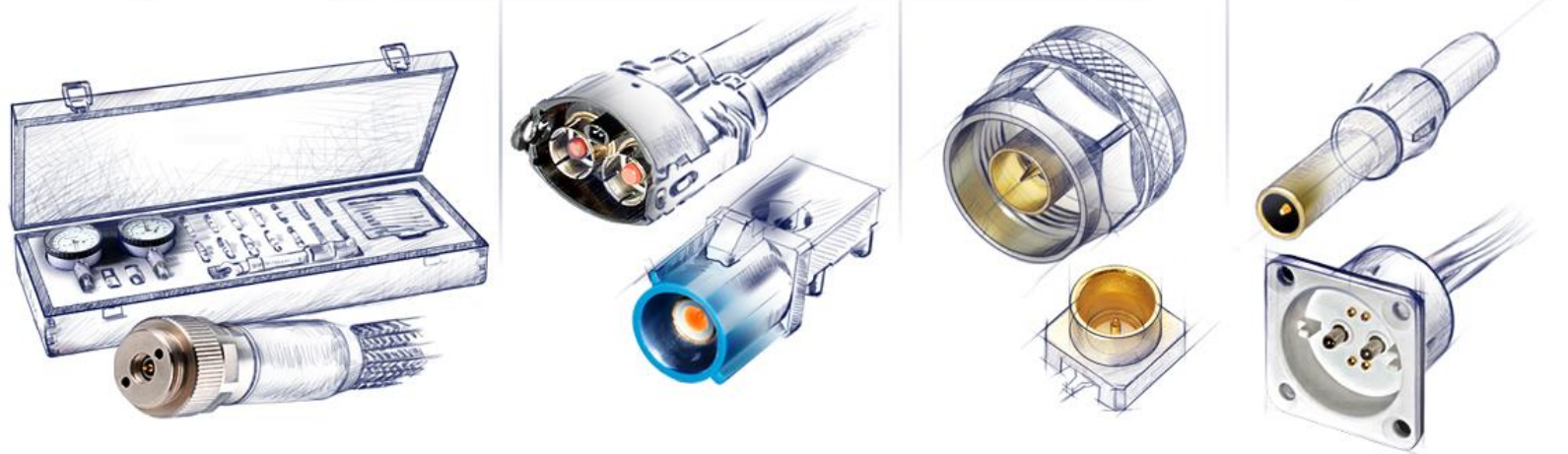

Rosenberger

ANSYS Santa Clara Convergence Conference 2013




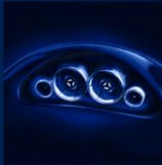


Frank Schonig, Sandeep Sankararaman, Steve Fahrner, Jim Jaquette

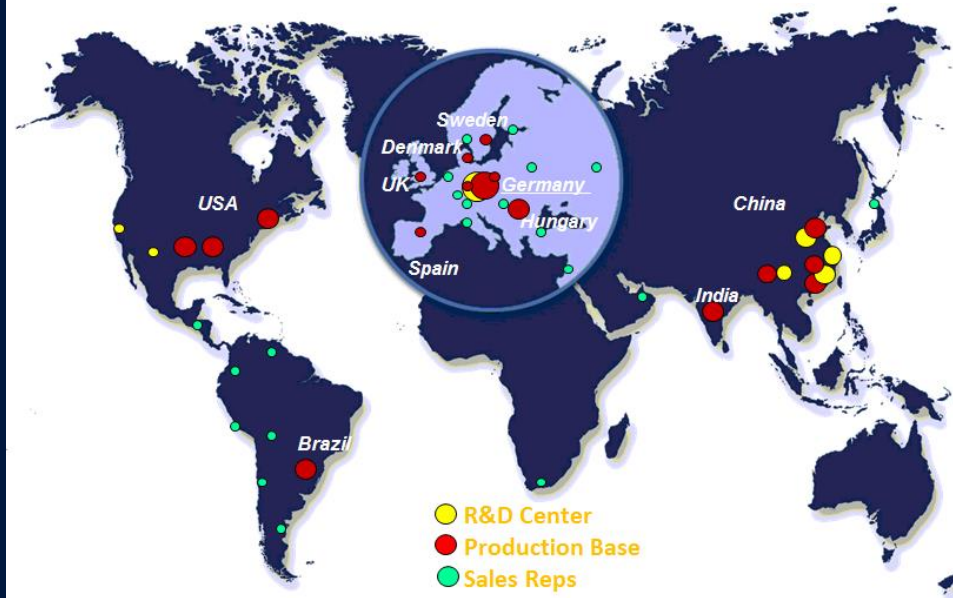


Outline

- Brief introduction to Rosenberger
- Brief introduction to the “LIGA” process
- Examples of parts produced with the “LIGA process”
- Mechanical Simulation Approach
- Electrical-Mechanical Bridge
- A little on HFSS
- Iterative Design
- Team Introduction
- Appendix (time allowing)

Business Areas

 <ul style="list-style-type: none">•Communication RF-Coaxial Connectors	 <ul style="list-style-type: none">•Communication SLink Site Solutions
 <ul style="list-style-type: none">•Test & Measurement	 <ul style="list-style-type: none">•Automotive FAKRA RosenbergerHSD®
 <ul style="list-style-type: none">•Medical Solutions	 <ul style="list-style-type: none">•Fiber Optics



12 Countries – A global engineering and manufacturing company

18 Production facilities WW

~4900 Employees WW

We are industry leaders in HF signal delivery

Most process lines vertically integrated

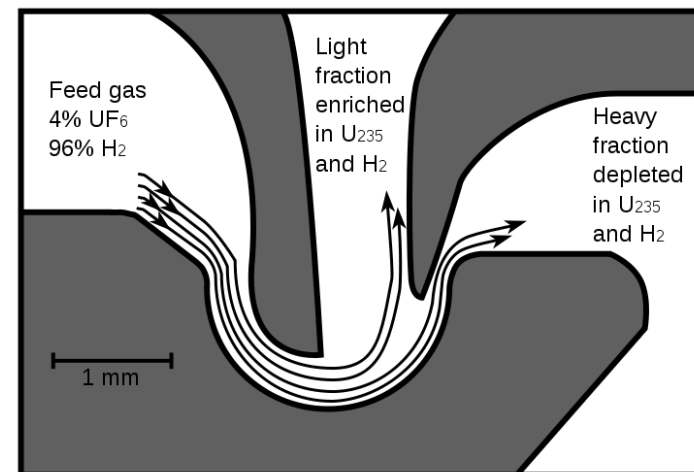
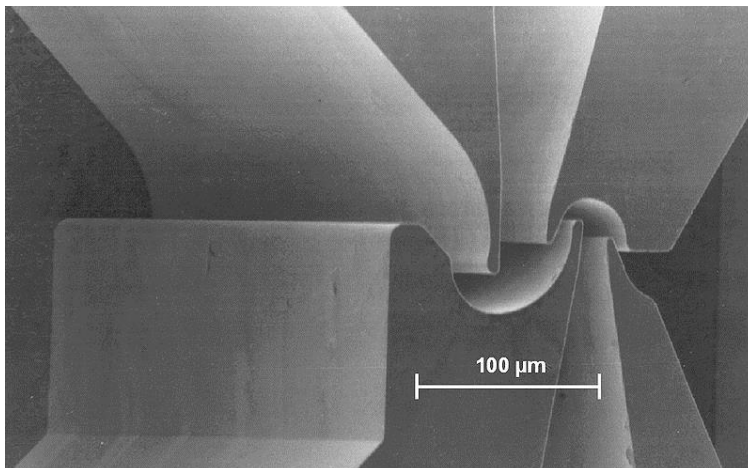
Well known, respected leader in innovation in all served market segments

LIGA is a German acronym for: **L**ithographie, **G**alvanoformung, **A**bformung

(Lithography, Electroplating, and Molding) a fabrication technology used to create high-aspect-ratio microstructures.

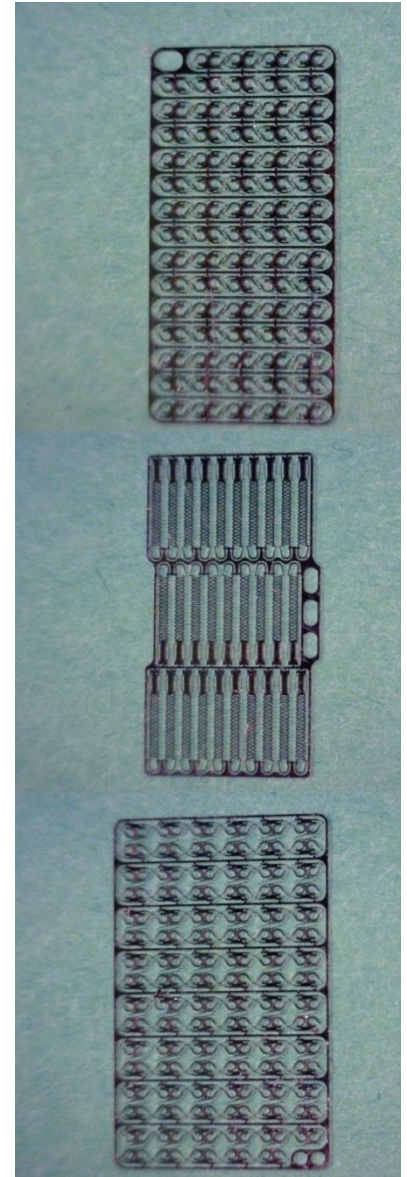
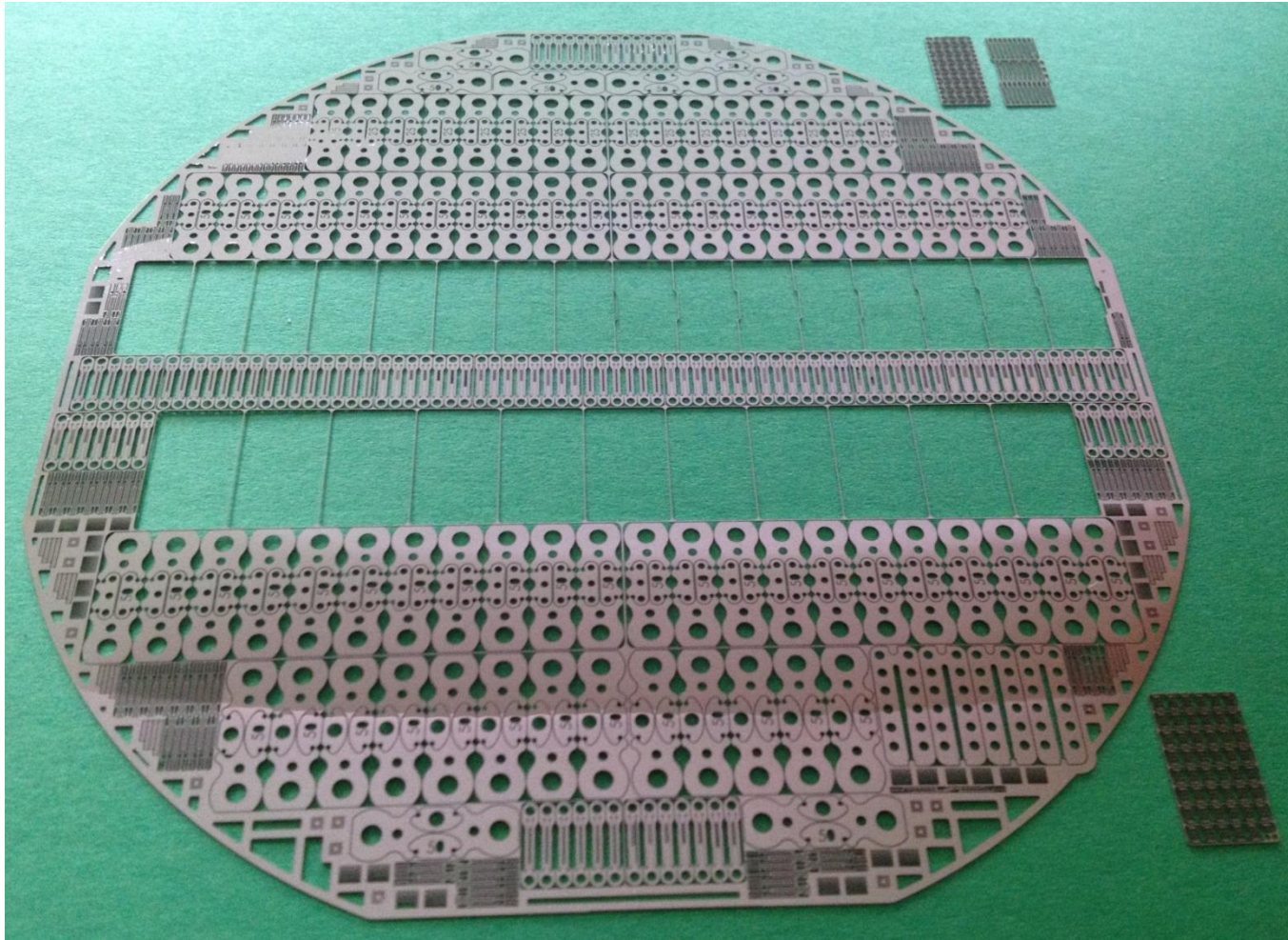
- X-Ray LIGA is a fabrication process in micro-technology that was developed in the early 1980s.
- X-Ray LIGA requires exposure to parallel beams of high-energy synchrotron radiation (X-rays)
- UV LIGA utilizes an inexpensive ultraviolet light source
- UV LIGA is much cheaper and more accessible than its X-ray counterpart.
- UV LIGA is not as effective at producing precision molds as its X-ray counterpart.
- UV LIGA is used when cost must be kept low and very high aspect ratios are not required.

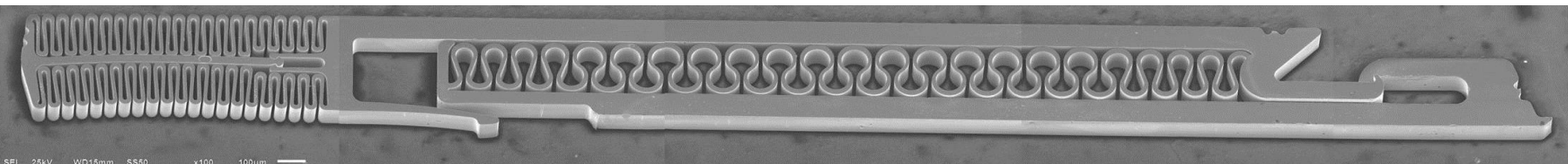
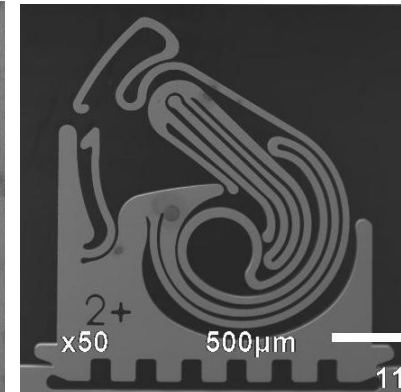
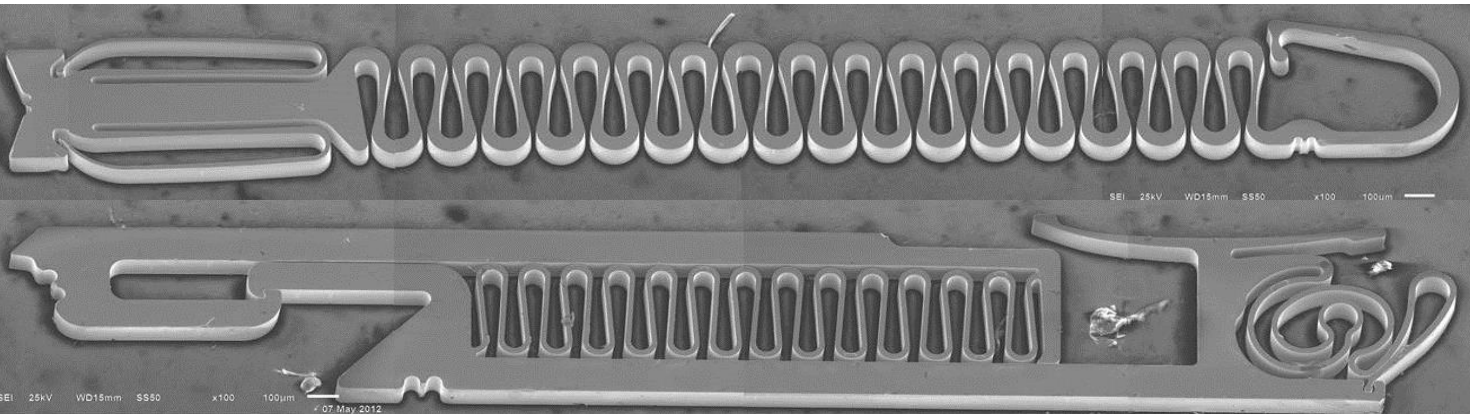
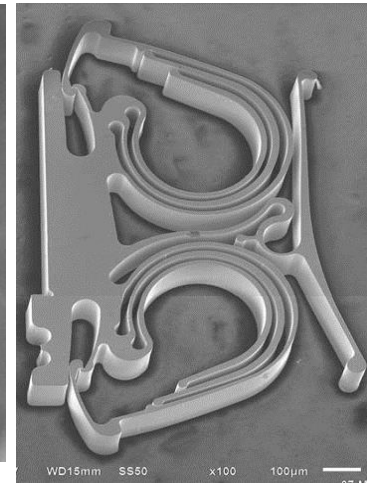
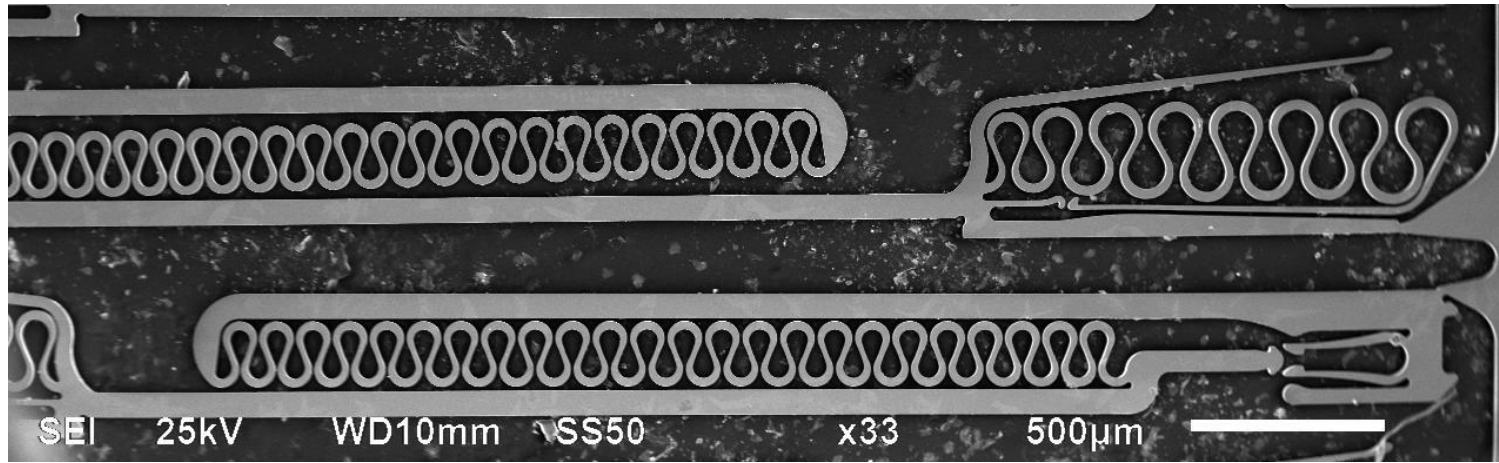
The X-ray LIGA process was originally developed at the Forschungszentrum Karlsruhe, Germany, to produce nozzles for uranium enrichment. <http://en.wikipedia.org/wiki/LIGA>



Example of released wafer (6")

Rosenberger





General idea of scale

Rosenberger

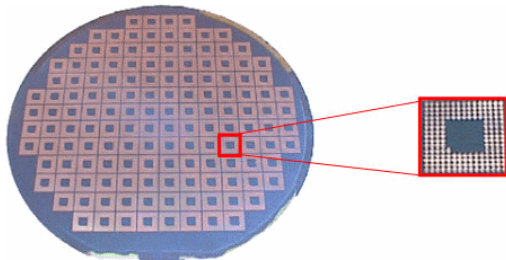
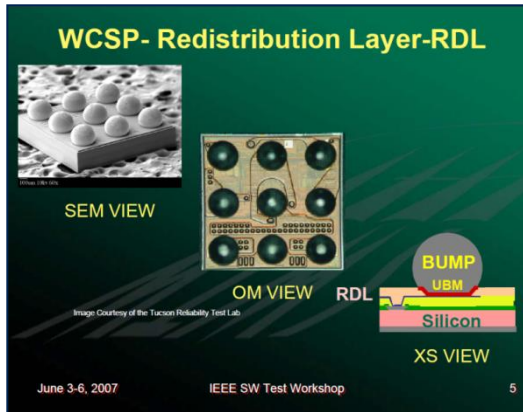
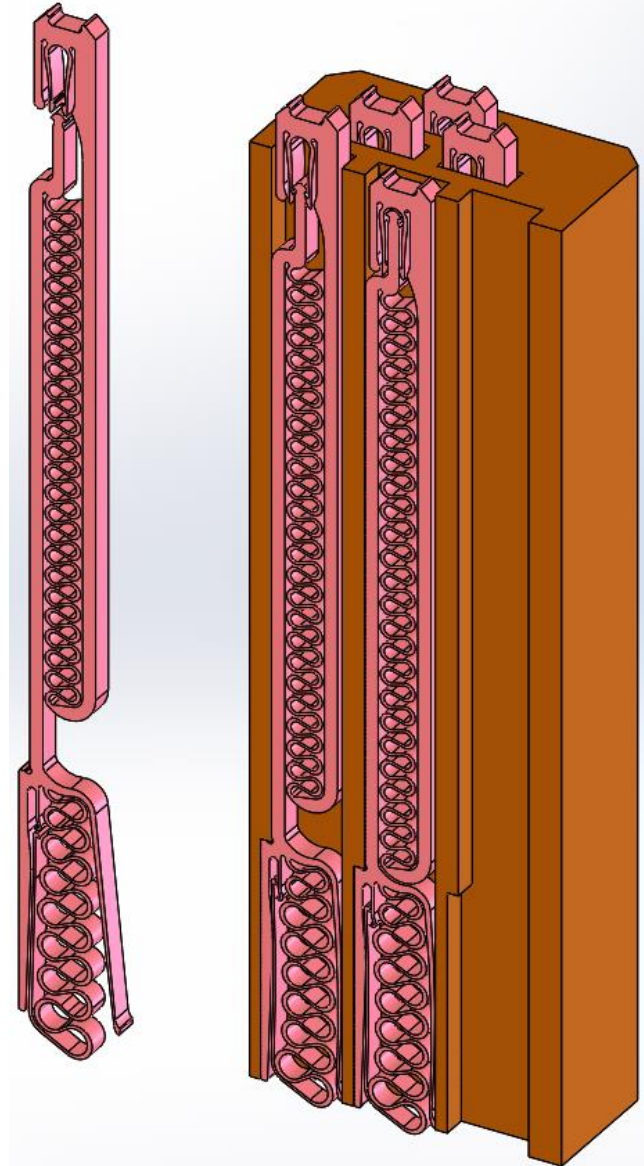
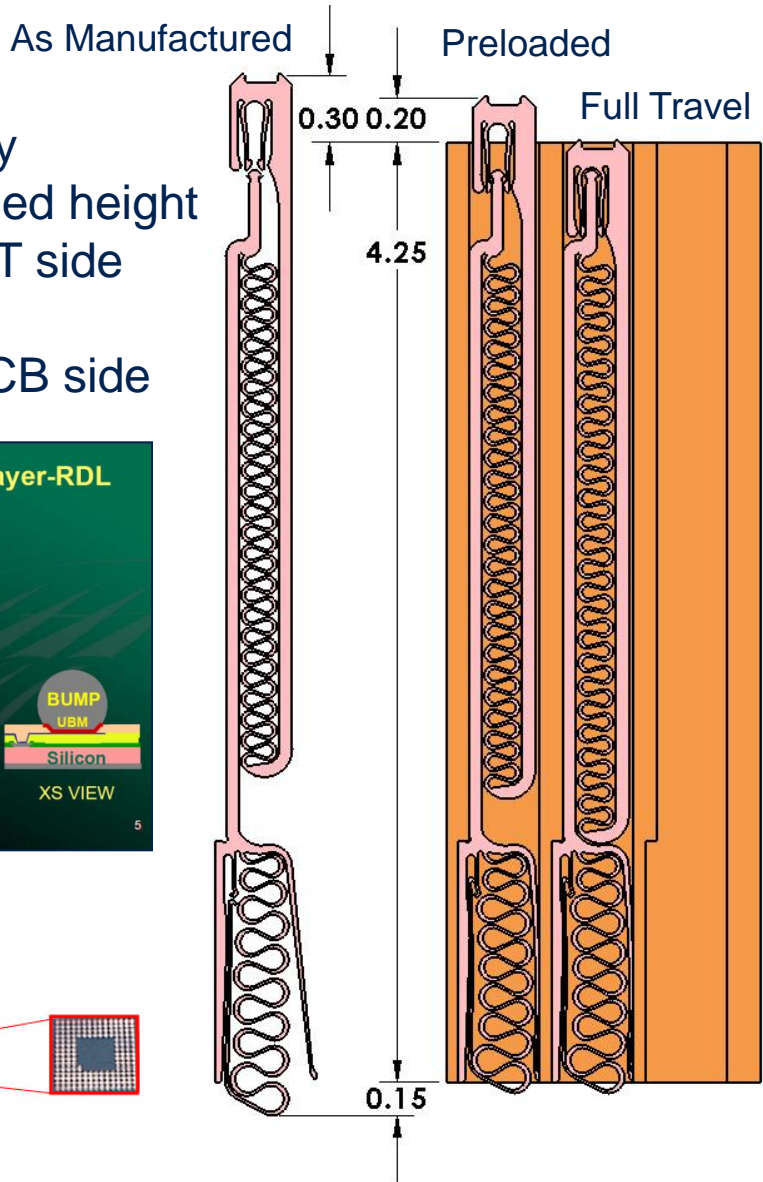


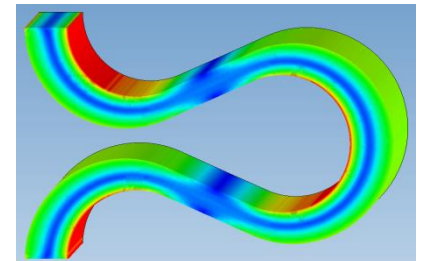
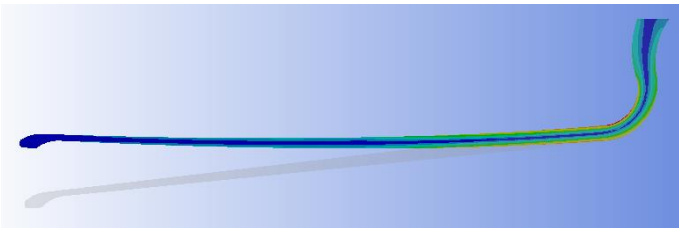
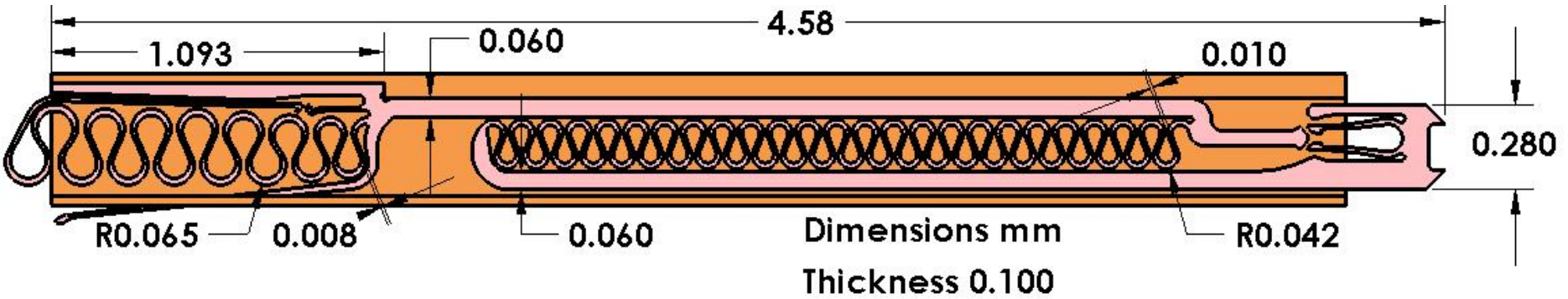
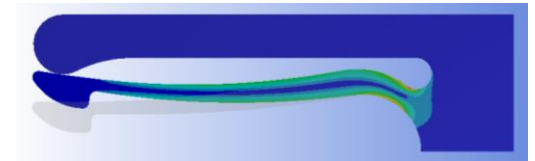
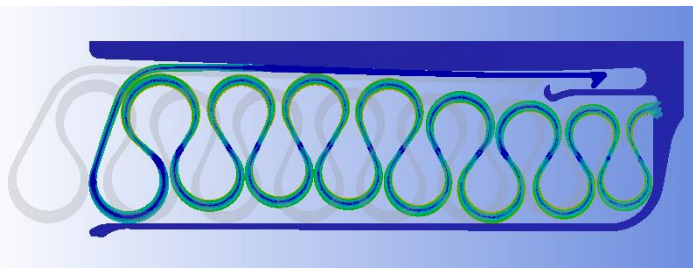
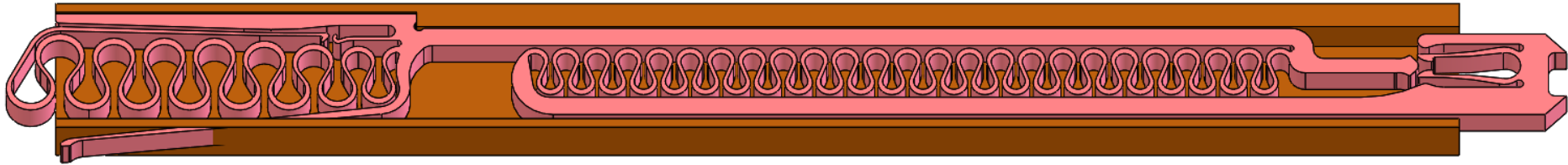
.02 € Ø 18.75
.01 \$ Ø 19.06
Globe Ø 7.6



LP6 – WLCSP Spring Pin Alternative

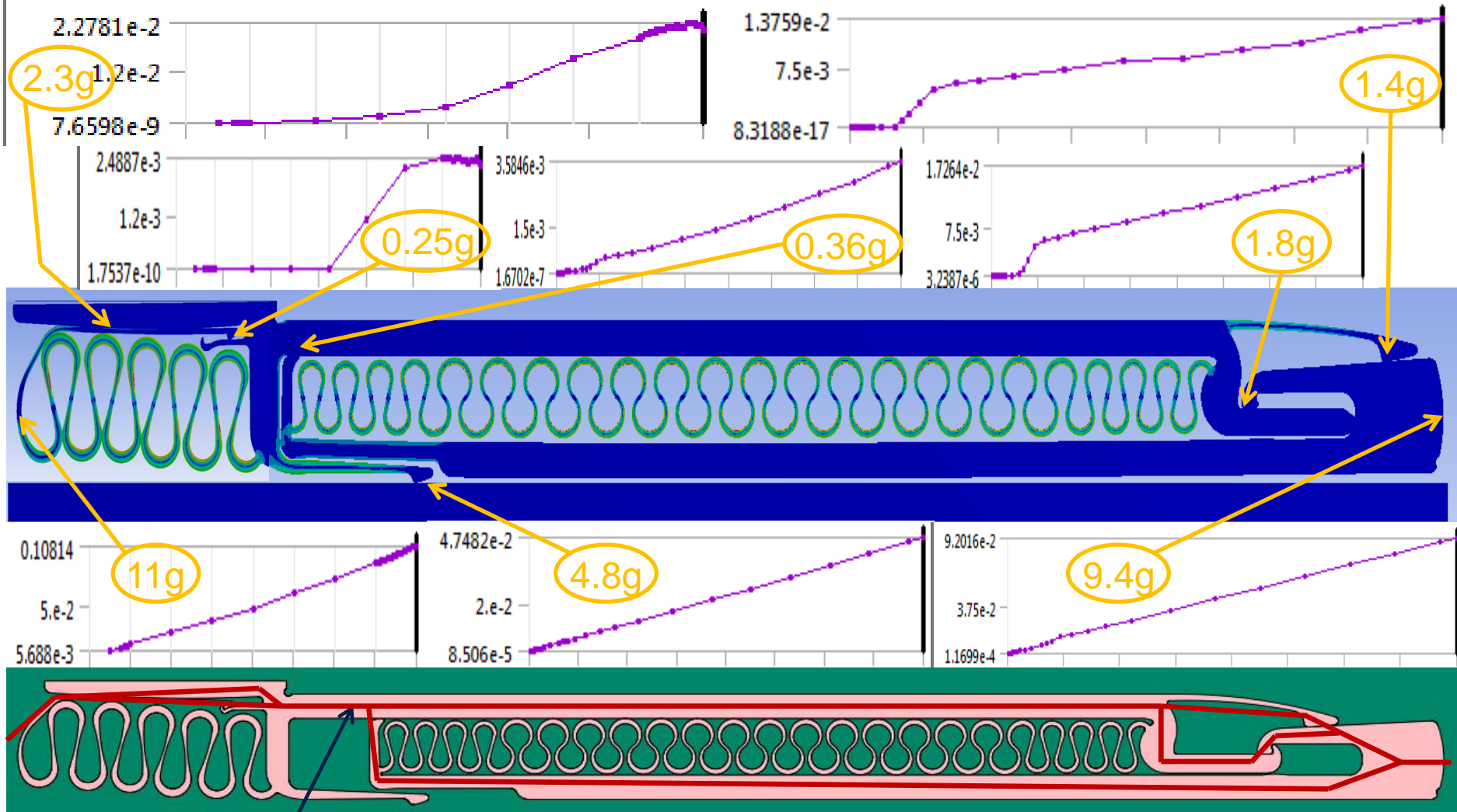
- 0.3 mm pitch array
- 4.2 mm compressed height
- 0.2 mm travel DUT side
- ~9 gf DUT side
- 0.15 mm travel PCB side





WLCSP-CSP Interconnects (0.4 mm Shown)

Rosenberger



Signal Path

Two Deformed Geometry Options (not to imply there are not more)

ANSYS

Creating Deformed Geometry

Hari Subramaniam

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This program is truly amazing. Our logo has always been very difficult to work with because of the horizontal lines that graduate through it. I was amazed that it was almost perfect with the first run-through. And then, using the built-in touch up tools get rid of a few stray pixels, I won't have to do anything to it. AWESOME!
- B. Wright, TEC Electric

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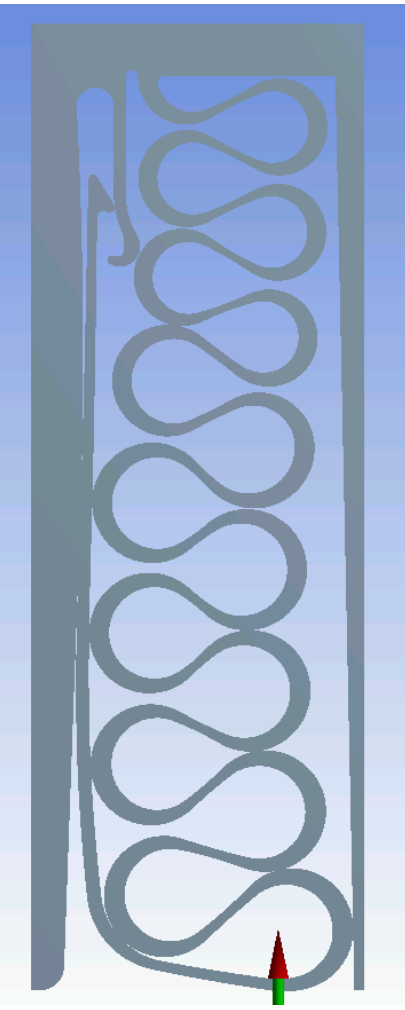
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- [What Are Vectors?](#)
- [What Are Bitmaps?](#)
- [Why Use Vectors?](#)
- [What Is Vectorization?](#)
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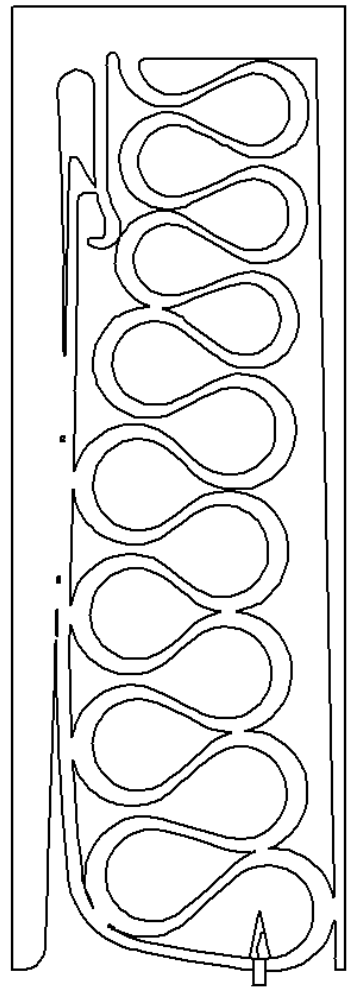
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Electrical-Mechanical Bridge (deformed shape conversion) **Rosenberger**

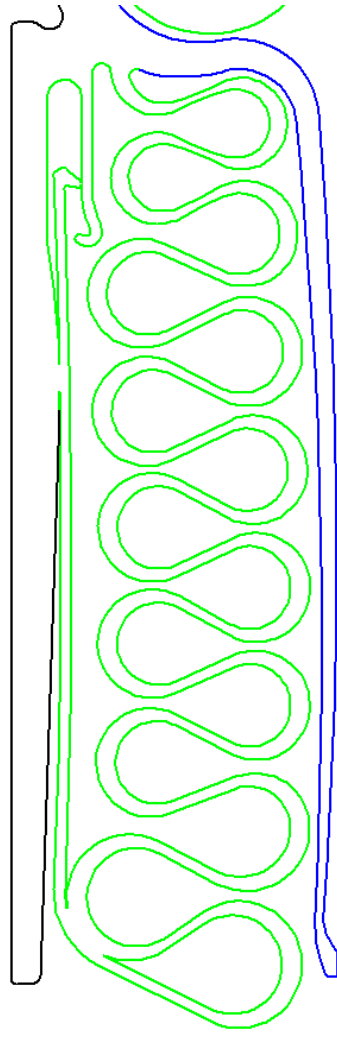
Ansys Screen shot compressed



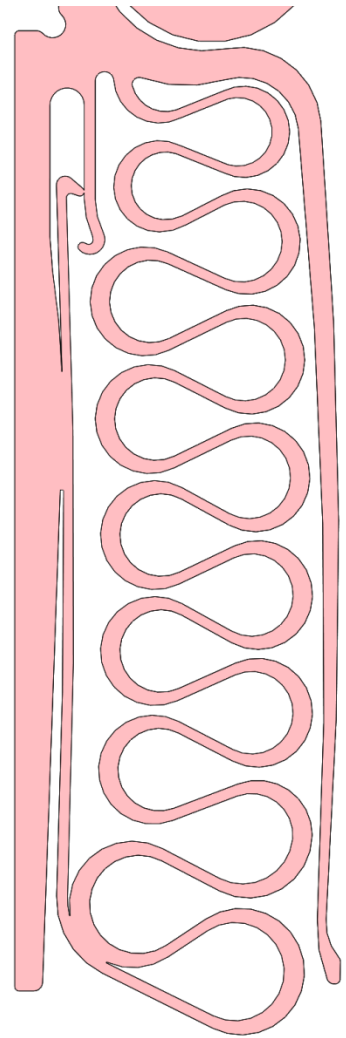
.dxf Output from Vector Magic



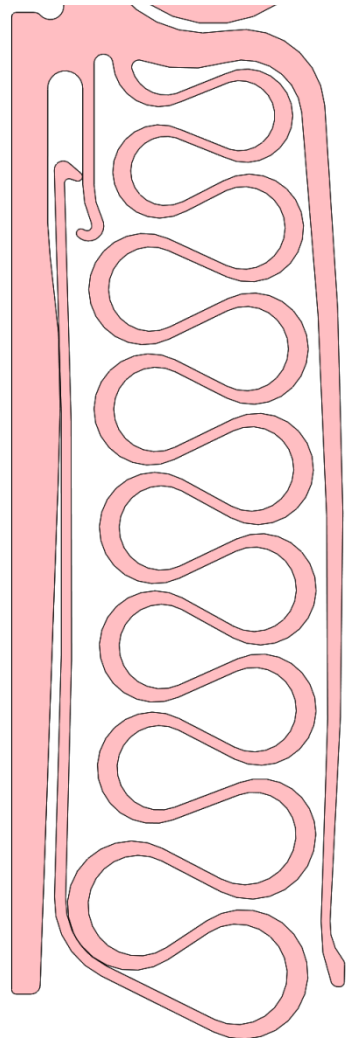
Rebuild model in 2D (.dwg)



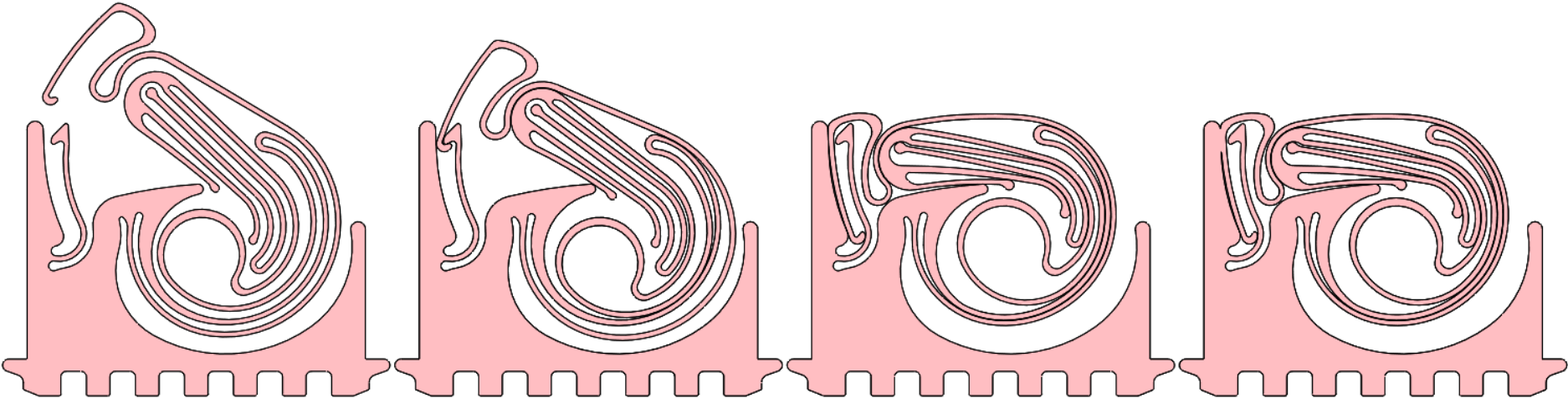
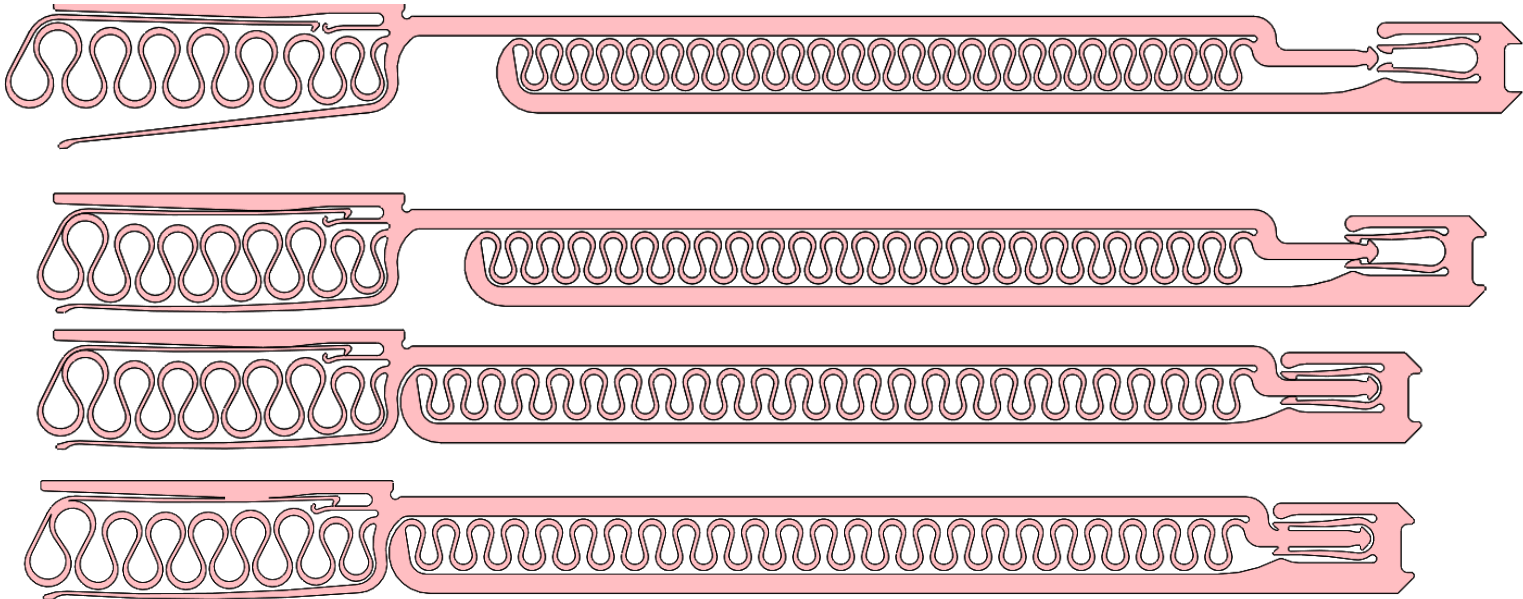
HFSS model file compressed



Cartoon model compressed

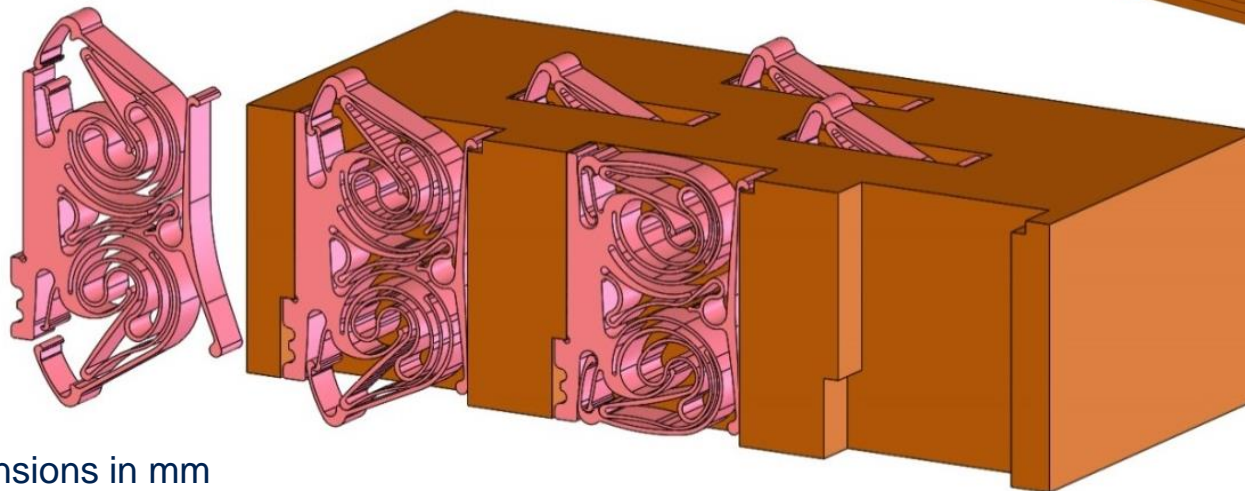
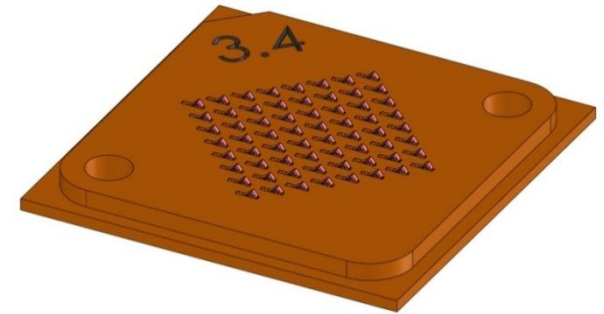
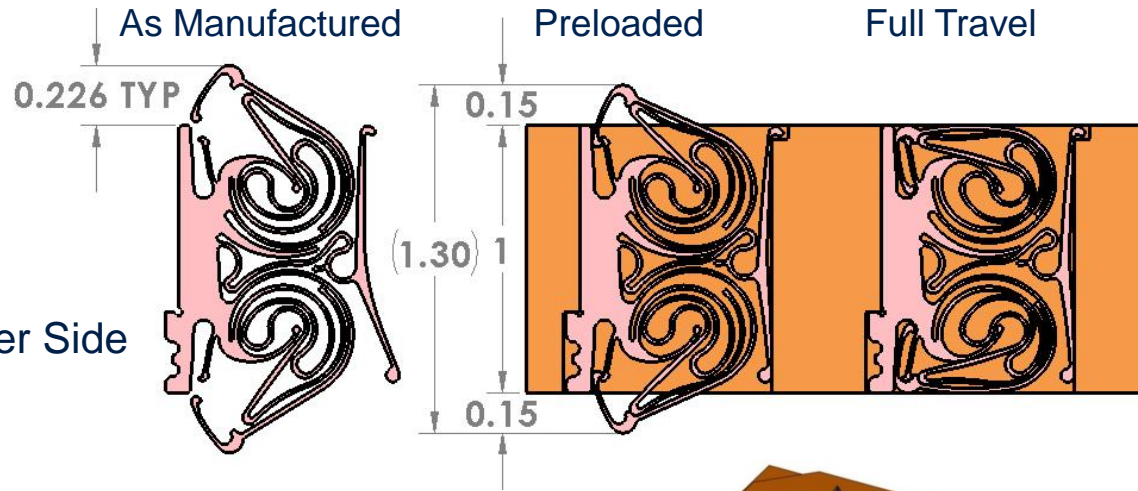


Electrical-Mechanical Bridge (deformed shape conversion) **Rosenberger**

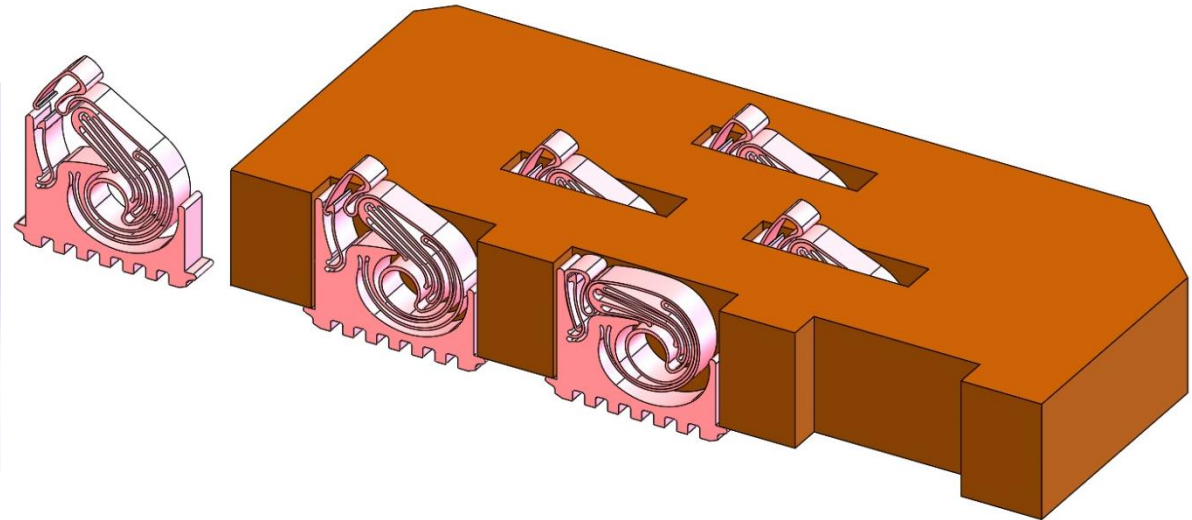
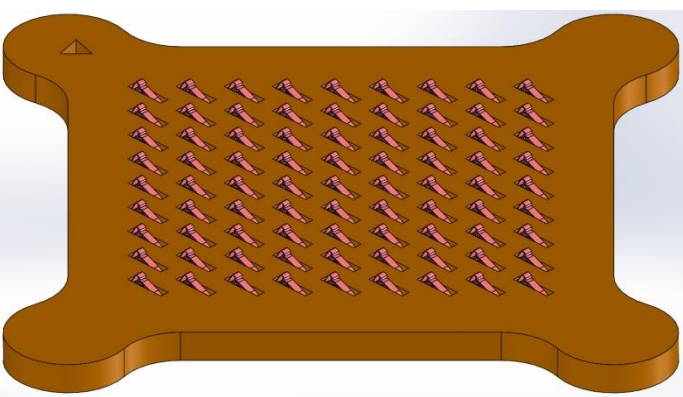
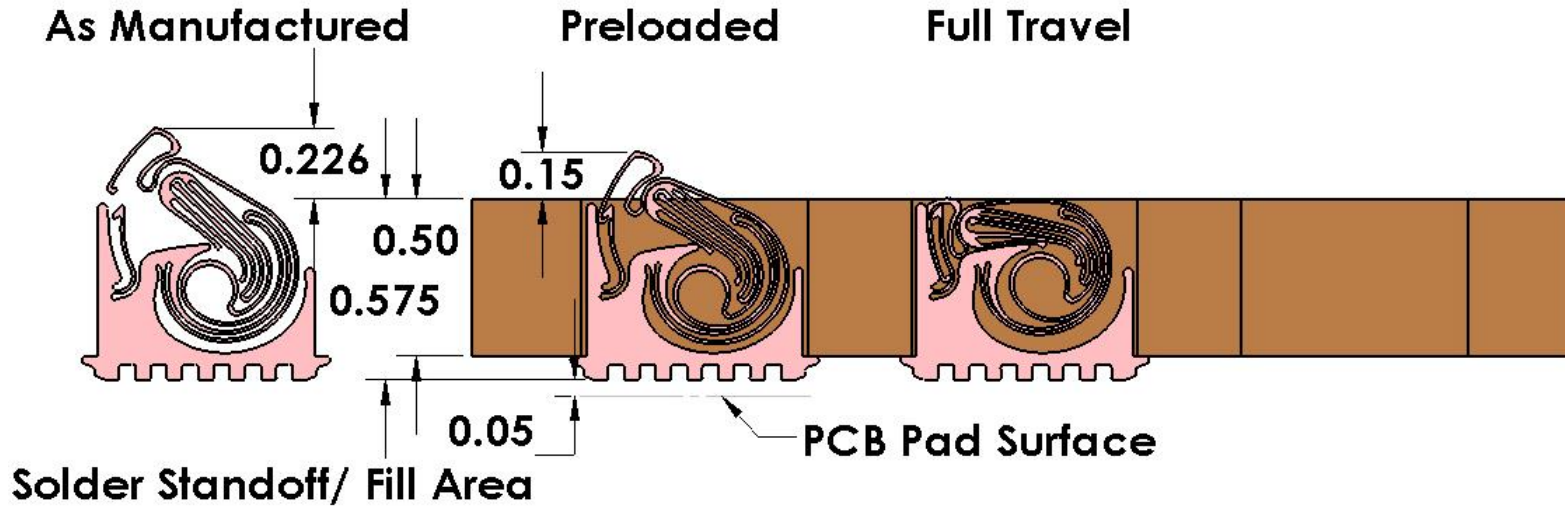


LP3 0.8 Pitch Array Interposer

- 0.076mm Preload Per Side
- 0.15mm Usable Travel Per Side
- 0.30mm Total Usable Travel
- 0.150mm Thickness
- 0.065mm Contact to DUT Scrub Per Side
- 1.0mm Fully compressed Height
- Total Travel is ~31% of Height
- Force target per side ~8gf

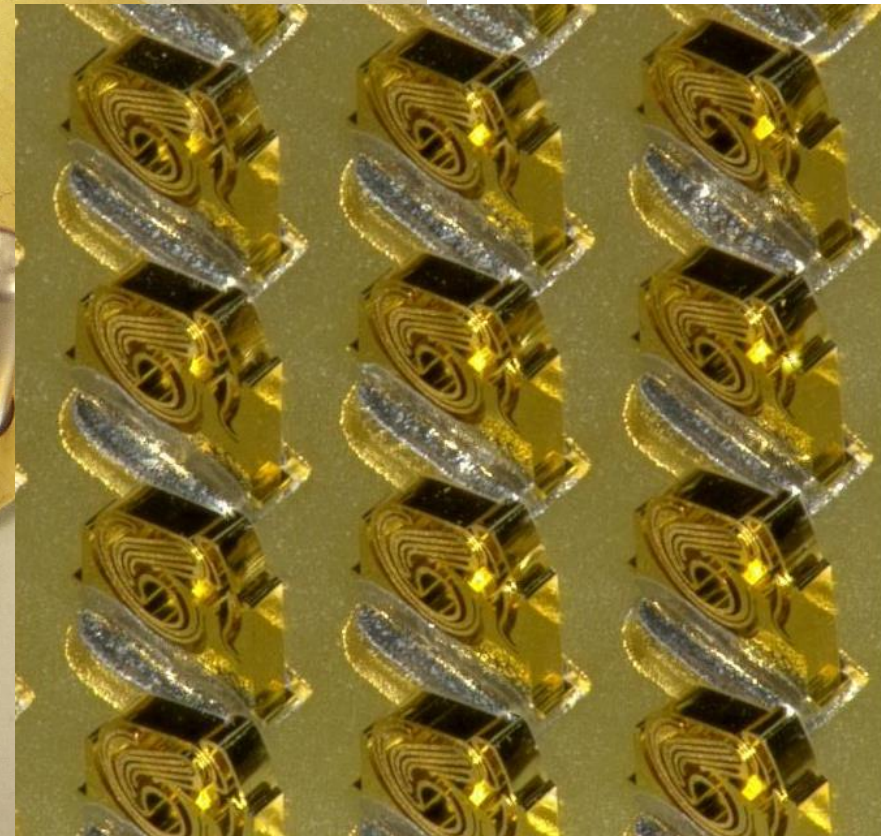
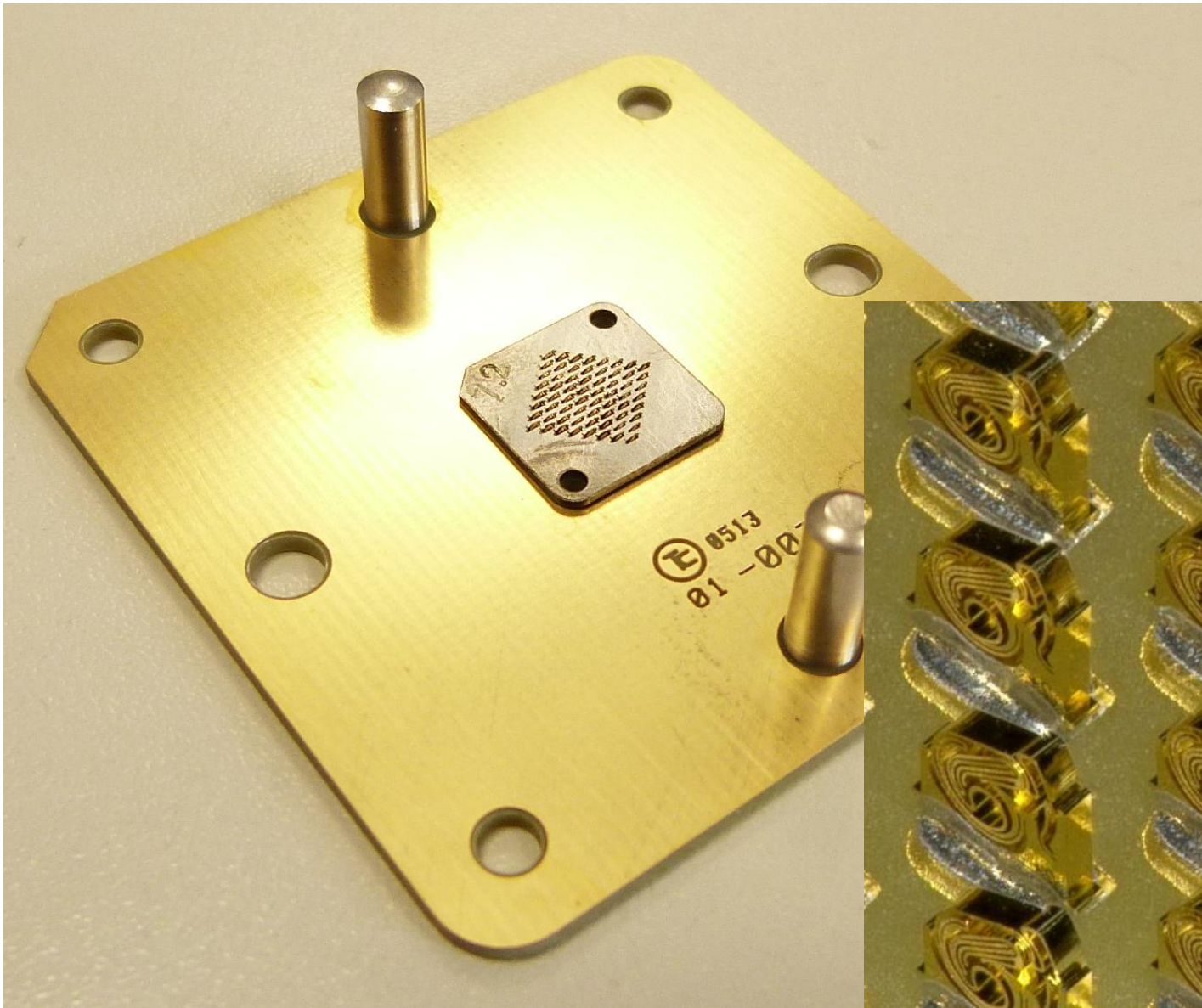


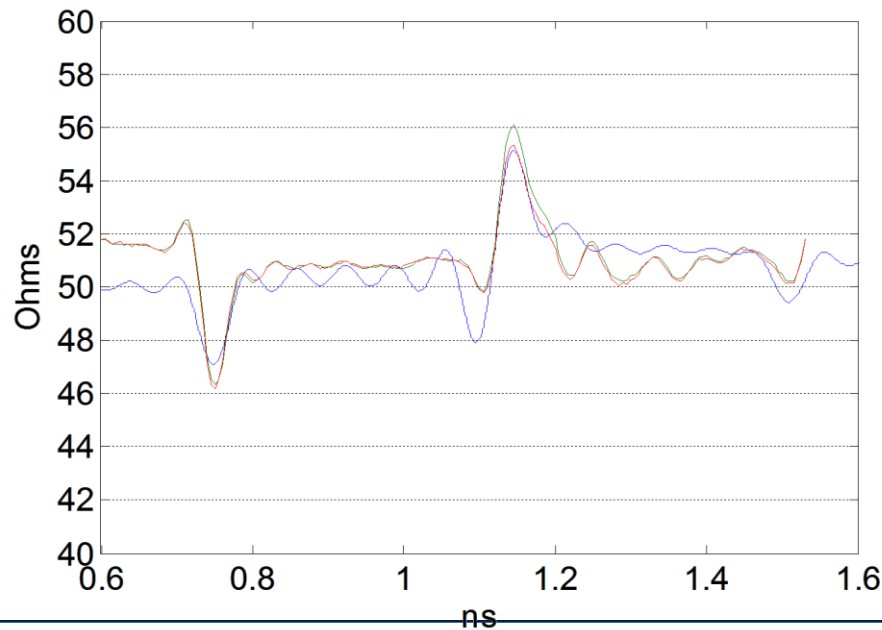
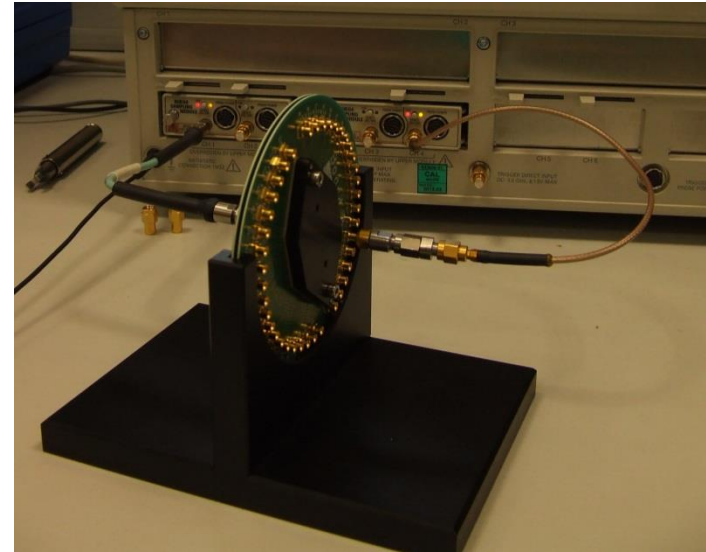
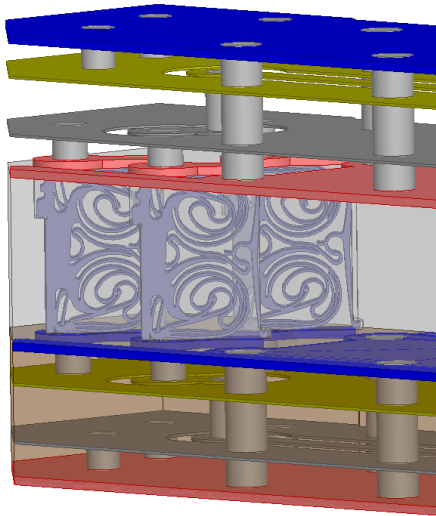
Dimensions in mm



50mm x 50mm PCB

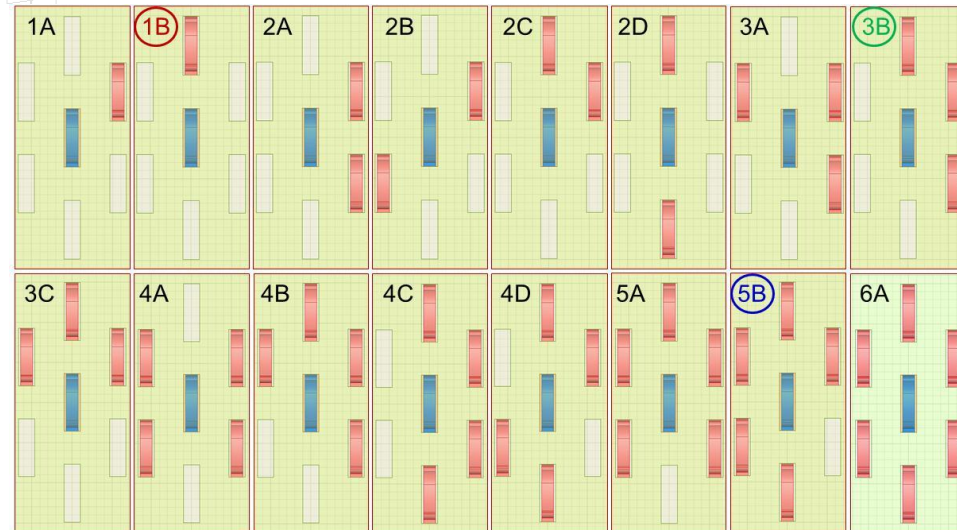
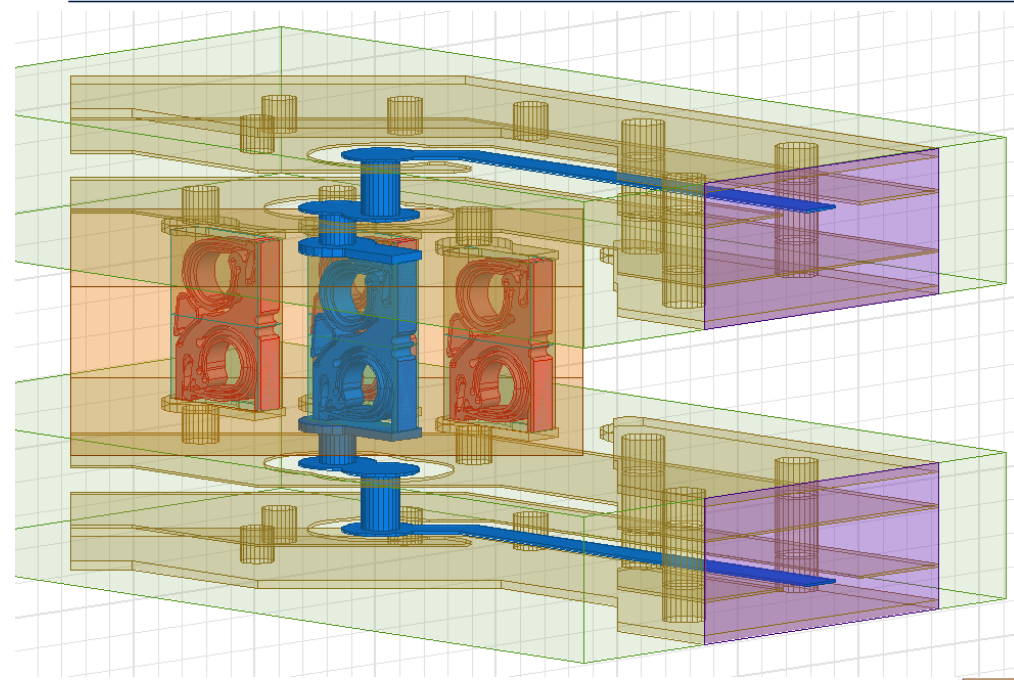
8x8 pin array @
0.7424mm pitch



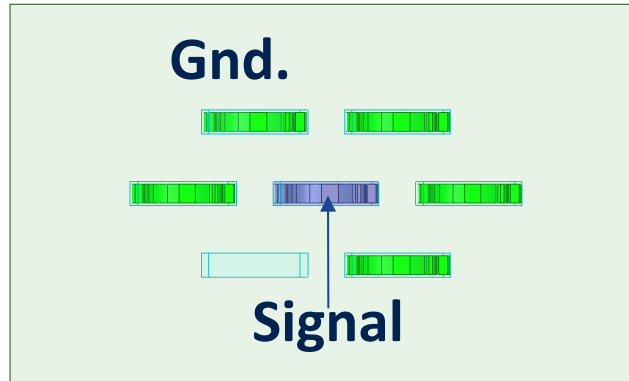
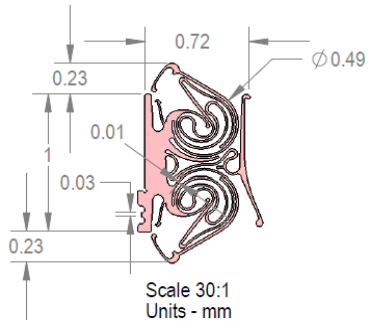


- HFSS
- Insufficient Compression (Measured)
- Designed Compression (Measured)

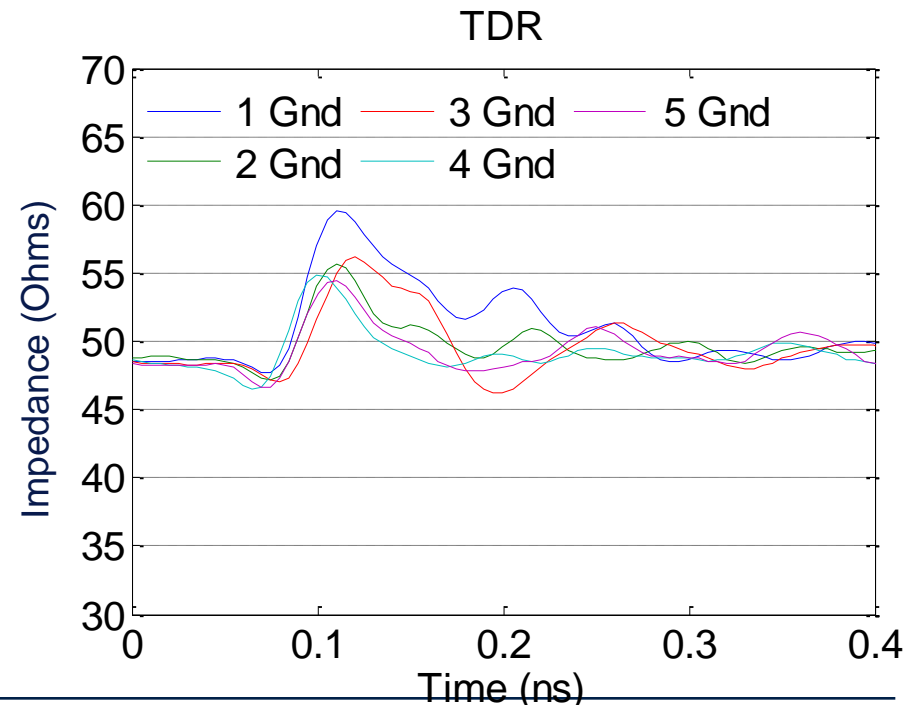
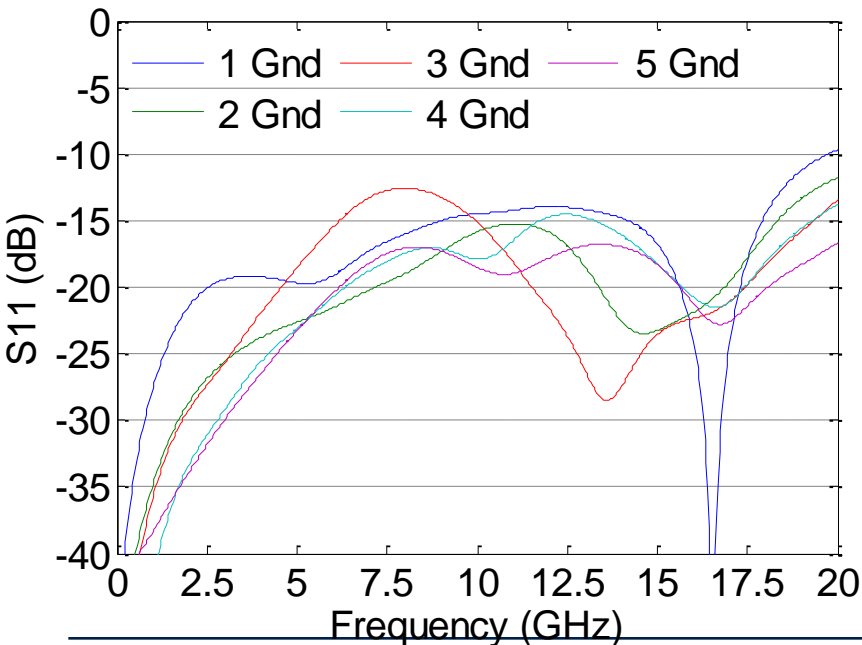
0.8mm Array HFFS Model



Pin configuration (Top view)



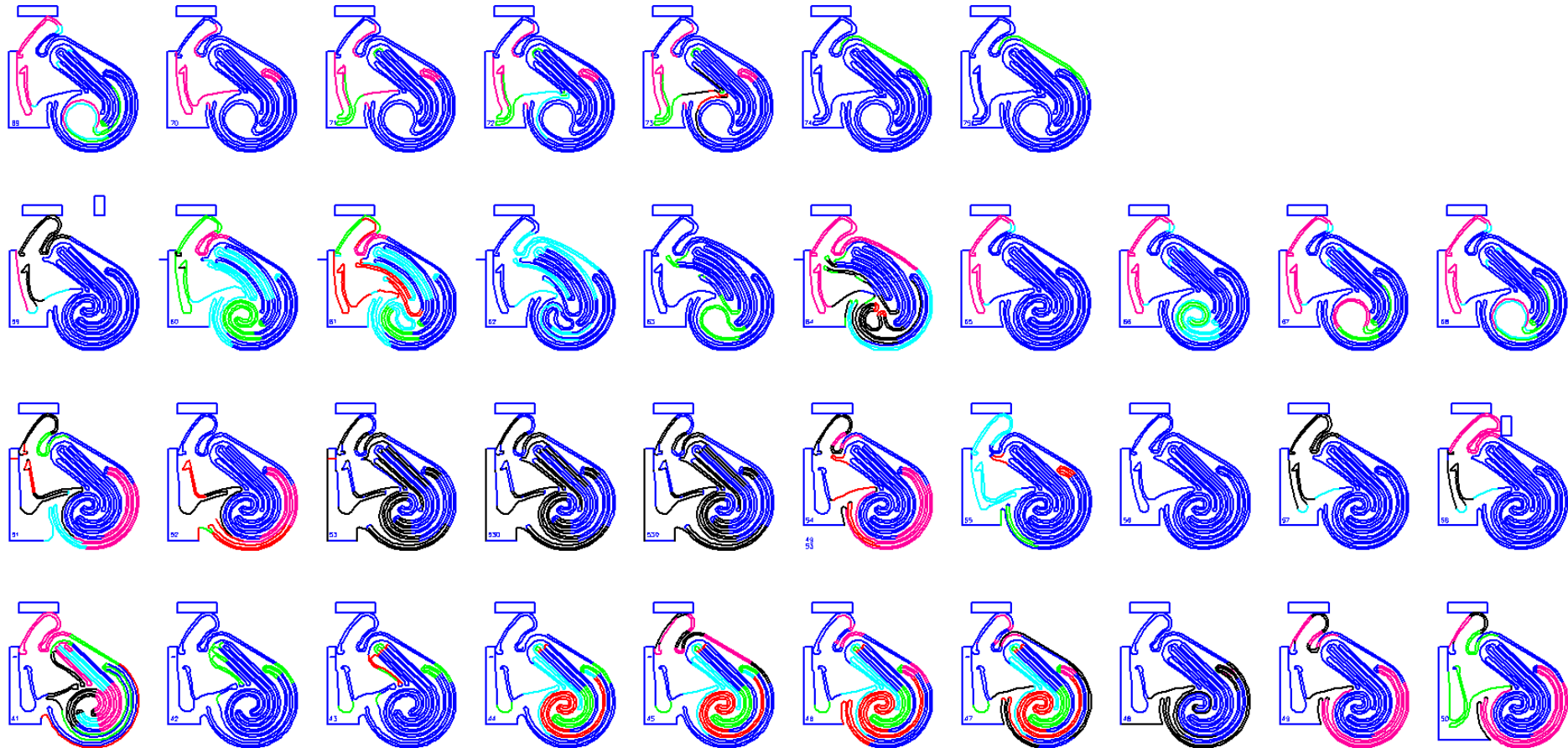
Config. (no. of returns)	Test fixture only 20-80 Risetime (ps)	Test fixture + MCI 20-80 Risetime (ps)	Equivalent BW (GHz)
1 GND	35.5	57.7	7.7
2 GND	35.1	56.3	8.0
3 GND	36.3	61.2	7.1
4 GND	36.8	52.6	9.3
5 GND	35.8	52.6	9.1

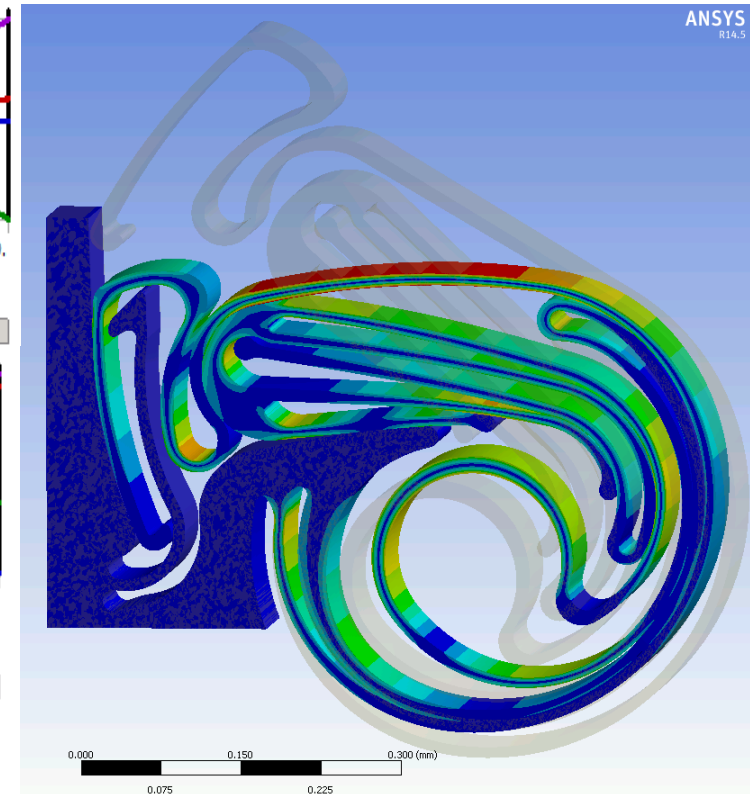
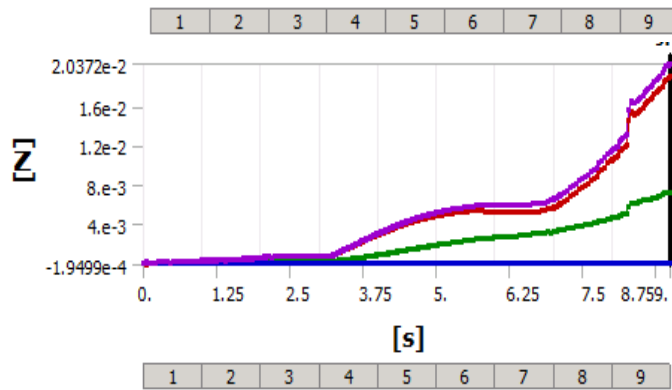
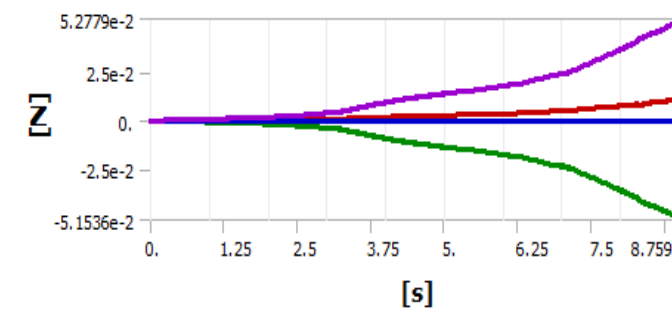


The path from design optimization to design verification

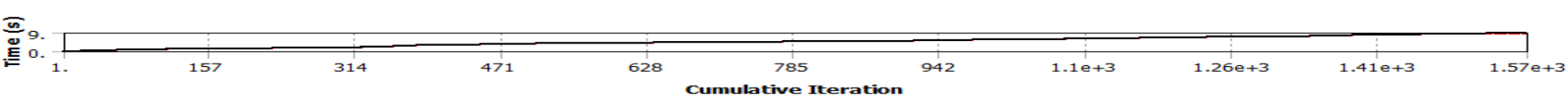
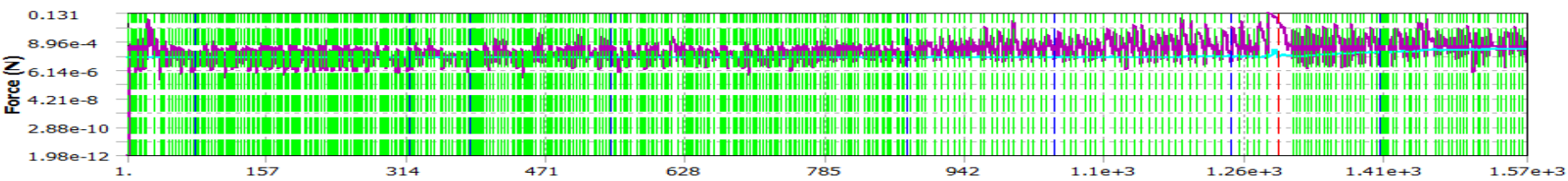
Traditionally
Designers design
Analysis analyze

Some thoughts on a different approach using Ansys
(both in general and specifically)





- Force Convergence (purple line with dots)
- Force Criterion (cyan line with dots)
- Bisection Occurred (red dashed line)
- Substep Converged (green dashed line)
- Load Step Converged (blue dashed line)



Outline

Filter: Name

Project

- LP6 full sim Assembly (B4)
 - Geometry
 - Btm Spring Push Block 2-1
 - LP6 RF Housing seed-1
 - LP6 Contact 1-2
 - Solder Ball-1
 - Coordinate Systems
 - Connections
 - Contacts
 - Frictionless - Contact surface to pusher
 - Frictionless - Coil 2 nested into Coil 1
 - Frictionless - Coil 3 to Coil 5
 - Frictionless - Coil 6 to Vert Beam
 - Frictionless - Vert Beam to Frame
 - Frictionless - Vert Beam Latch nose to preload La
 - Frictionless - Coil 11 to Finger Latch
 - Frictionless - Main Spring Coil 1 to Main Frame
 - Frictionless - Main Spring Coil 3 to Main Frame
 - Frictionless - Main Spring Coil 48 to RH Vert Fram
 - Frictionless - Main Spring Coil 46 to RH Vert Fram
 - Frictionless - Top latch finger LH to Latch post
 - Frictionless - Top latch finger RH to Latch post
 - Frictionless - Solder ball to Contact points
 - Frictionless - Main frame to Housing
 - Frictionless - Lower frame to Housing
 - Frictionless - RH Vert frame to Housing
 - Frictionless - Contact front side to Housing
 - Frictionless - Contact back side to Housing
- Mesh
- Static Structural (B5)**
 - Analysis Settings
 - Fixed Support
 - Displacement - Housing Latch
 - Displacement - Btm Spring
 - Displacement - Main Spring
- Solution (B6)**
 - Solution Information
 - Equivalent Stress
 - Force Reaction - Housing Latch
 - Force Reaction - Btm Spring
 - Force Reaction - Main Spring

ANSYS R14.5

0.000 0.500 1.000 (mm)

0.250 0.750

Geometry | Print Preview | Report Preview

Graph

Messages **Graph**

No Messages No Selection Metric (mm, kg, N, s, mV, mA) Degrees rad/s Celsius

Tabular Data

Steps	End Time [s]
10	10.
11	11.
12	12.
13	13.
14	14.
15	15.
16	16.
*	

Frank Schonig, R&D Advanced Technology Development (Mechanical)

Sandeep Sankararaman, R&D Advanced Technology Development, (EE)

Steve Fahrner, Perdix Engineering, Structural/Thermal Analyst (Analysis)

Jim Jaquette, R&D Advanced Technology Development (Program Management)

Thank you for your time
Hopefully you found some value in this

Common industry (LIGA) practice is for mechanical properties to be indirectly derived from failure data.

Current mechanical properties based on actual tests of micro samples.

Precise Yield stress is difficult to define.

There is no substitute for direct measurements...

