Uncertainty on the neutron yield due to material composition study. PLAN C, PDU +

Status: https://docs.google.com/spreadsheets/d/1bsjrGQ435MP6aPNUtITggpdJ46ePs4xzAWEZZhrQScU/edit?usp=sharing

1. Chemical elements crucial in terms of neutron yield from (alpha, n)?

- e.g. elements like B or F, – present in very small fractions (<1% mass fraction of the PU foam) give large contributions to the n. background (**~1%(B), 5%(F)** of total n background in DS)

2. Available data:

- The ranking of materials contributing to n background, which is being updated with the changing version of the design and material choices. - **'Vicente's spreadsheet'** :

- detailed material list (all resistor types), total mass, activity levels used for n budget estimation etc.

- SaG4n simulations of **(α,n)** => .root output file and text file ('Maxim's files') => neutron yields

- simplified/general material list (one resistor type etc),
- material composition used for the simulation,
- Target nucleus for **(α,n) reaction (TargetZ)**

outputs > ds20k > materials > 6_PPS > PPS_chain_u238up_bias_10k_nev_20M.out

	EventNumber	parName	parEnergy (MeV)	parWeight	pos_x (cm)	pos_y (cm)	pos_z (cm)	ux	uy	uz
2	TargetZ	TargetA	KinEne (MeV)	s_energy (MeV)	s_pos_x (cm)	s_pos_y (cm)	s_pos_z (cm)	s_ux	s_uy	s
3	7713	neutron	3.7672	0.000100048	−4.07066	−3.89159	2.34813	0.967272	−0.120889	−0.223092
4	6	13	3.15884	4.7746	−4.07006	−3.89235	2.3473	−0.46833	0.584501	0.66
5	8324	neutron	5.01138	0.000100001	−3.14412	0.251604	1.23617	−0.832173	−0.223387	0.507531
6	6	13	4.76692	4.7746	−3.14412	0.251601	1.23618	−0.203052	0.374904	−0.904
7	9636	neutron	3.54708	0.000100021	−4.76505	3.29219	2.85556	−0.690808	−0.705053	−0.160264
8	6	13	2.55069	4.151	−4.76476	3.2913	2.85486	−0.26123	0.751839	0.60
9	12045	neutron	5.35596	0.000100035	−2.46411	3.40177	−3.39643	0.50623	0.825905	−0.248218
10	6	13	3.86727	4.687	−2.4648	3.40173	−3.3965	0.993526	0.0480011	0.102
11	13926	neutron	3.53965	0.000100051	−4.86725	1.56012	−2.65435	0.316571	0.128405	−0.939838
12	6	13	2.75552	4.687	−4.86784	1.5597	−2.65567	0.392224	0.270673	0.879
13	19724	neutron	5.50966	0.000100008	−3.76695	4.33005	3.42444	0.64493	−0.749476	−0.149498
14	6	13	3.50752	4.198	−3.76711	4.33052	3.42461	0.314055	−0.889022	−0.333
15	28420	neutron	5.26427	0.000100011	2.14603	−3.88512	−3.22332	0.0450707	0.205966	0.977521
16	6	13	4.56556	4.7224	2.14591	−3.88516	−3.2233	0.936826	0.317509	−0.146
17	29466	neutron	4.2684	0.000100011	−0.351356	−2.69594	2.47982	0.309251	−0.909177	0.278856
18	6	13	3.25619	4.151	−0.351312	−2.6958	2.4805	−0.0573868	−0.203747	−0.97
19	29490	neutron	3.96055	0.000100024	−3.43118	0.182569	−3.38973	0.514337	−0.851685	0.100453
20	6	13	2.67324	4.198	−3.43172	0.182341	−3.38877	0.478356	0.209708	−0.852
21	31452	neutron	5.39112	0.000100036	1.61725	−2.89414	1.58041	−0.418767	0.894087	−0.15888
22	6	13	3.96838	4.687	1.61789	−2.89415	1.58047	−0.994671	0.0157263	−0.101
23	33101	neutron	4.14363	0.00010006	−4.54387	−0.551155	−1.14159	−0.733665	−0.669936	0.11367
24	6	13	2.37187	4.7746	−4.54413	−0.549368	−1.14136	0.136531	−0.98231	−0.128
25	35472	neutron	4.9173	0.000100039	0.264182	4.86715	4.22579	−0.776323	−0.338582	0.531682
26	6	13	3.19201	4.6205	0.265193	4.86663	4.22557	−0.87427	0.447528	0.188

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3.Analysis:
for each simulated material and chain (238U upper 238U mid 238U lower Th232 235U**)**

- histogram TargetZ (the n yield /chemical element/chain)
- combine with measured activites – **total n yield per chemical element in the material**

4. Results:

Ranking of chemical elements - most active in neutron production in DS-20k neutron budget
=> uncertainty of the chemical composition of the material (assumed 20% from EA results)
=> uncertainty on the neutron yield

DS specific input:

- Mass of the material (design)
- 'cut' coefficient (design + MC)

- **=> uncertainty on the neutron for DS-20k**