NLS
FINNISH GEOSPATIAL
RESEARCH INSTITUTE
FGI

National Report - Finland

EUREF Symposium 2025

Covilhã, Portugal, June 24-26, 2025

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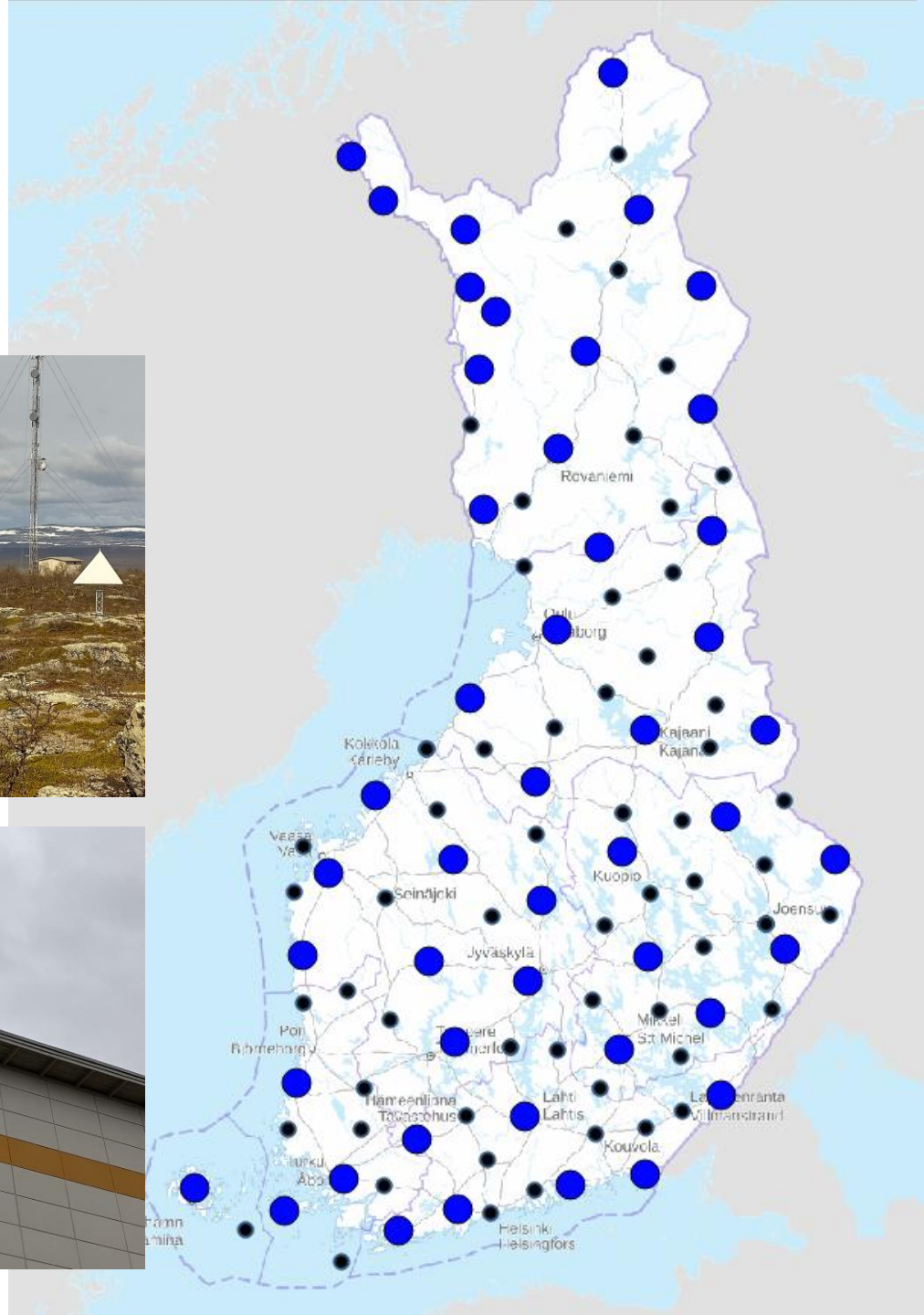
Topics

1. FinnRef CORS
2. Standardization of reference frames and transformations
3. Metrology
4. (Metsähovi)

1. FinnRef: Backbone of Finnish reference systems

- FinnRef: 47 CORS
  - 2 IGS
  - 20 EPN
  - 47 EPND
  - For reference frame purposes, mostly founded on bedrock
  - Long GNSS time series
- FINPOS: >50 CORS (+FinnRef)
  - Mostly rooftops
  - For NRTK positioning service
- FinnRef will connect terrestrial, vertical and gravity reference frames



1. FinnRef: Backbone of Finnish reference systems

- Connection to N2000 height system
  - Precise levellings for all (or most of the) stations by ~2026
    - Now 40/47 (2025: 2 stns)
  - Centering measurements (heights from the reserve markers to the GNSS antenna)
    - Now 45/47 (2025: 9 stns done)
- Gravity: repeated absolute gravity measurements
  - 20/47 stations with AG pillar, measured every 3 years
- SAR reflectors
  - 9 stations, mostly one passive reflector at the site (+ 2 at Aboa station in Antarctica)

2. Standardization of reference frames

- Many reference frames/coordinate reference systems (CRS) in Finland + international reference frames → transformations/ coordinate operations needed often to get data in the same CRS

→ Standardization needed to ensure availability, easy and correct use of the transformations

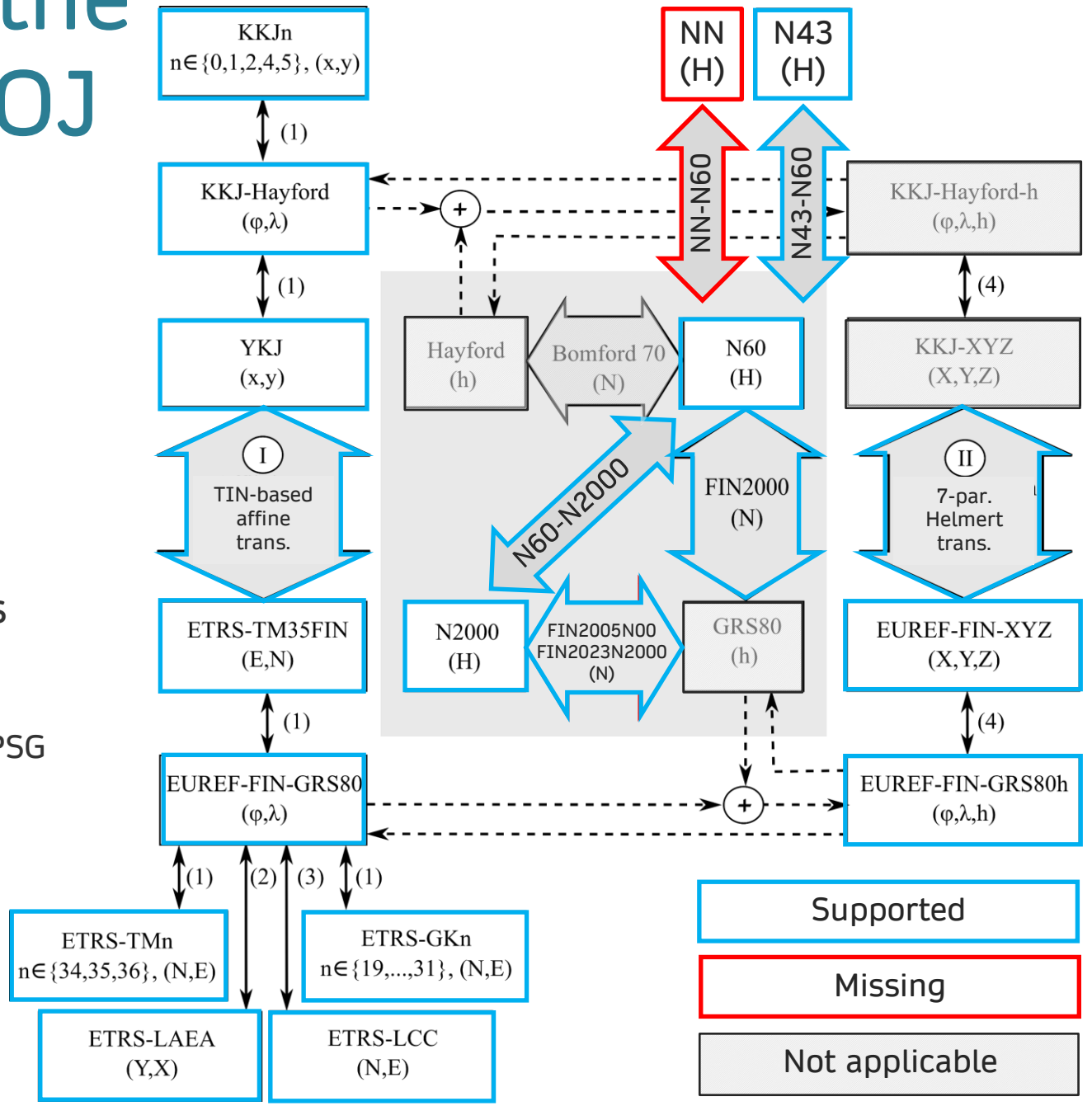
  - Geodetic registries including essential information in harmonized form
    - EPSG registry: de facto standard for reference frames and transformations
  - Standard(ized) and open implementations
    - PROJ: de facto implementation for transformations

→ Focus on EPSG registrations and PROJ implementation

2. Finnish updates to the EPSG registry and PROJ

- **EPSG data set and PROJ updated in 12/2024-3/2025. Additions:**
  - **EPSG: EUREF-FIN datum and associated CRSs, geoid models, triangle (TIN) –based transformations**
  - **PROJ: geoid models**
- Both EPSG and PROJ support practically all Finnish nationwide CRSs and transformations now (see figure)
  - PROJ support also dynamic NKG transformations (ITRFyy<->Nat.ETRS89), ongoing development for EPSG support

EPSG codes and PROJ 3/2025:



3. Metrology: Nummela Standard Baseline

- FGI's renowned metrological length standard was measured for the 17th time since 1947 using the Väisälä Interference Comparator in autumn 2024
- Six pillars, the longest distance 864 122,9 mm is known with less than ±0,1 mm standard uncertainty and has varied less than 0,07 mm since 1947
- The baseline is used for
  - (1) calibration of the most accurate electronic distance measurement (EDM) instruments,
  - (2) metrologically traceable scale transfer to other geodetic baselines and test fields, using calibrated instruments as transfer standards,
  - (3) testing and validation of modern absolute distance measurement (ADM) instruments as part of four European length metrology research projects since 2008,
  - (4) verifying the scale of measurement instruments used for local tie measurements at Metsähovi global geodetic observation site.

Metsähovi

- Commissioning of the VGOS system is progressing
  - In Q4/2024 new H-maser installed
- Contract with DiGOS GmbH (Germany) to finalize the commissioning of the Metsähovi SLR telescope and the SLR system
  - On-sky tests expected to start in Q3/2025
- 3 new technical experts hired 3.2025, technical team now 6 persons
- GNSS, gravimetric, and DORIS measurements have continued without any issues
- Local tie measurements are planned to be repeated in Q2/2025
- Exploring of options for replacement of technical facilities that are still in old building
- Finland established National Space Situational Awareness Center in Q4/2024 (FMI Lead)
  - Metsähovi SLR system update by Q4/2026 to observe space debris

Knowing the Earth – Securing the future

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