15th International Conference on Ground Penetrating Radar

GPR 2014

June 30 – July 4 2014

Square Brussels Meeting Centre, Brussels, Belgium

Conference programme
Organizing Committee

General Chair
Sébastien Lambot
(sebastien.lambot@uclouvain.be)
Université catholique de Louvain
(UCL, Belgium)

Co-Chairs
Evert Slob
(e.c.slob@tudelft.nl)
Delft University of Technology
(TUDelft, The Netherlands)

Antonis Giannopoulos
(agiannopoulos@ed.ac.uk)
The University of Edinburgh (UE, UK)

Christophe Craeye
(christophe.craeye@uclouvain.be)
Université catholique de Louvain
(UCL, Belgium)

Frédéric André
(frederic.andre@uclouvain.be)
Université catholique de Louvain
(UCL, Belgium)

Lara Pajewski
(lara.pajewski@uniroma3.it)
Roma Tre University (Italy) - EU
Cost Action TU1208

Local Organizing Committee
Carine Demeyer
(carine.demeyer@uclouvain.be)
Financial Chair

Laurence Mertens
(laurence.mertens@uclouvain.be)
Technical Program Chair

Albéric De Coster
(alberic.decoster@uclouvain.be)
Social Event Chair

Nicolas Mourmeaux
(nicolas.mourmeaux@uclouvain.be)
Delegate Chair
# GPR 2014 Programme

## 1. General Programme

### Monday June 30, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.00-9.30</td>
<td>Registration</td>
</tr>
<tr>
<td>9.30-10.00</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Plenary introduction (Sébastien Lambot)</td>
</tr>
<tr>
<td></td>
<td>Presentation of COST Action TU1208 (Lara Pajewski)</td>
</tr>
<tr>
<td></td>
<td>Presentation of EuroGPR (Erica Utsi)</td>
</tr>
<tr>
<td>10.00-10.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Invited talk: Immo Trinks</td>
</tr>
<tr>
<td></td>
<td>Large-scale high-resolution GPR prospection in archeology - recent developments and new challenges</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.00-11.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Invited talk: Francesco Soldovieri</td>
</tr>
<tr>
<td></td>
<td>Microwave tomography for radar imaging: status and perspectives</td>
</tr>
<tr>
<td>11.30-12.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Short exhibitor's presentations</td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch time</td>
</tr>
<tr>
<td>14.00-15.45</td>
<td>Silver Hall - Archaeology</td>
</tr>
<tr>
<td></td>
<td>Radar systems and antenna design</td>
</tr>
<tr>
<td>15.45-16.15</td>
<td>Coffee break</td>
</tr>
<tr>
<td>16.15-18.00</td>
<td>Silver Hall - Archaeology</td>
</tr>
<tr>
<td></td>
<td>Radar data processing and analysis</td>
</tr>
<tr>
<td></td>
<td>The Arc Radar systems and antenna design</td>
</tr>
<tr>
<td></td>
<td>The Arc Radar systems and antenna design</td>
</tr>
</tbody>
</table>

### Tuesday July 1, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00-10.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Early Stage Researchers</td>
</tr>
<tr>
<td></td>
<td>Radar data modelling and inversion, radar systems and antenna design</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.00-12.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Early Stage Researchers</td>
</tr>
<tr>
<td></td>
<td>Radar systems and antenna design, radar image processing, radar data processing and analysis</td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch time</td>
</tr>
<tr>
<td>14.00-15.45</td>
<td>Delvaux Foyer - poster session: Early stage researchers</td>
</tr>
<tr>
<td>15.45-16.15</td>
<td>Coffee break</td>
</tr>
<tr>
<td>16.15-16.45</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Bids for GPR 2016</td>
</tr>
<tr>
<td>16.45-17.45</td>
<td>Silver Hall - Ice and permafrost</td>
</tr>
<tr>
<td></td>
<td>The Arc Rock fractures</td>
</tr>
</tbody>
</table>

### Wednesday July 2, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00-10.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Early Stage Researchers</td>
</tr>
<tr>
<td></td>
<td>Archaeology, environment and agriculture, geological applications</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.00-12.30</td>
<td>Silver Hall - Plenary session</td>
</tr>
<tr>
<td></td>
<td>Early Stage Researchers</td>
</tr>
<tr>
<td></td>
<td>Geological applications, geotechnical applications, security applications</td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch time</td>
</tr>
<tr>
<td>14.00-15.45</td>
<td>Delvaux Foyer - poster session: Environment and agriculture, geological applications, road inspections, infrastructures and tunnels</td>
</tr>
<tr>
<td>15.45-16.15</td>
<td>Coffee break</td>
</tr>
<tr>
<td>16.15-18.15</td>
<td>Parc Royal - Exhibitor's field demonstrations</td>
</tr>
<tr>
<td>19.30-23.00</td>
<td>The Plaza Theatre - Gala Dinner</td>
</tr>
<tr>
<td></td>
<td>EuroGPR Meeting</td>
</tr>
<tr>
<td></td>
<td>Presenting GPR 2016 hosting</td>
</tr>
<tr>
<td></td>
<td>15th Anniversary of the GPR conference: Speed Painter Performer International Show!</td>
</tr>
</tbody>
</table>
### Thursday July 3, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00-9.30</td>
<td>Silver Hall</td>
<td>Plenary session</td>
</tr>
<tr>
<td>9.30-10.30</td>
<td>Silver Hall</td>
<td>Invited talk: Steven Arcone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The subbottom stratigraphy of Mirror Lake, Woodstock, NH: GPR profiles of Gyttja, glacifluvial deposits and till</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td></td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.00-12.30</td>
<td>Silver Hall</td>
<td>Infrastructures and tunnels</td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch time</td>
<td></td>
</tr>
<tr>
<td>14.00-15.45</td>
<td>Poster session</td>
<td>Poster session: archaeology, radar data processing and analysis, radar image processing, radar signal modelling and inversion, radar systems and antenna design, security applications, space applications</td>
</tr>
<tr>
<td>15.45-16.15</td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>16.15-17.00</td>
<td></td>
<td>Room 1: Silver Hall (7 presentations)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Security applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Space applications</td>
</tr>
<tr>
<td>18.15-19.00</td>
<td>The Arc</td>
<td>COST TU1208: Working group (WG) meeting</td>
</tr>
</tbody>
</table>

### Friday July 4, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00-9.30</td>
<td>Silver Hall</td>
<td>Plenary session</td>
</tr>
<tr>
<td>9.30-10.30</td>
<td>Silver Hall</td>
<td>Invited talk: John Bradford</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toward coupled geophysical and hydrologic inversions for improved characterization of dynamic water flow processes</td>
</tr>
<tr>
<td>10.30-11.00</td>
<td></td>
<td>Coffee break</td>
</tr>
<tr>
<td>11.00-12.30</td>
<td>Silver Hall</td>
<td>Environment and agriculture</td>
</tr>
<tr>
<td>12.30-14.00</td>
<td>Lunch time</td>
<td></td>
</tr>
<tr>
<td>14.00-14.30</td>
<td>Silver Hall</td>
<td>Presentation of the book &quot;Introduction to Ground Penetrating Radar: Inverse Scattering and Data Processing&quot;</td>
</tr>
<tr>
<td>14.30-15.45</td>
<td>Silver Hall</td>
<td>Road inspection</td>
</tr>
<tr>
<td>15.45-16.15</td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>16.15-17.00</td>
<td>Silver Hall</td>
<td>Presentation of IWAGPR 2015 hosting</td>
</tr>
</tbody>
</table>

### 2. Detailed session programme

#### Monday June 30, 2014

**Oral sessions in Silver Hall**

**Archaeology: Monday June 30, 14.00-17.00**

**Chairs:** Raffaele Persico and Marc Van Meirvenne

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.00-14.15</td>
<td>Liaven Verdouck, Ernie Haerinck and Bruno Overlaet</td>
</tr>
<tr>
<td></td>
<td>GPR survey to explore social stratification in a pre-Islamic burial area at Mleiha, Sharjah (United Arab Emirates)</td>
</tr>
<tr>
<td>14.15-14.30</td>
<td>Diego Arosio, Stefano Munda and Luigi Zanzi</td>
</tr>
<tr>
<td></td>
<td>A case study where dual-polarization was essential for correct interpretation of GPR results</td>
</tr>
<tr>
<td>14.30-14.45</td>
<td>Pier Matteo Harone and C. Ferrara</td>
</tr>
<tr>
<td></td>
<td>You can’t make an omelette without breaking some eggs: in which way can non-destructive and destructive techniques coexist?</td>
</tr>
<tr>
<td>14.45-15.00</td>
<td>Lorenada Matura, Marcello Cimadale, Raffaele Persico, Maria Teresa Giannotta, Valentino Desantis and Arcangelo Alessio</td>
</tr>
<tr>
<td></td>
<td>Application of a reconfigurable stepped frequency system to cultural heritage prospecting</td>
</tr>
<tr>
<td>15.00-15.15</td>
<td>M.Sato, H. Liu, T.Komagino and K. Takahashi</td>
</tr>
<tr>
<td></td>
<td>Archaeological survey by GPR for recovery from 3.11 Great Earthquake and Tsunami in East Japan</td>
</tr>
<tr>
<td></td>
<td>Study of wood beams in buildings with ground penetrating radar</td>
</tr>
<tr>
<td>15.30-15.45</td>
<td>Timothy Saey, Philippe De Smidt and Marc Van Meirvenne</td>
</tr>
<tr>
<td></td>
<td>Integrating GPR and EMI to three-dimensionally reconstruct a WW I training trench at Stonehenge</td>
</tr>
<tr>
<td>16.15-16.30</td>
<td>Lucia Orlando, G. De Donno, B. Renzi</td>
</tr>
<tr>
<td></td>
<td>Intensity of scattering for the lithotype characterization of an excavated pre-Trajan wall structure</td>
</tr>
<tr>
<td>16.30-16.45</td>
<td>Robert Evans, Richard Morrow and James Nash</td>
</tr>
<tr>
<td></td>
<td>The Use of Ground Penetrating Radar to Investigate a Chuchyard Burial Plot</td>
</tr>
<tr>
<td>16.45-17.00</td>
<td>Selma Kadioglu, Yusuf Kagan KADIOGLU, Kiyemt DENIZ and Ali Akin AKYOL</td>
</tr>
<tr>
<td></td>
<td>Ground Penetrating Radar and Micro Raman Spectroscopy in Keciova Mosque Casbah-Algiers (Algeria)</td>
</tr>
</tbody>
</table>
Radar data processing and analysis: Monday June 30, 17.00-18.00
Chairs: Jan van der Kruk and Chi-Chih Chen
17.00-17.15 Jianping Xiao and Lanbo Liu
Signal Fusion Using Extrapolation with Deterministic Deconvolution on Multi-Frequency Qinghai-Tibet Railway GPR Data for Permafrost Subgrade Detection
17.15-17.30 Kulyandin G.A., Omelyanenko A.V. and Omelyanenko P.A.
Methods of GPR Angular Scanning
17.30-17.45 Xiaoting Xiao, Amine Ihamouten, Gérardine Villain and Xavier Dérobert
Parametric study on processing GPR signals to get a dispersion curve
17.45-18.00 Lanbo Liu, Chuchuang Ma, John W. Lane, Jr. and Peter Joesten
Borehole Radar Interferometry Revisited

Oral sessions in The Arc
Radar systems and antenna design I: Monday June 30, 14.00-15.45
Chairs: Peter Annan and Xiongyao Xie
14.00-14.15 Bryan Reeves
Noise Modulated GPR: Second Generation Technology
14.15-14.30 A.P. Annan, N. Diamanti, J.D. Redman
GPR Emissions and Regulatory Limits
14.30-14.45 Xiaojun Liu, Shihan Lang, Bo Zhao, Feng Zhang, Jun Li, and Guangyou Fang, Xiangbin Cui, Bo Su
A high-resolution Polar Ice Penetrating Radar and Experiments in the 28th Chinese National Antarctic Research Expedition
14.45-15.00 Xiaoyao Xie, Hui Qin and Rongjie Yao
Design of an improved dipole antenna for detecting enclosure structure defects by cross-hole GPR
15.00-15.15 G. Casassa, J.L. Rodriguez and N. Blindow
Airborne GPR on high Andean glaciers - first results from 6000 m altitude
15.15-15.30 Patrick Klenk, Viktoria Keicher, Stefan Jaumann and Kurt Roth
Current limits for high precision GPR measurements
15.30-15.45 Ajith K. K. and Amitabh Bhattacharya
Improved Ultra-wide Bandwidth Bow-tie Antenna with Metamaterial Lens for GPR Applications

Radar systems and antenna design II: Monday June 30, 16.15-18.00
Chairs: Norbert Blindow and Egil Eide
16.15-16.30 Guido Manaorco, Mario Minati, Alessandro Simi, Rodolfo Guidi, Simone Lelli, Daniele Vacca, Devis Dei, Daniele Mecatti, Howard F. Scott, Martin Morey, Markus Hammer and Thomas Schauerte
A bore-head GPR for Horizontal Directional Drilling (HDD) equipment
16.30-16.45 Satoshi Ebihara, Akihito Umera, Tsukasa Kuroda and Hiroki Soda
Dipole Array Antenna and Loop Antenna for Estimation of Direction and Polarization in Borehole Radar
16.45-17.00 Egil Eide, Per Atle Viland and Jacopo Sala
Ground-Coupled Antenna Array for Step-Frequency GPR
17.00-17.15 Harun Cetinkaya, Jianping Wang, Dan Tran and Alexander G. Yanovsky
The Comparison of the Near Field Beam Patterns of 1D-CR MIMO and 2D-CR MIMO Arrays
17.15-17.30 C. Warren, N. Chwirzido and A. Giannopoulos
Radiation characteristics of a high-frequency antenna in different dielectric environments
17.30-17.45 M. Grasmueck, and P. Marchesini
Bushing Subsurface Mapping using flexible GPR Antenna tracked by Mini-GPS Loggers
17.45-18.00 S.R. Pennock, C.H.J. Jenks
Wideband Loaded Bicone Antennas for GPR Applications.

Tuesday July 1, 2014

Oral sessions in Silver Hall
Early stage researchers: Tuesday July 1, 9.00-12.30
Radar data modelling and inversion 9.00-10.15
Chairs: Francesco Soldovieri and Craig Warren
9.00-9.15 Emerson Almeida, Jorge Porsani, Ilaria Catapano, Gianluca Gemmarelli and Francesco Soldovieri
GPR data analysis enhanced by microwave tomography for forensic archaeology
9.15-9.30 Laurence Mertens, Adh Phuong Tran and Sebastien Lambot
Determination of the stability of a pulse GPR system and quantification of the drift effect on soil material characterization by full-wave inversion
9.30-9.45 Francis Watson and WRB. Lionheart
SVD analysis of GPR full-waveform inversion
9.45-10.00 Alberic De Coster, A.P. Tran and S. Lambot
Impact of the antenna offset and the number of frequencies on layered media reconstruction using full-wave inversion in near-field conditions
10.00-10.15 Nicolas Mourmeaux, A. P. Tran and S. Lambot
Soil permittivity and conductivity characterization by full-wave inversion of near-field GPR data

Radar systems and antenna design II: 10.15-11.15
Chairs: Motoyuki Sato and Antonis Giannopoulos
10.15-10.30 Khaldoun Alkalbilih, Christophe Craeye, Sebastien Lambot
Design of a 3D UWB Linear Array of Vivaldi Antennas Devoted to Water Leaks Detection
11.00-11.15 Youcheng Wang, Jingin Shao, Chao Chen, Yicai Ji, Zhou Bin, Hailing Zhang, Linui Wang, Guangyou Fang
Four-element Planar Array Antenna for UWB Application

Radar image processing: 11.15-12.15
Chairs: Motoyuki Sato and Antonis Giannopoulos
11.15-11.30 Davide Comite, A. Galli, I. Catapano, F. Soldovieri and E. Pettinelli
An Improved Tomographic Approach for Accurate Target Reconstruction from GPR Numerical Data

11.30-11.45 Li Yi, Motoyuki Sato and Kazunori Takahashi
Optimization of Data Sampling and Image Reconstruction by GPR

11.45-12.00 Marco Salucci, Paolo Rocca, Giacomo Oliveri and Andrea Musa
An Innovative Frequency-Hopping Multi-Zoom Inversion Strategy for GPR Subsurface Imaging

12.00-12.15 Niklas Allroggen, Loes van Schaik and Jens Tronicke
Time-lapse 3D GPR imaging of brilliant blue infiltration experiments

Radar data processing and analysis: 12.15-12.30
Chairs: Motoyuki Sato and Antonis Giannopoulos

12.15-12.30 Audrey Van der Wielen, L. Courand and F. Nguyen
Detection of near-field, low permittivity layers with Ground Penetrating Radar: analytical estimation of the reflection coefficient

Ice and Permafrost: Tuesday July 1, 16.45-17.45
Chairs: Steven Arcone and Anja Klotzsche

16.45-17.15 Invited talk: Emanuele Forte, Matteo Dossi, Roberto Renato Colucci and Mauro Colle Fontana
4-D quantitative GPR analyses to study the summer mass balance of a glacier: a case history

17.15-17.30 Cosciotti B., F. Di Paolo, Lauro S.E., Vannaroni G., Bella F., Pettinelli E. and Mattei E.
Electromagnetic characterization of saline mixture for shallow radar exploration

17.30-17.45 Di Paolo F., Cosciotti B., Lauro S.E., Vannaroni G. and Pettinelli E.
Thermal and electromagnetic models for radar sounding of the Galilean satellite icy crusts

Oral sessions in The Arc
Rock fractures: Tuesday July 1, 16.45-17.45
Chairs: Lanbo Liu and Xie Xiongyao

16.45-17.00 Sixin Liu, Xinghao Chang and Limin Ran
Analysis of Fractures Detectability by Borehole Radar

17.00-17.15 Xinjian Tang, Weizhong Ren, Tao Sun and Renjun Hou
Application of sparse representation of ground penetrating radar data in a study of extracting rock fracture signature

17.15-17.30 Deng Ya-leti, Song Lei, Yang Wei-hao and Li Hai-peng (presented by Xie Xiongyao)
Permittivity and EM wave filed of the stochastic broken rock and its applications

17.30-17.45 Maurizio Ercoli, Cristina Pauselli, Emanuele Forte, Roberto Volpe, Costanzo Federico
"2D-3D GPR as an efficient tool for paleoseismology: a successful case history across the Castrovillari fault (southern Apennines, Italy)"

Poster session (Delvaux Foyer) Tuesday July 1, 14.00-15.45: Early stage researchers
Chairs: Lara Pajewski and Antonis Giannopoulos

Archeology

p01 Christine Bunting, Nick Branche, Steve Robinson and Penny Johnes
"Ground penetrating radar as a tool to improve heriatage management of wet lands"

Environment and agriculture

p02 Emmanuel Leger, Albane Saintenoy and Yves Coquet
"Estimating saturated hydraulic conductivity from ground-based GPR monitoring Pocharet infiltration in sandy soil"

p03 Davide Comite, A. Galli, C. Ferrara, S. E. Lauro, E. Mattei, G. Vannaroni and E. Pettinelli
"Numerical and Experimental Surveys on the GPR Early-Time Signal Features for the Evaluation of Shallow-Soil Permittivity"

Geological applications

p04 Anna Lejzerowicz, Krzysztof Czuryłowicz, Sebastian Kowalczyk and Anna Wysocka
"Ground Penetrating Radar and sedimentological investigations of quartz-glauconite sands in Lubartów area (south-east Poland)"

p05 Sean Morrison, Harry Jol and Walter Loope
"Radar Analysis of the Grand Island Tombolo, MI, USA: A Case Study for Coastal Landscapes"

Geotechnical applications

p06 Jianping Wang, Harun Cetinkaya and Alexander Yarovoy
"On Polar Sampling of GPR for Tunneling Boring Machine"

Radar data processing and analysis

p15 Ralph Feld and Evert Slob
"Sampling aspects of interferometry"

Radar image processing
### Radar signal modelling and inversion

<table>
<thead>
<tr>
<th>Page</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>p19</td>
<td>Xin-xin Qu, Si-xin Liu</td>
<td>A new ray tracing technique for crosshole radar traveltime tomography based on multistencils fast marching method and the steepest descend method</td>
</tr>
</tbody>
</table>

---

### Radar systems and antenna design

<table>
<thead>
<tr>
<th>Page</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>p20</td>
<td>Xianlei Xu</td>
<td>Development of a Novel GPR for Roadbed Disease Inspection</td>
</tr>
</tbody>
</table>

---

### Wednesday July 2, 2014

#### Oral sessions in Silver Hall

**Early stage researchers: Wednesday July 2, 9.00-12.30**

- **Archaeology: 9.00-9.30**
  - **Chairs:** John Bradford and François Jonard
  - **09.00-09.15** Yossi Salmon, Lawrence Conyers, Harry Joel and Michal Artzy: Early Second Millennium Settlement Landscape in the Nami Region, Israel revealed by GPR investigations
  - **09.15-09.30** Ana Valls Ayuso, Francisco García García, Manuel Ramírez Blanco and Jaime Llanes Millán: Correlation between GPR data and historical documentation for assessing the pavement constructive phases of Los Silos of Burjassot, 16th century (Valencia, Spain)

- **Environment and agriculture: 9.30-9.45**
  - **Chairs:** John Bradford and François Jonard
  - **09.30-09.45** Jing Li, Zhaofa Zeng, Lingna Chen and Fengshan Liu: Estimation of mixed soil hydraulic and dielectric parameters by impedance inversion of GPR data

- **Geological applications: 9.45-10.30**
  - **Chairs:** John Bradford and François Jonard
  - **09.45-10.00** Lei Fu, Sixin Liu and Lanbo Liu: Internal Structure Characterization of Living Tree Trunk Cross Section Using GPR Numerical Examples and Field Data Analysis
  - **10.00-10.15** Sonia Santos-Assunção, V. Salinas, V. Pérez-Gracia, O. Caselles, L.G. Pujades, J. Clapés, R. González and N. Lantada: Geological structures evaluated by means of scattering noise in Ground penetrating radar images
  - **10.15-10.30** Tanja Tillmann: Why is barrier spit’s accretion not a simple process? Insights from GPR-surveys of Northern Amrum (North Sea/German Bight)
  - **11.00-11.15** Alwi Husein, Sungkono, Arif Wijaya and Soffian Hadi: Subsurface monitoring of P.79 - P.82 LUSI Embankment using GPR Method to Locate Subsidence and Possible Failure

- **Geotechnical applications: 11.00-12.00**
  - **Chairs:** Mercedes Solla and Richard Yelf
  - **11.00-11.15** Chunguang Mo, Qing Zhao, Xinghao Chang, Limin Ran and Lanbo Liu: Field test of Directional Borehole Radar in hydrocarbon production well
  - **11.15-11.30** Cui Du, Feng Yang, Xingjun Xu, Xianlei Xu and Meng Peng: Coal mine geological hazardous body detection using surface ground penetrating radar velocity tomography
  - **11.30-11.45** Moshab U. Ahmed, Iftijabal A. Tareifel and Amp K. Maji: Variation of FWD Modulus Due to Incorporation of GPR Predicted Layer Thicknesses

- **Security applications: 12.00-12.30**
  - **Chairs:** Xavier Neyt and Maria González-Huici
  - **12.00-12.15** Irakis Giannakis, Antonios Giannopoulos and Nigel Davidson: Realistic Modelling of Ground Penetrating Radar for Landmine Detection Using FD/TD.
  - **12.15-12.30** Zhenghuan Xia, Shengbo Ye, Zhiwu Xu, Qunying Zhang, Guangyou Fang and Hejun Yin: Design of Modulated M-sequence UWB Radar for Life Detection

#### Poster session (Delvaux Foyer) Wednesday July 2, 14.00-15.45

**Chairs:** Frederic André and Colette Grégoire

- **Environment and agriculture:**
  - **14.00-14.15** S.A. Grant, S.A. Arcone and G.E. Boitnott: Maxwell-Wagner-Sillars, Adsorbed Water, and Free-Water Dielectric Relaxations within a Hydrated Arid-Zone Calcic Soil

---

---

---
Geological applications

- Rongyi Qian, Jian Li, Usef Aladin, Alireza Shokraei, D. Tran
  Efficiency of 3D imaging in GPR diagnostics of joints and vertical construction contacts

- J-M. Simonin, V. Balthazart, P. Hornych, F. Benedetto
  Investigation of long term moisture changes in roadbeds using GPR

- L.L. Fedorova, K.O. Sokolov, D.V, Savvin (presented by Kulyandin G.A.)
  GPR modeling of placer deposits geological profiles of permafrost zone

- Sultan Krasniqi
  Large-scale analysis of dielectric and mechanical properties of pavement using GPR and LFWD

- Xiongyao Xie
  Study of Formation of Lena River Ice Cover: According of Decade Measurement by GPR

- Bahrain Yousefi, Usef Aladin, Alireza Shokraei
  Application of Ground Penetrating Radar to detect Sinkholes and Ground Subsidence in Borynak, Tehran

- Xiongyao Xie
  The Potential Use of GPR in the Exploration for Riprap Layers in Tidal Flat Embankment

Road inspections

- F. Benedetto, A. Benedetto, A. Tedeschi
  Mobile Android Application for Road and Pavement Inspection by GPR Data Processing

- J-M. Simonin, V. Balthazart, P. Hornych, X. Dérobert, E. Thibaut, J. Sala, V. Utsi
  Case study of detection of artificial defects in an experimental pavement structure using 3D GPR systems

- J. Hugenschmidt, Anja Herlyn
  Damages in pavements caused by previous excavation work?

- Celimkhana Khakiev, Alexander Kruglikov, Victor Yavna, Georgy Lazorenko
  Investigation of Soil Contamination by Iron Pipe Corrosion and its Influence on GPR Detection

- Xiongyao Xie
  Analysis of signal amplitude dispersion to detect structural permafrost heterogeneities by ground penetrating radar

- J. Hugenschmidt, Anja Herlyn
  Damage in pavements caused by previous excavation work?

- Fabio Tosti, Sara Adabi, Lara Pajewski, Giuseppe Schettini, Andrea Benedetto
  Large-scale analysis of dielectric and mechanical properties of pavement using GPR and LFWD

- Xiongyao Xie
  Study of Formation of Lena River Ice Cover: According of Decade Measurement by GPR

- Bahrain Yousefi, C.H.J. Jenks
  Road Surface and Pavement Condition Assessment by High Frequency GPR Diffraction.

Infrastructures and tunnels

- Csaba Ékes, Boríszlav Nedecza, and Peter Takacs
  Pipe Penetrating Radar Inspection of Large Diameter Underground Pipes

- I. Pentea, A. Benedetto, A. Tedeschi
  Mobile Android Application for Road and Pavement Inspection by GPR Data Processing

- J. Hugenschmidt, A. Fischer, L. Schiavi
  Punching failure of car park ceilings – An analysis using GPR

- Lech Krysinski, Jacek Sudyka
  Efficiency of 3D imaging in GPR diagnostics of joints and vertical construction contacts

  Investigation of Soil Contamination by Iron Pipe Corrosion and its Influence on GPR Detection

- S. Savvin (presented by Kulyandin G.A.)
  Imaging of the deterioration and concrete quality of the tunnels (Ziganà, Toràl) with ground penetrating radar

- D. Tran, V. Perahel, H. Cetinkaya, J. Wang, A. Yarovoy
  Full-wave Analysis of GPR-signal in Tunnel Boring Machine Environment, A Temporal and Spectral GPR Study

- Usef Aladin, Alireza Shokraei, Bahrain Yousefi
  Tracing the source of Water leakage in Aqoudadieh Street (North of Tehran) Using Ground Penetrating Radar Method

- M.R. Ardekani, P. Druyts, S. Lambot, A. De Coster, X. Neyt
  Investigating the structure of a layered soil, including layer thickness and dielectric permittivity, using the interfaces and objects backscattered detected in GPR B-scans

- Shikuan Deng
  Investigation of karst cavities under the railway basement by GPR: Application to artificiallyrenched sections of the Yichang-Wanzhou Railway

- Xiongyao Xie, Rongjie Yao, Hui Qin, Hai Liu
  Study on Radargram Characteristics of the Backfill Grouting Quality Evaluation of a Shield Tunnel Using GPR

- Xiongyao Xie, Hui Qin, Rongjie Yao
  Highway Shield Tunnel Inspection using Integrated GPR Equipment

- S. Fontul, E. Fortunato, F. De Chiara
  Evaluation of ballast fouling using GPR
Thursday July 3, 2014

Oral sessions in Silver Hall

Infrastructure and tunnels: Thursday July 3, 9.30-12.30
Chairs: Colette Grégoire and Nectaria Diamanti

9.30-9.45
H. Liu, C.N. Koyama, K. Takahashi and M. Sato
High-resolution imaging of damaged wooden structures for building inspection by polarimetric radar

9.45-10.00
Csaba Ékes, Peter Takacs and Borizsatz Nedecza
Condition Assessment of Critical Infrastructure with GPR

10.00-10.15
Kunwei Feng, Yonghui Zhao, Jiansheng Wu and Shuangcheng Ge
Cross-correlation Attribute Analysis of GPR data for Tunnel Engineering

10.15-10.30
P.C. Jha, V.R. Balasubramaniam, N. Sandeep, B Butchi Babu and Y.V. Sivaram
Application of GPR in assessing the stability of oil pipeline

11.00-11.15
V.K. Kapustin, A. Khmelinskii and V. Monahov (presented by Maxim Shirobokov)
Advanced GPR Software for Operational Railway Roadbed Studies

11.15-11.30
Aleksandr Ristic, Miro Govedarica, Milan Vrtunski, Dusan Petrovacki
Application of GPR for creating underground structure model of specific areas of interest

11.30-11.45
J. Hugenschmidt, F. Wenk and E. Brühlwiler
GPR chloride inspection of a RC bridge deck slab followed by an examination of the results

11.45-12.00
Amir M Alani and Kevin Banks
Applications of Ground Penetrating Radar in the Midway Tunnel – Inspection of Structural Joints

12.00-12.15
Vincent Utsi
Detection of Fiber Optic cables using GPR

12.15-12.30
Chi-Chih Chen, Vincent Utsi
Study of Electromagnetic Wave Excitation and Propagation in Underground Continuous Coal Mining Environments

Security applications: Thursday July 3, 10.15-10.30
Chairs: Xavier Nett and Maria González-Huici

10.15-10.30
Kunwei Feng, Yonghui Zhao, Jiansheng Wu and Shuangcheng Ge
Cross-correlation Attribute Analysis of GPR data for Tunnel Engineering

10.00-10.15
M. Van Meirvenne
GPR Inspection of the Cheyenne Meteorite Impact Site at the Chubuarka Lake Bottom

10.15-10.30
P. C. Jha, V. R. Balasubramaniam, N. Sandeep, B. Butchi Babu and Y. V. Sivaram
Application of GPR in assessing the stability of oil pipeline

11.00-11.15
V. Kapustin, A. Khmelinskii and V. Monahov (presented by Maxim Shirobokov)
Advanced GPR Software for Operational Railway Roadbed Studies

11.15-11.30
Aleksandr Ristic, Miro Govedarica, Milan Vrtunski, Dusan Petrovacki
Application of GPR for creating underground structure model of specific areas of interest

11.30-11.45
J. Hugenschmidt, F. Wenk and E. Brühlwiler
GPR chloride inspection of a RC bridge deck slab followed by an examination of the results

11.45-12.00
Amir M Alani and Kevin Banks
Applications of Ground Penetrating Radar in the Midway Tunnel – Inspection of Structural Joints

12.00-12.15
Vincent Utsi
Detection of Fiber Optic cables using GPR

12.15-12.30
Chi-Chih Chen, Vincent Utsi
Study of Electromagnetic Wave Excitation and Propagation in Underground Continuous Coal Mining Environments

Space applications: Thursday July 3, 17.15-18.15
Chairs: Xavier Nett and Maria González-Huici

17.15-18.00
Jeremy Pile, Adam Switzer, Hong Tat Lee and Sheena Harpal Kaur
Examination of ice filled fish crates using High-Frequency Ground Penetrating Radar (HFGPR) – contraband detection.

Oral sessions in The Arc

Stratigraphy: Thursday July 3, 9.30-10.30
Chairs: Jens Tronnicke and Sarah Kruse

9.30-9.45
Francke, Jan and Tatam, Dominic
Regional Variability of Ground Penetrating Radar Response – a Case Study from the Dune Fields of the United Arab Emirates (UAE)

9.45-10.00
M. Van Meirvenne, E. Van De Vijver, L. Vandenhaute & P. Seuntjens
Investigating soil pollution with the aid of EMF and GPR measurements

10.00-10.15
Sebastian Kowalczyk, Dominik Lukaniak and Kornelia Zikowska
Ground penetrating radar survey in the central and eastern part of the Calowaniec Fen, Central Poland

10.15-10.30
J. Goumanamis, A.D. Switzer, C. Bristow, K. Jankaew, D.T. Pham, C. Rubin, Y.S. Lee
Thin-bed Ground-Penetrating Radar analysis of preserved modern and palaeotsunami deposits from Phra Thong Island, Thailand

Poster session (Delvaux Foyer): Thursday July 3, 14.00-15.45
Chairs: Raffaele Persico and Christophe Craeye

Archeology

9.
Selmia KADIOGLU, Yusuf Kagan KADIOGLU and Ali Akin AKYOL
Imaging the Hittite Cemetery Site with 3D Half Bird’s Eye View of GPR Data Set in Sapinuva Ancient City of the Hittite Empire (Corum-Turkey)

Cesar Bonato, Pamela Elchichi, B. Pasik, E.D. Lopez and A. Dushlevsky

Raffaele Persico, Gianluca Gemmarrelli, Francesco Soldovieri
GPR prospecting on circular surfaces: preliminary results

A. Sainteny, F. Rejiba, E. Léger, S. Bonde, C. Maines
GPR Observation of the Moon from Orbit: Kaguya Lunar Radar Sounder

E. Çelik
Searching the clue of the 7000 years history with GPR traces
2D Ground Penetrating Radar Data Filtering Using the Radial Basis Functions Neural Network

Noise Attenuation from GPR Data Using wavelet transform and Artificial Neural Network

Dmitry Sukhanov, Ksenia Zaryzlova
Three-dimensional non-contact subsurface radiotomography through a non-planar interface between the media

Quanwei Dai, Bin Zhang, Xiaobo Yin
Rotated Staggered Grid Simulation and Migration Imaging for GPR

Feng Yang, Xu Qiao, Xianlei Xu
Prediction Method of Underground Pipeline Based on Hyperbolic Asymptote of GPR Image

Zelimkhan Khalikov, Victor Yavn, Alexey Hopersky, Alexey Nadolinsky
Algorithm for solving the inverse problem of GPR

A. Popov, I. Prokopovich, V. Kupnikin, D. Edemskij
Spectral Theory of Microwave Holographic Image Formation

Lunar Regolith Structure Model and Echo Simulation for Lunar Penetrating Radar

M. Biancheri-Astier, A. Santenoy, V. Ciarletti
Development of an Agile beam Georadar prototype for the Investigation of pLanetary Environment (AGILE)

V. Monahov, A. Dudnik, V. Pomozov (presented by Mr Shirobokov)
Low frequency through-wall radar-detector

Kazushige Wada, Satoshi Ebihara
Small-diameter directional borehole radar system with 3D sensing capability

Vasilii Parafosov, Dinh Tran, Diego Caratelli
A Novel Low-Profile SWB Unidirectional Superhetero Antenna for Advanced Ground Penetrating Radar Applications

A. Zhuravlev, S. Ivashov, A. Bugaev
Automated Data Acquisition System for Holographic Subsurface Radar

M. Biancheri-Astier, A. Santenoy, V. Ciarletti
Development of an Agile beam Georadar prototype for the Investigation of pLanetary Environment (AGILE)

V. Monahov, N. Semeykin, V. Pomozov (presented by Mr Shirobokov)
Integrated Multi-Channel Unit for Humanitarian Mine-Cleaning Operations

Fawzy Abujarad
Independent factor analysis for clutter reduction in GPR data for landmine detection

V. Monahov, N. Semeykin, V.Pomozov (presented by Mr Shirobokov)
Integrated Multi-Channel Unit for Humanitarian Mine-Cleaning Operations

Shun Dai, Yan Su, Yuan Xiao, Jian Qing Feng, Shu Guo Xing
Low frequency through-wall radar-detector

Kazushige Wada, Satoshi Ebihara
Small-diameter directional borehole radar system with 3D sensing capability

Vasilii Parafosov, Dinh Tran, Diego Caratelli
A Novel Low-Profile SWB Unidirectional Superhetero Antenna for Advanced Ground Penetrating Radar Applications

A. Zhuravlev, S. Ivashov, A. Bugaev
Automated Data Acquisition System for Holographic Subsurface Radar

M. Biancheri-Astier, A. Santenoy, V. Ciarletti
Development of an Agile beam Georadar prototype for the Investigation of pLanetary Environment (AGILE)

Securities applications

Independent factor analysis for clutter reduction in GPR data for landmine detection

V. Monahov, N. Semeykin, V. Pomozov (presented by Mr Shirobokov)
Integrated Multi-Channel Unit for Humanitarian Mine-Cleaning Operations

Space applications

Shun Dai, Yan Su, Yuan Xiao, Jian Qing Feng, Shu Guo Xing
Low frequency through-wall radar-detector

Kazushige Wada, Satoshi Ebihara
Small-diameter directional borehole radar system with 3D sensing capability

Vasilii Parafosov, Dinh Tran, Diego Caratelli
A Novel Low-Profile SWB Unidirectional Superhetero Antenna for Advanced Ground Penetrating Radar Applications

A. Zhuravlev, S. Ivashov, A. Bugaev
Automated Data Acquisition System for Holographic Subsurface Radar

M. Biancheri-Astier, A. Santenoy, V. Ciarletti
Development of an Agile beam Georadar prototype for the Investigation of pLanetary Environment (AGILE)

Modification of velocity semblance analysis for air-coupled GPR

Stephan Schennen, Jens Troncicek, Niklas Allroggen
Ground-penetrating radar for detailed imaging of complex permafrost environment

Additional posters (papers not available)

Jia Di Pan, Wai Comilli & Man Van Meirvenne
Modified velocity semblance analysis for air-coupled GPR
**Oral sessions in Silver Hall**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair(s)</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30-9:45</td>
<td>Environment and agriculture: Friday July 4, 9:30-11:45</td>
<td>Antoine Gianopoulos and Frédéric André</td>
<td>Frédéric André, Matthieu Jonand and Sébastien Lambot</td>
</tr>
<tr>
<td>9:45-10:00</td>
<td>Full-wave inversion of ground-penetrating radar data for forest litter characterization</td>
<td></td>
<td>François Jonard; François Desmontoux; Simon Bircher; Stephen Razafindratsima; Mike Schwanck; Lutz Weillermüller; Sébastien Lambot; Jean-Pierre Wigneron; Yann Kerr and Harry Vereecken</td>
</tr>
<tr>
<td>10:00-10:15</td>
<td>Non-destructive evaluation of timber structures using GPR technique</td>
<td></td>
<td>Markus Loeser, Norman Wagner and Jan Igel</td>
</tr>
<tr>
<td>10:15-10:30</td>
<td>Soil moisture variability effect on GPR data</td>
<td></td>
<td>Mohammad Reza Mahmouzadeh Ardekani, Daniela De Benedetto, Xavier Neyt, Evert Slob, Bas van Wesemael, Patrick Bogaert, Christophe Craeye and Sébastien Lambot</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Radar image processing: Friday July 4, 9:30-11:45</td>
<td>Ilaria Catapano and Motoyuki Sato</td>
<td>Wayne B. Muller</td>
</tr>
<tr>
<td>11:30-11:45</td>
<td>Non-Destructive Evaluation of Timber Structures Using GPR technique</td>
<td></td>
<td>Rani Hamrouche and Tino Sarenko</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>Improvement of a coreless method to calculate the average dielectric value of the whole asphalt layer of a road pavement</td>
<td></td>
<td>Thomas Kind, Christiana Trela, Marcus Schubert and Jens Wüstmann</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Assessment of moisture in road pavements</td>
<td></td>
<td>Francisco M. Fernandes and Jorge Pais</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Monitoring Hot Mix Asphalt Pavement Density Changes Using Ground Penetrating Radar at the FAA’s National Airport Pavement Test Facility</td>
<td></td>
<td>Injuan Song, Albert Larkin and Jeffrey Gagnon</td>
</tr>
<tr>
<td>12:30-12:45</td>
<td>Self-correcting pavement layer depth estimates using 3D multi-offset Ground Penetrating Radar (GPR)</td>
<td></td>
<td>Wayne B. Muller</td>
</tr>
<tr>
<td>12:45-13:00</td>
<td>Non-destructive assessment of the rate of hydration and strength gain in concrete</td>
<td></td>
<td>Caitlin Thea Johnson and Robert Evans</td>
</tr>
<tr>
<td>13:00-13:15</td>
<td>Improvement of a coreless method to calculate the average dielectric value of the whole asphalt layer of a road pavement</td>
<td></td>
<td>Thomas Kind, Christiana Trela, Marcus Schubert and Jens Wüstmann</td>
</tr>
<tr>
<td>13:15-13:30</td>
<td>Aggregates Scattering of GPR Waves in Concrete</td>
<td></td>
<td>Francisco M. Fernandes and Jorge Pais</td>
</tr>
<tr>
<td>13:30-13:45</td>
<td>Spectral shift and absorption of GPR signals in a wetted sand column</td>
<td></td>
<td>Andrew Strange, John Malos and Jonathan Ralston</td>
</tr>
<tr>
<td>13:45-14:00</td>
<td>GPR for Road Inspection: Georeferencing and Efficient Approach to Data Processing and Visualization</td>
<td></td>
<td>Caitlin Thea Johnson and Robert Evans</td>
</tr>
<tr>
<td>14:30-14:45</td>
<td>Monitoring Hot Mix Asphalt Pavement Density Changes Using Ground Penetrating Radar at the FAA’s National Airport Pavement Test Facility</td>
<td></td>
<td>Injuan Song, Albert Larkin and Jeffrey Gagnon</td>
</tr>
<tr>
<td>15:15-15:30</td>
<td>Monitoring Hot Mix Asphalt Pavement Density Changes Using Ground Penetrating Radar at the FAA’s National Airport Pavement Test Facility</td>
<td></td>
<td>Injuan Song, Albert Larkin and Jeffrey Gagnon</td>
</tr>
<tr>
<td>15:30-15:45</td>
<td>Spectral shift and absorption of GPR signals in a wetted sand column</td>
<td></td>
<td>Andrew Strange, John Malos and Jonathan Ralston</td>
</tr>
</tbody>
</table>

**Oral sessions in The Arc**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Chair(s)</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30-9:45</td>
<td>Radar image processing: Friday July 4, 9:30-11:30</td>
<td>Ilaria Catapano and Motoyuki Sato</td>
<td>Andrew Strange, John Malos and Jonathan Ralston</td>
</tr>
<tr>
<td>9:45-10:00</td>
<td>Time Despacing to Reduce Nonlinear Sampling Effects of GPR</td>
<td></td>
<td>Qi Lu, Cai Liu and Xuan Feng</td>
</tr>
<tr>
<td>10:00-10:15</td>
<td>Signal Enhancement of GPR Data Based on Empirical Mode Decomposition</td>
<td></td>
<td>Wallace Wai-Lok Lai</td>
</tr>
<tr>
<td>10:15-10:30</td>
<td>Spectral shift and absorption of GPR signals in a wetted sand column</td>
<td></td>
<td>Raffaele Solimene, Angela DellAversano and Giovanni Leone (presented by Raffaele Persico)</td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>GPR for Road Inspection: Georeferencing and Efficient Approach to Data Processing and Visualization</td>
<td></td>
<td>R. Penning, O.M. Abdial-Latif, C.H.J. Jenks</td>
</tr>
<tr>
<td>11:30-11:45</td>
<td>Rapid processing of GPR time slices for data visualization during field acquisition</td>
<td></td>
<td>Neil Linford</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>Modeling of GPR data in a stack of VTI-layers with an analytical code</td>
<td></td>
<td>J. Hunziker, J. Thorbecke and E. Slob</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>The Inversion GPR signal by Compressing Sensing and its application</td>
<td></td>
<td>Zhaolong Zeng, Jing Li, Qi Lu, Kun Wang Xuan Feng, Shuang Xia and Fengshun Liu</td>
</tr>
<tr>
<td>12:15-12:30</td>
<td>Full wave PILE method for the electromagnetic scattering from random rough layers</td>
<td></td>
<td>C. Bourlier, C. Le Bastard and N. Pinel</td>
</tr>
<tr>
<td>13:00-13:15</td>
<td>New Tomographic Imaging Strategies for GPR Surveys</td>
<td></td>
<td>Lorenzo Cirone, Lorenzo Di Donato and Gioo Sorbello</td>
</tr>
<tr>
<td>13:15-13:30</td>
<td>Simulation of scattering by cylindrical targets hidden behind a layer</td>
<td></td>
<td>Cristina Ponti, Lara Pawejewski, Giuseppe Schettini</td>
</tr>
<tr>
<td>13:30-13:45</td>
<td>Intrinsic modelling of radar antennas</td>
<td></td>
<td>Sébastien Lambot, Ash Phuong Tran, Frédéric André, Nicolas Mourmeaux, Albéric De Coster, Laurence Mertens and Evert Slob</td>
</tr>
</tbody>
</table>