SPIDER

Leica Spider Software

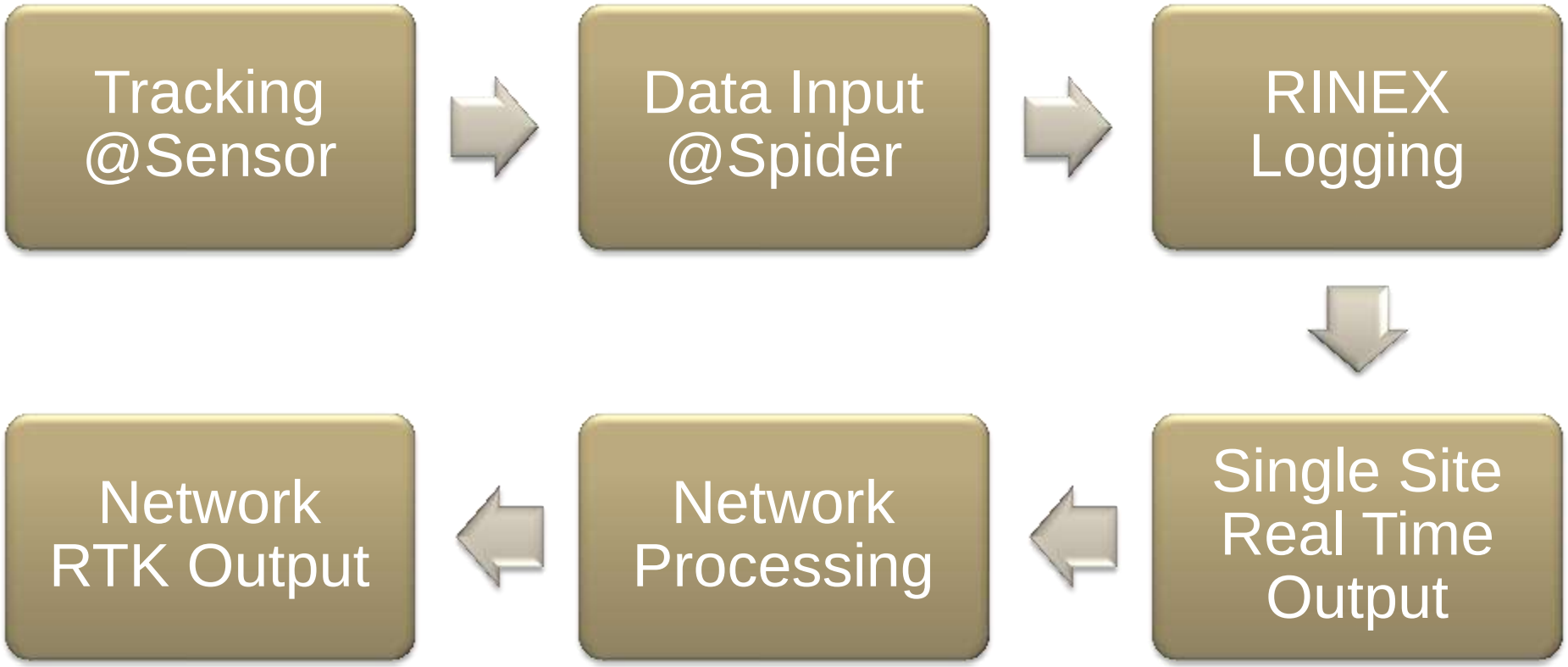
The all in one solution for GNSS networks and monitoring projects

Spider Software Suite

G4 Network RTK with Galileo and BeiDou

GNSS Signals

Spider Signals Processing Chain



Data Input in GNSS Spider

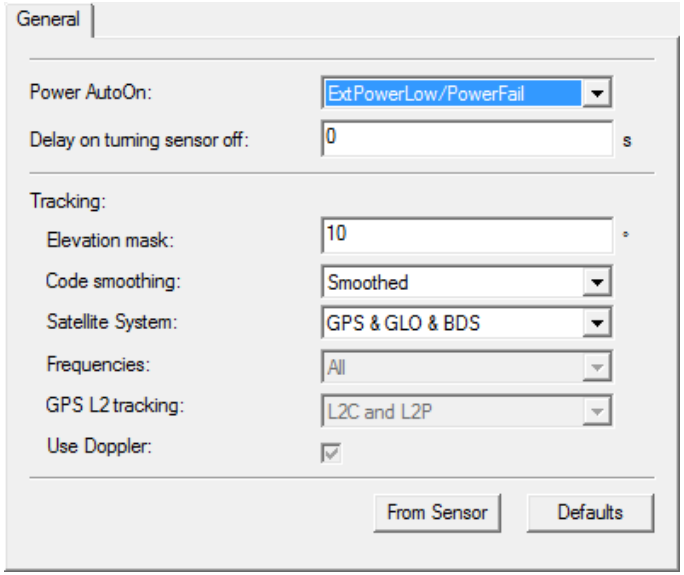
Galileo, BeiDou and QZSS

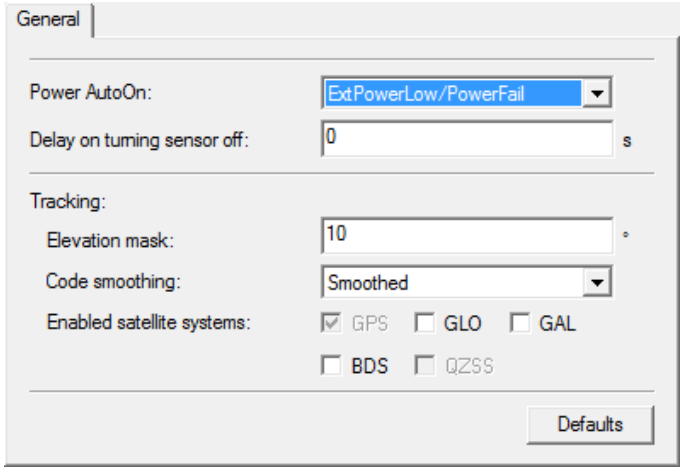
- **Supported as data input for observations**
  - Active Leica receivers
  - Passive LB2 streams
  - Passive RTCM 3.x (Extended), i.e. MSM4, MSM5
- **Supported as data input for ephemeris**
  - Active Leica receivers
  - Passive LB2 streams

Data Input in GNSS Spider

Active Receivers

Tracking settings for active receivers … simplified





Site Name	Site Code	Power AutoOn	Elevation Mask	Code Smoothing	GPS	GLO	GAL	BDS	QZSS
GR25_129 (REFD)	0129	ExtPowerLow/PowerFail	0	Smoothed	L1/L2P(Y)/L2C/L5	L1/L2P/L2C	E1/E5a/E5b/E5ab	B1/B2/-	-/-/-
GR10_140 (REFC)	GR10	ExtPowerLow/PowerFail	0	Not smoothed	L1/L2P(Y)/L2C/L5	L1/L2P/L2C	E1/E5a/E5b/E5ab	-/-/-	-/-/-
System 1200 ME3	1200	ExtPowerLow/PowerFail	0	Not smoothed	L1/L2P(Y)/-/-	L1/L2P/-	-/-/-/-	-/-/-	-/-/-
System 1200 ME2	REFD	ExtPowerLow/PowerFail	10	Smoothed	L1/L2P(Y)/-/-	-/-/-	-/-/-/-	-/-/-	-/-/-
System 500	S500	ExtPowerLow/PowerFail	10	-	L1/L2P(Y)/-/-	-/-/-	-/-/-/-	-/-/-	-/-/-

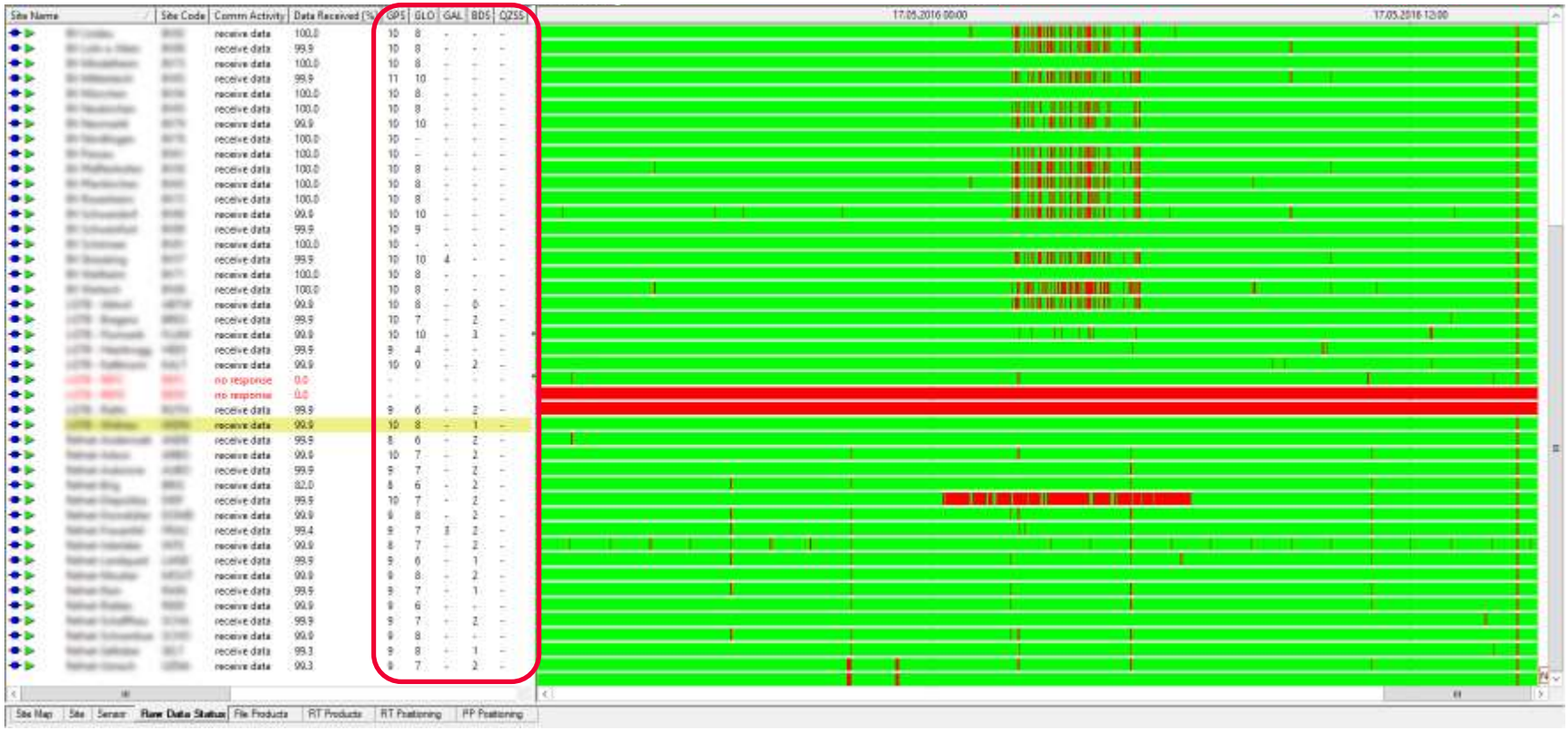
- when it has to be right

Leica Geosystems

Data Input in GNSS Spider

Visualization of Data Input

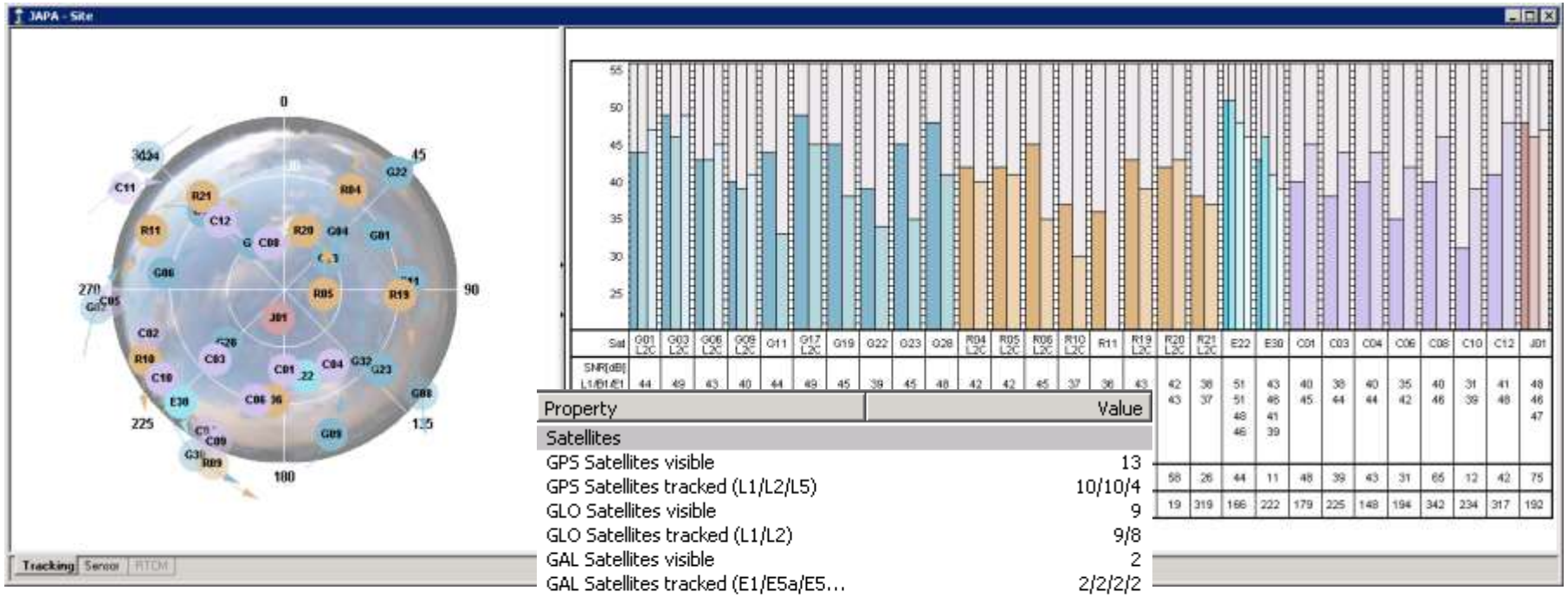
Raw Data Status Tab … simplified and extended



Data Input in GNSS Spider

Visualization of Data Input

Site Window showing 5 constellations



Property	Value
Satellites	
GPS Satellites visible	13
GPS Satellites tracked (L1/L2/L5)	10/10/4
GLO Satellites visible	9
GLO Satellites tracked (L1/L2)	9/8
GAL Satellites visible	2
GAL Satellites tracked (E1/E5a/E5...	2/2/2/2
BDS Satellites visible	9
BDS Satellites tracked (B1/B2/B3)	7/7/-
QZSS Satellites visible	1
QZSS Satellites tracked (L1/L2/L5)	1/1/1
Elevation mask	-
GDOP/PDOP	-

- when it has to be **right**

Leica Geosystems

Network Processing

Processing Kernel Facts

Key benefits of Leica GNSS Spider

- **No external information required**
- **Processes independently on local host**
- **Mixed manufacturer receivers can be processed**

Processing load increases with additional constellations

- **Current Galileo constellation: +30%**
- **Full Galileo constellation: +50%**

… compared to GPS & GLONASS processing

Network Processing

Licensing

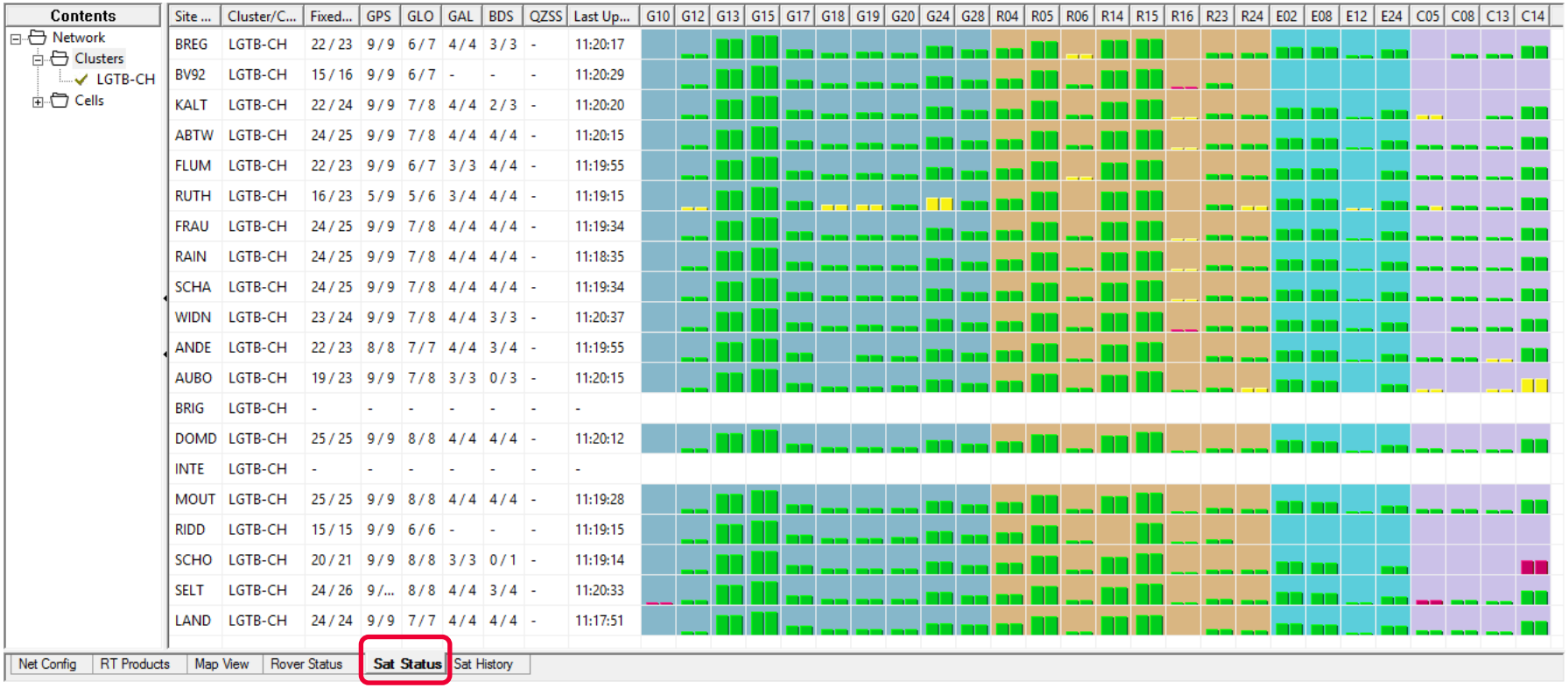
License Option Requirements

- **BeiDou:** 812422 “Spider Network RTK BeiDou option”
- **Galileo:** 812423 “Spider Network RTK Galileo option”
- **QZSS:** no additional license

Extends existing GPS & GLONASS capabilities

Network Processing

5-GNSS Network Visualization



Site ...	Cluster/C...	Fixed...	GPS	GLO	GAL	BDS	QZSS	Last Up...
BREG	LGTB-CH	22 / 23	9 / 9	6 / 7	4 / 4	3 / 3	-	11:20:17
BV92	LGTB-CH	15 / 16	9 / 9	6 / 7	-	-	-	11:20:29
KALT	LGTB-CH	22 / 24	9 / 9	7 / 8	4 / 4	2 / 3	-	11:20:20
ABTW	LGTB-CH	24 / 25	9 / 9	7 / 8	4 / 4	4 / 4	-	11:20:15
FLUM	LGTB-CH	22 / 23	9 / 9	6 / 7	3 / 3	4 / 4	-	11:19:55
RUTH	LGTB-CH	16 / 23	5 / 9	5 / 6	3 / 4	4 / 4	-	11:19:15
FRAU	LGTB-CH	24 / 25	9 / 9	7 / 8	4 / 4	4 / 4	-	11:19:34
RAIN	LGTB-CH	24 / 25	9 / 9	7 / 8	4 / 4	4 / 4	-	11:18:35
SCHA	LGTB-CH	24 / 25	9 / 9	7 / 8	4 / 4	4 / 4	-	11:19:34
WIDN	LGTB-CH	23 / 24	9 / 9	7 / 8	4 / 4	3 / 3	-	11:20:37
ANDE	LGTB-CH	22 / 23	8 / 8	7 / 7	4 / 4	3 / 4	-	11:19:55
AUBO	LGTB-CH	19 / 23	9 / 9	7 / 8	3 / 3	0 / 3	-	11:20:15
BRIG	LGTB-CH	-	-	-	-	-	-	-
DOMD	LGTB-CH	25 / 25	9 / 9	8 / 8	4 / 4	4 / 4	-	11:20:12
INTE	LGTB-CH	-	-	-	-	-	-	-
MOUT	LGTB-CH	25 / 25	9 / 9	8 / 8	4 / 4	4 / 4	-	11:19:28
RIDD	LGTB-CH	15 / 15	9 / 9	6 / 6	-	-	-	11:19:15
SCHO	LGTB-CH	20 / 21	9 / 9	8 / 8	3 / 3	0 / 1	-	11:19:14
SELT	LGTB-CH	24 / 26	9/...	8 / 8	4 / 4	3 / 4	-	11:20:33
LAND	LGTB-CH	24 / 24	9 / 9	7 / 7	4 / 4	4 / 4	-	11:17:51

G10	G12	G13	G15	G17	G18	G19	G20	G24	G28	R04	R05	R06	R14	R15	R16	R23	R24	E02	E08	E12	E24	C05	C08	C13	C14

Sat Status: Current processing

Network Processing

5-GNSS Network Visualization

New Toolbar

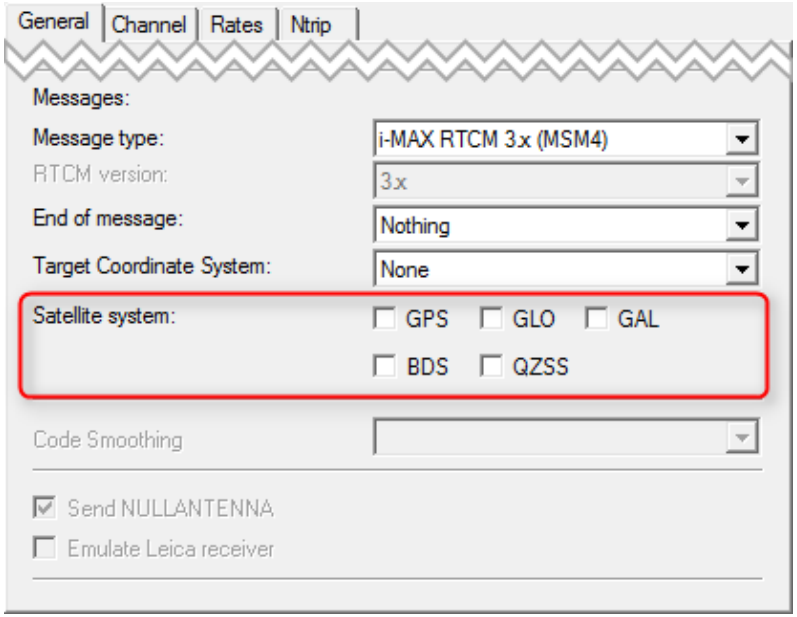
Sat History: Processing over time

Network RTK Output

Multi-GNSS Real-Time Output

Galileo, BeiDou, QZSS and GPS-L5 Support for Network Server Real-Time Products

- Single Site, i-MAX, Virtual RS
- RTCM 3.2 with MSM4 and MSM5
- Observations only
- Flexible constellation selection



- MAC and FKP not yet standardized

G4 Rover Positioning

Leica Investigation

SPIDER

Detailed Case Study

- Real Life data (Constellation, Purchasable Products)
- 3 Cases (Open Sky, Multipath, Canopy)

References:

- The Benefits of Galileo for High-Precision RTK,
  X. Luo, J. Chen, B. Richter, F. Takac,
  ENC 2017

- http://gpsworld.com/how-galileo-benefits-high-precision-rtk

G4 Rover Positioning

Summary of Leica Investigations

- **Under open sky conditions**
  - On average 3 Galileo satellites used for positioning
  - Improved precision, particularly over long baselines
- **Under multipath conditions**
  - Reduced time to fix
  - Higher accuracy and reliability (2D and 1D)
- **Under canopy conditions**
  - Higher availability without degrading reliability
  - Improved accuracy, particularly for height (1D)

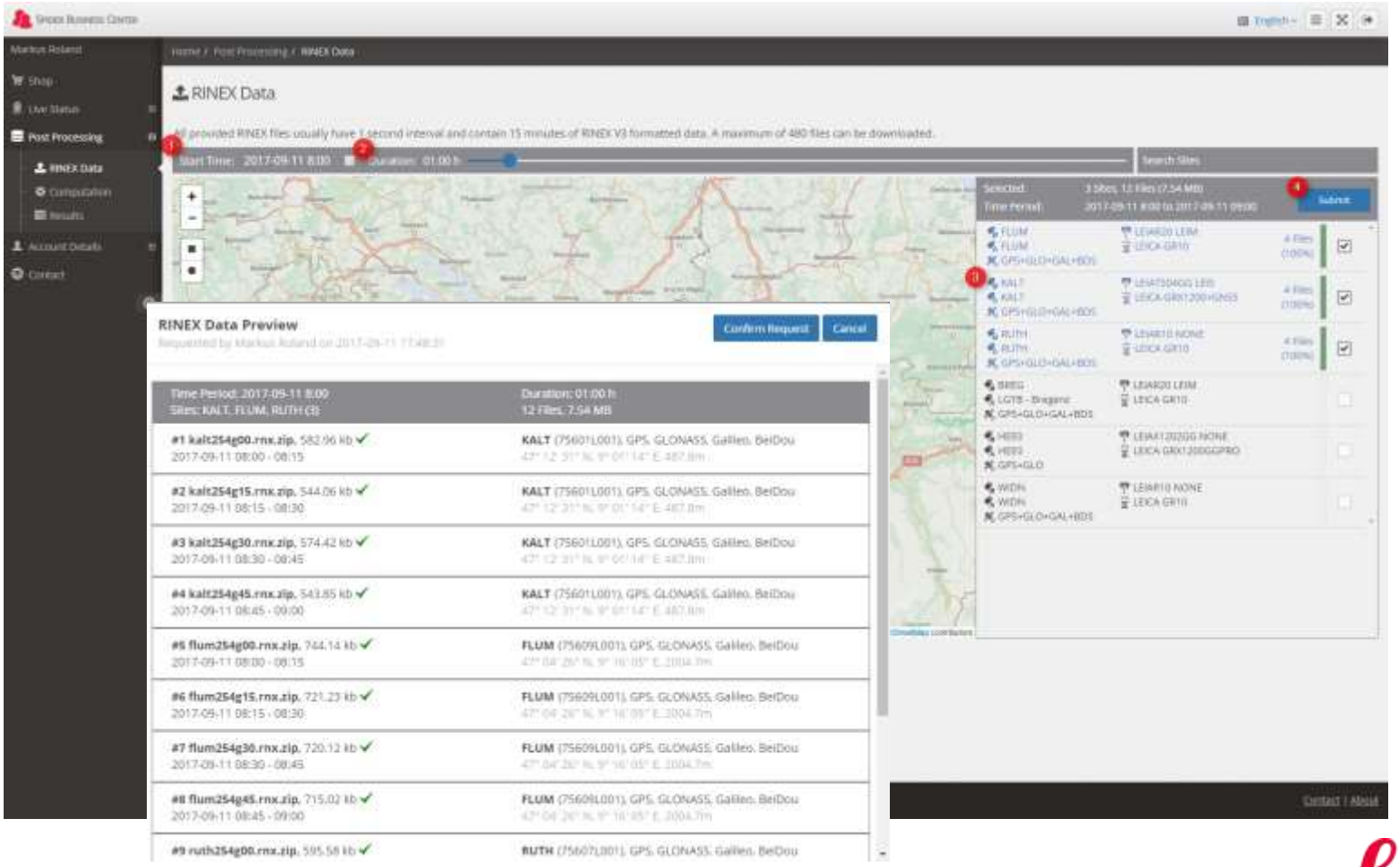
Post-Processing Services

Web Portal Services

- **Galileo and BeiDou support via RINEX v3**
- **Provided Services**
  - RINEX Download Service
  - Online Coordinate Computation Service
- **Combined with major modernization**
  - Services included in common SBC portal

Post-Processing Services

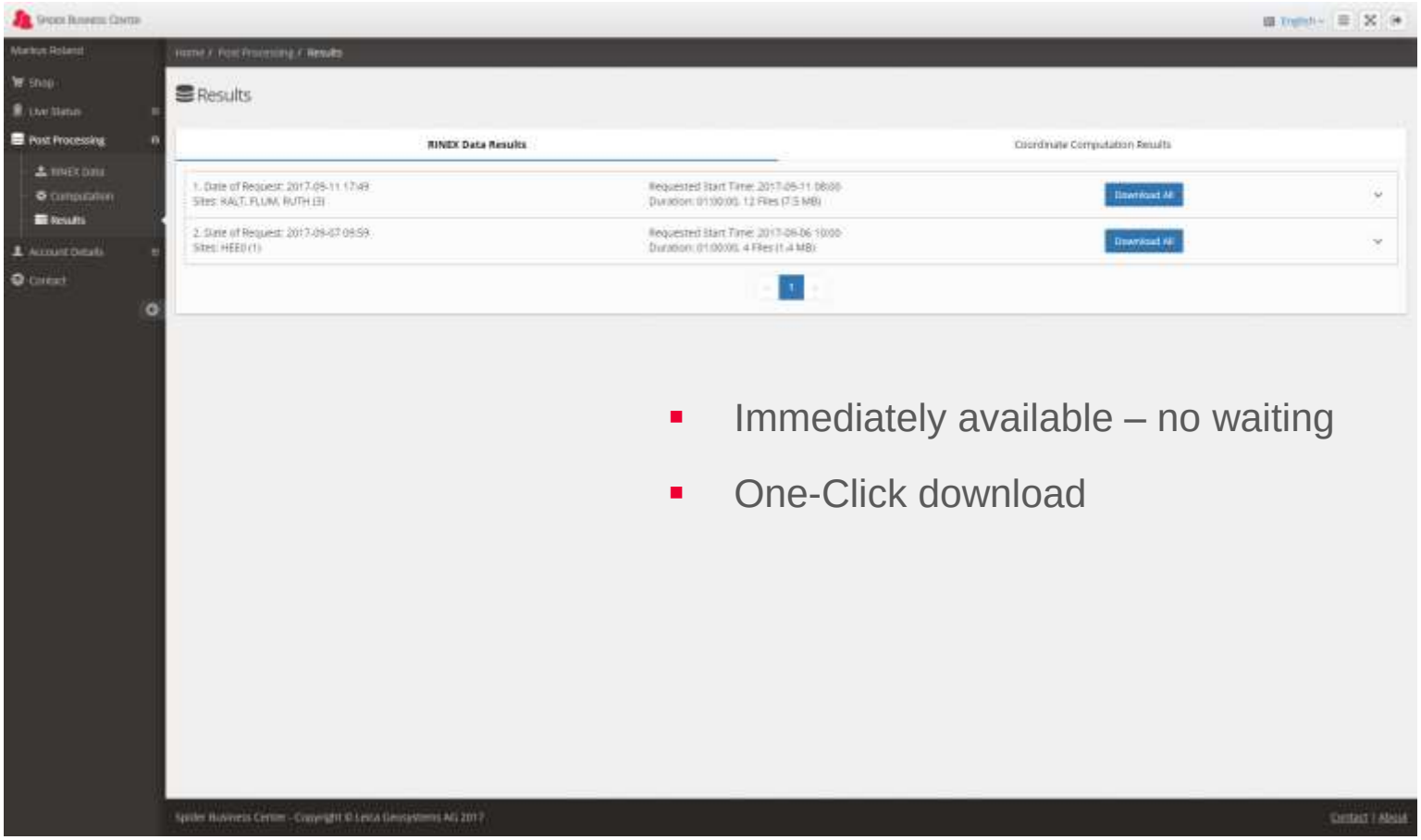
RINEX Download – Requests & Results



- when it has to be right

Post-Processing Services

RINEX Download – Requests & Results

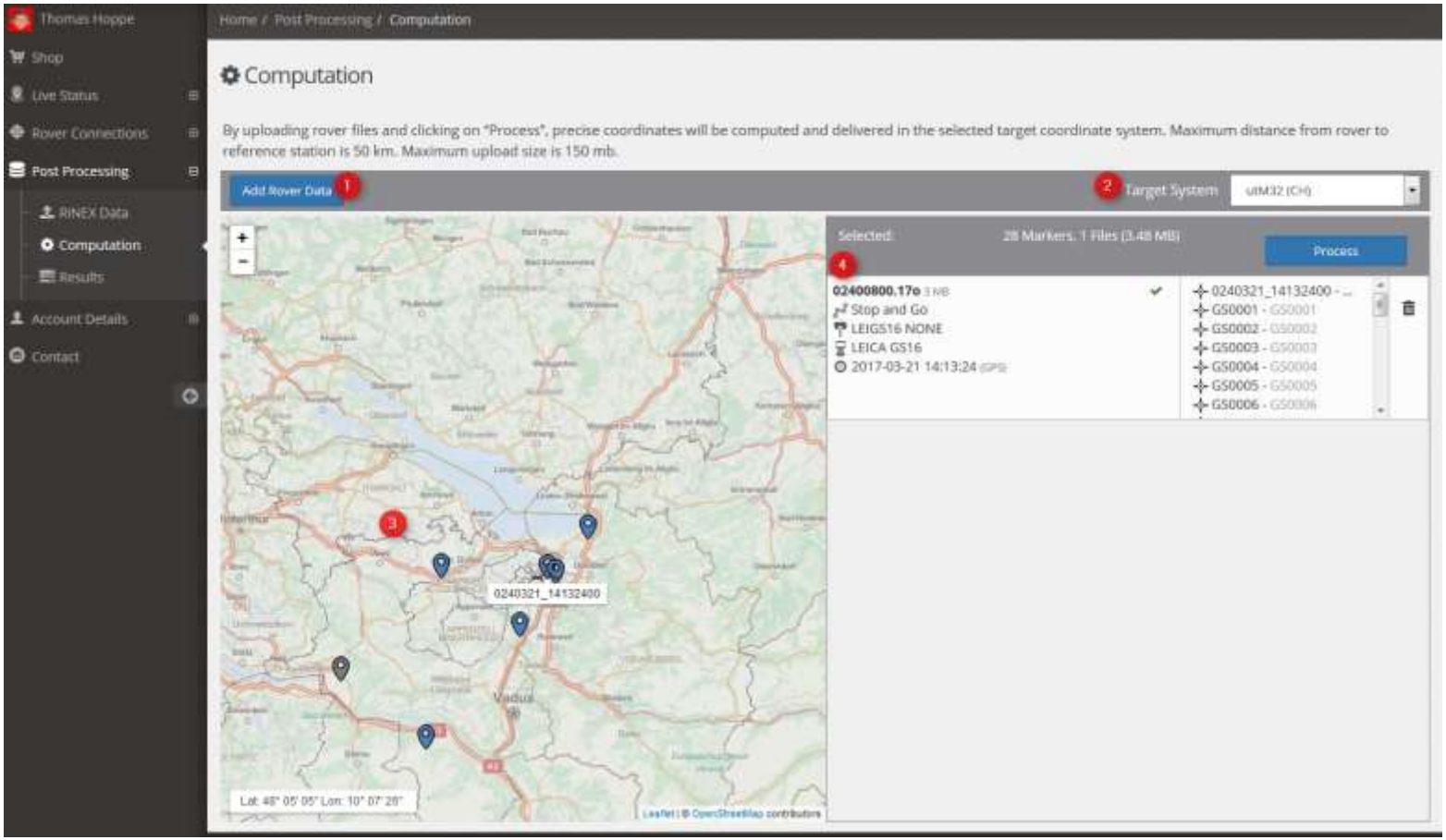


- Immediately available – no waiting
- One-Click download

- when it has to be right

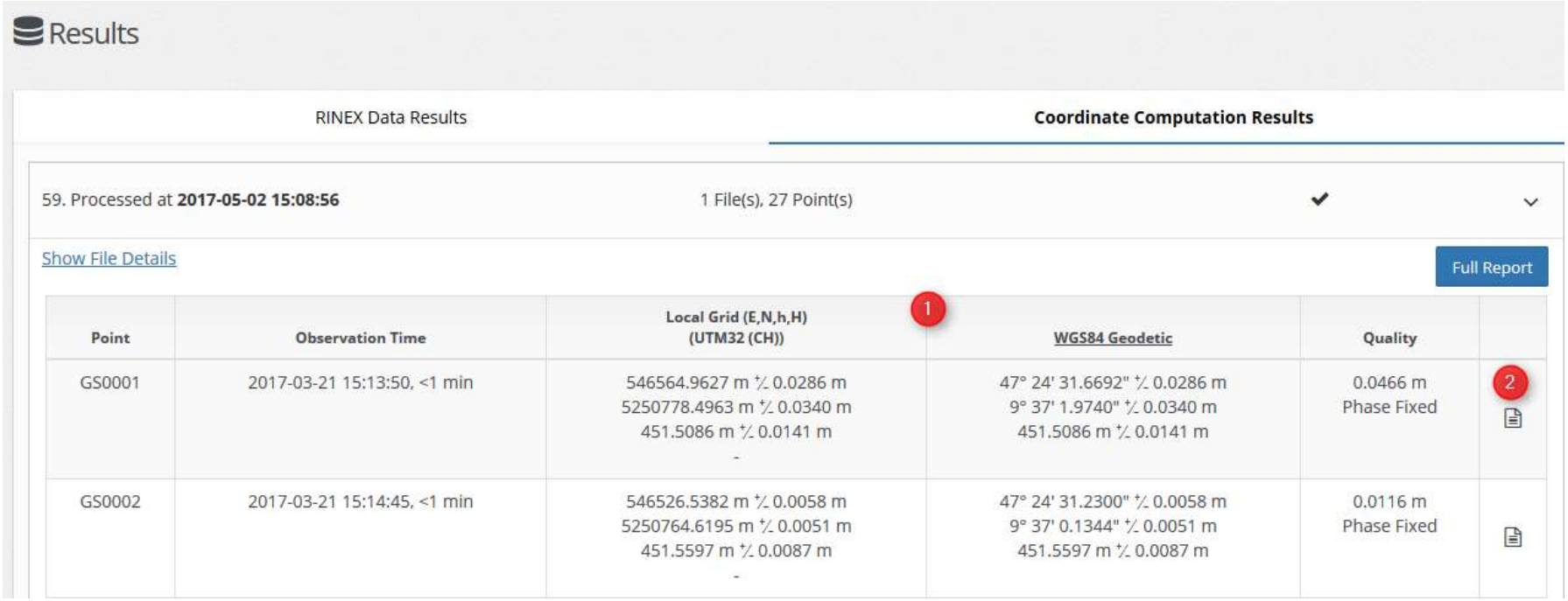
Post-Processing Services

GNSS Post-Processing – Requests & Results



Post-Processing Services

GNSS Post-Processing – Requests & Results



Results

RINEX Data Results | **Coordinate Computation Results**

59. Processed at **2017-05-02 15:08:56** — 1 File(s), 27 Point(s) — ✔

Show File Details — Full Report

Point	Observation Time	Local Grid (E,N,h,H) (UTM32 (CH))	WGS84 Geodetic	Quality
GS0001	2017-03-21 15:13:50, <1 min	546564.9627 m ± 0.0286 m 5250778.4963 m ± 0.0340 m 451.5086 m ± 0.0141 m -	47° 24' 31.6692" ± 0.0286 m 9° 37' 1.9740" ± 0.0340 m 451.5086 m ± 0.0141 m	0.0466 m Phase Fixed
GS0002	2017-03-21 15:14:45, <1 min	546526.5382 m ± 0.0058 m 5250764.6195 m ± 0.0051 m 451.5597 m ± 0.0087 m -	47° 24' 31.2300" ± 0.0058 m 9° 37' 0.1344" ± 0.0051 m 451.5597 m ± 0.0087 m	0.0116 m Phase Fixed

1

2

Post-Processing Services

GNSS Post-Processing – Requests & Results

SPIDER

Request:

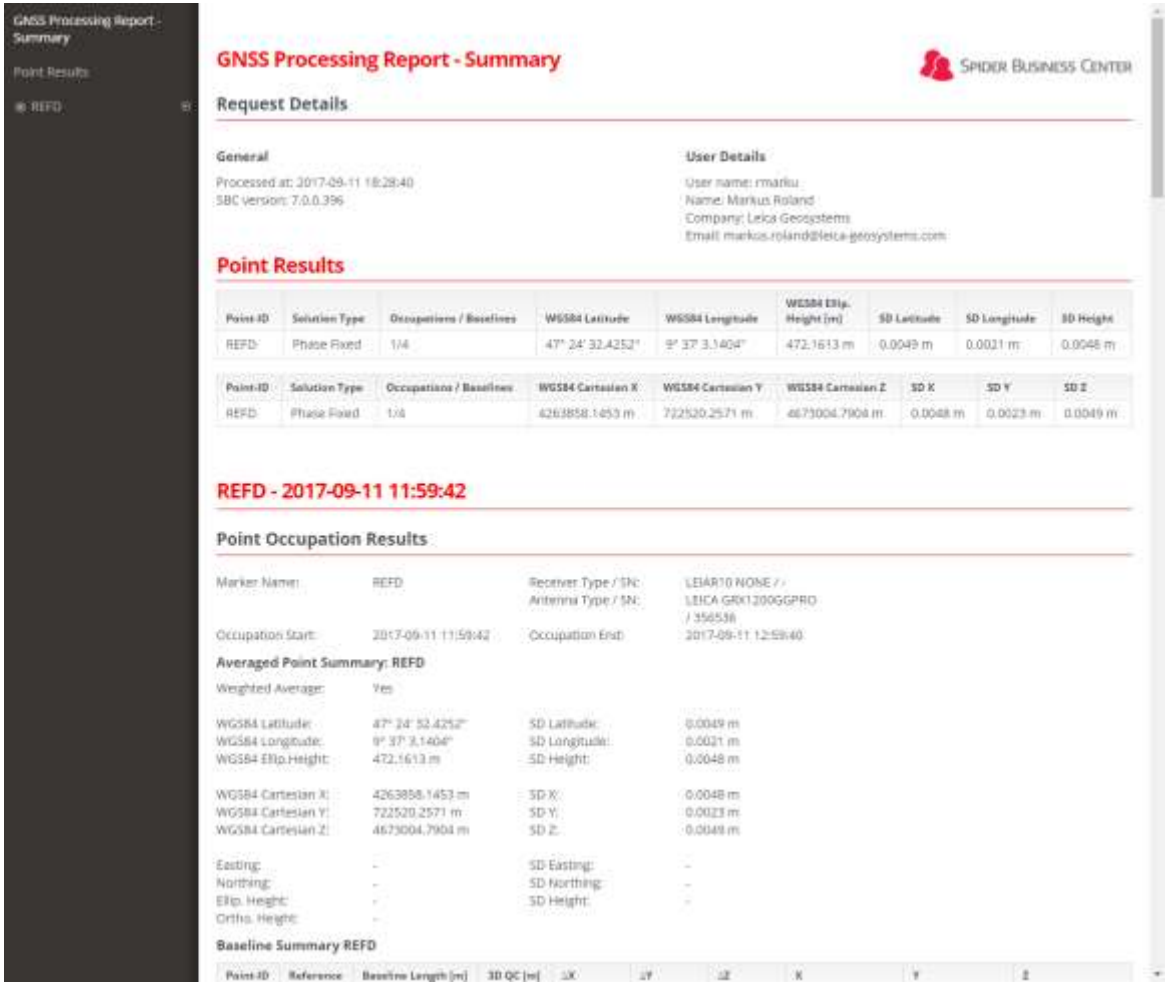
- RINEX v2, v3
- Static, Stop&Go, Kinematic
- Re-occupation
- Data Validation

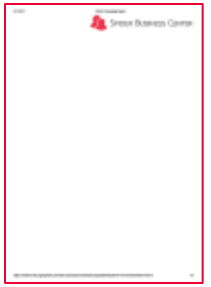
Results:

- WGS84 (Geodetic, Cartesian)
- Local grid coordinates
- Full stochastics
- Reports in HTML and PDF
- Down to baseline level
- Trajectory (Map, CSV, KML)

Post-Processing Services

GNSS Post-Processing – Report





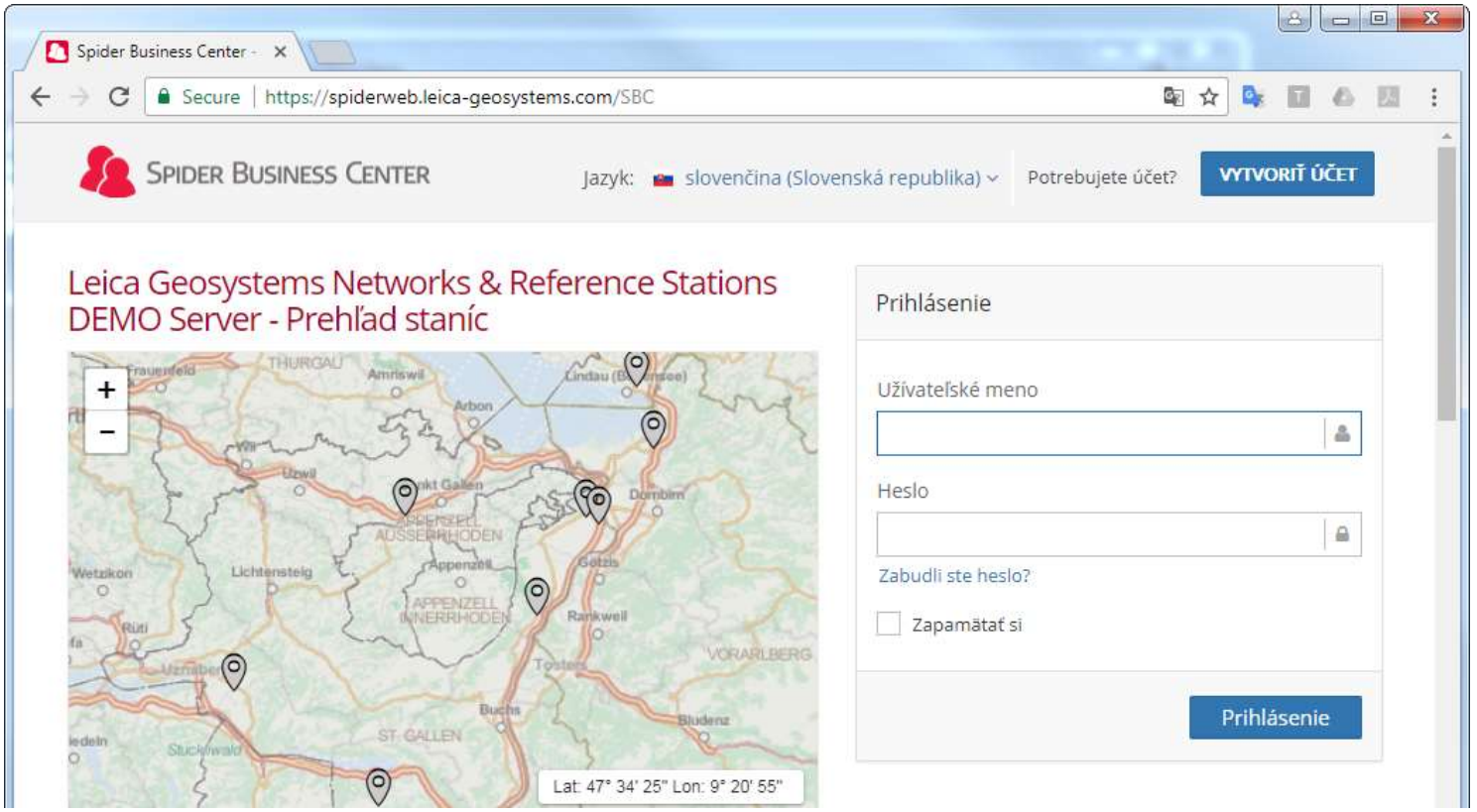
PDF

- when it has to be right

Post-Processing Services

Web Portal Services

Try it out yourself **https://spiderweb.leica-geosystems.com/SBC**



THANK YOU FOR YOUR ATTENTION!

The best answers combine the smartest solutions

The Leica Spider family of products provide all you need for smart solutions.
From single base stations to comprehensive infrastructure RTK networks.

GNSS Networks and Reference Stations

Smart Solutions from Leica Geosystems