# Performance for anisotropic flow measurements of the future CBM experiment at FAIR

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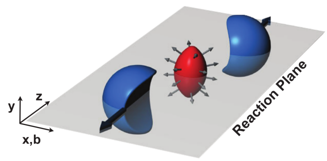
## Abstract

The Compressed Baryonic Matter experiment (CBM) at FAIR aims to study the area of the QCD phase diagram at high net baryon densities and moderate temperatures.
The CBM performance for anisotropic flow measurements is studied with Monte-Carlo simulations using gold ions at SIS-100 energies with lab momentum up to 12 AGeV/c employing different heavy-ion event generators. Various combinations of CBM detector subsystems are used to investigate the possible systematic biases in flow measurement and to study effects of detector azimuthal non-uniformity.

## Anisotropic flow

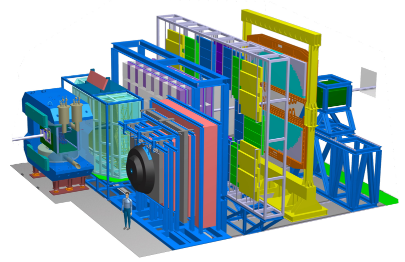
Anisotropic flow is quantified by $v_n$ coefficients in the Fourier decomposition of the particle's azimuthal distribution wrt. the reaction plane:

$$dN/d\phi \sim 1 + 2\sum_{n=1}^{\infty} v_n \cos[n(\phi - \Psi_n)]$$




$\Delta\phi$ - particle's azimuthal angle, $\Psi_n$ - collision symmetry plane. We study performance relative to spectator plane using CBM forward calorimeter PSD. The detector anisotropy in $\phi$ is corrected with Qn-Correction Framework [1, 2].

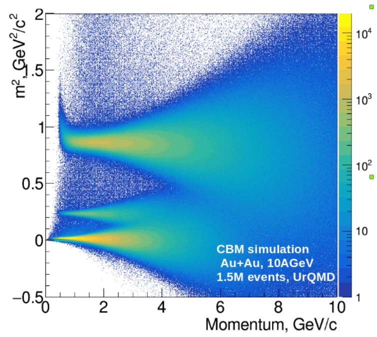
## CBM experiment and simulaton setup

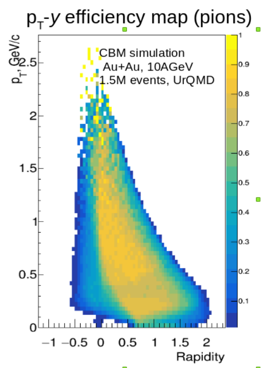


A sample of 5M Au+Au collisions with beam momentum of 10 AGeV simulated with UrQMD [3] event generator was used. Charge particles tracks are reconstructed in Silicon Tracking System (STS) and Micro-Vertex Detector (MVD). The Projectile Spectator Detector (PSD) modules were grouped for analysis into PSD1, PSD2 and PSD3 starting from most central part.

## Particle identification

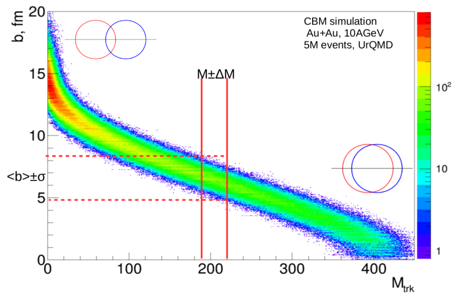
For results in this poster MC-true PID was used.



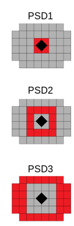

## Centrality selection

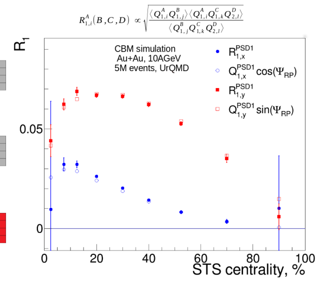
Centrality determination is performed following the procedure described in Ref. [4]. Impact parameter resolution with STS estimated to be 5-7%.



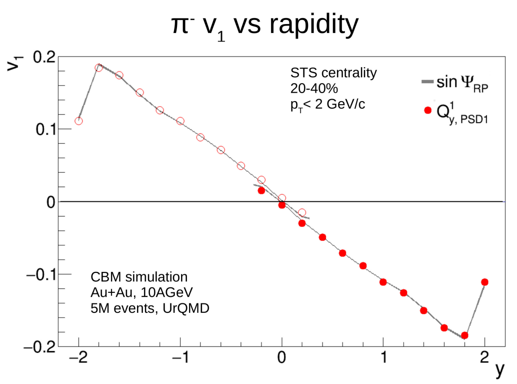

## Resolution correction

Second harmonic in equation for resolution allows to reduce non-flow correlations (e. g. contribution due to total momentum conservation) and reproduce MC-true resolution. PSD hole size was simulated to be equal 20 cm.

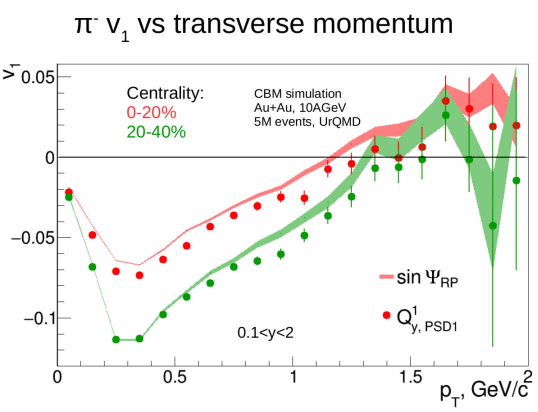



## Results




Directed flow for negatively charged pions with the event plane estimates from PSD is shown. Results are in agreement with that calculated using MC-true reaction plane angle.




## Summary

Directed flow as a function of rapidity and transverse momentum was calculated for different centrality classes. $p_T$-dependent acceptance and efficiency correction was applied to the extracted value of $v_1$. In future we plan to use TOF for particle identification and study flow coefficients for other harmonics and different particles (protons, kaons).

## References

[1] I. Selyuzhenkov and S. Voloshin, Phys. Rev. C **77**, 034904 (2008)
[2] V. Gonzalez, J. Onderwaater, and I. Selyuzhenkov, Detector non-uniformity corrections for collision symmetry plane estimates, GSI Scientific Report 2015
[3] M. Bleicher et al., J.Phys. G25, 1859 (1999).
[4] V. Klochkov *et al.* [CBM Collaboration], J. Phys. Conf. Ser. **798**, no. 1, 012059 (2017).