




Participants:

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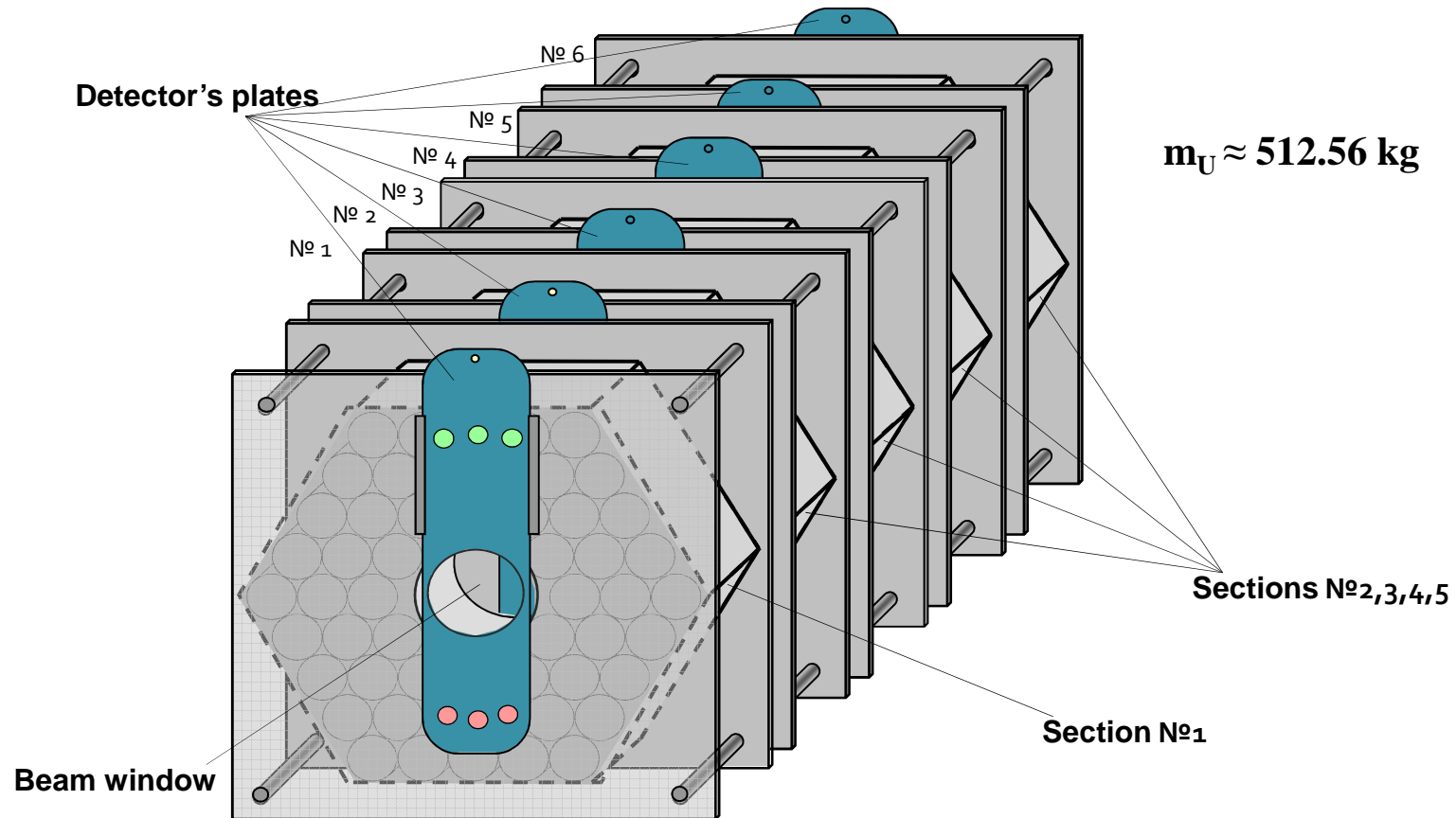
Spatial distribution of natural U fission rate in KVINTA subcritical assembly irradiated by 1, 4 and 8 GeV deuteron's beams

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Experiments objectives

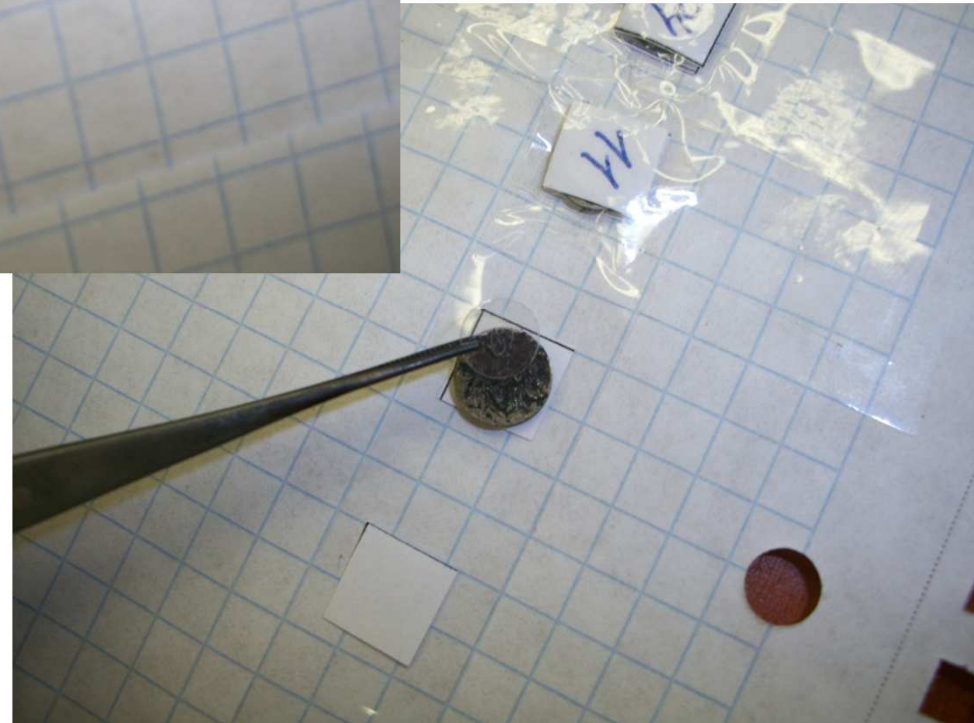
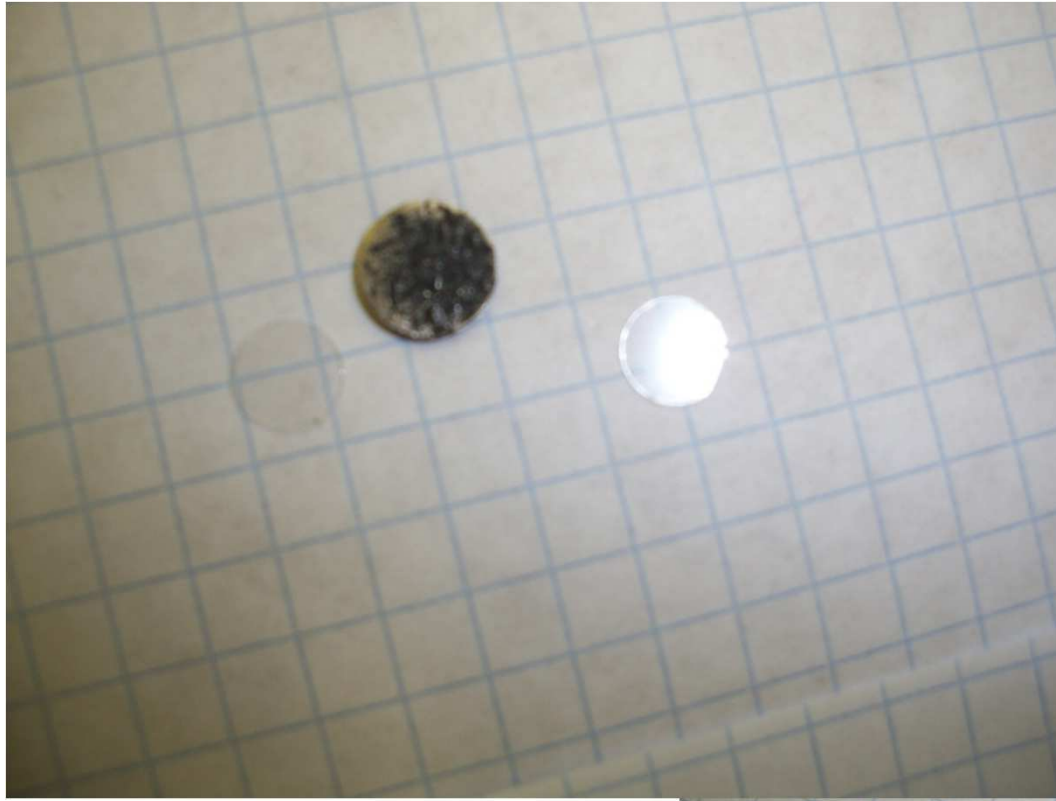
- Research experimental studies of:
 - natural uranium fission rate spatial distribution in KVINTA subcritical assembly;
 - natural uranium fission number spatial distribution in KVINTA subcritical assembly;
- Compare total fission number of natural U with results of earlier experiments.

Experimental assembly “QUINTA”



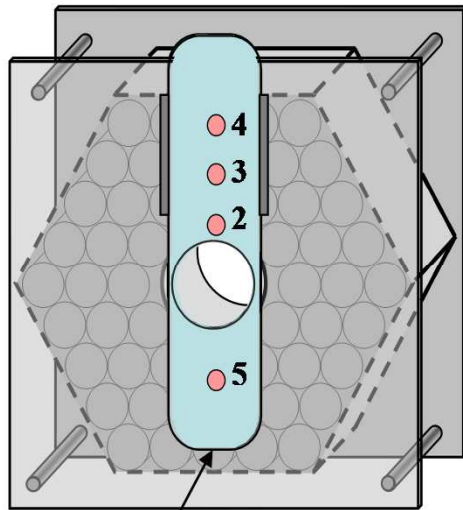
The experimental assembly “QUINTA” consists of a 5 uranium sections with total mass of uranium 512.56 kg.

Uranium foils + SSND (lavsan)



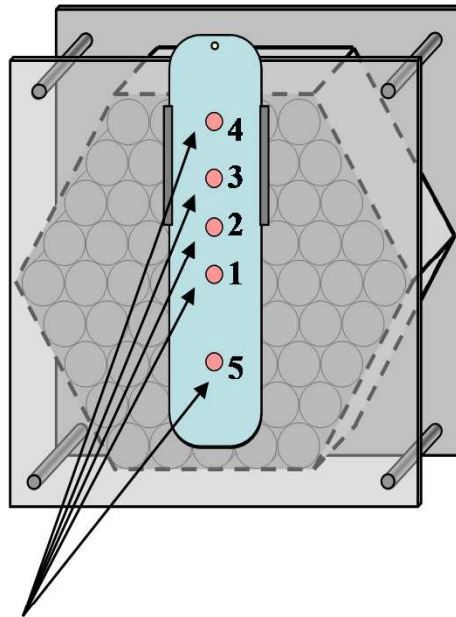
Description of uranium foils positions

Section №1



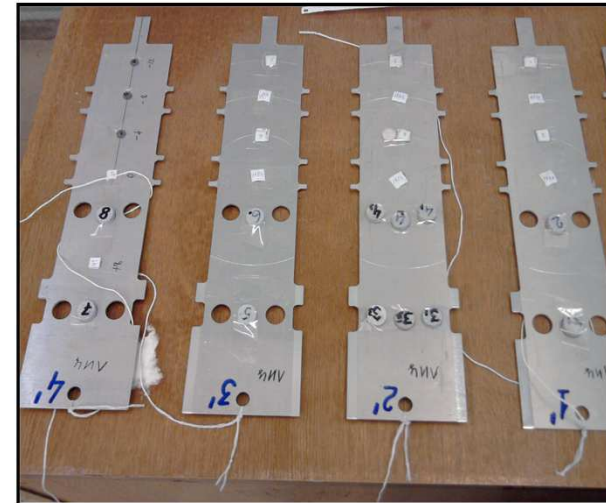
Location of the detector plate between sections

Sections №2,3,4,5



The scheme of sandwiches ^{nat}U - lavsan location on the detector plate, used in the experiment. Each plate had 5 positions at different distances from the longitudinal symmetry axis of the target

Detector plates



-
- 4 R = 120 mm
 - 3 R = 80 mm
 - 2 R = 40 mm
 - 1 R = 0
 - 5 R = -80 mm

Description of uranium foils positions

“ U_{ZR} ”

Z:

- 0 - Z = 0
- 1 - Z = 122.5 mm
- 2 - Z = 245 mm
- 3 - Z = 367.5 mm
- 4 - Z = 490 mm
- 5 - Z = 612.5 mm

R :

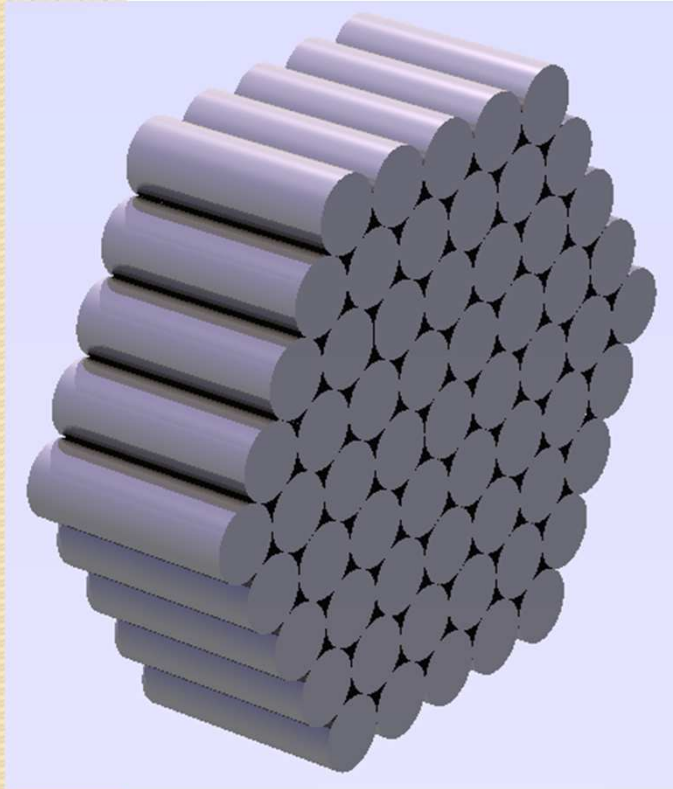
- 1 - R = 0
- 2 - R = 40 mm
- 3 - R = 80 mm
- 4 - R = 120 mm
- 5 - R = -80 mm

	0	122.5	245	367.5	490	612.5
120	U_{04}	U_{14}	U_{24}	U_{34}	U_{44}	U_{54}
80	U_{03}	U_{13}	U_{23}	U_{33}	U_{43}	U_{53}
40	U_{02}	U_{12}	U_{22}	U_{32}	U_{42}	U_{52}
0		U_{11}	U_{21}	U_{31}	U_{41}	U_{51}
-80	U_{05}	U_{15}	U_{25}	U_{35}	U_{45}	U_{55}

Deuterons total intensity

	Deuterons' Energy, GeV	Activation detectors' irradiation time	Deuterons total intensity
December 2011	1	start: 14.12.11 17 ³⁹ finish: 15.12.11 08 ⁰⁵	$1.47 \cdot 10^{13}$
	4	start: 16.12.11 19 ⁵⁷ finish: 17.12.11 08 ²¹	$1.96 \cdot 10^{13}$
	8	start: 19.12.11 00 ⁵⁹ finish: 19.12.11 05 ¹⁰ <i>(only fission from SSNTD)</i>	$6.3 \cdot 10^{10}$ (определено по ИК)
March 2012	1	start: 10.03.12 16 ⁰⁴ finish: 10.03.12 21 ⁰⁰	$1.9 \cdot 10^{13}$
	4	start: 15.03.12 00 ¹⁸ finish: 15.03.12 09 ¹⁰	$2.7 \cdot 10^{13}$
	8	start: 19.03.12 06 ²⁶ finish: 19.03.12 15 ²⁷	$3.7 \cdot 10^{12}$

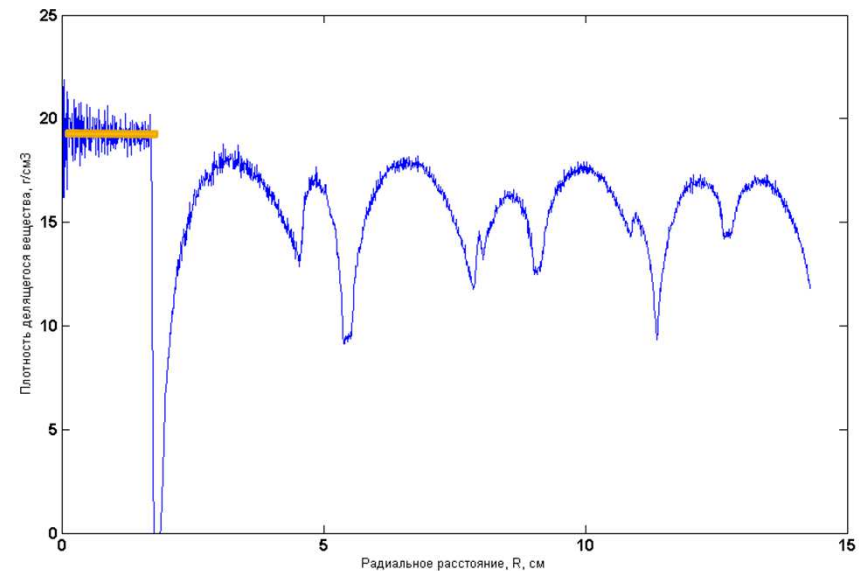
Irregularity of fissile material in KVINTA



Monte-Carlo calculation

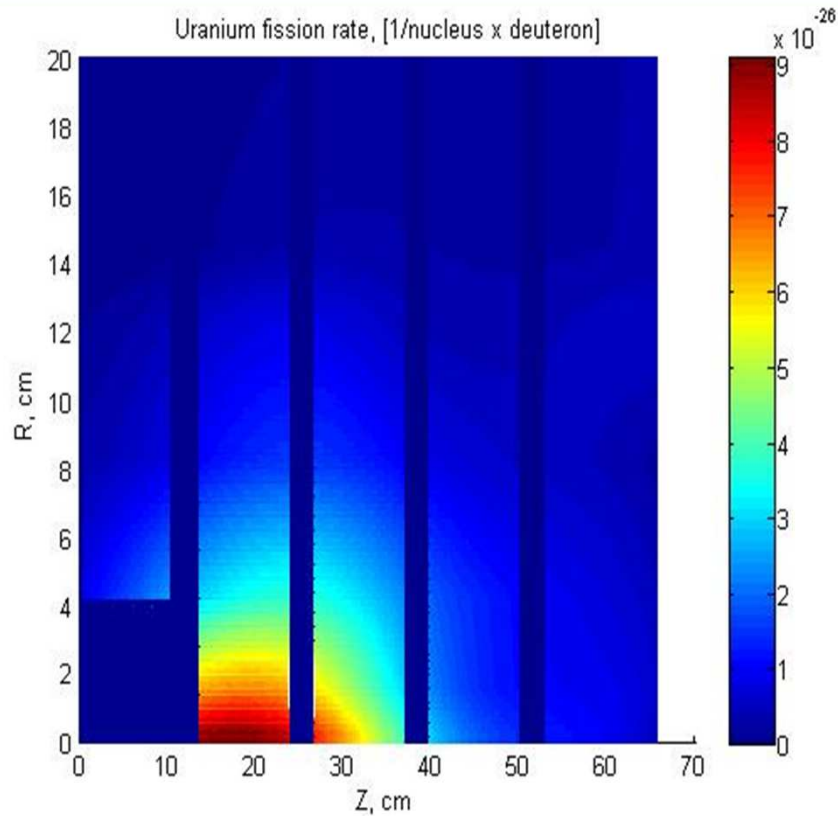
Calculation procedure:

1. neutron field is symmetrical with respect to principal axis
2. accounting of geometry fissile material spatial arrangement



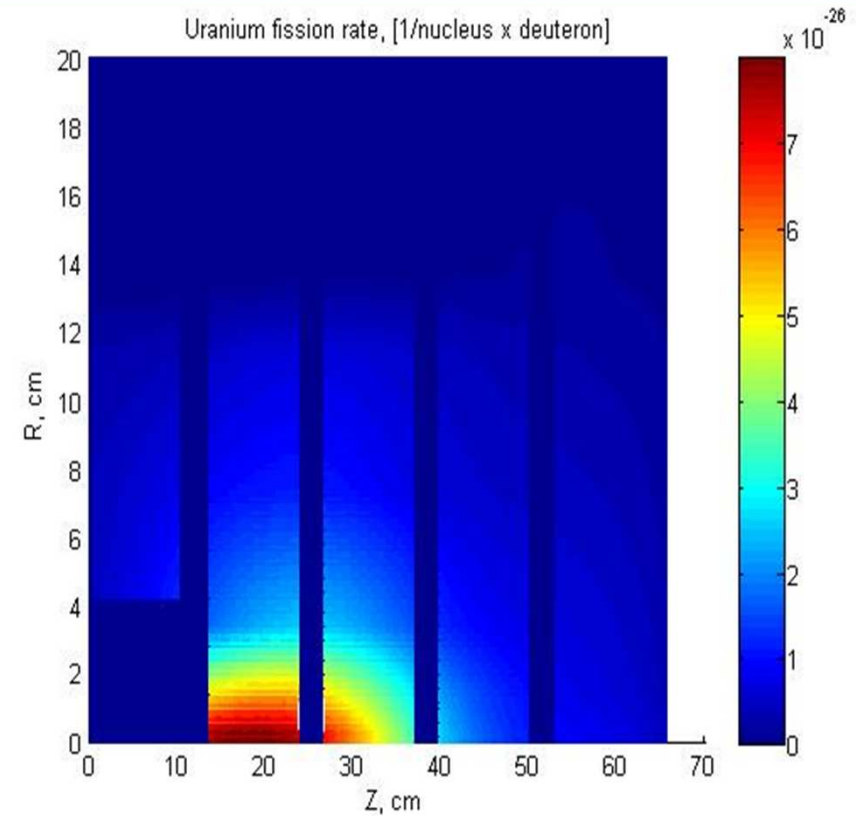
December 2011

$$I_{\text{tot}} = 1.47 \cdot 10^{13}$$



March 2012

$$I_{\text{tot}} = 1.9 \cdot 10^{13}$$



Natural U fission rate. $E=1$ GeV

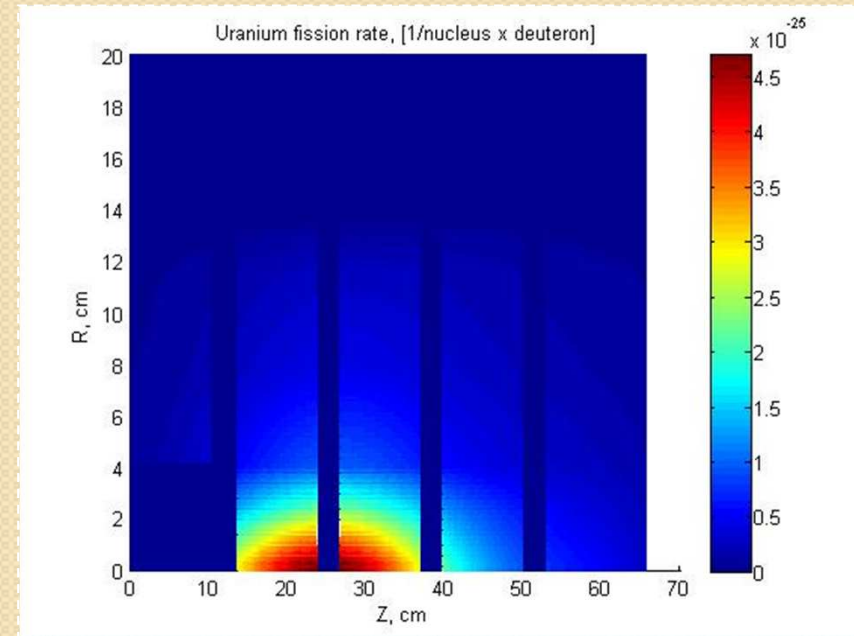
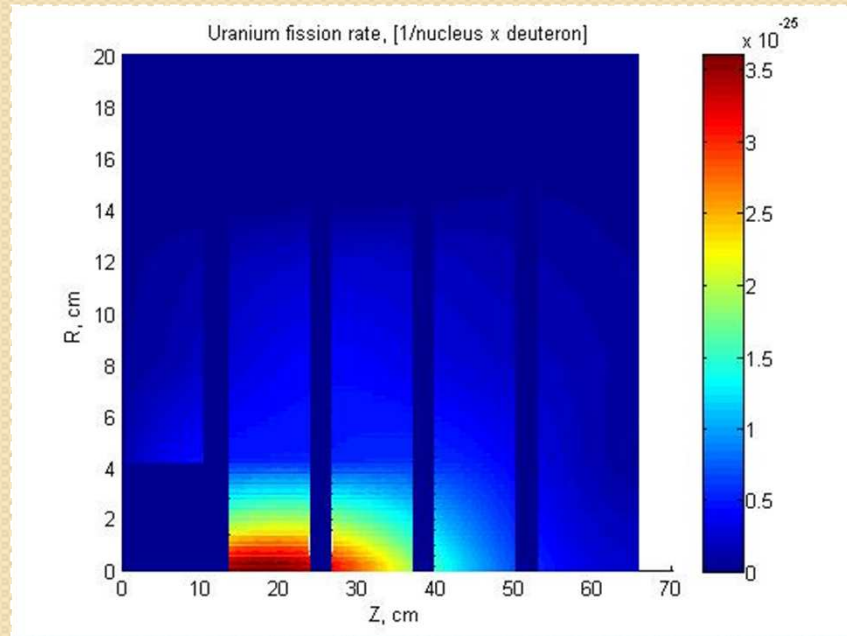
On figure distribution on an assembly axis (RZ) is shown

December 2011

$$I_{\text{tot}} = 1.96 \cdot 10^{13}$$

March 2012

$$I_{\text{tot}} = 2.7 \cdot 10^{13}$$

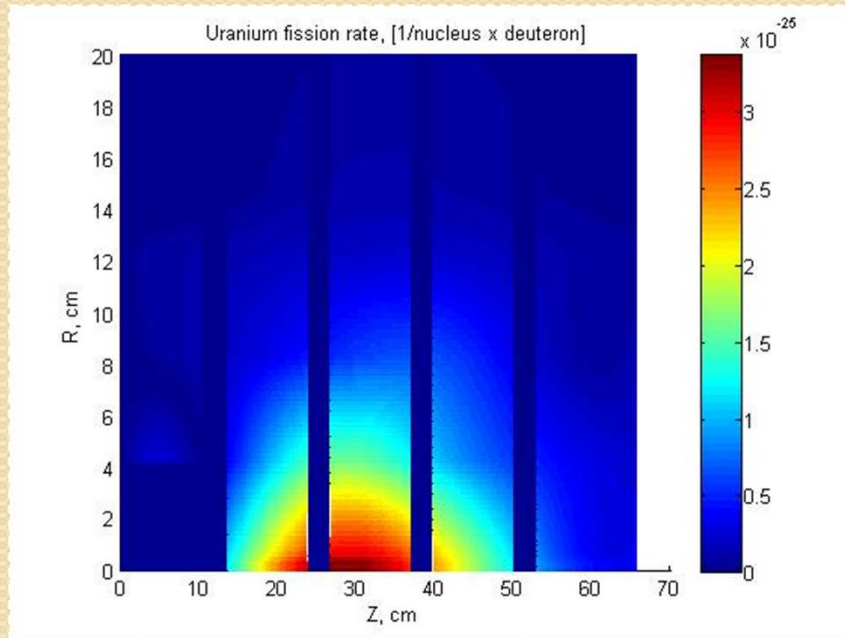


Natural U fission rate. E=4 GeV

On figure distribution on an assembly axis (RZ) is shown

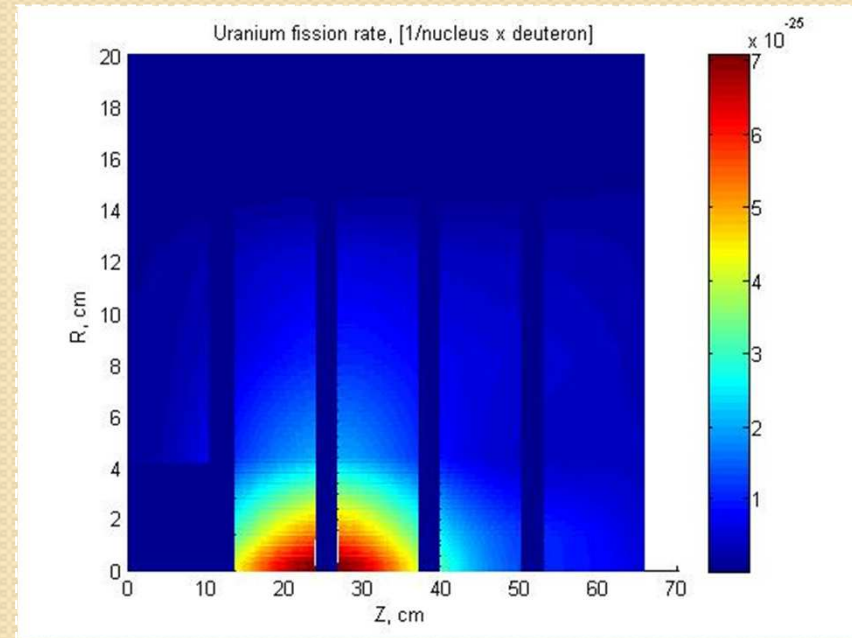
December 2011

$$I_{\text{tot}}=6.3 \cdot 10^{10}$$



March 2012

$$I_{\text{tot}}=3.7 \cdot 10^{12}$$

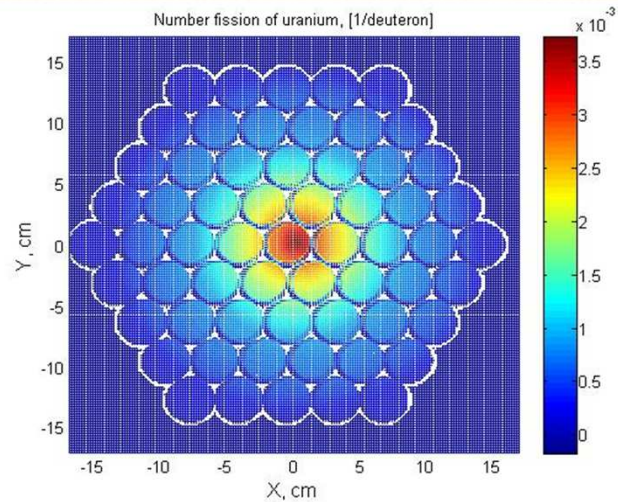


Natural U fission rate. $E=8$ GeV

On figure distribution on an assembly axis (RZ) is shown

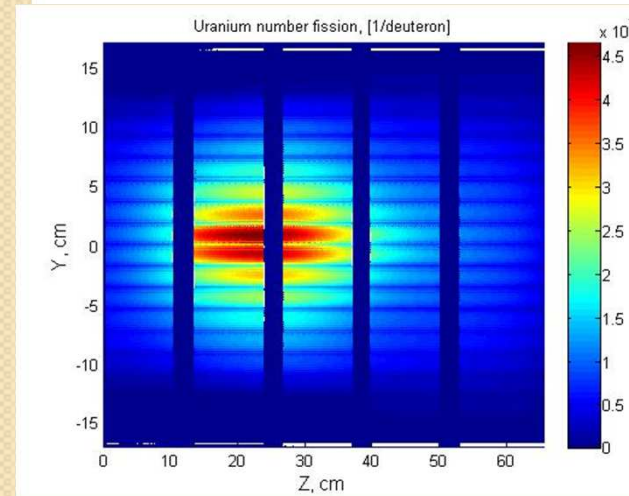
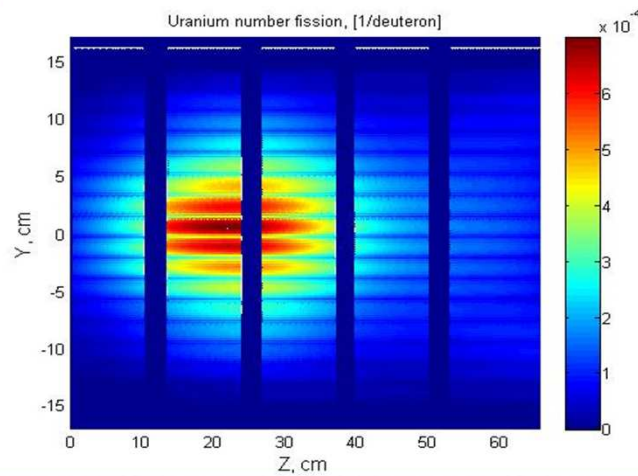
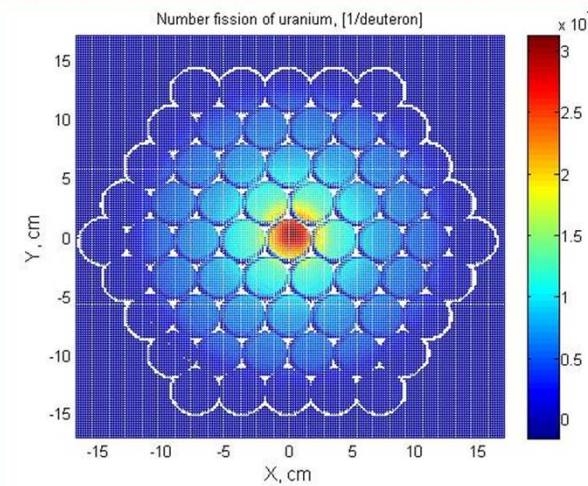
December 2011

$$I_{\text{tot}} = 1.47 \cdot 10^{13}$$



March 2012

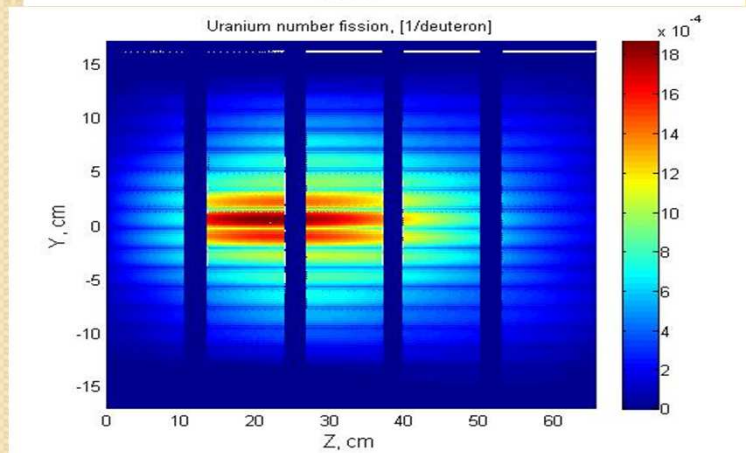
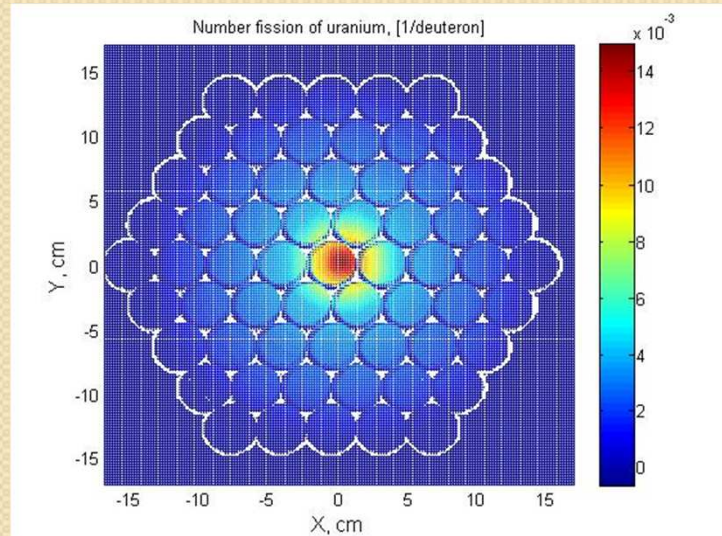
$$I_{\text{tot}} = 1.9 \cdot 10^{13}$$



Number fission of natural U in KVINTA. E=1 GeV

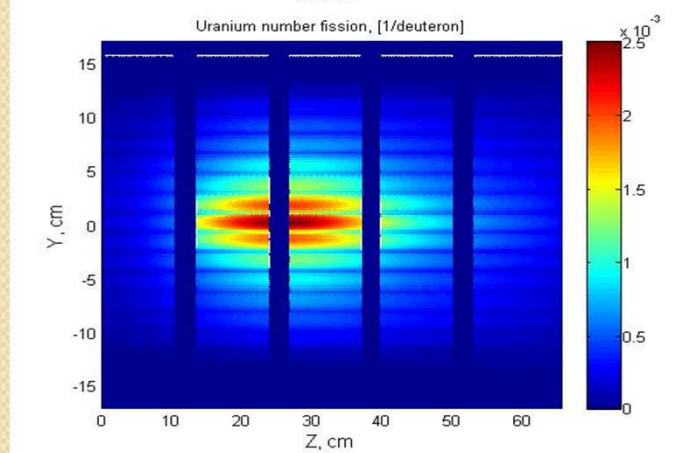
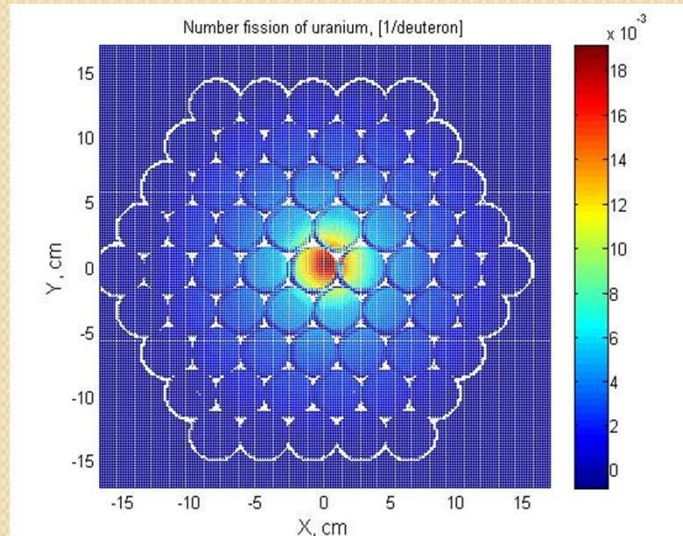
December 2011

$$I_{\text{tot}} = 1.96 \cdot 10^{13}$$



March 2012

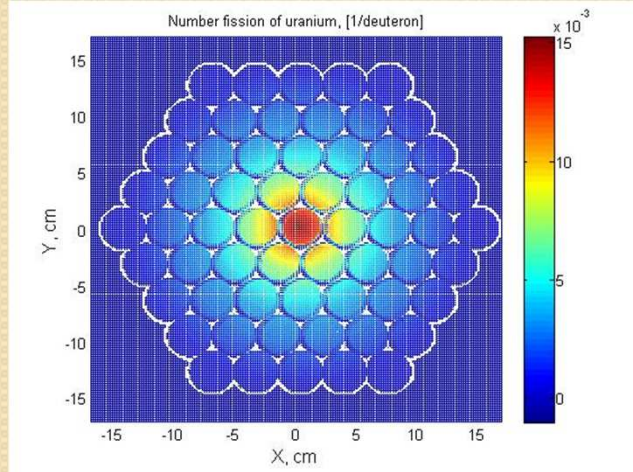
$$I_{\text{tot}} = 2.7 \cdot 10^{13}$$



Number fission of natural U in KVINTA. E=4 GeV

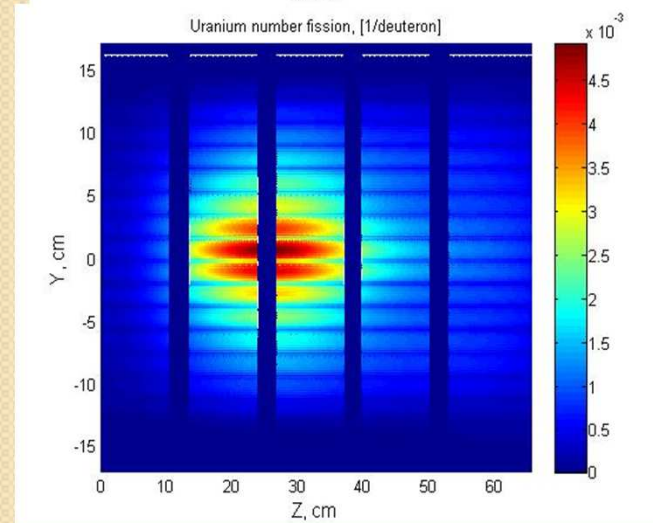
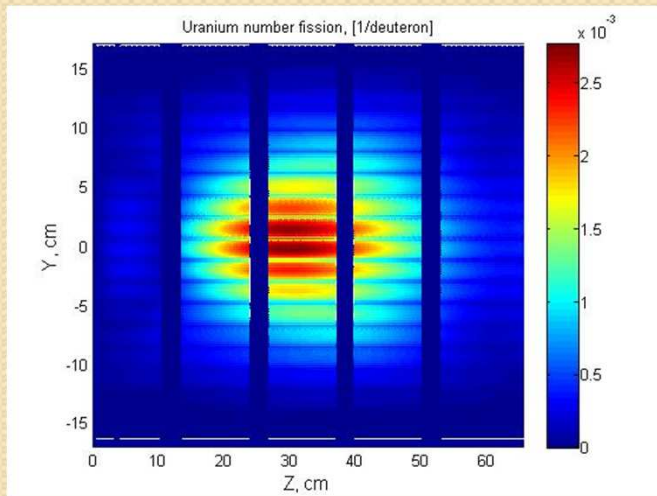
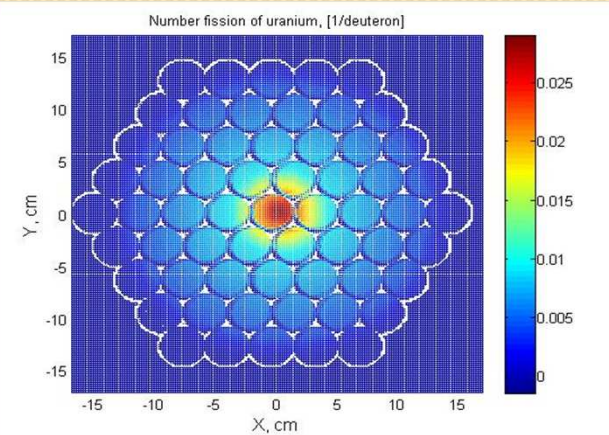
December 2011

$$I_{\text{tot}}=6.3 \cdot 10^{10}$$



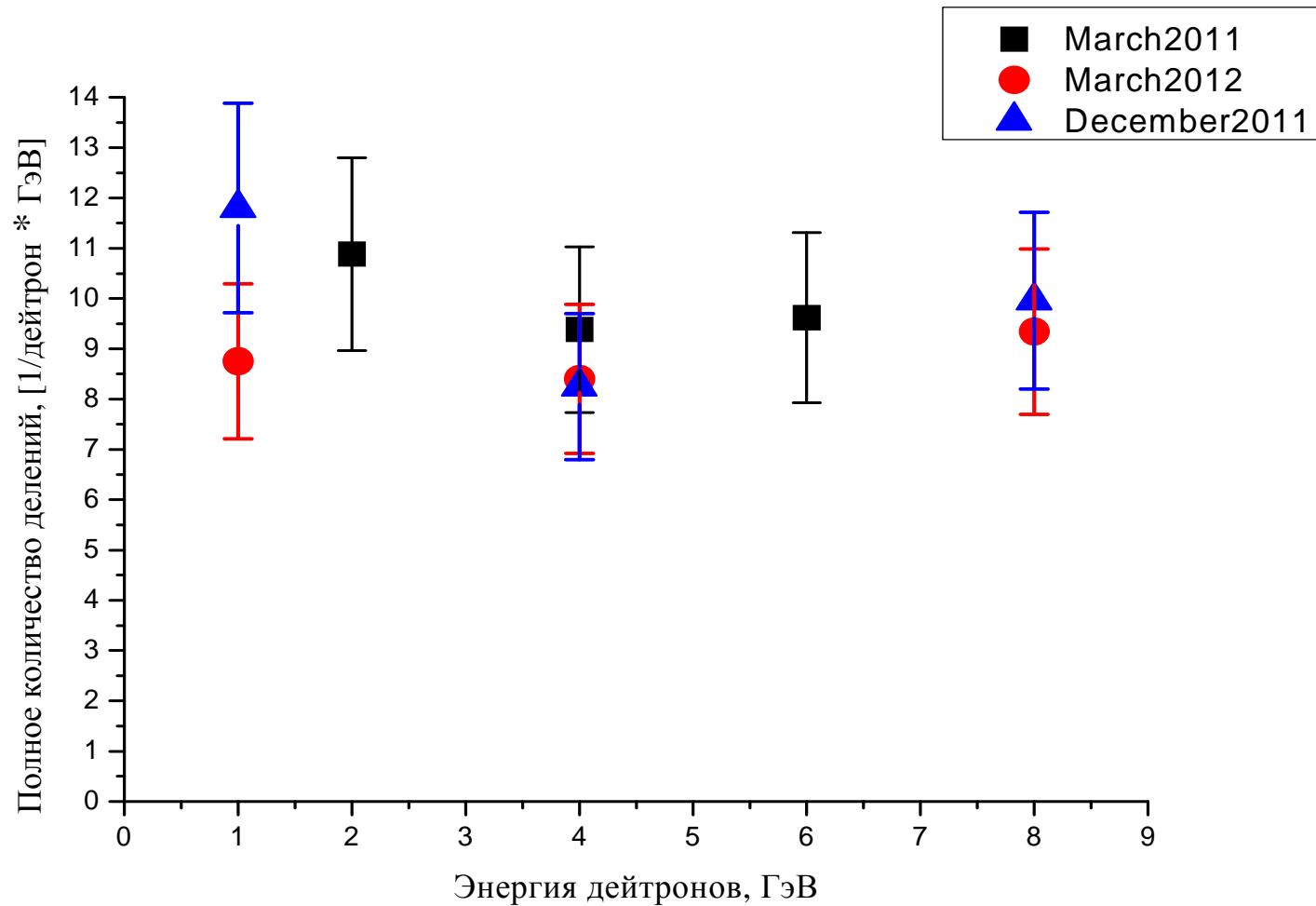
March 2012

$$I_{\text{tot}}=3.7 \cdot 10^{12}$$



Number fission of natural U in KVINTA. E=8 GeV

Total number fission of natural U in KVINTA



Conclusions:

- Obtain experimental distributions of natural uranium fission rate and natural uranium fission number in KVINTA subcritical assembly irradiated 1, 4, 8 GeV deuteron's beams;
- Total fission number of natural U, calculated per a deuteron and per 1 GeV energy of the deuteron, compared with results of RunMarch-2011 and RunDecember-2011. It does not depend on the primal energy of the deuteron beam.



*Thank you
for
your attention!*