

# Charter on EPN Reprocessing



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# Outline



- Introduction
- Status
- Results of the survey/poll
  - Software, Standards, Available Input-Products
- Working Plan
- Concluding Remark





# Introduction



- Coordinates are dependent on:
  - Reference system realizations
  - Correction models (e.g. PCV [abs])
  - Analysis strategy } so are the orbits and ERPs
- Therefore inconsistencies in the coordinates (time series) are obvious.
- First reprocessing initiative has been carried out by Potsdam-Dresden-Group for 1994-2007.
- Currently the IGS is involved in the reprocessing of the global IGS network.
- **Solutions of the EPN are strongly dependent on the products used! Therefore inconsistency are transferred by the applied products.**





# Status



- Reprocessing activities have been started by several LACs of the EPN
    - **EPN related:** WUT entire EPN \*), ROB \*\*), BEK \*), SGO \*\*), DEO \*\*\*)
    - **Others:** IGN , OLG, GOP, SUT
- Products used: \*) PDR05, \*\*) IGS-final, \*\*\*) JPL-Products
- During the LAC workshop in Frankfurt 2009 six LACs indicated an interest to participate in a reprocessing initiative of EUREF.
  - The analysis coordinator (BKG) confirmed to combine the reprocessed solutions (similar interest by SGO).
  - EPN Central Bureau would set up a dedicated data center with all the available data.
  - Preparation of a charter for a working group "Reprocessing" and presentation to the EUREF TWG by Christof Völksen (BEK).
    - Questionnaire sent to all the LAC and evaluation (review)



# Results of the Survey



## Contents:

- Participation (LAC and/or data center)
- Recent reprocessing activities of the LACs and purpose
- Network size (capability/ add sites)
- Strategy proposed
- Software to be used
- GPS or GPS/GLONASS,
- Models to be used (e.g. absolute PCV [type or indiv. Calibration])
- Synchronize data of the data centers,
- Update RINEX headers
- General ideas



## Participation in the planned activities

	LAC	Data Center
ASI	X	X
BEK	X	
BKG	(X)	X
DEO	X	
GOP	X	
IGE	X	(X)
IGN		(X)
NKG Bernese	X	
NKG GAMIT	X	
OLG	X	X
ROB	X	X
SGO	X depends	
SUT	X	
SWISSTOPO	X	
WUT (BERNESE/ GAMIT)	X	

**Very positive resonance  
by the different LACs!**

# Existing Reprocessing Activities

<b>ASI</b>	N/A
<b>BEK</b>	Reprocessing of the BEK sub-network was carried out for the years 1996-2007 applying EPN strategy!
<b>BKG</b>	N/A
<b>DEO</b>	Reprocessed the entire data sets several times after upgrade to new models (PCV etc.)
<b>GOP</b>	Reprocessed Czech GNSS sites, following EPN options after GPSW 1400, time span 2005-2008.
<b>IGE</b>	N/A
<b>IGN</b>	We have already reprocessed our data (RGB), including some EPN stations, spanning 1998 until 2007 using the "official IGS products" and the standard analysis options we use for the LAC processing. From GPS week 1463, the network <b>has been enlarged to a global one</b> including the IGS stations from the core network (about 340 stations).
<b>NKG Bernese</b>	N/A
<b>NKG GAMIT</b>	No, but we have performed some "re-processing" of old data within the BIFROST effort (some 47 EPN sites and totally some 80).
<b>OLG</b>	IGS+other stations of MON for 2000-2002, but not relevant for EPN
<b>ROB</b>	FIRST TEST REPROCESSING OF FULL EPN and ROB NETWORK IS DONE. NEW REPROCESSING WILL BE STARTED WITH REPROCESSED IGS ORBITS SOON.
<b>SGO</b>	I reprocessed the last 6 years of the SGO sub-network (30 sites) also adding the sites of the Hungarian GNSS network (+40 sites). The current EPN standards were used.
<b>SUT</b>	We did the reprocessing of network of about 45 permanent GPS stations in Central Europe, majority of them are the EPN stations. The reprocessing started from 1996.0 with 13 stations and finished in 2007.0 with 45 stations.
<b>SWISS- TOPO</b>	N/A
<b>WUT</b>	We made a trial reprocessing of the whole EPN network (1996-2007) in 2008. As a result we have weekly and daily solutions.



# Software



For the reprocessing activities of the EPN different software packages would be available:

- BERNESE 5.0 (8), GAMIT(WUT/NKG), MicroCosm 2007.0 (ASI), GIPSY/OASIS (ASI)

Different software packages will foster the discussion on the best analysis strategy.

- tropospheric mapping function (e.g. VMF, GMF - GAMIT, BERNESE 5.1)

Different approaches for the comparison are possible:

- Sub-network (e.g. BERNESE) by sub-network (GAMIT) or
- EPN (BERNESE) by EPN (GAMIT) (also GIPSY / MicroCosm)







# Standards



Standards have to be defined beforehand (task of the WG).

- Application of abs. PCV (type mean or individual calibrations)
  - Conform with the IGS
  - "Best available" (individual calibrations), (much) later near-field
- Mapping functions to be used (available in all software packages to be used)
  - VMF, GMF, IMF
- Datum realization
  - Regional (define selected reference sites)
  - Global approach (How to realize this?)
- Exchange of solutions?
  - Standard SINEX (coordinates and covariance matrix)
  - SINEX including NEQ (soon to be released by BERN)
- GLONASS?



## PCV Model to be used?

<b>ASI</b>	In this EPN reprocessing project IGS reprocessed products will be used so it is advisable to be conform with IGS.
<b>BEK</b>	Conform with the IGS sites and for the EPN sites best available (e.g. individual calibrations), very critical decision
<b>DEO</b>	Be conform with the IGS reprocessing.
<b>GOP</b>	We think that the IGS stations should be conform with the IGS reprocessing.
<b>IGE</b>	We think that the best available corrections is the best option.
<b>IGN</b>	Should use the up-to-date igs.atx file, including some individual antenna calibration models for some EPN stations.
<b>NKG Bernese</b>	We are in favour of using the best available antenna models. We assume we are talking about the antenna models at the receiver side and then We do not see that there should be any problems with consistency when using IGS-products (accept that the IGS05-coordinates will not fit on IGS-stations with individual antenna calibrations).
<b>NKG GAMIT</b>	In principle we are in favour of using the best available antenna models. However, for combination with the SOPAC global solution, IGS type calibration must be used, also we have no experience with using individual calibration tables with GAMIT. (Actually, we do not know if it can be used in our current version on the software.)
<b>OLG</b>	Best available (e.g. individual calibrations)
<b>ROB</b>	BOTH APPROACHES HAVE THEIR DISADVANTAGES/ADVANTAGES. IN ANY CASE AN IGS CONFORM REPROCESSING HAS TO BE DONE. THE BEST AVAILABLE CAN BE ADDED FOR TEST PURPOSES.
<b>SGO</b>	The term 'best available' is misleading. The individual PCV pattern makes less difference within one type as the local effects may cause. Practically this term does not bother me, just I do not believe this is true.
<b>SUT</b>	I prefer the best available corrections
<b>SWISSTOPO</b>	Difficult to say: here it is open to use a standard model of IGS/EPN (also important for densification of the ITRF2008) or to use always the newest model (discrepancies with ITRF / IGS). By the way: with the recent antenna change in WTZR we have absolute individual antenna values for the EPN standard processing (and also reprocessing), but group values for the ITRF2008 / IGS processing. Therefore: also feasible is to use the newest group absolute antenna PCVs (no individual models as in standard processing) - this to ensure also the compatibility to IGS / Reprocessing of IGS.
<b>WUT</b>	We think that "the best available" corrections should be used. As a conclusion from our trial reprocessing, we think, that absolute models of all antennas (made in laboratories) would be the best option.



# Input - Products



For the coordinated reprocessing activities of the EPN the best available products should be used.

Available are:

- PDR05 (of the Potsdam-Dresden-Group)
- Reprocessed orbits by the different IGS analysis centers are available at CDDIS: (<http://cddis.gsfc.nasa.gov/pub/gps/products/week/repro1>)

Combined reprocessed IGS final are yet not available and cannot be expected before the release of the ITRF08. (Possibly a new reprocessing campaign "repro2" will be started).

GLONASS orbits are yet **not** included in the reprocessed products!

➔ Currently only the PDR05 products cover a sufficient large time span to reprocess the entire EPN.





# Working Plan (I)



- Establishment of a working group "Reprocessing" that coordinates the multiple task of this project. Will discuss detailed problems in connection with the LACs.
- Redistribution of the EPN sites with the focus on redundancy (preferred 3 LACs for each site).
- Selection of suitable sets of reprocessed products as input for the first analysis of the 2007 data (**pilot phase**).
- Each participating LAC shall setup the facilities for the reprocessing of the 2007 data.
- Development of a common strategy to be used by all participating LACs. (At the moment EPN-Strategy preferred.)





## Working Plan (II)

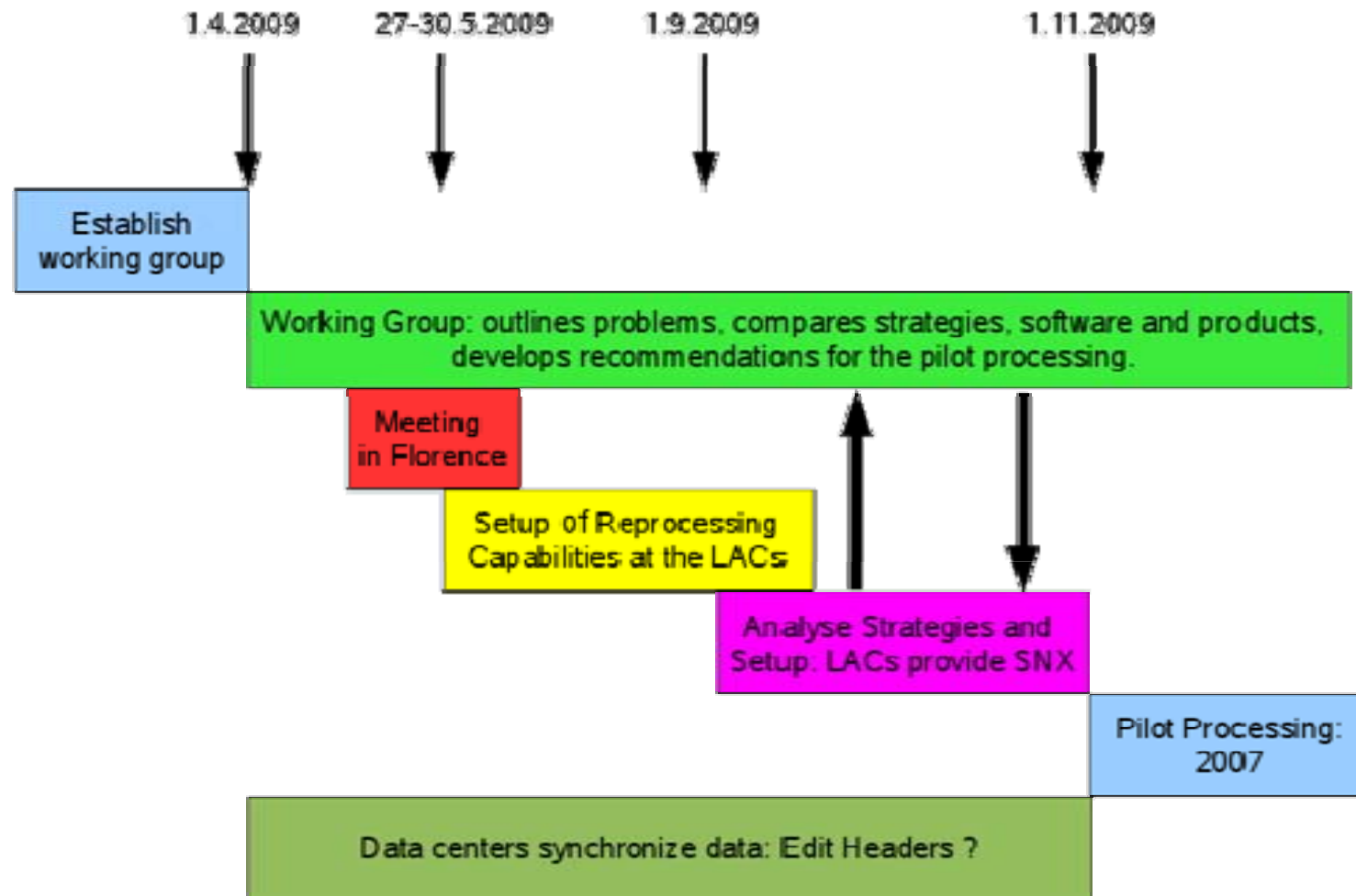


- Analysis of the daily/weekly coordinates by the participating LACs and supplying the results to the analysis coordinator.
- Combination of the different solutions by the analysis coordinator, reports and feedback to the working group and the LACs.
- Development and study of new strategies for the analysis of the entire EPN data set (1996-200x).
- Analysis of the complete EPN data set by the participating LACs.
- Estimation of reprocessed coordinates and velocities for the entire EUREF permanent network.





# Time table until "Pilot Phase"





# Advantages of the Reprocessing



- Reprocessed coordinates are consistent according to
  - the applied standards (models, software, analysis strategy)
  - reference system realization
  - used products
- Each LAC will establish "reprocessing capabilities"
  - Management of large data sets will allow to improve, based on the long time data sets, the reference system realization (ITRF08, ITRFxx..).
  - Reprocessing capabilities will also be used on smaller regional networks (national level - as already done).
- Long time geodynamic studies will certainly be improved due to the consistent time series.
- The "best possible" results of the reprocessing activities can also be used for other studies
  - Troposphere, review on the existing data with EPN project troposphere

