Zero Degree Calorimeters for Beam Optimization and Physics Measurement

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The zero degree calorimeters (ZDCs) have been built to complement the existing CMS detector in the very forward region ($8.5 < \eta$). They are sampling calorimeters of tungsten plate/quartz fiber ribbon stack core. Detecting γ and neutral particles in the very forward region the ZDCs will be of use in beam monitoring, event selection and will enhance the physics capabilities of CMS.

Figure 1. *(a) CMS and ZDC acceptance [1]. (b) Photograph of one of the ZDC detectors during the test beam run. (c) Schematic illustration the ZDC.*

Experience at RHIC

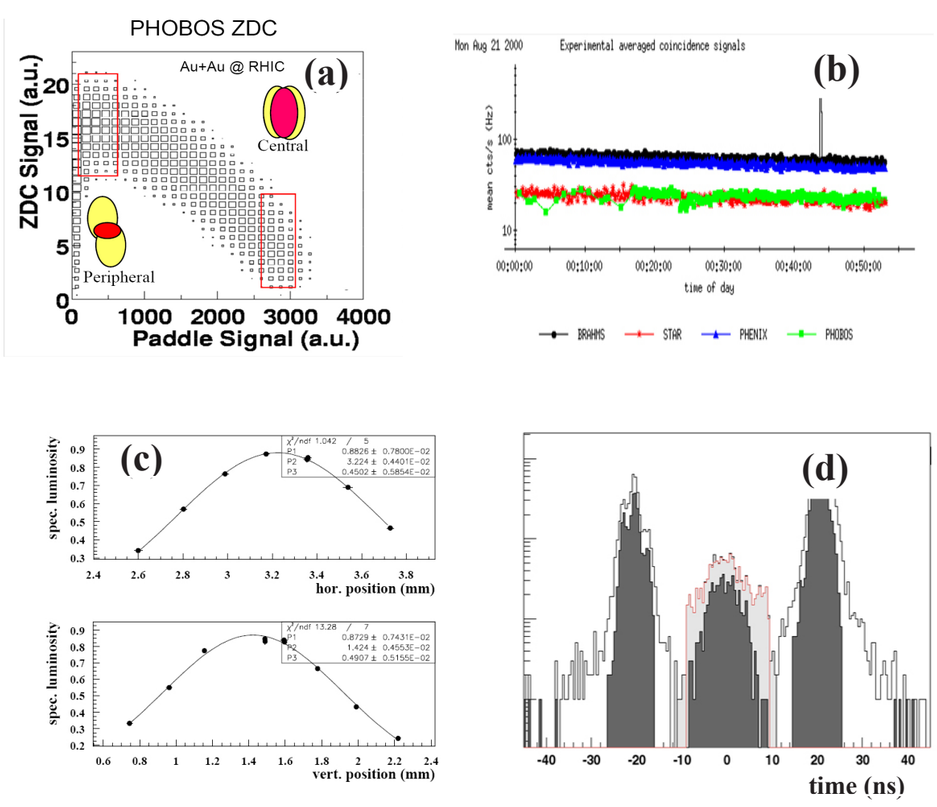

Figure 2. *(a) ZDC signal vs. centrality [2]. (b) Coincidence rate monitoring (c) ZDC coincidence rate vs. beam displacement [3](d) Time difference signal from beam-beam counters, light gray is the vertex cut generated with the ZDCs [2].*

SPS H2 Test Beam at CERN [3].

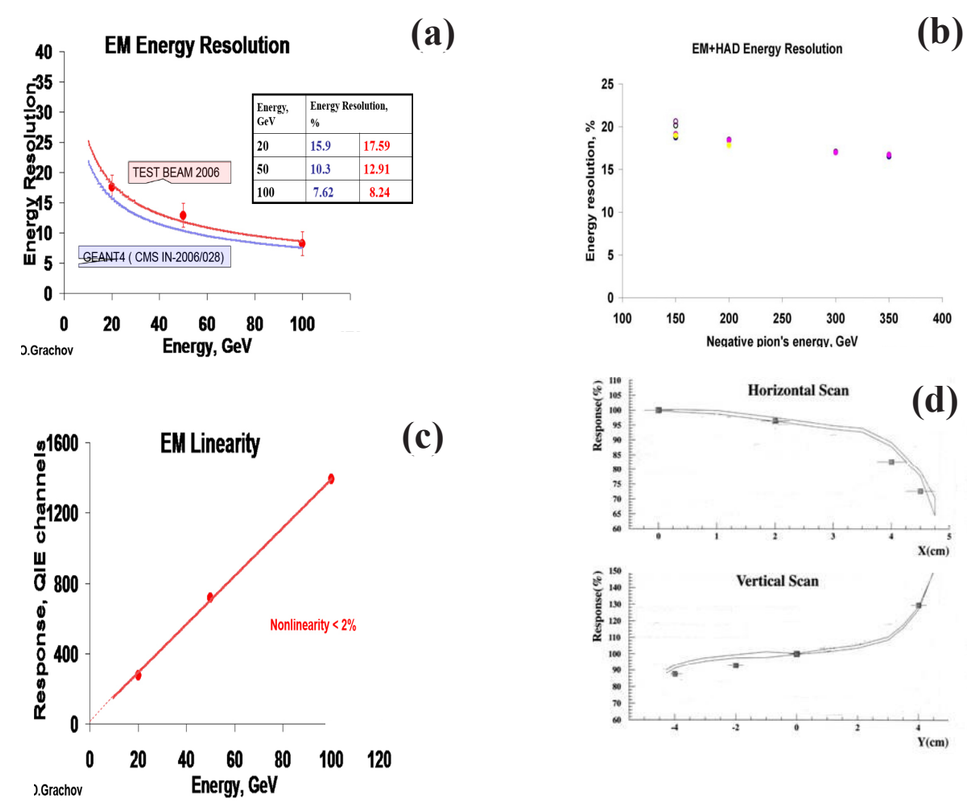

Figure 3. *(a) Resolution EM section. (b) Resolution EM+HAD section. (c) Linearity response (d) Relative resolution (EM+HAD) as function of transversal position [3].*

Physics Potential

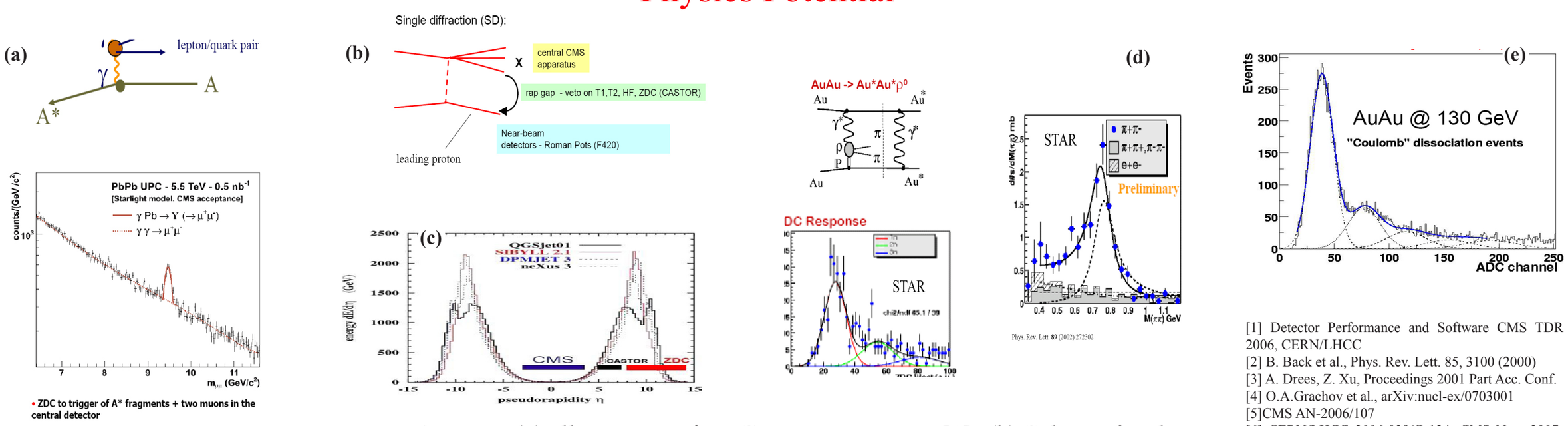

Figure 4. *(a) Illustration of UPC $\gamma\gamma$ measurement [4]. (b) Scheme for diffractive event detection at CMS. (c) Prediction of energy flow distribution for LHC pp [5] (e) Measurement of light quarks[6]. (e) Neutron distribution used to calculate absolute luminosity [7]*

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