

# **Introduction to EPN-Repro3**

Tasks and Objectives

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- EPN-Repro1:
  - Period: Jan. 1996 - Jan. 2007 (GPS week 834 - 1408)
  - Reference Frame: **IGS05**; Antenna calibration: **epn\_05.atx (individual)**
  - Solutions based on subnetworks (distributed processing) were provided
    - Solutions provided: Bernese: 14 / GAMIT:2 / GIPSY:2, finalized in 2012
  
- EPN-Repro2:
  - Period: Jan. 1996 - Dec. 2014 (GPS week 834 – 1824)
  - Reference Frame: **IGb08**; Antenna calibration: **epn\_08.atx (individual)**
  - 5 solutions provided, (**3 Full-EPN** solutions based on GAMIT, GIPSY and Bernese, plus 2 subnetworks based on Bernese) finalized in 2016

**IGS repro3 was performed to obtain consistent products from 1994 until 2020, providing homogeneous input data for the ITRF2020 estimation!**

Items to observe in IGS repro3 concerning IGS14/IGb14 (incomplete list) :

- **Ground antenna calibrations:** igs14.atx was replaced by new multi-GNSS calibrations in igsR3.atx
- If **no corrections** for the GLONASS or GALILEO frequencies are available, do not use those observations
- **Satellite z-PCOs:** update of the radial phase center offsets (z-PCOs) of all GPS and GLONASS satellites (Galileo Z-PCOs were provided by GSA [PCO estimated in an anechoic chamber])
- **IGSR3 reference frame:** IGS repro3 solutions are not aligned to the IGS14 reference frame but to a reference frame called IGSR3

- EPN-Repro3 products should be **largely consistent** with the future operational EPN solutions in the IGS20 (after week 2238)
- This guarantees long-term consistent time series of the positions and thus accurate velocities of the EPN stations
- IGS used a new set of antenna calibration models (type mean) containing multi frequency (MF) corrections for GPS, GLONASS and Galileo (robot calibrations from Geo++ and chamber calibration from Bonn) -> igsR3.atx
- The EPN ACs have decided to rely solely on type mean calibrations for the operational analysis and Repro3: **igs20.atx** :
  - Still, some antennas are missing in igs20.atx like antennas with radomes type **BEVA**, **TPSCR.CR5** **NONE** and others (see presentation by **Andrzej Araszkievicz**)
  - EPN antenna working group is in favour of using radome type "NONE" if a specific antenna and radome combination is not included in **igs20.atx**

- Distributed processing is proposed for EPN-Repro3 (subnetworks computed by different ACs)
- The GFZ (Geoforschungszentrum Potsdam) will participate in the EPN repro activities for the first time and intends to offer an operational service as well (presentation by **Benjamin Männel**)
- **11+1** ACs will share this task among themselves and participate in this activity (operational analysis will soon be carried out by 17 ACs)
- The generation of combined tropospheric products (presentation by **Rosa Pacione**) and the combination of subnetworks on the coordinate level require at least the presence of each station in three subnetworks
- As a result, the EPN-Repro3 analysis must fill in the gaps where some stations are not handled by at least three agencies (see presentation by **Tomasz Liwosz**).

# Participating ACs

LAC	#Sites	EPN-Repro3
<b>ASI</b>	<b>58</b>	No, at least not before spring 2023
BEK	104	Yes
<b>BEV</b>	<b>121</b>	No
BKG	128	Yes
<b>COE</b>	<b>34</b>	No
IGE	85	Yes
IGN	28	Yes
<b>LPT</b>	<b>58</b>	No, for the moment
MUT	130	Yes
NKG	104	Yes
<b>RGA</b>	<b>49</b>	No
ROB	106	Yes (firm commitment dep. on details)
SGO	41	Yes
SUT	56	Yes
UPA	66	Yes
WUT	132	Yes
<b>GFZ</b>	<b>?</b>	<b>Yes</b>

# Recommendations from the 1<sup>st</sup> EPN-Repro meeting

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- EPN ACs might use any reprocessed IGS-Repro3 product, which is most suitable for their software
- Combined IGS product are also possible when available
- The EPNCB historical database is recommended for access to GNSS data
  - the database is/was under a review process (see presentation by **Juliette Legrand**)
- The GNSS analysis software shall fulfil the requirements used in IGS Repro3
  - a new version of the Bernese (5.4) is now released
  - EPOS (GFZ), GAMIT and GIPSY fulfil the requirements
- All previously active EPN stations should be included in the analysis, even the stations that are inactive today (**discussion: also those stations with a history of less than 3 years?**)

- Determination of the subnetworks to be processed by the individual ACs
- Installation and training of new analysis software (here Bernese 5.4) wherever it is required
- Update of igs20.atx with missing antenna models if possible, also required for the operational analysis
- Proposal of a testing period by comparing reprocessed products with the new operational products
- The launch of EPN-Repro3 could be coordinated with the transition to IGS20 for operational analysis, but is very demanding in terms of time as the focus is first on the transition to the operational products.