

BOUT++ Results

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ABSTRACT

This document highlights some results from BOUT++ simulation

metadata

evolved: ['Ni' 'rho' 'jpar']

IC: [1.00000000e-08 0.00000000e+00 0.00000000e+00]

ZMAX: 5e-05

TIMESTEP: 100.0

ZMIN: 0.0

ShiftXderivs: false

restart: false

grid: /home/cryosphere/BOUT/examples/drift-instability/uedge.grd_std.cdl

MYG: 2.0

dump_format: nc

MXG: 2.0

NYPE: 1.0

TwistShift: false

NOUT: 200.0

MZ: 129.0

mxstep: 10000.0

RTOL: 1e-08

type: ccode

ATOL: 1e-12

AA: 2.0

estatic: true

nu_perp: 1e-20

phi_flags: 0.0

ZeroElMass: true

apar_flags: 0.0

ShearFactor: 0.0

ZZ: 1.0

Zeff: 4.0

ys_mode: 1.0

scale: 1e-08

zs_opt: 3.0

xs_opt: 0.0

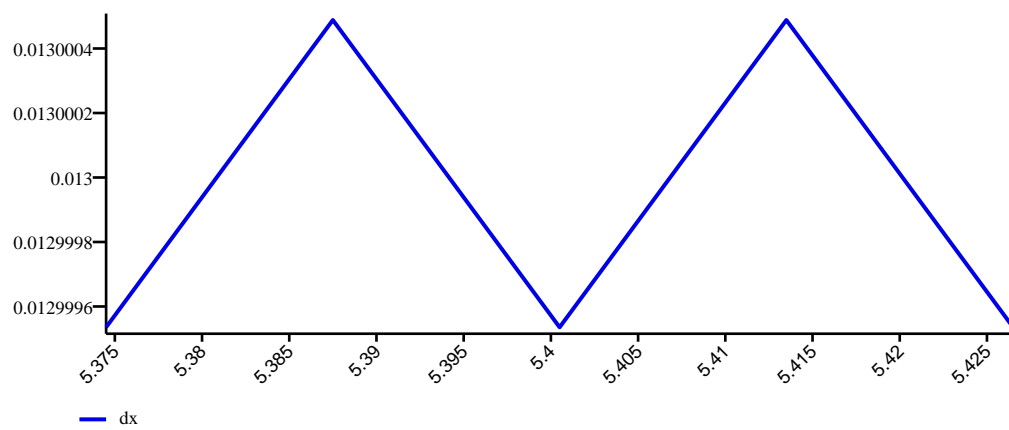
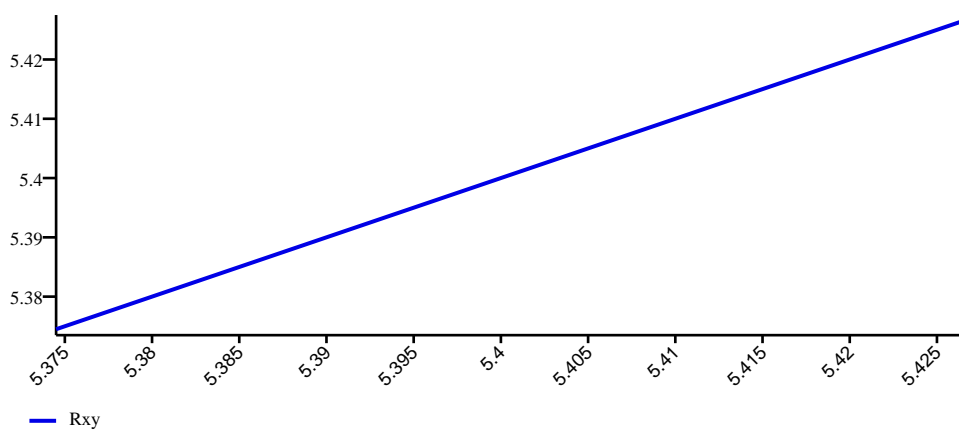
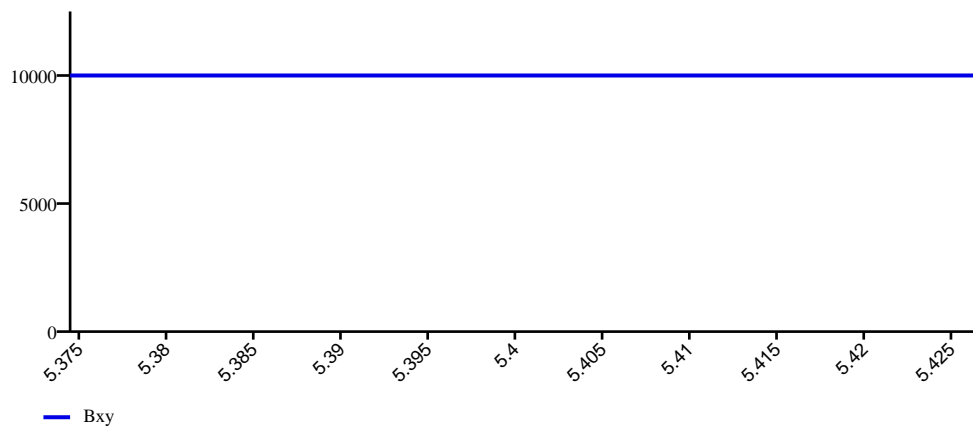
bndry_all: neumann

ys_opt: 2.0

zs_mode: 1.0

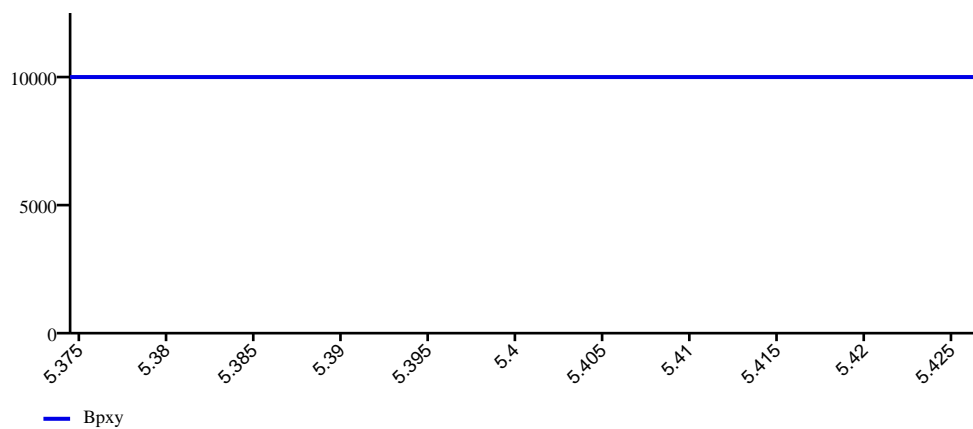
zs_phase: 0.5

Te_x: [50.] eV

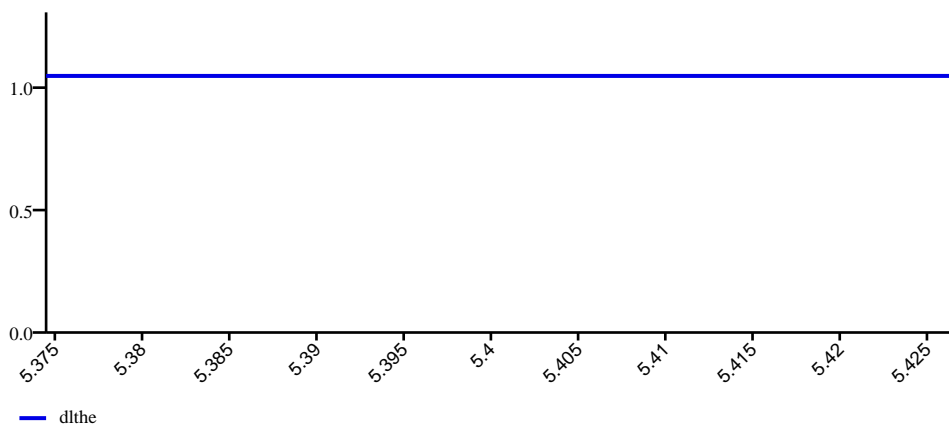
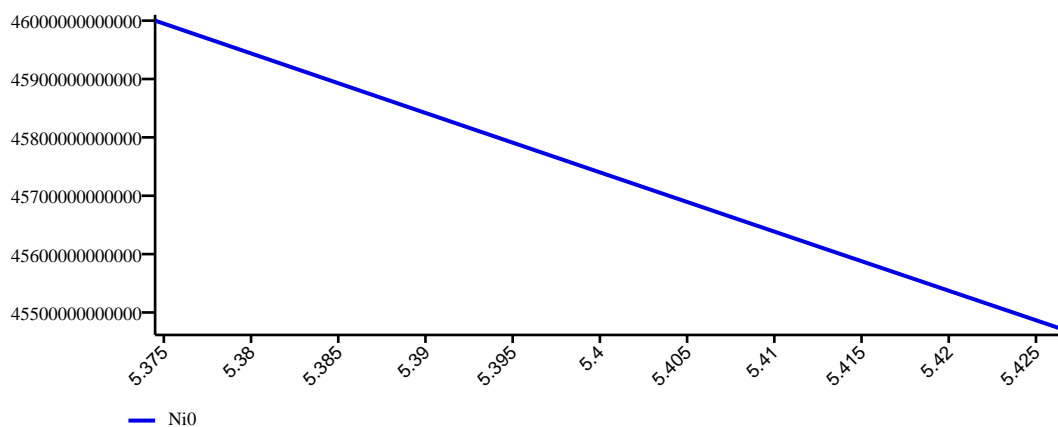


Ti_x: [0.01] eV

bmag: [10000.] gauss



hthe0: [5.33681965] m



Ni_x: [4.59999973e+13] cm^-3

nx: [4.59999973e+13] cm^-3

ny: [4.59999973e+13] cm⁻³

dt: 100.0

rho_s: [0.102] cm

rho_i: [0.0014425] cm

rho_e: [0.00168291] cm

fmei: 0.000272301492212

lambda_ei: [12.18219185]

lambda_ii: [0.01584053]

wci: [47900000.]

wpi: [6.33049754e+09]

wce: [1.78000003e+11]

wpe: [3.82523408e+11]

v_the: [2.96277728e+08]

v_thi: [69225.75]

c_s: [6319418.]

v_A: [22728.07226562]

nueix: [4612339.]

nuiix: [24628646.]

nu_hat: [0.38516402]

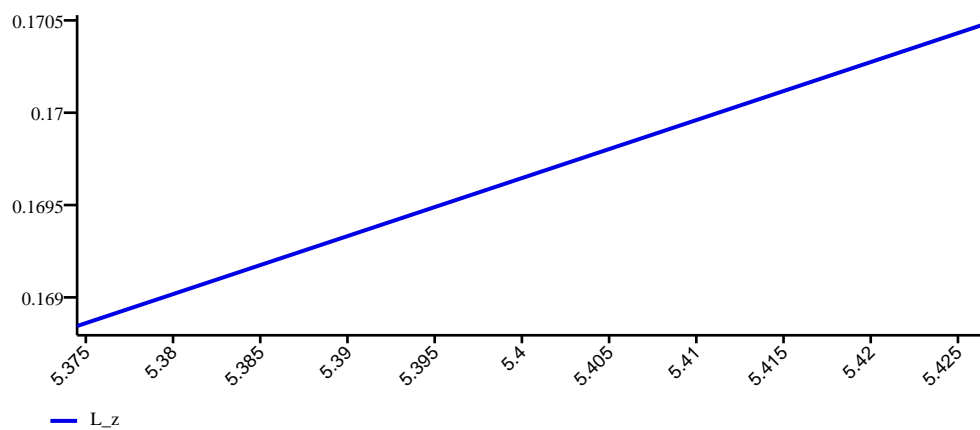
L_d: [0.00077463]

L_i_inrt: [4.75412893]

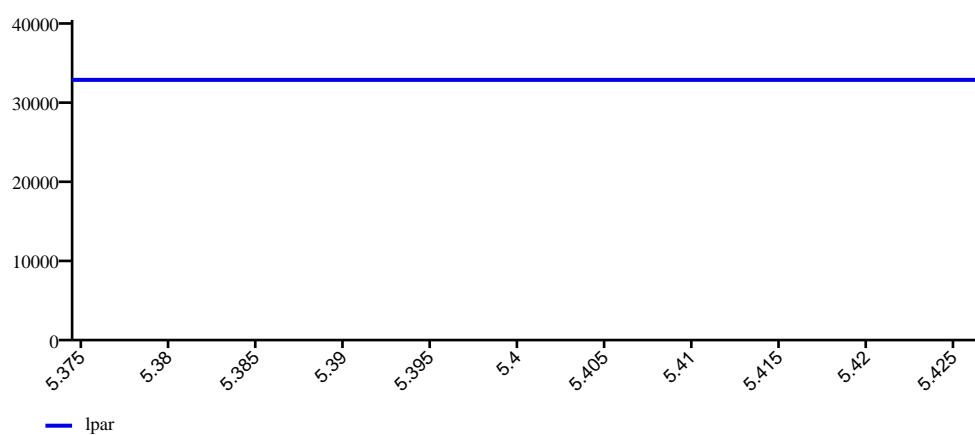
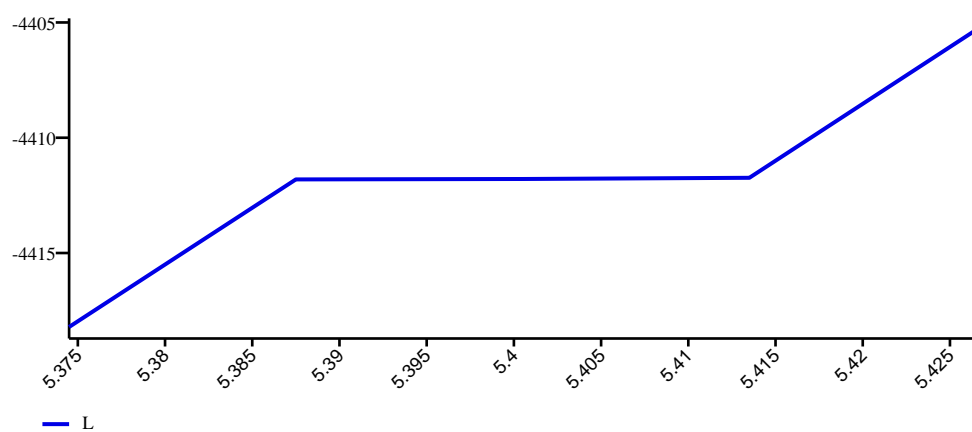
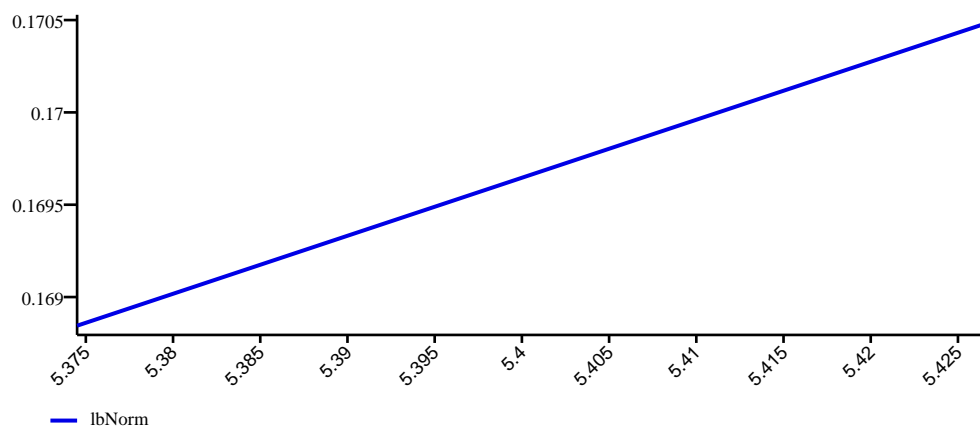
L_e_inrt: [3.60141711e+12]

Ve_x: [2.09500006e+09]

R0: [2.09500006e+09]



dz: [5.00000000e-05]



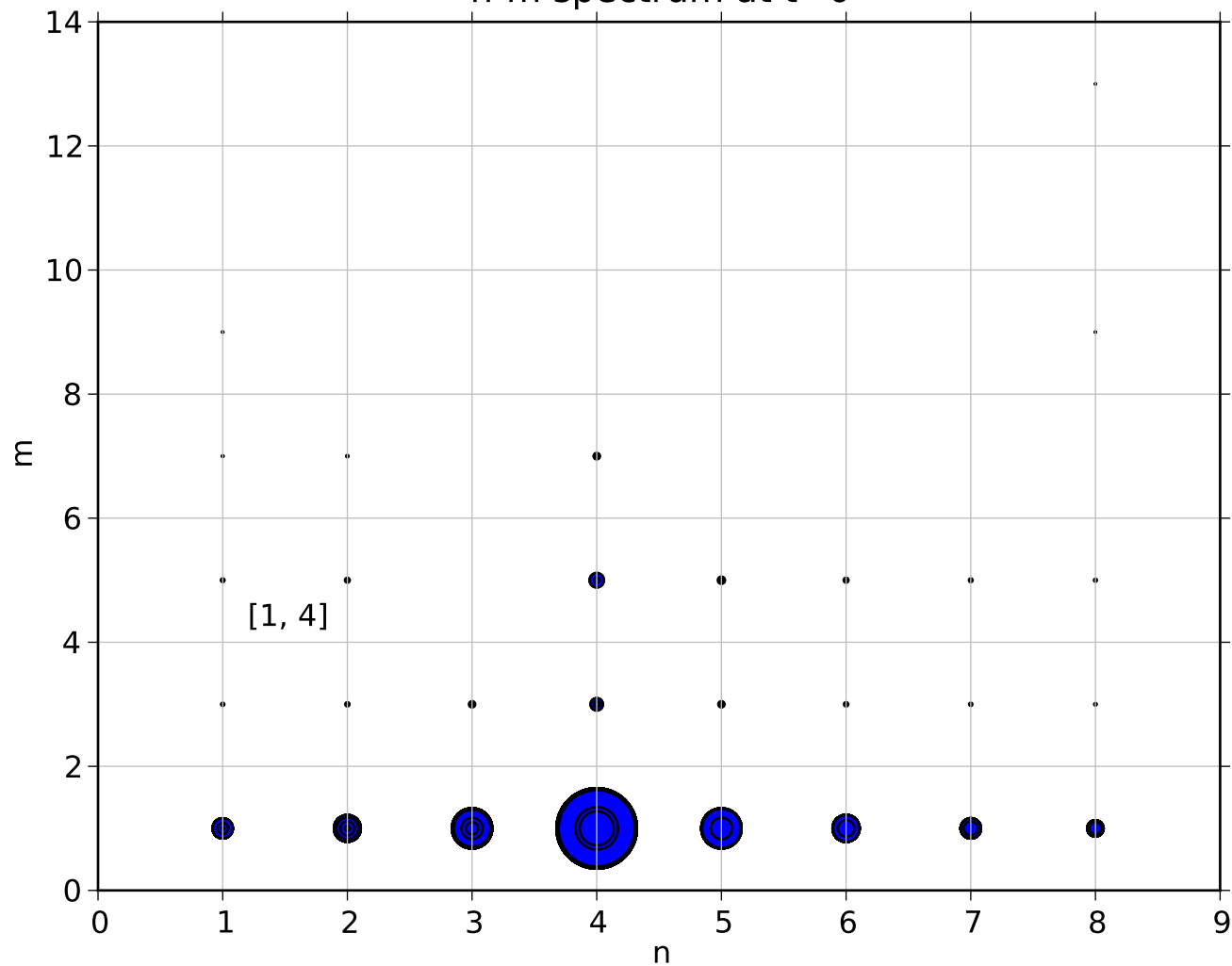
sig_par: [18695.37109375]

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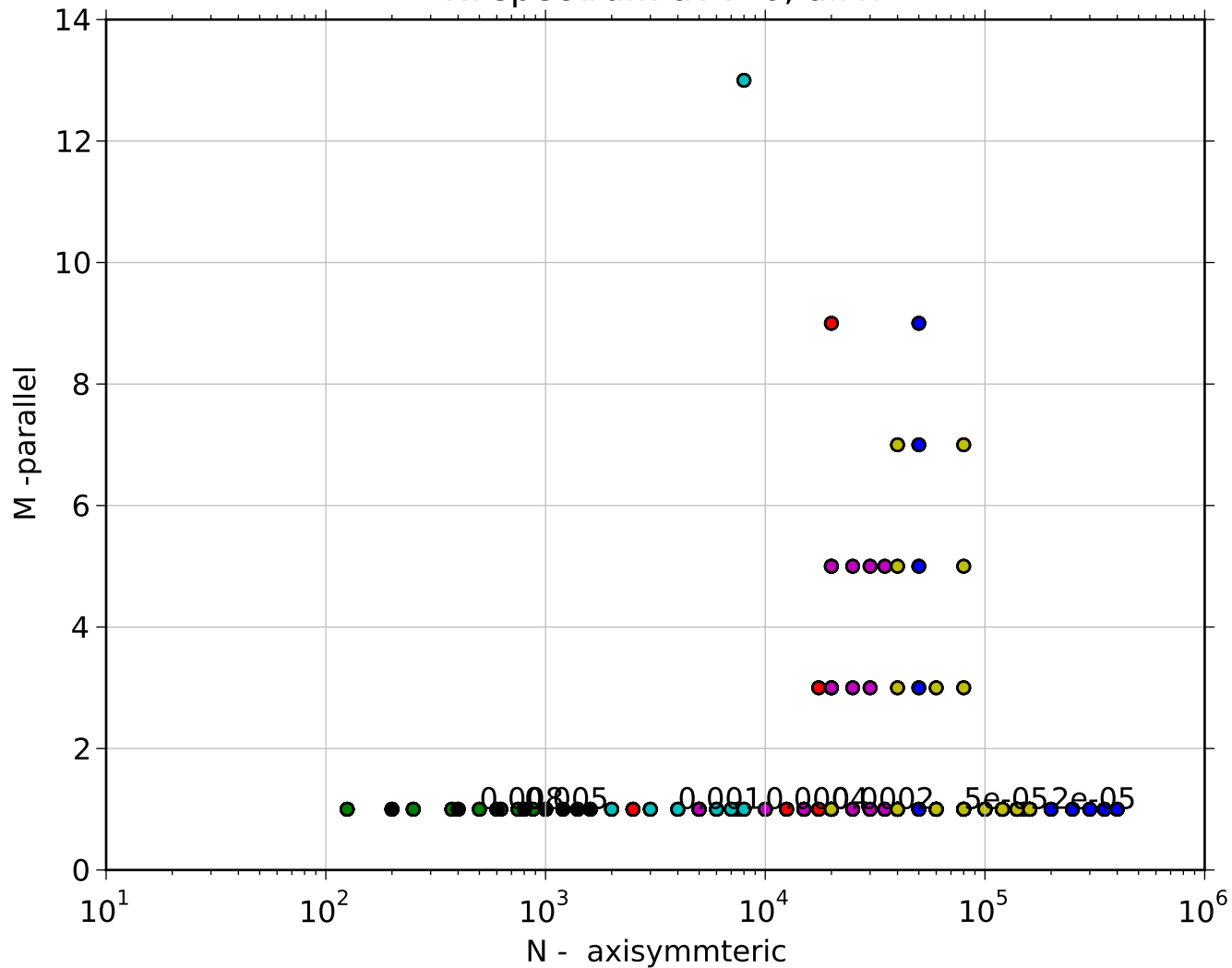
int physics_run(BoutReal t) { solve_phi_tridag(rho, phi, phi_flags); if(estatic || ZeroElMass) { Apar = 0.0;
} else { solve_apar_tridag(Ajpar, Apar, apar_flags); } mesh->communicate(comms); Nit = Ni0; Tit = Ti0; Tet
= Te0; Vit = Vi0; nu = nu_hat * Nit / (Tet^1.5); mu_i = mui_hat * Nit / (Tit^0.5); kapa_Te =
3.2*(1./fmei)*(wci/nueix)*(Tet^2.5); kapa_Ti = 3.9*(wci/nuiix)*(Tit^2.5); pei = (Te0+Ti0)*Ni + (Te +
Ti)*Ni0; pe = Te0*Ni + Te*Ni0; if(ZeroElMass) { jpar = ((Te0*Grad_par(Ni, CELL_YLOW)) -
(Ni0*Grad_par(phi, CELL_YLOW)))/(fmei*0.51*nu); jpar = lowPass(jpar,8); /* for(int
jx=MXG;jxngx-MXG;jx++) { for(int jy=MYG;jyngy-MYG;jy++) { for(int jz=0;jzngz;jz++) { jpar[jx][jy][jz]
= ( (Te0[jx][jy] * (Ni[jx][jy+1][jz] - Ni[jx][jy][jz])) - (Ni0[jx][jy] * (phi[jx][jy+1][jz] - phi[jx][jy][jz])) ) /
(fmei * 0.51 * nu[jx][jy][jz] * dy[jx][jy] * sqrt(mesh->g_22[jx][jy])); } } } */ jpar.applyBoundary();
mesh->communicate(jpar); Ve = Vi - jpar/Ni0; Ajpar = Ve; } else { Ve = Ajpar + Apar; jpar = Ni0*(Vi - Ve);
} ddt(Ni) = 0.0; if(evolve_ni) { ddt(Ni) -= vE_Grad(Ni0, phi); /* ddt(Ni) -= Vpar_Grad_par(Vi, Ni0) +
Vpar_Grad_par(Vi0, Ni) + Vpar_Grad_par(Vi, Ni); ddt(Ni) -= Ni0*Div_par(Vi) + Ni*Div_par(Vi0) +
Ni*Div_par(Vi); ddt(Ni) += Div_par(jpar); ddt(Ni) += 2.0*V_dot_Grad(b0xcv, pe); ddt(Ni) -=
2.0*(Ni0*V_dot_Grad(b0xcv, phi) + Ni*V_dot_Grad(b0xcv, phi0) + Ni*V_dot_Grad(b0xcv, phi)); */
ddt(Ni) = lowPass(ddt(Ni),8); } ddt(Vi) = 0.0; if(evolve_vi) { ddt(Vi) -= vE_Grad(Vi0, phi) + vE_Grad(Vi,
phi0) + vE_Grad(Vi, phi); ddt(Vi) -= Vpar_Grad_par(Vi0, Vi) + Vpar_Grad_par(Vi, Vi0) +
Vpar_Grad_par(Vi, Vi); ddt(Vi) -= Grad_par(pei)/Ni0; } ddt(Te) = 0.0; if(evolve_te) { ddt(Te) -=
vE_Grad(Te0, phi) + vE_Grad(Te, phi0) + vE_Grad(Te, phi); ddt(Te) -= Vpar_Grad_par(Ve, Te0) +
Vpar_Grad_par(Ve0, Te) + Vpar_Grad_par(Ve, Te); ddt(Te) += 1.333*Te0*( V_dot_Grad(b0xcv, pe)/Ni0 -
V_dot_Grad(b0xcv, phi) ); ddt(Te) += 3.333*Te0*V_dot_Grad(b0xcv, Te); ddt(Te) +=
(0.6666667/Ni0)*Div_par_K_Grad_par(kapa_Te, Te); } ddt(Ti) = 0.0; if(evolve_ti) { ddt(Ti) -=
vE_Grad(Ti0, phi) + vE_Grad(Ti, phi0) + vE_Grad(Ti, phi); ddt(Ti) -= Vpar_Grad_par(Vi, Ti0) +
Vpar_Grad_par(Vi0, Ti) + Vpar_Grad_par(Vi, Ti); ddt(Ti) += 1.333*( Ti0*V_dot_Grad(b0xcv, pe)/Ni0 -
Ti*V_dot_Grad(b0xcv, phi) ); ddt(Ti) -= 3.333*Ti0*V_dot_Grad(b0xcv, Ti); ddt(Ti) +=
(0.6666667/Ni0)*Div_par_K_Grad_par(kapa_Ti, Ti); } ddt(rho) = 0.0; if(evolve_rho) { /* ddt(rho) -=
vE_Grad(rho0, phi) + vE_Grad(rho, phi0) + vE_Grad(rho, phi); ddt(rho) -= Vpar_Grad_par(Vi, rho0) +
Vpar_Grad_par(Vi0, rho) + Vpar_Grad_par(Vi, rho); */ ddt(rho) += mesh->Bxy*mesh->Bxy*Div_par(jpar,
CELL_CENTRE); ddt(rho) = smooth_y(ddt(rho)); /* for(int jx=MXG;jxngx-MXG;jx++) { for(int
jy=MYG;jyngy-MYG;jy++) { for(int jz=0;jzngz;jz++) { ddt(rho)[jx][jy][jz] = Bxy[jx][jy]*Bxy[jx][jy] *
(jpar[jx][jy+1][jz] - jpar[jx][jy][jz]) / (dy[jx][jy] * sqrt(mesh->g_22[jx][jy])); } } } */ ddt(Ajpar) = 0.0;
if(evolve_ajpar) { /* for(int jx=MXG;jxngx-MXG;jx++) { for(int jy=MYG;jyngy-MYG;jy++) { for(int
jz=0;jzngz;jz++) { ddt(Ajpar)[jx][jy][jz] += (1./fmei) * (phi[jx][jy][jz] - phi[jx][jy-1][jz]) / (dy[jx][jy] *
sqrt(mesh->g_22[jx][jy])); ddt(Ajpar)[jx][jy][jz] -= (1./fmei)*(Te0[jx][jy]/Ni0[jx][jy])*(Ni[jx][jy][jz] -
Ni[jx][jy-1][jz]) / (dy[jx][jy] * sqrt(mesh->g_22[jx][jy])); } } } */ ddt(Ajpar) += (1./fmei)*Grad_par(phi,
CELL_YLOW); ddt(Ajpar) -= (1./fmei)*(Te0/Ni0)*Grad_par(Ni, CELL_YLOW); ddt(Ajpar) +=
0.51*interp_to(nu, CELL_YLOW)*jpar/Ni0; }

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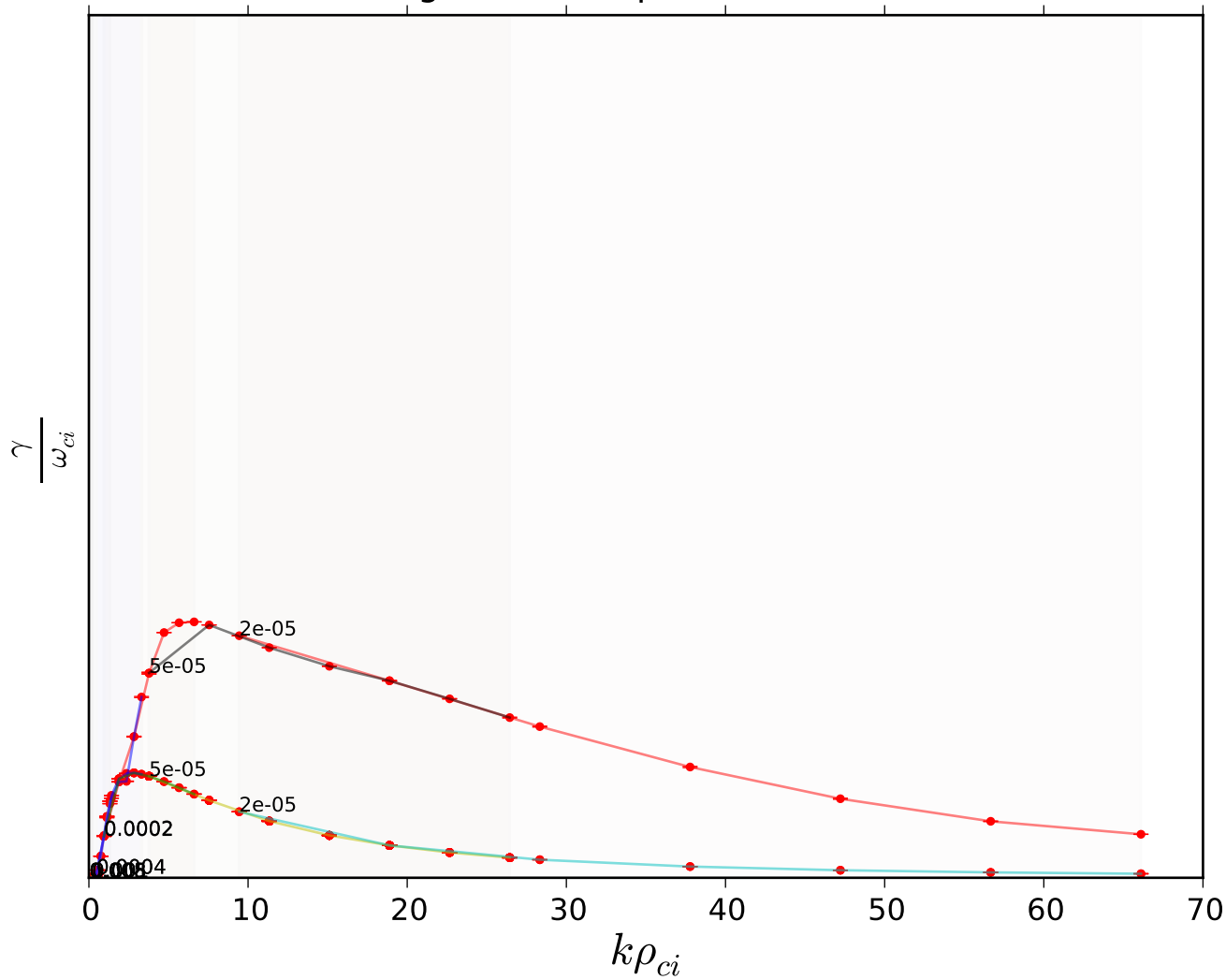
n-m spectrum at t=0



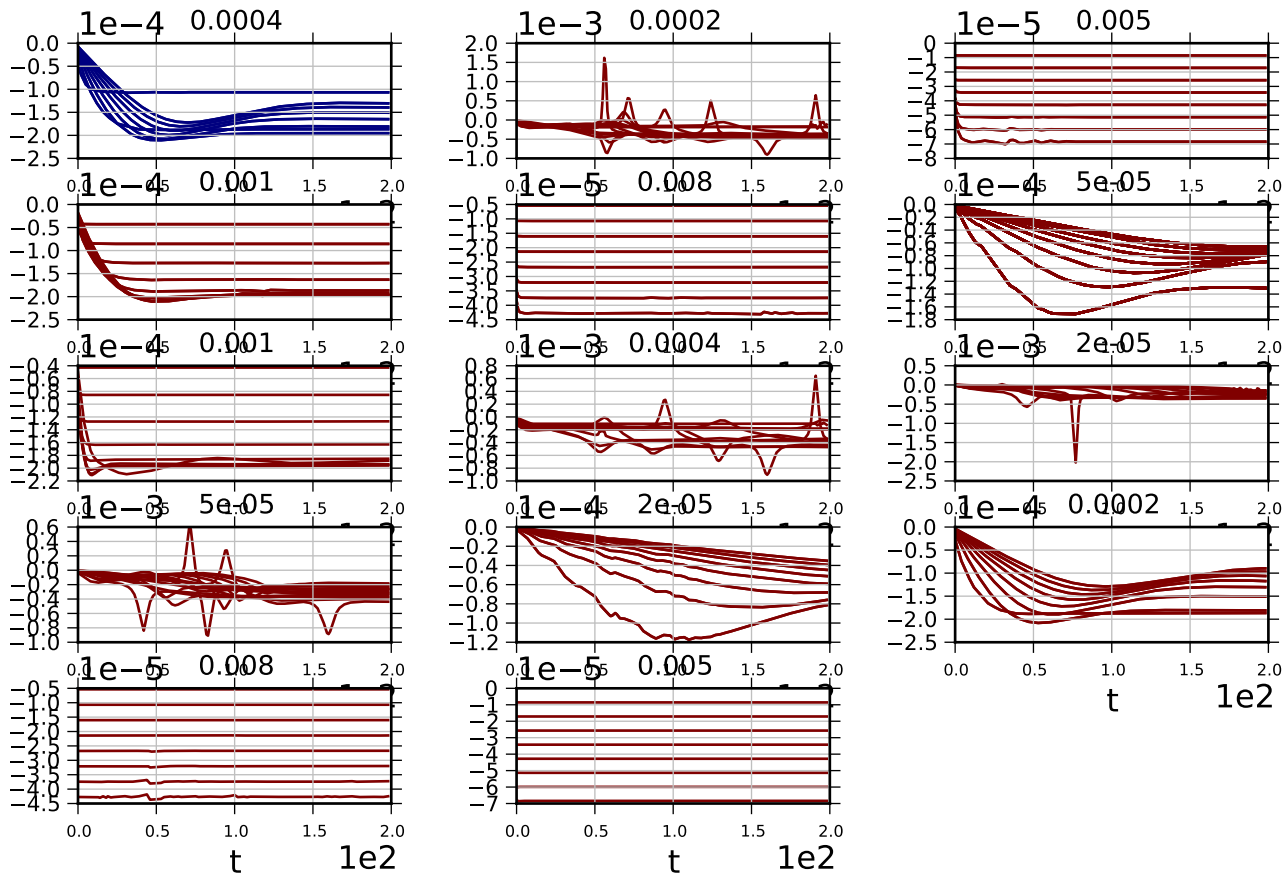
Ni spectrum at t=0, all x



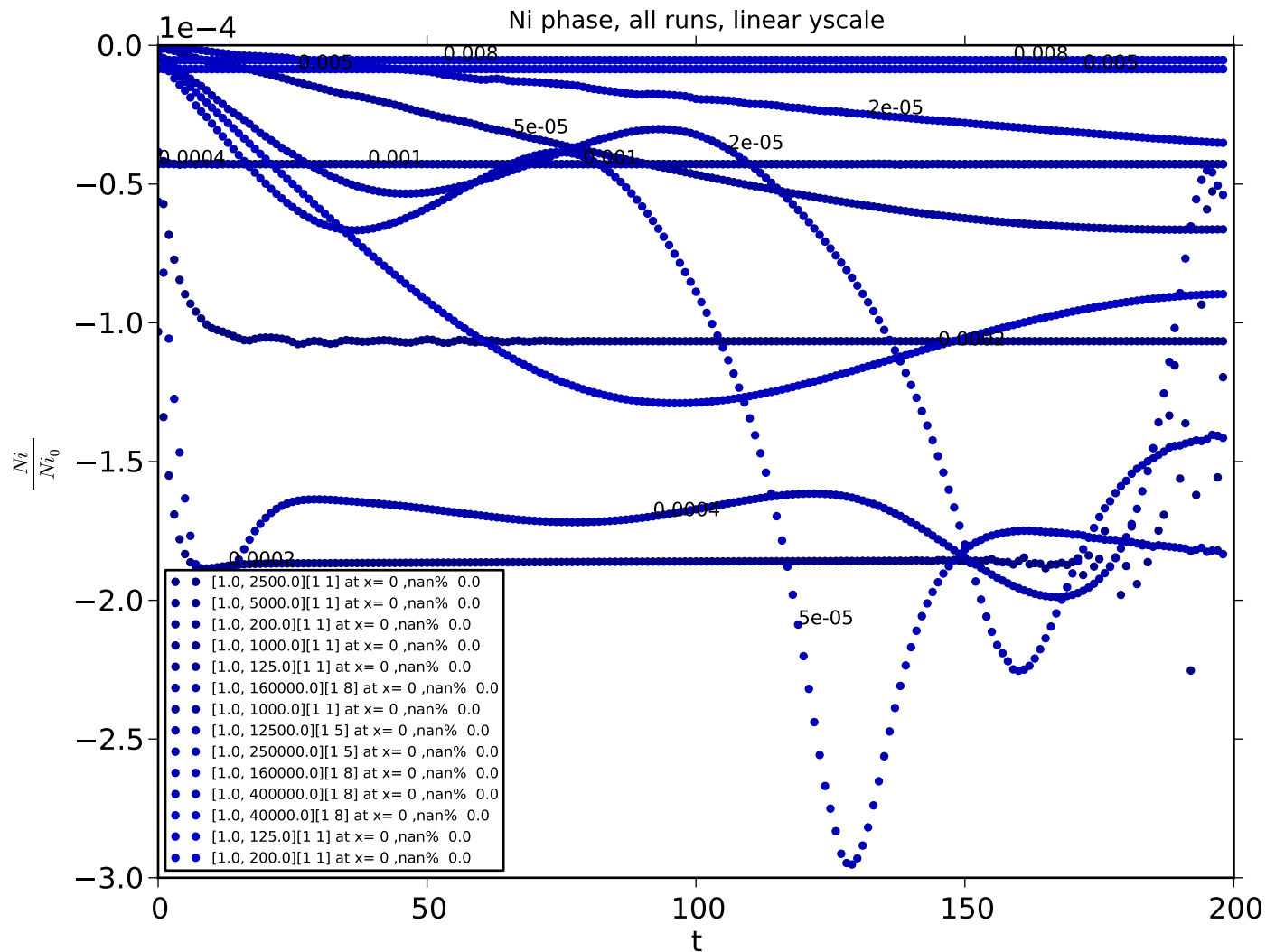
gamma computed from Ni



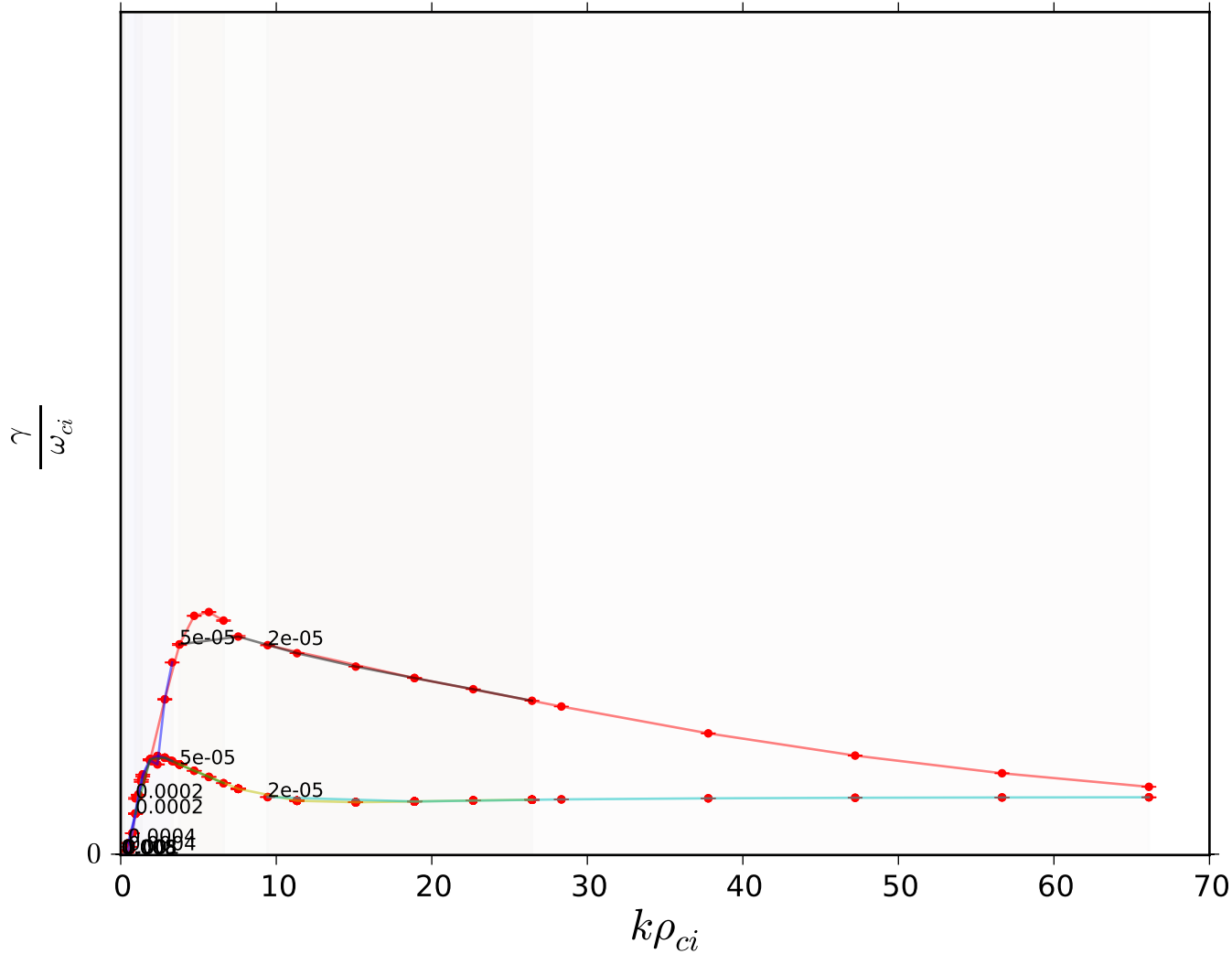
Dominant mode phase for Ni



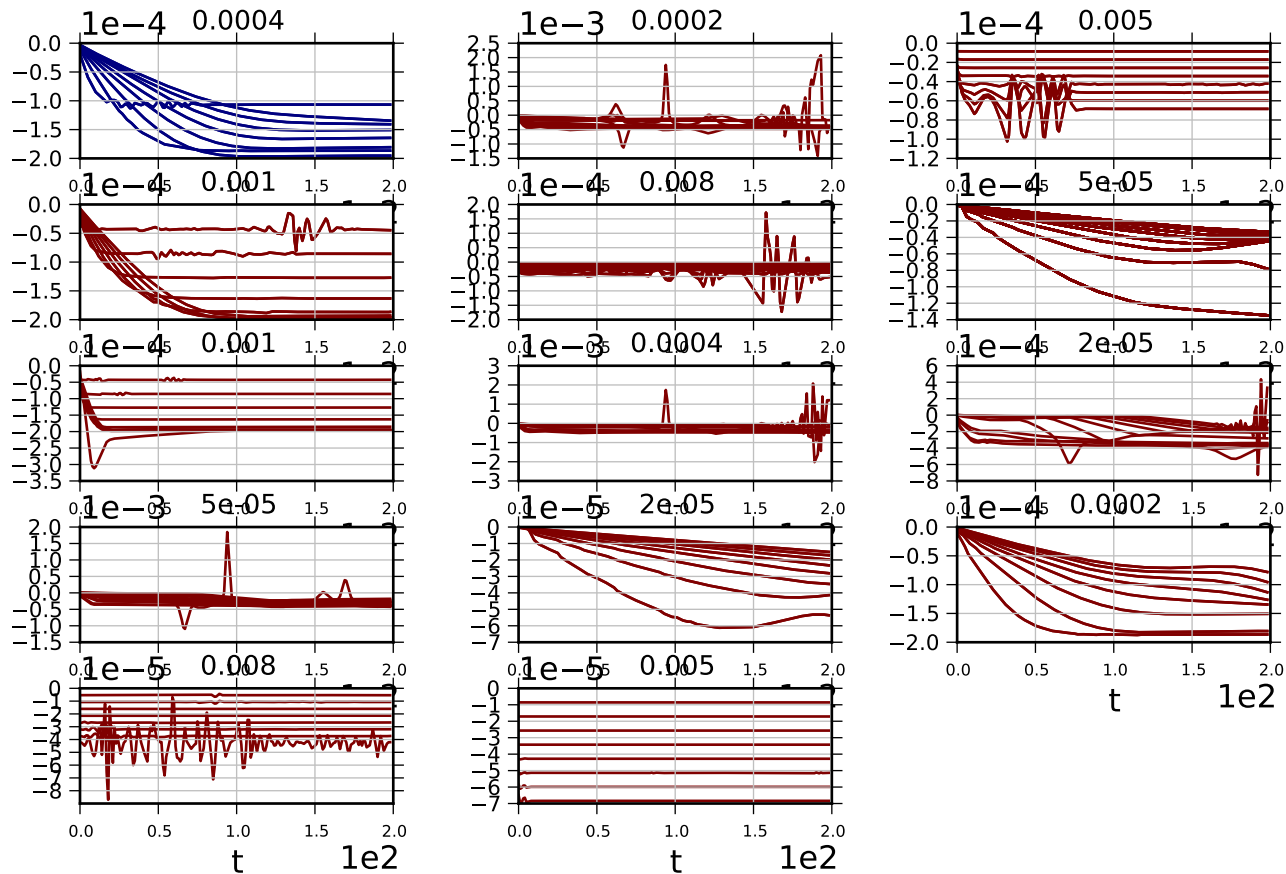
Dominant mode behavior for Ni



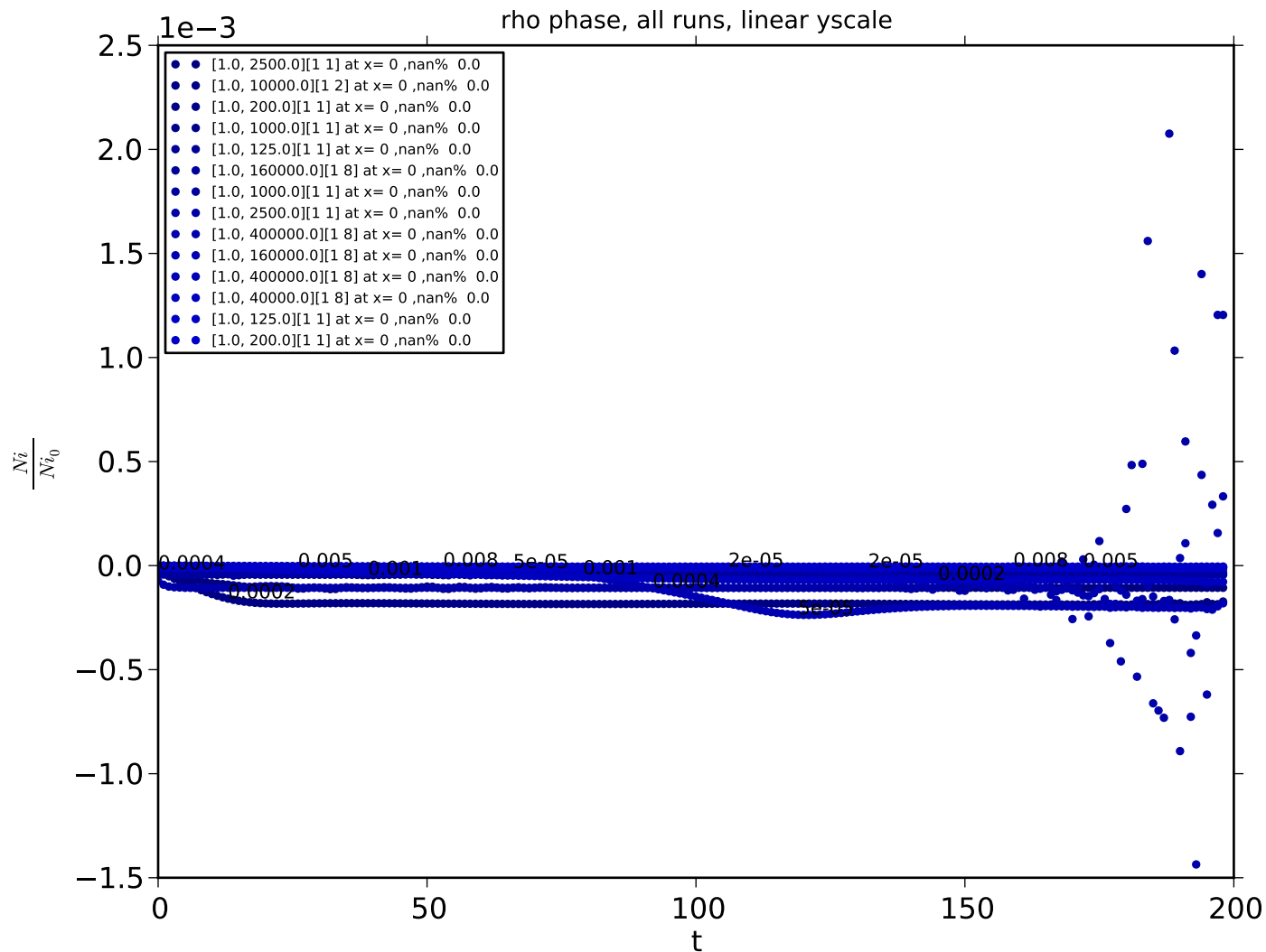
gamma computed from rho



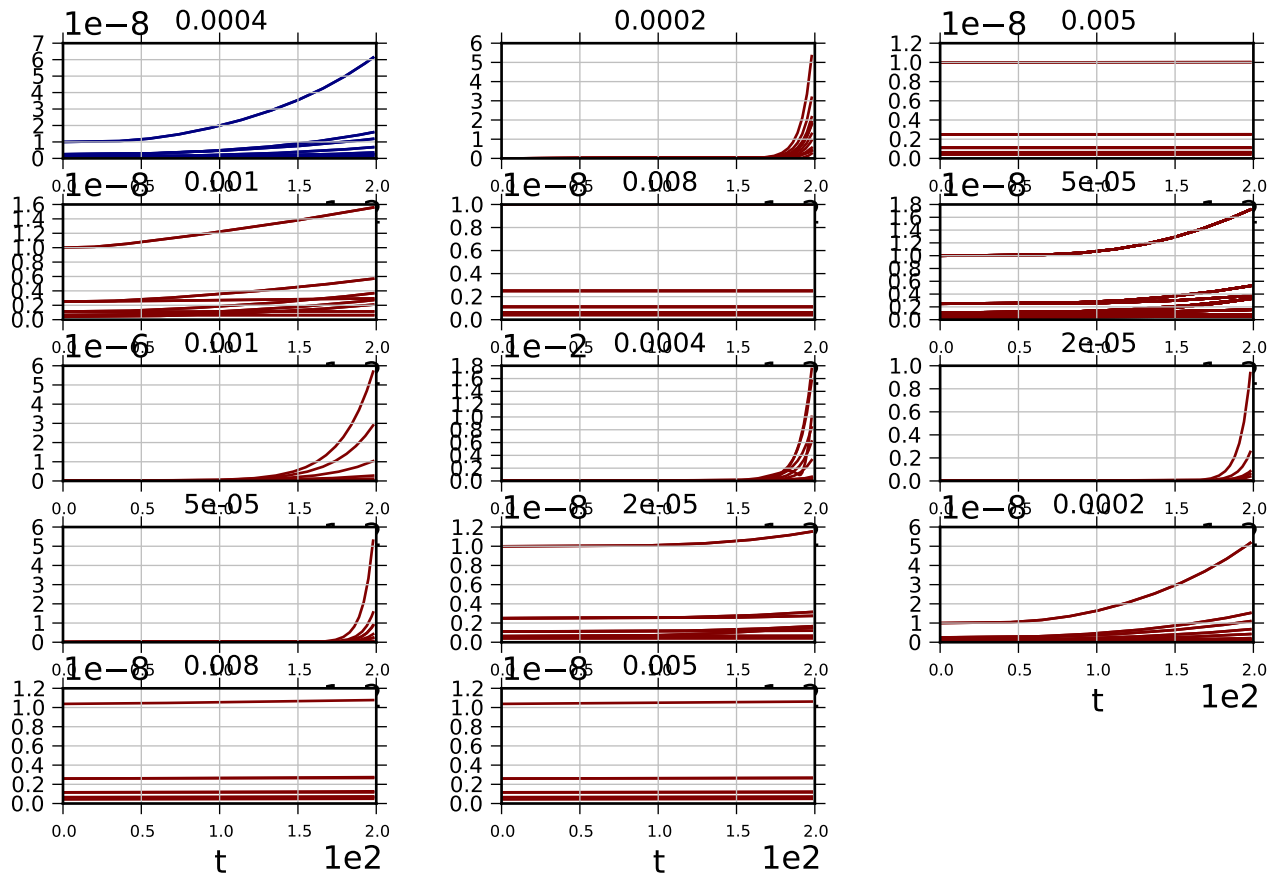
Dominant mode phase for rho



Dominant mode behavior for rho

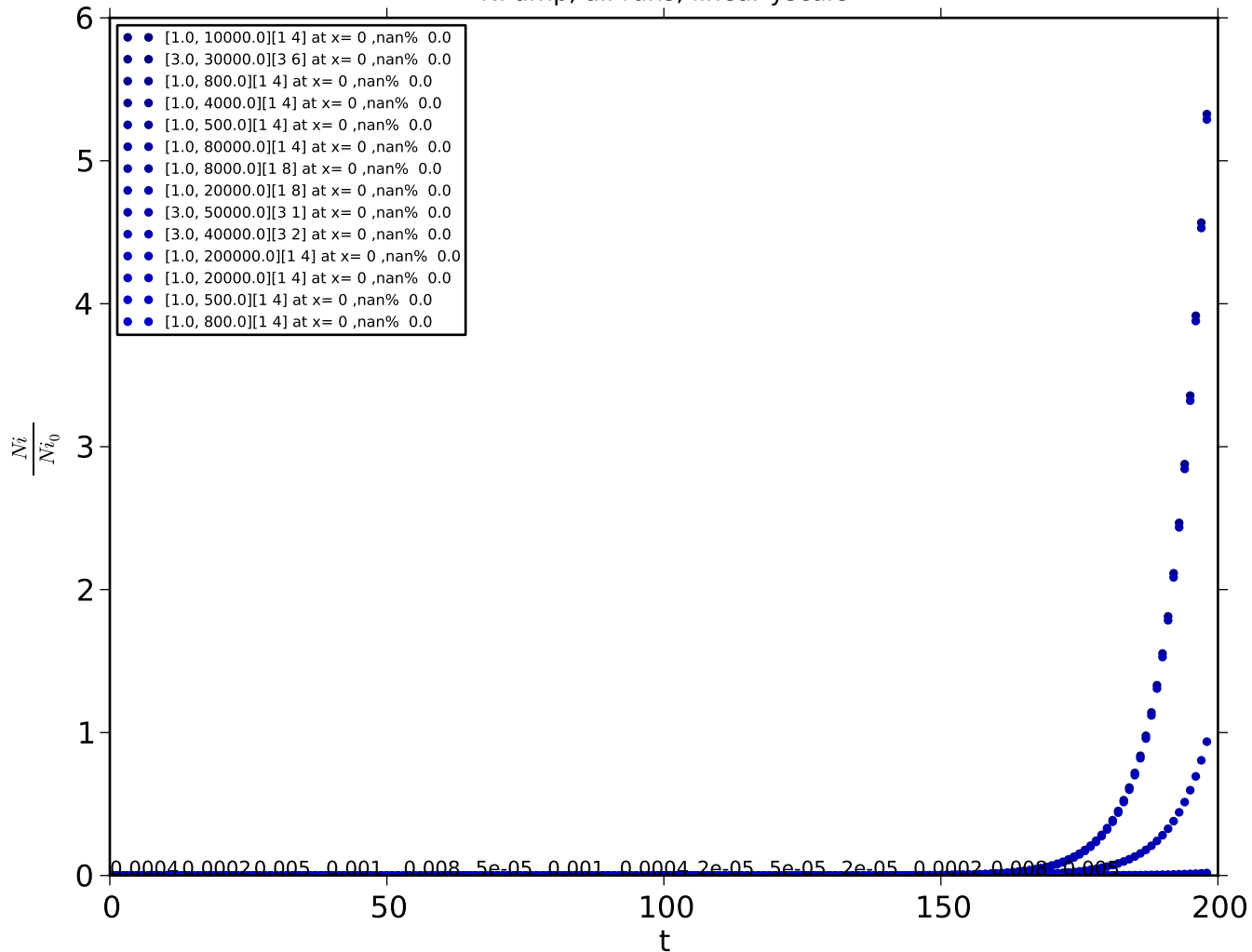


Dominant mode amp for Ni

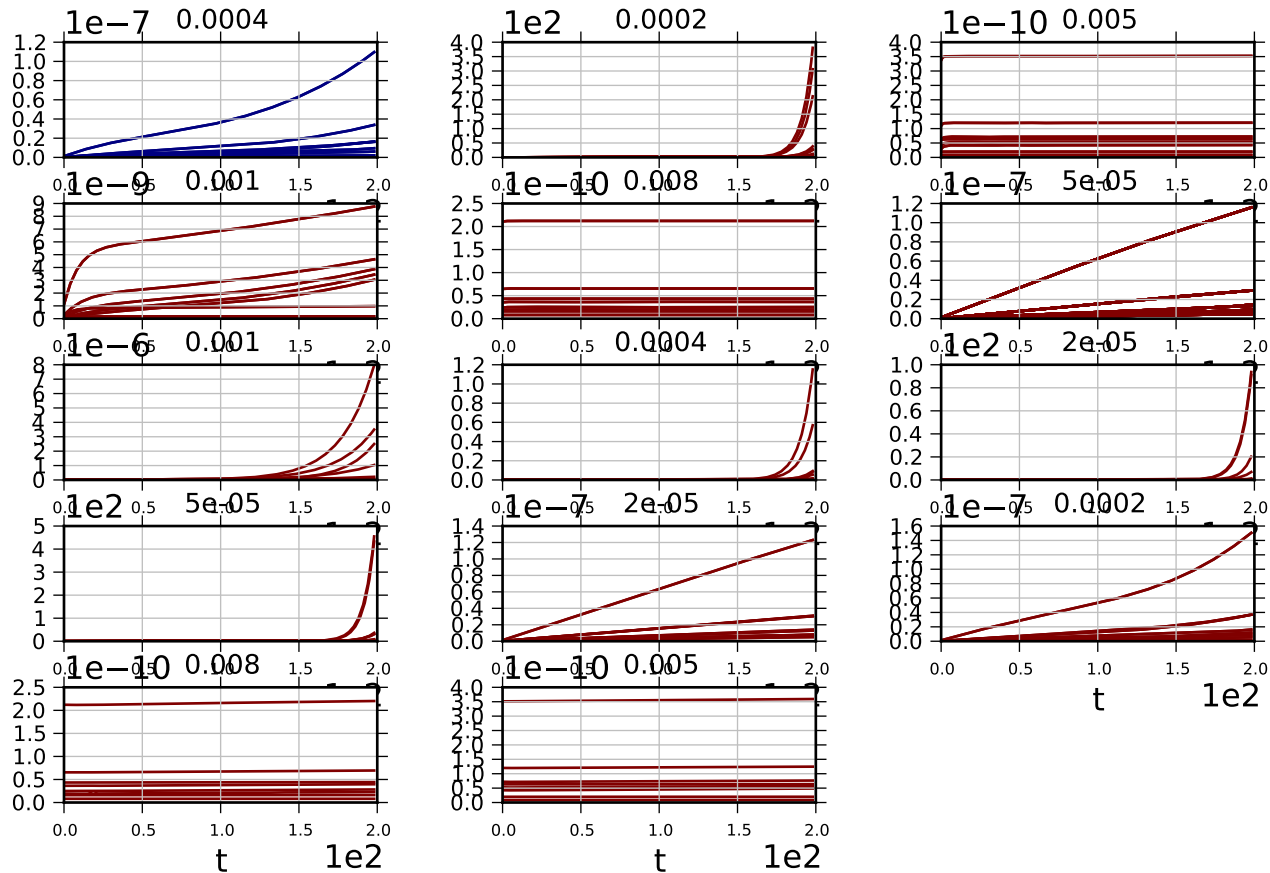


Dominant mode behavior for Ni

Ni amp, all runs, linear yscale

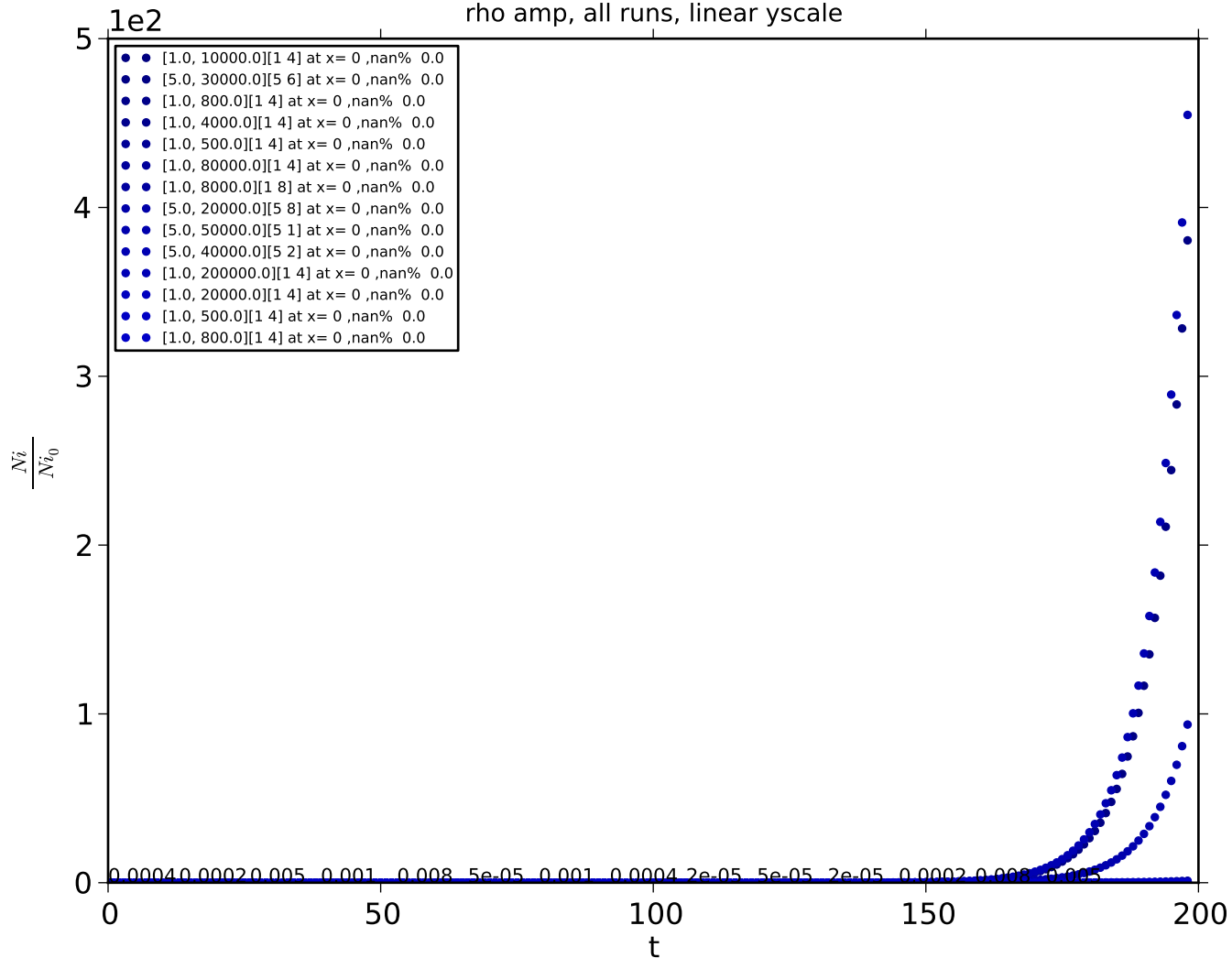


Dominant mode amp for rho

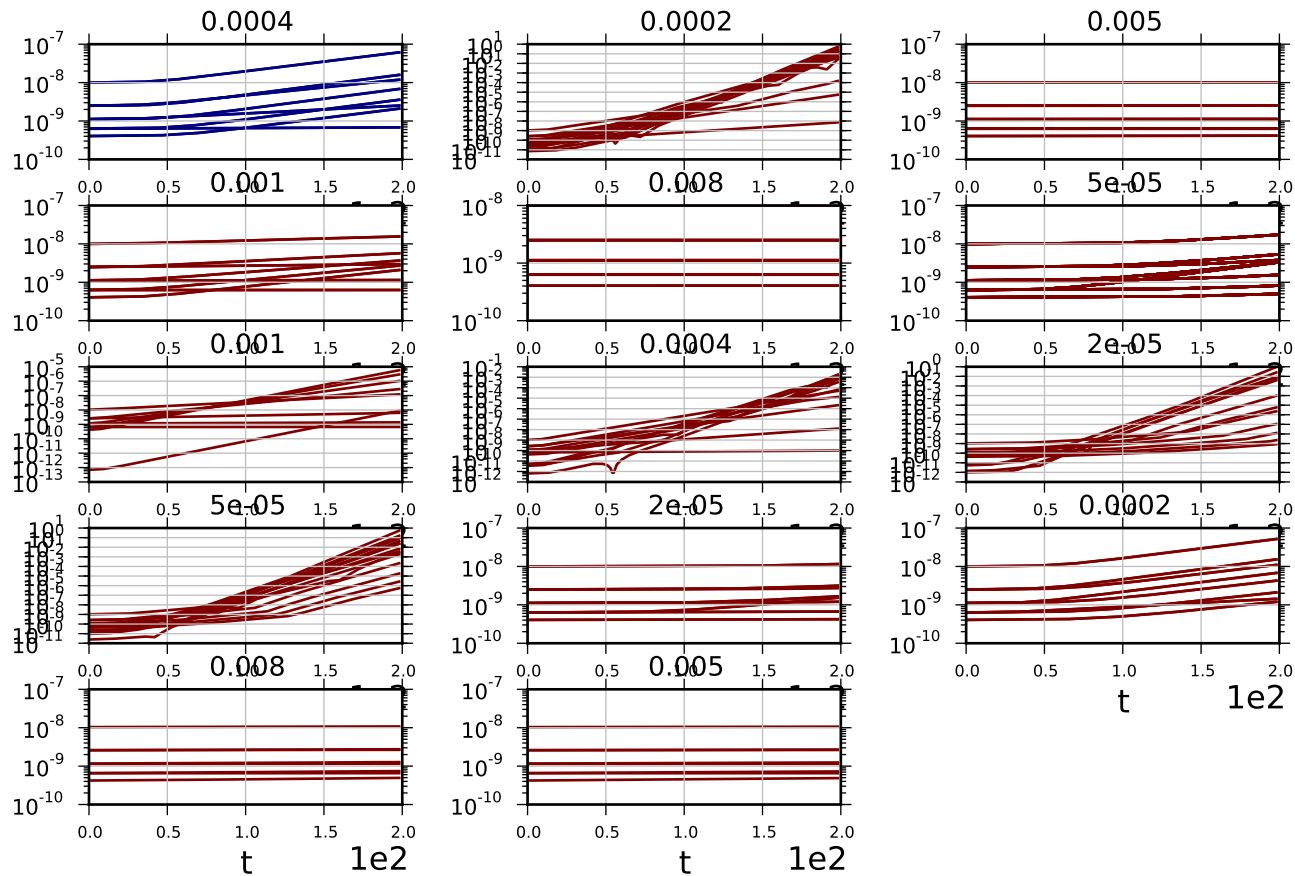


Dominant mode behavior for rho

rho amp, all runs, linear yscale

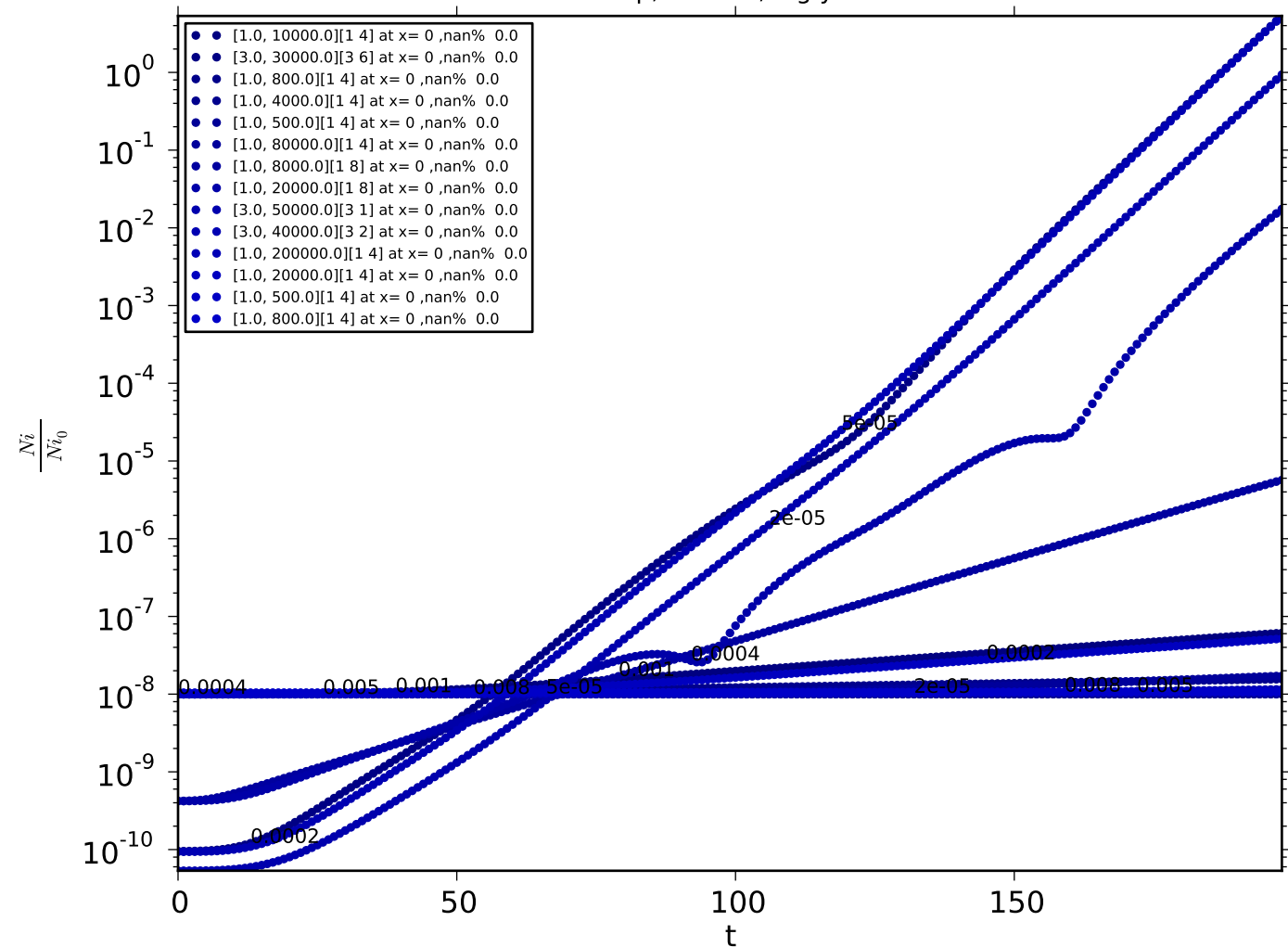


Dominant mode amp for Ni

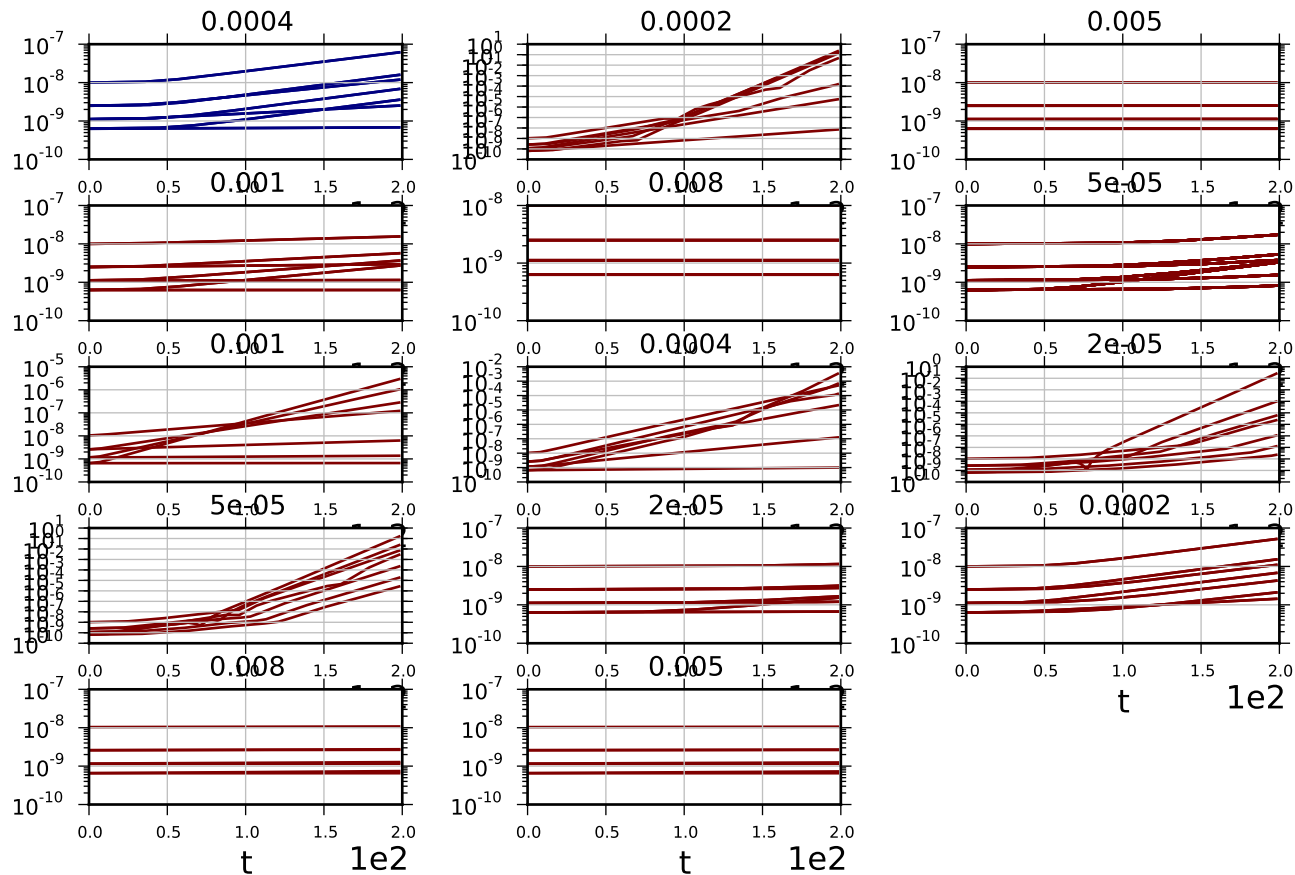


Dominant mode behavior for Ni

Ni amp, all runs, log yscale

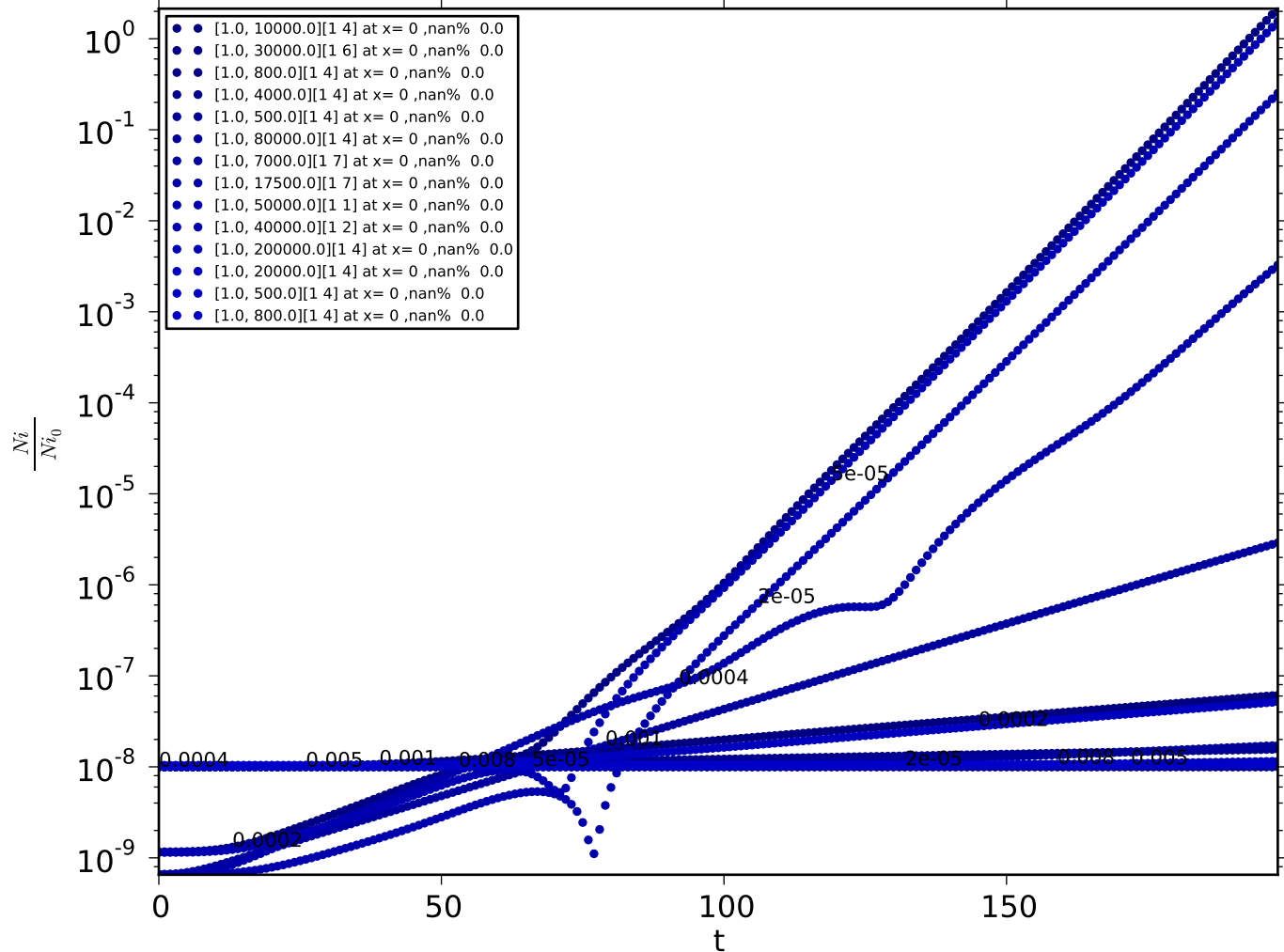


Dominant mode amp for Ni

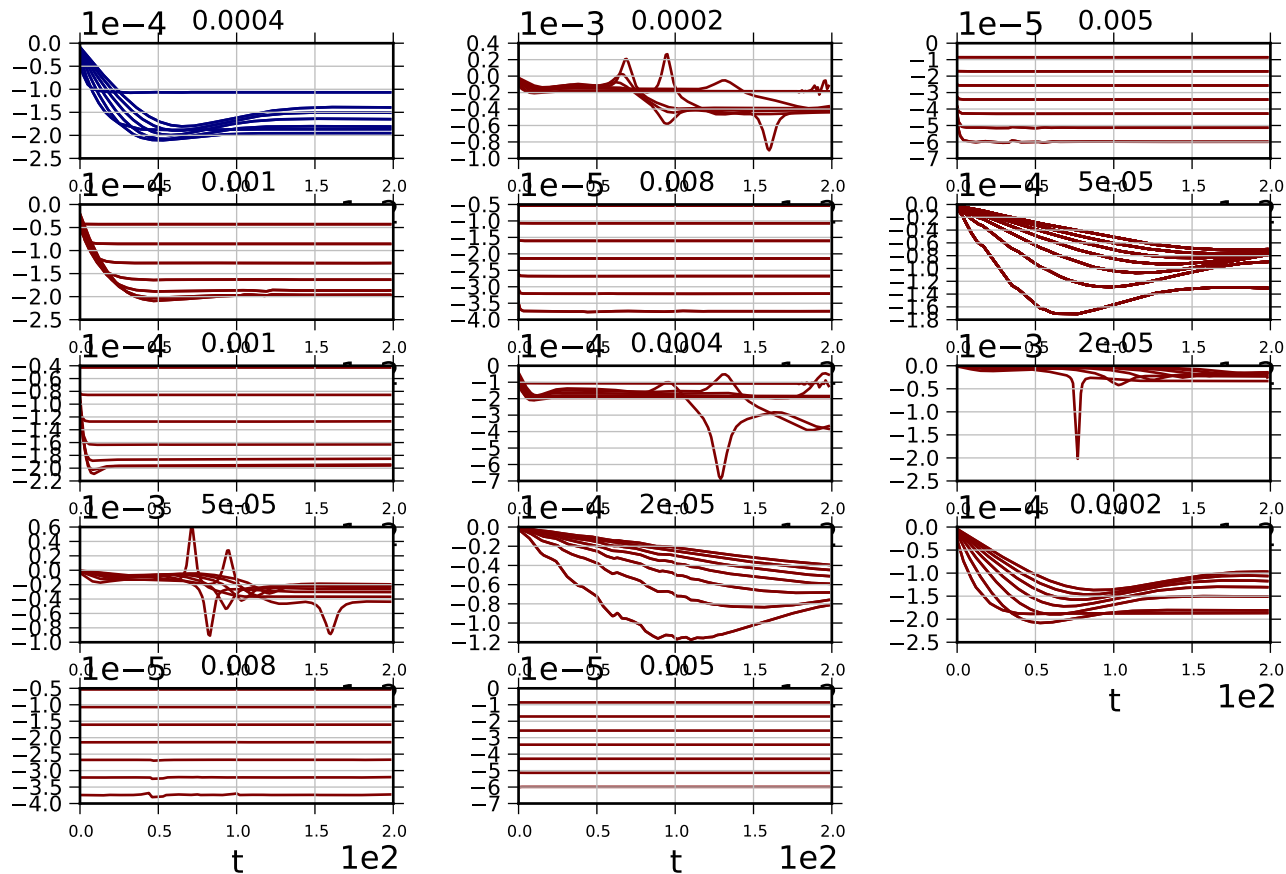


Dominant mode behavior for Ni

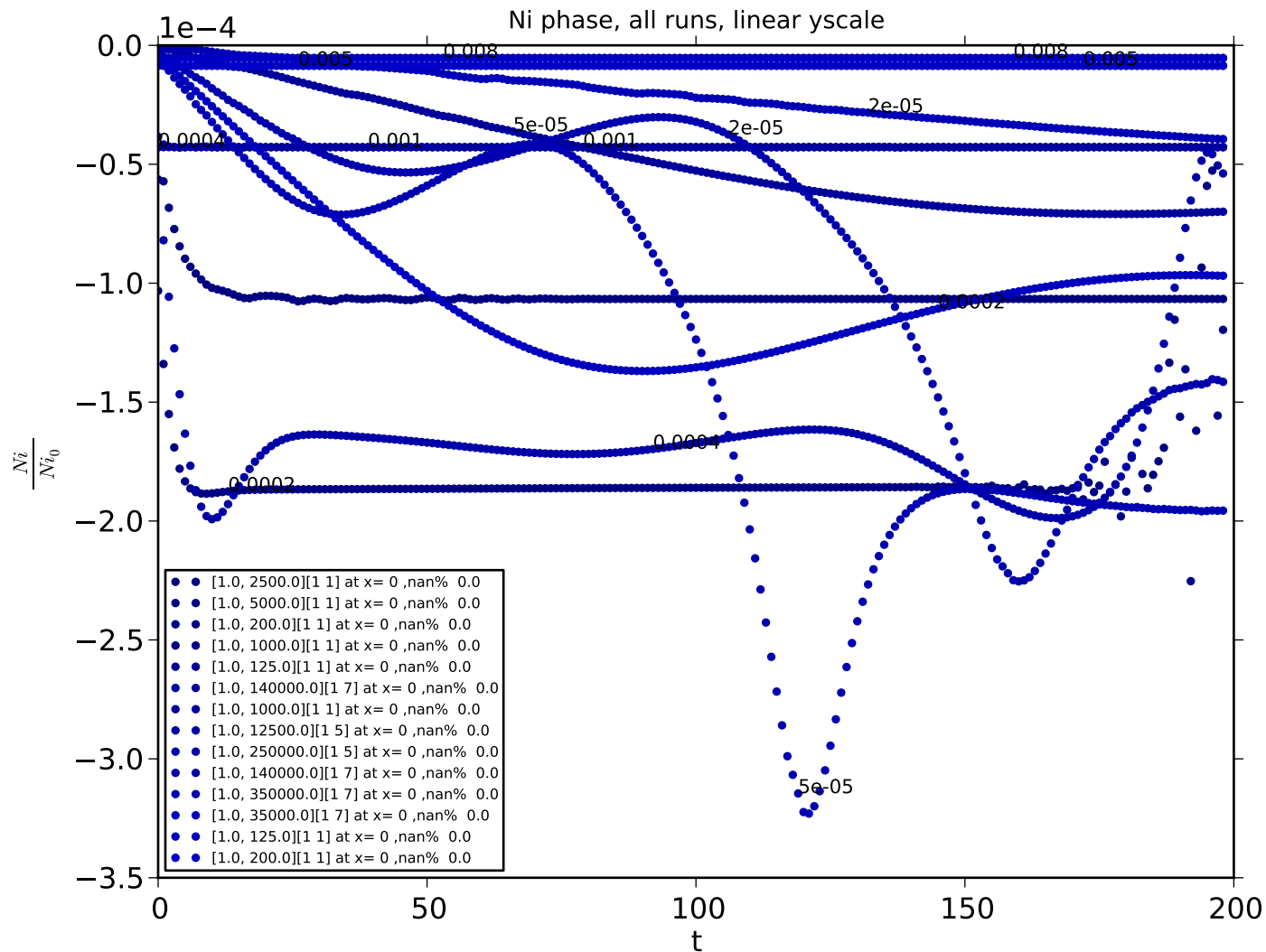
Ni amp, all runs, log yscale



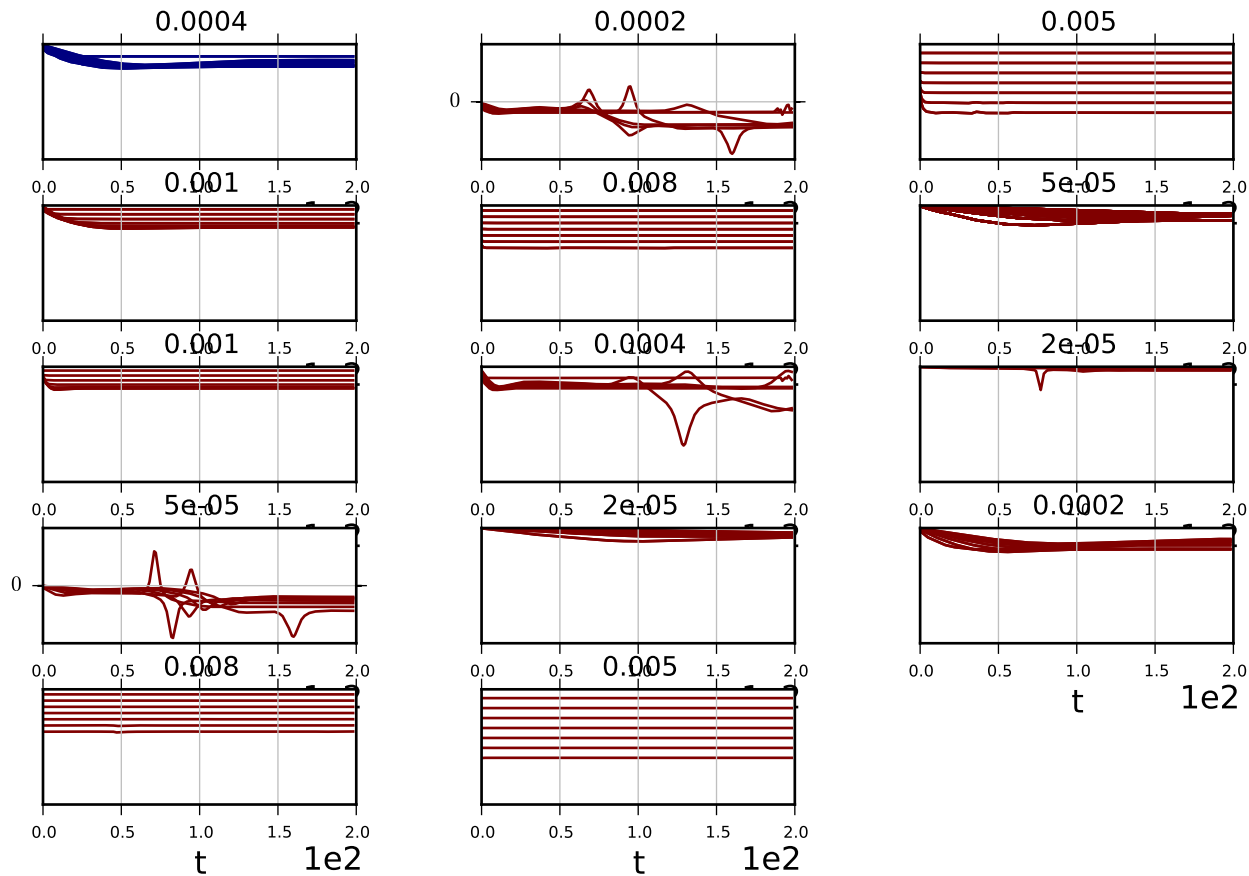
Dominant mode phase for Ni



Dominant mode behavior for Ni

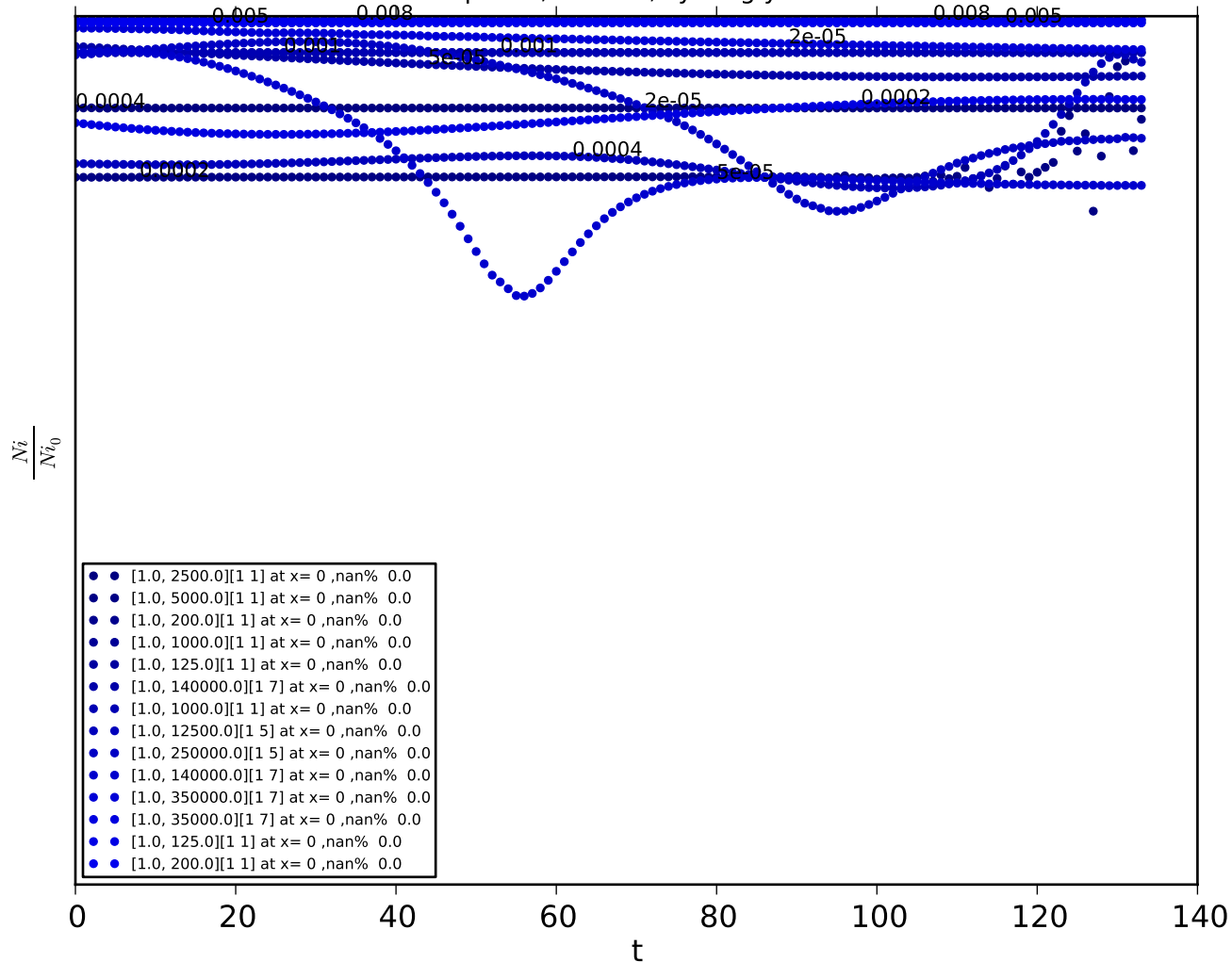


Dominant mode phase for Ni

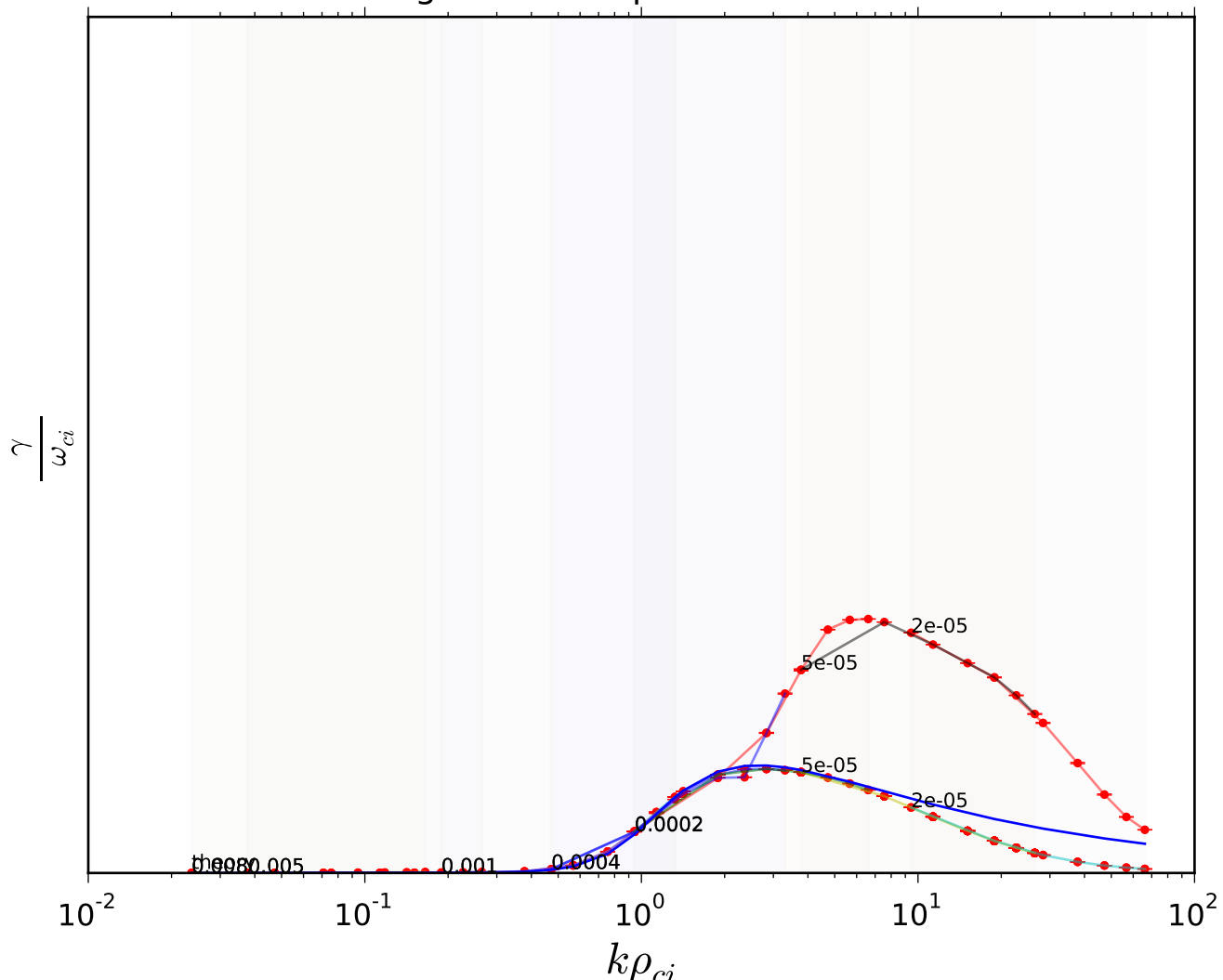


Dominant mode behavior for Ni

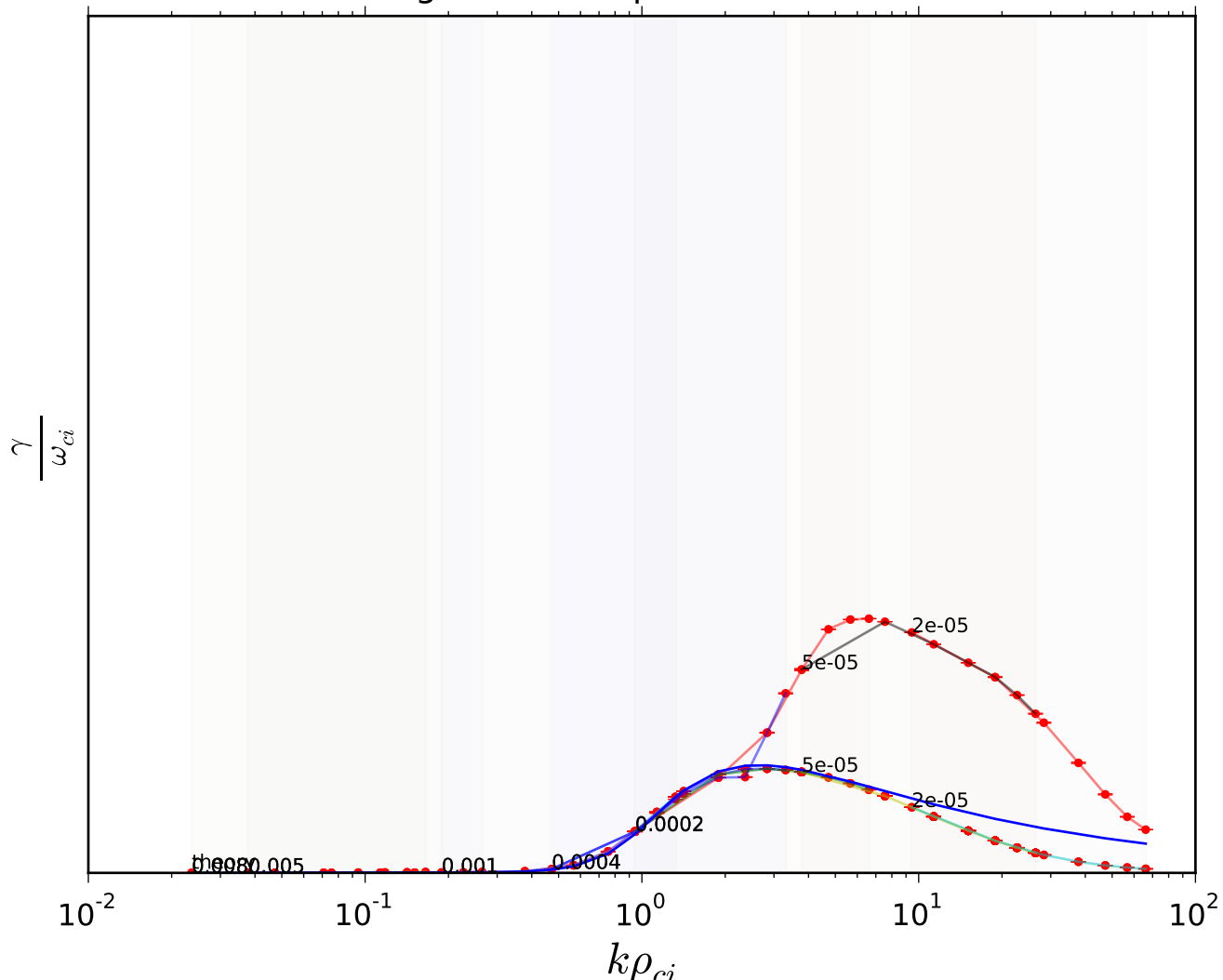
Ni phase, all runs, symlog yscale



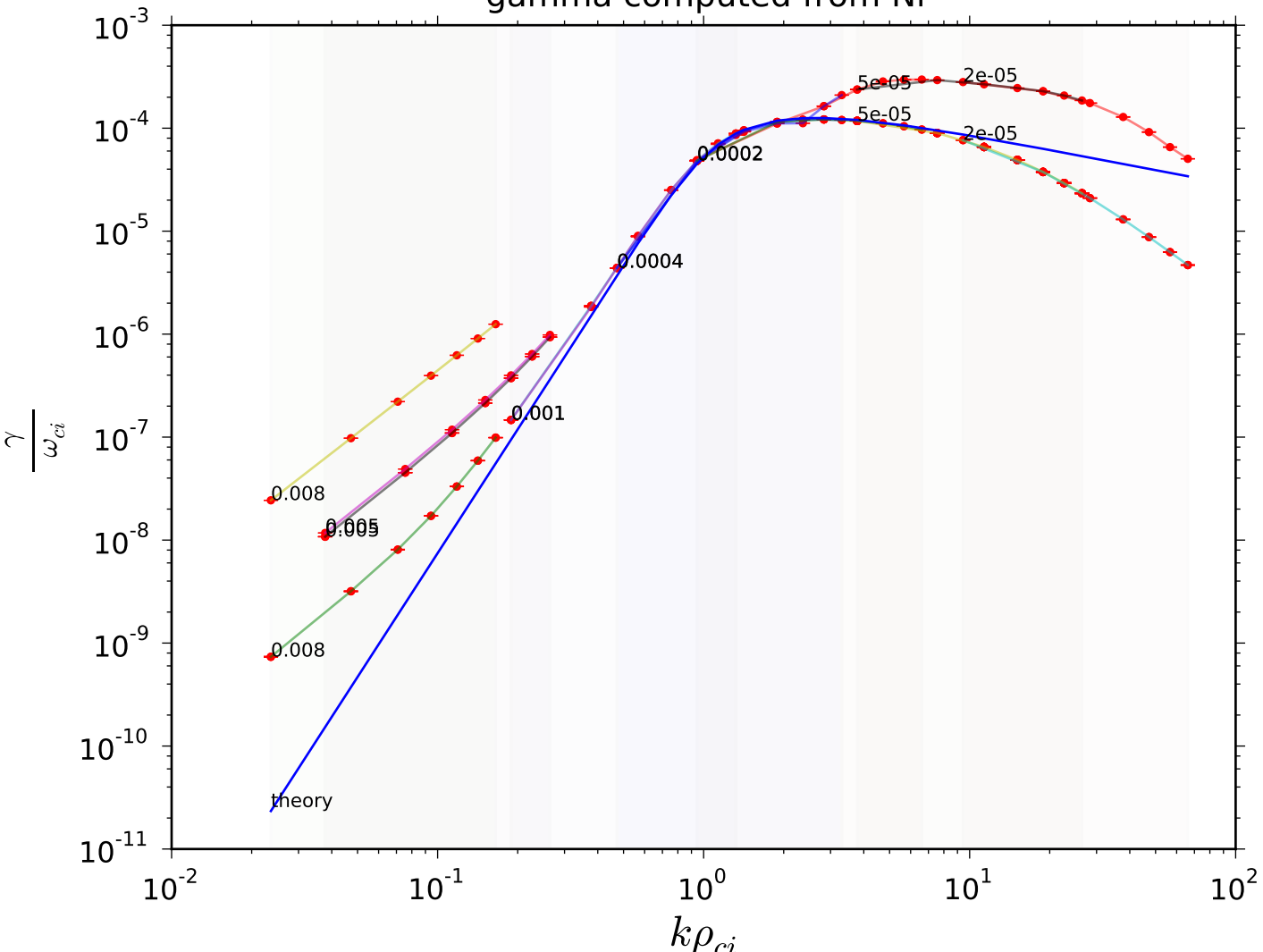
gamma computed from Ni

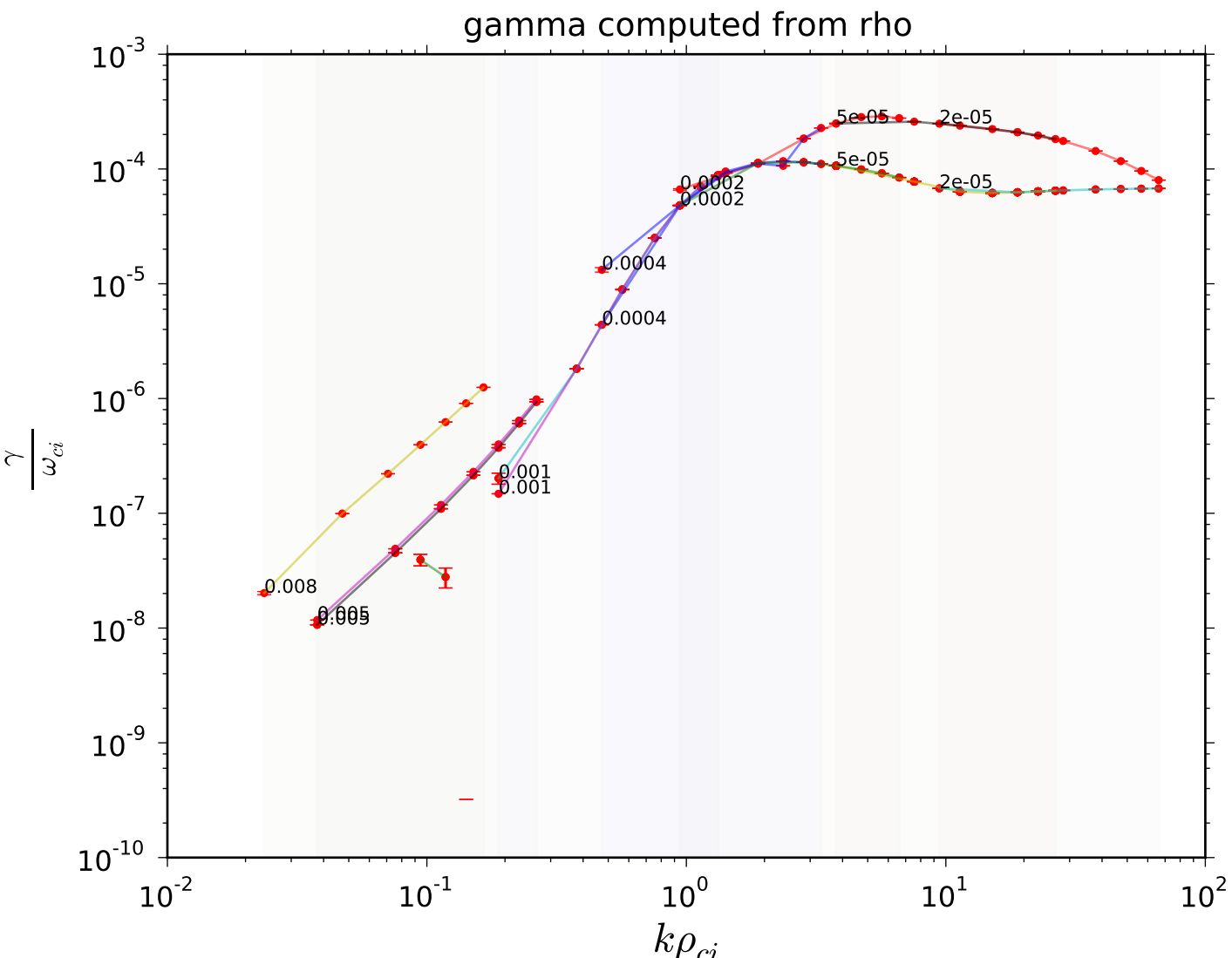


gamma computed from Ni

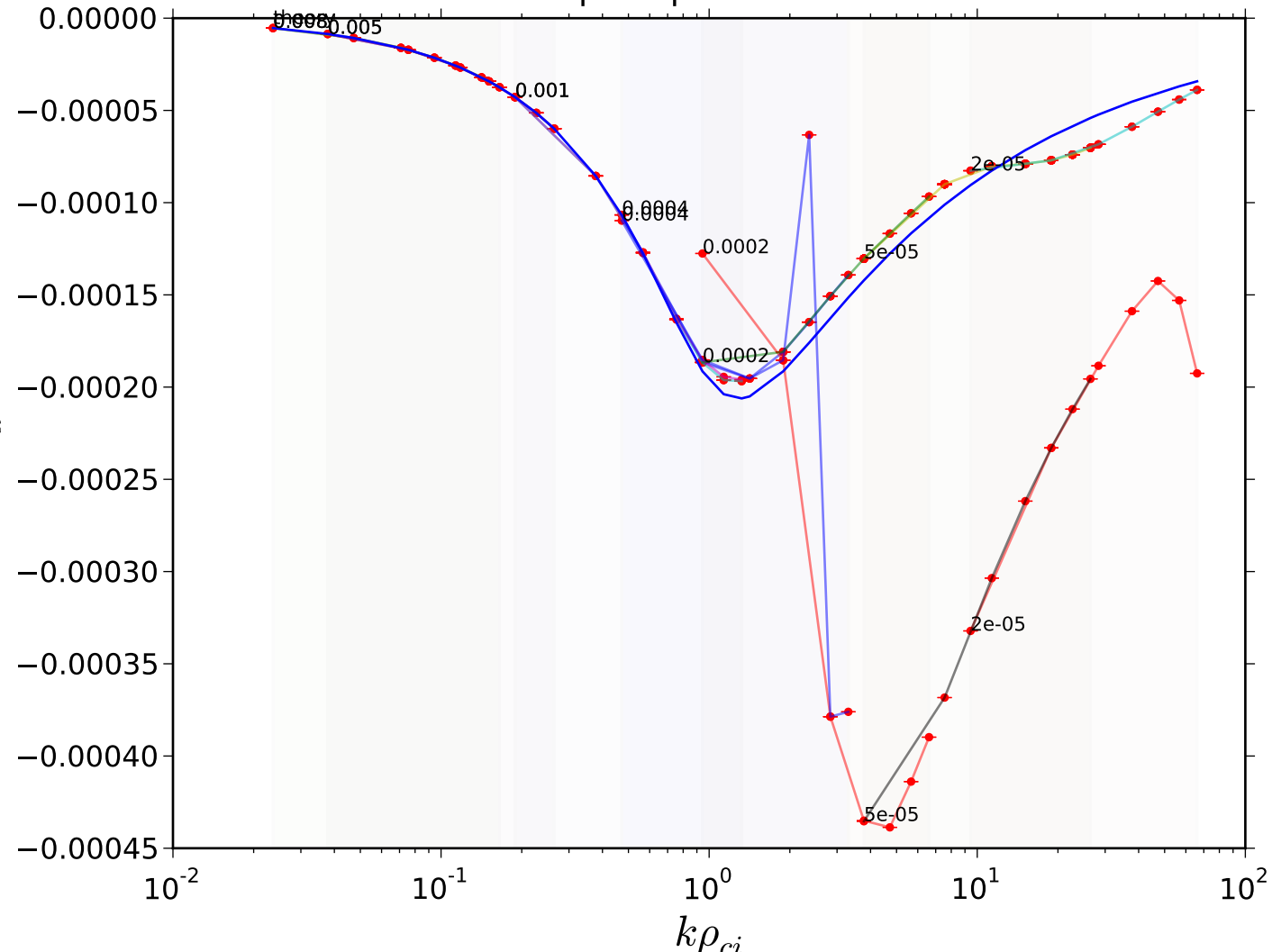


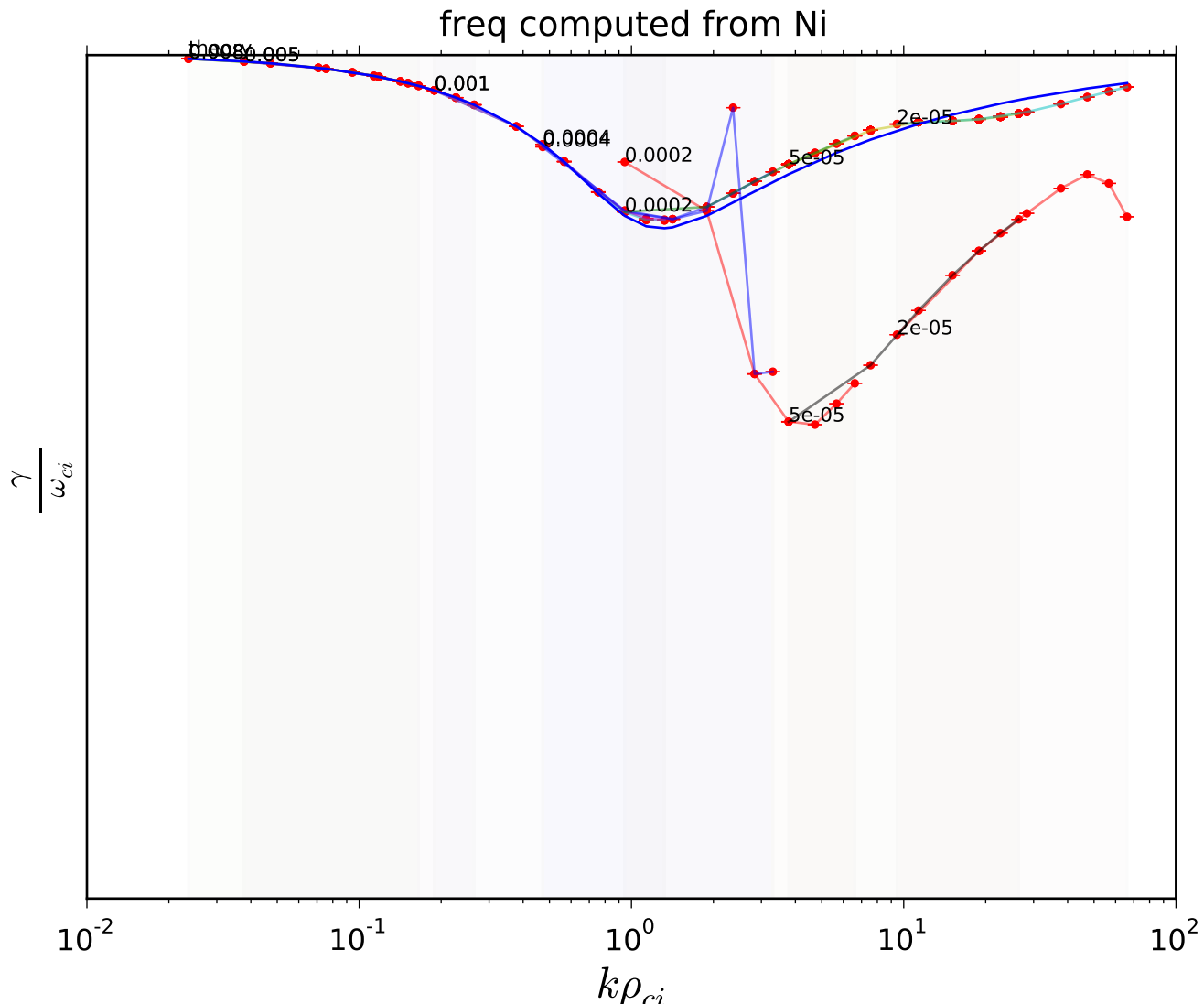
gamma computed from Ni

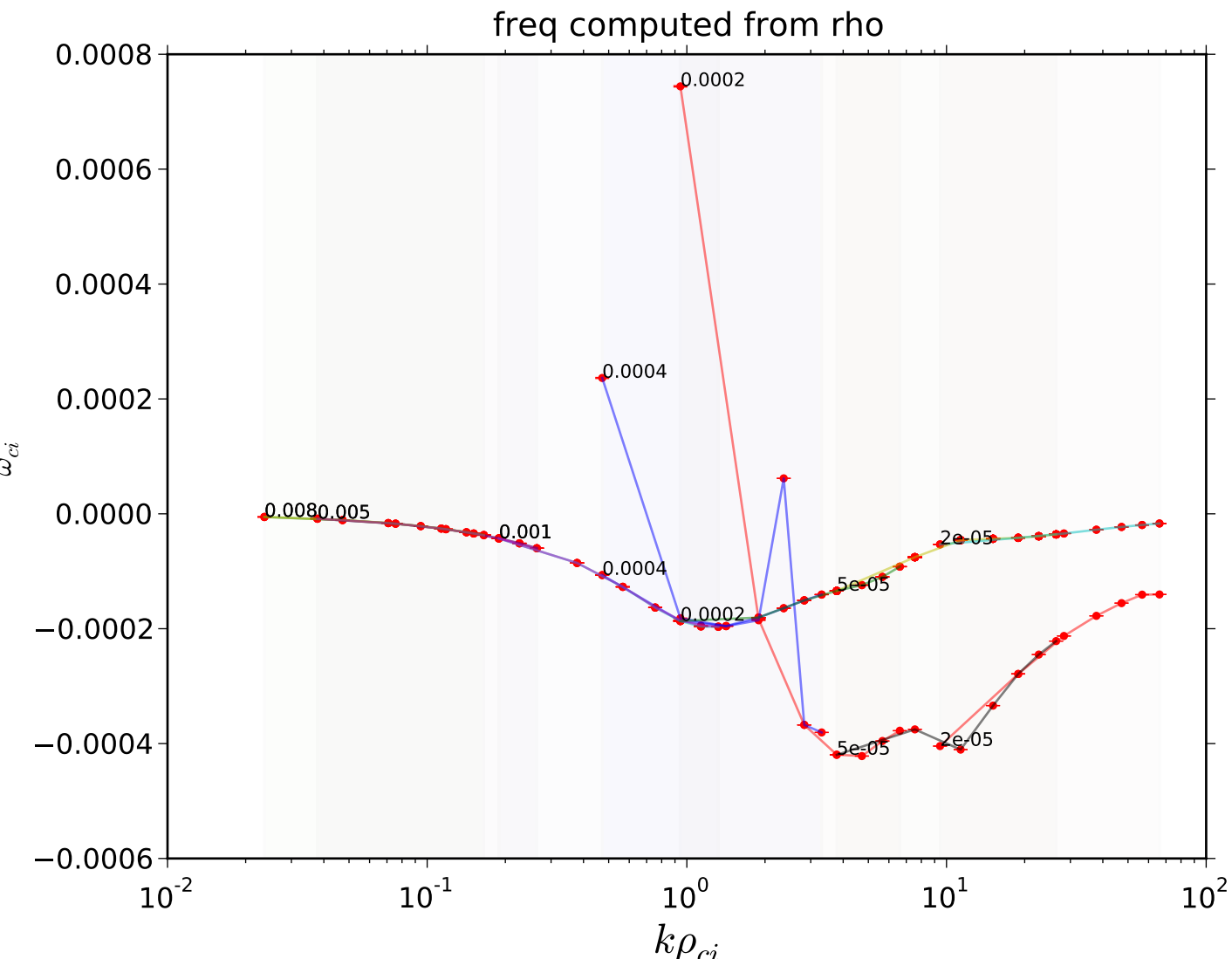




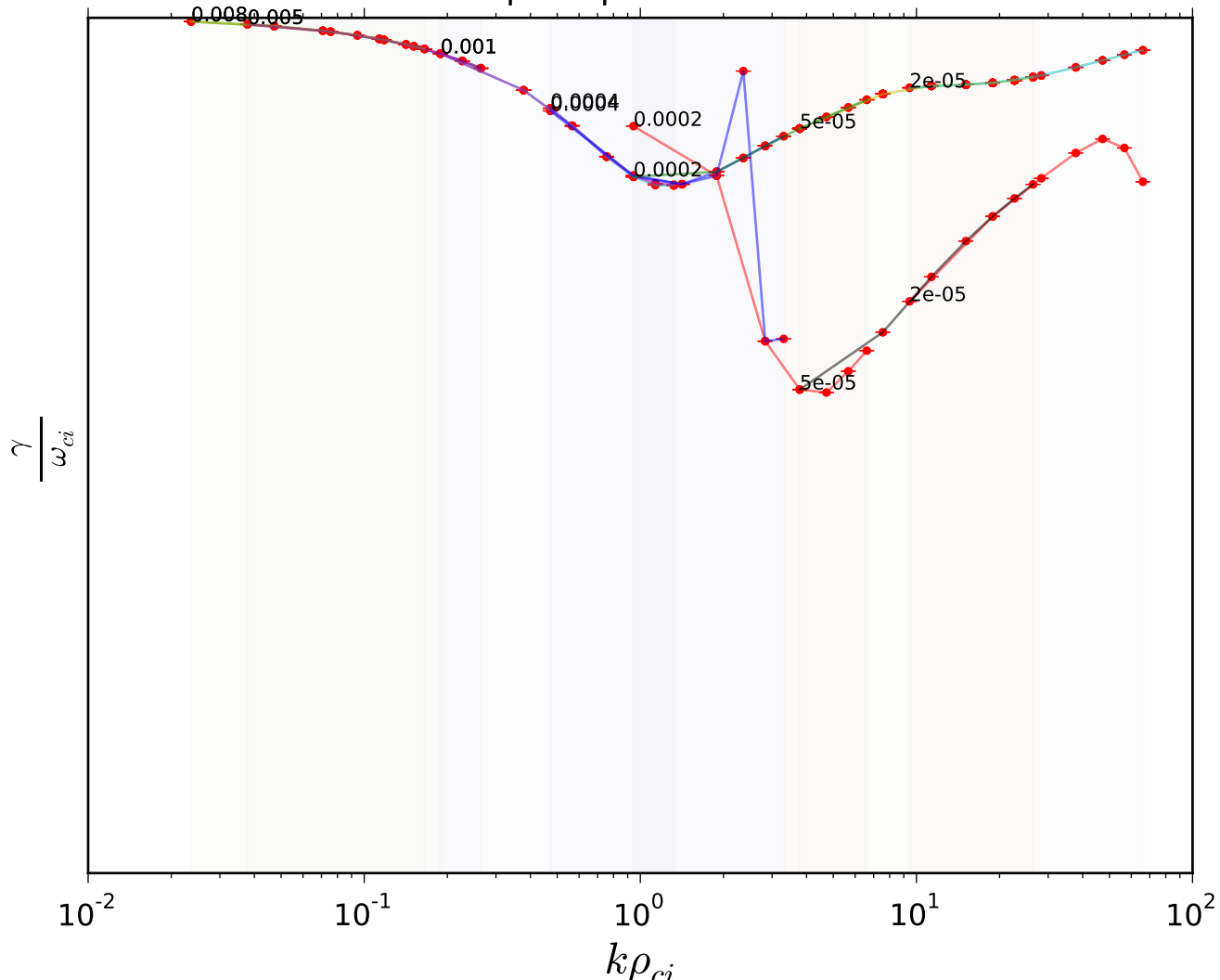
freq computed from Ni



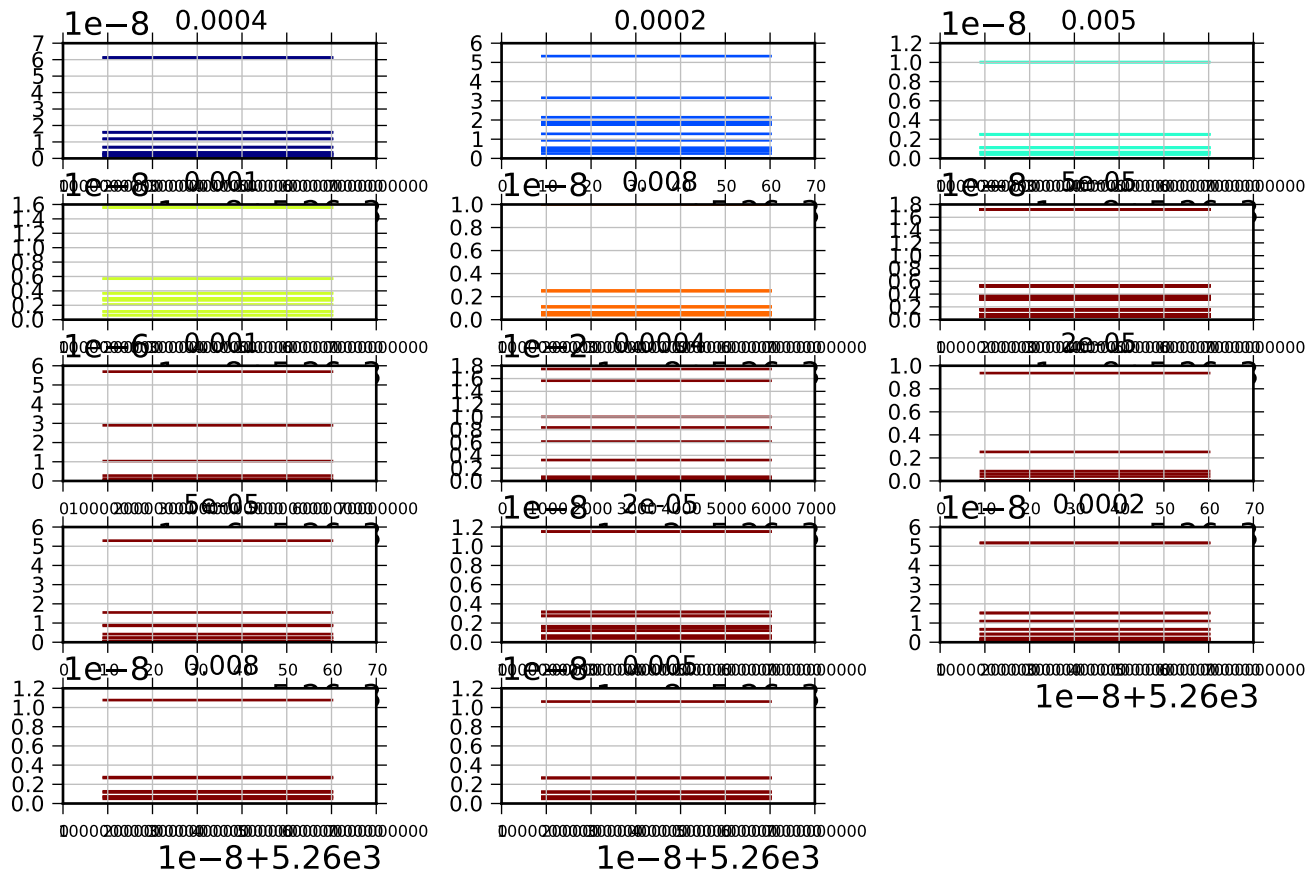




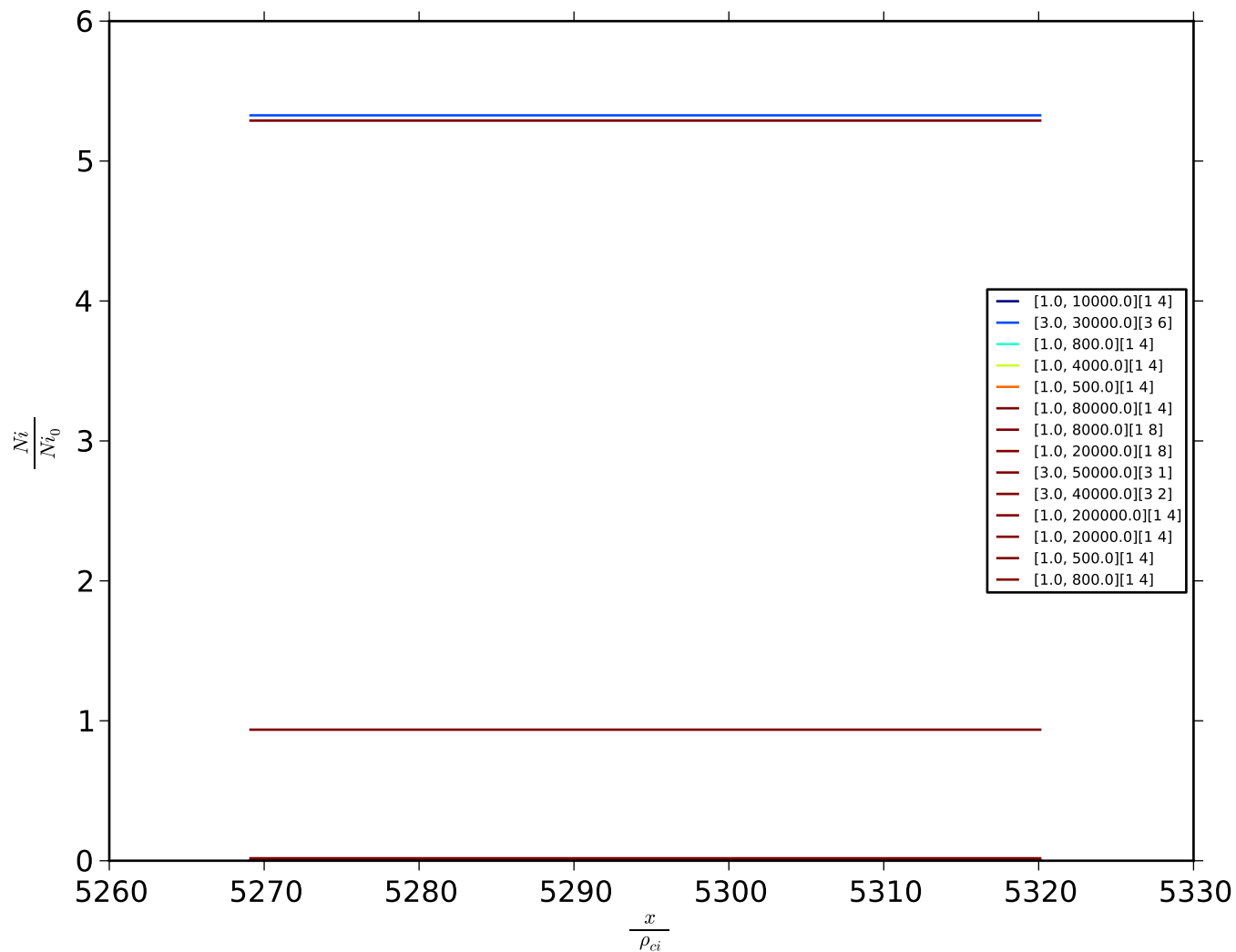
freq computed from Ni



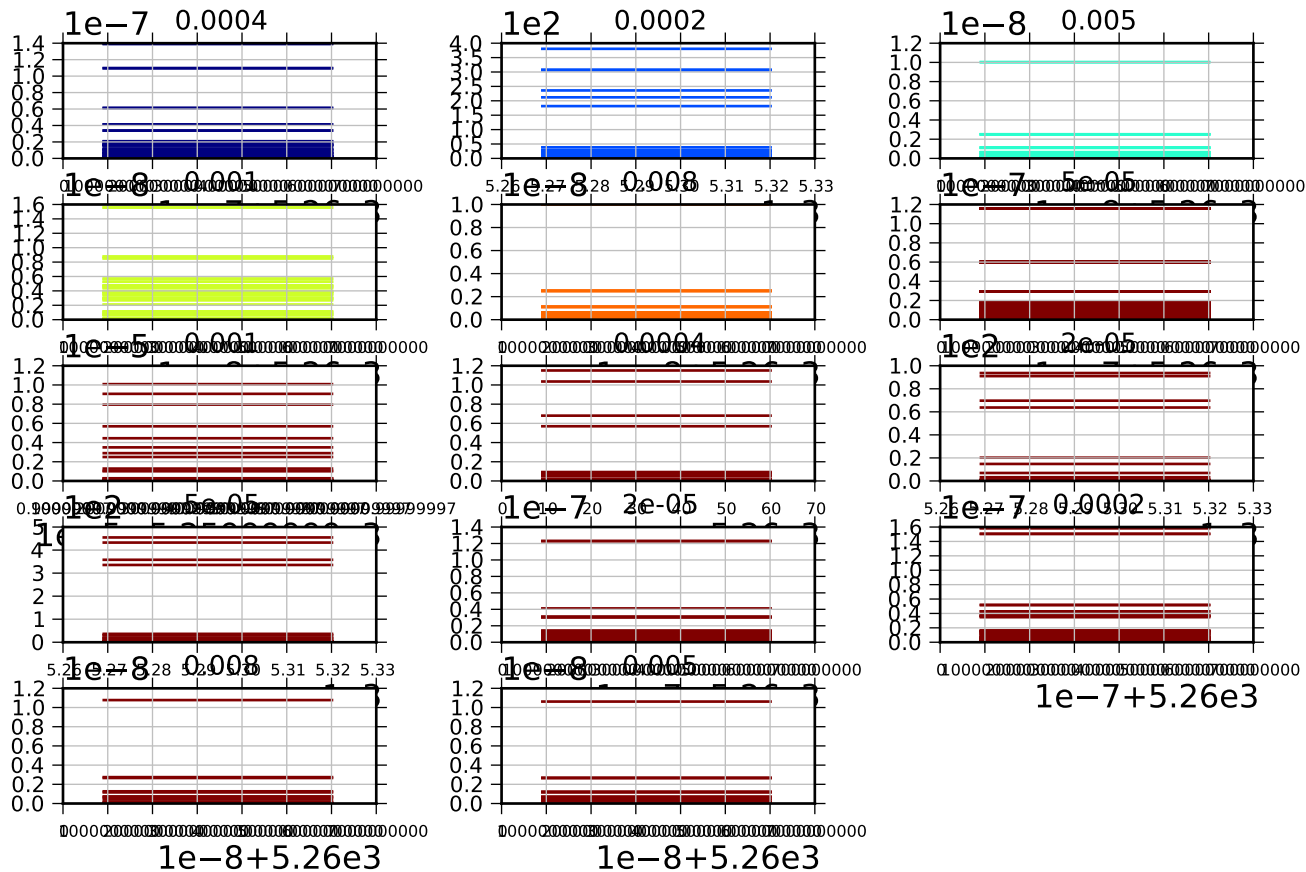
Dominant mode behavior for Ni



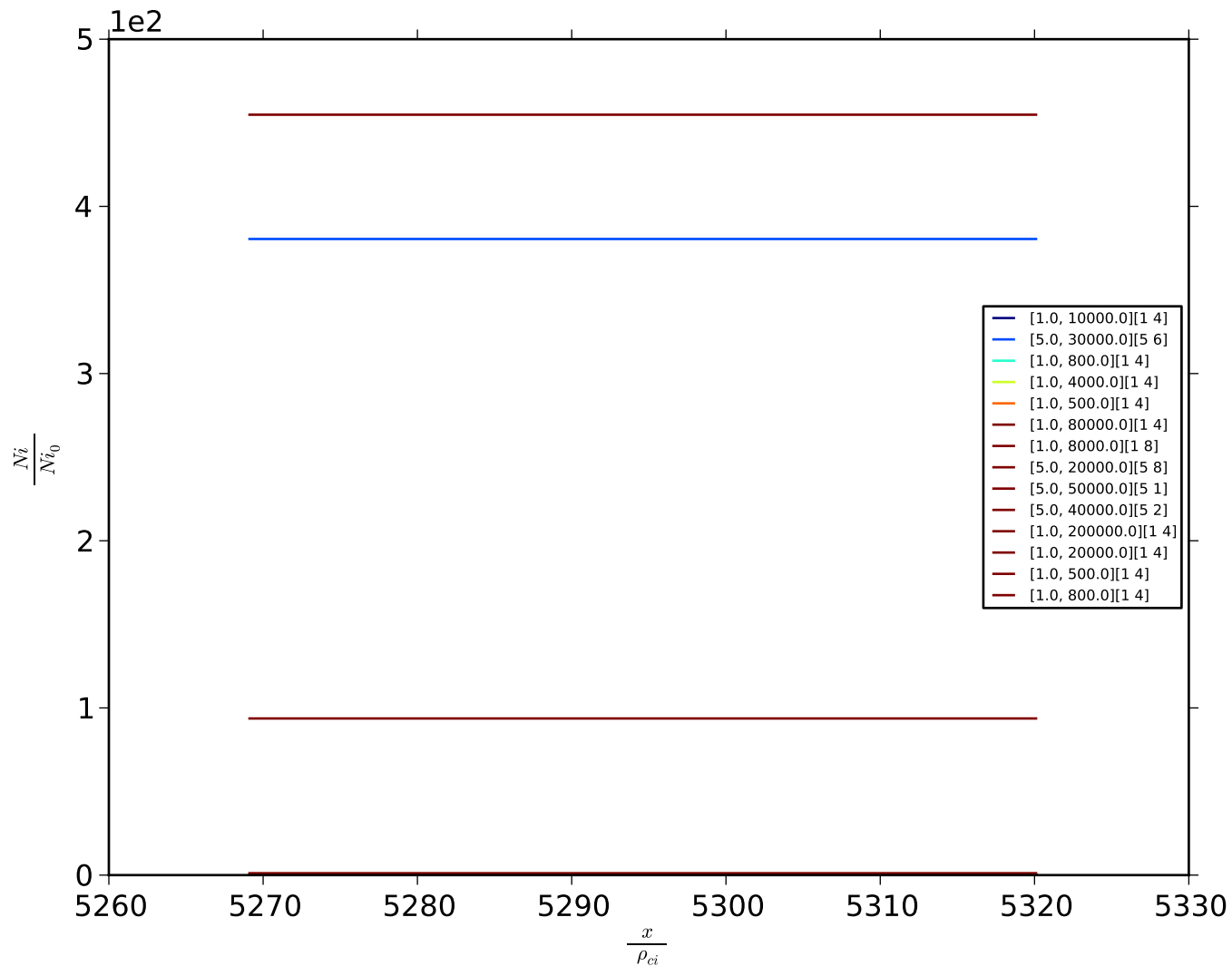
Dominant mode behavior for Ni



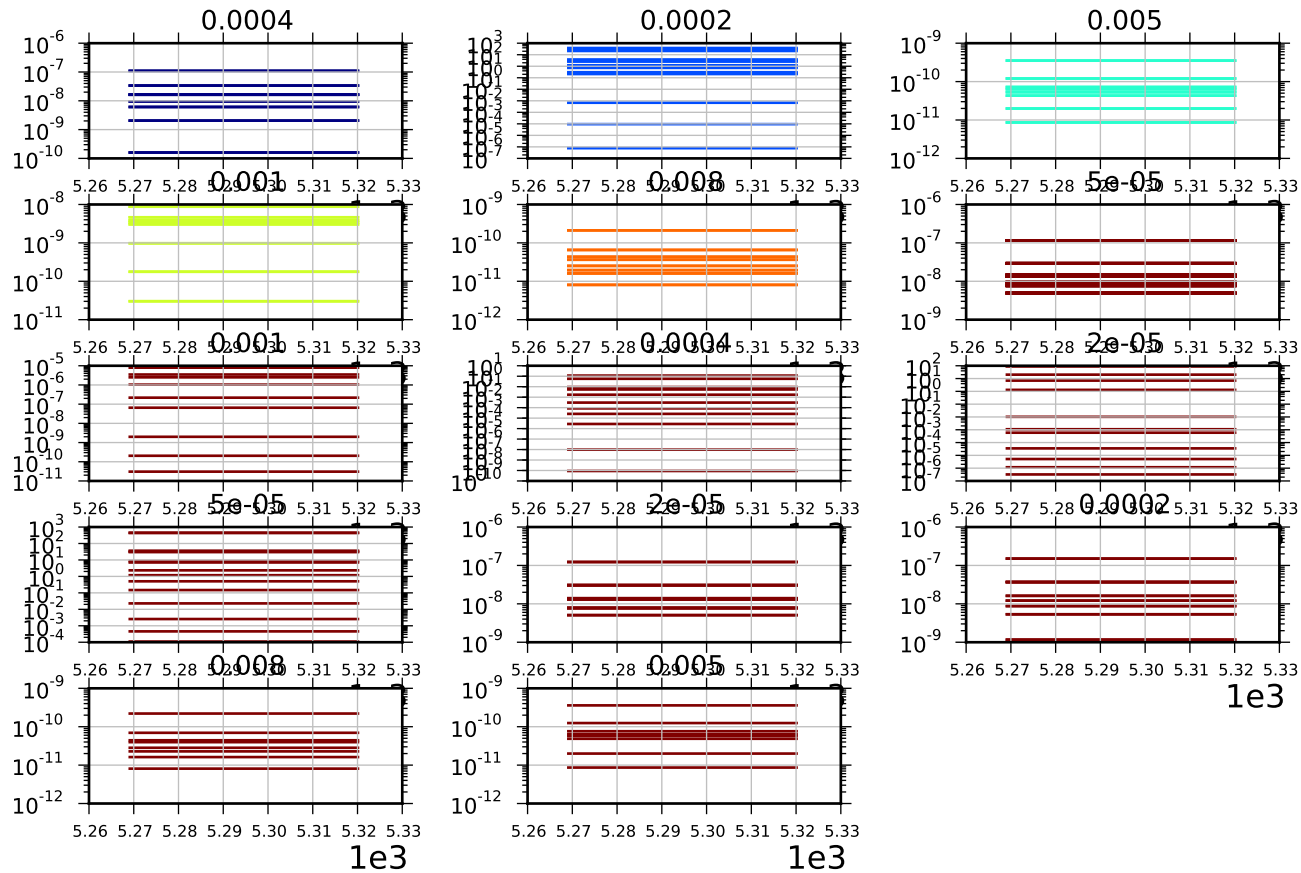
Dominant mode behavior for Vi



Dominant mode behavior for Vi



Dominant mode behavior for rho



Dominant mode behavior for rho

