Spectral attenuation measurements in step-index POFs with controlled input conditions using different fiber-optic elements

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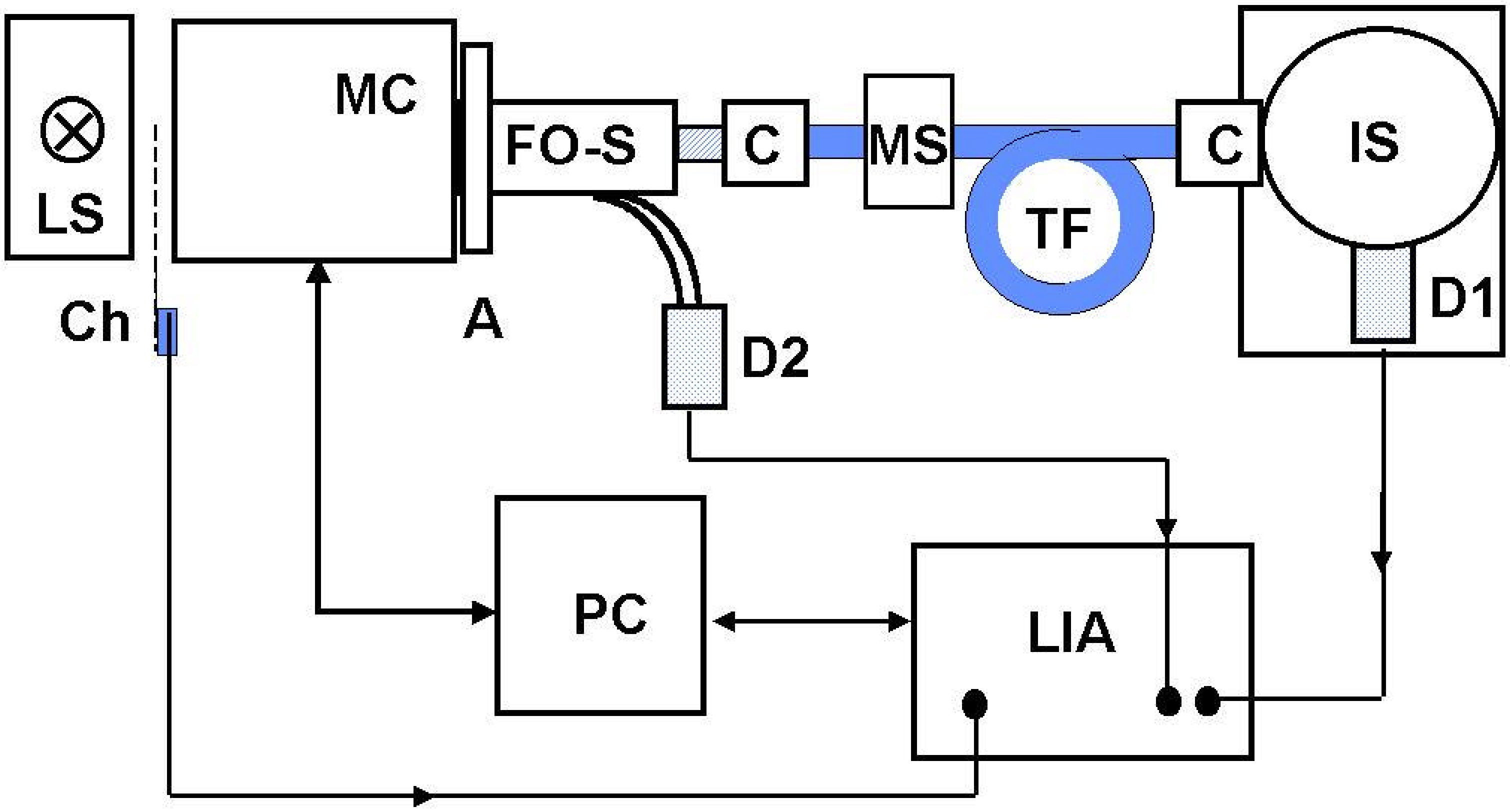
Abstract

Spectral attenuation is one of the key parameters of polymer optical fibers, depending strongly on the excitation-conditions. Because fiber characterization and system specifications may require different test-conditions, a measurement system should be designed to cover most of these.

Our realized measurement-system contains easily interchangeable fiber-optic elements with different diameters and numerical apertures at the input of the testfibers, leading to comparable excitation-conditions.

However, the excess loss due to excitations with variable input angle should be included, too.

Measurement-system with fiber-optics

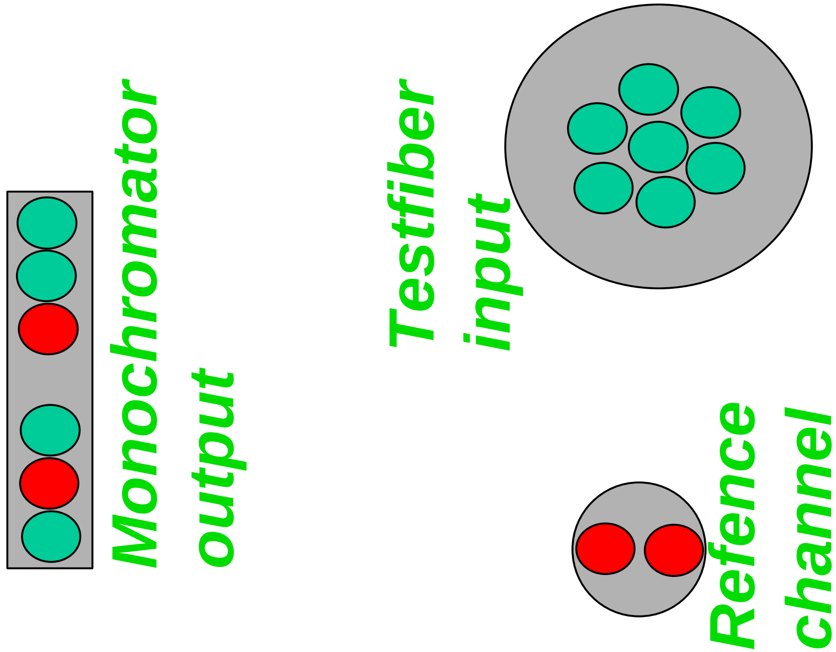


LS:	halogen lamp	FO-S:	fiber-optic splitter and cross-section converter	MS:	mode scrambler
Ch:	chopper	C:	connector	TF:	test fiber
MC:	monochromator	D:	detector	IS:	integrating sphere
A:	adapter			LIA:	lock-in amplifier

Fiber optic elements for controlled input conditions

different functions

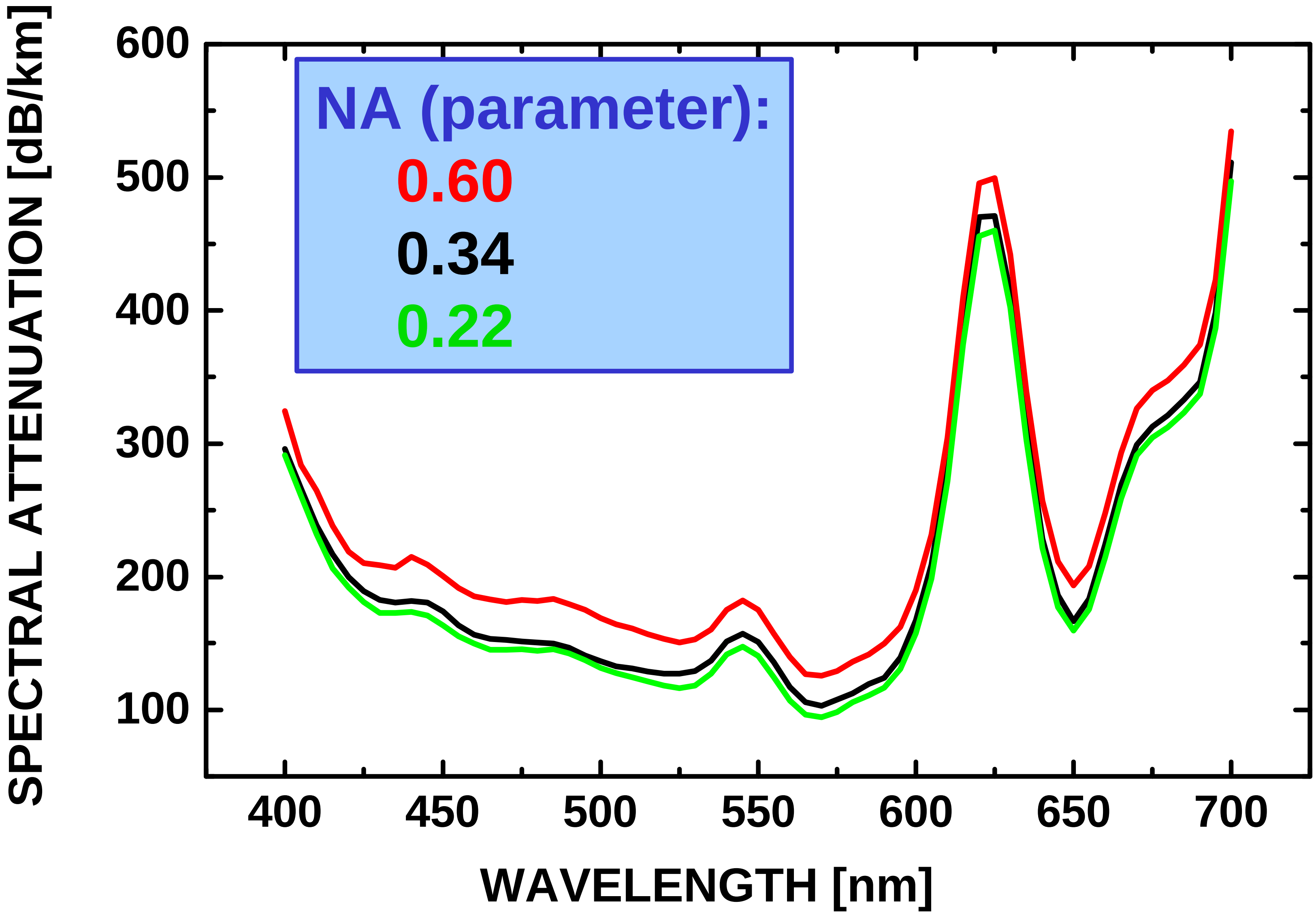
- **beam splitter**
- **cross-section converter**



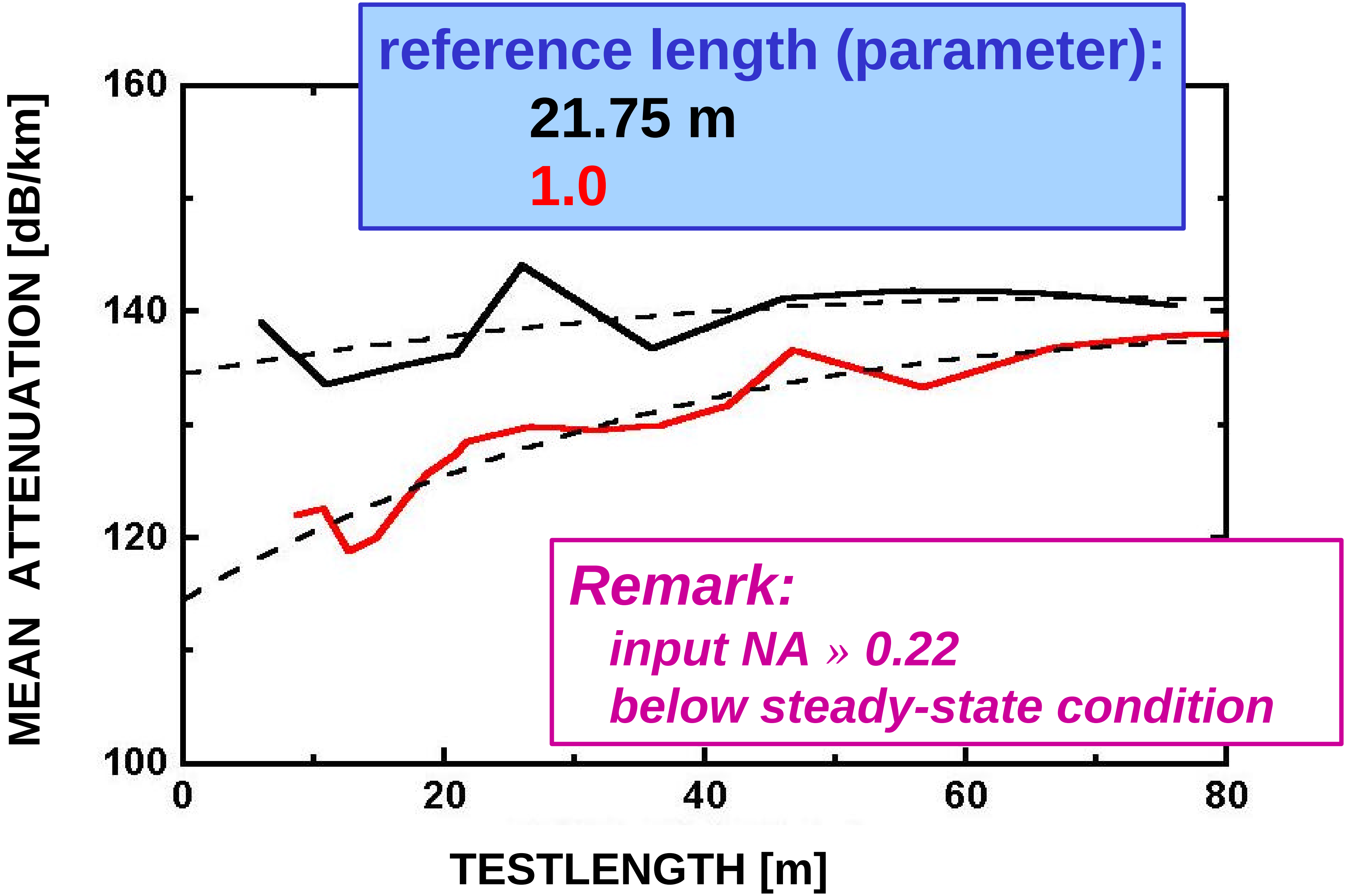
<u>three</u> different types

- **NA ≈ 0.22, diameter ≈ 350 µm**
  (All-silica fibers with Polyimide-coating)
- **NA ≈ 0.34, diameter ≈ 900 µm**
  (HCS-fibers; modemixer)
- **NA ≈ 0.60, diameter ≈ 1300 µm**
  (Teflon-coated silica fibers; volume diffuser)

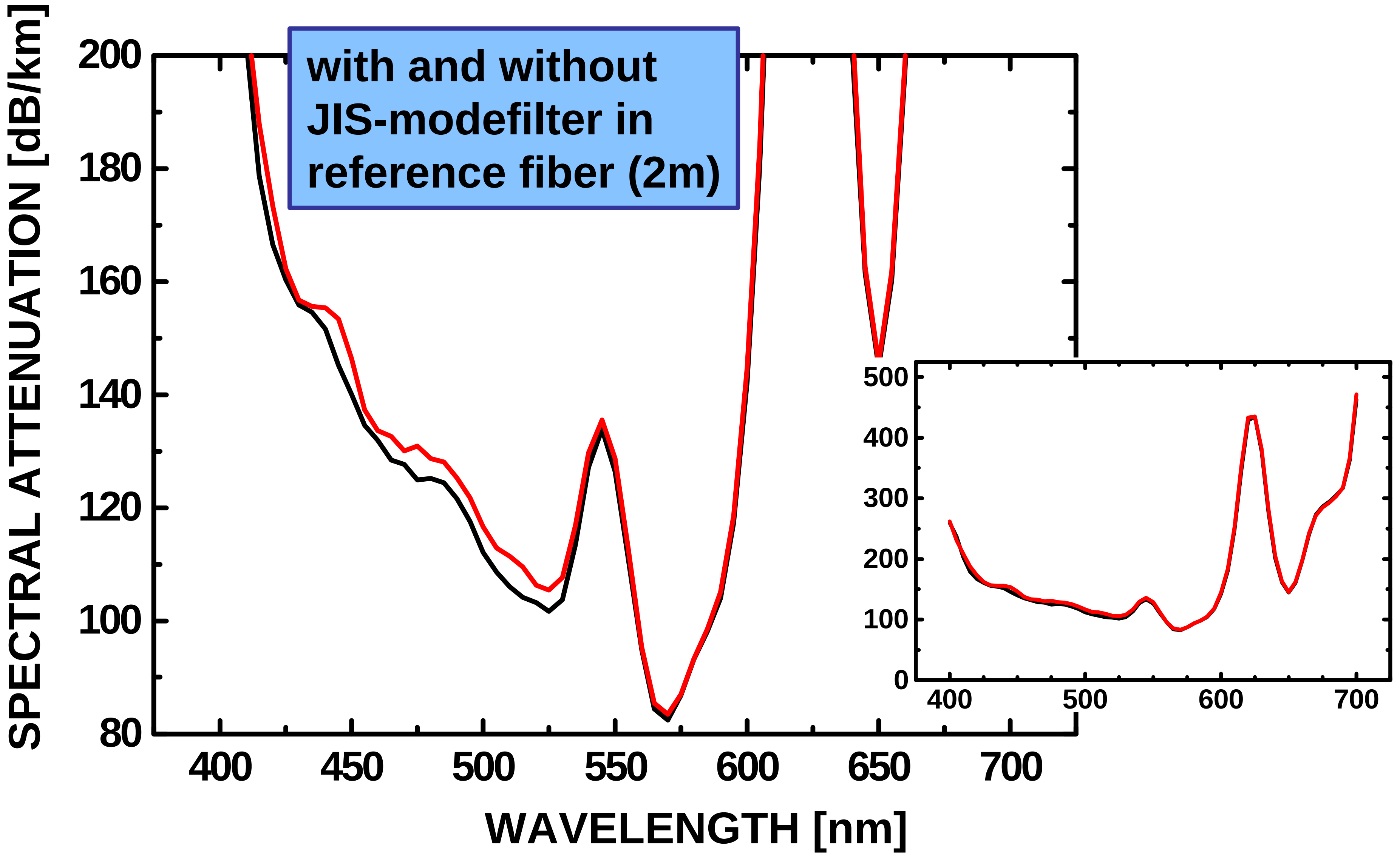
Influence of numerical aperture NA



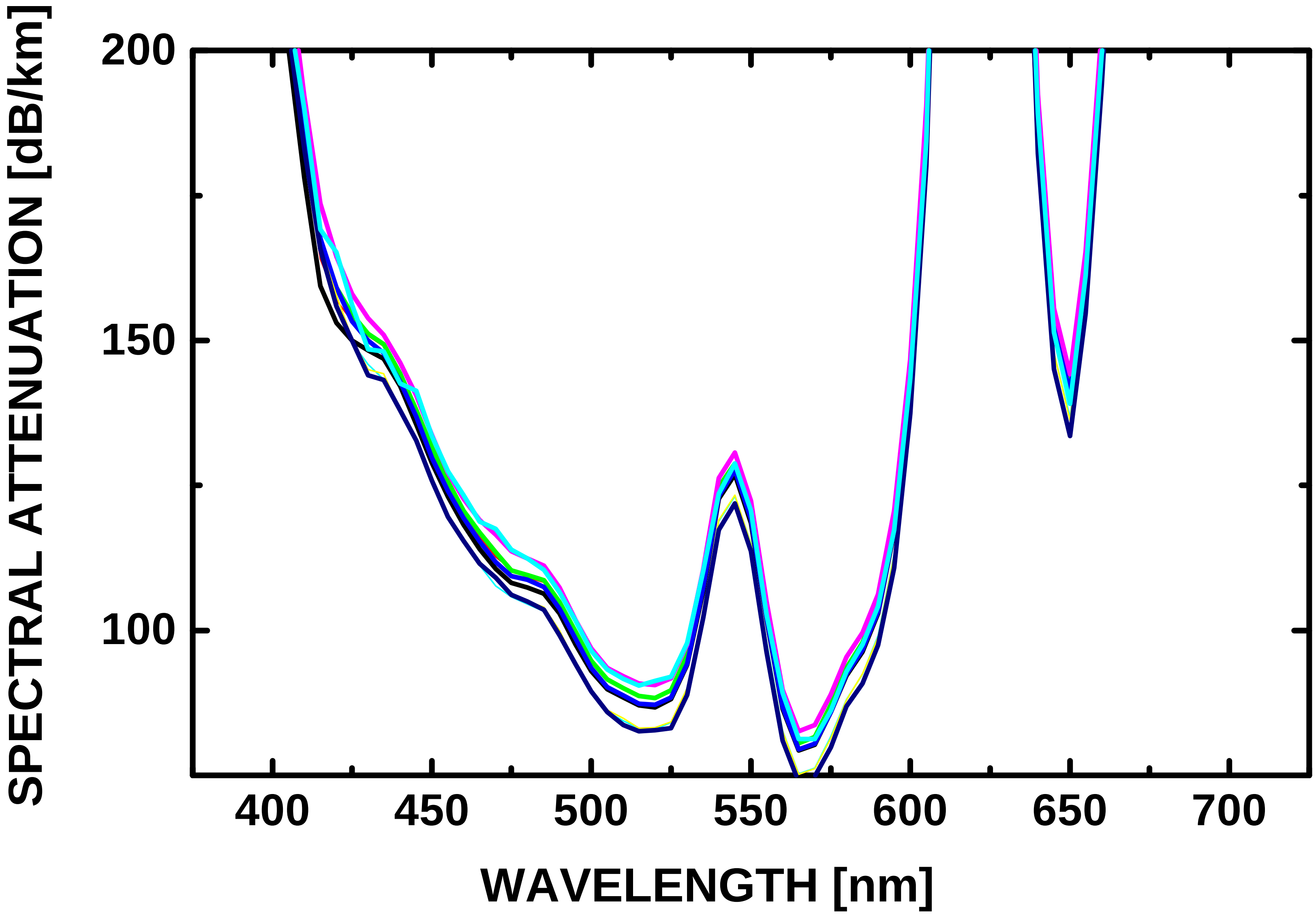
Attenuation along the fiber



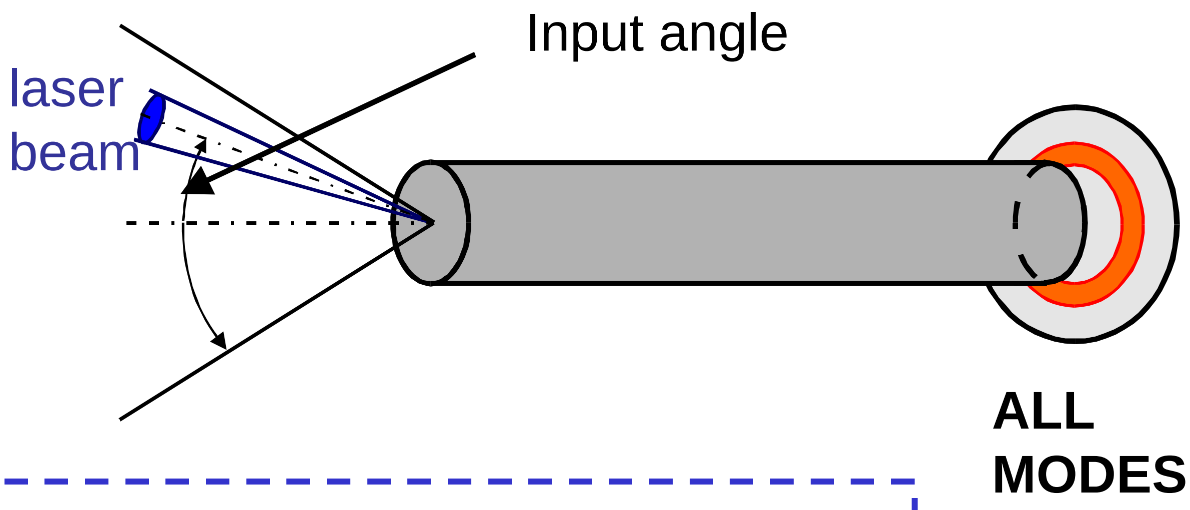
Controlled input conditions:
steady-state with fiber-optics (NA ≈ 0.34)



Reproducibility with polished endfaces



Principles for excitation-dependent losses



Inverse farfield

+

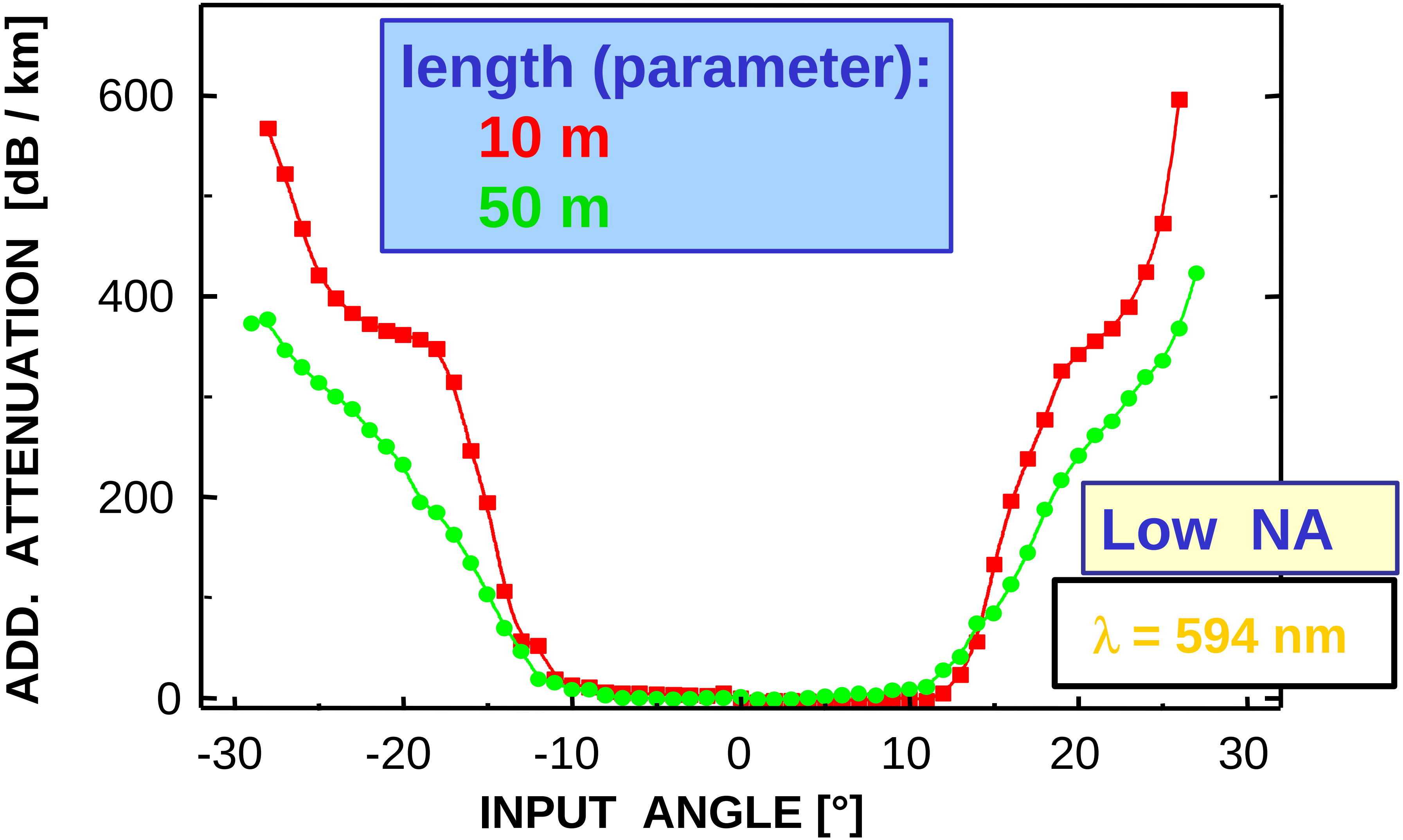
cutback-method

+ 3 different wavelengths

Fiber-lengths: approx. 1 .. 2 m (short)
approx. 10 .. 30 m (long))

Remarks: see presentation about inverse farfield method

Excitation-dependent spectral losses



Outlook

Reproducibility improvements:

usage of immersion liquid (under test)
influence of fiber chuck (holder) due to mode-stripping
easier preparation method

Low-NA fiber:

power distribution can be changed
significantly due to fiber bending
steady-state distribution has to be determined
cross-section converter may be a good solution
(in discussion)