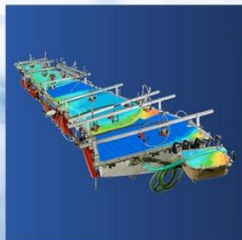


# ZODIAC DATA SYSTEMS

ZODIAC  
AEROSPACE

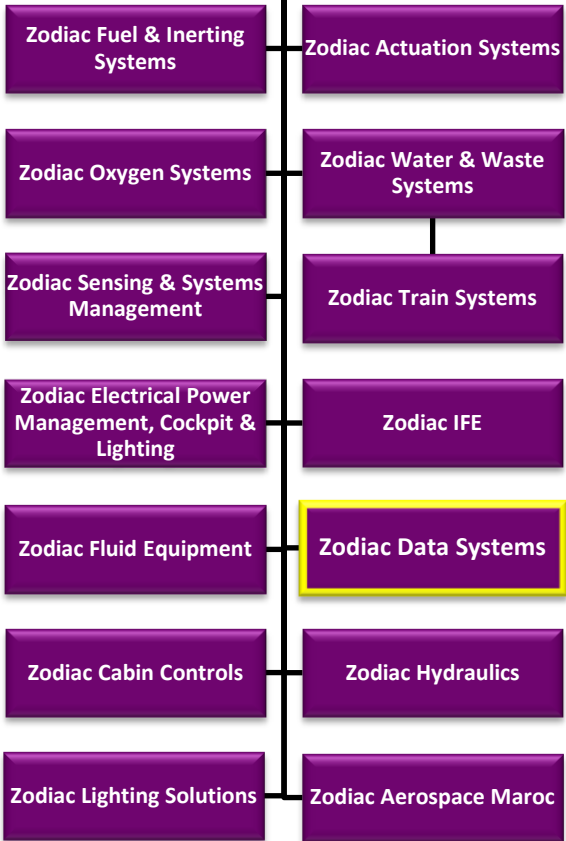


MASTERING THE ELEMENTS

ZODIAC  
AEROSPACE



**ZODIAC AEROSPACE GROUP**



**Stock exch:** ZC (Euronext)    **Sales:** 3450 M€    **Growth:** 25%    **Employees:** ~ 26000

**ZODIAC AIRCRAFT SYSTEMS**

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# The CORTEX Family

One philosophy, Multiple applications



**CRT**

**Command Ranging & Telemetry**

- 3000 units worldwide

**DS**

**Deep Space**

- Optimized hardware for Deep Space communications

**HDR**

**High Datarate Receiver**

- Up to 2 Gbps
- 16 QAM & 32/64APSK

**DTR**

**Digital Tracking Receiver**

- Carrier&SQPN tracking up to 3 channels

**RTR**

**Radio Telemetry Receiver**

- Quad-band telemetry receiver

**RSR**

**Radio Signal Recorder**

- Fully digital IF recorder / reproducer

# The IFoIP Family

**One hardware, Multiple applications**



IFoIP equipment:

- FPGA embedded-boards
- Real time IF processing
- High level of integration



*Customized*

**SDR**

Software  
Defined  
Radio

- Customized applications

*Inspection*

**CSI**

Carrier  
Signal  
Inspector

- Detects the carrier
- Display the noise floor

*Monitoring*

**CSM**

Carrier  
Signal  
Monitoring

- Database & Alarm management
- Reporting

*Analysis*

**CSA**

Carrier  
Signal  
Analyzer

- Characterize carriers in blind mode
- Carrier under carrier

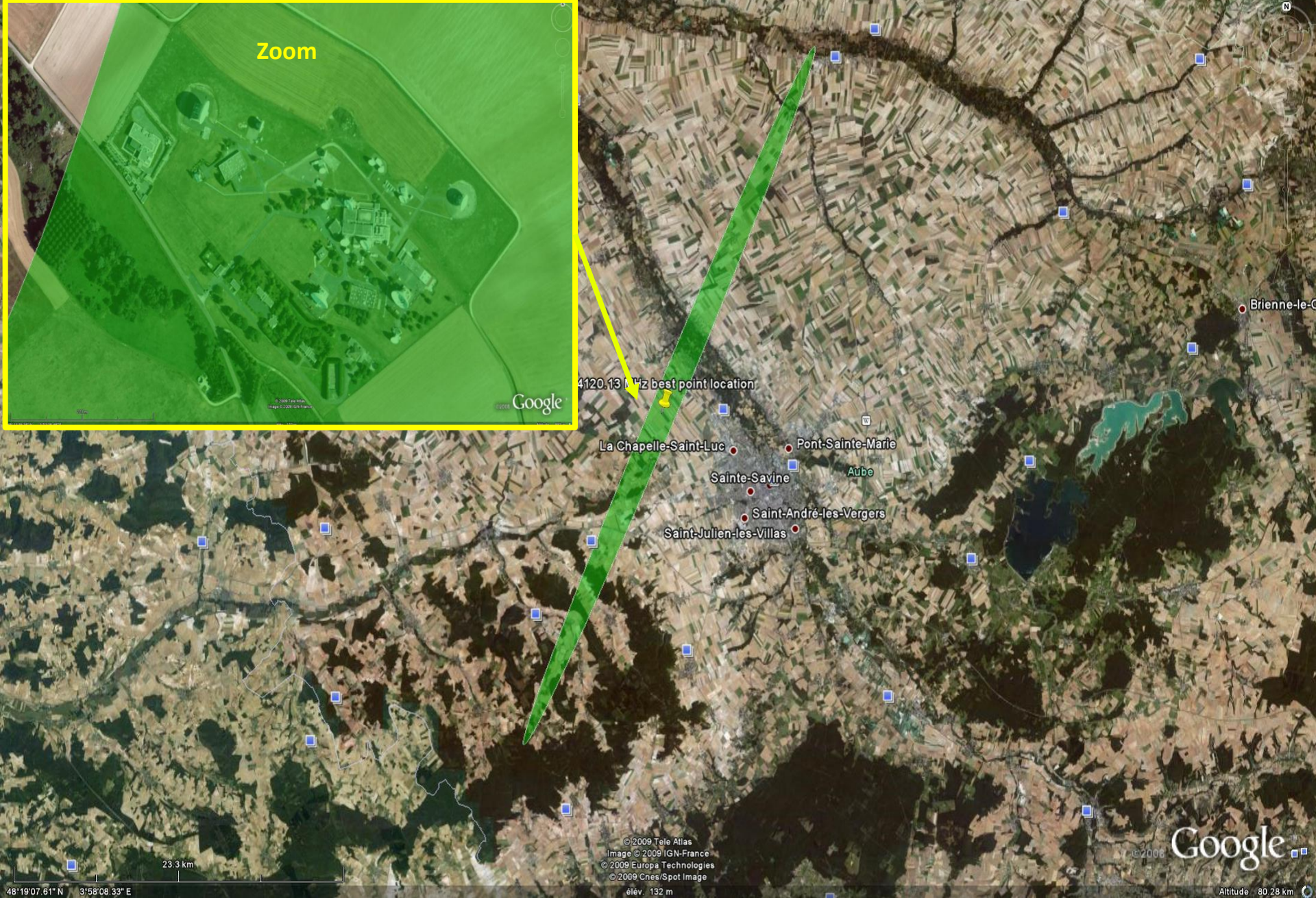
*Geolocation*

**CGL**

Compact  
Geo  
Location

- Locate transmitters





## ZODIAC AIRCRAFT SYSTEMS

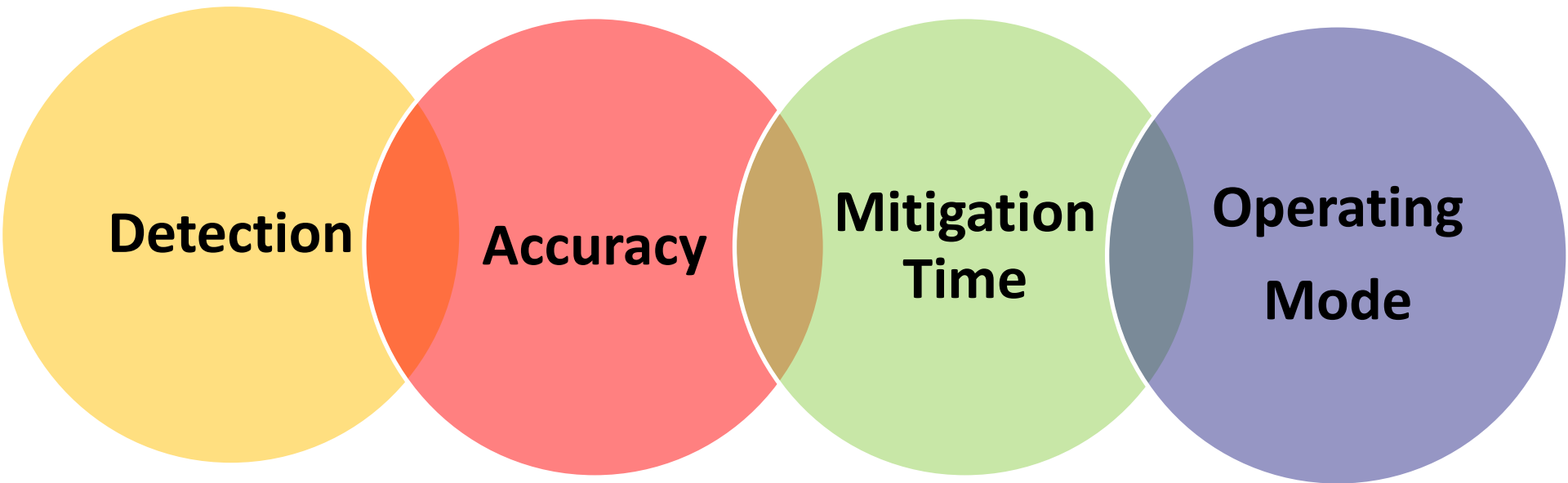
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10/06/2013

- 5



# Geolocation Performance Pillars



# Performance

## Detection – Computation of accurate TDOA / FDOA

### Factors affecting detection

#### Size of the antennas

Transmitters .....

Satellites angular separation .....

Mirror Satellite occupancy .....

Satellite Characteristics.....

Phase noise

Local Oscillator drift

Acceleration

Signal RF parameters.....

### ZDS supplies

#### → High processing gain

Up to 81dB (depending on carrier param.)

#### → Broad Carrier Cancellation capabilities

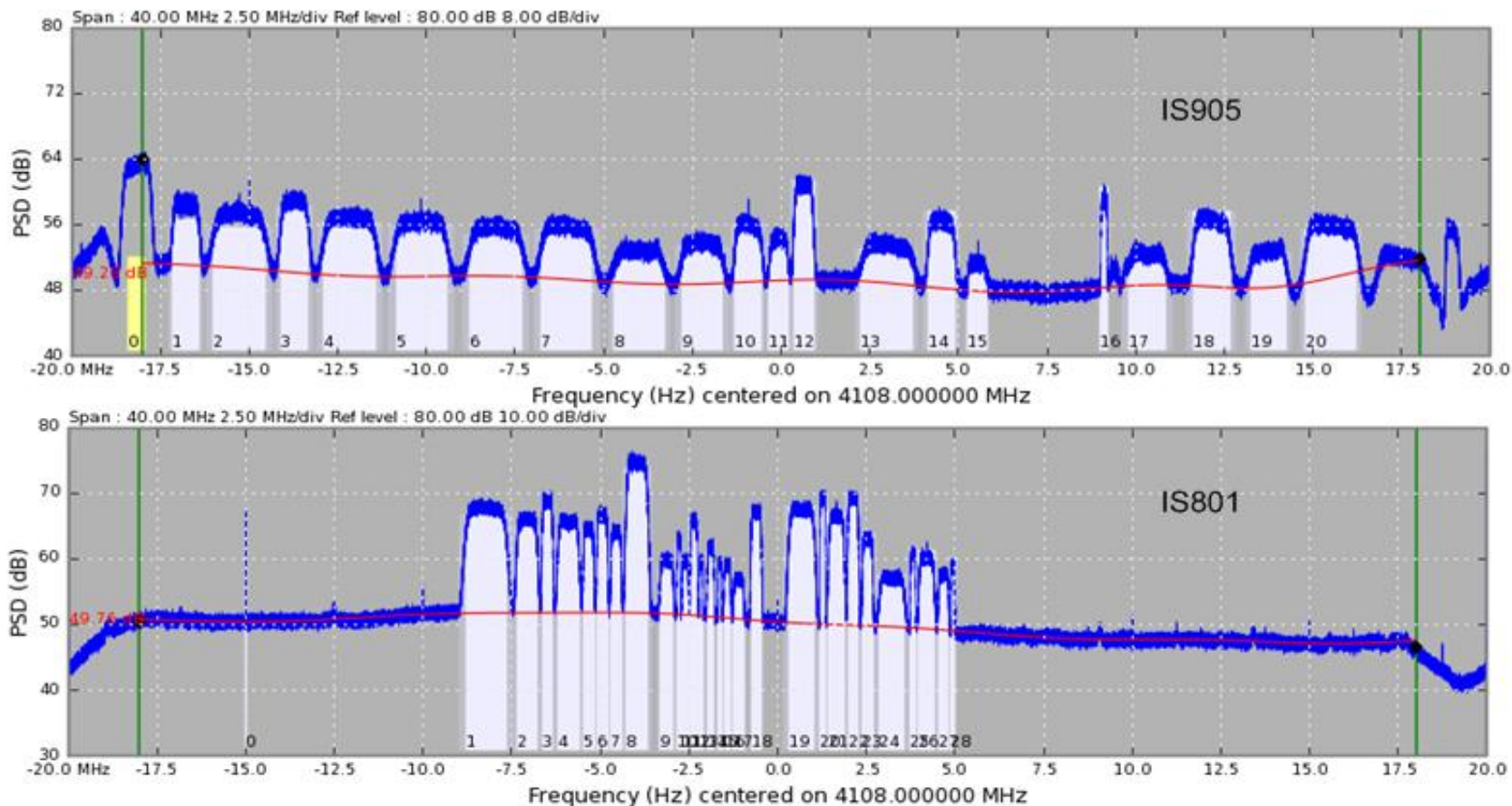
#### → Improved Compensation Algorithms

#### → Highly flexible, high throughput digitizer architecture

Ability to perform wide band recording during tens of seconds

# Performance

## Detection – Computation of accurate TDOA / FDOA Geoloc Examples



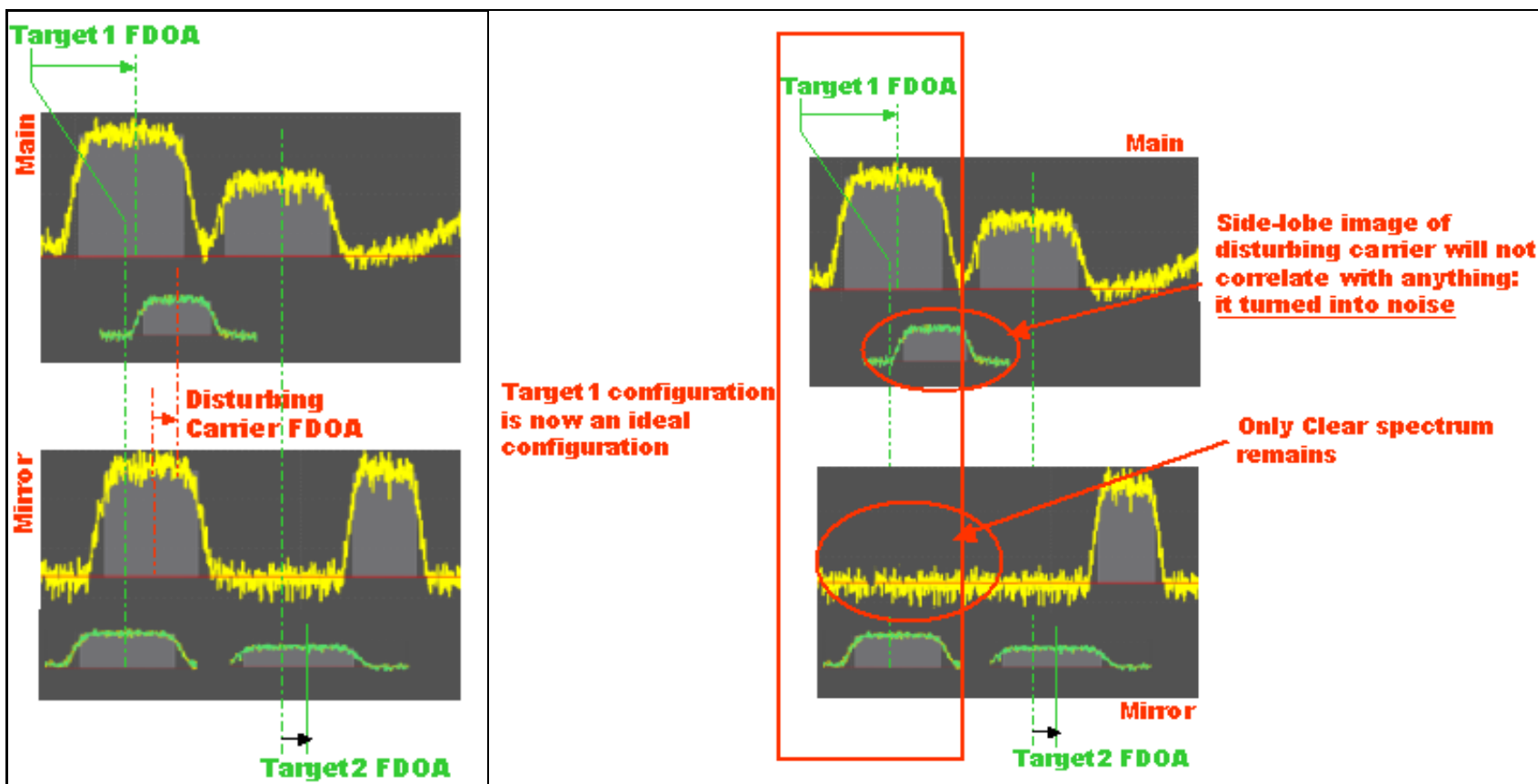


# Performance

## Detection – Computation of accurate TDOA / FDOA

### Carrier Cancellation

- Up to 60 MHz wide Carrier cancellation before correlation



# Performances

## Location Accuracy – Resolution of the final position

### Factors affecting location accuracy

FDOA/TDOA accuracy.....

Position of the references .....

Ephemeris .....

Relative positions of the satellites ..

### ZDS supplies

- Hardware / Algorithm design to guarantee the best achievable processing gain
- Ephemeris generation tools  
Mono-site (Co-Orbits) / Multi-Site (passive)
- Expert system to analysis the most suitable measurement time

### Speed

Hardware performances .....

Number of samples to process .....

High processing .....

### ZDS supplies

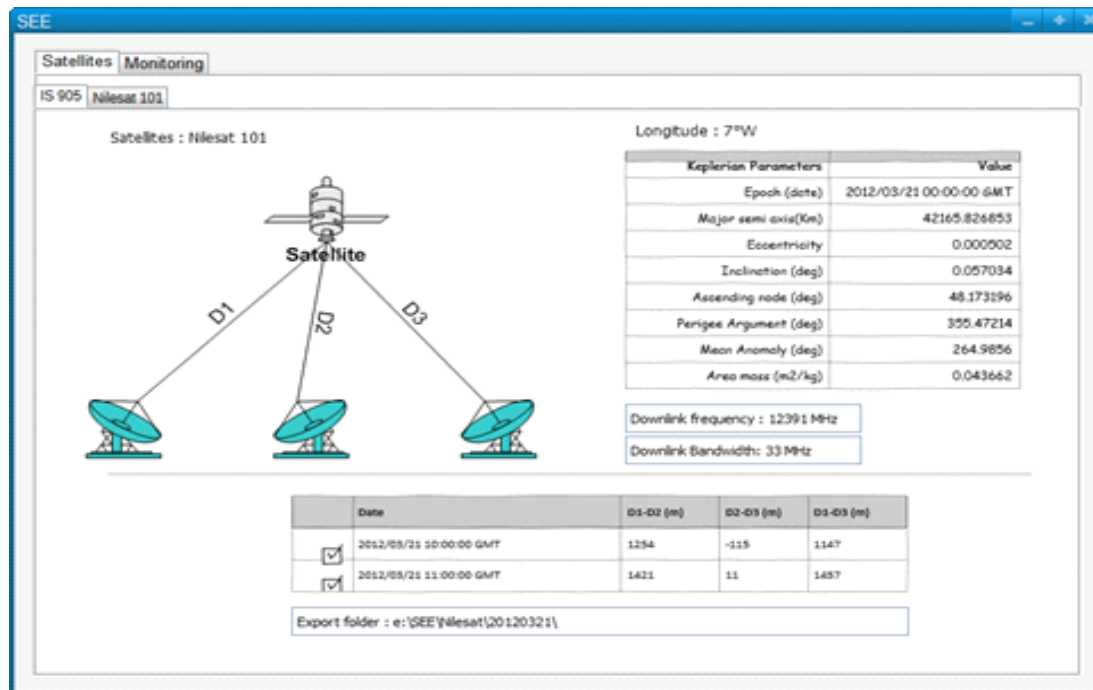
- Dedicated Hardware filtering architecture
- 64-bit Multi-Core Optimized software

# Satellite Ephemeris Estimator

## Passive ephemeris estimation add-on to geolocation system

### Principles

The passive method for geostationary satellite ephemeris estimation is based on differences distances measurement between the satellite and three ground stations installed in three different locations with an average 300 km distance gap.





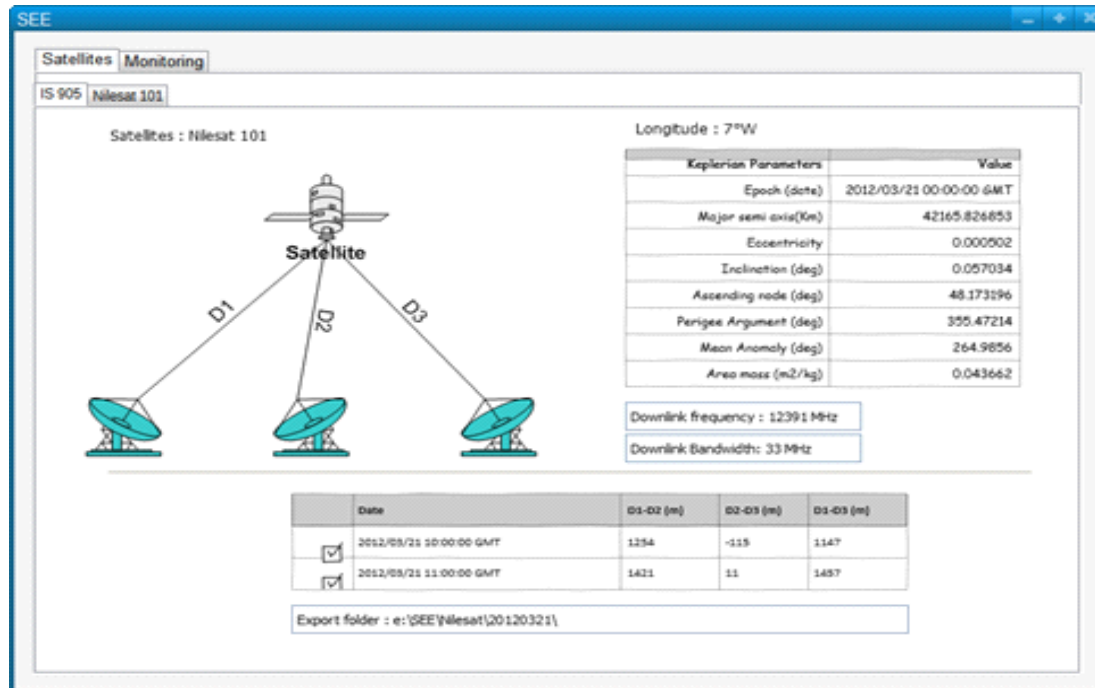
# Satellite Ephemeris Estimator

## Passive ephemeris estimation add-on to geolocation system

### Accuracy

The main purpose is to reach the accuracy at which one can use geolocation results without the use of additional reference transmitters: the operating mode then solely relies on a single reference carrier.

The system continuously streams main/mirror orbital data to the geolocation system: after stabilization phase, up to date, accurate data are available upon triggering of a geolocation task



# Performances

## Operating Mode: easing-up the process

### Operating mode

#### Automated

Detection & Geolocation .....

Full transponder.....

Full Manual (Metrology Approach) ..

Distant Antennas .....

Interface with other applications .....

Multi sites .....

Autonomous system .....

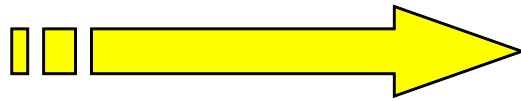
- ➔ One-Click Modes
- ➔ Macro Task Manager
- Geolocation-aware transponder monitoring
- Continuous Co-Orbit Estimation
- Multi-Carrier oriented Hardware Design
  
- ➔ Expert mode
- ➔ Multi-site GPS synchronisation
- ➔ XML interfaces
- ➔ Scalable system architecture
- ➔ Stand alone system

# Performances

## Operating Mode: Automated MacroTasks Architecture

### Main principles

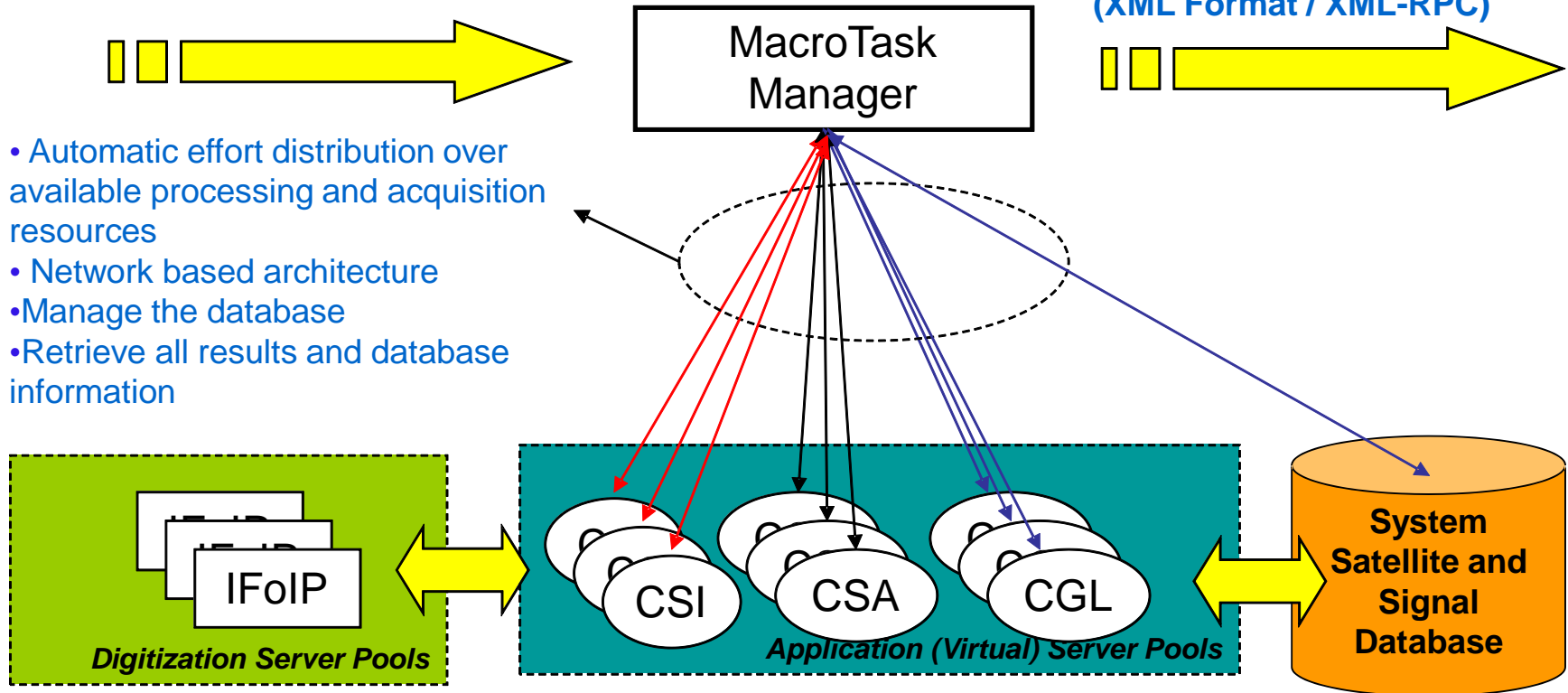
Input a given transponder frequency



Output Results  
(XML Format / XML-RPC)



- Automatic effort distribution over available processing and acquisition resources
- Network based architecture
- Manage the database
- Retrieve all results and database information





# Performances

## Operating Mode: Automated MacroTasks Architecture

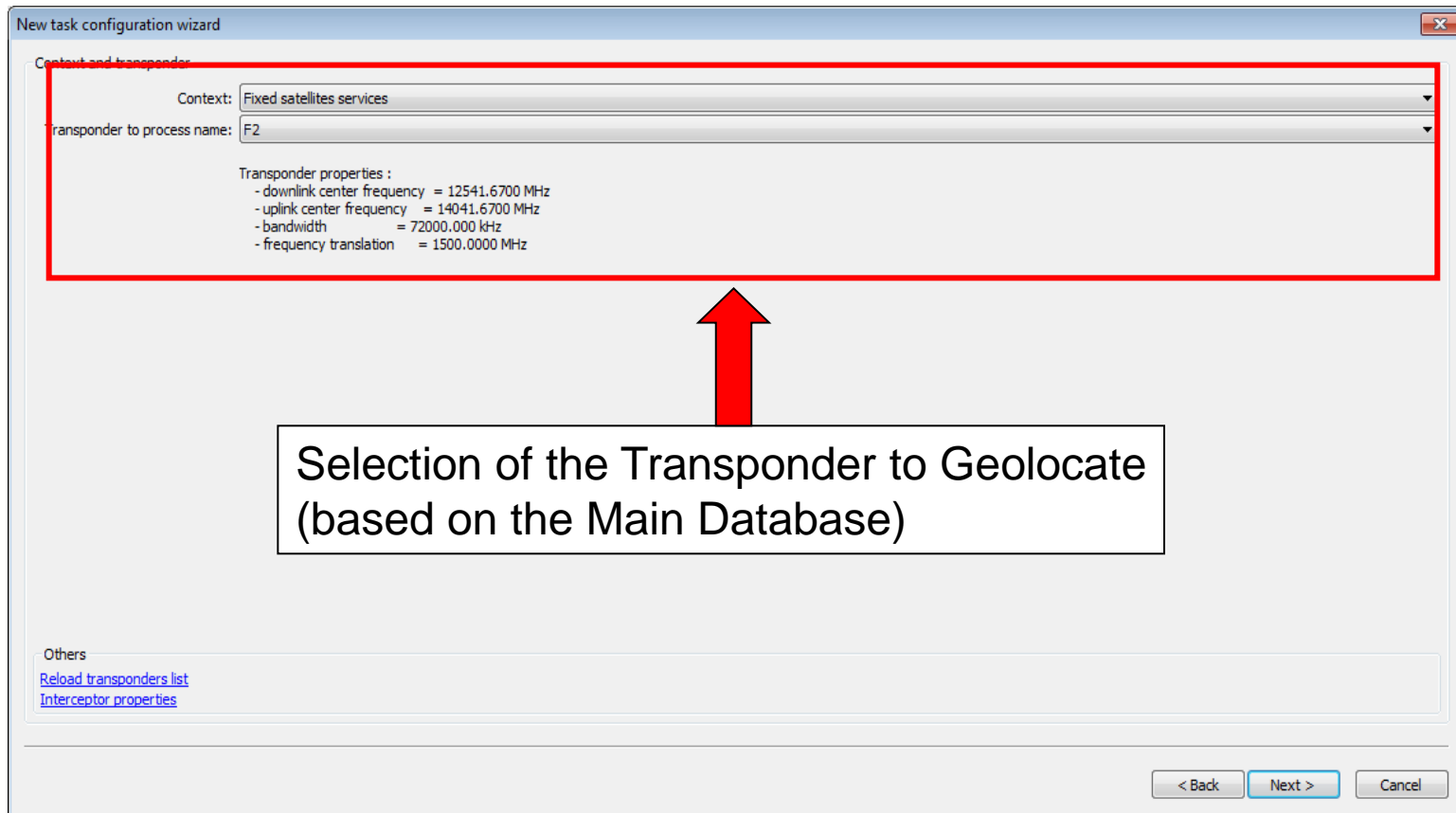
### A simple configuration process

The screenshot displays the HyperTask manager software interface. On the left, a vertical sidebar contains buttons for 'Other', 'Lock', 'Delete', 'Other', 'Forget', 'Other', 'Reload', 'Inter', 'Other', 'Reload', 'Inter', and 'Signal Plot and detected carriers'. The main window is titled 'HyperTask manager' and shows a 'Task specific parameters' dialog box. Below this, a table lists tasks with columns for Frequency [Hz], Bandwidth [Hz], SNR [dB], Occupation [%], Mean TOCA [s], Std. TOCA [s], Mean FOCA [Hz], Std. FOCA [Hz], Location [deg, deg], Elevation [m, km], and Status. The table contains 20 rows of task data. To the right of the table is an 'Operations' panel with a 'Start' button and a 'Task started at 2012/05/10 12:21:04.000000000 GMT +2' message. At the bottom, there is a 'Signal Plot and detected carriers' window showing a plot of signal amplitude over time and a map of a geographical area with a red location marker.

# Performances

Operating Mode: Automated MacroTasks Architecture

**Select your satellite and transponder**



# Performances

Operating Mode: Automated MacroTasks Architecture

Select your primary reference

The screenshot shows a 'New task configuration wizard' window with the following fields and controls:

- Task specific parameters:**
  - Main reference:** TLS-ASTRIUM-7A-12540.7-V - 12540.7382 MHz (EUTELSAT 7A )
  - Peak scan parameters:** Edit
  - Process by:** localhost:7765
  - Lock server for main reference process:**
- Forget analysis inside HyperLoc:**
- Others:**
  - [Reload references list](#)
  - [Interceptor properties](#)
- Navigation:** < Back, Finish, Cancel



# Performances

Operating Mode: Automated MacroTasks Architecture

Select your secondary references

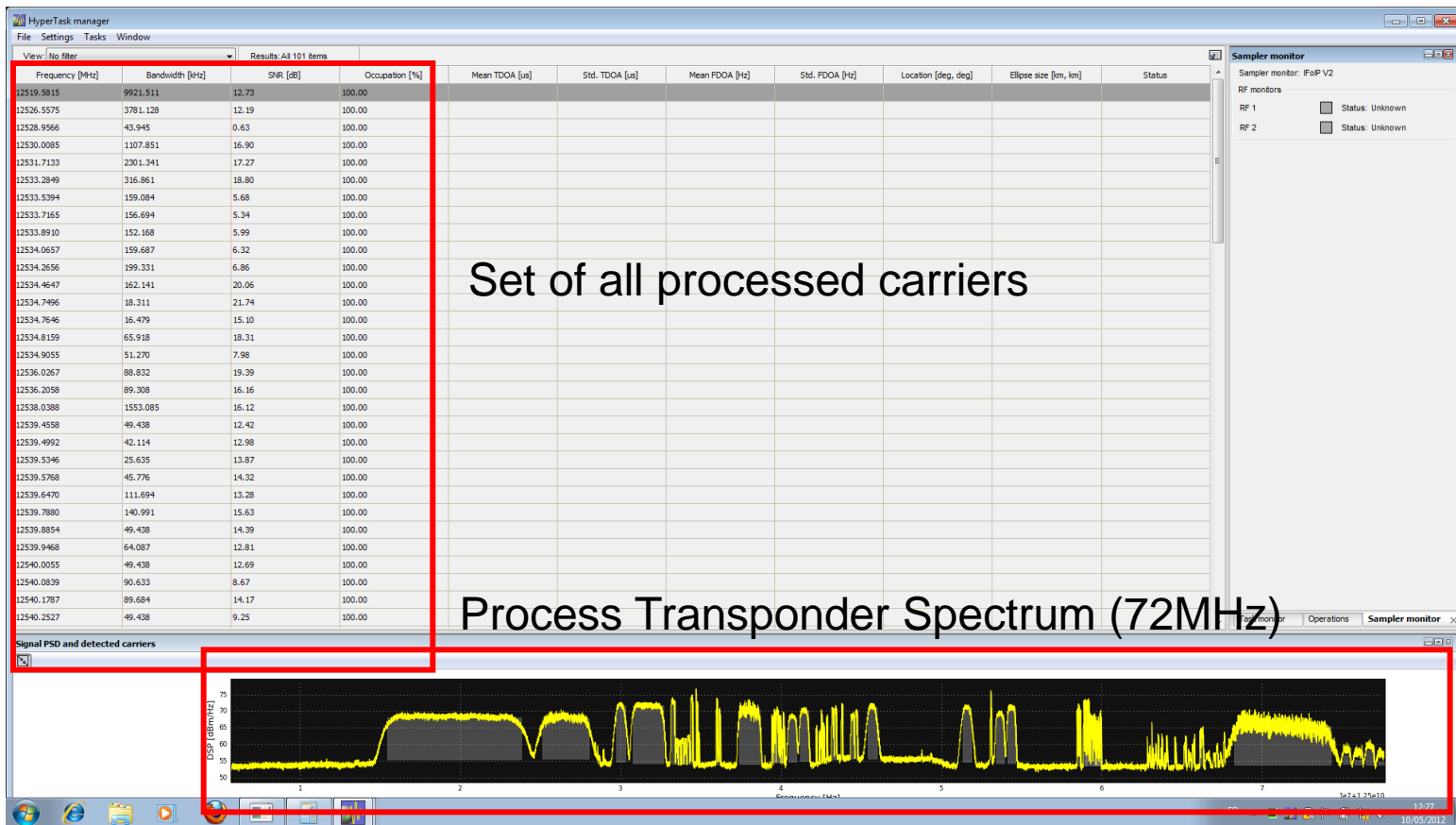
**Secondary Reference Selection for :**

- Automatic Ephemeris estimation
- Automatic Multi-Reference Correction

# Performances

Operating Mode: Automated MacroTasks Architecture

Select the carriers to locate



Set of all processed carriers

Process Transponder Spectrum (72MHz)

# Performances

Operating Mode: Automated MacroTasks Architecture

**Results: positions & information on the carriers**

The screenshot displays the HyperTask manager interface. The main window is titled "HyperTask manager" and shows a table of carrier data. A red box highlights the table, which is titled "Detailed Data for all carriers". The table has columns for Frequency [Hz], Bandwidth [Hz], SNR [dB], Occupation [%], Mean TDOA [µs], Std. TDOA [µs], Mean FDOA [Hz], Std. FDOA [Hz], Location [deg, deg], Ellipse size [m, km], and Status. The table lists 19 carriers with their respective parameters. A callout box "Detailed Data for all carriers" points to this table.

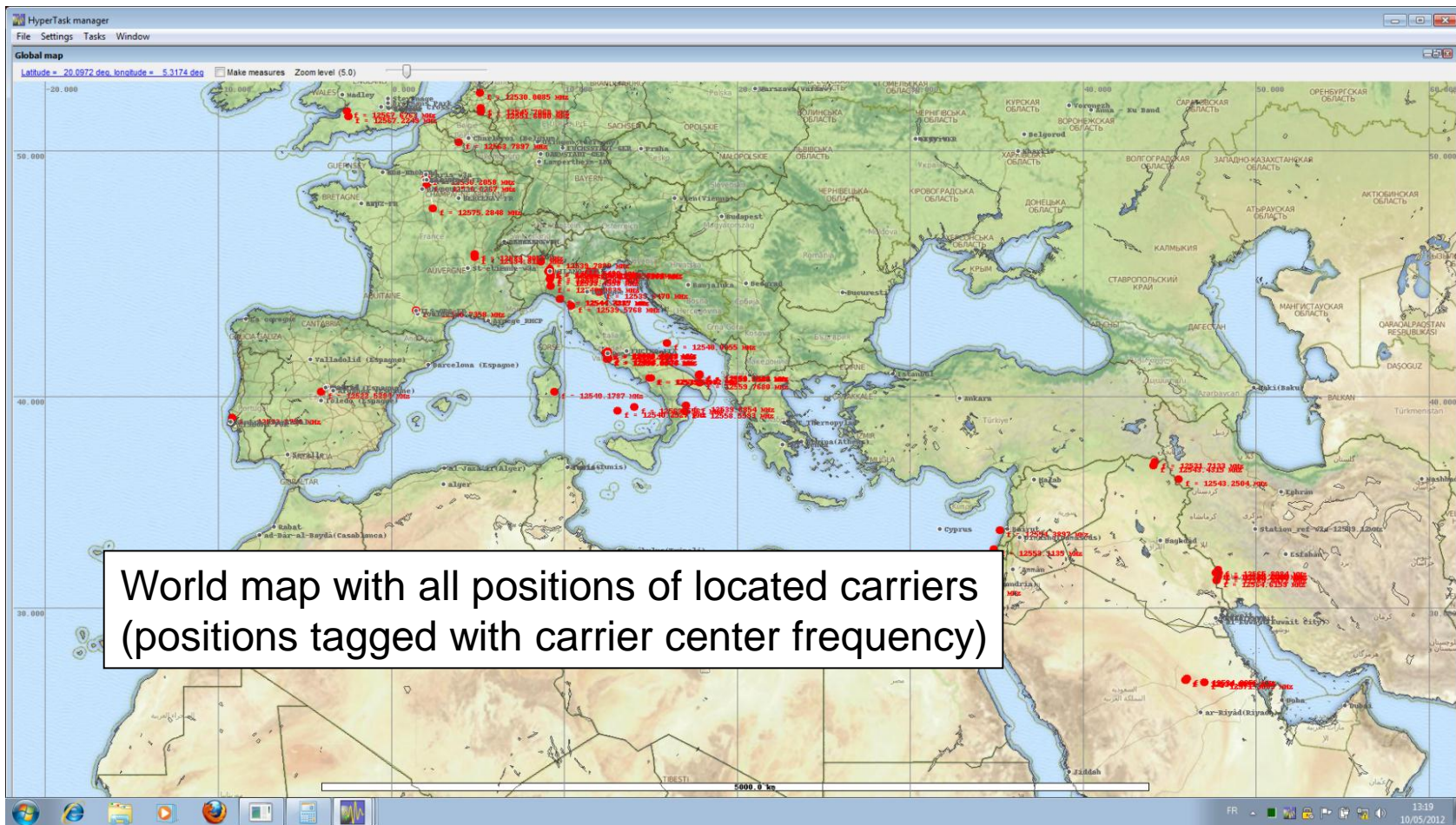
Frequency [Hz]	Bandwidth [Hz]	SNR [dB]	Occupation [%]	Mean TDOA [µs]	Std. TDOA [µs]	Mean FDOA [Hz]	Std. FDOA [Hz]	Location [deg, deg]	Ellipse size [m, km]	Status
-2564.0387						0.0012		(lat=-44.166, lon=9.782 ( 10.05, 0.66 ))		Done
-2564.0409						0.0001		(lat=-44.162, lon=9.737 ( 9.28, 0.21 ))		Done
-2564.5132						0.0013		(lat=-51.562, lon=5.163 ( 14.11, 0.22 ))		Done
-2564.5335						0.0014		(lat=-51.417, lon=5.175 ( 14.13, 0.23 ))		Done
-2562.4589						0.0005		(lat=-32.886, lon=34.80 ( 7.77, 1.40 ))		Done
-2564.0017						0.0015		(lat=-39.040, lon=-9.20 ( 9.31, 0.19 ))		Done
-2562.5339						0.0017		(lat=-33.805, lon=-35.18 ( 9.07, 0.20 ))		Done
-2563.8813						0.0024		(lat=-41.664, lon=-12.52 ( 13.11, 11.75 ))		Done
-2563.6039						0.0004		(lat=-39.312, lon=16.97 ( 8.06, 1.09 ))		Done
-2563.8986						0.0046		(lat=-41.894, lon=12.46 ( 17.53, 13.65 ))		Done
-2563.8815						0.0037		(lat=-41.631, lon=12.44 ( 13.86, 8.06 ))		Done
-2563.8822						0.0030		(lat=-41.640, lon=12.49 ( 12.56, 6.56 ))		Done
-2563.9021						0.0046		(lat=-41.897, lon=12.37 ( 17.46, 13.55 ))		Done
-2563.9038						0.0049		(lat=-41.952, lon=12.49 ( 18.37, 14.40 ))		Done
-2563.7462						0.0055		(lat=-41.927, lon=12.51 ( 20.10, 16.00 ))		Done
-2563.7455						0.0055		(lat=-41.890, lon=12.45 ( 20.10, 16.01 ))		Done
-2564.0321						0.0014		(lat=-45.282, lon=9.075 ( 9.75, 4.73 ))		Done
-2564.0182						0.0004		(lat=-45.074, lon=9.191 ( 8.00, 1.15 ))		Done
-2564.0243						0.0003		(lat=-45.168, lon=9.186 ( 7.80, 0.50 ))		Done
-2564.0345						0.0009		(lat=-45.334, lon=9.168 ( 7.80, 0.50 ))		Done

The bottom left of the screenshot shows a "Signal PSD and detected carriers" plot with DSP [dBm/Hz] on the y-axis and Frequency [Hz] on the x-axis. The bottom right shows a "Map Details for selected carriers" map with a red dot indicating the location of a selected carrier. The map shows a geographical area with a red dot at approximately 44.8493 deg latitude and 9.9307 deg longitude. A callout box "Map Details for selected carriers" points to this map.

# Performances

Operating Mode: Automated MacroTasks Architecture

**Results: positions on the map**





# Latest technologies

## New request

TDMA signal .....

Ka Band.....

Spotted satellites .....

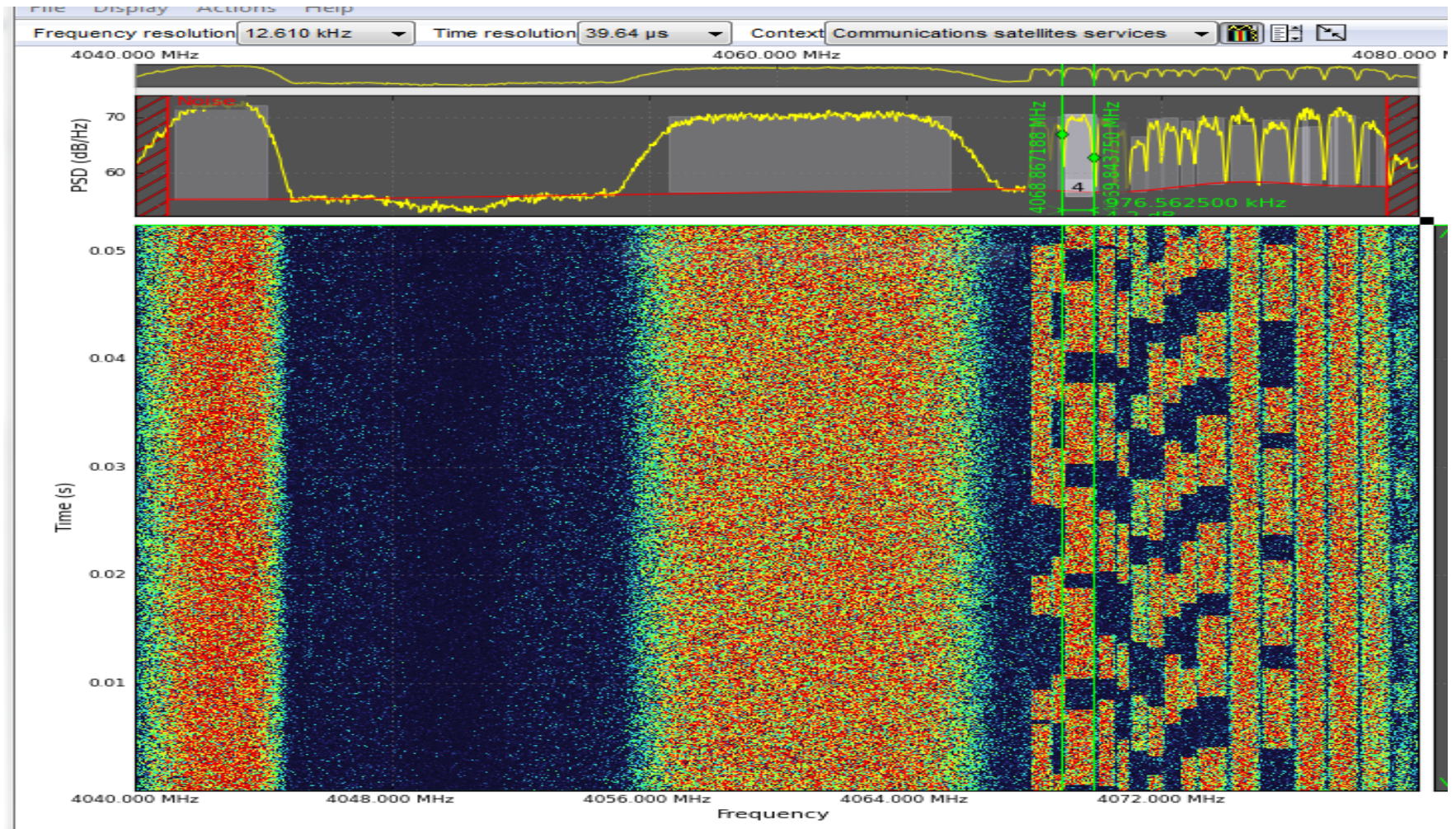
## ZDS Upcoming Features

- Geolocation of the users
- Better accuracy with One Sat
- Downsizing system configuration

# Performances

## Burst signal

In TDMA context

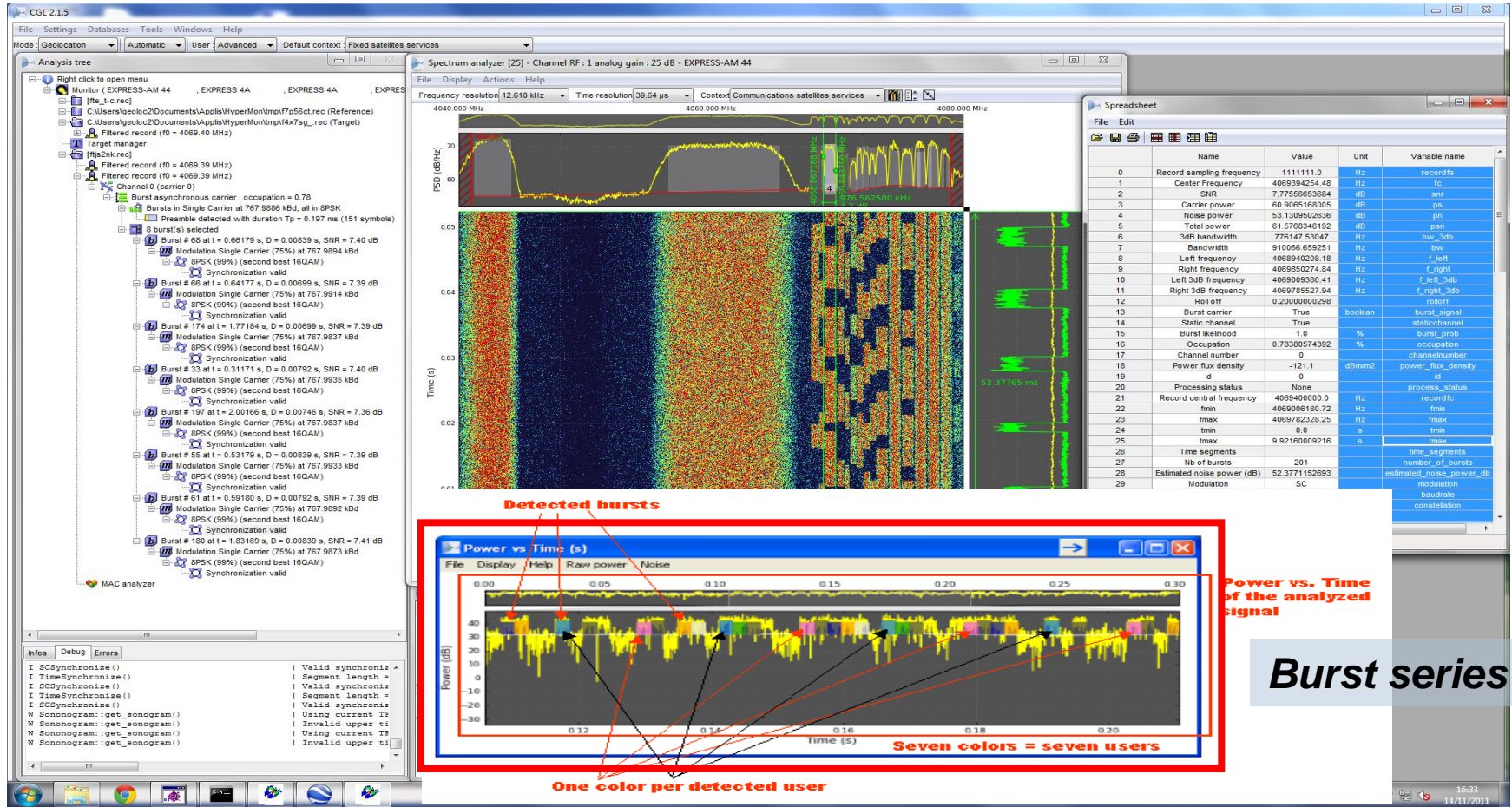




# Performances

## Burst Signal

In TDMA context



# Performances

## Burst Signal

In TDMA context

Geolocation manager : C:\Projects\Geoloc\Clients\EDGE Networks\Dana\ForDana\TDMA\_ExpAM44-Ku.mtl

Select target measurement for geolocation

From date [ ] to date [ ] from frequency [MHz] [ ] to frequency [MHz] [ ] Filter

Sampling date	Frequency [MHz]	Located at (lat, lon) [deg]	Ellipse size [km]	Process information	T
2011/11/14 16:45:18.4723012447 GMT	11008.0916	( 61.294, 57.867 )	( 629.89, 1.26 )	Standard geolocation done.	:
2011/11/14 16:45:18.4723265171 GMT	11008.0916	( 47.422, 16.373 )	( 140.47, 3.15 )	Standard geolocation done.	:
2011/11/14 16:45:18.4723446369 GMT	11008.0916	( 47.489, 16.413 )	( 141.36, 11.75 )	Standard geolocation done.	:
2011/11/14 16:45:18.4723582268 GMT	11008.0916	( 57.805, 60.022 )	( 854.49, 30.35 )	Standard geolocation done.	3
2011/11/14 16:45:18.4723794460 GMT	11008.0916	( 27.276, 2.629 )	( 373.66, 8.33 )	Standard geolocation done.	:
2011/11/14 16:45:18.4723794460 GMT	11008.0916	( 39.546, 4.721 )	( 214.36, 6.19 )	Standard geolocation done.	:
2011/11/14 16:45:18.4723970890 GMT	11008.0916	( 35.782, -0.569 )	( 252.03, 7.66 )	Standard geolocation done.	:
2011/11/14 16:45:18.4724235535 GMT	11008.0916	( 32.459, -5.537 )	( 291.48, 9.71 )	Standard geolocation done.	:

One single  
central frequency

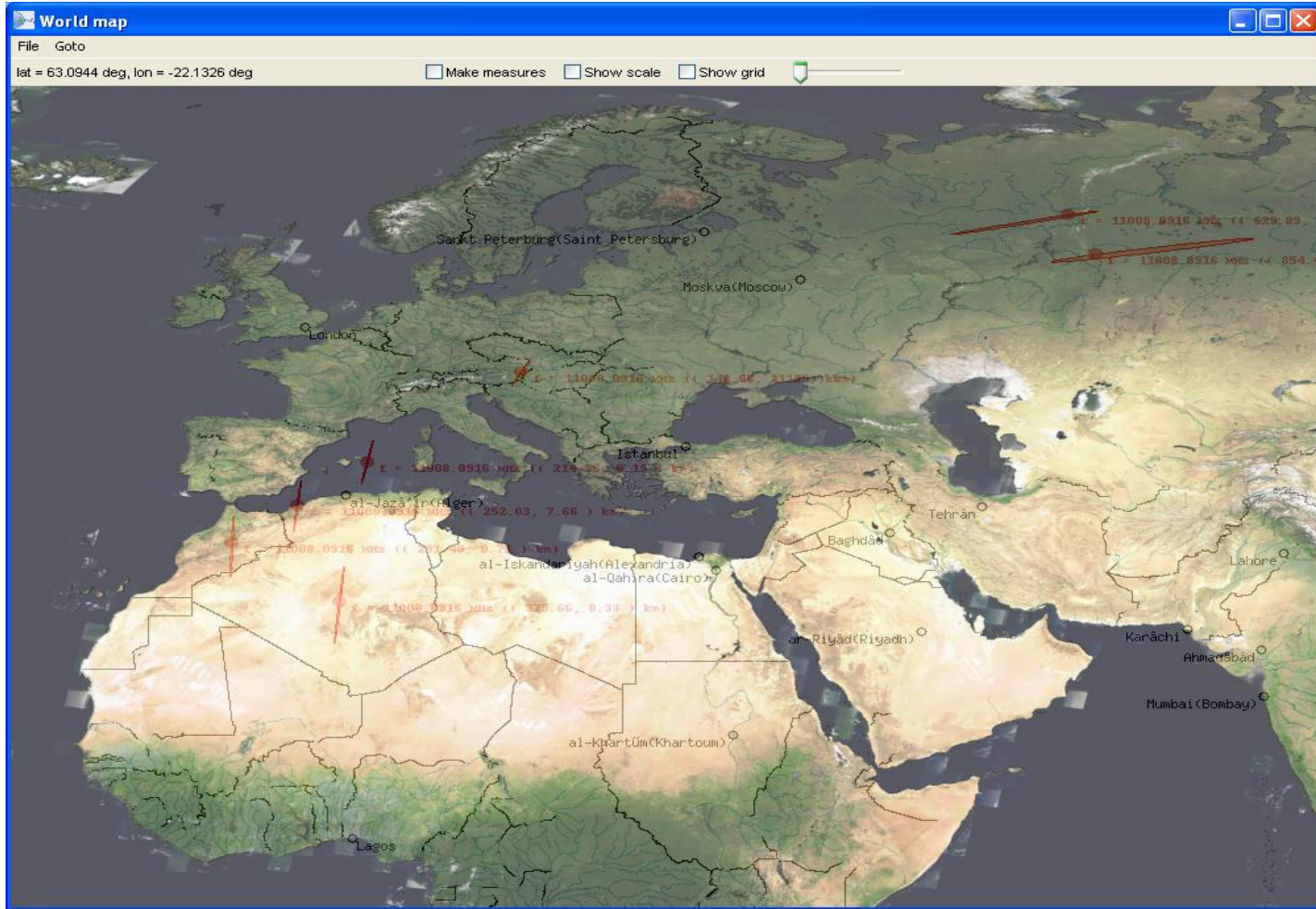
Several distinct  
locations



# Performances

## Burst Signal

## In TDMA context







**Thank you !**