Development of radiation sensors based on stacked RADFET technology (NEWRADSENS)
- project funded by FP7/People/Marie Curie actions -

NEWRADSENS project was a one year Marie Curie action that funded a one year fellowship (from September 2012 to August 2013, inclusive) of Prof. Ercan Yilmaz from Bolu University, Turkey at Tyndall National Institute, University College Cork, Ireland. Prof. Yilmaz has been working with the radiation dosimetry team at Tyndall on development of radiation dosimeters based on Radiation Sensing Field Effect Transistors (RADFETs).

Radiation dosimeters have found applications in a broad range of areas, such as space exploration, nuclear facilities, high energy physics laboratories, quality assurance of cancer radiation treatments, medical imaging, and monitoring of health and safety of personnel working close to radiation sources. Radiation dosimetry can often be extremely complicated and there are extensive research and development activities worldwide in this field, with significant scientific and commercial impacts.

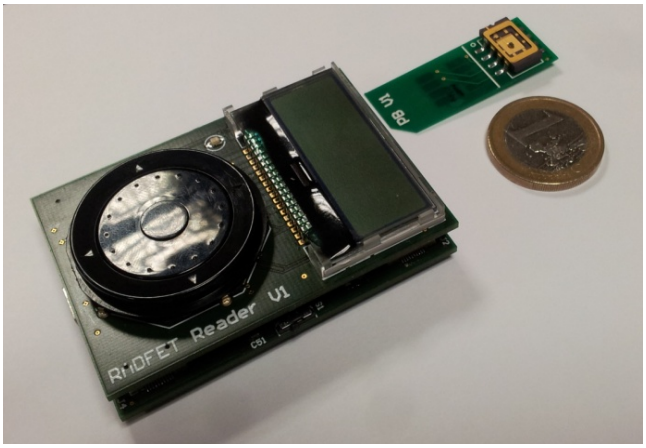
Tyndall is a world leader in research, development, and commercialisation of the RADFET dosimeter – specially designed discrete p-channel MOSFET optimised for radiation sensing. The general objective of the NEWRADSENS project was that Prof. Yilmaz help Tyndall team in an effort to improve the RADFET technology and in the process gain hands-on experience in design, fabrication, characterisation, and commercialisation of the RADFETs and other types of semiconductor dosimeters that he could apply at his university in Turkey, ideally through joint projects with Tyndall and other international partners.

The project general and particular objectives have been fully achieved, as follows:

- Research plan has been fully realised and even expanded with additional topics. Significantly improved standard RADFET, both in terms of fabrication yield and performance, has been fabricated. The first Tyndall RADFET reader has been designed and manufactured, representing a significant step from devices to systems. Foundations for the stacked RADFET development have been laid, with the first novel stacked RADFETs currently in production. Finally, originally planned research in the RADFET area was expanded with silicon photomultiplier/scintillator based detector research; young researcher from Prof. Yilmaz's group spent six months at Tyndall working on this topic under joint supervision.
- Prof. Yilmaz's theoretical expertise related to RADFETs has been systematised and reinforced. Regarding the practical aspects of RADFET R&D, Prof. Yilmaz received hands-on training in process/device simulation, device design, fabrication, electrical characterisation, and characterisation in radiation fields.
- Prof. Yilmaz has received training in technical and administrative aspects of Horizon 2020 programme through attendance at EU renown training courses organized at Tyndall. He has also received training in research commercialisation. In addition, he has been involved in practical activities related to early stage considerations regarding patenting of developed technologies and commercial negotiations regarding venture capital support.

- During the negotiation phase of NEWRADSENS, Prof. Yilmaz has got significant national funding to establish NURDAM centre for nuclear radiation research at his university, including the new fabrication laboratory. He co-ordinated establishment of NURDAM during the stay at Tyndall and received important advice from Tyndall experts regarding equipment and services infrastructure and consumables needed for the operation of the NURDAM centre.
- The project has included work with third parties on research and development of radiation dosimeters. These parties include European Space Agency, Granada University in Spain, University of Nis in Serbia, Irish start-up company SensL, and Irish venture capitalists Magellan Partners. Interactions with these partners have enhanced Prof. Yilmaz's experience in international co-operation and provided opportunities for future joint work of his Turkish team with the international players.

While the strongest emphasis in the project was placed on the benefits to the visiting Marie Curie fellow, it was essential that the host institution also had the clear positive outcomes from its participation in the project. This was indeed the case as complementary profiles of researchers involved and increased scientific and technical interactions between them and with third parties led to enhanced research/technical output and know-how of all participants in the project. It is expected that partnership established during NEWRADSENS will continue after project completion leading to long-term research co-operation and joint participation in the national and EU programmes in the future. Two joint project proposals between Bolu University and Tyndall have already been submitted to the Turkish national research funding agency (TUBITAK).



Prototype of RADFET reader developed during the NEWRADSENS project. The development of the reader demonstrates an important step from devices to systems in Tyndall RADFET research.

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