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PRINCIPAL LHCC DELIBERATIONS

11TH MEETING OF THE TOTEM RESOURCES REVIEW BOARD

30 OCTOBER 2012

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GENERAL

This document summarizes the principal LHCC deliberations concerning TOTEM at the Committee's sessions in June and September 2012.

The LHCC congratulates TOTEM for their successful physics runs and for the experiment's physics results.

CONCERNS FROM THE PREVIOUS TOTEM RESOURCES REVIEW BOARD

No major concerns were reported to the previous TOTEM Resources Review Board.

TOTEM PHYSICS RESULTS

The LHCC was informed of the upcoming publication of three TOTEM papers reporting the final measurements of the elastic, inelastic and total cross-sections from the proton-proton data at 7 TeV centre-of-mass energy. The Committee was pleased to see the consistency of the three independent methods used to determine the total cross-section σ_{tot} , including the luminosity-independent procedure. TOTEM reported on the latest developments for 2012 proton-proton data-taking runs at 8 TeV centre-of-mass energy. All detectors are fully operational, the Roman Pot (RP) step movements have been improved and their cooling system is working successfully. In July 2012, data were taken in a dedicated $\beta^*=90$ m run, of which an uncorrected spectrum of the t-differential elastic cross-section between $t = 7 \times 10^{-3} \text{ GeV}^2$ and 1.4 GeV^2 was shown. During the same fill in July 2012, TOTEM and CMS also exchanged again trigger signals and collected common data-sets during low pile-up runs at $\beta^*=90$ m. Both experiments share a round-loop system of triggers including RP information which reaches CMS within the Level-1 latency thanks to a fast RP electrical trigger. Both collaborations are analysing independently the resulting data -- whose events are later synchronised offline using the orbit and bunch numbers - and have set up offline tools of common data access. Several scientific publications, covering topics such as $dN_{\text{ch}}/d\eta$ in the range $|\eta| < 6.5$, central exclusive production and hard diffraction are expected. TOTEM and CMS also shared triggers and took combined data (albeit only with the T2 Telescope) during the pPb pilot physics run in mid-September 2012. The Committee **congratulates** CMS and TOTEM for these positive developments, which took place before the planned common DAQ integration, and **endorses** the continuation of this joint physics programme during suitable low-luminosity proton-proton runs in 2012 as well as in pPb collisions in 2013 (for which some time for alignment of the RPs will be needed).

FUTURE PLANS FOR TOTEM OPERATION

In view of the successful CMS and TOTEM developments, the LHCC also **supports** the request to test RP insertions during normal (high-luminosity) physics runs before the end of the year in order to determine the maximum possible safe approach to the beam and the associated collimator settings. Such tests are of importance to study the feasibility of future (post-Long Shutdown 1 LS1) common measurements of hard diffractive and exclusive processes with CMS. TOTEM also informed the LHCC of the machine developments (MD) for the $\beta^*=1$ km optics in September 2012. Unfortunate beam dumps over the night previous to the end of the MD time prevented to fully optimise the

collimation settings. The Committee supports maintaining the eight-hour MD time already allocated in October 2012 to finalise the $\beta^*=1$ km collimator optimisation, and thus guarantee the successful physics measurements at very high β^* at 8 TeV centre-of-mass energy.

TOTEM has started preparations for consolidation work during LS1. Although all activities (work packages) are integrated in the CMS planning, the LHCC would like to see at the next meeting a detailed schedule for the TOTEM-only activities during LS1. The T1 Telescope will be moved to the surface, whereas the T2 Telescope will stay for some time on the CMS Hadronic Forward calorimeter platform. RP work during LS1 includes services of the motor drive and control system, cooling, and the anti-collision switch. The RPs at 147m will be completely removed and parts will be reused in new upgraded horizontal RPs at 220m. Such additional RPs at 220m can be equipped with ultrafast (sub-10ps range) timing and radiation-hard pixel detectors in order to measure physics processes with leading protons (high-mass exclusive pomeron- and gamma- induced processes) at high luminosities. The Committee invites TOTEM to present a more complete overview of the scope of this programme (in possible combination with CMS) at the next LHCC meeting, including the presentation of the physics case, ongoing R&D efforts, and expected performances (proton momentum resolution, vertex separation under high pile-up conditions, ...).

The LHCC took notice of two other important issues impacting the post-LS1 running. First, water-cooled cables for QP quadrupole magnets need to be laid-down during LS1 in order to be able to carry-out the TOTEM baseline measurements at centre-of-mass energies exceeding 13 TeV with very high β^* (~ 2 km) optics: t -differential elastic scattering approaching $t=0$, Coulomb-nuclear interference region at very low t , and the ρ parameter. These cables should soon be available, but there is no plan for installation, for neither TOTEM nor the ATLAS ALFA detector. The Committee **supports** scheduling the installation of such cables during LS1. Second, the LHCC was informed that the TCL-5 collimator will need to be opened for ATLAS Forward Physics to run after LS1, forcing the installation of a new TCL-6 collimator. Whereas such a collimator change does not impact TOTEM running in LS2, it will prevent CMS upgrade plans to install a test Hamburg moving pipe at 220 m from the interaction point for future measurements with leading protons at high luminosity (ultimately, exclusive Higgs measurement will require a moving beampipe at 420 m from the interaction point). The Committee invites TOTEM and CMS to continue discussing (and possibly converge with) their upgrade programmes regarding such measurements. Discussions between the two Collaborations are underway and are advancing well.