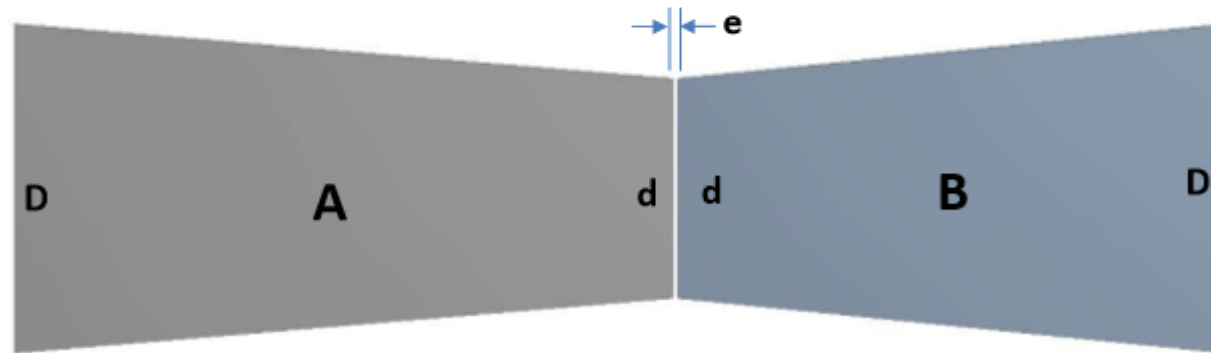


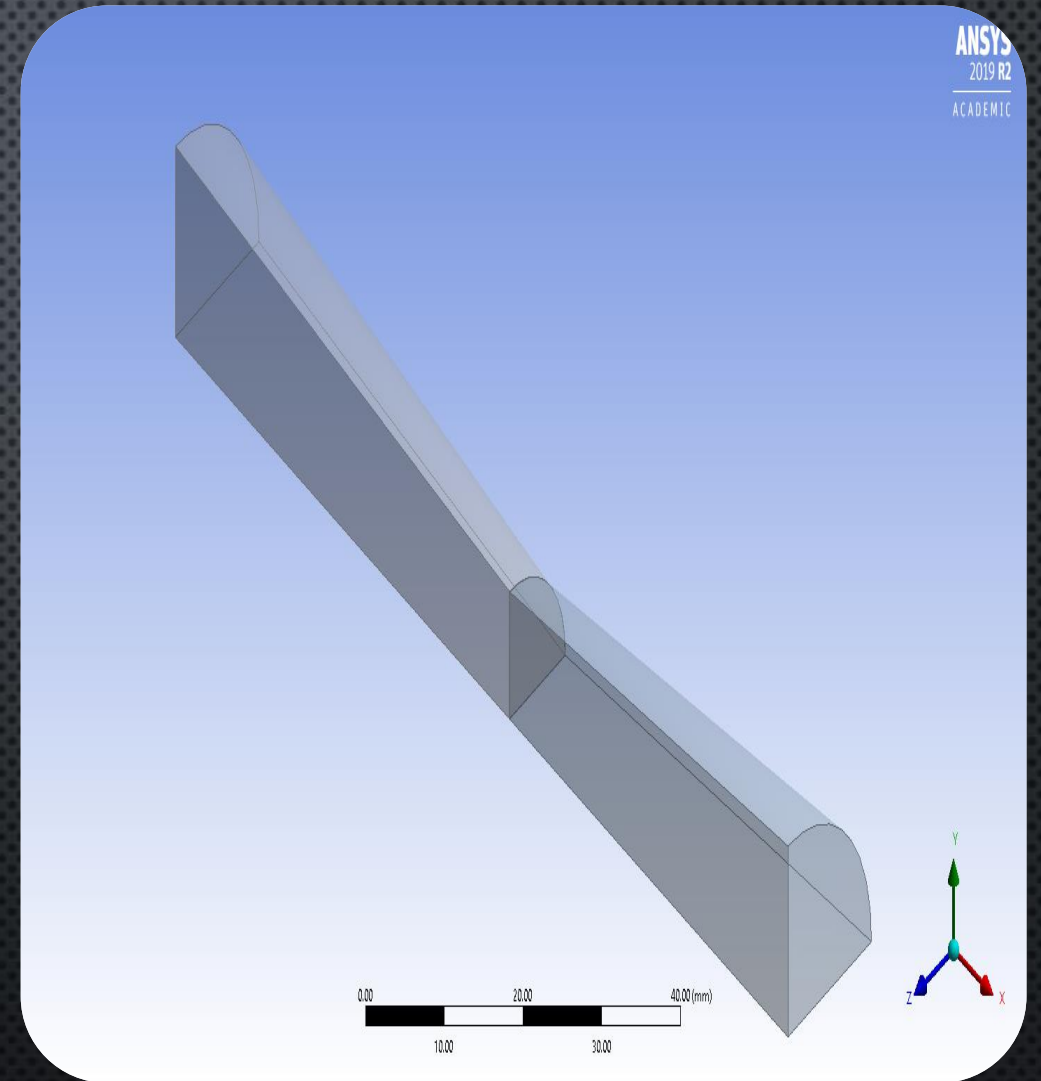
# ASSIGNMENT 12

## Problem -1

At room temperature  $22^{\circ}\text{C}$  a gap of “ $e$ ” mm exists between ends of the shown two conical steel rods. Rod **A** is 60 mm length and Rod **B** is 50 mm length. Both cones have large diameter 30 mm and small diameter of 20 mm. The working environment of these rods is expected to be  $(150^{\circ}\text{C} - 250^{\circ}\text{C})$ . It is required to find the relation between the environment temperature and the contact pressure between the Rods ends at different gap distance. Consider the gap distance between 0.05 to 0.35 mm.



# Geometry





# Mesh

Details of "Mesh" ▾ □ ×

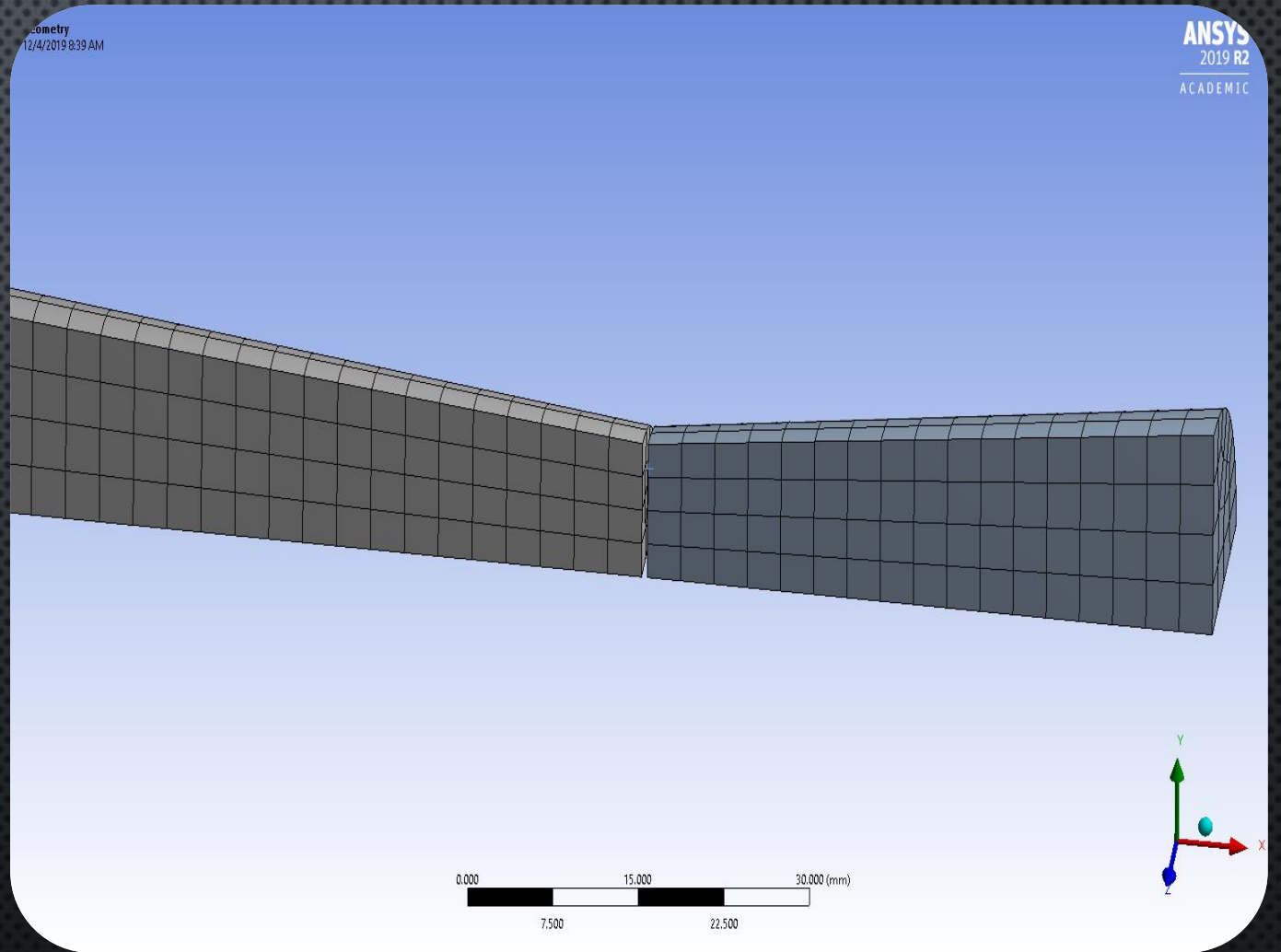
- [-] **Display**

Display Style	Use Geometry Setting
---------------	----------------------
- [-] **Defaults**

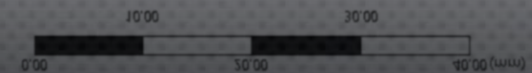
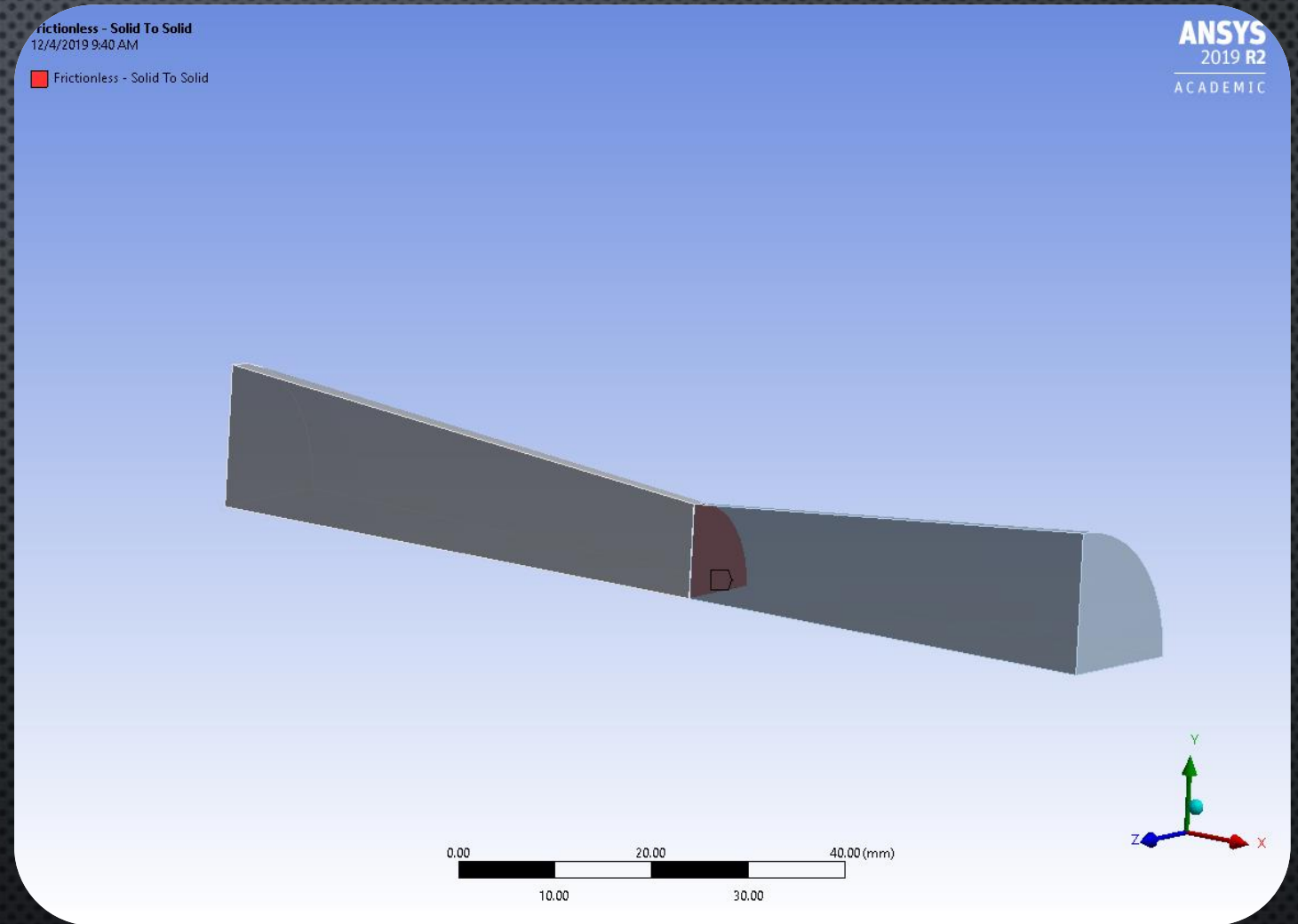
Physics Preference	Nonlinear Mechanical
Element Order	Program Controlled
<input type="checkbox"/> Element Size	3.0 mm
- [+] **Sizing**
- [+] **Quality**
- [+] **Inflation**
- [+] **Advanced**
- [-] **Statistics**

<input type="checkbox"/> Nodes	3706
<input type="checkbox"/> Elements	666

Manage Views



# Connection



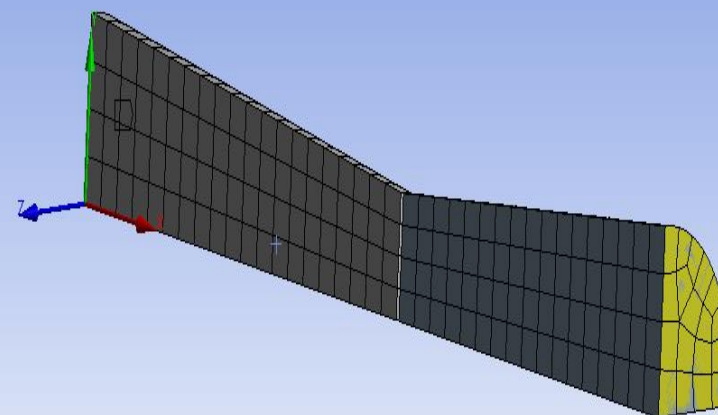
# Boundary Conditions

Details of "Displacement"	
<b>Scope</b>	
Scoping Method	Geometry Selection
Geometry	2 Faces
<b>Definition</b>	
Type	Displacement
Define By	Components
Coordinate System	Global Coordinate System
<input type="checkbox"/> X Component	0. mm (ramped)
Y Component	Free
Z Component	Free
Suppressed	No

Static Structural  
Displacement  
Time: 1. s  
12/4/2019 8:53 AM

Displacement  
Components: 0, Free, Free mm

ANSYS  
2019 R2  
ACADEMIC



0.00 15.00 30.00 45.00 60.00 (mm)

0.00 15.00 30.00 45.00 60.00 (mm)



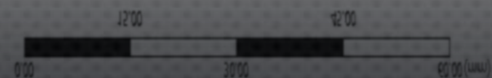
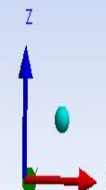
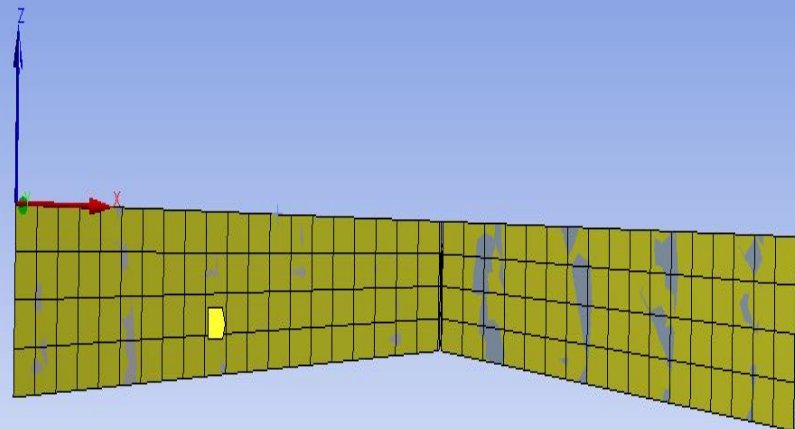
# Boundary Conditions

Scope	
Scoping Method	Geometry Selection
Geometry	2 Faces
Definition	
Type	Displacement
Define By	Components
Coordinate System	Global Coordinate System
X Component	Free
<input type="checkbox"/> Y Component	0. mm (ramped)
Z Component	Free
Suppressed	No

Static Structural  
Displacement 3  
Time: 1. s  
12/4/2019 8:53 AM

Displacement 3  
Components: Free, 0, Free mm

ANSYS  
2019 R2  
ACADEMIC



# Boundary Conditions

Details of "Displacement 2"

## Scope

Scoping Method	Geometry Selection
Geometry	2 Faces

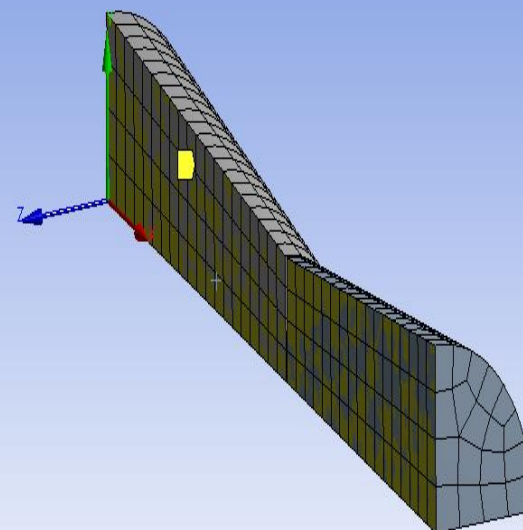
## Definition

Type	Displacement
Define By	Components
Coordinate System	Global Coordinate System
X Component	Free
Y Component	Free
<input type="checkbox"/> Z Component	0. mm (ramped)
Suppressed	No

Static Structural  
Displacement 2  
Time: 1. s  
12/4/2019 8:53 AM

Displacement 2  
Components: Free, Free, 0. mm

ANSYS  
2019 R2  
ACADEMIC



0.00 15.00 30.00 45.00 60.00 (mm)

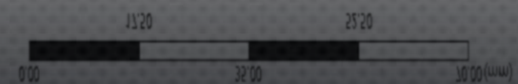
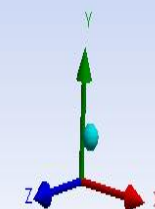
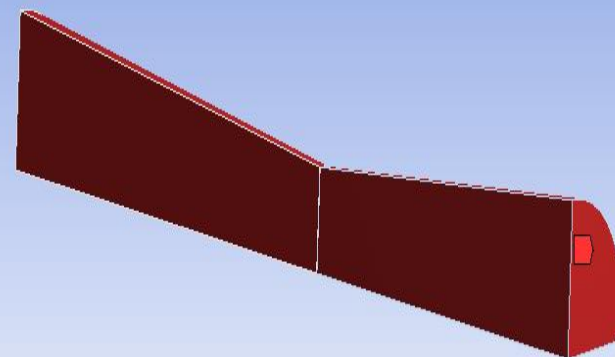
0.00 12.00 24.00 36.00 48.00 (mm)



# Boundary Conditions

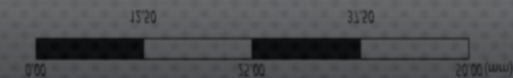
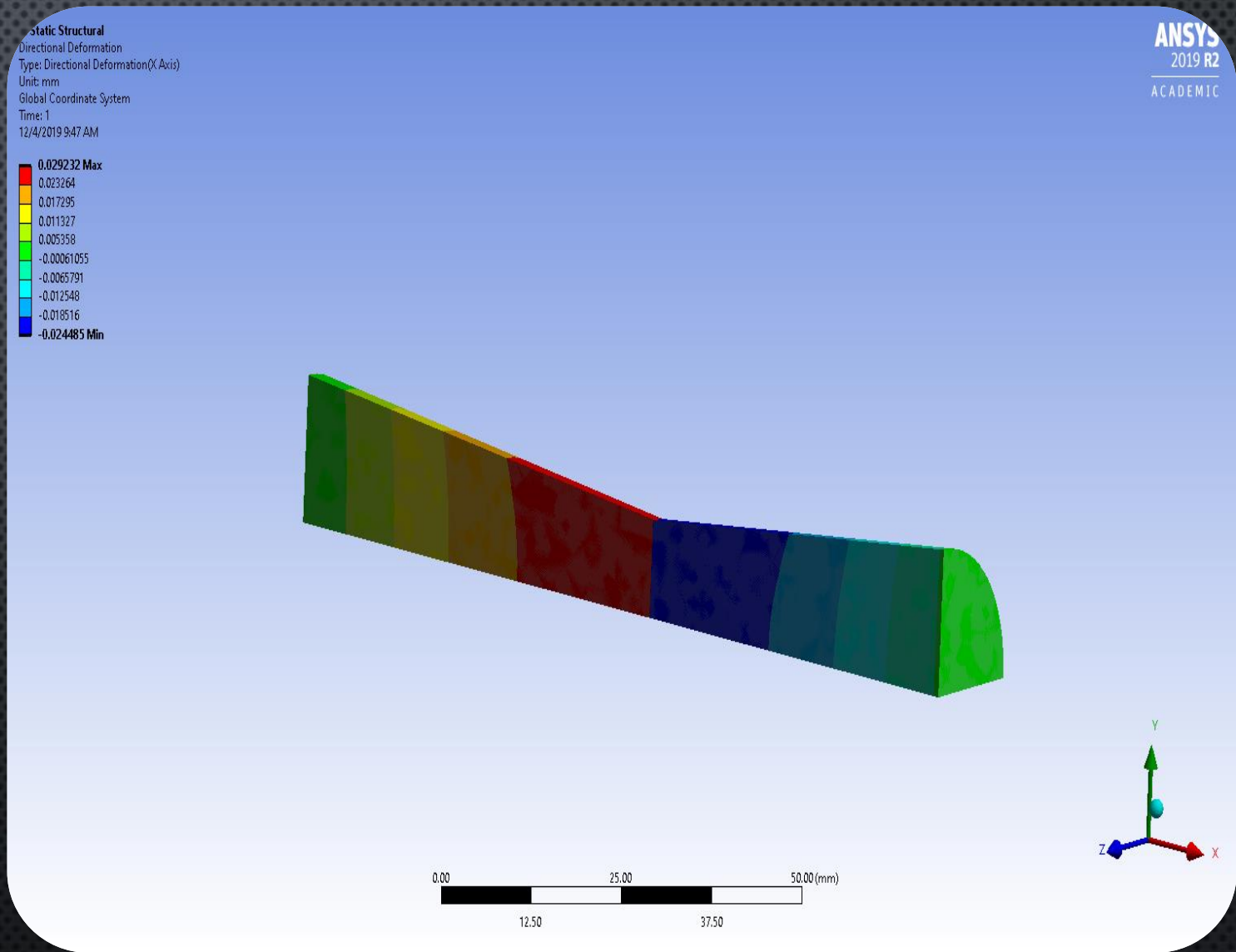
ANSYS Static Structural  
Thermal Condition  
Time: 1. s  
12/4/2019 9:45 AM  
Thermal Condition: 150. °C

ANSYS  
2019 R2  
ACADEMIC

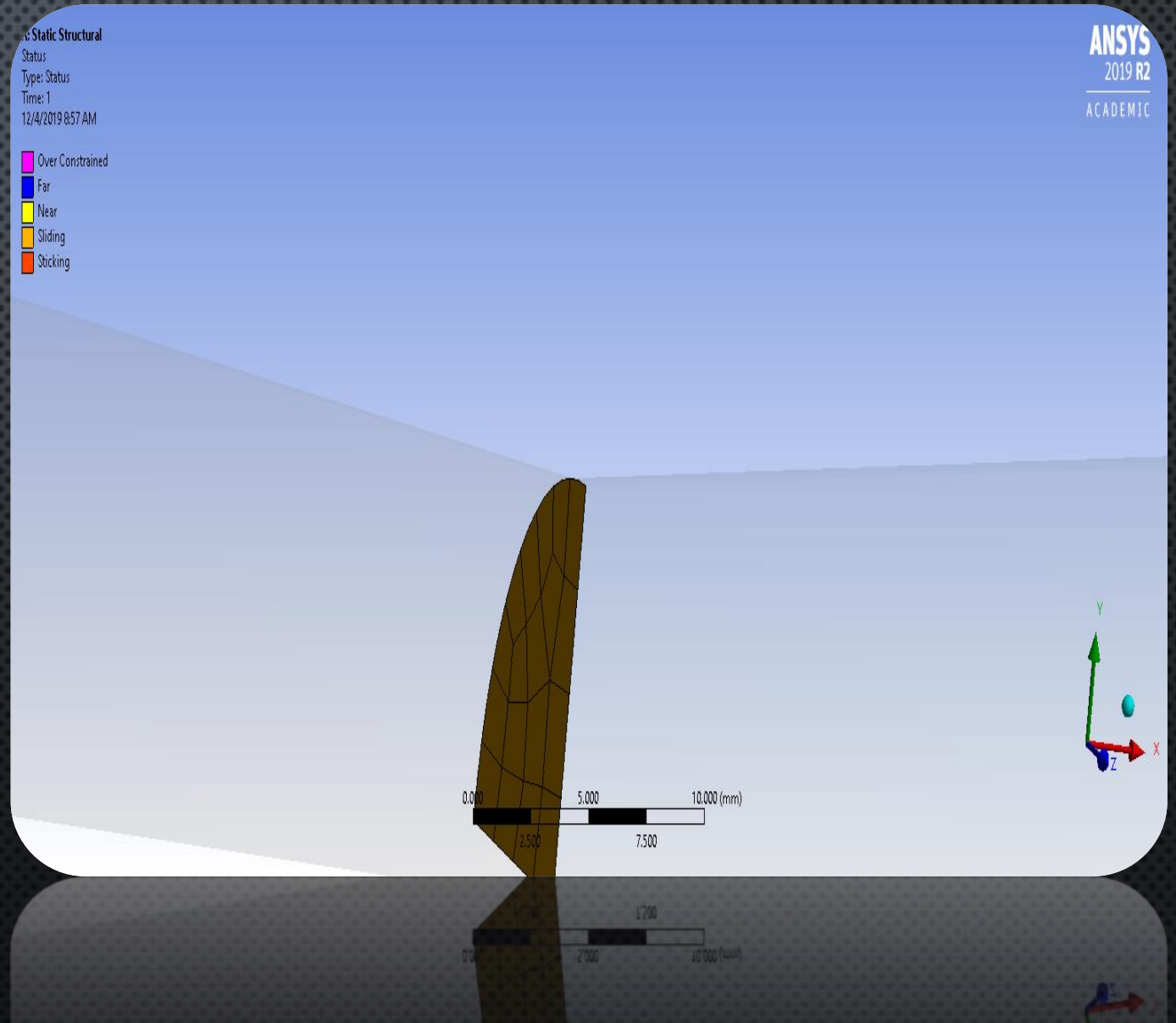




# Results:

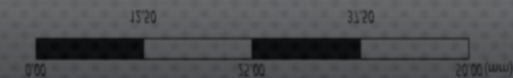
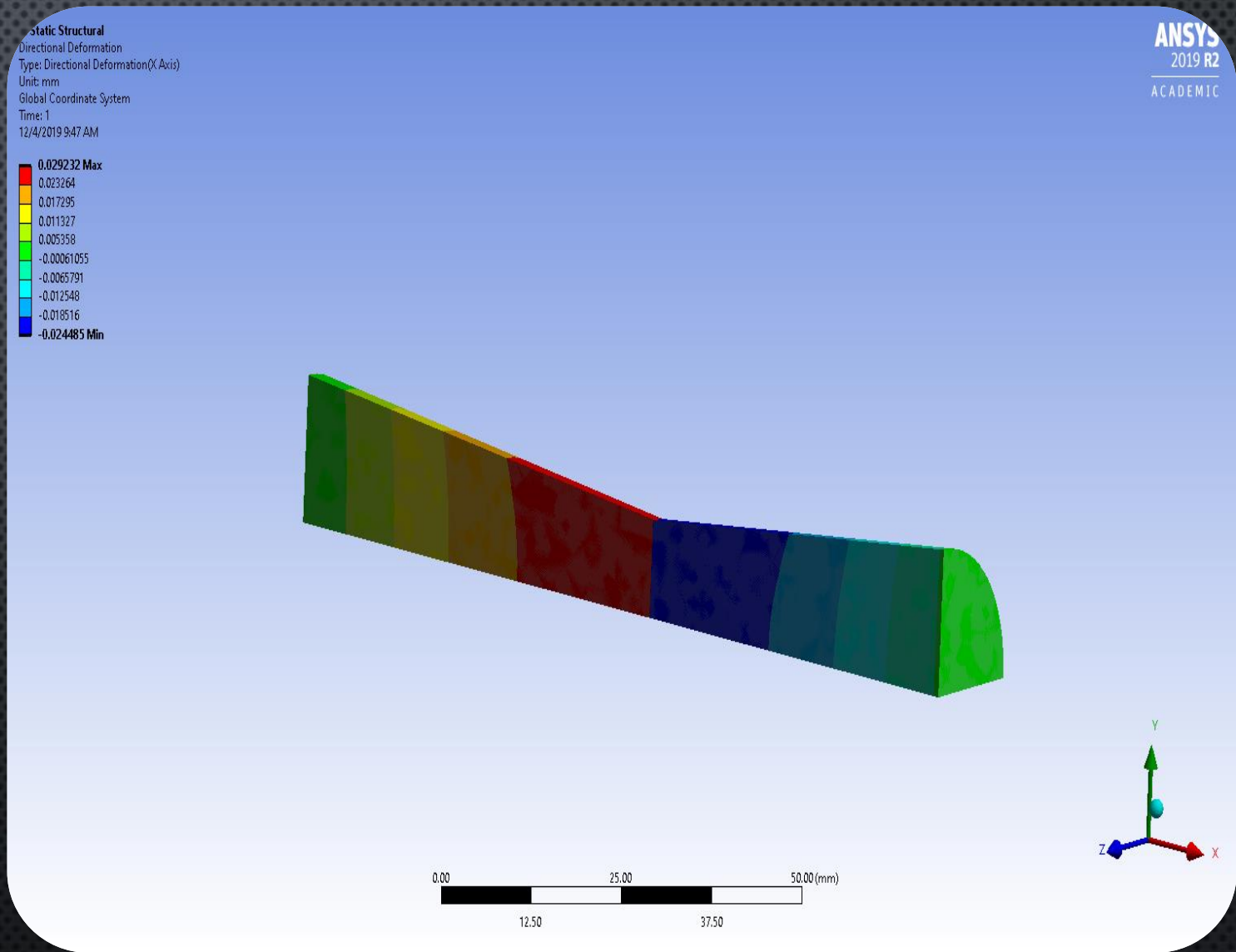


# Results:

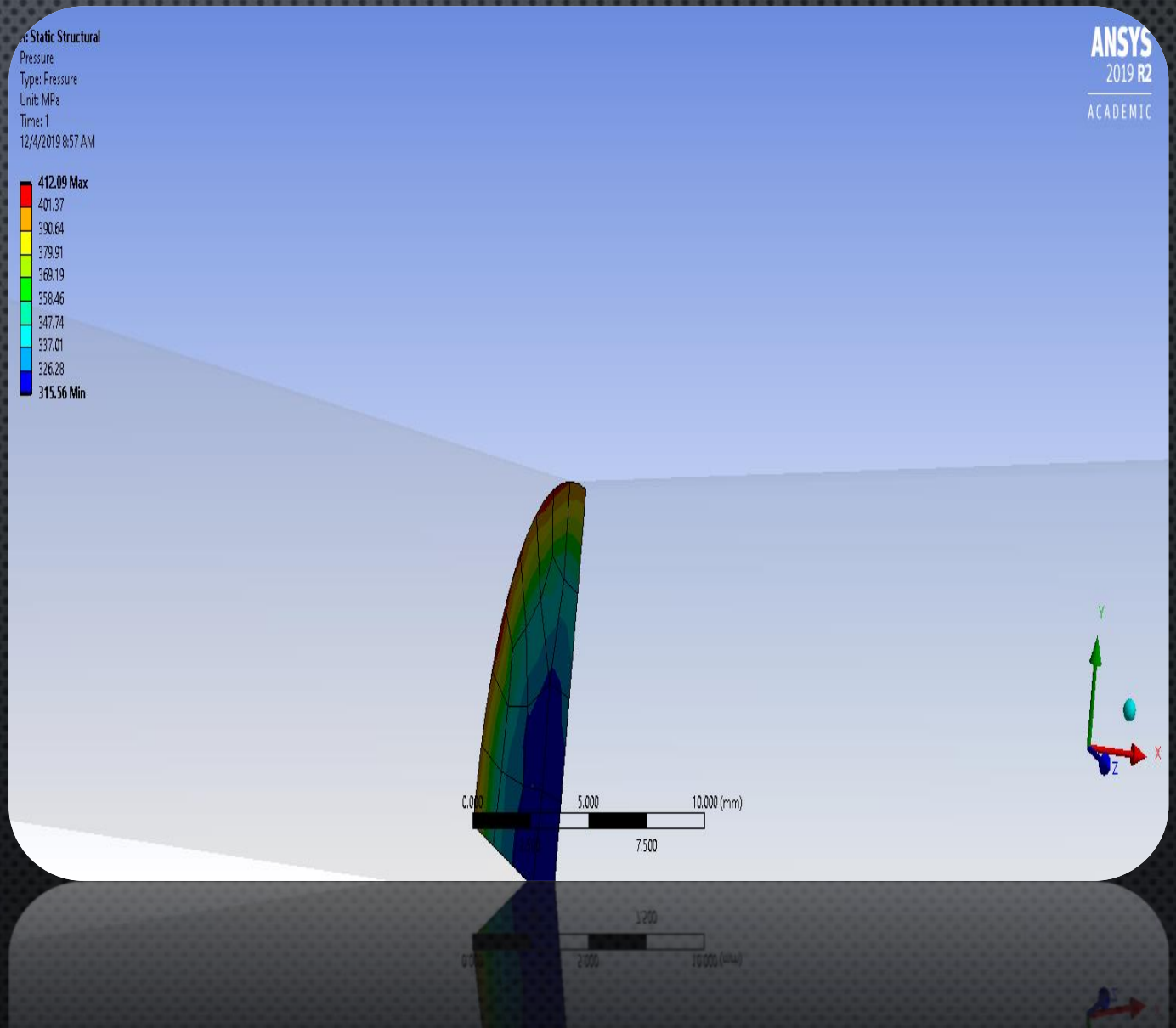




# Results:










# Results:





# Parametric

P1 is the gap distance between the two bodies

Outline of All Parameters				
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	[-] Input Parameters			
3	[-] [Static Structural (A1)]			
4	 P1	XYPlane.H6	0.05	mm 
5	 P2	Thermal Condition Magnitude	150	C 
*	 New input parameter	New name	New expression	
7	[-] Output Parameters			
8	[-] [Static Structural (A1)]			
9	 P3	Pressure Average	323.38	MPa
*	 New output parameter		New expression	
11	Charts			

# Parametric

As can be seen from the table, pressure increases as the temperature increases while it decreases if the gap between the ends increases.

Table of Design Points				
	A	B	C	D
1	Name ▼	P1 - XYPlane.H6 ▼	P2 - Thermal Condition Magnitude ▼	P3 - Pressure Average ▼
2	Units	mm ▼	C ▼	MPa
3	DP 0 (Current)	0.05	150	323.38
4	DP 1	0.05	200	502.8
5	DP 2	0.05	250	682.21
6	DP 3	0.2	150	0
7	DP 4	0.2	200	95.035
8	DP 5	0.2	250	274.45
9	DP 6	0.35	150	0
10	DP 7	0.35	200	0
11	DP 8	0.35	250	0
12	DP 9	0.35	300	0
13	DP 10	0.35	350	0
14	DP 11	0.35	400	0
15	DP 12	0.35	450	0
16	DP 13	0.35	500	0
17	DP 14	0.35	550	0
18	DP 15	0.35	600	0
19	DP 16	0.35	650	0
20	DP 17	0.35	700	0
21	DP 18	0.35	750	0
22	DP 19	0.35	800	0
23	DP 20	0.35	850	0
24	DP 21	0.35	900	0
25	DP 22	0.35	950	0
26	DP 23	0.35	1000	0
27	DP 24	0.35	1050	0
28	DP 25	0.35	1100	0
29	DP 26	0.35	1150	0
30	DP 27	0.35	1200	0
31	DP 28	0.35	1250	0
32	DP 29	0.35	1300	0
33	DP 30	0.35	1350	0
34	DP 31	0.35	1400	0
35	DP 32	0.35	1450	0
36	DP 33	0.35	1500	0
37	DP 34	0.35	1550	0
38	DP 35	0.35	1600	0
39	DP 36	0.35	1650	0
40	DP 37	0.35	1700	0
41	DP 38	0.35	1750	0
42	DP 39	0.35	1800	0
43	DP 40	0.35	1850	0
44	DP 41	0.35	1900	0
45	DP 42	0.35	1950	0
46	DP 43	0.35	2000	0
47	DP 44	0.35	2050	0
48	DP 45	0.35	2100	0
49	DP 46	0.35	2150	0
50	DP 47	0.35	2200	0
51	DP 48	0.35	2250	0
52	DP 49	0.35	2300	0
53	DP 50	0.35	2350	0
54	DP 51	0.35	2400	0
55	DP 52	0.35	2450	0
56	DP 53	0.35	2500	0
57	DP 54	0.35	2550	0
58	DP 55	0.35	2600	0
59	DP 56	0.35	2650	0
60	DP 57	0.35	2700	0
61	DP 58	0.35	2750	0
62	DP 59	0.35	2800	0
63	DP 60	0.35	2850	0
64	DP 61	0.35	2900	0
65	DP 62	0.35	2950	0
66	DP 63	0.35	3000	0
67	DP 64	0.35	3050	0
68	DP 65	0.35	3100	0
69	DP 66	0.35	3150	0
70	DP 67	0.35	3200	0
71	DP 68	0.35	3250	0
72	DP 69	0.35	3300	0
73	DP 70	0.35	3350	0
74	DP 71	0.35	3400	0
75	DP 72	0.35	3450	0
76	DP 73	0.35	3500	0
77	DP 74	0.35	3550	0
78	DP 75	0.35	3600	0
79	DP 76	0.35	3650	0
80	DP 77	0.35	3700	0
81	DP 78	0.35	3750	0
82	DP 79	0.35	3800	0
83	DP 80	0.35	3850	0
84	DP 81	0.35	3900	0
85	DP 82	0.35	3950	0
86	DP 83	0.35	4000	0
87	DP 84	0.35	4050	0
88	DP 85	0.35	4100	0
89	DP 86	0.35	4150	0
90	DP 87	0.35	4200	0
91	DP 88	0.35	4250	0
92	DP 89	0.35	4300	0
93	DP 90	0.35	4350	0
94	DP 91	0.35	4400	0
95	DP 92	0.35	4450	0
96	DP 93	0.35	4500	0
97	DP 94	0.35	4550	0
98	DP 95	0.35	4600	0
99	DP 96	0.35	4650	0
100	DP 97	0.35	4700	0
101	DP 98	0.35	4750	0
102	DP 99	0.35	4800	0
103	DP 100	0.35	4850	0
104	DP 101	0.35	4900	0
105	DP 102	0.35	4950	0
106	DP 103	0.35	5000	0
107	DP 104	0.35	5050	0
108	DP 105	0.35	5100	0
109	DP 106	0.35	5150	0
110	DP 107	0.35	5200	0
111	DP 108	0.35	5250	0
112	DP 109	0.35	5300	0
113	DP 110	0.35	5350	0
114	DP 111	0.35	5400	0
115	DP 112	0.35	5450	0
116	DP 113	0.35	5500	0
117	DP 114	0.35	5550	0
118	DP 115	0.35	5600	0
119	DP 116	0.35	5650	0
120	DP 117	0.35	5700	0
121	DP 118	0.35	5750	0
122	DP 119	0.35	5800	0
123	DP 120	0.35	5850	0
124	DP 121	0.35	5900	0
125	DP 122	0.35	5950	0
126	DP 123	0.35	6000	0
127	DP 124	0.35	6050	0
128	DP 125	0.35	6100	0
129	DP 126	0.35	6150	0
130	DP 127	0.35	6200	0
131	DP 128	0.35	6250	0
132	DP 129	0.35	6300	0
133	DP 130	0.35	6350	0
134	DP 131	0.35	6400	0
135	DP 132	0.35	6450	0
136	DP 133	0.35	6500	0
137	DP 134	0.35	6550	0
138	DP 135	0.35	6600	0
139	DP 136	0.35	6650	0
140	DP 137	0.35	6700	0
141	DP 138	0.35	6750	0
142	DP 139	0.35	6800	0
143	DP 140	0.35	6850	0
144	DP 141	0.35	6900	0
145	DP 142	0.35	6950	0
146	DP 143	0.35	7000	0
147	DP 144	0.35	7050	0
148	DP 145	0.35	7100	0
149	DP 146	0.35	7150	0
150	DP 147	0.35	7200	0
151	DP 148	0.35	7250	0
152	DP 149	0.35	7300	0
153	DP 150	0.35	7350	0
154	DP 151	0.35	7400	0
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156	DP 153	0.35	7500	0
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164	DP 161	0.35	7900	0
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166	DP 163	0.35	8000	0
167	DP 164	0.35	8050	0
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169	DP 166	0.35	8150	0
170	DP 167	0.35	8200	0
171	DP 168	0.35	8250	0
172	DP 169	0.35	8300	0
173	DP 170	0.35	8350	0
174	DP 171	0.35	8400	0
175	DP 172	0.35	8450	0
176	DP 173	0.35	8500	0
177	DP 174	0.35	8550	0
178	DP 175	0.35	8600	0
179	DP 176	0.35	8650	0
180	DP 177	0.35	8700	0
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188	DP 185	0.35	9100	0
189	DP 186	0.35	9150	0
190	DP 187	0.35	9200	0
191	DP 188	0.35	9250	0
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193	DP 190	0.35	9350	0
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210	DP 207	0.35	10200	0
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213	DP 210	0.35	10350	0
214	DP 211	0.35	10400	0
215	DP 212	0.35	10450	0
216	DP 213	0.35	10500	0
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219	DP 216	0.35	10650	0
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221	DP 218	0.35	10750	0
222	DP 219	0.35	10800	0
223	DP 220	0.35	10850	0
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225	DP 222	0.35	10950	0
226	DP 223	0.35	11000	0
227	DP 224	0.35	11050	0
228	DP 225	0.35	11100	0
229	DP 226	0.35	11150	0
230	DP 227	0.35	11200	0
231	DP 228	0.35	11250	0
232	DP 229	0.35	11300	0
233	DP 230	0.35	11350	0
234	DP 231	0.35	11400	0
235	DP 232	0.35	11450	0
236	DP 233	0.35	11500	0
237	DP 234	0.35	11550	0
238	DP 235	0.35	11600	0
239	DP 236	0.35	11650	0
240	DP 237	0.35	11700	0
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242	DP 239	0.35	11800	0
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245	DP 242	0.35	11950	0
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249	DP 246	0.35	12150	0
250	DP 247	0.35	12200	0
251	DP 248	0.35	12250	0
252	DP 249	0.35	12300	0
253	DP 250	0.35	12350	0
254	DP 251	0.35	12400	0
255	DP 252	0.35	12450	0
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257	DP 254	0.35	12550	0
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260	DP 257	0.35	12700	0
261	DP 258	0.35	12750	0
262	DP 259	0.35	12800	0
263	DP 260	0.35	12850	0
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265	DP 262	0.35	12950	0
266	DP 263	0.35	13000	0
267	DP 264	0.35	13050	0
268	DP 265	0.35	13100	0
269</				