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Design and Analysis of UHTC Leading Edge Attachment

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Ohio Aerospace Institute, Brook Park, Ohio

July 2002

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Space Administration

Glenn Research Center

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Design and Analysis of UHTC Leading Edge Attachment

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Summary

NASA Glenn Research Center was contacted to provide technical support to NASA Ames Research Center in the design and analysis of an ultra high temperature ceramic (UHTC) leading edge. UHTC materials are being considered for reusable launch vehicles because their high temperature capability may allow for un-cooled sharp leading edge designs. While ceramic materials have the design benefit of allowing sub-components to run hot, they also provide a design challenge in that they invariably must be in contact with cooler sub-components elsewhere in the structure. NASA Glenn Research Center proposed a modification to an existing attachment design. Thermal and structural analyses of the leading edge assembly were carried out using ABAQUS finite element software. Final results showed that the proposed modifications aided in thermally isolating hot and cold sub-components and reducing bearing stresses at the attachment location.

1. Introduction

Ultra high temperature ceramic (UHTC) materials are being considered for leading edge applications on reusable launch vehicles (RLV's). The high use temperature capability they provide may allow for un-cooled, or passively cooled, sharp leading edge vehicle designs. This positively increases the lift to drag ratio for the RLV, and at the same time decreases vehicle complexity. Fig. 1 shows a photograph of a carbon/carbon (C/C) leading edge for NASA's Hyper-X Mach 7 vehicle. The Mach 10 version of this vehicle is expected to experience temperatures in excess of the C/C single use limit [Glass, 2000]. As a result, in addition to the general interest in UHTC leading edges, they are being specifically considered for the Hyper-X Program.

While ceramic materials have the design benefit of allowing sub-components to run hot, they also provide a design challenge in that these hot sub-components invariably must be in contact with cooler parts elsewhere in the structure. This can lead to the development of severe thermal stresses if the attachment design is not properly addressed. NASA Ames Research Center has been working on a UHTC leading edge concept as part of the Bantam-X Technology Program since the mid-1990's. NASA Glenn Research Center was contacted in 1999 to support a redesign effort for the attachment scheme. A modification to the existing attachment design was proposed, and a review and analysis study ensued. Two-dimensional thermal and structural analyses of the leading edge assembly were carried out using ABAQUS finite element software. The Bantam class RLV's were still in the conceptual stage, and an actual flight profile did not exist. Therefore, the flight profile for the Mach 10 Hyper-X vehicle was used in the analyses. Final

results showed that the proposed modifications aided in thermally isolating hot and cold sub-components and reducing bearing stresses at the attachment location.

2. Proposed Design

A cross-sectional view of the original Ames design for the attachment is shown in Fig. 2a. The design calls for the leading edge to be comprised of multiple UHTC tiles or segments rather than a one-piece continuous edge. Each UHTC leading edge segment has an approximate length of 135 mm with a leading edge width (i.e., into the plane of the page) on the order of 50 to 75 mm per segment. The leading edge is captured between two ceramic matrix composite (CMC) brackets via a dovetail approach. The brackets are then bolted directly to the ballast of the vehicle. This design approach is very conducive to minimizing stresses in the UHTC leading edge – there are no mechanical fasteners, and the CMC bracket is also a hot sub-component. In essence, the attachment concerns have been pushed back to the bracket/ballast interface. In this region, there is concern over hot and cold sub-components coming into direct contact with one another. Additionally, there are mechanical stress concentrations arising from the bolted attachment.

The modified design is illustrated in Fig. 2b. This design maintains the dovetailed attachment of the UHTC leading edge, but redesigns the bracket attachment region. A tapered thickness is introduced for the bracket. This allows for the inclusion of a fastening plate to help distribute the bearing stresses. High temperature gaskets have also been introduced at the bracket/ballast and bracket/fastening plate interfaces to provide thermal insulation. As a secondary effect, they also serve to alleviate localized stress risers in the bracket due to the presence of surface asperities.

It is proposed that the bracket be made of 2-D woven fabric laid up to form the necessary finished composite structure. The tapered thickness of the component can be achieved by one of two methods. One approach involves bonding two half-thickness plates together (this is being investigated in another sub-task led by M. Singh at NASA Glenn Research Center), and is illustrated schematically in Fig. 3a. Another approach is an interleaved layered architecture as shown in Fig. 3b. This fabrication method has been carried out successfully in other programs, but requires a hand lay-up procedure making it more expensive.

The sharp nose will be made of the UHTC ZrB_2 -SiC (zirconium di-boride with silicon carbide secondary phase). C/SiC – MI (carbon fiber with a melt infiltrated silicon carbide matrix) has been selected for the bracket material. Grafoil™ has been chosen for the gaskets, and tungsten for the ballast and fastening plate.

3. Modeling Considerations

A two dimensional finite element analysis of the leading edge cross-section was chosen to determine proof of concept for the proposed tapered bracket design. The full leading edge assembly (i.e., nose, brackets, fastening plates, gaskets, and ballast) was modeled. This entailed including contact – both thermal and structural – between all subcomponents for the analyses.

MSC/Patran was used to build the finite element model, and HKS/ABAQUS was used as the solver.

Thermal boundary conditions considered are presented in Fig. 4. The prescribed heat flux conditions varied with respect to time and location. This information was supplied by NASA Ames (see Appendix C). Radiation to an ambient sink temperature of $-85\text{ }^{\circ}\text{C}$ was included. A uniform initial temperature of $-44.15\text{ }^{\circ}\text{C}$ was assumed. The gap conductance across the various interfaces was assumed to be $1000\text{ [W/m}^2\text{ }^{\circ}\text{C]}$. This value is typical for machined surfaces of low carbon steel. Conductivities for the actual surface interactions in question were unavailable, but should be lower than the assumed value (thus making this assumption conservative in nature). Similarly, the conductance was conservatively assumed to be constant as long as contact was present (i.e., the conductance was independent of pressure).

Structural boundary conditions are shown in Fig. 5. The dynamic pressures and inertial loads were taken from the Hyper-X Mach 10 flight profile (see Appendix D). Under the Hyper-X program, two key design points were identified corresponding to *Pull-up* (Case ID: B-1, time = 17 seconds) and *Maximum Axial Acceleration Forward* (Case ID: B-3, time = 76 seconds). Structural finite element analyses were performed at these two time steps. The bolted attachment was approximated by applying a clamping pressure on the top faces of the fastening plates as shown. The adjoining nodes at the interfaces directly below the clamping region (i.e., fastening plate/gasket, gasket/bracket, bracket/gasket and gasket/ballast) were each tied so that their displacements normal to their respective lines of contact were the same, while still allowing relative motion along the respective lines of contact. For regions of contact along these interfaces, but beyond the clamping region, as well as all other contact regions in the model, small sliding contact was assumed with a coefficient of friction value of 0.21 for all surfaces.

The final model was comprised of 18,534 four (4) noded quadrilateral elements with 20,533 nodes. Plane stress conditions were assumed for the structural analysis. All analyses were run on a Silicon Graphics unix workstation. Thermal runs took approximately one (1) hour and structural runs took approximately two (2) hours.

4. Results

Maximum Pull-up

At seventeen seconds into the mission, the maximum pull-up condition is encountered. The temperature profile for the leading edge assembly is shown in Fig. 6. Temperatures for this stage are still very low having a maximum of $30\text{ }^{\circ}\text{C}$ at the tip and a minimum of $-43\text{ }^{\circ}\text{C}$ occurring back in the ballast (initial temperatures at time $t = 0$ were uniformly $-44.15\text{ }^{\circ}\text{C}$). An exaggerated deformed geometry solution for this condition is shown in Fig. 7. The downward deflection of the nose assembly agrees with pull-up conditions.

The in-plane (i.e., parallel to the top face) longitudinal stresses, σ_{xx} , for the C/SiC brackets are shown in Fig. 8. The maximum tensile stress is 9.57 MPa (two orders of magnitude below the manufacturer's supplied strength of 517 MPa for this temperature) occurring at the root of the

inset for the fastening plate on the top bracket. The maximum compressive stress of -10.9 MPa (again far below the manufacturer's supplied strength of -544 MPa for this temperature) is obtained in the bottom bracket at the point where it contacts the rearward end of the nose's dovetail. Maximum out of plane tensile and compressive stresses for the bracket are 1.12 MPa and -8.75 MPa, respectively, as shown in Fig. 9. They occur in the same corresponding locations as the maximum in-plane longitudinal stresses. No manufacturer reported strength values are available for the out of plane strength of this material. However, typical out-of-plane tensile strengths for 2-D ceramic composites of a similar type are near 14 MPa. In Fig. 10 the out of plane shear stress results for the brackets are presented. The largest magnitude shear stress of 2.59 MPa is obtained where the bracket fits into the root of the ballast inset. The manufacturer's supplied shear strength value is 34.5 MPa, again considerably greater than the stress level present.

Major and minor principal stresses (2-D) for the UHTC nose are given in Figs. 11 and 12, respectively. The maximum tensile value is 1.03 MPa occurring at the nose tip. This compares to a reported bend strength of 345 MPa at 27 °C. The largest compressive value is -6.01 MPa achieved at the rearward end of the dovetail where it contacts the bottom bracket. The reported compressive strength of -3.45 GPa was given for an unspecified temperature.

Maximum Axial Acceleration

At seventy six seconds into the mission, the maximum axial acceleration condition is encountered. The temperature profile for the leading edge assembly is shown in Fig. 13. Temperatures for this stage have reached extremely high levels. A maximum of 1990 °C is achieved at the tip, and a relatively cold minimum value of 23 °C is maintained back in the ballast. This maximum value is approaching the maximum allowable multiple use temperature limit of 2015.9 °C (NASA Ames TPSX database). An exaggerated deformed geometry solution for this condition is shown in Fig. 14. In this figure, the original undeformed geometry has been offset for clarity. The thermal growth of the assembly due to the elevated temperatures is evident in the model results.

The in-plane longitudinal stresses for the C/SiC brackets under maximum axial acceleration are shown in Fig. 15. The maximum tensile stress is 12.3 MPa (manufacturer's supplied strength at this temperature: 525 MPa) occurring at the base of the tapered section in the top bracket. The maximum compressive stress of -22.2 MPa (manufacturer's supplied strength at room temperature: -544 MPa (no elevated temperature value available)) is obtained in the bottom bracket at the point where it contacts the rearward end of the nose dovetail. A Hertzian contact stress situation occurring in the bottom bracket where it contacts the rearward end of the nose's dovetail is the source for both the peak tensile and compressive out of plane stresses. Values of 5.04 MPa and -25.0 MPa are achieved, as shown in Fig. 16 (tensile strength for similar material: ~ 14 MPa). Fig. 17 presents out of plane shear stress results for the brackets. Both maximum positive and negative shear stresses arise due to the Hertzian contact situation just described. Both of these shear stresses are similar in magnitude, 4.60 MPa in the bottom bracket and -4.63 MPa in the top bracket. The manufacturer's supplied shear strength value at room temperature is 34.5 MPa (no elevated temperature strength value available).

Figs. 18 and 19 present the major and minor principal stresses (2-D), respectively, for the UHTC nose. The maximum tensile value is 36.2 MPa occurring at the nose tip. This compares to a reported bend strength of 241 MPa. The largest compressive value is -30.4 MPa achieved at a slight setback from the tip. The reported compressive strength of -3.45 GPa was reported at an unspecified temperature.

5. Concluding Remarks

A concept was proposed for attaching a UHTC leading edge to a flight vehicle through the use of a C/SiC bracketing system. Preliminary 2-D finite element thermal and structural analyses were performed as a first step towards proof of concept. The results of these analyses showed that the temperatures reached in the UHTC leading edge were pushing the limits for the material. However, the temperatures and stresses in the attachment brackets appear to be well within the material capabilities. The stresses induced in the UHTC leading edge due to the brackets also were within the material's capabilities. Based on the results of this preliminary analysis, a more thorough investigation is justified. Such an analysis should look at a 3-D section of the leading edge, and include the actual bolted fastener.

6. References

Glass, David E., "Hyper-X Mach 10 Leading-Edge Evaluation" presented at the 25th Airbreathing Propulsion Subcommittee Meeting of the JANNAF Interagency Propulsion Committee, Monterey, CA, November 13–17, 2000.

Moses, P.L., "Hyper-X Mach 10 Design Notice 98–013," NASA restricted distribution report, September 11, 1998.

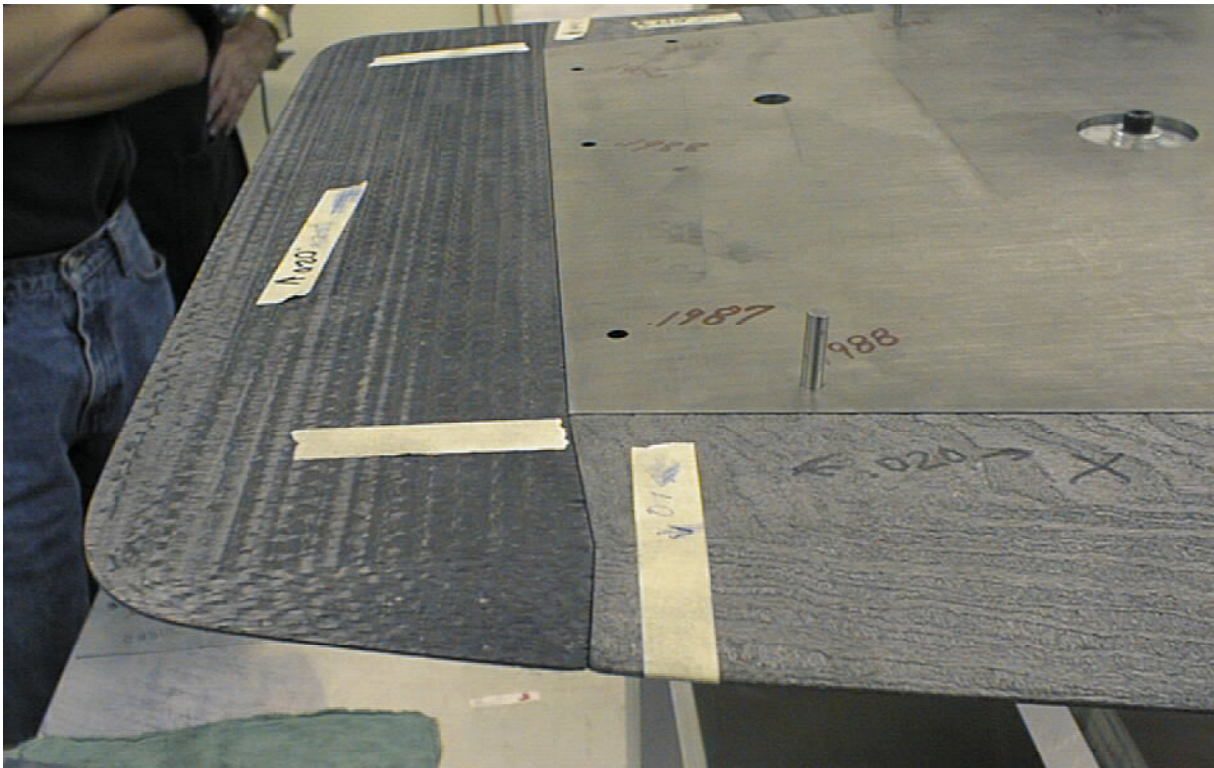


Figure 1: Photograph of the C/C nose leading edge and side chines on Mach 7 vehicle [Glass, 2000].

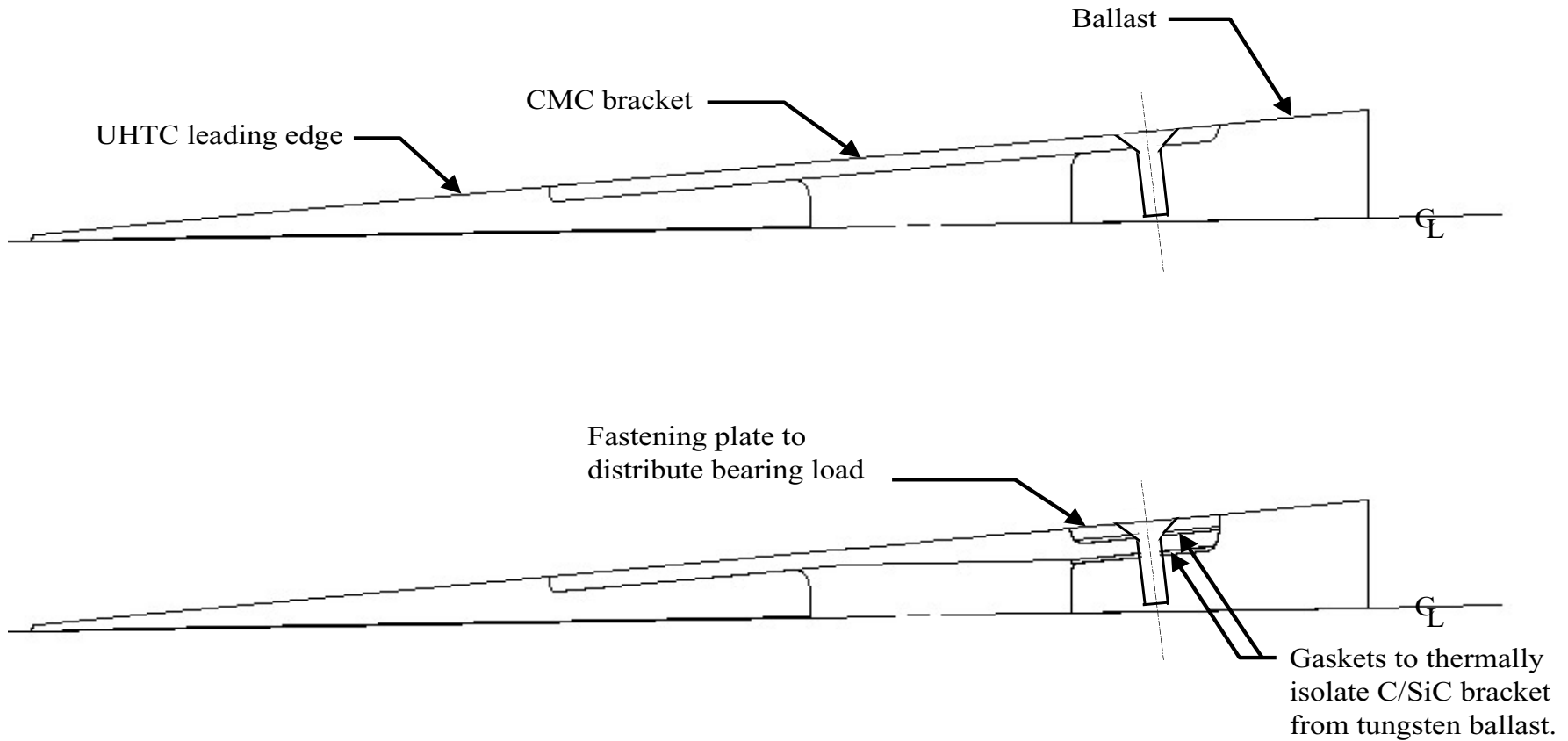


Figure 2: a.) The original NASA Ames dovetail design leading edge assembly. b.) Modified design proposed under this task with redesigned bracket and the addition of fastening plates and gaskets.

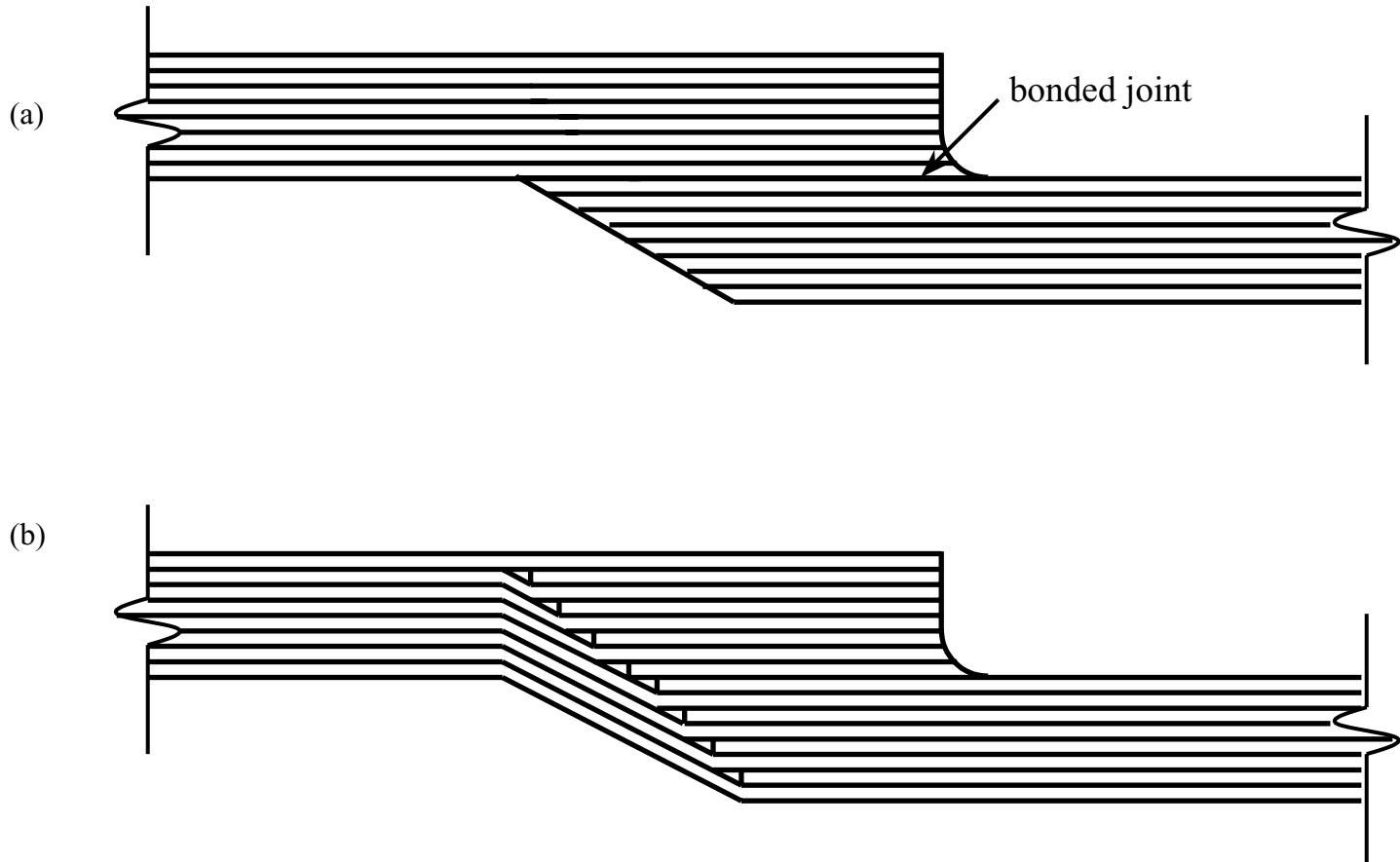


Figure 3: a.) Bonded lap joint approach for manufacturing tapered bracket. b.) Interleaved layer approach for producing the tapered bracket.

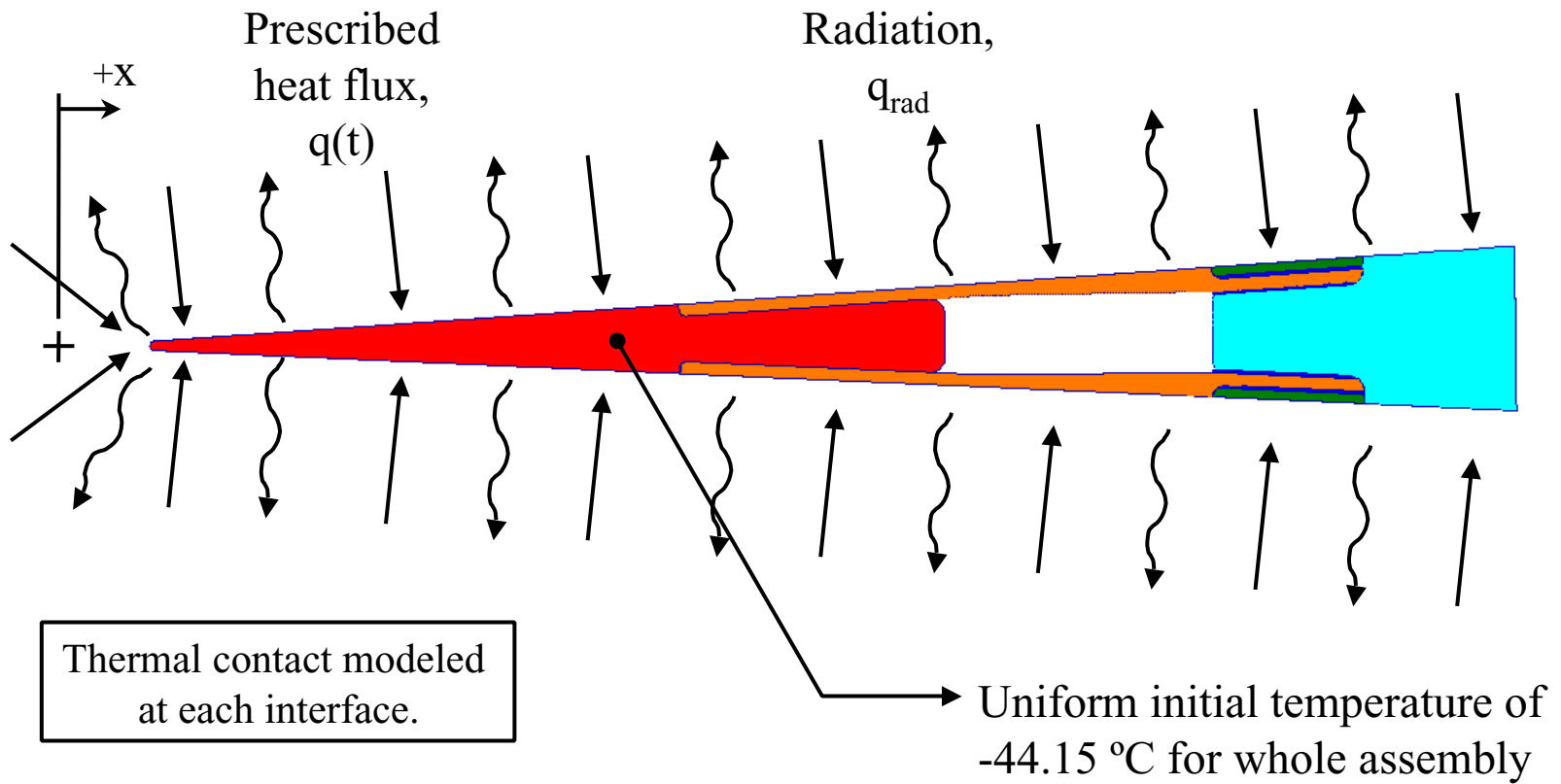


Figure 4: Thermal boundary conditions considered by the FEA model.

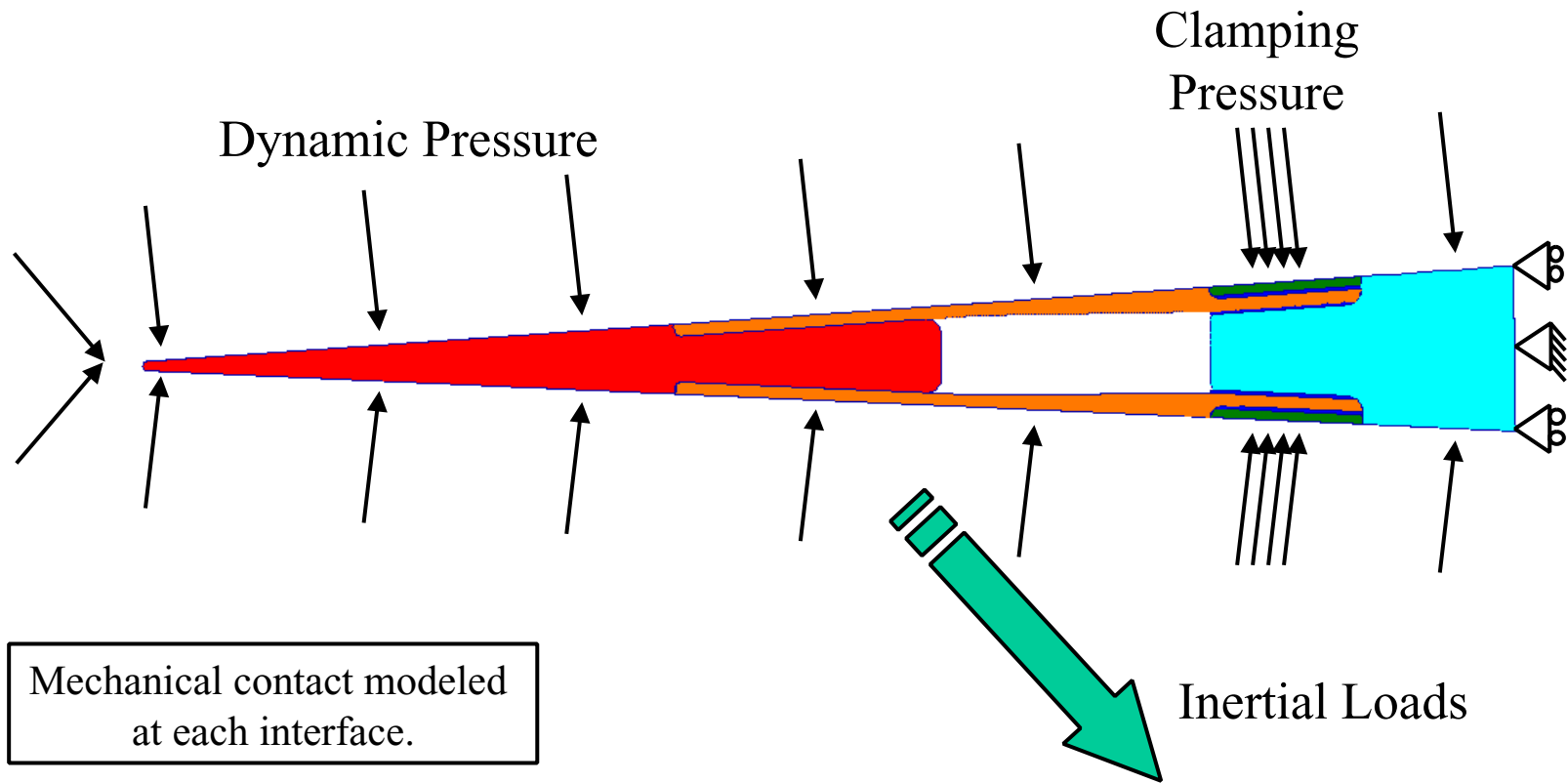


Figure 5: Structural boundary conditions considered by the FEA model.

MSC/PATRAN Version 9.0 27-Sep-01 13:16:17

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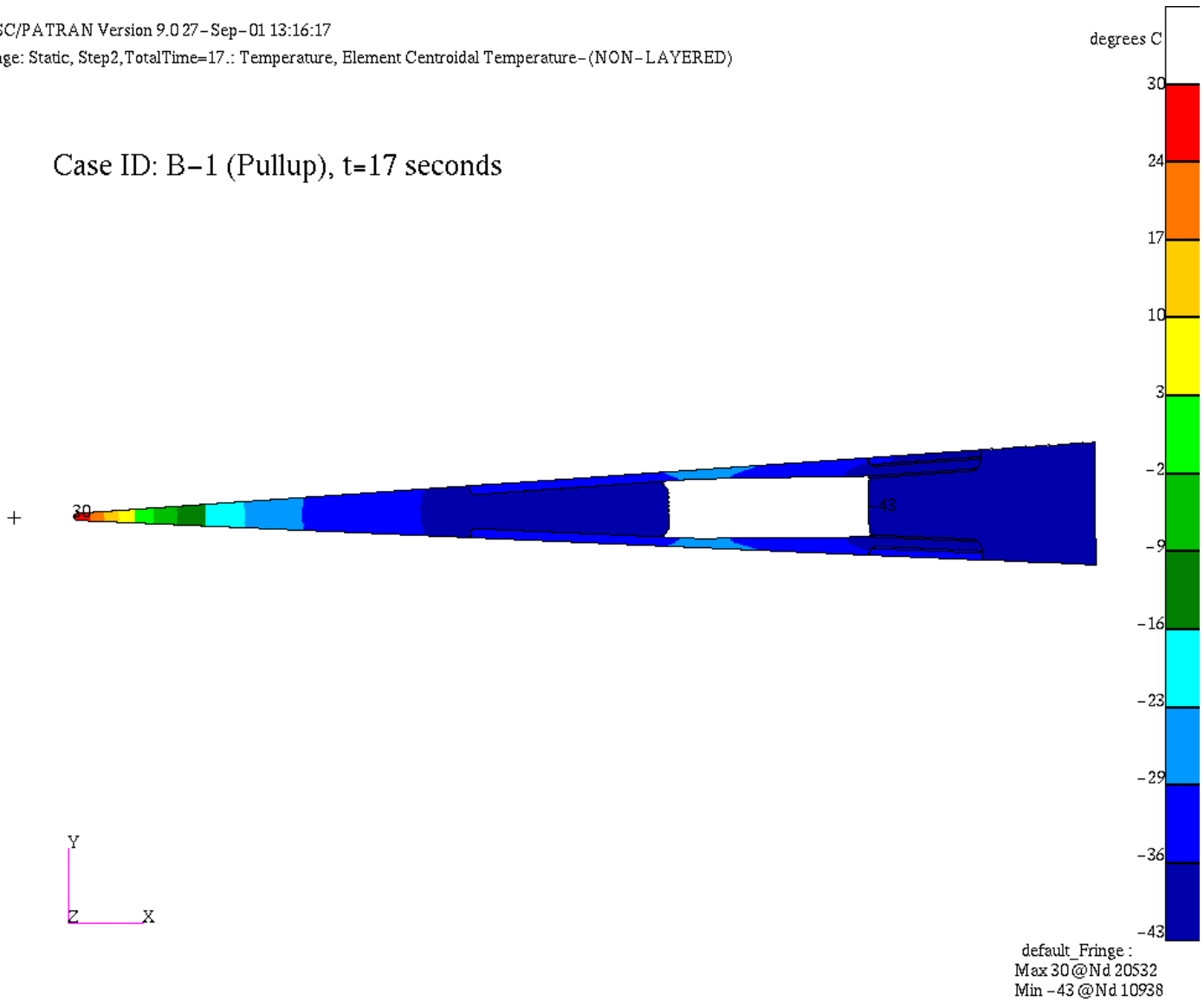


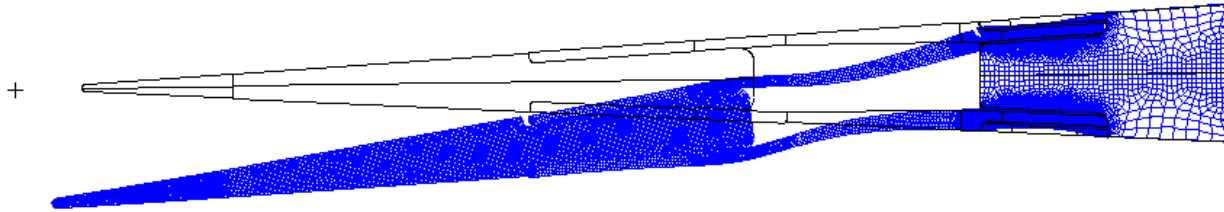
Figure 6: Temperature profile for leading edge assembly at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.0 27-Sep-01 13:02:05
Deform: Static, Step2, TotalTime=17., Deformation, Displacements, (NON-LAYERED)

Case ID: B-1 (Pullup), t=17 seconds

Black – original geometry

Blue – deformed mesh



default_Deformation :
Max 7.68-05 @Nd 20520

Figure 7: Deformations for leading edge assembly at a time of 17 seconds (corresponding to maximum pull-up condition). Actual displacement of nose tip in the y direction is 2.993×10^{-5} m.

MSC/PATRAN Version 9.0 27-Sep-01 15:44:41
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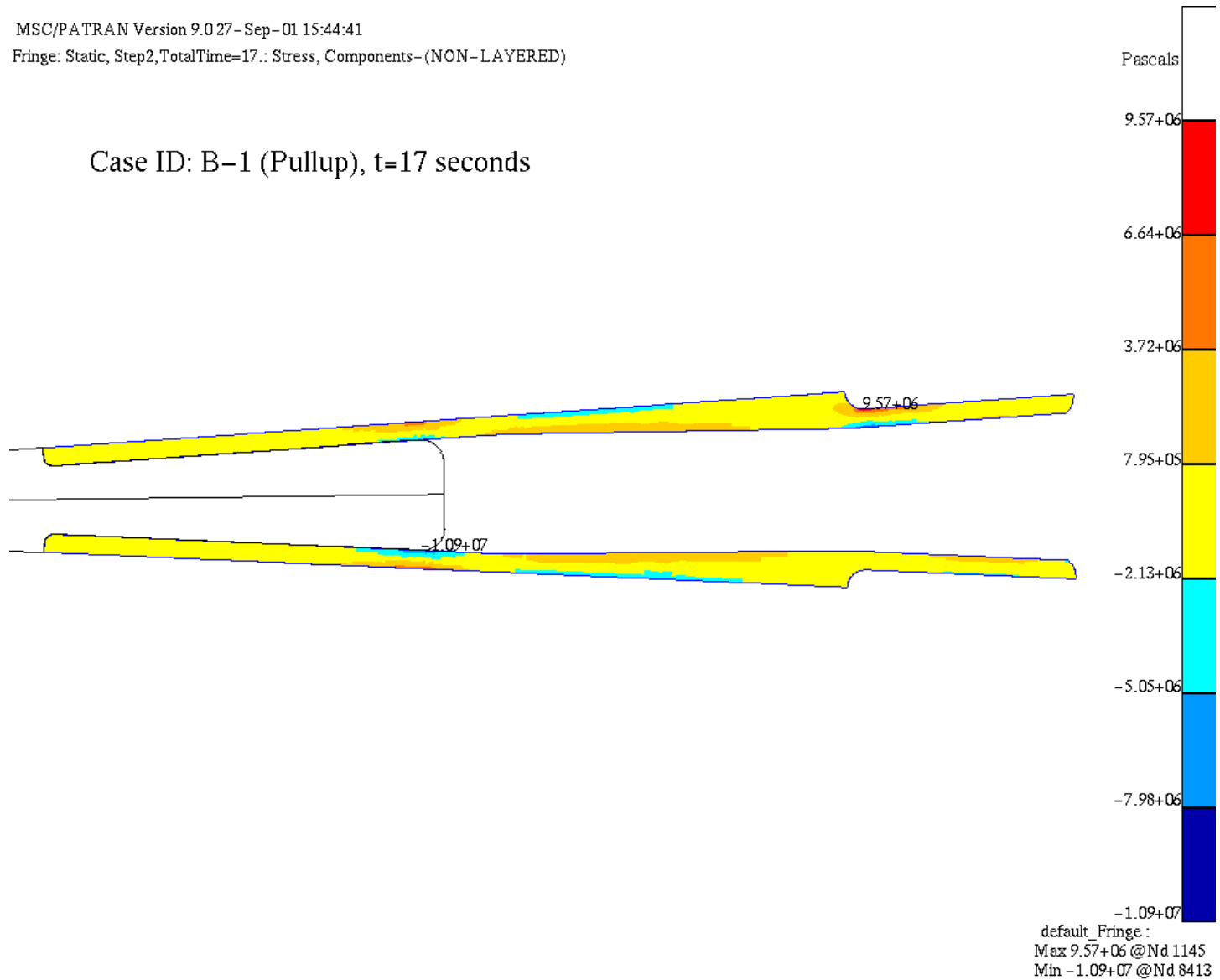


Figure 8: In-plane longitudinal stress (σ_{xx}) present in the brackets at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:45:13
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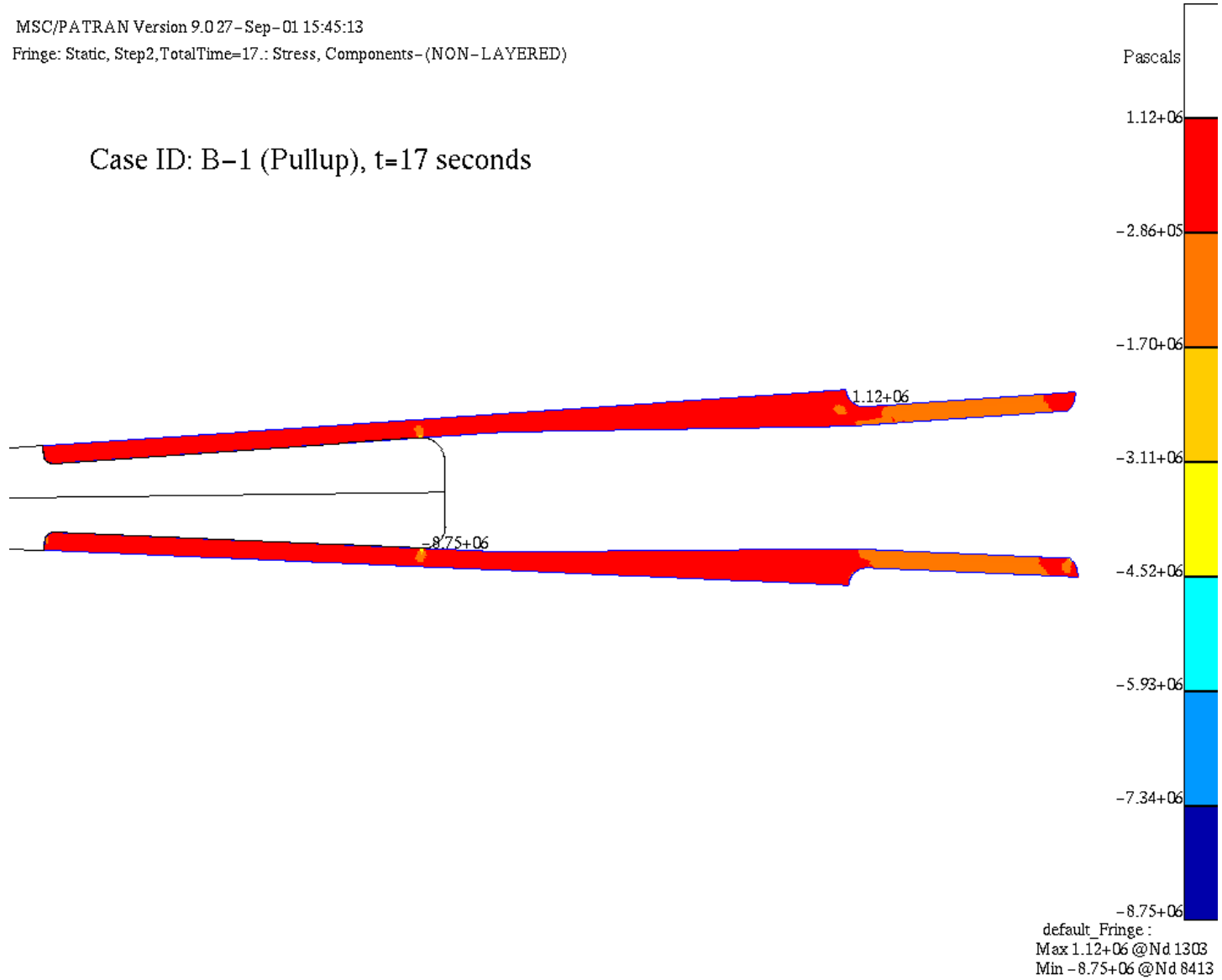


Figure 9: Out-of-plane tensile stress (σ_{zz}) present in the brackets at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:43:25
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Case ID: B-1 (Pullup), t=17 seconds

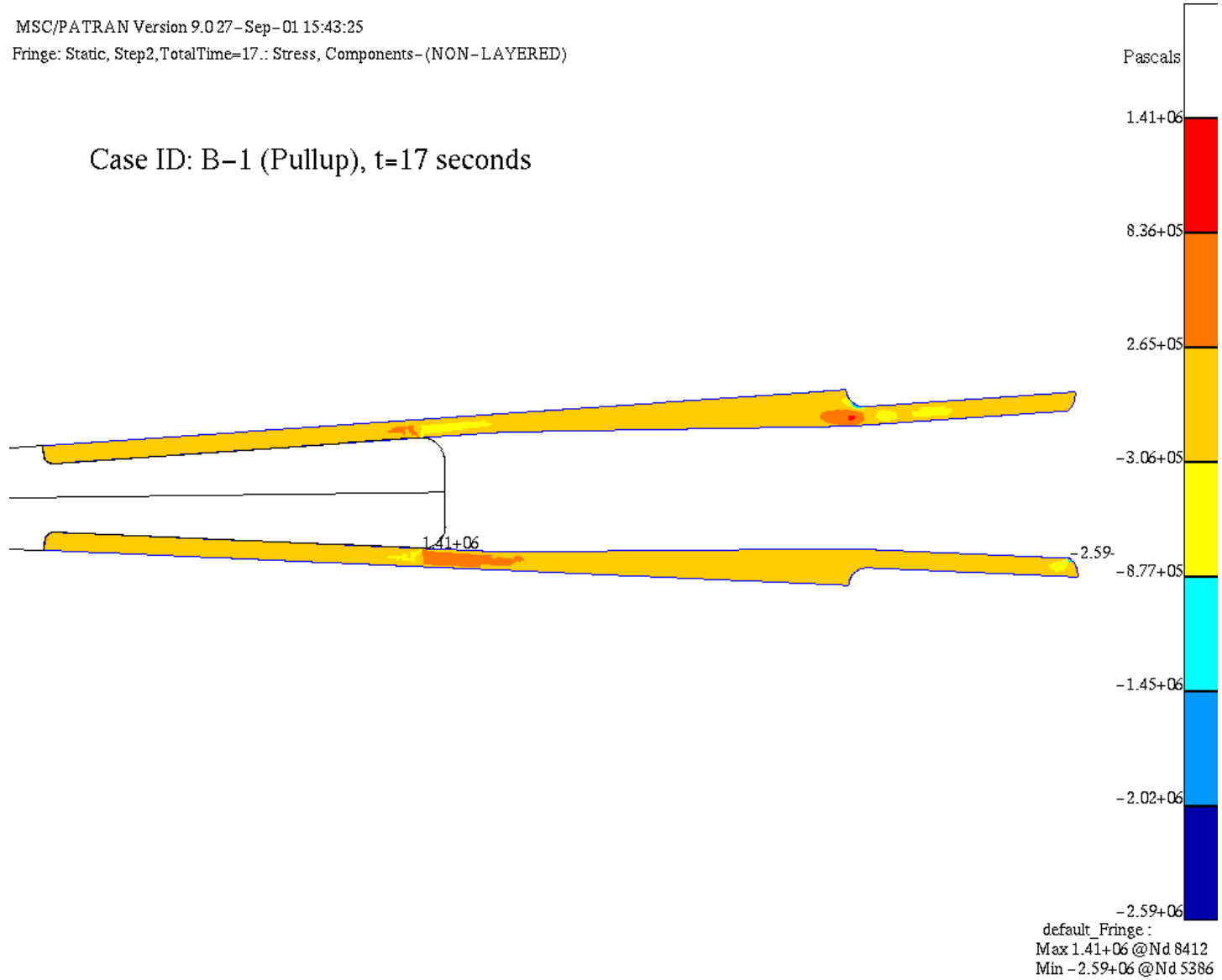


Figure 10: Out-of-plane shear stress (τ_{xz}) present in the brackets at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.027 - Sep-01 15:12:39
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Case ID: B-1 (Pullup), t=17 seconds

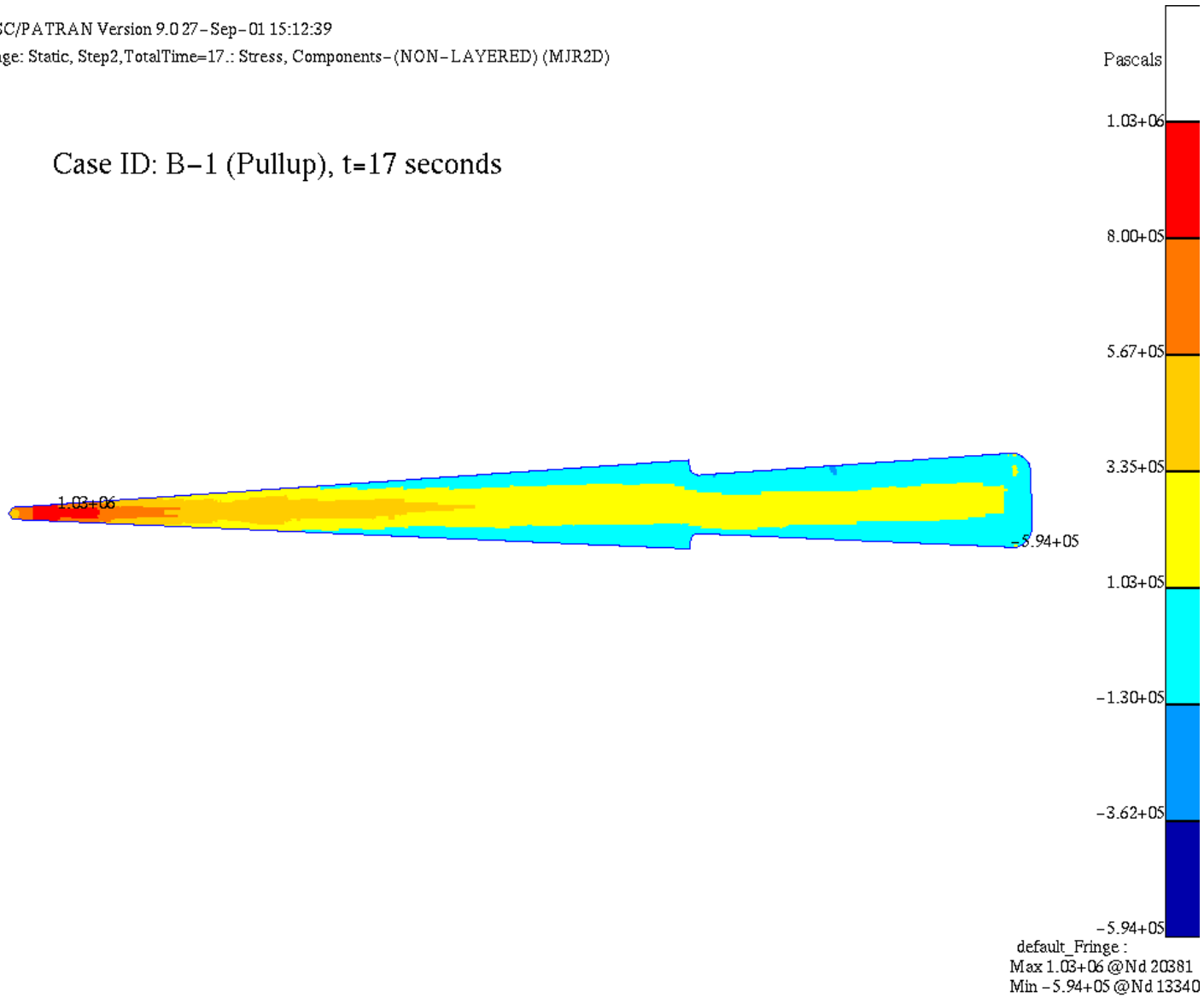


Figure 11: Major principal stress present in the nose at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:12:25
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Case ID: B-1 (Pullup), t=17 seconds

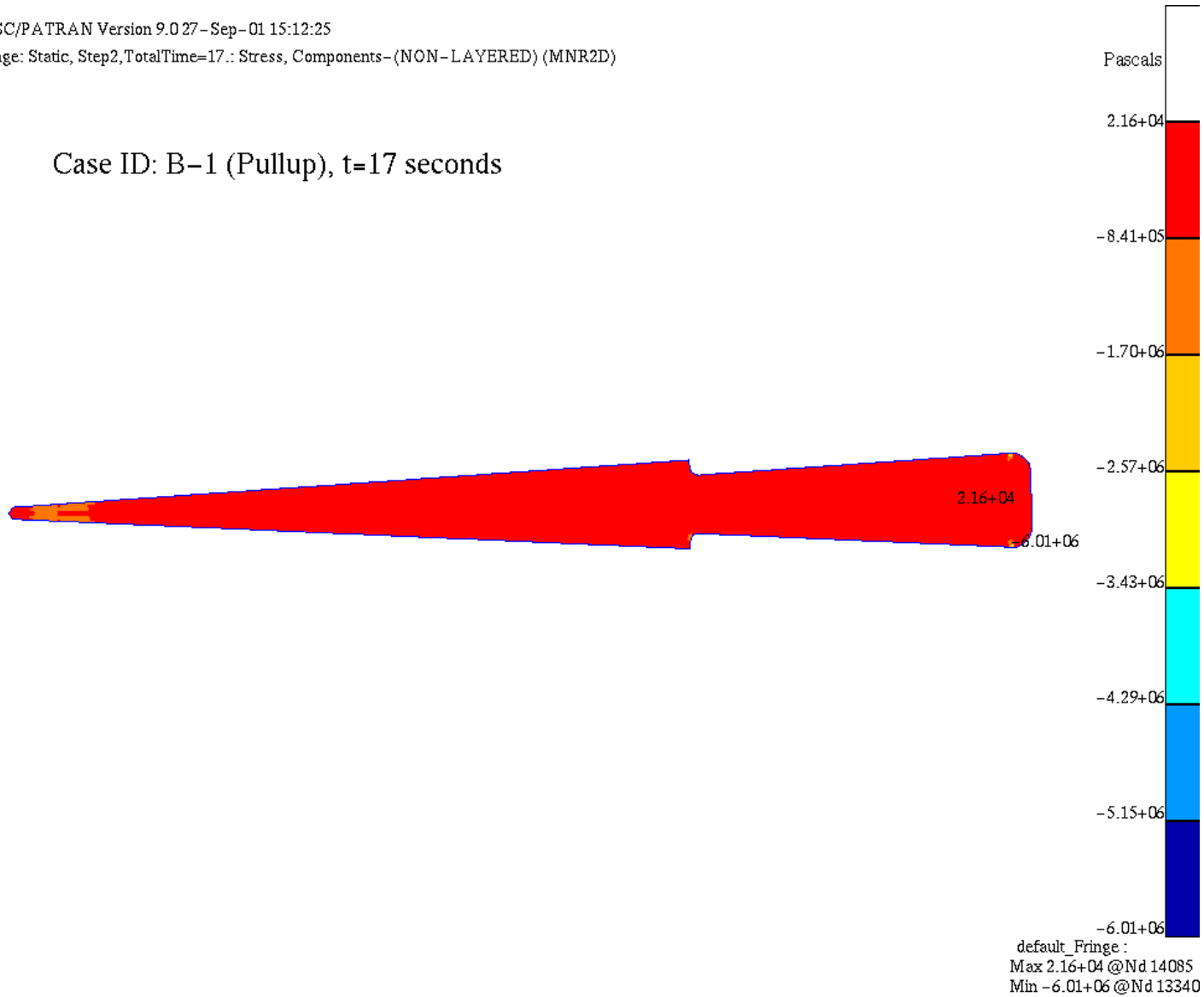


Figure 12: Minor principal stress present in the nose at a time of 17 seconds (corresponding to maximum pull-up condition).

MSC/PATRAN Version 9.0 27-Sep-01 13:15:00

Fringe: Static, Step3, TotalTime=76.: Temperature, Element Centroidal Temperature-(NON-LAYERED)

Case ID: B-3 (maximum axial acceleration forward), t=76 seconds

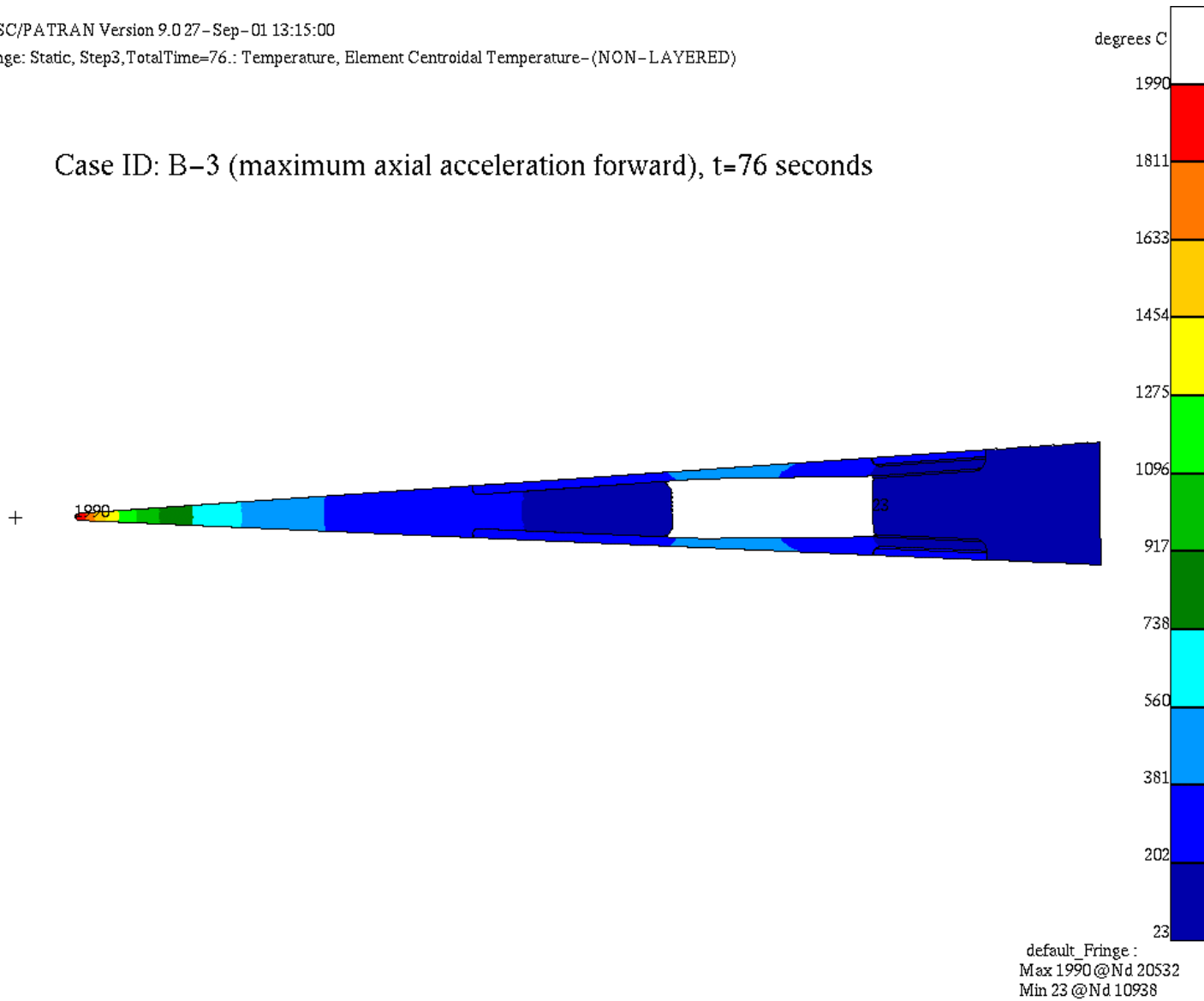


Figure 13: Temperature profile for leading edge assembly at a time of 76 seconds (corresponding to maximum axial acceleration condition).

MSC/PATRAN Version 9.0 27-Sep-01 13:06:29

Deform: Static, Step3, TotalTime=76., Deformation, Displacements, (NON-LAYERED)

Case ID: B-3 (maximum axial acceleration forward), t=76 seconds

Black – original geometry (offset for clarity)

Blue – deformed mesh

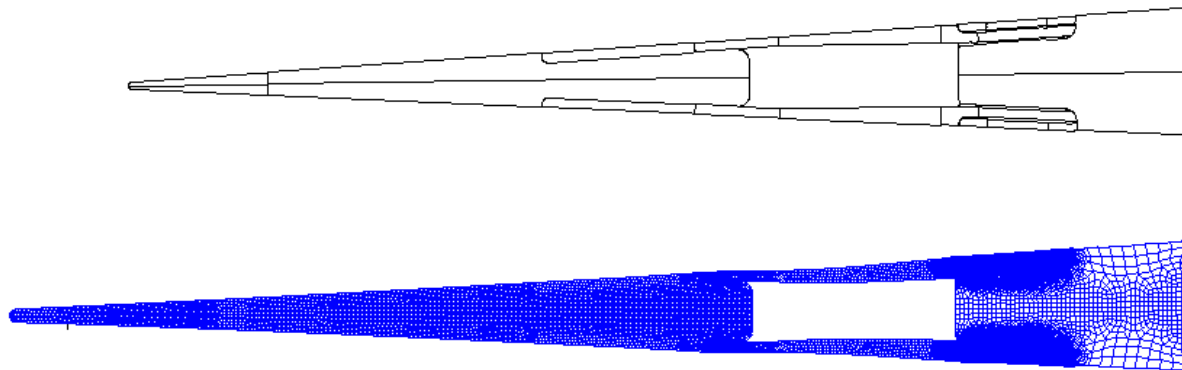
default_Deformation :
Max 5.35-04 @Nd 20532

Figure 14: Deformations for leading edge assembly at a time of 76 seconds (corresponding to maximum axial acceleration condition). Actual displacement of nose tip in the x direction is 5.347×10^{-4} m.

MSC/PATRAN Version 9.0 27-Sep-01 15:41:23
 Fringe: Static, Step3, TotalTime=76.: Stress, Components-(NON-LAYERED)

Case ID: B-3 (maximum axial acceleration forward), t=76 seconds



Figure 15: In-plane longitudinal stress (σ_{xx}) present in the brackets at a time of 76 seconds (corresponding to maximum axial acceleration condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:42:01
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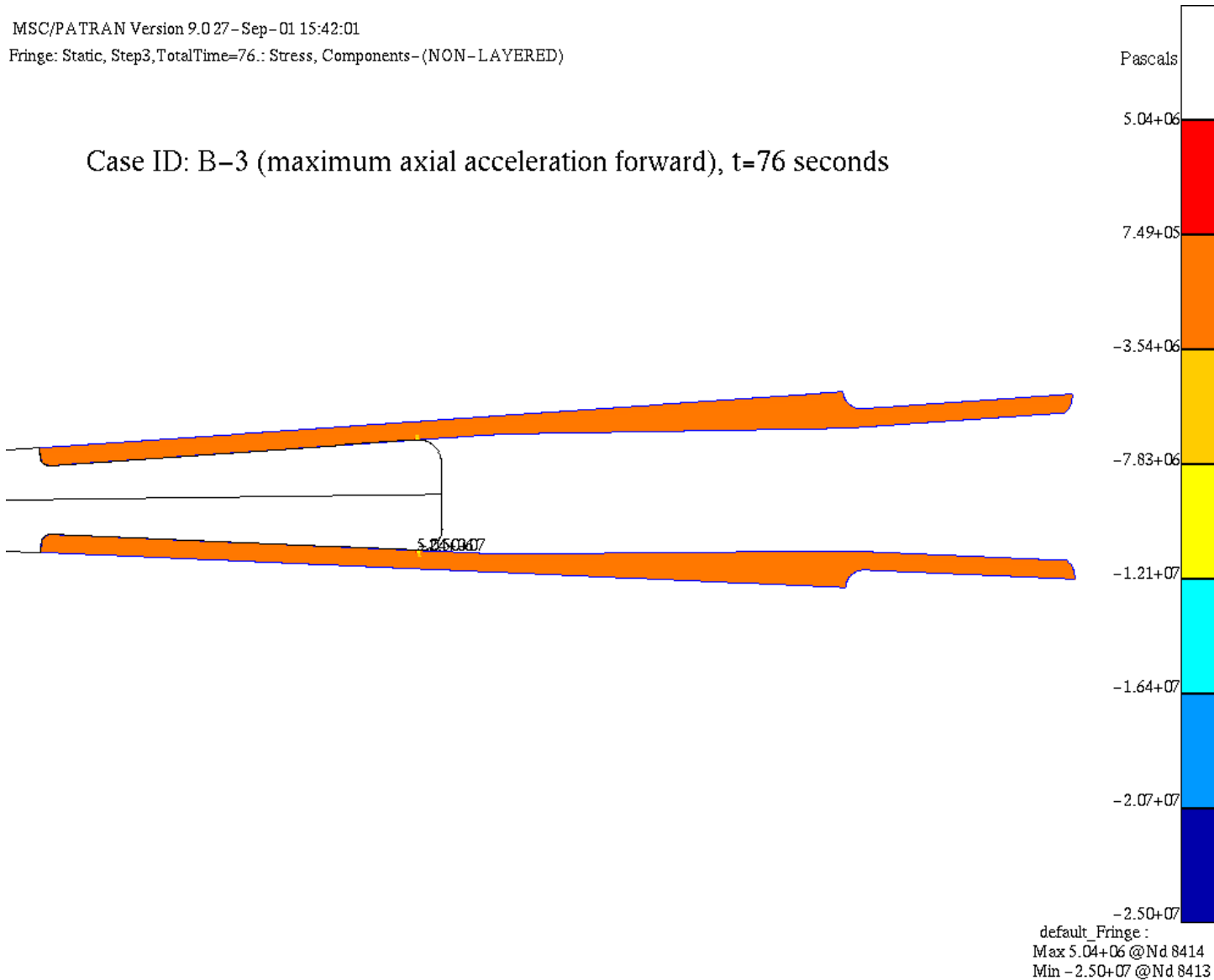


Figure 16: Out-of-plane tensile stress (σ_{zz}) present in the brackets at a time of 76 seconds (corresponding to maximum axial acceleration condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:42:34
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Case ID: B-3 (maximum axial acceleration forward), t=76 seconds

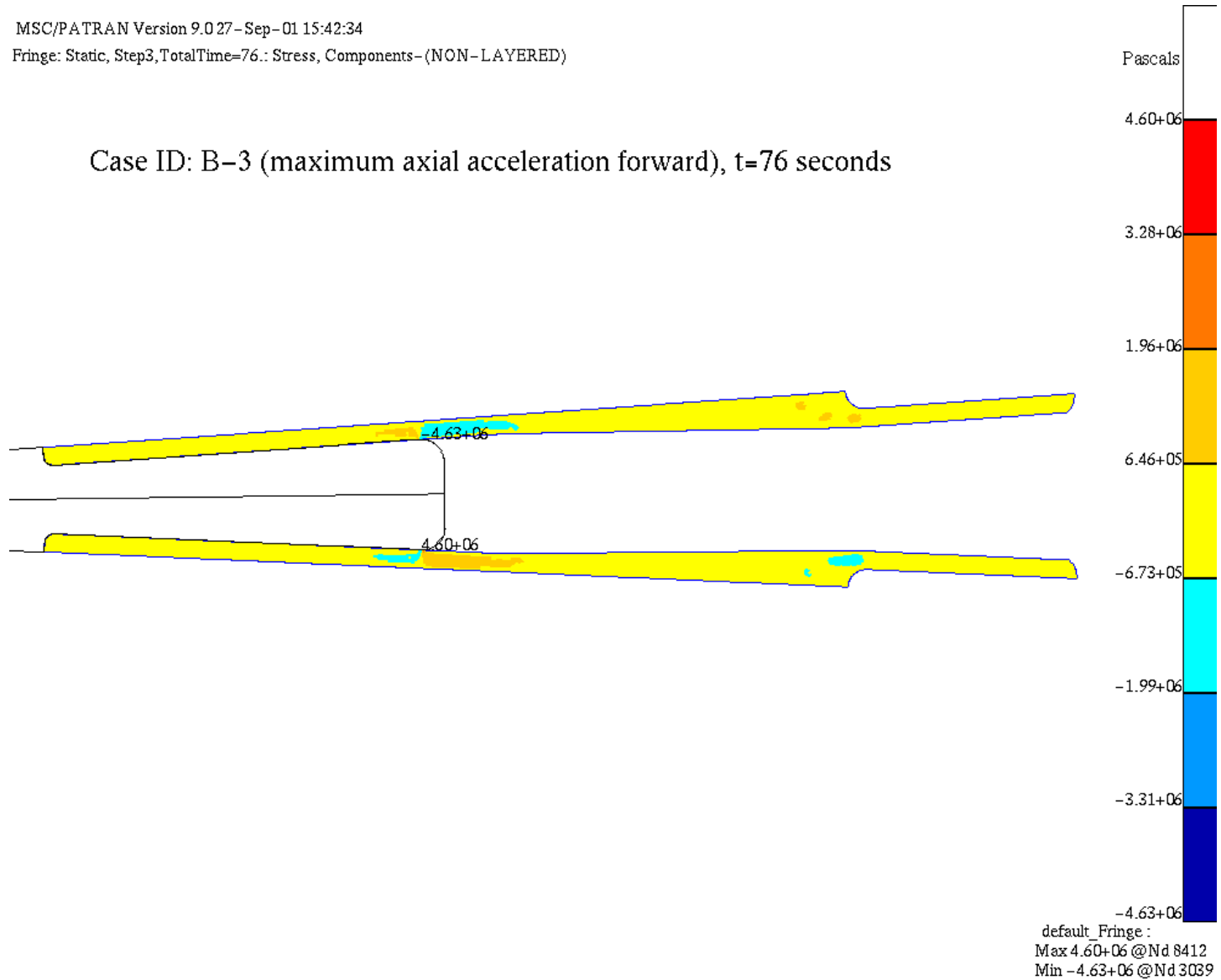


Figure 17: Out-of-plane shear stress (τ_{xz}) present in the brackets at a time of 76 seconds (corresponding to maximum axial acceleration condition).

C:/PATRAN Version 9.002-Oct-01 16:32:03
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Case ID: B-3 (maximum axial acceleration forward), t=76 seconds

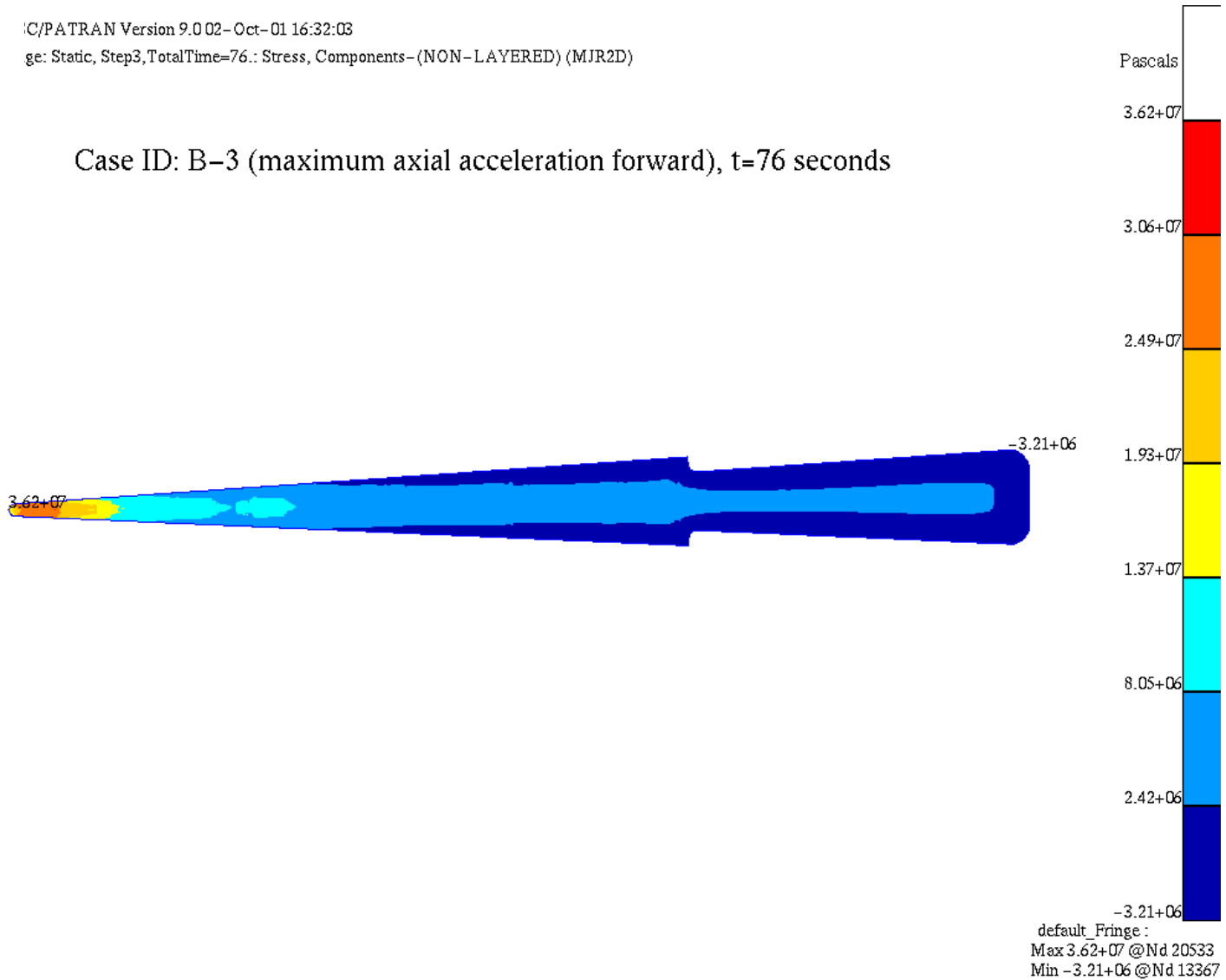


Figure 18: Major principal stress present in the nose at a time of 76 seconds (corresponding to maximum axial acceleration condition).

MSC/PATRAN Version 9.0 27-Sep-01 15:13:52
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Case ID: B-3 (maximum axial acceleration forward), t=76 seconds

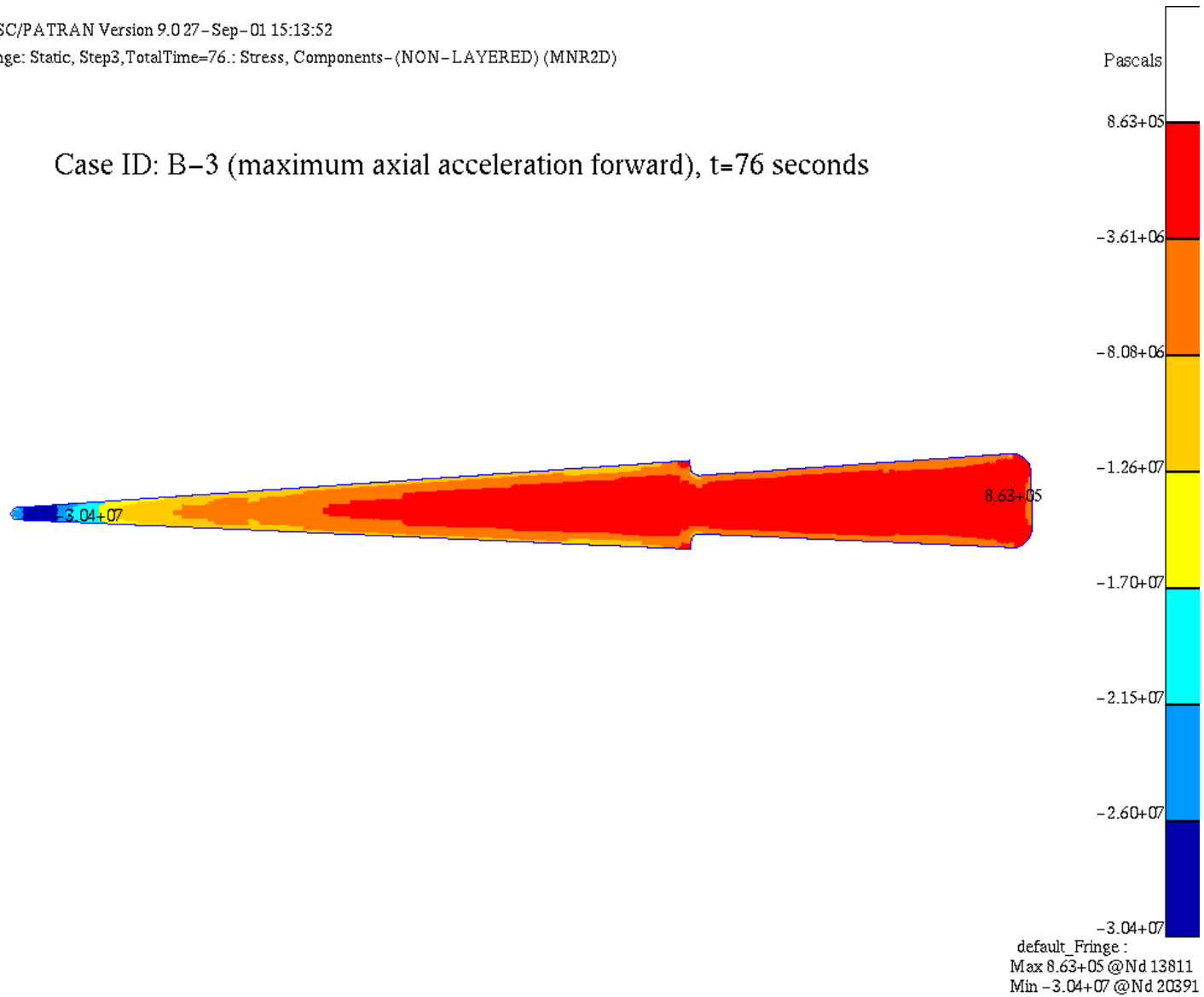
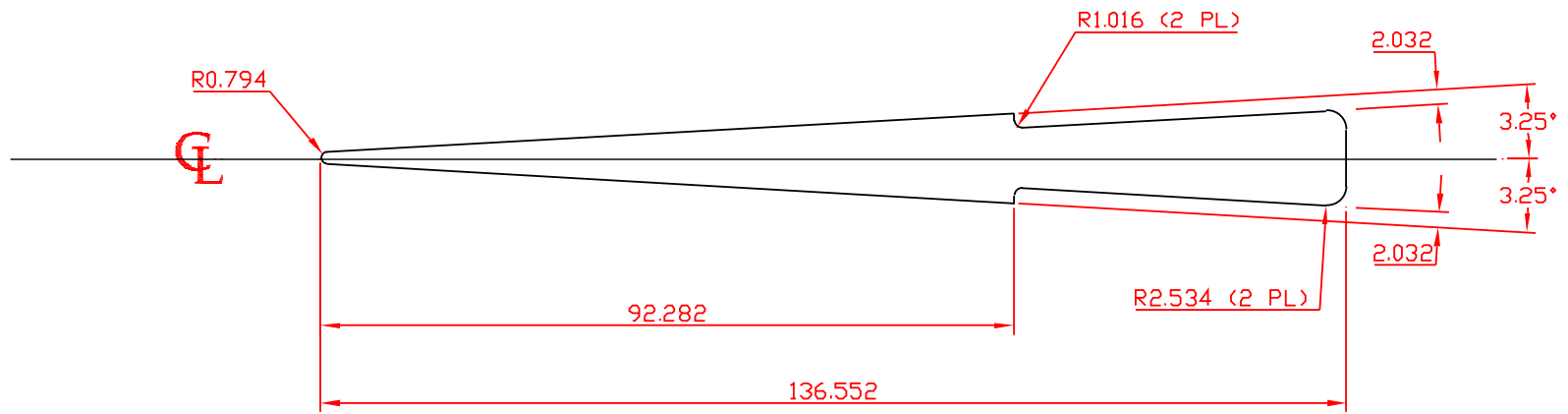


Figure 19: Minor principal stress present in the nose at a time of 76 seconds (corresponding to maximum axial acceleration condition).

Appendix A: Engineering Drawings

<u>Part Detail</u>	<u>Page Number</u>
Nose	26
Bracket	27
Fastening Plate	28
Top Gasket	29
Bottom Gasket	30
Ballast	31

Nose

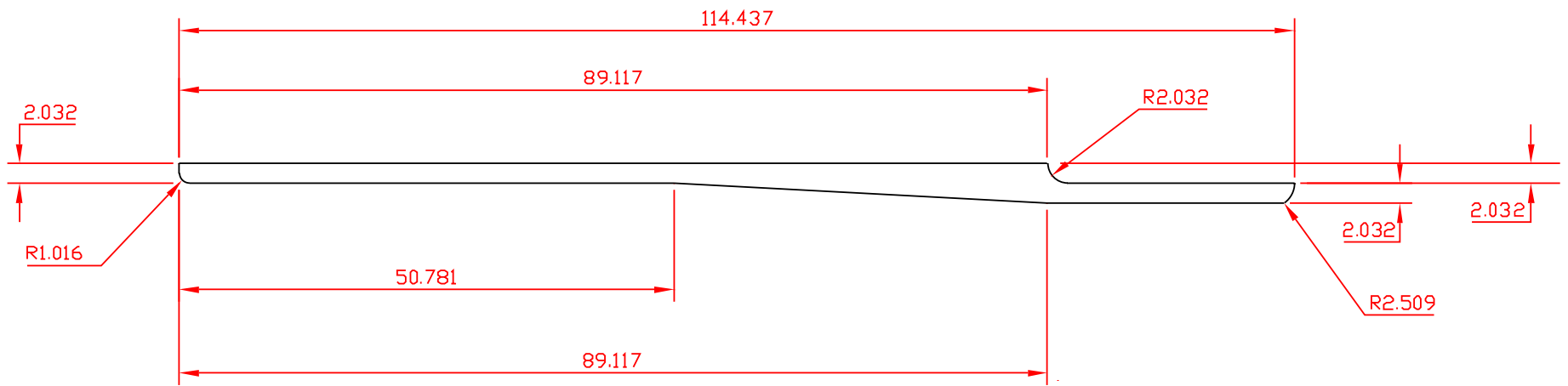


Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
Drawing Title: Nose	
Material: UHTC (ZrB ₂ -SiC)	
Drawn by: DJT	Date: 10/22/01
Dimensions in mm	Sheet 1 of 1
Scale 1:1	Task: TPS-6

Bracket

NASA/CR—2002-211505

27

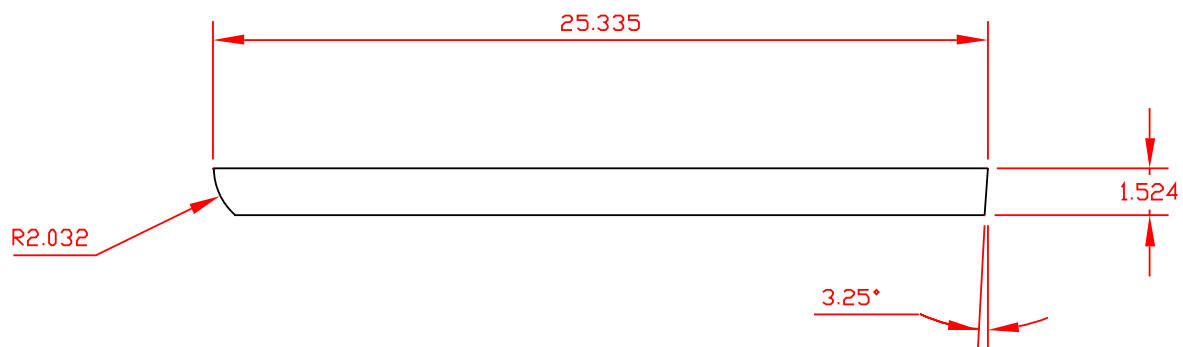


Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
Drawing Title: Bracket (2 Reqd.)	
Material: C/SiC	
Drawn by: DJT	Date: 10/22/01
Dimensions in mm	Sheet 1 of 1
Scale 1.5:1	Task: TPS-6

Fastening Plate

NASA/CR—2002-211505

28

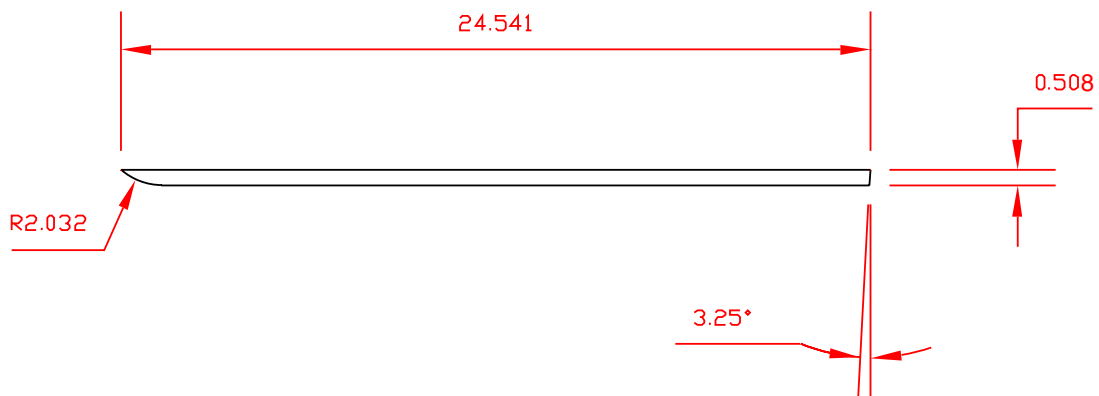


Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
Drawing Title: Fastening Plate	
Material: tungsten	
Drawn by: DJT	Date: 11/01/01
Dimensions in mm	Sheet 1 of 1
Scale 4:1	Task: TPS-6

Top Gasket

NASA/CR—2002-211505

29

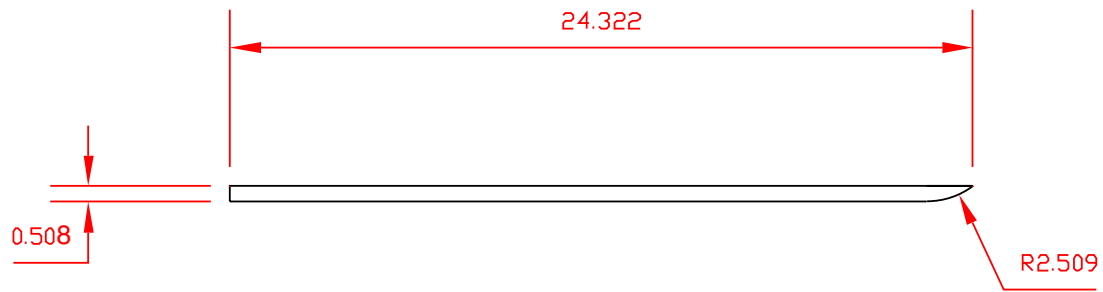


Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
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Dimensions in mm	Sheet 1 of 1
Scale 4:1	Task: TPS-6

Bottom Gasket

NASA/CR—2002-211505

30

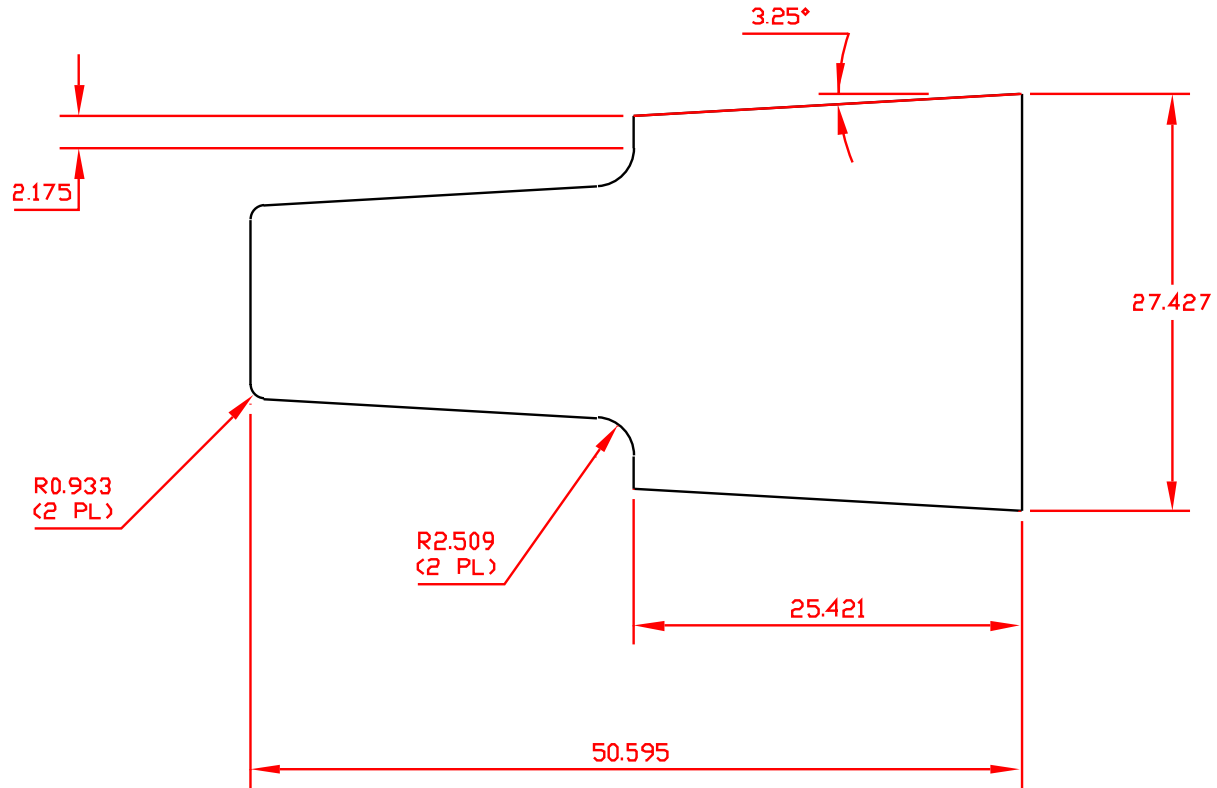


Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
Drawing Title: Bottom Gasket (2 Req'd.)	
Material: Grafoil	
Drawn by: DJT	Date: 11/05/01
Dimensions in mm	Sheet 1 of 1
Scale 4:1	Task: TPS-6

Ballast

NASA/CR—2002-211505

31



Ohio Aerospace Institute 22800 Cedar Point Rd. Cleveland, Ohio 44142	
Drawing Title: Ballast	
Material: tungsten	
Drawn by: DJT	Date: 10/22/01
Dimensions in mm	Sheet 1 of 1
Scale 2:1	Task: TPS-6

Appendix B: Material Properties

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C/SiC	34
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C/SiC Data values used in analysis

Source: TPSX database from NASA Ames

Source: Honeywell - ACI data from web page

Material Specs

Fiber content	Unknown	
Architecture	Unknown	
Density	ρ (lb/in ³)	ρ (kg/m ³)
	0.07523	2082.35937
Porosity	Unknown	

Tensile modulus in plane

No Data

Tensile strength in plane

No Data

Compressive modulus in plane

No Data

Compressive strength in plane

Material Specs

Fiber content	45%	
Architecture	Plain weave fabric	
Density	ρ (lb/in ³)	ρ (kg/m ³)
	0.08	2214.3925
Porosity	10% by volume	

Tensile modulus in plane

T (deg F)	E1T, E2T (psi)	T (deg C)	E1T, E2T (Pa)
73	1.09E+07	22.8	7.52E+10
2200	1.66E+07	1204.4	1.14E+11

Tensile strength in plane

T (deg F)	X1T, X2T (psi)	T (deg C)	X1T, X2T (Pa)
73	7.50E+04	22.8	5.17E+08
2200	7.88E+04	1204.4	5.43E+08

Compressive modulus in plane

T (deg F)	E1C, E2C (psi)	T (deg C)	E1C, E2C (Pa)
73	1.48E+07	22.8	1.02E+11

Compressive strength in plane

No Data

Tensile modulus through the thickness

T (deg R)	T (deg F)	T (deg C)	E3T (psf)	E3T (psi)	E3T (Pa)
492	32.3	0.2	1.47E+09	1.02E+07	7.03E+10
2471	2011.3	1099.6	1.94E+09	1.35E+07	9.31E+10
3281	2821.3	1549.6	1.53E+09	1.06E+07	7.31E+10
3731	3271.3	1799.6	8.02E+08	5.57E+06	3.84E+10

Shear modulus in plane

No Data

Shear modulus out of plane

No Data

Interlaminar shear strength

No Data

T (deg F)	X1C, X2C (psi)	T (deg C)	X1C, X2C (Pa)
73	7.89E+04	22.8	5.44E+08

Tensile modulus through the thickness

No Data

Shear modulus in plane

	T (deg F)	G12 (psi)	T (deg C)	G12 (Pa)
No Data	73	2.73E+06	22.8	1.88E+10
(assume G12 = 25%E11)	2200	4.15E+06	1204.4	2.86E+10

Shear modulus out of plane

	T (deg F)	G13, G23 (psi)	T (deg C)	G13, G23 (Pa)
No Data	73	2.18E+06	22.8	1.50E+10
(assume G13=G23 = 80%G12)	2200	3.32E+06	1204.4	2.29E+10

Interlaminar shear strength

T (deg F)	ILS (psi)	T (deg C)	ILS (Pa)
73	5.00E+03	22.8	3.45E+07

Poisson's ratios

No Data

Coefficient of thermal expansion in plane

T (deg R)	T (deg F)	α_1, α_2 (1/R)	T (deg C)	α_1, α_2 (1/K)
460	0.3	0	-17.6	0
960	500.3	8.37E-07	260.2	1.51E-06
1460	1000.3	1.38E-06	538.0	2.48E-06
1960	1500.3	1.90E-06	815.7	3.42E-06
2460	2000.3	2.20E-06	1093.5	3.96E-06
2960	2500.3	2.50E-06	1371.3	4.50E-06
3460	3000.3	2.76E-06	1649.1	4.97E-06
3960	3500.3	3.52E-06	1926.9	6.34E-06

Coefficient of thermal expansion through the thickness

T (deg R)	T (deg F)	α_3 (1/R)	T (deg C)	α_3 (1/K)
460	0.3	0	-17.6	0
960	500.3	4.23E-06	260.2	7.61E-06
1460	1000.3	3.18E-06	538.0	5.72E-06
1960	1500.3	4.98E-06	815.7	8.96E-06
2460	2000.3	4.56E-06	1093.5	8.21E-06

Poisson's ratios

No Data

(assume $\nu_{12} = \nu_{13} = \nu_{23} = 0.2$)

Coefficient of thermal expansion in plane

No Data

Coefficient of thermal expansion through the thickness

No Data

2960	2500.3	5.24E-06	1371.3	9.43E-06
3460	3000.3	1.25E-05	1649.1	2.25E-05
3960	3500.3	2.49E-05	1926.9	4.48E-05

Thermal conductivity in plane

T (deg R)	T (deg F)	k1, k2 (BTU/ft-s-R)	T (deg C)	k1, k2 (W/m-C)
492.0	32.3	1.884E-03	0.2	11.738
851.4	391.7	2.184E-03	199.9	13.607
1211.4	751.7	2.412E-03	399.9	15.028
1571.4	1111.7	2.520E-03	599.9	15.701
1931.4	1471.7	2.640E-03	799.9	16.448
2291.4	1831.7	2.700E-03	999.9	16.822
2651.4	2191.7	2.736E-03	1199.9	17.046
3011.4	2551.7	2.760E-03	1399.9	17.196

Thermal conductivity in plane

No Data

Thermal conductivity through the thickness

T (deg R)	T (deg F)	k3 (BTU/ft-s-R)	T (deg C)	k3 (W/m-C)
492.0	32.3	6.432E-04	0.2	4.007
851.4	391.7	8.040E-04	199.9	5.009
1211.4	751.7	9.252E-04	399.9	5.764
1571.4	1111.7	1.045E-03	599.9	6.512
1931.4	1471.7	1.126E-03	799.9	7.013
2291.4	1831.7	1.190E-03	999.9	7.417
2651.4	2191.7	1.224E-03	1199.9	7.626
3011.4	2551.7	1.224E-03	1399.9	7.626

Thermal conductivity through the thickness

No Data

Specific heat

T (deg R)	T (deg F)	Cp (BTU/lbm-R)	T (deg C)	Cp (J/kg-K)
460	0.3	0.140	-17.6	586.117
660	200.3	0.140	93.5	586.117
860	400.3	0.185	204.6	774.512
1060	600.3	0.220	315.7	921.042
1260	800.3	0.245	426.9	1025.705
1460	1000.3	0.264	538.0	1105.250
1660	1200.3	0.269	649.1	1126.183
2060	1600.3	0.311	871.3	1302.018

Emissivity

Constant wrt Temp	0.8
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Specific heat (through the thickness)

T (deg F)	Cp (BTU/lbm-F)
77	0.22
572	0.31

Emissivity

No Data

Grafoil™

Source: TPSX database from NASA Ames

Material Specs

Architecture	Unknown	
Density	ρ (lb/in ³)	ρ (kg/m ³)
	0.0405097	1121.3039

Tensile modulus in plane

T (deg F)	E1T (psi)	T (deg C)	E1T (Pa)
-	2.00E+05	-	1.38E+09

Tensile strength in plane

T (deg F)	X1T (psi)	T (deg C)	X1T (Pa)
-	6.50E+02	-	4.48E+06

Compressive modulus in plane

No Data

Compressive strength in plane

T (deg F)	X1C (psi)	T (deg C)	X1C (Pa)
-	3.50E+04	-	2.41E+08

Tensile modulus through the thickness

No Data		T (deg F)	E3T (psi)	T (deg C)	E3T (Pa)
assume E3T = E3C		-	2.70E+04	-	1.86E+08

Compressive modulus through the thickness

T (deg F)	E3C (psi)	T (deg C)	E3C (Pa)
-	2.70E+04	-	1.86E+08

Shear modulus in plane

No Data		T (deg F)	G12 (psi)	T (deg C)	G12 (Pa)
(assume G12 = 25%E1)		-	5.00E+04	-	3.45E+08

Shear modulus out of plane

No Data		T (deg F)	G13, G23 (psi)	T (deg C)	G13, G23 (Pa)
(assume G13=G23 = 80%G12)		-	4.00E+04	-	2.76E+08

Interlaminar shear strength

No Data

Poisson's ratios

No Data	
(assume nu12 = nu13 = nu23 = 0.05)	

Coefficient of thermal expansion in plane

T (deg F)	α_1, α_2 (1/R)	T (deg K)	T (deg C)	α_1, α_2 (1/K)
70.3	-2.00E-07	294.4	21.3	-3.60E-07
1999.3	-2.00E-07	1366.1	1093.0	-3.60E-07
2000.4	5.00E-07	1366.7	1093.6	9.00E-07
4000.4	5.00E-07	2477.8	2204.7	9.00E-07

Coefficient of thermal expansion through the thickness

T (deg F)	α_3 (1/R)	T (deg K)	T (deg C)	α_3 (1/K)
70.3	1.60E-05	294.4	21.3	2.88E-05
4000.4	1.60E-05	2477.8	2204.7	2.88E-05

Thermal conductivity in plane

T (deg F)	k1, k2 (BTU/ft-s-R)	T (deg C)	k1, k2 (W/m-C)
-	2.223E-02	-	138.500

Thermal conductivity through the thickness

T (deg F)	k3 (BTU/ft-s-R)	T (deg C)	k3 (W/m-C)
-	8.333E-04	-	5.192

Specific heat

	T (deg F)	Cp (BTU/lbm-R)	T (deg C)	Cp (J/kg-K)
(assume constant)	75.0	0.170	23.9	711.700

Emissivity

Constant wrt Temp 0.5

Thermal diffusivity

No Data

Tungsten

Source: Thermal properties - TPSX database from NASA Ames
 Structural properties – “Mark’s Standard Handbook for Mechanical Engineers, Ninth Edition,” McGraw Hill Publishing, 1978.

Density

T (deg F)	ρ (lb/in ³)	ρ (kg/m ³)
70.0	0.69725669	19300

Tensile modulus

T (deg F)	ET (psi)	T (deg C)	ET (Pa)
70.0	5.00E+07	21.1	3.45E+11

Tensile strength

(alloy dependent)

T (deg F)	XT (psi)		T (deg C)	XT (Pa)	
	min	max		min	max
70.0	1.80E+04	6.00E+05	21.1	1.24E+08	4.14E+09

Compressive modulus

No Data

Compressive strength

No Data

Poisson's ratio

nu = .28

Coefficient of thermal expansion

T (deg F)	α (1/F)	T (deg C)	α (1/K)
70.0	2.50E-06	21.1	4.50E-06

Thermal conductivity

T (deg F)	k (BTU/ft-s-R)	T (deg K)	T (deg C)	k (W/m-C)
212.0	3.339E-02	100.0	-173.2	208.0
392.0	2.985E-02	200.0	-73.2	186.0
572.0	2.793E-02	300.0	26.9	174.0
752.0	2.552E-02	400.0	126.9	159.0
1112.0	2.199E-02	600.0	326.9	137.0
1472.0	2.006E-02	800.0	526.9	125.0
1832.0	1.894E-02	1000.0	726.9	118.0
2192.0	1.814E-02	1200.0	926.9	113.0
2732.0	1.717E-02	1500.0	1226.9	107.0
3632.0	1.605E-02	2000.0	1726.9	100.0
4532.0	1.525E-02	2500.0	2226.9	95.0

Specific heat

T (deg F)	Cp (BTU/lbm-R)	T (deg K)	T (deg C)	Cp (J/kg-K)
212.0	0.021	100.0	-173.2	87.0
392.0	0.029	200.0	-73.2	122.0
572.0	0.032	300.0	26.9	132.0

752.0	0.033	400.0	126.9	137.0
1112.0	0.034	600.0	326.9	142.0
1472.0	0.035	800.0	526.9	145.0
1832.0	0.035	1000.0	726.9	148.0
2192.0	0.036	1200.0	926.9	152.0
2732.0	0.038	1500.0	1226.9	157.0
3632.0	0.040	2000.0	1726.9	167.0
4532.0	0.042	2500.0	2226.9	176.0

Emissivity

("Fundamentals of Heat and Mass Transfer," Incropera and Dewitt, p. 779 (1981))

T (deg K)	T (deg C)	T (deg F)	ϵ
1000.0	726.9	1832.0	0.10
1200.0	926.9	2192.0	0.13
1500.0	1226.9	2732.0	0.18
2000.0	1726.9	3632.0	0.25
2500.0	2226.9	4532.0	0.29

Thermal diffusivity

No Data

ZrB₂/SiC - two phase Ultra-High Temperature Ceramic

Source: TPSX database from NASA Ames

Density

T (deg F)	ρ (lb/in ³)	T (deg K)	T (deg C)	ρ (kg/m ³)
80.3	0.19791866	300.0	26.9	5478.4
620.3	0.19676114	600.0	326.9	5446.3
1160.3	0.19502522	900.0	626.9	5398.3
1700.3	0.19386771	1200.0	926.9	5366.2
2240.3	0.19271055	1500.0	1226.9	5334.2
2780.3	0.19155303	1800.0	1526.9	5302.2
3320.3	0.19039551	2100.0	1826.9	5270.1
3860.3	0.18923799	2400.0	2126.9	5238.1

Tensile modulus

T (deg F)	ET (psi)	T (deg K)	T (deg C)	ET (Pa)
80.3	7.60E+07	300.0	26.9	5.24E+11
620.3	7.40E+07	600.0	326.9	5.10E+11
1160.3	7.20E+07	900.0	626.9	4.96E+11
1700.3	7.00E+07	1200.0	926.9	4.83E+11
2240.3	6.70E+07	1500.0	1226.9	4.62E+11
2780.3	6.40E+07	1800.0	1526.9	4.41E+11

Tensile strength

No Data

Bending strength

T (deg F)	XTbend (psi)	T (deg K)	T (deg C)	XTbend (Pa)
80.3	5.00E+04	300.0	26.9	3.45E+08
620.3	5.10E+04	600.0	326.9	3.52E+08
1160.3	5.20E+04	900.0	626.9	3.59E+08
1700.3	5.30E+04	1200.0	926.9	3.65E+08
2240.3	4.80E+04	1500.0	1226.9	3.31E+08
2780.3	4.30E+04	1800.0	1526.9	2.97E+08

Compressive strength

T (deg F)	XC (psi)	T (deg K)	T (deg C)	XC (Pa)
-	5.00E+04	-	-	3.45E+08

Poisson's ratio

$\nu = .14$

Coefficient of thermal expansion

T (deg F)	α (1/F)	T (deg K)	T (deg C)	α (1/K)
80.3	4.20E-06	300.0	26.9	7.56E-06
254.4	4.25E-06	396.7	123.6	7.65E-06
1472.3	4.20E-06	1073.3	800.2	7.56E-06
2192.3	4.26E-06	1473.3	1200.2	7.67E-06
2912.3	4.31E-06	1873.3	1600.2	7.76E-06

Thermal conductivity

T (deg F)	k (BTU/ft-s-R)	T (deg K)	T (deg C)	k (W/m-C)
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572.0	1.666E-02	300.0	26.9	103.8
1112.0	1.417E-02	600.0	326.9	88.3
1652.0	1.333E-02	900.0	626.9	83.1
2192.0	1.278E-02	1200.0	926.9	79.6
2732.0	1.222E-02	1500.0	1226.9	76.2
3272.0	1.167E-02	1800.0	1526.9	72.7
3812.0	1.111E-02	2100.0	1826.9	69.2
4352.0	1.083E-02	2400.0	2126.9	67.5

Specific heat

T (deg F)	Cp (BTU/lbm-R)	T (deg K)	T (deg C)	Cp (J/kg-K)
572.0	0.100	300.0	26.9	418.7
1112.0	0.150	600.0	326.9	628.0
1652.0	0.160	900.0	626.9	669.9
2192.0	0.170	1200.0	926.9	711.7
2732.0	0.176	1500.0	1226.9	736.9
3272.0	0.184	1800.0	1526.9	770.4
3812.0	0.189	2100.0	1826.9	791.3
4352.0	0.193	2400.0	2126.9	808.0

Emissivity

T (deg K)	T (deg C)	T (deg F)	ϵ
300.0	26.9	572.0	0.70
600.0	326.9	1112.0	0.70
900.0	626.9	1652.0	0.70
1200.0	926.9	2192.0	0.70
1500.0	1226.9	2732.0	0.60
1800.0	1526.9	3272.0	0.54
2100.0	1826.9	3812.0	0.50

Thermal diffusivity

No Data

Appendix C: Prescribed Heat Fluxes on Exterior Surfaces

t = 0 [sec]		t = 1 [sec]		t = 2 [sec]		t = 3 [sec]		t = 4 [sec]	
x[m]	q[W/m ²]	x[m]	q[W/m ²]	x[m]	q[W/m ²]	x[m]	q[W/m ²]	x[m]	q[W/m ²]
0.00E+00	2.00E+04	0.00E+00	1.88E+04	0.00E+00	1.81E+04	0.00E+00	1.74E+04	0.00E+00	1.68E+04
1.41E-05	1.97E+04	1.41E-05	1.86E+04	1.41E-05	1.79E+04	1.41E-05	1.72E+04	1.41E-05	1.66E+04
7.52E-05	1.76E+04	7.52E-05	1.66E+04	7.52E-05	1.60E+04	7.52E-05	1.54E+04	7.52E-05	1.48E+04
1.82E-04	1.67E+04	1.82E-04	1.58E+04	1.82E-04	1.52E+04	1.82E-04	1.46E+04	1.82E-04	1.40E+04
3.26E-04	1.51E+04	3.26E-04	1.43E+04	3.26E-04	1.38E+04	3.26E-04	1.32E+04	3.26E-04	1.27E+04
5.01E-04	1.27E+04	5.01E-04	1.20E+04	5.01E-04	1.16E+04	5.01E-04	1.11E+04	5.01E-04	1.07E+04
5.05E-03	3.99E+03	5.05E-03	4.11E+03	5.05E-03	4.02E+03	5.05E-03	3.91E+03	5.05E-03	3.78E+03
1.01E-02	2.87E+03	1.01E-02	3.09E+03	1.01E-02	3.09E+03	1.01E-02	3.07E+03	1.01E-02	3.04E+03
1.48E-02	2.38E+03	1.48E-02	2.60E+03	1.48E-02	2.63E+03	1.48E-02	2.66E+03	1.48E-02	2.68E+03
1.99E-02	2.06E+03	1.99E-02	2.25E+03	1.99E-02	2.30E+03	1.99E-02	2.35E+03	1.99E-02	2.40E+03
2.47E-02	1.86E+03	2.47E-02	2.02E+03	2.47E-02	2.07E+03	2.47E-02	2.13E+03	2.47E-02	2.19E+03
2.98E-02	1.69E+03	2.98E-02	1.84E+03	2.98E-02	1.89E+03	2.98E-02	1.94E+03	2.98E-02	2.02E+03
3.49E-02	1.57E+03	3.49E-02	1.70E+03	3.49E-02	1.74E+03	3.49E-02	1.80E+03	3.49E-02	1.87E+03
3.96E-02	1.47E+03	3.96E-02	1.60E+03	3.96E-02	1.63E+03	3.96E-02	1.68E+03	3.96E-02	1.76E+03
4.47E-02	1.39E+03	4.47E-02	1.50E+03	4.47E-02	1.54E+03	4.47E-02	1.58E+03	4.47E-02	1.65E+03
4.95E-02	1.32E+03	4.95E-02	1.43E+03	4.95E-02	1.46E+03	4.95E-02	1.50E+03	4.95E-02	1.57E+03
5.46E-02	1.26E+03	5.46E-02	1.36E+03	5.46E-02	1.39E+03	5.46E-02	1.43E+03	5.46E-02	1.49E+03
5.93E-02	1.20E+03	5.93E-02	1.30E+03	5.93E-02	1.33E+03	5.93E-02	1.37E+03	5.93E-02	1.43E+03
6.44E-02	1.16E+03	6.44E-02	1.25E+03	6.44E-02	1.28E+03	6.44E-02	1.31E+03	6.44E-02	1.37E+03
6.92E-02	1.12E+03	6.92E-02	1.21E+03	6.92E-02	1.23E+03	6.92E-02	1.27E+03	6.92E-02	1.32E+03
7.43E-02	1.08E+03	7.43E-02	1.16E+03	7.43E-02	1.19E+03	7.43E-02	1.22E+03	7.43E-02	1.27E+03
7.94E-02	1.04E+03	7.94E-02	1.12E+03	7.94E-02	1.15E+03	7.94E-02	1.18E+03	7.94E-02	1.23E+03
8.41E-02	1.01E+03	8.41E-02	1.09E+03	8.41E-02	1.11E+03	8.41E-02	1.15E+03	8.41E-02	1.19E+03
8.92E-02	9.84E+02	8.92E-02	1.06E+03	8.92E-02	1.07E+03	8.92E-02	1.09E+03	8.92E-02	1.13E+03
9.40E-02	9.58E+02	9.40E-02	1.03E+03	9.40E-02	1.04E+03	9.40E-02	1.07E+03	9.40E-02	1.10E+03
9.91E-02	9.34E+02	9.91E-02	1.00E+03	9.91E-02	1.02E+03	9.91E-02	1.04E+03	9.91E-02	1.07E+03
1.04E-01	9.11E+02	1.04E-01	9.76E+02	1.04E-01	9.91E+02	1.04E-01	1.01E+03	1.04E-01	1.04E+03
1.09E-01	8.91E+02	1.09E-01	9.55E+02	1.09E-01	9.69E+02	1.09E-01	9.89E+02	1.09E-01	1.02E+03
1.14E-01	8.71E+02	1.14E-01	9.33E+02	1.14E-01	9.47E+02	1.14E-01	9.67E+02	1.14E-01	9.96E+02
1.19E-01	8.53E+02	1.19E-01	9.14E+02	1.19E-01	9.27E+02	1.19E-01	9.47E+02	1.19E-01	9.75E+02
1.24E-01	8.35E+02	1.24E-01	8.95E+02	1.24E-01	9.08E+02	1.24E-01	9.27E+02	1.24E-01	9.55E+02
1.29E-01	8.19E+02	1.29E-01	8.77E+02	1.29E-01	8.90E+02	1.29E-01	9.09E+02	1.29E-01	9.36E+02
1.34E-01	8.04E+02	1.34E-01	8.62E+02	1.34E-01	8.74E+02	1.34E-01	8.93E+02	1.34E-01	9.20E+02
1.39E-01	7.90E+02	1.39E-01	8.46E+02	1.39E-01	8.58E+02	1.39E-01	8.77E+02	1.39E-01	9.04E+02
1.44E-01	7.76E+02	1.44E-01	8.32E+02	1.44E-01	8.44E+02	1.44E-01	8.63E+02	1.44E-01	8.90E+02
1.49E-01	7.63E+02	1.49E-01	8.18E+02	1.49E-01	8.31E+02	1.49E-01	8.49E+02	1.49E-01	8.76E+02
1.54E-01	7.50E+02	1.54E-01	8.05E+02	1.54E-01	8.17E+02	1.54E-01	8.36E+02	1.54E-01	8.63E+02
1.58E-01	7.39E+02	1.58E-01	7.93E+02	1.58E-01	8.05E+02	1.58E-01	8.24E+02	1.58E-01	8.51E+02
1.63E-01	7.27E+02	1.63E-01	7.81E+02	1.63E-01	7.93E+02	1.63E-01	8.12E+02	1.63E-01	8.39E+02
1.68E-01	7.17E+02	1.68E-01	7.70E+02	1.68E-01	7.82E+02	1.68E-01	8.00E+02	1.68E-01	8.28E+02
1.73E-01	7.06E+02	1.73E-01	7.58E+02	1.73E-01	7.71E+02	1.73E-01	7.89E+02	1.73E-01	8.17E+02
1.78E-01	6.96E+02	1.78E-01	7.44E+02	1.78E-01	7.53E+02	1.78E-01	7.67E+02	1.78E-01	7.87E+02
1.83E-01	6.87E+02	1.83E-01	7.34E+02	1.83E-01	7.44E+02	1.83E-01	7.57E+02	1.83E-01	7.77E+02
1.88E-01	6.78E+02	1.88E-01	7.24E+02	1.88E-01	7.33E+02	1.88E-01	7.47E+02	1.88E-01	7.66E+02
1.93E-01	6.70E+02	1.93E-01	7.15E+02	1.93E-01	7.24E+02	1.93E-01	7.37E+02	1.93E-01	7.57E+02
1.98E-01	6.61E+02	1.98E-01	7.06E+02	1.98E-01	7.15E+02	1.98E-01	7.28E+02	1.98E-01	7.47E+02
2.03E-01	6.53E+02	2.03E-01	7.01E+02	2.03E-01	7.13E+02	2.03E-01	7.31E+02	2.03E-01	7.58E+02
2.08E-01	6.45E+02	2.08E-01	6.92E+02	2.08E-01	7.04E+02	2.08E-01	7.22E+02	2.08E-01	7.49E+02
2.13E-01	6.37E+02	2.13E-01	6.84E+02	2.13E-01	6.95E+02	2.13E-01	7.13E+02	2.13E-01	7.39E+02
2.28E-01	6.17E+02	2.28E-01	6.62E+02	2.28E-01	6.73E+02	2.28E-01	6.89E+02	2.28E-01	7.14E+02

t = 7 [sec]		t = 11 [sec]		t = 15 [sec]		t = 17 [sec]		t = 18 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	3.26E+04	0.00E+00	7.76E+04	0.00E+00	1.40E+05	0.00E+00	1.57E+05	0.00E+00	1.79E+05
1.41E-05	3.21E+04	1.41E-05	7.58E+04	1.41E-05	1.37E+05	1.41E-05	1.53E+05	1.41E-05	1.74E+05
7.52E-05	2.83E+04	7.52E-05	6.62E+04	7.52E-05	1.18E+05	7.52E-05	1.30E+05	7.52E-05	1.49E+05
1.82E-04	2.65E+04	1.82E-04	5.96E+04	1.82E-04	1.02E+05	1.82E-04	1.12E+05	1.82E-04	1.27E+05
3.26E-04	2.34E+04	3.26E-04	4.68E+04	3.26E-04	7.63E+04	3.26E-04	8.08E+04	3.26E-04	8.96E+04
5.01E-04	1.94E+04	5.01E-04	3.35E+04	5.01E-04	5.48E+04	5.01E-04	6.77E+04	5.01E-04	7.84E+04
5.05E-03	6.69E+03	5.05E-03	1.38E+04	5.05E-03	2.18E+04	5.05E-03	2.34E+04	5.05E-03	2.51E+04
1.01E-02	5.22E+03	1.01E-02	9.97E+03	1.01E-02	1.60E+04	1.01E-02	1.82E+04	1.01E-02	1.95E+04
1.48E-02	4.56E+03	1.48E-02	8.64E+03	1.48E-02	1.40E+04	1.48E-02	1.65E+04	1.48E-02	1.79E+04
1.99E-02	4.09E+03	1.99E-02	7.73E+03	1.99E-02	1.26E+04	1.99E-02	1.53E+04	1.99E-02	1.67E+04
2.47E-02	3.75E+03	2.47E-02	7.09E+03	2.47E-02	1.16E+04	2.47E-02	1.43E+04	2.47E-02	1.58E+04
2.98E-02	3.46E+03	2.98E-02	6.56E+03	2.98E-02	1.08E+04	2.98E-02	1.35E+04	2.98E-02	1.50E+04
3.49E-02	3.22E+03	3.49E-02	6.13E+03	3.49E-02	1.01E+04	3.49E-02	1.28E+04	3.49E-02	1.43E+04
3.96E-02	3.03E+03	3.96E-02	5.79E+03	3.96E-02	9.56E+03	3.96E-02	1.22E+04	3.96E-02	1.38E+04
4.47E-02	2.86E+03	4.47E-02	5.47E+03	4.47E-02	9.06E+03	4.47E-02	1.16E+04	4.47E-02	1.32E+04
4.95E-02	2.72E+03	4.95E-02	5.21E+03	4.95E-02	8.65E+03	4.95E-02	1.11E+04	4.95E-02	1.27E+04
5.46E-02	2.59E+03	5.46E-02	4.97E+03	5.46E-02	8.27E+03	5.46E-02	1.07E+04	5.46E-02	1.22E+04
5.93E-02	2.48E+03	5.93E-02	4.77E+03	5.93E-02	7.94E+03	5.93E-02	1.03E+04	5.93E-02	1.18E+04
6.44E-02	2.38E+03	6.44E-02	4.58E+03	6.44E-02	7.63E+03	6.44E-02	9.89E+03	6.44E-02	1.13E+04
6.92E-02	2.29E+03	6.92E-02	4.42E+03	6.92E-02	7.37E+03	6.92E-02	9.56E+03	6.92E-02	1.10E+04
7.43E-02	2.21E+03	7.43E-02	4.27E+03	7.43E-02	7.12E+03	7.43E-02	9.24E+03	7.43E-02	1.06E+04
7.94E-02	2.14E+03	7.94E-02	4.13E+03	7.94E-02	6.89E+03	7.94E-02	8.96E+03	7.94E-02	1.03E+04
8.41E-02	2.08E+03	8.41E-02	4.02E+03	8.41E-02	6.70E+03	8.41E-02	8.71E+03	8.41E-02	1.01E+04
8.92E-02	1.96E+03	8.92E-02	3.80E+03	8.92E-02	6.31E+03	8.92E-02	7.94E+03	8.92E-02	9.00E+03
9.40E-02	1.91E+03	9.40E-02	3.70E+03	9.40E-02	6.14E+03	9.40E-02	7.72E+03	9.40E-02	8.75E+03
9.91E-02	1.86E+03	9.91E-02	3.61E+03	9.91E-02	5.98E+03	9.91E-02	7.52E+03	9.91E-02	8.52E+03
1.04E-01	1.81E+03	1.04E-01	3.52E+03	1.04E-01	5.83E+03	1.04E-01	7.33E+03	1.04E-01	8.30E+03
1.09E-01	1.77E+03	1.09E-01	3.44E+03	1.09E-01	5.70E+03	1.09E-01	7.17E+03	1.09E-01	8.13E+03
1.14E-01	1.73E+03	1.14E-01	3.36E+03	1.14E-01	5.58E+03	1.14E-01	7.02E+03	1.14E-01	7.96E+03
1.19E-01	1.70E+03	1.19E-01	3.29E+03	1.19E-01	5.46E+03	1.19E-01	6.87E+03	1.19E-01	7.80E+03
1.24E-01	1.66E+03	1.24E-01	3.23E+03	1.24E-01	5.35E+03	1.24E-01	6.74E+03	1.24E-01	7.65E+03
1.29E-01	1.63E+03	1.29E-01	3.16E+03	1.29E-01	5.25E+03	1.29E-01	6.62E+03	1.29E-01	7.52E+03
1.34E-01	1.60E+03	1.34E-01	3.11E+03	1.34E-01	5.16E+03	1.34E-01	6.52E+03	1.34E-01	7.42E+03
1.39E-01	1.57E+03	1.39E-01	3.06E+03	1.39E-01	5.08E+03	1.39E-01	6.43E+03	1.39E-01	7.32E+03
1.44E-01	1.55E+03	1.44E-01	3.01E+03	1.44E-01	5.00E+03	1.44E-01	6.34E+03	1.44E-01	7.23E+03
1.49E-01	1.53E+03	1.49E-01	2.96E+03	1.49E-01	4.93E+03	1.49E-01	6.26E+03	1.49E-01	7.14E+03
1.54E-01	1.50E+03	1.54E-01	2.92E+03	1.54E-01	4.85E+03	1.54E-01	6.18E+03	1.54E-01	7.06E+03
1.58E-01	1.48E+03	1.58E-01	2.88E+03	1.58E-01	4.79E+03	1.58E-01	6.10E+03	1.58E-01	6.99E+03
1.63E-01	1.46E+03	1.63E-01	2.84E+03	1.63E-01	4.73E+03	1.63E-01	6.04E+03	1.63E-01	6.92E+03
1.68E-01	1.44E+03	1.68E-01	2.80E+03	1.68E-01	4.66E+03	1.68E-01	5.96E+03	1.68E-01	6.84E+03
1.73E-01	1.42E+03	1.73E-01	2.76E+03	1.73E-01	4.60E+03	1.73E-01	5.89E+03	1.73E-01	6.77E+03
1.78E-01	1.37E+03	1.78E-01	2.67E+03	1.78E-01	4.41E+03	1.78E-01	5.48E+03	1.78E-01	6.18E+03
1.83E-01	1.35E+03	1.83E-01	2.63E+03	1.83E-01	4.35E+03	1.83E-01	5.40E+03	1.83E-01	6.10E+03
1.88E-01	1.33E+03	1.88E-01	2.59E+03	1.88E-01	4.29E+03	1.88E-01	5.33E+03	1.88E-01	6.01E+03
1.93E-01	1.32E+03	1.93E-01	2.56E+03	1.93E-01	4.24E+03	1.93E-01	5.26E+03	1.93E-01	5.94E+03
1.98E-01	1.30E+03	1.98E-01	2.53E+03	1.98E-01	4.18E+03	1.98E-01	5.19E+03	1.98E-01	5.86E+03
2.03E-01	1.32E+03	2.03E-01	2.57E+03	2.03E-01	4.29E+03	2.03E-01	5.57E+03	2.03E-01	6.46E+03
2.08E-01	1.31E+03	2.08E-01	2.54E+03	2.08E-01	4.24E+03	2.08E-01	5.49E+03	2.08E-01	6.36E+03
2.13E-01	1.29E+03	2.13E-01	2.50E+03	2.13E-01	4.18E+03	2.13E-01	5.41E+03	2.13E-01	6.27E+03
2.28E-01	1.25E+03	2.28E-01	2.42E+03	2.28E-01	4.04E+03	2.28E-01	5.22E+03	2.28E-01	6.04E+03

t = 19 [sec]		t = 20 [sec]		t = 21 [sec]		t = 22 [sec]		t = 24 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	2.00E+05	0.00E+00	2.20E+05	0.00E+00	2.41E+05	0.00E+00	2.64E+05	0.00E+00	2.88E+05
1.41E-05	1.93E+05	1.41E-05	2.14E+05	1.41E-05	2.34E+05	1.41E-05	2.56E+05	1.41E-05	2.79E+05
7.52E-05	1.64E+05	7.52E-05	1.81E+05	7.52E-05	1.97E+05	7.52E-05	2.16E+05	7.52E-05	2.35E+05
1.82E-04	1.40E+05	1.82E-04	1.53E+05	1.82E-04	1.66E+05	1.82E-04	1.81E+05	1.82E-04	1.96E+05
3.26E-04	9.63E+04	3.26E-04	1.03E+05	3.26E-04	1.09E+05	3.26E-04	1.15E+05	3.26E-04	1.51E+05
5.01E-04	8.71E+04	5.01E-04	9.58E+04	5.01E-04	1.04E+05	5.01E-04	1.13E+05	5.01E-04	1.12E+05
5.05E-03	2.69E+04	5.05E-03	2.87E+04	5.05E-03	3.02E+04	5.05E-03	3.18E+04	5.05E-03	3.35E+04
1.01E-02	2.13E+04	1.01E-02	2.31E+04	1.01E-02	2.48E+04	1.01E-02	2.64E+04	1.01E-02	2.81E+04
1.48E-02	1.97E+04	1.48E-02	2.16E+04	1.48E-02	2.34E+04	1.48E-02	2.51E+04	1.48E-02	2.69E+04
1.99E-02	1.85E+04	1.99E-02	2.04E+04	1.99E-02	2.22E+04	1.99E-02	2.41E+04	1.99E-02	2.59E+04
2.47E-02	1.76E+04	2.47E-02	1.95E+04	2.47E-02	2.13E+04	2.47E-02	2.32E+04	2.47E-02	2.50E+04
2.98E-02	1.68E+04	2.98E-02	1.87E+04	2.98E-02	2.05E+04	2.98E-02	2.23E+04	2.98E-02	2.41E+04
3.49E-02	1.61E+04	3.49E-02	1.79E+04	3.49E-02	1.97E+04	3.49E-02	2.15E+04	3.49E-02	2.33E+04
3.96E-02	1.55E+04	3.96E-02	1.73E+04	3.96E-02	1.90E+04	3.96E-02	2.08E+04	3.96E-02	2.26E+04
4.47E-02	1.48E+04	4.47E-02	1.66E+04	4.47E-02	1.83E+04	4.47E-02	2.01E+04	4.47E-02	2.18E+04
4.95E-02	1.43E+04	4.95E-02	1.60E+04	4.95E-02	1.77E+04	4.95E-02	1.95E+04	4.95E-02	2.12E+04
5.46E-02	1.38E+04	5.46E-02	1.55E+04	5.46E-02	1.71E+04	5.46E-02	1.88E+04	5.46E-02	2.05E+04
5.93E-02	1.33E+04	5.93E-02	1.50E+04	5.93E-02	1.66E+04	5.93E-02	1.83E+04	5.93E-02	1.99E+04
6.44E-02	1.29E+04	6.44E-02	1.45E+04	6.44E-02	1.61E+04	6.44E-02	1.77E+04	6.44E-02	1.93E+04
6.92E-02	1.25E+04	6.92E-02	1.41E+04	6.92E-02	1.56E+04	6.92E-02	1.72E+04	6.92E-02	1.88E+04
7.43E-02	1.21E+04	7.43E-02	1.37E+04	7.43E-02	1.52E+04	7.43E-02	1.67E+04	7.43E-02	1.83E+04
7.94E-02	1.18E+04	7.94E-02	1.33E+04	7.94E-02	1.47E+04	7.94E-02	1.63E+04	7.94E-02	1.78E+04
8.41E-02	1.15E+04	8.41E-02	1.30E+04	8.41E-02	1.44E+04	8.41E-02	1.59E+04	8.41E-02	1.74E+04
8.92E-02	1.01E+04	8.92E-02	1.13E+04	8.92E-02	1.24E+04	8.92E-02	1.35E+04	8.92E-02	1.47E+04
9.40E-02	9.83E+03	9.40E-02	1.10E+04	9.40E-02	1.20E+04	9.40E-02	1.32E+04	9.40E-02	1.43E+04
9.91E-02	9.57E+03	9.91E-02	1.07E+04	9.91E-02	1.17E+04	9.91E-02	1.28E+04	9.91E-02	1.39E+04
1.04E-01	9.33E+03	1.04E-01	1.04E+04	1.04E-01	1.14E+04	1.04E-01	1.25E+04	1.04E-01	1.36E+04
1.09E-01	9.13E+03	1.09E-01	1.02E+04	1.09E-01	1.12E+04	1.09E-01	1.22E+04	1.09E-01	1.33E+04
1.14E-01	8.95E+03	1.14E-01	9.99E+03	1.14E-01	1.10E+04	1.14E-01	1.20E+04	1.14E-01	1.31E+04
1.19E-01	8.77E+03	1.19E-01	9.80E+03	1.19E-01	1.08E+04	1.19E-01	1.18E+04	1.19E-01	1.28E+04
1.24E-01	8.62E+03	1.24E-01	9.63E+03	1.24E-01	1.07E+04	1.24E-01	1.17E+04	1.24E-01	1.26E+04
1.29E-01	8.48E+03	1.29E-01	9.48E+03	1.29E-01	1.05E+04	1.29E-01	1.15E+04	1.29E-01	1.24E+04
1.34E-01	8.36E+03	1.34E-01	9.35E+03	1.34E-01	1.04E+04	1.34E-01	1.14E+04	1.34E-01	1.23E+04
1.39E-01	8.26E+03	1.39E-01	9.25E+03	1.39E-01	1.03E+04	1.39E-01	1.13E+04	1.39E-01	1.22E+04
1.44E-01	8.17E+03	1.44E-01	9.15E+03	1.44E-01	1.02E+04	1.44E-01	1.12E+04	1.44E-01	1.21E+04
1.49E-01	8.08E+03	1.49E-01	9.06E+03	1.49E-01	1.01E+04	1.49E-01	1.11E+04	1.49E-01	1.20E+04
1.54E-01	8.00E+03	1.54E-01	8.98E+03	1.54E-01	1.00E+04	1.54E-01	1.10E+04	1.54E-01	1.19E+04
1.58E-01	7.92E+03	1.58E-01	8.90E+03	1.58E-01	9.95E+03	1.58E-01	1.09E+04	1.58E-01	1.18E+04
1.63E-01	7.85E+03	1.63E-01	8.83E+03	1.63E-01	9.88E+03	1.63E-01	1.09E+04	1.63E-01	1.18E+04
1.68E-01	7.77E+03	1.68E-01	8.74E+03	1.68E-01	9.79E+03	1.68E-01	1.08E+04	1.68E-01	1.17E+04
1.73E-01	7.69E+03	1.73E-01	8.66E+03	1.73E-01	9.71E+03	1.73E-01	1.07E+04	1.73E-01	1.16E+04
1.78E-01	6.92E+03	1.78E-01	7.71E+03	1.78E-01	8.45E+03	1.78E-01	9.22E+03	1.78E-01	9.97E+03
1.83E-01	6.83E+03	1.83E-01	7.65E+03	1.83E-01	8.34E+03	1.83E-01	9.09E+03	1.83E-01	9.84E+03
1.88E-01	6.73E+03	1.88E-01	7.54E+03	1.88E-01	8.22E+03	1.88E-01	8.96E+03	1.88E-01	9.70E+03
1.93E-01	6.65E+03	1.93E-01	7.45E+03	1.93E-01	8.11E+03	1.93E-01	8.85E+03	1.93E-01	9.57E+03
1.98E-01	6.56E+03	1.98E-01	7.35E+03	1.98E-01	8.00E+03	1.98E-01	8.72E+03	1.98E-01	9.44E+03
2.03E-01	7.39E+03	2.03E-01	8.37E+03	2.03E-01	9.37E+03	2.03E-01	1.04E+04	2.03E-01	1.14E+04
2.08E-01	7.29E+03	2.08E-01	8.32E+03	2.08E-01	9.20E+03	2.08E-01	1.02E+04	2.08E-01	1.12E+04
2.13E-01	7.18E+03	2.13E-01	8.19E+03	2.13E-01	9.05E+03	2.13E-01	1.00E+04	2.13E-01	1.10E+04
2.28E-01	6.91E+03	2.28E-01	7.88E+03	2.28E-01	8.70E+03	2.28E-01	9.61E+03	2.28E-01	1.05E+04

t = 25 [sec]		t = 26 [sec]		t = 27 [sec]		t = 28 [sec]		t = 29 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	3.20E+05	0.00E+00	3.42E+05	0.00E+00	3.70E+05	0.00E+00	3.95E+05	0.00E+00	4.32E+05
1.41E-05	3.10E+05	1.41E-05	3.32E+05	1.41E-05	3.58E+05	1.41E-05	3.82E+05	1.41E-05	4.18E+05
7.52E-05	2.61E+05	7.52E-05	2.79E+05	7.52E-05	3.01E+05	7.52E-05	3.20E+05	7.52E-05	3.50E+05
1.82E-04	2.16E+05	1.82E-04	2.31E+05	1.82E-04	2.48E+05	1.82E-04	2.64E+05	1.82E-04	2.88E+05
3.26E-04	1.68E+05	3.26E-04	1.79E+05	3.26E-04	1.94E+05	3.26E-04	1.88E+05	3.26E-04	2.06E+05
5.01E-04	1.22E+05	5.01E-04	1.30E+05	5.01E-04	1.39E+05	5.01E-04	1.38E+05	5.01E-04	1.50E+05
5.05E-03	3.55E+04	5.05E-03	3.68E+04	5.05E-03	3.83E+04	5.05E-03	3.99E+04	5.05E-03	4.19E+04
1.01E-02	2.99E+04	1.01E-02	3.13E+04	1.01E-02	3.27E+04	1.01E-02	3.42E+04	1.01E-02	3.60E+04
1.48E-02	2.88E+04	1.48E-02	3.04E+04	1.48E-02	3.19E+04	1.48E-02	3.34E+04	1.48E-02	3.53E+04
1.99E-02	2.78E+04	1.99E-02	2.95E+04	1.99E-02	3.10E+04	1.99E-02	3.26E+04	1.99E-02	3.46E+04
2.47E-02	2.70E+04	2.47E-02	2.86E+04	2.47E-02	3.03E+04	2.47E-02	3.19E+04	2.47E-02	3.38E+04
2.98E-02	2.61E+04	2.98E-02	2.78E+04	2.98E-02	2.94E+04	2.98E-02	3.11E+04	2.98E-02	3.30E+04
3.49E-02	2.53E+04	3.49E-02	2.70E+04	3.49E-02	2.86E+04	3.49E-02	3.02E+04	3.49E-02	3.21E+04
3.96E-02	2.45E+04	3.96E-02	2.62E+04	3.96E-02	2.78E+04	3.96E-02	2.95E+04	3.96E-02	3.13E+04
4.47E-02	2.37E+04	4.47E-02	2.54E+04	4.47E-02	2.70E+04	4.47E-02	2.86E+04	4.47E-02	3.05E+04
4.95E-02	2.30E+04	4.95E-02	2.47E+04	4.95E-02	2.63E+04	4.95E-02	2.79E+04	4.95E-02	2.97E+04
5.46E-02	2.23E+04	5.46E-02	2.40E+04	5.46E-02	2.56E+04	5.46E-02	2.71E+04	5.46E-02	2.89E+04
5.93E-02	2.17E+04	5.93E-02	2.33E+04	5.93E-02	2.49E+04	5.93E-02	2.64E+04	5.93E-02	2.82E+04
6.44E-02	2.11E+04	6.44E-02	2.26E+04	6.44E-02	2.42E+04	6.44E-02	2.57E+04	6.44E-02	2.75E+04
6.92E-02	2.05E+04	6.92E-02	2.21E+04	6.92E-02	2.36E+04	6.92E-02	2.51E+04	6.92E-02	2.68E+04
7.43E-02	2.00E+04	7.43E-02	2.15E+04	7.43E-02	2.30E+04	7.43E-02	2.45E+04	7.43E-02	2.62E+04
7.94E-02	1.95E+04	7.94E-02	2.10E+04	7.94E-02	2.25E+04	7.94E-02	2.39E+04	7.94E-02	2.56E+04
8.41E-02	1.90E+04	8.41E-02	2.05E+04	8.41E-02	2.20E+04	8.41E-02	2.34E+04	8.41E-02	2.51E+04
8.92E-02	1.60E+04	8.92E-02	1.71E+04	8.92E-02	1.82E+04	8.92E-02	1.93E+04	8.92E-02	2.06E+04
9.40E-02	1.56E+04	9.40E-02	1.66E+04	9.40E-02	1.77E+04	9.40E-02	1.87E+04	9.40E-02	2.00E+04
9.91E-02	1.52E+04	9.91E-02	1.62E+04	9.91E-02	1.72E+04	9.91E-02	1.82E+04	9.91E-02	1.94E+04
1.04E-01	1.48E+04	1.04E-01	1.58E+04	1.04E-01	1.68E+04	1.04E-01	1.78E+04	1.04E-01	1.90E+04
1.09E-01	1.45E+04	1.09E-01	1.55E+04	1.09E-01	1.65E+04	1.09E-01	1.74E+04	1.09E-01	1.86E+04
1.14E-01	1.42E+04	1.14E-01	1.52E+04	1.14E-01	1.62E+04	1.14E-01	1.71E+04	1.14E-01	1.83E+04
1.19E-01	1.40E+04	1.19E-01	1.49E+04	1.19E-01	1.59E+04	1.19E-01	1.68E+04	1.19E-01	1.80E+04
1.24E-01	1.37E+04	1.24E-01	1.47E+04	1.24E-01	1.57E+04	1.24E-01	1.66E+04	1.24E-01	1.77E+04
1.29E-01	1.35E+04	1.29E-01	1.45E+04	1.29E-01	1.55E+04	1.29E-01	1.64E+04	1.29E-01	1.75E+04
1.34E-01	1.34E+04	1.34E-01	1.44E+04	1.34E-01	1.53E+04	1.34E-01	1.62E+04	1.34E-01	1.73E+04
1.39E-01	1.33E+04	1.39E-01	1.42E+04	1.39E-01	1.52E+04	1.39E-01	1.61E+04	1.39E-01	1.72E+04
1.44E-01	1.32E+04	1.44E-01	1.41E+04	1.44E-01	1.51E+04	1.44E-01	1.60E+04	1.44E-01	1.71E+04
1.49E-01	1.31E+04	1.49E-01	1.40E+04	1.49E-01	1.50E+04	1.49E-01	1.59E+04	1.49E-01	1.70E+04
1.54E-01	1.30E+04	1.54E-01	1.40E+04	1.54E-01	1.49E+04	1.54E-01	1.59E+04	1.54E-01	1.70E+04
1.58E-01	1.29E+04	1.58E-01	1.39E+04	1.58E-01	1.49E+04	1.58E-01	1.58E+04	1.58E-01	1.69E+04
1.63E-01	1.29E+04	1.63E-01	1.38E+04	1.63E-01	1.48E+04	1.63E-01	1.57E+04	1.63E-01	1.68E+04
1.68E-01	1.28E+04	1.68E-01	1.37E+04	1.68E-01	1.47E+04	1.68E-01	1.56E+04	1.68E-01	1.67E+04
1.73E-01	1.27E+04	1.73E-01	1.36E+04	1.73E-01	1.46E+04	1.73E-01	1.55E+04	1.73E-01	1.66E+04
1.78E-01	1.09E+04	1.78E-01	1.16E+04	1.78E-01	1.23E+04	1.78E-01	1.31E+04	1.78E-01	1.39E+04
1.83E-01	1.07E+04	1.83E-01	1.14E+04	1.83E-01	1.21E+04	1.83E-01	1.28E+04	1.83E-01	1.37E+04
1.88E-01	1.06E+04	1.88E-01	1.13E+04	1.88E-01	1.20E+04	1.88E-01	1.26E+04	1.88E-01	1.35E+04
1.93E-01	1.04E+04	1.93E-01	1.11E+04	1.93E-01	1.18E+04	1.93E-01	1.25E+04	1.93E-01	1.33E+04
1.98E-01	1.03E+04	1.98E-01	1.10E+04	1.98E-01	1.16E+04	1.98E-01	1.23E+04	1.98E-01	1.31E+04
2.03E-01	1.25E+04	2.03E-01	1.35E+04	2.03E-01	1.45E+04	2.03E-01	1.55E+04	2.03E-01	1.67E+04
2.08E-01	1.23E+04	2.08E-01	1.33E+04	2.08E-01	1.43E+04	2.08E-01	1.53E+04	2.08E-01	1.65E+04
2.13E-01	1.21E+04	2.13E-01	1.31E+04	2.13E-01	1.41E+04	2.13E-01	1.50E+04	2.13E-01	1.62E+04
2.28E-01	1.16E+04	2.28E-01	1.25E+04	2.28E-01	1.35E+04	2.28E-01	1.44E+04	2.28E-01	1.55E+04

t = 30 [sec]		t = 31 [sec]		t = 32 [sec]		t = 33 [sec]		t = 34 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	4.58E+05	0.00E+00	4.91E+05	0.00E+00	5.20E+05	0.00E+00	5.79E+05	0.00E+00	6.08E+05
1.41E-05	4.43E+05	1.41E-05	4.75E+05	1.41E-05	5.02E+05	1.41E-05	5.59E+05	1.41E-05	5.87E+05
7.52E-05	3.71E+05	7.52E-05	3.98E+05	7.52E-05	4.20E+05	7.52E-05	4.67E+05	7.52E-05	4.91E+05
1.82E-04	3.04E+05	1.82E-04	3.25E+05	1.82E-04	3.43E+05	1.82E-04	3.80E+05	1.82E-04	3.99E+05
3.26E-04	2.18E+05	3.26E-04	2.33E+05	3.26E-04	2.46E+05	3.26E-04	2.73E+05	3.26E-04	2.87E+05
5.01E-04	1.58E+05	5.01E-04	1.68E+05	5.01E-04	1.77E+05	5.01E-04	1.95E+05	5.01E-04	2.04E+05
5.05E-03	4.32E+04	5.05E-03	4.45E+04	5.05E-03	4.56E+04	5.05E-03	4.80E+04	5.05E-03	4.91E+04
1.01E-02	3.73E+04	1.01E-02	3.84E+04	1.01E-02	3.94E+04	1.01E-02	4.17E+04	1.01E-02	4.27E+04
1.48E-02	3.68E+04	1.48E-02	3.80E+04	1.48E-02	3.91E+04	1.48E-02	4.15E+04	1.48E-02	4.26E+04
1.99E-02	3.61E+04	1.99E-02	3.73E+04	1.99E-02	3.85E+04	1.99E-02	4.09E+04	1.99E-02	4.21E+04
2.47E-02	3.53E+04	2.47E-02	3.66E+04	2.47E-02	3.78E+04	2.47E-02	4.02E+04	2.47E-02	4.14E+04
2.98E-02	3.45E+04	2.98E-02	3.58E+04	2.98E-02	3.70E+04	2.98E-02	3.94E+04	2.98E-02	4.06E+04
3.49E-02	3.36E+04	3.49E-02	3.49E+04	3.49E-02	3.61E+04	3.49E-02	3.85E+04	3.49E-02	3.96E+04
3.96E-02	3.28E+04	3.96E-02	3.41E+04	3.96E-02	3.53E+04	3.96E-02	3.77E+04	3.96E-02	3.88E+04
4.47E-02	3.20E+04	4.47E-02	3.33E+04	4.47E-02	3.45E+04	4.47E-02	3.68E+04	4.47E-02	3.79E+04
4.95E-02	3.12E+04	4.95E-02	3.25E+04	4.95E-02	3.37E+04	4.95E-02	3.60E+04	4.95E-02	3.71E+04
5.46E-02	3.04E+04	5.46E-02	3.17E+04	5.46E-02	3.29E+04	5.46E-02	3.52E+04	5.46E-02	3.63E+04
5.93E-02	2.97E+04	5.93E-02	3.10E+04	5.93E-02	3.21E+04	5.93E-02	3.44E+04	5.93E-02	3.55E+04
6.44E-02	2.89E+04	6.44E-02	3.02E+04	6.44E-02	3.14E+04	6.44E-02	3.36E+04	6.44E-02	3.47E+04
6.92E-02	2.83E+04	6.92E-02	2.95E+04	6.92E-02	3.07E+04	6.92E-02	3.29E+04	6.92E-02	3.40E+04
7.43E-02	2.76E+04	7.43E-02	2.89E+04	7.43E-02	3.00E+04	7.43E-02	3.23E+04	7.43E-02	3.33E+04
7.94E-02	2.70E+04	7.94E-02	2.83E+04	7.94E-02	2.94E+04	7.94E-02	3.16E+04	7.94E-02	3.27E+04
8.41E-02	2.65E+04	8.41E-02	2.77E+04	8.41E-02	2.89E+04	8.41E-02	3.10E+04	8.41E-02	3.21E+04
8.92E-02	2.16E+04	8.92E-02	2.25E+04	8.92E-02	2.33E+04	8.92E-02	2.49E+04	8.92E-02	2.57E+04
9.40E-02	2.09E+04	9.40E-02	2.18E+04	9.40E-02	2.26E+04	9.40E-02	2.42E+04	9.40E-02	2.49E+04
9.91E-02	2.04E+04	9.91E-02	2.13E+04	9.91E-02	2.20E+04	9.91E-02	2.36E+04	9.91E-02	2.43E+04
1.04E-01	1.99E+04	1.04E-01	2.07E+04	1.04E-01	2.15E+04	1.04E-01	2.30E+04	1.04E-01	2.37E+04
1.09E-01	1.95E+04	1.09E-01	2.03E+04	1.09E-01	2.11E+04	1.09E-01	2.26E+04	1.09E-01	2.33E+04
1.14E-01	1.92E+04	1.14E-01	2.00E+04	1.14E-01	2.07E+04	1.14E-01	2.22E+04	1.14E-01	2.29E+04
1.19E-01	1.89E+04	1.19E-01	1.97E+04	1.19E-01	2.04E+04	1.19E-01	2.19E+04	1.19E-01	2.26E+04
1.24E-01	1.86E+04	1.24E-01	1.94E+04	1.24E-01	2.01E+04	1.24E-01	2.16E+04	1.24E-01	2.23E+04
1.29E-01	1.84E+04	1.29E-01	1.92E+04	1.29E-01	1.99E+04	1.29E-01	2.14E+04	1.29E-01	2.20E+04
1.34E-01	1.82E+04	1.34E-01	1.90E+04	1.34E-01	1.98E+04	1.34E-01	2.12E+04	1.34E-01	2.19E+04
1.39E-01	1.81E+04	1.39E-01	1.89E+04	1.39E-01	1.97E+04	1.39E-01	2.11E+04	1.39E-01	2.18E+04
1.44E-01	1.80E+04	1.44E-01	1.88E+04	1.44E-01	1.96E+04	1.44E-01	2.10E+04	1.44E-01	2.17E+04
1.49E-01	1.79E+04	1.49E-01	1.87E+04	1.49E-01	1.95E+04	1.49E-01	2.09E+04	1.49E-01	2.16E+04
1.54E-01	1.79E+04	1.54E-01	1.87E+04	1.54E-01	1.94E+04	1.54E-01	2.09E+04	1.54E-01	2.16E+04
1.58E-01	1.78E+04	1.58E-01	1.86E+04	1.58E-01	1.94E+04	1.58E-01	2.08E+04	1.58E-01	2.15E+04
1.63E-01	1.77E+04	1.63E-01	1.86E+04	1.63E-01	1.93E+04	1.63E-01	2.08E+04	1.63E-01	2.14E+04
1.68E-01	1.76E+04	1.68E-01	1.85E+04	1.68E-01	1.92E+04	1.68E-01	2.06E+04	1.68E-01	2.13E+04
1.73E-01	1.75E+04	1.73E-01	1.83E+04	1.73E-01	1.91E+04	1.73E-01	2.05E+04	1.73E-01	2.12E+04
1.78E-01	1.46E+04	1.78E-01	1.52E+04	1.78E-01	1.57E+04	1.78E-01	1.68E+04	1.78E-01	1.74E+04
1.83E-01	1.43E+04	1.83E-01	1.49E+04	1.83E-01	1.54E+04	1.83E-01	1.65E+04	1.83E-01	1.70E+04
1.88E-01	1.41E+04	1.88E-01	1.47E+04	1.88E-01	1.52E+04	1.88E-01	1.63E+04	1.88E-01	1.68E+04
1.93E-01	1.39E+04	1.93E-01	1.45E+04	1.93E-01	1.50E+04	1.93E-01	1.61E+04	1.93E-01	1.66E+04
1.98E-01	1.37E+04	1.98E-01	1.43E+04	1.98E-01	1.48E+04	1.98E-01	1.58E+04	1.98E-01	1.63E+04
2.03E-01	1.77E+04	2.03E-01	1.86E+04	2.03E-01	1.94E+04	2.03E-01	2.10E+04	2.03E-01	2.18E+04
2.08E-01	1.74E+04	2.08E-01	1.83E+04	2.08E-01	1.91E+04	2.08E-01	2.07E+04	2.08E-01	2.15E+04
2.13E-01	1.71E+04	2.13E-01	1.80E+04	2.13E-01	1.88E+04	2.13E-01	2.03E+04	2.13E-01	2.11E+04
2.28E-01	1.64E+04	2.28E-01	1.72E+04	2.28E-01	1.80E+04	2.28E-01	1.95E+04	2.28E-01	2.02E+04

t = 35 [sec]		t = 36 [sec]		t = 37 [sec]		t = 38 [sec]		t = 39 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	6.36E+05	0.00E+00	6.64E+05	0.00E+00	7.27E+05	0.00E+00	7.63E+05	0.00E+00	7.96E+05
1.41E-05	6.15E+05	1.41E-05	6.41E+05	1.41E-05	7.02E+05	1.41E-05	7.37E+05	1.41E-05	7.68E+05
7.52E-05	5.13E+05	7.52E-05	5.35E+05	7.52E-05	5.86E+05	7.52E-05	6.14E+05	7.52E-05	6.41E+05
1.82E-04	4.17E+05	1.82E-04	4.34E+05	1.82E-04	4.75E+05	1.82E-04	4.98E+05	1.82E-04	5.19E+05
3.26E-04	3.00E+05	3.26E-04	3.13E+05	3.26E-04	3.43E+05	3.26E-04	3.60E+05	3.26E-04	3.75E+05
5.01E-04	2.12E+05	5.01E-04	2.20E+05	5.01E-04	2.40E+05	5.01E-04	2.50E+05	5.01E-04	2.60E+05
5.05E-03	5.01E+04	5.05E-03	5.12E+04	5.05E-03	5.36E+04	5.05E-03	5.47E+04	5.05E-03	5.57E+04
1.01E-02	4.37E+04	1.01E-02	4.47E+04	1.01E-02	4.68E+04	1.01E-02	4.79E+04	1.01E-02	4.89E+04
1.48E-02	4.37E+04	1.48E-02	4.48E+04	1.48E-02	4.70E+04	1.48E-02	4.82E+04	1.48E-02	4.92E+04
1.99E-02	4.32E+04	1.99E-02	4.44E+04	1.99E-02	4.66E+04	1.99E-02	4.78E+04	1.99E-02	4.89E+04
2.47E-02	4.25E+04	2.47E-02	4.37E+04	2.47E-02	4.59E+04	2.47E-02	4.71E+04	2.47E-02	4.82E+04
2.98E-02	4.17E+04	2.98E-02	4.28E+04	2.98E-02	4.50E+04	2.98E-02	4.62E+04	2.98E-02	4.73E+04
3.49E-02	4.08E+04	3.49E-02	4.19E+04	3.49E-02	4.41E+04	3.49E-02	4.52E+04	3.49E-02	4.63E+04
3.96E-02	3.99E+04	3.96E-02	4.10E+04	3.96E-02	4.32E+04	3.96E-02	4.43E+04	3.96E-02	4.53E+04
4.47E-02	3.90E+04	4.47E-02	4.01E+04	4.47E-02	4.22E+04	4.47E-02	4.33E+04	4.47E-02	4.43E+04
4.95E-02	3.82E+04	4.95E-02	3.92E+04	4.95E-02	4.14E+04	4.95E-02	4.24E+04	4.95E-02	4.34E+04
5.46E-02	3.73E+04	5.46E-02	3.84E+04	5.46E-02	4.04E+04	5.46E-02	4.15E+04	5.46E-02	4.24E+04
5.93E-02	3.65E+04	5.93E-02	3.76E+04	5.93E-02	3.96E+04	5.93E-02	4.06E+04	5.93E-02	4.16E+04
6.44E-02	3.57E+04	6.44E-02	3.67E+04	6.44E-02	3.88E+04	6.44E-02	3.98E+04	6.44E-02	4.07E+04
6.92E-02	3.50E+04	6.92E-02	3.60E+04	6.92E-02	3.80E+04	6.92E-02	3.90E+04	6.92E-02	3.99E+04
7.43E-02	3.43E+04	7.43E-02	3.53E+04	7.43E-02	3.73E+04	7.43E-02	3.83E+04	7.43E-02	3.92E+04
7.94E-02	3.37E+04	7.94E-02	3.46E+04	7.94E-02	3.66E+04	7.94E-02	3.76E+04	7.94E-02	3.85E+04
8.41E-02	3.31E+04	8.41E-02	3.40E+04	8.41E-02	3.60E+04	8.41E-02	3.69E+04	8.41E-02	3.78E+04
8.92E-02	2.65E+04	8.92E-02	2.72E+04	8.92E-02	2.87E+04	8.92E-02	2.95E+04	8.92E-02	3.02E+04
9.40E-02	2.57E+04	9.40E-02	2.64E+04	9.40E-02	2.79E+04	9.40E-02	2.86E+04	9.40E-02	2.93E+04
9.91E-02	2.50E+04	9.91E-02	2.57E+04	9.91E-02	2.72E+04	9.91E-02	2.79E+04	9.91E-02	2.85E+04
1.04E-01	2.45E+04	1.04E-01	2.51E+04	1.04E-01	2.65E+04	1.04E-01	2.72E+04	1.04E-01	2.79E+04
1.09E-01	2.40E+04	1.09E-01	2.47E+04	1.09E-01	2.60E+04	1.09E-01	2.67E+04	1.09E-01	2.74E+04
1.14E-01	2.36E+04	1.14E-01	2.43E+04	1.14E-01	2.56E+04	1.14E-01	2.63E+04	1.14E-01	2.70E+04
1.19E-01	2.32E+04	1.19E-01	2.39E+04	1.19E-01	2.52E+04	1.19E-01	2.59E+04	1.19E-01	2.65E+04
1.24E-01	2.29E+04	1.24E-01	2.36E+04	1.24E-01	2.49E+04	1.24E-01	2.56E+04	1.24E-01	2.62E+04
1.29E-01	2.27E+04	1.29E-01	2.33E+04	1.29E-01	2.47E+04	1.29E-01	2.53E+04	1.29E-01	2.59E+04
1.34E-01	2.25E+04	1.34E-01	2.32E+04	1.34E-01	2.45E+04	1.34E-01	2.51E+04	1.34E-01	2.58E+04
1.39E-01	2.25E+04	1.39E-01	2.31E+04	1.39E-01	2.44E+04	1.39E-01	2.51E+04	1.39E-01	2.57E+04
1.44E-01	2.24E+04	1.44E-01	2.30E+04	1.44E-01	2.43E+04	1.44E-01	2.50E+04	1.44E-01	2.56E+04
1.49E-01	2.23E+04	1.49E-01	2.29E+04	1.49E-01	2.42E+04	1.49E-01	2.49E+04	1.49E-01	2.55E+04
1.54E-01	2.22E+04	1.54E-01	2.29E+04	1.54E-01	2.42E+04	1.54E-01	2.48E+04	1.54E-01	2.55E+04
1.58E-01	2.22E+04	1.58E-01	2.28E+04	1.58E-01	2.41E+04	1.58E-01	2.48E+04	1.58E-01	2.54E+04
1.63E-01	2.21E+04	1.63E-01	2.28E+04	1.63E-01	2.41E+04	1.63E-01	2.48E+04	1.63E-01	2.54E+04
1.68E-01	2.20E+04	1.68E-01	2.26E+04	1.68E-01	2.40E+04	1.68E-01	2.46E+04	1.68E-01	2.52E+04
1.73E-01	2.19E+04	1.73E-01	2.25E+04	1.73E-01	2.38E+04	1.73E-01	2.45E+04	1.73E-01	2.51E+04
1.78E-01	1.79E+04	1.78E-01	1.84E+04	1.78E-01	1.94E+04	1.78E-01	1.99E+04	1.78E-01	2.04E+04
1.83E-01	1.75E+04	1.83E-01	1.80E+04	1.83E-01	1.90E+04	1.83E-01	1.95E+04	1.83E-01	1.99E+04
1.88E-01	1.72E+04	1.88E-01	1.77E+04	1.88E-01	1.87E+04	1.88E-01	1.92E+04	1.88E-01	1.96E+04
1.93E-01	1.70E+04	1.93E-01	1.75E+04	1.93E-01	1.84E+04	1.93E-01	1.89E+04	1.93E-01	1.94E+04
1.98E-01	1.68E+04	1.98E-01	1.72E+04	1.98E-01	1.82E+04	1.98E-01	1.87E+04	1.98E-01	1.91E+04
2.03E-01	2.25E+04	2.03E-01	2.32E+04	2.03E-01	2.47E+04	2.03E-01	2.54E+04	2.03E-01	2.61E+04
2.08E-01	2.22E+04	2.08E-01	2.29E+04	2.08E-01	2.44E+04	2.08E-01	2.51E+04	2.08E-01	2.57E+04
2.13E-01	2.18E+04	2.13E-01	2.25E+04	2.13E-01	2.39E+04	2.13E-01	2.46E+04	2.13E-01	2.52E+04
2.28E-01	2.09E+04	2.28E-01	2.15E+04	2.28E-01	2.29E+04	2.28E-01	2.35E+04	2.28E-01	2.42E+04

t = 40 [sec]		t = 41 [sec]		t = 42 [sec]		t = 43 [sec]		t = 44 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	8.79E+05	0.00E+00	9.21E+05	0.00E+00	9.79E+05	0.00E+00	1.05E+06	0.00E+00	1.13E+06
1.41E-05	8.48E+05	1.41E-05	8.89E+05	1.41E-05	9.44E+05	1.41E-05	1.02E+06	1.41E-05	1.09E+06
7.52E-05	7.07E+05	7.52E-05	7.41E+05	7.52E-05	7.86E+05	7.52E-05	8.53E+05	7.52E-05	9.04E+05
1.82E-04	5.71E+05	1.82E-04	5.98E+05	1.82E-04	6.35E+05	1.82E-04	6.88E+05	1.82E-04	7.37E+05
3.26E-04	4.14E+05	3.26E-04	4.35E+05	3.26E-04	4.62E+05	3.26E-04	5.02E+05	3.26E-04	5.40E+05
5.01E-04	2.86E+05	5.01E-04	2.99E+05	5.01E-04	3.16E+05	5.01E-04	3.42E+05	5.01E-04	3.66E+05
5.05E-03	5.84E+04	5.05E-03	5.99E+04	5.05E-03	6.19E+04	5.05E-03	6.50E+04	5.05E-03	6.92E+04
1.01E-02	5.13E+04	1.01E-02	5.25E+04	1.01E-02	5.45E+04	1.01E-02	5.69E+04	1.01E-02	5.97E+04
1.48E-02	5.19E+04	1.48E-02	5.34E+04	1.48E-02	5.57E+04	1.48E-02	5.82E+04	1.48E-02	6.07E+04
1.99E-02	5.15E+04	1.99E-02	5.30E+04	1.99E-02	5.54E+04	1.99E-02	5.80E+04	1.99E-02	6.05E+04
2.47E-02	5.08E+04	2.47E-02	5.22E+04	2.47E-02	5.45E+04	2.47E-02	5.71E+04	2.47E-02	5.95E+04
2.98E-02	4.98E+04	2.98E-02	5.12E+04	2.98E-02	5.34E+04	2.98E-02	5.60E+04	2.98E-02	5.82E+04
3.49E-02	4.87E+04	3.49E-02	5.00E+04	3.49E-02	5.22E+04	3.49E-02	5.47E+04	3.49E-02	5.68E+04
3.96E-02	4.77E+04	3.96E-02	4.90E+04	3.96E-02	5.11E+04	3.96E-02	5.35E+04	3.96E-02	5.55E+04
4.47E-02	4.66E+04	4.47E-02	4.79E+04	4.47E-02	5.00E+04	4.47E-02	5.23E+04	4.47E-02	5.42E+04
4.95E-02	4.57E+04	4.95E-02	4.69E+04	4.95E-02	4.90E+04	4.95E-02	5.12E+04	4.95E-02	5.31E+04
5.46E-02	4.47E+04	5.46E-02	4.59E+04	5.46E-02	4.79E+04	5.46E-02	5.00E+04	5.46E-02	5.19E+04
5.93E-02	4.37E+04	5.93E-02	4.49E+04	5.93E-02	4.69E+04	5.93E-02	4.90E+04	5.93E-02	5.08E+04
6.44E-02	4.28E+04	6.44E-02	4.40E+04	6.44E-02	4.59E+04	6.44E-02	4.79E+04	6.44E-02	4.97E+04
6.92E-02	4.20E+04	6.92E-02	4.32E+04	6.92E-02	4.51E+04	6.92E-02	4.71E+04	6.92E-02	4.88E+04
7.43E-02	4.12E+04	7.43E-02	4.24E+04	7.43E-02	4.42E+04	7.43E-02	4.62E+04	7.43E-02	4.79E+04
7.94E-02	4.05E+04	7.94E-02	4.16E+04	7.94E-02	4.34E+04	7.94E-02	4.53E+04	7.94E-02	4.71E+04
8.41E-02	3.98E+04	8.41E-02	4.09E+04	8.41E-02	4.27E+04	8.41E-02	4.46E+04	8.41E-02	4.64E+04
8.92E-02	3.20E+04	8.92E-02	3.29E+04	8.92E-02	3.43E+04	8.92E-02	3.60E+04	8.92E-02	3.76E+04
9.40E-02	3.09E+04	9.40E-02	3.18E+04	9.40E-02	3.32E+04	9.40E-02	3.48E+04	9.40E-02	3.63E+04
9.91E-02	3.01E+04	9.91E-02	3.10E+04	9.91E-02	3.24E+04	9.91E-02	3.39E+04	9.91E-02	3.54E+04
1.04E-01	2.94E+04	1.04E-01	3.03E+04	1.04E-01	3.16E+04	1.04E-01	3.32E+04	1.04E-01	3.46E+04
1.09E-01	2.89E+04	1.09E-01	2.97E+04	1.09E-01	3.10E+04	1.09E-01	3.25E+04	1.09E-01	3.40E+04
1.14E-01	2.85E+04	1.14E-01	2.93E+04	1.14E-01	3.05E+04	1.14E-01	3.20E+04	1.14E-01	3.35E+04
1.19E-01	2.80E+04	1.19E-01	2.88E+04	1.19E-01	3.00E+04	1.19E-01	3.15E+04	1.19E-01	3.30E+04
1.24E-01	2.76E+04	1.24E-01	2.84E+04	1.24E-01	2.97E+04	1.24E-01	3.11E+04	1.24E-01	3.25E+04
1.29E-01	2.74E+04	1.29E-01	2.81E+04	1.29E-01	2.94E+04	1.29E-01	3.08E+04	1.29E-01	3.22E+04
1.34E-01	2.72E+04	1.34E-01	2.80E+04	1.34E-01	2.92E+04	1.34E-01	3.06E+04	1.34E-01	3.21E+04
1.39E-01	2.71E+04	1.39E-01	2.79E+04	1.39E-01	2.91E+04	1.39E-01	3.05E+04	1.39E-01	3.19E+04
1.44E-01	2.70E+04	1.44E-01	2.77E+04	1.44E-01	2.90E+04	1.44E-01	3.04E+04	1.44E-01	3.18E+04
1.49E-01	2.69E+04	1.49E-01	2.77E+04	1.49E-01	2.89E+04	1.49E-01	3.03E+04	1.49E-01	3.17E+04
1.54E-01	2.69E+04	1.54E-01	2.76E+04	1.54E-01	2.88E+04	1.54E-01	3.02E+04	1.54E-01	3.16E+04
1.58E-01	2.68E+04	1.58E-01	2.76E+04	1.58E-01	2.88E+04	1.58E-01	3.02E+04	1.58E-01	3.16E+04
1.63E-01	2.68E+04	1.63E-01	2.75E+04	1.63E-01	2.87E+04	1.63E-01	3.01E+04	1.63E-01	3.15E+04
1.68E-01	2.66E+04	1.68E-01	2.74E+04	1.68E-01	2.86E+04	1.68E-01	3.00E+04	1.68E-01	3.13E+04
1.73E-01	2.65E+04	1.73E-01	2.72E+04	1.73E-01	2.84E+04	1.73E-01	2.98E+04	1.73E-01	3.12E+04
1.78E-01	2.16E+04	1.78E-01	2.22E+04	1.78E-01	2.32E+04	1.78E-01	2.44E+04	1.78E-01	2.56E+04
1.83E-01	2.10E+04	1.83E-01	2.16E+04	1.83E-01	2.26E+04	1.83E-01	2.37E+04	1.83E-01	2.49E+04
1.88E-01	2.07E+04	1.88E-01	2.13E+04	1.88E-01	2.23E+04	1.88E-01	2.34E+04	1.88E-01	2.45E+04
1.93E-01	2.05E+04	1.93E-01	2.11E+04	1.93E-01	2.20E+04	1.93E-01	2.31E+04	1.93E-01	2.42E+04
1.98E-01	2.02E+04	1.98E-01	2.08E+04	1.98E-01	2.17E+04	1.98E-01	2.28E+04	1.98E-01	2.39E+04
2.03E-01	2.76E+04	2.03E-01	2.84E+04	2.03E-01	2.97E+04	2.03E-01	3.12E+04	2.03E-01	3.26E+04
2.08E-01	2.72E+04	2.08E-01	2.80E+04	2.08E-01	2.93E+04	2.08E-01	3.08E+04	2.08E-01	3.22E+04
2.13E-01	2.67E+04	2.13E-01	2.75E+04	2.13E-01	2.88E+04	2.13E-01	3.02E+04	2.13E-01	3.16E+04
2.28E-01	2.55E+04	2.28E-01	2.63E+04	2.28E-01	2.75E+04	2.28E-01	2.89E+04	2.28E-01	3.03E+04

t = 45 [sec]		t = 46 [sec]		t = 47 [sec]		t = 48 [sec]		t = 49 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	1.20E+06	0.00E+00	1.27E+06	0.00E+00	1.34E+06	0.00E+00	1.41E+06	0.00E+00	1.48E+06
1.41E-05	1.16E+06	1.41E-05	1.23E+06	1.41E-05	1.29E+06	1.41E-05	1.36E+06	1.41E-05	1.42E+06
7.52E-05	9.63E+05	7.52E-05	1.02E+06	7.52E-05	1.08E+06	7.52E-05	1.13E+06	7.52E-05	1.18E+06
1.82E-04	7.81E+05	1.82E-04	8.21E+05	1.82E-04	8.65E+05	1.82E-04	9.08E+05	1.82E-04	9.51E+05
3.26E-04	5.74E+05	3.26E-04	6.08E+05	3.26E-04	6.40E+05	3.26E-04	6.68E+05	3.26E-04	7.00E+05
5.01E-04	3.88E+05	5.01E-04	4.10E+05	5.01E-04	4.31E+05	5.01E-04	4.52E+05	5.01E-04	4.72E+05
5.05E-03	7.32E+04	5.05E-03	7.73E+04	5.05E-03	8.15E+04	5.05E-03	8.57E+04	5.05E-03	9.00E+04
1.01E-02	6.24E+04	1.01E-02	6.49E+04	1.01E-02	6.74E+04	1.01E-02	6.98E+04	1.01E-02	7.21E+04
1.48E-02	6.31E+04	1.48E-02	6.54E+04	1.48E-02	6.75E+04	1.48E-02	6.96E+04	1.48E-02	7.15E+04
1.99E-02	6.27E+04	1.99E-02	6.48E+04	1.99E-02	6.67E+04	1.99E-02	6.84E+04	1.99E-02	7.00E+04
2.47E-02	6.17E+04	2.47E-02	6.37E+04	2.47E-02	6.55E+04	2.47E-02	6.70E+04	2.47E-02	6.85E+04
2.98E-02	6.02E+04	2.98E-02	6.21E+04	2.98E-02	6.39E+04	2.98E-02	6.55E+04	2.98E-02	6.69E+04
3.49E-02	5.87E+04	3.49E-02	6.05E+04	3.49E-02	6.22E+04	3.49E-02	6.37E+04	3.49E-02	6.51E+04
3.96E-02	5.74E+04	3.96E-02	5.91E+04	3.96E-02	6.07E+04	3.96E-02	6.21E+04	3.96E-02	6.34E+04
4.47E-02	5.60E+04	4.47E-02	5.77E+04	4.47E-02	5.92E+04	4.47E-02	6.06E+04	4.47E-02	6.18E+04
4.95E-02	5.48E+04	4.95E-02	5.64E+04	4.95E-02	5.79E+04	4.95E-02	5.92E+04	4.95E-02	6.04E+04
5.46E-02	5.36E+04	5.46E-02	5.52E+04	5.46E-02	5.66E+04	5.46E-02	5.79E+04	5.46E-02	5.91E+04
5.93E-02	5.25E+04	5.93E-02	5.40E+04	5.93E-02	5.54E+04	5.93E-02	5.67E+04	5.93E-02	5.79E+04
6.44E-02	5.14E+04	6.44E-02	5.30E+04	6.44E-02	5.44E+04	6.44E-02	5.57E+04	6.44E-02	5.70E+04
6.92E-02	5.05E+04	6.92E-02	5.20E+04	6.92E-02	5.35E+04	6.92E-02	5.48E+04	6.92E-02	5.61E+04
7.43E-02	4.96E+04	7.43E-02	5.11E+04	7.43E-02	5.26E+04	7.43E-02	5.40E+04	7.43E-02	5.52E+04
7.94E-02	4.88E+04	7.94E-02	5.03E+04	7.94E-02	5.18E+04	7.94E-02	5.32E+04	7.94E-02	5.45E+04
8.41E-02	4.80E+04	8.41E-02	4.96E+04	8.41E-02	5.11E+04	8.41E-02	5.25E+04	8.41E-02	5.38E+04
8.92E-02	3.90E+04	8.92E-02	4.04E+04	8.92E-02	4.17E+04	8.92E-02	4.28E+04	8.92E-02	4.39E+04
9.40E-02	3.77E+04	9.40E-02	3.91E+04	9.40E-02	4.04E+04	9.40E-02	4.16E+04	9.40E-02	4.28E+04
9.91E-02	3.68E+04	9.91E-02	3.81E+04	9.91E-02	3.94E+04	9.91E-02	4.07E+04	9.91E-02	4.18E+04
1.04E-01	3.60E+04	1.04E-01	3.73E+04	1.04E-01	3.86E+04	1.04E-01	3.99E+04	1.04E-01	4.11E+04
1.09E-01	3.54E+04	1.09E-01	3.67E+04	1.09E-01	3.80E+04	1.09E-01	3.93E+04	1.09E-01	4.04E+04
1.14E-01	3.49E+04	1.14E-01	3.62E+04	1.14E-01	3.74E+04	1.14E-01	3.86E+04	1.14E-01	3.98E+04
1.19E-01	3.43E+04	1.19E-01	3.56E+04	1.19E-01	3.69E+04	1.19E-01	3.82E+04	1.19E-01	3.93E+04
1.24E-01	3.39E+04	1.24E-01	3.52E+04	1.24E-01	3.65E+04	1.24E-01	3.78E+04	1.24E-01	3.89E+04
1.29E-01	3.36E+04	1.29E-01	3.49E+04	1.29E-01	3.62E+04	1.29E-01	3.74E+04	1.29E-01	3.86E+04
1.34E-01	3.34E+04	1.34E-01	3.47E+04	1.34E-01	3.60E+04	1.34E-01	3.72E+04	1.34E-01	3.84E+04
1.39E-01	3.33E+04	1.39E-01	3.46E+04	1.39E-01	3.58E+04	1.39E-01	3.70E+04	1.39E-01	3.82E+04
1.44E-01	3.31E+04	1.44E-01	3.44E+04	1.44E-01	3.57E+04	1.44E-01	3.69E+04	1.44E-01	3.81E+04
1.49E-01	3.30E+04	1.49E-01	3.44E+04	1.49E-01	3.56E+04	1.49E-01	3.69E+04	1.49E-01	3.80E+04
1.54E-01	3.30E+04	1.54E-01	3.43E+04	1.54E-01	3.55E+04	1.54E-01	3.68E+04	1.54E-01	3.80E+04
1.58E-01	3.29E+04	1.58E-01	3.42E+04	1.58E-01	3.54E+04	1.58E-01	3.67E+04	1.58E-01	3.78E+04
1.63E-01	3.28E+04	1.63E-01	3.41E+04	1.63E-01	3.54E+04	1.63E-01	3.66E+04	1.63E-01	3.77E+04
1.68E-01	3.27E+04	1.68E-01	3.39E+04	1.68E-01	3.52E+04	1.68E-01	3.64E+04	1.68E-01	3.75E+04
1.73E-01	3.25E+04	1.73E-01	3.38E+04	1.73E-01	3.50E+04	1.73E-01	3.62E+04	1.73E-01	3.74E+04
1.78E-01	2.67E+04	1.78E-01	2.79E+04	1.78E-01	2.93E+04	1.78E-01	3.07E+04	1.78E-01	3.18E+04
1.83E-01	2.60E+04	1.83E-01	2.72E+04	1.83E-01	2.83E+04	1.83E-01	2.93E+04	1.83E-01	3.03E+04
1.88E-01	2.57E+04	1.88E-01	2.69E+04	1.88E-01	2.79E+04	1.88E-01	2.89E+04	1.88E-01	2.99E+04
1.93E-01	2.55E+04	1.93E-01	2.65E+04	1.93E-01	2.76E+04	1.93E-01	2.86E+04	1.93E-01	2.96E+04
1.98E-01	2.51E+04	1.98E-01	2.62E+04	1.98E-01	2.72E+04	1.98E-01	2.82E+04	1.98E-01	2.92E+04
2.03E-01	3.40E+04	2.03E-01	3.54E+04	2.03E-01	3.67E+04	2.03E-01	3.80E+04	2.03E-01	3.92E+04
2.08E-01	3.36E+04	2.08E-01	3.50E+04	2.08E-01	3.63E+04	2.08E-01	3.75E+04	2.08E-01	3.89E+04
2.13E-01	3.30E+04	2.13E-01	3.43E+04	2.13E-01	3.56E+04	2.13E-01	3.68E+04	2.13E-01	3.82E+04
2.28E-01	3.16E+04	2.28E-01	3.28E+04	2.28E-01	3.42E+04	2.28E-01	3.54E+04	2.28E-01	3.66E+04

t = 50 [sec]		t = 51 [sec]		t = 52 [sec]		t = 53 [sec]		t = 54 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	1.60E+06	0.00E+00	1.68E+06	0.00E+00	1.82E+06	0.00E+00	1.90E+06	0.00E+00	2.03E+06
1.41E-05	1.54E+06	1.41E-05	1.63E+06	1.41E-05	1.75E+06	1.41E-05	1.84E+06	1.41E-05	1.96E+06
7.52E-05	1.28E+06	7.52E-05	1.36E+06	7.52E-05	1.46E+06	7.52E-05	1.53E+06	7.52E-05	1.62E+06
1.82E-04	1.03E+06	1.82E-04	1.09E+06	1.82E-04	1.18E+06	1.82E-04	1.24E+06	1.82E-04	1.31E+06
3.26E-04	7.59E+05	3.26E-04	8.05E+05	3.26E-04	8.72E+05	3.26E-04	9.13E+05	3.26E-04	9.72E+05
5.01E-04	5.06E+05	5.01E-04	5.35E+05	5.01E-04	5.78E+05	5.01E-04	6.04E+05	5.01E-04	6.42E+05
5.05E-03	9.72E+04	5.05E-03	1.01E+05	5.05E-03	1.07E+05	5.05E-03	1.10E+05	5.05E-03	1.16E+05
1.01E-02	7.60E+04	1.01E-02	7.84E+04	1.01E-02	8.22E+04	1.01E-02	8.46E+04	1.01E-02	8.81E+04
1.48E-02	7.48E+04	1.48E-02	7.71E+04	1.48E-02	8.06E+04	1.48E-02	8.29E+04	1.48E-02	8.63E+04
1.99E-02	7.28E+04	1.99E-02	7.51E+04	1.99E-02	7.84E+04	1.99E-02	8.06E+04	1.99E-02	8.38E+04
2.47E-02	7.10E+04	2.47E-02	7.32E+04	2.47E-02	7.65E+04	2.47E-02	7.86E+04	2.47E-02	8.16E+04
2.98E-02	6.92E+04	2.98E-02	7.14E+04	2.98E-02	7.45E+04	2.98E-02	7.65E+04	2.98E-02	7.94E+04
3.49E-02	6.74E+04	3.49E-02	6.95E+04	3.49E-02	7.25E+04	3.49E-02	7.45E+04	3.49E-02	7.72E+04
3.96E-02	6.56E+04	3.96E-02	6.77E+04	3.96E-02	7.07E+04	3.96E-02	7.26E+04	3.96E-02	7.53E+04
4.47E-02	6.39E+04	4.47E-02	6.59E+04	4.47E-02	6.88E+04	4.47E-02	7.06E+04	4.47E-02	7.33E+04
4.95E-02	6.25E+04	4.95E-02	6.44E+04	4.95E-02	6.72E+04	4.95E-02	6.90E+04	4.95E-02	7.16E+04
5.46E-02	6.11E+04	5.46E-02	6.31E+04	5.46E-02	6.58E+04	5.46E-02	6.75E+04	5.46E-02	7.00E+04
5.93E-02	6.00E+04	5.93E-02	6.19E+04	5.93E-02	6.45E+04	5.93E-02	6.63E+04	5.93E-02	6.87E+04
6.44E-02	5.90E+04	6.44E-02	6.09E+04	6.44E-02	6.35E+04	6.44E-02	6.52E+04	6.44E-02	6.76E+04
6.92E-02	5.82E+04	6.92E-02	6.00E+04	6.92E-02	6.26E+04	6.92E-02	6.43E+04	6.92E-02	6.67E+04
7.43E-02	5.74E+04	7.43E-02	5.92E+04	7.43E-02	6.18E+04	7.43E-02	6.35E+04	7.43E-02	6.58E+04
7.94E-02	5.67E+04	7.94E-02	5.85E+04	7.94E-02	6.10E+04	7.94E-02	6.27E+04	7.94E-02	6.51E+04
8.41E-02	5.60E+04	8.41E-02	5.78E+04	8.41E-02	6.04E+04	8.41E-02	6.20E+04	8.41E-02	6.44E+04
8.92E-02	4.59E+04	8.92E-02	4.75E+04	8.92E-02	4.98E+04	8.92E-02	5.12E+04	8.92E-02	5.34E+04
9.40E-02	4.48E+04	9.40E-02	4.64E+04	9.40E-02	4.86E+04	9.40E-02	5.00E+04	9.40E-02	5.21E+04
9.91E-02	4.39E+04	9.91E-02	4.54E+04	9.91E-02	4.76E+04	9.91E-02	4.90E+04	9.91E-02	5.11E+04
1.04E-01	4.31E+04	1.04E-01	4.46E+04	1.04E-01	4.68E+04	1.04E-01	4.82E+04	1.04E-01	5.02E+04
1.09E-01	4.25E+04	1.09E-01	4.40E+04	1.09E-01	4.61E+04	1.09E-01	4.75E+04	1.09E-01	4.96E+04
1.14E-01	4.18E+04	1.14E-01	4.33E+04	1.14E-01	4.55E+04	1.14E-01	4.68E+04	1.14E-01	4.88E+04
1.19E-01	4.13E+04	1.19E-01	4.28E+04	1.19E-01	4.49E+04	1.19E-01	4.63E+04	1.19E-01	4.83E+04
1.24E-01	4.09E+04	1.24E-01	4.24E+04	1.24E-01	4.45E+04	1.24E-01	4.59E+04	1.24E-01	4.78E+04
1.29E-01	4.06E+04	1.29E-01	4.21E+04	1.29E-01	4.42E+04	1.29E-01	4.55E+04	1.29E-01	4.74E+04
1.34E-01	4.04E+04	1.34E-01	4.18E+04	1.34E-01	4.39E+04	1.34E-01	4.52E+04	1.34E-01	4.72E+04
1.39E-01	4.02E+04	1.39E-01	4.16E+04	1.39E-01	4.37E+04	1.39E-01	4.50E+04	1.39E-01	4.69E+04
1.44E-01	4.01E+04	1.44E-01	4.15E+04	1.44E-01	4.36E+04	1.44E-01	4.49E+04	1.44E-01	4.68E+04
1.49E-01	4.00E+04	1.49E-01	4.15E+04	1.49E-01	4.35E+04	1.49E-01	4.48E+04	1.49E-01	4.67E+04
1.54E-01	4.00E+04	1.54E-01	4.14E+04	1.54E-01	4.34E+04	1.54E-01	4.47E+04	1.54E-01	4.66E+04
1.58E-01	3.98E+04	1.58E-01	4.13E+04	1.58E-01	4.33E+04	1.58E-01	4.46E+04	1.58E-01	4.65E+04
1.63E-01	3.97E+04	1.63E-01	4.11E+04	1.63E-01	4.32E+04	1.63E-01	4.45E+04	1.63E-01	4.64E+04
1.68E-01	3.95E+04	1.68E-01	4.10E+04	1.68E-01	4.30E+04	1.68E-01	4.43E+04	1.68E-01	4.61E+04
1.73E-01	3.94E+04	1.73E-01	4.08E+04	1.73E-01	4.27E+04	1.73E-01	4.40E+04	1.73E-01	4.59E+04
1.78E-01	3.37E+04	1.78E-01	3.49E+04	1.78E-01	3.68E+04	1.78E-01	3.81E+04	1.78E-01	3.99E+04
1.83E-01	3.20E+04	1.83E-01	3.32E+04	1.83E-01	3.49E+04	1.83E-01	3.61E+04	1.83E-01	3.77E+04
1.88E-01	3.16E+04	1.88E-01	3.28E+04	1.88E-01	3.45E+04	1.88E-01	3.56E+04	1.88E-01	3.72E+04
1.93E-01	3.12E+04	1.93E-01	3.24E+04	1.93E-01	3.41E+04	1.93E-01	3.52E+04	1.93E-01	3.68E+04
1.98E-01	3.08E+04	1.98E-01	3.20E+04	1.98E-01	3.37E+04	1.98E-01	3.48E+04	1.98E-01	3.64E+04
2.03E-01	4.13E+04	2.03E-01	4.28E+04	2.03E-01	4.49E+04	2.03E-01	4.62E+04	2.03E-01	4.81E+04
2.08E-01	4.10E+04	2.08E-01	4.25E+04	2.08E-01	4.45E+04	2.08E-01	4.59E+04	2.08E-01	4.78E+04
2.13E-01	4.03E+04	2.13E-01	4.17E+04	2.13E-01	4.38E+04	2.13E-01	4.51E+04	2.13E-01	4.70E+04
2.28E-01	3.86E+04	2.28E-01	4.00E+04	2.28E-01	4.19E+04	2.28E-01	4.32E+04	2.28E-01	4.50E+04

t = 55 [sec]		t = 56 [sec]		t = 57 [sec]		t = 58 [sec]		t = 59 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	2.15E+06	0.00E+00	2.27E+06	0.00E+00	2.40E+06	0.00E+00	2.46E+06	0.00E+00	2.65E+06
1.41E-05	2.07E+06	1.41E-05	2.19E+06	1.41E-05	2.31E+06	1.41E-05	2.37E+06	1.41E-05	2.55E+06
7.52E-05	1.72E+06	7.52E-05	1.82E+06	7.52E-05	1.94E+06	7.52E-05	1.97E+06	7.52E-05	2.12E+06
1.82E-04	1.39E+06	1.82E-04	1.47E+06	1.82E-04	1.58E+06	1.82E-04	1.61E+06	1.82E-04	1.73E+06
3.26E-04	1.03E+06	3.26E-04	1.08E+06	3.26E-04	1.04E+06	3.26E-04	1.06E+06	3.26E-04	1.14E+06
5.01E-04	6.79E+05	5.01E-04	7.16E+05	5.01E-04	7.23E+05	5.01E-04	7.39E+05	5.01E-04	7.90E+05
5.05E-03	1.21E+05	5.05E-03	1.26E+05	5.05E-03	1.32E+05	5.05E-03	1.35E+05	5.05E-03	1.40E+05
1.01E-02	9.14E+04	1.01E-02	9.46E+04	1.01E-02	9.83E+04	1.01E-02	1.01E+05	1.01E-02	1.03E+05
1.48E-02	8.93E+04	1.48E-02	9.23E+04	1.48E-02	9.54E+04	1.48E-02	9.78E+04	1.48E-02	9.98E+04
1.99E-02	8.67E+04	1.99E-02	8.94E+04	1.99E-02	9.23E+04	1.99E-02	9.47E+04	1.99E-02	9.63E+04
2.47E-02	8.45E+04	2.47E-02	8.71E+04	2.47E-02	8.99E+04	2.47E-02	9.22E+04	2.47E-02	9.37E+04
2.98E-02	8.22E+04	2.98E-02	8.48E+04	2.98E-02	8.74E+04	2.98E-02	8.97E+04	2.98E-02	9.12E+04
3.49E-02	7.99E+04	3.49E-02	8.23E+04	3.49E-02	8.49E+04	3.49E-02	8.72E+04	3.49E-02	8.87E+04
3.96E-02	7.78E+04	3.96E-02	8.02E+04	3.96E-02	8.28E+04	3.96E-02	8.50E+04	3.96E-02	8.64E+04
4.47E-02	7.59E+04	4.47E-02	7.83E+04	4.47E-02	8.07E+04	4.47E-02	8.28E+04	4.47E-02	8.42E+04
4.95E-02	7.41E+04	4.95E-02	7.64E+04	4.95E-02	7.88E+04	4.95E-02	8.10E+04	4.95E-02	8.23E+04
5.46E-02	7.24E+04	5.46E-02	7.46E+04	5.46E-02	7.70E+04	5.46E-02	7.91E+04	5.46E-02	8.05E+04
5.93E-02	7.10E+04	5.93E-02	7.32E+04	5.93E-02	7.56E+04	5.93E-02	7.77E+04	5.93E-02	7.91E+04
6.44E-02	6.99E+04	6.44E-02	7.21E+04	6.44E-02	7.45E+04	6.44E-02	7.65E+04	6.44E-02	7.79E+04
6.92E-02	6.90E+04	6.92E-02	7.12E+04	6.92E-02	7.36E+04	6.92E-02	7.55E+04	6.92E-02	7.69E+04
7.43E-02	6.81E+04	7.43E-02	7.03E+04	7.43E-02	7.26E+04	7.43E-02	7.46E+04	7.43E-02	7.60E+04
7.94E-02	6.73E+04	7.94E-02	6.94E+04	7.94E-02	7.18E+04	7.94E-02	7.38E+04	7.94E-02	7.52E+04
8.41E-02	6.66E+04	8.41E-02	6.87E+04	8.41E-02	7.11E+04	8.41E-02	7.31E+04	8.41E-02	7.45E+04
8.92E-02	5.54E+04	8.92E-02	5.74E+04	8.92E-02	5.95E+04	8.92E-02	6.12E+04	8.92E-02	6.27E+04
9.40E-02	5.41E+04	9.40E-02	5.61E+04	9.40E-02	5.82E+04	9.40E-02	5.98E+04	9.40E-02	6.13E+04
9.91E-02	5.31E+04	9.91E-02	5.50E+04	9.91E-02	5.71E+04	9.91E-02	5.87E+04	9.91E-02	6.02E+04
1.04E-01	5.22E+04	1.04E-01	5.41E+04	1.04E-01	5.62E+04	1.04E-01	5.77E+04	1.04E-01	5.92E+04
1.09E-01	5.15E+04	1.09E-01	5.34E+04	1.09E-01	5.54E+04	1.09E-01	5.70E+04	1.09E-01	5.85E+04
1.14E-01	5.07E+04	1.14E-01	5.26E+04	1.14E-01	5.46E+04	1.14E-01	5.62E+04	1.14E-01	5.76E+04
1.19E-01	5.02E+04	1.19E-01	5.20E+04	1.19E-01	5.40E+04	1.19E-01	5.55E+04	1.19E-01	5.70E+04
1.24E-01	4.97E+04	1.24E-01	5.15E+04	1.24E-01	5.35E+04	1.24E-01	5.50E+04	1.24E-01	5.65E+04
1.29E-01	4.93E+04	1.29E-01	5.11E+04	1.29E-01	5.31E+04	1.29E-01	5.46E+04	1.29E-01	5.61E+04
1.34E-01	4.90E+04	1.34E-01	5.08E+04	1.34E-01	5.28E+04	1.34E-01	5.43E+04	1.34E-01	5.58E+04
1.39E-01	4.89E+04	1.39E-01	5.06E+04	1.39E-01	5.26E+04	1.39E-01	5.41E+04	1.39E-01	5.56E+04
1.44E-01	4.86E+04	1.44E-01	5.04E+04	1.44E-01	5.23E+04	1.44E-01	5.38E+04	1.44E-01	5.53E+04
1.49E-01	4.85E+04	1.49E-01	5.03E+04	1.49E-01	5.22E+04	1.49E-01	5.37E+04	1.49E-01	5.51E+04
1.54E-01	4.84E+04	1.54E-01	5.02E+04	1.54E-01	5.20E+04	1.54E-01	5.36E+04	1.54E-01	5.50E+04
1.58E-01	4.83E+04	1.58E-01	5.00E+04	1.58E-01	5.19E+04	1.58E-01	5.34E+04	1.58E-01	5.48E+04
1.63E-01	4.82E+04	1.63E-01	4.99E+04	1.63E-01	5.18E+04	1.63E-01	5.33E+04	1.63E-01	5.47E+04
1.68E-01	4.79E+04	1.68E-01	4.96E+04	1.68E-01	5.14E+04	1.68E-01	5.29E+04	1.68E-01	5.43E+04
1.73E-01	4.76E+04	1.73E-01	4.93E+04	1.73E-01	5.11E+04	1.73E-01	5.26E+04	1.73E-01	5.40E+04
1.78E-01	4.15E+04	1.78E-01	4.32E+04	1.78E-01	4.50E+04	1.78E-01	4.64E+04	1.78E-01	4.81E+04
1.83E-01	3.93E+04	1.83E-01	4.08E+04	1.83E-01	4.24E+04	1.83E-01	4.38E+04	1.83E-01	4.52E+04
1.88E-01	3.88E+04	1.88E-01	4.03E+04	1.88E-01	4.19E+04	1.88E-01	4.33E+04	1.88E-01	4.47E+04
1.93E-01	3.83E+04	1.93E-01	3.98E+04	1.93E-01	4.16E+04	1.93E-01	4.29E+04	1.93E-01	4.42E+04
1.98E-01	3.79E+04	1.98E-01	3.95E+04	1.98E-01	4.11E+04	1.98E-01	4.23E+04	1.98E-01	4.36E+04
2.03E-01	5.00E+04	2.03E-01	5.17E+04	2.03E-01	5.35E+04	2.03E-01	5.51E+04	2.03E-01	5.64E+04
2.08E-01	4.96E+04	2.08E-01	5.13E+04	2.08E-01	5.31E+04	2.08E-01	5.48E+04	2.08E-01	5.60E+04
2.13E-01	4.88E+04	2.13E-01	5.05E+04	2.13E-01	5.22E+04	2.13E-01	5.38E+04	2.13E-01	5.51E+04
2.28E-01	4.67E+04	2.28E-01	4.84E+04	2.28E-01	5.01E+04	2.28E-01	5.16E+04	2.28E-01	5.28E+04

t = 60 [sec]		t = 61 [sec]		t = 62 [sec]		t = 63 [sec]		t = 64 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	2.74E+06	0.00E+00	2.97E+06	0.00E+00	3.19E+06	0.00E+00	3.35E+06	0.00E+00	3.56E+06
1.41E-05	2.64E+06	1.41E-05	2.86E+06	1.41E-05	3.07E+06	1.41E-05	3.22E+06	1.41E-05	3.42E+06
7.52E-05	2.19E+06	7.52E-05	2.38E+06	7.52E-05	2.55E+06	7.52E-05	2.67E+06	7.52E-05	2.84E+06
1.82E-04	1.77E+06	1.82E-04	1.91E+06	1.82E-04	2.05E+06	1.82E-04	2.14E+06	1.82E-04	2.27E+06
3.26E-04	1.18E+06	3.26E-04	1.28E+06	3.26E-04	1.37E+06	3.26E-04	1.44E+06	3.26E-04	1.53E+06
5.01E-04	8.17E+05	5.01E-04	8.84E+05	5.01E-04	9.47E+05	5.01E-04	9.93E+05	5.01E-04	1.05E+06
5.05E-03	1.43E+05	5.05E-03	1.51E+05	5.05E-03	1.60E+05	5.05E-03	1.66E+05	5.05E-03	1.74E+05
1.01E-02	1.06E+05	1.01E-02	1.10E+05	1.01E-02	1.15E+05	1.01E-02	1.19E+05	1.01E-02	1.24E+05
1.48E-02	1.02E+05	1.48E-02	1.06E+05	1.48E-02	1.11E+05	1.48E-02	1.14E+05	1.48E-02	1.19E+05
1.99E-02	9.88E+04	1.99E-02	1.02E+05	1.99E-02	1.06E+05	1.99E-02	1.09E+05	1.99E-02	1.13E+05
2.47E-02	9.61E+04	2.47E-02	9.93E+04	2.47E-02	1.03E+05	2.47E-02	1.06E+05	2.47E-02	1.10E+05
2.98E-02	9.35E+04	2.98E-02	9.67E+04	2.98E-02	1.00E+05	2.98E-02	1.03E+05	2.98E-02	1.07E+05
3.49E-02	9.10E+04	3.49E-02	9.40E+04	3.49E-02	9.76E+04	3.49E-02	1.00E+05	3.49E-02	1.03E+05
3.96E-02	8.86E+04	3.96E-02	9.16E+04	3.96E-02	9.50E+04	3.96E-02	9.75E+04	3.96E-02	1.01E+05
4.47E-02	8.64E+04	4.47E-02	8.92E+04	4.47E-02	9.26E+04	4.47E-02	9.50E+04	4.47E-02	9.81E+04
4.95E-02	8.45E+04	4.95E-02	8.73E+04	4.95E-02	9.06E+04	4.95E-02	9.28E+04	4.95E-02	9.59E+04
5.46E-02	8.26E+04	5.46E-02	8.54E+04	5.46E-02	8.86E+04	5.46E-02	9.09E+04	5.46E-02	9.39E+04
5.93E-02	8.12E+04	5.93E-02	8.40E+04	5.93E-02	8.72E+04	5.93E-02	8.96E+04	5.93E-02	9.25E+04
6.44E-02	8.00E+04	6.44E-02	8.28E+04	6.44E-02	8.61E+04	6.44E-02	8.84E+04	6.44E-02	9.14E+04
6.92E-02	7.90E+04	6.92E-02	8.18E+04	6.92E-02	8.51E+04	6.92E-02	8.74E+04	6.92E-02	9.04E+04
7.43E-02	7.81E+04	7.43E-02	8.09E+04	7.43E-02	8.42E+04	7.43E-02	8.65E+04	7.43E-02	8.95E+04
7.94E-02	7.73E+04	7.94E-02	8.01E+04	7.94E-02	8.34E+04	7.94E-02	8.57E+04	7.94E-02	8.87E+04
8.41E-02	7.66E+04	8.41E-02	7.94E+04	8.41E-02	8.27E+04	8.41E-02	8.50E+04	8.41E-02	8.80E+04
8.92E-02	6.45E+04	8.92E-02	6.71E+04	8.92E-02	7.00E+04	8.92E-02	7.22E+04	8.92E-02	7.50E+04
9.40E-02	6.30E+04	9.40E-02	6.56E+04	9.40E-02	6.85E+04	9.40E-02	7.06E+04	9.40E-02	7.34E+04
9.91E-02	6.19E+04	9.91E-02	6.45E+04	9.91E-02	6.74E+04	9.91E-02	6.94E+04	9.91E-02	7.22E+04
1.04E-01	6.09E+04	1.04E-01	6.35E+04	1.04E-01	6.64E+04	1.04E-01	6.85E+04	1.04E-01	7.12E+04
1.09E-01	6.02E+04	1.09E-01	6.28E+04	1.09E-01	6.56E+04	1.09E-01	6.77E+04	1.09E-01	7.05E+04
1.14E-01	5.95E+04	1.14E-01	6.20E+04	1.14E-01	6.49E+04	1.14E-01	6.69E+04	1.14E-01	6.96E+04
1.19E-01	5.88E+04	1.19E-01	6.13E+04	1.19E-01	6.41E+04	1.19E-01	6.62E+04	1.19E-01	6.89E+04
1.24E-01	5.82E+04	1.24E-01	6.08E+04	1.24E-01	6.36E+04	1.24E-01	6.57E+04	1.24E-01	6.83E+04
1.29E-01	5.78E+04	1.29E-01	6.03E+04	1.29E-01	6.32E+04	1.29E-01	6.52E+04	1.29E-01	6.79E+04
1.34E-01	5.75E+04	1.34E-01	6.00E+04	1.34E-01	6.28E+04	1.34E-01	6.49E+04	1.34E-01	6.75E+04
1.39E-01	5.73E+04	1.39E-01	5.98E+04	1.39E-01	6.26E+04	1.39E-01	6.46E+04	1.39E-01	6.73E+04
1.44E-01	5.69E+04	1.44E-01	5.94E+04	1.44E-01	6.22E+04	1.44E-01	6.43E+04	1.44E-01	6.69E+04
1.49E-01	5.68E+04	1.49E-01	5.93E+04	1.49E-01	6.21E+04	1.49E-01	6.41E+04	1.49E-01	6.67E+04
1.54E-01	5.66E+04	1.54E-01	5.91E+04	1.54E-01	6.19E+04	1.54E-01	6.39E+04	1.54E-01	6.65E+04
1.58E-01	5.65E+04	1.58E-01	5.89E+04	1.58E-01	6.17E+04	1.58E-01	6.37E+04	1.58E-01	6.63E+04
1.63E-01	5.63E+04	1.63E-01	5.88E+04	1.63E-01	6.15E+04	1.63E-01	6.35E+04	1.63E-01	6.61E+04
1.68E-01	5.59E+04	1.68E-01	5.83E+04	1.68E-01	6.11E+04	1.68E-01	6.30E+04	1.68E-01	6.56E+04
1.73E-01	5.56E+04	1.73E-01	5.80E+04	1.73E-01	6.07E+04	1.73E-01	6.26E+04	1.73E-01	6.52E+04
1.78E-01	5.05E+04	1.78E-01	5.30E+04	1.78E-01	5.57E+04	1.78E-01	5.77E+04	1.78E-01	6.03E+04
1.83E-01	4.66E+04	1.83E-01	4.88E+04	1.83E-01	5.12E+04	1.83E-01	5.30E+04	1.83E-01	5.53E+04
1.88E-01	4.60E+04	1.88E-01	4.82E+04	1.88E-01	5.06E+04	1.88E-01	5.23E+04	1.88E-01	5.46E+04
1.93E-01	4.56E+04	1.93E-01	4.77E+04	1.93E-01	5.01E+04	1.93E-01	5.18E+04	1.93E-01	5.41E+04
1.98E-01	4.50E+04	1.98E-01	4.71E+04	1.98E-01	4.95E+04	1.98E-01	5.12E+04	1.98E-01	5.34E+04
2.03E-01	5.81E+04	2.03E-01	6.05E+04	2.03E-01	6.33E+04	2.03E-01	6.52E+04	2.03E-01	6.78E+04
2.08E-01	5.78E+04	2.08E-01	6.02E+04	2.08E-01	6.29E+04	2.08E-01	6.49E+04	2.08E-01	6.74E+04
2.13E-01	5.68E+04	2.13E-01	5.92E+04	2.13E-01	6.19E+04	2.13E-01	6.38E+04	2.13E-01	6.63E+04
2.28E-01	5.45E+04	2.28E-01	5.68E+04	2.28E-01	5.94E+04	2.28E-01	6.16E+04	2.28E-01	6.40E+04

t = 65 [sec]		t = 66 [sec]		t = 67 [sec]		t = 68 [sec]		t = 69 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	3.77E+06	0.00E+00	3.95E+06	0.00E+00	4.17E+06	0.00E+00	4.48E+06	0.00E+00	4.75E+06
1.41E-05	3.62E+06	1.41E-05	3.80E+06	1.41E-05	4.01E+06	1.41E-05	4.31E+06	1.41E-05	4.57E+06
7.52E-05	3.00E+06	7.52E-05	3.23E+06	7.52E-05	3.33E+06	7.52E-05	3.58E+06	7.52E-05	3.79E+06
1.82E-04	2.40E+06	1.82E-04	2.58E+06	1.82E-04	2.71E+06	1.82E-04	2.87E+06	1.82E-04	3.00E+06
3.26E-04	1.62E+06	3.26E-04	1.75E+06	3.26E-04	1.85E+06	3.26E-04	1.99E+06	3.26E-04	2.11E+06
5.01E-04	1.11E+06	5.01E-04	1.20E+06	5.01E-04	1.26E+06	5.01E-04	1.36E+06	5.01E-04	1.44E+06
5.05E-03	1.82E+05	5.05E-03	1.93E+05	5.05E-03	2.03E+05	5.05E-03	2.15E+05	5.05E-03	2.26E+05
1.01E-02	1.28E+05	1.01E-02	1.34E+05	1.01E-02	1.40E+05	1.01E-02	1.48E+05	1.01E-02	1.55E+05
1.48E-02	1.23E+05	1.48E-02	1.28E+05	1.48E-02	1.33E+05	1.48E-02	1.40E+05	1.48E-02	1.46E+05
1.99E-02	1.17E+05	1.99E-02	1.22E+05	1.99E-02	1.26E+05	1.99E-02	1.32E+05	1.99E-02	1.38E+05
2.47E-02	1.13E+05	2.47E-02	1.18E+05	2.47E-02	1.22E+05	2.47E-02	1.27E+05	2.47E-02	1.32E+05
2.98E-02	1.10E+05	2.98E-02	1.14E+05	2.98E-02	1.18E+05	2.98E-02	1.23E+05	2.98E-02	1.28E+05
3.49E-02	1.07E+05	3.49E-02	1.11E+05	3.49E-02	1.14E+05	3.49E-02	1.19E+05	3.49E-02	1.24E+05
3.96E-02	1.04E+05	3.96E-02	1.08E+05	3.96E-02	1.11E+05	3.96E-02	1.16E+05	3.96E-02	1.20E+05
4.47E-02	1.01E+05	4.47E-02	1.05E+05	4.47E-02	1.08E+05	4.47E-02	1.13E+05	4.47E-02	1.17E+05
4.95E-02	9.89E+04	4.95E-02	1.03E+05	4.95E-02	1.06E+05	4.95E-02	1.10E+05	4.95E-02	1.14E+05
5.46E-02	9.68E+04	5.46E-02	1.00E+05	5.46E-02	1.04E+05	5.46E-02	1.08E+05	5.46E-02	1.12E+05
5.93E-02	9.55E+04	5.93E-02	9.90E+04	5.93E-02	1.02E+05	5.93E-02	1.07E+05	5.93E-02	1.11E+05
6.44E-02	9.44E+04	6.44E-02	9.79E+04	6.44E-02	1.01E+05	6.44E-02	1.06E+05	6.44E-02	1.09E+05
6.92E-02	9.34E+04	6.92E-02	9.70E+04	6.92E-02	1.00E+05	6.92E-02	1.05E+05	6.92E-02	1.09E+05
7.43E-02	9.25E+04	7.43E-02	9.61E+04	7.43E-02	9.95E+04	7.43E-02	1.04E+05	7.43E-02	1.08E+05
7.94E-02	9.17E+04	7.94E-02	9.53E+04	7.94E-02	9.87E+04	7.94E-02	1.03E+05	7.94E-02	1.07E+05
8.41E-02	9.10E+04	8.41E-02	9.46E+04	8.41E-02	9.80E+04	8.41E-02	1.02E+05	8.41E-02	1.06E+05
8.92E-02	7.77E+04	8.92E-02	8.10E+04	8.92E-02	8.42E+04	8.92E-02	8.89E+04	8.92E-02	9.33E+04
9.40E-02	7.62E+04	9.40E-02	7.94E+04	9.40E-02	8.26E+04	9.40E-02	8.66E+04	9.40E-02	9.03E+04
9.91E-02	7.50E+04	9.91E-02	7.82E+04	9.91E-02	8.13E+04	9.91E-02	8.53E+04	9.91E-02	8.90E+04
1.04E-01	7.40E+04	1.04E-01	7.72E+04	1.04E-01	8.03E+04	1.04E-01	8.43E+04	1.04E-01	8.80E+04
1.09E-01	7.32E+04	1.09E-01	7.64E+04	1.09E-01	7.95E+04	1.09E-01	8.35E+04	1.09E-01	8.72E+04
1.14E-01	7.24E+04	1.14E-01	7.56E+04	1.14E-01	7.86E+04	1.14E-01	8.26E+04	1.14E-01	8.63E+04
1.19E-01	7.16E+04	1.19E-01	7.48E+04	1.19E-01	7.78E+04	1.19E-01	8.18E+04	1.19E-01	8.54E+04
1.24E-01	7.10E+04	1.24E-01	7.42E+04	1.24E-01	7.73E+04	1.24E-01	8.12E+04	1.24E-01	8.48E+04
1.29E-01	7.06E+04	1.29E-01	7.37E+04	1.29E-01	7.67E+04	1.29E-01	8.07E+04	1.29E-01	8.43E+04
1.34E-01	7.02E+04	1.34E-01	7.33E+04	1.34E-01	7.63E+04	1.34E-01	8.03E+04	1.34E-01	8.38E+04
1.39E-01	6.99E+04	1.39E-01	7.31E+04	1.39E-01	7.60E+04	1.39E-01	8.00E+04	1.39E-01	8.35E+04
1.44E-01	6.96E+04	1.44E-01	7.27E+04	1.44E-01	7.57E+04	1.44E-01	7.95E+04	1.44E-01	8.31E+04
1.49E-01	6.94E+04	1.49E-01	7.25E+04	1.49E-01	7.55E+04	1.49E-01	7.94E+04	1.49E-01	8.29E+04
1.54E-01	6.91E+04	1.54E-01	7.23E+04	1.54E-01	7.53E+04	1.54E-01	7.91E+04	1.54E-01	8.29E+04
1.58E-01	6.89E+04	1.58E-01	7.20E+04	1.58E-01	7.50E+04	1.58E-01	7.89E+04	1.58E-01	8.27E+04
1.63E-01	6.86E+04	1.63E-01	7.18E+04	1.63E-01	7.47E+04	1.63E-01	7.88E+04	1.63E-01	8.24E+04
1.68E-01	6.81E+04	1.68E-01	7.12E+04	1.68E-01	7.42E+04	1.68E-01	7.82E+04	1.68E-01	8.17E+04
1.73E-01	6.77E+04	1.73E-01	7.09E+04	1.73E-01	7.38E+04	1.73E-01	7.77E+04	1.73E-01	8.12E+04
1.78E-01	6.27E+04	1.78E-01	6.57E+04	1.78E-01	6.86E+04	1.78E-01	7.29E+04	1.78E-01	7.68E+04
1.83E-01	5.75E+04	1.83E-01	6.03E+04	1.83E-01	6.29E+04	1.83E-01	6.65E+04	1.83E-01	6.98E+04
1.88E-01	5.69E+04	1.88E-01	5.96E+04	1.88E-01	6.22E+04	1.88E-01	6.57E+04	1.88E-01	6.90E+04
1.93E-01	5.63E+04	1.93E-01	5.90E+04	1.93E-01	6.16E+04	1.93E-01	6.51E+04	1.93E-01	6.80E+04
1.98E-01	5.56E+04	1.98E-01	5.83E+04	1.98E-01	6.09E+04	1.98E-01	6.38E+04	1.98E-01	6.69E+04
2.03E-01	7.04E+04	2.03E-01	7.35E+04	2.03E-01	7.63E+04	2.03E-01	8.01E+04	2.03E-01	8.36E+04
2.08E-01	7.00E+04	2.08E-01	7.30E+04	2.08E-01	7.59E+04	2.08E-01	8.01E+04	2.08E-01	8.36E+04
2.13E-01	6.92E+04	2.13E-01	7.22E+04	2.13E-01	7.51E+04	2.13E-01	7.89E+04	2.13E-01	8.25E+04
2.28E-01	6.64E+04	2.28E-01	6.94E+04	2.28E-01	7.21E+04	2.28E-01	7.58E+04	2.28E-01	7.93E+04

t = 70 [sec]		t = 71 [sec]		t = 72 [sec]		t = 73 [sec]		t = 74 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	4.93E+06	0.00E+00	5.26E+06	0.00E+00	5.70E+06	0.00E+00	5.92E+06	0.00E+00	6.31E+06
1.41E-05	4.74E+06	1.41E-05	5.06E+06	1.41E-05	5.48E+06	1.41E-05	5.69E+06	1.41E-05	6.06E+06
7.52E-05	3.99E+06	7.52E-05	4.20E+06	7.52E-05	4.54E+06	7.52E-05	4.80E+06	7.52E-05	5.03E+06
1.82E-04	3.17E+06	1.82E-04	3.36E+06	1.82E-04	3.58E+06	1.82E-04	3.78E+06	1.82E-04	4.02E+06
3.26E-04	2.23E+06	3.26E-04	2.34E+06	3.26E-04	2.54E+06	3.26E-04	2.68E+06	3.26E-04	2.83E+06
5.01E-04	1.52E+06	5.01E-04	1.62E+06	5.01E-04	1.73E+06	5.01E-04	1.81E+06	5.01E-04	1.93E+06
5.05E-03	2.36E+05	5.05E-03	2.50E+05	5.05E-03	2.68E+05	5.05E-03	2.81E+05	5.05E-03	2.98E+05
1.01E-02	1.61E+05	1.01E-02	1.68E+05	1.01E-02	1.79E+05	1.01E-02	1.87E+05	1.01E-02	1.97E+05
1.48E-02	1.51E+05	1.48E-02	1.57E+05	1.48E-02	1.66E+05	1.48E-02	1.73E+05	1.48E-02	1.81E+05
1.99E-02	1.42E+05	1.99E-02	1.48E+05	1.99E-02	1.56E+05	1.99E-02	1.61E+05	1.99E-02	1.69E+05
2.47E-02	1.37E+05	2.47E-02	1.42E+05	2.47E-02	1.49E+05	2.47E-02	1.54E+05	2.47E-02	1.61E+05
2.98E-02	1.32E+05	2.98E-02	1.37E+05	2.98E-02	1.43E+05	2.98E-02	1.48E+05	2.98E-02	1.54E+05
3.49E-02	1.27E+05	3.49E-02	1.32E+05	3.49E-02	1.38E+05	3.49E-02	1.43E+05	3.49E-02	1.49E+05
3.96E-02	1.24E+05	3.96E-02	1.28E+05	3.96E-02	1.34E+05	3.96E-02	1.39E+05	3.96E-02	1.44E+05
4.47E-02	1.20E+05	4.47E-02	1.25E+05	4.47E-02	1.31E+05	4.47E-02	1.35E+05	4.47E-02	1.40E+05
4.95E-02	1.18E+05	4.95E-02	1.22E+05	4.95E-02	1.28E+05	4.95E-02	1.32E+05	4.95E-02	1.37E+05
5.46E-02	1.15E+05	5.46E-02	1.19E+05	5.46E-02	1.25E+05	5.46E-02	1.29E+05	5.46E-02	1.34E+05
5.93E-02	1.14E+05	5.93E-02	1.18E+05	5.93E-02	1.24E+05	5.93E-02	1.28E+05	5.93E-02	1.33E+05
6.44E-02	1.13E+05	6.44E-02	1.17E+05	6.44E-02	1.23E+05	6.44E-02	1.27E+05	6.44E-02	1.32E+05
6.92E-02	1.12E+05	6.92E-02	1.16E+05	6.92E-02	1.22E+05	6.92E-02	1.26E+05	6.92E-02	1.31E+05
7.43E-02	1.11E+05	7.43E-02	1.15E+05	7.43E-02	1.21E+05	7.43E-02	1.25E+05	7.43E-02	1.31E+05
7.94E-02	1.10E+05	7.94E-02	1.15E+05	7.94E-02	1.21E+05	7.94E-02	1.25E+05	7.94E-02	1.30E+05
8.41E-02	1.10E+05	8.41E-02	1.14E+05	8.41E-02	1.20E+05	8.41E-02	1.24E+05	8.41E-02	1.30E+05
8.92E-02	9.67E+04	8.92E-02	1.01E+05	8.92E-02	1.07E+05	8.92E-02	1.11E+05	8.92E-02	1.16E+05
9.40E-02	9.34E+04	9.40E-02	9.73E+04	9.40E-02	1.03E+05	9.40E-02	1.07E+05	9.40E-02	1.12E+05
9.91E-02	9.21E+04	9.91E-02	9.60E+04	9.91E-02	1.01E+05	9.91E-02	1.05E+05	9.91E-02	1.10E+05
1.04E-01	9.11E+04	1.04E-01	9.50E+04	1.04E-01	1.00E+05	1.04E-01	1.04E+05	1.04E-01	1.09E+05
1.09E-01	9.03E+04	1.09E-01	9.42E+04	1.09E-01	9.96E+04	1.09E-01	1.03E+05	1.09E-01	1.08E+05
1.14E-01	8.94E+04	1.14E-01	9.33E+04	1.14E-01	9.87E+04	1.14E-01	1.03E+05	1.14E-01	1.08E+05
1.19E-01	8.85E+04	1.19E-01	9.23E+04	1.19E-01	9.78E+04	1.19E-01	1.02E+05	1.19E-01	1.06E+05
1.24E-01	8.79E+04	1.24E-01	9.17E+04	1.24E-01	9.71E+04	1.24E-01	1.01E+05	1.24E-01	1.06E+05
1.29E-01	8.73E+04	1.29E-01	9.12E+04	1.29E-01	9.65E+04	1.29E-01	1.00E+05	1.29E-01	1.05E+05
1.34E-01	8.69E+04	1.34E-01	9.07E+04	1.34E-01	9.60E+04	1.34E-01	9.98E+04	1.34E-01	1.05E+05
1.39E-01	8.66E+04	1.39E-01	9.04E+04	1.39E-01	9.57E+04	1.39E-01	9.95E+04	1.39E-01	1.04E+05
1.44E-01	8.61E+04	1.44E-01	8.99E+04	1.44E-01	9.53E+04	1.44E-01	9.91E+04	1.44E-01	1.04E+05
1.49E-01	8.60E+04	1.49E-01	8.98E+04	1.49E-01	9.51E+04	1.49E-01	9.89E+04	1.49E-01	1.04E+05
1.54E-01	8.59E+04	1.54E-01	8.97E+04	1.54E-01	9.50E+04	1.54E-01	9.88E+04	1.54E-01	1.04E+05
1.58E-01	8.57E+04	1.58E-01	8.94E+04	1.58E-01	9.48E+04	1.58E-01	9.85E+04	1.58E-01	1.03E+05
1.63E-01	8.54E+04	1.63E-01	8.92E+04	1.63E-01	9.45E+04	1.63E-01	9.82E+04	1.63E-01	1.03E+05
1.68E-01	8.48E+04	1.68E-01	8.85E+04	1.68E-01	9.38E+04	1.68E-01	9.75E+04	1.68E-01	1.02E+05
1.73E-01	8.42E+04	1.73E-01	8.79E+04	1.73E-01	9.32E+04	1.73E-01	9.69E+04	1.73E-01	1.02E+05
1.78E-01	7.98E+04	1.78E-01	8.35E+04	1.78E-01	8.94E+04	1.78E-01	9.33E+04	1.78E-01	9.81E+04
1.83E-01	7.25E+04	1.83E-01	7.59E+04	1.83E-01	8.07E+04	1.83E-01	8.42E+04	1.83E-01	8.78E+04
1.88E-01	7.17E+04	1.88E-01	7.47E+04	1.88E-01	7.90E+04	1.88E-01	8.24E+04	1.88E-01	8.67E+04
1.93E-01	7.04E+04	1.93E-01	7.37E+04	1.93E-01	7.83E+04	1.93E-01	8.17E+04	1.93E-01	8.58E+04
1.98E-01	6.95E+04	1.98E-01	7.28E+04	1.98E-01	7.73E+04	1.98E-01	8.07E+04	1.98E-01	8.48E+04
2.03E-01	8.66E+04	2.03E-01	9.02E+04	2.03E-01	9.54E+04	2.03E-01	9.92E+04	2.03E-01	1.04E+05
2.08E-01	8.67E+04	2.08E-01	9.03E+04	2.08E-01	9.56E+04	2.08E-01	9.94E+04	2.08E-01	1.04E+05
2.13E-01	8.55E+04	2.13E-01	8.91E+04	2.13E-01	9.44E+04	2.13E-01	9.81E+04	2.13E-01	1.03E+05
2.28E-01	8.22E+04	2.28E-01	8.57E+04	2.28E-01	9.08E+04	2.28E-01	9.45E+04	2.28E-01	9.89E+04

t = 75 [sec]		t = 76 [sec]	
x[m]	q[W/m2]	x[m]	q[W/m2]
0.00E+00	6.64E+06	0.00E+00	6.87E+06
1.41E-05	6.37E+06	1.41E-05	6.60E+06
7.52E-05	5.29E+06	7.52E-05	5.58E+06
1.82E-04	4.16E+06	1.82E-04	4.38E+06
3.26E-04	2.96E+06	3.26E-04	3.12E+06
5.01E-04	2.02E+06	5.01E-04	2.11E+06
5.05E-03	3.14E+05	5.05E-03	3.30E+05
1.01E-02	2.06E+05	1.01E-02	2.14E+05
1.48E-02	1.89E+05	1.48E-02	1.96E+05
1.99E-02	1.75E+05	1.99E-02	1.81E+05
2.47E-02	1.67E+05	2.47E-02	1.72E+05
2.98E-02	1.60E+05	2.98E-02	1.65E+05
3.49E-02	1.54E+05	3.49E-02	1.59E+05
3.96E-02	1.49E+05	3.96E-02	1.54E+05
4.47E-02	1.45E+05	4.47E-02	1.50E+05
4.95E-02	1.42E+05	4.95E-02	1.46E+05
5.46E-02	1.39E+05	5.46E-02	1.43E+05
5.93E-02	1.38E+05	5.93E-02	1.42E+05
6.44E-02	1.37E+05	6.44E-02	1.41E+05
6.92E-02	1.36E+05	6.92E-02	1.40E+05
7.43E-02	1.35E+05	7.43E-02	1.40E+05
7.94E-02	1.35E+05	7.94E-02	1.39E+05
8.41E-02	1.35E+05	8.41E-02	1.39E+05
8.92E-02	1.21E+05	8.92E-02	1.26E+05
9.40E-02	1.16E+05	9.40E-02	1.20E+05
9.91E-02	1.15E+05	9.91E-02	1.19E+05
1.04E-01	1.14E+05	1.04E-01	1.18E+05
1.09E-01	1.13E+05	1.09E-01	1.17E+05
1.14E-01	1.12E+05	1.14E-01	1.16E+05
1.19E-01	1.11E+05	1.19E-01	1.15E+05
1.24E-01	1.10E+05	1.24E-01	1.14E+05
1.29E-01	1.10E+05	1.29E-01	1.14E+05
1.34E-01	1.09E+05	1.34E-01	1.13E+05
1.39E-01	1.09E+05	1.39E-01	1.13E+05
1.44E-01	1.09E+05	1.44E-01	1.13E+05
1.49E-01	1.08E+05	1.49E-01	1.12E+05
1.54E-01	1.08E+05	1.54E-01	1.12E+05
1.58E-01	1.08E+05	1.58E-01	1.12E+05
1.63E-01	1.08E+05	1.63E-01	1.12E+05
1.68E-01	1.07E+05	1.68E-01	1.11E+05
1.73E-01	1.06E+05	1.73E-01	1.10E+05
1.78E-01	1.03E+05	1.78E-01	1.07E+05
1.83E-01	9.15E+04	1.83E-01	9.52E+04
1.88E-01	9.05E+04	1.88E-01	9.41E+04
1.93E-01	8.97E+04	1.93E-01	9.33E+04
1.98E-01	8.86E+04	1.98E-01	9.22E+04
2.03E-01	1.08E+05	2.03E-01	1.12E+05
2.08E-01	1.09E+05	2.08E-01	1.13E+05
2.13E-01	1.07E+05	2.13E-01	1.11E+05
2.28E-01	1.03E+05	2.28E-01	1.07E+05

Appendix D: Structural Loads

Hyper-X Structural Loads [Moses, 1998]						
Case ID	Time [seconds]	Dynamic Pressures [MPa]	Mean Angle of Attack [degrees]	Normal Load (Perpendicular to center line of assembly) [g's]	Axial Load (Aligned with center line of assembly) [g's]	Description
B-1	17	28.776	17.3	-2.37	3.08	Maximum Pull-up
B-3	76	74.358	-1.37	.42	8.26	Maximum Axial Acceleration

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13. ABSTRACT (Maximum 200 words) NASA Glenn Research Center was contacted to provide technical support to NASA Ames Research Center in the design and analysis of an ultra high temperature ceramic (UHTC) leading edge. UHTC materials are being considered for reusable launch vehicles because their high temperature capability may allow for un-cooled sharp leading edge designs. While ceramic materials have the design benefit of allowing subcomponents to run hot, they also provide a design challenge in that they invariably must be in contact with cooler subcomponents elsewhere in the structure. NASA Glenn Research Center proposed a modification to an existing attachment design. Thermal and structural analyses of the leading edge assembly were carried out using ABAQUS finite element software. Final results showed that the proposed modifications aided in thermally isolating hot and cold subcomponents and reducing bearing stresses at the attachment location.				
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