# EPN Reprocessing

# a new EPN Project

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http://epn-repro.bek.badw.de

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250 Jahre
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2009

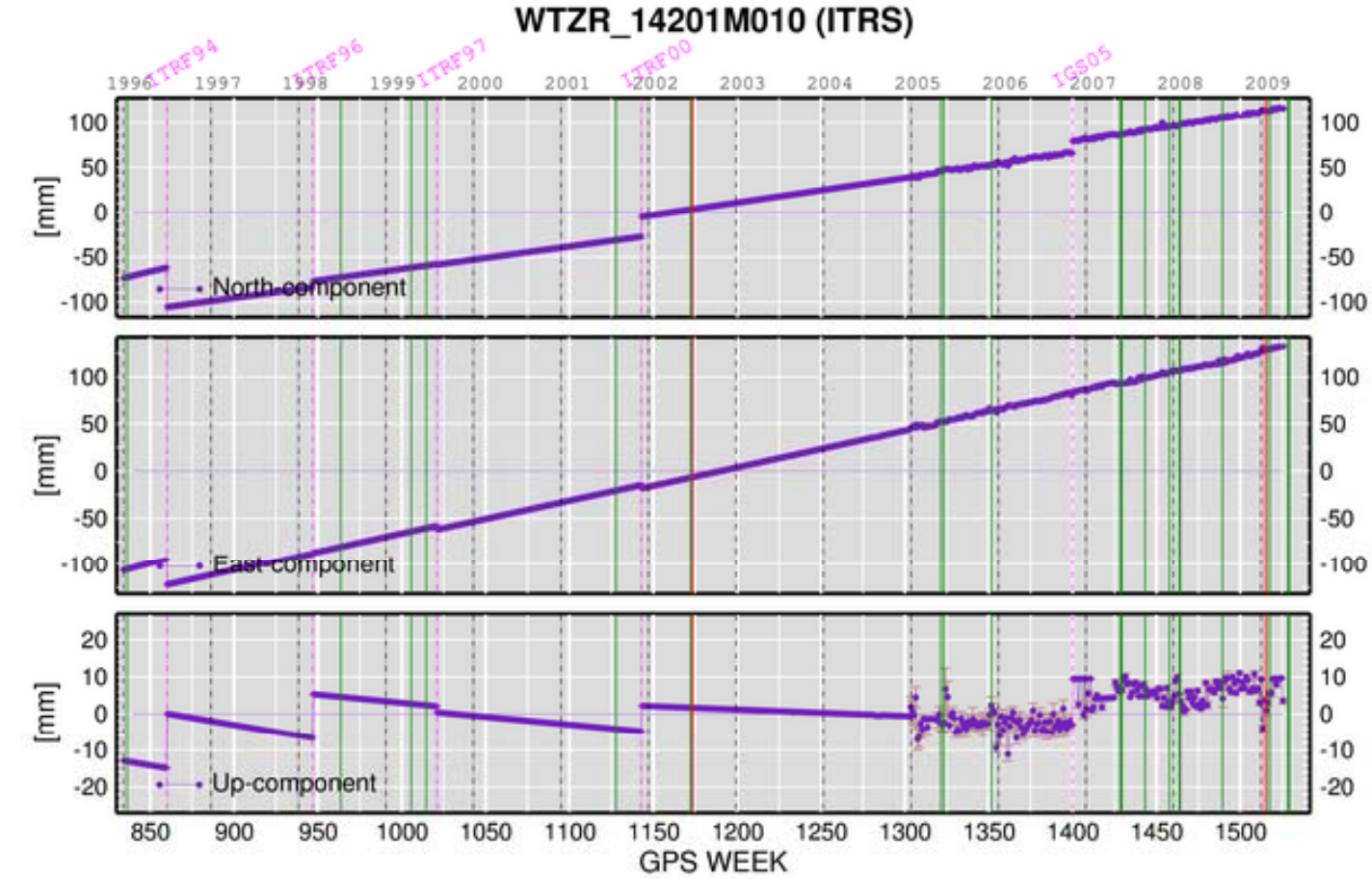
# Introduction

- 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 if one of the above factors has been changed.
- First global reprocessing initiative has been carried out by Potsdam-Dresden-Group for 1994-2006.
- Currently the IGS is involved in the reprocessing of the global IGS network (REPRO1).
- **Solutions of the EPN are strongly dependent on the products used! Therefore inconsistency are transferred by the applied products.**

# Time Series of Position Changes
# Station Wettzell



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# Evolution of the Initiative for the EPN Project „**Reprocessing**"

- 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
- Six LACs indicated an interest to participate in a reprocessing initiative of EPN during the LAC workshop in Frankfurt 2008.
  - 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 (RINEX).
  - Draft of a charter and presentation to the TWG in Budapest Feb. 2009.
- Establishment of a new EPN Project "Reprocessing" chaired by Christof Völksen (BEK).

# Participation

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

Each LAC will participate in the project Reprocessing!

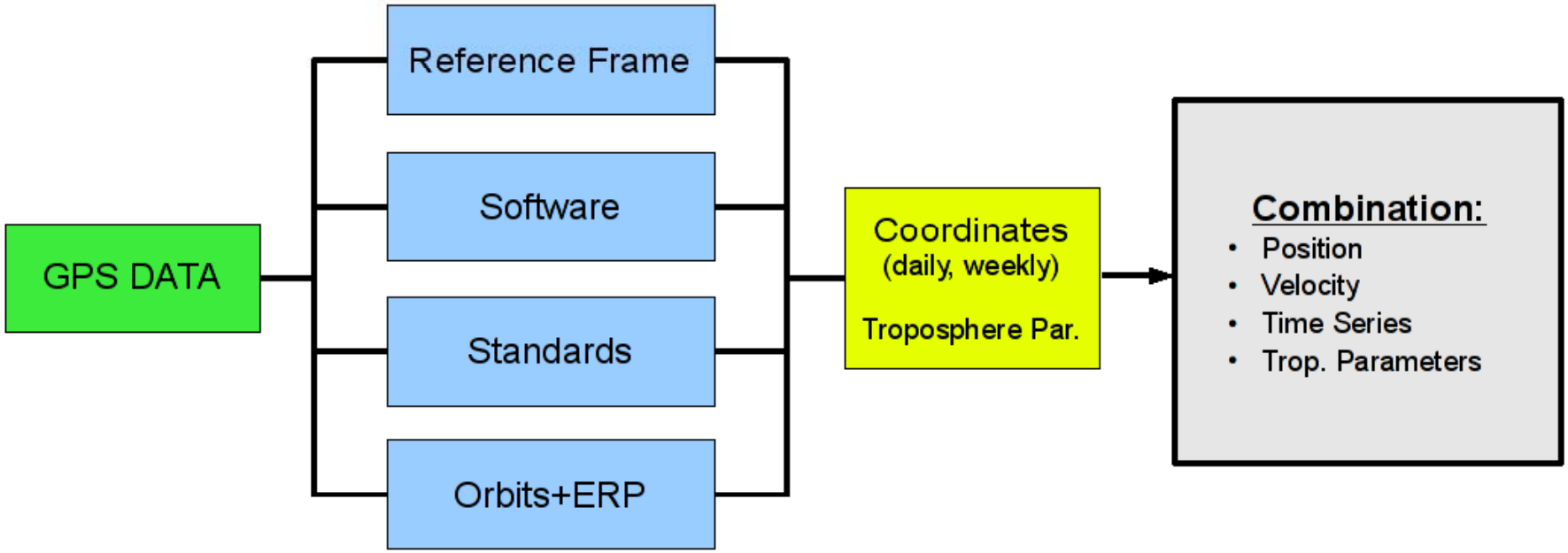
More contribution than in the standard EPN processing can be expected:

- software
- analysis strategies

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

# Processing Flow

**Analysis**



# Software

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

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

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

- Tropospheric mapping function (e.g. VMF, GMF – GAMIT, BERNESE: near future GMF/GPT, etc.)

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)
  - NMF, GMF, IMF or VMF
- Datum realization
  - Regional (e.g. define selected reference sites)
  - Global approach (see Legrand & Bruyninx 2008)
- Exchange of solutions?
  - Standard SINEX (coordinates and covariance matrix)
  - SINEX including NEQ (soon to be released by BERN)

# Input – Products (ORBIT+ERP)

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

Available are:

- PDR05 (of the Potsdam-Dresden-Group) (http://iscd.gfz-potsdam.de)
- Reprocessed orbits by the different IGS analysis centers are available at CDDIS: (ftp://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 (probably by the end of 2009).

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

➔ Currently only the PDR05 products cover a sufficient large time span to reprocess the entire EPN (1994-2006+).

# Working Plan
## (Pilot Phase)

- Establishment of a working group "Reprocessing" that coordinates the multiple task of this project.
- 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 2006 data (**pilot phase**).
- Each participating LAC shall setup the facilities for the reprocessing of the 2006 data.
- Development of a common strategy to be used by all participating LACs. (e.g. current EPN-Strategy)

# Working Group „Reprocessing“

| | | | |
|---|---|---|---|
| Christof Völksen (Chair) | BEK | Stefan Schaer | LPT |
| Rolf Dach | AIUB/ CODE | Lotti Jivall | NKG |
| Carmela Ferraro | ASI | Martin Lidberg | NKG |
| Rosa Pacione | ASI | Cornelia Aichhorn | OLG |
| Heinz Habrich | BKG | Günter Stangl | OLG |
| Wolfgang Soehne | BKG | Carine Bruyninx | ROB |
| Rui Fernandes | DEO | Juliette Legrand | ROB |
| Jan Dousa | GOP | Ambrus Kenyeres | SGO |
| Vratislav Filler | GOP | Jan Hefty SUT | SUT |
| Macelino Valdes | IGE | Miroslava Igondova | SUT |
| Miguel A. Cano | IGE | Alessandro Caporali | UPA |
| Bruno Garayt | IGN | Mariusz Figurski | WUT/MUT |
| Daniel Ineichen | LPT | Karolina Szafranek | WUT/MUT |



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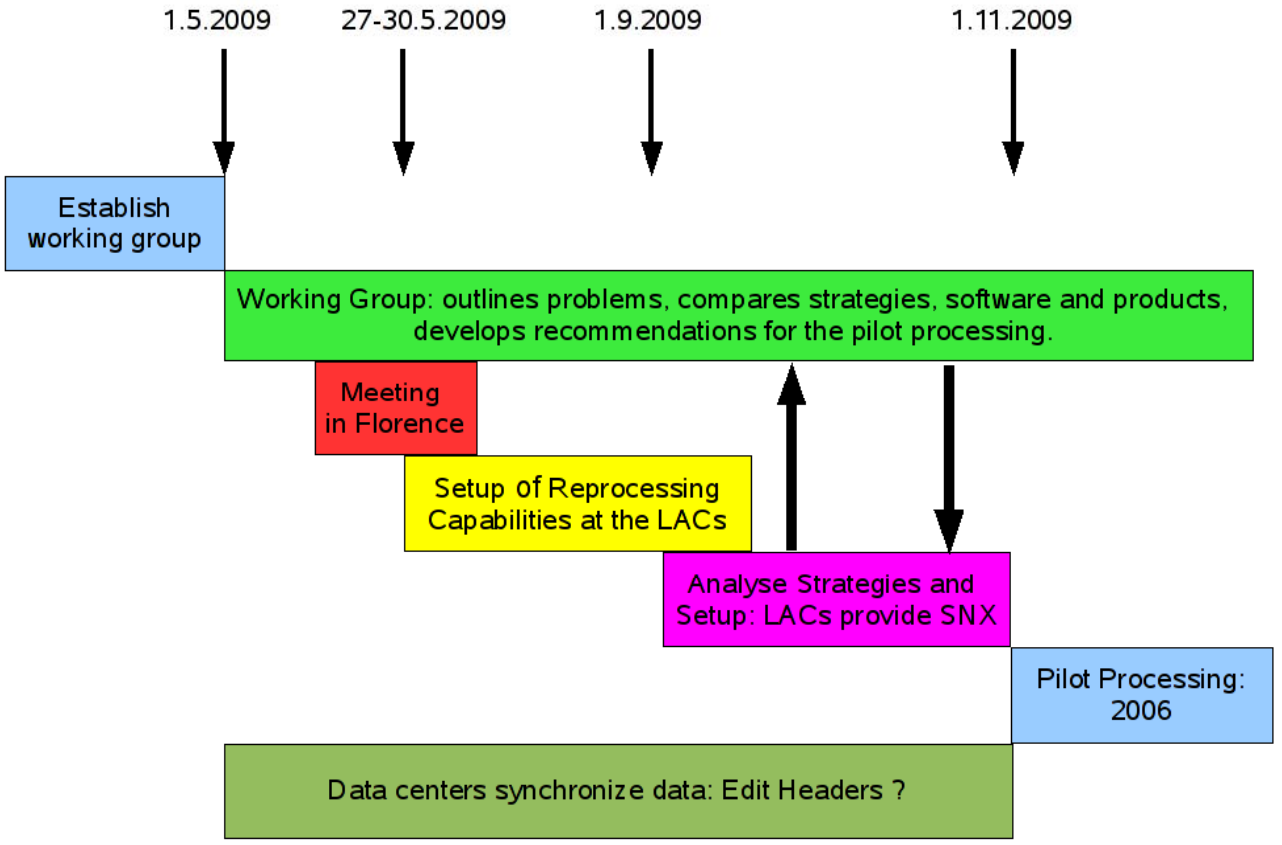
# Time table "Pilot Phase"



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# Working Plan
## (after Pilot Phase)

- Analysis of the complete EPN data set (1996-200x) applying the new strategies and standards.
- 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.
- Estimation of reprocessed coordinates and velocities for the entire EUREF permanent network.

# Conclusions

- Reprocessed coordinates are consistent according to
  - the applied standards (models, software, analysis strategy),
  - reference system realization and
  - 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.
- Reprocessing will probably become an important part of the analysis of GPS data for the coming years (Repro x).