Update on Coalescence with Argonne v18

Small preface

The deuteron wavefunction

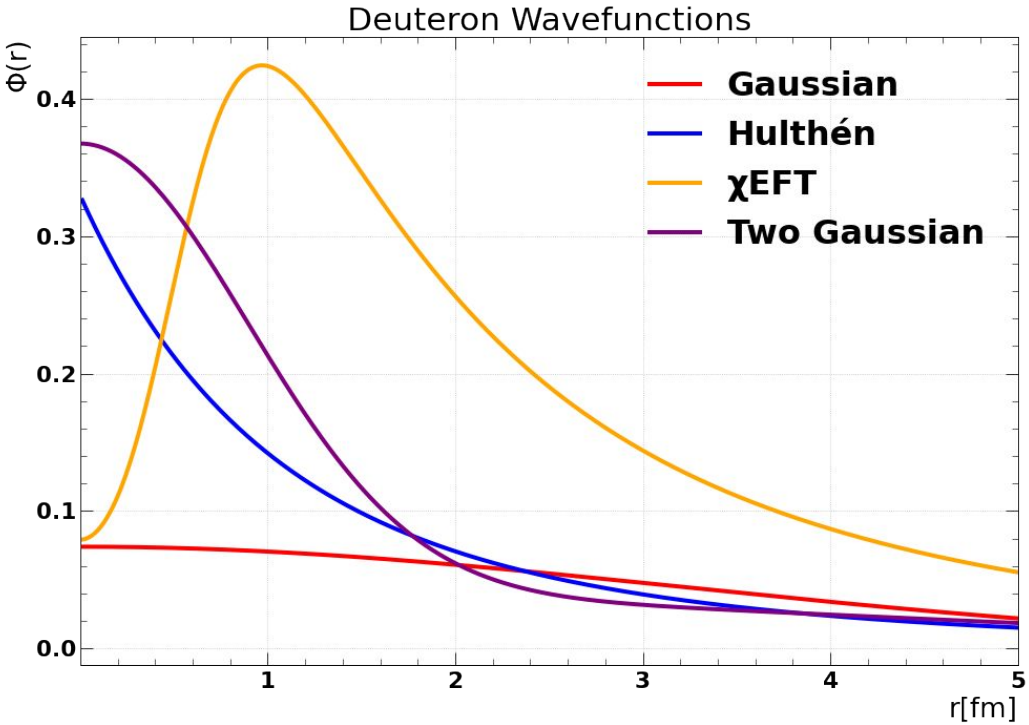
- There are multiple models for the deuteron wave function
- Simplistic:

  Single Gaussian ✔
- Experimental data (‘50s):

  Two Gaussian ✔
- From *pion field theory* (‘50s):

  Hulthén ✔
- From modern χ_{EFT}:

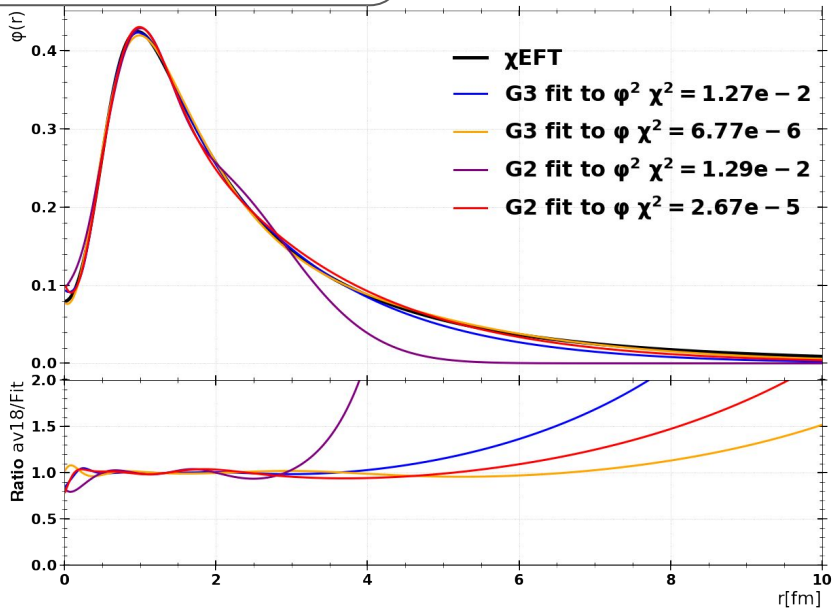
  Argonne v_{18}



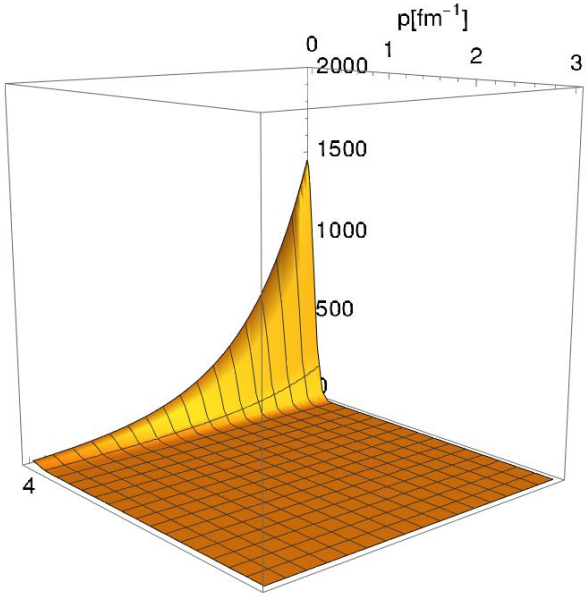
The wave function

$$F(r) = \underbrace{\underbrace{N_1 e^{-br^2}(cr^2 + a) + N_2 e^{i\alpha} e^{-f(r-m)^2}}_{G_2} + N_3 e^{i\alpha} e^{-dr^2}}_{G_3}$$

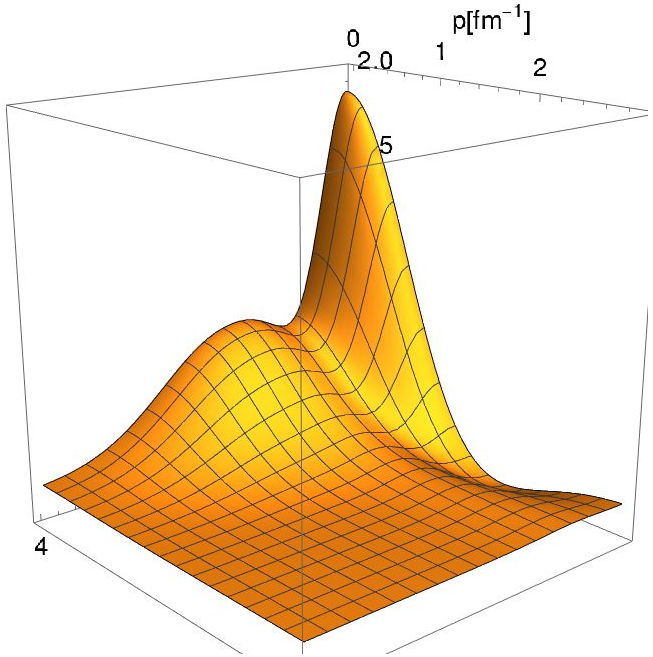
- Adding complex phases cancels cross terms
- BUT: Only fit to ϕ^2
- Fitting directly to ϕ gives much better fits (remove phase)
- Regardless of phase the cross terms vanish (all imaginary (?))



The Wigner functions



G3fit to ϕ^2 (G2 fit to ϕ very similar)
However: peak height at (0,0) varies with the fit



G2 fit to ϕ^2 (worst fit)

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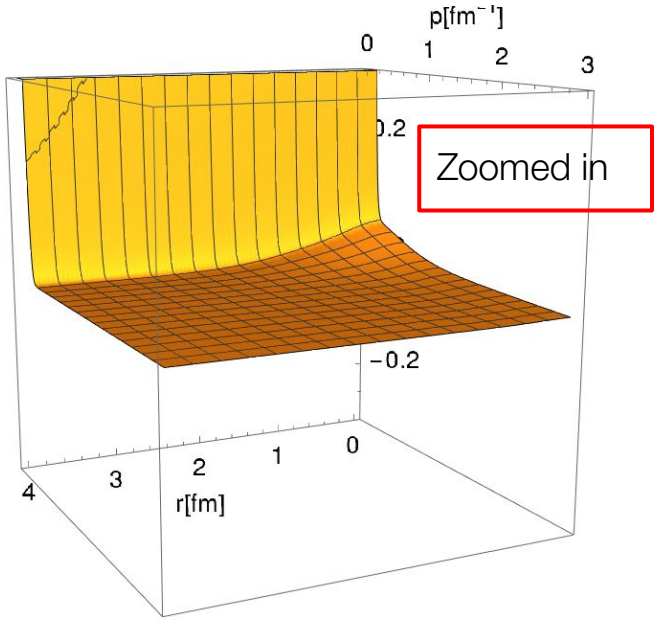

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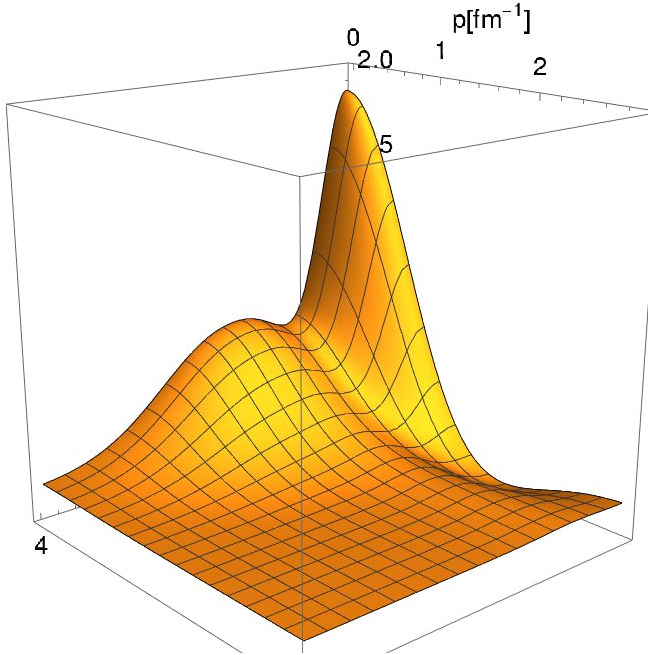
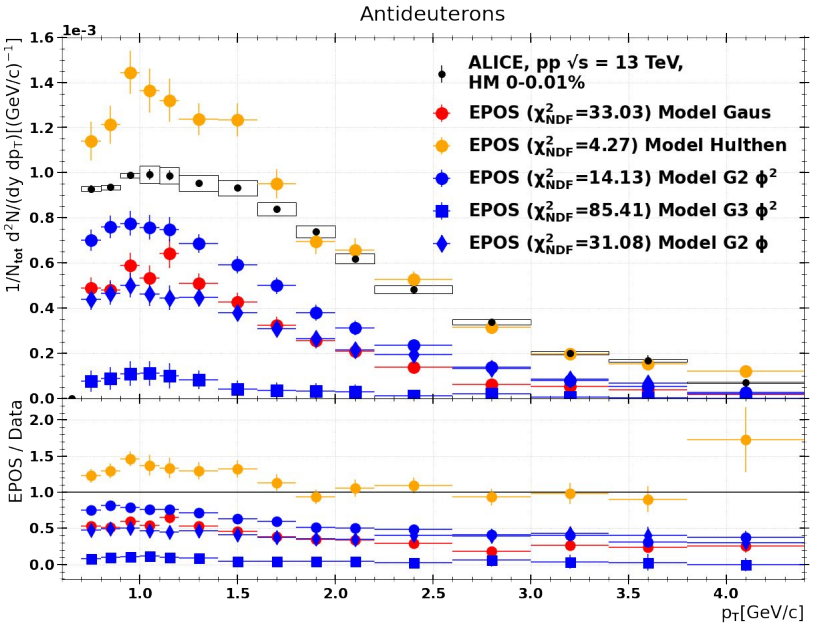


G2 fit to ϕ^2 (worst fit)

Deuteron Spectra

- Deuteron spectra using the different fits
- Results depend a lot on the initial fit function



Deuteron Spectra

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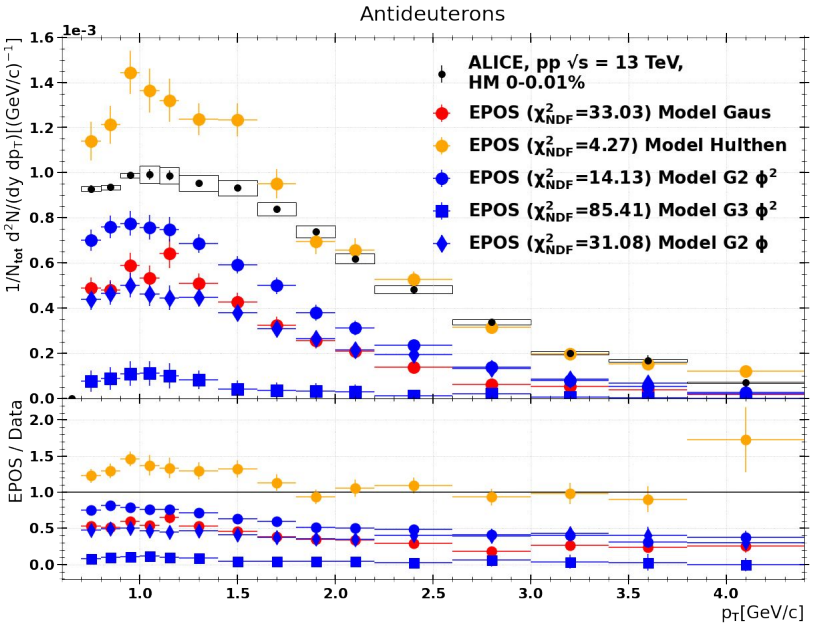
Next steps:

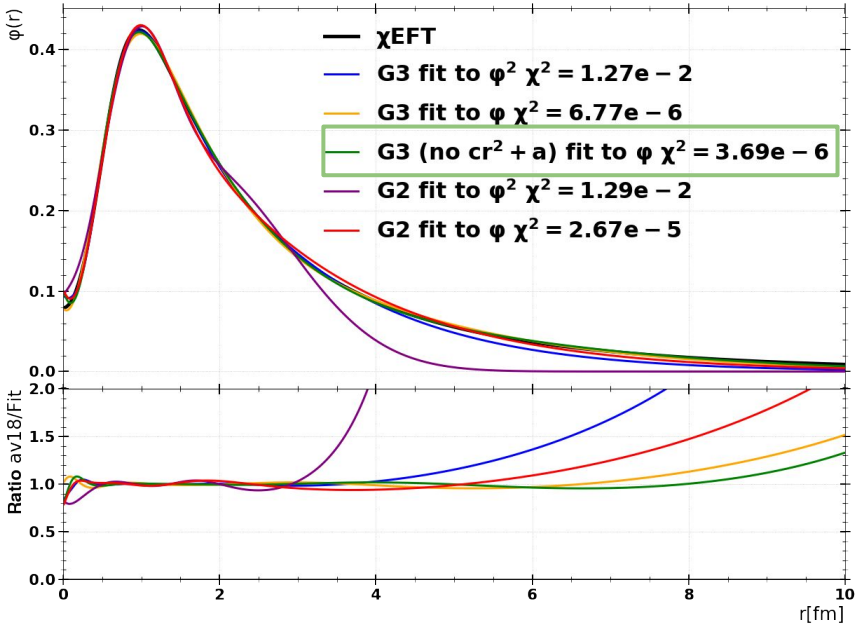
- Bhawani is doing the calculation as well
- Used improved fit function with 3 Gaus but removed (cr^2+a) term



Improved fit function

$$F(r) = N_1 e^{-br^2}(cr^2 + a) + N_2 e^{i\alpha} e^{-f(r-m)^2} + N_3 e^{i\alpha} e^{-dr^2}$$

- Removing two fit parameters improves fit quality
- Makes calculation easier
- However: no imaginary cross-terms



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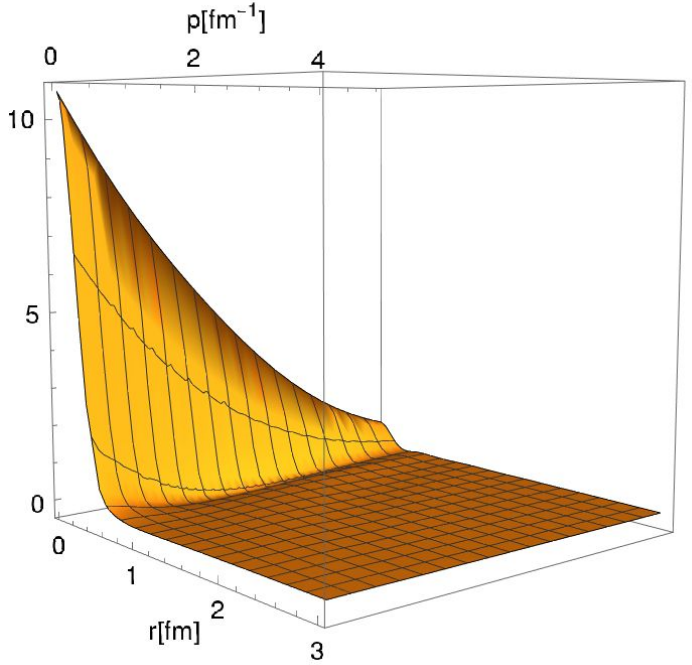

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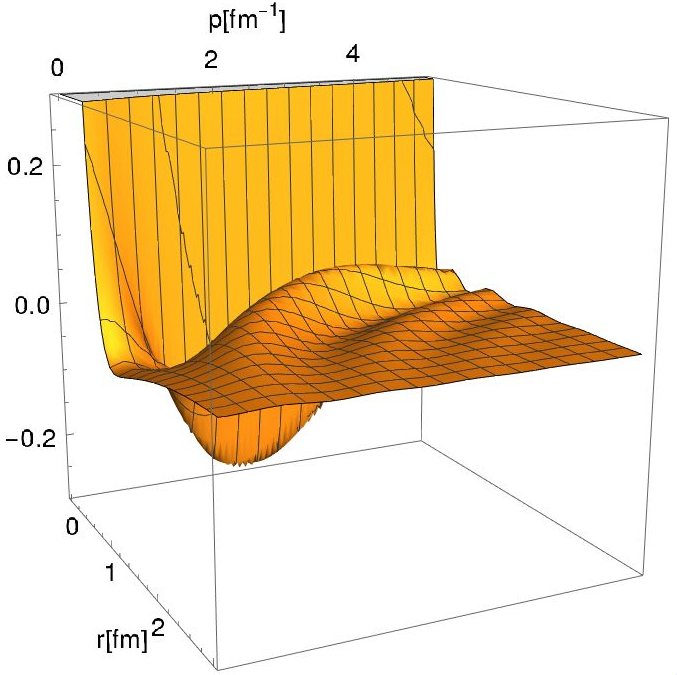

BACKUP

The wave function

ϕ^2

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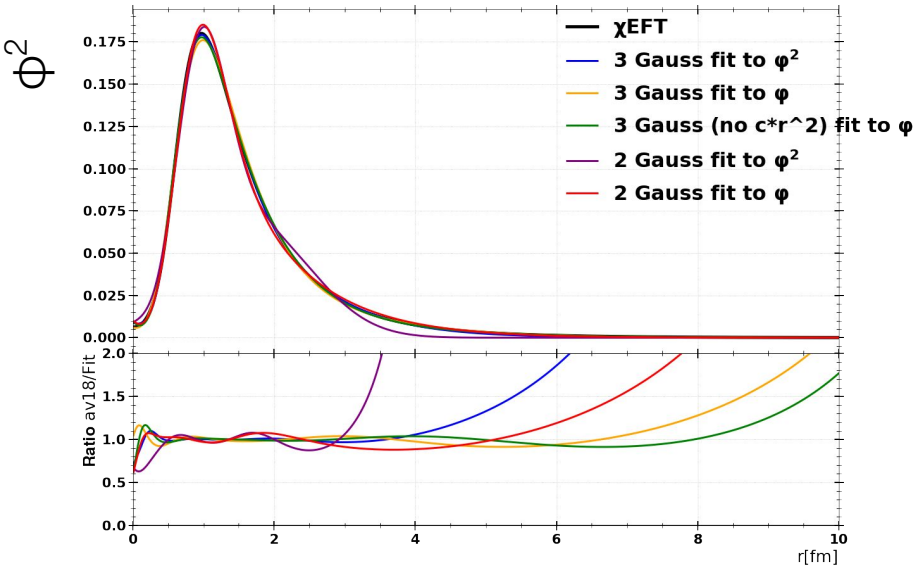

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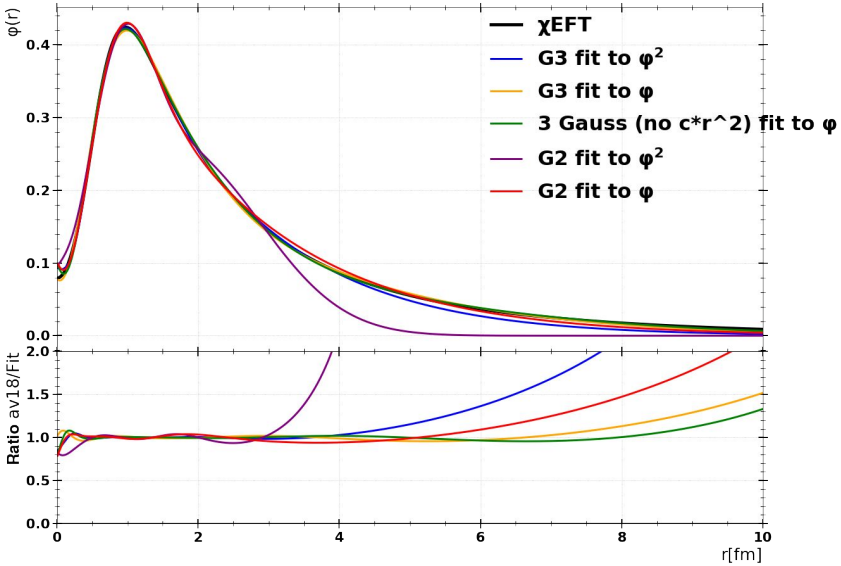
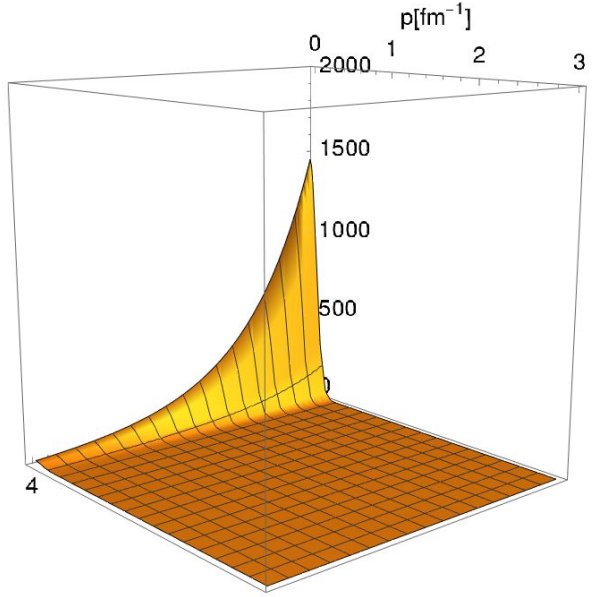
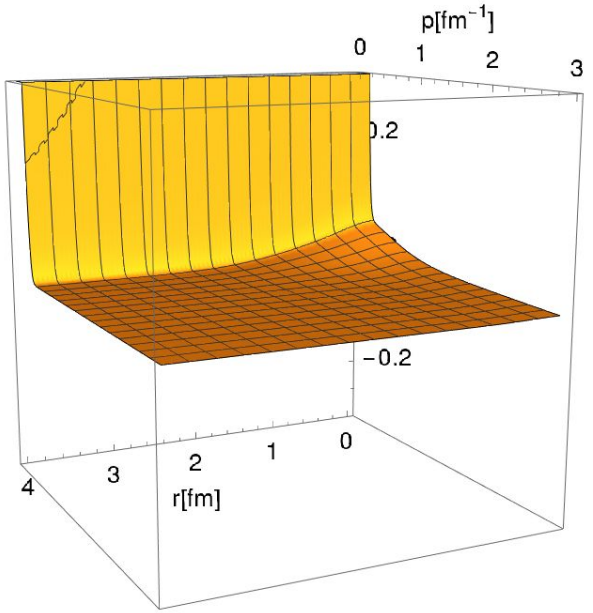




G3fit to phi^2



Zoomed in