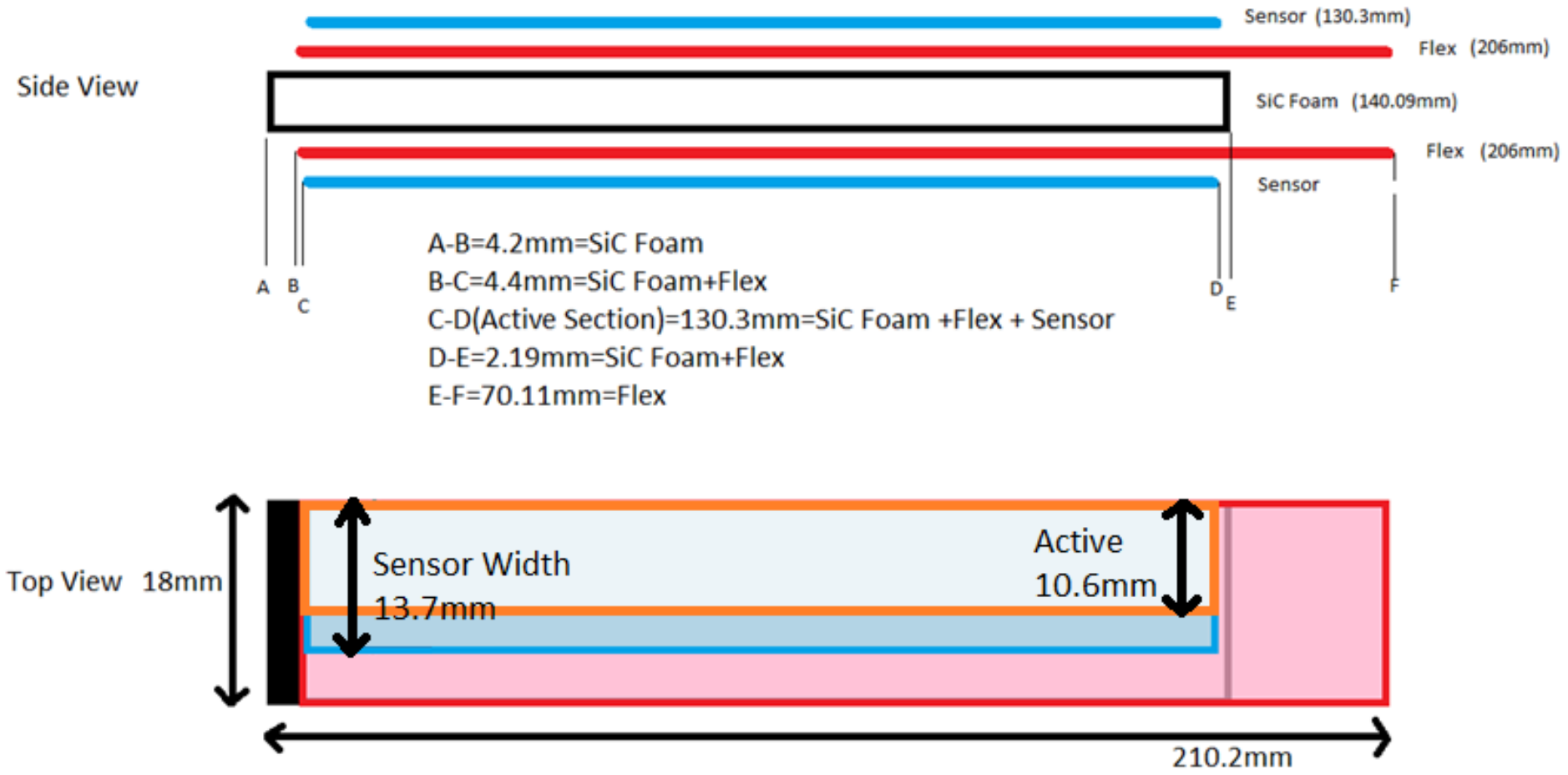
MATERIAL BUDGET CALCULATION

Rhorry Gauld, Material Budget 10/06/11

Assumptions

- Sensor Thickness ~50 micron
- Flex Thickness~52(20+20+12)micron Kapton
- Glue Thickness ~10 micron
- SMD components – 1.4% of flex area(1.6mm*0.8mm*20) 0.5mm thickness (Al – 8.1cm X0)
- Metal layer covers approx. 90% of flex area
- Flex geometry were taken from recent Flex design
- Layer weighting to active mimosa area of 10.6mm width

PLUME LADDER SET-UP



Flex/Metal contribution to Active area has weighting 18/10.6

Sensor contribution to Active area has weighting 13.7/10.6

Copper metal layers – Opti'11 assumptions

Calculation	Thickness(mm)	X0(mm)	Number	Weighted Region Contribution	Active X0 %	Ave.		
Sensor	0.05	94	2	1.292	0.137			
Metal layer(90%)	0.013	14.4	4	1.528	0.552		Metal	Cu
Glue	0.01	250	2	1.698	0.014		Metal X0(mm)	14.4
SMD Components	0.5	89	2	0.014	0.016			
Flex(Kapton)	0.052	286	2	1.698	0.062			
SiC	2	81	1	0.052	0.128		SiC %=	4
					0.908			

Aluminium metal layers – Opti'11 assumptions

Calculation	Thickness(mm)	X0(mm)	Number	Weighted Region Contribution	Active X0 %	Ave.		
Sensor	0.05	94	2	1.292	0.137			
Metal layer(90%)	0.013	81	4	1.528	0.098		Metal	Al
Glue	0.01	250	2	1.698	0.014		Metal X0(mm)	81
SMD Components	0.5	89	2	0.014	0.016			
Flex(Kapton)	0.052	286	2	1.698	0.062			
SiC	2	81	1	0.052	0.128		SiC %=	4
					0.455			

Ladder Parameters

	Width(mm)	Length(mm)
Flex	18	206
Sensor	13.7	130.3
Active Sensor	10.6	130.3
SiC	18	140.9

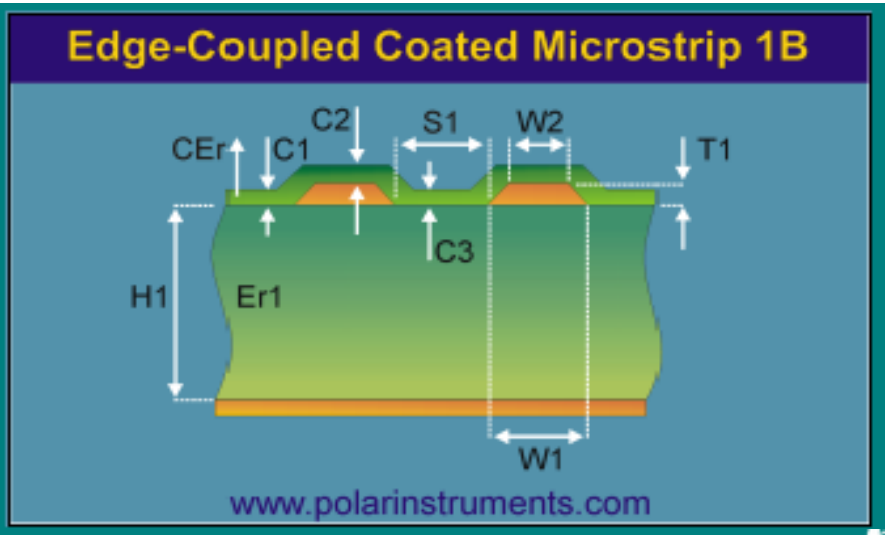
Flex Parameters

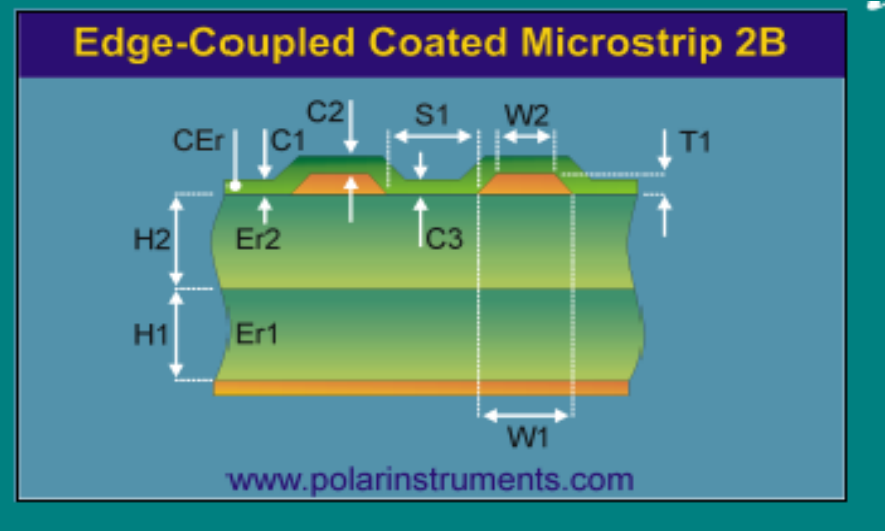
	Opti'11(um)	in mm
Trace Width	60	0.06
Trace Seperation	75	0.075
Trace Thickness	13	0.013
Coating Thickness	20	0.02
Polyimide Thickness	12	0.012

Calculation	Thickness(mm)	X0(mm)	Number	**Weighted Region Contribution**	Active X0 %			
Sensor	0.05	94	2	1.292	0.137			
Metal layer(90%)	0.013	81	4	1.528	0.098	Metal	Al	
Glue	0.01	250	2	1.698	0.014	Metal X0(mm)		81
SMD Components	0.5	89	2	0.014	0.016			
Flex(Kapton)	0.052	286	2	1.698	0.062			
SiC	2	81	1	0.052	0.128	SiC %=		4
					0.455			

Impedance Simulations

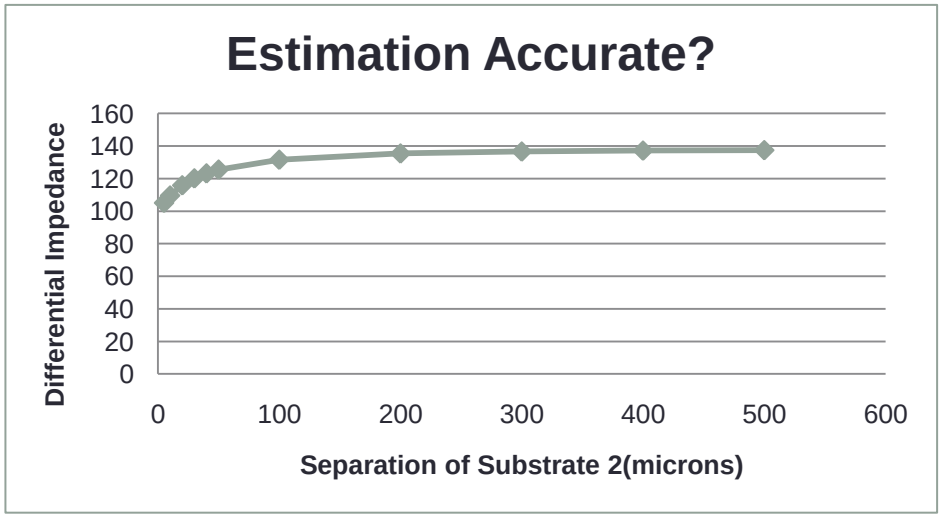
- Simulations done using: Polar Instruments SI9000 v7.1.0





1b – simulating impedance with a ground plate

2b – simulating impedance with no ground plate or plate not at ground by increasing the
Distance H1 to maximum and using a dielectric constant of 1 (Er1)



Results for Opti'11 varying thickness

Optiprint 11

Polar Software Simulations

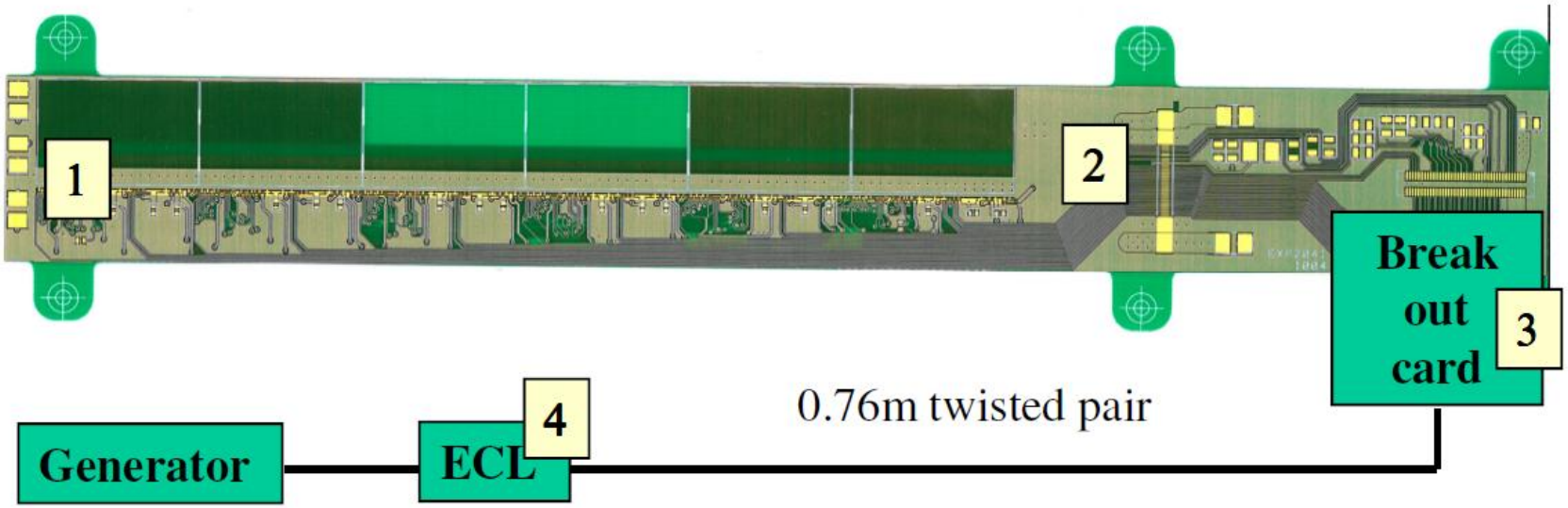
Trace Width	60um
Trace Seperation	75um
Coat Thickness	20um
Trace Thickness	13um

Substrate Height(um)	Impedance(ground)	Impedance(no ground)	Reflectivity
12	52	150	-0.48225338
20	68	147	-0.36744186
30	85	144	-0.257641921
40	96	142	-0.193277311

Ground and no-ground areas will cause problem in signal transfer?

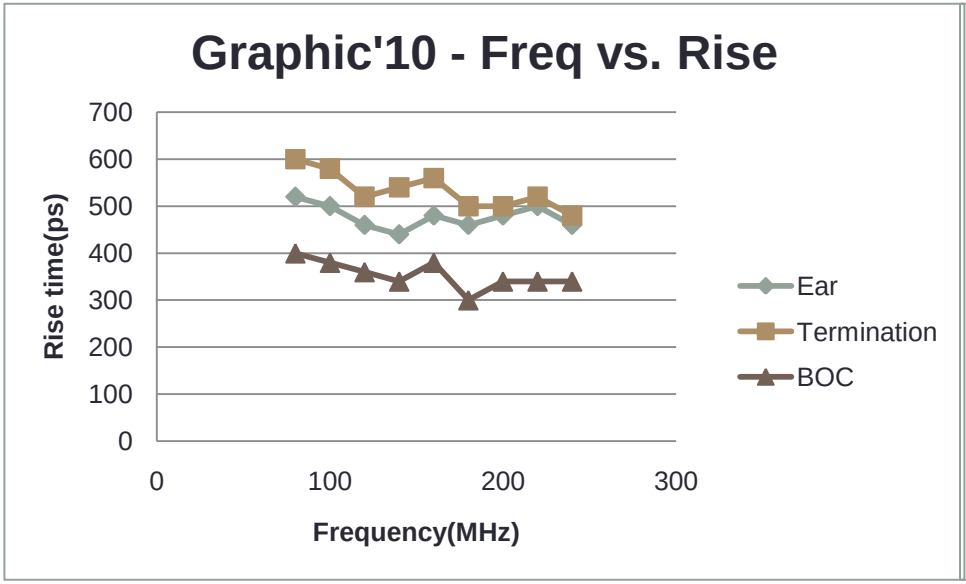
How does Cadence compare?

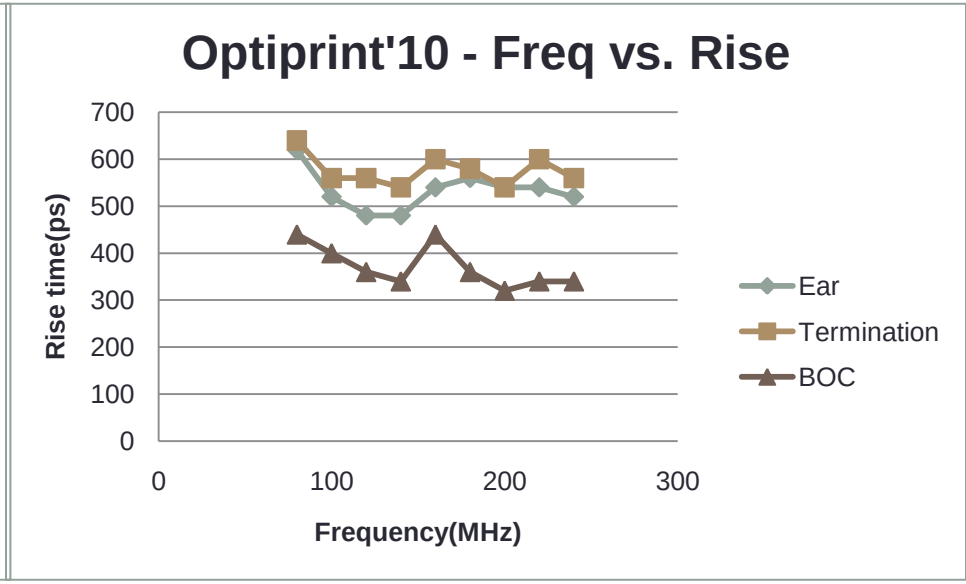
Clock Propagation



- Input signal ranging from 80MHz – 240MHz
- Absolute peak-peak measurements taken at;
  [1] – 100 Ohm `Termination'
  [2] – `Ears'
  [3] – Break out card(BOC)
- 1GHz Oscilloscope + 1.5GHz Differential Probe used

Results – Graphic'10 vs. Optiprint'10





- Reflec. Coeff. 0.33 for Opti'10 (from polar)
- Comparable rise times for both flexes
- Slower rise time at termination as expected – due to degradation of signal along clock path

AID Box

AID Box stage built up in Oxford now.