2020 Nuclear Fusion Prize acceptance speech

It is a great honour and pleasure to receive the 2020 *Nuclear Fusion Award* for our article "*Results from recent detachment experiments in alternative divertor configurations on TCV*" and I would like to express my deep gratitude to IAEA, the *Nuclear Fusion* journal, and its Board of Editors for this important recognition.

This article is a splendid example of how successful teamwork can be and this recognition goes to a large number of contributors. It is an outcome of the first EUROfusion Medium-Sized Tokamak campaign at TCV, which has, and continues to be, now in an even broader setup, a highly successful framework for fostering close collaborations and knowledge exchange within Europe and beyond. There have been particularly strong contributions to this work from colleagues from the UK and I would like, in particular, to mention Bruce Lipschultz and James Harrison. Clearly, inter-institutional collaborations were easier before the pandemic, with unconstrainted travelling. For example, important progress on this work not only took place together in the TCV control room, but also in a gelateria in Rome during the PSI Conference 2016. At the same time, we have become considerably better with remote communication tools, which I hope will further boost collaborations in the future.

I would also like to acknowledge the important contributions from the other co-authors, in particular Holger Reimerdes, Benoit Labit, Basil Duval, Cedric Tsui, and Wouter Vijvers, and, very importantly, the entire TCV team that makes high quality research constantly possible. It is this team that makes TCV such a fantastic place to test new ideas within a relatively short time. Not only for alternative divertors, of course, but also for example for enhanced diagnostic capabilities or control techniques, or for exploring new concepts such as negative triangularity and even doublet plasmas. And the constant source of new, bright students, directly from the EPFL campus or elsewhere, is greatly inspirational every day. I feel this prize can really be seen as a general recognition to the research conducted at TCV. I would, therefore, like to express my gratitude again to the entire TCV team, and to the theory and industrial plasma physics groups at the Swiss Plasma Center at EPFL. The close collaboration between these groups are really one of the Center's strongest points. From TCV, I would like to particularly acknowledge three people who contribute enormously to its success. They are Ambrogio Fasoli, the director of the Center, Stefano Coda, our responsible for TCV operation, and Basil Duval, in charge of diagnostics and IT. What they do every day is really impressive! Finally, I would also like to thank my former colleagues at the MIT Plasma Science and Fusion Center. Many of the ideas discussed there have been an inspiration for the present work and I am really pleased to see that our collaboration continues across the Atlantic.

Moving to the content of the paper, assuring safe power exhaust clearly remains a key challenge on the way to fusion electricity. While there has been great ongoing progress with conventional divertors, clearly apparent at this year's IAEA Fusion Energy Conference and soon projected for ITER, alternative exhaust solutions are a very promising path for progress, not only in terms of improved power exhaust and divertor-core compatibility, but also as a tool to better understand the rich physics processes in the boundary plasma and their complex interplay. In our paper, we have shown proof of principle studies of some of the most promising geometrical divertor aspects thought to provide benefits. Some of the predicted benefits were observed in experiments, others not, but most importantly, we highlighted that there remains a lot we still need to learn. I think we have made substantial further progress on TCV since then, again thanks to the strong support and interest from

EUROFusion, and we have many further plans for the future on TCV. I am very pleased to note that improved exhaust solutions will, or continue to, be explored on many other devices, to name but a few, at DIII-D, EAST, the recently commissioned MAST-U device, HL-2M, and, in the not so distant future, on ASDEX-Upgrade with its new, alternative upper divertor, and hopefully soon in DTT and SPARC and, who knows, DEMO. Interest in this research continues to be very high experimentally. Furthermore, on the theory side, a lot of exciting progress is taking place, both with simplified models and increasingly extensive numerical simulations. In particular, recent progress with first-principle turbulence simulations is opening up exciting possibilities to better understand and predict effects of divertor geometry on the SOL and divertor plasma and on power and particle exhaust.

With this, I would like to, again, thank the *Nuclear Fusion* journal, also in the name of the co-authors, for this prestigious recognition.

ORCHID iDs
Christian Theiler https://orcid.org/0000-0003-3926-1374