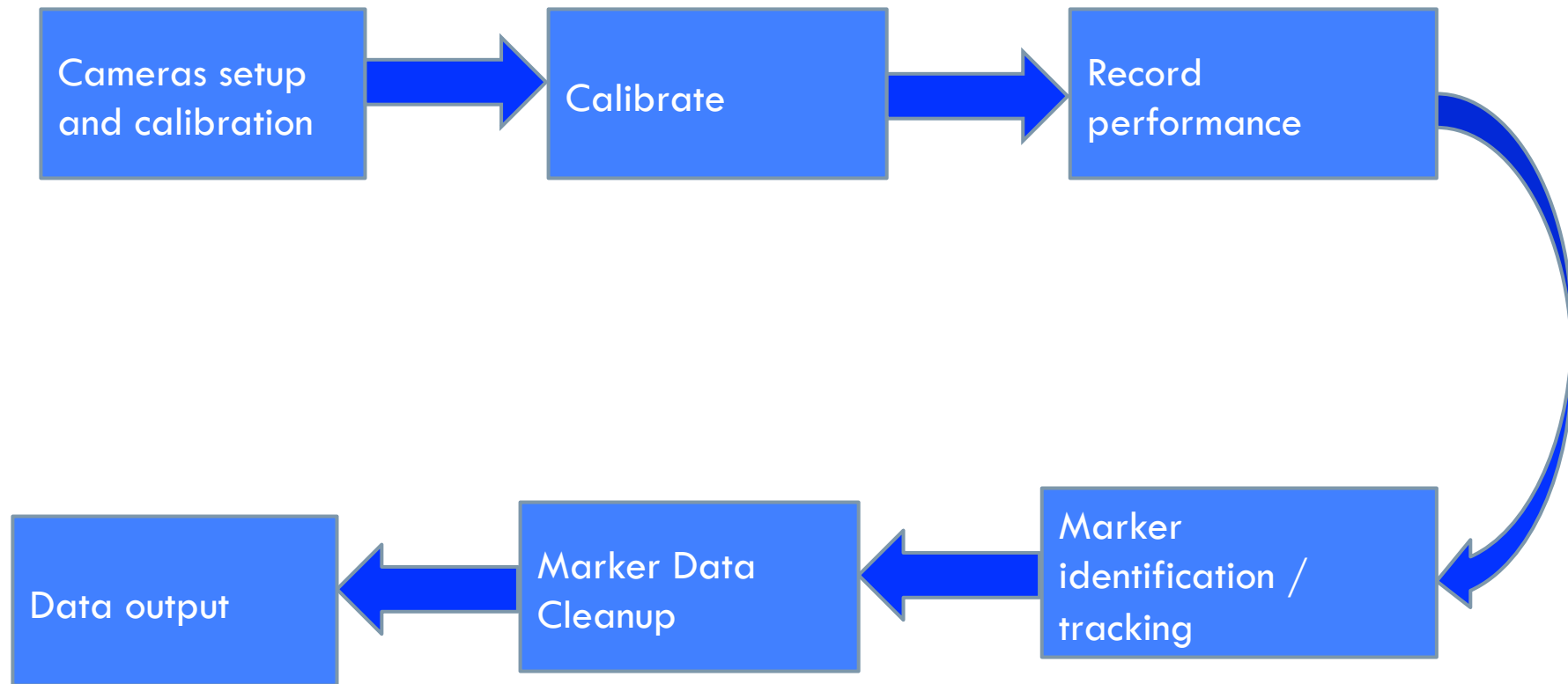


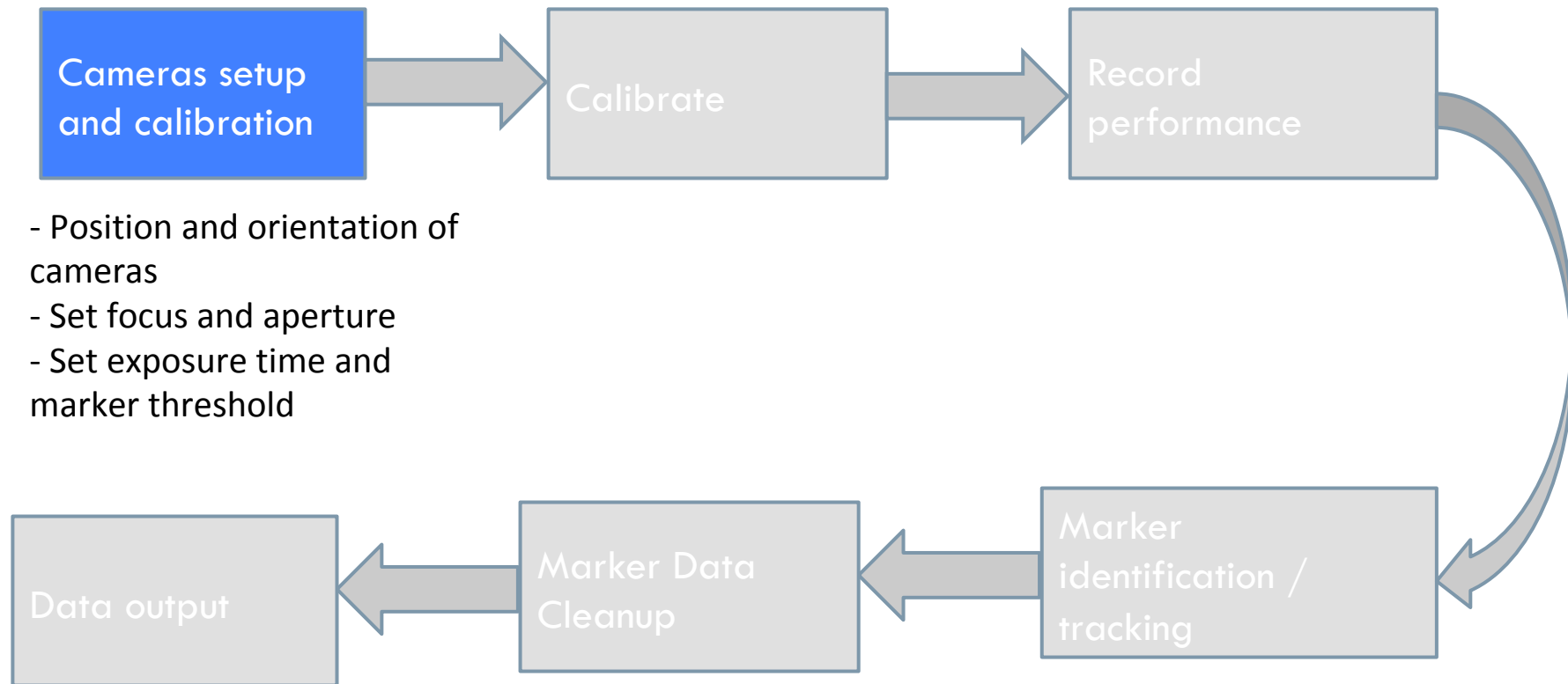
Movement and Artificial Intelligence

MoCap pipeline

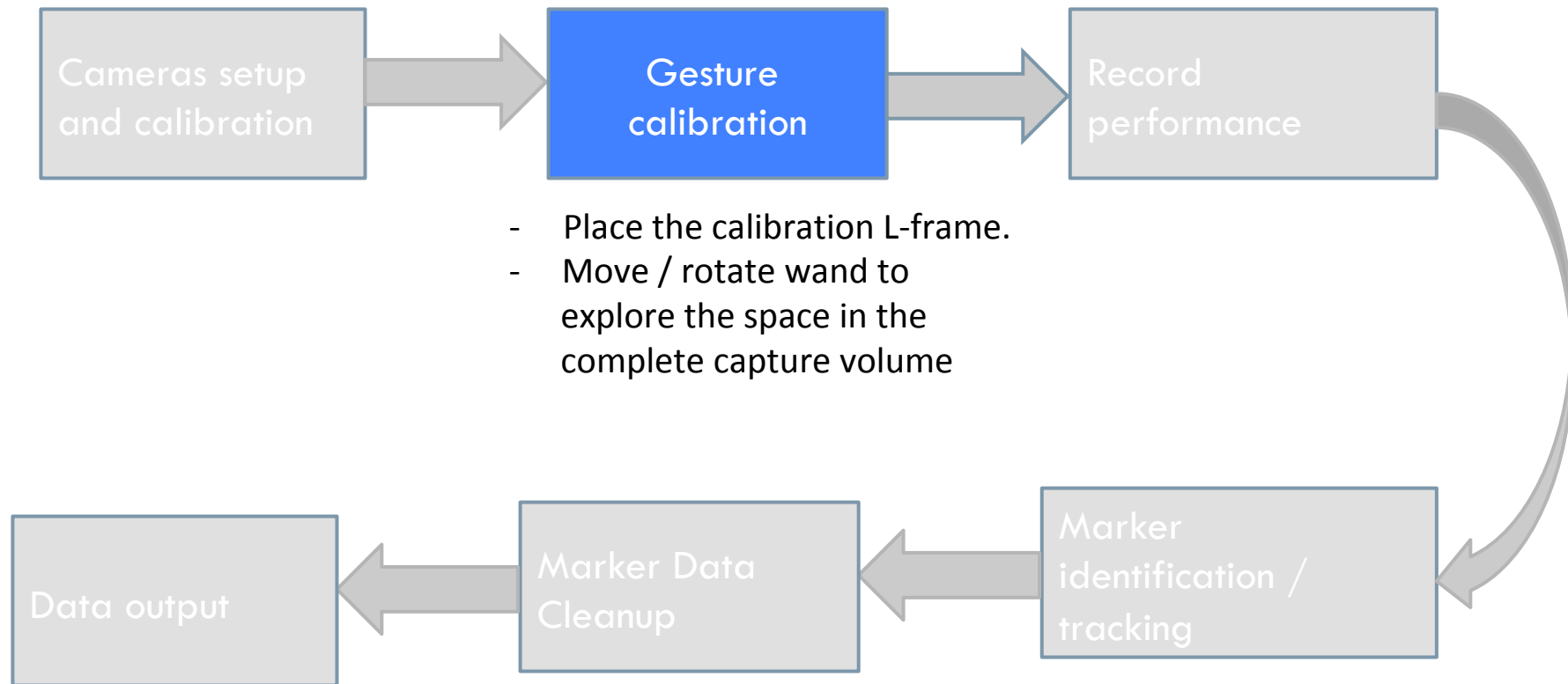
MoCap with markers - pipeline



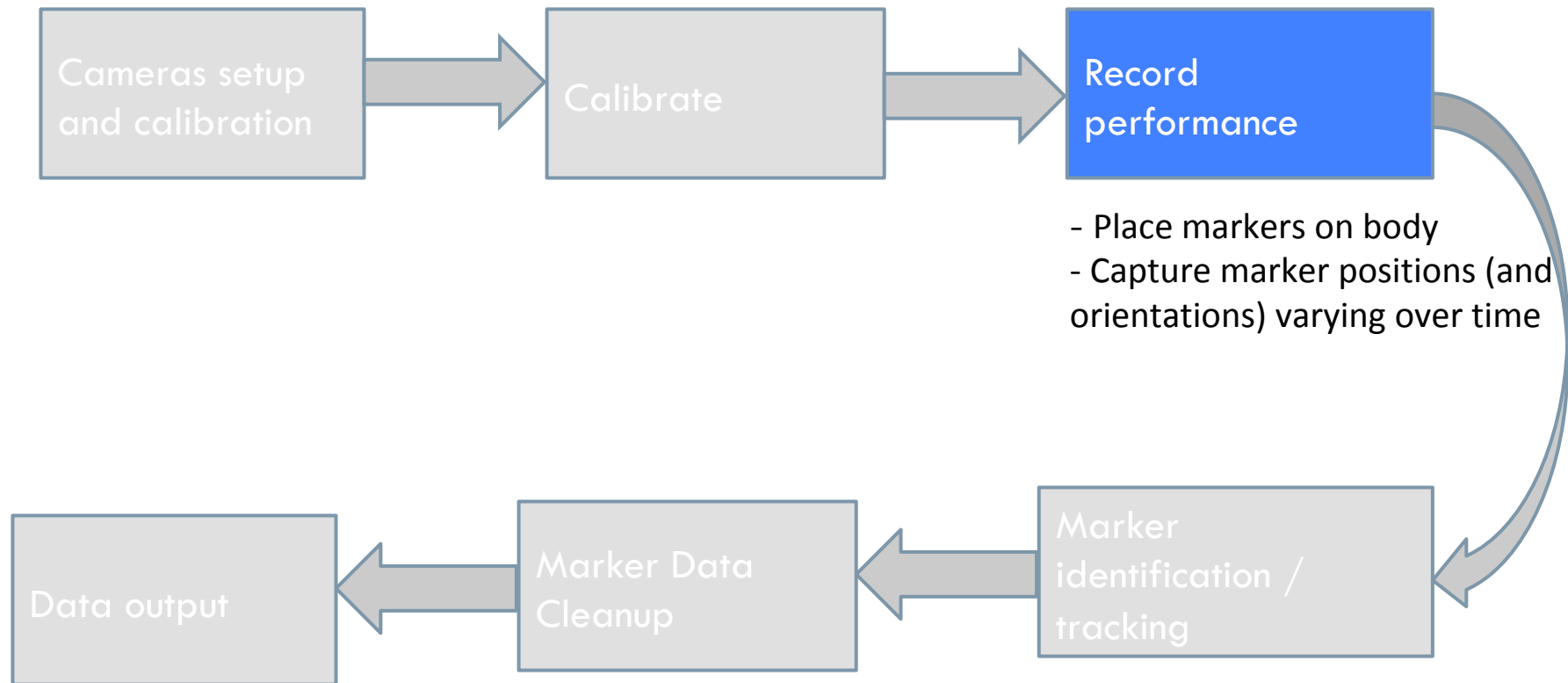
MoCap with markers - pipeline



MoCap with markers - pipeline



MoCap with markers - pipeline



Optical MoCap

■ Marker placement on the subject

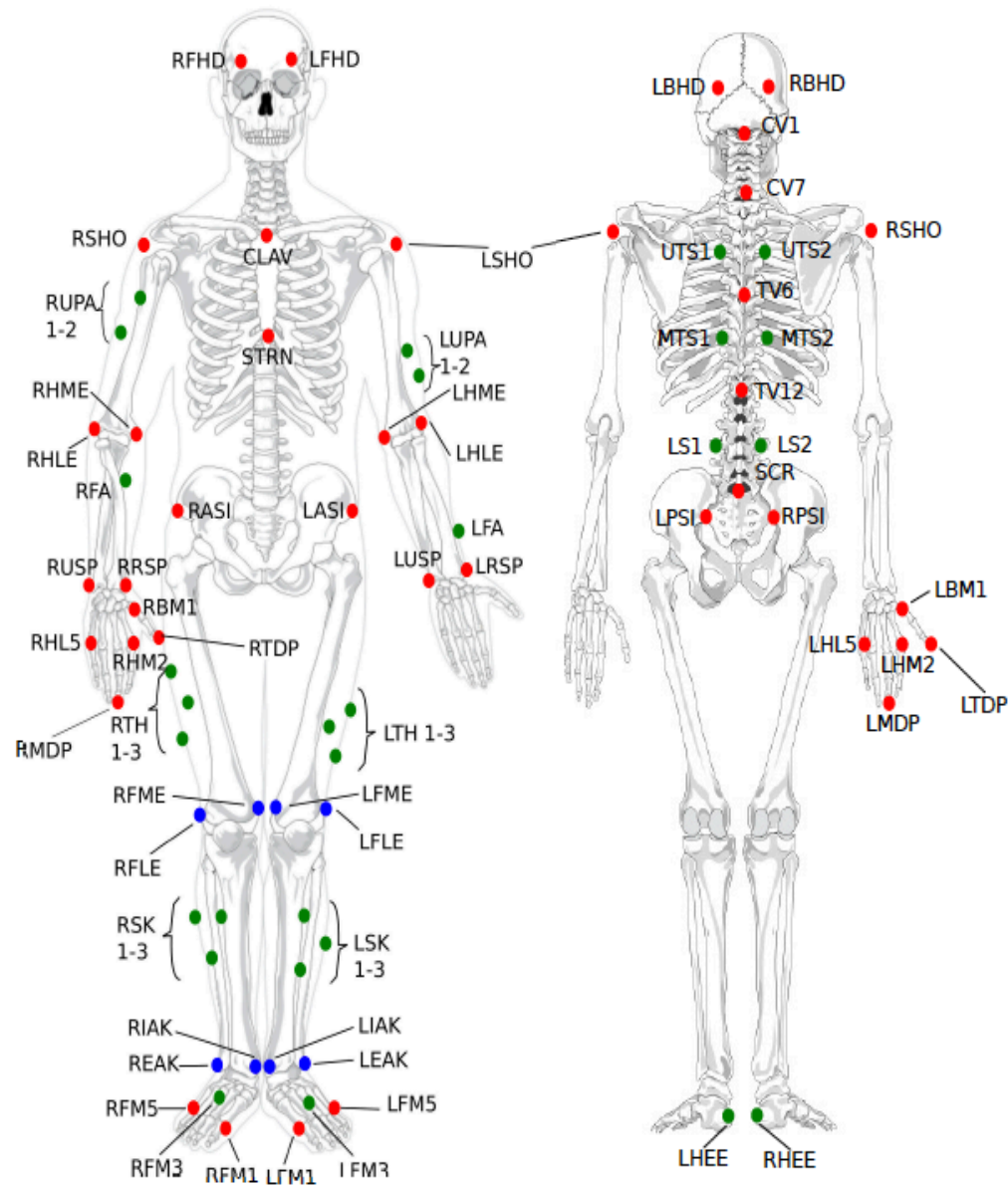
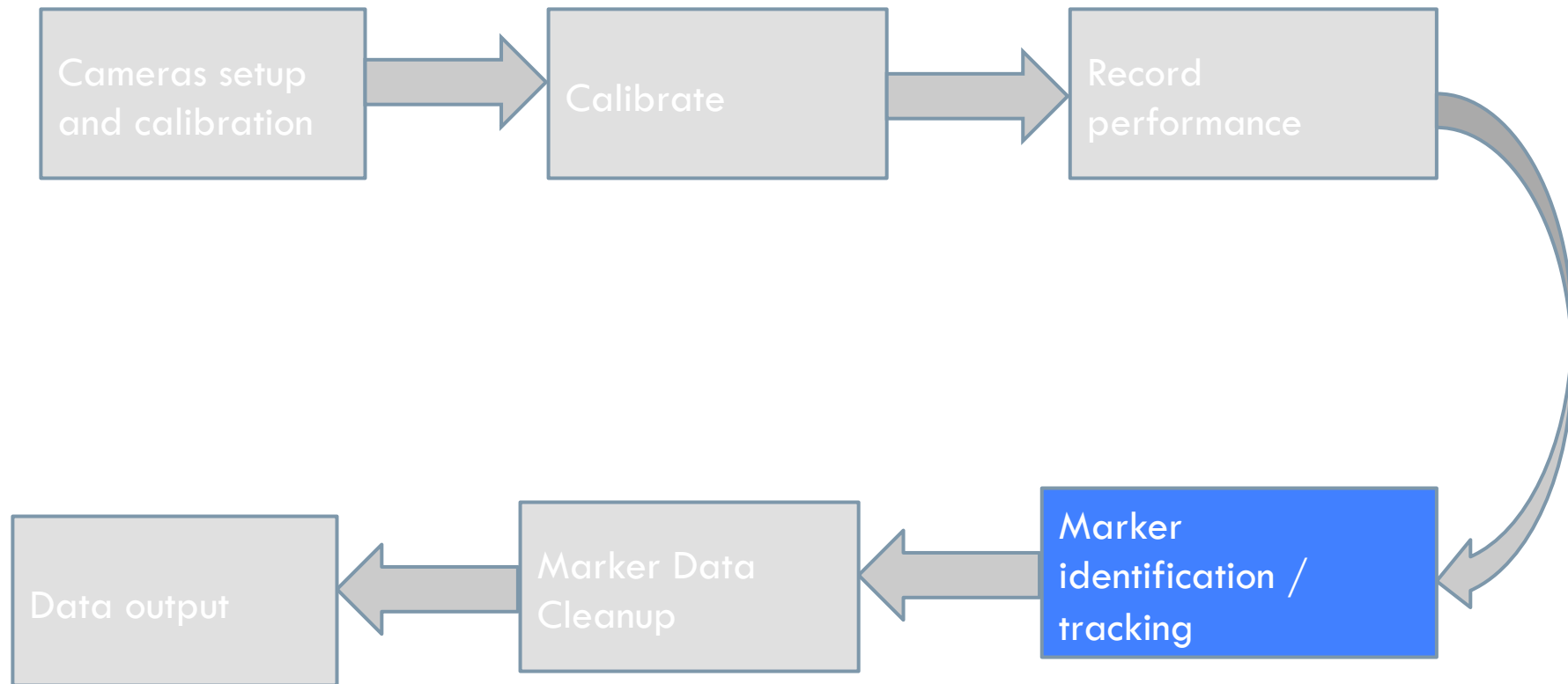


Figure 1: Whole-body marker-set

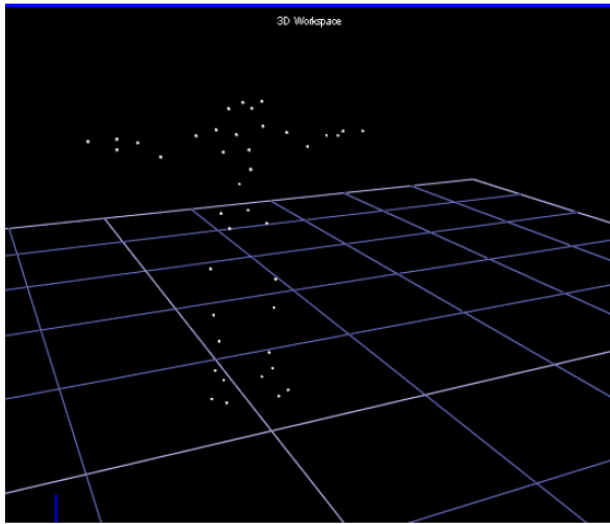
MoCap with markers - pipeline



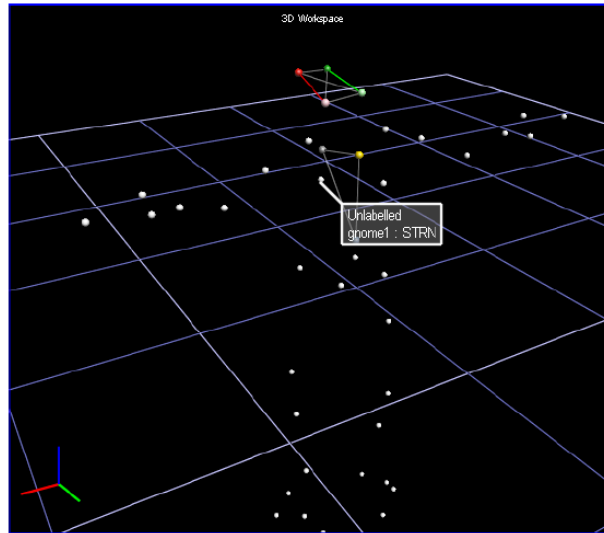
- Labeling trajectories (naming joints),
- Applying AIM model with bones

Optical MoCap pipeline

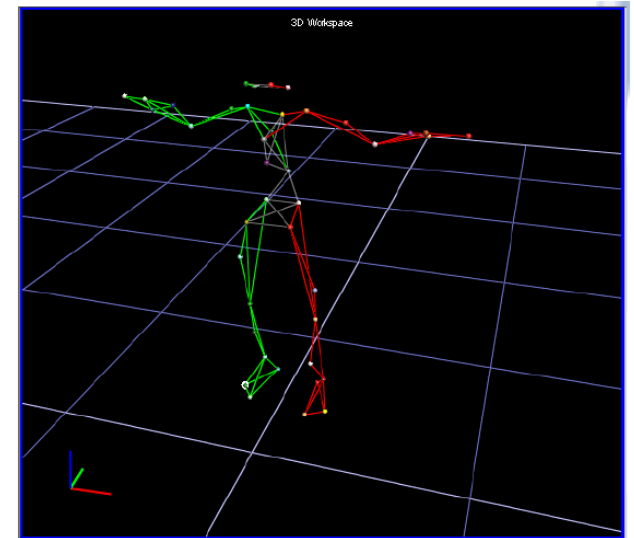
■ Marker tracking and labeling



Markers reconstructed in 3D

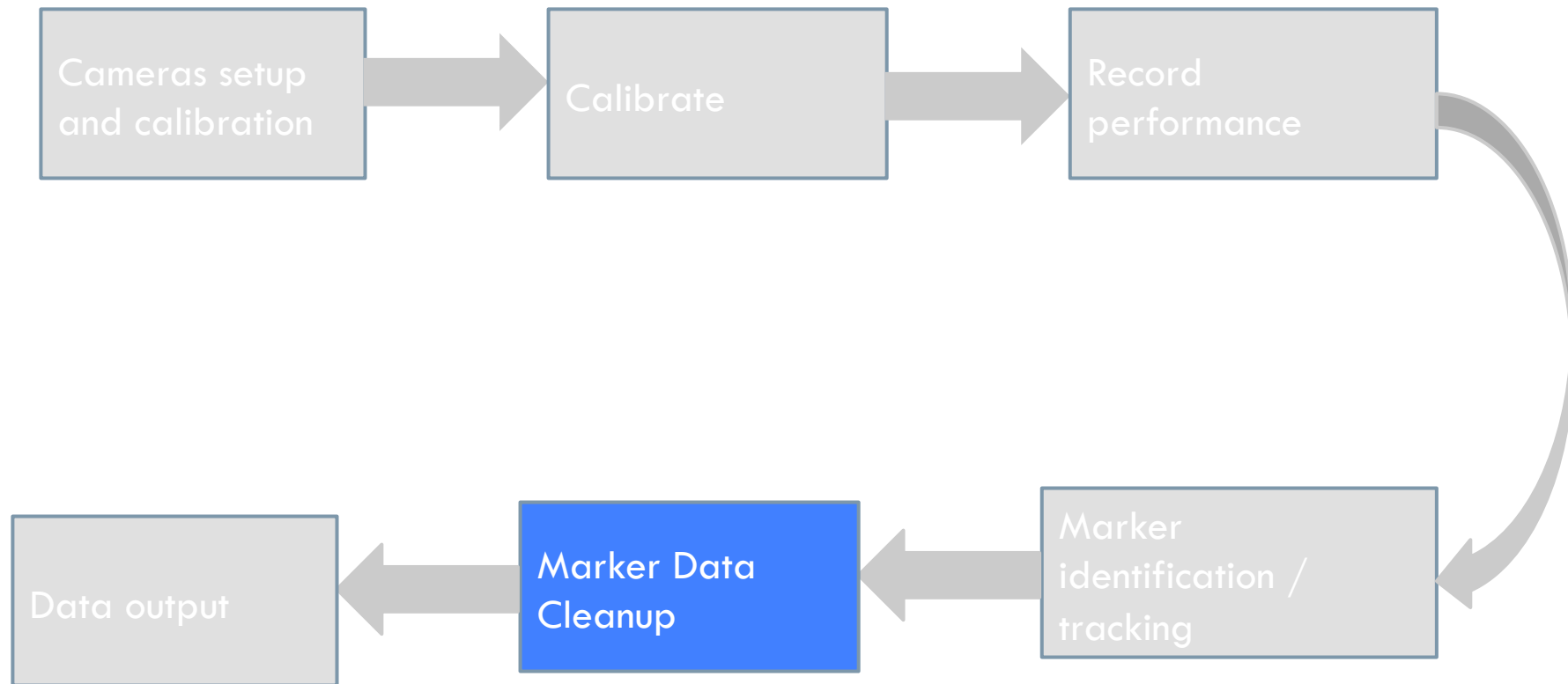


Labeling in a T-pose



Full-labeling (AIM model)

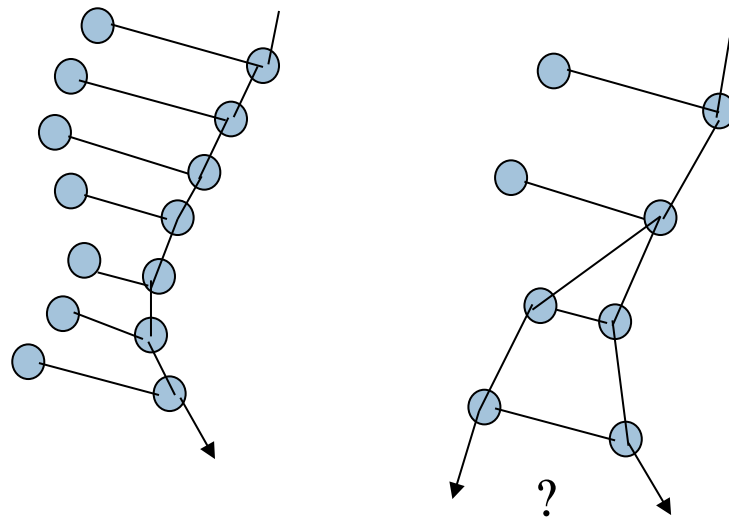
MoCap with markers - pipeline



Occlusion and marker swap
problems

Marker Data Cleanup

- Problems: markers occlusion, noise, rapid movements
 - ▣ Track markers position along time to extend the labelling results on the trajectories
 - ▣ Swap the markers when needed: markers inversions can occur when the trajectories of two neighbours are very close, and when the distance between two successive points is large.



Marker Data Cleanup

- Filling the gap, denoising
 - Filling the gap
 - Take off the noise (markers positions are moved according to the skin, muscles, clothes)

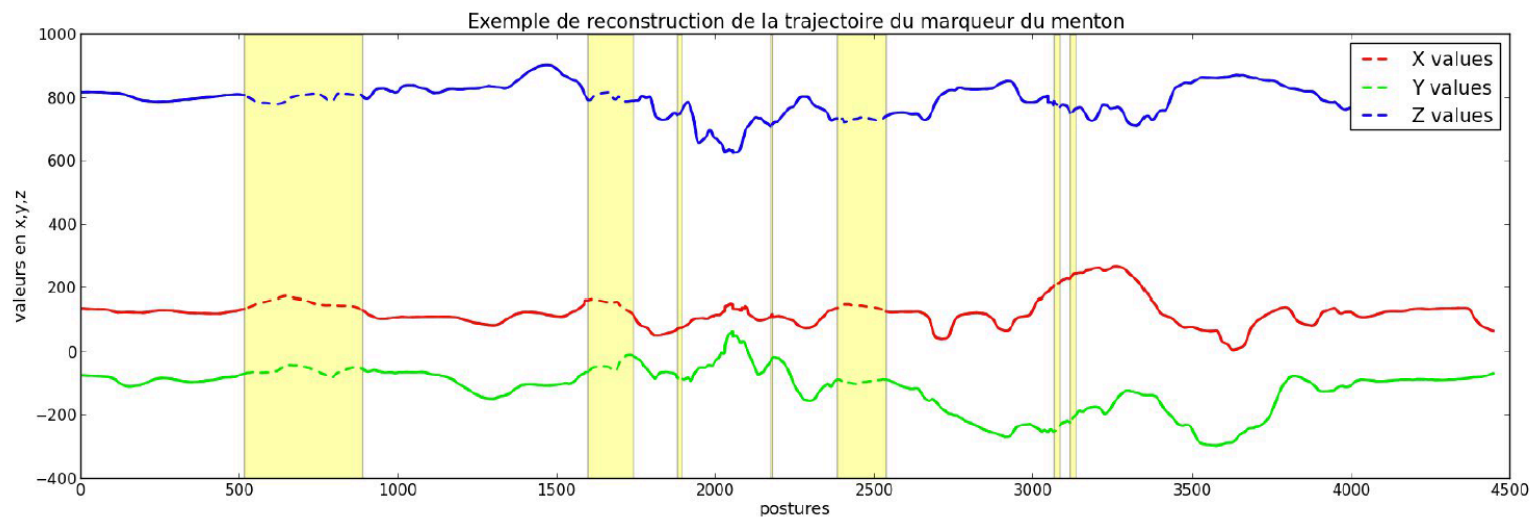
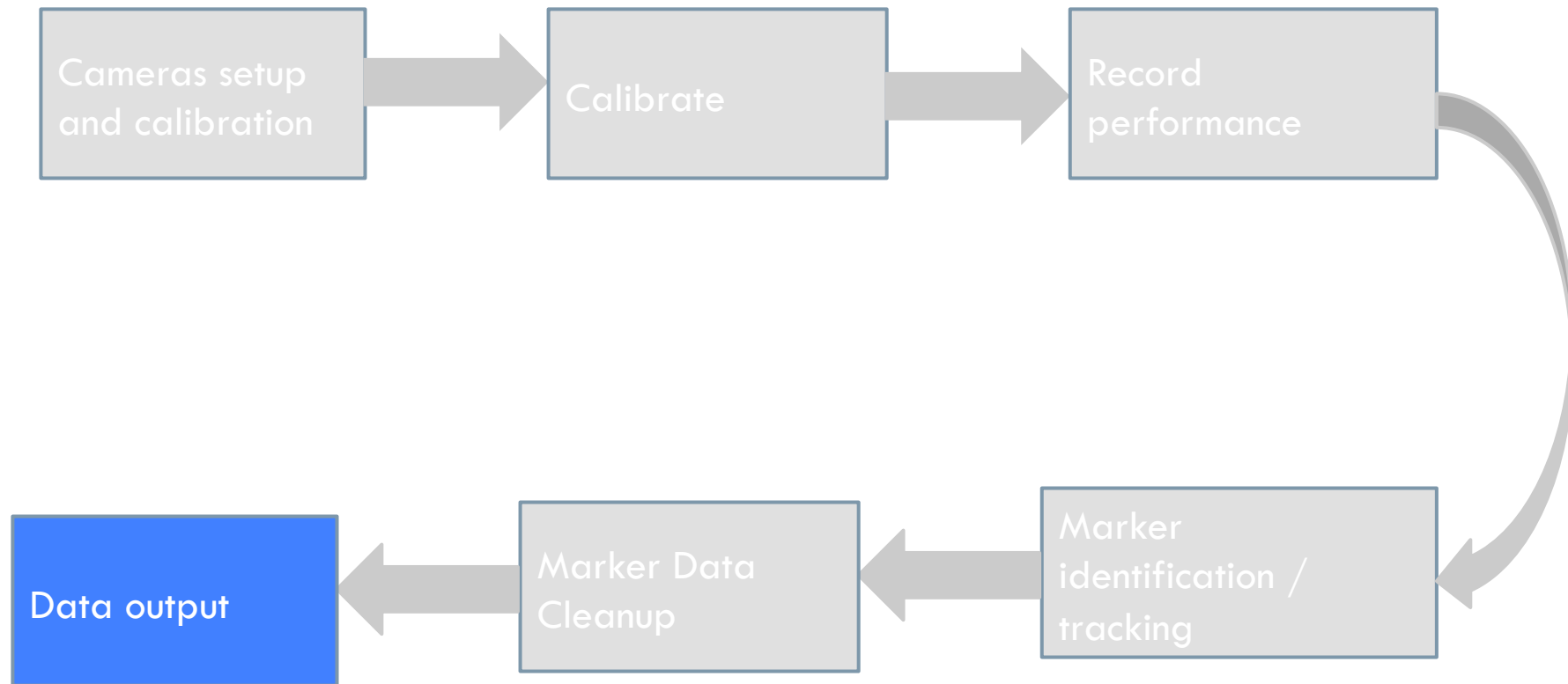


Figure 1: *Reconstruction de la trajectoire en X (rouge), Y (vert) et Z(bleu) du marqueur du menton par notre méthode d'interpolation. En trait pointillé (mis en évidence par les cadres jaunes) les trajectoires reconstruites.*

MoCap with markers - pipeline



Export data: bvh,
fbx, etc.

Data export

- Different data formats
- 3D position data:
 - ▣ C3D format (standard in MoCap): textual, binary
 - ▣ CSV, TSV formats : textual
- Reconstructed skeleton
 - ▣ BVH format
 - ▣ AMC/ASF
 - ▣ FBX format (format propriétaire)

Data export

- Format BVH: describe skeleton movements from joint values (Biovision)
- For each recorded movement, 1 file, 2 parts
 - ▣ Part 1: skeleton hierarchy
 - ▣ Part 2: motion: sequence of angular values (rotations of the articulations)

BVH – Skeleton hierarchy

HIERARCHY

Hips is the root node

ROOT Hips

```
{  
  OFFSET 0.00 0.00 0.00  
  CHANNELS 6 Xposition Yposition Zposition Zrotation Xrotation Yrotation  
  JOINT LeftHip  
  {  
    OFFSET 3.29 0.00 0.00  
    CHANNELS 3 Zrotation Xrotation Yrotation  
    JOINT LeftKnee  
    {  
      OFFSET 0.00 -16.57 0.00  
      CHANNELS 3 Zrotation Xrotation Yrotation  
      JOINT LeftAnkle  
      {  
        OFFSET 0.00 -16.55 0.00  
        CHANNELS 3 Zrotation Xrotation Yrotation  
        End Site  
        {  
          OFFSET 0.00 -3.30 0.00
```

BVH – Skeleton hierarchy

- ROOT: absolute offset
- OFFSET:
 - ▣ defines the translation of the node relatively to its parent
 - ▣ Always XYZ (no orientation)
 - ▣ Also defines the length of the parent segment
- For each recorded movement, 1 file, 2 parts
 - ▣ Part 1: skeleton hierarchy
 - ▣ Part 2: motion: sequence of angular values (rotations of the articulations)

BVH - Motion

MOTION

Frames: 30

Frame Time: 0.033333

10.87	36.65	13.54	8.70	1.67	91.18	
10.89	9.41	-1.80	-2.30	7.50	12.08	0.00
-10.56	0.00	-13.95	10.19	2.52	1.45	
7.58	-10.90	0.00	-12.38	0.00	-2.30	7.22
-0.10	-0.13	0.00	5.48	48.69	-5.16	
13.44	-10.40	-22.07	-14.50	-0.21	-5.66	-0.02
7.72	0.00	-7.17	-52.62	2.63	-1.95	
-1.90	-20.04	-18.84	0.16	-4.85	0.01	0.00
35.36	0.00	1.77	-36.47	-2.39		

Other formats

■ **Format AMC/ASF : Acclaim**

.AMC file: skeleton structure

.ASF file: motion

□ **Format FBX**

FBX[®] data exchange technology is a 3D asset exchange format that facilitates higher-fidelity data exchange between 3ds Max, Maya, MotionBuilder, Unity and other propriety and third-party software.