

Statement for the election of CMS spokesperson: Roberto Carlin

CMS, one of the largest and most successful scientific experiments of all time, has produced an enormous wealth of physics results from proton-proton and heavy-ions collisions, highlighted by the discovery of the Higgs boson, the most important achievement of our field in many years. It continues to publish important results at the astonishing rate of 2.5 papers per week. The LHC has provided us with a Higgs and top factory, giving us access to processes with femtobarn cross sections. We have recently observed $H \rightarrow \tau\tau$, and we may soon see evidence of $H \rightarrow \mu\mu$. Moreover, boosted techniques are enabling BSM searches with inclusive $H \rightarrow bb$: an amazing achievement once considered impossible. CMS has an extensive set of BSM searches, including a robust program of searches for Dark Matter particles and mediators, complementary to those in non-accelerator experiments.

There are multiple reasons for this success: our Collaboration, following many years of design, construction, installation and commissioning, has deployed and continues to develop a superb detector with innovative trigger, readout, data acquisition and computing systems. It has provided excellent performance, and the flexibility to handle the demanding conditions of luminosity and pileup well above design values. The reconstruction and analysis software are effective and innovative, enabling us to exploit the talent, dedication and creativity of the Collaboration to execute the full range of physics analyses with expanding reach as the data volume increases and new techniques are brought to bear. Students and physicists, along with engineers, technicians and administrative personnel have been committed to operating all aspects of CMS efficiently, learning from the inevitable problems and continuously improving our ability to rapidly respond to challenges as they arise.

But there is much more ahead of us. We have collected at most 30% of the expected luminosity before the HL-LHC upgrade and less than 5% of what we will ultimately collect. We do not know what lies beyond the Standard Model - new discoveries may be brought to light through precision measurements or in unexpected remote corners of the vast, unexplored phase space accessible to us. We have the honour and duty to collect the data with the highest efficiency and quality, and to analyse it in full detail as we push the limits of physics.

Our challenge is to maintain, improve and operate the detector this run and to prepare for the next, while at the same time launching the Phase 2 upgrade with innovative and bold solutions in the long tradition of CMS, aiming for the best Phase 2 detector, ready and fully tested for the start of HL LHC operation.

The two-year mandate of the next Spokesperson will cover most of Long Shutdown 2 (LS2), where we will complete the Phase 1 upgrades (mostly in HB), likely replace the inner layer of the new pixel detector to fix recent issues, and proceed with Phase 2 detector and infrastructure work. We must also take full stock of the 13 TeV data to produce the most accurate analyses possible, and be fully ready for the 2021-2023 run. And the Phase 2 upgrades must rapidly proceed to prototyping and final design to stay on schedule, with thorough testing at each step to guarantee reliability.

The **Phase 2 Upgrade** presents a demanding challenge that can be met through the Collaboration's extensive experience in advanced R&D and large-scale construction. However, we will not rest on our laurels, but learn from the problems we have recently faced to address this newest set of challenges. CMS needs a strong Upgrade Coordination team that works with the Technical Coordination, the SP team, and the project and area coordinators to oversee progress, find synergies, organize CMS reviews, prepare for external reviews, and call for interventions as needed. A coordinated plan properly balanced among the needs of the different projects must be established as soon as possible to ensure convergence.

The TC team has a demanding role encompassing operations and upgrades, with upgrade activities already in full swing in LS2. CMS management should work with CERN and the Collaboration to strengthen the TC team and infrastructure.

We also face challenges in physics analysis, where we need to make high precision measurements with a detector exposed to increasing levels of radiation, and in maintaining support for operations. It will be critical to maintain the expertise needed to efficiently operate the detector and develop the tools to face even more demanding conditions. We can leverage the tradition of innovation that is at the heart of our community and profit from ongoing developments for the HL-LHC in object reconstruction, trigger algorithms, innovative computing, automation, new analysis themes and techniques. This synergy between near-term operations and upgrades can motivate the high level of interest needed to maintain and develop expertise and to guarantee long-term sustainability.

Meeting all of these challenges is possible for a Collaboration, even one as strong as CMS, only if we ensure that the diverse resources and talent we have around the world are fully engaged and committed. **Long-term planning**

is key for the **engagement of the entire CMS Collaboration**, and a focus on our remote and new institutions will enable them to play central roles, and promote and grow a new diverse cohort of present and future leaders.

Institutional commitments are a central element of this program, with a coherent set of tasks to be carried forward by an institution or cluster of institutions, providing continuity and sustainability and motivating the efforts in innovation and improved efficiency. This includes tasks in coordination areas that we sometimes struggle to fully support, even when they are highly visible and have proven to provide an upward career path for young physicists. We should guide groups who have recently joined or will soon join CMS, discussing proposed clusters and tasks that will enable them to participate fully and establish leadership roles.

Even with good planning, CMS will inevitably be confronted by **short-term needs and/or emergencies** resulting from unforeseeable conditions (the “8b4e” LHC beam structure in 2017, for example). Strong cross-coordination among the different areas and projects is important, and in many cases task forces composed of senior and younger members from the Collaboration can be created to add expertise and focus. This has proven to be very effective so long as there is direct and continuous contact with the coordinators and system managers involved.

Scientific publications are our final product. We are entering an era of longer luminosity-doubling times that will have a profound impact on our analysis, conference and publication strategies, requiring longer term planning and sustained vision. We must ensure that flagship analyses are well defined and supported by the Collaboration, while encouraging pursuit of novel investigations and innovation in analysis techniques to maximize our physics reach. And we must remain ready to respond to compelling new developments in theory or phenomenology. Discoveries may still be around the corner; we need to clarify our approach in case of unexpected signals.

Clear and transparent involvement of the Collaboration is needed for all of our activities. We should enhance the interest in the Weekly General Meeting, presently the most direct way that the SP has to communicate with the collaboration. We need to promote institute-level dissemination of the information, and ensure that discussions and decisions in the executive, management and collaboration meetings are fully reported throughout the collaboration. The goal should be better awareness not only of the decisions and plans for operations, upgrades, analysis and publication strategy, but also of the context and reasons behind the decisions. Continuous interaction with the CB chair and CB bodies is particularly important. Equally important is the bottom-up flow of information. The SP should consult regularly with the SP advisors, regional representative and CBIs, and hold regular meetings with the young members of the Collaboration.

The SP and Deputies have multiple roles. They serve as the interface to CERN, to external referee and review committees, and to the funding agencies. They coordinate the management of the experiment, guided by the strategic directions and policies set by the CB, making sure to provide adequate opportunity for discussions on the path to decisions. They must try to optimize and balance the efforts in all areas, while promoting creative new ideas, and they must maintain and promote CMS’ position of scientific leadership in our field as a central goal. Equally importantly, the SP team together with the CB and all the Project Managers and Coordinators must make sure that CMS will continue to provide a first-class, motivating and enjoyable research environment, offering our young members many opportunities to grow while actively promoting diversity in all areas.

To succeed in these roles, the SP must be able to analyse and understand a wide range of issues, continuously engaging expertise from across the Collaboration to devise effective solutions with adequate community input and support. Decisions must be taken deliberately, and rapidly where needed, often while handling multiple issues at once, balancing future and immediate needs, and striving to make the most of the physics opportunities at hand while promoting and advancing the younger members of the collaboration to positions of leadership.

I have many years of experience in the field, with several leading roles in Zeus at HERA and in CMS, where I moved 12 years ago. This experience, including my recent role as Deputy SP, has given me a clear and comprehensive view of our experiment and its path forward. My personal expertise and specific experience is well-suited to the known challenges of the next two years. I am convinced that I can serve effectively as Spokesperson of CMS, meeting the challenges of the coming term. If elected, I will serve CMS to the best of my ability, knowing full well that to succeed one needs a strong team, strong teamwork, and a strong focus on continuous engagement and support of the whole CMS Collaboration worldwide.

