

Exploring the high density matter at FAIR

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The goal of the heavy-ion collision program at FAIR is to explore the phase diagram of strongly interacting matter in the region of the highest baryon densities. The CBM research program addresses fundamental aspects of non-perturbative QCD including the equation-of-state of highly compressed baryonic matter, the predicted first-order de-confinement phase transition and its critical endpoint, the onset of chiral symmetry restoration at high baryon densities, and the in-medium properties of hadrons. The corresponding key observables comprise low-mass vector mesons decaying into lepton pairs which serve as penetrating probes, hidden and open charm produced at threshold beam energies, (multi-) strange particles, and global features like collective flow and event-by event fluctuations.

The experimental task is to identify both hadrons and leptons and to detect rare probes in a heavy-ion environment. The experimental challenge is to select rare events in nucleus-nucleus collisions with charged particle multiplicities of about 1000 per central event at reaction rates of up to 10 MHz. Such measurements require fast and radiation hard detectors, fast and self-triggered read-out electronics, a high-speed data acquisition system, and online event selection based on full track reconstruction. The layout of the CBM detector system and the results of feasibility studies will be presented.

More than 400 scientists from 50 institutions and 15 countries are participating in the realization of the CBM experiment which represents a major international effort in future heavy-ion physics.