$h := 6.636\cdot 10^{-34}\cdot m^2\cdot \frac{kg}{s}$ $m_n := 1.6749\cdot 10^{-27}\cdot kg$ $k_b := 1.38064852\cdot 10^{-23}\cdot \frac{J}{K}$

$eV := 1.60218\cdot 10^{-19}\cdot J$

$\omega := 500\cdot 2\cdot \pi\cdot sec^{-1}$

Merlin Gd chopper: $R_{ch} := 5\cdot mm$ $H_{ch} := 0.2\cdot mm$ $\rho := 10^6\cdot m$

$\gamma := \frac{\omega\cdot R_{ch}^2}{H_{ch}} = 392.699\,\frac{m}{s}$ $\omega = 3.142\times 10^3\,\frac{1}{s}$

MERLIN distances (counted from moderator)

$L_2 := 2.5\cdot m$

$L_{chop} := 10m$ $L_{samp} := 11.8\cdot m$ $L_{det} := L_2 + L_{samp}$ Assuming L_chop=L_Ei_mon1

$\varepsilon_{beg} := 150$ $\varepsilon_{end} := 11$

$v(\varepsilon) := \sqrt{\frac{2\cdot 1.60218\cdot 10^{-22}\cdot J}{m_n}\cdot \varepsilon}$

Chopper opening time:

$\Delta t := \frac{R_{ch}}{\gamma}$ $\Delta t = 1.273\times 10^{-5}\,s$

$v(\varepsilon_{end}) = 1.451\times 10^3\,\frac{m}{s}$

$v(\varepsilon_{beg}) = 5.357\times 10^3\,\frac{m}{s}$

TOF for energy ε at the positon L in chopper opening time units:

$\tau_e(\varepsilon, L) := \frac{L\cdot\omega\cdot R_{ch}}{v(\varepsilon)\cdot H_{ch}}$

$\tau_e(151.9276, L_{chop}) = 145.678$

$V_{char} := \frac{L_{det} - L_{samp}}{\Delta t}$ $V_{char} = 1.963\times 10^5\,\frac{m}{s}$ $N_p := 1000$

$V_{sc} := \frac{v(\varepsilon_{beg})}{V_{char}}\cdot 1000$

$a_1 := 10$ $\sigma_1 := 0.01\cdot V_{sc}$ $v_1 := 0$ $\sigma_v := 0.1\cdot V_{sc}$

$a_2 := 15$ $\sigma_2 := 0.05\cdot V_{sc}$ $v_2 := 0.2\cdot V_{sc}$

$v0 := V_{sc}$ $L_v := 3\cdot V_{sc}$

$a_3 := 10$ $\sigma_3 := 0.1\cdot V_{sc}$ $v_3 := 0.5\cdot V_{sc}$

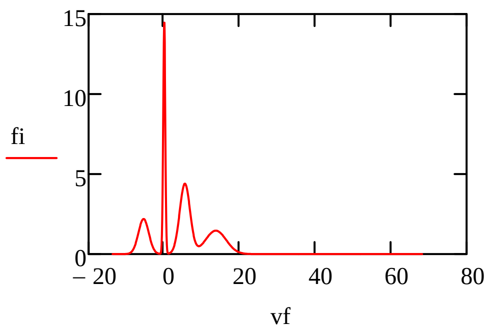
$$fs(\Delta v) := \frac{a_1}{\sqrt{2\pi}\cdot\sigma_1}\cdot e^{-0.5\cdot\left(\frac{\Delta v}{\sigma_1}\right)^2} + \frac{\left[e^{\frac{-(\Delta v - v_2)^2}{2\cdot\sigma_2^2}} + 0.5\cdot e^{\frac{-(\Delta v + v_2)^2}{2\cdot\sigma_2^2}}\right]}{\sqrt{2\cdot\pi}\cdot\sigma_2}\cdot a_2 + \frac{a_3}{\sqrt{2\cdot\pi}\cdot\sigma_3}\cdot e^{\frac{-(\Delta v - v_3)^2}{2\cdot\sigma_3^2}}$$

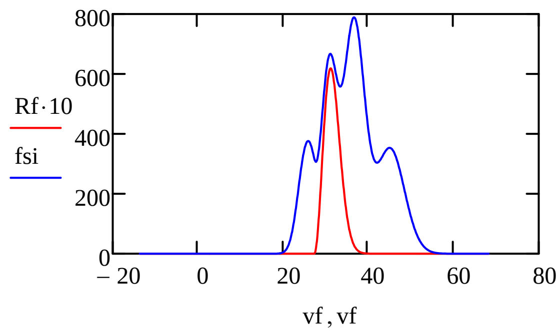
$$R_v(v, v0) := \left| \begin{array}{l} vp \leftarrow v - v0 \\ \text{return } 0 \text{ if } vp < 0 \\ \text{otherwise} \\ \quad \left| \begin{array}{l} vp2 \leftarrow vp \cdot vp \\ \text{return } \sigma_v^{\frac{3}{2}} \cdot vp2 \cdot \sqrt{2 \cdot \pi}\, e^{-0.5 \frac{vp2}{\sigma_v \cdot \sigma_v}} \end{array} \right. \end{array} \right.$$

$$fm(v) := \int_{-\frac{L_v}{2}+v0}^{v0} R_v(v - \delta v, v0) \cdot fs(\delta v)\, d\delta v + \int_{v0}^{\frac{L_v}{2}+v0} R_v(v - \delta v, v0) \cdot fs(\delta v)\, d\delta v$$

$$\Delta_v := \frac{L_v}{N_p - 1} \qquad i := 0 .. N_p - 1 \qquad vf_i := \frac{-L_v}{2} + v0 + i \cdot \Delta_v \qquad fi_i := fs(vf_i) \qquad Rf_i := R_v(vf_i, v0)$$

$$fsi_i := fm(vf_i) \qquad v0 = 27.283$$





$$M(v) := \left| \begin{array}{l} 0 \text{ if } v < \frac{-L_v}{2} + v0 \vee v > \frac{L_v}{2} + v0 \\ \text{linterp}(vf, fsi, v) \text{ otherwise} \end{array} \right.$$

high frequency filter for spectra:

$$\varepsilon_{Res} := 1 \cdot 10^{-6}$$

$$filts(I, R, Nf, Shift) := \left| \begin{array}{l} np \leftarrow \text{length}(I) \\ cent \leftarrow \frac{np}{2} \\ cutR \leftarrow \varepsilon_{Res} \cdot |R_0| \\ \text{for } k \in 0 .. np - 1 \\ \quad \left| \begin{array}{l} rez_k \leftarrow 0 \text{ if } |k - cent| < Nf \\ \text{otherwise} \\ \quad \left| \begin{array}{l} \Delta s \leftarrow e^{2\pi \cdot i \cdot k \cdot Shift} \text{ if } k < cent \\ \Delta s \leftarrow e^{-2\pi \cdot i \cdot k \cdot Shift} \text{ otherwise} \\ rez_k \leftarrow 0 \text{ if } |R_k| < cutR \\ rez_k \leftarrow \frac{I_k \cdot \Delta s}{R_k + \varepsilon_{Res}} \text{ otherwise} \end{array} \right. \end{array} \right. \end{array} \right.$$

high frequency filter for spectra:

$$\text{if}\left(|n - 50| < 40, 0, D_n\right)$$

$$\varepsilon_{Res} := 10^{-9}$$

$$filt(I, R, Nf) := \left| \begin{array}{l} np \leftarrow \text{length}(I) \\ cent \leftarrow \frac{np}{2} \\ \text{for } i \in 0 .. np - 1 \\ \quad \left| \begin{array}{l} rez_i \leftarrow 0 \text{ if } |i - cent| < Nf \\ \text{otherwise} \\ \quad \left| \begin{array}{l} rez_i \leftarrow 0 \text{ if } |R_i| < \varepsilon_{Res} \\ rez_i \leftarrow \frac{I_i}{R_i + \varepsilon_{Res}} \text{ otherwise} \end{array} \right. \end{array} \right. \end{array} \right.$$

$\tau_1 := 1$ $\tau_2 := 0.1$ $R1 := 0.5$

$$R_t(\tau) := \begin{array}{|l} \text{return } 0 \text{ if } \tau < 0 \\ \text{return } \tau^2 \cdot \dfrac{e^{-\frac{\tau}{\tau_1}}}{\tau_1} \cdot \left[(1 - R1) + \dfrac{R1}{\tau_2 + \tau_1} \cdot e^{\frac{-\tau}{\tau_2}} \right] \text{ otherwise} \end{array}$$

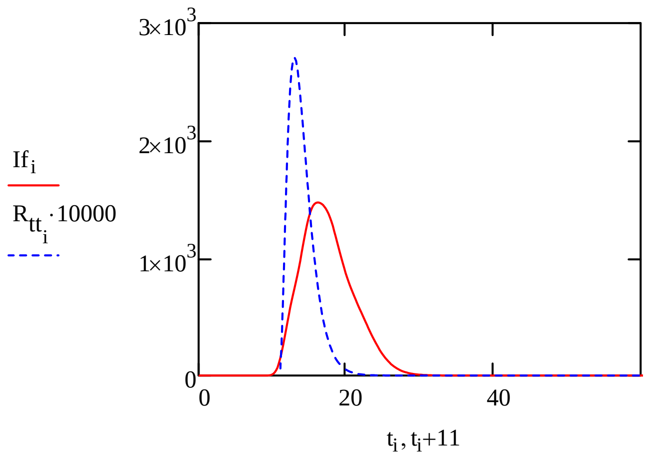
$$t_{min} := \frac{L_2}{R_{ch} \cdot \max(vf)} \qquad t_{min} = 7.331 \qquad L2_p := \frac{L_2}{R_{ch}} \qquad L_v = 81.849$$

$L2_p = 500$

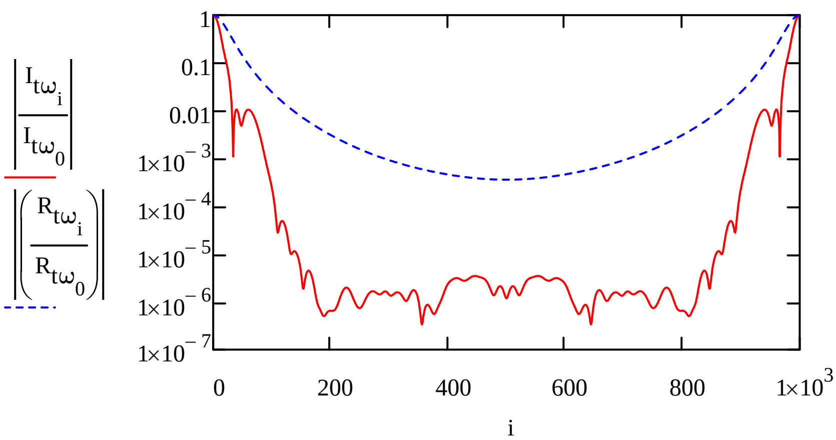
$$I(t) := \int_{0.1}^{\frac{L_v}{2}} R_t\left(t - \frac{L2_p}{v}\right) \cdot M(v)\, dv + \int_{\frac{L_v}{2}}^{3 \cdot L_v} R_t\left(t - \frac{L2_p}{v}\right) \cdot M(v)\, dv + \int_{3L_v}^{\infty} R_t\left(t - \frac{L2_p}{v}\right) \cdot M(v)\, dv$$

$$\delta t := \frac{200 - t_{min}}{N_p}$$

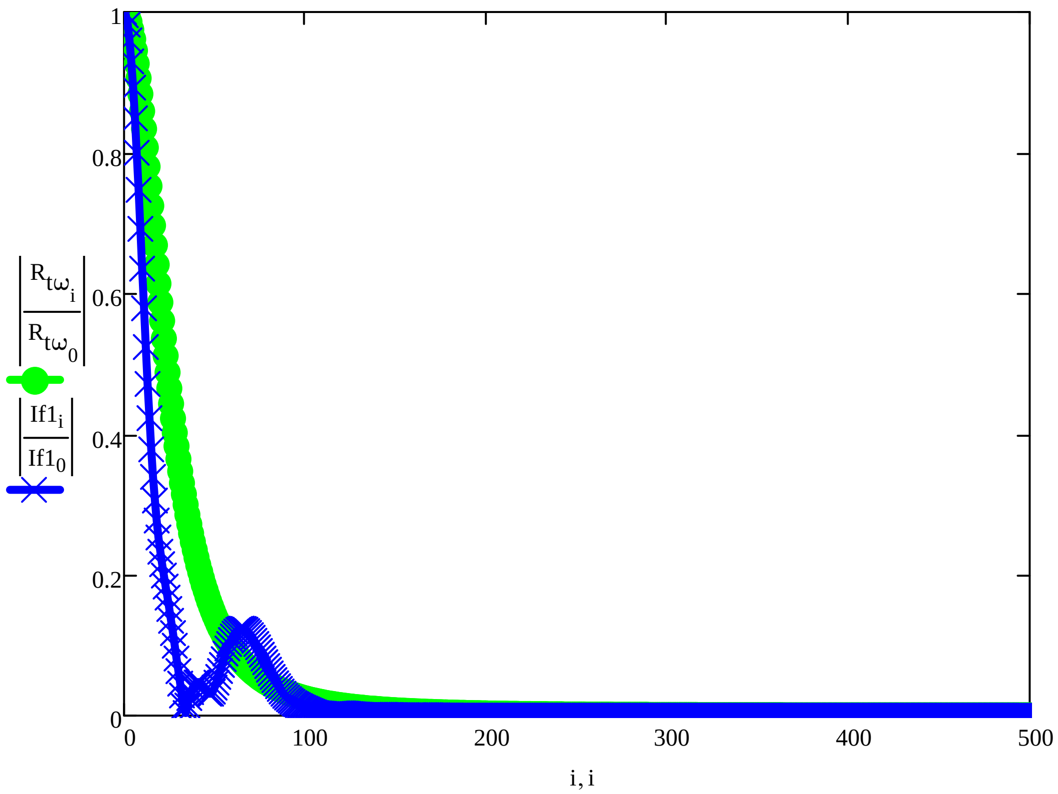
$t_i := 0.1 + \delta t \cdot i$ $If_i := I(t_i)$ $R_{tt_i} := R_t(t_i)$ $T := \max(t)$



$I_{t\omega} := \text{cfft}(If)$ $R_{t\omega} := \text{cfft}(R_{tt})$

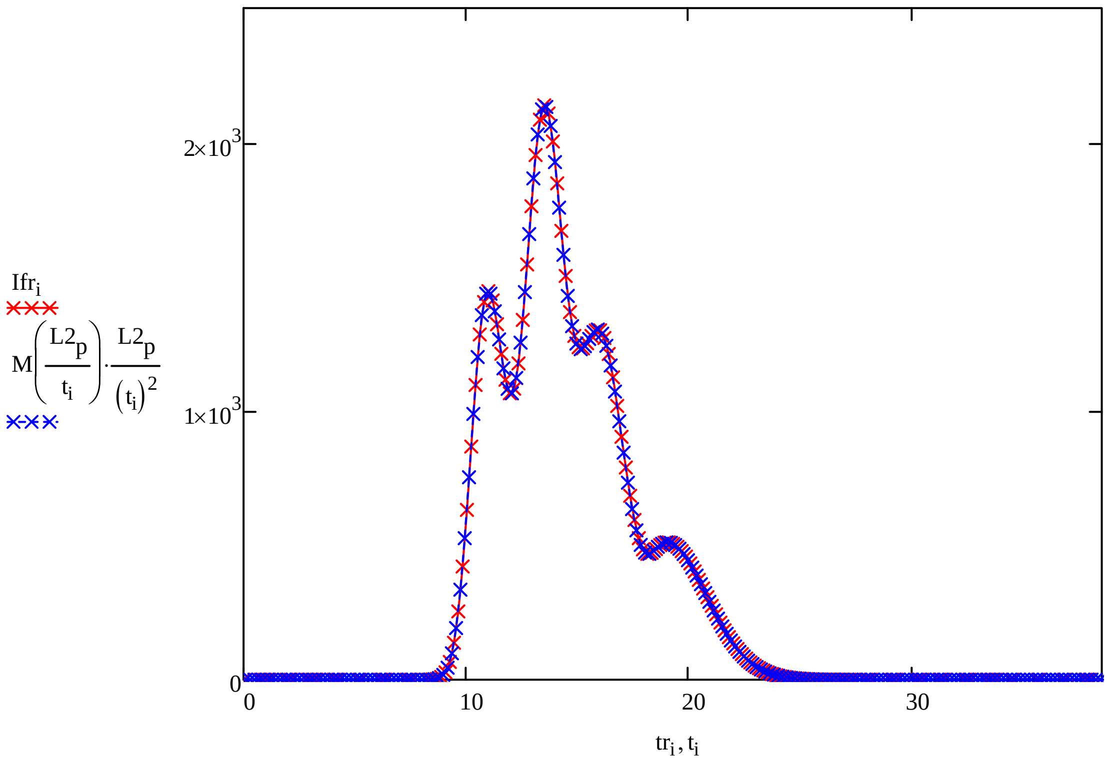


$$If1 := \mathrm{filt}\left(I_{t\omega}, R_{t\omega}, 320\right)$$



$$\Delta := \frac{T}{N_p - 1}$$

$$Ifr := \frac{1}{\Delta\cdot\sqrt{N_p - 1}}\cdot \mathrm{icfft}(If1) \qquad tr_i := \Delta\cdot i + 0.001$$



$v2_i := \dfrac{L2_p}{t_{N_p-1-i}}$ $\qquad$ $M_{rr_i} := \dfrac{Ifr_{N_p-i-1} \cdot \left(t_{N_p-i-1}\right)^2}{L2_p}$

$\max(tr) = 192.578$

$v_{max} := \max(v2)$ $\qquad$ $v_{min} := \min(v2)$ $\qquad$ $v_{max} = 5 \times 10^3$ $\qquad$ $v_{min} = 2.596$

$v_{min} := 2$

$v_{max} := 100$

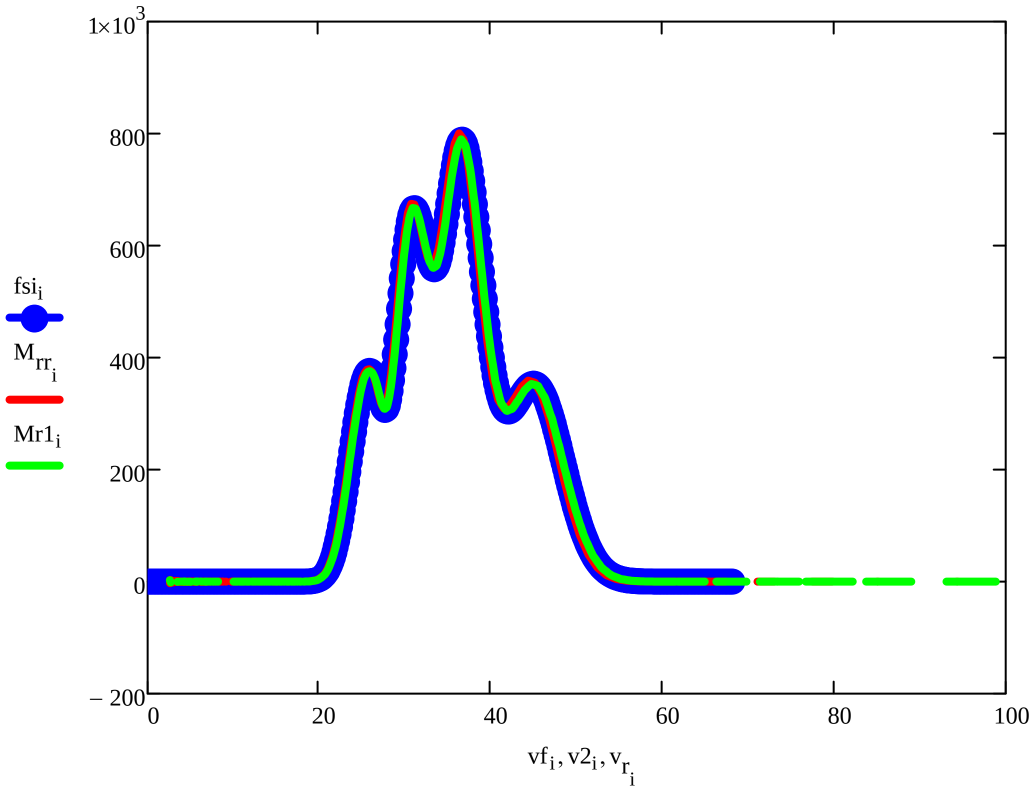
$Npi := 1N_p$ $\qquad$ $ii := 0 .. Npi - 1$ $\qquad$ $Npi = 1 \times 10^3$

$\Delta v := \dfrac{v_{max} - v_{min}}{Npi - 1}$ $\qquad$ $v_{r_{ii}} := v_{min} + ii \cdot \Delta v$ $\qquad$ $\text{length}(v_r) = 1 \times 10^3$

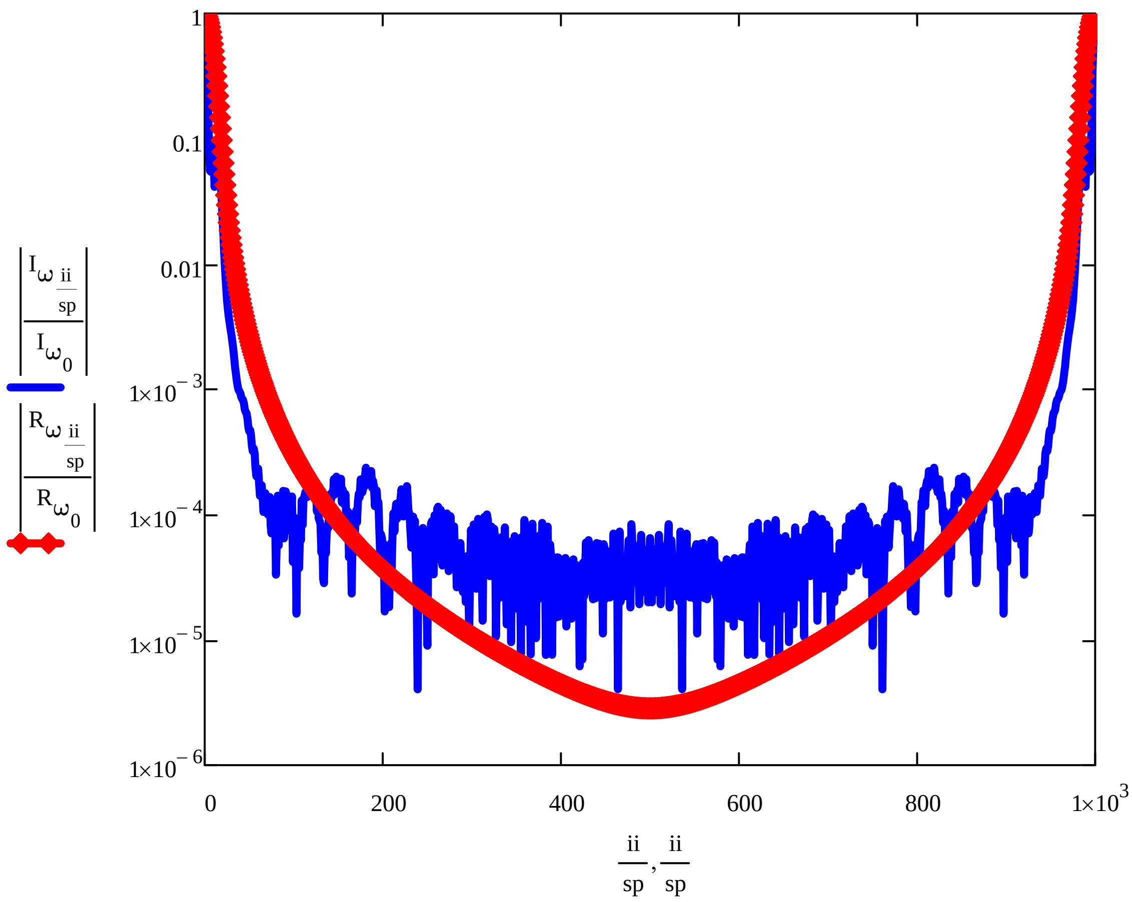
$tr_{min} := \min(tr)$ $\qquad$ $tr_{max} := \max(tr)$

$$
\text{Mif}(v) := \left|
\begin{array}{l}
ti \leftarrow \dfrac{L2_p}{v} \\
In \leftarrow 0 \ \text{ if } \ ti < tr_{min} \vee ti > tr_{max} \\
In \leftarrow \text{linterp}(tr, Ifr, ti) \ \text{ otherwise} \\
rez \leftarrow \dfrac{In \cdot ti^2}{L2_p}
\end{array}
\right.
$$

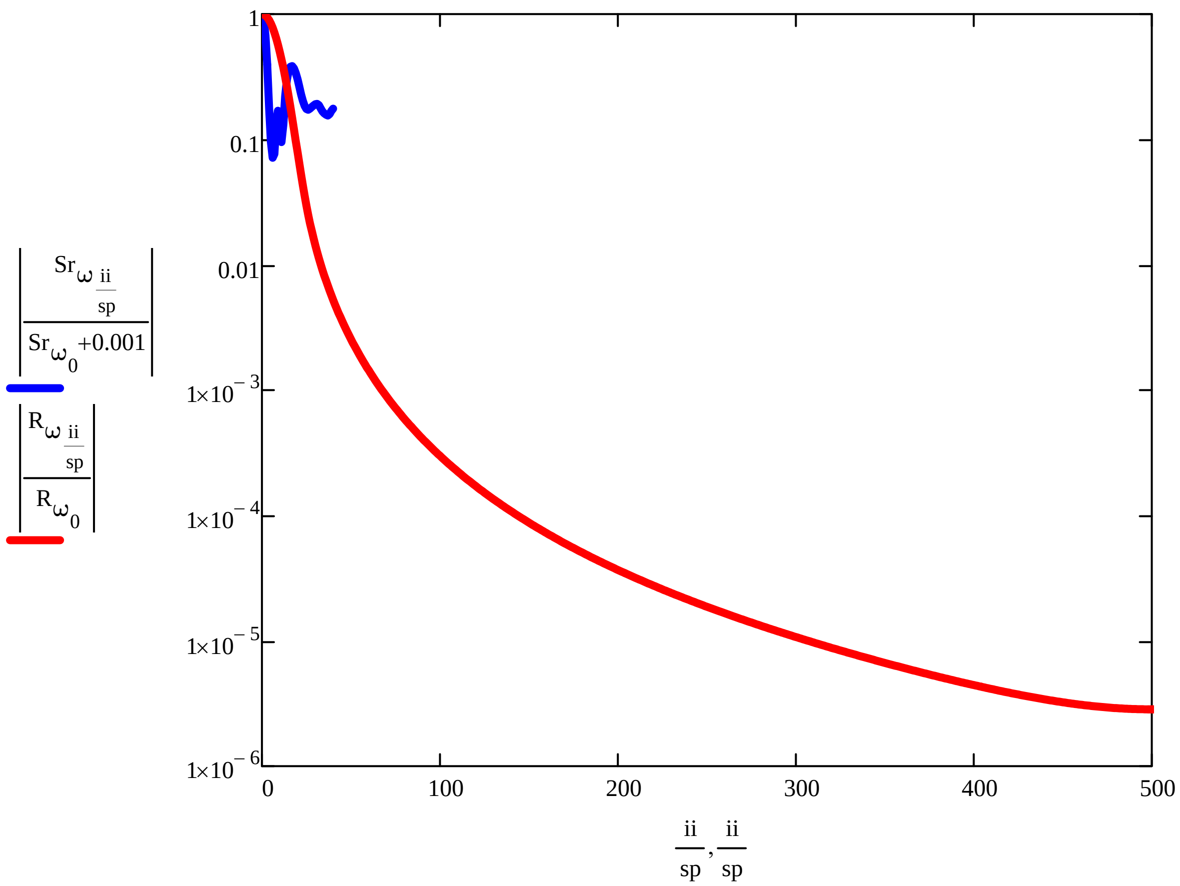
$Mr1_{ii} := \text{Mif}\left(v_{r_{ii}}\right)$ $\qquad$ $Rf2_{ii} := R_v\left(v_{r_{ii}}, v0\right)$ $\qquad$ $\text{length}(Mr1) = 1 \times 10^3$



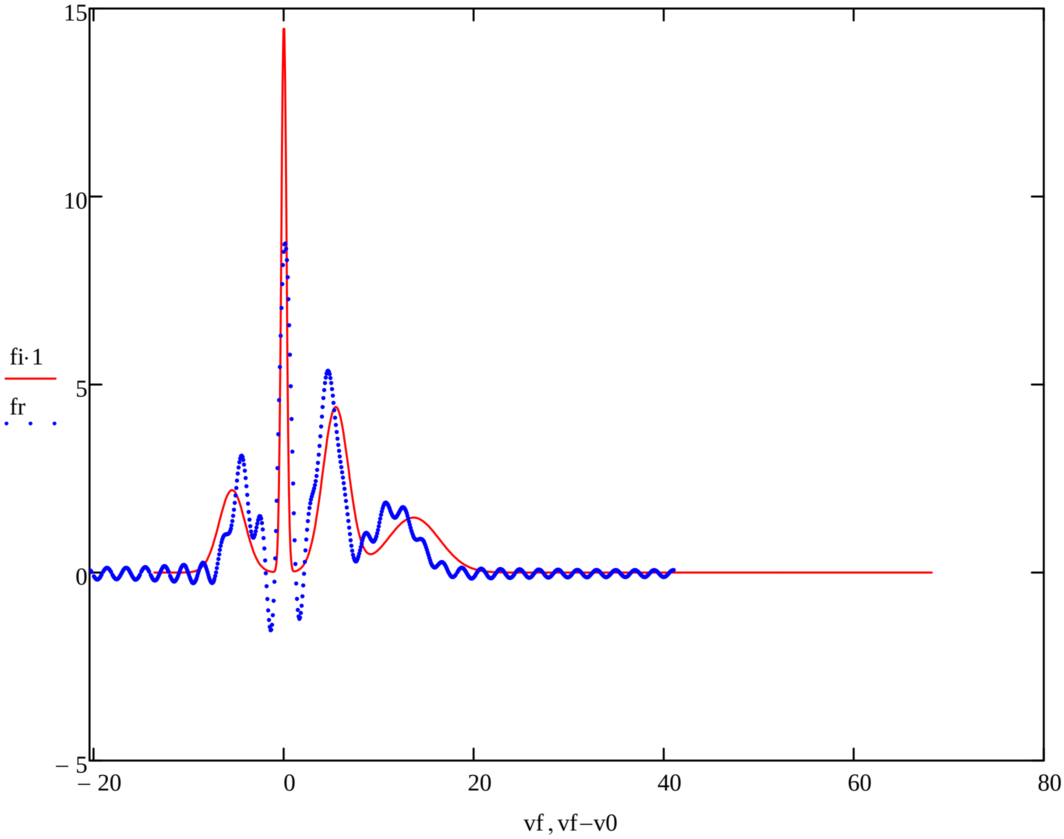
$I_\omega := \mathrm{cfft}(Mr1)$ $\qquad R_\omega := \mathrm{cfft}(Rf2)$ $\qquad sp := 1$

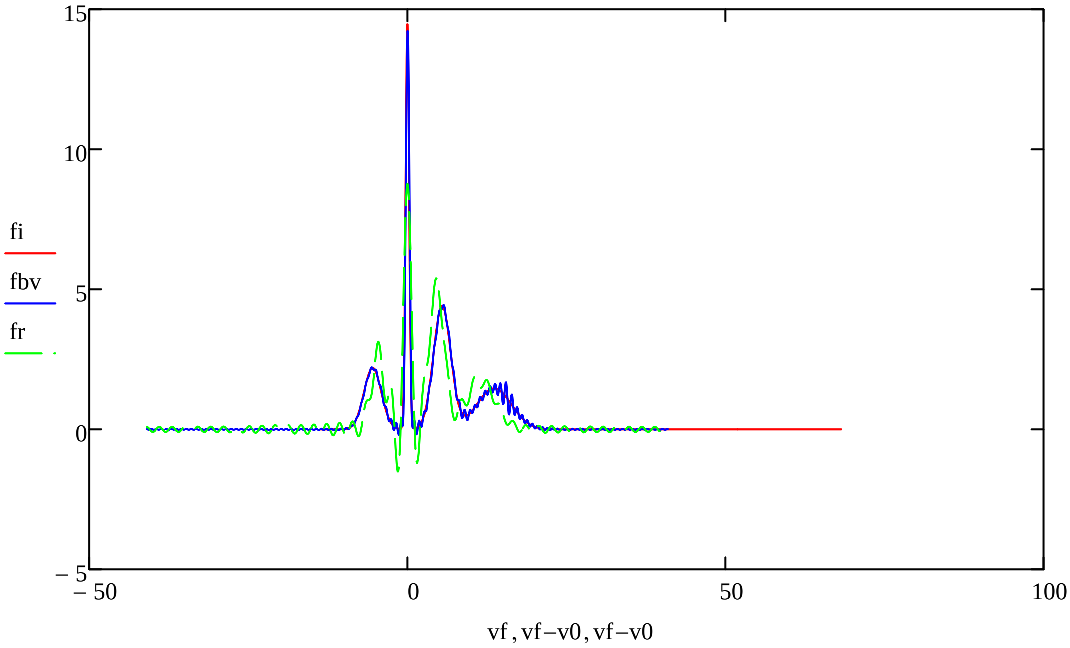


$Sr_\omega := \mathrm{filts}\left(I_\omega, R_\omega, 460, 0.5\right)$



$$fr := \frac{1}{\Delta_v \cdot \sqrt{Npi}} \cdot icfft\left(Sr_\omega\right)$$

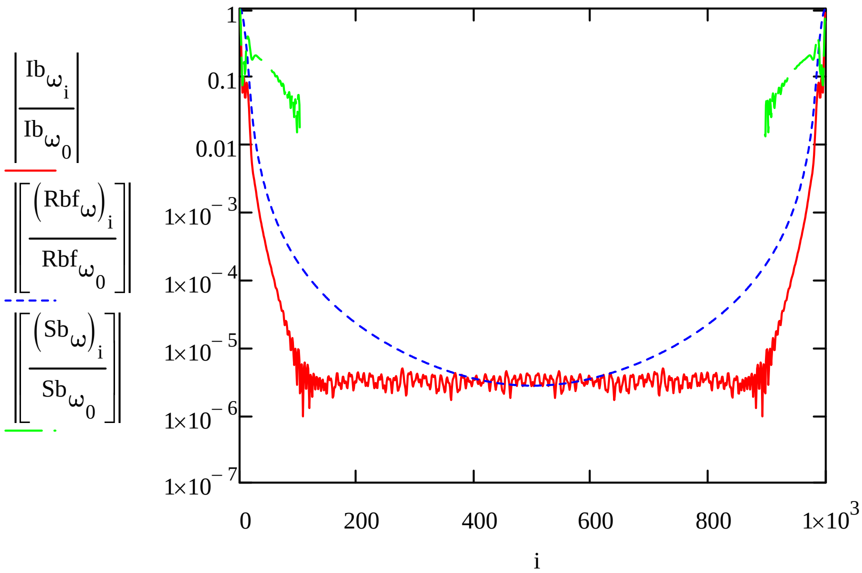




$Ib_\omega := \mathrm{cfft}(fsi)$ $\qquad$ $Rbf_\omega := \mathrm{cfft}(Rf)$

$$\frac{v0}{\Delta_v \cdot N_p} = 0.333$$

$Sb_\omega := \mathrm{filts}\left(Ib_\omega, Rbf_\omega, 396, 0.5\right)$



$$fbv := \frac{1}{\Delta_v \cdot \sqrt{N_p}} \cdot \mathrm{icfft}\left(Sb_\omega\right)$$