

Extension and Verification of the Cross-Section Library for the VVER-1000 Surveillance Specimen Region

D. Kirilova, S. Belousov and Kr. Ilieva
E-mail:dkirilova@inrne.bas.bg

Need for BGL extension?

DATA

- BUGLE and BGL cross-section libraries - problem oriented for PWR and VVER reactor shielding calculations of the reactor middle plane;
- Location of the surveillance specimens of VVER-1000/320 - on the baffle above the reactor core where the neutron field gradient is very high;
- BGL cross-section libraries generated by collapsing the problem independent fine group library VITAMIN-B6 applying VVER spectrum in one-dimensional radial model.

QUESTIONS

- Different neutron spectra?
- Additional inaccuracy in the neutron fluence calculation in the region of the surveillance specimens ?
- Choice of one-dimensional geometry model for the cross-section collapsing?

Cross-section library - method and contents

- SCALE software package and one-dimensional geometry model;
- Upscattering data for the five thermal groups below 0.5 eV;
- Order of scattering of the Legendre expansion - P7;
- ANISN card image format;
- Data for: absorption cross-section, fission cross section, total cross-section, upscattering cross-section, within-group scattering cross-section, down-scattering cross-section.

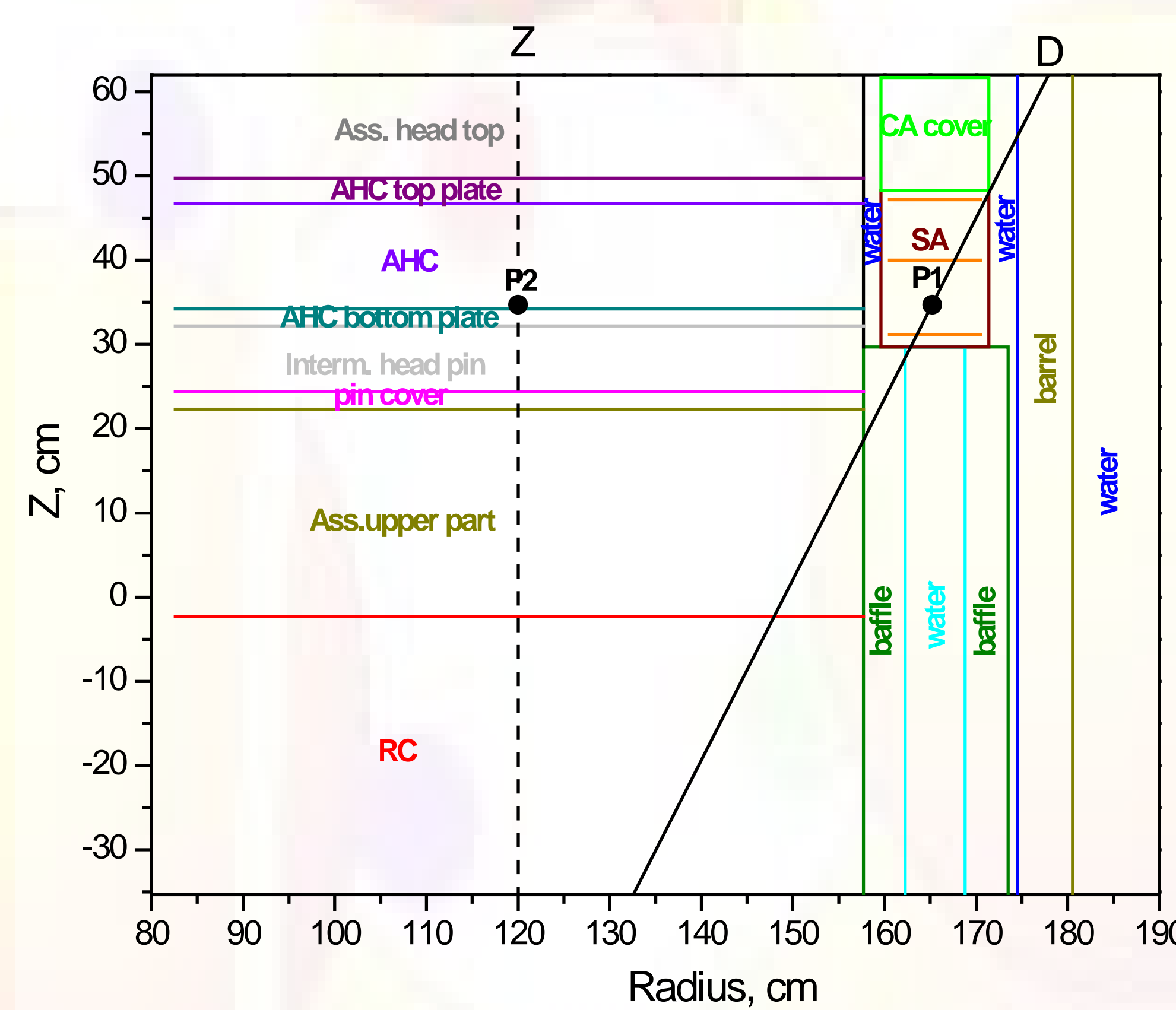
Sensitivity analysis

- High sensitivity to the choice of one-dimensional model for the cross-section collapsing;
- Assessment of the neutron importance in the SS region - adjoint solution obtained with 2D DORT code and VITAMIN-B6 cross-section library;

$$\Psi(r) = Q(r)\Phi^*(r) \quad 2\pi \iint \Psi(r)rdrdz = 1$$

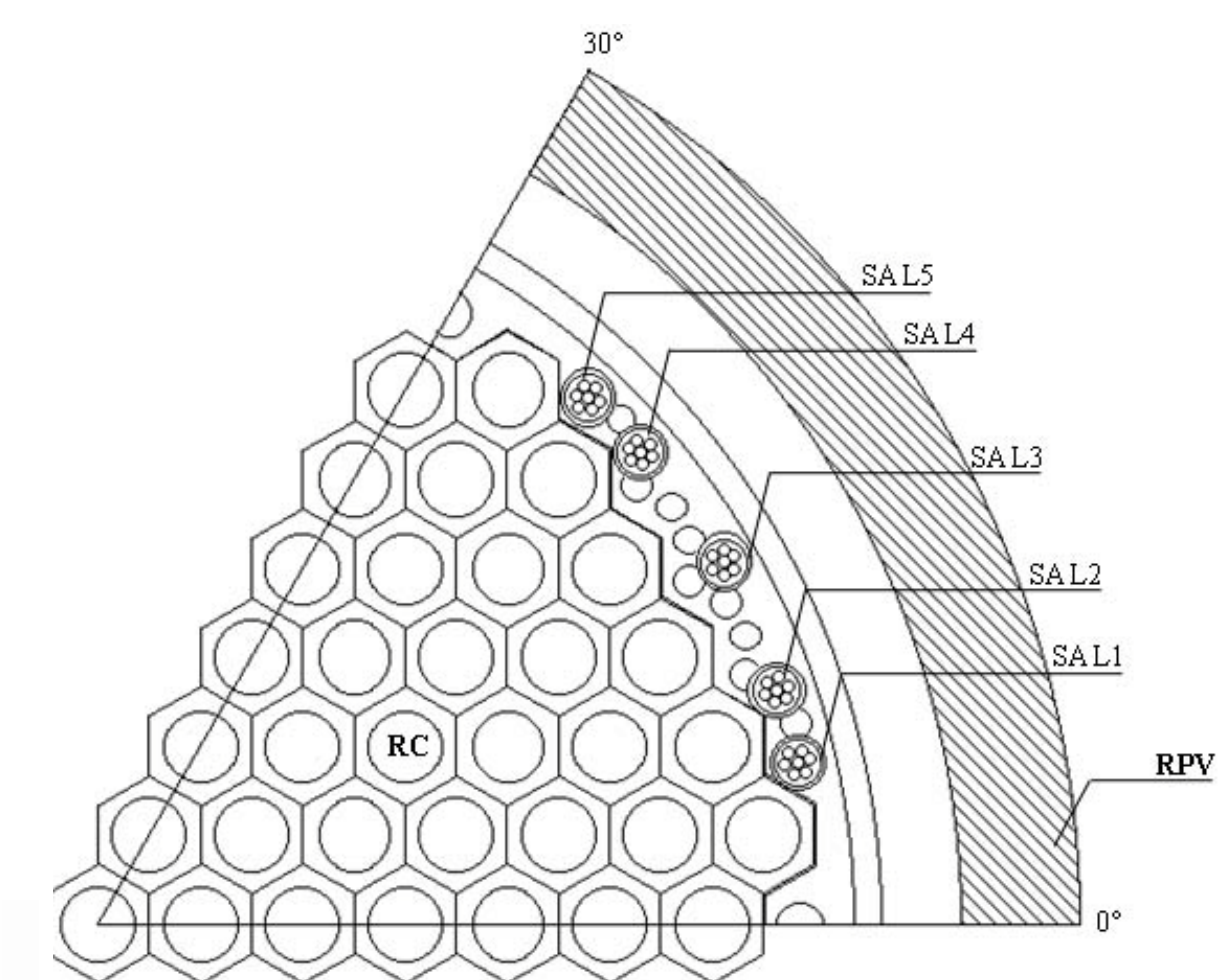
- Homogenization of the weighed materials in radial direction for every axial level z.

$$m_{\text{hom}} = 2\pi \int_0^R \Psi(r)m(r)rdr$$

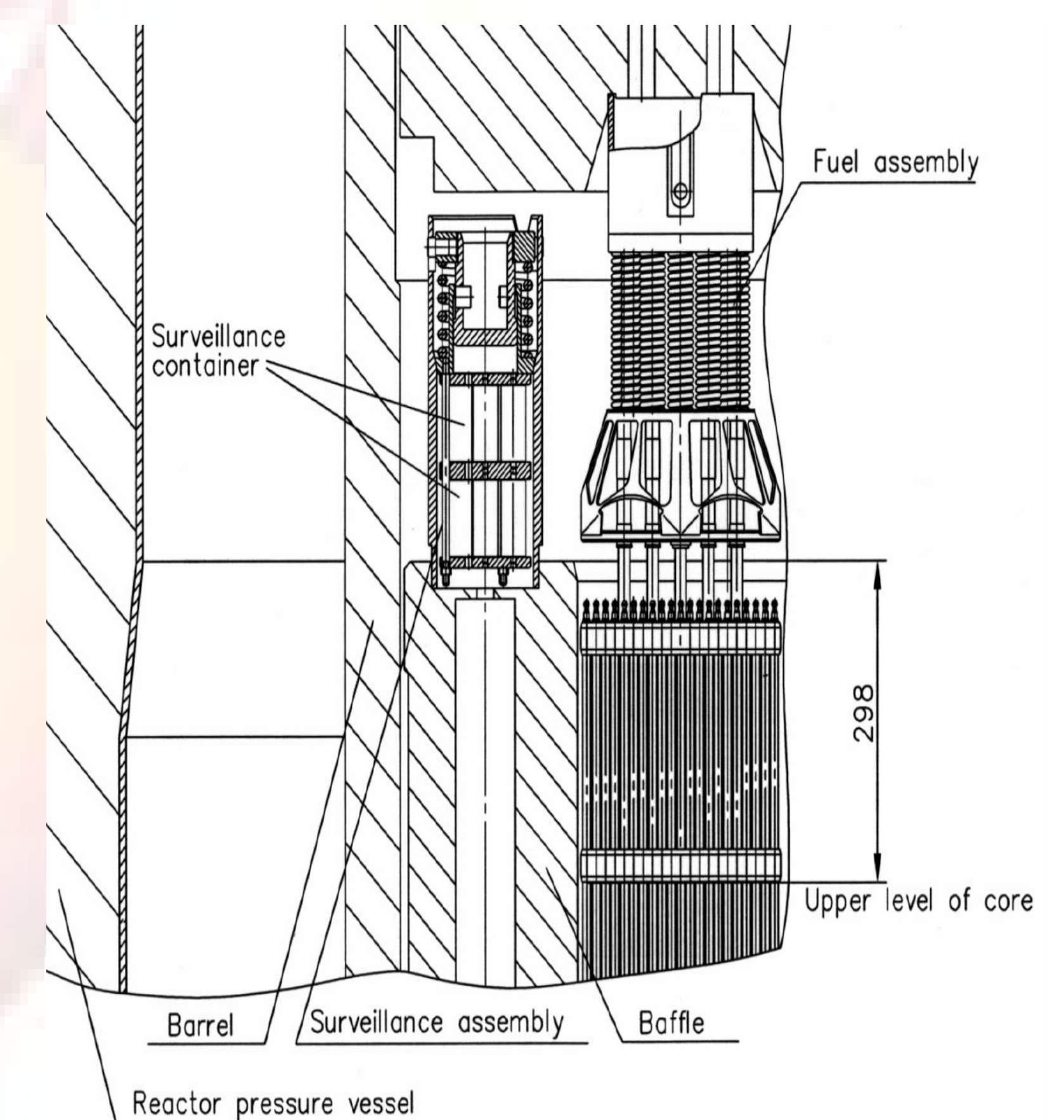


Geometry model

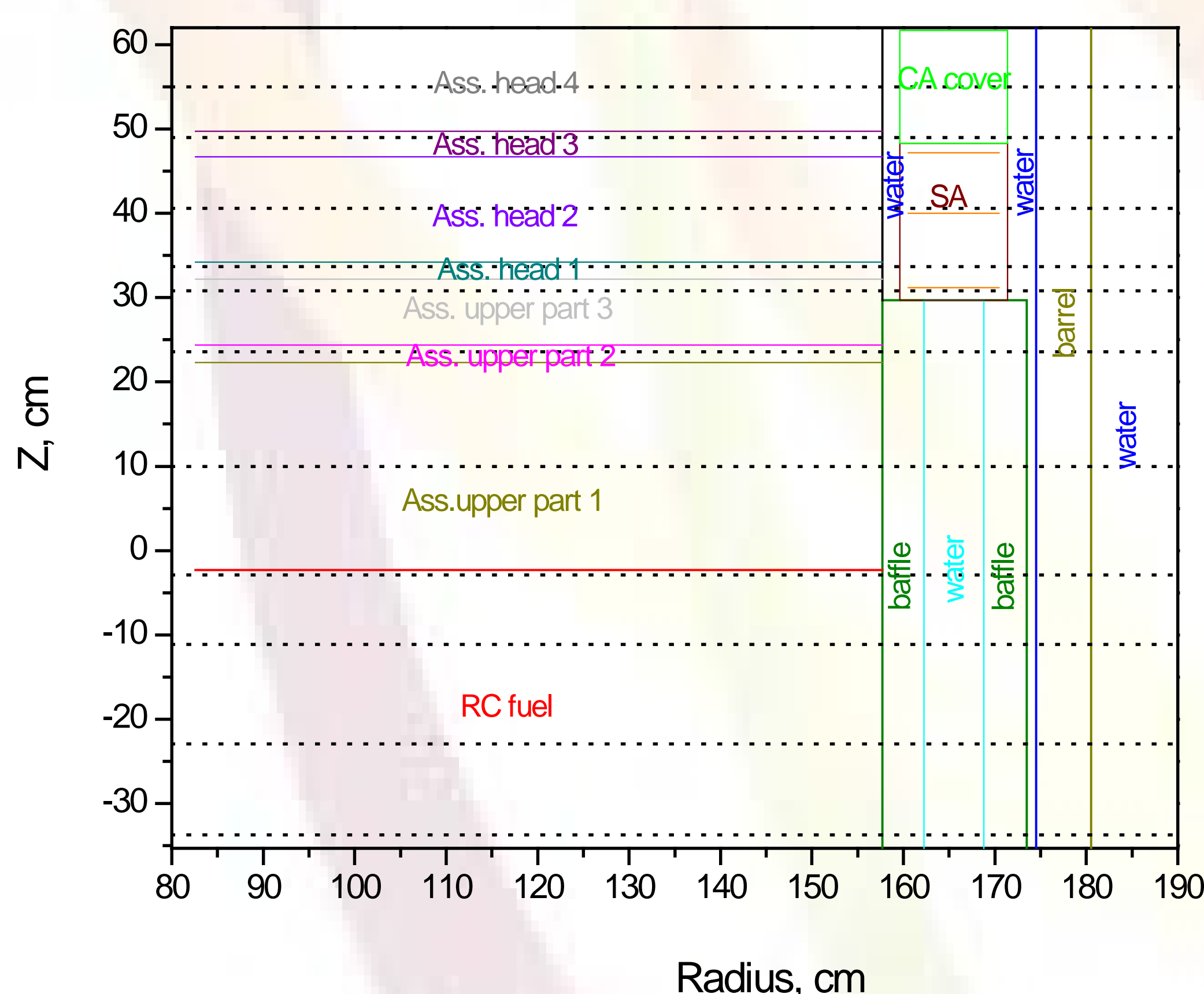
Geometry of the surveillance specimens



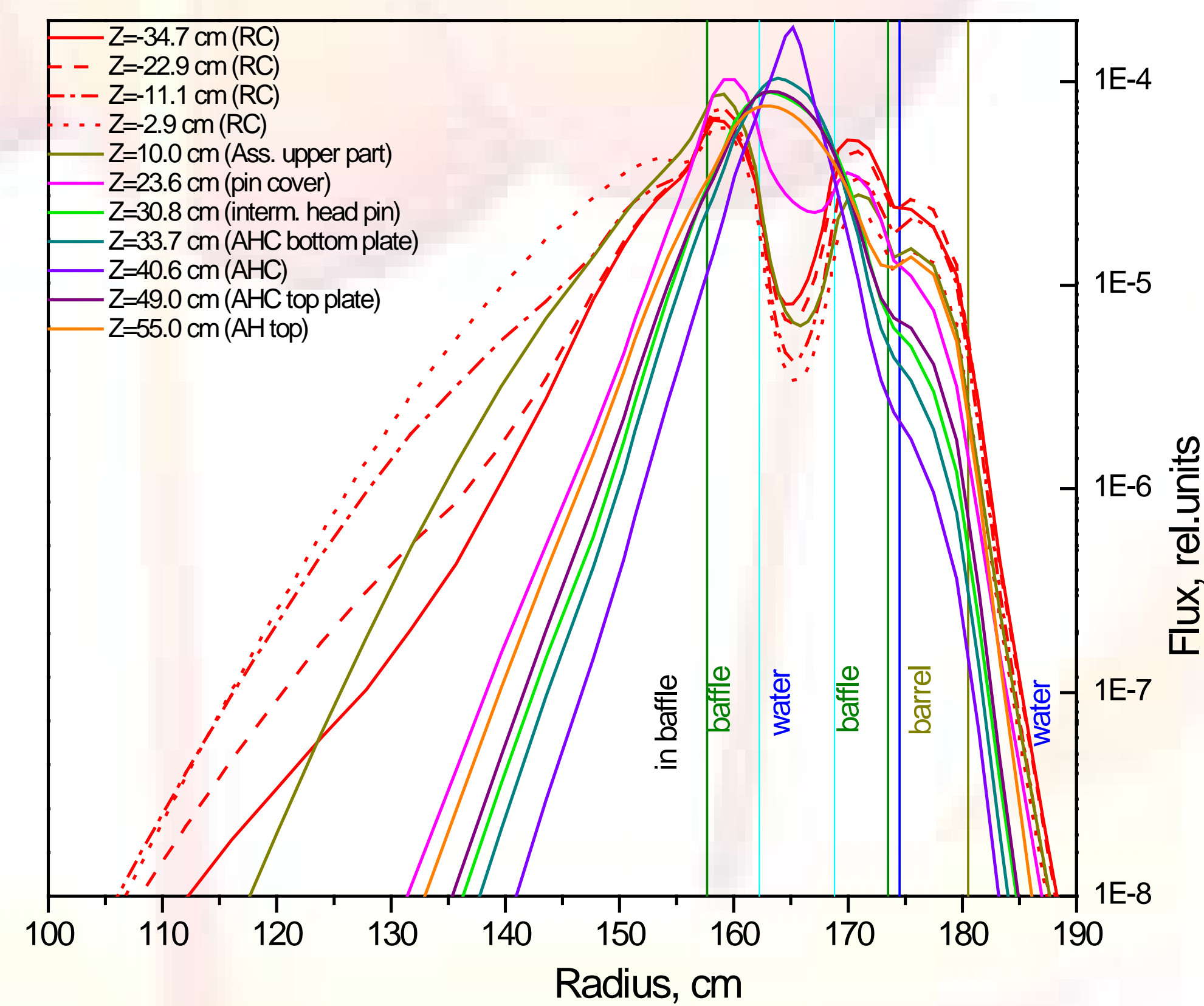
Azimuth position of surveillance assemblies in 60°-sector of symmetry



Axial position of the surveillance specimens



Axial levels applied for material homogenization



Distribution of weighed function $\Psi(r)$ for every axial level of homogenization

- One-dimensional geometry model for the cross-section collapsing - determined by the material limits in axial direction above the RC and by homogenization of the weighed materials in radial direction for every axial level;
- Software package SCALE;
- Generation of the BGLex library - containing cross-sections for the SS region.

Forthcoming work:

- Verification and validation of the BGLex extended cross-section library:
- Comparison between the calculated results with the new version BGLex and the libraries BGL and VITAMIN-B6;
- Comparison between calculated and experimental results.