

# **Deformation Integrity Monitoring for GNSS-Positioning Services including a Scalable Hazard Monitoring by the Karlsruhe Approach (MONIKA)**

## **- Software Handling -**

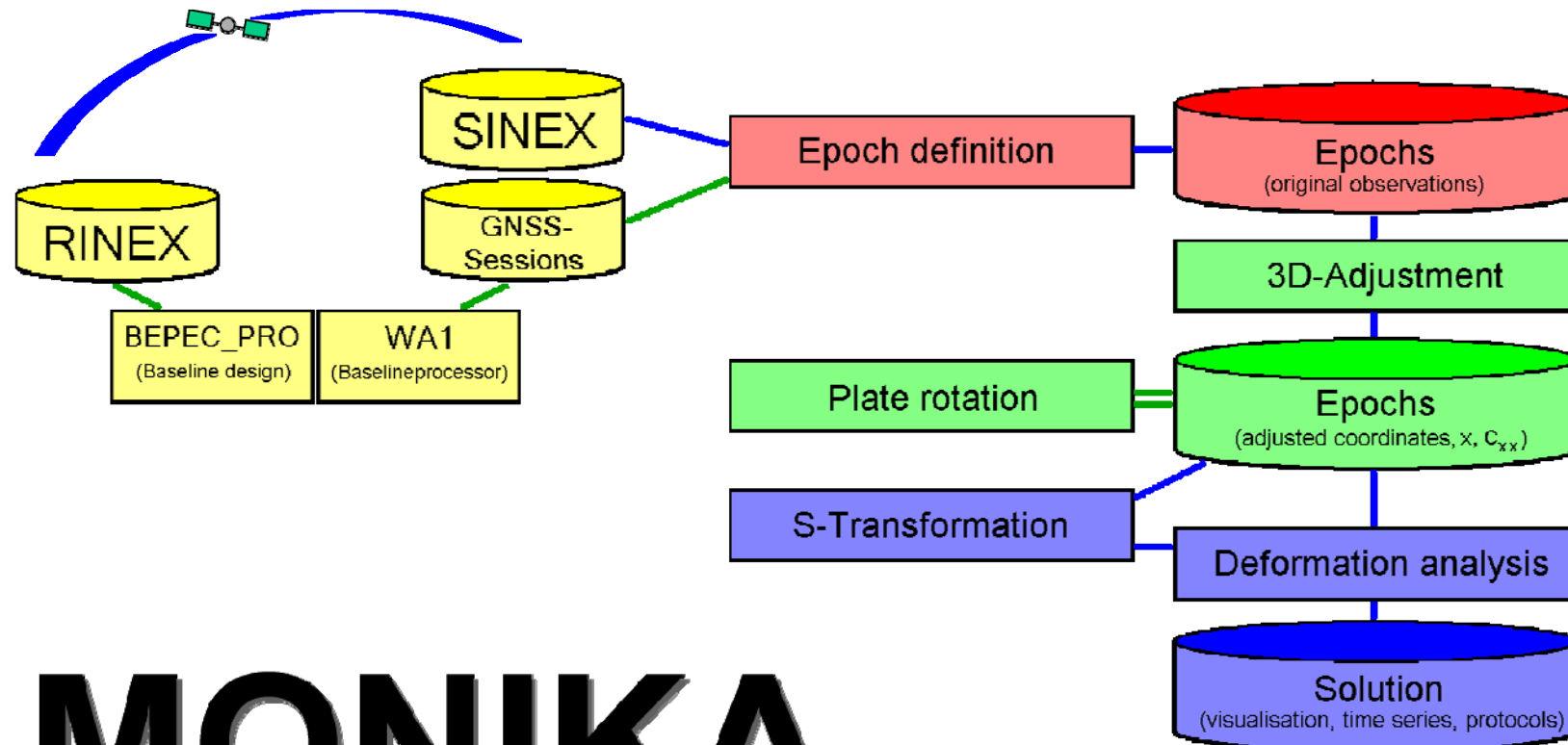
Speaker:

Dipl.Ing. Peter Spohn

# Content

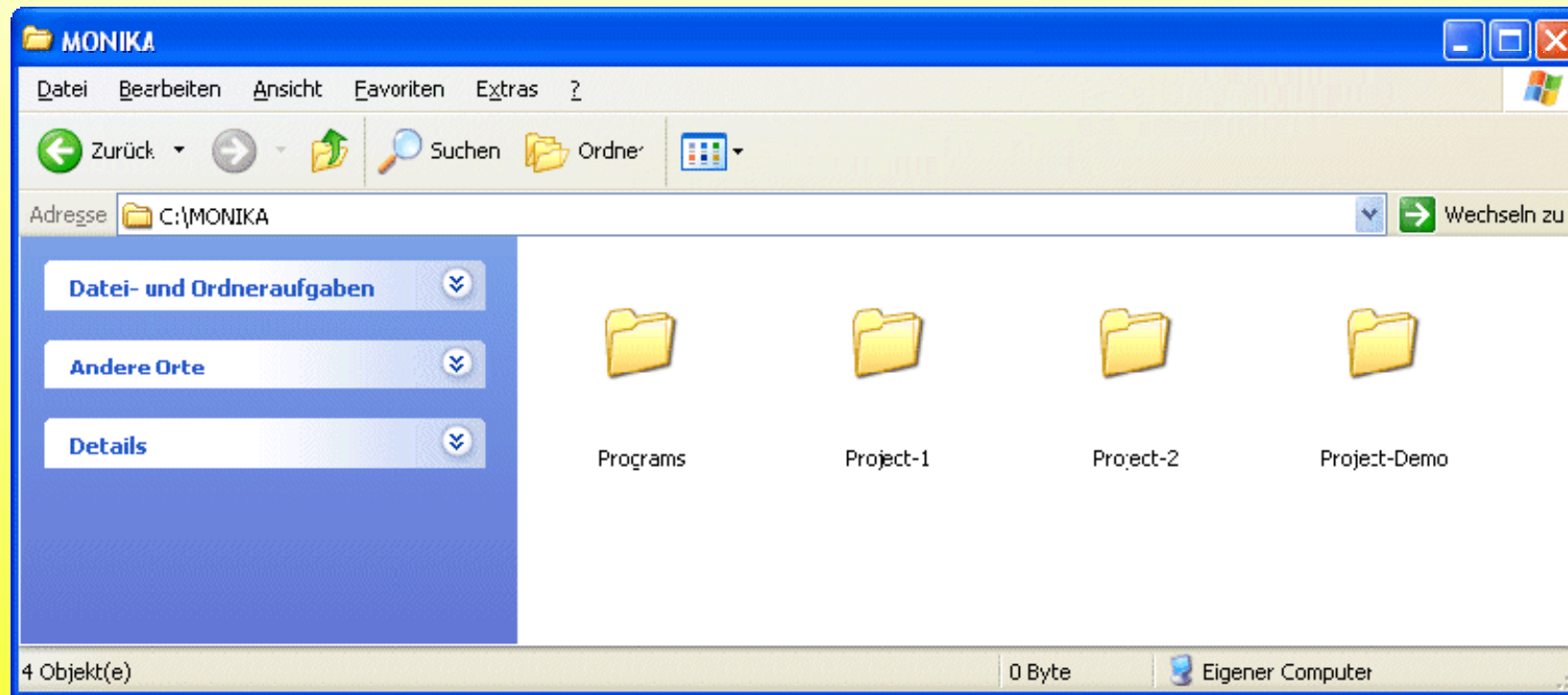
1. Preparations
2. New project
3. Baseline processing
4. Epoch definition
5. 3D-Adjustment
6. Plate rotation
7. Deformation analysis
8. Automations

# Overview



# MONIKA

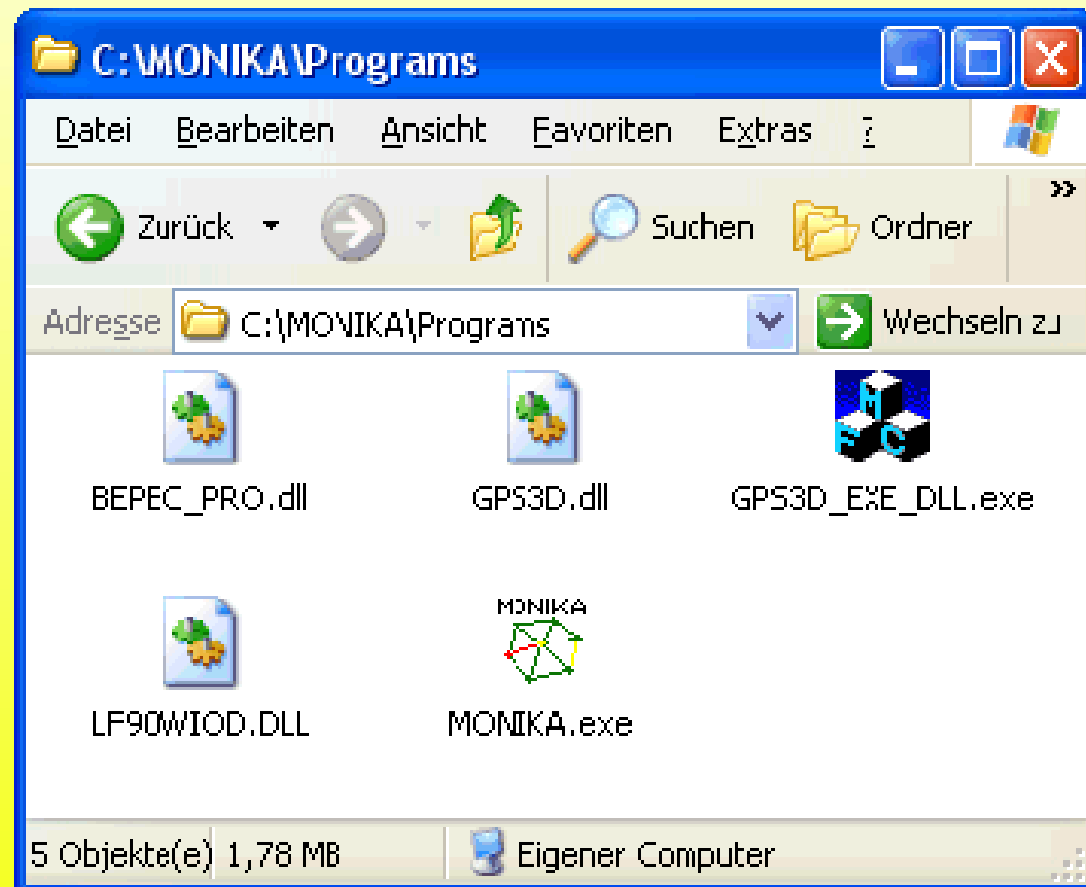
# 1. Preparations



- Project and folder-based file handling

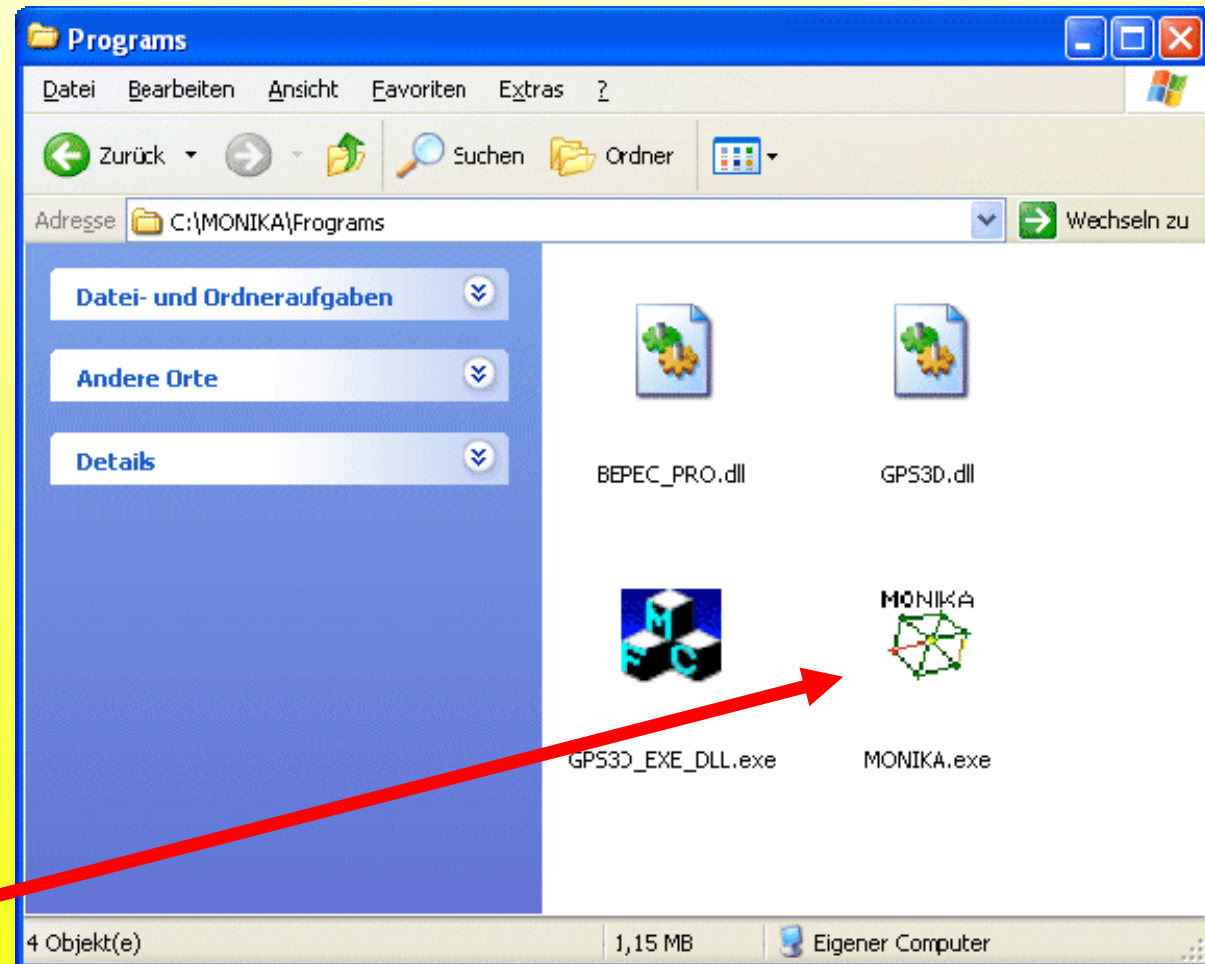
# MONIKA-Files

- MONIKA.exe
- BEPEC\_PRO.dll
- GPS3D.dll
- GPS\_EXE\_DLL.exe
- LF90WIOD.dll



# MONIKA-Files

- MONIKA.exe
- BEPEC\_PRO.dll
- GPS3D.dll
- GPS\_EXE\_DLL.exe

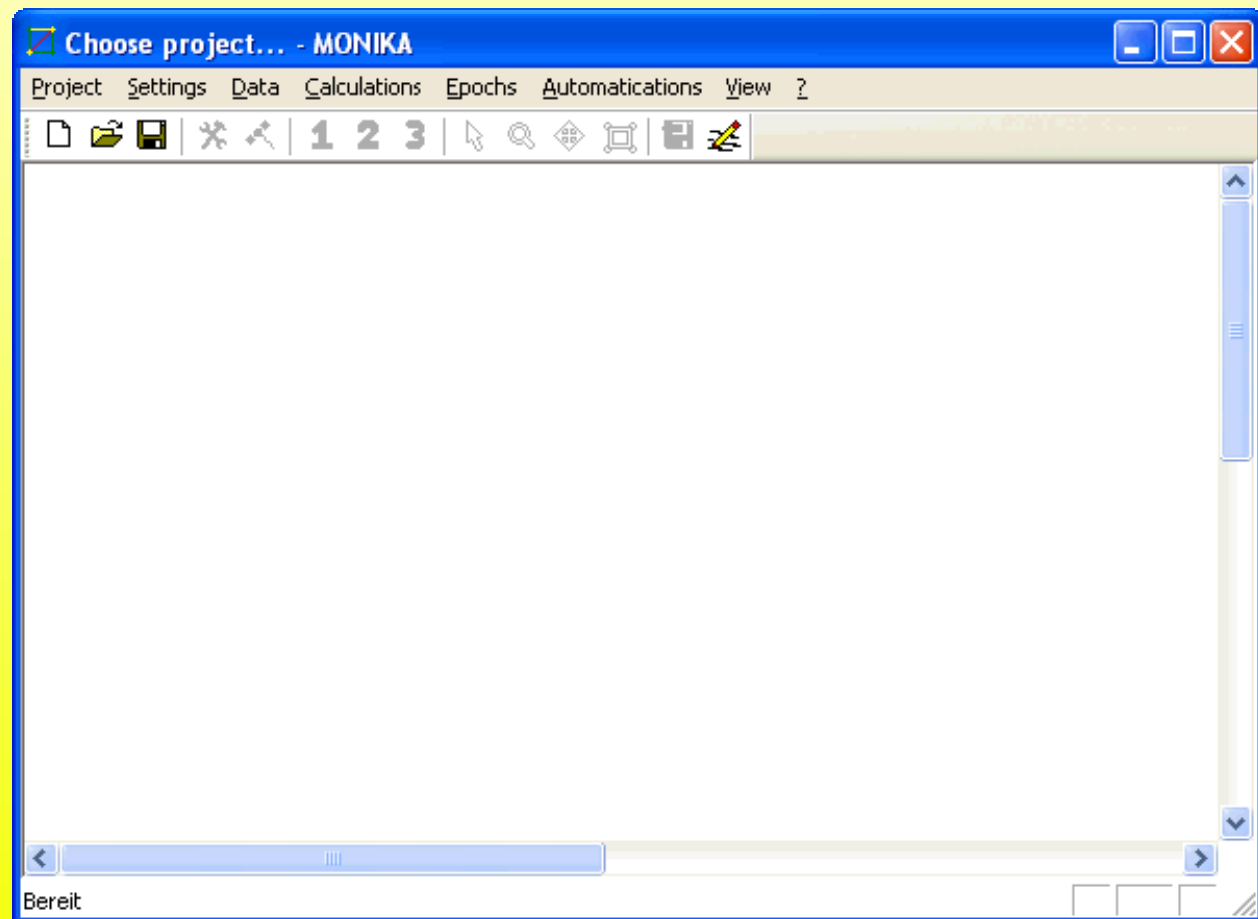


**start MONIKA**

## 2. New project

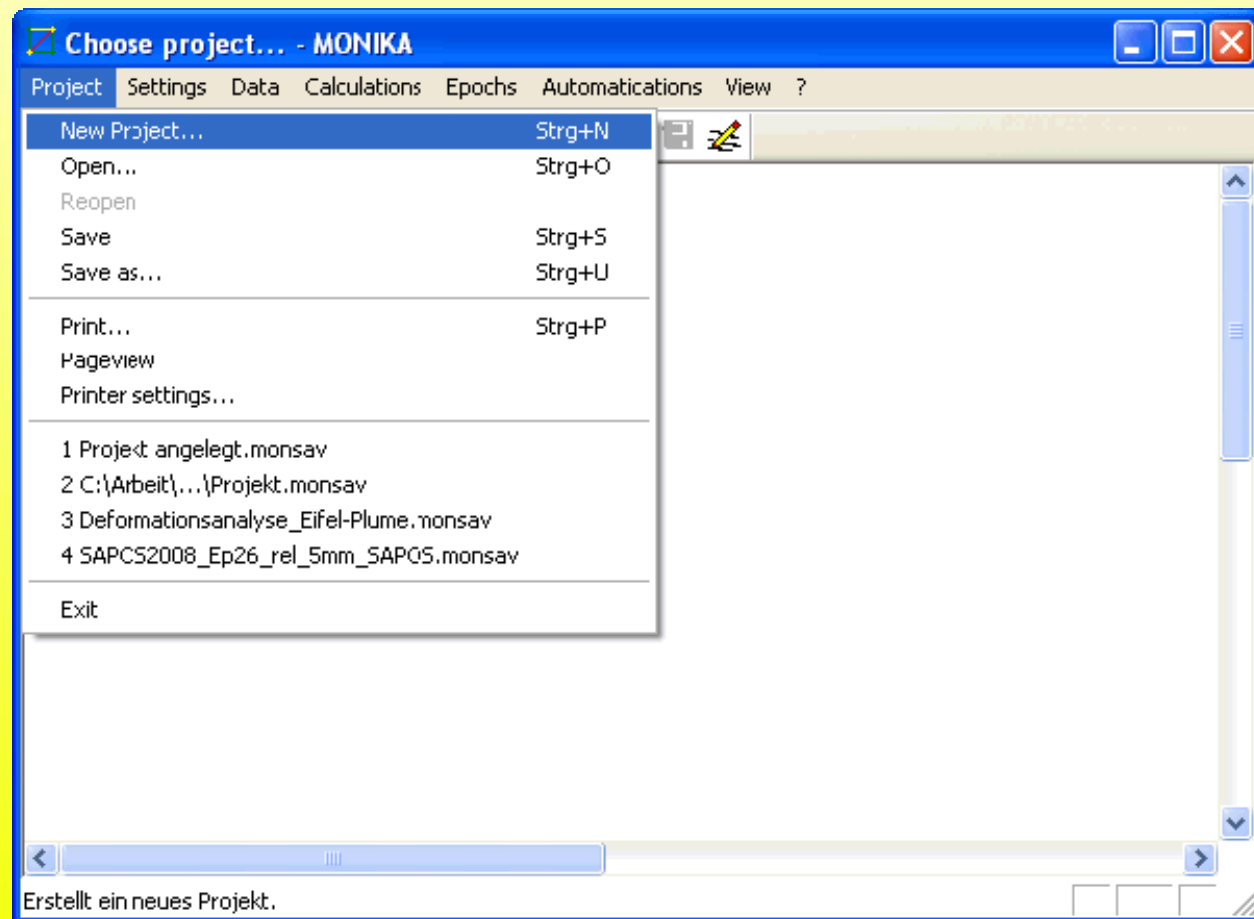
### 2.1 Program window

- menu bar
- shortcut bar
- status bar



2.1 Program window

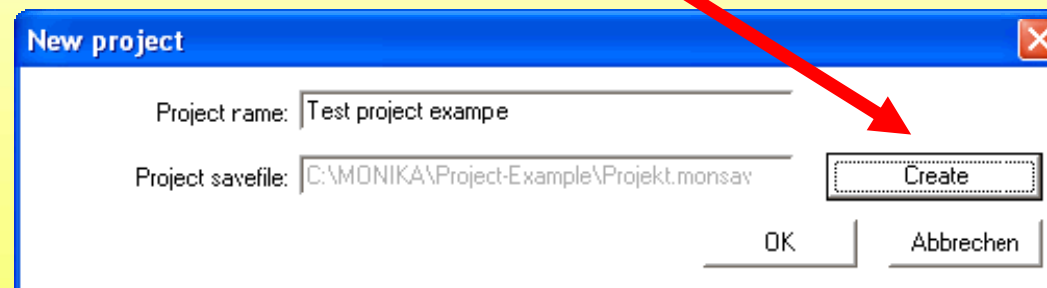
creating a new project



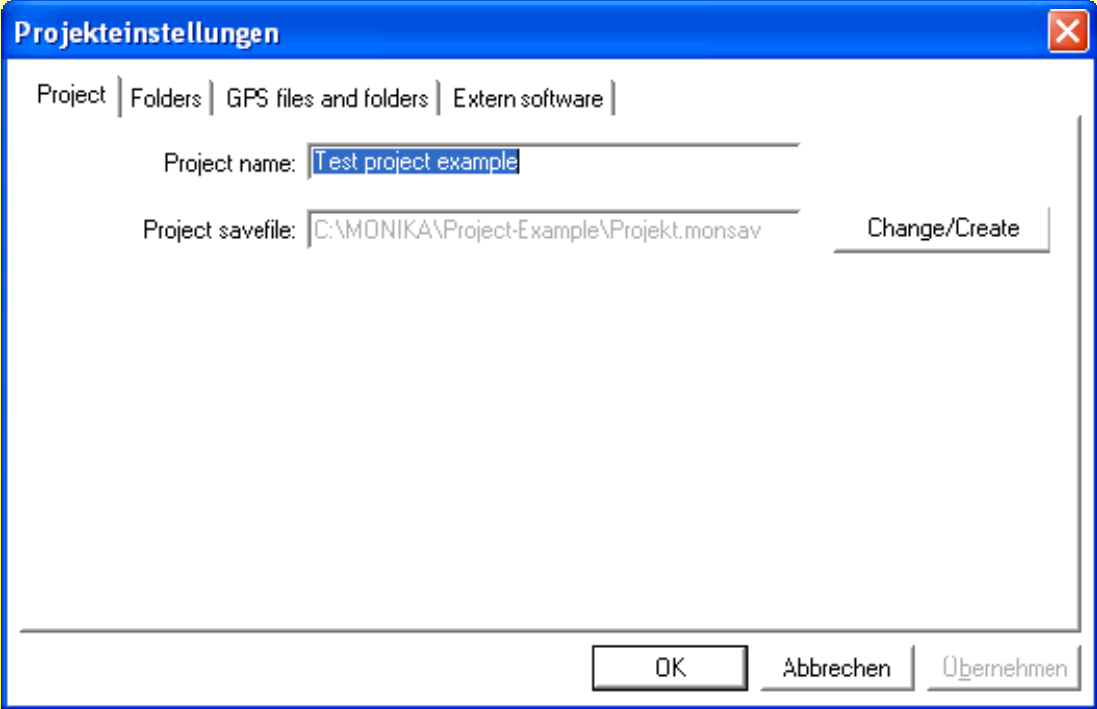
## 2.2 Creating Project



creating a new save file



## Project settings - Project page



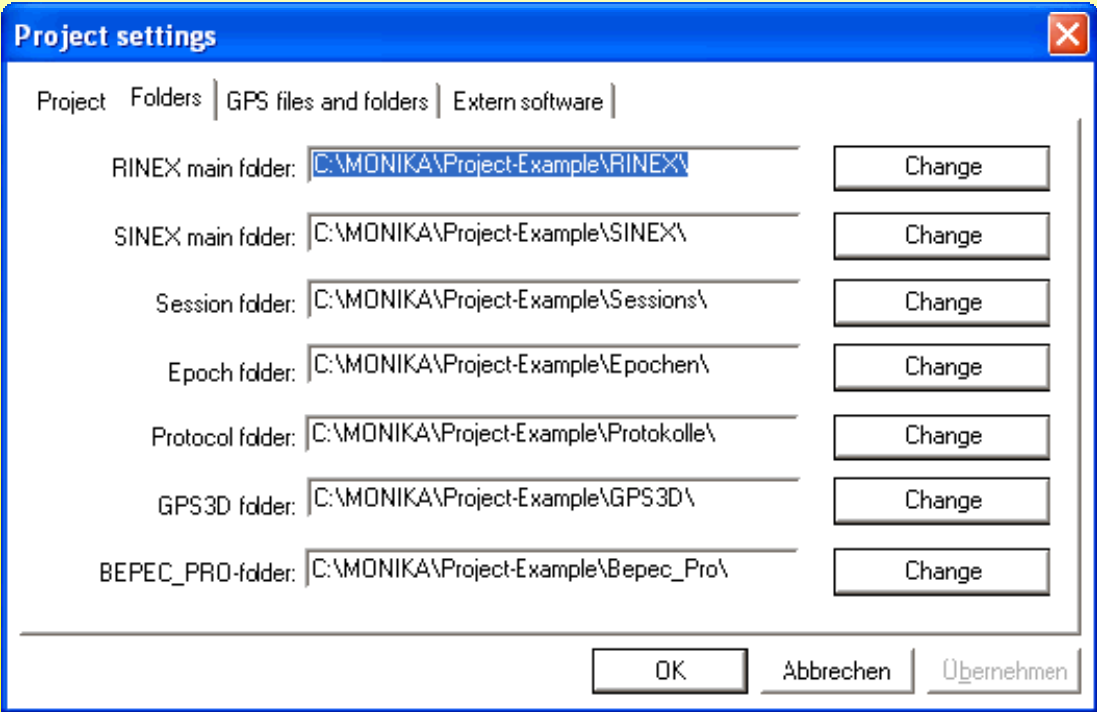
**Projekteinstellungen**

Project | Folders | GPS files and folders | Extern software |

Project name:

Project savefile:

## Project settings - Folders page

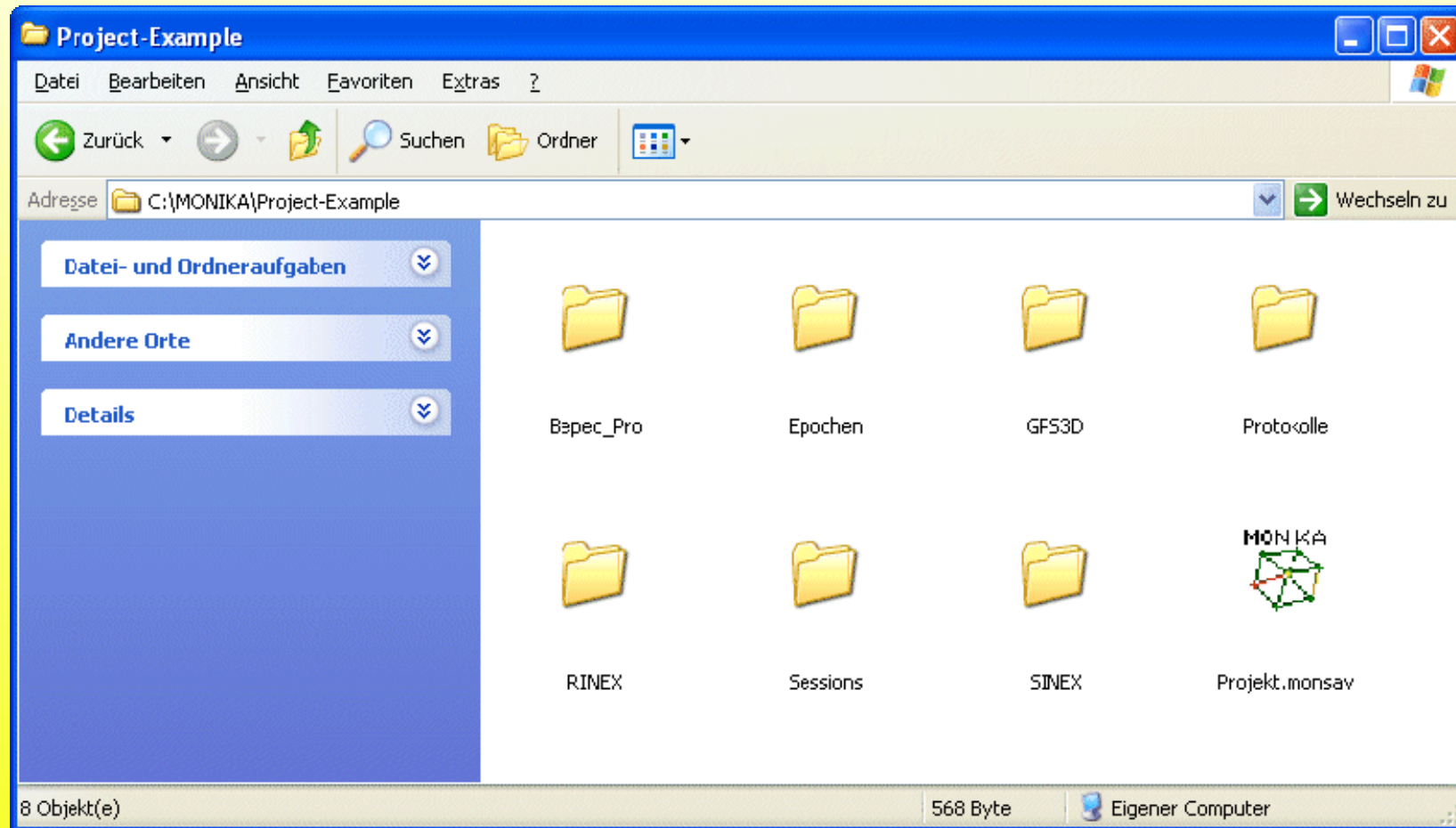


**Project settings**

Project | **Folders** | GPS files and folders | Extern software

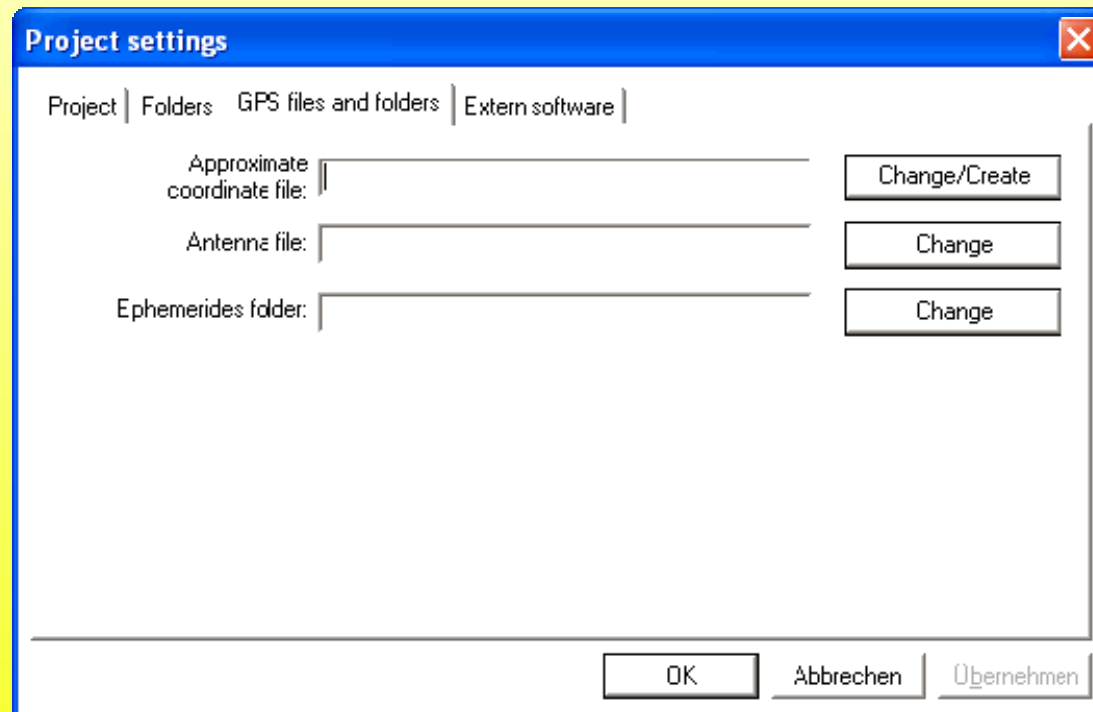
RINEX main folder:	C:\MONIKA\Project-Example\RINEX\	Change
SINEX main folder:	C:\MONIKA\Project-Example\SINEX\	Change
Session folder:	C:\MONIKA\Project-Example\Sessions\	Change
Epoch folder:	C:\MONIKA\Project-Example\Epochen\	Change
Protocol folder:	C:\MONIKA\Project-Example\Protokolle\	Change
GPS3D folder:	C:\MONIKA\Project-Example\GPS3D\	Change
BEPEC_PRO folder:	C:\MONIKA\Project-Example\Bepec_Pro\	Change

OK Abbrechen Übernehmen



folder-based file handling

## Project settings - GPS page



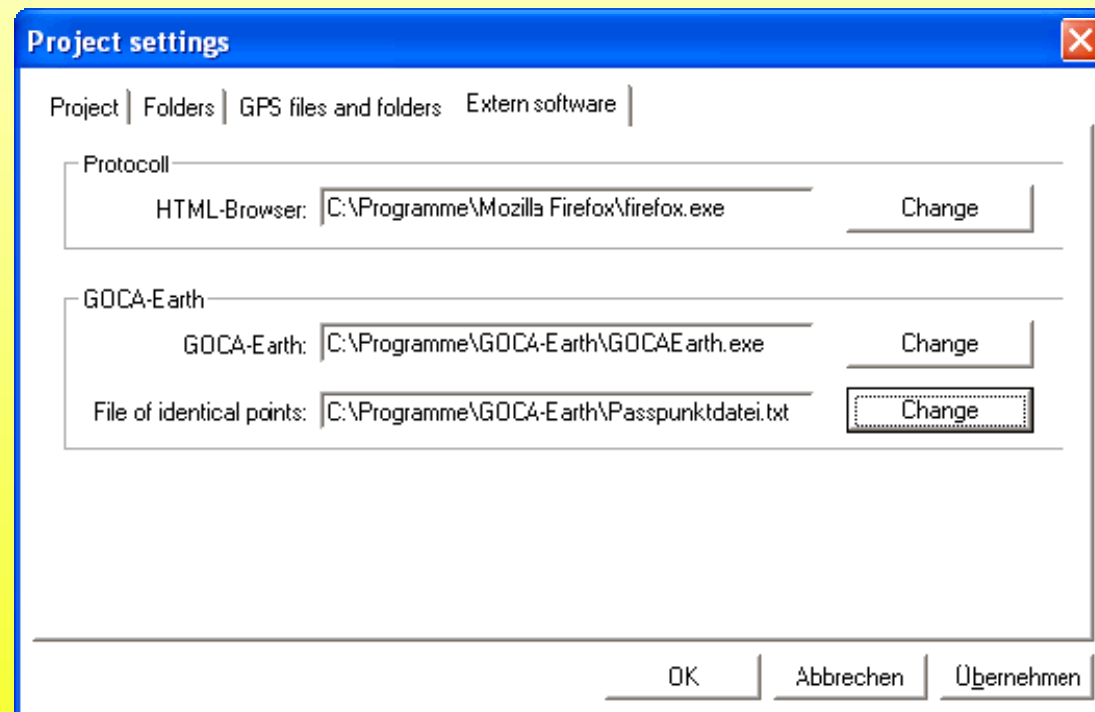
The screenshot shows a 'Project settings' dialog box with a blue title bar and a red close button. It has four tabs: 'Project', 'Folders', 'GPS files and folders', and 'Extern software'. The 'GPS files and folders' tab is selected. It contains three text input fields with corresponding buttons to their right:

- 'Approximate coordinate file:' with a 'Change/Create' button.
- 'Antenna file:' with a 'Change' button.
- 'Ephemerides folder:' with a 'Change' button.

At the bottom of the dialog are three buttons: 'OK', 'Abbrechen', and 'Übernehmen'.

files which are needed for the baseline processing

## Project settings - extern software page



eg. internet browser for protocol viewing

# 3. Baseline processing



## 3.1 Preparatory work

Files needed:

- Aproximate coordinates (for net design) →
- Antenna calibration file
- RINEX files
- Ephemerides data (optional)

SAPPOS-X0.koo - Editor

Datei	Bearbeiten	Format	Ansicht	Σ
C384	4157367.0000	671171.0000	4774690.0000	
C386	4126956.0000	669775.0000	4800826.0000	
C387	4112214.0000	627442.0000	4818951.0000	
C388	4164699.0000	593657.0000	4778281.0000	
C389	4123747.0000	706187.0000	4798643.0000	
C390	4236029.0000	583607.0000	4717073.0000	
C391	4165864.0000	719747.0000	4760759.0000	
C392	4081117.0000	695459.0000	4836010.0000	
C393	4195910.0000	586037.0000	4752085.0000	
C394	4180767.0000	666765.0000	4755490.0000	
C395	4232700.0000	717747.0000	4701825.0000	
C396	4205648.0000	725950.0000	4724763.0000	
C397	4214033.0000	684329.0000	4723570.0000	
C398	4192063.0000	620213.0000	4751866.0000	
C399	4224103.0000	628656.0000	4722440.0000	
FHEB	4276062.0000	573481.0000	4682319.0000	
FRIC	4271934.0000	608891.0000	4682092.0000	
KARL	4146524.0000	615117.0000	4791516.0000	
KREU	4250723.0000	685424.0000	4690487.0000	
SCHA	4348835.0000	646812.0000	4697774.0000	
STGA	4264776.0000	701896.0000	4675676.0000	

SAPPOS Antennendaten Editor

1.3

Written by CCANT (www.wasoft.de) 2008-09-11 10:52:10

SAPPOS Antennendaten Editor

Edited by Hans-Joerg Niek, Ref. 01, /0000-00-01

10041747.00 1/10/747071

10001

2.0 90.0 5.0

2

0.0 0.48 10.00

NOZZ 0.00 -0.09 -0.24 -0.06 -0.31 -0.30 -0.39 -0.30 -0.33 -0.07 -0.42 -0.30 -0.22 -0.40 -0.12 0.02 0.09 0.44

0.0 0.00 -0.11 -0.29 -0.02 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20 -0.20

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50.0 0.00 -0.02 -0.11 -0.01 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11 -0.11

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95.0 0.00 0.00 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02

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110.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

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140.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

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160.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

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170.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

175.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

180.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

185.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

190.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

195.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

200.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

205.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

210.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

215.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

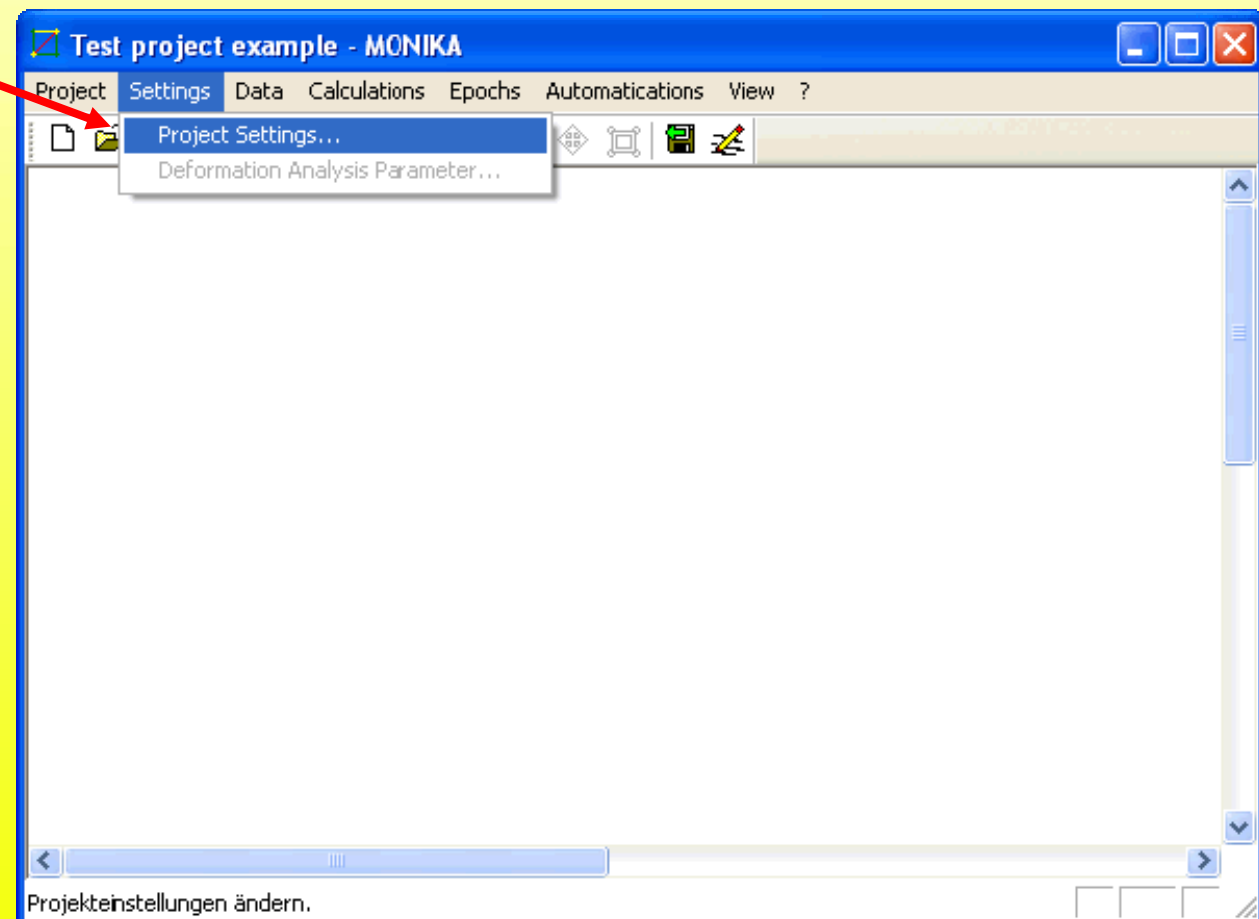
220.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

225.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

230.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

## 3. Baseline processing

project settings

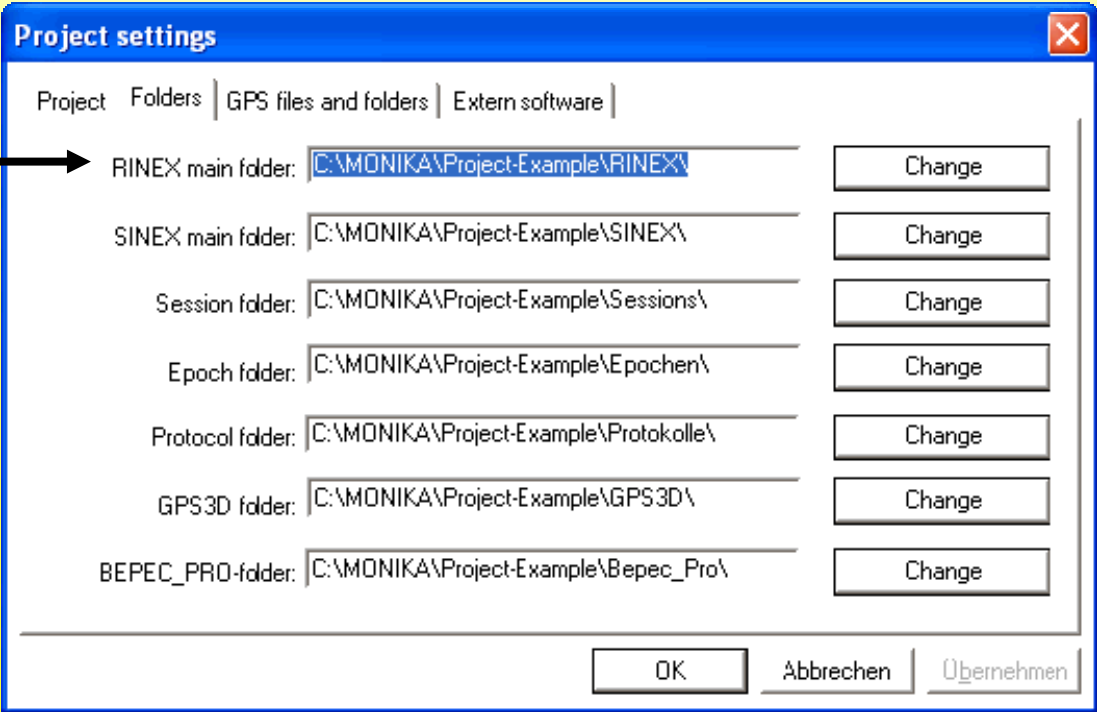


### 3.1 Baseline processing



## Project settings - Folders page

main folder for  
RINEX files



**Project settings**

Project | **Folders** | GPS files and folders | Extern software

RINEX main folder: C:\MONIKA\Project-Example\RINEX\

SINEX main folder: C:\MONIKA\Project-Example\SINEX\

Session folder: C:\MONIKA\Project-Example\Sessions\

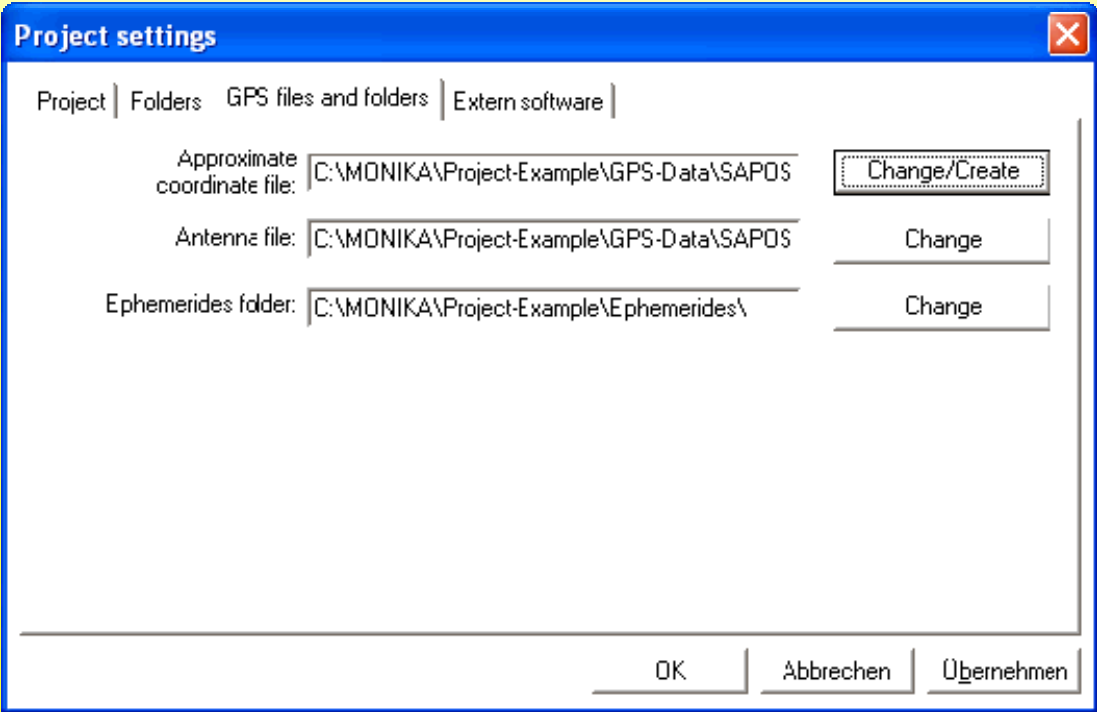
Epoch folder: C:\MONIKA\Project-Example\Epochen\

Protocol folder: C:\MONIKA\Project-Example\Protokolle\

GPS3D folder: C:\MONIKA\Project-Example\GPS3D\

BEPEC\_PRO folder: C:\MONIKA\Project-Example\Bepec\_Pro\

## Project settings - GPS page



**Project settings**

Project | Folders | GPS files and folders | Extern software

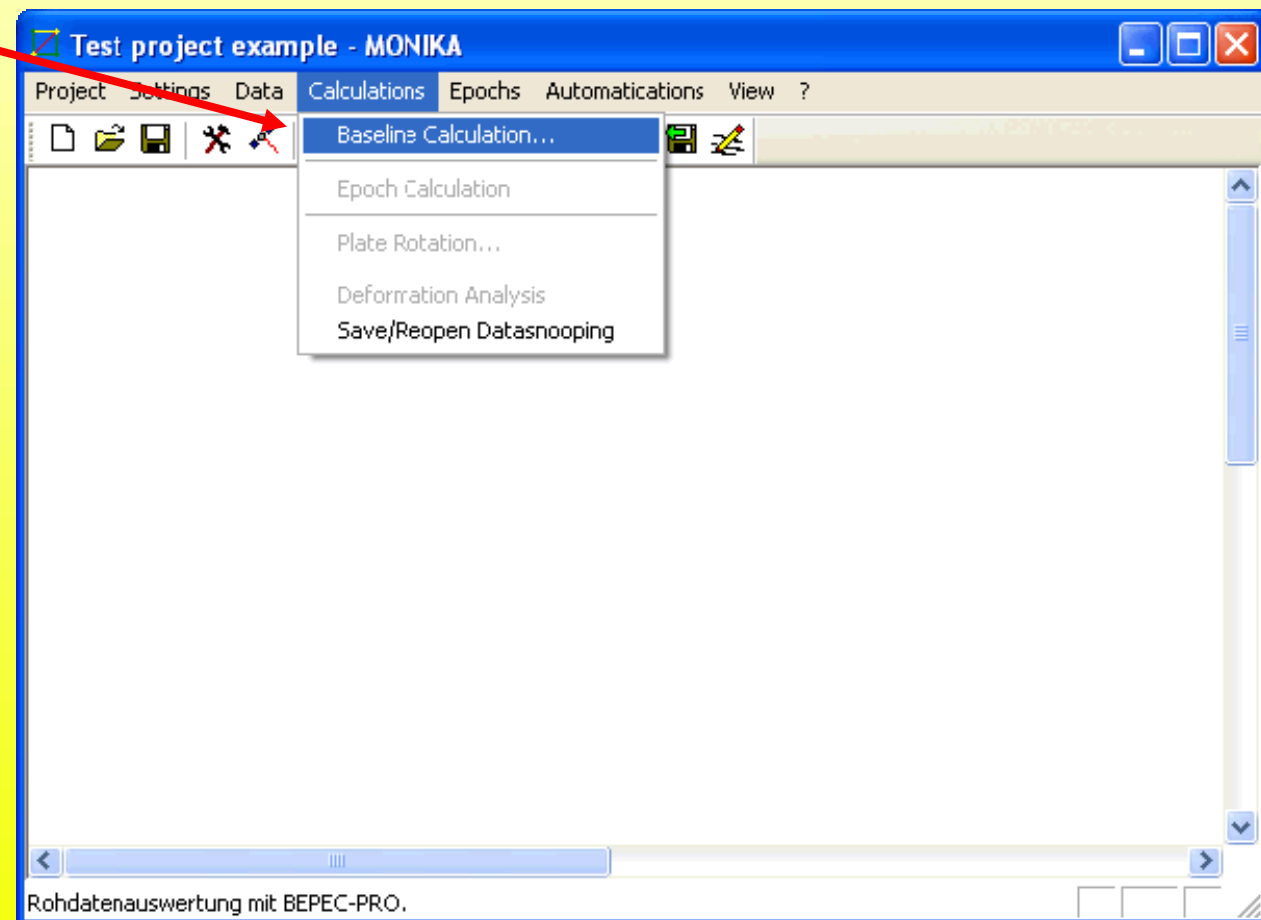
Approximate coordinate file: C:\MONIKA\Project-Example\GPS-Data\SAPDS

Antenna file: C:\MONIKA\Project-Example\GPS-Data\SAPDS

Ephemerides folder: C:\MONIKA\Project-Example\Ephemerides\

files which are needed for the baseline processing

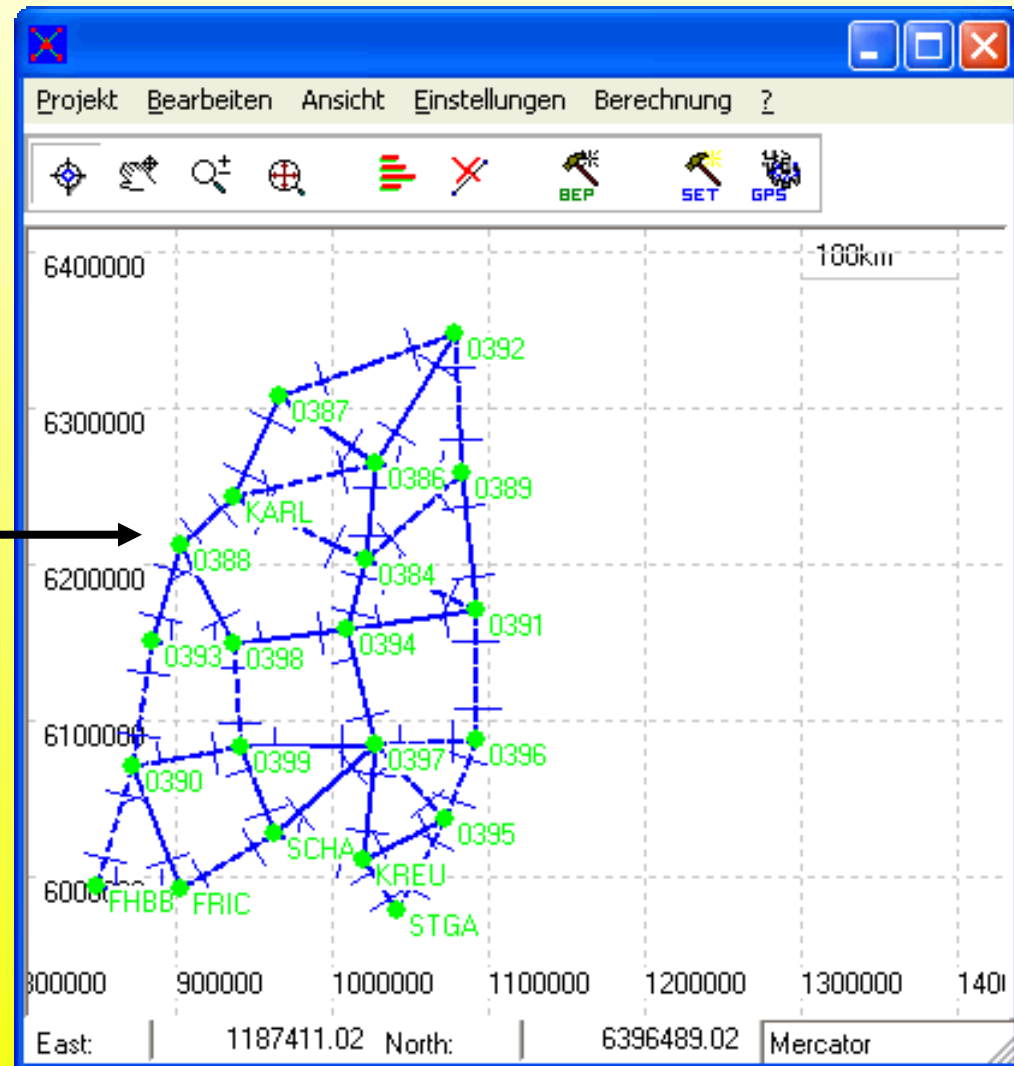
baseline processing



# BEPEC\_PRO DLL

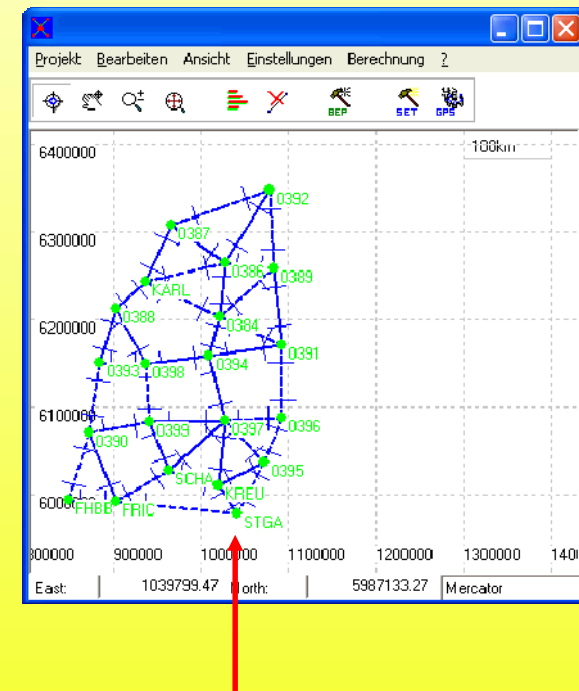
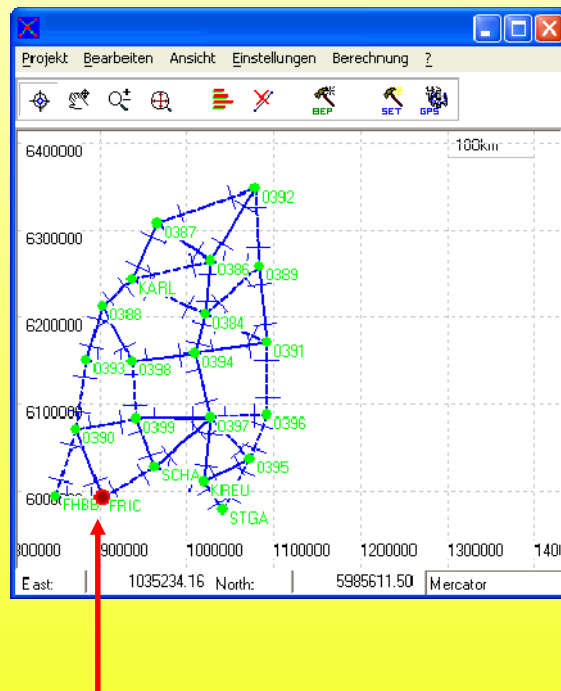
## Automatic baseline creation

(only german interface available)



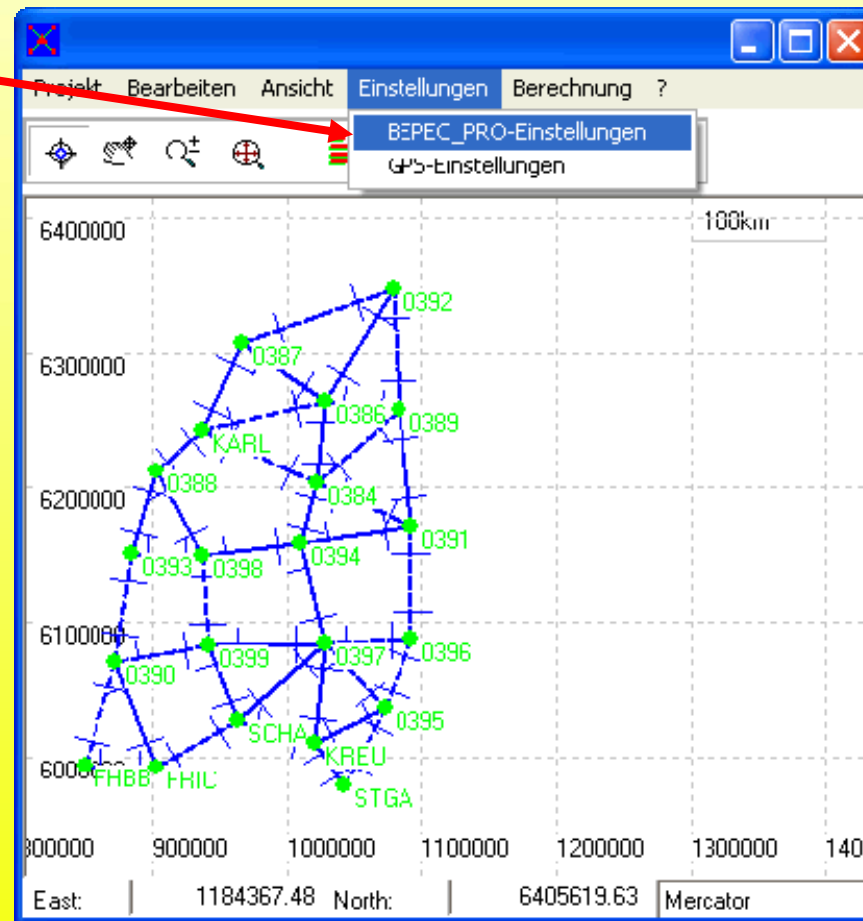
## BEPEC\_PRO DLL

create baseline  
(left click on points)



delete baseline: Mark baseline with left click and then delete  
it with right click.

# BEPEC\_PRO settings



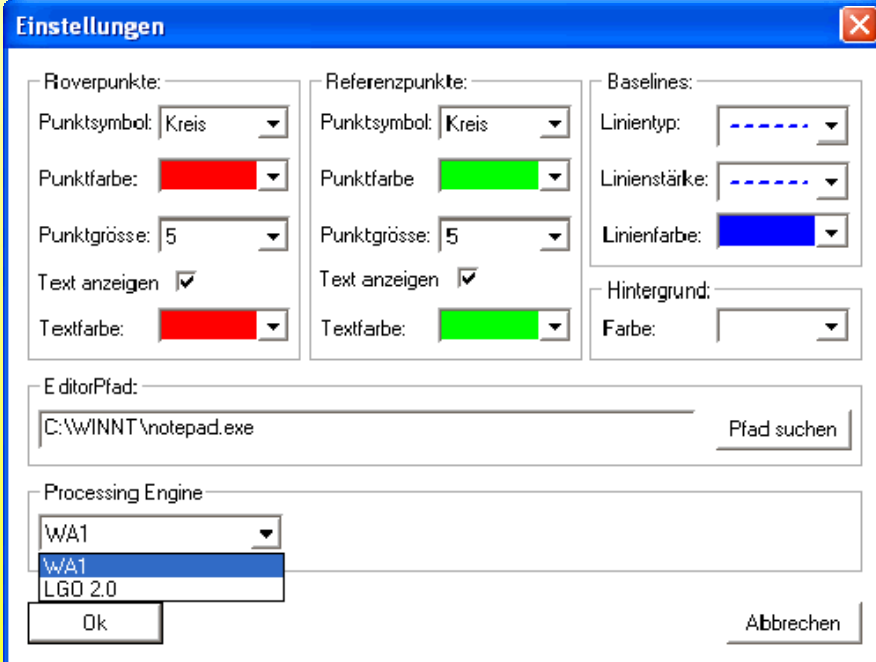
## BEPEC\_PRO DLL

View settings

Editor setting

**Processing engine**

(WA1, LGO 2.0)



**Einstellungen**

Roverpunkte:	Referenzpunkte:	Baselines:
Punktsymbol: Kreis	Punktsymbol: Kreis	Linientyp: ---
Punktfarbe: Red	Punktfarbe: Green	Linienstärke: ---
Punktgröße: 5	Punktgröße: 5	Linienfarbe: Blue
Text anzeigen: <input checked="" type="checkbox"/>	Text anzeigen: <input checked="" type="checkbox"/>	Hintergrund: Farbe
Textfarbe: Red	Textfarbe: Green	

EditorPfad: C:\WINNT\notepad.exe Pfad suchen

Processing Engine  
WA1  
LGO 2.0

Ok Abbrechen

## GPS settings



## 3.2 BEPEC\_PRO



# BEPEC\_PRO DLL

used satellites



solution type (best)

raw data intervall (all data)

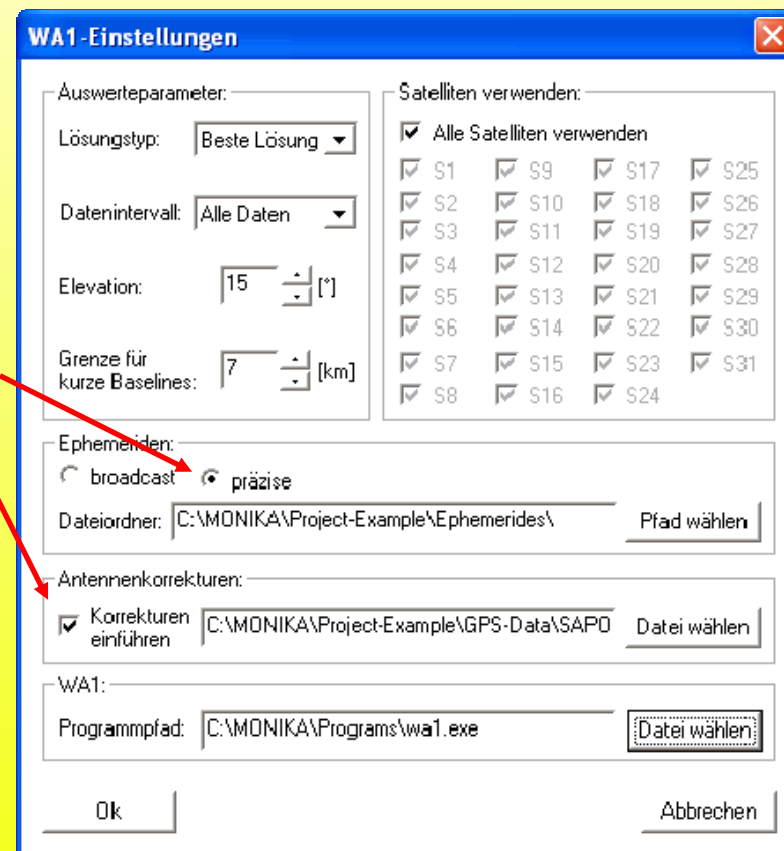
activate !

Ephemerides

Antenna corrections

Processing engine

(executeable file)



**WA1-Einstellungen**

Auswertparameter:

Lösungstyp: Beste Lösung

Datenintervall: Alle Daten

Elevation: 15 [°]

Grenze für kurze Baselines: 7 [km]

Satelliten verwenden:

☒ Alle Satelliten verwenden

<input checked="" type="checkbox"/> S1	<input checked="" type="checkbox"/> S9	<input checked="" type="checkbox"/> S17	<input checked="" type="checkbox"/> S25
<input checked="" type="checkbox"/> S2	<input checked="" type="checkbox"/> S10	<input checked="" type="checkbox"/> S18	<input checked="" type="checkbox"/> S26
<input checked="" type="checkbox"/> S3	<input checked="" type="checkbox"/> S11	<input checked="" type="checkbox"/> S19	<input checked="" type="checkbox"/> S27
<input checked="" type="checkbox"/> S4	<input checked="" type="checkbox"/> S12	<input checked="" type="checkbox"/> S20	<input checked="" type="checkbox"/> S28
<input checked="" type="checkbox"/> S5	<input checked="" type="checkbox"/> S13	<input checked="" type="checkbox"/> S21	<input checked="" type="checkbox"/> S29
<input checked="" type="checkbox"/> S6	<input checked="" type="checkbox"/> S14	<input checked="" type="checkbox"/> S22	<input checked="" type="checkbox"/> S30
<input checked="" type="checkbox"/> S7	<input checked="" type="checkbox"/> S15	<input checked="" type="checkbox"/> S23	<input checked="" type="checkbox"/> S31
<input checked="" type="checkbox"/> S8	<input checked="" type="checkbox"/> S16	<input checked="" type="checkbox"/> S24	

Ephemeriden:

☐ broadcast ☒ präzise

Dateiordner: C:\MONIKA\Project-Example\Ephemerides\ Pfad wählen

Antennenkorrekturen:

☒ Korrekturen einführen C:\MONIKA\Project-Example\GPS-Data\SAP0 Datei wählen

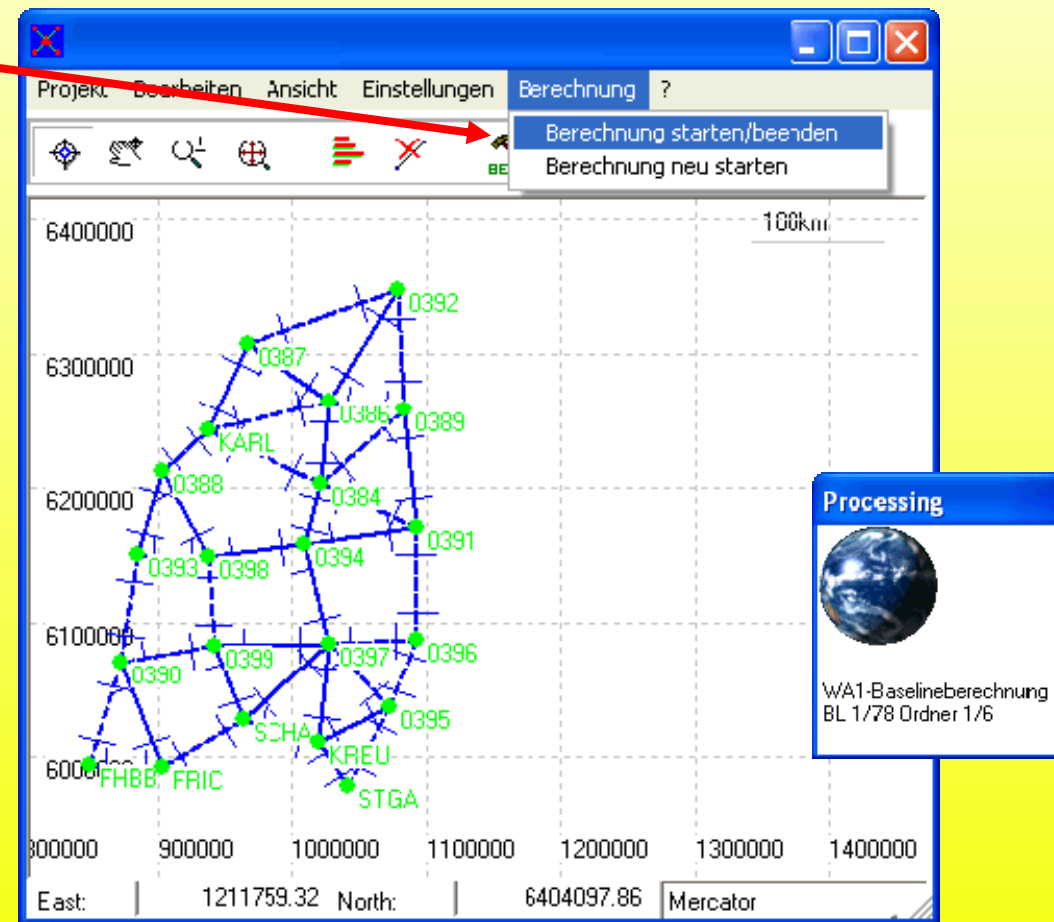
WA1:

Programmpfad: C:\MONIKA\Programs\wa1.exe Datei wählen

Ok Abbrechen

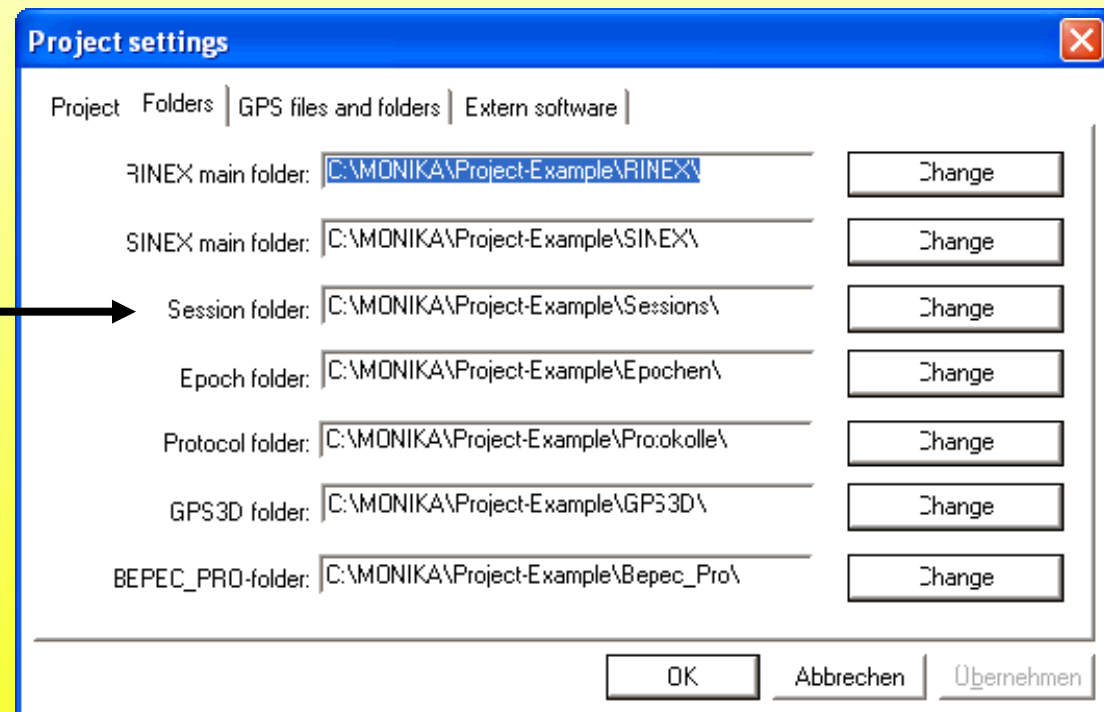
# BEPEC\_PRO DLL

start processing



## Project settings - Folders page

baseline processing  
solutions are saved  
here



The screenshot shows the 'Project settings' dialog box with the 'Folders' tab selected. The 'Session folder' is highlighted with an arrow from the text 'baseline processing solutions are saved here'. The 'Session folder' path is 'C:\MONIKA\Project-Example\Sessions\'. Other folders listed include RINEX main folder, SINEX main folder, Epoch folder, Protocol folder, GPS3D folder, and BEPEC\_PRO folder, all with their respective paths and 'Change' buttons.

Folder	Path	Action
RINEX main folder:	C:\MONIKA\Project-Example\RINEX\	Change
SINEX main folder:	C:\MONIKA\Project-Example\SINEX\	Change
Session folder:	C:\MONIKA\Project-Example\Sessions\	Change
Epoch folder:	C:\MONIKA\Project-Example\Epochen\	Change
Protocol folder:	C:\MONIKA\Project-Example\Protokolle\	Change
GPS3D folder:	C:\MONIKA\Project-Example\GPS3D\	Change
BEPEC_PRO folder:	C:\MONIKA\Project-Example\Bepec_Pro\	Change

OK Abbrechen Übernehmen

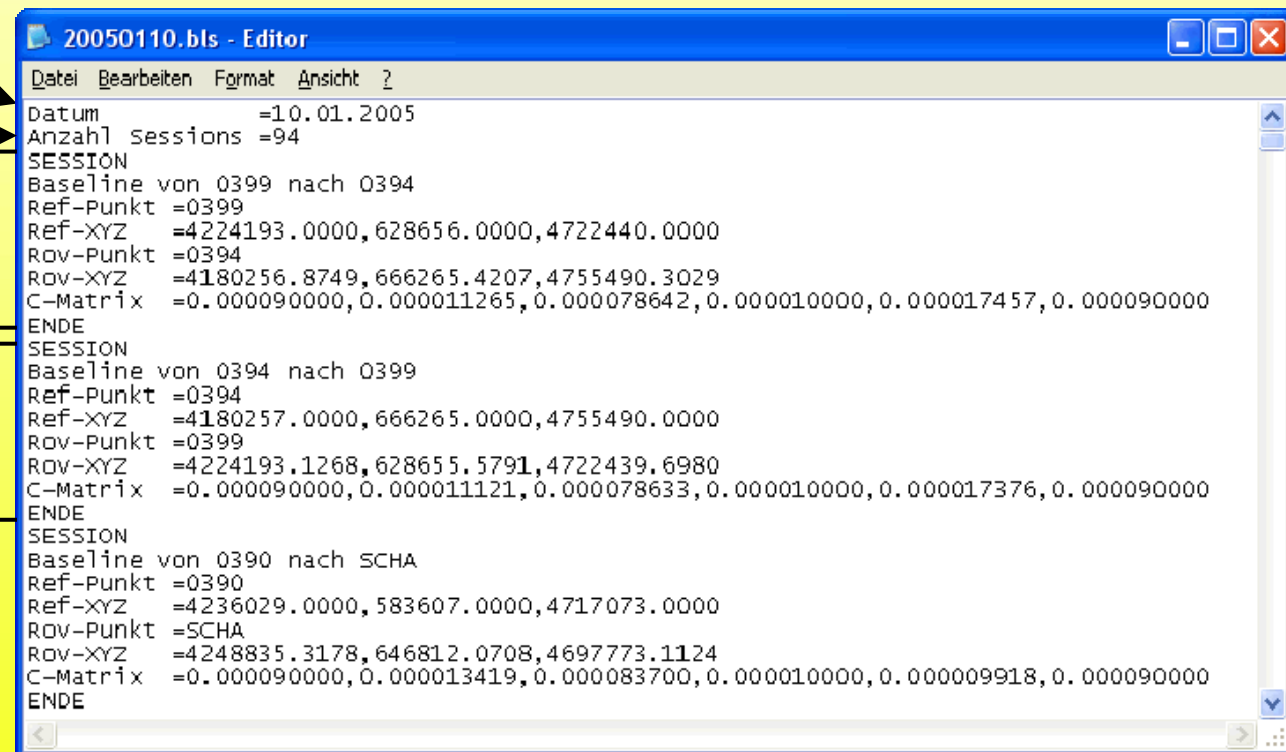
## 3.4 BLS-Format

Date

Number of  
Sessions

1. Baseline

2. Baseline

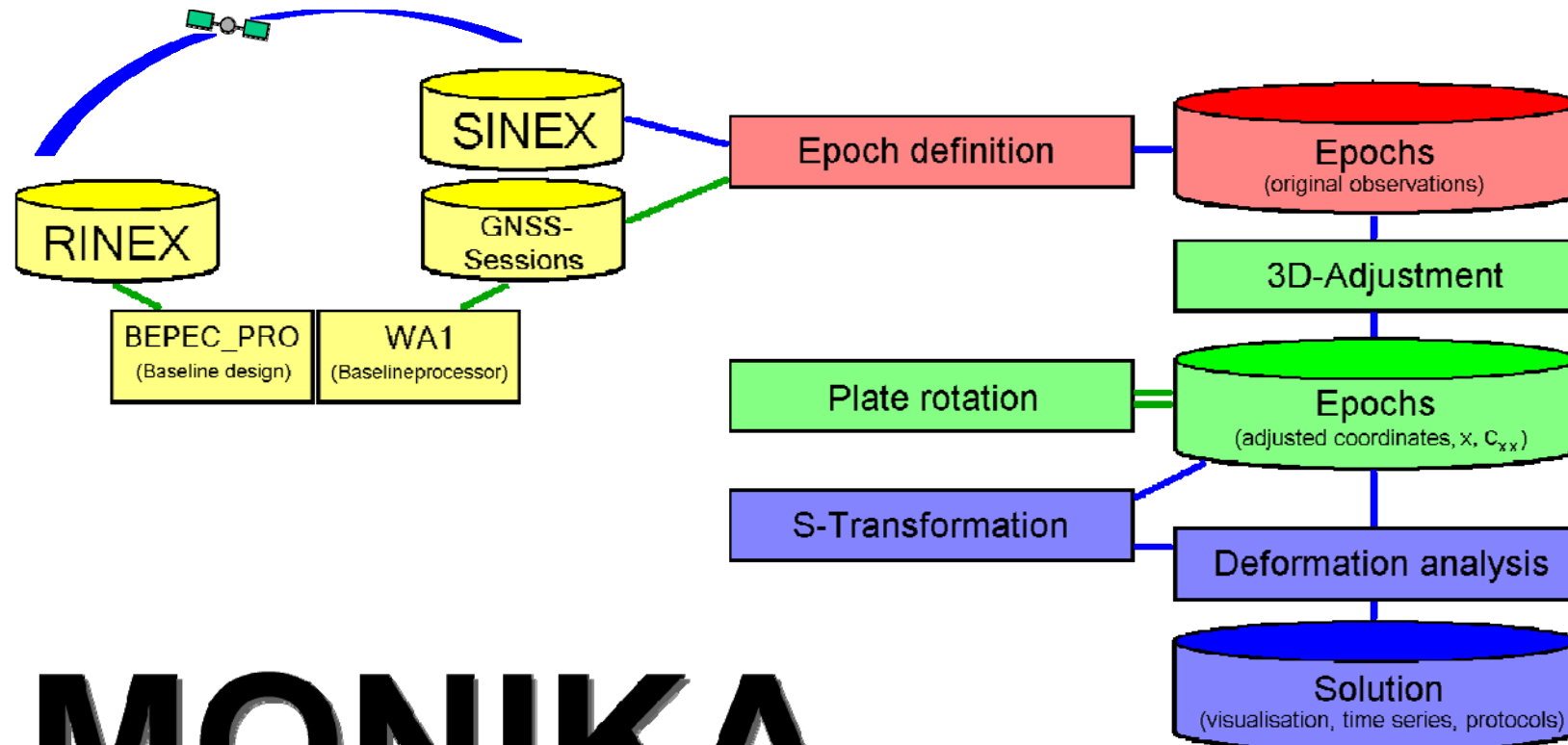


```

20050110.bls - Editor
Datei Bearbeiten Format Ansicht ?
Datum =10.01.2005
Anzahl Sessions =94
SESSION
Baseline von 0399 nach 0394
Ref-Punkt =0399
Ref-XYZ =4224193.0000,628656.0000,4722440.0000
Rov-Punkt =0394
Rov-XYZ =4180256.8749,666265.4207,4755490.3029
C-Matrix =0.000090000,0.000011265,0.000078642,0.000010000,0.000017457,0.000090000
ENDE
SESSION
Baseline von 0394 nach 0399
Ref-Punkt =0394
Ref-XYZ =4180257.0000,666265.0000,4755490.0000
Rov-Punkt =0399
Rov-XYZ =4224193.1268,628655.5791,4722439.6980
C-Matrix =0.000090000,0.000011121,0.000078633,0.000010000,0.000017376,0.000090000
ENDE
SESSION
Baseline von 0390 nach SCHA
Ref-Punkt =0390
Ref-XYZ =4236029.0000,583607.0000,4717073.0000
Rov-Punkt =SCHA
Rov-XYZ =4248835.3178,646812.0708,4697773.1124
C-Matrix =0.000090000,0.000013419,0.000083700,0.000010000,0.000009918,0.000090000
ENDE

```

# Overview



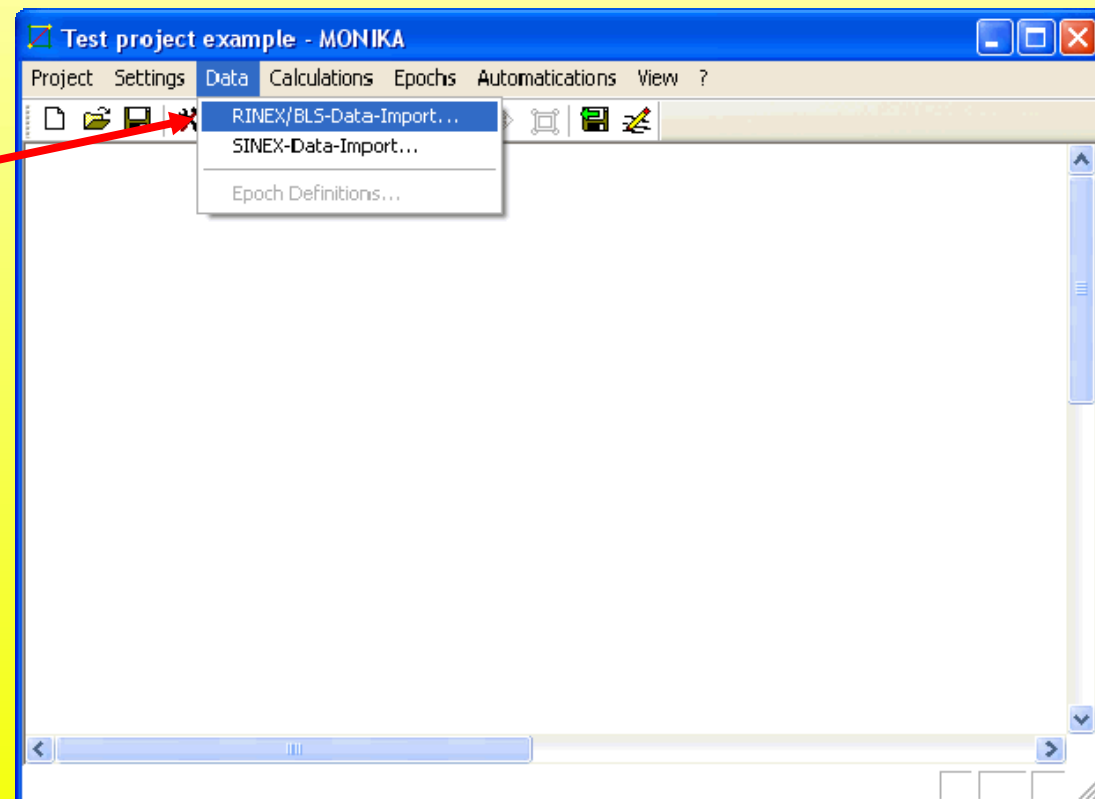
# MONIKA

## 4. Epoch definition

### 4.1 BLS-Data-Import

Dayly sessions files

RINEX/BLS-Import



4. Epoch definition

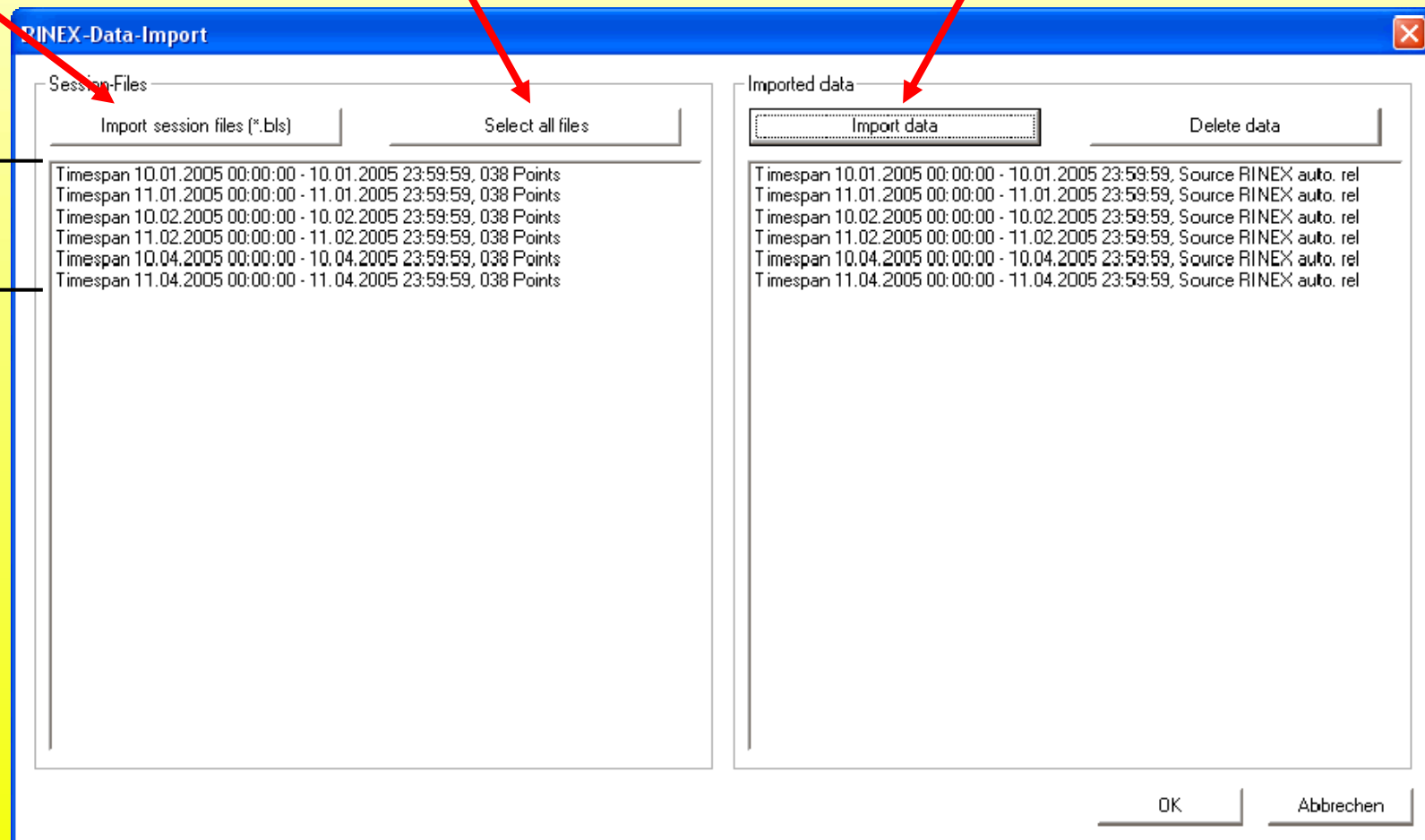
## BLS-Data-Import dialog

1.open files (\*.bls)

2.select files

3.import files

data



**RINEX-Data-Import**

Session-Files

Import session files (\*.bls)      Select all files

Timespan 10.01.2005 00:00:00 - 10.01.2005 23:59:59, 038 Points  
Timespan 11.01.2005 00:00:00 - 11.01.2005 23:59:59, 038 Points  
Timespan 10.02.2005 00:00:00 - 10.02.2005 23:59:59, 038 Points  
Timespan 11.02.2005 00:00:00 - 11.02.2005 23:59:59, 038 Points  
Timespan 10.04.2005 00:00:00 - 10.04.2005 23:59:59, 038 Points  
Timespan 11.04.2005 00:00:00 - 11.04.2005 23:59:59, 038 Points

Imported data

Import data      Delete data

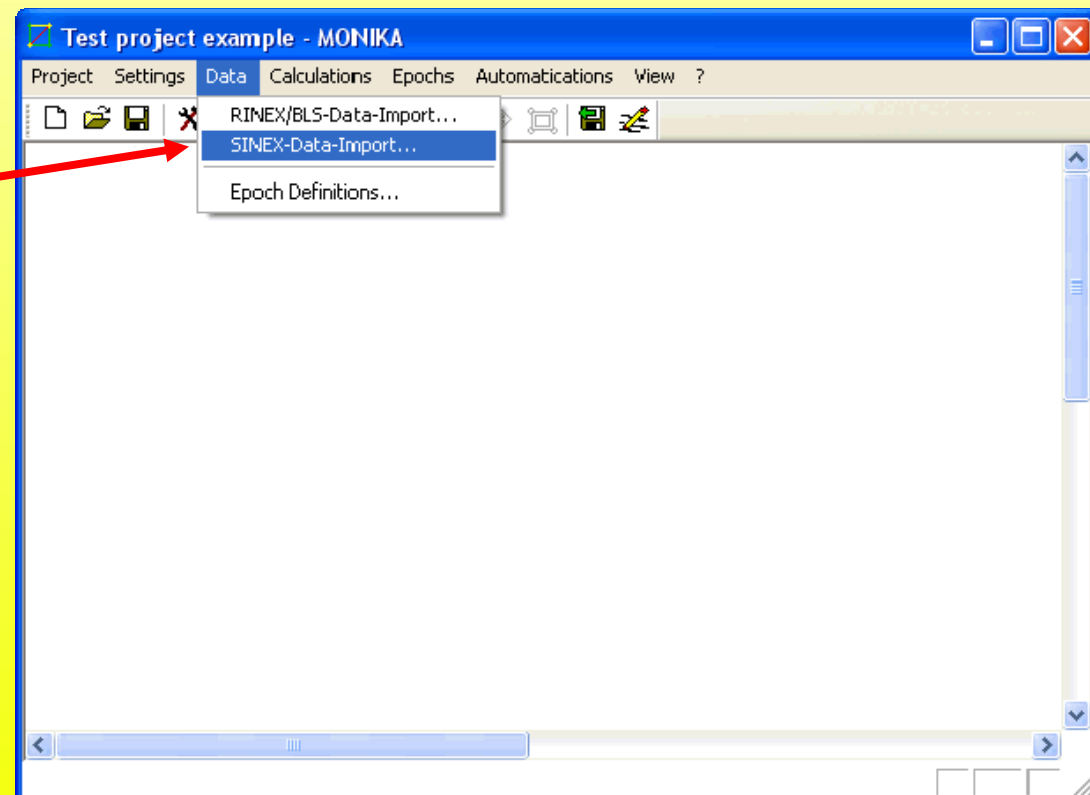
Timespan 10.01.2005 00:00:00 - 10.01.2005 23:59:59, Source RINEX auto. rel  
Timespan 11.01.2005 00:00:00 - 11.01.2005 23:59:59, Source RINEX auto. rel  
Timespan 10.02.2005 00:00:00 - 10.02.2005 23:59:59, Source RINEX auto. rel  
Timespan 11.02.2005 00:00:00 - 11.02.2005 23:59:59, Source RINEX auto. rel  
Timespan 10.04.2005 00:00:00 - 10.04.2005 23:59:59, Source RINEX auto. rel  
Timespan 11.04.2005 00:00:00 - 11.04.2005 23:59:59, Source RINEX auto. rel

OK      Abbrechen

## 4.2 SINEX-Data-Import

(SINEX Format V2.1, Estimate solution or Normal Equation - Format)

SINEX-Import





# SINEX-Data-Import dialog

1.open files (\*.snx)

2.select files

3.import files

**SINEX-Data-Import**

**SINEX Files**

Import SINEX files (\*.snx)      Select all files

**data** —

Timespan 02.11.2008 00:00:00 - 02.11.2008 23:59:30, 042 Points  
 Timespan 03.11.2008 00:00:00 - 03.11.2008 23:59:30, 044 Points  
 Timespan 04.11.2008 00:00:00 - 04.11.2008 23:59:30, 044 Points  
 Timespan 05.11.2008 00:00:00 - 05.11.2008 23:59:30, 041 Points  
 Timespan 06.11.2008 00:00:00 - 06.11.2008 23:59:30, 044 Points  
 Timespan 07.11.2008 00:00:00 - 07.11.2008 23:59:30, 044 Points  
 Timespan 08.11.2008 00:00:00 - 08.11.2008 23:59:30, 041 Points

**absolute or relative data ?** —

☒ relative observations

**Imported data**

Import data      Delete data

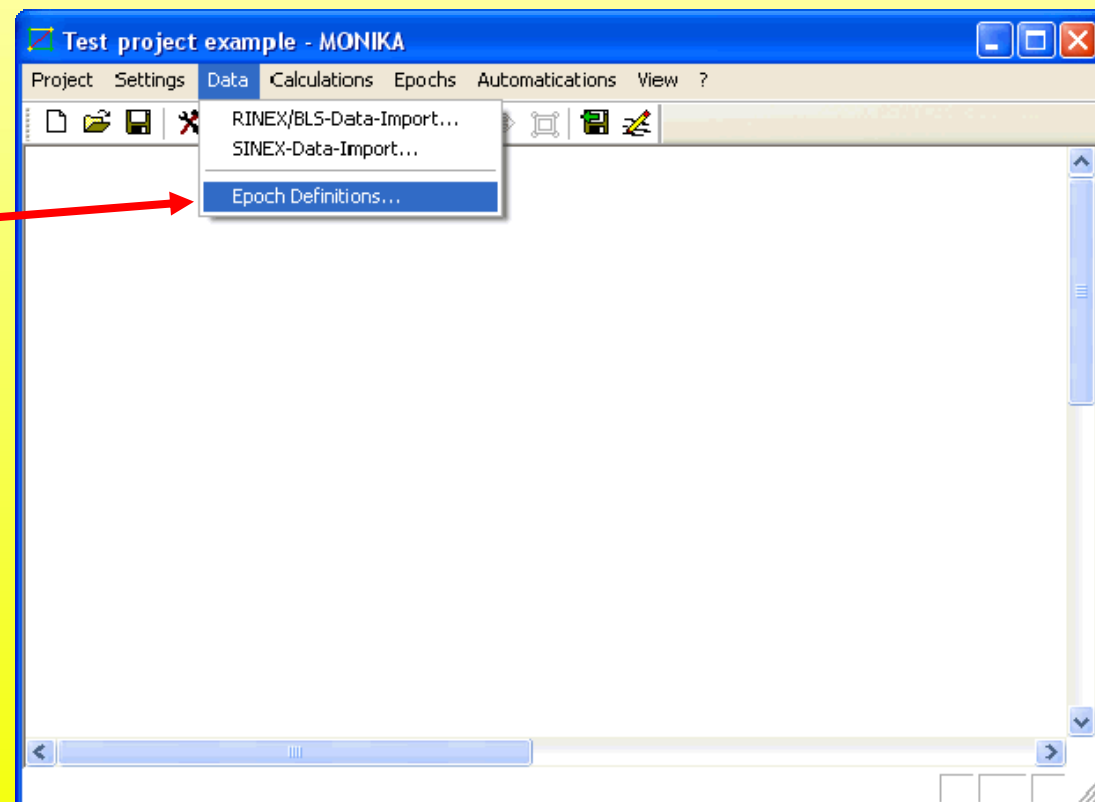
Timespan 10.01.2005 00:00:00 - 10.01.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.01.2005 00:00:00 - 11.01.2005 23:59:59, Source RINEX auto. rel  
 Timespan 10.02.2005 00:00:00 - 10.02.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.02.2005 00:00:00 - 11.02.2005 23:59:59, Source RINEX auto. rel  
 Timespan 10.04.2005 00:00:00 - 10.04.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.04.2005 00:00:00 - 11.04.2005 23:59:59, Source RINEX auto. rel  
 Timespan 02.11.2008 00:00:00 - 02.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 03.11.2008 00:00:00 - 03.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 04.11.2008 00:00:00 - 04.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 05.11.2008 00:00:00 - 05.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 06.11.2008 00:00:00 - 06.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 07.11.2008 00:00:00 - 07.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 08.11.2008 00:00:00 - 08.11.2008 23:59:30, Source SINEX auto. rel

OK      Abbrechen

## 4.3 Epoch definition

(only available, if data already have been imported)

epoch definition



4.3 Epoch definition

# Epoch definition dialog

1.select data

2.create epoch

data

GPS -  
factor ?

**Epoch definition**

Imported data

Delete data Delete all data

Timespan 10.01.2005 00:00:00 - 10.01.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.01.2005 00:00:00 - 11.01.2005 23:59:59, Source RINEX auto. rel  
 Timespan 10.02.2005 00:00:00 - 10.02.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.02.2005 00:00:00 - 11.02.2005 23:59:59, Source RINEX auto. rel  
 Timespan 10.04.2005 00:00:00 - 10.04.2005 23:59:59, Source RINEX auto. rel  
 Timespan 11.04.2005 00:00:00 - 11.04.2005 23:59:59, Source RINEX auto. rel  
 Timespan 02.11.2008 00:00:00 - 02.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 03.11.2008 00:00:00 - 03.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 04.11.2008 00:00:00 - 04.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 05.11.2008 00:00:00 - 05.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 06.11.2008 00:00:00 - 06.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 07.11.2008 00:00:00 - 07.11.2008 23:59:30, Source SINEX auto. rel  
 Timespan 08.11.2008 00:00:00 - 08.11.2008 23:59:30, Source SINEX auto. rel

Epochs

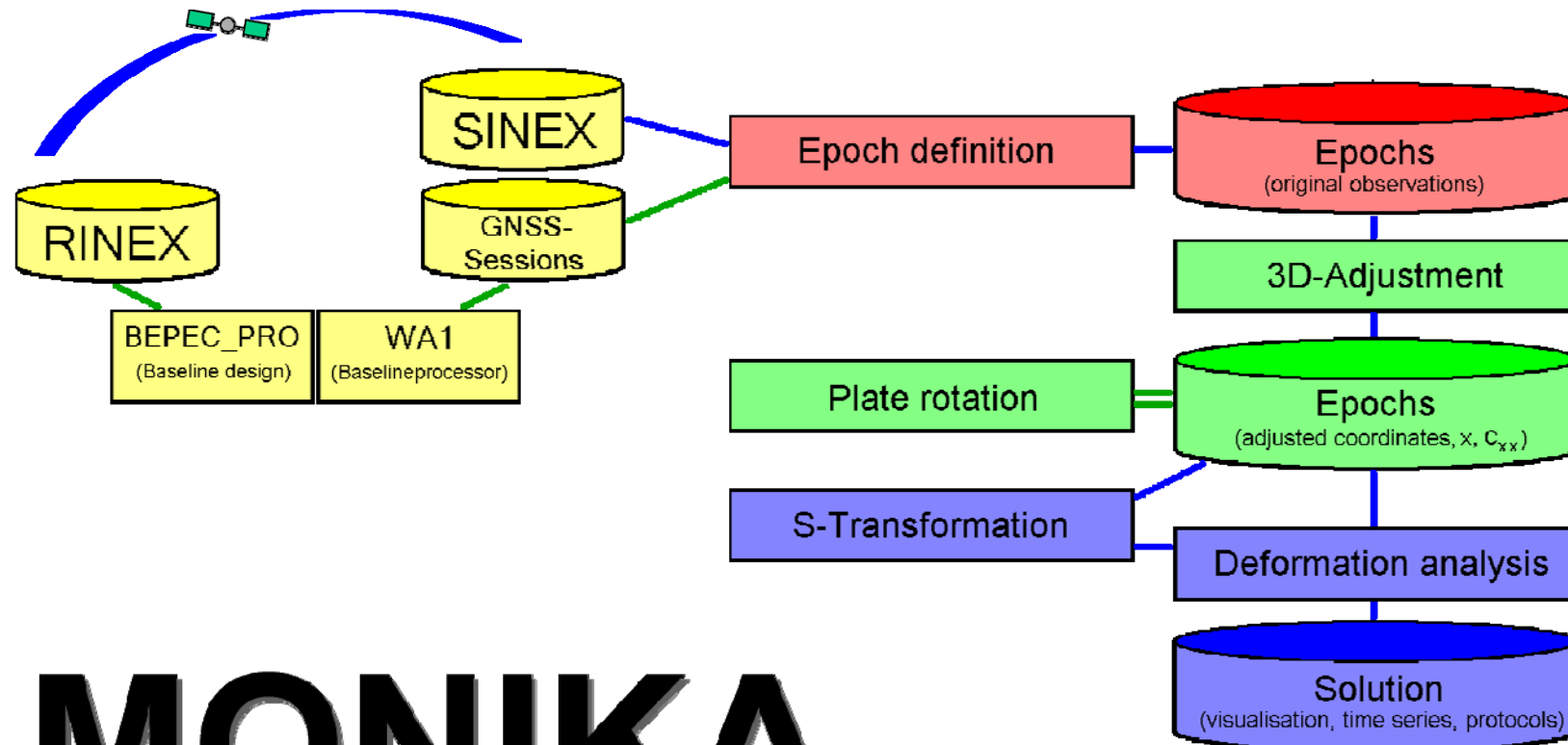
Create epoch Delete epoch Delete all epochs

Epoch 10.01.2005 00:00:00 - 11.01.2005 23:59:59, Type rel +  
 Epoch 10.02.2005 00:00:00 - 11.02.2005 23:59:59, Type rel +  
 Epoch 10.04.2005 00:00:00 - 11.04.2005 23:59:59, Type rel +

GPS-Factor (inner/outer Acc.): 0 ☒ autom. Set factor

OK Abbrechen

# Overview



# MONIKA

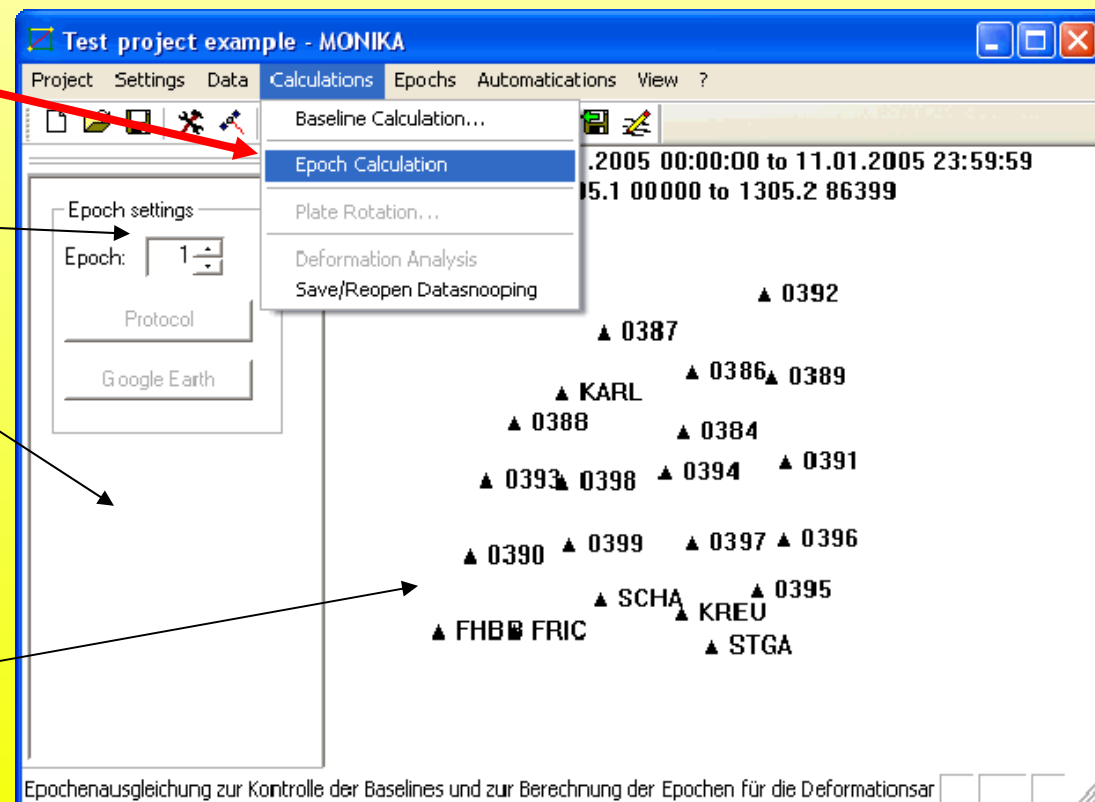
# 5. 3D-Adjustment

(with GPS3D.dll)

start 3D-Epoch-Adjustment

actual epoch  
navigation bar

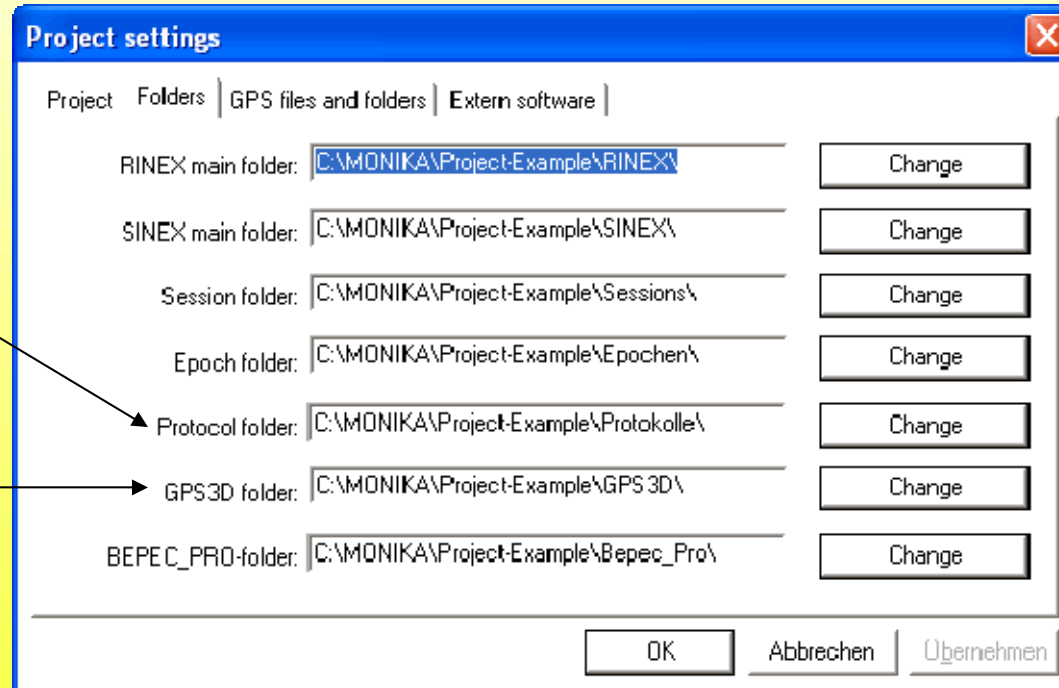
when epochs are  
defined, they are  
displayed in the  
main window



# Solutions

GPS3D-HTLM-  
Protocol

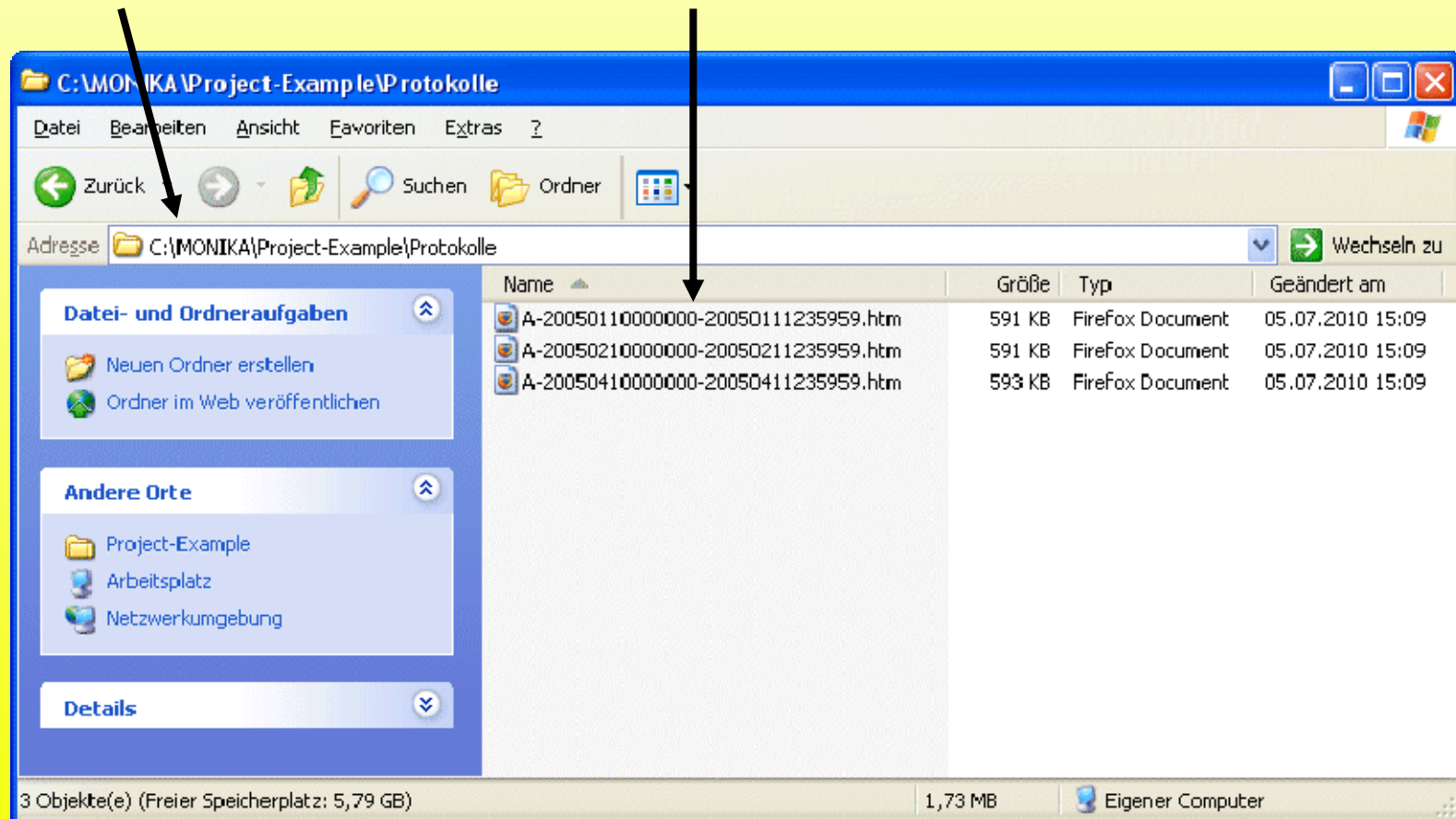
temporary files  
(can be deleted)



# HTML-Protocols

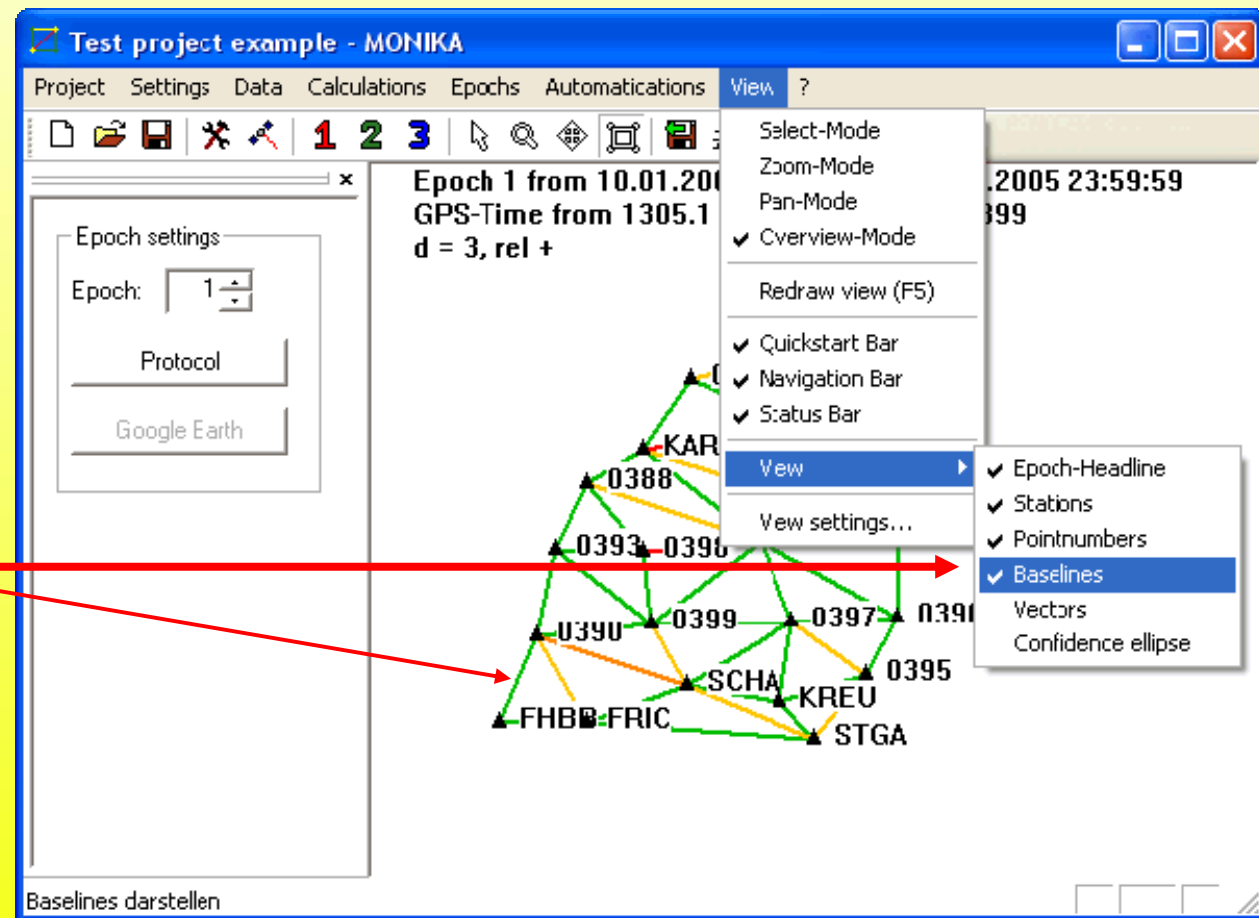
Protocol-Folder

GPS3D-HTLM-Protocols



## Display settings

show baselines

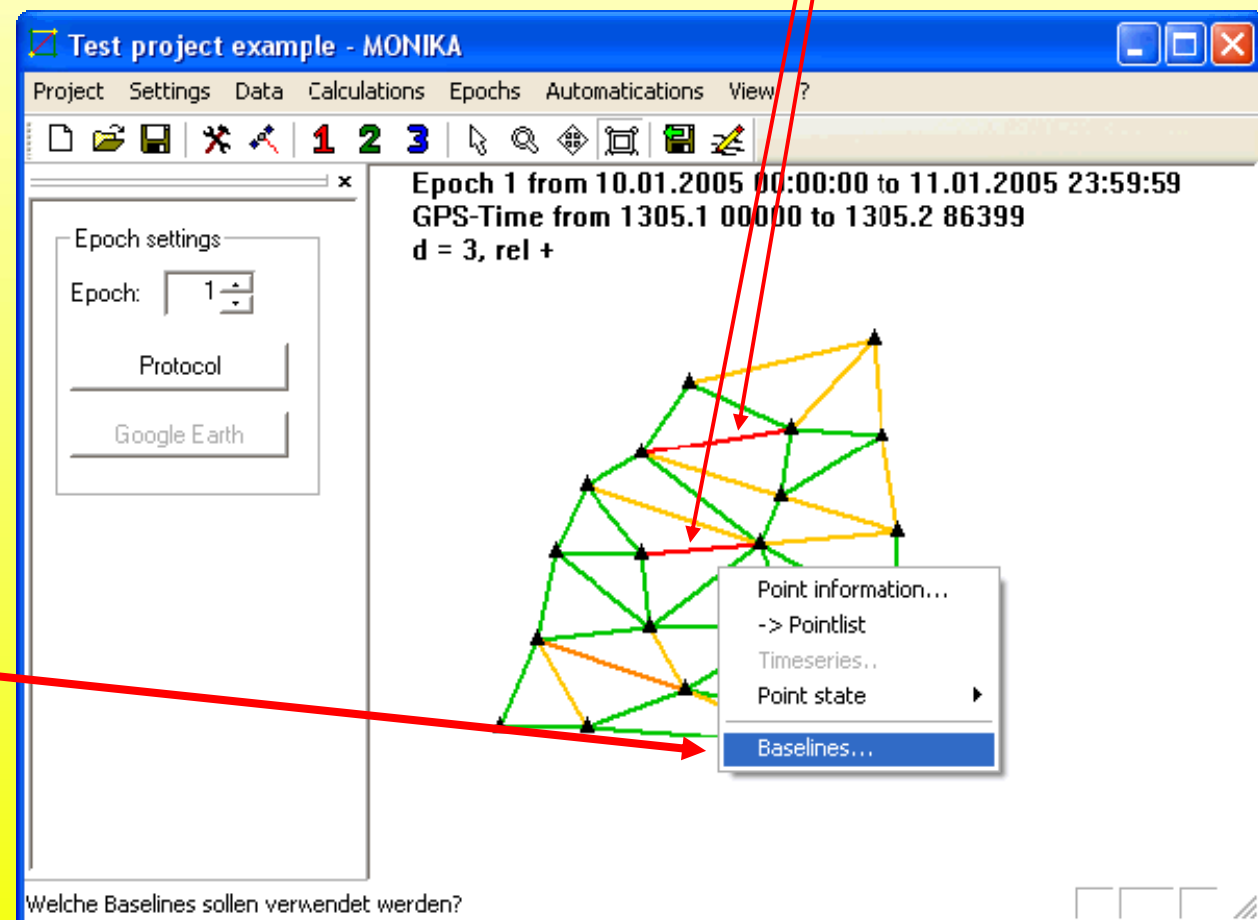




# Analyse 3D-Adjustment

critical baselines

show baselines  
at point  
(right click)



## Analyse 3D-Adjustment

critical baseline

deactivate baseline

Baselinelist

Baseline at point 0394

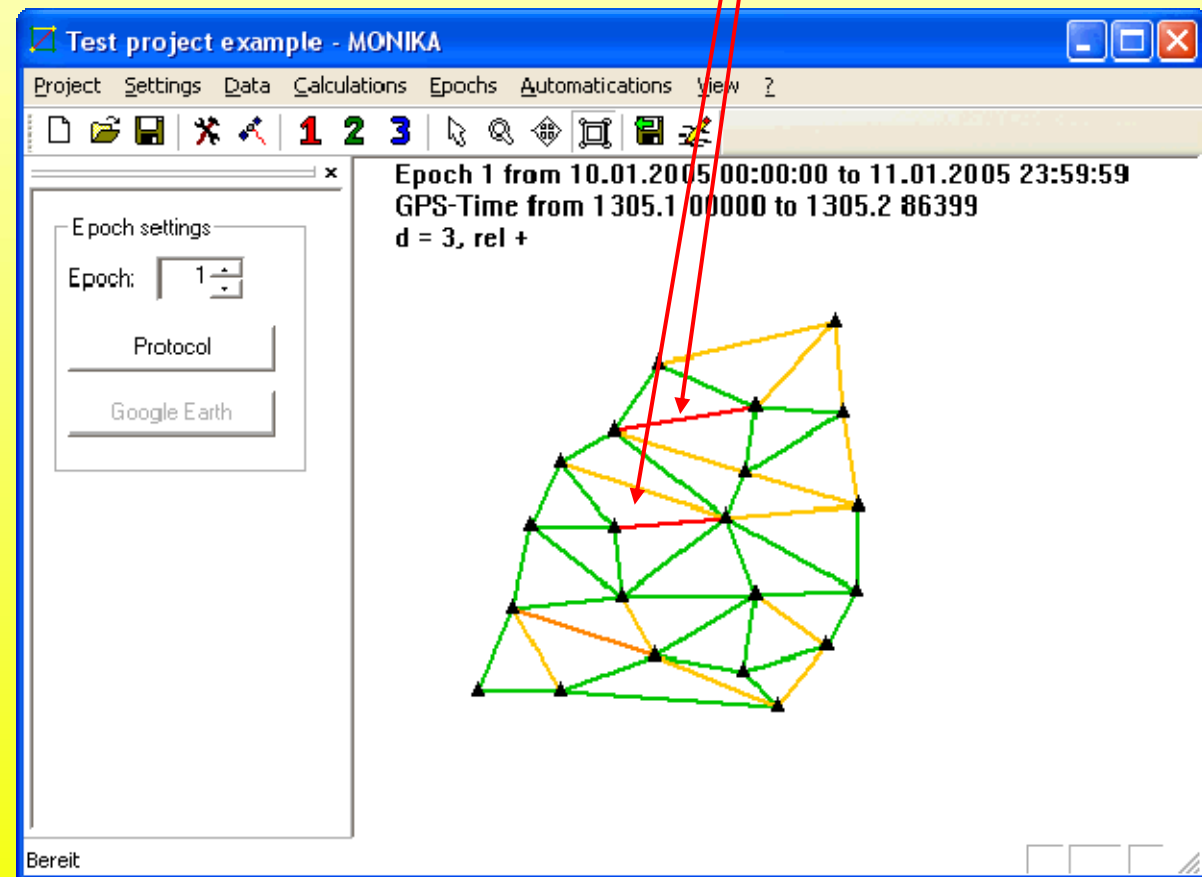
active	from	to	length	rel. Test	max. Def.
<input checked="" type="checkbox"/>	0384	0394	30321.6289 m	0.37	
<input checked="" type="checkbox"/>	0394	0384	30321.6289 m	0.37	
<input checked="" type="checkbox"/>	0384	0394	30321.6311 m	0.42	
<input checked="" type="checkbox"/>	0394	0384	30321.6312 m	0.42	
<input checked="" type="checkbox"/>	0398	0394	47684.8827 m	0.21	
<input type="checkbox"/>	0398	0394	47684.8828 m	1.09	0.0005 m
<input checked="" type="checkbox"/>	0394	0398	47684.8834 m	0.56	
<input checked="" type="checkbox"/>	0394	0398	47684.8835 m	0.53	
<input checked="" type="checkbox"/>	0394	0397	49860.3265 m	0.07	
<input checked="" type="checkbox"/>	0397	0394	49860.3267 m	0.07	
<input checked="" type="checkbox"/>	0394	0397	49860.3277 m	0.19	
<input checked="" type="checkbox"/>	0397	0394	49860.3279 m	0.28	
<input checked="" type="checkbox"/>	0391	0394	55634.5668 m	0.53	
<input checked="" type="checkbox"/>	0394	0391	55634.5678 m	0.19	
<input checked="" type="checkbox"/>	0391	0394	55634.5684 m	0.05	
<input checked="" type="checkbox"/>	0394	0391	55634.5694 m	0.19	
<input checked="" type="checkbox"/>	0399	0394	66612.1152 m	0.16	
<input checked="" type="checkbox"/>	0394	0399	66612.1159 m	0.05	
<input checked="" type="checkbox"/>	0399	0394	66612.1170 m	0.05	
<input checked="" type="checkbox"/>	0394	0399	66612.1178 m	0.14	
<input checked="" type="checkbox"/>	0396	0394	71754.7668 m	0.09	
<input checked="" type="checkbox"/>	0394	0396	71754.7676 m	0.00	
<input checked="" type="checkbox"/>	0396	0394	71754.7689 m	0.14	

OK Abbrechen

## Analyse 3D-Adjustment

1. search for critical baselines in all epochs
2. deactivate the most critical baselines
3. calculate the 3D-Adjustment again

critical baselines

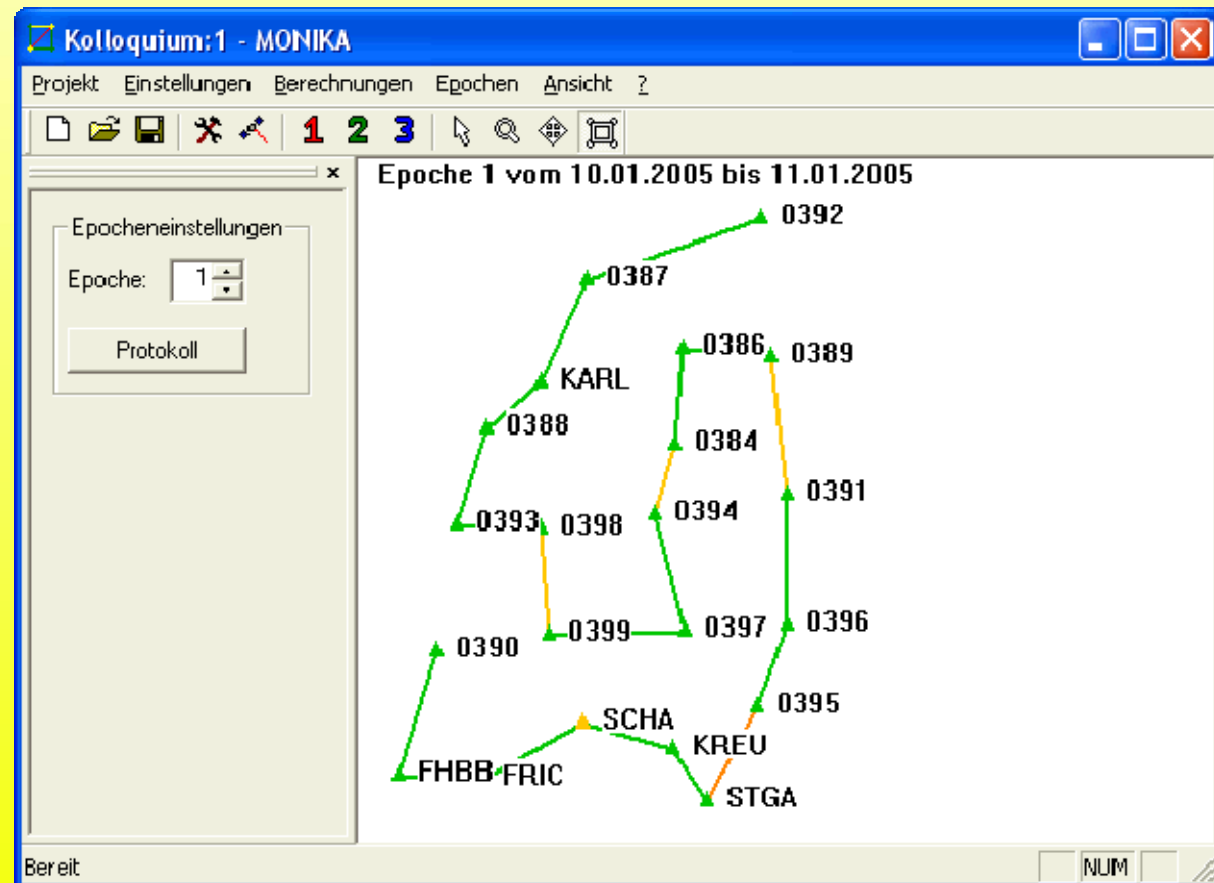


## Baseline correlation

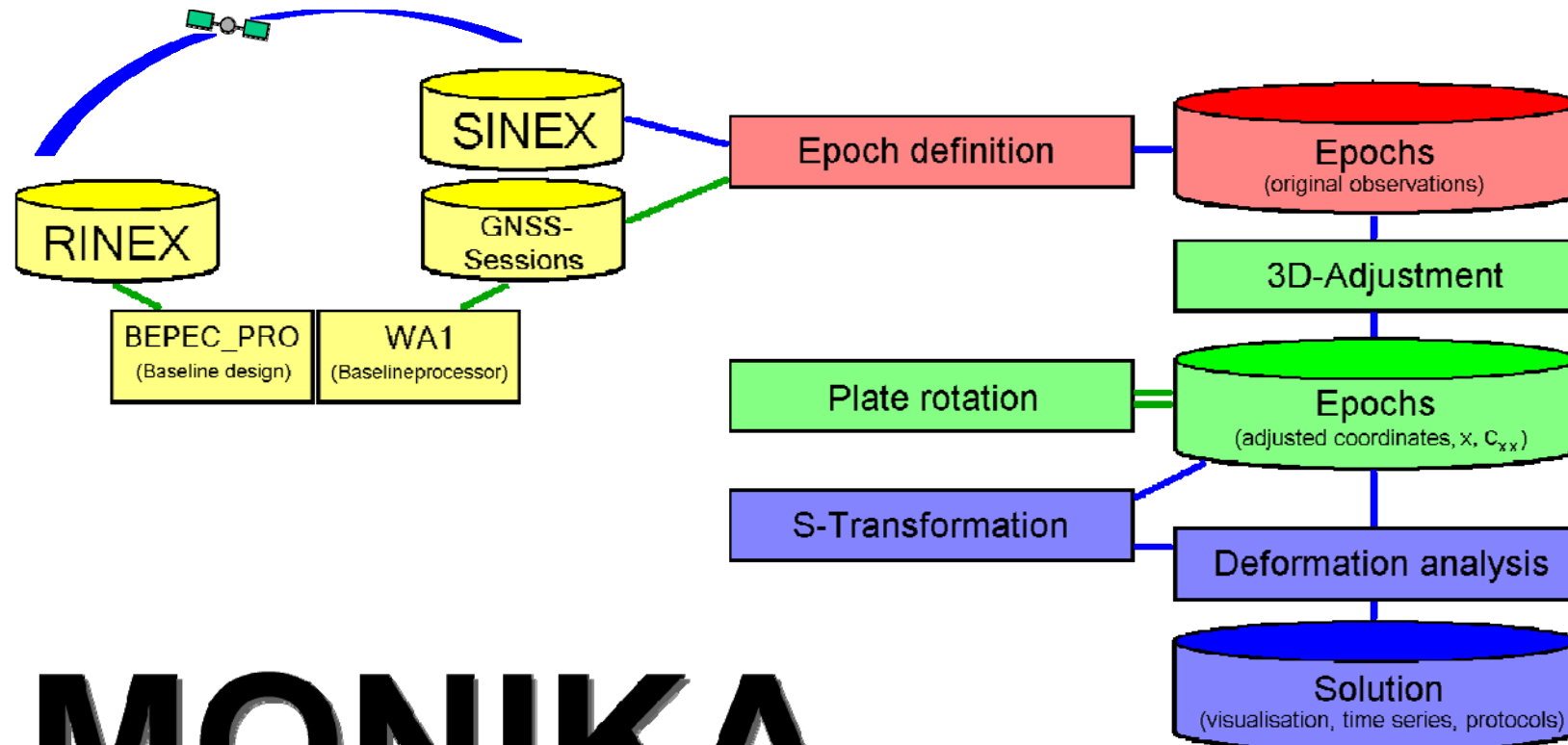
because of the the identical RINEX data, the baselines are correlated with each other.

solution:

➔ line of baselines



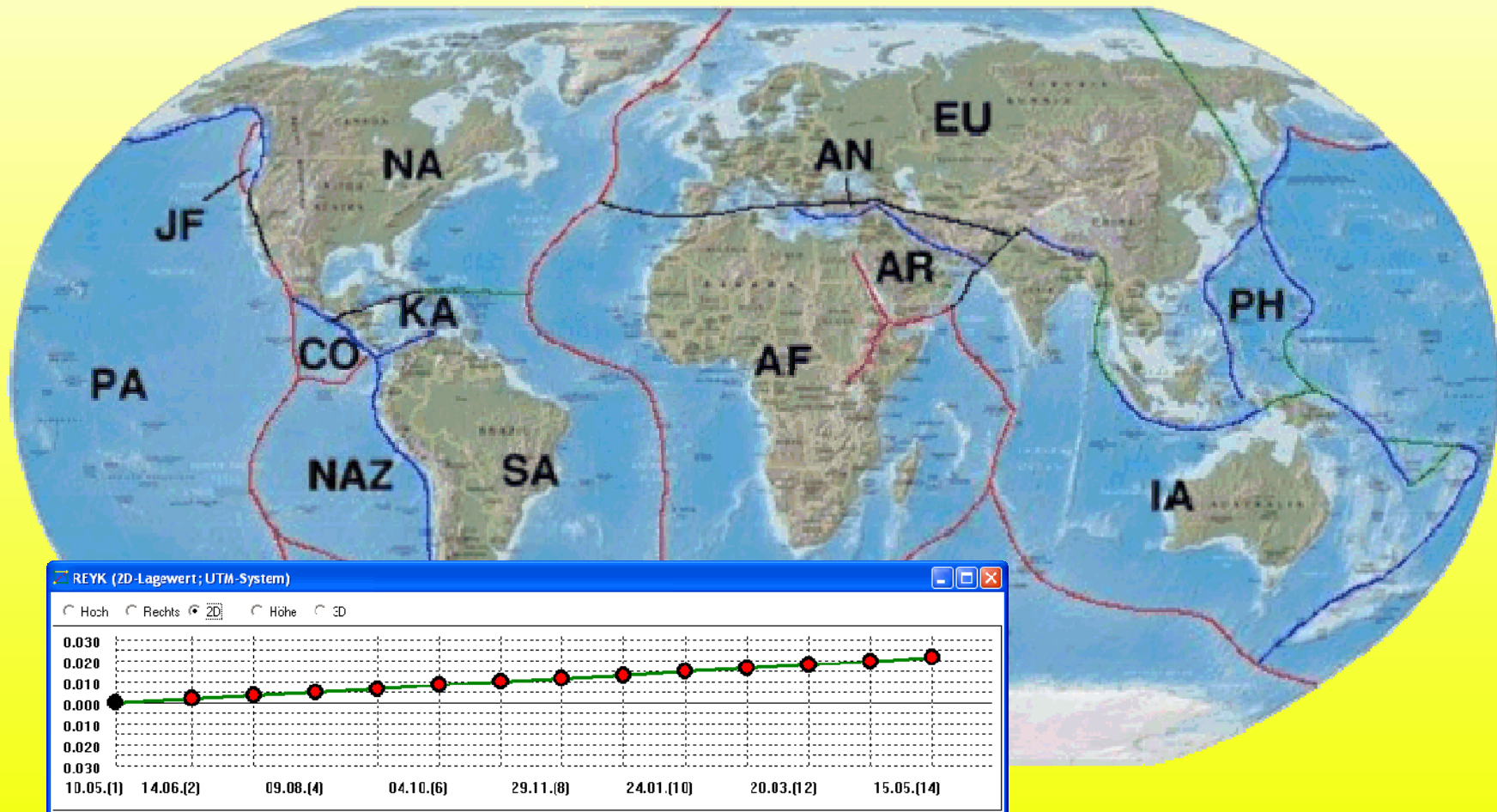
# Overview



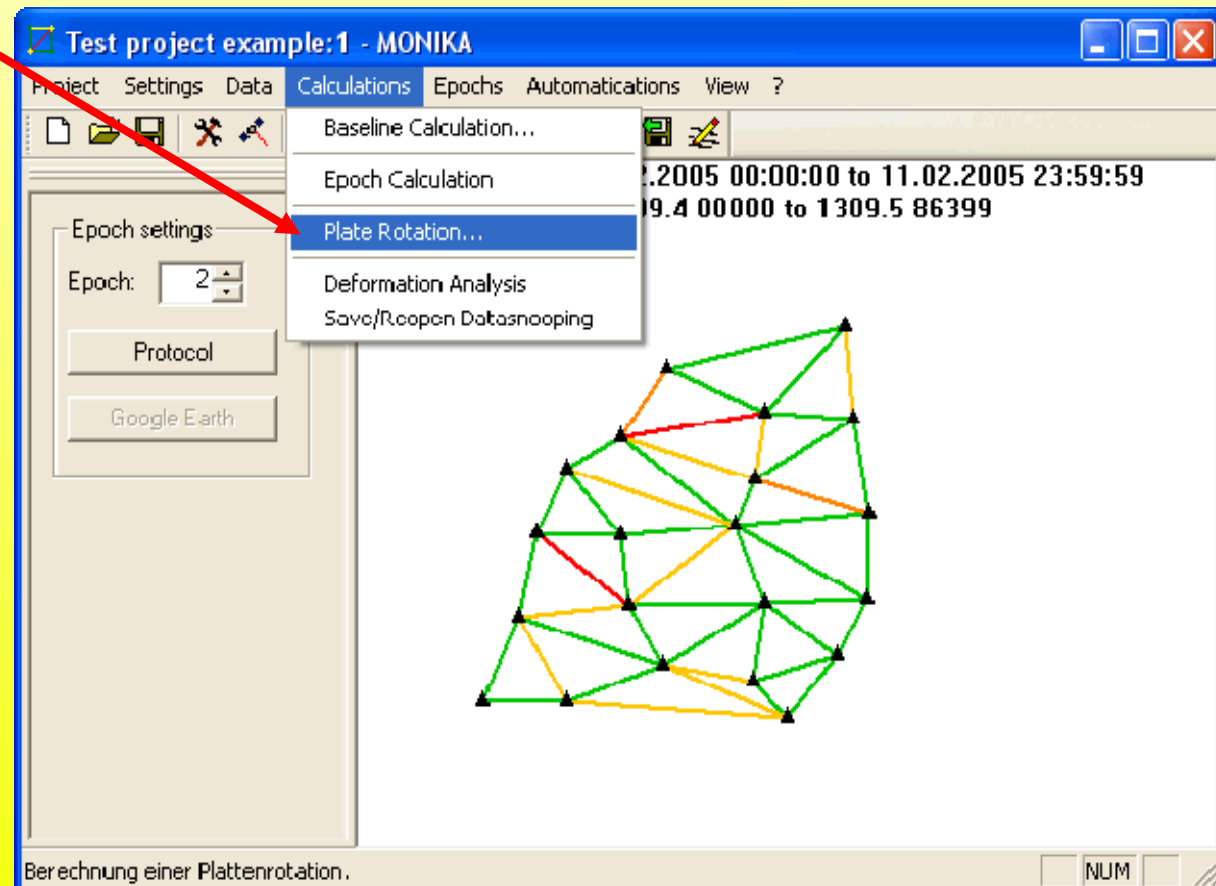
# MONIKA

## 6. Plate rotation

necessary when large GNSS-networks or a long timespan is calculated



initialise plate rotation calculation



6. Plate rotation

calculate  
transformation

**Plate rotation**

Epoch settings

List of epochs :

☒ all epochs

Active	Epoch	Ep.Start	Ep.End	Ponts.	State
<input checked="" type="checkbox"/>	01	2005.01.10 ...	2005.01.11 ...	21	rel +
<input checked="" type="checkbox"/>	02	2005.02.10 ...	2005.02.11 ...	21	rel +
<input checked="" type="checkbox"/>	03	2005.04.10 ...	2005.04.11 ...	21	rel +

Reference time : 25.02.2005 00:00:00 midtime

Plate settings

Plate model : object-E>ample\PlateRotationModel\NNR-NUVEL-1A.txt Import

Plate borders : mple\PlateRotationModel\NNR-NUVEL-1A\_Borders.txt Import

☒ automatical poin: to plate selection

☐ manual point to plate selection

Transform points Abbrechen OK



border file

NNR-NUVEL-1A\_Borders.txt - Editor

```
Date Bearbeiten Format Ansicht ?
: AFRC African
359.30 -54.80
359.70 -54.50
.80 -54.90
3.00 -53.60
4.00 -54.20
5.00 -54.80
7.60 -53.60
8.30 -54.00
11.50 -52.20
12.70 -52.80
13.90 -51.80
15.10 -52.20
15.90 -51.70
18.50 -52.70
20.00 -52.80
22.50 -53.00
25.50 -53.80
26.20 -52.50
27.80 -52.80
29.50 -50.20
30.50 -49.80
32.50 -47.00
34.80 -47.20
```

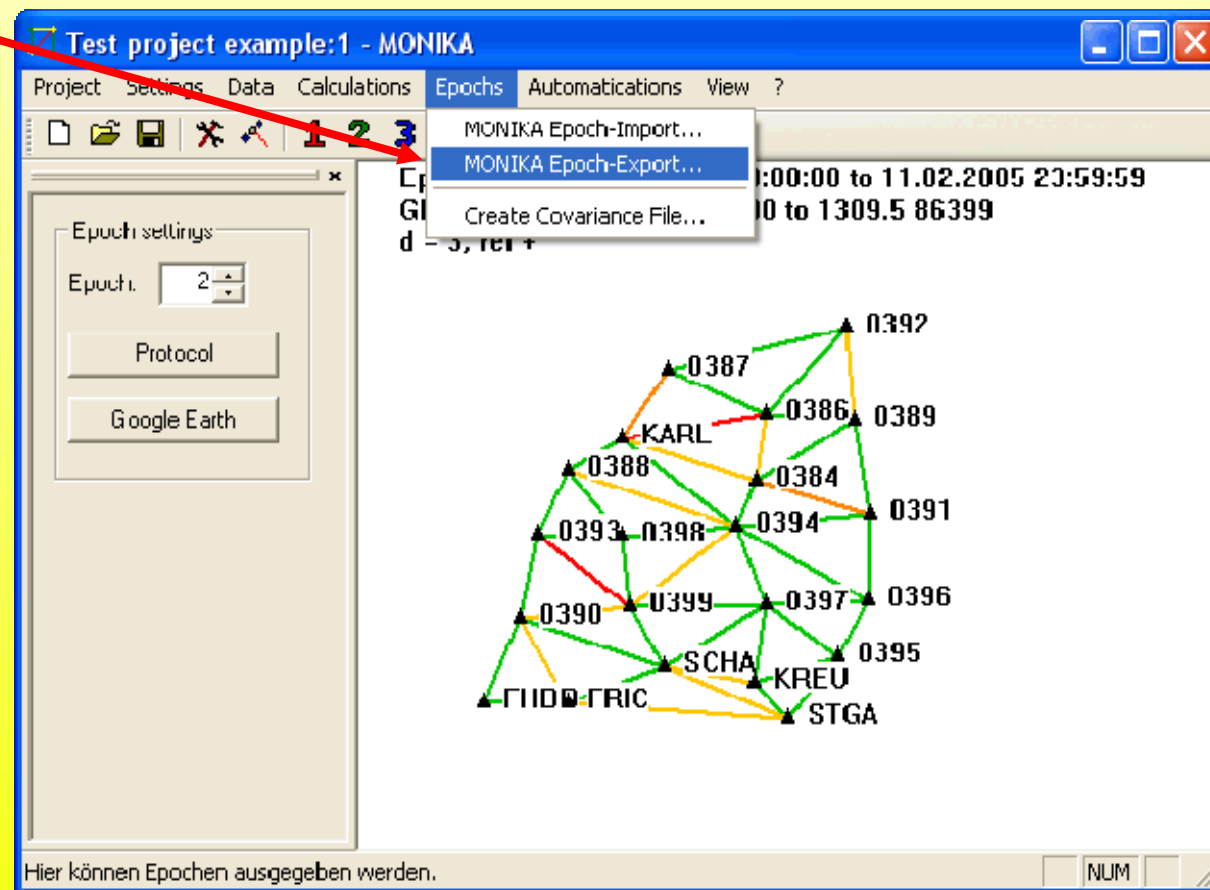
plate model file

NNR-NUVEL-1A.txt - Editor

```
Date Bearbeiten Format Ansicht ?
:Plate PHI LAM OMEGA omega(x) omega(y) omega(z) Plate
: [deg] [deg] [deg/Ma] - [rad/Ma] [rad/Ma] [rad/Ma] - Name
-----
NNR-NUVEL-1A
AFRC 50.569 -73.978 0.2909 0.000891 -0.003099 0.003922 Africa
ANTA 62.986 244.264 0.2383 -0.000821 -0.001701 0.003706 Antarctica
ARAB 45.233 -4.464 0.5455 0.006685 -0.000521 0.006760 Arabia
AUST 33.852 33.175 0.6461 0.007839 0.005124 0.006282 Australia
CARB 25.014 266.989 0.2143 -0.000178 -0.003385 0.001581 Caribbea
COCO 24.487 244.242 1.5103 -0.010425 -0.021605 0.010925 Cocos
EURA 50.631 247.725 0.2337 -0.000981 -0.002395 0.003153 Eurasia
INDI 45.505 0.345 0.5453 0.006670 0.000040 0.006790 India
NOAM -2.438 -85.895 0.2069 0.000258 -0.003599 -0.000153 N.America
NAZC 47.804 259.870 0.7432 -0.001532 -0.008577 0.009609 Nazca
PCFC -63.045 107.325 0.6408 -0.001510 0.004840 -0.009970 Pacific
SOAM -25.325 235.570 0.1164 -0.001038 -0.001515 -0.000870 S.America
JUFU -30.054 58.870 0.6658 0.005200 0.008610 -0.005820 Juan de Fuca
PHIL -38.011 -35.360 0.8997 0.010090 -0.007160 -0.009670 Philippine
RIVR 20.428 253.128 1.9781 -0.009390 -0.030960 0.012050 Rivera
SCOT -25.273 261.234 0.1705 -0.000410 -0.002660 -0.001270 Scotia
```

## 6.1 Epoch-Export

# export epochs



epoch number → Epoch number:  Epoche vom 10.02.2005 bis 11.02.2005

information file → Output files  
Epoch information file:

coordinate file → Epoch coordinate file:

covariance file → Epoch covariance file:

export epoch →

## 6.2 Epoch-Format

epoch date

epoch defect

epoch type

coordinates

variance factor

covariances

20050210000000-20050211235959.epinfo - Editor

Datei Bearbeiten Format Ansicht ?

Epochenbeginn = 10.02.2005 00:00:00  
 Epochenende = 11.02.2005 23:59:59  
 Datumsdefekt = 3  
 Netztyp = relativ  
 Redundanz = 477  
 Omega = 4.770381670000000e-004  
 s0 a priori = 1.000000000000000e-003  
 s0 a post = 1.000040007000000e-003

20050210000000-20050211235959.epkoo - Editor

Datei Bearbeiten Format Ansicht ?

0399	4224192.9988	628655.7003	4722440.0819
0394	4180256.8697	666265.1202	4755490.3818
0390	4236028.9339	583606.9469	4717073.4656
SCHA	4248835.2463	646812.0149	4697773.5703
0396	4205647.7919	725929.7903	4724762.9523
STGA	4264775.7308	701895.6020	4675676.0176
0393	4195909.6268	586036.6888	4752085.4104
0388	4164699.3068	593657.3106	4778280.6812
KARL	4146524.0453	613137.3080	4791516.5142

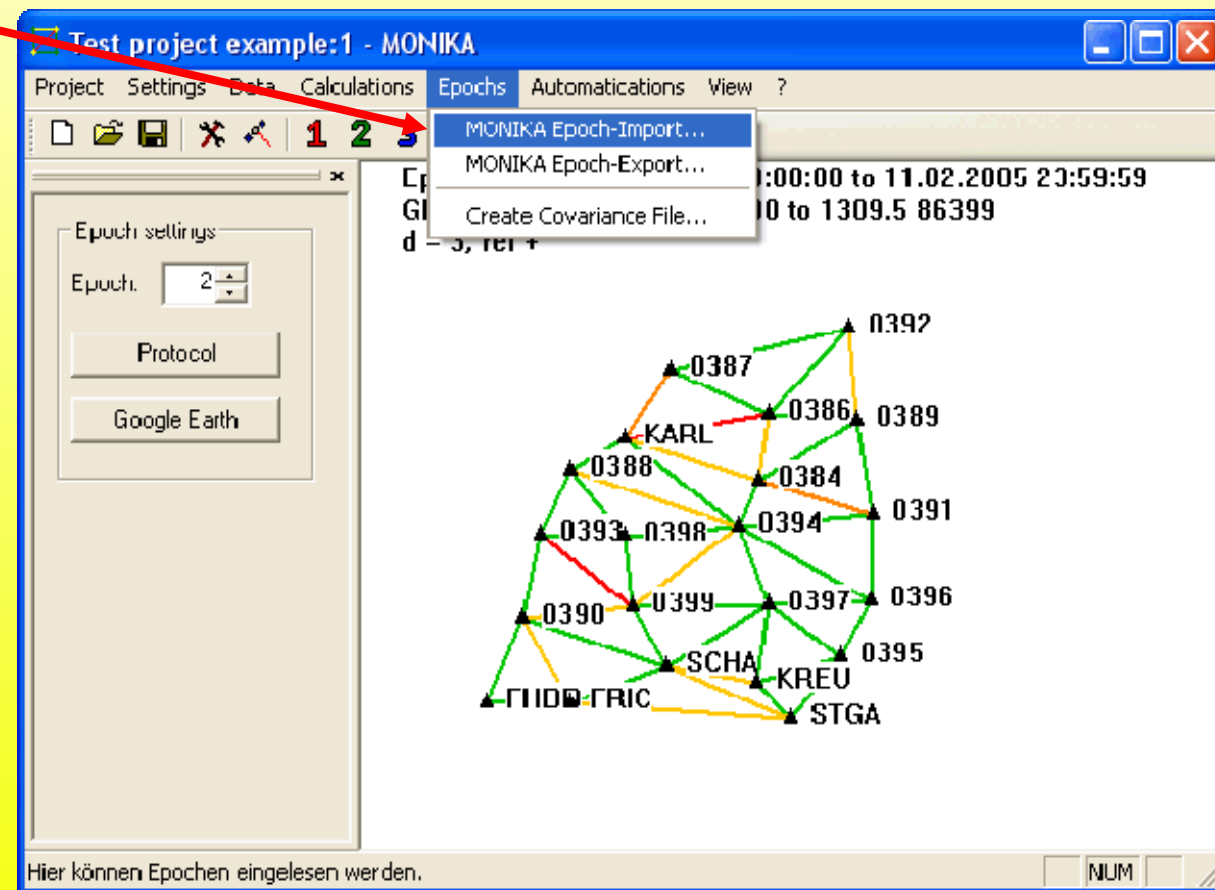
20050210000000-20050211235959.epkov - Editor

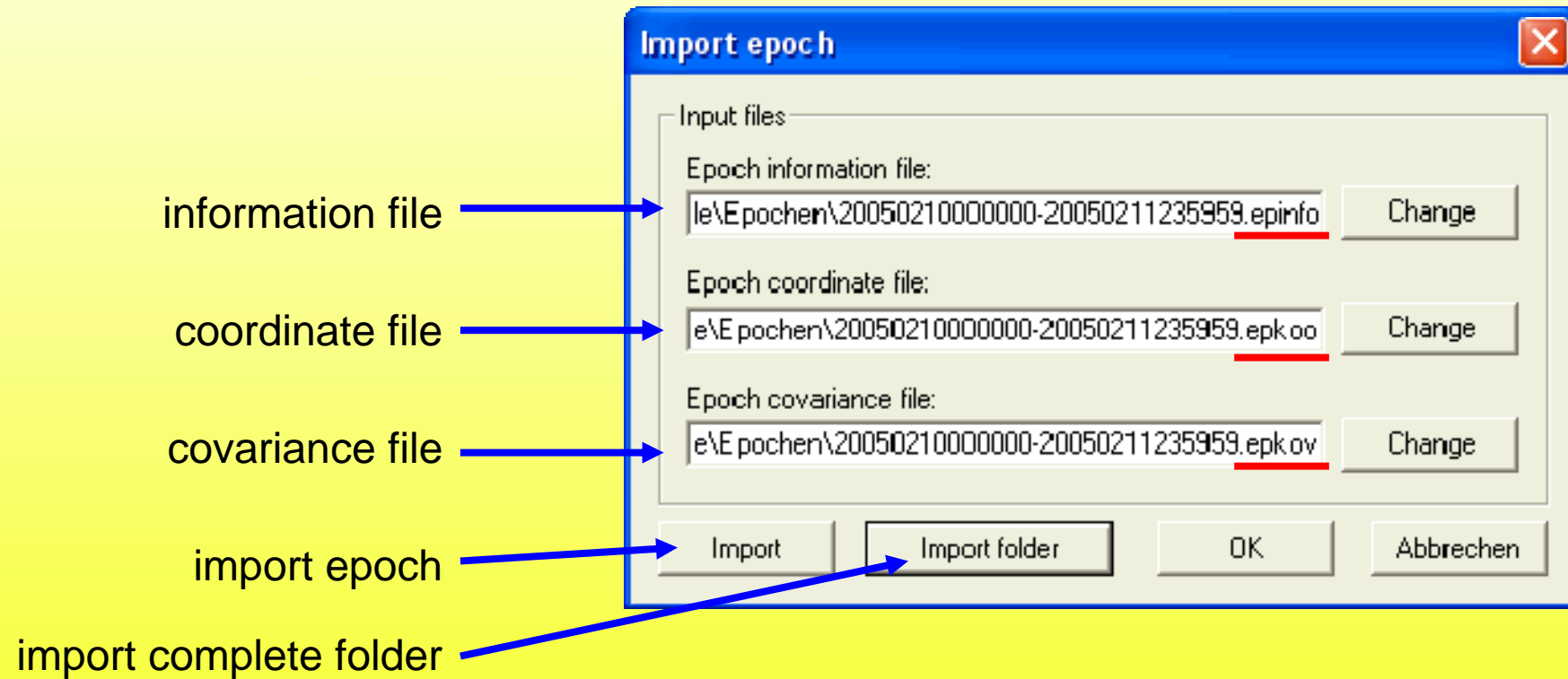
Datei Bearbeiten Format Ansicht ?

1.000000000000000D+000		
3.147890616392679D-007	5.944971208560817D-008	3.202718825881980D-007
1.144978866138047D-008	-3.299651747120533D-010	-1.135422953138765D-009
7.951039223830534D-008	1.657727219489761D-008	9.626205736730467D-008
6.356873107776283D-008	1.259143337991418D-008	7.568156386135962D-008
-1.809963709842461D-008	-4.517700892116433D-009	-2.872940970182244D-008
2.465588108862477D-008	5.503902396625515D-009	3.515961067725017D-008
1.053424495550385D-007	2.431188546703496D-008	1.159318702455547D-007
1.436614946075203D-008	2.244081922207540D-009	1.689141839098506D-010

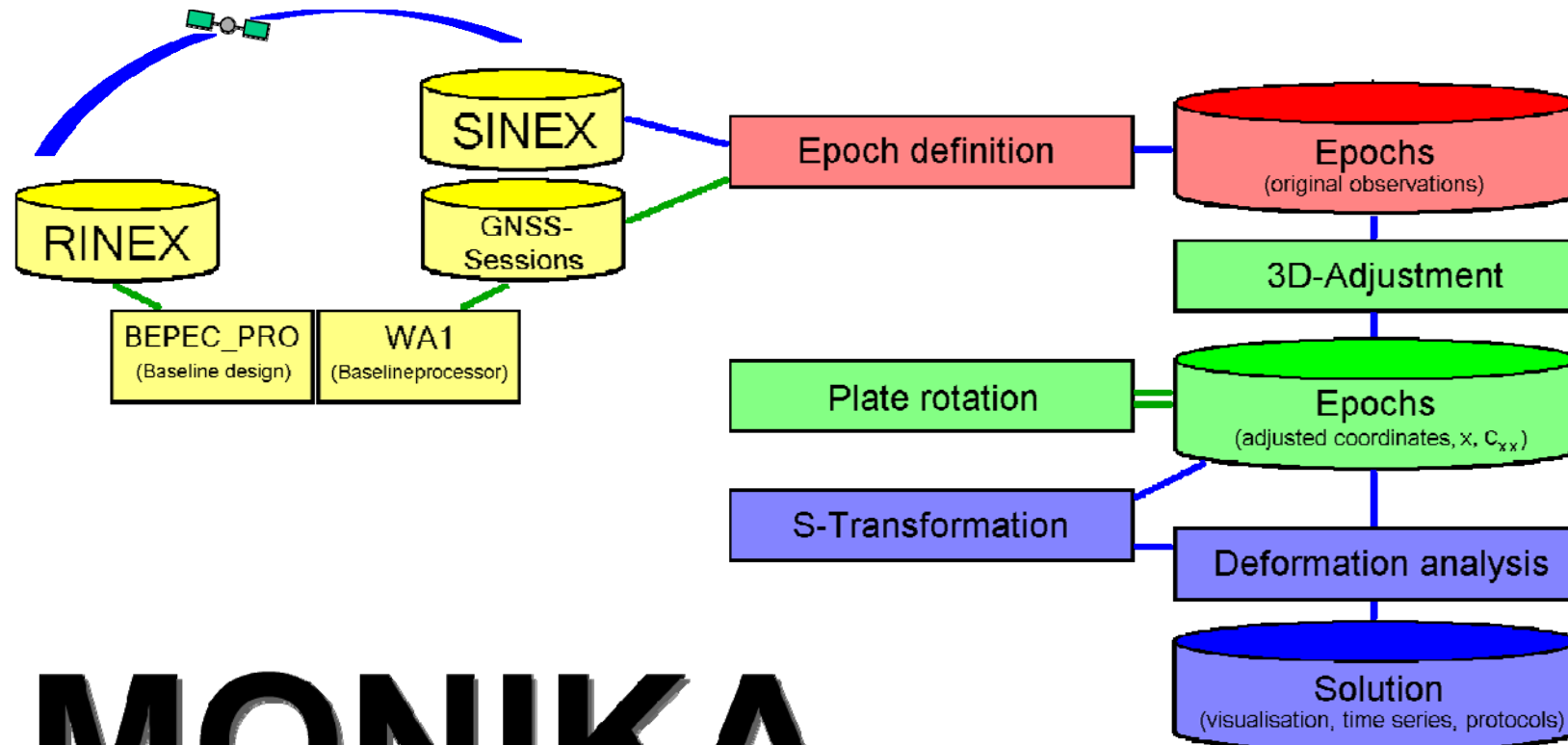
## 6.3 Epoch-Import

import epochs





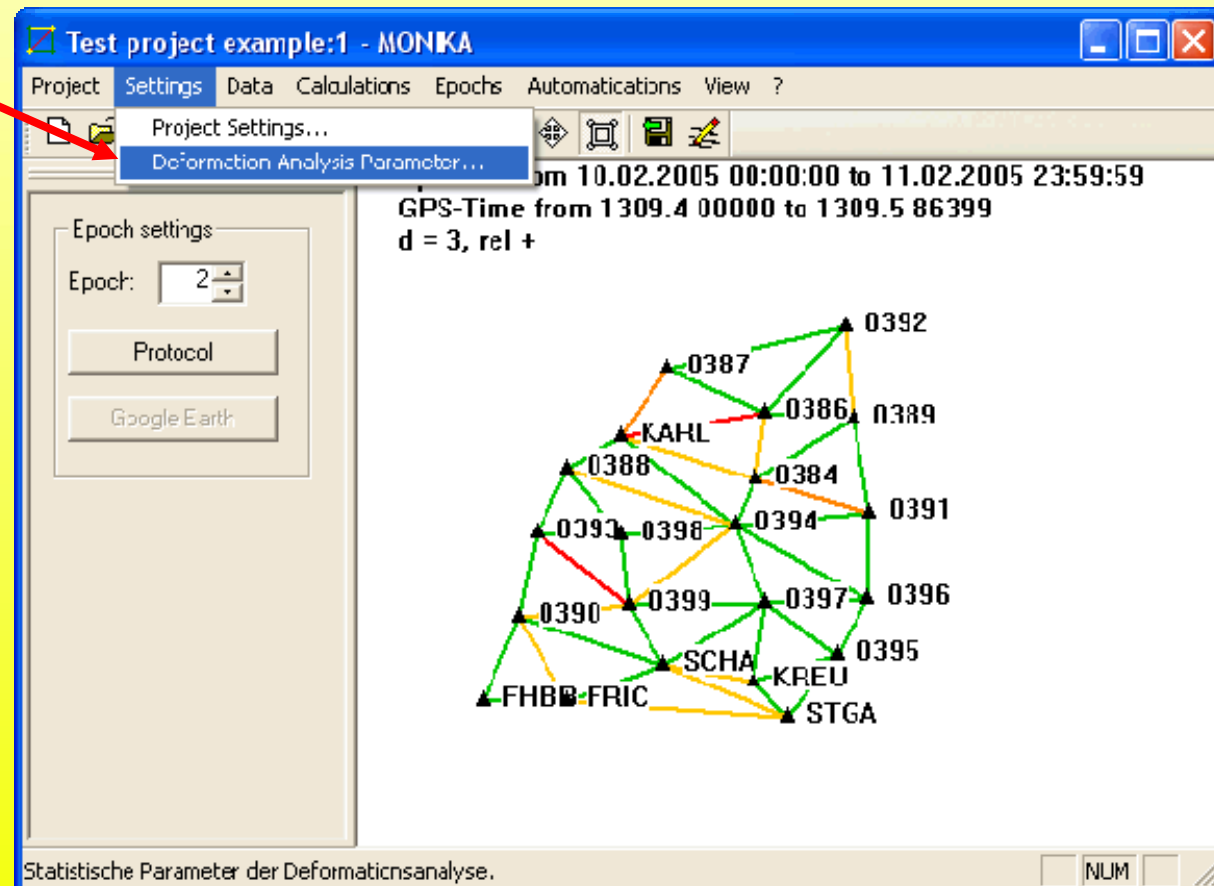
# Overview



# MONIKA

## 7. Deformation analysis

## deformation analysis parameter settings



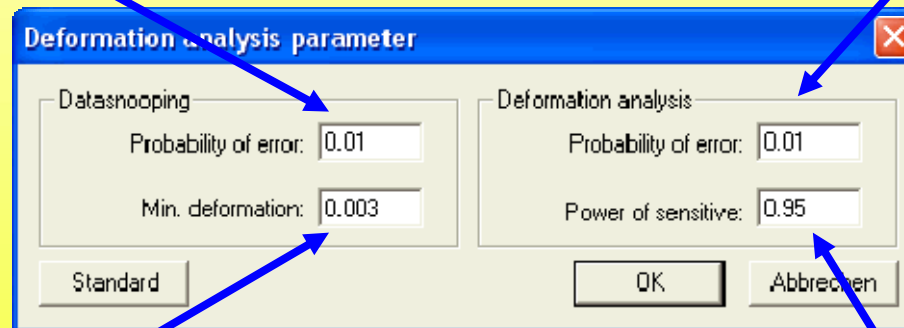
## 7. Deformation analysis



## 7.1 Parameters

probability of error  
during the datasnooping

probability of error  
during the final  
deformation analysis



The dialog box titled "Deformation analysis parameter" contains two main sections: "Datasnooping" and "Deformation analysis". The "Datasnooping" section has a "Probability of error" field set to 0.01 and a "Min. deformation" field set to 0.003. The "Deformation analysis" section has a "Probability of error" field set to 0.01 and a "Power of sensitive" field set to 0.95. At the bottom, there are buttons for "Standard", "OK", and "Abbrechen". Blue arrows point from the surrounding text to the "Probability of error" fields in both sections and the "Min. deformation" field.

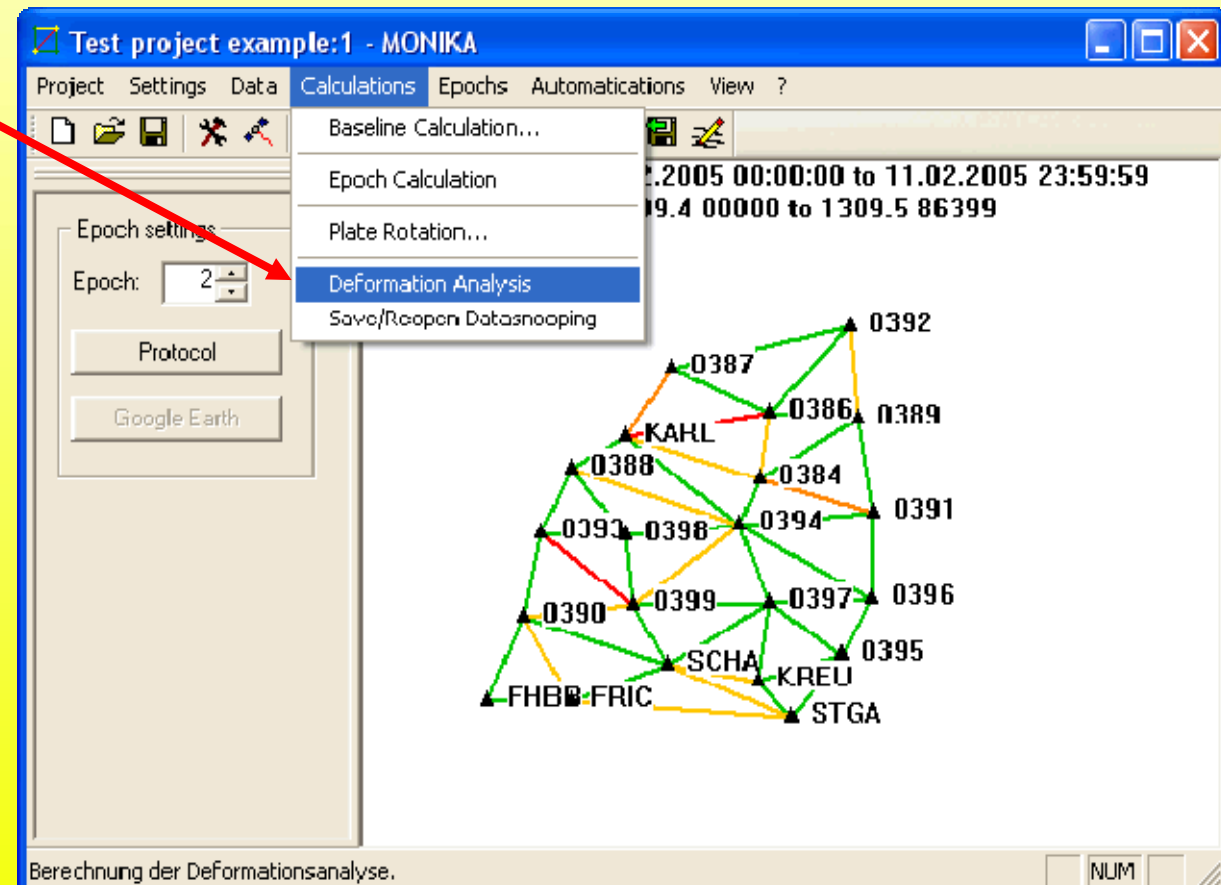
Section	Parameter	Value
Datasnooping	Probability of error	0.01
	Min. deformation	0.003
Deformation analysis	Probability of error	0.01
	Power of sensitive	0.95

minimal deformation for an  
deformed reference point

power of the  
sensitivity analysis

## 7.2 Deformation analysis

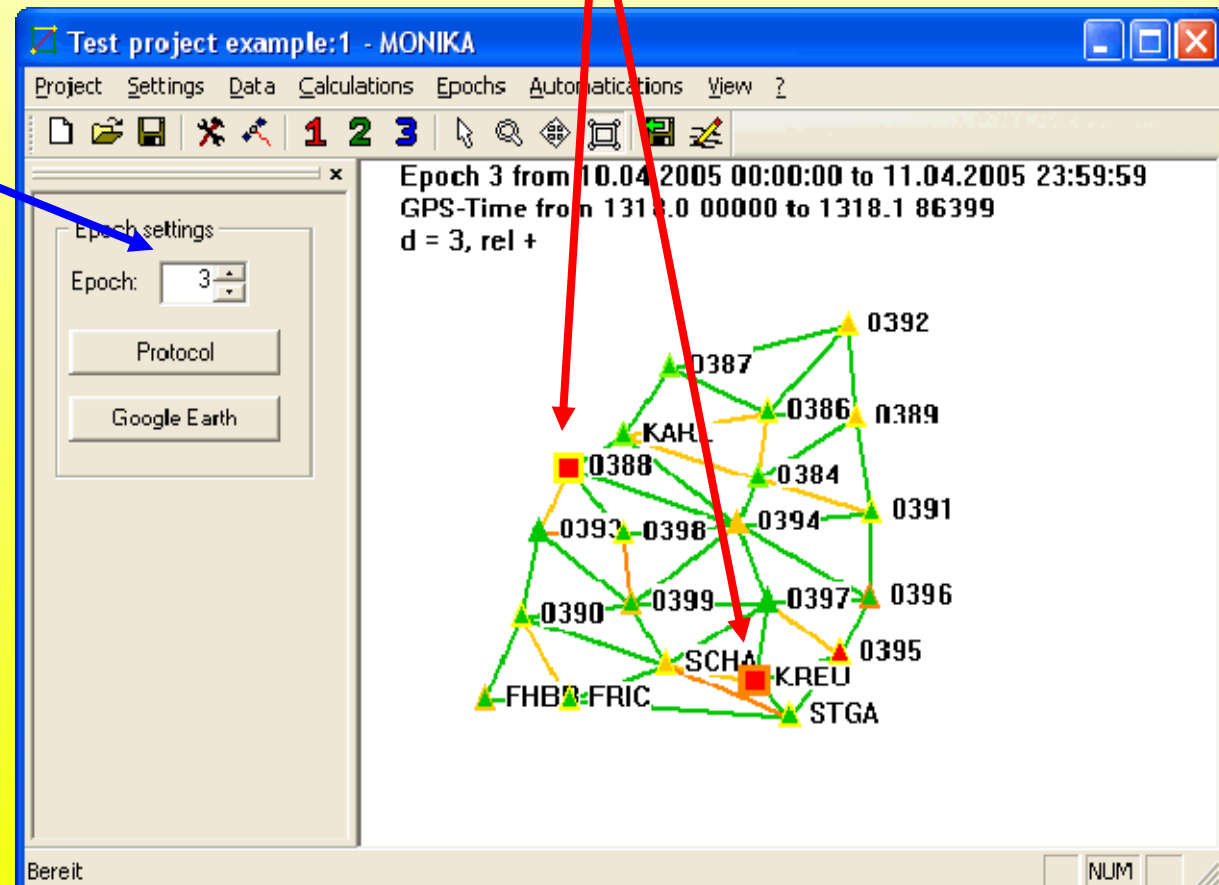
## starting the deformation analysis



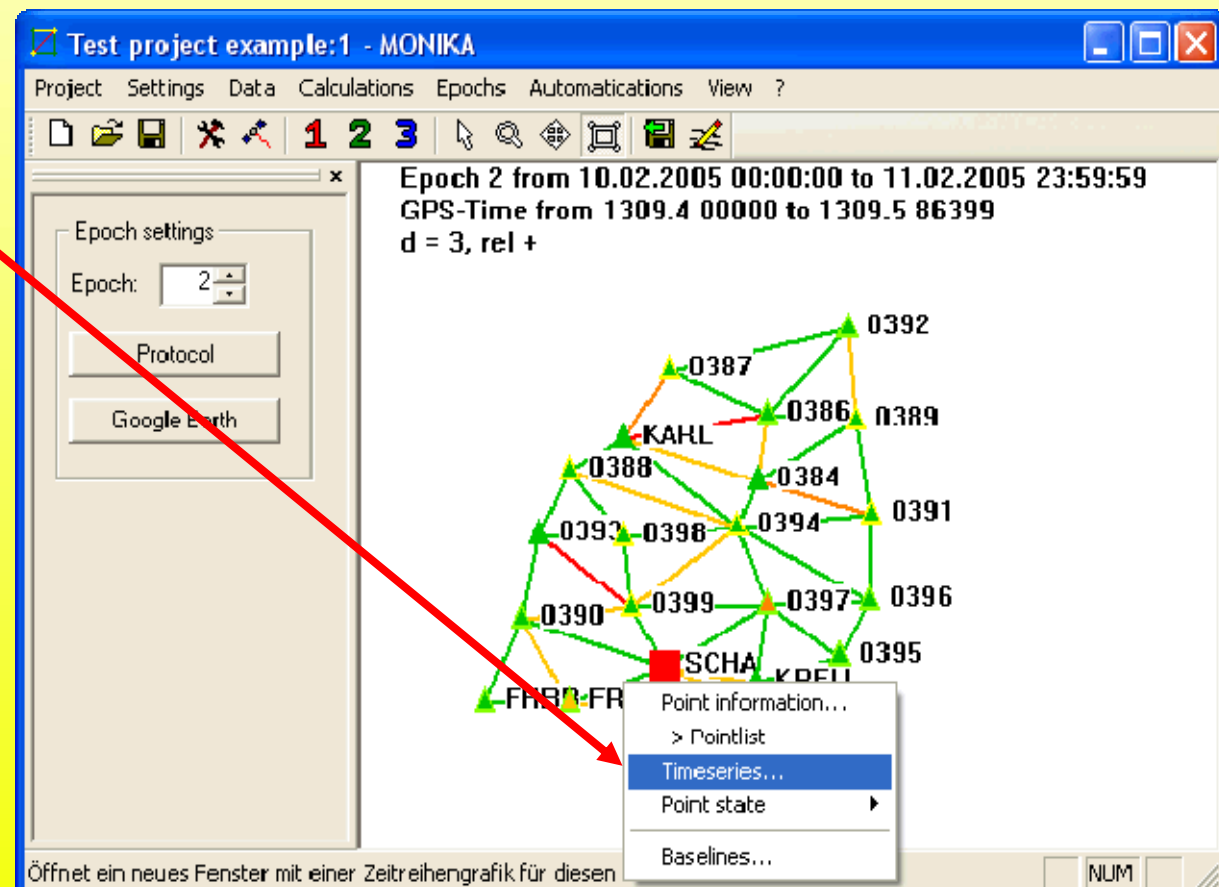


search for deformed reference points

switch through  
all epochs



open time  
series diagramm  
at point  
(right click)



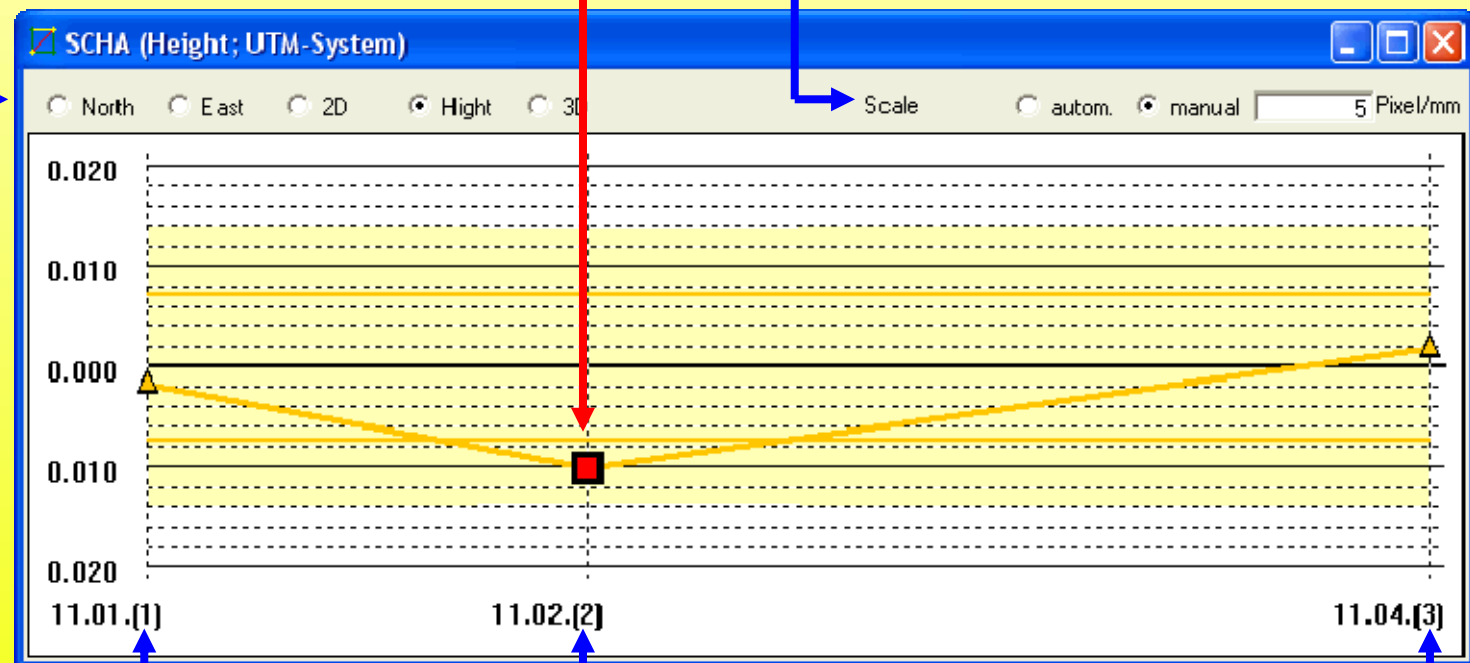
deformed reference point (2. epoch)

reference system

set scale

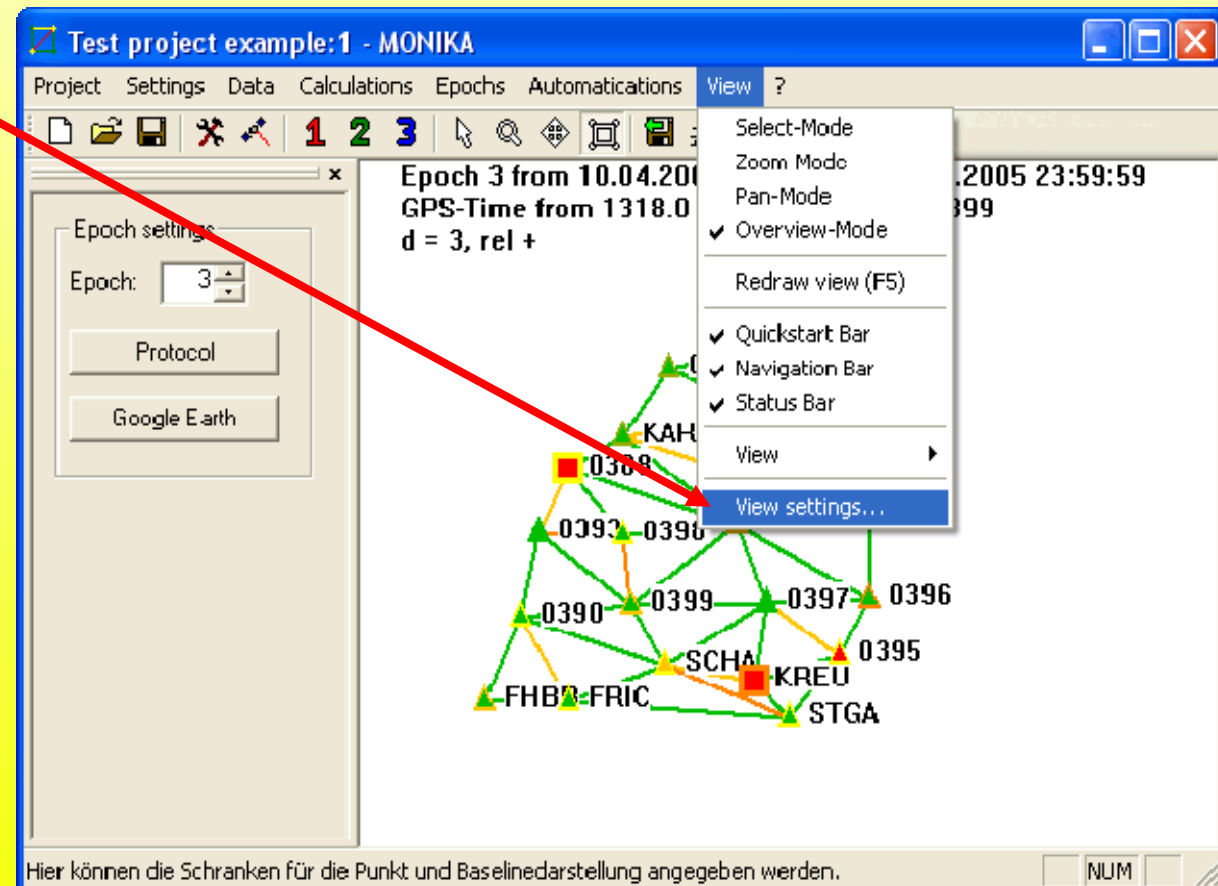
scale

epochs

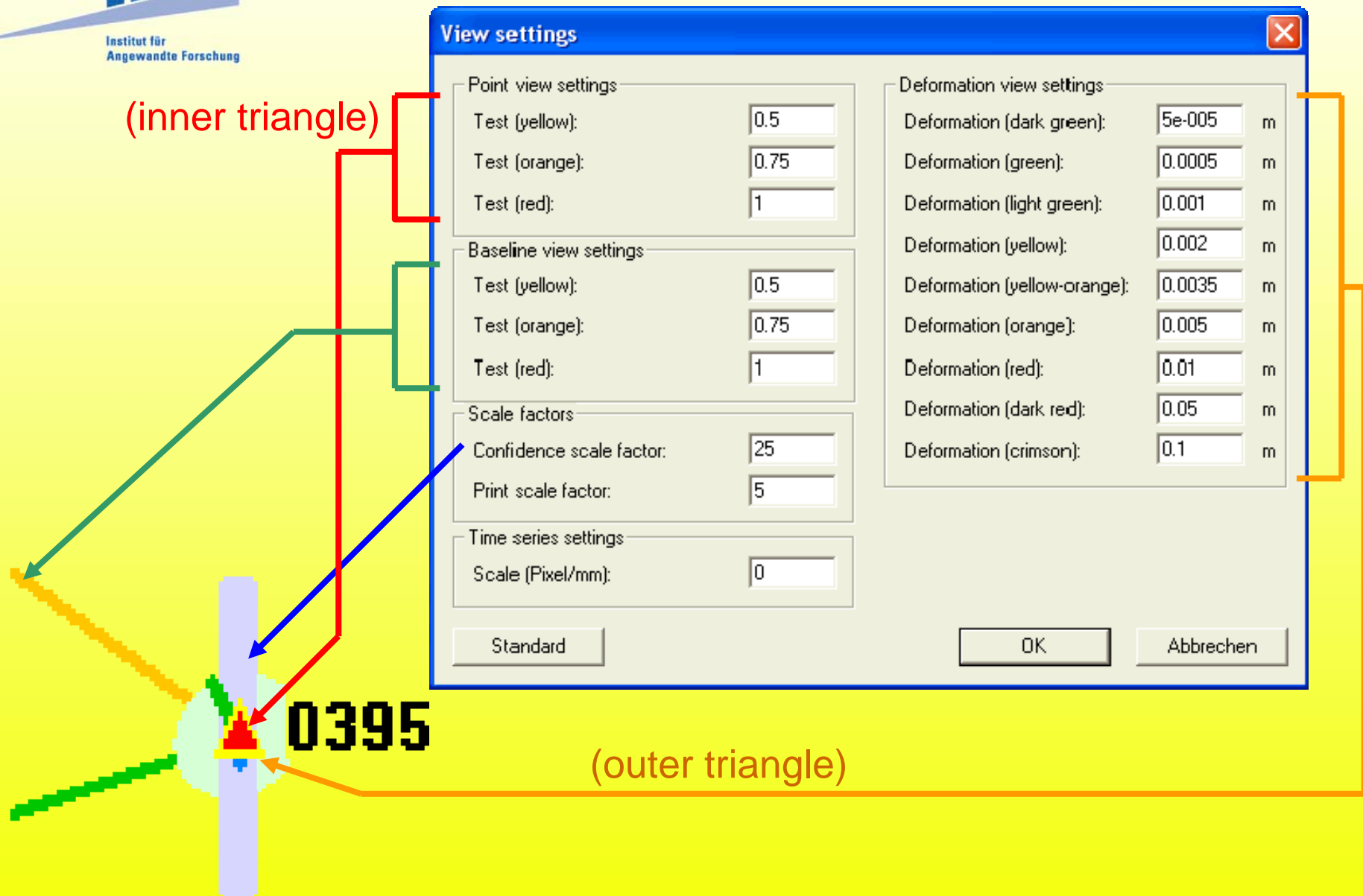


## 7.4 View settings

open the view settings



## 7.4 View Settings



**View settings**

**Point view settings**

Test (yellow):	0.5
Test (orange):	0.75
Test (red):	1

**Baseline view settings**

Test (yellow):	0.5
Test (orange):	0.75
Test (red):	1

**Scale factors**

Confidence scale factor:	25
Print scale factor:	5

**Time series settings**

Scale (Pixel/mm):	0
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**Deformation view settings**

Deformation (dark green):	5e-005	m
Deformation (green):	0.0005	m
Deformation (light green):	0.001	m
Deformation (yellow):	0.002	m
Deformation (yellow-orange):	0.0035	m
Deformation (orange):	0.005	m
Deformation (red):	0.01	m
Deformation (dark red):	0.05	m
Deformation (crimson):	0.1	m

Standard OK Abbrechen

**0395**

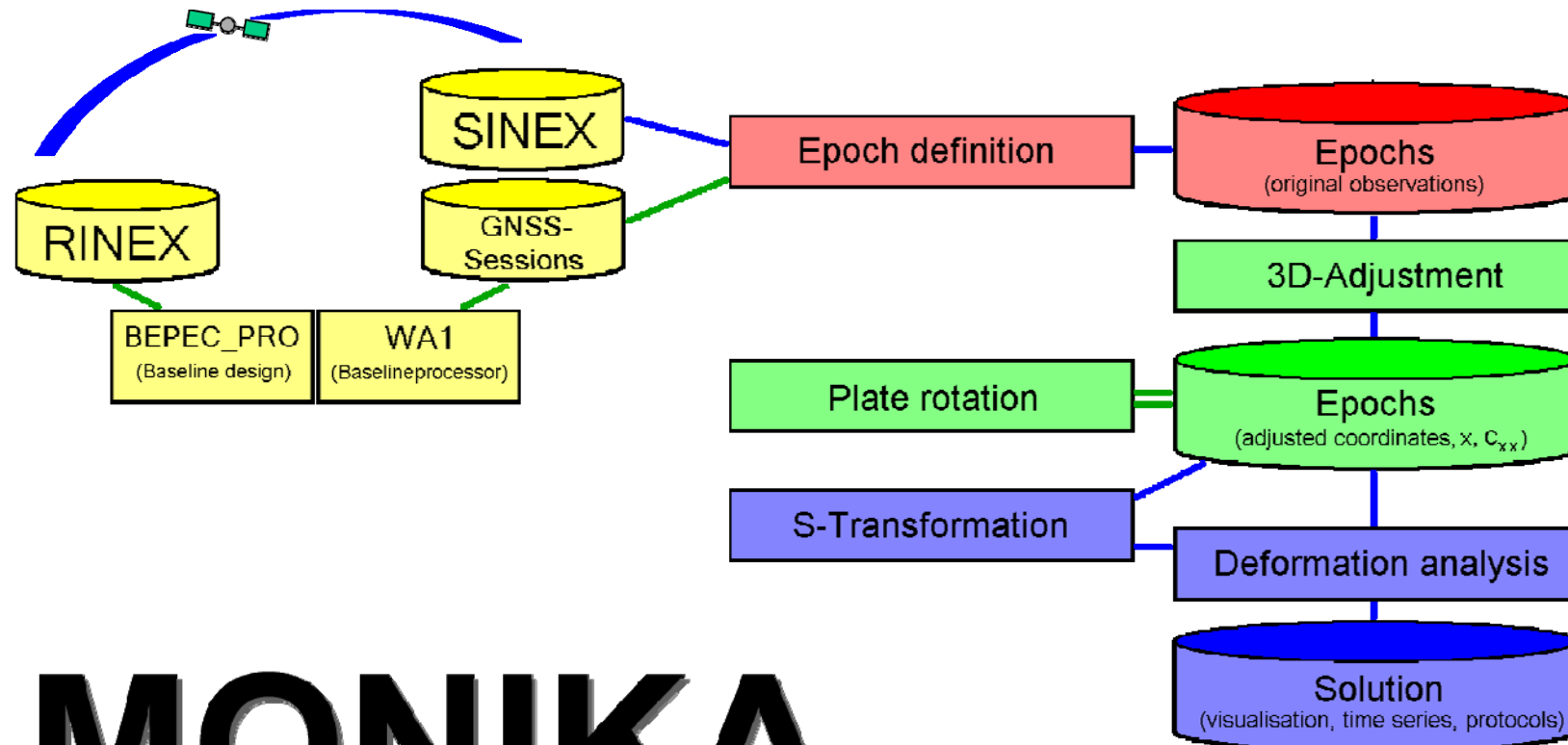
(inner triangle)

(outer triangle)

## 7.4 View Settings



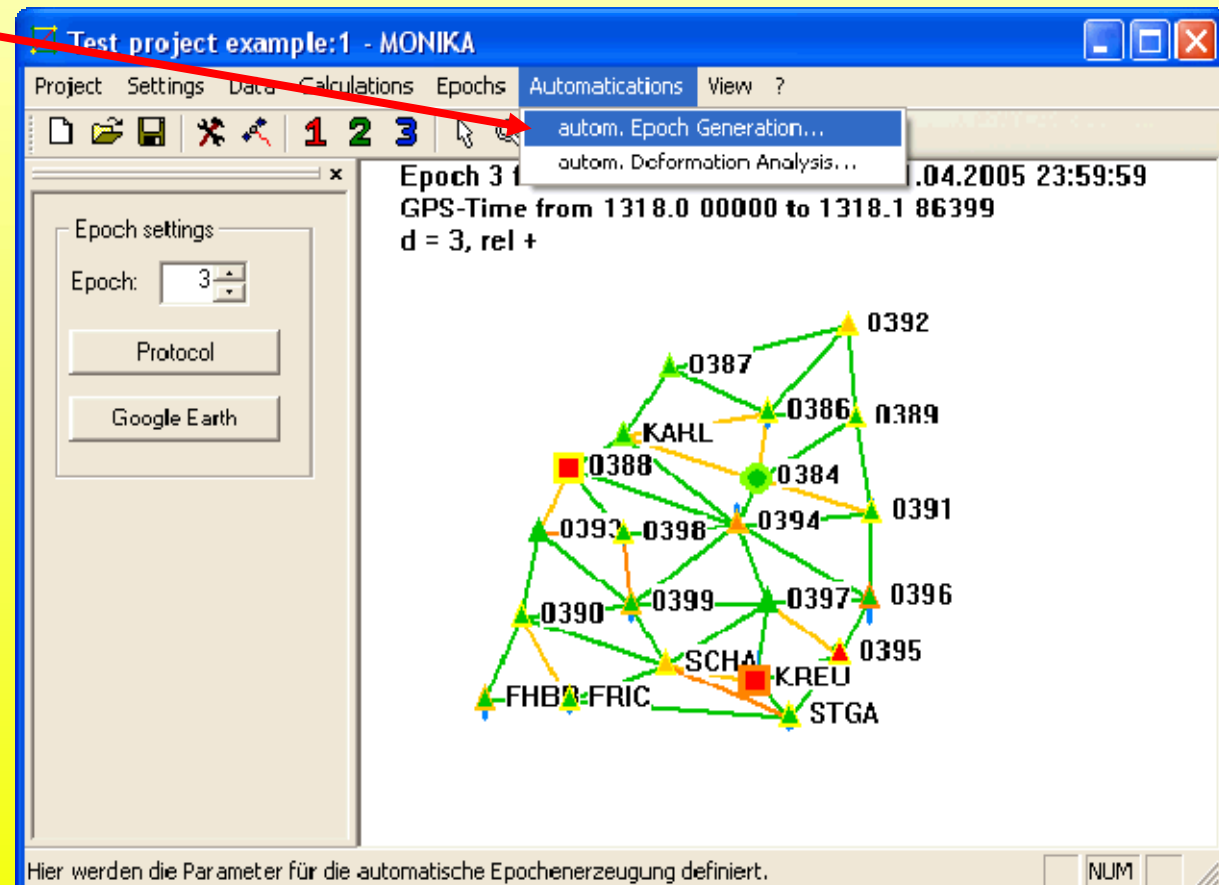
# Overview



# MONIKA

## 8. Automations

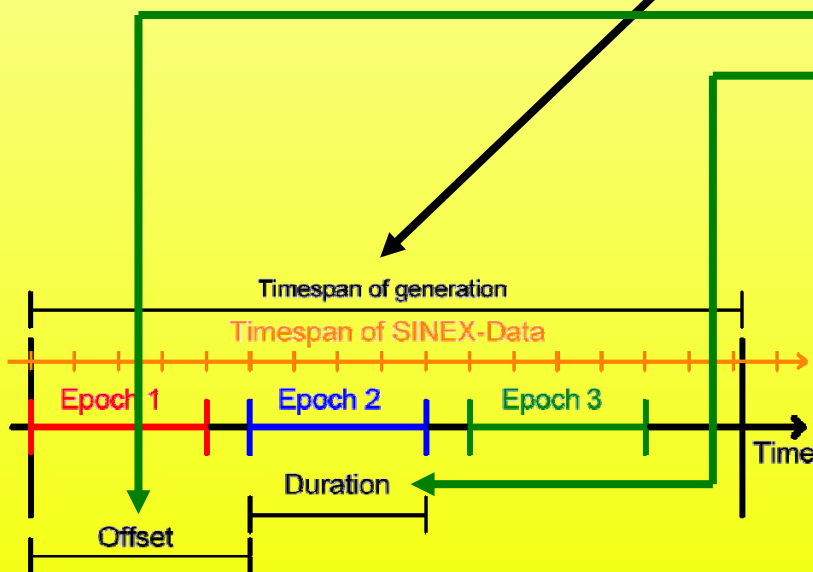
automatic epoch generation



activation

new generation

Input folder  
Output folder  
Archive folder  
(for old files)



**Epoch generation settings**

General settings

Name : Generation 1

SINEX folder : C:\MONIKA\Project-Example\SINEX\ Change

Epoch folder : C:\MONIKA\Project-Example\Epochen\ Change

Archive folder : C:\MONIKA\Project-Example\Epochen\ Change

Time settings

Generation period : from 27.06.2010 00:00:00 to 02.07.2011 23:59:59  
GPS: 1590.0 00000 GPS: 1642.6 36399

Epoch distance : 1 days 0 seconds (1 day = 86400 sec)

Epoch duration : 0 days 86399 seconds

Process settings

☒ GPS-Factor (inner/outer Accuracy)  
GPS-Factor : 10

☒ automatic variance component estimation

Type of observations

☐ absolute observations  
☒ relative observations ?

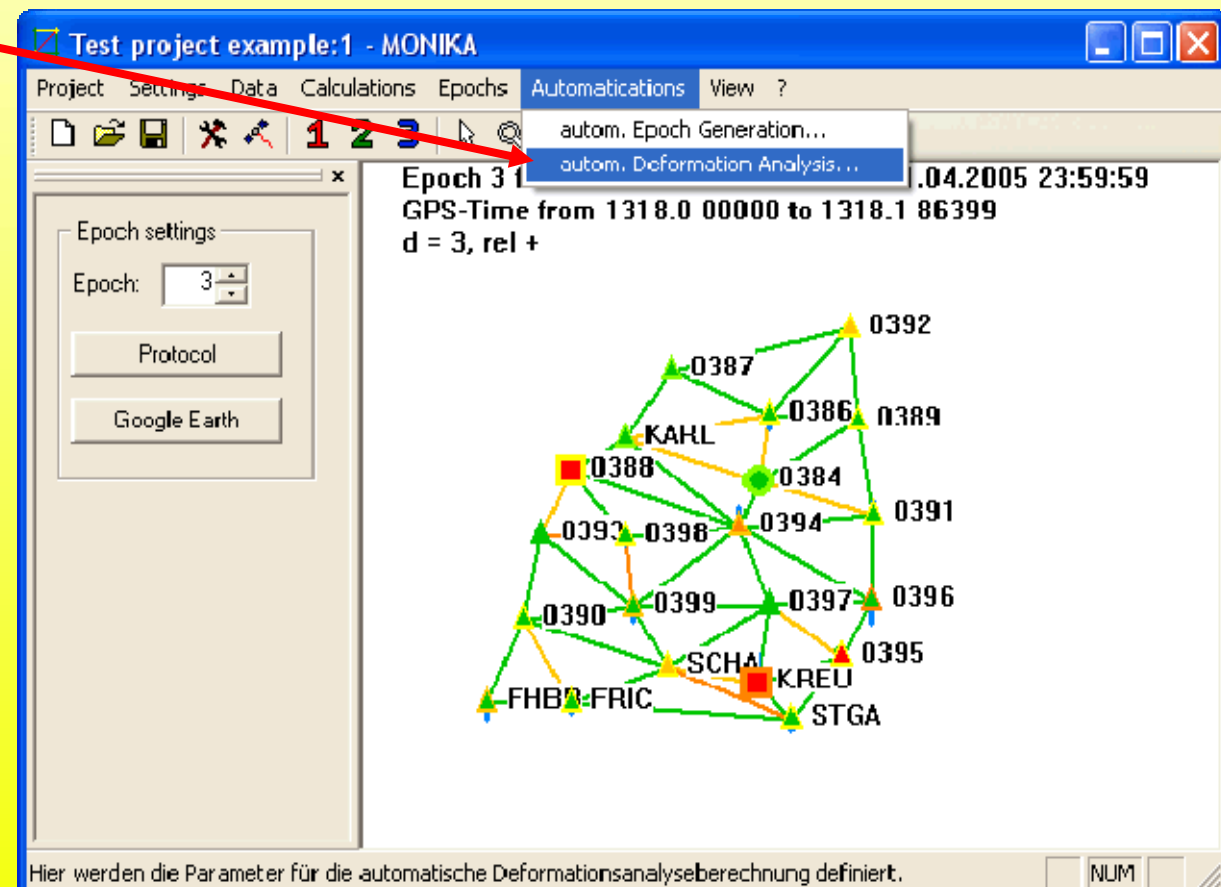
Process settings

Waiting loop 60 second Message display loop 300 ms

Abbrechen OK

## 8.1 Epoch Generation

## automatic deformation analysis generation



## 8.2 Deformation Analysis generation

## 8.1 Deformation analysis generation

# activation

new generation

[illegible]

## 8.2 Deformation Analysis generation

Input folder  
Output folder  
Archive folder  
(for old files)

**Deformation analysis generations settings**

General settings

Name: Deformation 2

Epoch folder: C:\MONIKA\Project-Example\Epochen\ Change

Solution folder: C:\MONIKA\Project-Example\Protokolle\ Change

Archive folder: C:\MONIKA\Project-Example\Protokolle\ Change

Time settings

Generation period: from 29.06.2010 00:00:00 to 28.06.2011 23:59:59

GPS: 1590.2 00000 GPS: 1642.2 86399

Analysis distance: 4 days 0 seconds (1 day = 86400 sec)

Epoch distance: 2 days 0 seconds Abw.: 360 seconds

Epoch duration: 4 days 86399 seconds Abw.: 360 seconds

Number of epochs per deformation analysis: 5 epochs

☐ Reference epoch: chen\B-20050110000000-20050411235959-03.epinfo Change ?

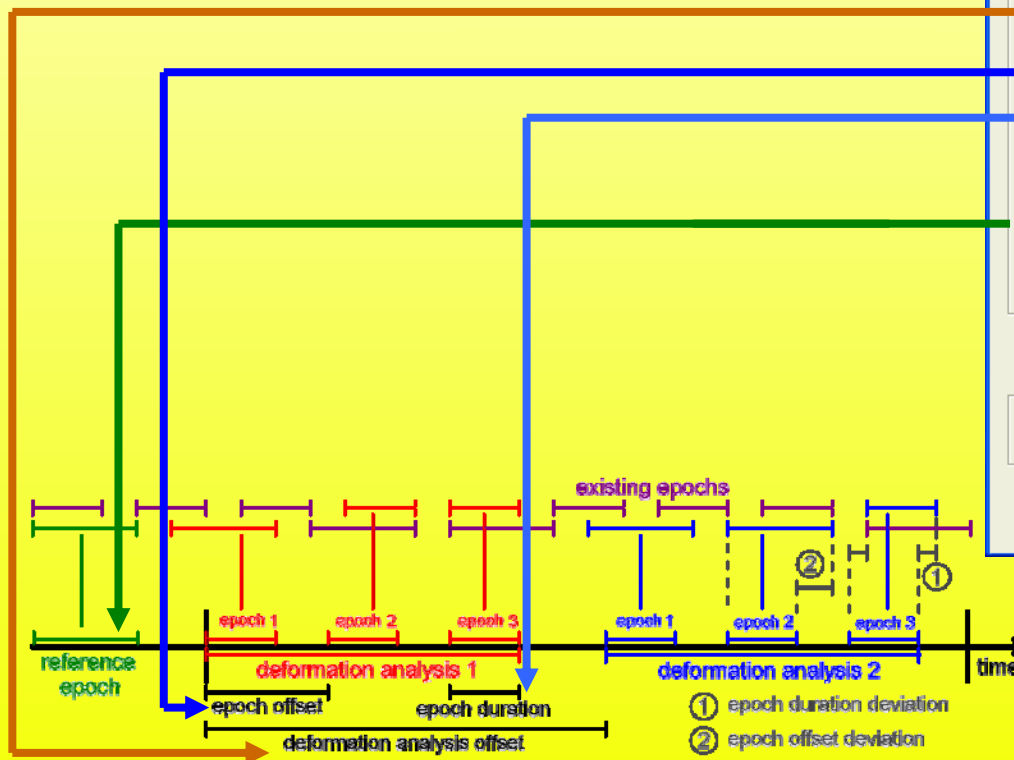
☐ Object point list: Change ?

Deformation analysis parameter View settings

Process settings

Waiting loop: 60 seconds Message display loop: 300 ms

Abbrechen OK



## 8.2 Deformation Analysis generation

FIN-Files for GOCA

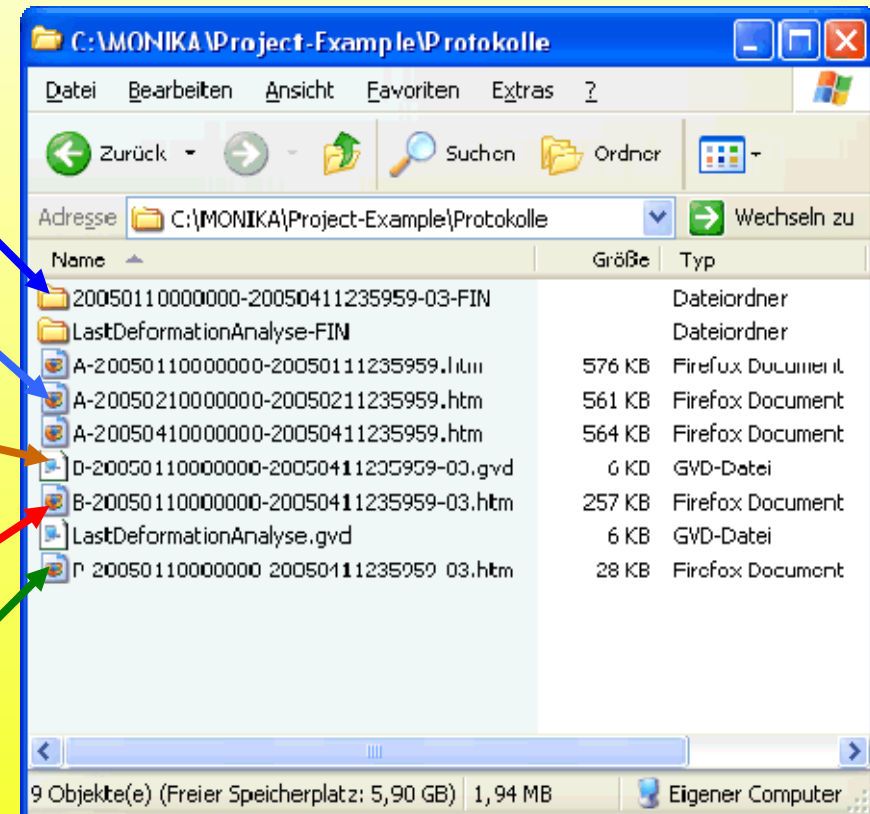
HTML-GPS3D-Protocol

GVD-File for GOCA-Earth

(identical points + deformations)

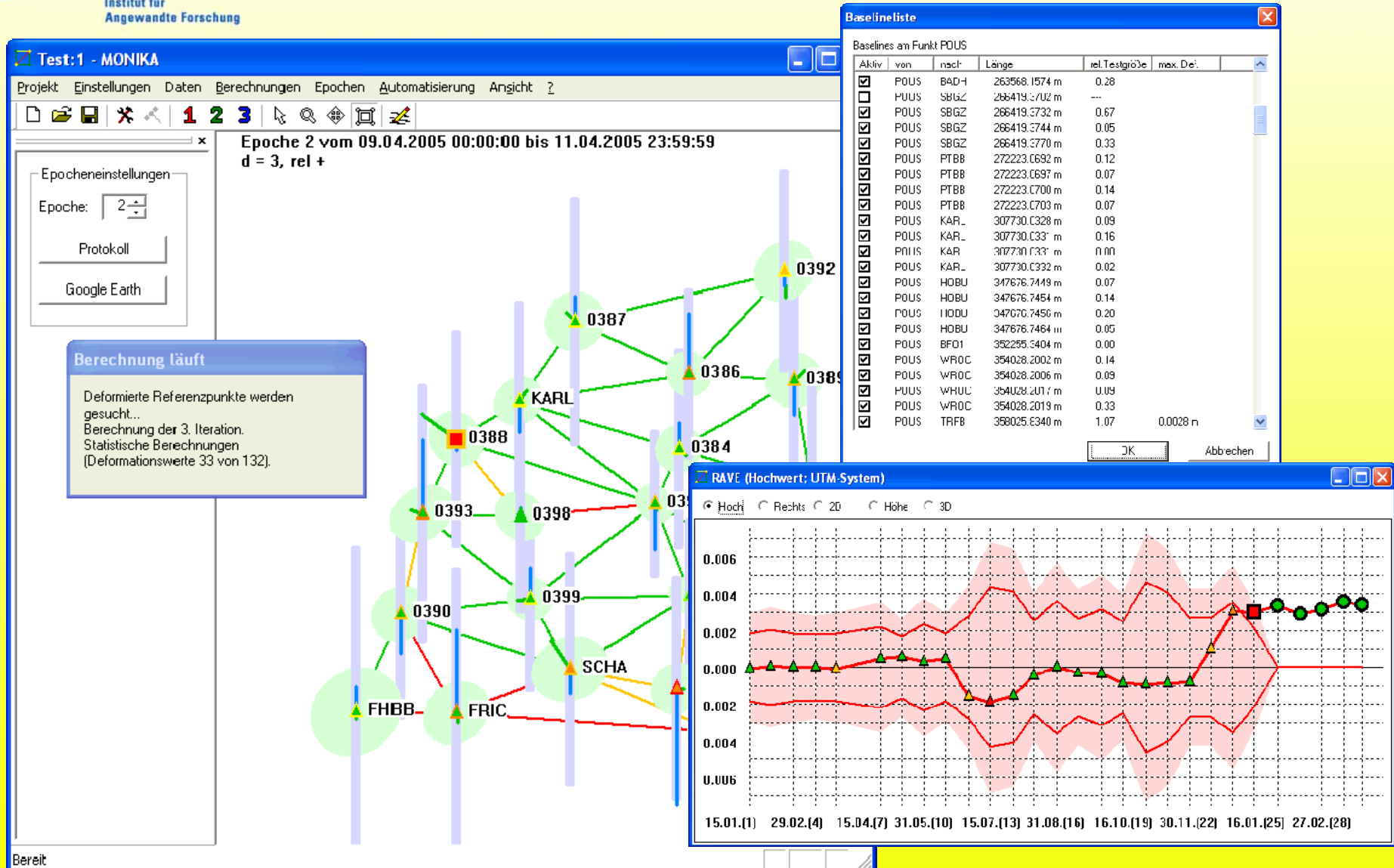
HTML-Deformation-Protocol

HTML-Plate-Rotation-Protocol



## 8.3 Deformation Analysis Files





**Thank you for your attention !**

**Any questions?**