R-F. HADRON PHYSICS AT CERN SPS AND LHC

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CERN-ALICE experiment. — We took part in the data analysis of the HMPID subdetector, as well as in the research and development of the DAQ system for the planned VHMPID detector. Beside these activities, we also participated in the operation of the ALICE GRID Tier-2 site, and performed detector control tasks. Our most important result was the theoretical and experimental analysis of the pseudorapidity density and nuclear modification factors in $\sqrt{s}$ = 5 TeV center-of-mass energy p-Pb collisions. Our model predictions, published at the beginning of the year, are in good agreement with the results of these first measurements.

CERN-CMS experiment, hadron physics. — We have determined the inelastic p-p cross section with a simple event counting method at $\sqrt{s}$ = 7 TeV, and have contributed to a combined cross section paper, together with a pile-up counting analysis. We have measured the spectra of identified charged hadrons in p-p collisions at $\sqrt{s}$ = 0.9, 2.76, and 7 TeV. Charged pions, kaons, and protons in the transverse-momentum (p_T) range 0.1-1.7 GeV/c were identified via their energy loss in the silicon tracker. The average $p_T$increases rapidly with the mass of the hadron and the event charged-particle multiplicity, independently of the center-of-mass energy. We have presented both results at the DIS2012 conference.

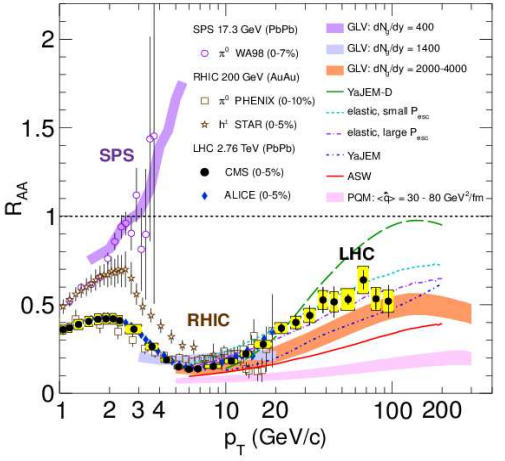

Fig 1. CMS: The nuclear modification factor R_{AA} in central heavy-ion collisions for neutral and charged hadrons, at several center-of-mass energies.

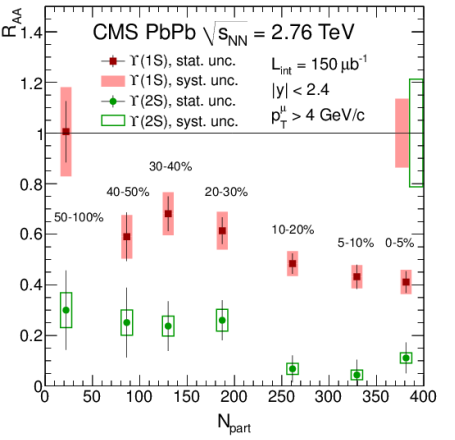

Fig 2. CMS: The nuclear modification factor R_{AA} for upsilon states as a function of the centrality of the heavy-ion collision.

We have participated in the measurement of the relative and absolute suppression of Y states in Pb-Pb collisions. We see the expected sequential melting of quarkonium states. We have

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performed a study of Z boson production in Pb-Pb collisions with a high statistics data set, obtained in 2011. The measurements compared to NLO calculations show that the production of Z bosons is not modified by the strongly interacting matter produced in heavy-ion collisions. We also have participated in the measurement of the nuclear modification factor of charged particles in Pb-Pb collisions, using the data set mentioned above. The results were presented at the HP2012 conference. We took part in the analysis of jet-track correlations by evaluating the performance of tracking and the related uncertainties of the final results. We have developed the trigger menu used to record the first p-Pb collisions, and also contributed to the measurement of two-particle correlations by developing the event selection and performing various cross-checks.

CERN-NA61 experiment. — We have measured the spectra of charged pions and kaons in minimum bias p-C collisions at 31 GeV/c beam momentum. These data have been used as reference data to for a precise calculation of neutrino fluxes produced at the T2K neutrino beam experiment. We have also recorded a large statistics minimum bias p-Pb data set at 158 GeV/c beam momentum, a unique reference for comparisons with heavy-ion collisions. For event centrality determination in these collisions a new detector, the Low Momentum Particle Detector, was developed in the framework of the REGARD group, in close collaboration with us. We have significantly upgraded the DAQ system of the experiment, making it possible to record data with sufficient speed and quality. Furthermore, we also started to develop a new offline software system, for fast data reconstruction and analysis.

Independent works. — We have studied the estimation of energy loss rate (*dE/dx*) for charged particles in tracking detectors. The truncated mean method was generalized to the weighted mean of the measurements. The optimized weights are rather independent of particle momentum and track segment length, and their values are given by a simple universal description as a function of the number of measured track segments. We have approximated the energy loss distribution of charged particles in silicon by a simple analytical parametrization. With the help of energy deposits in sensing elements of the detector, the position of track segments and the corresponding deposited energies were estimated with improved accuracy and less bias. The parametrization was successfully used to estimate the energy loss rate of charged particles, and applied to detector gain calibration tasks.

GRANTS AND INTERNATIONAL COOPERATION

OTKA K 81614	New analysis methods and tests of quantum chromodynamics at the LHC (F. Siklér, 2010-2014)
OTKA NK 81447	Hungary in the CMS experiment of the Large Hadron Collider (D. Horváth, 2010-2013)
OTKA K 68506	Experimental and model study of high momentum transfer phenomena at pp, pA and AA reactions (Z. Fodor; 2007-2012)
CERN-NA49	D. Barna, Z. Fodor, A. László, G. Pálla, F. Siklér, Gy. Vesztergombi
CERN-NA61	L. Boldizsár, Z. Fodor, A. László, G. Pálla, Gy. Vesztergombi
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GSI-FOPI Z. Fodor, J. Kecskeméti, Z. Seres Swiss National Science Foundation (SNSF) SCOPES 128079, First years of data taking with the CMS experiment at the LHC; Dissertori G; 2009-2012

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♦ Highlighted publication, where the contribution of our group was decisive.

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