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Systematics of yields of strange hadrons produced in heavy-ion collisions at a few AGeV

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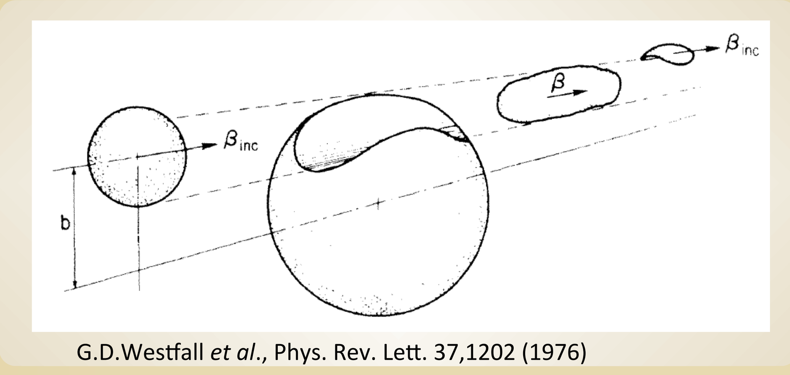
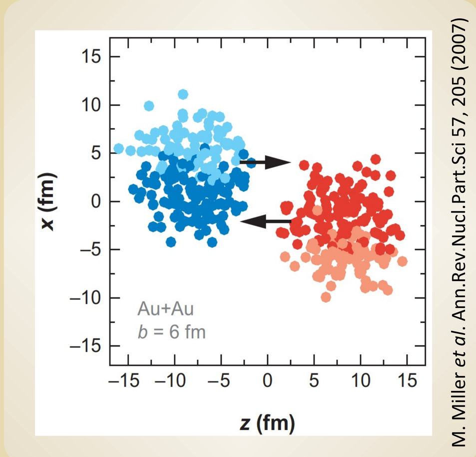
Since first measurement of strange hadrons from HI collisions (1981), about 100 yields of K^+, K^-, K^0_s, ϕ, $\Lambda+\Sigma^0$ were found at different energies around thresholds in NN collision, and different centralities.



G.D.Westfall *et al.*, Phys. Rev. Lett. 37,1202 (1976)

However, authors used different models to determine the mean No. of participants, $\langle A_{part}\rangle_b$:

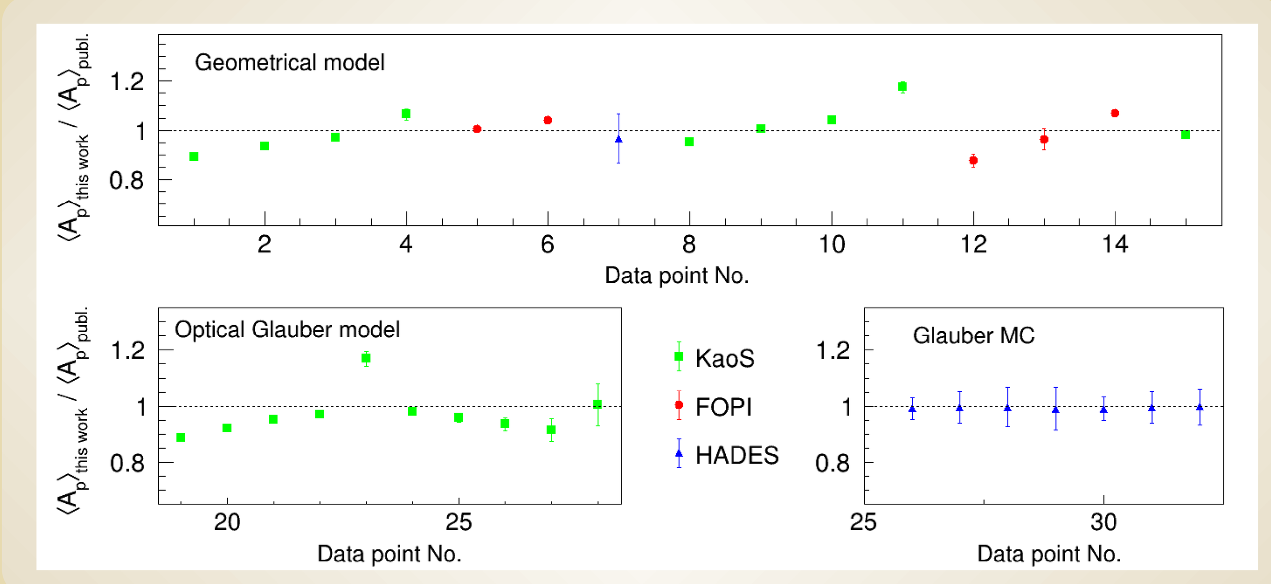
- for 45% of yields the Geometrical model was used
- for 20% the Optical Glauber model
- for 35% the Glauber Monte Carlo (MC).



M. Miller et al. Ann.Rev.Nucl.Part.Sci 57, 205 (2007)

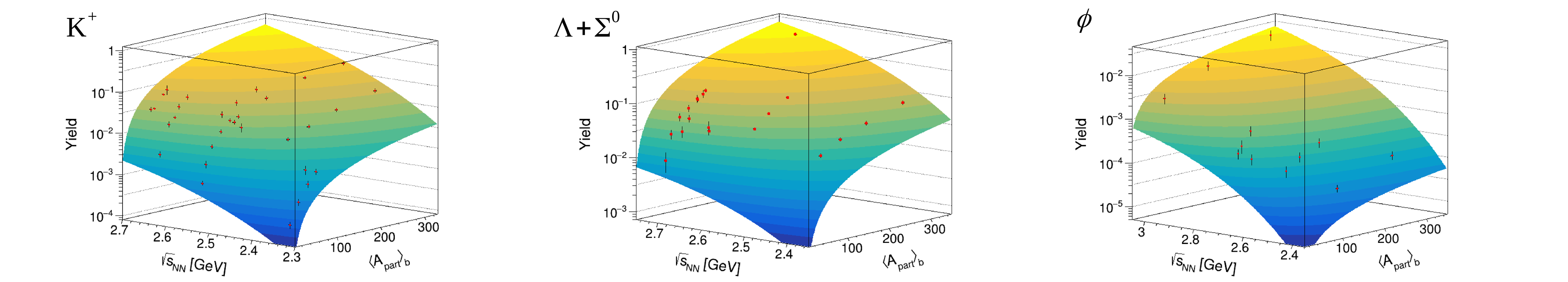
To have a common method of extraction of $\langle A_{part}\rangle_b$ we made the Glauber MC calculations to all the data, using TGlauberMC.

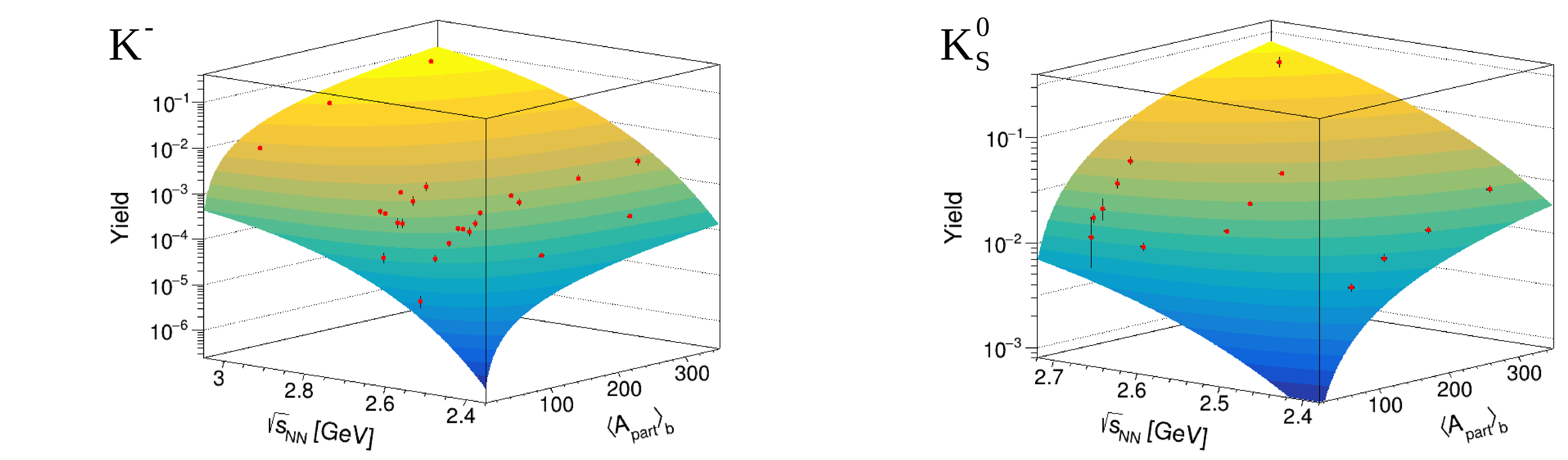
E.g. for K^+ data the range of corrections wrt $\langle A_{part}\rangle_b$ published originally, reaches ~ 20% for geometrical model, and ~ 10% for Optical Glauber. For $\langle A_{part}\rangle_b$ originally found by MC Glauber, our calculations are in agreement.



In search for a formula that parameterizes the yields as function of available energy $\sqrt{s_{NN}}$ and $\langle A_{part}\rangle_b$ with best χ^2/ν at a limited No. of parameters, we found this function:

$$P = N \cdot \langle A_{part}\rangle^{\alpha} \cdot \exp\left[-\left(C \cdot \sqrt{s}\right)^{\beta}\right]$$





Paper with procedure ⊕ v1 of systematics:

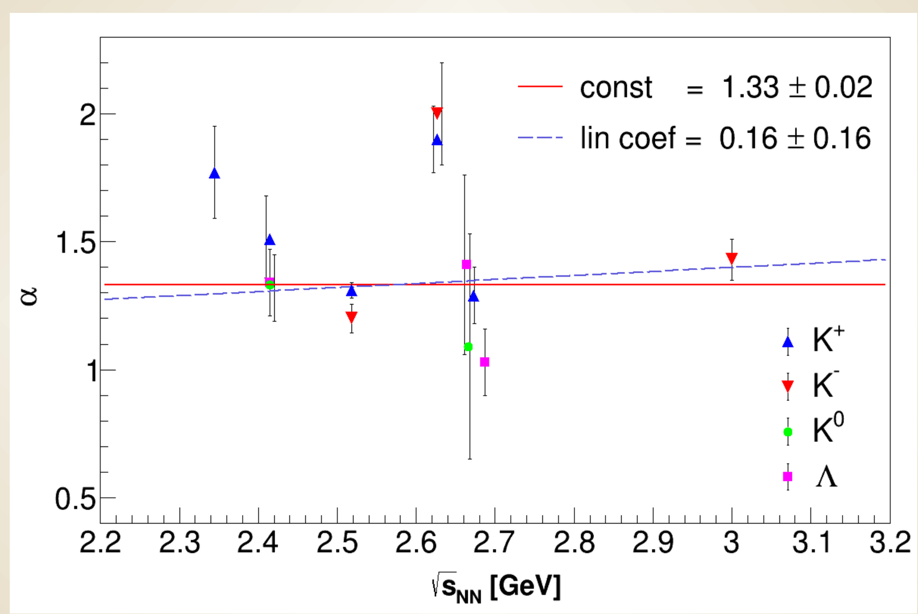
KP, PP, EPJA 59, 272 (2023)

Database of yields and results

t.ly/YGzT4

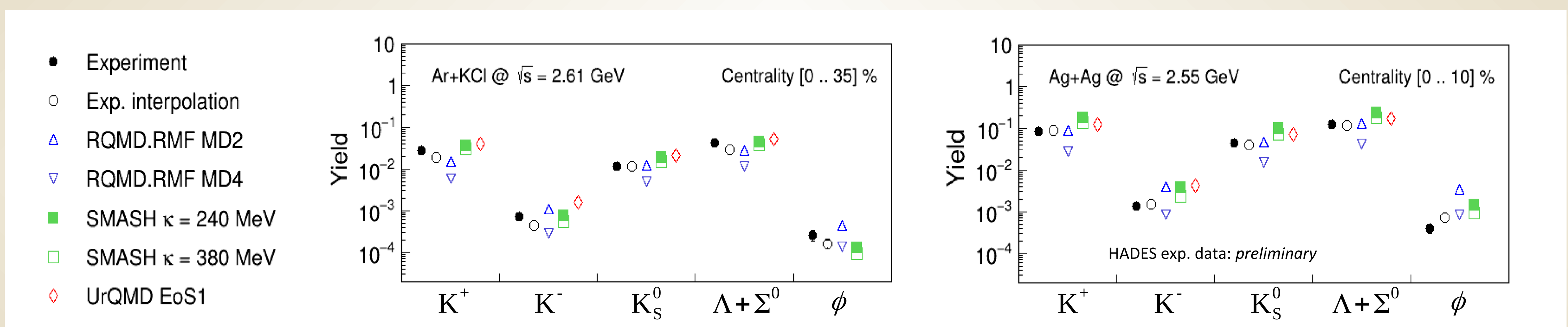
Here you can find the fitted parameters. Caution - strong correlations. See database.

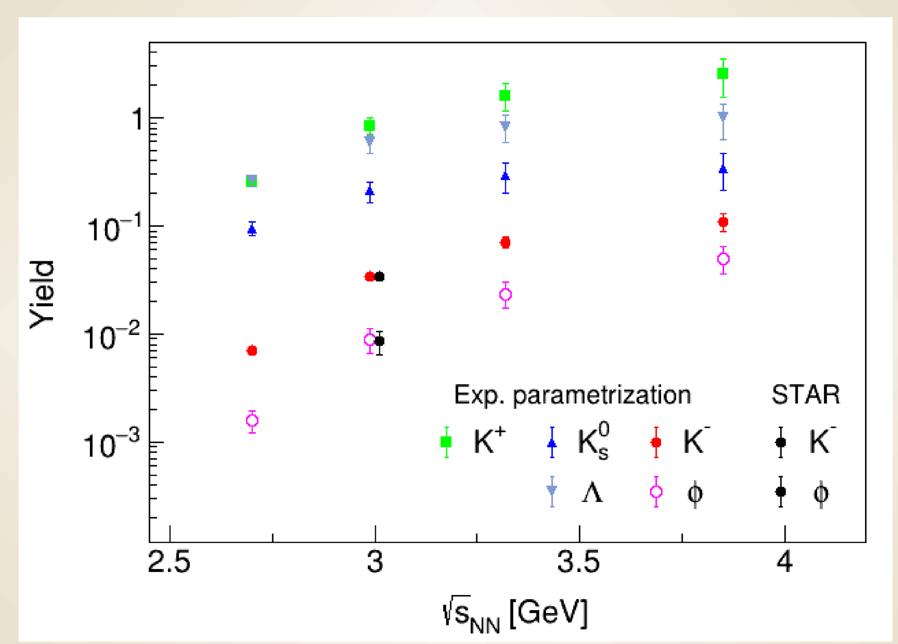
Hadron	K^+	K^-	$\Lambda+\Sigma^0$	ϕ	K^0
No. points	32	25	20	12	14
χ^2/ν	2.7	2.2	2.6	1.20	3.1
N	$(2.9 \pm 0.2) \cdot 10^{-3}$	$(1.5 \pm 0.7) \cdot 10^{-4}$	$(2.4 \pm 1.3) \cdot 10^{-3}$	$(4.7 \pm 3.3) \cdot 10^{-4}$	$(1.0 \pm 0.6) \cdot 10^{-3}$
α	1.40±0.03	1.34±0.04	1.20±0.04	1.05±0.14	1.15±0.04
β	-5.8±0.3	-7.1±0.6	-8.0±1.6	-5.07±0.09	-8.5±1.9
C	0.31±0.03	0.318±0.009	0.355±0.017	0.277 (fixed)	0.359±0.018



Exponent of $\langle A_{part}\rangle_b$ dependency of yield. A common exponent for all the strangeness may point to common first step: $s\bar{s}$ production

Phenomenological and transport-model predictions can be benchmarked on exp data. Both can also be used to predict the yields in unmeasured regions.





Prediction for CBM and STAR low E region

SQM2024
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