

mouse_2609_150ms_control_iDS, signature 4091a5ca

Recording

Open-Source Low-Cost Cardiac Optical Mapping System: mouse_2609_150ms_control_iDS. 200 × 200 px, 1,954 frames, 0.977 kHz, pixel size not stated, deposit checks: negative values. Source 10.5281/zenodo.5557829; publication 10.1371/journal.pone.0259174; licence cc-by-4.0; Rybashlykov Dmitry. sha256 f9f4309fb395aa43ccae96f6e85724a7a739a98c295ff45598a6417b01605709.

Run

ee804172-2876-47fb-94df-d522ea5c6e03, 2026-10-28 20:47 UTC to 2026-10-28 20:51 UTC, status done. Protocol Mouse whole heart optical mapping (Luther lab), parameters v3 set by developer (not a domain scientist). Code 0d2391b04113d316716bce2e2f9ee6ec6728d5d3 (clean), 4 workers.

Methods

Using provisional parameter set version 3 for protocol f65d786f-f194-4be2-88b8-10d3dd25d674, the provisional fixed criteria were applied with baseline_frames=901, spatial_sigma=1.0, spatial_truncate=4.0, pad_frames=500, rotor_threshold=0.9, rotor_erode_px=3, link_px=4.0, max_gap=5, min_cycles=1.0, pair_dist_px=3.0, paired_frac=0.5, and render_step=4. The recording has 1954 frames of 200 x 200 pixels in mat format; the frame rate is 977.0 Hz from the recording-row admission citing the paper methods quote that recordings were 200x200 pixels at 977 frames per second, and the pixel size is not available. The analysed frames are 500 to 1454, and the provisional segment definition is one whole_recording segment, labelled whole recording, from start_frame=0 to end_frame=1954, defined at admission with no detected or logged events.

Verdict

Verdict: no cited-range physiology pass/fail can be assigned, and the ranges, the stability threshold of 0.25 x median, and the criteria are provisional; reportable descriptive outputs are singularity_frames_frac with range 0.9444444444444444 to 1.0 fraction of frames and dominant_freq_hz with range 6.145 to 7.169 Hz, while whole_recording.persistent_rotors and persistent_rotor_tracks are unstable at 9.0 to 609.0 and whole_recording.persistent_rotor_count_max is unstable at 1.0 to 75.0, so those counts are not reportable as single values; review the undocumented all-negative deposited values, low-confidence polarity, whole-frame mask, provisional SNR/processing thresholds, and tracker sensitivity of 80, 308, and 64 rotors, with mouse spiral-wave context from DOI 10.1371/journal.pcbi.1011660. physiology_ok: None; send back: False. Reviewer sign-off: pending.

Parameters (as run)

```
% Mouse whole heart optical mapping (Luther lab), v3, read-only
% set by developer (not a domain scientist); provisional, REVIEW_NEEDED 16
baseline_frames = 901;      % no baseline rule recorded for this run
pad_frames      = 500;      % each side, outside the window
spatial_sigma   = 1.0;      % px, Gaussian, phase only
spatial_truncate = 4.0;      % kernel radius, sigma
lowpass         = [];       % none
polarity        = 1;        % measured, skew of dV/dt
rotor_threshold = 0.9;      % turns, |winding| per plaquette
rotor_erode_px  = 3;        % px from tissue edge ignored
link_px         = 4.0;      % tracking, max step per frame
max_gap         = 5;        % frames a track may vanish
min_cycles      = 1.0;      % own rotations, min_frames = 136
pair_dist_px    = 3.0;      % opposite-charge pairing
paired_frac     = 0.5;      % max paired fraction of a track
render_step     = 4;        % movie only
```

Segments

Segment	Defined	Analysed	Cycle, frames	Expected rotors	Bounded by
Whole recording	0-1,954	500-1,454	[not measured]	not stated	recording start → recording end

Metrics

Metric	Unit	Whole recording	Physiological range
Rhythm			
Dominant frequency	Hz	7.169	none cited
Rotors			
Persistent rotors	count	9–609 (unstable)	none cited
Max concurrent persistent rotors	count	1–75 (unstable)	none cited
Frames with a singularity	fraction	1.000	none cited
Beats, where a global rhythm exists			
Beats	count	0	none cited
Global amplitude ratio	ratio	0.28	gate ≥ 0.30 provisional
APD50	ms	no global beat	none cited
APD90	ms	no global beat	none cited
Conduction velocity	cm/s	no global beat	none cited

Criteria and reportable values

Item	Rule or segment	Result
Design expectations	none stated for this recording's segments	no criterion to test; counts are descriptive (provisional)
persistent rotor tracks	all	9-609 count, unstable, not reportable
dominant freq (Hz)	whole recording	7.169 Hz, no cited range
persistent rotors	whole recording	9-609 count, unstable, not reportable
singularity frames fraction	whole recording	1 fraction of frames, no cited range
persistent rotor count max	whole recording	1-75 count, unstable, not reportable

Provisional rules behind this signature

Rule	Description	Expert	Status
protocol_parameter_set worker/voltage/protocol_params.py (developer_defaults, set_params)	Each protocol's fixed, versioned analysis parameters (version 1 = developer defaults); no run or agent may deviate	optical mapping analyst	provisional
baseline_window_rule worker/voltage/baseline_rule.py (FACTOR, evaluate)	A run proceeds only if the protocol's baseline window is $\geq 2 \times$ the slowest segment's cycle, the cycle from the MAP channel when a DAQ log exists, else from per-pixel dominant frequency on linearly detrended pixels; otherwise the run is held by code	optical mapping analyst	provisional
filter_defaults worker/voltage/preprocess.py (Params)	Default baseline window (frames) and spatial Gaussian sigma/truncate for phase	optical mapping analyst (cardiac electrophysiology)	provisional
tissue_mask worker/voltage/io.py (tissue_mask_info, otsu_threshold, largest_component)	Tissue mask from, in order: (1) NaN in frame 0 when the recording has any NaN; (2) a mask or background-image variable shipped in the file whose shape matches the frame (binary as is, an intensity image thresholded with Otsu); (3) Otsu's threshold on the mean image, the class with more temporal signal as tissue, largest connected component kept; source, coverage and threshold recorded	optical mapping analyst	provisional
polarity worker/voltage/preprocess.py (polarity)	Dye polarity from sign of median per-pixel skew of dV/dt	optical mapping analyst / voltage dye chemist	provisional
singularity_detection worker/voltage/preprocess.py (Params.rotor_threshold, rotor_erode_px)	Phase singularity = $ \text{winding} > \text{threshold turns}$, $\geq$ erode px from tissue edge	computational cardiac electrophysiologist (phase mapping)	provisional
rotor_persistence worker/voltage/rotors.py (TrackParams)	Track linking distance/gap and minimum lifetime for a persistent rotor	computational cardiac electrophysiologist (phase mapping)	provisional
chirality_pairing worker/voltage/rotors.py (TrackParams.pair_dist_px, paired_frac)	Opposite-charge singularities within pair distance are a pair; tracks paired most of their life are excluded from rotors	computational cardiac electrophysiologist (phase mapping)	provisional
sensitivity_grid worker/voltage/sensitivity.py (SIGMAS, BASELINE_MULTIPLES, baseline_levels)	Filter levels tested: spatial sigma and baseline window values	optical mapping analyst	provisional
analysis_window worker/voltage/runs.py (default_window)	Frames analysed: whole recording minus one filter pad at each end (unless the plan narrows it)	cardiac electrophysiologist familiar with the dataset	provisional
prior_processing_flags worker/voltage/inspect.py (prior_processing)	Thresholds for flagging depositor processing (normalization, masking, temporal/spatial smoothing)	imaging scientist (camera acquisition and noise)	provisional
pipeline_check worker/agents/pipeline.py (INSTRUCTIONS, validator)	The pipeline agent's hold/proceed decision from protocol mismatches and inspector anomalies; it chooses no parameter	optical mapping analyst	provisional

Provisional rules behind this signature

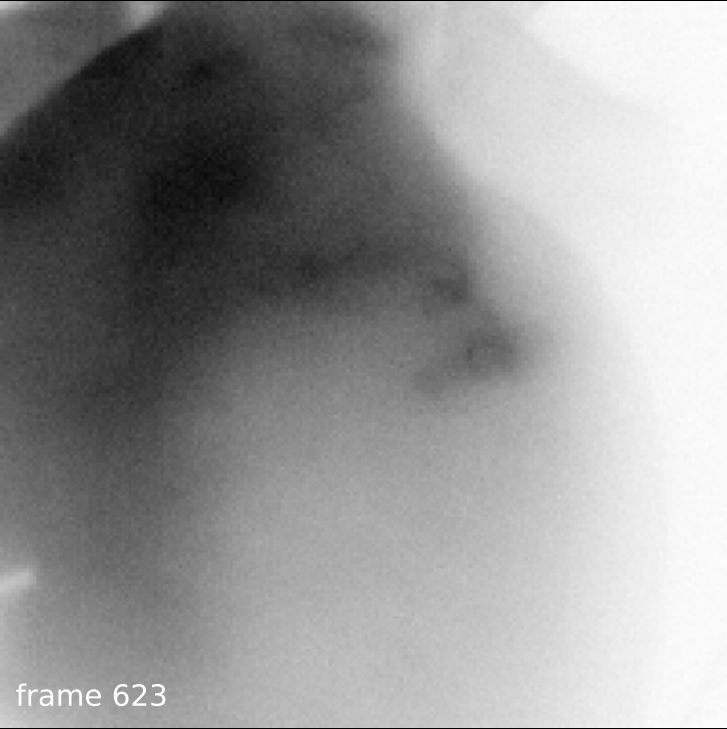
Rule	Description	Expert	Status
physiology_reference_rates worker/voltage/physiology.py (RANGES, TOLERANCE_FRAC)	Cited physiological ranges (single-study values widened by a 25% tolerance), applied to segments by their expected rhythm; used by the critic and for frame-rate sanity checks	cardiac electrophysiologist per species	provisional
stability_rule worker/agents/critic.py (STABLE_FRAC, stability)	A metric is reportable only if its spread across all sensitivity settings is $\leq 25\%$ of its median (zero spread when all values are 0); otherwise 'unstable, not reportable'	biostatistician + optical mapping analyst	provisional
persistence_threshold_variants worker/agents/critic.py (persistence_variants)	The persistent-rotor rule is run at two lifetimes, one measured cycle of the fastest segment and the paper's cited rotation period; both verdicts stored, disagreement flagged	computational cardiac electrophysiologist (phase mapping)	provisional
persistent_rotor_criterion worker/voltage/sensitivity.py (MIN_ROTORS_PRESENT, MAX_ROTORS_ABSENT)	Persistent-rotor finding holds if every 'present' segment has ≥ 1 persistent rotor and every 'absent' segment has none, at every setting	cardiac electrophysiologist	provisional

Review items

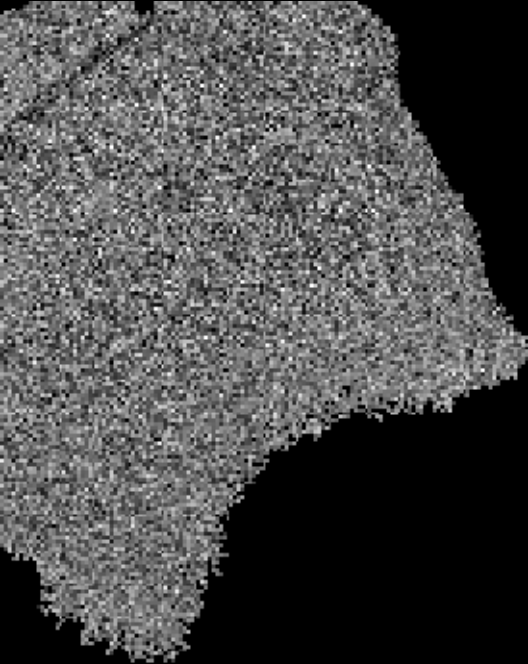
Topic	Detail	Severity
unstable:whole_recording.persiste nt_rotors	The metric varies from 9.0 to 609.0 across filter grid and tracker settings and is not reportable as a single count.	warn
unstable:whole_recording.persiste nt_rotor_count_max	The metric varies from 1.0 to 75.0 across filter grid and tracker settings and is not reportable as a single maximum count.	warn
unstable:persistent_rotor_tracks	The metric varies from 9.0 to 609.0 across filter grid and tracker settings and is not reportable as a single track count.	warn
Undocumented pre-deposit transformation	The deposited file appears transformed before deposit based on all-negative integer values, and the deposit metadata and paper text do not explain that transformation.	warn
Polarity confidence	Measured polarity is not inverted, but confidence is low; use pipeline measurement-based orientation rather than assuming raw Di-4-ANEPPS fluorescence polarity.	warn
Whole-frame mask	No depositor mask exists and the generated mask may include background as tissue; replace or check the mask before spatial interpretation.	warn
SNR and processing thresholds are provisional	SNR and the flags used to infer prior processing come from provisional tool thresholds and methods, and temporal smoothing may inflate SNR.	info
tracker count sensitivity	Strict, default, and loose tracker settings returned 80, 308, and 64 persistent rotors, while the rule verdict agrees; this should be reviewed as sensitivity rather than taken as proof the qualitative finding is false.	warn

Open-Source Low-Cost Cardiac Optical Mapping System: mouse_2609_150ms_control_iDS

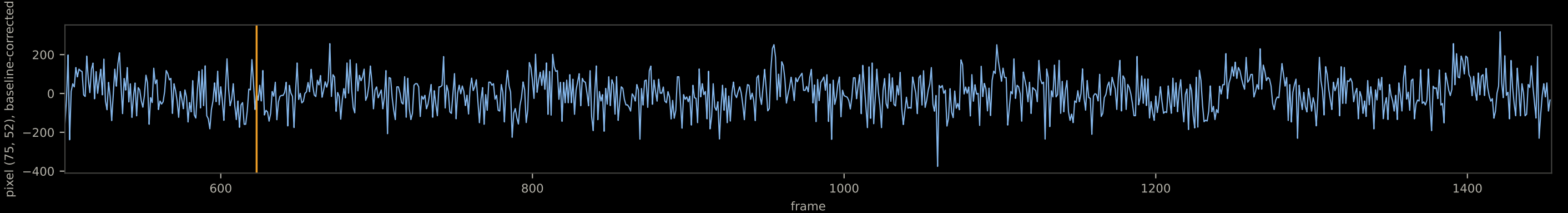
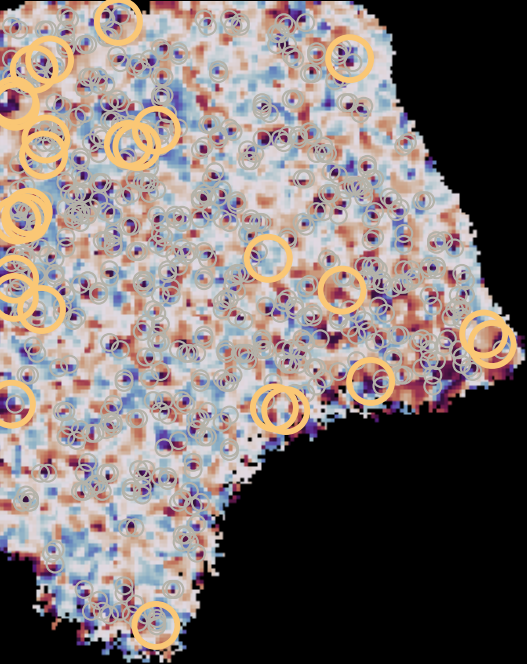
camera: frame as deposited



voltage: baseline-corrected only



phase: singularities (small), persistent rotors (ring)



Data: Public reference recording, Hussaini, Luther, Lädke (MPI Göttingen), CC-BY 4.0. doi:10.5281/zenodo.5557829. 200x200 px, 1954 frames; shown 500-1454 every 1. Frame rate: 977.0 Hz.
Camera: values as deposited (may include the depositor's processing), linear gray -7.38e+03 to -4, NaN black; nothing subtracted or filtered by us.
Voltage: baseline-corrected only (901-frame centered moving average subtracted), polarity x+1, no spatial filter, gray +/-213 (99th pct |V|).
Phase: Hilbert, on spatial Gaussian sigma=1.0 px (truncate 4.0) of the voltage signal, 500-frame pad. Singularity (small circle): |winding| > 0.9 turns, >= 3 px from tissue edge. Persistent rotor (large ring): tracked same-charge singularity lasting >= one cycle, not mostly in a close opposite-charge pair. Thresholds provisional.
Temporal low-pass: none. Display: native pixels, nearest-neighbour, no interpolation or boundary smoothing.
Opening frame 623: display choice: frame with the most concurrent persistent rotors (26) in whole recording, midpoint of the longest such stretch.

Provenance

```
{
  "recording": {
    "id": "669d42ed-e0bf-4229-9a5f-9301454eafe0",
    "label": "Open-Source Low-Cost Cardiac Optical Mapping System:
mouse_2609_150ms_control_iDS",
    "source": "admission",
    "source_ref": "10.5281/zenodo.5557829",
    "publication_ref": "10.1371/journal.pone.0259174",
    "storage_path": "uploads/public/7764050e/mouse_2609_150ms_control_iDS.mat",
    "format": "mat",
    "sha256": "f9f4309fb395aa43ccae96f6e85724a7a739a98c295ff45598a6417b01605709",
    "size_bytes": 114024466,
    "license": "cc-by-4.0",
    "attribution": "Rybashlykov Dmitry",
    "rights_source": {
      "ref": "10.5281/zenodo.5557829",
      "kind": "deposit_metadata",
      "admitted_by": "project lead",
      "license_as_stated": "cc-by-4.0"
    },
    "frame_rate_hz": 977.0,
    "frame_rate_source": {
      "by": "project lead",
      "ref": "10.1371/journal.pone.0259174",
      "kind": "admission",
      "quote": "The custom software was designed to make recordings with a resolution of
200x200 pixels and a framerate of 977 frames per second (FPS).",
      "source": "paper_methods"
    },
    "pixel_size_um": null,
    "pixel_size_source": null,
    "frames": 1954,
    "height": 200,
    "width": 200,
    "inverted": false
  },
  "protocol": {
    "id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
    "name": "Mouse whole heart optical mapping (Luther lab)",
    "species": "mouse",
    "tissue": "whole_heart",
    "params_version": 3,
    "params_set_by": "developer (not a domain scientist)",
    "params_note": "version 3: baseline 901 frames = 2.1 x the 433-frame (2.31 Hz) post-
termination cycle resolved under v2; v2's 641 frames was 1.48 cycles, on the 1.5-cycle line,
and the pipeline check held one run and passed another on the same inputs. pad 500 >= half
the window. Provisional (REVIEW_NEEDED item 16).",
    "run": {
      "id": "ee804172-2876-47fb-94df-d522ea5c6e03",
      "status": "done",
      "started_at": "2026-10-28T20:47:10.483007+00:00",
```

```
"finished_at": "2026-10-28T20:51:26.621979+00:00",
"code": {
  "dirty": false,
  "git_commit": "0d2391b04113d316716bce2e2f9ee6ec6728d5d3"
},
"workers": 4,
"steps": [
  "load",
  "deposit_checks",
  "baseline_correct",
  "polarity",
  "spatial_filter(phase only)",
  "hilbert_phase",
  "phase_singularities",
  "track_and_pair",
  "beats_apd_cv",
  "sensitivity",
  "render"
],
"protocol_params": {
  "params": {
    "link_px": 4.0,
    "max_gap": 5,
    "min_cycles": 1.0,
    "pad_frames": 500,
    "paired_frac": 0.5,
    "render_step": 4,
    "pair_dist_px": 3.0,
    "spatial_sigma": 1.0,
    "rotor_erode_px": 3,
    "baseline_frames": 901,
    "rotor_threshold": 0.9,
    "spatial_truncate": 4.0
  },
  "version": 3,
  "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674"
},
"baseline_rule": {
  "ok": null,
  "cycles": {
    "whole_recording": {
      "n_frames": 1954,
      "cycle_frames": null,
      "pixels_with_rhythm_frac": 0.0
    }
  },
  "factor": 2.0,
  "reason": "no segment cycle could be measured",
  "source": "per-pixel dominant frequency (images)",
  "status": "provisional",
  "baseline_frames": 901
},
"deposit_checks": {
  "flags": [
```

```

{
  "flag": "negative_values",
  "value": 1.0,
  "suggests": "baseline-subtracted or normalized; raw fluorescence counts are non-
negative",
  "threshold": 0.01
}
],
"status": "provisional",
"measures": {
  "max": -4.0,
  "min": -7378.0,
  "frames_used": 1954,
  "integer_frac": 1.0,
  "negative_frac": 1.0,
  "frames_with_nan": 0,
  "dv_lag1_autocorr_median": -0.3829070739238835,
  "neighbour_dv_corr_median": 0.23243111156884547
},
"processed_before_deposit": true
},
"pipeline_check": {
  "model": "openai:gpt-5.5",
  "proceed": true,
  "anomalies": [
    {
      "topic": "Undocumented pre-deposit transformation",
      "severity": "warn",
      "effect_on_analysis": "The fixed pipeline can run, but the deposited values are all
negative integers rather than raw non-negative fluorescence. Polarity, baseline correction,
amplitudes and any interpretation of preprocessing-dependent quantities should be read as
applying to this transformed deposit, not to raw camera fluorescence; prior filtering or
sign/offset changes may make the total preprocessing unknown."
    },
    {
      "topic": "Polarity confidence",
      "severity": "warn",
      "effect_on_analysis": "The analysis should use the pipeline's measurement-based
orientation rather than dye expectation. Because the measured skew is weak and block
agreement is incomplete, activation/upstroke orientation is less certain, although this is
not by itself a parameter mismatch."
    },
    {
      "topic": "Whole-frame mask",
      "severity": "warn",
      "effect_on_analysis": "The available mask covers the full 200 x 200 frame because no
depositor mask or NaN mask is present. Spatial summaries and phase/rotor analyses may
include background unless the generated tissue mask is checked or replaced outside this
fixed-parameter run."
    },
    {
      "topic": "baseline-window rule",
      "severity": "info",
      "effect_on_analysis": "The coded baseline-window rule returned ok=null with reason 'no

```

segment cycle could be measured' from per-pixel dominant frequency images, using factor 2.0 and baseline_frames 901. Per instruction this is reported only as information and does not hold the run."

```
    }
  ],
  "rationale": "The recording matches the protocol at the level of the available facts: it is a mouse whole-heart optical mapping deposit from the referenced study, and there is no conflicting protocol-specified frame rate, indicator, pixel size or image size. The fixed version 3 parameters are therefore applicable as the provisional protocol settings for this recording, with important caveats: the deposited data appear transformed before deposit, the polarity measurement is low-confidence, and the automatic mask is the whole frame. These issues affect interpretation and quality control of the fixed pipeline outputs but do not create a blocking mismatch in the protocol parameters.",
  "mismatches": [],
  "hold_reason": null,
  "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
  "methods_text": "Using provisional parameter set version 3 for protocol f65d786f-f194-4be2-88b8-10d3dd25d674, the provisional fixed criteria were applied with baseline_frames=901, spatial_sigma=1.0, spatial_truncate=4.0, pad_frames=500, rotor_threshold=0.9, rotor_erode_px=3, link_px=4.0, max_gap=5, min_cycles=1.0, pair_dist_px=3.0, paired_frac=0.5, and render_step=4. The recording has 1954 frames of 200 x 200 pixels in mat format; the frame rate is 977.0 Hz from the recording-row admission citing the paper methods quote that recordings were 200x200 pixels at 977 frames per second, and the pixel size is not available. The analysed frames are 500 to 1454, and the provisional segment definition is one whole_recording segment, labelled whole recording, from start_frame=0 to end_frame=1954, defined at admission with no detected or logged events.",
  "recording_id": "669d42ed-e0bf-4229-9a5f-9301454eafe0",
  "params_version": 3,
  "prompt_version": "pipeline-v2"
},
"signature": {
  "id": "4091a5ca-4825-4b42-bced-67d6ecc7a015",
  "created_at": "2026-10-28T20:50:40.714483+00:00",
  "movie_path": "runs/ee804172-2876-47fb-94df-d522ea5c6e03/movie.mp4",
  "frames": {
    "f0": 500,
    "f1": 1454,
    "maps": "runs/ee804172-2876-47fb-94df-d522ea5c6e03/frames/maps.npz",
    "dtype": "<f4",
    "phase": "runs/ee804172-2876-47fb-94df-d522ea5c6e03/frames/phase.npy",
    "shape": [
      954,
      200,
      200
    ],
  },
  "sha256": {
    "maps": "febd1fedf4c5ac367f926ee31d180e1aab1d706d2a508aae05ecad79a2aec05a",
    "phase": "2b59c98a1241c41c4686211bbd340f252a47a248feee3fb1d1bf7483064de237",
    "voltage": "e9da51c3d0d7dbdfd641c20930ab62c145eae47daeb674c3b3455bb85ec4b7f1"
  },
  "voltage": "runs/ee804172-2876-47fb-94df-d522ea5c6e03/frames/voltage.npy",
  "map_keys": [
    "dominant_frequency:whole_recording",
  ],
}
```

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    "dominant_frequency:window",
    "mask"
  ],
  "map_units": {
    "mask": "tissue mask, source file_variable",
    "dominant_frequency:window": "Hz",
    "dominant_frequency:whole_recording": "Hz"
  }
},
"filter_params": {
  "mask": "not NaN in frame 0 and nonzero temporal std",
  "render": {
    "step": 4,
    "palettes": {
      "phase": "twilight",
      "camera": "gray",
      "voltage": "gray"
    },
    "interpolation": "nearest"
  },
  "window": {
    "f0": 500,
    "f1": 1454,
    "segments": [
      {
        "name": "whole_recording",
        "label": "whole recording",
        "defined": [
          0,
          1954
        ],
        "analysed": [
          500,
          1454
        ],
        "citation": null,
        "defined_by": "admission (project lead); no comparison defined",
        "segment_id": "fcc54c6f-a622-4cc6-887e-4ff6ac65ca40",
        "end_event_id": null,
        "start_event_id": null,
        "expected_persistent_rotors": null
      }
    ],
    "illumination": null,
    "frame_rate_hz": 977.0,
    "frame_rate_source": {
      "by": "project lead",
      "ref": "10.1371/journal.pone.0259174",
      "kind": "admission",
      "quote": "The custom software was designed to make recordings with a resolution of 200x200 pixels and a framerate of 977 frames per second (FPS).",
      "source": "paper_methods"
    },
    "segment_cycles_frames": {

```

```

    "whole_recording": 136
  }
},
"lowpass": null,
"polarity": 1,
"tracking": {
  "link_px": 4.0,
  "max_gap": 5,
  "min_cycles": 1.0,
  "min_frames": 136,
  "paired_frac": 0.5,
  "pair_dist_px": 3.0
},
"pad_frames": 500,
"phase_method": "angle of scipy.signal.hilbert along time, on spatially filtered signal",
"spatial_sigma": 1.0,
"rotor_erode_px": 3,
"spatial_method": "scipy.ndimage.gaussian_filter per frame, mode=reflect; NaN set to 0
before filtering, non-tissue zeroed after",
"baseline_frames": 901,
"baseline_method": "scipy.ndimage.uniform_filter1d, mode=reflect, subtracted per pixel",
"polarity_method": "sign of median per-pixel skew of dV/dt on baseline-corrected signal",
"rotor_threshold": 0.9,
"spatial_truncate": 4.0,
"spatial_applies_to": "phase/activation only; displayed voltage is baseline-corrected
only"
},
"criteria_status": {
  "note": null,
  "rules": [
    {
      "id": "protocol_parameter_set",
      "expert": "optical mapping analyst",
      "status": "provisional",
      "values": {
        "set_by": "developer (not a domain scientist)",
        "protocol": "Mouse whole heart optical mapping (Luther lab)",
        "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
        "params_version": 3
      }
    },
    {
      "id": "baseline_window_rule",
      "expert": "optical mapping analyst",
      "status": "provisional",
      "values": {
        "ok": null,

```

```

    "factor": 2.0,
    "source": "per-pixel dominant frequency (images)",
    "required_min_frames": null,
    "slowest_cycle_frames": null
  },
  "decision": null,
  "location": "worker/voltage/baseline_rule.py (FACTOR, evaluate)",
  "reviewed": false,
  "reviewer": null,
  "description": "A run proceeds only if the protocol's baseline window is >= 2x the
slowest segment's cycle, the cycle from the MAP channel when a DAQ log exists, else from
per-pixel dominant frequency on linearly detrended pixels; otherwise the run is held by
code",
  "reviewed_at": null
},
{
  "id": "filter_defaults",
  "expert": "optical mapping analyst (cardiac electrophysiology)",
  "status": "provisional",
  "values": {
    "lowpass": null,
    "spatial_sigma": 1.0,
    "baseline_frames": 901,
    "spatial_truncate": 4.0
  },
  "decision": null,
  "location": "worker/voltage/preprocess.py (Params)",
  "reviewed": false,
  "reviewer": null,
  "description": "Default baseline window (frames) and spatial Gaussian sigma/truncate
for phase",
  "reviewed_at": null
},
{
  "id": "tissue_mask",
  "expert": "optical mapping analyst",
  "status": "provisional",
  "values": {
    "rule": "intensity variable 'bgimage' in the file, Otsu threshold 1628, class above
with more temporal signal, largest connected component",
    "side": "above",
    "source": "file_variable",
    "coverage": 0.44555,
    "variable": "bgimage",
    "threshold": 1627.92578125,
    "tissue_pixels": 17822
  },
  "decision": null,
  "location": "worker/voltage/io.py (tissue_mask_info, otsu_threshold,
largest_component)",
  "reviewed": false,
  "reviewer": null,
  "description": "Tissue mask from, in order: (1) NaN in frame 0 when the recording has
any NaN; (2) a mask or background-image variable shipped in the file whose shape matches the

```

frame (binary as is, an intensity image thresholded with Otsu); (3) Otsu's threshold on the mean image, the class with more temporal signal as tissue, largest connected component kept; source, coverage and threshold recorded",

```
    "reviewed_at": null
  },
  {
    "id": "polarity",
    "expert": "optical mapping analyst / voltage dye chemist",
    "status": "provisional",
    "values": {
      "method": "median skew of dV/dt",
      "result": 1
    },
    "decision": null,
    "location": "worker/voltage/preprocess.py (polarity)",
    "reviewed": false,
    "reviewer": null,
    "description": "Dye polarity from sign of median per-pixel skew of dV/dt",
    "reviewed_at": null
  },
  {
    "id": "singularity_detection",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",
    "values": {
      "rotor_erode_px": 3,
      "rotor_threshold": 0.9
    },
    "decision": null,
    "location": "worker/voltage/preprocess.py (Params.rotor_threshold, rotor_erode_px)",
    "reviewed": false,
    "reviewer": null,
    "description": "Phase singularity = |winding| > threshold turns, >= erode px from
tissue edge",
    "reviewed_at": null
  },
  {
    "id": "rotor_persistence",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",
    "values": {
      "link_px": 4.0,
      "max_gap": 5,
      "min_cycles": 1.0,
      "min_frames": 136
    },
    "decision": null,
    "location": "worker/voltage/rotors.py (TrackParams)",
    "reviewed": false,
    "reviewer": null,
    "description": "Track linking distance/gap and minimum lifetime for a persistent
rotor",
    "reviewed_at": null
  },
  },
```

```

{
  "id": "chirality_pairing",
  "expert": "computational cardiac electrophysiologist (phase mapping)",
  "status": "provisional",
  "values": {
    "paired_frac": 0.5,
    "pair_dist_px": 3.0
  },
  "decision": null,
  "location": "worker/voltage/rotors.py (TrackParams.pair_dist_px, paired_frac)",
  "reviewed": false,
  "reviewer": null,
  "description": "Opposite-charge singularities within pair distance are a pair; tracks
paired most of their life are excluded from rotors",
  "reviewed_at": null
},
{
  "id": "sensitivity_grid",
  "expert": "optical mapping analyst",
  "status": "provisional",
  "values": {
    "sigmas": {
      "light": 0.5,
      "default": 1.0,
      "heavier": 2.0
    },
    "trackers": {
      "loose": [
        6.0,
        10
      ],
      "strict": [
        2.0,
        1
      ],
      "default": [
        4.0,
        5
      ]
    },
    "baselines": {
      "run": 901,
      "3x_cycle": 408,
      "6x_cycle": 816,
      "1.5x_cycle": 204
    }
  },
  "decision": null,
  "location": "worker/voltage/sensitivity.py (SIGMAS, BASELINE_MULTIPLES,
baseline_levels)",
  "reviewed": false,
  "reviewer": null,
  "description": "Filter levels tested: spatial sigma and baseline window values",
  "reviewed_at": null
}

```

```

},
{
  "id": "analysis_window",
  "expert": "cardiac electrophysiologist familiar with the dataset",
  "status": "provisional",
  "values": {
    "f0": 500,
    "f1": 1454
  },
  "decision": null,
  "location": "worker/voltage/runs.py (default_window)",
  "reviewed": false,
  "reviewer": null,
  "description": "Frames analysed: whole recording minus one filter pad at each end
(unless the plan narrows it)",
  "reviewed_at": null
},
{
  "id": "prior_processing_flags",
  "expert": "imaging scientist (camera acquisition and noise)",
  "status": "provisional",
  "values": {
    "flags": [
      "negative_values"
    ],
    "thresholds": {
      "int_frac": 0.5,
      "neg_frac": 0.01,
      "dv_autocorr": 0.5,
      "neighbour_corr": 0.8
    }
  },
  "decision": null,
  "location": "worker/voltage/inspect.py (prior_processing)",
  "reviewed": false,
  "reviewer": null,
  "description": "Thresholds for flagging depositor processing (normalization, masking,
temporal/spatial smoothing)",
  "reviewed_at": null
},
{
  "id": "pipeline_check",
  "expert": "optical mapping analyst",
  "status": "provisional",
  "values": {
    "model": "openai:gpt-5.5",
    "proceed": true,
    "anomalies": [
      "Undocumented pre-deposit transformation",
      "Polarity confidence",
      "Whole-frame mask",
      "baseline-window rule"
    ],
    "mismatches": []
  }
}

```

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    },
    "decision": null,
    "location": "worker/agents/pipeline.py (INSTRUCTIONS, validator)",
    "reviewed": false,
    "reviewer": null,
    "description": "The pipeline agent's hold/proceed decision from protocol mismatches and
inspector anomalies; it chooses no parameter",
    "reviewed_at": null
  },
  {
    "id": "physiology_reference_rates",
    "expert": "cardiac electrophysiologist per species",
    "status": "provisional",
    "values": {
      "ranges": [
        "mouse_spiral_rotation_hz"
      ],
      "tolerance_frac": 0.25,
      "segment_rhythm_rule": "expected persistent rotors 'present' -> spiral arrhythmia"
    },
    "decision": null,
    "location": "worker/voltage/physiology.py (RANGES, TOLERANCE_FRAC)",
    "reviewed": false,
    "reviewer": null,
    "description": "Cited physiological ranges (single-study values widened by a 25%
tolerance), applied to segments by their expected rhythm; used by the critic and for frame-
rate sanity checks",
    "reviewed_at": null
  },
  {
    "id": "stability_rule",
    "expert": "biostatistician + optical mapping analyst",
    "status": "provisional",
    "values": {
      "unstable": [
        "whole_recording.persistent_rotors",
        "whole_recording.persistent_rotor_count_max",
        "persistent_rotor_tracks"
      ],
      "stable_frac": 0.25
    },
    "decision": null,
    "location": "worker/agents/critic.py (STABLE_FRAC, stability)",
    "reviewed": false,
    "reviewer": null,
    "description": "A metric is reportable only if its spread across all sensitivity
settings is <= 25% of its median (zero spread when all values are 0); otherwise 'unstable,
not reportable'",
    "reviewed_at": null
  },
  {
    "id": "persistence_threshold_variants",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",

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    "values": {
      "measured_cycle": 136,
      "paper_rotation": null
    },
    "decision": null,
    "location": "worker/agents/critic.py (persistence_variants)",
    "reviewed": false,
    "reviewer": null,
    "description": "The persistent-rotor rule is run at two lifetimes, one measured cycle
of the fastest segment and the paper's cited rotation period; both verdicts stored,
disagreement flagged",
    "reviewed_at": null
  },
  {
    "id": "persistent_rotor_criterion",
    "expert": "cardiac electrophysiologist",
    "status": "provisional",
    "values": {
      "max_absent": 0,
      "min_present": 1
    },
    "decision": null,
    "location": "worker/voltage/sensitivity.py (MIN_ROTORS_PRESENT, MAX_ROTORS_ABSENT)",
    "reviewed": false,
    "reviewer": null,
    "description": "Persistent-rotor finding holds if every 'present' segment has >= 1
persistent rotor and every 'absent' segment has none, at every setting",
    "reviewed_at": null
  }
],
"status": "provisional",
"all_reviewed": false,
"superseded_by_run": null
}
},
"segments": [
  {
    "id": "fcc54c6f-a622-4cc6-887e-4ff6ac65ca40",
    "position": 1,
    "name": "whole_recording",
    "label": "whole recording",
    "start_frame": 0,
    "end_frame": 1954,
    "expected_persistent_rotors": null,
    "definition": "whole recording; no events detected or logged at admission",
    "defined_by": "admission (project lead); no comparison defined",
    "citation": null,
    "evidence": {},
    "provisional": true
  }
],
"events": []
}

```