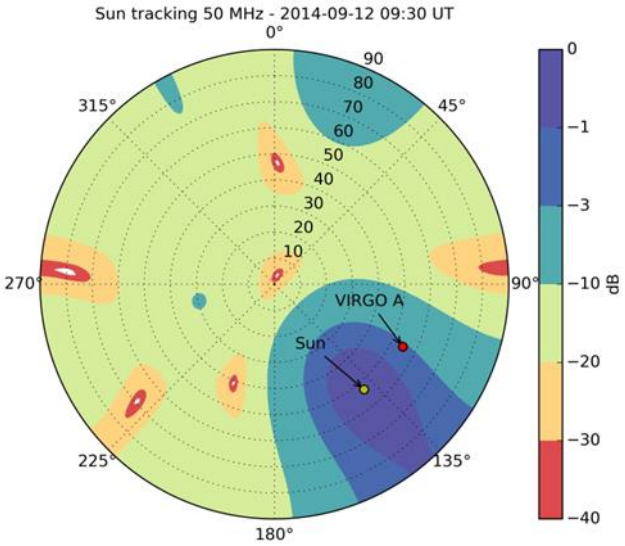
SPADE

A fully digital prototype of a phased-array radio solar spectrograph

DURATION
15/12/2014 - 31/12/2017

BUDGET
149.863 €

PROJECT DESCRIPTION



The study of the solar activity for scientific and operational purposes requires a nearly constant monitoring of the Sun to observe eruptive events. Satellite observations have given to scientists new insights on eruptive processes occurring in the solar atmosphere by opening up a new window of the electromagnetic spectrum from the EUV to the gamma rays. The most important eruptive events such as flares and coronal mass ejections can also be observed from the ground. With that respect, radio observations provide unique information on physical processes occurring during these events. In the lowest part of the radio spectrum observable from the ground (metric-decametric range), radio emissions of different kinds have been identified and linked to fundamental aspects of the eruption: particle acceleration, propagation of shock waves or magnetic field restructuring in the aftermath of the event.

Observation of these radio emissions is therefore of prime importance for the understanding of these eruptive phenomena. However, there is currently little coordination between the different radio observatories around the world, which hampers our ability to survey the activity of the Sun at low radio frequencies.

New international radio projects are multi purpose instruments, for which the Sun represents only a minor share of the observing time. There is therefore a need for new and dedicated solar radio monitoring instruments.
For all radio astronomy projects, interference issues and the growing use of the radio spectrum for civil and governmental activities represent a challenge. This is particularly true for solar observations, which are by essence broad band. New radio instruments should be designed to cope with this constantly evolving situation, and digital radio technologies are, today, the only way to provide enough flexibility.

SPADE the “Small Phased Array DEmonstrator” is an instrumental project aimed at developing a prototype of a low-cost, small solar interferometer and radio spectrometer that could be replicated in several places around the world, to form a network of identical instruments. This instrument will be entirely digital, relying on off-the-shelf Software Defined Radio receivers for performing the interferometric operations of the array (beam forming), calculating the spectrum, and dealing with interference issues. This project will address the different aspects of the prototyping: optimizing the instrument performances during the design phase for optimal science return, reviewing and evaluating the pre-selected hardware, developing a fully operational control software, based on open-source libraries, for the different components of the instrument operation (beam forming, spectrometry and handling of interferences), setting up of the prototype onsite (radio astronomy station of Humain, near Marche-en-Famenne), calibration and first light.

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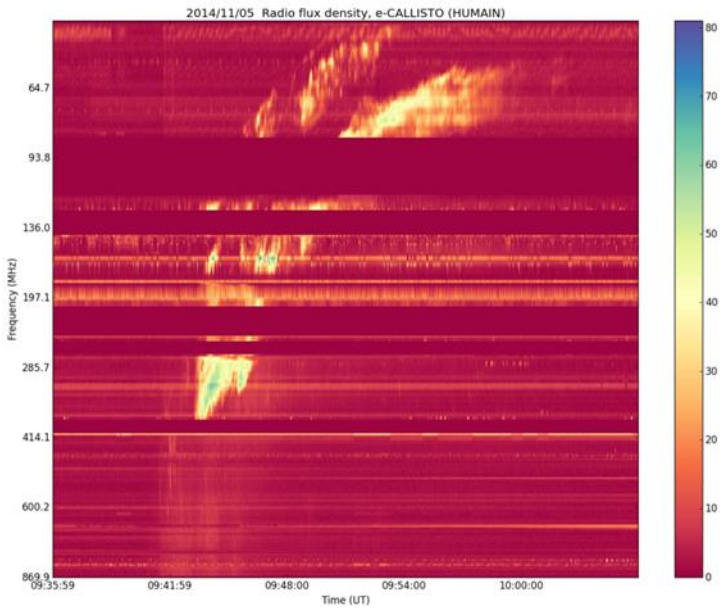
By designing an instrument that can, potentially, be replicated at reasonable cost around the world by institutional bodies (universities, observatories), this project can significantly improve our monitoring capabilities of the Sun in the radio domain, and therefore our basic understanding of solar eruptive events. It will not compete, in terms of performances with giant international projects being developed or commissioned but will complement them by providing regular solar observations suitable for science and operational activities.

This project will, in the end, be an open assessment of an instrument concept and prototype tested on field. All technical documents, software and data will be released on the project website. The main aspects of the project, together with the first light observations will be published in a peer-reviewed journal.



CONTACT INFORMATION

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LINKS

http://sidc.be/SPADE/