Hypernuclei Production in CBM at FAIR: A Feasibility Study

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Hypernuclei production at CBM experiment:
- Single and double hypernuclei
- Precise measurements of hypernuclei lifetime
- Measurement of branching ratios of hypernuclei
- Direct access to the hyperon-nucleon (YN) interaction through measurements of $\Lambda^0$ in a hypernucleus
- "Hyperon puzzle" in the astrophysics: understanding of YN interaction is crucial for neutron star physics
- Search for strange matter (e.g., heavy multi-strange objects)

Advantages of CBM:
- Highest production cross section for hypernuclei at CBM
- Access to CBM energies (yet no experimental data)
- Complex topology of decays can be easily identified in CBM and helps suppressing the background thanks to precise tracking and particle finding algorithm
- Reliable identification of produced hypernuclei
- $\Lambda^0$-hypernuclei: high interaction rates, optimal collision energies and clean identification

Experimental challenges at CBM:
- CBM — future fixed-target, heavy-ion experiment at FAIR, Darmstadt, Germany.
- $10^7$—$10^8$ collisions per second.
- Up to 1000 charged particles/collision.
- Free streaming data.
- No hardware triggers (HLT only).
- On-line event reconstruction and selection is required in the first trigger level.

Conclusions
- CBM is perfectly suited for detection of hypernuclei thanks to PID precise and precise tracking.
- Algorithms developed for reconstruction hypernuclei with high efficiency and statistical significance.
- Observation of $\Lambda^0$-hypernuclei is possible given the optimal energy at $10^3$ interaction rate.
- Missing mass method: measurement of more hybrid nucleus decay channels → direct measurement of branching ratios + tools for the control over systematic errors.

Plans:
- Improve daughter particle PID using dE/dx method
- Add more decay channels
- Study systematic errors