



Cost Action: TU1302
Action Title: Satellite Positioning Performance
Assessment for Road Transport –SaPPART
Short Term Scientific Mission

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Cost SaPPART STSM Steering Committee

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Objectives

The main objective of the STSM was to prepare the training materials for the 1st training school of COST action: SaPPART with Dr. Valerie Renaudin and other researchers from the GEOLOC laboratory, IFSTTAR. In addition, the STSM researcher presented the research activities carried out in his home institute Finnish Geodetic Institute (FGI) to the GEOLOC researchers. There was also a presentation from GEOLOC researchers about the ongoing research activities in GEOLOC.

Work Schedule

The work schedule for the 1st STSM is shown in Table 1.

Table 1: Work schedule for the 1st STSM

Duration	2 weeks
Schedule	06 October, Monday – 17 October, Friday, 2014
Host Institute	The French institute of science and technology for transport, development and networks (IFSTTAR), Nantes, France
Home Institute	Finnish Geodetic Institute (FGI), Kirkkonummi, Finland

Work Description

The STSM researcher was assigned to develop laboratory materials for the 1st training school of COST action: SaPPART with the help of Dr. Valerie Renaudin and other researchers from the GEOLOC laboratory. It was presumed that two of the labs on Day 2 and Day 3 will be organized by GEOLOC and FGI researchers. The lab work description in brief is given below:

Lab on Day 2 is termed as ‘Lab 2’, and lab on Day 3 is termed as ‘Lab 3’:

Lab 2 will be divided in two parts:

- i. Lab 2a: GNSS data collection (field experiment)
- ii. Lab 2b: Analysis and positioning quality assessment (computer lab)

Lab 2a: GNSS data collection

Data will be acquired on spot. There will be X number of low cost systems (i.e., Garmin, Smartphone Data) available for the students with at least two of groups carrying 2 reference systems.

Lab 2b: Analysis and positioning quality assessment

- Each team sketches the itinerary (suggest specific patterns) on the map
- Extract the sketched trajectory
- Assess the output with map visualization
- Frenet distance using the sketched trajectory
- Error analysis based on time stamped data using the reference trajectory (same dataset for everybody)

At the end of the lab, the students will be asked to answer few questions with their gained experience. The students will also be asked to produce a customized html report based on provided Matlab functions.

Lab 3: Position Estimation using the Different Processing Techniques

A predefined data set will be used for performance comparison of different processing techniques. The idea behind this lab is to show the students how different processing techniques affect the ultimate performance of the navigation solution. The students will mainly evaluate the following processing techniques:

- i. Least square solution
- ii. Least square + Map matched solution
- iii. Kalman filter with FDE (Fault Detection & Exclusion) solution
- iv. Kalman filter with FDE + Map aided solution
- v. Kalman filter with FDE + Map matched solution

The students will be asked to compare the performance of these techniques using the same quality assessment criterion they used in Lab 2. At the end of the lab, the students will have to answer few questions based on their understanding on the processed data sets with different processing techniques.

Main Results

The materials for the 1st training school for Day 2 and Day 3 were prepared. There are still some efforts required to finalize the contents of the training materials. The prepared Matlab interfaces for Labs 2 and 3 are shown in Figs. 1 and 2, respectively.

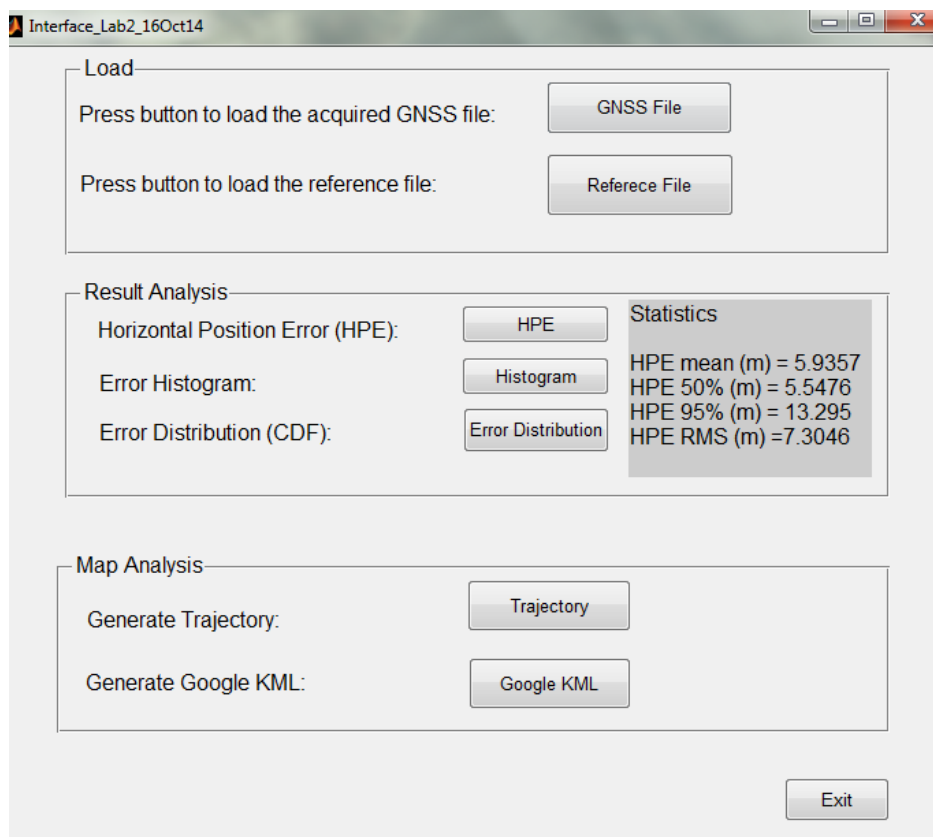


Fig. 1: Matlab interface for Lab 2: GNSS data collection, analysis and positioning quality assessment

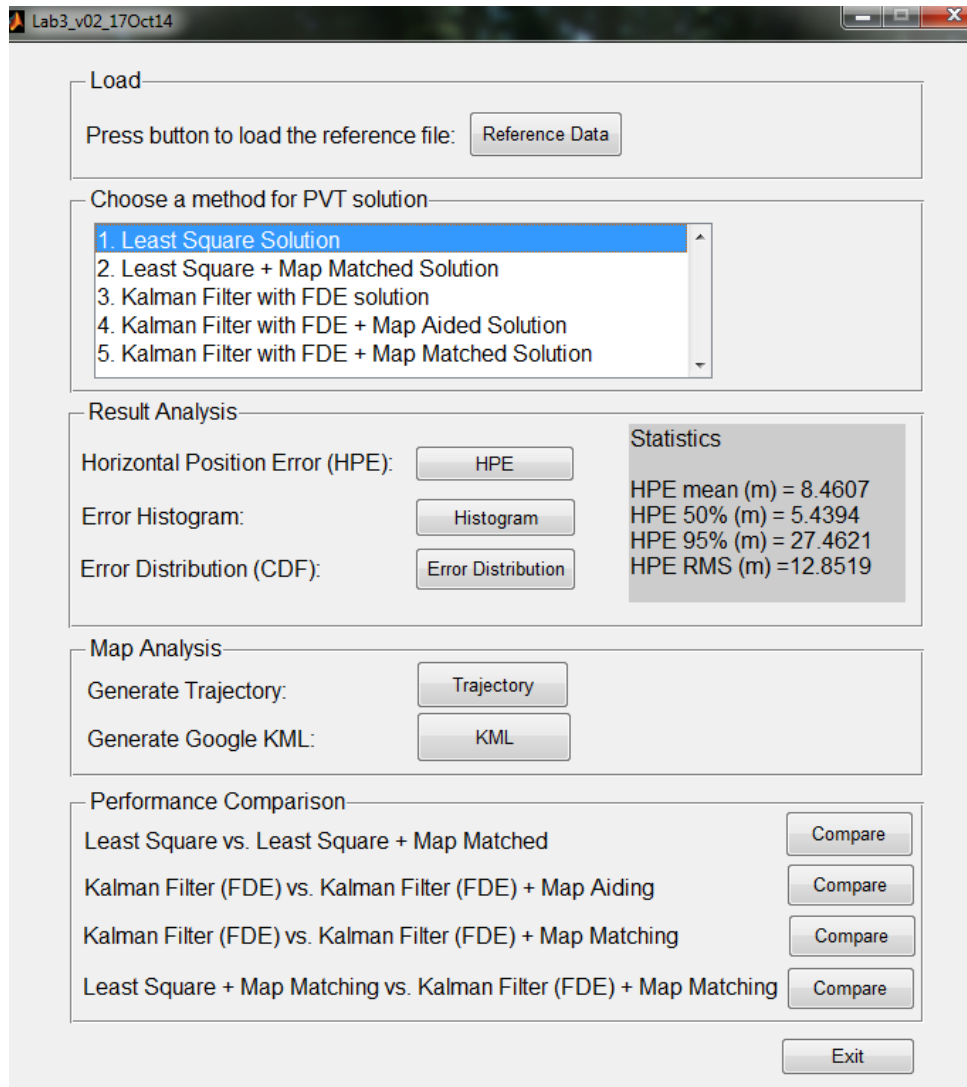


Fig. 2: Matlab interface for Lab 3: Position estimation using different processing techniques

The source codes for these two labs along with the necessary location text files can be obtained as a separate zip file.

Future collaboration between FGI and IFSTTAR

The STSM researcher and Dr. Valerie Renaudin discussed about the potential research collaboration in future. Both the researchers agreed to cooperate in future research calls from EU or ESA on the topic that both the participating institutes have common interest. In addition, FGI, as a home institute, already expressed interest to host any researcher under the COST action SaPPART. The STSM researcher will keep close contact with IFSTTAR in order to make the 1st training school a successful event.

Research activities

The STSM researcher discussed the following research topics with Dr. Valerie Renaudin for possible continuation of research directions under the COST framework:

- Testing the benefits of Multi-frequency Multi-GNSS navigation solution in ITS applications in terms of availability, accuracy, integrity, etc.
 - The test scenarios:
 - i. Dense urban environment
 - ii. Urban/sub-urban environment
- Implementation of Advanced Receiver Autonomous Integrity Monitoring (A-RAIM) for ITS applications in view of multi-frequency multi-GNSS systems
 - The scenarios that could be of interest for ITS:
 - i. Jamming,
 - ii. Spoofing,
 - iii. Unintentional interference from other radio navigation signals, etc.

The STSM researcher plans to continue research on the above areas in future depending on the availability of the research projects.

Conclusions

It was indeed a great experience to visit and work with some researchers in GEOLoc laboratory, IFSTTAR, Nantes, France. The STSM researcher got to know about some of the research activities conducted in IFSTTAR. In general, the STSM is an excellent opportunity for a young early stage researcher to work with other researchers from other EU member states. The STSM researcher sincerely expresses his gratitude towards the STSM committee members for availing this STSM grant.