ANALYSIS OF NEUTRON FLUX AROUND MEDICAL ELECTRON LINEAR ACCELERATOR, PLACED IN THE ROOM RECONSTRUCTED AFTER DECOMMISSIONING OF ^{60}CO UNITS, USING MONTE CARLO SIMULATION

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Introduction - earlier research

- Increased neutron flux was measured around 18 MV Siemens Oncor accelerator
  - placed in the room reconstructed after decommissioning of ^{60}Co unit[1]
- The main limitation - space
  - extremely short maze were used
  - walls were strengthened by lead.

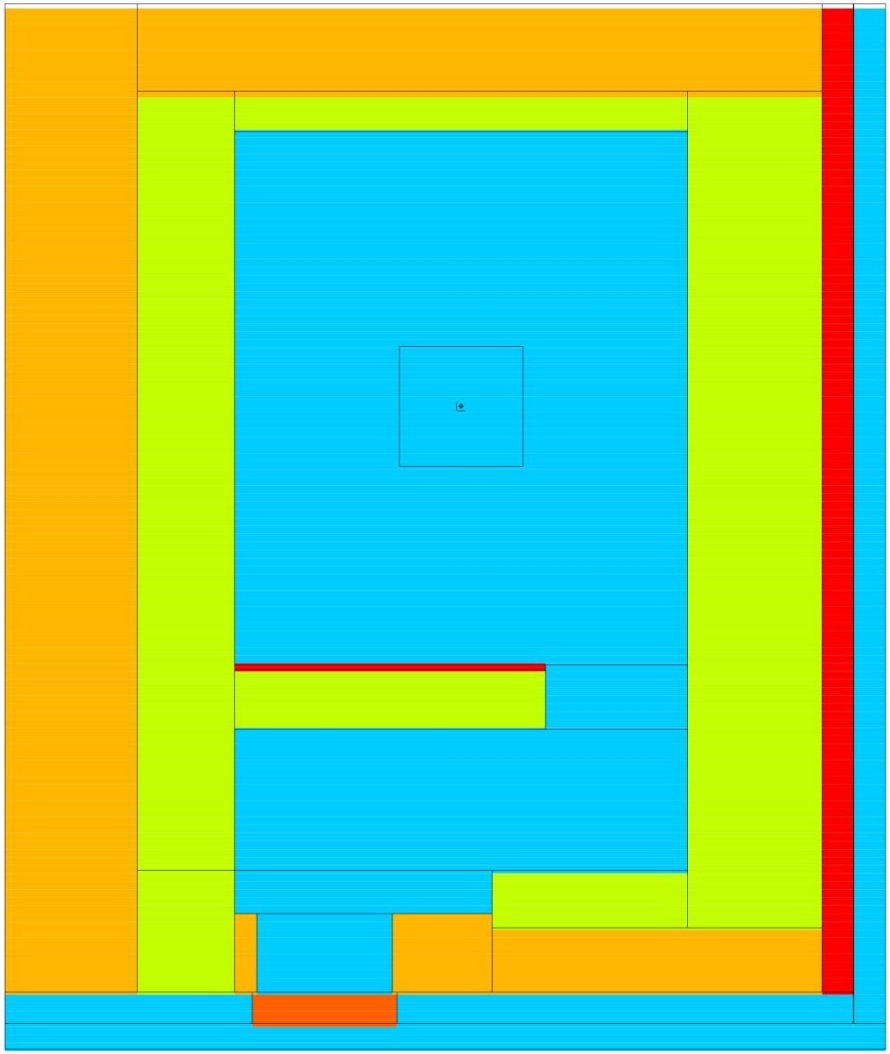
[1] Poje, Ivkovic et al. 2014

Methods - model

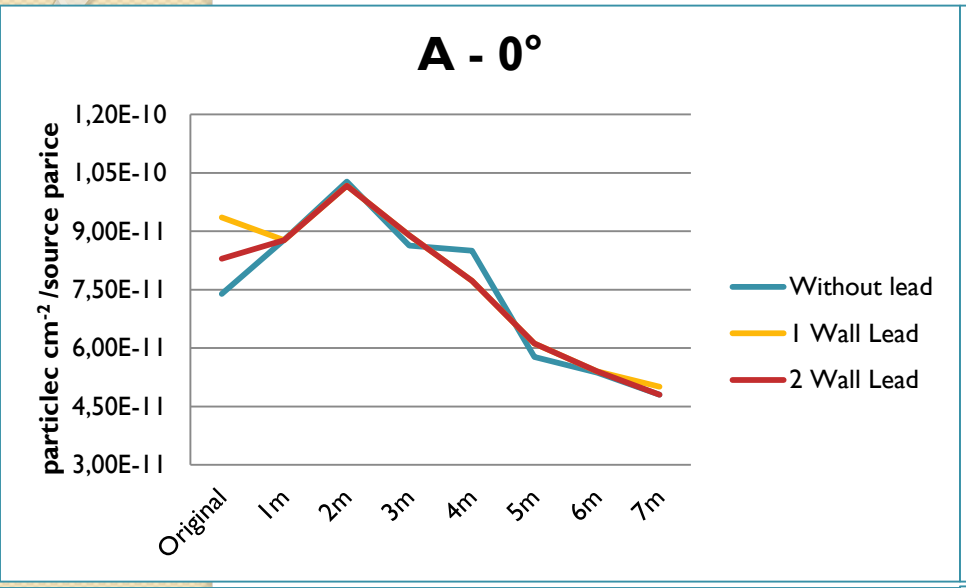
- Model of accelerator and its room has been built
- MCNP611 code was used to model
- 40x40 field was used
- Point in the maze was analysed
- Extension of the maze was modelled
- Addition of the lead at the walls was also modelled

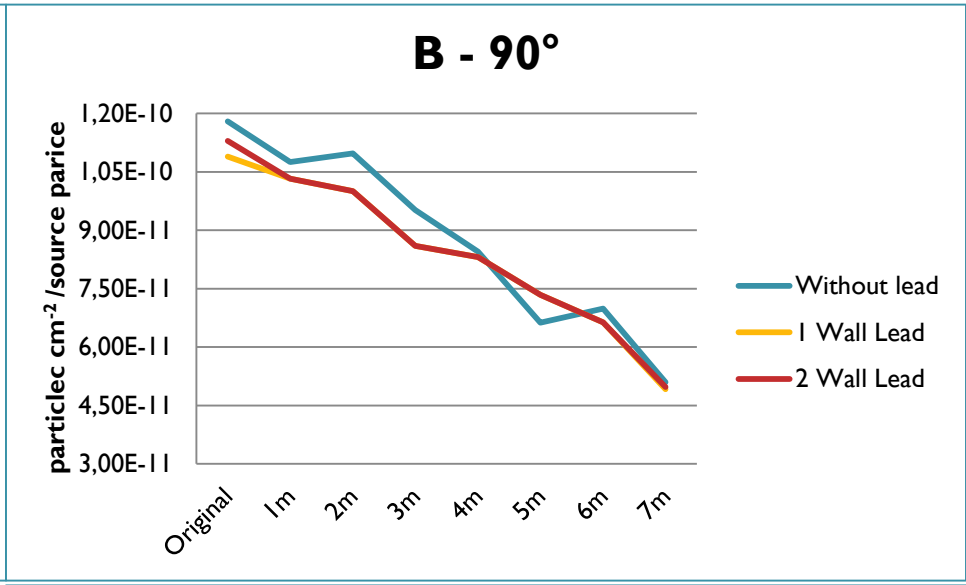
Plan view

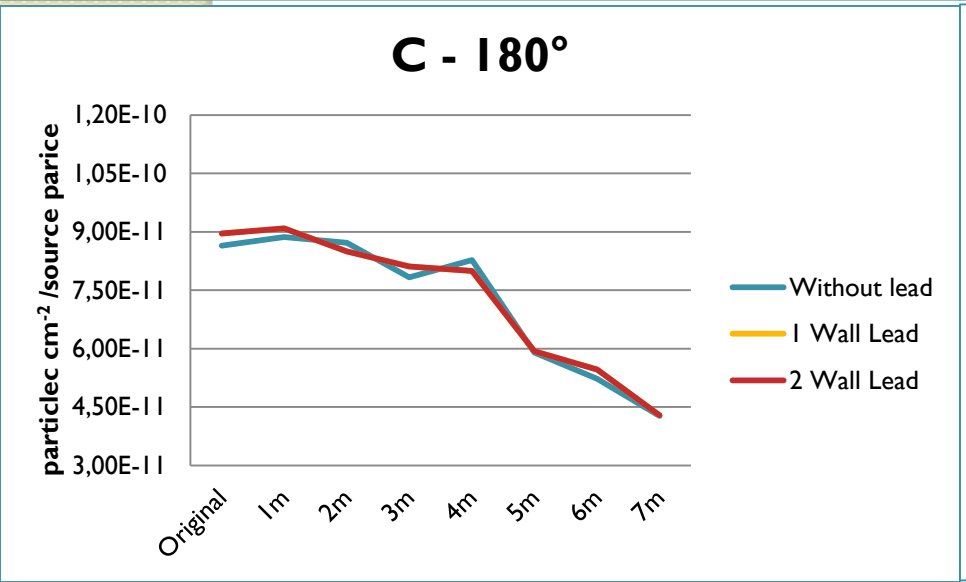
- Red – lead
- Blue – air
- Orange – parafin
- Light orange – bricks
- Green - concrete

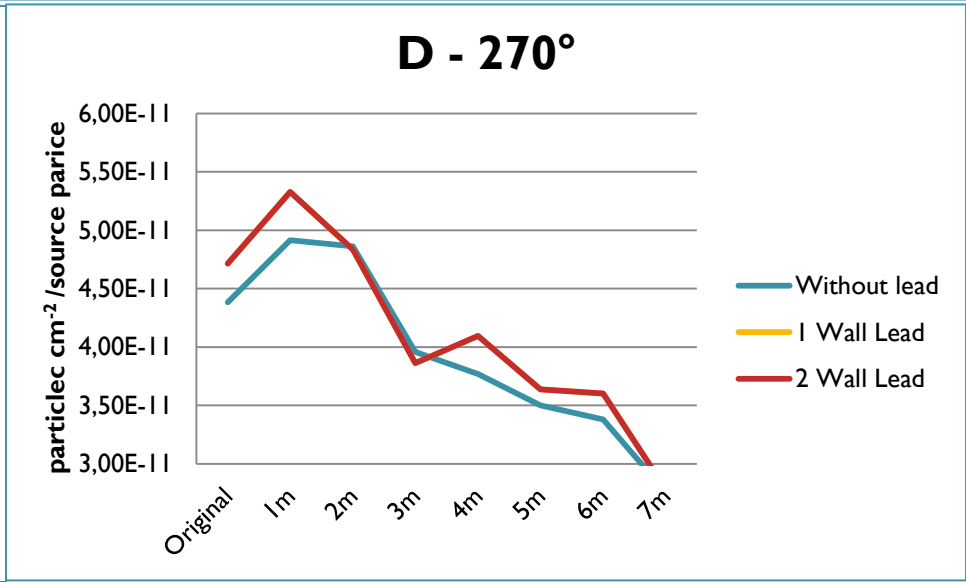


Results


A - 0°
particlec cm-2 /source parice
1,20E-10
1,05E-10
9,00E-11
7,50E-11
6,00E-11
4,50E-11
3,00E-11
Original
1m
2m
3m
4m
5m
6m
7m
Without lead
1 Wall Lead
2 Wall Lead


B - 90°
particlec cm-2 /source parice
1,20E-10
1,05E-10
9,00E-11
7,50E-11
6,00E-11
4,50E-11
3,00E-11
Original
1m
2m
3m
4m
5m
6m
7m
Without lead
1 Wall Lead
2 Wall Lead


C - 180°
particlec cm-2 /source parice
1,20E-10
1,05E-10
9,00E-11
7,50E-11
6,00E-11
4,50E-11
3,00E-11
Original
1m
2m
3m
4m
5m
6m
7m
Without lead
1 Wall Lead
2 Wall Lead


D - 270°
particlec cm-2 /source parice
6,00E-11
5,50E-11
5,00E-11
4,50E-11
4,00E-11
3,50E-11
3,00E-11
Original
1m
2m
3m
4m
5m
6m
7m
Without lead
1 Wall Lead
2 Wall Lead

Conclusions

- The flux is highest when beam is pointend toward the lead wall
- Flux drops as the maze is longer
- Results are in accordance with Kersey formula (where d_2 represents maze elongation)

$$D = \left(\frac{1}{d_1}\right)^2 \cdot \frac{S_0}{S_1} \cdot 10^{-\left(d_2/5\right)}$$

Funding

- Modelling and measuring neutron dose equivalent around medical linear accelerator of electrons