Silicon photonic, planar coupled, 4-channel WDM transmitter

Marc Schneider, Birgit Burger, Thomas Kühner, Frank Simon

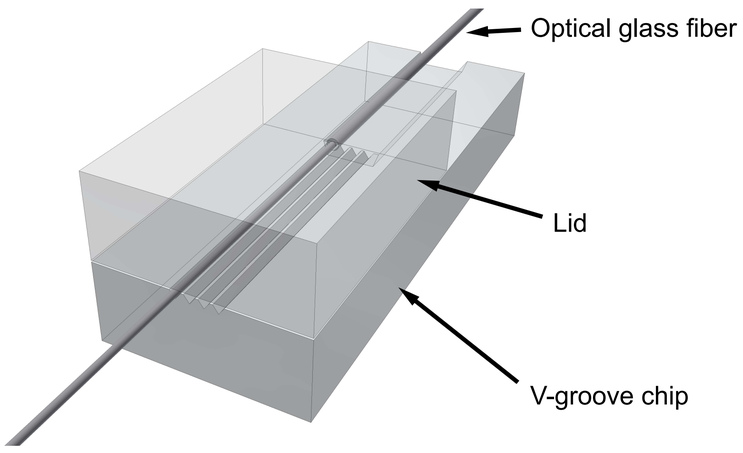
Karlsruhe Institute of Technology (KIT), Institute for Data Processing and Electronics (IPE), Germany

Link demonstrator:

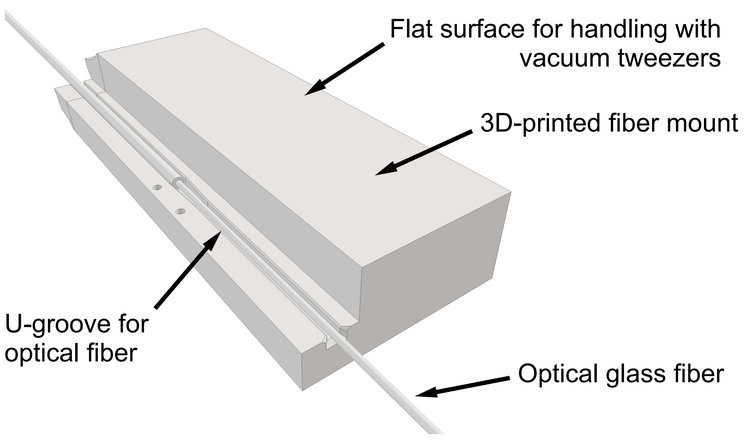
- Silicon photonic 4-channel WDM system chip
- Angle polished glass fibers for fiber-chip-coupling
  - Input: polarization maintaining, single mode fiber
  - Output: Standard single mode fiber
- DC-bias board
- RF-fan-out board

All assembled on glass substrate:

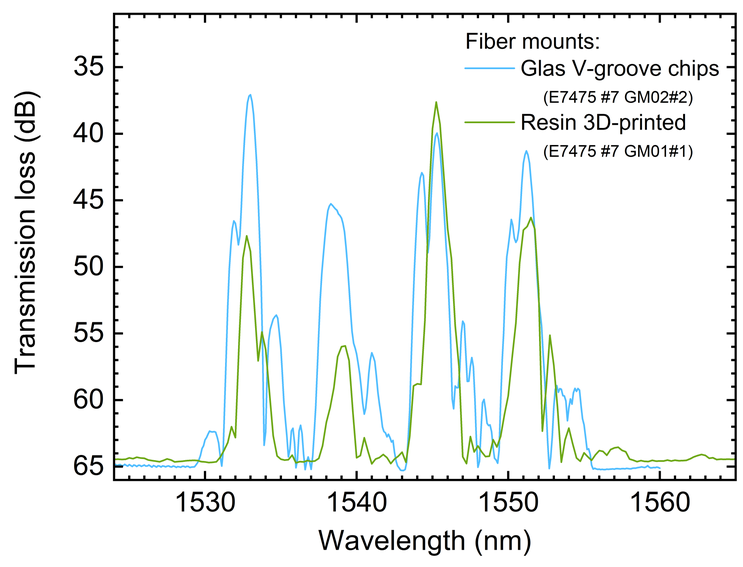
- Microscope slide 76x26x1 mm³



Commercial **glass V-groove chip** with optical glass fiber and lid. Thickness options (height) are limited.



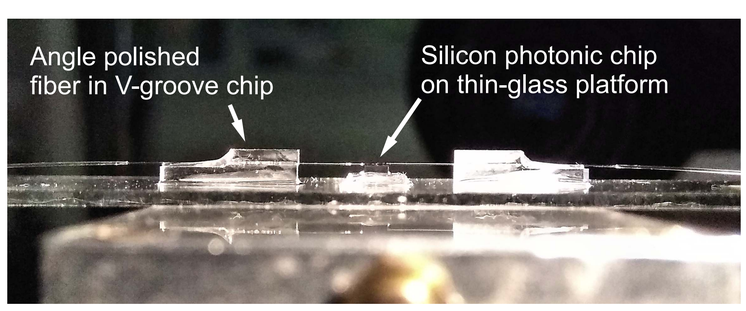
Resin 3D-printed fiber mount with optical glass fiber. Fiber height can easily be adjusted to the chip thickness and no platform below the photonic chip for height adjustment is required.
Through smart orientation of the part in the printing volume, sub-resolution dimensions can be accurately achieved. The fiber height has to be adjusted to approximately 3 µm above the chip surface to achieve a good coupling efficiency while preventing the fiber from sticking to the chip surface and interfering with fiber positioning.



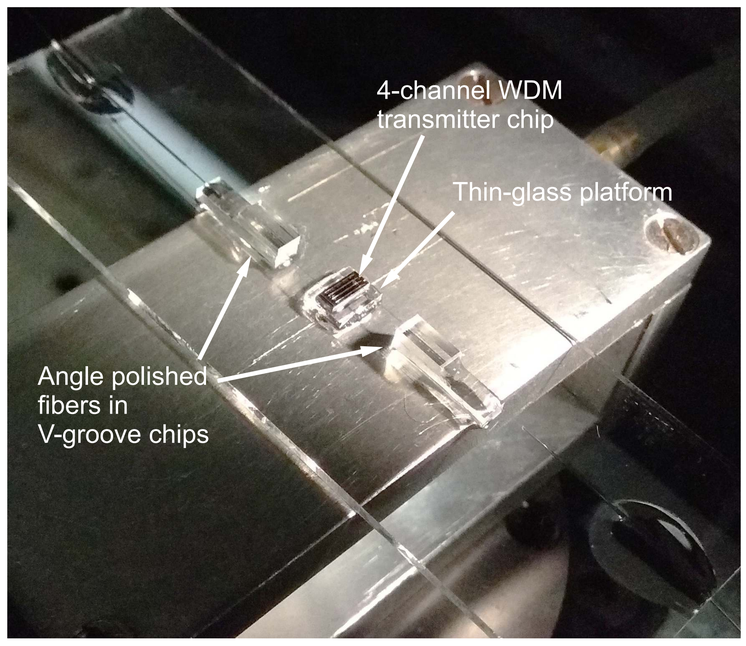
Transmission loss of unbiased system chips. Optical coupling by angle polished, single mode glass fibers. Normal, unbiased optical transmission state of modulators is opaque.

Two demonstrators:

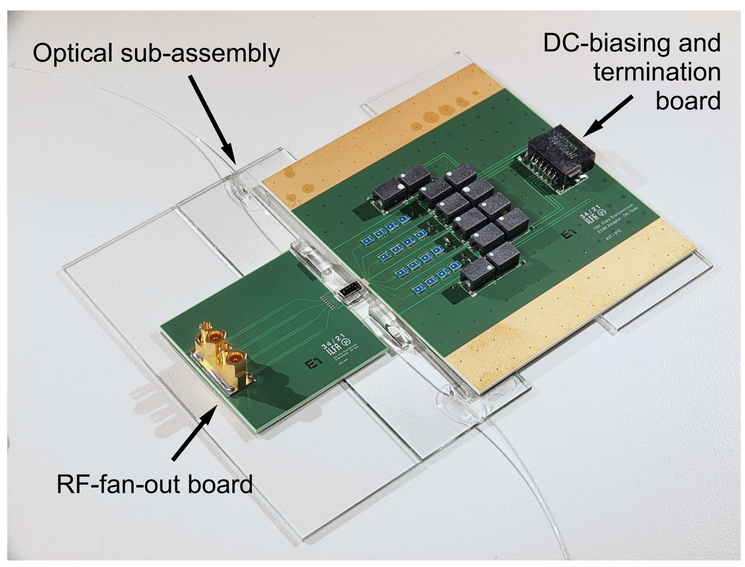
1. Angle polished fibers in **glass V-groove** chips and silicon photonic chip bonded to glass platform for height adjustment.
2. Angle polished fibers in **resin 3D-printed mounts** and silicon photonic chip directly bonded to substrate.



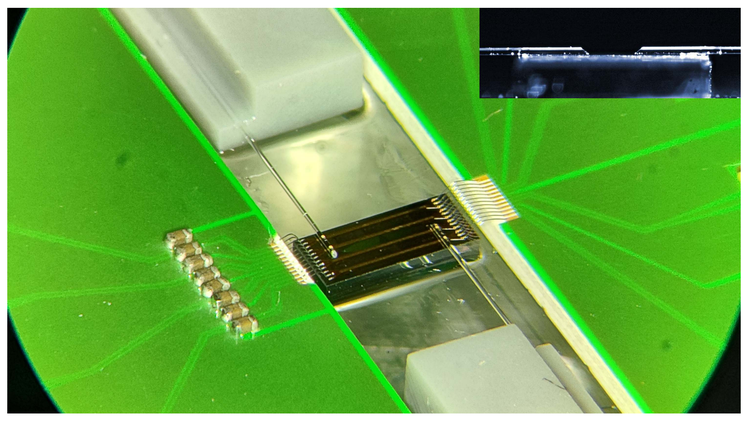
Input and output fibers glass V-groove chips bonded besides silicon photonic chip on glass platform for height adjustment.



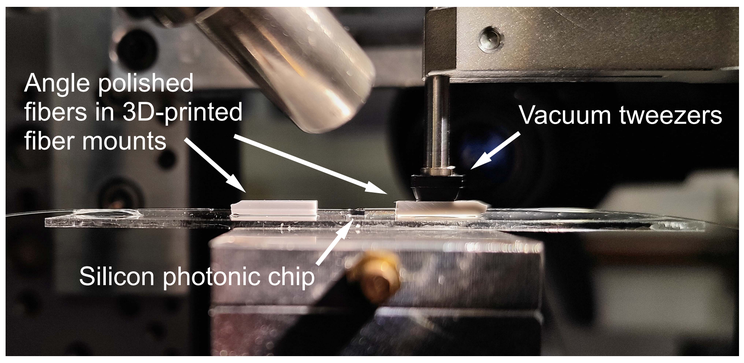
Optical sub-assembly of system demonstrator of type 1 with glass V-groove fiber mounts.



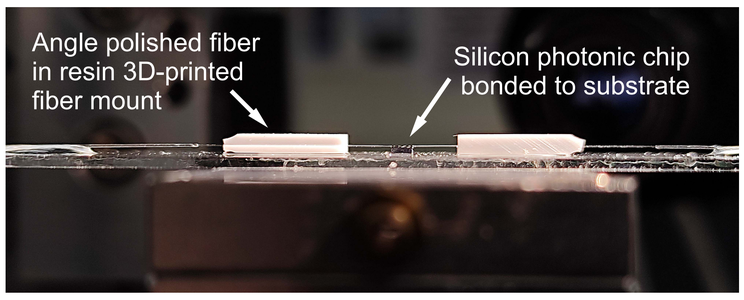
Assembled system demonstrators with RF-fan-out boards and DC-biasing and termination boards. Additional microscope slides were attached to support the printed circuit boards.



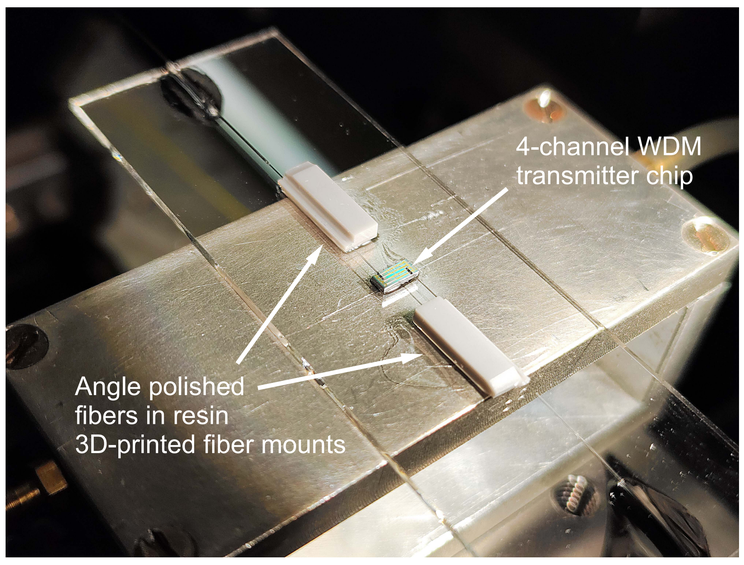
Close-up view of bonded chip with optical fiber-chip-coupling and electrical wire bonds.
Inset: angle polished fibers on photonic chip.



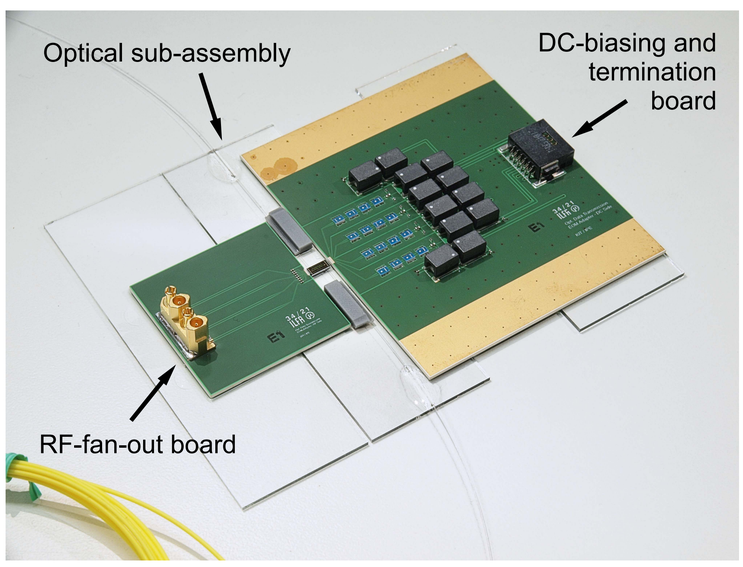
Placement of fiber mount with angle polished fiber on glass substrate and adjustment to grating coupler on silicon photonic chip.



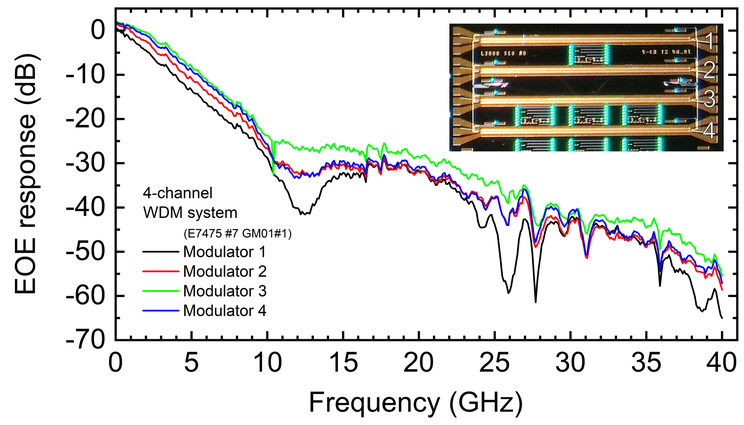
Input and output fibers in 3D-printed fiber mounts bonded besides silicon photonic chip.



Optical sub-assembly of system demonstrator of type 2 with resin printed fiber mounts.



Assembled system demonstrators with RF-fan-out boards and DC-biasing and termination boards. Additional microscope slides were attached to support the printed circuit boards.



Electrical-optical-electrical RF-characteristics of current modulators. A much improved photonic chip is expected end of November.

Contact: Dr.-Ing. Marc Schneider
Email: Marc.Schneider@kit.edu
Phone: +49 721 608-28757