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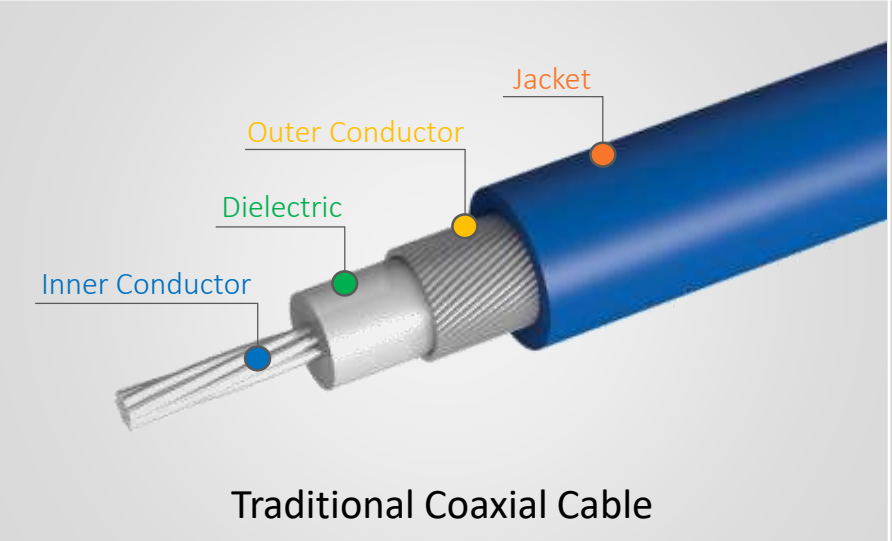
Twinax Basics | Presenter: John Abbott

Introduction

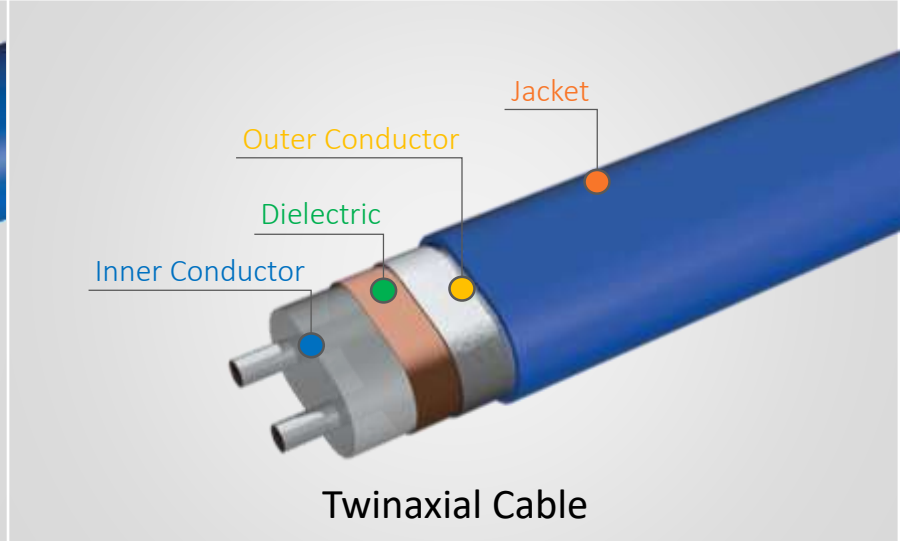
- What is twinaxial Cable?
- Twinax Signal Integrity Advantages
- Twinax Signal Integrity Challenges
- Twinax Constructions and their Impact on SI

What is Twinaxial Cable?

- Architecturally, twinaxial cable is similar to coaxial cable as both have inner and outer conductors and a dielectric.
- Twinax has a second conductor as it is primarily used for differential signaling.



Traditional Coaxial Cable

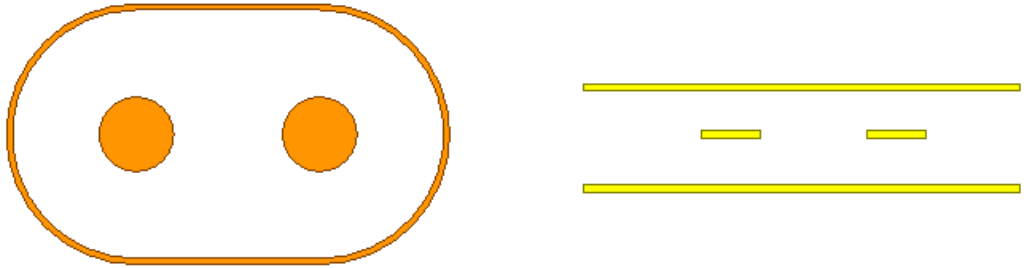


Twinaxial Cable

Signal Integrity Advantages: Loss

- Twinax has a distinct loss advantage over a PCB trace. Why is twinax so much better?

MORE COPPER

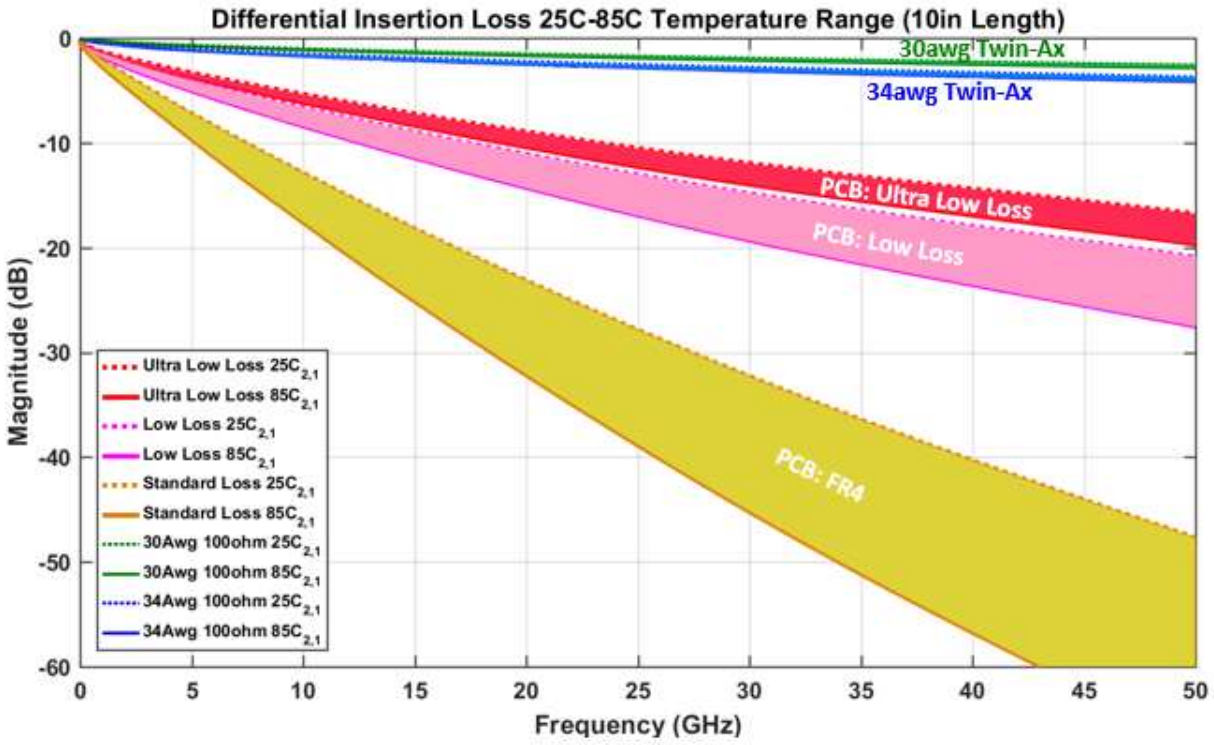


Dimensional difference between 34 AWG twinax and 0.50 oz PCB trace

LOWER LOSS DIELECTRIC

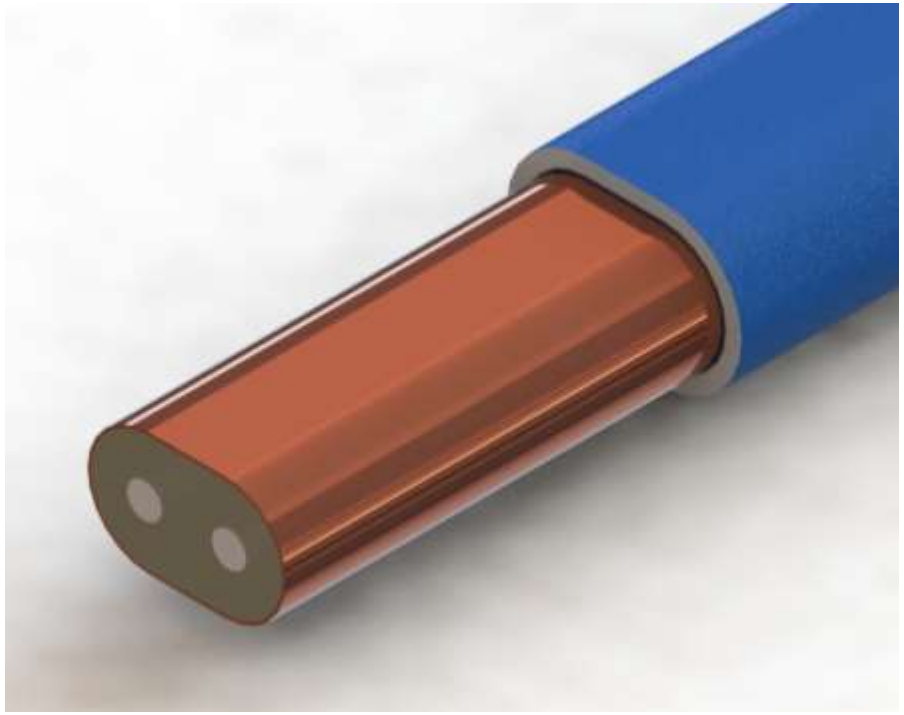
FEP has an order of magnitude less loss than the best PCB material

BETTER THERMAL PERFORMANCE



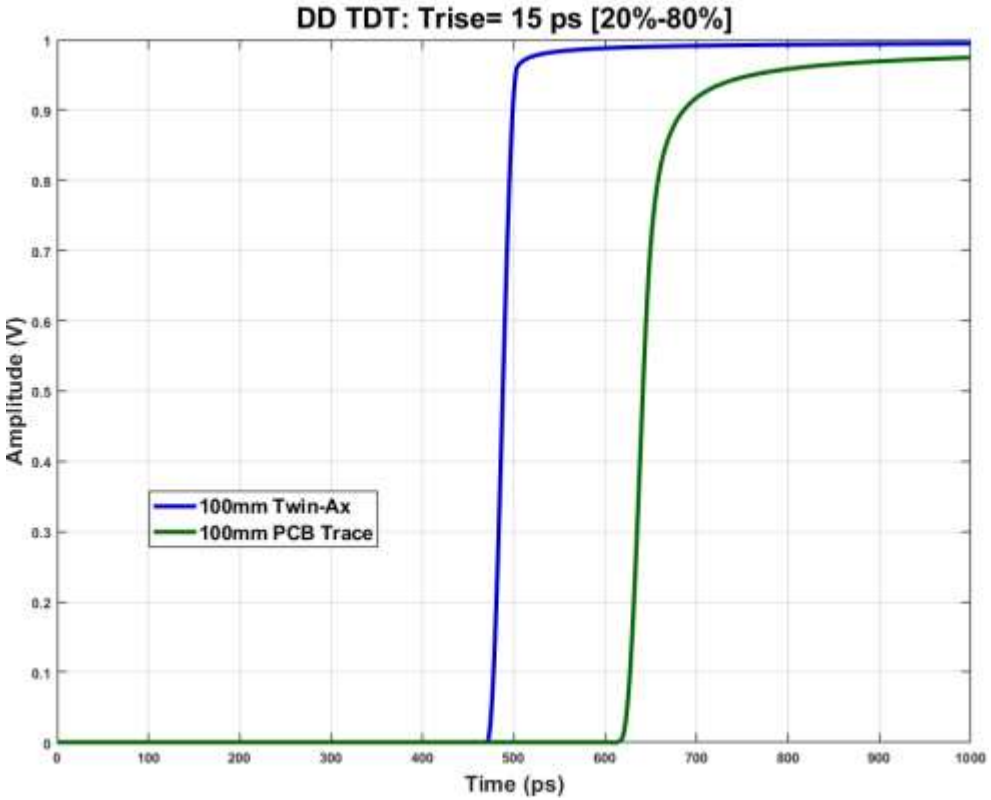
SI Advantages: Miscellaneous

MINIMAL CROSSTALK



Some twinax cables are completely wrapped with a solid outer conductor

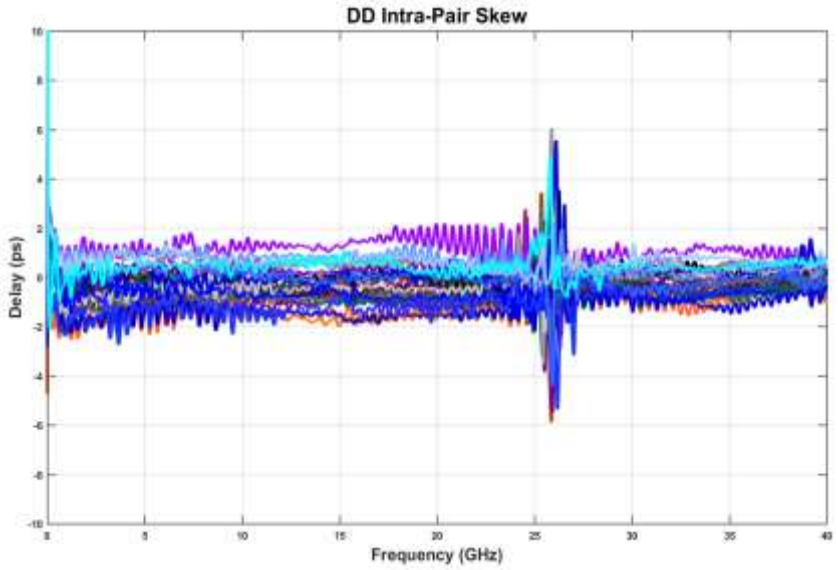
FASTER PROPAGATION VELOCITY



Twinax cable can have a 20%-40% faster propagation velocity than PCB trace

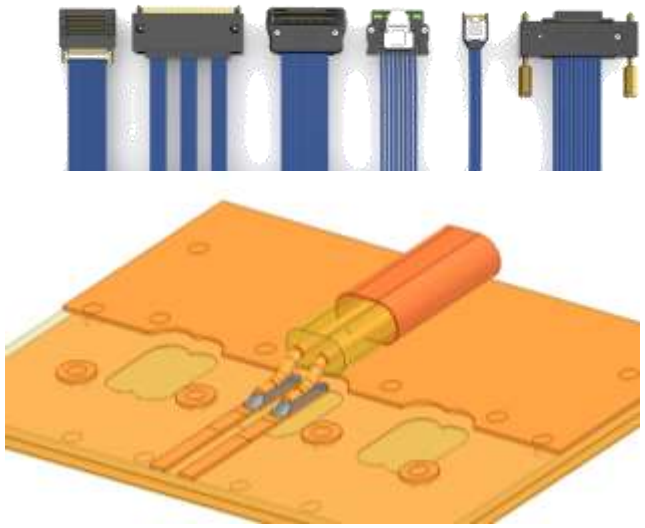
SI Challenges

INTRA-PAIR SKEW



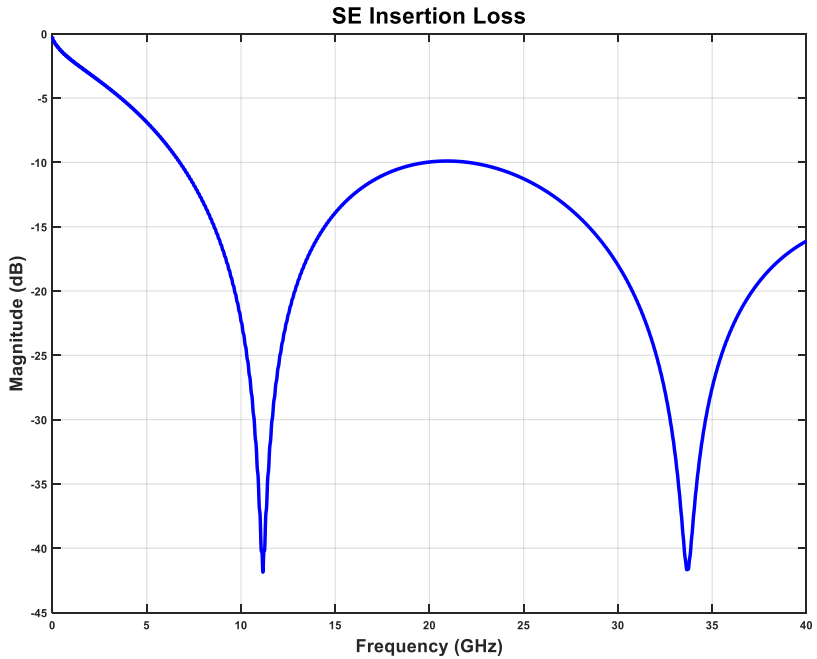
Depending on the architecture, skew with a differential pair can be challenging

TRANSITIONING TO/FROM PCB



Getting signals from silicon into twinax is not easy, and there is always an SI penalty

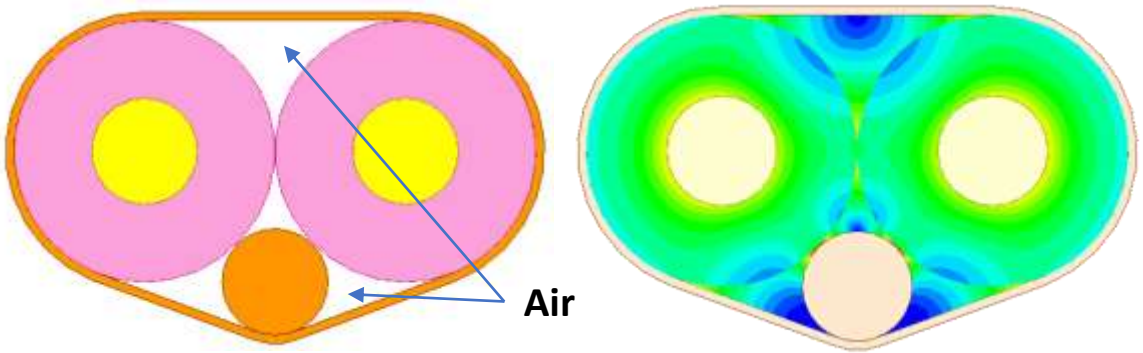
HIGH FREQUENCY SINGLE-ENDED SIGNALING



In addition to obvious crosstalk issues, the presence of even a small amount of air causes enough mode conversion to limit how fast a single-ended signal can travel in twinax

Twinax Construction: Drain Wires

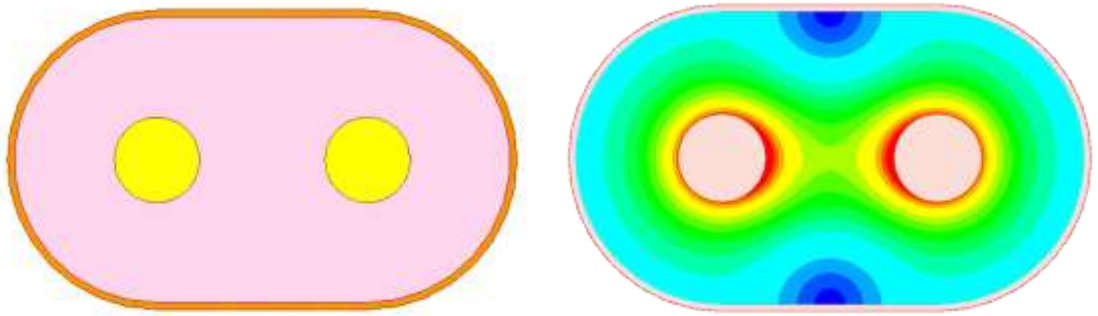
SINGLE-DRAIN (CENTER)



Pros:
Easy to solder/weld to terminating interconnect.
Easy to manufacture.

Cons:
Trapped air can cause large insertion loss “suck-out”.
High intra-pair skew.
Larger bend radius.

DRAIN-LESS



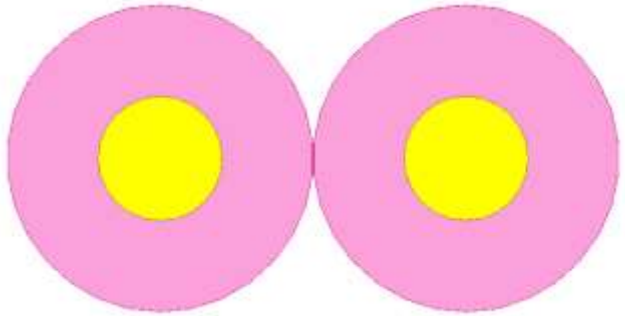
Pros:
Less air, more homogenous environment. (Low skew)
Tighter bend radius.

Cons:
Difficult to solder shield to terminating interconnect.

Twinax Construction: Extrusion Types

Cable Extruder

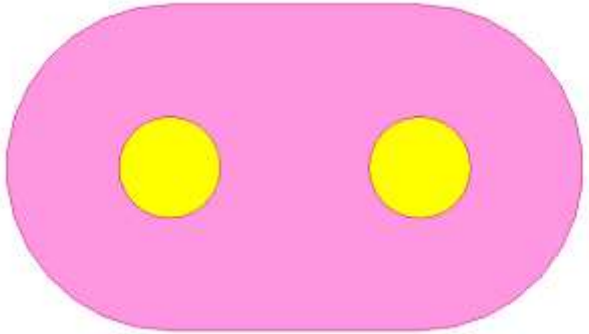
SINGLE EXTRUSION (X2)



Pros:
Easy to manufacture,
particularly at smaller AWG

Cons:
Higher skew.
Insertion loss “suck-out”

CO-EXTRUSION

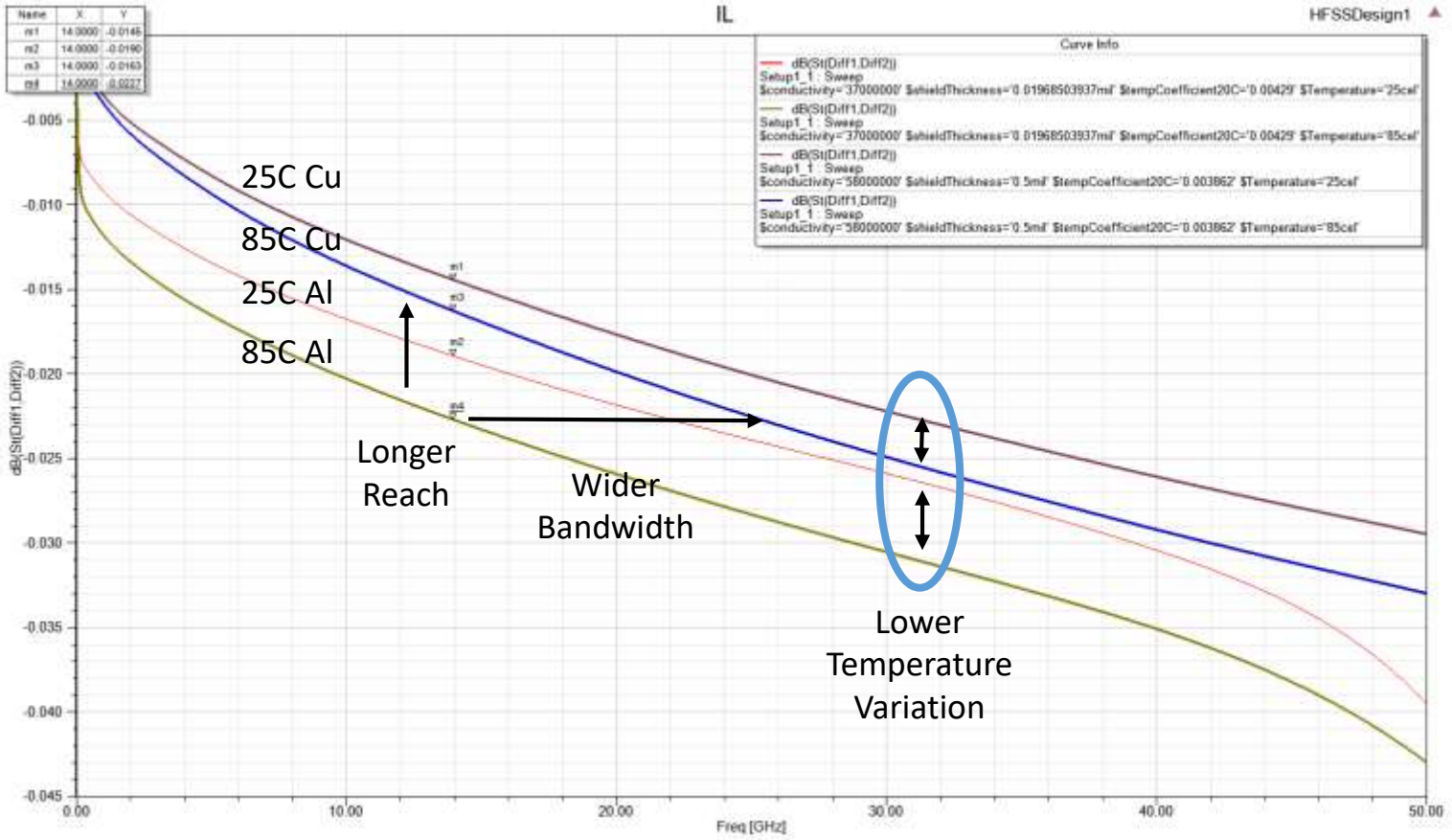


Pros:
Best skew performance

Cons:
Difficult to manufacture

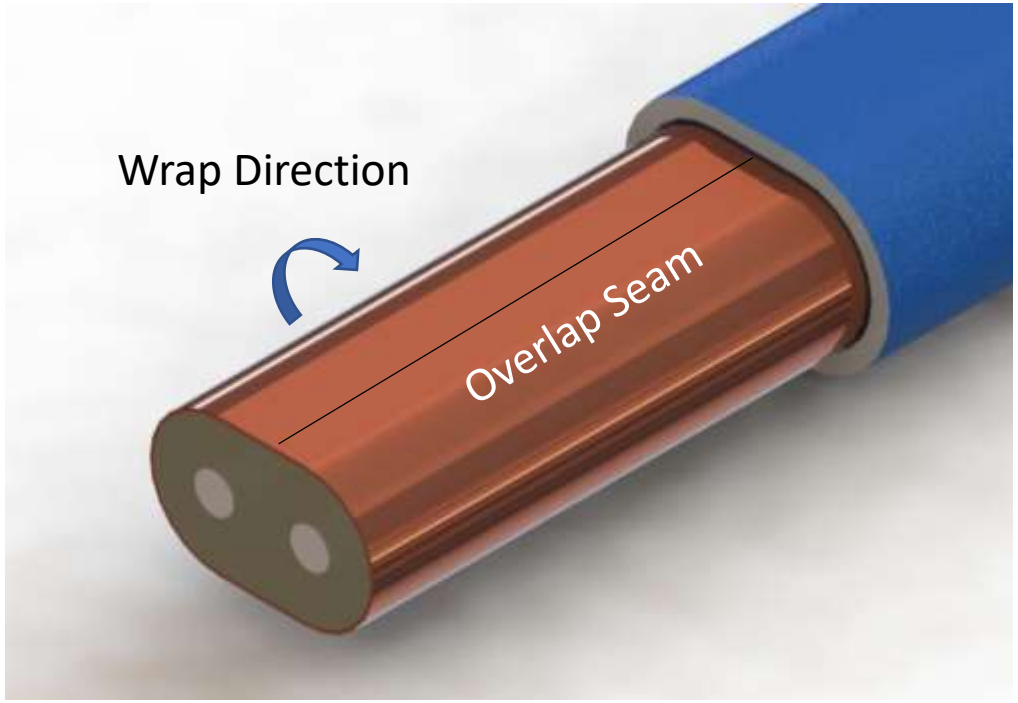
Twinax Construction: Cu vs Al Wrap

Cu shield is 10x in thickness of Aluminized Mylar



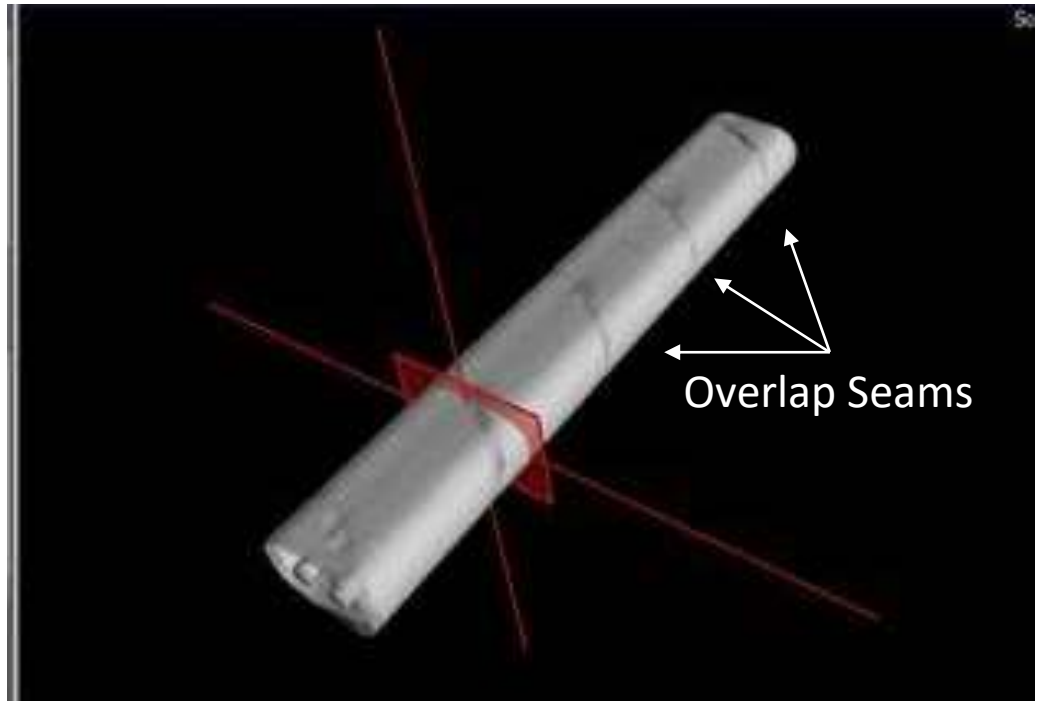
Twinax Construction

LONGITUDINAL WRAP



- Difficult to wrap reliably
- Overlap seam is in a static location, more likely to cause skew
- Less flexible

HELICAL WRAP



- Overlap seam creates a spiral air channel that self corrects, lowering skew
- A repetitive discontinuity does occur and can cause sharp narrow band resonance but can be controlled and placed out of band

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