



HELMUT SCHMIDT
UNIVERSITÄT

Universität der Bundeswehr Hamburg

Tunable Finite Impulse Response Filter for Dispersion Compensation using Multi-Arm MZIs in SOI Technology

Stefan Schwarz, Christian G. Schäffer

Helmut Schmidt University Hamburg, Department of High-Frequency Engineering and Optoelectronics

Abdul Rahim, Jürgen Bruns, Klaus Petermann

Berlin University of Technology, Institute of High-Frequency Engineering

11th May 2011

Agenda

- Motivation
- Dispersion Compensation Concept
- Device Layout and Fabrication
- Comparison of Measurement vs. Theory
- Summary and Outlook



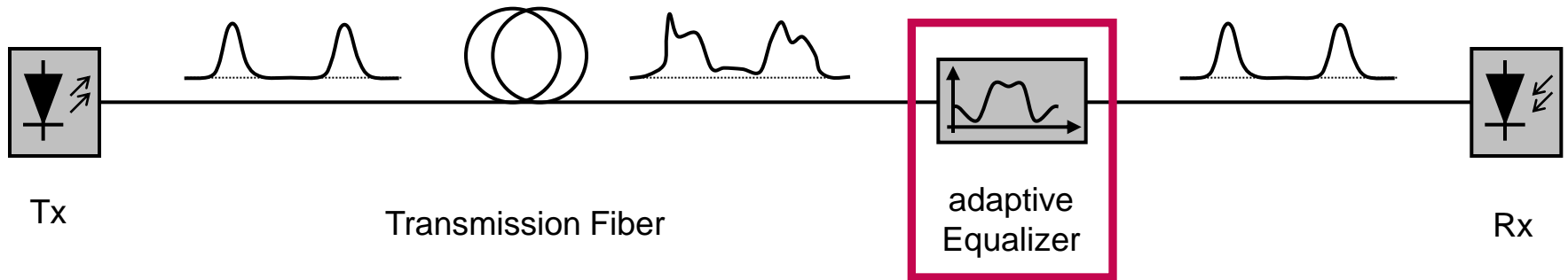
Agenda

- Motivation
- Dispersion Compensation Concept
- Device Layout and Fabrication
- Comparison of Measurement vs. Theory
- Summary and Outlook



Motivation

- Chromatic Dispersion leads to signal distortion



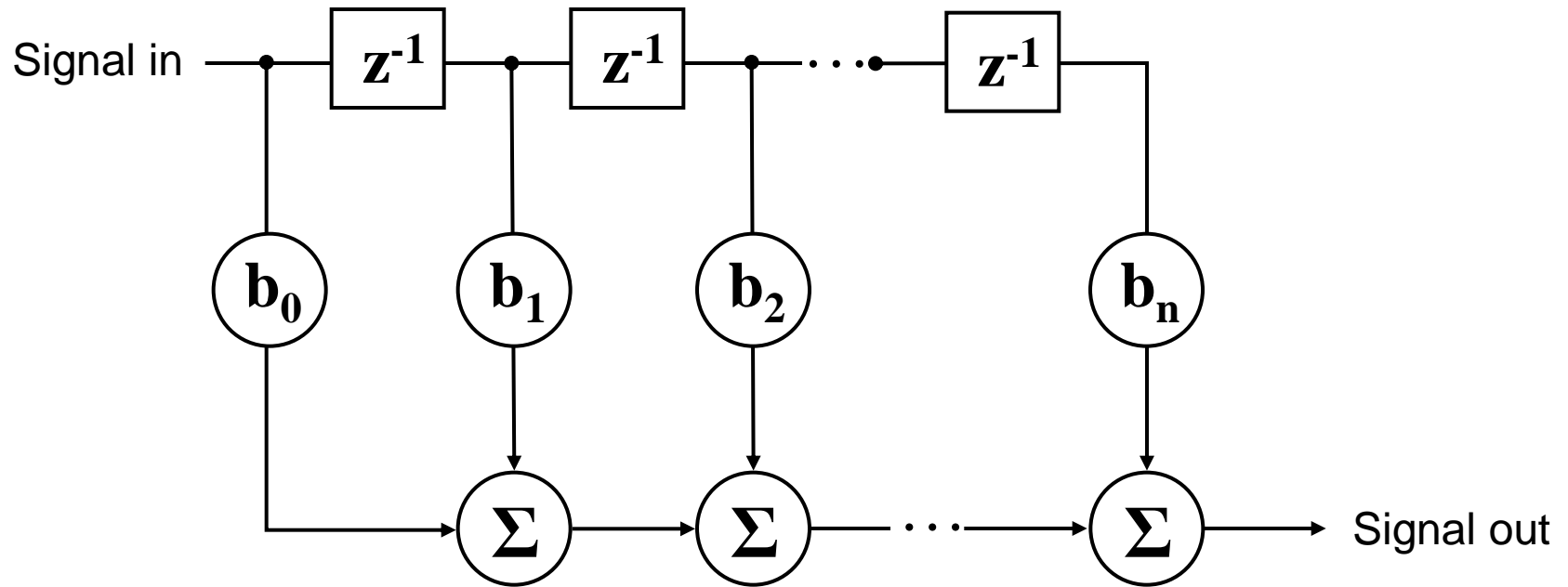
Agenda

- Motivation
- Dispersion Compensation Concept
- Device Layout and Fabrication
- Comparison of Measurement vs. Theory
- Summary and Outlook



Dispersion Compensation Concept

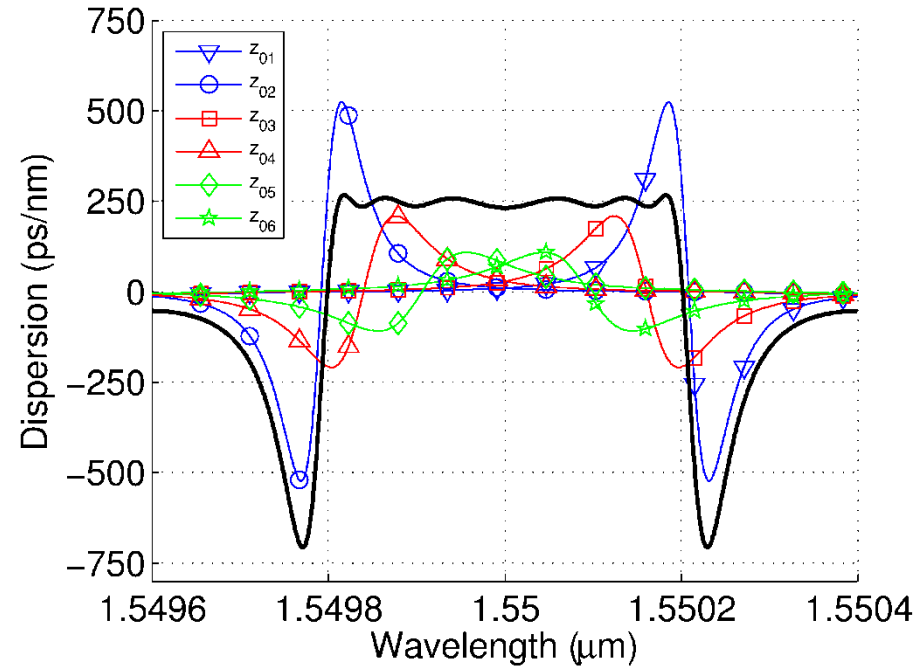
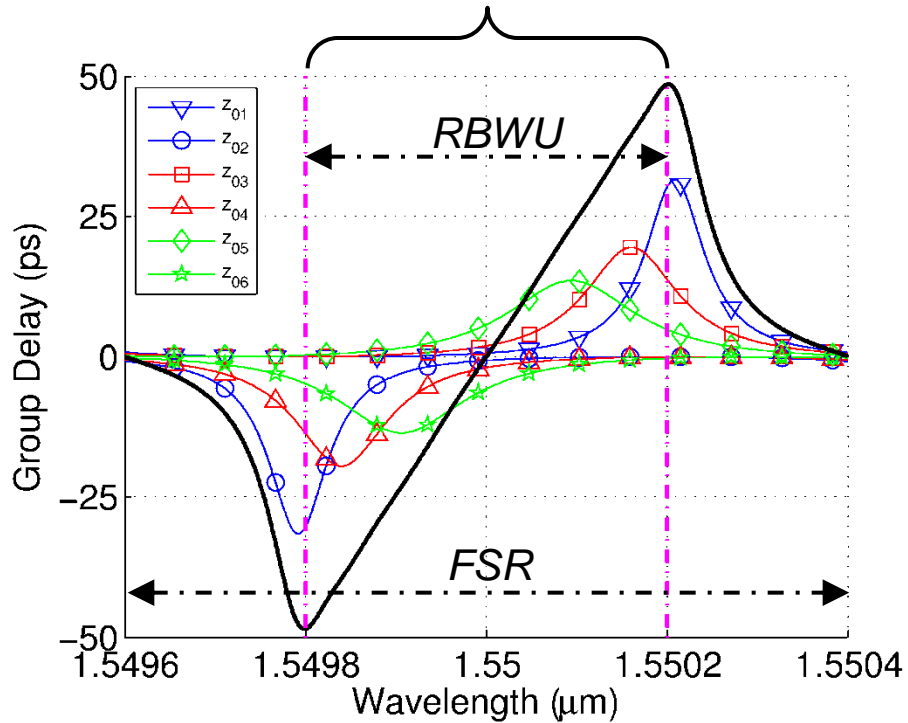
➤ General FIR Filter



Dispersion Compensation Concept

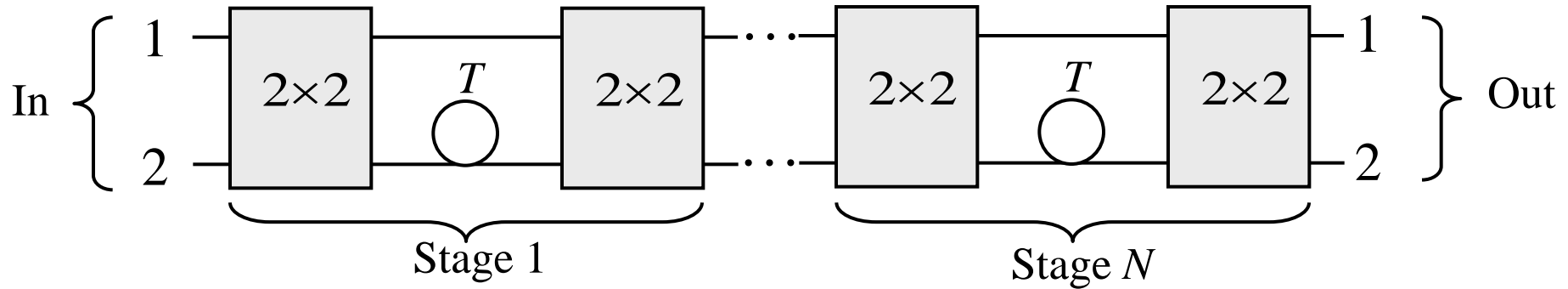
- Example for superposition of 6 filter zero contributions

GD Ripple < 1.15 ps

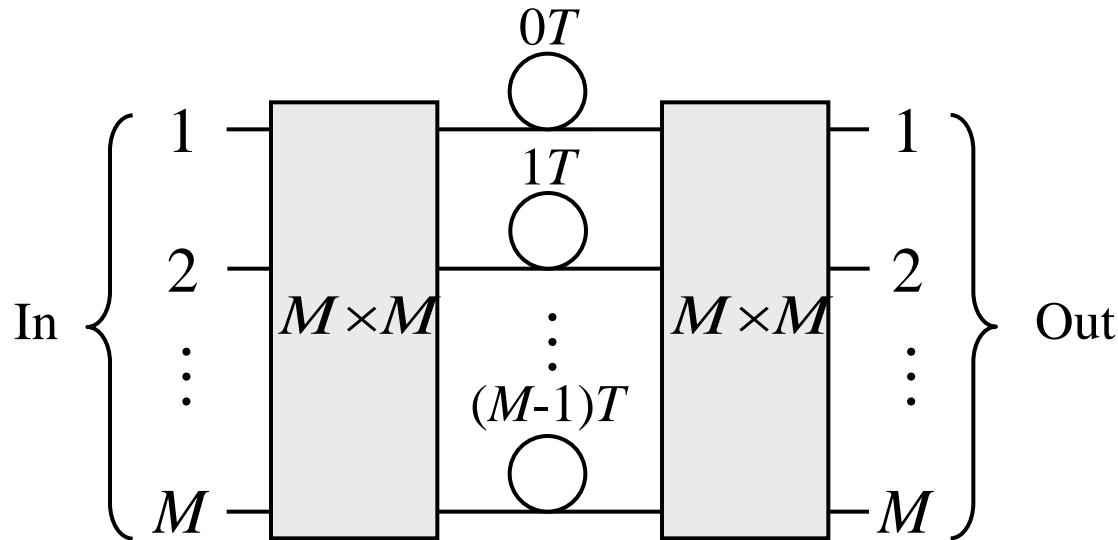


Dispersion Compensation Concept

➤ Serial Filter Architecture



➤ Parallel Filter Architecture



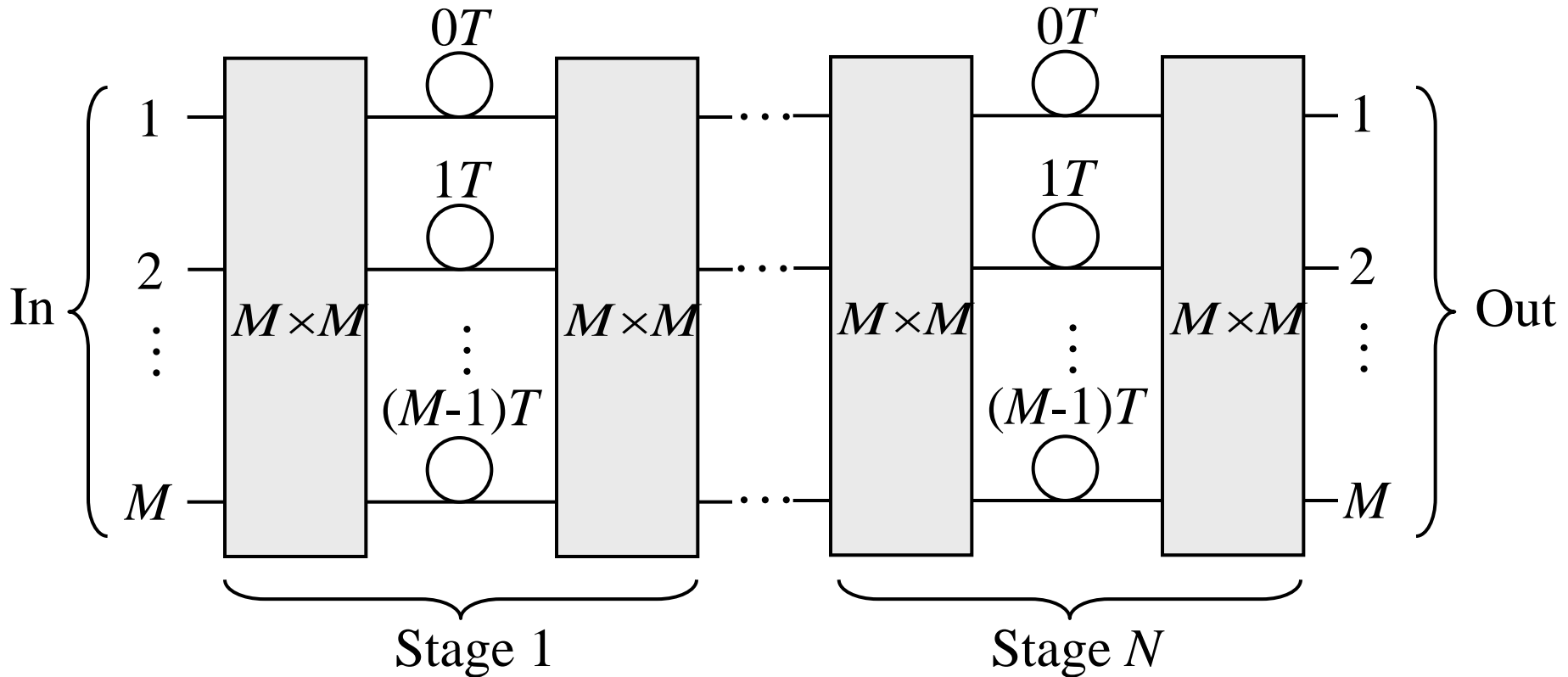
Design Criteria:

- Filter Length
- Bandwidth



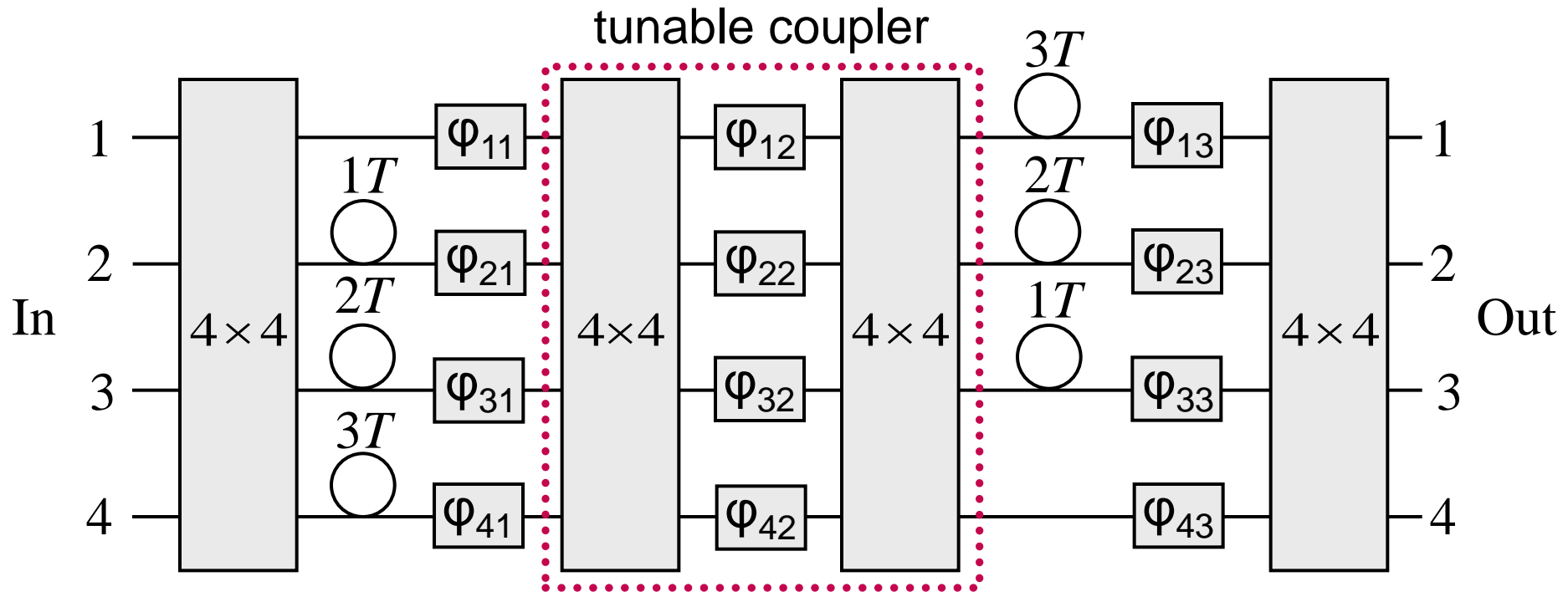
Dispersion Compensation Concept

➤ Serial-Parallel Filter Architecture



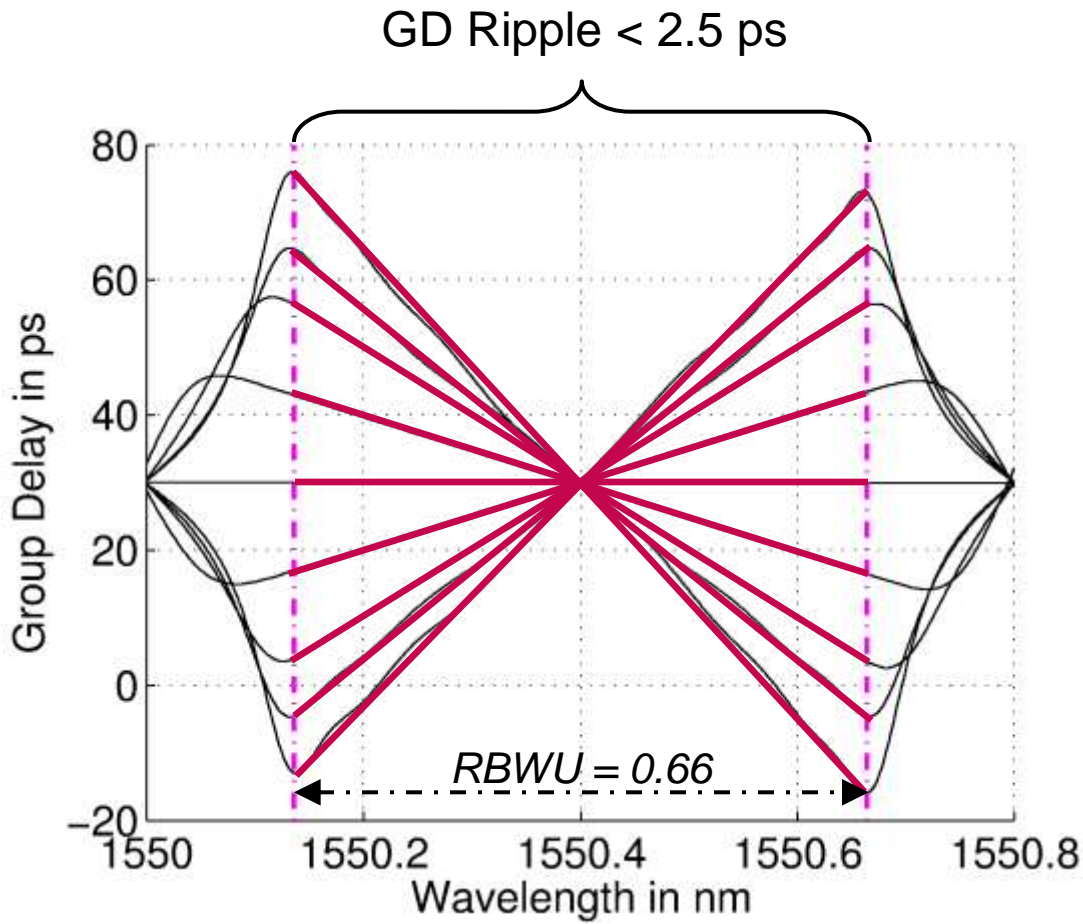
Dispersion Compensation Concept

➤ Example: 2-stage 6th order FIR Filter



Dispersion Compensation Concept

➤ Tuning the Group Delay Slope



Tuning of **12** DOF
with
9 Phase Controller

Dispersion in ps/nm

-172

-130

-99

-50

0

50

98

130

161



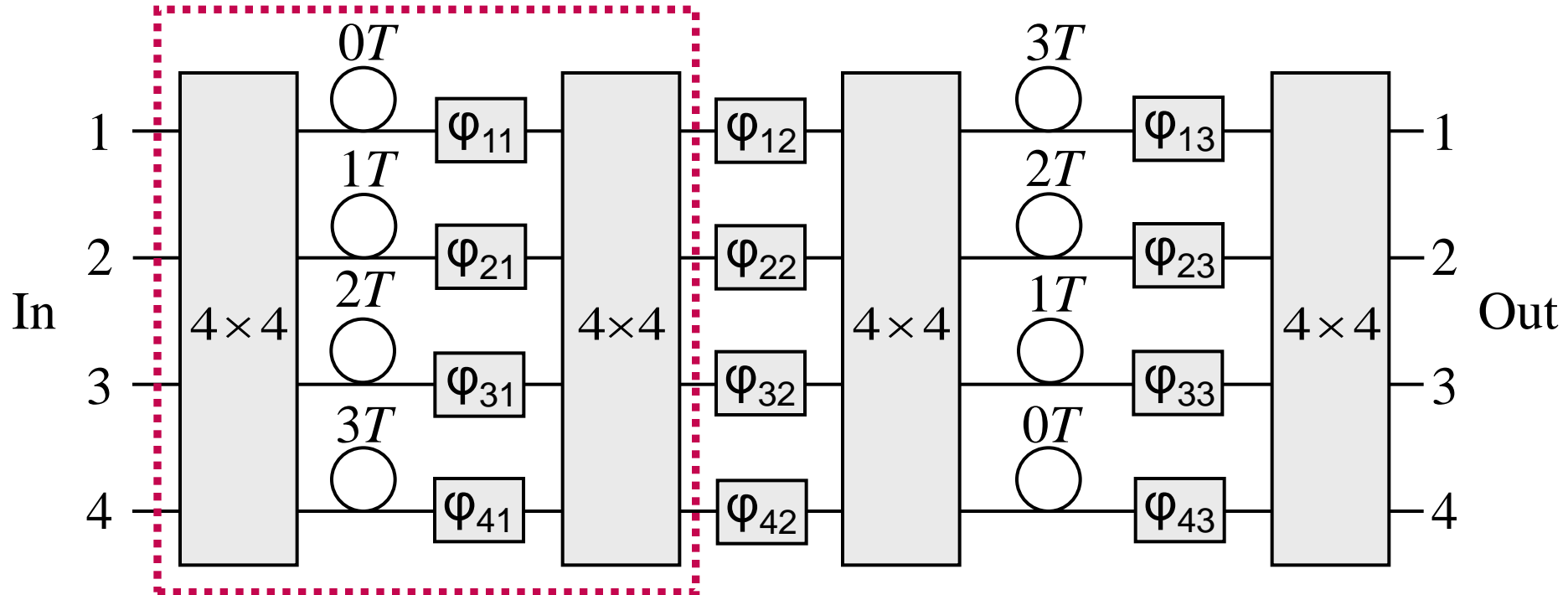
Agenda

- Motivation
- Dispersion Compensation Concept
- **Device Layout and Fabrication**
- Comparison of Measurement vs. Theory
- Summary and Outlook



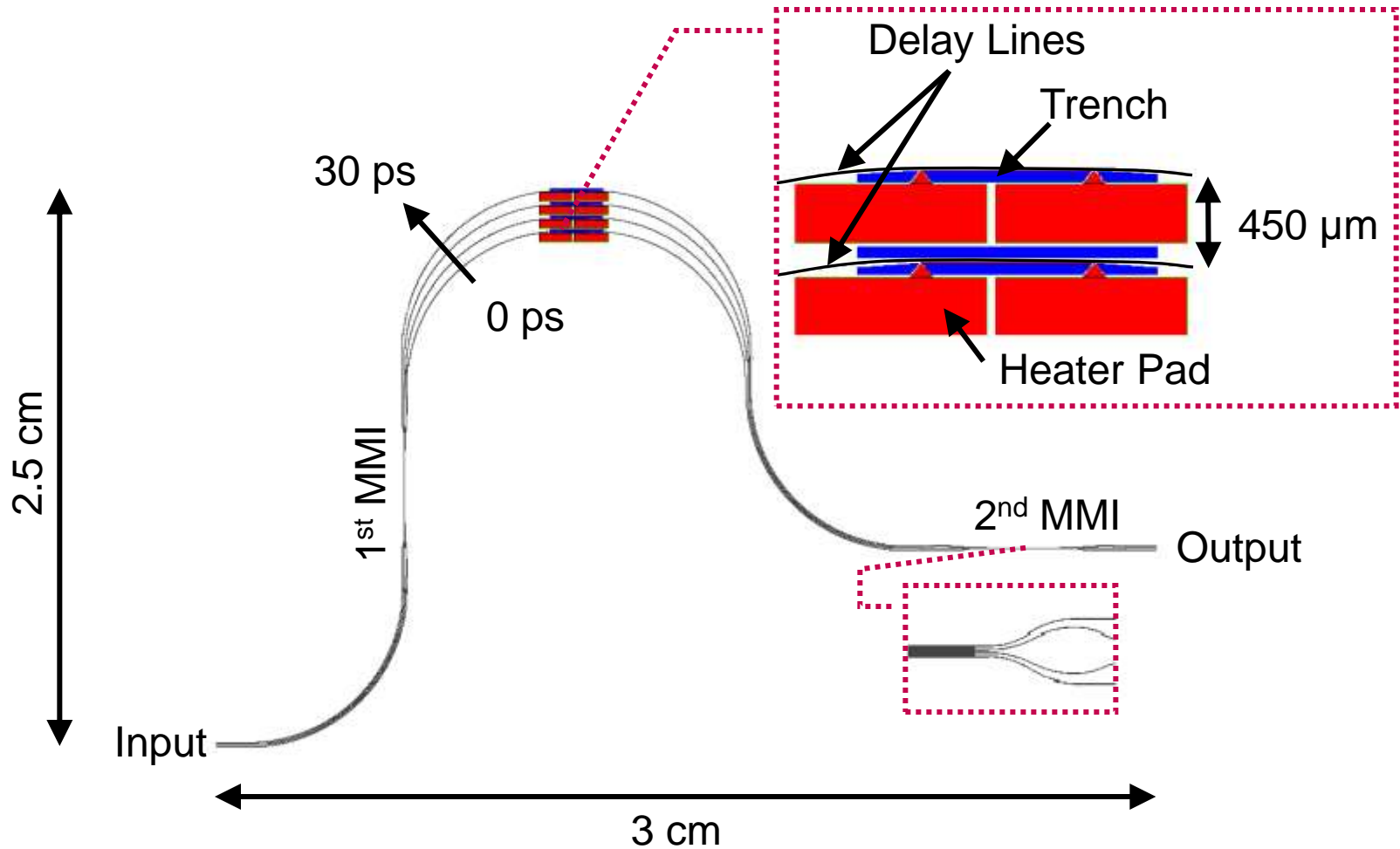
Device Layout and Fabrication

➤ Realization of 1st stage (Schematic)



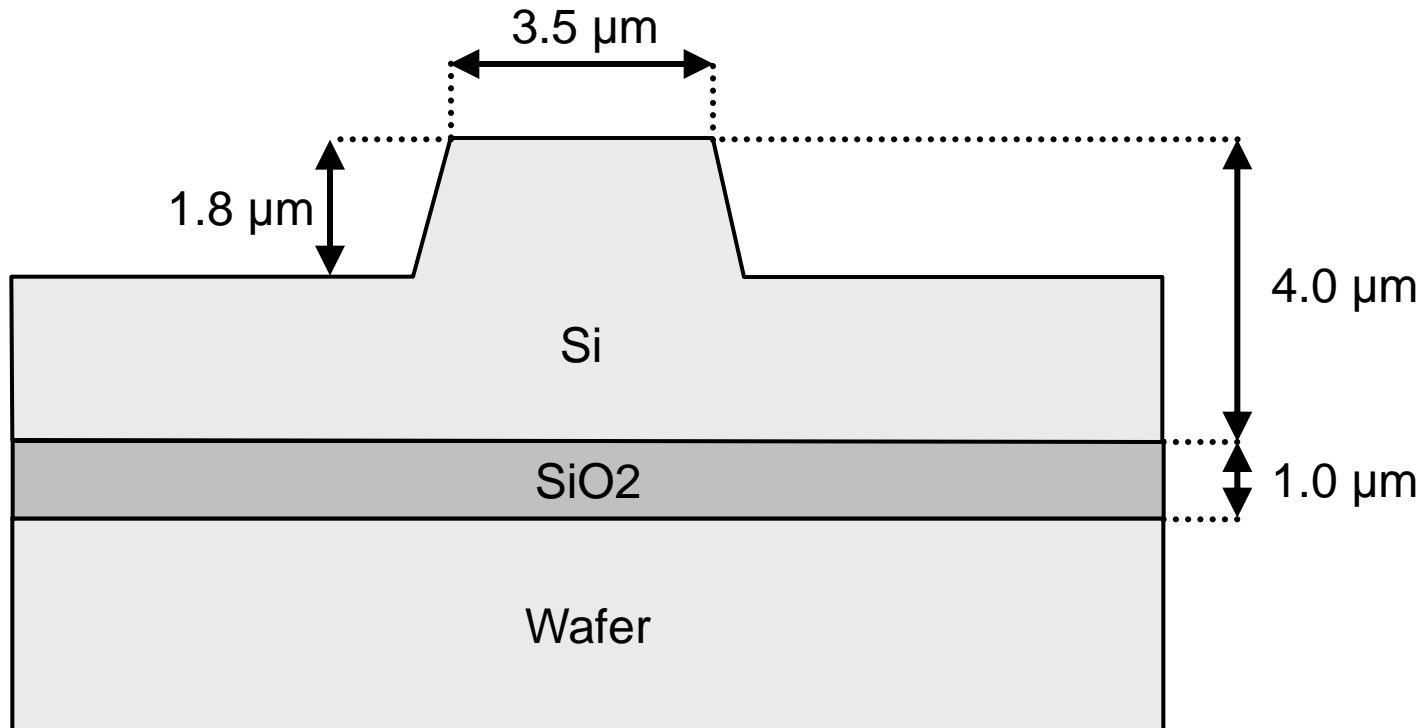
Device Layout and Fabrication

➤ Realization of 1st stage (Layout)



Device Layout and Fabrication

➤ Realization of 1st stage (Dimensions)



Agenda

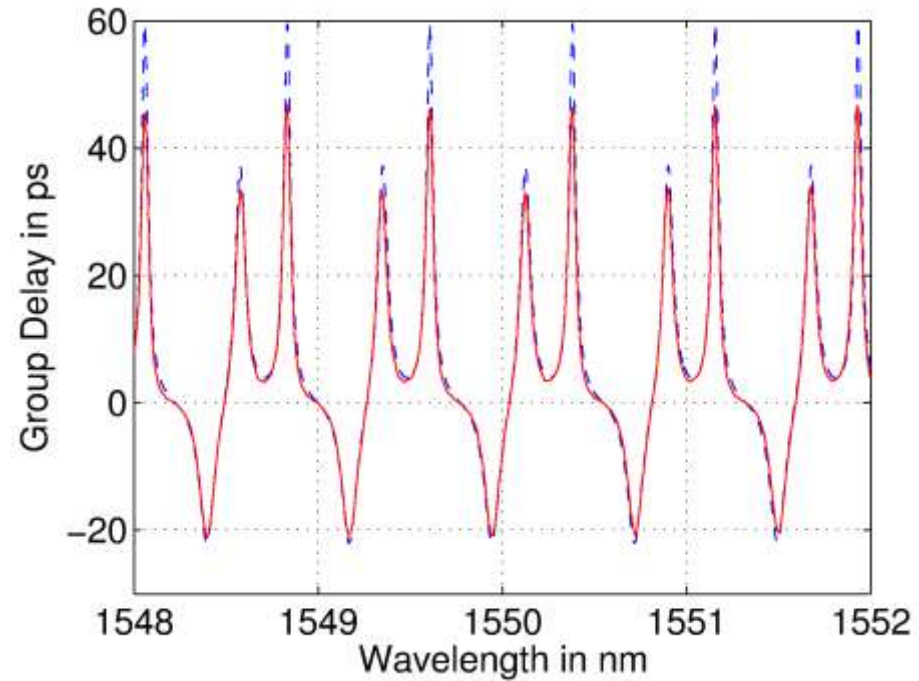
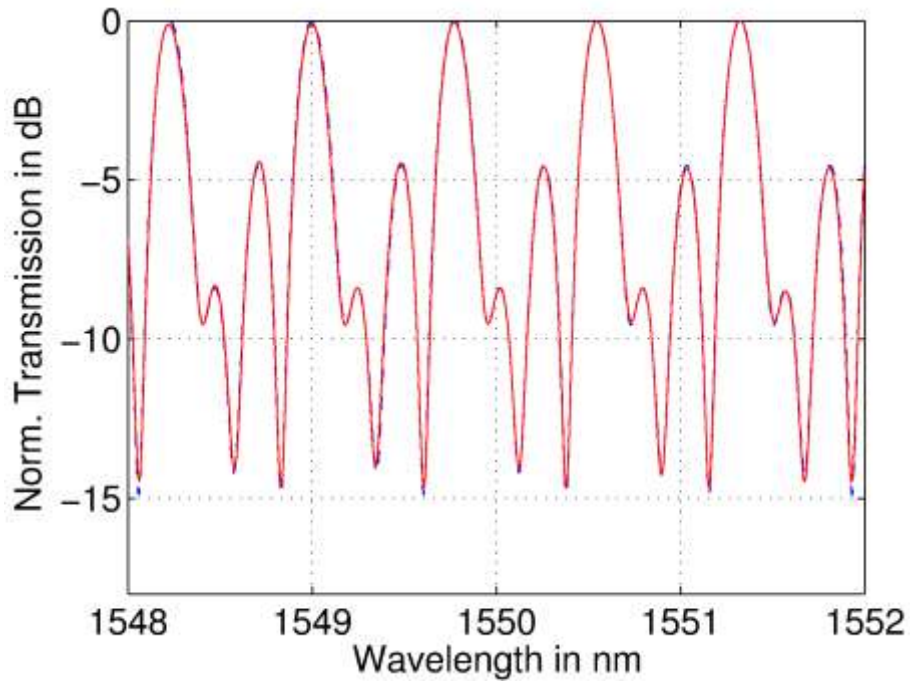
- Motivation
- Dispersion Compensation Concept
- Device Layout and Fabrication
- **Comparison of Measurement vs. Theory**
- Summary and Outlook



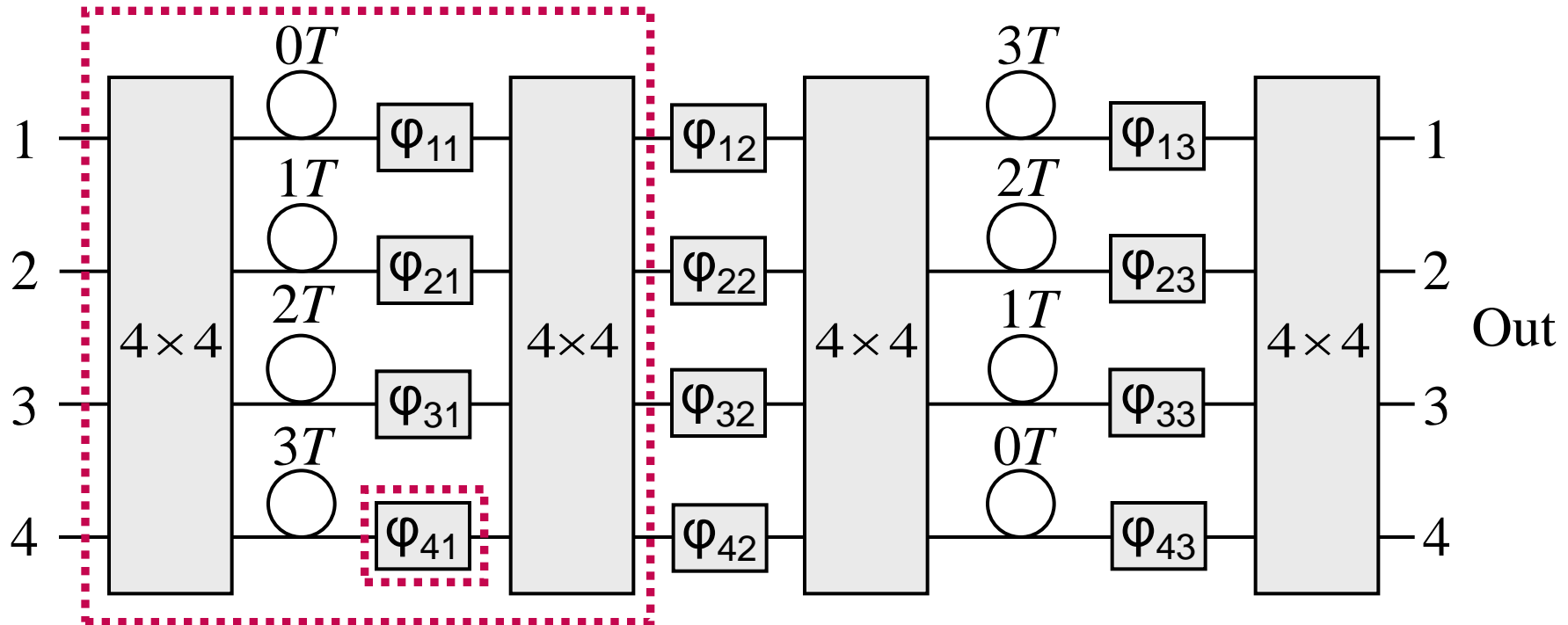
Comparison of Measurement vs. Theory

Legend:

- Measurement
- ⋯ Simulation



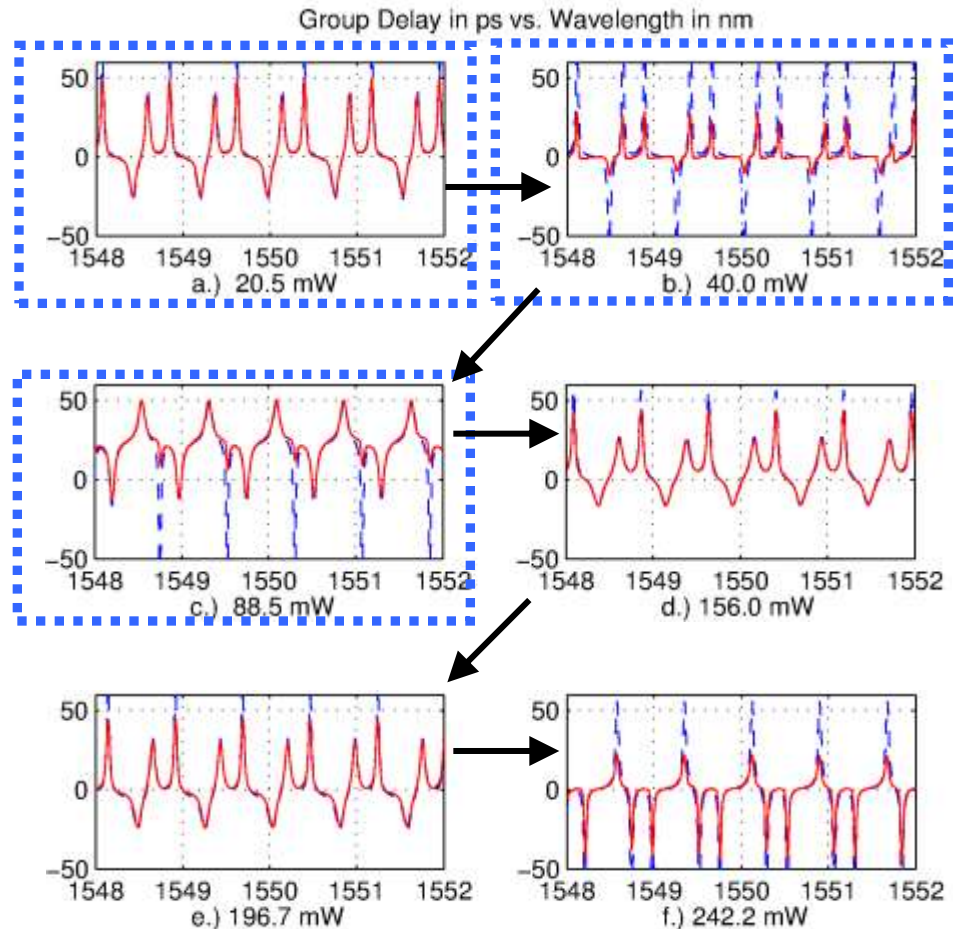
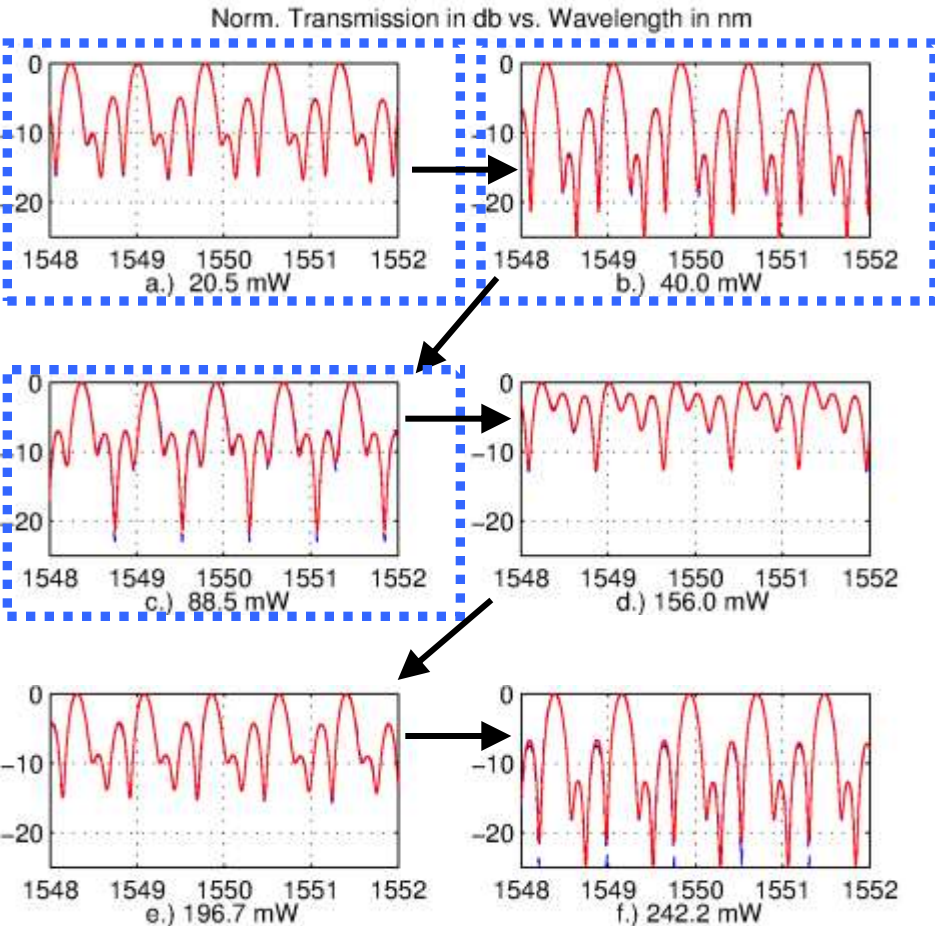
Comparison of Measurement vs. Theory



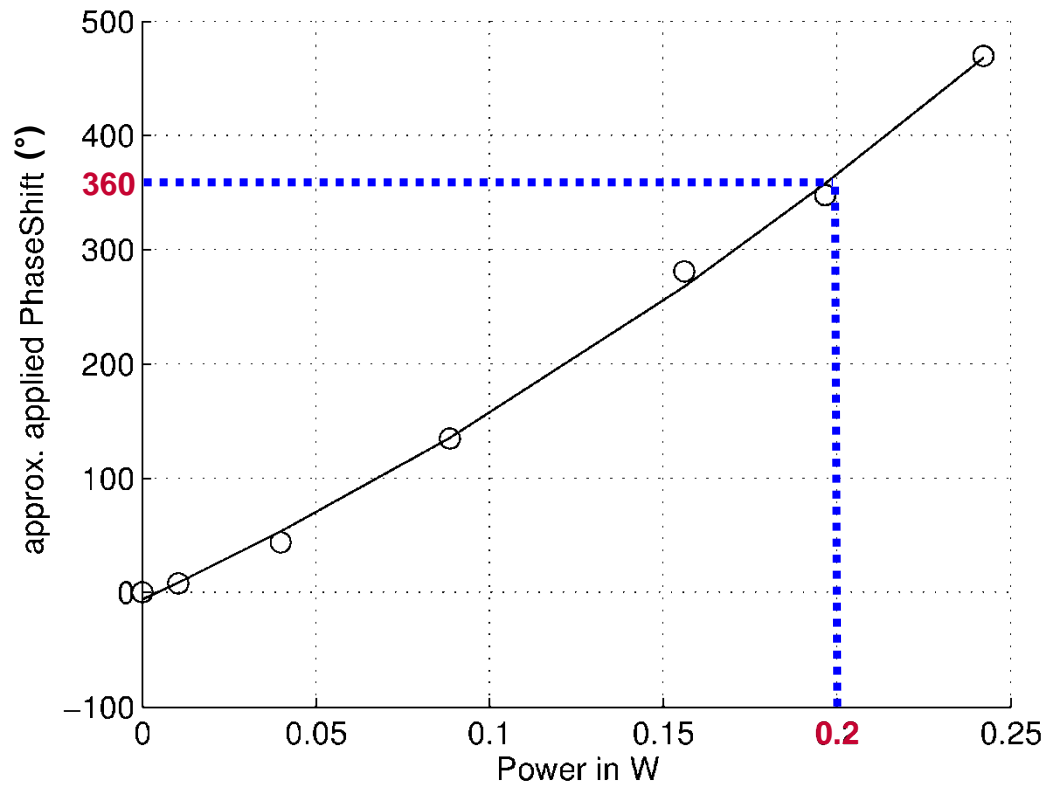
Comparison of Measurement vs. Theory

Legend:

- Measurement
- ⋯ Simulation



Comparison of Measurement vs. Theory



Agenda

- Motivation
- Dispersion Compensation Concept
- Device Layout and Fabrication
- Comparison of Measurement vs. Theory
- **Summary and Outlook**



Summary and Outlook

Summary:

- compact and tunable FIR filter on SOI platform
- architecture is a combination of serial and parallel signal processing
- 1st stage has been realized
- good agreement between the simulated and measured filter responses

Outlook:

- extension of filter to 2-stage 6th order FIR Filter
- tuning of the phase controlling elements



Thank you for your attention!

