



Measurement Systems

Probe Catalog



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Unlensed Spot Probe

TYPICAL APPLICATIONS:

Low resolution applications

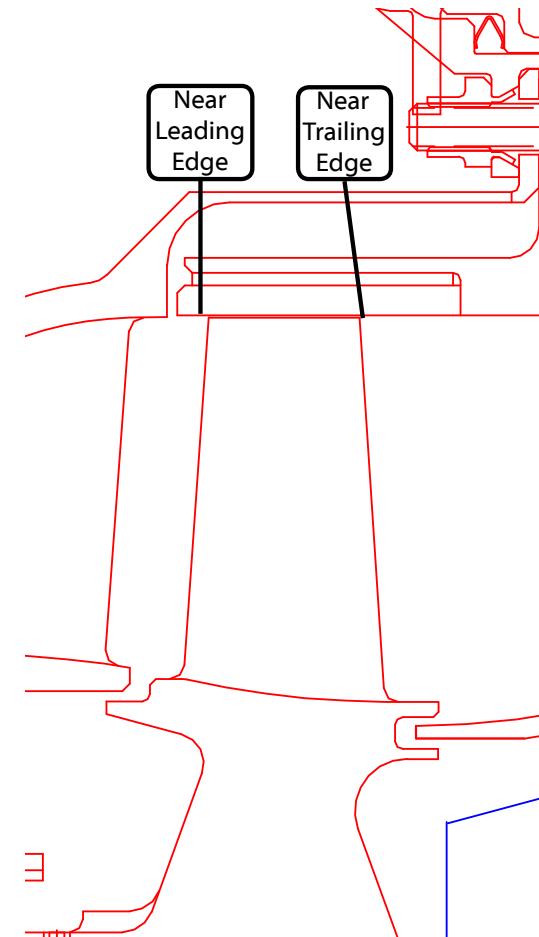
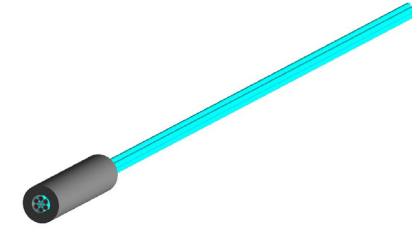
- Fan sections
- Fundamental mode HCF investigations
- Flutter/Health monitor

Unpurged high temperature applications (Aluminum, Gold)

- Back stages of HPC
- Areas of high spatial constraints

Field investigation

- Probe boss can be machined without case removal

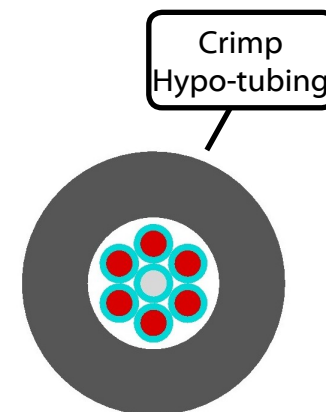
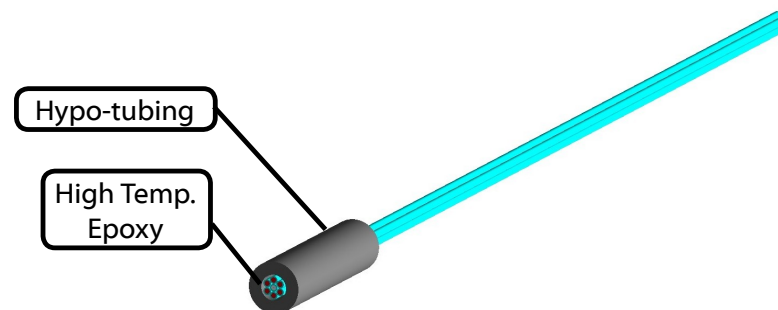




Unlensed Spot Probe

MECHANICAL CHARACTERISTICS:

- Epoxy version
 - Fused Silica, step index, polyimide buffer fiber, 570F continuous, 725F short term
 - Epoxylite 550F continuous. Ceramic cement option for higher temp.
 - Purged in compressor applications
 - 0.125 OD hypo-tube outer purge transport with 0.040 OD hypo-tube for fiber concealment
 - Can be run unpurged in fans
 - 0.050 OD hypo-tube
- Crimped version
 - Fused silica, step index, aluminum or Gold buffer fiber
 - 750F continuous for Aluminum, 1300F continuous for Gold
 - 0.050 OD hypo-tube
- Material: 300 series stainless or Inconel for better bend characteristics

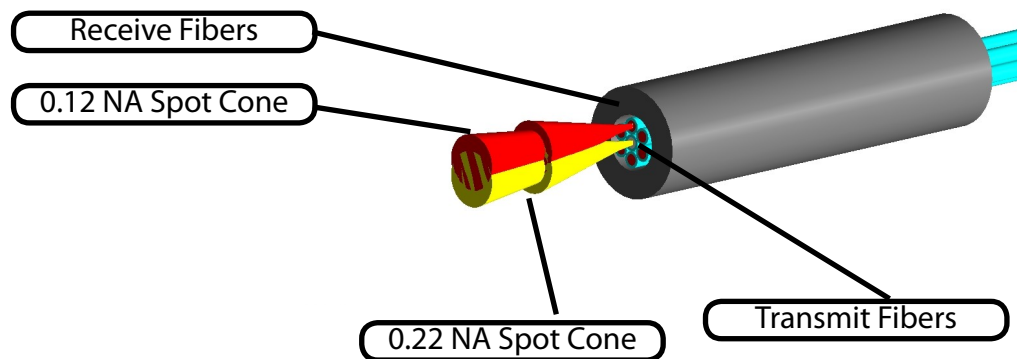




Unlensed Spot Probe

OPTICAL CHARACTERISTICS:

- One transmit fiber 100/110/140
- Six receive fibers 100/110/140
- 0.22 numerical aperture from fiber is standard
 - Spot size = $2D \tan(12 \text{ degrees}) + 100\mu\text{M}$, where D is the distance to the target
 - Working range 100uM to infinity
- 0.12 numerical aperture available for smaller spot size
 - Spot size = $2D \tan(7 \text{ degrees}) + 100\mu\text{M}$, where D is the distance to the target
 - Working range 165uM to infinity





Lensed Spot Probe

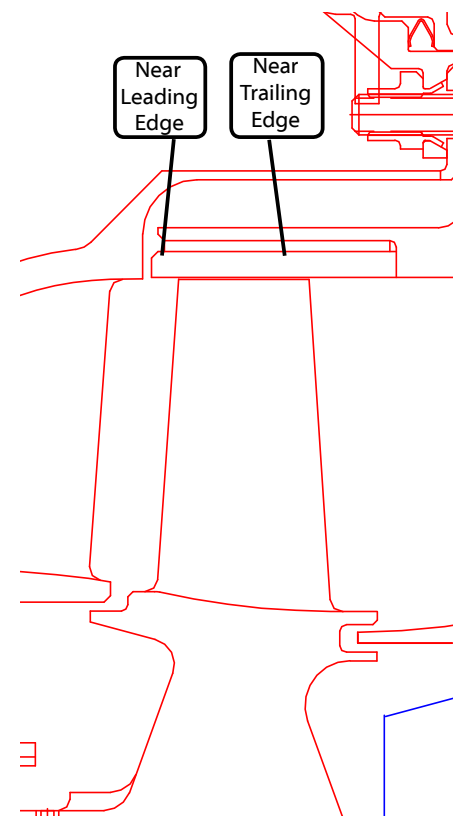
TYPICAL APPLICATIONS:

High resolution applications

- Fan, HPC, LPT and HPT sections
- Full HCF investigations

Field investigation

- Probe boss can be machined without case removal although boss for the lense version is typically larger than the unlensed spot

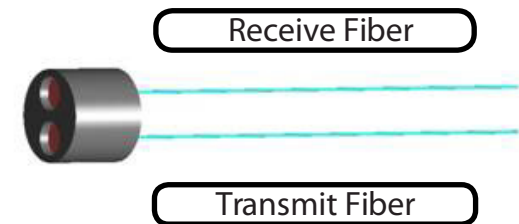
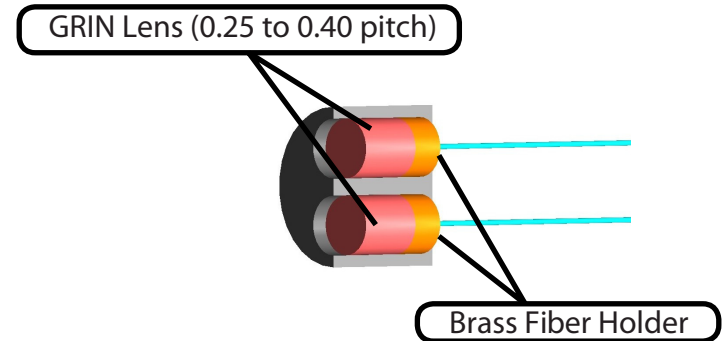




Lensed Spot Probe

MECHANICAL CHARACTERISTICS:

- Two GRIN lens (transmit, receive) configuration
- Spare transmit, receive combinations available
- Epoxy construction
 - Epoxylite 550F continuous
 - Fused Silica, step index, polyimide buffer fiber, 570F continuous, 725F short term
 - Purged in compressor/turbine applications
 - 0.125 OD hypo-tube outer purge transport with 0.040 OD hypo-tube for fiber concealment (3' to 10')
 - 0.250 Tyflex braided stainless steel line to purge input and fiber connector ends (~20')
 - Can be run unpurged in fans
- 0.040 OD hypo-tube to transmit/receive splitter
- Tyflex or external extension fiber connection to laser & detector
- Material: 300 series stainless or Inconel Hypo-tubing for better bend characteristics

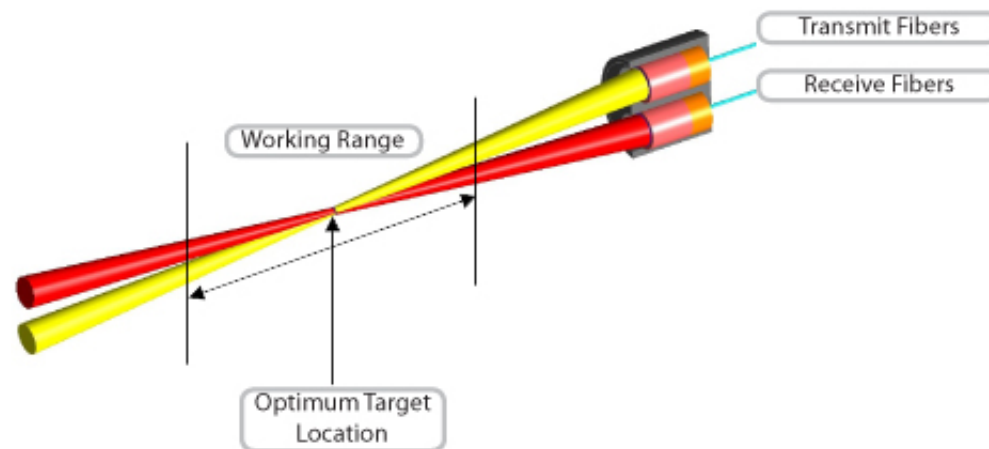




Lensed Spot Probe

OPTICAL CHARACTERISTICS:

- One to three transmit fibers 100/110/140 (1 primary, 2 spares)
- 50uM transmit for smaller spot at the expense of probe efficiency
- One to three receive fibers (1 primary, 2 spares)
- Receive diameter equal to the transmit size for better Infra-red rejection in hot sections
- Receive fiber greater than the transmit size for extended range and efficiency
- 1.8mm or 1.0mm GRIN lens, pitch is set by working range requirement
- Working range 1.8mm: 0.125" to 3.0"
- Working range 1.0mm: 0.070" to 3.0"
- The span of the working can be adjusted with lens locations
- Overlap is obtained with either off-axis fiber placement or angled lenses

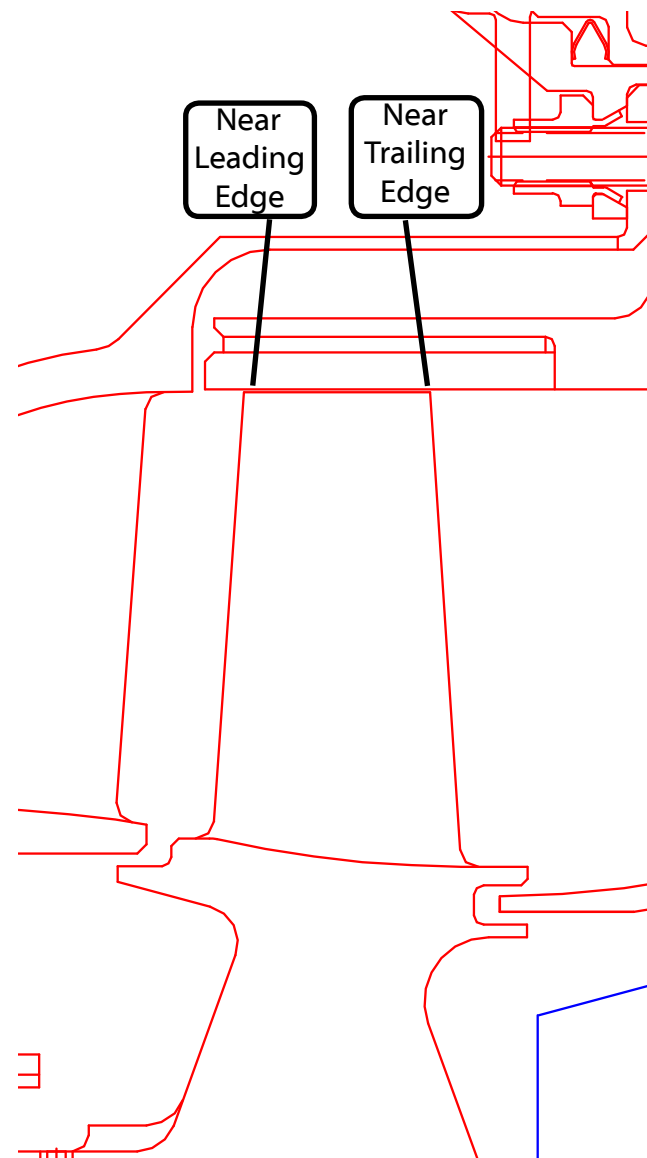




Line Probe

TYPICAL APPLICATIONS:

- Fan and HPC stages where blade geometries provide good leading edge and trailing edge targets
- HCF investigations that require highly accurate stress conversions for modes with high modal gradients such as low aspect ratio tip modes
- HCF investigations that require knowledge of the axial and tangential components of vibration
- Untwist measurements

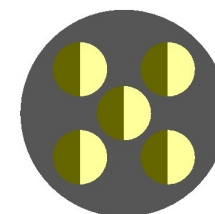
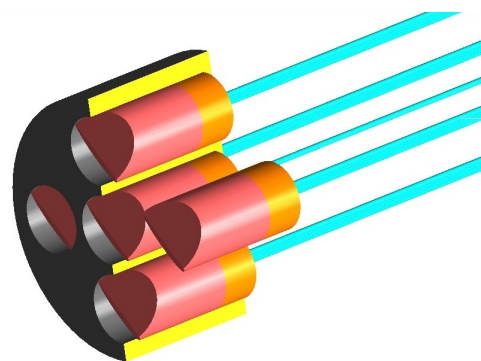
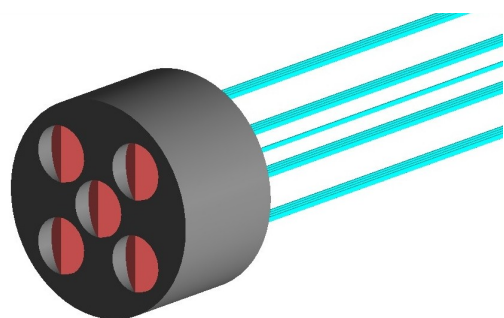




Line Probe

MECHANICAL CHARACTERISTICS:

- Two or five lens configurations
- Two lens configuration for short line length applications
- five lens configuration for long line length application in fan sections
- Epoxy construction
- Epoxylite 550F continuous
- ~0.300" OD probe head for a five lens configuration
- ~0.200" OD probe head for a five lens configuration
- Case hole requires slot. Dimensions are dependent on the line length requirement
- Unpurged capability in low temperature environments

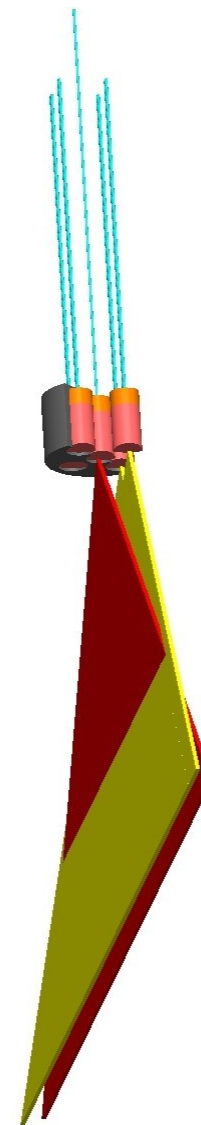




Line Probe

OPTICAL CHARACTERISTICS:

- Two or five lens configurations
- One transmit fiber, multiple receive fibers
- Three or four receives for two lens configurations
- 12 or 16 receives for the five lens configurations
- 100uM fused silica step index transmit
- Polyimide buffer 550F continuous, 725F short term
- 200uM fused silica step index receive fibers
- 100uM options if coupling to extension fiber is required
- Polyimide buffer 550F continuous, 725F short term
- Spare transmit fibers (2) available

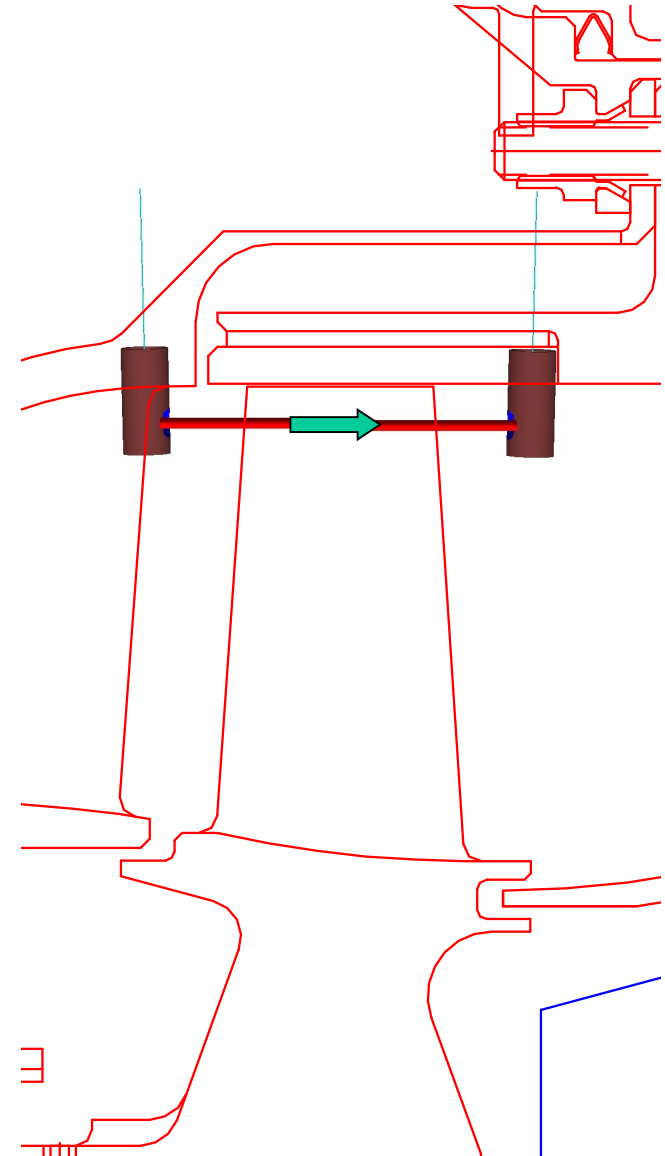




Beam Interrupt Probe

TYPICAL APPLICATIONS:

- Fan stages where the axial motion exceeds the capability of the typical line probe.
- Measures both LE and Trailing edge of the blade
- HCF investigations that require highly accurate stress conversions for modes with high modal gradients such as low aspect ratio tip modes
- HCF investigations that require knowledge of the axial and tangential components of vibration
- Untwist measurements

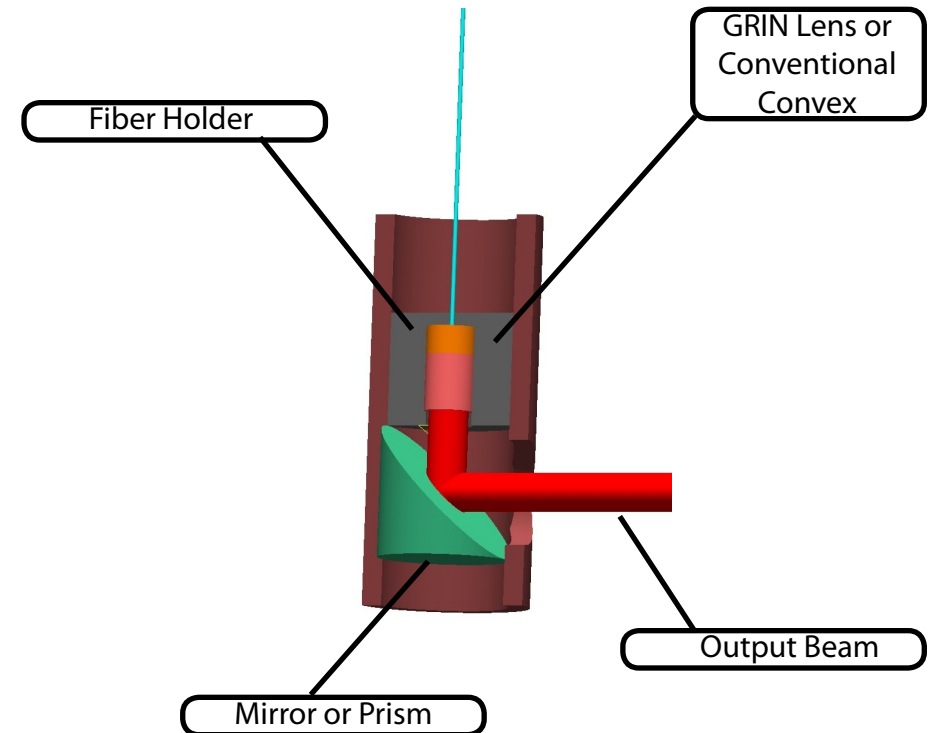




Beam Interrupt Probe

MECHANICAL CHARACTERISTICS:

- Separate transmit and receive probes
- Epoxy construction
- Epoxylite 550F continuous
- ~0.200" OD probe head (actual diameter is determined by flow path insertion and conditions)
- Probes are located ahead and behind the stage being measured
- Single transmit fiber
- Single or multiple receive fibers
- Probe contains a mirror or prism to direct beam
- Unpurged configuration available for low temperature environment

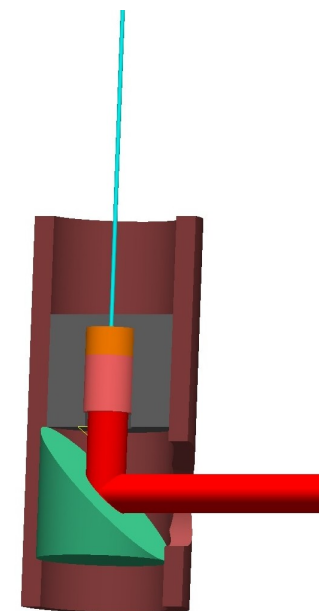




Beam Interrupt Probe

OPTICAL CHARACTERISTICS:

- Transmit Probe
- 100uM step index silica fiber. 50uM available for smaller spot applications
- 1.8mm 0.25 pitch for 3" or less optical path
- 2-3mm convex lens for greater than 3" optical paths
- Unlensed receive probe
- ~16 100uM or 200uM fiber bundle
- Lensed receive probe
- Single 200uM fiber
- Prism or mirror used for beam directioning
- Stainless steel mirror
- Prism
- Highly efficient since transmit energy is directly connected to the receive optics

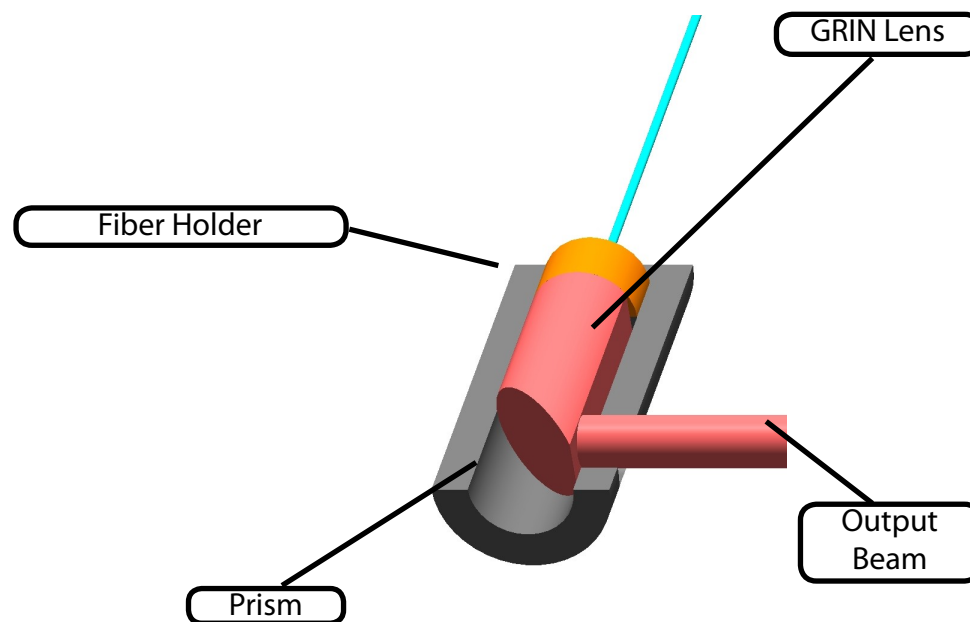




Miniature Beam Interrupt Probe

MECHANICAL CHARACTERISTICS:

- Separate transmit and receive probes.
- Epoxy construction
 - Epoxylite 550F continuous
- ~0.060" OD probe head
- Probes are located ahead and behind the stage being measured
- Single transmit fiber
- Single receive fiber
- Probe contains prism fabricated in the GRIN lens to direct beam
- Unpurged configuration available for low temperature environment
- High temperature construction techniques available

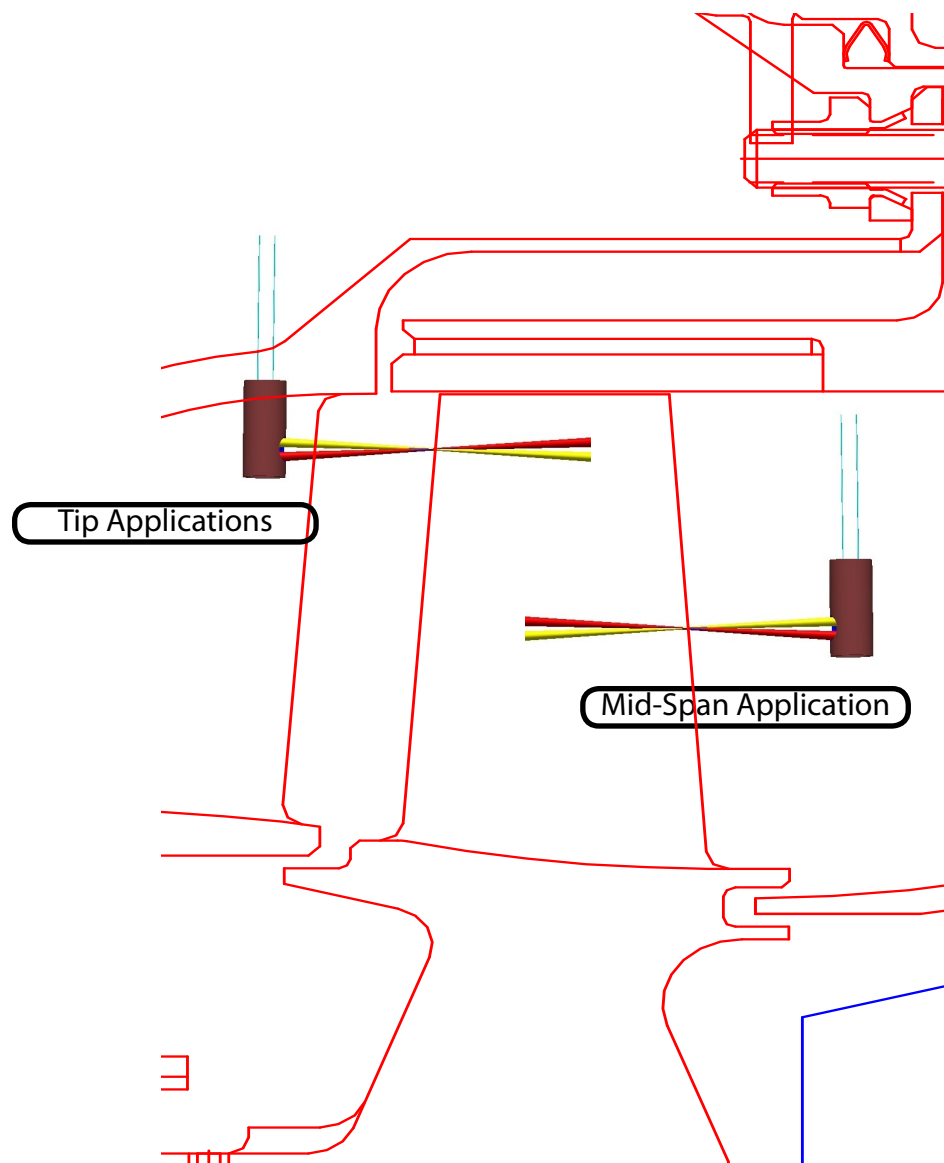




Borescope Probe

TYPICAL APPLICATIONS:

- Use in field investigations through standard borescope ports
- Use on tip shrouded blades to access mid-span modal components

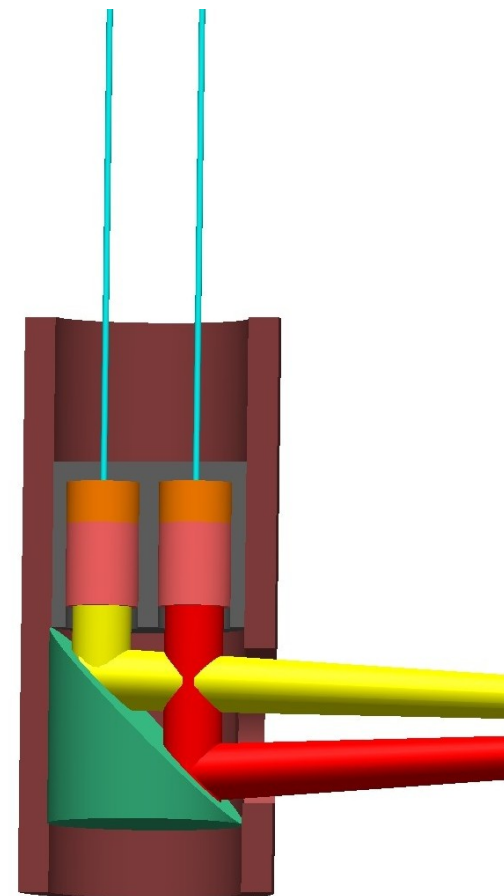




Borescope Probe

MECHANICAL CHARACTERISTICS:

- Single beam or V beam configuration
- Epoxy construction
- Epoxylite 550F continuous
- ~0.200" OD probe head. Actual diameter is determined by flow path insertion and conditions
- Probes are located ahead or behind the stage being measured
- Single transmit fiber
- Single receive fiber
- Probe contains a mirror or prism to direct beam
- Unpurged configuration available for low temperature environment

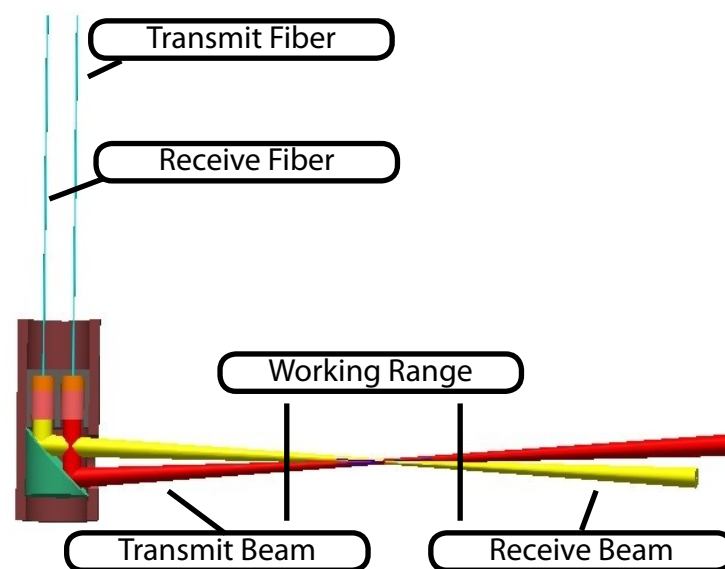




Borescope Probe

OPTICAL CHARACTERISTICS:

- Optics are similar to a long range lensed spot probe
 - Single 100uM step index silica transmit fiber
 - Single 200uM step index silica receive fiber
 - 100uM option for greater IR rejection in hot sections at the expense of a shorter working range
 - 50uM transmit available for smaller spot applications
 - 2 spare transmit/receive combinations available
- Metal Mirror or prism used to redirect the beam
- Highly inefficient due to the large working range of ~2"

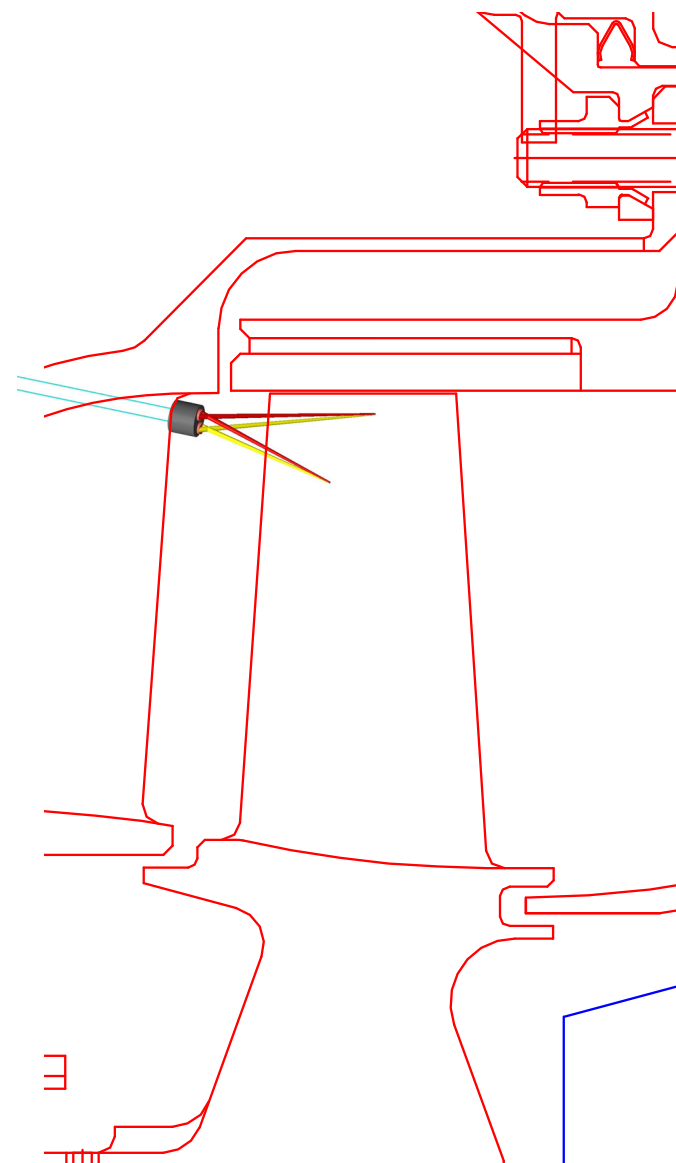
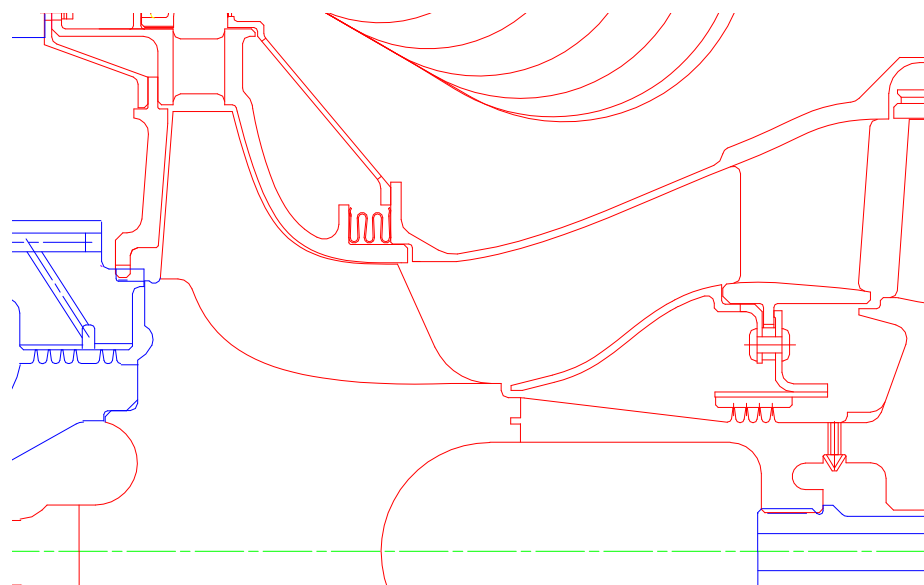




V Probe

TYPICAL APPLICATIONS:

- Use in field investigations through standard borescope ports for measurement of axial blade deflections
- Used instead of a single beam to get some noise reject capability
- Used for tip clearance measurement on all blades
- Used for measurement of non-bladed hardware such as seals, etc



V Probe

OPTICAL & MECHANICAL CHARACTERISTICS:

- Similar in design to focused spot and beam probes
- Two construction methods
- Single fiber input
- For close working ranges and high resolution requirements
- Does not have independent beam control
- Dual fiber input
- For use with large working ranges such as borescope applications
- Allows for independent control of beam amplitudes
- Calibration required for V beam angle

