

mouseventricle06062018_A_FLEC_1uM_Paced, signature daa60525

Recording

Mouse Whole Heart Optical Mapping Data: Mouse Whole Heart.zip/Mouse Whole Heart/06062018 A/mouseventricle06062018 A_FLEC 1uM Paced. 51 × 51 px, 5,000 frames, 1 kHz, 156 µm/px. Source 10.6084/m9.figshare.17158742.v1; publication 10.1038/s41597-022-01253-1; licence CC0; Ming Lei. sha256 1ab7a0072312341c56240fbd22c16132ce5908f5655c90c06c8677696b6f6195.

Run

1d65814d-f982-424e-ae62-1ed747dc6cf7, 2026-10-28 19:22 UTC to 2026-10-28 19:25 UTC, status done. Protocol Mouse whole heart optical mapping (Luther lab), parameters v3 set by developer (not a domain scientist). Code 4533745bb9cdd7aab7940336430ca22779950c4f (clean), 4 workers.

Methods

Using provisional parameter set version 3 for protocol f65d786f-f194-4be2-88b8-10d3dd25d674, the fixed parameters are 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 5000 frames of 51 x 51 MAT data, with frame rate 1000.0 Hz from admission/paper_methods for 10.1038/s41597-022-01253-1 and pixel size 156.0 µm from the same source. The analysed window is frames 500 to 4500. The provisional segment definition is whole_recording, labelled whole recording, spanning frames 0 to 5000, defined at admission with no events detected or logged; the parameter set, segment definitions, and criteria are provisional.

Verdict

Provisional review: the only stable metric is dominant_freq_hz at 9.25 Hz, but it has no applicable cited range for this paced mouse whole-heart recording; the mouse spiral-wave context from DOI 10.1371/journal.pcbi.1011660 gives ≈20 Hz and ≈18.75 Hz, corresponding at 1000 frames/s to 50 and 53 frames, but that is not a population range for this file. The rotor-related outputs are unstable and not reportable: singularity_frames_frac spans 0.021 to 0.6705, persistent_rotors spans 0.0 to 13.0, persistent_rotor_count_max spans 0.0 to 2.0, and persistent_rotor_tracks spans 0.0 to 13.0 across the tested settings. The persistent-rotor threshold variants are not applicable because there are no segment expectations; strict/default/loose trackers found 0, 4, and 13 persistent rotors, so tracking sensitivity needs review rather than serving as proof that the finding is false. Before reporting, review the inspector block on frame-rate provenance, unavailable depositor documentation, tissue annotation/mask, physiology-reference limitations, and baseline drift/bleaching; all ranges, the stability threshold, and the criteria are provisional.

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;      % >= 2 x slowest cycle (7, images): ok
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 = 108
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	0-5,000	500-4,500	7 (98% of pixels)	not stated	recording start → recording end

Metrics

Metric	Unit	Whole recording	Physiological range
Rhythm			
Dominant frequency	Hz	9.250	none cited
Rotors			
Persistent rotors	count	0-13 (unstable)	none cited
Max concurrent persistent rotors	count	0-2 (unstable)	none cited
Frames with a singularity	fraction	0.021-0.670 (unstable)	none cited
Beats, where a global rhythm exists			
Beats	count	38	none cited
Global amplitude ratio	ratio	0.78	gate ≥ 0.30 provisional
APD50	ms	15	none cited
APD90	ms	40	none cited
Conduction velocity	cm/s	2.6	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	0-13 count, unstable, not reportable
dominant freq (Hz)	whole recording	9.25 Hz, no cited range
persistent rotors	whole recording	0-13 count, unstable, not reportable
singularity frames fraction	whole recording	0.021-0.67 fraction of frames, unstable, not reportable
persistent rotor count max	whole recording	0-2 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

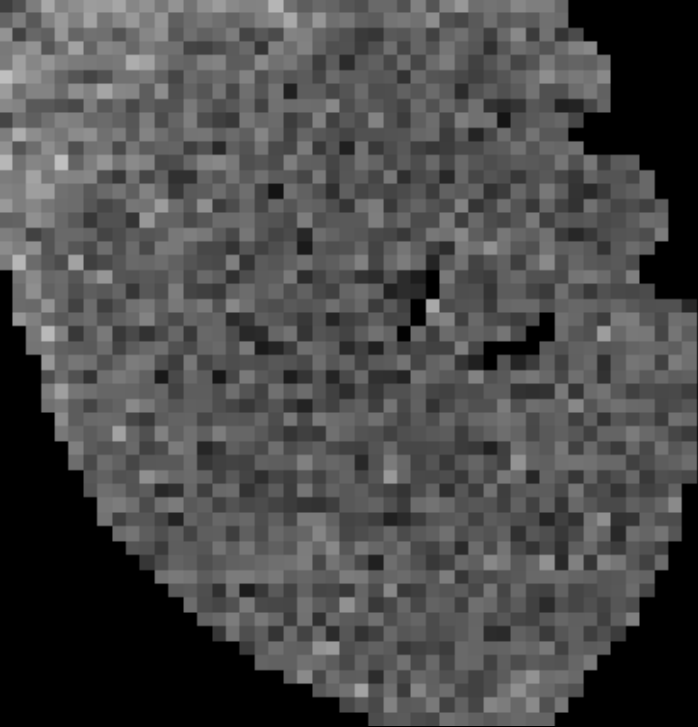
Topic	Detail	Severity
unstable:whole_recording.singularity_frames_frac	Varies from 0.021 to 0.6705 across the filter grid, exceeding the provisional stability rule.	warn
unstable:whole_recording.persistent_rotors	Varies from 0.0 to 13.0 across filter and tracker settings, so persistent-rotor count is not reportable.	warn
unstable:whole_recording.persistent_rotor_count_max	Varies from 0.0 to 2.0 across filter and tracker settings, so the maximum simultaneous count is not reportable.	warn
unstable:persistent_rotor_tracks	Varies from 0.0 to 13.0 across filter and tracker settings, so track count is not reportable.	warn
Frame rate unavailable	Inspector reports that no frame-rate source was available from upload/admission, accessible deposit metadata, publication text, or acquisition log, so time conversion for paced data needs review despite the analysis overview listing 1000.0 Hz.	block
Accessible depositor documentation unavailable	Figshare deposit documentation could not be read by the metadata tool, so preprocessing steps and protocol statements were not independently verified.	warn
Tissue annotation/mask	Recording metadata and path labeling conflict on atrium versus mouseventricle, and the analysis mask covers the full 51 x 51 frame based only on nonzero temporal standard deviation.	warn
Physiology-reference limitations	The only provisional reference rate is mouse spiral rotation at 14.0625 to 25.0 Hz from a different context, while this filename indicates paced recording.	info
Baseline drift/bleaching	Inspector reports slow baseline change nearly one beat amplitude, so detrending and baseline handling may materially affect amplitude-based and rotor-related measurements.	warn
tracker sensitivity	Strict/default/loose tracker settings returned 0/4/13 persistent rotors; treat as a tracking-sensitivity review item rather than a false-positive verdict by itself.	warn

Mouse Whole Heart Optical Mapping Data: Mouse Whole Heart.zip/Mouse Whole Heart/06062018 A/mouseventricle06062018 A_FLEC 1uM Paced

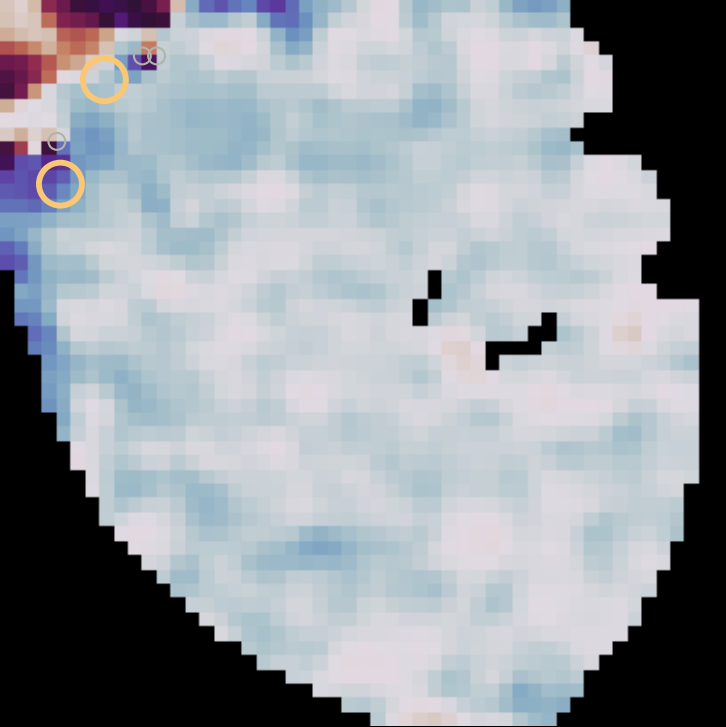
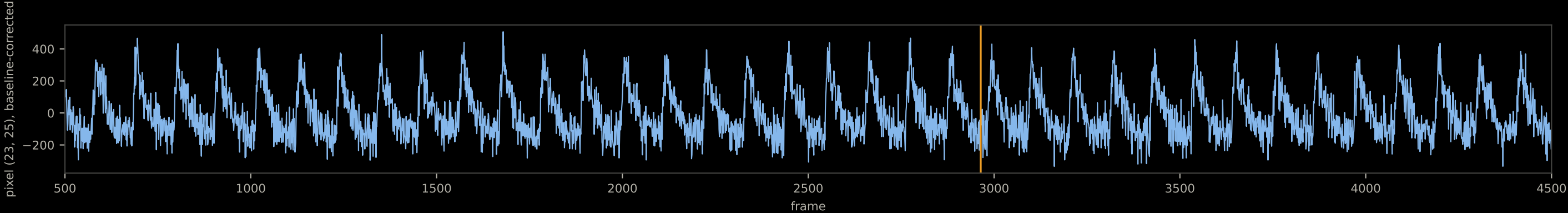
camera: frame as deposited



voltage: baseline-corrected only



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



Data: Public reference recording, Hussaini, Luther, Lädke (MPI Göttingen), CC-BY 4.0. doi:10.6084/m9.figshare.17158742.v1. 51x51 px, 5000 frames; shown 500-4500 every 1. Frame rate: 1000.0 Hz.

Camera: values as deposited (may include the depositor's processing), linear gray 2.66e+03 to 2.85e+04, 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 +/-372 (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 2964: display choice: frame with the most concurrent persistent rotors (2) in whole recording, midpoint of the longest such stretch.

Provenance

```
{
  "recording": {
    "id": "f84bc560-2a52-46d8-8ca3-e654c30d8fdf",
    "label": "Mouse Whole Heart Optical Mapping Data: Mouse Whole Heart.zip/Mouse Whole
Heart/06062018 A/mouseventricle06062018 A_FLEC 1uM Paced",
    "source": "admission",
    "source_ref": "10.6084/m9.figshare.17158742.v1",
    "publication_ref": "10.1038/s41597-022-01253-1",
    "storage_path": "uploads/public/5a7107e9/Mouse_Whole_Heart.zip/Mouse_Whole_Heart/06062018_
A/mouseventricle06062018_A_FLEC_1uM_Paced.mat",
    "format": "mat",
    "sha256": "1ab7a0072312341c56240fbd22c16132ce5908f5655c90c06c8677696b6f6195",
    "size_bytes": 24803475,
    "license": "CC0",
    "attribution": "Ming Lei",
    "rights_source": {
      "ref": "10.6084/m9.figshare.17158742.v1",
      "kind": "deposit_metadata",
      "admitted_by": "project lead",
      "license_as_stated": "CC0"
    },
    "frame_rate_hz": 1000.0,
    "frame_rate_source": {
      "by": "project lead",
      "ref": "10.1038/s41597-022-01253-1",
      "kind": "admission",
      "quote": "Emission photons were imaged by Evolve Delta 512 \u00d7 512 pixel EMCCD cameras
(1000 Hz sampling rate, 51 \u00d7 51 pixels, 156 \u00b5m/pixel).",
      "source": "paper_methods"
    },
    "pixel_size_um": 156.0,
    "pixel_size_source": {
      "by": "project lead",
      "ref": "10.1038/s41597-022-01253-1",
      "kind": "admission",
      "quote": "Emission photons were imaged by Evolve Delta 512 \u00d7 512 pixel EMCCD cameras
(1000 Hz sampling rate, 51 \u00d7 51 pixels, 156 \u00b5m/pixel).",
      "source": "paper_methods"
    },
    "frames": 5000,
    "height": 51,
    "width": 51,
    "inverted": true
  },
  "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": "1d65814d-f982-424e-ae62-1ed747dc6cf7",
  "status": "done",
  "started_at": "2026-10-28T19:22:06.124087+00:00",
  "finished_at": "2026-10-28T19:25:54.130217+00:00",
  "code": {
    "dirty": false,
    "git_commit": "4533745bb9cdd7aab7940336430ca22779950c4f"
  },
  "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": true,
    "ratio": 128.714,
    "cycles": {
      "whole_recording": {
        "n_frames": 5000,
        "cycle_frames": 7,
        "pixels_agreeing_frac": 0.9762022806147744,
        "pixels_with_rhythm_frac": 1.0,
```

```

    "interval_quartiles_frames": [
      7.0,
      7.0,
      7.0
    ]
  },
  "factor": 2.0,
  "reason": null,
  "source": "per-pixel dominant frequency (images)",
  "status": "provisional",
  "baseline_frames": 901,
  "slowest_segment": "whole_recording",
  "required_min_frames": 14,
  "slowest_cycle_frames": 7
},
"deposit_checks": {
  "flags": [],
  "status": "provisional",
  "measures": {
    "max": 29335.0,
    "min": 2659.0,
    "frames_used": 2000,
    "integer_frac": 1.0,
    "negative_frac": 0.0,
    "frames_with_nan": 0,
    "dv_lag1_autocorr_median": -0.45790942859000267,
    "neighbour_dv_corr_median": 0.24034260643672625
  },
  "processed_before_deposit": false
},
"pipeline_check": {
  "model": "openai:gpt-5.5",
  "proceed": true,
  "anomalies": [
    {
      "topic": "Frame rate unavailable",
      "severity": "warn",
      "effect_on_analysis": "The inspector could not independently recover a frame rate, which would block conversion of the paced dominant cycle to time. The recording_facts source, however, supplies 1000.0 Hz from admission/paper_methods, so the fixed analysis can proceed using that source; timing statements should cite that source."
    },
    {
      "topic": "Accessible depositor documentation unavailable",
      "severity": "warn",
      "effect_on_analysis": "Depositor README/notebook statements and documented preprocessing could not be verified by the inspector. Automated prior-processing checks did not flag smoothing or other pre-deposit processing, but absence of processing is not independently documented."
    },
    {
      "topic": "Tissue annotation/mask",
      "severity": "warn",

```

```

    "effect_on_analysis": "The mask covers the full 51 x 51 frame using nonzero temporal
standard deviation only. If the frame contains background, the fixed pipeline would analyze
it as tissue, affecting spatial, phase, and rotor measurements; the inconsistent
atrium/ventricle/whole-heart labels also limit anatomical interpretation."
  },
  {
    "topic": "Baseline drift/bleaching",
    "severity": "warn",
    "effect_on_analysis": "The slow baseline changes by nearly one beat amplitude, so
detrending and the fixed 901-frame baseline correction materially affect amplitude-based
measurements; phase-based outputs may still be usable but remain dependent on baseline
handling."
  },
  {
    "topic": "Baseline-window rule",
    "severity": "info",
    "effect_on_analysis": "The coded baseline rule reports ok: baseline_frames 901, factor
2.0, slowest_segment whole_recording, slowest_cycle_frames 7, required_min_frames 14, ratio
128.714. Per instruction this rule is reported only as informational and does not hold the
run."
  }
],
"rationale": "The protocol is broadly applicable because this is a mouse optical-mapping
recording in the Luther-lab whole-heart reference dataset, and the recording_facts source
provides the needed acquisition scale: 1000.0 Hz and 156.0 \u00b5m/pixel. The fixed
version-3 parameters are frame-based and the coded baseline-window rule passes; the segment-
level dominant cycle is 108.1 frames over the analysed window, giving baseline_over_cycle
8.33 under the 901-frame baseline. The run should nevertheless be treated as provisional
because tissue labels are inconsistent, the full frame is treated as tissue, depositor
documentation was not accessible for independent preprocessing verification, and the
recording has substantial slow baseline drift/bleaching.",
"mismatches": [
  {
    "field": "tissue",
    "detail": "The protocol is a mouse whole-heart optical-mapping protocol, but the
available tissue annotations are internally inconsistent. This does not by itself make the
fixed frame-based parameters wrong, but it limits tissue-specific interpretation and
interacts with the full-frame mask warning.",
    "severity": "warn",
    "protocol_value": "whole_heart",
    "recording_value": "recording row identified as atrium by the inspector; path label
contains 'mouseventricle' while the deposit label is Mouse Whole Heart"
  }
],
"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 fixed parameters are 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 5000 frames of 51 x 51 MAT data, with frame rate 1000.0
Hz from admission/paper_methods for 10.1038/s41597-022-01253-1 and pixel size 156.0 \u00b5m
from the same source. The analysed window is frames 500 to 4500. The provisional segment
definition is whole_recording, labelled whole recording, spanning frames 0 to 5000, defined

```

at admission with no events detected or logged; the parameter set, segment definitions, and criteria are provisional.",

```
    "recording_id": "f84bc560-2a52-46d8-8ca3-e654c30d8fdf",
    "params_version": 3,
    "prompt_version": "pipeline-v2"
  }
},
"signature": {
  "id": "daa60525-79d0-40ac-80a8-d131bab1047a",
  "created_at": "2026-10-28T19:25:27.633986+00:00",
  "movie_path": "runs/1d65814d-f982-424e-ae62-1ed747dc6cf7/movie.mp4",
  "frames": {
    "f0": 500,
    "f1": 4500,
    "maps": "runs/1d65814d-f982-424e-ae62-1ed747dc6cf7/frames/maps.npz",
    "dtype": "<f4",
    "phase": "runs/1d65814d-f982-424e-ae62-1ed747dc6cf7/frames/phase.npy",
    "shape": [
      4000,
      51,
      51
    ],
    "sha256": {
      "maps": "9de7029ac11a25eb89d2412d55ebad140d474628a9d5366bbdaa943c0c21c762",
      "phase": "de90341142805de8a8ad6adb8ff8165f5426d4efbba66bb9dc73eeca2e3f9ac4",
      "voltage": "f6efcc8ca66d76e006519c44f95784312999b2b60d95d1b75607cc63f1ca8994"
    },
    "voltage": "runs/1d65814d-f982-424e-ae62-1ed747dc6cf7/frames/voltage.npy",
    "map_keys": [
      "activation:whole_recording",
      "dominant_frequency:whole_recording",
      "dominant_frequency:window",
      "mask"
    ],
    "map_units": {
      "mask": "tissue mask, source otsu_mean_image",
      "dominant_frequency:window": "Hz",
      "activation:whole_recording": "ms",
      "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": 4500,
"segments": [
  {
    "name": "whole_recording",
    "label": "whole recording",
    "defined": [
      0,
      5000
    ],
    "analysed": [
      500,
      4500
    ],
    "citation": null,
    "defined_by": "admission (project lead); no comparison defined",
    "segment_id": "87f493f2-8b99-4c2a-90af-b95efbbdc6b6",
    "end_event_id": null,
    "start_event_id": null,
    "expected_persistent_rotors": null
  }
],
"illumination": null,
"frame_rate_hz": 1000.0,
"frame_rate_source": {
  "by": "project lead",
  "ref": "10.1038/s41597-022-01253-1",
  "kind": "admission",
  "quote": "Emission photons were imaged by Evolve Delta 512 \u00d7 512 pixel EMCCD cameras (1000 Hz sampling rate, 51 \u00d7 51 pixels, 156 \u00b5m/pixel).",
  "source": "paper_methods"
},
"segment_cycles_frames": {
  "whole_recording": 108
}
},
"lowpass": null,
"polarity": -1,
"tracking": {
  "link_px": 4.0,
  "max_gap": 5,
  "min_cycles": 1.0,
  "min_frames": 108,
  "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
        },
        "decision": null,
        "location": "worker/voltage/protocol_params.py (developer_defaults, set_params)",
        "reviewed": false,
        "reviewer": null,
        "description": "Each protocol's fixed, versioned analysis parameters (version 1 =
developer defaults); no run or agent may deviate",
        "reviewed_at": null
      },
      {
        "id": "baseline_window_rule",
        "expert": "optical mapping analyst",
        "status": "provisional",
        "values": {
          "ok": true,
          "factor": 2.0,
          "source": "per-pixel dominant frequency (images)",
          "required_min_frames": 14,
          "slowest_cycle_frames": 7
        },
        "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,

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    "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": "Otsu threshold 1.553e+04 on the mean image, class above with more temporal
signal, largest connected component",
    "side": "above",
    "source": "otsu_mean_image",
    "coverage": 0.7754709727028066,
    "variable": null,
    "threshold": 15527.156127929688,
    "tissue_pixels": 2017
  },
  "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",

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"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": 108
  },
  "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": {

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    "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": 324,
    "6x_cycle": 648,
    "1.5x_cycle": 162
  }
},
"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": 4500
  },
  "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": {

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    "flags": [],
    "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": [
      "Frame rate unavailable",
      "Accessible depositor documentation unavailable",
      "Tissue annotation/mask",
      "Baseline drift/bleaching",
      "Baseline-window rule"
    ],
    "mismatches": [
      "tissue"
    ]
  },
  "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,

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    "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.singularity_frames_frac",
            "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",
    "values": {
        "measured_cycle": 108,
        "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
    }
}

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    },
    "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": "87f493f2-8b99-4c2a-90af-b95efbbdc6b6",
  "position": 1,
  "name": "whole_recording",
  "label": "whole recording",
  "start_frame": 0,
  "end_frame": 5000,
  "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": []
}
```