EAF Measurement Method

Shigeru Kobayashi

TE Connectivity

March 9-12, 2015

Contributors:
Satoshi Takahashi, POF Promotion
Takehiro Hayashi, HAT Lab
Manabu Kagami, Toyota Central R&D Labs.

Overview

Background

- How to define optical condition in POF was discussed at the Ad Hoc telephone meeting on Feb. 28

Purpose

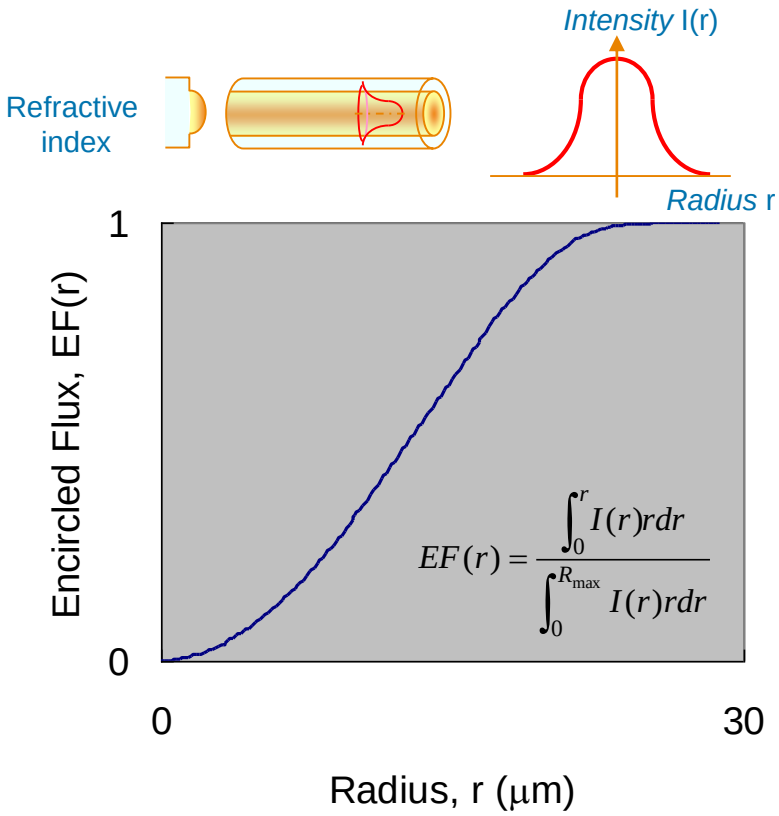
- Introduction of the definition and the measurement method of mode power distribution (MPD) in a step index multi-mode fiber (SI-MMF)
    - IEC 61300-3-54: Examinations and measurements - Encircled angular flux (EAF) measurement method based on two-dimensional far field data from step index multimode waveguide (including fibre) - released on Feb. 5, 2015
    - This IS was proposed from the previous Project O-GEAR.

MPD in GI-MMFs and SI-MMFs

IEC 61280-4-1 for GI-MMFs

EF: Encircled Flux

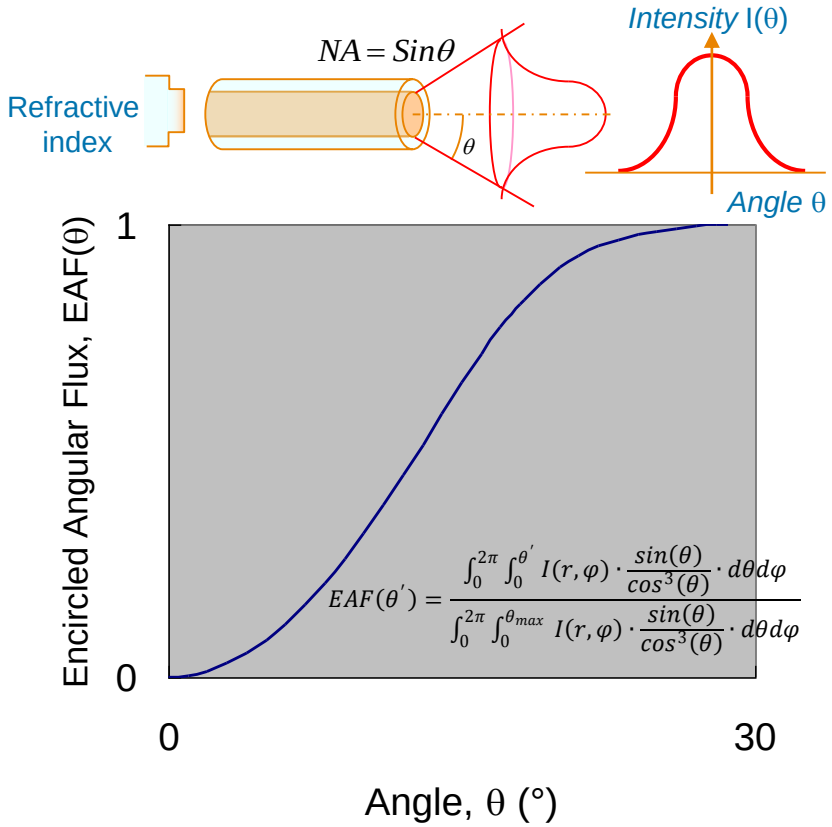
Computed from Near Field Pattern



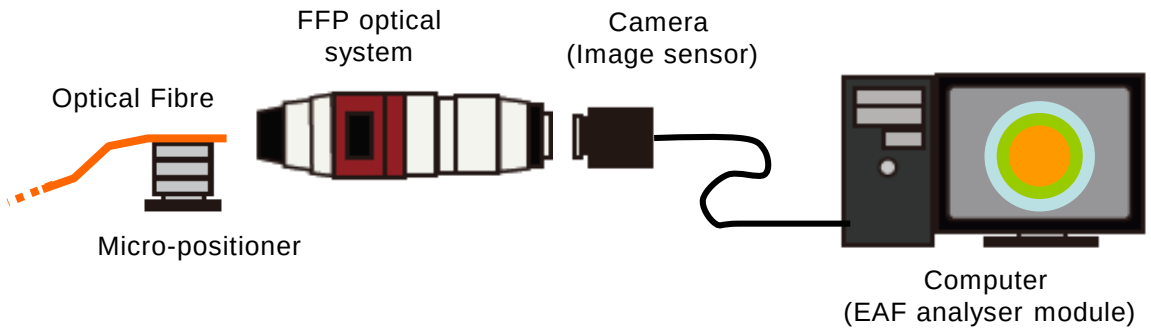
IEC61300-3-35 for SI-MMFs

EAF: Encircled Angular Flux

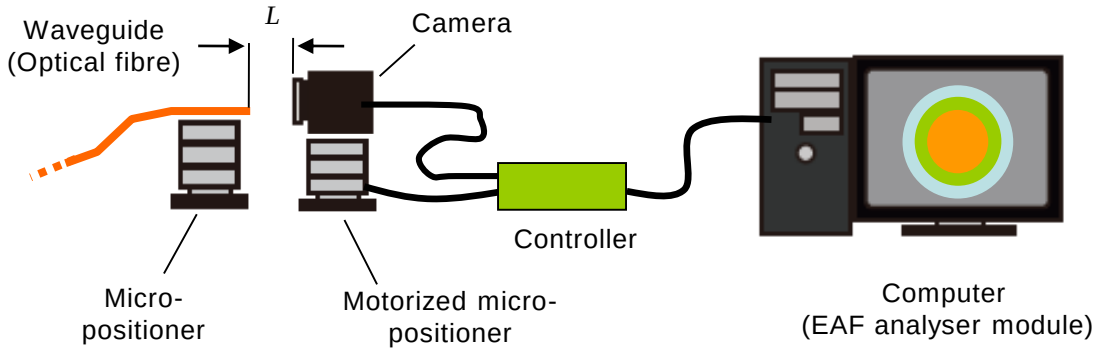
Computed from Far Field Pattern



Examples of FFP Measurement Method

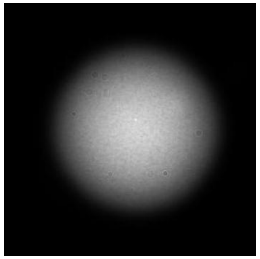


fθ Lens Imaging

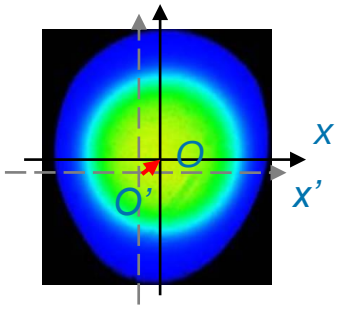


Direct Imaging using An Imaging Device

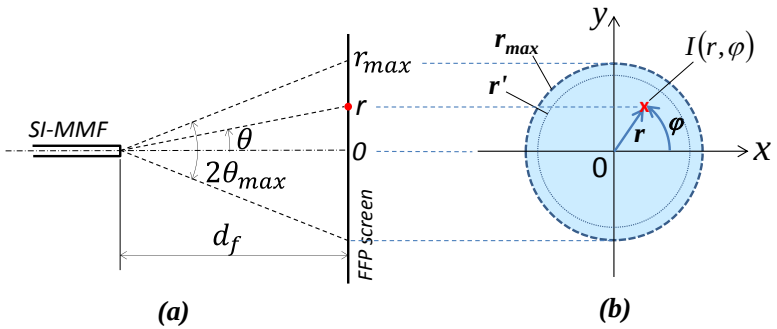
Computation of EAF



[1] Acquired FFP Image

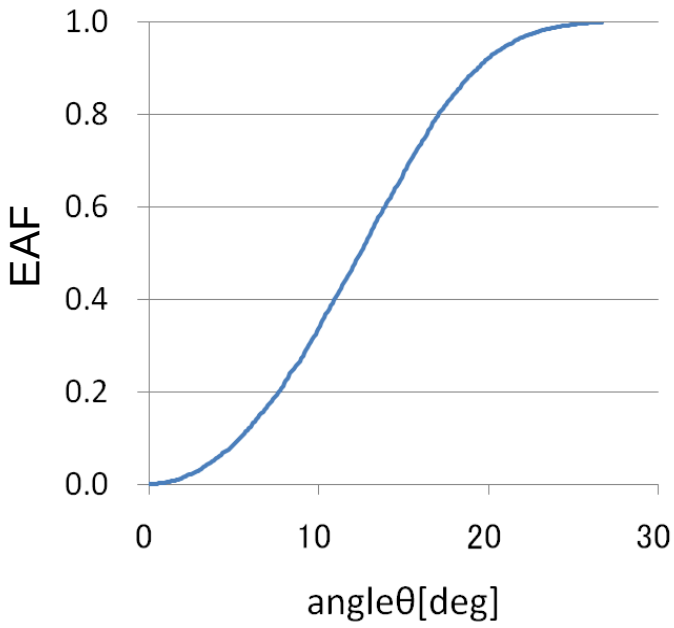


[2] Optical Center Determination



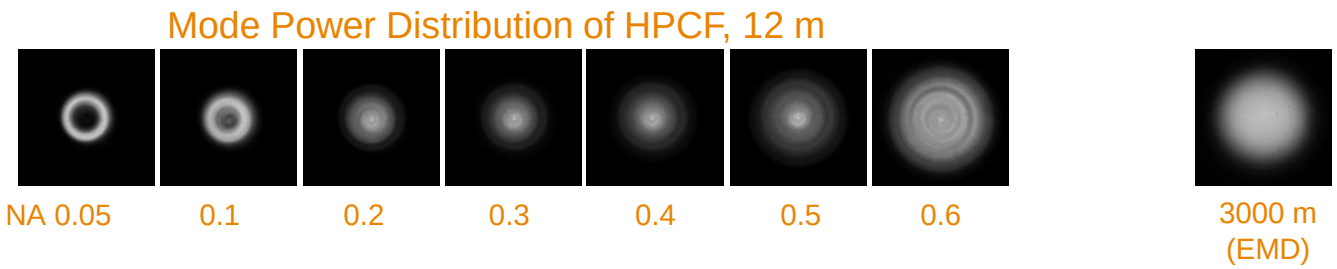
$$EAF(\theta') = \frac{\int_0^{2\pi}\int_0^{\theta'} I(r,\varphi)\cdot\frac{sin(\theta)}{cos^3(\theta)}\cdot d\theta d\varphi}{\int_0^{2\pi}\int_0^{\theta_{max}} I(r,\varphi)\cdot\frac{sin(\theta)}{cos^3(\theta)}\cdot d\theta d\varphi}$$

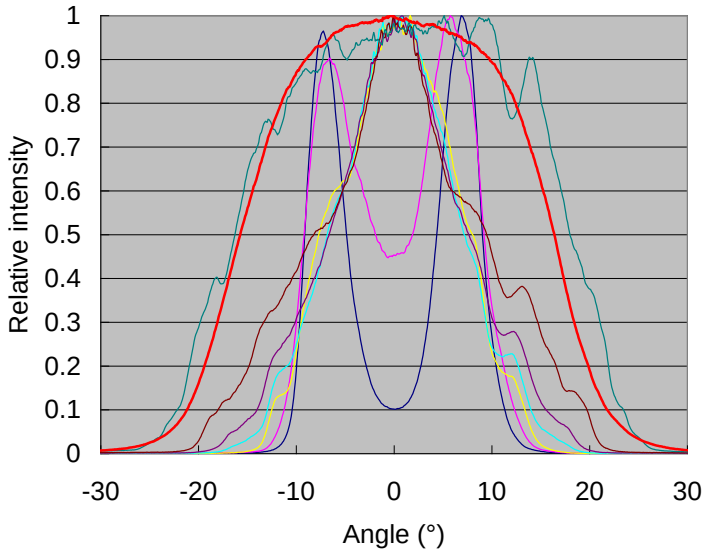
[3] EAF Calculation



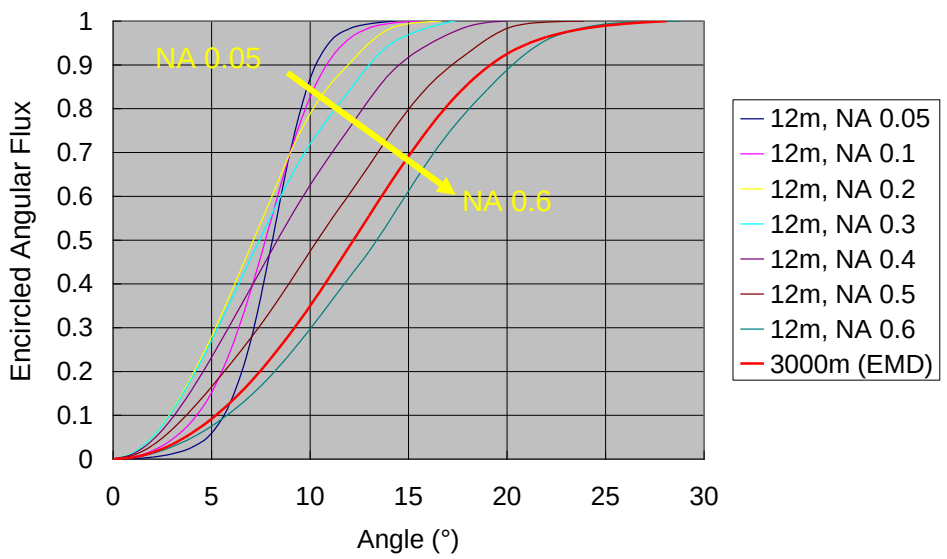
[4] Angular flux chart

How EAF Shows MDP States



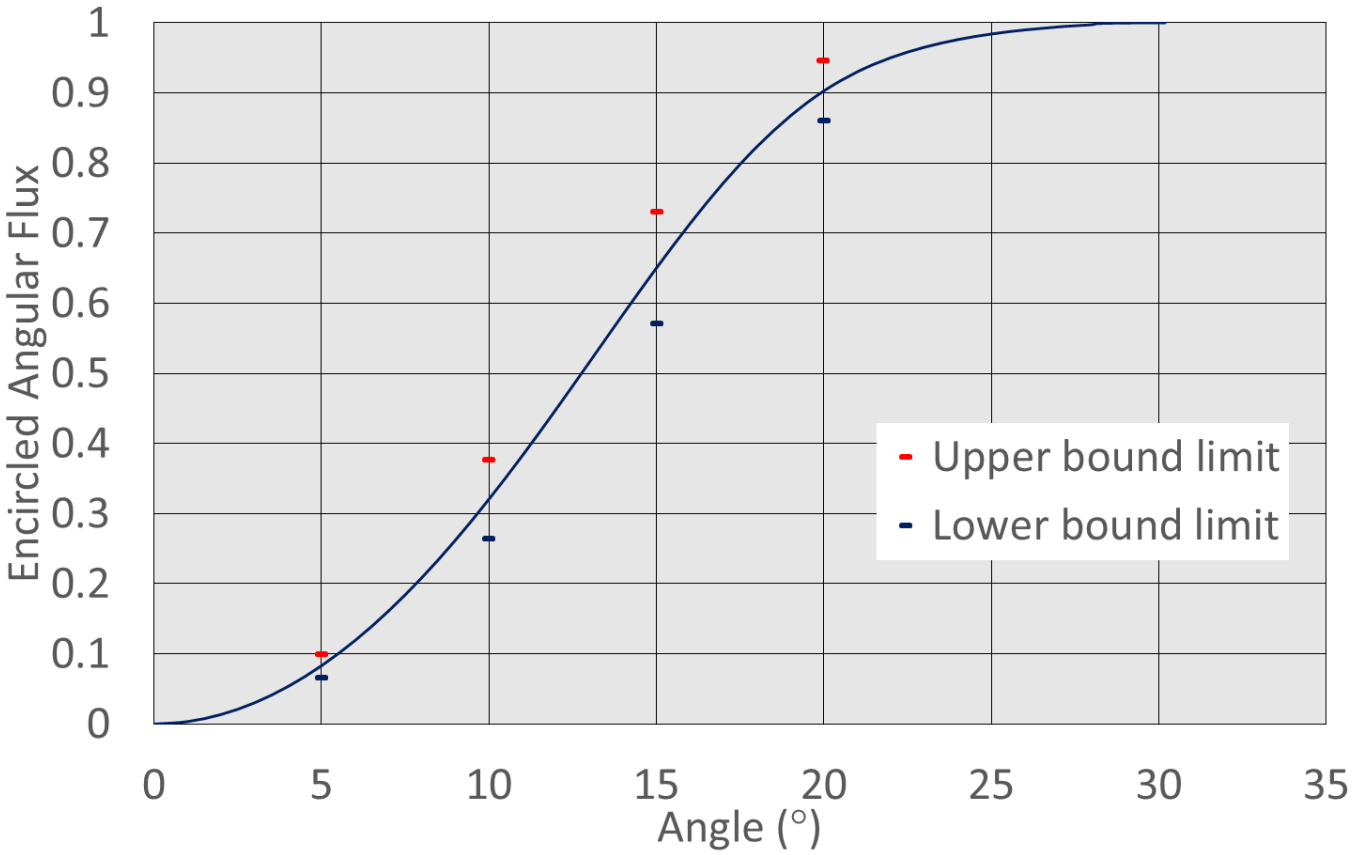


X-axis



EAF

An Example of Launching Template for Insertion Loss Measurement



Summary

- MPD in SI-MMFs is clearly given using IEC61300-3-53, EAF: Encircled Angular Flux

Next Steps:

- EAF templates for IL measurement, IEC61300-1
- Define MPDs to transmit 1 Gbps and/or 10 Gbps signals at TP2 and TP3