

1 **Supplementary Information for Online Thickness Determination**
2 **with Position Averaged Convergent Beam Electron Diffraction using**
3 **Convolutional Neural Networks**

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13 **In this document we show additional data supplementing the main text with the performance of**
14 **the thickness determination at pure Poisson noise corrupted PACBEDs, the service at falsely**
15 **declared input parameters, and the similarity between PACBEDs.**

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17 **S1. Performance test with Poisson noise**

18 To demonstrate the capabilities of the CNN to handle Poisson noise we test the service with
19 simulated PACBEDs, which are corrupted with this kind of noise. The PACBEDs are from rutile
20 at 80 kV. The convergence angle, mistilt, and direction of mistilt are randomized within the
21 parameter space of the training dataset. For Poisson noise, defined doses are distributed over
22 the image. The original simulated image acts as probability distribution, which corresponds
23 to an infinite dose. Although, the CNNs are trained only with Gaussian noise, the predictions
24 are stable against increasing Poisson noise (see Fig. I). The highest percentage deviation is
25 only 10 %.

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28 **S2. Incorrect input parameters**

29 By comparing the processed pattern with the best match of the CNN, incorrect input
30 parameters can be identified. Fig. II demonstrates the analysis of an experimental PACBED
31 pattern from a rutile crystal, but the user declares it falsely as a STO crystal. Although, the
32 predictions are close, the structure mismatch is easily recognizable.

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35 **S3. Similarity of PACBEDs**

36 The similarity of simulated PACBEDs among each other can be visualized by calculating a
37 pixelwise L2 norm and plotting the sum in a confusion matrix. Each PACBED is normalized by
38 its mean intensity before calculating the L2 norm. It can be shown that the similarity with
39 other PACBEDs at different thicknesses depend strongly on the system parameters (see
40 Fig. III). However, higher similarity values do not mean the uniqueness of a PACBED pattern
41 is lost, especially because an analysis by CNN is more general than a simple L2-norm.

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