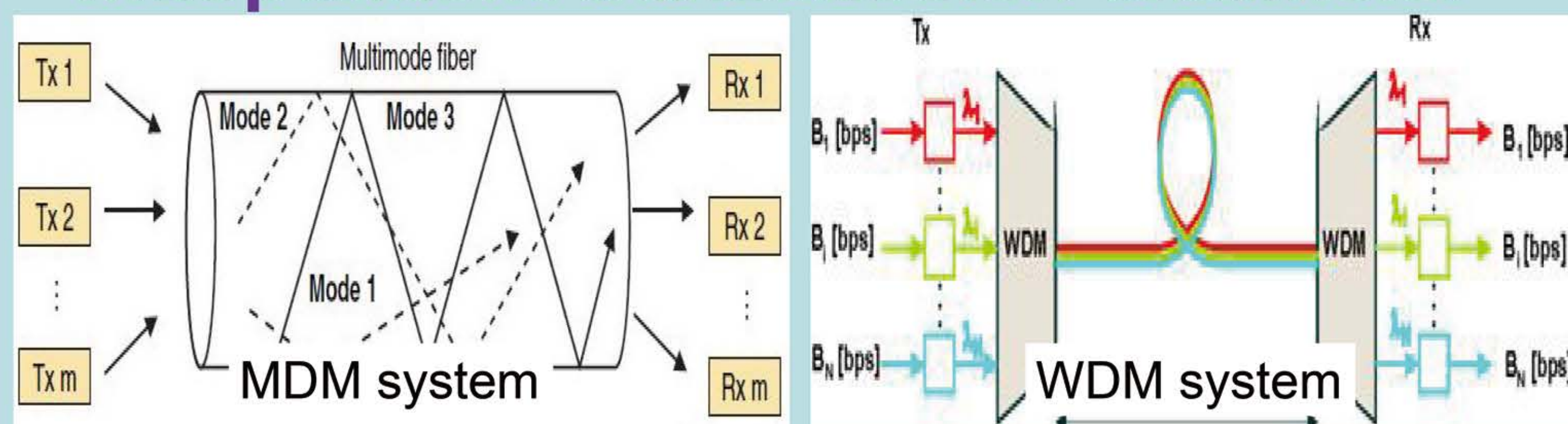


# Broadband Optical Fiber Mode Converters

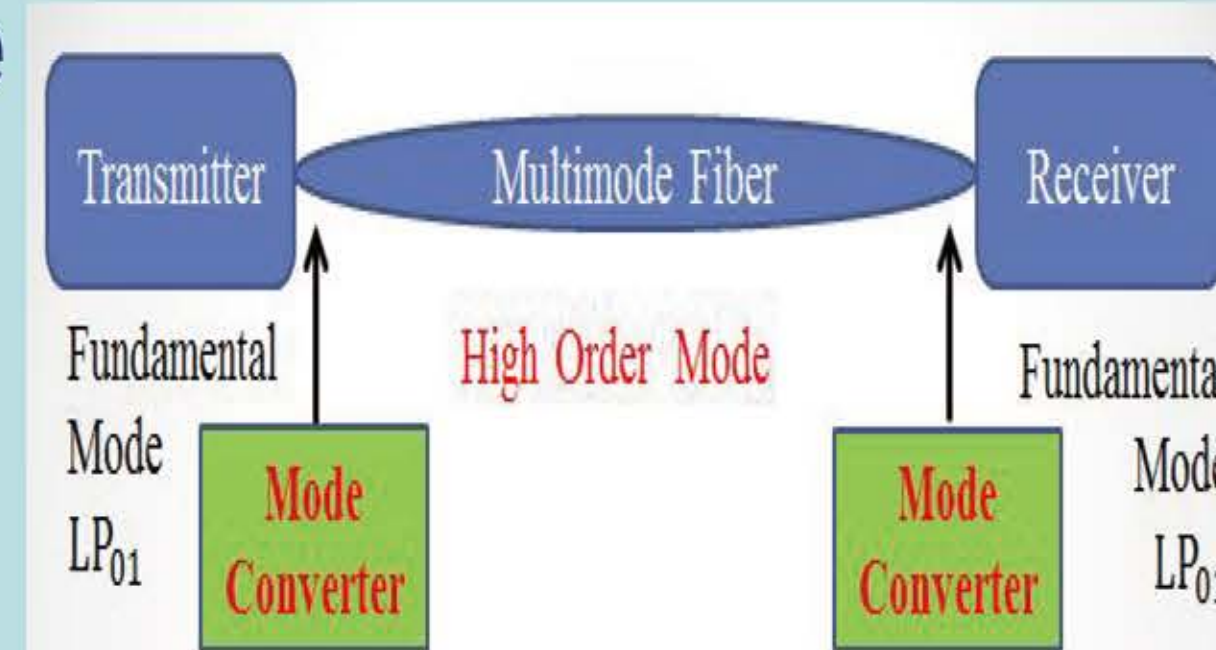
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Program: BEng3ECE (Department of Electronic Engineering)

## 1. Motivation and background

- Mode-division-multiplexing system uses different fiber modes as independent transmission channels.
- Wavelength-division-multiplexing system uses different wavelengths as independent transmission channels.



Mode converters couple light between fundamental mode and higher order modes.

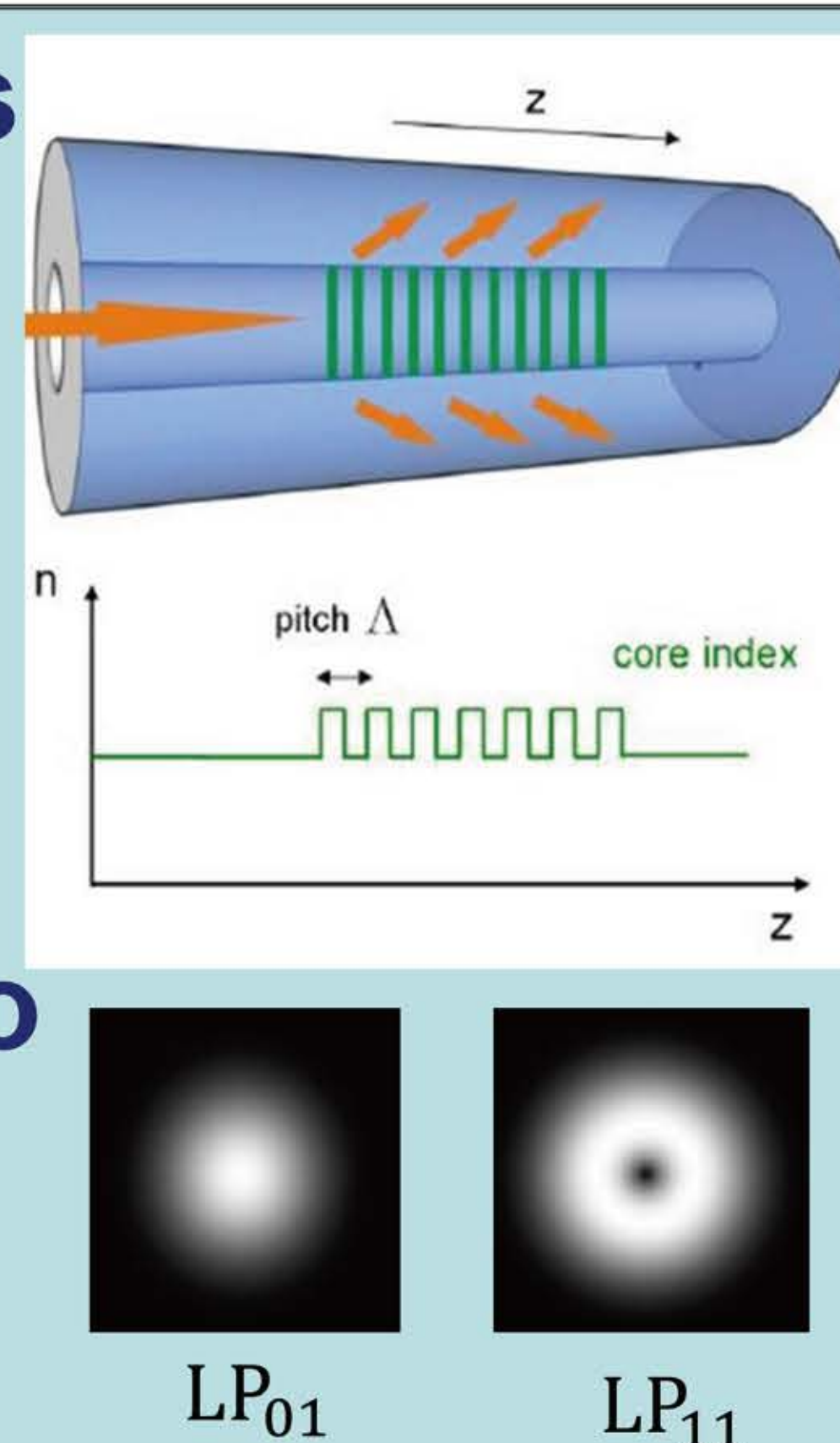


Broadband mode converters are needed so that WDM techniques can be applied in each channel to further enhance transmission capacity.

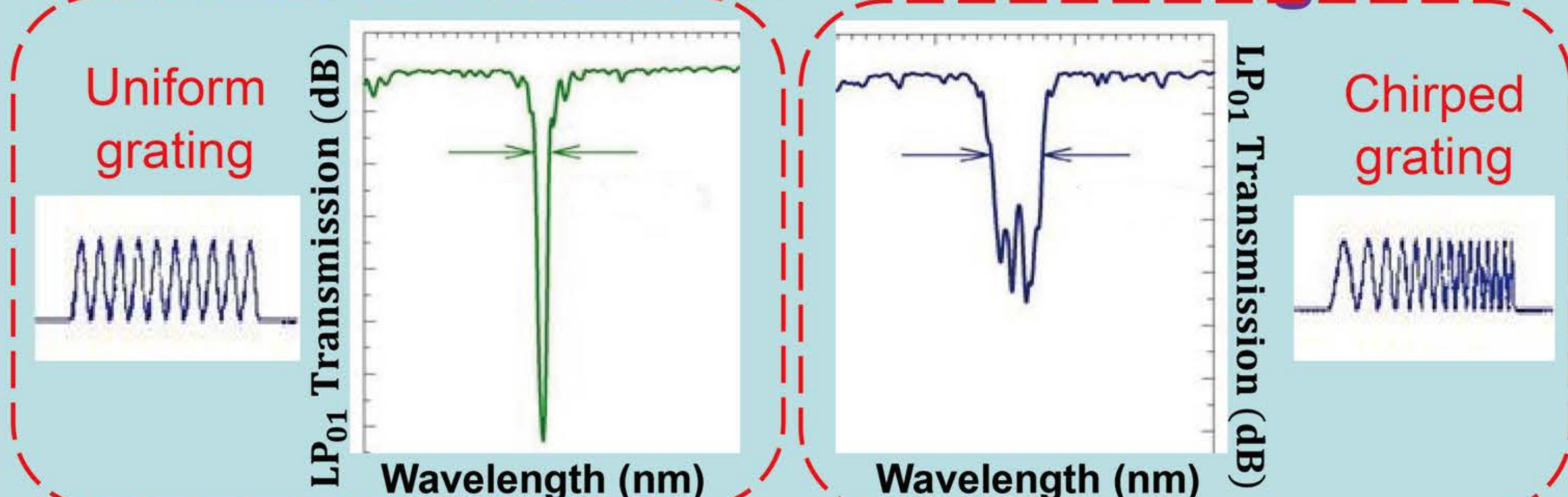
## 2. Principle

Long period fiber grating is applied to fabricate mode converters due to periodic core index modulation

In this project, mode converters are fabricated to couple light between  $LP_{01}$  and  $LP_{11}$  mode



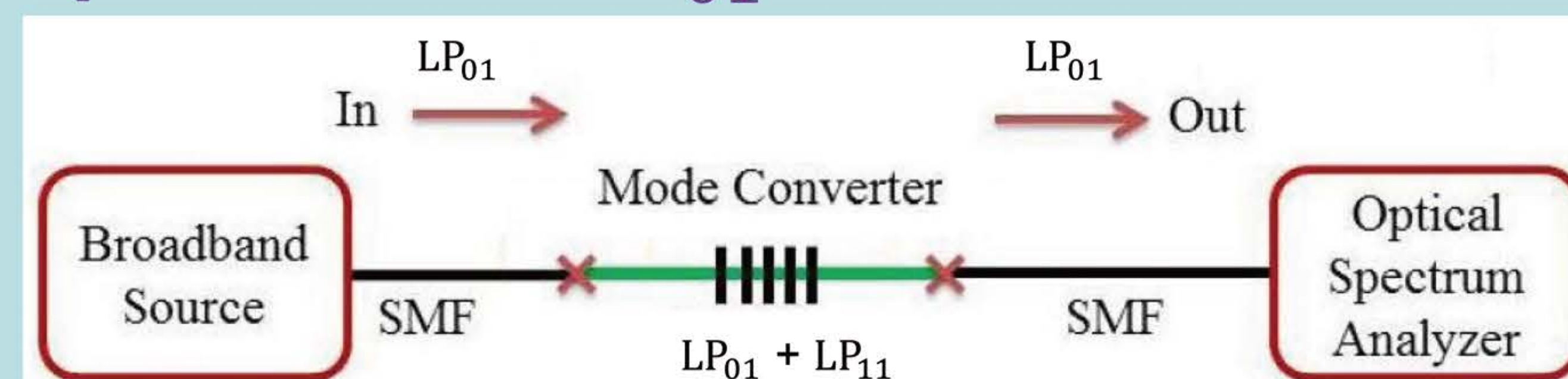
- Linearly chirped grating refers to grating whose pitch varies along the fiber.
- Chirped grating can enhance bandwidth as different pitches will lead to different resonance wavelengths.



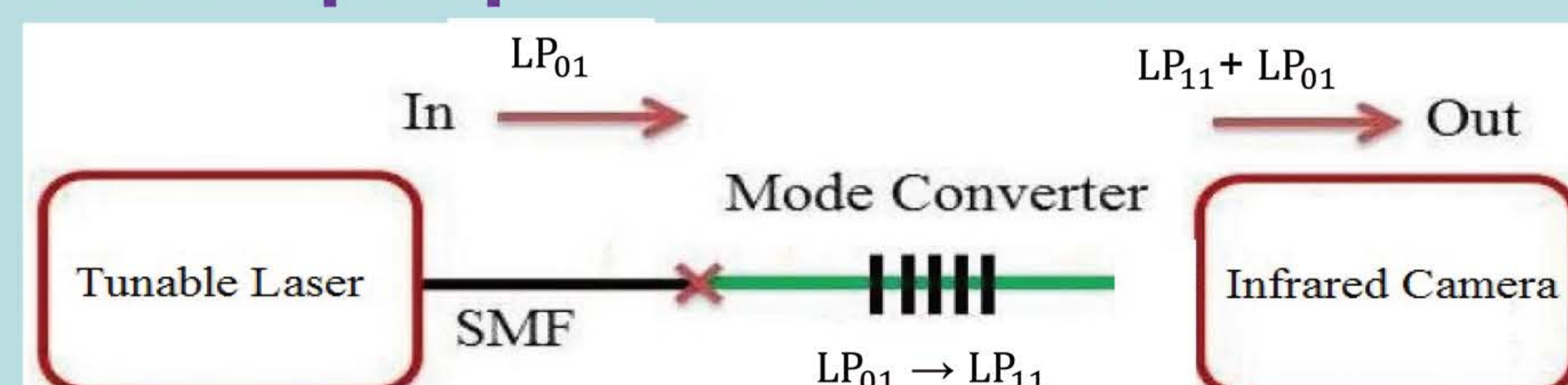
## 3. Experiment

Experiment consists of two parts:

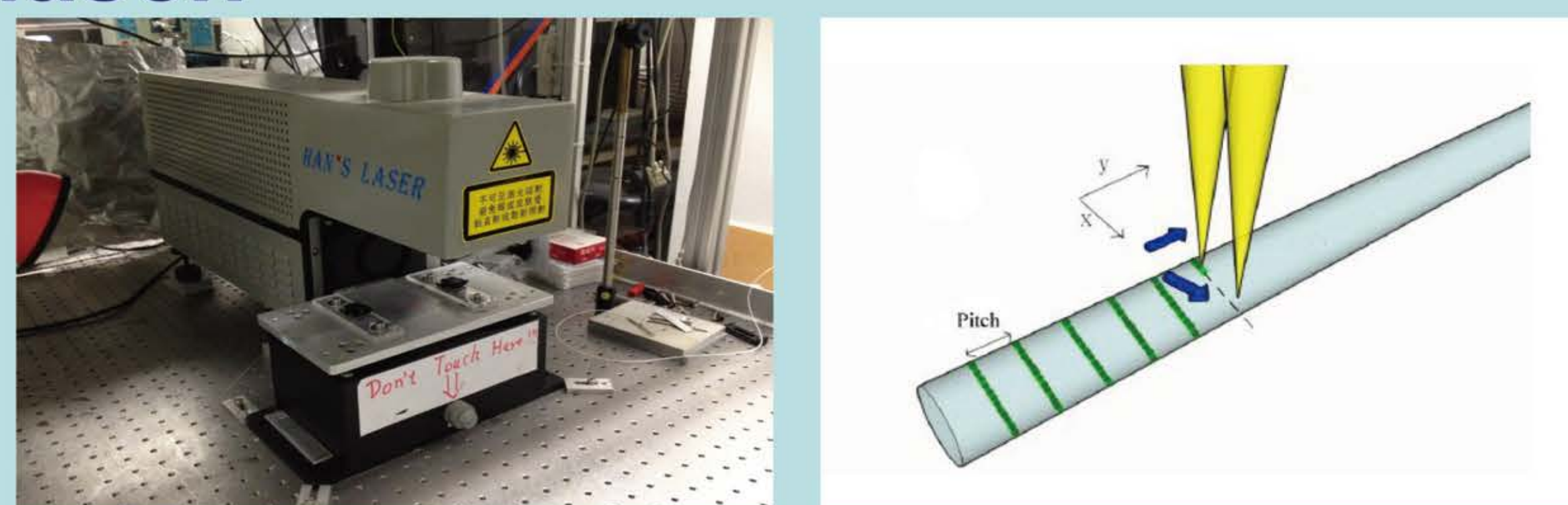
1. Measurement of transmission spectrum for  $LP_{01}$  mode.



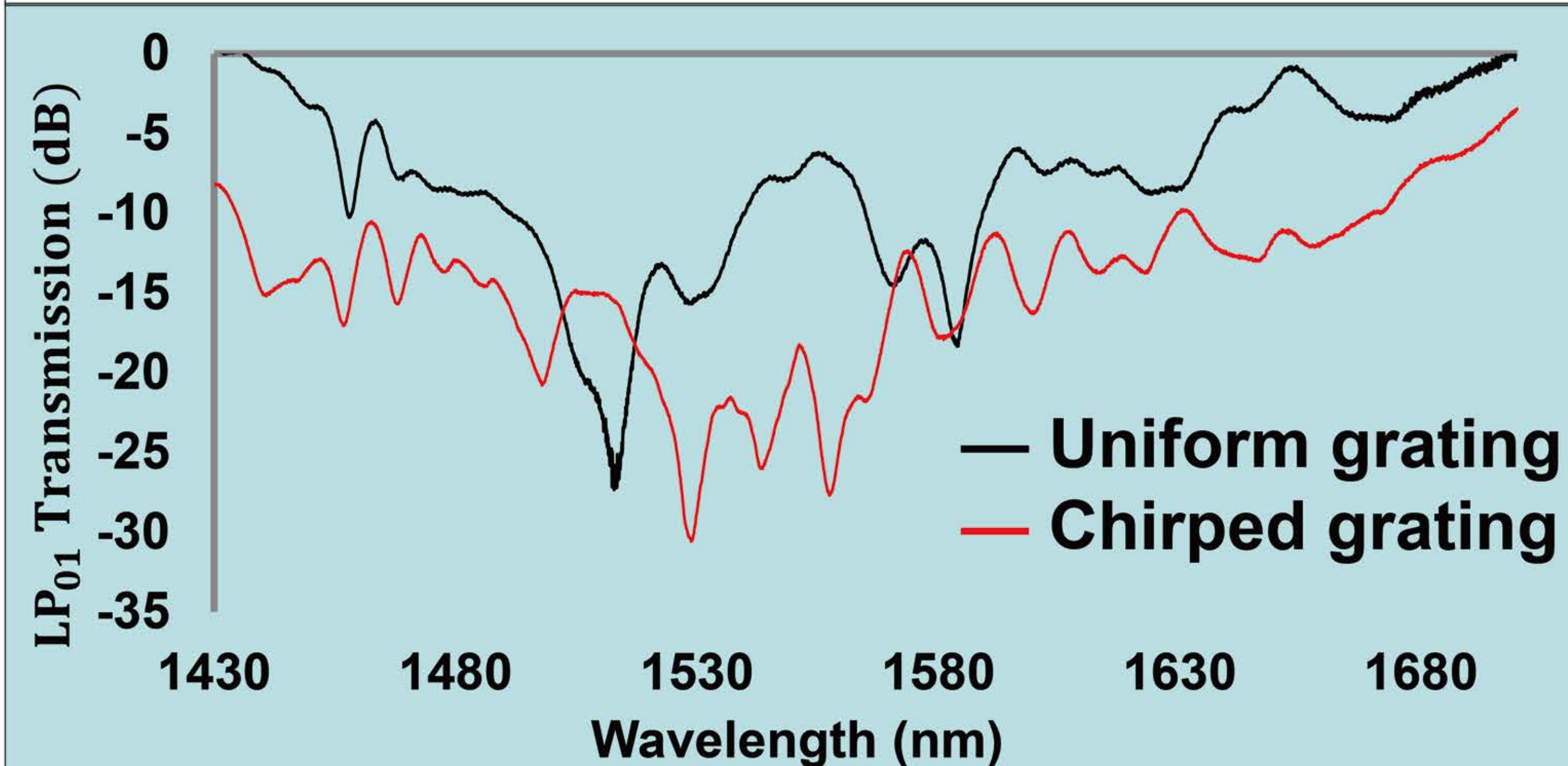
2. Measurement of mode field pattern at the output port of converter.



Long period fiber grating is fabricated by  $CO_2$  laser.



## 4. Results



- For 20 period uniform grating, -10 dB bandwidth is **49.68 nm** while -20 dB bandwidth is **10.50 nm**.
- For 20 period linearly chirped grating, -10 dB bandwidth is **239.82 nm** while -20 dB bandwidth is **29.28 nm**.

Mode field patterns measured are dominated by  $LP_{11}$  mode.

