Stability Issues for QAS3_C10

- In the Project Review in September, 1998, we stated that QAS3_C10 was stable to the kink and ballooning modes with an appropriate choice of the pressure and current profiles.

- The calculations for kink were based on a displacement mode table which contains 38 modes:

  n=1, m=0, 13; n=-1, m=1, 7; n=4, m=0, 8; n=7, m=6, 13

- Convergence studies, however, showed that QAS3_C10 was unstable when more displacement modes were included.

- Re-stabilizing C10 leads to a revised configuration, QAS3_C76 (Fig.1 and 2).

Cont.

- Stability calculations leading to the development of C76 were based on a displacement mode table containing 91 modes:

  n=1, m=0, 14; n=-1, m=1, 8; n=2, m=0, 15; n=-2, m=1, 4;
  n=4, m=1, 14; n=5, m=2,16; n=7, m=0, 18

  - With this mode table, the growth rate (λ), for QAS3_C10 is 0.0014 and the dominant mode is (3,1).
  - λ for QAS3_C76 is ~0.00003 and the dominant modes are (9,4) and (5,2).

- A study is under way to include even more modes to check the stability.

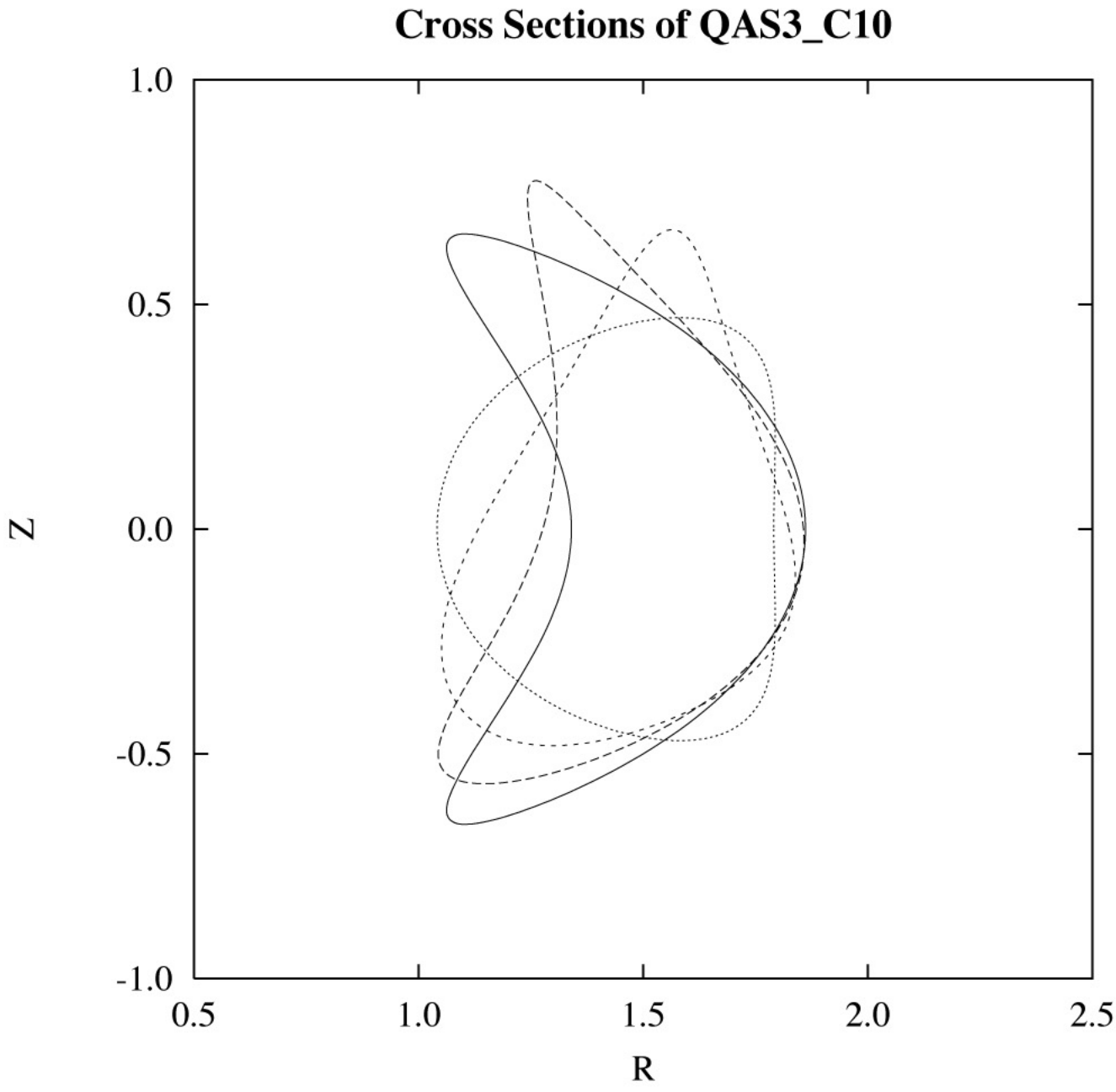
Cont.

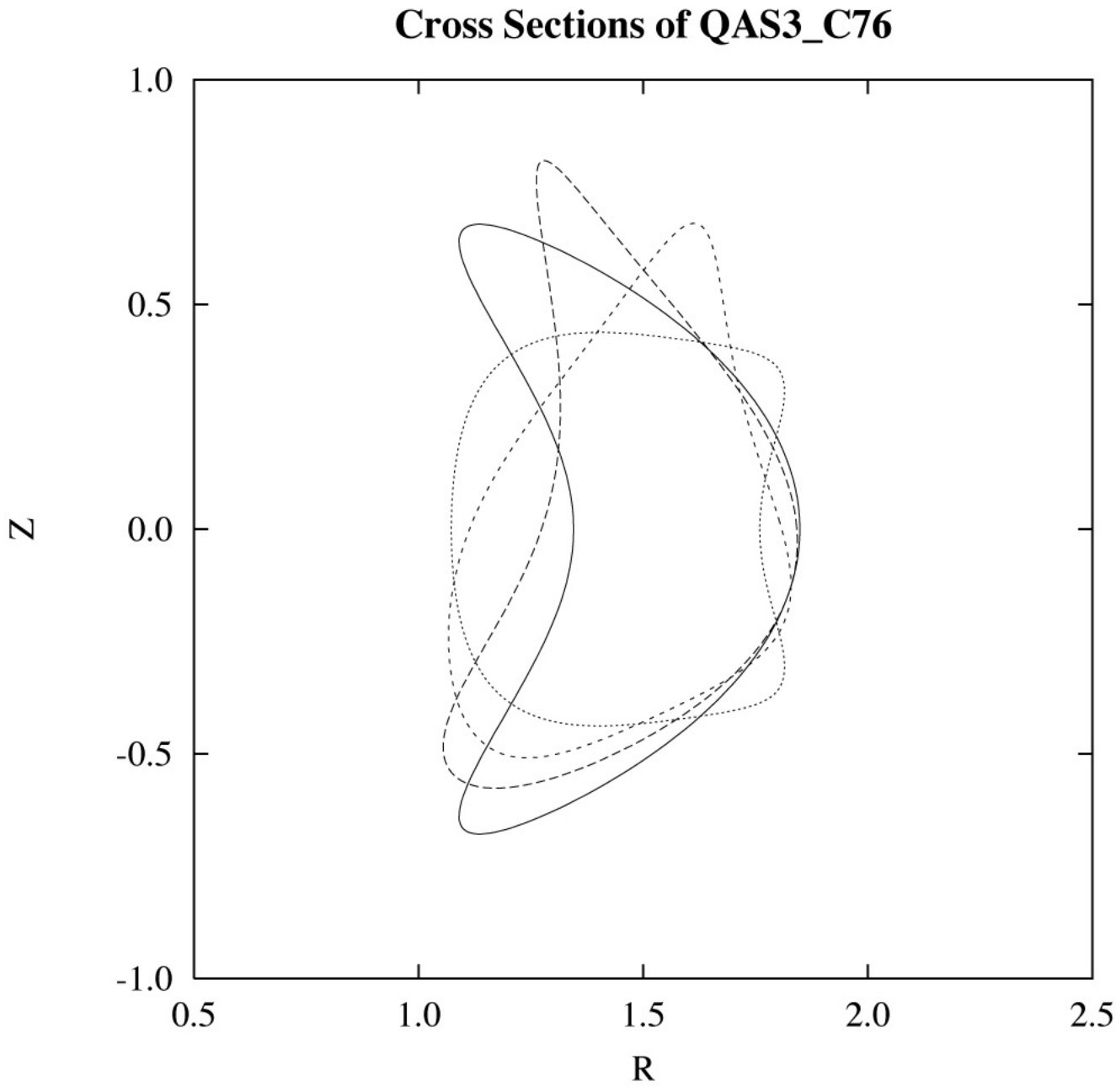
- QAS3_C76 has about the same chi-square for the Bmns as QAS3_C10, but it has more secondary ripple wells in the outer region (Fig. 3 and 4).

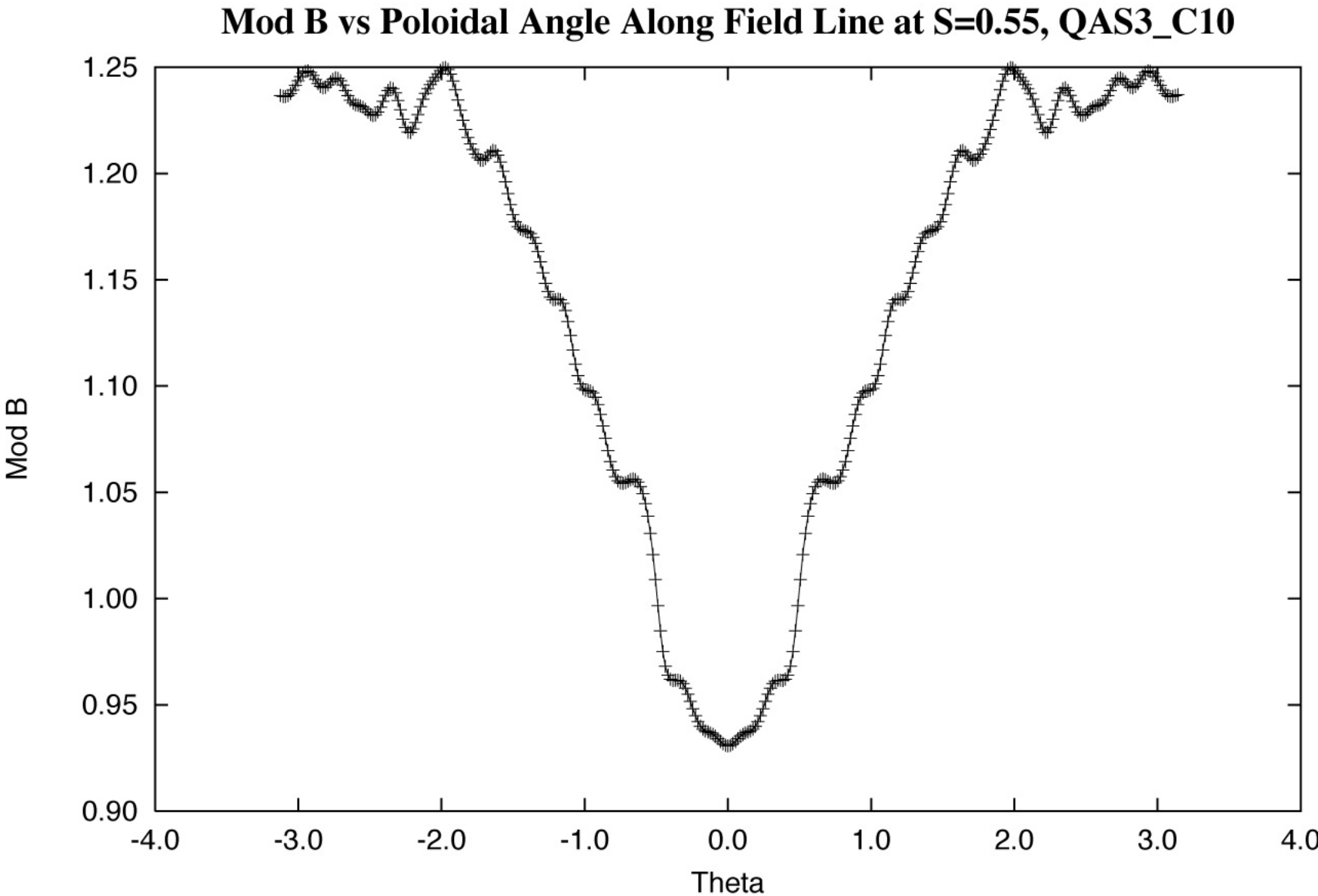
- A study is underway to improve the transport by specifically targeting the ripple wells.

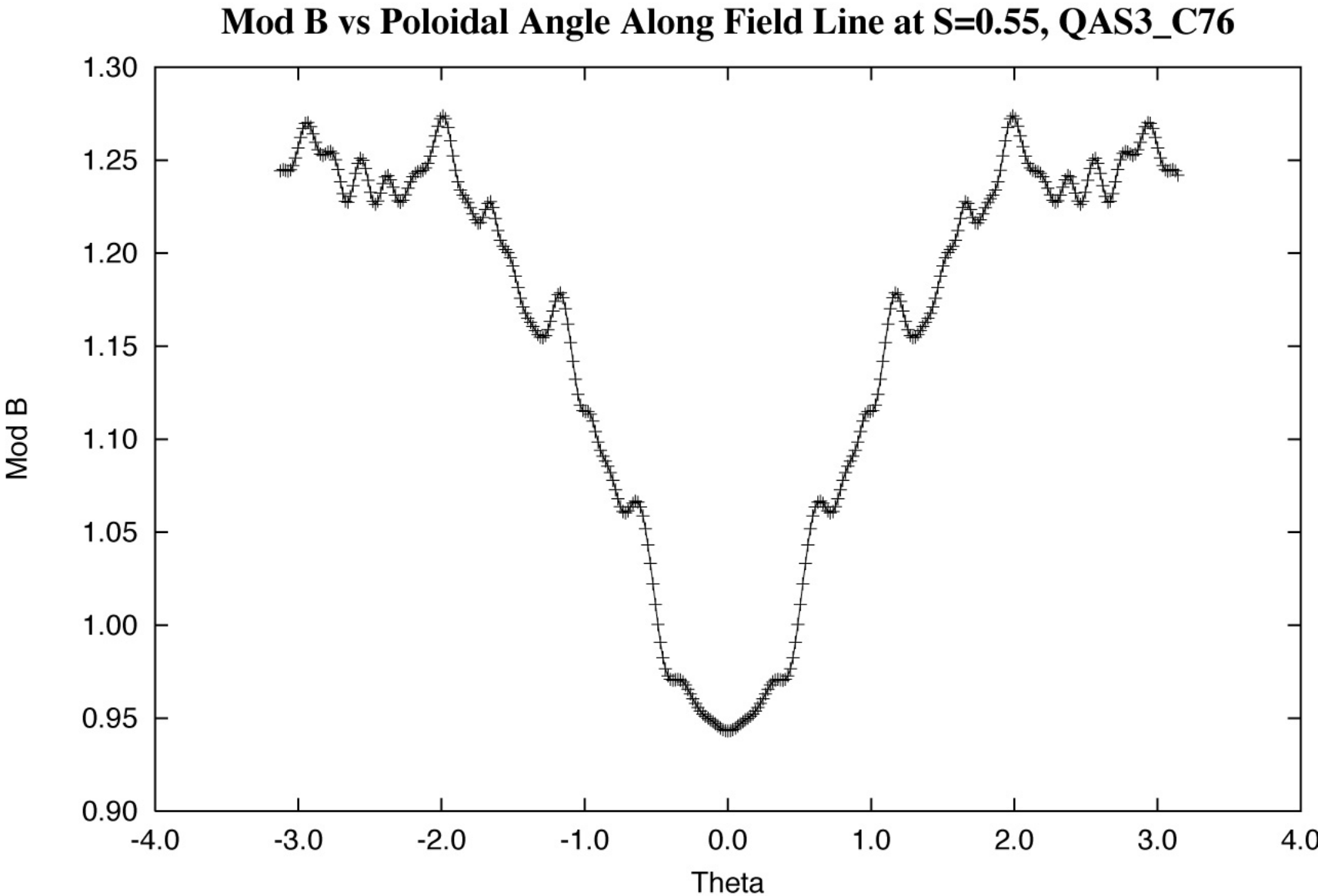
- We have also tried to stabilize C10 using the technique of local corrugation (Furth-Hartman coils). With a corrugation amplitude of 10-15% of the minor radius, poloidal width 1.0, m=4, and n=1 that have been used before, little effect to the kink growth rate is observed.

- Calculations of ballooning stability for C76 are underway, but we have experienced some numerical difficulties. Preliminary results indicated that the pressure profile for stable C10 will also make C76 stable to ballooning.


Cross Sections of QAS3_C10
1.0
0.5
0.0
-0.5
-1.0
Z
0.5
1.0
1.5
2.0
2.5
R


Cross Sections of QAS3_C76
1.0
0.5
0.0
-0.5
-1.0
Z
0.5
1.0
1.5
2.0
2.5
R


Mod B vs Poloidal Angle Along Field Line at S=0.55, QAS3_C10
Mod B
Theta
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0


Mod B vs Poloidal Angle Along Field Line at S=0.55, QAS3_C76
Mod B
Theta
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0