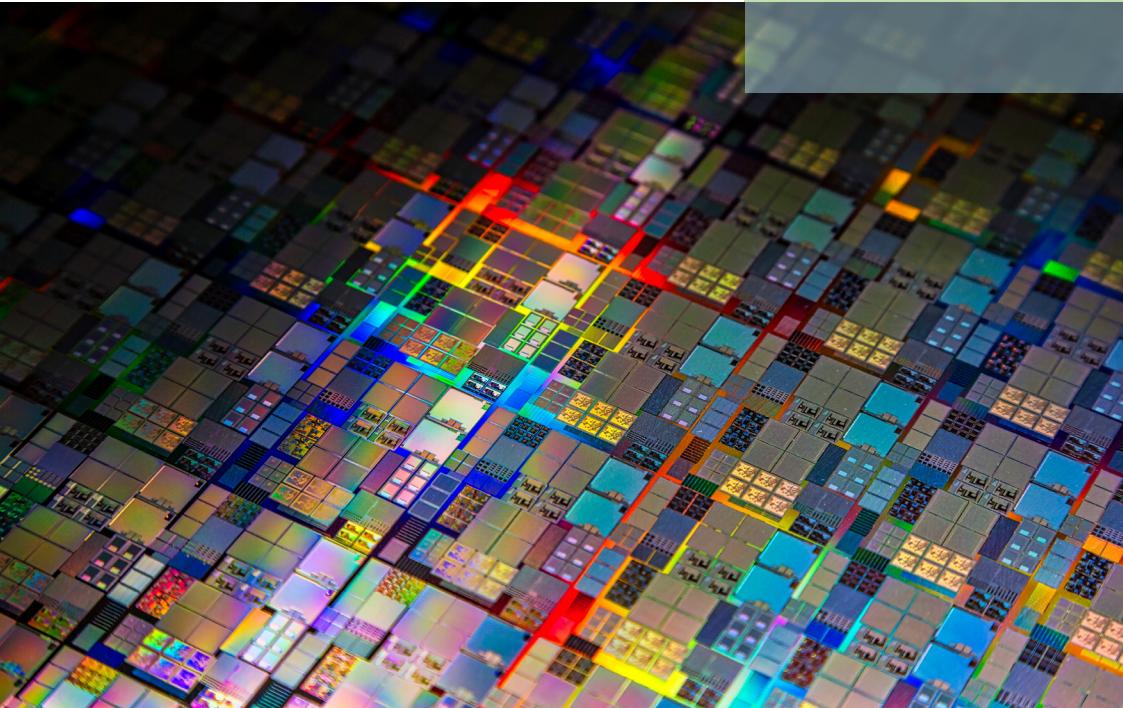




Science for Peace
and Security (SPS)
Programme

Virtual Closing Ceremony of the SPS Multi-Year Project

Implementation of a Terahertz Imaging and Detection System



Monday, 17 May 2021, 10:00 CEST

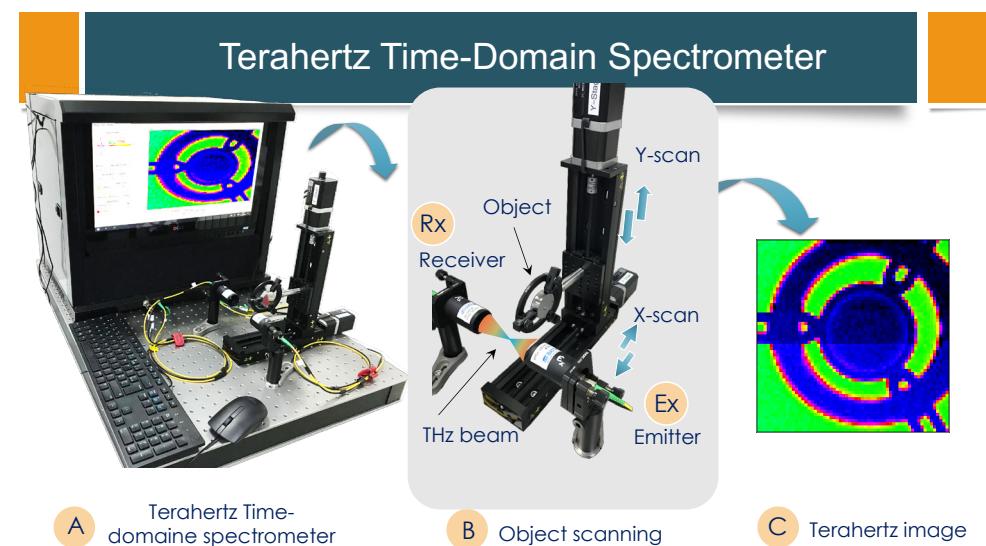
Emerging Security
Challenges Division

Project Overview

This Multi-Year Project designed and developed a terahertz (THz) imaging and detection system for dangerous materials, for the purpose of securing vulnerable sites from terrorist threats. Kicked-off in 2017, the project was led by scientists from Algeria, France, and Sweden.

THz radiation is a promising technology with strong penetrating capabilities. It allows screening through many non-conductive materials such as skin, clothing, paper, wood, cardboard, and plastics. It requires low energy and is not-ionizing - it is therefore, it is expected not to damage tissues and DNA.

Many substances of interest, such as drugs and explosives, exhibit strong specific absorption lines in the THz domain. These spectral signatures allow their detection and identification, impossible in other frequencies. In the long term, this promising technology could be exploited for other relevant applications, such as environment monitoring.



Deliverables

- Installation of a THz spectroscopy laboratory at the École Militaire Polytechnique (EMP) in Algiers.
- Conception, construction and demonstration of a THz imaging system dedicated to security applications.
- Exploration and generation of new efficient sources of THz radiation based on optical rectification in periodic crystals.
- Implementation and empirical demonstration of different experimental setups of a THz detection and imaging system for different applications.
- Development of a strong and effective scientific partnership between scientists from France and two NATO partner nations: Algeria and Sweden.
- Improvement of advanced knowledge and expertise in the Algerian detection and imaging capabilities.

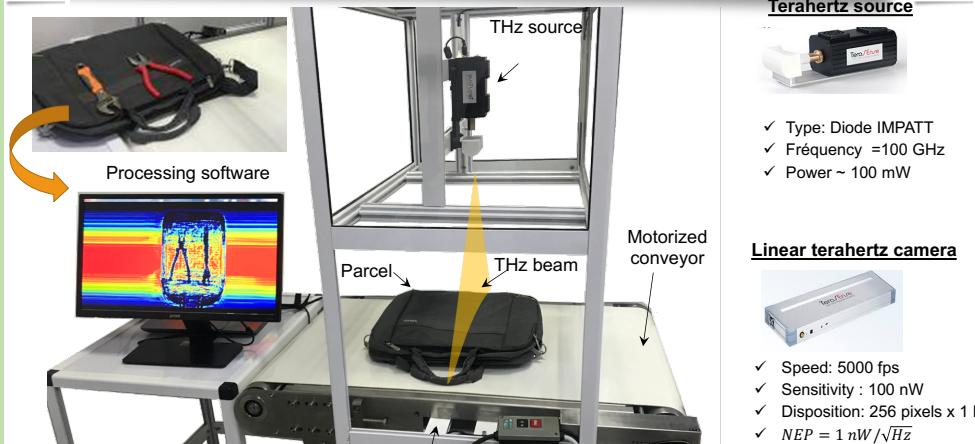
Outcome

This project installed the first THz imaging and detection system in North Africa. Important know-how, competences, and expertise were transferred to Algerian scientists in this field.

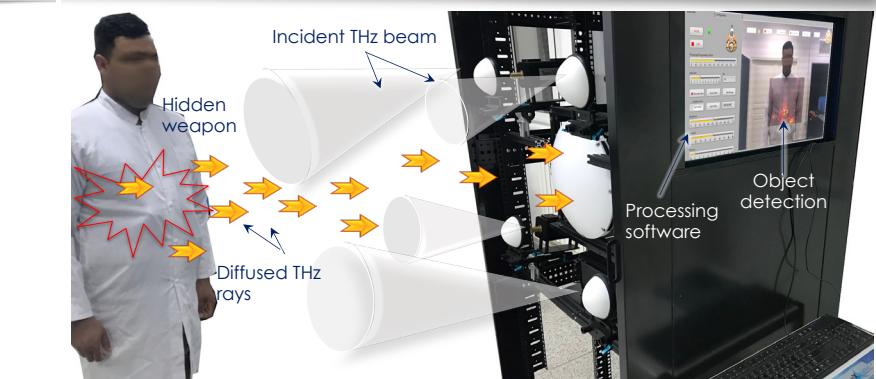
By proposing efficient THz generation in periodically poled devices, this project improved the efficiency of existing terahertz imaging and detection systems, and optimized their performance. This technological breakthrough has the potential to make important advancements for security applications, such as automatic screening devices for detection of dangerous materials to protect high-security buildings.

The results represent a significant step towards applying THz imaging technology in real-life conditions and analysing the recorded data. In particular, the project advanced knowledge and techniques in the preparation of samples from powders, recorded their THz properties (refractive index and absorption spectra), and conducted a number of detection trials in different scenarios (in luggages, boxes, concealed under clothes, etc.)

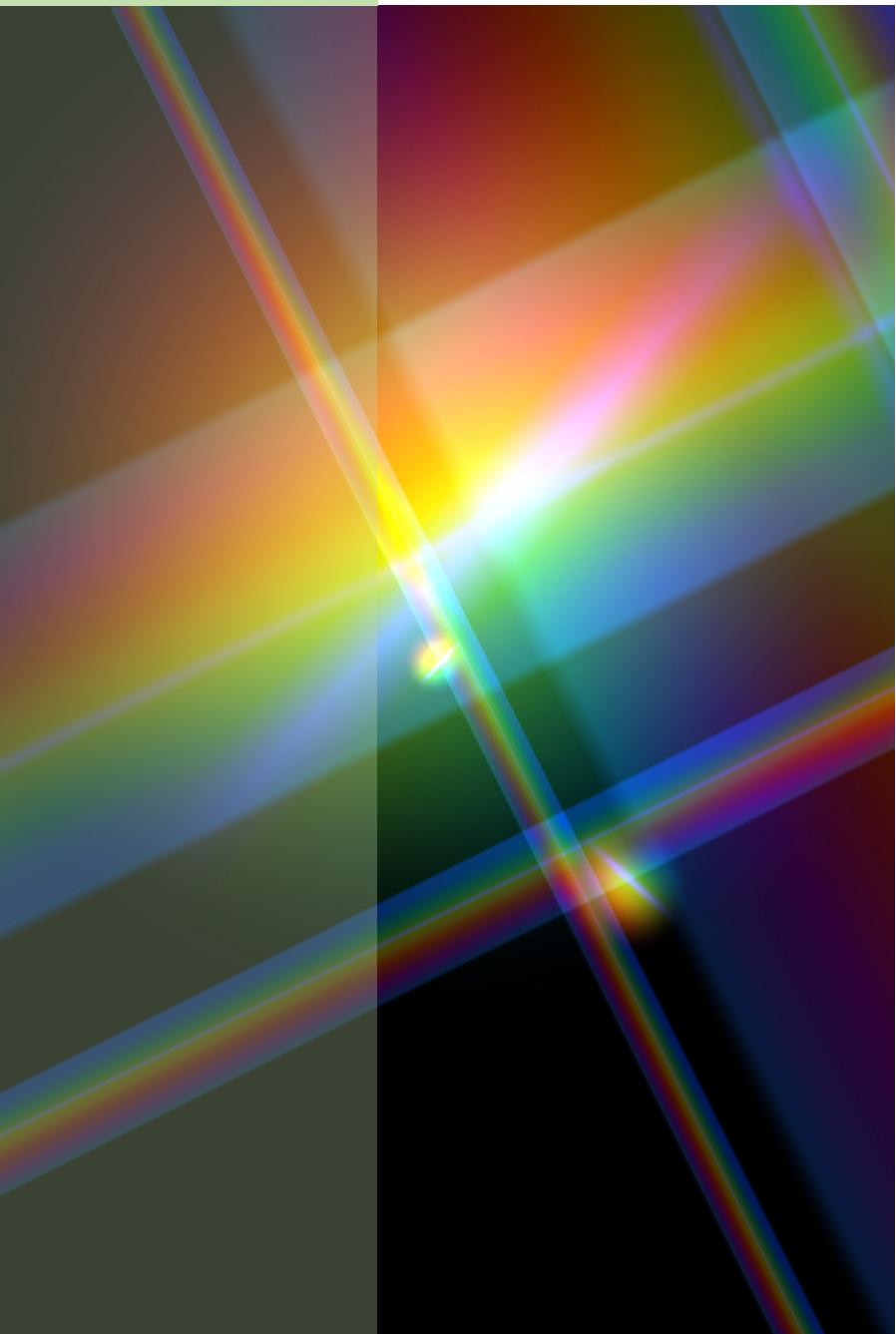
Terahertz Parcel imaging



Terahertz body scanner



Programme



10:00 - 10:30

Introductory Remarks

Moderator: Dr. Deniz Beten, Senior SPS and Partnership Cooperation Advisor, NATO

- Mr. David van Weel, Assistant Secretary General for Emerging Security Challenges, NATO
- Mr. Alexandre Escoria, Deputy Permanent Representative of France to NATO
- H.E. Mr. Mohamed Haneche, Ambassadeur de la République Algérienne Démocratique et Populaire à Bruxelles
- Mrs. Sara Uddenberg, Deputy Head of Mission/Minister Counselor, Mission of Sweden to NATO
- Général Serir Aomar, Commandant de l'École Militaire Polytechnique, Algeria

10:30 - 10:35

Video presentation of the THz laboratory in Algeria

10:35 - 10:45

Virtual Ribbon Cutting

10:45 - 11:00

Presentation of Project Results

Moderator: Dr. Claudio Palestini, SPS Advisor, NATO

- Prof. Jean-Louis Coutaz, Université Savoie Mont Blanc, France
- Dr. Mohamed Lazoul, École Militaire Polytechnique, Algeria
- Prof. Fredrik Laurell, Royal Institute of Technology, Sweden

11:00 - 11:10

Closing Remarks

Dr. Deniz Beten, Senior SPS and Partnership Cooperation Advisor, NATO

Participating Institutions

Université Savoie Mont Blanc (USMB)



Université Savoie Mont Blanc is a higher education institution that combines proximity to its territories and a wide opening on Europe and the world. USMB focuses on developing international projects, joint award qualifications, and programmes delivered in English, as well as encouraging mobility for students, lecturers and researchers. The Institute de Microélectronique Electromagnétisme Photonique and Laboratoire d'Hyperfréquences et de Caratération (IMEP-LAHC), common laboratory of USMB, the French National Research Center (CNRS), the Technical University of Grenoble (G-INP), and the University of Grenoble-Alpes, conducts research in electronics, from fundamental of semiconductors physics to systems. They include micro- and nano-electronics, microwaves, telecoms, photovoltaics and optoelectronics. At the IMEP-LAHC, the THz Optoelectronics team addresses research on ultrafast optoelectronics, namely THz, electro-optics and opto-microwaves since 1994. The team owns a unique park of seven THz time-domain setups fed by four different femtosecond lasers, allowing the characterization of any type of material.



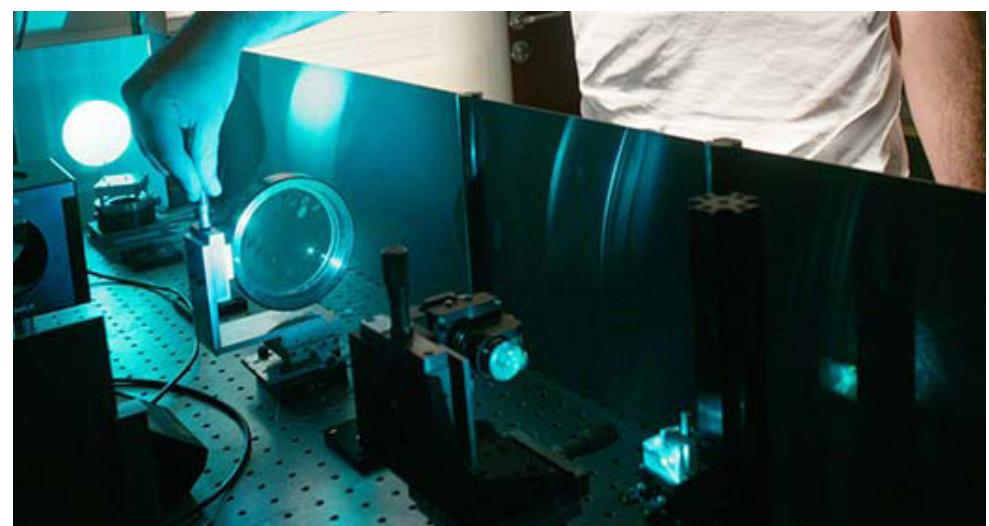
Ecole Militaire Polytechnique (EMP)

The Ecole Militaire Polytechnique (EMP) is a multidisciplinary higher education institution under the dual supervision of the Algerian Ministry of National Defence and Ministry of Higher Education and Scientific Research. It was created in 1995 to train highly qualified executives and provide courses for engineers, researchers and teachers. It carries out, for the benefit of various national sectors, any research or scientific study related to its field of activity. The school cooperates on training and research with national and foreign schools and institutions, as well as on pedagogical engineering with world-class schools. It organizes and participates in scientific events at the national and international level.

KTH Royal Institute of Technology



Since its founding in 1827, the KTH Royal Institute of Technology in Stockholm has grown to become one of Europe's leading technical and engineering universities, and a key centre of intellectual talent and innovation. It is Sweden's largest technical research and learning institution and home to students and researchers from around the world dedicated to advancing knowledge. KTH is working with the industry and society in the pursuit of sustainable solutions to some of humanity's greatest challenges: climate change, future energy supply, urbanisation and quality of life for the rapidly-growing elderly population. Basic and applied research are performed side-by-side at KTH, and interdisciplinary research is conducted in parallel with work in specific fields. This approach encourages versatile solutions and the innovative climate offered by the Institute creates many opportunities to realise great ideas. KTH is part of extensive international research collaborations with universities and colleges in Europe, the U.S., Australia, Asia, and Africa.



The Science for Peace and Security (SPS) Programme

The Science for Peace and Security (SPS) Programme is an established brand for NATO based on four pillars: science, partnership, security, and unconventional issues (hybrid threats). It has been contributing to the core goals of the Alliance for more than six decades. Today, the SPS Programme continues to be one of the largest and most important partnership programmes addressing 21st century security challenges, particularly cyber defence, counter-terrorism, CBRN defence, energy security and advanced technologies.

The NATO Science for Peace and Security (SPS) Programme enhances security-related civil science and technology to address emerging security challenges and their impacts on international security. It connects scientists, experts and officials from NATO and Partner countries to work together to address these challenges. The SPS Programme provides funding and expert advice for security-relevant activities in the form of Multi-Year Projects (MYP), Advanced Research Workshops (ARW), Advanced Training Courses (ATC), and Advanced Study Institutes (ASI). SPS activities are always demand-driven, modular, and designed to meet the requirements of the nation(s) and end user(s). The relevance of SPS activities in response to NATO Strategic Objectives and political priorities is reinforced also via special calls, which are issued on an ad hoc basis to draw the attention of the scientific community towards current topics of interest for Allies.

Every year, approximatively 2000 experts participate in SPS activities and help to build capacity in partner nations, and support NATO's goals.

More than 20 Nobel Laureates have been involved in the SPS Programme, a testament to the scientific excellence supported by the SPS Programme.

Young scientists are also actively supported through SPS activities, which contribute to broaden their professional network and scientific expertise.

The SPS Programme also has a high public diplomacy value for NATO, providing the Alliance with separate, non-military communication channels by bringing together experts from NATO and Partner countries, often in situations or regions where other forms of dialogue more directly focused on defence and security are difficult to establish. Accordingly, the Programme enables NATO to become actively involved in such regions, often serving as the first concrete link between NATO and a new Partner.

