

JVET-AD0131

**AhG7: Coding efficiency/runtime tradeoff
metrics**

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Introduction

- **The main goal is to introduce a simple and informative metrics in the Excel sheet of the ECM results to rapidly obtain a measure representative of the performance of one given technical proposal.**
 - Initially introduced by Fraunhofer HHI in JVET-B0044
- **This performance metrics could be useful to compare proposals**
 - in particular in the scope of the EE2 or of the AhG 7.
 - It would indeed enable to rank rapidly the different proposals in addition to the traditional encoding/decoding runtime and BDR measure.
- **This informative metrics could be also useful in order to set a minimum tradeoff value to further consider a technology in an Exploration Experiment.**

Proposed metrics

- This metrics evaluates the trade off between the coding performance and the runtime
- Principle: just compute the corresponding "slope angle" between the BDR measure (G) and the encoder (or decoder) time (R)

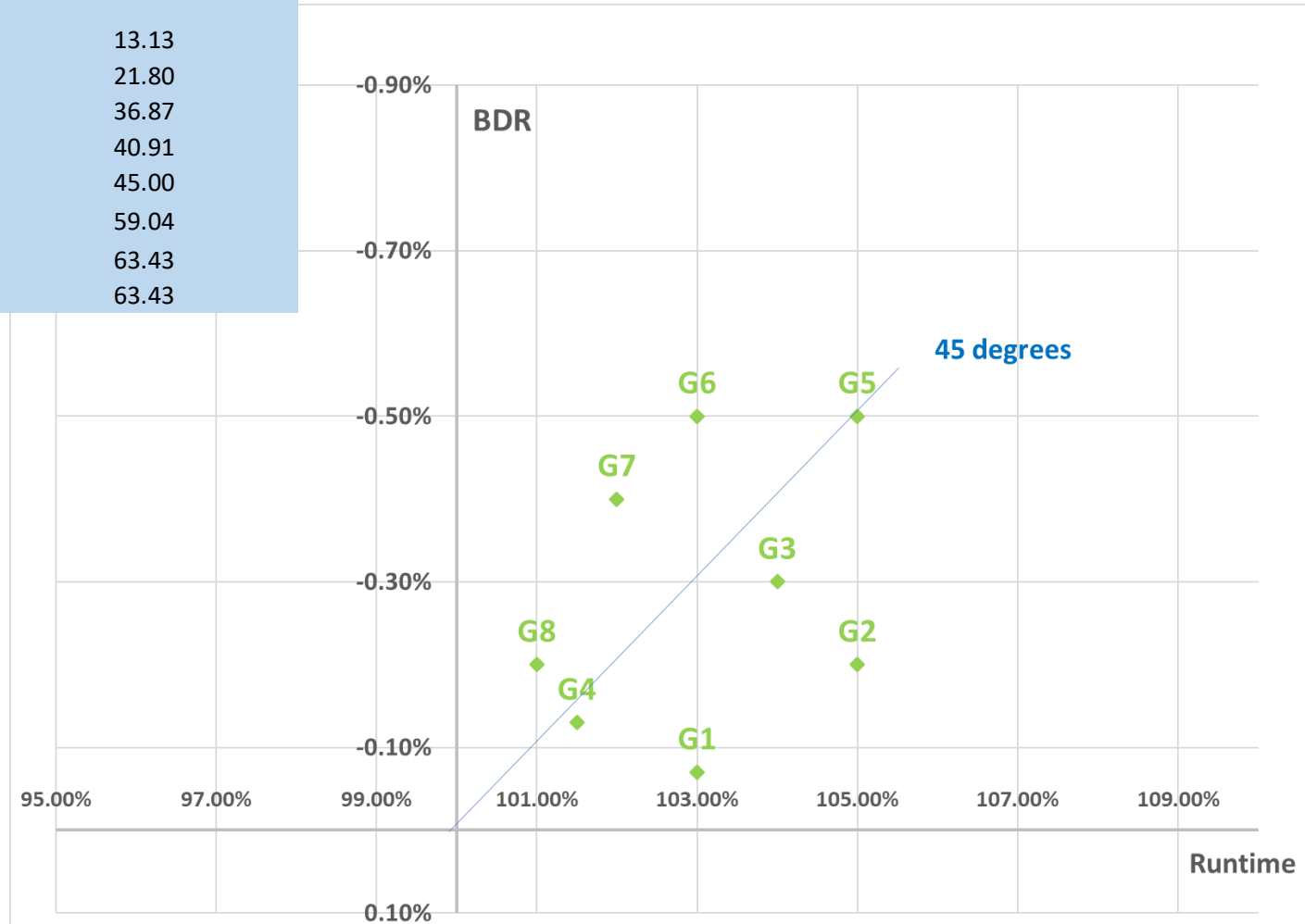
$$A = \text{Artan} \left(\frac{G}{R} \right)$$

- By using some normalization using percentage value for G and R in our current Excel sheets

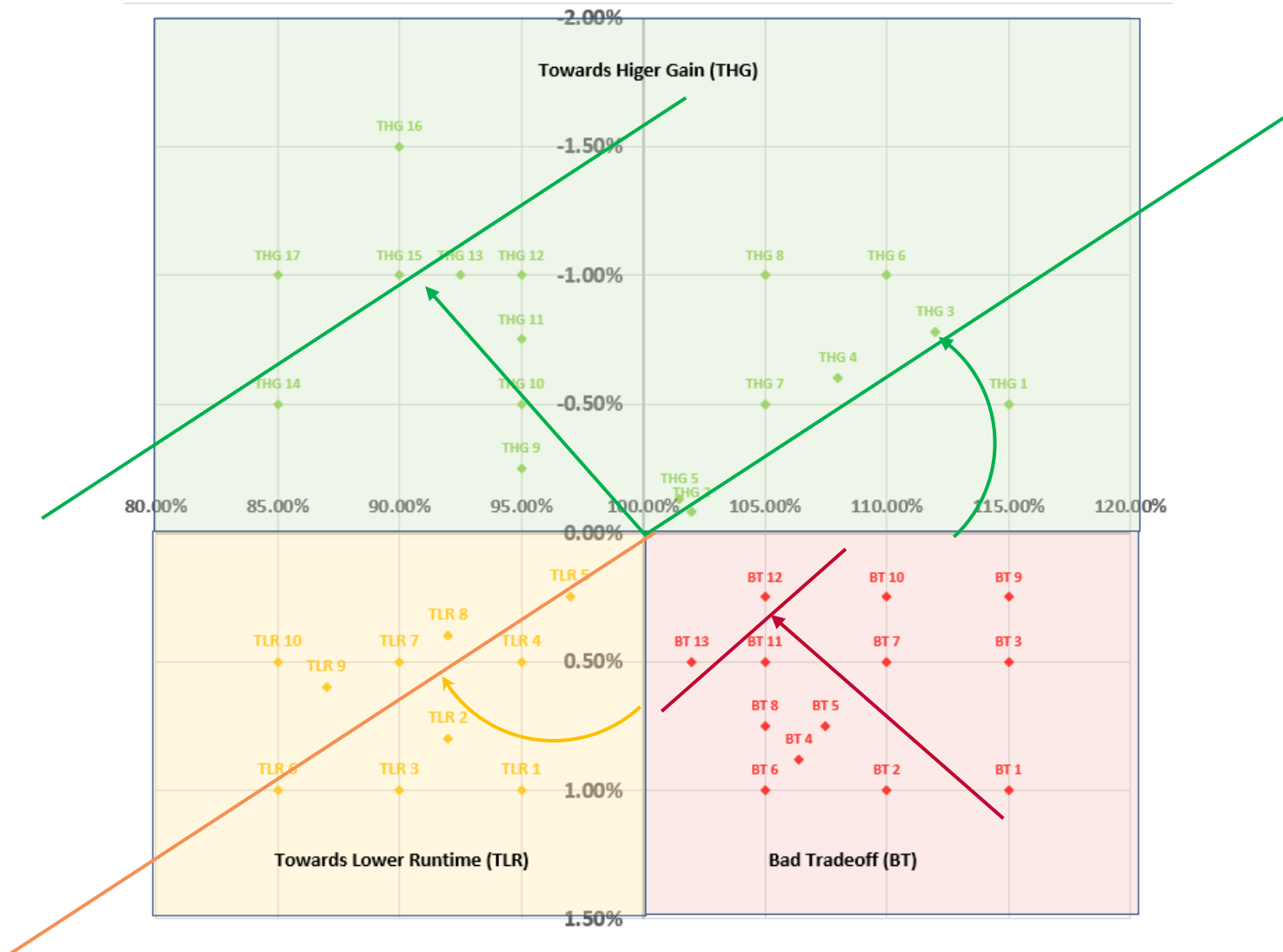
$$A = \text{Artan} \left(\frac{G * 100}{(R - 1) * 10} \right)$$

Basic examples

	Y BDR	Encoder runtime	Gain/runtime tradeoff
	0.00%	100.00%	Tradeoff angle
G1	-0.07%	103.00%	13.13
G2	-0.20%	105.00%	21.80
G3	-0.30%	104.00%	36.87
G4	-0.13%	101.50%	40.91
G5	-0.50%	105.00%	45.00
G6	-0.50%	103.00%	59.04
G7	-0.40%	102.00%	63.43
G8	-0.20%	101.00%	63.43



Extension to the 4 quadrants



Sorted EE2 result examples

#	Test	AI	RA					LB							
			Inter prediction												
2.1b	CPMV refinement with simplification		-0.05%	0.00%	-0.04%	99%	THG	90.3	100%						
2.1a	CPMV search with simplification		-0.03%	0.00%	-0.05%	99%	THG	90.2	100%						
2.1e	Test 2.1d with simplification		-0.05%	-0.07%	-0.02%	100%	THG	90.0	101%						
2.6	BDOF		-0.20%	-0.19%	-0.18%	100%	THG	90.0	101%						
2.12a	Prediction of MVD magnitude suffix bins (up to 6 bins for blocks with width and height larger than 4, and up to 2 bins otherwise)		-0.05%	-0.02%	-0.02%	100%	THG	90.0	99%	-0.13%	0.10%	-0.13%	100%	100%	
2.12a*	Test 2.12a over ECM-8.0 with MVD sign prediction disabled		-0.10%	-0.11%	-0.12%	100%	THG	90.0	100%	-0.22%	-0.07%	-0.11%	101%	100%	
2.7b	Test2.7a + OBMC with LIC		-0.36%	-0.18%	-0.25%	102%	THG	58.9	101%	-0.37%	-0.18%	-0.23%	102%	101%	
2.1l	Test 2.1e + Test 2.1c		-0.11%	-0.13%	-0.10%	101%	THG	48.0	102%						
2.12h	Test 2.12a + Test 2.7a		-0.34%	-0.12%	-0.16%	103%	THG	45.0	101%	incomplete					
2.7a	LIC for bi-prediction		-0.30%	-0.06%	-0.07%	103%	THG	40.1	101%	-0.25%	-0.10%	-0.09%	102%	101%	
2.1c	Affine DMVR extension to affine MMVD and adaptive BM merge modes		-0.07%	-0.02%	-0.06%	101%	THG	32.6	100%						
2.4	Template matching-based subblock motion refinement		-0.07%	-0.03%	-0.01%	101%	THG	31.0	100%	-0.07%	0.19%	-0.03%	102%	102%	
2.5a	Test 2.2 + Test 2.4 (enabled for larger than 720p at encoder)		-0.11%	-0.10%	-0.02%	102%	THG	26.6	100%	-0.23%*	-0.02%	-0.08%	103%	102%	
2.1k	Test 2.1a + Test 2.1b + Test 2.1d		-0.13%	-0.12%	-0.07%	103%	THG	22.3	105%						
2.1d	Affine parameters refinement		-0.08%	-0.05%	-0.08%	102%	THG	21.1	103%						
2.3a	SbTMVP with MMVD		-0.04%	-0.02%	-0.01%	101%	THG	19.3	100%	-0.23%	-0.06%	-0.02%	102%	101%	
2.3b	SbTMVP with MMVD by using TM-based reordering		-0.06%	-0.04%	-0.04%	102%	THG	15.6	102%	-0.34%	-0.21%	-0.09%	105%	112%	
2.2*	Test 2.2 with encoder speedup		-0.06%	-0.03%	-0.04%	102%	THG	15.4	100%	-0.22%*	0.06%	0.04%	102%	100%	
2.12g	Test 2.12a + Test 2.2		-0.10%	-0.11%	-0.11%	104%	THG	14.3	100%	incomplete					
2.11e	Adaptive OBMC control		-0.02%	0.00%	-0.01%	101%	THG	9.6	100%	-0.07%	0.08%	0.18%	100%	99%	
2.2	AMVP with SbTMVP mode		-0.07%	-0.02%	-0.04%	104%	THG	8.8	100%	-0.22%	0.15%	-0.14%	103%	100%	
2.5c	Test 2.2 + Test 2.3b		-0.08%	-0.07%	-0.07%	105%	THG	8.3	102%	-0.32%*	0.02%	-0.20%	109%	113%	
2.5b	Test 2.2 + Test 2.3a		-0.06%	-0.03%	-0.02%	105%	THG	6.1	101%	-0.20%*	-0.16%	-0.16%	106%	103%	
2.12f	ECM-8.0 with MVD sign prediction disabled		0.05%	0.09%	0.10%	100%	TLR	0.0	100%	0.09%	0.17%	-0.02%	99%	99%	

Using YUV BDR => $G = (8*Y+U+V)/10$

AhG7 example 1

■ Group 3 off

All Intra Main10							
Over ECM-8.1							
	Y	U	V	EncT	Tradeoff metrics	DecT	
Class A1	0.45%	0.29%	0.35%	83%	TLR	72.7	93%
Class A2	1.03%	1.10%	1.19%	84%	TLR	52.3	88%
Class B	1.15%	1.04%	1.23%	83%	TLR	51.1	86%
Class C	0.95%	0.78%	0.80%	84%	TLR	55.1	83%
Class E	1.89%	1.88%	1.88%	84%	TLR	35.6	84%
Overall	1.09%	1.01%	1.09%	84%	TLR	51.6	86%
Class D	0.72%	0.38%	0.53%	85%	TLR	61.9	82%
Class F	1.79%	1.69%	2.05%	92%	TLR	19.3	92%
Class TGM	4.10%	4.52%	4.91%	93%	TLR	8.4	98%

Random Access Main 10							
Over ECM-8.1							
	Y	U	V	EncT	Tradeoff metrics	DecT	
Class A1	0.26%	0.13%	0.39%	96%	TLR	48.1	99%
Class A2	0.54%	0.22%	0.71%	96%	TLR	28.9	99%
Class B	0.61%	0.40%	0.55%	95%	TLR	32.5	99%
Class C	0.40%	0.30%	0.63%	96%	TLR	40.9	98%
Class E							
Overall (Ref)	0.47%	0.28%	0.57%	96%	TLR	36.0	99%
Class D	0.38%	0.24%	0.37%	96%	TLR	41.8	98%
Class F	1.01%	1.14%	0.96%	97%	TLR	14.0	99%
Class TGM	2.04%	2.28%	2.40%	96%	TLR	8.1	100%

AhG7 example 2

■ Group 4 off

All Intra Main10							
Over ECM-8.1							
	Y	U	V	EncT	Tradeoff metrics		DecT
Class A1	1.53%	4.43%	5.96%	88%	TLR	25.5	96%
Class A2	2.41%	4.37%	4.80%	87%	TLR	21.9	98%
Class B	1.00%	4.75%	3.80%	88%	TLR	33.2	97%
Class C	0.87%	2.21%	1.97%	87%	TLR	45.6	98%
Class E	1.11%	4.73%	2.84%	88%	TLR	32.6	97%
Overall	1.31%	4.07%	3.76%	87%	TLR	30.9	97%
Class D	0.79%	1.79%	1.75%	87%	TLR	49.5	98%
Class F	1.15%	2.95%	2.87%	93%	TLR	22.7	96%
Class TGM	1.74%	2.69%	2.84%	92%	TLR	18.3	98%

Random Access Main 10							
Over ECM-8.1							
	Y	U	V	EncT	Tradeoff metrics		DecT
Class A1	1.36%	2.96%	4.83%	93%	TLR	18.5	99%
Class A2	1.13%	2.55%	3.37%	94%	TLR	17.8	99%
Class B	0.58%	4.28%	3.64%	93%	TLR	26.9	99%
Class C	0.34%	1.41%	1.39%	95%	TLR	38.0	100%
Class E							
Overall (Ref)	0.78%	2.91%	3.22%	94%	TLR	23.8	99%
Class D	0.35%	2.04%	1.32%	96%	TLR	30.8	100%
Class F	0.61%	1.96%	1.60%	97%	TLR	18.4	100%
Class TGM	0.53%	1.09%	1.02%	94%	TLR	37.9	100%

- This contribution proposes to use a simple metrics based on the slope between the encoder (or decoder) runtime and the BDR gain to rapidly assess any technical proposal without introducing any new concept.

- We suggest considering this metrics (adapted for the 4 quadrants) when reporting results to get one single value representative of the tradeoff performance of any proposed technology based on the BDR/runtime figures provided by any proponent:
 - Could be used in EE2 report for sorting the experiments
 - For AhG7 in the context of “tools off” tests evaluation.

The background features a light gray gradient with several white geometric patterns. On the left, a white triangle points towards the bottom-left corner. On the right, a series of white lines radiate from the bottom-right corner, creating a grid-like pattern that extends towards the top-right.

Annex

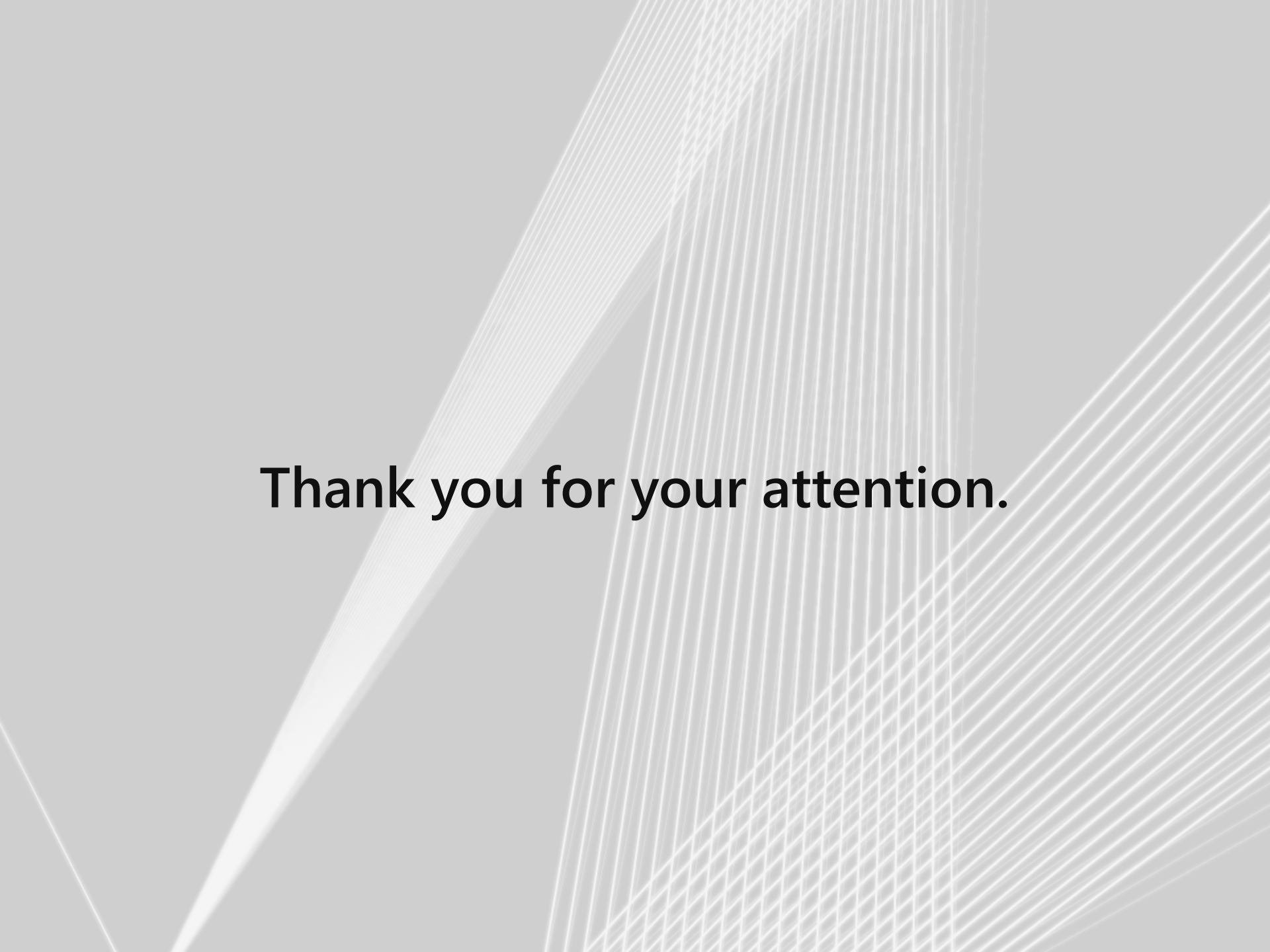
VBA formula

```
Function TRADEOFF_ANGLE(gain, runtime)

    scaled_gain = gain * 100
    scaled_runtime = (runtime - 1) * 10

    If (scaled_gain < 0) Then
        If (runtime > 1) Then
            'THG
            TRADEOFF_ANGLE = Application.Atan2(scaled_runtime, -scaled_gain) * 180 / Application.Pi()
        Else
            'THG over 90°
            TRADEOFF_ANGLE = Application.Atan2(-1 / scaled_gain, -scaled_runtime) * 180 / Application.Pi()
            TRADEOFF_ANGLE = 90 + TRADEOFF_ANGLE
        End If
    Else
        If (runtime > 1) Then
            'BT
            TRADEOFF_ANGLE = Application.Atan2(scaled_gain, 1 / scaled_runtime) * 180 / Application.Pi()

        Else
            'TLR
            TRADEOFF_ANGLE = Application.Atan2(scaled_gain, -scaled_runtime) * 180 / Application.Pi()
        End If
    End If
End Function
```

The background features a light gray gradient with a series of thin, white, parallel lines that create a sense of depth and movement, resembling a stylized architectural or geometric pattern.

Thank you for your attention.