

## **C-TFN:** an update

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- Support the redefinition of the SI second being carried out between now and 2030+ by NPL, PTB, Syrte and INRIM.
- Perform fundamental physics research e.g. gravity wave experiments.
- **Supplement GNSS** with a fibre network to increase reliability of time distribution
- Support **European-wide commercial services** such as very accurate time stamps for banks to validate high-frequency trading.



- First proof-of-concept link for the CLONETS C-TFN
- The purpose is to prove both frequency and time transfer
- The system was successfully installed on the 23<sup>rd</sup> of Sept
- Uses equipment from PIK Time Systems





Regenerator laser station



ELSTAB



#### Modified Allan Deviation (Mod $\sigma_V(T)$ )



Trace	Sample Interval	Duration
PSNC -> PTB -> PSNC (2 x 690 km)	1 s	3d 7h 11m 45s

- GEANT WP6 is adapting TimeMap software to support the Pathfinder
- Link state and beat power are reported for each end of the link
- Investigating adding frequency counter measurements



~ Location: PSNC\_Poznan\_pathfinder\_2

#### How things stand today



#### Frequency network:

- Green links built by NRENs in collaboration with national NMIs
- Blue links built by local NMIs/researchers

#### NMIs:

 Four big NMIs are involved in redefining the SI second highlighted in red

NMI Frequency reference

Research institute

Hut for housing RLS

### What is missing?



#### Missing:

- National based networks need to be interconnected
- Eastern and Western islands of frequency services are not linked
- A full ring/mesh of the big four NMIs will enable them to complete definition of the SI second
- Link will also be needed to Nordics, SE and SW Europe as they develop Optical clocks



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### **Proposed solution**



• Red lines are proposed for GN5-2

Solution:

- These will interconnect national 'islands' of frequency networks
- Support redefinition of the SI second
- Primary users are national frequency reference providers
- Secondary users are research institutes that connect via their national frequency provider



### **Proposed solution**



#### Solution:

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 Ring supports the four big NMIs that are part of the campaign for redefinition of the SI second

**NMI Frequency reference** 

Research institute

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#### WDM wavelength plan for TF signals (lambdas TBD)





### **Optical frequency network topology**





Local linkwest, source; east, sink

### **C-TFN Timeline**

- 2024: build and Pathfinder link and prepare C-TFN
- 2025 2027: Build TFN Phase 1
- After July 2027: TFN Phase 2 (funding not yet identified)



- Why do we need a new Special Interest Group?
- New scientific community of metrology
- SIG-TFN brings together NRENs and the science of accurate time
- Strong interest: 100 subscribers to <u>sig-tfn@lists.geant.org</u>



Web page: <a href="mailto:community.geant.org/sig-tfn">community.geant.org/sig-tfn</a>

- There are two working groups within the SIG-TFN:
  - T/F Sustainability (led by Richard Lui)
  - C-TFN technical specification (Led by Guy Roberts)
- We will have the first in-person SIG-TFN meeting in Amsterdam on the 16/17<sup>th</sup> Oct 2024.
  <u>https://wiki.geant.org/display/SIG/1st+SIG-</u> <u>TFN+meeting+-+Amsterdam%2C+Netherlands</u>







- GÉANT is building two fibre routes in the next 3 years:
  - France-Belgium-Netherlands-Germany-Poland
  - Italy-Austria-Germany-Czechia-Poland
- GÉANT has created a new SIG to coordinate collaboration between metrology and NRENs
- Funding in place for Jan 2025 to July 2027.
- The sustainability working group is actively working with the EC to find funding after 2027





# Thank You

Any questions?

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