AnyBody Technology – Vicon

Integration Webinar

Dr Kim Duffy, Vicon – Senior Product Manager for Life Sciences

Søren Tørholm, AnyBody Technology - Co-founder & Head of Services

26/04/2023

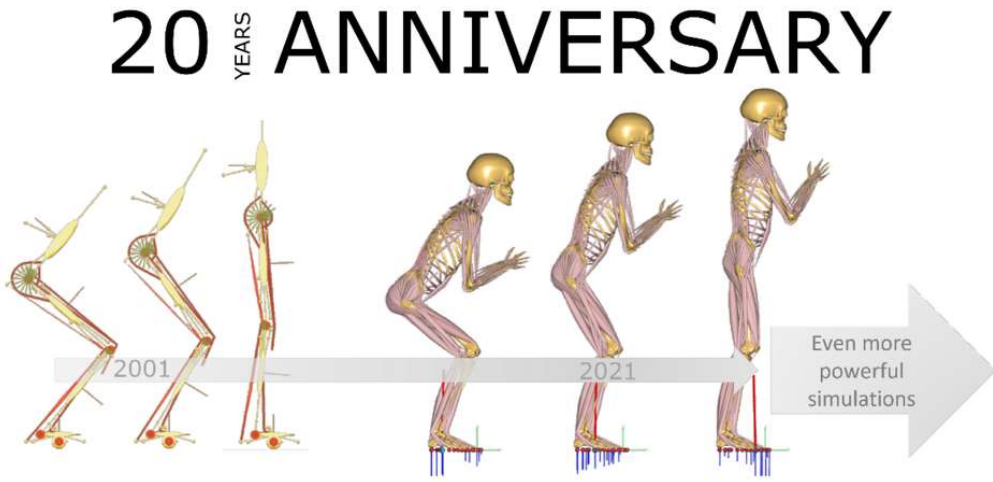
Outline

- Introduction to AnyBody Modeling System
- Introduction to the AnyMocap model in AMMR
- Introduction to the new model library using Vicon data
- Questions and answers

Søren Tørholm
Head of Services
PhD, cofounder
AnyBody Technology

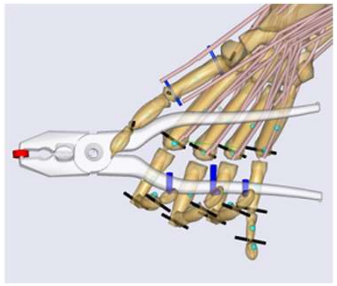
AnyBody Technology

- AnyBody Modeling System
- AnyBody Managed Model Repository
- Licenses
- Training
- Support
- Consulting Services
- Founded 2001

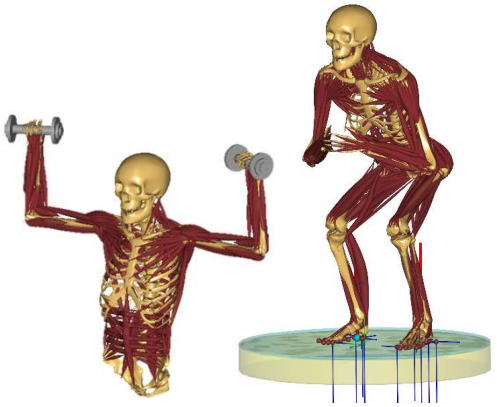


ANYBODY TECHNOLOGY

Motion analysis

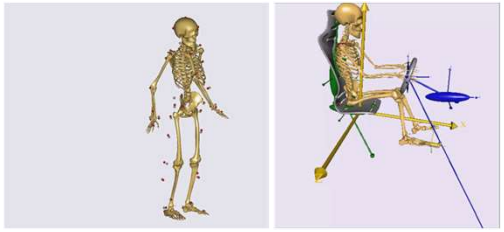


Product design and optimization

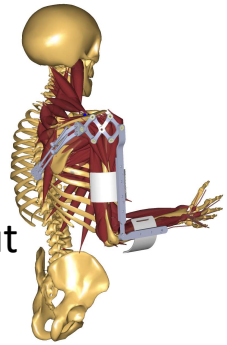


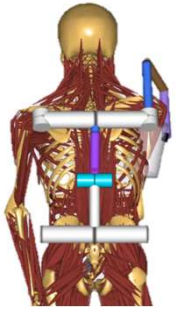
Sports Optimization

Automotive

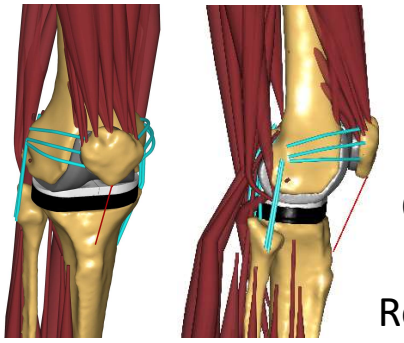


ANYBODY Modeling System



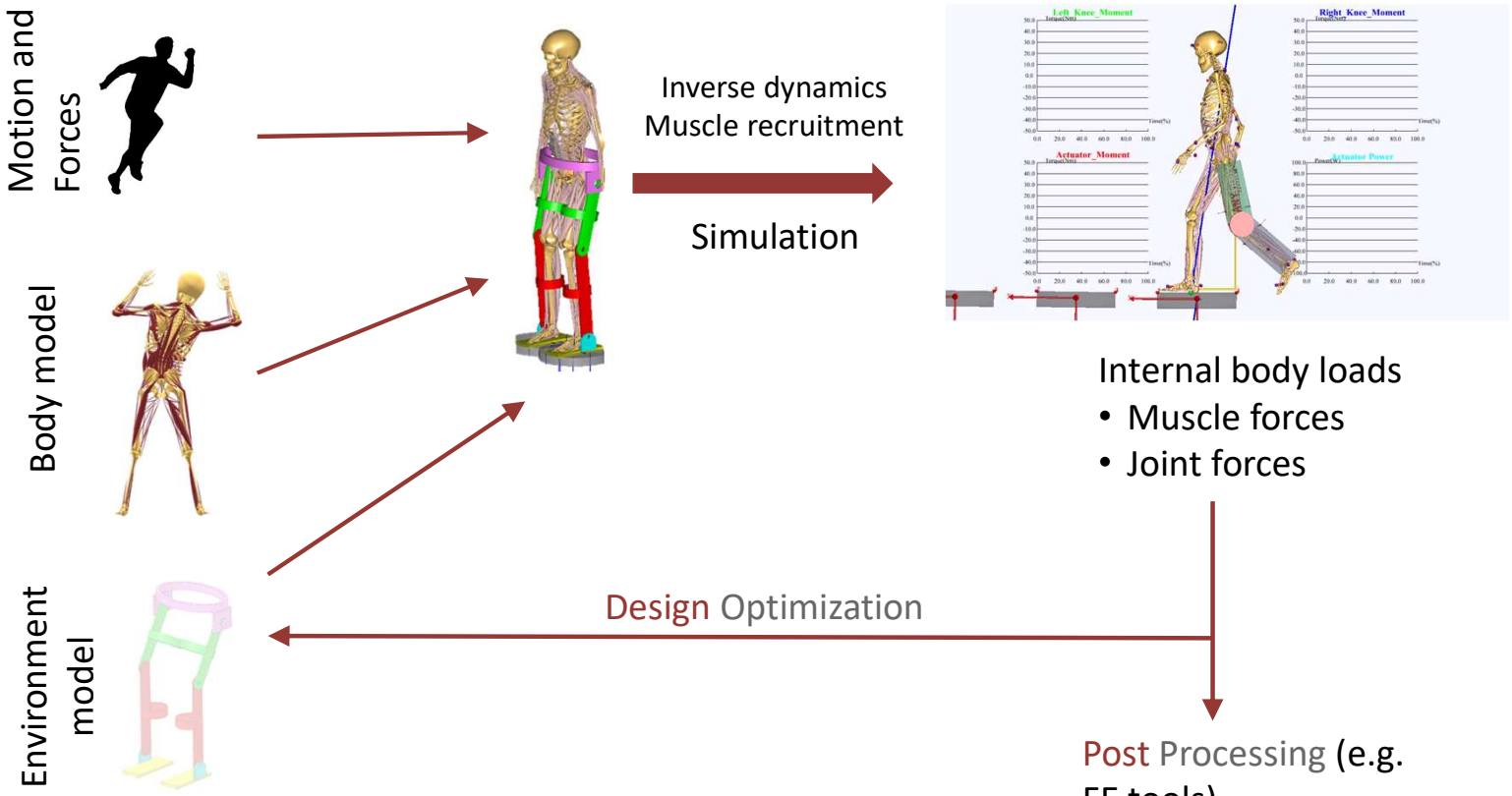


Ergonomics with/without exoskeletons



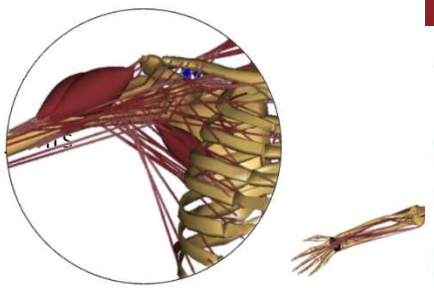
Orthopedics and Rehabilitations

AnyBody Modelling System

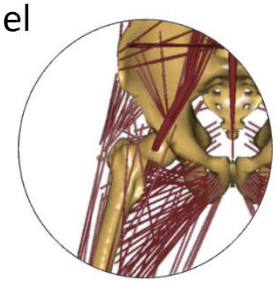


The AnyBody Managed Model Repository™

- Open model library
  - Muscles, ligaments, bones,
  - Detailed
  - Validated
  - Published



- Personalizing the model
  - Anthropometric scaling
  - Morphing



Publication list

Resources Publication list

Industry

sports | exoskeleton | work place ergonomics | orthopedics | defense | aerospace | automotive | consumer products | furniture

Research area

gait | methods | validation | animal | sensitivity analysis | rehab | seating | fea | occupational health

Body part

knee | lower extremity | foot | spine | upper extremity | hand | shoulder | hip | mandible | wrist | trunk | elbow | ankle | leg

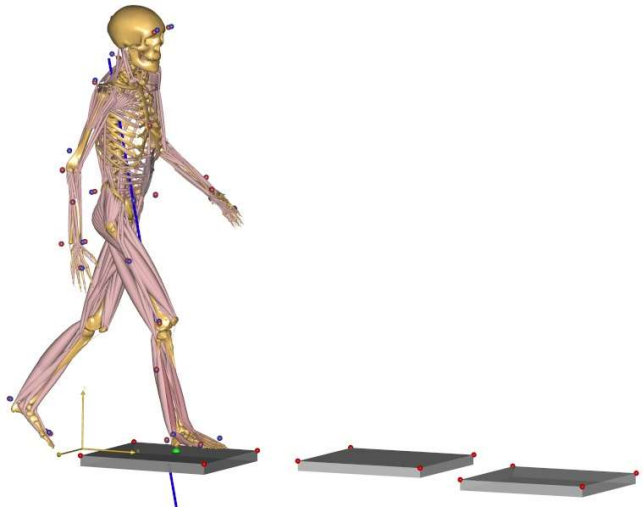
NEW

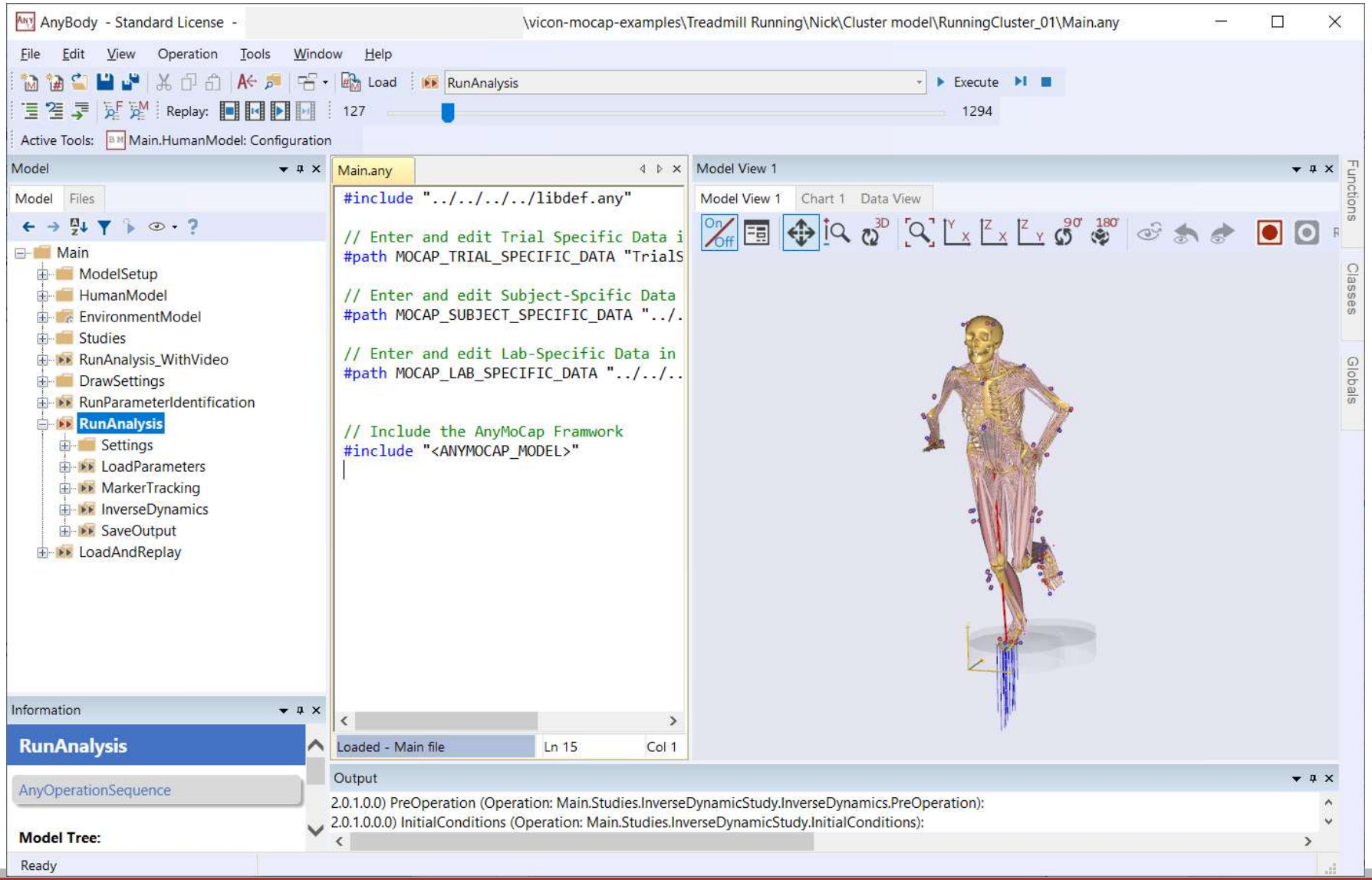
Year 154 Publications

2023	Bayoglu R, Witt JP, Chatain GP, Okonkwo DO, Ignasiak D, (2023), **"Clinical Validation of a Novel Musculoskeletal Modeling Framework to Predict Postoperative Sagittal Alignment"**. vol. Publish Ahead of Print, [DOI, WWW]	orthopedics spine validation
2022	Qin B, Baldoni M, Wu B, Zhou L, Qian Z, Zhu Q, (2022), **"Effect of Lumbar Muscle Atrophy on the Mechanical Loading Change on Lumbar Intervertebral Discs"**. pp. 111120. [DOI, WWW]	orthopedics spine validation
2021	Melzner M, Engelhardt L, Simon U, Dendorfer S, (2021), **"Electromyography Based Validation of a Musculoskeletal Hand Model"**. [DOI, WWW]	hand validation
2021	Melzner M, Süß F, Dendorfer S, (2021), **"The impact of anatomical uncertainties on the predictions of a musculoskeletal hand model – a sensitivity study"**. pp. 1-9. [DOI, WWW]	hand validation

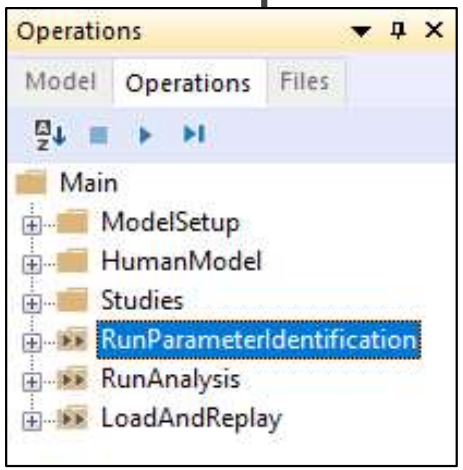
AnyMocap models in AMMR

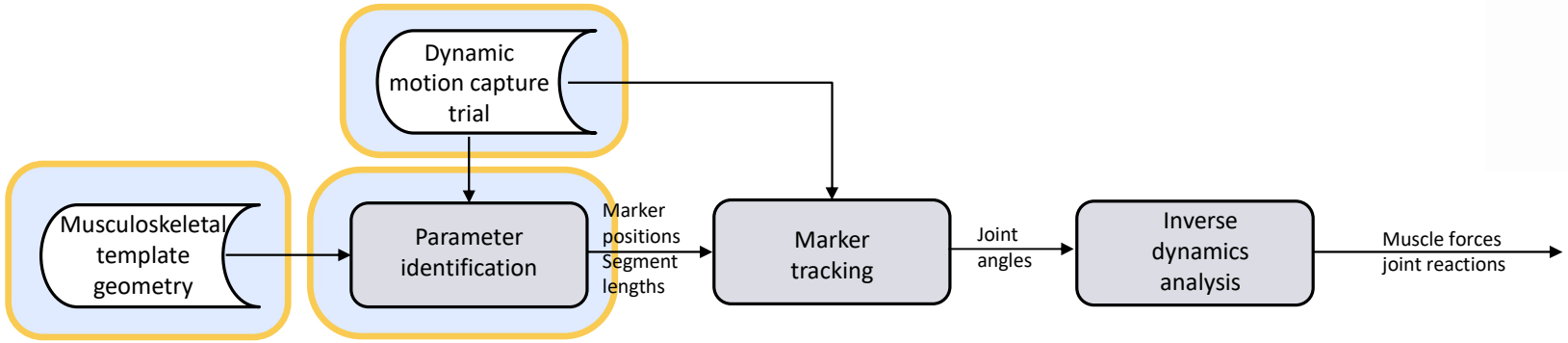
- Features:
  - Adapts to any Mocap protocol
  - Runs on C3D input
  - Optimization of marker locations and anthropometrics.
  - Support for standard force plates: (Types 1-5) plus more.
  - Prediction of ground reaction forces
  - Easy setup with multiple trials and subjects



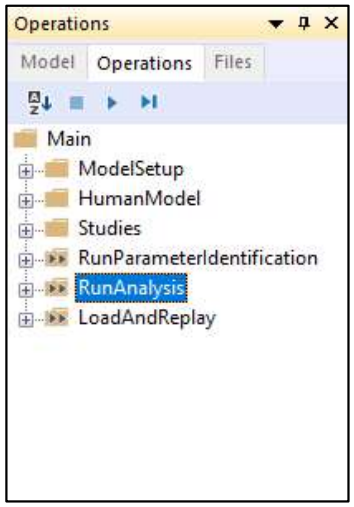

AnyBody - Standard License -
\vicon-mocap-examples\Treadmill Running\Nick\Cluster model\RunningCluster_01\Main.any
File Edit View Operation Tools Window Help
Load
RunAnalysis
Execute
Replay:
127
1294
Active Tools:
Main.HumanModel: Configuration
Model
Model Files
Main
ModelSetup
HumanModel
EnvironmentModel
Studies
RunAnalysis_WithVideo
DrawSettings
RunParameterIdentification
RunAnalysis
Settings
LoadParameters
MarkerTracking
InverseDynamics
SaveOutput
LoadAndReplay
Main.any
#include "../../../../libdef.any"
// Enter and edit Trial Specific Data i
#path MOCAP_TRIAL_SPECIFIC_DATA "TrialS
// Enter and edit Subject-Spcific Data
#path MOCAP_SUBJECT_SPECIFIC_DATA "../.
// Enter and edit Lab-Specific Data in
#path MOCAP_LAB_SPECIFIC_DATA "../../..
// Include the AnyMoCap Framwork
#include "<ANYMOCAP_MODEL>"
Loaded - Main file
Ln 15
Col 1
Model View 1
Model View 1 Chart 1 Data View
Information
RunAnalysis
AnyOperationSequence
Model Tree:
Output
2.0.1.0.0) PreOperation (Operation: Main.Studies.InverseDynamicStudy.InverseDynamics.PreOperation):
2.0.1.0.0.0) InitialConditions (Operation: Main.Studies.InverseDynamicStudy.InitialConditions):
Ready
Functions
Classes
Globals

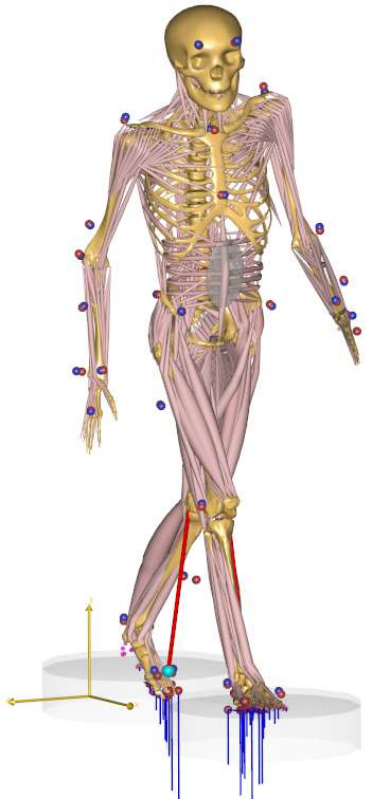
Framework for MoCap models

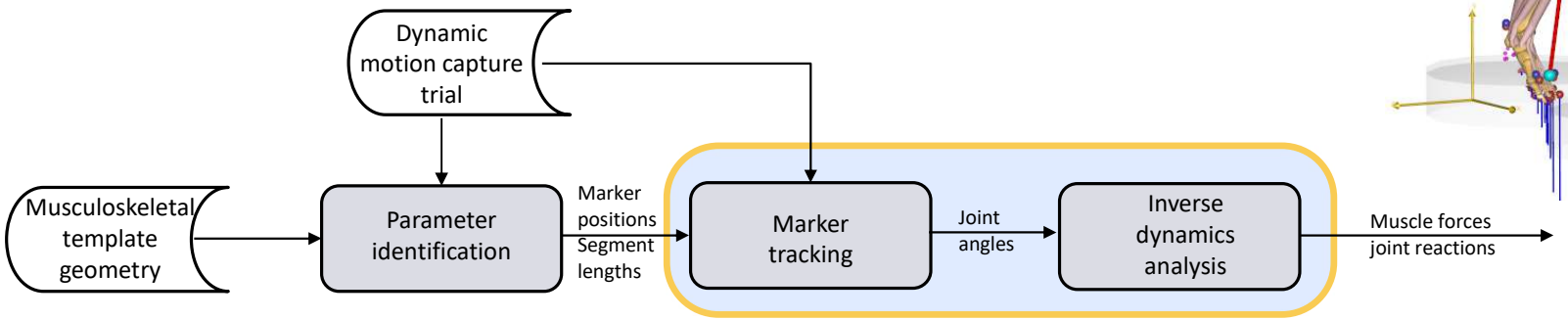




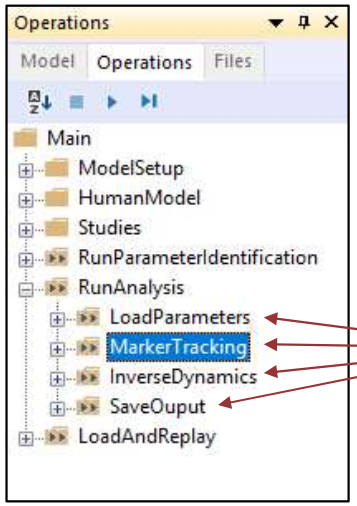
Framework for MoCap models



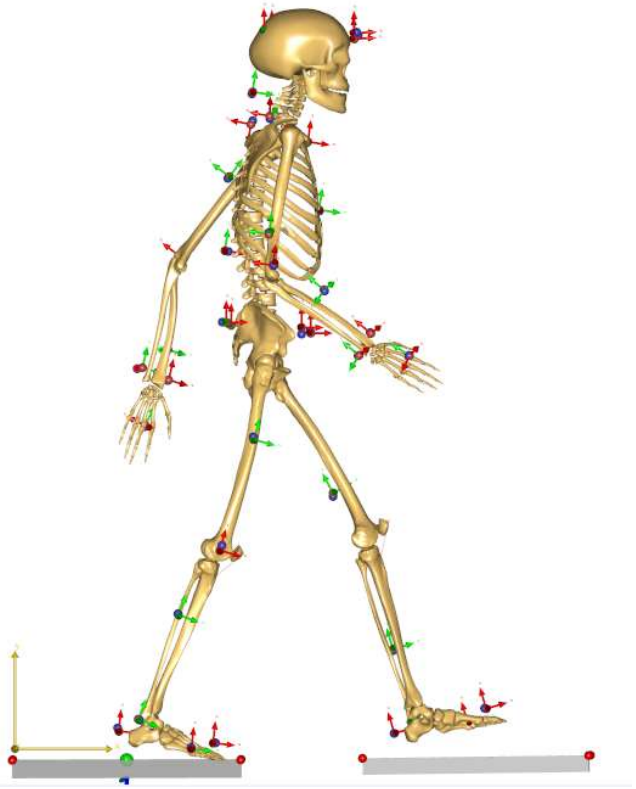


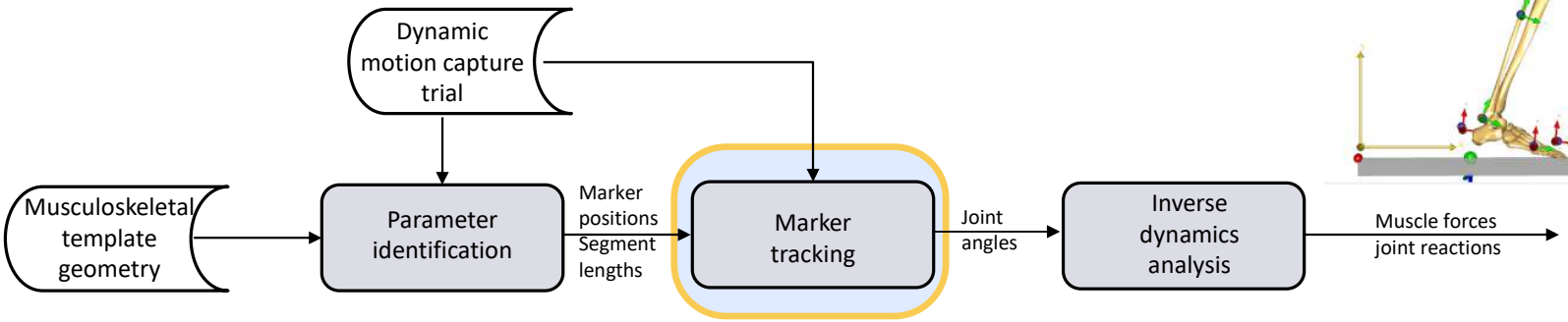


Framework for MoCap model

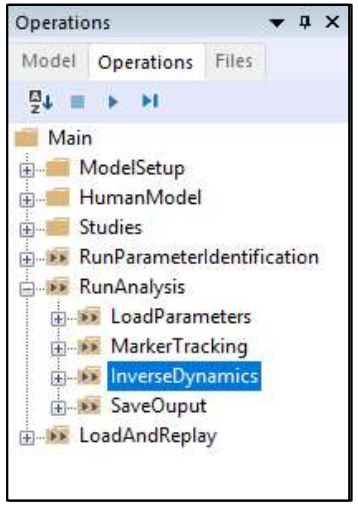


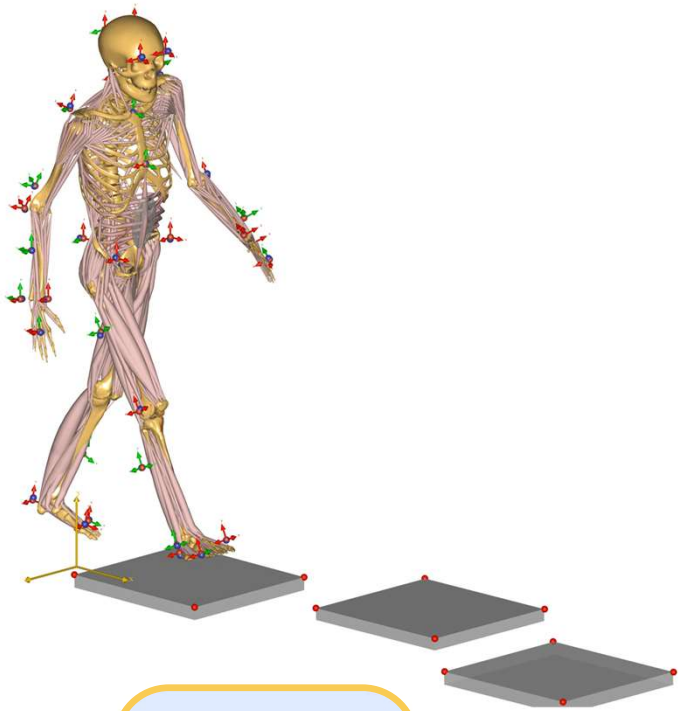
`RunAnalysis` is split into several steps

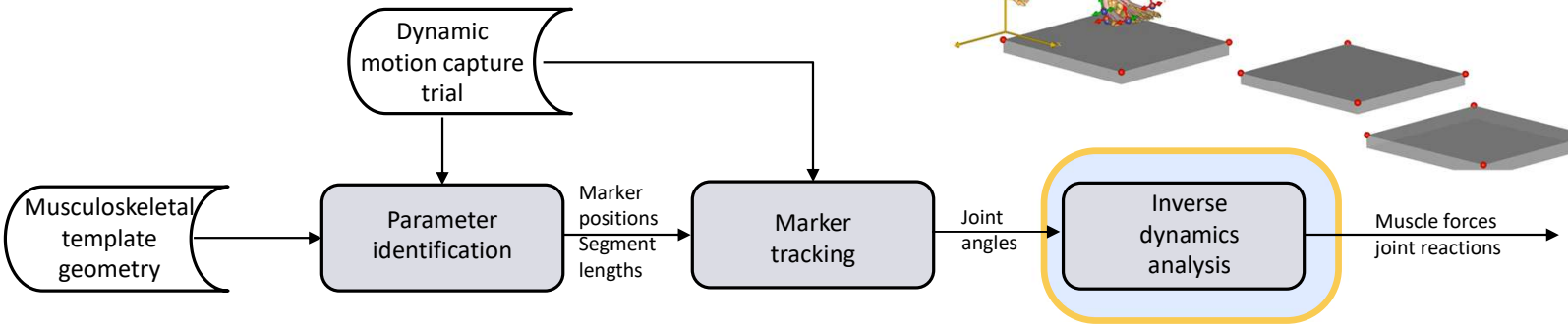




Framework for MoCap models

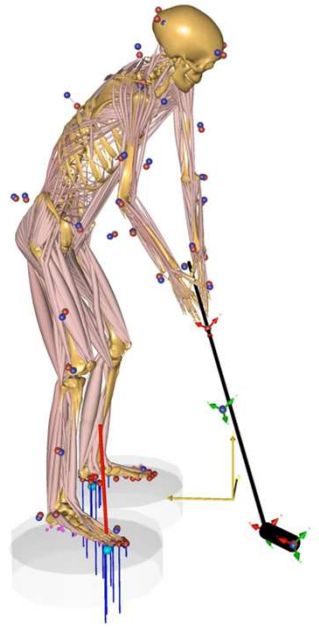






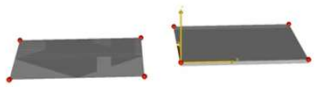
AnyMocap models using Vicon data

- Aims:
  - Easy creation of AnyBody model using Vicon marker protocols
  - AnyBody application models made available using the Vicon Nexus Sample Data set
    - https://www.vicon.com/software/models-and-scripts/nexus-sample-data/?section=downloads
- Examples on all Protocols in dataset
- Examples on all force plate types
- Inclusion of external objects: golfclub, cricket bat, bicycle …



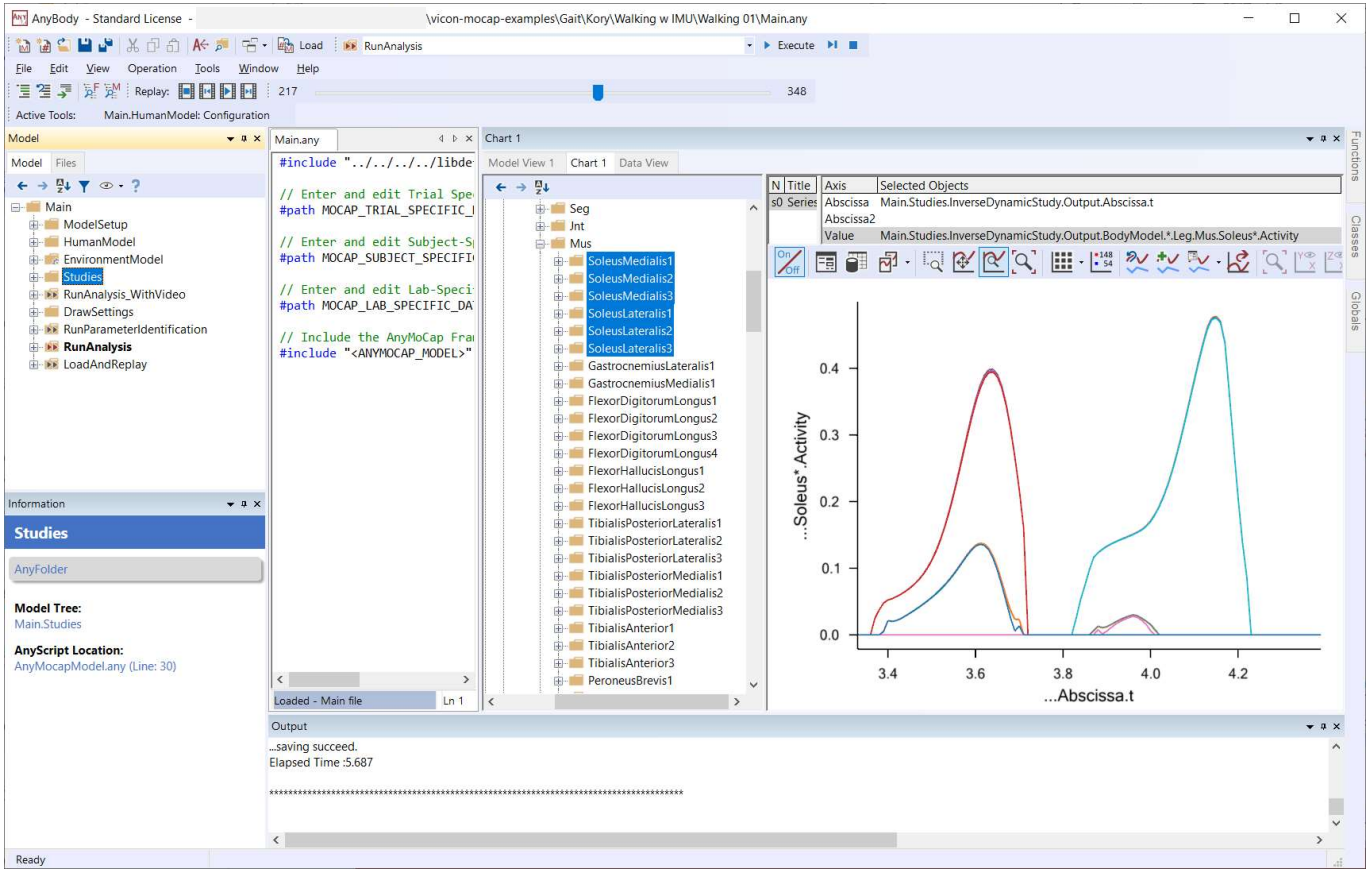
Example: Gait

- Gait
- Lower body
- PlugInGait LowerBody
- 6 Dynamic trials
- 3 Calibration trials



Example: Gait results

- Individual muscle activations/forces available
- Joint reactions forces
- and much more!

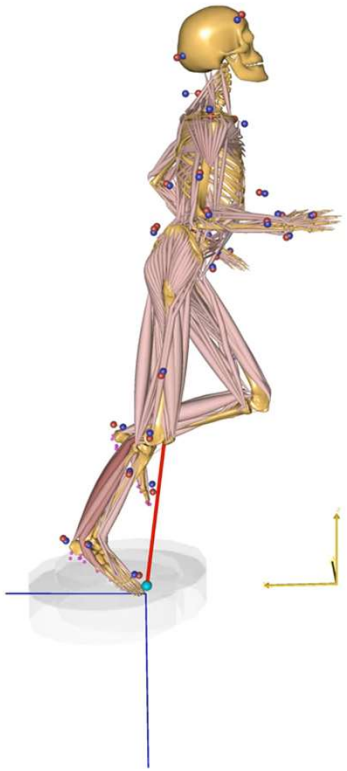


Example: Treadmill running cluster

- Treadmill running
- Fullbody
- Cluster protocol
- 2 Dynamic trials
- 1 Calibration trial
- Note: Ground speed not zero

Example: Treadmill running PiG

- Treadmill running
- Fullbody
- PluginGaitFullbody
- 2 Dynamic trials
- 1 Calibration trial
- Note: Ground speed not zero

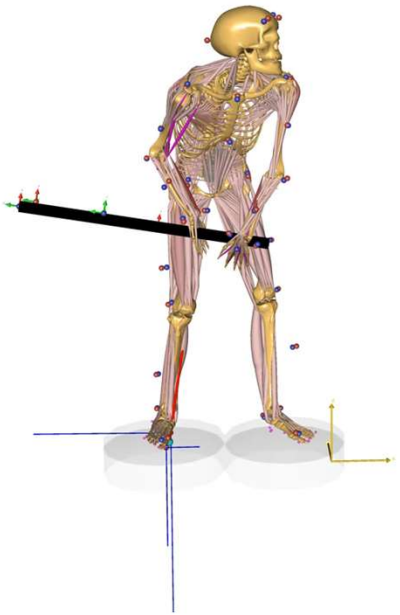


Example: Baseball

- Baseball batting
- GRF prediction
- Fullbody
- PluginGaitFullbody
- 2 Dynamic trials
- 1 Calibration trial
- External optimization: Bat parameters

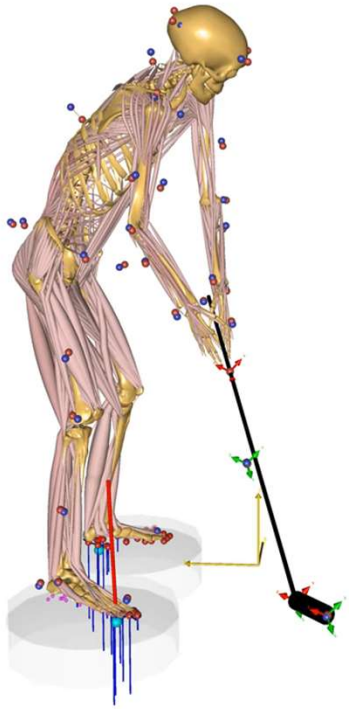
Example: Cricket

- Cricket throwdown
- GRF prediction
- Fullbody
- PluginGaitFullbody
- 2 Dynamic trials
- 1 Calibration trial
- External optimization: Bat parameters



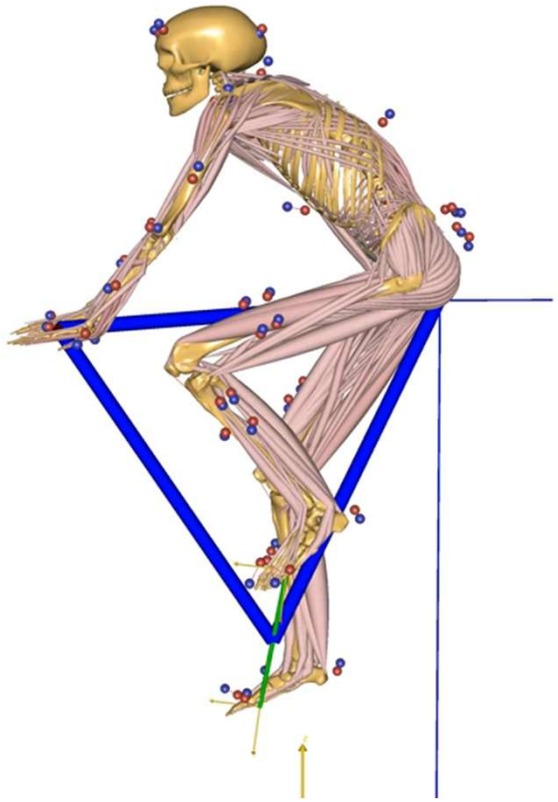
Example: Golf

- Golf
- GRF prediction
- Fullbody
- PluginGaitFullbody
- 2 Dynamic trials
- 1 Calibration trial
- External optimization: Golf club parameters



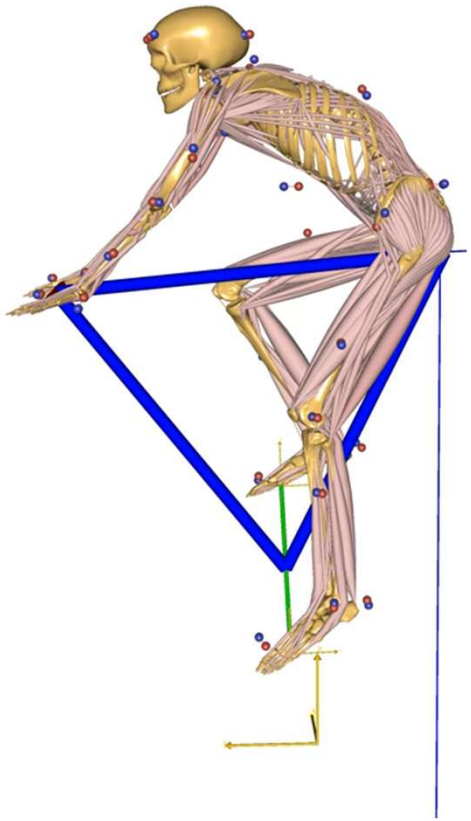
Example: Cycling Cluster

- Cycling
- Fullbody
- Cluster
- 2 Dynamic trials
- 1 Calibration trial
- External optimization: Bicycle parameters



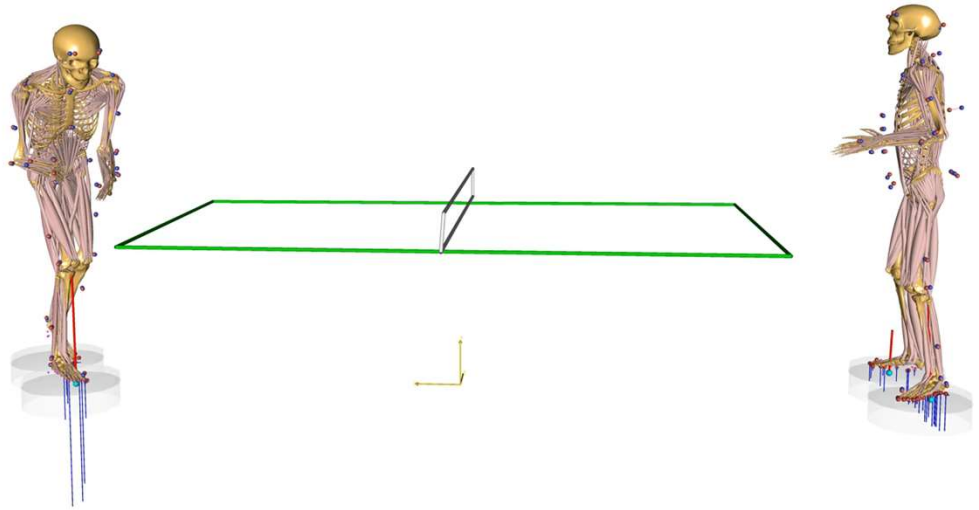
Example: Cycling PiG

- Cycling
- Fullbody
- PluginGaitFullbody
- 2 Dynamic trials
- 1 Calibration trial
- External optimization: Bicycle parameters

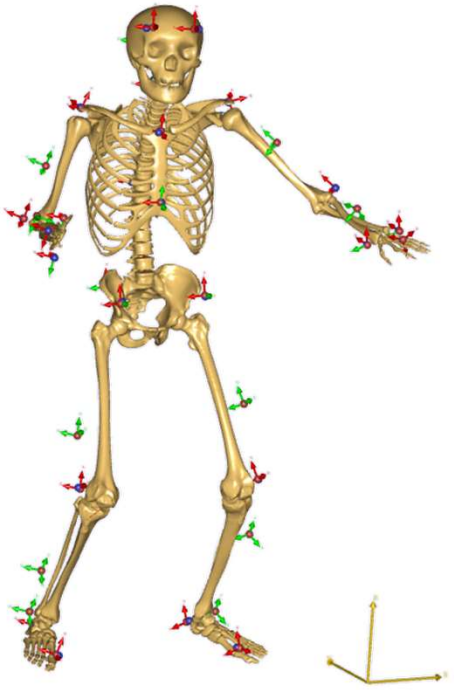


Example: Table tennis

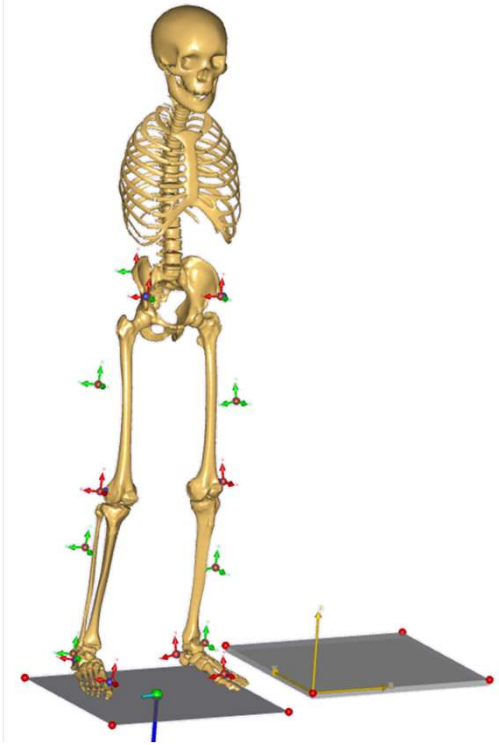
- Table tennis
- Fullbody
- PluginGaitFullbody
- GRF prediction
- 2 Dynamic trials
- 1 Calibration trial
- Note: Separate analysis for players



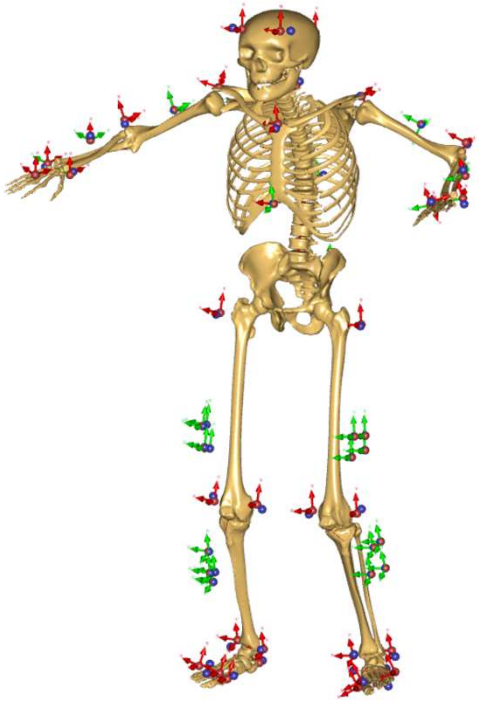
Protocols



PlugInGait FullBody



PlugInGait LowerBody (automatically adds extra drivers on spine)

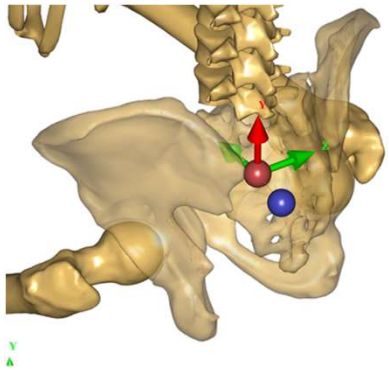


Cluster

Using a different marker protocol?

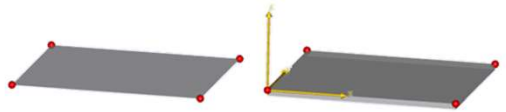
- Not a problem
- Easy to change
- Flexible setup
- We can help

```
// Marker on the Left Posterior Superior Iliac
CreateMarkerDriver LPSI (
UseC3DWeightResiduals = ON,
MarkerPlacement=Trunk.SegmentsLumbar.PelvisSeg,
PlaceMarkerAt =Left.PSIS,
OptX=ON, OptY=OFF, OptZ=ON,
UseC3DWeightResiduals=ON
) = {
     sRelOpt = {0.0,0.0, 0.0};
};
```

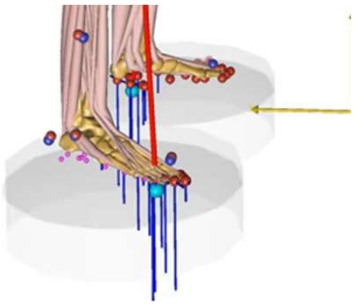


Applying forces

- Apply forces
  - Measured data
  - Use GRF prediction
- Easy to create using templates
- Flexible setup
- We can help



Apply measured forces
Currently support for type 1,2,3,4 & 5

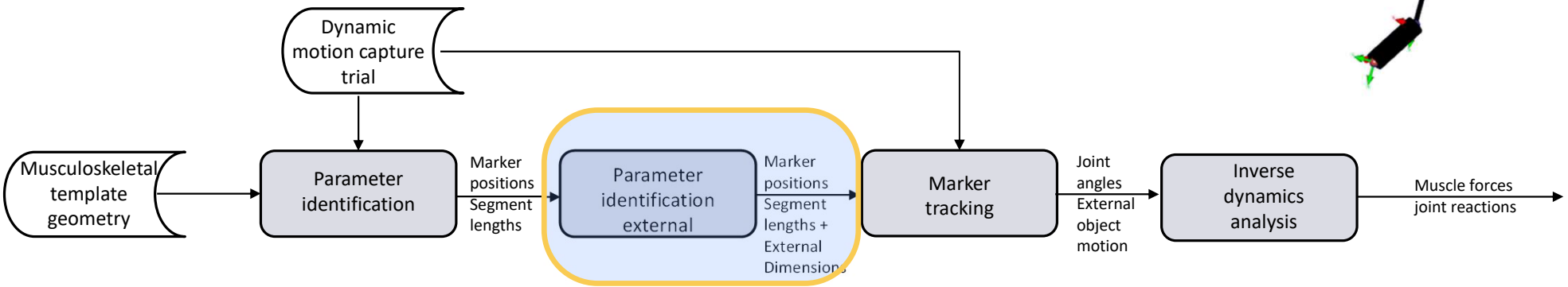


GRF prediction (requires fullbody motion)

External objects

- Incorporating external objects like
  - Cricket bat
  - Golfclub
  - Bike

- User specifies:
  - Marker locations (initial guess)
  - Mass/inertia
  - Visuals representation
  - Bike model (crank load specification)

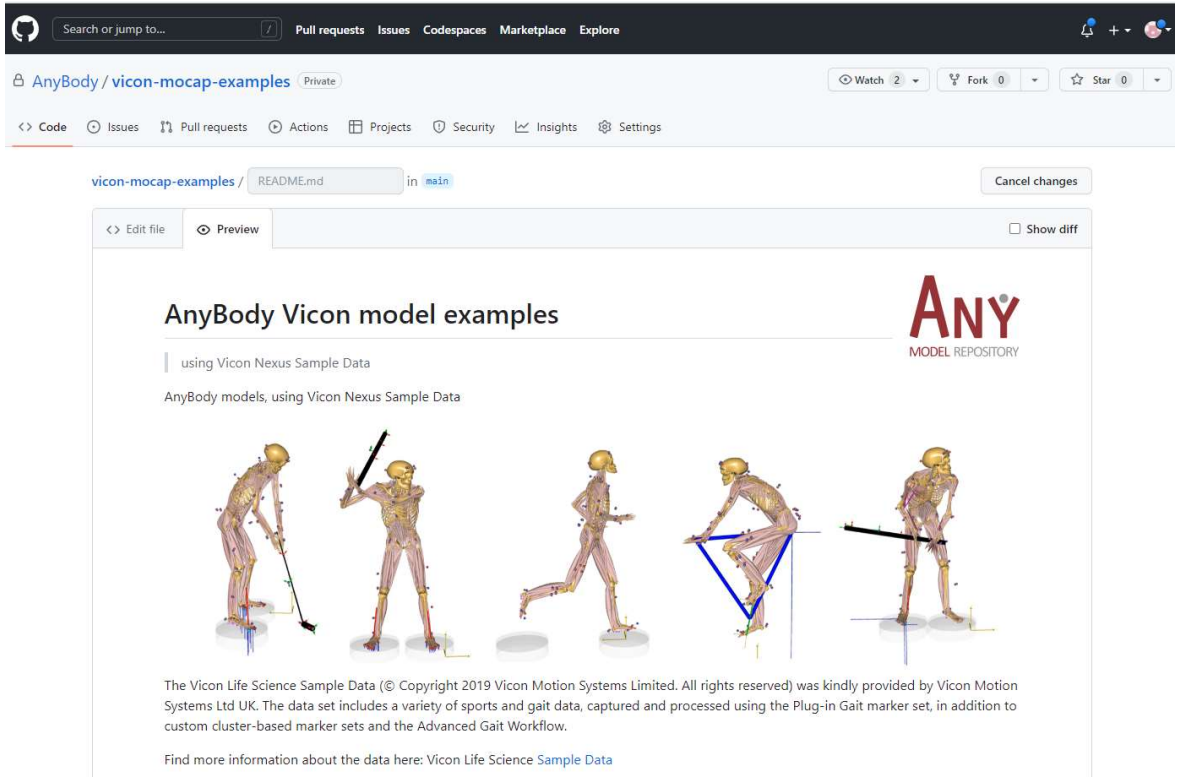


Processing

- Processing script part of library
- Based on Python “batchprocess.py”
- Using AnyPyTools (AnyPyTools’ documentation! — AnyPyTools 1.9.0 documentation (anybody-research-group.github.io))
- Using AnyBody console application
- Displays automatic setup for running models

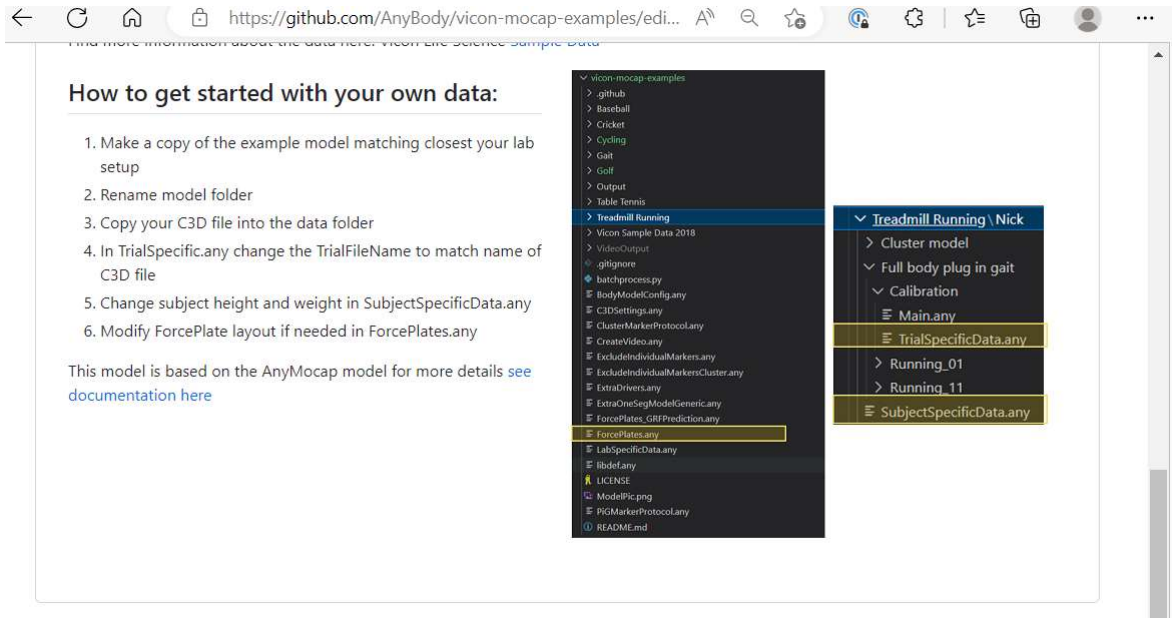
Availability

- On GitHub now
- [AnyBody/vicon-mocap-examples: AnyBody models, using Vicon Nexus Sample Data (github.com)]
- To be part of AnyBody
- Tested to run with AMMR 2.4.4



How to get started with own data?

- Make a copy of a model resembling your lab settings
- Follow instruction on GitHub



Take home

- Easy to use Vicon C3D files in AnyBody
- Repository available
- Want a trial license ? sales@anybodytech.com
- Want a meeting ?

VICON ANYBODY TECHNOLOGY

Thank you

Q&A

https://www.anybodytech.com/

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kim.duffy@vicon.com - twitter.com/lil_Kim263