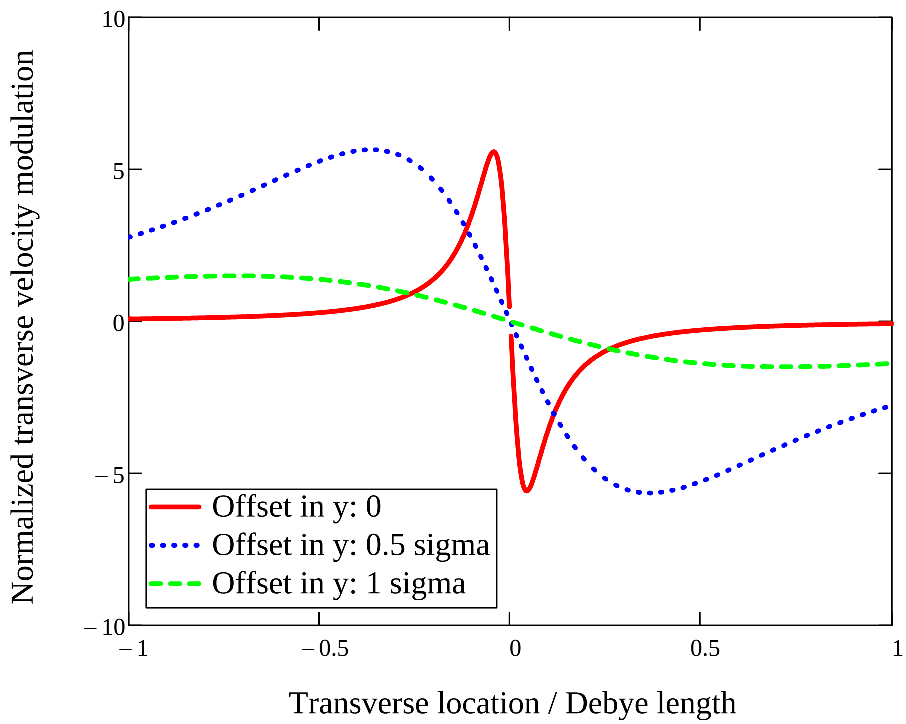
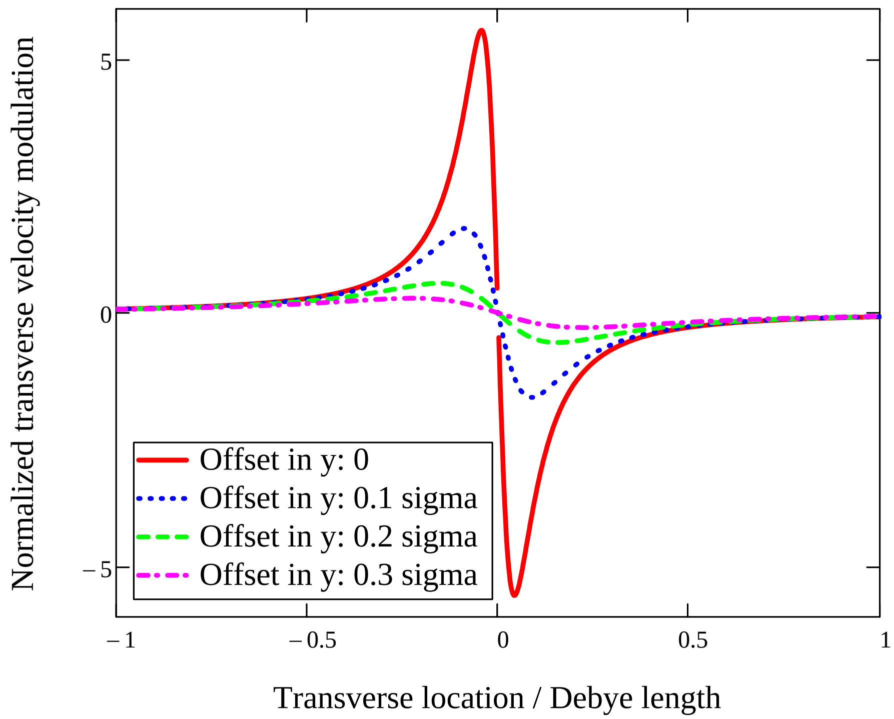
$$j_x(x,y,t_{max}) := x\cdot\int_0^{t_{max}}\left[\frac{2\cdot\sin(t_1)}{\left(t_1^2+x^2+y^2\right)^2}+\frac{\cos(t_1)}{x^2+y^2}\cdot\left(\frac{t_1}{t_1^2+x^2+y^2}-\frac{\operatorname{atan}\left(\frac{\sqrt{x^2+y^2}}{t_1}\right)}{\sqrt{x^2+y^2}}\right)\right]dt_1$$

Increased the green and blue plots by a factor of 50 to make curve visible





$Z_i := 79$ $\quad r_e := 2.8\cdot 10^{-15}\mathrm{m}$ $\quad \beta_x := 2\cdot 10^{6}\,\frac{\mathrm{m}}{\mathrm{s}}$

$a_x := 340\cdot 10^{-6}\mathrm{m}$

$$A_x := \frac{2\cdot Z_i}{\pi}\cdot\frac{c}{\beta_x}\cdot\frac{r_e}{a_x}\cdot c \qquad A_x = 18.612\,\frac{\mathrm{m}}{\mathrm{s}}$$

$\beta_z := 3\cdot 10^5 \frac{m}{s}$

$a_z := 40\cdot 10^{-6} \frac{m}{s}$

$A_z := \frac{2\cdot Z_i}{\pi}\cdot\frac{c}{\beta_z}\cdot\frac{r_e}{a_z}\cdot c$

$A_z = 1.055\times 10^3\,m$

A simple estimate to show that it is possible to have two orders of magnitude change of vx for electrons at y=0 and y=0.5*sigma

$\omega_{pb} := 6.4\cdot 10^9\cdot\frac{1}{s}$

$ds_1 := 0.3m$

$\lambda_{plab} := 12.6m$

$dt_1 := \frac{2\pi}{\omega_{pb}}\cdot\frac{ds_1}{\lambda_{plab}}$

$dt_1 = 2.337\times 10^{-11}\,s$

$m_e := 9.11\cdot 10^{-31}kg$

$q_e := 1.6\cdot 10^{-19}C$

1. an electron sit at y=0 and x=50 um

$dx_{b1} := 50\cdot 10^{-6}m$

$ds_{b1} := dx_{b1}$

$F_{ion1} := \frac{Z_i\cdot q_e^{\,2}}{4\pi\cdot\varepsilon_0\cdot ds_{b1}^{\,2}}$

$F_{ion1}\cdot 10^{10} = 7.271\times 10^{-8}\,N$

$F_{ion1x} := F_{ion1}$

$dv_{b1x} := \frac{F_{ion1x} \cdot dt_1}{m_e}$ $\quad dv_{b1x} = 186.552 \frac{m}{s}$

2. an electron sit at y=0.5*sigma and x=50 um

$\sigma_{e13} := 683 \cdot 10^{-6} m$

$dy_{b2} := 0.5 \cdot \sigma_{e13}$

$dx_{b2} := dx_{b1} \cdot 5$

$ds_{b2} := \sqrt{dx_{b2}^{\ 2} + dy_{b2}^{\ 2}}$

$F_{ion2} := \frac{Z_i \cdot q_e^{\ 2}}{4\pi \cdot \varepsilon_0 \cdot ds_{b2}^{\ 2}}$

$F_{ion2x} := F_{ion2} \cdot \frac{dx_{b2}}{ds_{b2}}$ $\quad F_{ion2x} \cdot 10^{10} = 5.994 \times 10^{-10} N$

$dv_{b2x} := \frac{F_{ion2x} \cdot dt_1}{m_e}$ $\quad dv_{b2x} = 1.538 \frac{m}{s}$

x=50um may not be the location for the peak value of vx, hence we increase x to find the peak--->

3. an electron sit at y=0.5*sigma and x=250 um

$$dy_{b3} := 0.5 \cdot \sigma_{e13}$$

$$dx_{b3} := 250 \cdot 10^{-6} m$$

$$ds_{b3} := \sqrt{dx_{b3}^{2} + dy_{b3}^{2}}$$

$$F_{ion3} := \frac{Z_i \cdot q_e^{2}}{4\pi \cdot \varepsilon_0 \cdot ds_{b3}^{2}}$$

$$F_{ion3x} := F_{ion2} \cdot \frac{dx_{b3}}{ds_{b3}} \qquad F_{ion3x} \cdot 10^{10} = 5.994 \times 10^{-10} N$$

$$dv_{b3x} := \frac{F_{ion3x} \cdot dt_1}{m_e} \qquad dv_{b3x} = 1.538 \frac{m}{s}$$