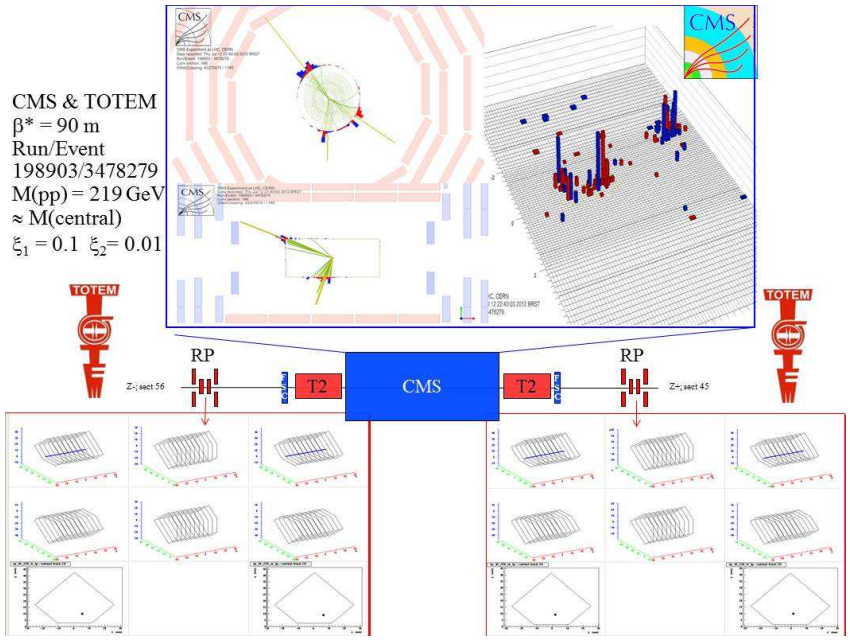
LHC Forward Physics Working Group

Christophe Royon
University of Kansas, Lawrence, USA

HESZ Workshop, Nagoya, Japan, 26-29 September 2017



The LHC Forward Physics WG

- Welcome to HESZ Workshop in Nagoya, one of the workshops related to the LHC Forward Physics WG: Coordinate and discuss activities in the domain of forward physics at the LHC, as part of the LPCC (LHC Physics Centre at CERN), interactions with the theory community
- Coordinators: Paul Newman, Ralf Ulrich, Christophe Royon
- Interact with LPCC coordinator (Michelangelo Mangano), LHCC and experiments (ATLAS, CMS, LHCb, ALICE, LHCf, TOTEM) to define the special run programme, forward detectors (including roman pots to detect intact protons), data taking at high luminosity...
- Define the medium and long term activities in the domain of forward physics: High lumi LHC, future FCC collider project
- Relation with cosmic-ray physics
- Three to four meetings per year: next meeting at CERN (December 7 and 8) and then in Madrid (March 20 to 23)
- For more information and register to the mailing list: see https://lpcc.web.cern.ch/lhc-wg-forward-physics-and-diffraction

Physics Program: Yellow Report

LHC Forward Physics

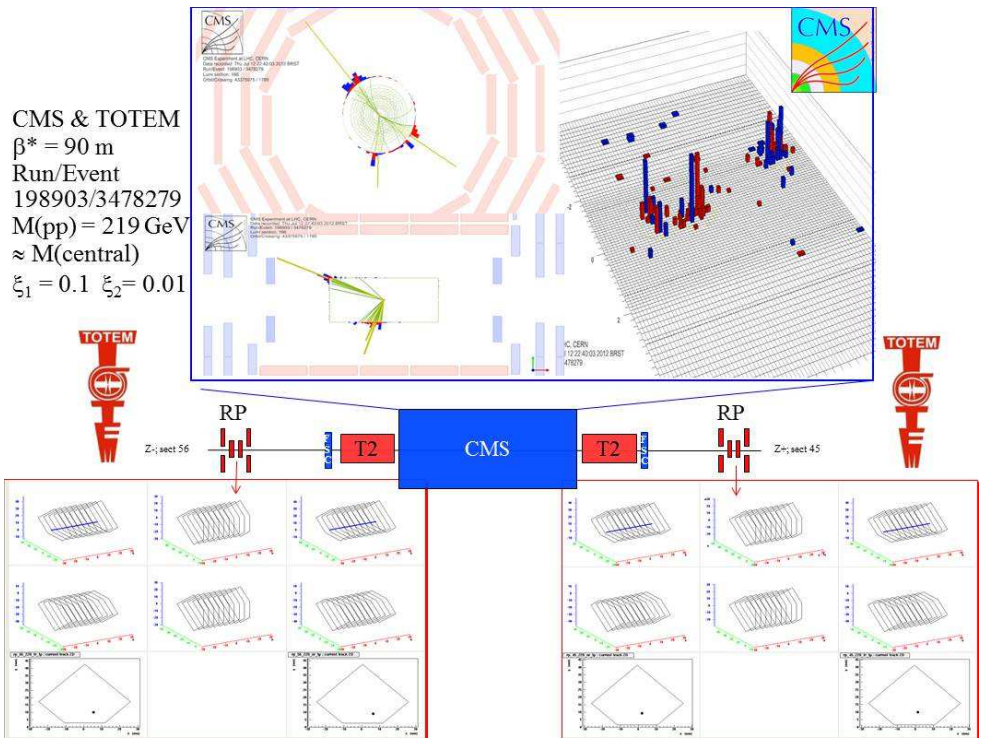
Editors: N. Cartiglia, C. Royon
The LHC Forward Physics Working Group

K. Akiba[21], M. Akbiyik[1], M. Albrow[2], M. Arneodo[3,4], V. Avati[5,6], J. Baechler[6], O. Villalobos Baillie[87], P. Bartalini[7], J. Bartels[8], S. Baur[1], C. Baus[1], W. Beaumont[9], U. Behrens[10], D. Berge[11], M. Berretti[6,12], E. Bossini[12], R. Boussarie[13], S. Brodsky[14], M. Broz[15], M. Bruschi[16], P. Bussey[17], W. Byczynski[81], J. C. Cabanillas Noris[18], E. Calvo Villar[19], A. Campbell[10], F. Caporale[22], W. Carvalho[21], G. Chachamis[22],

- The LHC Forward Physics "Yellow Report" is now published: K Akiba et al 2016 J. Phys. G: Nucl. Part. Phys. 43 110201
- See: http://iopscience.iop.org/0954-3899/43/11/110201/media for full text
  - Background and run plans: V. Avati, C. Royon
  - Monte Carlo: L. Harland-Lang
  - Soft Diffraction: V. Avati, T. Martin
  - Hard Diffraction: M. Ruspa, M. Trzebinski
  - Central Exclusive Production: M. Saimpert, L. Harland-Lang, V. Khoze
  - BFKL and saturation: C. Marquet, J. Bartels, H. Jung
  - Cosmic ray: T. Pierog
  - Heavy ions: D. Tapia Takaki
  - Detectors: J. Baechler, V. Avati

A few general remarks about Forward Physics

- Forward Physics adresses QCD dynamics at the interface between hard and soft physics
  - Example I: Total pp cross section probes long transverse distances
  - Example II: BFKL (Balitsky Fadin Kuraev Lipatov) Pomeron is valid at short distances
  - Transition: hard diffraction, structure of Pomeron
- Allows in addition searching for physics beyond the standard model
- Important for understanding underlying events, soft QCD: MC tuning, almost all MC designed for hard processes and new physics have difficulties with incorporating diffraction, and need improvement. Measurements of diffraction (rapidity gaps) are vital for testing MC



LHC running conditions vs experiments

- Low luminosity runs
  - No pile up ($\mu << 1$) (very low luminosity) - dedicated to LHCf measurements (together will all other LHC experiments): data were taken, proton oxygen data would be of high interest
  - No pile up high β^*, ALFA and TOTEM, dedicated to total cross section measurements
- Medium luminosity runs
  - LHCb runs with little pile up, a few fb^{-1} accumulated
  - Alice, ATLAS, CMS runs at low pile up, rapidity gap measurements
  - CMS-TOTEM and ALFA/AFP special runs at medium β^*, $\mu \sim$2–3, a couple of weeks needed to accumulate 50 to 100 pb^{-1}
  - AFP and CMS/TOTEM running at low β^*, low pile up: not such a good acceptance at low mass, needs beam defocussing
- High pile up ($\mu =$20,...,100) (high luminosity) with proton tagging; Possibility to collect data with high pile up (50 and above), sensitivity to beyond standard model physics (anomalous coupling studies...)

Running conditions: proton tagging

- Possibility to tag intact protons in the final state in CMS-TOTEM/CT-PPS and in ATLAS/ALFA and AFP
- High and low β^* runnings: complementarity in kinematical domain, see ξ versus t plots
- High β^* (90 m for instance): good acceptance for all ξ values for $t > 2.10^{-2}$ GeV^2, which means good acceptance for low diffractive masses where cross section is highest, and thus low values of accumulated luminosity enough
- Low β^* for standard high luminosity running: acceptance at high ξ ($\xi > 0.015$), which means high diffractive masses $M > 400$ GeV, low cross section and exploratory physics, high luminosity needed
- Many aspects discussed at this workshop