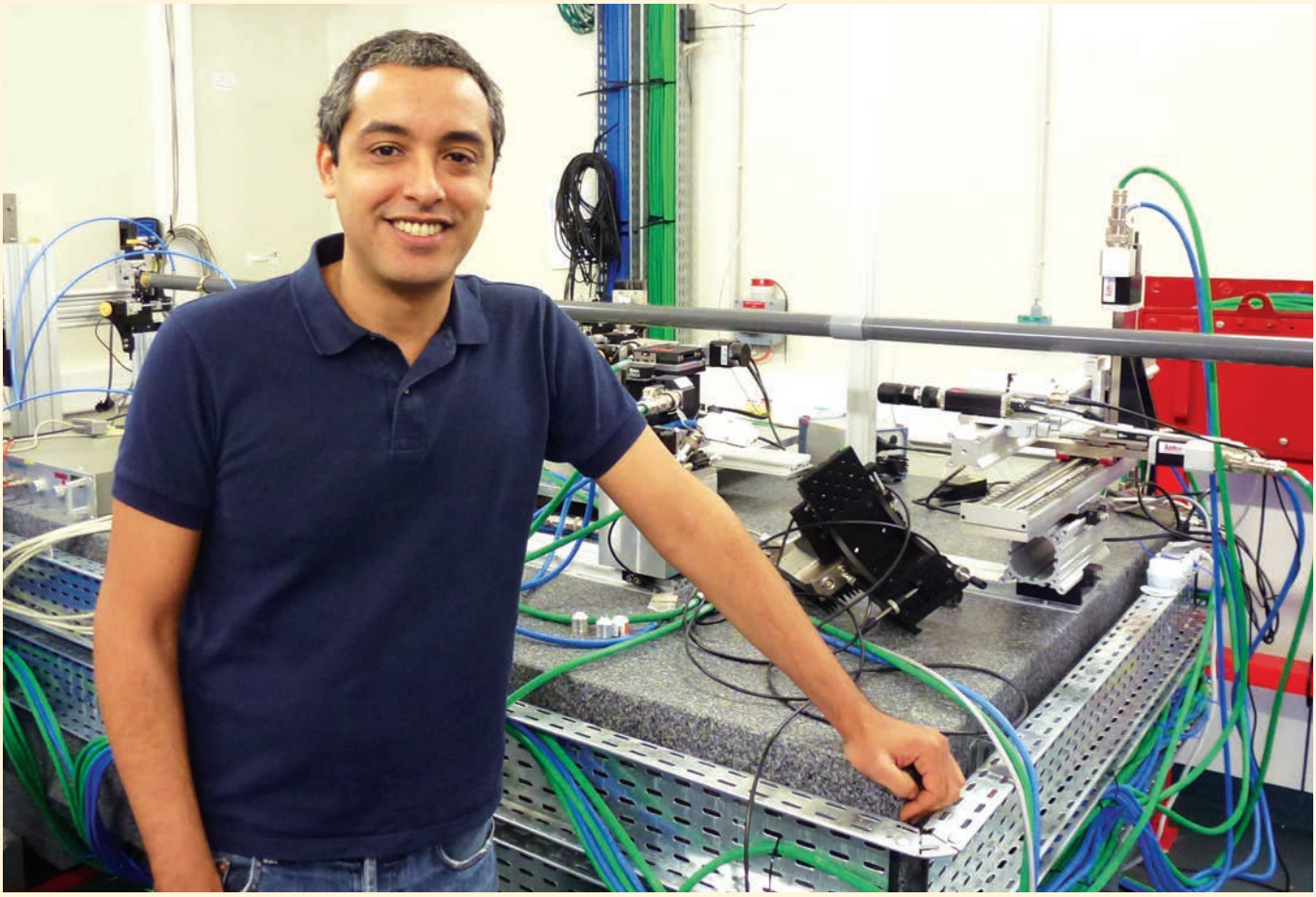
EXPERT PORTRAIT

Kadda MEDJOUBI,
scientist on the NANOSCOPIUM beamline



Recruited at SOLEIL in the Detectors Group in 2004, Kadda Medjoubi –with a PhD in Physics in the field of X-rays imaging- has been scientist on the long beamline NANOSCOPIUM since 20012. An always high-speed path for a scientist who succeeded in keeping the chilling of his thesis, going from challenge to challenge.

What is your training path?

I completed all my studies at the University of Paris XI Orsay. Meanwhile, I had the chance of doing all my internships on projects of the LHC linked with detectors for High Energy Physics. This is about the time when I discovered a strong interest in the physic of interaction of particles with matter, in detectors and their modelling. I actually dived into this field, partially, when I started my thesis with a small team of 4 people led by Georges Charpak, in the Biospace startup company (EOS imaging today). Partially because I discovered another exciting field: X-ray Imaging. The (reached) purposed of my thesis was to develop a medical imaging system (still on the market today) allowing acquiring radiographic images within limiting the X-ray dose absorbed by the patient.

How did you end up at SOLEIL?

When I completed my PhD, I went to Grenoble for a post-doctoral position at the Laue-Langevin Institute, where I especially worked on the development of a large neutron detector for bio-crystallography. It was my first experience in a user-open facility. I was offered a permanent position, but in parallel an opportunity showed up in the Detector Group at SOLEIL. I was quickly interested in the synchrotron world, because it was a way to come back to X-rays, and to X imaging.

What was your job for 8 years?

As a physicist member of the Detector Group, I worked essentially on two-dimensional detectors for hard X-rays, in tight collaboration with my colleagues from the beamlines. Thanks to my thesis experience on contrast and noise transfer theory on imaging systems, I have been able to develop and settle methods – unusual in the synchrotron world- allowing optimizing the functioning of a large number of two-dimensional detectors used on the beamlines. I was also deeply involved in the XPAD3 adventure (Rayon de SOLEIL n°21 p20), a 2D detector of counting photons. It was an exciting R&D project, raising a wealth of new possibilities, realized in partnership with teams from the Center of Particle Physics in Marseille, with which I am still tightly in touch today. My knowledge of analytical modelling of X radiation interactions, combined with my experience in instrumentation, allowed me to develop and explore with this kind of detector new experimental methods such as color imaging for the Laue Diffraction in collaboration with PROXIMA 1, PSICHE and METROLOGIE[1]. Thanks to this multiple skill, I have also been strongly involved in the FLYSCAN project (Rayon de SOLEIL 22, p.9) developed with the NANOSCOPIUM beamline and the Electronics and Acquisition control Groups at SOLEIL. The FLYSCAN project led me to multi-technique scanning X microscopy experiments. It was an extremely ambitious project, a big challenge for SOLEIL and an opportunity for me to return to imaging itself. For "pleasure" (in addition to the tasks linked to my position in the Detectors Group), I realized algorithmic developments and the image treatment for 2D/3D multi-techniques experiments we had developed. All the projects would not have been successful without the strong motivation of many colleagues from SOLEIL.

Speaking about it, why did you decide to join a beamline?

Since the beginning I kept the deep willing of working on X imaging. To keep a tight link with this subject, I taught at the Paris XI University (MASTER 2 APIM, Particle Accelerators and Interaction with matter) and I'm still teaching today at Paris V (Master 2 PMV, Medical Physics and Living).

When a position opened on the NANOSCOPIUM beamline- which is an extremely ambitious project, with cutting edge instrumentation and unexplored imaging methodologies- I saw a true challenge I wanted to address.

Are you satisfied with this choice?

Totally, and I come into my new scientific career on the NANSOCOPIUM beamline with a lot of enthusiasm. I am now in charge of an experimental station dedicated to fast scanning and highly spatial resolved multimodal X imaging. My research subject is partially methodological and focuses on algorithm and the reconstruction and coupling of different modalities such as phase imaging, absorption, dark field and fluorescence. In another hand, the strong coherent properties of the beam specific to NANOSCOPIUM allow me turning towards new imaging methods.

The combination of these techniques has opened a very exciting and brand new way for 2D/3D quantitative imaging. It is actually in this working frame I am supervising a thesis in multi-disciplinary collaboration with the Curie Institute. My work relies on an application of the methods for biological research. So much motivating challenges remaining!

The unique possibilities of the methods have first been exploited in a partnership with the *Institut de Physique du Globe de Paris* in the field of paleobiology. For the first time, information has been obtained on the metal concentration and morphology of stromatolites samples (successive layers of sedimented bacterial lawn) more than 2.7 billion of years old[2]. This work shows the role of arsenic in the metabolism of the bacteria, and makes it a good bio-marker of primitive life on Earth.

Scientific possibilities of a beamline like NANOSCOPIUM are incredible. It makes the work of beamline scientist really intense, but I definitely think this is when I appreciate it the most!

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References:
[1] **Medjoubi, K. et al.** Journal of Synchrotron Radiation, 19(3): 323 (2012).
[2] **Sforna, M. C. et al.** Nature Geoscience, 7 (11): 811. (2014).