

Towards Continuum Limit of Screening Lengths with Chiral Fermions

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T. I. F. R., Mumbai, India

** In collaboration with Sourendu Gupta, TIFR, Mumbai and Robert Lacaze, SPHT, Saclay, CEA*

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Introduction

Simulation Details

Results

Summary

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- Quark Number Susceptibilities : Successful check on the schemes.

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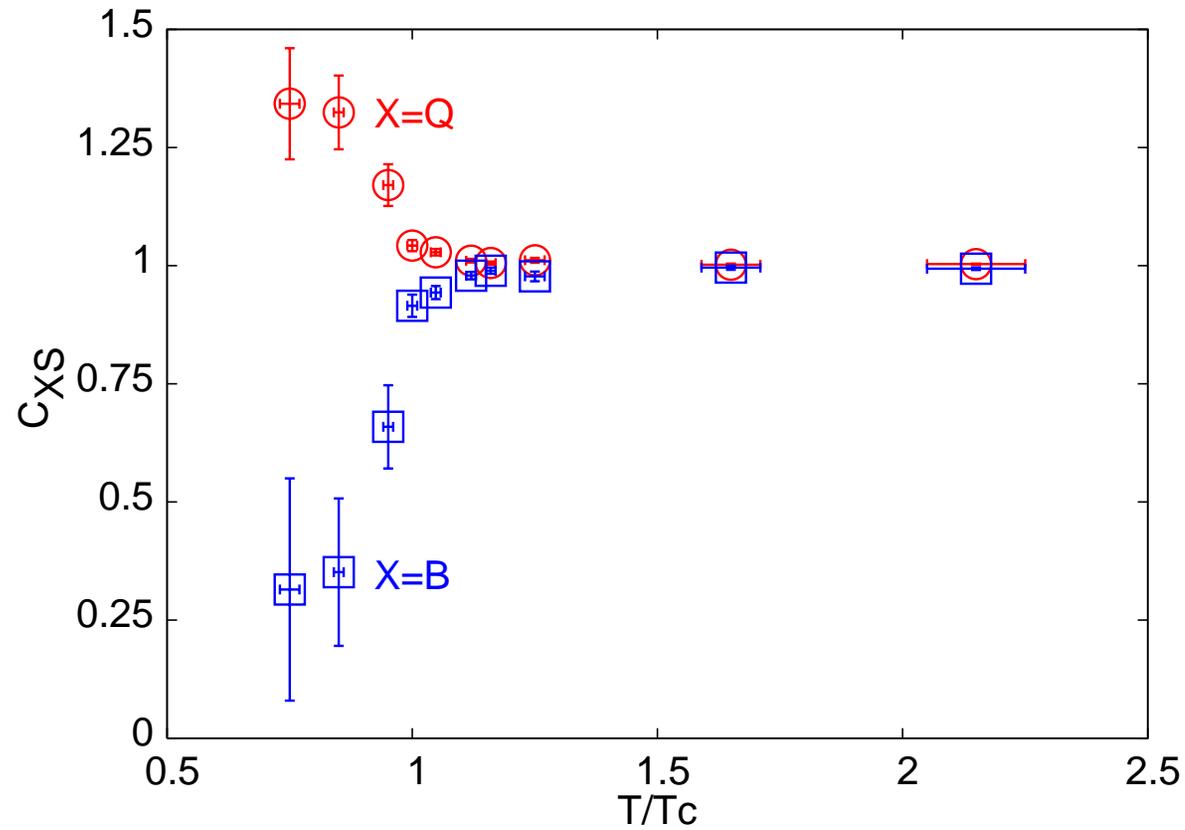
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- Fate of J/ψ and other mesons above T_c & Viscosity (quenched QCD) \rightsquigarrow strongly coupled QGP up to a few T_c .
- **Screening Masses : $T \geq 2T_c$: Close to Fermi gas of quarks.**
- **Flavour Correlations : C_{BS} and C_{QS} suggest quasi-quark behaviour.**

- Gavai and Gupta, Phys. Rev. D73, 014004 (2006)



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♣ Our earlier results (Lat '01, PRD 65 (2002) 094504) showed that *both* pseudoscalar and vector meson screening masses are close to the ideal gas values for $T \geq 1.25T_c$.

Simulation Details

- Overlap Dirac operator $D = 1 - D_w(D_w^\dagger D_w)^{-1/2}$, where (D_w) is Wilson-Dirac operator (D_w) .
- We computed $y = M^{-1/2}b$ by using the Zolotarev algorithm :
 $M^{-1/2}b = \sum_{l=1}^{N_O} \left(\frac{c_l}{M+d_l} b \right)$, where c_l and d_l are computed with Jacobi elliptic functions.

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- N_O defined by requiring a precision $\epsilon/2$ for the approximation of $1/\sqrt{z}$ in a domain 10 % larger than defined by min and max eigenvalue on a given configuration, $\epsilon = 10^{-5}$.
- Typical $N_O \sim 7 - 8$.

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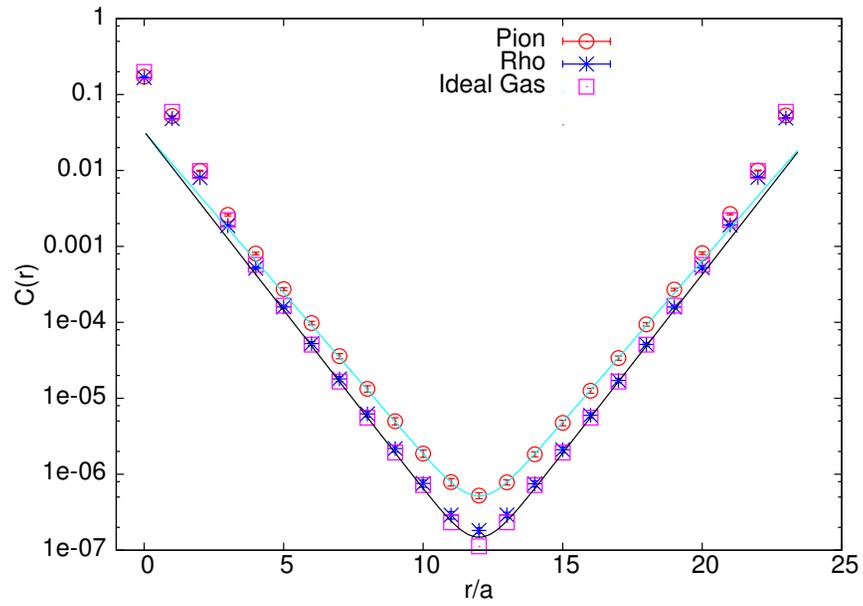
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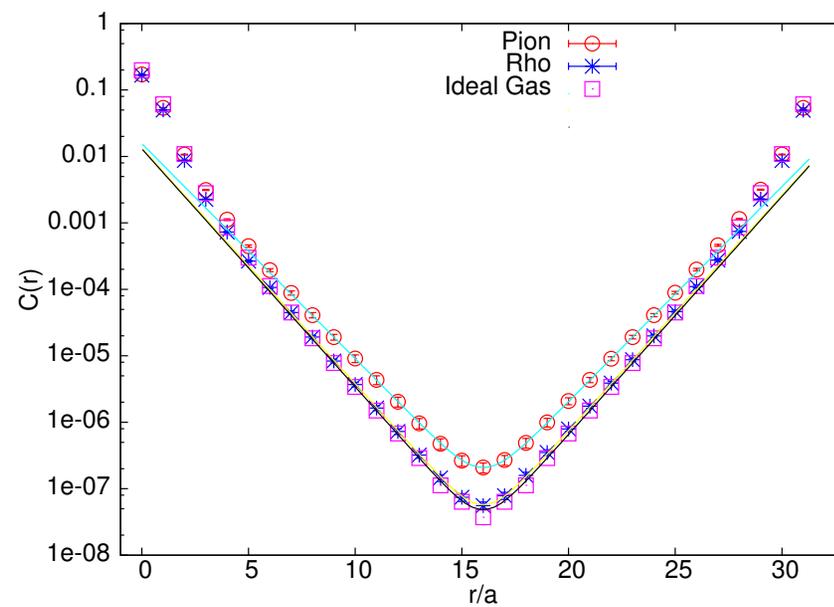
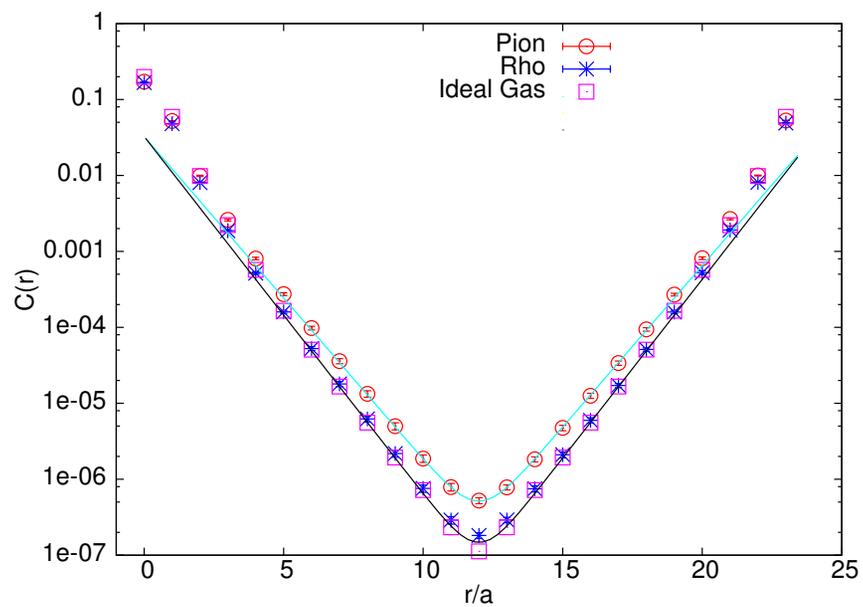
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♡ 20-25 Configurations separated by 1000 sweeps used.

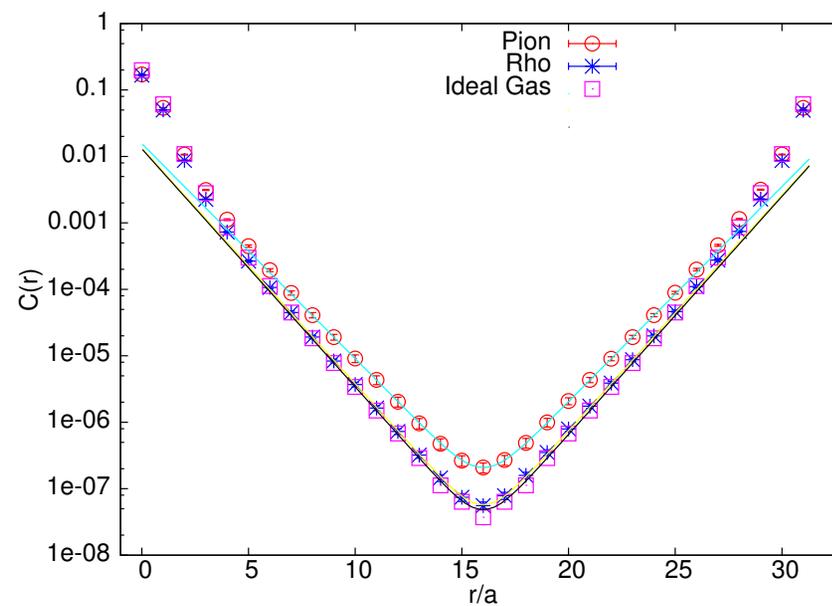
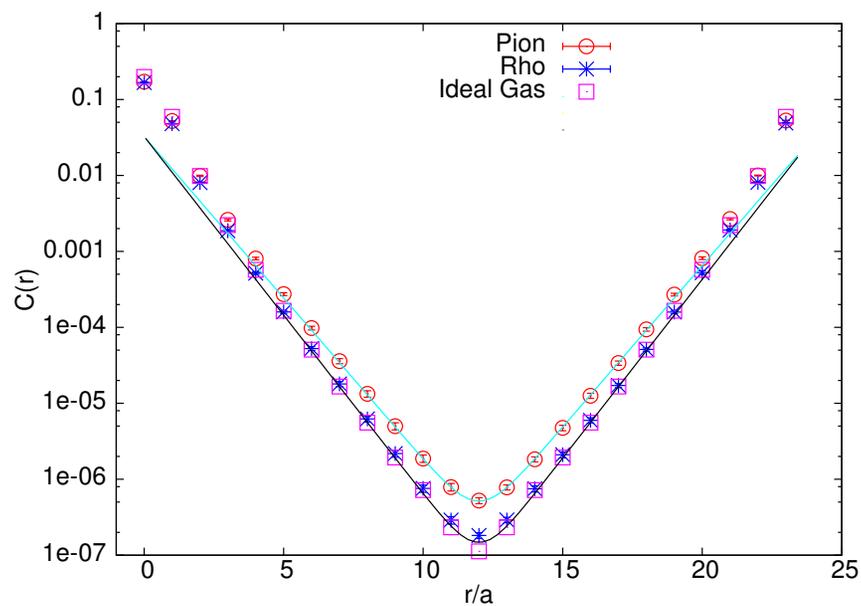
Our Results



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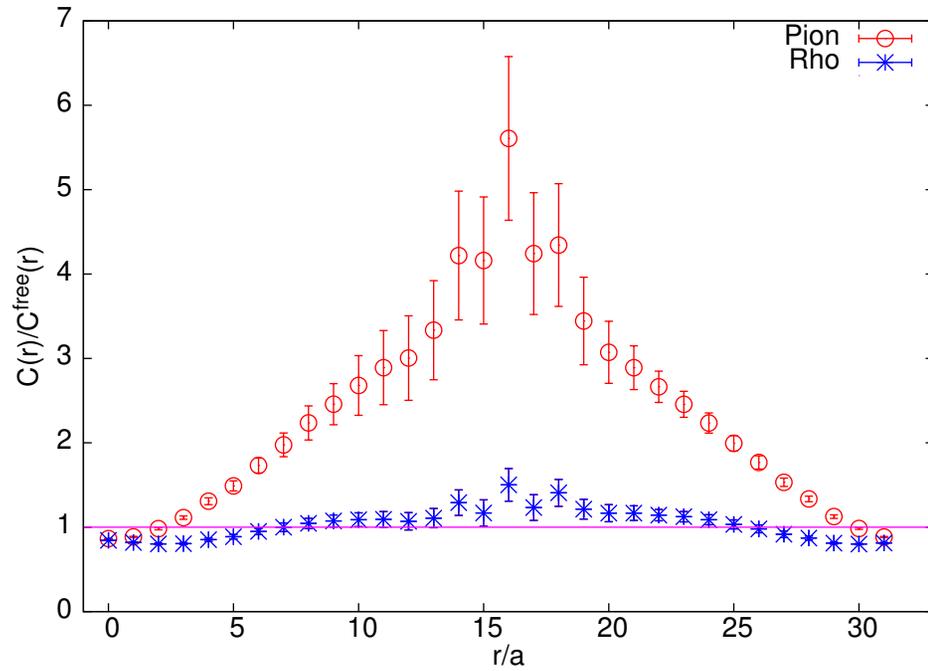
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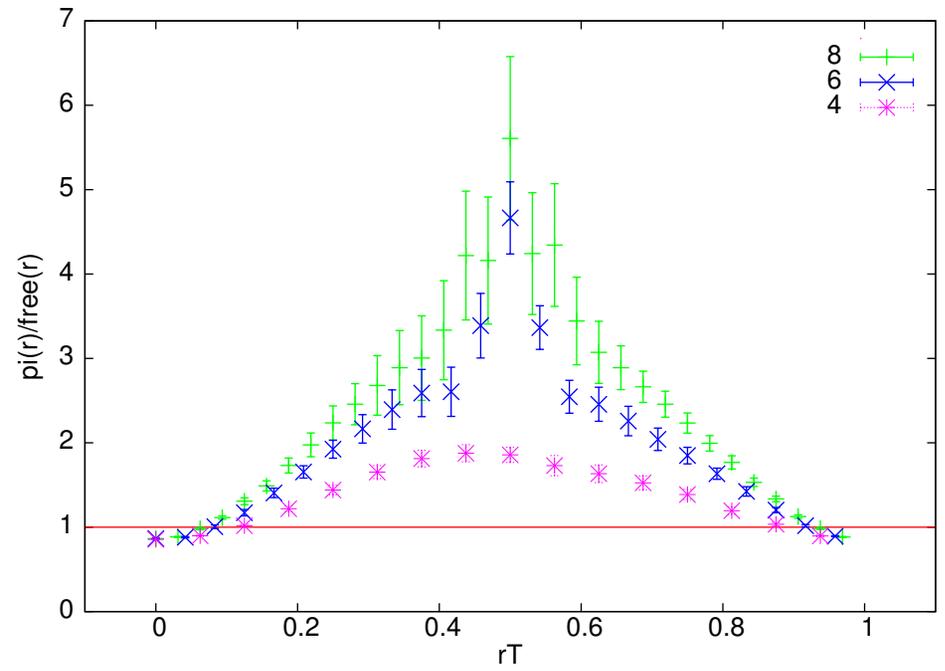
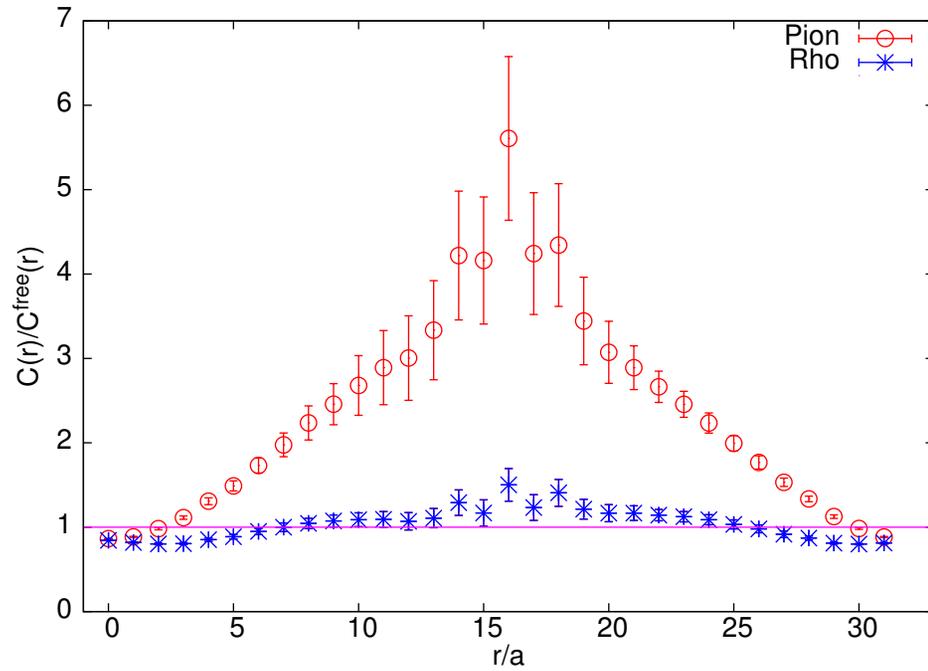
- ♣ On both $N_t = 6$ and 8 , cosh-like behaviour is seen.
- ♣ Ideal gas correlator very close in each case.

♣ Pion seems to deviate from FFT much more than rho.

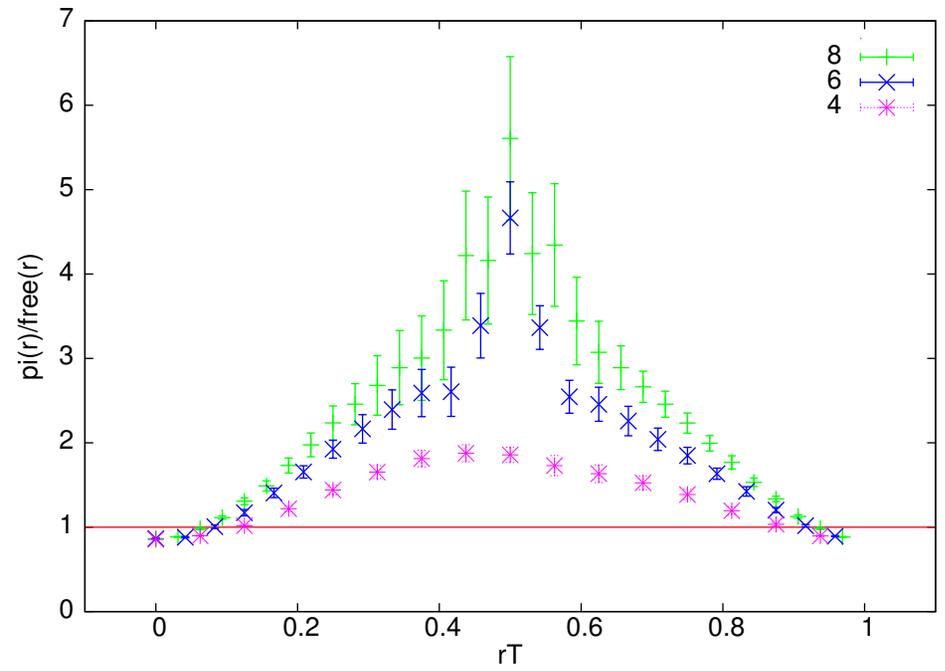
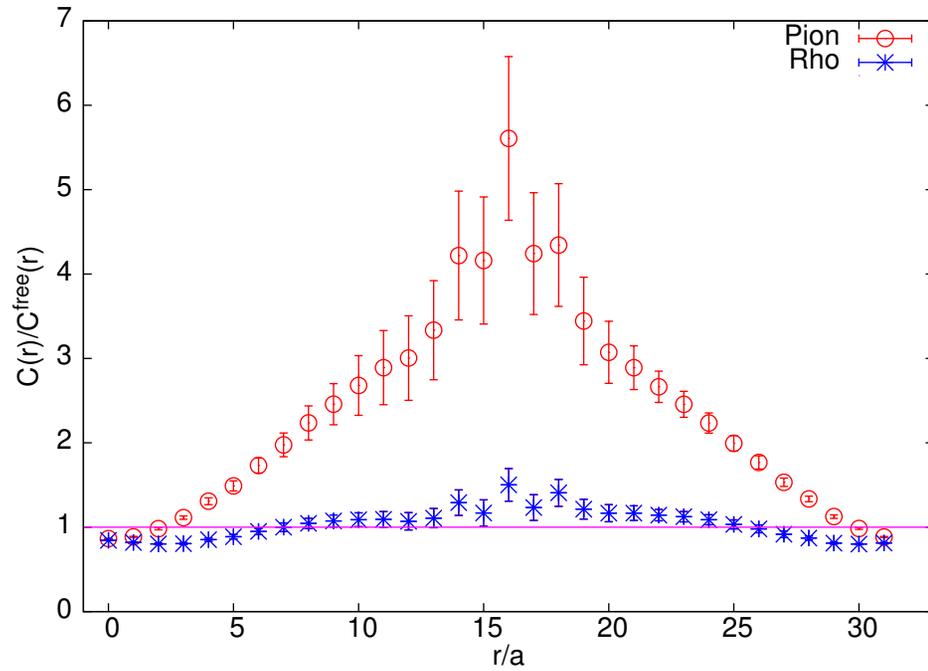
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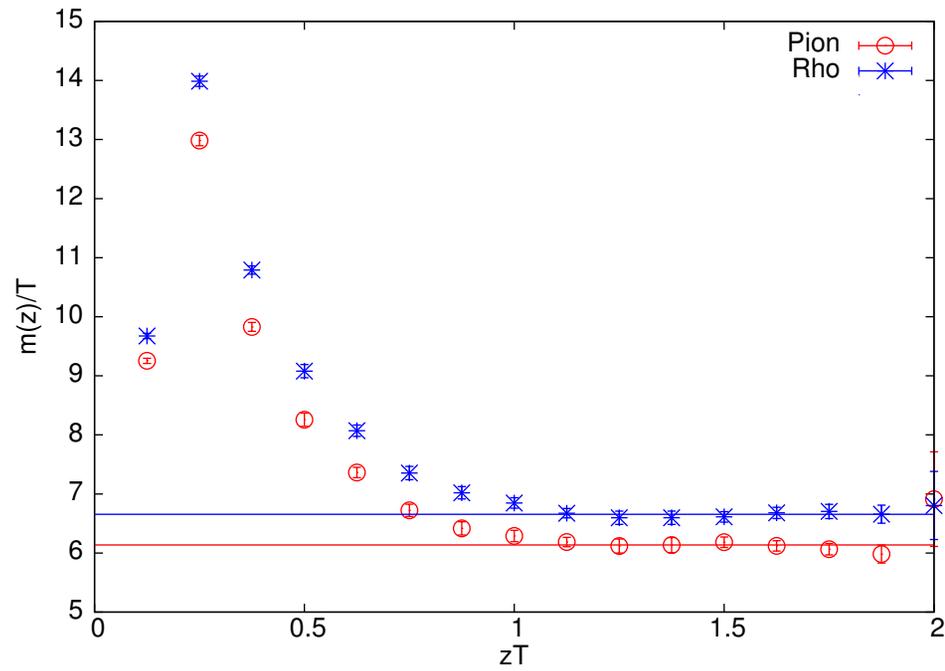
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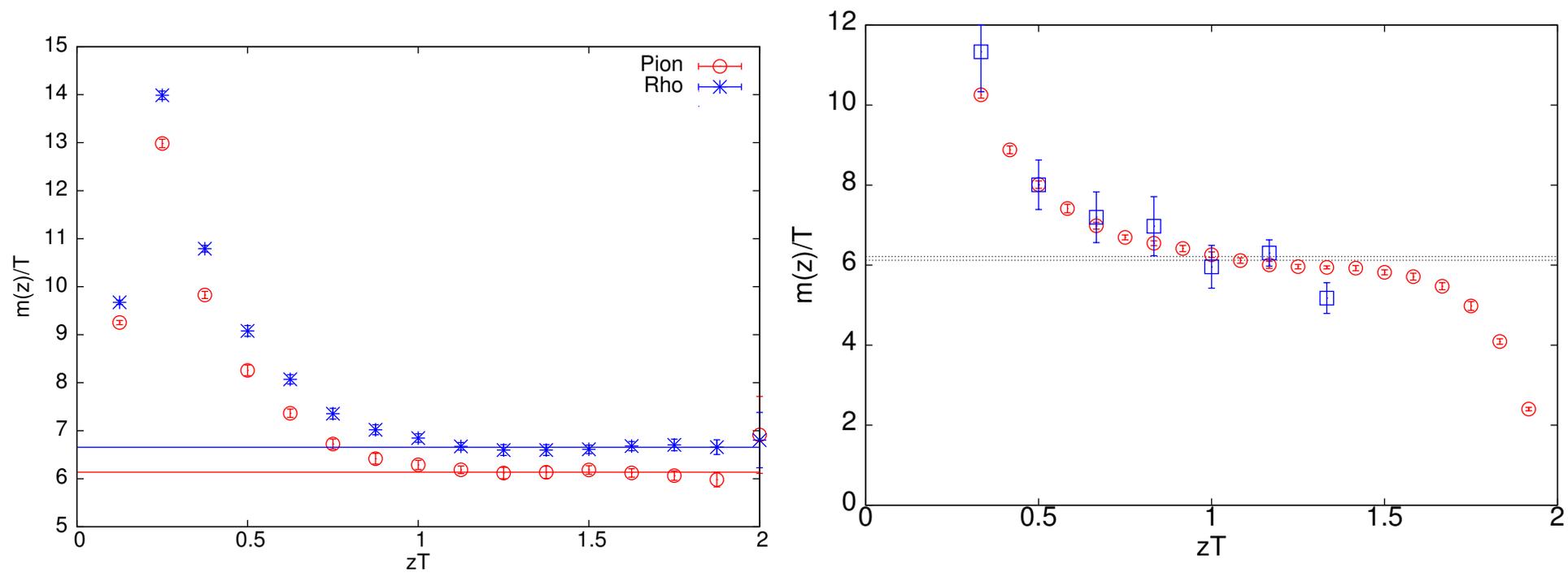
♣ As a gets smaller, the pion deviations increase.

♣ Local masses show nice plateau behaviour for π & ρ .

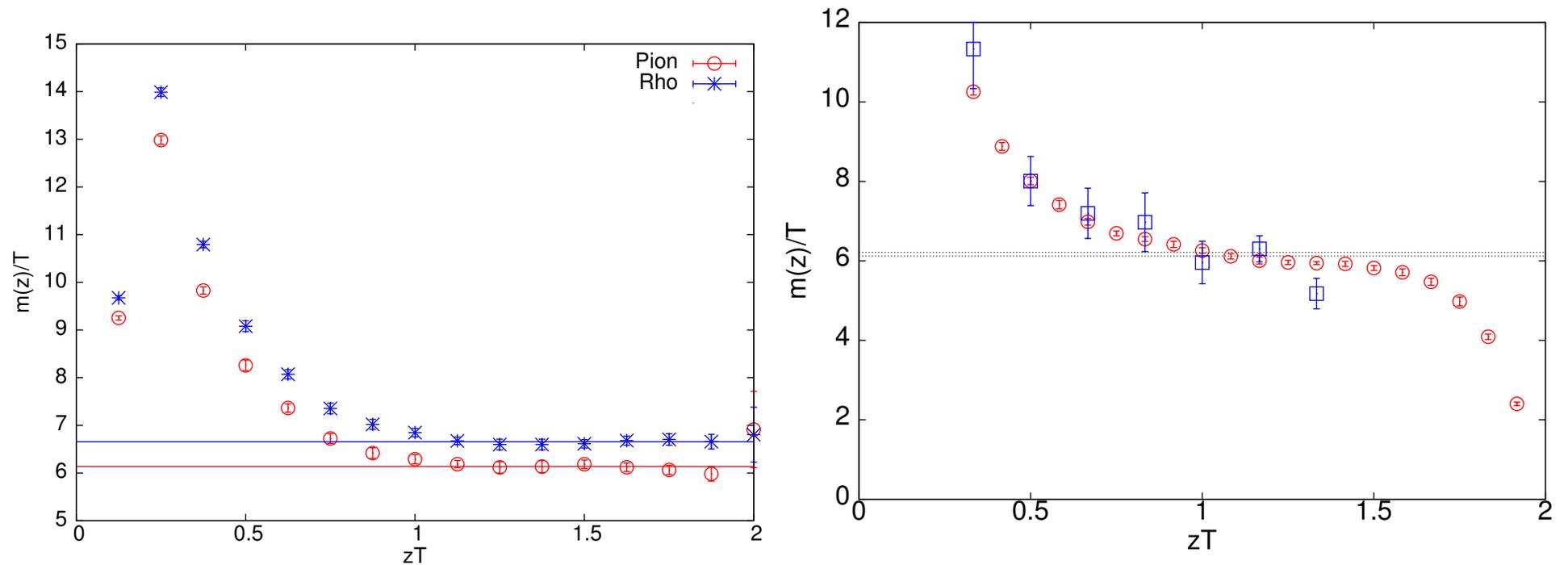
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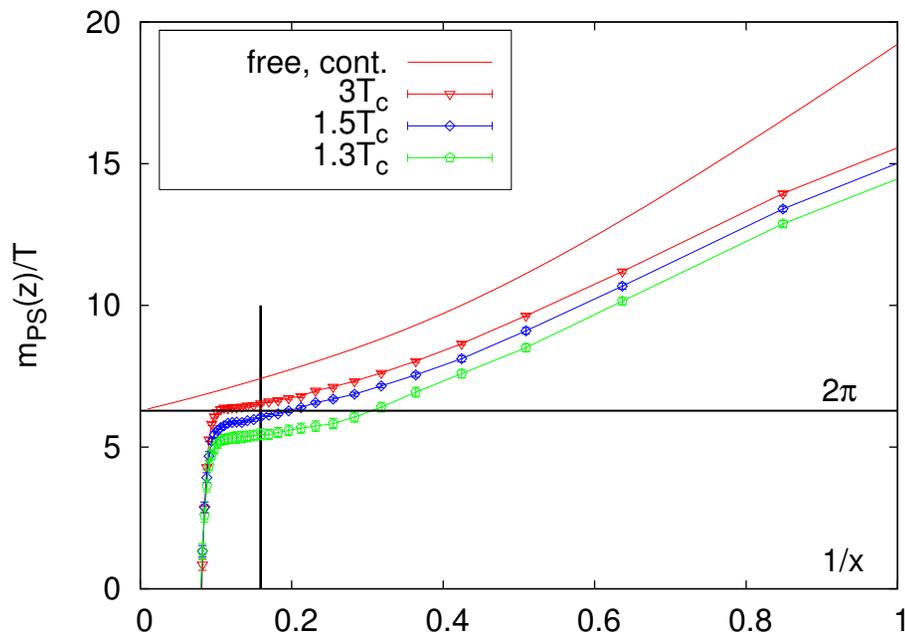
♣ Contrast this with the staggered effective mass (Gavai & Gupta PRD 2002).

Comparison with Wilson Fermions

♣ Wilson Fermion figure from PoS Lattice 2005, 164. (Bielefeld Group)

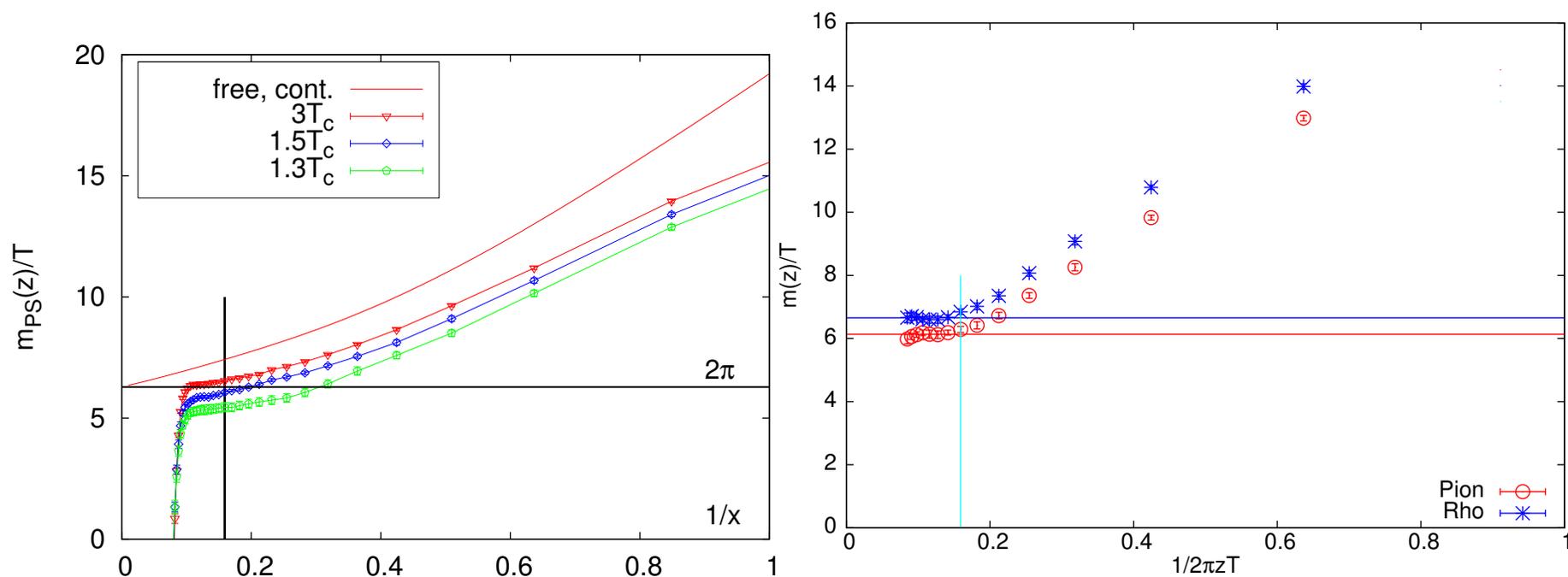
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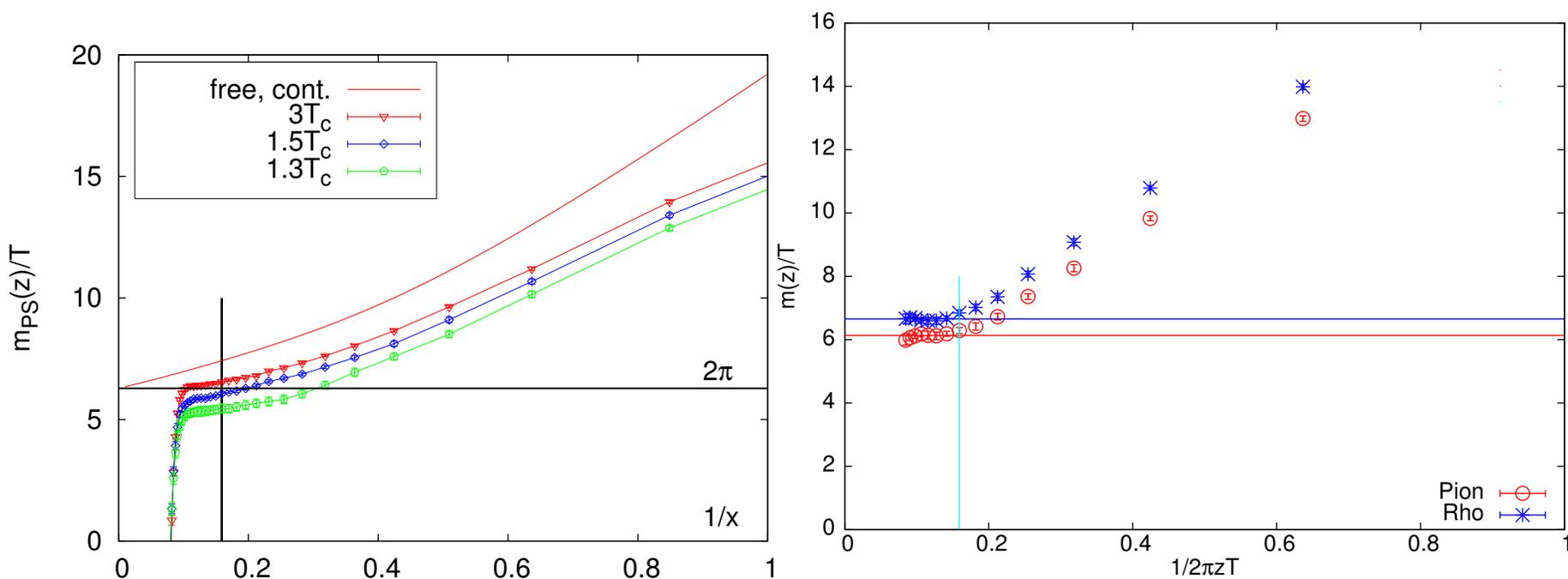
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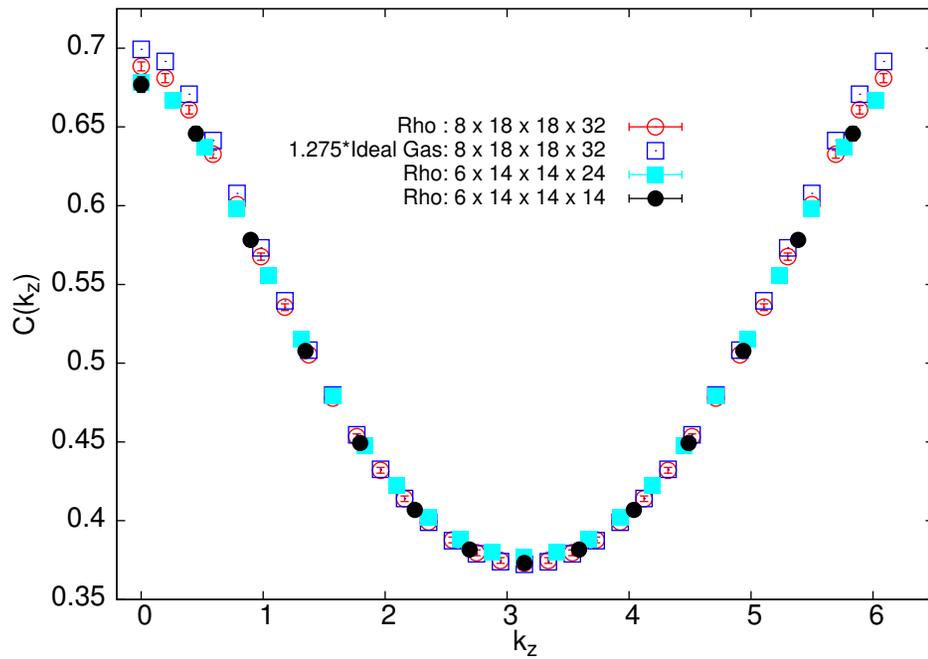
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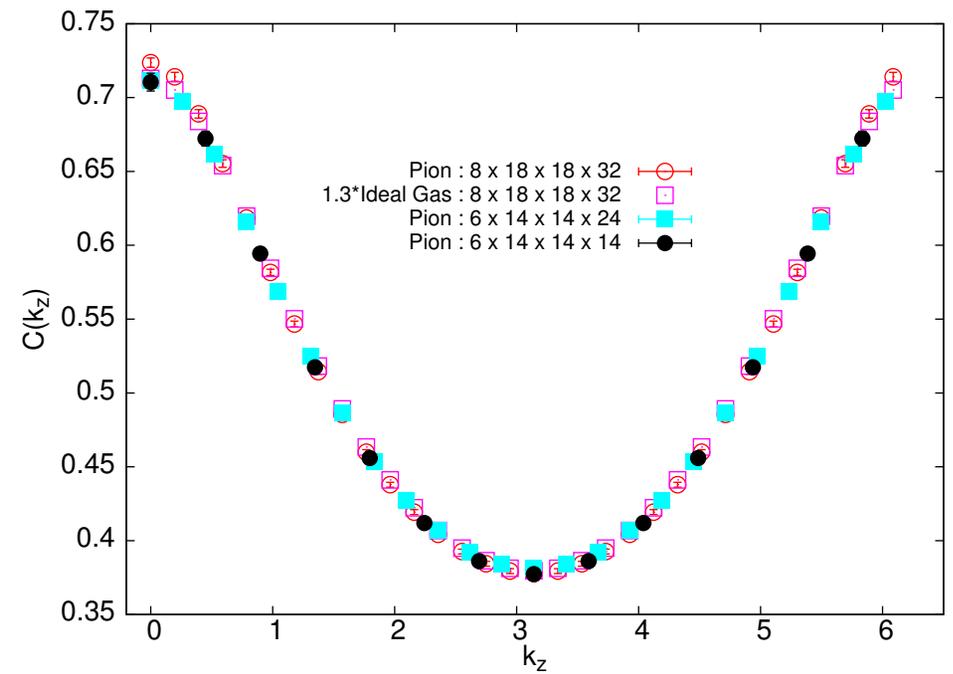
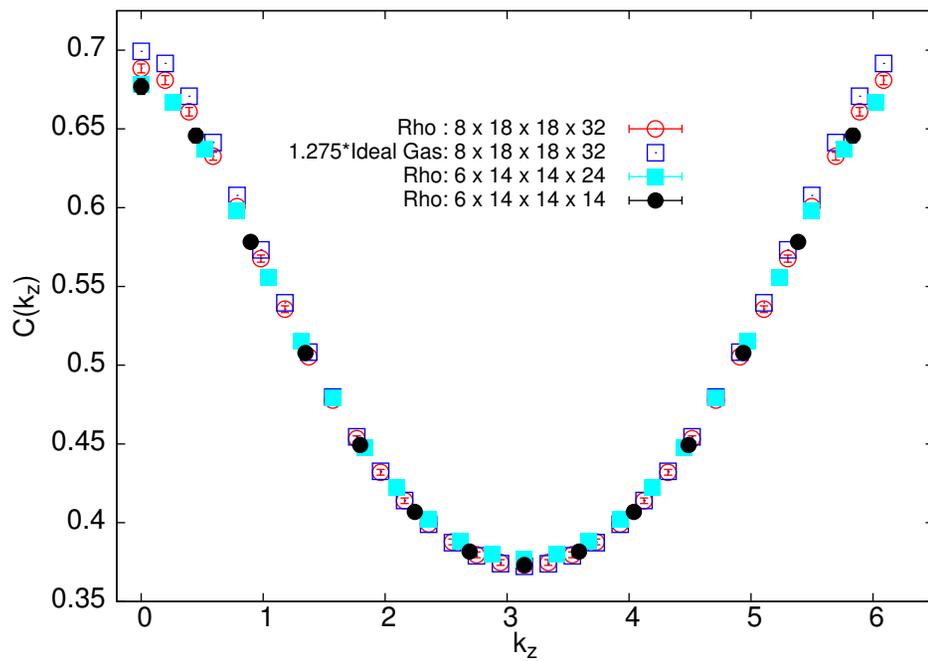


♣ Nice plateau behaviour for Overlap fermions.

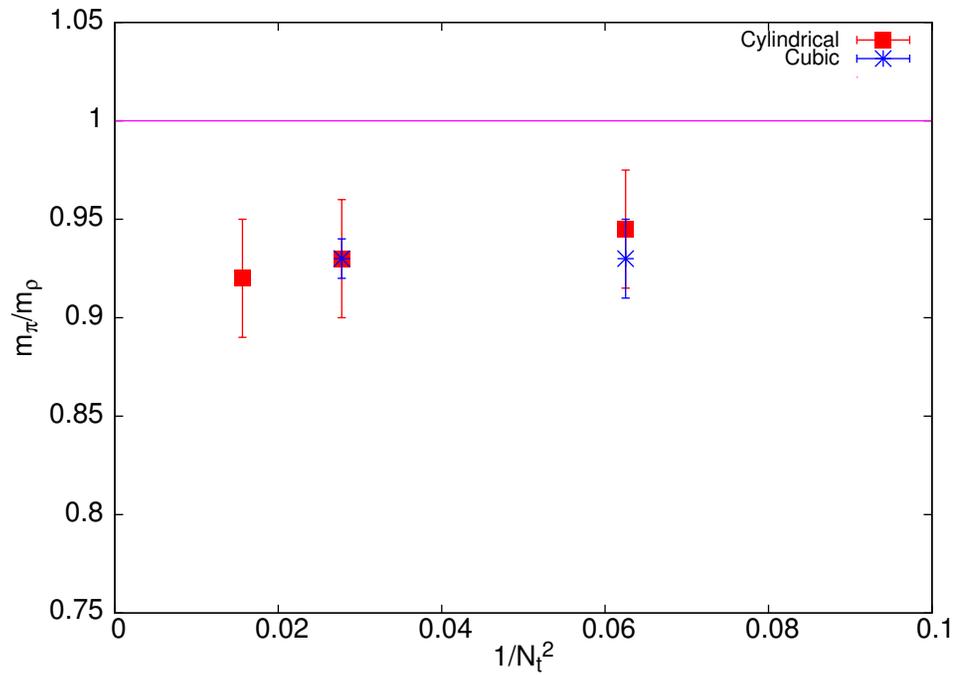
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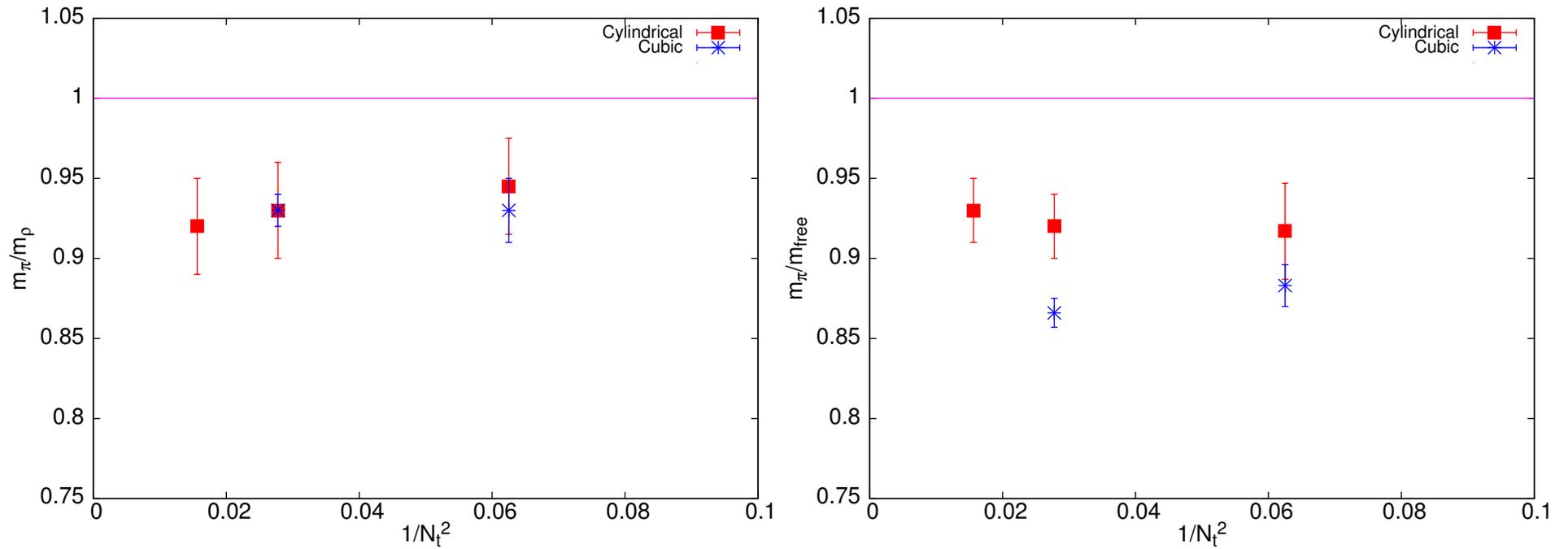
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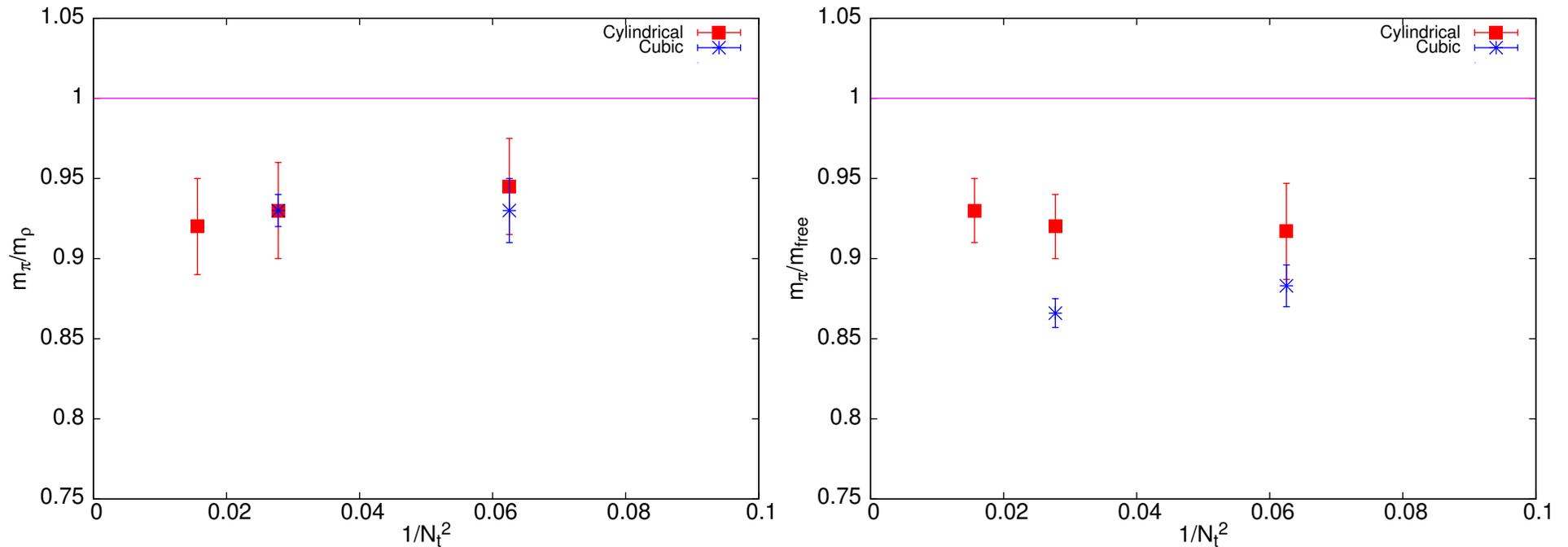
Screening masses vs. a



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♣ Very small a dependence.

♣ m_ρ consistent with Ideal Gas but m_π smaller by about 10 %.

Summary

- Single *cosh* behaviour, leading to nice plateau in local masses, seen on both $N_t = 6$ and 8, as on $N_t = 4$ earlier.
- Rho correlator in very good agreement with ideal gas one, but pion differs on all N_t .

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- Single *cosh* behaviour, leading to nice plateau in local masses, seen on both $N_t = 6$ and 8, as on $N_t = 4$ earlier.
- Rho correlator in very good agreement with ideal gas one, but pion differs on all N_t .
- Pion screening mass remained different from the ideal gas at $\sim 10\%$ or 3σ level, while rho mass was in agreement.
- Very little, if any, a dependence \implies difference to persist on very large N_t .

