1D laser absorption comparisons

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Test problem 2

Bonus test problem

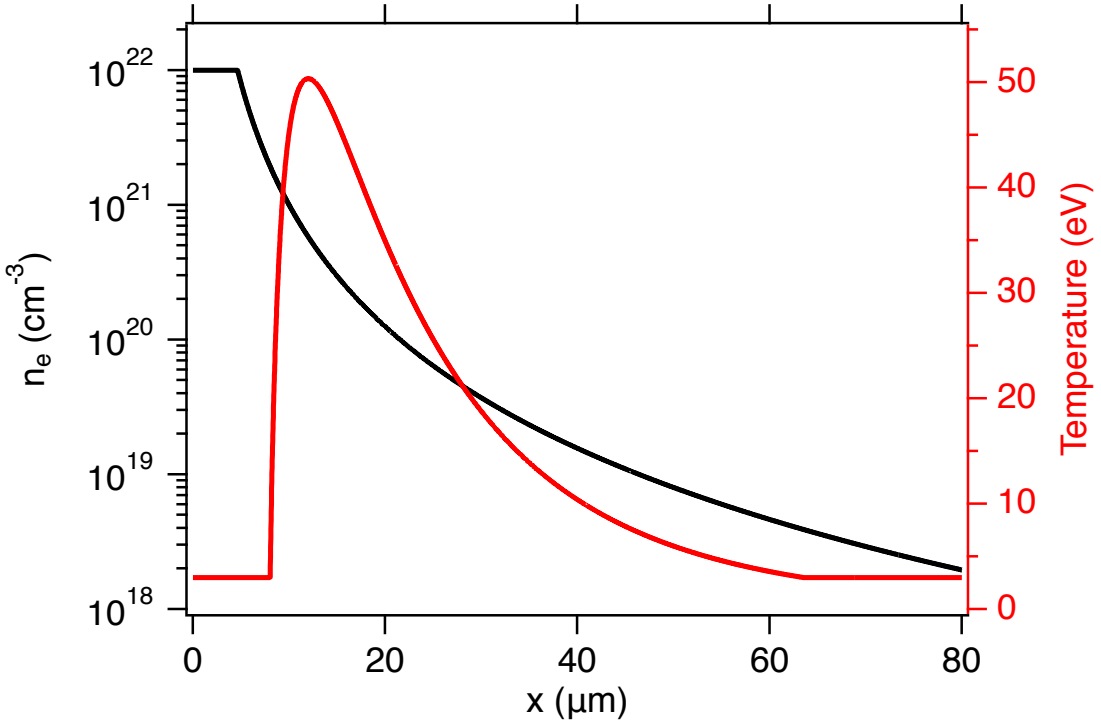
Test problem 2

Steady-state absorption

- 1D planar geometry
- Fully ionized hydrogen plasma
- Specified fixed plasma temperature & electron density
- Specified spatial grid:

  $x \in [0., 300.]$ μm , 20000 uniform zones

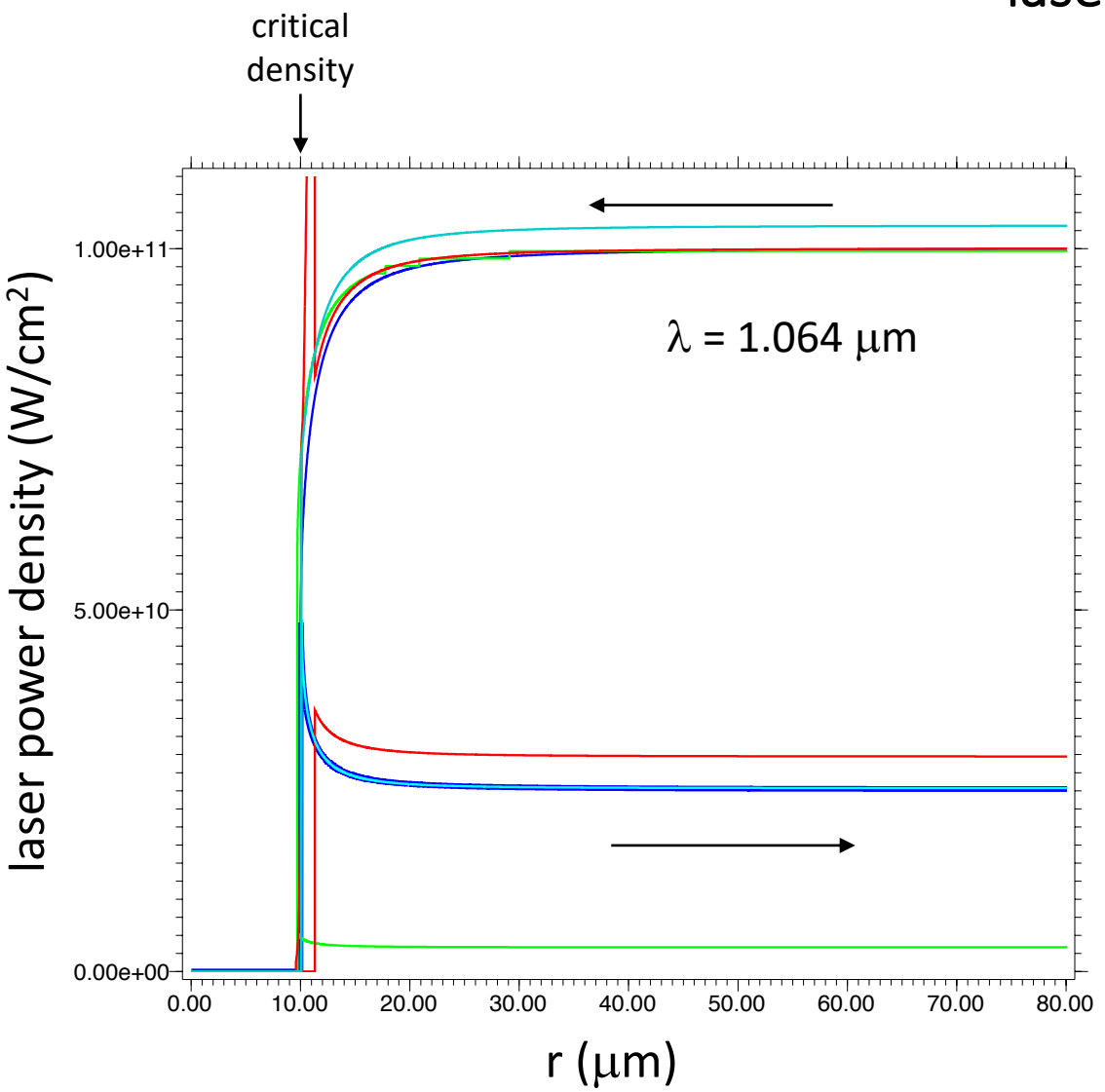
- Laser incident @ x = 300. μm
- Laser power density = 10^{11} W/cm^2
- Laser wavelength: λ = 1.064 μm & 10.6 μm
- Absorption from inverse bremsstrahlung only

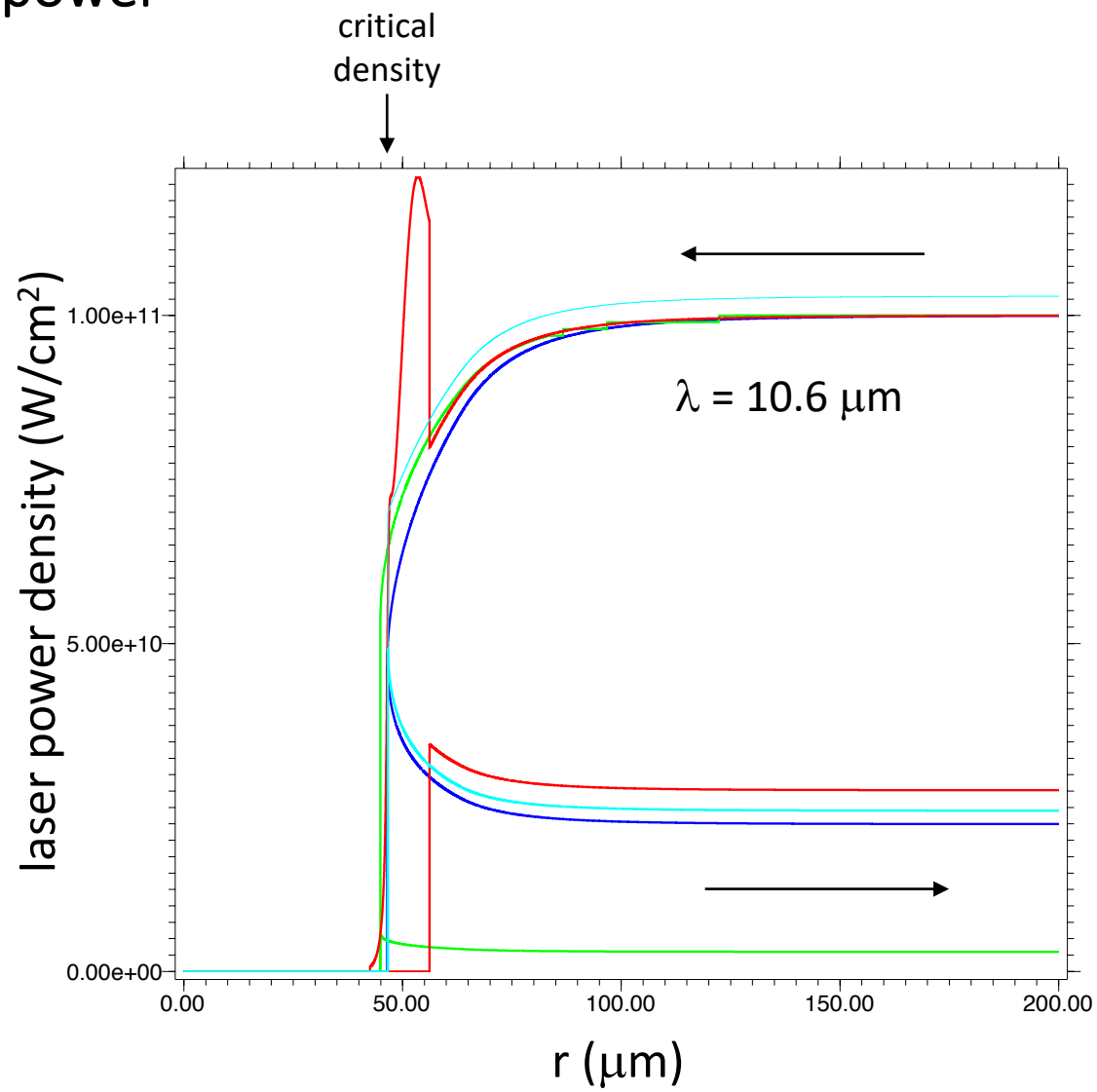


This is intended to provide a baseline for future comparisons involving laser absorption

Test problem 2 results

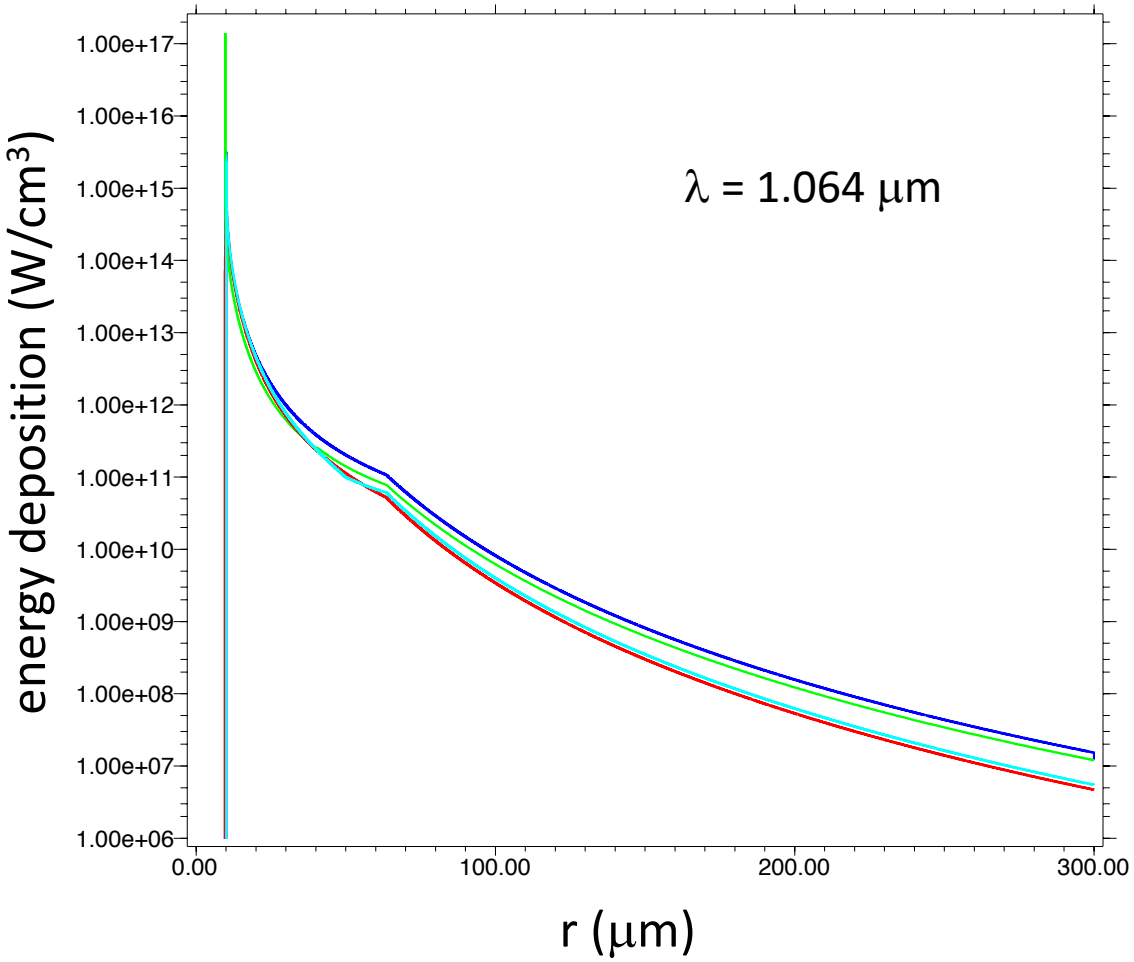
laser power

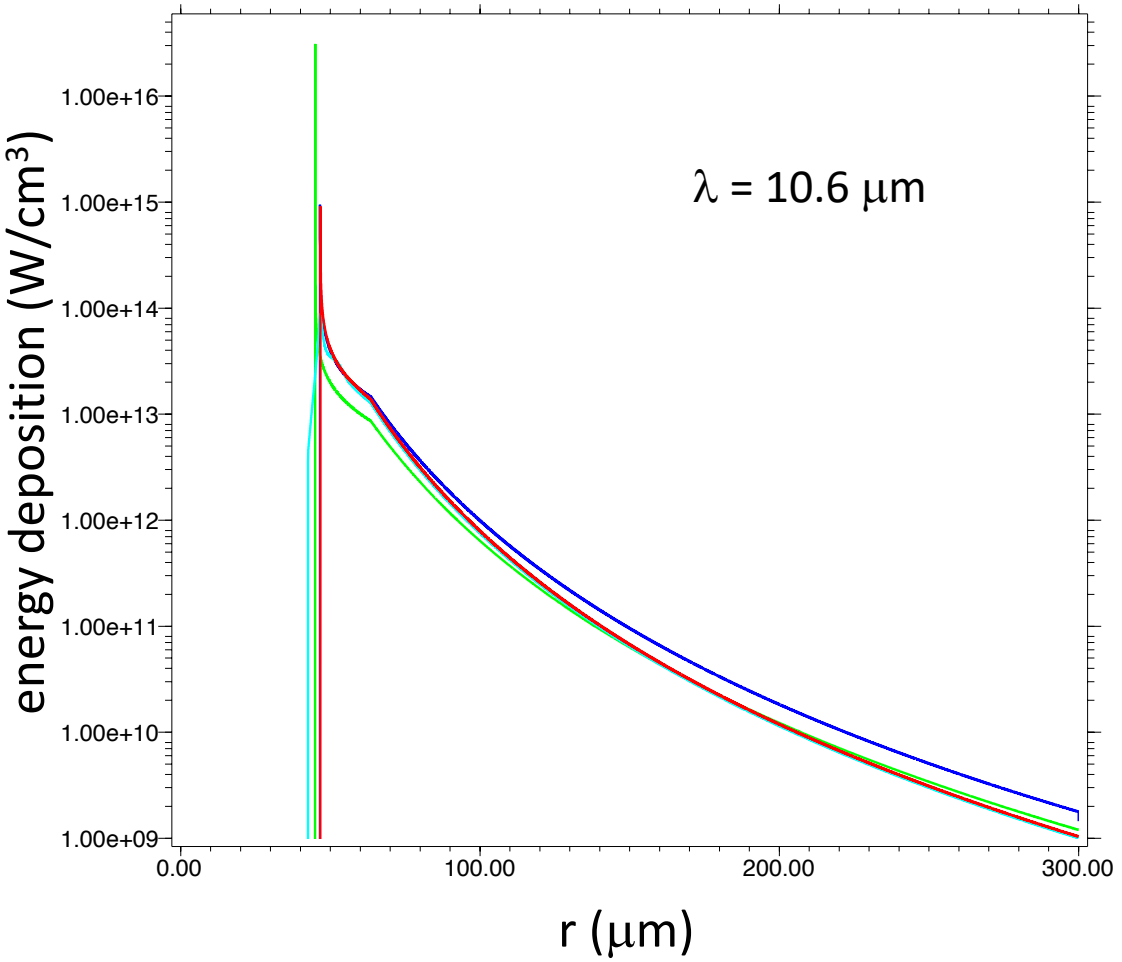




Test problem 2 results

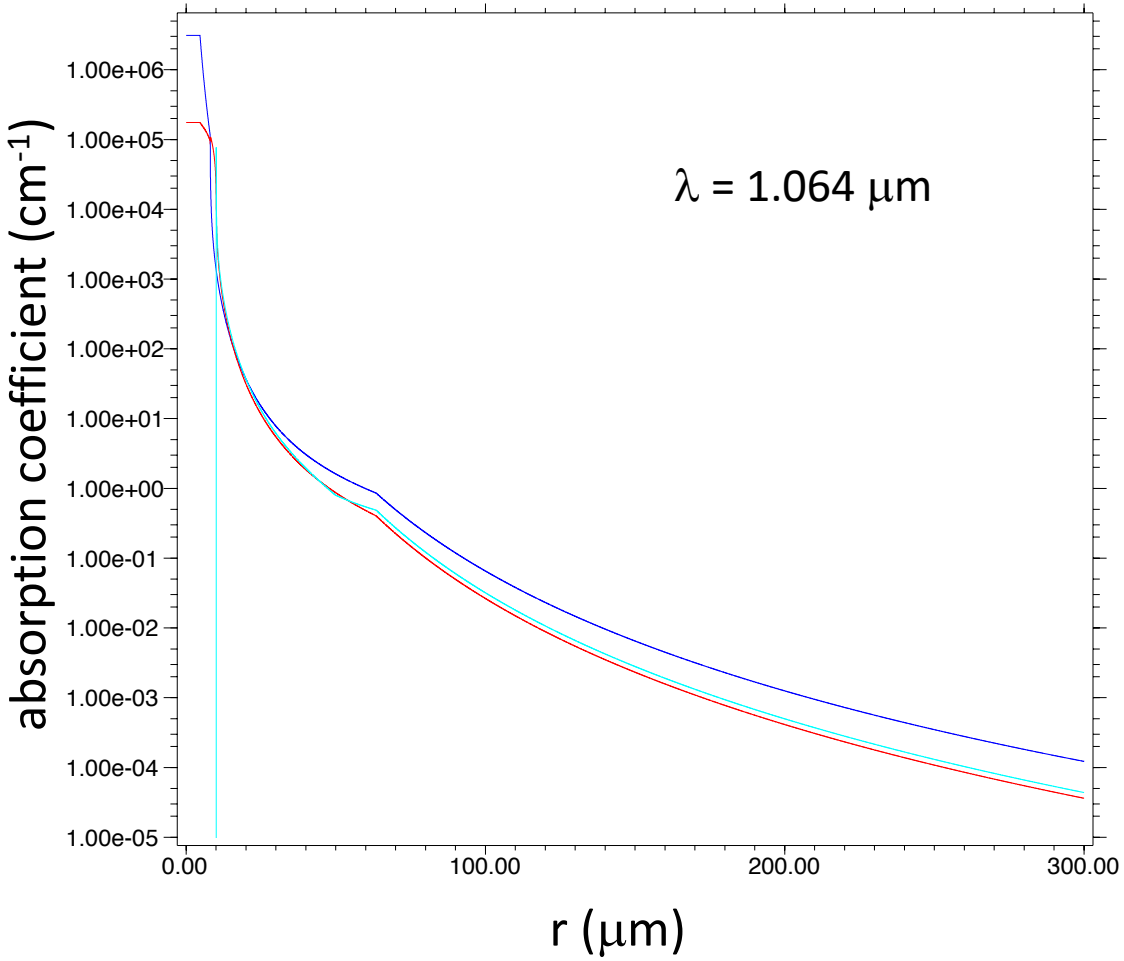
energy deposition

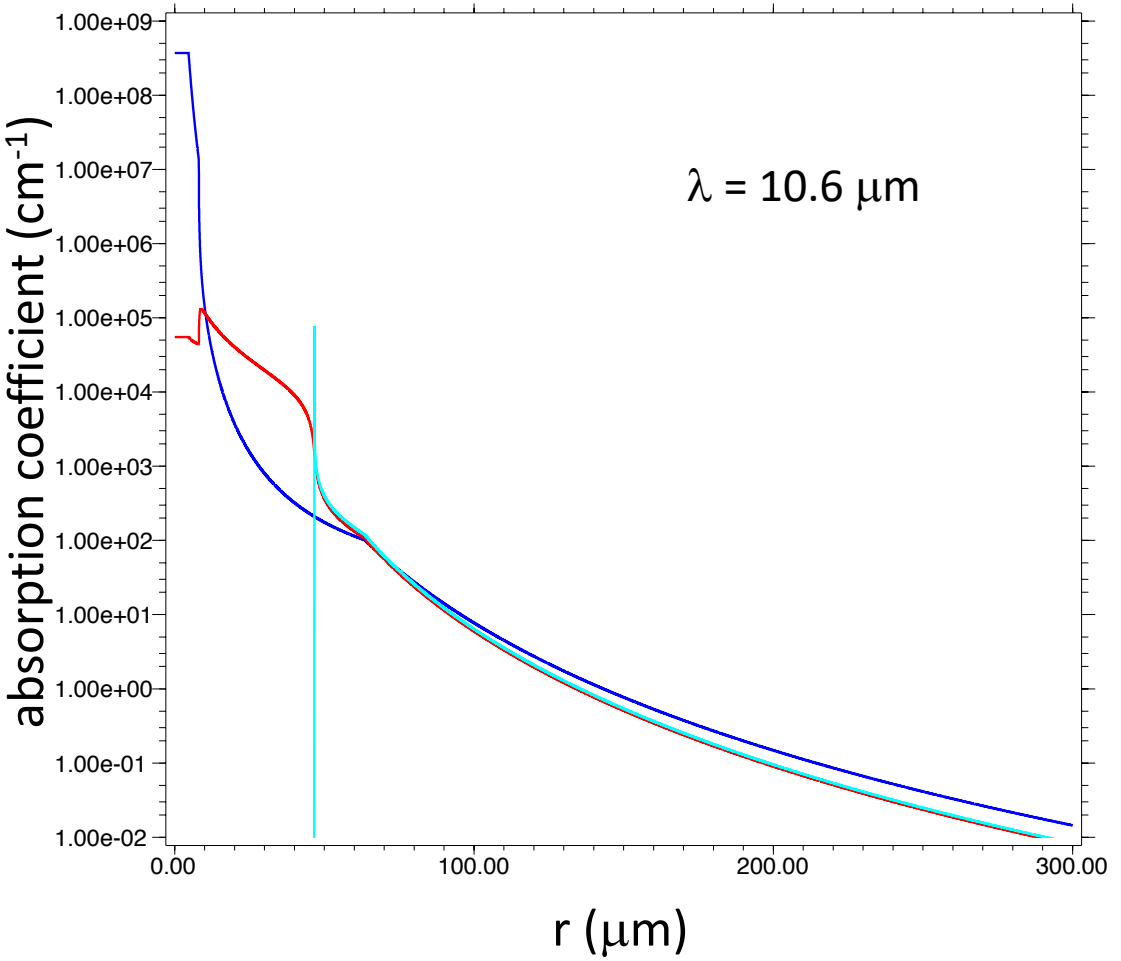




Test problem 2 results

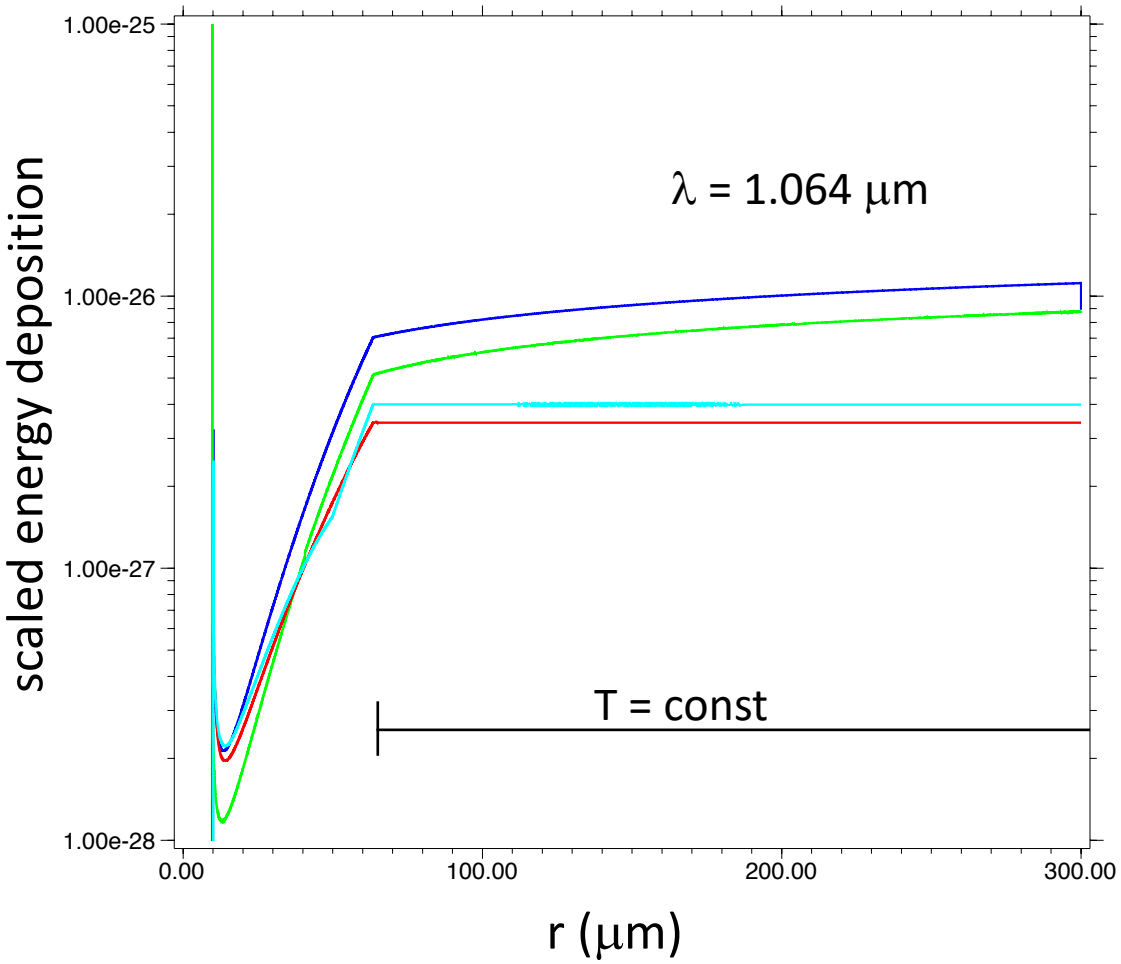
absorption coefficient

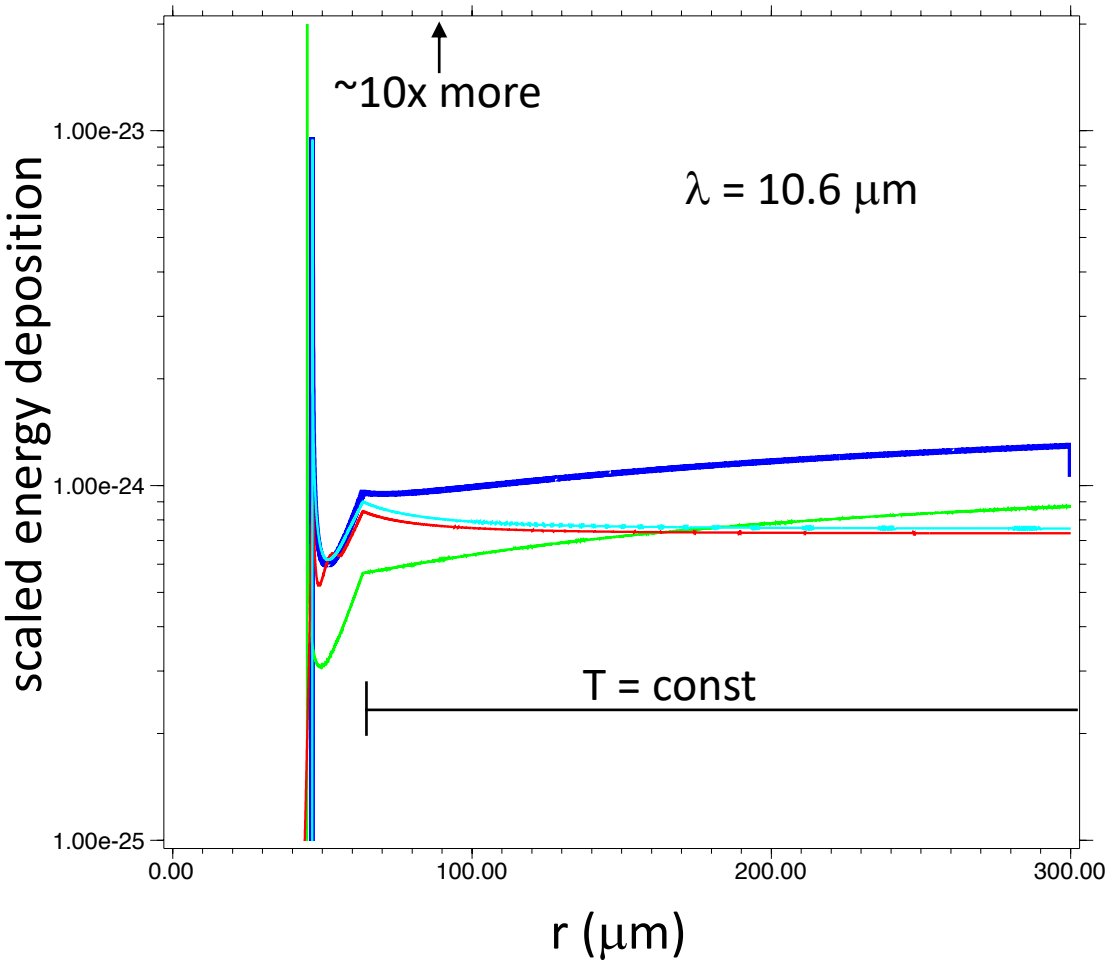




Test problem 2 results

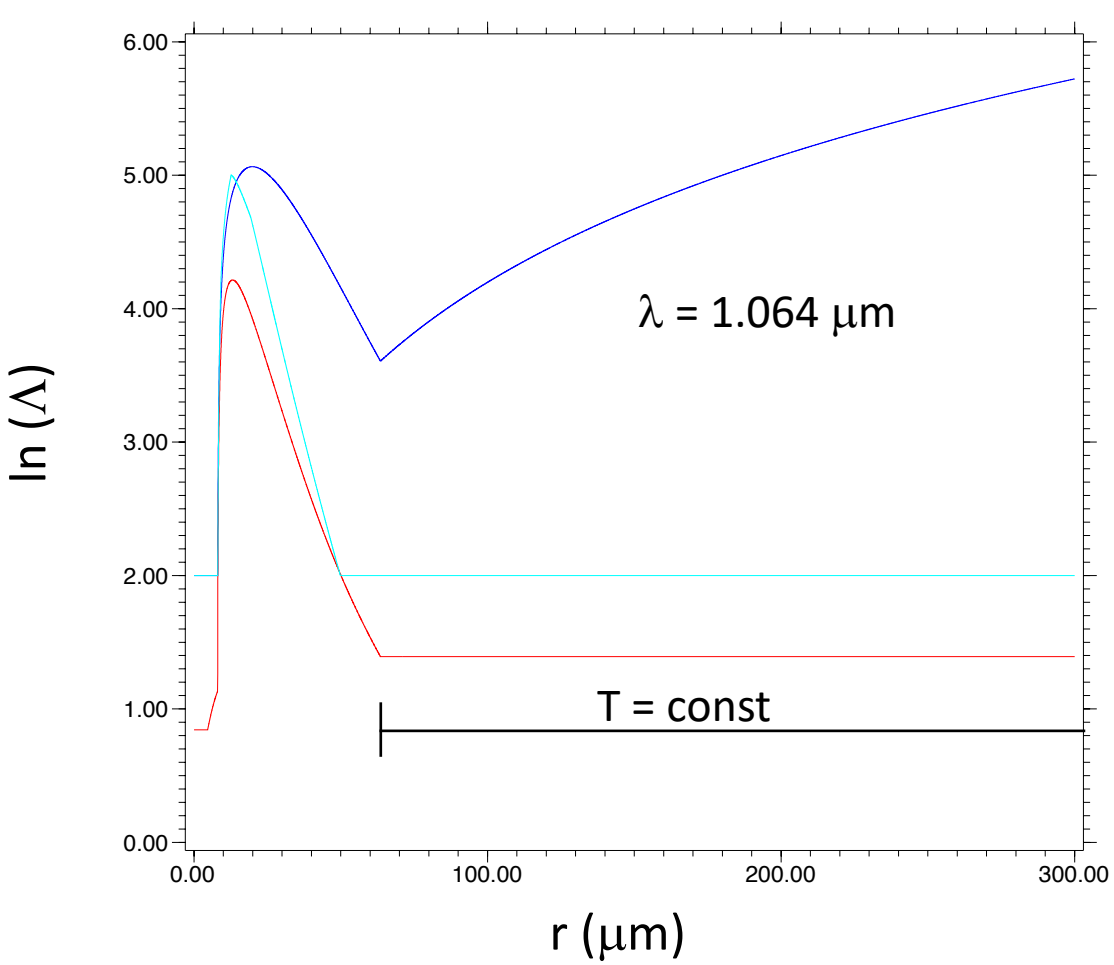
energy deposition x n_e x n_i

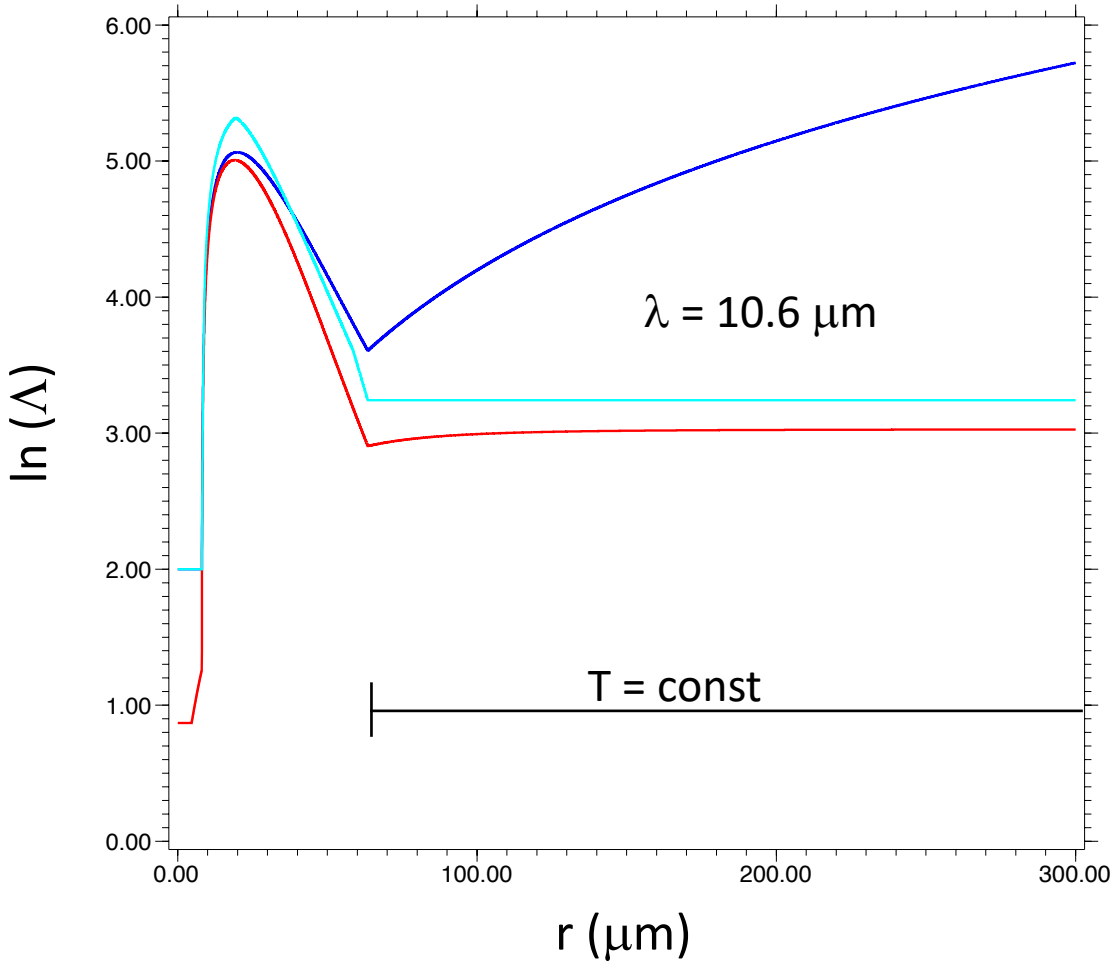




Test problem 2 results

Coulomb logarithm





Test problem 2 discussion

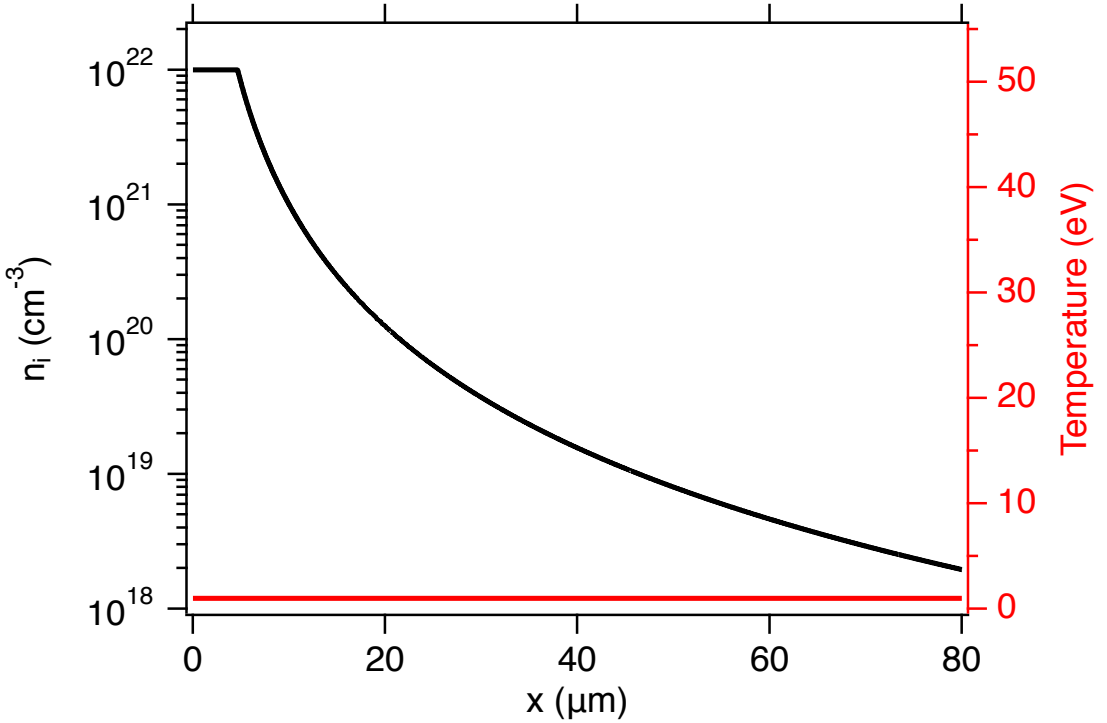
- The expectation / hope was that we would agree pretty well
- We are doing the same physics, but some details differ –
  - Coulomb logarithm (~2x)
  - absorption close to critical density
  - index of refraction?

- How does this translate to absorption in a Sn plasma?

Bonus test problem

Time-dependent laser absorption / plasma evolution

- 1D planar geometry
- Partially ionized hydrogen plasma
- Specified initial plasma temperature & ion density
- Plasma ionization to be calculated in NLTE



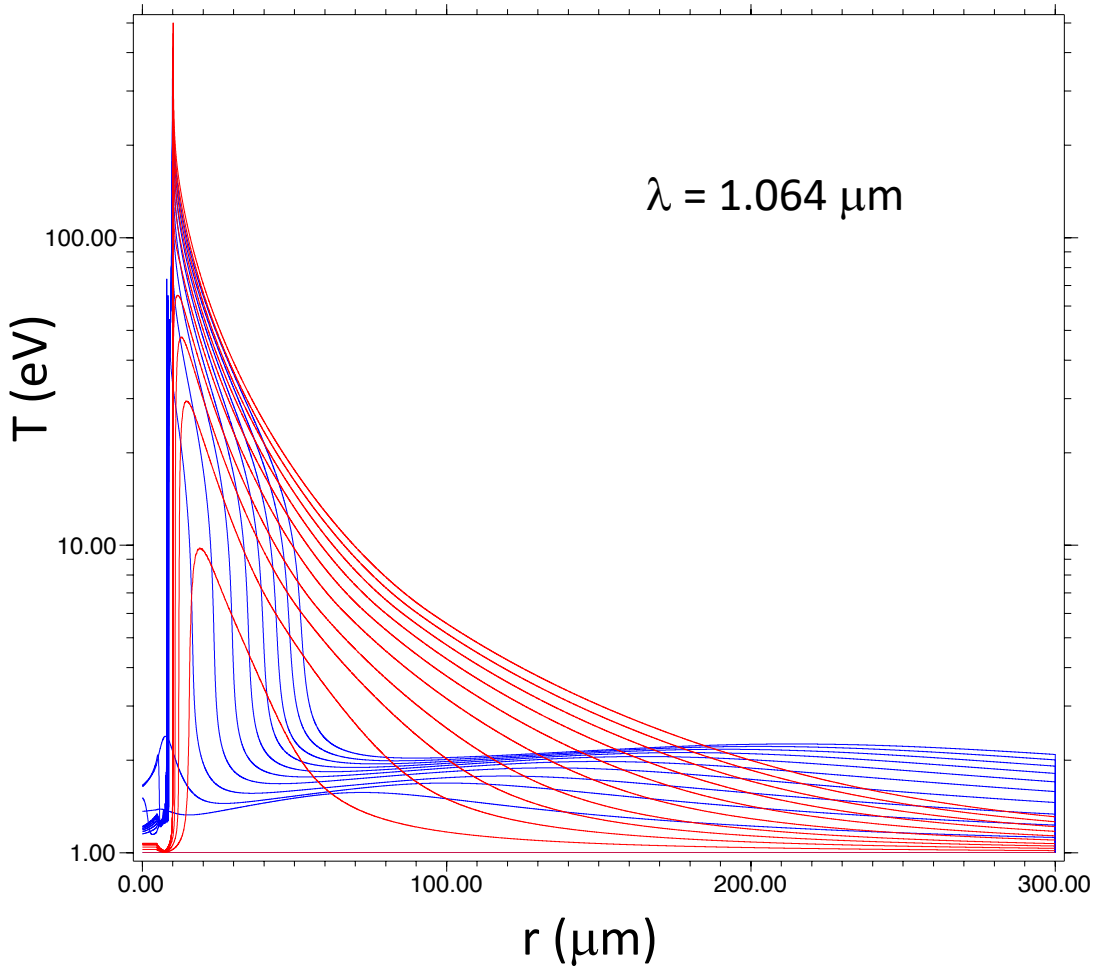
- Same spatial extent and grid
- Same laser intensity and wavelength(s)

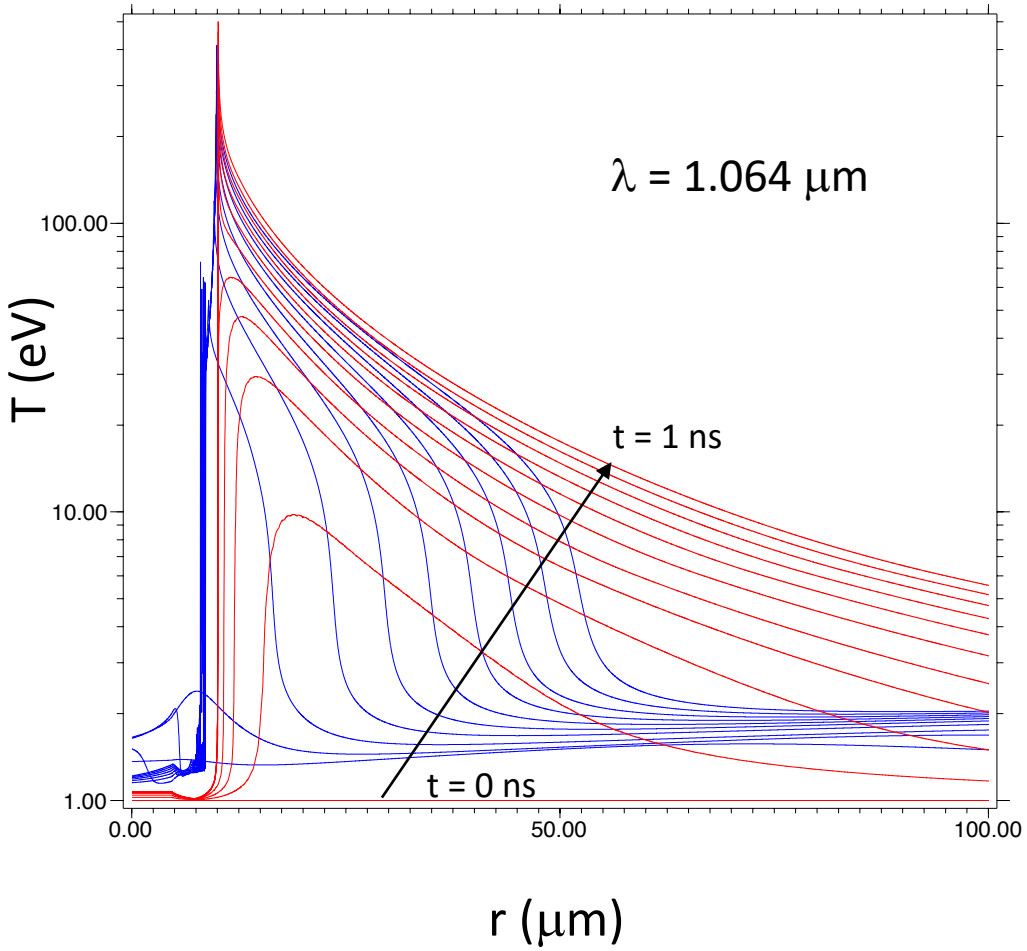
- Temporal extent of laser pulse
  - λ = 1.064 μm : t ∈ [0., 1.] ns
  - λ = 10.6 μm : t ∈ [0., 0.1] ns

- Goal is to calculate time-dependent laser absorption and temperature evolution

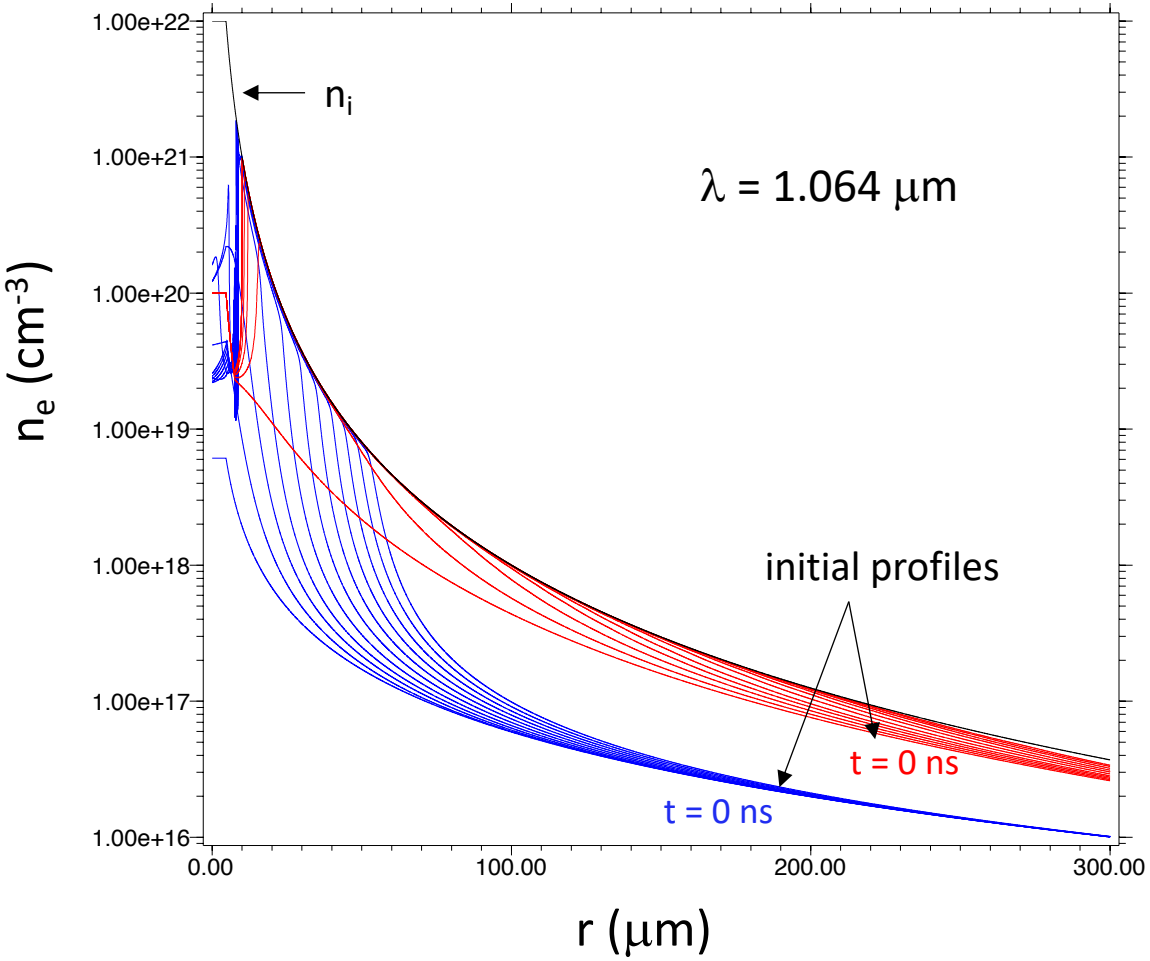
This is intended to identify issues in doing time-dependent comparisons

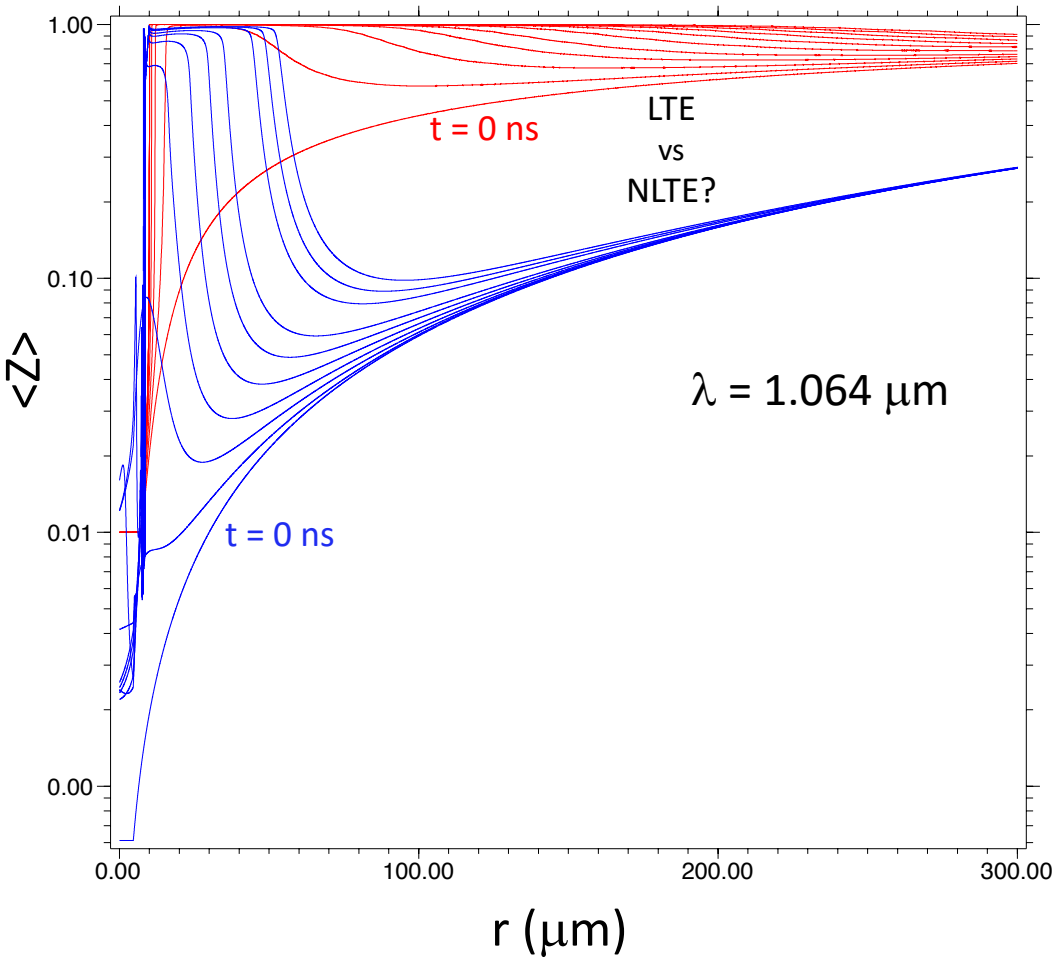
Bonus test problem results





Bonus test problem results





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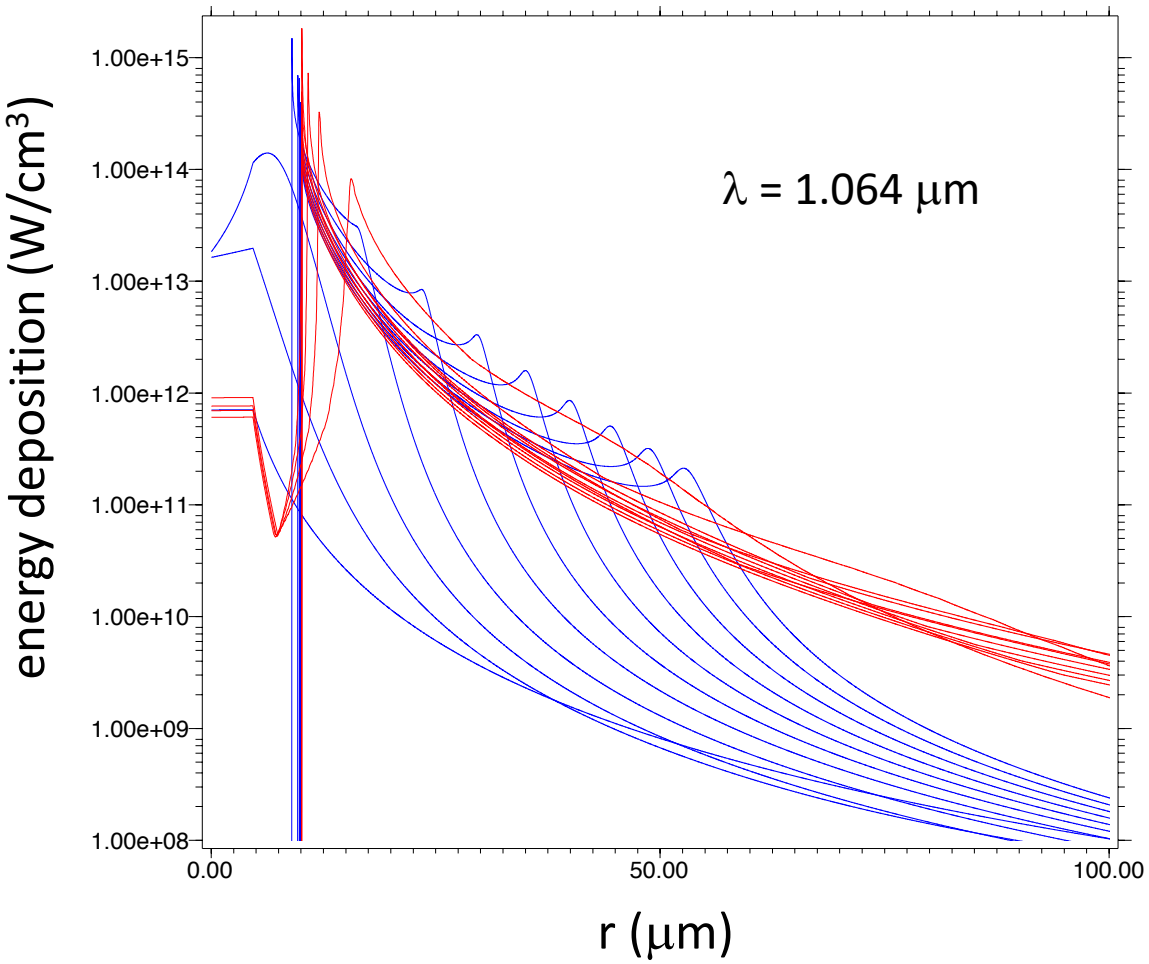

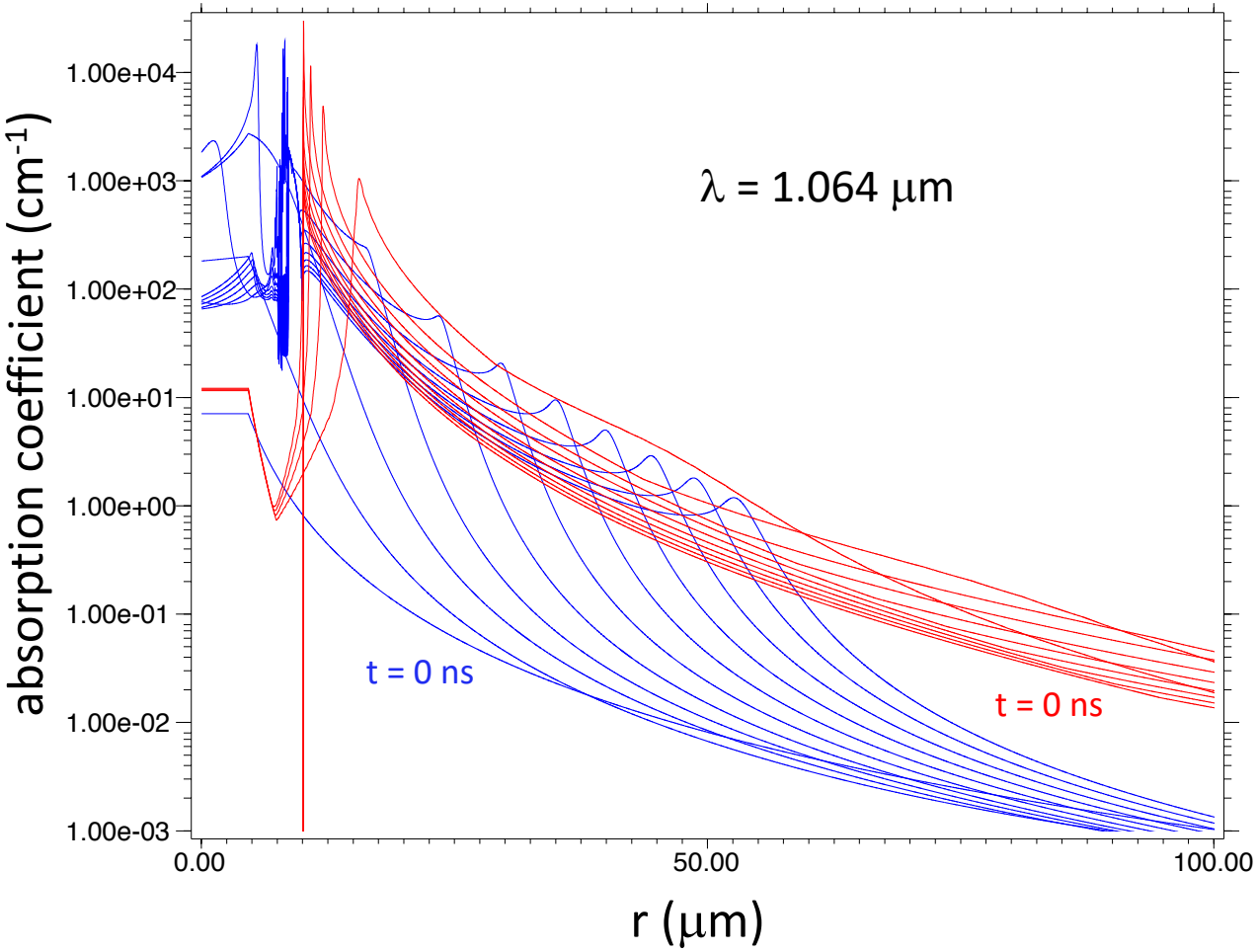

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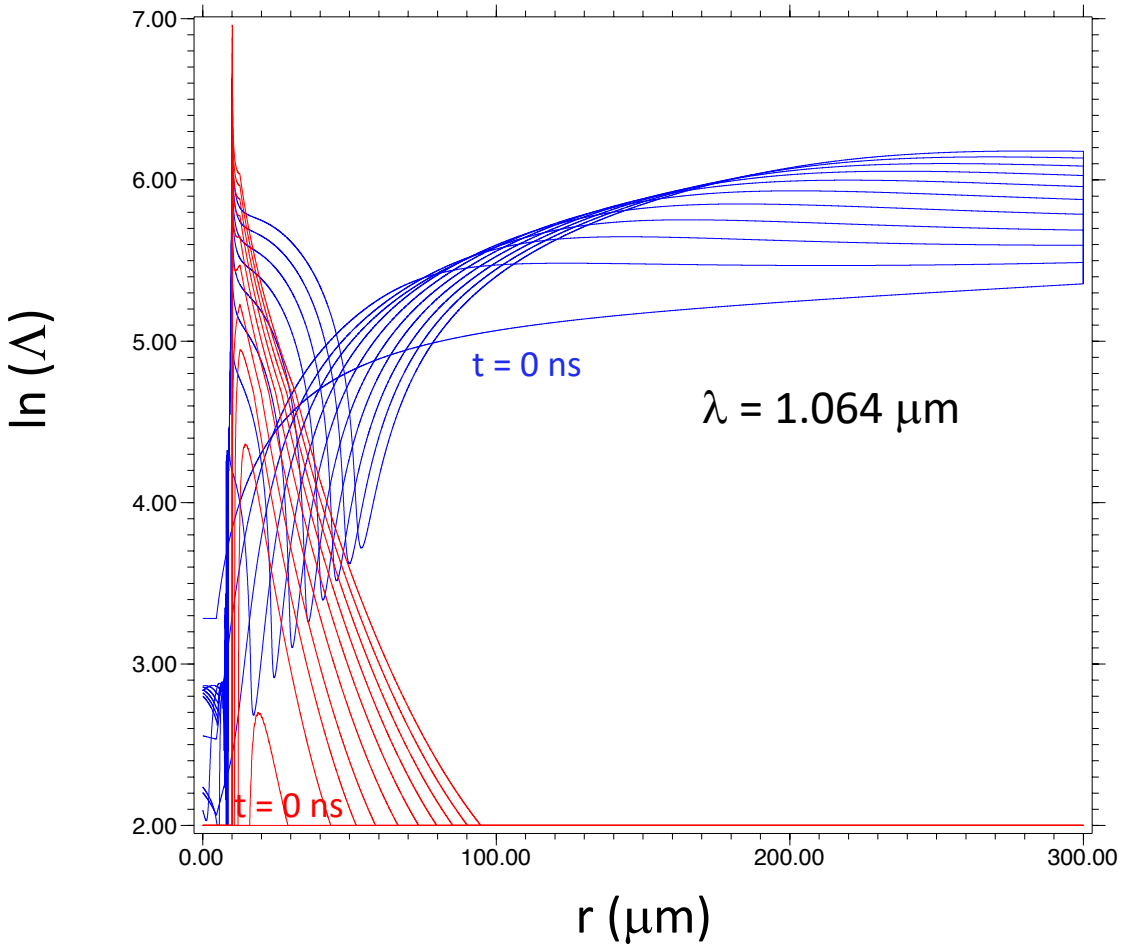

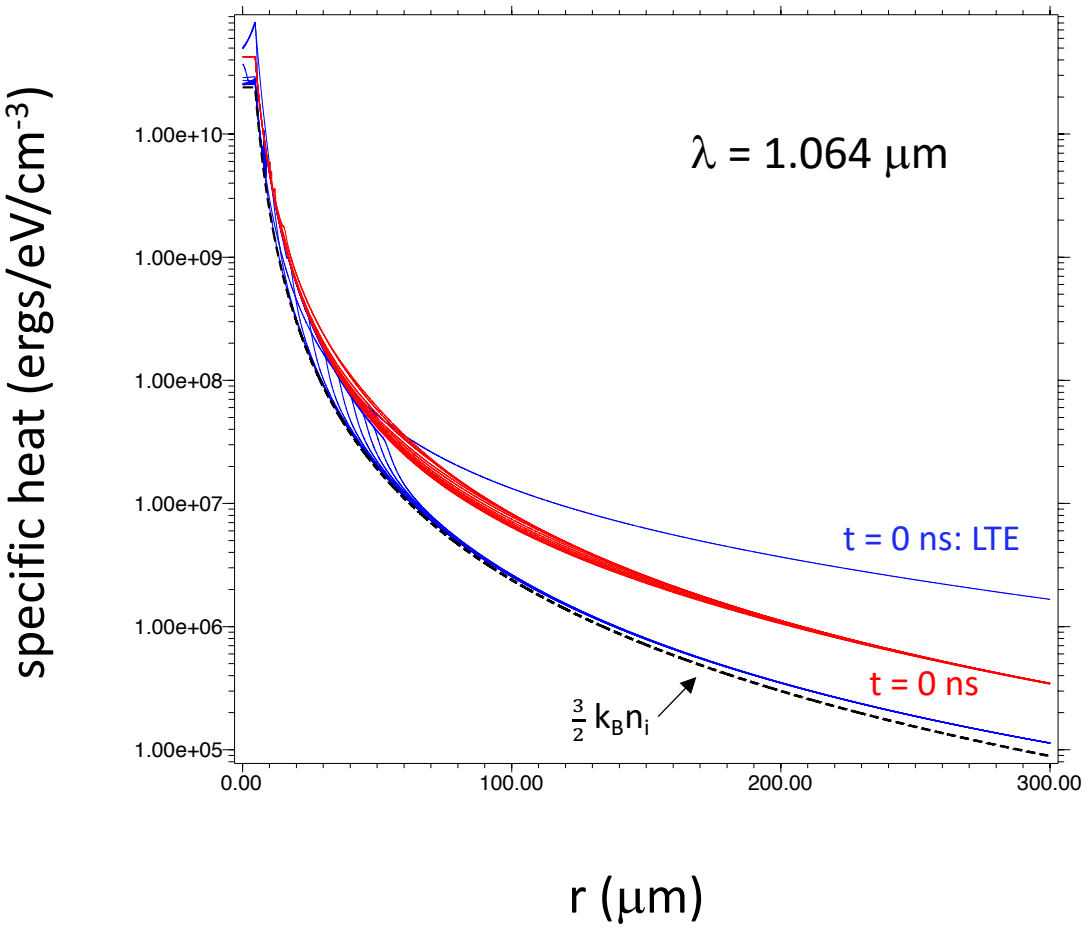

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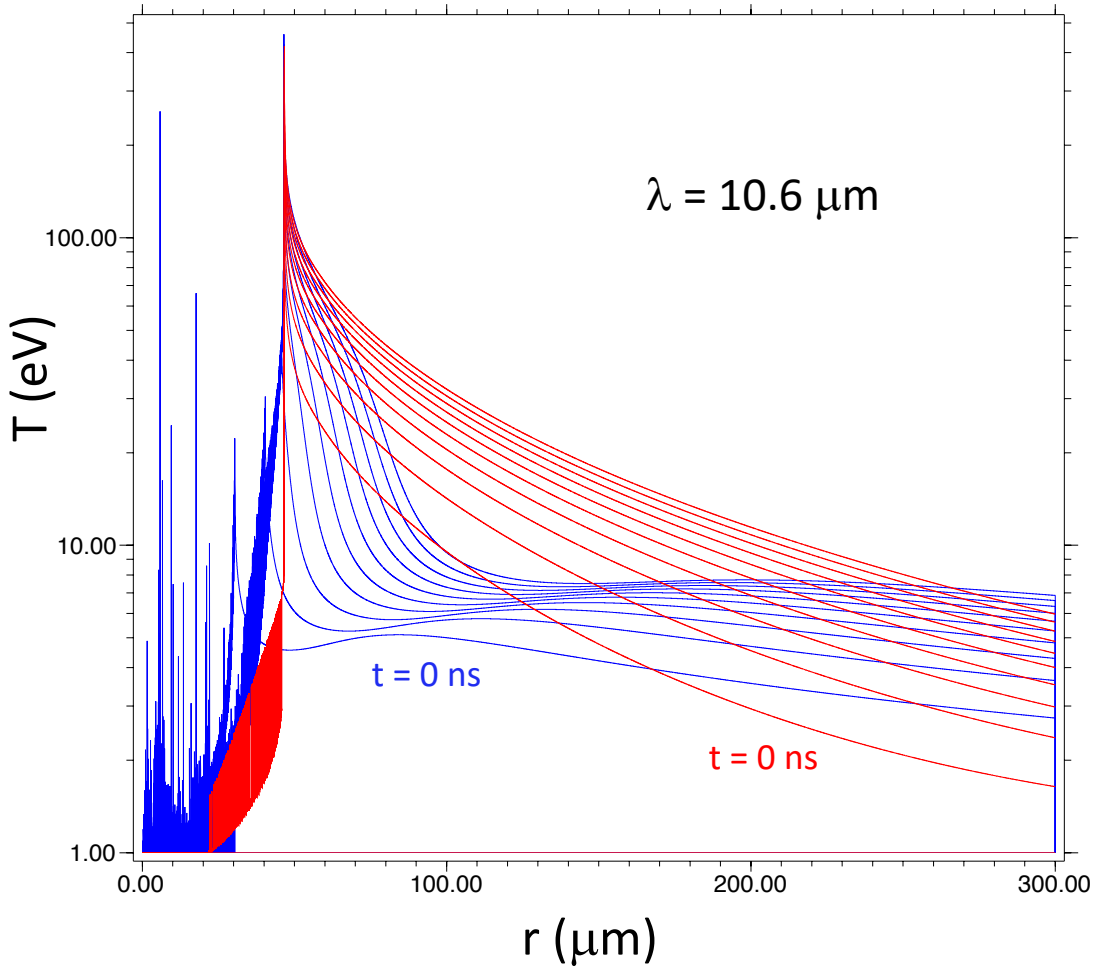

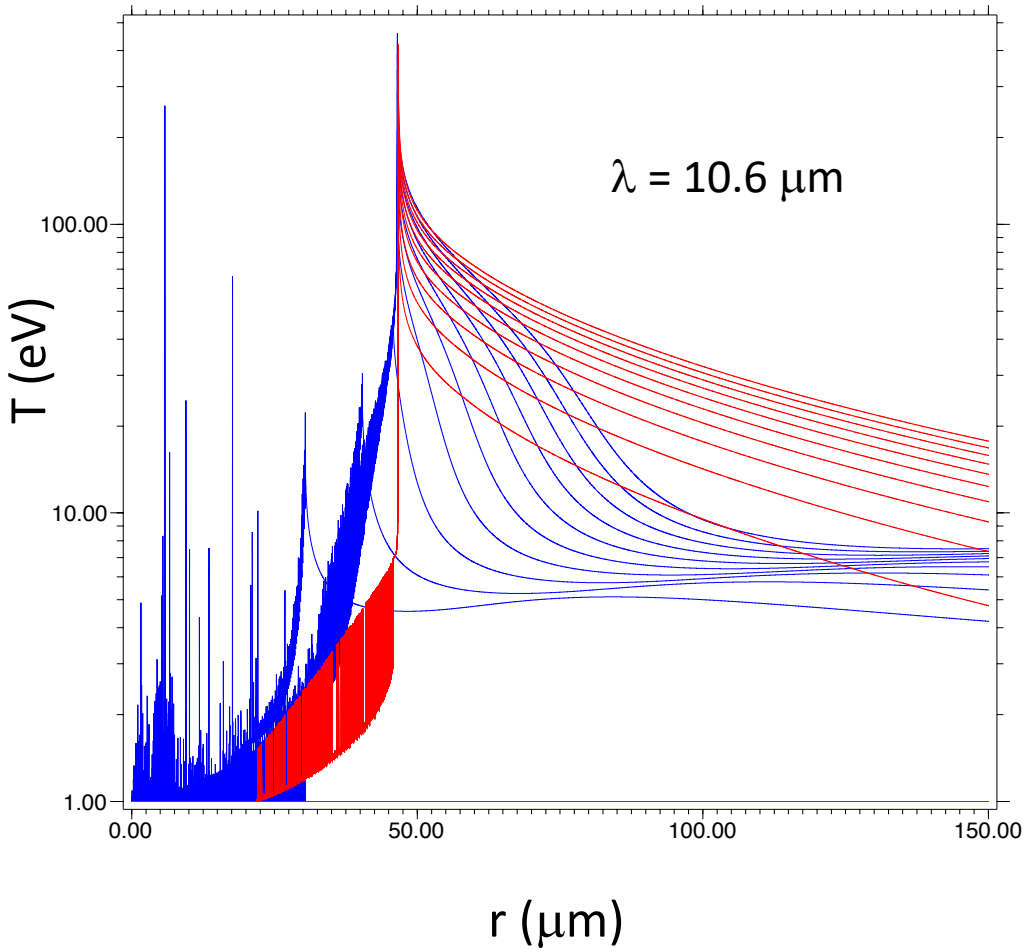

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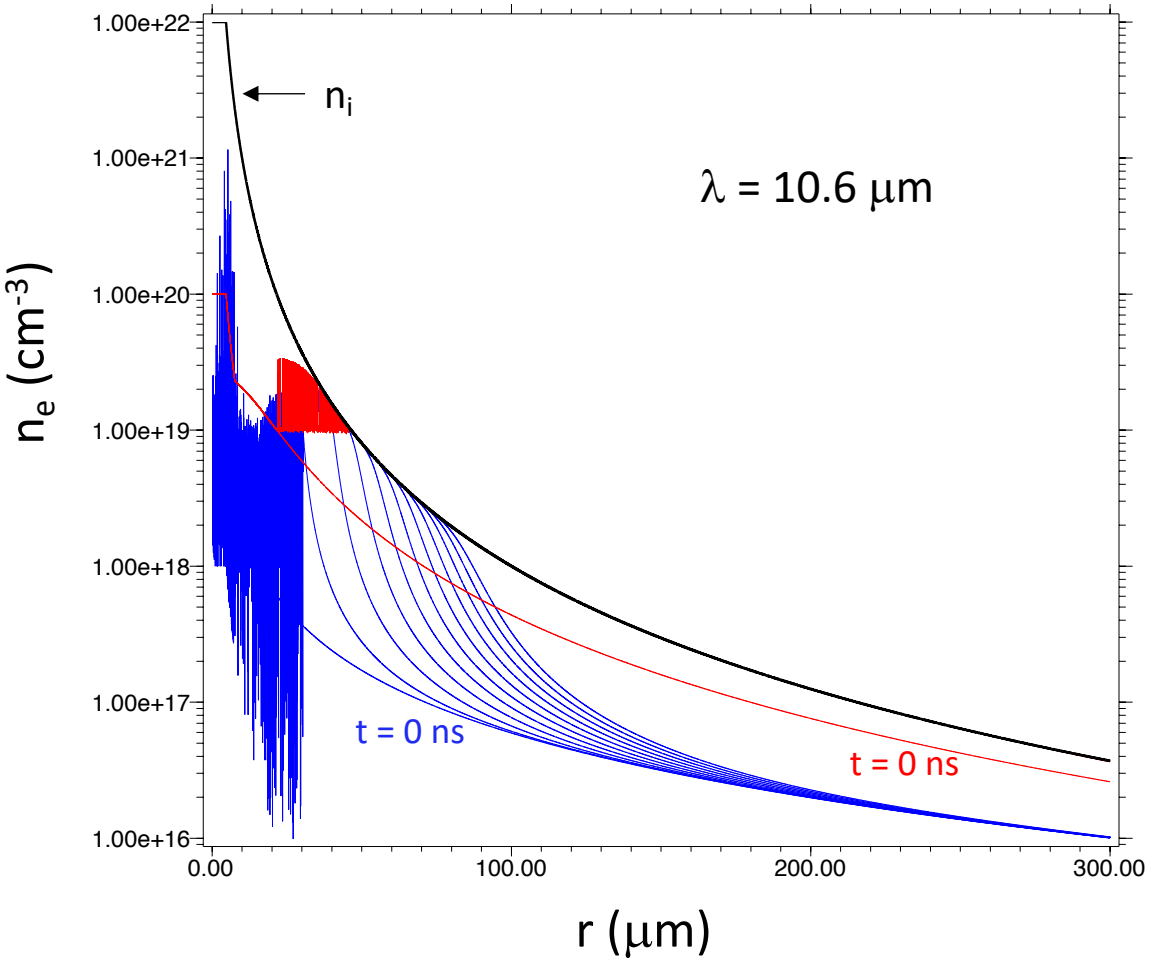

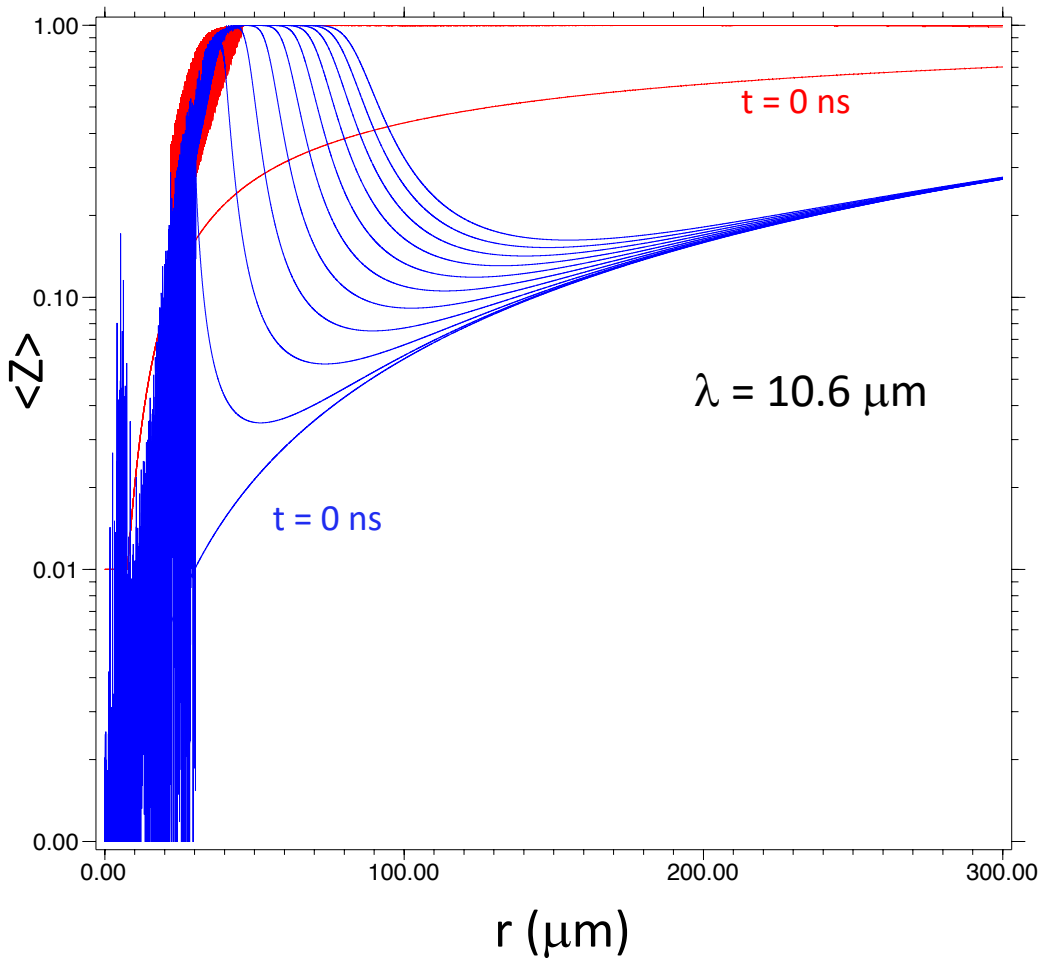

Bonus test problem discussion

- The 2 codes did different problems ⇒ need to verify understanding of description
- Why only 2 codes?

- Did this identify any (other) issues?
- Where do we go from here?