

3BC working points

proposed working point (June 2008)

without self effects!
the mcad summary

working points with reduced energy spread in BC0

fundamental relation spread \leftrightarrow r56 & compression
summary: 8 working points

8 × mcad summary in detail



bc – parameters
rf setting without self effects

RF0: $V = 173.172$ MV
 $\varphi = 22.535$ deg
 $V^{(3)} = 30.203$ MV
 $\varphi = -172.576$ deg $\sim 2.8\% / \sigma$

chirp before BC0 = -3.574 MeV / σ
BC0: $E_0 = 130$ MeV, $r_{56} = -40$ mm

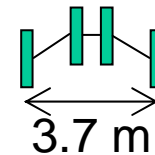
RF1: $V = 372.993$ MV
 $\varphi = 7.264$ deg
chirp before BC1 = -5.241 MeV / σ
BC1: $E_1 = 500$ MeV, $r_{56} = -110$ mm

RF2: $V = 1.596$ GV
 $\varphi = 20.000$ deg
chirp before BC2 = -7.341 MeV / σ
BC2: $E_2 = 2.0$ GeV, $r_{56} = -31.272$ mm

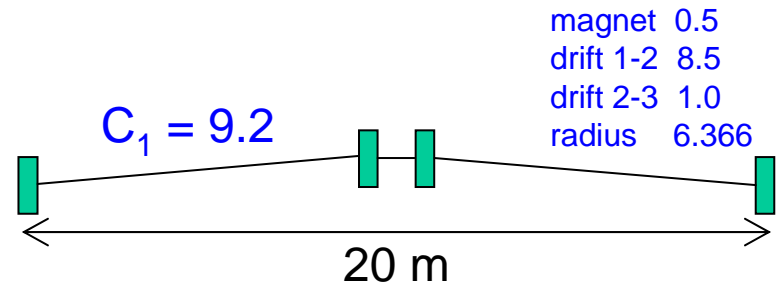
chirp after BC2 = -7.341 MeV / σ

lengths / m (projected to z –axis)

magnet 0.3
drift 1-2 1.0
drift 2-3 0.5
radius 2.352

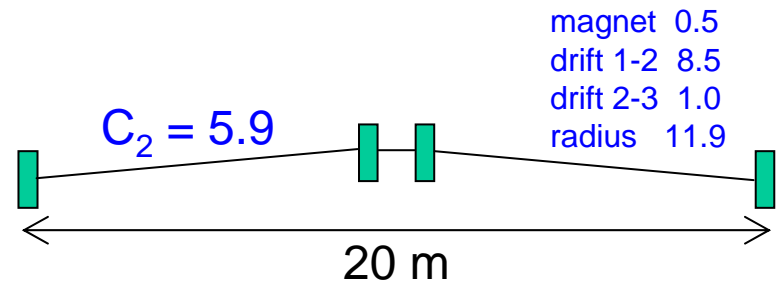


$C_0 = 1.85$



$C_1 = 9.2$

magnet 0.5
drift 1-2 8.5
drift 2-3 1.0
radius 6.366



$C_2 = 5.9$

magnet 0.5
drift 1-2 8.5
drift 2-3 1.0
radius 11.9



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.04 & 1.85 \\ 5 \times 10^8 & -0.11 & 9.1891892 \\ 2 \times 10^9 & -0.0318385 & 100 \end{pmatrix} \quad r56 \text{ \& C} \quad v3.9$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 173.172 \\ 30.202 \\ 372.993 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} 22.535 \\ -172.576 \\ 7.264 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.843 & -0.3 \\ 0 & 0 \end{pmatrix}$$

$$Imax1 = 50 \quad MV1 = \begin{pmatrix} 0.152 & 1 \\ -0.102 & 1 \end{pmatrix} \quad \text{deg1} = \begin{pmatrix} 0.038 & 1 \\ -0.047 & -1 \end{pmatrix}$$

$$Imax2 = 92.577 \quad \Delta e2 = -0.028 \quad \sigma E \quad MV2 = \begin{pmatrix} 0.113 & 1 \\ -0.139 & 1 \end{pmatrix} \quad \text{deg2} = \begin{pmatrix} 0.076 & -1 \\ -0.062 & 1 \end{pmatrix}$$

$$Imax3 = 850.242 \quad \Delta e3 = -0.011 \quad MV3 = \begin{pmatrix} 0.772 & -1 \\ -0.624 & 1 \end{pmatrix} \quad \text{deg3} = \begin{pmatrix} 0.048 & 1 \\ -0.059 & -1 \end{pmatrix}$$

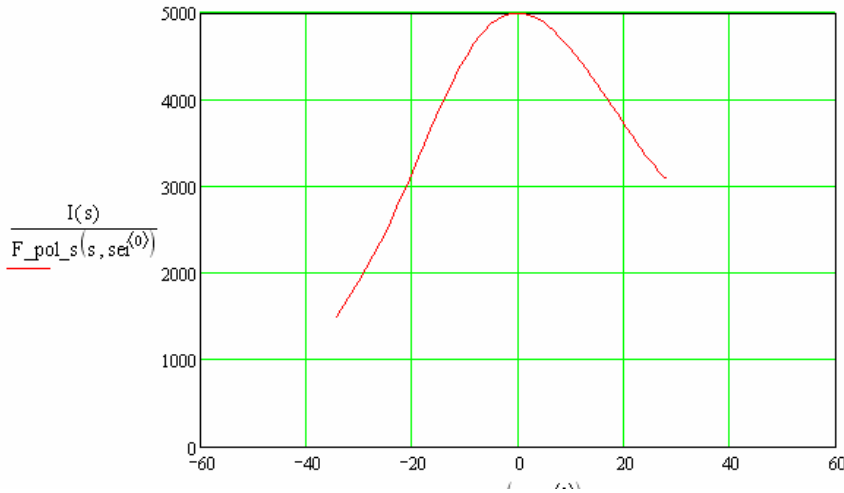
$$Imax4 = 5000 \quad \Delta e4 = -3.689 \times 10^{-3} \quad MV4 = 0 \quad \text{deg4} = 0$$

$$\frac{\Delta e4_BC_S1_2_p}{MV} = -7.377 \quad \text{end-chirp}$$

$$MV5 = \begin{pmatrix} 18.433 & -1 \\ -15.178 & 1 \end{pmatrix} \quad \text{deg5} = \begin{pmatrix} 0.648 & 1 \\ -0.832 & -1 \end{pmatrix}$$

$$MV6 = 0 \quad \text{deg6} = 0$$

$$\min(\text{stack}(\text{am}, \text{ph})) = 7.319 \times 10^{-4} \quad \text{tol} \quad \min(\text{am}) = 7.319 \times 10^{-4} \quad \min(\text{ph}) = 7.496 \times 10^{-4}$$



$$Ene1 = 1.3 \times 10^8$$

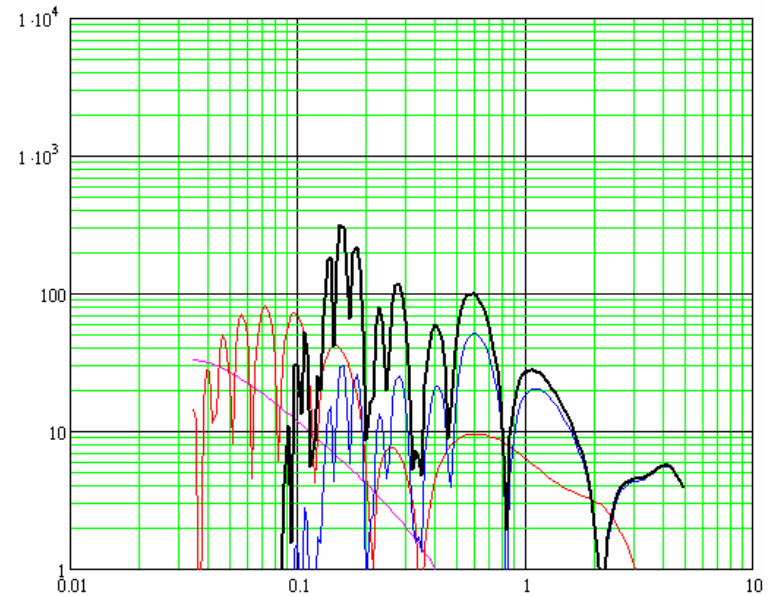
Z(BC1 to BC2) is scaled with $(500\text{MeV} / E_BC1)^{**2}$
 Z(BC2 to ...) is scaled with $(2000\text{MeV} / E_BC2)^{**2}$

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.455 \times 10^{-6} \\ -5.966 \times 10^4 \end{pmatrix} \quad I_{rms} = 67.383 \text{ noise}$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98549$$

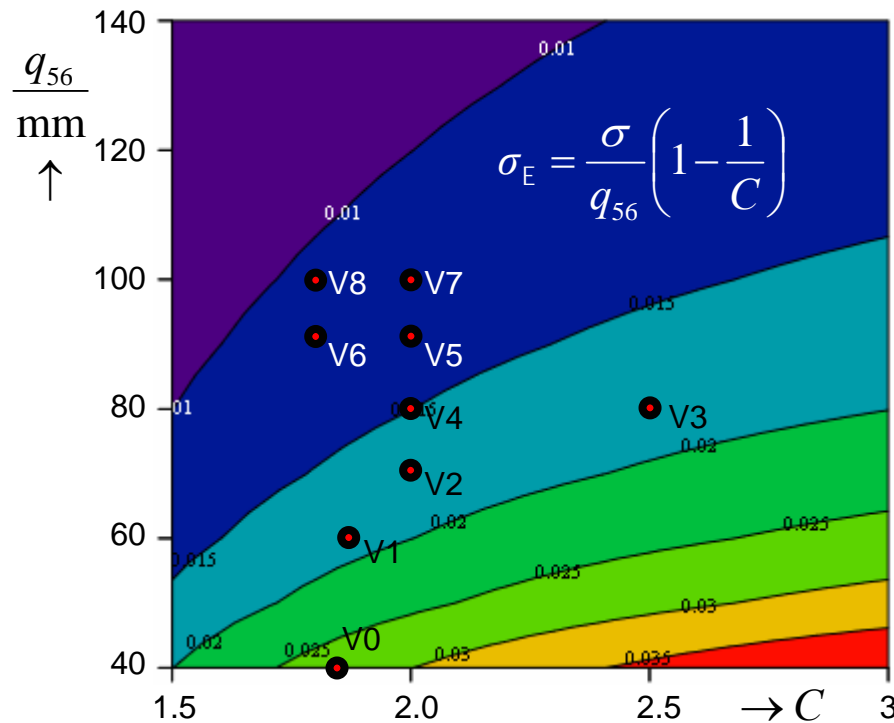
$$E_{rms} = 1 \times 10^4 \quad C_{tot} E_{rms} = 1 \times 10^6$$



working points with reduced energy spread in BC0

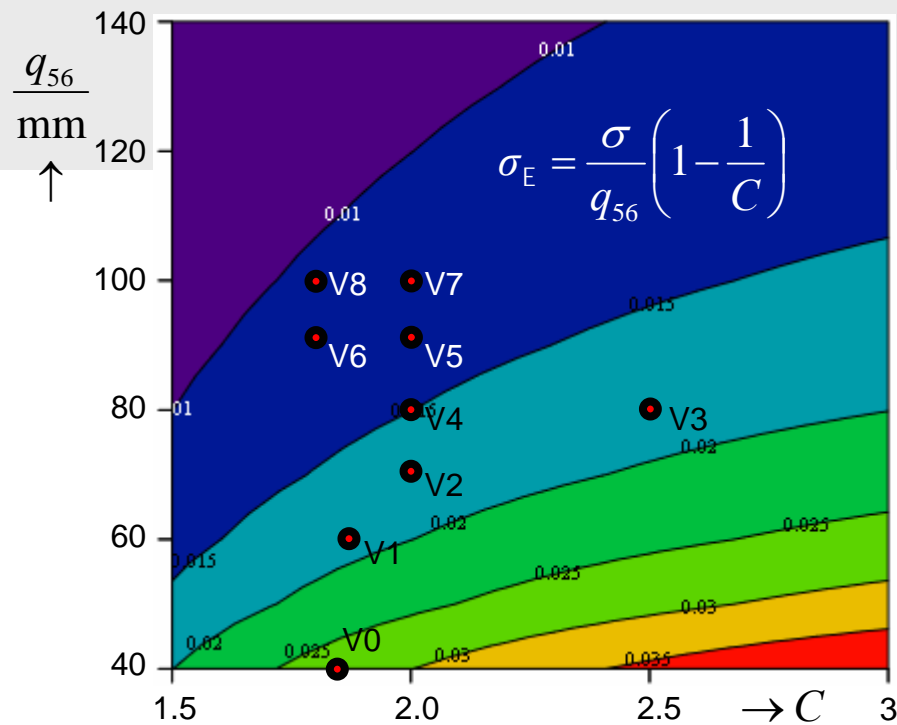
compression in BC0: $C = \frac{1}{1 + q_{56} \frac{E'}{E}}$

relative energy spread: $\sigma_E = \left| \frac{E'}{E} \right| \sigma$



gaussian, 1nC, 50A $\rightarrow \sigma = 2.4$ mm





	q56 /mm	C	σ_E *100	tol. *1000	V3.9 MV	end-chirp noise MV@1 σ	A	
V0	40	1.85	2.7	0.732	30.2	7.4	68	
V1	60	1.87	1.9	0.709	28.9	7.4	112	
V2	70	2.00	1.7	0.664	26.6	7.7	163	
V3	80	2.5	1.8	0.539	26.9	6.2	123	
V4	80	2.0	1.5	0.453	36.0	7.2	137	
V5	90	2.0	1.3	0.439	29.3	7.7	217	cto
V6	90	1.8	1.2	0.302	50.6	8.6	276	cto
V7	100	2.0	1.2	0.394	32.2	7.8	242	cto
V8	100	1.8	1.1	0.273	50.6	8.6	307	cto

close to overcompression = cto



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.06 & 1.87 \\ 5 \times 10^8 & -0.11 & 9.0909091 \\ 2 \times 10^9 & -0.0321137 & 100 \end{pmatrix}$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 157.635 \\ 28.932 \\ 378.358 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix}$$

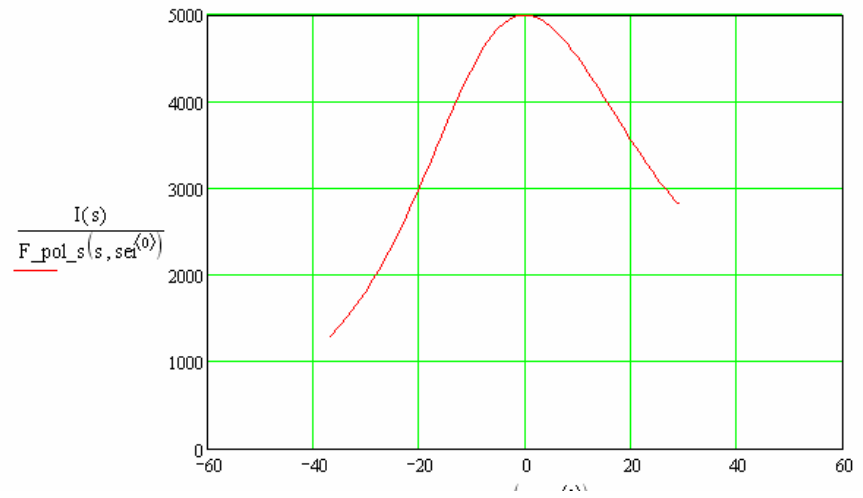
$$\frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} 3.277 \\ 161.258 \\ 12.065 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.6886 & 2 \\ 0 & 0 \end{pmatrix}$$

$Imax1 = 50$		$MV1 = \begin{pmatrix} 0.088 & 1 \\ -0.199 & 1 \end{pmatrix}$	$deg1 = \begin{pmatrix} 0.036 & 1 \\ -0.045 & -1 \end{pmatrix}$
$Imax2 = 93.856$	$\Delta e2 = -0.018$	$MV2 = \begin{pmatrix} 0.101 & 1 \\ -0.3 & 1 \end{pmatrix}$	$deg2 = \begin{pmatrix} 0.073 & -1 \\ -0.059 & 1 \end{pmatrix}$
$Imax3 = 851.473$	$\Delta e3 = -0.01$	$MV3 = \begin{pmatrix} 0.954 & -1 \\ -0.771 & 1 \end{pmatrix}$	$deg3 = \begin{pmatrix} 0.046 & 1 \\ -0.056 & -1 \end{pmatrix}$
$Imax4 = 5000.01$	$\Delta e4 = -3.675 \times 10^{-3}$	$MV4 = 0$	$deg4 = 0$
		$MV5 = \begin{pmatrix} 18.457 & -1 \\ -15.194 & 1 \end{pmatrix}$	$deg5 = \begin{pmatrix} 0.645 & 1 \\ -0.829 & -1 \end{pmatrix}$
		$MV6 = 0$	$deg6 = 0$

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -7.349$$

$$\min(\text{stack}(\text{am}, \text{ph})) = 7.089 \times 10^{-4} \quad \min(\text{am}) = 9.105 \times 10^{-4} \quad \min(\text{ph}) = 7.089 \times 10^{-4}$$



$$Ene1 = 1.3 \times 10^8$$

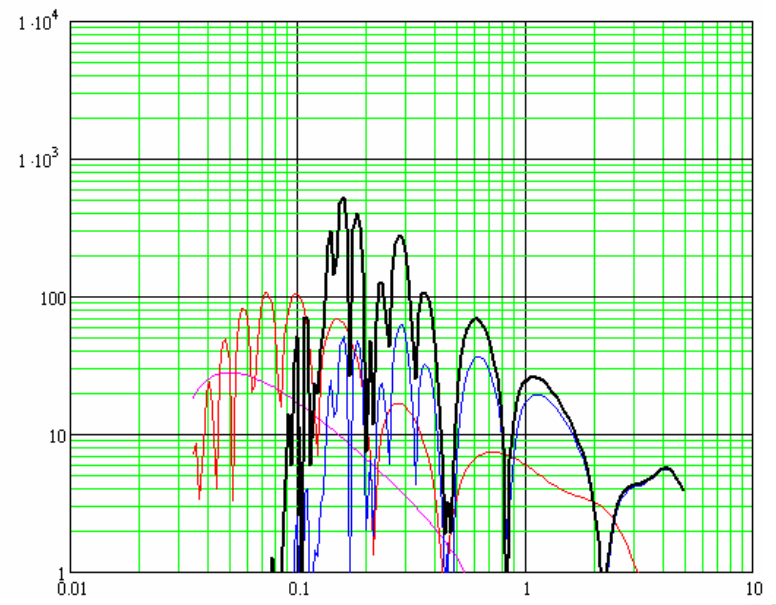
Z(BC1 to BC2) is scaled with $(500\text{MeV} / E_BC1)^{**2}$
 Z(BC2 to ...) is scaled with $(2000\text{MeV} / E_BC2)^{**2}$

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.515 \times 10^{-6} \\ -6.89 \times 10^4 \end{pmatrix} \quad Irms = 112.939$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98561$$

$$E_{rms} = 1 \times 10^4 \quad Ctot \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.07 & 2 \\ 5 \times 10^8 & -0.1 & 7 \\ 2 \times 10^9 & -0.038295 & 100 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.584 & 1.5 \\ 0 & 0 \end{pmatrix}$$

Imax1 = 50

Imax2 = 100.433 Δe2 = -0.017

Imax3 = 701.776 Δe3 = -0.01

Imax4 = 5000.004 Δe4 = -3.87 × 10⁻³

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -7.74$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 156.356 \\ 26.6 \\ 380.53 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} 5.087 \\ 165.392 \\ 13.51 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

MV1 = $\begin{pmatrix} 0.079 & 1 \\ -0.128 & 1 \end{pmatrix}$ deg1 = $\begin{pmatrix} 0.041 & 1 \\ -0.05 & -1 \end{pmatrix}$

MV2 = $\begin{pmatrix} 0.1 & 1 \\ -0.214 & 1 \end{pmatrix}$ deg2 = $\begin{pmatrix} 0.082 & -1 \\ -0.067 & 1 \end{pmatrix}$

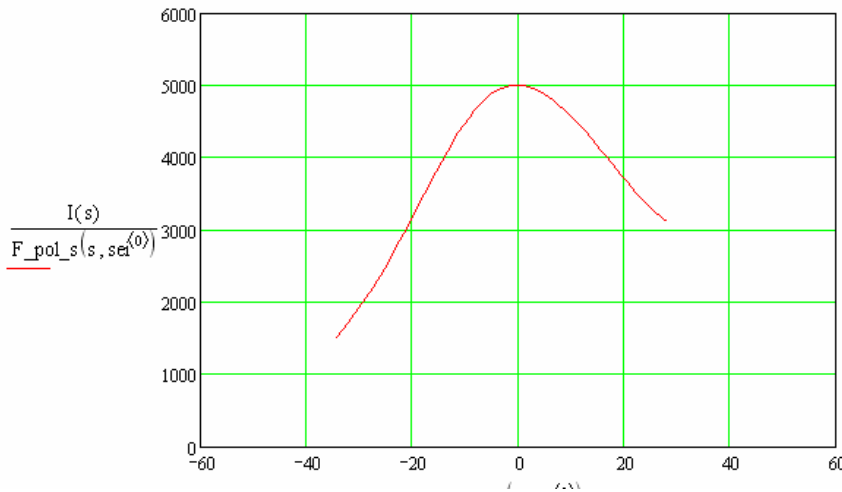
MV3 = $\begin{pmatrix} 1.42 & -1 \\ -1.132 & 1 \end{pmatrix}$ deg3 = $\begin{pmatrix} 0.055 & 1 \\ -0.068 & -1 \end{pmatrix}$

MV4 = 0 deg4 = 0

MV5 = $\begin{pmatrix} 15.003 & -1 \\ -12.346 & 1 \end{pmatrix}$ deg5 = $\begin{pmatrix} 0.484 & 1 \\ -0.613 & -1 \end{pmatrix}$

MV6 = 0 deg6 = 0

min(stack(am, ph)) = 6.638 × 10⁻⁴ min(am) = 6.638 × 10⁻⁴ min(ph) = 7.882 × 10⁻⁴



Ene1 = 1.3 × 10⁸

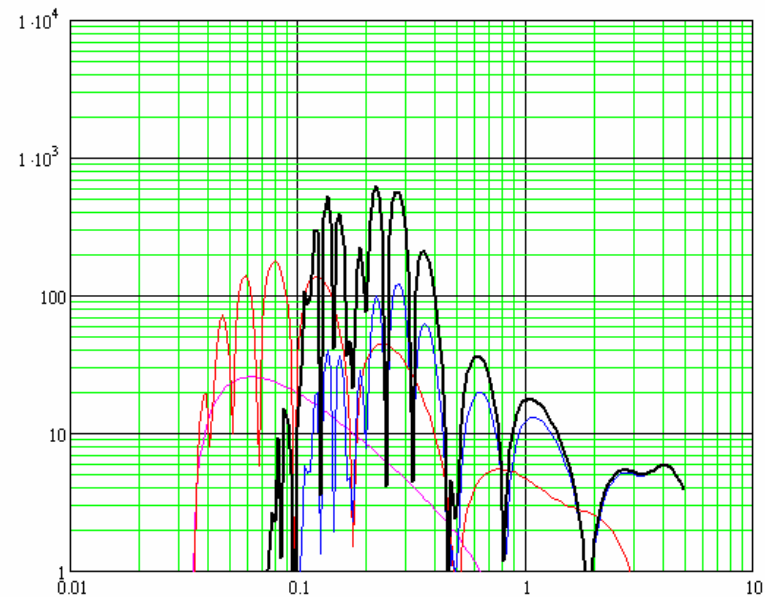
Z(BC1 to BC2) is scaled with (500MeV / E_BC1)**2
 Z(BC2 to ...) is scaled with (2000MeV / E_BC2)**2

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.348 \times 10^{-6} \\ -7.421 \times 10^4 \end{pmatrix} \quad I_{rms} = 163.433$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98483$$

$$E_{rms} = 1 \times 10^4 \quad C_{tot} \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.08 & 2.5 \\ 5 \times 10^8 & -0.1 & 8 \\ 2 \times 10^9 & -0.0320548 & 100 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.385 & 3 \\ 0 & 0 \end{pmatrix}$$

$$Imax1 = 50$$

$$Imax2 = 125.185 \quad \Delta e2 = -0.018$$

$$Imax3 = 1 \times 10^3 \quad \Delta e3 = -8.412 \times 10^{-3}$$

$$Imax4 = 5000.008 \quad \Delta e4 = -3.076 \times 10^{-3}$$

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -6.152$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 152.748 \\ 26.916 \\ 376.736 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{deg} = \begin{pmatrix} -3.227 \\ 146.737 \\ 10.851 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$MV1 = \begin{pmatrix} 0.145 & 1 \\ -0.187 & -1 \end{pmatrix} \quad deg1 = \begin{pmatrix} 0.028 & 1 \\ -0.034 & -1 \end{pmatrix}$$

$$MV2 = \begin{pmatrix} 0.063 & 1 \\ -0.082 & -1 \end{pmatrix} \quad deg2 = \begin{pmatrix} 0.071 & -1 \\ -0.058 & 1 \end{pmatrix}$$

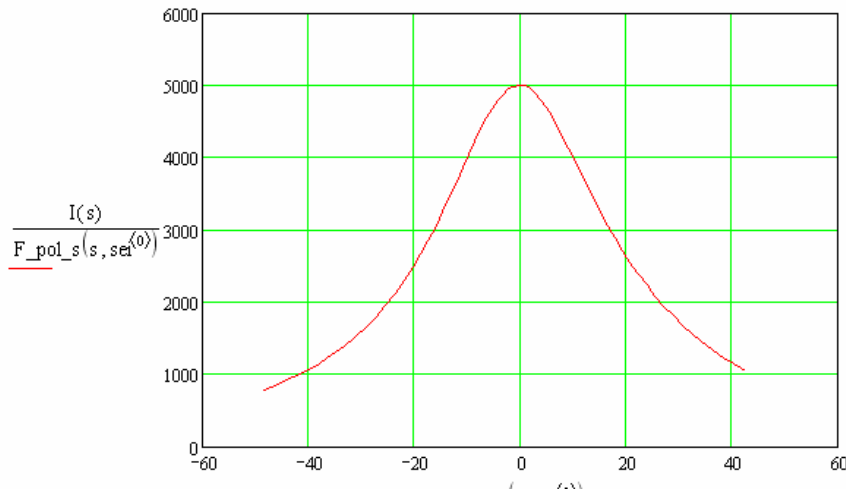
$$MV3 = \begin{pmatrix} 1.204 & -1 \\ -0.971 & 1 \end{pmatrix} \quad deg3 = \begin{pmatrix} 0.067 & 1 \\ -0.083 & -1 \end{pmatrix}$$

$$MV4 = 0 \quad deg4 = 0$$

$$MV5 = \begin{pmatrix} 22.624 & -1 \\ -18.659 & 1 \end{pmatrix} \quad deg5 = \begin{pmatrix} 0.774 & 1 \\ -0.988 & -1 \end{pmatrix}$$

$$MV6 = 0 \quad deg6 = 0$$

$$\min(\text{stack}(\text{am}, \text{ph})) = 5.39 \times 10^{-4} \quad \min(\text{am}) = 1.086 \times 10^{-3} \quad \min(\text{ph}) = 5.39 \times 10^{-4}$$



$$Ene1 = 1.3 \times 10^8 \quad +$$

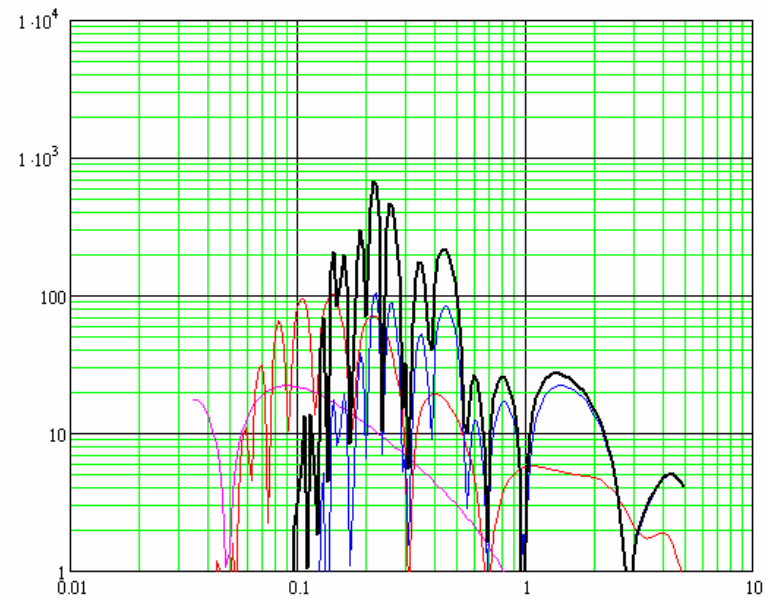
Z(BC1 to BC2) is scaled with $(500\text{MeV} / E_BC1)^{**2}$
 Z(BC2 to ...) is scaled with $(2000\text{MeV} / E_BC2)^{**2}$

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 4.359 \times 10^{-6} \\ -8.797 \times 10^4 \end{pmatrix} \quad Irms = 123.431$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98816$$

$$E_{rms} = 1 \times 10^4 \quad Ctot \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.08 & 2 \\ 5 \times 10^8 & -0.11 & 8 \\ 2 \times 10^9 & -0.0359491 & 100 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.54 & 5 \\ 0 & 0 \end{pmatrix}$$

Imax1 = 50

Imax2 = 100.544 Δe2 = -0.015

Imax3 = 801.844 Δe3 = -9.609 × 10⁻³

Imax4 = 5000 Δe4 = -3.604 × 10⁻³

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -7.208$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 162.224 \\ 35.975 \\ 379.887 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} -17.133 \\ 134.078 \\ 13.101 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$MV1 = \begin{pmatrix} 0.087 & 1 \\ -0.111 & -1 \end{pmatrix} \quad \text{deg1} = \begin{pmatrix} 0.023 & 1 \\ -0.029 & -1 \end{pmatrix}$$

$$MV2 = \begin{pmatrix} 0.072 & 1 \\ -0.094 & -1 \end{pmatrix} \quad \text{deg2} = \begin{pmatrix} 0.057 & -1 \\ -0.046 & 1 \end{pmatrix}$$

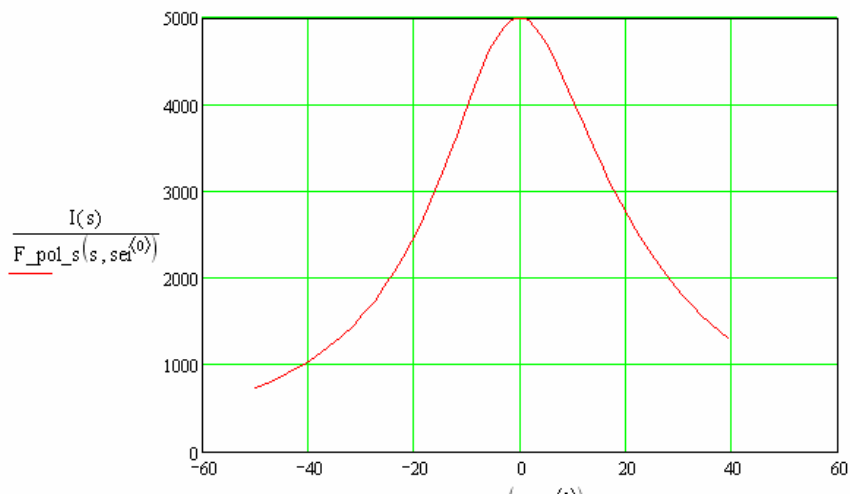
$$MV3 = \begin{pmatrix} 1.289 & -1 \\ -1.031 & 1 \end{pmatrix} \quad \text{deg3} = \begin{pmatrix} 0.05 & 1 \\ -0.062 & -1 \end{pmatrix}$$

MV4 = 0 deg4 = 0

$$MV5 = \begin{pmatrix} 17.436 & -1 \\ -14.352 & 1 \end{pmatrix} \quad \text{deg5} = \begin{pmatrix} 0.573 & 1 \\ -0.734 & -1 \end{pmatrix}$$

MV6 = 0 deg6 = 0

min(stack(am, ph)) = 4.531 × 10⁻⁴ min(am) = 6.114 × 10⁻⁴ min(ph) = 4.531 × 10⁻⁴



Ene1 = 1.3 × 10⁸

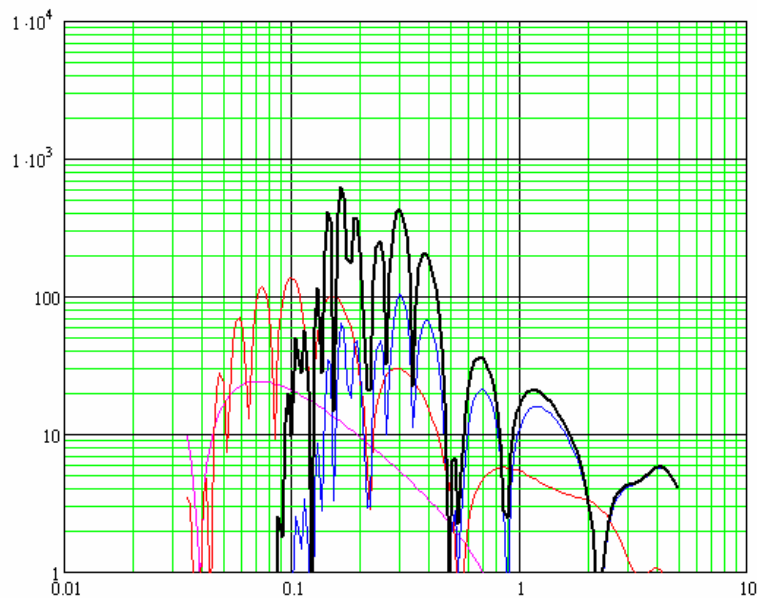
Z(BC1 to BC2) is scaled with (500MeV / E_BC1)**2
 Z(BC2 to ...) is scaled with (2000MeV / E_BC2)**2

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.703 \times 10^{-6} \\ -8.157 \times 10^4 \end{pmatrix} \quad I_{rms} = 136.748$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98617$$

$$E_{rms} = 1 \times 10^4 \quad C_{tot} \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.09 & 2 \\ 5 \times 10^8 & -0.1 & 7 \\ 2 \times 10^9 & -0.038295 & 100 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.54 & 3 \\ 0 & 0 \end{pmatrix}$$

Imax1 = 50

Imax2 = 100.841 Δe2 = -0.013

Imax3 = 703.591 Δe3 = -0.01

Imax4 = 5000.349 Δe4 = -3.897 × 10⁻³

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -7.793$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 156.186 \\ 29.253 \\ 384.34 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} -6.99 \\ 148.812 \\ 15.701 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

MV1 = $\begin{pmatrix} 0.058 & 1 \\ -0.079 & -1 \end{pmatrix}$ deg1 = $\begin{pmatrix} 0.03 & 1 \\ -0.037 & -1 \end{pmatrix}$

MV2 = $\begin{pmatrix} 0.251 & 1 \\ -0.25 & 1 \end{pmatrix}$ deg2 = $\begin{pmatrix} 0.068 & -1 \\ -0.056 & 1 \end{pmatrix}$

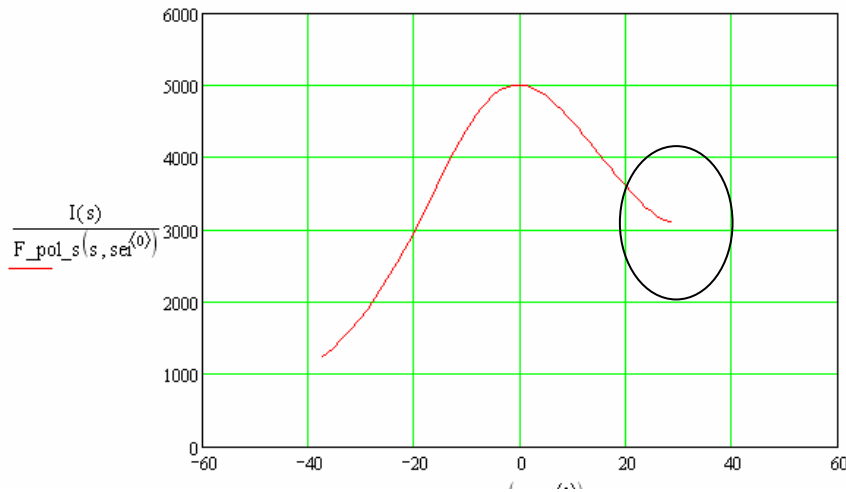
MV3 = $\begin{pmatrix} 1.613 & -1 \\ -1.283 & 1 \end{pmatrix}$ deg3 = $\begin{pmatrix} 0.054 & 1 \\ -0.067 & -1 \end{pmatrix}$

MV4 = 0 deg4 = 0

MV5 = $\begin{pmatrix} 15.018 & -1 \\ -12.354 & 1 \end{pmatrix}$ deg5 = $\begin{pmatrix} 0.484 & 1 \\ -0.613 & -1 \end{pmatrix}$

MV6 = 0 deg6 = 0

min(stack(am, ph)) = 4.389 × 10⁻⁴ min(am) = 4.389 × 10⁻⁴ min(ph) = 5.826 × 10⁻⁴



Ene1 = 1.3 × 10⁸

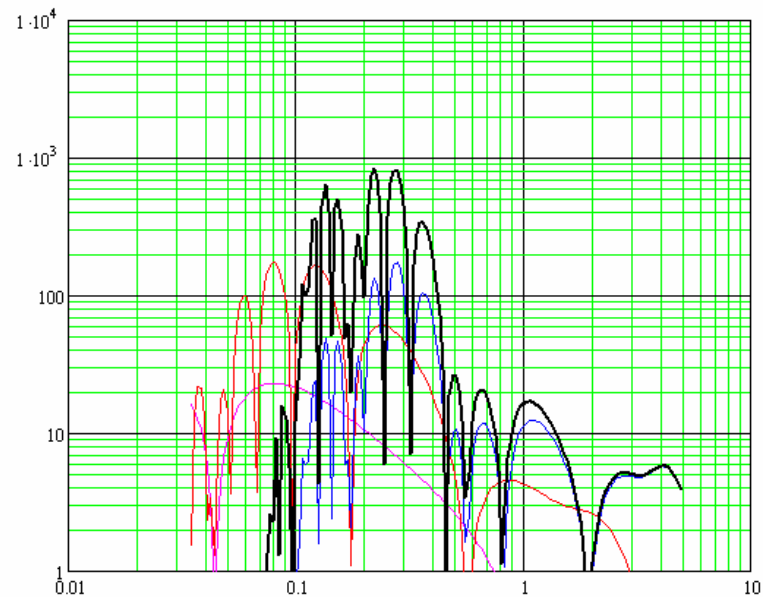
Z(BC1 to BC2) is scaled with (500MeV / E_BC1)**2
 Z(BC2 to ...) is scaled with (2000MeV / E_BC2)**2

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.379 \times 10^{-6} \\ -8.408 \times 10^4 \end{pmatrix} \quad I_{rms} = 217.019$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98483$$

$$E_{rms} = 1 \times 10^4 \quad C_{tot} \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.09 & 1.8 \\ 5 \times 10^8 & -0.1 & 7.7777778 \\ 2 \times 10^9 & -0.0352434 & 100 \end{pmatrix}$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 188.602 \\ 50.567 \\ 388.117 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix}$$

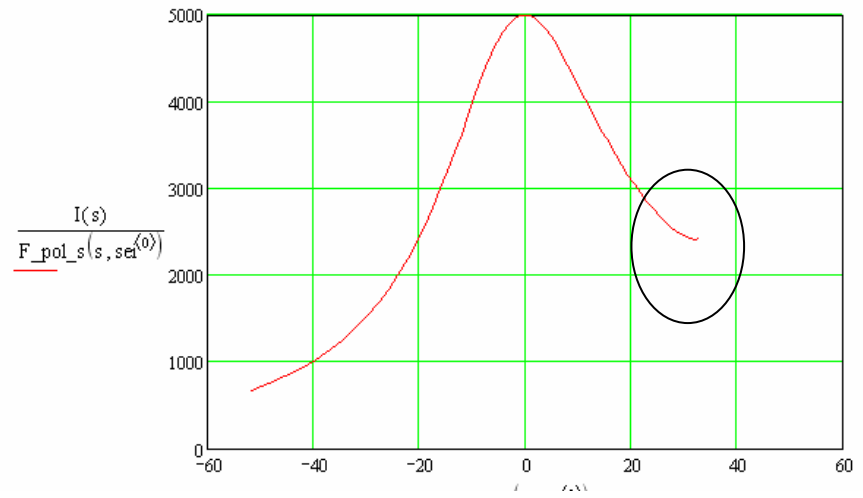
$$\frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} -33.306 \\ 123.114 \\ 17.575 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.7 & 8 \\ 0 & 0 \end{pmatrix}$$

$Imax1 = 50$		$MV1 = \begin{pmatrix} 0.075 & 1 \\ -0.098 & -1 \end{pmatrix}$	$deg1 = \begin{pmatrix} 0.015 & 1 \\ -0.019 & -1 \end{pmatrix}$
$Imax2 = 91.199$	$\Delta e2 = -0.011$	$MV2 = \begin{pmatrix} 0.082 & 1 \\ -0.109 & -1 \end{pmatrix}$	$deg2 = \begin{pmatrix} 0.042 & -1 \\ -0.034 & 1 \end{pmatrix}$
$Imax3 = 704.503$	$\Delta e3 = -0.012$	$MV3 = \begin{pmatrix} 1.332 & -1 \\ -1.072 & 1 \end{pmatrix}$	$deg3 = \begin{pmatrix} 0.046 & 1 \\ -0.057 & -1 \end{pmatrix}$
$Imax4 = 5000.029$	$\Delta e4 = -4.318 \times 10^{-3}$	$MV4 = 0$	$deg4 = 0$
		$MV5 = \begin{pmatrix} 14.806 & -1 \\ -12.17 & 1 \end{pmatrix}$	$deg5 = \begin{pmatrix} 0.506 & 1 \\ -0.64 & -1 \end{pmatrix}$
		$MV6 = 0$	$deg6 = 0$

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -8.637$$

$$\min(\text{stack}(\text{am}, \text{ph})) = 3.015 \times 10^{-4} \quad \min(\text{am}) = 4.59 \times 10^{-4} \quad \min(\text{ph}) = 3.015 \times 10^{-4}$$



$$Ene1 = 1.3 \times 10^8$$

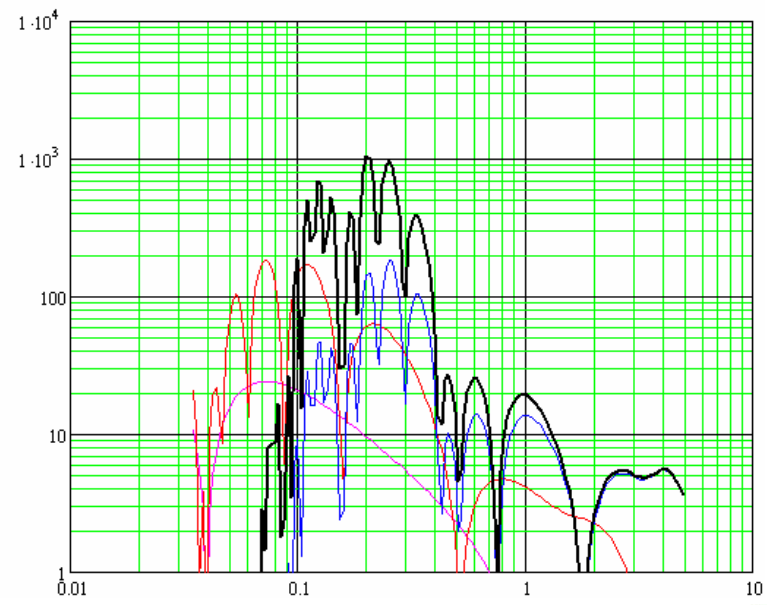
Z(BC1 to BC2) is scaled with $(500\text{MeV} / E_BC1)^{**2}$
 Z(BC2 to ...) is scaled with $(2000\text{MeV} / E_BC2)^{**2}$

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.096 \times 10^{-6} \\ -7.913 \times 10^4 \end{pmatrix} \quad I_{rms} = 275.745$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98354$$

$$E_{rms} = 1 \times 10^4 \quad C_{tot} \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.1 & 2 \\ 5 \times 10^8 & -0.1 & 7 \\ 2 \times 10^9 & -0.038295 & 100 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.52 & 4 \\ 0 & 0 \end{pmatrix}$$

Imax1 = 50

Imax2 = 101.032 Δe2 = -0.012

Imax3 = 703.708 Δe3 = -0.01

Imax4 = 5001.456 Δe4 = -3.921 × 10⁻³

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -7.842$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 159.354 \\ 32.211 \\ 385.805 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix} \quad \frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} -13.882 \\ 140.069 \\ 16.457 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

MV1 = $\begin{pmatrix} 0.052 & 1 \\ -0.074 & -1 \end{pmatrix}$ deg1 = $\begin{pmatrix} 0.024 & 1 \\ -0.03 & -1 \end{pmatrix}$

MV2 = $\begin{pmatrix} 0.193 & 1 \\ -0.25 & 1 \end{pmatrix}$ deg2 = $\begin{pmatrix} 0.059 & -1 \\ -0.048 & 1 \end{pmatrix}$

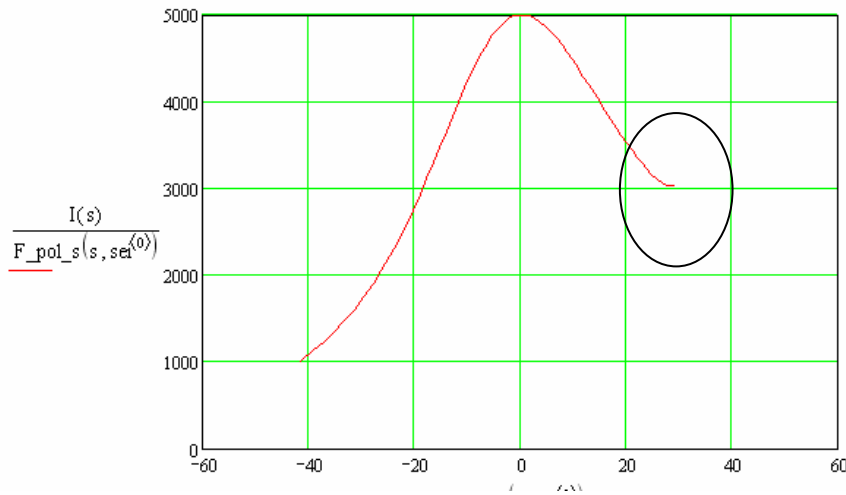
MV3 = $\begin{pmatrix} 1.698 & -1 \\ -1.349 & 1 \end{pmatrix}$ deg3 = $\begin{pmatrix} 0.054 & 1 \\ -0.066 & -1 \end{pmatrix}$

MV4 = 0 deg4 = 0

MV5 = $\begin{pmatrix} 14.968 & -1 \\ -12.307 & 1 \end{pmatrix}$ deg5 = $\begin{pmatrix} 0.482 & 1 \\ -0.611 & -1 \end{pmatrix}$

MV6 = 0 deg6 = 0

min(stack(am, ph)) = 3.944 × 10⁻⁴ min(am) = 3.944 × 10⁻⁴ min(ph) = 4.708 × 10⁻⁴



Ene1 = 1.3 × 10⁸

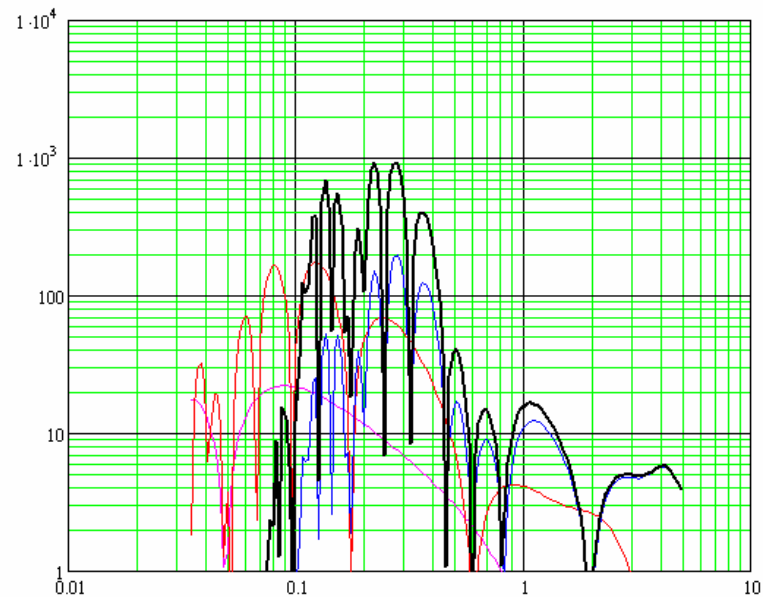
Z(BC1 to BC2) is scaled with (500MeV / E_BC1)**2
 Z(BC2 to ...) is scaled with (2000MeV / E_BC2)**2

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.394 \times 10^{-6} \\ -8.901 \times 10^4 \end{pmatrix} \quad I_{rms} = 241.51$$

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$$\frac{Ene4}{MV} = 1.75 \times 10^4 \quad \frac{r56_4}{0.001} = 0.84 \quad C4 = 0.98483$$

$$E_{rms} = 1 \times 10^4 \quad C_{tot} \cdot E_{rms} = 1 \times 10^6$$



compression with BC1 ... BC3

$$BC_S1 = \begin{pmatrix} 1.3 \times 10^8 & -0.1 & 1.8 \\ 5 \times 10^8 & -0.1 & 7.7777778 \\ 2 \times 10^9 & -0.0352434 & 100 \end{pmatrix}$$

$$\frac{rf^{(0)}}{MV} = \begin{pmatrix} 190.067 \\ 50.649 \\ 389.415 \\ 0 \\ 1.596 \times 10^3 \\ 0 \end{pmatrix}$$

$$\frac{rf^{(1)}}{\text{deg}} = \begin{pmatrix} -33.972 \\ 123.053 \\ 18.169 \\ 0 \\ 20 \\ 0 \end{pmatrix}$$

$$QT = \begin{pmatrix} 0.7 & 8 \\ 0 & 0 \end{pmatrix}$$

Imax1 = 50

Imax2 = 91.564 Δe2 = -0.01

Imax3 = 707.381 Δe3 = -0.012

Imax4 = 5006.19 Δe4 = -4.32 × 10⁻³

$$\frac{\Delta e4_BC_S1_{2,0}}{MV} = -8.639$$

$$MV1 = \begin{pmatrix} 0.063 & 1 \\ -0.085 & -1 \end{pmatrix}$$

$$deg1 = \begin{pmatrix} 0.014 & 1 \\ -0.017 & -1 \end{pmatrix}$$

$$MV2 = \begin{pmatrix} 0.089 & 1 \\ -0.125 & -1 \end{pmatrix}$$

$$deg2 = \begin{pmatrix} 0.039 & -1 \\ -0.032 & 1 \end{pmatrix}$$

$$MV3 = \begin{pmatrix} 1.376 & -1 \\ -1.107 & 1 \end{pmatrix}$$

$$deg3 = \begin{pmatrix} 0.046 & 1 \\ -0.057 & -1 \end{pmatrix}$$

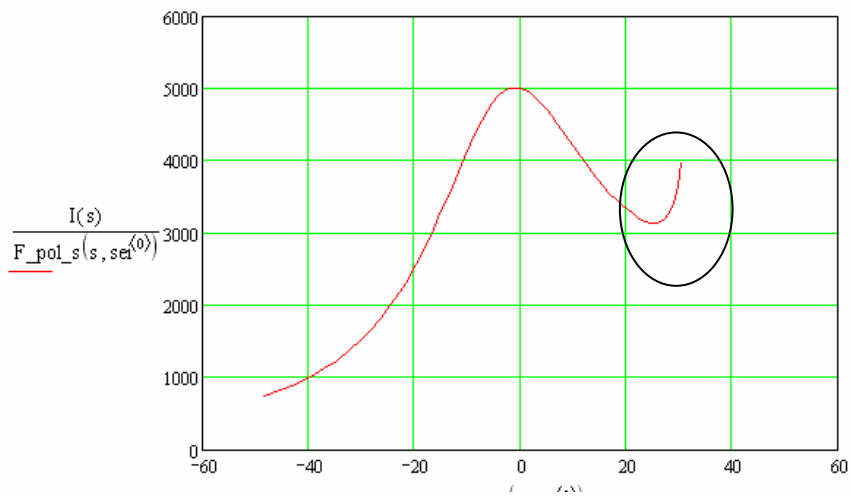
MV4 = 0 deg4 = 0

$$MV5 = \begin{pmatrix} 14.861 & -1 \\ -12.217 & 1 \end{pmatrix}$$

$$deg5 = \begin{pmatrix} 0.508 & 1 \\ -0.643 & -1 \end{pmatrix}$$

MV6 = 0 deg6 = 0

min(stack(am, ph)) = 2.726 × 10⁻⁴ min(am) = 3.899 × 10⁻⁴ min(ph) = 2.726 × 10⁻⁴



Ene1 = 1.3 × 10⁸

Z(BC1 to BC2) is scaled with (500MeV / E_BC1)**2
 Z(BC2 to ...) is scaled with (2000MeV / E_BC2)**2

$$T_S1(BC_S1) \cdot \begin{pmatrix} 0 \\ E_{rms} \end{pmatrix} = \begin{pmatrix} 3.11 \times 10^{-6} \\ -8.396 \times 10^4 \end{pmatrix}$$

Irms = 307.376

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$$\frac{Ene4}{MV} = 1.75 \times 10^4$$

$$\frac{r56_4}{0.001} = 0.84$$

C4 = 0.98354

E_rms = 1 × 10⁴ Ctot · E_rms = 1 × 10⁶

