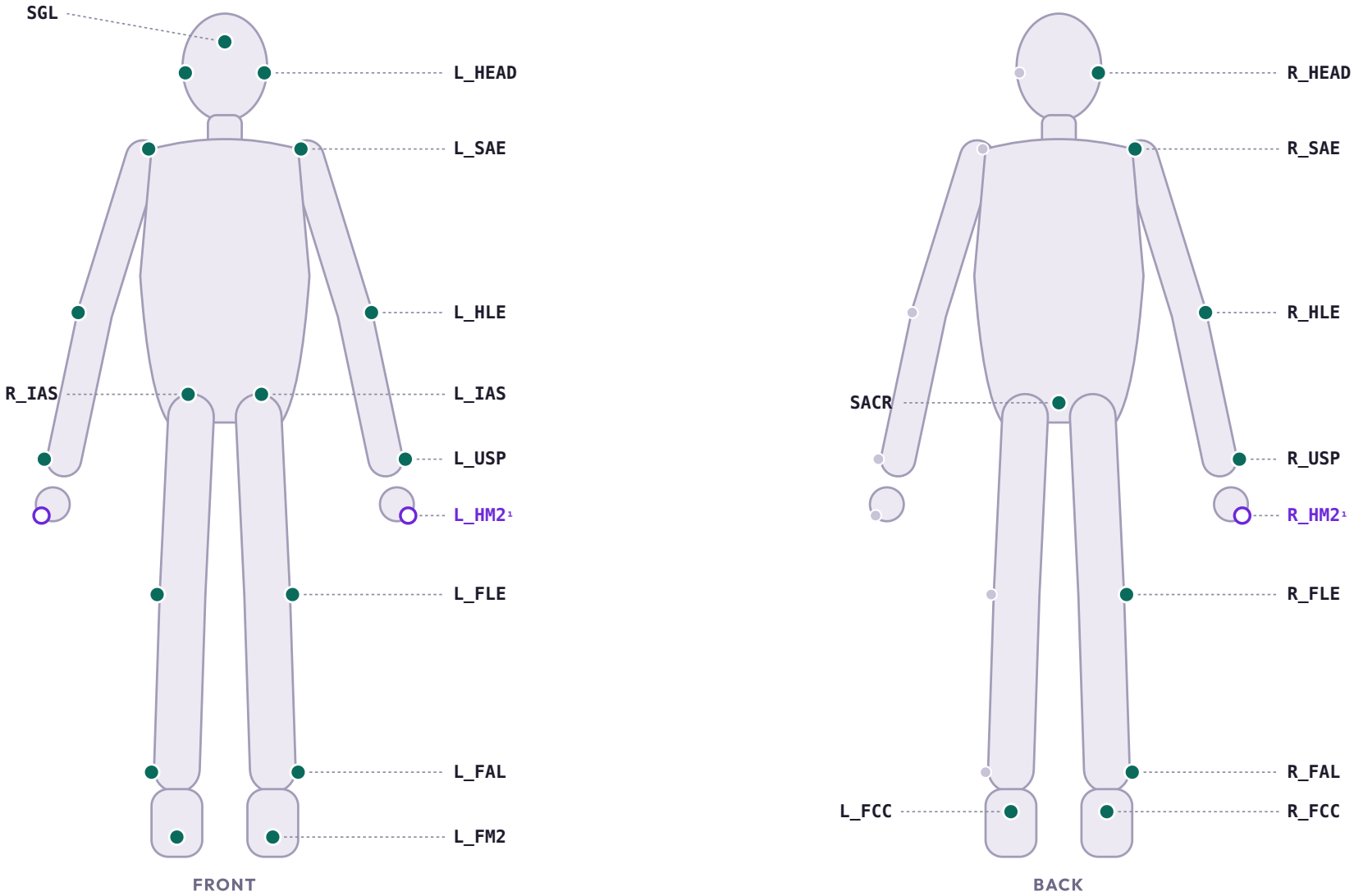
biomex Minimal Marker Set

Minimum 20 markers · [1] optional · no static-only markers

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anatomical marker (named) · optional: L_HM2 / R_HM2 for hand tasks · same marker, labelled on the other view

Labels: left = L_, right = R_ (the subject's own side). Landmark codes follow van Sint Jan (2007).

Detailed marker description

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#	LABEL	REF[1]	SEGMENT	LOCATION	QUALISYS SPORTS NAME	IN PAF RUNNING	USED FOR
1	**SGL**	SGL	Head	Glabella: forehead, midline, just above the nose.	HeadFront	✓	head orientation, head CoM
2	**L_HEAD**	–	Head	Left side of the head, just above the ear (headband).	HeadL	✓	head orientation, head CoM
3	**R_HEAD**	–	Head	Right side of the head, just above the ear (headband).	HeadR	✓	head orientation, head CoM
4	**L_SAE**	SAE	Shoulder	Acromial edge: top of the shoulder, lateral bony prominence.	LShoulderTop	✓	shoulder centre, trunk width
5	**R_SAE**	SAE	Shoulder	Acromial edge: top of the shoulder, lateral bony prominence.	RShoulderTop	✓	shoulder centre, trunk width
6	**L_HLE**	HLE	Elbow	Humerus, lateral epicondyle: outside of the elbow.	LElbowOut	✓	elbow centre
7	**R_HLE**	HLE	Elbow	Humerus, lateral epicondyle: outside of the elbow.	RElbowOut	✓	elbow centre
8	**L_USP**	USP	Wrist	Ulna, styloid process: outside of the wrist, little-finger side.	LWristOut	✓	wrist centre
9	**R_USP**	USP	Wrist	Ulna, styloid process: outside of the wrist, little-finger side.	RWristOut	✓	wrist centre
10	**L_HM2** [1]	HM2	Hand	Head of the 2nd metacarpal: back of the hand at the base of the index finger.	LHand2	✓	hand segment (optional)
11	**R_HM2** [1]	HM2	Hand	Head of the 2nd metacarpal: back of the hand at the base of the index finger.	RHand2	✓	hand segment (optional)
12	**L_IAS**	IAS	Pelvis	Anterior superior iliac spine: front of the pelvis, bony prominence.	WaistLFront	✓	pelvis frame, hip centres
13	**R_IAS**	IAS	Pelvis	Anterior superior iliac spine: front of the pelvis, bony prominence.	WaistRFront	✓	pelvis frame, hip centres
14	**SACR**	SACR	Pelvis	Sacrum: midpoint between the left and right posterior superior iliac spines.	WaistBack	✓	pelvis frame, hip centres
15	**L_FLE**	FLE	Knee	Femur, lateral epicondyle: outside of the knee.	LKneeOut	✓	knee centre
16	**R_FLE**	FLE	Knee	Femur, lateral epicondyle: outside of the knee.	RKneeOut	✓	knee centre
17	**L_FAL**	FAL	Ankle	Fibula, apex of the lateral malleolus: outside of the ankle.	LAnkleOut	✓	ankle centre
18	**R_FAL**	FAL	Ankle	Fibula, apex of the lateral malleolus: outside of the ankle.	RAnkleOut	✓	ankle centre
19	**L_FCC**	FCC	Foot	Calcaneus: back of the heel at the Achilles insertion.	LHeelBack	✓	foot axis, toe-off
20	**R_FCC**	FCC	Foot	Calcaneus: back of the heel at the Achilles insertion.	RHeelBack	✓	foot axis, toe-off
21	**L_FM2**	FM2	Foot	Head of the 2nd metatarsal: top of the foot at the base of the 2nd toe.	LForefoot2	✓	foot axis, toe-off
22	**R_FM2**	FM2	Foot	Head of the 2nd metatarsal: top of the foot at the base of the 2nd toe.	RForefoot2	✓	foot axis, toe-off

[1] Sint Jan, S. Van (2007). *Color Atlas of Skeletal Landmark Definitions: Guidelines for Reproducible Manual and Virtual Palpations.* Edinburgh: Churchill Livingstone. Optional markers in purple.

Additional information

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Purpose

A teaching set: the fewest markers that still define every major joint, so students can capture a whole body in a few minutes, see a skeleton, and read joint angles and a centre of mass. It is deliberately a *joint-marker* set, one lateral marker per joint, rather than a six-degree-of-freedom segment set.

Placement

- Palpate each landmark as described by van Sint Jan (2007); the Ref column gives the atlas code.
- Head markers on a headband: SGL on the midline above the nose, L_HEAD and R_HEAD just above each ear.
- Foot markers go on the shoe if shoes are worn: FCC on the heel counter, FM2 over the base of the second toe.
- Lateral markers (HLE, USP, FLE, FAL) sit on the bony prominence, not beside it; that is what makes the joint-centre offset predictable.
- No static-only markers. Record a short standing trial anyway (upright, feet flat, arms slightly abducted) to check labels and to serve as the reference posture.

What biomex derives from it

- **Hip joint centres** from L_IAS, R_IAS and SACR by the Bell, Pedersen & Brand (1990) regression: 0.36 PW lateral, 0.19 PW posterior and 0.30 PW inferior to the ASIS midpoint, where PW is the inter-ASIS distance.
- **Other joint centres** are the lateral marker itself (knee, ankle, elbow, wrist) and the acromion for the shoulder. Expect roughly 1 to 2 cm of medial bias at the knee and elbow; add the medial marker (CAST) when that matters.
- **Skeleton**: 25 bones through 5 derived points (HEAD_C, SHO_C, PELV_C, L_HJC (regression), R_HJC (regression)); 16 body segments for the Bones view (skull, pelvis, ribcage, spine, upperarm L, upperarm R, forearm L, forearm R, hand L, hand R, thigh L, thigh R, shank L, shank R, foot L, foot R). Shown in /mocap as lines, solid segments, or stylised bones posed from the marker frames.
- **Segment lengths and whole-body centre of mass** follow from the joint centres with de Leva (1996) segment parameters (in preparation).

Limits

One marker per joint gives segment long axes, flexion-extension and planar angles, and a usable centre of mass. It does not give axial rotation of a limb, and it is not a substitute for a cluster or medial-lateral set when research-grade joint kinematics are the aim. Skin movement over the lateral epicondyles is largest at the knee during deep flexion.

Compatibility and extension

- **Qualisys PAF Running**: all 20 labels are in Running.qam, so that AIM model labels this set directly. Adding its other 15 markers (SME, TV2, TV12, UOA, HME, RSP, PAS, TTC and the hand pair) gives the full Running set.
- **Qualisys Skeleton Solver**: load a custom label mapping (Project Options → Skeleton Solver → Marker Label Mapping) using the Sports names in the table; the solver needs its full 41 markers for a complete skeleton, so use it with the Sports set, not this one.
- **Other labels**: /mocap also recognises Plug-in Gait, CAST and Qualisys Sports/Animation spellings, and lets you map any label by hand.
- **Going further**: add medial knee, ankle, elbow and wrist markers for true joint centres; add four-marker clusters on thigh and shank for six-degree-of-freedom segments.

Citing and reuse

Callaway, A. (2026). *biomex Minimal Marker Set*, biomex.studio/markerset. Licence to confirm: CC BY 4.0.

Bell, A.L., Pedersen, D.R. & Brand, R.A. (1990). J Biomech 23(6):617–621 · de Leva, P. (1996). J Biomech 29(9):1223–1230 · Sint Jan, S. Van (2007). Churchill Livingstone.