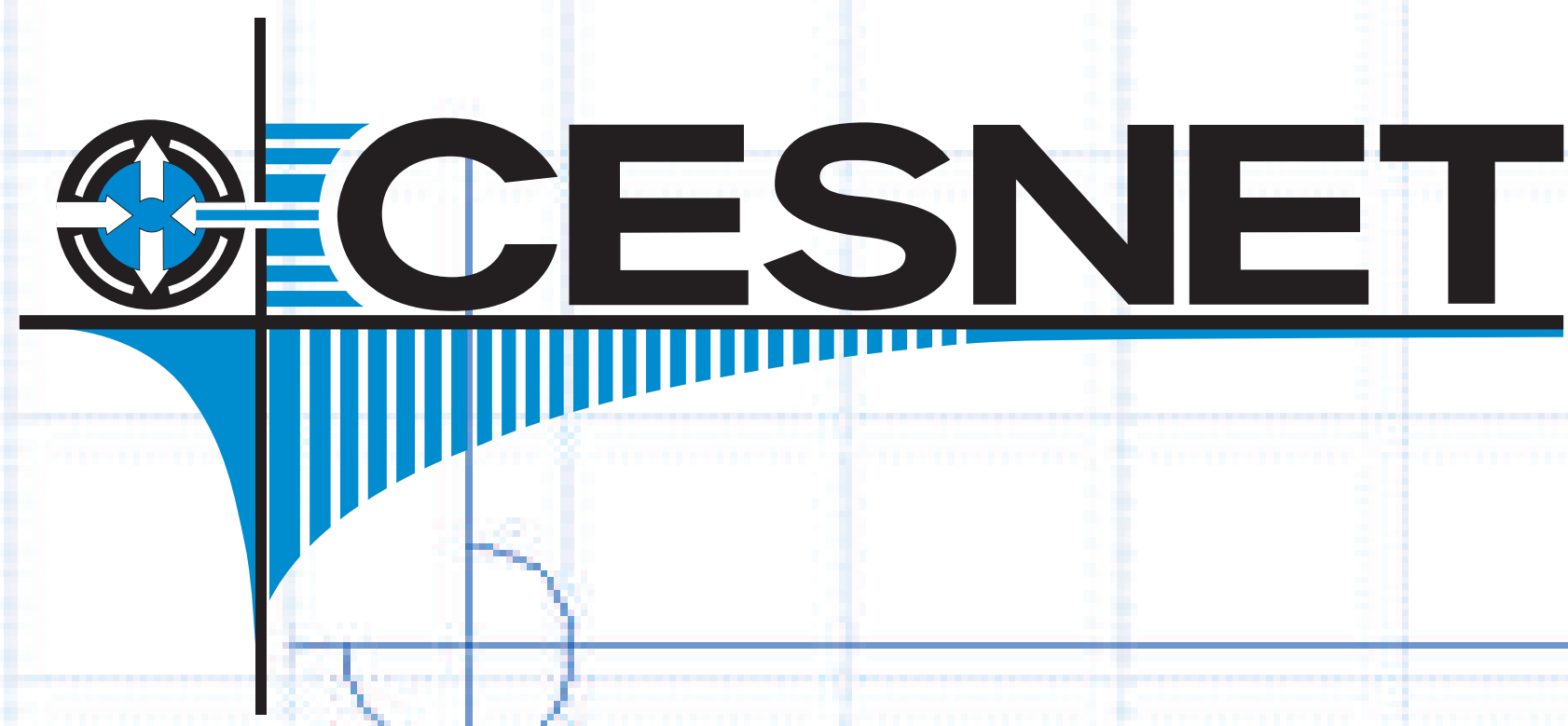


# Experimental transmissions of 10 GE over G.652 without in-line amplifiers

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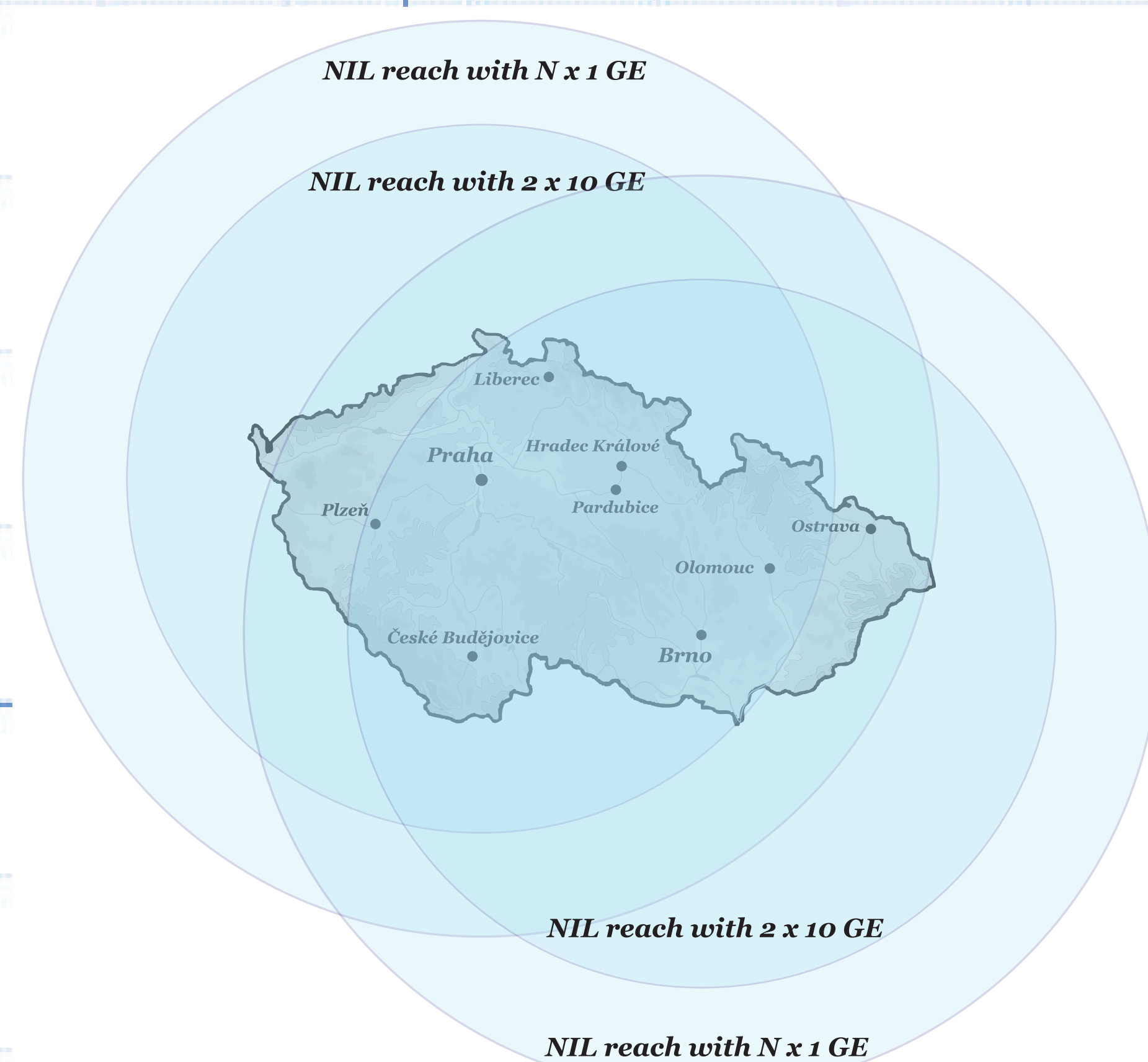
Czech  
Light

## Motivations

Utilization of dark fibres  
Looking for cost effective solutions  
1 GE and 10 GE everywhere  
Nothing-In-Line (NIL) approach  
Drawbacks with in-line equipment

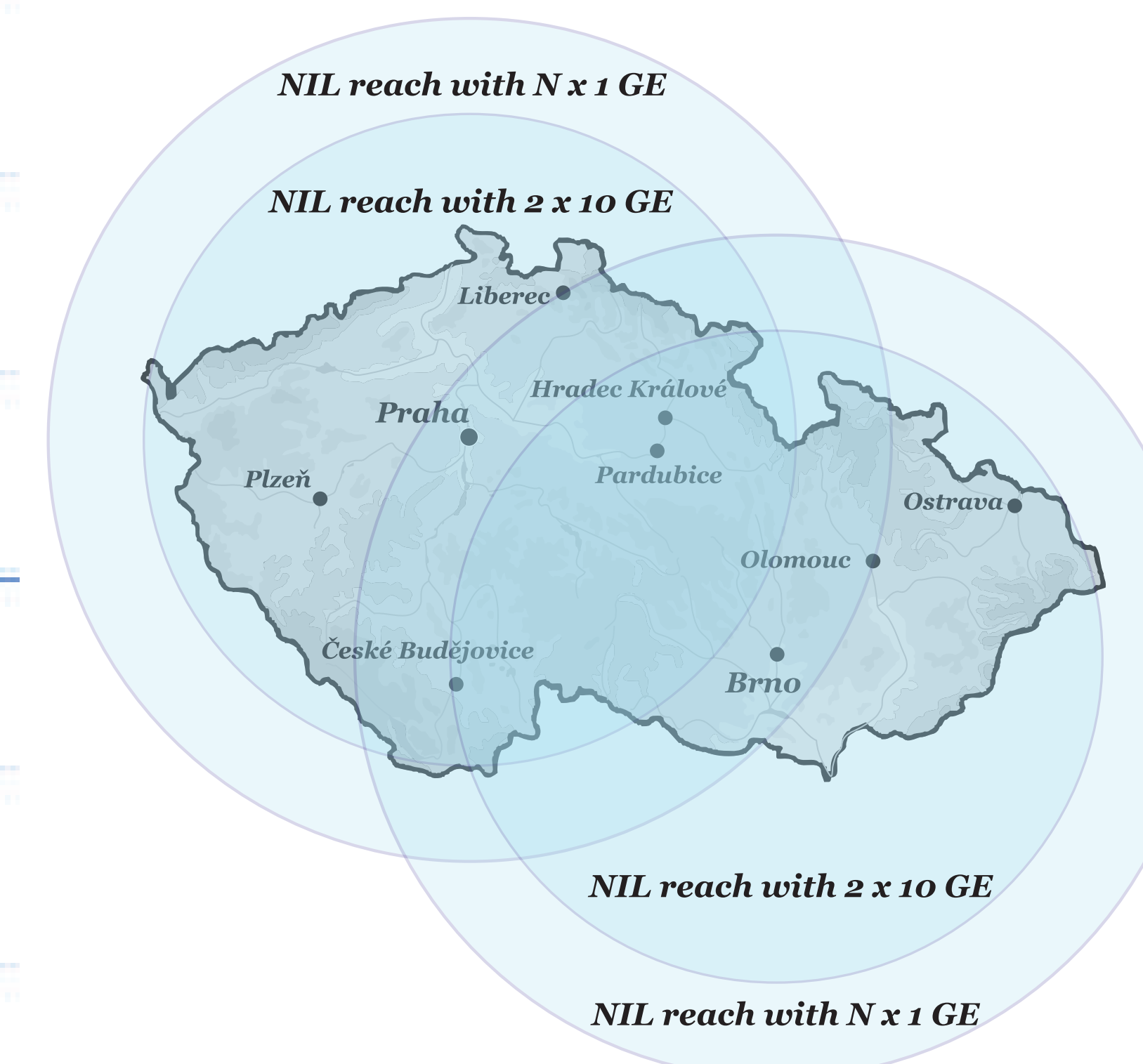
## CzechLight

Experimental AND breakable network  
Multivendor environment  
CESNET is now a TransLight Affiliate Member  
Transformation of research into production environment



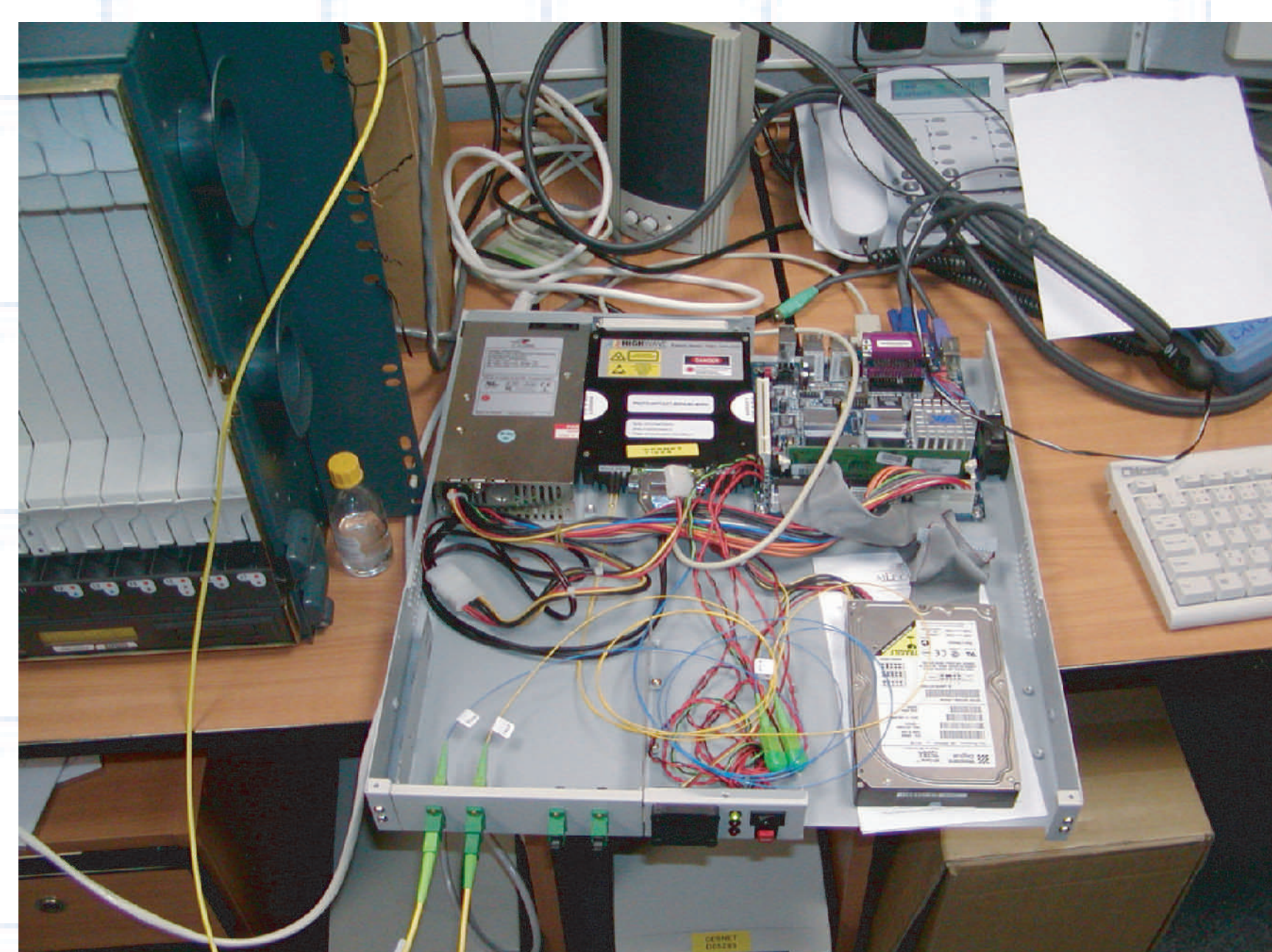
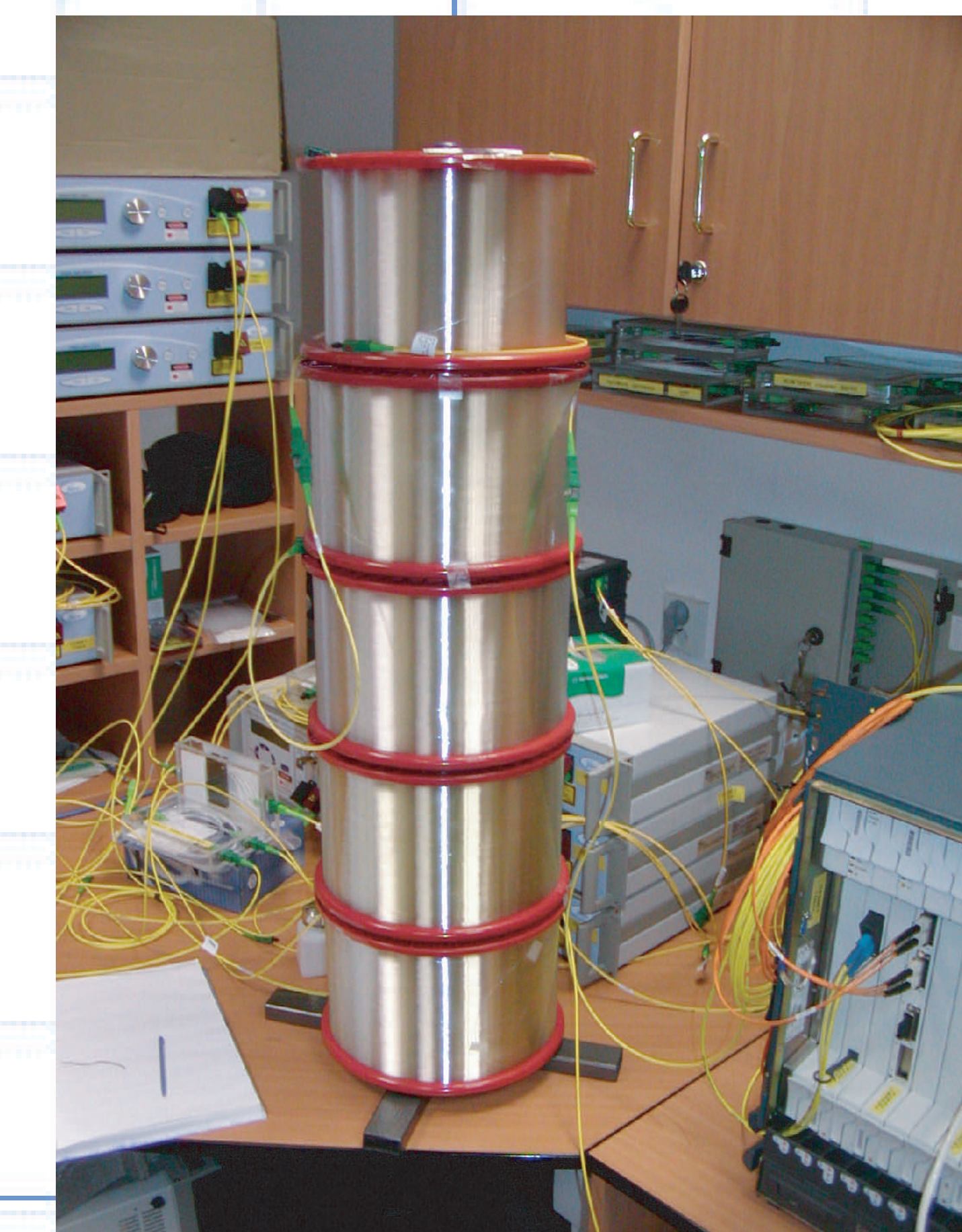
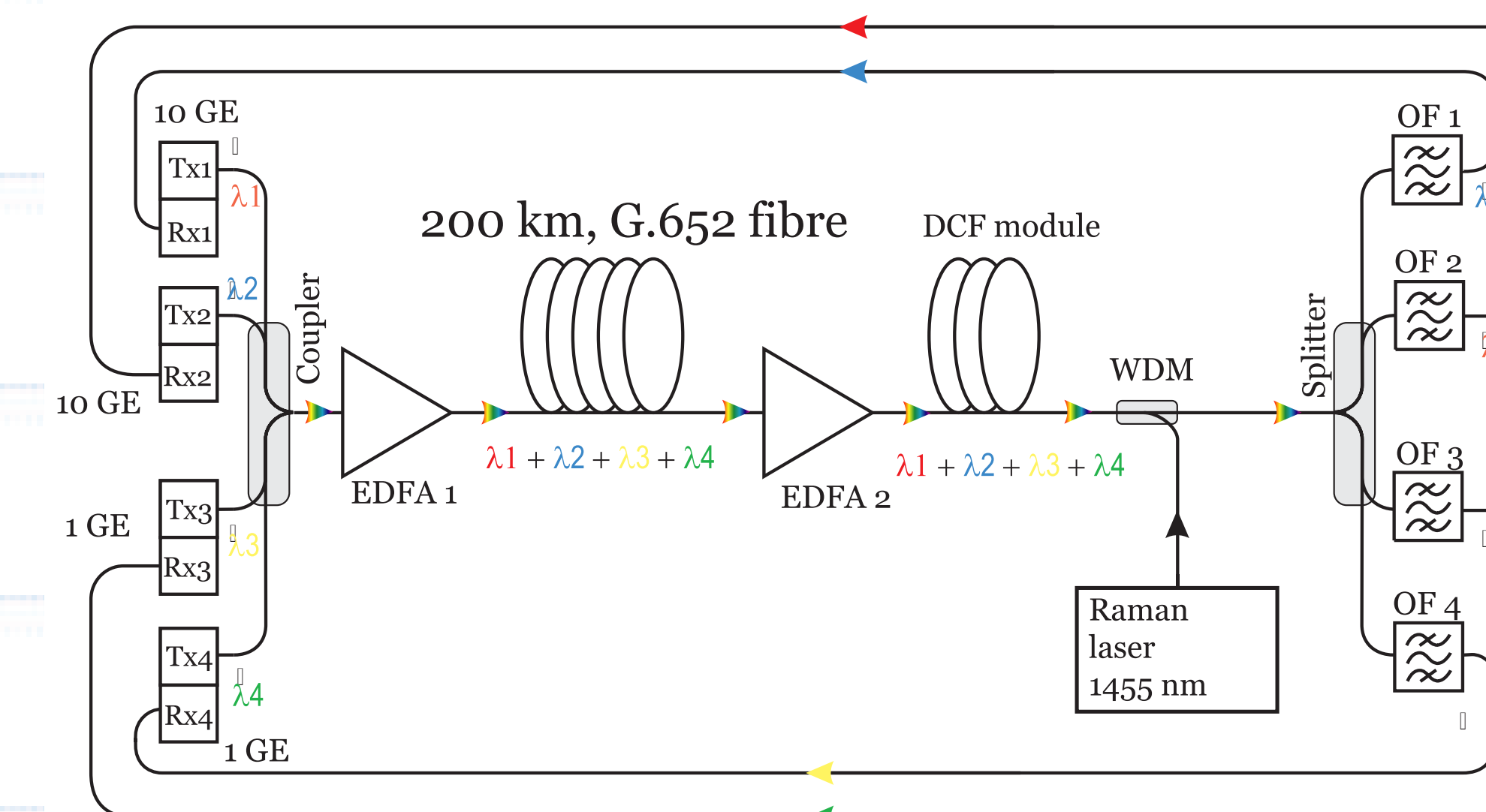
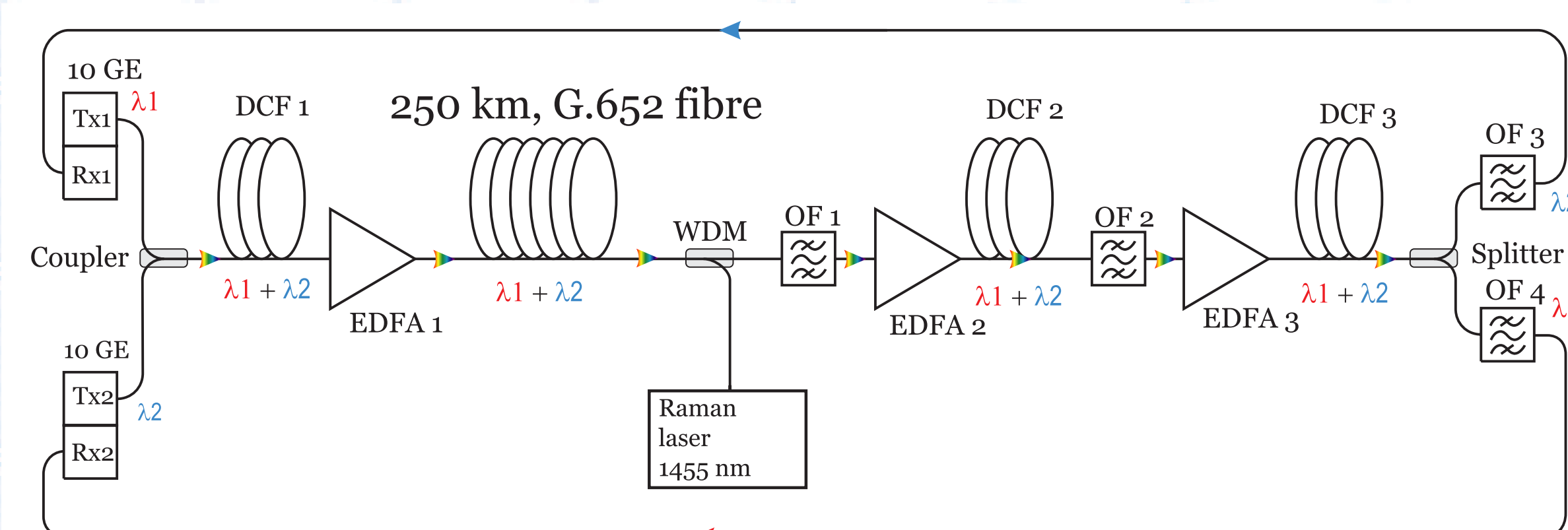
## Practical results

2 x 10 GE plus 2 x 1 GE over 202 km  
2 x 10 GE over 252 km  
1 x 10 G SONET over 290 km  
Cisco Catalyst 6503 with 10 GE ER blades  
Cisco ONS 15454 with 10 G DWDM blades  
Keopsys EDFAs and Raman fibre lasers  
Santec tunable filters  
OFS fibres (G.652 and DCM)  
BER =  $10^{-13}$



## „Home made“ EDFAs & Ramans

With EDFA modules from spin-offs  
Even Raman pumps available  
Standard PC for SNMP/SSH  
Can really fit your needs



## Conclusions

Cost effective deployment of WDM/DWDM 1 GE and 10 GE pipes  
Nothing-In-Line solutions if possible  
For breakable experimental optical networks (e.g. CzechLight)  
Lightpaths - one stream of photons  
Bandwidth on demand for new users - grids, superclusters  
Deployment of new „home made“ optical equipment

## References

- [1] Karásek, M. - Peterka, P. - Radil, J. , „202 km repeaterless transmission of 2 x 10 GE plus 2 x 1 GE channels over standard single mode fibre. “, In: Optics Communications 235, 2004, pp. 269-274.
- [2] Karásek, M. - Peterka, P. - Radil, J. , „Repeaterless Transmission of 2 x 10 GE Channels over 252 km of Standard Single Mode Fibre without in-line EDFA. “, In: IEEE J. on Selected Areas in Communications, sfp, 2004.
- [3] Radil, J. - Karásek, M., „Experiments with 10 GE long-haul transmissions in academic and research networks.“, In: 12 member meeting, Arlington, VA, 2004.
- [4] Radil, J. „Experiments on optical layer and breakable research networks.“, In: TF-NGN meeting, Amsterdam, 2004.