

SPS TRANSVERSE IMPEDANCE AND TMCI INTENSITY THRESHOLD FROM MOSES FOR THE YEARS 2002, 2003, 2004 AND 2006

E. Métral

- ◆ **SPS transverse impedance**
- ◆ **TMCI intensity threshold for the LHC beam in the SPS**
- ◆ **TMCI intensity threshold for the low and very low longitudinal emittance beam in the SPS**

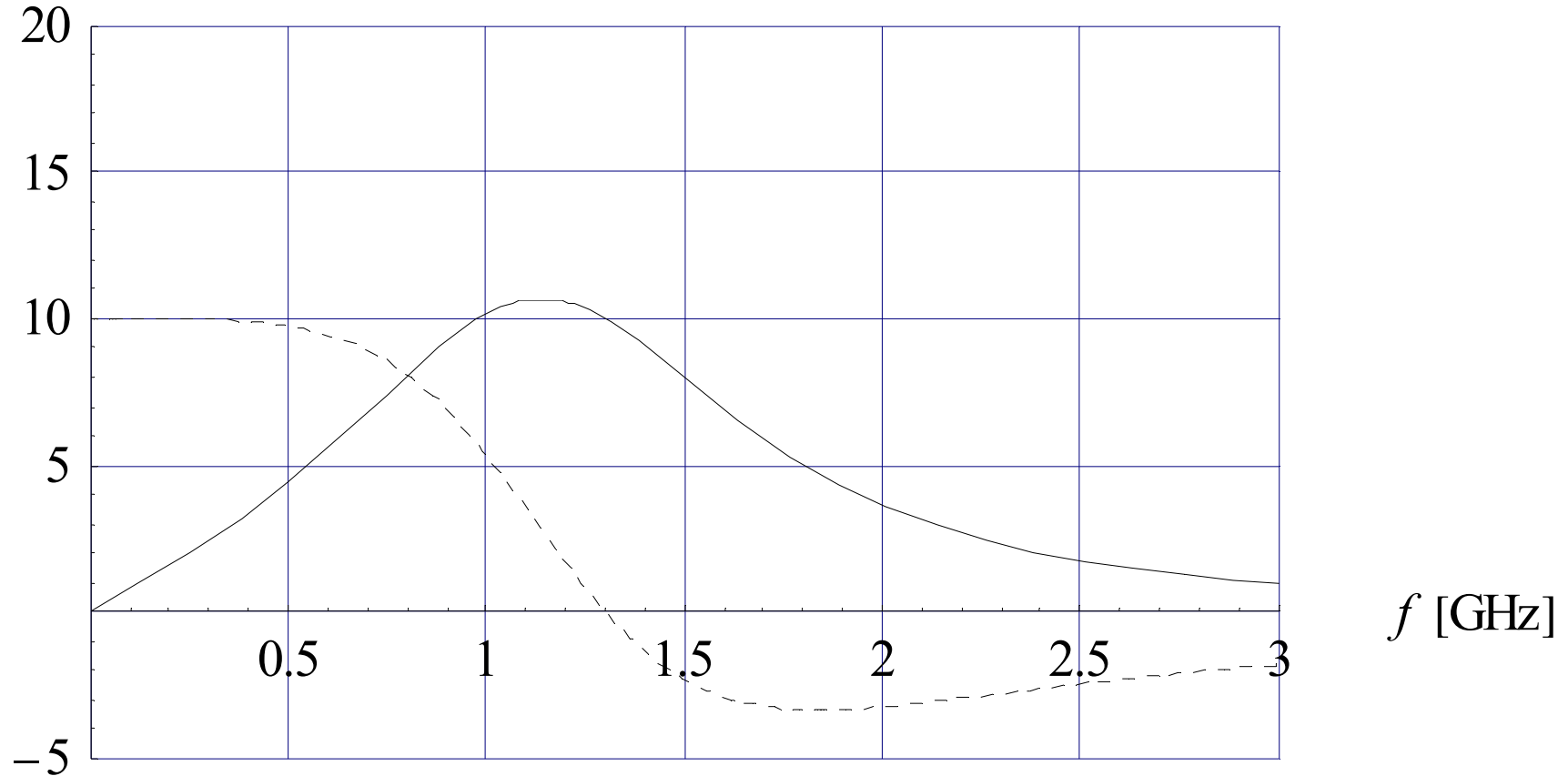
2002 : Broad-Band (BB) impedance

$$f_r^{BB} = 1.3 \text{ GHz}$$

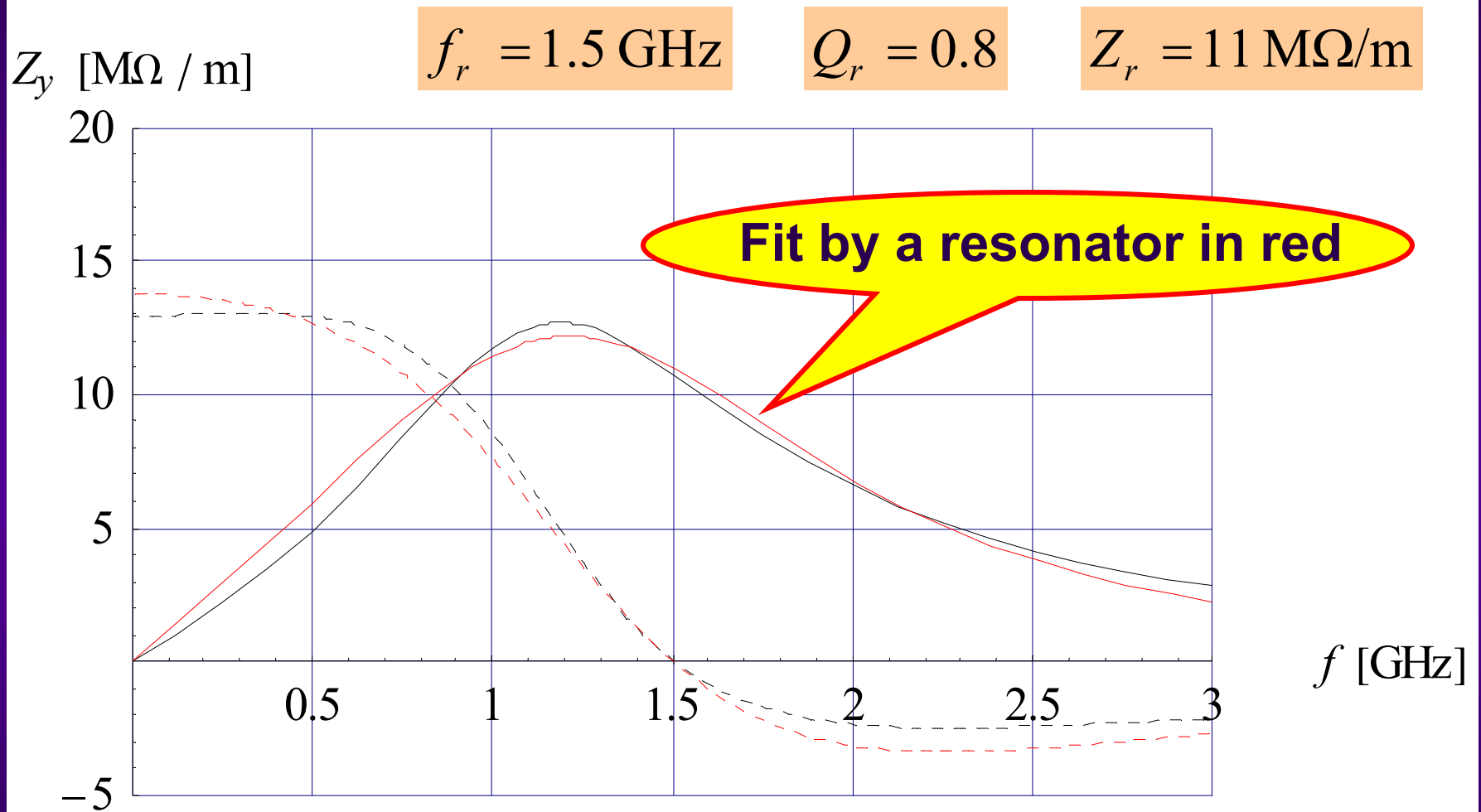
$$Q_r^{BB} = 1$$

$$Z_r^{BB} = 10 \text{ M}\Omega/\text{m}$$

Z_y [M Ω / m]



2003 : BB + 5 MKE kickers with 4A4 ferrite



2003 : BB + 5 MKE kickers with 8C11 ferrite

$$f_r = 1.5 \text{ GHz}$$

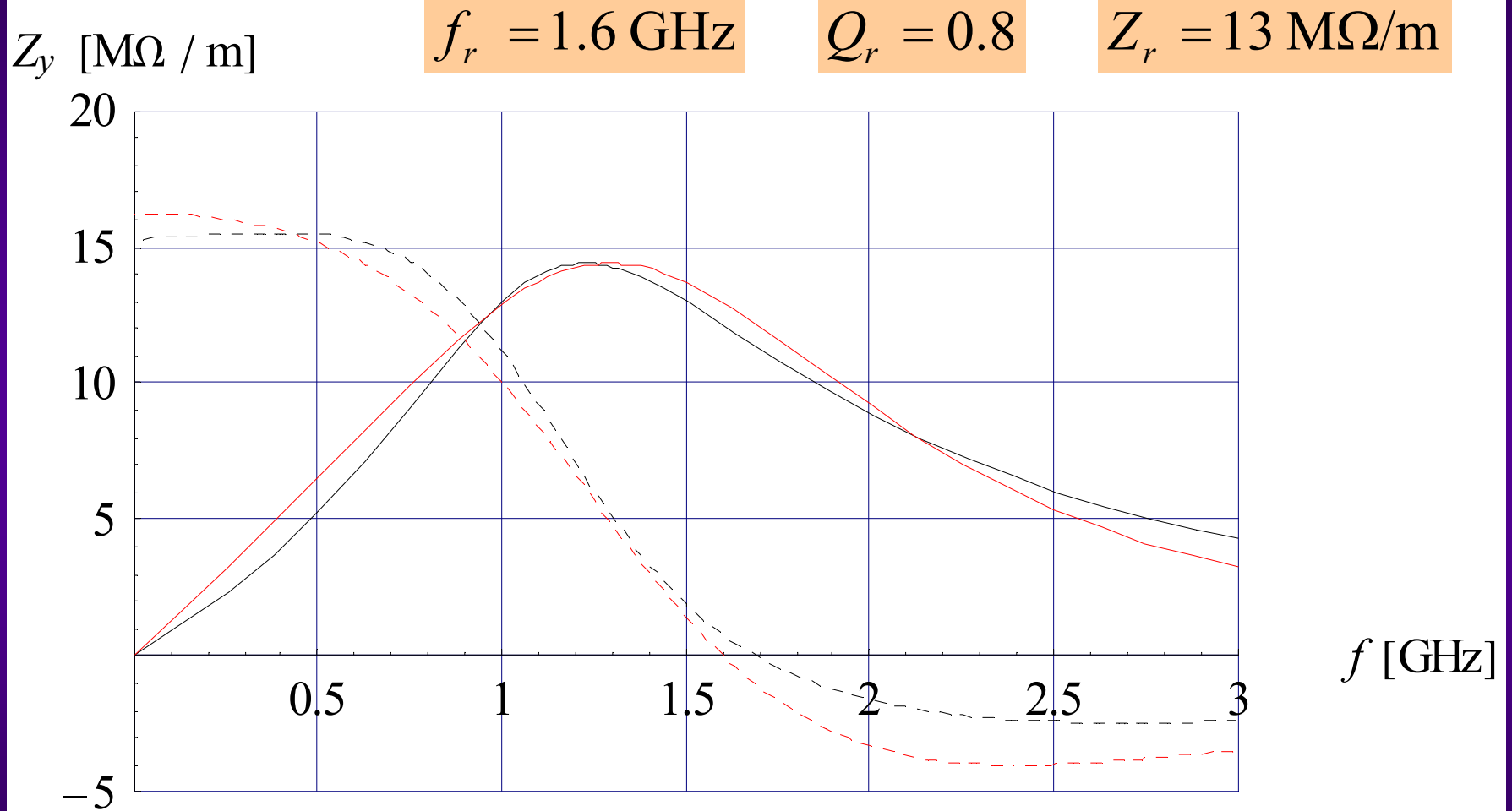
$$Q_r = 0.8$$

$$Z_r = 11 \text{ M}\Omega/\text{m}$$

Z_y [M Ω / m]



2006 : BB + 9 MKE kickers with 4A4 ferrite



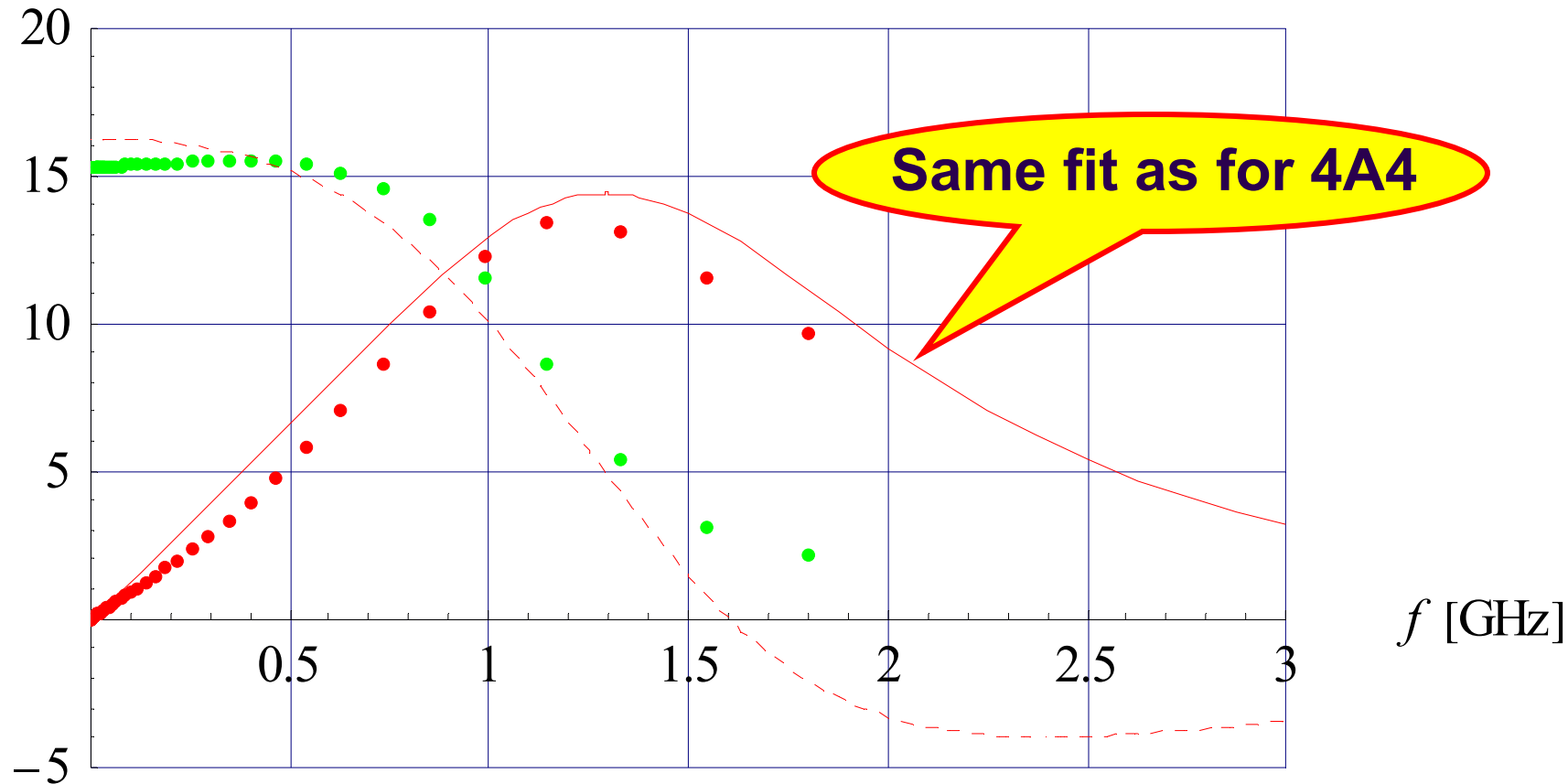
2006 : BB + 9 MKE kickers with 8C11 ferrite

Z_y [M Ω / m]

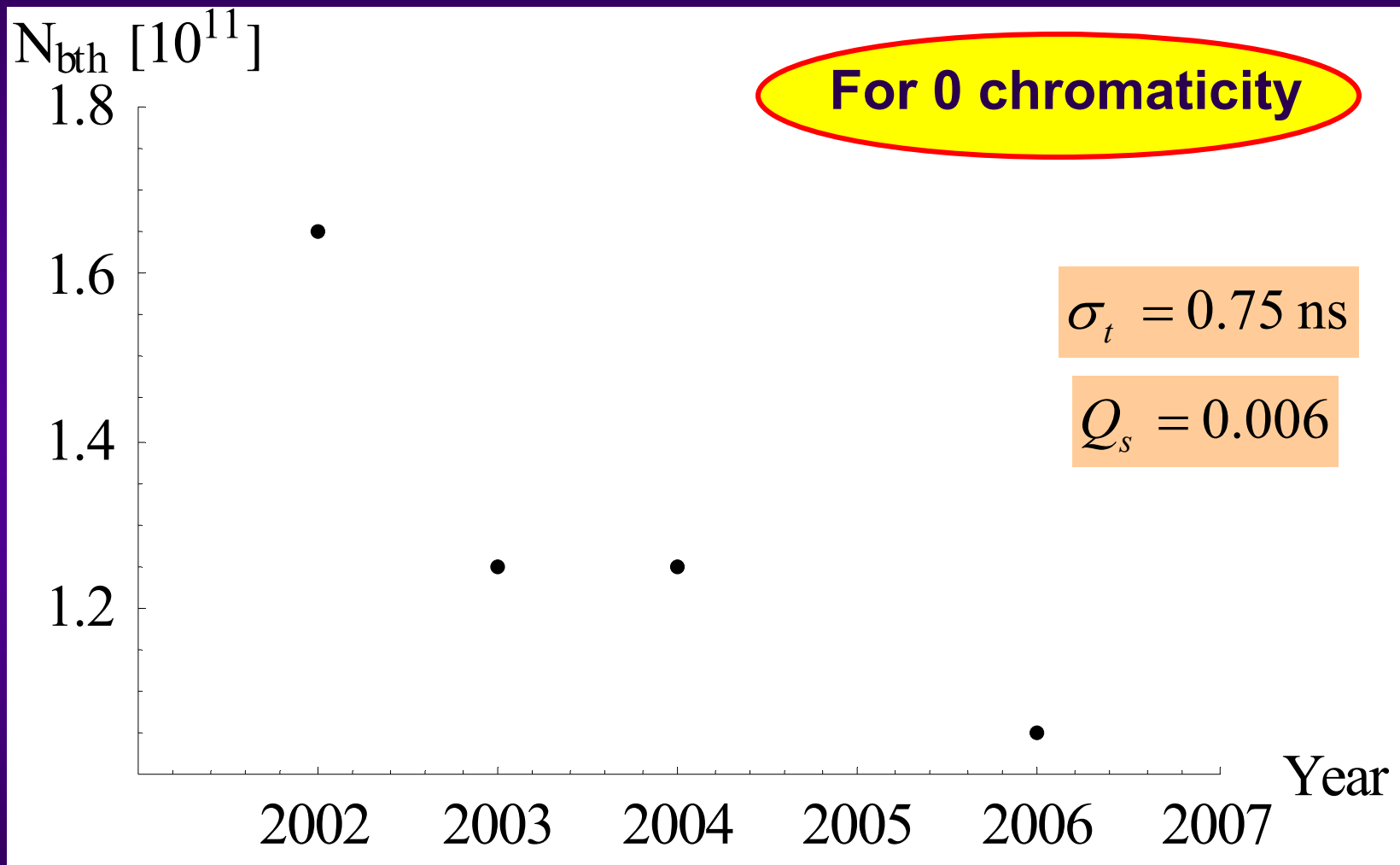
$f_r = 1.6$ GHz

$Q_r = 0.8$

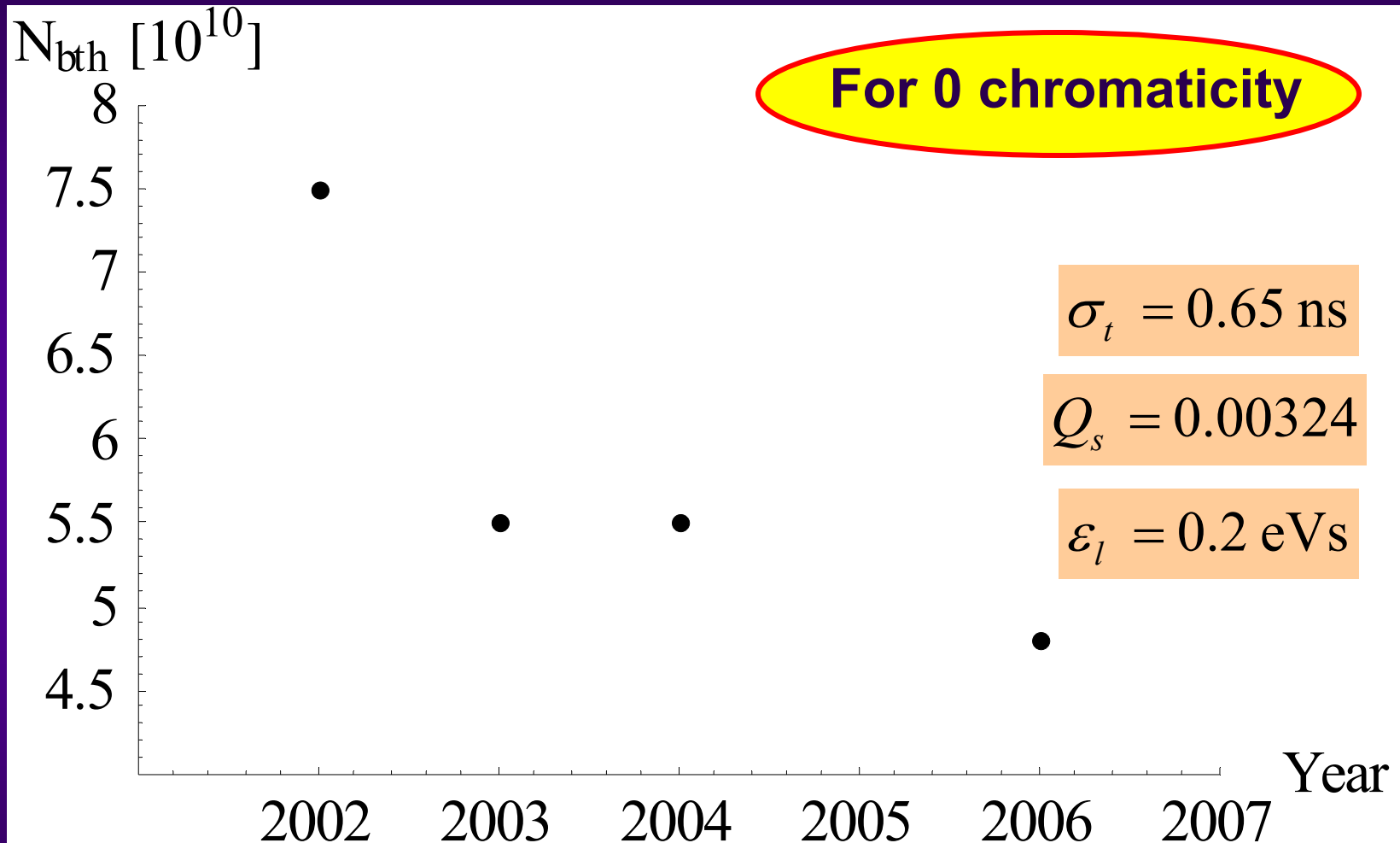
$Z_r = 13$ M Ω /m



TMCI intensity threshold from MOSES for the LHC beam in the SPS at 26 GeV/c



TMCI intensity threshold from MOSES for the low longitudinal emittance beam in the SPS at 26 GeV/c



In **2003**, no losses observed if intensity reduced to $\sim 5.5-6.5 \times 10^{10}$ p/b (cf. AB Note-2003-093 (MD) by G. Arduini et al.)

TMCI intensity threshold from MOSES for the very low longitudinal emittance beam in the SPS at 26 GeV/c in 2003

$$\sigma_t = 0.55 \text{ ns}$$

$$Q_s = 0.00324$$

$$\varepsilon_l = 0.15 \text{ eVs}$$

◆ **MOSES**

⇒

$$N_{\text{bth}} = 4.5 \times 10^{10} \text{ p/b}$$

◆ **Measurements**

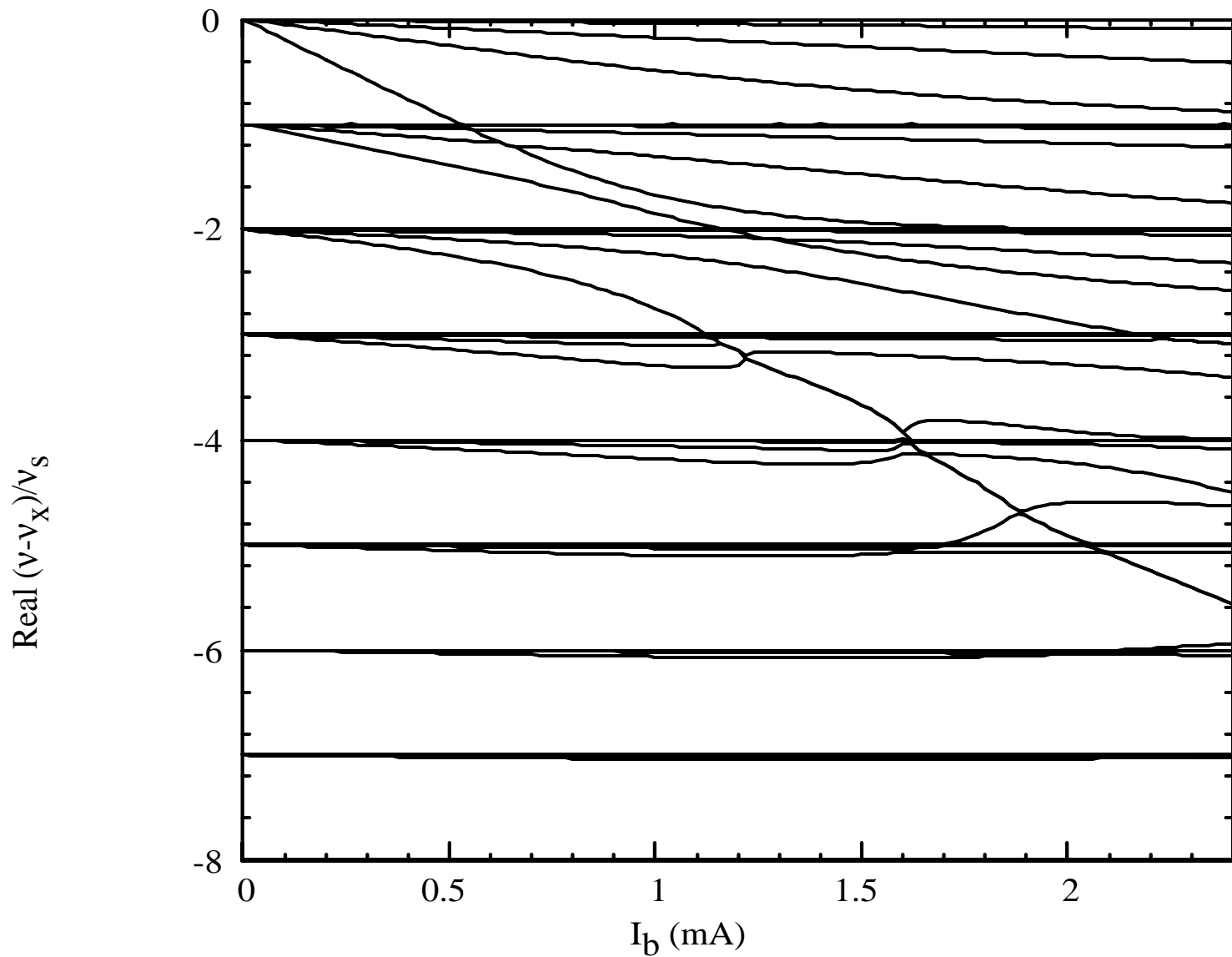
⇒

$$N_{\text{bth}} \approx 3 - 4 \times 10^{10} \text{ p/b}$$

- Real Part of $(v-v_x)/v_s$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.10.39 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

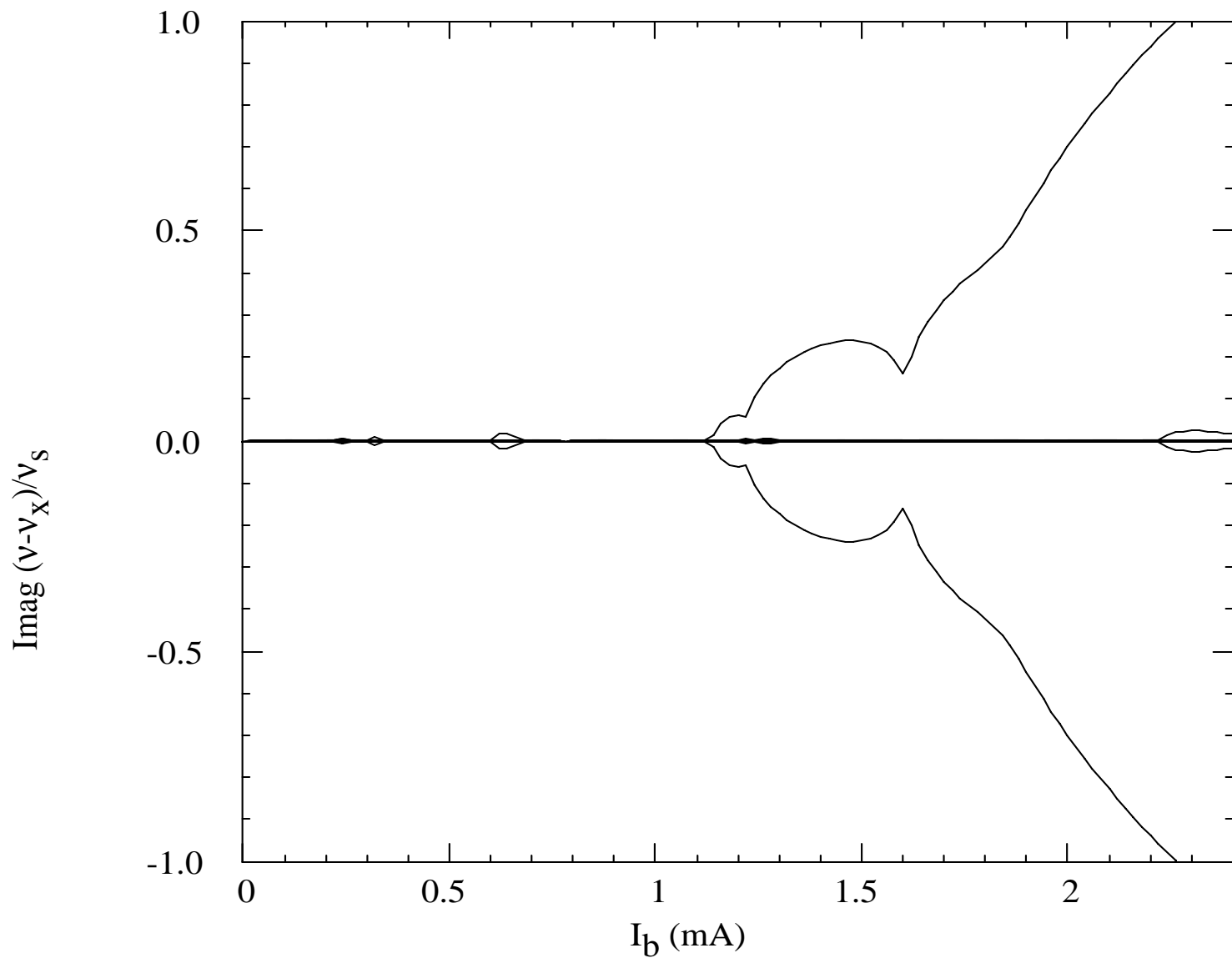


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.130E+04 (MHz)
RS = 10.0 (M Ω /m)
QV = 1.00
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.10.39 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

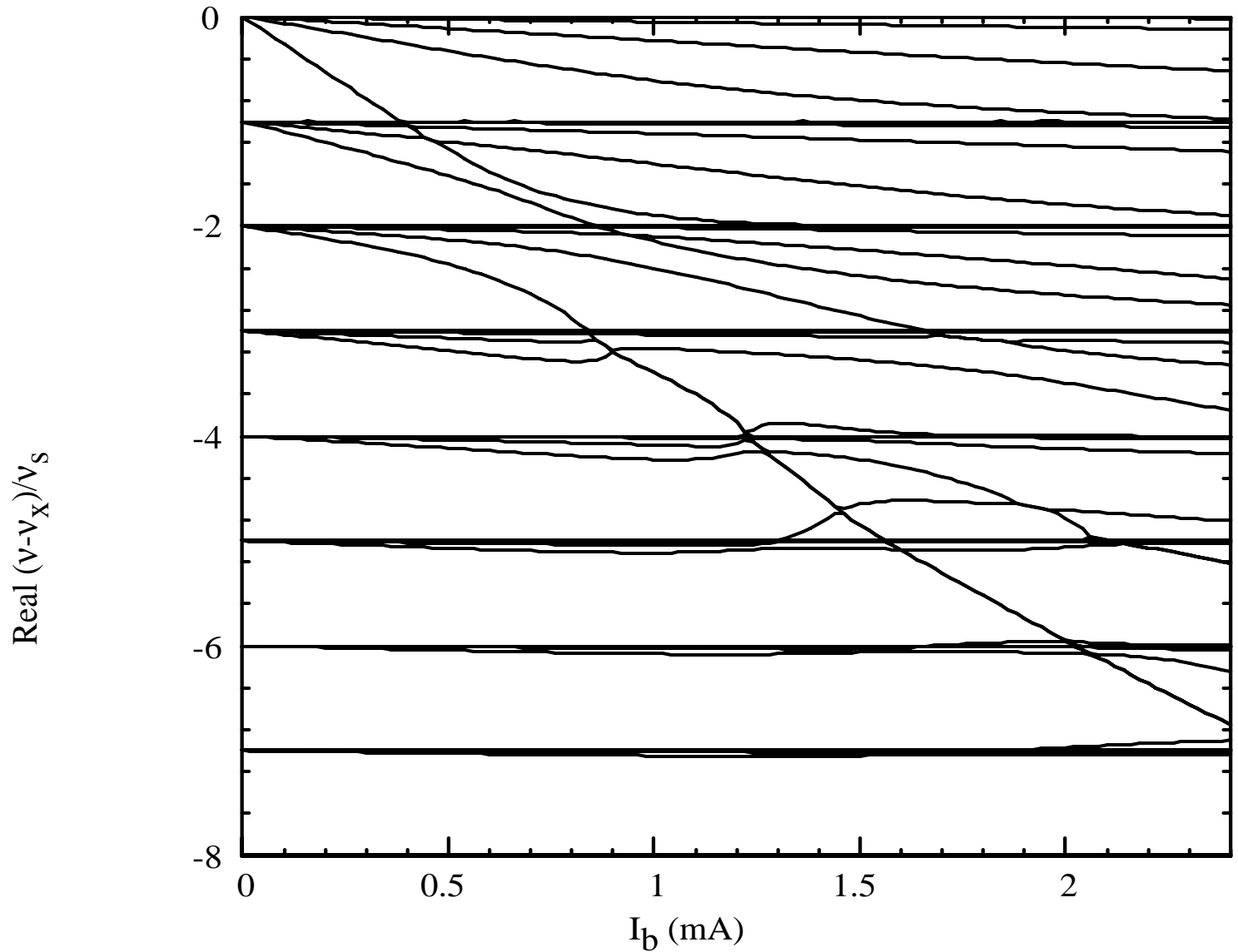


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QV = 1.00
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- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.22.19 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

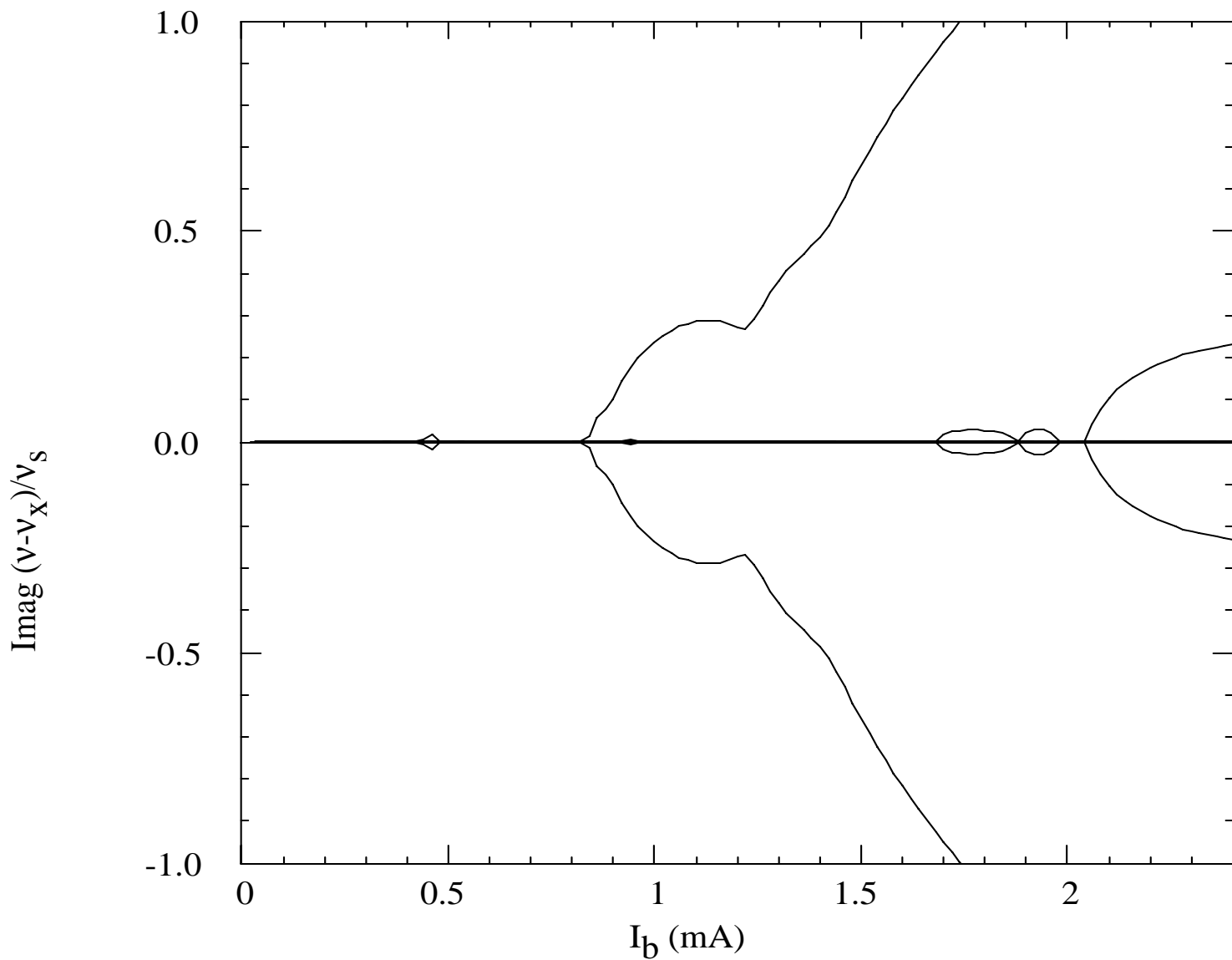


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.150E+04 (MHz)
RS = 11.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.22.19 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

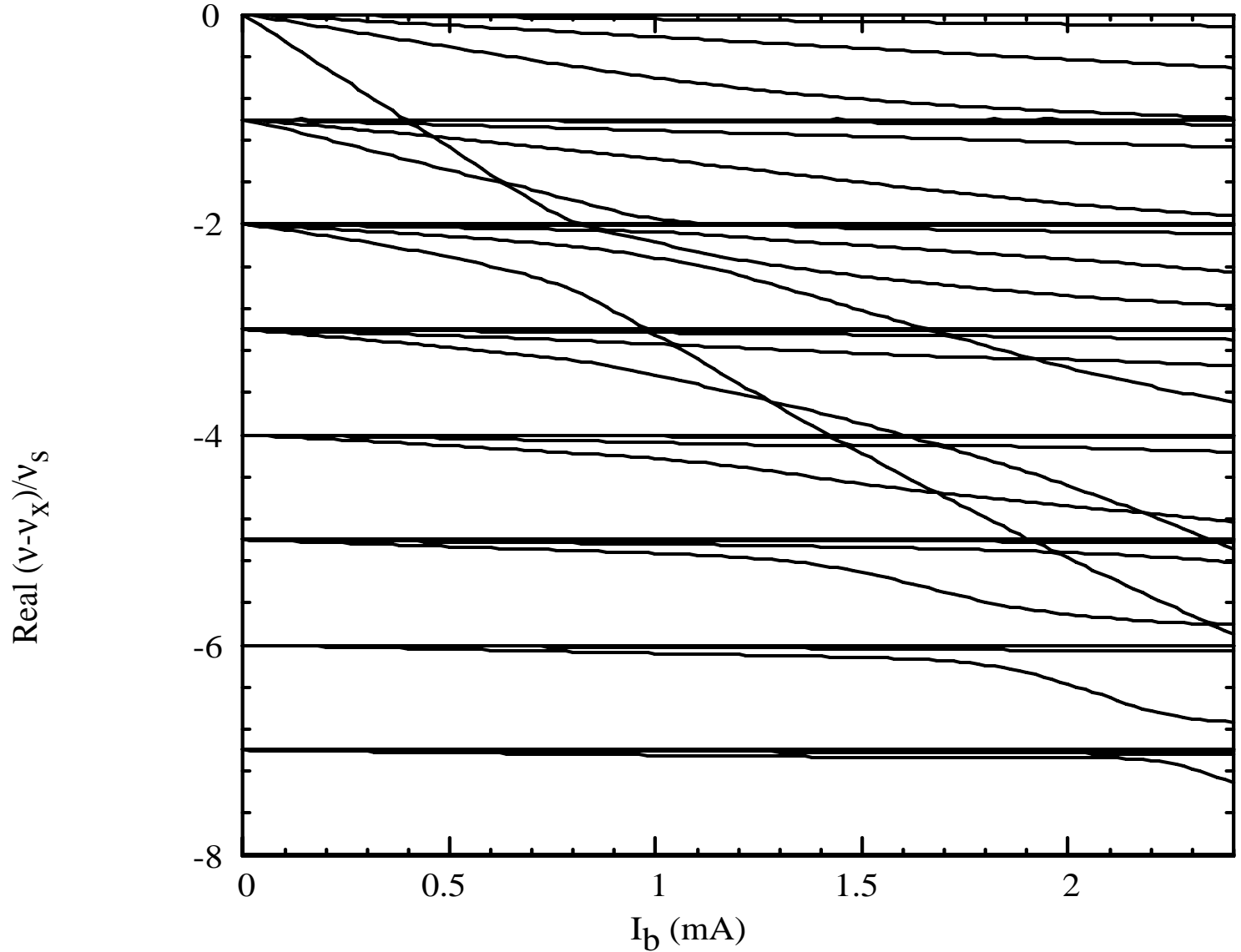


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFREQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.150E+04 (MHz)
RS = 11.0 (MOhm/m)
QV = 0.800
LBIN = F
MU = 5

- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 06.22.45 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

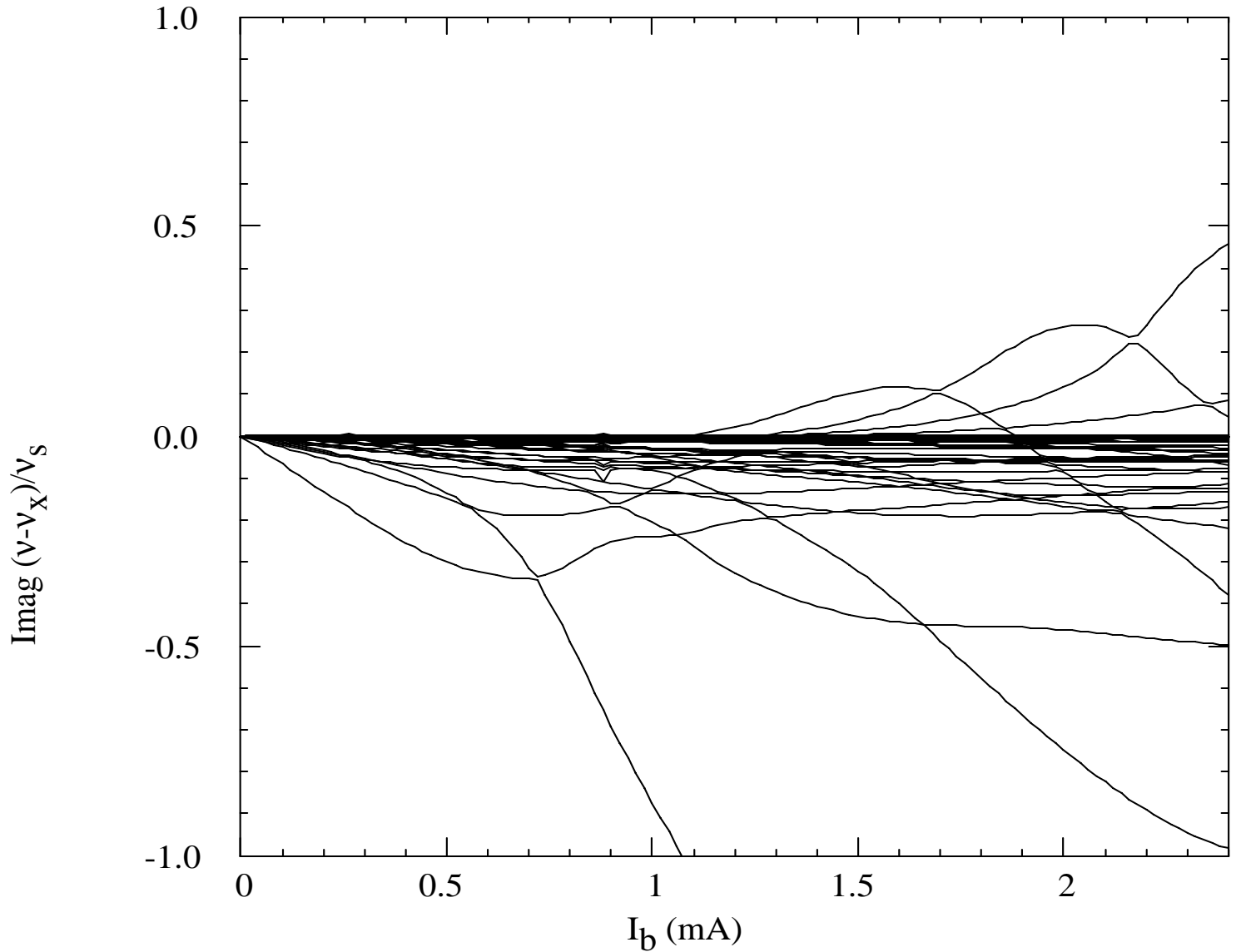


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 13.0
FREQ = 0.150E+04 (MHz)
RS = 11.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 06.22.45 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

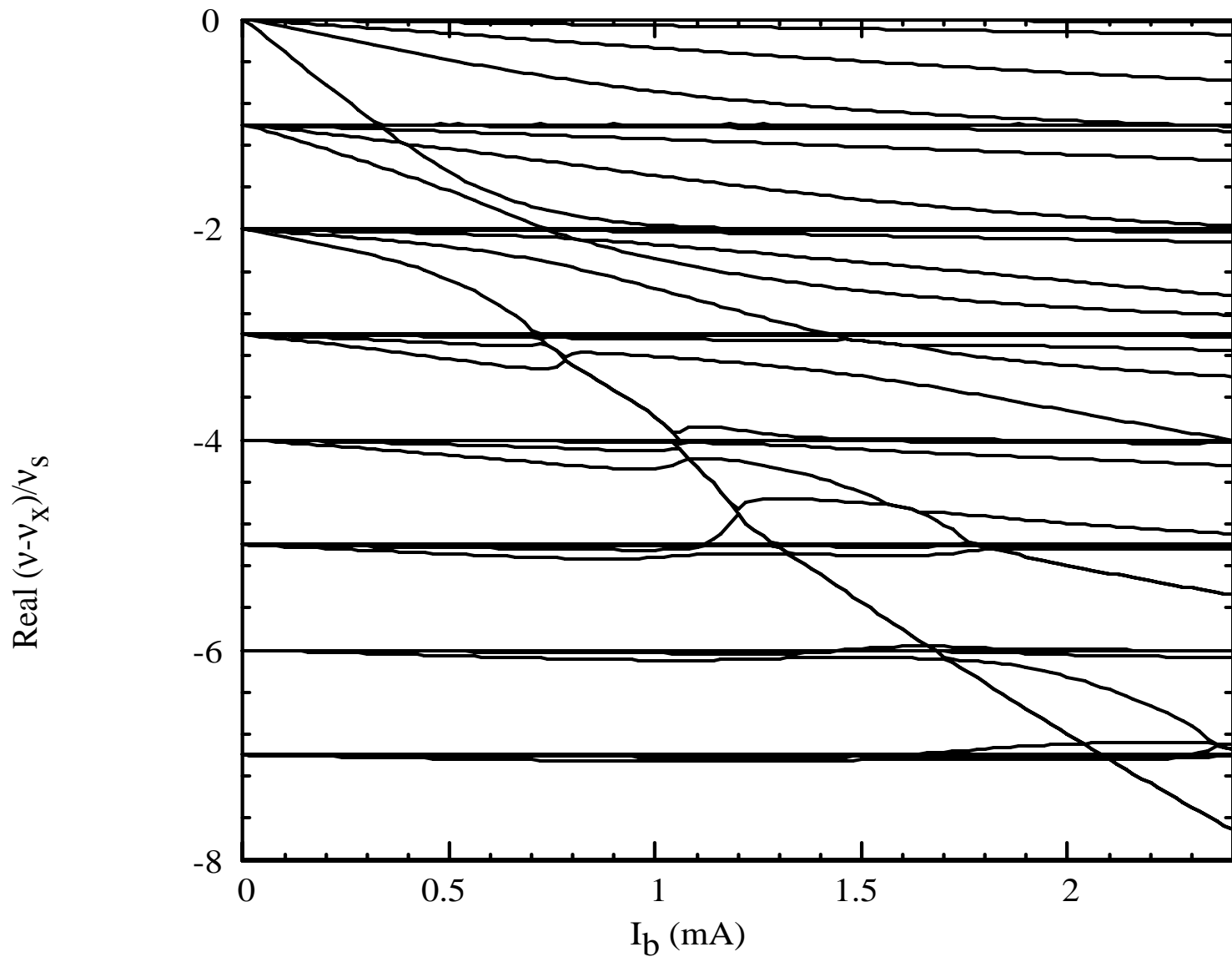


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFREQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 13.0
FREQ = 0.150E+04 (MHz)
RS = 11.0 (MOhm/m)
QV = 0.800
LBIN = F
MU = 5

- Real Part of $(v-v_x)/v_s$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.24.09 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

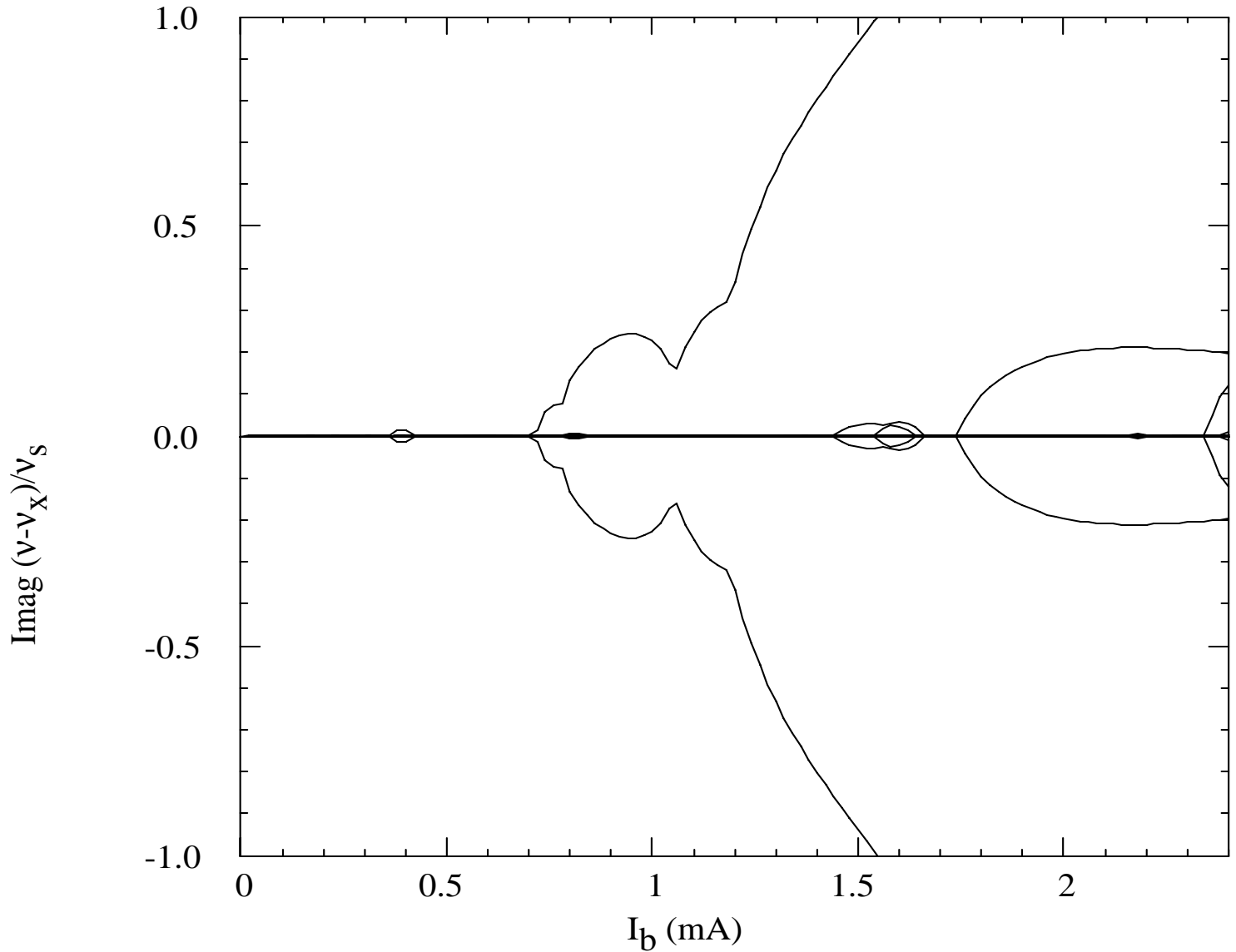


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.160E+04 (MHz)
RS = 13.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

11/10/04 16.24.09 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

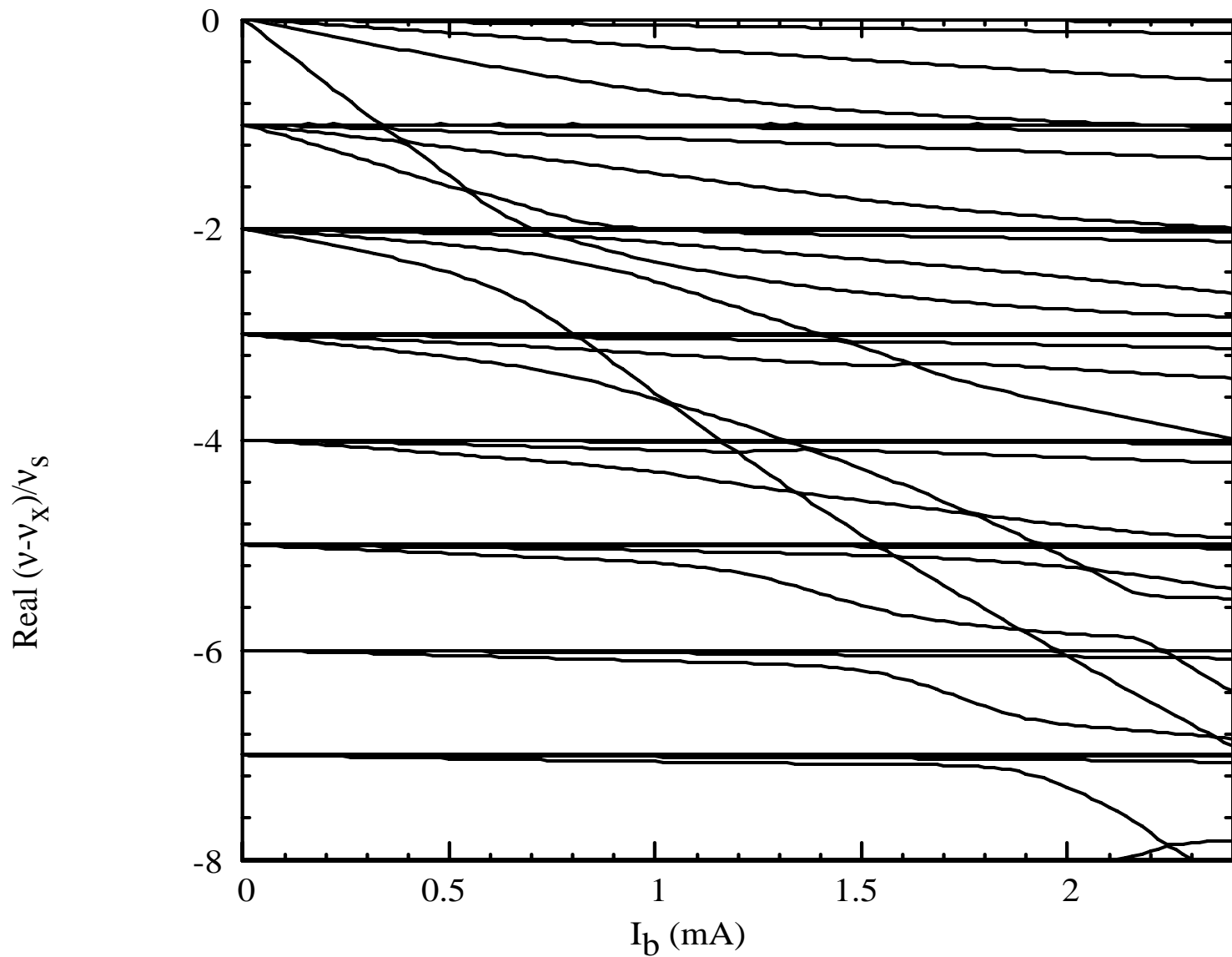


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFREQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.160E+04 (MHz)
RS = 13.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 06.24.50 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

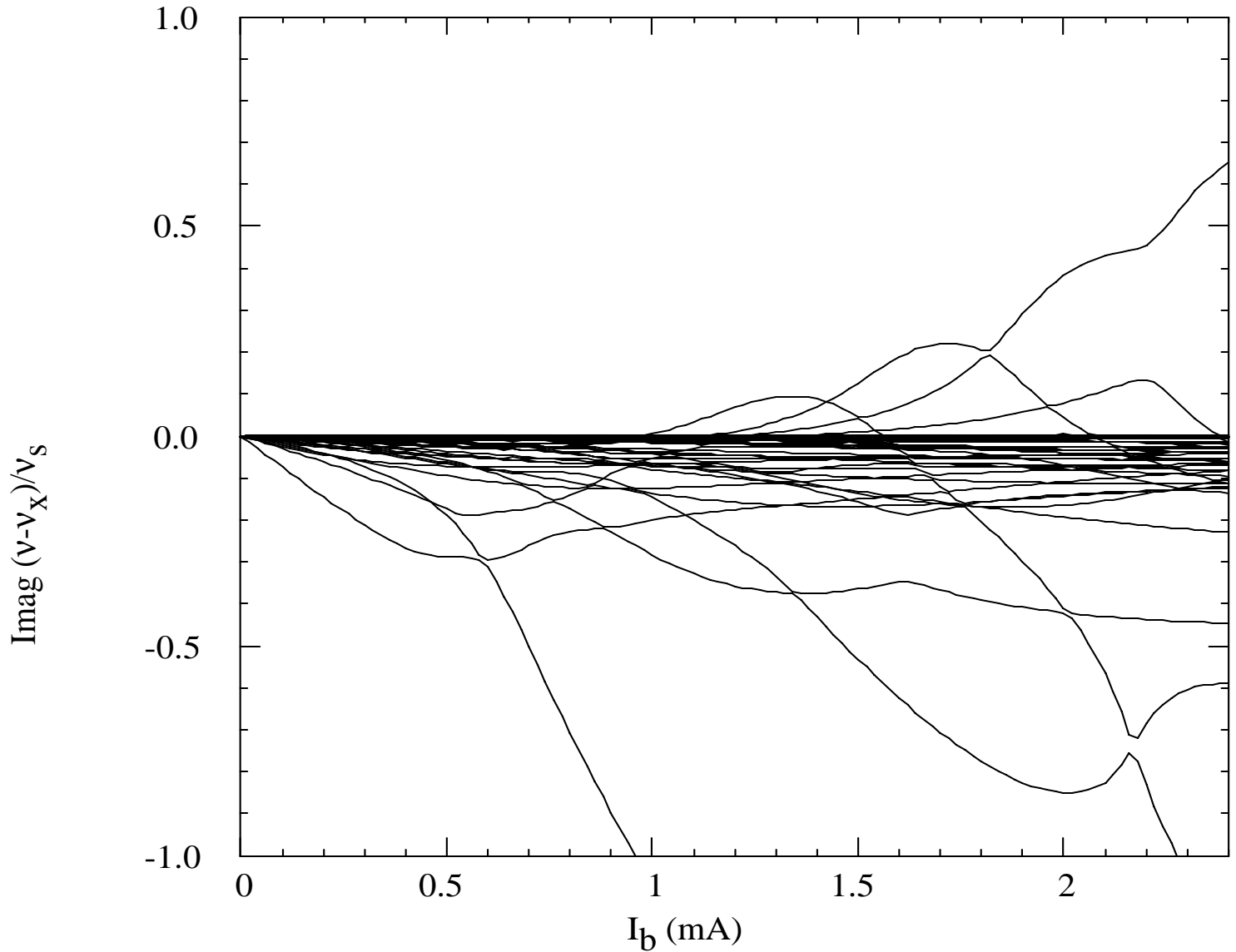


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 13.0
FREQ = 0.160E+04 (MHz)
RS = 13.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 06.24.50 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

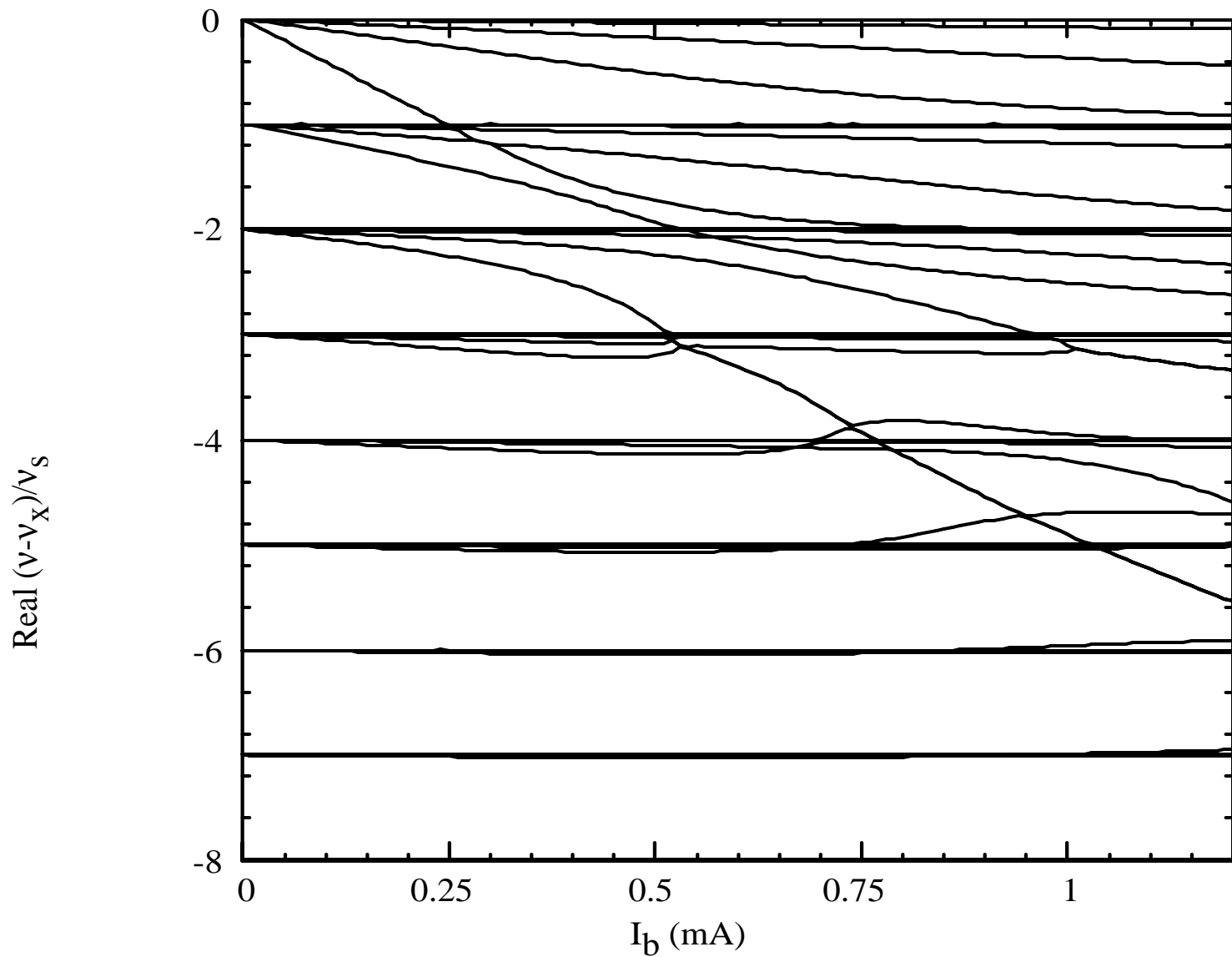


SPRD = 0.000E+00
NUS = 0.600E-02
ENGY = 26.0 (GeV)
SGMZ = 22.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 13.0
FREQ = 0.160E+04 (MHz)
RS = 13.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 11.54.17 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

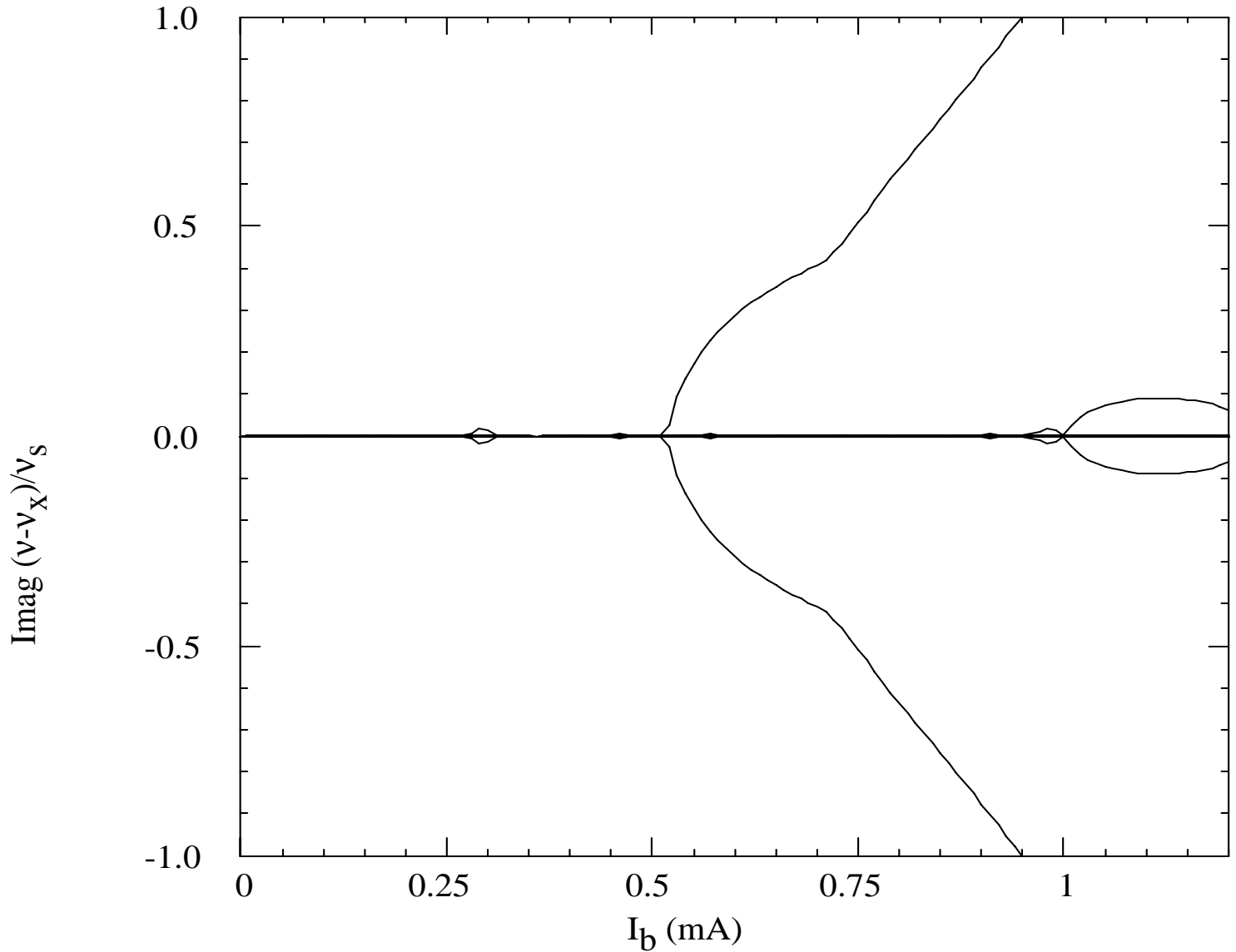


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NUS = 0.323E-02
ENGY = 26.0 (GeV)
SGMZ = 19.6 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.130E+04 (MHz)
RS = 10.0 (M Ω /m)
QV = 1.00
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MU = 5

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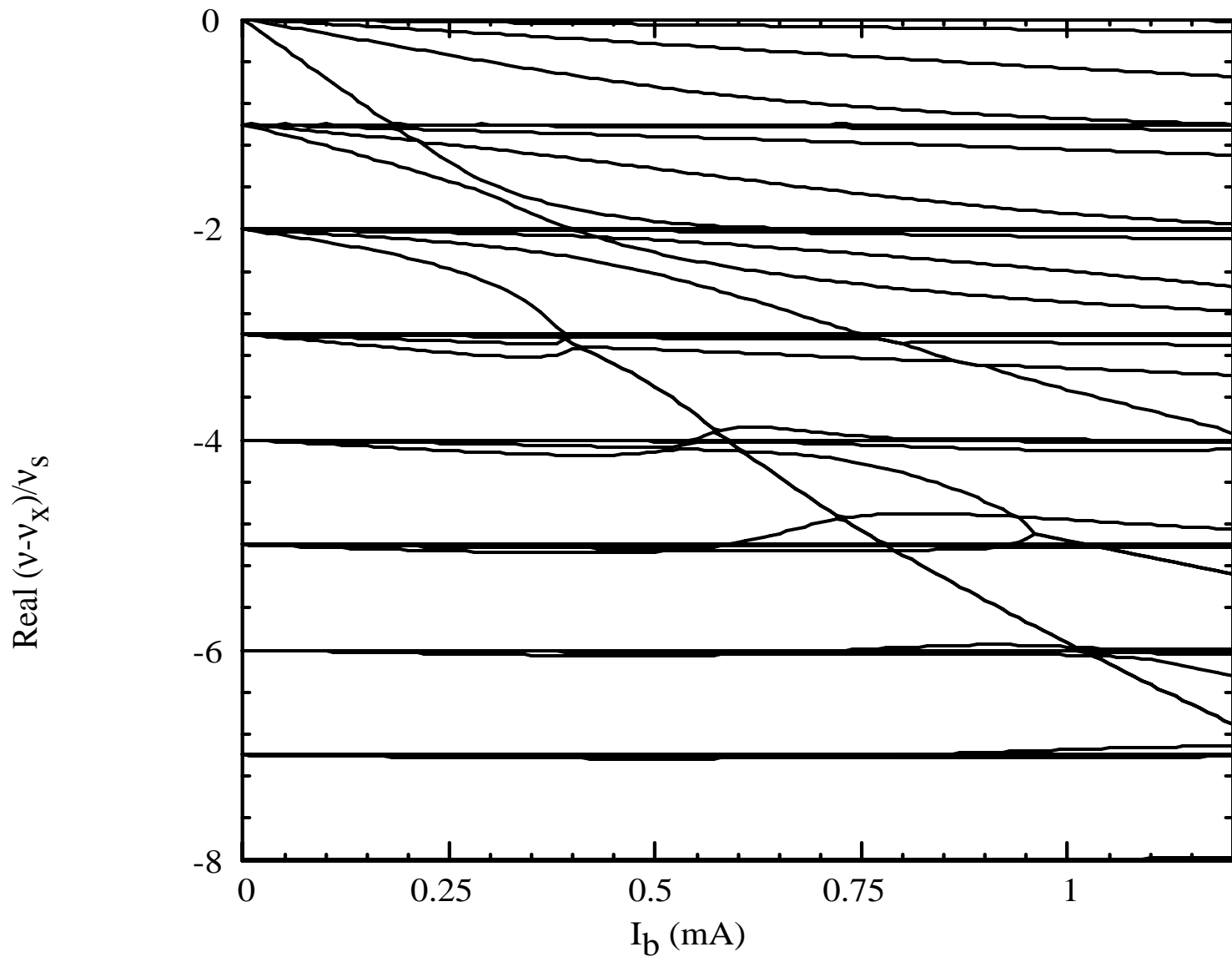


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LBIN = F
MU = 5

- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 11.56.45 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

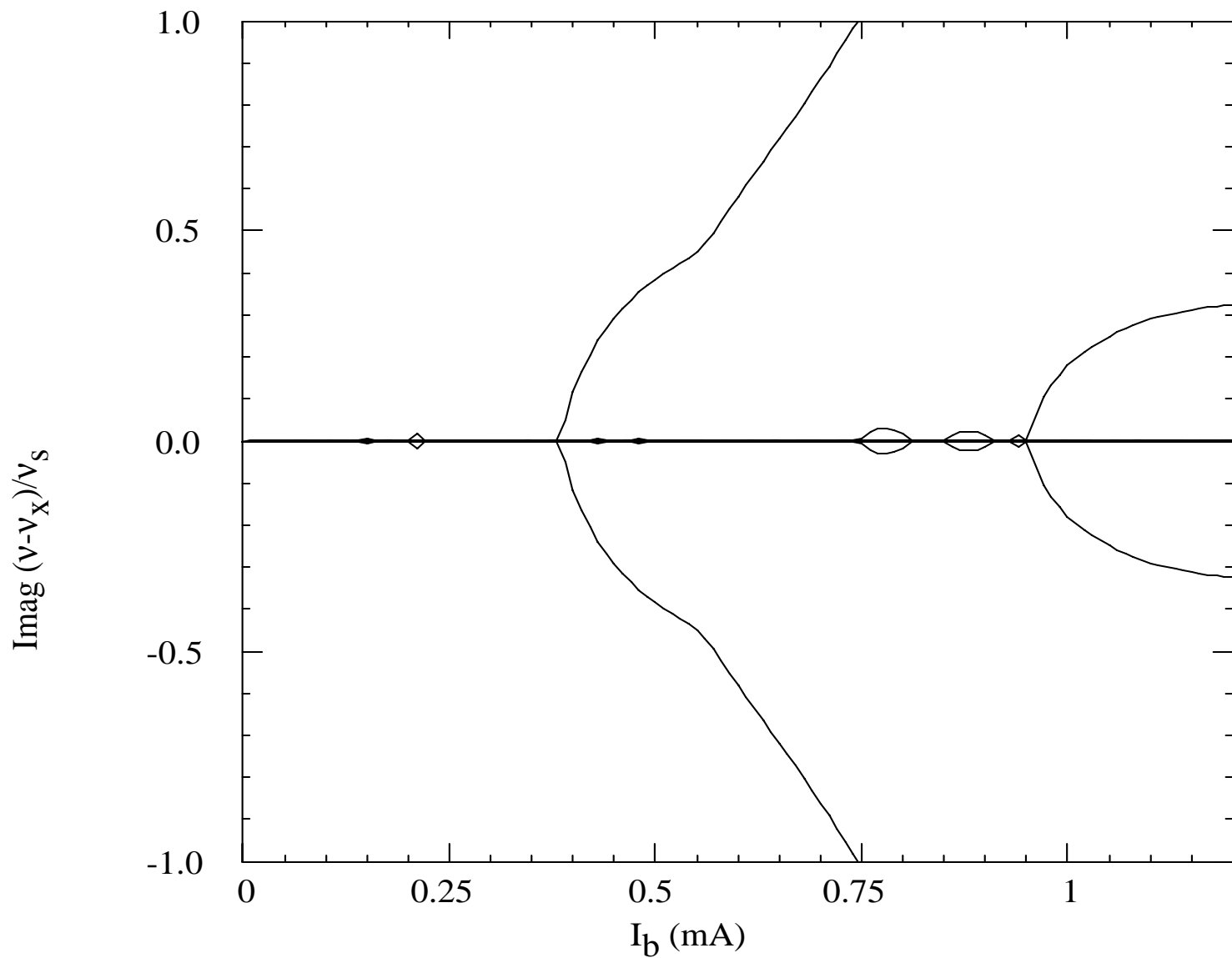


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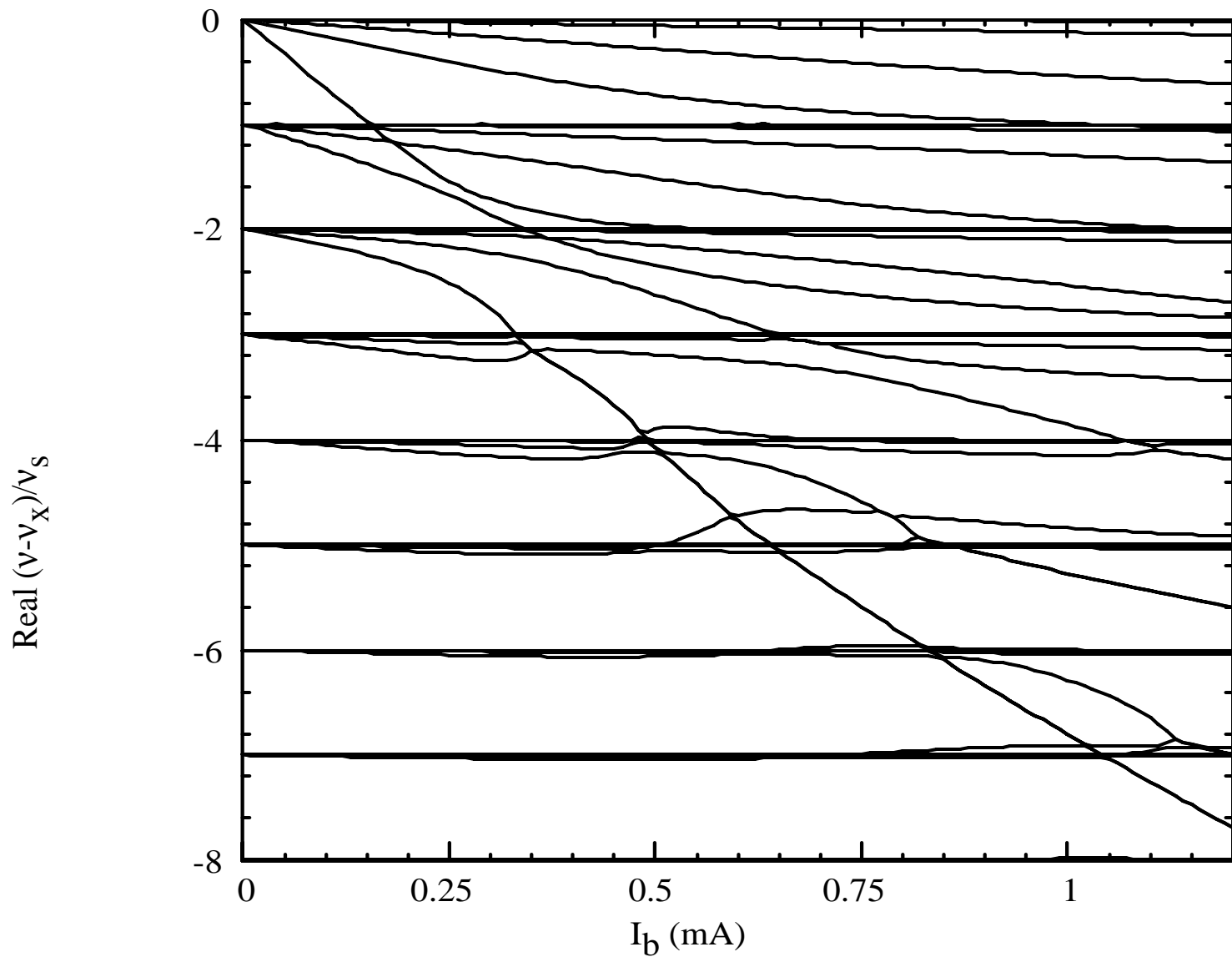


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QV = 0.800
LBIN = F
MU = 5

- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 12.00.16 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

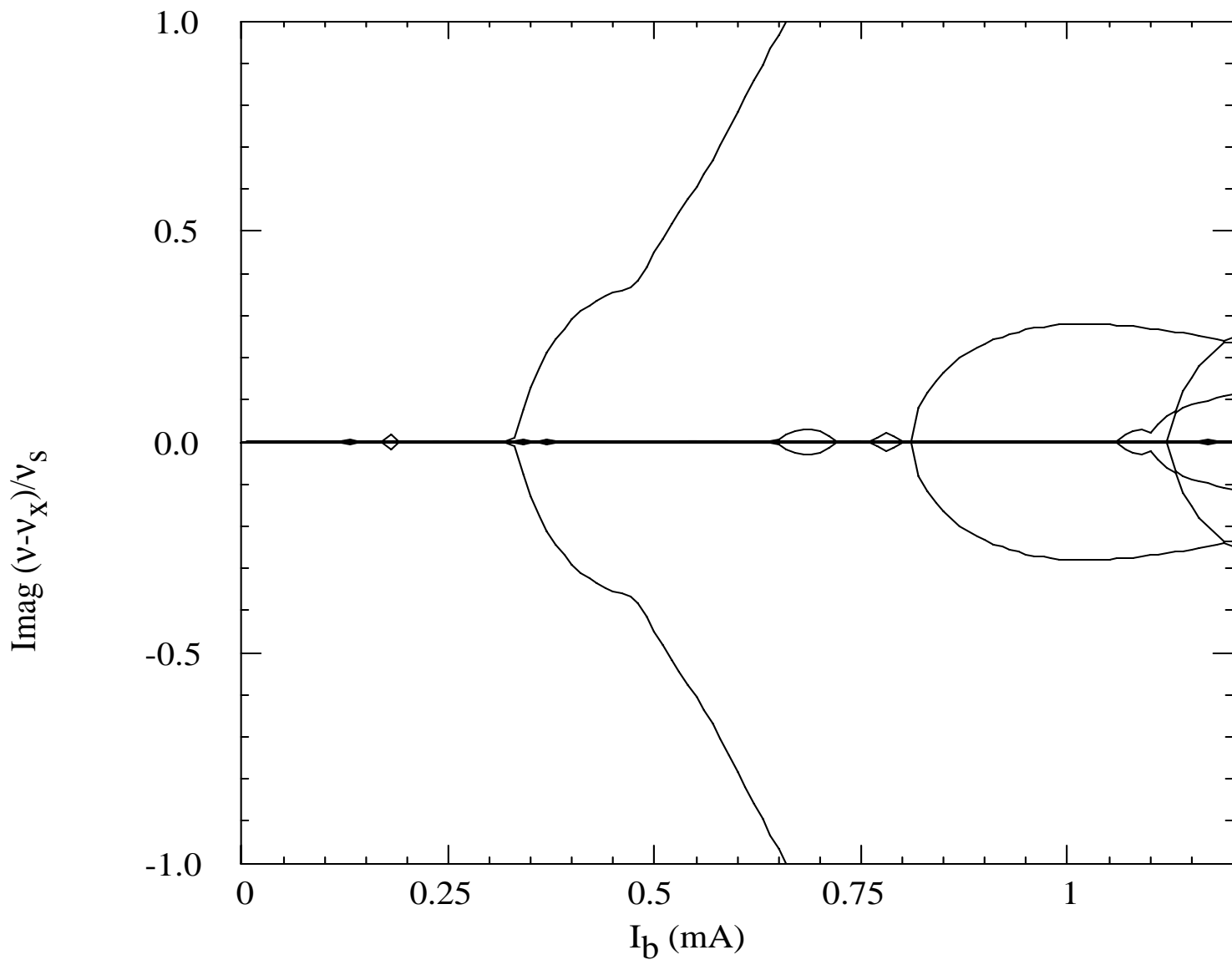


SPRD = 0.000E+00
NUS = 0.323E-02
ENGY = 26.0 (GeV)
SGMZ = 19.6 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.160E+04 (MHz)
RS = 13.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

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MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 12.00.16 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

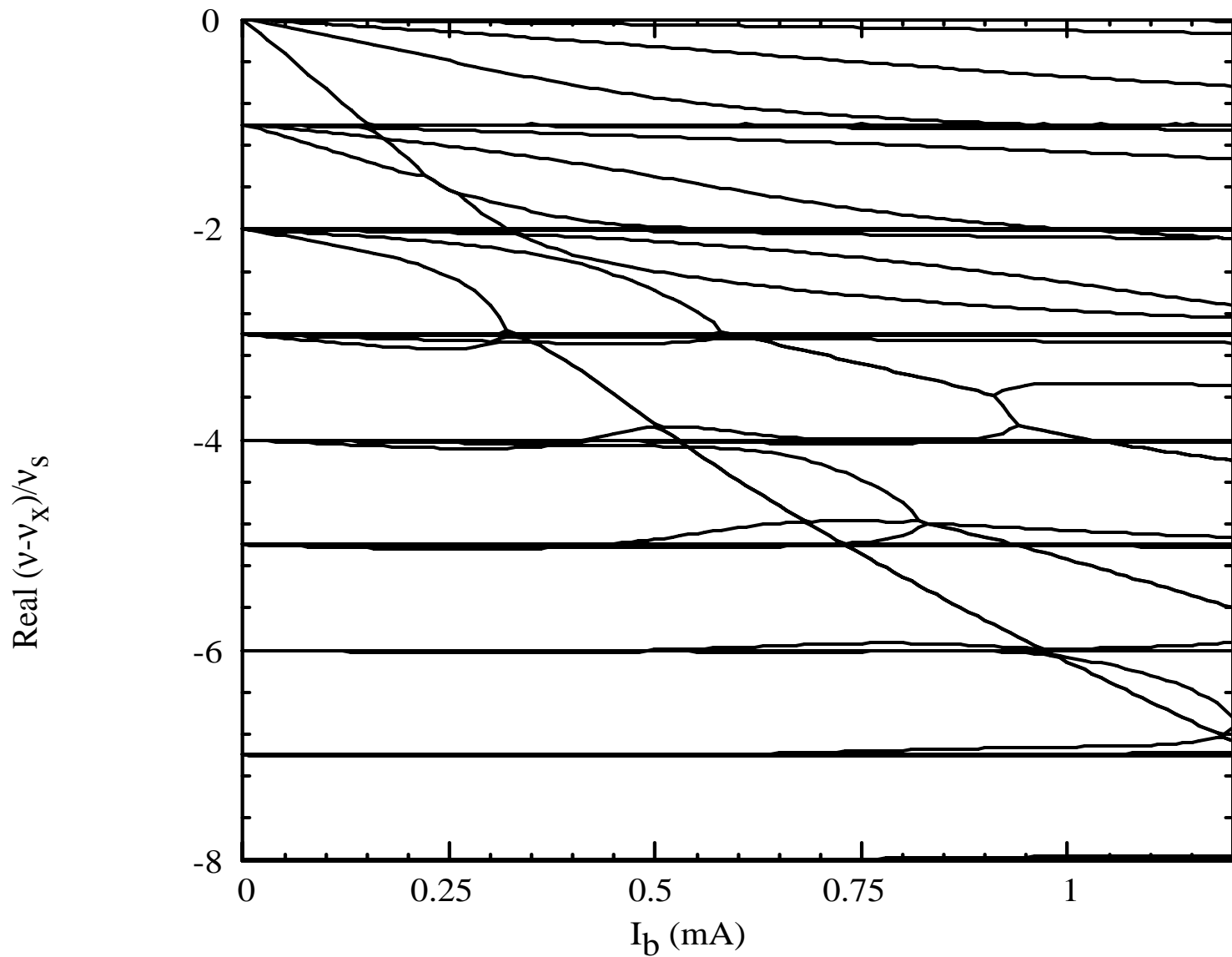


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ALPHA = 0.192E-02
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- Real Part of $(\nu - \nu_X)/\nu_S$ -

MOSES -- MODE COUPLING INSTABILITY IN SPS AT 26 GEV

12/10/04 14.36.20 VERSION 3.3 CPU TIME USED: 0.536-314 (s)

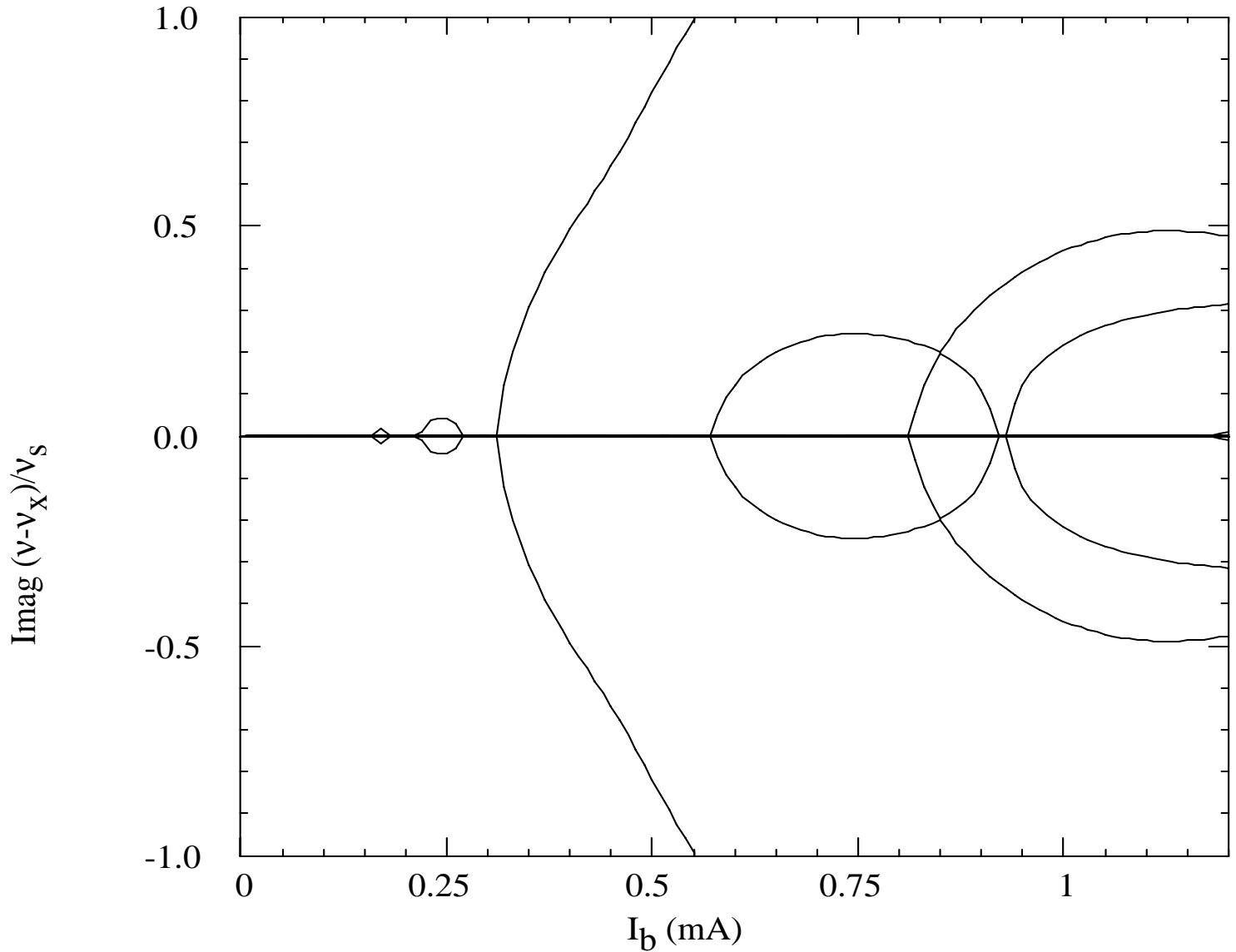


SPRD = 0.000E+00
NUS = 0.323E-02
ENGY = 26.0 (GeV)
SGMZ = 16.5 (cm)
BETAC = 40.0 (m)
REVFRQ= 0.433E-01 (MHz)
ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.150E+04 (MHz)
RS = 11.0 (M Ω /m)
QV = 0.800
LBIN = F
MU = 5

- Imaginary Part of $(v-v_X)/v_S$ -

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BETAC = 40.0 (m)
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ALPHA = 0.192E-02
CHORM = 0.000E+00
FREQ = 0.150E+04 (MHz)
RS = 11.0 (MOhm/m)
QV = 0.800
LBIN = F
MU = 5