Recent Configuration Studies
(with Paul Garabedian)

- **New configurations have been developed which are optimized for the vacuum.**

- **These configurations are characterized by:**

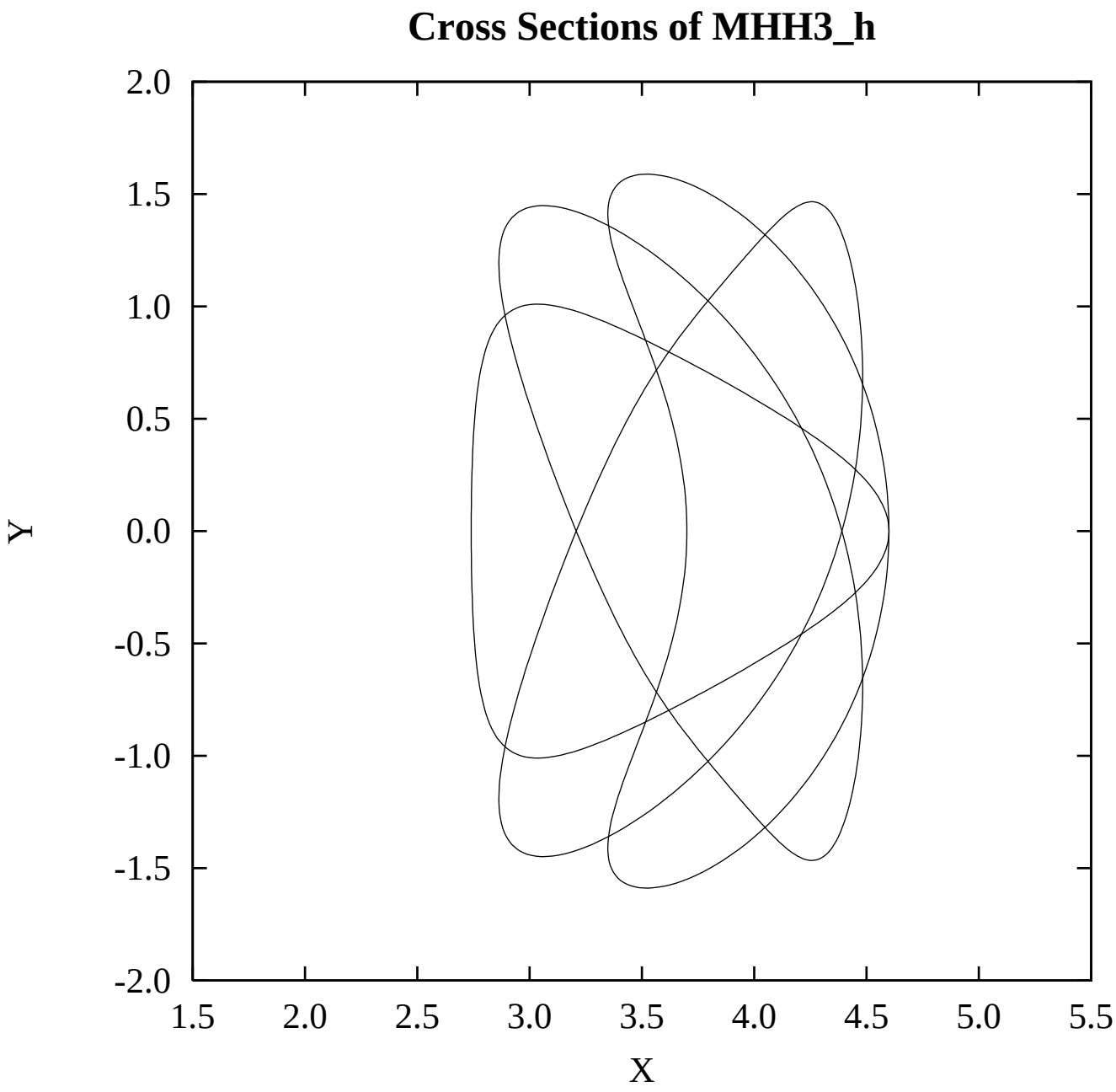
  - **3 field period,**
  - **aspect ratio -- 3.5-4.0,**
  - **rotational transform -- 0.06-0.12 per field period,**

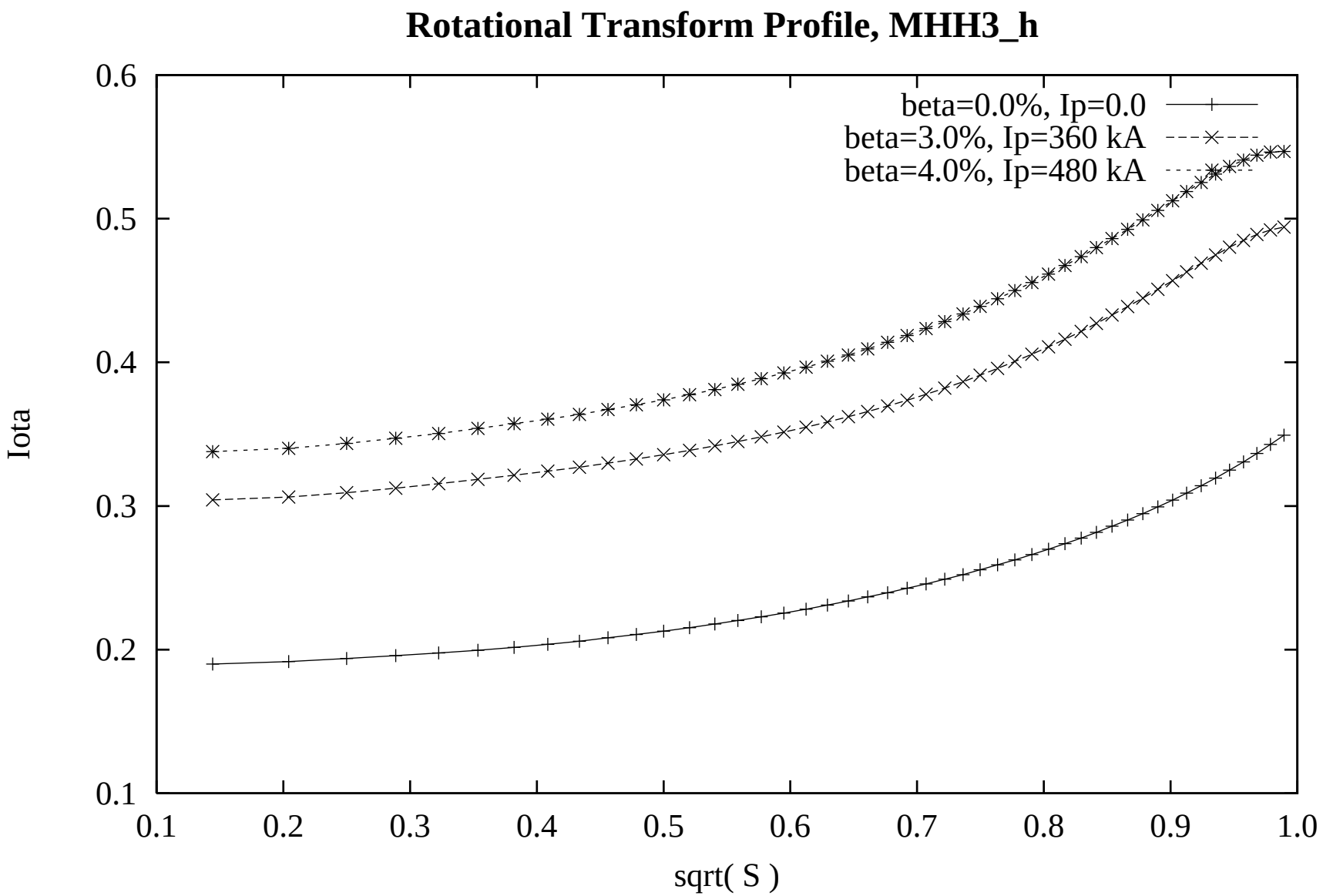
- good stellarator shear,
- deep magnetic well -- >7%,
- good surface shape.

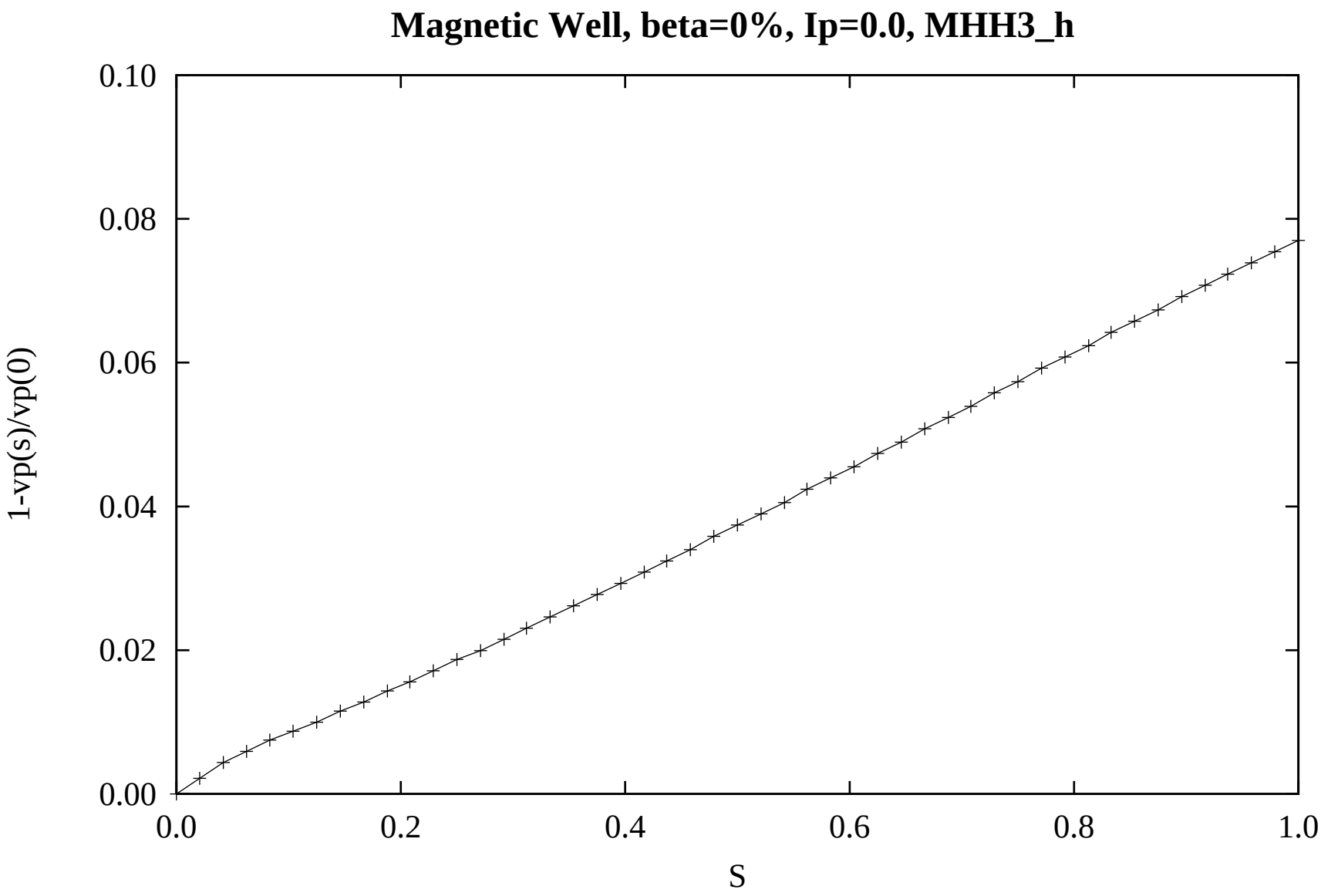
- **The critical beta to ballooning modes is > 3%. The critical beta depends on the amount of current and B(0,1).**

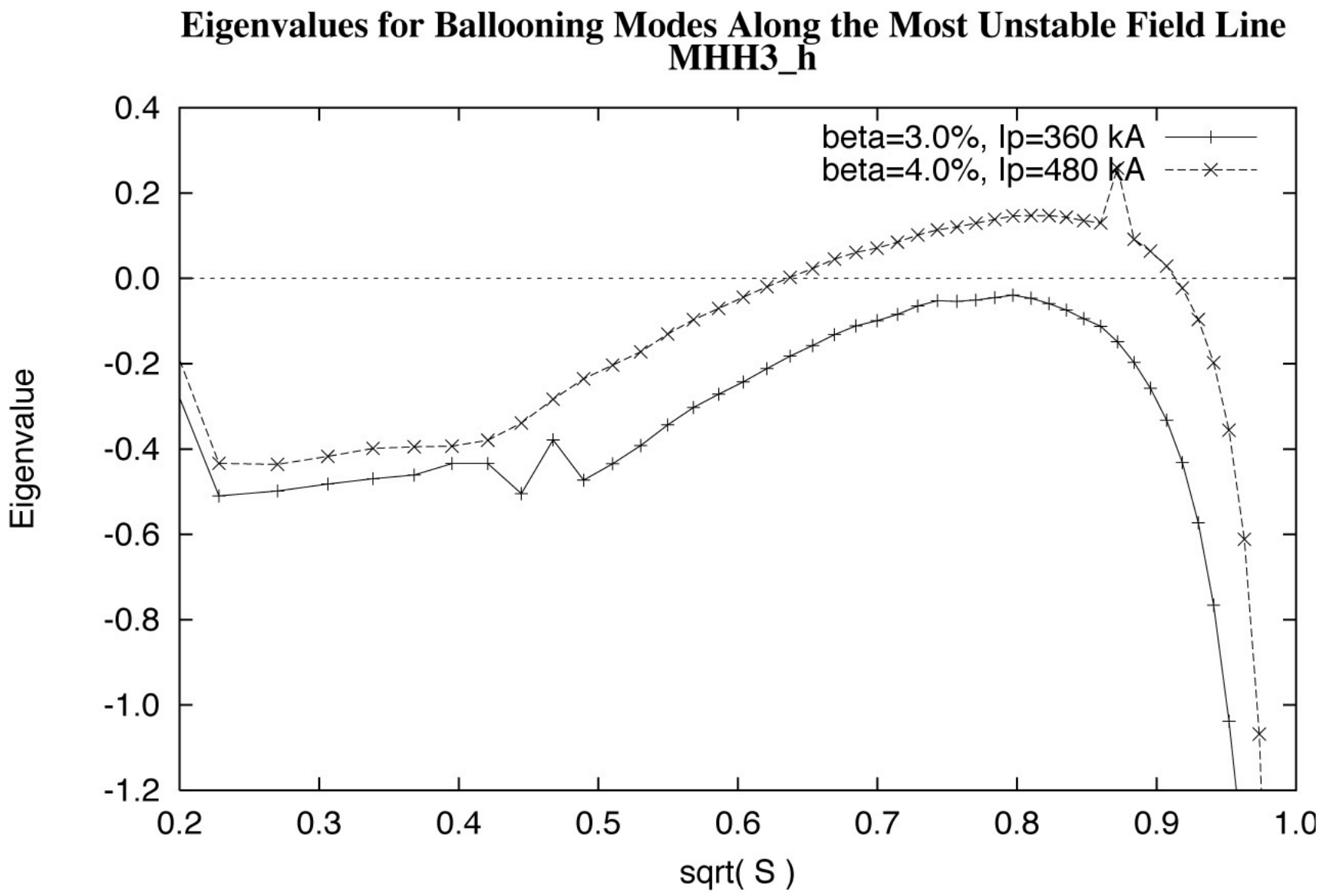
- **Quasi-symmetry is reasonable, but need further improvement.**

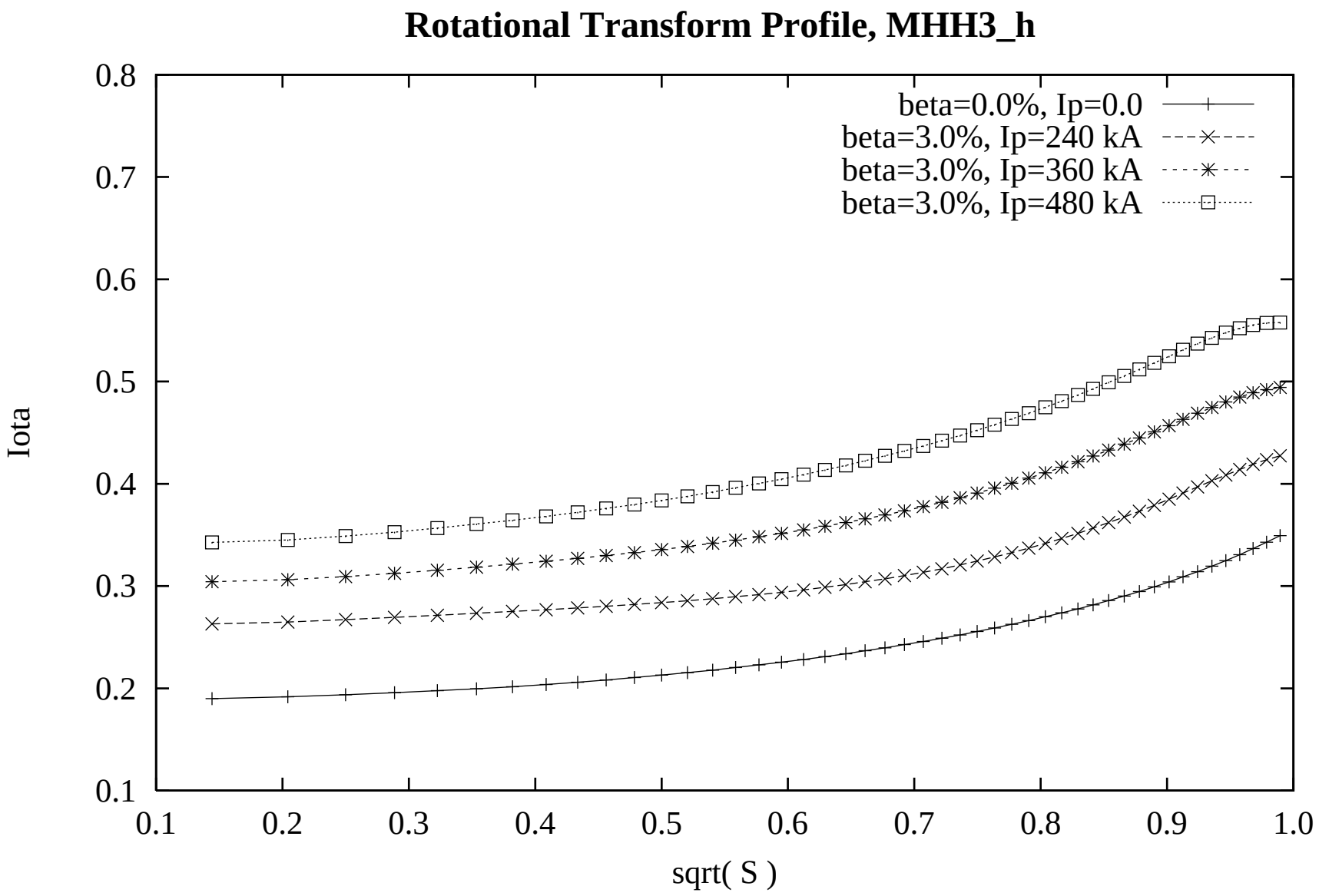
- **More detailed studies of transport and stability to low-n modes are in progress.**


Cross Sections of MHH3_h
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Y
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
X

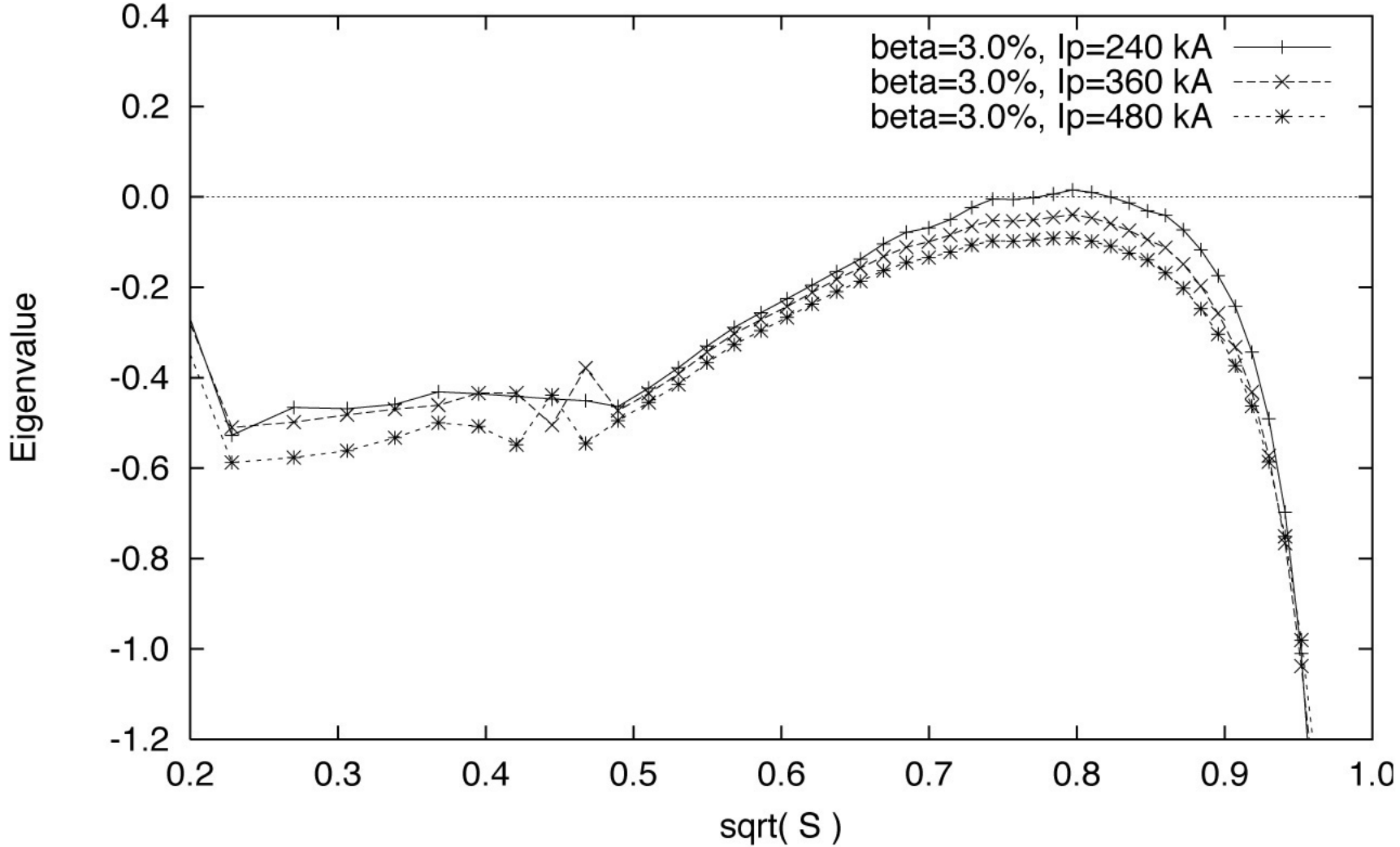

Rotational Transform Profile, MHH3_h
beta=0.0%, Ip=0.0
beta=3.0%, Ip=360 kA
beta=4.0%, Ip=480 kA
Iota
sqrt(S)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

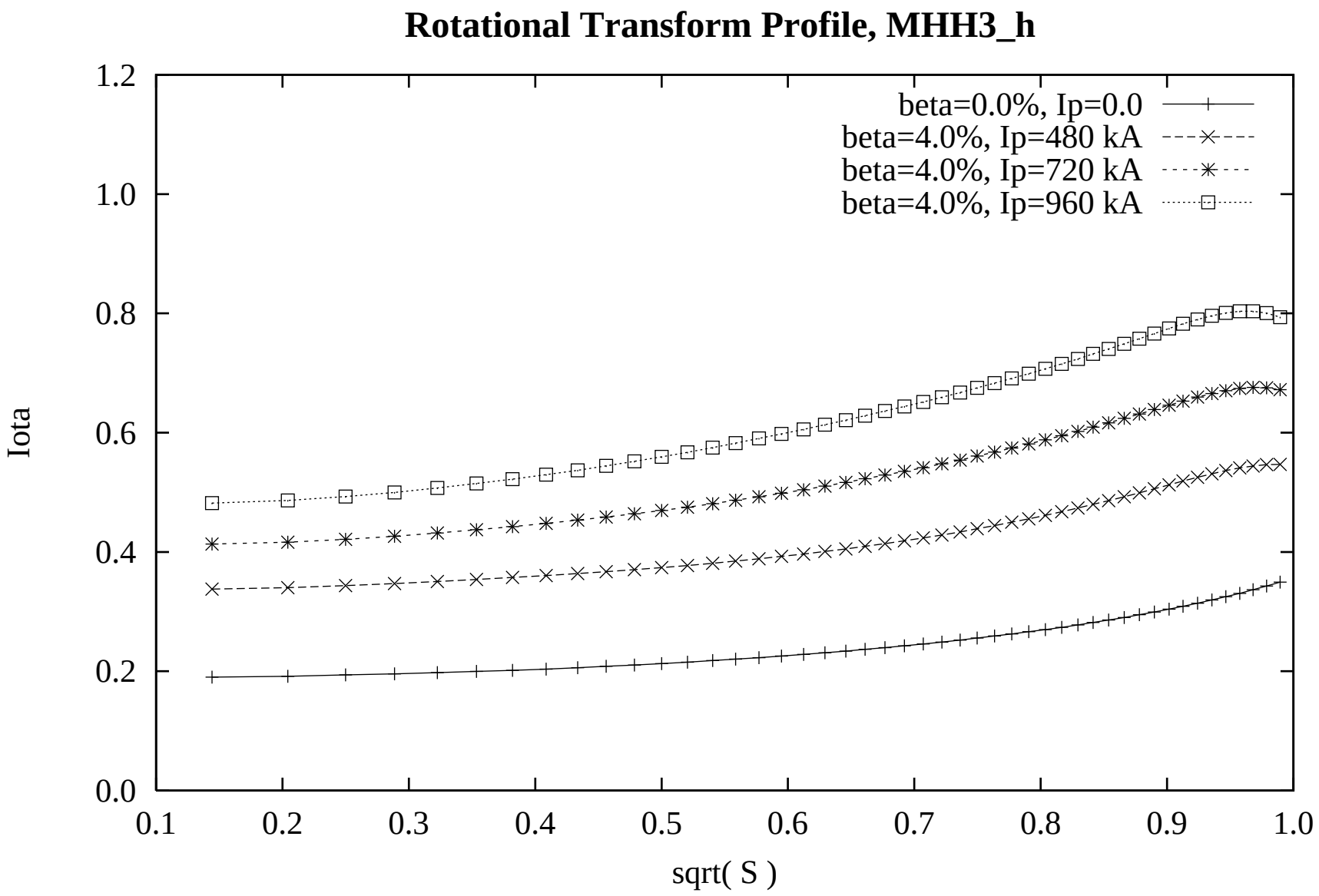

Magnetic Well, beta=0%, Ip=0.0, MHH3_h
0.10
0.08
0.06
0.04
0.02
0.00
1-vp(s)/vp(0)
0.0
0.2
0.4
0.6
0.8
1.0
S


Eigenvalues for Ballooning Modes Along the Most Unstable Field Line
MHH3_h
beta=3.0%, Ip=360 kA
beta=4.0%, Ip=480 kA
Eigenvalue
sqrt(S)
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

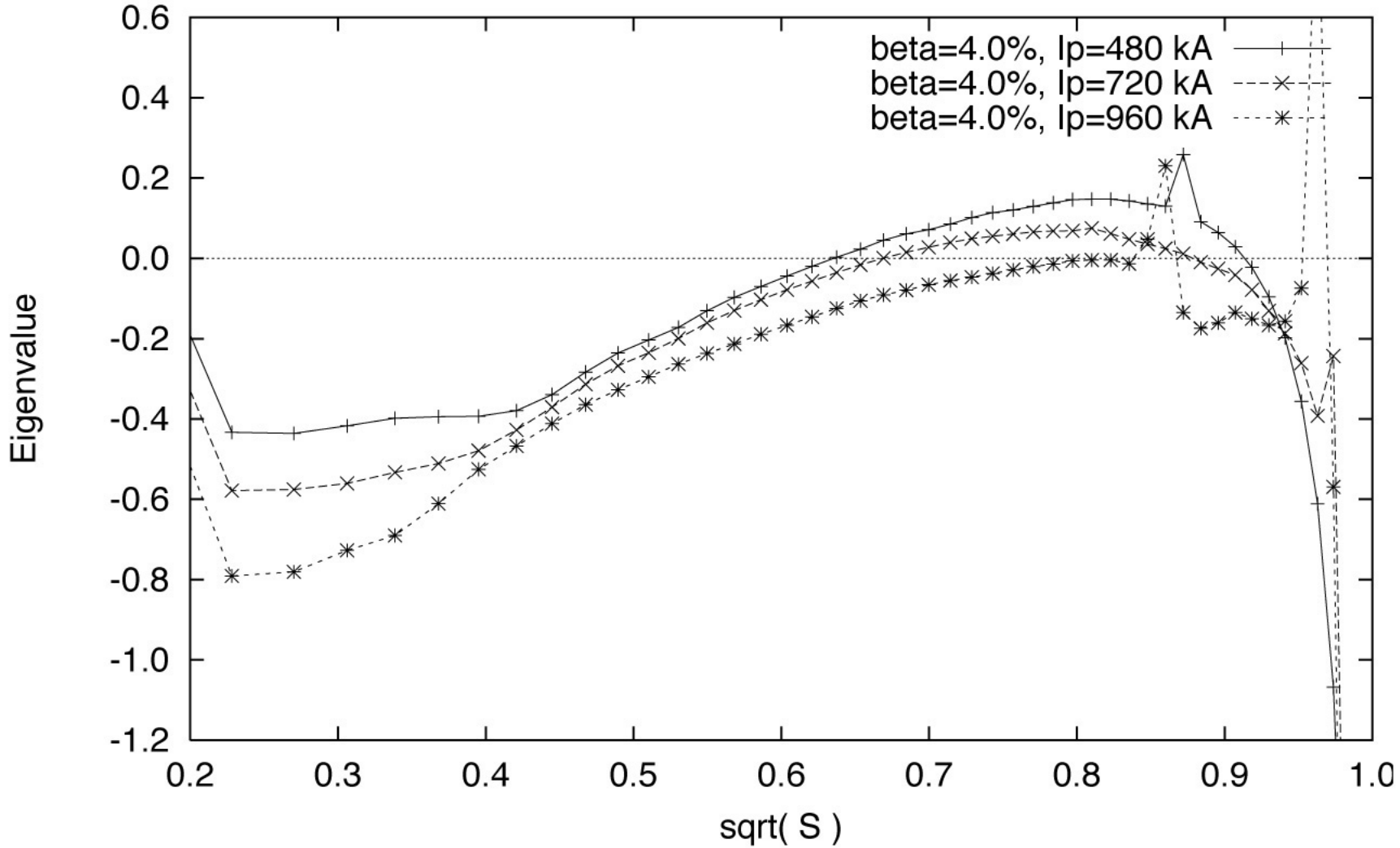

Rotational Transform Profile, MHH3_h
beta=0.0%, Ip=0.0
beta=3.0%, Ip=240 kA
beta=3.0%, Ip=360 kA
beta=3.0%, Ip=480 kA
Iota
sqrt(S)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

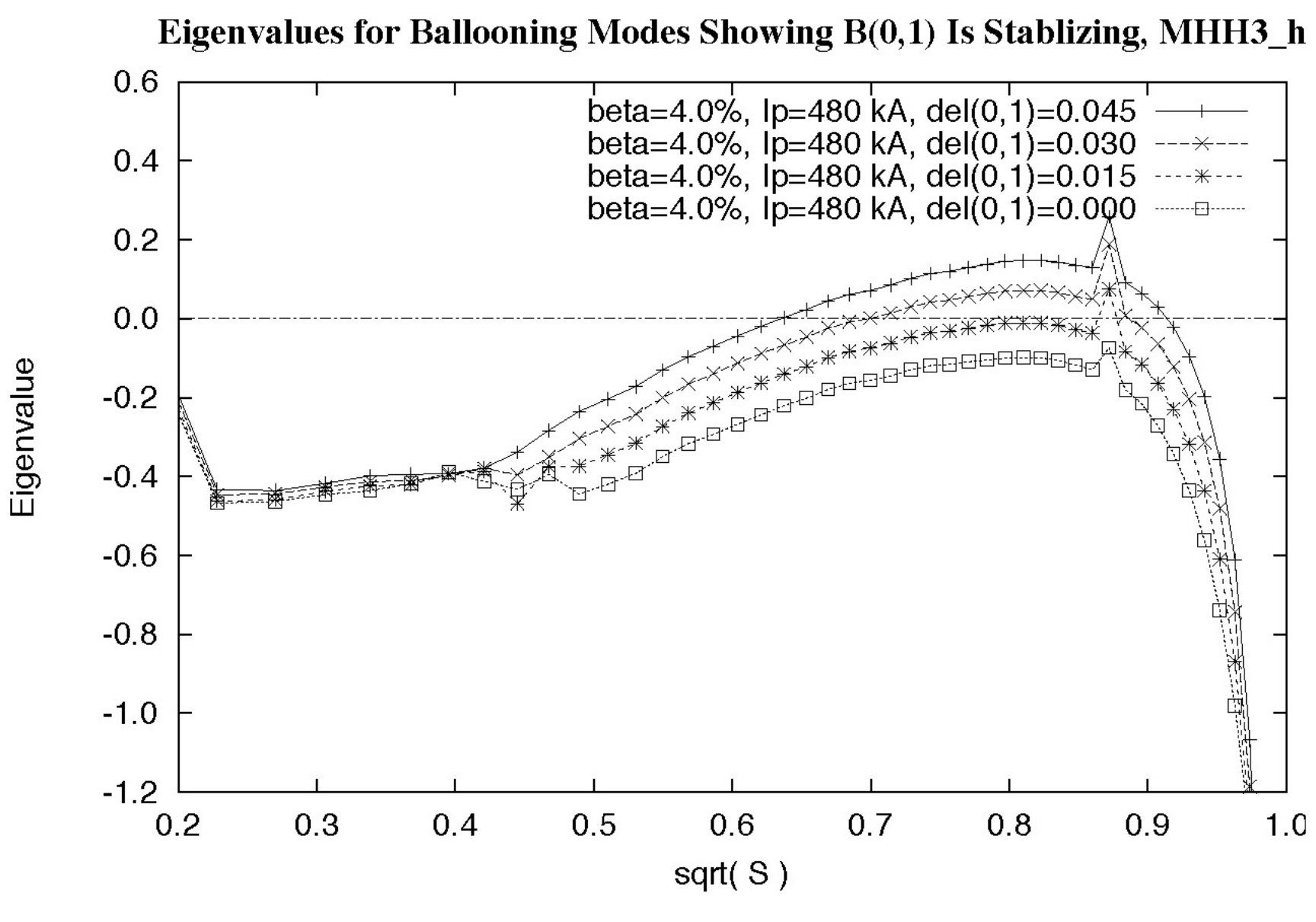
Eigenvalues for Ballooning Modes Showing Plasma Current Is Stablizing
MHH3_h

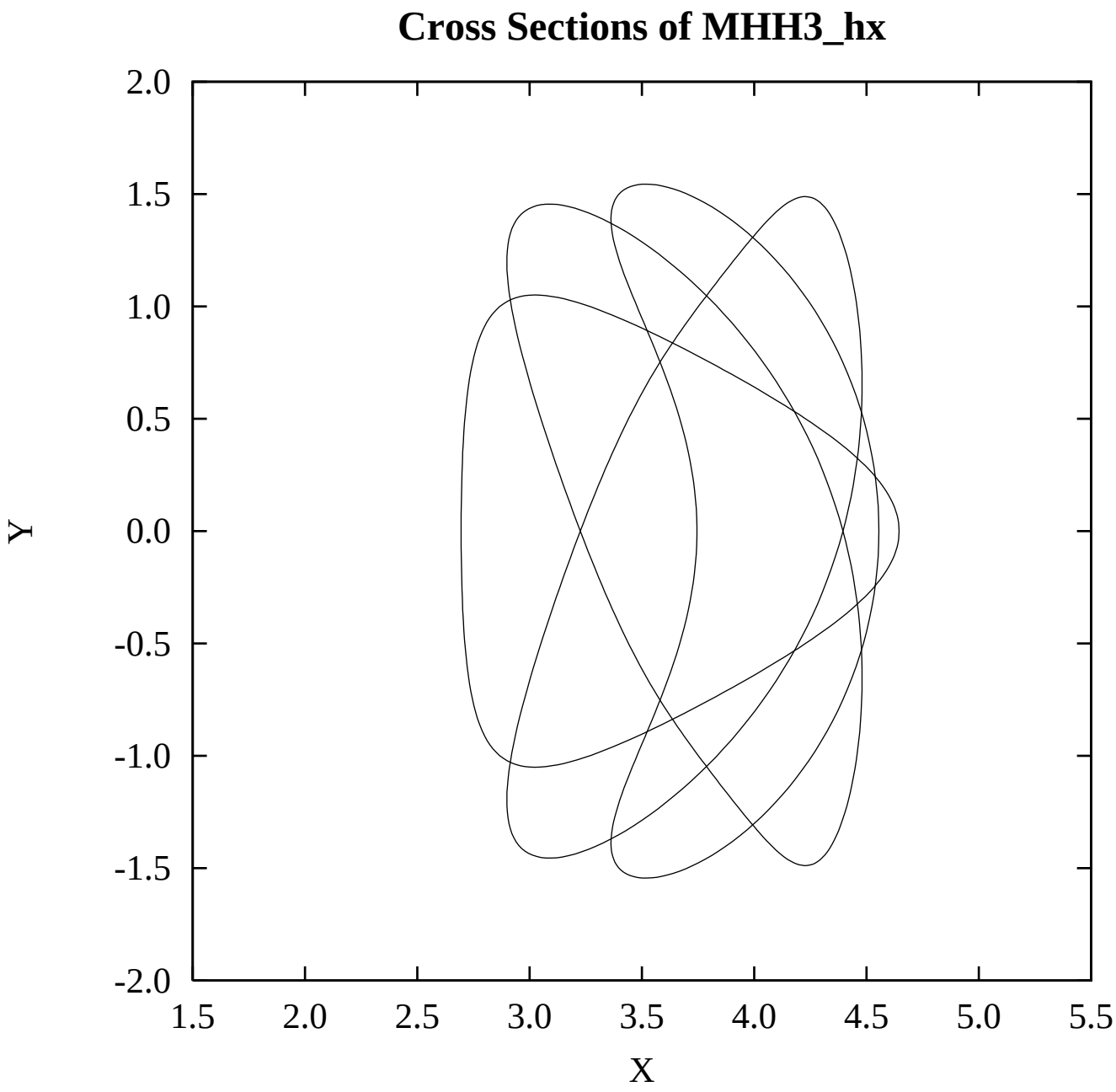


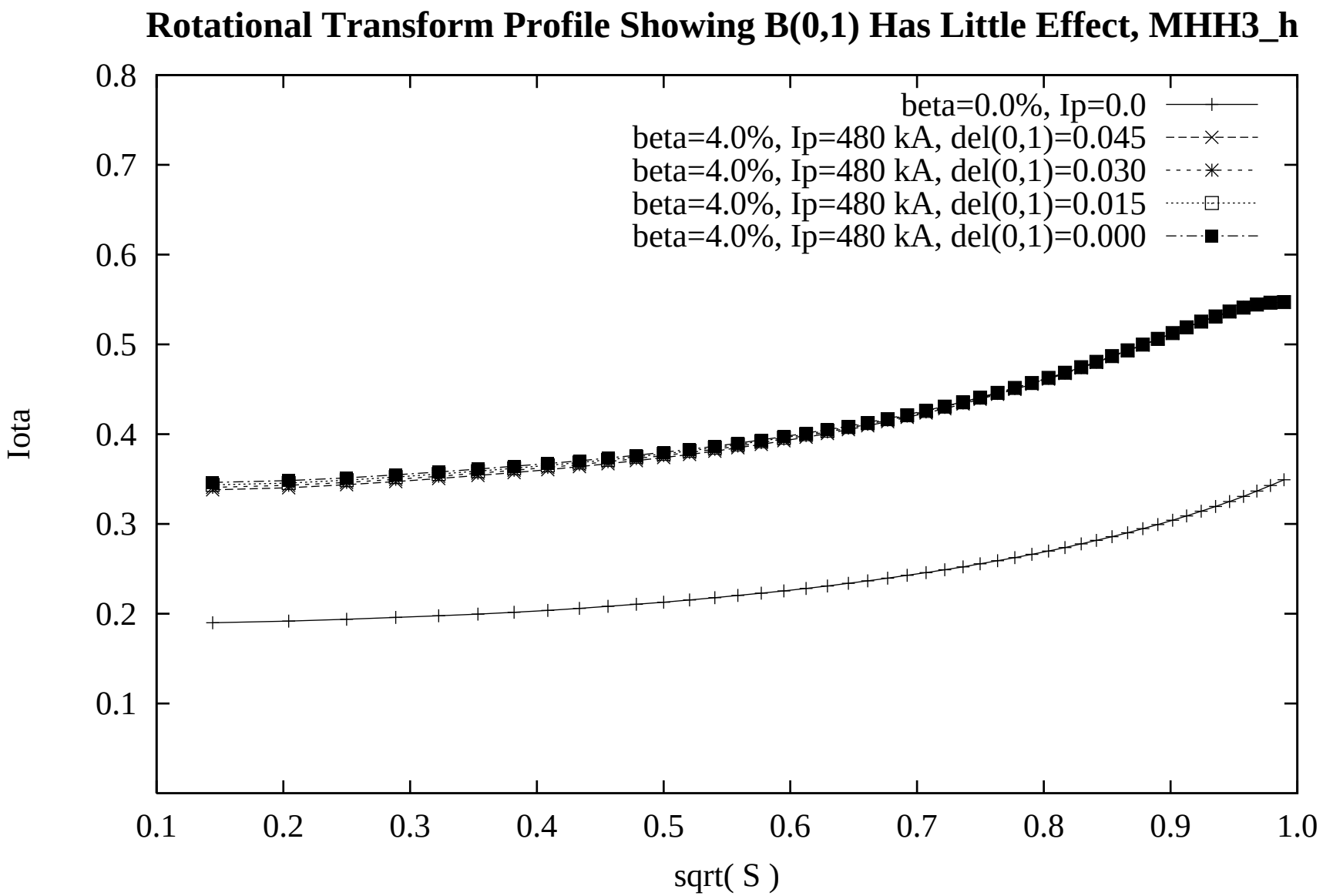

Rotational Transform Profile, MHH3_h
beta=0.0%, Ip=0.0
beta=4.0%, Ip=480 kA
beta=4.0%, Ip=720 kA
beta=4.0%, Ip=960 kA
Iota
sqrt(S)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

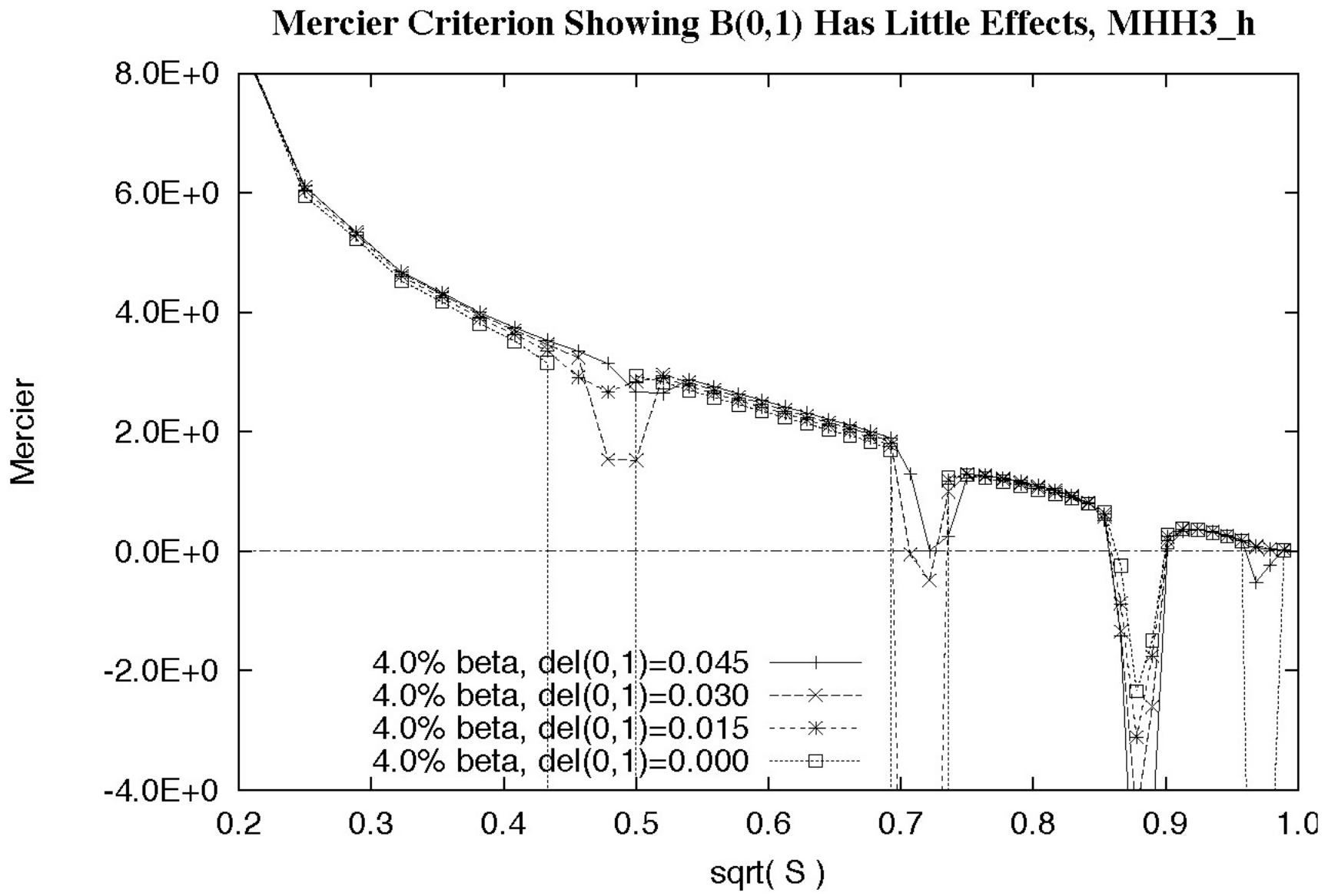
Eigenvalues for Ballooning Modes Showing Plasma Current Is Stablizing
MHH3_h

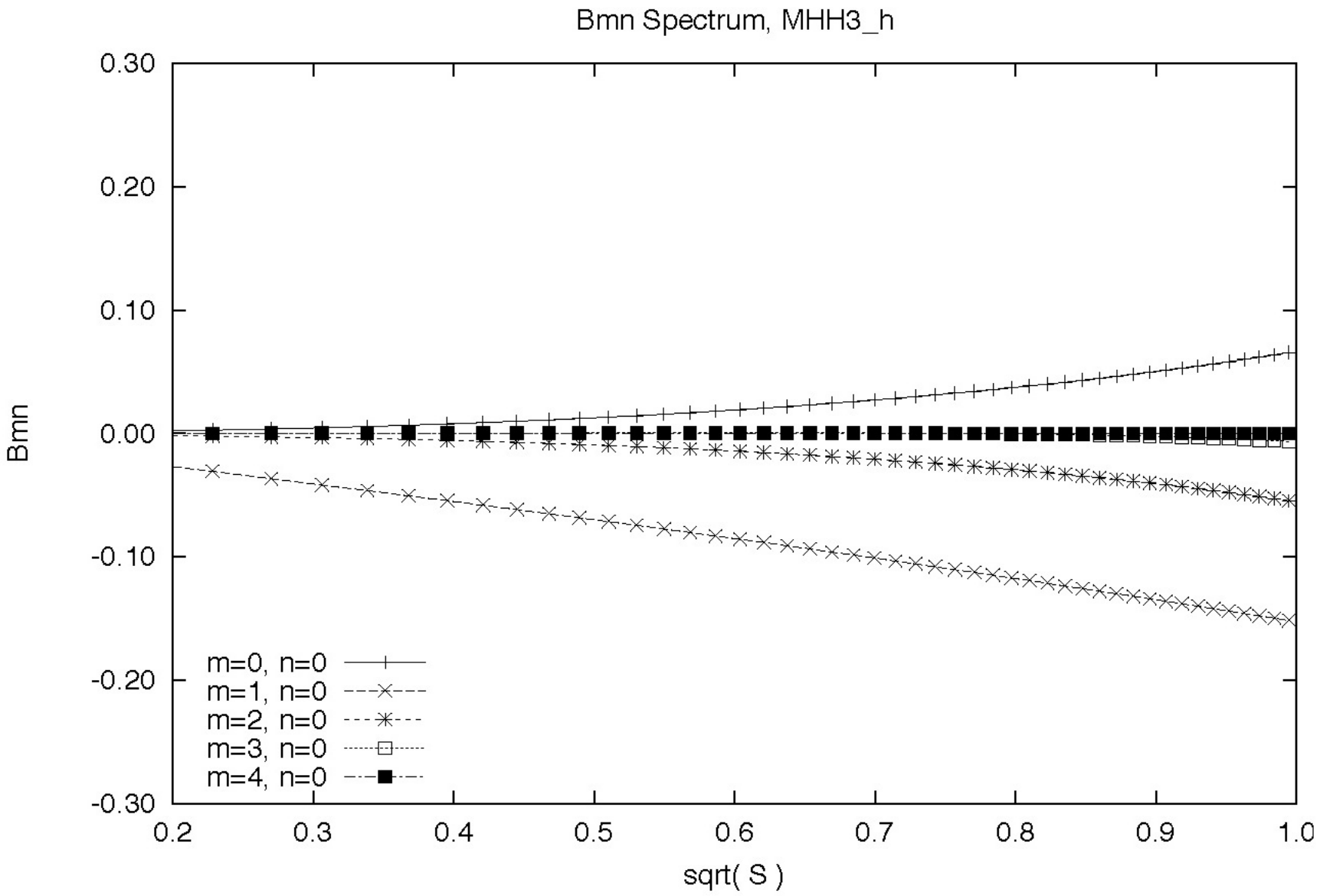


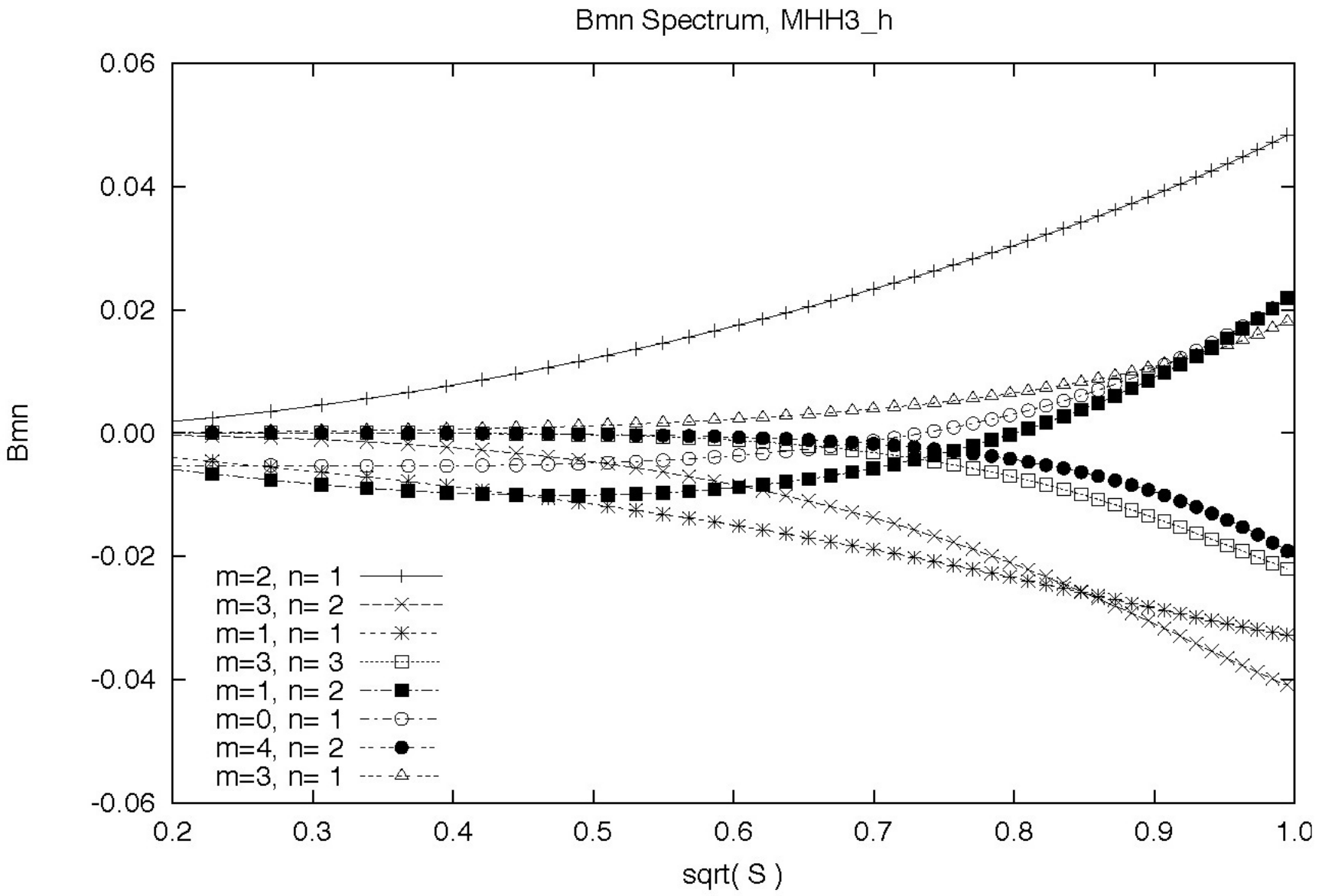

Eigenvalues for Ballooning Modes Showing B(0,1) Is Stablizing, MHH3_h
beta=4.0%, Ip=480 kA, del(0,1)=0.045
beta=4.0%, Ip=480 kA, del(0,1)=0.030
beta=4.0%, Ip=480 kA, del(0,1)=0.015
beta=4.0%, Ip=480 kA, del(0,1)=0.000
Eigenvalue
sqrt(S)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


Cross Sections of MHH3_hx
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Y
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
X


Rotational Transform Profile Showing B(0,1) Has Little Effect, MHH3_h
beta=0.0%, Ip=0.0
beta=4.0%, Ip=480 kA, del(0,1)=0.045
beta=4.0%, Ip=480 kA, del(0,1)=0.030
beta=4.0%, Ip=480 kA, del(0,1)=0.015
beta=4.0%, Ip=480 kA, del(0,1)=0.000
Iota
sqrt(S)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0


Mercier Criterion Showing B(0,1) Has Little Effects, MHH3_h
8.0E+0
6.0E+0
4.0E+0
2.0E+0
0.0E+0
-2.0E+0
-4.0E+0
Mercier
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
sqrt(S)
4.0% beta, del(0,1)=0.045
4.0% beta, del(0,1)=0.030
4.0% beta, del(0,1)=0.015
4.0% beta, del(0,1)=0.000


Bmn Spectrum, MHH3_h
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
Bmn
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
sqrt(S)
m=0, n=0
m=1, n=0
m=2, n=0
m=3, n=0
m=4, n=0


Bmn Spectrum, MHH3_h
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
Bmn
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
sqrt(S)
m=2, n= 1
m=3, n= 2
m=1, n= 1
m=3, n= 3
m=1, n= 2
m=0, n= 1
m=4, n= 2
m=3, n= 1