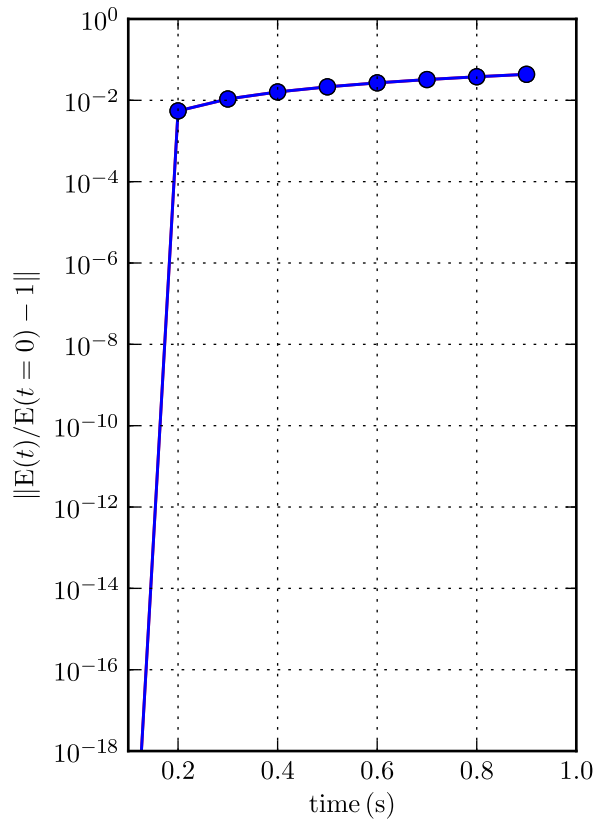# Part. & Energy conservation
[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with initial solution - log scale; total time and zoom over time

Particle conservation (electrons and ions)
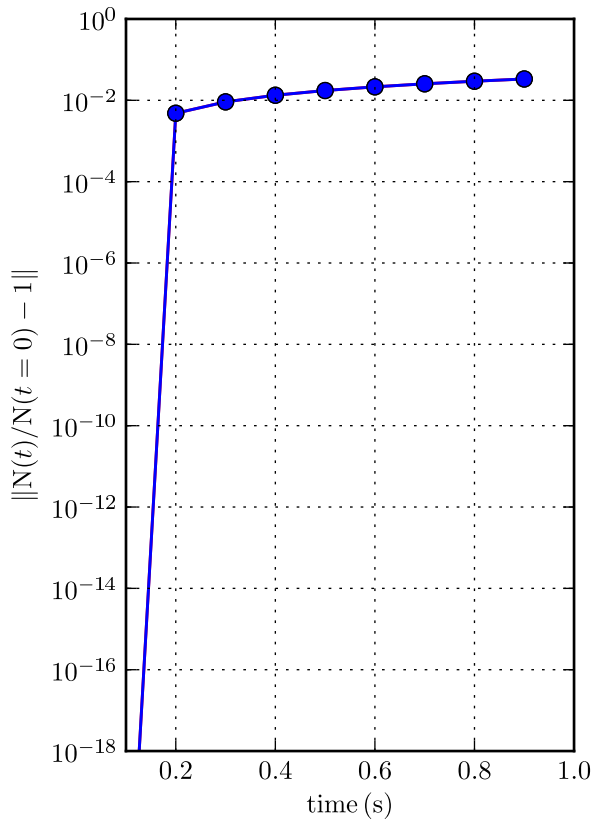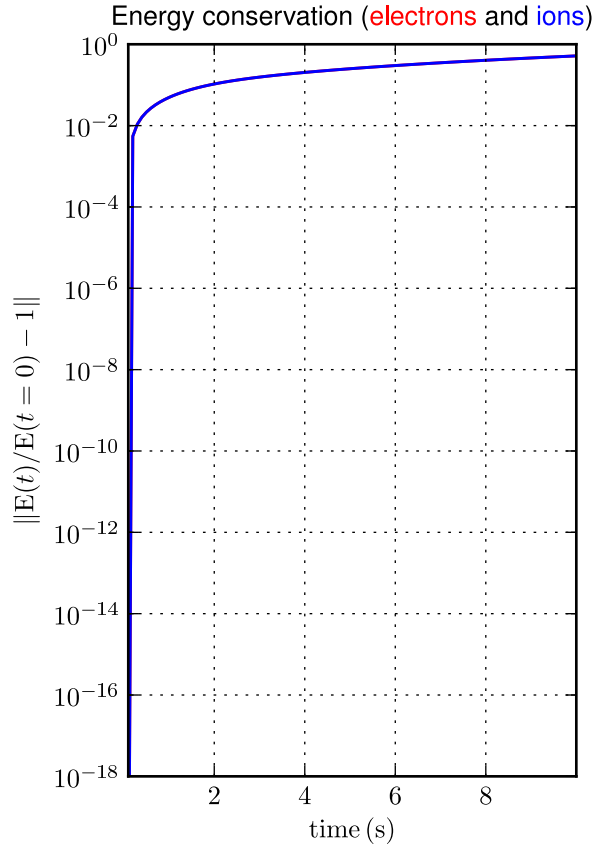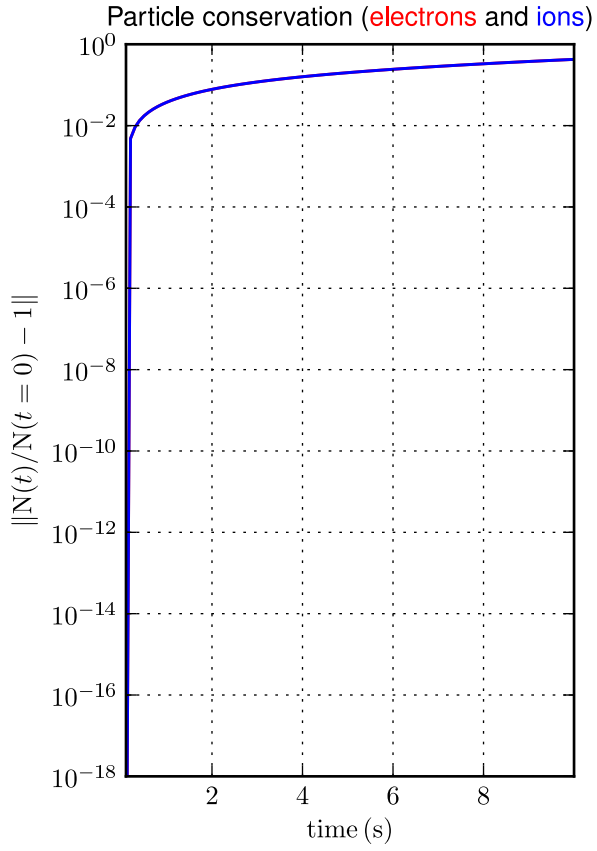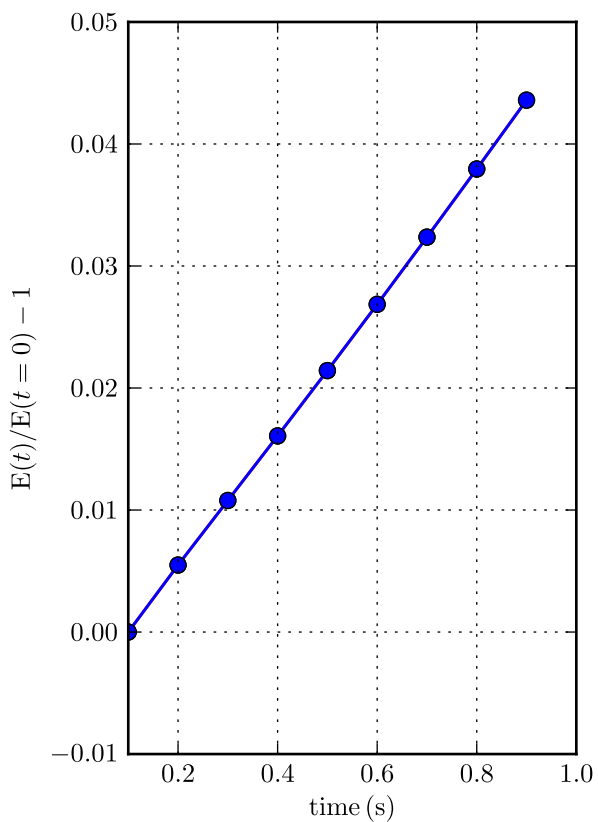
Energy conservation (electrons and ions)

Part. & Energy conservation

[Case: I.1.5.b, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
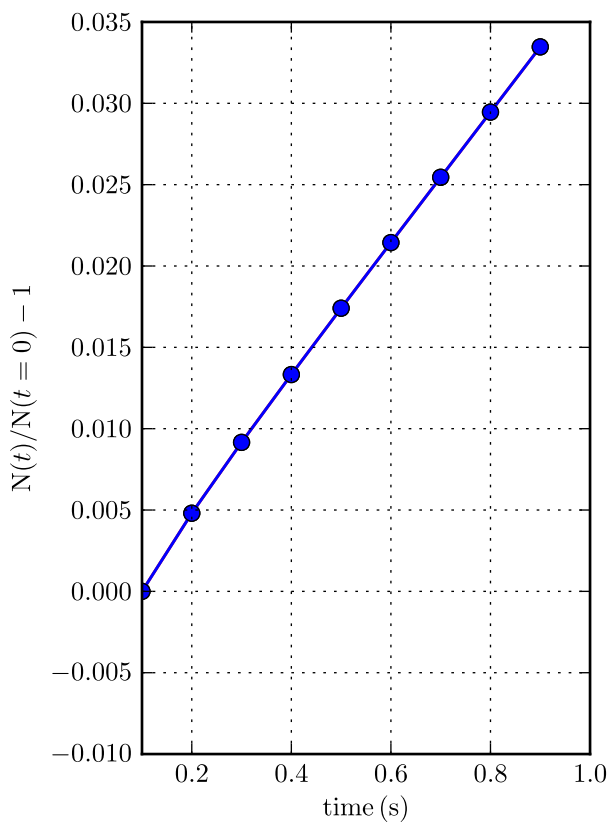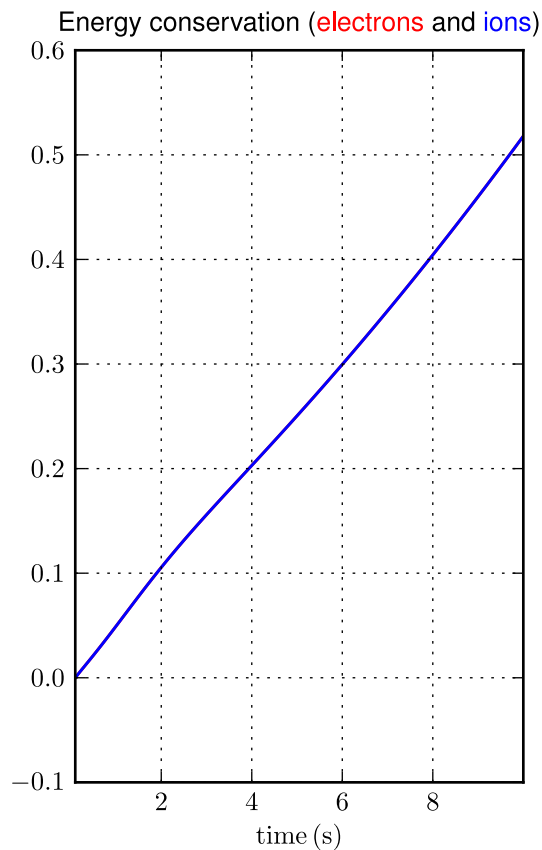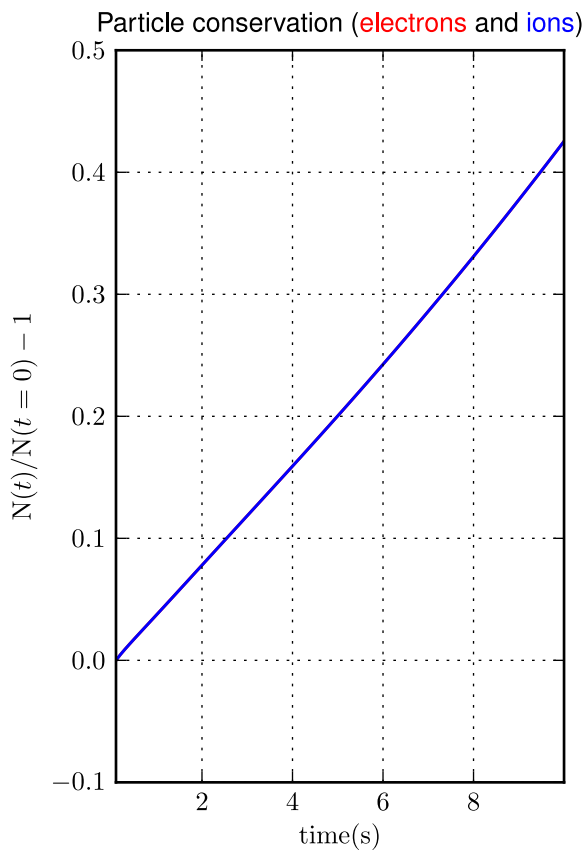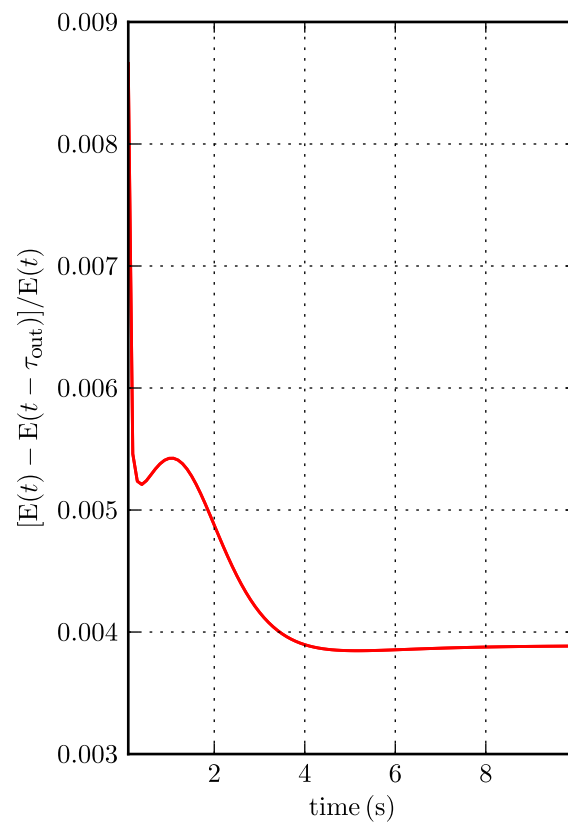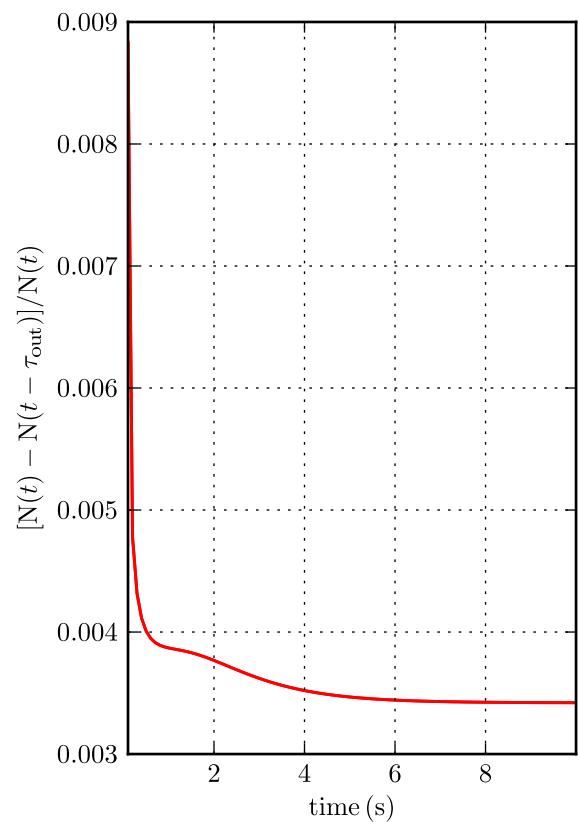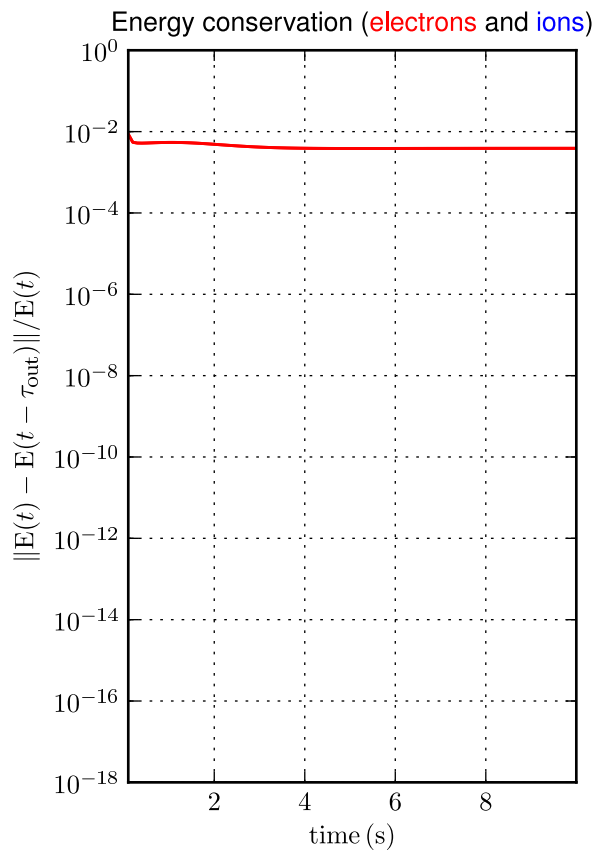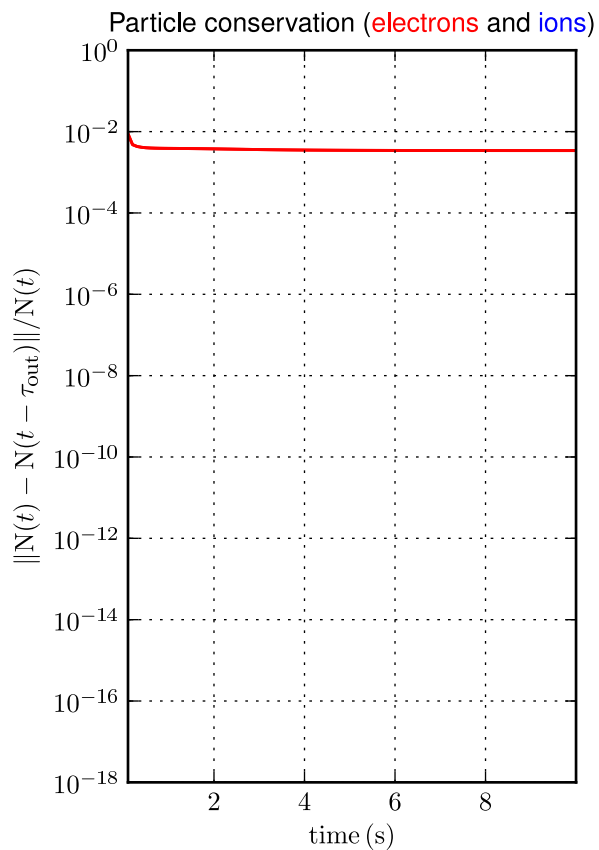
Comparison with initial solution - linear scale; total time and zoom over time

Particle conservation (electrons and ions)

Energy conservation (electrons and ions)

Part. & Energy conservation
[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with previous time-sampled (τ_{out}) solution - log and linear scales

Particle conservation
[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, Δt = **10.00**, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with asymptotic solution (electrons and ions); total time and zoom over time

Profiles
[Case: I.1.5.b, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
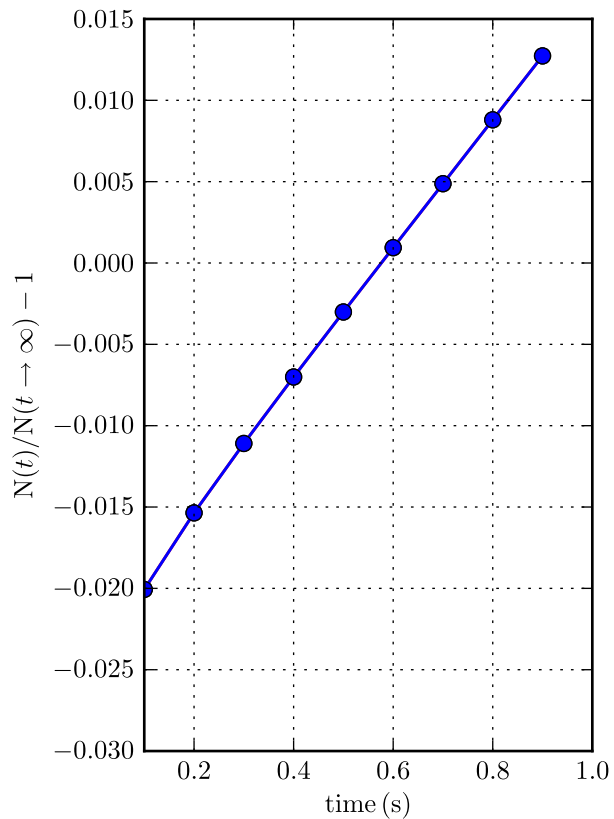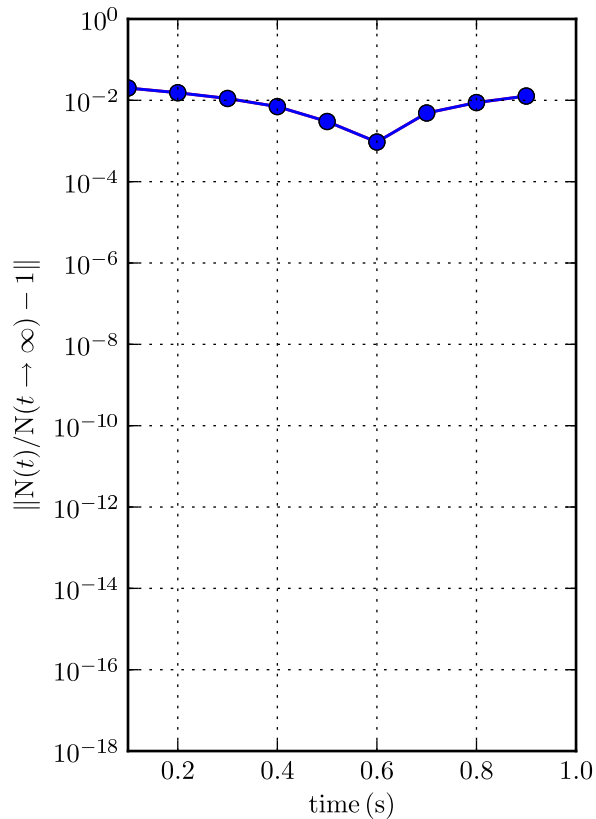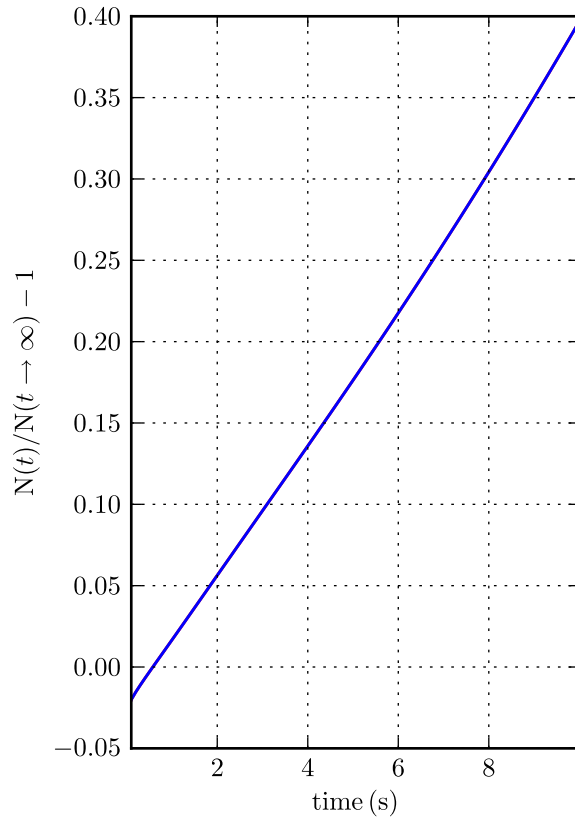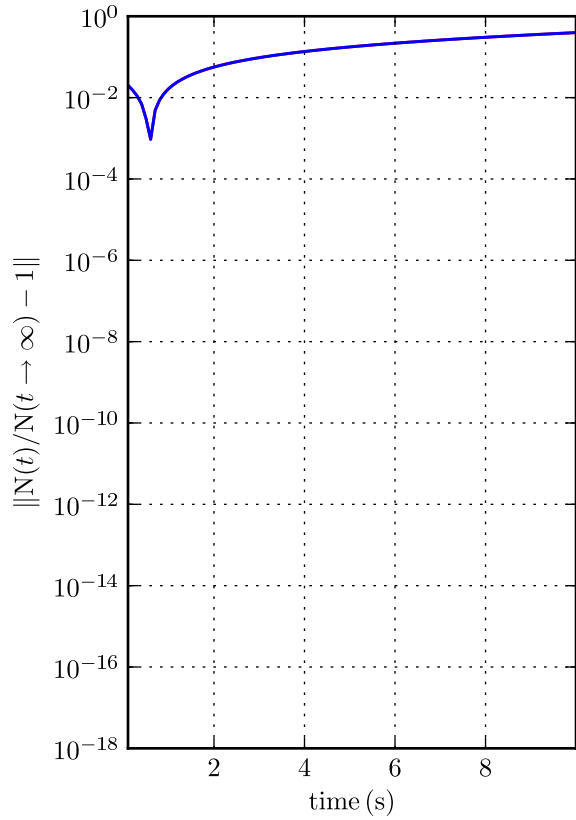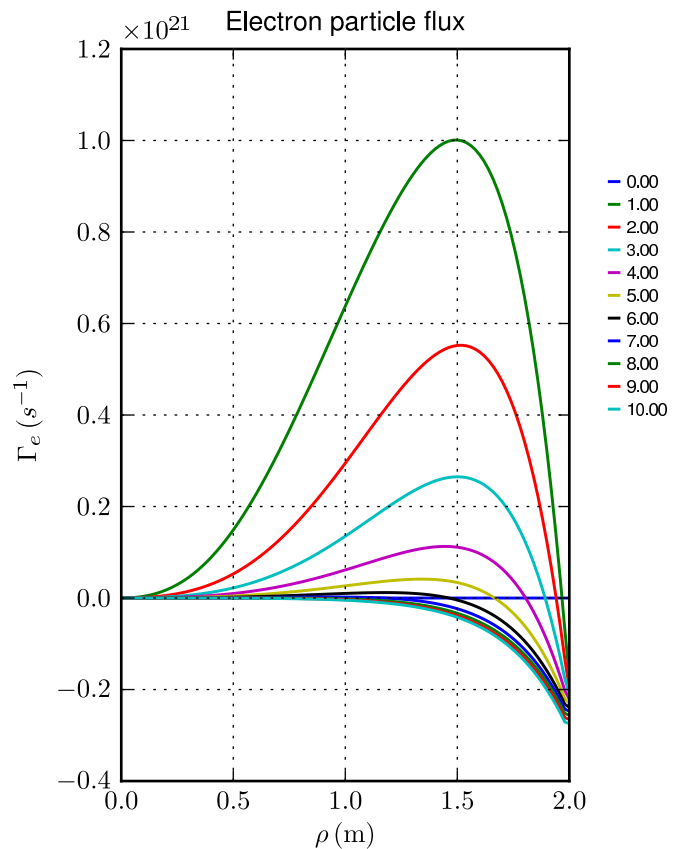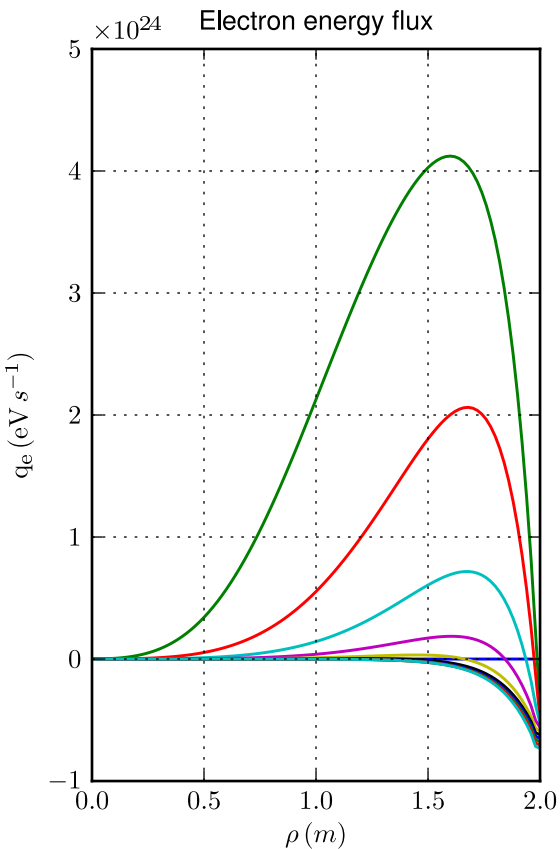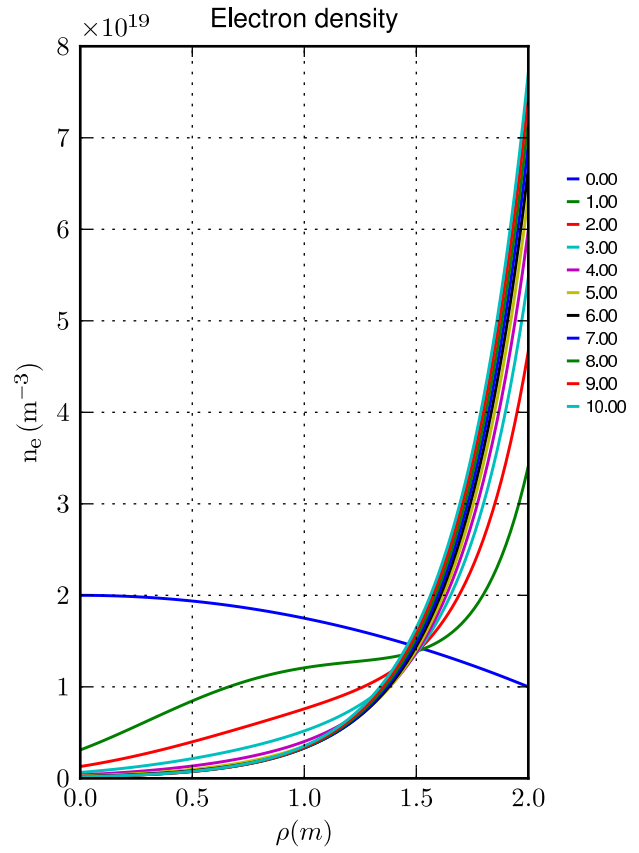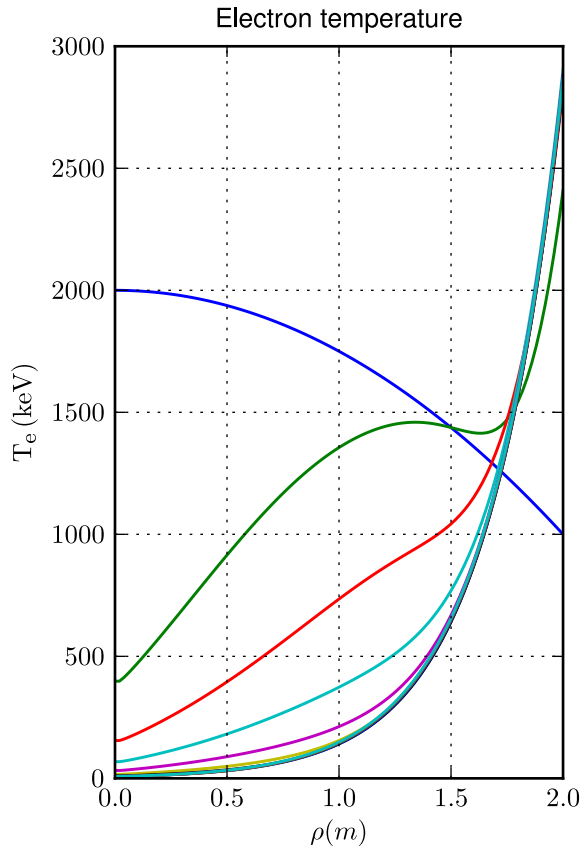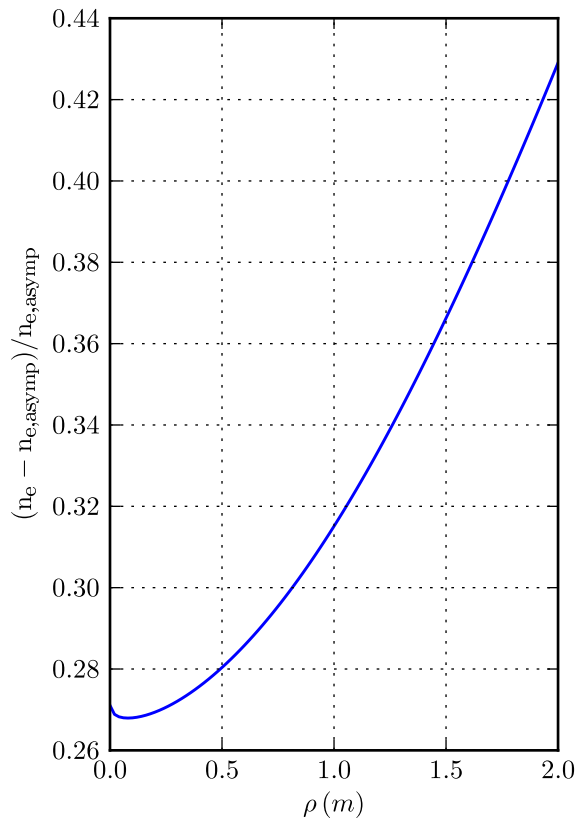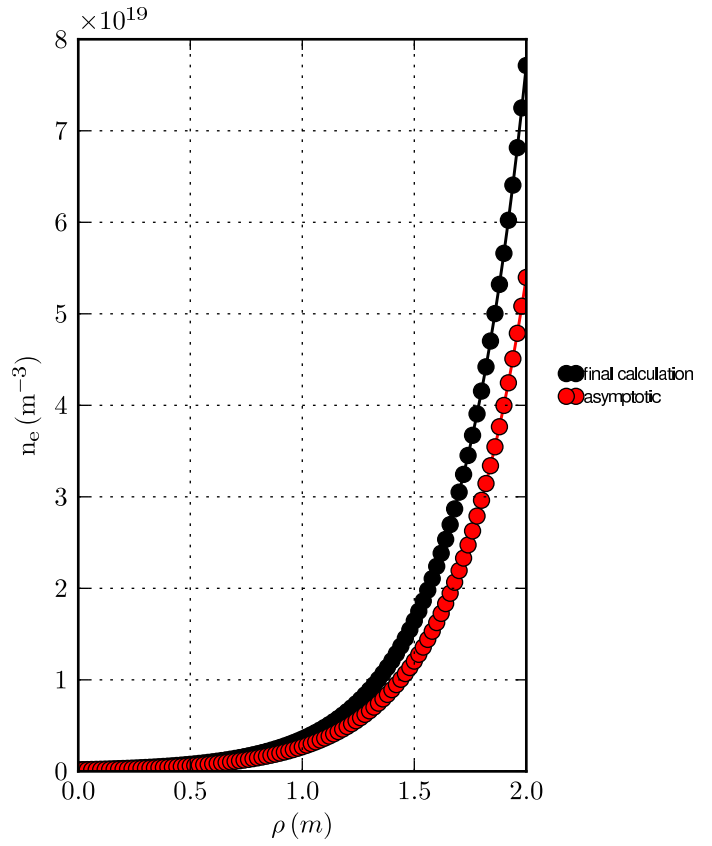Time sampling: total simulation time/10

Profiles
[Case: **I.1.5.b**, Solver: **3**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
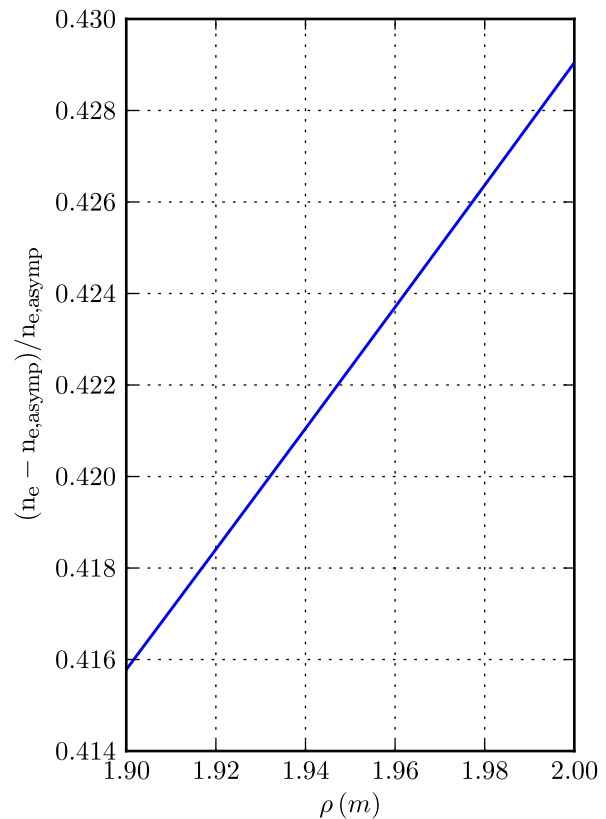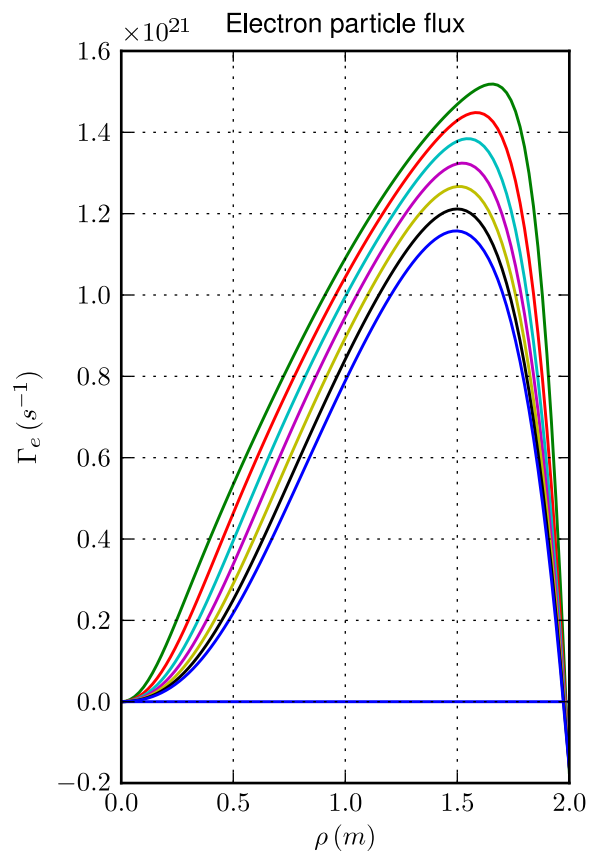### Comparison with asymptotic solution

Profiles
[Case: **I.1.5.b**, Solver: **3**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, Δt = **10.00**, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
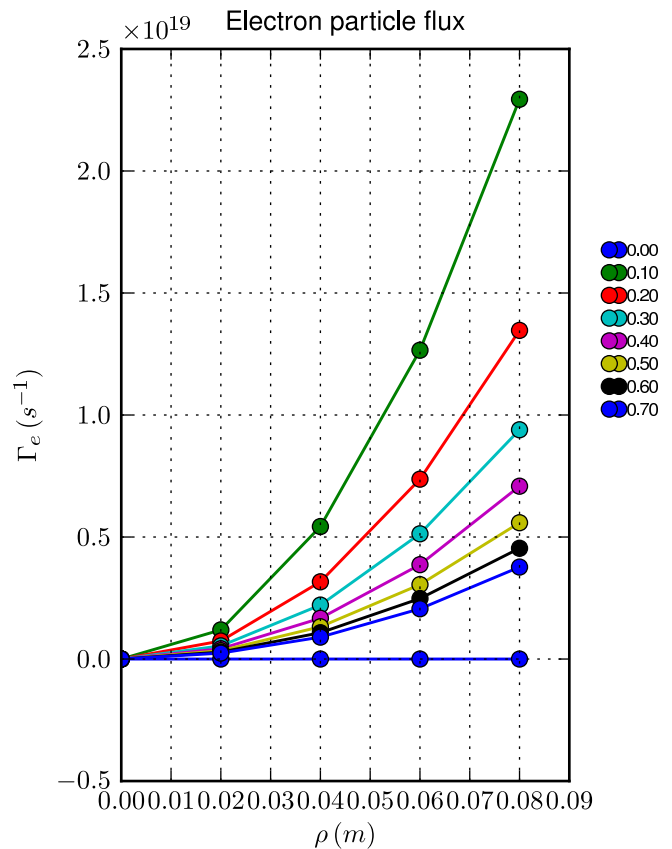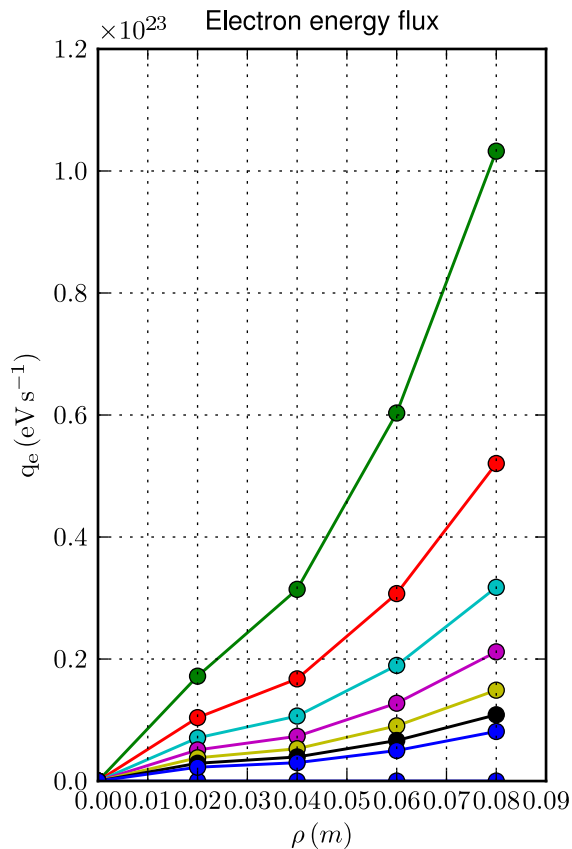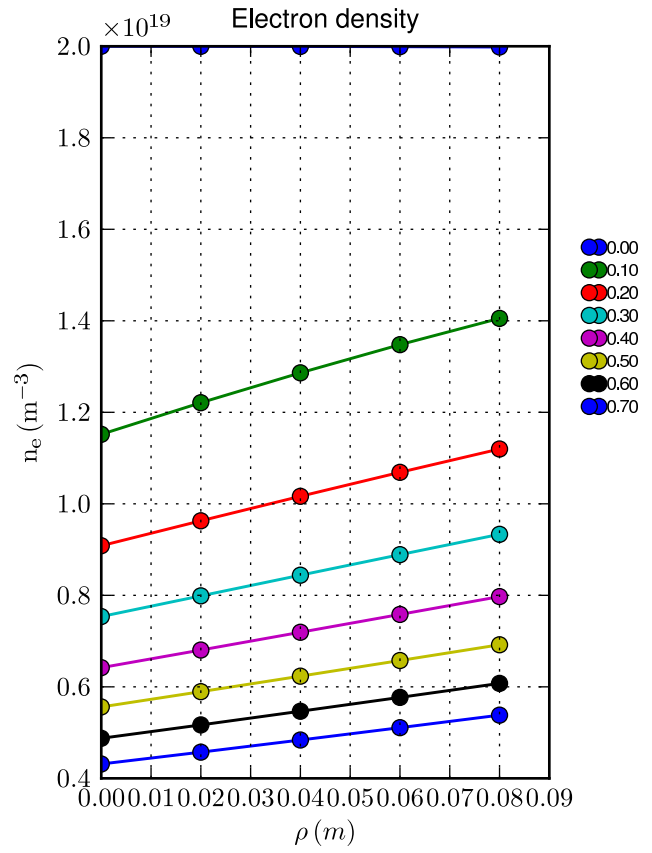Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
[Case: **I.1.5.b**, Solver: 3, $D = 0.1 \, \mathrm{m^2/s}$, $v = 0.30 \, \mathrm{m/s}$, $\Delta t = $ **10.00**, $\tau = 1.0 \times 10^{-3} \, \mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis
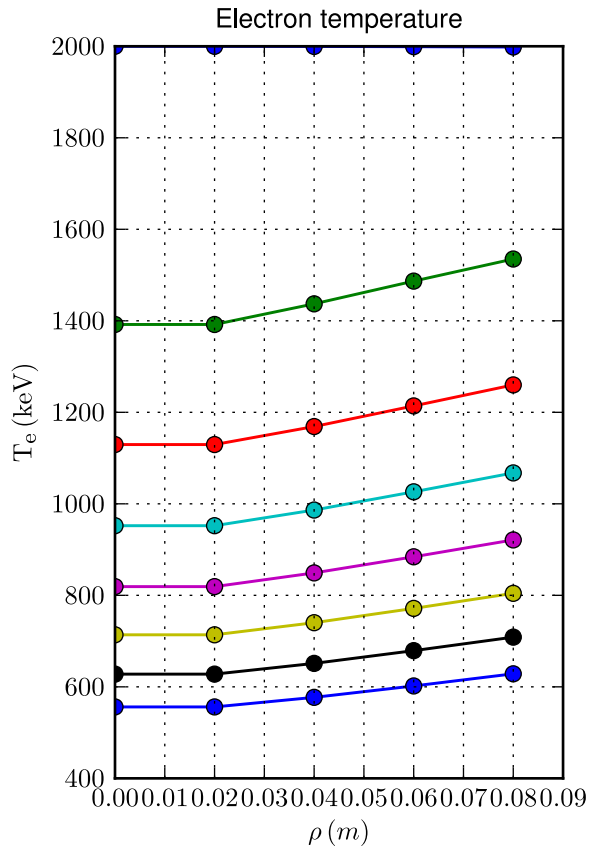Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = $ 0.80 s

Profiles
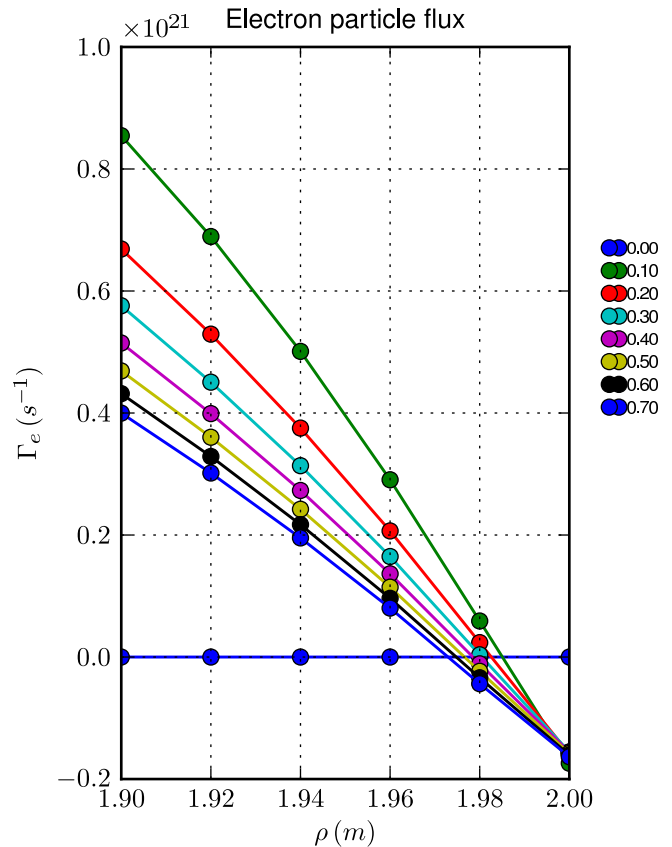
[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]

Spatial zoom over edge

Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
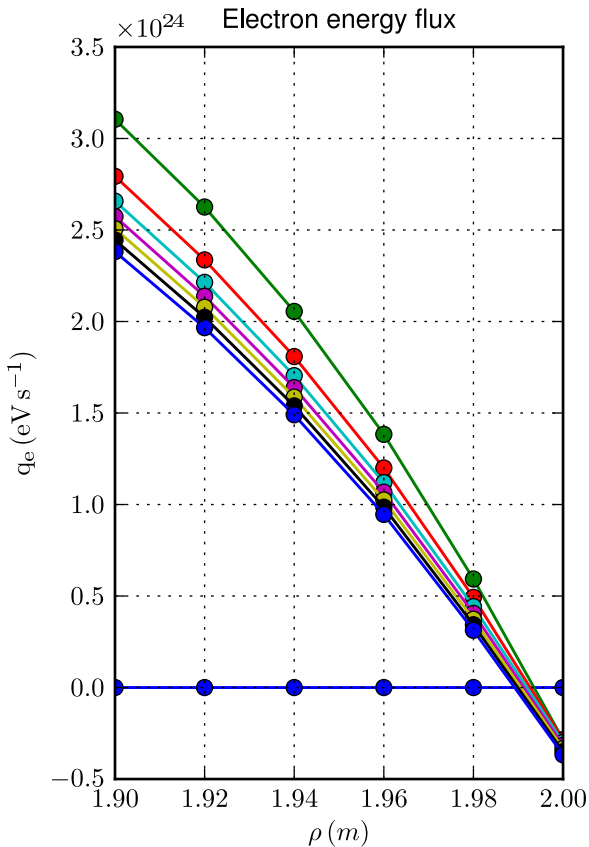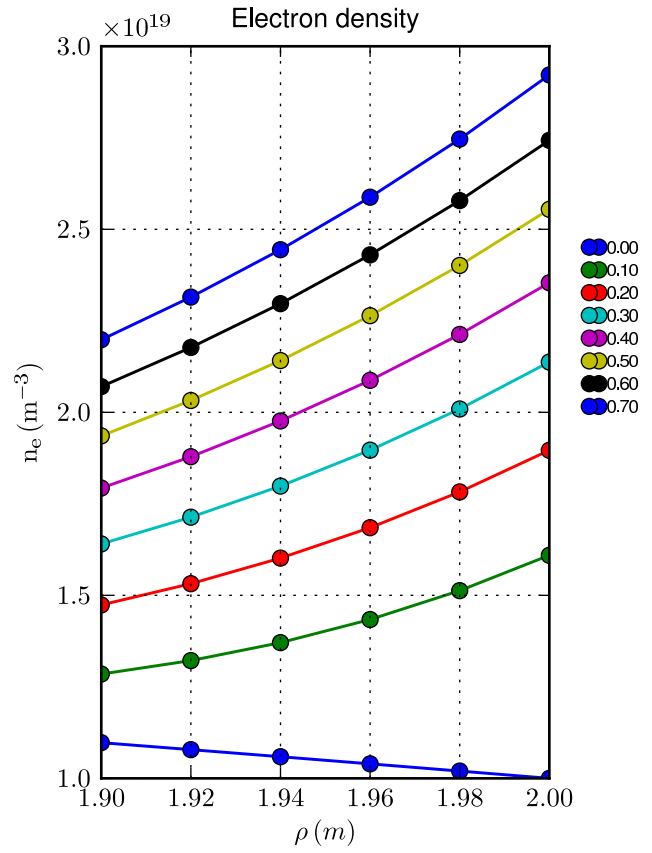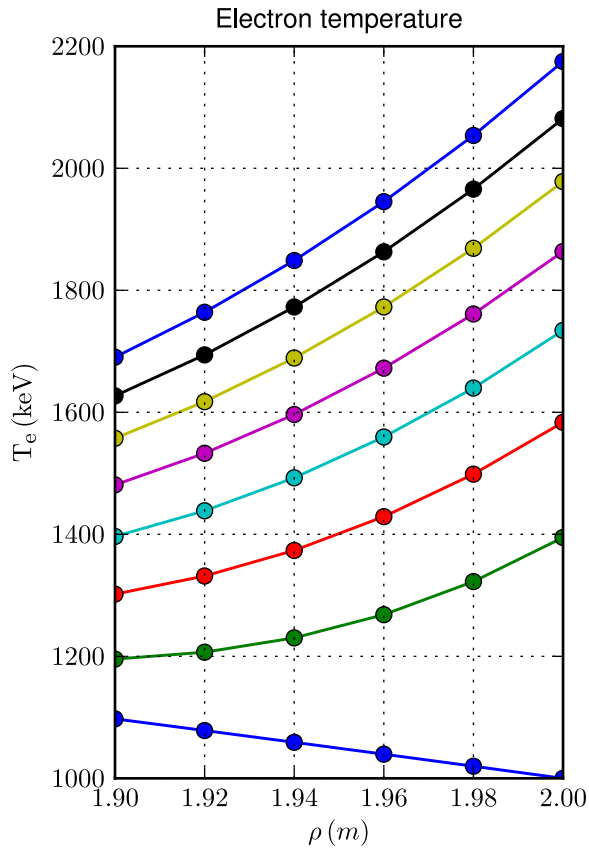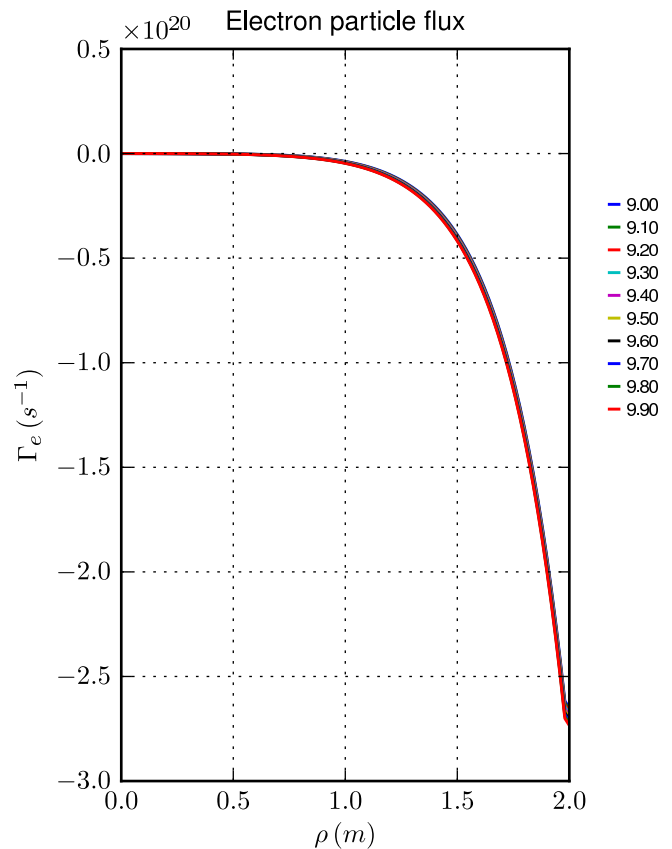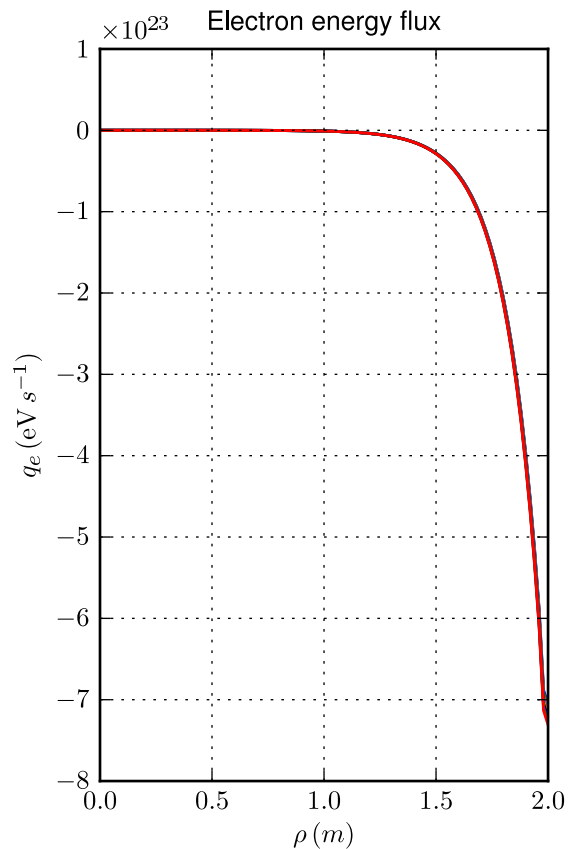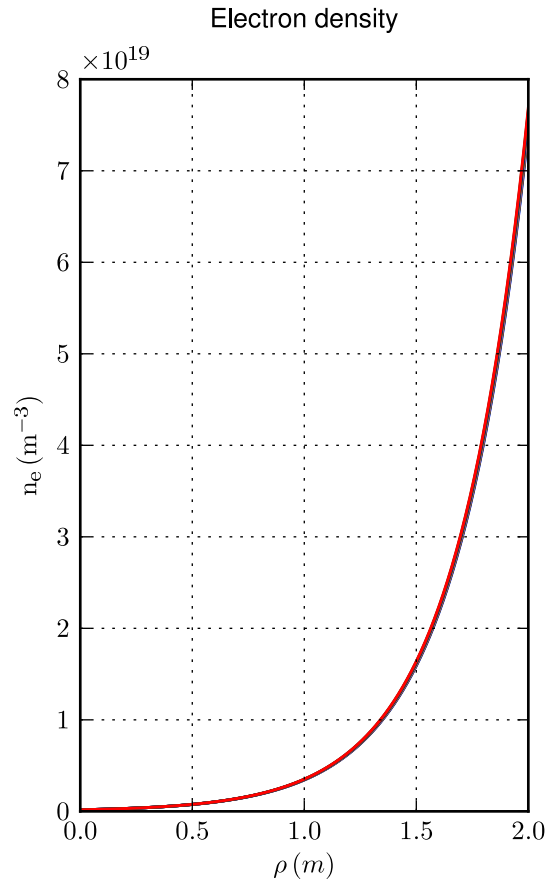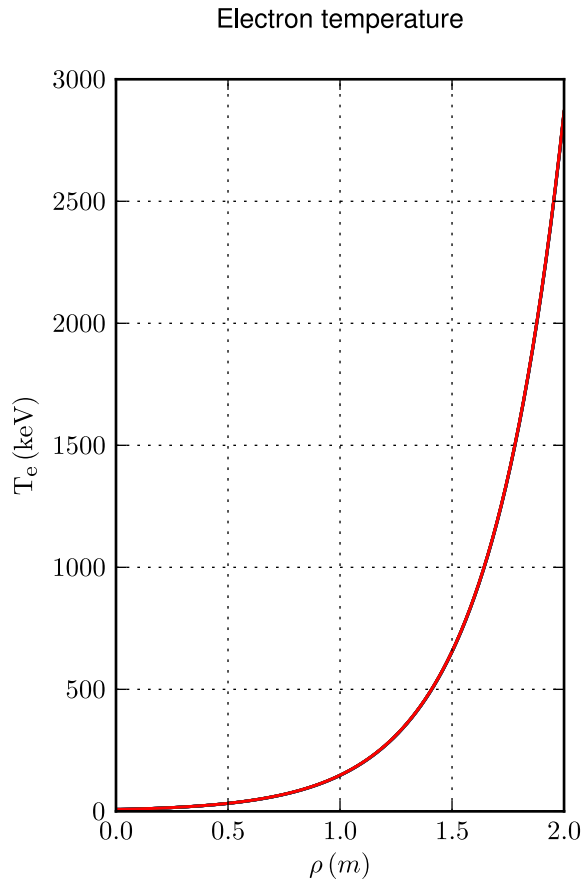[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Time sampling: last 10 time slices

Profiles
[Case: **I.1.5.b**, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
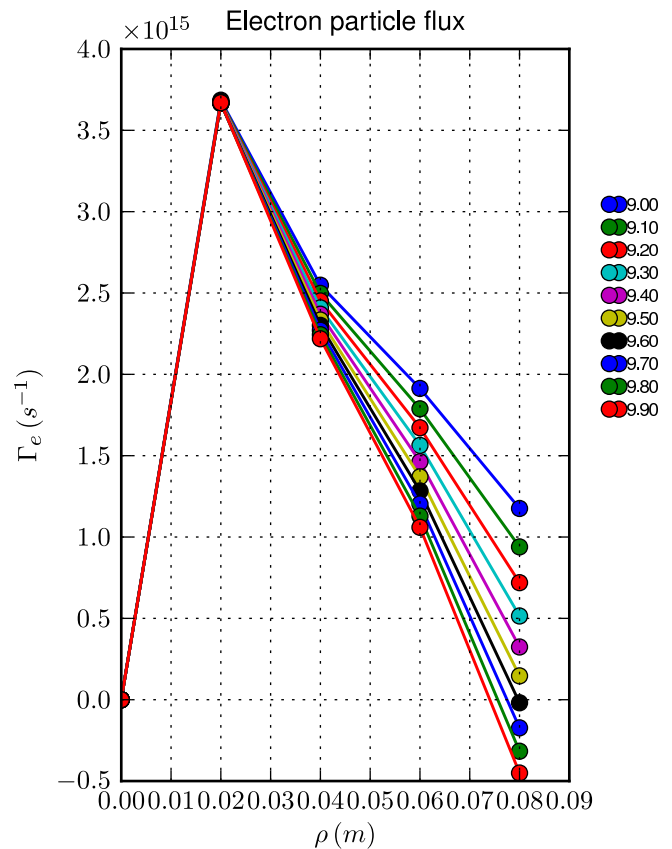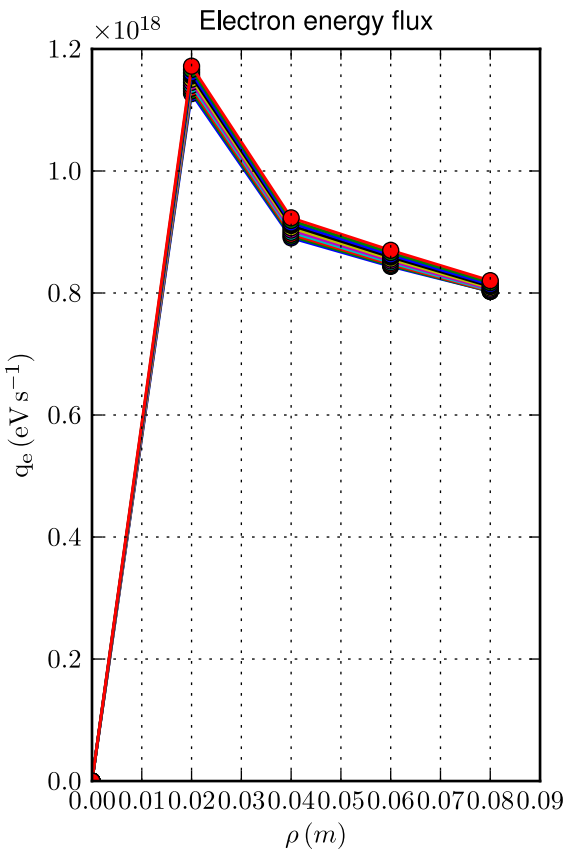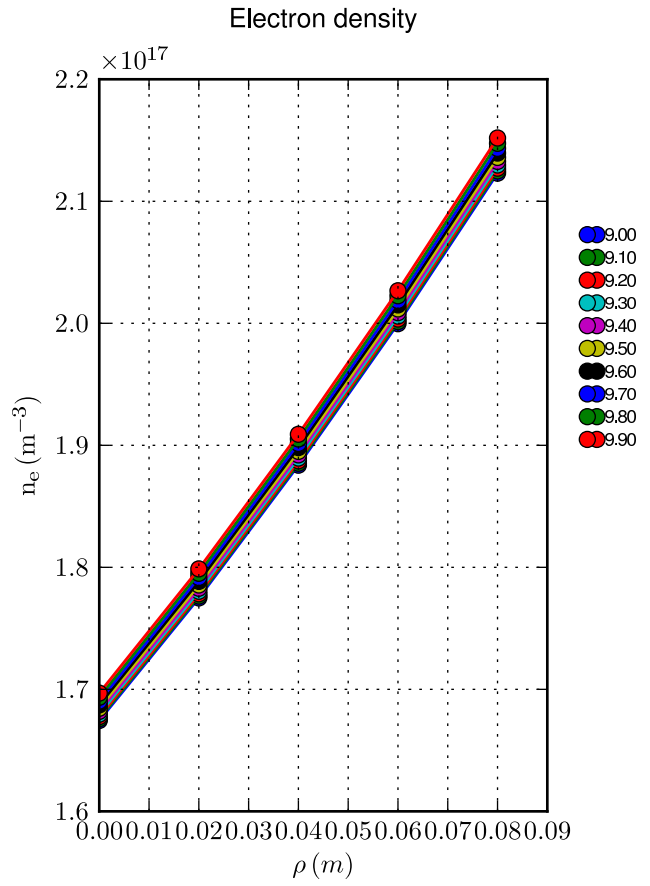Spatial zoom over magnetic axis; time sampling: last 10 time slices

Profiles
[Case: I.1.5.b, Solver: 3, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
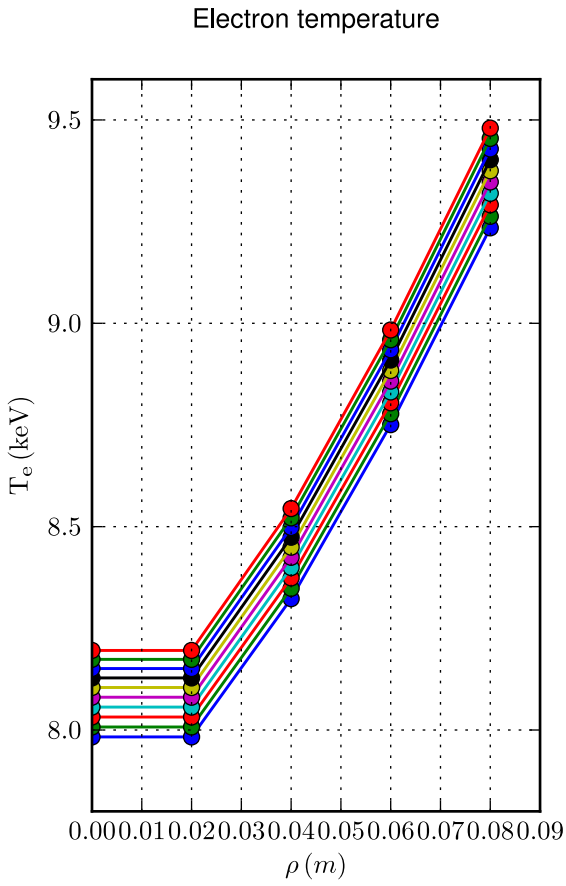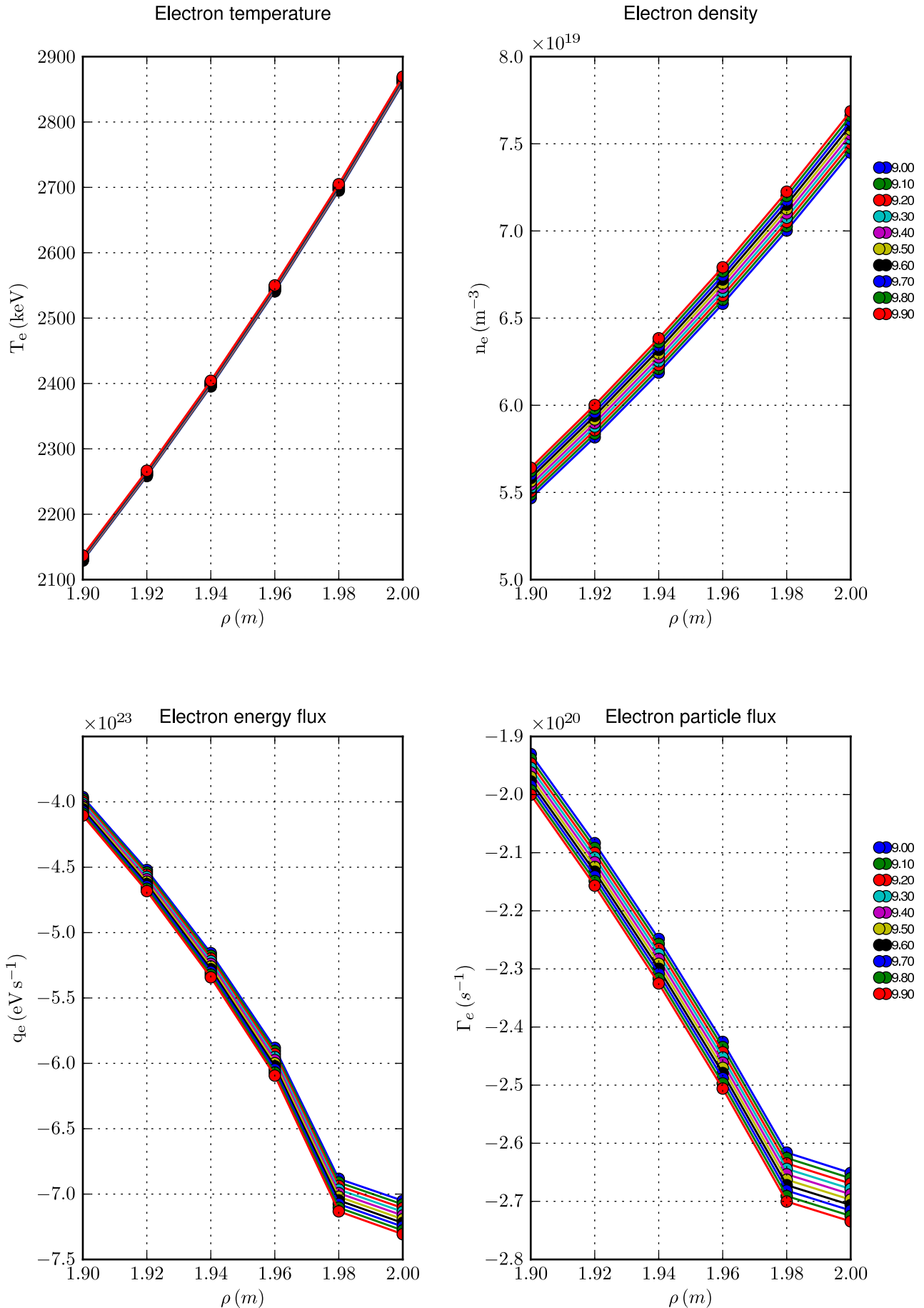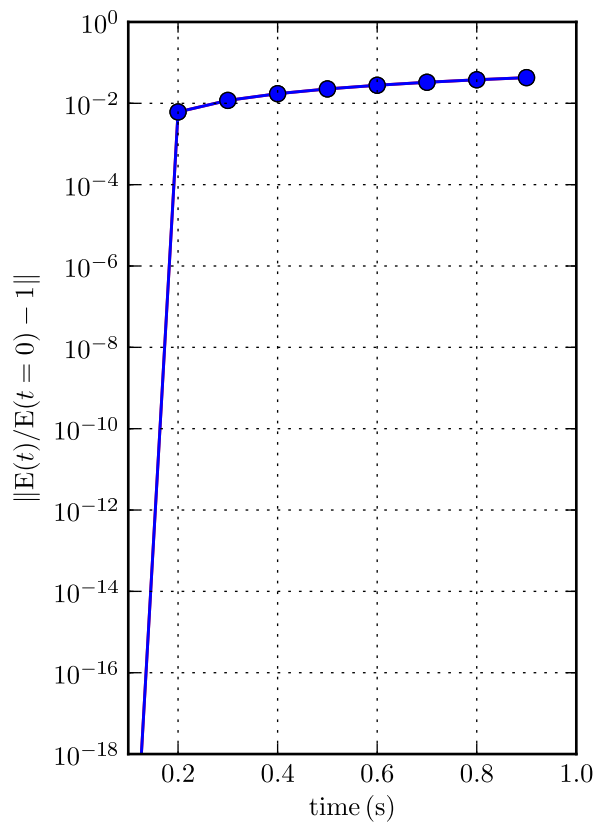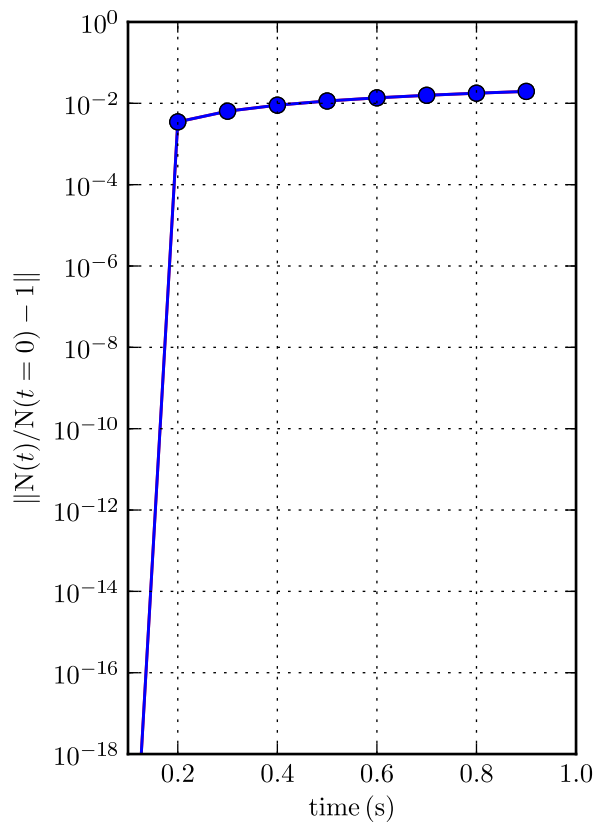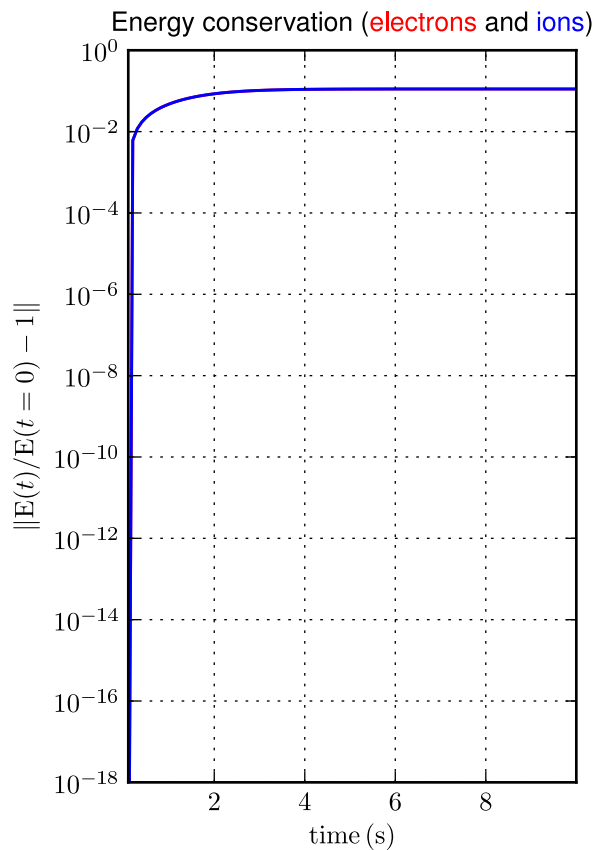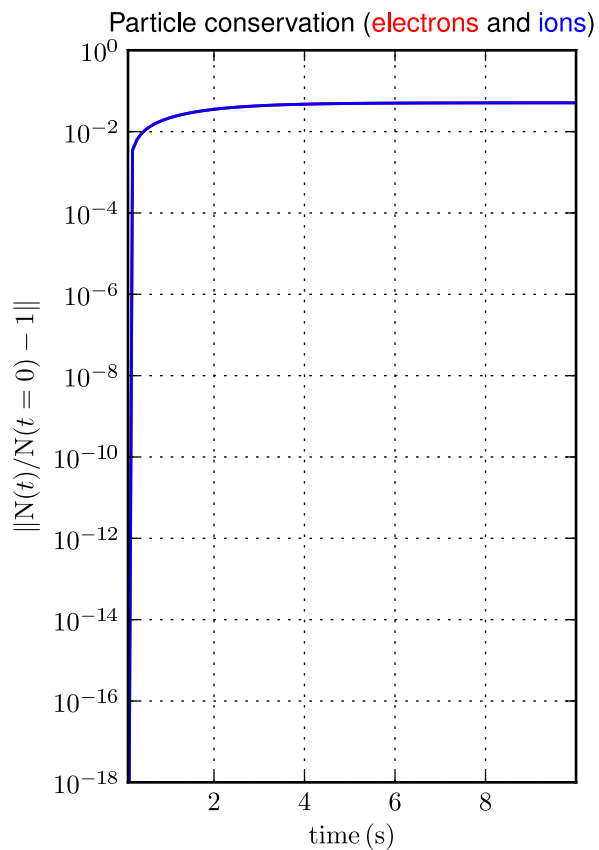Spatial zoom over edge; time sampling: last 10 time slices

Part. & Energy conservation

[Case: **I.1.5.b**, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = $ **10.00**, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
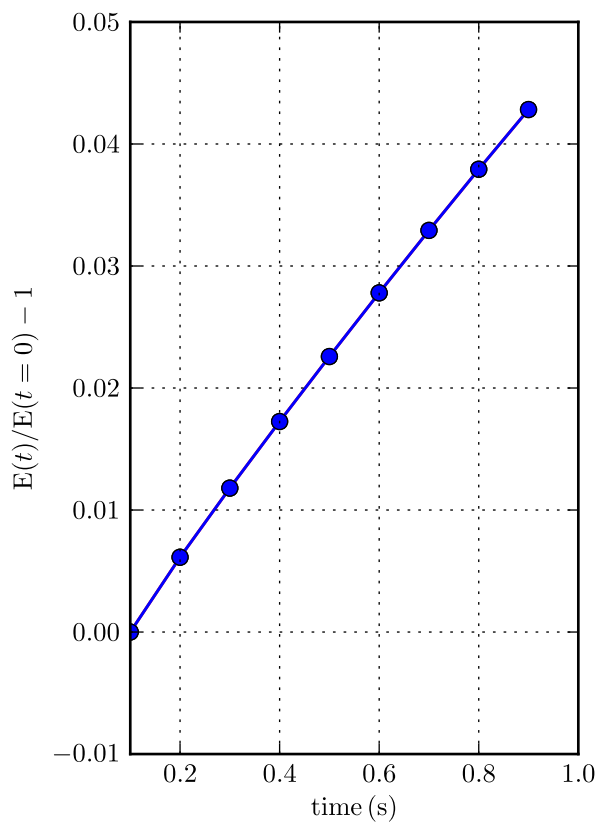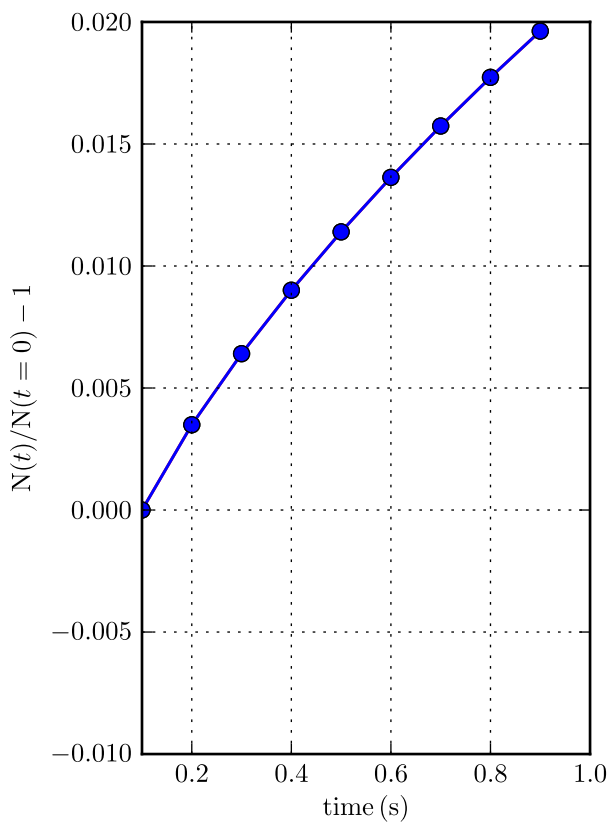
Comparison with initial solution - log scale; total time and zoom over time

Part. & Energy conservation
[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
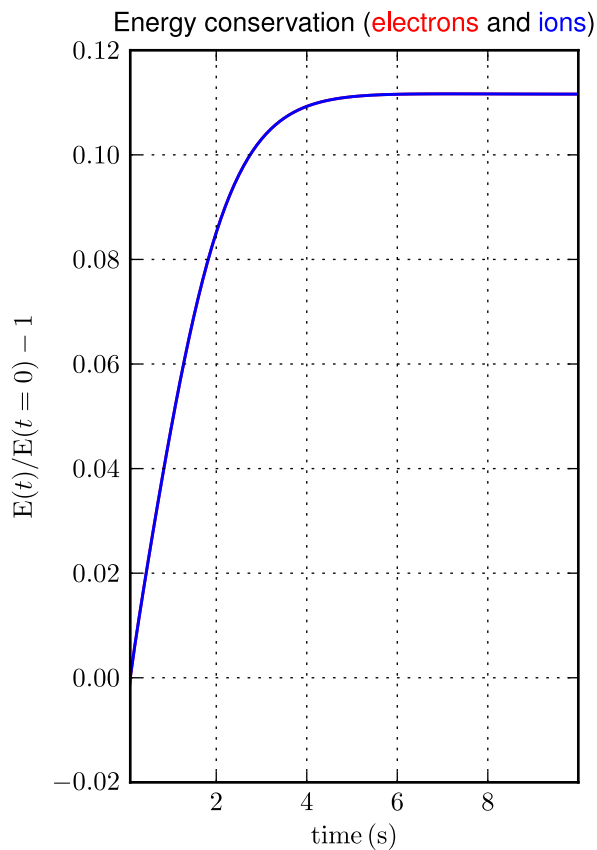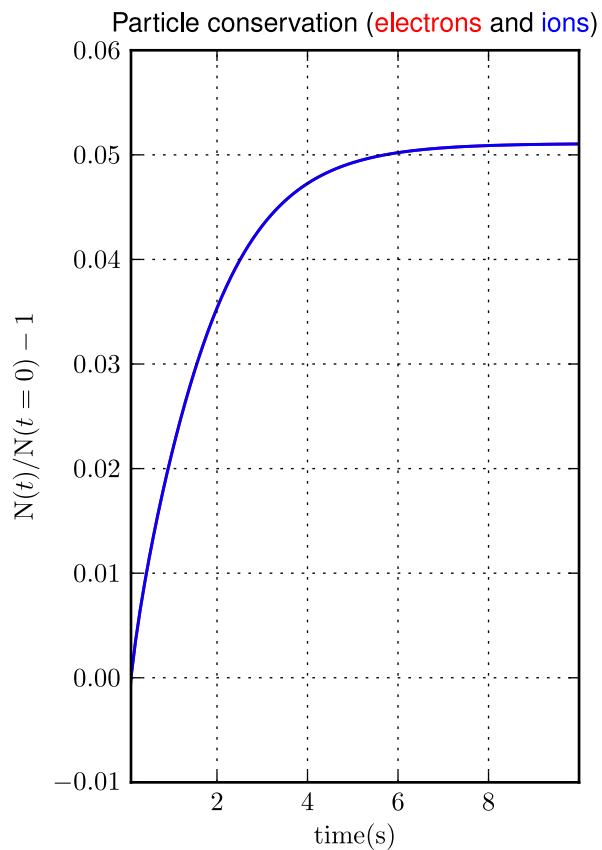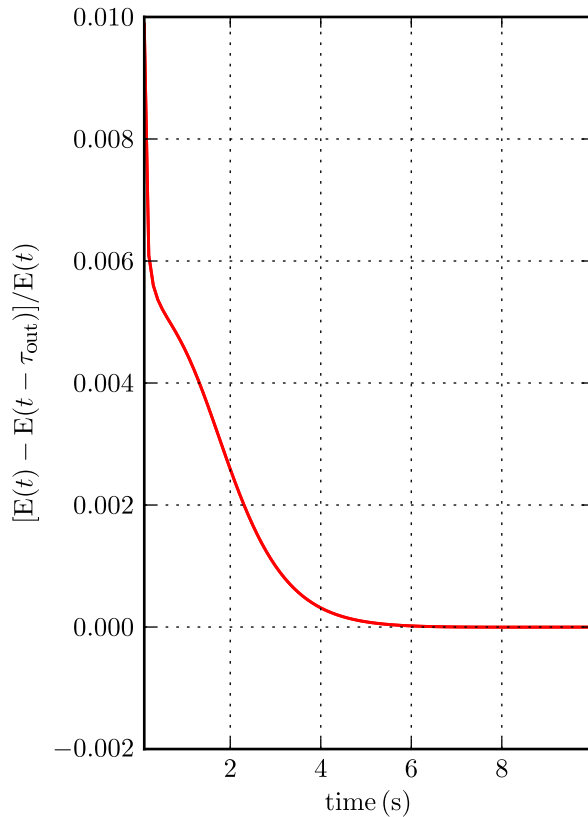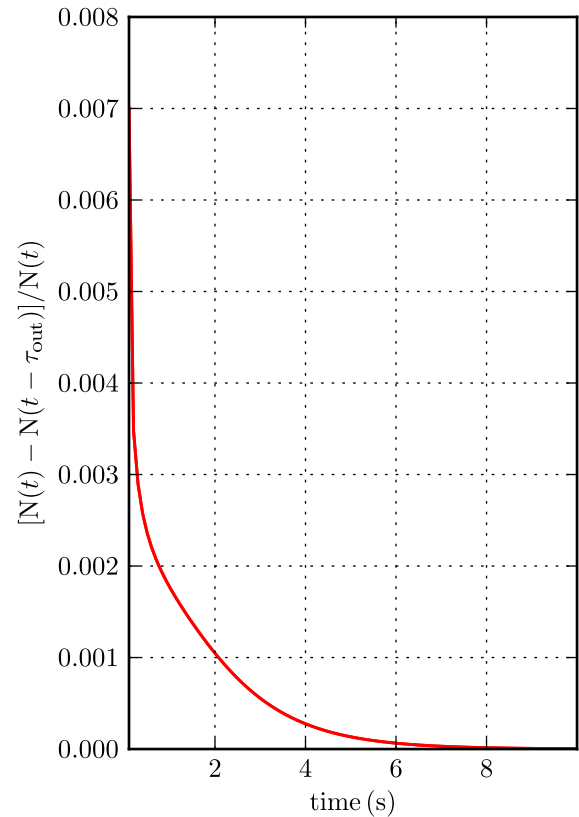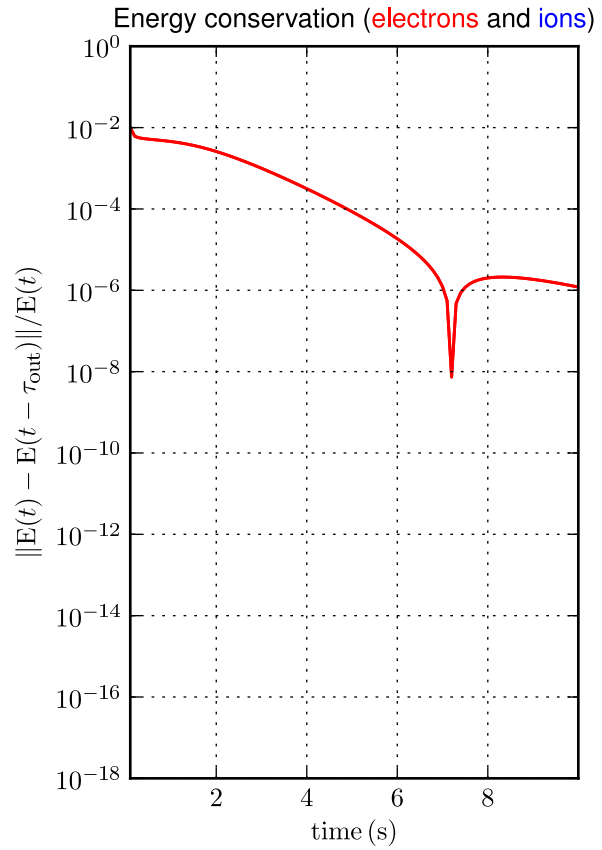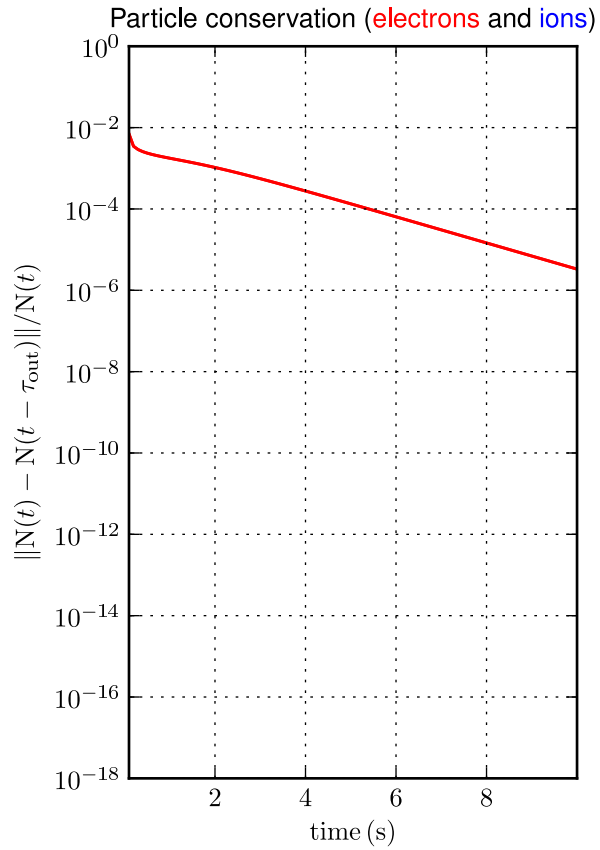## Comparison with initial solution - linear scale; total time and zoom over time

Part. & Energy conservation

[Case: **I.1.5.b**, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]

Comparison with previous time-sampled (τ_{out}) solution - log and linear scales

Particle conservation (electrons and ions)

Energy conservation (electrons and ions)

Particle conservation
[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
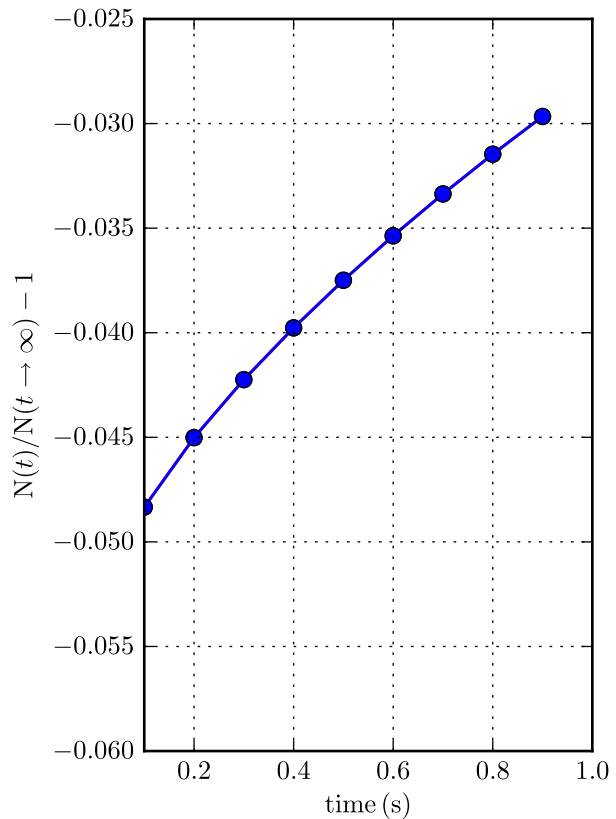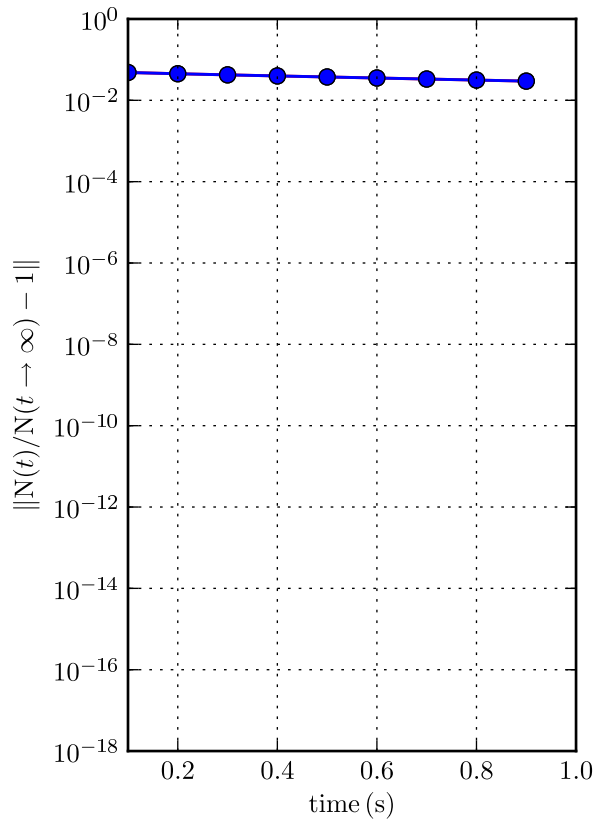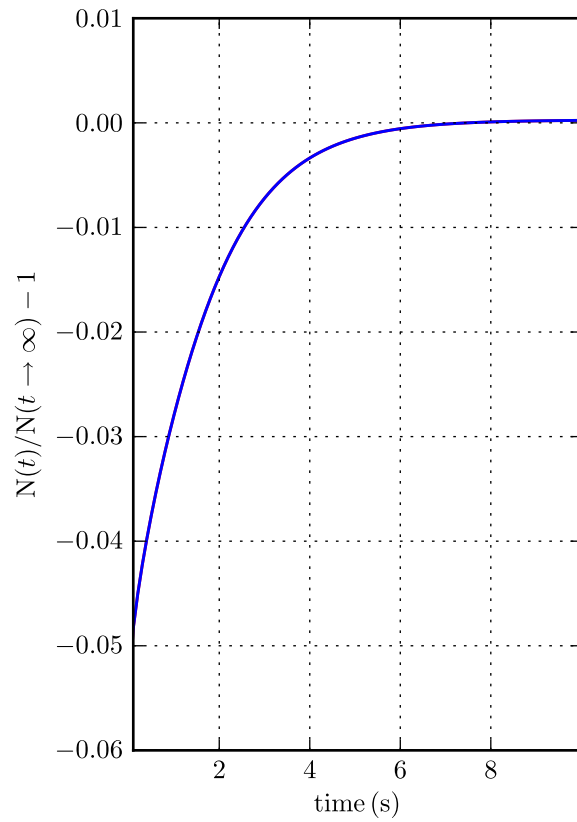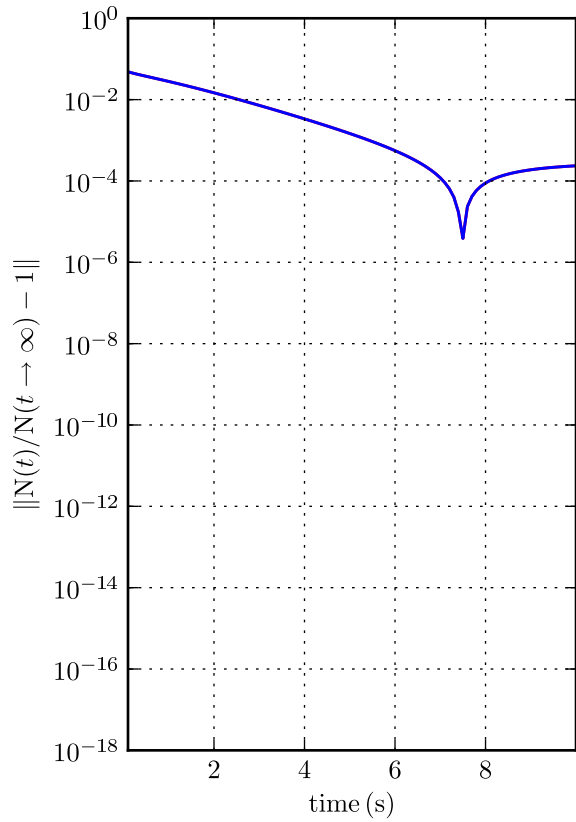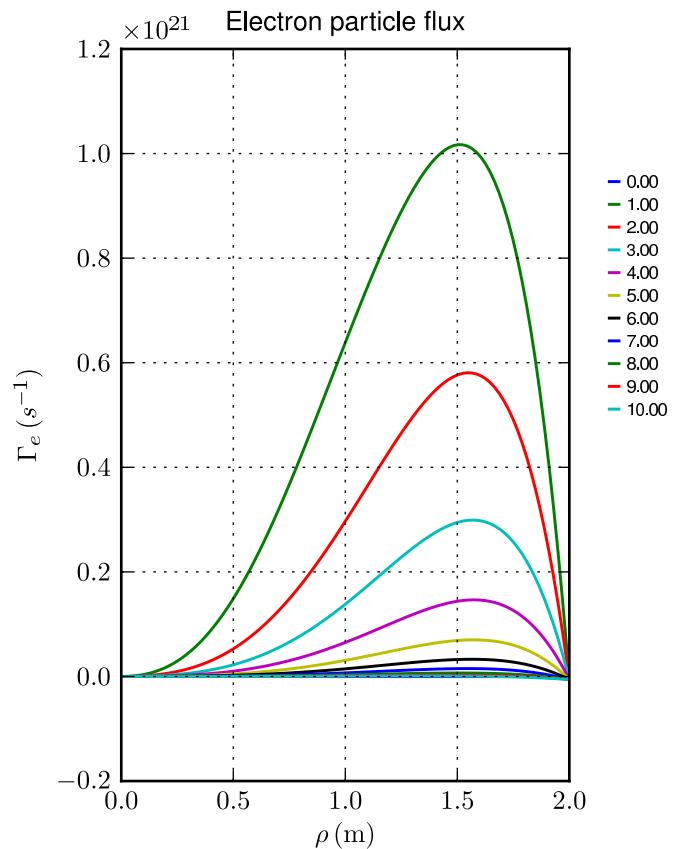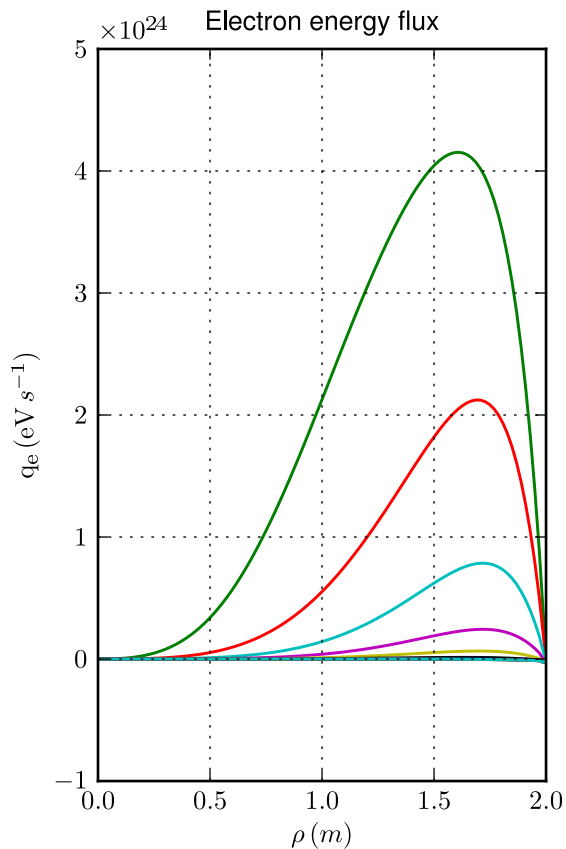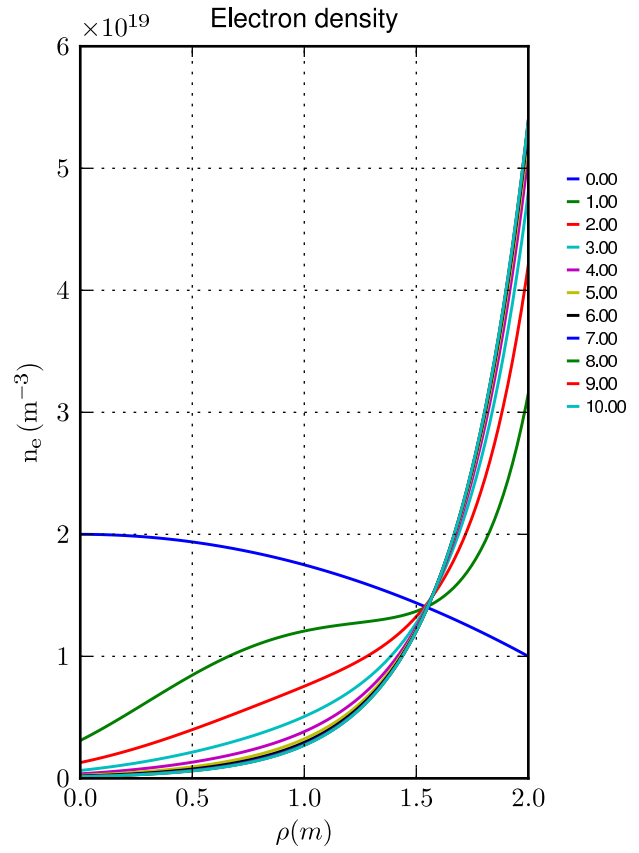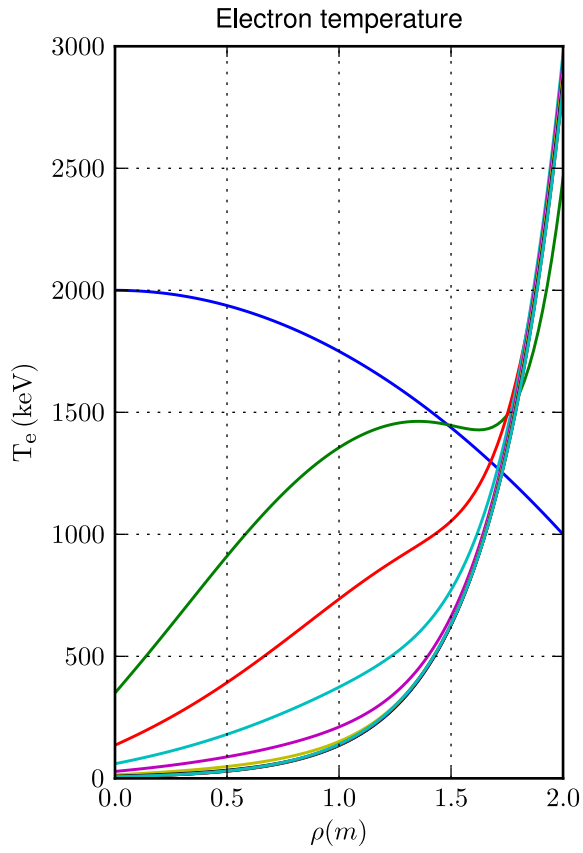Comparison with asymptotic solution (electrons and ions); total time and zoom over time

Profiles

[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m}^2/\mathrm{s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
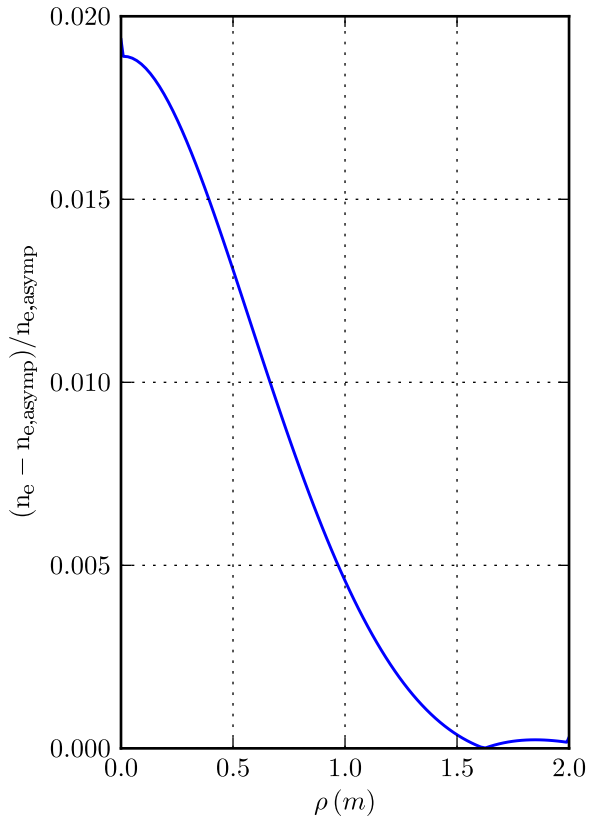
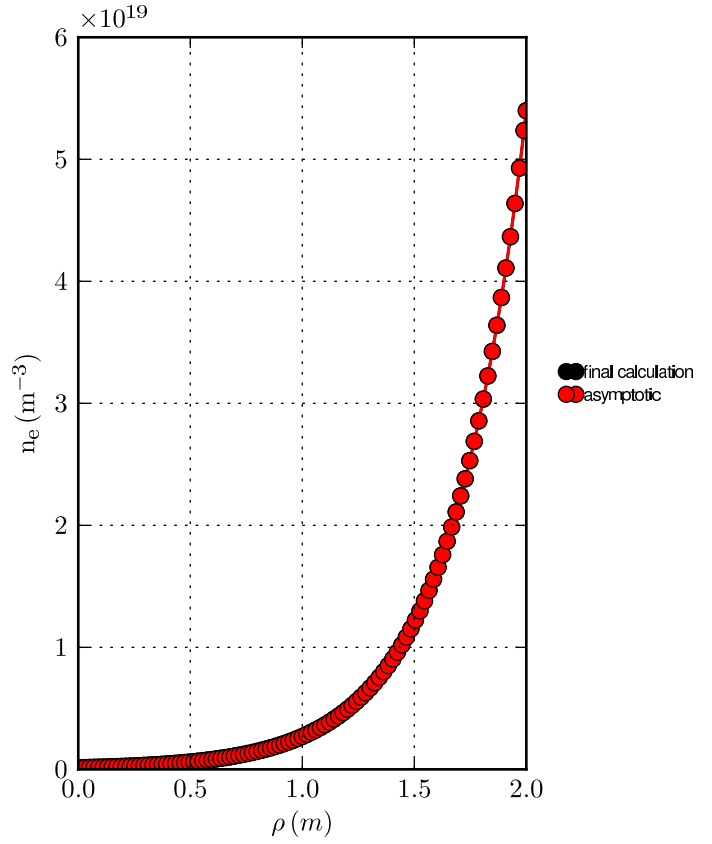Time sampling: total simulation time/10

Profiles

[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]

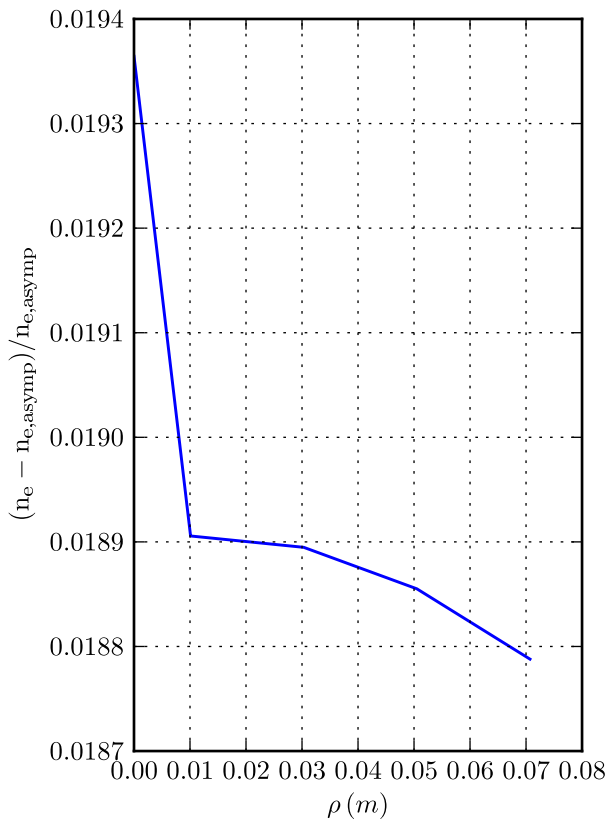## Comparison with asymptotic solution
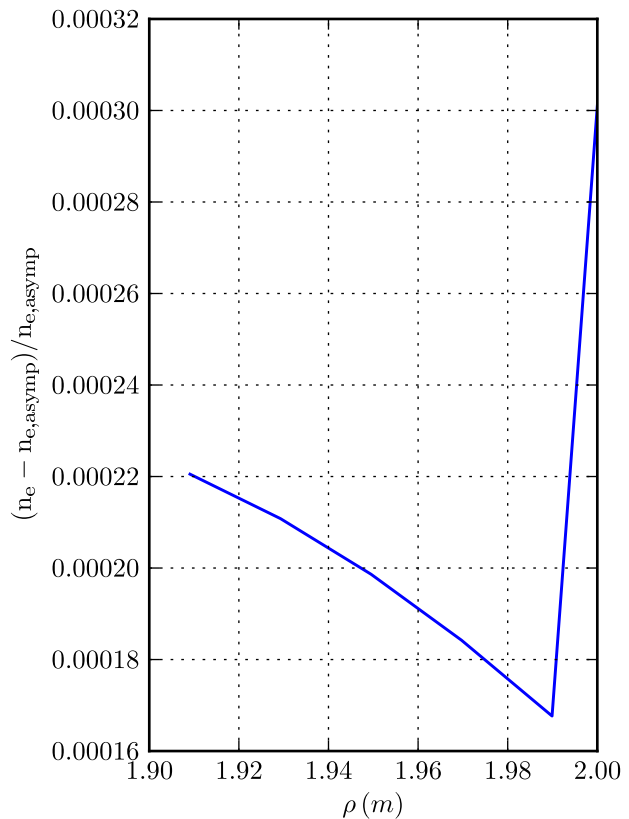
Electron density relative error
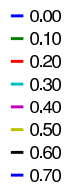

Electron density
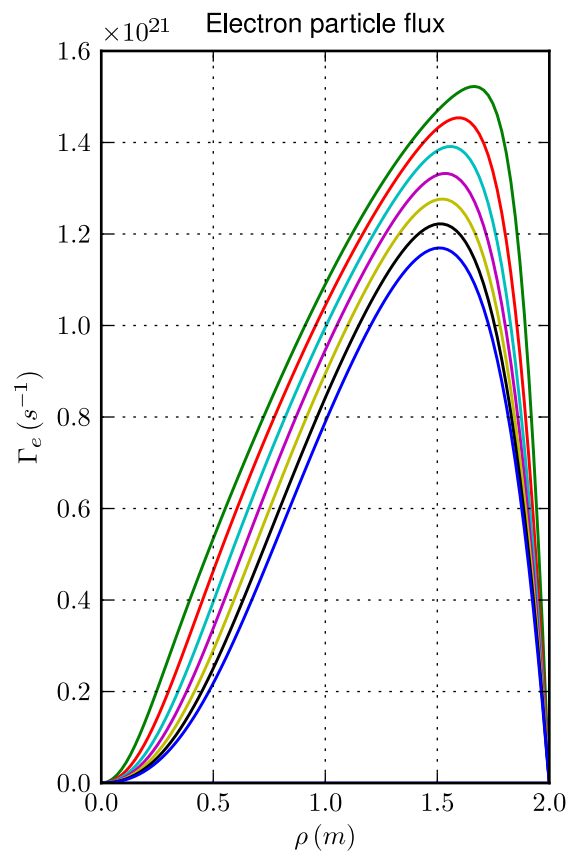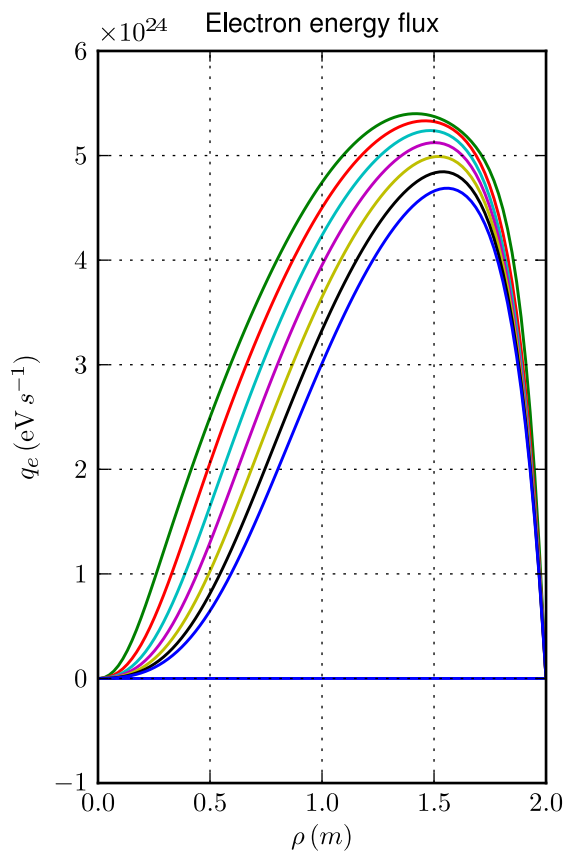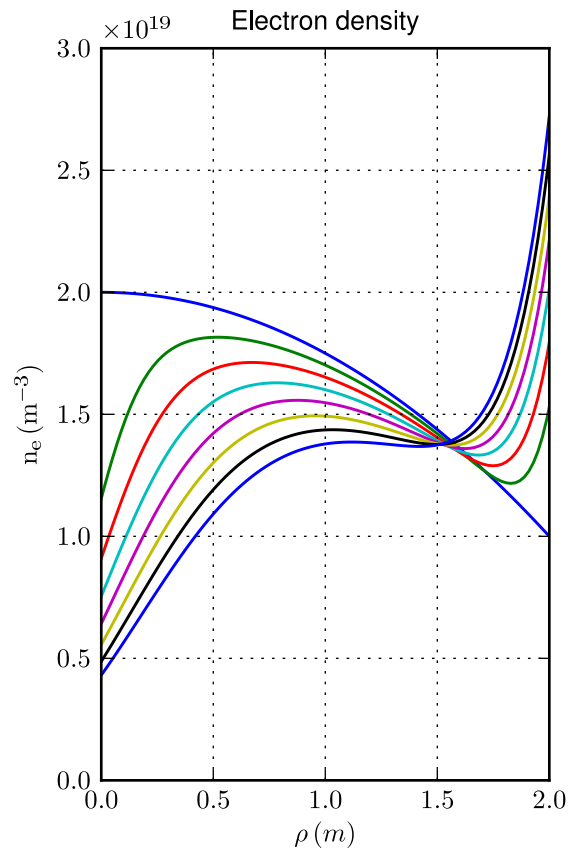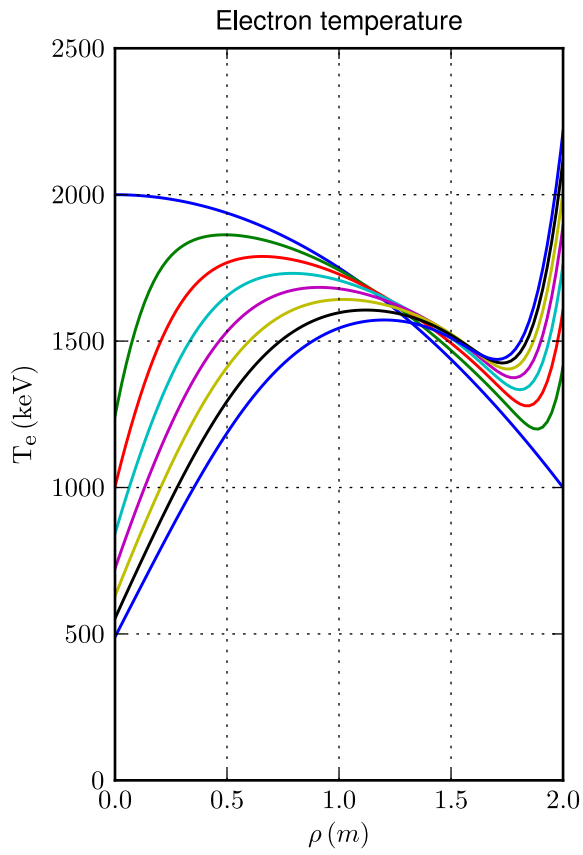

Error: zoom over axis

Error: zoom over edge

Profiles
[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, Δt = 10.00, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
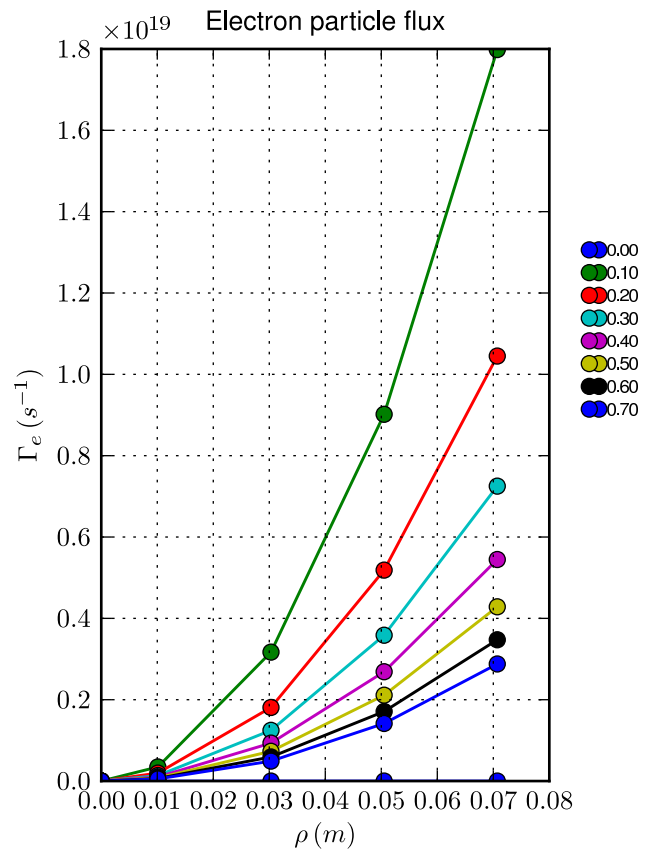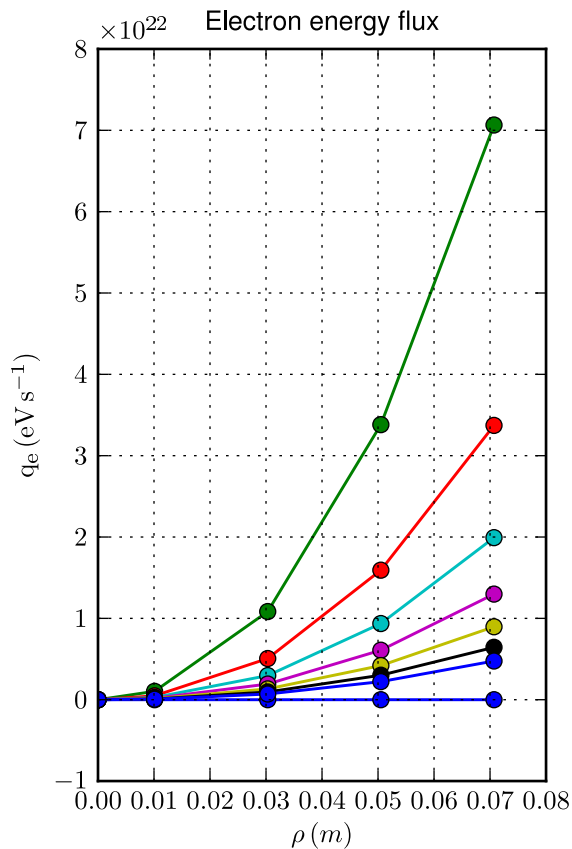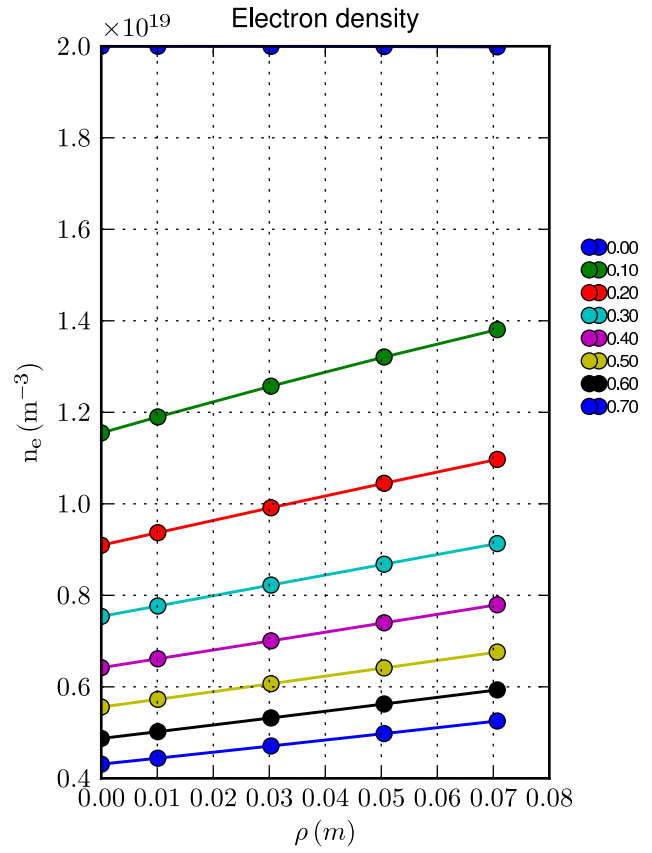Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis
Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
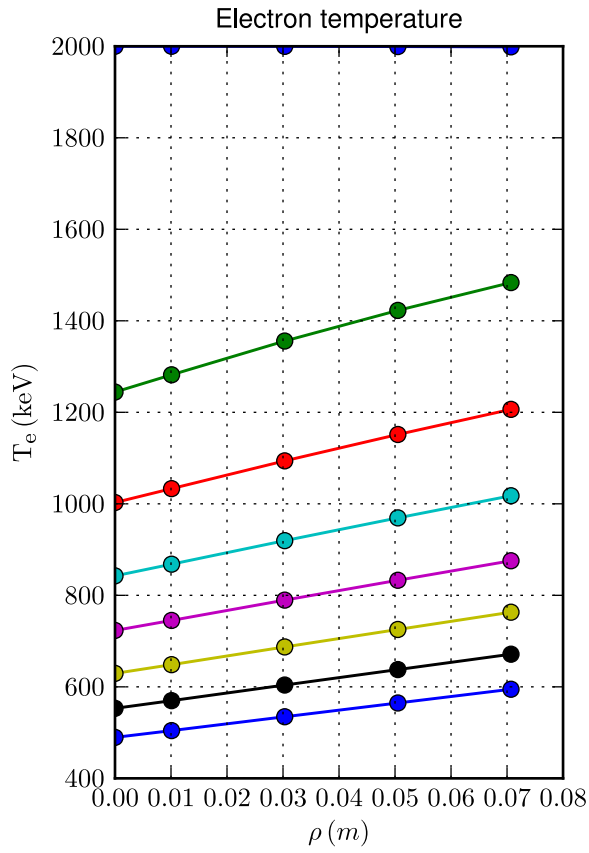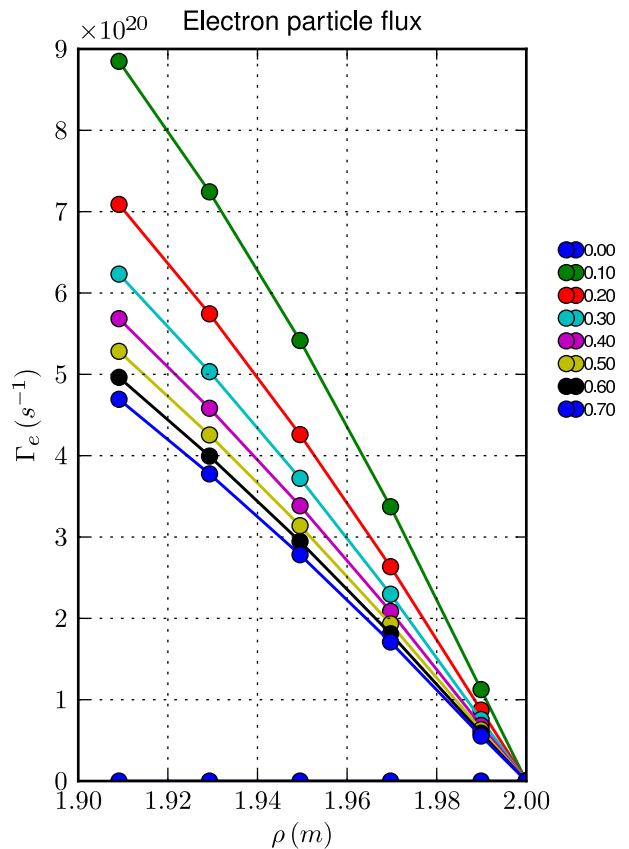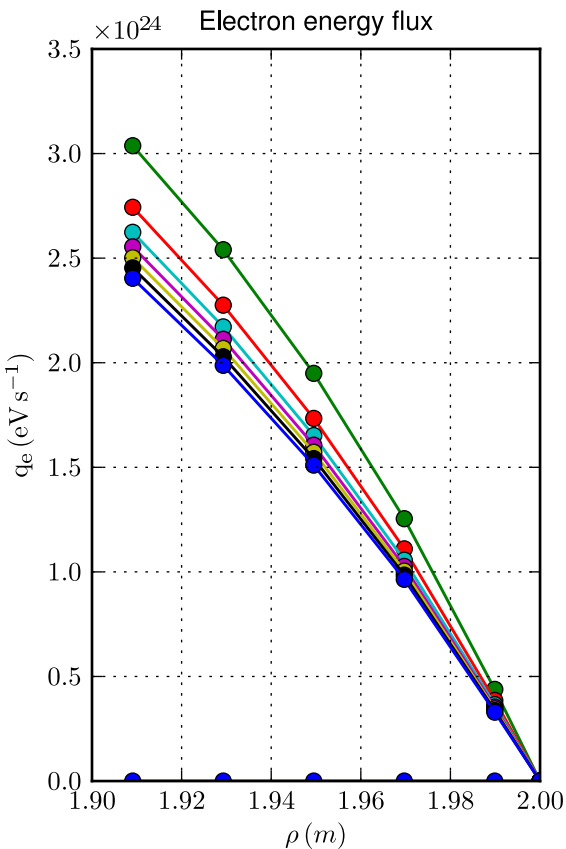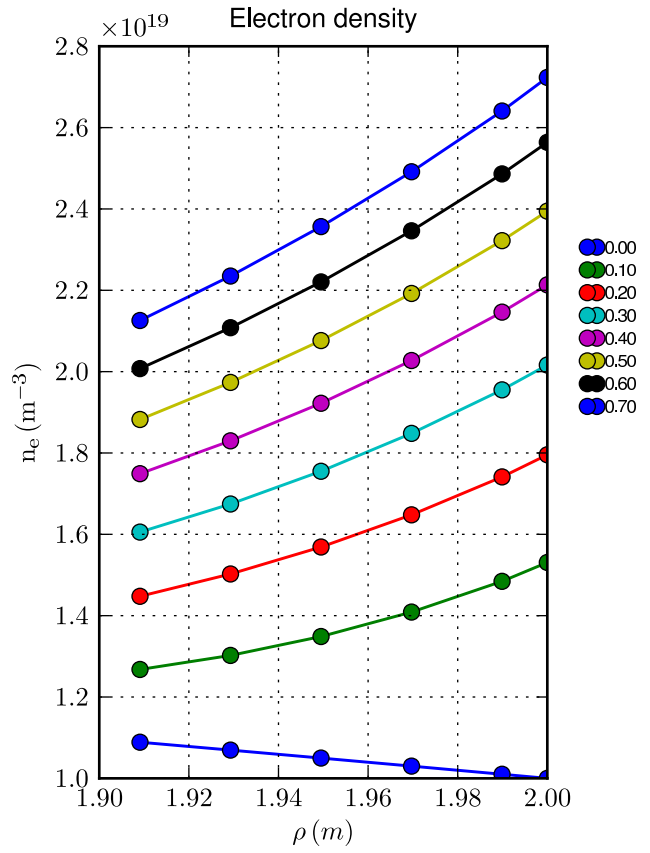[Case: **I.1.5.b**, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, Δt = **10.00**, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over edge
Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)|$ =0.80 s

Profiles
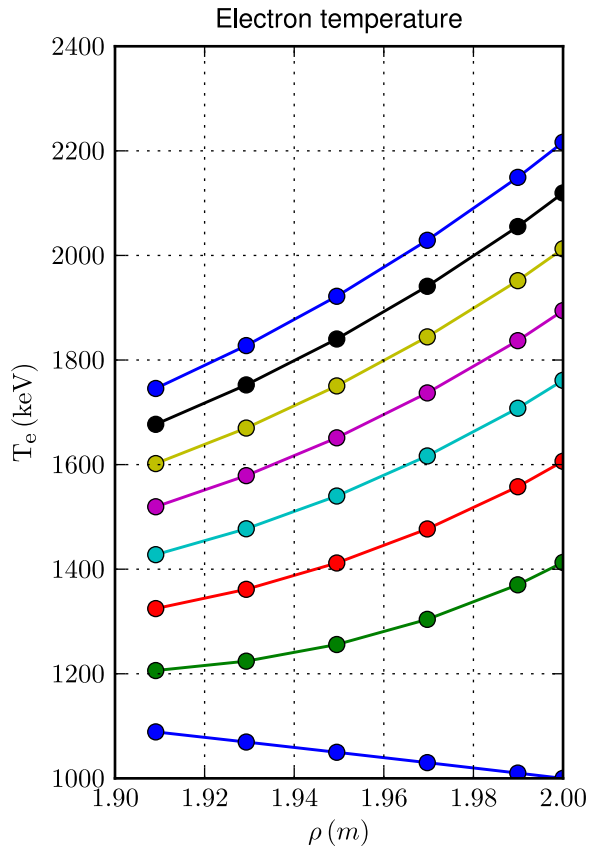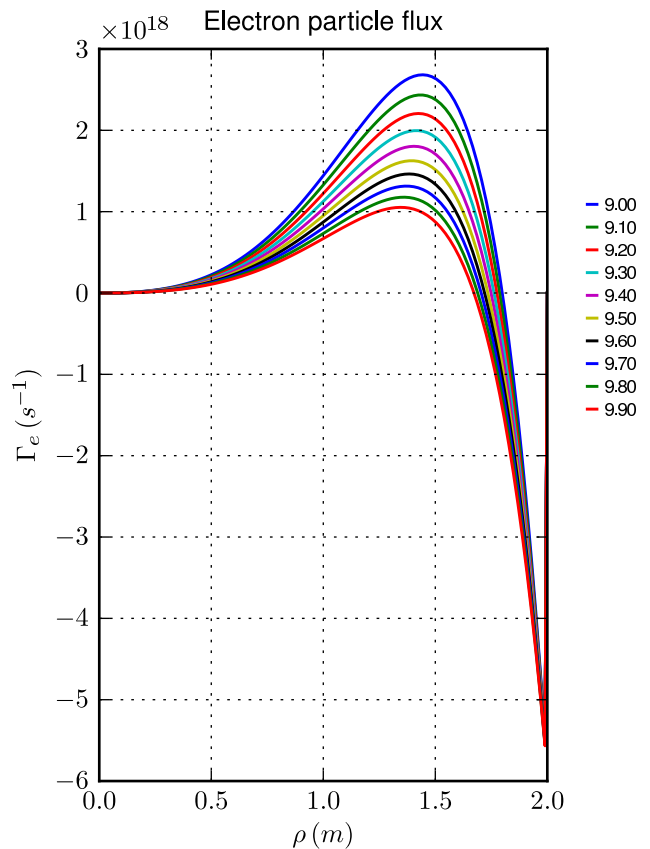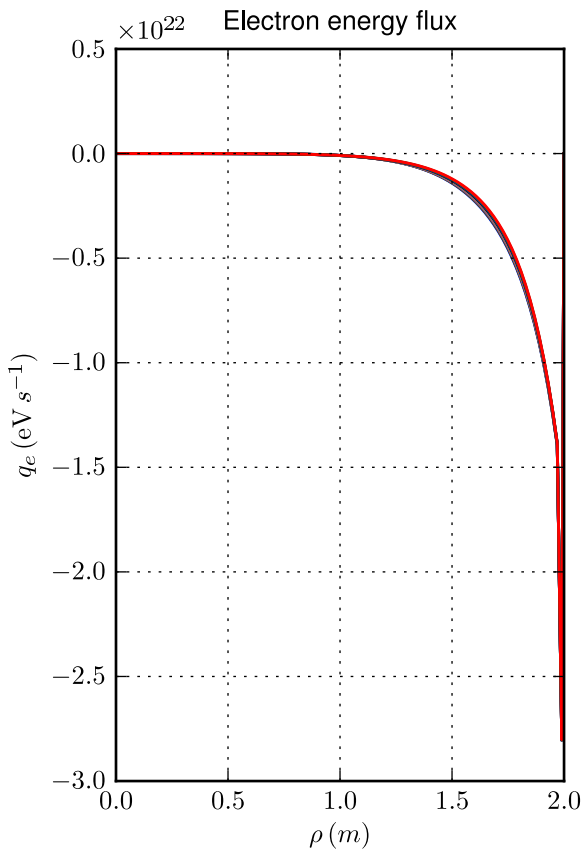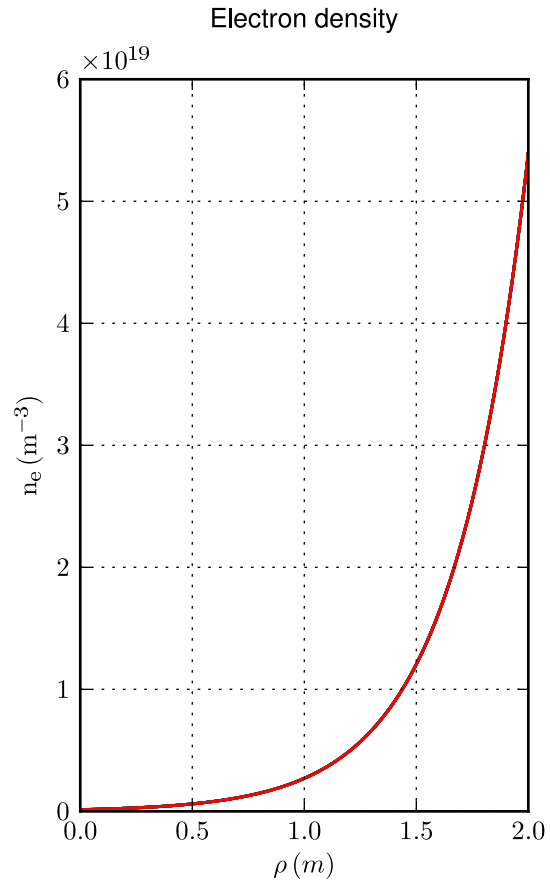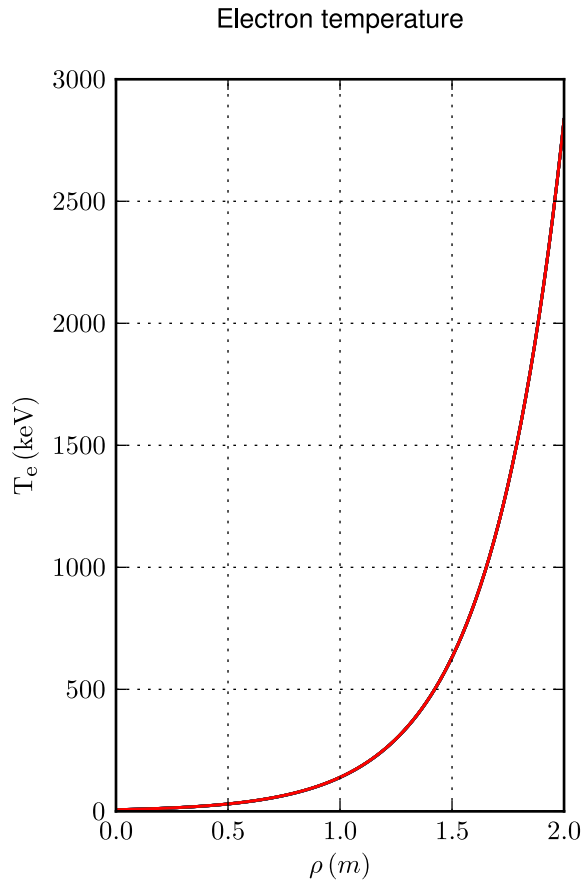[Case: **I.1.5.b**, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Time sampling: last 10 time slices

Profiles
[Case: **I.1.5.b**, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis; time sampling: last 10 time slices

Electron temperature

Electron density

Electron energy flux

Electron particle flux

Profiles
[Case: I.1.5.b, Solver: 4, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
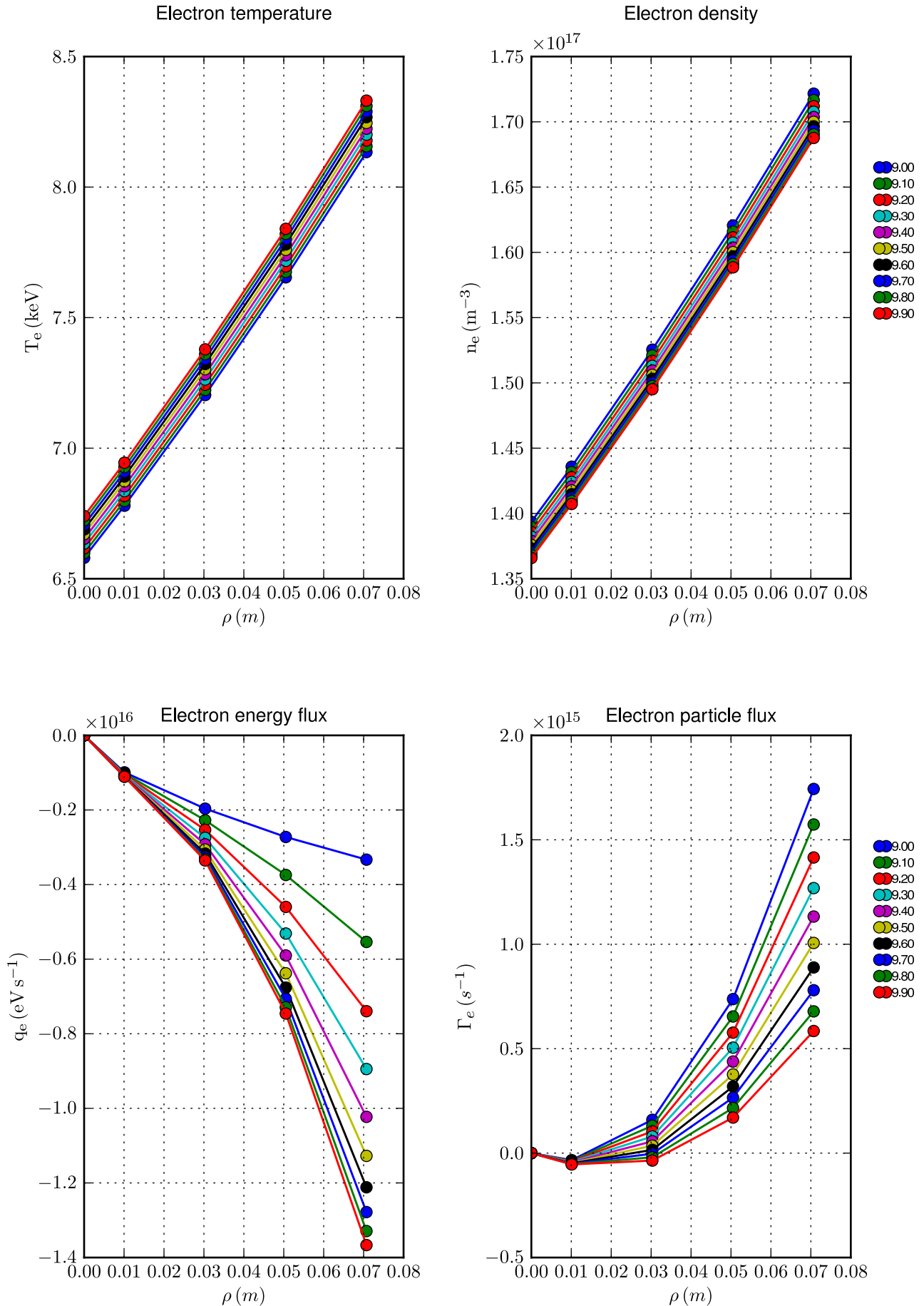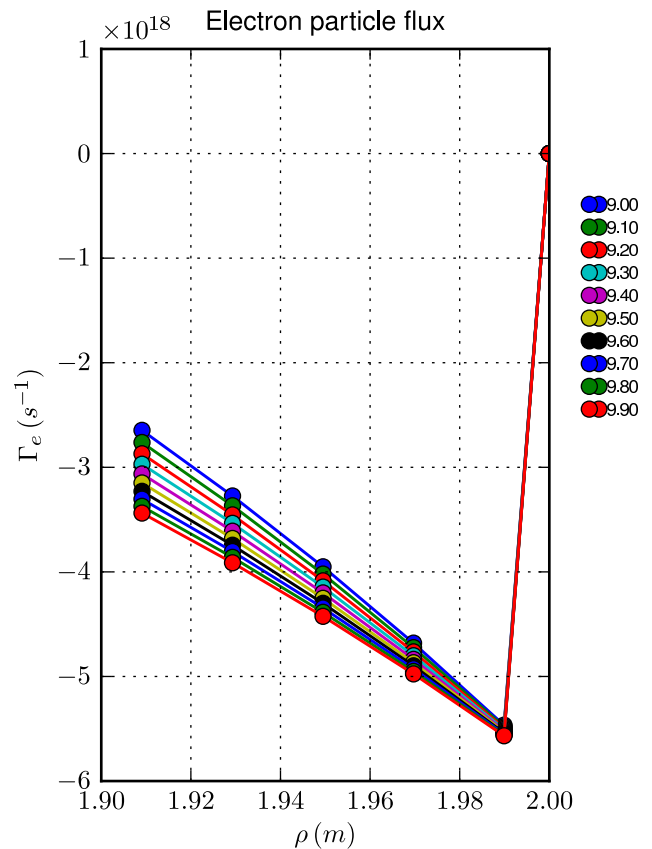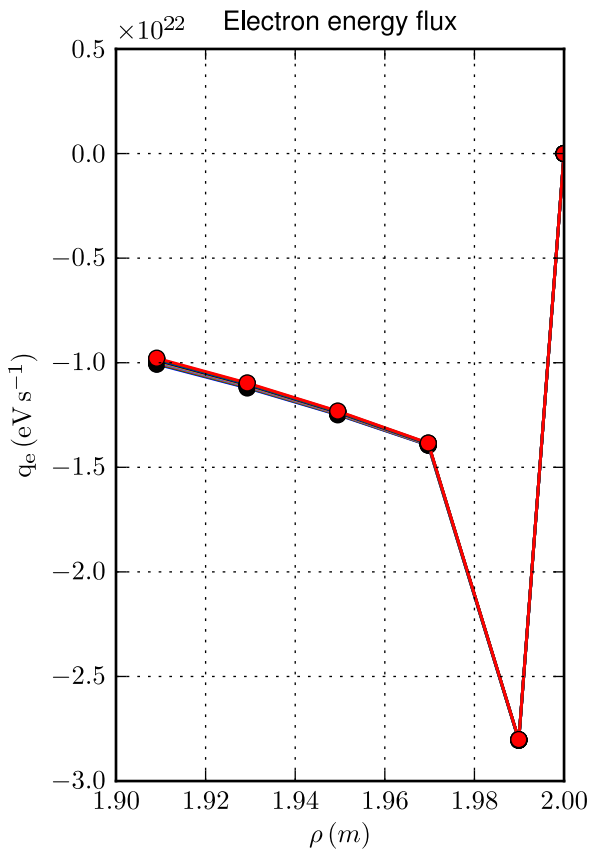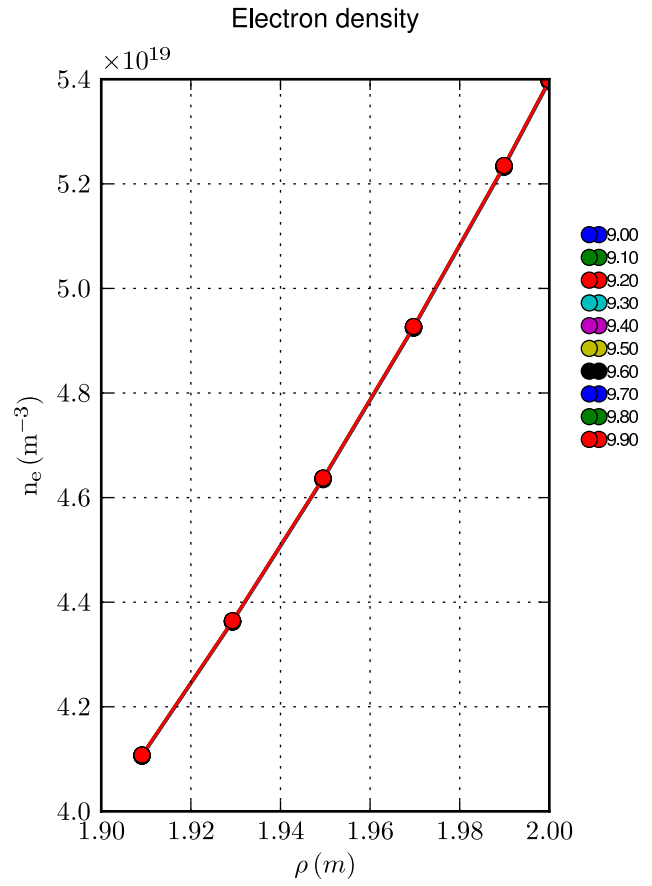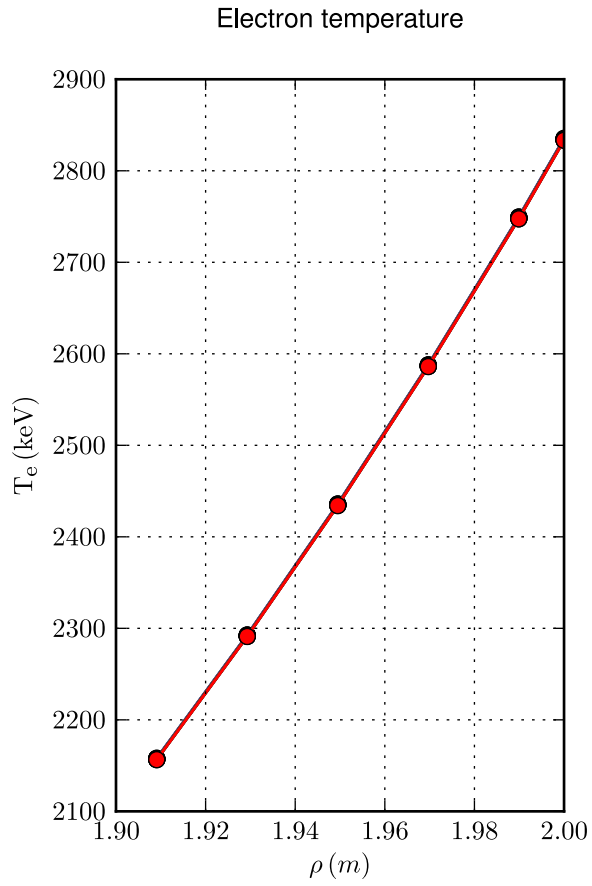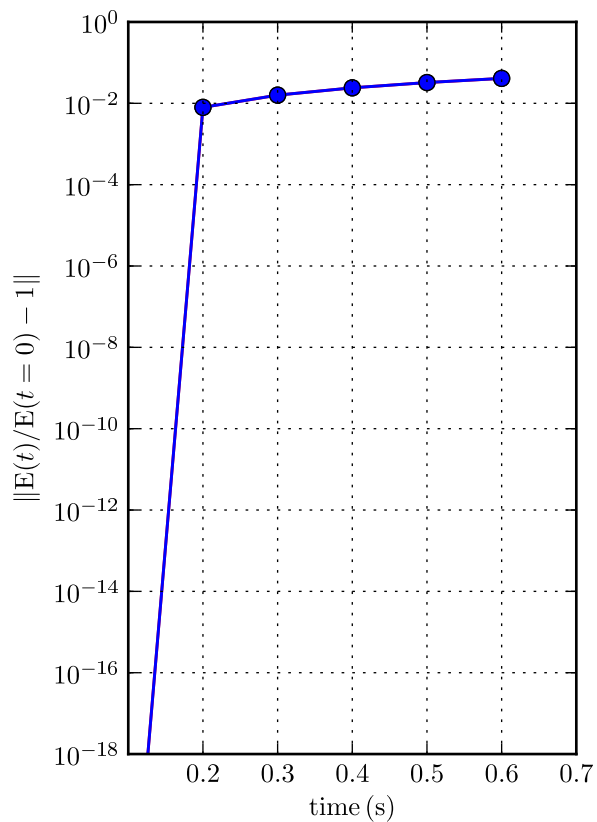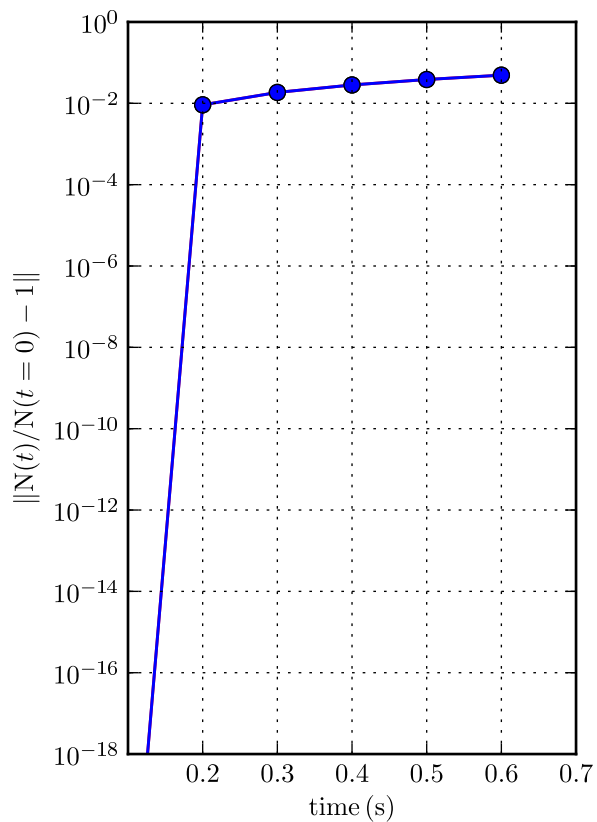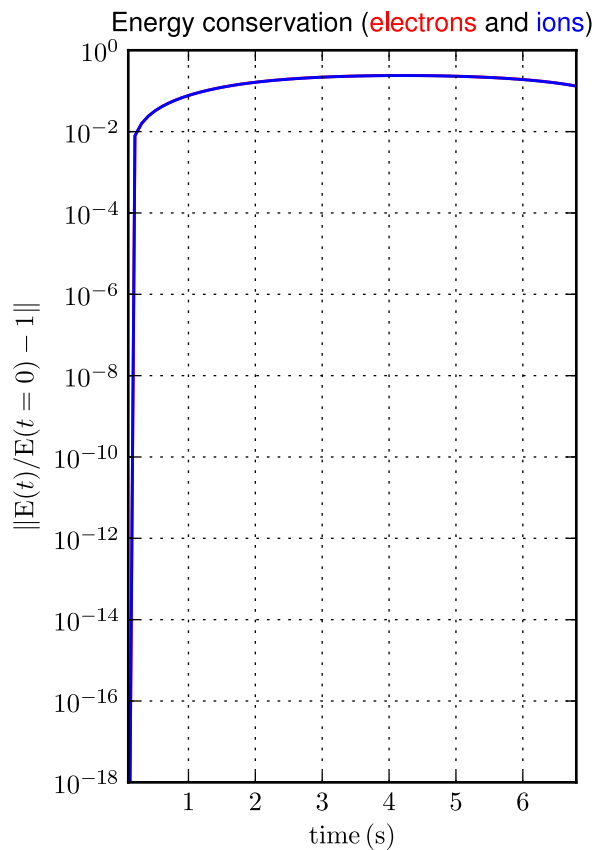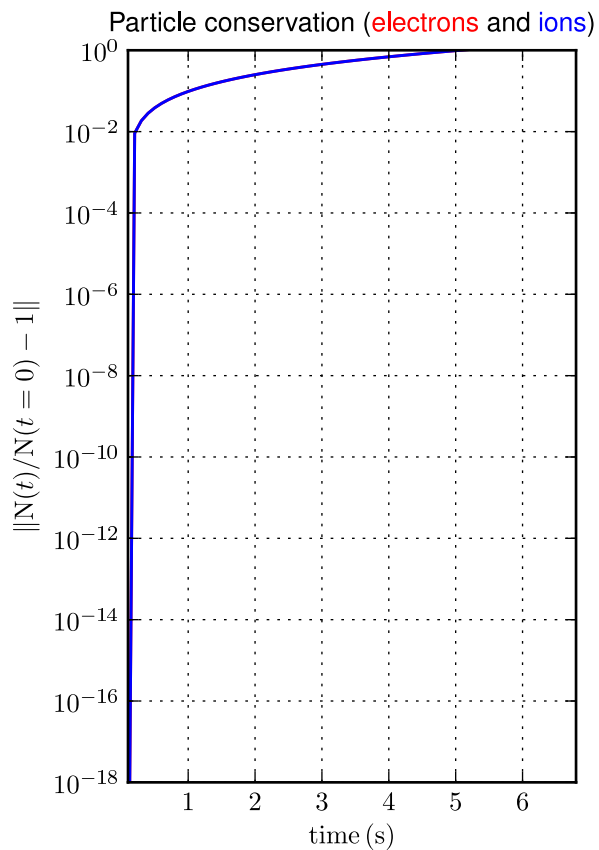Spatial zoom over edge; time sampling: last 10 time slices

Part. & Energy conservation
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
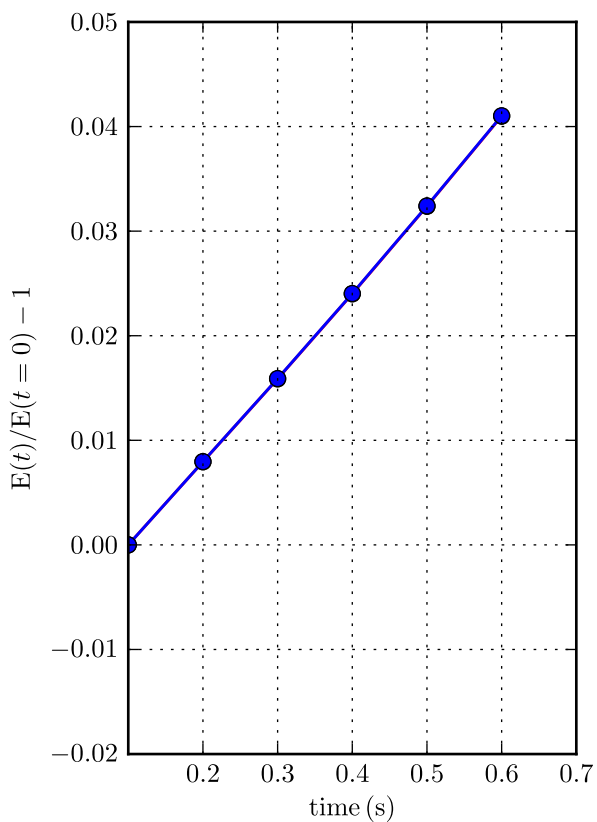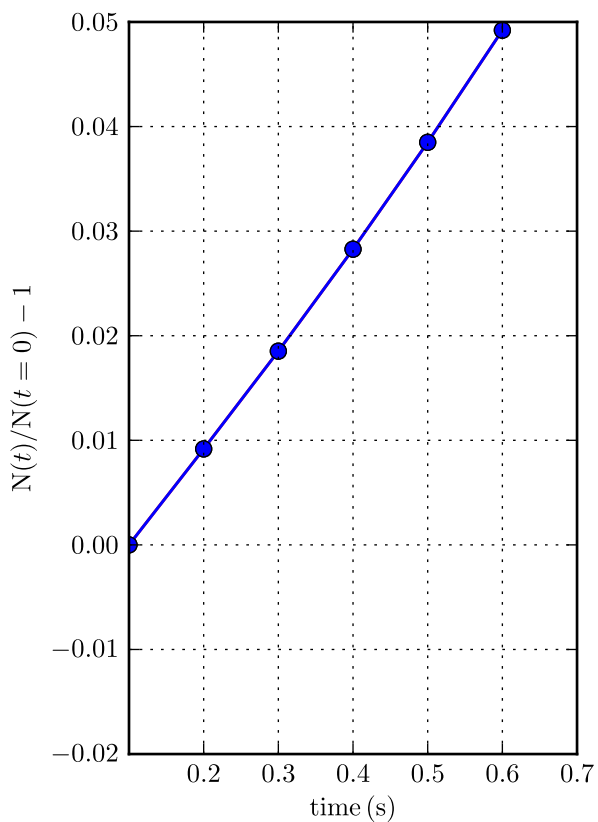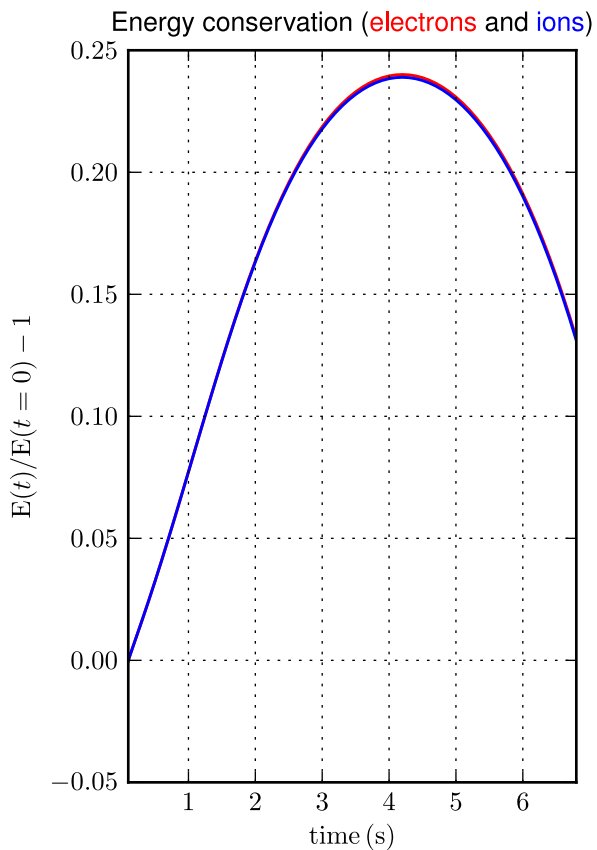Comparison with initial solution - log scale; total time and zoom over time

Part. & Energy conservation
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
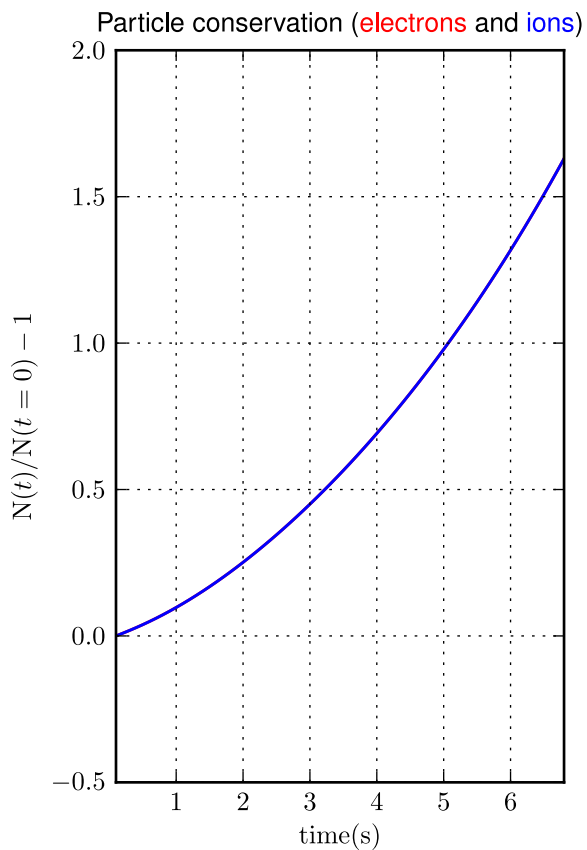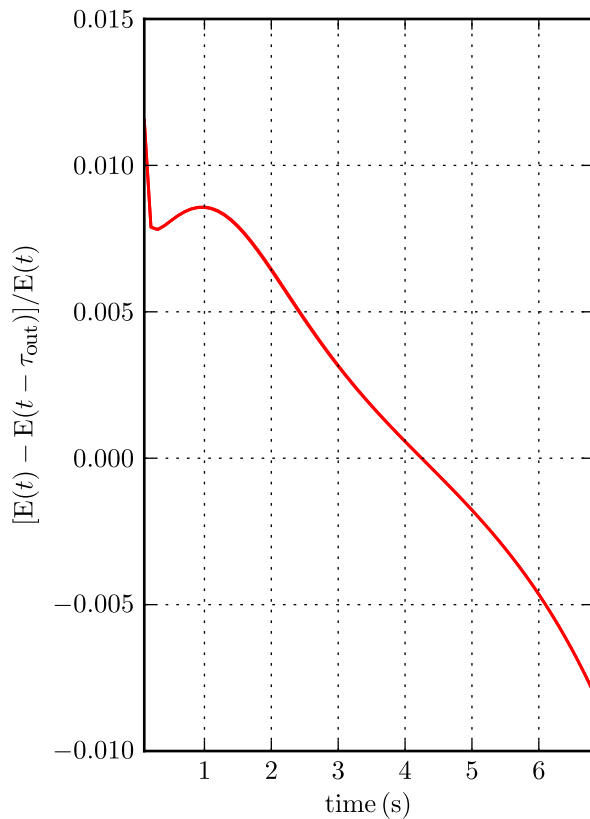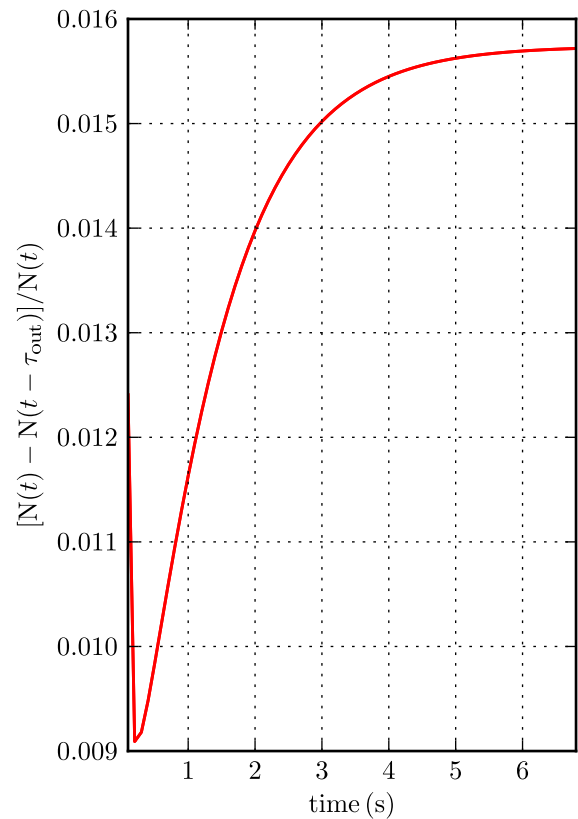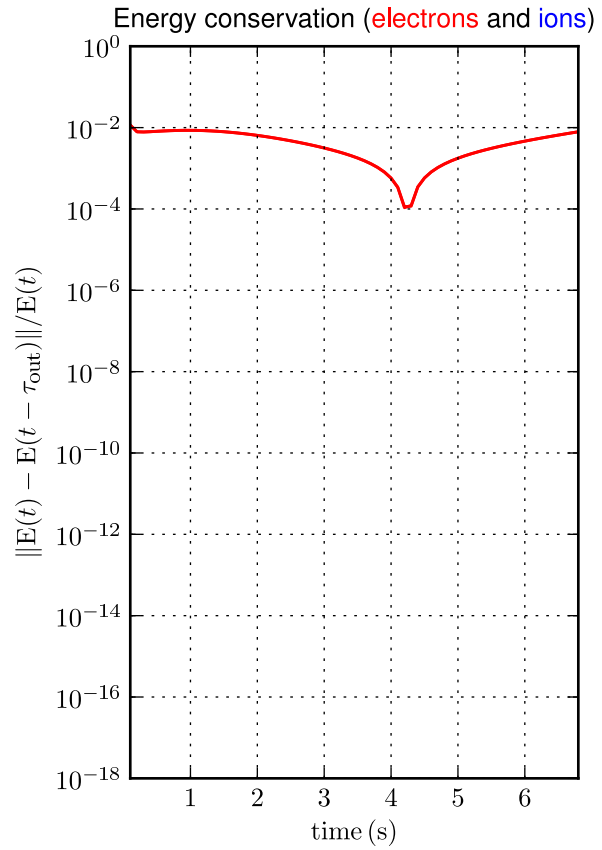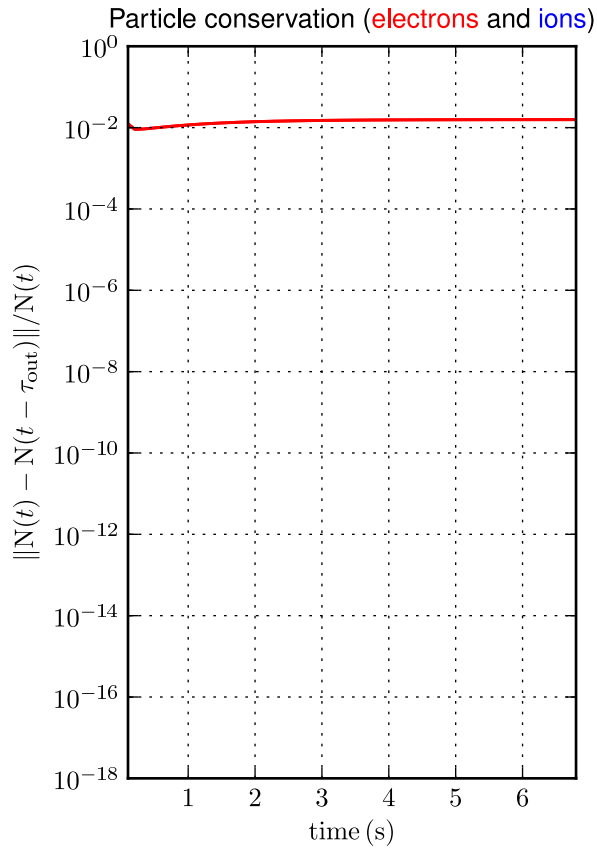Comparison with initial solution - linear scale; total time and zoom over time

Part. & Energy conservation
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with previous time-sampled (τ_{out}) solution - log and linear scales

Particle conservation (electrons and ions)

Energy conservation (electrons and ions)

Particle conservation
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
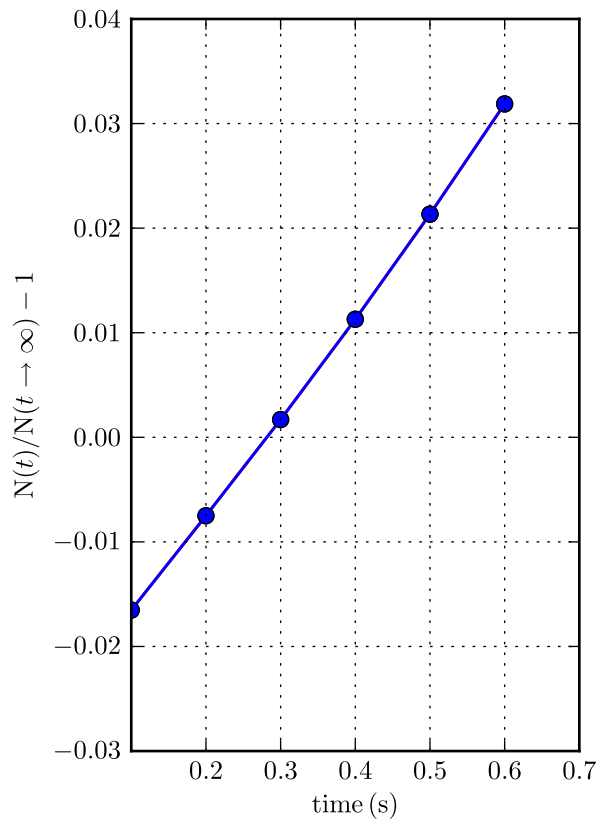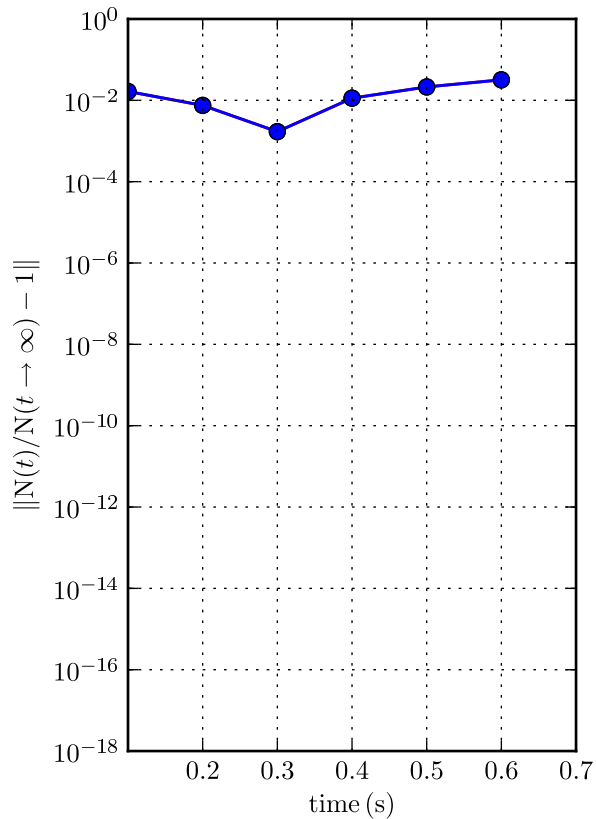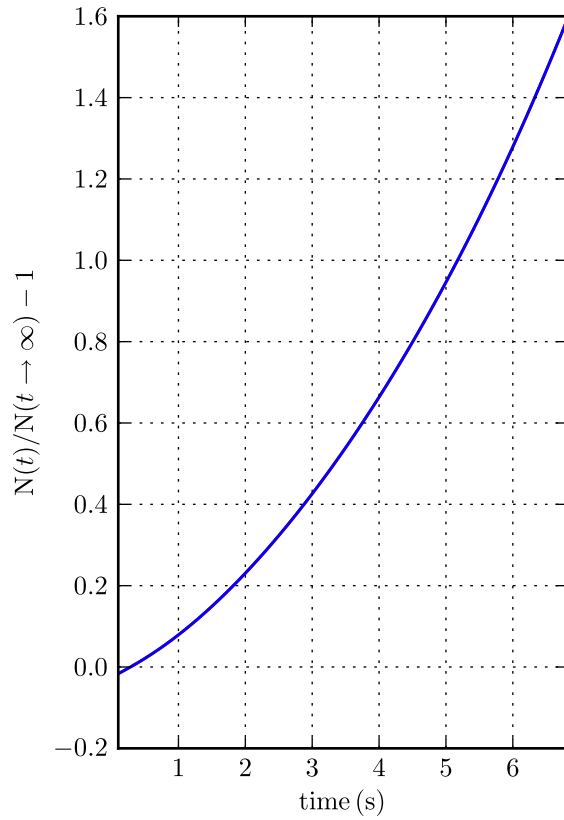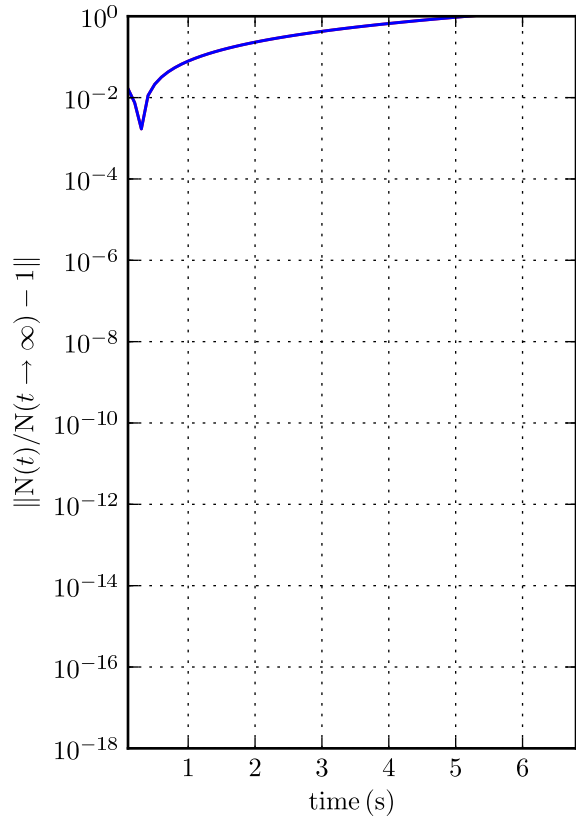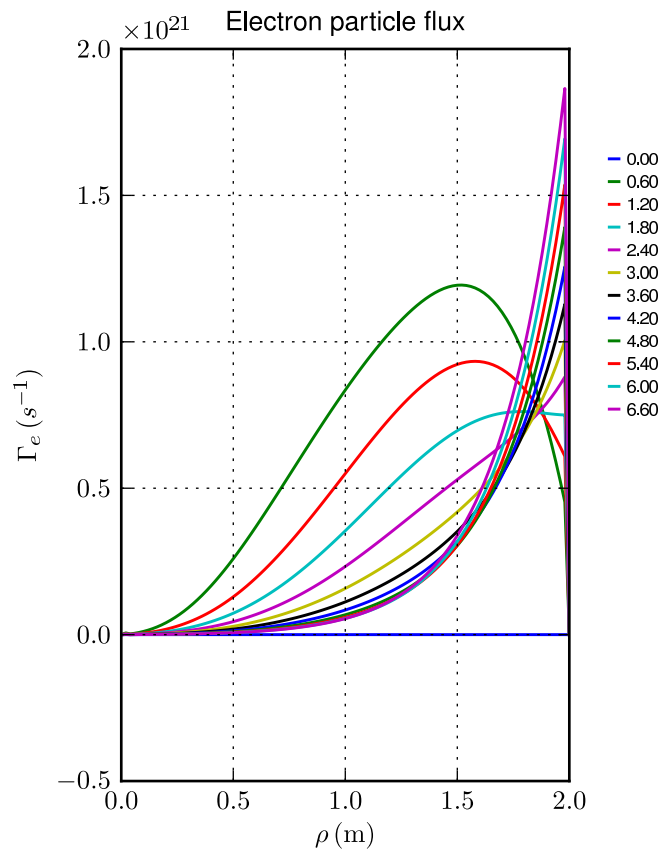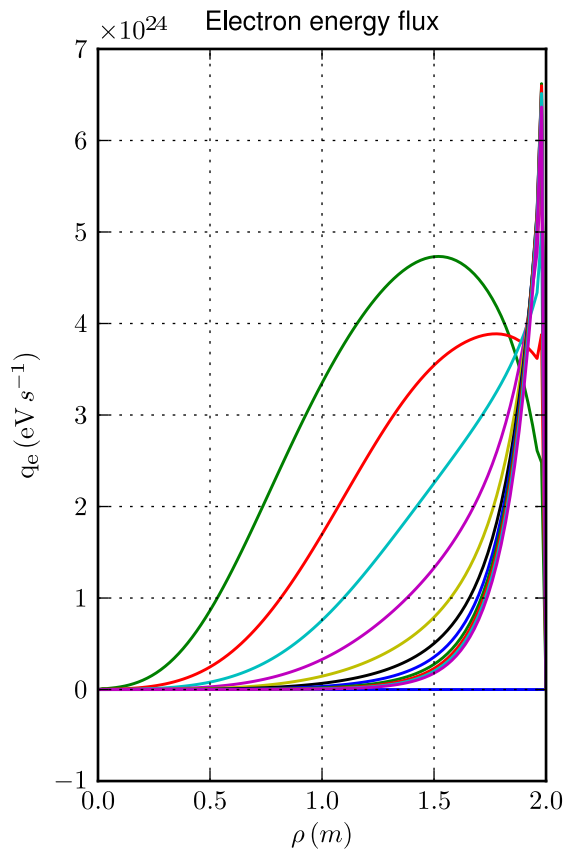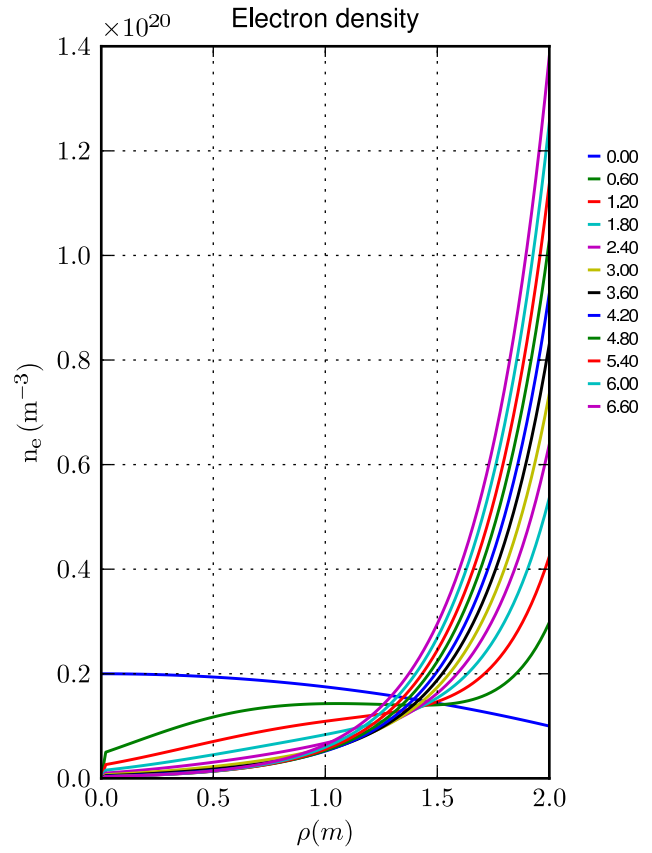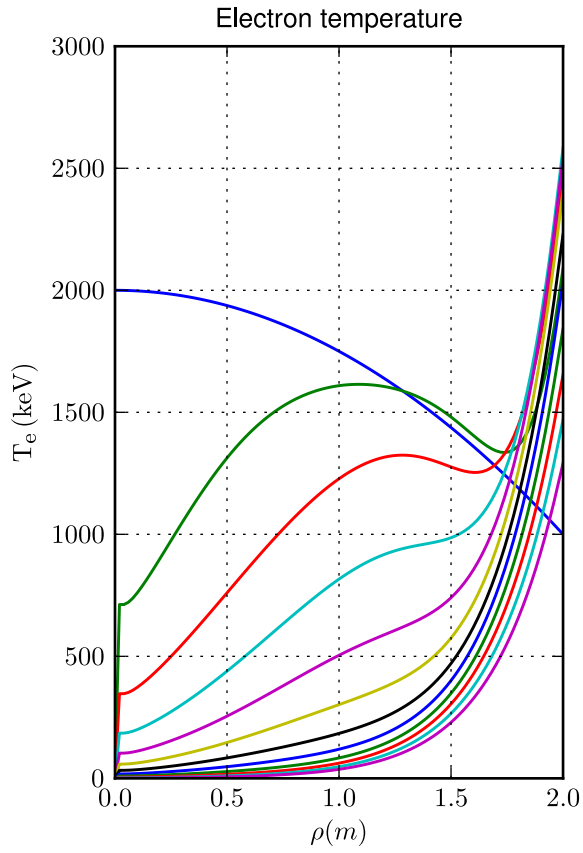Comparison with asymptotic solution (electrons and ions); total time and zoom over time

Profiles
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
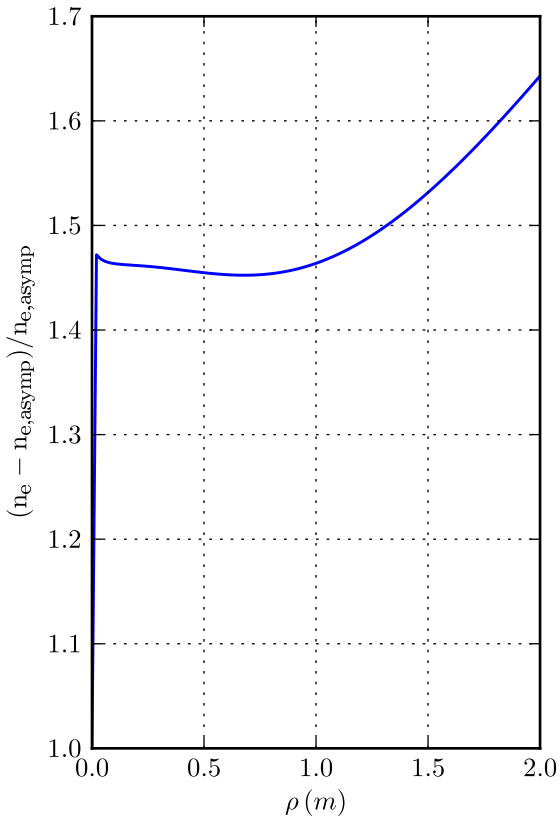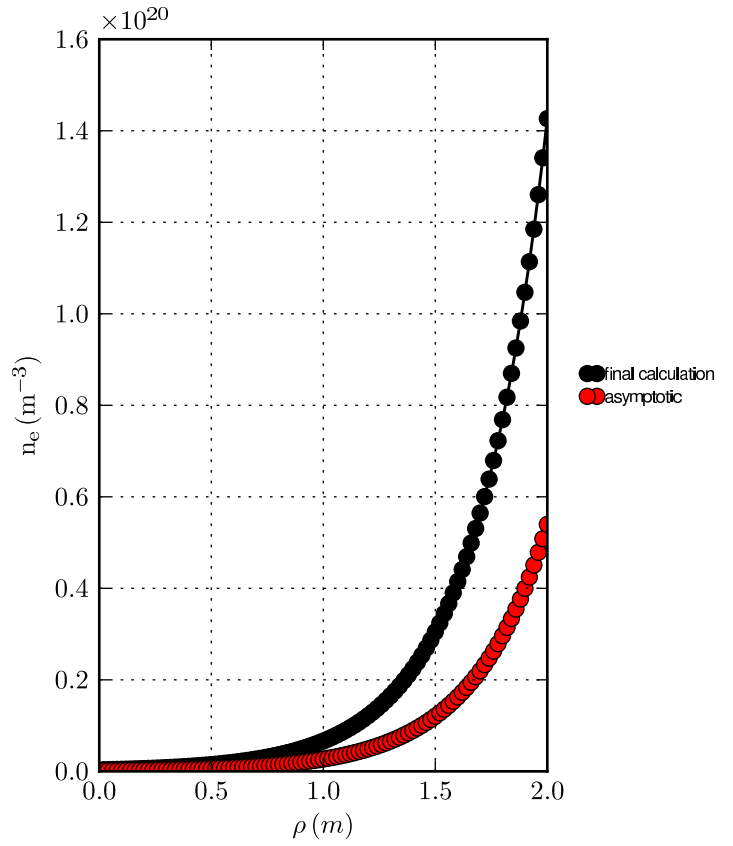Time sampling: total simulation time/10

Profiles
[Case: **I.1.5.b**, Solver: **7**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
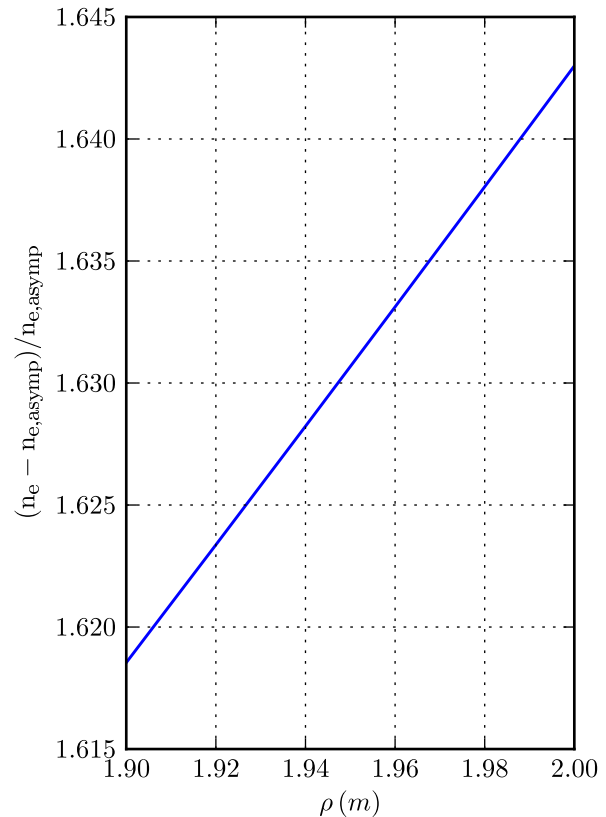Comparison with asymptotic solution

Electron density relative error

Electron density

final calculation
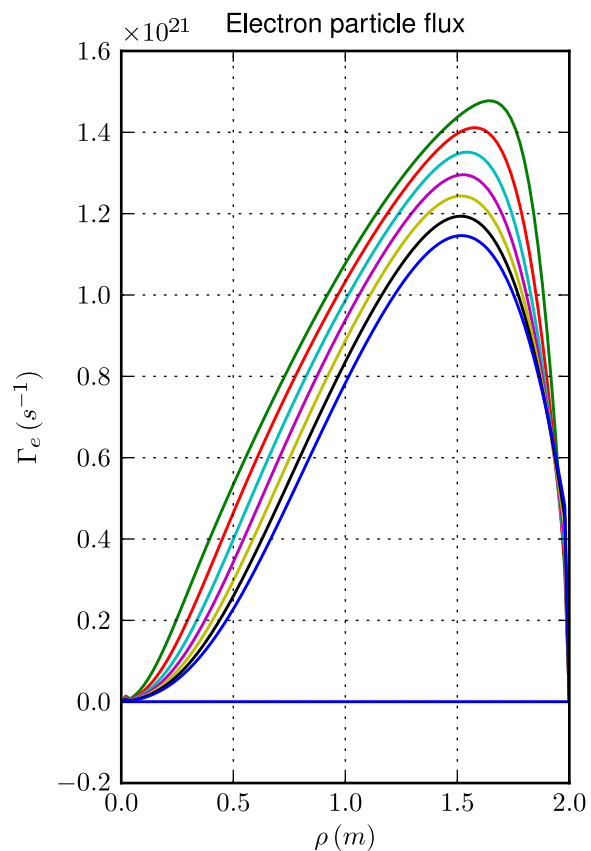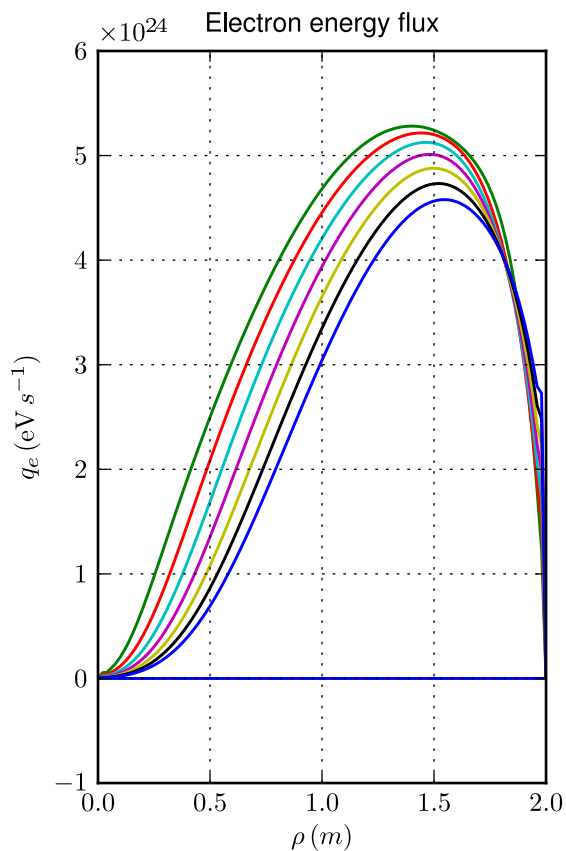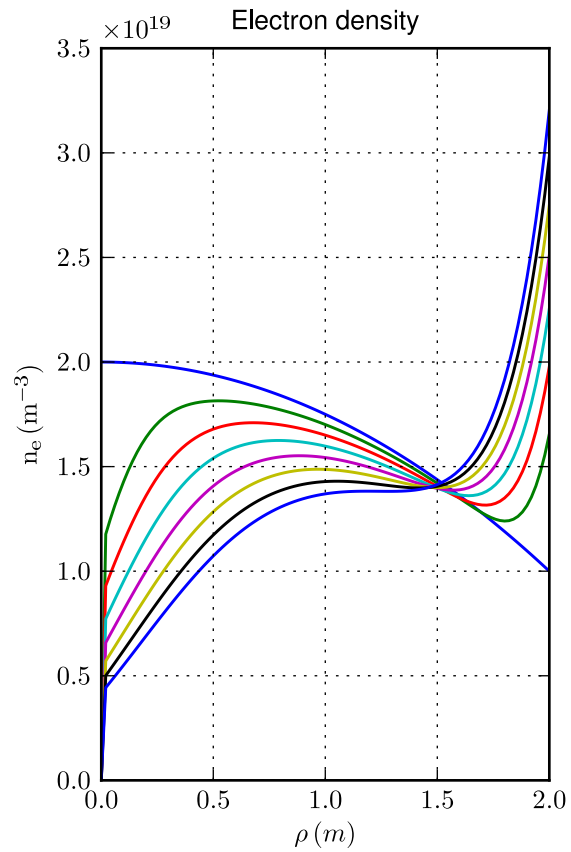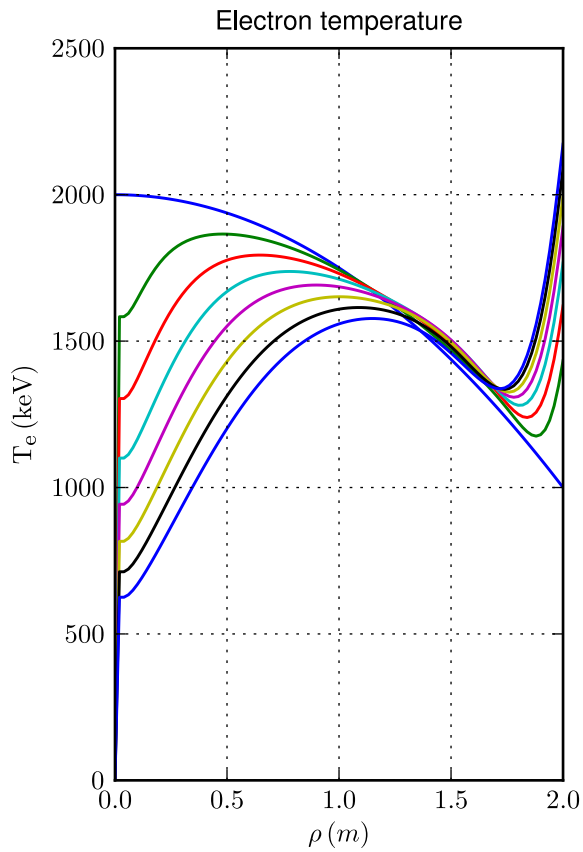asymptotic

Error: zoom over axis

Error: zoom over edge

Profiles
[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
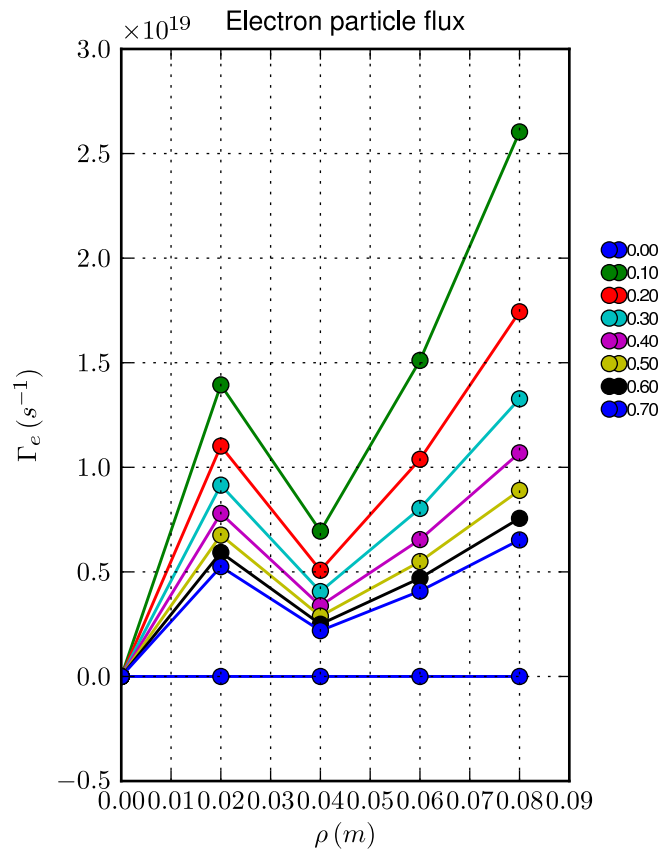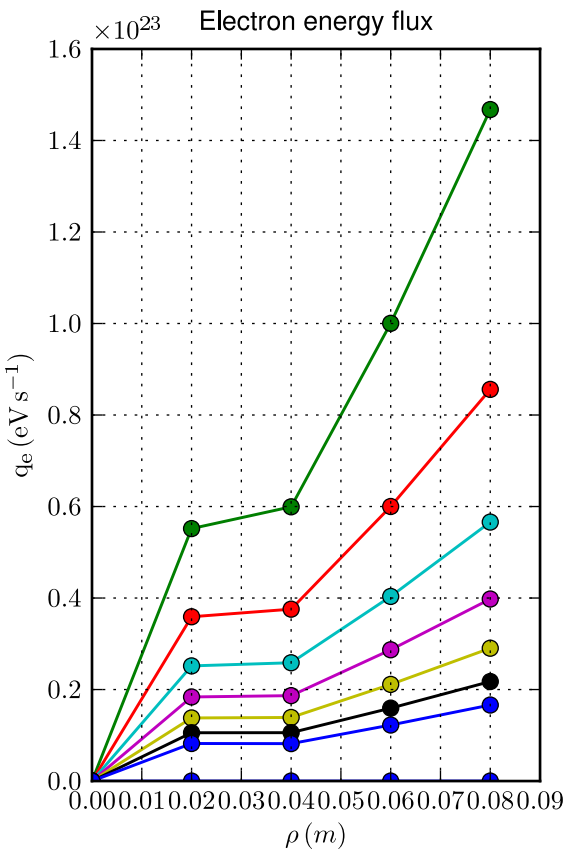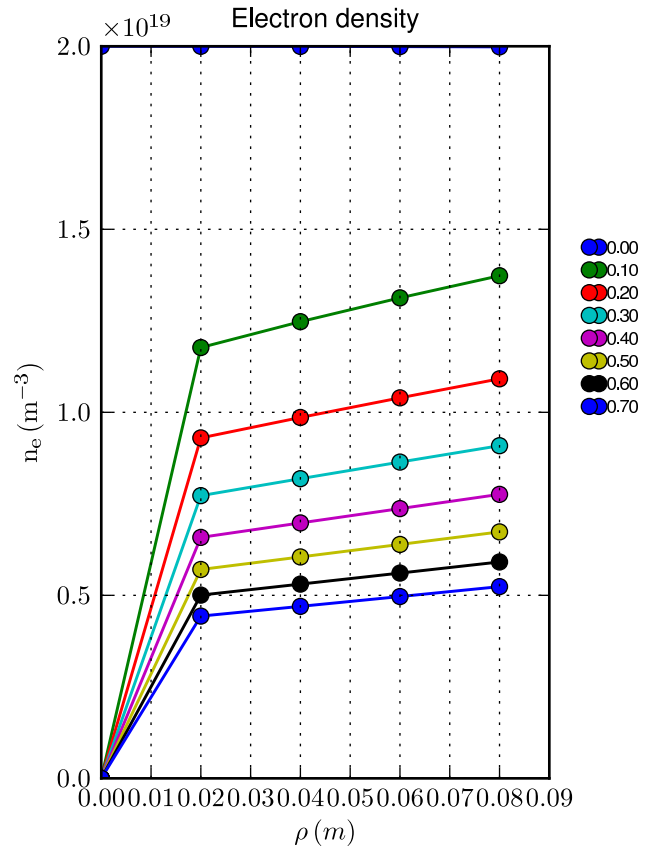Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
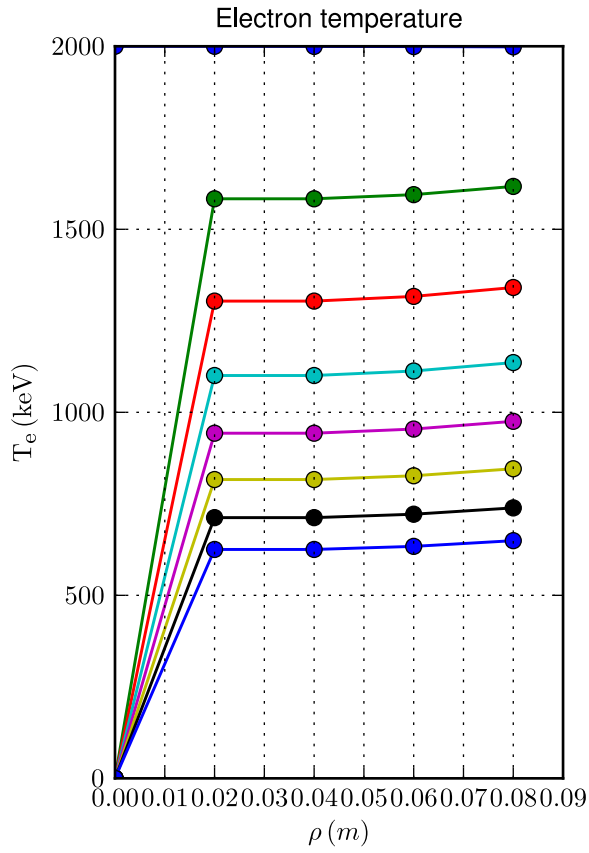[Case: I.1.5.b, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis
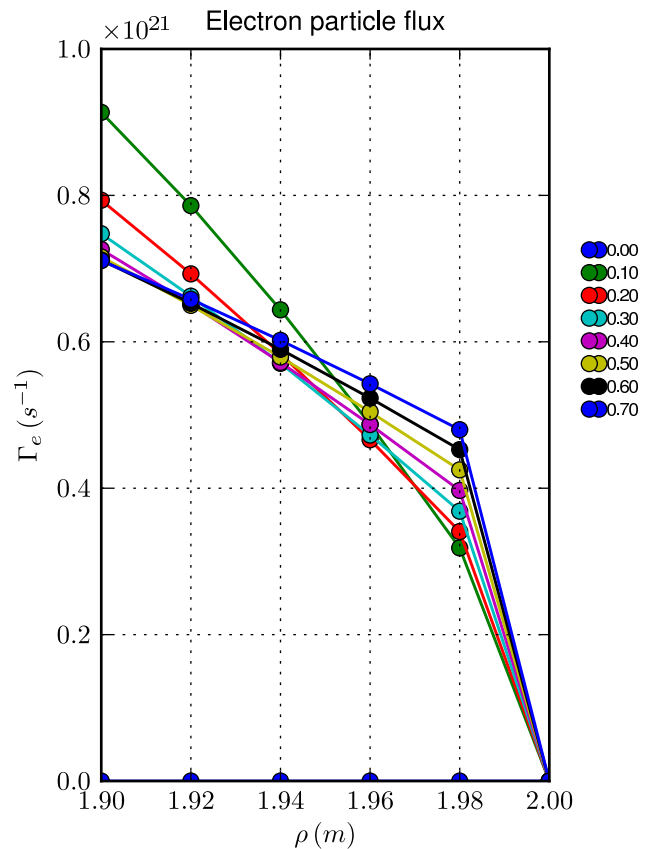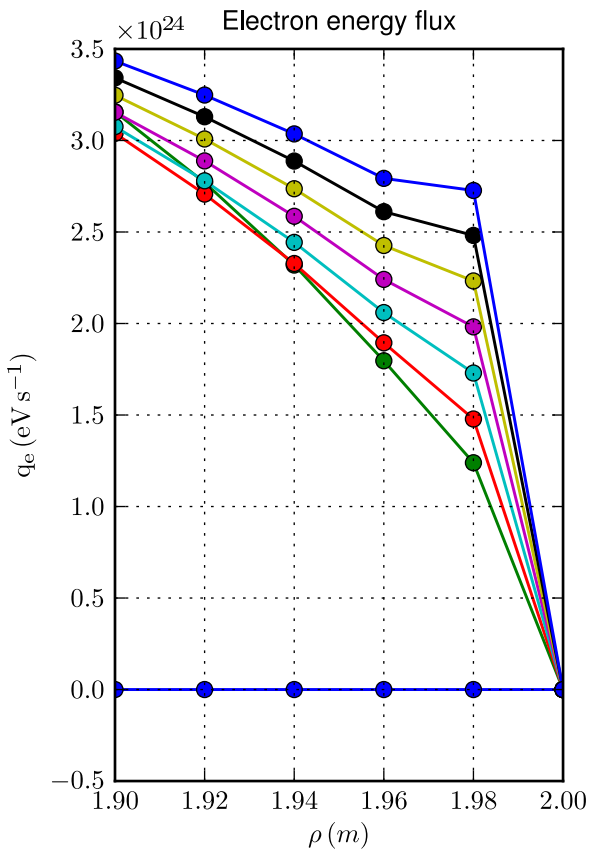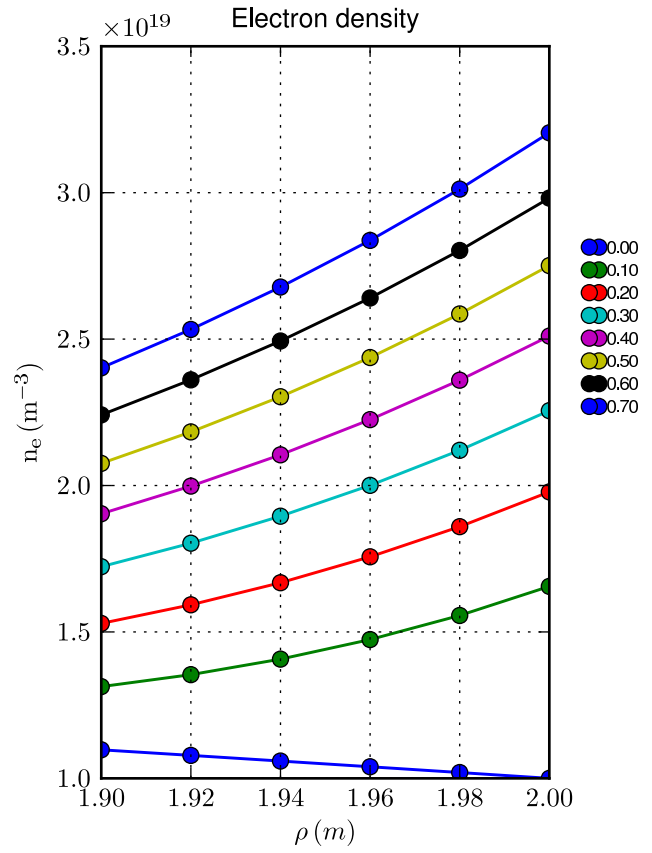Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
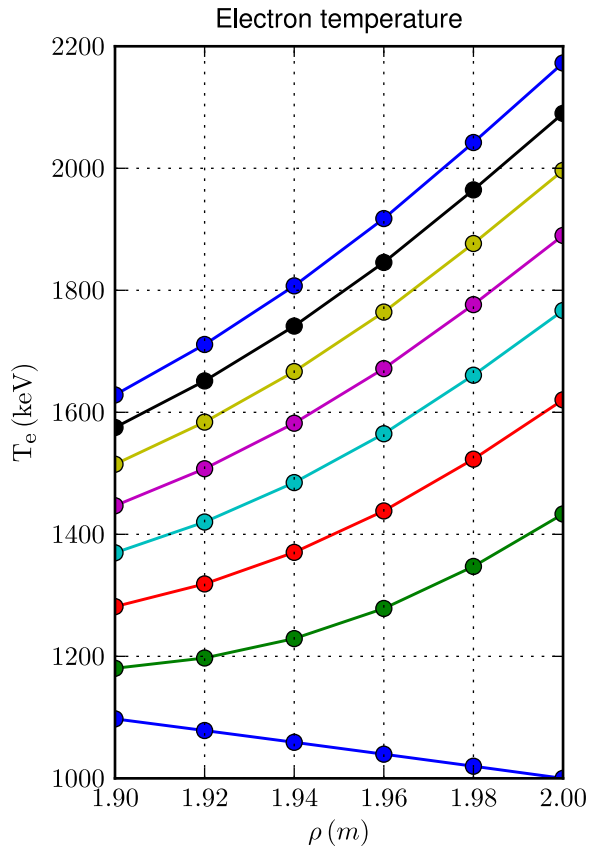[Case: **I.1.5.b**, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
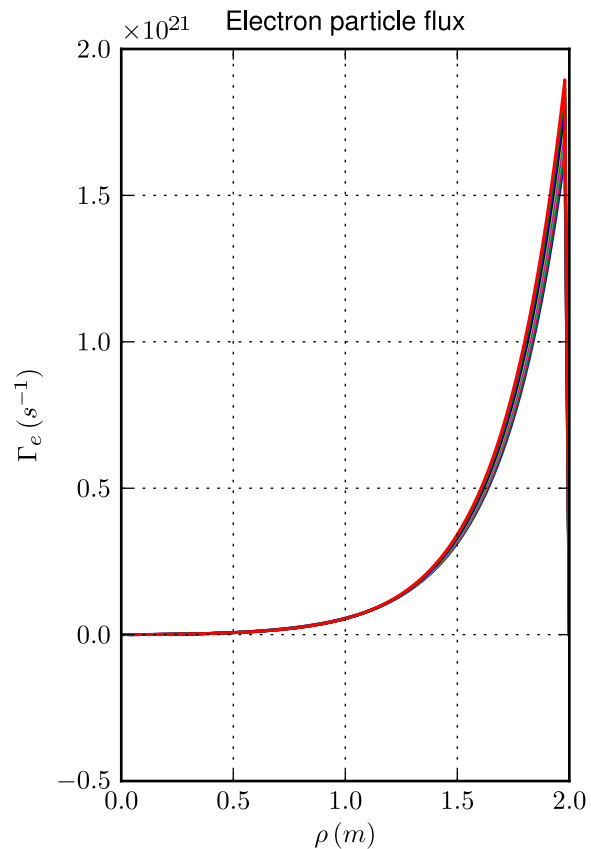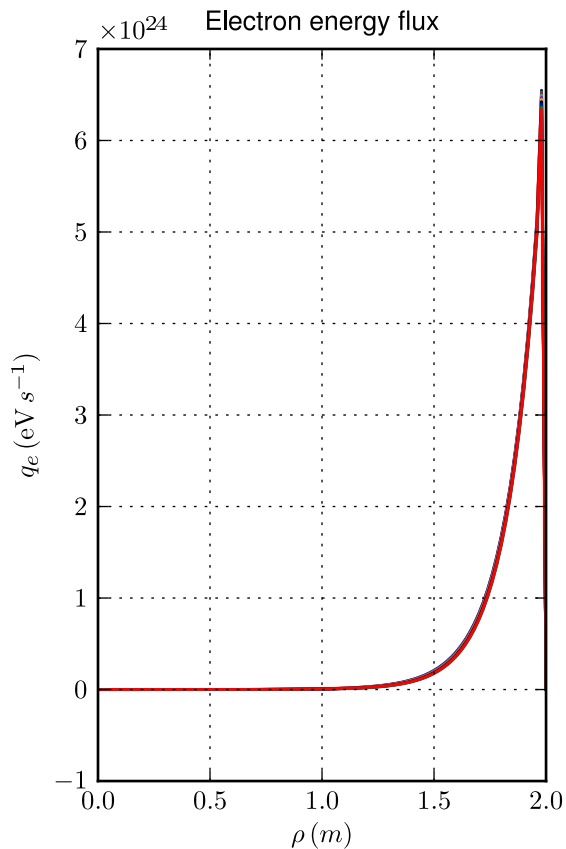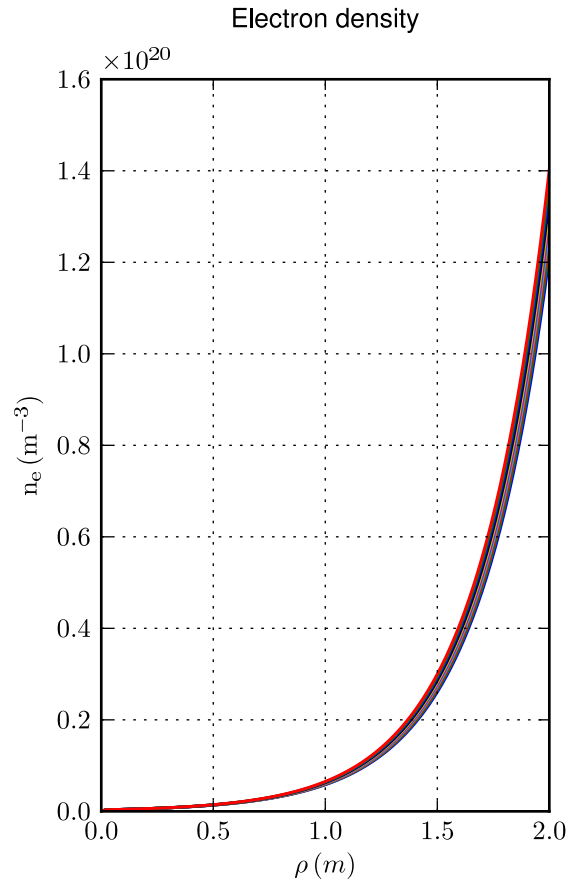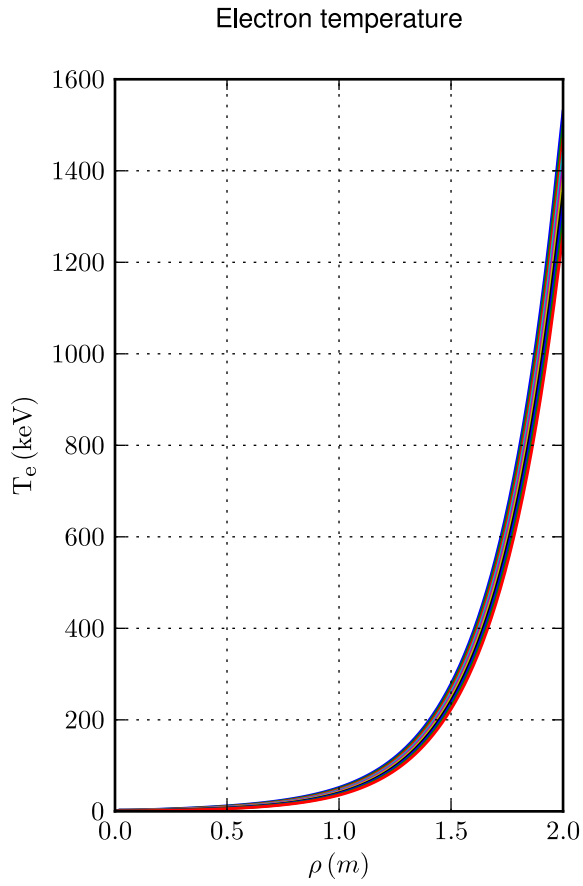Spatial zoom over edge
Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80\,\mathrm{s}$

Profiles

[Case: **I.1.5.b**, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = $ **10.00**, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
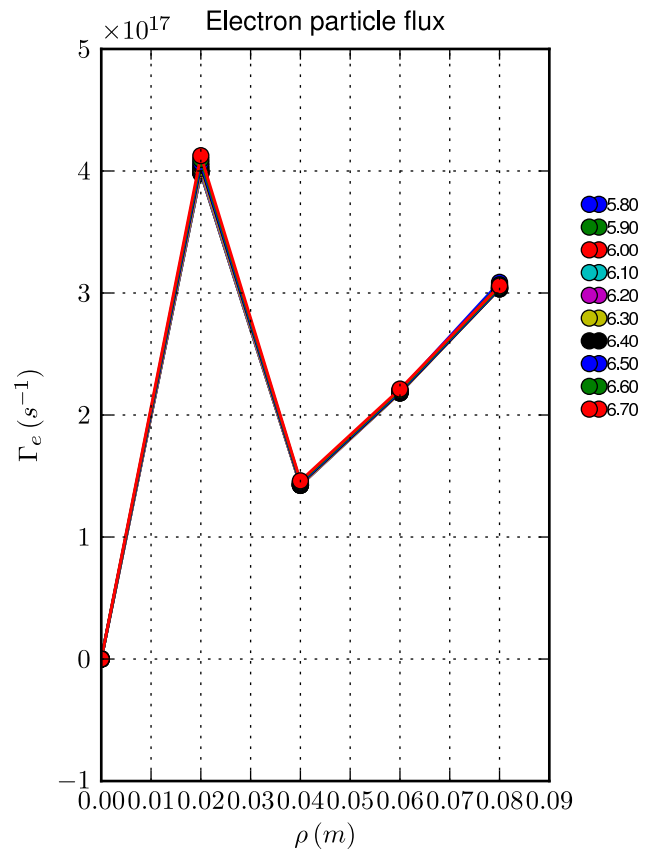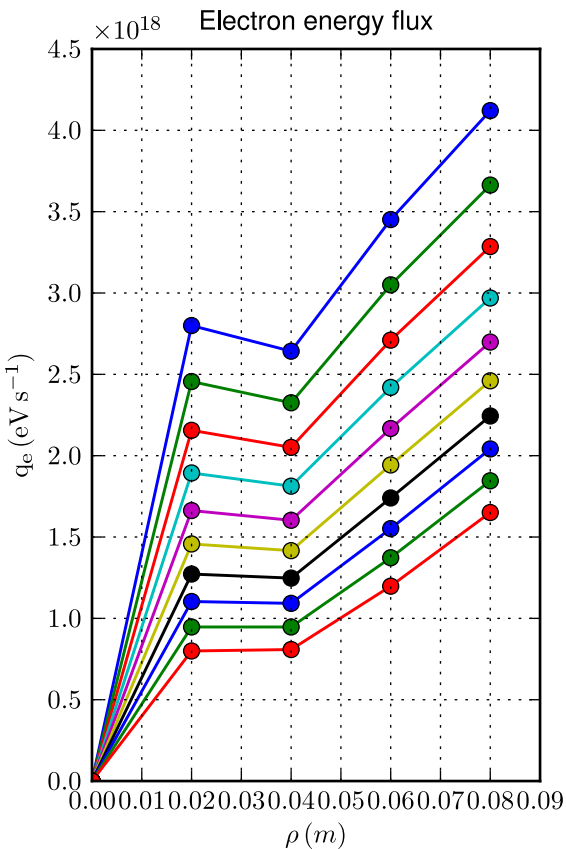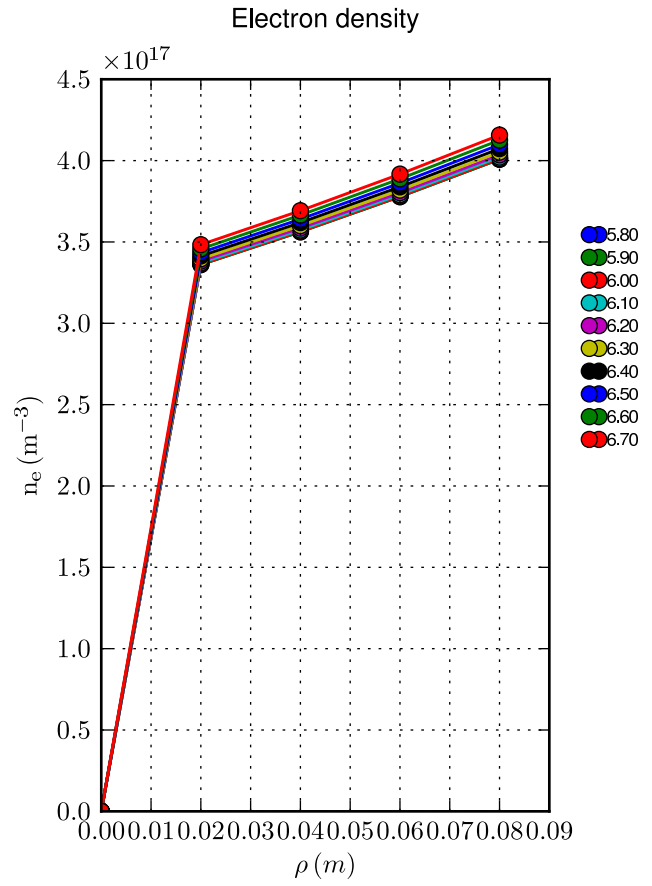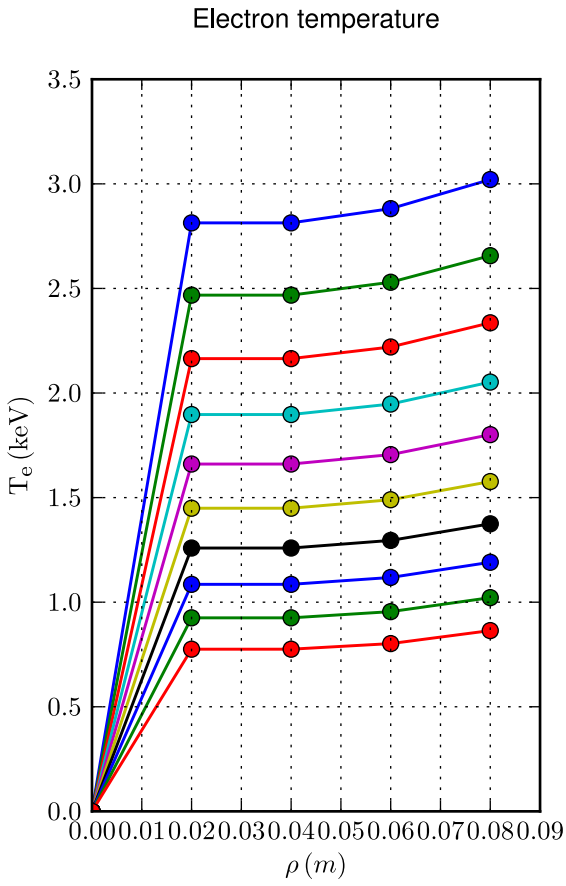
Time sampling: last 10 time slices

Profiles

[Case: **I.1.5.b**, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
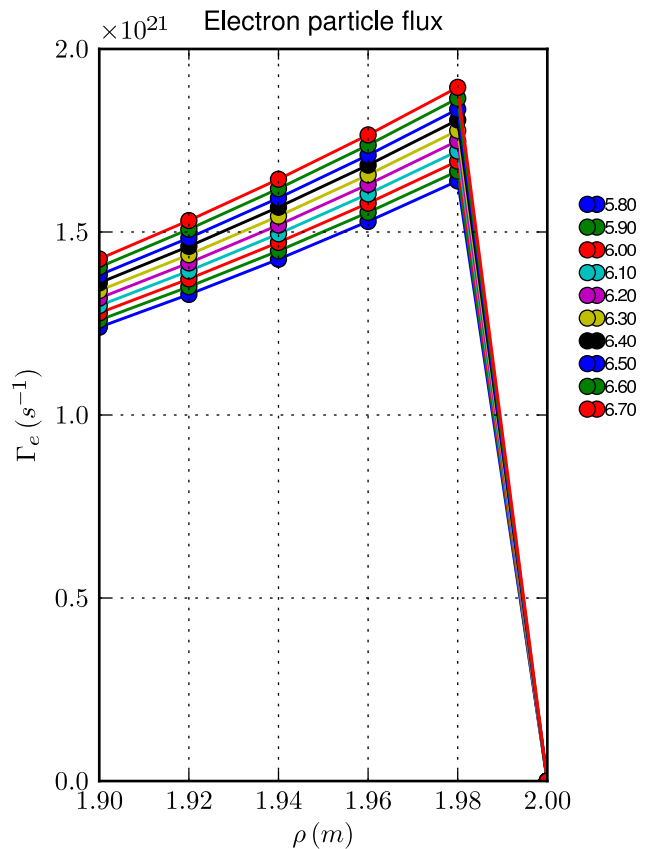
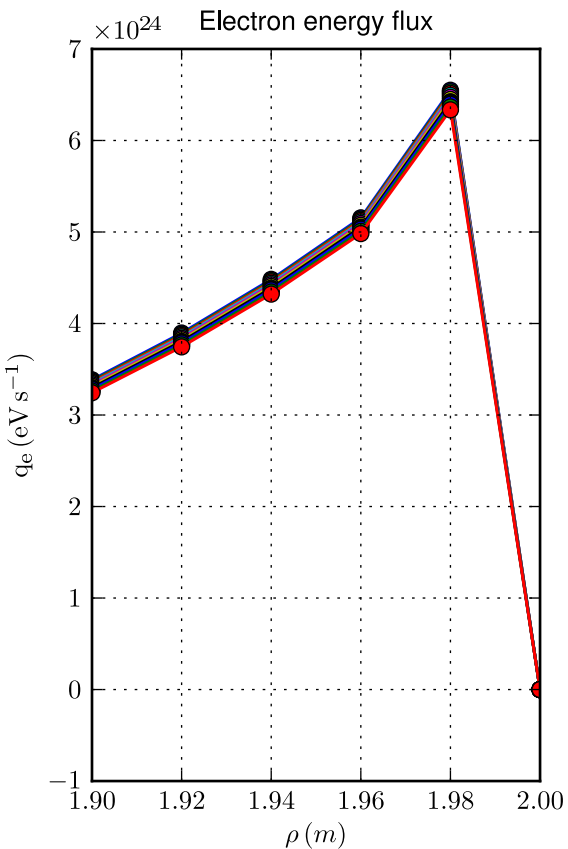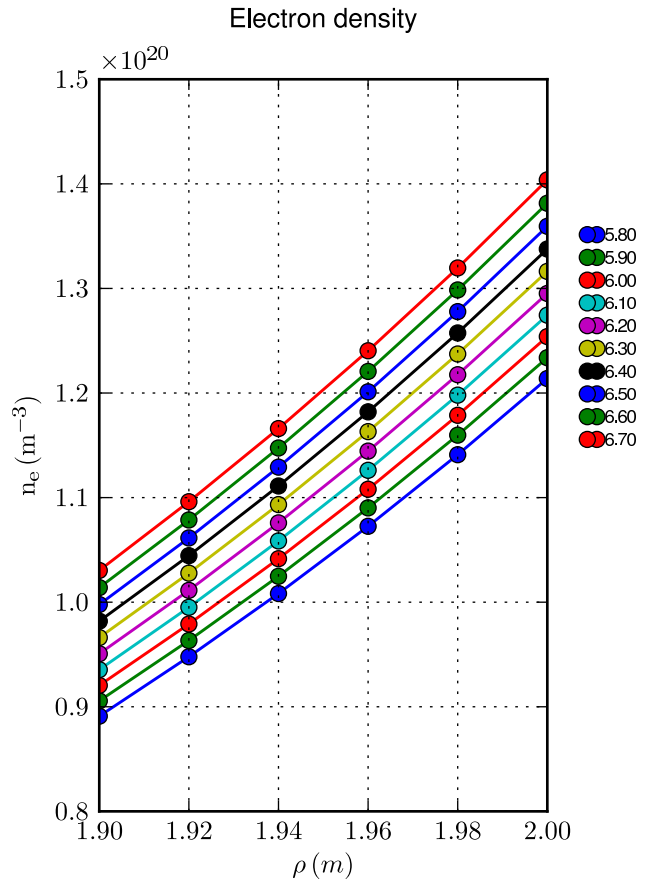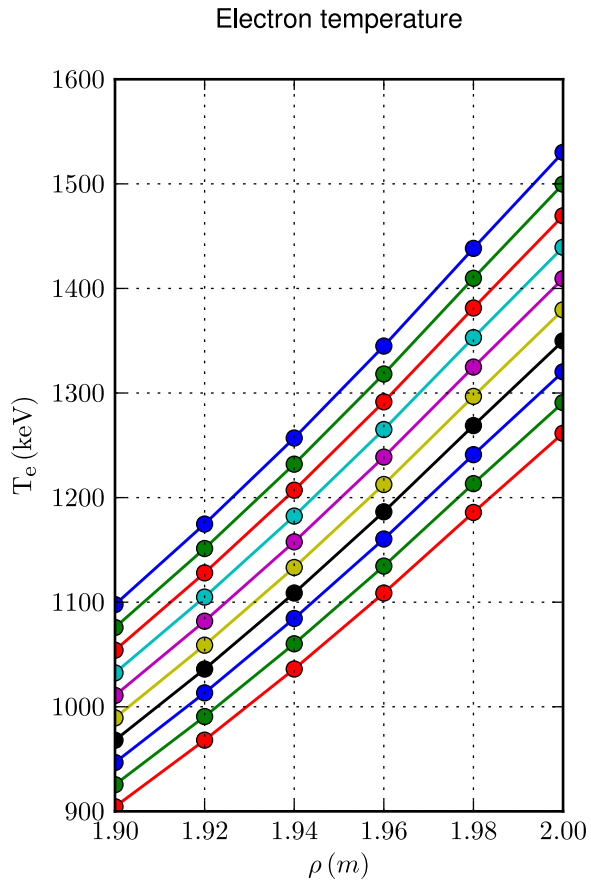Spatial zoom over magnetic axis; time sampling: last 10 time slices

Profiles
[Case: **I.1.5.b**, Solver: 7, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
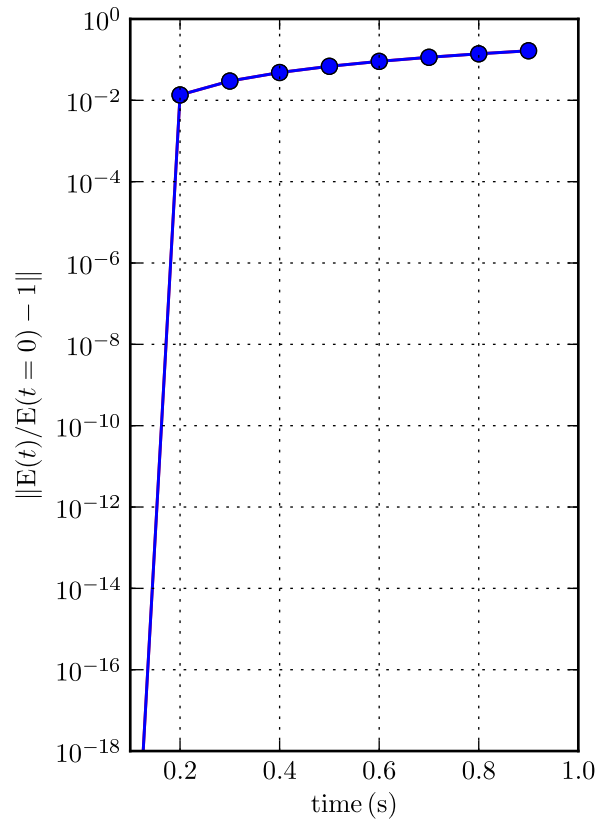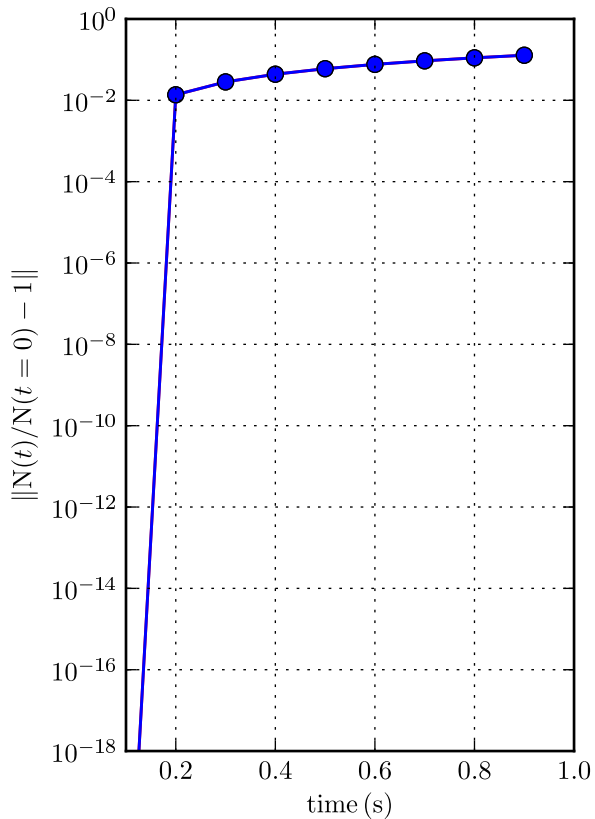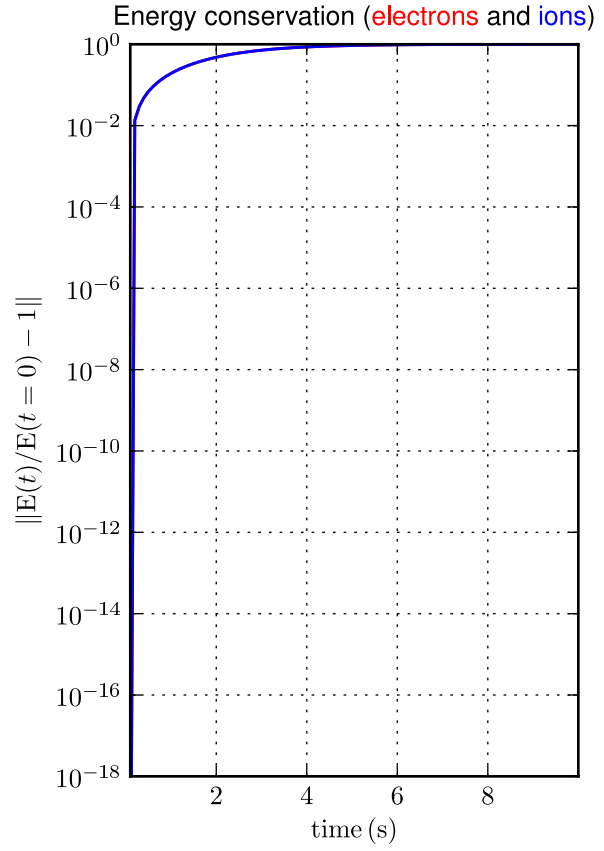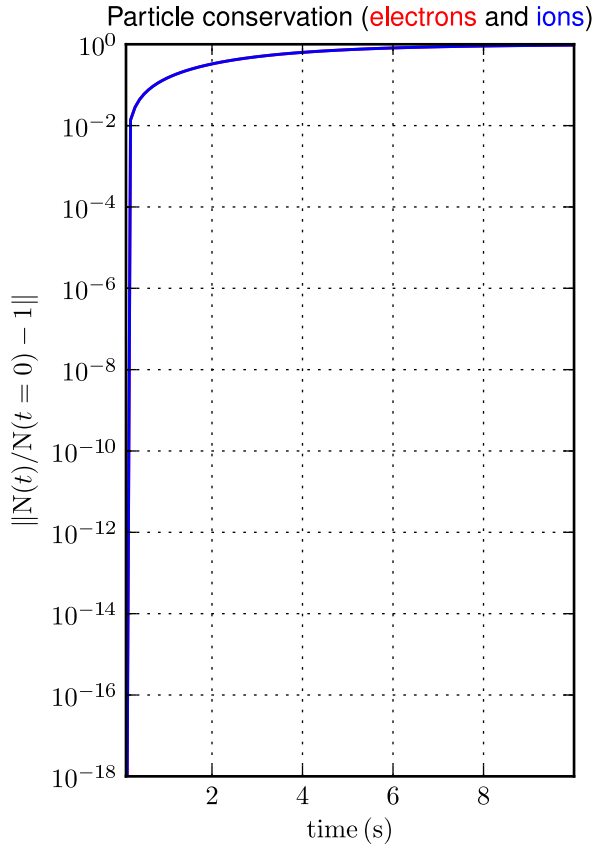Spatial zoom over edge; time sampling: last 10 time slices

Part. & Energy conservation
[Case: **I.1.5.b**, Solver: **10**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
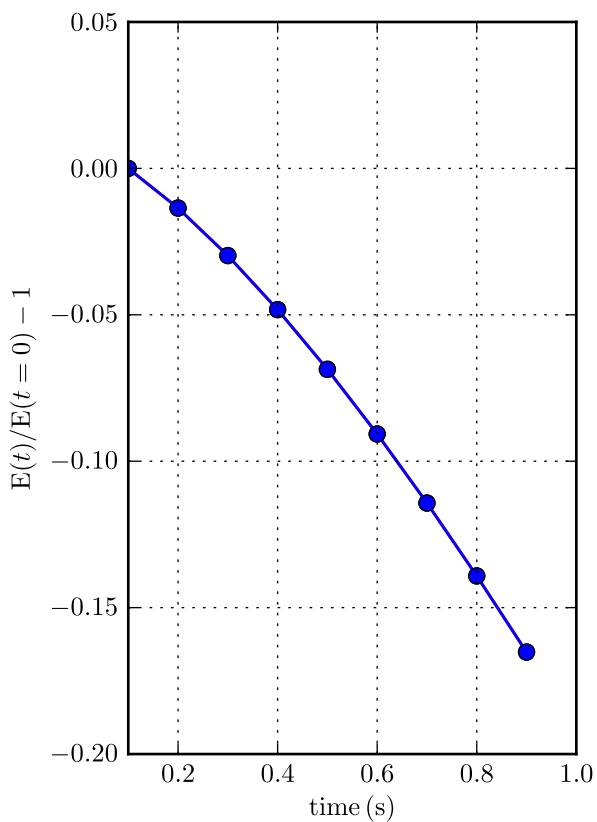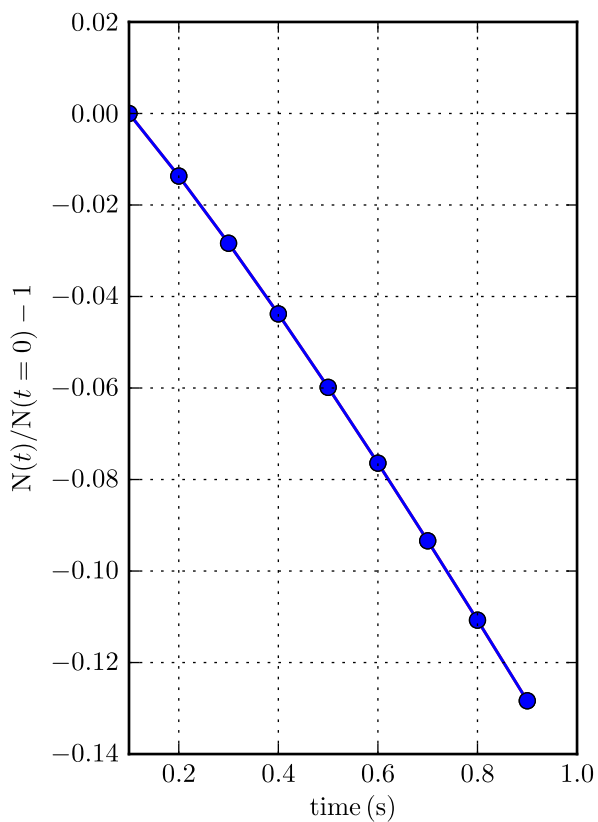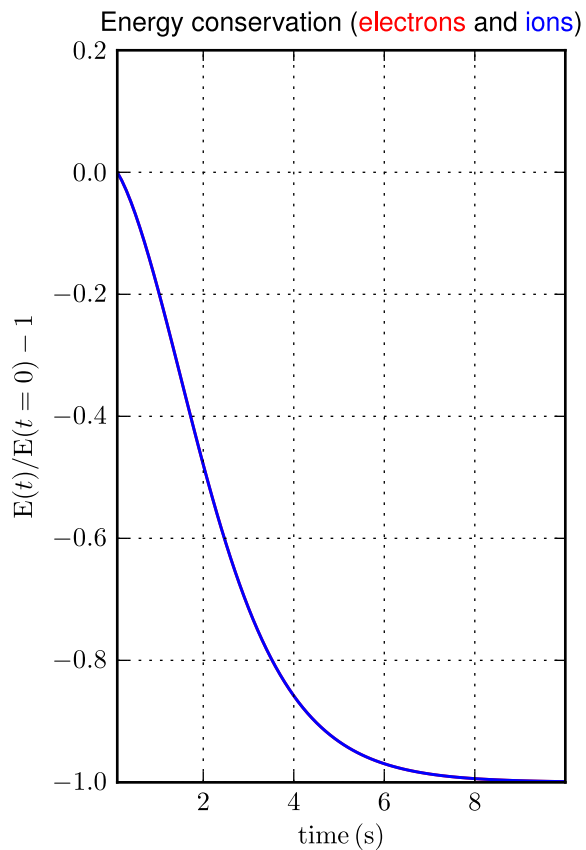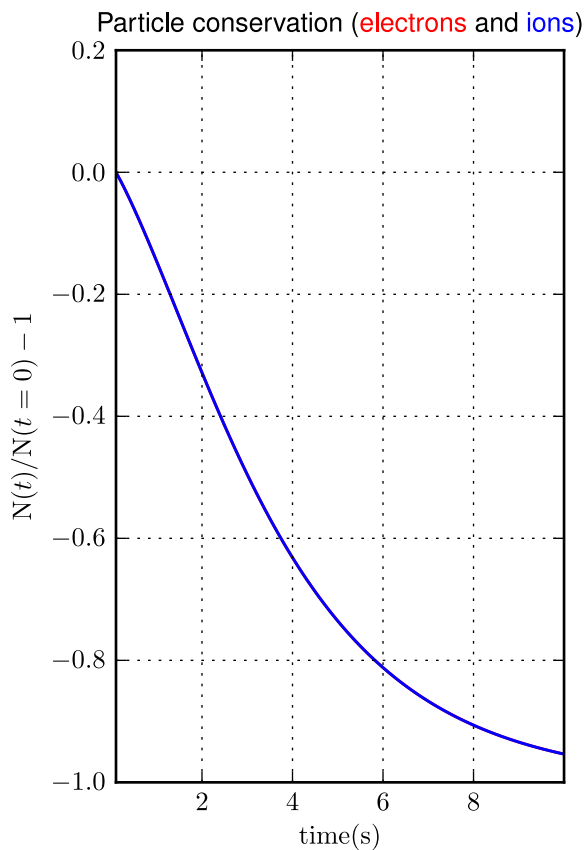Comparison with initial solution - log scale; total time and zoom over time

Part. & Energy conservation
[Case: **I.1.5.b**, Solver: **10**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \textbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with initial solution - linear scale; total time and zoom over time

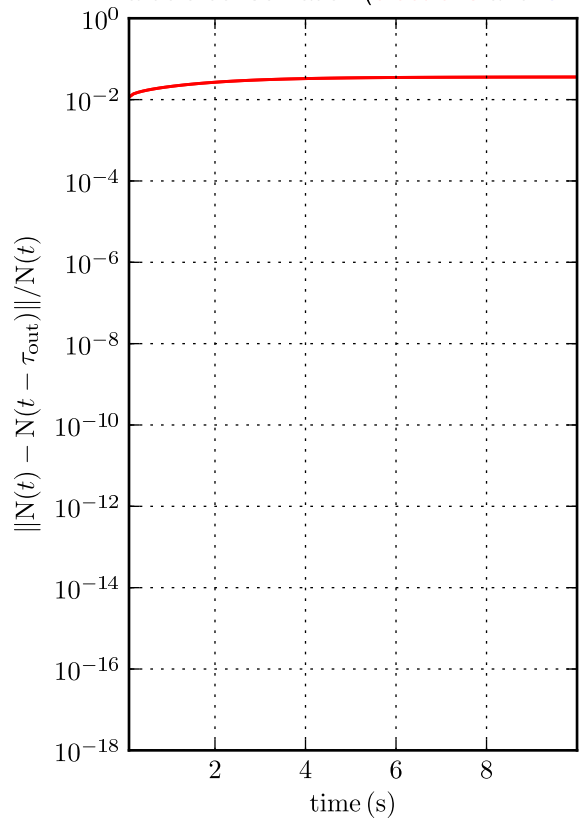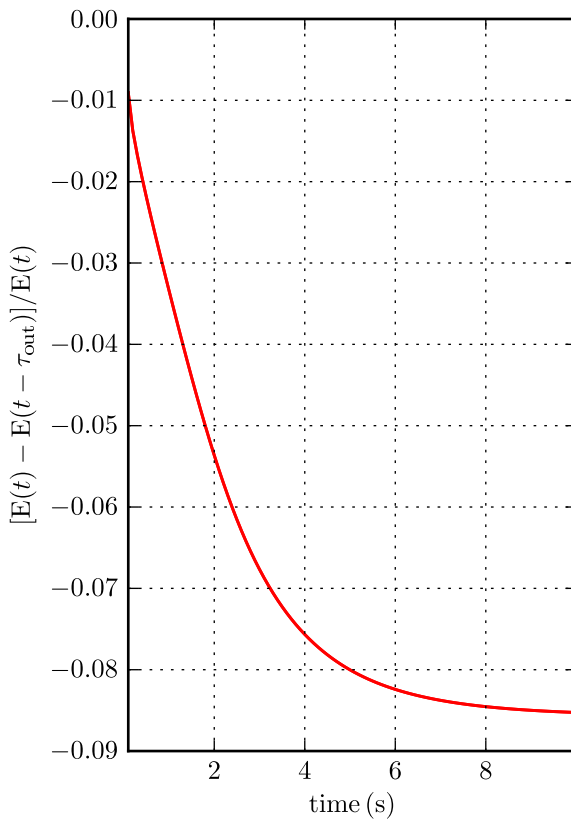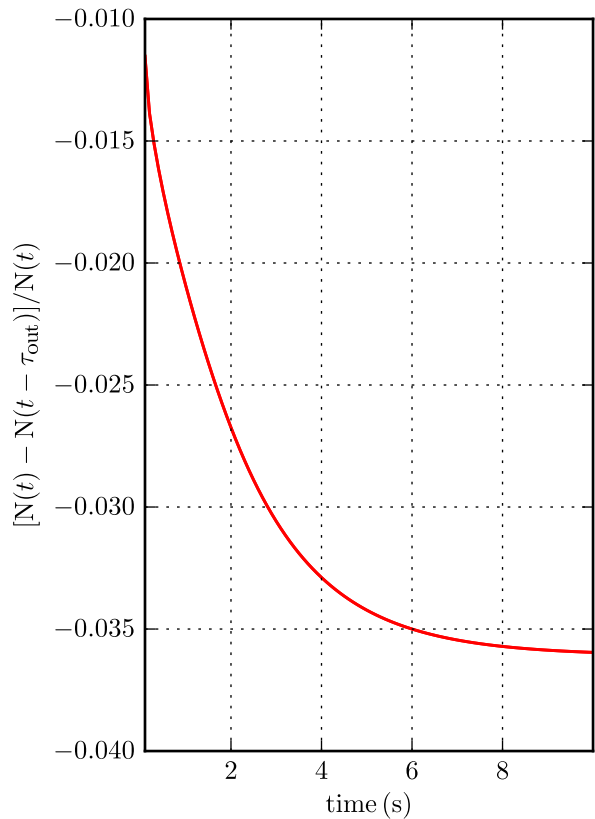Particle conservation (electrons and ions)
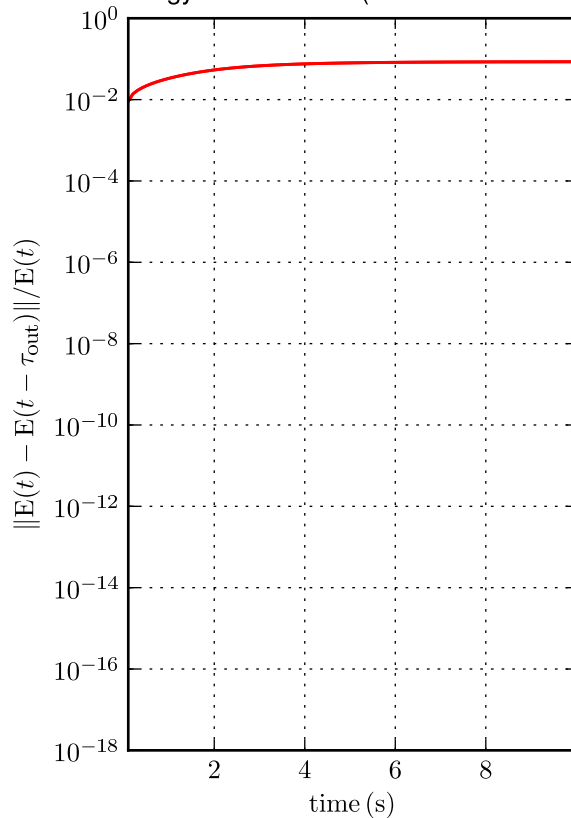
Energy conservation (electrons and ions)

Part. & Energy conservation

[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]

Comparison with previous time-sampled (τ_{out}) solution - log and linear scales
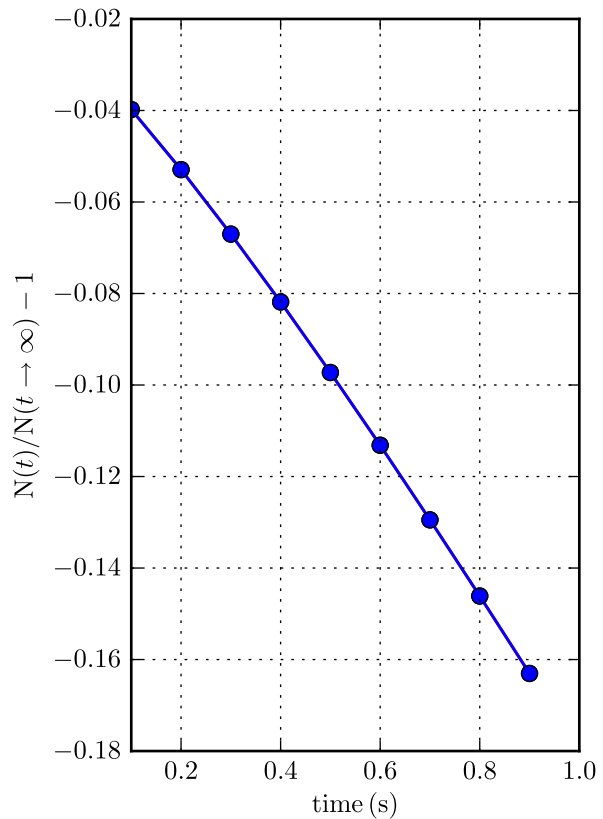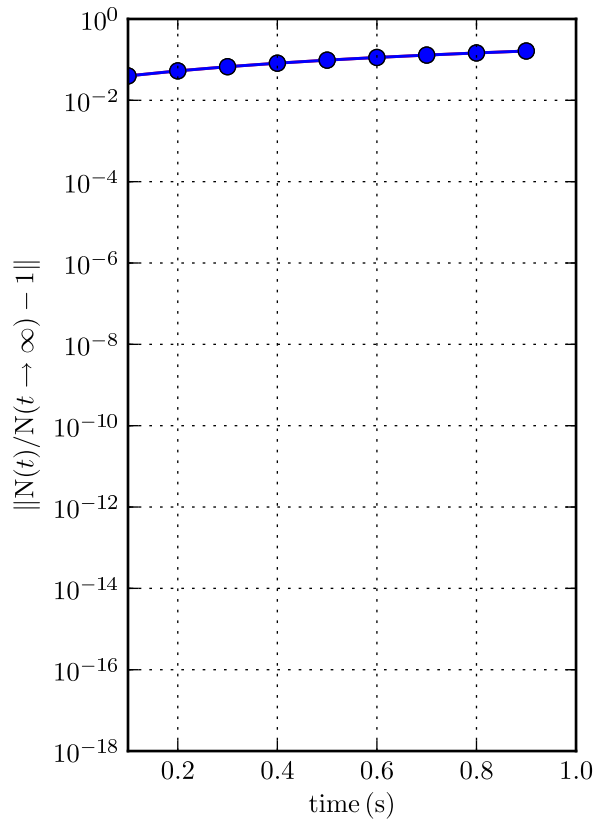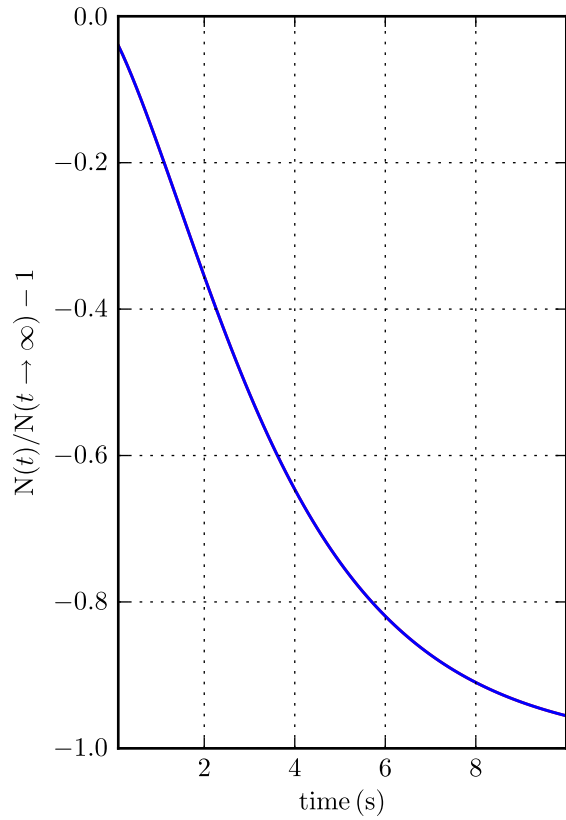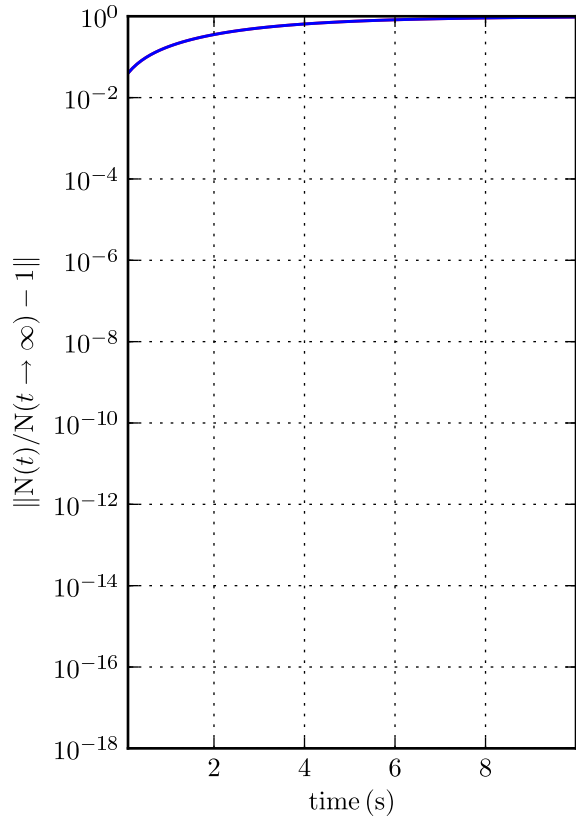

Particle conservation (electrons and ions)

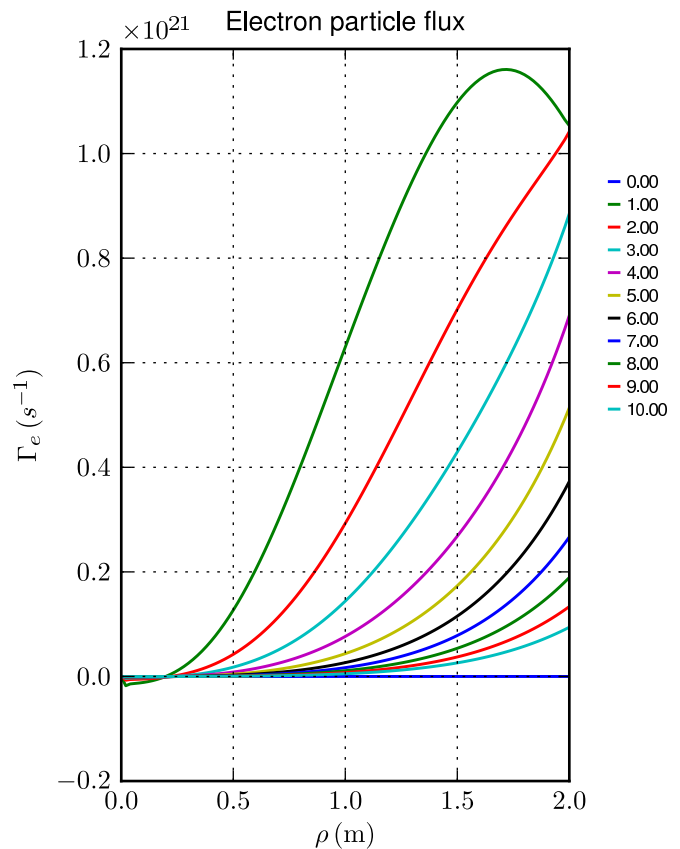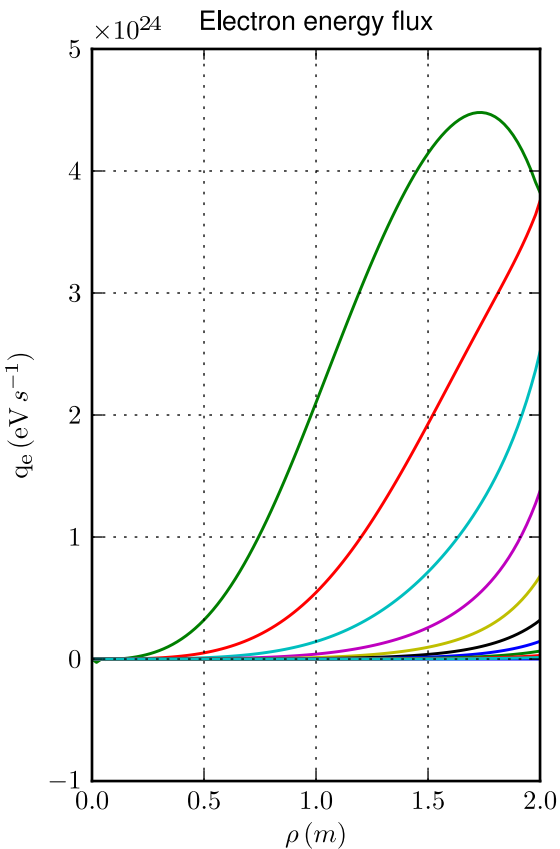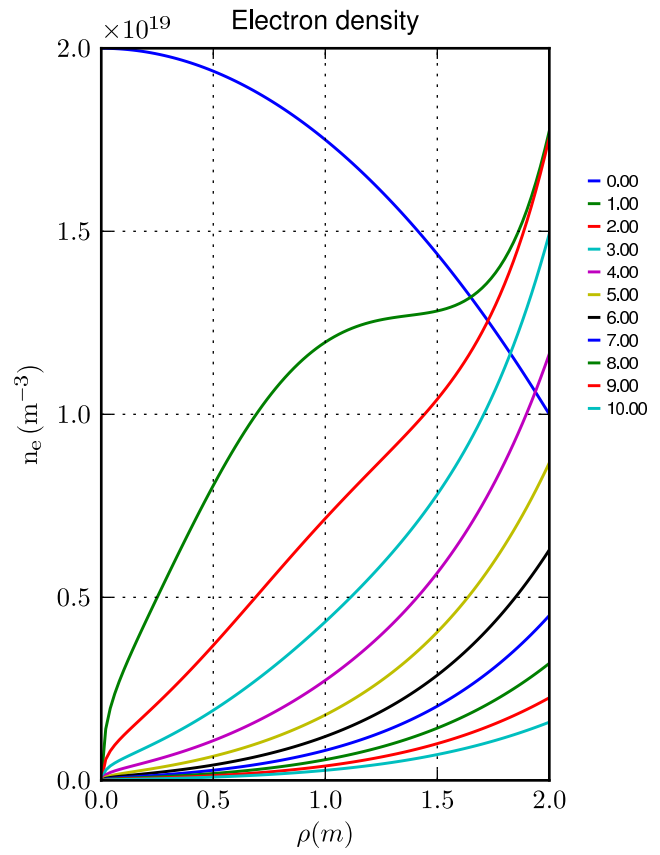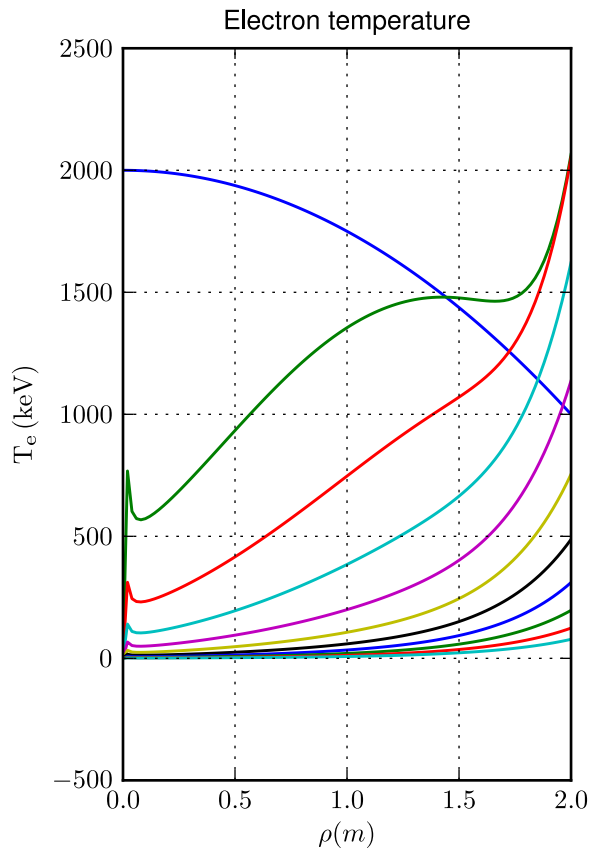Energy conservation (electrons and ions)

Particle conservation
[Case: **I.1.5.b**, Solver: **10**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Comparison with asymptotic solution (electrons and ions); total time and zoom over time

Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
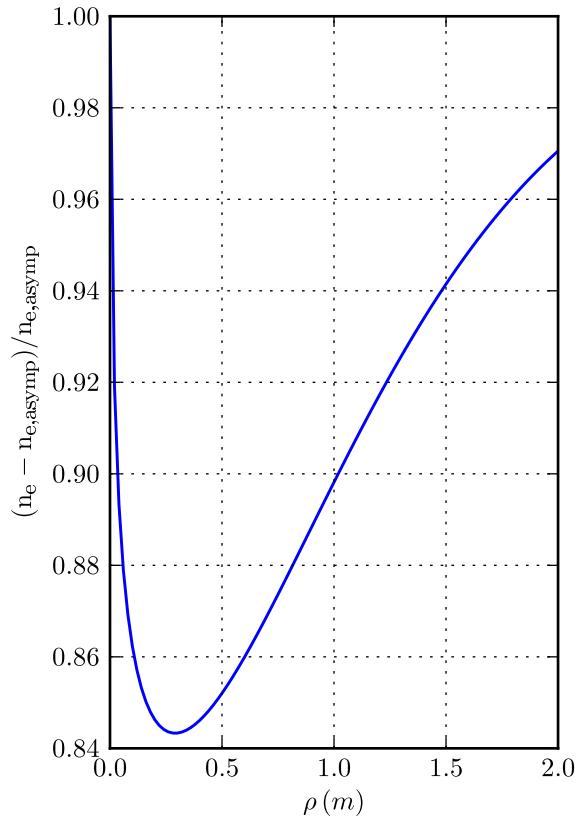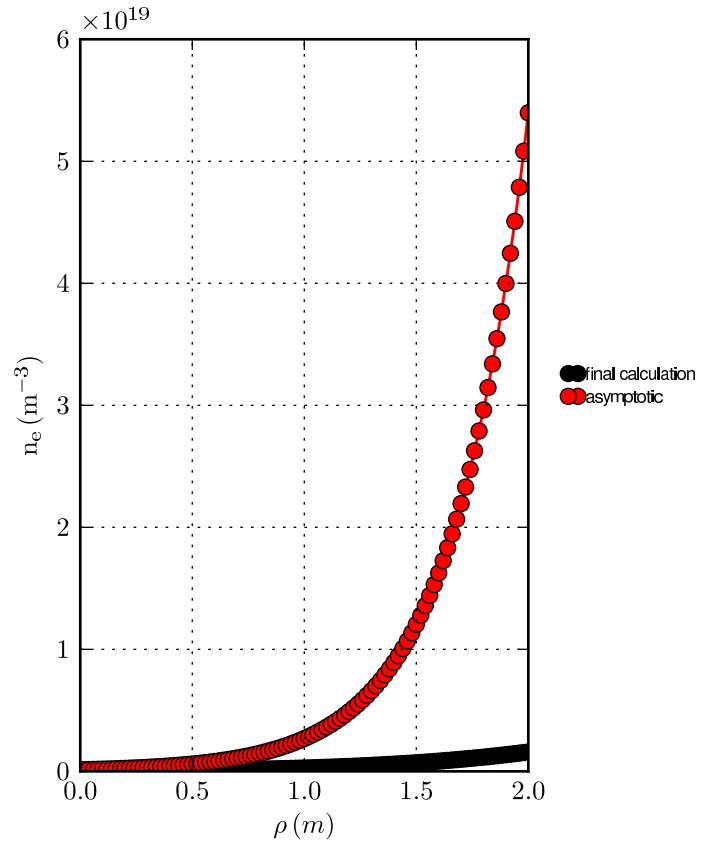Time sampling: total simulation time/10

Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
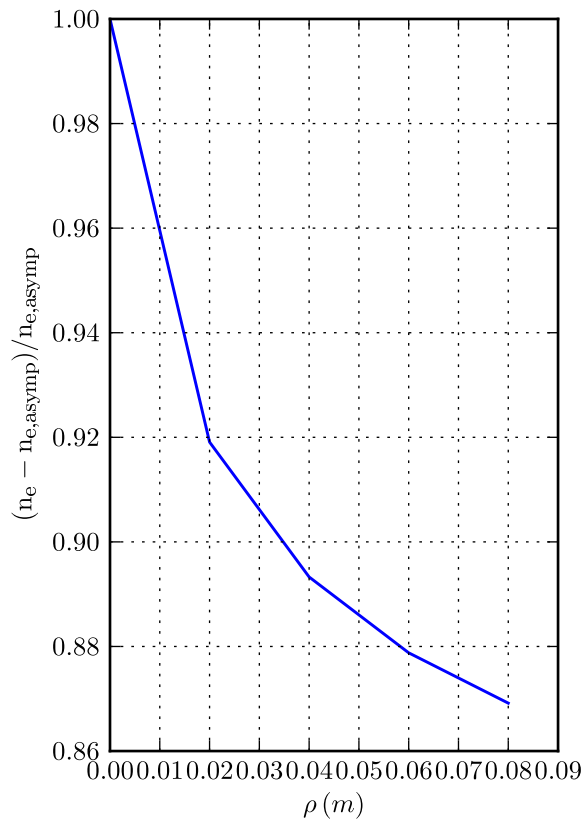Comparison with asymptotic solution

Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s
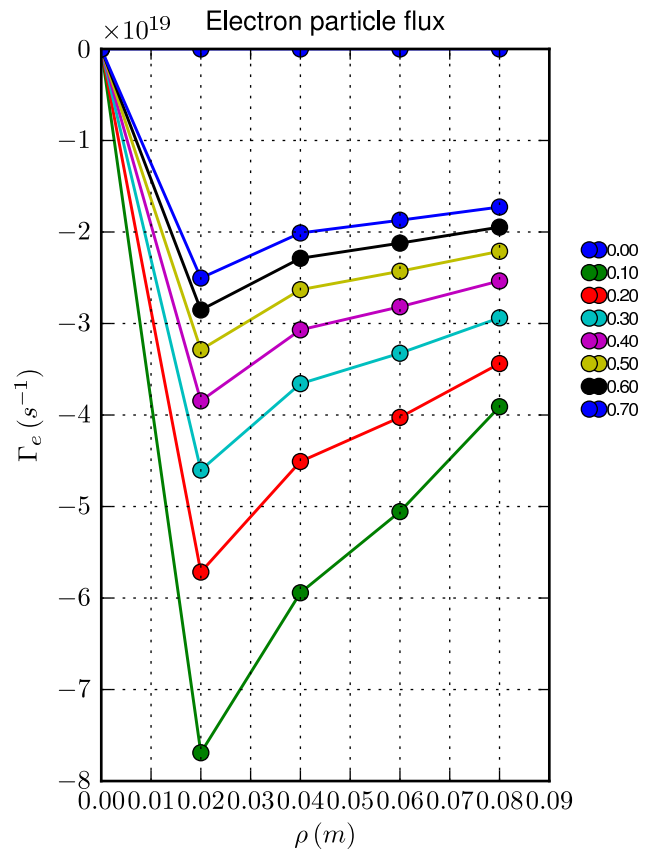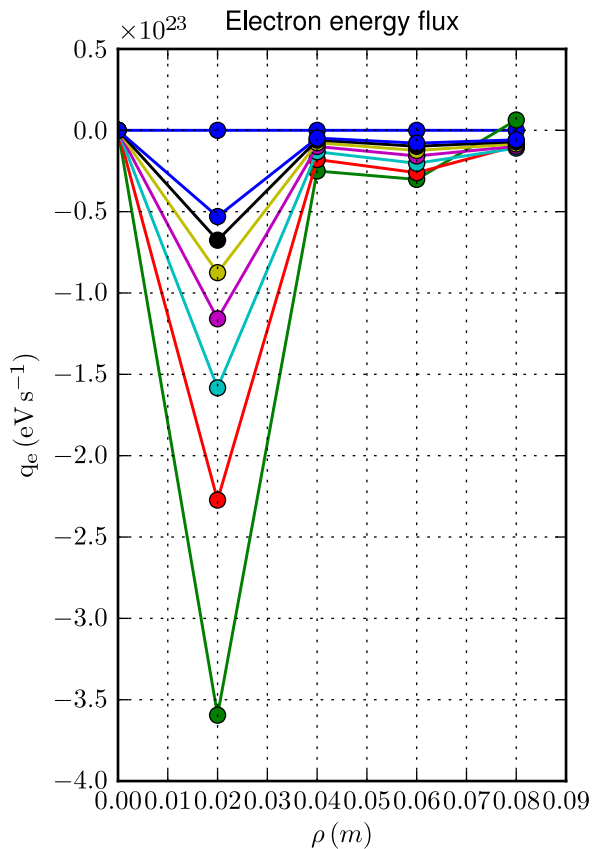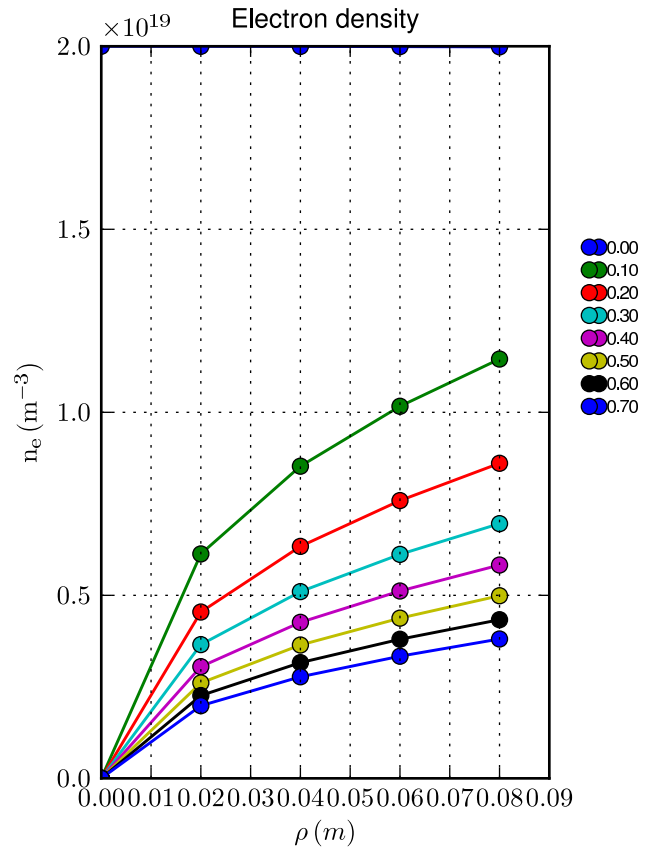
Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis
Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles
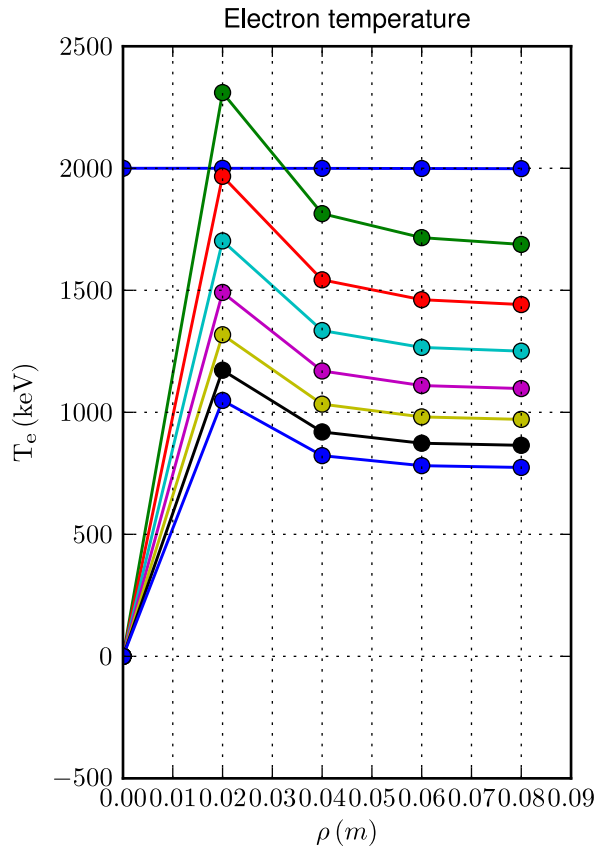
[Case: **I.1.5.b**, Solver: **10**, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = \mathbf{10.00}$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]

Spatial zoom over edge

Time sampling: first 10 time slices or zoom over time $0.1 \times (a^2/D)/|1 - (Va/D)| = 0.80$ s

Profiles

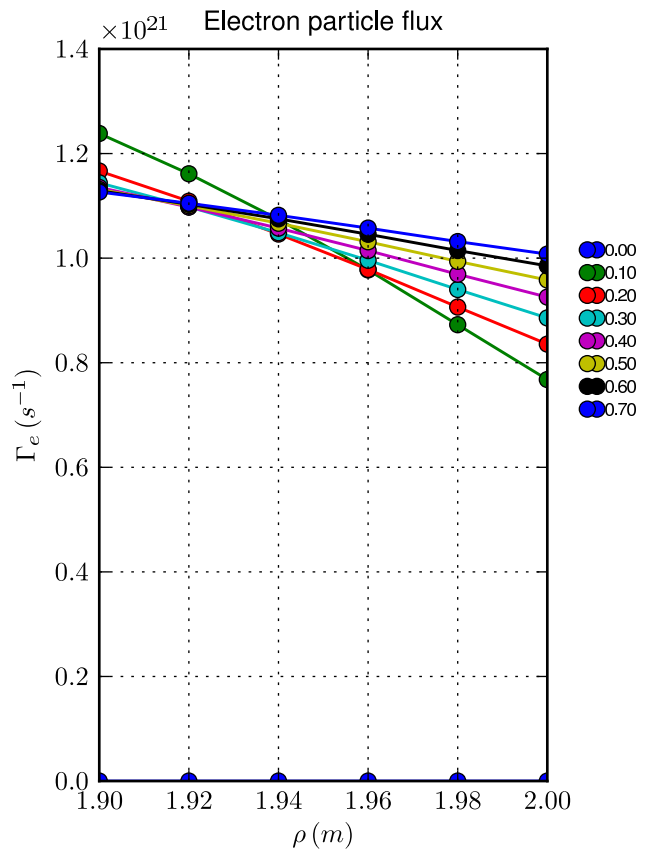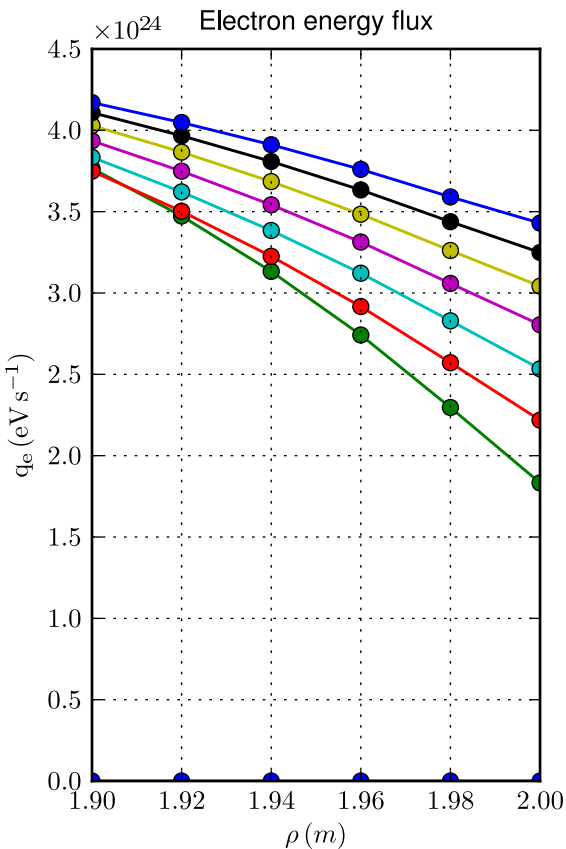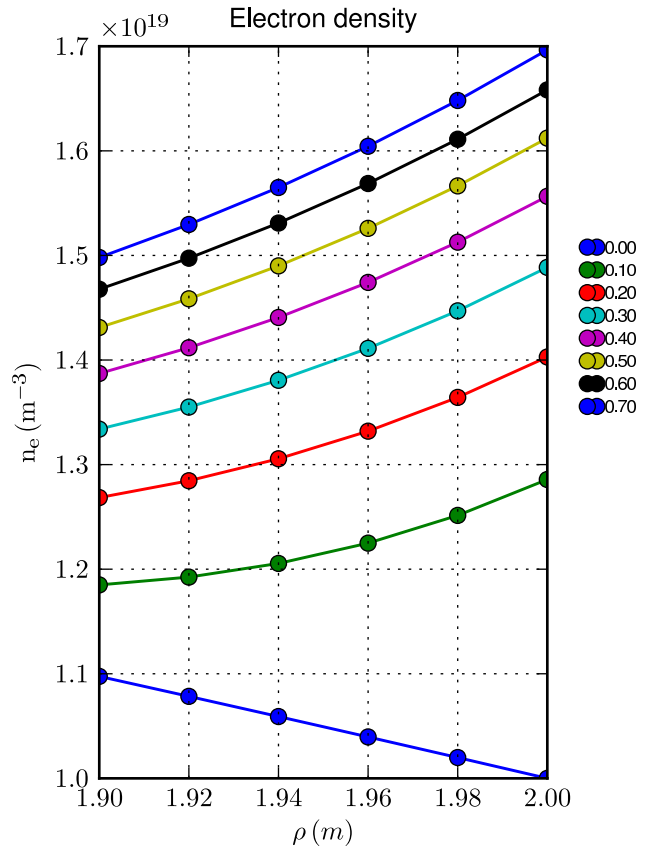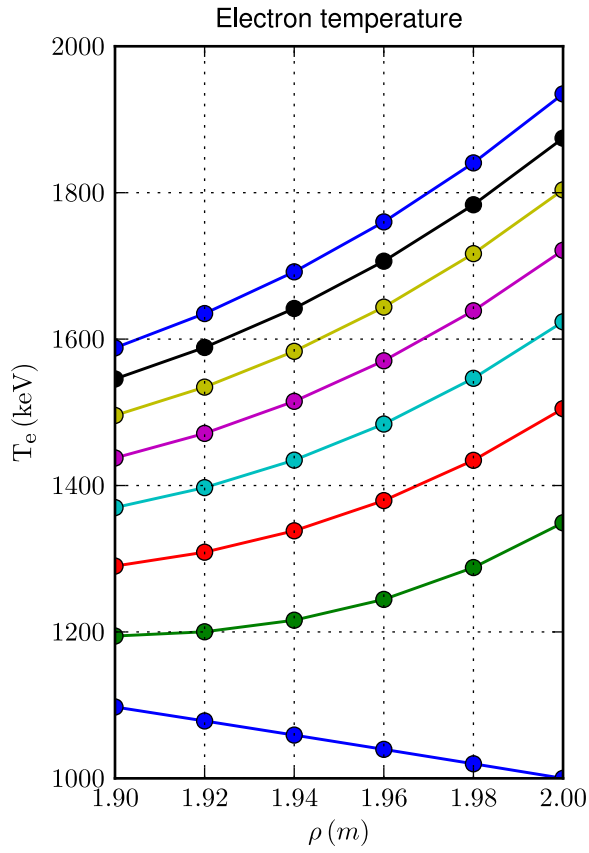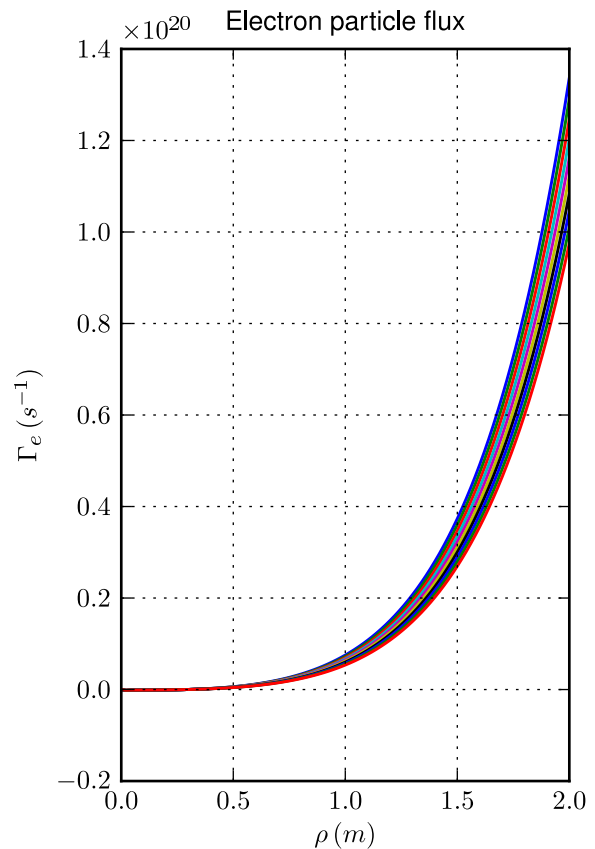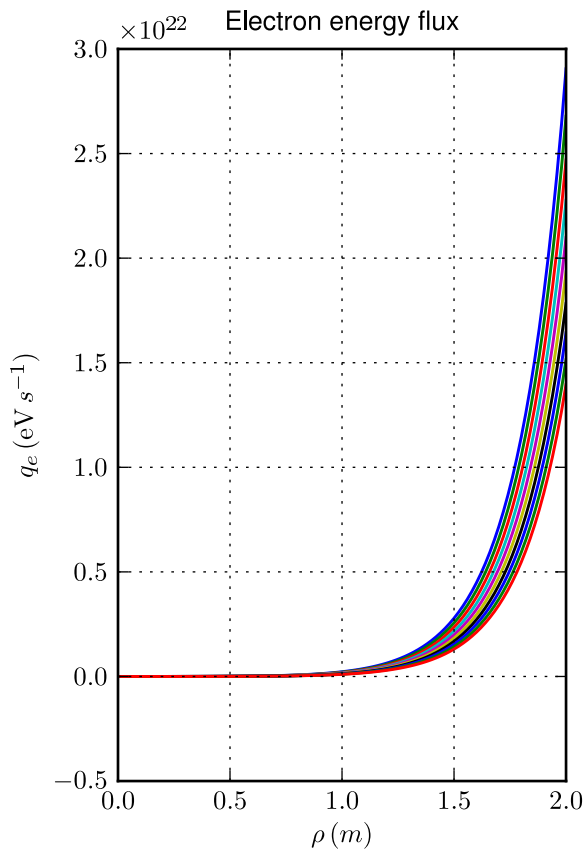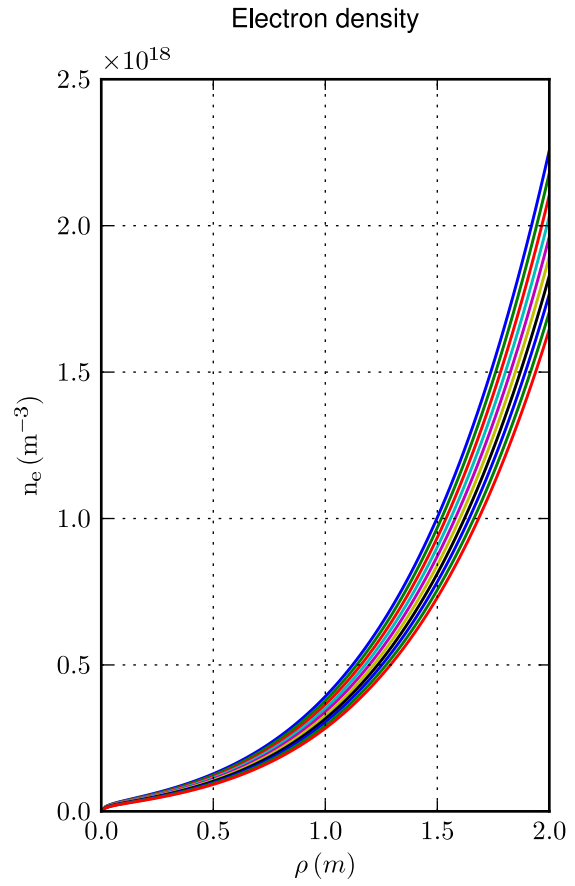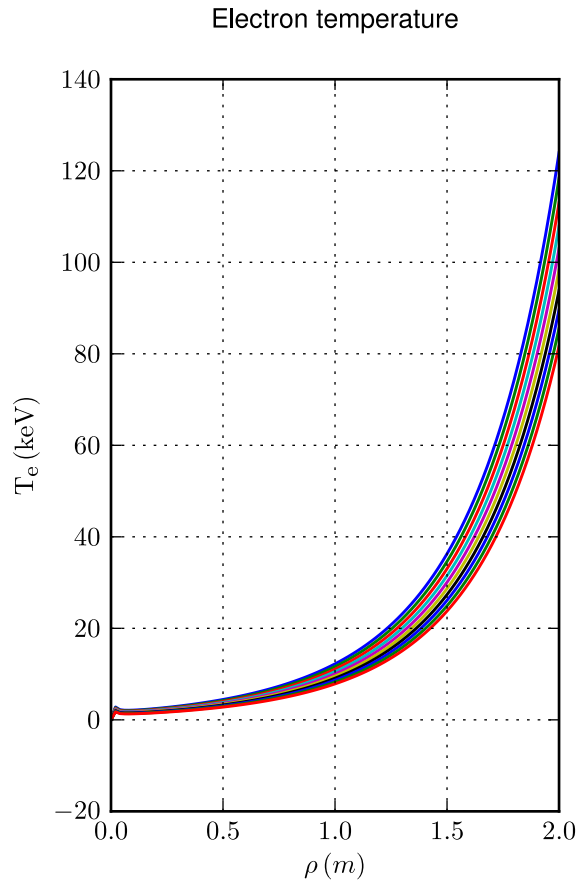[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
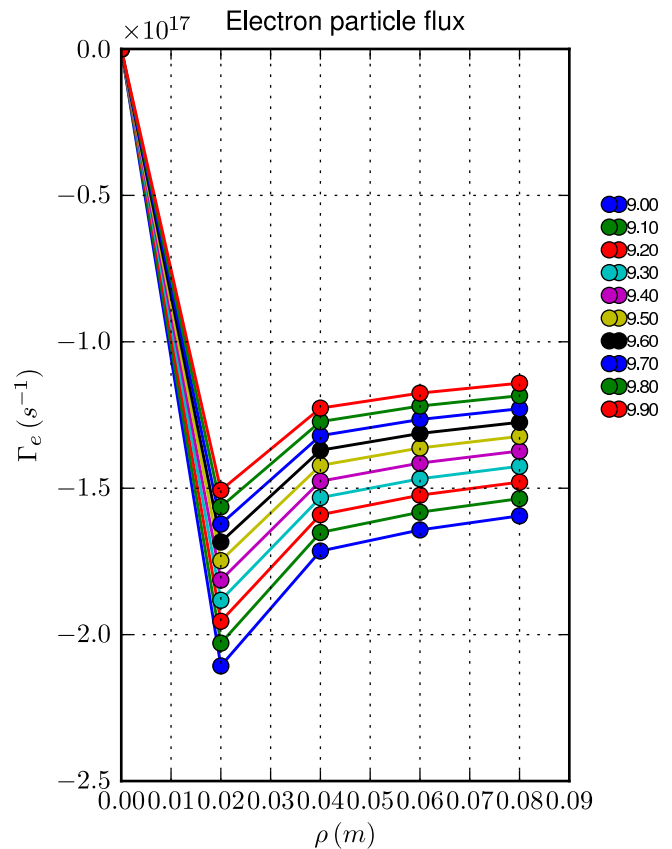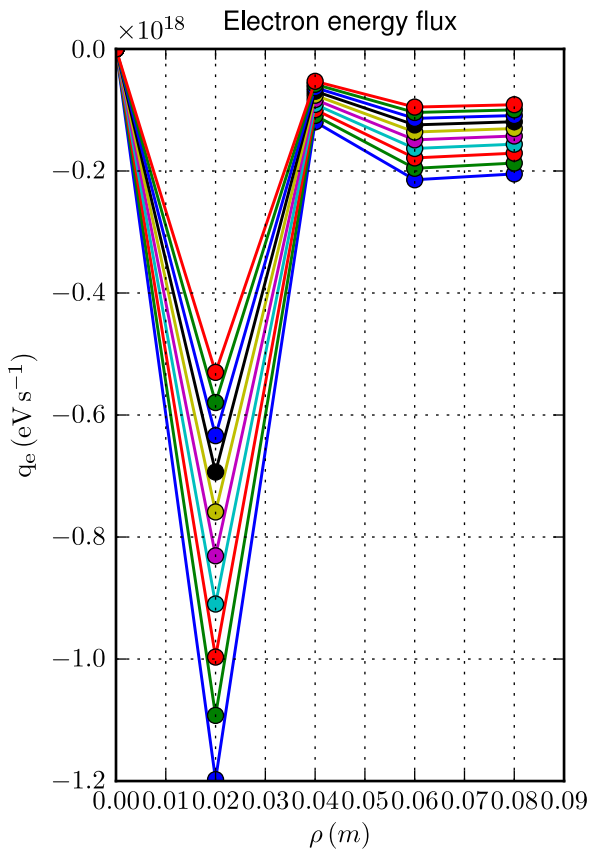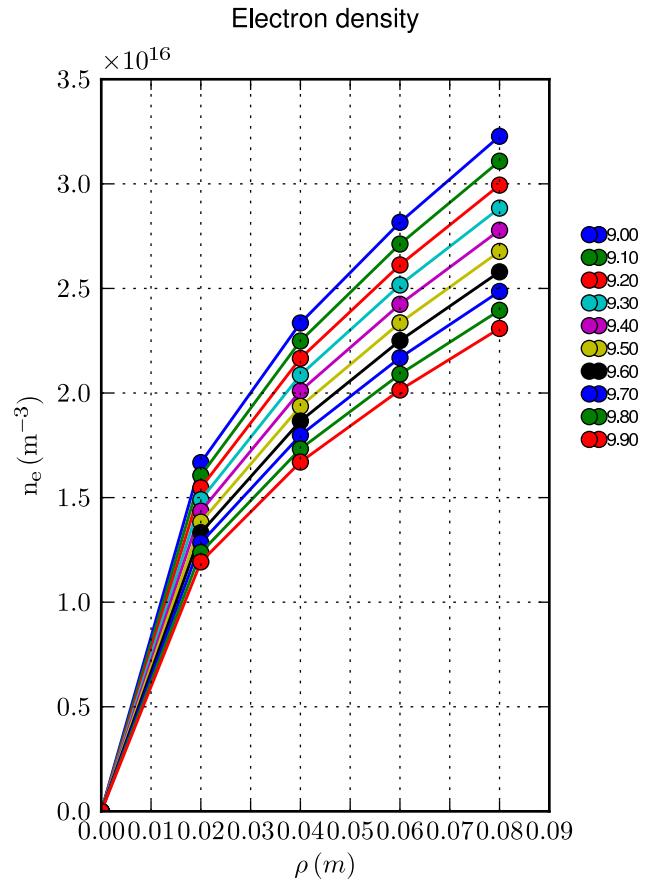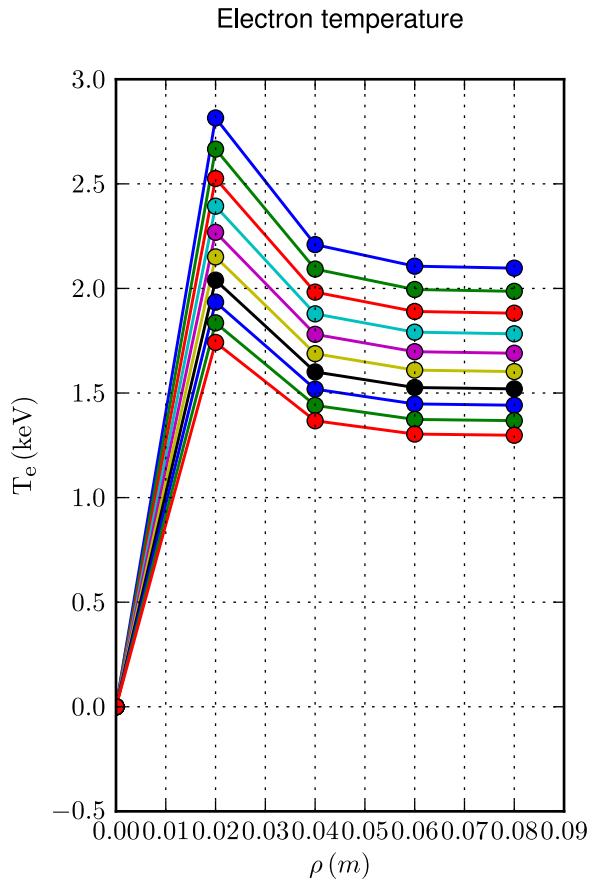
Time sampling: last 10 time slices

Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over magnetic axis; time sampling: last 10 time slices

Profiles
[Case: I.1.5.b, Solver: 10, $D = 0.1\,\mathrm{m^2/s}$, $v = 0.30\,\mathrm{m/s}$, $\Delta t = 10.00$, $\tau = 1.0 \times 10^{-3}\,\mathrm{s}$, $N_\rho = 101$]
Spatial zoom over edge; time sampling: last 10 time slices