

Energy Deposition Curves for Standard LLE Radiochromic Film Packs

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Notes

Energy deposition curves are calculated using the radiochromic film detector stack feature in [PlasmaPy](#), using proton stopping power from the [NIST PSTAR database](#).

Stopping power in the following materials is modeled using the closest match in the PSTAR database:

Material	Material used (closest equivalent)
RCF film (active layer & substrate)	AC-150 tissue-equivalent plastic
CR39 plastic	Polycarbonate

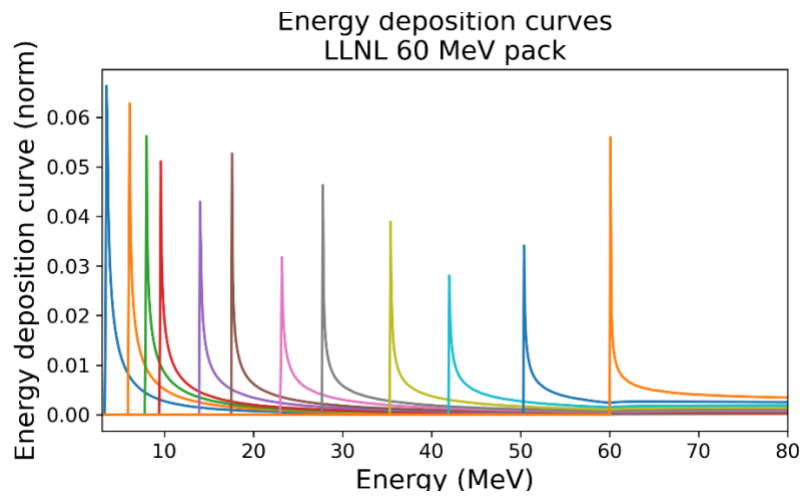
Stopping power for all other materials are explicitly included in the PSTAR database.

Note that [MD-V3 is a direct replacement for MD-v2-55 film](#)

For questions, for raw energy deposition curve data, or for assistance calculating energy deposition curves for a custom stack, email pheu@lle.rochester.edu

Chart 1: LLNL “60 MeV” Pack Assembly by Layer

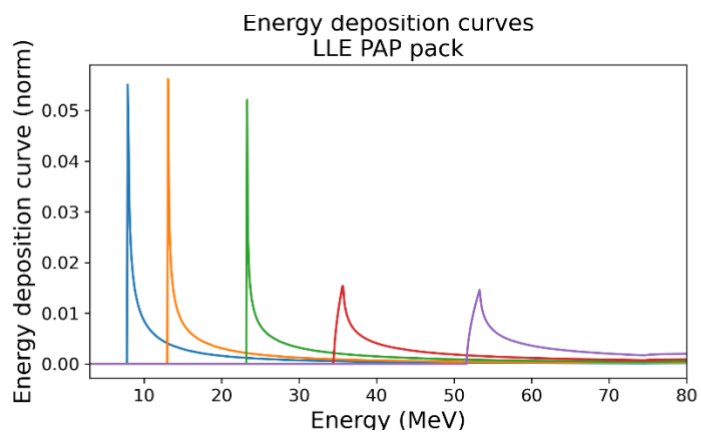
Layer	60 MeV Pack Assembly	
	Material	Label
1	100 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	500 μm Al	
10	HD-V2 Film	H5
11	500 μm Al	
12	HD-V2 Film	H6
13	1000 μm Al	
14	HD-V2 Film	H7
15	1000 μm Al	
16	HD-V2 Film	H8
17	2000 μm Al	
18	HD-V2 Film	H9
19	2000 μm Al	
20	HD-V2 Film	H10
21	3000 μm Al	
22	MD-v2-55 Film	M11
23	4000 μm Al	
24	MD-v2-55 Film	M12



Number of layers	36	
Number of active layers	12	
Total stack thickness (mm)	15.708	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	3.5	3.8
2	6.1	6.2
3	8	8.1
4	9.6	9.7
5	14	14.2
6	17.6	17.7
7	23.2	23.4
8	27.8	27.9
9	35.4	35.5
10	42	42.2
11	50.4	50.5
12	60.1	60.1

LLE PAP

Layer	PAP Pack Assembly	
	Material	Label
1	100 μm Al	
2	25 μm Cu	
3	50 μm Cu	
4	50 μm Cu	
5	HD-V2 Film	H5
6	100 μm Cu	
7	100 μm Cu	
8	HD-V2 Film	H8
9	300 μm Cu	
10	300 μm Cu	
11	MD-v2-55 Film	M11
12	500 μm Cu	
13	500 μm Cu	
14	500 μm CR-39	NONE
15	1000 μm Cu	
16	1000 μm Cu	
17	1000 μm CR-39	NONE
18	1000 μm Cu	
19	7000 μm Al	

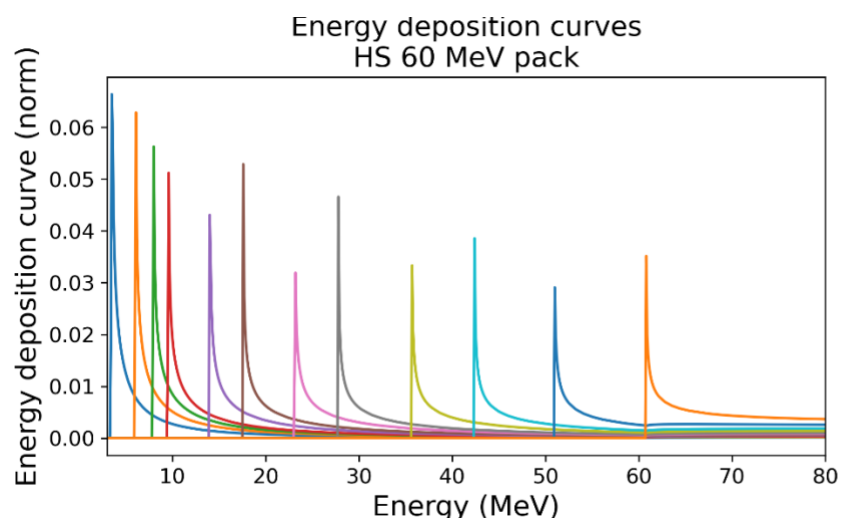


Number of layers	23	
Number of active layers	5	
Total stack thickness (mm)	14.003	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	7.9	8.1
2	13.1	13.2
3	23.3	23.4
4	34.9	36.7
5	52.2	54.6

HS 60 MEV

“High sensitivity”

HS 60 MeV Pack Assembly		
Layer	Material	Label
1	100 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	500 μm Al	
10	HD-V2 Film	H5
11	500 μm Al	
12	HD-V2 Film	H6
13	1000 μm Al	
14	HD-V2 Film	H7
15	1000 μm Al	
16	HD-V2 Film	H8
17	2000 μm Al	
18	MD-v2-55 Film	M9
19	2000 μm Al	
20	MD-v2-55 Film	M10
21	3000 μm Al	
22	MD-v2-55 Film	M11
23	4000 μm Al	
24	MD-v2-55 Film	M12

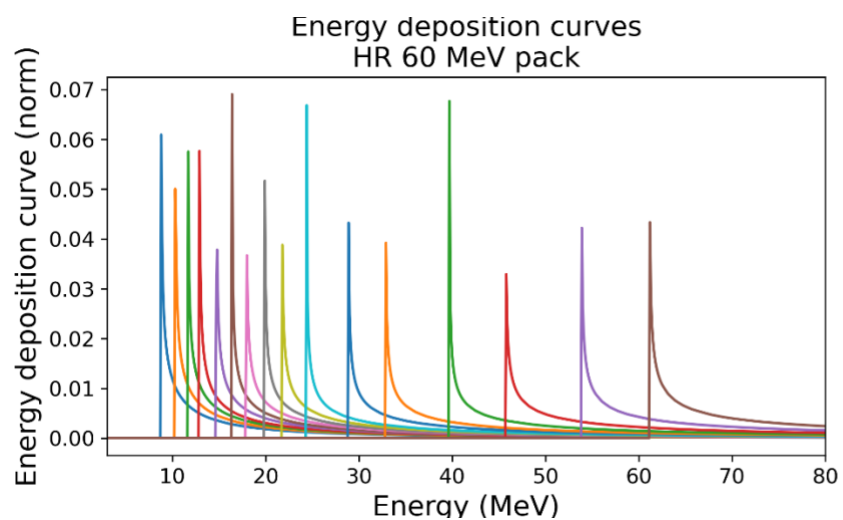


Number of layers	40	
Number of active layers	12	
Total stack thickness (mm)	16.312	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	3.5	3.8
2	6.1	6.2
3	8	8.1
4	9.6	9.7
5	14	14.2
6	17.6	17.7
7	23.2	23.4
8	27.8	27.9
9	35.7	35.8
10	42.4	42.5
11	51	51.2
12	60.8	60.9

HR 60 MeV

“High resolution”

High Resolution 60 MeV Pack Assembly		
Layer	Material	Label
1	500 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	200 μm Al	
10	HD-V2 Film	H5
11	200 μm Al	
12	HD-V2 Film	H6
13	200 μm Al	
14	HD-V2 Film	H7
15	300 μm Al	
16	HD-V2 Film	H8
17	300 μm Al	
18	HD-V2 Film	H9
19	500 μm Al	
20	HD-V2 Film	H10
21	1000 μm Al	
22	HD-V2 Film	H11
23	1000 μm Al	
24	HD-V2 Film	H12
25	2000 μm Al	
26	HD-V2 Film	H13
27	2000 μm Al	
28	HD-V2 Film	H14
29	3000 μm Al	
30	MD-V2-55	M15
31	3000 μm Al	
32	MD-V2-55	M16
33	4000 μm Al	
34	4000 μm Al	
35	5000 μm Al	



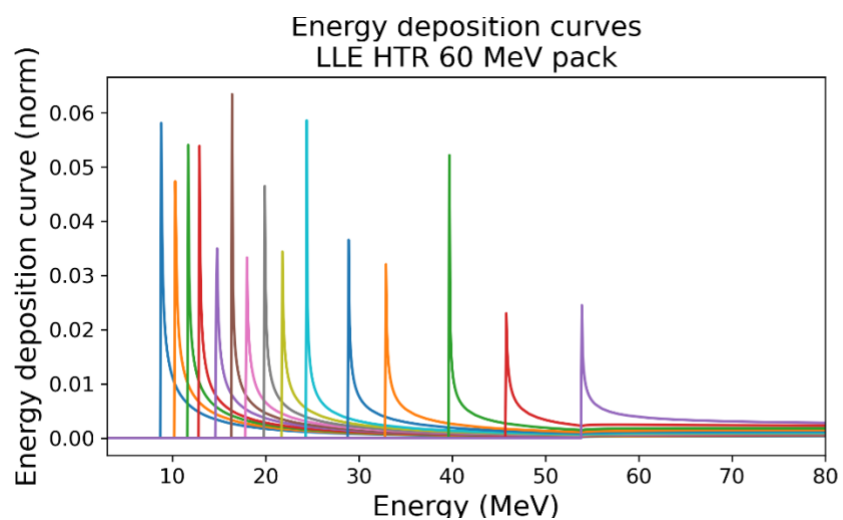
Number of layers	53	
Number of active layers	16	
Total stack thickness (mm)	29.546	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	8.8	8.9
2	10.3	10.5
3	11.7	11.8
4	12.9	13
5	14.7	15
6	16.4	16.4
7	18	18.2
8	19.9	20
9	21.8	22
10	24.4	24.4
11	28.9	29
12	32.9	33
13	39.7	39.7
14	45.8	46
15	53.9	54
16	61.2	61.4

LLE HTR 60 MeV

“High temporal resolution”

Note that this is almost identical to the HR 60 MeV pack except for one extra film and some filtering at the end?

High Temporal Resolution 60 MeV Pack Assembly		
Layer	Material	Label
1	500 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	200 μm Al	
10	HD-V2 Film	H5
11	200 μm Al	
12	HD-V2 Film	H6
13	200 μm Al	
14	HD-V2 Film	H7
15	300 μm Al	
16	HD-V2 Film	H8
17	300 μm Al	
18	HD-V2 Film	H9
19	500 μm Al	
20	HD-V2 Film	H10
21	1000 μm Al	
22	HD-V2 Film	H11
23	1000 μm Al	
24	HD-V2 Film	H12
25	2000 μm Al	
26	HD-V2 Film	H13
27	2000 μm Al	
28	HD-V2 Film	H14
29	3000 μm Al	
30	MD-V2-55	M15



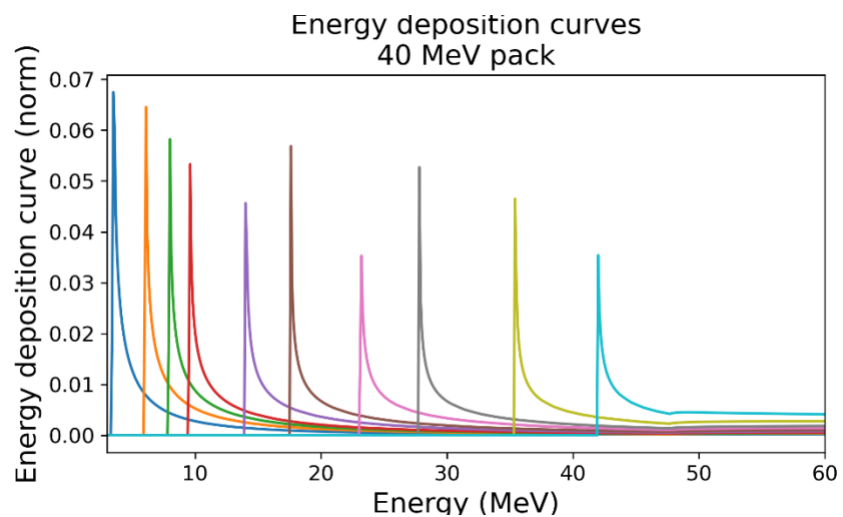
Number of layers	46	
Number of active layers	15	
Total stack thickness (mm)	13.286	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	8.8	8.9
2	10.3	10.5
3	11.7	11.8
4	12.9	13
5	14.7	15
6	16.4	16.4
7	18	18.2
8	19.9	20
9	21.8	22
10	24.4	24.4
11	28.9	29
12	32.9	33
13	39.7	39.7
14	45.8	46
15	53.9	54.1

Pg. 12: LLE HTR 60 MeV

LLNL 40 MeV

Chart 7: LLNL “40 MeV” Pack Assembly by Layer

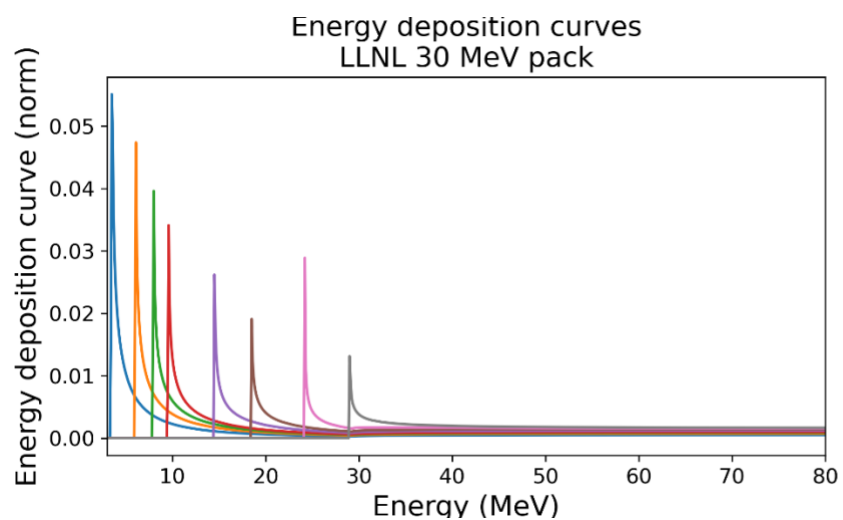
Layer	40 MeV Pack Assembly	
	Material	Label
1	100 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	500 μm Al	
10	HD-V2 Film	H5
11	500 μm Al	
12	HD-V2 Film	H6
13	1000 μm Al	
14	HD-V2 Film	H7
15	1000 μm Al	
16	HD-V2 Film	H8
17	2000 μm Al	
18	HD-V2 Film	H9
19	2000 μm Al	
20	HD-V2 Film	H10
21	2000 μm Al	



Number of layers	31	
Number of active layers	10	
Total stack thickness (mm)	10.49	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	3.5	3.8
2	6.1	6.2
3	8	8.1
4	9.6	9.7
5	14	14.2
6	17.6	17.7
7	23.2	23.4
8	27.8	27.9
9	35.4	35.5
10	42	42.2

LLNL 30 MeV

30 MeV Pack Assembly		
Layer	Material	Label
1	100 μm Al	
2	HD-V2 Film	H1
3	100 μm Al	
4	HD-V2 Film	H2
5	100 μm Al	
6	HD-V2 Film	H3
7	100 μm Al	
8	HD-V2 Film	H4
9	500 μm Al	
10	MD-V2-55 Film	M5
11	500 μm Al	
12	MD-V2-55 Film	M6
13	1000 μm Al	
14	MD-V2-55 Film	M7
15	1000 μm Al	
16	MD-V25-- Film	M8

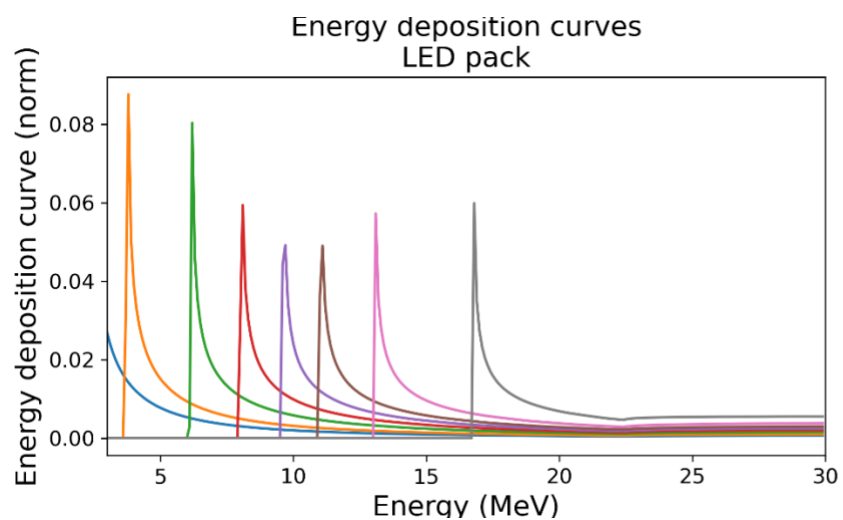


Number of layers	28	
Number of active layers	8	
Total stack thickness (mm)	4.876	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	3.5	3.8
2	6.1	6.2
3	8	8.1
4	9.6	9.7
5	14.5	14.7
6	18.5	18.7
7	24.2	24.2
8	29	29.2

LED

“Low energy divergence”

Low Energy Divergence Assembly		
Layer	Material	Label
1	50 μm Al	
2	HD-V2 Film	H1
3	HD-V2 Film	H2
4	100 μm Al	
5	HD-V2 Film	H3
6	100 μm Al	
7	HD-V2 Film	H4
8	100 μm Al	
9	HD-V2 Film	H5
10	100 μm Al	
11	HD-V2 Film	H6
12	200 μm Al	
13	HD-V2 Film	H7
14	500 μm Al	
15	HD-V2 Film	H8
16	1000 μm Al	



Number of layers	24	
Number of active layers	8	
Total stack thickness (mm)	3.022	
Layer	FWHM beginning (MeV)	FWHM end (MeV)
1	2.3	2.6
2	3.8	3.9
3	6.2	6.3
4	8.1	8.3
5	9.6	9.9
6	11	11.3
7	13.1	13.2
8	16.8	16.9