

COCONUT

Ultra-dense WDM-PONs solutions in COCONUT

Ernesto Ciaramella

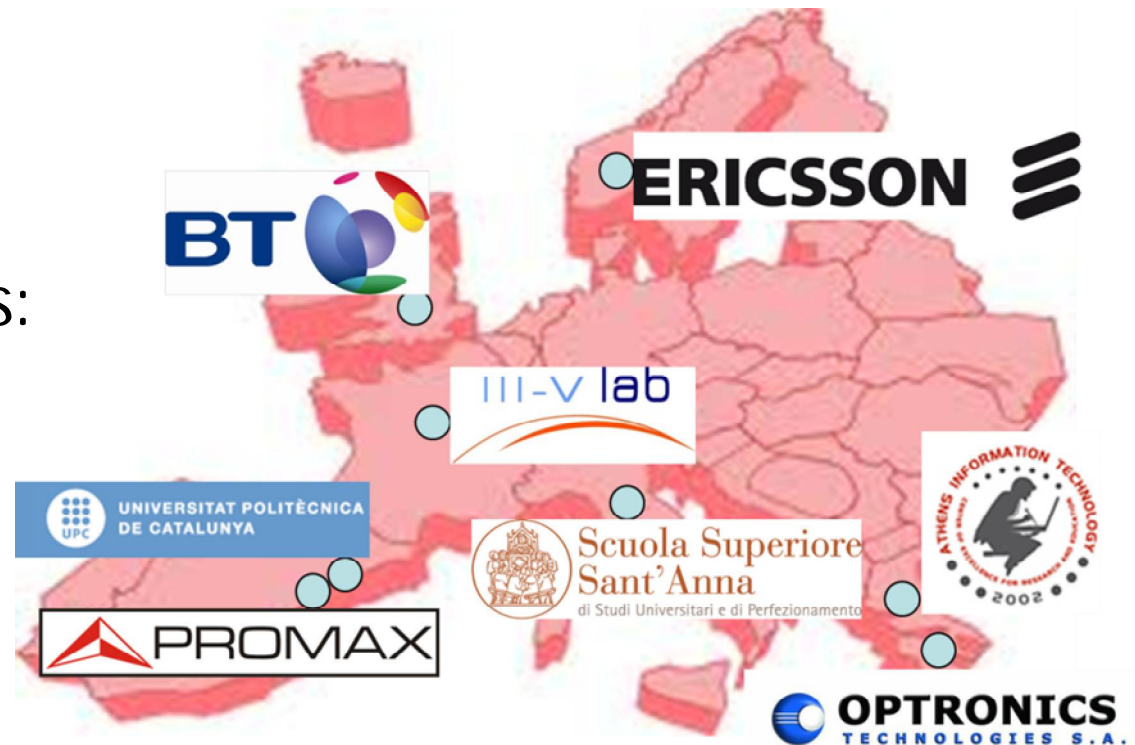
February 5th , 2016



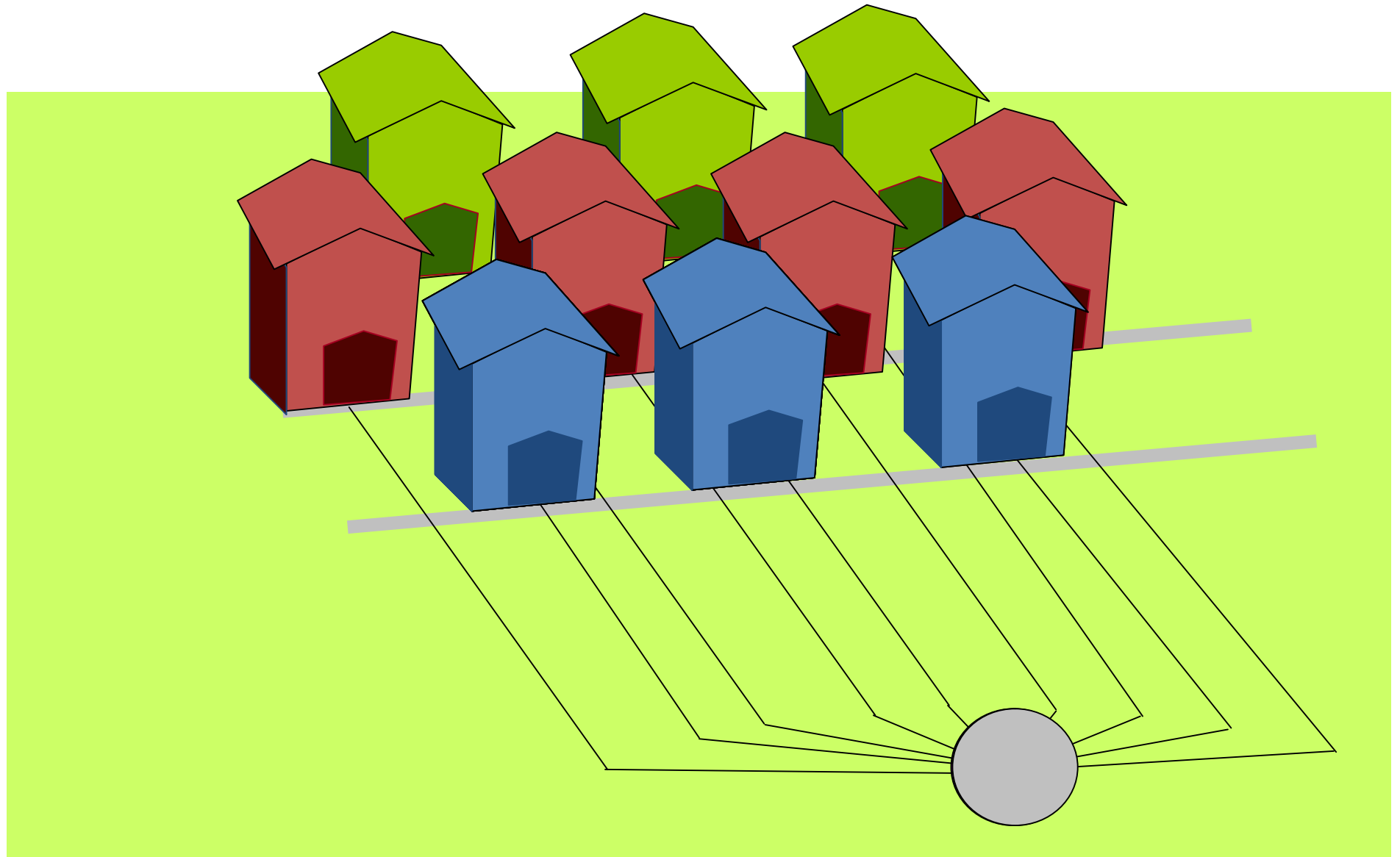
Sant'Anna
Scuola Universitaria Superiore Pisa

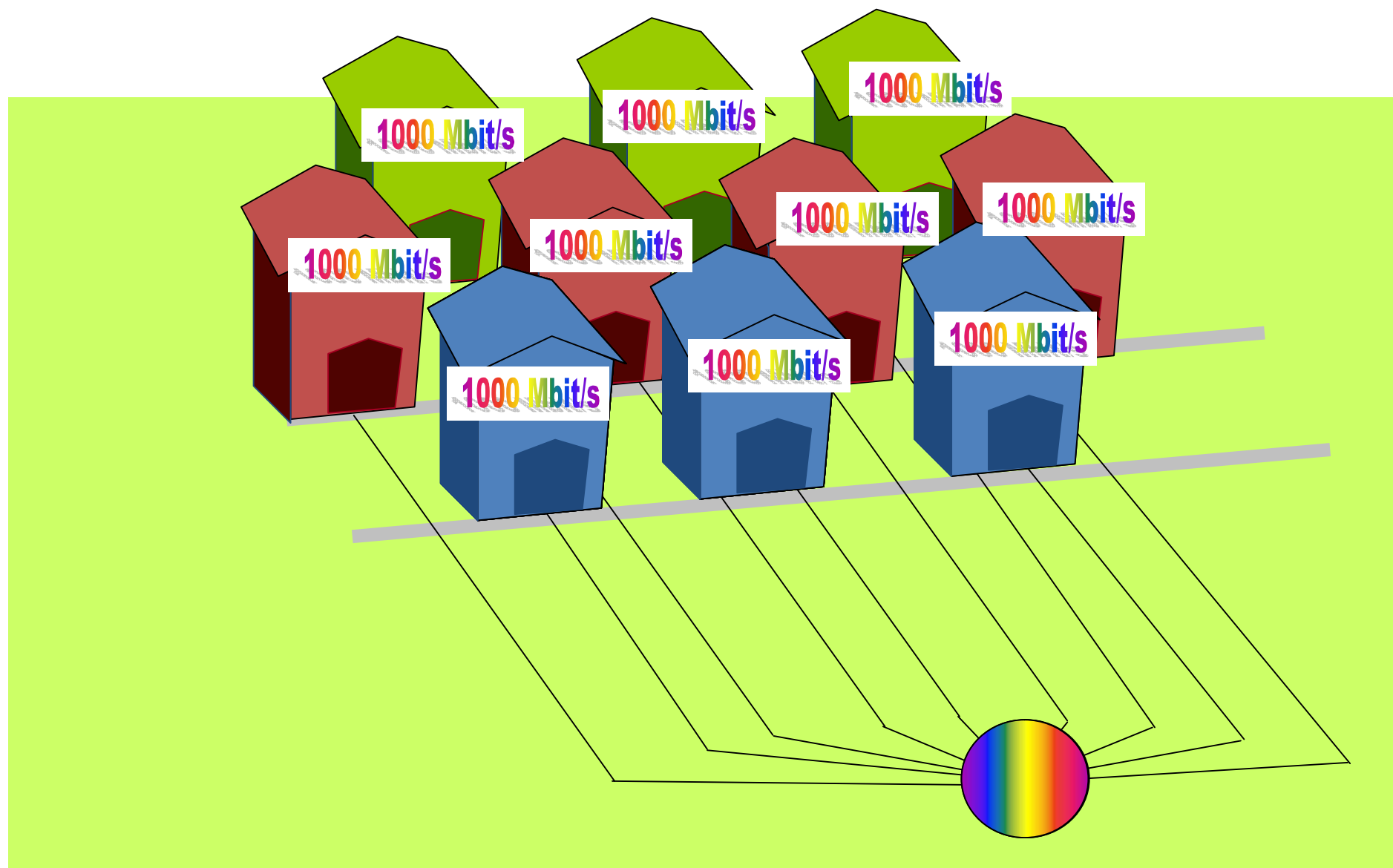
- Project introduction
- Motivations
- Key Technical Results
- Conclusions

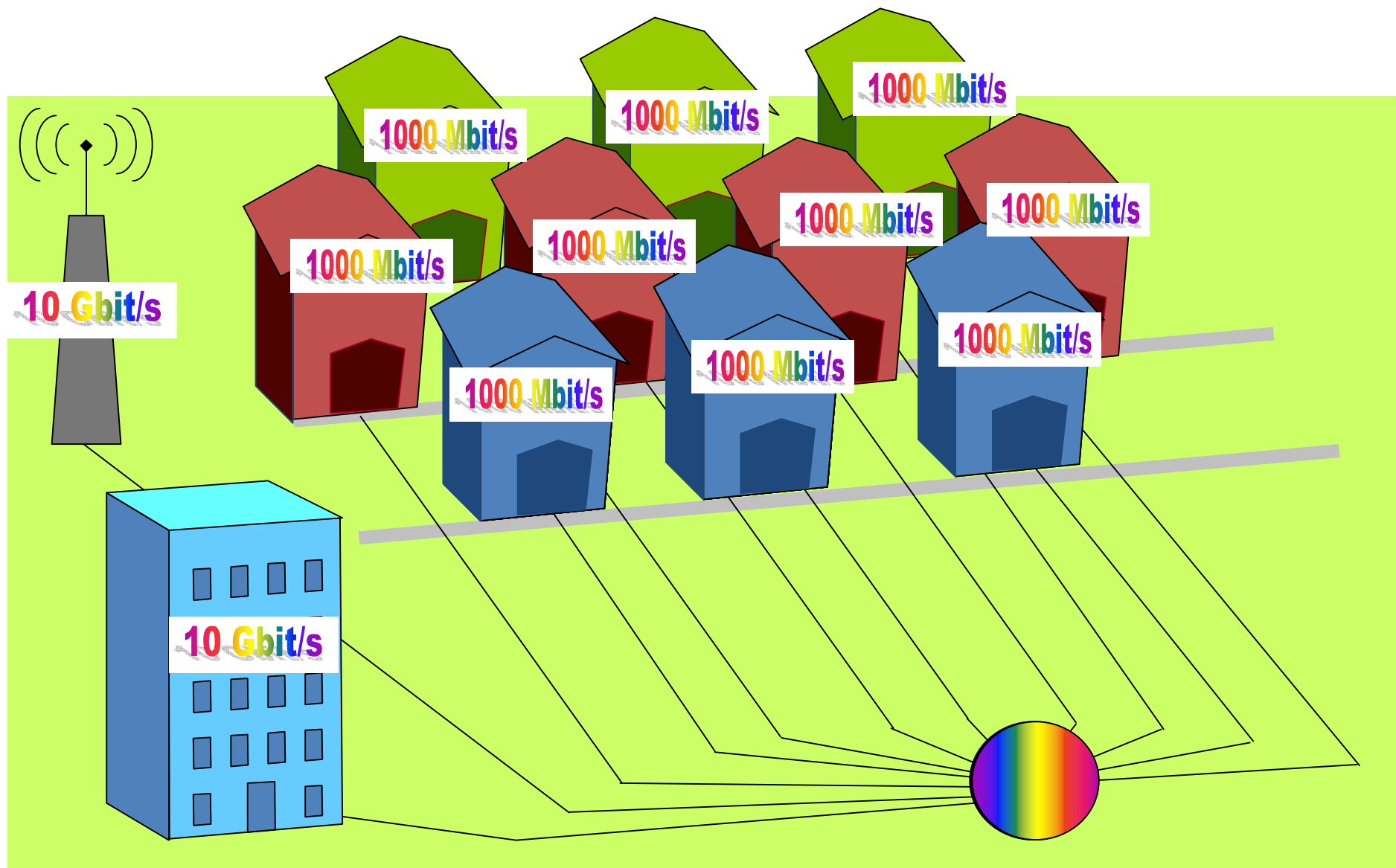
- STREP, ICT Objectives 1.1 a) b)
- Start: Nov. 1st 2012
- Overall Budget: 4M€
- Balanced mix of partners:
 - 3 Universities
 - 3 major companies
 - 2 SMEs
- GA: 318515



- Fiber access networks will be crucial to provide **broadband services for everyone**
- PON solutions currently proposed:
 - use medium access (TDMA), require excess electrical bandwidth and power consumption
 - cannot scale simply
 - use passive splitters
- Ultra-dense WDM PON (1 wavelength/user) requires
- **narrow spacing (down to 6.25 GHz at 1.25 Gbs)**
- **high power budget (compatibility with splitter-based PON)**

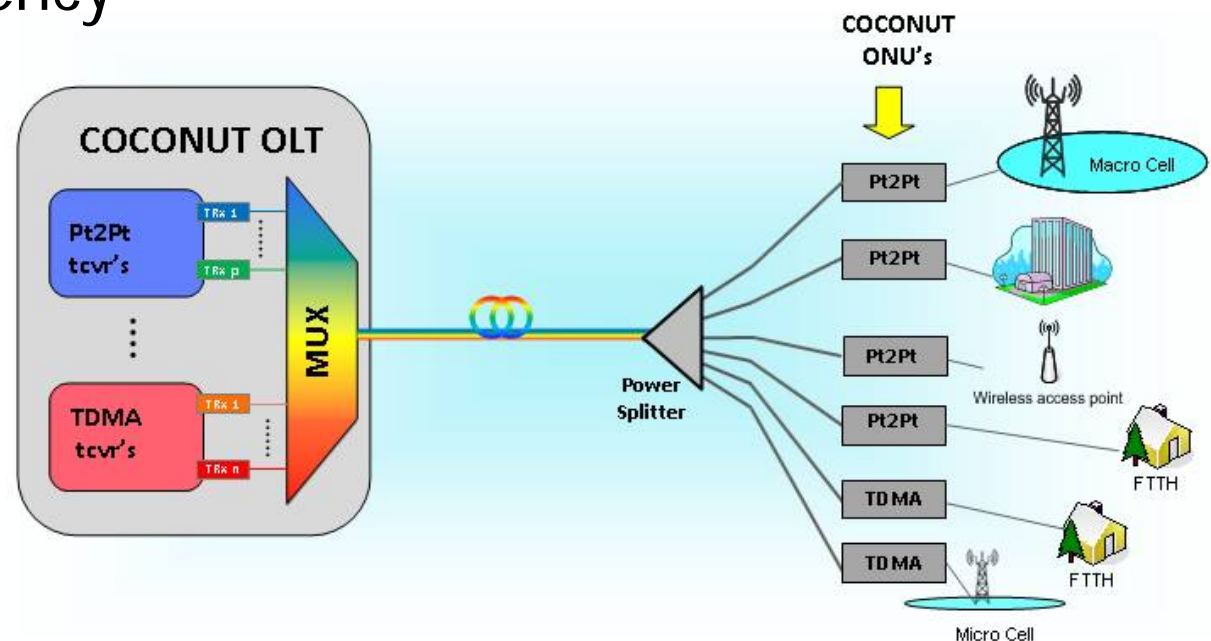






- **Optical Coherent Systems for access networks**
 - Low Cost
 - available optical components
 - analog electronic processing
 - Simple (real time operation with home-made TX/RX)
- Two main benefits:
 - **Longer reach** (wider area covered): ODN loss >45 dB
 - **Higher number of users** (Ultra-dense WDM: frequency spacing 6.25 GHz @1.25 Gbit/s)

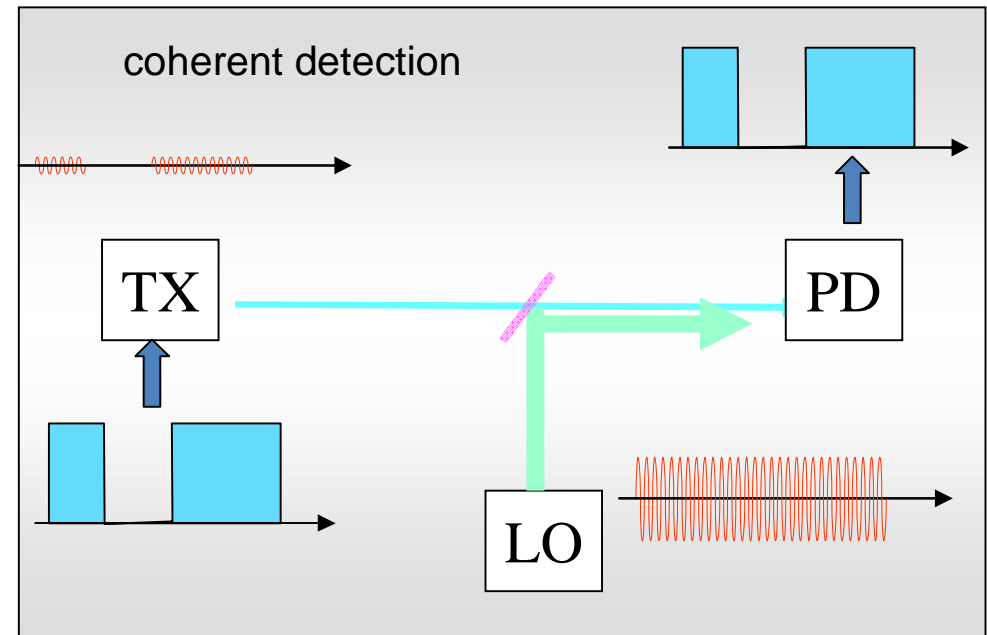
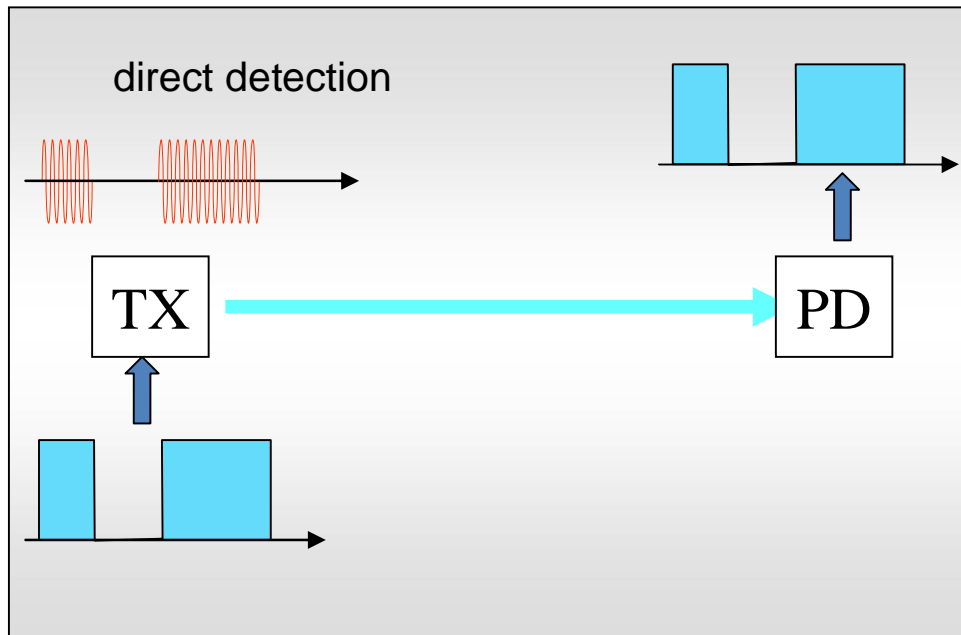
- **Main target: demonstrate simple coherent solutions at 1 and 10 Gbs allowing:**
 - ultra dense WDM (UD-WDM), with no/limited filters
 - higher power budget (e.g. 35-40 dB)
 - network scalability and with simplified operation
 - higher power efficiency
 - low-cost levels



- **reuse of the optical distribution network**
- no active components
- no intervention in the outside plan
- smooth upgrade from legacy systems
- use of the same technology for point-to-point and point-to-multi-point links

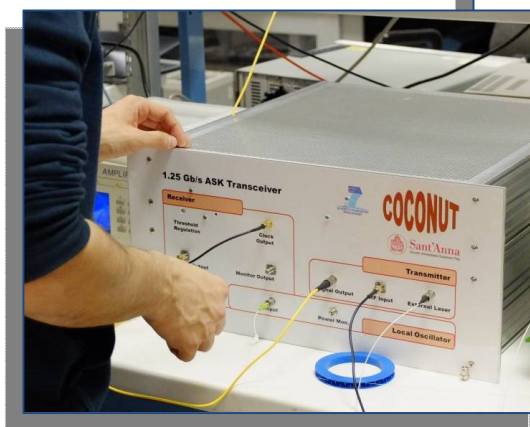
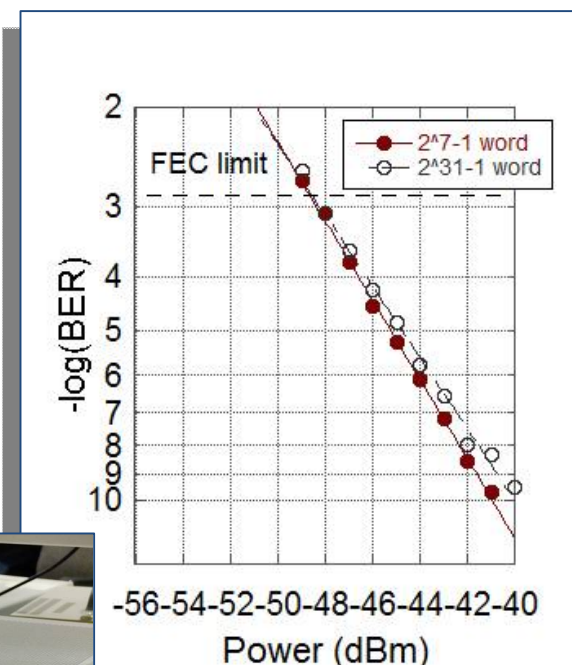
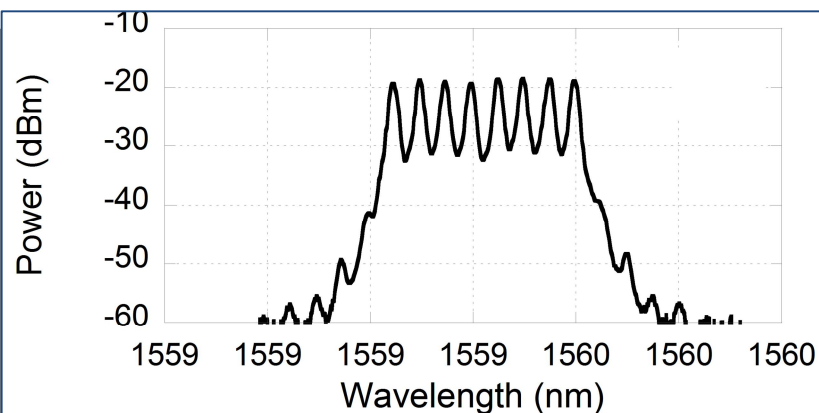
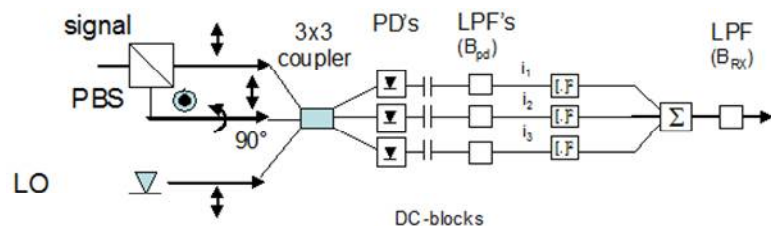
- Definition, study and realization of a **new fully scalable optical access network significantly extending the network dimensions** (bandwidth utilization, reach and number of users)
- Evolution from the TDMA-PON and WDM-PON architectures to the **Ultra-Dense WDM solutions** (also allowing “wavelength-to-the-user”)
- Key enabling technology is a **new cost-effective coherent detection scheme(s)**, to implement “cheap” coherent terminals

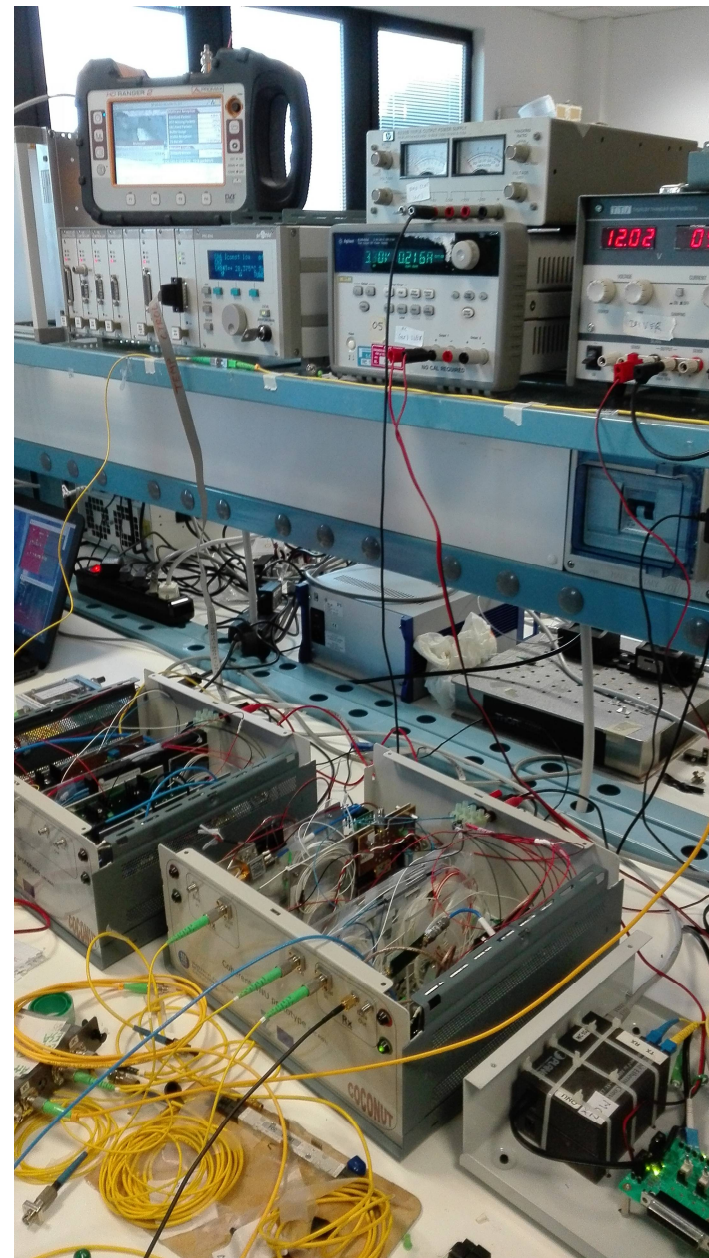
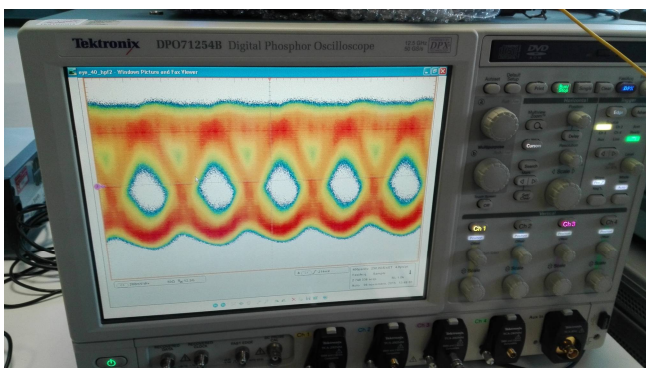
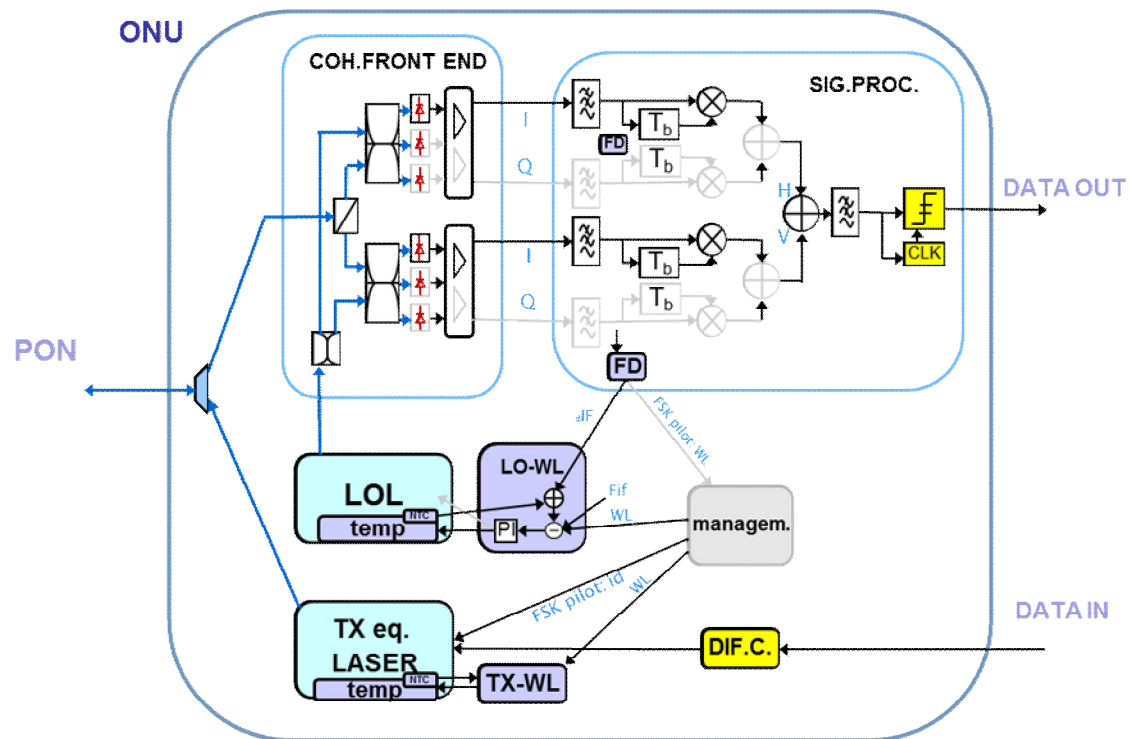
- Mixing a (weak) signal with another CW lightwave, generated locally



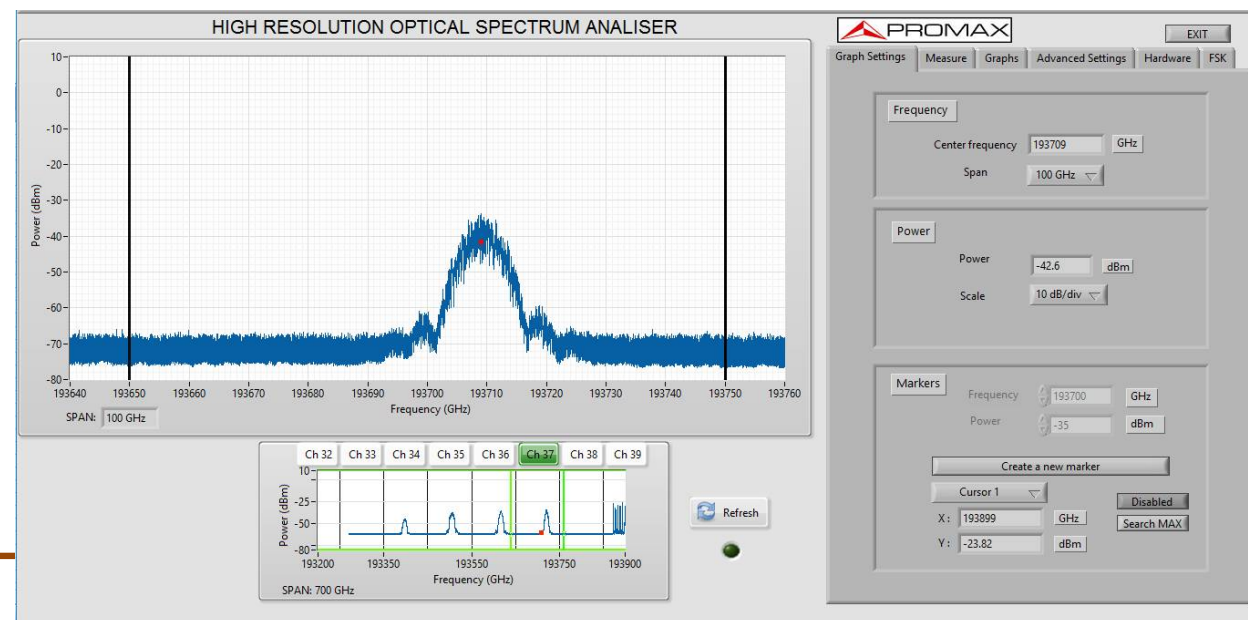
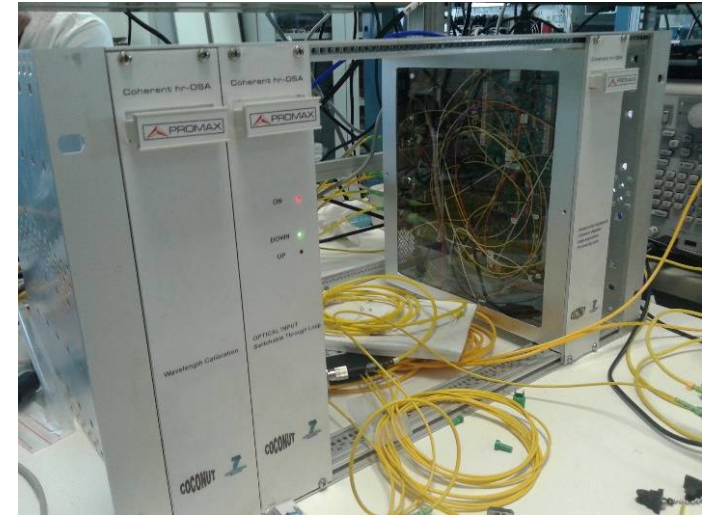
- Most common issues: locking LO, polarization independence, electronic processing
 - **ALL successfully solved, using commercial devices**

■ Novel Polarization-Independent RX



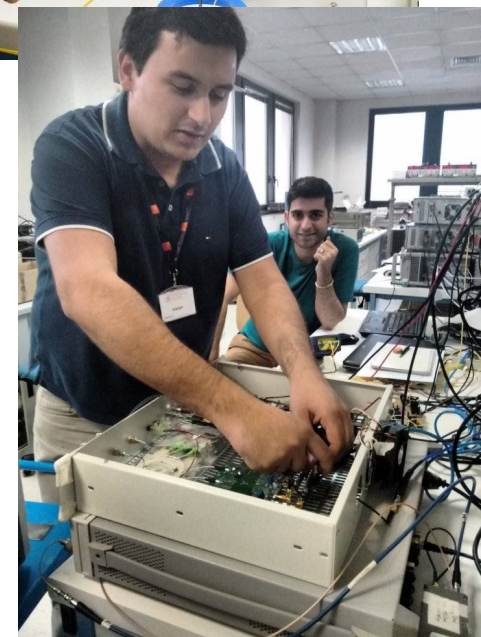
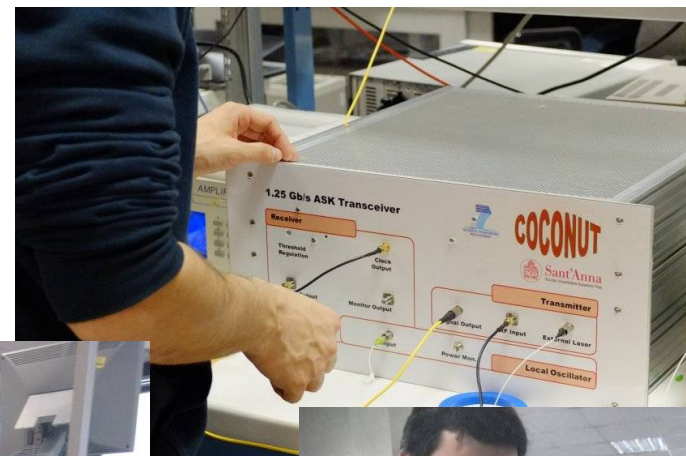


- Coherent detection
- Monitoring functions
- Resolution: 100 MHz
- Scalable full C-Band
- Cost-effective components

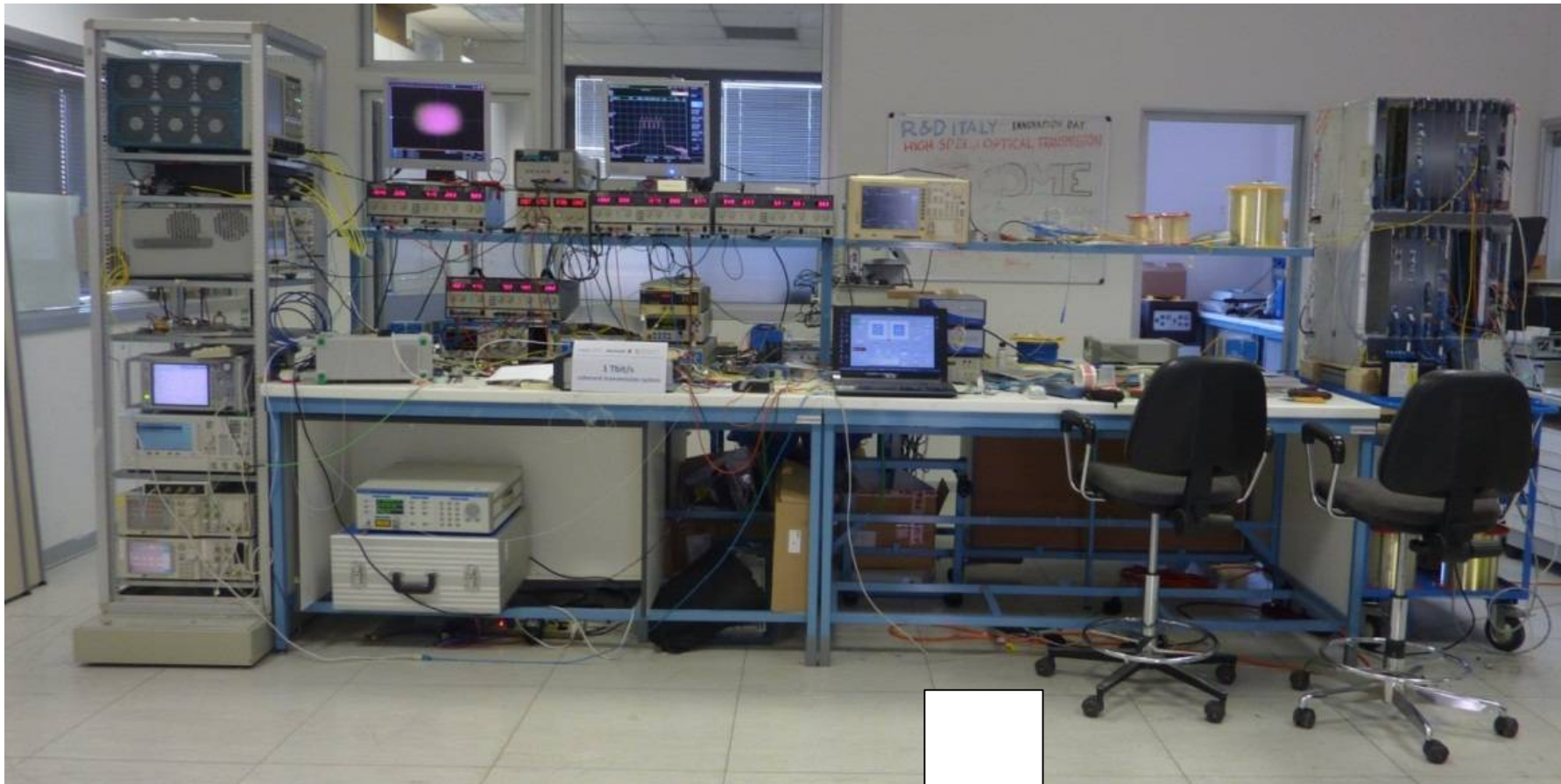


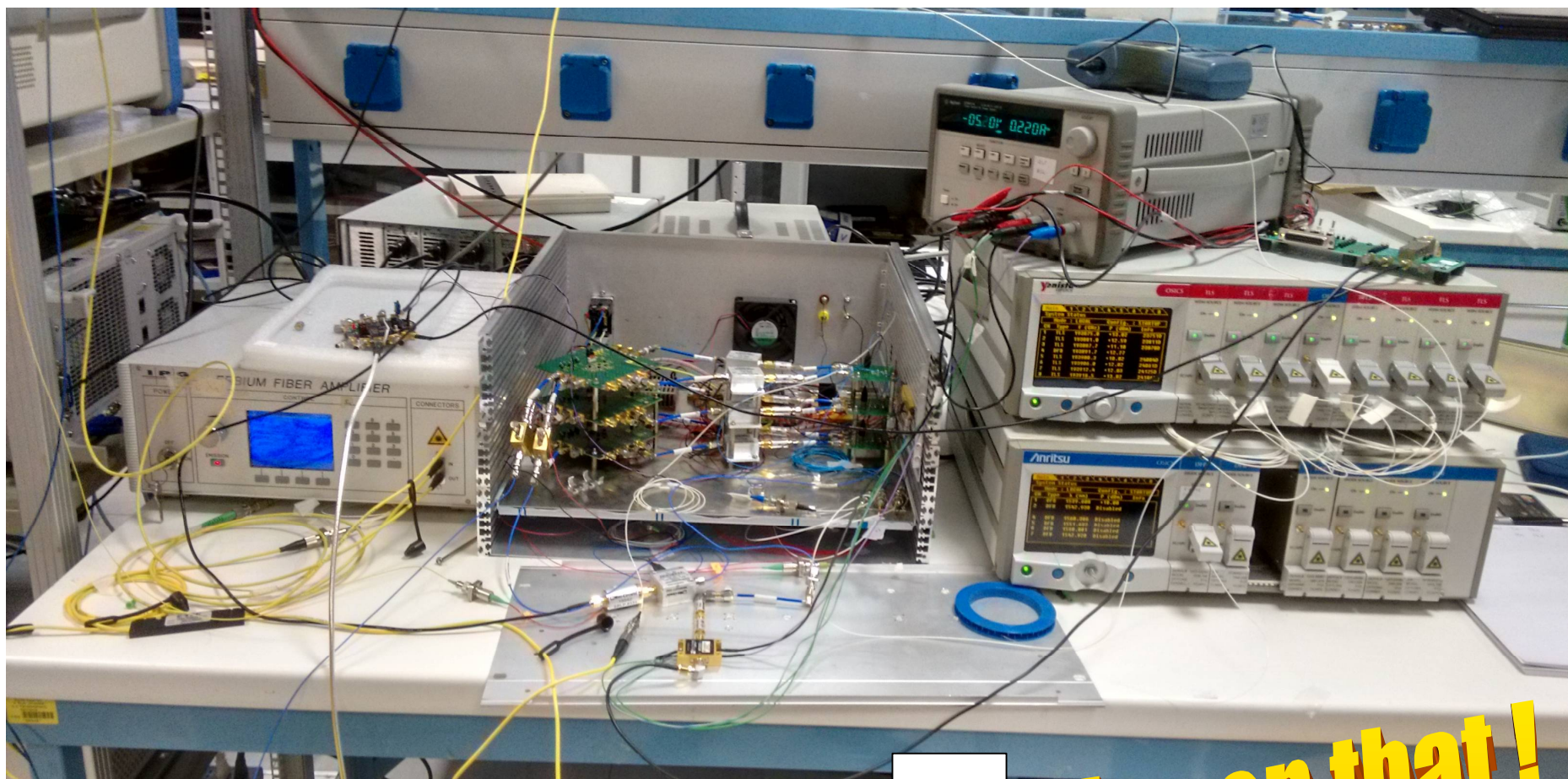
- COCONUT solutions can today provide:
 - Extended power budget ($> + 8$ dB)
 - Higher reconfigurability
 - Support for existing splitter-based infrastructures (including hybrid architectures with different users)

- 10 Gbs coherent channels feasible
 - already demonstrated using off-line processing
 - compatible with 100 GHz grid
 - Extended power budget
 - With LO-based channel selection



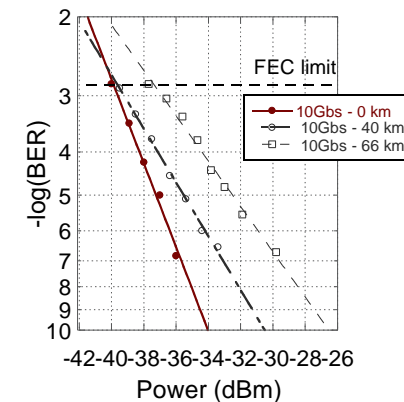
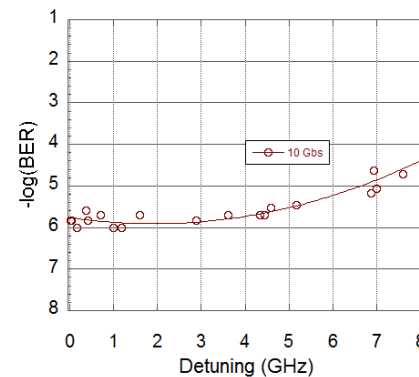
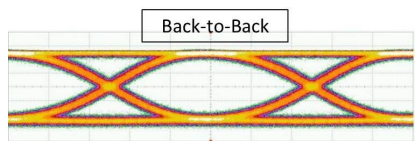
- 100 gbit/s with Coherent Detection (@SA)





We will be working on that ! ?

- Access networks evolving towards speed > 1 Gb/s
- COCONUT already proved scaling of the solutions to **10 Gbit/s** (see demo)



- Even higher speed may be considered (especially for supporting **5G** networks)

- <http://www.ict-coconut.eu/>



The screenshot shows the COCONUT website homepage. The header features the COCONUT logo in large, stylized letters, followed by the tagline "Cost-effective COhereNt Ultra-dense-WDM-PON for lambda-To-the-user access". Below the header is a navigation bar with links: Home, About Coconut, News / Events, Dissemination Activities, Deliverables, Consortium, Contacts, Restricted Area, and Review Area.

The main content area is divided into three columns:

- About Coconut:** A text block describing the project's goals: "COCONUT aims at the definition, study and realization of a new fully scalable optical access network significantly extending the network dimensions in terms of bandwidth utilization, reach and number of accommodated users. The envisioned access network evolves from the almost-commercial WDM-PON architecture to the realisation of the Ultra-Dense WDM solutions, opening the way to the 'wavelength-to-the-user' concept. The key enabling technology will be a new cost-effective coherent detection scheme."
- Latest News:** A list of recent events with "Read more..." links:
 - COCONUT at Ericsson's stakeholder review meeting**
 - COCONUT at Ericsson Opto Day**: "COCONUT results were presented at the Ericsson Opto Day."
 - COCONUT at FSAN**
 - COCONUT at ECOC**
 - COCONUT at Ericsson Innovation Day**: "COCONUT TX/RX presented at the Ericsson Innovation Day(s) in Genova."
- Upcoming events:** A single event listed:
 - COCONUT Final Project Demonstration**: "5 February 2016, Pisa (Italy)"

On the left side, there are links for "News RSS" and "Events RSS", and a "Follow Us on TWITTER" button. At the bottom left, there is a small counter showing "0 2 1 3 6 3".

**We acknowledge all COCONUT
partners and researchers**

Thanks for your kind attention

For further information:

<http://www.ict-coconut.eu>

email: e.ciaramella@sssup.it

A large, stylized, brown, blocky version of the word "COCONUT" with a slight 3D effect.