Receiver Antenna Calibrations Available from the EPN CB

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http://www.epncb.eu/

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ROYAL OBSERVATORY OF BELGIUM

EUREF AC Workshop Brussels, Oct. 25-26, 2017

Introduction

Nov. 2006 (GPS week 1400) :
IGS switch from relative to absolute antenna calibrations

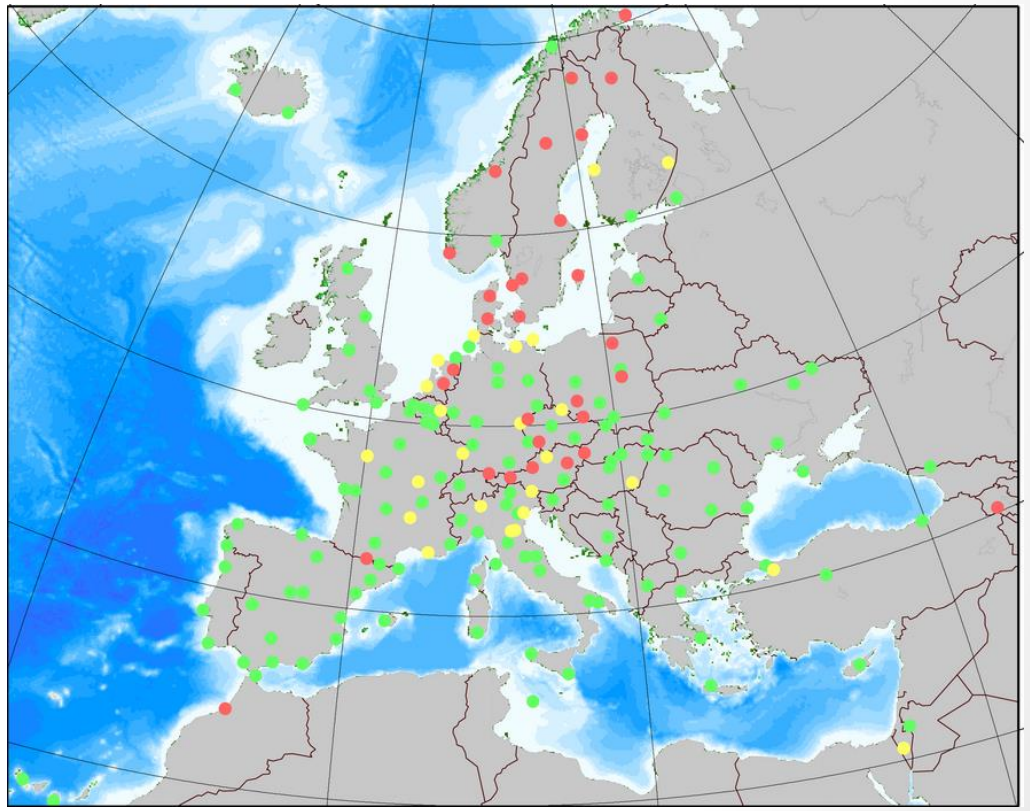
Absolute antenna calibrations used in IGS are provided by GEO++

GEO++

- IGS CB has permission to distribute type mean GEO++ calibrations for antennas/radomes belonging to IGS
- EPN CB does not have permission to freely distribute type mean GEO++ calibrations for antennas/radomes included in the EPN, but not in IGS → license fee to be paid to GEO++
- EPN CB has permission to freely distribute individual antenna calibrations from GEO++ (password protected)

Absol. from robot	69%
Absol. from relative	16%
No absolute	15%

Nov. 2006



EUREF TWG meeting Frankfurt, Nov. 6-7, 2006

OPTION 1: Use same antenna calibrations as IGS

- Pro:
  - At first sight: Complete consistency with IGS
- Against:
  - Antennas/radomes in EPN, but not included in IGS

    Even if calibrated by GEO++ → EPN fallback to converted relative calibrations.
    - If this antenna/radome is introduced later in IGS → IGS will use GEO++ calibrations
    - 2 options in EPN: stick with converted antenna calibrations (loose consistency with IGS) or switch to GEO++ calibrations (jump in EPN time series)

OPTION 2: Use individual antenna/radome calibrations and IGS calibrations

- Pro:
  - EPN can integrate new equipment, even if not (yet) in IGS
  - EPN has permission to distribute individual calibrations (GEO++), even if antennas/radomes are not in IGS
  - Independently of changes in IGS, indiv. calib used in EPN will not change
- Against:
  - Different approach from IGS (consistency issue)
  - Need to maintain EPN-specific atx file with individual calibrations (consistency antenna serial number in RINEX, site log, atx necessary)
  - More complicated for users

Introduction of Indiv. Antenna Calib. in EPN

Change of EPN guidelines

requirement for new stations, and antenna/radome replacements :

antenna+radome must have individual absolute calibrations or absolute antenna calibrations available from IGS CB

<u>exceptions</u> are allowed for

- antenna/radome combinations
  - where the effect of the radome on the APC is negligible or
  - which cannot be absolutely calibrated,
  - provided an on-site relative test/calibration is carried out
- stations that provide a clear added-value to EPN

Introduction of Indiv. Antenna Calib. in EPN

EUREF Mail: Nov. 8, 2006

Collection of individual absolute antenna calibrations in ATX format

→Compilation of epnc_05.atx: indiv. calib. for 13 antennas/radomes

→Improve consistency of antenna serial number in site logs

Mid-November 2006 (final EPN solutions from GPS week 1400 on):

→EPN switch to individual antenna calibrations + absolute (IGS) antenna calibrations (incl. type mean from GEO++)

Introduction of Indiv. Antenna Calib. in EPN

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2009

- GEO++ agrees to make publicly available the type mean calibrations for antennas/radomes that are in EPN and not in IGS.
- If new EPN antenna/radome has no indiv. antenna calibrations
  - Check if type mean calibrations are available from IGS
    - If yes → OK
    - If not, check if type mean calibrations available from GEO++
      - If yes, contact chair of the IGS antenna WG and ask to add calibration in IGS atx file
      - If not, do not accept station in EPN

2010

- GEO++ grants permission to remove password protection from individual antenna calibrations
- Access to individual calibrations: ftp with User/password changed to anonymous ftp

GLONASS Spikes…

- Nov. 2012:
  - W. Aerts (ROB) reports strange spikes (1 -2 mm) in GLONASS indiv. GEO++ calibrations of ROB antennas
  - Problem known by GEO++: bug in program generating the ANTEX files (spikes should have 0.00 value)
- Jan. 2013:
  - W. Aerts sees same strange spikes in igs08.atx type mean GLONASS calibrations and reports it to chairman of IGS antenna WG (R. Schmid) – 45 affected antenna types
  - Also other indiv. calibrations from EPN are affected – 19 calib.
- April 2013: GEO++ provides corrected type mean (IGS) and corrected indiv. calib. (EPN)
  - Correction of igs08.atx file (igs08_1734.atx)
  - Correction of epnc_08.atx + send corrected indiv. calib. to affected station managers

No influence expected on computed station positions

Antenna serial numbers (last 5 digits)

Important because required to link indiv. calib. to specific antenna/radome in a specific station

- SINEX:

```
TRM29659.00     NONE 81598 0.1556 0.0016 0.0000 0.1641 0.0013 0.0000 epnc08
```

- Site log :

```
4.3  Antenna Type             : TRM29659.00     NONE
     Serial Number            : 02201 81598
     (A*, but note the last A5 is used in SINEX)
```

- RINEX:

```
02201 81598          TRM29659.00     NONE                    ANT # / TYPE
```

- Calibration atx file:

```
TRM29659.00     NONE 81598                                   TYPE / SERIAL NO
```

- Bernese STA file:

		orig	*used*
TRM29659.00	NONE	81598	81598

Switch to full antenna serial numbers

2013: New EPN station (SUN6) proposed with same antenna/radome and same last 5-char SN as existing EPN station (VALE).
Both have individual calibrations.

Station	Antenna/Radome	Full Serial number	Part used of SN	Indiv. Calib.
SUN6	LEIAR25.R3 LEIT	08490012	90012	YES
VALE	LEIAR25.R3 LEIT	10190012	90012	YES

Individual calibration file: ftp://epncb.oma.be/pub/station/general/epnc_08.atx
ANTEX uses only last 5 digits of antenna serial number (origin: SINEX format)

Nov. 2013 : release of epnc_08_FULLSN.atx ; EUREF52_FULLSN.STA (testing)

May 2015: epnc_FULLSN.atx → epnc_08.atx ; EUREF52_FULLSN.STA → EUREF52.STA

ROYAL OBSERVATORY OF BELGIUM

Antenna serial numbers (full serial number)

Important because required to link indiv. calib. to specific antenna/radome in a specific station

- Site log :

```
4.3  Antenna Type              : TRM29659.00     NONE
     Serial Number             : 0220181598   (stat XXXX)   or   0220681598  (stat SSSS)
     (A*, but note the last A5 is used in SINEX)
```

- RINEX:

```
stat XXXX     0220181598      TRM29659.00     NONE                    ANT # / TYPE
stat SSSS     0220681598      TRM29659.00     NONE                    ANT # / TYPE
```

- Calibration

```
stat XXXX     TRM29659.00     NONE0220181598                          TYPE / SERIAL NO
              EPNC_XXXX                                               SINEX CODE
stat SSSS     TRM29659.00     NONE0220161598                          TYPE / SERIAL NO
              EPNC_SSSS                                               SINEX CODE
```

- Bernese STA file

```
                                        orig          internally
stat XXXX     TRM29659.00     NONE      0220181598    81598
stat XXXX     TRM29659.00     NONE      0220681598    12345  (arbitrary)
```

- SINEX

```
TRM29659.00     NONE 81598 0.1556 0.0016 0.0000 0.1641 0.0013 0.0000 EPNC_XXXX
```

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Maintenance of EPN Indiv. Antenna Calibration file

General principle:

New release of epnc_xx.atx

- simultaneously with update of igsxx.atx file :

wk: 1400	wk: 1632	wk: 1934	
igs05.atx	igs08.atx	igs14.atx	
epnc_05.atx	epnc_08.atx	epnc_14.atx	→ indiv only
epn_05.atx	epn_08.atx	epn_14.atx	→ igsxx.atx + indiv

- additional indiv. calibrations for antenna/radomes already included in EUREF solution when indiv. calibration was received by EPN CB
- removed calibrations (more later)
- replaced calibrations (more later)

One an epnc_xx.atx is released:
NO changes to calibrations of antenna/radomes that are used in actual EPN products.

Antenna calibration facilities

- ROBOT calibrations

GEO++ robot system

  - GEO++ GmbH
  - IfE, Univ. Leibniz (University of Hannover, Institute of Geodesy)
  - SenStadt BERLIN (State Survey Authorities of Berlin)
  - GeoScience Australia
  - ~~LWA, TU Dresden~~
- Chamber calibrations
  - IGG, Univ. Bonn (University of Bonn, Institute of Geodesy and Geoinformation)

Links at http://epncb.oma.be/_documentation/equipment_calibration/

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Changes from epnc_08.atx to epnc_14.atx

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✓ **1 removed calibration :**

Calibration facility not recognized by IGS

```
TRM55971.00      TZGD 30260441   FIELD LWa        KLOP00DEU
```

✓ **8 additional individual calibrations :**

Antenna/radome already in the routine EPN solutions when we received the calibration, or for new EPN stations.

```
JAV_RINGANT_G3T NONE 316         BONN CHAMBER     POTS00DEU
LEIAR25.R4      LEIT 10471002    GEO  ROBOT       CTAB00CZE
LEIAR25.R4      LEIT 10361017    GEO  ROBOT       CLIB00CZE
LEIAR25.R4      LEIT 10401009    GEO  ROBOT       CPAR00CZE
LEIAR25.R4      LEIT 10161007    GEO  ROBOT       CRAK00CZE
TPSCR3_GGD      CONE 2170400     GEO  ROBOT       COMO00ITA
LEIAR25.R4      LEIT 725072      GEO  ROBOT       LDB200DEU       new station
TPSCR3_GGD      CONE 2170244     GEO  ROBOT       LDB200DEU       new station
```

✓ **4 replaced individual calibrations :**

Robot calibrations replaced by chamber calibrations for these antenna with both robot and chamber calibrations

```
LEIAR25.R3      NONE 09300021    BONN CHAMBER     DOUR00BEL
LEIAR25.R3      LEIT 10240009    BONN CHAMBER     WRLG00DEU
LEIAR25.R4      LEIT 726339      BONN CHAMBER     ISTA00TUR
```

22 antenna/radomes with more than one set of calibrations

AUBG	LEIAR25.R4/LEIT	11013	ROBOT (GEO)	CHAMBER (BONN)
BORJ	LEIAR25.R3/LEIT	00021	ROBOT (GEO)	CHAMBER (BONN)
DIEP	LEIAR25.R4/LEIT	25268	ROBOT (GEO)	CHAMBER (BONN)
DILL	LEIAR25.R4/LEIT	25058	ROBOT (GEO)	CHAMBER (BONN)
DOUR	LEIAR25.R3/NONE	00021	ROBOT (GEO)	CHAMBER (BONN)
DRES	LEIAR25.R3/LEIT	70015	ROBOT (GEO)	CHAMBER (BONN)
EUSK	LEIAR25.R4/LEIT	25299	ROBOT (GEO)	CHAMBER (BONN)
GELL	LEIAR25.R4/LEIT	25266	ROBOT (GEO)	CHAMBER (BONN)
GOR2	LEIAR25.R4/LEIT	25057	ROBOT (GEO)	CHAMBER (BONN)
HEL2	LEIAR25.R3/LEIT	20025	ROBOT (GEO)	CHAMBER (BONN)
HELG	LEIAR25.R4/LEIT	25559	ROBOT (GEO)	CHAMBER (BONN)
HOE2	LEIAR25.R3/LEIT	70026	ROBOT (GEO)	CHAMBER (BONN)
HOE2	LEIAR25.R4/LEIT	25267	ROBOT (GEO)	CHAMBER (BONN)
HOFJ	LEIAR25.R4/LEIT	11018	ROBOT (GEO)	CHAMBER (BONN)
ISTA	LEIAR25.R4/LEIT	26339	ROBOT (GEO)	CHAMBER (BONN)
KARL	LEIAR25.R4/LEIT	25092	ROBOT (GEO)	CHAMBER (BONN)
LDB2	LEIAR25.R4/LEIT	25072	ROBOT (GEO)	CHAMBER (BONN)
LEIJ	LEIAR25.R3/LEIT	90011	ROBOT (GEO)	CHAMBER (BONN)
RANT	LEIAR25.R4/LEIT	25552	ROBOT (GEO)	CHAMBER (BONN)
SAS2	LEIAR25.R4/LEIT	25558	ROBOT (GEO)	CHAMBER (BONN)
WARN	LEIAR25.R3/LEIT	50002	ROBOT (GEO)	CHAMBER (BONN)
WRLG	LEIAR25.R3/LEIT	40009	ROBOT (GEO)	CHAMBER (BONN)

Included in epnc_14.atx

Not included in epnc_14.atx (priority given to CHAMER)

Not included in epnc_14.atx (for active EPN stations and arrived after release)

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All available indiv. calibrations for EPN stations

G01	G02	G05
196	196	13
222	222	31

R01	R02	R03
155	155	1
178	178	1

E01	E05	E06	E07	E08
13	13	13	13	12
31	31	31	31	30

C01	C06	C07
1	1	1
1	1	1

J01	J02	J05	J06
1	1	1	1
1	1	1	1

S01	S05
1	1
1	1

LEIAR25.R4-LEIT-26339-BONN-20151013-ISTA.atx 2015-10-13

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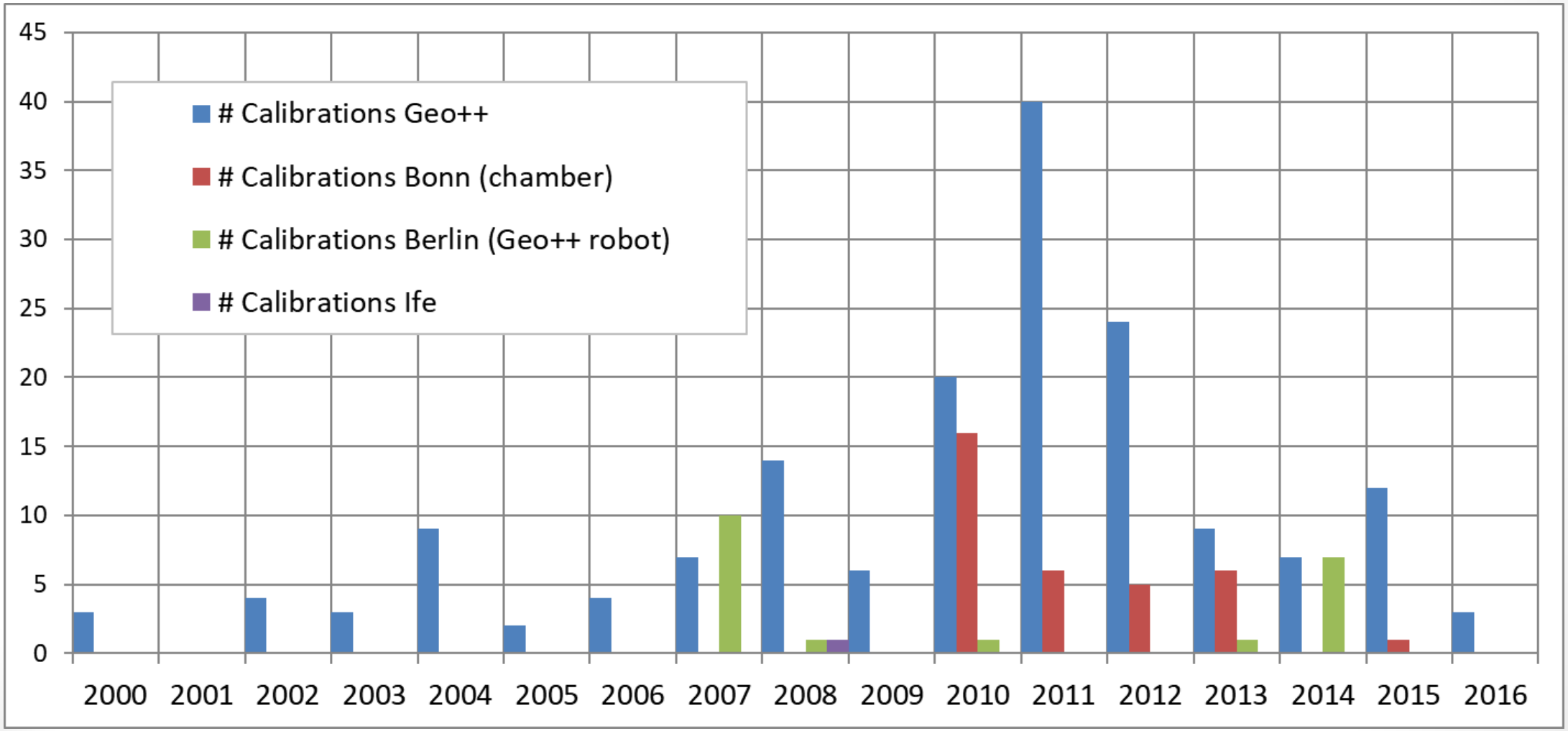
Calibration dates



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Where to find all this info on EPN CB?

EPN stations:

ftp://epncb.eu/ftp/station/general/indiv_calibrations/ 222 indiv. antenna calibrations

ROBOT: 20 Senstadt BERLIN + 1 Univ Leibniz Hannover, IfE + 167 GEO++

CHAMBER: 34 Bonn

LEIAR25-LEIT-20006-GEO-20081103-ADAR.atx

ANTENNA_NAME-RADOME_NAME-ANTENNA SERIAL NUMBER (last 5 digits)
-CALIBRATION FACILITY-CALIBRATION DATE-STATION NAME (4CHAR)

ftp://epncb.eu/ftp/station/general/ epnc_xx.atx and epn_xx.atx

EPN densification stations:

ftp://epncb.eu/station/densification/indiv_calibrations 12 indiv. antenna calibrations

ROBOT: 11 GEO++

CHAMBER: 1 Bonn

Thank you

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