

CathCAD®

THE SOFTWARE FOR DEVELOPING YOUR NEXT MICROCATHETER

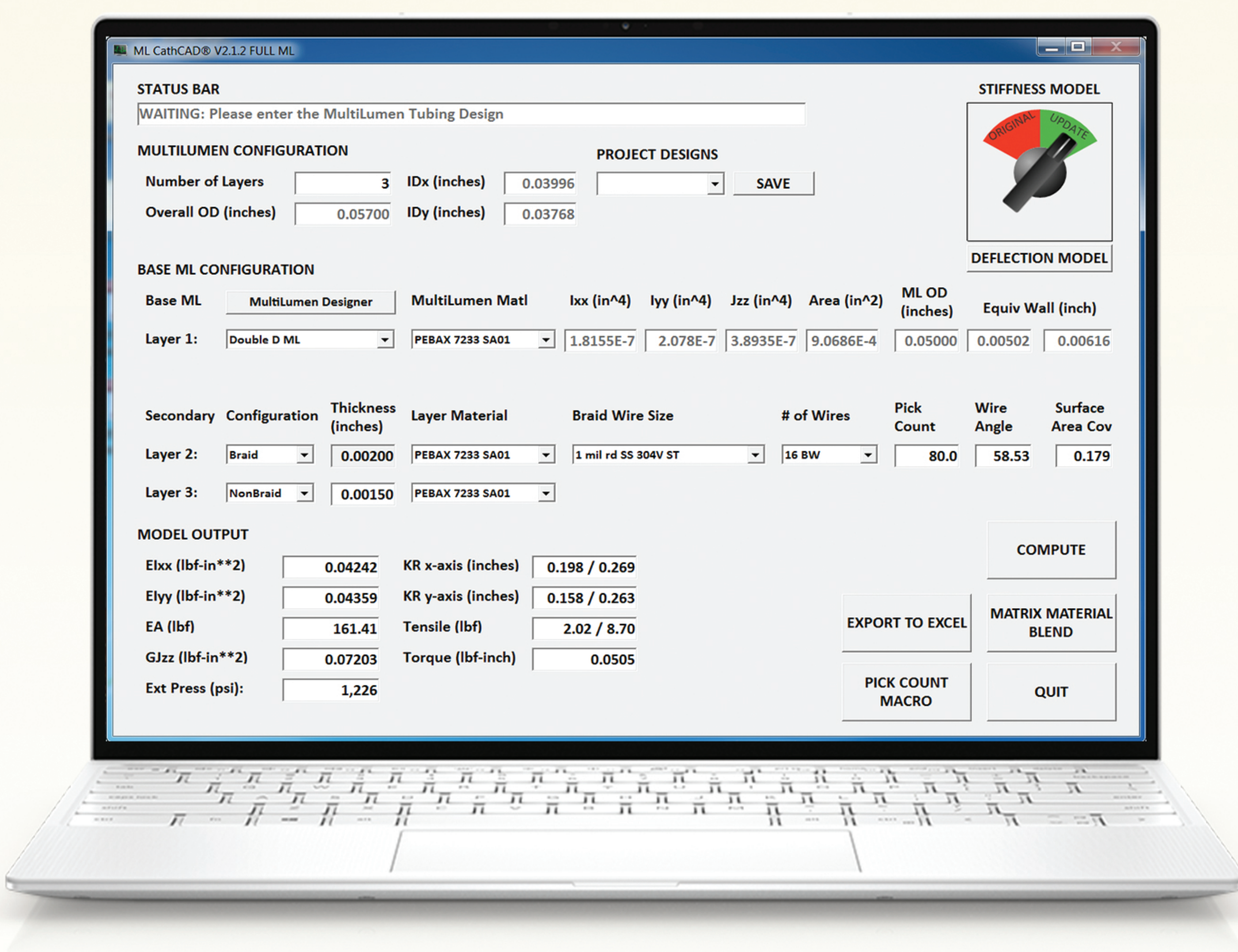
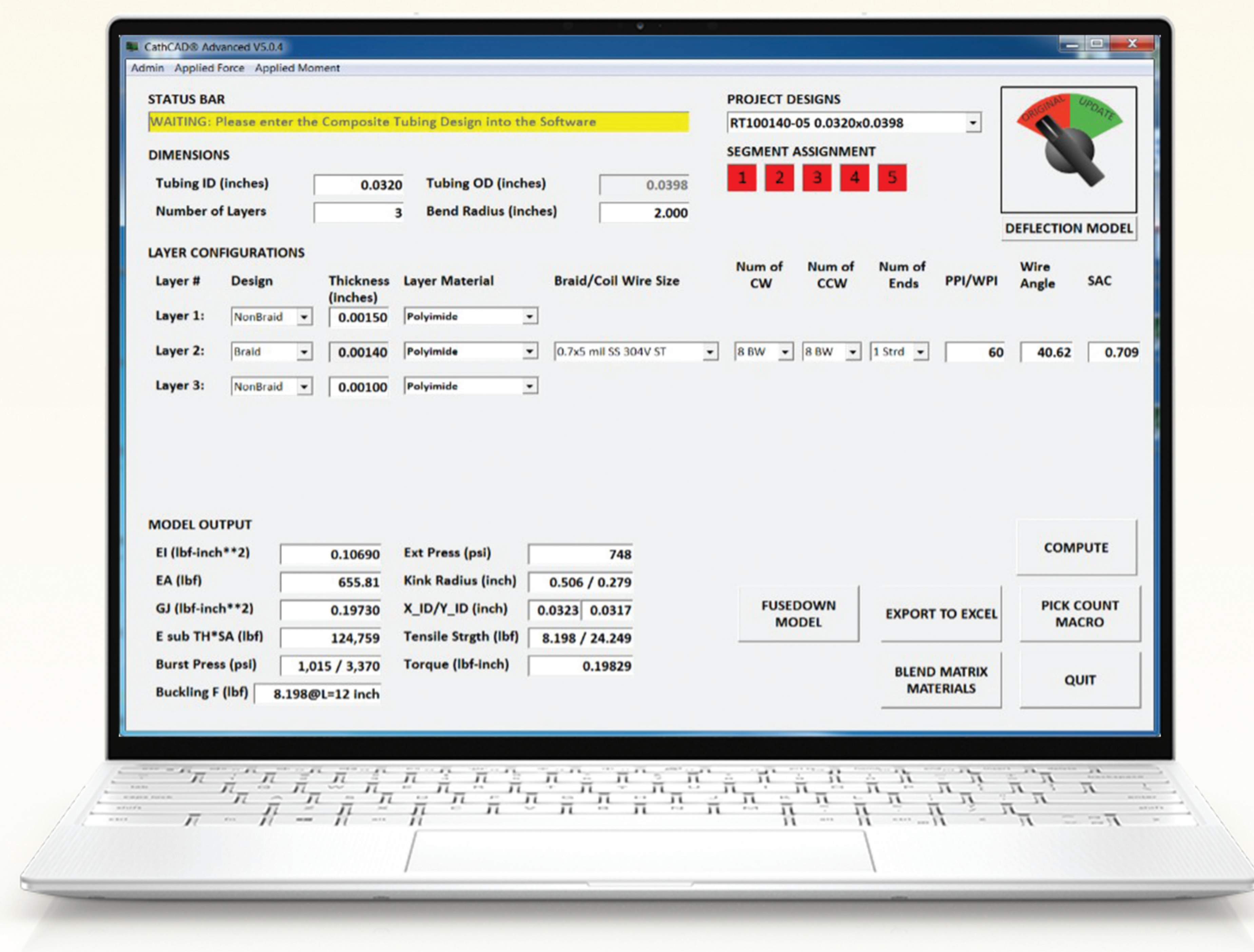
CathCAD® is the software solution that allows the User to analyze and predict the mechanical characteristics of microcatheters. The Software is based (in part) on the engineering fundamentals summarized in the article, Design Considerations in Small-Diameter Medical Tubing, which was the January, 2001 Cover Story in Medical Device & Diagnostic Industry (MDDI) magazine.

The computational algorithms are based on the following models and/or data sources:

- Mechanics of Materials
- Composite Laminate Theory
- The Tube Buckling (kink radius) computations are based on the model developed by Brazier
- Vendor material data sheets are used for loading material properties for standard materials used in medical catheter products.
- The software computational engine is NOT based on empirical or tabulated measurement data.

As of 2025 our customer base consists of over 200 medical device firms with over 400+ licensed users. Since the software inception over 300,000+ computational CathCAD® models have been completed by our licensed Users.

The Software was mentioned in a peer reviewed journal publication: Computer Assisted Surgery is an open access journal that aims to improve patient care by publishing research which advances the use of computers during surgical treatment. The CathCAD® software was utilized by researchers in designing a sensorized guiding catheter Authors: Roberta Piazza, Sara Condino, Aldo Alberti, Raffaella Nice



Software License includes three variants:

- CathCAD® Standard.
- CathCAD® Advanced, and
- MultiLumen CathCAD®

Roth Technologies

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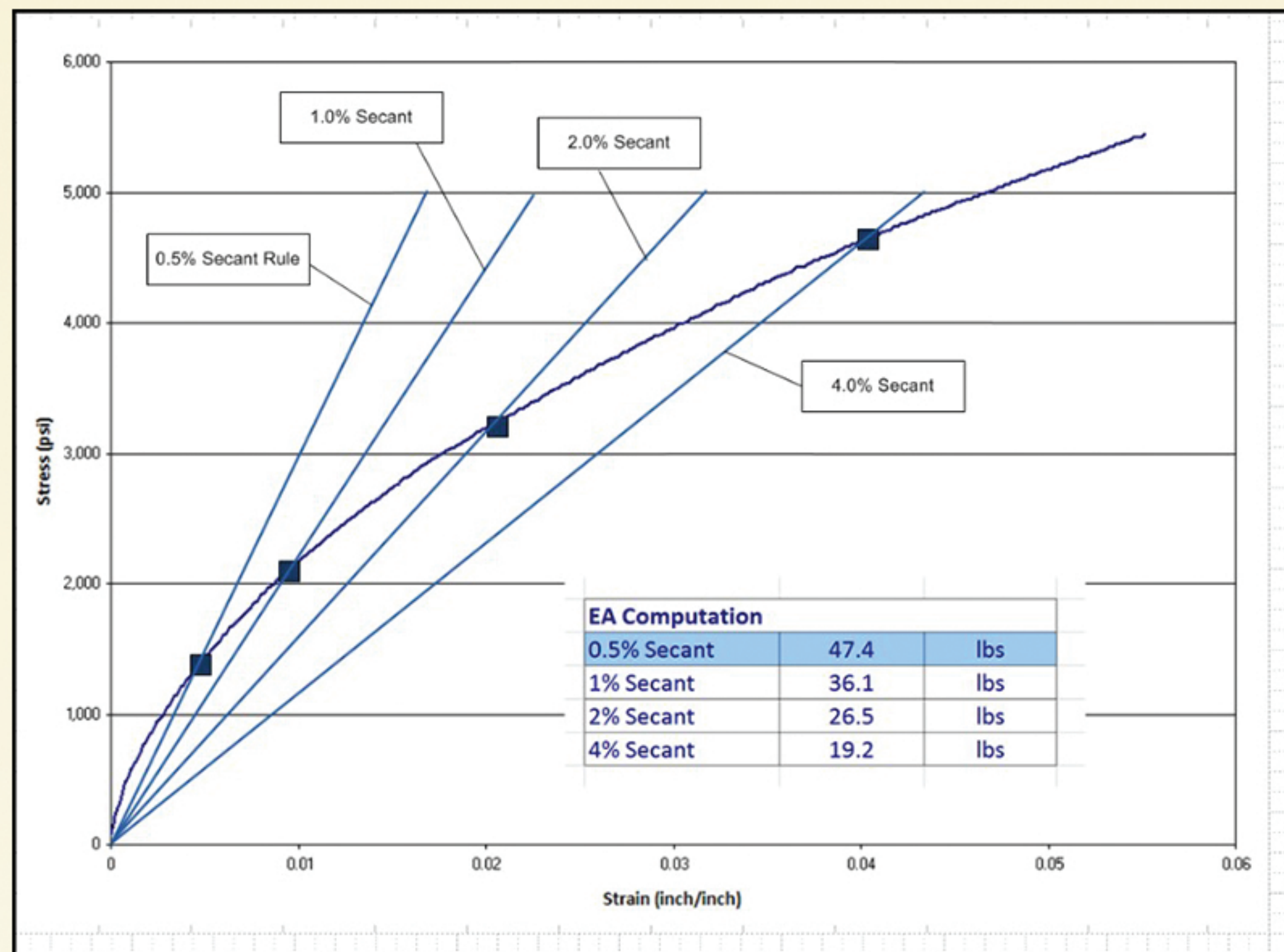
Website: www.cathcad.com

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Independent comparison of the Software's outputs to actual device measured properties is typically within 25 percent for flexural, longitudinal, and torsional rigidities. This table summarizes a braiding comparison to the Software for a 7Fr guide catheter.

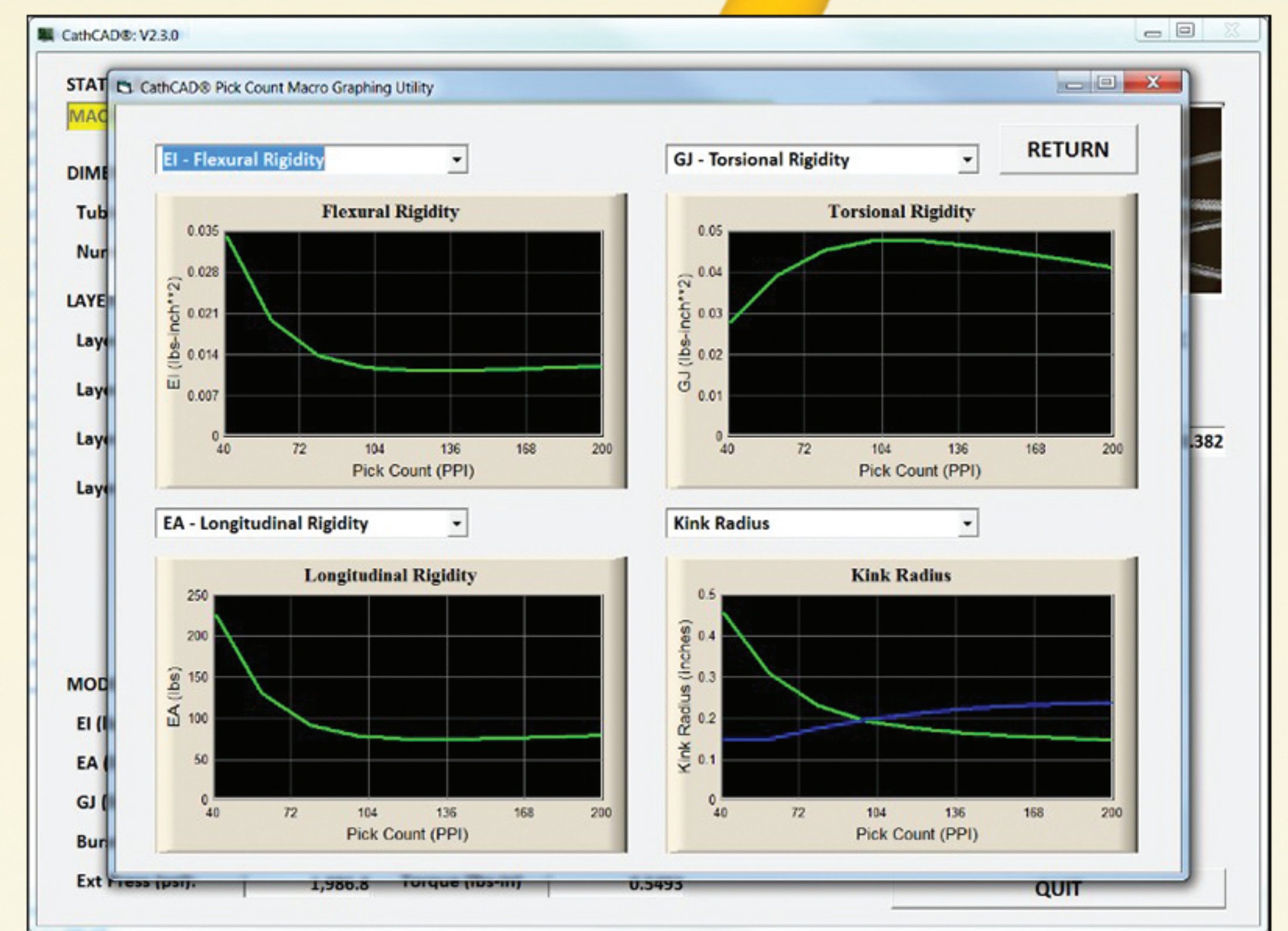
Design	Kink Radius			Flexural Modulus			Shear Modulus		
Braid Pattern	CathCAD (in)	Measured (in)	Percent Error (%)	CathCAD (ksi)	Measured (ksi)	Percent Error (%)	CathCAD (ksi)	Measured (ksi)	Percent Error (%)
1u1o1	0.451	0.460	2%	46.05	44.71	3%	160.48	157.80	2%
1u2o2		0.470	4%		46.61	1%		163.90	2%
2u2o2		0.440	2%		46.36	2%		100.30	37%



The Software assumes “small deflections” and the results from elongation testing and/or three point bending of physical samples may be directly correlated to the Software outputs.

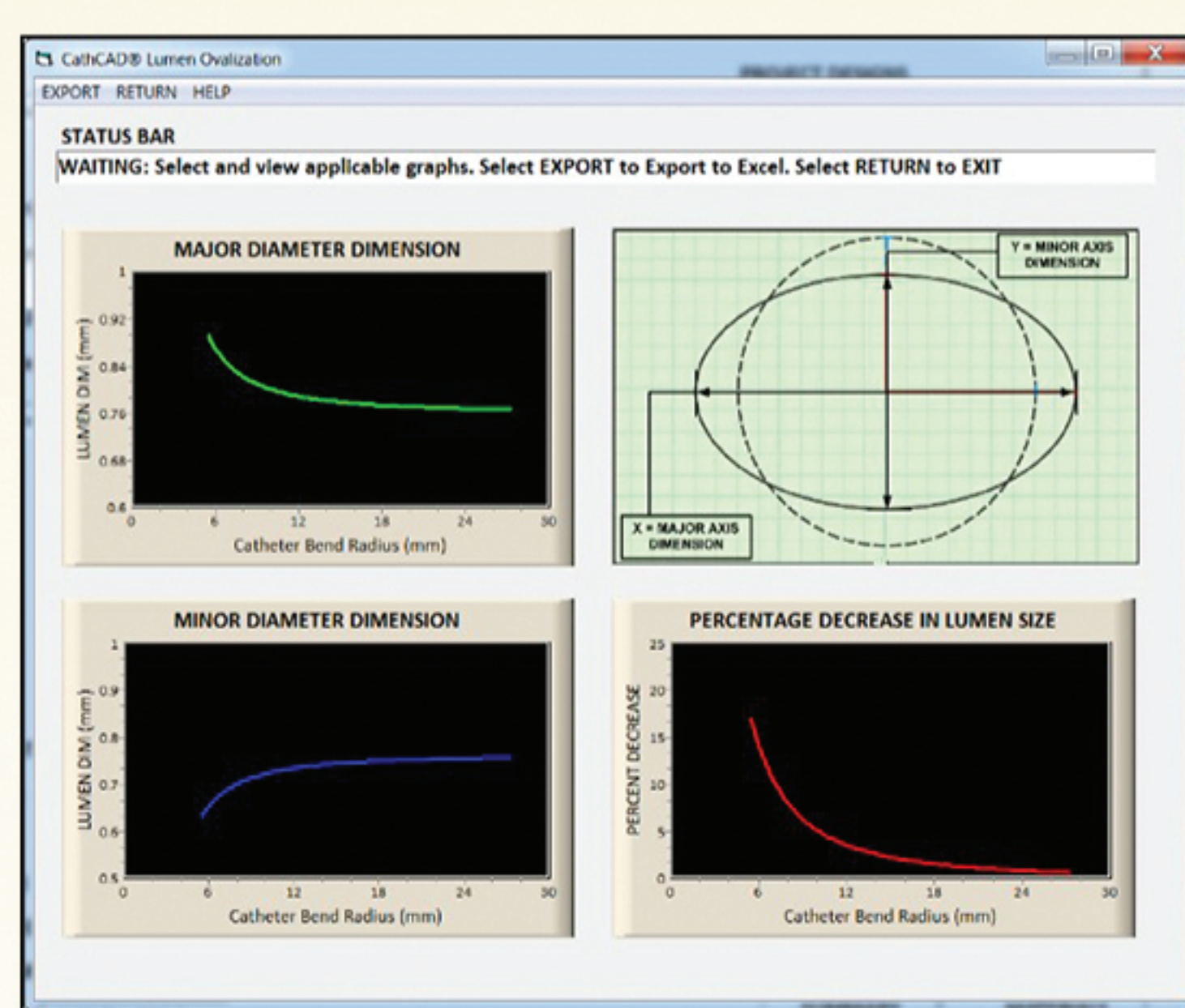
CableCAD V5.5.4		Robt Technologies, LLC		printed on 4/15/2021 at 3:38 AM	
MODEL RUN ID		UNIT #	BT10001001		
ID	inches	0.000			
OD	inches	0.008			
TOTAL WALL	IN.	0.008			
COMPOSITE LAYERED DESIGN Layer 1 Inside Layer SA = Steel GFRP = Glass Fiber Reinforced Polymer BFR = Boron Matrix Resin	Layer 1	1.6 mils Polyimide			
	Layer 2	6.7 mils of 27x3 mil 55.500V BT BFR/60 PH, 60-40 BFR/60, 60-40 FR-4, 60-40 FR-4			
	Layer 3	1.6 mils Polyimide			
	Layer 4	N/A			
	Layer 5	N/A			
	Layer 6	N/A			
CableCAD's Output:					
COMPOSITE MODULUS OF ELASTICITY		FSI	1.48E+06		
COMPOSITE SHEAR MODULUS		FSI	1.37E+02		
TENSILE MODULUS		B/F mils*in ²	0.10800		
LONGITUDINAL RIGIDITY		lbf	695.81		
TORSIONAL RIGIDITY		B/F mils*in ²	0.10750		
MINIMUM FAILURE RADIUS		inches	0.006 / 0.279		
BEND RADIUS		inches	2.900		
CLAMP_T_PINS @ BEND RADIUS		inches	0.0002 / 0.0007		
TENSILE STRENGTH		lbf	0.108 / 24.240		
6.0 BRAIDED YIELD STRENGTH		lbf mils	0.10809		
INTERNAL PRESTRESS		lbf	0.015 / 3.397		
EXTERNAL PRESTRESS		lbf	76.1		
BACKLASH FORCE @ L = 12.0 inch		lbf	0.108		

The Software outputs are seamlessly exported to Microsoft Excel in a “ready to print” format



The Pick Count Maco allows the User to look at the design property outputs as a function of a range of braid angles in graphical form

The Matrix Material Bend function allows the User to create a custom blend of two materials by volumetric percentages



The Ovalization function allows the User to review the design's ovalized dimensions as a function of bend radius

STATUS BAR
WARNING: Please update Fusedown ID in order to compute Fusedown tube design

Inputs to the Fusedown Model

ODI (inches)	0.73400	Nominal OD that the Braid Layer resides
ODI (inches)	0.81600	Nominal OD of the Braid Layer
ODI (inches)	0.81900	Nominal OD of the Design
VF (fraction)	0.111116	Braid fiber fractional volume
Vm (fraction)	0.88884	Braid matrix fractional volume

Fusedown Area Computations, units = inches2**

A1: Total Area of Braid Layer	0.00339292	Cross-sectional Area of the Braid Layer
A2: Matrix Braid Area	0.00301577	Matrix Material required to fill Braid layer
A3: Area Outer Layer	0.00313092	Matrix Material required to fill Outer layer
A4: Total Area = (A2 + A3)/Vm	0.00594669	Total Matrix Material required

Fusedown Tube Design Specifications

Volume Multiplier (VM)	
Fusedown ID (inches)	<input type="text" value="2.00"/>
Fusedown OD (inches)	<input type="text" value="0.2282"/>
Wall (inches)	<input type="text" value="0.01041"/>

RETURN

The Fuse-down Designer allows the User to compute the expected dimensions of the design obtained during the lamination manufacturing process.

STATUS BAR									
WARNING: Please enter an updated applied force (lbf) and/or individual segment lengths as applicable									
Applied Force (lbf)		LOD1	Longitudinal Force that is applied to the composite tube		Total Deflection (inches)				
Seg #	Enable	ID (inches)	OD (inches)	Segment Description	Length (inches)	EA (lbf/in)	Stiffness (lbf/inch)	Deflection (inches)	Strain (in/inch)
1	☒	0.03000	0.03710	0.75 mils PTFE Film Coat Bredt: 1 mil of SS 304P-2, BW/WD, 80 PPI, BAH=6.5 DEG, SAC=0.05 in, BSA = PEXAB VESTARIUM C&S N62/L1 0.8 mils VESTARIUM C&S N62/L1	36.00	136.51	3.803	0.023474	0.000032
				0.75 mils PTFE Film Coat Bredt: 1 mil of SS 304P-2, BW/WD, 80 PPI, BAH=6.5 DEG, SAC=0.05 in, BSA = PEXAB 7215 S&G/L1 0.8 mils PEXAB C&S S&S S&S	2.00	55.63	18.544	0.008414	0.001005
2	☒	0.03000	0.03710	0.75 mils PTFE Film Coat Bredt: 1 mil of SS 304P-2, BW/WD, 80 PPI, BAH=6.5 DEG, SAC=0.05 in, BSA = PEXAB 7215 S&G/L1 0.8 mils PEXAB C&S S&S S&S	3.00	34.02	11.341	0.007872	0.002624
3	☒	0.03000	0.03710	0.75 mils PTFE Film Coat Bredt: 1 mil of SS 304P-2, BW/WD, 80 PPI, BAH=6.5 DEG, SAC=0.05 in, BSA = PEXAB 7215 S&G/L1 0.8 mils PEXAB C&S S&S S&S	3.00	13.05	4.349	0.002526	0.006842
4	☒	0.03000	0.03710	0.75 mils PTFE Film Coat Bredt: 1 mil of SS 304P-2, BW/WD, 80 PPI, BAH=6.5 DEG, SAC=0.05 in, BSA = PEXAB 7215 S&G/L1 0.8 mils PEXAB C&S S&S S&S	2.00	7.14	7.142	0.012100	0.021500

The Applied Force/Applied Torque modules allow the User to compute the expected strain or shear strain as a function of applied force or torque for a multisegmented design.

CathCAD® includes a comprehensive materials and braid wire database hosted on a MySQL server. The base materials library includes over sixty materials including Polyimide, PTFE, PFA, PEEK, FEP, ETFE, Pebax, Polyurethanes, Polyethylene (LDPE, MDPE, and HDPE), Grilamid, and Vestamid. The software will model Extrusion AND Film Cast materials as well as material combinations, that is, the software modelling capabilities are process independent.

CathCAD® is the SOFTWARE solution that allows the User to develop/define the construction parameters for the fabrication of composite tubing with the desired output mechanical properties.

- Construction parameters include materials and reinforcement wires (braid, coil, and/or reinforcement wires)
- Geometry includes ID, OD, and individual layer thicknesses
- Mechanical properties include flexural, axial/longitudinal, torsional rigidities and also include kink radius, tensile strength, and internal/external failure pressures.
- Supports the analysis of Single and Multilumen Designs
- The SOFTWARE includes a Fusedown Designer algorithm which may be used to precisely specify the design of the fuse down tube for braided composite tubing

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