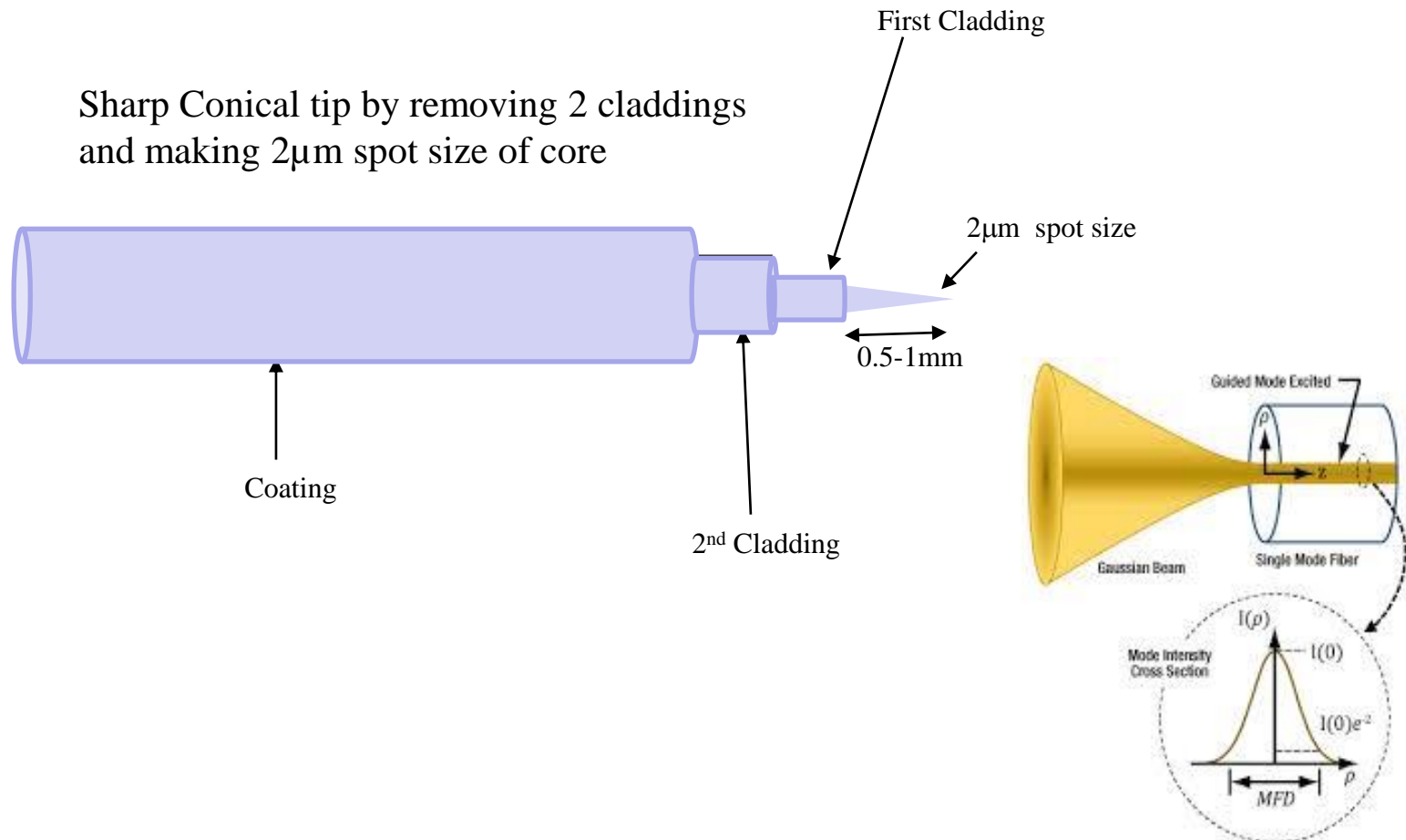


Bare fiber mode

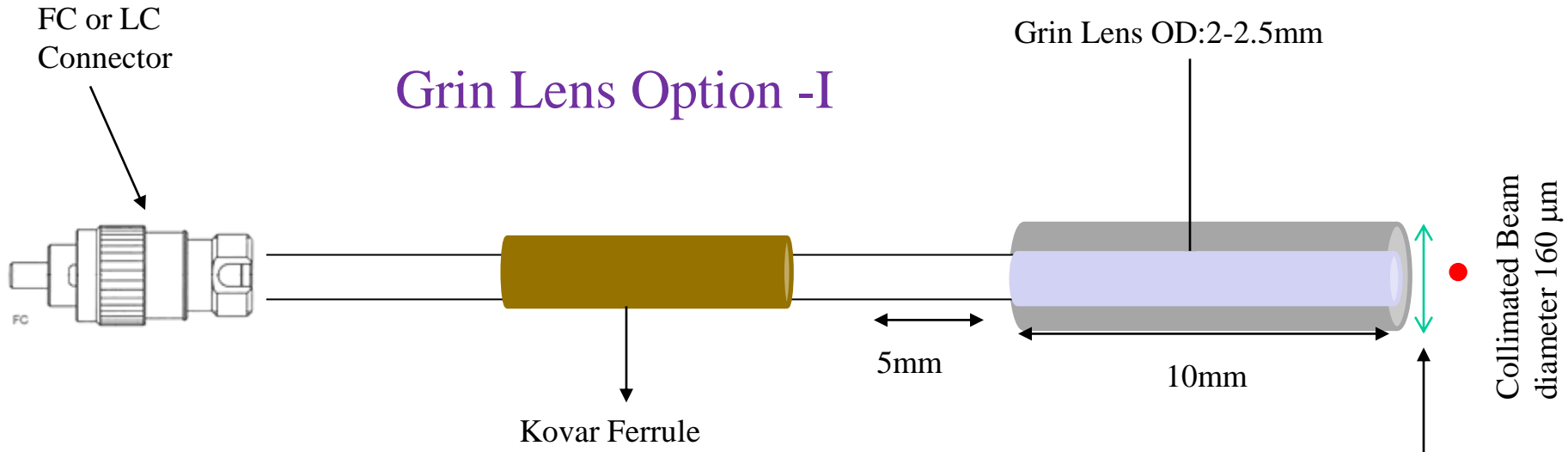
Fresnel lens focal spot



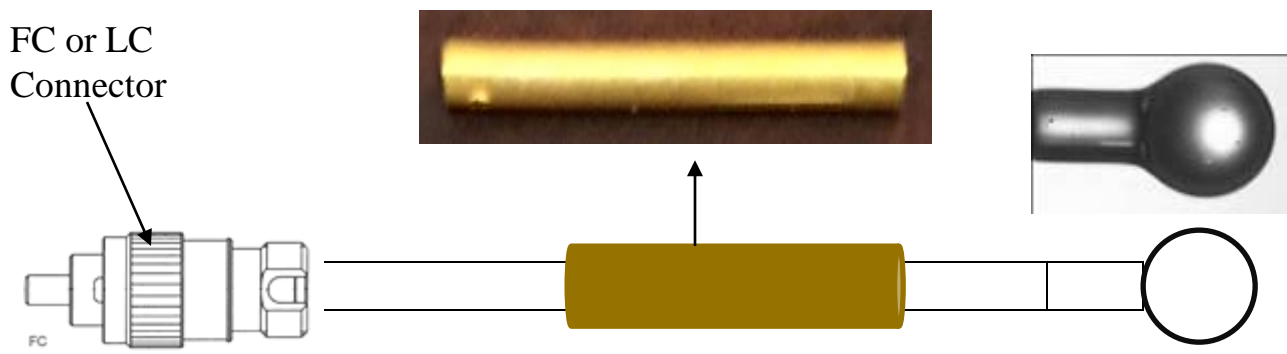
Double Clad Fiber-Lensed-Fibers-Sharp Conical Tip



Collimated Beam Lens System for long working distance

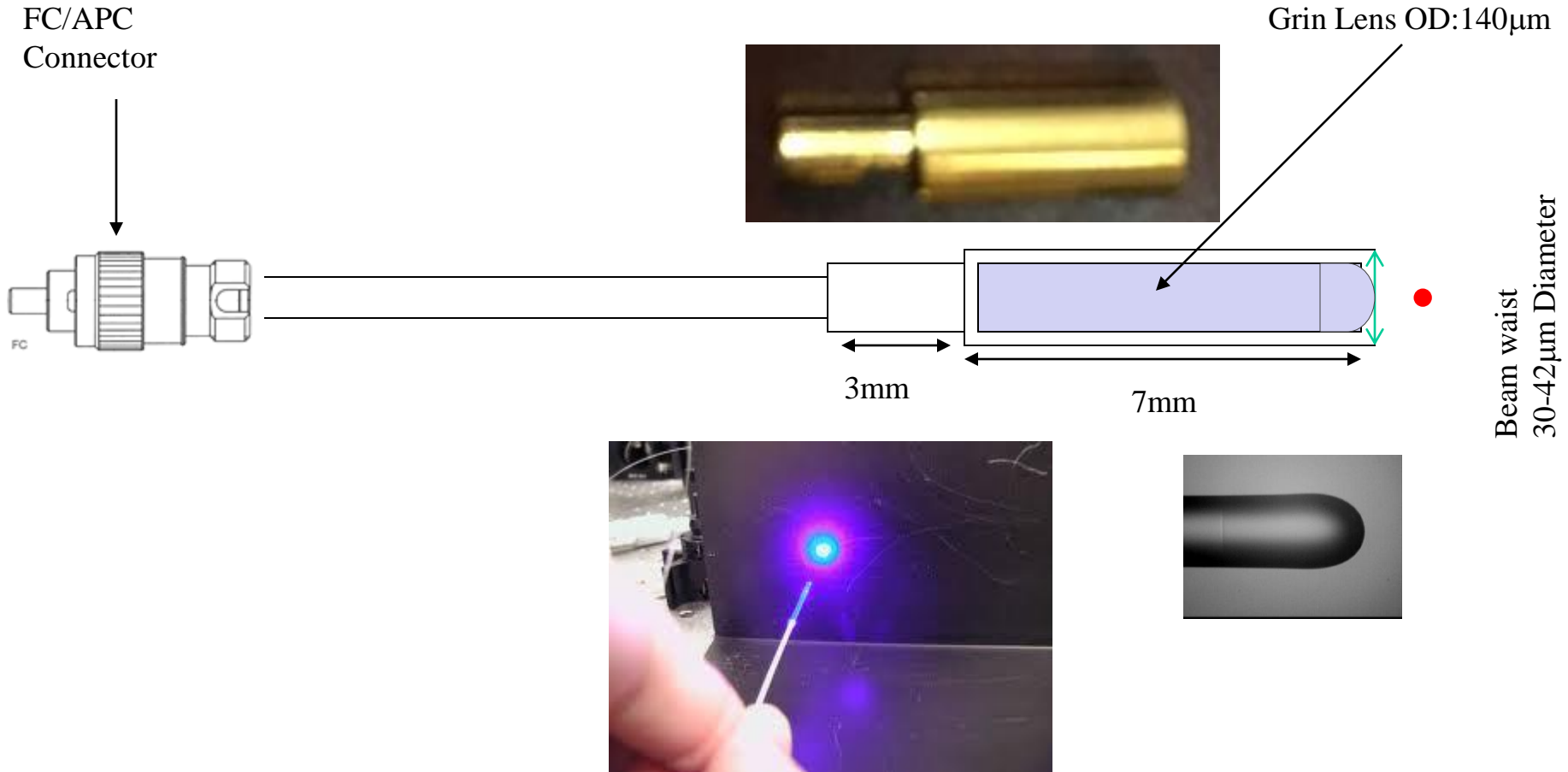


Ball Lens Option - II

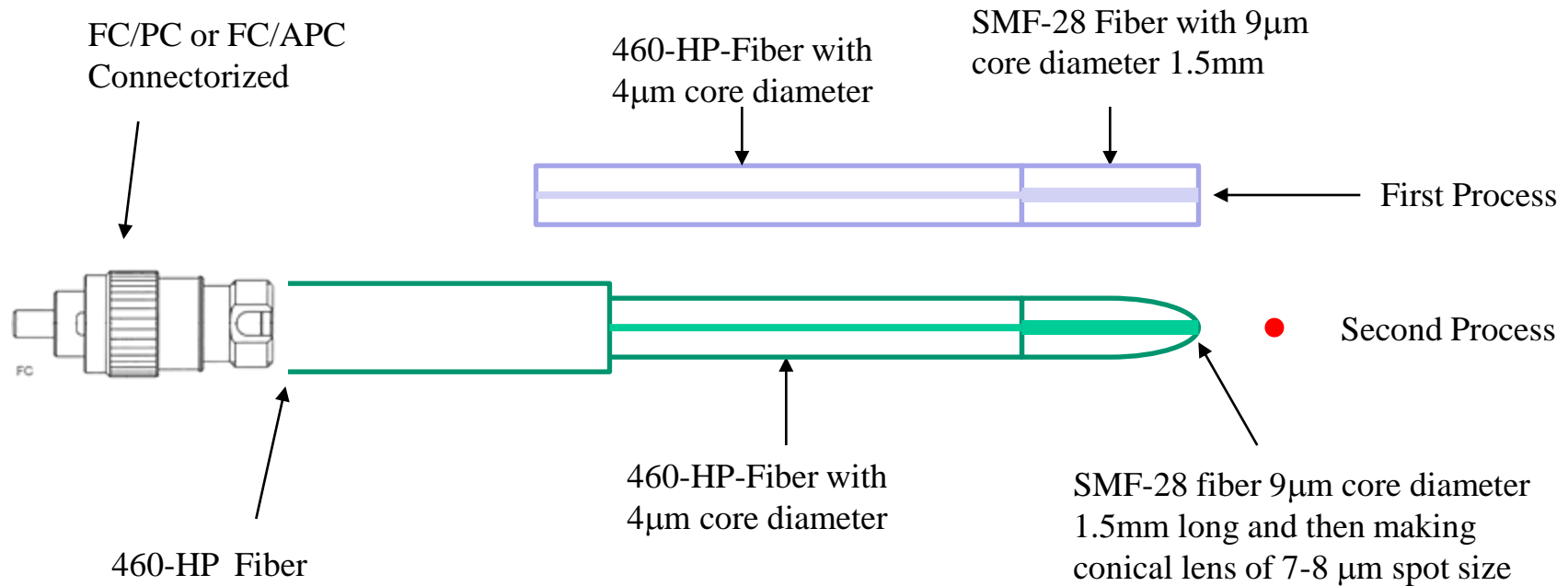




Grin Lens System for long working distance



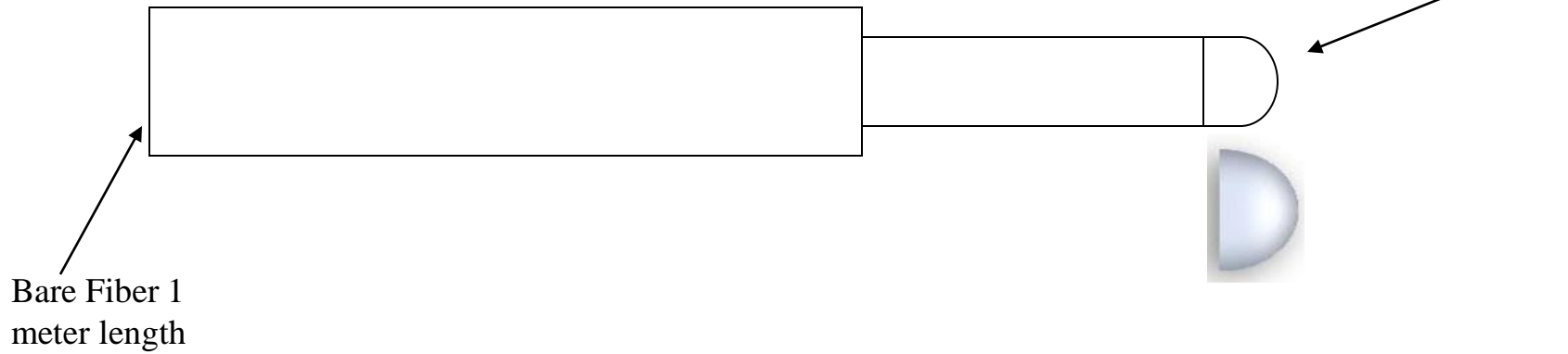
Nufern 460-HP fiber, Conical Lens with 8 μ m spot size pigtail assembly



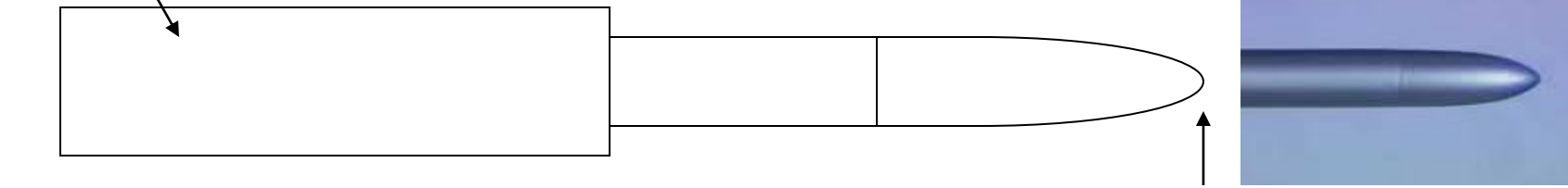
Plastic Optical Fiber Tapered/Lensed of 980 μ m core

Ball Lensed Fiber (Bare Fiber)

Hemispherical Lens

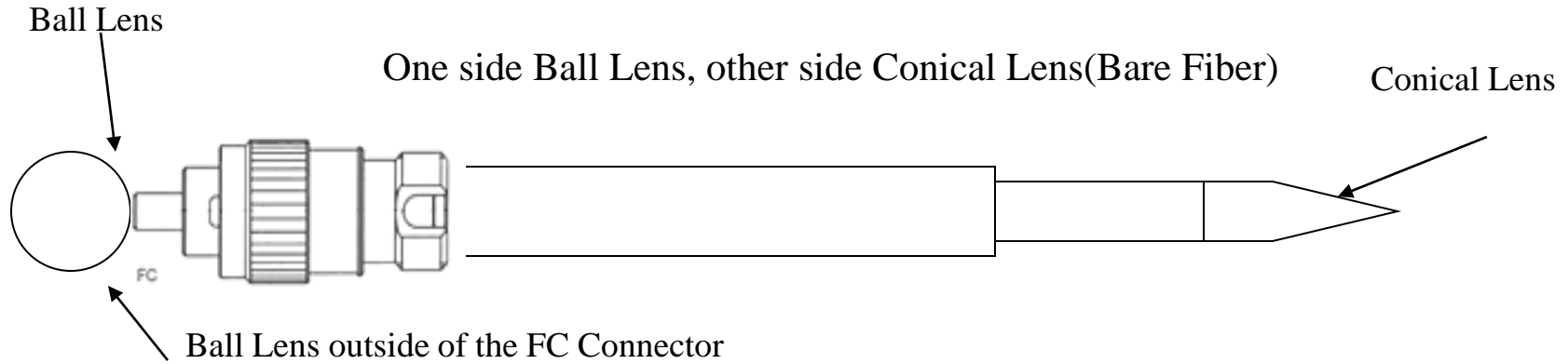


Conical tip (Bare Fiber)

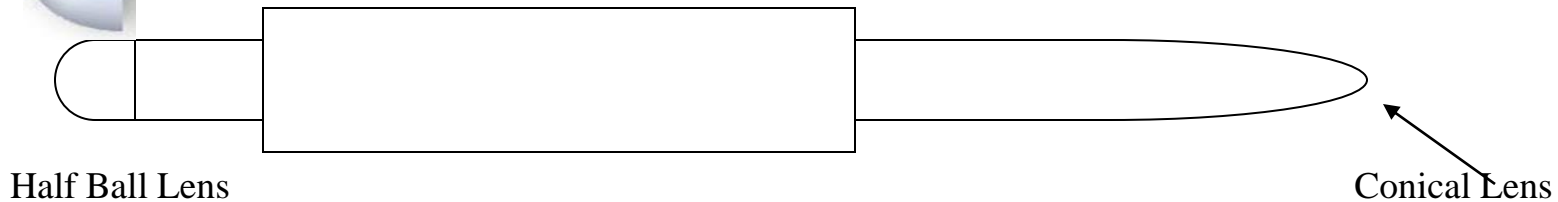


Conical Lens Tip 90 μ m

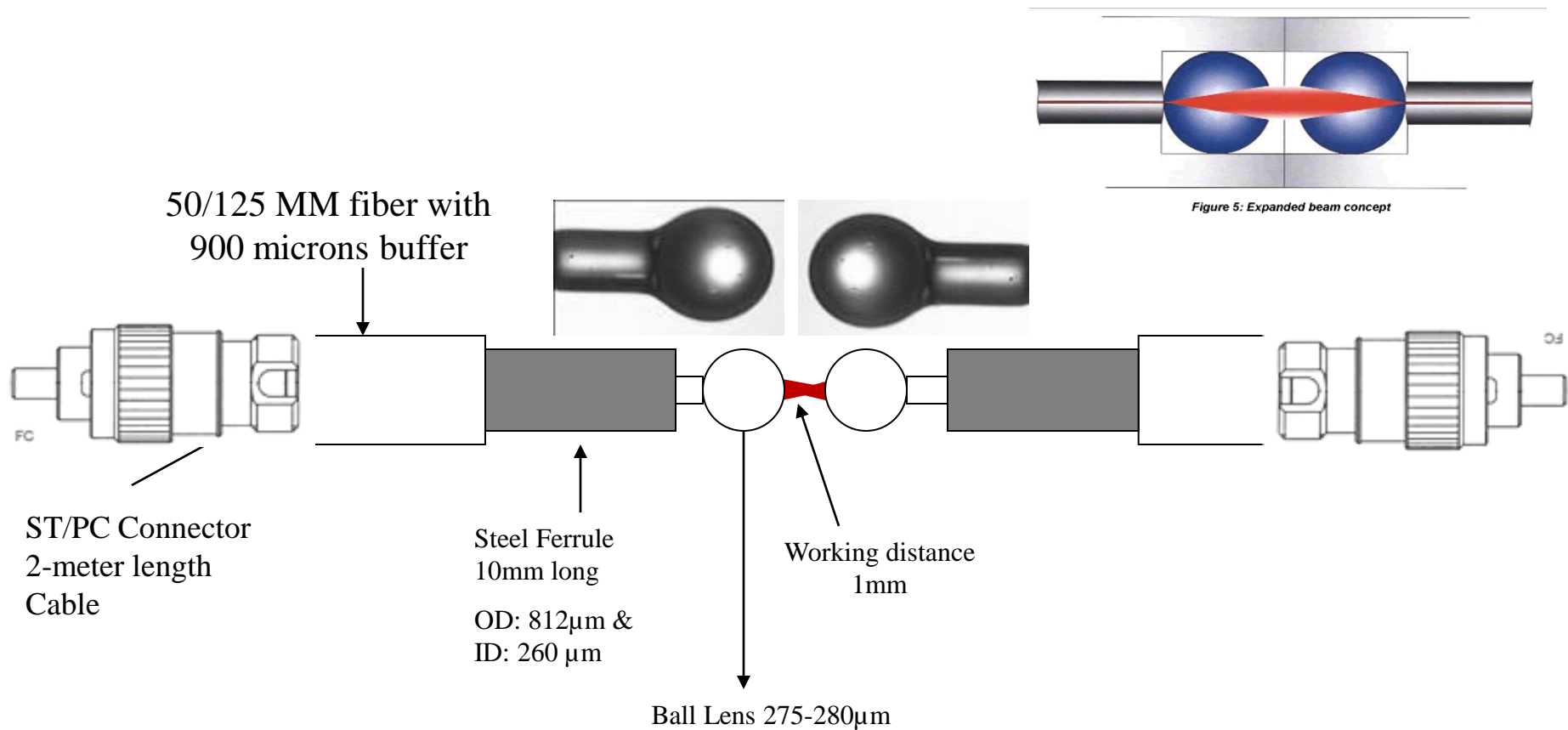
980 μ m Optical Fiber Tapered Conical & Ball



One side Half Ball Lens and other side
Conical Lensed Fiber (Bare Fiber)



LaseOptics- Ball Lensed to Ball Lensed Fibers Pigtail with Steel Ferrule

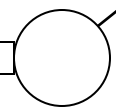
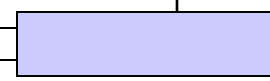




Ball Lensed Fiber (Bare Fiber) 480 SM PM

Metal Ferrule

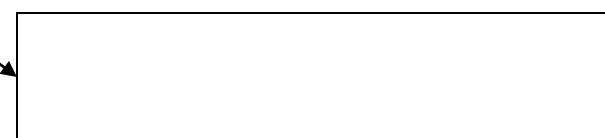
Ball Lens 275μm



FC/APC Connector
1 meter length



Kovar Ferrule



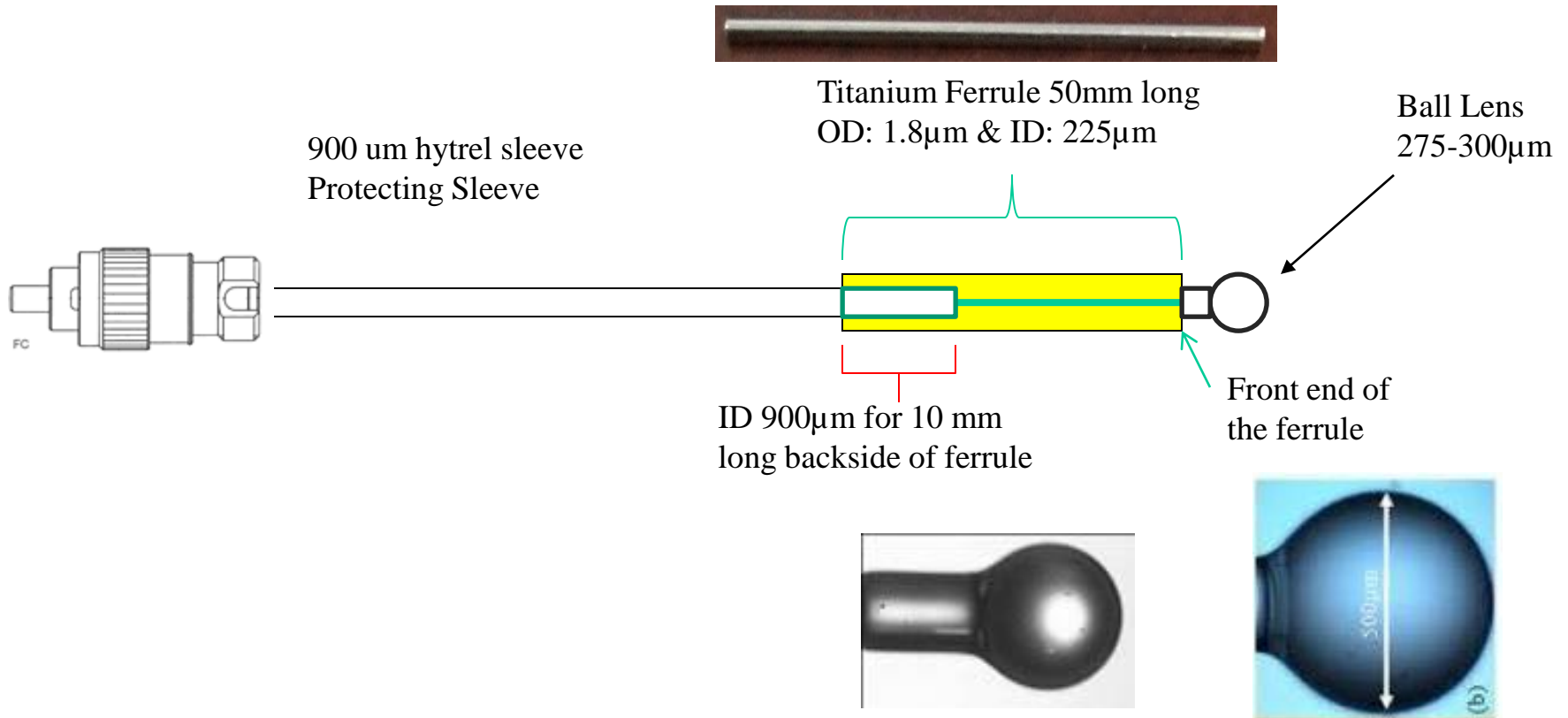
Semi Ball

If you want we can do Metallization: Ni: 2~3 μm +Au:
0.1~0.2 μm 15mm length,

LaseOptics Lensed Fibers with Kovar Ferrule or Metallization

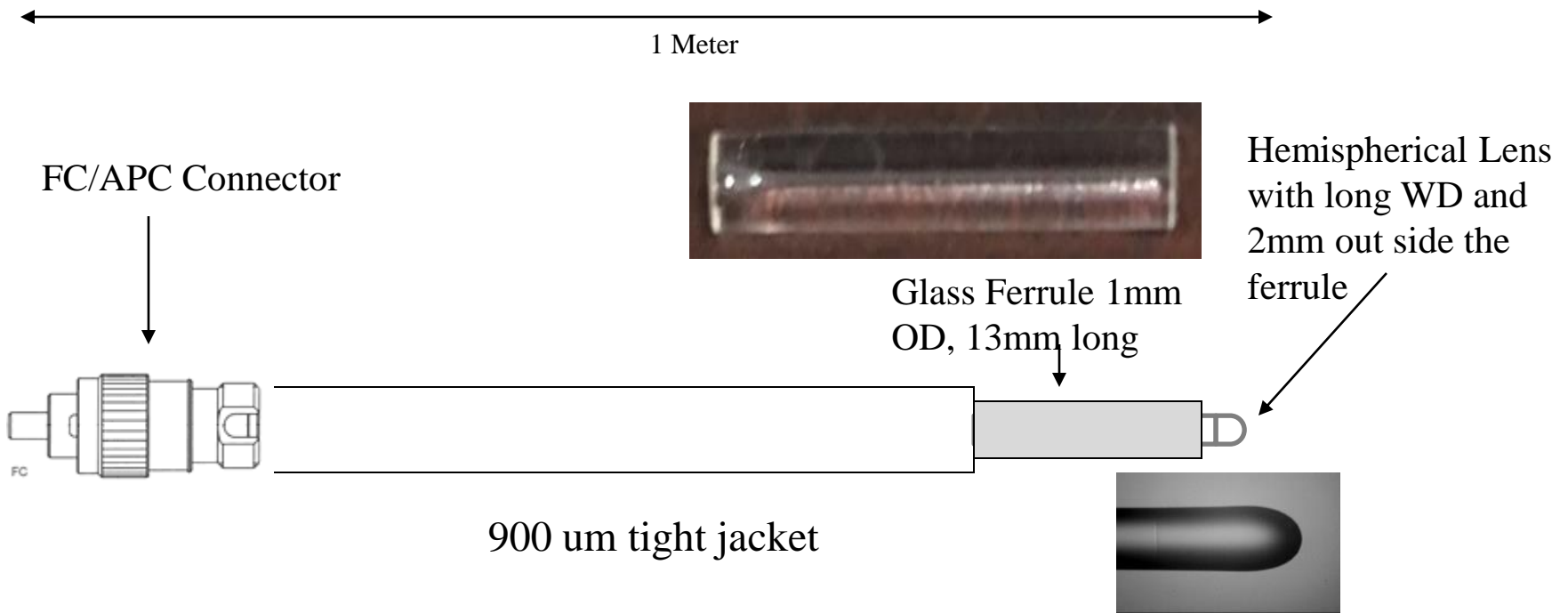


Ball Lens Fibers with Titanium Ferrule (Supplied by Customer) SLB-Japan





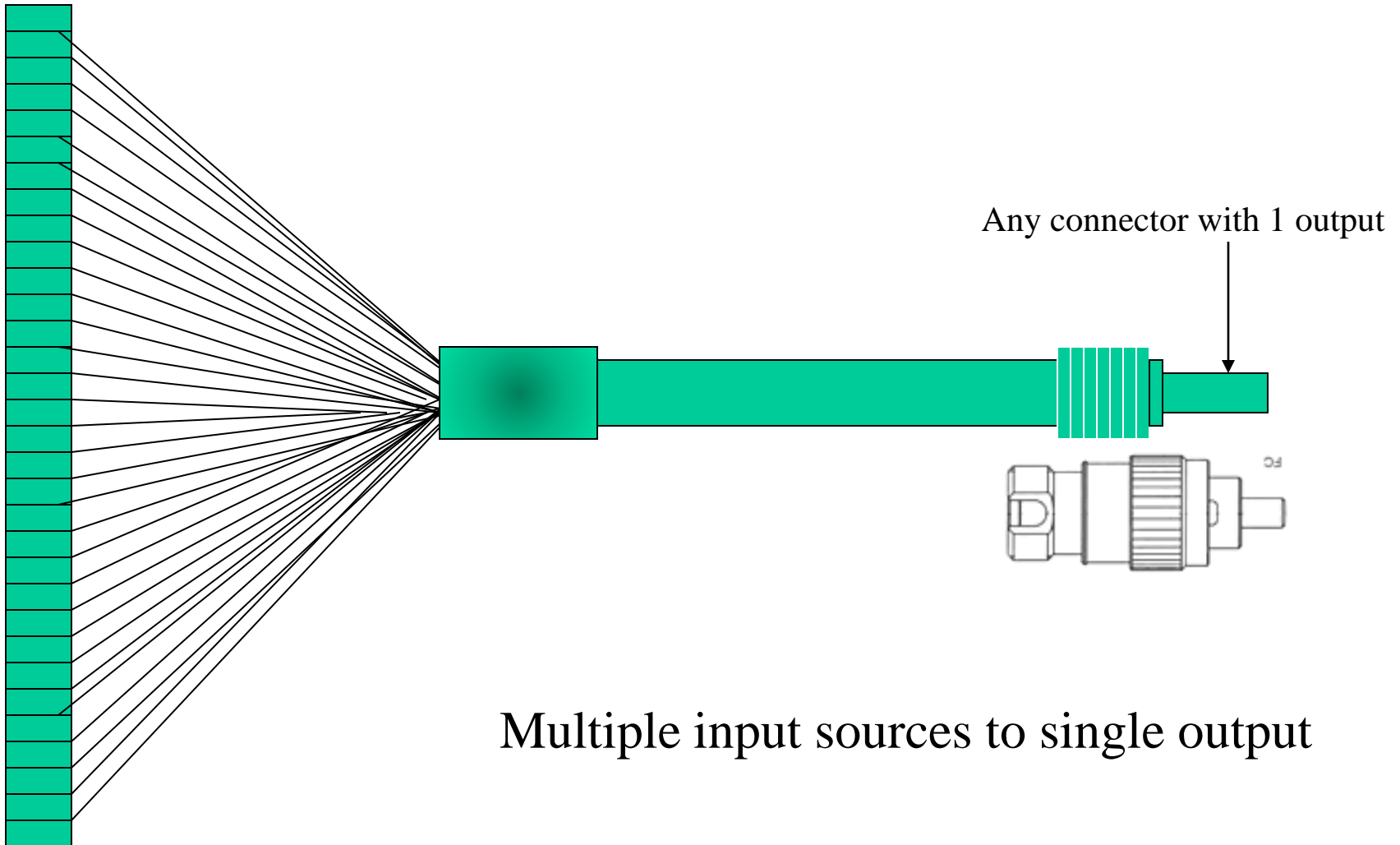
Hemispherical Lensed Fiber with Glass Ferrule



LaseOptics Lensed Fibers with Kovar Ferrule or Metallization



50 cm



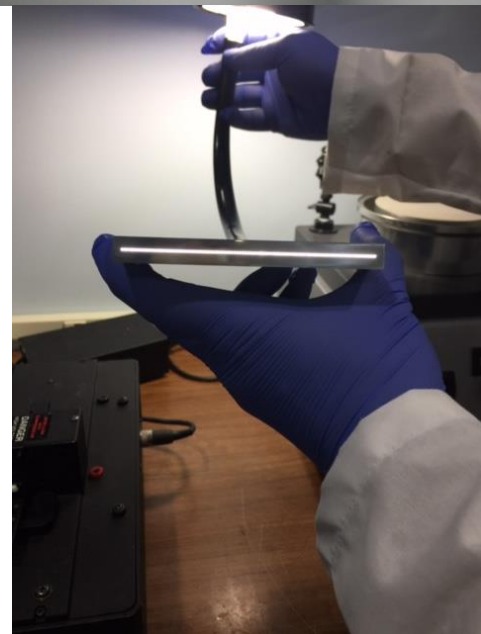
Multiple input sources to single output

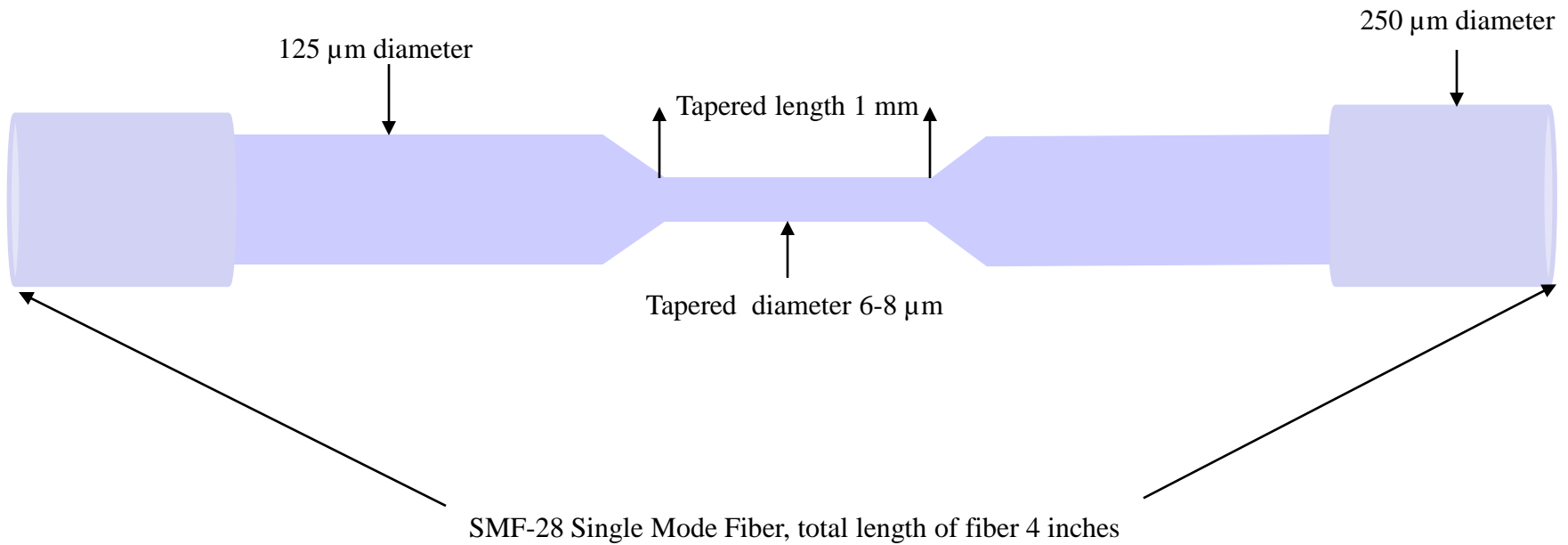
100 Fiber Arrays one Output



100 individual fibers

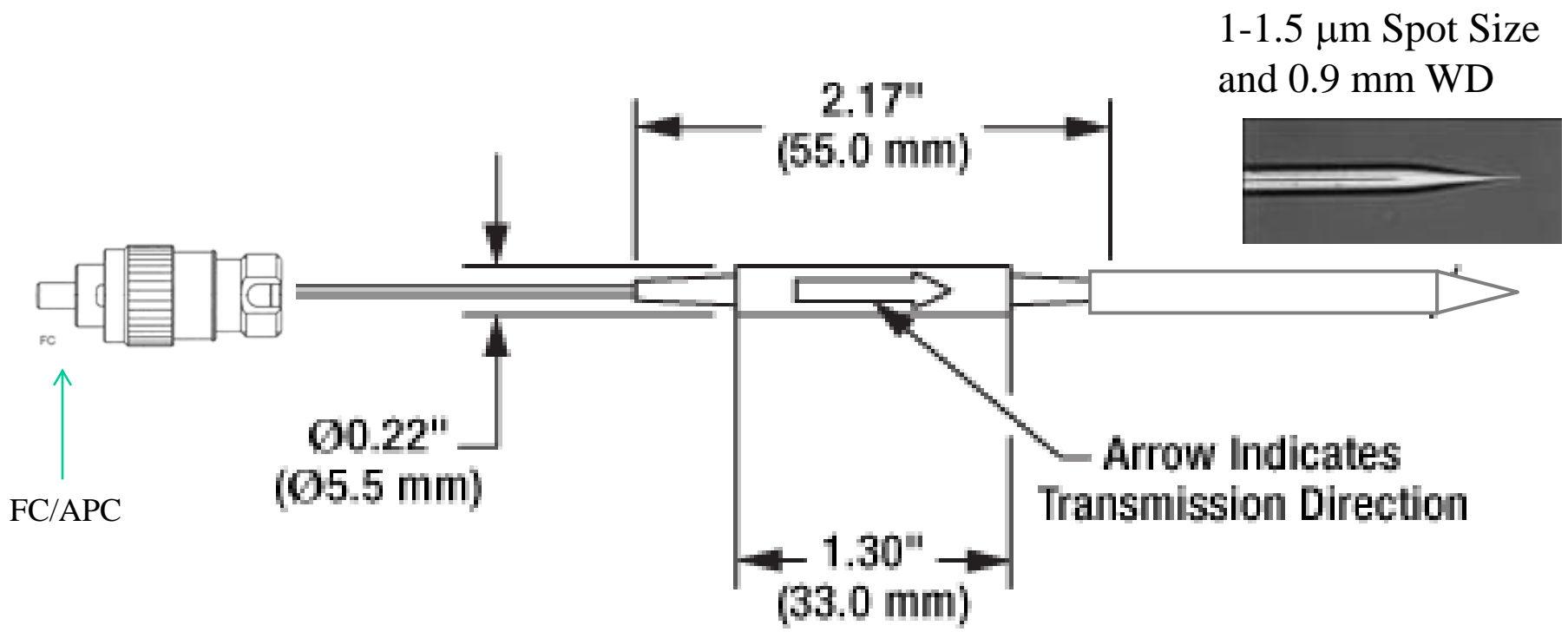
100 fibers with One output Connector



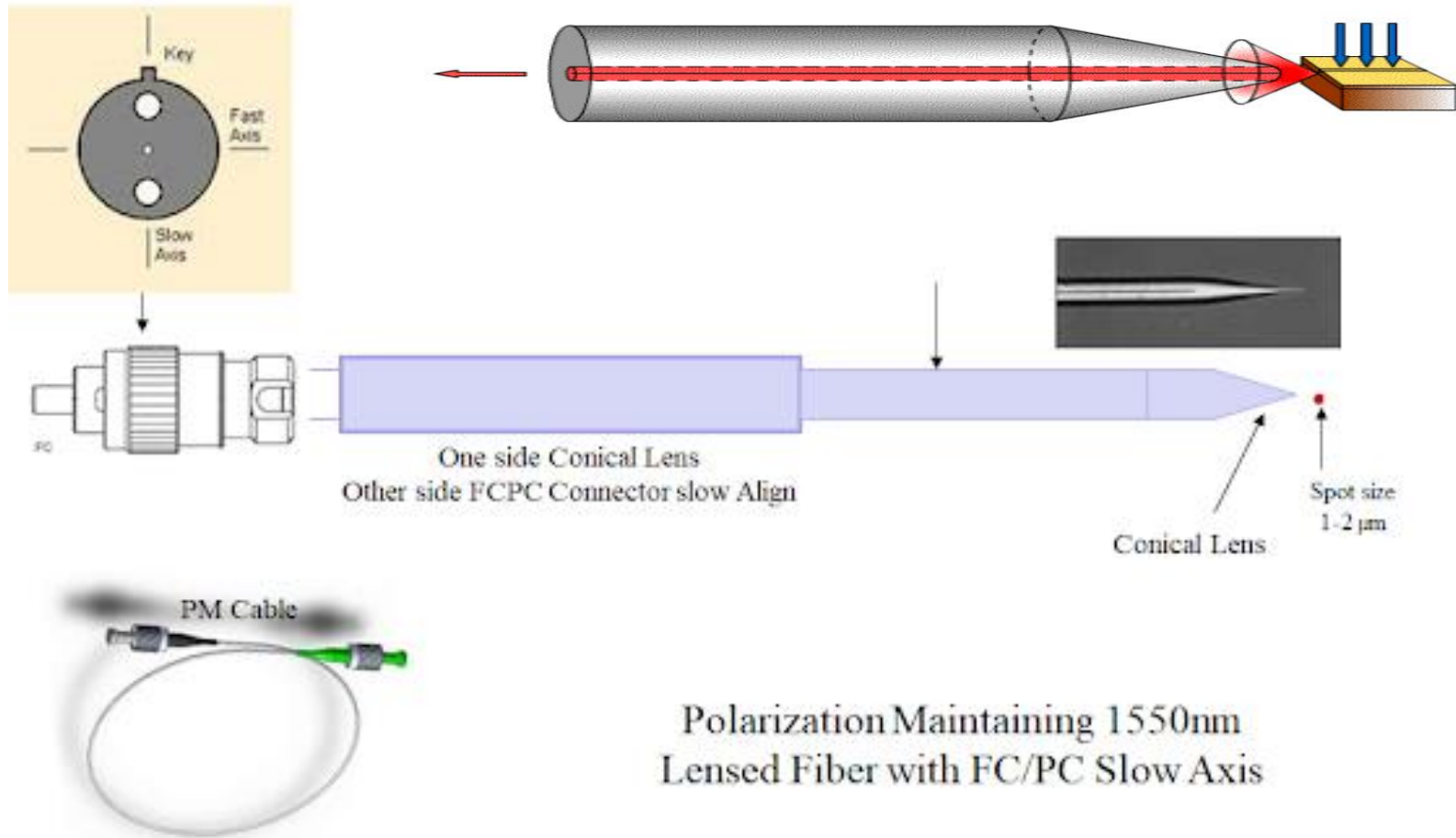


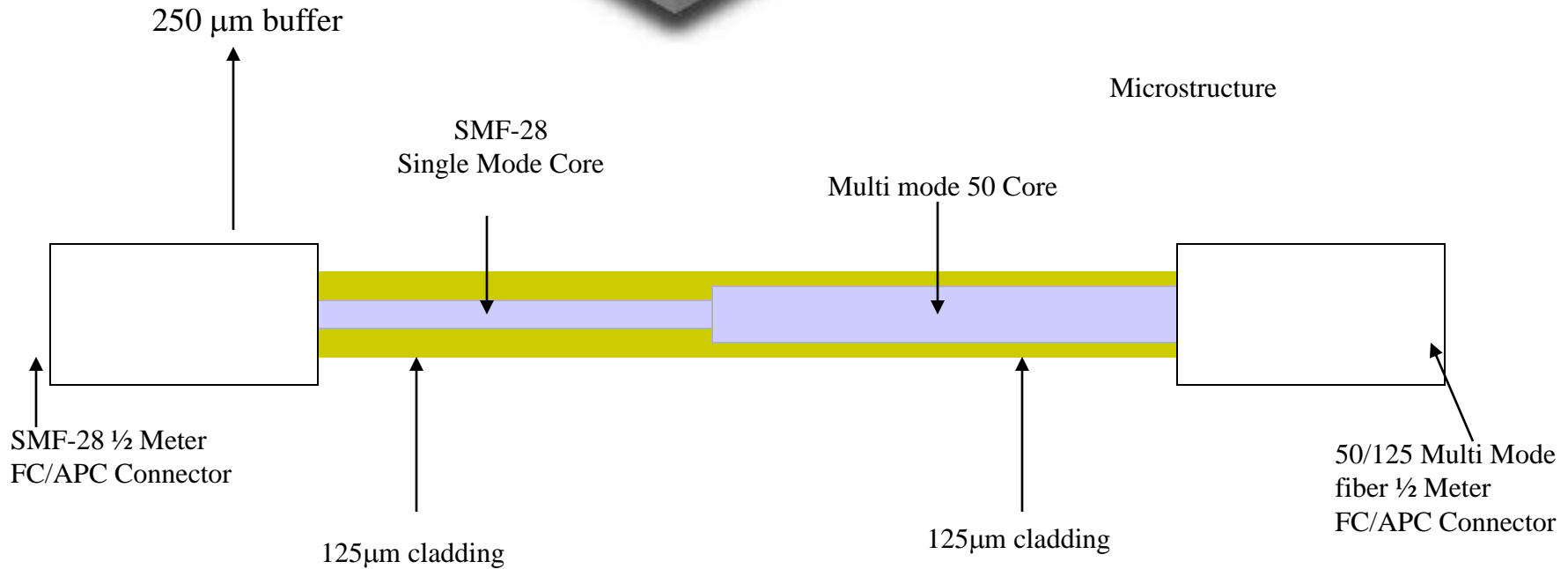
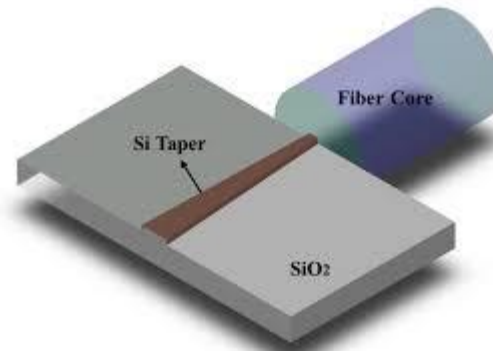
LaseOptics Center-Tapered Fiber

Polarization Maintaining fiber with polarizer isolator with conical lens with FC/APC connector

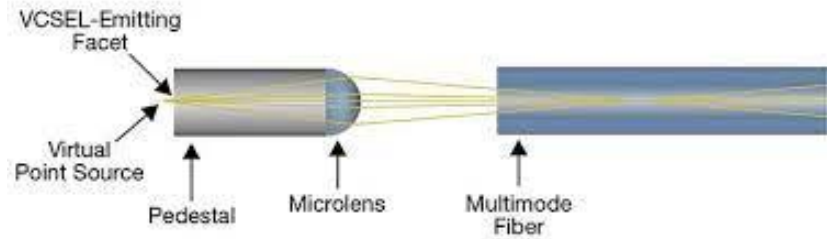


Polarization Maintaining 1550nm fiber with conical lens with FC/PC Connector

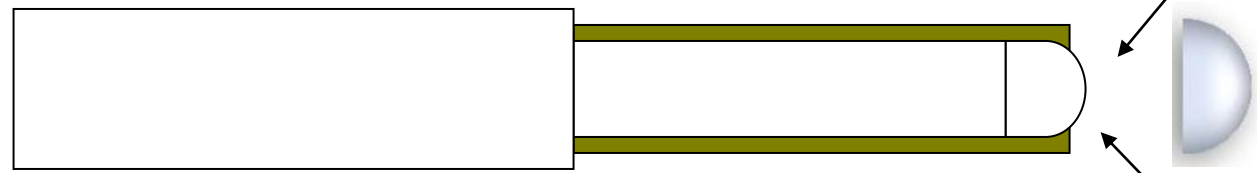




SMF-28 - Single Mode + 50μm Core Multi mode Tapering

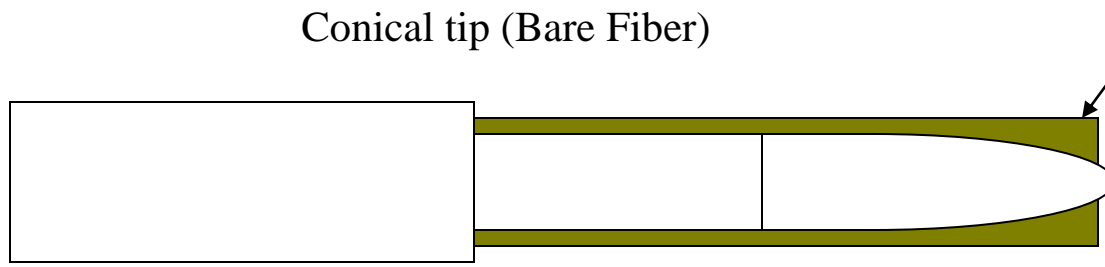


Hemispherical Lens

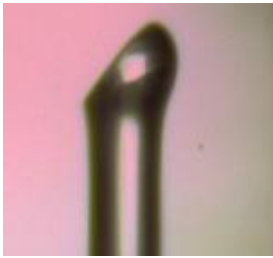


Lensed Fiber slightly outside of Metal Ferrule

Bare Fiber 1 meter length

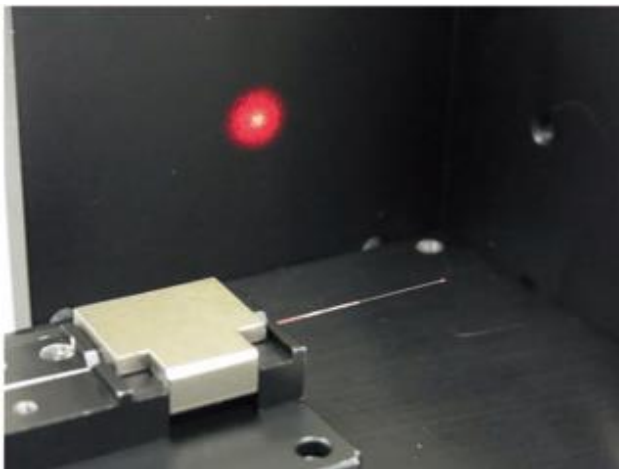
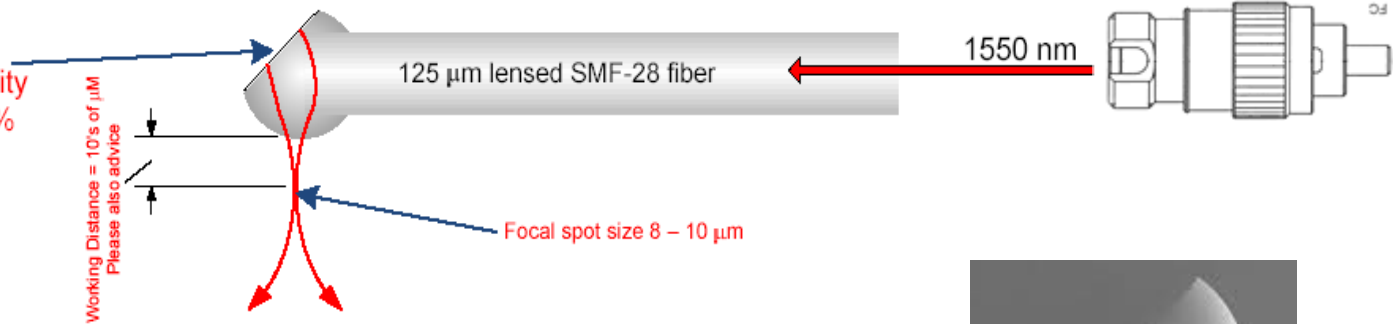


980 μm Optical Fiber with Semi Ball & Conical lens slightly outside the Ferrule



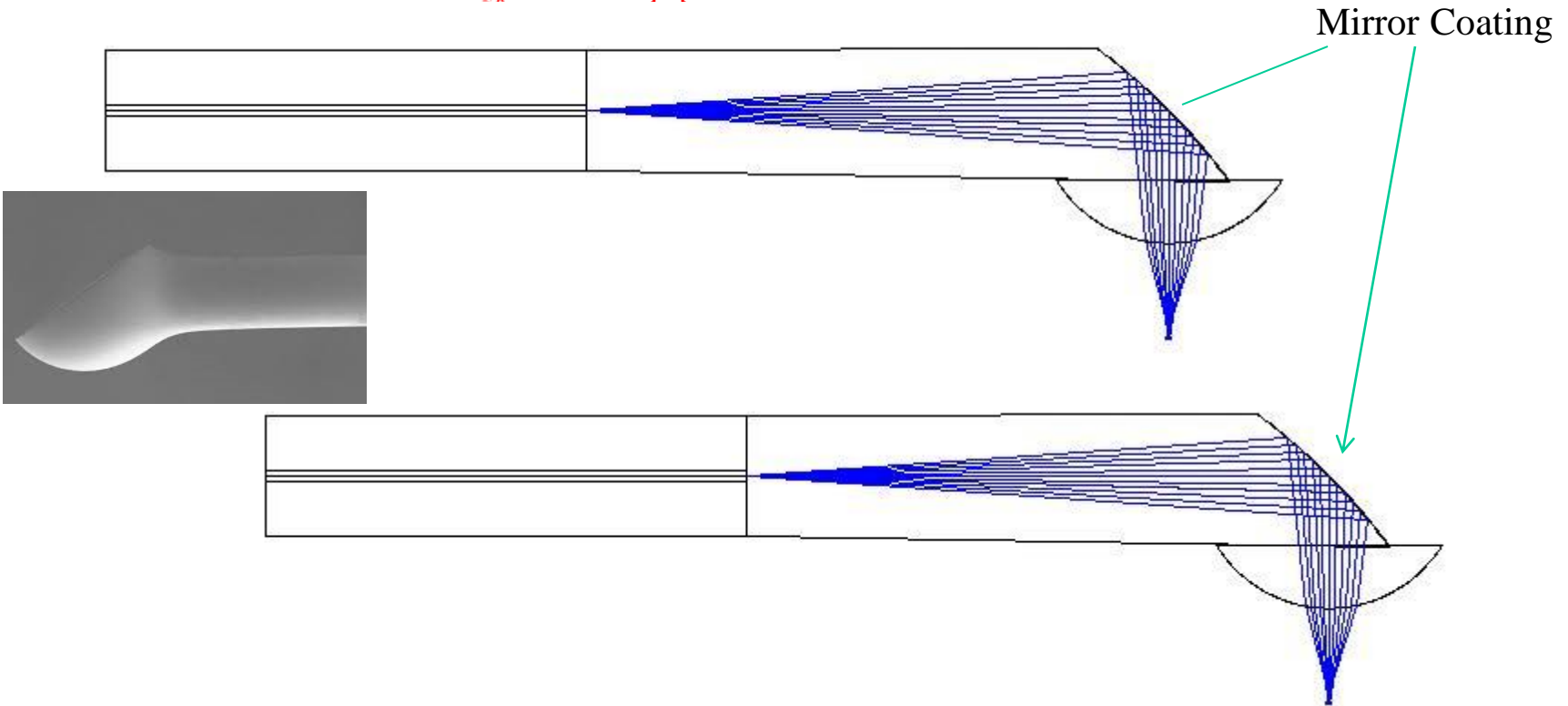
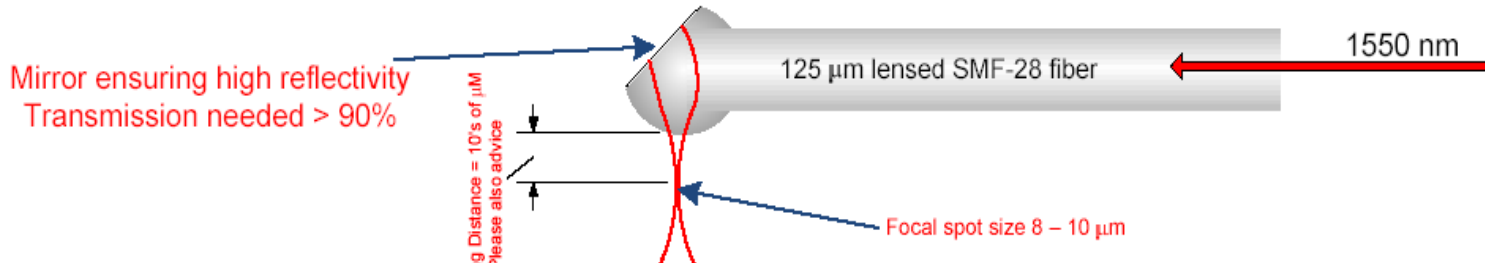
LaseOptics-Lensed Fiber-Perpendicular

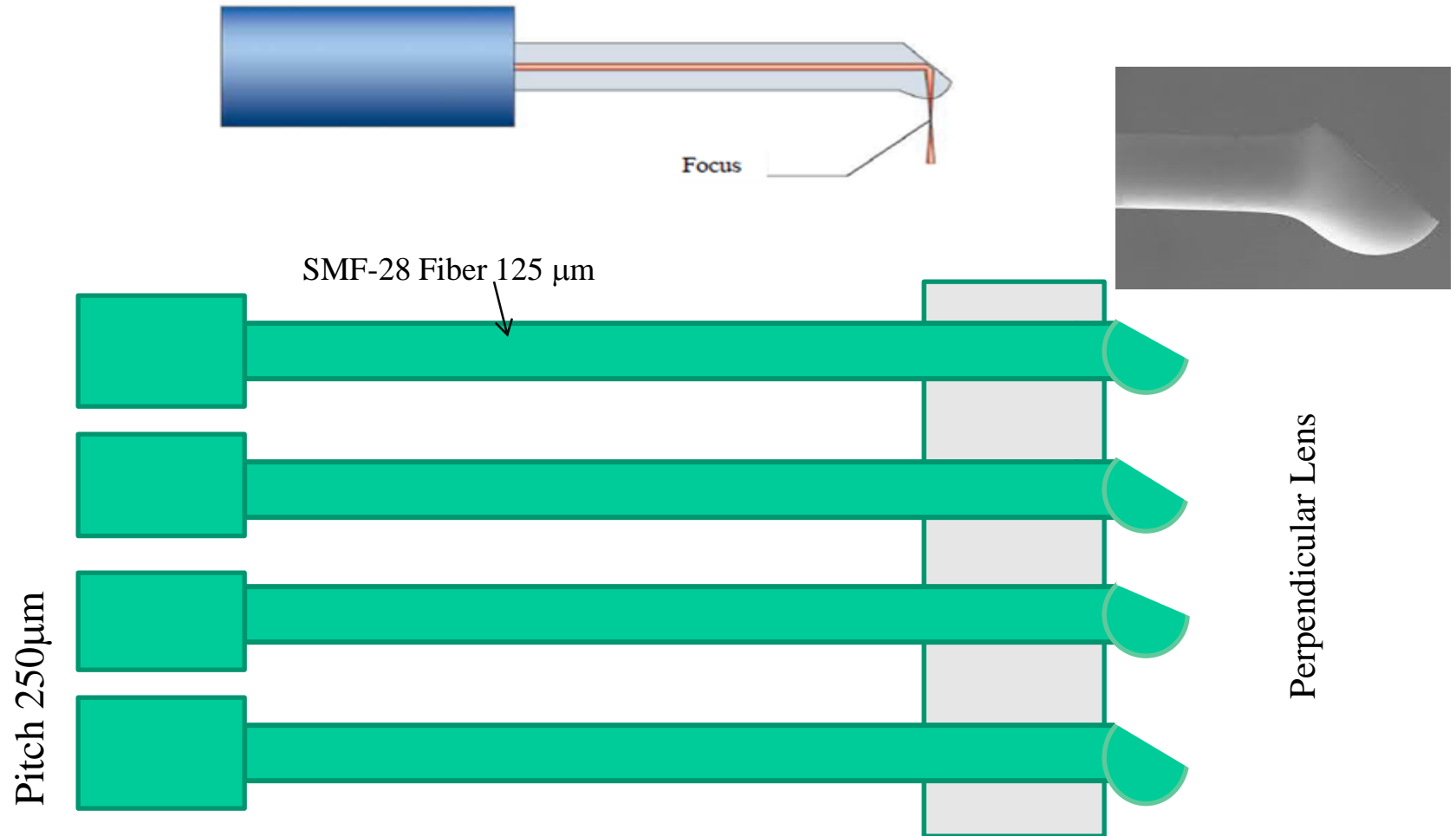
Mirror ensuring high reflectivity
Transmission needed > 90%



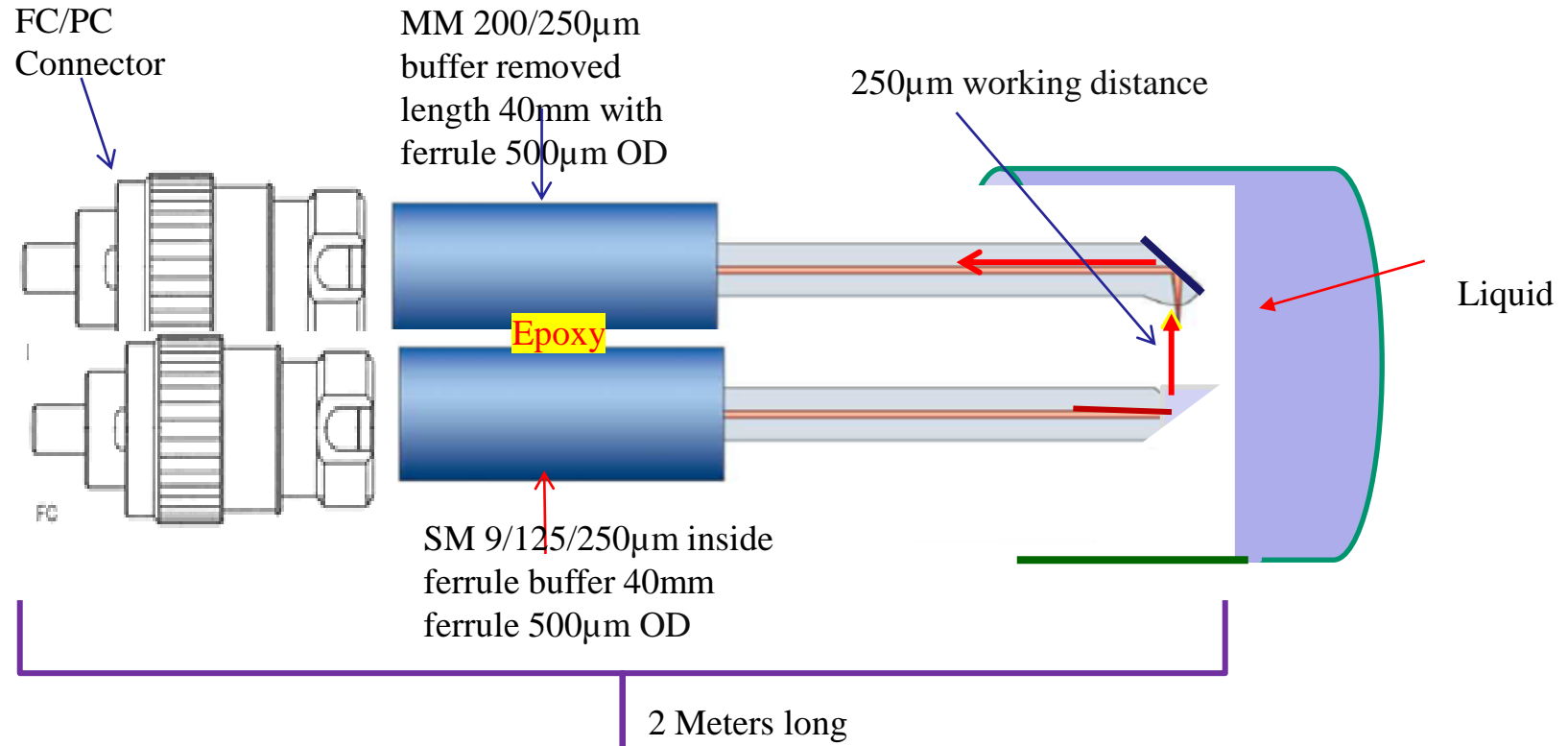
Mirror coating on micro-polished angle fibers to bring high reflectivity transmission (95%)

LaseOptics-Lensed Fiber-Perpendicular



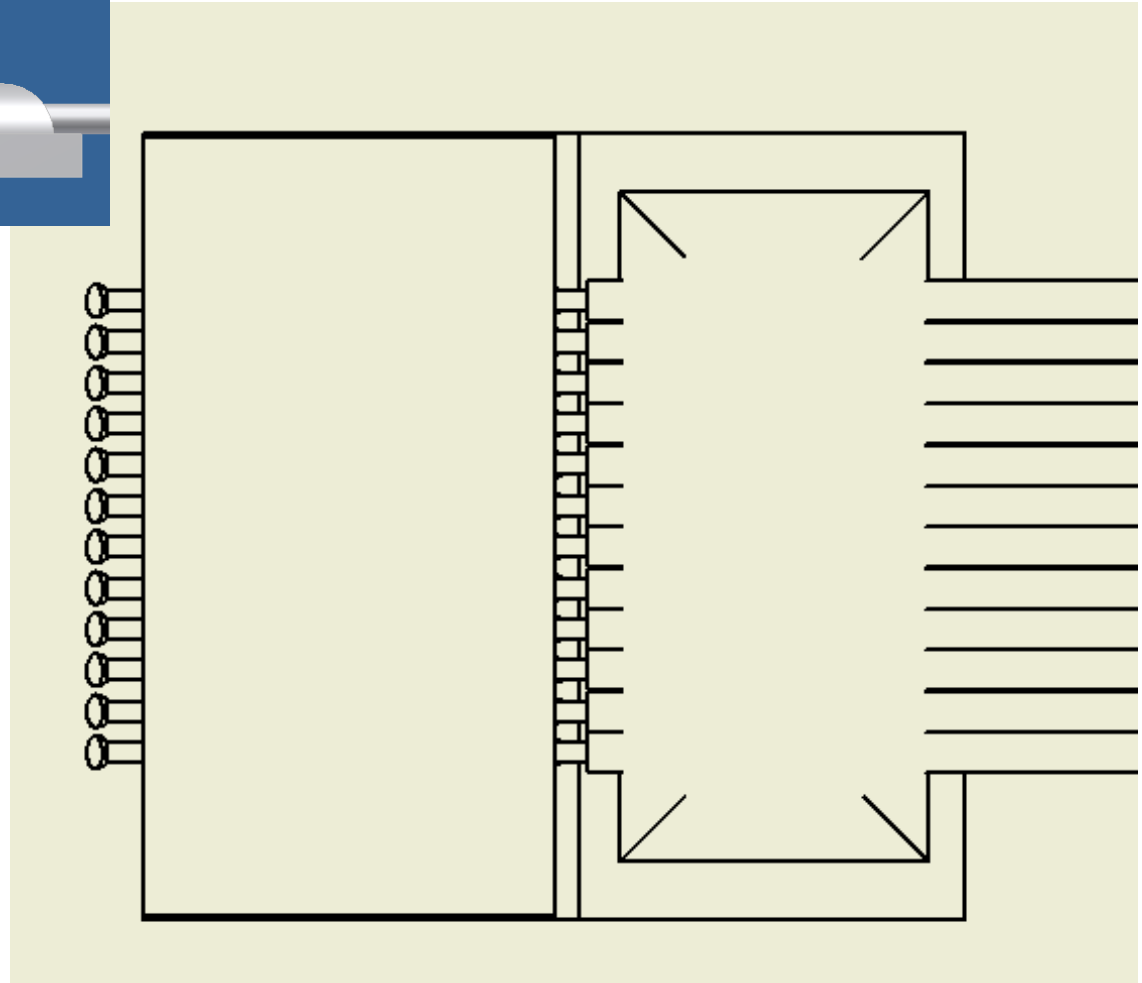
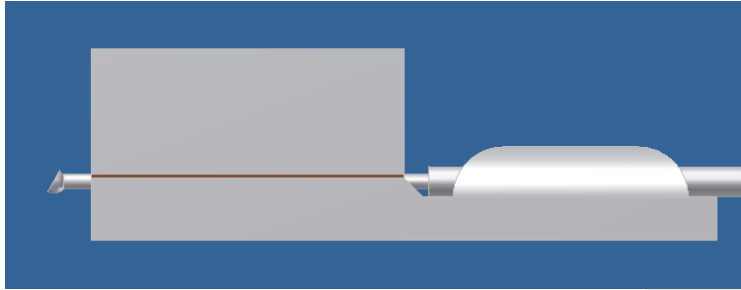


Perpendicular Lensed Fiber Array on V-grooves 4 channel

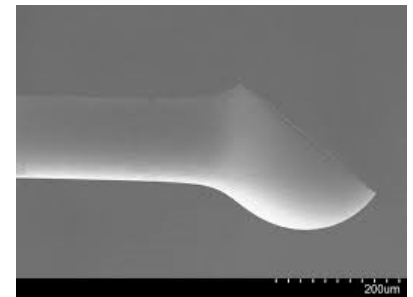
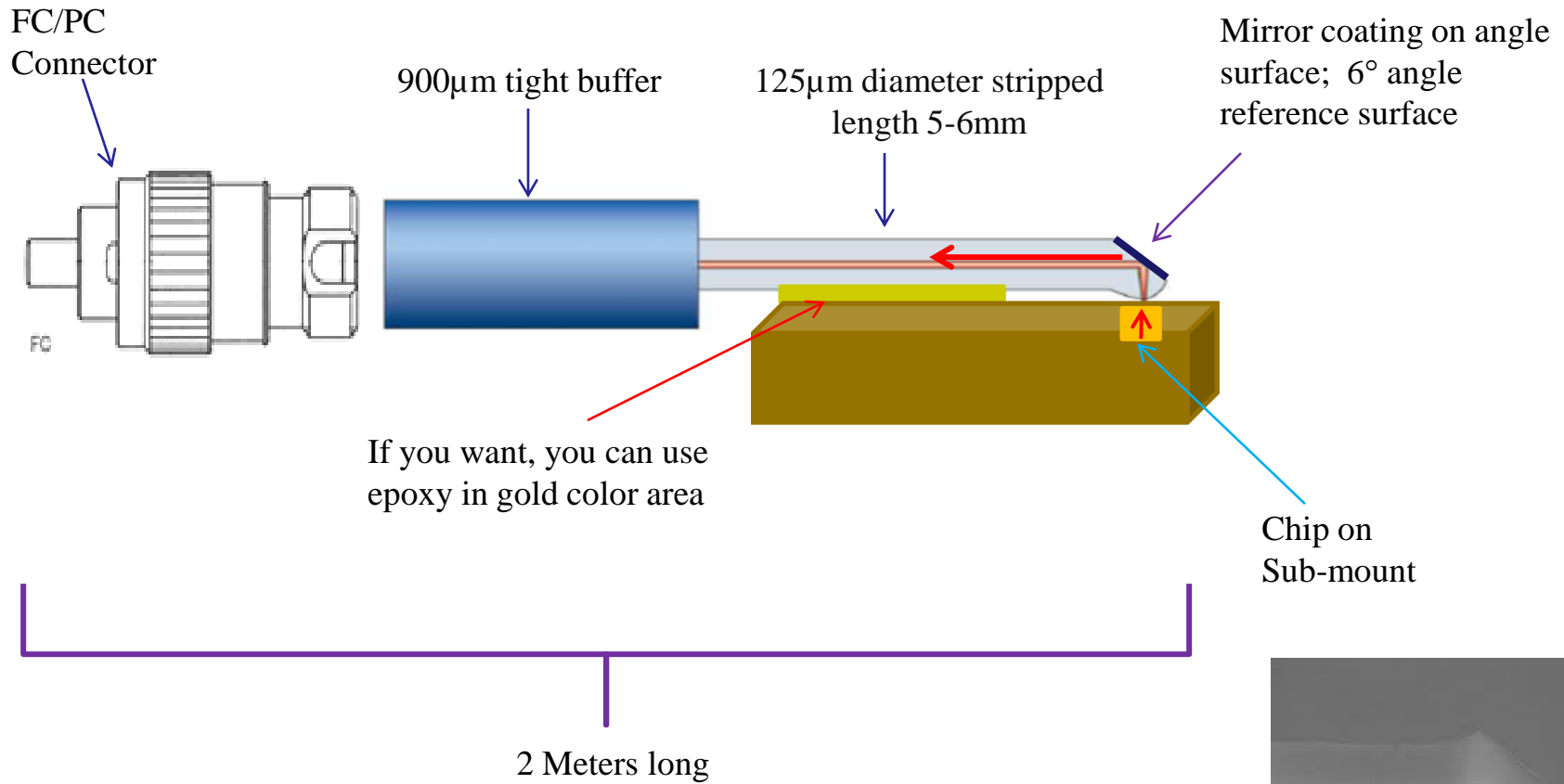


Multi mode 200/225/500, we have to remove buffer at least 40mm and where as SMF-28 stripped length 10mm only, we have use 500µm ferrule size, without buffer for MM fiber and with SMF-28 with buffer because of working distance and two ferrule are stick together

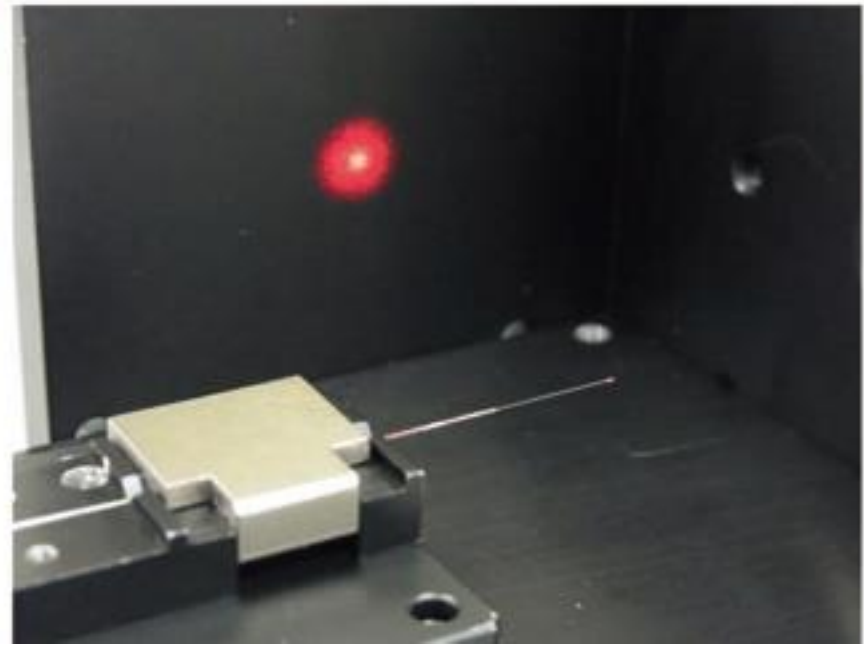
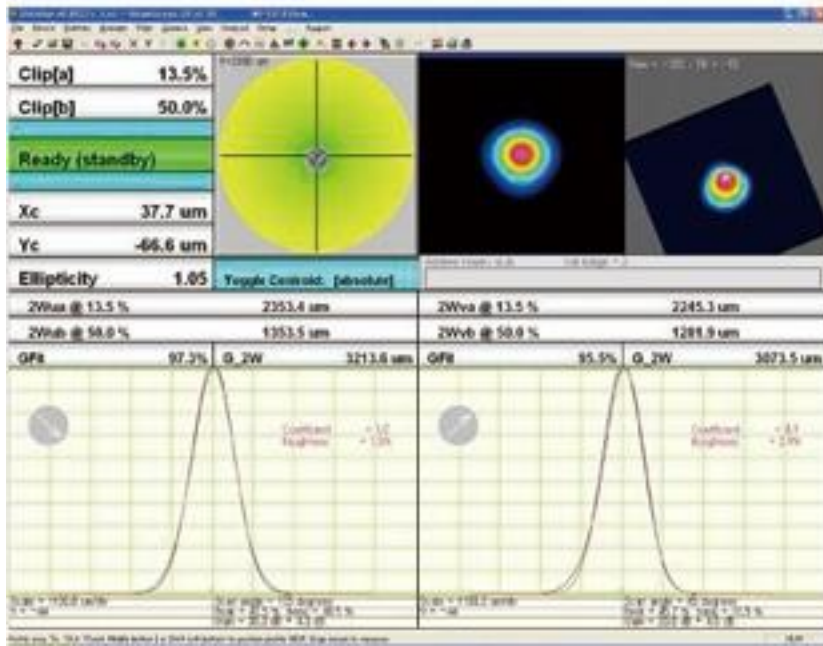
Siding firing fiber and perpendicular fiber bundle in water application



Perpendicular Lensed Fiber Array on V-grooves 12 channel

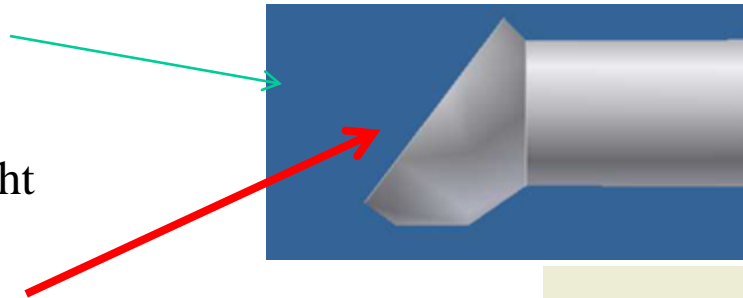


Perpendicular Lensed Fiber on Light coupling from Chip

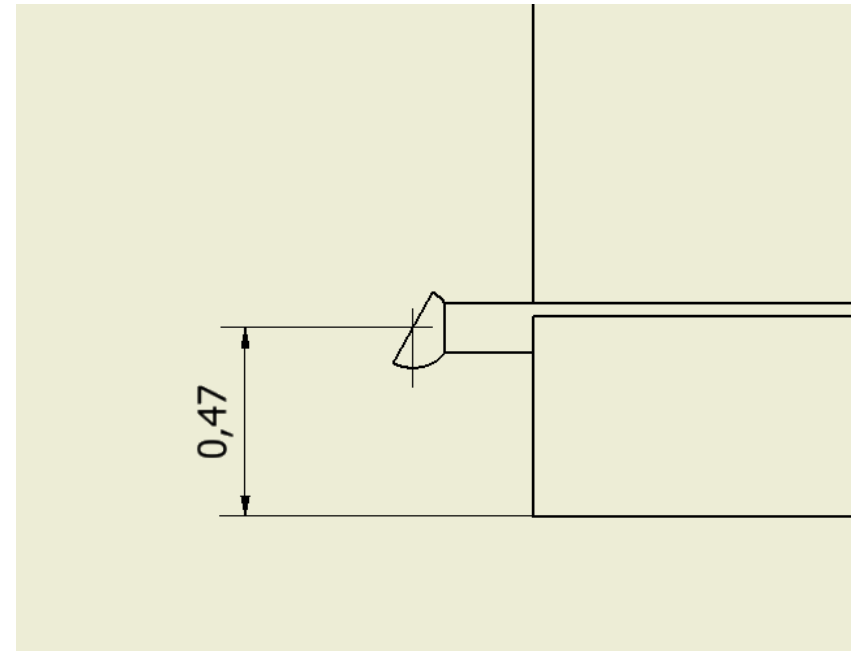
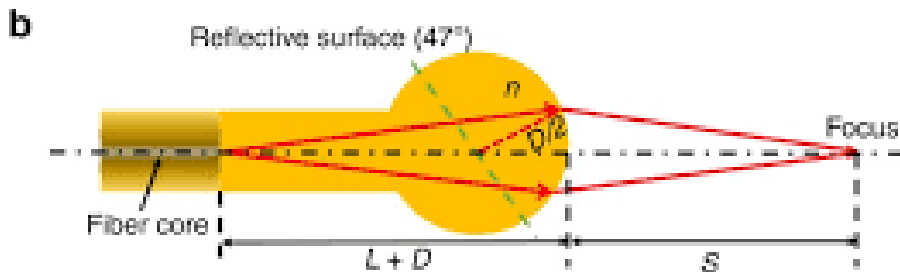
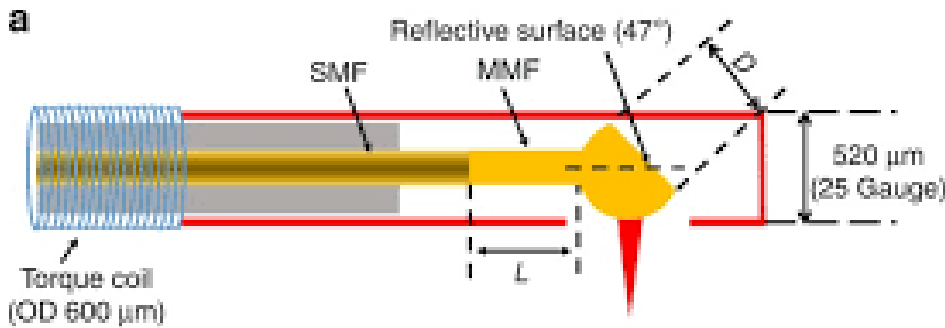


One side Perpendicular Lens other end we can put any connectors

Mirror reflective coating 36° angle perpendicular to light for total 45° angle With 8° of arriving light



Light output 8° angle



Focal point coincides with base of fiber block assembly



250 μm
Ball Diameter

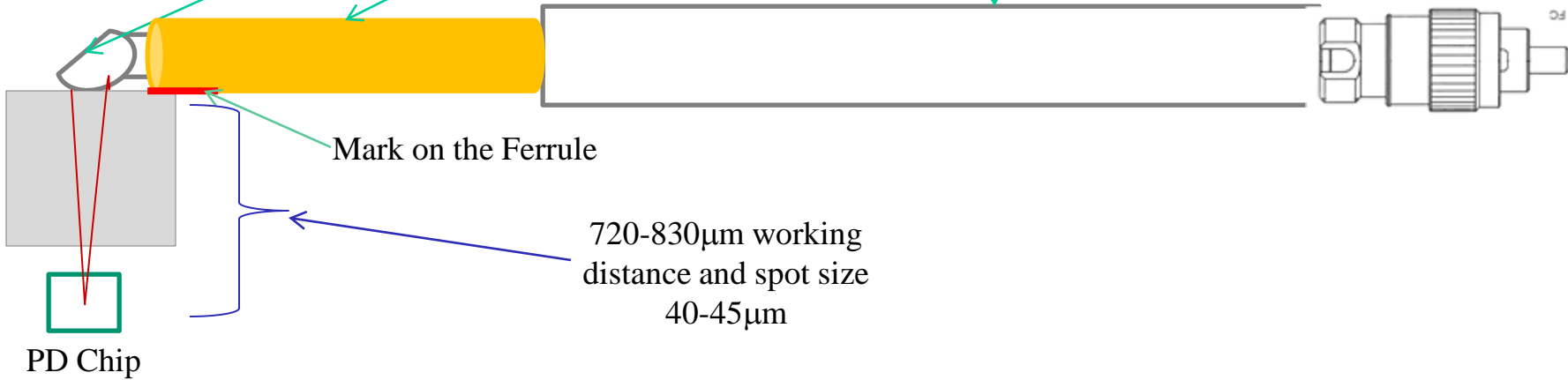
250 μm Ball Diameter
Angled Micro-Polished and
Mirror Coating



Perpendicular Lensed Fiber
Micro-Polished

900 μm tight jacket

SS Metal Ferrule
OD: 0.51mm & 17mm L

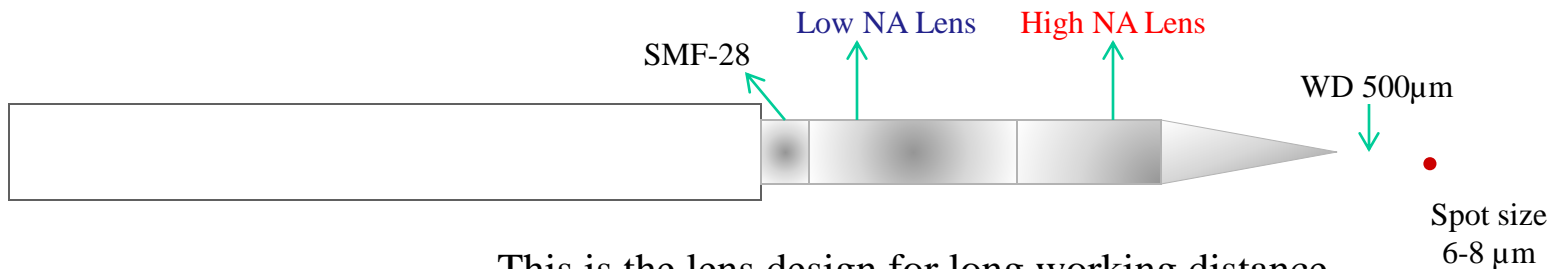
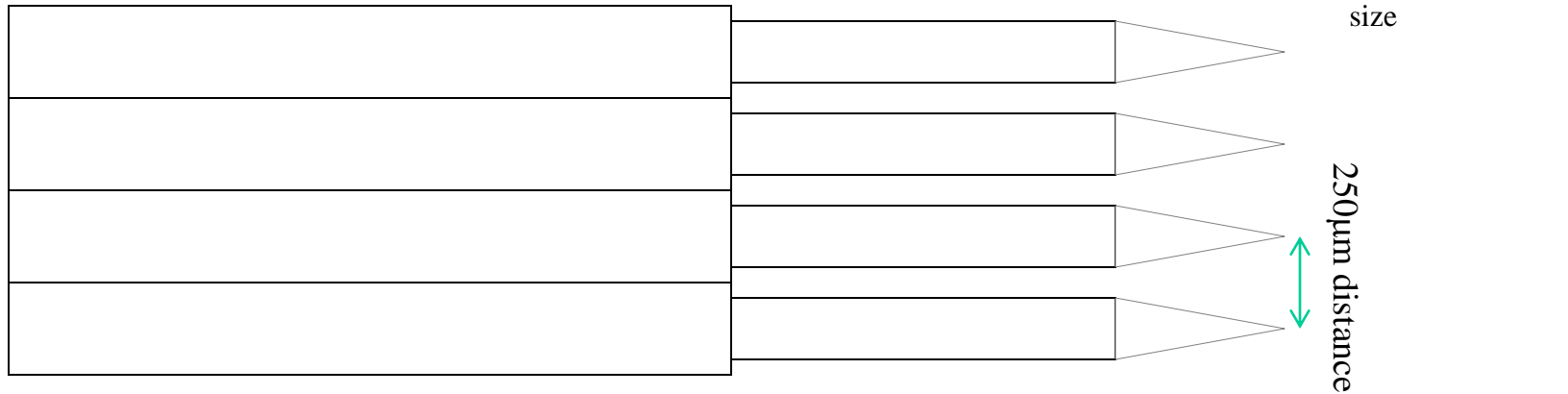


One side Perpendicular Lens with Ferrule with mark other side FC/PC



LaseOptics Single Mode Lensed Fibers

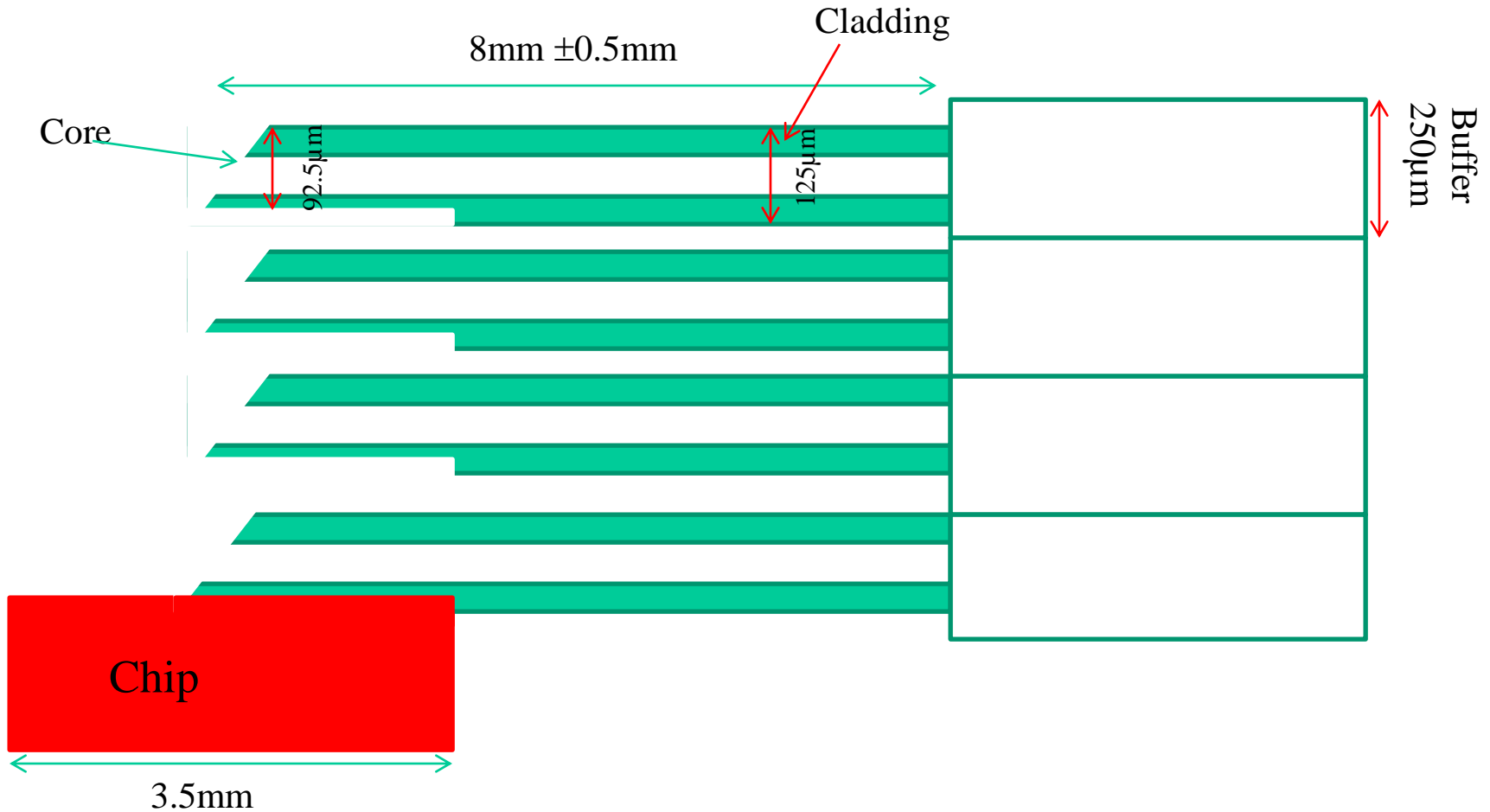
Conical Lensed Fiber Array SMF-28



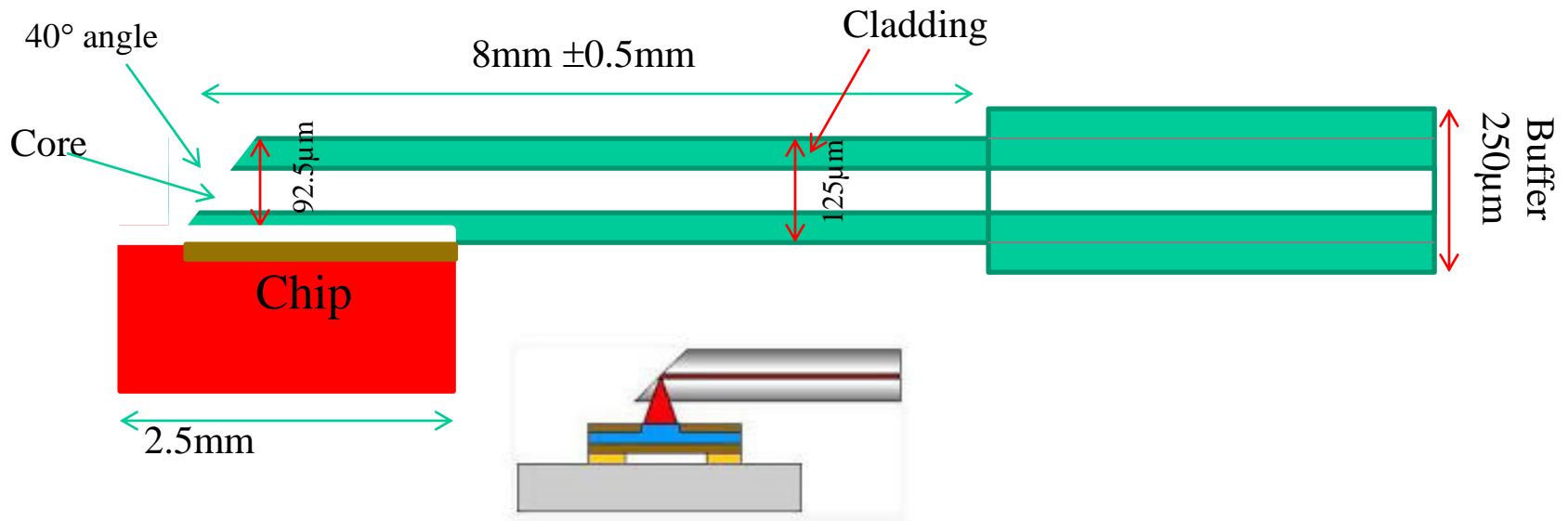
Long Working Distance Lensed Fibers



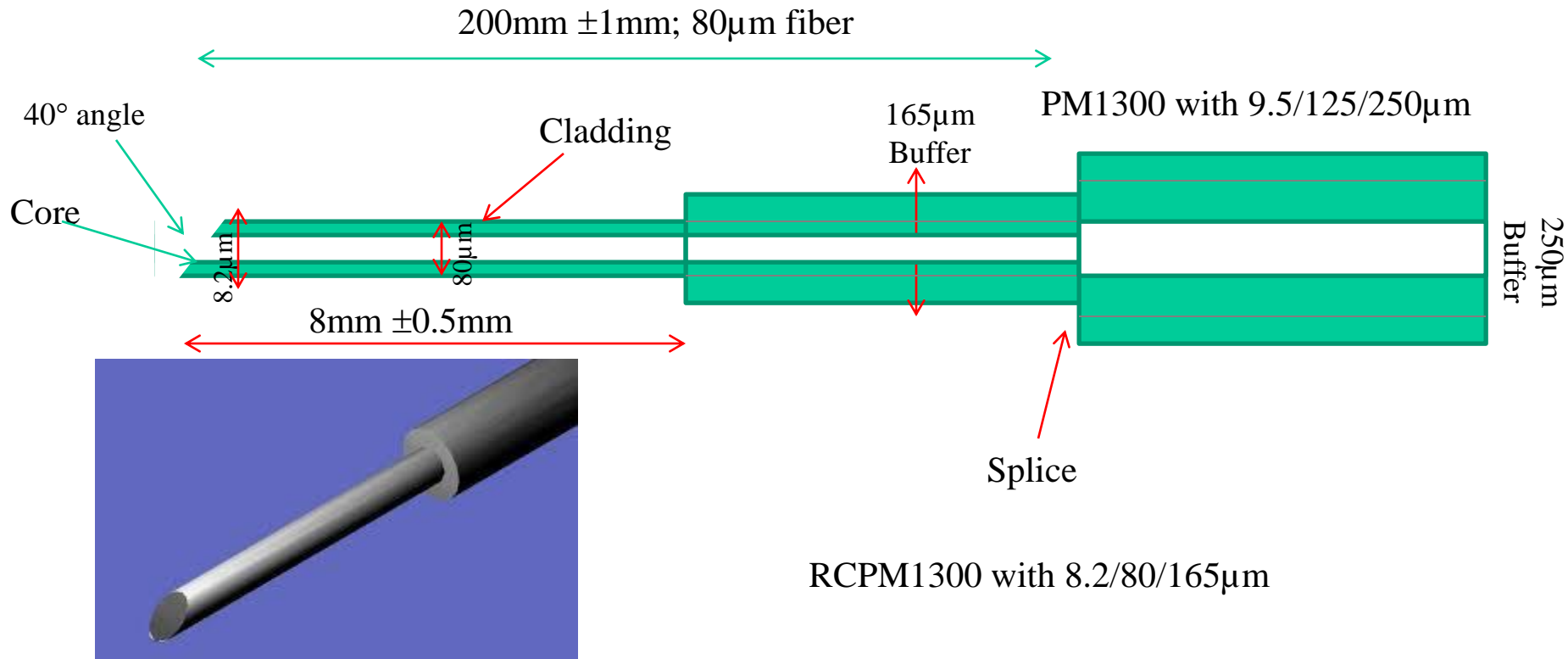
Fiber Array 4 Channel with 40° angle with reduced clad to 92.5um 3.5mm long (same 20 channels)

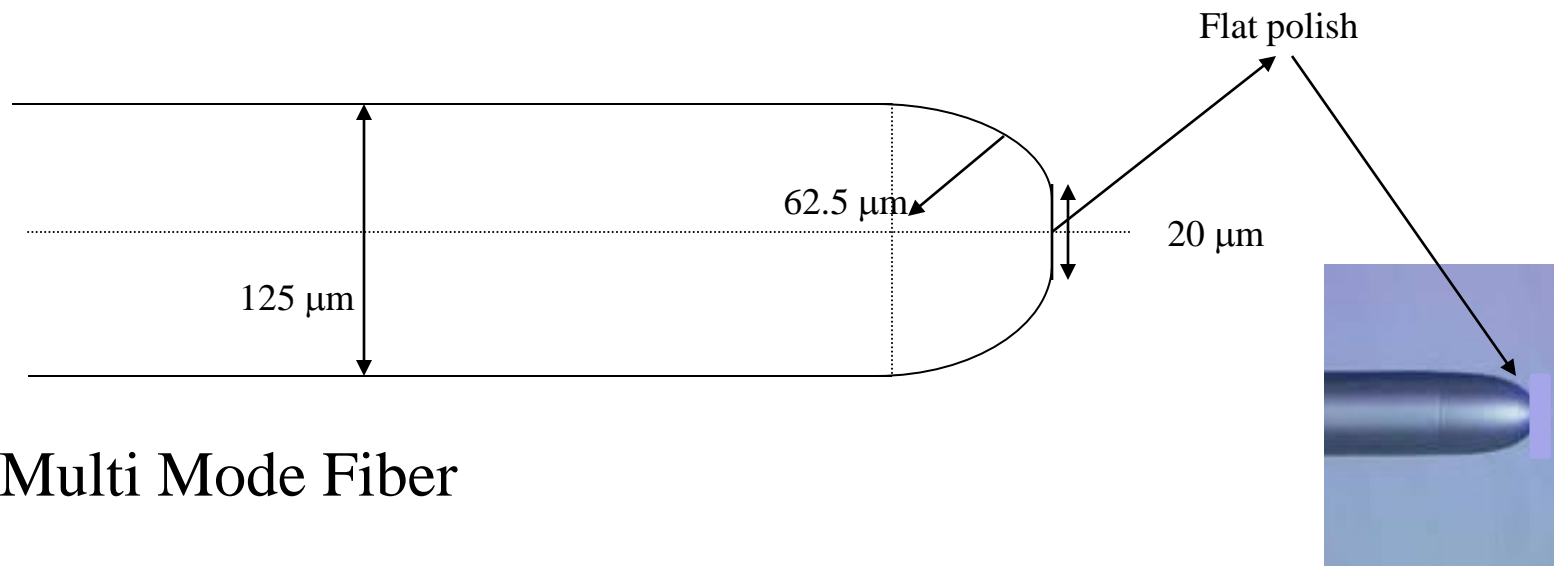
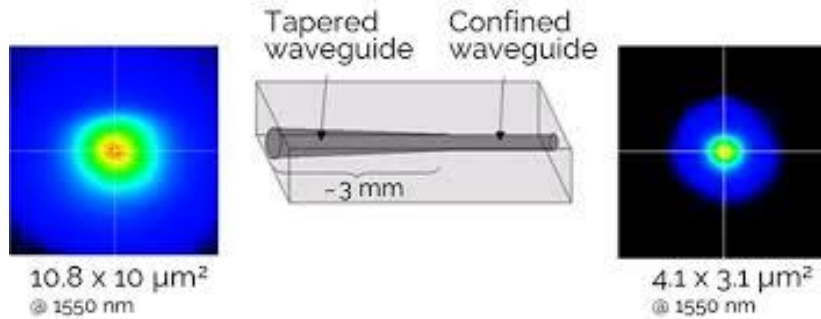


SMF-28 fiber with 40° angle with reduced clad to 92.5um of 2.5mm long



Single fiber with 40° angle with reduced clad RCPM80μm of 200mm long with PM1300 fiber.



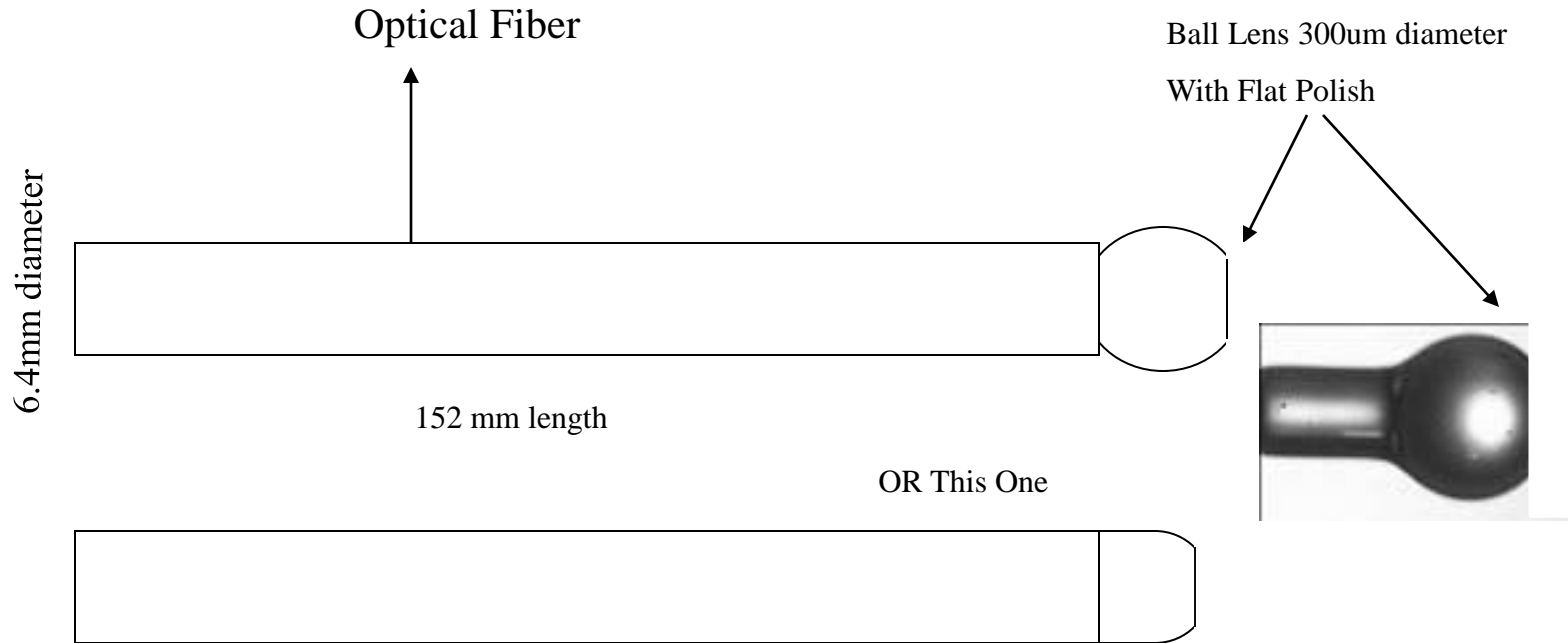


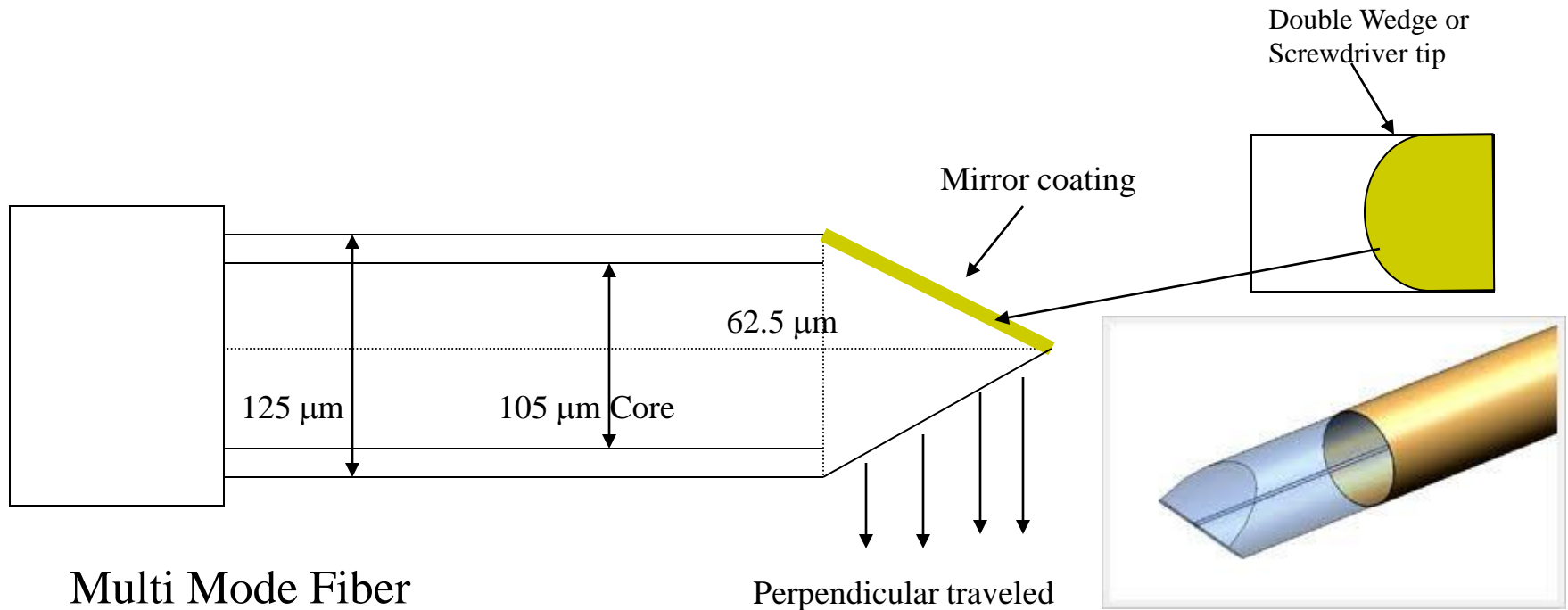
Multi Mode Fiber

LaseOptics-Curvature with Flat Polish Lensed Fiber



LaseOptics Ball Lens with Flat Polish on Image Conduit



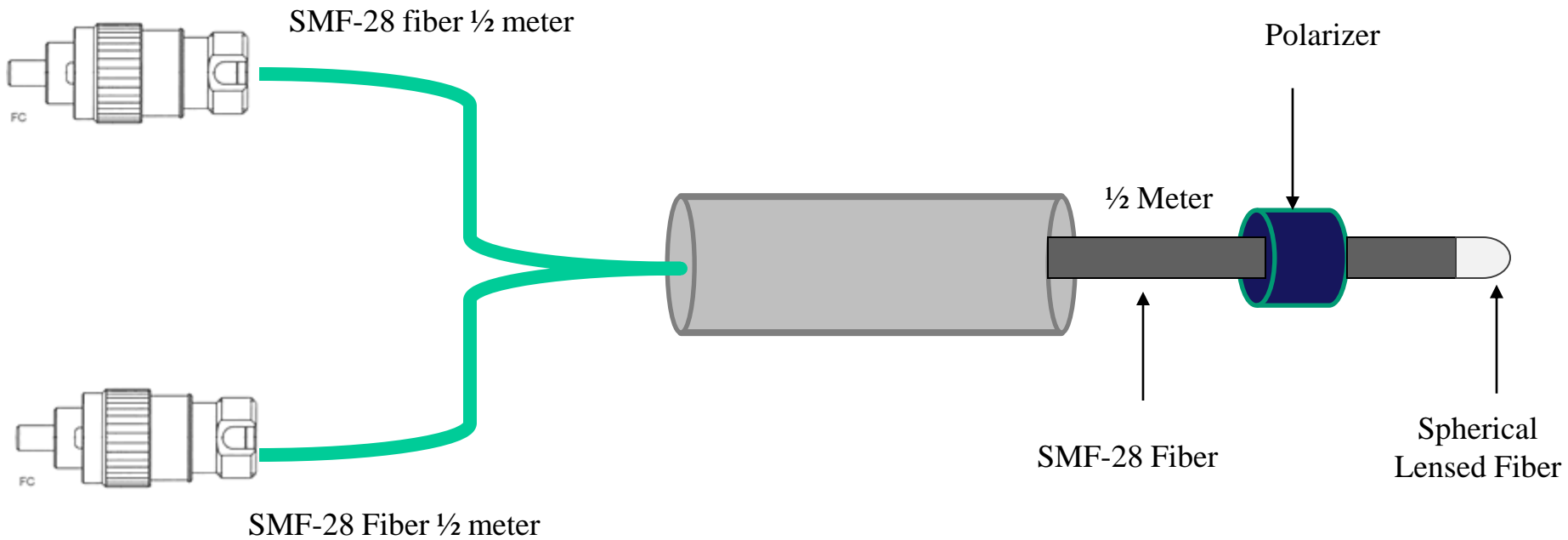


Multi Mode Fiber
Double Wedge Lens
not Conical Tip

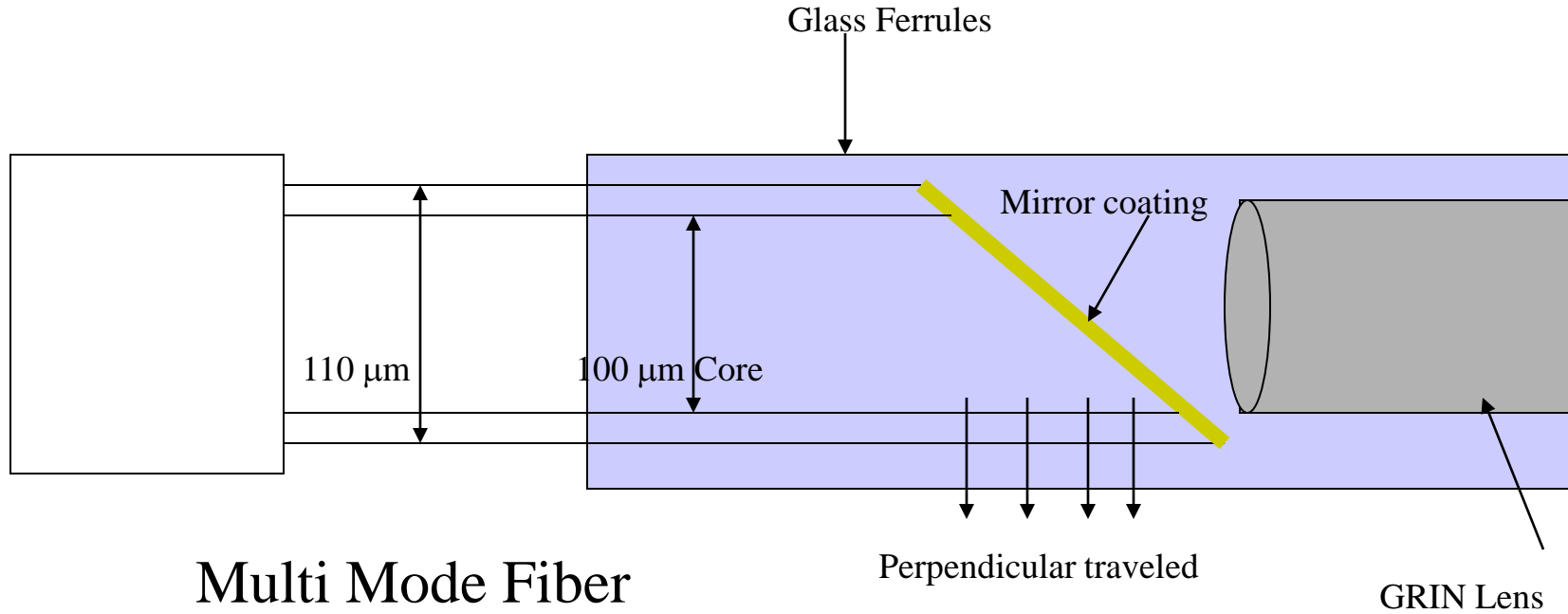
LaseOptics-Side firing fiber with 45° Angle Mirror Coated



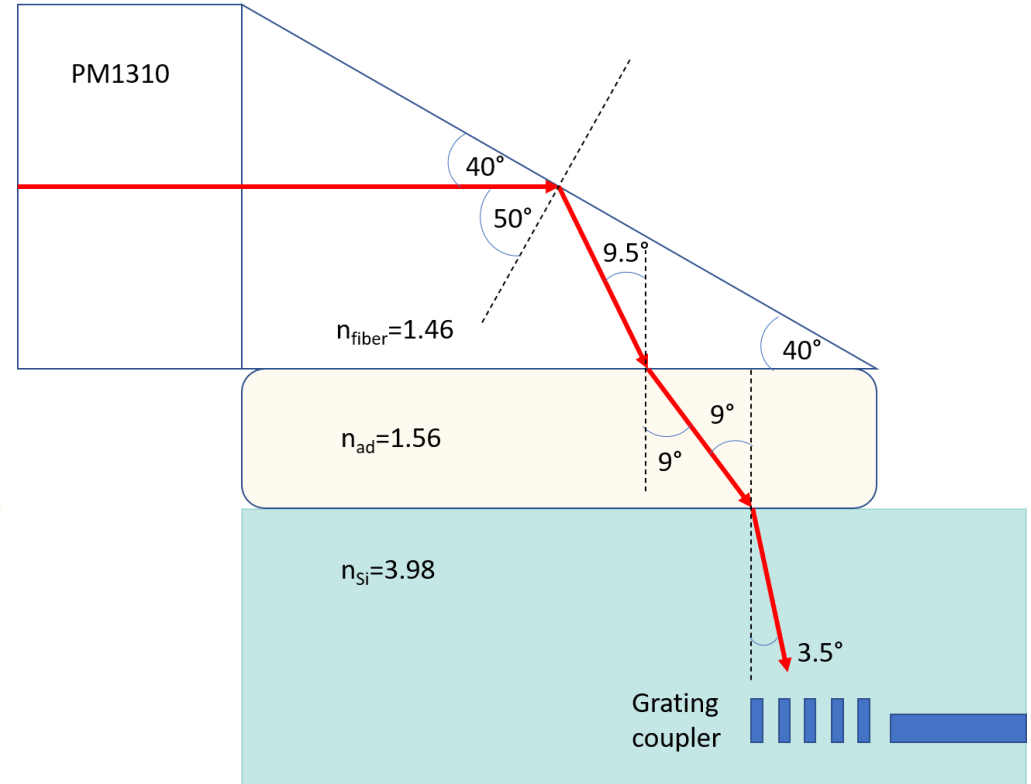
SMF-28 Coupler with Fiber Polarizer with Spherical Collimated Lens



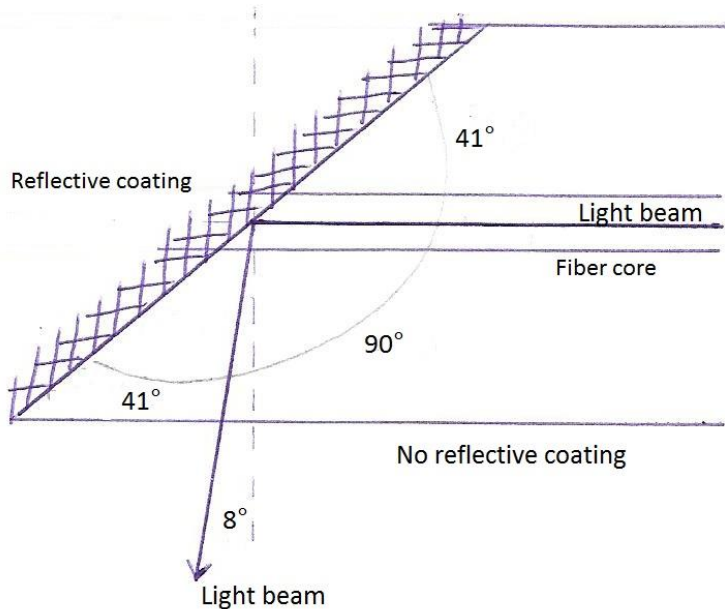
LaseOptics-Side firing fiber with 45 degree Angle Mirror Coated with Grin Lens



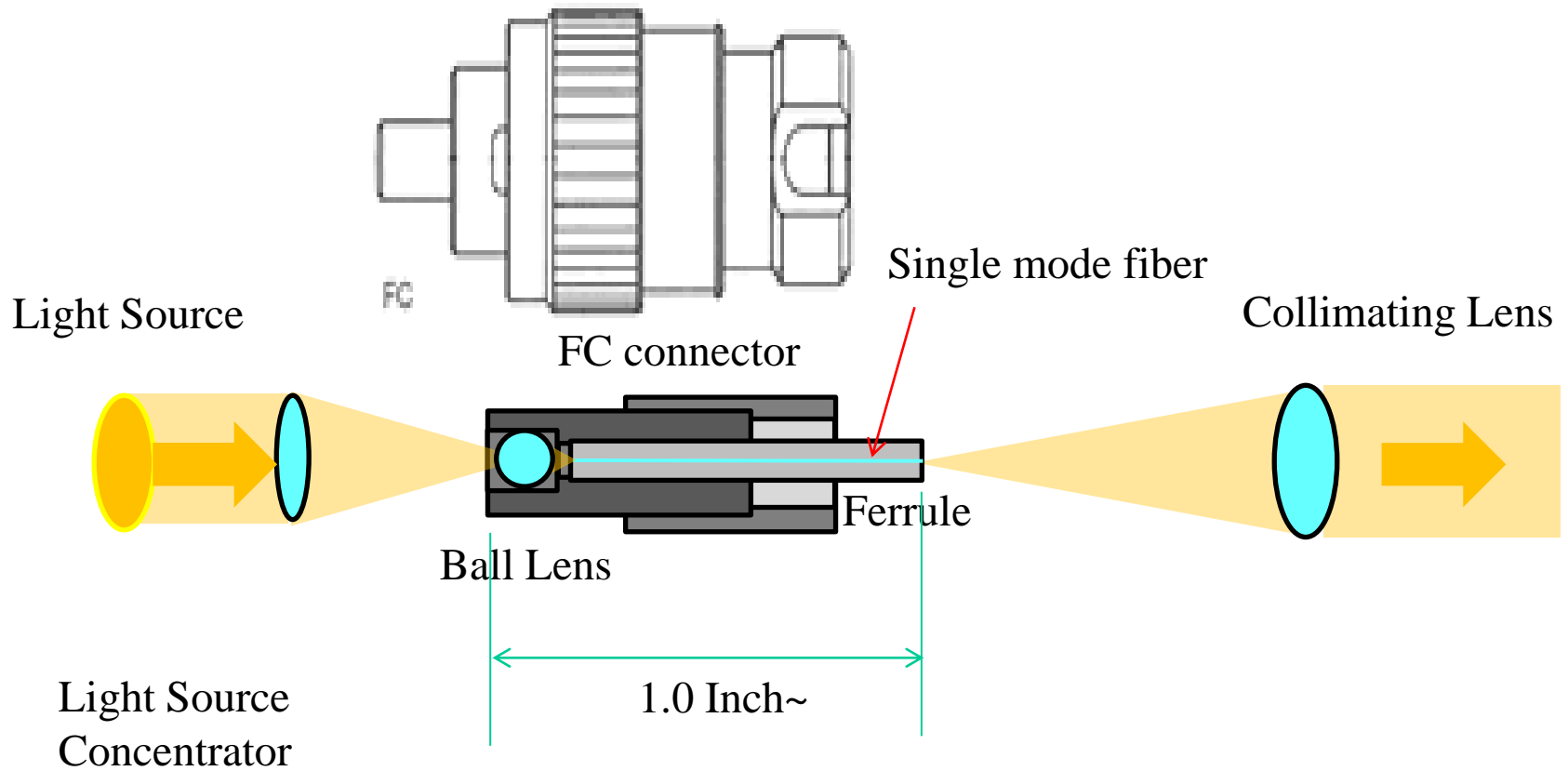
LaseOptics-Side firing fiber with 41° Angle Mirror Coated with Grin Lens



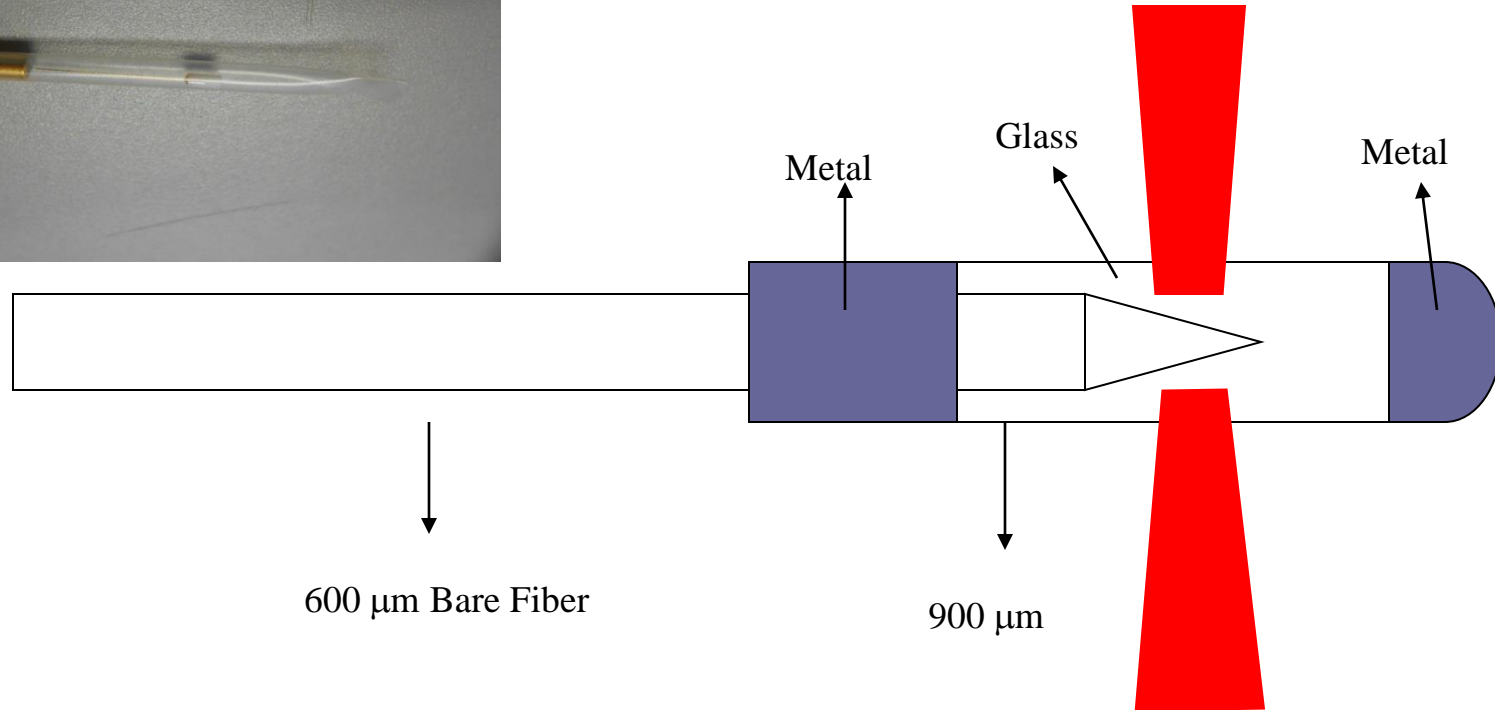
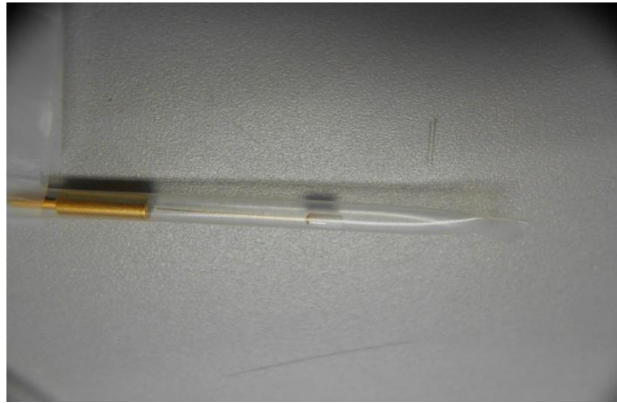
Fiber end facet: side view



Star Tester Source with Ball Lens in FC Connector Small Package

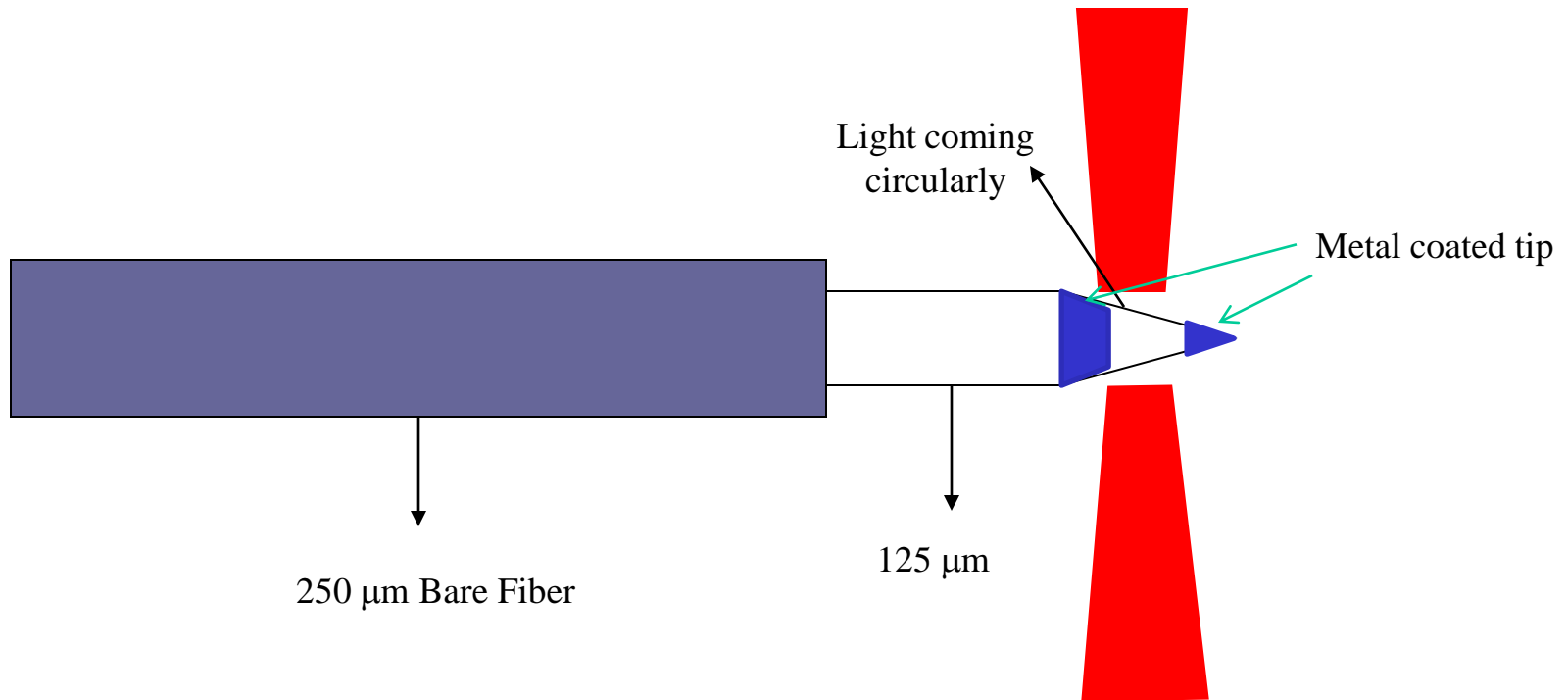


Ring Side Firing Lensed Fibers of 600/660/710 MM Fiber



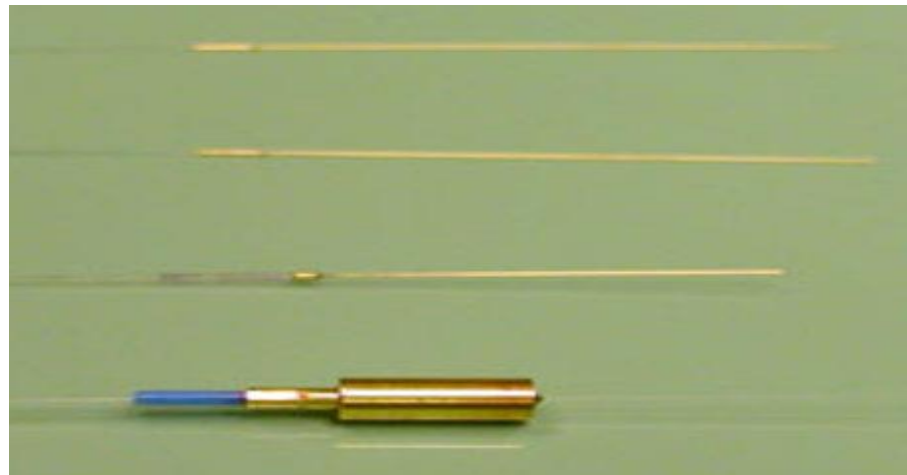
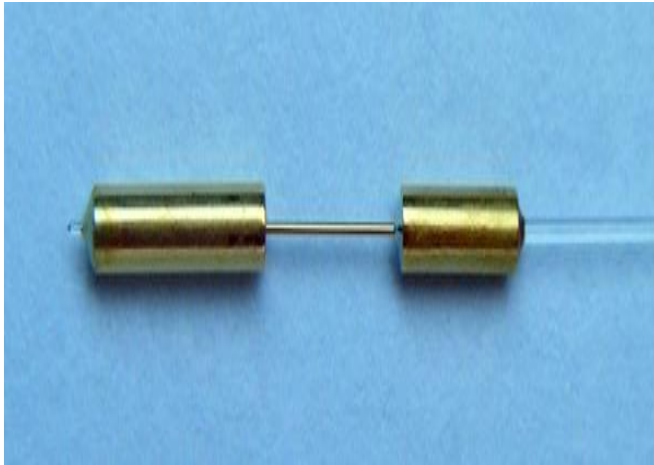
Side Firing Lensed Fiber (Bare Fiber)

Circularly/Ring Focused on Center Lensed Fibers SMF-28



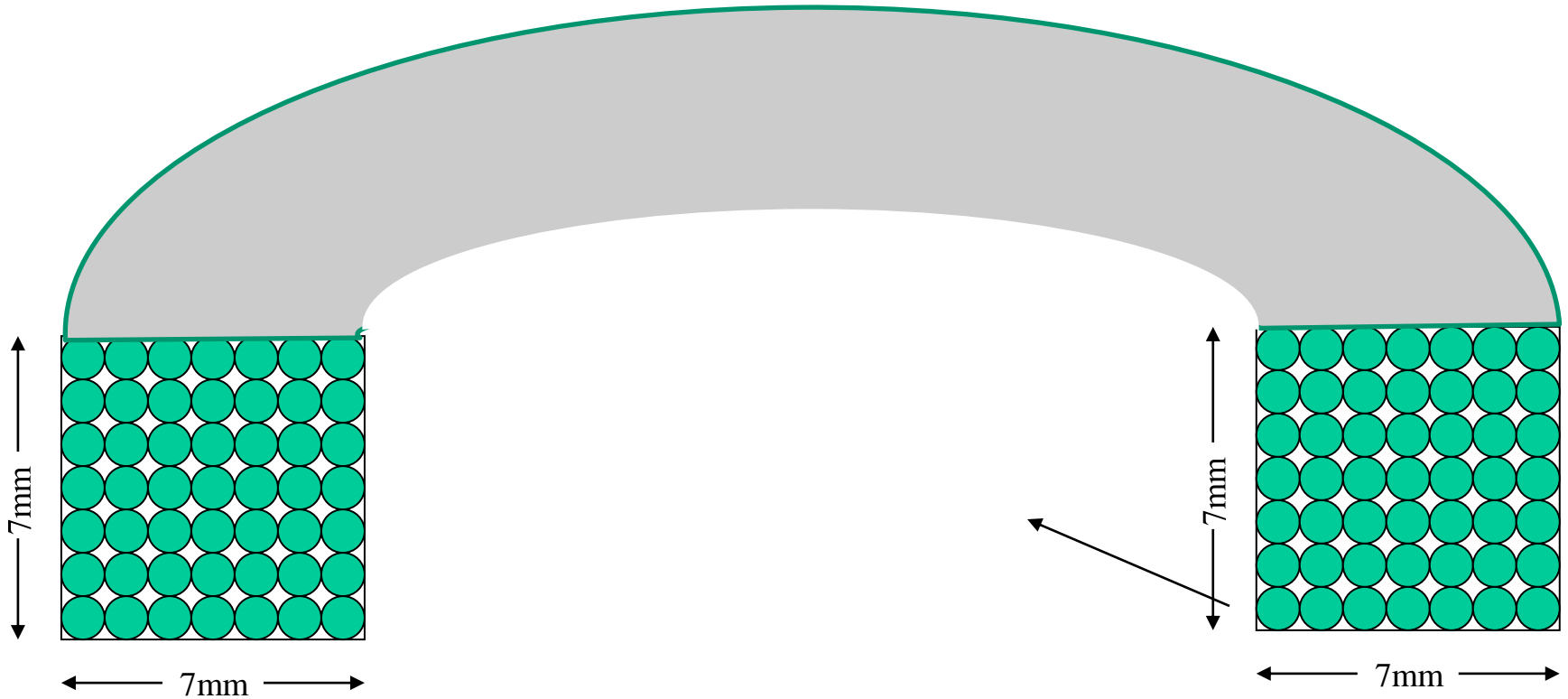


LaseOptics-Ferrule with any Lensed Fibers Packaging





300 μ m Diameter 2D Ball Lensed Fiber Arrays in Matrix Square Package

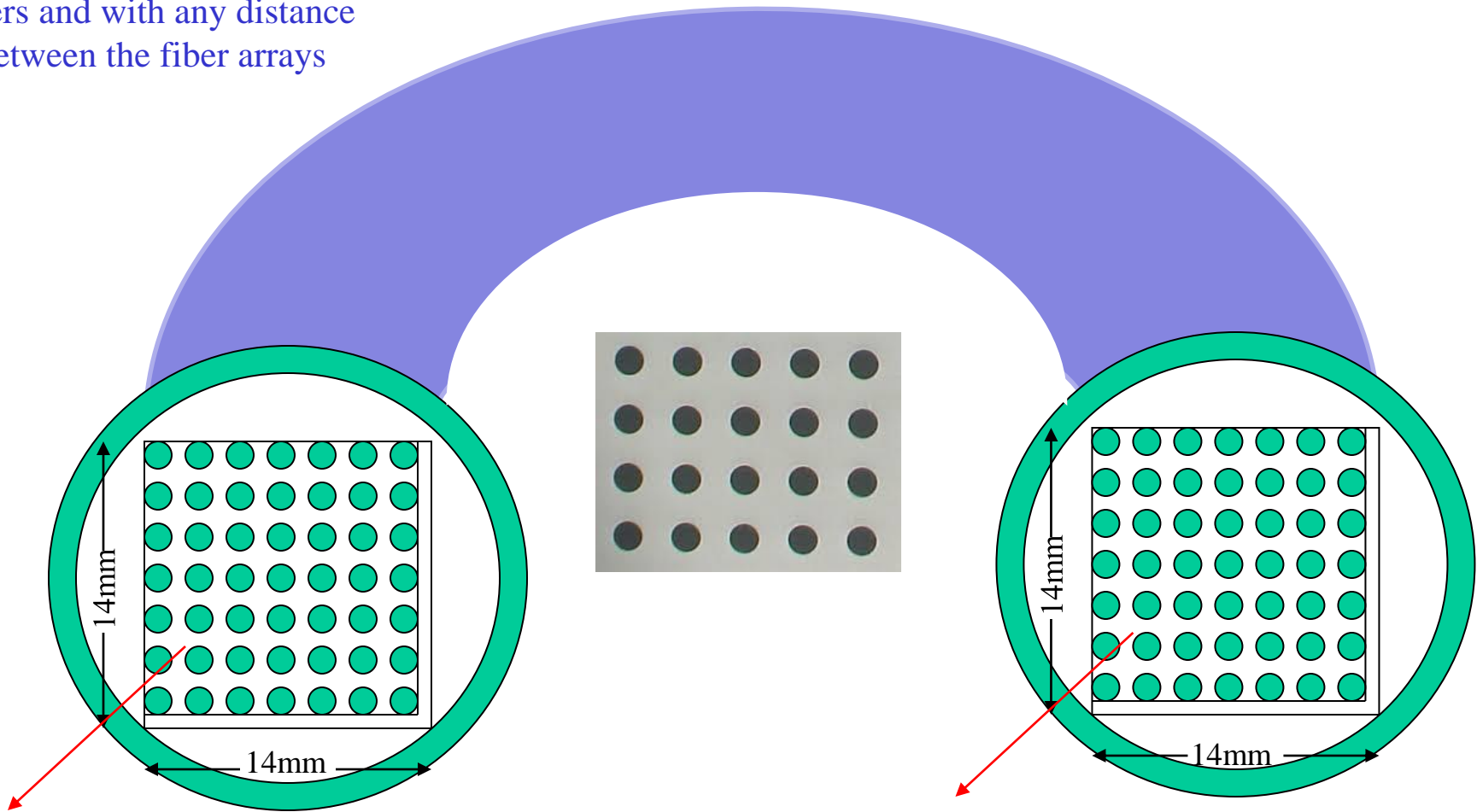


The distance between each fiber would be ~500 micron

The distance between each fiber would be ~500 micron

100/110/140 Multi Mode Fiber with 49 Ball Lenses in 2D square package

We can make any type of fibers and with any distance between the fiber arrays

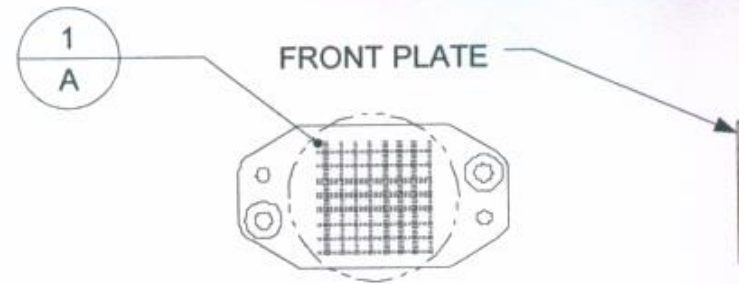
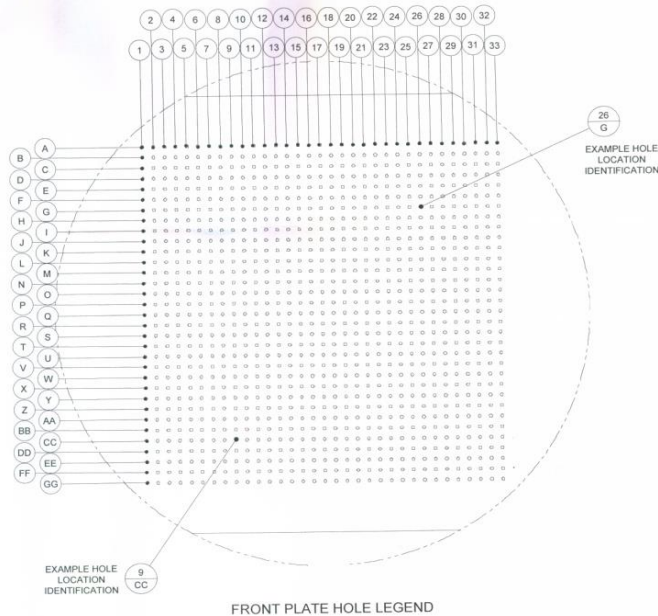
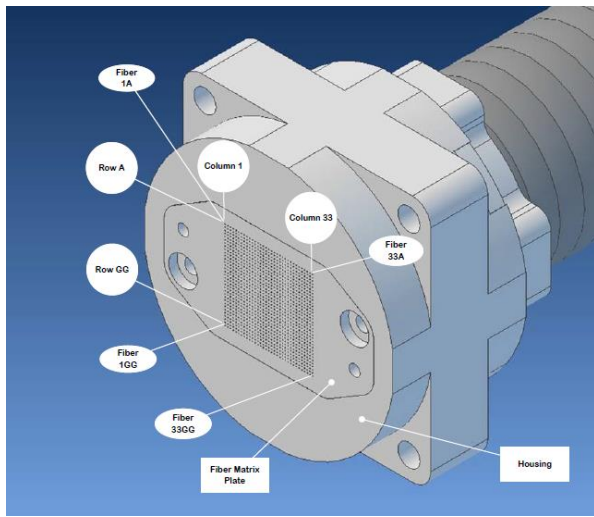


The distance between each fiber would be ~1000 micron

The distance between each fiber would be ~1000 micron

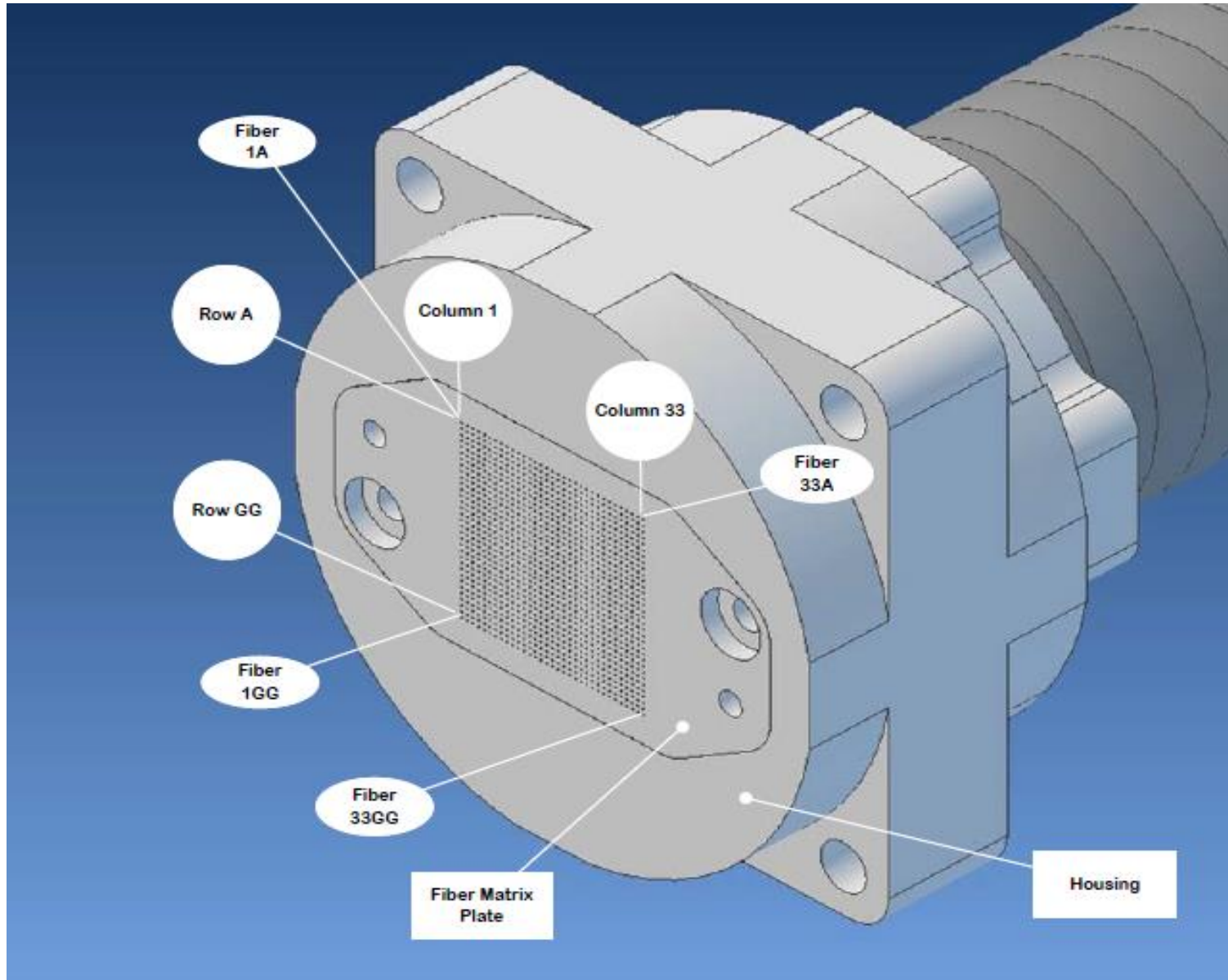
Circular Ferrule or Steel Rigid Tube

100/110/140 Multi Mode Fiber with 49 Ball Lenses in 2D square package



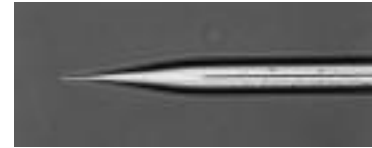
100/110/140 Multi Mode Fiber with 33 x 33 Ball Lenses in square package (1089)

100/110/140 Multi Mode Fiber with 33 x 33 Ball Lenses in square package

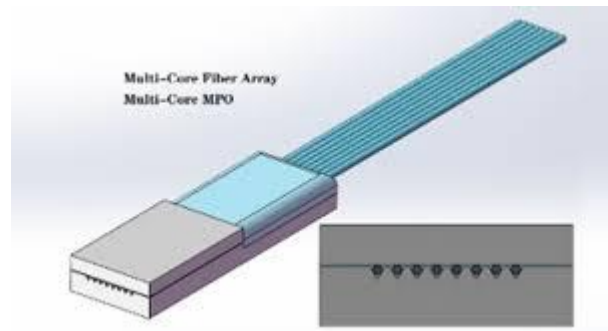
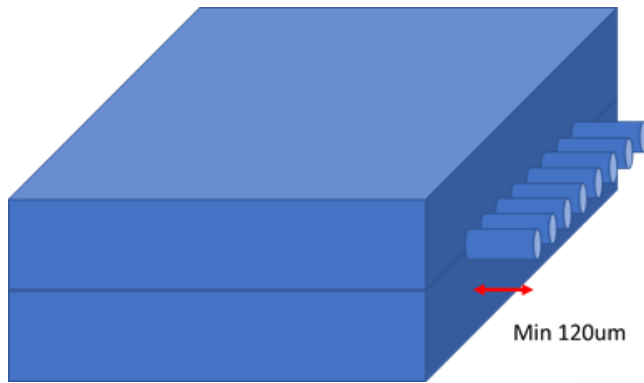




Ball Lensed Fiber Array 10 Channels



Conical Lensed Fiber Array 10 Channels

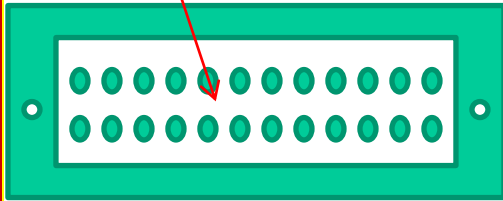


Lensed Fiber Arrays on Silicon V-grooves 4, 6, & 10 Channels

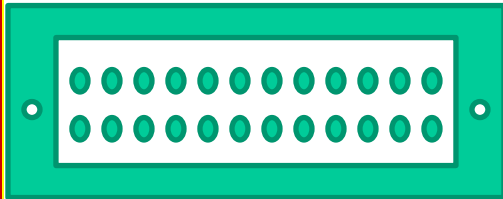


MTP connector 24 channels with multi mode fiber of 62.5/125 output end FC/PC 7 MTP connectors each MTP connector contains 24 channels/fibers 24 fibers insert into 1 FC/PC connectors of 1 MTP connector

24 Fibers 62.5/125 MM



MTP 24 Ch connector 1



MTP 24 Ch connector 2



MTP 24 Ch connector 3



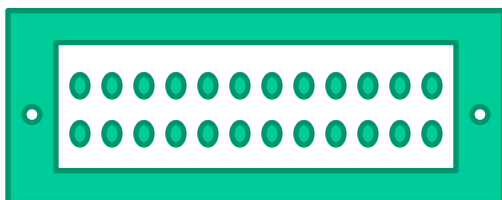
MTP 24 Ch connector 4



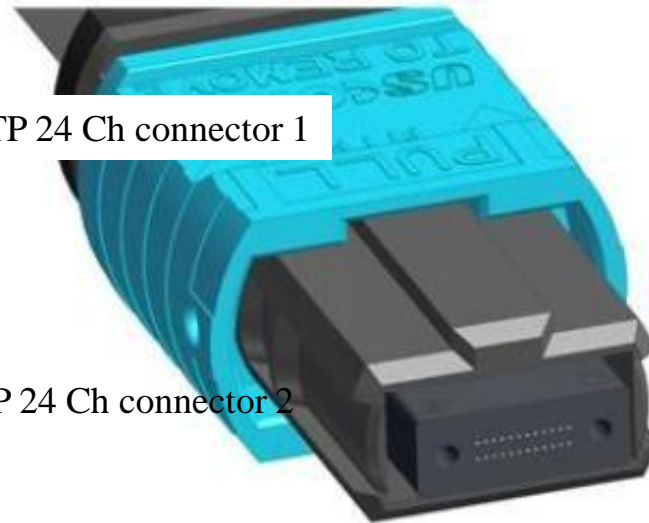
MTP 24 Ch connector 5



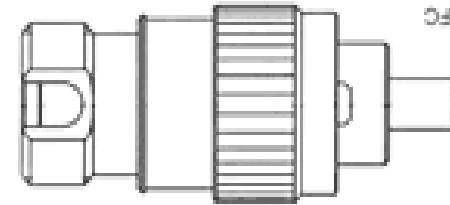
MTP 24 Ch connector 6



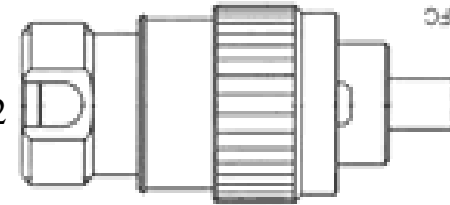
MTP 24 Ch connector 7



SMA 1



SMA 2



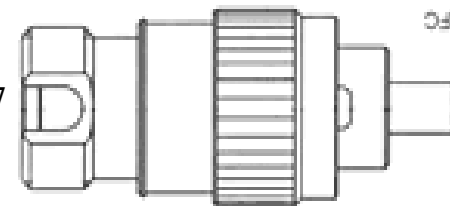
SMA 3

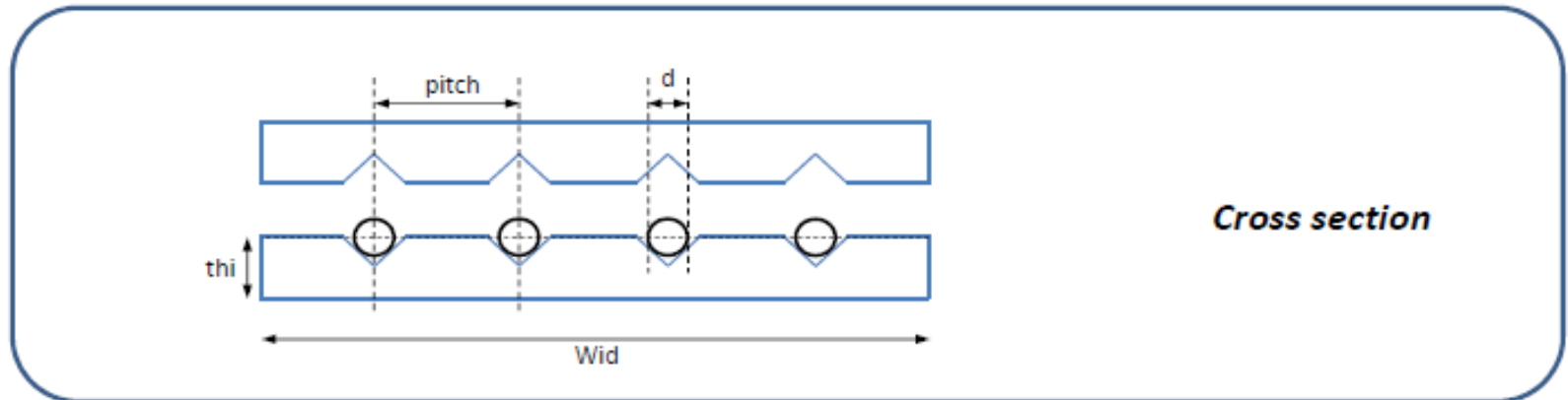
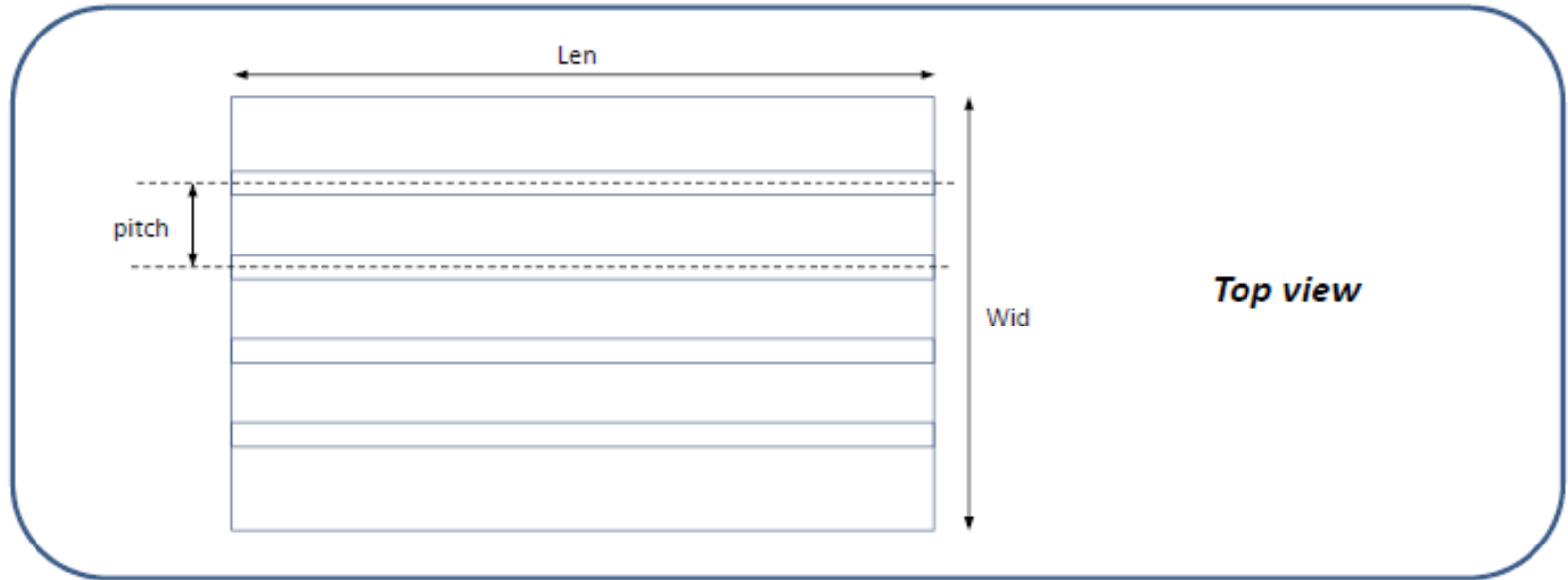
SMA 4

SMA 5

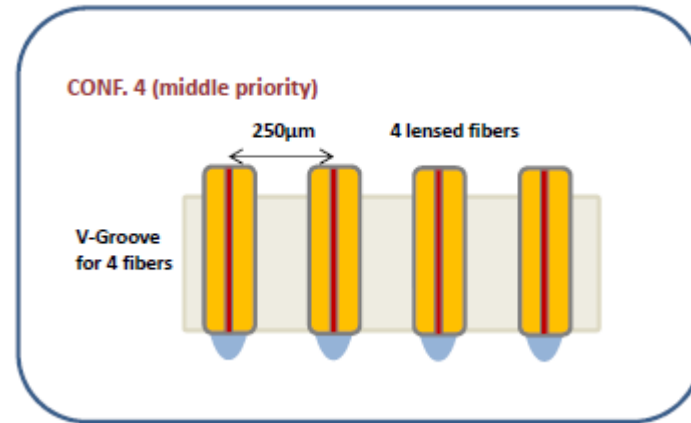
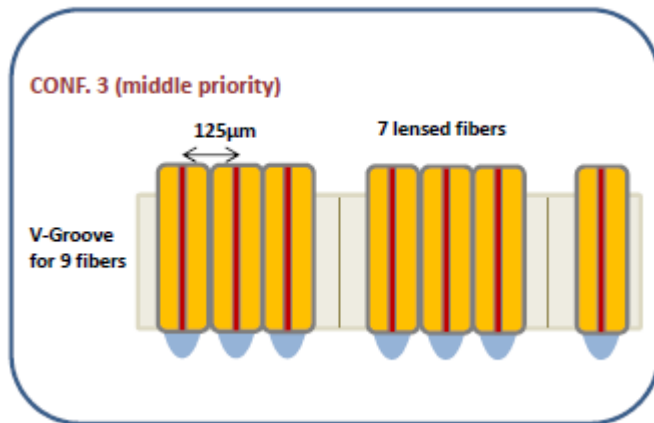
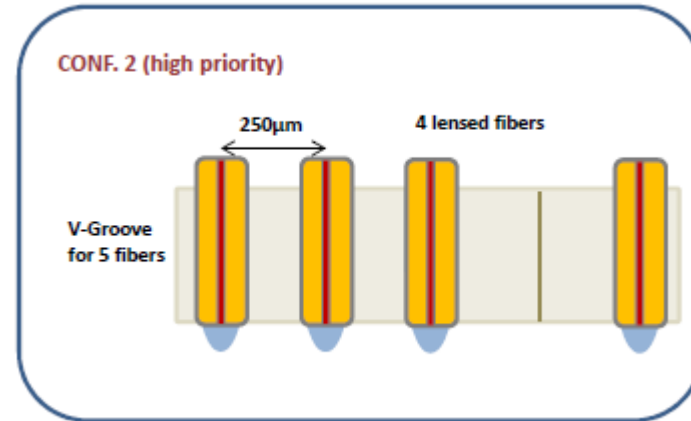
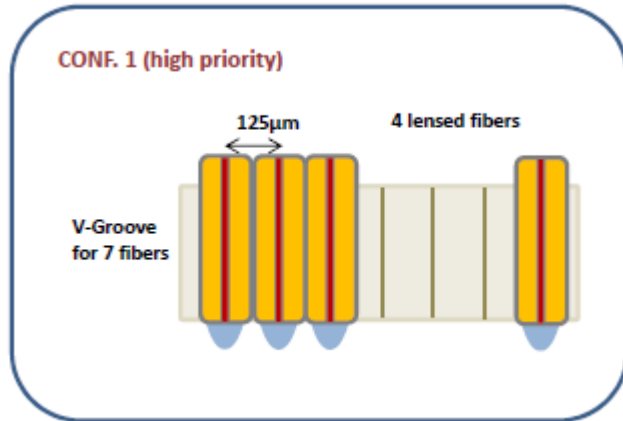
SMA 6

SMA 7





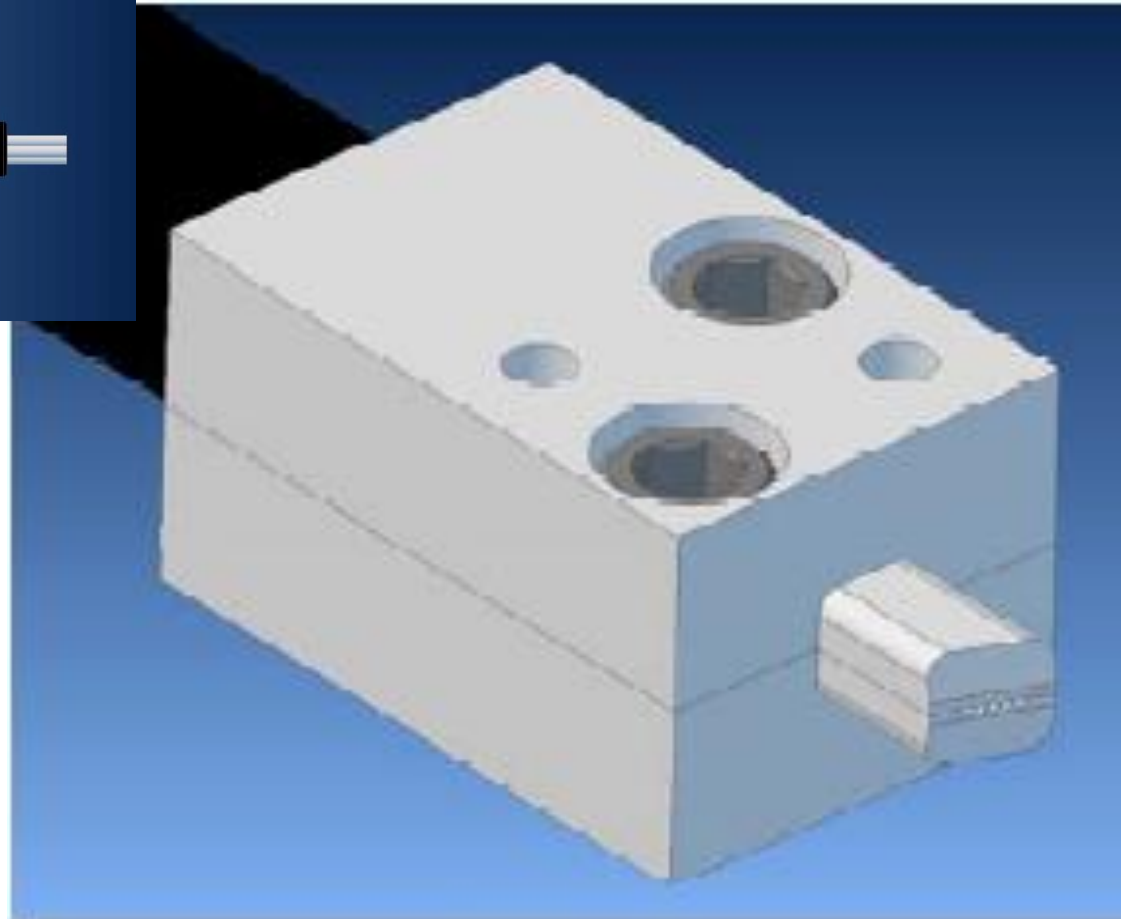
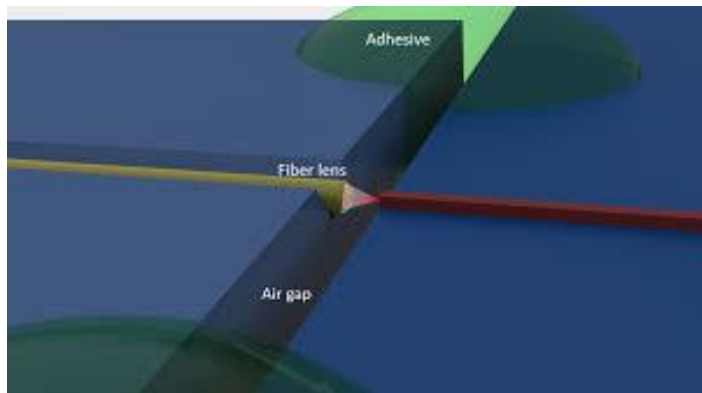
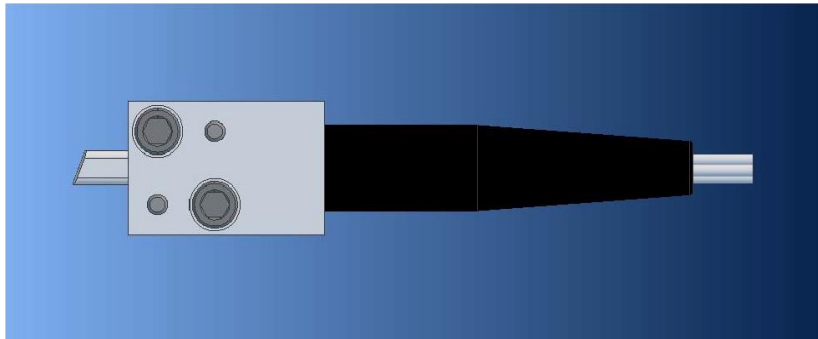
Arrays Silicon V-grooves Top & Cross Section View



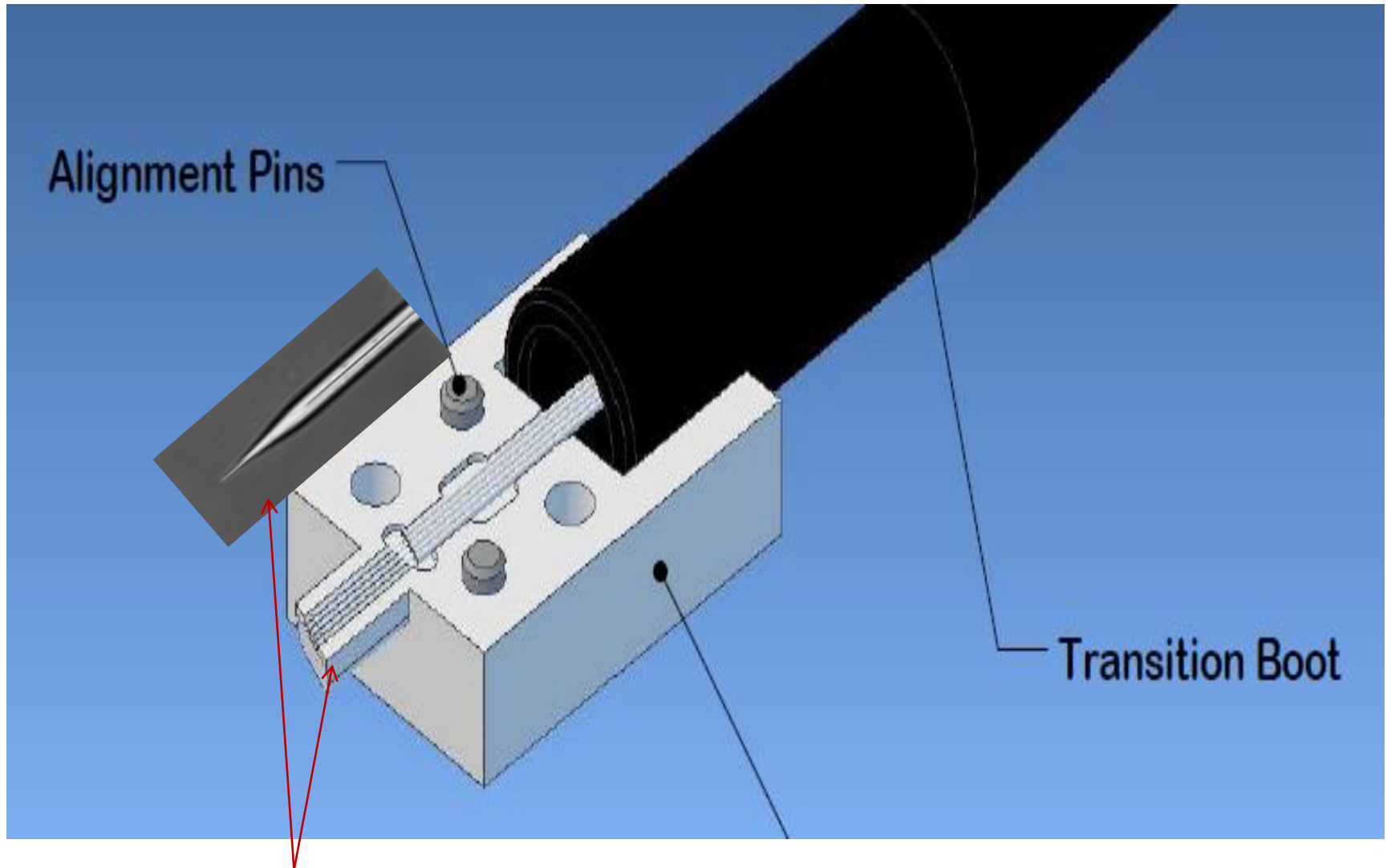
Lensed Fiber Arrays on V-grooves with skipping some channels



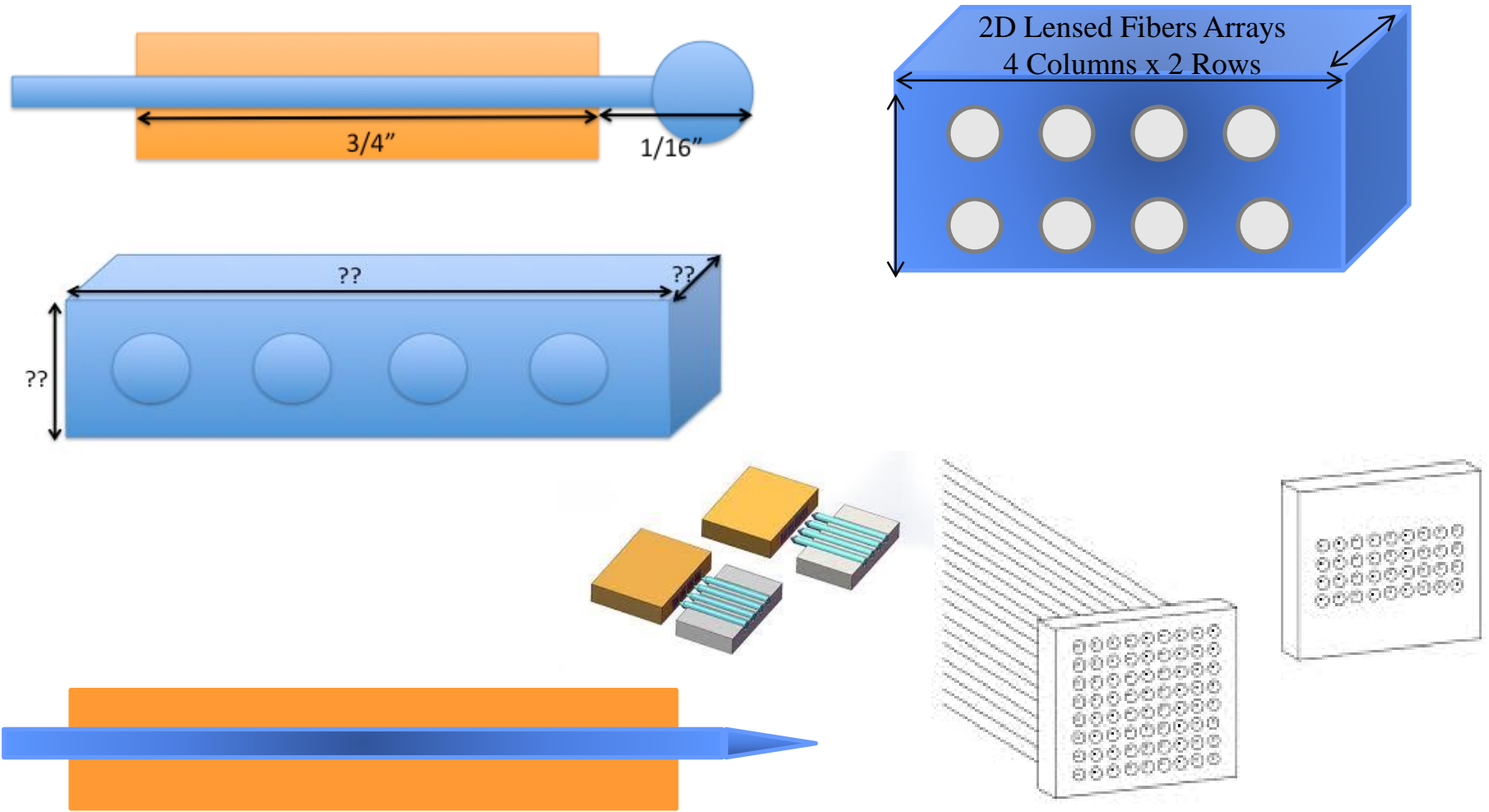
Angled Conical Lensed Fiber Array 5 Channels



Angled Array Conical Lensed Fiber 5 Channels

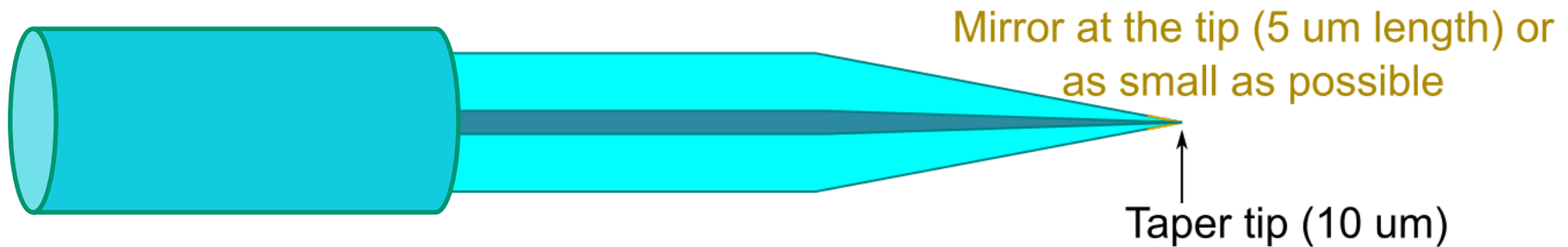
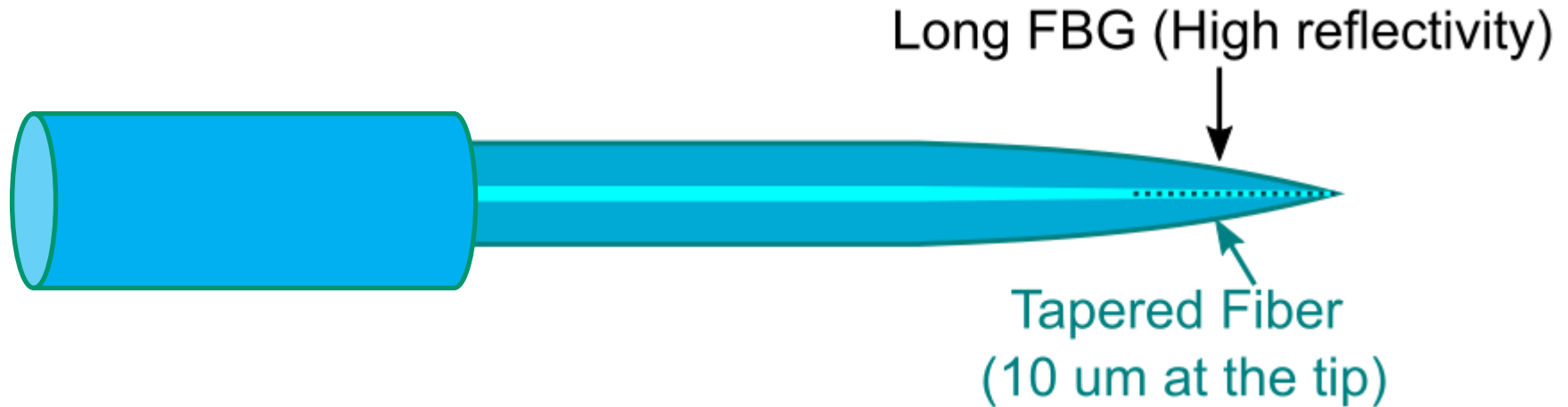


Ball Lensed 2D Fiber Arrays 4 or 6 or 8 or 10 Channels

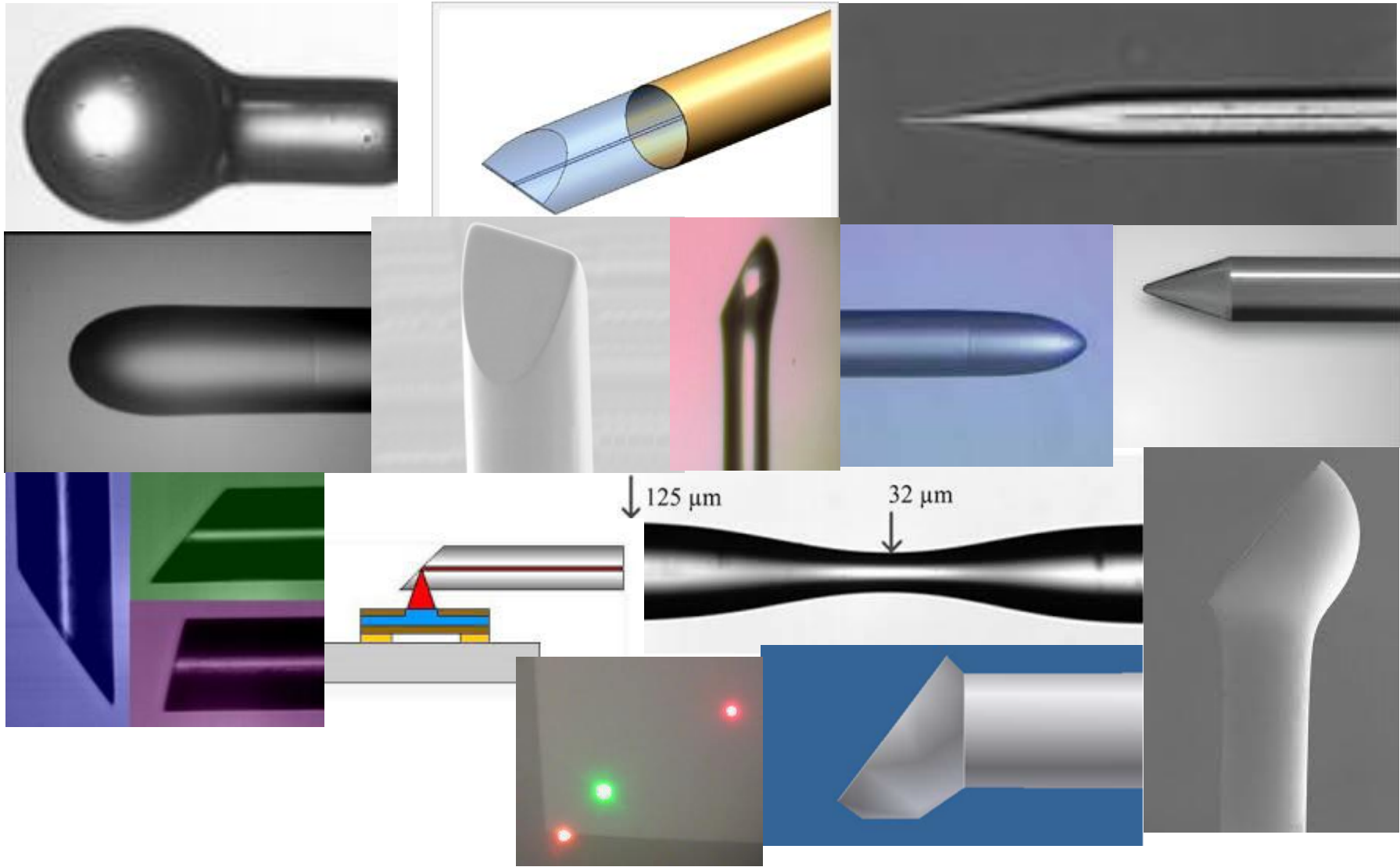


Lensed Fiber Arrays on Silicon V-grooves 4, or 2D Arrays

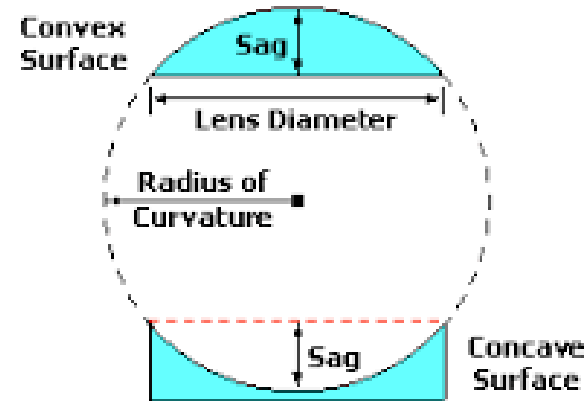
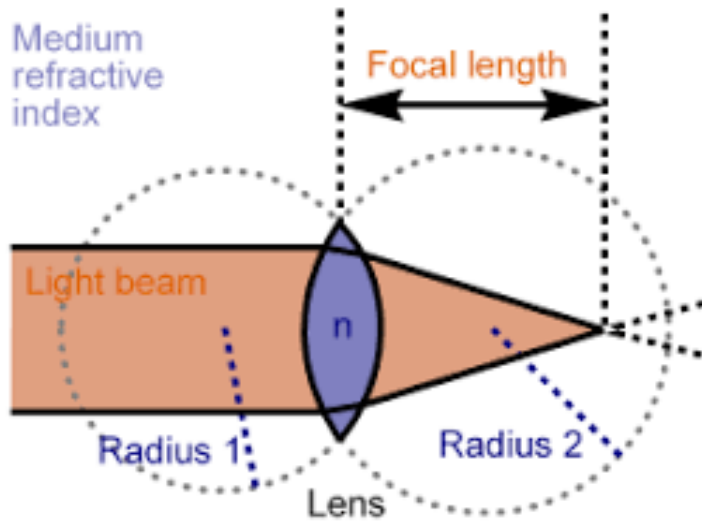
Lensed Fiber with Fiber Brag Grating



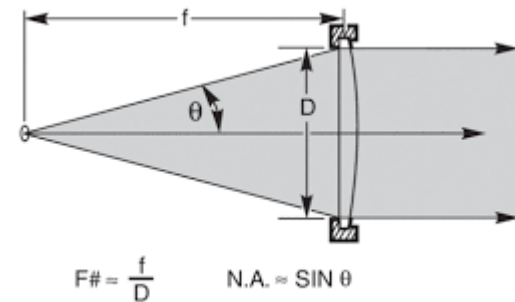
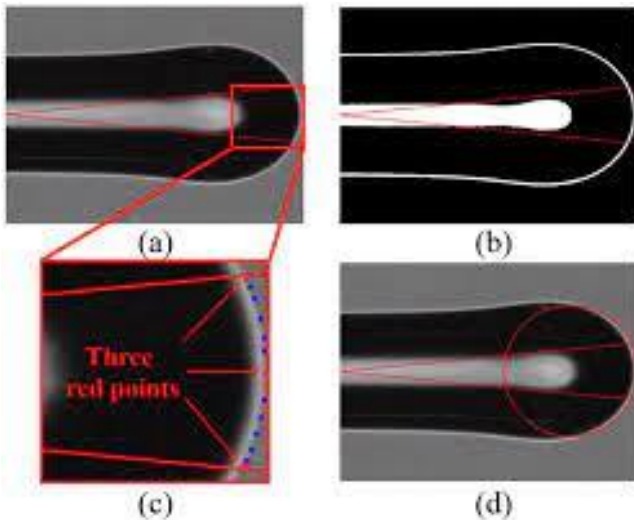
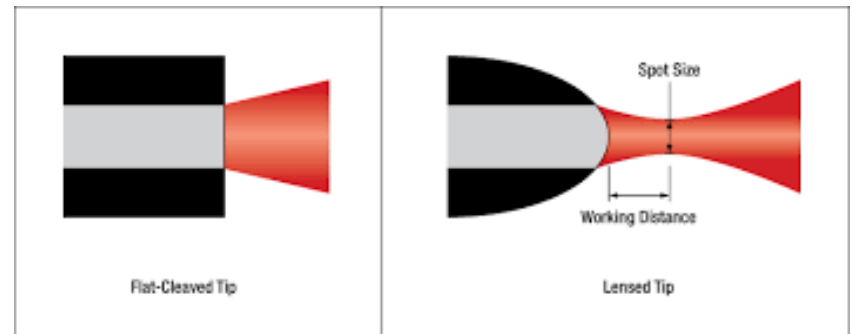
Different Shapes of Lensed Fibers for Different Application



Lensed Fibers Different Parameters



Geometry of a Lens Surface





THANK YOU