Q&A Transcript:

Q1 Can you get rid of the annoying constraint of an authenticated classical channel that is mandated in most QKD protocols?

*– In general, this is addressed during deployment. Pre-share secure key are used to authenticate the devices. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q2 Do you need an external synchronization reference signal (frequency sync or time sync to precise) or only in case of P to MP?

*– All synchronization signals are generated internally within the units. The FPGA cores communicate with each-other via a 10G SFP interface for sifting, synchronization, timing and feedback parameter calculation. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q3 How do you generate enough random numbers for the T12 protocol at 1 GHz if your QRNG can only do 4 Gb/s?

*– For this we (Toshiba Europe) developed a proprietary combinatory logic algorithm to bias the otherwise uniform stream of random numbers. It is outlined in our recent publication in Nature Photonics. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q4 What are the perceived metrology pain points (opportunities) that might be enabled with standards?

*– When we reach a critical mass of vendors, interoperability will become essential, i.e., devices from different supplier should be able to communicate with each other. Standards will be essential for that purpose. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q5 What is the benefit of the pluggable photonic modules for a commercial product?

*– The advantage is the same as in conventional coherent optics devices. Pluggable interconnect allows to decouple the optical hardware and the drive electronics. By ensuring the compatibility of successive generations of chips with the same electronics the system becomes easily upgradable. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q6 How do you control the polarization of the quantum signal before entering your lithium niobate phase modulator at the Bob side?

*– In our case the polarization state is controlled externally, we (Toshiba Europe) did not include polarization control elements on our chips. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q7 Is there any work planned to produce a quantum photonic integrated circuit that will miniaturise the quantum analogue to digital converter lab experiment produced under horizon 2020?

*– I'm not aware of a photonic activity to follow up this Horizon 2020 experiment - it would be very interesting to explore this idea. (**Response from Taofiq Paraiso, Toshiba Europe**)*

Q8 Why do you think that DV QKD will use dark fibre in the future in your standardization slide? There are quite a few QKD co-existence with optical communication, even in a main trunk line.

*– Yes. I think O-band DV-QKD at 80km with co-propagation with C-band optical communication is possible. But reach 120km in co-propagation for O-band DV-QKD seems challenging if we just use gated III-V SPD. (**Response from Yi Qian, CICT**)*

Q9 How do you expect that integrated photonics will influence your optical quantum computer?

*– There is no doubt that integrated optics has absolute advantages including adjustability, maintainability and scalability. I believe that integrated optics will greatly promote optical quantum computing. At present, the biggest problem is the loss, which is the reason why we did not use integrated optics in the GBS experiment. We are looking forward to low-loss tuneable chips. (**Response from Han-sen Zhong, USTC**)*

Q10 What is the highest coupling efficiency from fibre to PIC? any theoretical limit on it?

*– In many cases we could do 0.3dB and in the industry majority will be able to achieve 0.5dB coupling loss. (**Response from Bernard Lee, SENKO Advanced Components**)*

Q11 Any theoretical limit on your loss? It is a great progress but still not enough for quantum computing

*– It depends on what you want to do. For boson sampling, the overall transmission of the entire setup needs to be about 2 dB, so right now we're eating up the entire loss budget. (**Response from Jelmer Renema, QuiX**)*

Q12 How can your efficiency be improved further?

*– Here we depend on our foundry LioniX as well; they are continuously bringing down waveguide losses and coupling losses. (**Response from Jelmer Renema, QuiX**)*

Q13 What kind of quantum algorithm can be demonstrated on your SiN based circuit? Is it reconfigurable via phase modulation?

*– See Hansen's talk: algorithms for NISQ quantum systems is very much an open field. The circuit is fully reconfigurable. I did not have time today to talk about this but have a look at our paper for details. (**Response from Jelmer Renema, QuiX**)*

Q14 Is there any other loss tolerant algorithm to show quantum advantage or be useful? Any theoretical limits?

*– That's still very much subject to research. As far as I know there is no theoretical limit on how low the losses could go. The eventual limit is that the circuits become too large because you have to go to single stripe. (**Response from Jelmer Renema, QuiX**)*