

CR/KR Channel Analysis Trends Suggesting COM Parameters Path Forward

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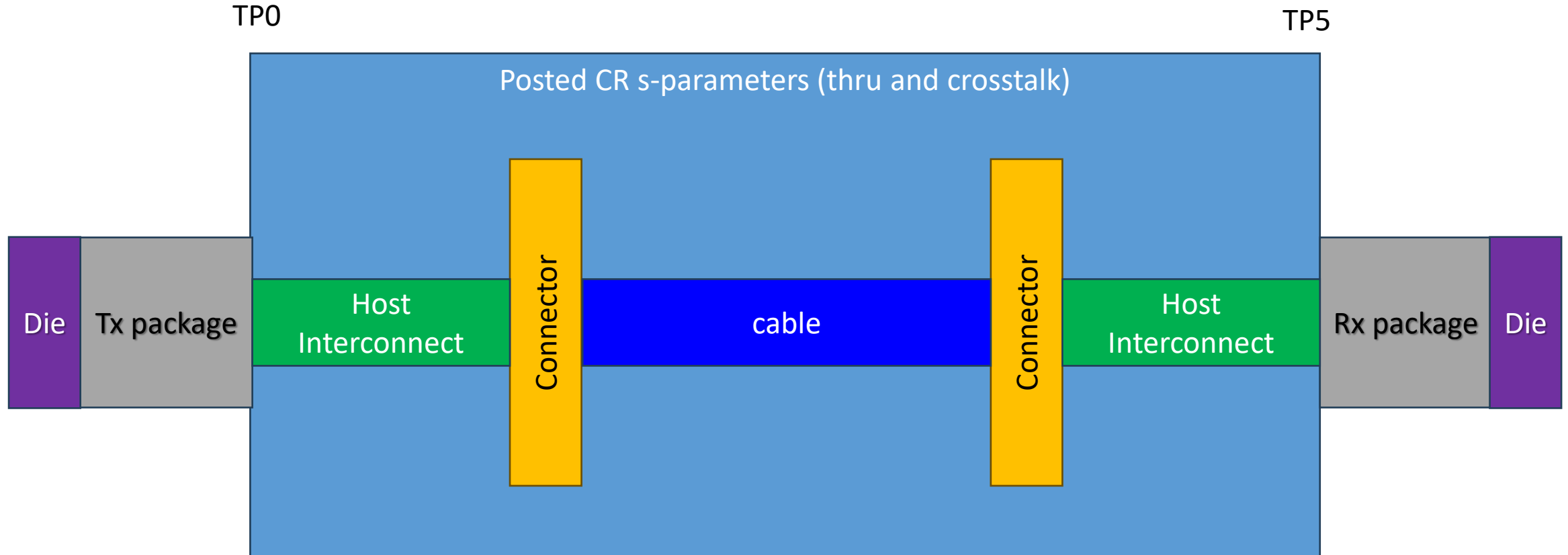
Agenda

- ❑ Investigation Highlights
- ❑ General CR/KR diagram
- ❑ COM parameters
- ❑ COM results for all posted channels
- ❑ Discussion/Summary

Investigation of the effect of some parameters on COM

- ❑ IL die to die loss
 - Shave down posted channels to manageable target selection
- ❑ Number of Rx FFE taps
 - Floating taps?

COM Interconnect Diagram



COM Interaction Experiments

- ❑ Compute COM for all posted CR channels
- ❑ Vary Tx/Rx package loss to get a rich set of channel loss
 - 2.4 dB, 5.7 dB, 7 dB, and 9.1 dB
- ❑ Pre cursor Rx FFE taps set to 6.
- ❑ Vary Rx FFE post cursor length
 - just “taps” for short in following slides
 - 15, 24, 60, and 120 taps

COM 4.1 Configuration Highlights

- ❑ Die to die computation (not VEC)
- ❑ Termination impedance (R_d): 50 Ω
- ❑ RLM = 0.95, SNR_{TX}=33 dB, $A_{dd} = 0.02 U_{I_{pk}}$, $\sigma_{RJ} = 0.01 U_{I_{RMS}}$
- ❑ $\text{Eta}_0 = 6.0 \text{ e-}09 \text{ V}^2/\text{GHz}$, $\text{DER}_0 = 1.0 \text{ e-}04$
- ❑ Ideal source 20 % - 80 % Rise/Fall Time (T_r): 4.0 ps
- ❑ TX FIR: 2-pre, 0-post
- ❑ Unity gain CTLE (mellitz_3dj_01a_2305, set 2)
- ❑ $f_r = 0.58 f_b$
- ❑ Package: benartsi_3df_01a_2211
- ❑ Die: mli_3df_02_220316

How many taps? CR base configuration

FFE_POST_TAP_LEN = 15, 24, 60, 120 (TAPS)

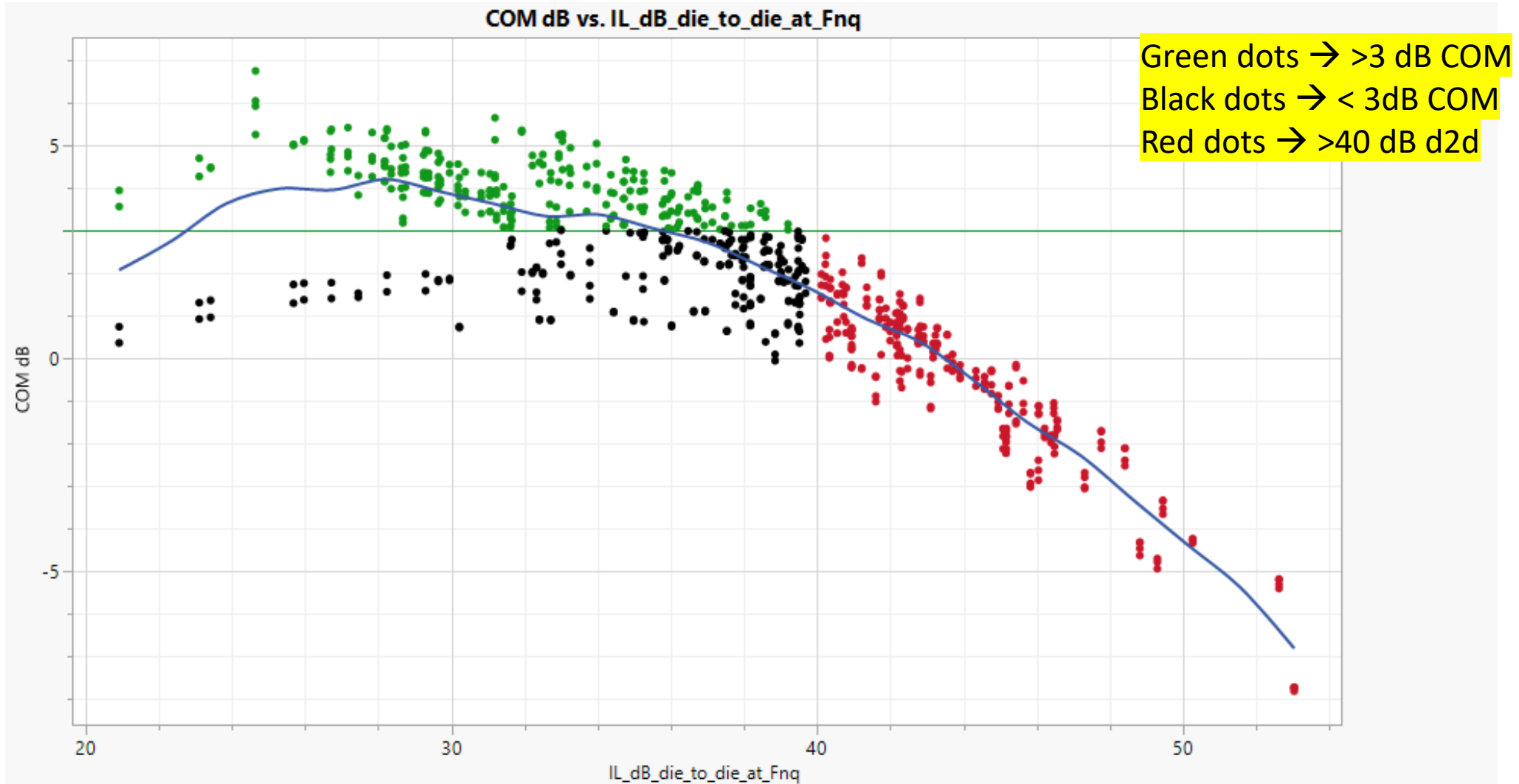
Table 93A-1 parameters				I/O control			Table 93A-3 parameters				SAVE_CONFIG2MAT	1			
Parameter	Setting	Units	Information	DIAGNOSTICS		logical	Parameter	Setting	Units	Information	Receiver testing				
f_b	106.25	GBd		DISPLAY_WINDOW	1	logical	package_tl_gamma0_a1_a2	[0 0.0008455 0.000340225]			RX_CALIBRATION	0	logical		
f_min	0.05	GHz		CSV_REPORT	1	logical	package_tl_tau	0.00644805	ns/mm		Sigma BBN step	5.00E-03	V		
Delta_f	0.01	GHz		RESULT_DIR	.\results\KRCR_1_{date}\		package_Z_c	[92 92 ; 70 70; 80 80; 100 100]	Ohm		ICN parameters				
C_d	[0.4e-4 0.9e-4 1.1e-4 ; 0.4e-4 0.9e-4 1.1e-4]	nF	[TX RX]	SAVE_FIGURES	0	logical	z_p select	[1 2 3 4]		[test cases to run]	f_v	0.278	Fb		
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	nH	[TX RX]	Port Order	[1 3 2 4]		z_p (TX)	[9 25 31 41 ; 1 1 1 1; 1 1 1 1; 0.5 0.5 0.5 0.5]	mm	[test cases]	f_f	0.278	Fb		
C_b	[0.3e-4 0.3e-4]	nF	[TX RX]	RUNTAG	CRKR_eval		z_p (NEXT)	[7 22 29 39 ; 1 1 1 1; 1 1 1 1; 0.5 0.5 0.5 0.5]	mm	[test cases]	f_n	0.278	Fb		
R_0	50	Ohm		COM_CONTRIBUTION	1	logical	z_p (FEXT)	[9 25 31 41 ; 1 1 1 1; 1 1 1 1; 0.5 0.5 0.5 0.5]	mm	[test cases]	f_2	61.625	GHz		
R_d	[50 50]	Ohm	[TX RX]	TDR and ERL options			z_p (RX)	[7 22 29 39 ; 1 1 1 1; 1 1 1 1; 0.5 0.5 0.5 0.5]	mm	[test cases]	A_ft	0.450	V		
A_v	0.413	V	vp/vf=	TDR	1	logical	C_p	[0.5e-4 0.5e-4]	nF	[TX RX]	A_nt	0.450	V		
A_fe	0.413	V	vp/vf=	ERL	1	logical	Filter: Rx FFE								
A_ne	0.45	V		ERL_ONLY	0	ns	ffe_pre_tap_len	6	UI		Parameter		Setting		
L	4			TR_TDR	0.01		ffe_post_tap_len	15	UI		board_tl_gamma0_a1_a2	6.44084e-4	3.6036e-04	1.4 db/in @ 53.125G	
M	32			N	6000	logical	ffe_tap_step_size	0			board_tl_tau	5.790E-03		ns/mm	
filter and Eq				TDR_Butterworth	1		ffe_main_cursor_min	1			board_Z_c	100		Ohm	
f_r	0.58		*fb	beta_x	0		ffe_pre_tap1_max	1			z_bp (TX)	32		mm	
c(0)	0.54		min	rho_x	0.618		ffe_post_tap1_max	1			z_bp (NEXT)	32		mm	
c(-1)	[-0.4:0.02:0]		[min:step:max]	TDR_W_TXPKG	0	UI	ffe_tapn_max	1			z_bp (FEXT)	32		mm	
c(-2)	[0.02:0.1]		[min:step:max]	N_bx	20		Operational								
c(-3)	0		[min:step:max]	fixture delay time	[0 0]		ERL Pass threshold	10	dB		C_0	[0.2e-4 0]		nF	
c(-4)	0		[min:step:max]	Tukey_Window	1		COM Pass threshold	3	db		C_1	[0.2e-4 0]		nF	
c(1)	0		[min:step:max]	Noise, jitter			DER_0	1.00E-04			Include PCB			0	logical
N_b	1	UI		sigma_RJ	0.01	UI	T_r	0.00400			Seletions (rectangle, gaussian,dual_rayleigh,triangle				
b_max(1)	0.75		As/dfe1	A_DD	0.02	V^2/GHz	FORCE_TR	1	logical		Histogram_Window_Weight	gaussian		selection	
b_max(2..N_b)	0.3		As/dfe2..N_b	eta_0	6.00E-09	dB	PMD_type	C2C			Qr	0.02		UI	
b_min(1)	0		As/dfe1	SNR_TX	33		EW	1			Floating Tap Control				
b_min(2..N_b)	-0.15	S	As/dfe2..N_b	R_LM	0.95		MLSE	0	logical		N_bg	0		0 1 2 or 3 groups	
g_DC	[-15:1:-3]	dB	[min:step:max]	benartsi_3df_01a_2211			ts_anchor	1			N_bf	4		taps per group	
f_z	25.16	GHz		mli_3df_02_220316			sample_adjustment	[- 2 12]			N_f	60		UI span for floating taps	
f_p1	40.00	GHz		healey_3dj_01_2309			Local Search	2			bmaxg	0.2		max DFE value for floating taps	
f_p2	56.00	GHz		slide 6 rounded up							B_float_RSS_MAX	0.2		rss tail tap limit	
g_DC_HP	[-5:1:0]		[min:step:max]												

- ❑ Floating taps are not used for this set of experiments
- ❑ First determine how many Rx FFE taps are needed
 - Address floating taps base on those results

IEEE P802.3dj 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s Ethernet Task Force

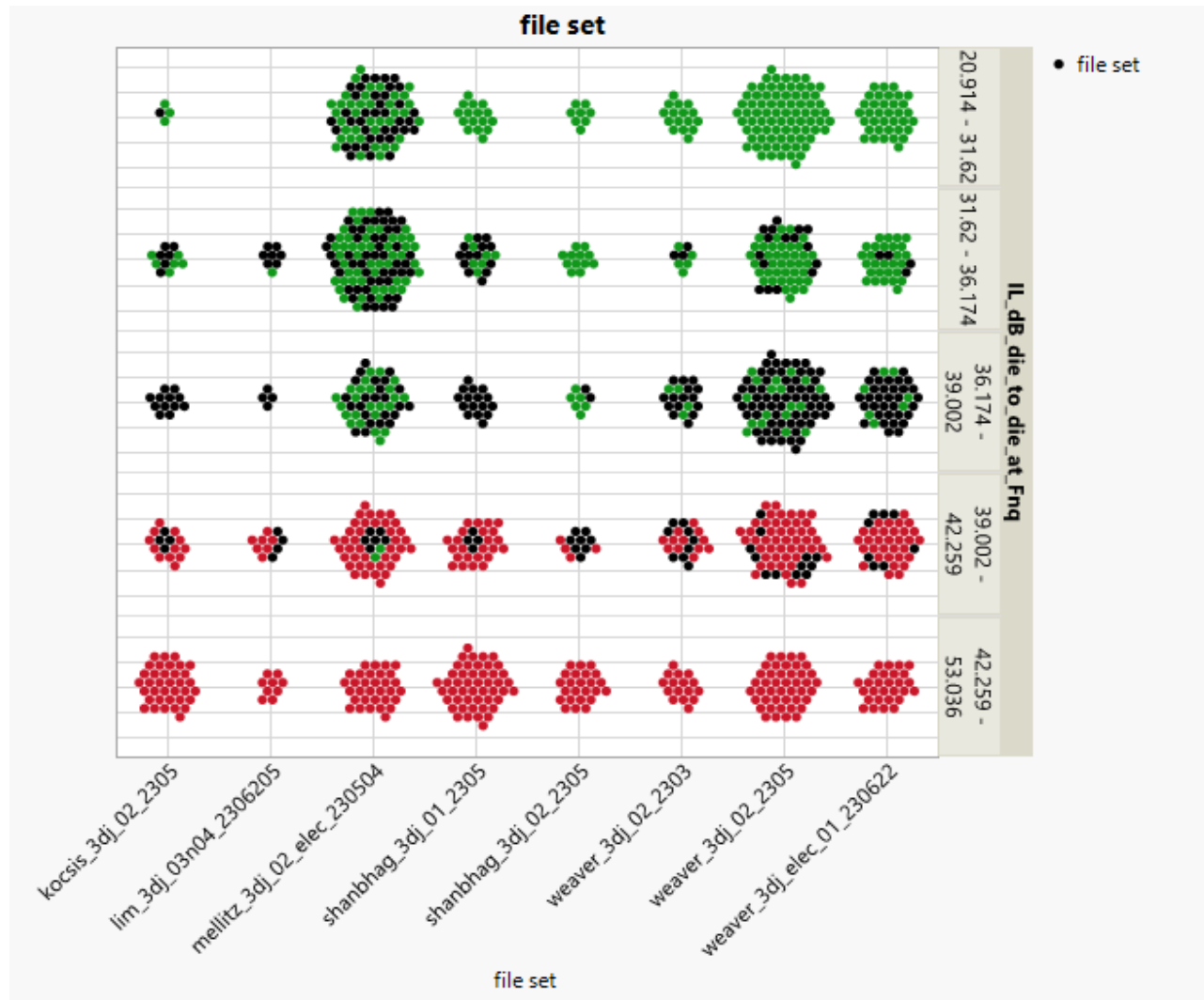
First look at the CR/KR channels

COMBINED RESULTS FOR 15, 24, 60, AND 120 TAPS



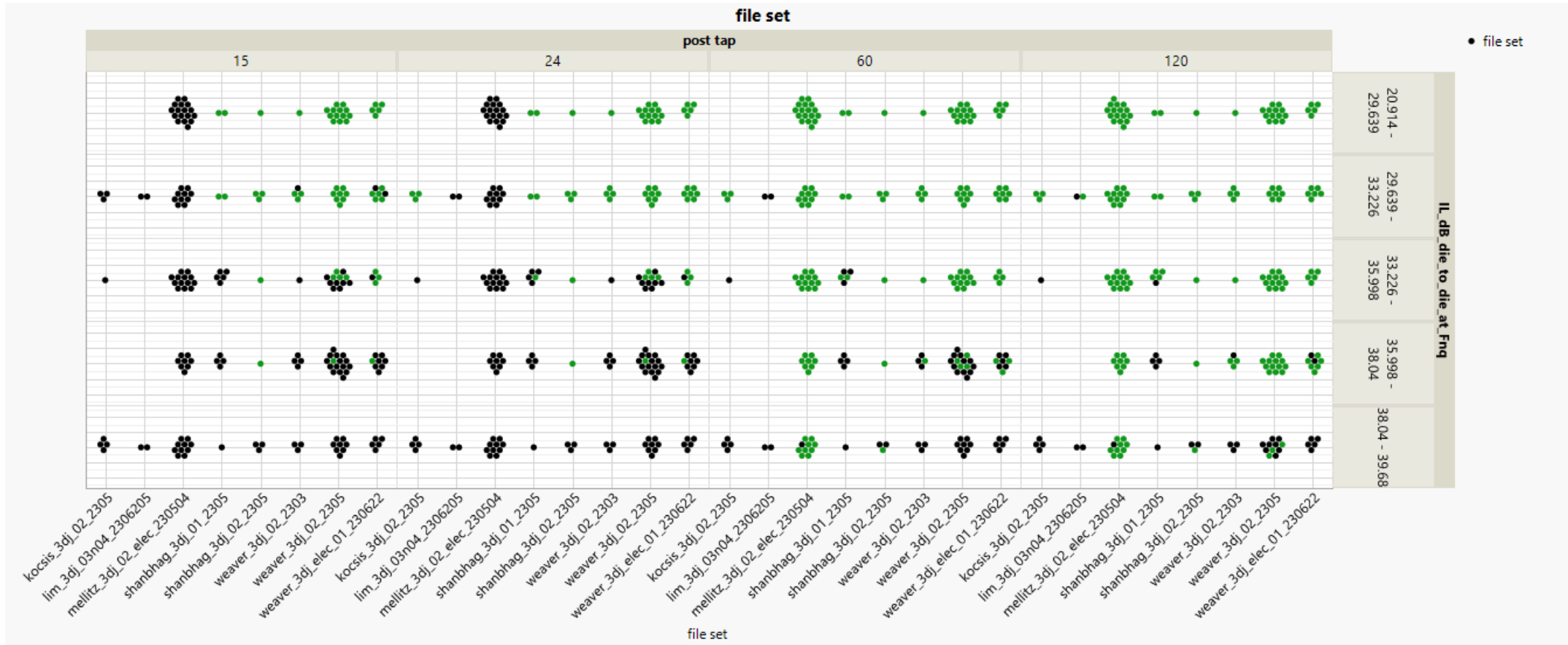
CR/KR Channel sets

BREAK DOWN BY LOSS



Now add a post tap dimension

Omitted channels > 40 dB die to die loss



60 + taps does seem to yield some benefit for channels over 33 dB (d2d)

Discussion/Summary

- ❑ 40 dB die to die loss is challenging
 - With 60+ taps?
 - Are 60+ taps possible even with floating taps?
 - CR seems to benefit more with 60+ taps than C2M
 - Or MLSE and maybe less taps?
 - Analysis would be required here
- ❑ Next steps: Call for proposals
 - “first error” MLSE
 - Need suggestions for sweep parameters for another set of COM runs
- ❑ Review CR channels between 2.0 dB and 3.25 dB COM
 - See backup for list
 - Emails and meeting for further discussion likely

Thank You!

Back up data

Channels Of Interest (COM 2 dB To 3.25 dB)

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CHANNELS VS. TX/RX PACKAGE LENGTH

