

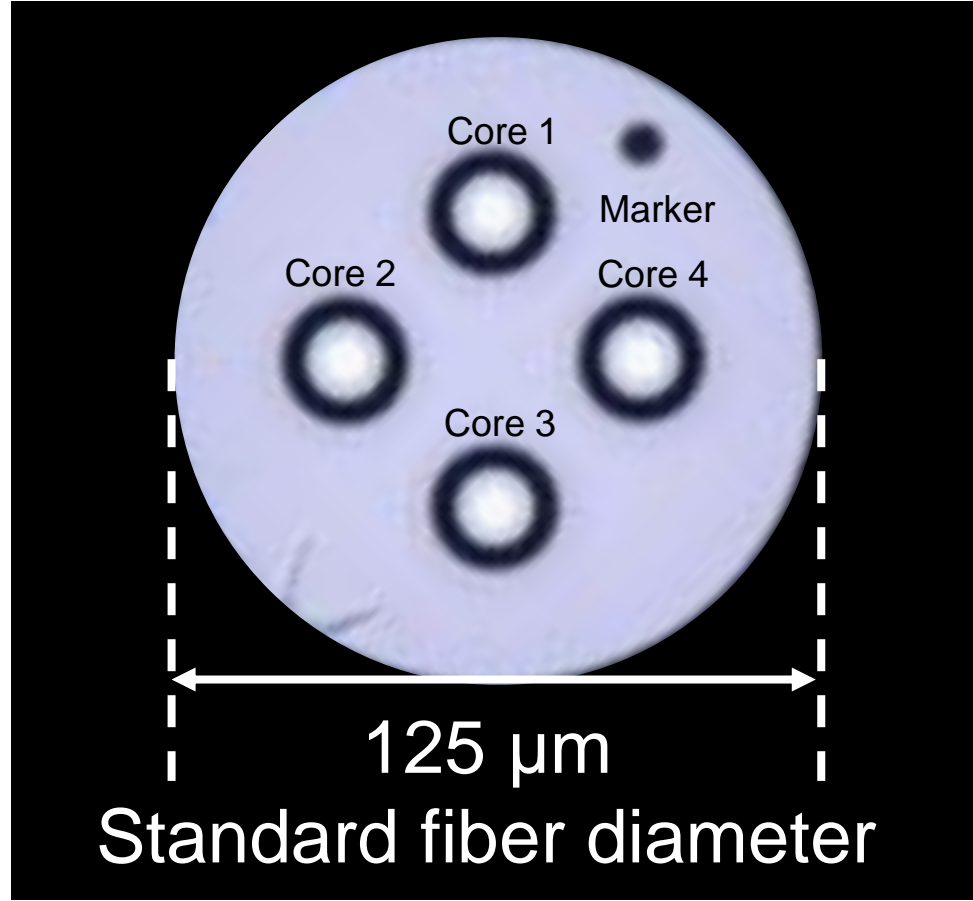
Low Fusion Splice Loss Technique for Multicore Fiber with 2- and 3-electrode Fusion Splicers

Toshiyuki Fujii, Masanori Takahashi, Ryuichi Sugizaki, Akio Tanabe, and Yoshihiro Arashitani
Furukawa Electric Co., Ltd.

Introduction

◆ Background

For expansion of communication systems, "Space Division Multiplexing" with Multicore Fibers (MCFs) is hot topic

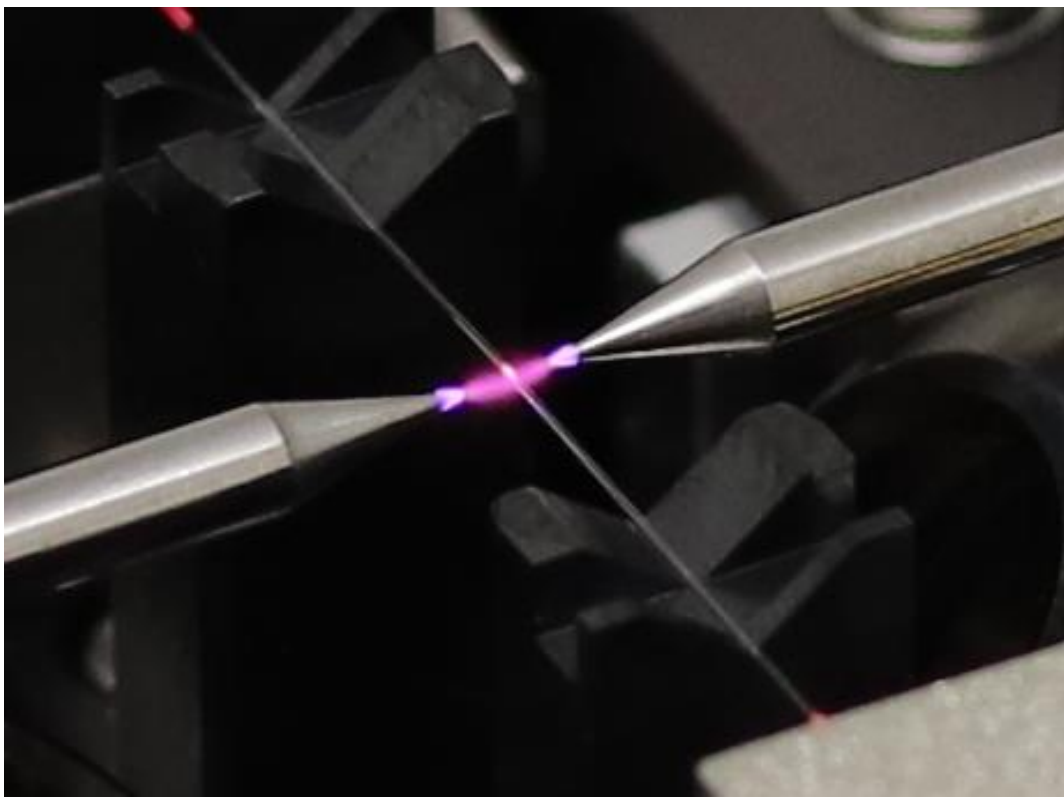


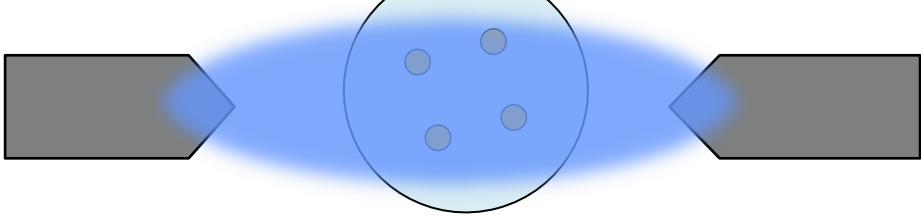
For commercialization of MCFs, "Fusion Splicing MCFs" is essential

Fusion Splicing:
Technology to melt fiber by discharge heat and joint

- Low splice loss
- Long-term durability

◆ Discharge shape

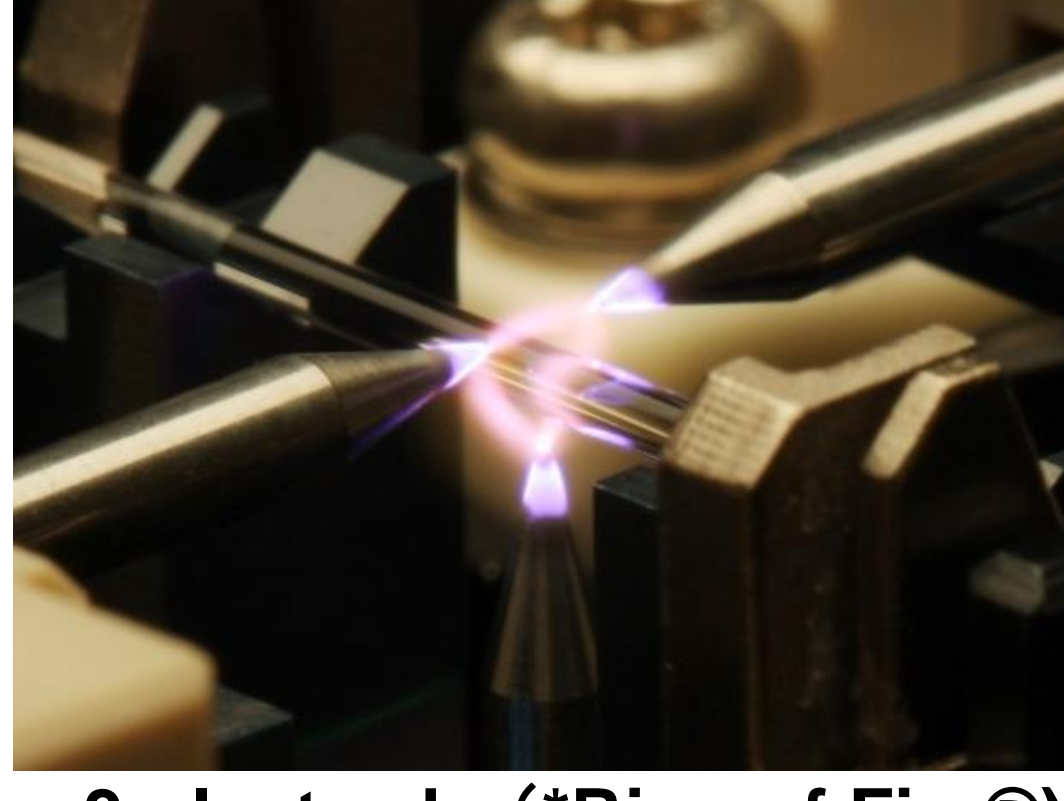


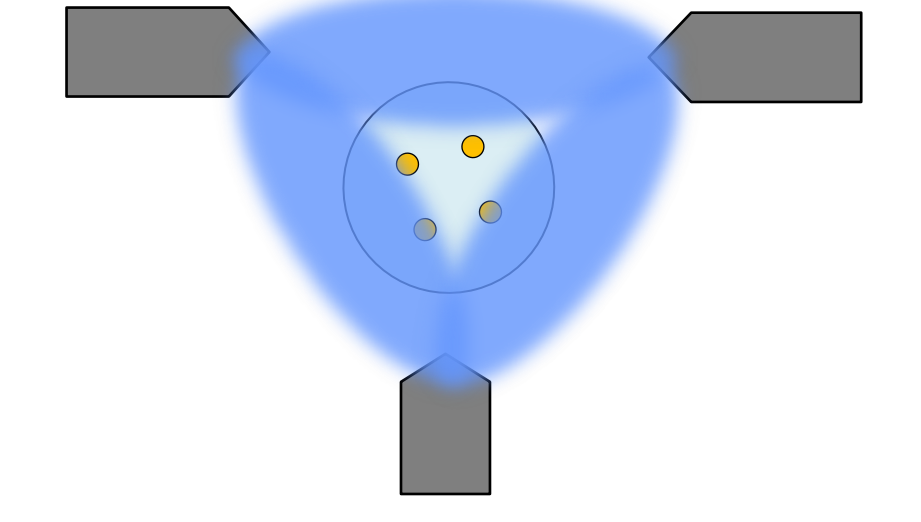


Linear shape discharge

- Standard
- Less expensive than 3-electrode

2-electrode





Triangular shape discharge

- Effective for large diameter fiber

3-electrode (*Ring of Fire®)

*The "Ring of Fire®" ROF® technology is 3SAE's patented Wide-Area Plasma heat source generated using three electrodes

Reported 4MCF splice loss

2-electrode: ~0.2dB

Relatively high loss

3-electrode < 0.1 dB

Low loss!!

- [1] M. Ohzeki et al., Optical Fiber Communication Conference (OFC2022), paper M4E.4.
[2] T. Kremp et al., European Conference on Optical Communication (ECOC2022), Sep. 2022, Tu3A.3.
[3] M. Takahashi et al., Proc. Of 27th CC/PSC 2022), Jul. 2022, MC1-3.

Purpose

- Reduce 4MCF splice loss with standard cladding diameter 125 μm
- Use 2-electrode splicer, which is standard and less expensive

Methodology

◆ Characteristics of 4-core MCF used in splice experiment

| Item | Unit | Value |
|---------------------------|------------------|--------|
| Cladding diameter | μm | 125 |
| Core pitch | μm | 40 |
| MFD @1550nm | μm | 9.2 |
| λ _{cc} | nm | 1189 |
| Bending loss @1550nm | dB/turn @R=20 mm | 0.255 |
| Attenuation loss @1550 nm | dB/km | 0.209 |
| XT @1550 nm * | dB | -55.08 |

*) After 1 km transmission, R=80 mm

◆ Fusion splicer used in splice experiment



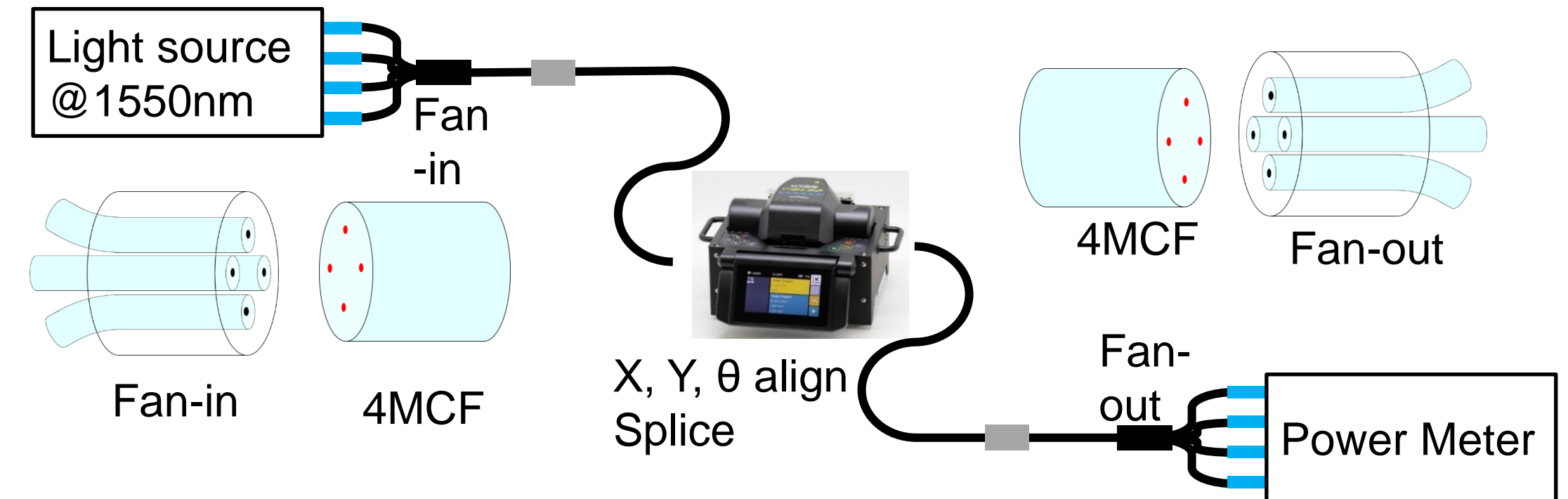
S185 Fusion Splicer (FITEL)

Compact size
Size : 210(W) x 180(D) x 150(H)
Light weight
Weight : 4.75 kg

Selectable models with 2- or 3-electrode

Automatic alignment of MCF with X & Y viewing

◆ Setup of measurement



*Measure splice loss by cutting 4MCF in middle and splicing each cut edge together

◆ Our multicore alignment

Same number core connected: 100%

Splice time duration: ~150 sec

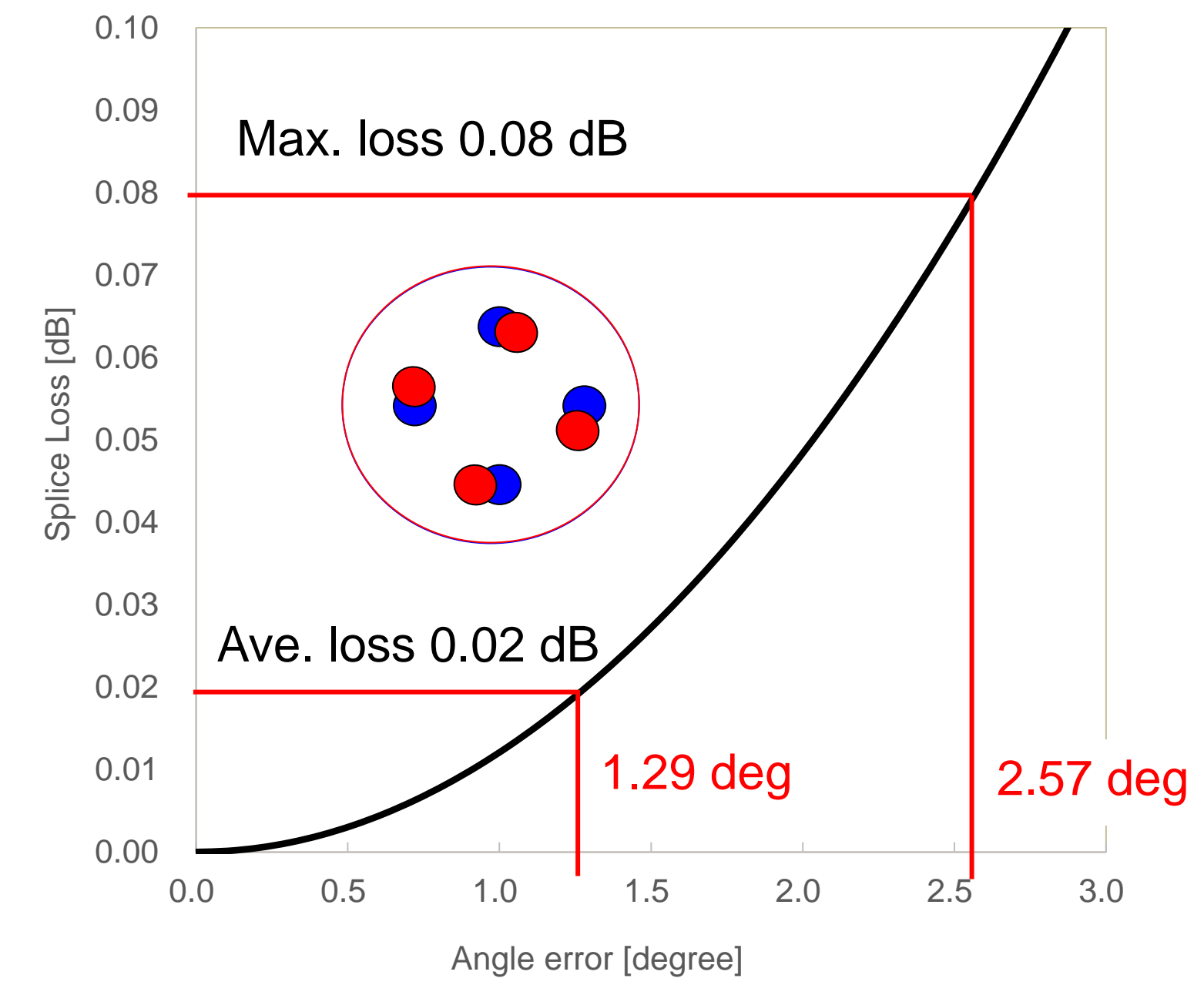
Splice loss with 3-electrode :

Ave: 0.02dB Max: 0.08 dB

Estimated angle error: Right graph

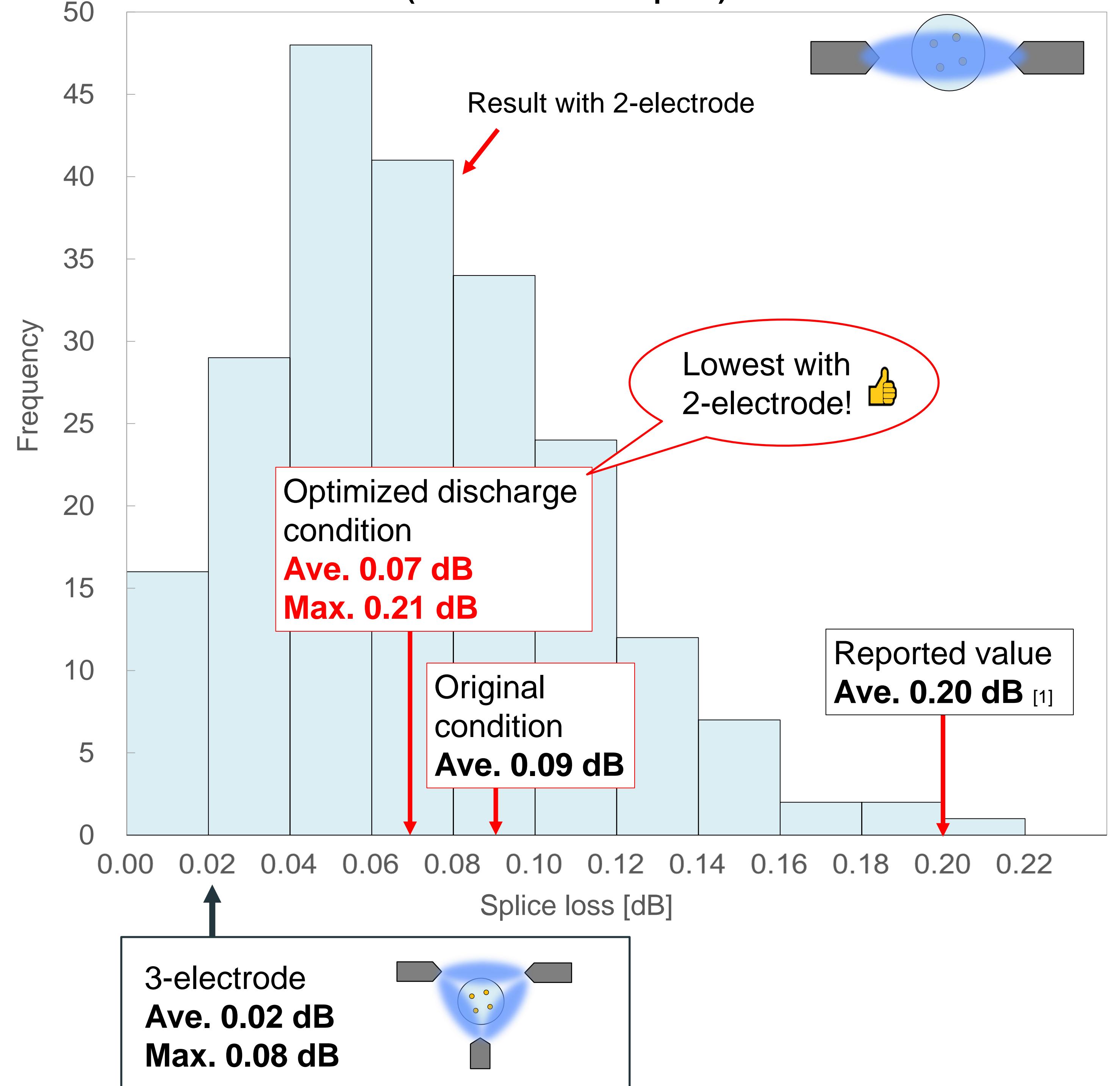
*Assuming loss depends on only rotational misalignment
If other factors exist, angle error is smaller

Sufficiently accurate alignment



Results

Result of splice loss with 2-electrode (N = 4 cores x 50 splice)



Conclusion

◆ This study

- Demonstrate splice loss of 4-core fiber with standard cladding diameter of 125 μm
- Use 2-electrode fusion splicer, which is less expensive and more widely used than 3-electrode

◆ Achievement

- Average splicing loss of 0.07dB is achieved
- Best splice loss of 4MCF with 2-electrode in reported ever
- However, could not reach to level of 3-electrode

Contact details for enquiries

Furukawa Electric Europe Ltd
splicers@furukawa.co.uk T.: +44 (0) 207 313 5311