



Federal Agency for  
Cartography and Geodesy

# Practical Exercise BKG Ntrip Client (BNC)

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# BNC at a glance



- BKG supported the development of the Ntrip standard as an open industry standard for streaming GNSS data over the internet
- Development of BNC started in 2005 as a multi-stream NtripClient , that allows pulling of hundred data streams simultaneously
- Decoding RTCM observation streams and conversion into RINEX files for near real time applications is a by product of this development
- In 2010 the development of a PPP client starts, which was completely renewed in 2014.
- 2012 support of Galileo, QZSS and Beidou was added

# BNC at a glance



- 130.000 lines of C++ code
- GNU Public License, open source code
- Available for Linux, Windows, MacOS
- Used in productive as well as experimental environments and as a software example to improve the understanding of basic real time GNSS principles
- Latest Release: 2.12.2

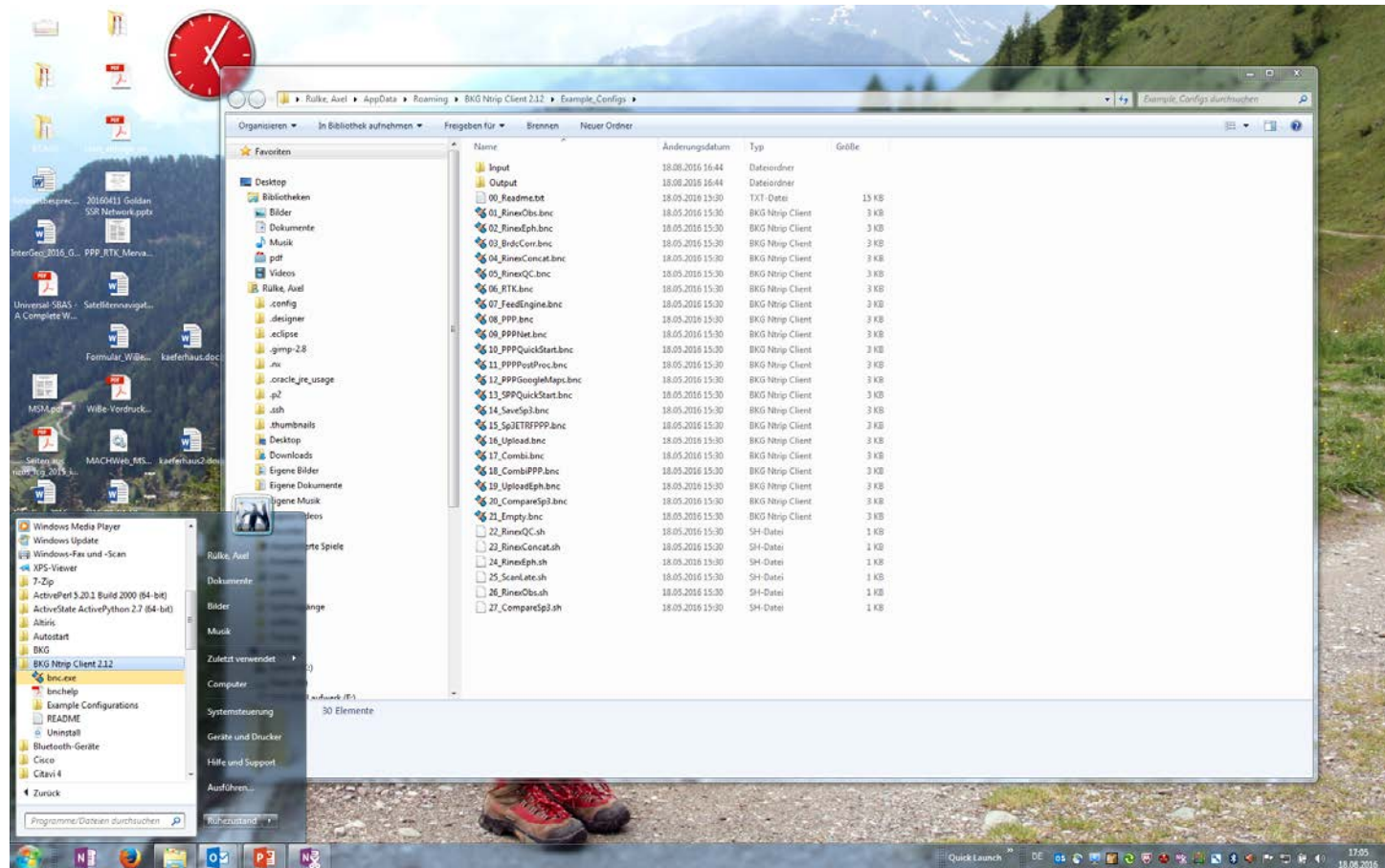
# BNC installation

Download: <https://igs.bkg.bund.de/ntrip/download>

The following tables provide links to free pre-compiled binaries - including binaries for BNC - which support the Ntrip transport protocol.


Multi-Function Ntrip Software and Assisting Tools					
Name, Description	Operating System	Code Executable	Provider	Vers.	Type Size
BKG Ntrip Client (BNC), Decoder, Converter and Monitor reading RTCM 2.x and RTCM 3.x formats, supporting Real-time PPP, High-rate RINEX Data Centers, Real-time GNSS Engines and Real-time Combination Centers	Source Code, GPL	<a href="#">C++ v2.12.2</a>	Leos Mervart (Czech Technical University, Prague) Georg Weber (BKG) Andrea Stürze (BKG) Axel Rülke (BKG) Dirk Stöcker (Alberding GmbH)	2.12 <a href="#">ChangeLog</a>	ZIP ~5...20 MB
	openSUSE12 64bit	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	openSUSE42 64bit	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	Debian 8 64bit	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	Ubuntu 14.04 64bit	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	RHEL/CentOS 6, 64bit	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	Raspberry Pi 2 (Raspbian 7)	<a href="#">v2.12.2 shared</a>			
	Raspberry Pi 3 (Raspbian 8)	<a href="#">v2.12.2 shared</a> <a href="#">v2.12.2 static</a>			
	Mac, Static Universal Binaries	<a href="#">DMG v2.12.2</a>			
	Windows	<a href="#">v2.12.2 msi</a>			
BKG Ntrip Professional Caster	Linux	<a href="#">Order Form</a>	BKG	2.0.25	bz2 576KB
NtripClient, NtripServer, and NtripCaster Repositories, search for 'ntrip'	Unix/Linux, Distributions: SUSE, Fedora, Mandriva	<a href="#">RPM's or Search SUSE</a>	Dirk Stoecker	--	--
RTKLIB, Open Source Program Package for RTK-GPS	Windows NT/2000/XP	<a href="#">RTKLIB</a>	Tomoji Takasu, Japan	2.4	ZIP ~30 MB
GnssSurfer, Ntrip-Client and Server, RTCM 2.x and 3.x Encoder & Decoder, Topcon/Javad Raw Decoder, RINEX Generator, Web-Monitoring, Backup-System	Windows (x64)	<a href="#">Executable</a>	Juergen Siebert, SAPOS	1.10	ZIP ~9 MB
		<a href="#">Light Version</a>		1.08	
GnssCaster, Ntrip-Caster	Windows (x64)	<a href="#">Console-Version</a>	Juergen Siebert, SAPOS	1.071	ZIP 14.5MB
RTCM 2.x Decoder, reading from local IP Port	Windows 98/NT/2000/XP	<a href="#">Executable</a>	Manfred Baeumker, FH Bochum	2.1	ZIP 17 K

# Where is BNC on Windows?




# HELP!

PDF documentation comes with your installation  
HTML Help




Bundesamt für  
Kartographie und Geodäsie



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Mitteilungen  
des Bundesamts  
Kartographie und  
Geodäsie

Band 49



BKG N  
Version 2.12.2

Georg Weber, Leoš Mervart, Armin

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BKG Ntrip Client (BNC) Version 2.12.2

File Help

RINEX Observations RINEX Ephemeris RINEX Editing & QC SP3 Comparison Broadcast Corrections Feed Engine Serial Output

Saving RINEX observation files.

Directory: D:\Users\ruecke\Documents\TEMP\

Interval: 1 day Sampling: 0 sec

Skeleton extension: SKL Skeleton mandatory: ☒

Script (full path):

Version 2: CWPX\_? Signal priority

Version 3: ☒ Version 3 filenames: ☒

Streams:	resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	products.igs-ip.net:2101/CLK11	RTCM_3.0	50.08967	8.66458	no	1	0 byte(s)
2	products.igs-ip.net:2101/RTCM3EPH	RTCM_3.2	50.08967	8.66458	no	1	0 byte(s)
3	www.igs-ip.net:2101/FFM1	RTCM_3.1	50.09	8.66	no	1	0 byte(s)

Log Throughput Latency PPP Plot

Add Stream Delete Stream Map Start Stop

Help?=Shift+F1

Help on context

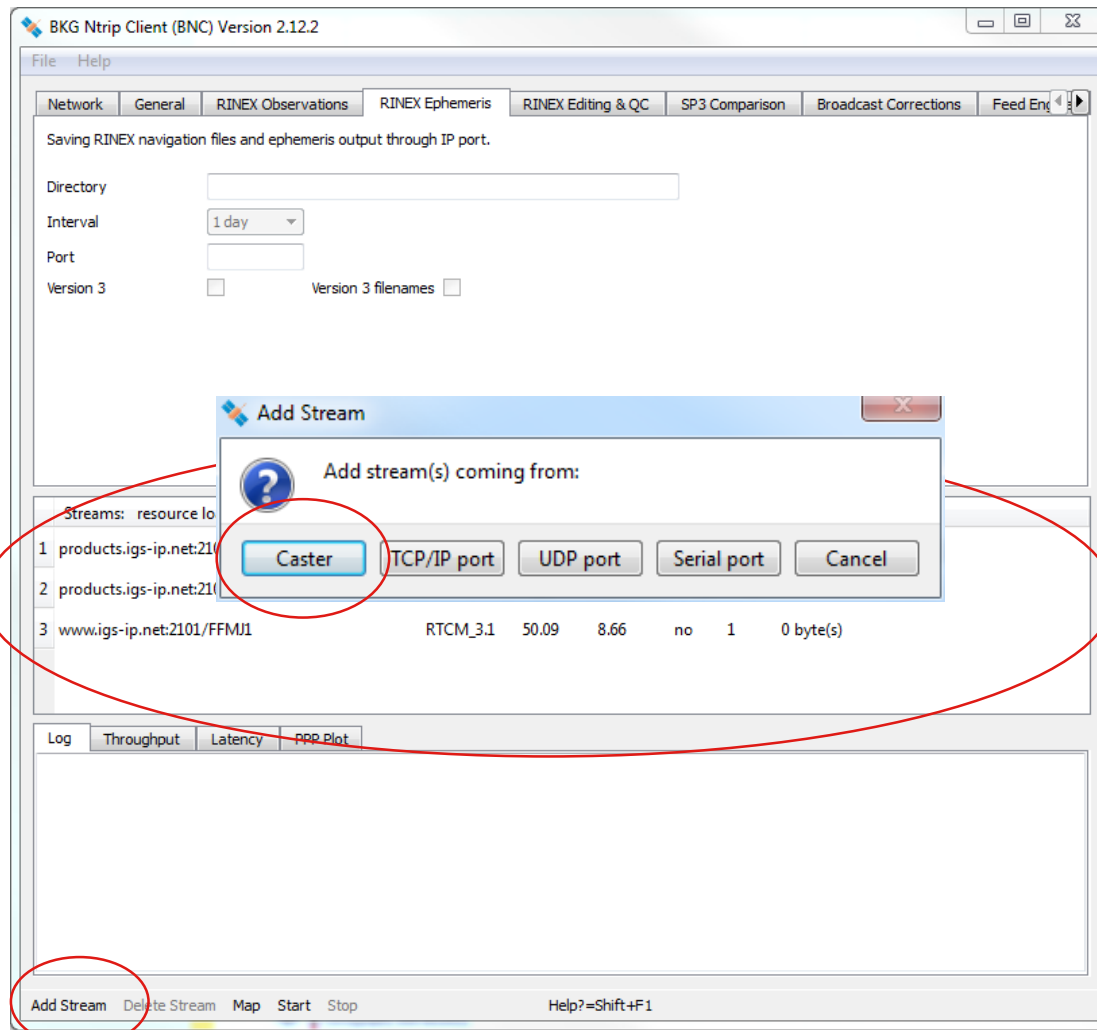


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# Exercises BNC

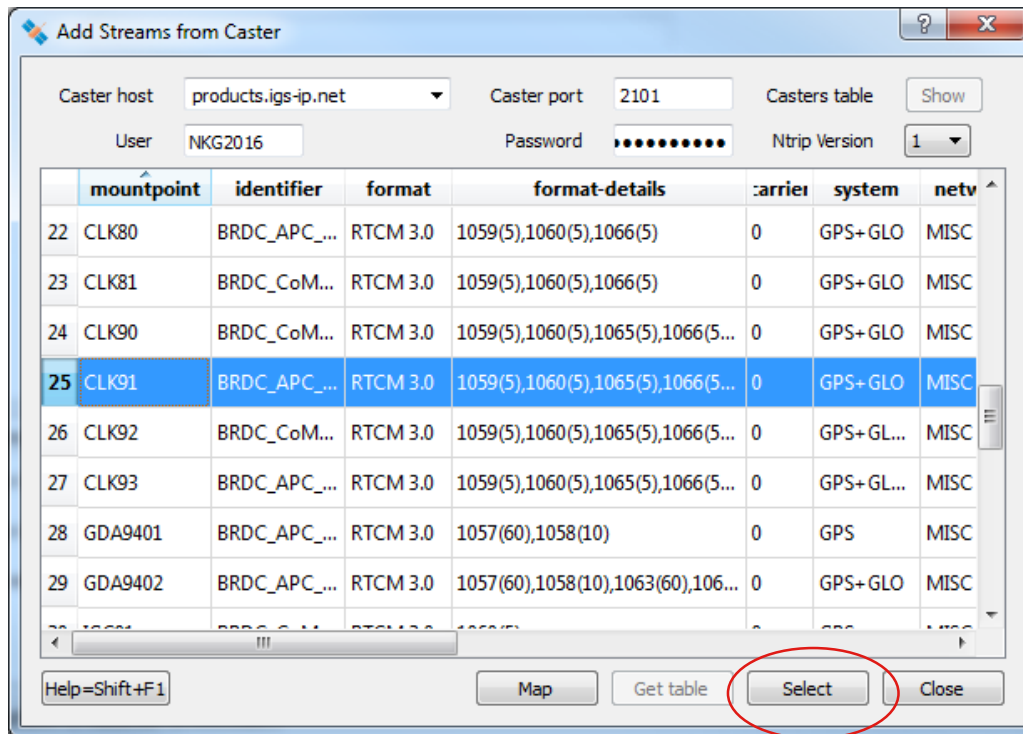
1. Data streams
2. RINEX conversion from rt streams (Obs/Nav
3. Precise Point Positioning
4. RINEX QC and editing (optional)

# Data streams





# Data streams



## Select Caster

Observations:  
igs-ip.net

Correction data streams,  
Ephemerides:  
products.igs-ip.net

User:Passwd  
NKG2016:SummerSchool

Generic account (very limited  
data streams for BNC  
examples only):  
Example:Config

# Conversion RTCM to RINEX Observations

**Select RINEX-Observations**

File Help

Network General **RINEX Observations** RINEX Ephemeris RINEX Editing & QC SP3 Comparison Broadcast Corrections Feed Eng

Saving RINEX observation files.

Directory  0 ... all observations are stored

Interval  Sampling  Select, if use of skl file is mandatory

Skeleton extension  Skeleton mandatory ☒

Script (full path)

Version 2  Signal priority

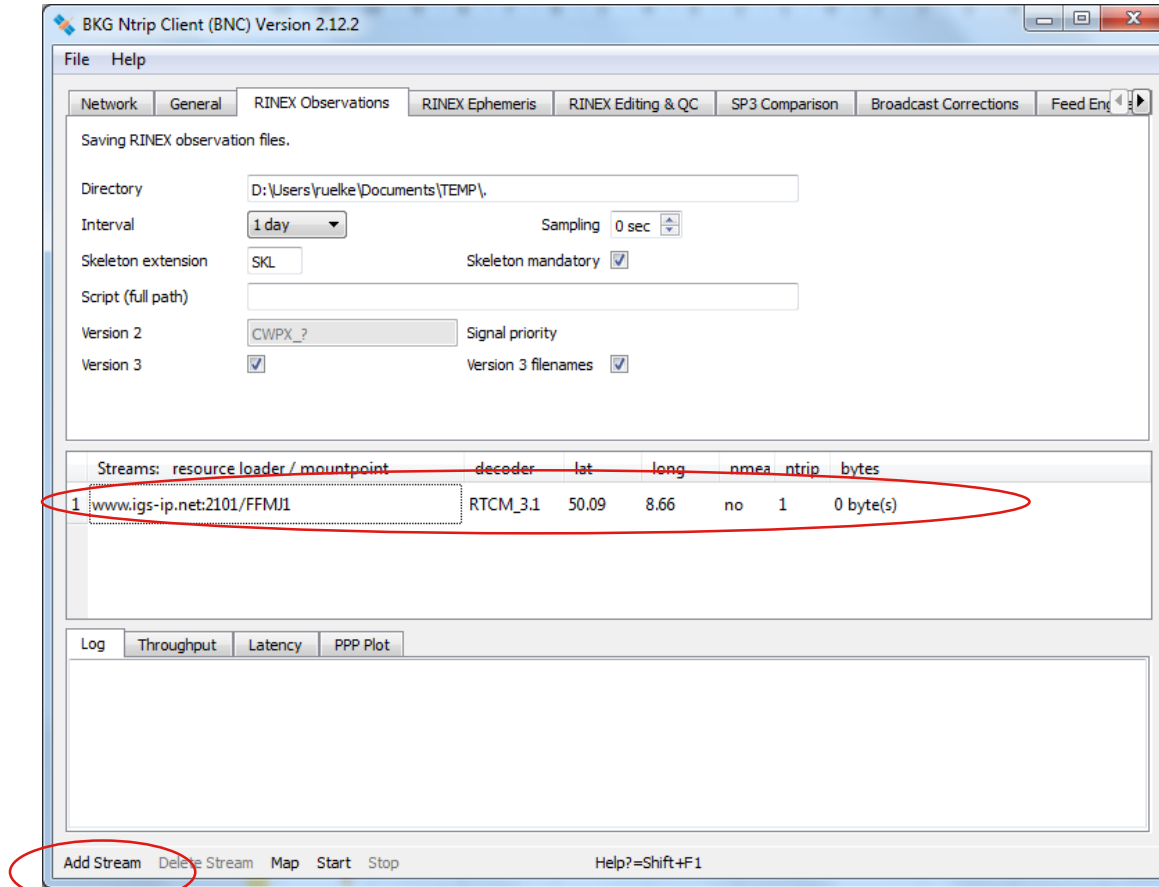
Version 3 ☒ Version 3 filenames ☒ **Select RINEX 3**

Streams:	resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	products.igs-ip.net:2101/CLK11	RTCM_3.0	50.08967	8.66458	no	1	0 byte(s)
2	products.igs-ip.net:2101/CLK93	RTCM_3.0	43.56186	1.48164	no	1	0 byte(s)
3	products.igs-ip.net:2101/RTCM3EPH	RTCM_3.2	50.08967	8.66458	no	1	0 byte(s)

Log Throughput Latency PPP Plot

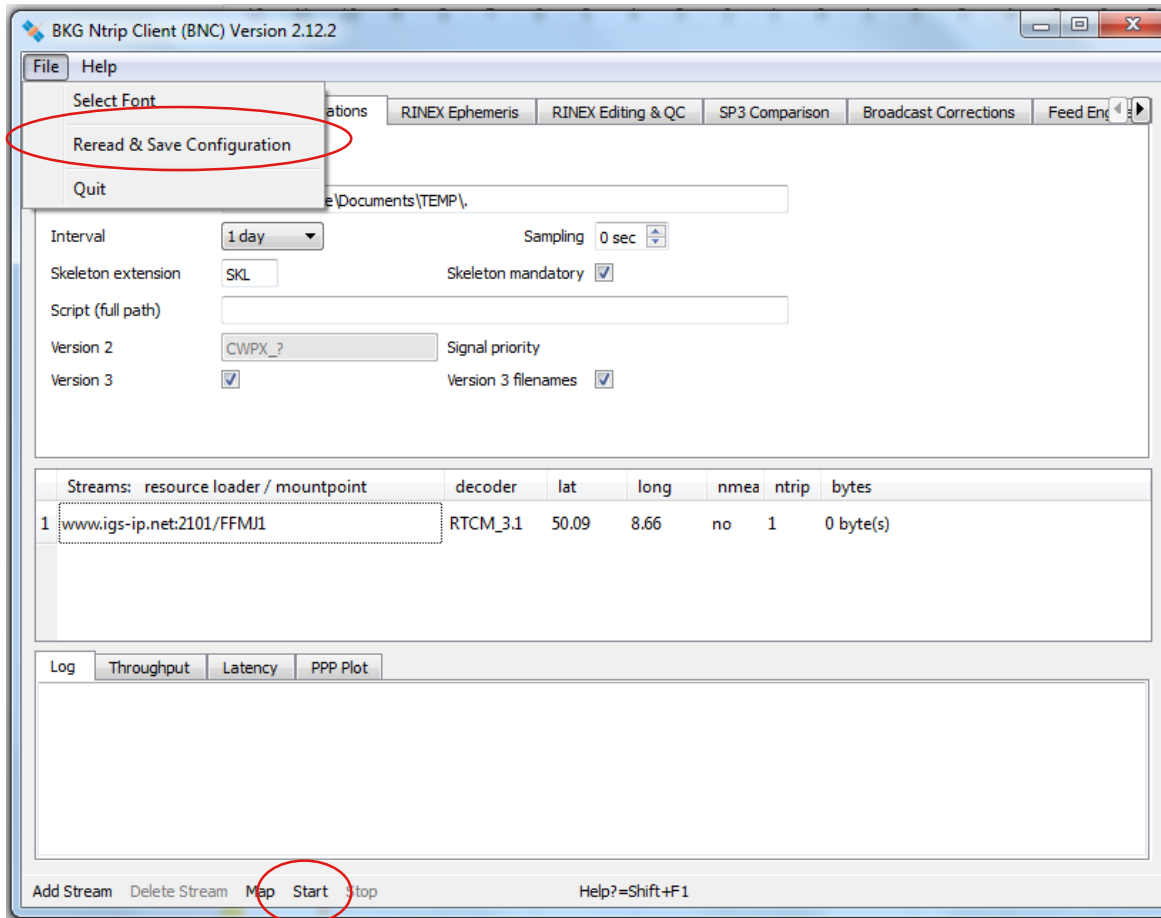
Add Stream Delete Stream Map Start Stop Help?=Shift+F1

# Conversion RTCM to RINEX Observations



Select data stream from a observation caster by (Add Stream)

# Conversion RTCM to RINEX Observations



1. Reread & Save Configuration
2. Start
3. Watch Bytes in Stream Canvas
4. Watch RINEX files

# Conversion RTCM to RINEX Navigation Messages

Configure conversion of navigation messages

Stop processing

Use RTCM3EPH stream from [products.igs-ip.net](http://products.igs-ip.net)

Start again

→ If you have not deselected RINEX observation conversion, both file types should be created

# Precise Point Positioning PPP(1)

Coordinate file and ANTEX file comes with Example configurations

C:\Users\ruelke\AppData\Roaming\BKG Ntrip Client  
2.12\Example\_Configs\Input\APRIORI.CRD

C:\Users\ruelke\AppData\Roaming\BKG Ntrip Client  
2.12\Example\_Configs\Input\igs08.atx

# Precise Point Positioning PPP(1)

BKG Ntrip Client (BNC) Version 2.12.2

File Help

Outages Miscellaneous **PPP (1)** PPP (2) PPP (3) PPP (4) Combine Corrections Upload Corrections Upload Ephemeris

Precise Point Positioning - Input and Output

Data source: **Real Time Streams**

Corrections stream: **CLK11**

Corrections file: ...

Coordinates file: **\\lke/Documents/bnc\_workspace/input/APRIORI.CRD**

Logfile directory: **D:/Users/ruelke/Documents/bnc\_workspace/log**

SNX TRO directory: ...

RINEX Obs file: ...

RINEX Nav file: ...

ANTEX file: **C:/Users/ruelke/AppData/Roaming/BKG Ntrip C...**

Version 3 filenames: ☐

NMEA directory: ...

SNX TRO interval: 1 hour

SNX TRO sampling: 0 sec

SNX TRO AC: ...

SNX TRO solution: ...

Streams:	resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	products.igs-ip.net:2101/CLK11	RTCM_3.0	50.08967	8.66458	no	1	0 byte(s)
2	products.igs-ip.net:2101/RTCM3EPH	RTCM_3.2	50.08967	8.66458	no	1	0 byte(s)
3	www.igs-ip.net:2101/FFMJ1	RTCM_3.1	50.09	8.66	no	1	0 byte(s)

Log Throughput Latency PPP Plot

Add Stream Delete Stream Map Start Stop

Help?=Shift+F1

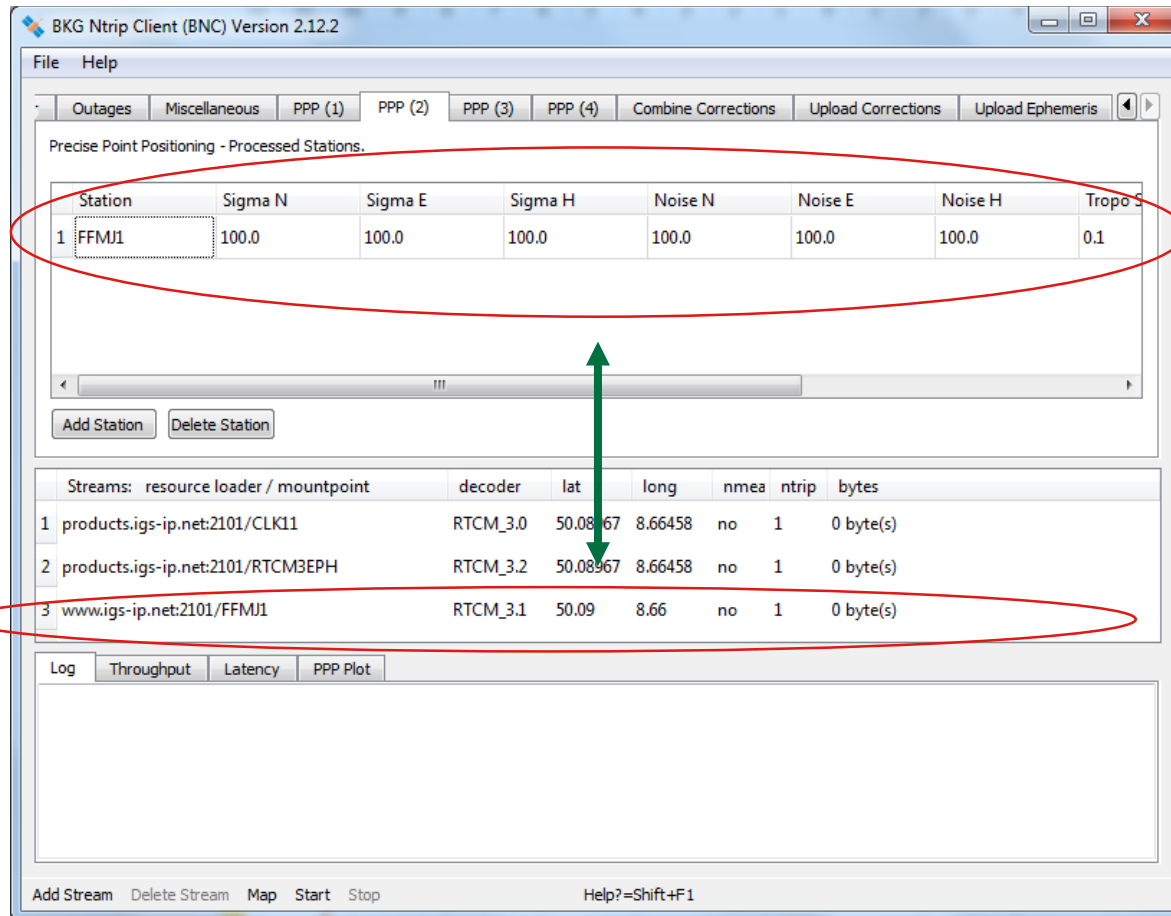
Select Real-Time Streams

Select a correction stream

Select  
Coordinate file  
Logfile directory  
ANTEX file

Get  
Observation data stream  
Correction data stream  
Broadcast Ephemeris stream

# Precise Point Positioning PPP(2)



Define the station to be Processed (according to Observation data streams)  
Sigma and Noise: 100m  
Tropo Sigma: 0.1  
Tropo Noise:  $3e-6$   
NMEA port: 0

You can process more than one station at the same Time.



# Precise Point Positioning PPP(3)

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File Help

Outages Miscellaneous PPP (1) PPP (2) **PPP (3)** PPP (4) Combine Corrections Upload Corrections Upload Ephemeris

Precise Point Positioning - Options.

GPS LCs: P3&L3  
GLONASS LCs: P3&L3  
Galileo LCs: P3&L3  
BDS LCs: no  
Wait for clock corr.: 5 sec

Sigma C1: 2.0  
Max Res C1: 4.0  
Ele Wgt Code: ☒  
Min # of Obs: 4  
Seeding (sec): 0

Sigma L1: 0.01  
Max Res L1: 0.03  
Ele Wgt Phase: ☒  
Min Elevation: 0 deg

	Streams: resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	products.igs-ip.net:2101/CLK11	RTCM_3.0	50.08967	8.66458	no	1	0 byte(s)
2	products.igs-ip.net:2101/RTCM3EPH	RTCM_3.2	50.08967	8.66458	no	1	0 byte(s)
3	www.igs-ip.net:2101/FFMJ1	RTCM_3.1	50.09	8.66	no	1	0 byte(s)

Log Throughput Latency PPP Plot

Add Stream Delete Stream Map Start Stop Help? = Shift+F1

Select signals to be processed

Wait for clock corr: try 5s

Sigma C1: 2.0

Max Res C1: 4.9

Ele Wgt Code: Yes

Min # of Obs: 4

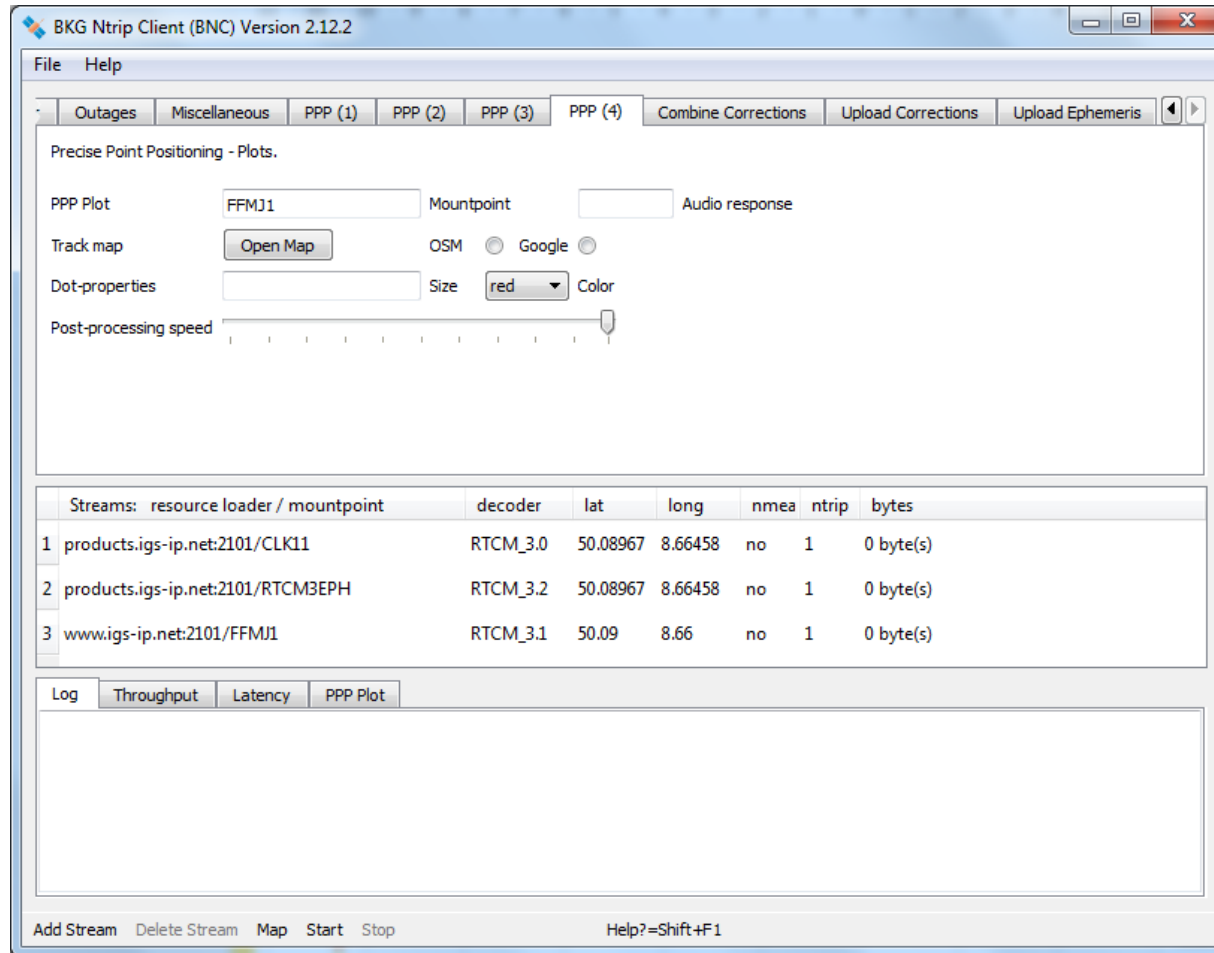
Sampling: 0

Sigma L1: 0.01

Max Res L1: 0.03

Min Elevation: 0 deg.

# Precise Point Positioning PPP(4)



Select options for  
plotting

# Precise Point Positioning

## Run PPP

1. Save & Reread configuration
2. Start

Play around with different options, e.g.

- Different stations
- Different correction data streams
- Different processing options (e.g. different GNSS, different Kalman filter parameters) → for Galileo processing use CNES data stream CLK93

Checkout

- Conversion Time
- Latency
- Log files

# QC RINEX files

1. Get RINEX file from IGS database e.g. [igs.bkg.bund.de](http://igs.bkg.bund.de)
2. Run QC on your own

# Summary

If you like BNC

- Use it
- Check out example configurations coming with your installation
- Read manual
- Report bugs and improvements
- Extend the software for your own purposes
- Ask for caster access at BKG or elsewhere

Thank you very much for your attention!

# Thank you for your kind attention!

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