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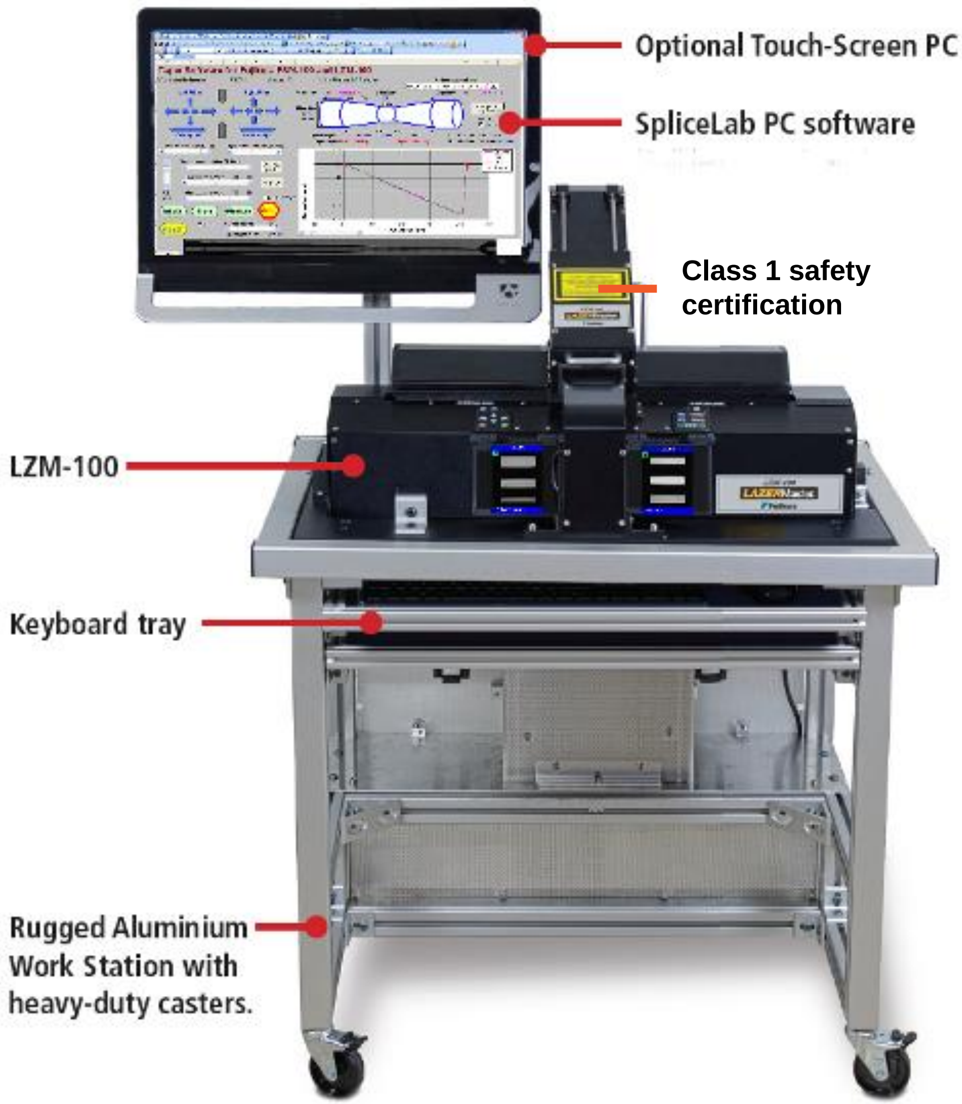
LZM-100 Features

LZM-100
LazerMaster

- CO_2 stabilized laser
- 2 x 130 mm Z travel
- 2.3 mm fiber auto align
- XLDF manual align
- Adiabatic taper function
- Ball lensing
- Fully PC controllable
- Optional end-view, rotators
- 3-way laser safety
- Assembled in USA



LZM-100 Advantages

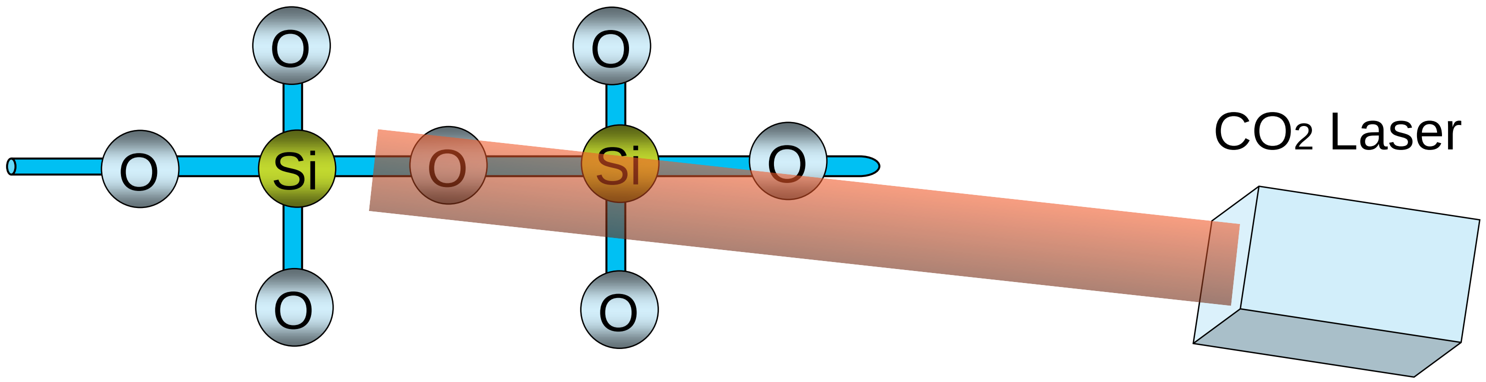
- Very clean heat source: No contamination or deposits on fiber surface
- Extremely stable, repeatable and easy to use operation
- Ultra high strength splicing
- Virtually no CO_2 laser maintenance results in significant operational cost savings compared to other heat sources
- An advanced, configurable system capable of producing tapers, ball lens, combiners, MFA, TEC, glass shaping and splicing
- Saves Time & Money: Eliminates the need to change electrodes or filaments
- Initial investment offset by reduced daily operational costs
- Excellent for splicing dissimilar size fiber diameters due to the absorption of the laser wavelength

CO_2 Laser as Heating Source

- Cleanest and lowest maintenance heating source available
- Class 1 laser safety enclosure with triple redundant interlock
- Dual split laser beam from a stabilized CO_2
- The first commercial CO_2 glass processing

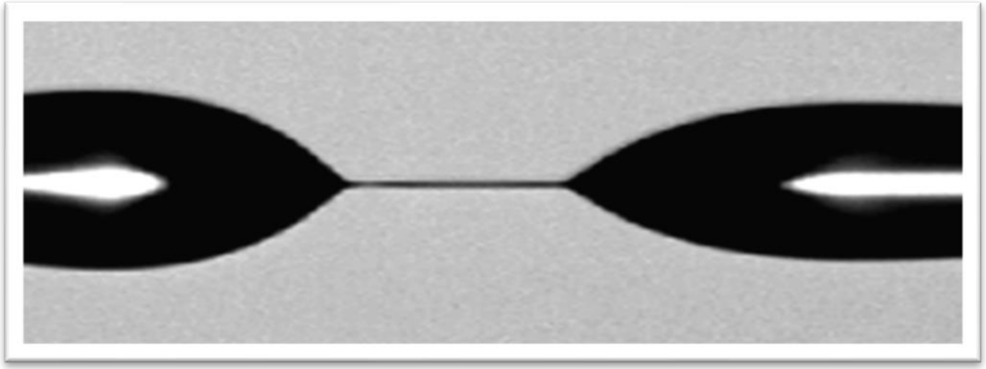
CO_2 Energy Absorption

- Main structure of Silica is tetrahedral SiO_4 groups
- Silica has very intense absorption band at infrared region from 8.5 µm to 13 µm wavelength range due to linkages using silicon
- The absorption is caused by elastic vibration of Oxygen atom between 2 Silicon atoms
- CO_2 laser with 10.6 µm wavelength is right in the middle of the absorption range of Silica
- Fiber heated by flame, arc discharge, or filament is due to heat radiation and conduction, similar to food is heated in a traditional oven. But Initial/outer fiber heating by CO_2 laser is mainly due to absorption, which is similar to food heated in microwave oven



CO_2 Beam Heating by Absorption

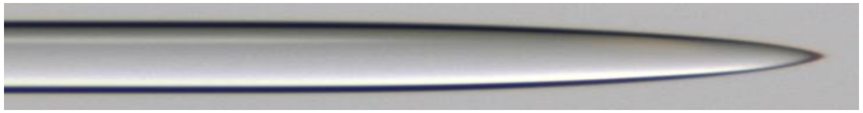
- Surface of silica fiber absorb the CO_2 laser energy strongly at 10.6 µm wavelength band. This is a self-heating which is very different from external heating, such as arc discharge, flame, and filament
- The silica surface is a good absorption material for CO_2 laser energy such that the beam hardly penetrates into the interior of the fiber, and very little is scattered into the air
- The heated fiber surface rapidly conducts the heat energy into the fiber inner structure, similar to external heating methods (arc, filament)
- The major difference from external heating methods is that a thin fiber will not be over heated compared to a thick fiber at the same CO_2 power, since the thin fiber has less absorption surface area



SMF28 fiber is heated by CO_2 beam and pulled slowly. 5 µm glass thread is formed uniformly due to the low absorption

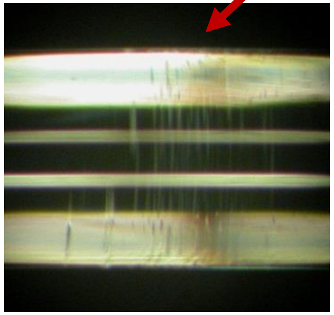
Best Heat Source for High Power Fiber Lasers

- High power fiber lasers need a very clean fiber glass surface, since most fiber laser designs use the entire glass for energy delivery
- Glass surface contamination results in laser power leakage and may induce fire
- Degraded electrodes and filaments may deposit significant amounts of contamination on the surface of fibers
- High power splicing (required for LDF) or long tapering time very easily causes degradation of electrodes and filaments and increases risks of contamination and power leakage
- CO_2 laser heating will cause no risk of contamination on glass surface

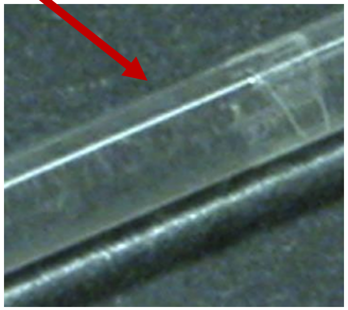


Very clean glass surface with CO2 heating

1.5 mm fiber spliced by arc discharge

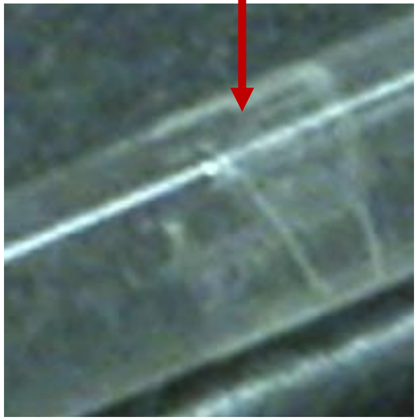


Magnified with back illumination

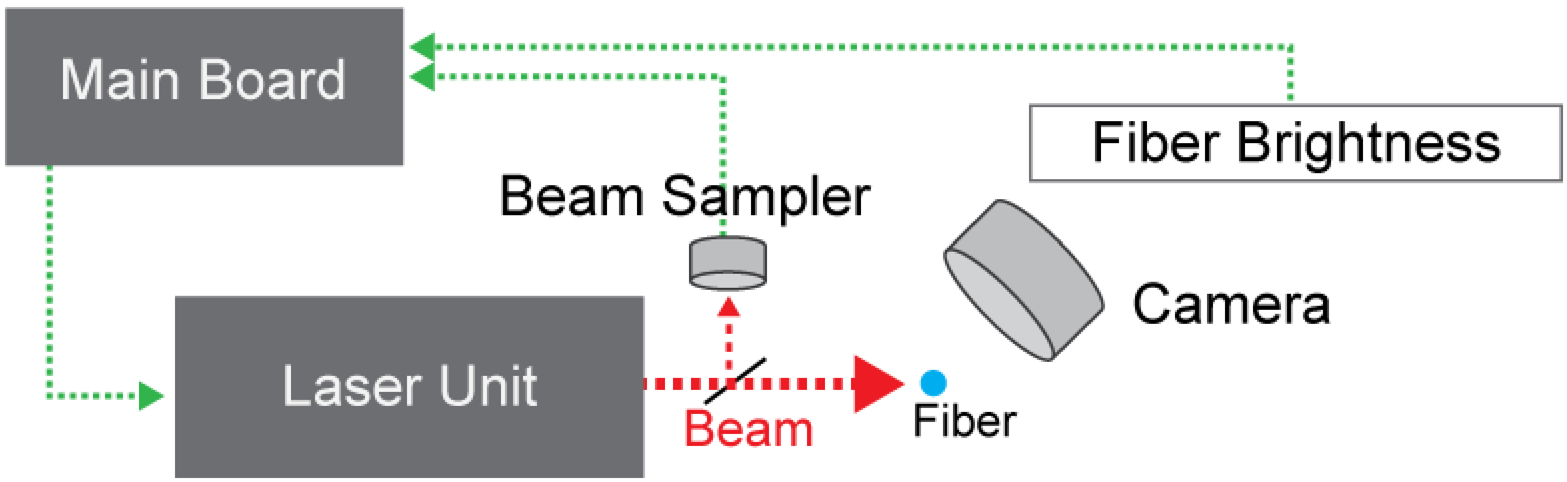


Magnified with reflective illumination

Cloudy surface observed on the glass after arc discharge. The surface has to be cleaned by HF acid bath

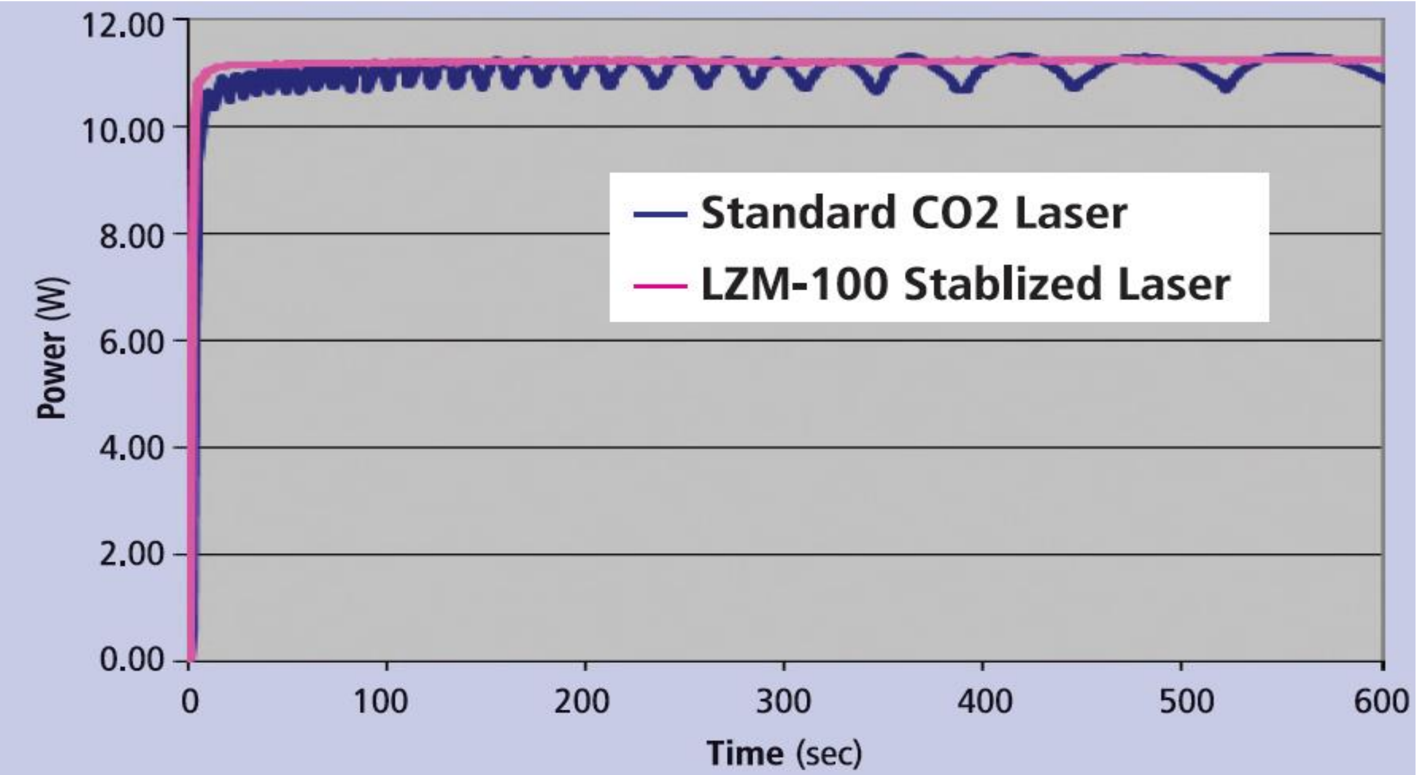


Real-Time Feedback Control



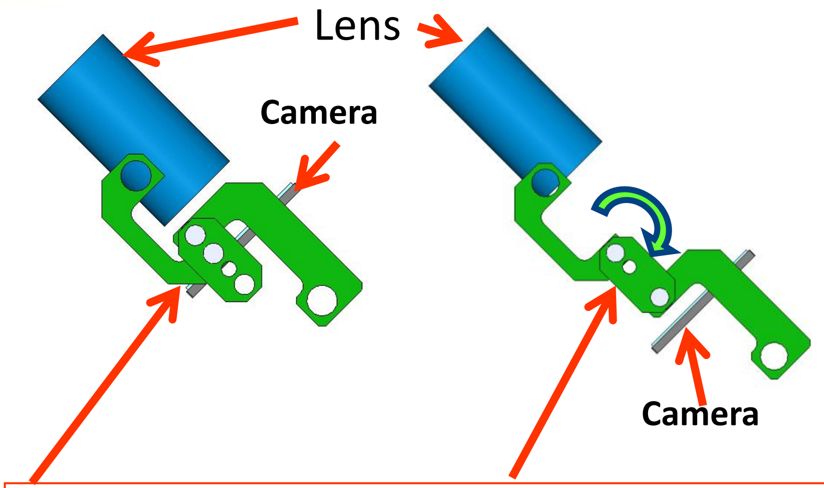
- There are two different types of feedback that can be used to control the stability of CO_2 laser power:
  - Beam sampler: with a beam splitter, a small percentage of laser beam can be detected by a power detector (Beam sampler)
  - Camera image: the image brightness of heated optical fiber can also be used for feedback control for tapering and splicing of similar types of fiber

Stabilized CO_2 Laser Power

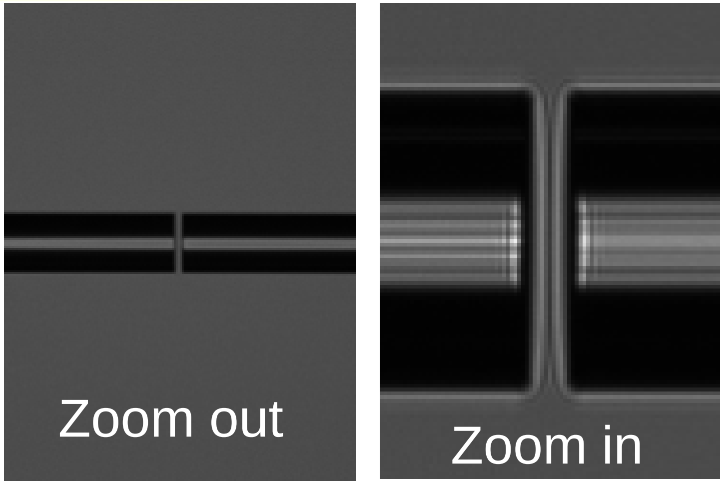


- Typical CO_2 lasers have output power fluctuation +/-5%, which can result unpredictable splice losses and large taper ripples
- The LZM-100 utilizes proprietary (patent pending) closed-loop power stabilization technique which resulting very stable laser output

Optical Zooming for Core and PM Alignment



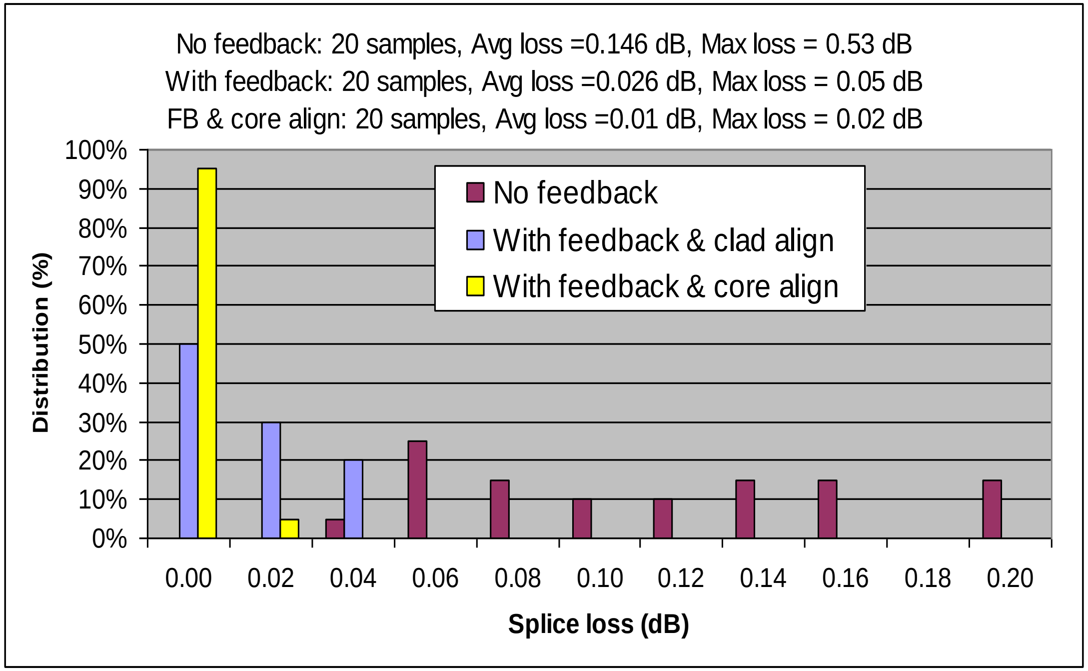
Rotate this bar 180 degree to zoom in and out



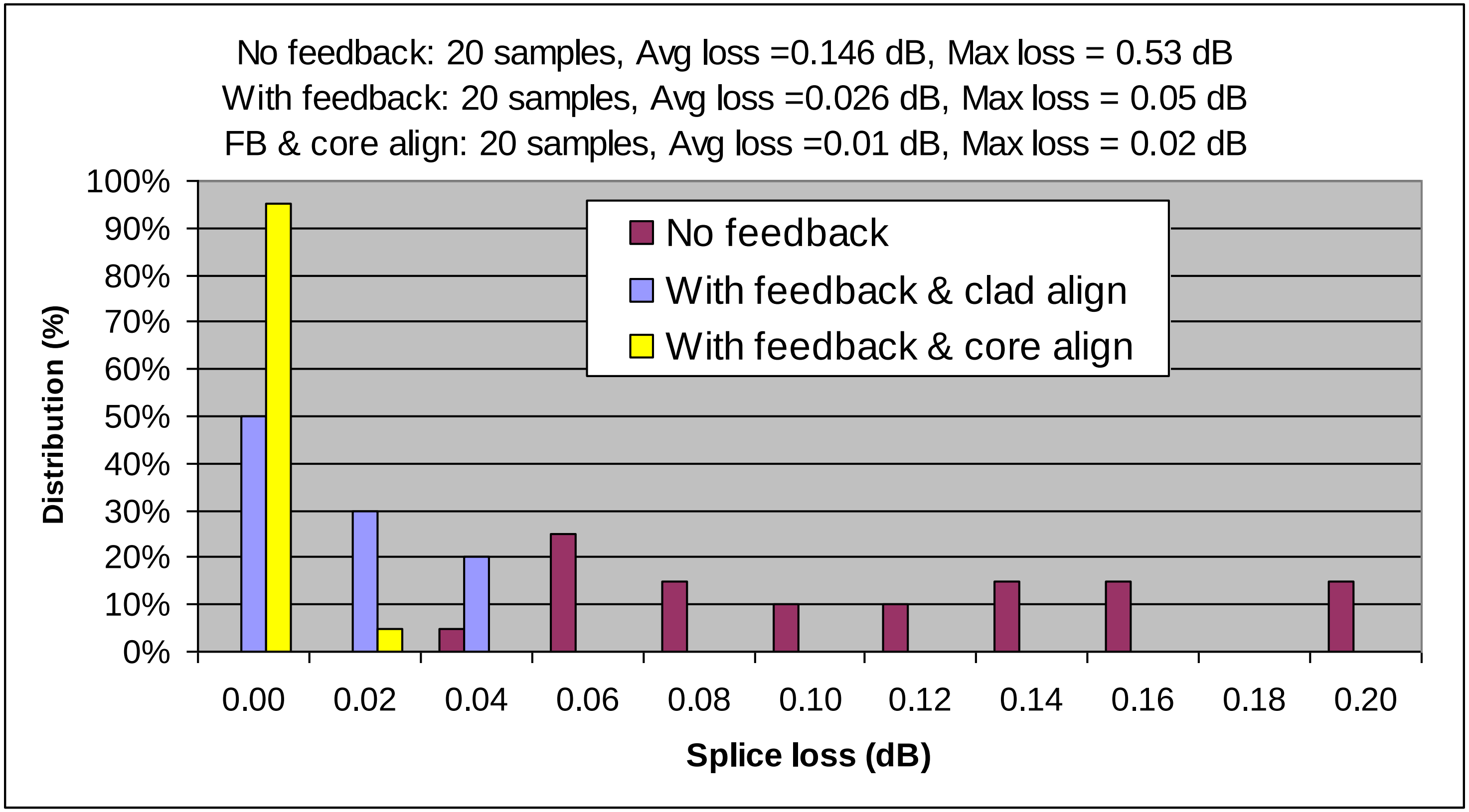
For large field of view

For core alignment

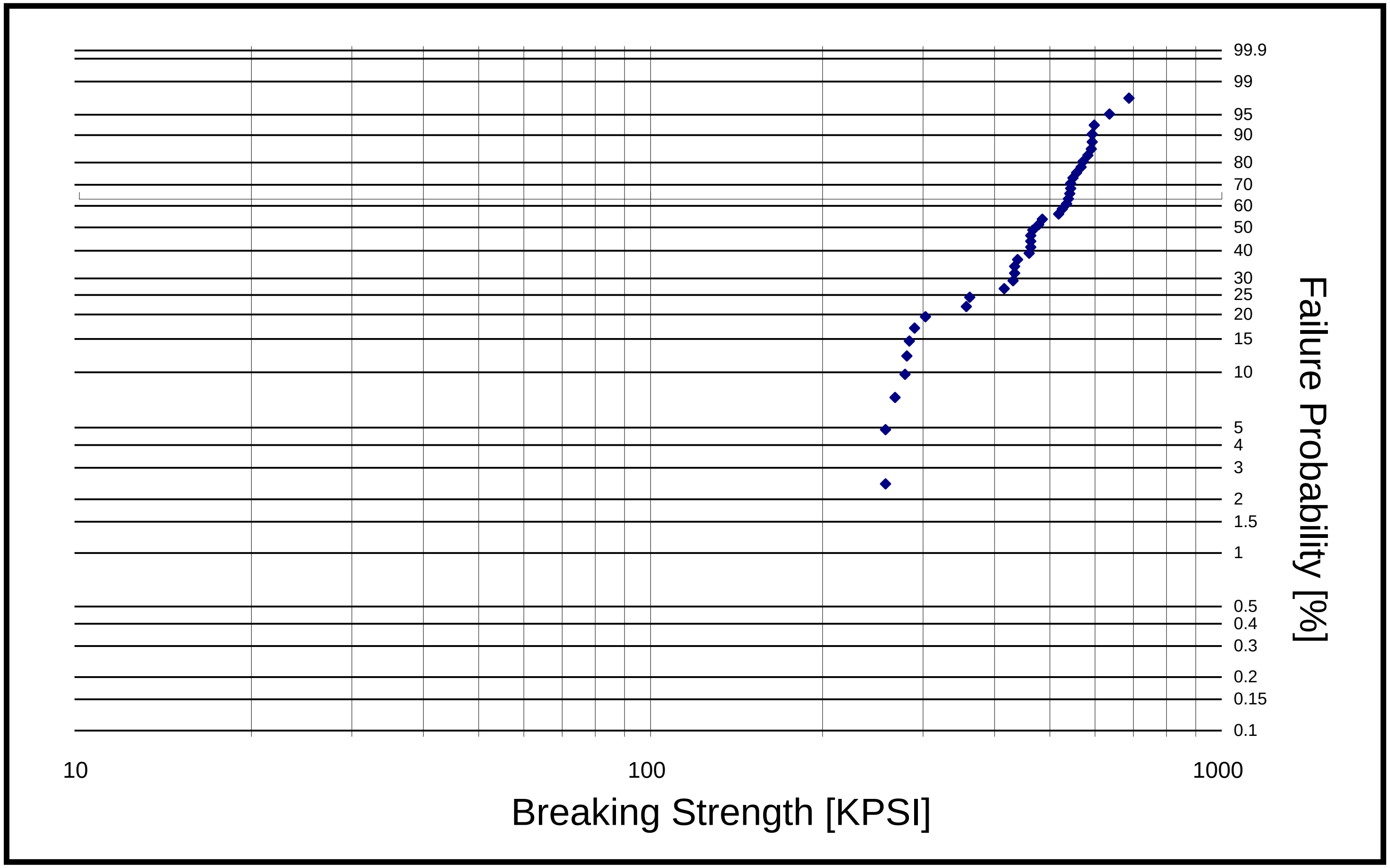
- LZM-100 needs large view for LDF up to 2.3 mm diameter
- LZM-100 also needs large resolution for observing core and fiber structure for alignment
- The zooming system meets the both requirements



Optical Zooming for Core and PM Alignment



LZM-100 Splice Strength Study



- 40 SMF28 splices were made with 2 LZM-100 units.
- No clean room was used.
- Average strength is 466 kpsi with STD 116 kpsi

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