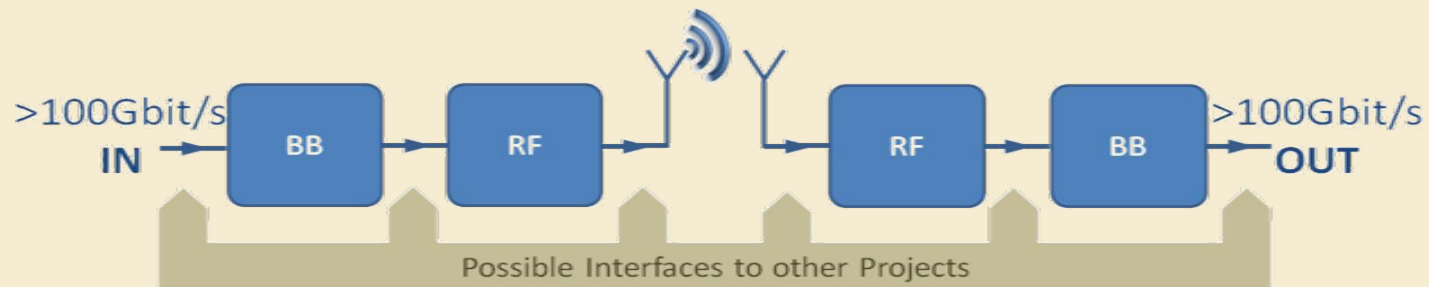


Tera50

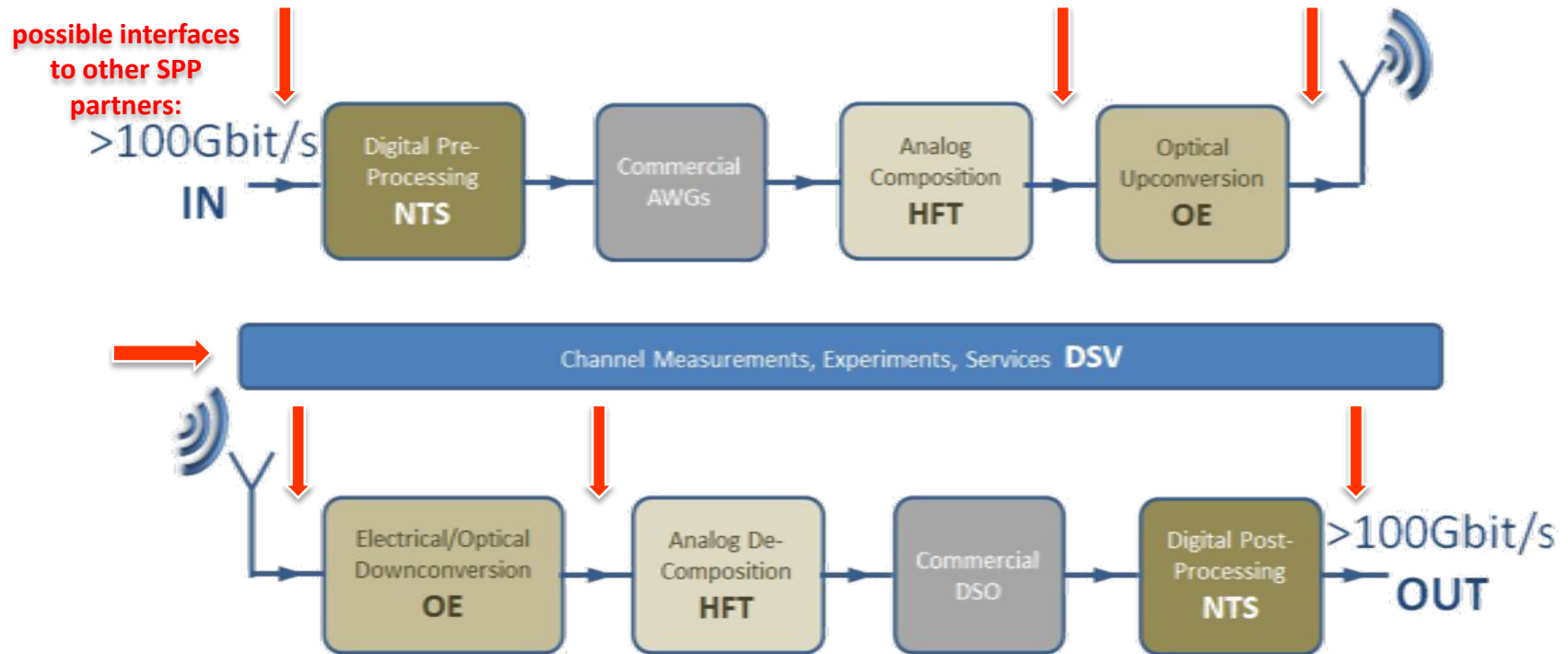
A 10-1000 GHz Wireless Measurement System with 50 GHz Bandwidth

Andreas Stöhr, Andreas Czulwik, Thomas Kaiser, and Klaus Solbach



- to develop and demonstrate a modular and accurate wireless measurement system, **for everybody.**
- to demonstrate data rates up to 100 Gbit/s in the air, **for achieving the general SPP goal.**
- to investigate MIMO characteristics as a function of carrier frequency, **for exemplary channel measurements.**
- to develop 225-275 GHz band o/e-mixers, **for providing variable wireless bandwidths up to 50 GHz.**
- to analyze and compensate analog RF impairments at very high frequencies, **for enabling arbitrary signal transmission.**

Generic Architecture of the High Data-Rate *Tera50* Wireless System



The Tera50 measurement system will be made available to SPP, e.g. to those who design:

- **Base Band Units** (e.g. transmission over the air and testing with real data)
- **Radio Front Ends** (e.g. providing arbitrary base band waveforms)
- **Complete Receiver / Complete Transmitter** (e.g. providing the missing counter piece or testing capabilities as a reference system)
- **Algorithms** (e.g. studying massive MIMO arrays, impact of quantization, RF imperfections, ..)

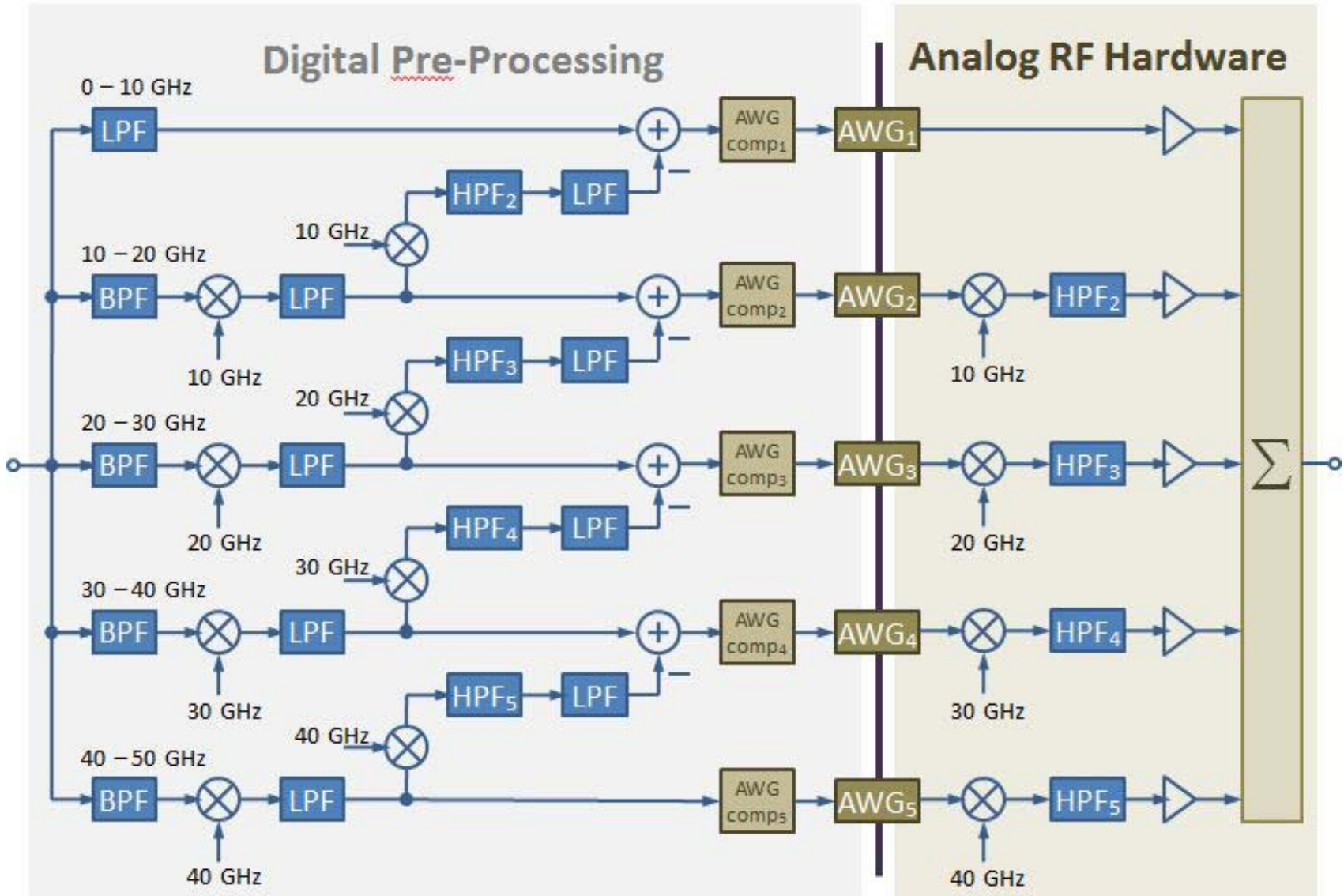
Evolutionary Strategy in *Tera50* to Allow for Early Channel and RF Measurements

- 1st System Generation
(**Month 0**) 3-10 GHz MIMO system with 5 GHz bandwidth
- 2nd System Generation
(**Month 9**) 60 GHz SISO system with 7 GHz bandwidth
(**Month 18**) 60 GHz DP-MIMO system with 20 GHz bandwidth
- 3rd System Generation
(**Month 30**) 250 GHz MIMO system with 50 GHz bandwidth

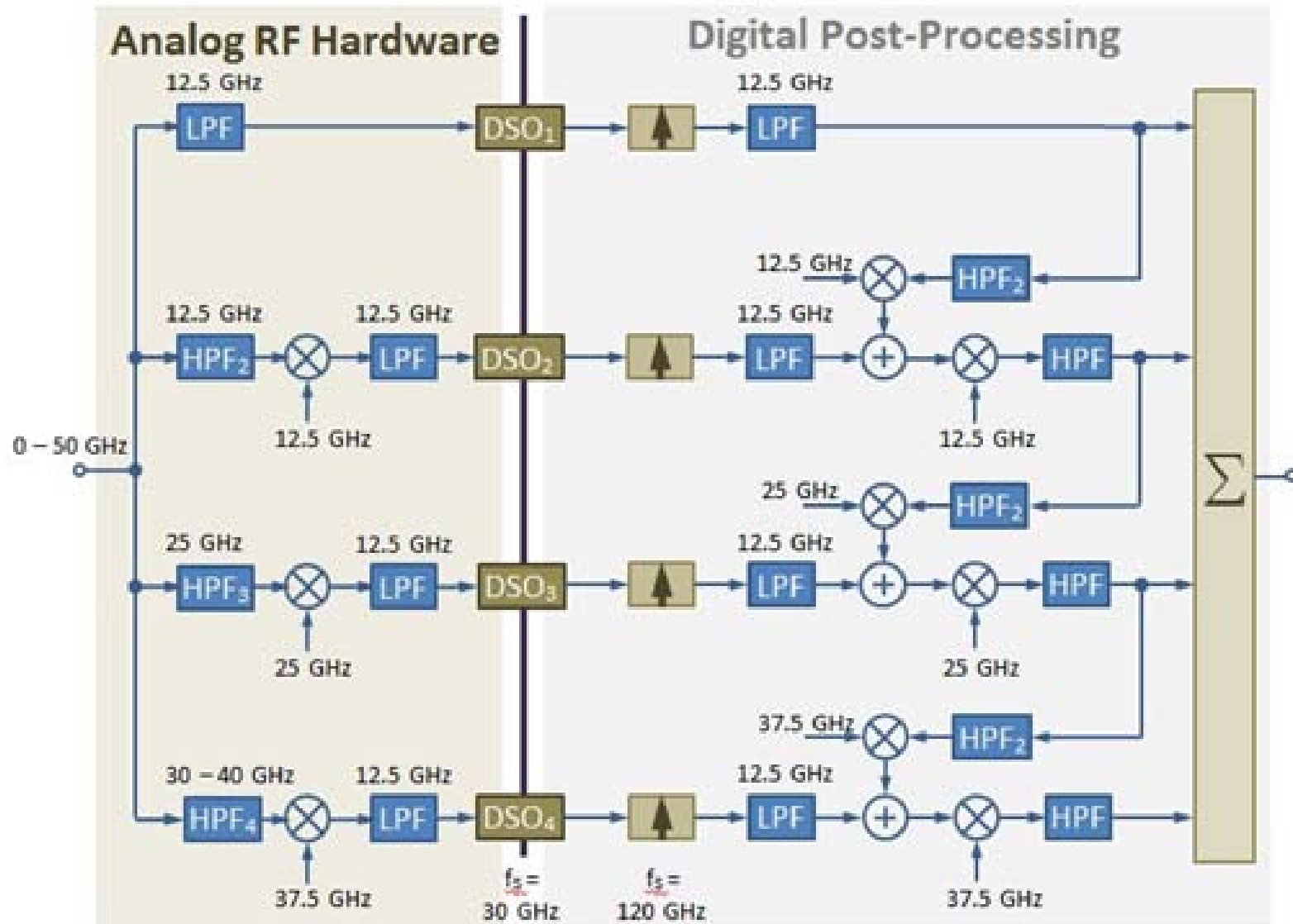


Tera50

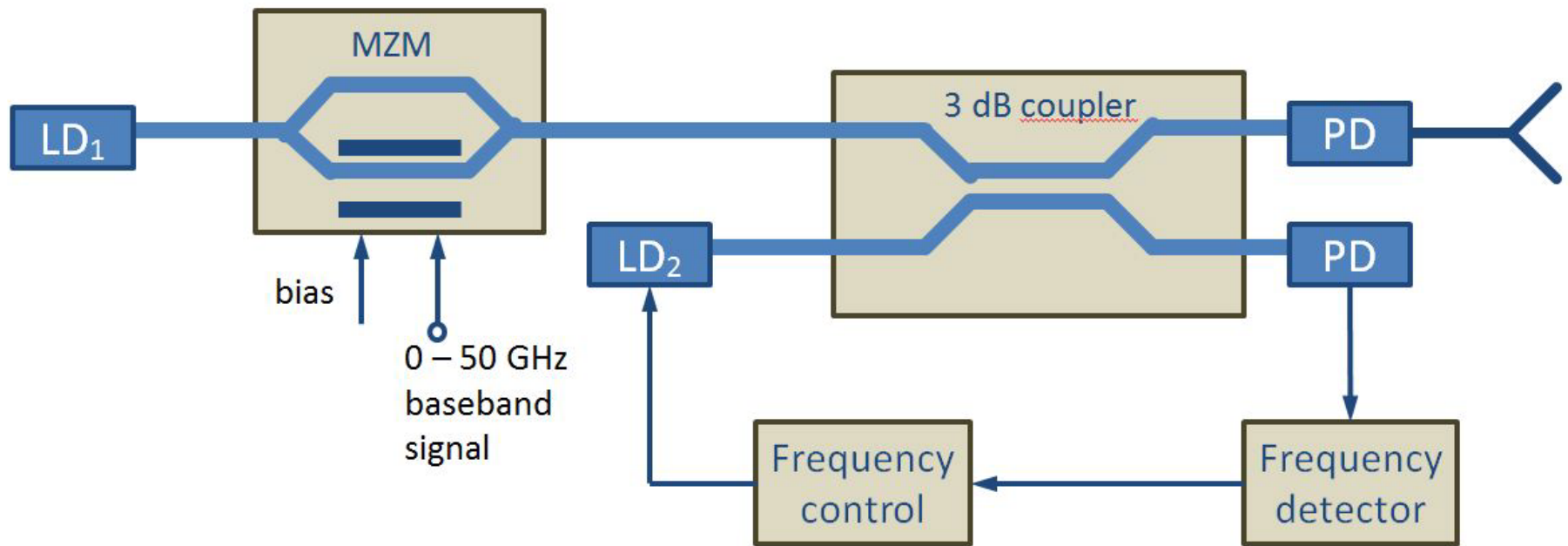
Analog Multiplexed AWG for Achieving 50 GHz Measurement Bandwidth



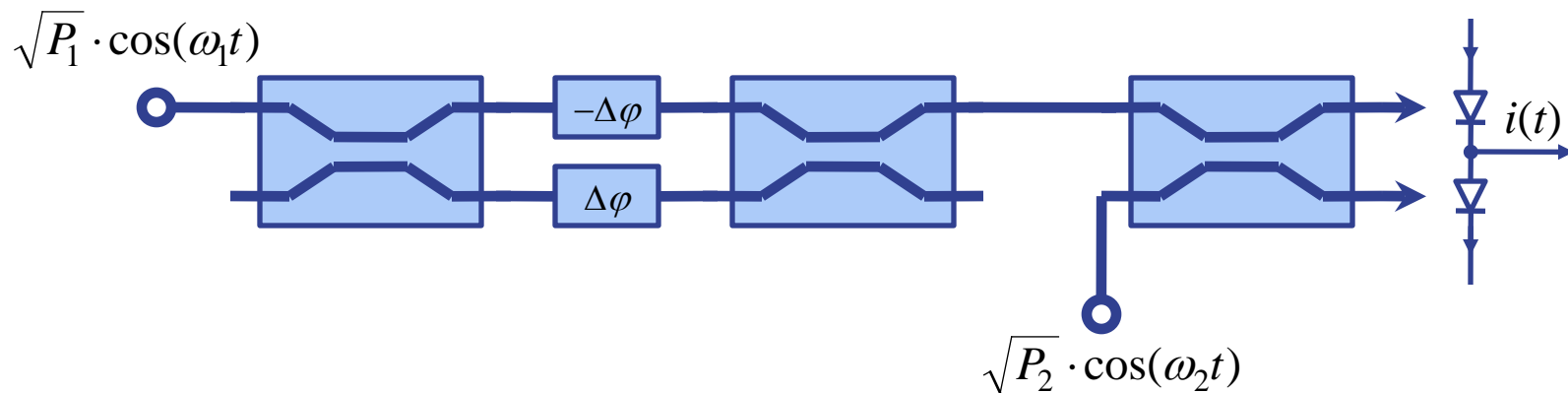
Analog Multiplexed DSO for Achieving 50 GHz Measurement Bandwidth



- Advantage of optical heterodyning: almost arbitrary carrier frequencies



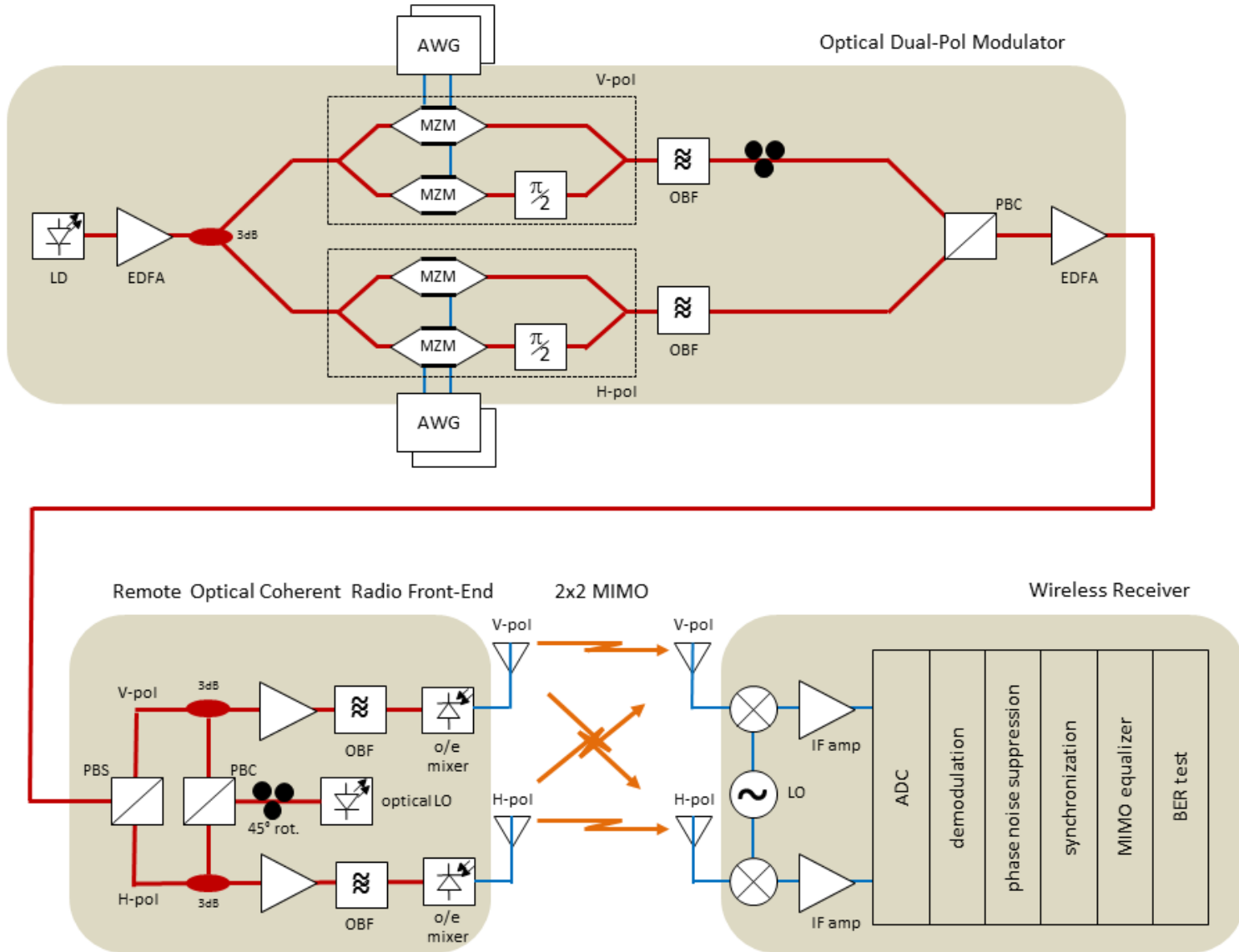
- Disadvantage of optical heterodyning: nonlinear transmission characteristic
- Simplified block diagram



- Photocurrent:

$$i(t) = -\frac{\eta e}{hf} 2\sqrt{P_1 P_2} \cdot \sin(\Delta\varphi) \cdot \cos((\omega_1 - \omega_2)t)$$

Analog Multiplexed AWG and DSO for Achieving 50 GHz Measurement Bandwidth



- ***Tera50***: Measurement system with a carrier frequency of 250 GHz and a bandwidth of 50 GHz
- Optoelectronic mixing:
 - arbitrary carrier frequency
 - nonlinear transmission characteristic
- Offline compensation of RF and optoelectronic impairments

Thank you very much for
your attention!