

Investigating the importance of geometrical accuracy in acoustic simulation: A comparison of NURBS and mesh-based approaches

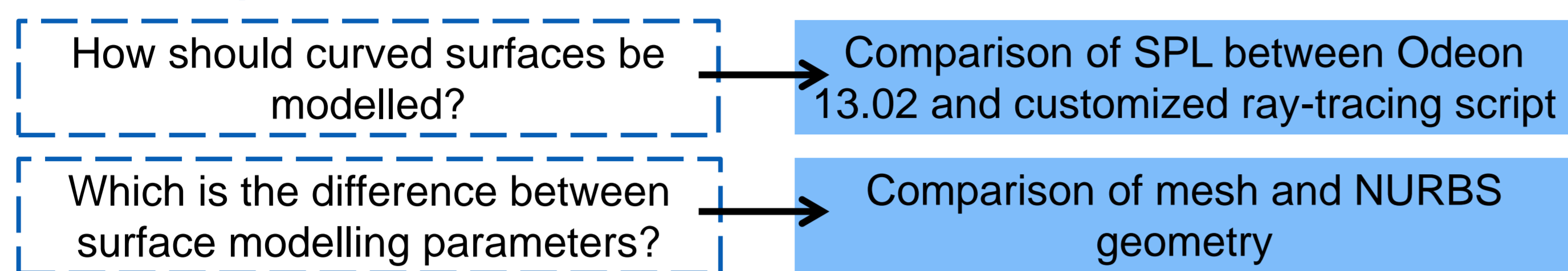
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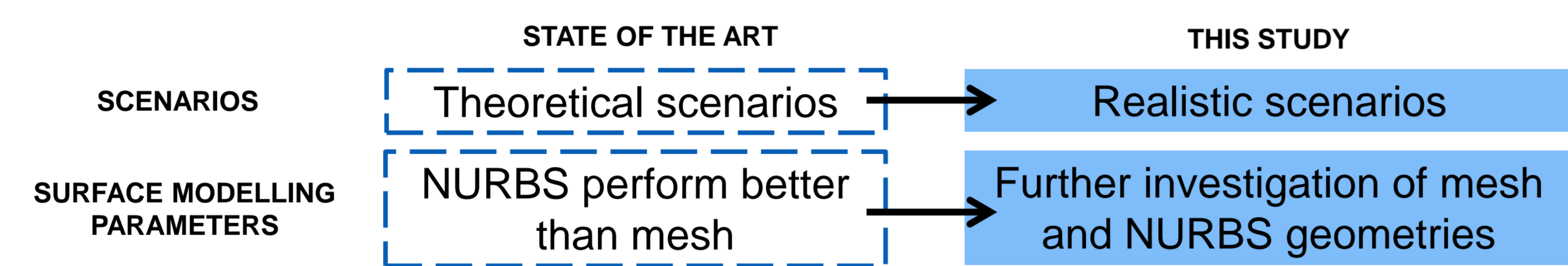
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Outline of the work

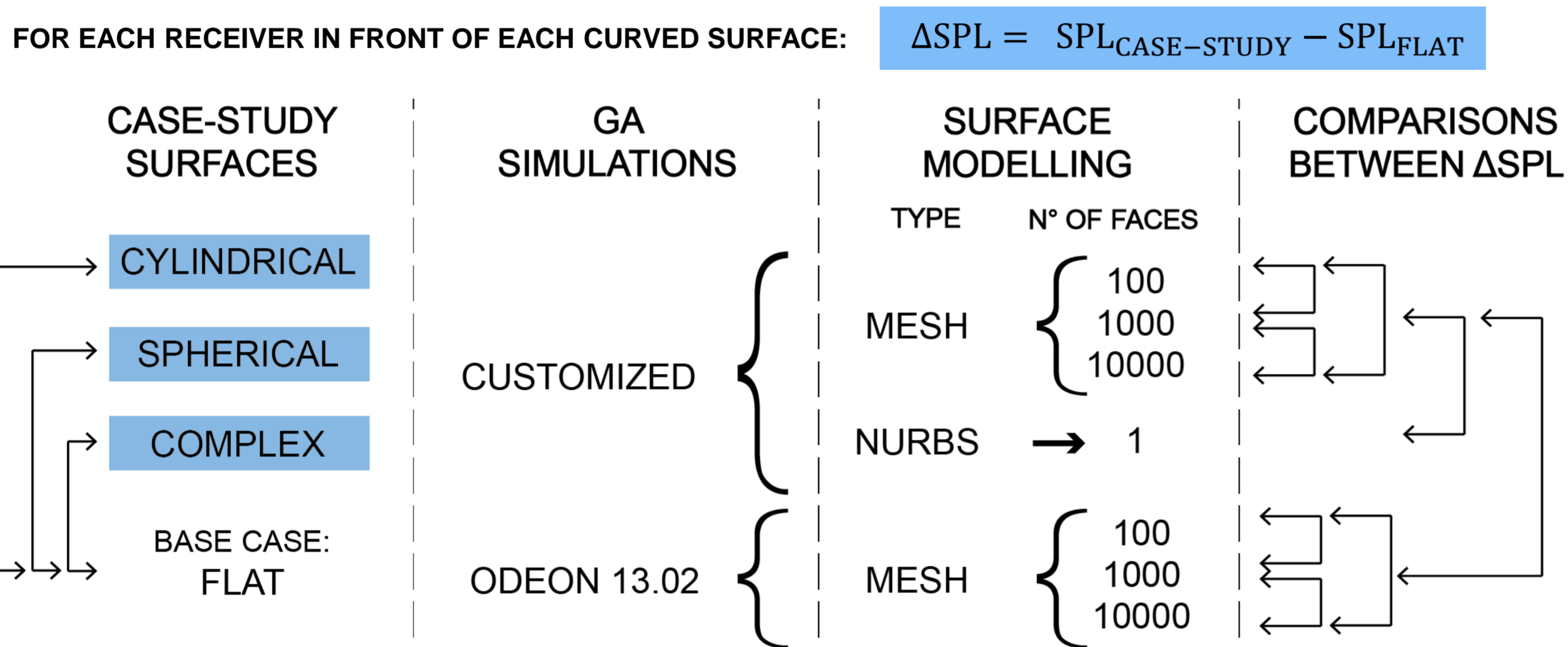
Research questions



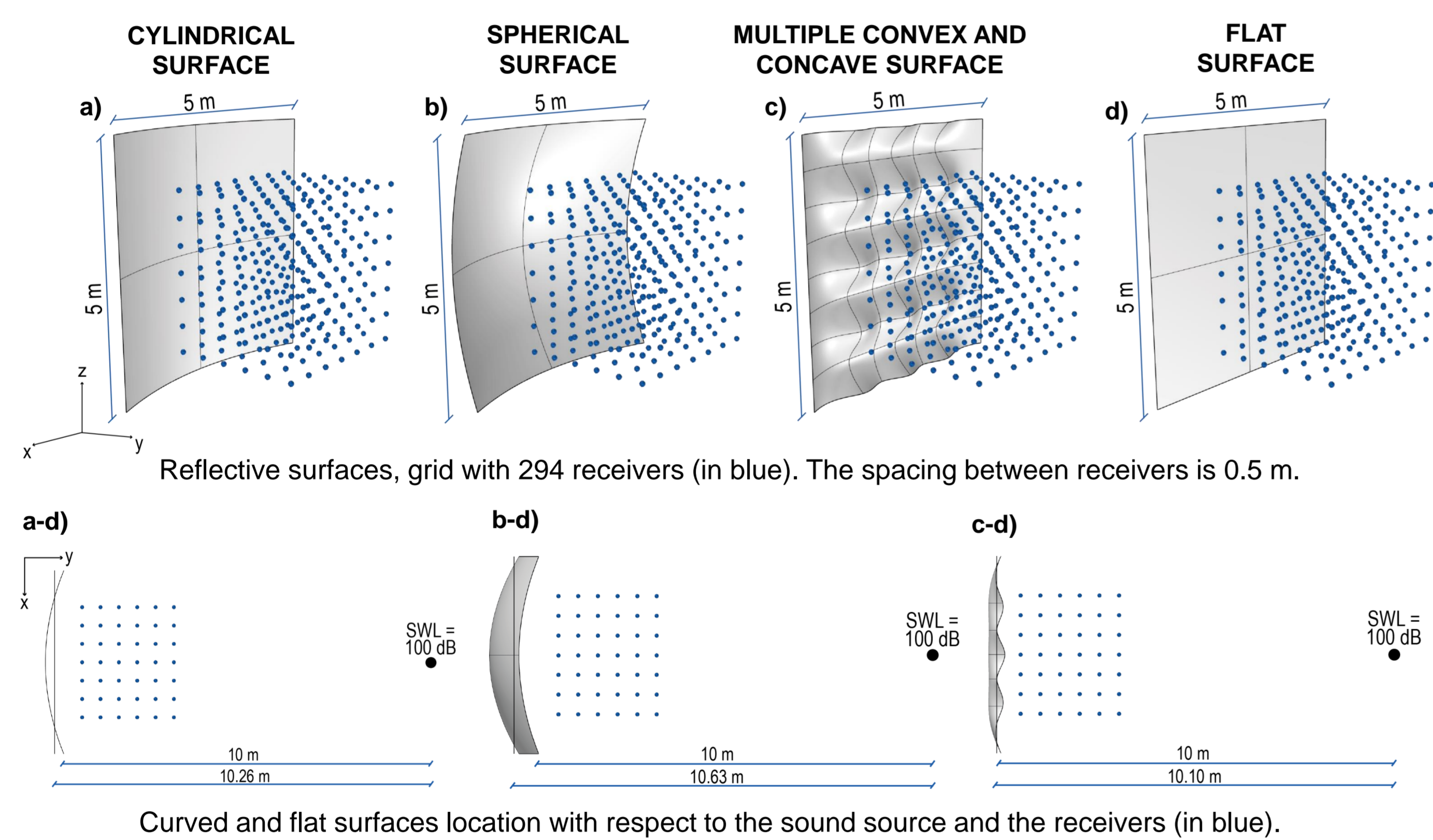
Scientific innovation and relevance



Method



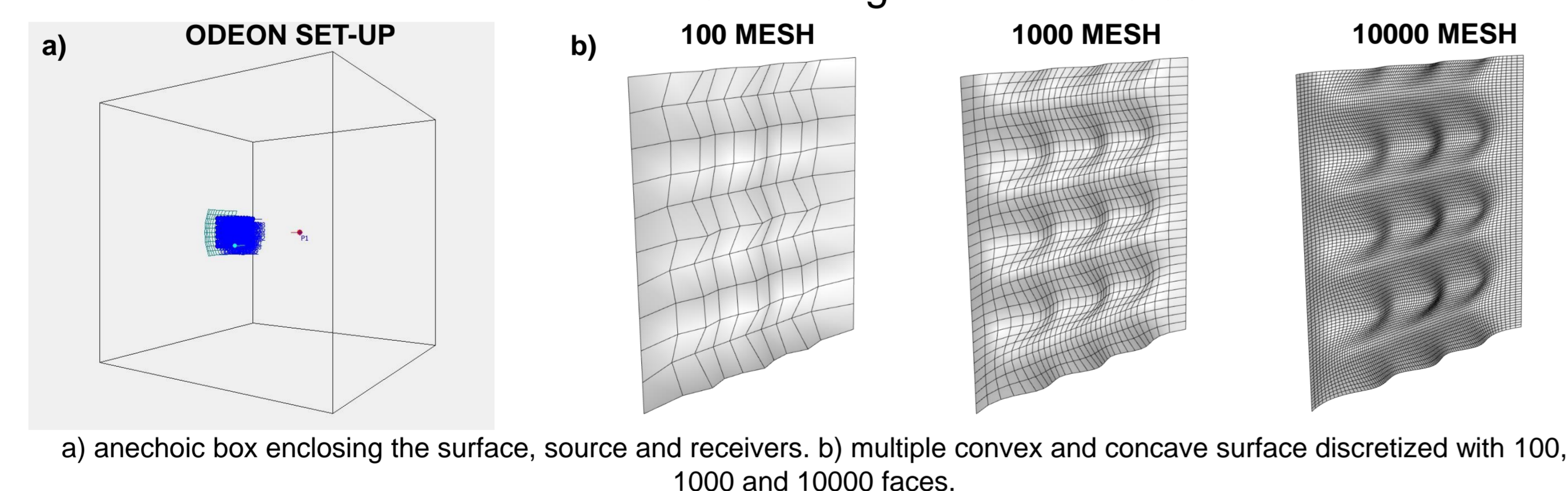
Case-studies



GA-based simulations

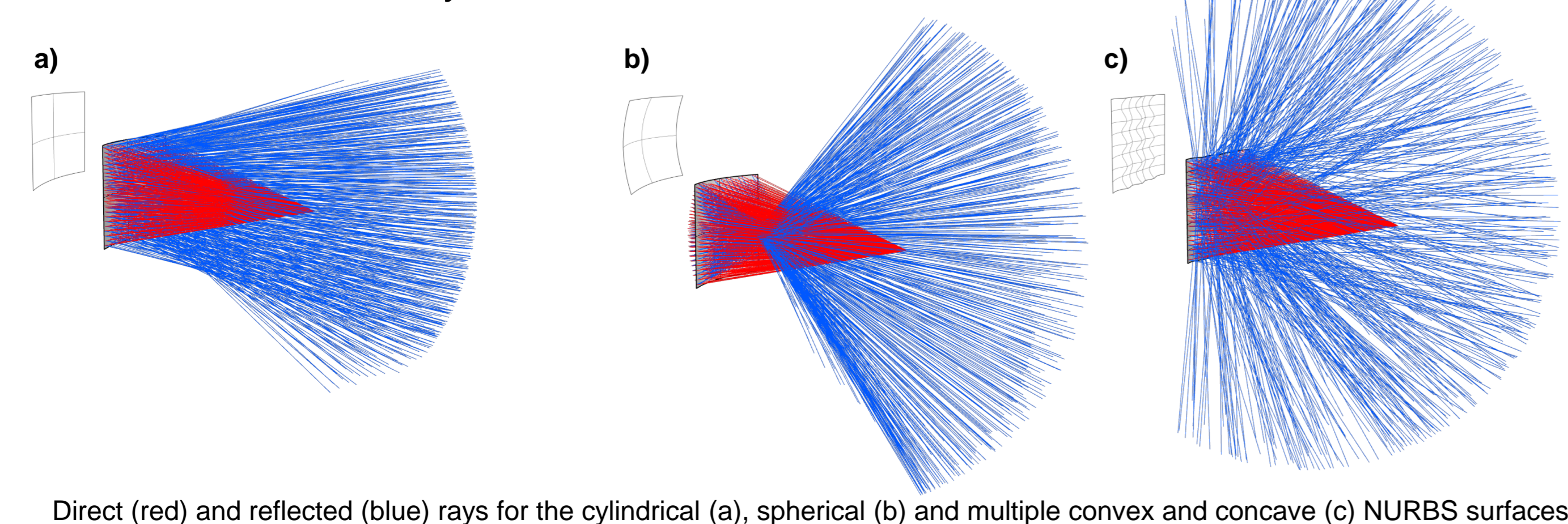
Odeon 13.02

Mesh geometries with 100, 1000, 10000 faces. Number of rays: 30,000; Reflection-based scatter: disabled. Scattering coefficient: 0.05.



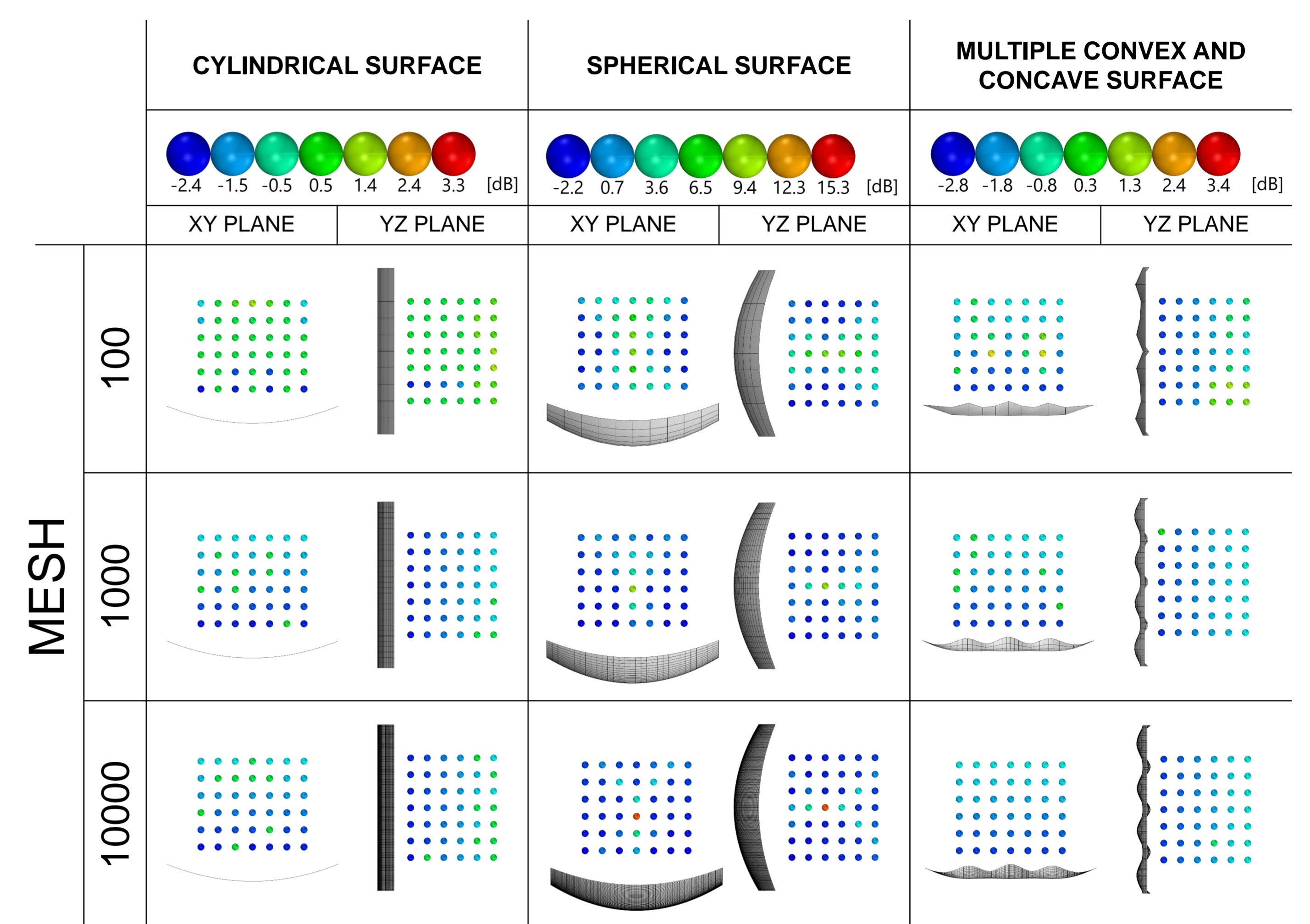
Customized ray-tracing script

Customized ray-tracing algorithm in Python, based on [6], implemented within Rhinoceros CAD environment. Mesh geometries with 100, 1000, 10000 faces + NURBS. Number of rays: 30,000.

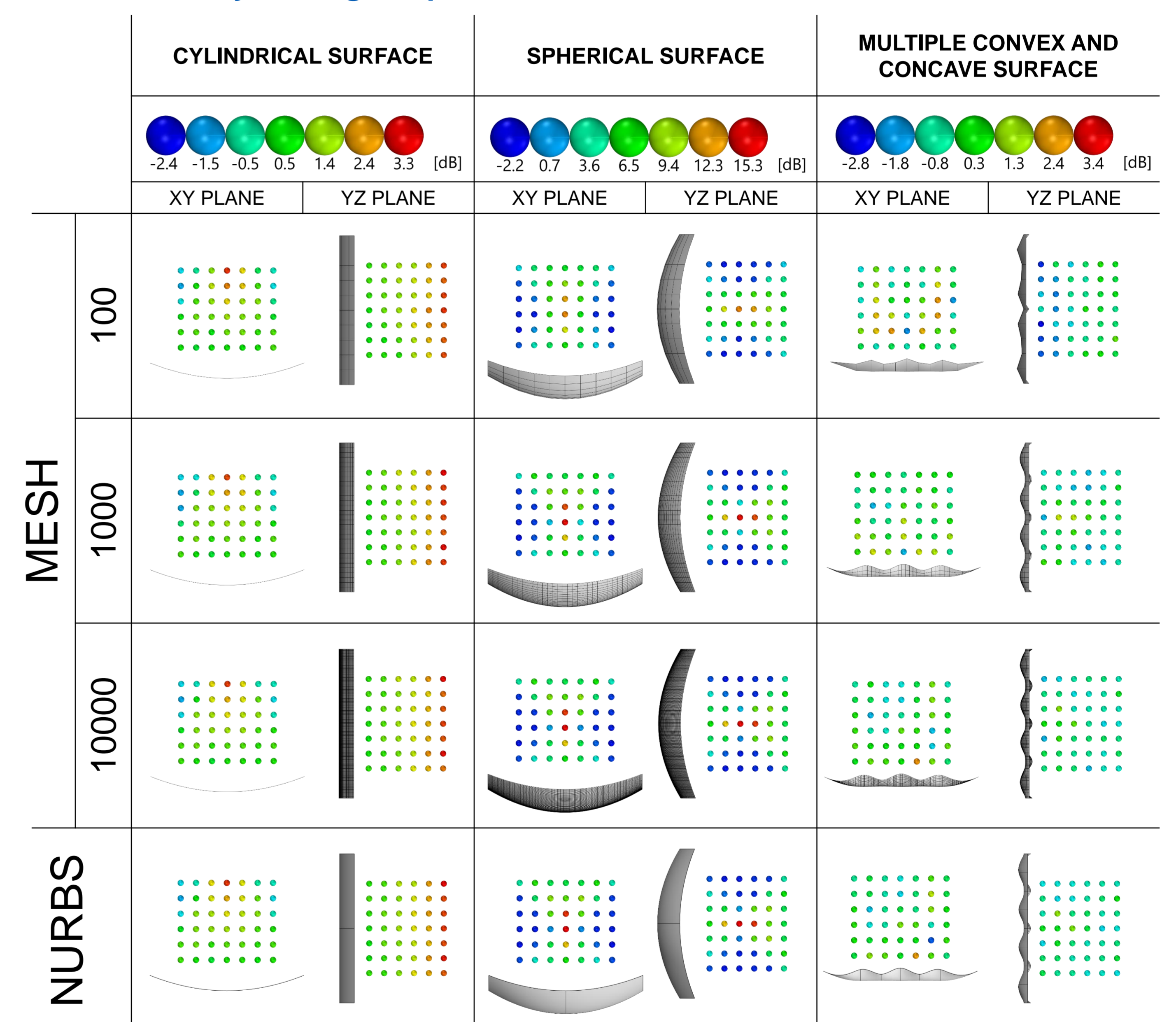


Results

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Customized ray-tracing script



Conclusions

In realistic scenarios with mesh geometries, SPL concentrations are more clearly evidenced by the customized ray-tracer

Mesh discretizations of at least 1000 faces are required to achieve ΔSPL comparable to those obtained with NURBS geometries

Main references

- Vercammen, M.: Sound Reflections from Concave Spherical Surfaces. Part I: Wave Field Approximation. Acta Acustica united with Acustica 96 (2010), 82 – 91.
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- Kuttruff, H.: Some Remarks on the Simulation of Sound Reflection from Curved Walls. Acustica united with Acustica 77 (1992), 176 – 182.
- Vercammen, M.: Sound Concentration Caused by curved Surfaces, PhD thesis, Eindhoven University of Technology, 2012.
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- Zeng X., Chen K., Sun J. On the accuracy of the ray-tracing algorithms based on various sound receiver models, Applied Acoustics 64 (2003), pp. 433–441.