Mid-term review presentation
3rd August 2010

Ioannis Papakonstantinou

Work Package 4 – Experienced Researcher

Overview

- Introduction
- Technical details of ER's research project
- Training within Marie Curie fellowship
- Life after ACEOLE

Introduction – My background

EDUCATION

- Diploma in Electrical and Computer Engineering 2000 (NTUA - Greece)
- MSc in Broadband Technologies for Communications 2002 (UCL – UK)
- PhD in Analysis, Design and Measurement of Guided Wave Optical Backplane Interconnection 2007 (UCL – UK)

INDUSTRIAL EXPERIENCE

- Telecommunications Engineer, Intracom SA, Athens – Greece, 2000-2001
- Telecommunications Engineer, Greek Telecom, London – UK, 2001-2002
- Research Associate Sharp Laboratories of Europe, Oxford – UK, 2008-2009
- Marie Curie fellow, Geneva – Switzerland, 2009 – 2010
- CERN fellow, Geneva – Switzerland, 2010 - currently

Technical Details of PON Project

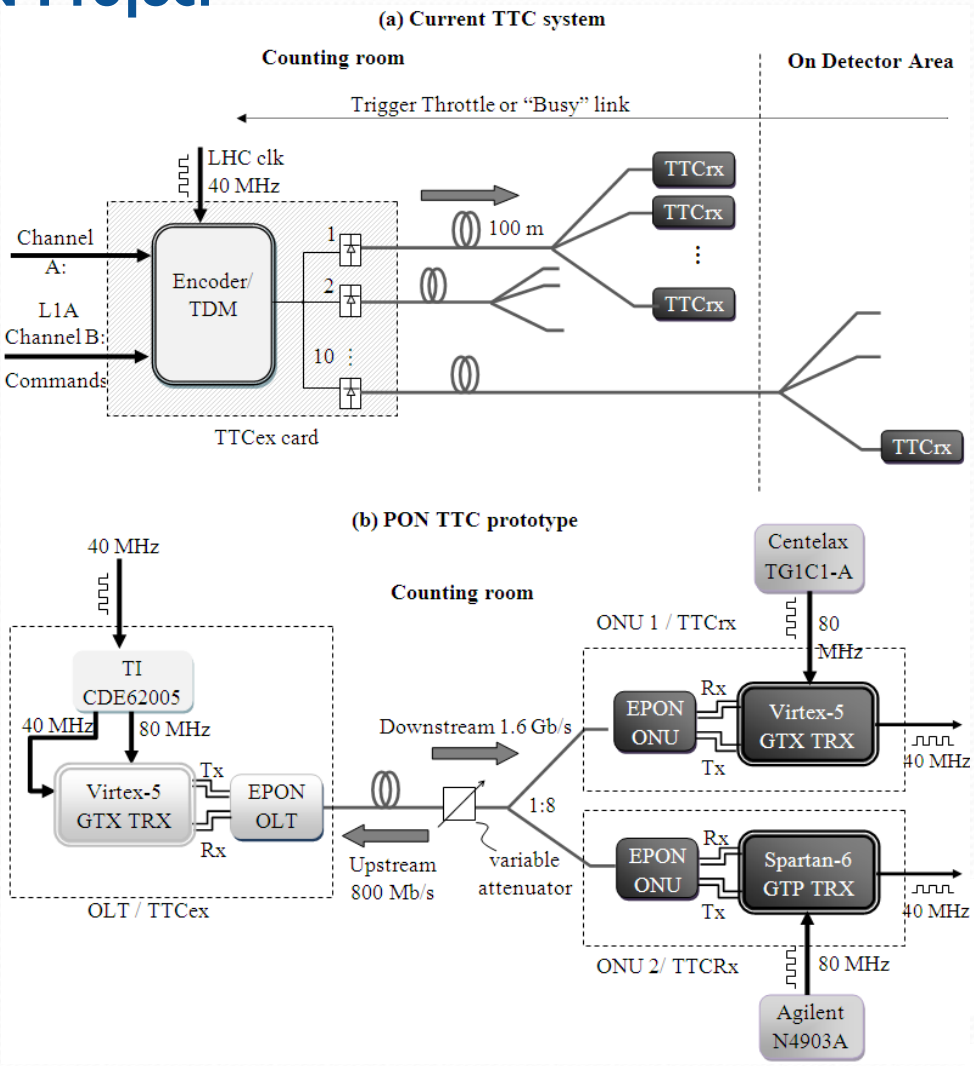
- Passive Optical Networks in Particle Physics Experiments
- PONs aim at replacing the existing P2MP optical links in TTC systems. Advantages of PON TTC:

a) Low cost as it is based exclusively on COTS components

b) The inherent bidirectionality of PONs simplifies previous network architecture

c) Latency variations can be measured and corrected for

d) FPGA based implementation offers a simple path to upgradability



Technical Details of PON Project

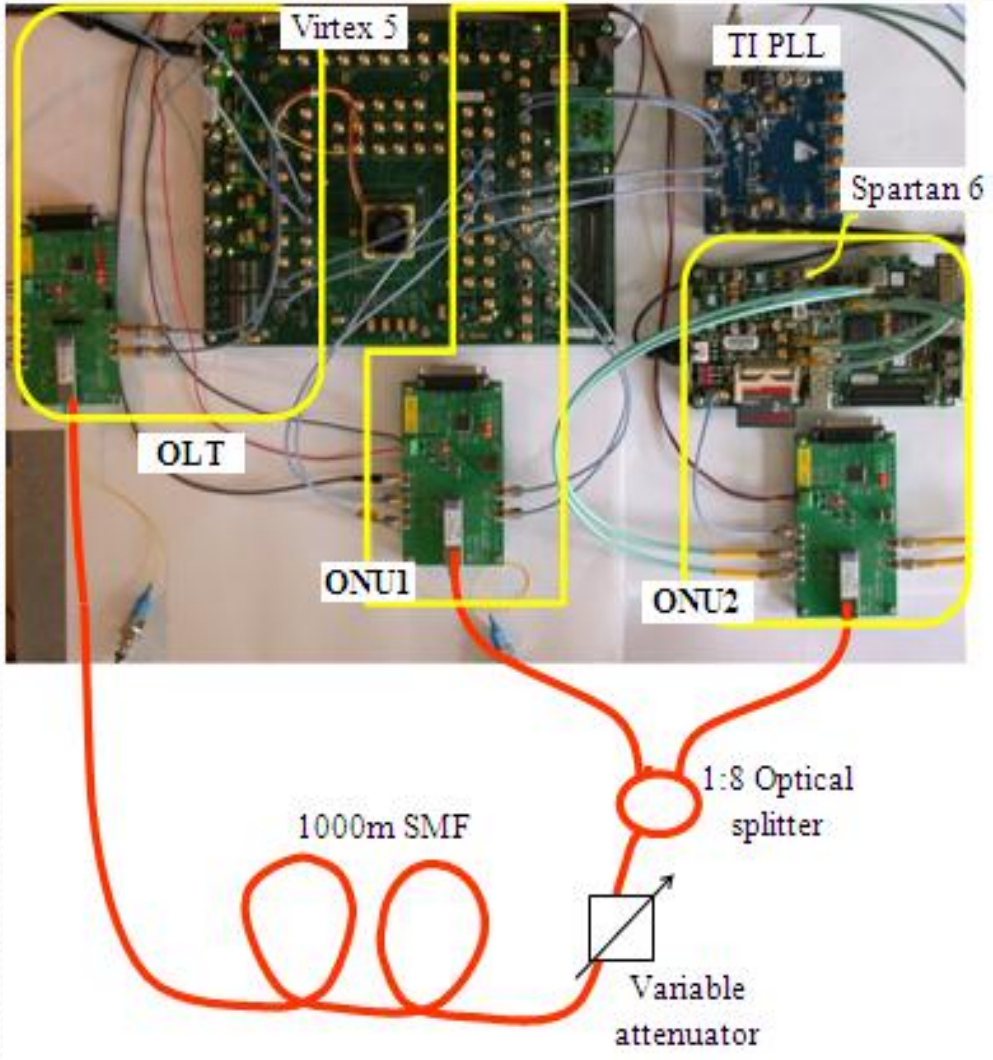
- Prototype demonstrator features the following characteristics:

a) The downstream link is a low and fixed latency, gigabit link

b) The LHC clock is recovered from serial data in the receiver

c) The recovered clock can be used for further distribution of data to the detector front-end components and

d) Feedback link is used for general information and to monitor the feeder fiber latency



Technical Details of PON Project - Publications

A Passive Optical Network with Latency Monitoring Capability for the Distribution of Timing-Trigger and Control Signals in High Energy Physics Experiments

Ioannis Papakonstantinou, *Member, IEEE*, Csaba Soos, Spyridon Papadopoulos, *Student Member, IEEE*, Stephan Detraz, Christophe Sigaud, Pavel Stejskal, Sarah Storey, Jan Troska, *Member, IEEE*, Francois Vasey, *Member, IEEE* and Izzat Darwazeh *Senior Member, IEEE*

***Abstract*—This paper discusses recent advances in a Passive Optical Network inspired Timing-Trigger and Control scheme installed in the experiments' counting rooms at an upgraded Large Hadron Collider. The timing passive optical network is provides a fixed latency gigabit downlink that can carry level 1 trigger accepts along with control commands for the front-end electronics as well as an upstream link for feedback to the Trigger/DAQ system. Implementation is based on commercially available FPGAs and Ethernet passive optical network transceivers.**

***Index Terms*— Field Programmable Gate Arrays and Gigabit Links, Fixed and Low Latency Serial Links, Passive Optical Networks in High Energy Physics Experiments, Timing Trigger and Control Applications.**

I. Introduction

POINT-to-multipoint optical links are extensively deployed in the experiments installed at the Large Hadron Collider (LHC) for Timing-Trigger and Control (TTC) applications [1-5]. These links are unidirectional and carry the level 1 trigger accept decision (L1A) as well as individually-addressed or broadcast commands for the various subdetector partitions [1-3]. Separate electrical "trigger throttle" links have been experiments' counting rooms but the concept could be extended in future to reach the on-detector electronics with further development. The proposed scheme satisfies the strict timing constraints of a TTC network - namely fixed and deterministic downlink latency; can distribute a reference clock with low jitter; and features a latency monitoring capability. The development of our system is based on commercially available passive optical network (PON) optoelectronic transceivers and field programmable gate arrays (FPGAs).

A number of papers have reported FPGA-based synchronous serial links. The authors in [6] have proposed a fixed-latency TTC distribution optical tree with FPGAs at the end-nodes. However, the reference clock is made available at both ends of the link, a feature that is not available in the TTC systems we are targeting, and the implemented optical link is unidirectional. The same authors proposed another FPGA-based synchronous implementation [7] for the replacement of the obsolete GLink chip-set in the ATLAS experiment at CERN, but yet again this link is unidirectional. The white rabbit consortium [8] has developed fixed latency, bidirectional optical networks by exploiting the synchronous Ethernet protocol. This scheme implements Gigabit serial

Training – Experience Researcher with a Focus on Academia

- Required skills
  - Publish in world leading scientific journals and international peer-reviewed conferences
  - Student supervision
  - Organising and managing projects
  - Experience in proposal writing
  - Forging collaborations with industry and other research institutes

List of Publications – Technical Reports

- **Referred Journal Publications:**

1) **Papakonstantinou I.**, Papadopoulos S., Troska J., Vasey F., Vichoudis P., and Soos C., "Intermodal Dispersion Mitigation in Standard Single Mode Fibers at 850nm with Fiber Mode Filters," Accepted for publication *IEEE Photonics Technology Letters,* May 2010

2) **Papakonstantinou I.**, Papadopoulos S., Soos C., Stephan D., Sigaud C., Storey S., Troska J., Vasey F., and Darwazeh I., "A Fully Bidirectional Optical Network with Latency Monitoring Capability for the Distribution of Timing-Trigger and Control Signals in High Energy Physics Experiments," Submitted for publication *IEEE Transactions on Nuclear Science,* June 2010

- **Refereed Conference/Workshop Publications**

3) **Papakonstantinou I.**, Papadopoulos S., Soos C., Stephan D., Sigaud C., Storey S., Troska J., and Vasey F., "Passive Optical Networks for Timing-Trigger and Control Applications in High Energy Physics Experiments," *Proc. 17th IEEE Real Time Conference*, Lisbon, Portugal, May 24-28, 2010.

4) **Papakonstantinou I.** *et. al.*, "Passive Optical Networks in High Energy Particle Physics", *Proc. Topical Workshop on Electronics for Particle Physics*, Paris, Sep. 21-25, 2009.

5) Troska J., Papadopoulos S. **Papakonstantinou I.**, Silva S., Stejskal P., Soos C., Detraz S., Sigaud C., Vasey F., "The Versatile Transceiver Proof of Concept," *Proc. Topical Workshop on Electronics for Particle Physics,* Paris, Sep. 21-25, 2009.

6) Silva S., Amaral L., Sigaud C., **Papakonstantinou I.**, Soos C., Papadopolos S., Stejkal P., Detraz S., Troska J., Vassey F., Salgado H. "Characterization of Semiconductor Lasers for Radiation Hard High Speed Transceivers," *Proc. Topical Workshop on Electronics for Particle Physics,* Paris, Sep. 21-25, 2009.

- **Selected Technical Reports:**

7) "Passive Optical Networks in the Super-Large Hadron Collider". Technical report to PH-ESE section at CERN.

8) "Single Mode Fibers and 850 nm VCSELs for the upgrade of the pixel detector". Technical report submitted to PH-ESE section at CERN.

Training – Student Supervision

- Co-supervised an ESR working on WDM PONs
  - ESR is also a PhD student affiliated with UCL
  - ESR has contributed to a number of papers and technical reports
  - Student is about to submit his transfer thesis

Training – Organising and Managing Projects

- Enthusiasm for Engineering. A training program for teachers at CERN
  - In collaboration with PH-EDU in CERN

Objectives of the program:

- To persuade young children to follow a career in engineering or IT in the future
- To promote the exchange of knowledge and experience among teachers of different nationalities
- To better communicate CERN's achievements in engineering and IT to the outside world

ENTHUSIASM FOR ENGINEERING

ENTHUSIASM FOR ENGINEERING

ENTHUSIASM FOR ENGINEERING

conCERN for engineering

PEOPLE

Training – Proposal writing

- Co-supervised an ESR working on WDM PONs
  - Attended training course: Writing successful FP7 proposals Student is about to submit his transfer thesis, May 2009
  - Already submitted a research proposal (unsuccessfully) on photovoltaics to the EPSRC in the UK. 6 international academic and 2 industrial collaborators.
  - Will contribute to writing the proposal for ACEOLE 2 on fiber optic networks for particle physics experiments

Life after ACEOLE

- Working as CERN fellow since January 2010, continuing my work on PONs and also has moved on to two new projects
- Contract with CERN will come to its end in the end of 2010
- Applied for a position as a lecturer to a UK university
- Will apply for more research jobs in academia and industry
- My goal is to create my own research area and research group in optics for PV applications