PRESSURE EQUIPMENT ENGINEERING SERVICES, INC.

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FINITE ELEMENTS ANALYSIS OF SPHEROID VESSEL

PROBLEM DESCRIPTION:

The 20,000 barrel spheroid (67' dia. x 51' high) was fabricated and erected by Chicago Bridge and Iron Company and put in service in 1942. The spheroid has curvature changing with height. The lowest most course of the vessel is supported on the ground. Above that level, there is base ring with gussets for anchorage of the spheroid. There is outside corrosion in lower parts of the vessel, especially in course #8 just above the ground level. As no engineering calculations are available for the vessel, it is required to perform the fitness-for-service evaluation of the vessel with the intent to calculate the minimum required thicknesses of various courses of the spheroid vessel and to maximize the remaining safe and useful life of the vessel.

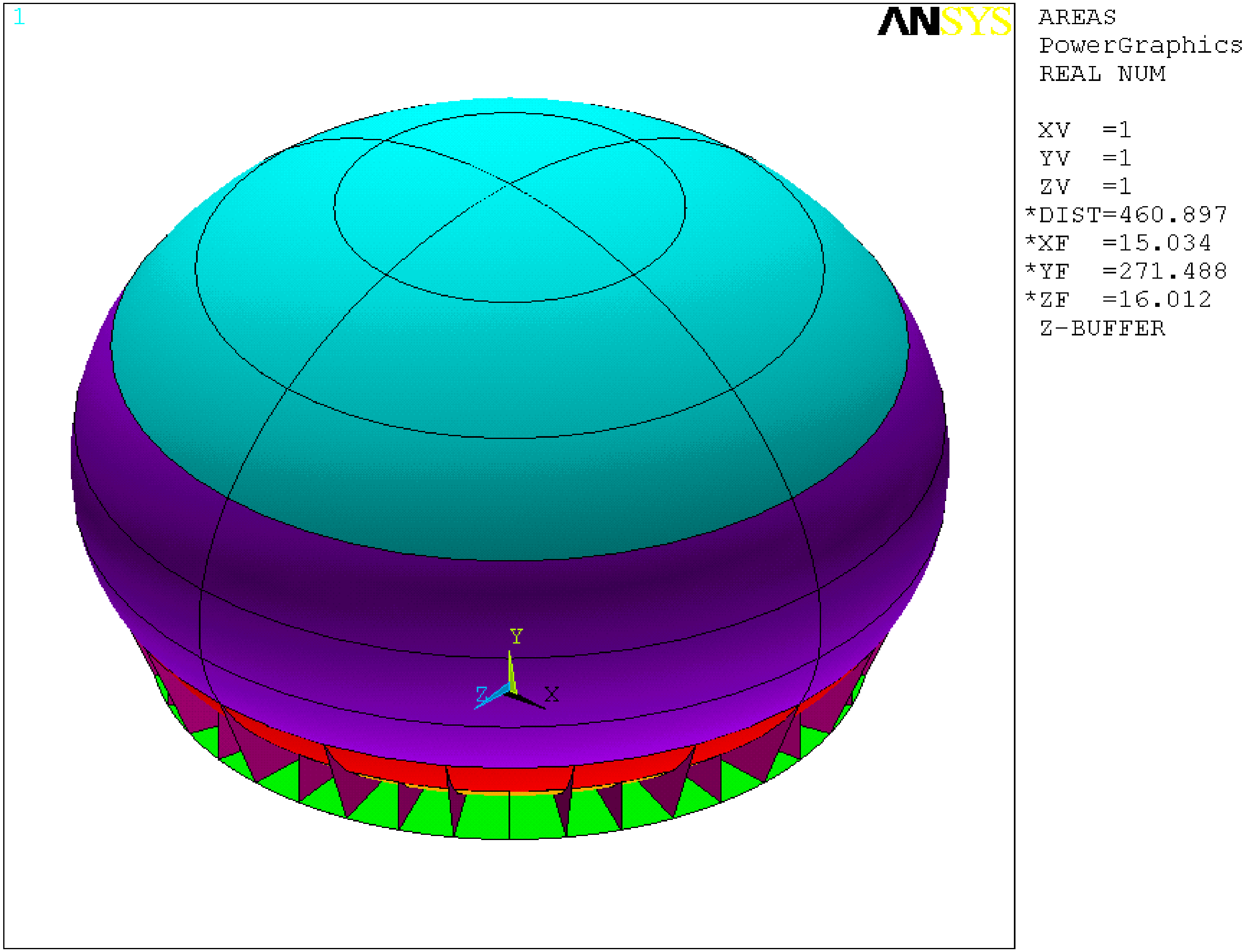
The loading for spheroid includes self weight, hydrostatic loading due to 3/4th filled vessel and internal design pressure of 15 psig.

The fitness-for-service evaluation was performed using Finite element analysis to check for continued future operation of the spheroid vessel.

RESULTS:

The Finite elements analysis was performed using FEA software ANSYS. The appropriate weight, hydrostatic load and pressure loadings were applied in the model. Based on the results, it was found that the maximum stresses were present in course #8 (lowest exposed course) between the gussets. Based on the available thicknesses, the spheroid vessel was found to be in compliance with ASME code, Section VIII, Div.-2, Appendix-4 criteria. Also, the minimum thickness values were specified for various courses which allowed the spheroid vessel to be fit-for-service for some more operating life.

The attached FEA plots show the model and results for one of the cases analyzed.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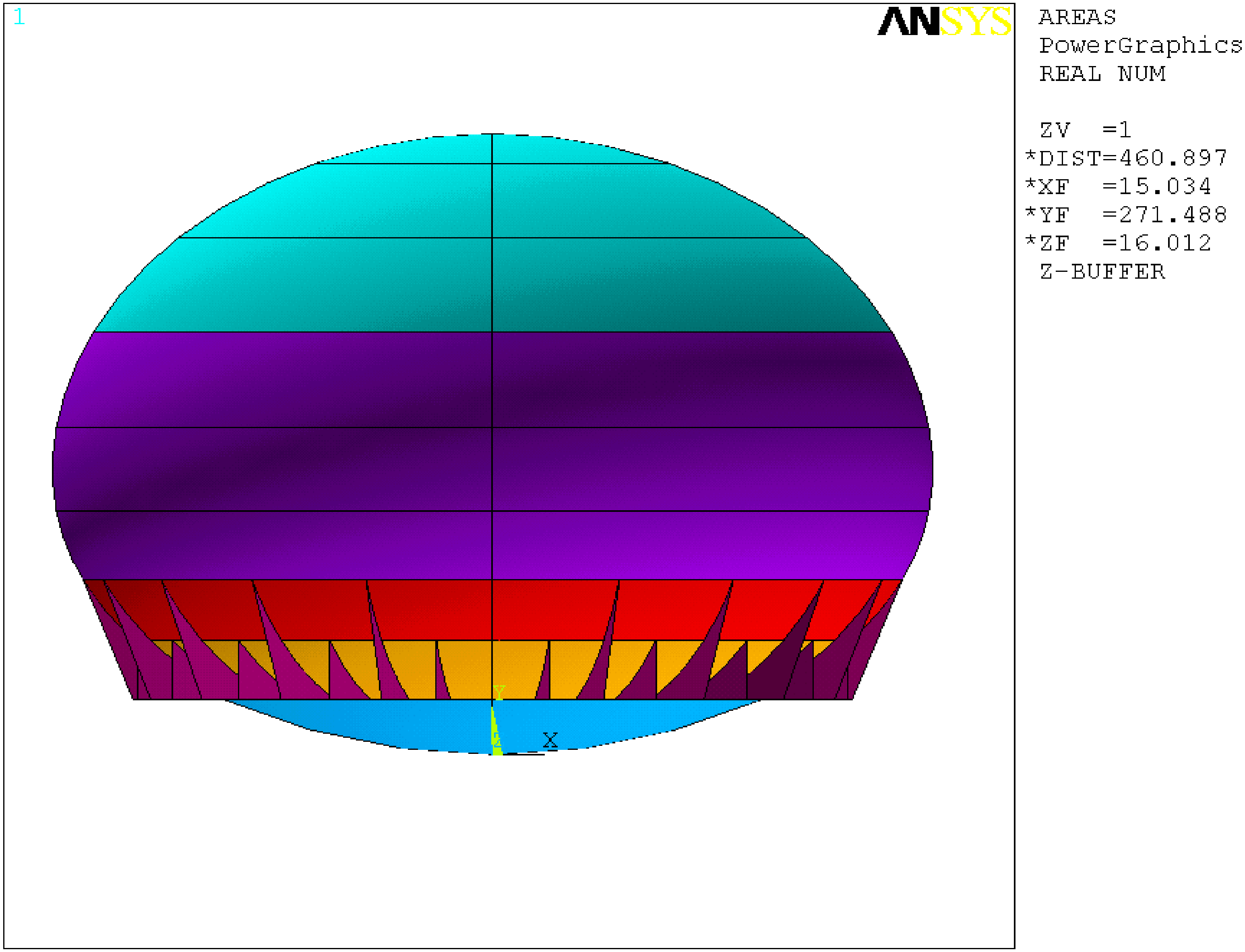
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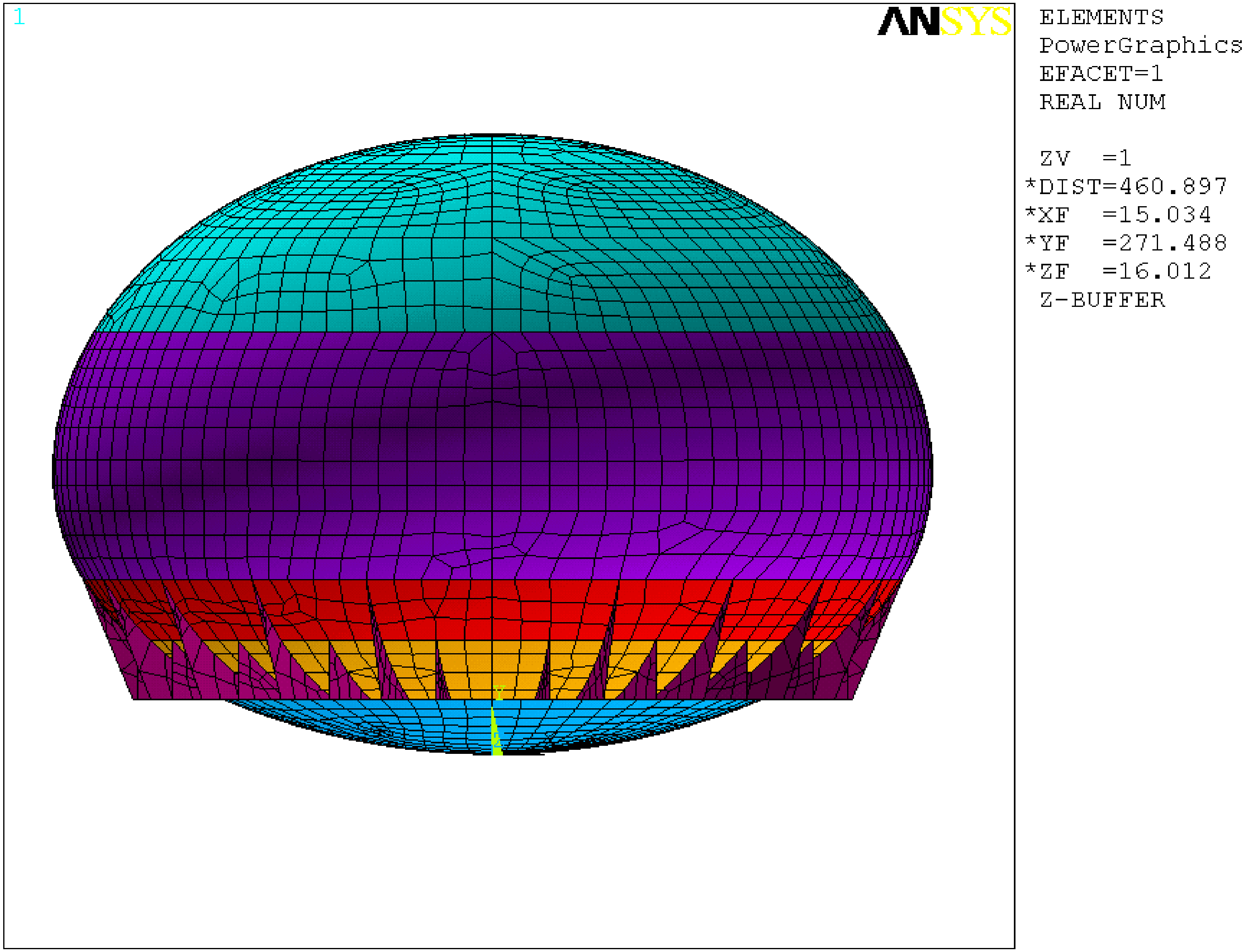
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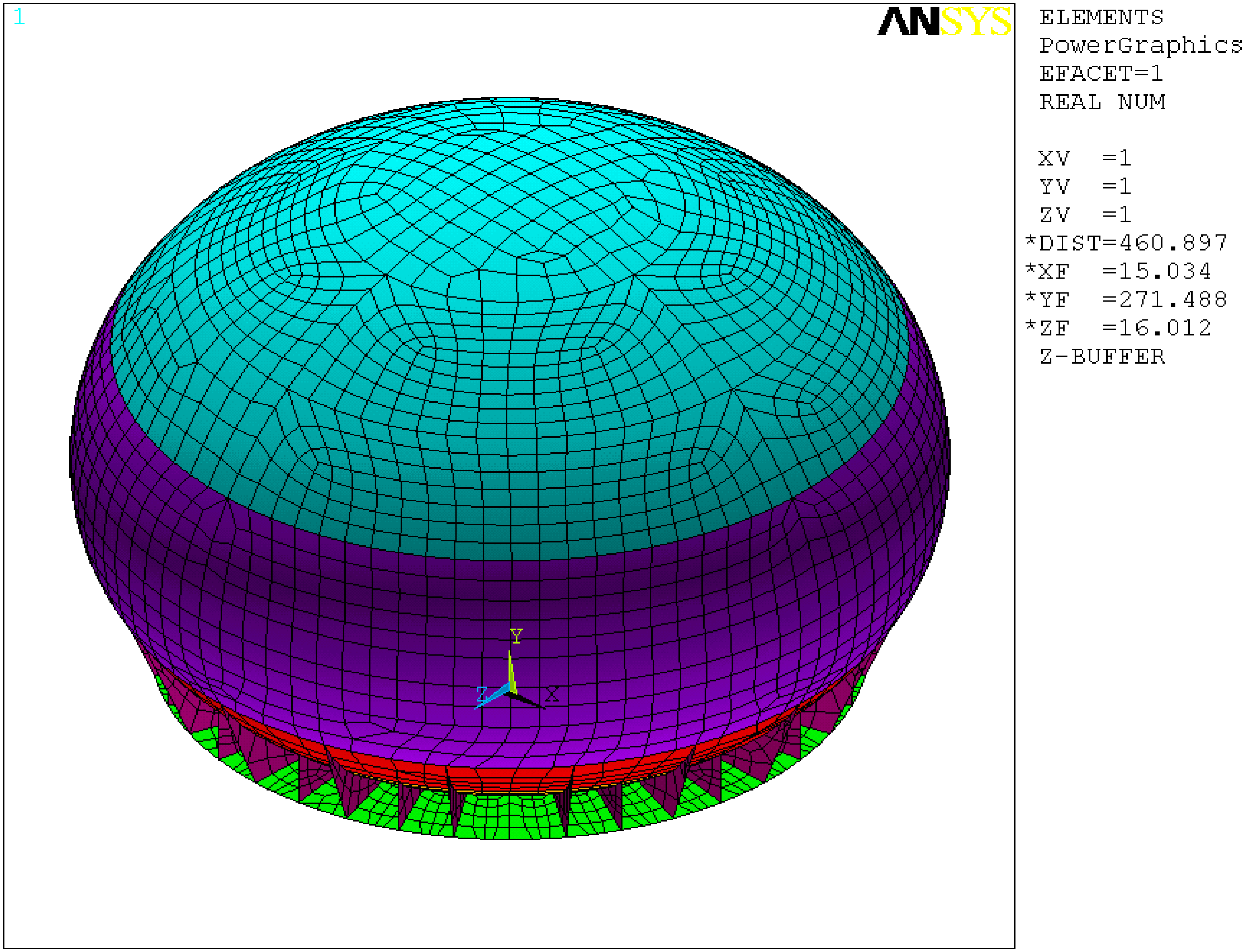
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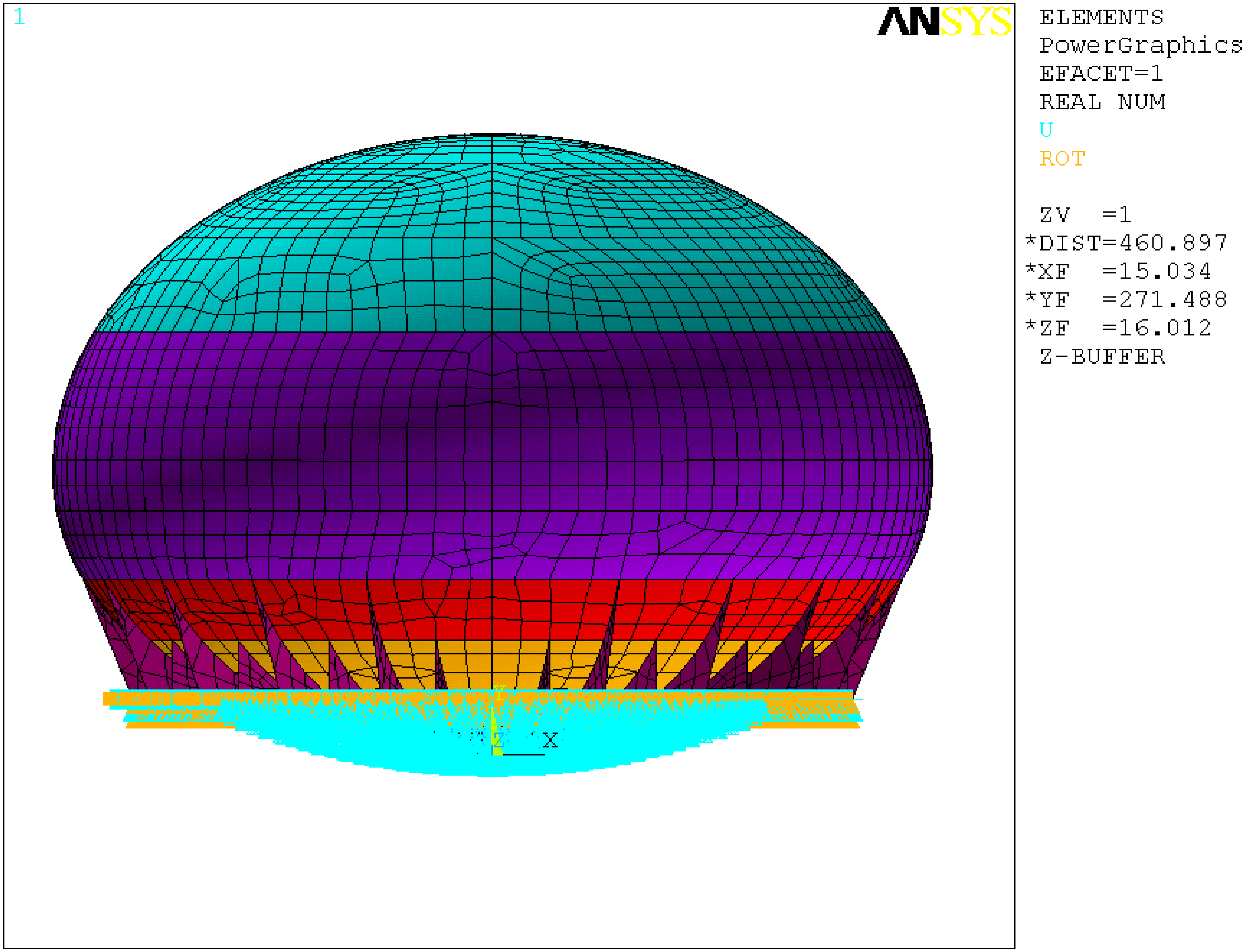
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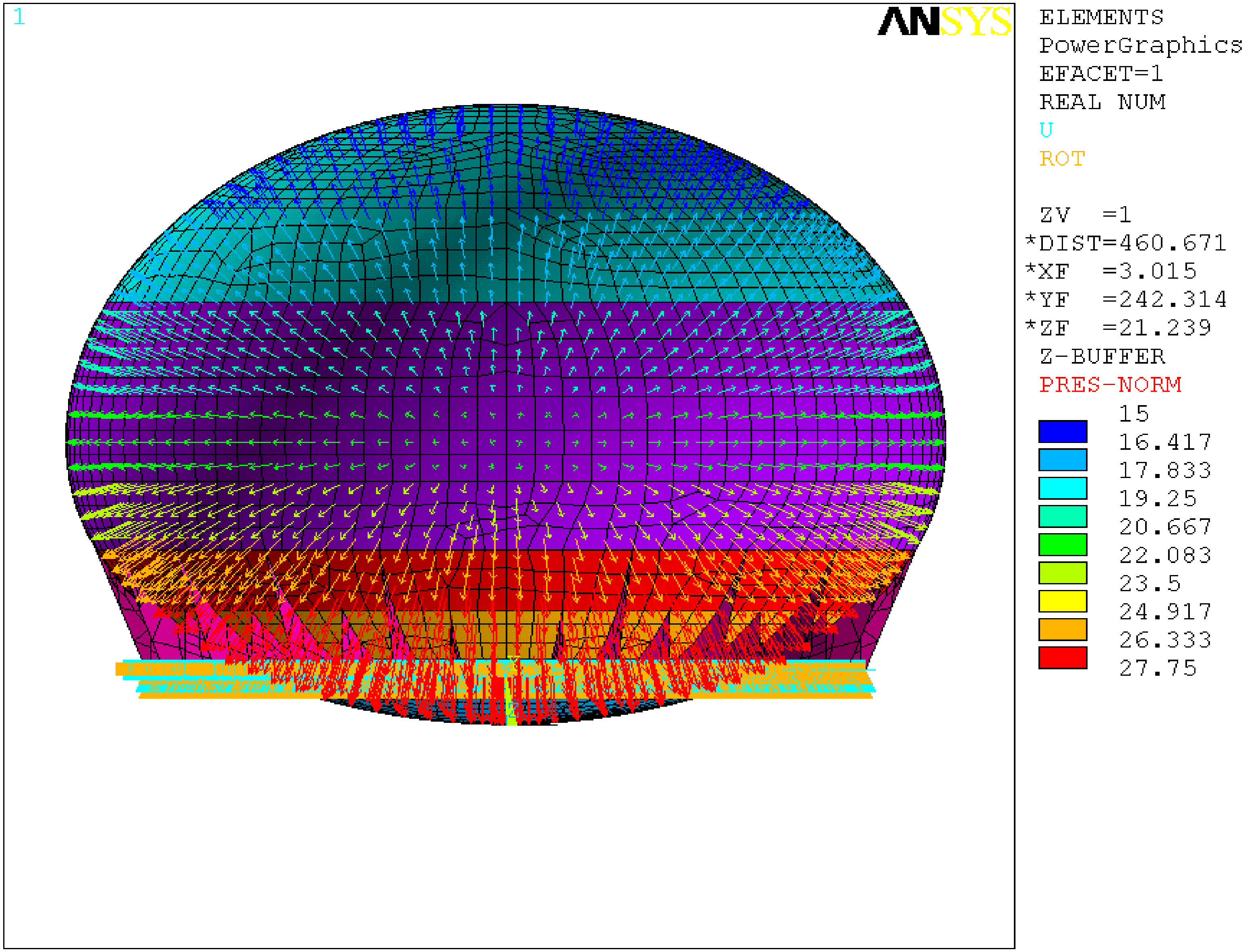

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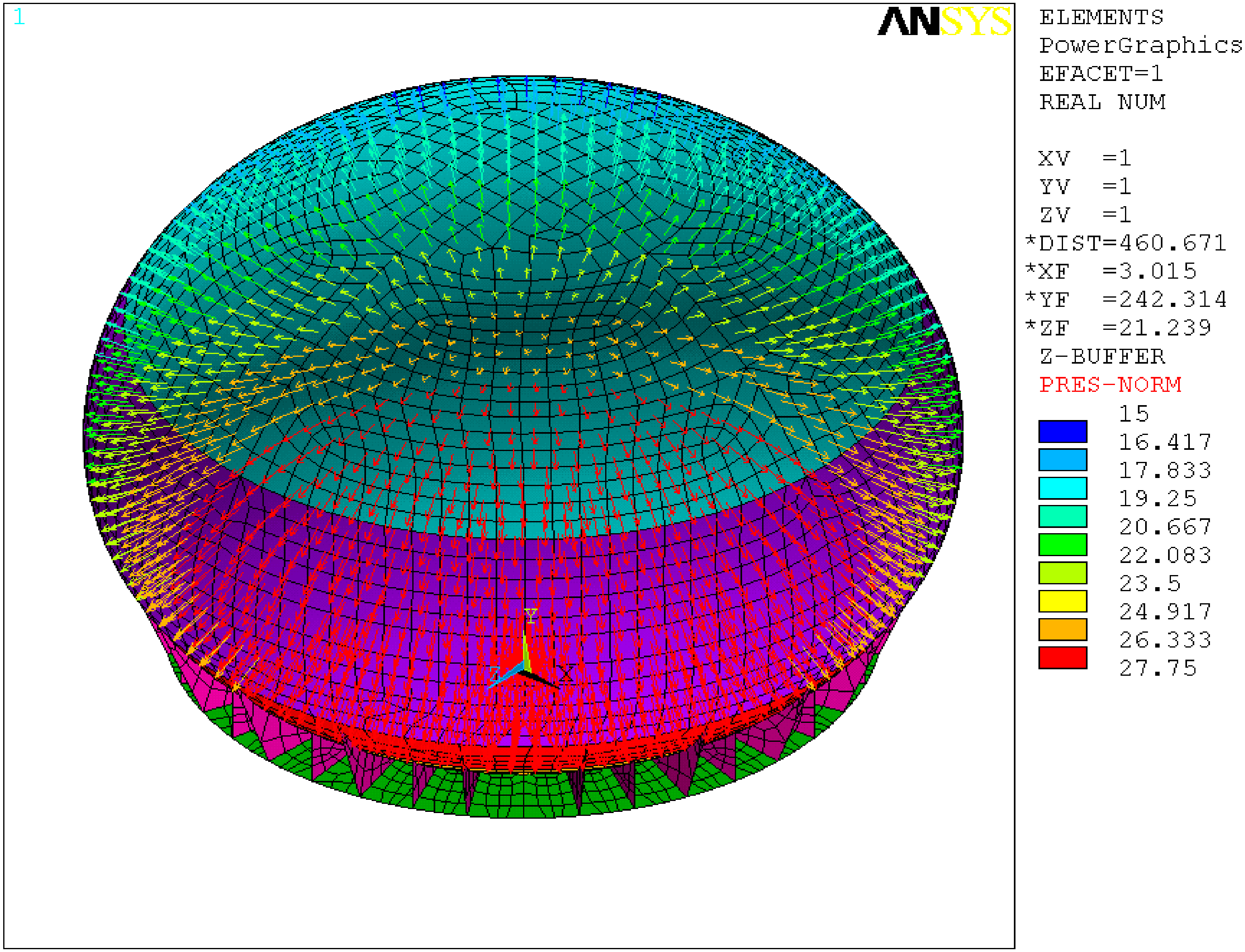
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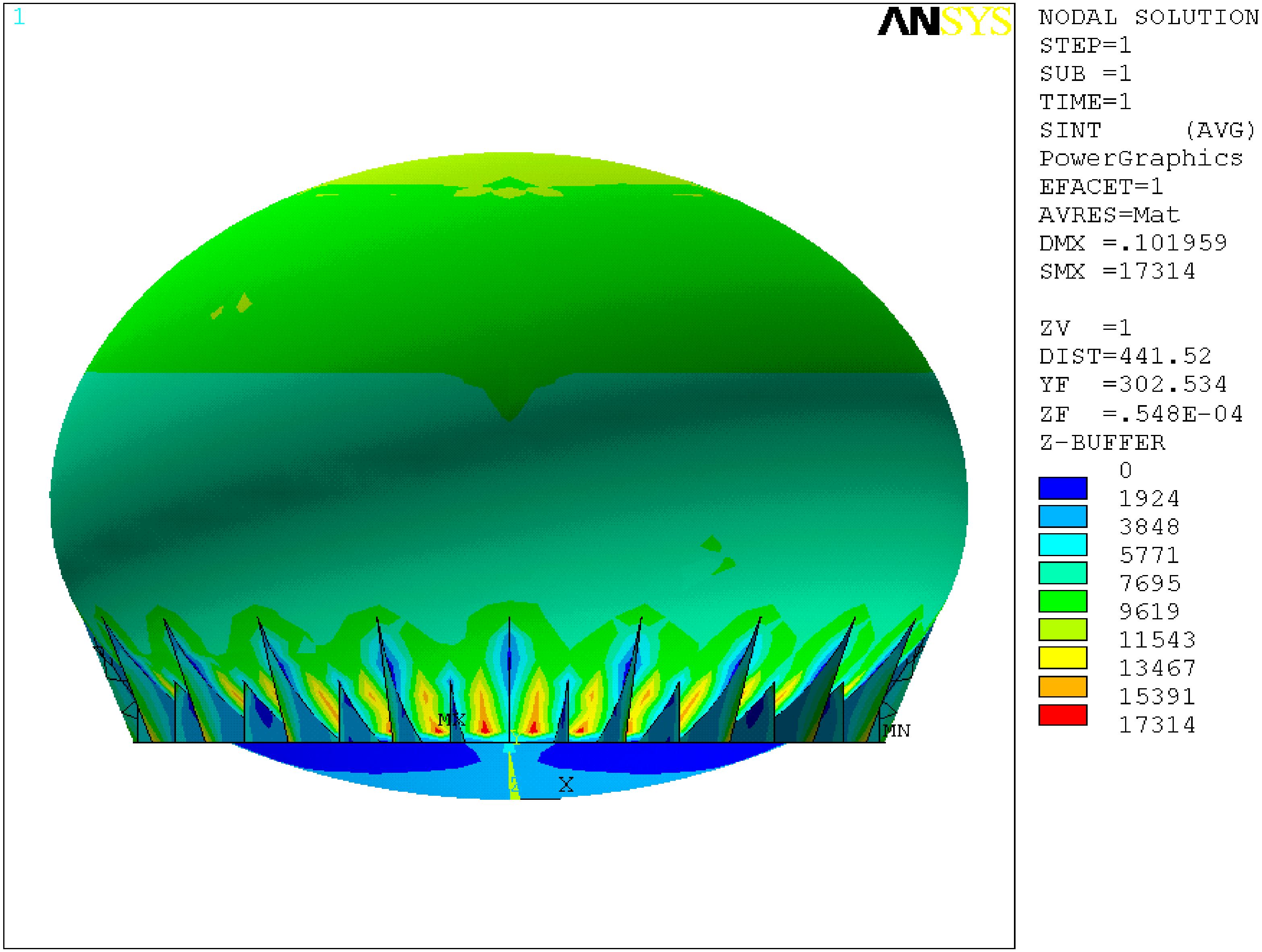

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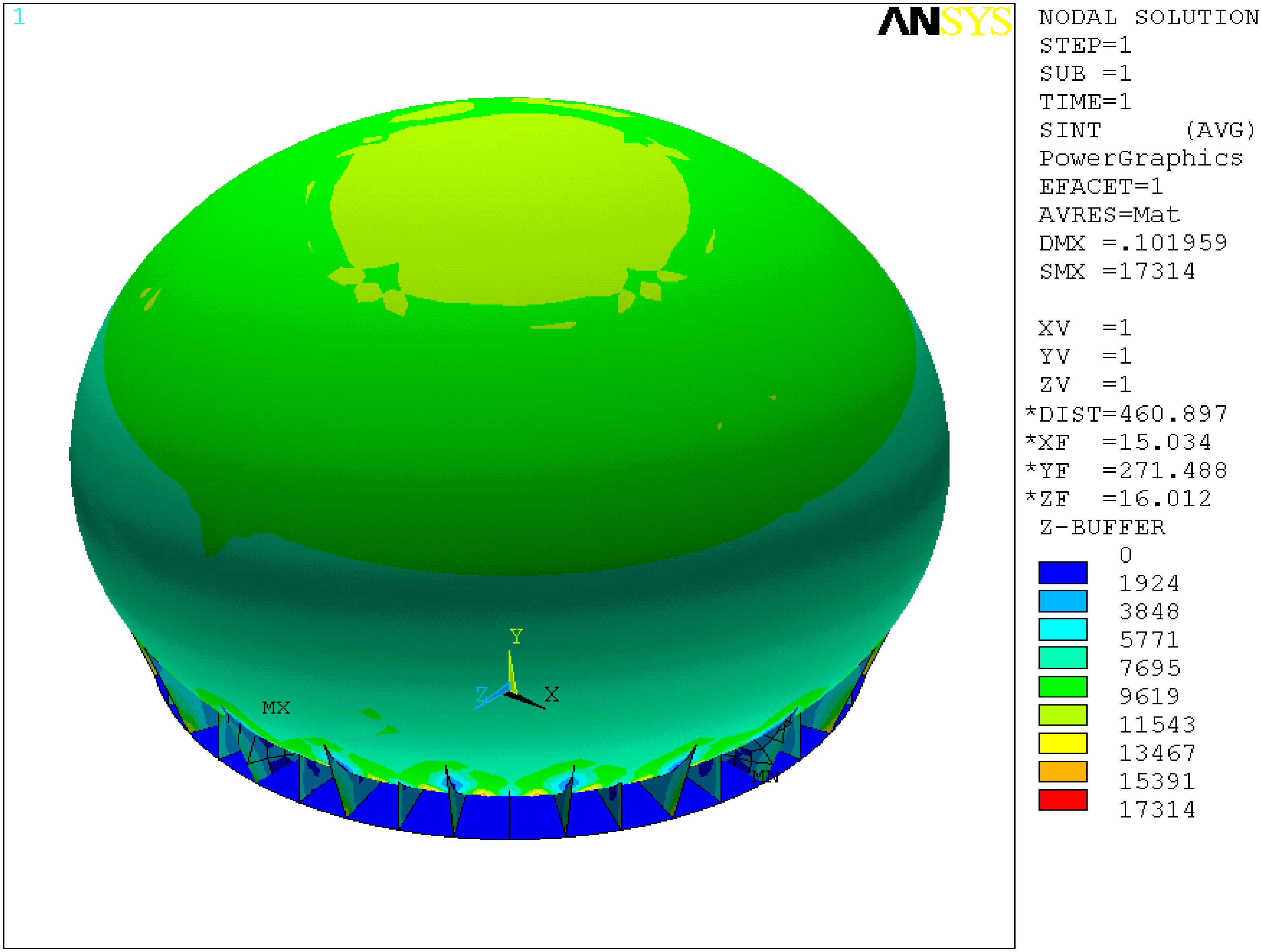
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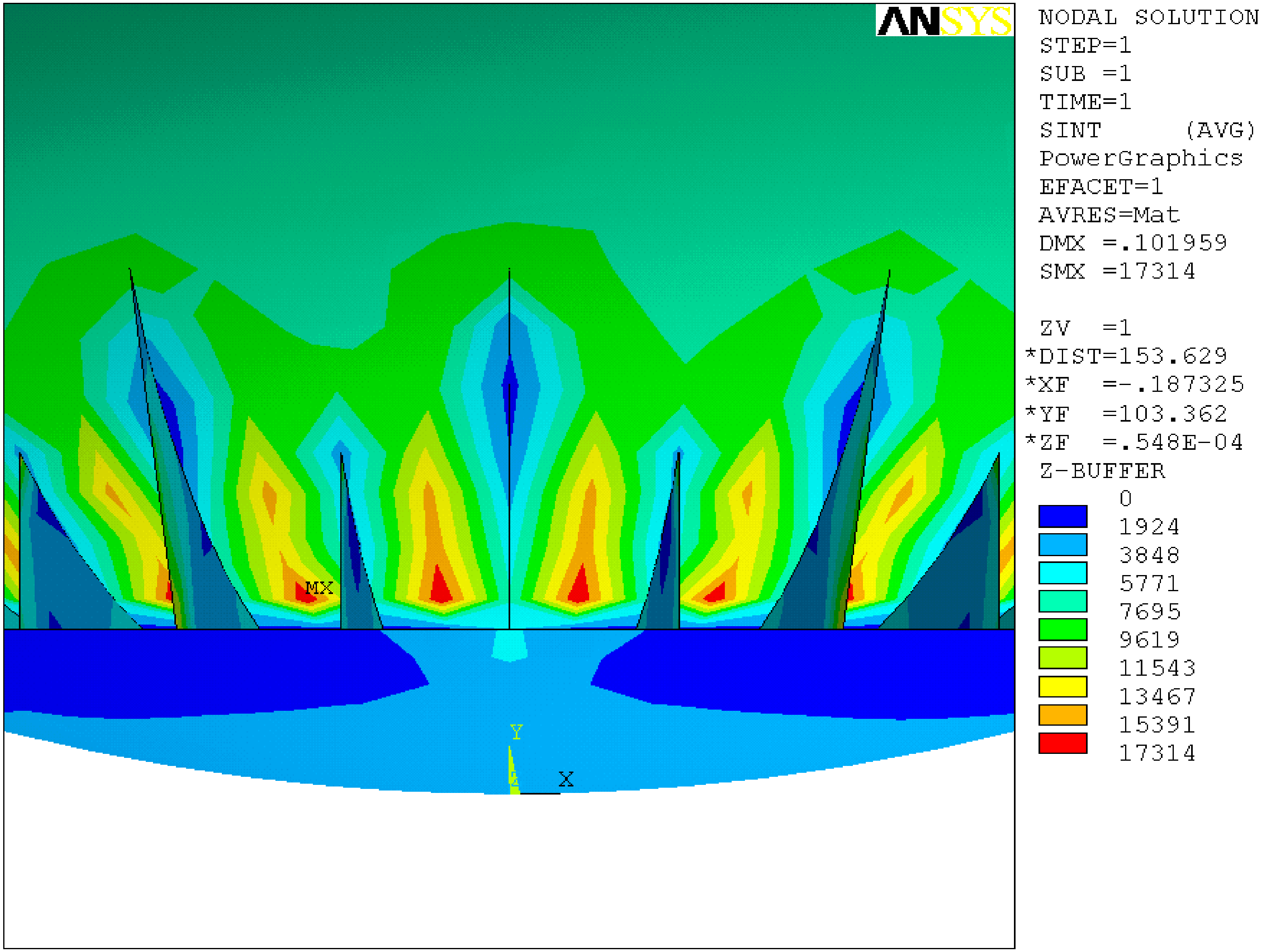
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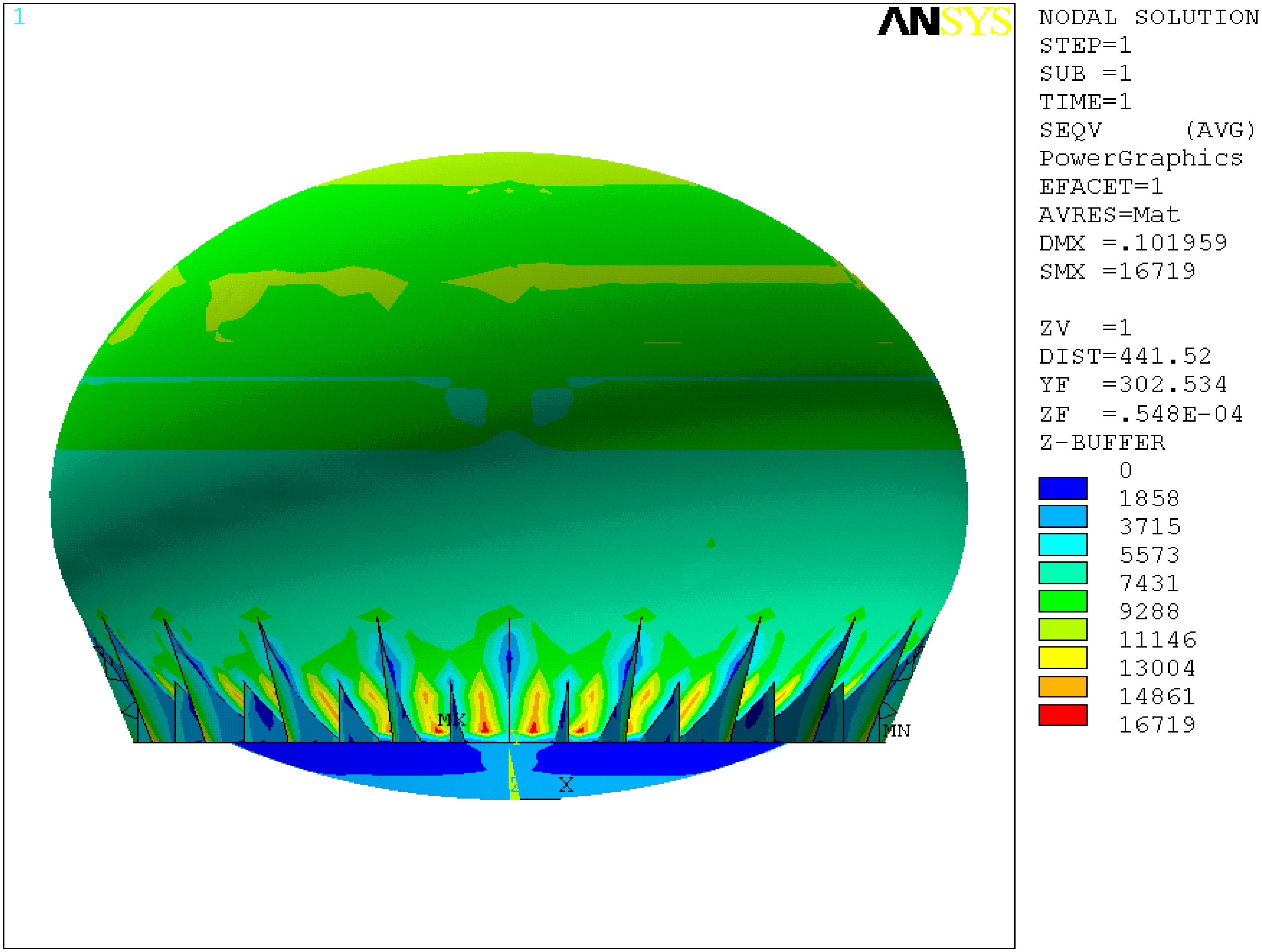
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