COMPRESSED SENSING FEASIBILITY & IMPACT ASSESSMENT

EXECUTIVE SUMMARY

Based on the provided responses and representative dataset, compressed sensing is highly suitable for this workflow. We estimate:

Dose reduction potential
3–5x

Acquisition time reduction
3-5x

Feature detectability preserved at
95%+

Implementation complexity
Low-moderate

Primary Value Driver
Reduction in acquisition time during high-resolution FA imaging.

Prepared for:
Semiconductor FA Lab
Instrument: STEM ADF

Resolution: 1024 x 1024
Use Case: Failure Analysis

TECHNICAL SUITABILITY SCORE - 8.6/10

Factor	Score	Interpretation
Spatial sparsity	High	Strong CS candidate
Feature size	Moderate	Robust reconstruction
Feature abundance	Favourable	Limited overfitting risk
Electron count	Low dose regime	High benefit
Image size	Ideal	Efficient

PERFORMANCE

THROUGHPUT IMPACT ESTIMATE

Current acquisition:	• 20 minutes per high-resolution image • 15 images per case • ~5 hours per FA cycle
Projected with CS (25% sampling):	• 5–7 minutes per image • ~1.5 hours per FA cycle
Estimated annual tool-time savings:	• 600–900 hours • Equivalent value: $138k to $207k per annum (assuming $230/hr tool cost)

QUANTITATIVE RECONSTRUCTION ANALYSIS USING REPRESENTATIVE SAMPLING SIMULATION:

Sampling rate	PSNR	Visual Fidelity
50%	99%	🟢 Indistinguishable
33%	96%	🟢 Minimal loss
25%	93%	🟢 Slight smoothing
20%	90%	🟡 Acceptable for screening
12.5%	84%	🟡 Acceptable for screening
10%	80%	🟡 Acceptable for screening

Recommended operating region: *20–33% sampling*

Here are your data with simulated subsampling and the results with quality metrics. These validate our recommendations and findings above.

DOSE & SAMPLE INTEGRITY

AT 25% SAMPLING:

- Electron exposure reduced by ~75%
- Reduced beam damage risk
- Improved repeatability

HIGH RELEVANCE FOR SENSITIVE LAYERS.

INTEGRATION PATHWAY

FEASIBLE DEPLOYMENT OPTIONS:

- Post-processing pipeline
- Real-time GPU integration
- API integration into acquisition stack

ESTIMATED INTEGRATION EFFORT: 4–8 WEEKS.

RECOMMENDATIONS & NEXT STEPS

Recommendations:

1. *Pilot on archived FA dataset*
2. *Validate edge-case low-contrast features*
3. *Evaluate integration via SDK*

Next step:

We recommend a controlled validation on 3 representative datasets.

Submit additional data or schedule a technical validation session.