

Fiber diameter report (SEM)

Demo · Sample DEMO · 2026-10-21

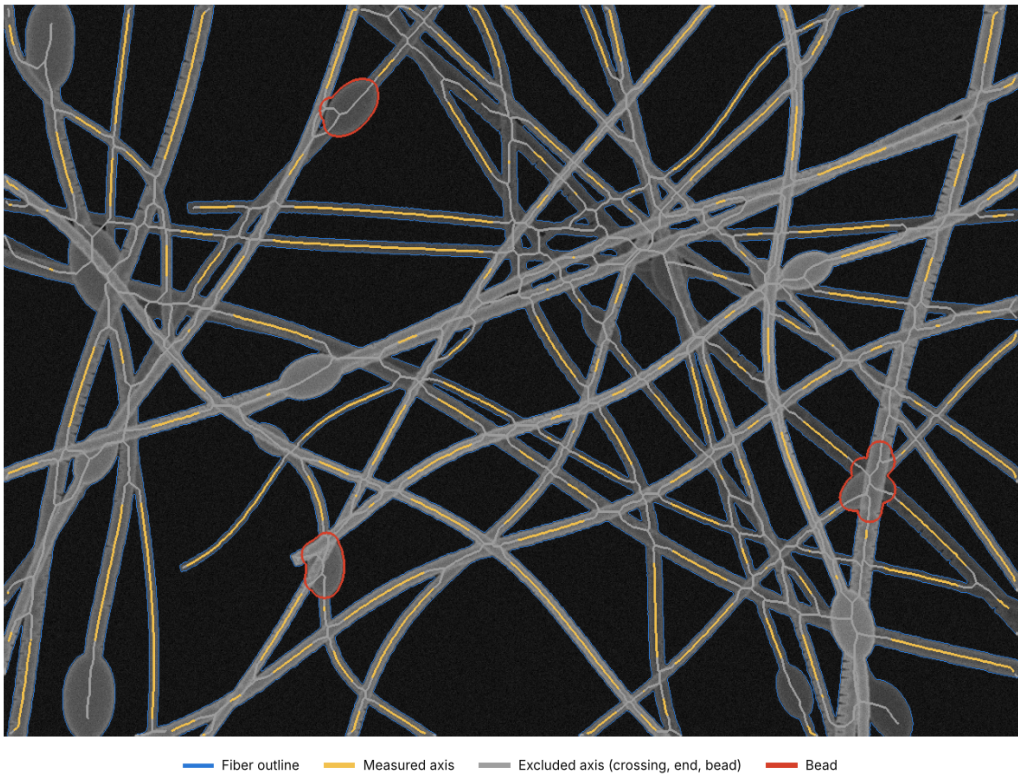
DEMO — the analysed images are synthetic, generated with known fiber diameters and beads. The validation table compares the measurement with the truth.

Main results

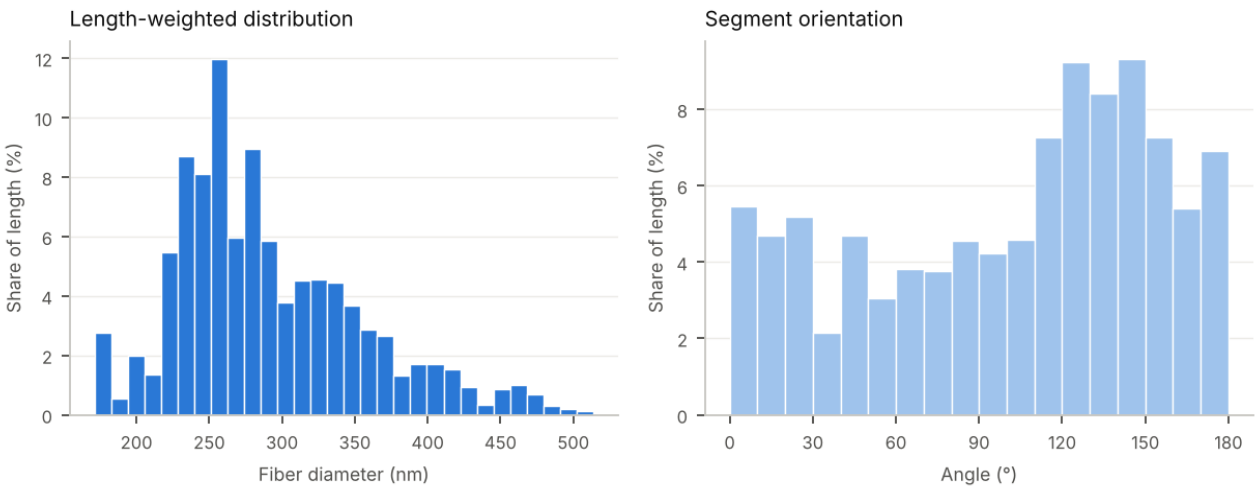
Fiber diameter (length-weighted)	292 ± 70 nm (mean ± SD) · CV 24 %
95 % confidence interval on the mean	284 - 300 nm (precision ± 2.7 %)
Median (95 % CI)	277 nm (268 - 284 nm)
D10 · D50 · D90	224 · 277 · 388 nm
Measurement	293 fiber segments, 598 µm of fiber measured on 4 images
Clearly identified beads (lower bound)	12 beads · 0.66 per 100 µm² · median diameter 1309 nm (4.7 × the fiber)
Orientation	alignment index 0.21 (0 = random, 1 = fully aligned) · main direction 141°
Field covered by fibers	35 % (visible layer)
Pixel size	20.00 nm/px (scale bar 5000 nm = 250 px)

Detection check (image 1)

demo_fibers_3.tif — detected fibers



Diameter distribution and orientation



Results per image

Image	Segments	Length (μm)	Mean (nm)	Median (nm)	Beads
demo_fibers_3.tif	67	139	313	295	3
demo_fibers_19.tif	71	157	272	254	3
demo_fibers_31.tif	78	146	308	299	4
demo_fibers_47.tif	77	156	278	264	2

Validation against ground truth (synthetic images)

Quantity	Truth	Measured	Difference
Length-weighted mean diameter (nm)	295	292	−0.9 %
Median fiber diameter (nm)	280	277	−0.9 %
Beads (including hidden under other fibers)	56	12	

The synthetic images have fibers of known diameter (with blur, noise, depth and crossings), so this table measures the error of the whole chain. The true median is over fibers; the measured median is weighted by visible length.

Method

Pixel size read from the microscope metadata (Zeiss or Thermo Fisher TIFF), measured on the scale bar of the data band, or given. Gaussian smoothing ($\sigma = 1$ px). An inclusive fiber mask (threshold halfway between the background and the Otsu threshold) is only used to trace the fiber axes (skeleton) and find crossings. The diameter is measured at each axis point on the intensity profile perpendicular to the fiber (direction from the structure tensor): full width at half maximum between the local background and the peak, interpolated to sub-pixel, as in CD-SEM metrology. This measurement does not depend on the threshold. Crossings (branch points of the skeleton), fiber ends and beads are excluded. Beads: large, compact regions that survive a morphological opening wider than the fibers and are crossed by few skeleton branches; the rule is prudent, so beads on a crossing or under other fibers are not counted (lower bound). Length-weighted statistics; confidence intervals by bootstrap over fiber segments (2,000 resamples, fixed seed), because points of the same segment are not independent. Alignment index: modulus of the length-weighted mean of $\exp(2i\theta)$.

Quality checks

Automatic check	Value	Status
Scale consistent (images, metadata, scale bar)	spread 0.0 %	pass
Resolution (median diameter in pixels)	14 px	pass
Fiber segments measured	293	pass
Precision on the mean diameter (95 % CI)	$\pm 2.7 \%$	pass
Share of the axis excluded (crossings, beads, fibers side by side)	60 %	pass
Consistency between images (max deviation from the mean)	7 %	pass
Fiber / background contrast (separability)	0.85	pass
Saturated pixels	0.0 %	pass
Visual review by an analyst	—	not done (automated run)

Delivered files

This report (PDF) · segments.csv (one row per fiber segment: length, mean and median diameter, orientation) · a control image per image · summary.json.

Traceability

Item	Value
Analysis engine version	1.0.0
Parameters	seuil_relatif = 0.5, mesure = profil, lissage_px = 1.0, aire_min_px = 40, trou_max_px = 30, marge_croisement = 1.6, marge_extremite = 1.0, perle_ouverture = 1.6, perle_aspect_max = 2.0, perle_aire_min = 10.0, perle_sorties_max = 6, perle_solidite_min = 0.88, segment_min_diametres = 3.0, correction_diametre_px = -0.5, bootstrap_tirages = 2000, bootstrap_graine = 0
SHA-256 fingerprint of demo_fibers_3.tif	20ee31838ceb77ac...
SHA-256 fingerprint of demo_fibers_19.tif	daefde5075669cdd...
SHA-256 fingerprint of demo_fibers_31.tif	774d343032718832...
SHA-256 fingerprint of demo_fibers_47.tif	9c625f9b9f352859...

The same images, parameters and engine version always give exactly the same results.

Limitations

Automated image analysis: sample preparation (coating), acquisition and the representativeness of the fields are the user's responsibility. Only visible fibers are measured; fibers lying side by side along their whole length can read as one wider fiber. Hollow, ribbon-like or highly porous fibers are not distinguished. Not an accredited (ISO/IEC 17025) measurement: for R&D and internal quality control.

Analysis: Automated analysis