Scheme Report

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July 11, 2021

1 Background

2 Methods

2.1 Schemes

Kocks p138 introduces name 'scheme'

2.1.1 Single schemes

Figure 1: Pole figure scatter plots for the ND single sampling scheme (marked in blue), RD single sampling scheme (marked in red), TD single sampling scheme (marked in green), and Morris single sampling scheme (marked in yellow).

2.1.2 Ring schemes

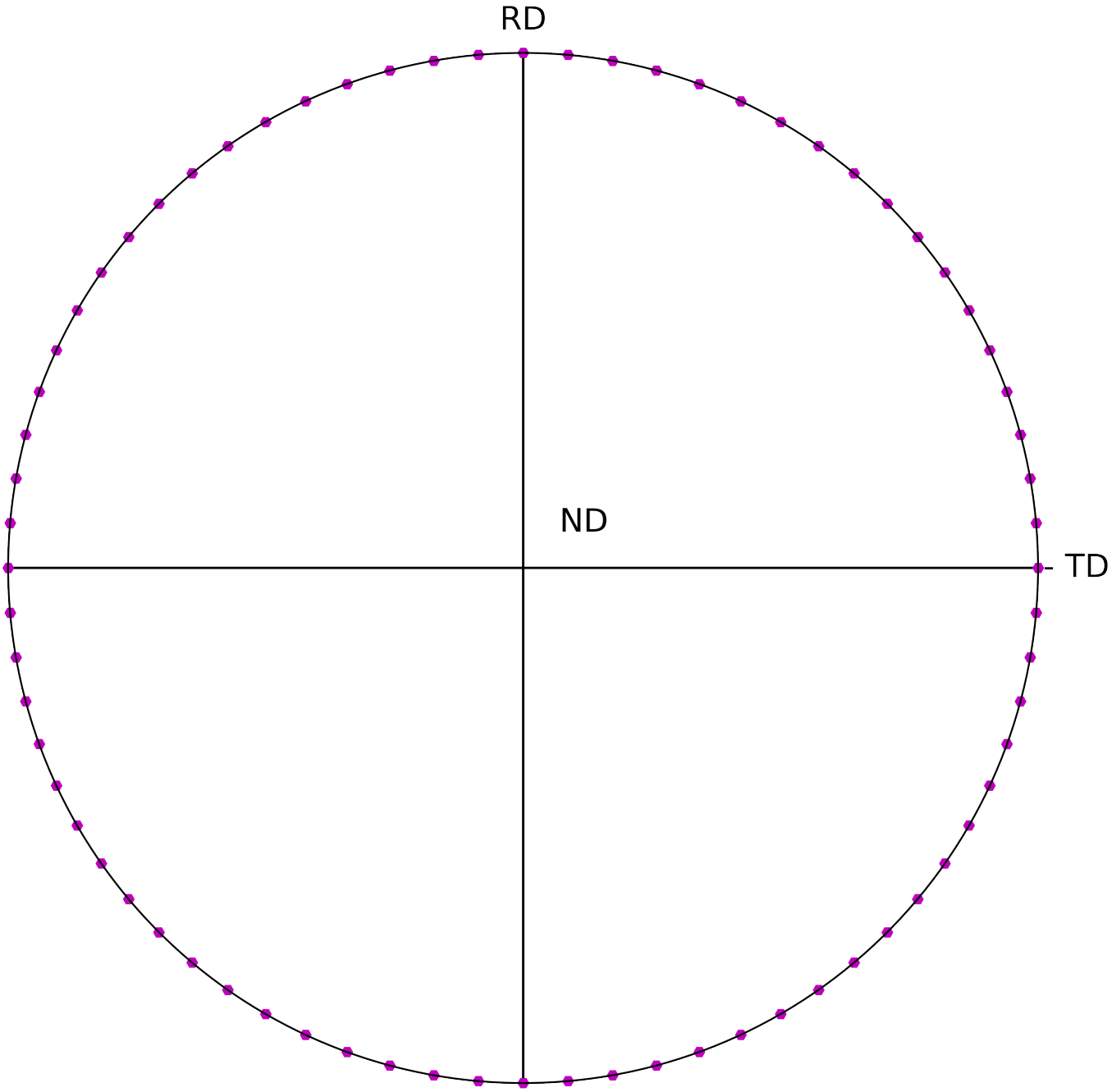

Figure 2: Pole figure scatter plot for sampling ring scheme about the ND

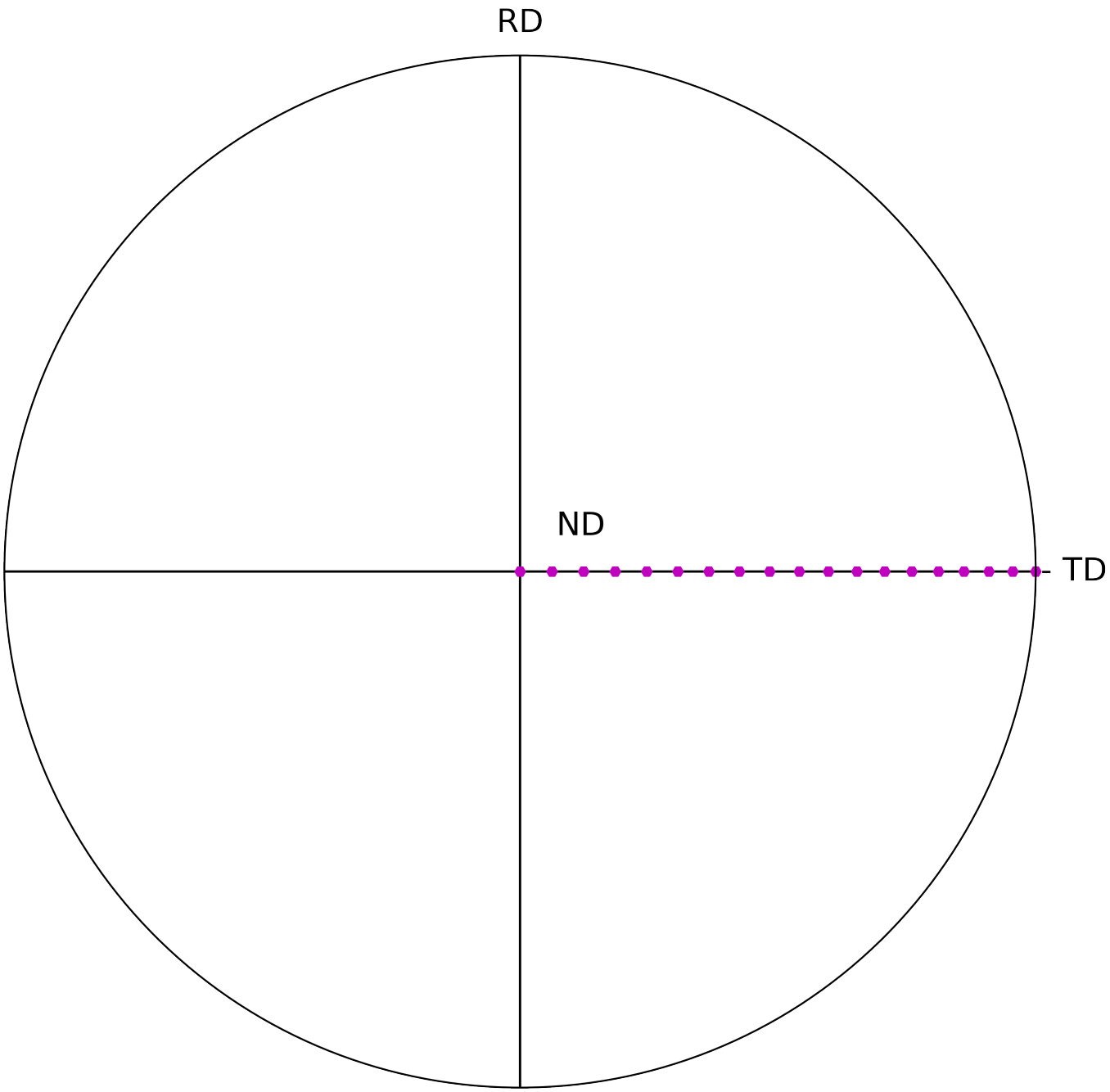

Figure 3: Pole figure scatter plot for sampling ring scheme about the RD

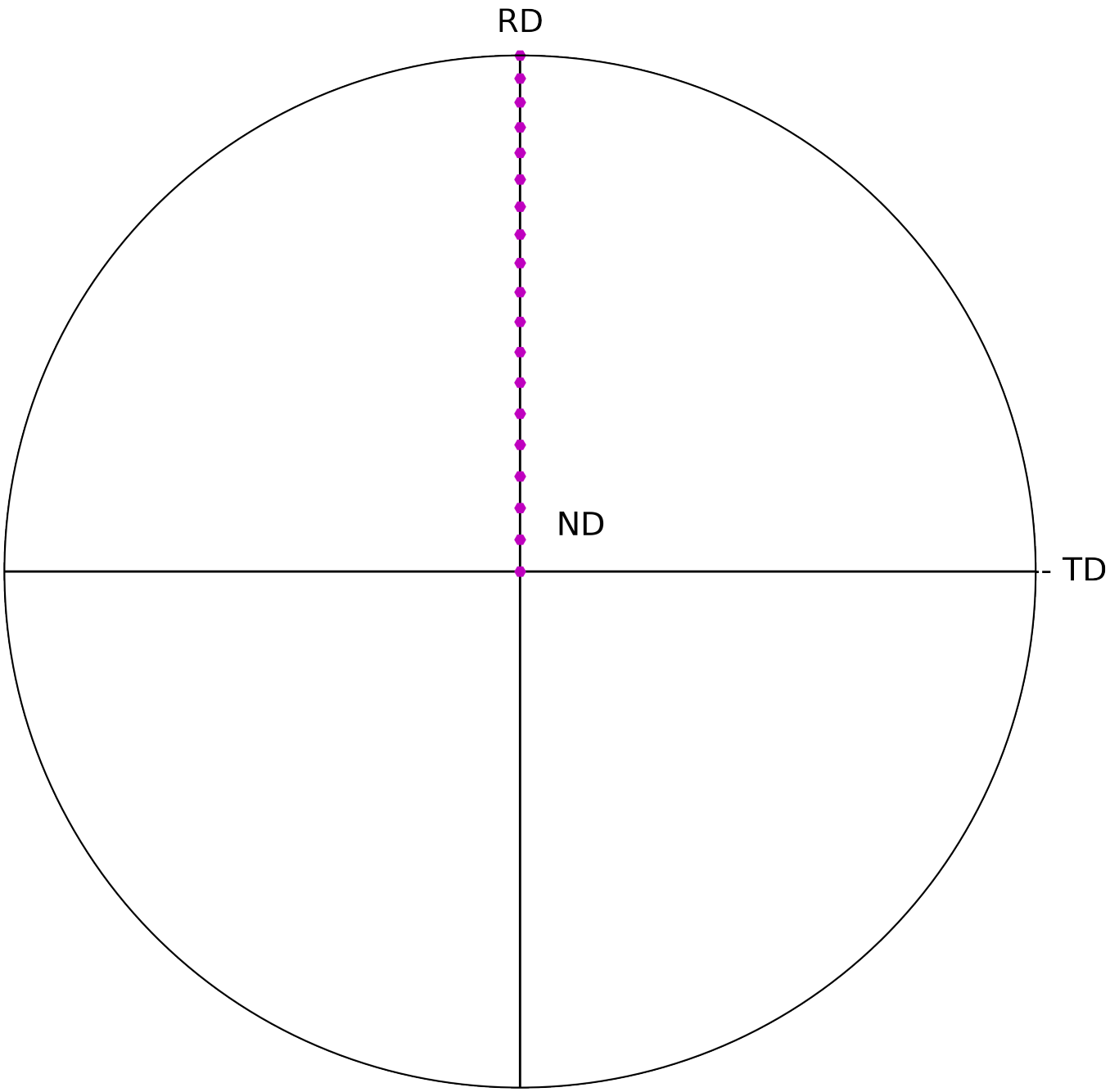

Figure 4: Pole figure scatter plot for sampling ring scheme about the TD

High energy (infinite) single rings

High energy (finite) rotated rings [PKP19], where I got the rotated rings from

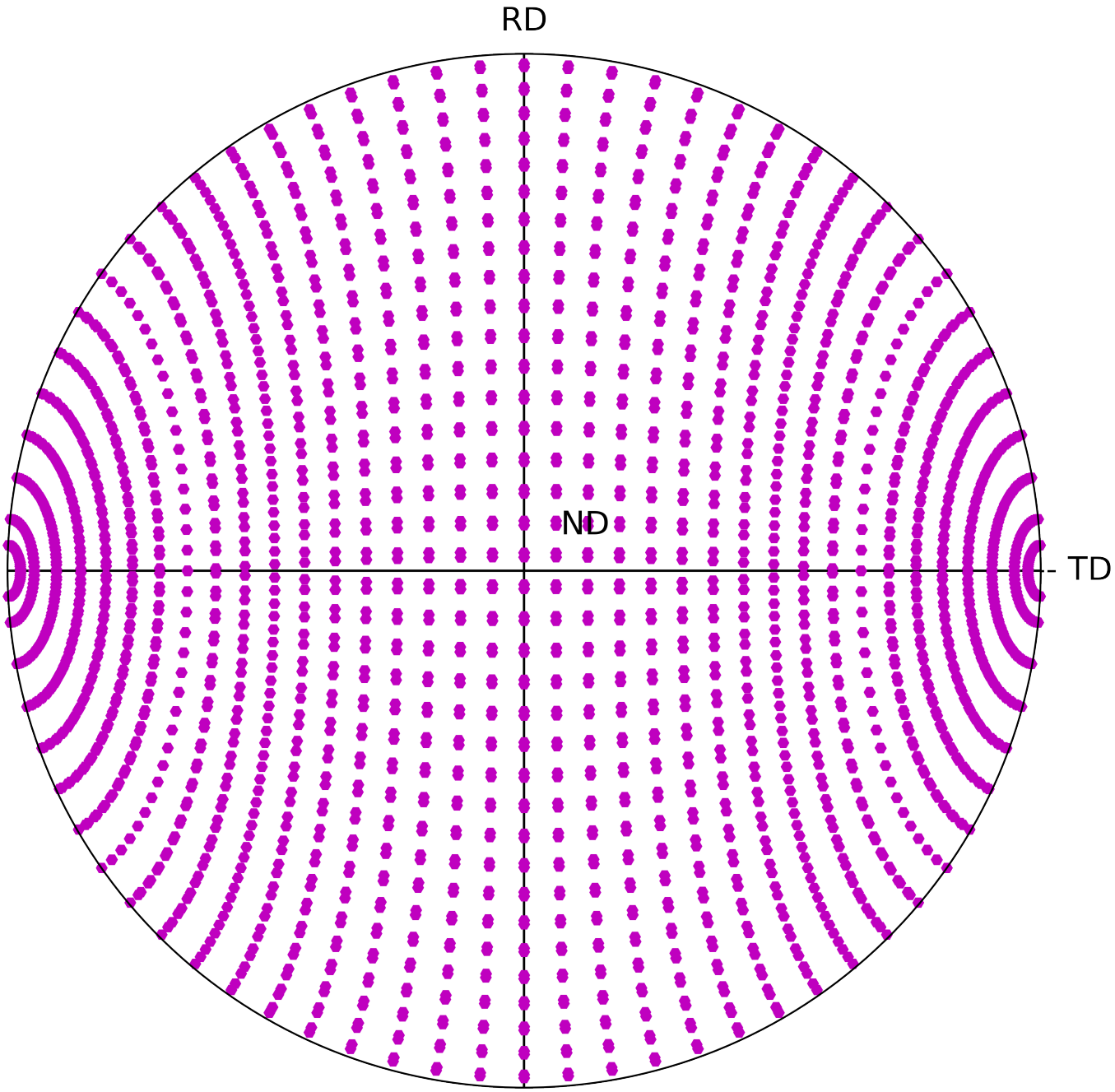

Figure 5: Pole figure scatter plot for complete rotated-ring sampling scheme

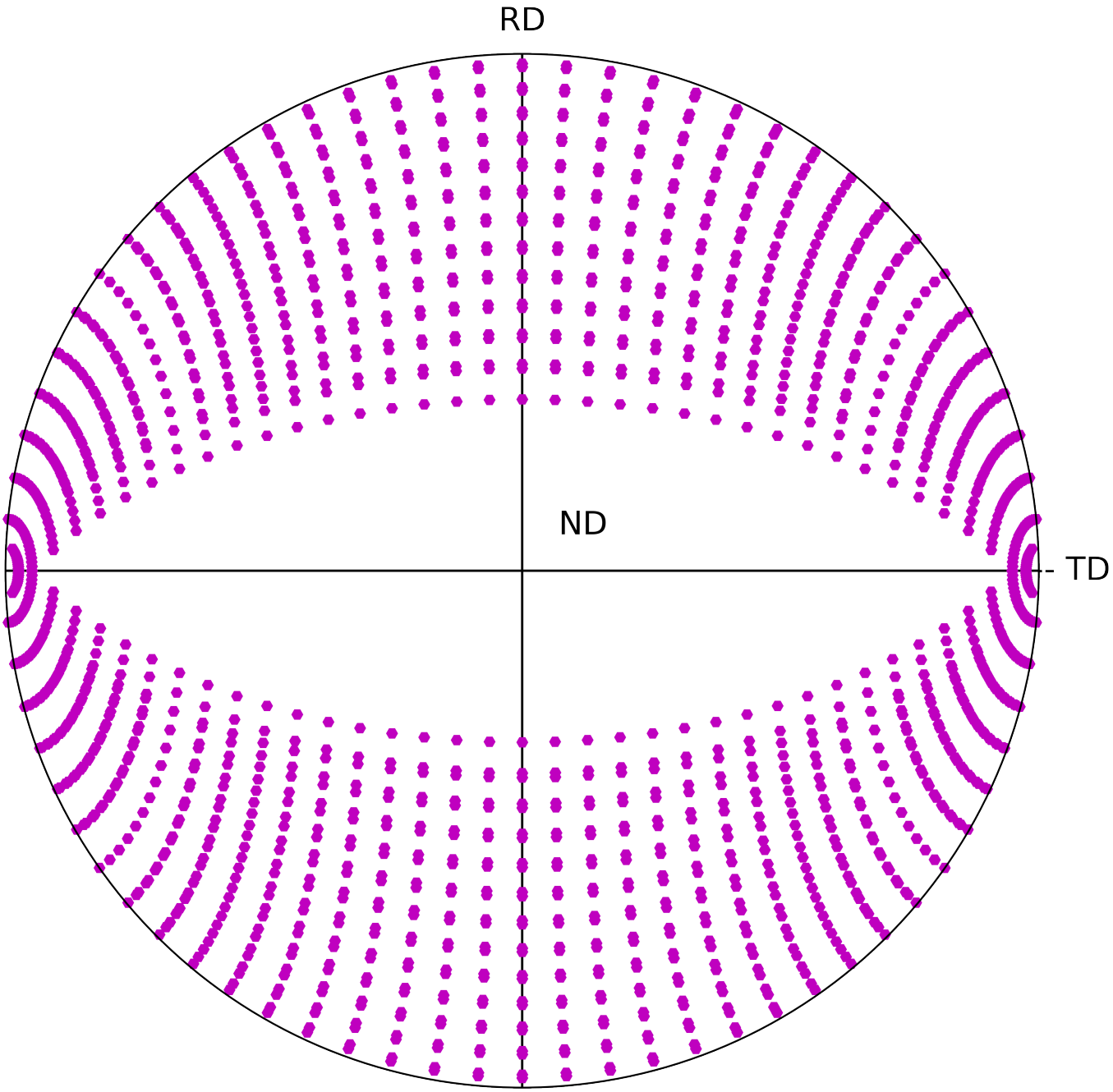

Figure 6: Pole figure scatter plot for partial rotated-ring sampling scheme

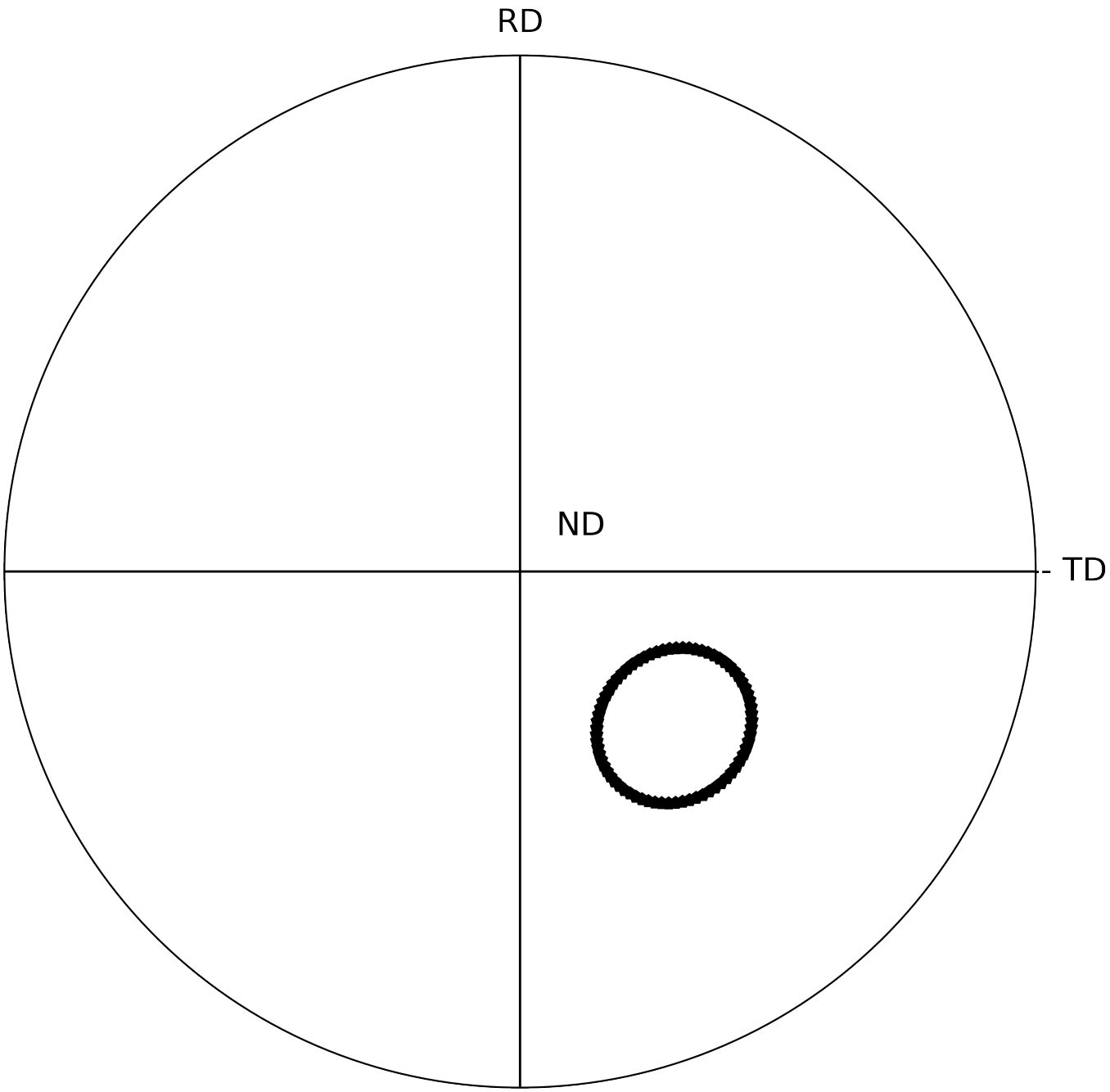

Figure 7: Pole figure scatter plot of the Offset ring shifted 45 degrees, for measuring the Ferrite phase

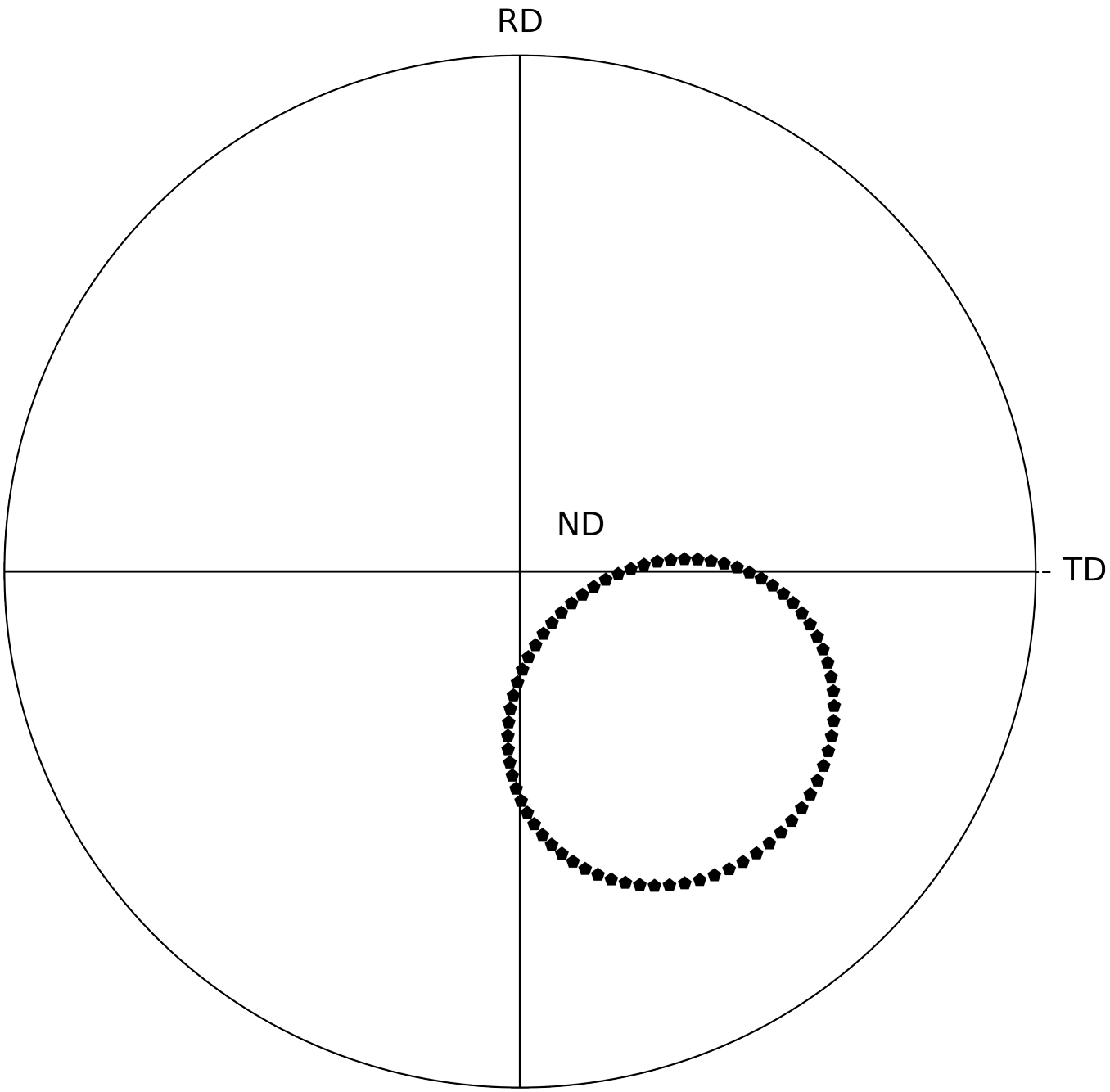

Figure 8: Pole figure scatter plot of the Offset ring shifted 45 degrees, for measuring the Austenite phase

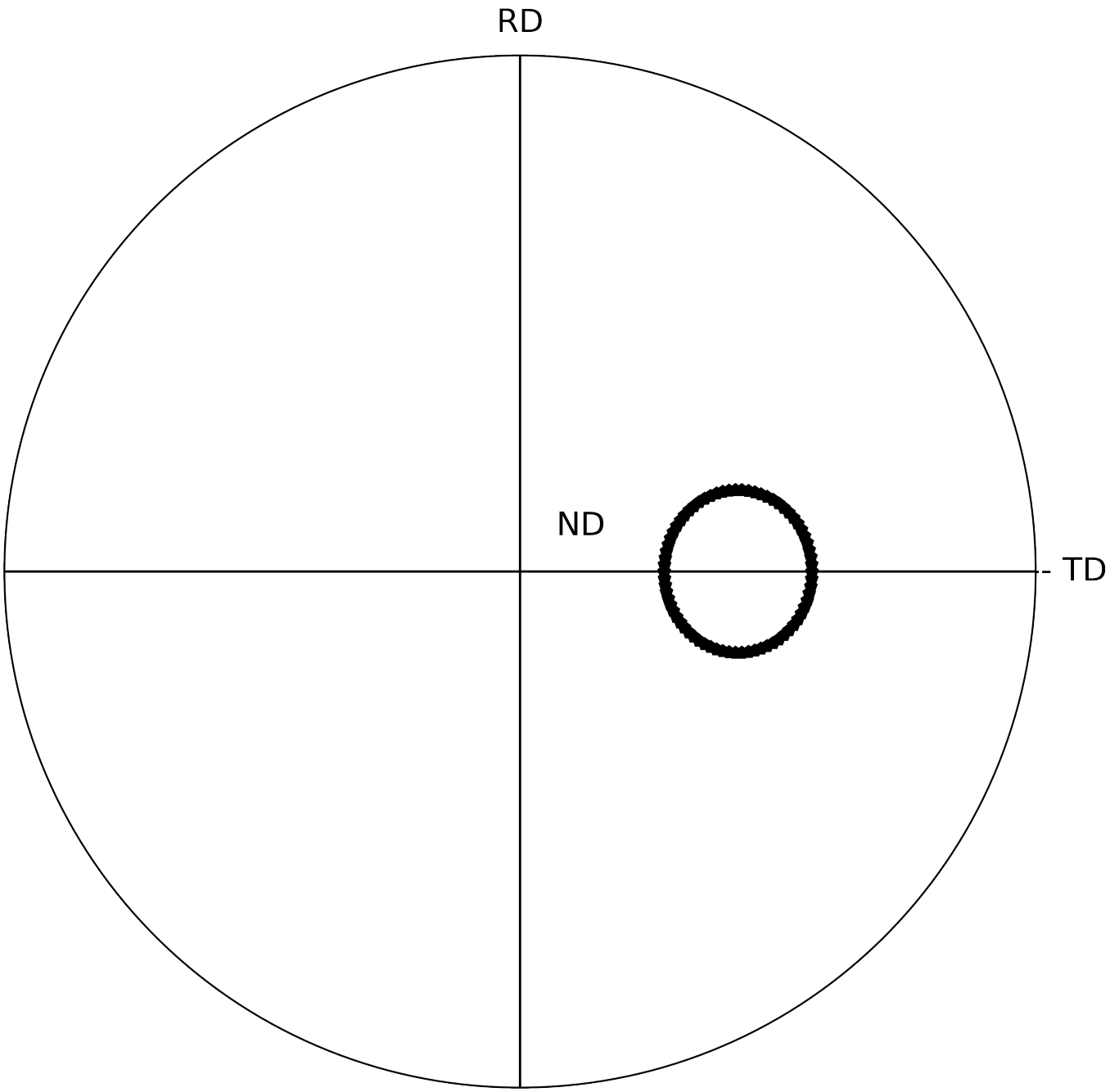

Figure 9: Pole figure scatter plot of the Offset ring shifted along the TD, for measuring the Ferrite phase

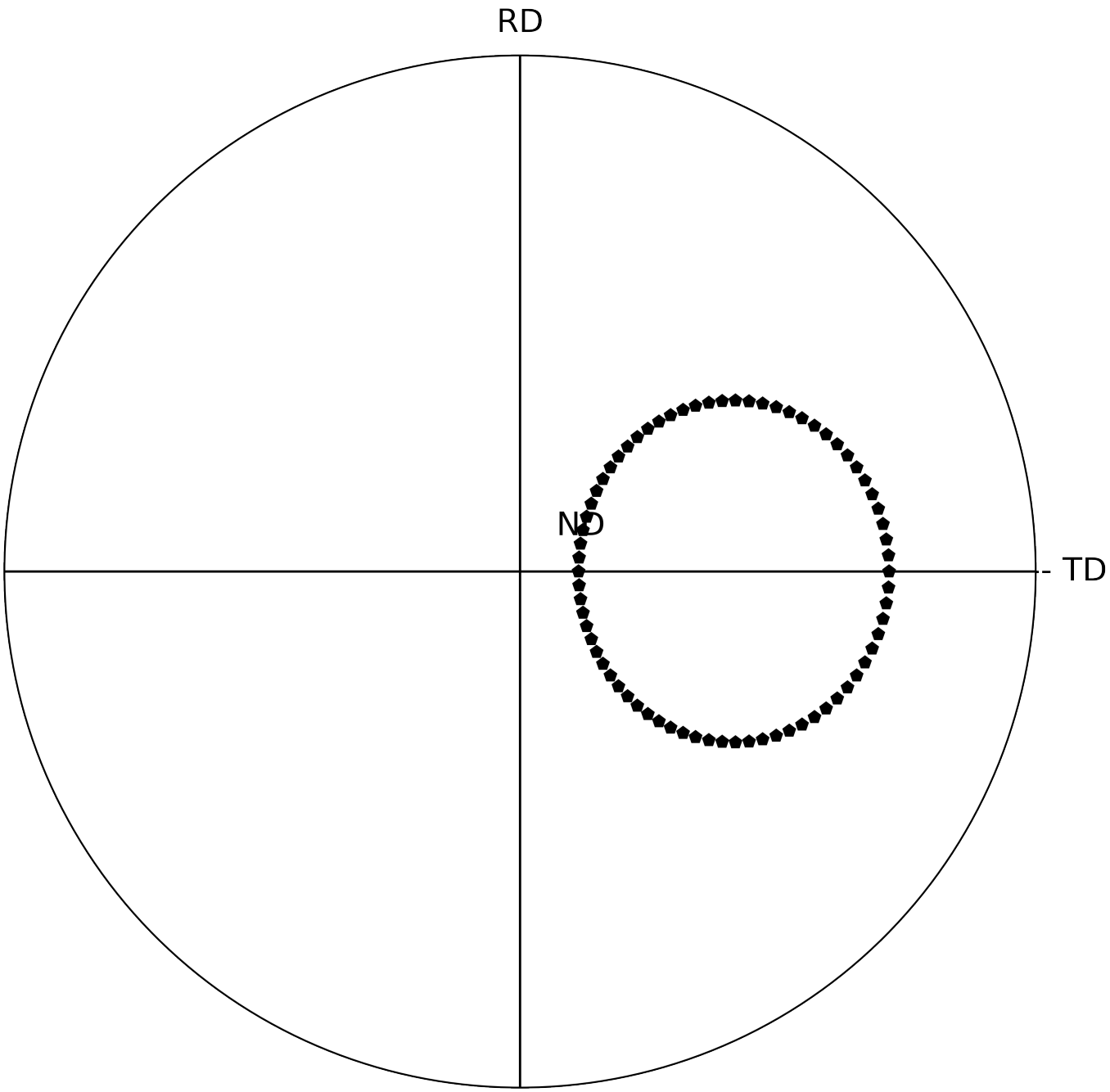

Figure 10: Pole figure scatter plot of the Offset ring shifted along the TD, for measuring the Austenite phase

Lower energy single rings

2.1.3 Equal Angle

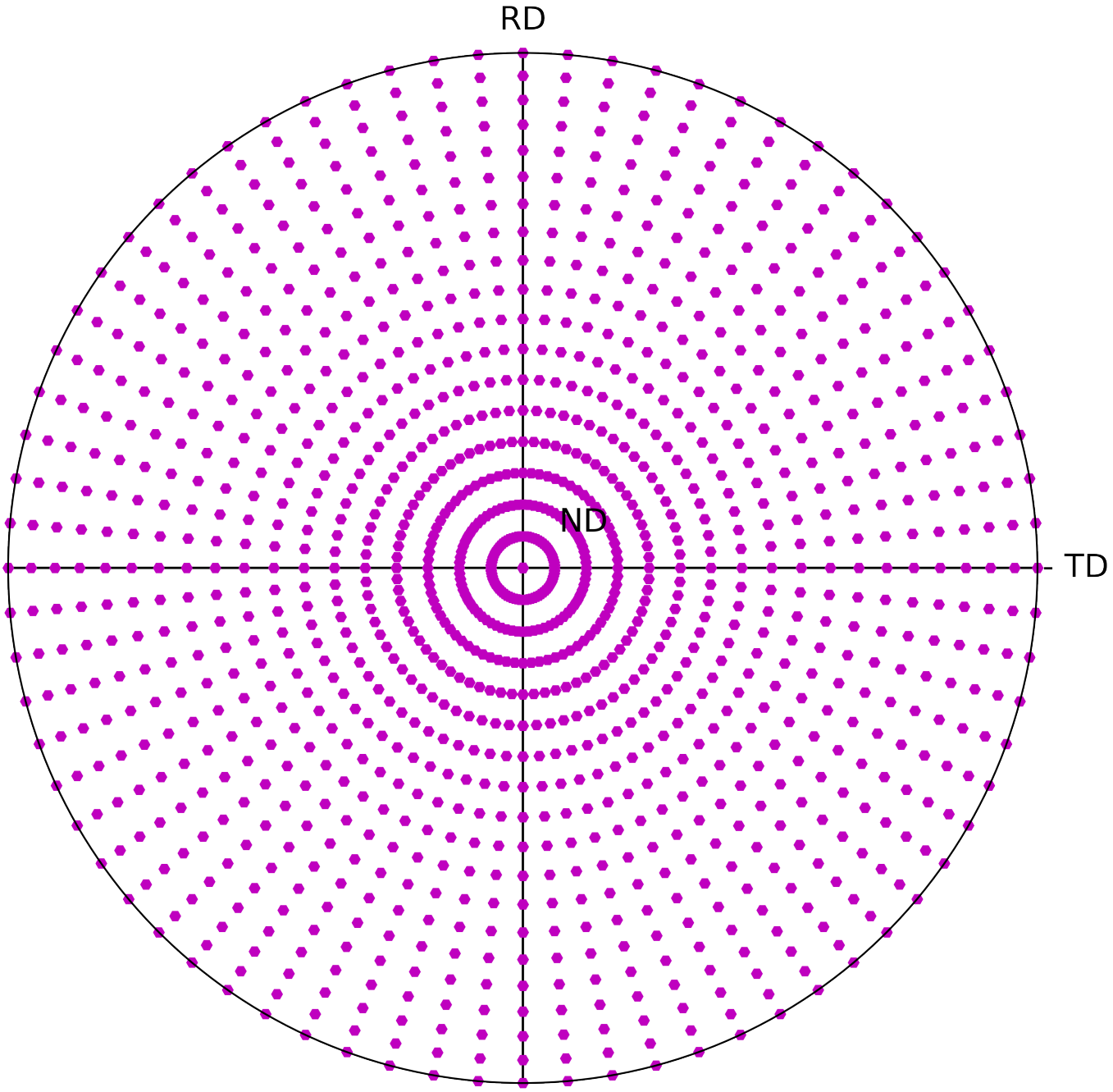

Figure 11: Pole figure scatter plot of the Equal Angle sampling scheme

2.1.4 Tilt and Rotate

SAE publication [JLS80]

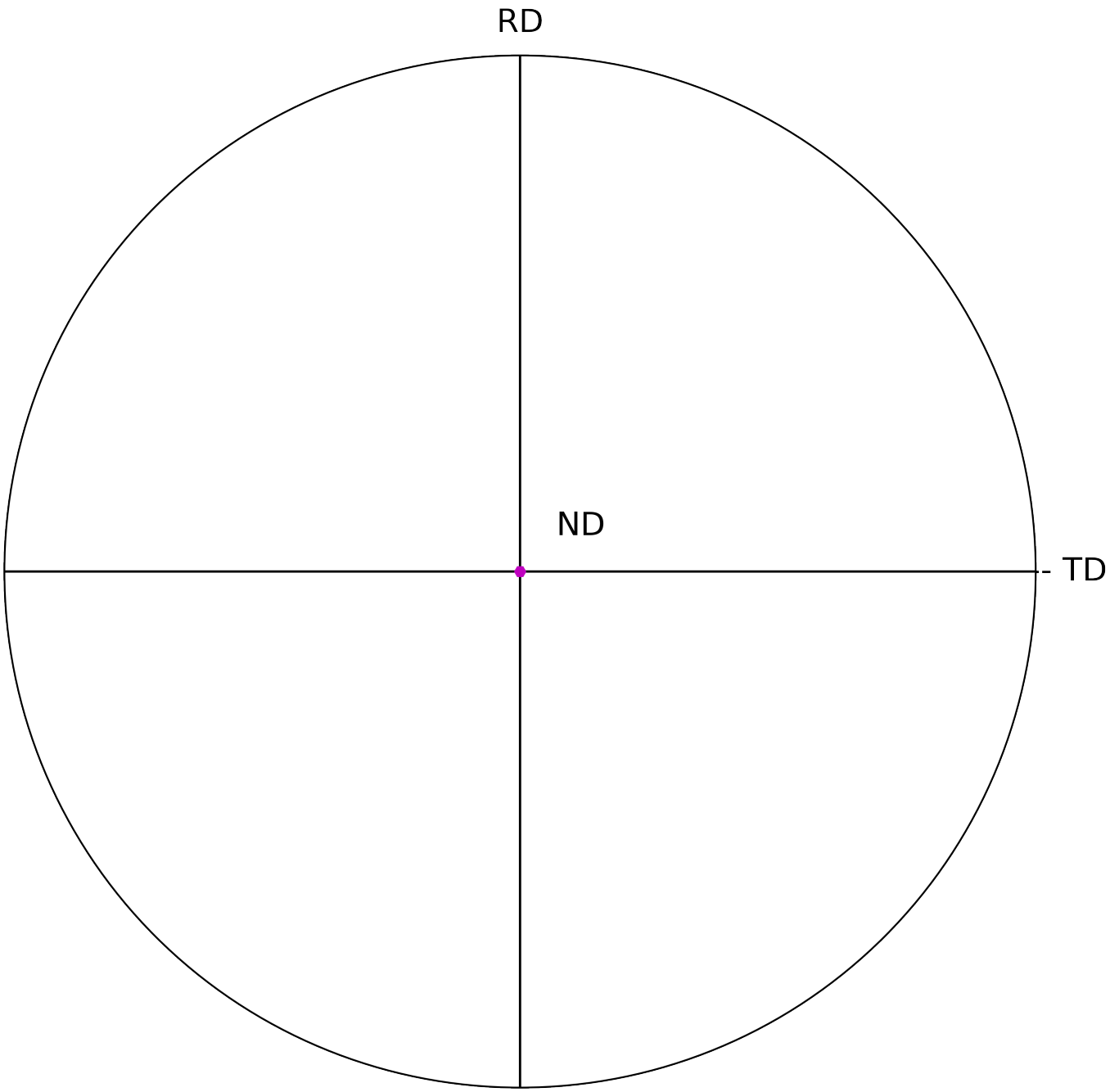

Figure 12: Pole figure scatter plot of rotation-only sampling scheme measurement

Rotation Alone

Tilt Alone SAE publication page 48 found tilting produced reasonably accurate results [JLS80].

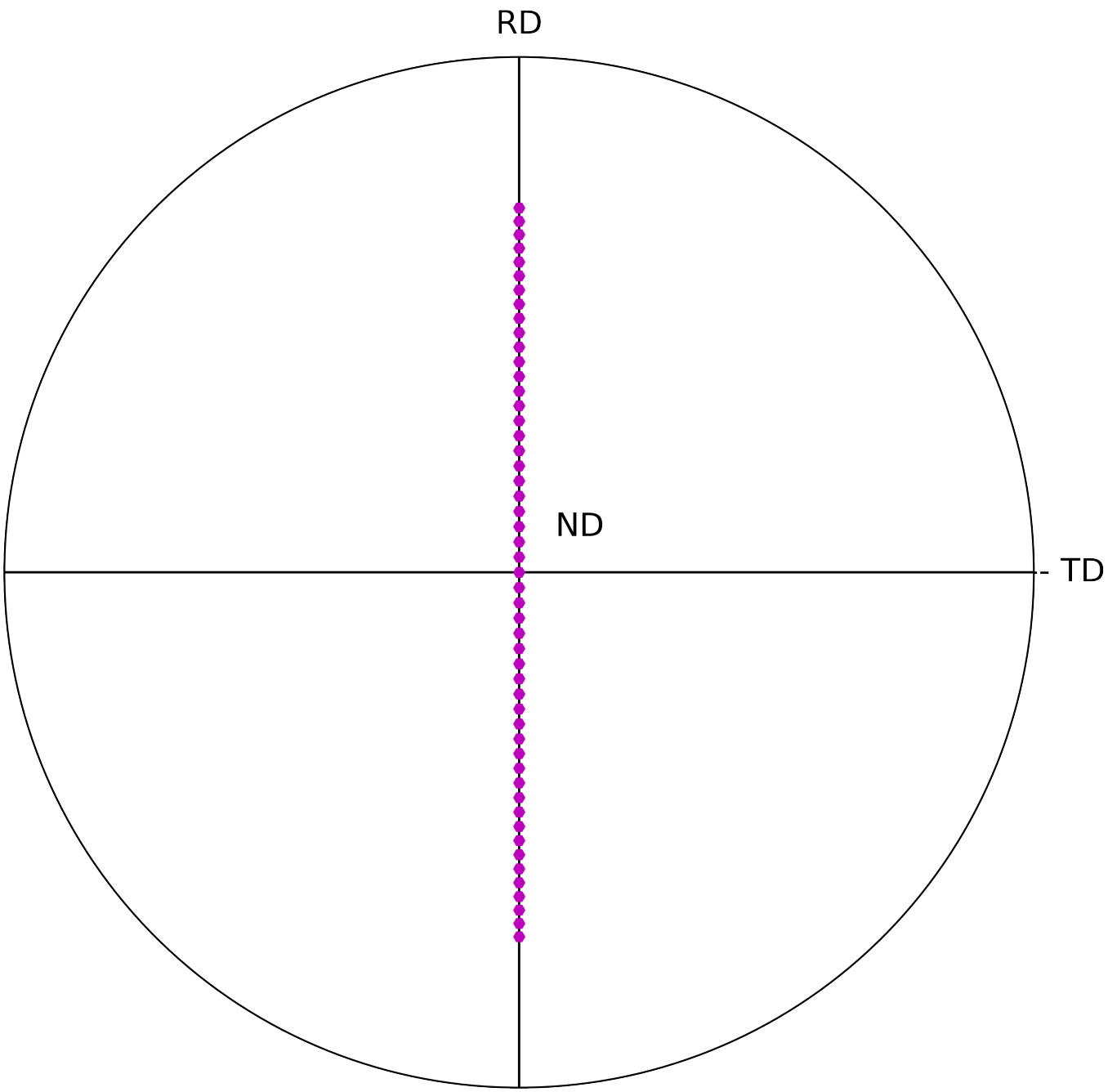

Figure 13: Pole figure scatter plot of tilt-only sampling scheme measurement

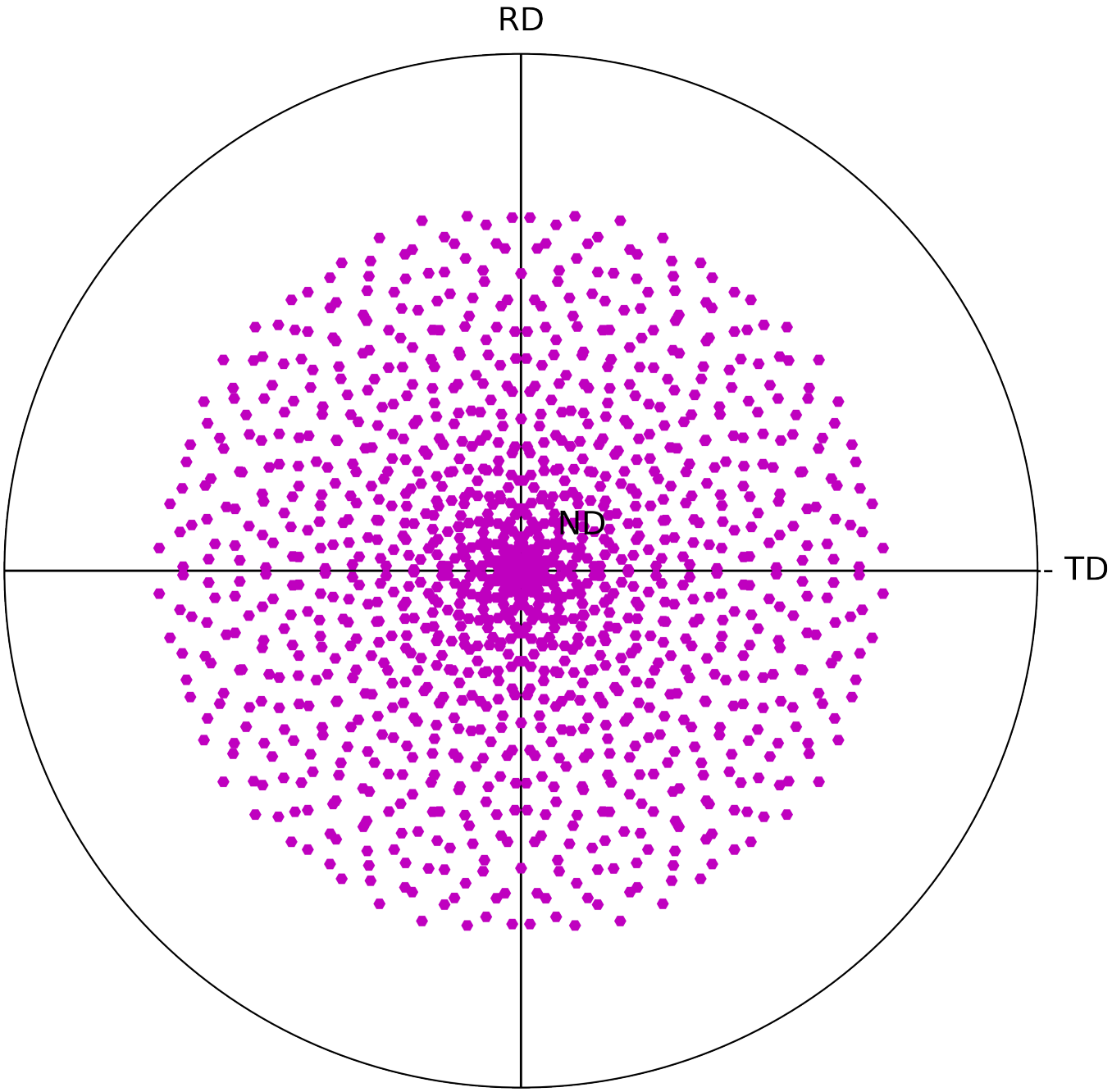

Figure 14: Pole figure scatter plot of combined tilt-and-rotation sampling scheme measurement

Tilt and rotation

2.1.5 Spiral schemes

Fixed tilt and rotation rate Spiral [KA74] shows this

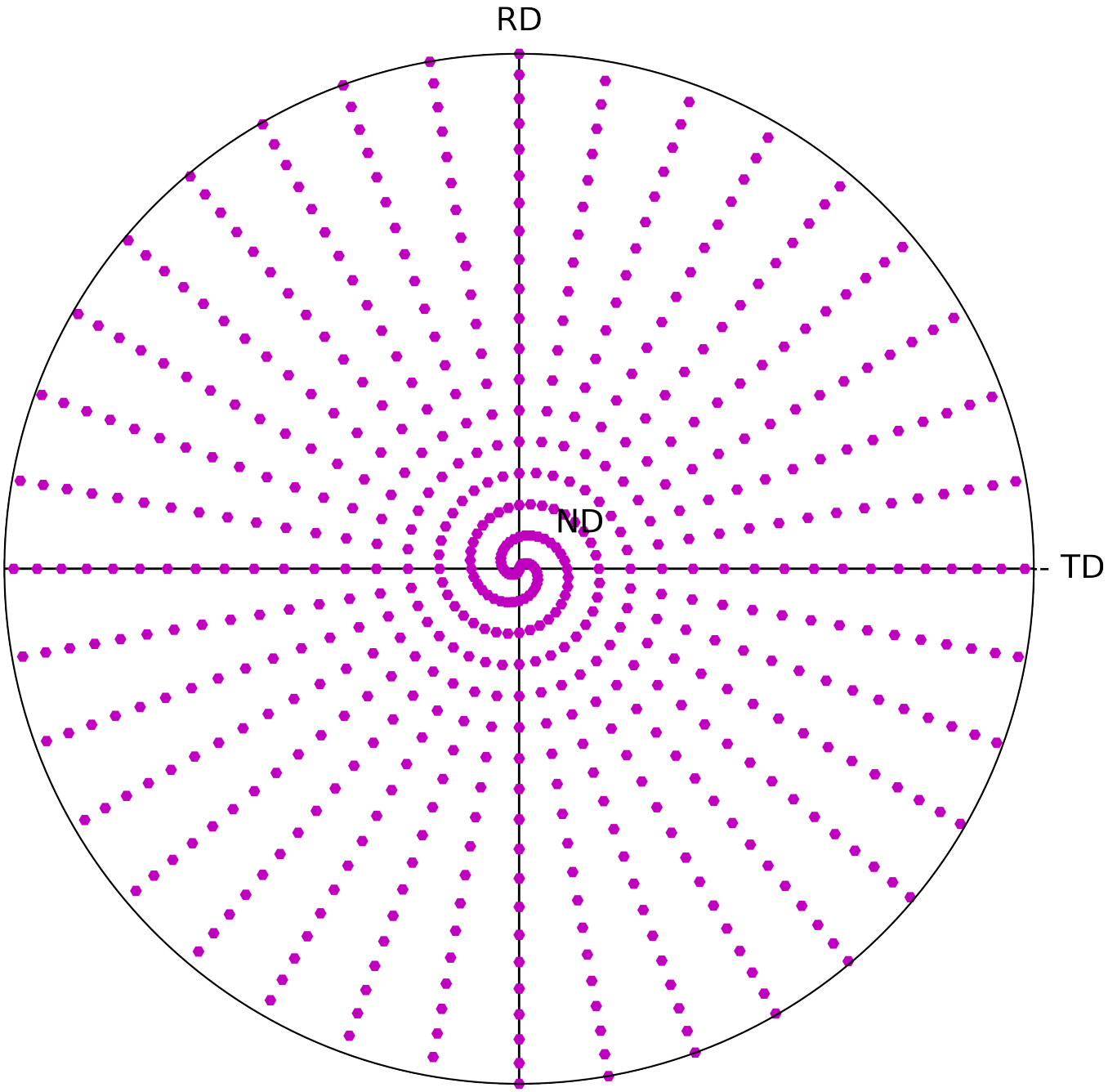

Figure 15: Pole figure scatter plot of Archimedean spiral sampling scheme. From [**?**]

Logarithmic Spiral Seems developed by [Riz08]

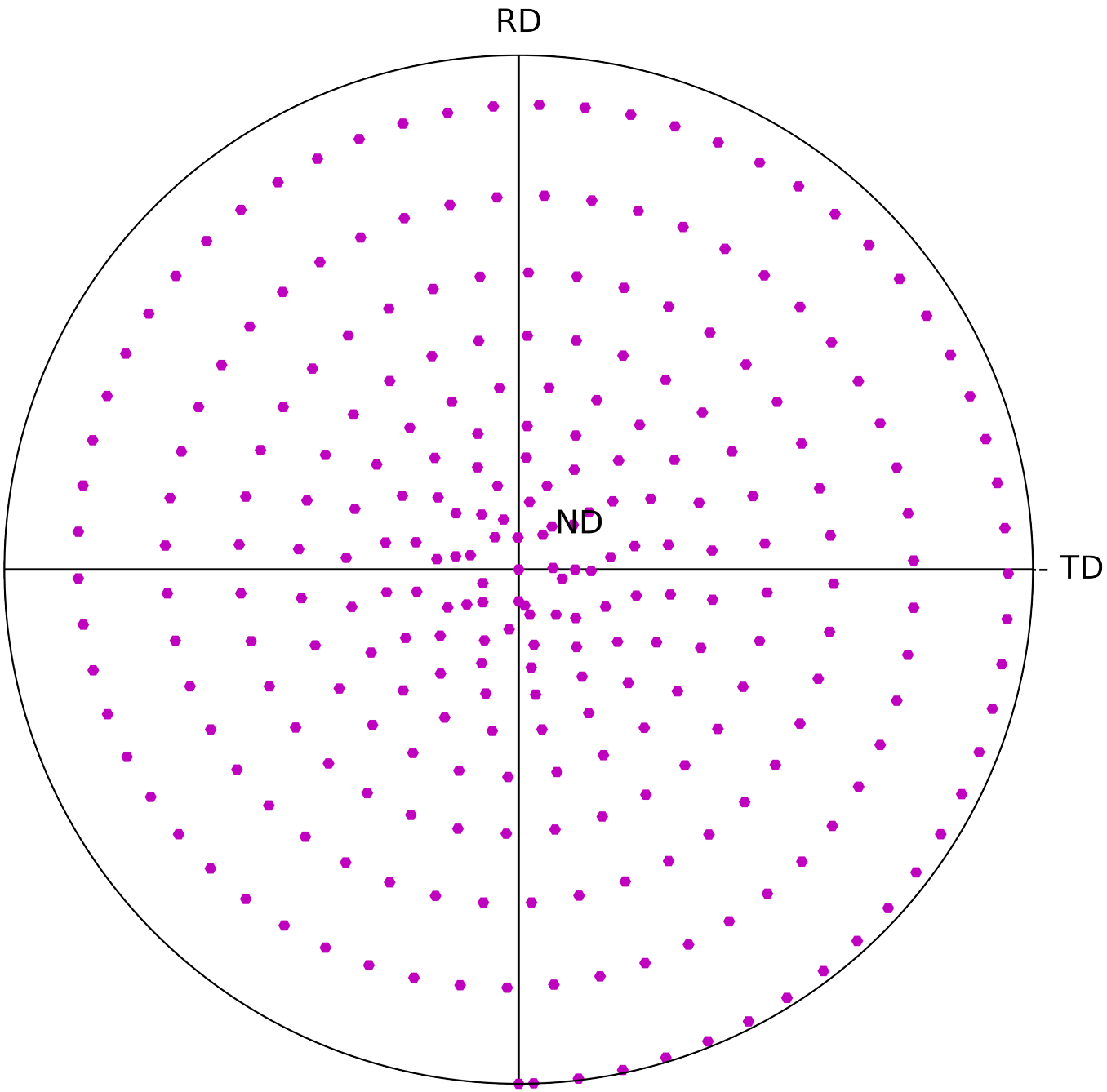

Figure 16: Pole figure scatter plot of logarithmic spiral sampling scheme. From [Riz08]

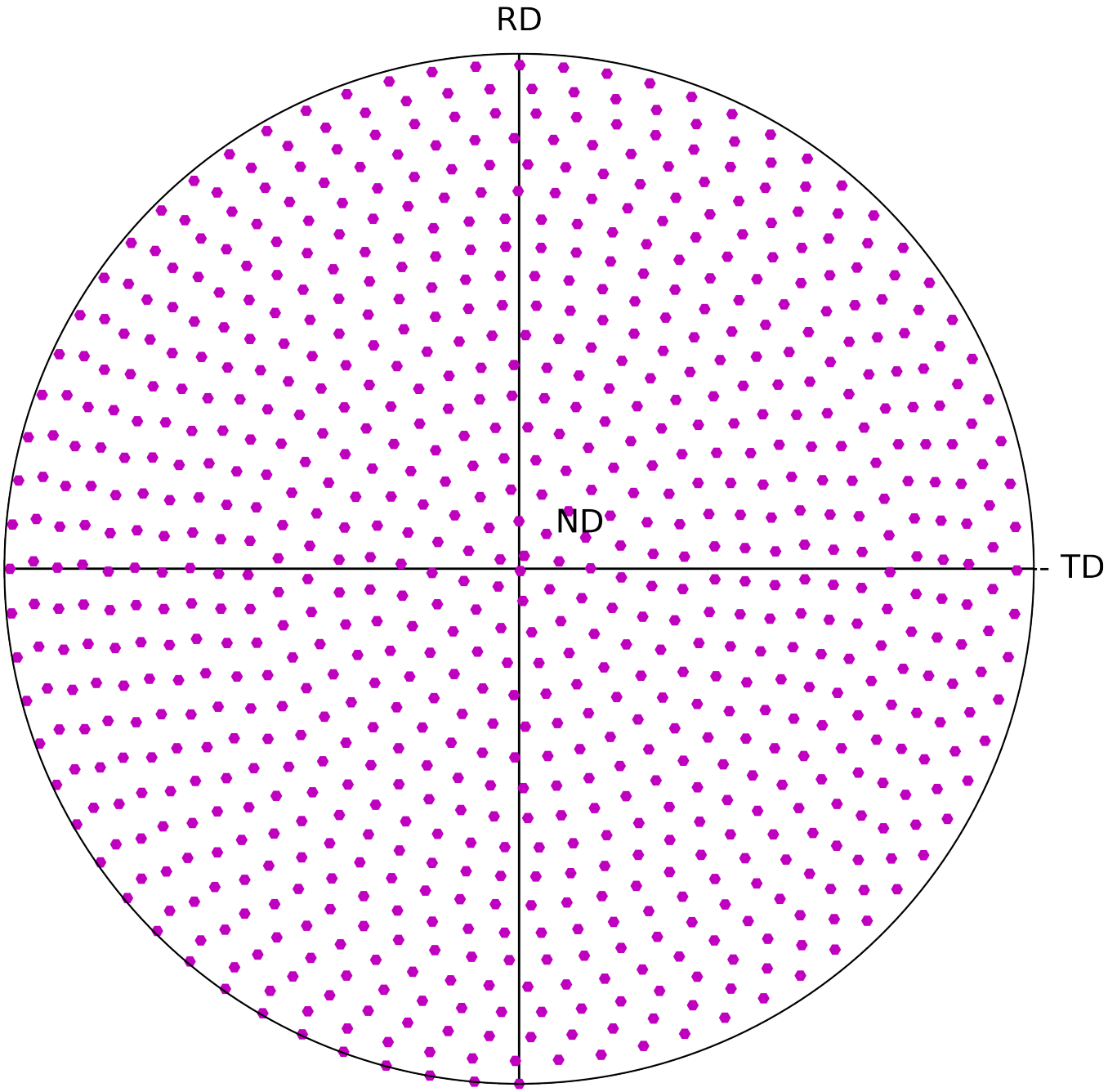

Figure 17: Pole figure scatter plot of new spiral sampling scheme

Equal Coverage Spiral

2.1.6 Hexagonal schemes

Rizzie Hex From [Riz08], references [MW92]

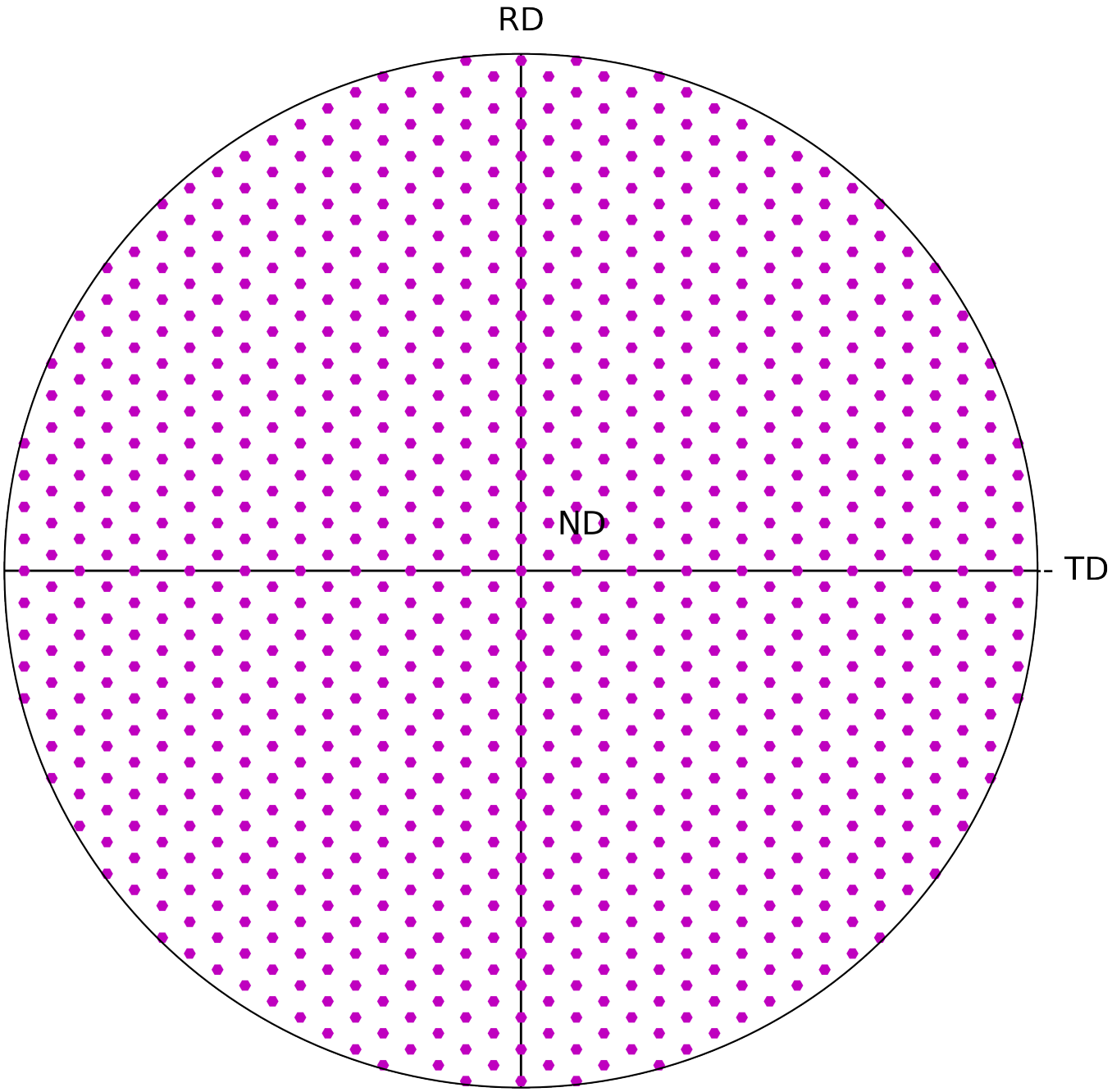

Figure 18: Pole figure scatter plot of Hexagonal grid sampling scheme. From [Riz08]

Matthies Hex [MW92], code from Thomas (cite?)

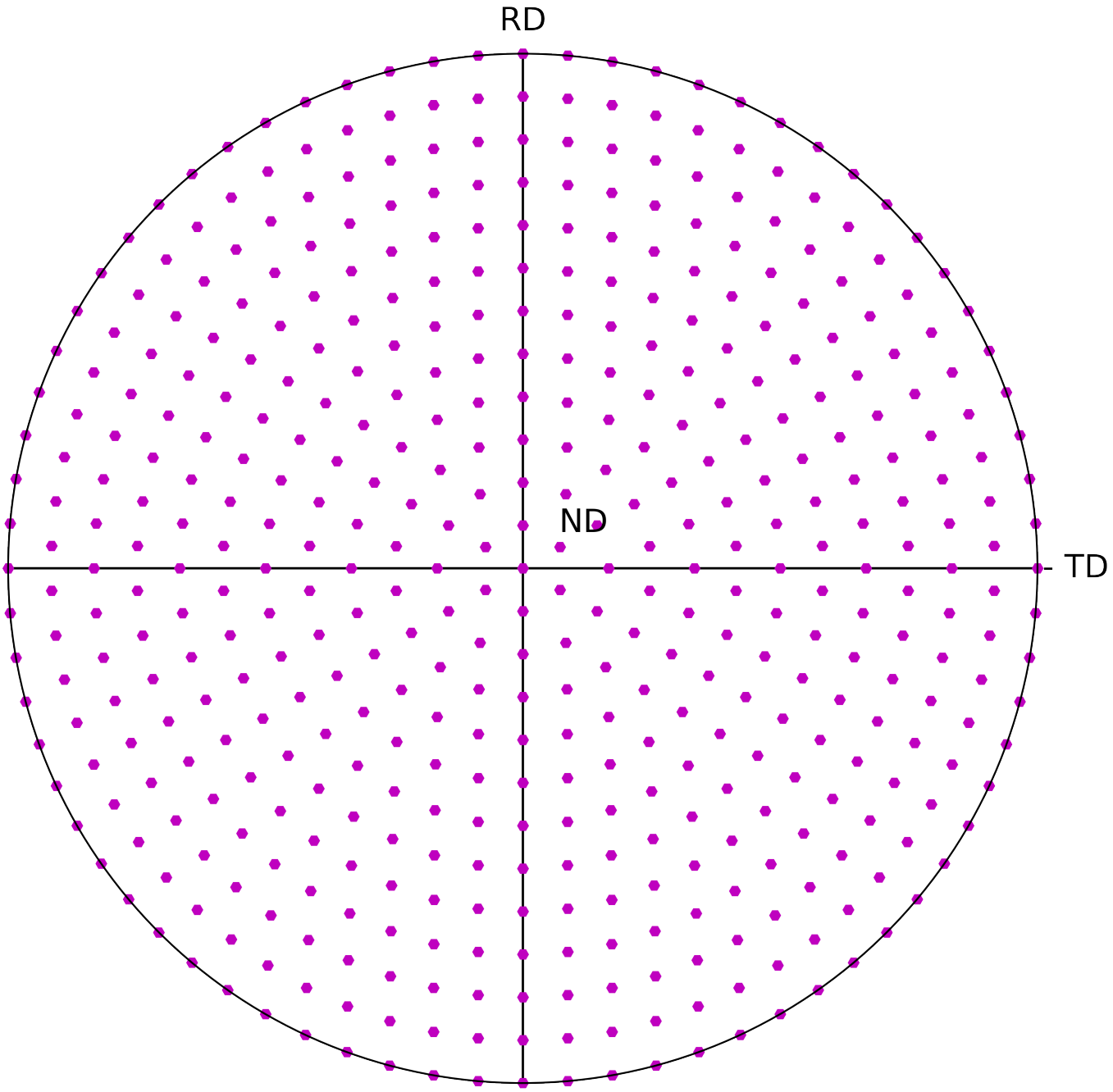

Figure 19: Pole figure scatter plot of Thomas Hexagonal grid sampling scheme. From [MW92]

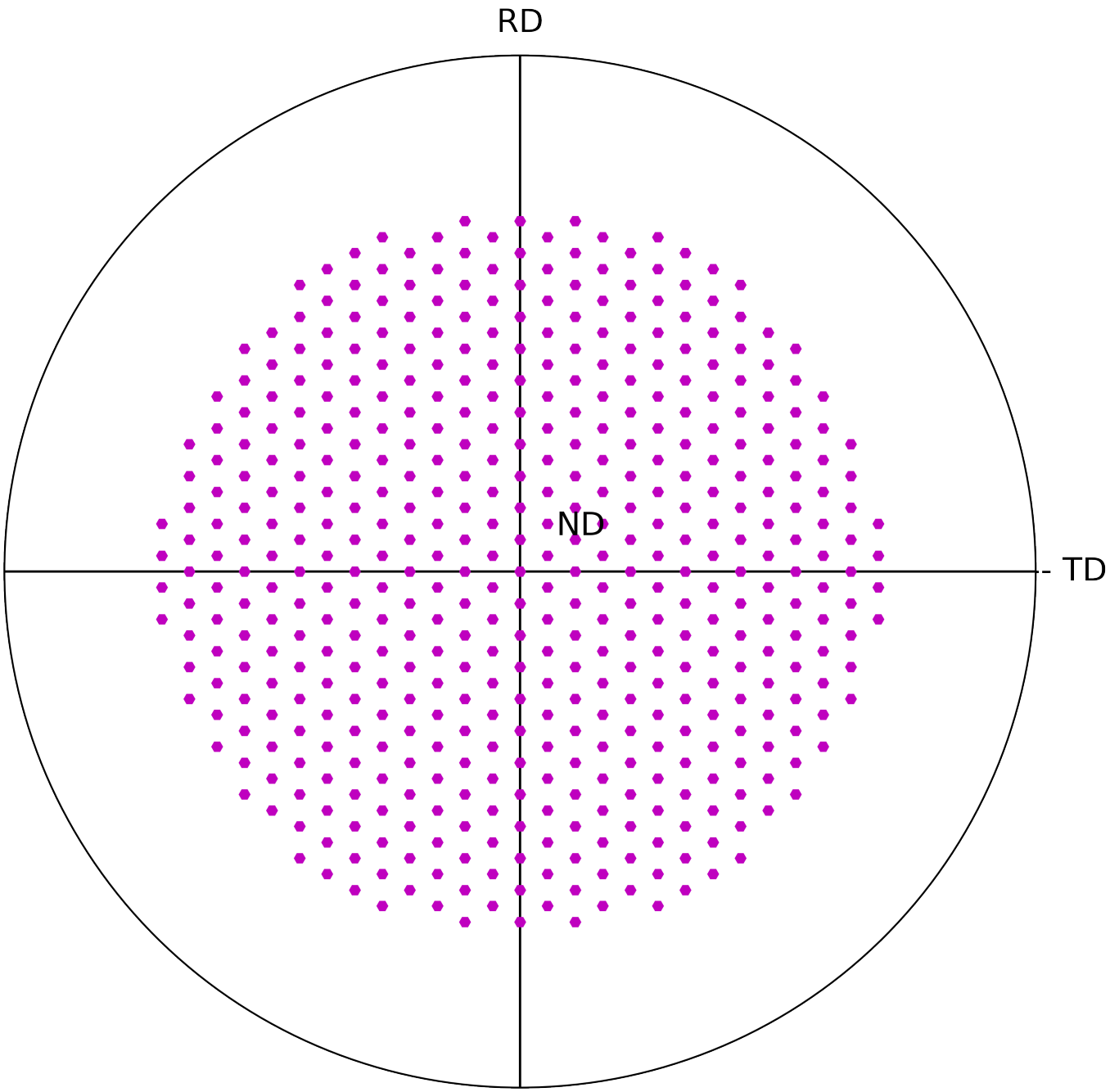

Figure 20: Pole figure scatter plot of partial hexagonal grid sampling scheme. From [Riz08]

Partial Hex

2.1.7 CLRGrid

Included in Bruker Diffrac.Texture manual [Gmb16]

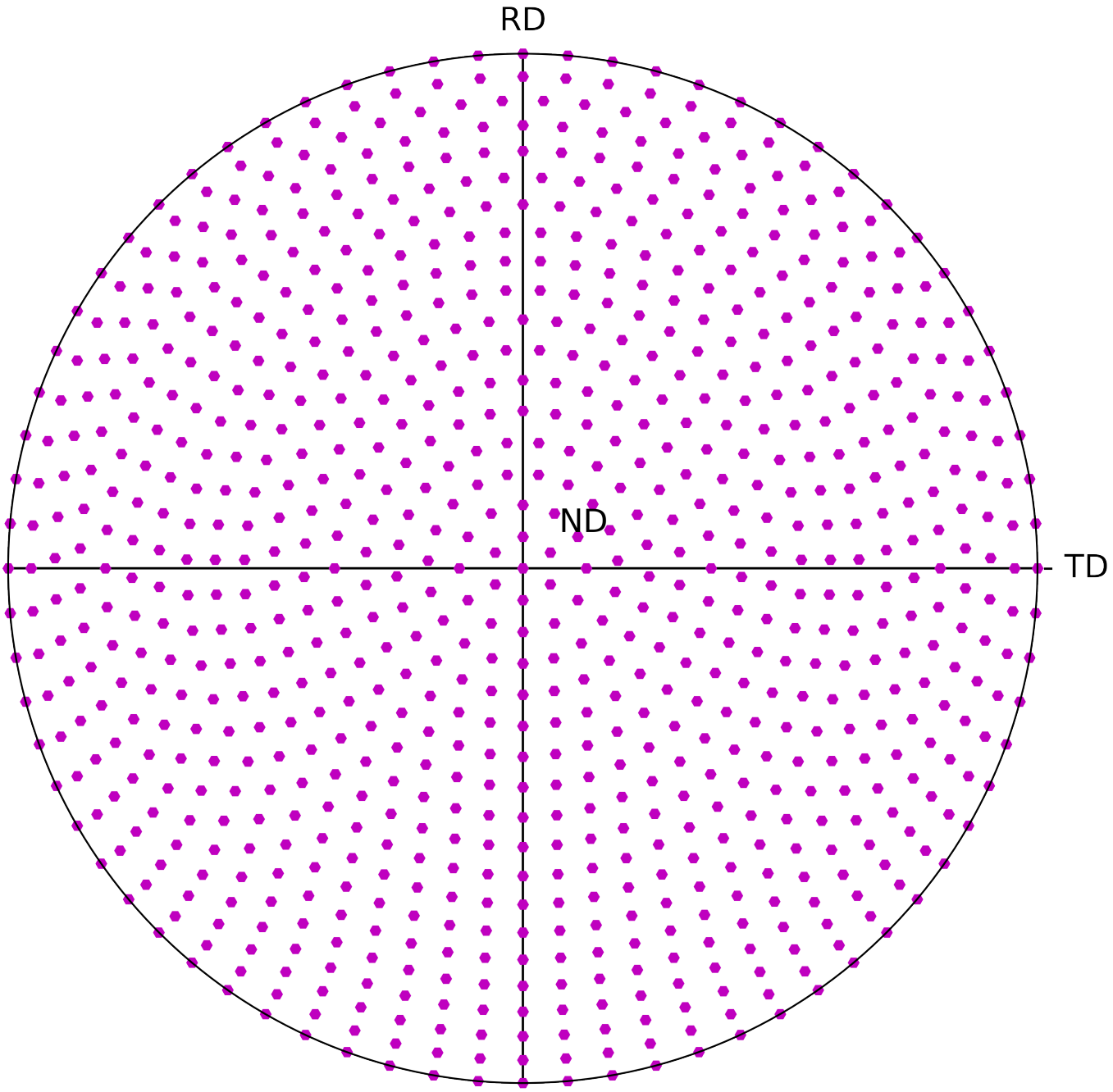

Figure 21: Pole figure scatter plot of CLR grid sampling scheme. From [Gmb16]

2.1.8 Gaussian Quadrature

[LLD15] Main reference with equations, also [Lan17]

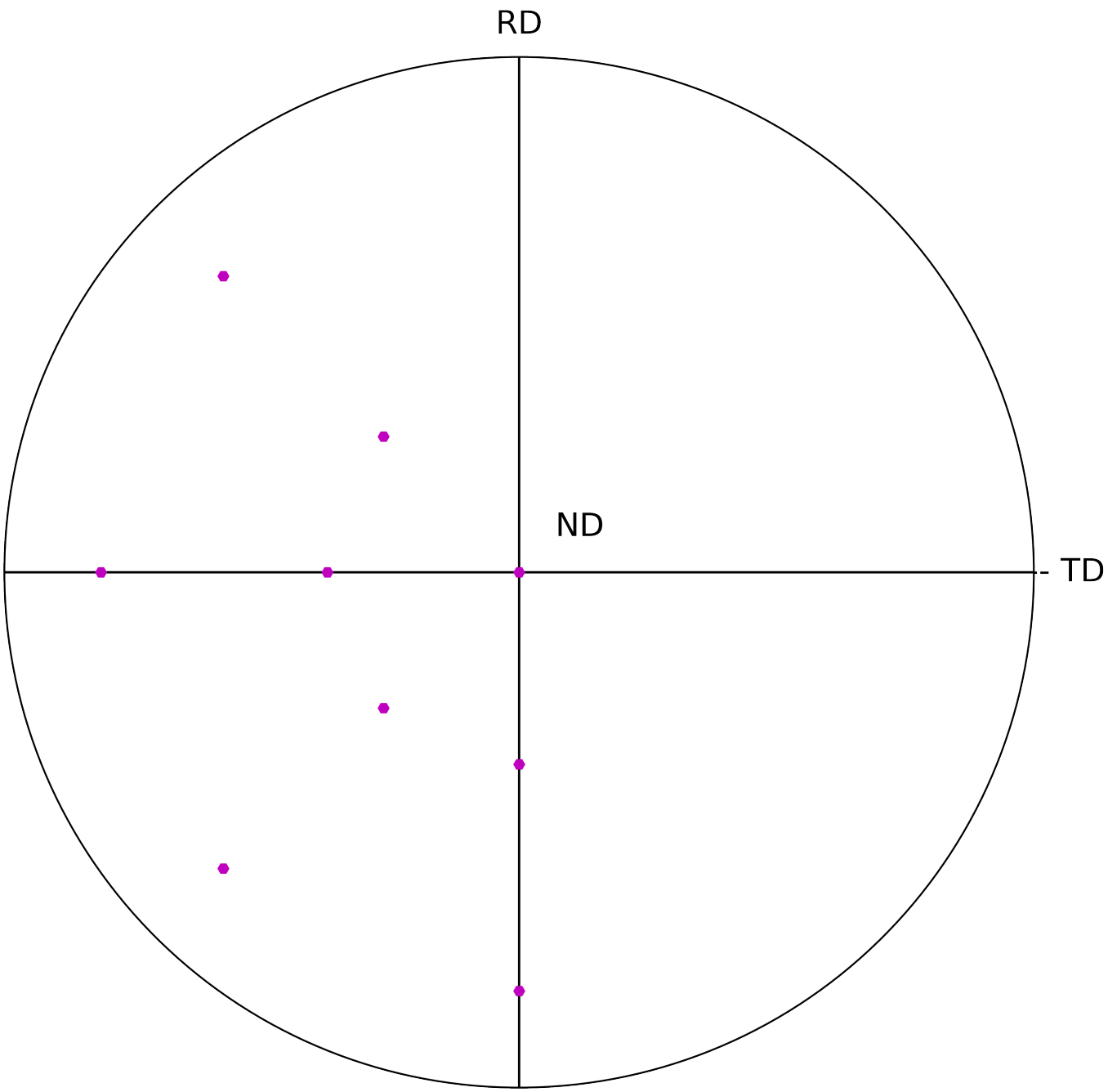

Figure 22: Pole figure scatter plot of Gaussian Quadrature sampling scheme. From [LLD15] and [Lan17]

3 Results

3.1 Contour Plot Images

3.1.1 Single schemes

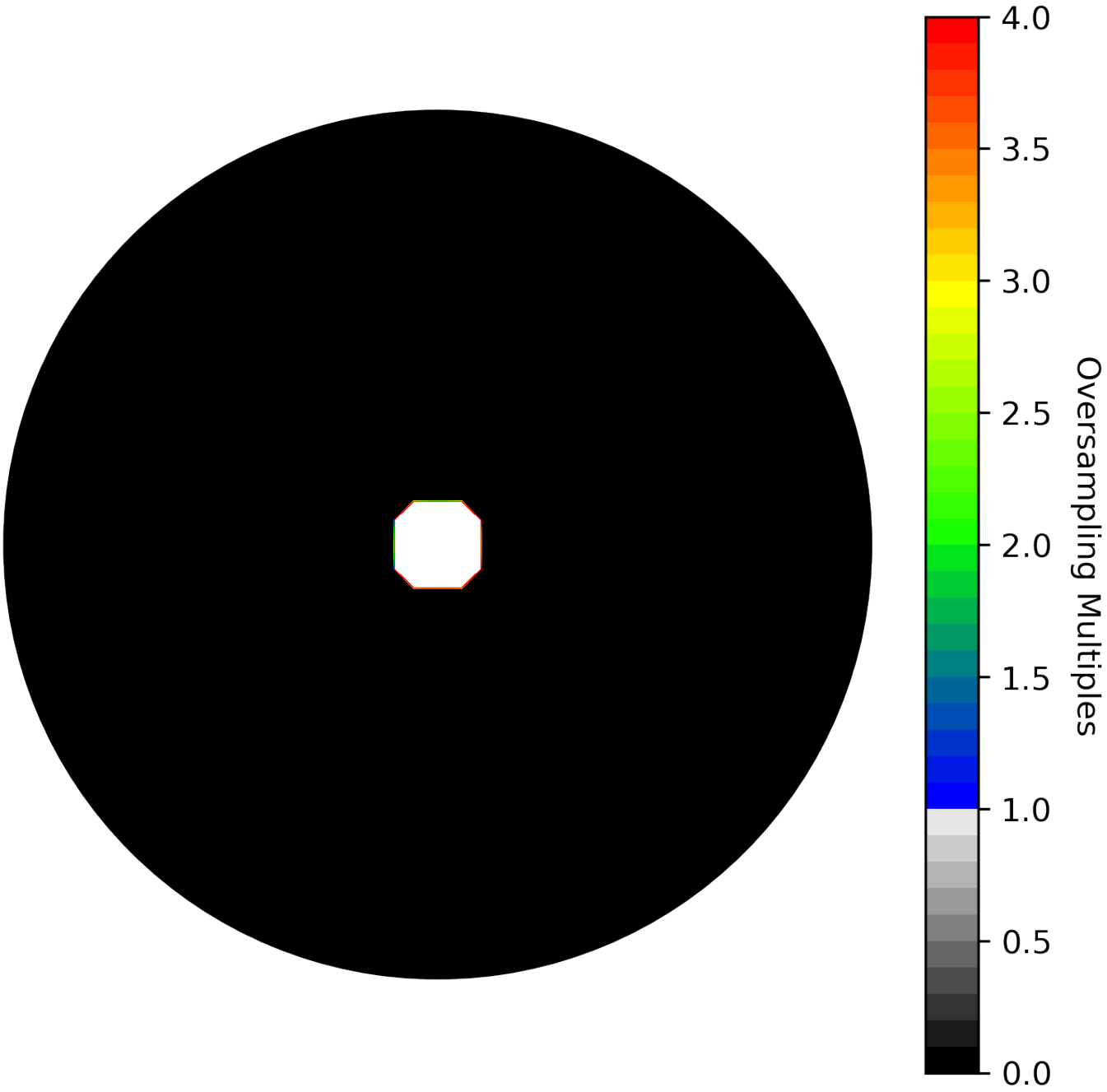

Figure 23: Pole figure contour plot for the ND single sampling scheme

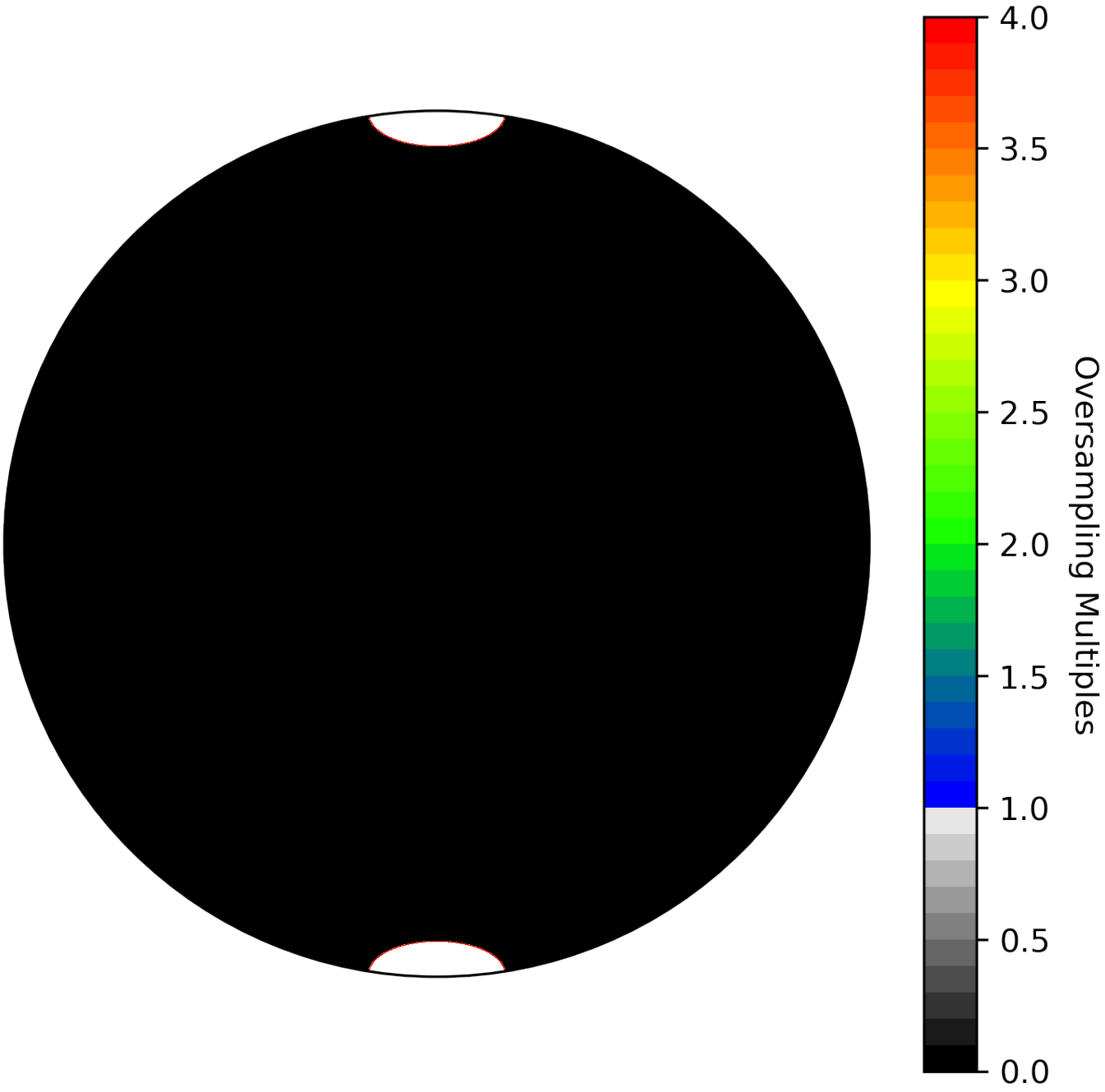

Figure 24: Pole figure contour plot for the RD single sampling scheme

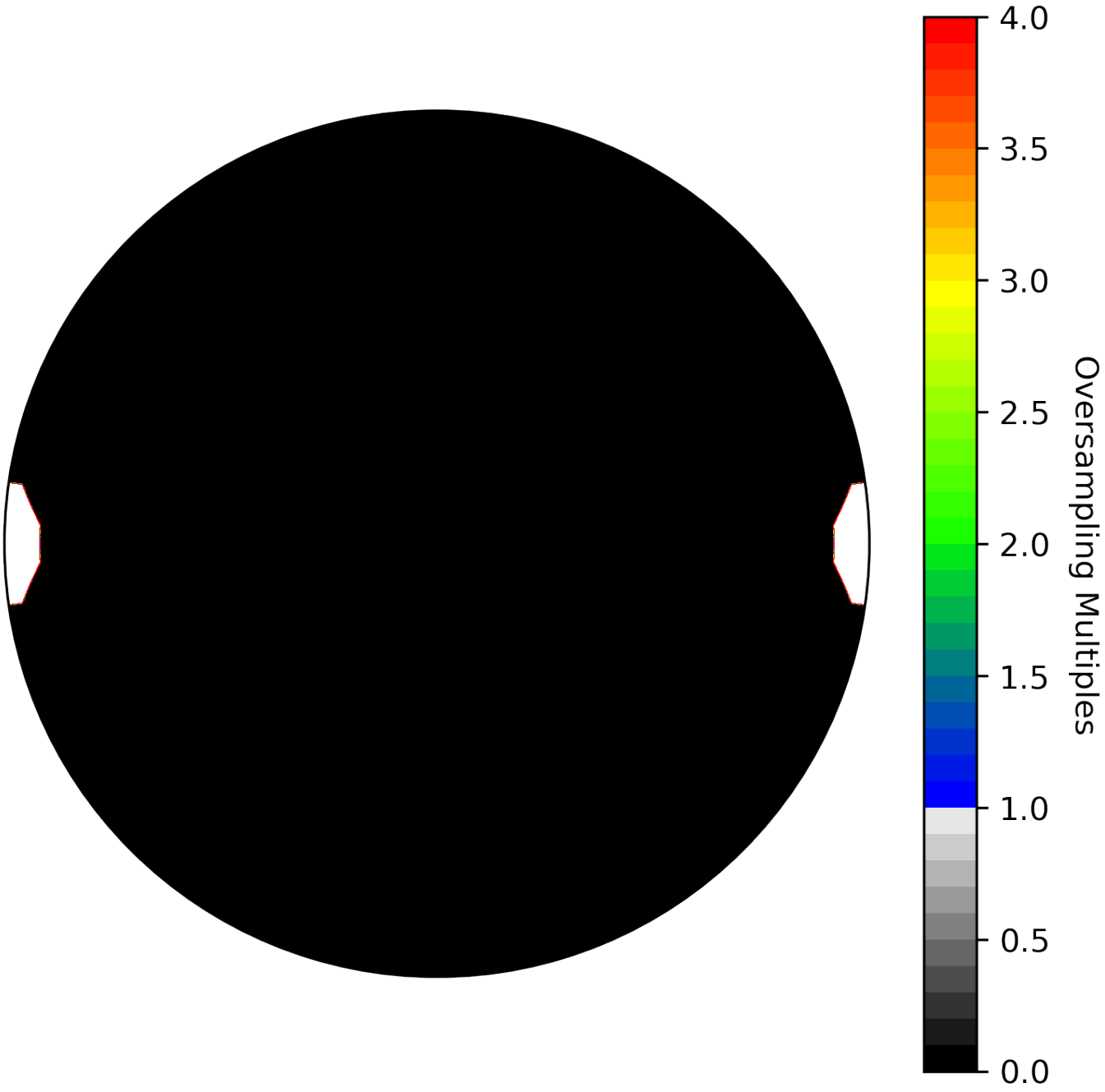

Figure 25: Pole figure contour plot for the TD single sampling scheme

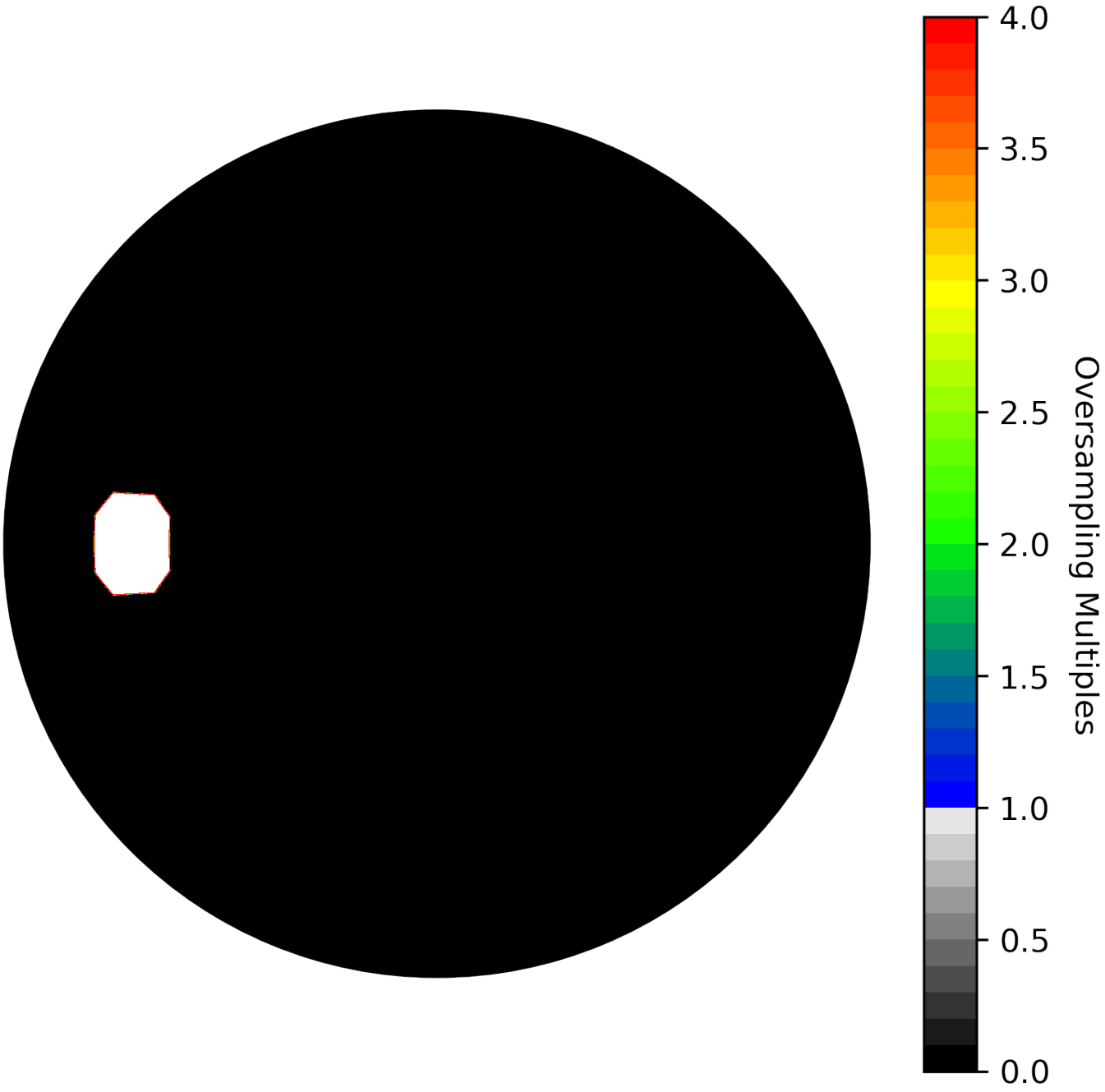

Figure 26: Pole figure contour plot for the Morris single sampling scheme

3.1.2 Ring schemes

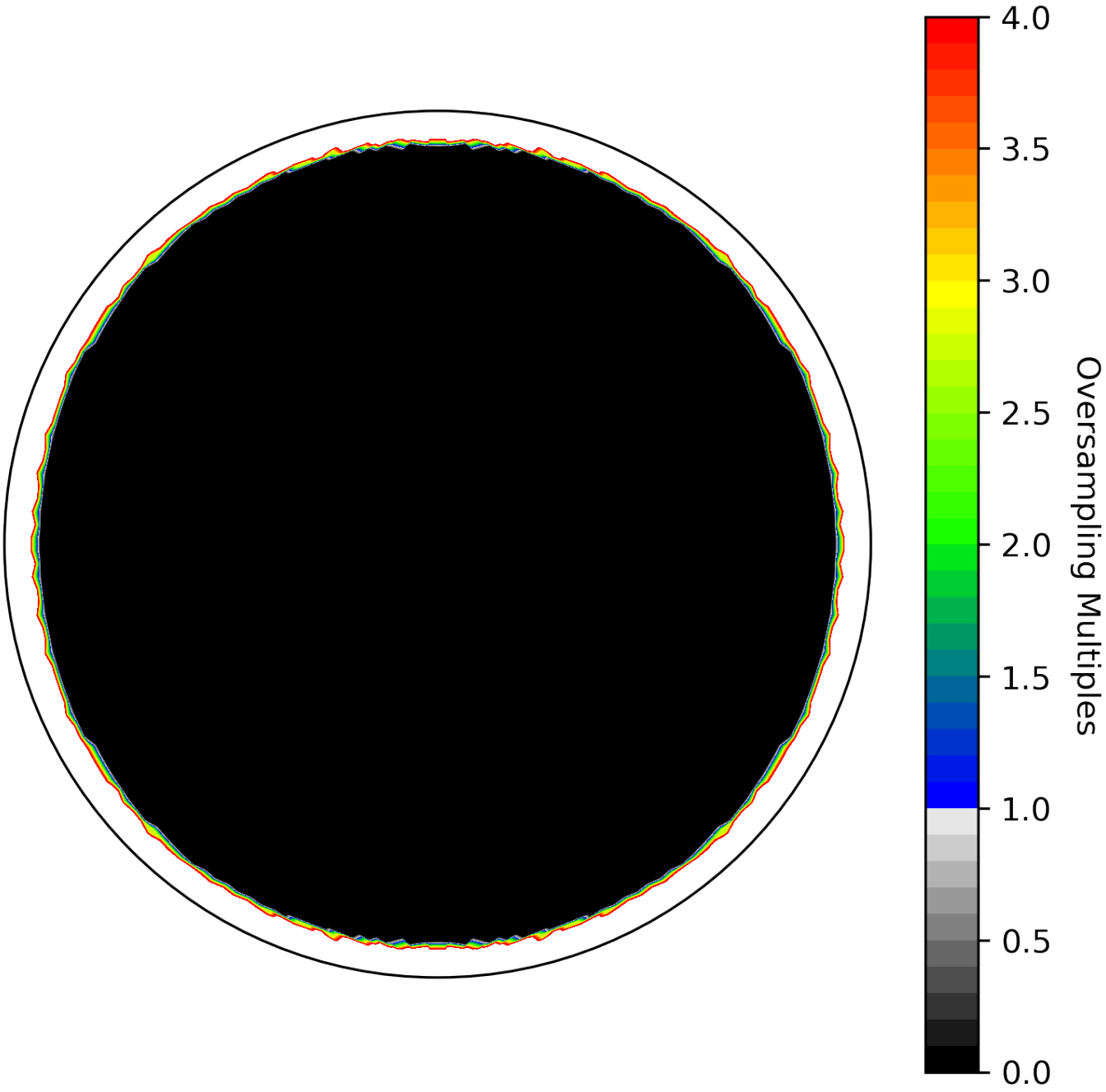

Figure 27: Pole figure contour plot for sampling ring scheme about the ND

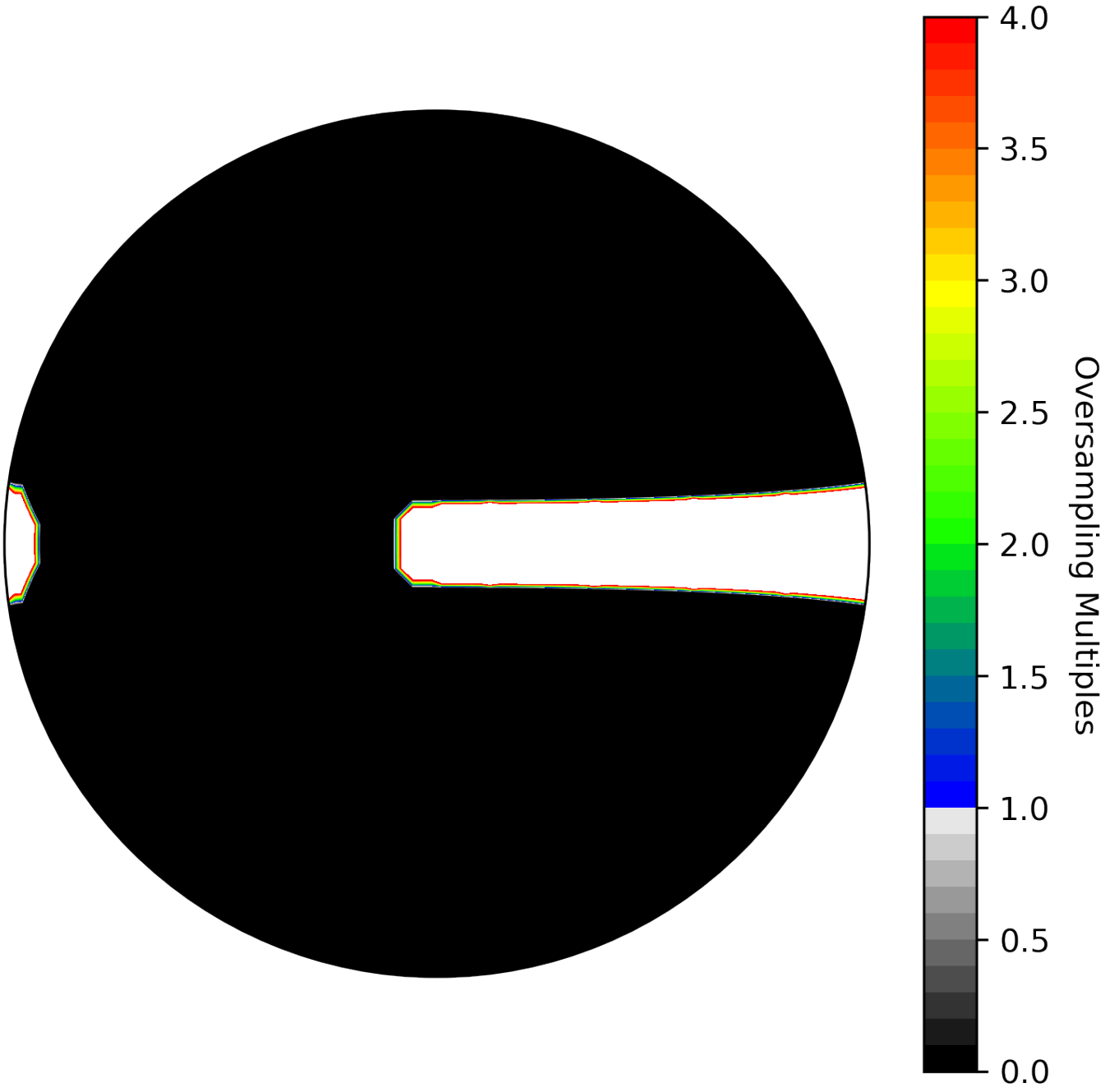

Figure 28: Pole figure contour plot for sampling ring scheme about the RD

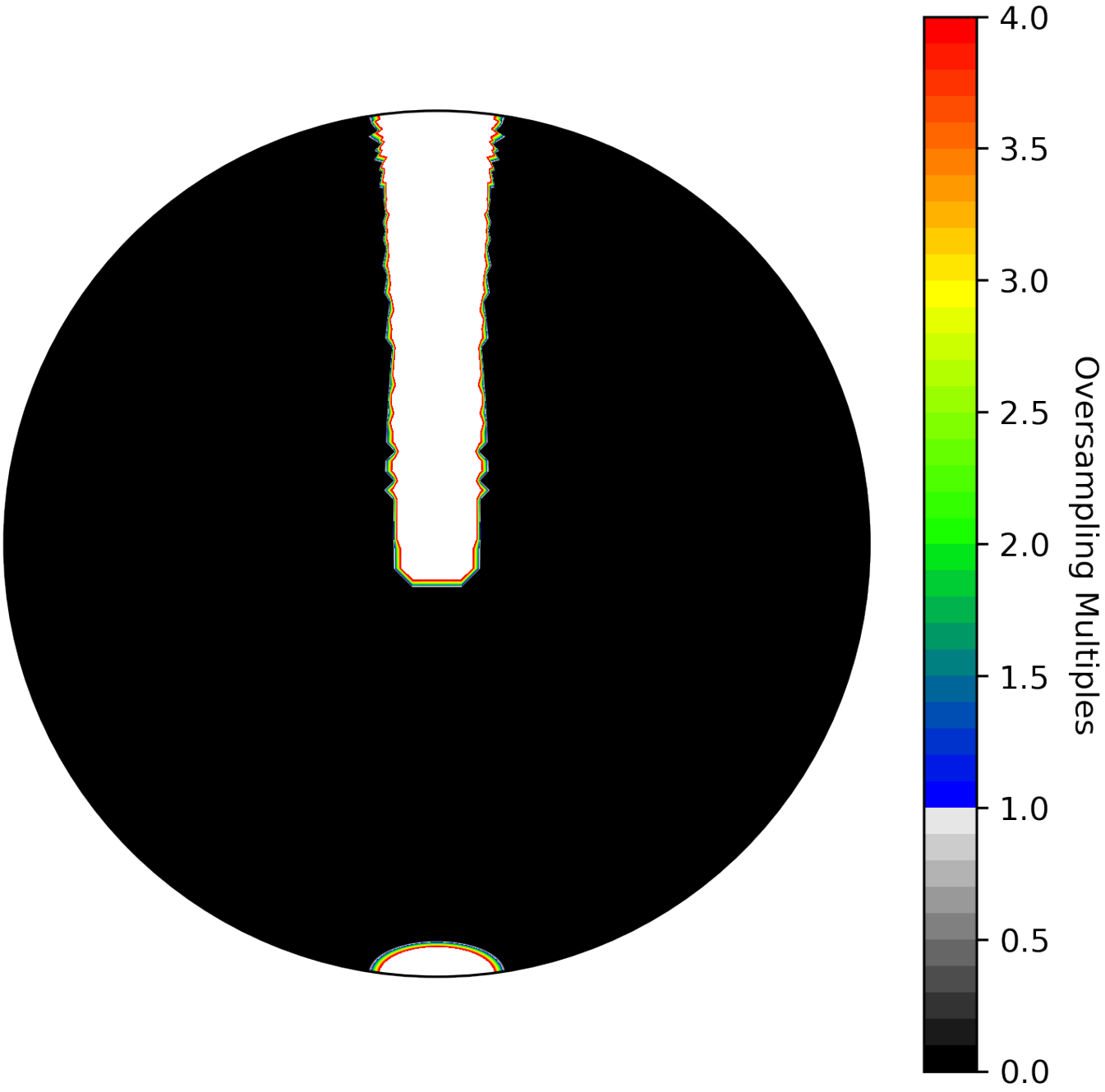

Figure 29: Pole figure contour plot for sampling ring scheme about the TD

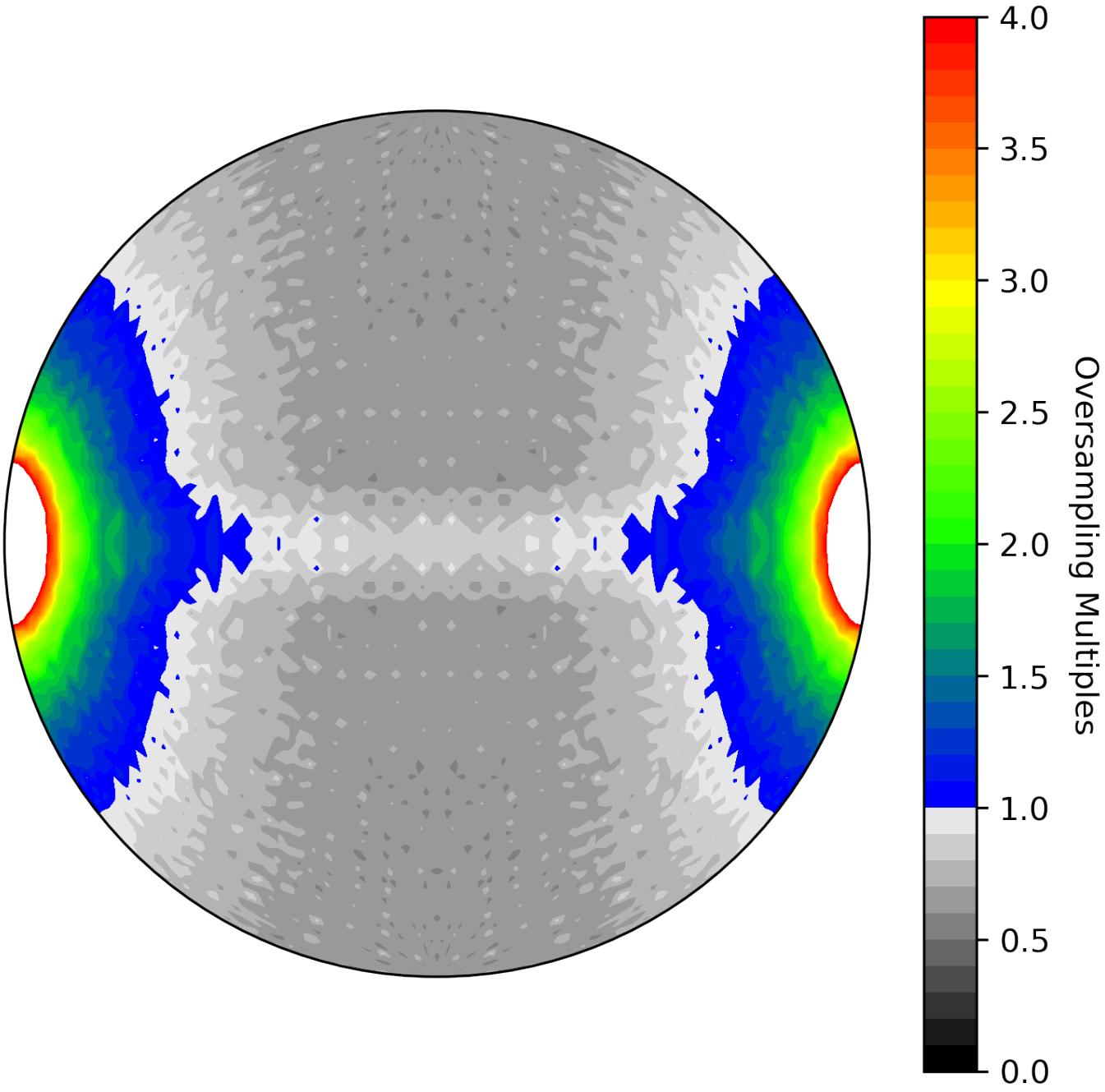

Figure 30: Pole figure contour plot for complete rotated-ring sampling scheme

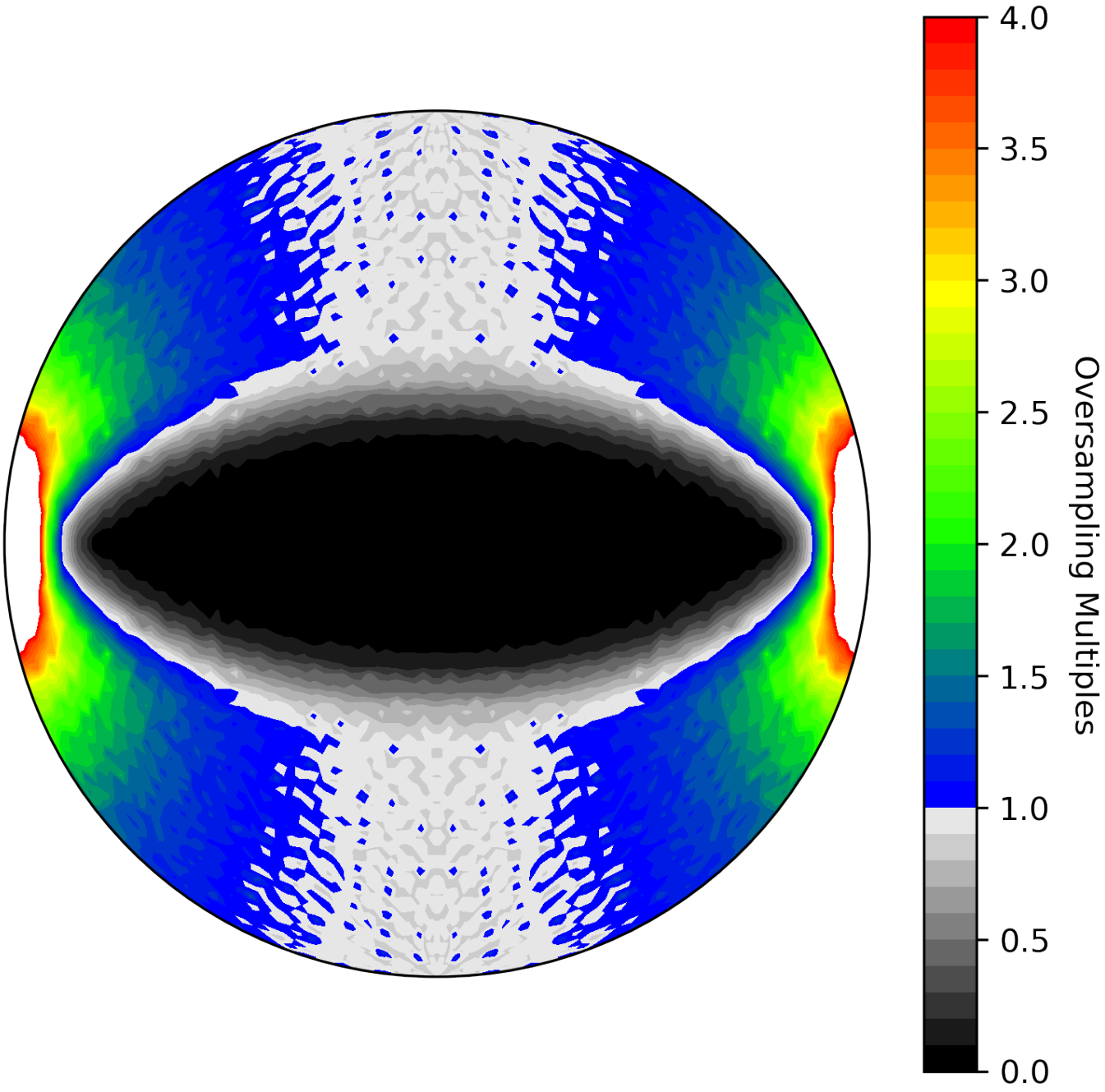

Figure 31: Pole figure contour plot for partial rotated-ring sampling scheme

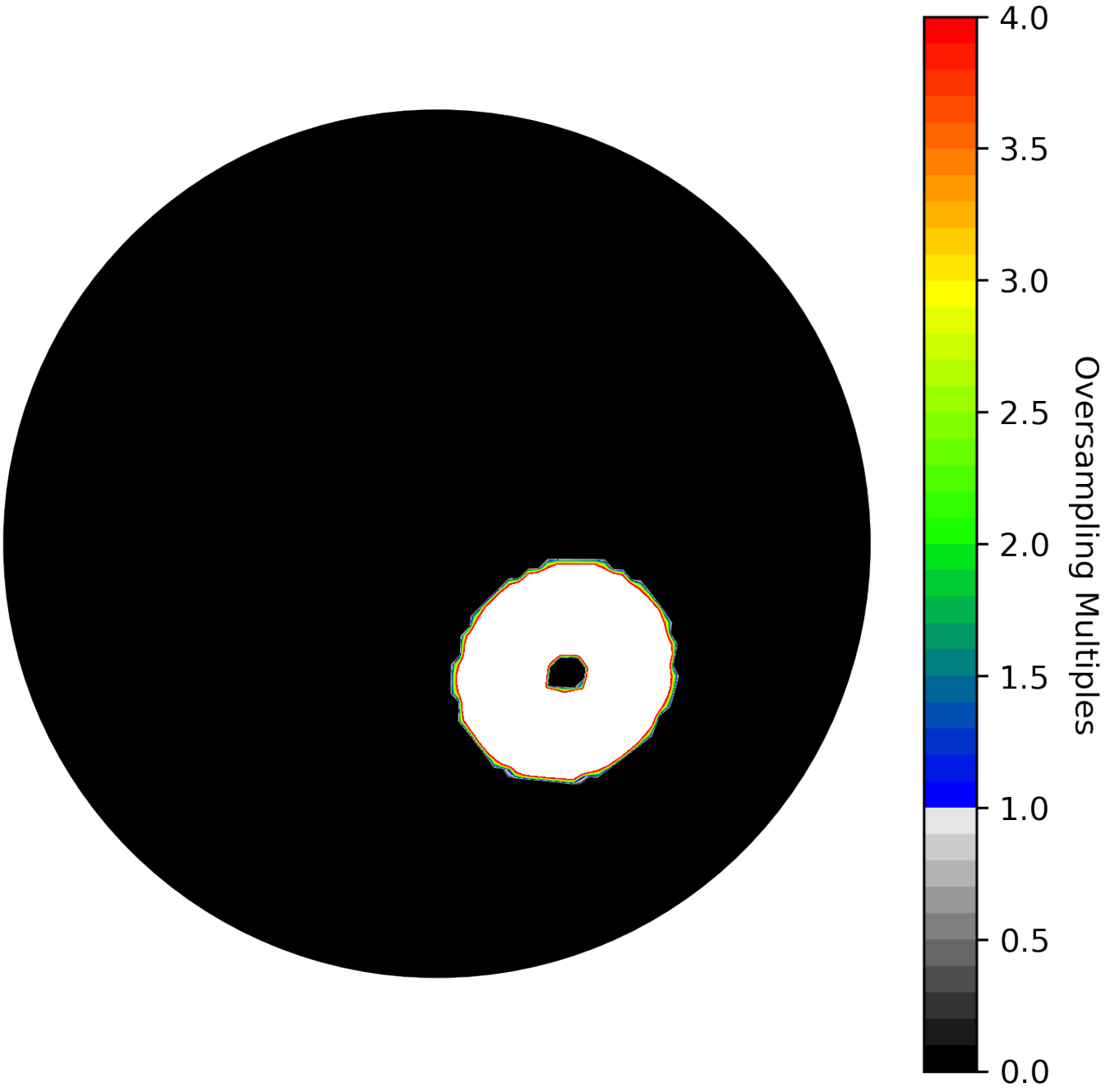

Figure 32: Pole figure contour plot of the Offset ring shifted 45 degrees, for measuring the Ferrite phase

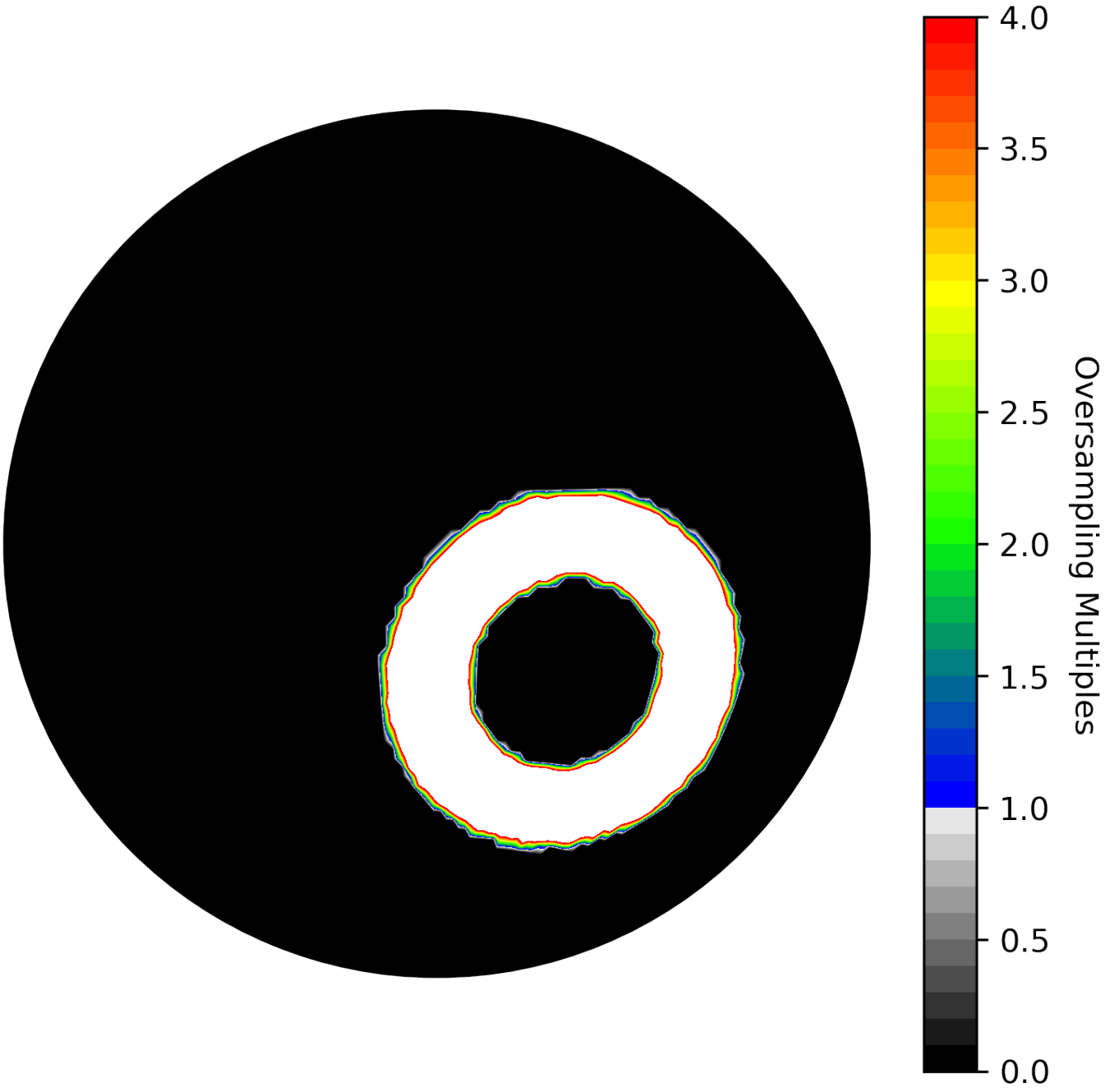

Figure 33: Pole figure contour plot of the Offset ring shifted 45 degrees, for measuring the Austenite phase

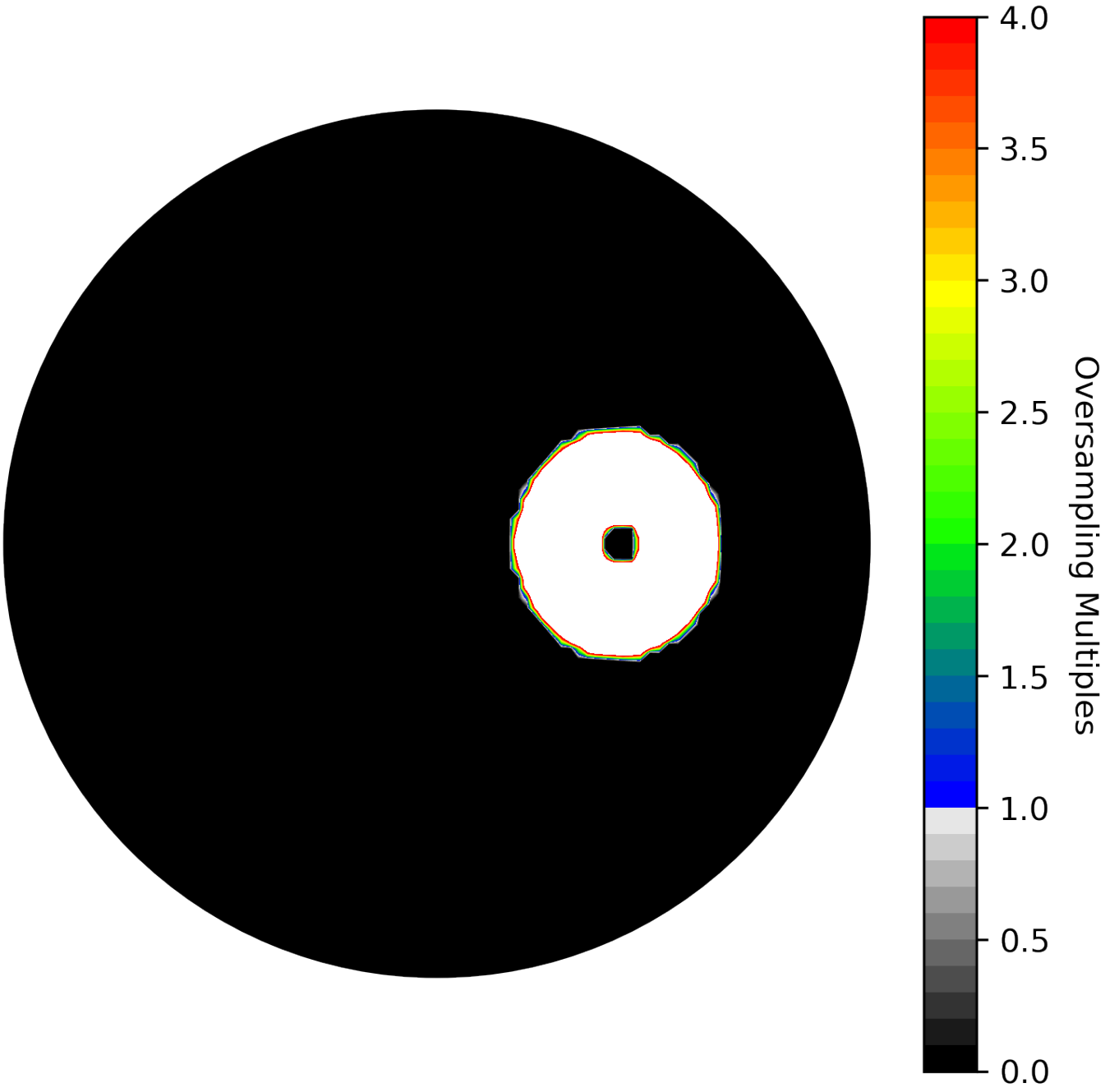

Figure 34: Pole figure contour plot of the Offset ring shifted along the TD, for measuring the Ferrite phase

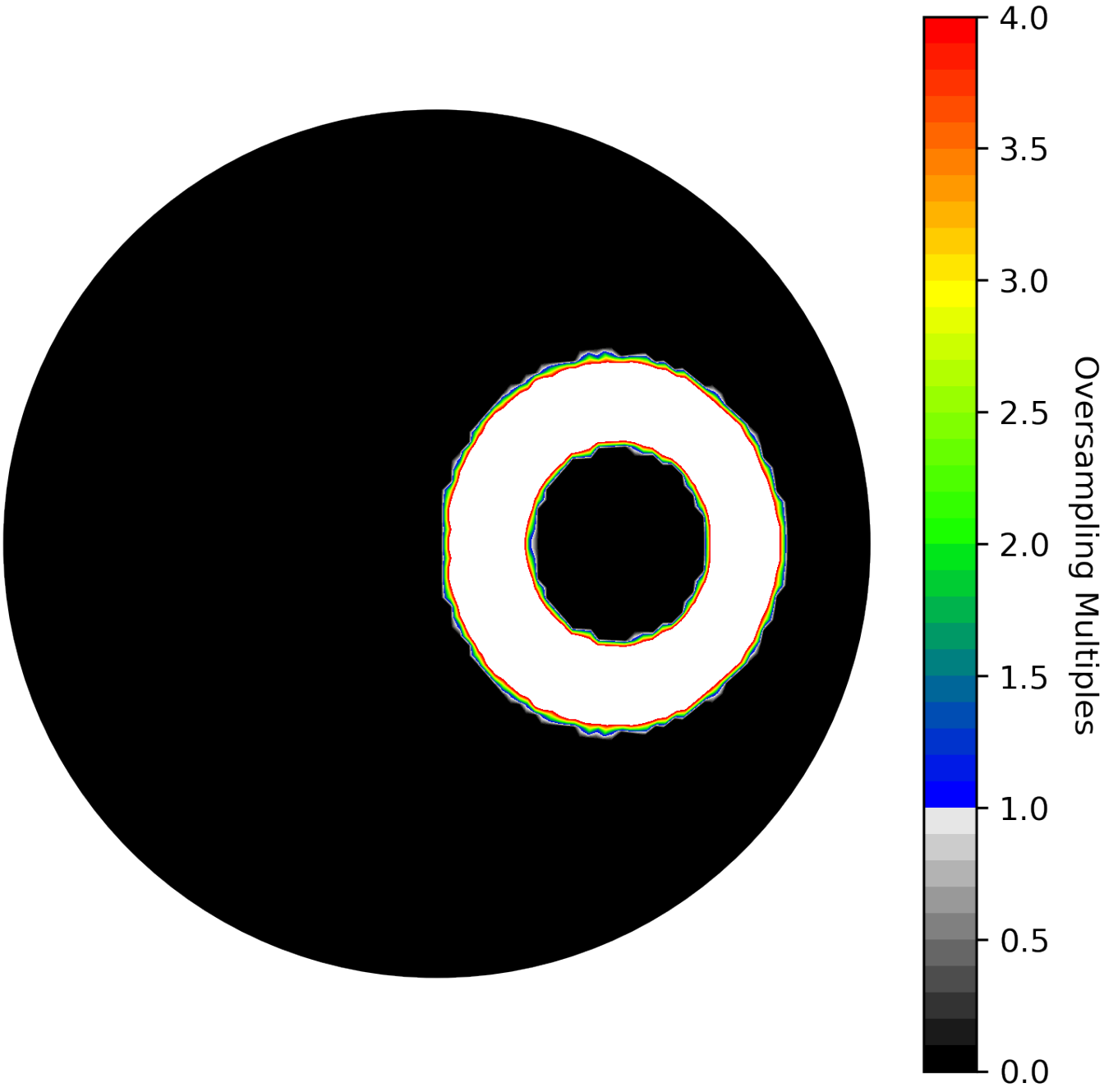

Figure 35: Pole figure contour plot of the Offset ring shifted along the TD, for measuring the Austenite phase

3.1.3 Equal Angle

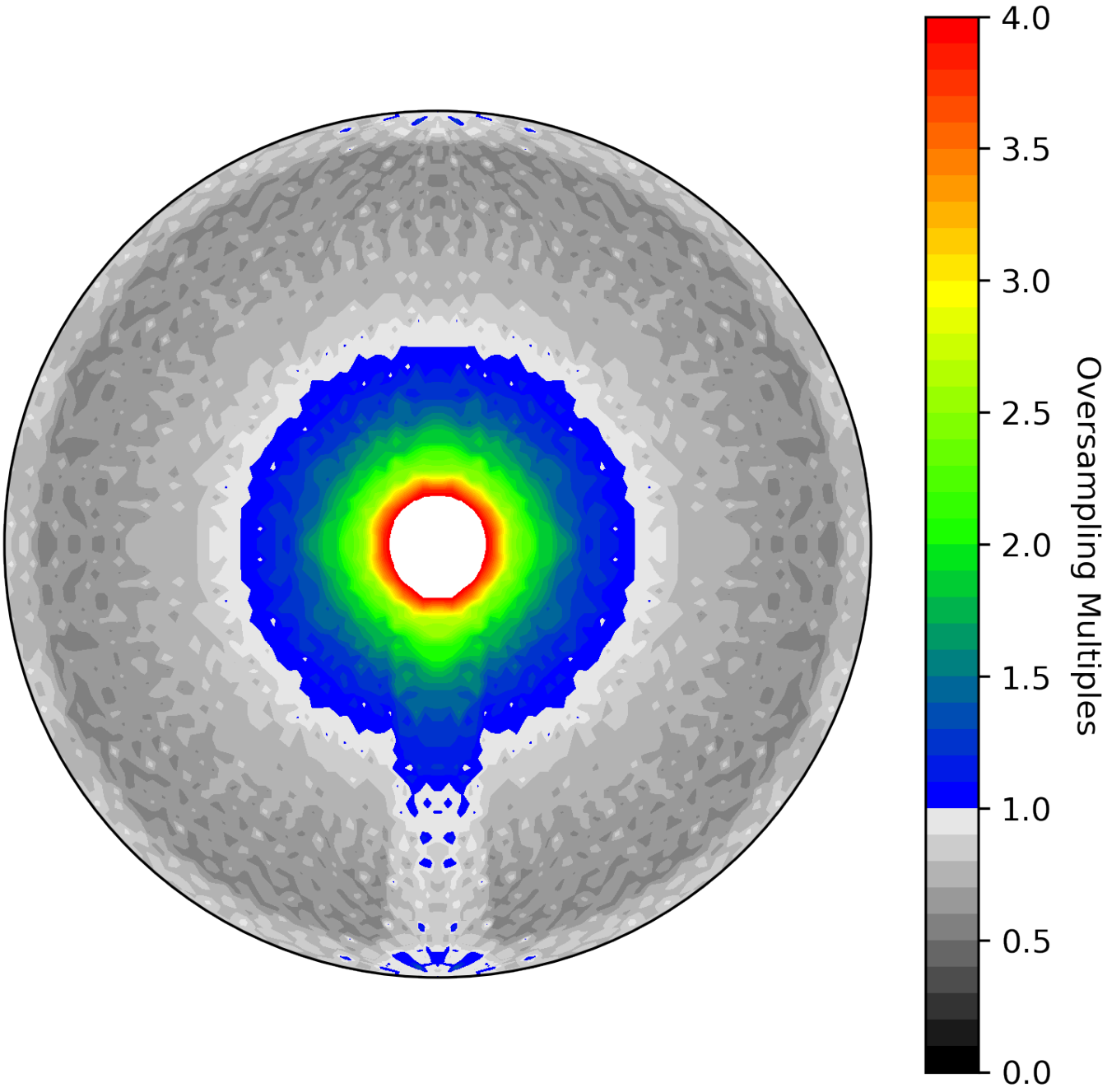

Figure 36: Pole figure contour plot of the Equal Angle sampling scheme

3.1.4 Tilt and Rotate

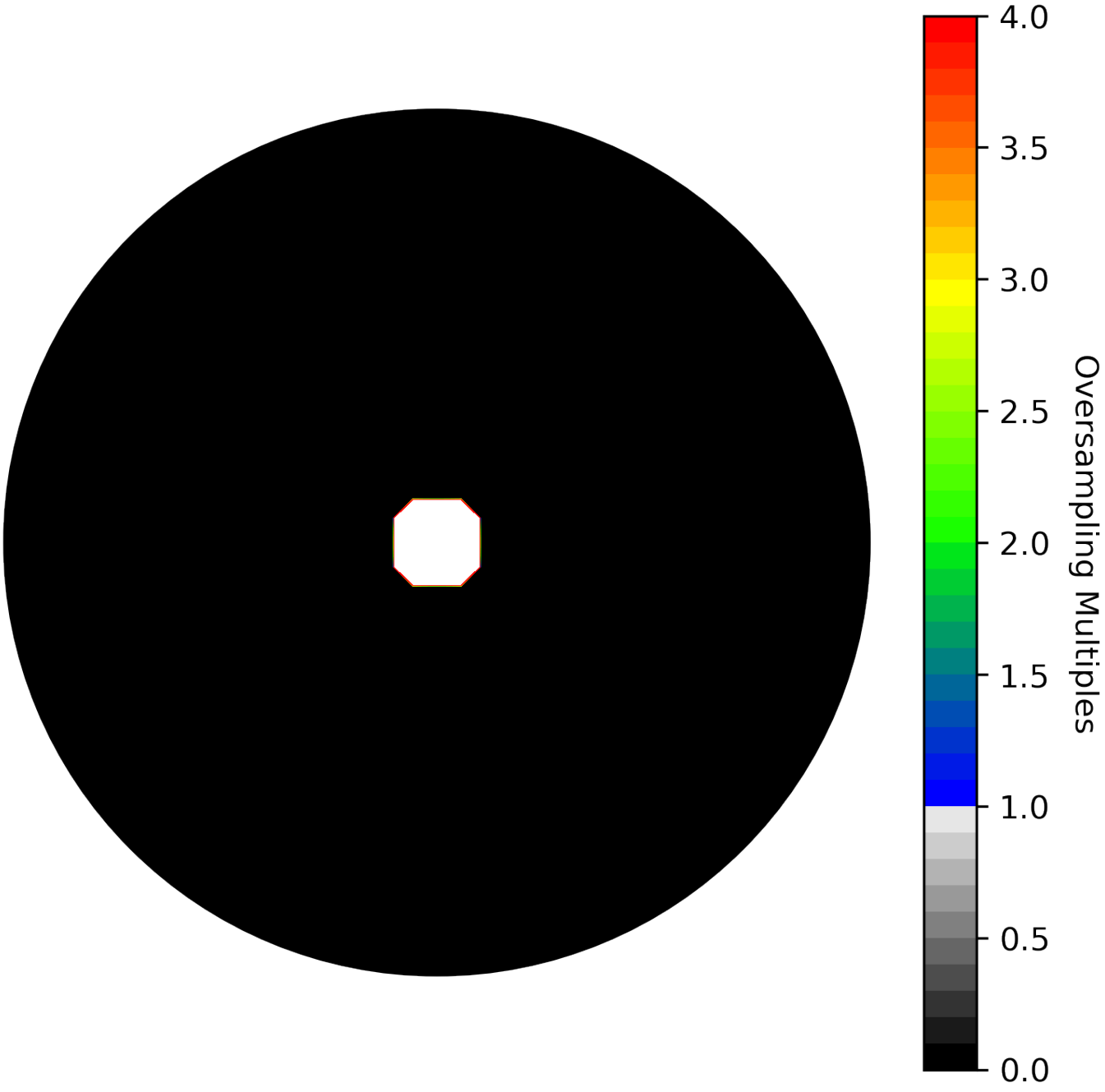

Figure 37: Pole figure contour plot of rotation-only sampling scheme measurement

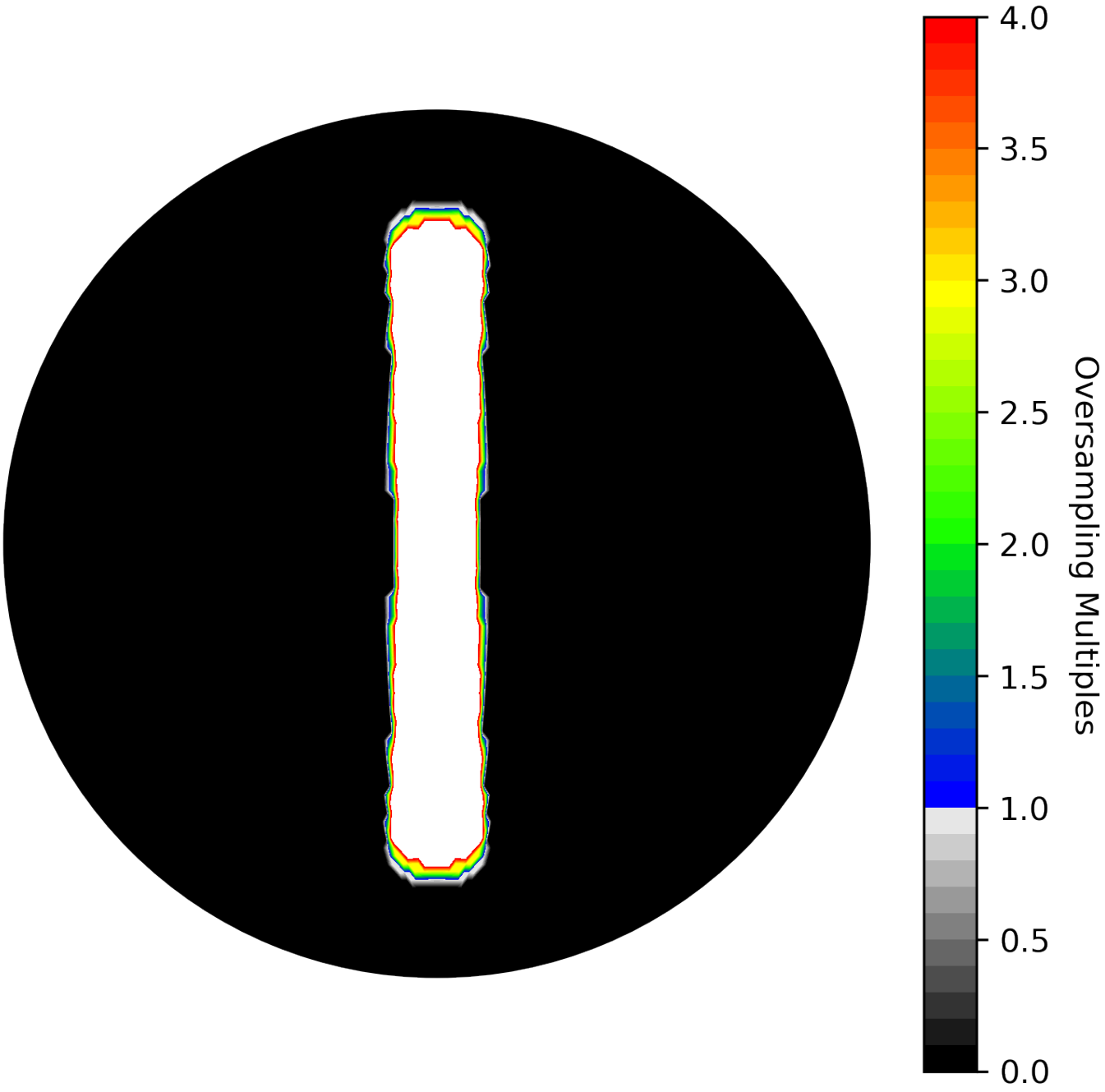

Figure 38: Pole figure contour plot of tilt-only sampling scheme measurement

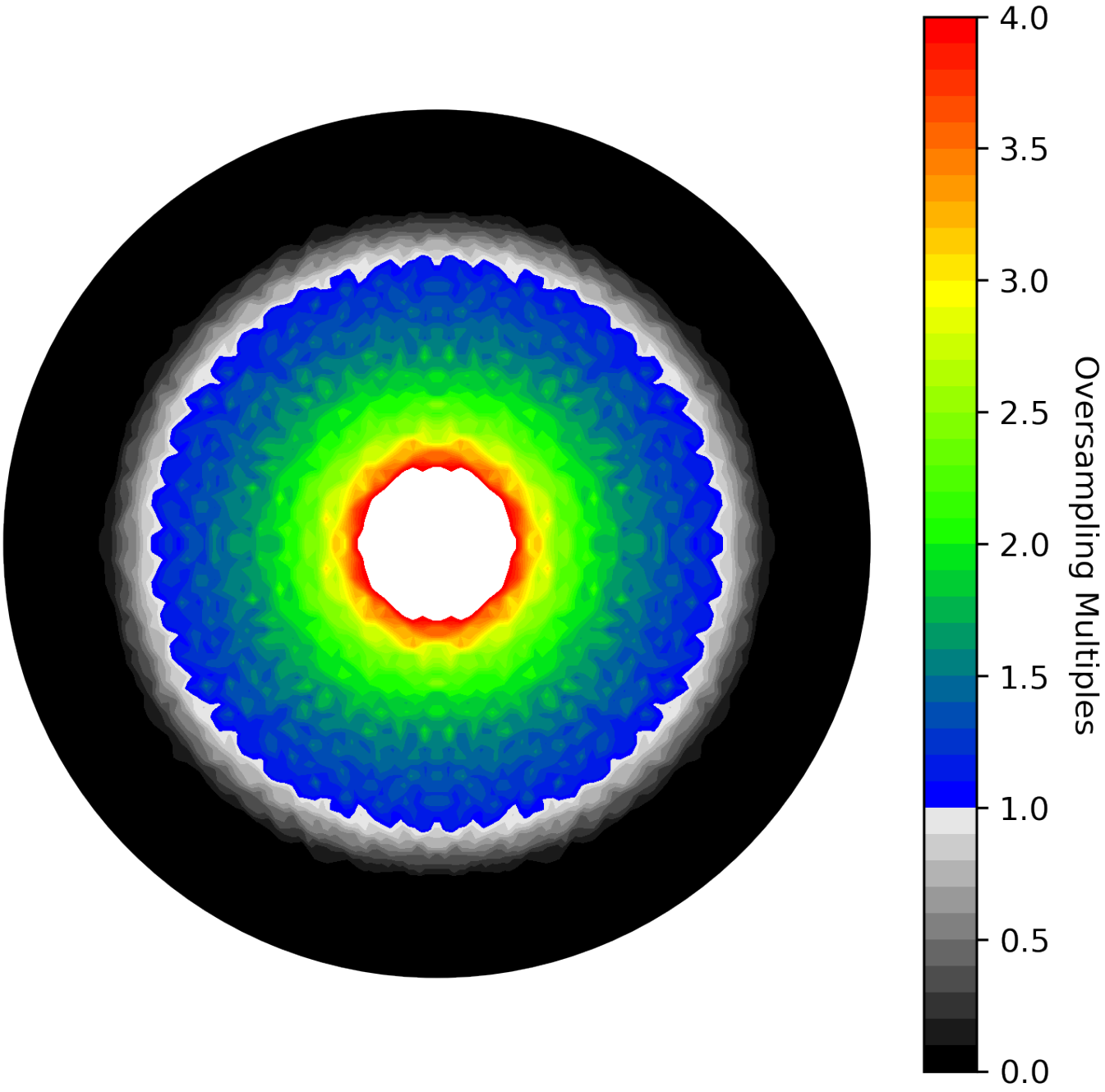

Figure 39: Pole figure contour plot of combined tilt-and-rotation sampling scheme measurement

3.1.5 Spiral schemes

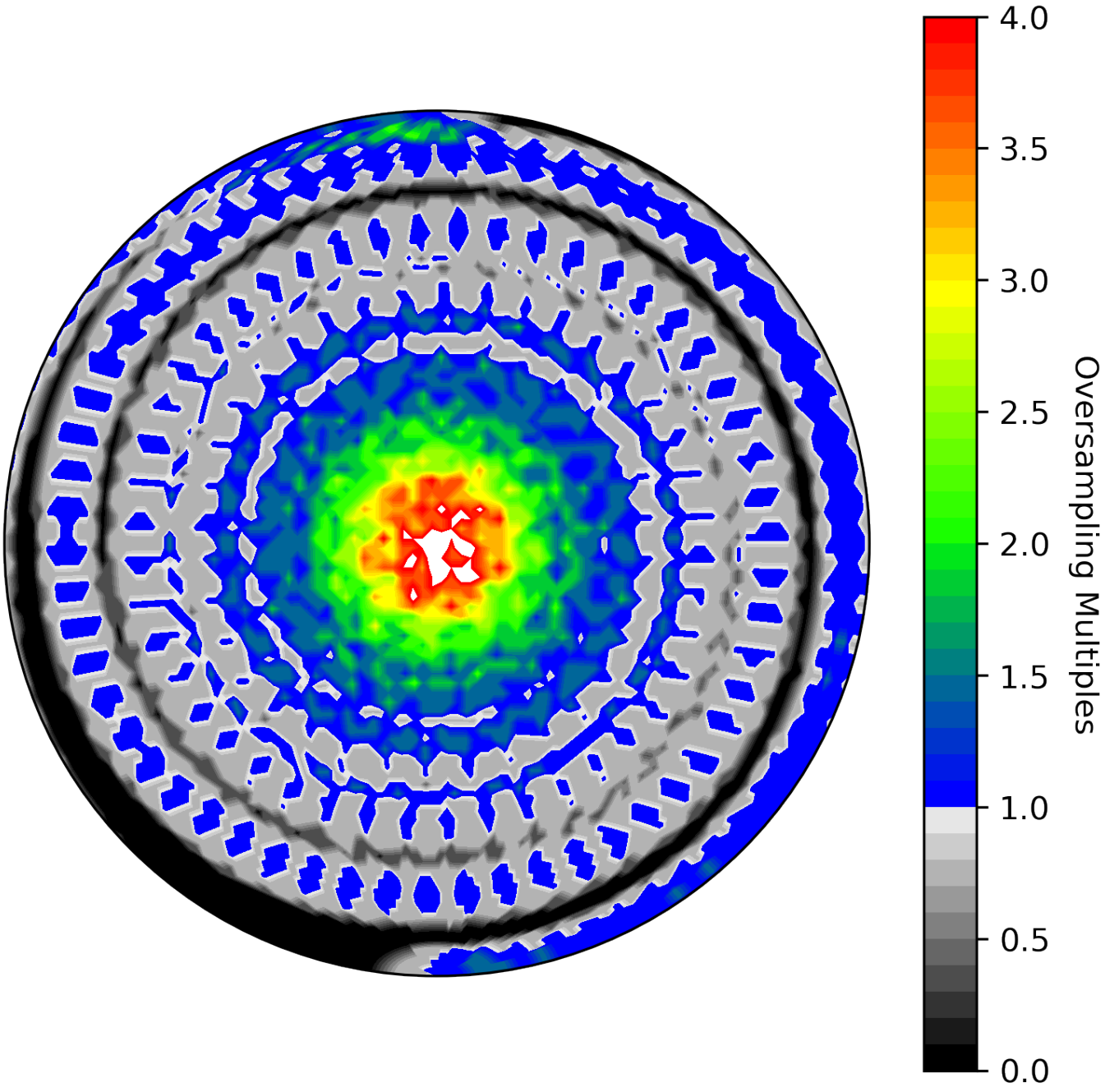

Figure 40: Pole figure contour plot of logarithmic spiral sampling scheme. From [**?**]

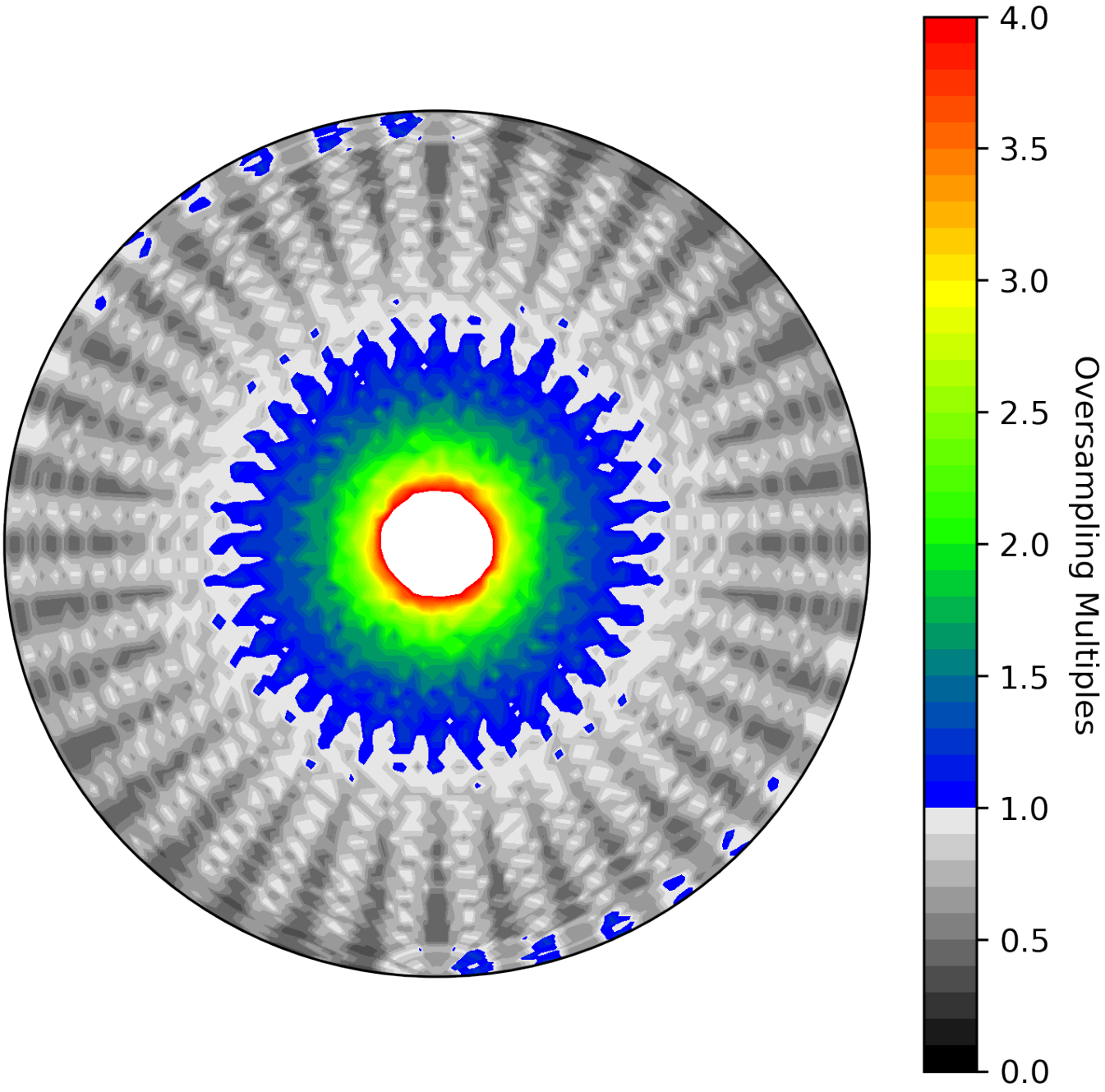

Figure 41: Pole figure contour plot of Archimedean spiral sampling scheme. From [**?**]

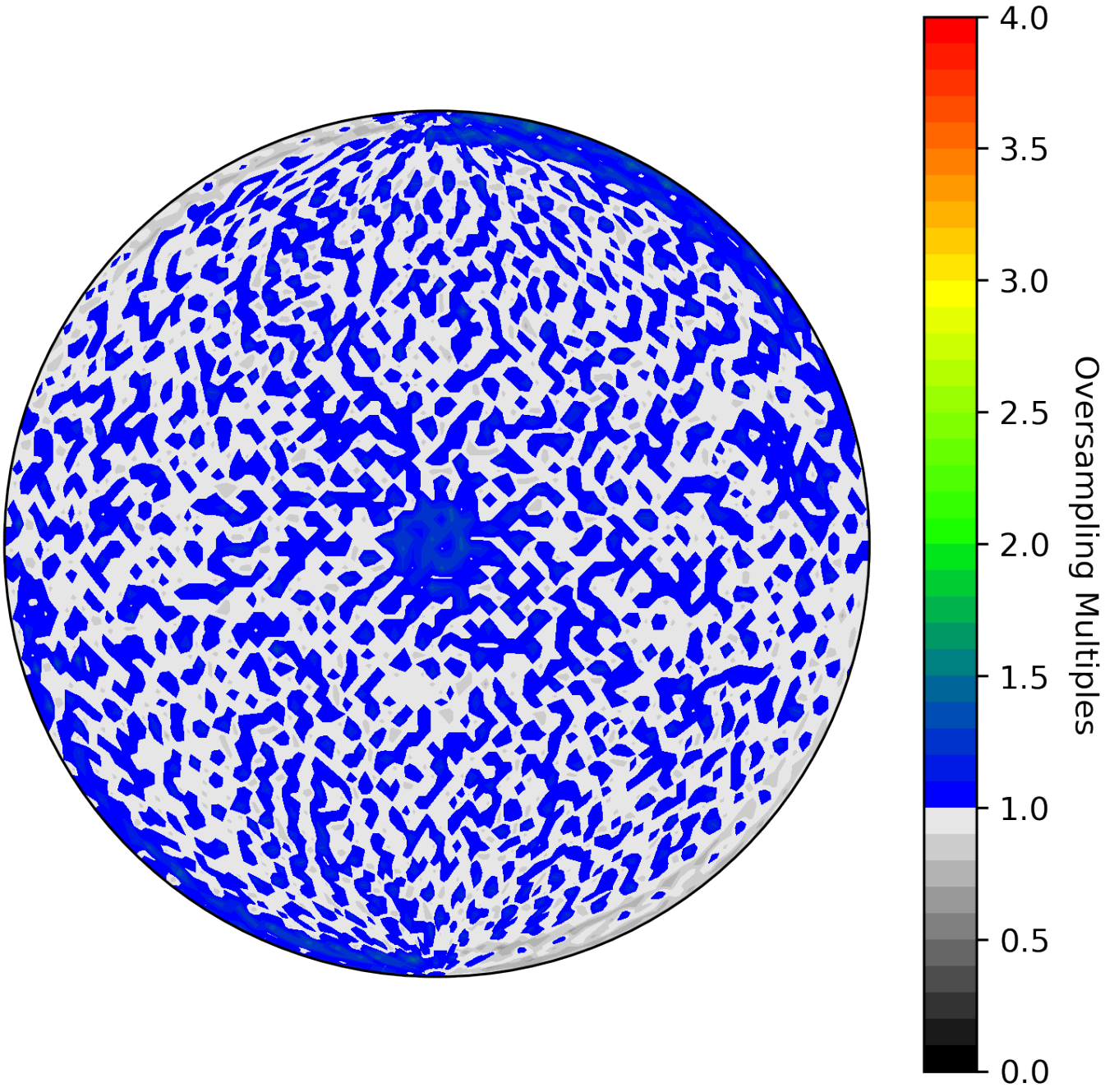

Figure 42: Pole figure contour plot of new spiral sampling scheme

3.1.6 Hexagonal schemes

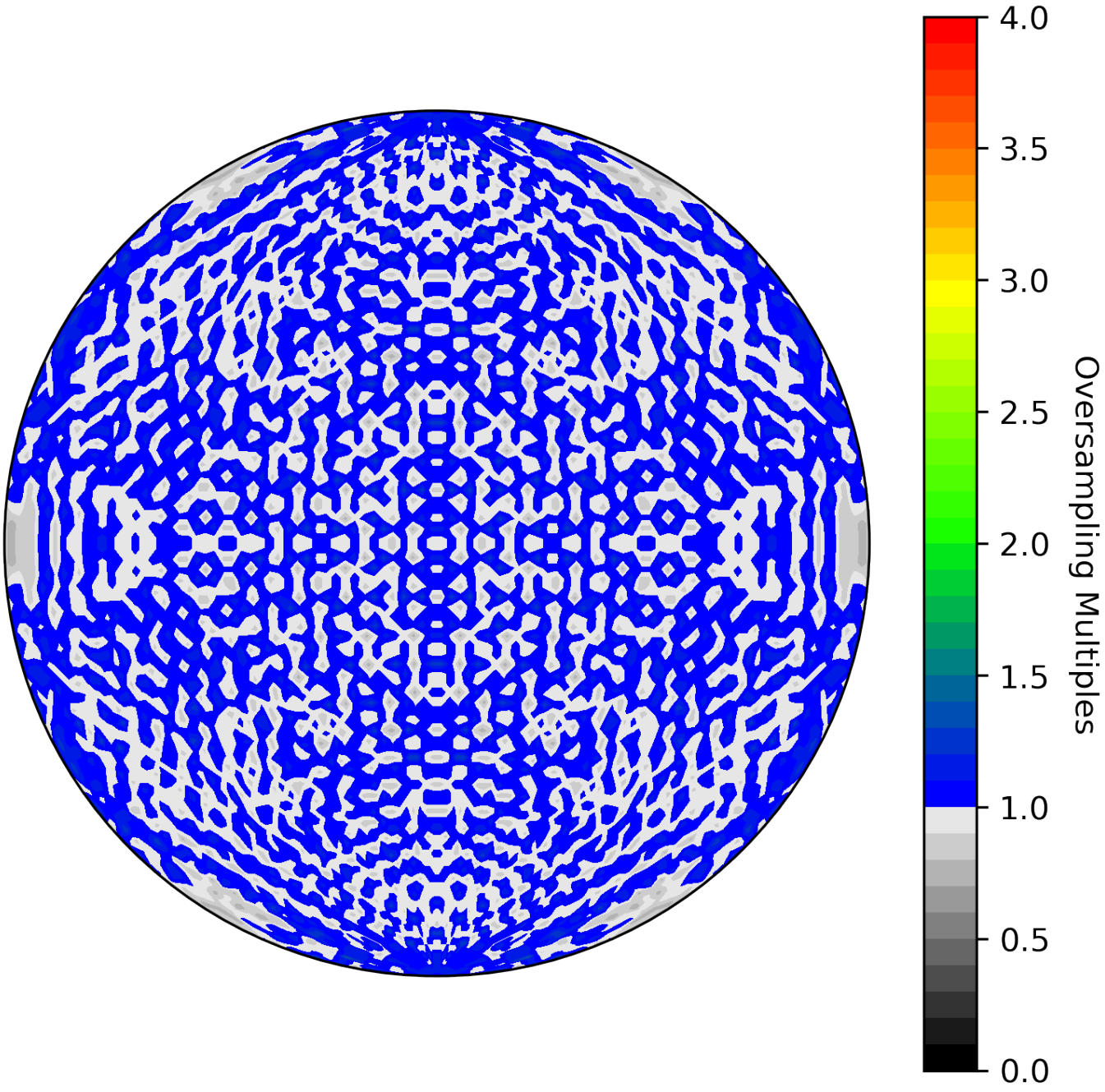

Figure 43: Pole figure contour plot of Hexagonal grid sampling scheme. From [**?**]

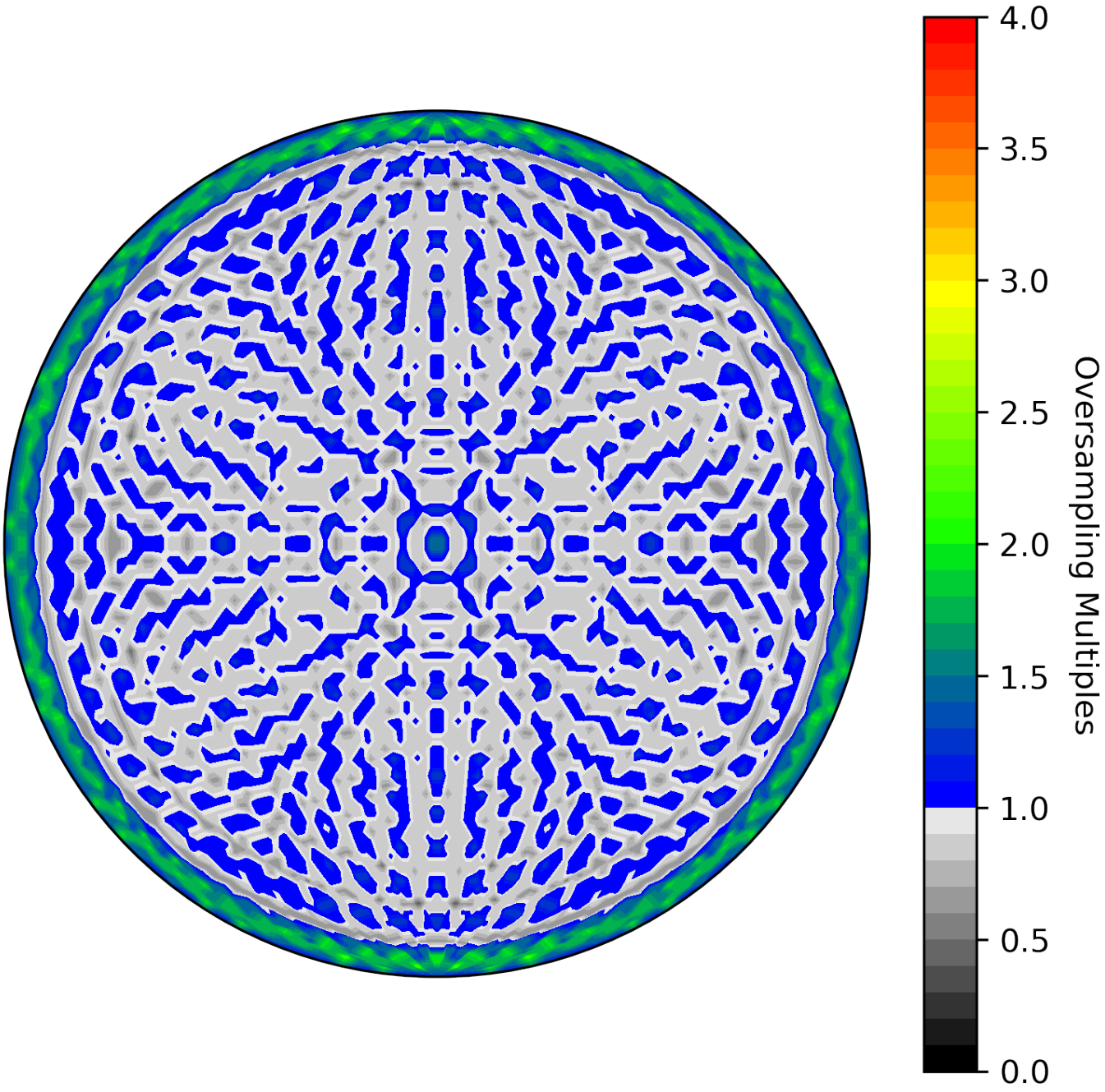

Figure 44: Pole figure contour plot of Thomas Hexagonal grid sampling scheme. From [**?**]

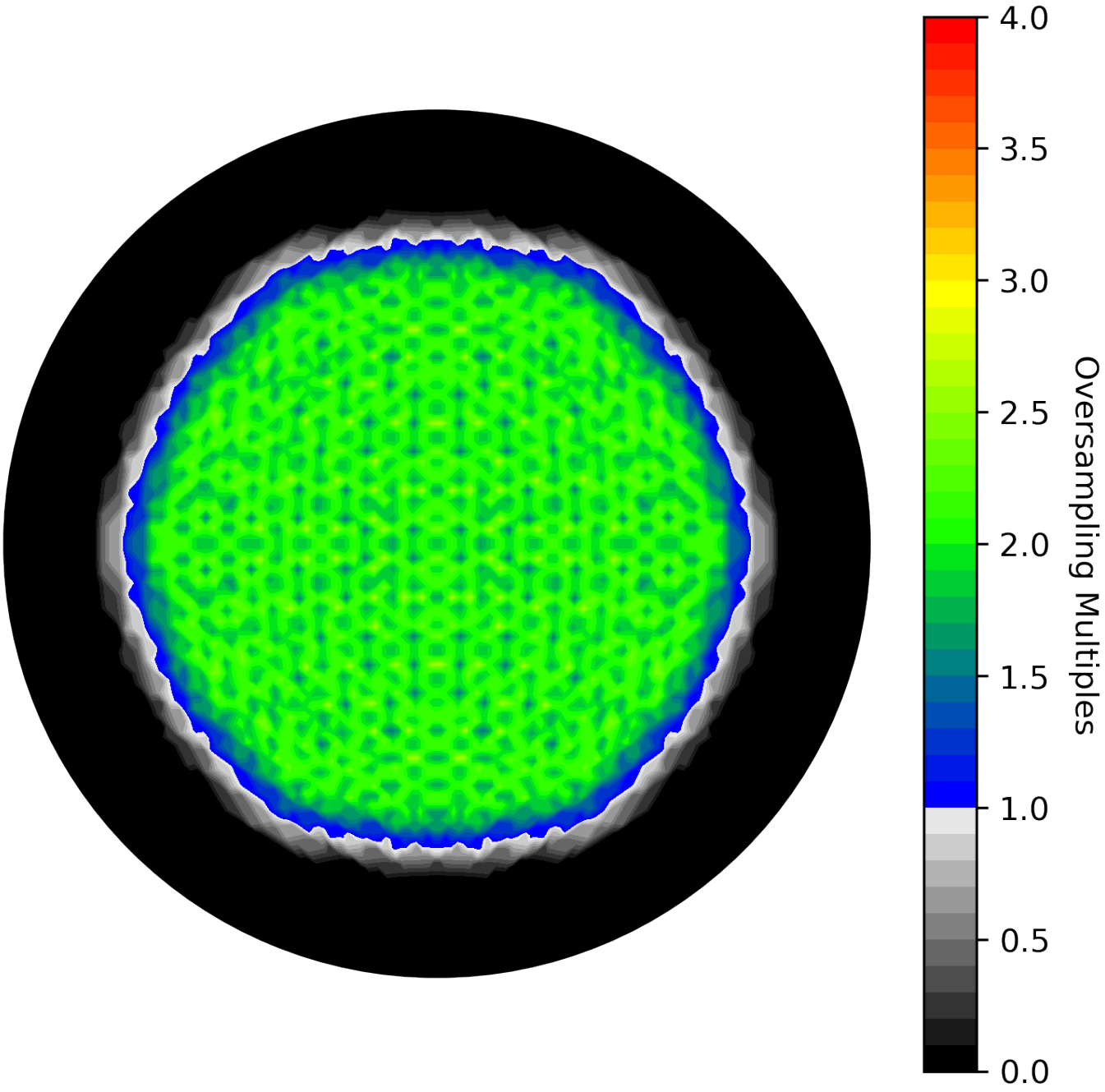

Figure 45: Pole figure contour plot of partial hexagonal grid sampling scheme. From [**?**]

3.1.7 CLRGrid

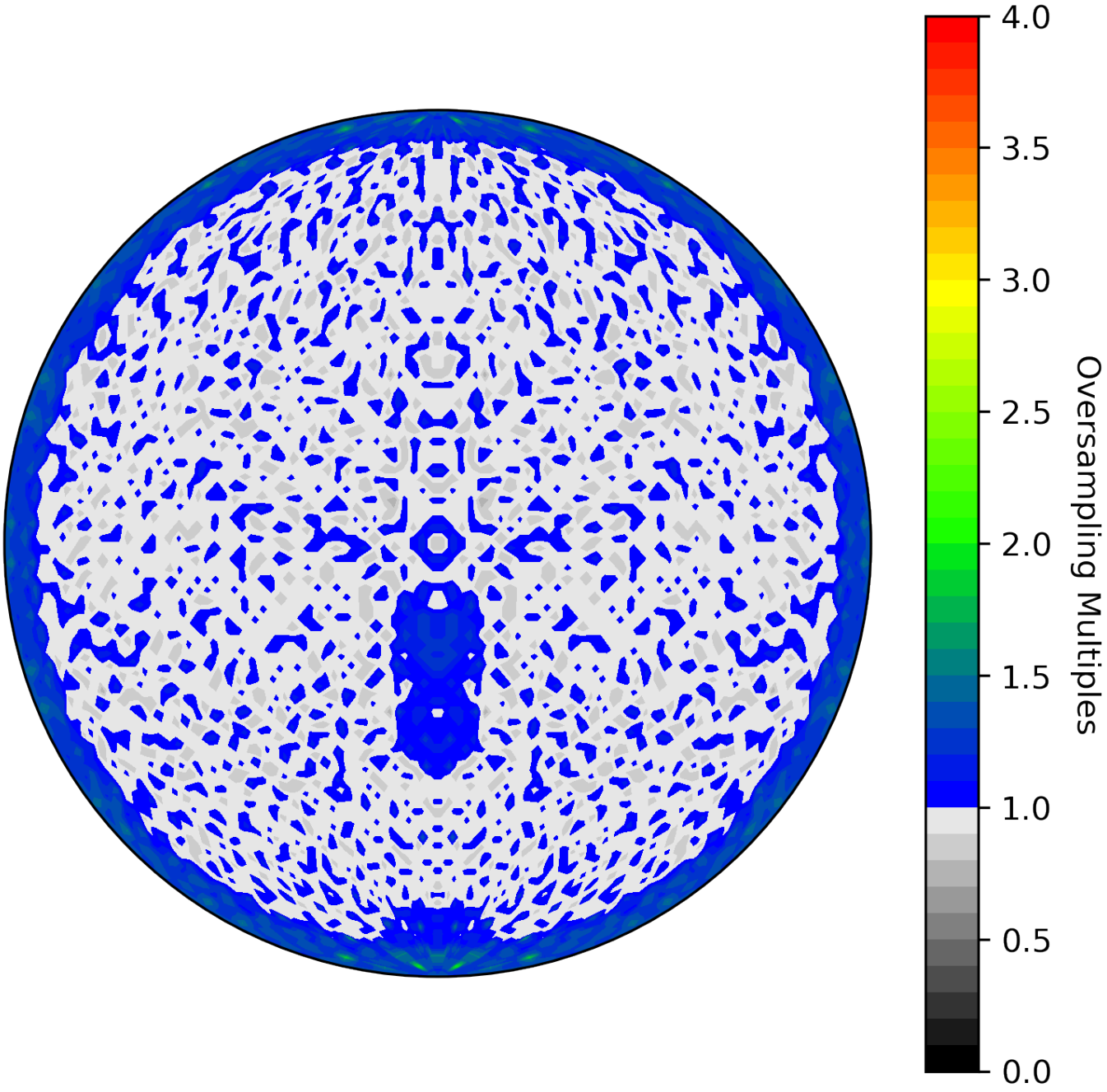

Figure 46: Pole figure contour plot of CLR grid sampling scheme. From [**?**]

3.1.8 Gaussian Quadrature

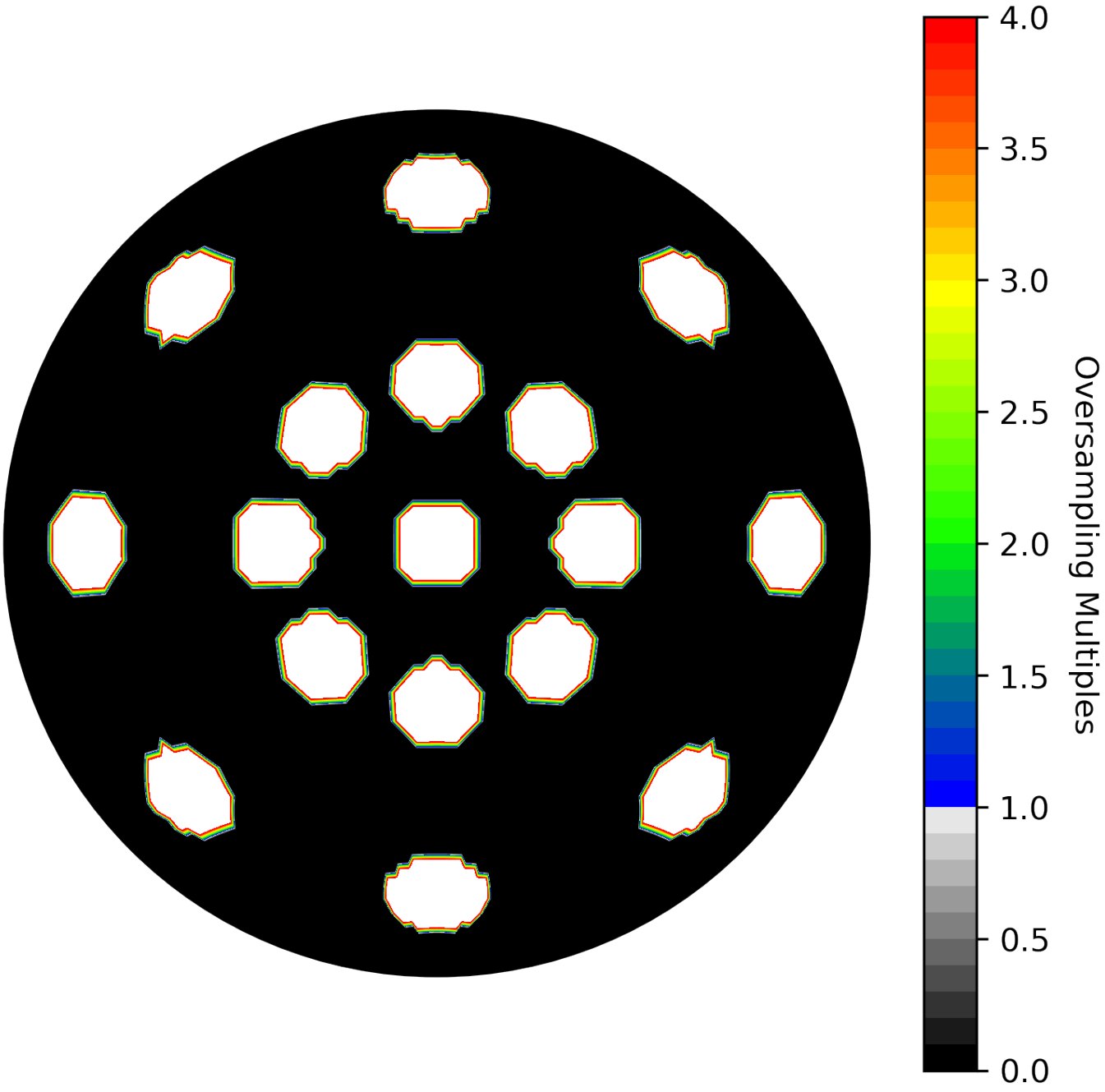

Figure 47: Pole figure contour plot of Gaussian Quadrature sampling scheme. From [**?**] and [**?**].

4 Discussion

5 Conclusions

References

[Gmb16] Bruker AXS GmbH. Diffrac.Texture User Manual, 2016.

[JLS80] Chester F. Jatczak, John A. Larson, and Steve W. Shin. *SAE SP-453 Retained austenite and its measurements by X-ray diffraction: an information manual.* Society of Automotive Engineers, Warrendale, PA, 1980. SAE Special Publication 453.

[KA74] Harold P. Klug and Leroy E. Alexander. *X-Ray Diffraction Procedures.* John Wiley & Sons Inc, 2nd edition, 1974.

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[LLD15] Bo Lan, Michael J.S. Lowe, and Fionn P.E. Dunne. A generalized spherical harmonic deconvolution to obtain texture of cubic materials from ultrasonic wave speed. *Journal of the Mechanics and Physics of Solids*, 83:221–242, October 2015.

[MW92] S. Matthies and Hans-Rudolf Wenk. Optimization of Texture Measurements by Pole Figure Coverage with Hexagonal Grids. *Physica Status Solidi A*, 133:253–257, 1992.

[PKP19] Thien Q. Phan, Felix H. Kim, and Darren C. Pagan. Micromechanical response quantification using high-energy X-rays during phase transformations in additively manufactured 17-4 stainless steel. *Materials Science and Engineering: A*, 759:565–573, June 2019.

[Riz08] Anthony C. Rizzie. Elaboration on the Hexagonal Grid and Spiral Method for Data Collection Via Pole Figures. Vol 5, 2008.