

Bariery rozszczepieniowe najcięższych jąder

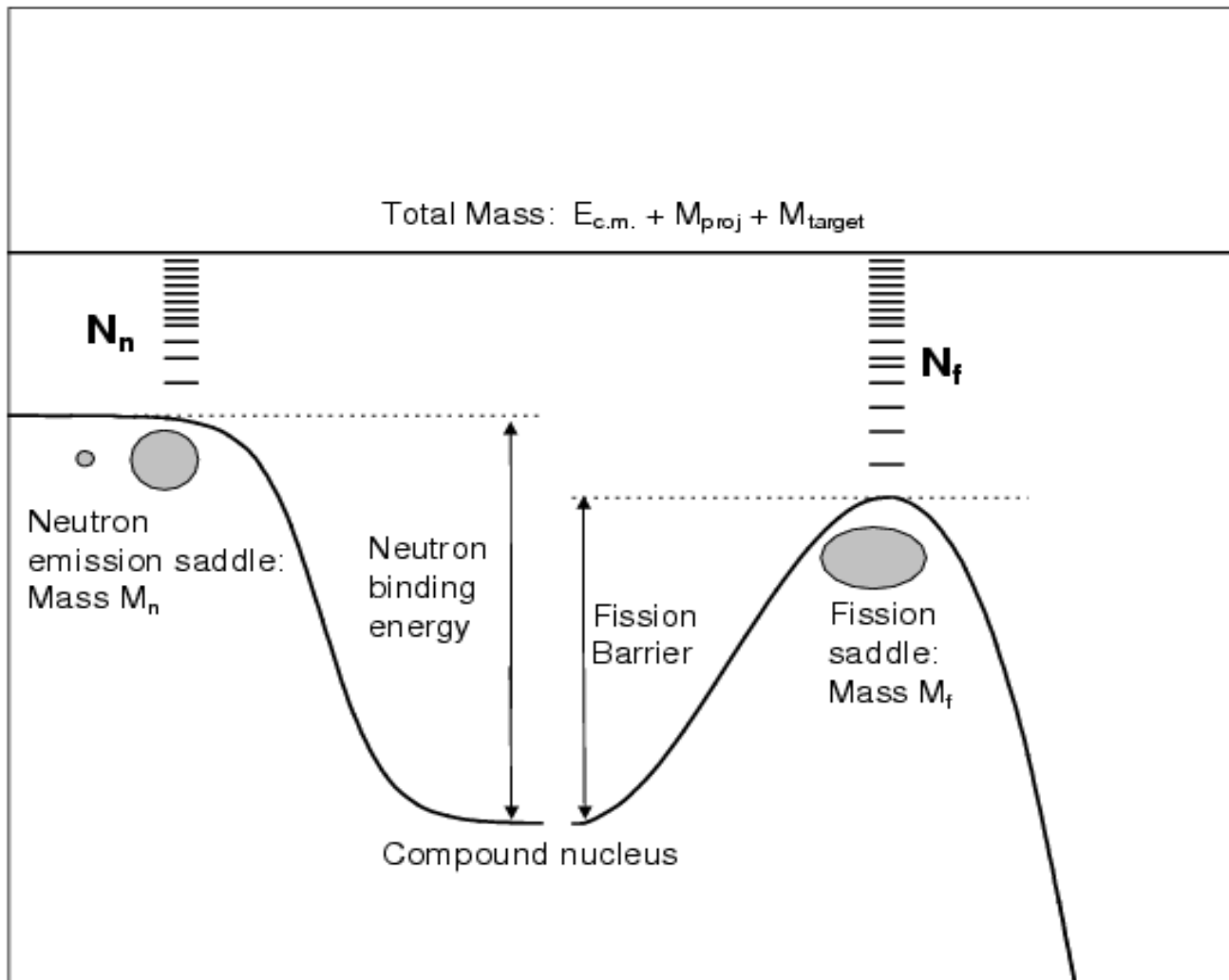
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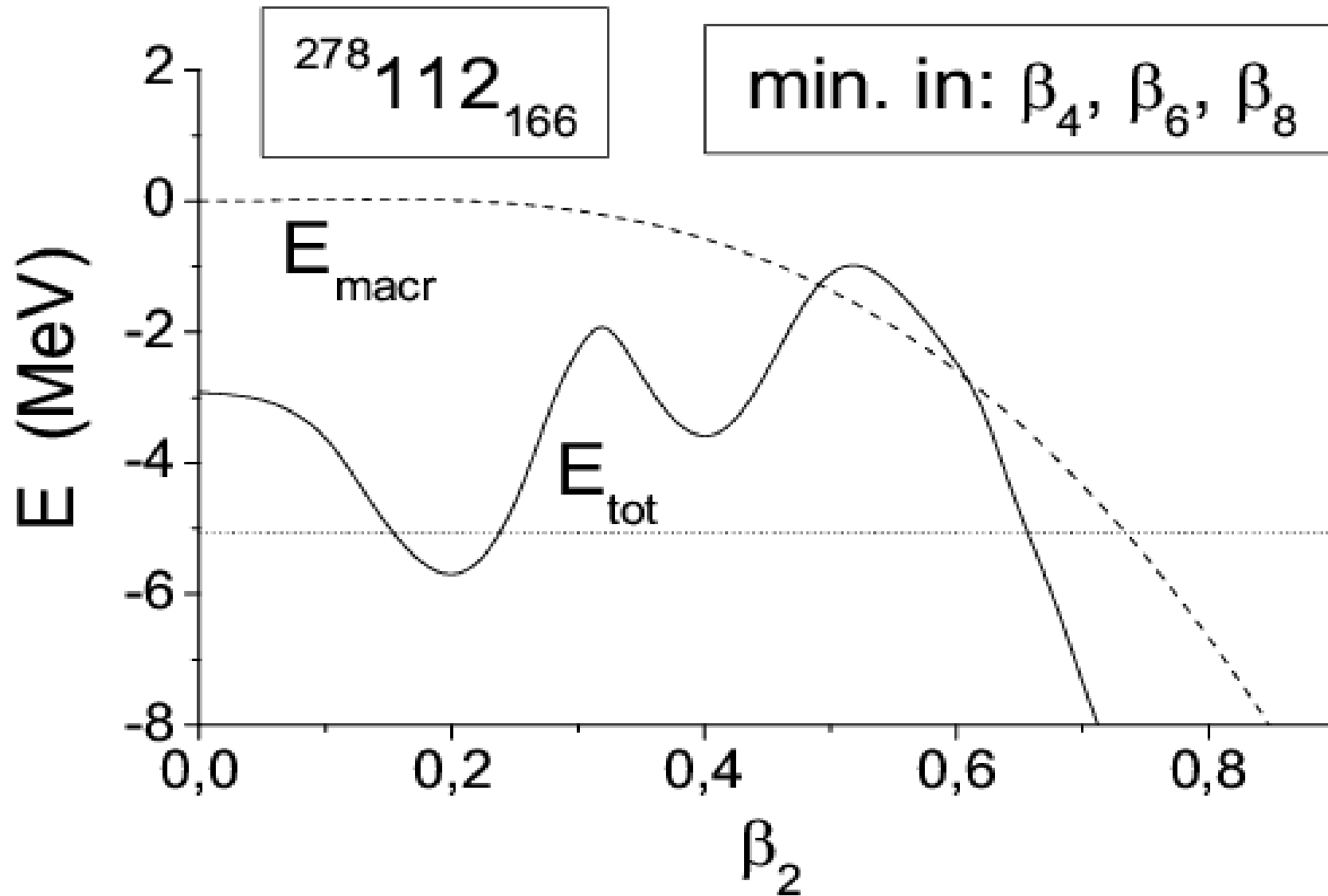
Instytut Problemów Jądrowych

- I. Wstęp
- II. Metoda obliczeń
- III. Przestrzeń deformacji
- IV. Wyniki i dyskusja
 - 1. Deformacja jądra w punktach równowagi i siodłowym oraz jej wpływ na B_f
 - 2. Efekt struktury powłokowej na energię pot. jądra w punktach równowagi i siodłowym
- V. Wnioski

I. Introduction

1. Two main problems with heaviest nuclei (HN):
 - **cross sections** σ (~ 1 pb \rightarrow ~ 50 fb) $\leftarrow B_f^{\text{st}}$
 - **half-lives**
2. Present state of HN (map of HN)
3. Role of B_f^{st} -
 - sensitivity of σ to B_f^{st}
 - a need for a **large accuracy of B_f^{st}**
4. Two configurations important for B_f^{st}
 - **eq. and s.p.** (example of fission barrier)





The barrier: **thin but high,**
created totally by shell effects

$$R(\vartheta, \varphi) = R_0 \left\{ 1 + \beta_2 \left[\cos \gamma_2 Y_{20} + \sin \gamma_2 Y_{22}^{(+)} \right] \right. \\ \left. + \beta_4 Y_{40} + \beta_6 Y_{60} + \beta_8 Y_{80} \right. \\ \left. + \beta_3 Y_{30} + \beta_5 Y_{50} + \beta_7 Y_{70} \right\},$$

II. Method

Macro-micro (same as used for description of many properties of HN)

$$E_{\text{tot}} = E_{\text{macr}} + E_{\text{micr}}$$

$$E_{\text{macr}} = \text{Yukawa} + \text{exp}$$

$$E_{\text{micr}} = \text{shell corr.}$$

III. Deformation space

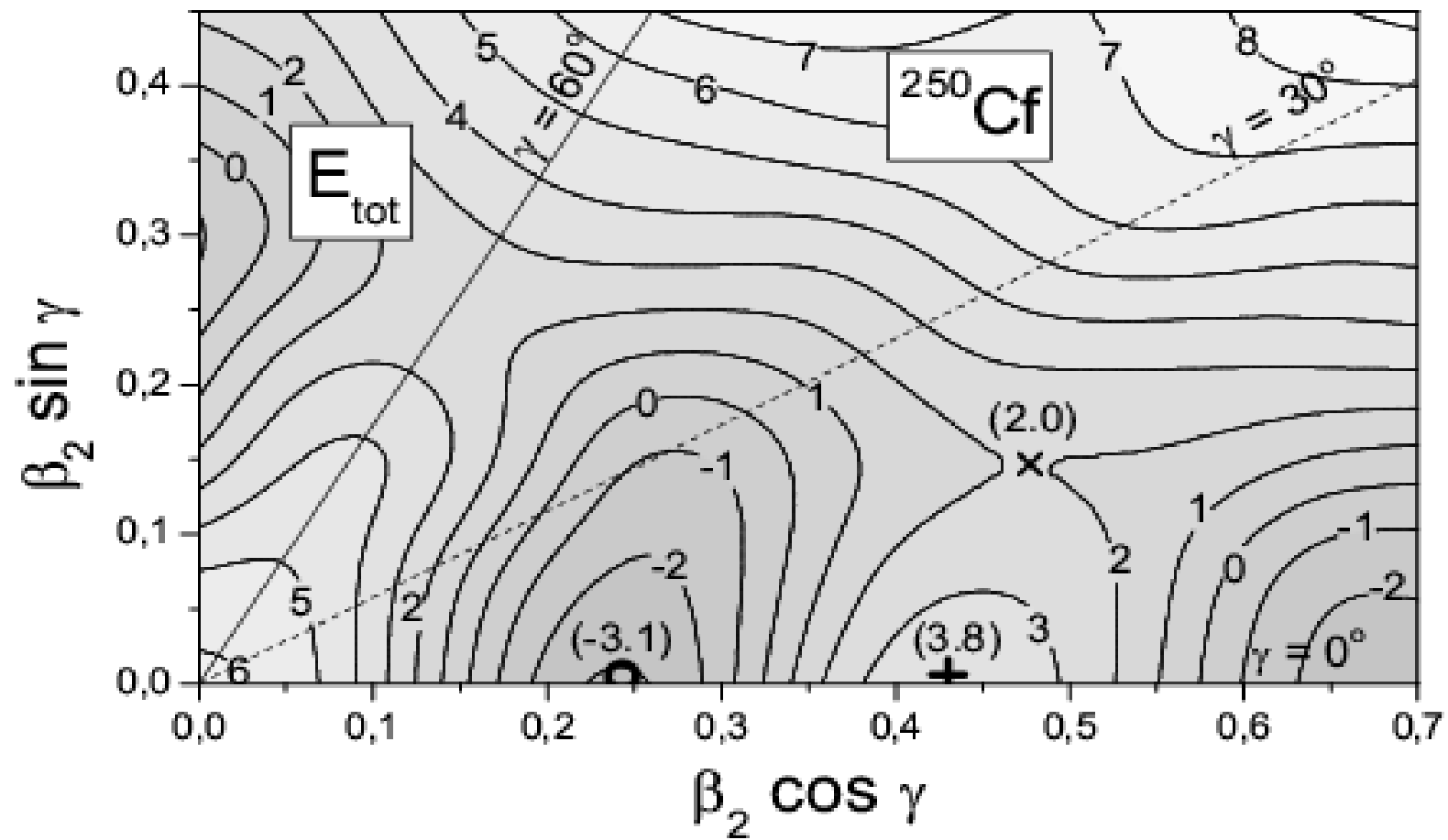
1. As large as possible
2. Larger space, better description of the properties
(e.g. mass, especially B_f^{st} and T_{sf})
3. Specification of the space: **axial**, **non-axial** and **reflection-asymmetric**
shapes included

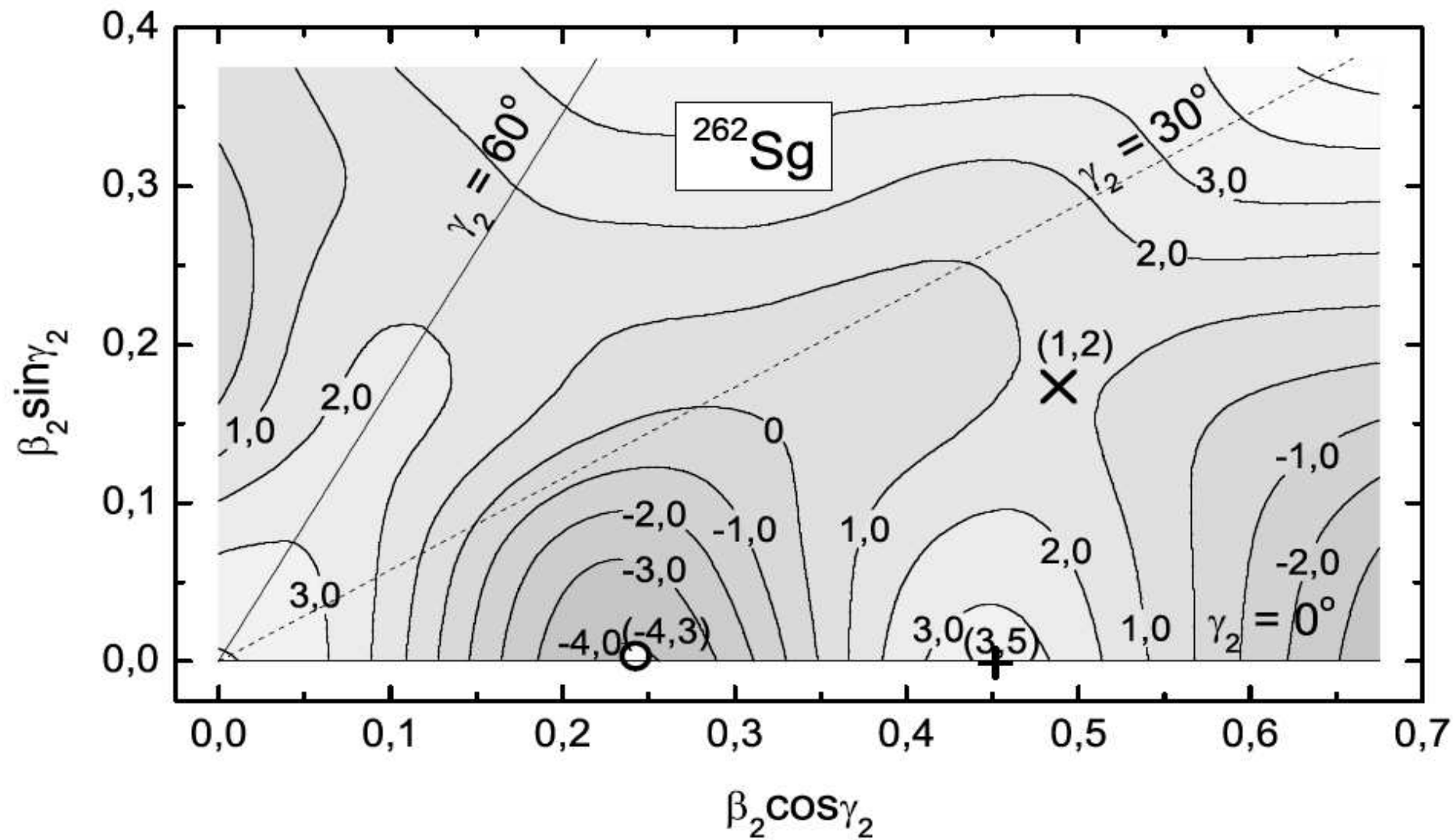
IV. Results

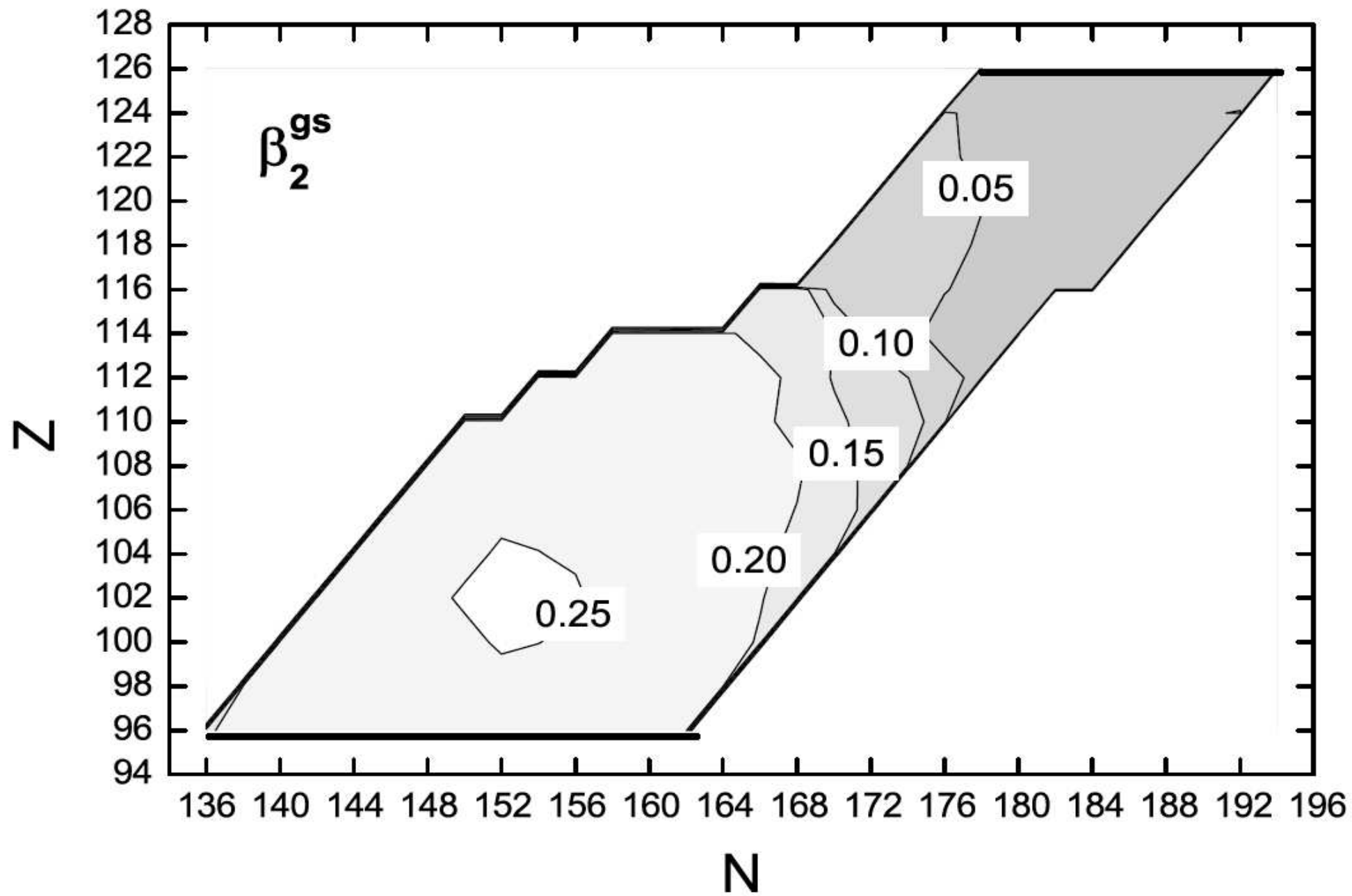
1. Examples of the potential energy maps: ^{250}Cf , ^{262}Sg
 - axial sym. of eq. conf.
 - generally non-axial s.p. shapes
 - effect of non-axiality may be large

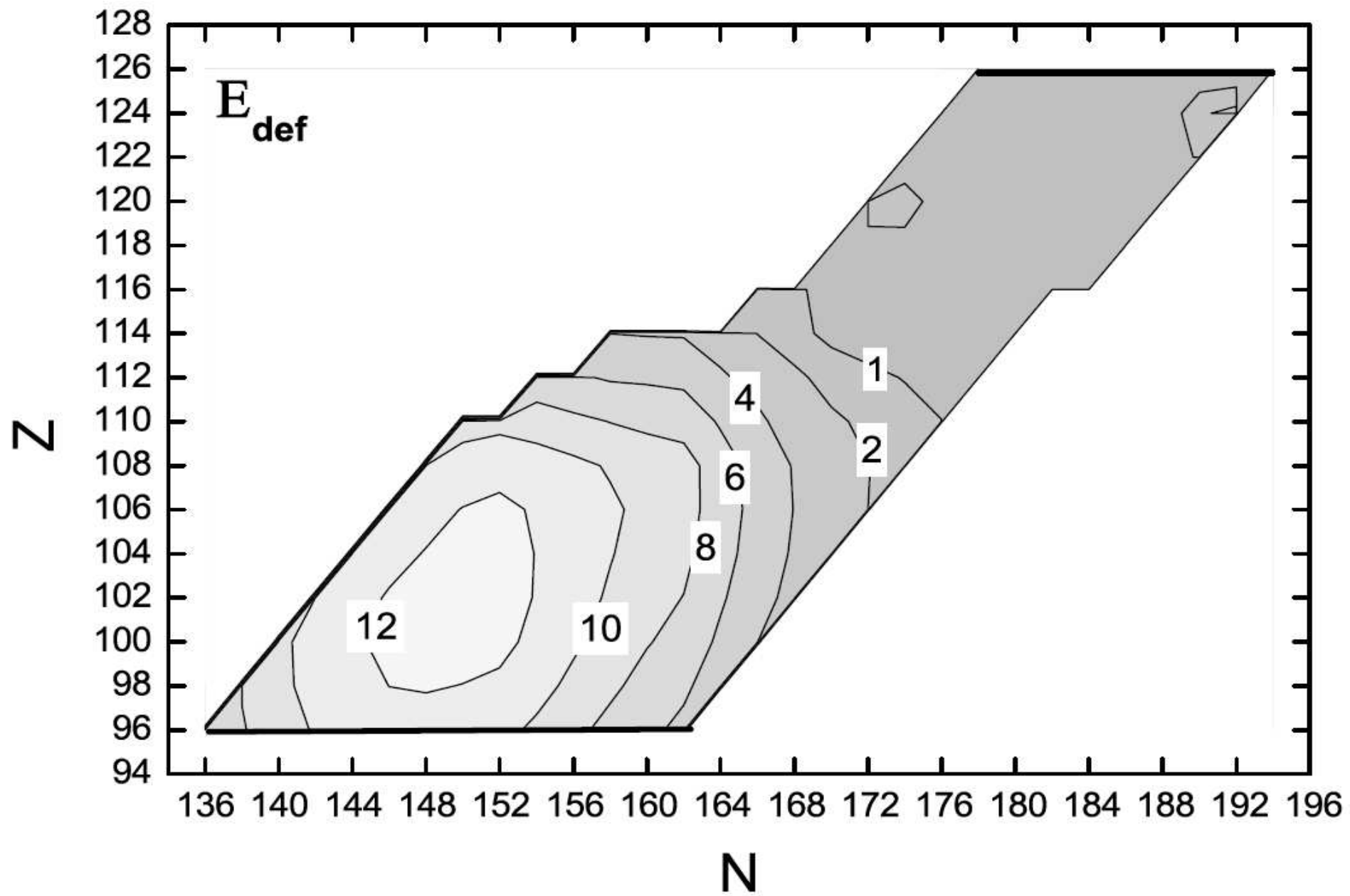
2. Shapes at eq. and s.p. conf.

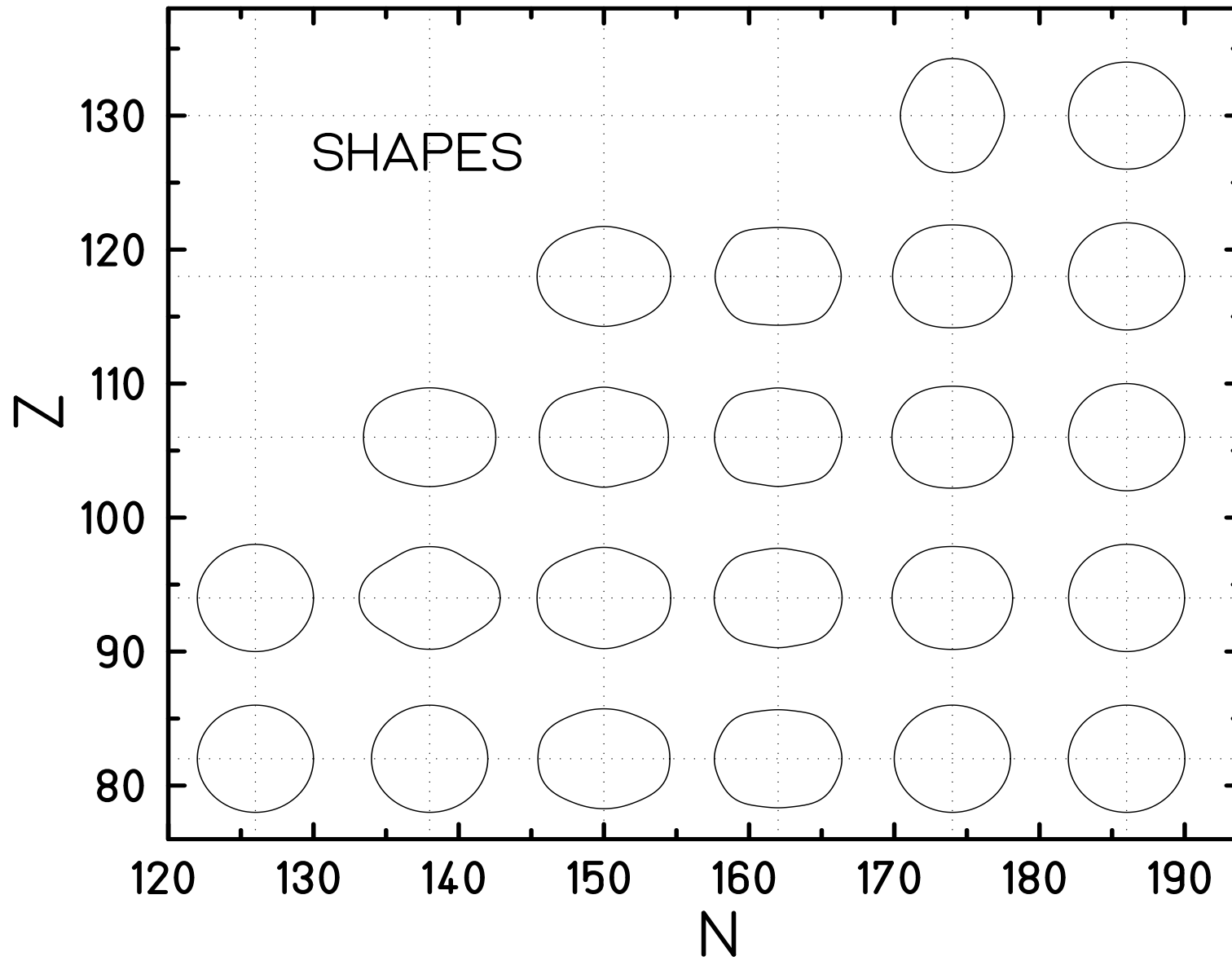
3. Shell correction
 - at eq. conf.
 - at s.p. conf. (although smaller than at eq., it is still large, up to about 2.5 MeV)

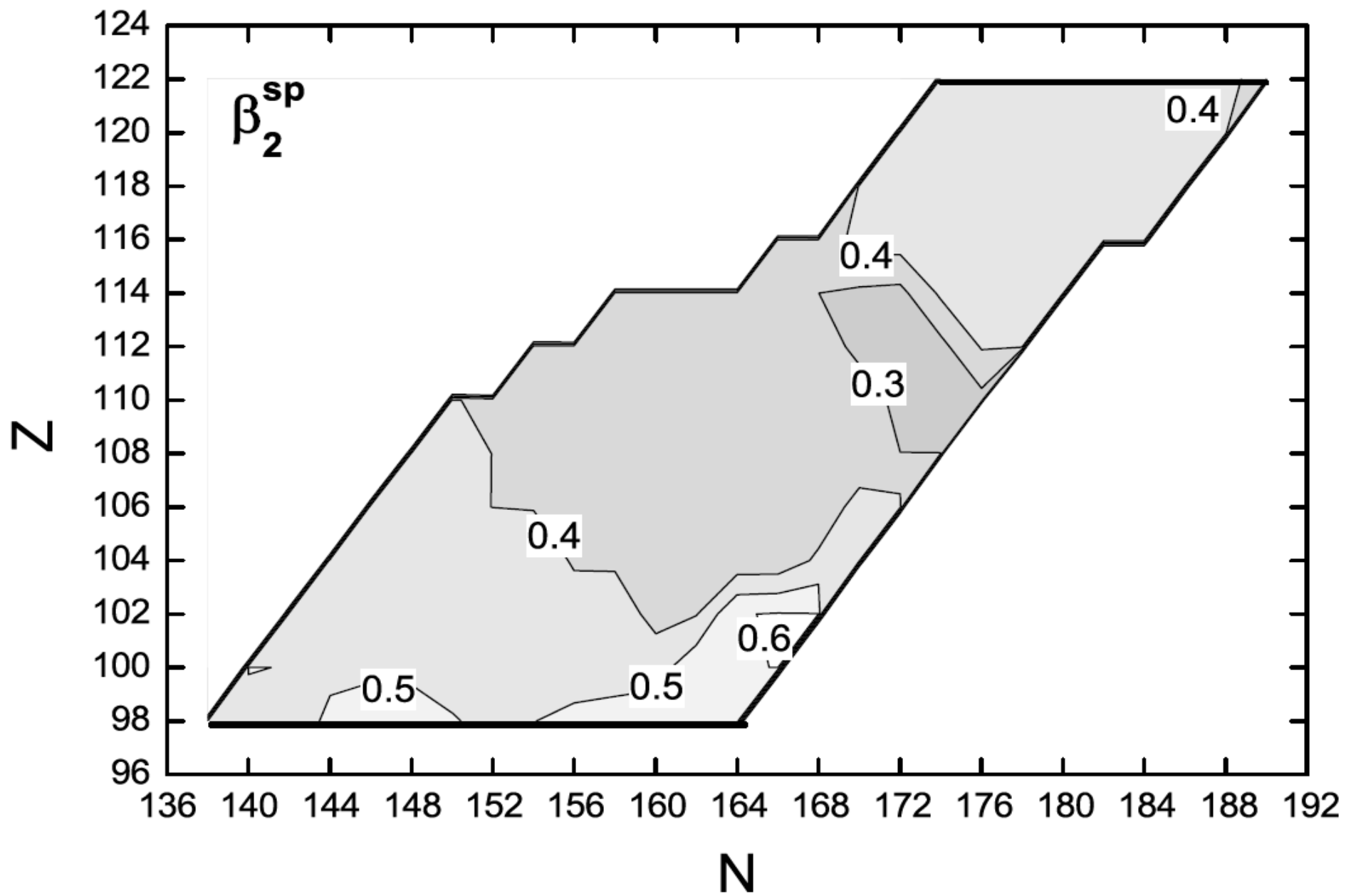


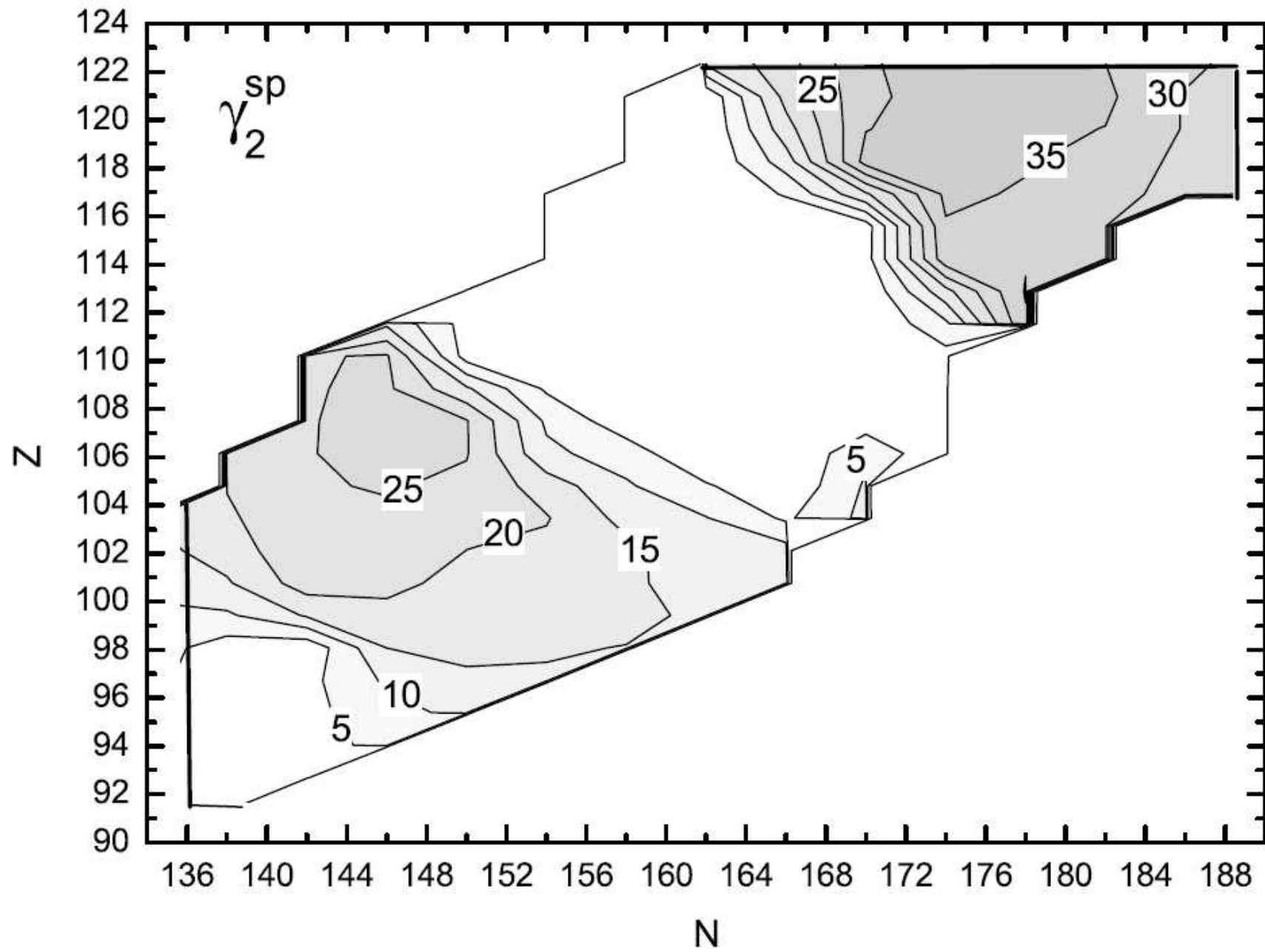


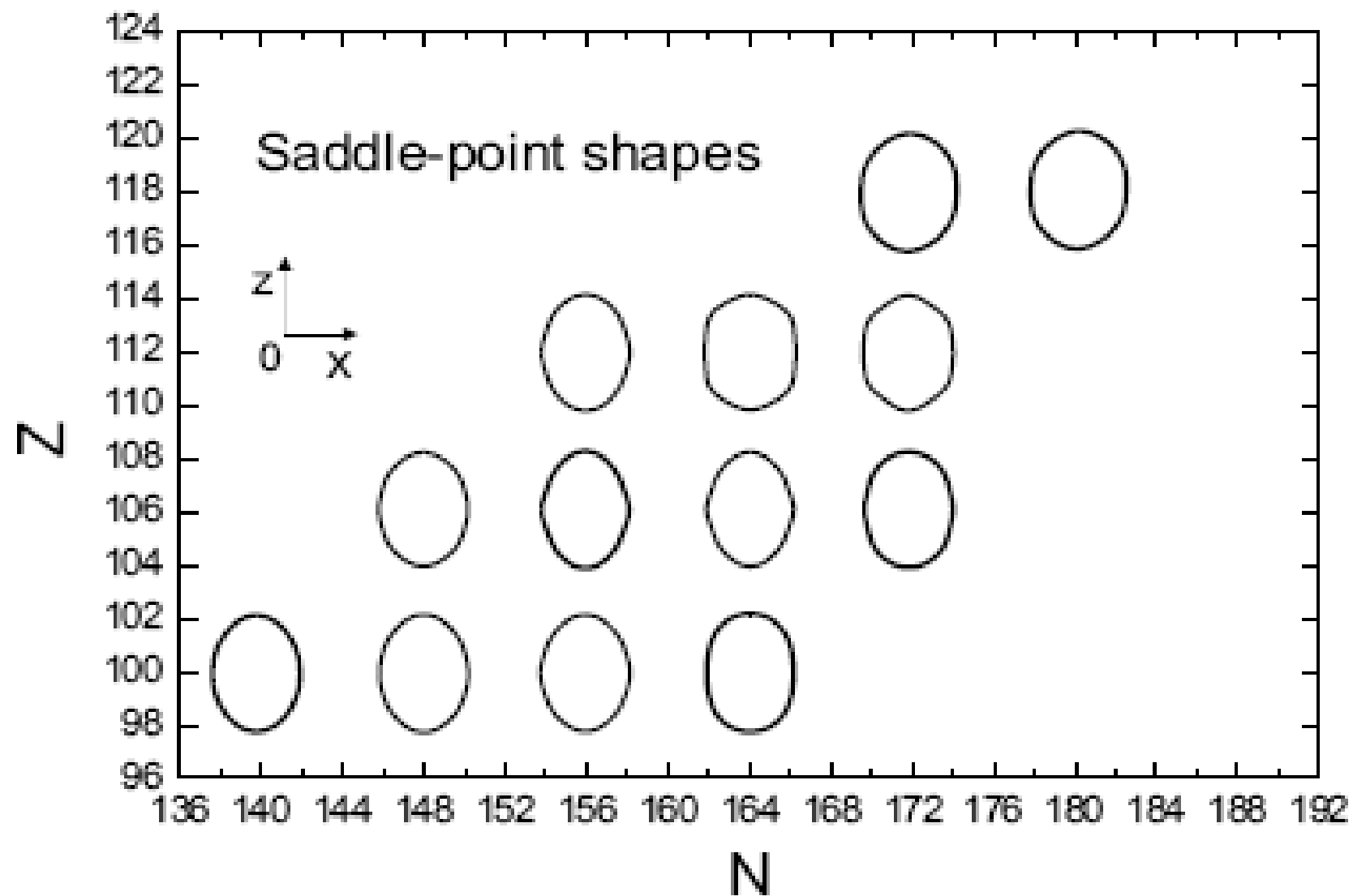


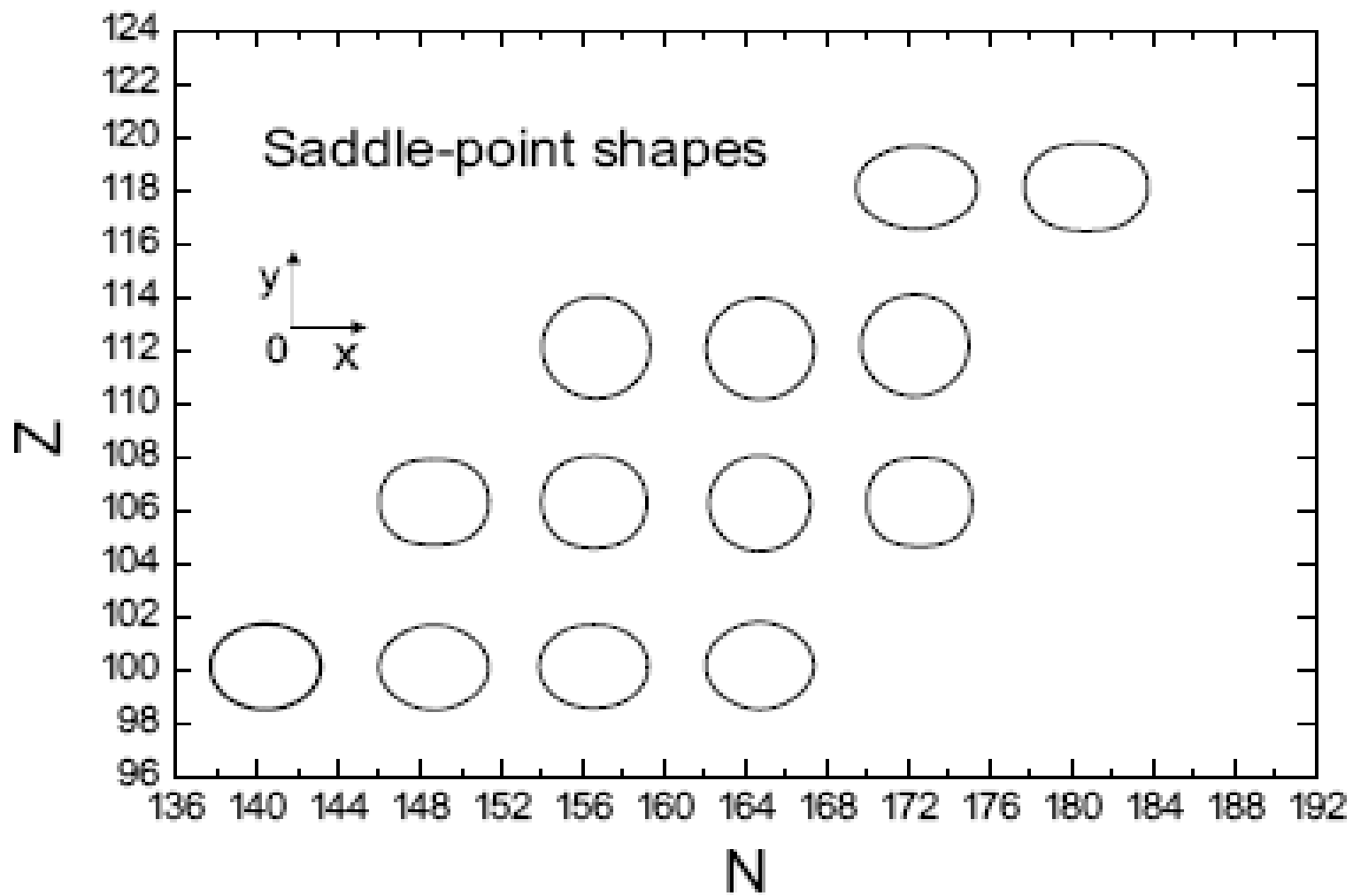


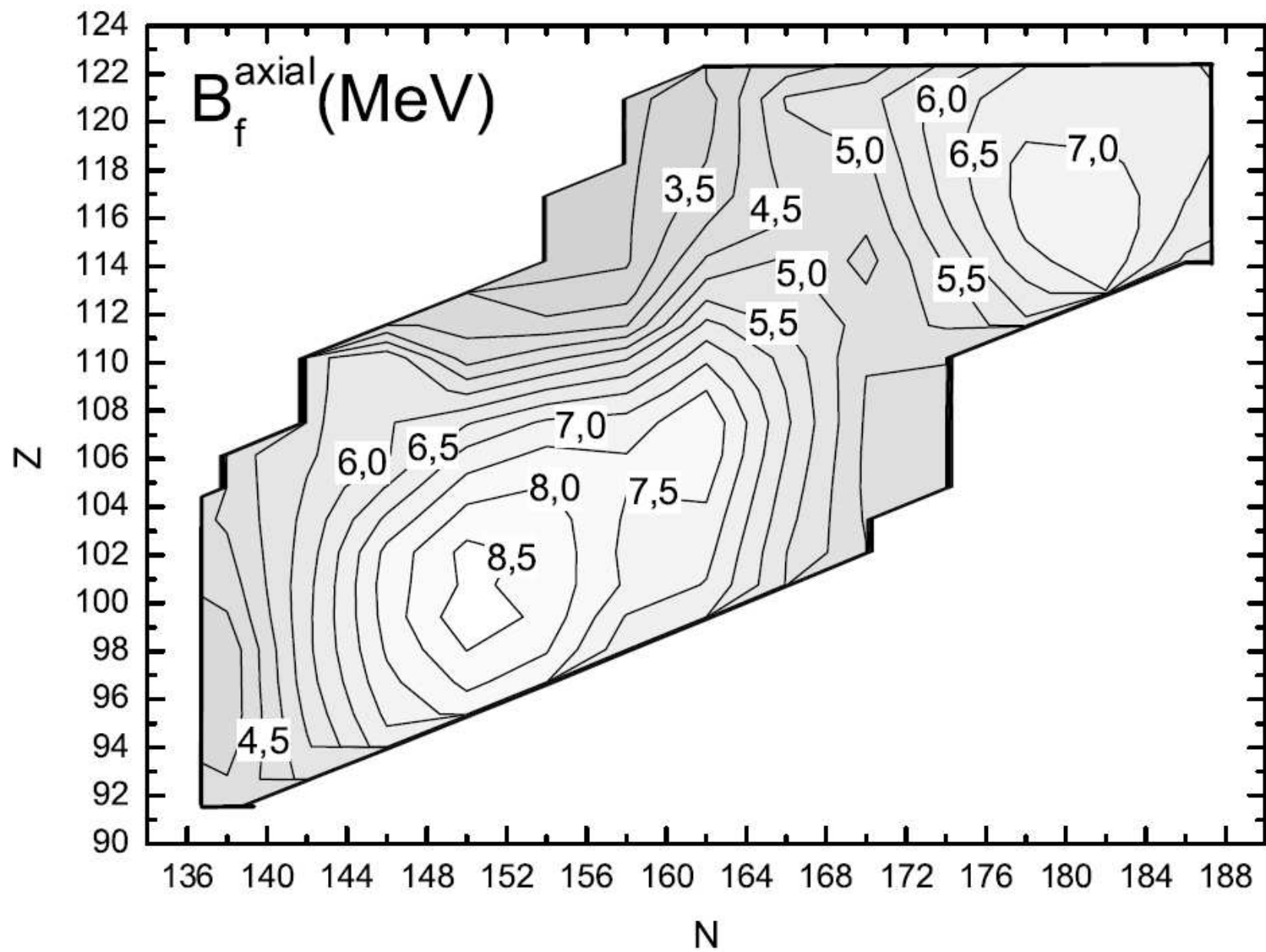


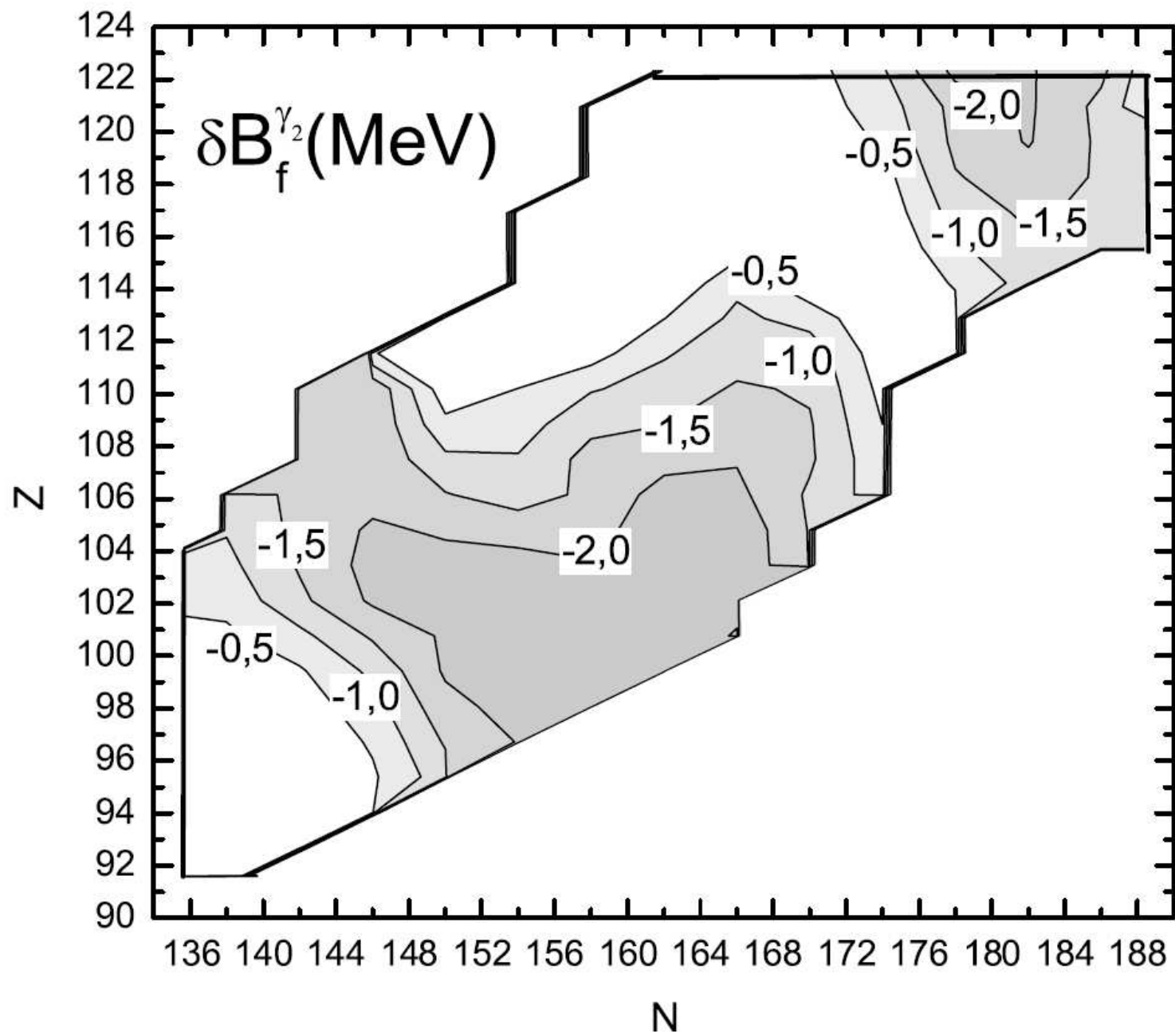


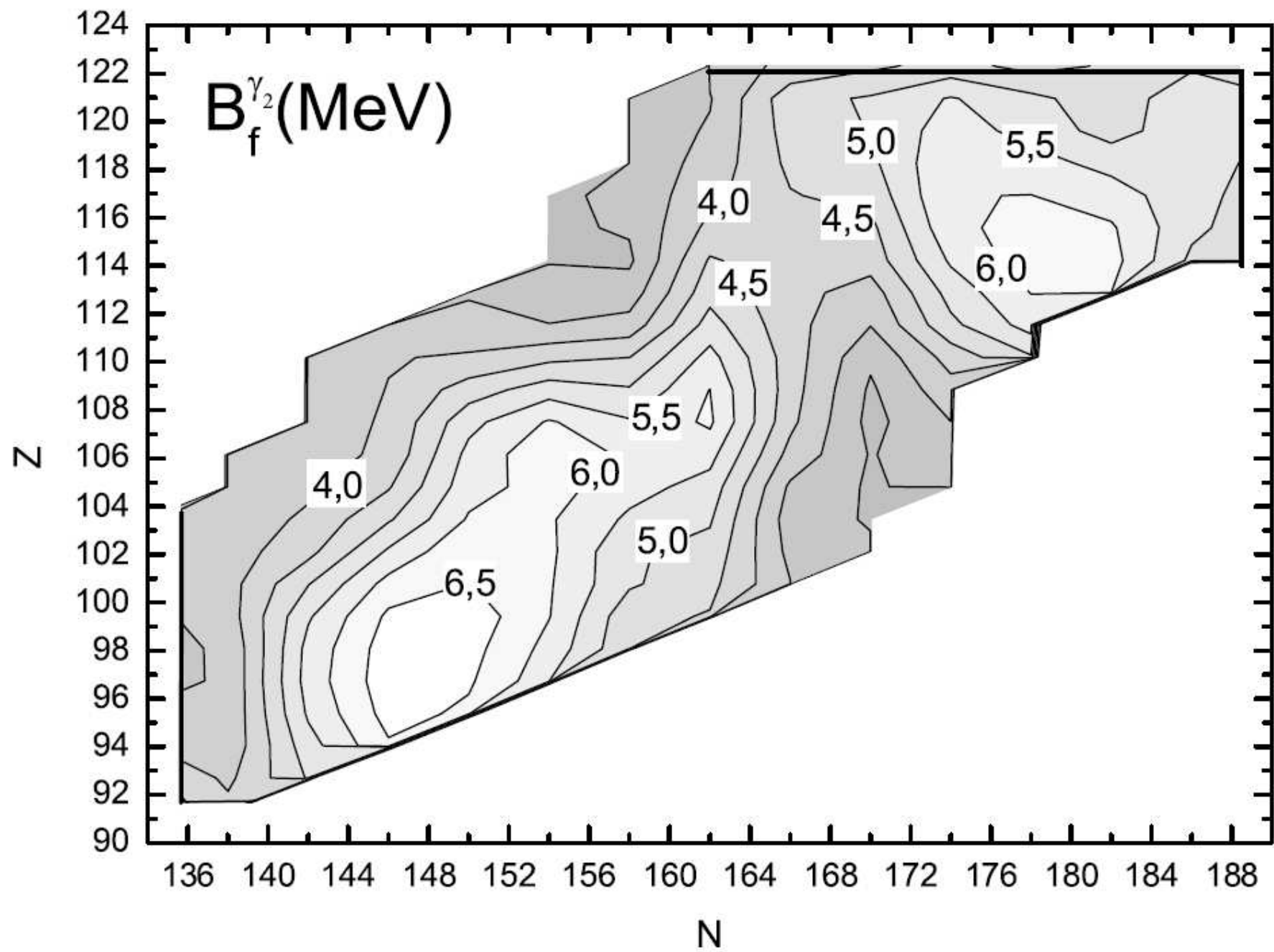


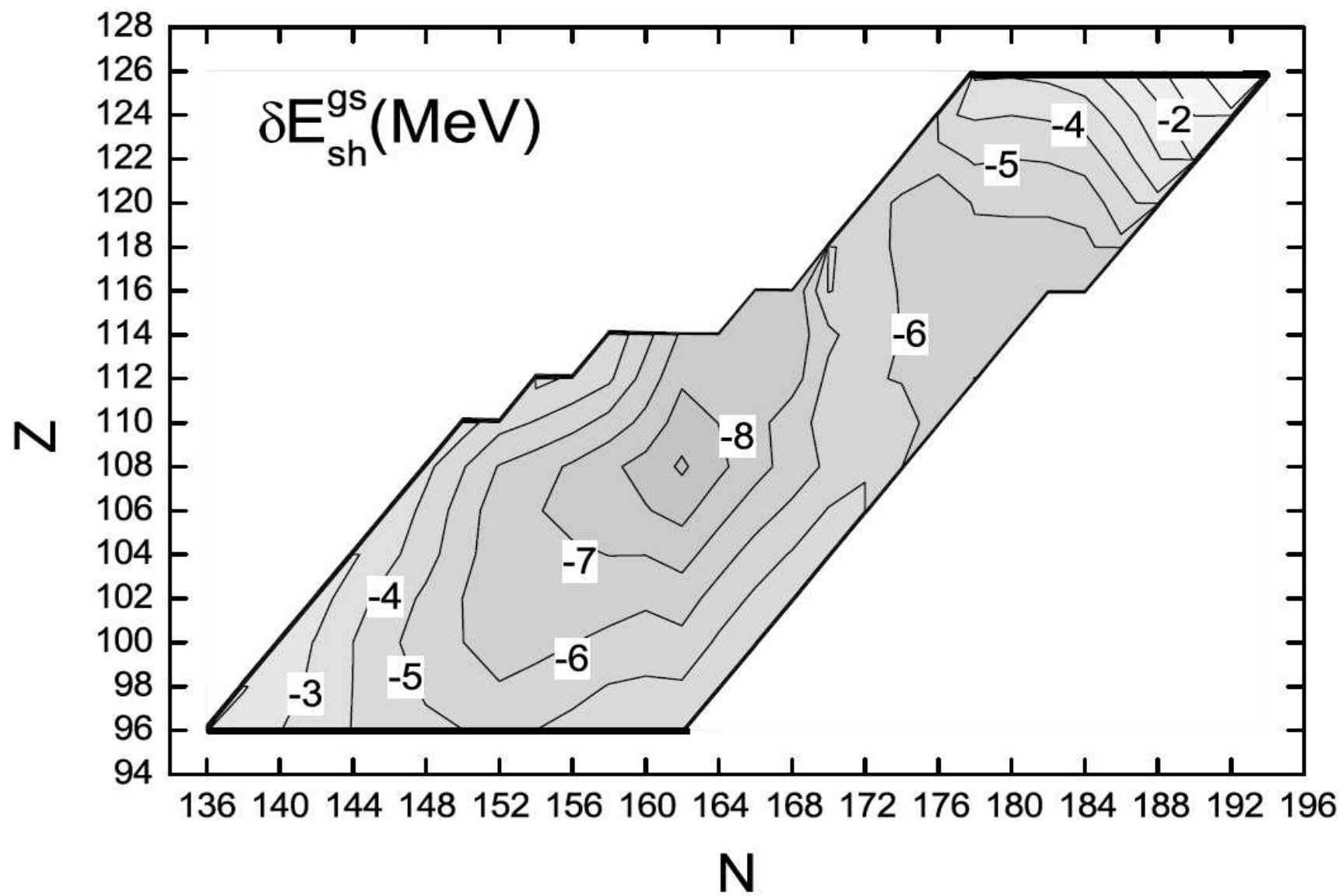


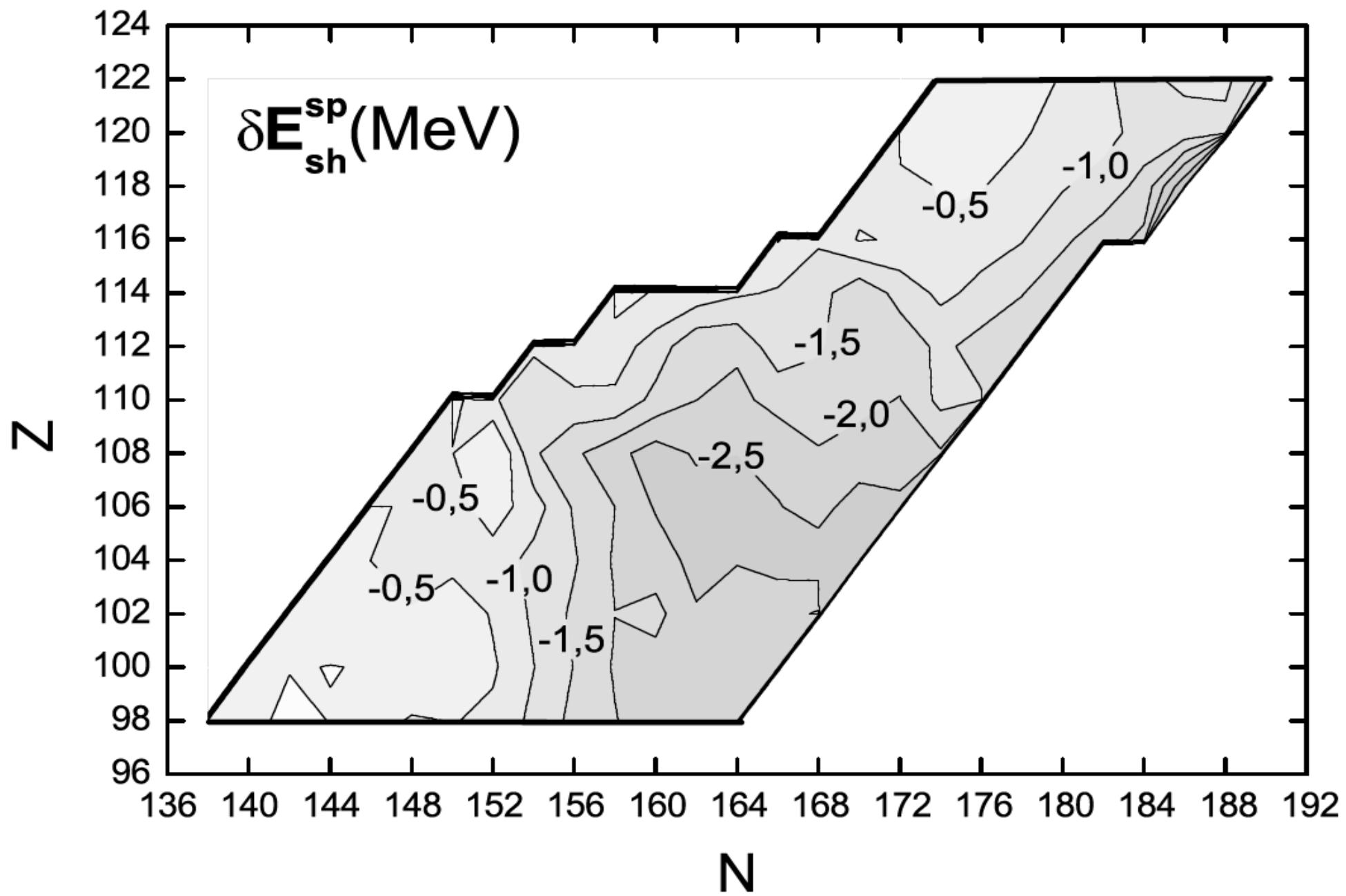












Conclusions

1. **Shapes and shell correction of HN have been studied at two configurations: equil. (ground state) and saddle point.**
2. **For an accurate study, a large deformation space is needed (10-dimensional space has been used).**
3. **Equil. config.:**
 - the shapes are axially- and reflection-symmetric for all studied nuclei
 - shell correction is large (up to about 9 MeV for a doubly magic def. nucleus with $Z=108$, $N=162$ and a spherical one with $Z=114$, $N=184$).
4. **Saddle-point config.:**
 - shapes are generally non-axial, but reflection sym.; only lighter nuclei (around uranium and below) are reflection asym. at their saddle point.
 - shell corr., although smaller than at equil., is still large (up to about 2.5 MeV). It should not be disregarded (as quite often done).
 - effect of non-axiality is large, up to more than 2 MeV. This is a big effect, if one keeps in mind that a 1 MeV change in B_f^{st} changes the calculated σ by one order of magnitude or even more.