

Focusing field in modulator simulations

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Numerical setting

- Domain
 - Transversal : $4\text{e-}3\text{m}$ ($14 \times \text{Debyelength}$) open boundary
 - Longitudinal : $2\text{e-}5\text{m}$ ($20 \times \text{Debyelength}$) periodic boundary
- Grid number : 20 per Debye length
- Electron
 - Gaussian in x, y
 - Uniform in z

Linear focusing field

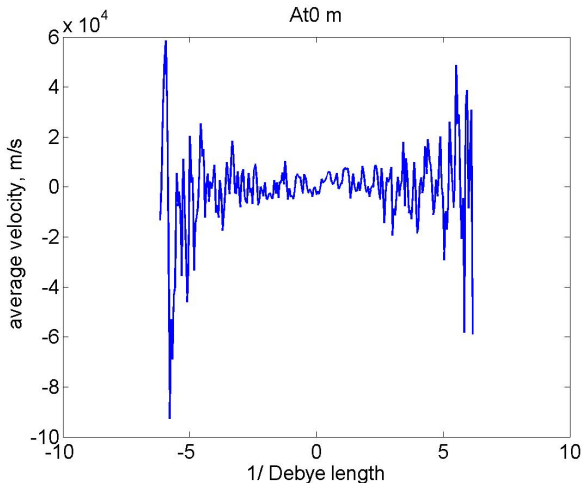
$$\vec{E}_0(x) = \frac{m_e \sigma^2}{e r_0^2} (x - x_0)$$

G. Bell et al., VLASOV AND PIC SIMULATIONS OF A MODULATOR SECTION FOR COHERENT ELECTRON COOLING, Proceedings of 2011 Particle Accelerator Conference, New York, NY, USA, MOP067.

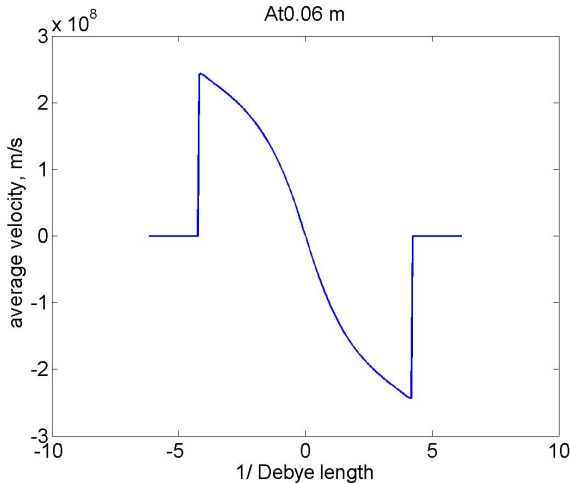
Implemented as

$$\vec{E} = k\vec{x}$$

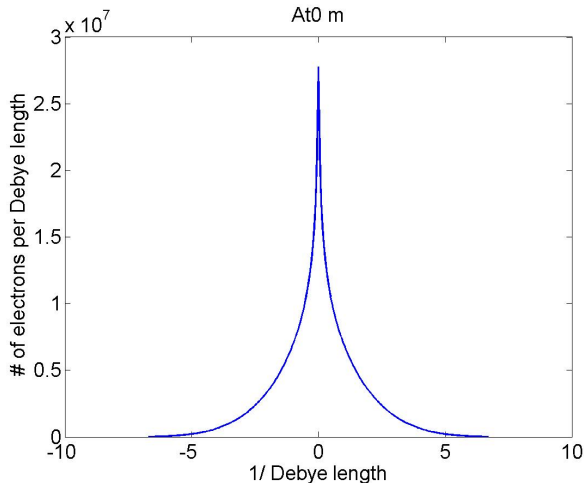
Transversal velocity distribution, $k=3e+11 \text{ V/m}^2$



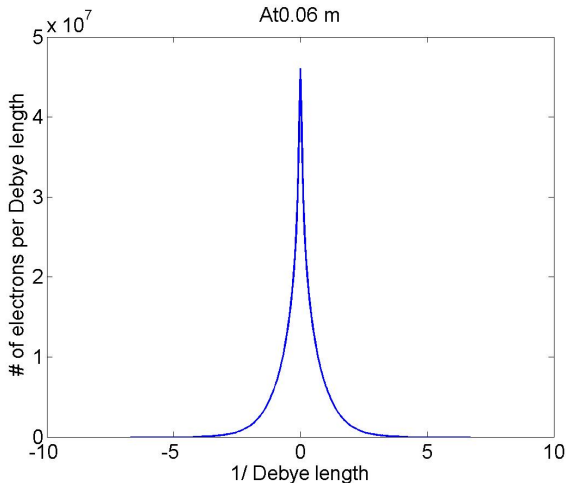
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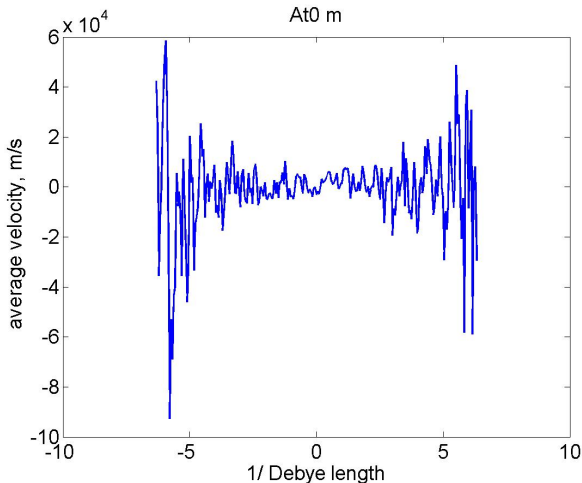
Transversal number distribution, $k=3e+11 \text{ V/m}^2$



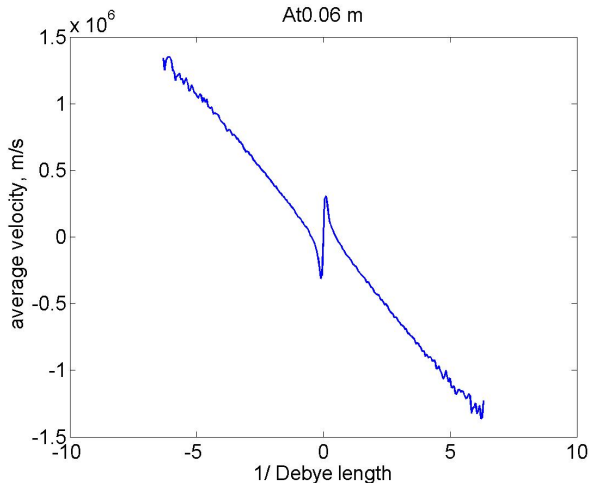
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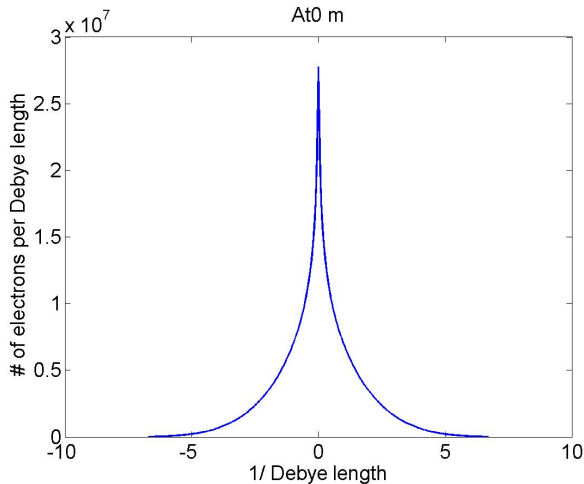
Transversal velocity distribution, $k=1e+9 \text{ V/m}^2$



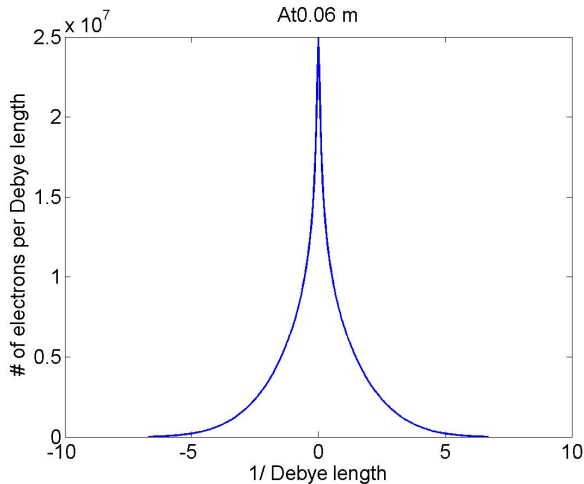
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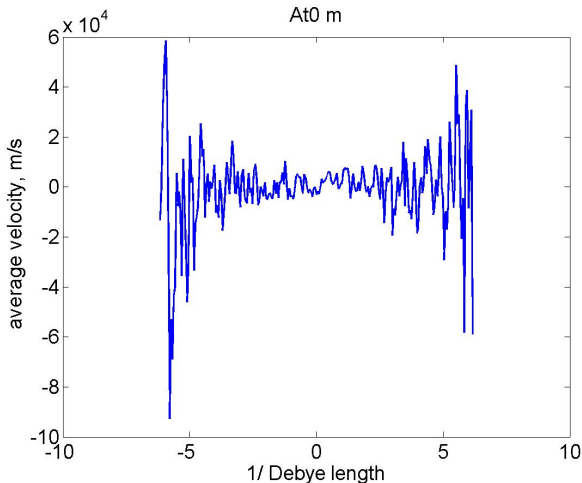
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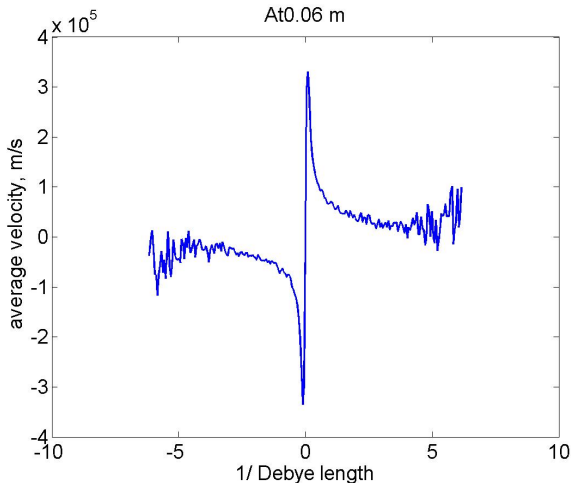
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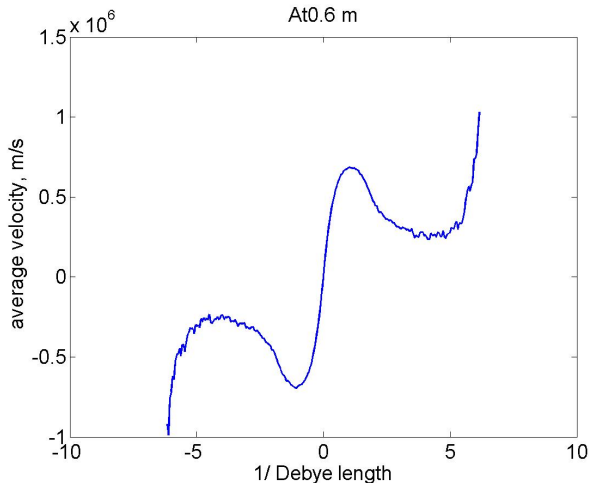
Transversal velocity distribution, $k=1e+8 \text{ V/m}^2$



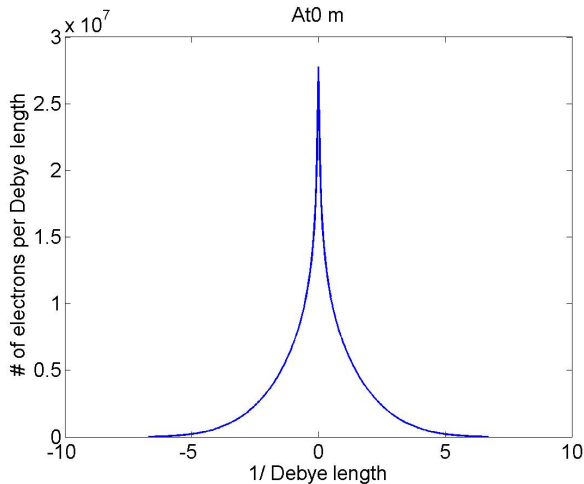
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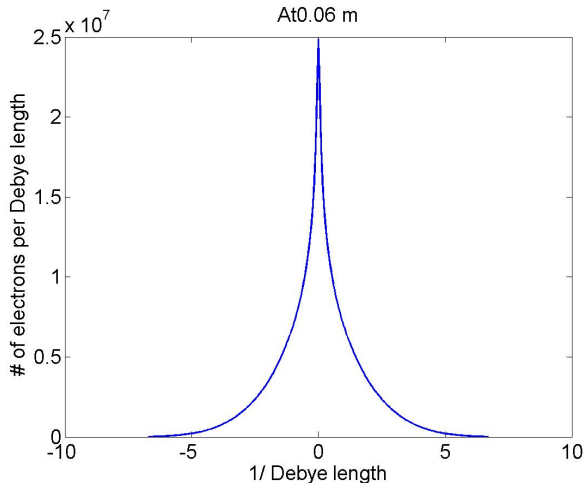
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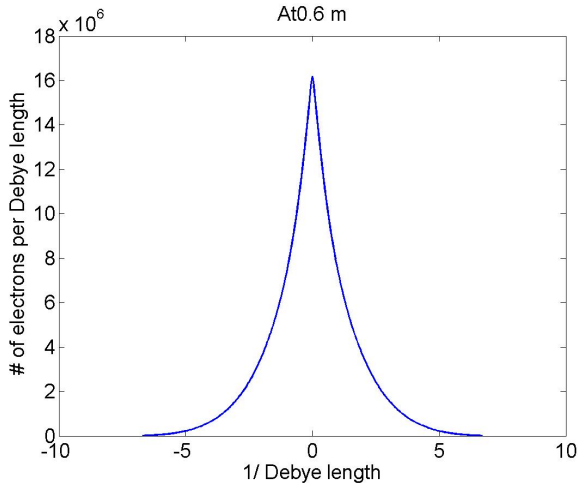
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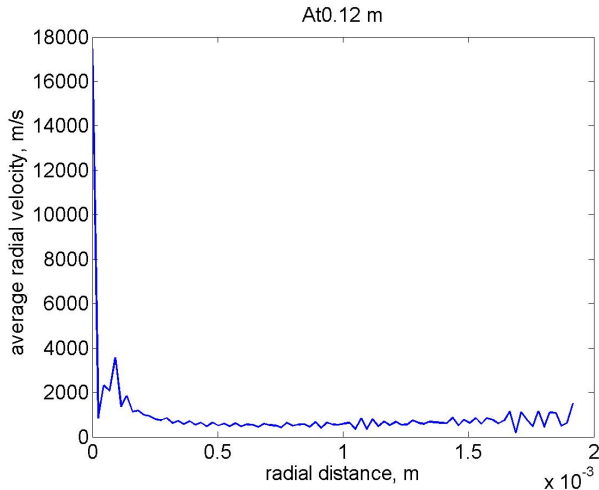
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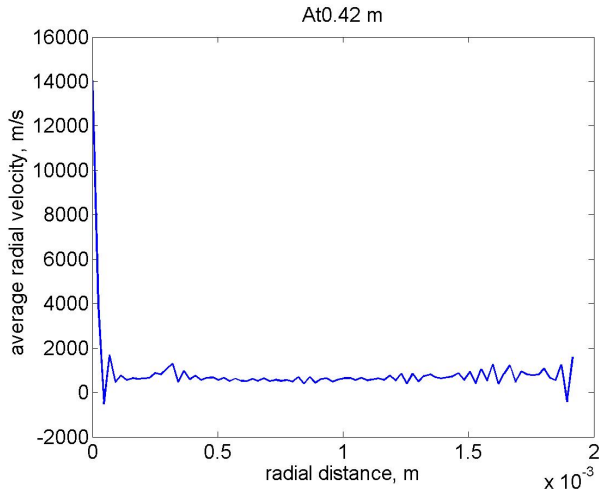
Self-consistent focusing

- Estimate expansion velocity
- Subtract expansion effect

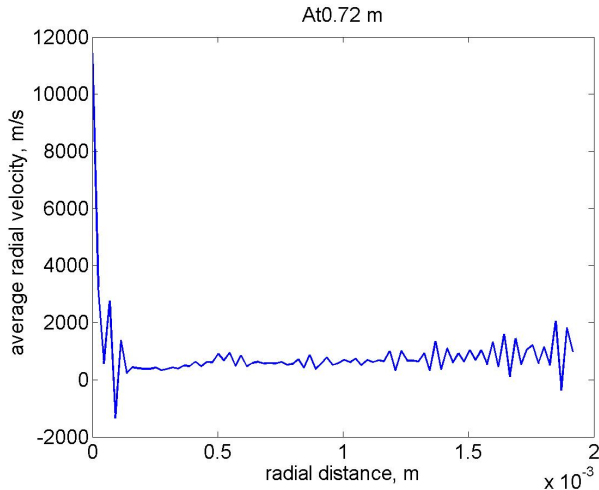
Expansion velocity



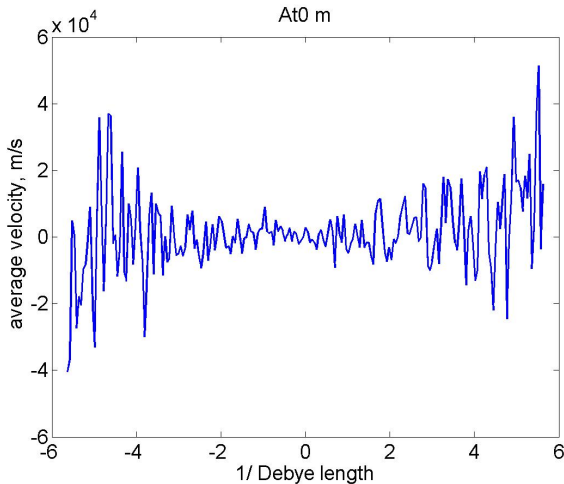
Expansion velocity



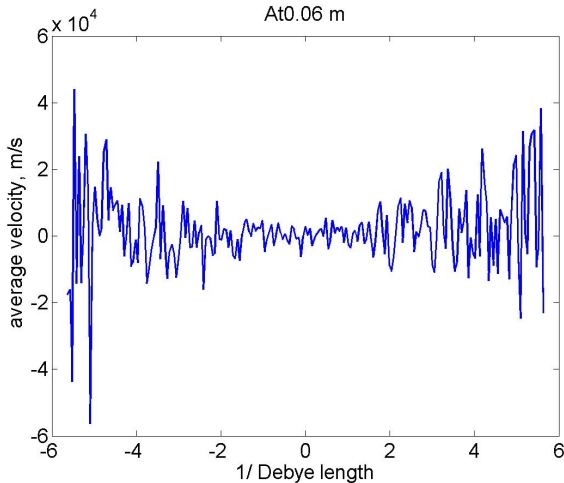
Expansion velocity



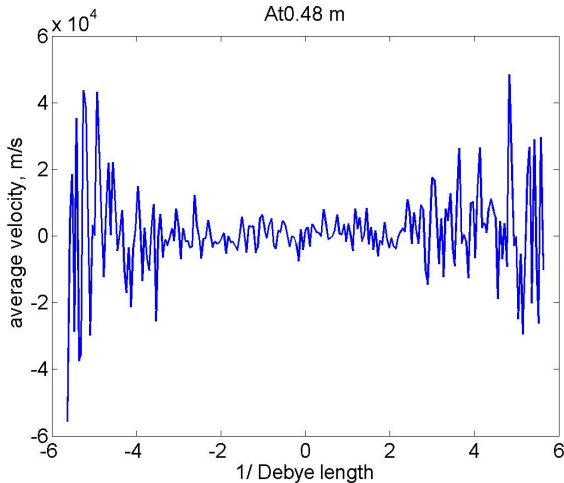
Transversal velocity distribution



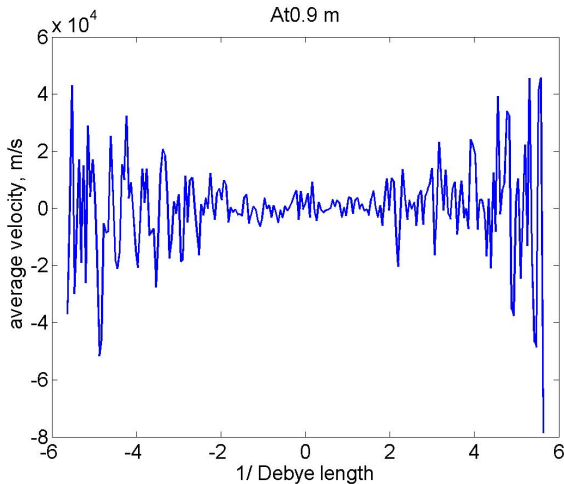
Transversal velocity distribution



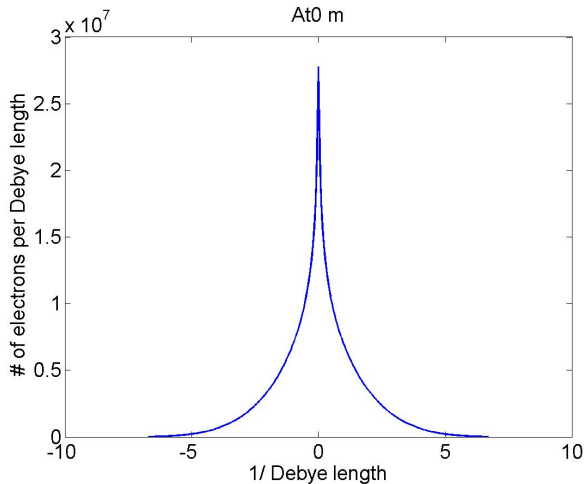
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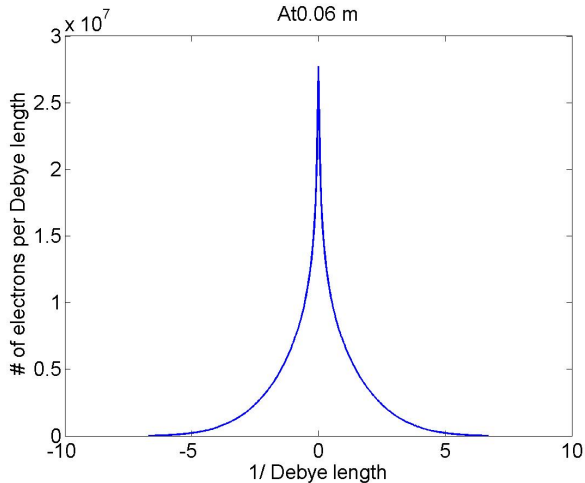
Transversal velocity distribution



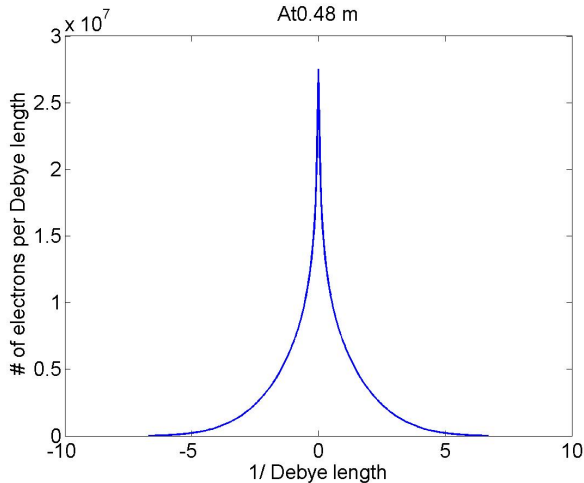
Transversal number distribution



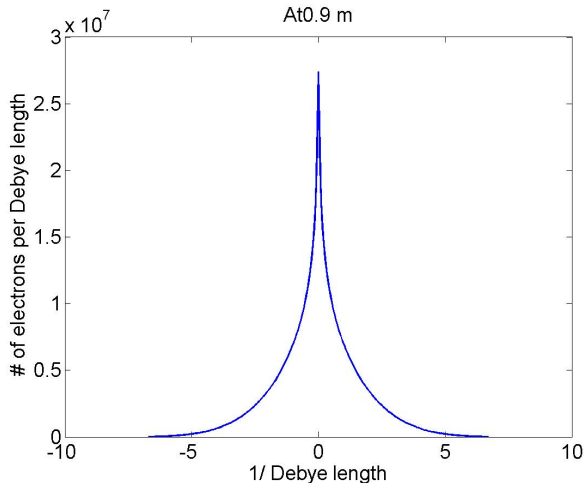
Transversal number distribution



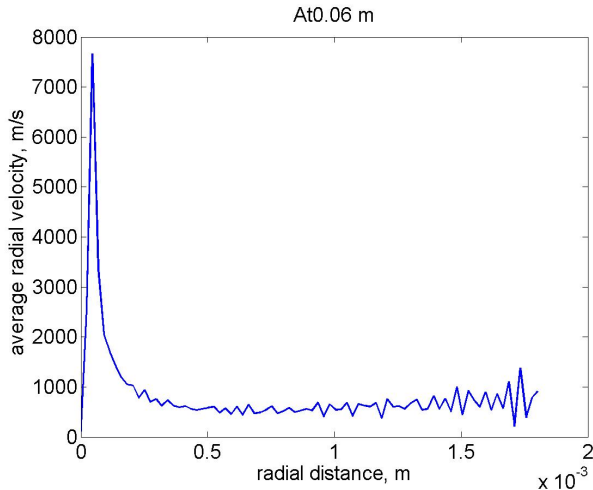
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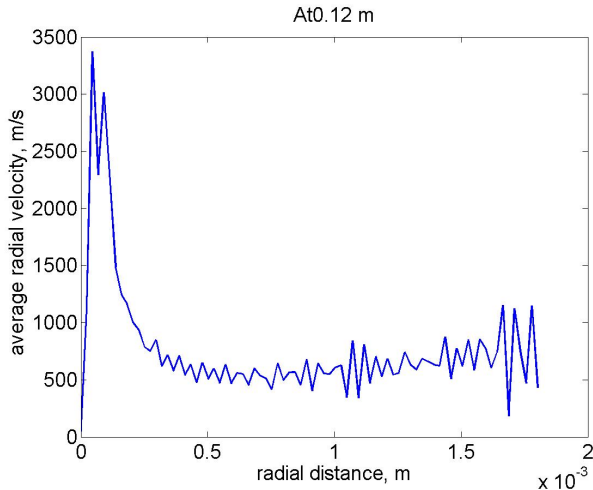
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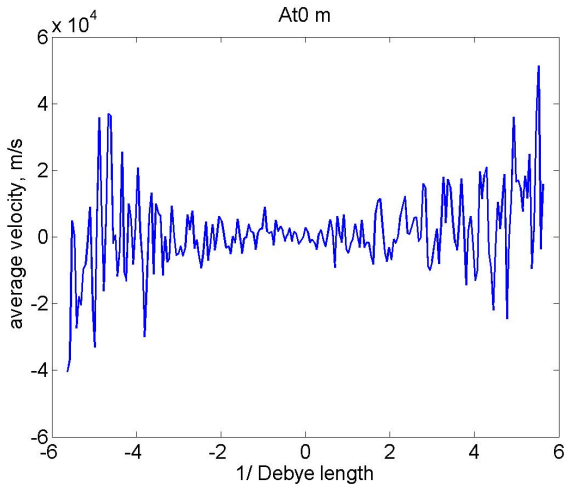
Expansion velocity



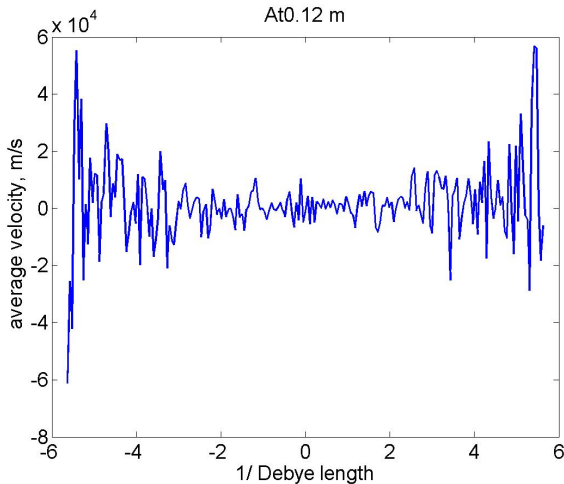
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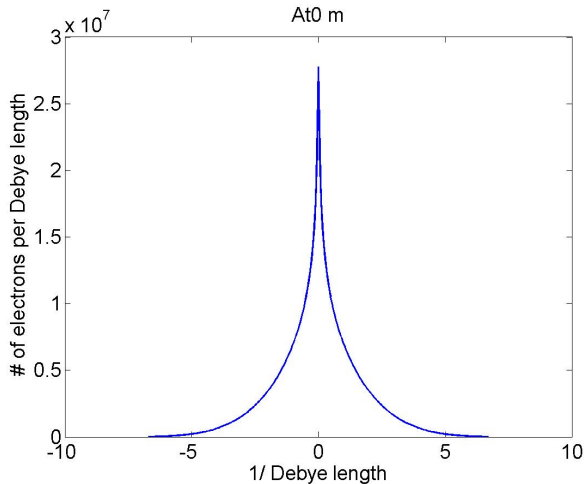
Transversal velocity distribution



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Transversal number distribution



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