Updated Dynamic Threshold Recommendations for EPI-Hi/LET

Richard Mewaldt

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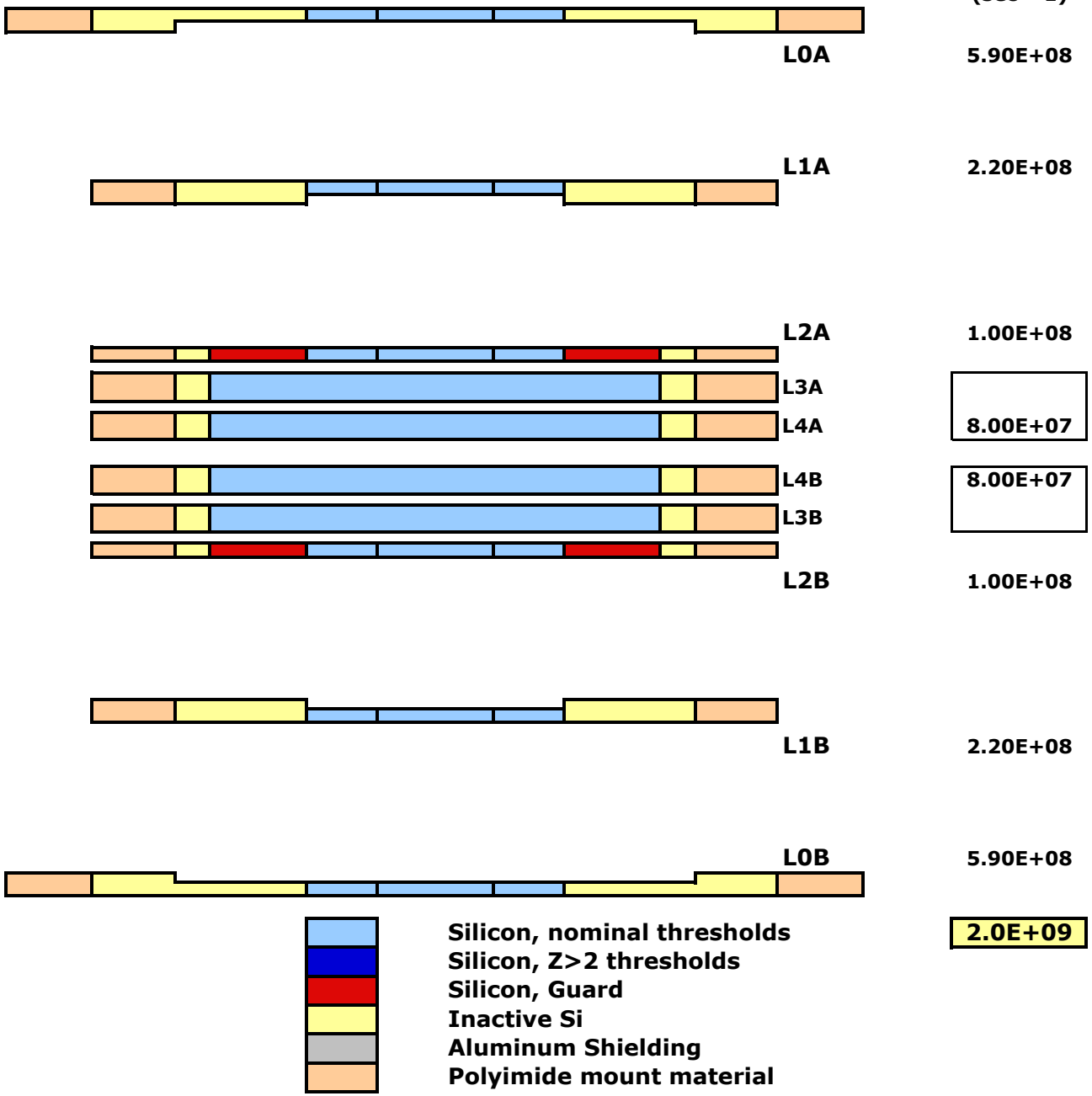
Abstract

In an memo dated 11/26/13 (updated on 1/28/14) I outlined 7 stages of dynamic thresholds for LET-1 ranging from "Nominal" to "Pixel". The idea (based on the STEREO LET dynamic thresholds; see Mewaldt et al. SSR, 2007) is to reduce the LET singles rates due to H and He by progressively raising selected detector thresholds to Z ≥ 6 levels, thereby reducing the geometry factor for H and He single detector triggers and events. The Pixel count rates in LET will serve as the "monitor" rates that trigger these successive changes (and guide the retreat to normal operations). We use the 95% "Worst-Case" spectrum defined in the EDTRD to estimate the singles count rates in counts/sec. Note that the Z ≥ 6 geometry can remain fully active in all of the "stages", although some guard thresholds will be raised and thus less effective, and the "stopping" energy range may be affected.

In this update we reduce the 7 possible stages to recommend four (including the Nominal and Pixel modes). We also recommend one of the two choices for Level 2 that were suggested in the memo of 1/28/14. Also included are the corresponding LET-2 modes. Presented here are the trigger modes, single detector rates, energy ranges, geometry factors, and particle identification matrices that would be needed. Note that the Level 2 configuration requires a new coincidence mode for H & He (L2center vs. L3; see slide 5).

Using the 95% Worst-Case Spectrum the estimated LET-1 singles rates for Levels 0 through 3 are 1.0 x 10^9/sec; 2.5 x 10^8/sec, 8 x 10^7/sec, and 1.0 x 10^7/sec. They are about a factor of 2 lower for LET-2. The estimated count rates for the Bastille day event of 2000 would be about a factor of 1000 lower.

LET-1: Level 0 = Nominal



Rate (sec^-1)	
L0A	5.90E+08
L1A	2.20E+08
L2A	1.00E+08
L3A	8.00E+07
L4A	
L4B	8.00E+07
L3B	
L2B	1.00E+08
L1B	2.20E+08
L0B	5.90E+08
	2.0E+09

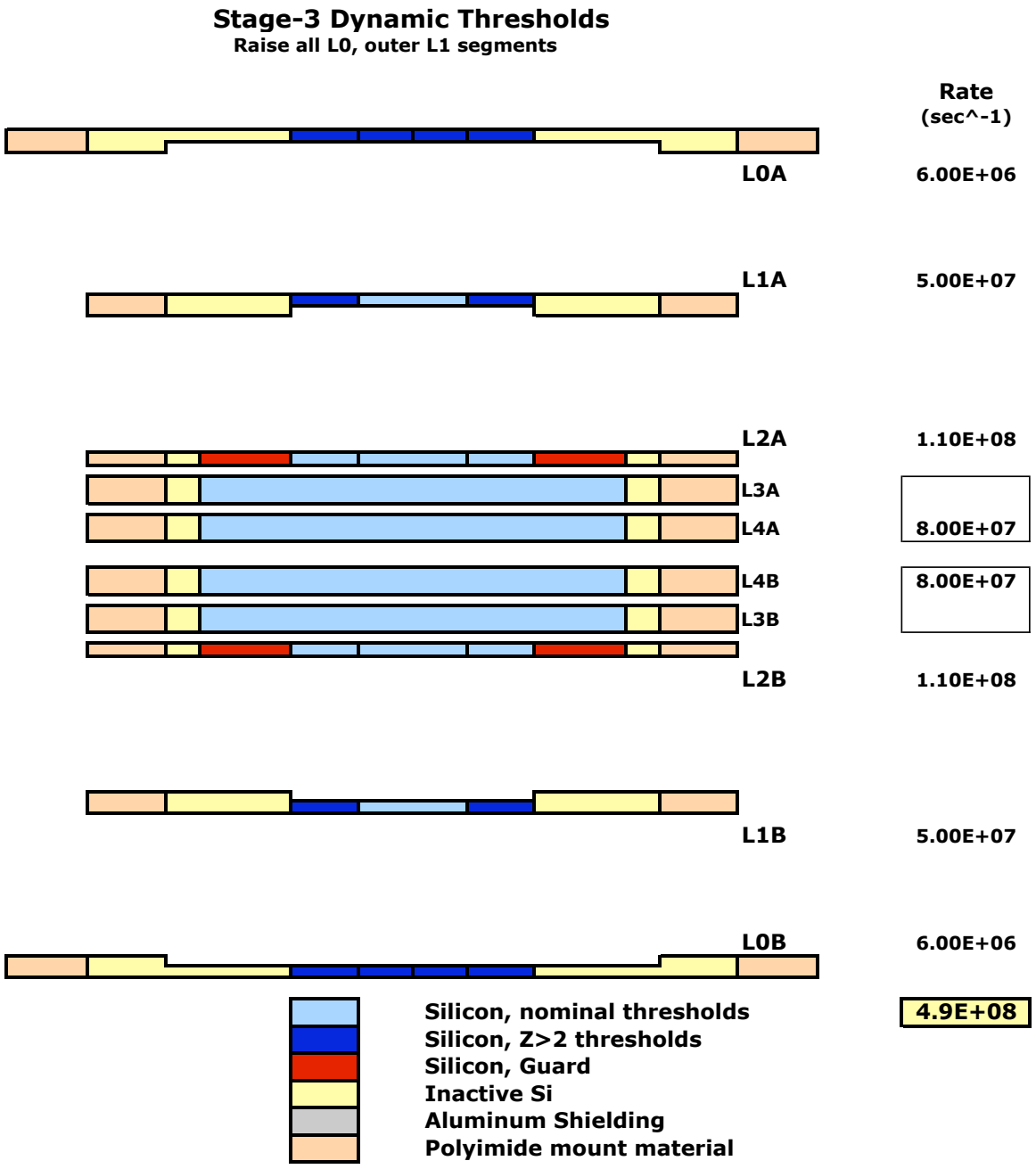
The count rates are approximate estimates of singles rates for the "95%-Worst- Case SEP spectrum

Trigger modes:
Stopping
L0•L1, L1•L2 with all guards in Anticoincidence.

Penetrating: We should consider L2Acenter•L2Bcenter as a backup for HET H and He (otherwise we cannot meet our requirements without HET

Matrices:
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs. L4; L4 vs. L3)

LET-1: Level 1 = L1 Trigger

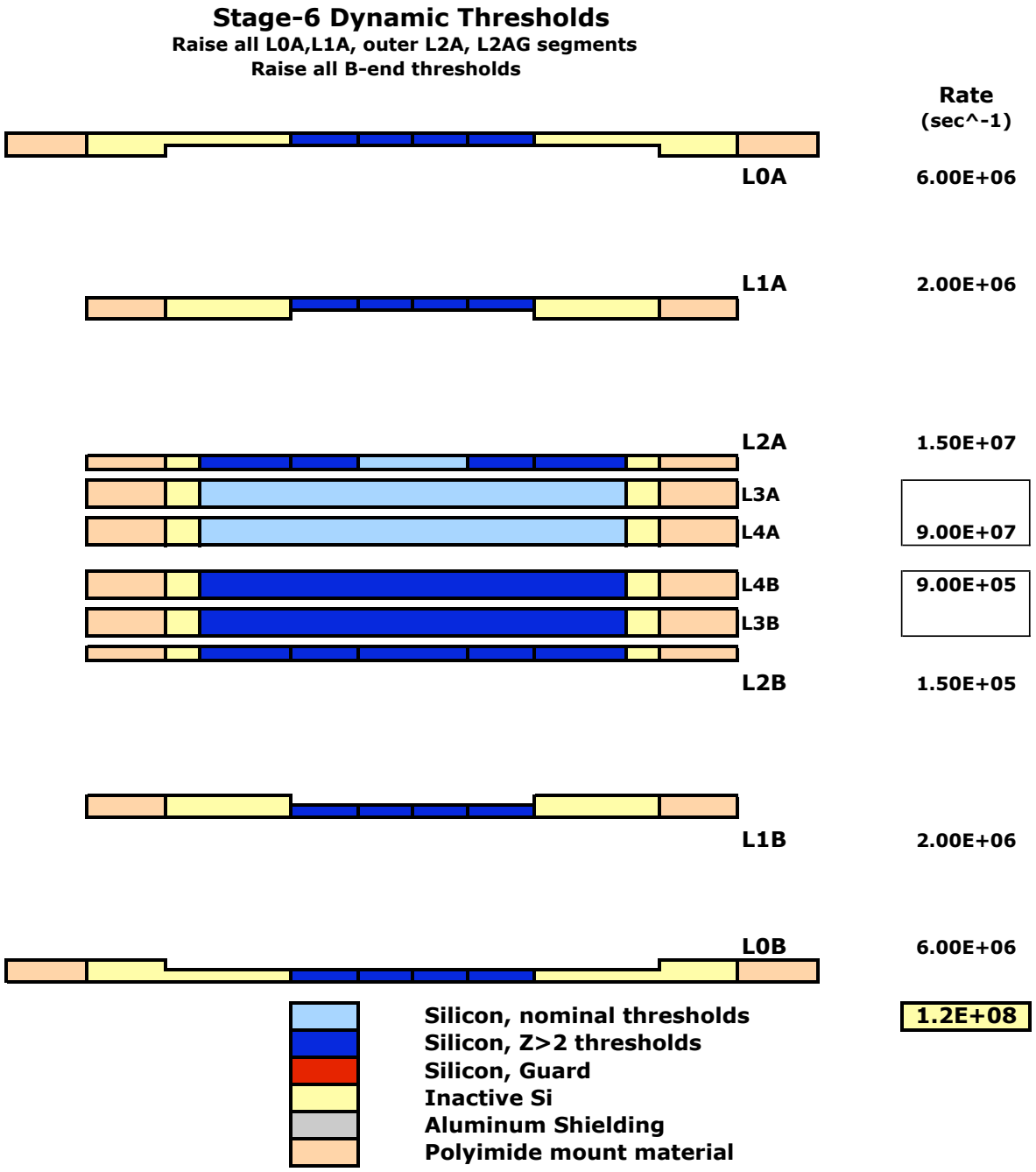


Raise all L0 & all outer L1 segments to Z≥6 levels.

<u>Trigger modes:</u>
L0•L1, L1•L2

<u>Matrices:</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L4; L4 vs. L3)

LET-1: Level 2 = L2 Trigger, Favored Possibility



Raise all L0A and L1A, and outer L2A segments to Z≥6 levels. Raise all B-end thresholds to Z≥6 levels.

Note: Primary H & He mode would be L2A vs L3A with L4A in anticoincidence (don't think we can use L2A•L3A•L4A events or they would dominate)

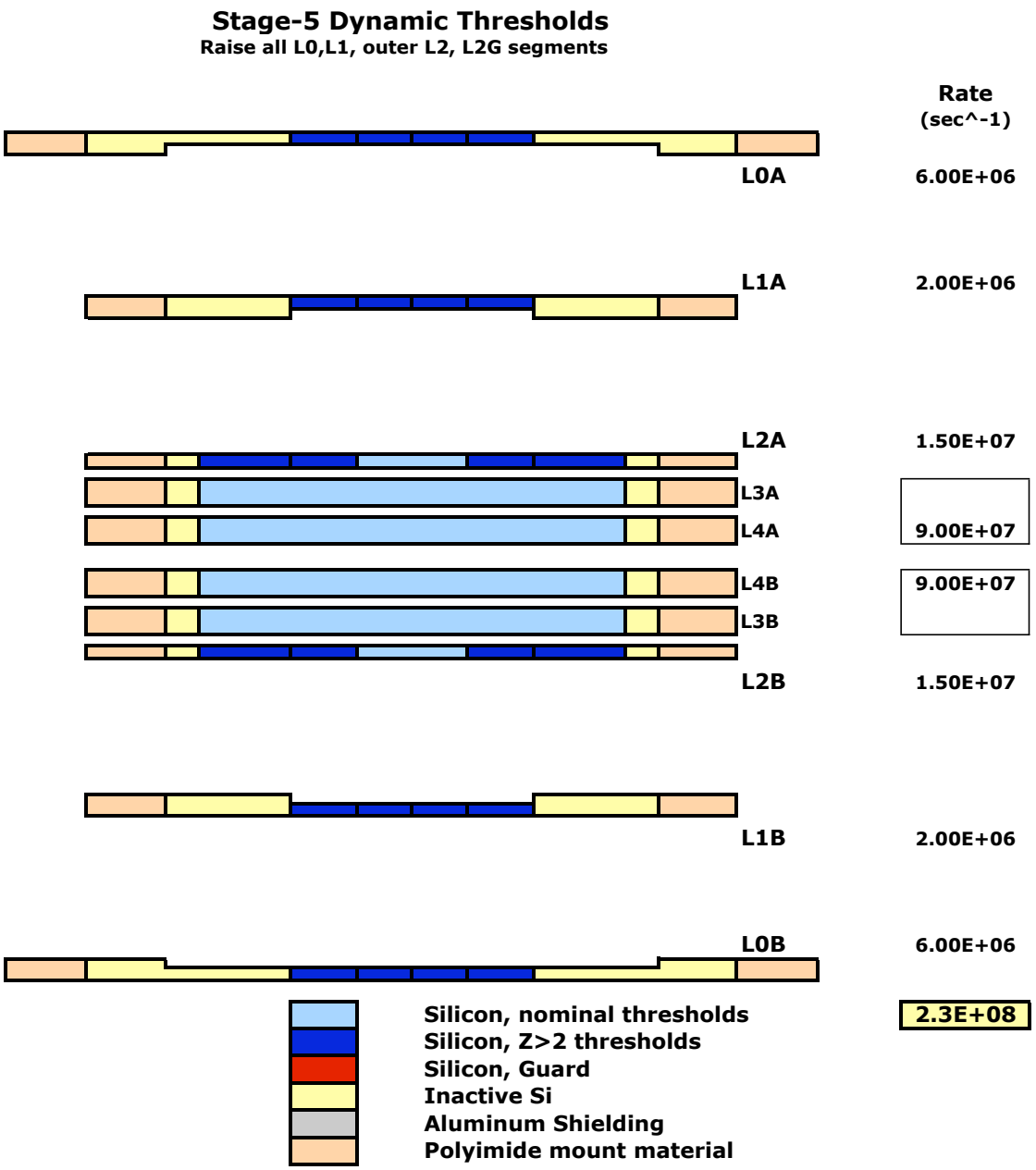
<u>Trigger modes (both ends):</u>
L0•L1, L1•L2 for heavy ions
L2Ac vs. L3A for H&He

<u>Matrices:</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L4; L4 vs. L3)

Pros: Lower singles rates
Cons: Smaller E-range for H, He

Could also consider L4B & L3B on
But then singles ~2.2e8

LET-1: Level 2 = L2 Trigger (less desirable possibility)



Raise all L0 and L1, and outer L2 segments to Z≥6 levels.

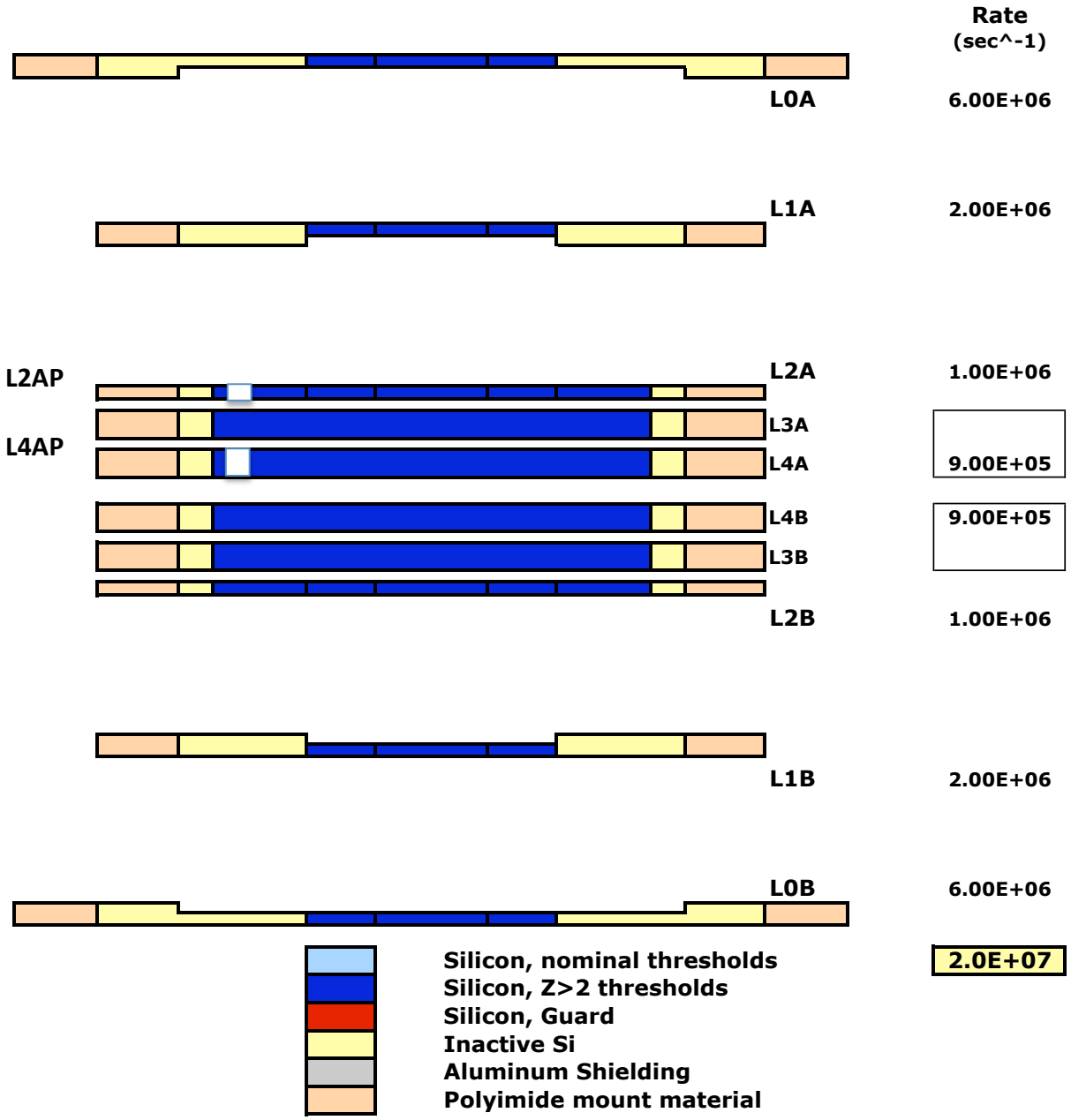
<u>Trigger modes (both ends):</u>
L0•L1, L1•L2
L2Ac•L3A•notL3B and
L2Bc•L3B•notL3A (not previously used)

Could also consider L2A•L2B (Pen Mode)

<u>Matrices:</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L4; L4 vs. L3)

Pros:
- Still double ended
- H & H range = 10-25 MeV/nuc (not totally clean)
- Same E-Range for for LETB => easy to combine

LET-1: Level 3 =“Pixel”



Raise all L0, L1, L2, L3, and L3 inner, outer, and guard segments to Z≥6 levels.

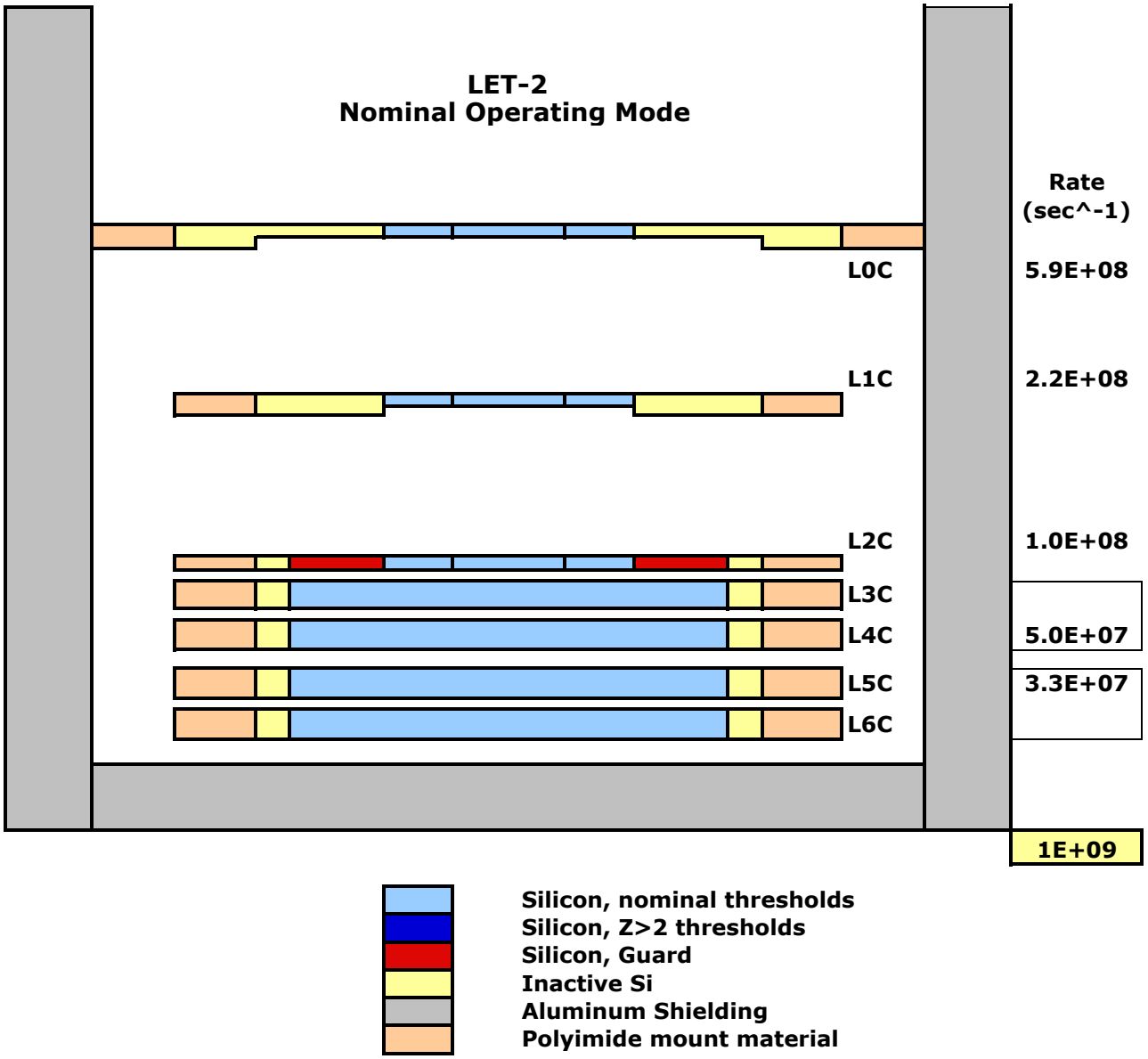
For H rely entirely on Pixel count rates. Shown are L2AP and L4AP pixels, which start at ~2 MeV and at ~16 MeV.

If L2P counts too high, could raise threshold so it only counts He

<u>Trigger modes (both ends):</u>
L0•L1, L1•L2
L2Ac vs. L3A for H&He

<u>Matrices (for Z≥6 only):</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L4; L4 vs. L3)

LET-2: Level 0 = Nominal Operation

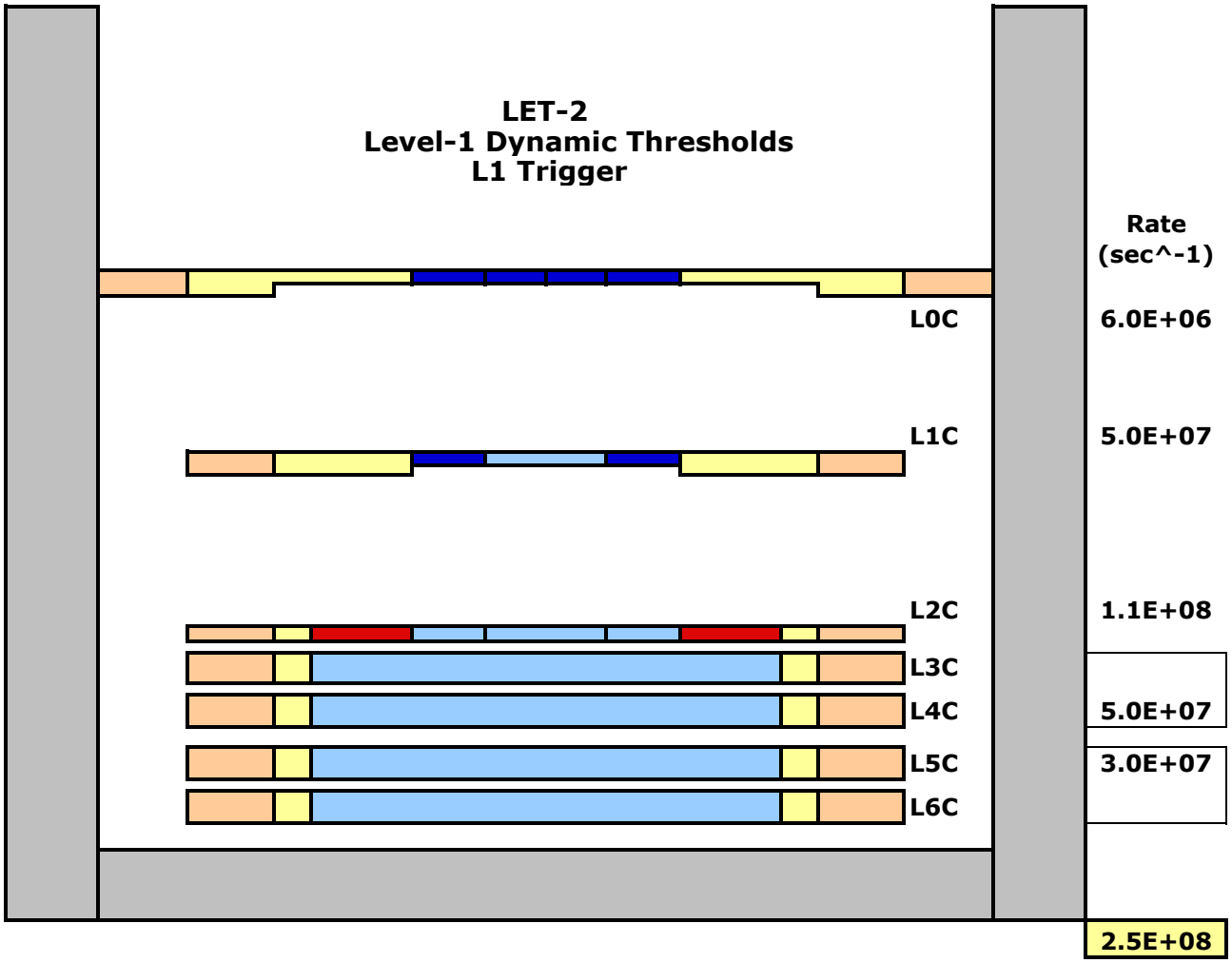


The count rates are approximate estimates of singles rates for the "95%-Worst- Case SEP spectrum

<u>Trigger modes:</u>
L0C•L1C, L1C•L2C with guards and L6C in anticoincidence

<u>Matrices:</u>
L0 vs. L1 (12μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs. L5)

LET-2: Level 1 = L1 Trigger

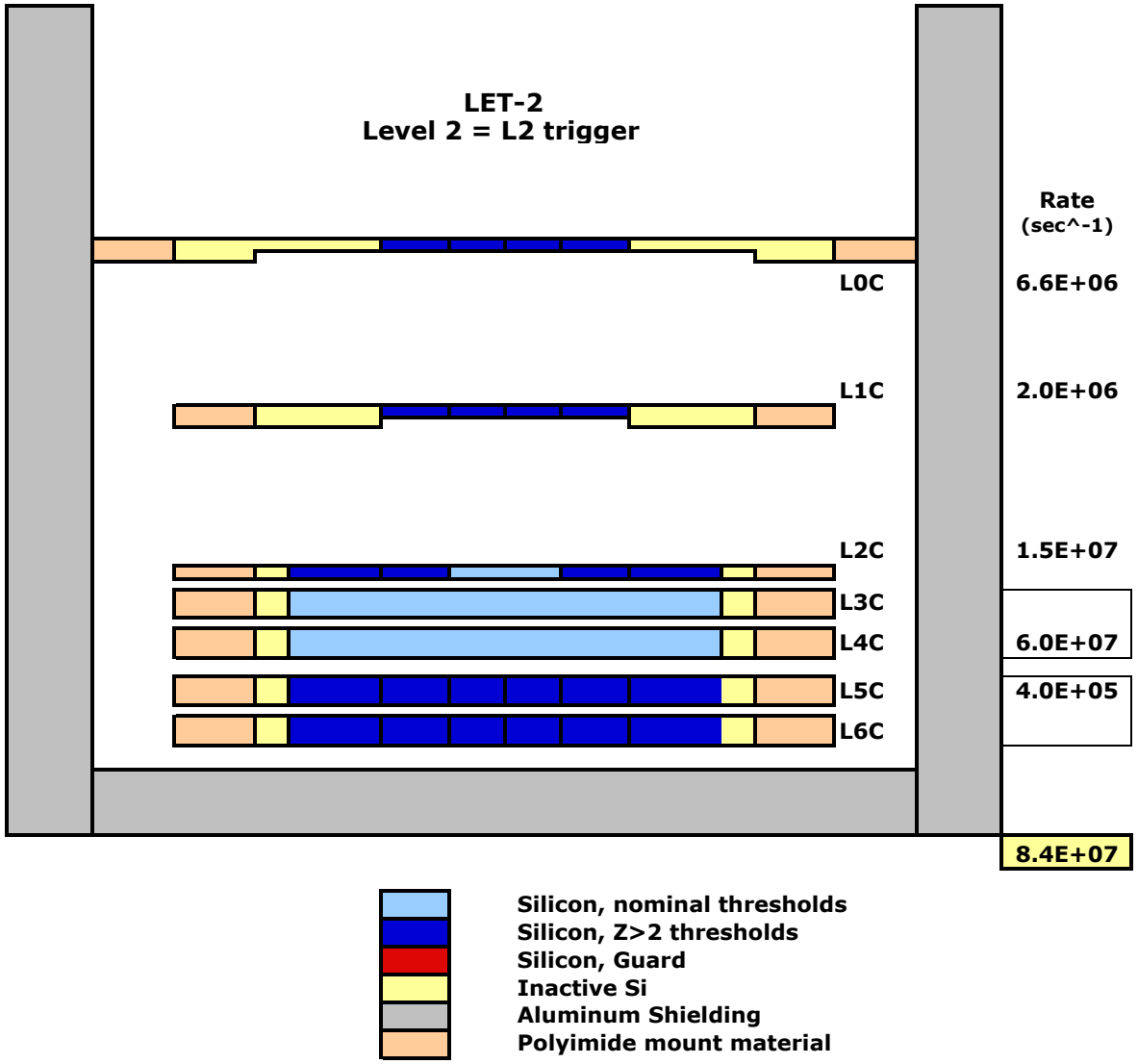


Raise all L0 & outer L1 segments to Z≥6 levels.

<u>Trigger modes:</u>
L0C•L1C, L1C•L2C with L6C & guards In anticoincidence

<u>Matrices:</u>
L0 vs. L1 (12μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L5)

LET-2: Level 2 = L2 Trigger

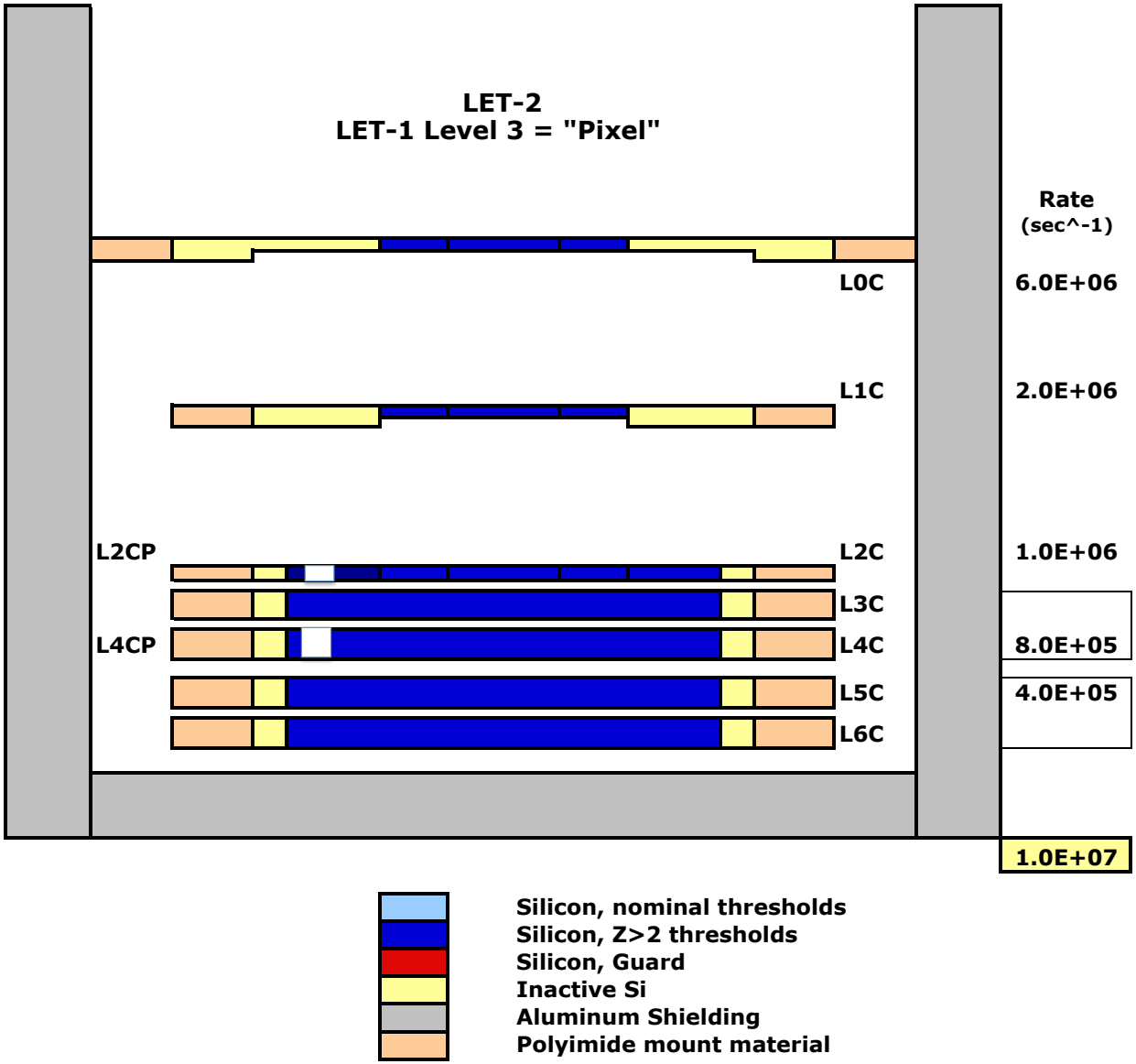


Raise all L0 and L1, and outer L2 segments to Z≥6 levels. Also L5 and L6

<u>Trigger modes (1-end):</u>
L2C vs L3C with guards and L4C in anticoincidence for H & He;
Guards & L6C in anticoincidence Z≥6

<u>Matrices:</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)

LET-2: Level 3 = “Pixel”



Raise all L0C through L6C inner, outer, and guard segments to Z≥6 levels.

For H rely entirely on Pixel count rates. Shown are L2CP and L4CP pixels, which start at ~2 MeV and at ~16 MeV.

If L2P counts too high, could raise threshold so it only counts He

<u>Trigger modes (both ends):</u>
L0•L1, L1•L2

<u>Matrices (for Z≥6 only):</u>
L0 vs. L1 (1μ vs. 25μ)
L1 vs. L2 (25μ vs. 500μ)
L2 vs. L3 (500μ vs. 1000μ)
L3 vs. L4 (1000μ vs. 1000μ)
(and L4 vs L5; L5 vs. L6)

7.14.14

Summary of Reccommended Dynamic Threshold Modes for SPP/LET1
(High-lighted Modes are Recommended)

Stage Number	Estimated Singles Rate (s^-1)	Approximate H,He Stop (MeV/n)	Elec. Thresh (MeV)	Stopping O Energy (MeV/n)	Stopping Fe Energy (MeV/n)	H,He,e Geom (cm2sr)	O, Fe Geom (cm2sr)	H,He Pen Emax (MeV/n)
0	2.0E+09	1-15,30	0.5	1.5-70	1.0-130	1.08	1.08	60
1	1.1E+09	1-15,30	0.5	1.5-70	1.0-130	1.08	1.08	60
2	7.2E+08	1-15,30	0.5	1.5-70	1.0-130	1.08	1.08	60
3	4.9E+08	2-15,30	0.5	1.5-70	1.0-130	1.08	1.08	60
4	3.1E+08	2-26,26	0.5	1.5-70	1.0-130	1.08	1.08	60
5	2.3E+08	9-26,26	0.5	1.5-70	1.0-130	1.08	1.08	0
6	1.2E+08	9-17,17	0.5	1.5-70	1.0-130	0.46	1.08	0
7	2.0E+07	Pix = 7-22	none	1.5-70	1.0-130	~0.01	1.08	0

Summary of Reccommended Dynamic Threshold Modes for SPP/LET2

Stage Number	Estimated Singles Rate (s^-1)	Approximate H,He Stop (MeV/n)	Elec. Thresh (MeV)	O Energy (MeV/n)	Fe Energy (MeV/n)	H,He,e Geom (cm2sr)	O, Fe Geom (cm2sr)	H,He Pen Emax (MeV/n)
0	1.0E+09	1-15,26	0.5	1.5-55	1.0-100	0.54	0.54	0
1	2.5E+08	2-15,26	0.5	1.5-55	1.0-100	0.54	0.54	0
2	8.0E+07	9-17,17	0.5	1.5-55	1.0-100	0.54	0.54	0
3	1.0E+07	Pix = 7-22	none	1.5-55	1.0-100	~0.01	0	0