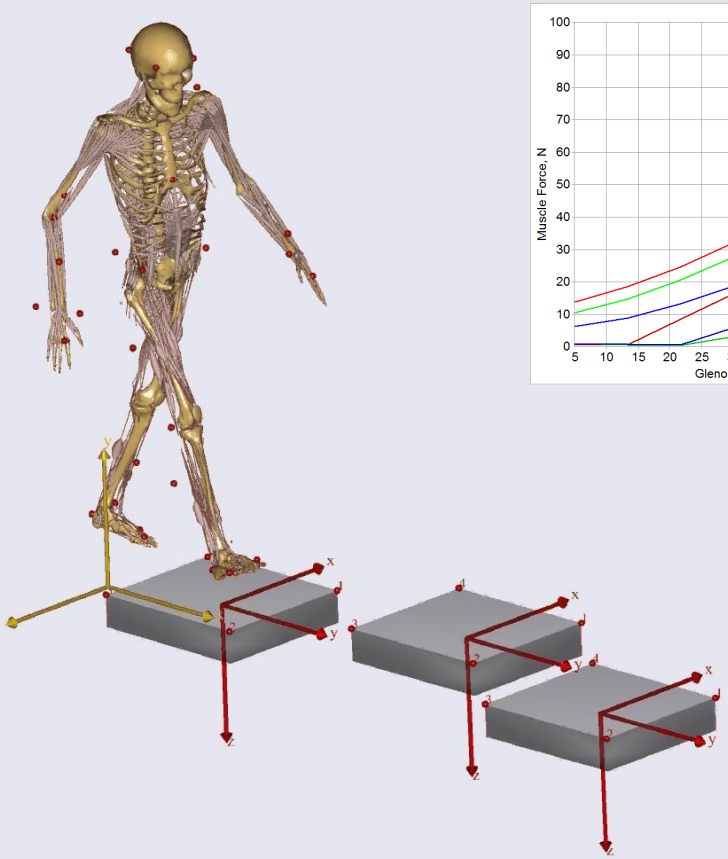
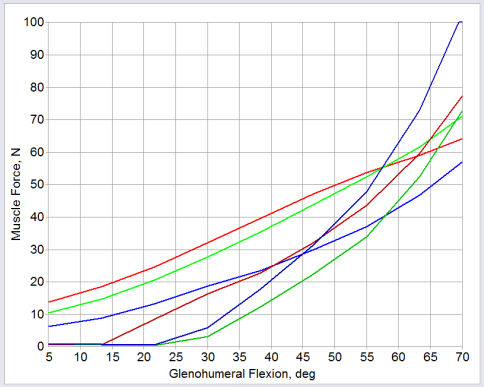
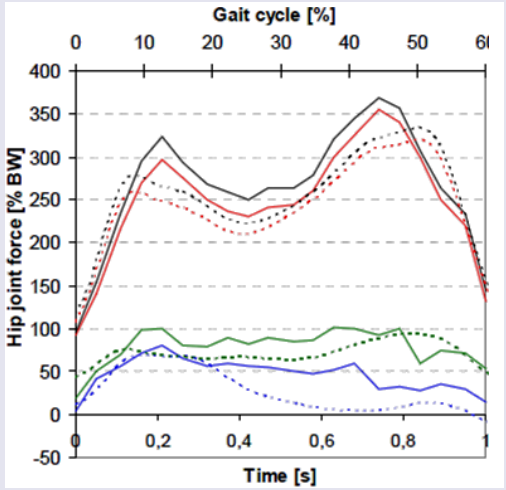
AnyGait: A powerful gait lab application to process motion capture trials

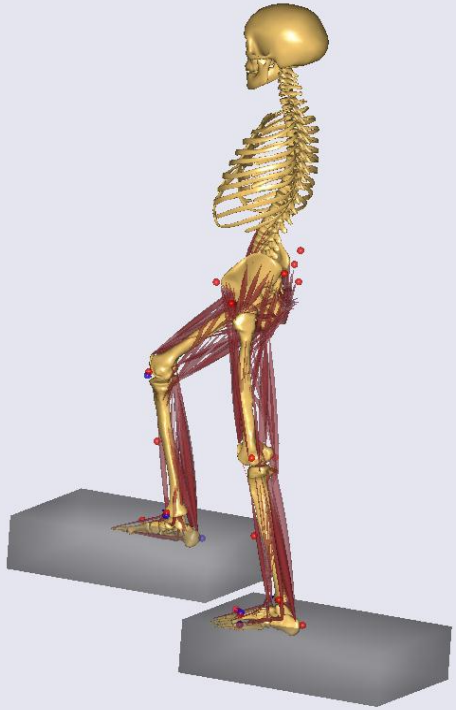
Amir Al-Munajjed, Søren Tørholm & *Arne Kiis*

The web cast will start in a few minutes….









Presenters

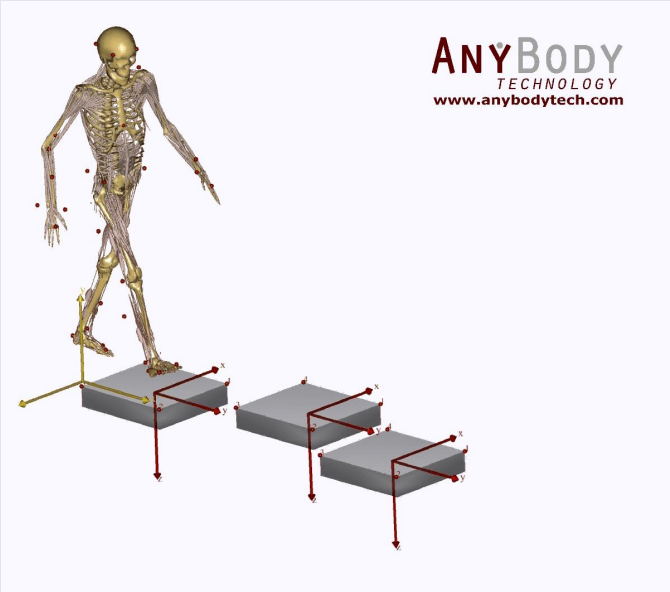
Arne Kiis
(Host/Panelist)

Søren Tørholm
(Panelist)

Amir Al-Munajjed
(Presenter)

Agenda

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



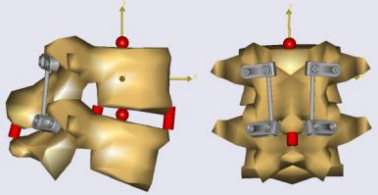
AnyBody Technology

- Software licenses
- Consulting
- Training
- Support
- AnyGait

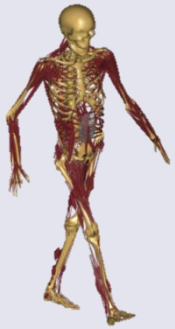
2002

2006

2010

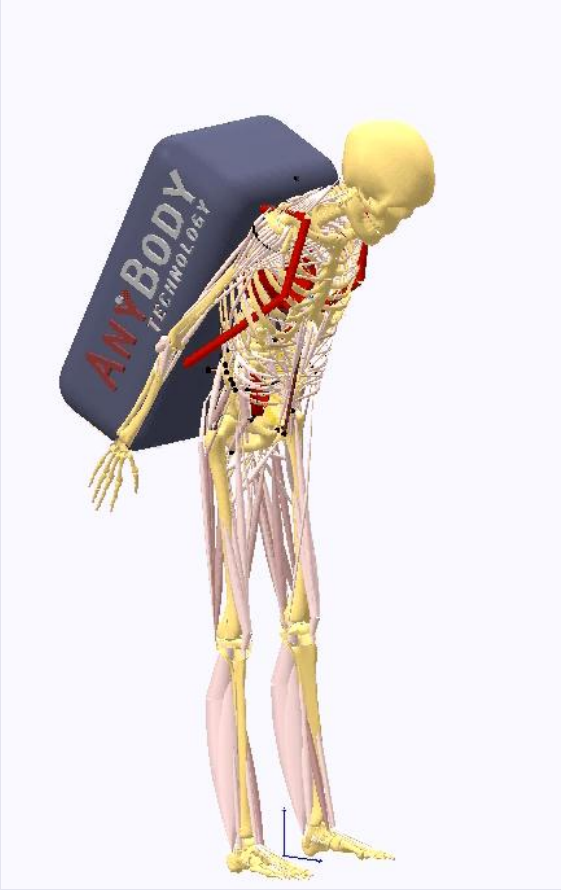


2012

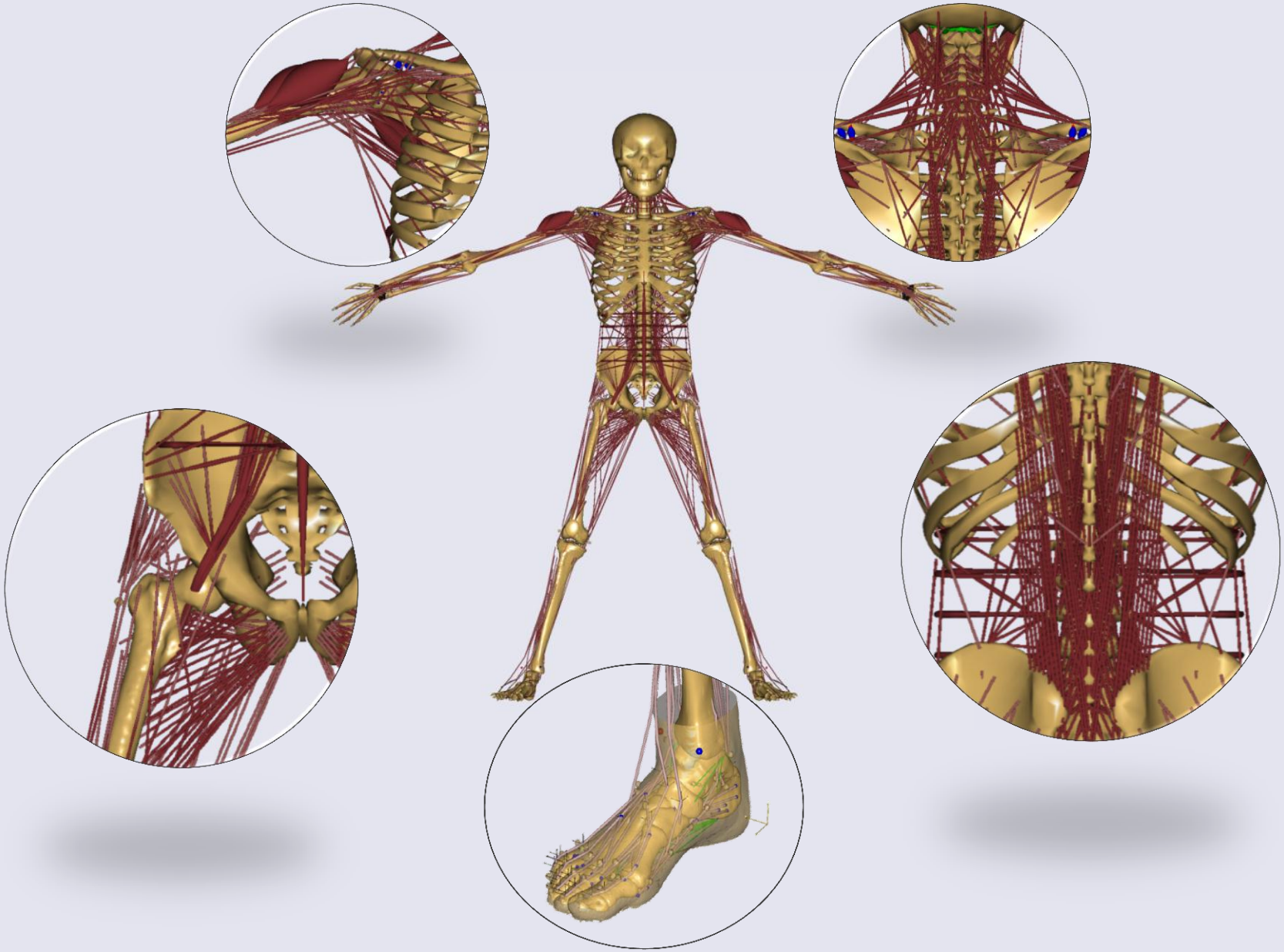


AnyBody Modeling System

- 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

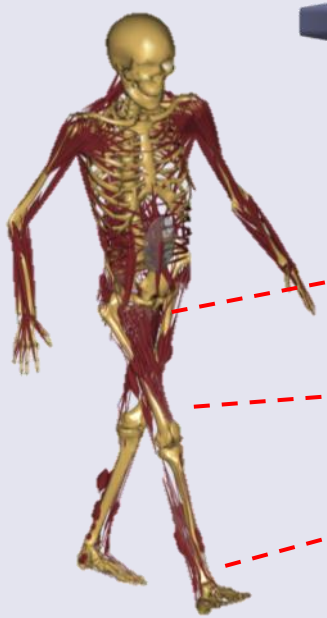


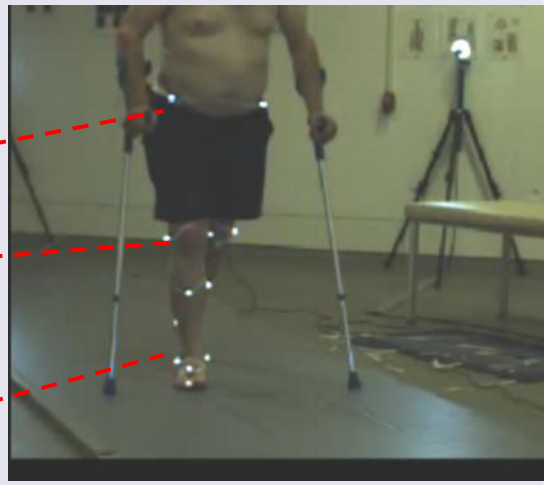
Body Model Library



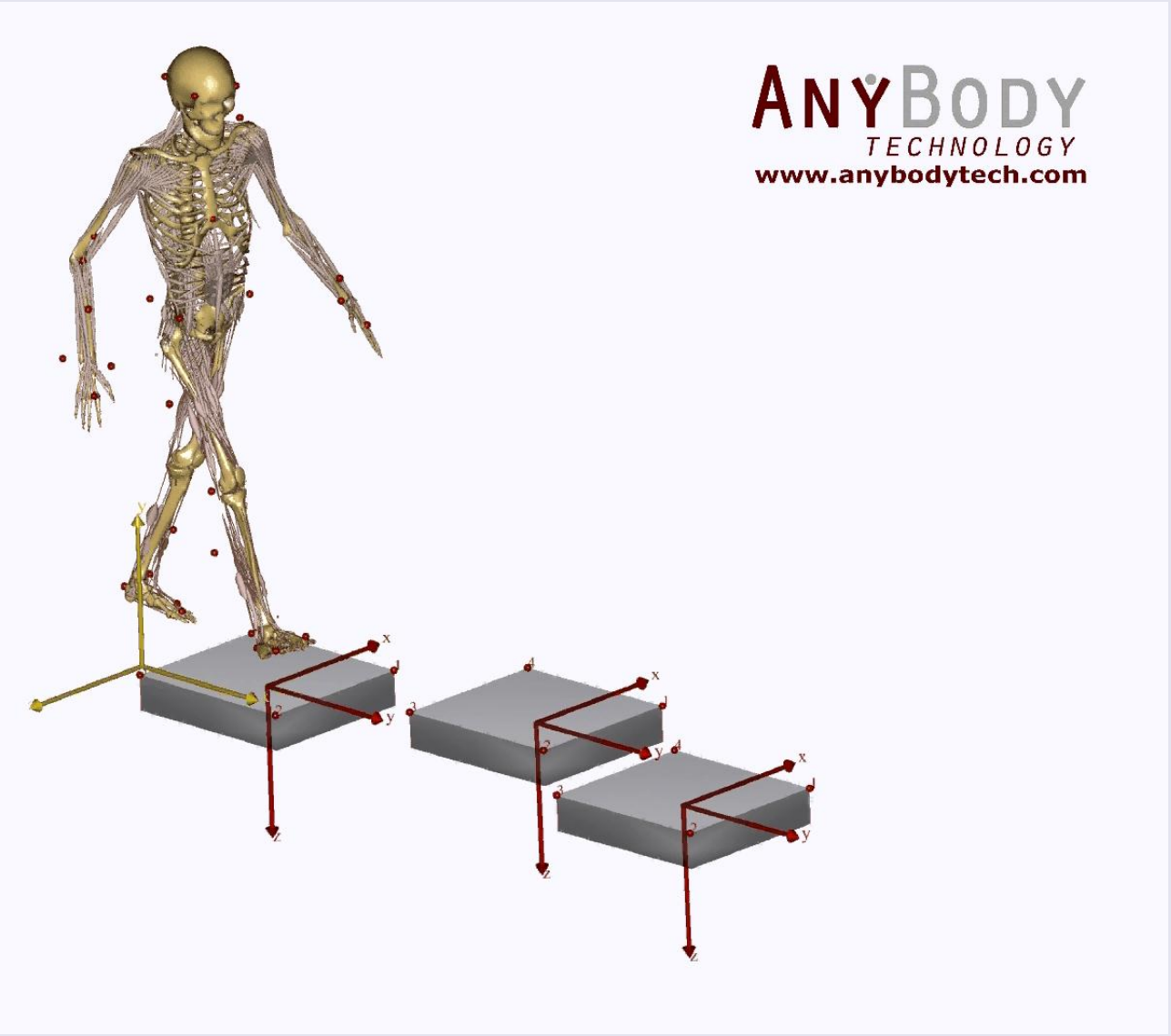
Subject Specific Modeling

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

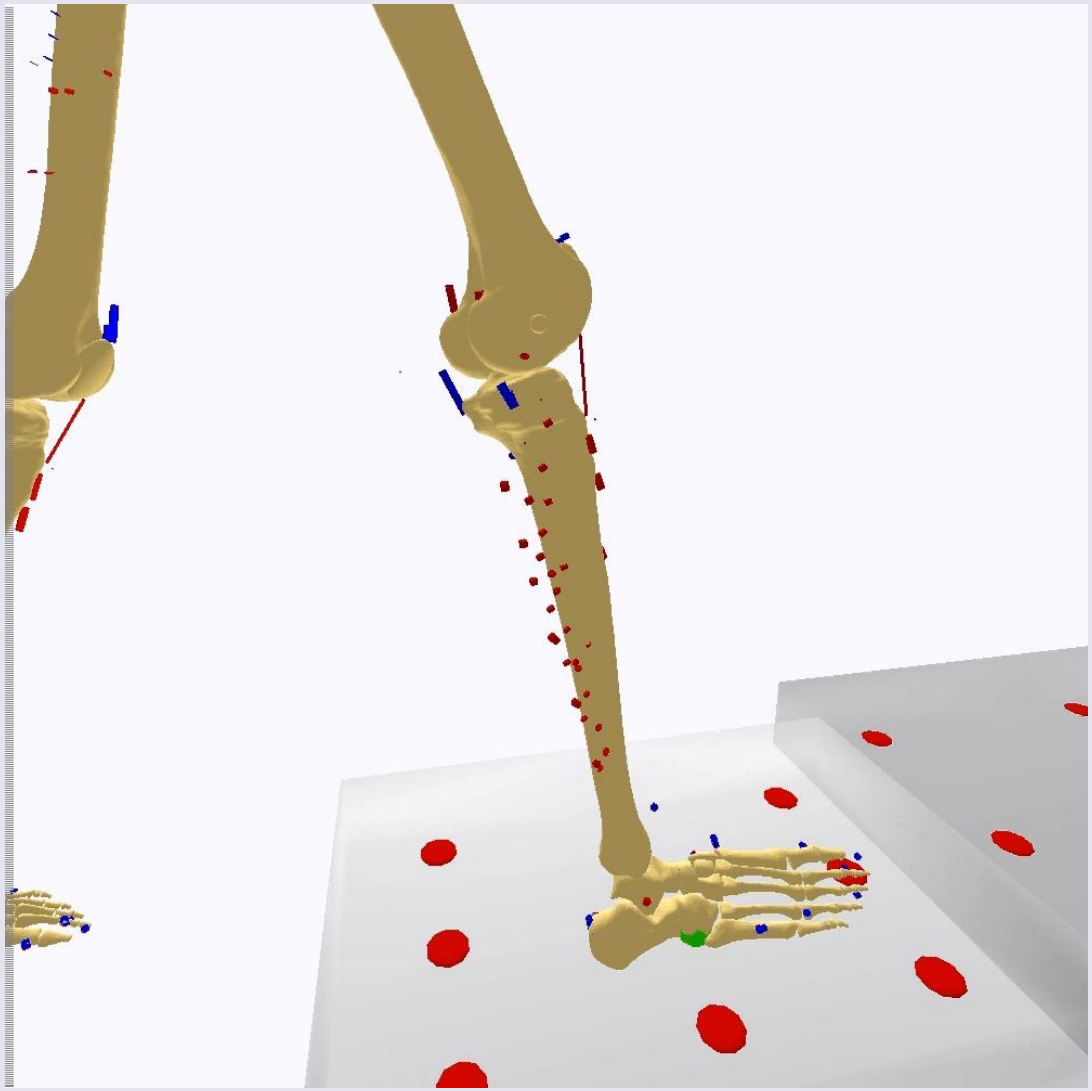




Activities of Daily Living

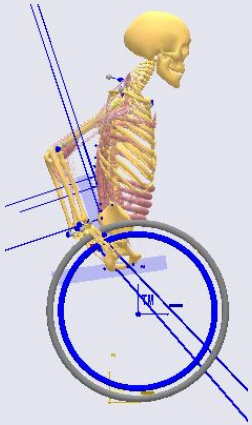


Dynamic Physiological Loads

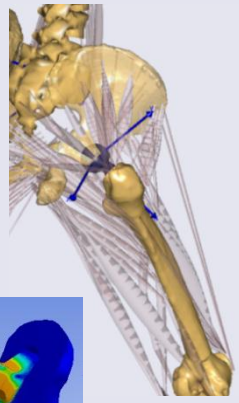


ANYBODY TECHNOLOGY

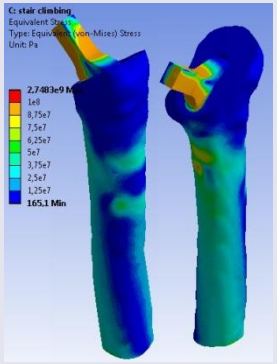
Product design optimization

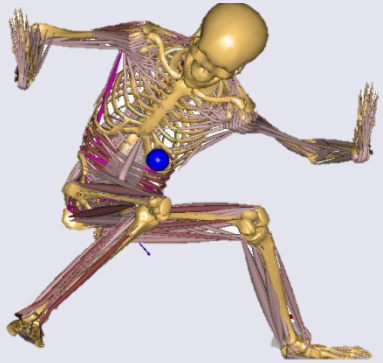


Ergonomic analysis and documentation

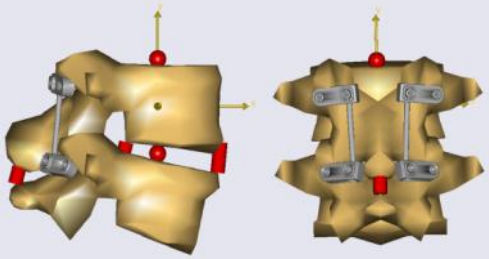


ANYBODY
Modeling System





Physiological load cases for Finite Element Analysis



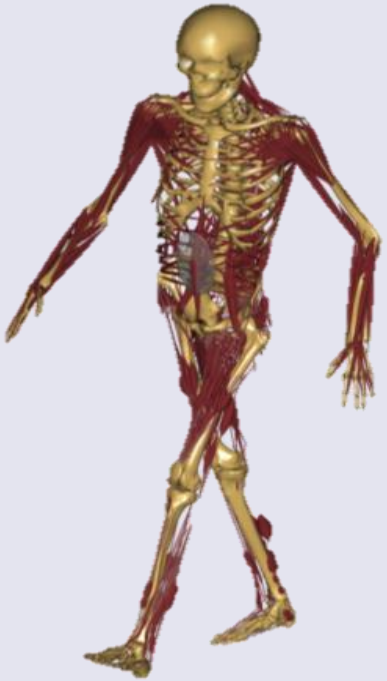
Pre-op planning post-op evaluation, failure analysis

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

AnyGait - Model

AnyGait is:

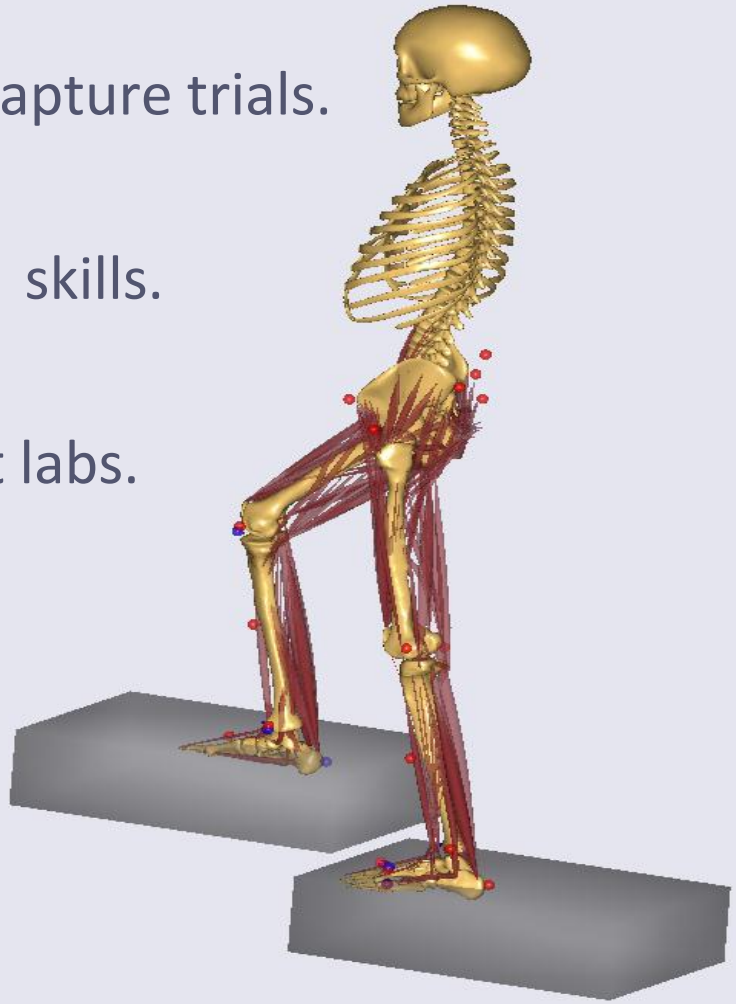
- an easy-to-use model to analyze motion capture trials in a gait lab or clinical environment.
- a *Gait Application* with all major muscle fascicles.
- highly customable to fit specific needs of gait labs (gait lab setup, patient group, …)



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.



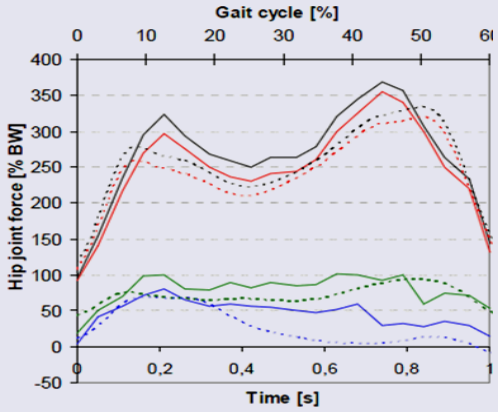
AnyGait – Input/Output

Input:

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

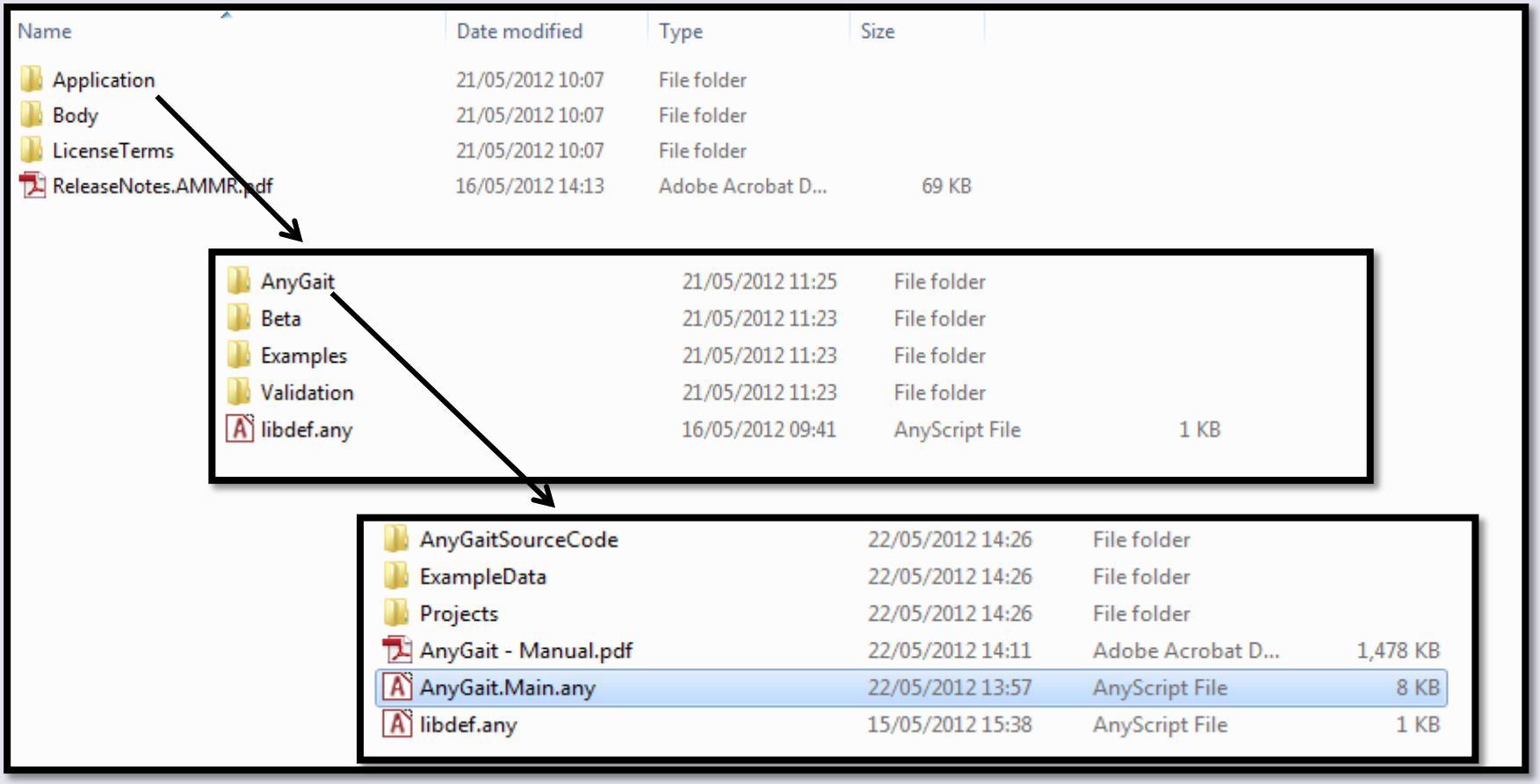
Output:

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

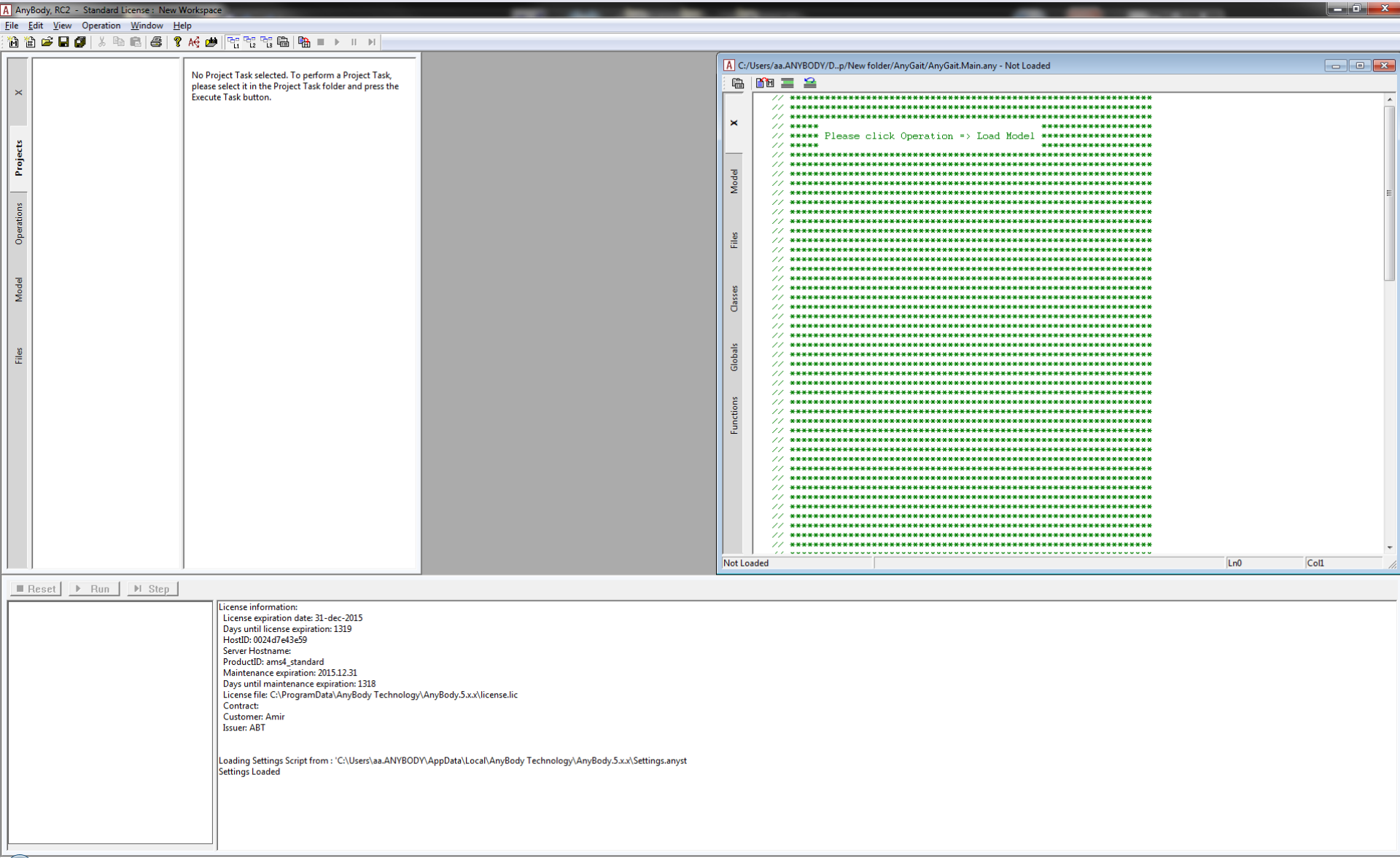


Open AnyGait

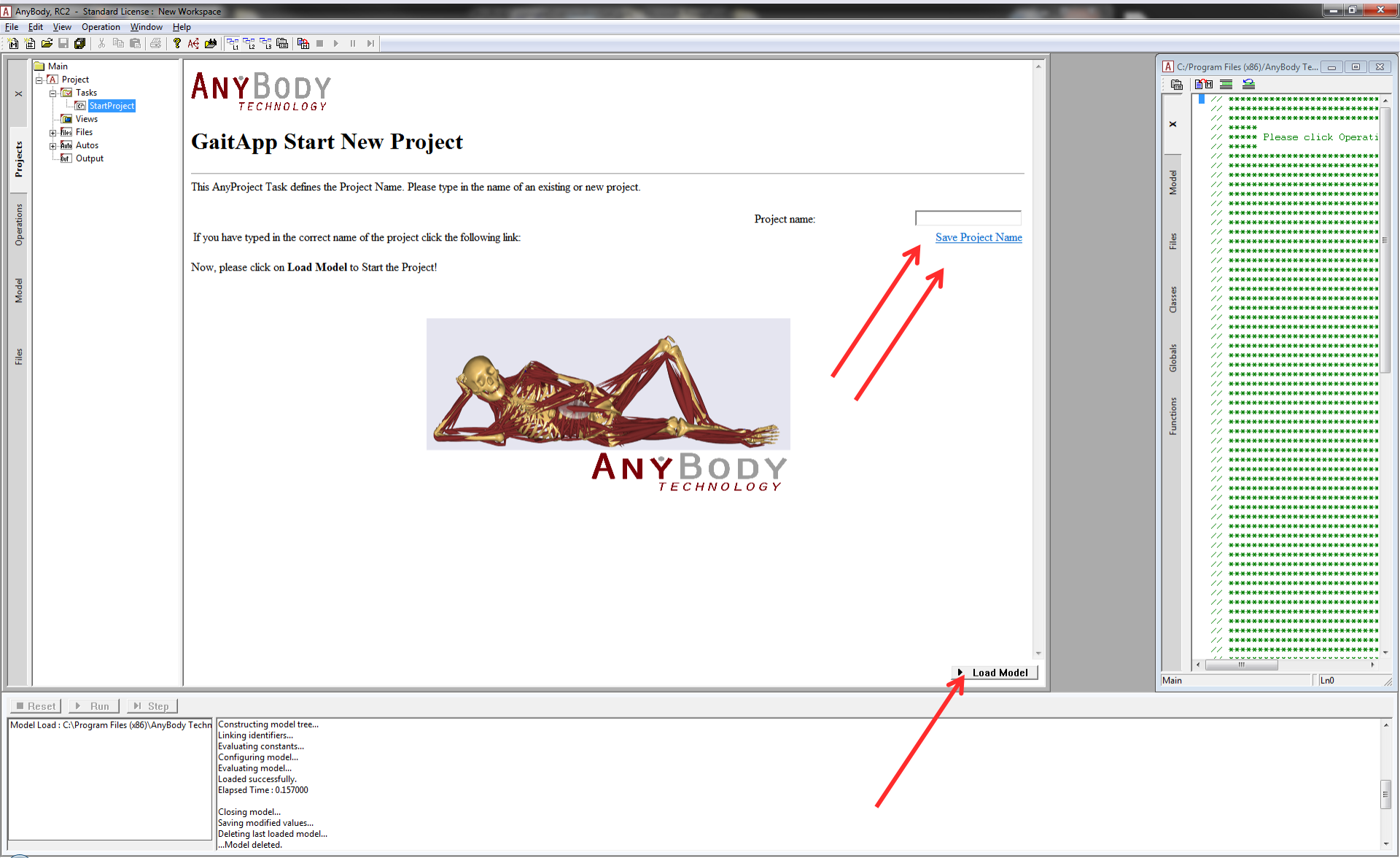
AMMR v1.5: AnyBody Managed Model Repository



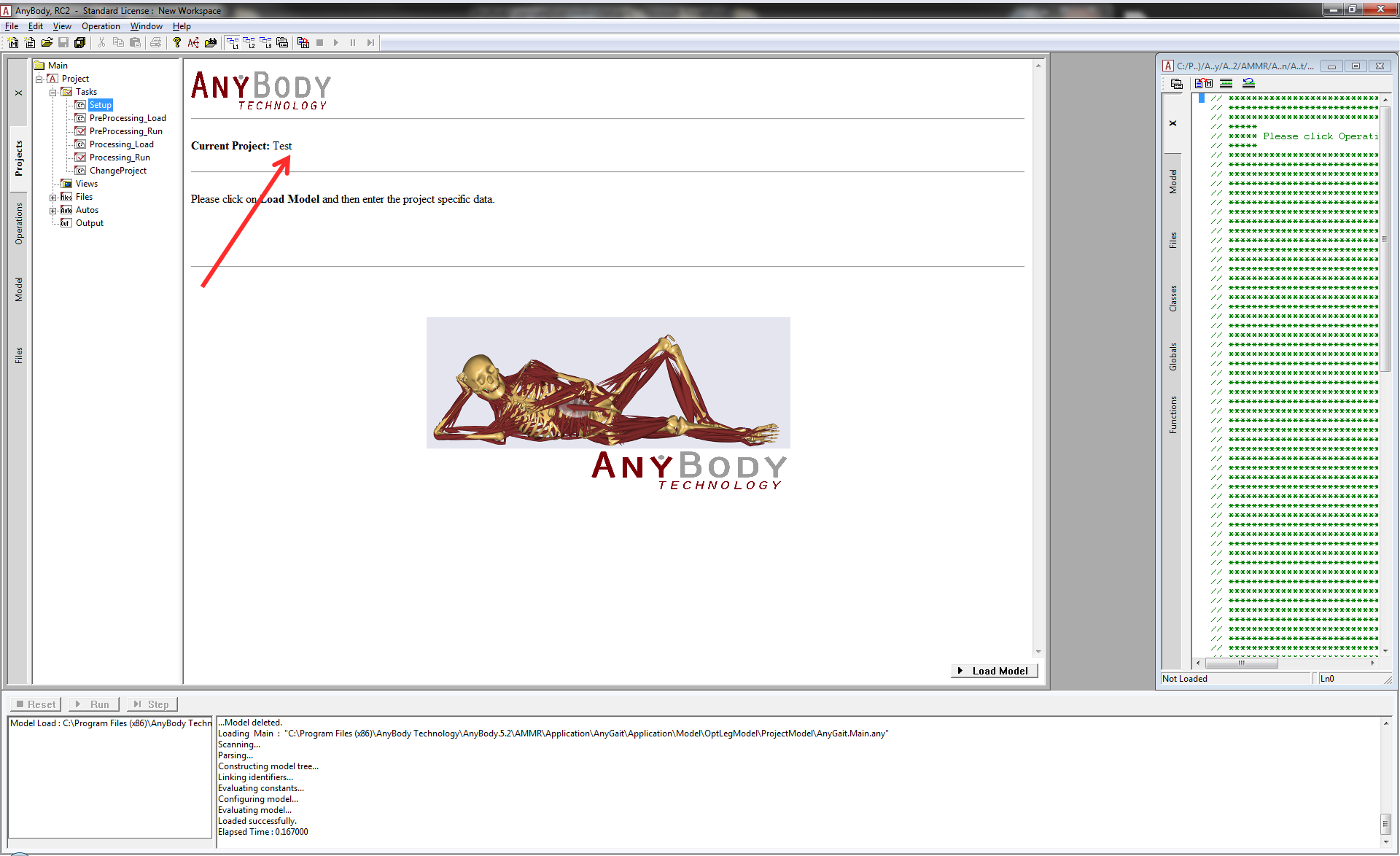
Load AnyGait



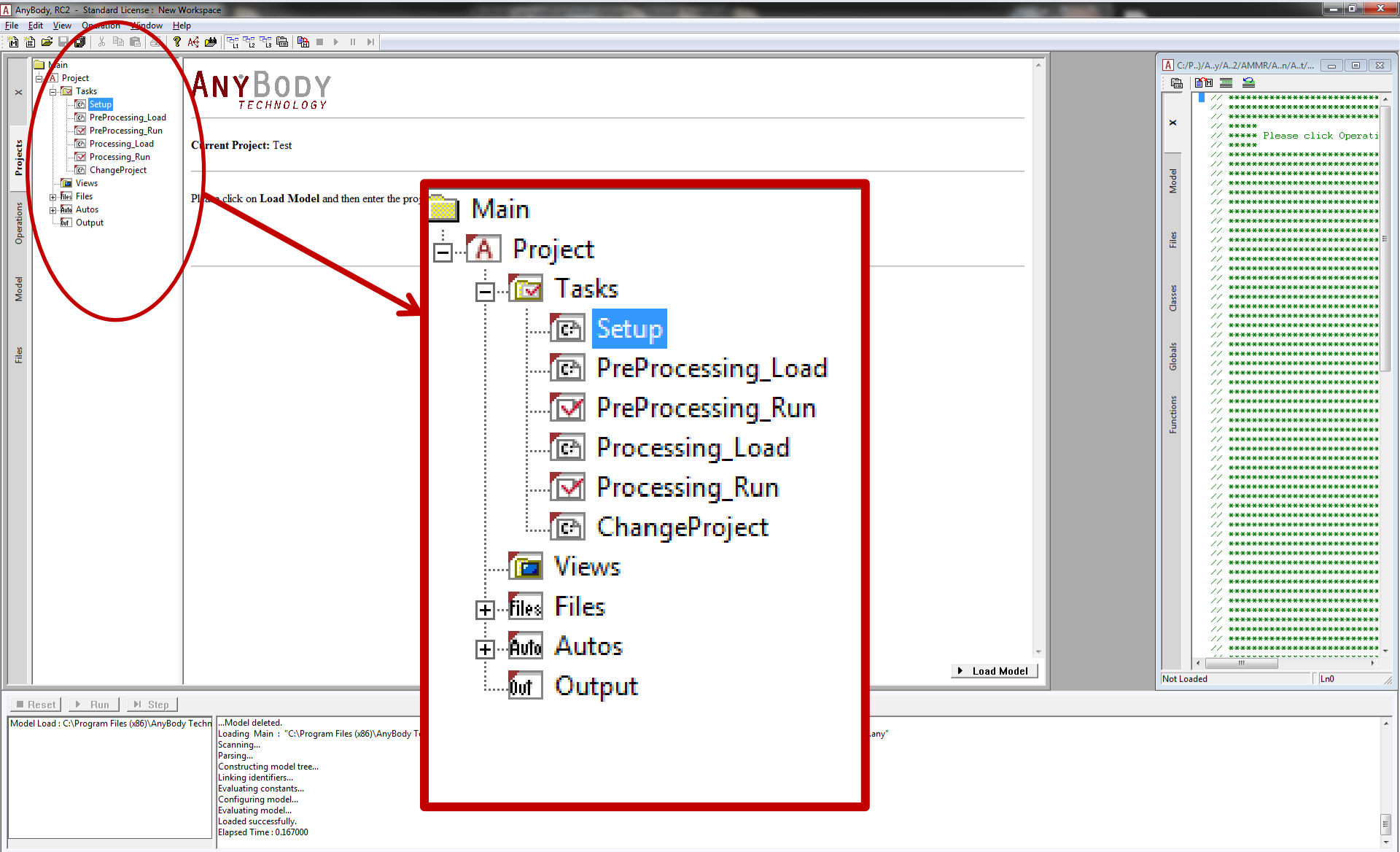
Start New Project



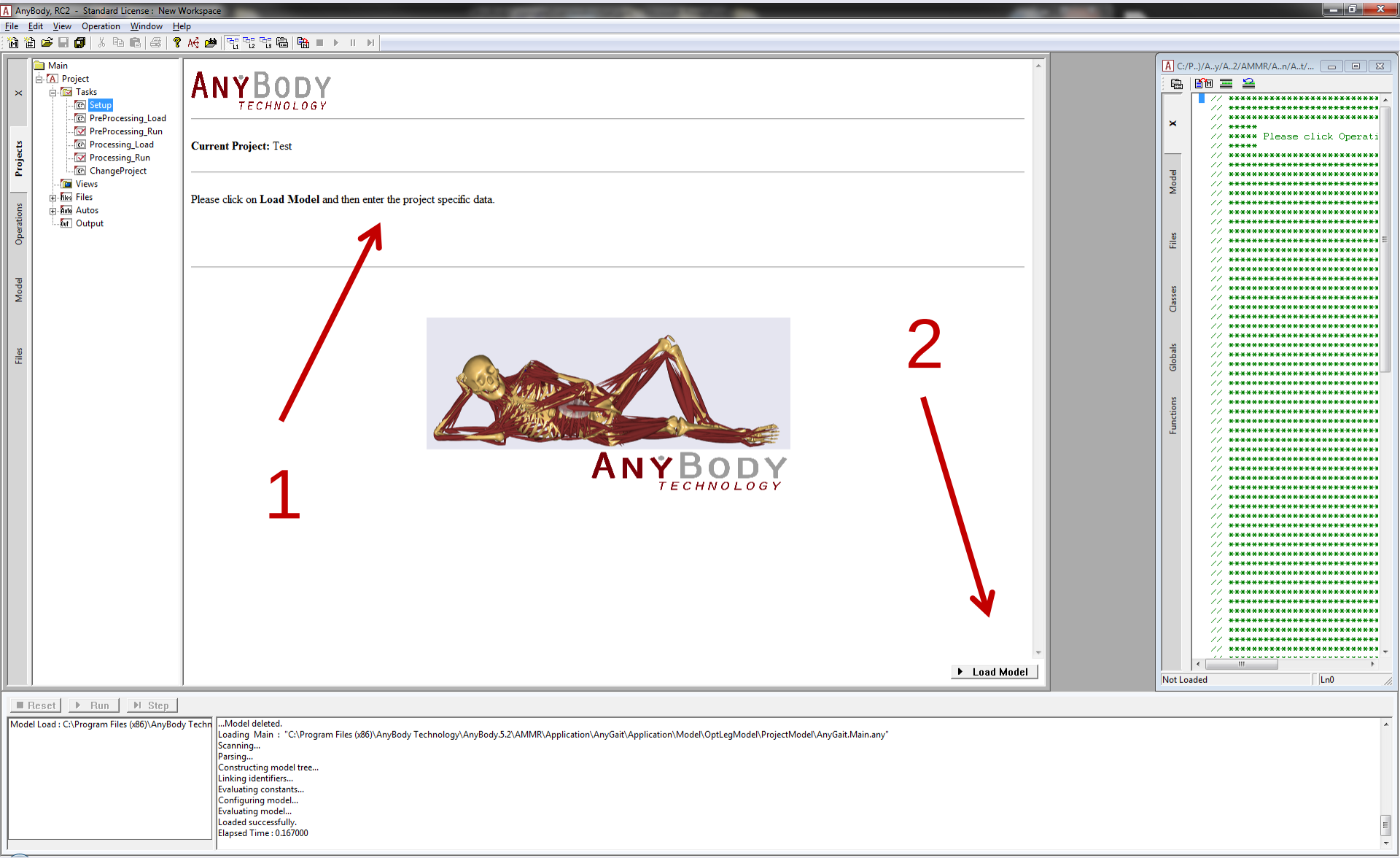
AnyGait Environment



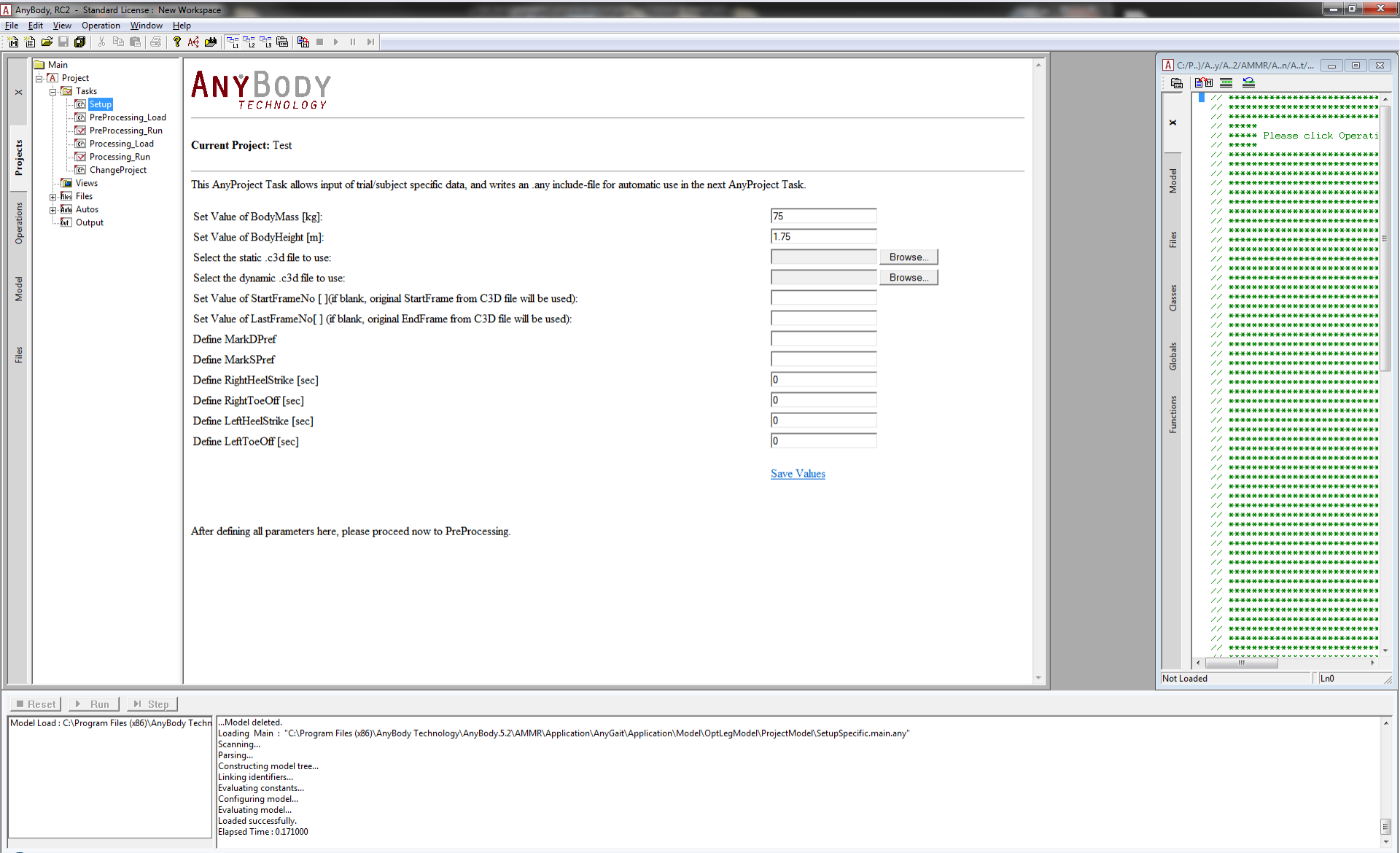
AnyGait Environment



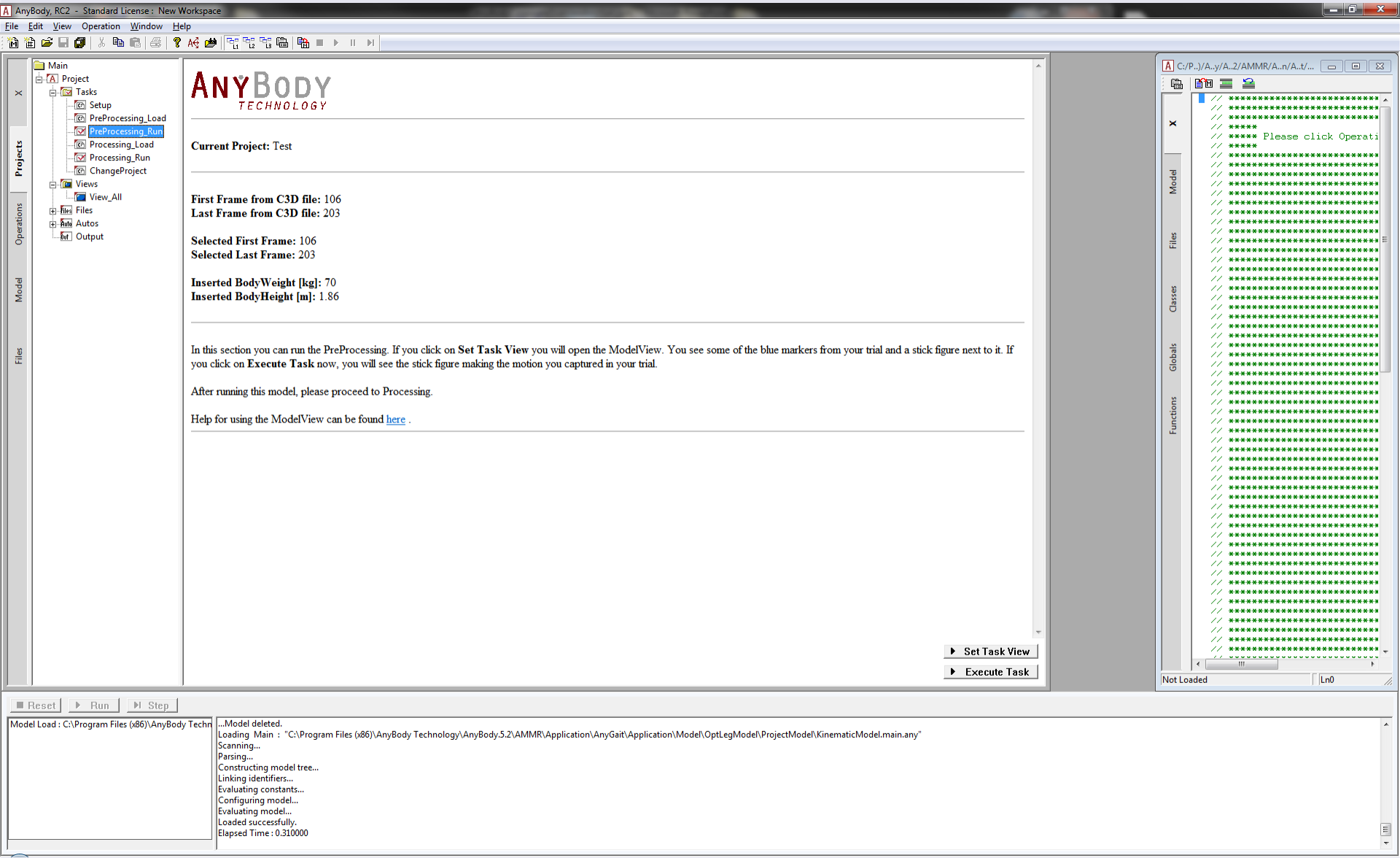
AnyGait Environment



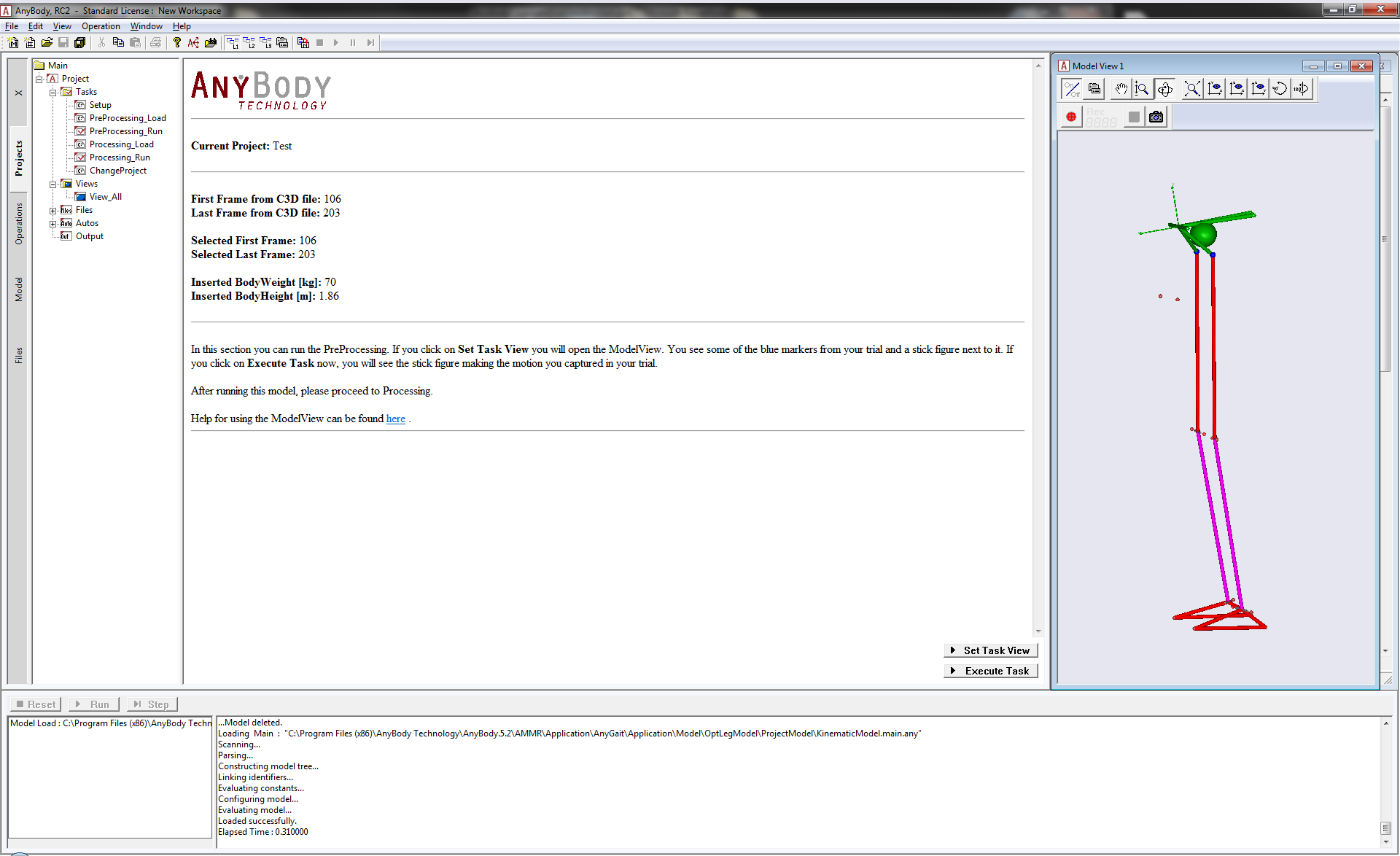
Setup Environment



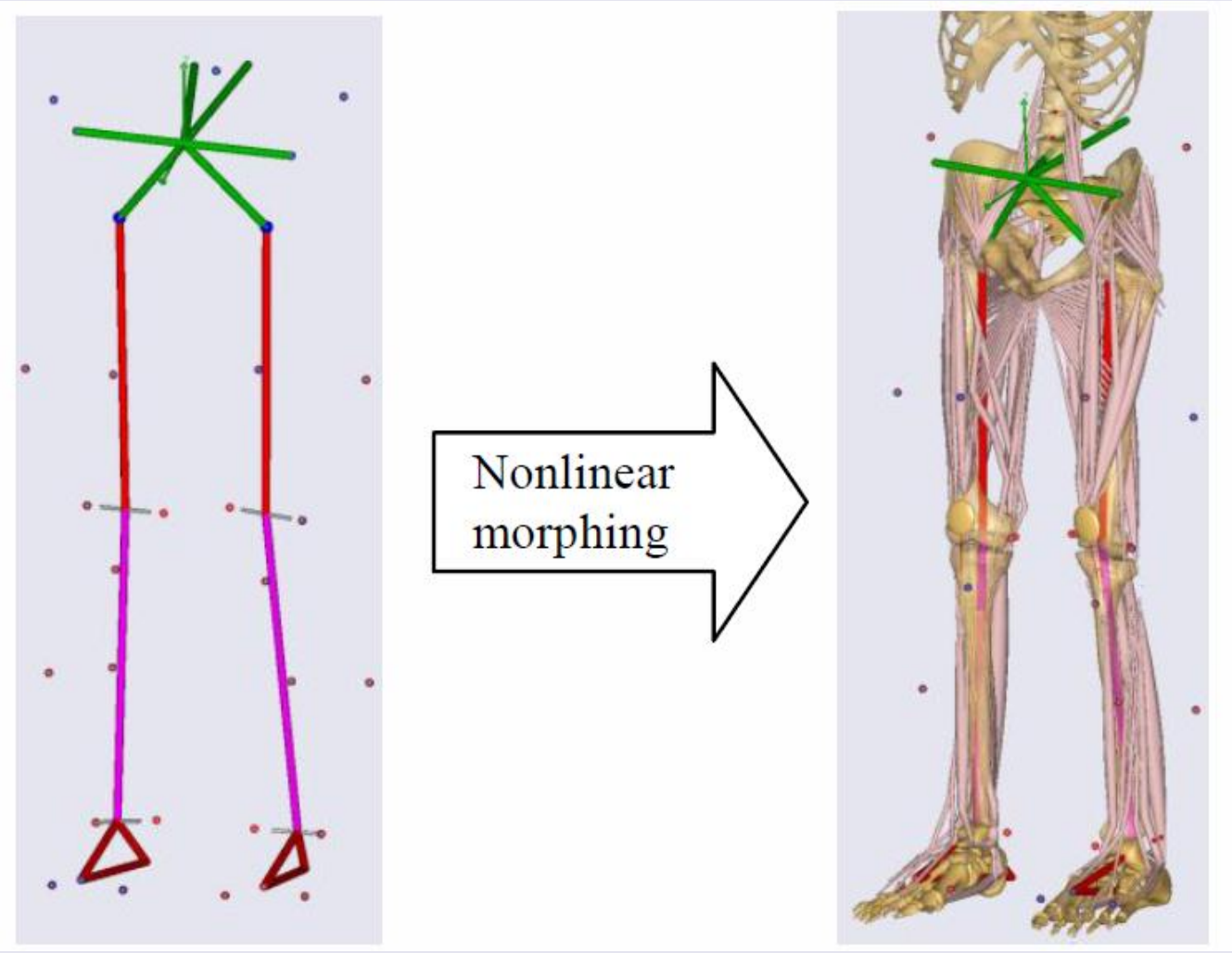
PreProcessing Environment



PreProcessing Environment

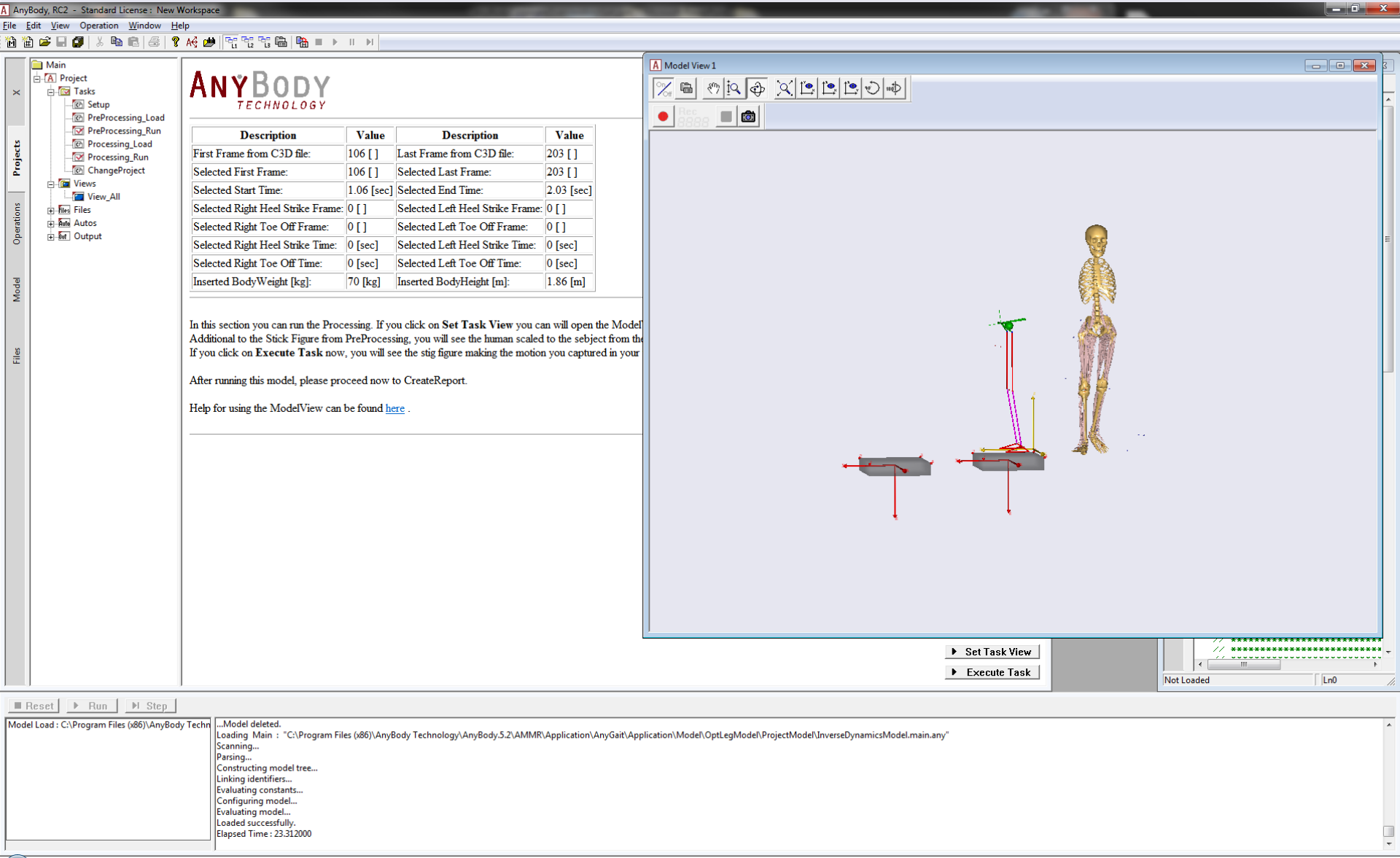


Nonlinear Morphing



M.S. Andersen *et al.* 2012

Processing Environment



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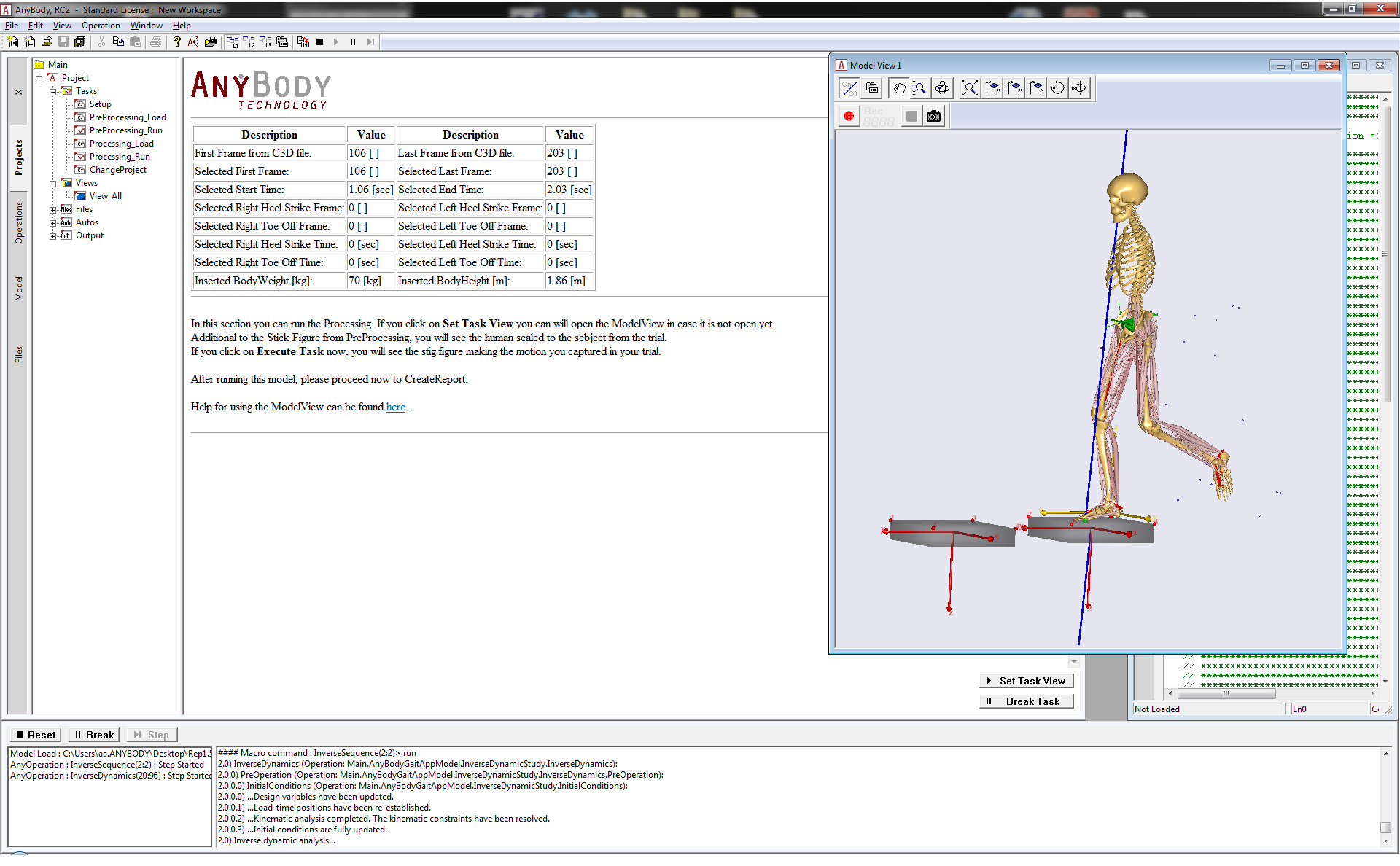

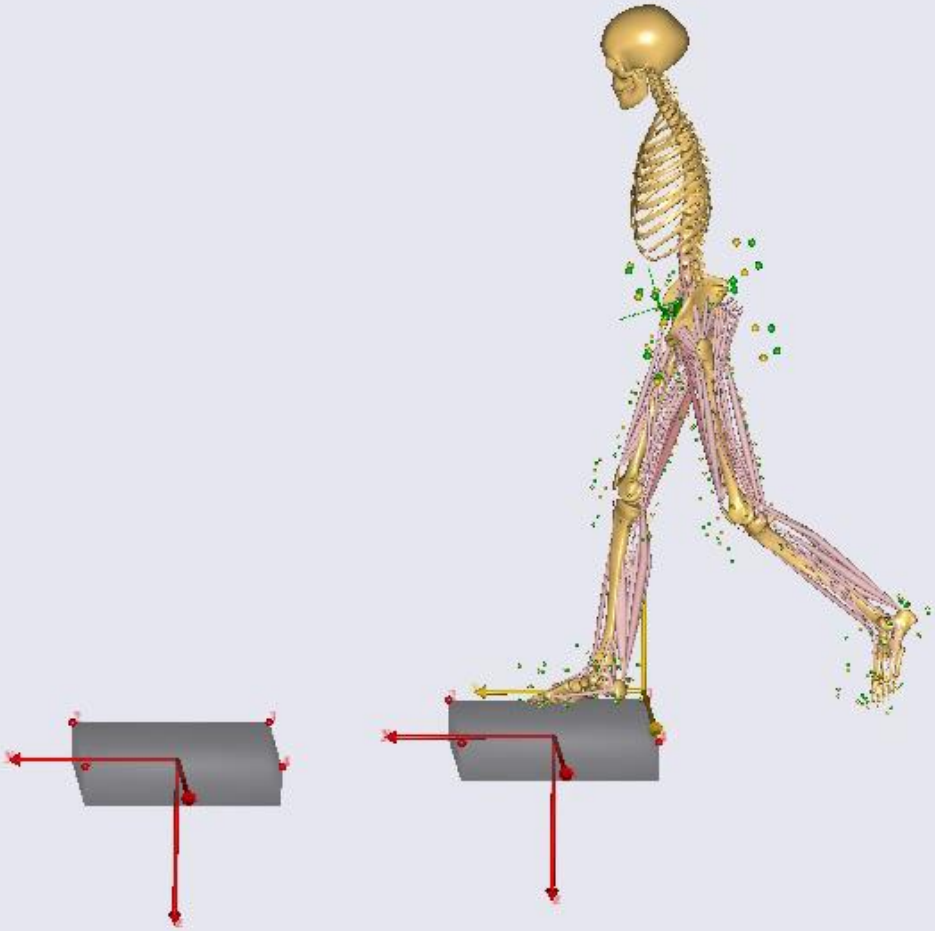

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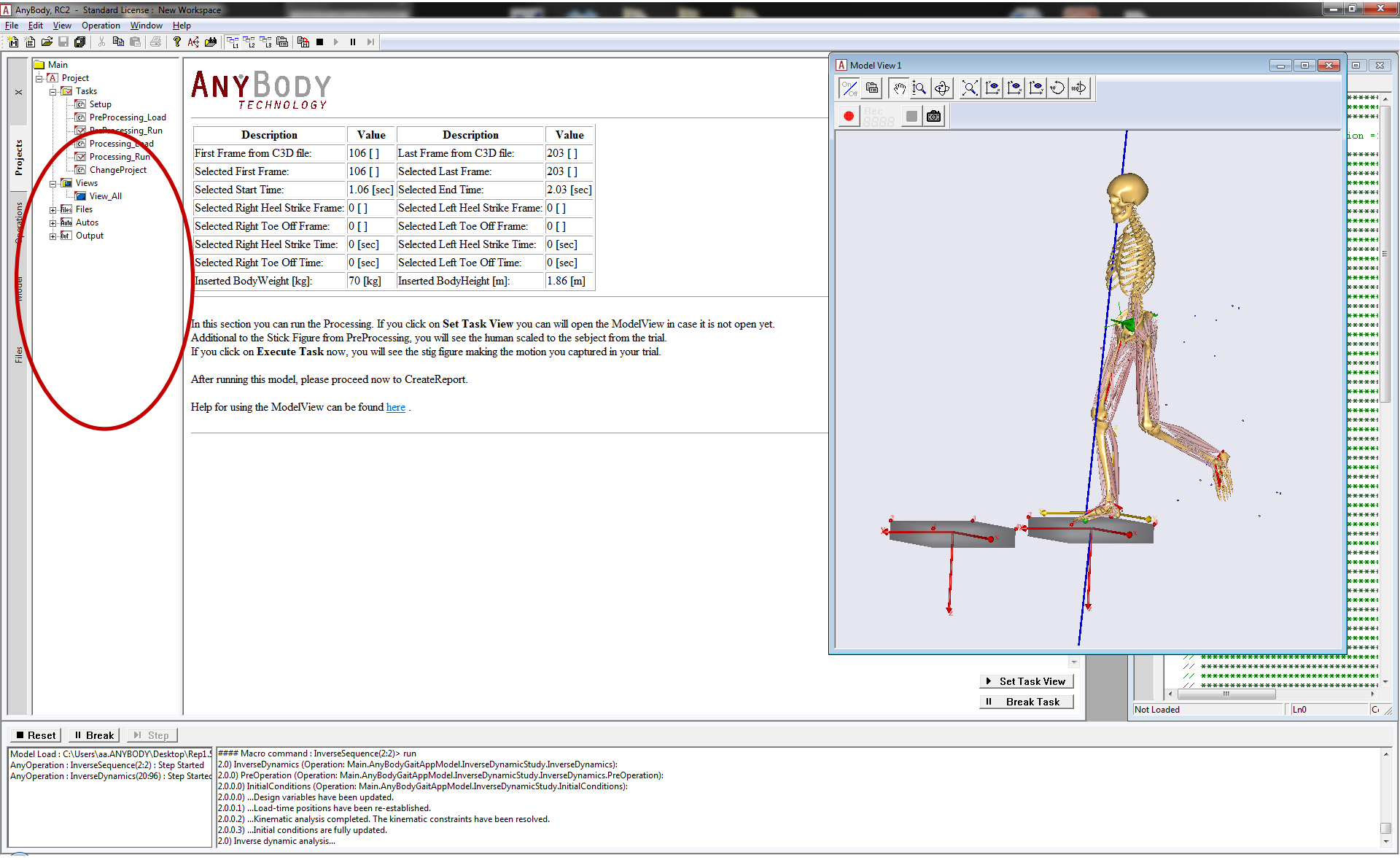
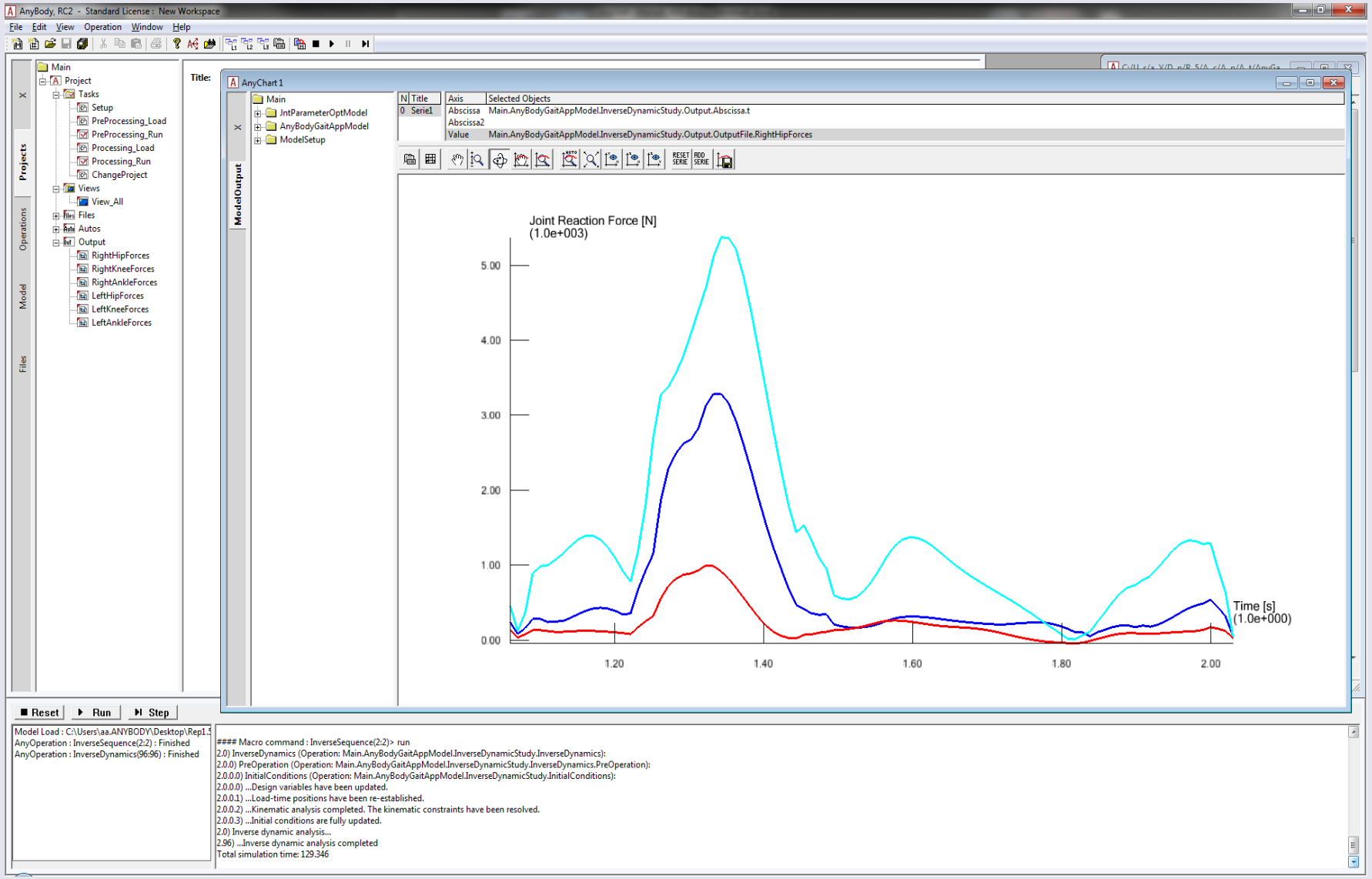


Results


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
RightHipForces
RightKneeForces
RightAnkleForces
LeftHipForces
LeftKneeForces
LeftAnkleForces
Title:
AnyChart 1
JntParameterOptModel
AnyBodyGaitAppModel
ModelSetup
Axis
Selected Objects
Abscissa Main.AnyBodyGaitAppModel.InverseDynamicStudy.Output.Abscissa.t
Abscissa2
Value Main.AnyBodyGaitAppModel.InverseDynamicStudy.Output.OutputFile.RightHipForces
Joint Reaction Force [N]
(1.0e+003)
5.00
4.00
3.00
2.00
1.00
0.00
1.20
1.40
1.60
1.80
2.00
Time [s]
(1.0e+000)
Reset
Run
Step
Model Load : C:\Users\aa.ANYBODY\Desktop\Rep1.
AnyOperation : InverseSequence(2:2) : Finished
AnyOperation : InverseDynamics(96:96) : Finished
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...
2.96) ...Inverse dynamic analysis completed
Total simulation time: 129.346

Output

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

Test	22/05/2012 14:26	File folder	
CurrentConfig.any	22/05/2012 13:23	AnyScript File	1 KB

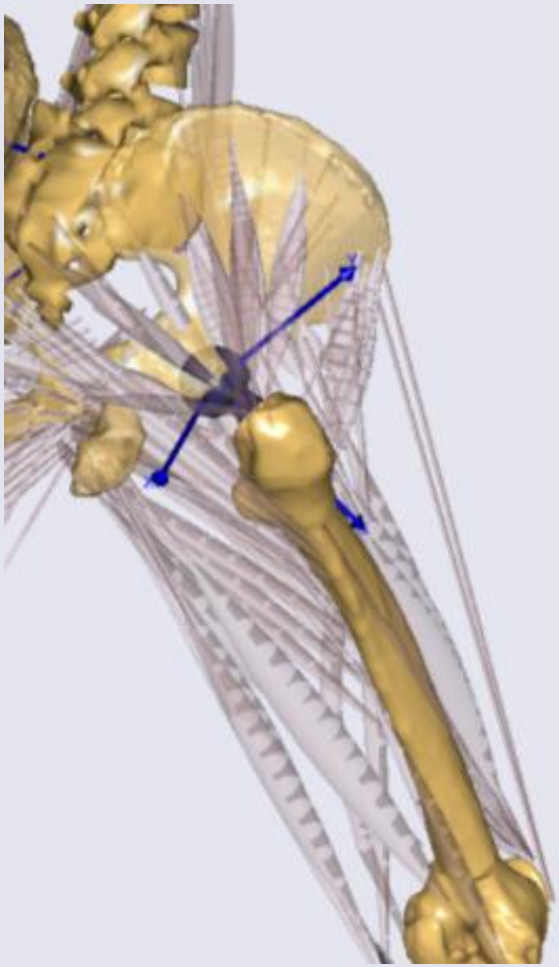
setupfile.any	15/05/2012 15:38	AnyScript File	1 KB
dyn.c3d	15/05/2012 15:38	C3D data file	167 KB
stat.c3d	15/05/2012 15:38		
GCD	22/05/2012 14:00		
-output-euler-leftlegtd.txt	22/05/2012 13:22		
-output-euler-pelvis.txt	22/05/2012 13:22		
-output-euler-rightlegtd.txt	22/05/2012 13:22		
Results.txt	22/05/2012 14:00		

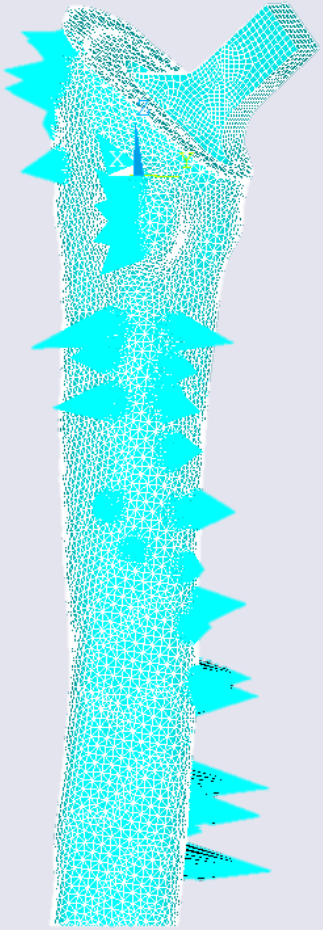
Marker Names

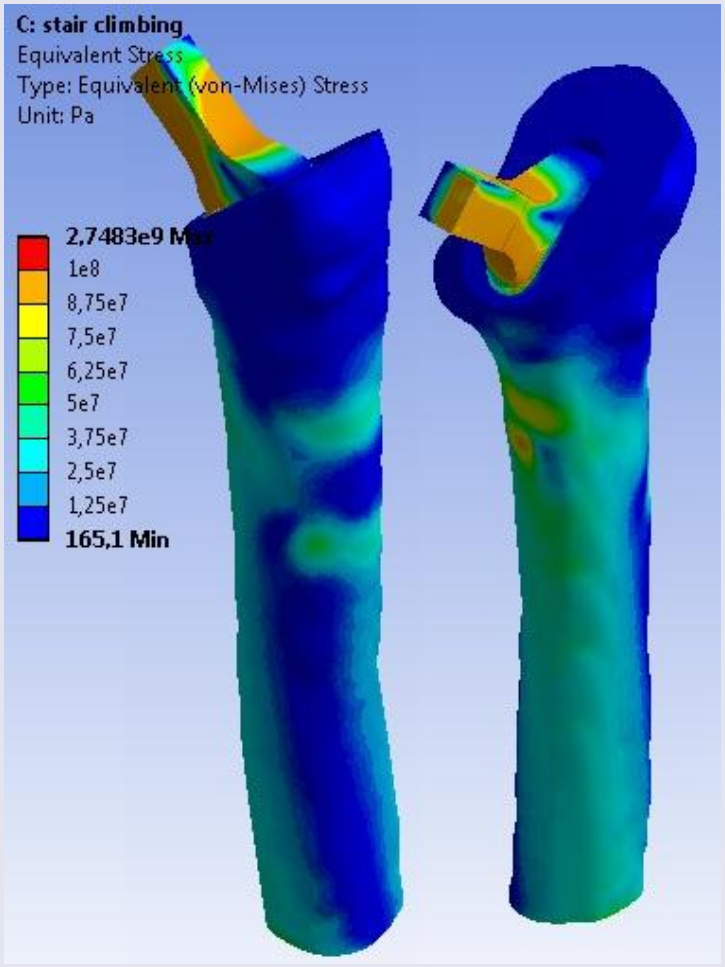
// Right Leg
RThighSuperior, RKneeLateral, RKneeMedial, RShankSuperior, RAnkleLateral, RAnkleMedial, RHeel, RToe
// Left Leg
LThighSuperior, LKneeLateral, LKneeMedial, LShankSuperior, LAnkleLateral, LAnkleMedial, LHeel, LToe
// Hip
RAsis, LAsis, RPsis, LPsis

// 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







Putzer *et al.* 2011

Special Issue Article

Institution of MECHANICAL ENGINEERS

Journal of ENGINEERING IN MEDICINE

Proc IMechE Part H:
J Engineering in Medicine
0(0) 1–8

DOI: 10.1177/0954411912447728
pih.sagepub.com
SAGE

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

Tim Weber[1,2], Sebastian Dendorfer[2], Silvia Dullien[1], Joachim Grifka[1], Gijsbertus Jacob Verkerke[3,4] and Tobias Renkawitz[1]

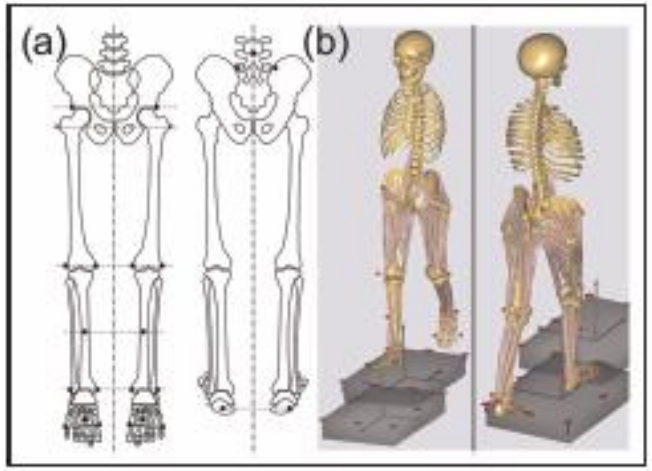


Figure 1. (a) The specified marker set used in this study and its placement on the bony landmarks; (b) front and rear view of subject 1 during the musculoskeletal simulation.

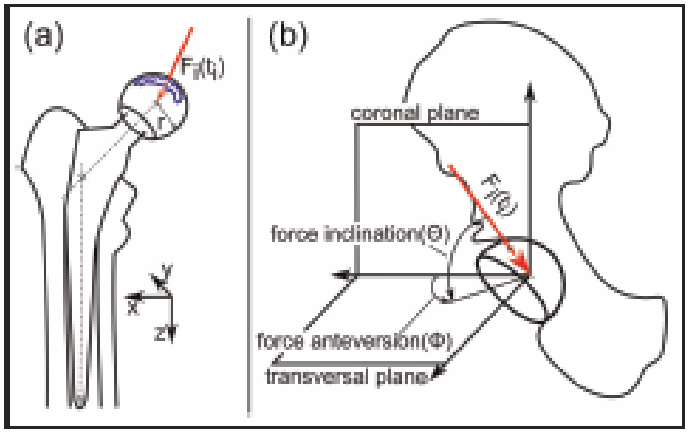


Figure 2. (a) Force path (line) on the head of the implant for every computed time step (t_i) during the stance phase. (b) Force angles (and their definition) on the cup of the joint for every computed time step (t_i) during the stance phase.

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

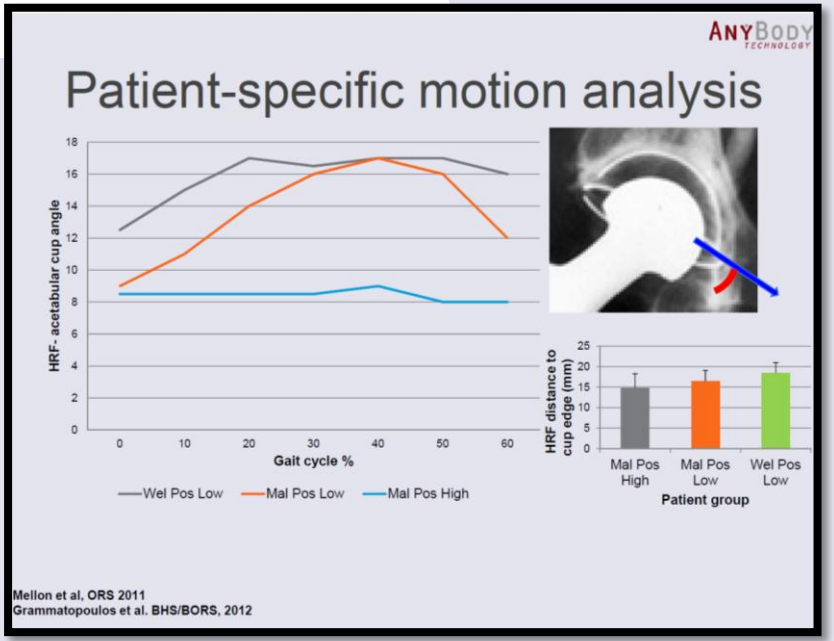
Andersen M. S. [1], Mellon S. [2], Lund M. E. [1],Grammatopoulos G. [2], Gill H. S. [2]
[1] M-Tech, Aalborg University, Aalborg, Denmark, msa@m-tech.aau.dk
[2] NDORMS, University of Oxford, Oxford, United Kingdom

3DHMA 2012, Bologna, Italy

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

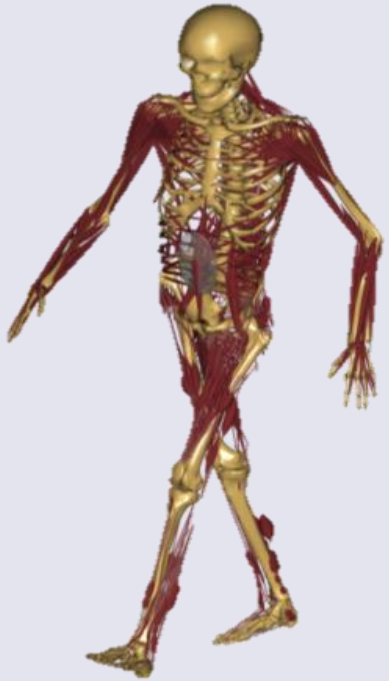
G Grammatopoulos, S Mellon, M S Andersen, H Pandit, R Gundle, P McLardy- Smith, D Murray, H Gill
NDORMS, University of Oxford, Oxford, Nuffield Orthopaedic Centre, Oxford, UK, Aalborg University, Denmark

ORS 2012, San Fransisco, CA

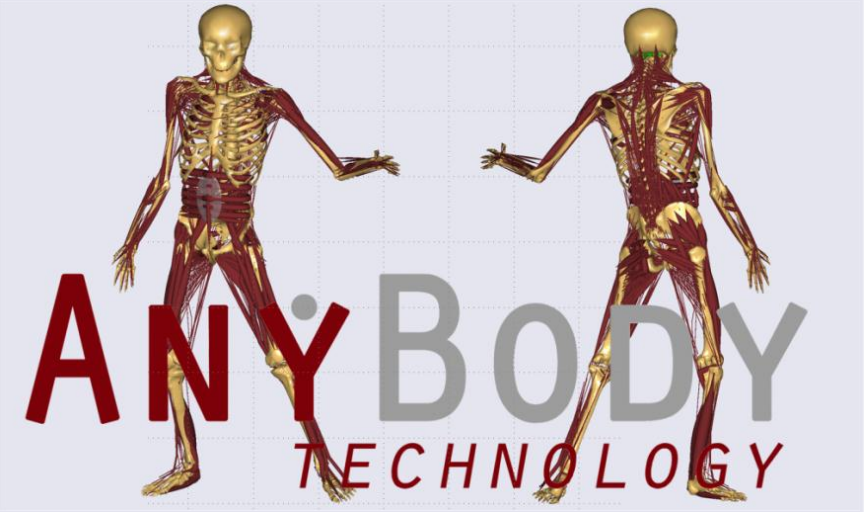


Final Remarks

- 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 customable 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!