

White paper

Quantitative PET/CT Response Assessment in mint Lesion

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mintmedical

mint Lesion turns PET/CT reads into criteria-conformant response assessments. Six published PET-based response criteria, from PERCIST for solid tumors to Lugano for lymphoma, are derived automatically, built on vendor-neutral SUV calculation following the QIBA FDG-PET/CT profile.

PET-based endpoints are now standard in lymphoma and increasingly used in solid tumors and prostate cancer. Each set of response criteria prescribes its own way of using PET: SUVpeak normalized to lean body mass and checked against liver or blood-pool reference for PERCIST, tumor volume at defined SUV thresholds for RECIP 1.0, visual Deauville scoring against mediastinum and liver for Lugano. Applying these rules consistently, with the right metric, normalization, threshold and comparator across readers, sites and time points, is what makes a PET endpoint reliable.

mint Lesion addresses this on three levels:

- Criteria implemented according to the publications, with documented interpretations
- A reading workflow with built-in conformity checks
- SUV values calculated consistently across scanner makes

All of this comes with the flexibility to configure protocol-specific requirements.



Figure 1: PERCIST read with CT, PET, fused PET/CT and MIP. SUV metrics, segmentation threshold and the change in the sum of SUVpeak are captured in the lesion and summary panels.

Measurement toolkit

PET tools appear automatically when a PET series is active. Measurements made in a fused PET/CT view always refer to the underlying PET data.

Tool	Method	Typical use
PET volume (% of SUVmax)	3D threshold segmentation relative to the lesion's SUVmax	PERCIST target lesions, metabolic tumor volume
PET volume (absolute)	3D threshold segmentation at a fixed SUV inside a user-placed sphere	RECIP 1.0 (e.g. SUV 3.0 for bone)
Reference tissue (3 cm sphere, 1 cm × 2 cm cylinder, 1 cm sphere)	Fixed-geometry VOI	Liver and aortic / mediastinal blood pool reference
Interpolated VOI	Manual contours on several slices, interpolated in 3D	Volumetric SUV where thresholding is unsuitable
2D ROI (polygon, smooth polygon, ellipse)	Manual contour on one slice	Lesion or background SUV on a single slice

Threshold presets are defined per study, and readers can adjust the threshold per lesion with a slider. The segmented voxels are shown on the image.

Each PET measurement reports:

- **SUV statistics:** SUVmax, SUVmean, SUVmedian, SUVmin and standard deviation, plus a histogram of voxel values
- **SUVpeak (3D VOIs):** the highest mean SUV in a 1 cm^3 sphere within the VOI, the quantity PERCIST relies on
- **Activity concentration** (Bq/ml) and the applied segmentation threshold
- **Volume (3D VOIs):** metabolic tumor volume (MTV) for threshold-based VOIs

Sums and changes against baseline, nadir and the previous time point are calculated as the respective response criteria require. PET measurements can also be fed into the mint Lesion radiomics module like any other 2D or 3D measurement.

Technical note

Vendor-neutral SUV calculation

SUV calculation follows the QIBA FDG-PET/CT profile and is verified against the QIBA Digital Reference Object (DRO). The calculation itself is not tracer-specific; the same SUV values feed PSMA-based assessment with RECIP 1.0.

$$SUV = \frac{C_{PET}[Bq/ml] \times N}{A_{inj}[Bq] \times 2^{-\Delta t \,/\, T½}}$$

C: activity concentration · N: body-size normalization · A: injected activity · Δt: injection to scan start.

Normalizations: body weight, lean body mass (James) and body surface area (Du Bois), as specified by QIBA. All three are calculated and exported; the reported normalization is defined per study.

Vendor-neutral: scanner-specific DICOM encodings are handled as described in the QIBA profile, so SUVs are calculated consistently across scanner makes.

Safeguards: SUVs are only calculated for attenuation- and decay-corrected data with complete dose, timing and patient data. Authorized users can correct weight, height and dose; original values are retained.

Supported PET response criteria

mint Lesion derives time-point and overall response automatically for six published PET-based response criteria. Where a publication is ambiguous, the interpretation chosen is documented, and the alternatives can be configured.

Response criteria	Indication	PET input	Response driven by	Implementation notes
PERCIST 1.0	Solid tumors, FDG	Quantitative	SUVpeak (LBM) of the hottest lesion, or sum of up to 5 target lesions	Both published variants available. Liver and aorta reference checks automated. Nadir as default comparator for progression, rationale documented and configurable. MTV and TLG as exploratory values
Lugano 2014	Lymphoma	Qualitative (Deauville 5-point scale), optional SUV	Metabolic, morphologic or combined response	Combined PET/CT and CT-only assessment in one read. Deauville "X", time points without PET and reference-tissue SUVs configurable
RECIL 2017	Lymphoma	Qualitative (Deauville, bone marrow on PET)	CT sum of longest diameters plus Deauville score	Deauville 1–3 upgrades PR to CR as published. SUVmax (BW) recorded as exploratory
LYRIC	Lymphoma under immunomodulatory therapy	Qualitative	Lugano with indeterminate response categories	Covers the increase-in-uptake scenario (IR3)
Cheson 2007	Lymphoma	Qualitative PET state per lesion	CT measurements plus PET state	PET state applied according to FDG avidity of the lymphoma type
RECIP 1.0	Metastatic CRPC, PSMA PET	Quantitative	Total PSMA-positive tumor volume (PSMA-VOL) and new lesions	2022 criteria by default, 2023 variant configurable. SUV 3.0 threshold for bone, reference-derived threshold for soft tissue applied at every time point. Lesions are segmented individually by the reader

Additional PET-related configuration is available per trial, for example a CRF question for time points without PET, reference-tissue categories and criteria-specific screen layouts. For protocol-specific or exploratory endpoints, a configurable response template can be set up, for example based on sums of SUV metrics or metabolic tumor volumes.

Workflow, quality and consistency

The reading workflow guides readers through the rules of the response criteria.

- **Viewing:** dedicated PET layouts combine CT, PET, fused PET/CT and a rotating maximum intensity projection (MIP), for one time point or side by side for baseline and follow-up. Fusion opacity, PET color maps and thin-slab rendering are adjustable.
- **Navigation:** the MIP crosshair jumps to the point of highest uptake along the viewing direction, and the position is synchronized across all series in the same frame of reference.
- **Conformity checks:** mint Lesion verifies the rules of the response criteria while the reader works. Examples are the lesion limits per organ, the required VOI type, the minimum uptake against the reference tissue for PERCIST and the required segmentation thresholds for RECIP 1.0.
- **Automatic response derivation:** target, non-target, new-lesion and overall responses update as measurements are entered.
- **Controlled overrides:** readers can overrule a derived response with a documented reason, and overruled values stay marked in reports and exports.
- **Reporting and export:** PET results use mint Lesion's standard reporting and data export, like any other measurement. SUVs are exported in all three normalizations, together with volumes, thresholds and derived responses.

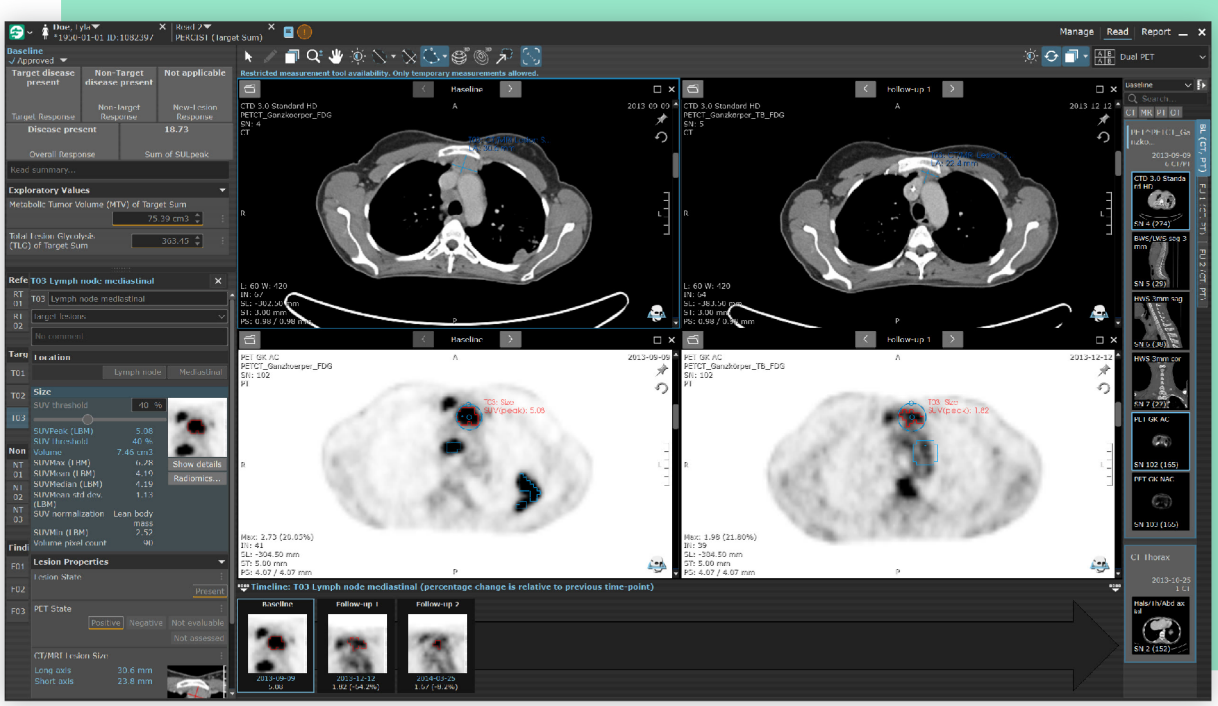


Figure 2: Baseline and follow-up side by side: CT and PET of both time points, synchronized for lesion matching.

Scope and good practice

The PET module is purpose-built for criteria-based response assessment within the mint Lesion reading workflow. It works with hybrid PET/CT data registered at acquisition. Lesions are segmented one by one with reader-controlled, threshold-based tools; there is no automated lesion detection or whole-body segmentation. Volume-based assessment of extensive disease, such as RECIP 1.0 on PSMA PET, is supported, but requires lesion-by-lesion segmentation and correspondingly more reading time.

Measurement tools and threshold presets can be set per study. SUVmax and SUVpeak are largely independent of the segmentation tool and threshold, as long as the VOI covers the hottest region. SUVmean, MTV and TLG depend on the segmentation, so for comparisons across readers and time points the same tool and threshold should be used.

References

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mint Lesion is a medical device manufactured by Mint Medical GmbH, Heidelberg, Germany, and is CE-marked under the EU MDR and FDA 510(k)-cleared. Described functionality refers to mint Lesion 3.12. Availability of features may vary by market and configuration; please contact us regarding your region.