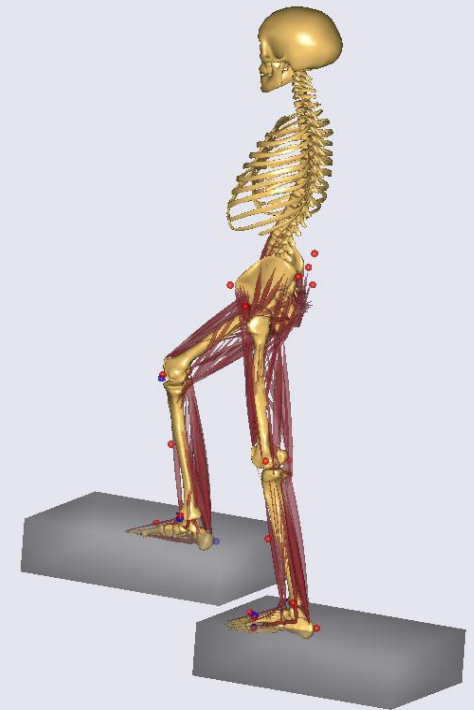
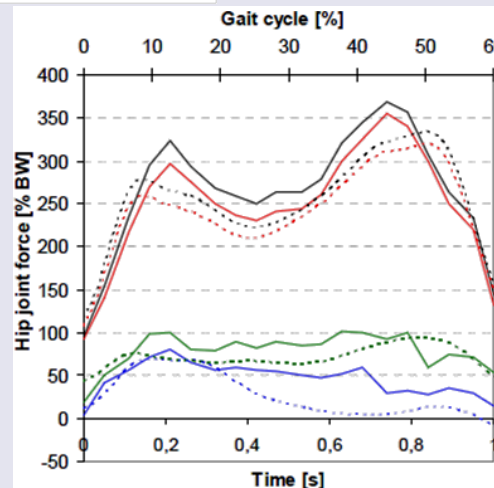
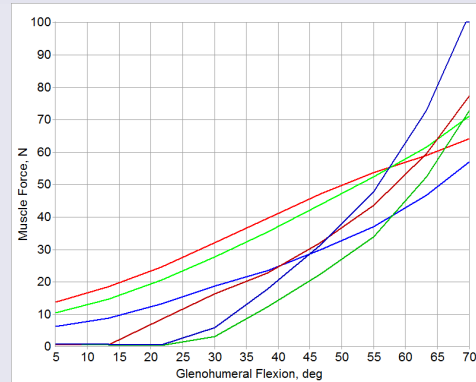
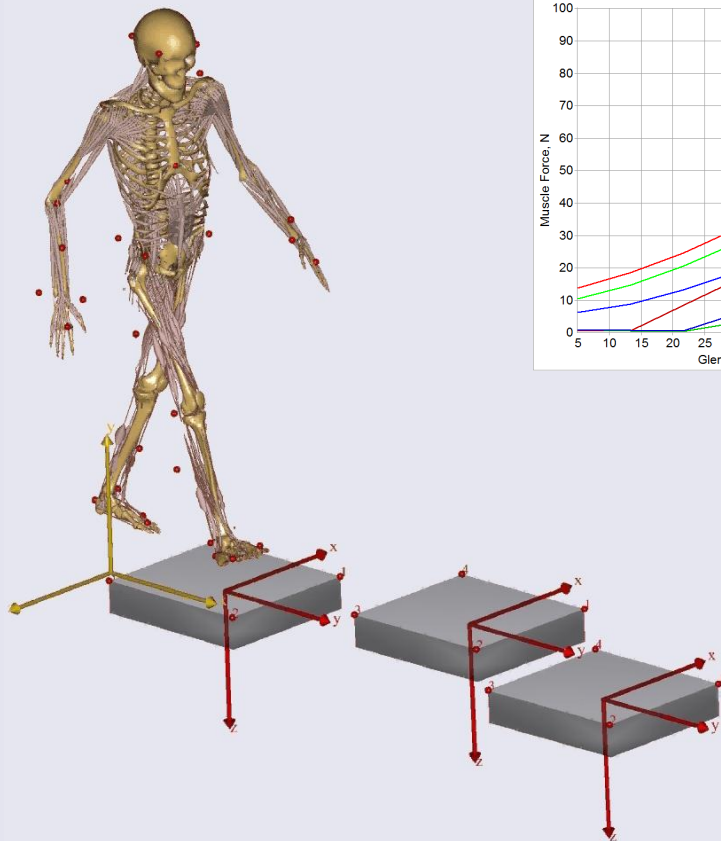


AnyGait: A powerful gait lab application to process motion capture trials

Amir Al-Munajjed, Søren Tørholm & Arne Kiis

The web cast will start in a few minutes....



Presenters



Arne Kiis
(Host/Panelist)



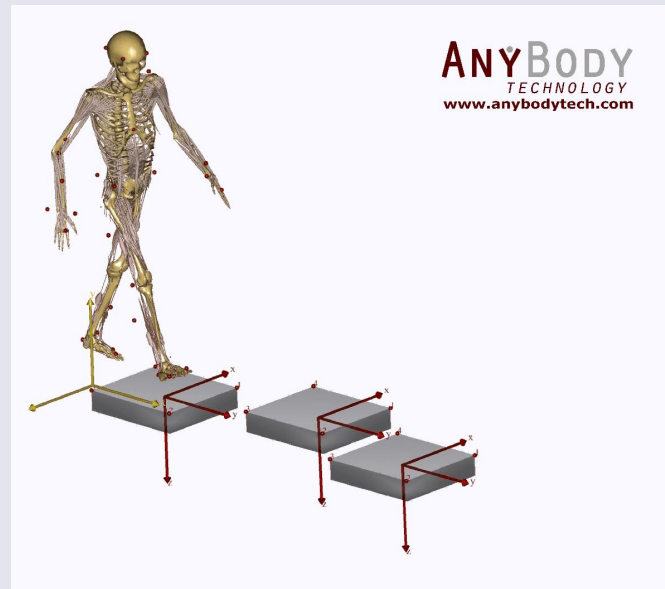
Søren Tørholm
(Panelist)



Amir Al-Munajjed
(Presenter)

Agenda

- Who is AnyBody?
- The AnyBody Modeling System
- AnyGait
- Examples
- Q & A



AnyBody Technology

- Software licenses
- Consulting
- Training
- Support
- AnyGait

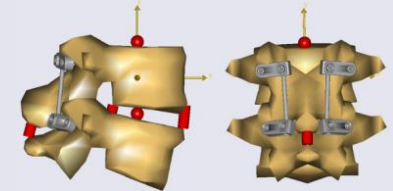
2002



2006



2010

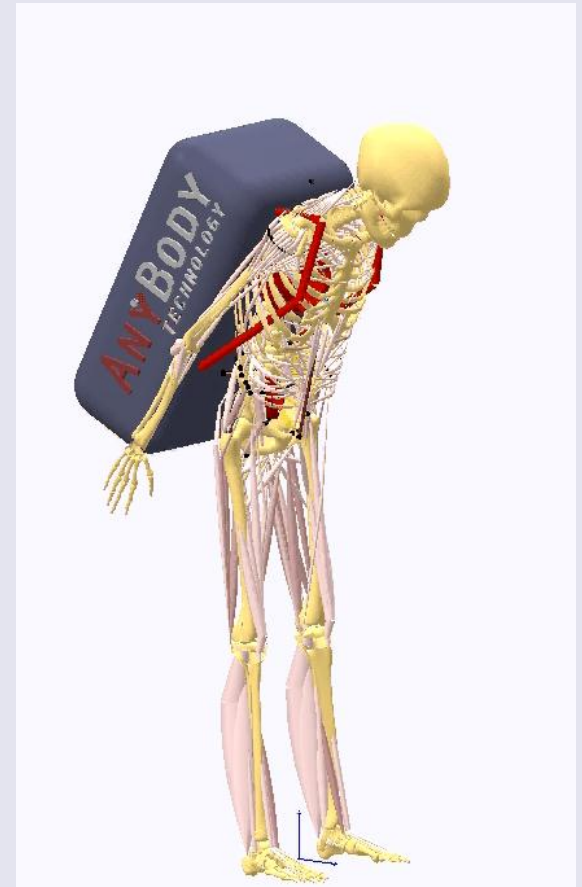


2012

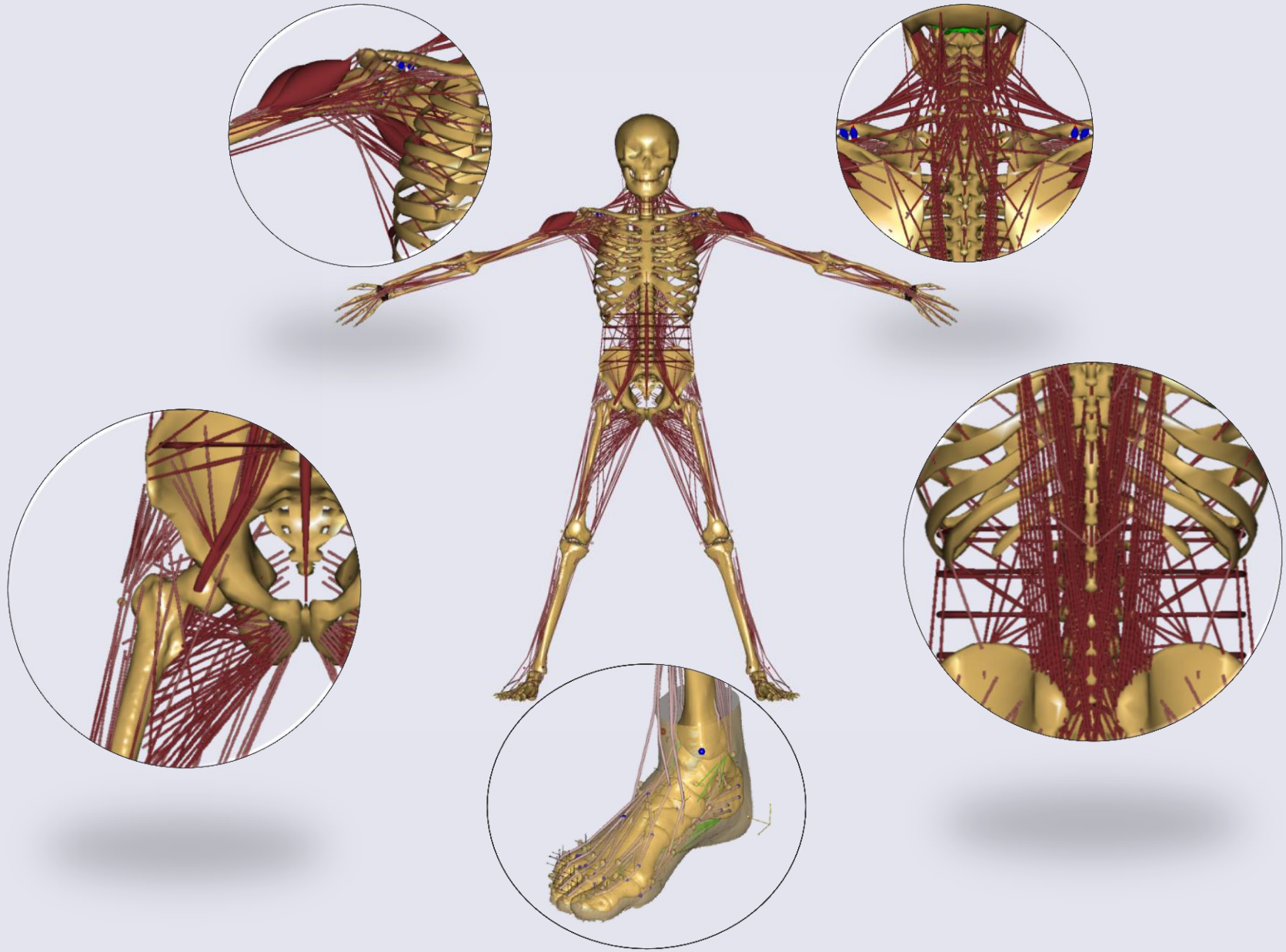


AnyBody Modeling System

- Developed in-house for musculoskeletal analysis
- Self-contained system
- Interfacing to
 - motion capture
 - image-based bone and muscle data
 - CAD
 - finite-element software
 - office systems
- Open body model
- Broad and deep model validation
- API for imbedded use

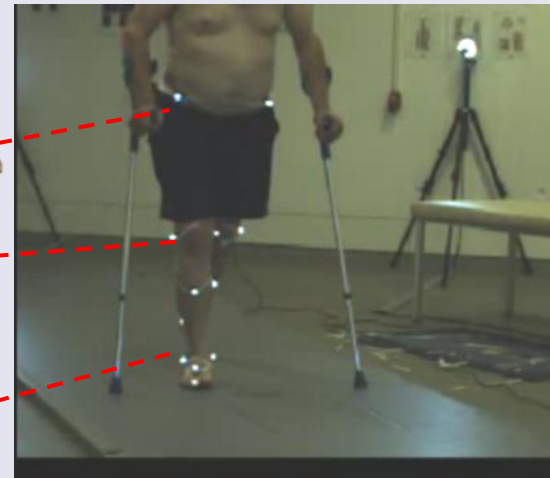
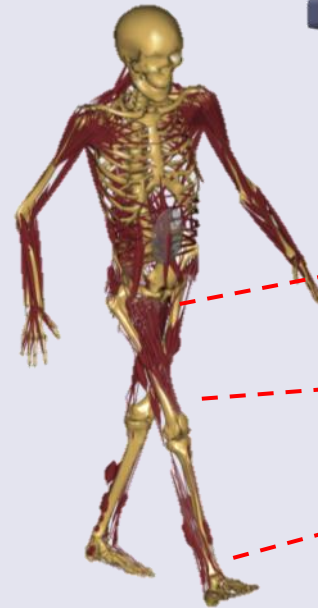


Body Model Library

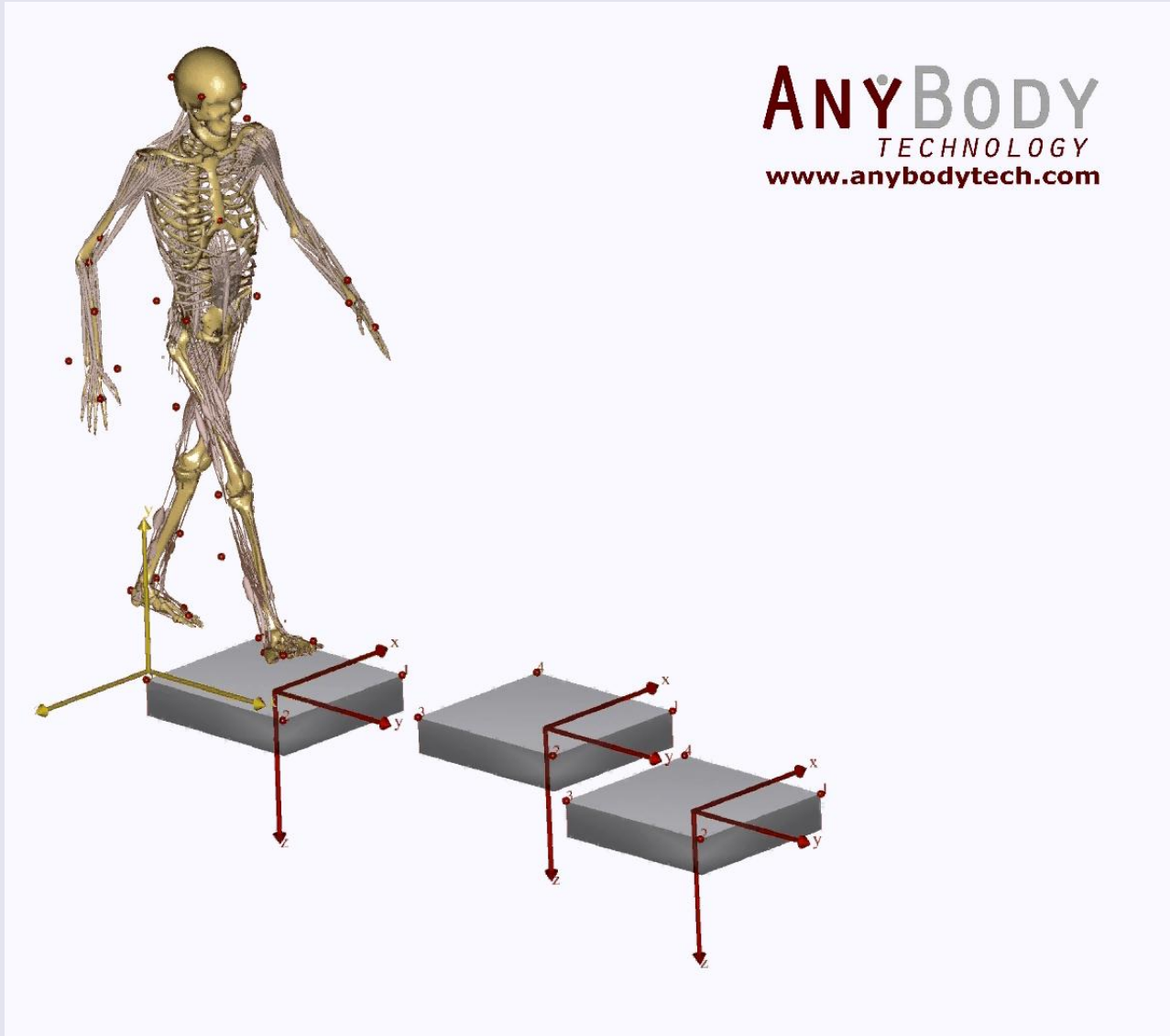


Subject Specific Modeling

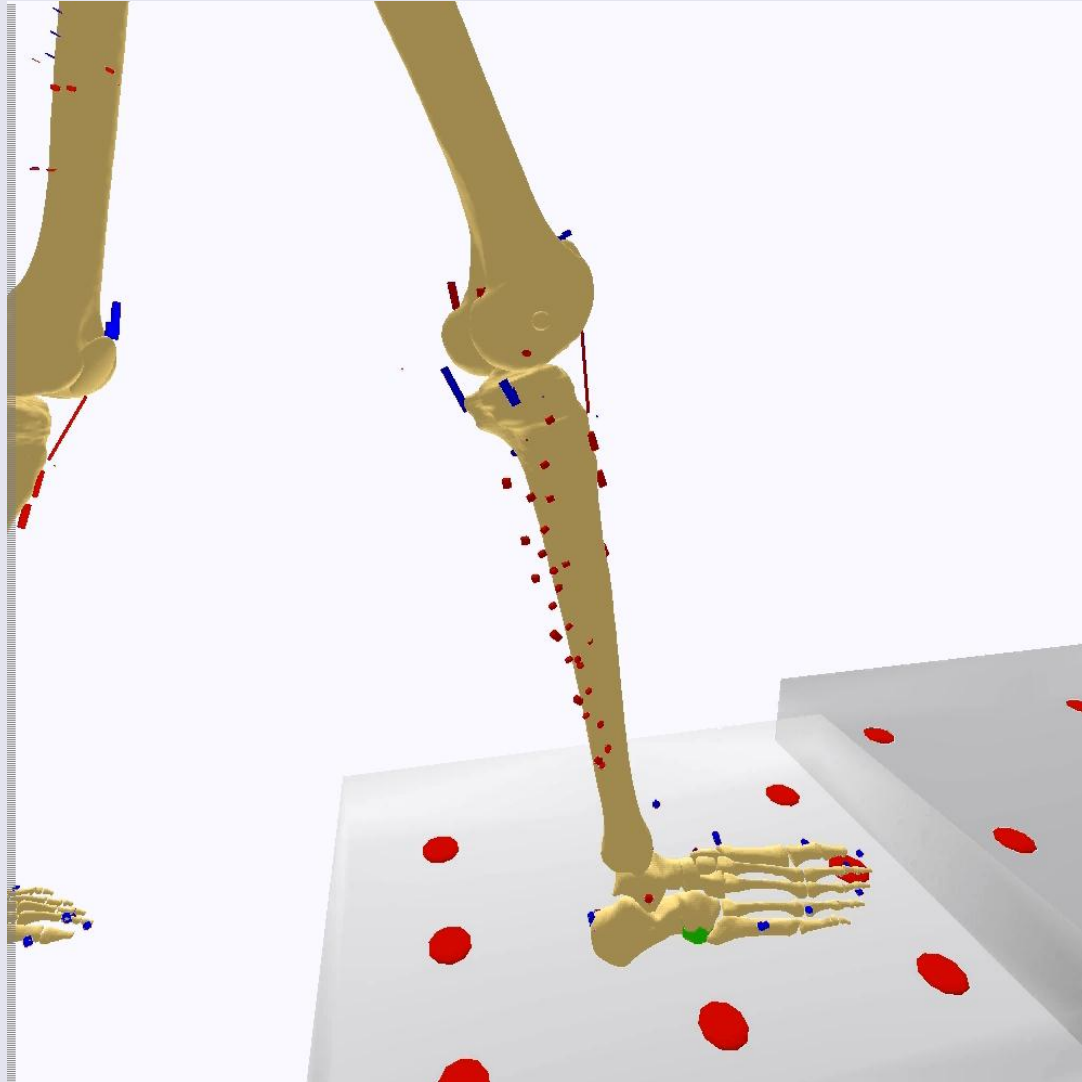
- **Anthropometric scaling**
 - Overall body size and shape
- **Subject-specific scaling**
 - Joint centers
 - Body anthropometry
- **Patient-specific bones:**
 - Muscle attachments
- **Surgical effects**
 - Muscle removal



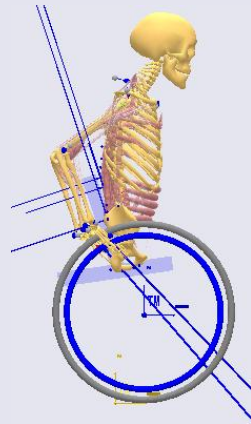
Activities of Daily Living



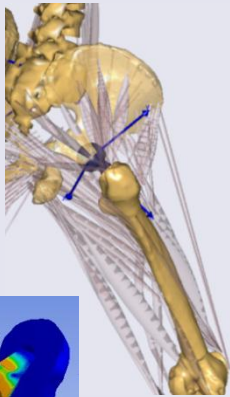
Dynamic Physiological Loads



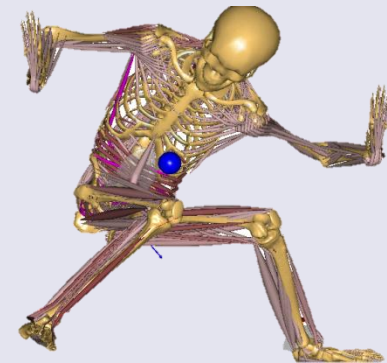
Product design
optimization



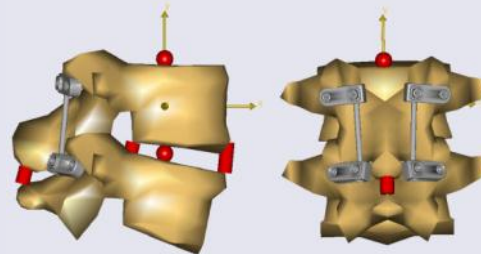
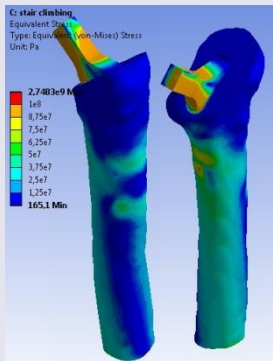
Ergonomic analysis
and documentation



ANYBODY Modeling System



Physiological load
cases for Finite
Element Analysis



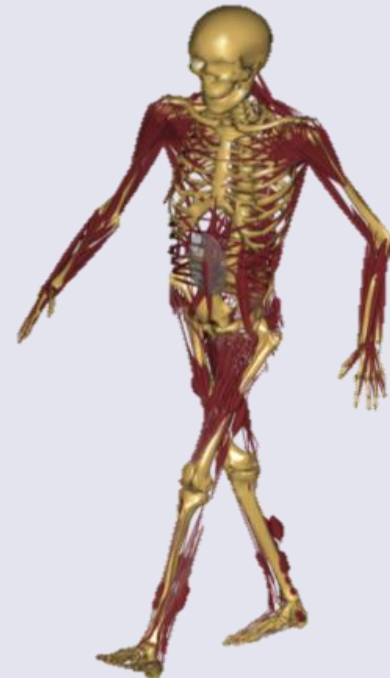
Pre-op planning
post-op evaluation,
failure analysis

AnyGait: A powerful gait lab application to process motion capture trials

AnyGait - Model

AnyGait is:

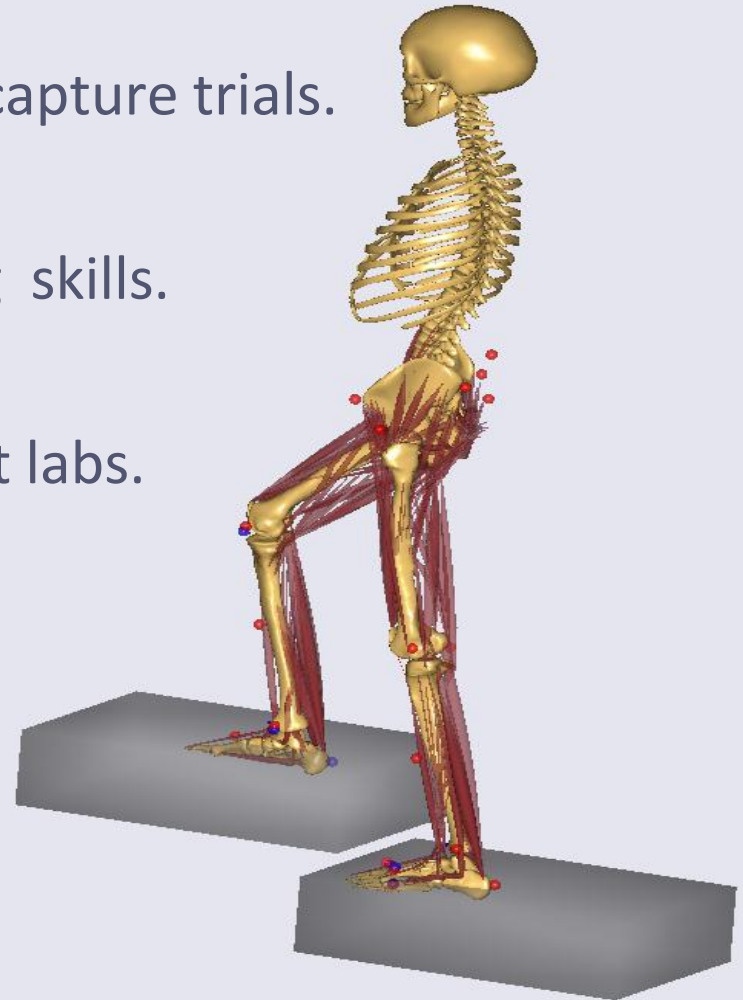
- an easy-to-use model to analyze motion capture trials in a gait lab or clinical environment.
- a *Gait Application* with all major muscle fascicles.
- highly customizable to fit specific needs of gait labs (gait lab setup, patient group, ...)



AnyGait – GUI

New Graphical User Interface:

- enables easy processing of motion capture trials.
- requires no modeling/programming skills.
- is adaptable to specific needs of gait labs.



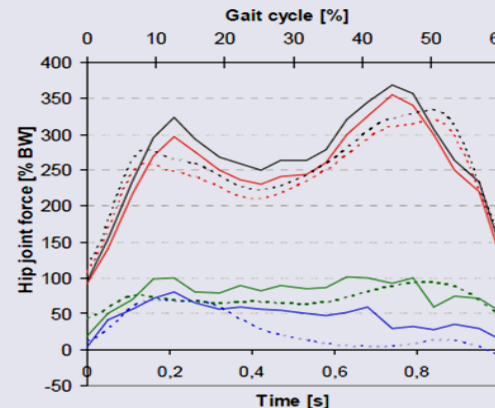
AnyGait – Input/Output

Input:

- C3D files including force plate data
 - predefined and ready-to-use for most Motion Capture system
 - adaptable to almost any kind of setup

Output:

- Important results are displayed in an easy-to-read form.
- All features and results of the AnyBody Modeling System are accessible.

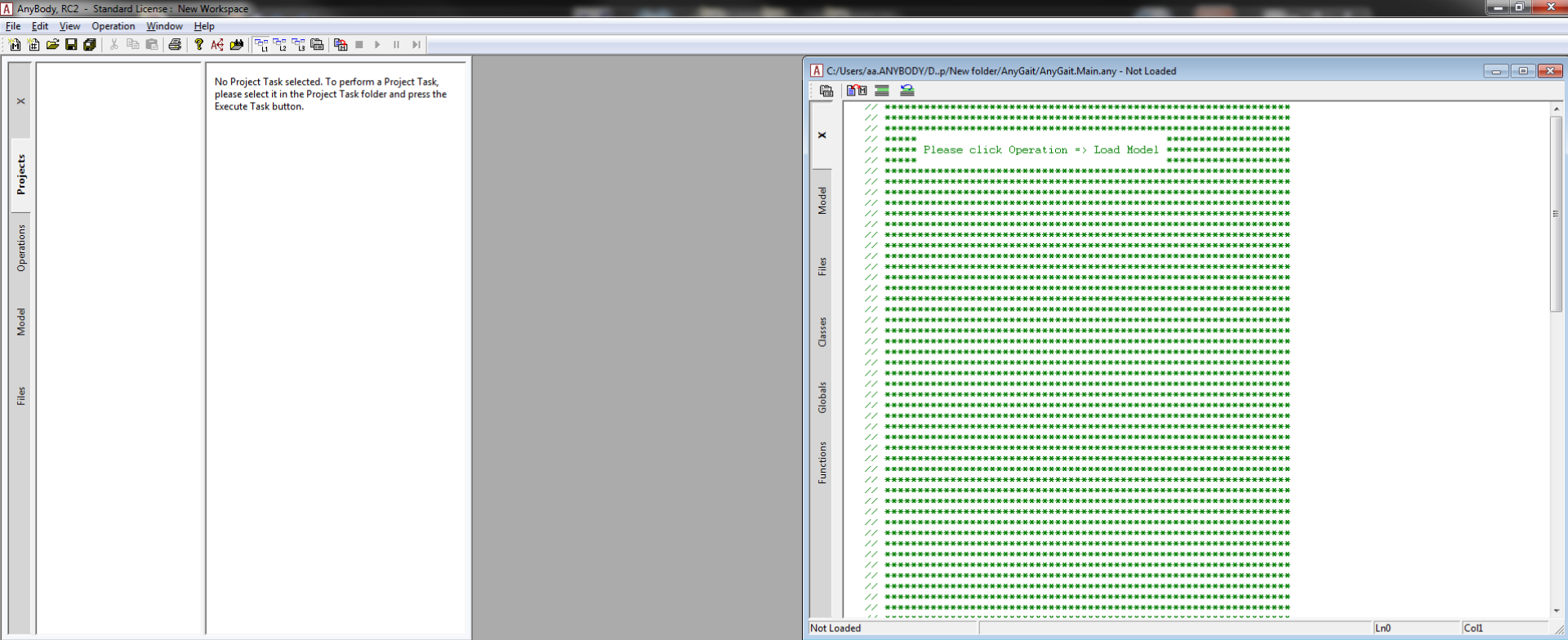


Open AnyGait

AMMR v1.5: AnyBody Managed Model Repository

Name	Date modified	Type	Size
Application	21/05/2012 10:07	File folder	
Body	21/05/2012 10:07	File folder	
LicenseTerms	21/05/2012 10:07	File folder	
ReleaseNotes.AMMR.pdf	16/05/2012 14:13	Adobe Acrobat D...	69 KB
AnyGait	21/05/2012 11:25	File folder	
Beta	21/05/2012 11:23	File folder	
Examples	21/05/2012 11:23	File folder	
Validation	21/05/2012 11:23	File folder	
libdef.any	16/05/2012 09:41	AnyScript File	1 KB
AnyGaitSourceCode	22/05/2012 14:26	File folder	
ExampleData	22/05/2012 14:26	File folder	
Projects	22/05/2012 14:26	File folder	
AnyGait - Manual.pdf	22/05/2012 14:11	Adobe Acrobat D...	1,478 KB
AnyGait.Main.any	22/05/2012 13:57	AnyScript File	8 KB
libdef.any	15/05/2012 15:38	AnyScript File	1 KB

Load AnyGait



■ Reset ▶ Run ▶▶ Step

```

License information:
License expiration date: 31-dec-2015
Days until license expiration: 1319
HostID: 0024d7e43e59
Server Hostname:
ProductID: ams4_standard
Maintenance expiration: 2015.12.31
Days until maintenance expiration: 1318
License file: C:\ProgramData\AnyBody Technology\AnyBody.5.x.x\license.lic
Contract:
Customer: Amir
Issuer: ABT

Loading Settings Script from : 'C:\Users\aa.ANYBODY\AppData\Local\AnyBody Technology\AnyBody.5.x.x\Settings.any.txt'
Settings Loaded
    
```


Start New Project

AnyBody_RC2 - Standard License : New Workspace

File Edit View Operation Window Help

Main
Project
Tasks
StartProject
Views
Files
Autos
Output

ANYBODY TECHNOLOGY

GaitApp Start New Project

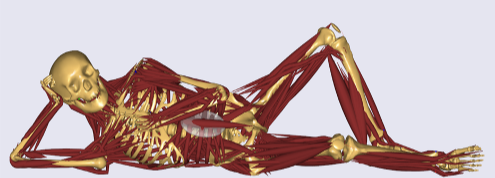
This AnyProject Task defines the Project Name. Please type in the name of an existing or new project.

If you have typed in the correct name of the project click the following link:

Now, please click on **Load Model** to Start the Project!

Project name:

[Save Project Name](#)



ANYBODY TECHNOLOGY

Model
Files
Classes
Globals
Functions

Model
Files
Classes
Globals
Functions

Model Load : C:\Program Files (x86)\AnyBody Techn...
Constructing model tree...
Linking identifiers...
Evaluating constants...
Configuring model...
Evaluating model...
Loaded successfully.
Elapsed Time : 0.157000

Closing model...
Saving modified values...
Deleting last loaded model...
...Model deleted.

Reset Run Step

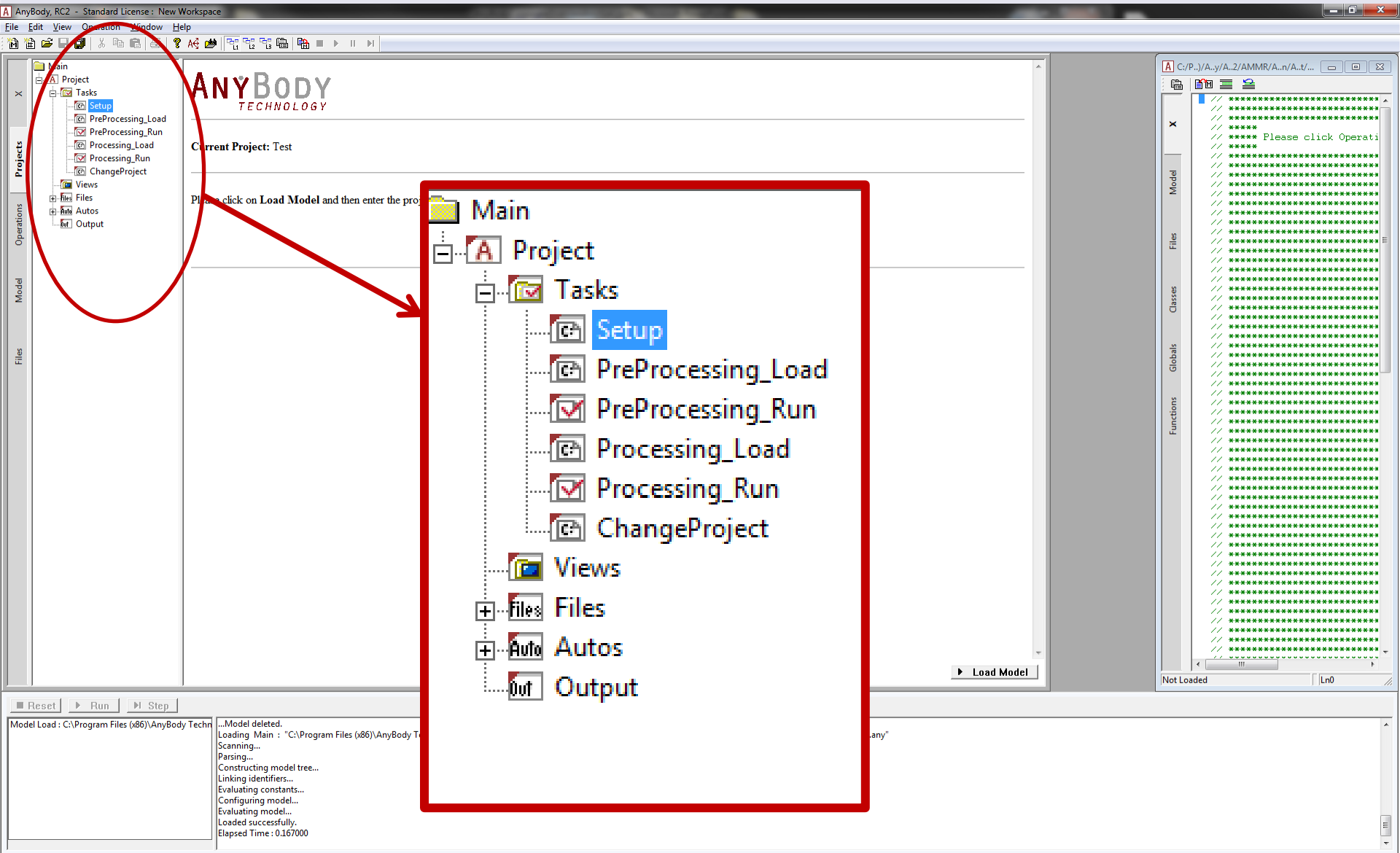
Main Ln0

Load Model

AnyGait Environment

The screenshot displays the AnyBody RC2 software interface. The main window shows the AnyBody TECHNOLOGY logo and the text "Current Project: Test". Below this, there is a red arrow pointing to the text "Please click on Load Model and then enter the project specific data." A 3D model of a human skeleton is visible in the center. The interface includes a menu bar (File, Edit, View, Operation, Window, Help), a toolbar, and a sidebar with tabs for Projects, Operations, Model, Files, Classes, Globals, Functions, and Model. The bottom status bar shows "Model Load : C:\Program Files (x86)\AnyBody Techn..." and a list of operations: "...Model deleted.", "Loading Main : 'C:\Program Files (x86)\AnyBody Technology\AnyBody.5.2\AMMR\Application\AnyGait\Application\Model\OptLegModel\ProjectModel\AnyGait.Main.any'", "Scanning...", "Parsing...", "Constructing model tree...", "Linking identifiers...", "Evaluating constants...", "Configuring model...", "Evaluating model...", "Loaded successfully.", and "Elapsed Time : 0.167000".

AnyGait Environment



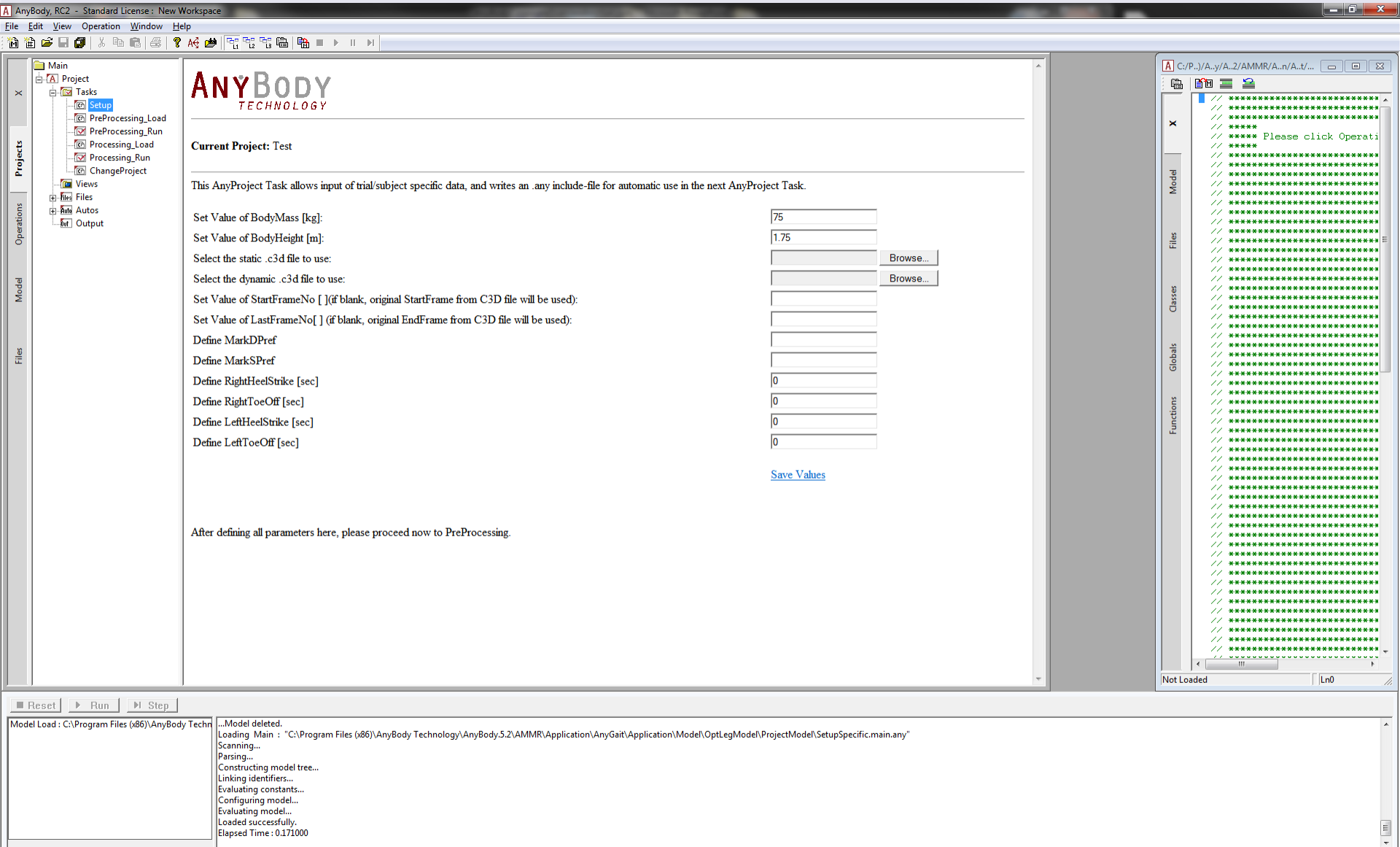
AnyGait Environment

The screenshot displays the AnyBody RC2 software interface. The main window shows a 3D model of a human skeleton in a reclining position, with the AnyBody Technology logo below it. A red arrow labeled '1' points to the 3D model. Below the model is a 'Load Model' button, with a red arrow labeled '2' pointing to it. The interface includes a menu bar (File, Edit, View, Operation, Window, Help), a toolbar, and a project tree on the left. The project tree shows a hierarchy: Main > Project > Tasks > Setup, PreProcessing_Load, PreProcessing_Run, Processing_Load, Processing_Run, ChangeProject. Below the main window is a status bar with 'Reset', 'Run', and 'Step' buttons. A console window at the bottom shows the following text:

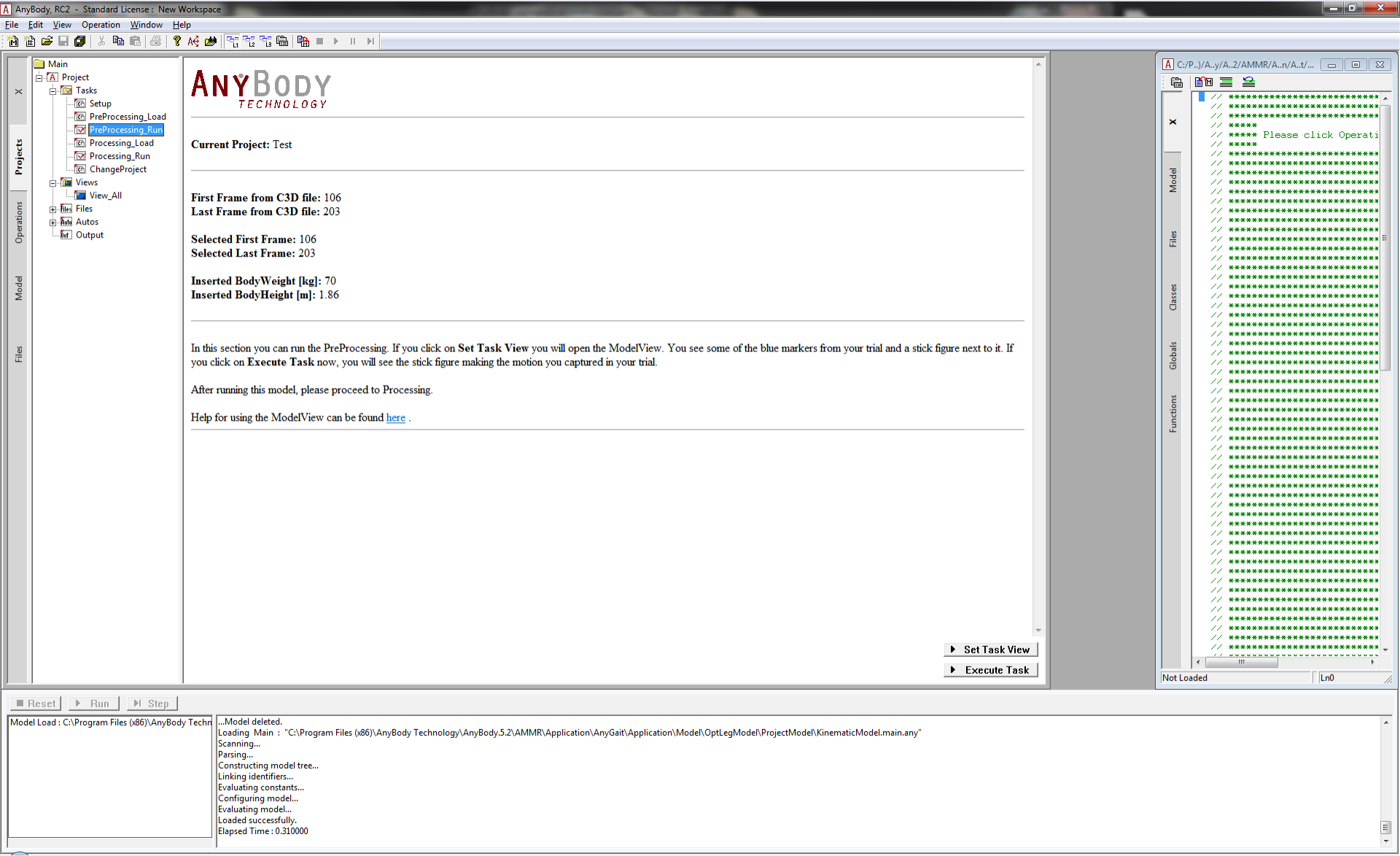
```

Model Load : C:\Program Files (x86)\AnyBody Techn...
...Model deleted.
Loading Main : "C:\Program Files (x86)\AnyBody Technology\AnyBody.5.2\AMMR\Application\AnyGait\Application\Model\OptLegModel\ProjectModel\AnyGait.Main.any"
Scanning...
Parsing...
Constructing model tree...
Linking identifiers...
Evaluating constants...
Configuring model...
Evaluating model...
Loaded successfully.
Elapsed Time : 0.167000
  
```

Setup Environment



PreProcessing Environment



PreProcessing Environment

AnyBody_RC2 - Standard License : New Workspace

File Edit View Operation Window Help

ANYBODY TECHNOLOGY

Current Project: Test

First Frame from C3D file: 106
Last Frame from C3D file: 203

Selected First Frame: 106
Selected Last Frame: 203

Inserted BodyWeight [kg]: 70
Inserted BodyHeight [m]: 1.86

In this section you can run the PreProcessing. If you click on **Set Task View** you will open the ModelView. You see some of the blue markers from your trial and a stick figure next to it. If you click on **Execute Task** now, you will see the stick figure making the motion you captured in your trial.

After running this model, please proceed to Processing.

Help for using the ModelView can be found [here](#).

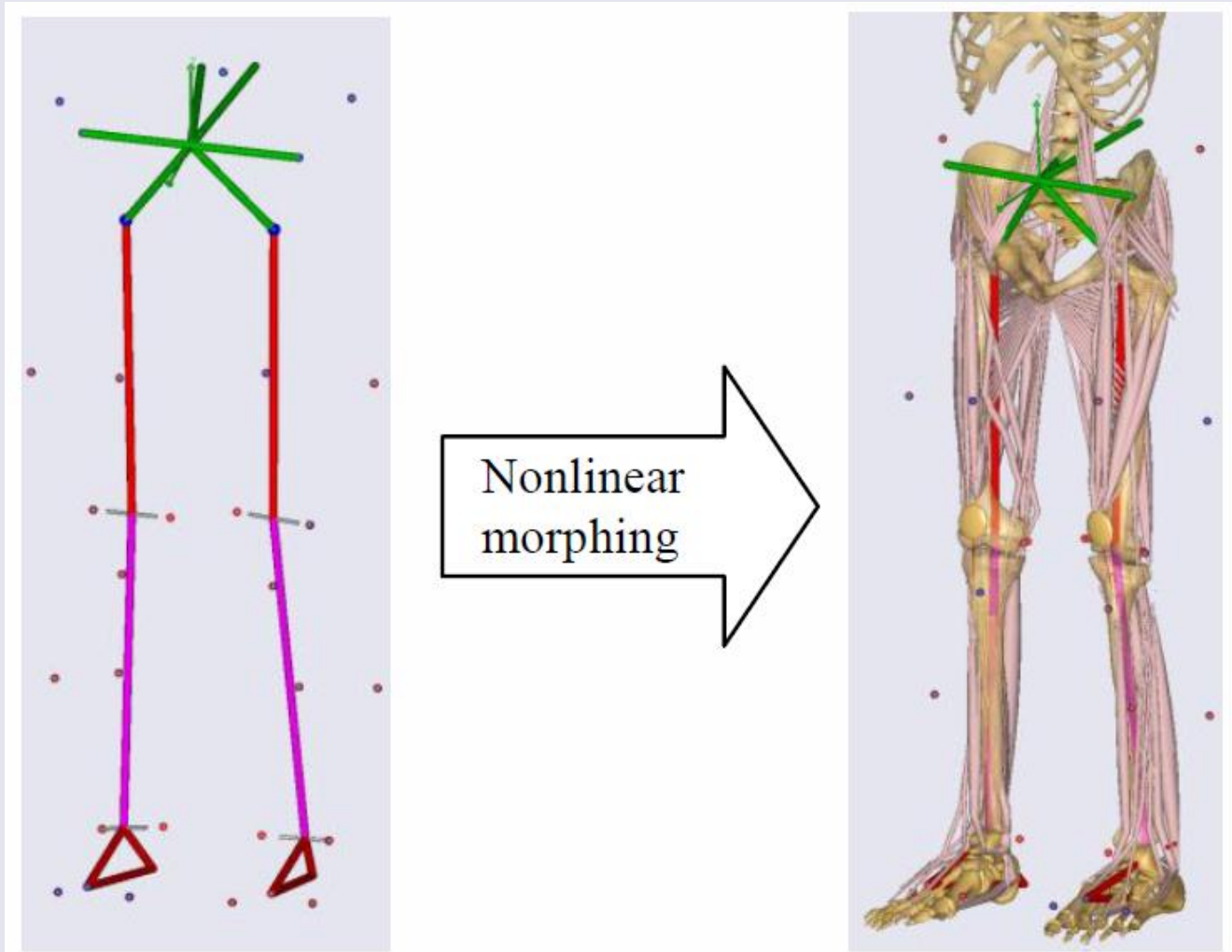
Model View 1

Set Task View
Execute Task

Reset Run Step

Model Load : C:\Program Files (x86)\AnyBody Techn...
...Model deleted.
Loading Main : "C:\Program Files (x86)\AnyBody Technology\AnyBody.5.2\AMMR\Application\AnyGait\Application\Model\OptLegModel\ProjectModel\KinematicModel.main.any"
Scanning...
Parsing...
Constructing model tree...
Linking identifiers...
Evaluating constants...
Configuring model...
Evaluating model...
Loaded successfully.
Elapsed Time : 0.310000

Nonlinear Morphing



Processing Environment

AnyBody, RC2 - Standard License : New Workspace

File Edit View Operation Window Help

Main

- Project
 - Tasks
 - Setup
 - PreProcessing_Load
 - PreProcessing_Run
 - Processing_Load
 - Processing_Run
 - ChangeProject
 - Views
 - View_All
 - Files
 - Autos
 - Output

ANYBODY
TECHNOLOGY

Description	Value	Description	Value
First Frame from C3D file:	106 []	Last Frame from C3D file:	203 []
Selected First Frame:	106 []	Selected Last Frame:	203 []
Selected Start Time:	1.06 [sec]	Selected End Time:	2.03 [sec]
Selected Right Heel Strike Frame:	0 []	Selected Left Heel Strike Frame:	0 []
Selected Right Toe Off Frame:	0 []	Selected Left Toe Off Frame:	0 []
Selected Right Heel Strike Time:	0 [sec]	Selected Left Heel Strike Time:	0 [sec]
Selected Right Toe Off Time:	0 [sec]	Selected Left Toe Off Time:	0 [sec]
Inserted BodyWeight [kg]:	70 [kg]	Inserted BodyHeight [m]:	1.86 [m]

In this section you can run the Processing. If you click on **Set Task View** you can open the ModelView. Additional to the Stick Figure from PreProcessing, you will see the human scaled to the subject from the C3D file. If you click on **Execute Task** now, you will see the stick figure making the motion you captured in your video.

After running this model, please proceed now to **CreateReport**.

Help for using the ModelView can be found [here](#).

Model View 1

Model Load : C:\Program Files (x86)\AnyBody Techn...

Reset Run Step

```

...Model deleted.
Loading Main : "C:\Program Files (x86)\AnyBody Technology\AnyBody.5.2\AMMR\Application\AnyGait\Application\Model\OptLegModel\ProjectModel\InverseDynamicsModel.main.any"
Scanning...
Parsing...
Constructing model tree...
Linking identifiers...
Evaluating constants...
Configuring model...
Evaluating model...
Loaded successfully.
Elapsed Time : 23.312000
  
```

Not Loaded |Ln0


Processing Environment

AnyBody_RC2 - Standard License : New Workspace

File Edit View Operation Window Help

Main

- Project
- Tasks
 - Setup
 - PreProcessing_Load
 - PreProcessing_Run
 - Processing_Load
 - Processing_Run
 - ChangeProject
- Views
 - View_All
- Files
 - Autos
 - Output



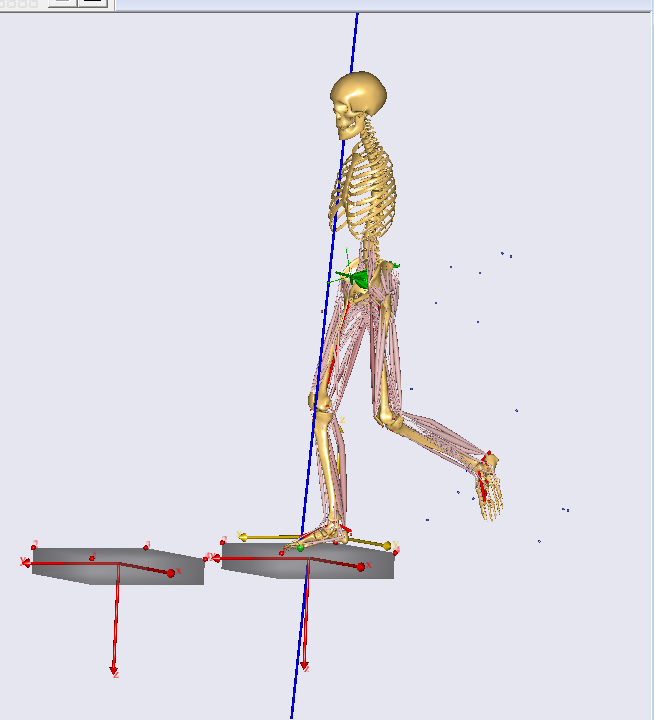
Description	Value	Description	Value
First Frame from C3D file:	106 []	Last Frame from C3D file:	203 []
Selected First Frame:	106 []	Selected Last Frame:	203 []
Selected Start Time:	1.06 [sec]	Selected End Time:	2.03 [sec]
Selected Right Heel Strike Frame:	0 []	Selected Left Heel Strike Frame:	0 []
Selected Right Toe Off Frame:	0 []	Selected Left Toe Off Frame:	0 []
Selected Right Heel Strike Time:	0 [sec]	Selected Left Heel Strike Time:	0 [sec]
Selected Right Toe Off Time:	0 [sec]	Selected Left Toe Off Time:	0 [sec]
Inserted BodyWeight [kg]:	70 [kg]	Inserted BodyHeight [m]:	1.86 [m]

In this section you can run the Processing. If you click on Set Task View you can will open the ModelView in case it is not open yet. Additional to the Stick Figure from PreProcessing, you will see the human scaled to the subject from the trial. If you click on Execute Task now, you will see the stig figure making the motion you captured in your trial.

After running this model, please proceed now to CreateReport.

Help for using the ModelView can be found [here](#).

Model View 1



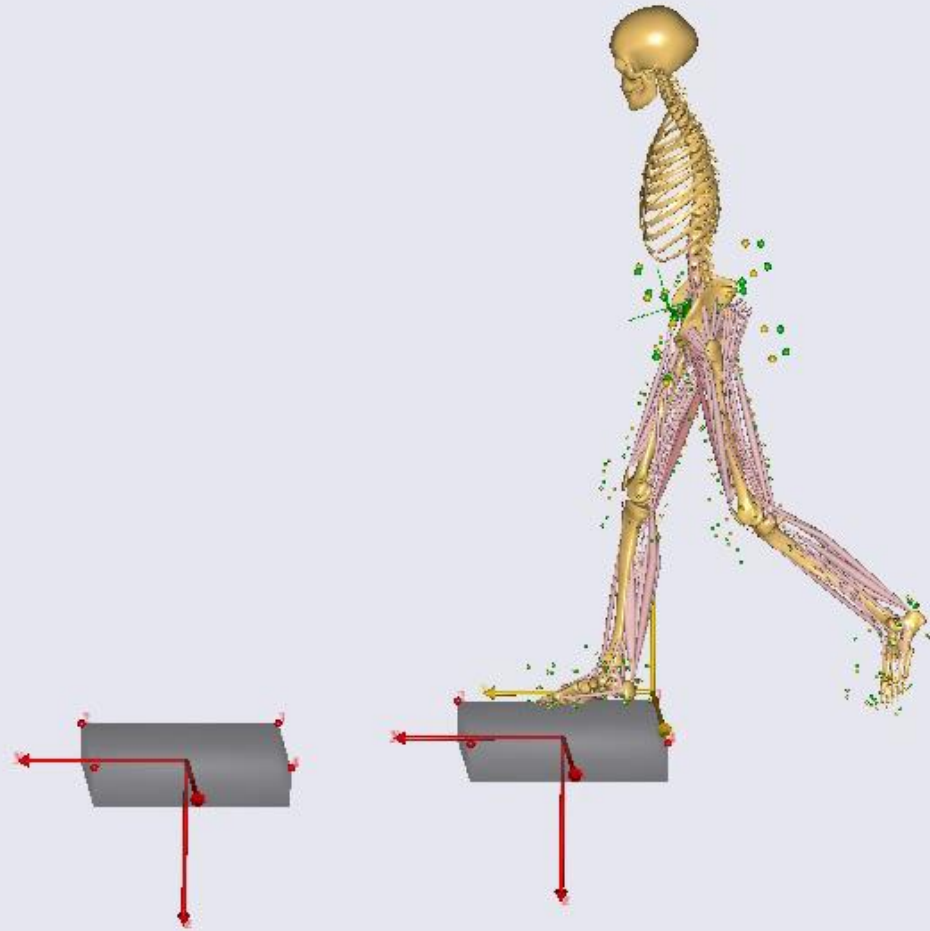
▶ Set Task View
|| Break Task

Not Loaded | Ln0

■ Reset
|| Break
▶ Step

```

Model Load : C:\Users\aa\ANYBODY\Desktop\Rep1.4
AnyOperation : InverseSequence(2;2) : Step Started
AnyOperation : InverseDynamics(20;96) : Step Started
##### Macro command : InverseSequence(2;2)> run
2.0) InverseDynamics (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InverseDynamics);
2.0.0) PreOperation (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InverseDynamics.PreOperation);
2.0.0.0) InitialConditions (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InitialConditions);
2.0.0.0) ...Design variables have been updated.
2.0.0.1) ...Load-time positions have been re-established.
2.0.0.2) ...Kinematic analysis completed. The kinematic constraints have been resolved.
2.0.0.3) ...Initial conditions are fully updated.
2.0) Inverse dynamic analysis...
    
```



Processing Environment

AnyBody_RC2 - Standard License: New Workspace

File Edit View Operation Window Help

ANYBODY TECHNOLOGY

Description	Value	Description	Value
First Frame from C3D file:	106 []	Last Frame from C3D file:	203 []
Selected First Frame:	106 []	Selected Last Frame:	203 []
Selected Start Time:	1.06 [sec]	Selected End Time:	2.03 [sec]
Selected Right Heel Strike Frame:	0 []	Selected Left Heel Strike Frame:	0 []
Selected Right Toe Off Frame:	0 []	Selected Left Toe Off Frame:	0 []
Selected Right Heel Strike Time:	0 [sec]	Selected Left Heel Strike Time:	0 [sec]
Selected Right Toe Off Time:	0 [sec]	Selected Left Toe Off Time:	0 [sec]
Inserted BodyWeight [kg]:	70 [kg]	Inserted BodyHeight [m]:	1.86 [m]

In this section you can run the Processing. If you click on Set Task View you can will open the ModelView in case it is not open yet. Additional to the Stick Figure from PreProcessing, you will see the human scaled to the subject from the trial. If you click on Execute Task now, you will see the stig figure making the motion you captured in your trial.

After running this model, please proceed now to CreateReport.

Help for using the ModelView can be found [here](#).

Model View 1

Set Task View

Break Task

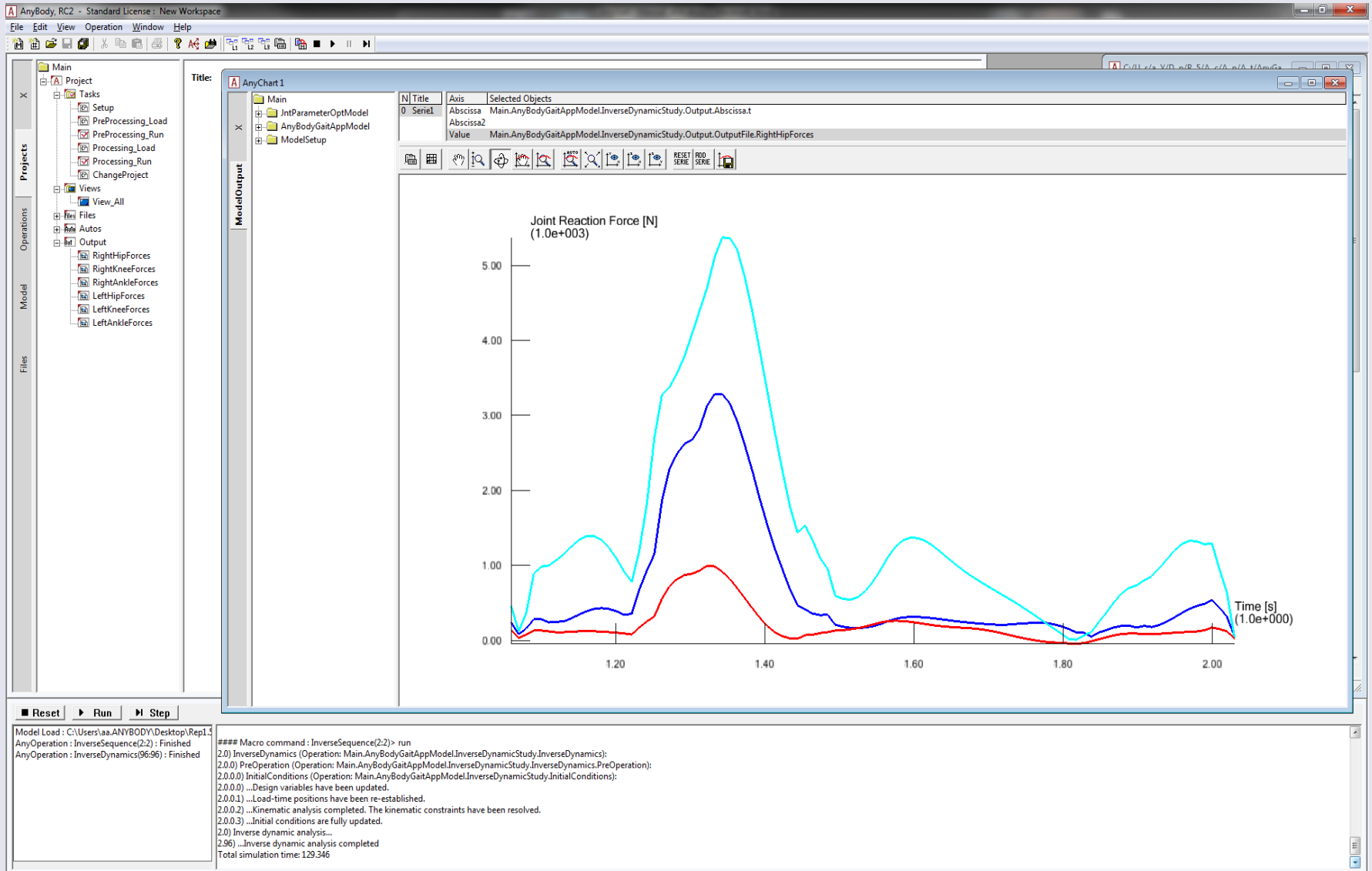
Not Loaded Ln0

■ Reset
|| Break
▶ Step

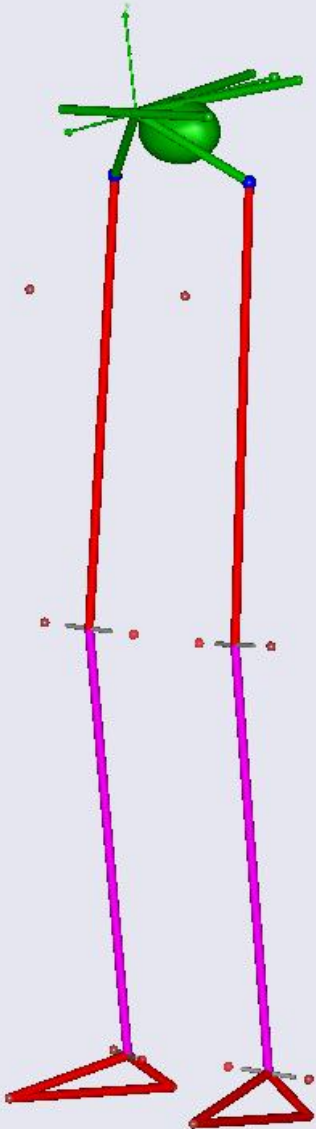
```

Model Load : C:\Users\aa\ANYBODY\Desktop\Rep1.4
AnyOperation : InverseSequence(2;2) : Step Started
AnyOperation : InverseDynamics(20;96) : Step Started
#### Macro command : InverseSequence(2;2)> run
2.0) InverseDynamics (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InverseDynamics):
2.0.0) PreOperation (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InverseDynamics.PreOperation):
2.0.0.0) InitialConditions (Operation: Main.AnyBodyGaitAppModel.InverseDynamicStudy.InitialConditions):
2.0.0.0.0) ...Design variables have been updated.
2.0.0.0.1) ...Load-time positions have been re-established.
2.0.0.2) ...Kinematic analysis completed. The kinematic constraints have been resolved.
2.0.0.3) ...Initial conditions are fully updated.
2.0) Inverse dynamic analysis...
    
```

Results



Marker Names



// Right Leg

RThighSuperior, RKneeLateral, RKneeMedial,
RShankSuperior, RAnkleLateral, RAnkleMedial, RHeel,
RToe

// Left Leg

LThighSuperior, LKneeLateral, LKneeMedial,
LShankSuperior, LAnkleLateral, LAnkleMedial, LHeel, LToe

// Hip

RAsis, LAsis, RPsis, LPsis

// Right Leg

RTHI, RKNE, RTHL, RTIB, RANK, RMMA, RHEE, RTOE

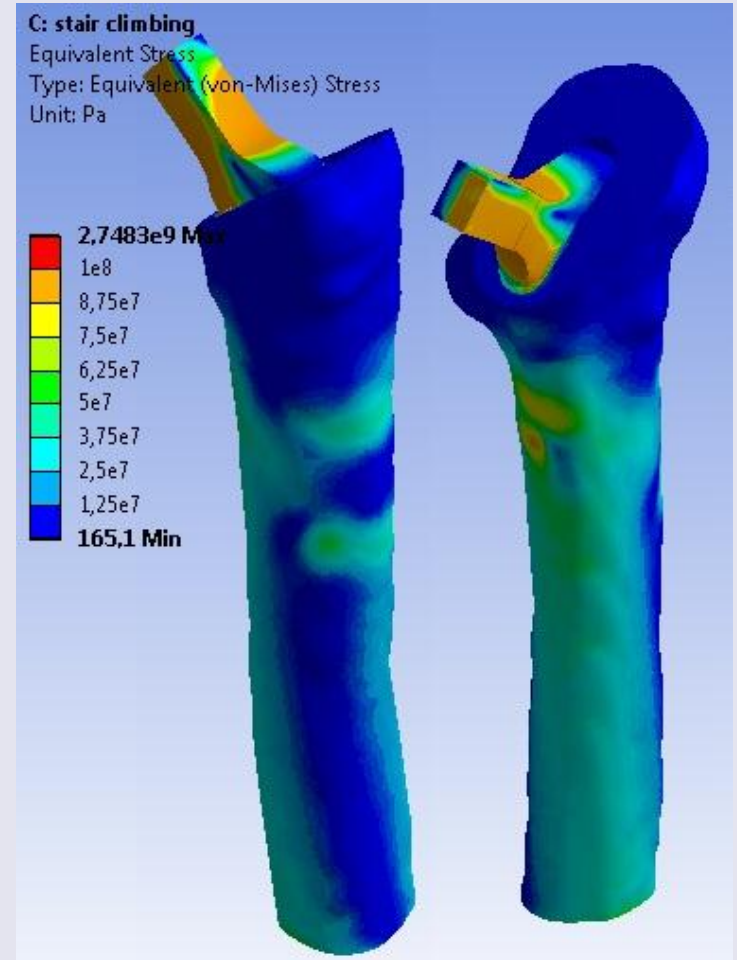
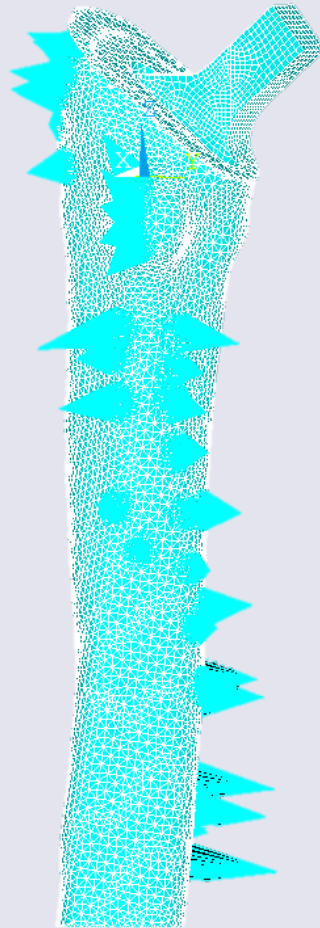
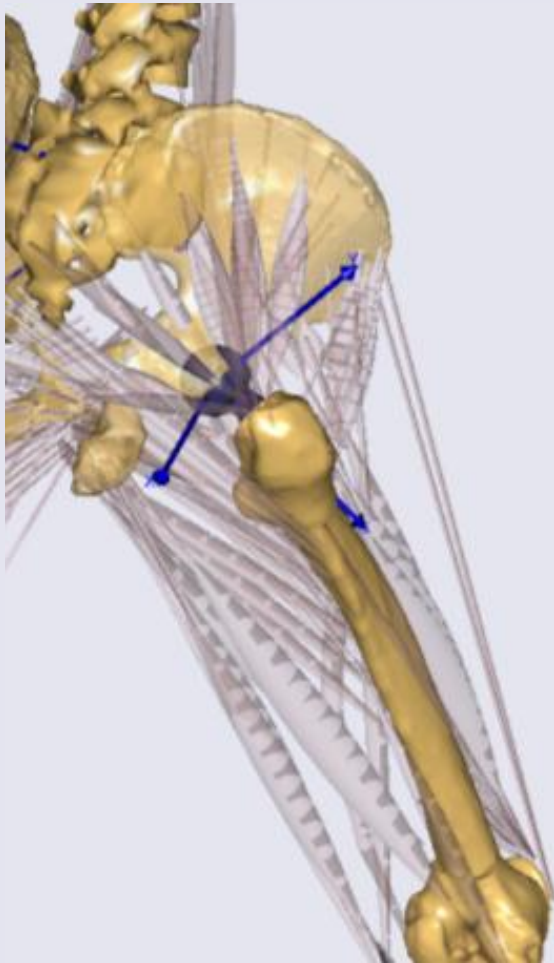
// Left Leg

LTHI, LKNE, LTHL, LTIB, LANK, LMMA, LHEE, LTOE

// Hip

RASI, LASI, RPSI, LPSI

Some Examples of Early Stage Users



Measuring functional outcome after total hip replacement with subject-specific hip joint loading

Tim Weber^{1,2}, Sebastian Dendorfer², Silvia Dullien¹, Joachim Grifka¹,
Gijsbertus Jacob Verkerke^{3,4} and Tobias Renkawitz¹

ProcIMechE Part H:
J Engineering in Medicine
0(0) 1–8
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DOI: 10.1177/10954411912447728
ph.sagepub.com
SAGE

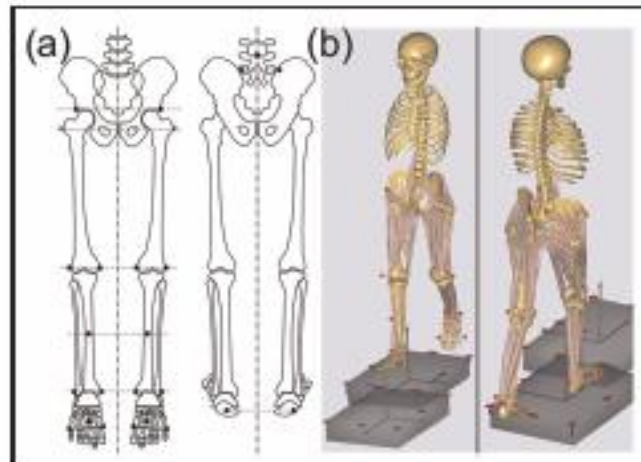


Figure 1. (a) The specified marker set used in this study and its placement on the bony landmarks; (b) front and rear view of subject 1 during the musculoskeletal simulation.

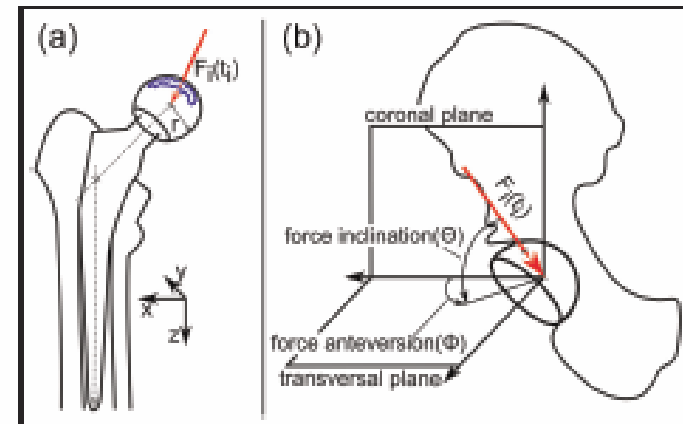


Figure 2. (a) Force path (line) on the head of the implant for every computed time step (t_i) during the stance phase. (b) Force angles (and their definition) on the cup of the joint for every computed time step (t_i) during the stance phase.

The effect of including accurate pelvis bony landmarks in a nonlinearly scaled musculoskeletal lower extremity model

Andersen M. S. ¹, Mellon S. ², Lund M. E. ¹, Grammatopoulos G. ², Gill H. S. ²

¹M-Tech, Aalborg University, Aalborg, Denmark, msa@m-tech.aau.dk

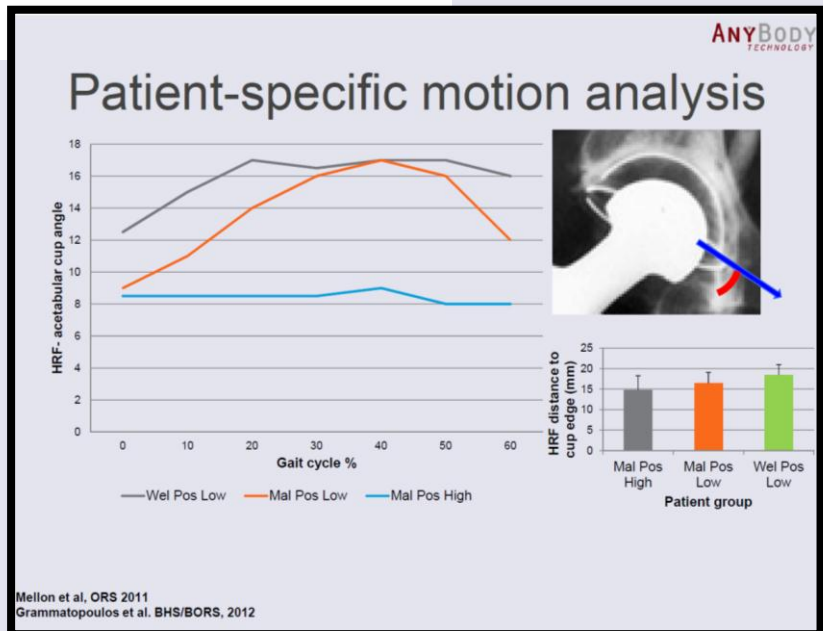
²NDORMS, University of Oxford, Oxford, United Kingdom

3DHMA 2012, Bologna, Italy

WHY DON'T ALL MALPOSITIONED RESURFACED CUPS HAVE HIGH WEAR? - A DYNAMIC, GAIT LAB STUDY.

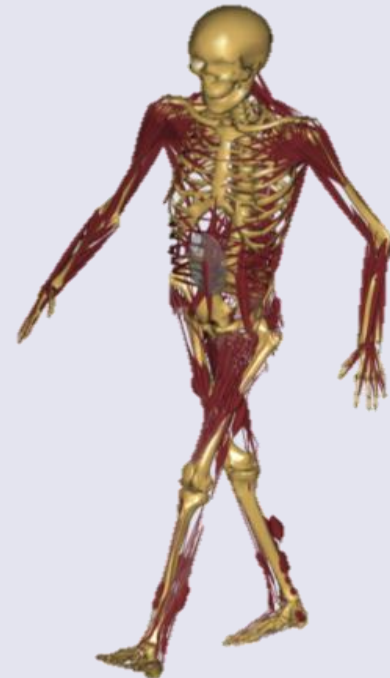
G Grammatopoulos, S Mellon, M S Andersen, H Pandit, R Gundle, P McLardy-Smith, D Murray, H Gill
NDORMS, University of Oxford, Oxford, Nuffield Orthopaedic Centre, Oxford, UK, Aalborg University, Denmark

ORS 2012, San Fransisco, CA

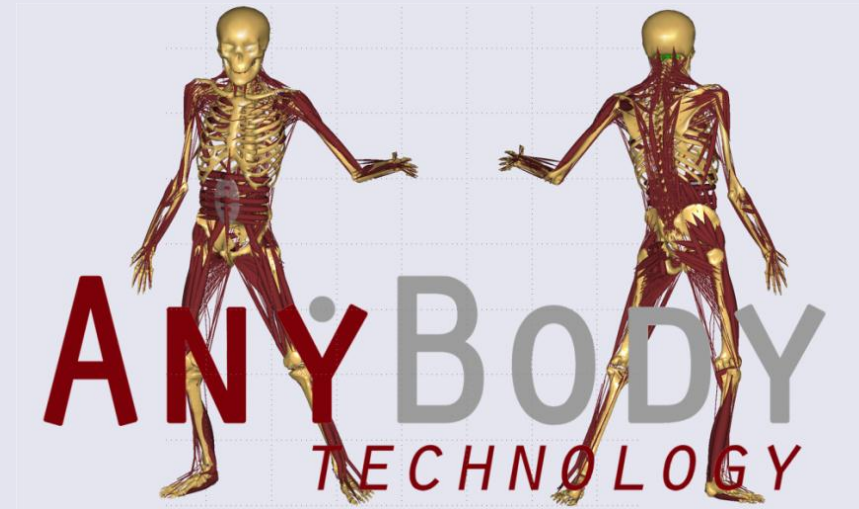


Final Remarks

- AnyGait is a powerful model to analyze motion capture trials in a gait lab or clinical environment.
- Pre-defined GUI makes it easy-to-use, but still highly customizable to fit specific needs.
- In a few minutes from C3D to e.g. *Joint Reaction Forces* and *Muscle Activations...*



Q & A



- www.anybodytech.com
- www.anyscript.org

Webcast:

- 28 June: Features of the New AnyBody Modeling System v5.2

Conferences:

- 18-20 July: *3D Analysis of Human Movement*, Bologna, Italy
- 15-18 Aug: *Am. Soc. Biomechanics*, Gainesville, FL
- 13-15 Sep: *ESMAC*, Stockholm, Sweden

This presentation will be available in a few days and sent to you!