10 GBIT/S 2-PSK TRANSMISSION AND HOMODYNE COHERENT DETECTION USING COMMERCIAL OPTICAL COMPONENTS

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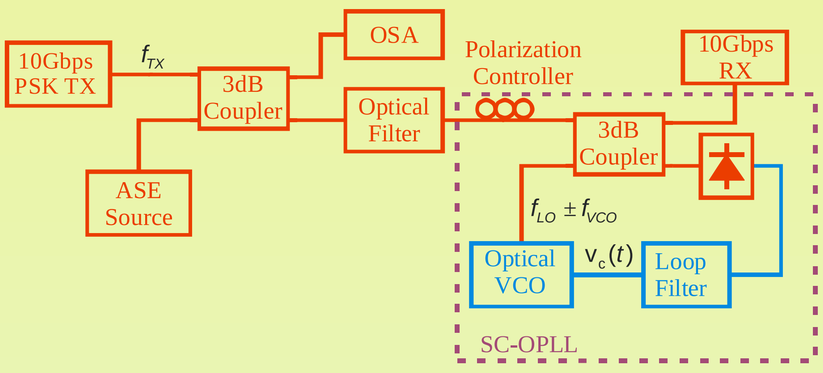
➢**Coherent detection: potential field of application:**

- Multilevel optical phase modulation (*N*-PSK)
- Dispersion compensation in the electrical domain
- Ultra-dense WDM
- Fastly reconfigurable optical networks
- Optical sensor, microwave photonics, etc.

➢**Targets of this work:**

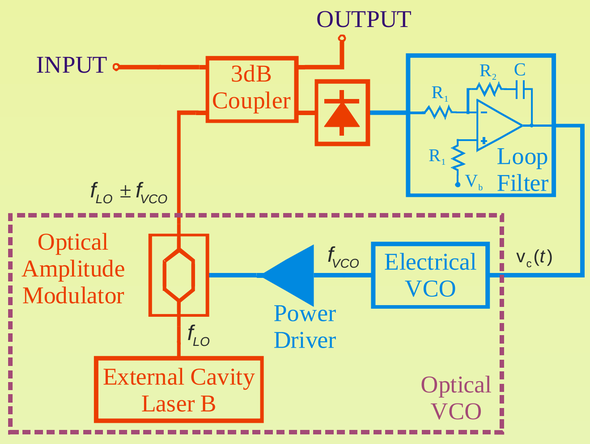
- **We introduce a novel technique to implement an optical homodyne PLL using only off-the-shelf optical components**
- **We demonstrate its feasibility on a 10 Gbit/s PSK experiment**
  - We show that the RX sensitivity is significantly better than conventional IM-DD

System schematic



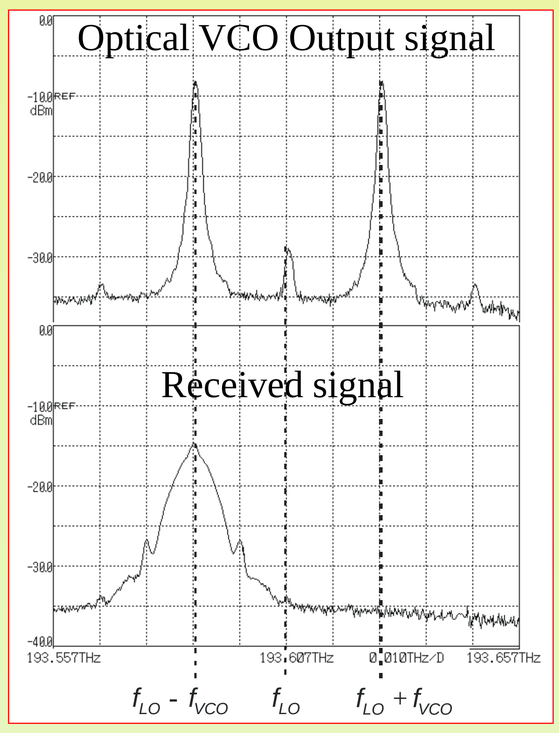
The Sub-Carrier OPLL (SC-OPLL) is our novel OPLL setup.
It is the key element of the proposed coherent system.

Sub Carrier Optical PLL (SC-OPLL)

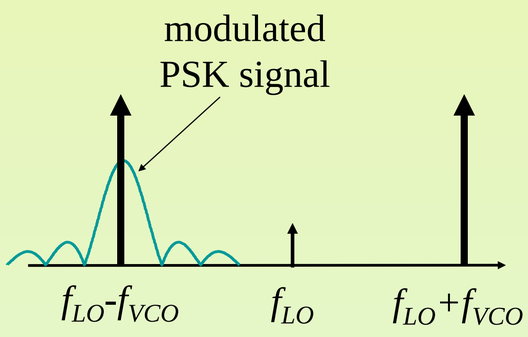


Two main Sub Carriers at frequency $f_{LO} \pm f_{VCO}$ are generated. We are able to tune *both* by simply changing the voltage applied to the *electrical* VCO, thus implementing an Optical VCO.
f_{LO} is set in order to obtain f_{LO}-f_{VCO} equal to the received signal frequency f_{TX}.

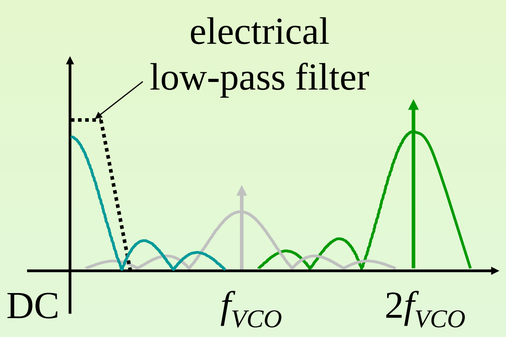
SC-OPLL: Spectrums



Photodiode Input

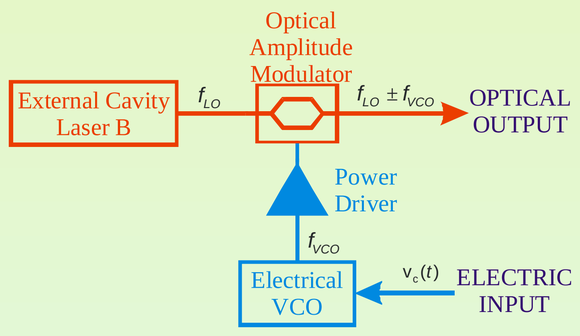


Photodiode Output



At photodiode output, the signal carried by the transmitter is translated to base-band. In principle, due to beating with the other SCs, copies of this signal appears also around frequencies fVCO and 2·fVCO, but they are filtered out by the electrical receiver filter.

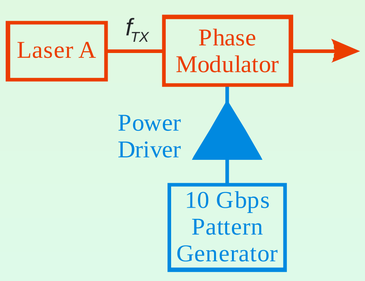
Optical VCO

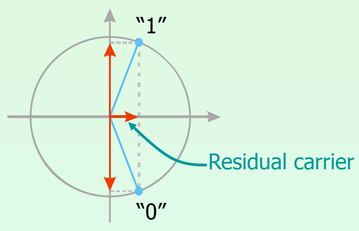


The amplitude modulator is a high bandwidth Corning-OTI LiNbO3 Mach-Zehnder (MZ) and is biased at a null of its transfer function, a sinusoidal carrier-suppressed modulation is obtained.

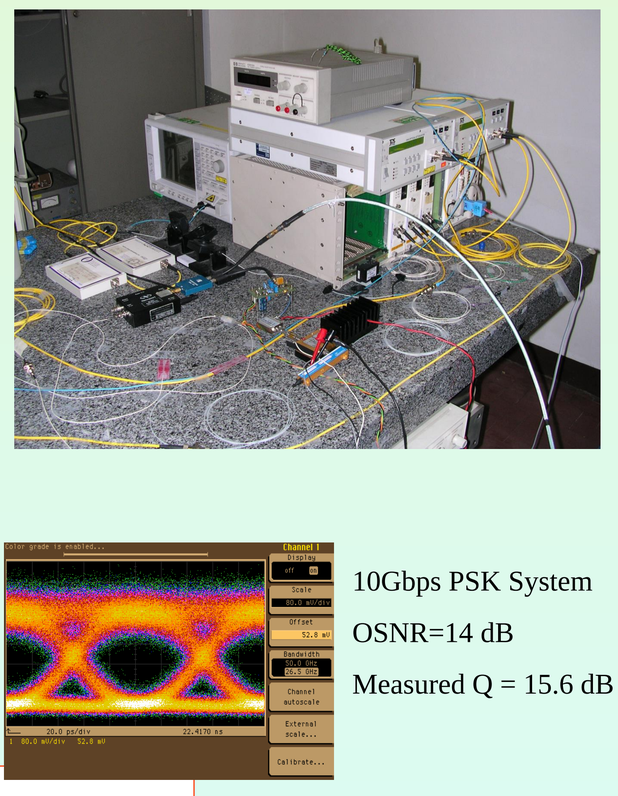
The electrical VCO is a low jitter silicon-bipolar based 20 GHz VCO from Agilent Technologies.

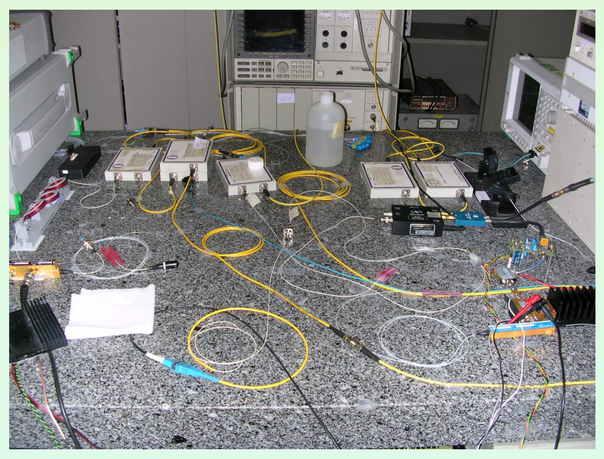
10Gbps 2-PSK Transmitter



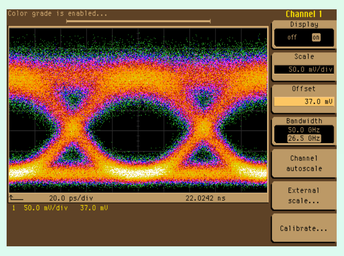


The transmitter is based on a Corning-OTI $LiNbO_3$ 10Gbit/s phase modulator, driven by an NRZ signal. The modulation voltage has been set to a slightly lower value than the modulator V_π voltage. The SC-OPLL locks the residual carrier.





10Gbps PSK System
OSNR=14 dB
Measured Q = 15.6 dB



10Gbps IM-DD System
OSNR=18 dB
Measured Q = 15.8 dB

Experimental Results

Conclusions

➢All the SC-OPLL components are commercially available today
➢We demonstrated its feasibility on a 10 Gbit/s PSK experiment
- RX sensitivity is 4 dB better than conventional IM-DD

Acknowledgements

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