Satellite QKD Subsystems

EPIC Online Technology Meeting on Satellite Quantum Communication

Martin Wölz, Jena-Optronik GmbH, 24.10.22

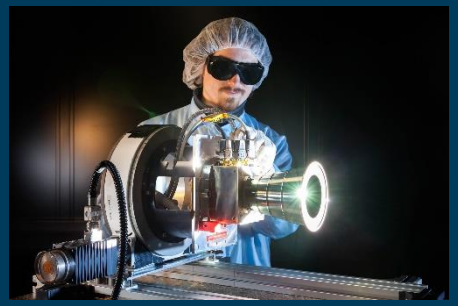
Jena-Optronik GmbH

- Jena-Optronik is …
  - **the world leading supplier for AOCS Sensors** (Star Sensors and Rendezvous and Docking Sensors)
  - … **focussing on optro-electronic subsystems**
- Location: ***German Optical Valley*, Jena, Thuringia, Germany**
- Employees: **235**

New Company Facilities since 2015

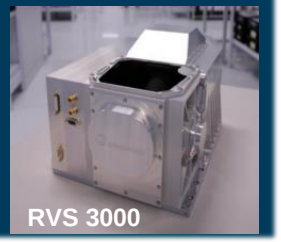
Star sensors
(ASTRO product family)

- Market leader #1 for telecom and earth observation missions
- System solutions for primes
- 1st tier supplier



Rendezvous sensors
(RVS product family)

- World leader: the most successful LIDAR sensor for Rendezvous and Docking to supply the ISS
- New generation RVS 3000 sensor
- New market of in-orbit servicing and future lander missions/applications

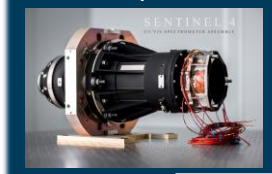


In-house Test capabilities

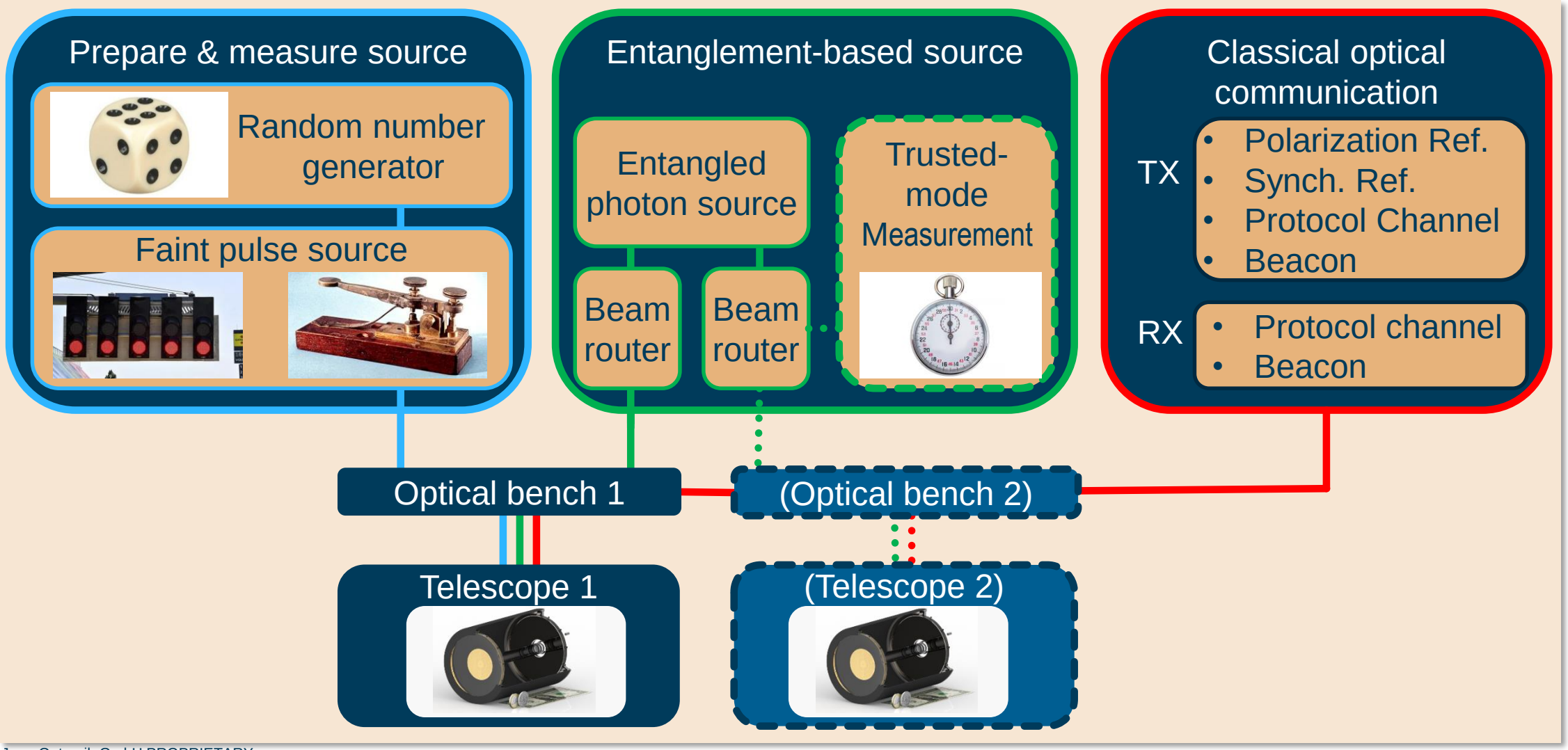
- 2000m² cleanroom facilities
- 6 TVCs
- 4 Turn Tables
- Vibration Test System
- Various OGSE & other test facilities

Space optics & electronics
(opto-electronic subsystems)

- Satellite QKD subsystems
- `Product like` opto-electronics for space instruments
- Contribute with value-added MAIT process to success of instrument primes in Europe

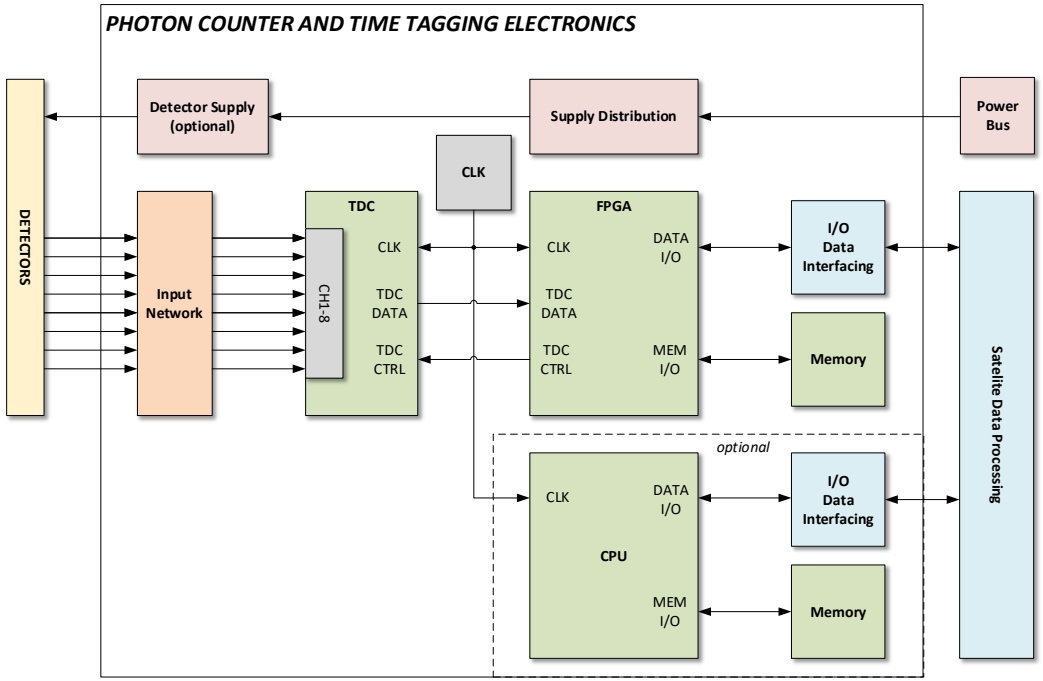


Optical terminal



Single photon time tagging – a TRL 2 to TRL 4 engineering example

- On-board detection and processing of single photons
  - 10s ps resolution
  - 100s Mcps
  - radiation hard
- Commercial IC not available, no mass market
- Indispensable for some QKD space missions, eg. Trusted mode entanglement source as proposed in „GEO QKD“
- Bottom-up IC design financed by BMBF research project QSOURCE (Fraunhofer IOF, Jena-Optronik, et al.)
- Breadboard expected in 2023



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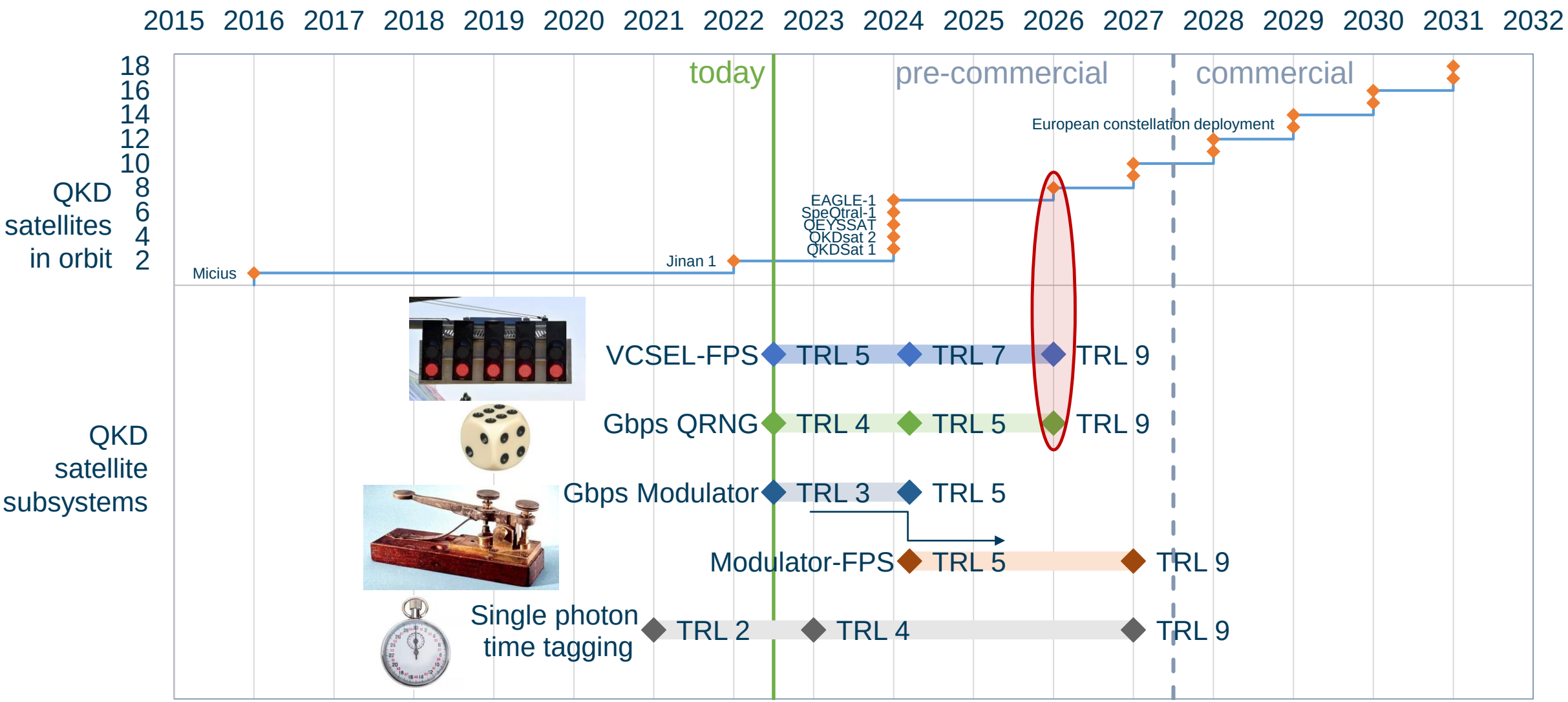
Federal Ministry of Education and Research

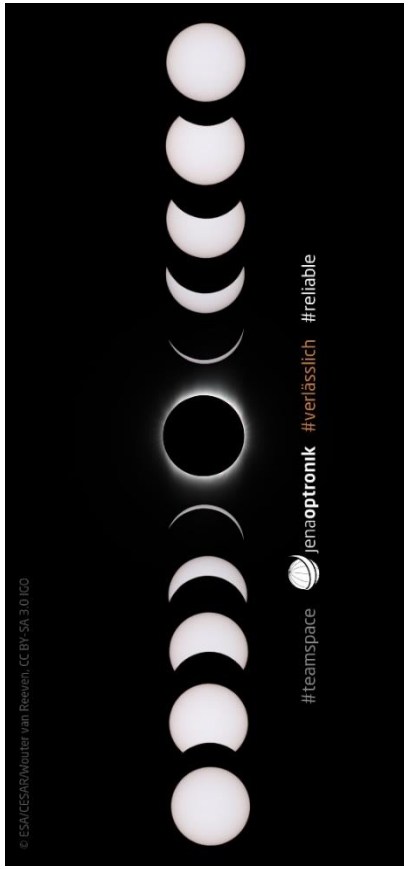
Jena-Optronik QKD Roadmap



Thank You!

Space electronics for satellite QKD

- Satellite QKD is moving to the industrialization phase
- QKD subsystem development by Jena-Optronik
  - QRNG
  - VCSEL FPS
  - Modulator driver
  - Single photon time-tagging
- Looking for
  - new photonic devices for space qualification
  - eg. active polarization compensation
- QKD missions timelines are competitive and require industry expertise in design and verification for space → Jena-Optronik GmbH



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