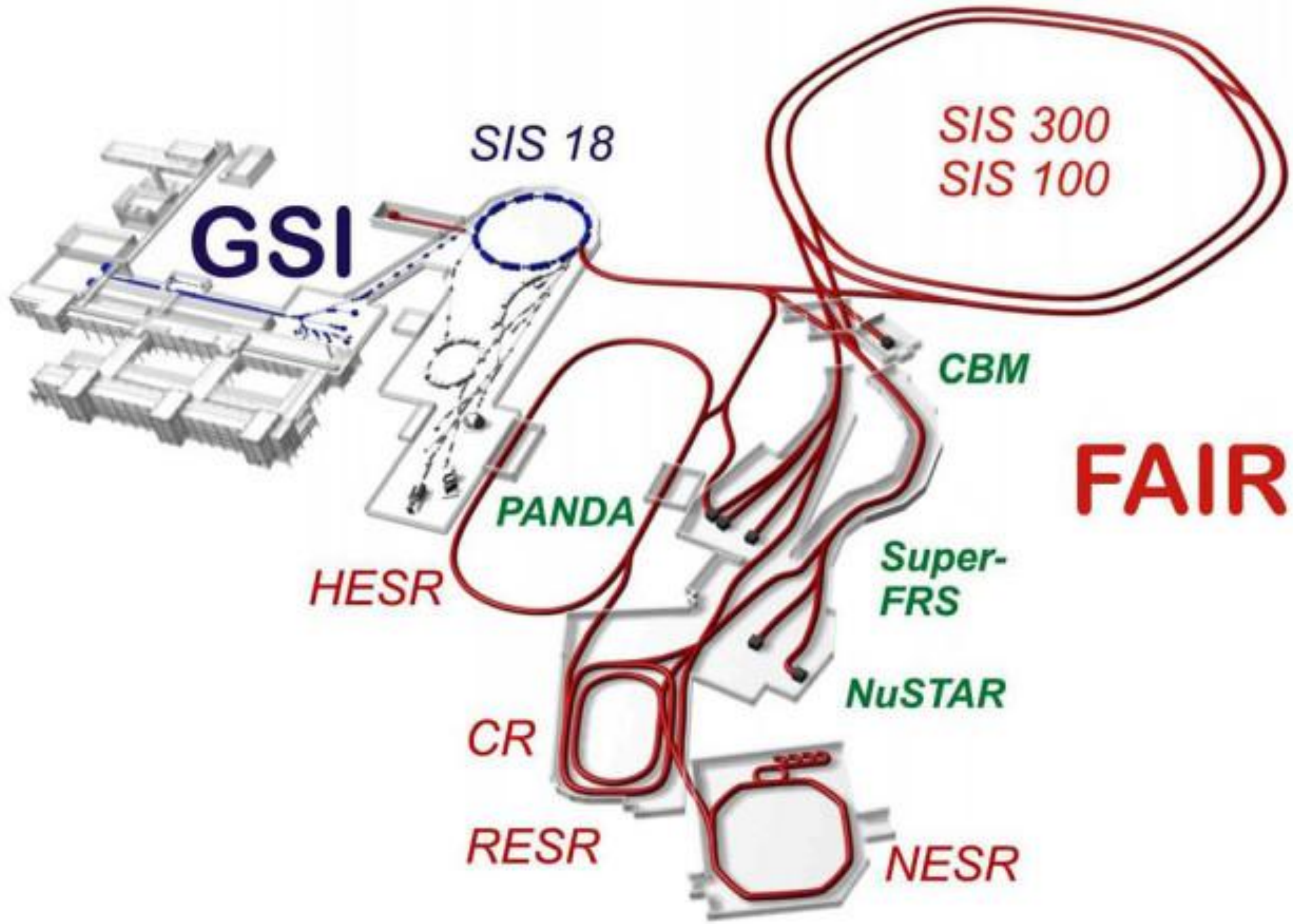
Основные подсистемы СВМ и их назначение

FAIR – сложный ускорительный комплекс, который будет предоставлять высокоэнергичные, прецизионно настроенные пучки антипротонов и ионов.

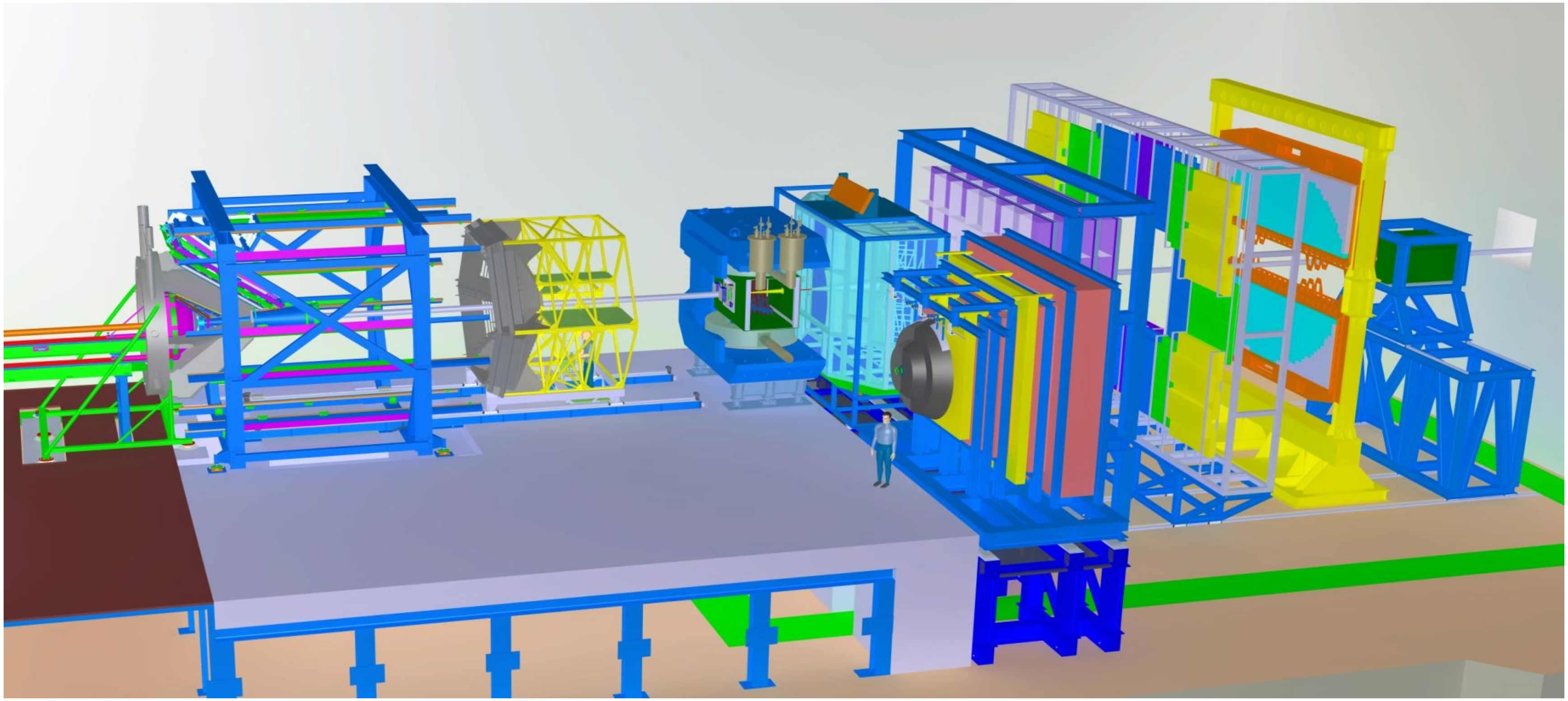


<u>CBM</u> –

изучение сверхплотной ядерной материи, создаваемой при энергии **SIS300** в центральных столкновениях тяжелых ионов (барионная плотность сравнима сп

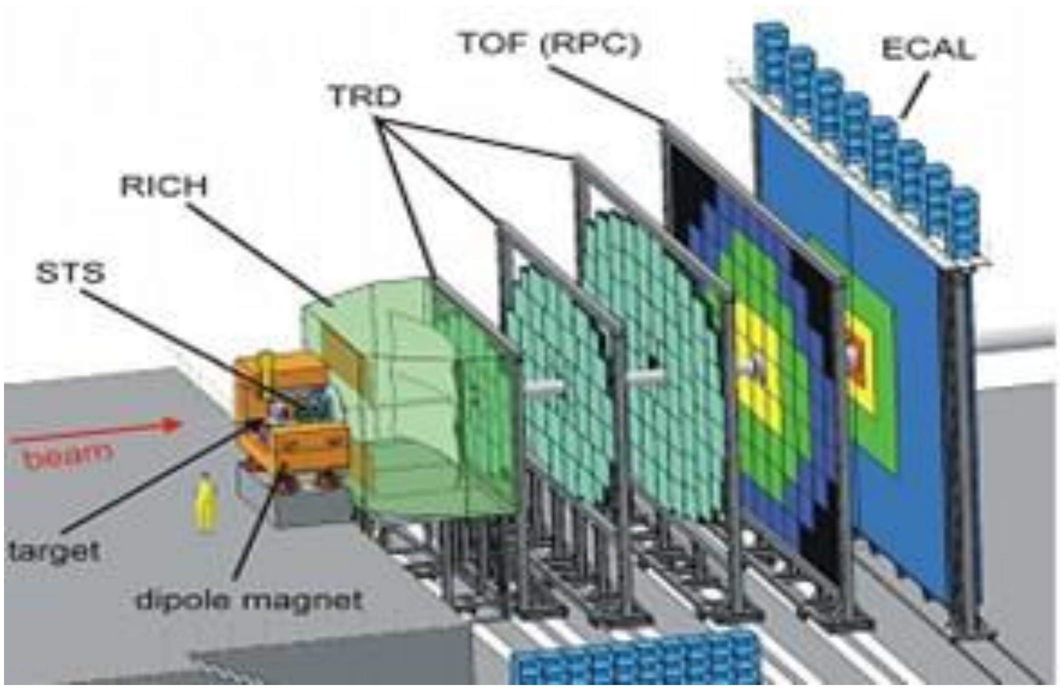
лотностью в сердцевине нейтронных звезд и в ~10 раз превосходит обычнуюяде

рную плотность).



TheCompressedBaryonicMatter(CBM) experiment

- TheCBM setup consists of :
- a large acceptance dipole magnet
- radiation-hard Silicon pixel/strip detectors for tracking and vertex determination (STS, MVD)
- a Ring Imaging Cherenkov detector (RICH) and TransitionRadiationDetectors(TRD) for electron identification
- ResistivePlateChambers (RPC) for time-of-flight measurement
- an Electromagnetic Calorimeter (ECAL) for photon identification
- a Projectile Spectator Detector (PSD) for centrality and reaction plane determination.


TOF (RPC)
ECAL
TRD
RICH
STS
beam
target
dipole magnet

- **Измерение импульсов и треков частиц** –**STS** (Silicon Tracking System) – 8 слоев двусторонних стриповых детекторов размещены в **сверхпроводящем дипольном магните** большой апертуры
- The Silicon Tracking System (STS) consists of low-mass silicon micro-strip detectors possibly complemented by one or two hybrid-pixel detector layers providing unambiguous space point measurements. The STS allows for track reconstruction in a wide momentum range from about 100 MeV up to more than 10 GeV with a momentum resolution of about 1%.
- They are located downstream of the target at distances between 30 and 100 cm in a magnetic dipole field of about 1 Tm bending power.
-

- **На стадии исследований процессов с открытым чармом** дополнительно к **STS** устанавливается микро вершинный детектор The Micro-Vertex Detector
  MVD (два слоя пиксельных детекторов,расположенных вб лизи мишени)
- The Micro-Vertex Detector (MVD) is needed to determine secondary vertices with high precision for D meson identification. The MVD consists of two layers of ultra-thin and highly-granulated Monolithic Active silicon Pixel Sensors (MAPS) which are located close to the target.

- The measurement of electrons will be performed with a Ring Imaging Cherenkov (RICH) detector (for momenta below 8–10 GeV/c) together with Transition Radiation Detectors (TRD) for electrons with momenta above 1.5 GeV/c.
- **Идентификация электронов** – реконструкция треков (**STS** и **TRD**),реконструкция колец в**RICH**, анализ энергетических потерь в **TRD**
- The RICH detector is designed to provide identification of electrons and suppression of pions in the momentum range below 8GeV/c.
- Three Transition Radiation Detector stations each consisting of 3–4 detector layers will serve for particle tracking and for the identification of electrons and positrons with p>1.5 GeV/c (γ>1,000).

- Muons will be measured with an active hadron absorber system consisting of iron layers and muon tracking chambers (MuCh). For muon measurements the MuCh will be moved to the position of the RICH.
- **MUCH** (Muon Chambers) –
  изучение мюонных мод распада.

- Charged hadron identification will be performed by a time-of-flight (TOF) measurement with a wall of RPCs located at a distance of 10 m behind the target.
- **Идентификация адронов** –
  реконструкция треков (**STS** и **TRD**) + **TOF** (стоп - **RPC**, старт –**алмазный пиксельный детектор**)
- An array of Resistive Plate Chambers will be used for hadron identification via TOF measurements.

- The PSD will be used to determine the collision centrality and the orientation of the reaction plane. A very precise characterization of the event class is of crucial importance for the analysis of event-by-event observables. The study of collective flow requires a well defined reaction plane which has to be determined by a method not involving particles participating in the collision. The detector is designed to measure the number of non-interacting nucleons from a projectile nucleus in nucleus-nucleus collisions. The PSD is a full compensating modular lead-scintillator calorimeter which provides very good and uniform energy resolution [14]. The calorimeter comprises 12×9 individual modules, each consisting of 60 lead/scintillator layers with a surface of 10×10 cm2. The scintillation light is read out via wavelength shifting (WLS) fibers by Multi-Avalanche Photo-Diodes (MAPD with an active area of 3×3 mm2 and a pixel density of 104/mm2).

The Electromagnetic CALorimeter (ECAL)

- Will be used to measure direct photon, neutral mesons ($\pi 0$, η) decaying into photons.
- The ECAL will be composed of modules which
- 872 2 The CBM detector concept
- consist of 140 layers of 1mm lead and 1mm scintillator

- High statistics measurements of rare probes require high reaction rates. The CBM detectors, the online event selection systems, and the data acquisition will be designed for event rates of 10 MHz, corresponding to a beam intensity of 109 ions/s and a 1% interaction target, for example. Therefore, measurements with event rates of 10 MHz require online event selection algorithms (and hardware) which reject the background events (which contain no signal) by a factor of 400 or more. The event selection system will be based on a fast on-line event reconstruction running on a PC farm equipped with many-core CPUs and graphics cards. Different many-core architectures developed by Intel, IBM, NVIDIA and AMD are under investigation. Track reconstruction, which is the most time consuming combinatorial stage of the event reconstruction,will be based on parallel track finding and fitting algorithms, implementing the Cellular Automaton and Kalman Filter methods. Novel languages, such as CUDA,
- 2.9 Online event selection and data acquisition 873
- Ct and OpenCL, can be used for parallel programming on the heterogeneous CPU/GPU on-line event selection system. Foropencharmproductionthetriggerwillbebasedonanonlinesearchfor secondary vertices which requires high speed tracking and event reconstruction in the STS and MVD. The highest suppression factor has to be achieved for J/ψ mesons where a high-energetic pair of electrons or muons is required in the TRD or in the MuCh. For low-mass electron pairs no online selection is possible due to the large number of rings/event in the RICH caused by the material budget of the STS. In the case of low-mass muon pairs some background rejection on the trigger level seems to be feasible.