

The webcast will start in a few minutes....

How to batch process

YOUR ANYBODY MODELS

Outline

- Introduction by the Host
- Batch Process AnyBody Models
 - Intro to the AnyBody macro language
 - Running models from Python
 - Create a simple Batch process setup
 - Example from LifeLongJoint project.
- Final words from the host
- Questions and answers



Morten Enemark Lund
R&D Engineer, AnyBodyTech
(Presenter)



Mohammad S. Shourijeh
R&D Engineer, AnyBodyTech
(Host)

Control Panel

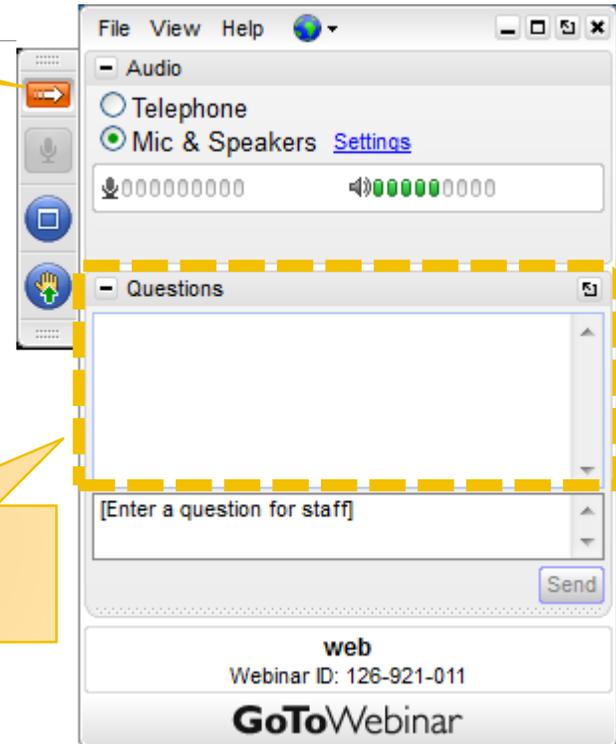
The Control Panel appears on the right side of your screen.

Submit questions and comments via the Questions panel.

Questions will be addressed at the end of the presentation. If your question is not addressed we will do so by email.

Expand/Collapse the Control Panel

Ask a question during the presentation



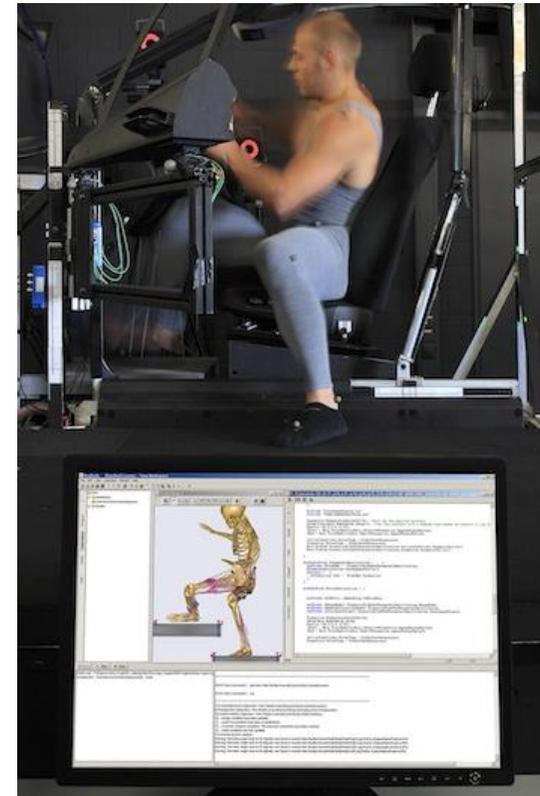
AnyBody Modelling System

Musculoskeletal analysis

AnyBody Managed Model Repository

Wide range of simulation options

- Motion capture
- Ground reaction force prediction
- Imaging → Patient-specific anatomy
- Man-machine simulations



Rasmussen et. al. (2011), ORS Annual Meeting



Movement
Analysis

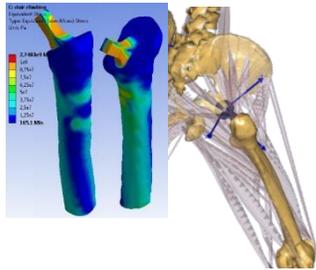


Product Design
Optimization



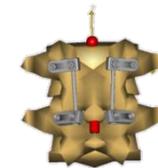
Ergonomic
Analysis

ANYBODY Modeling System

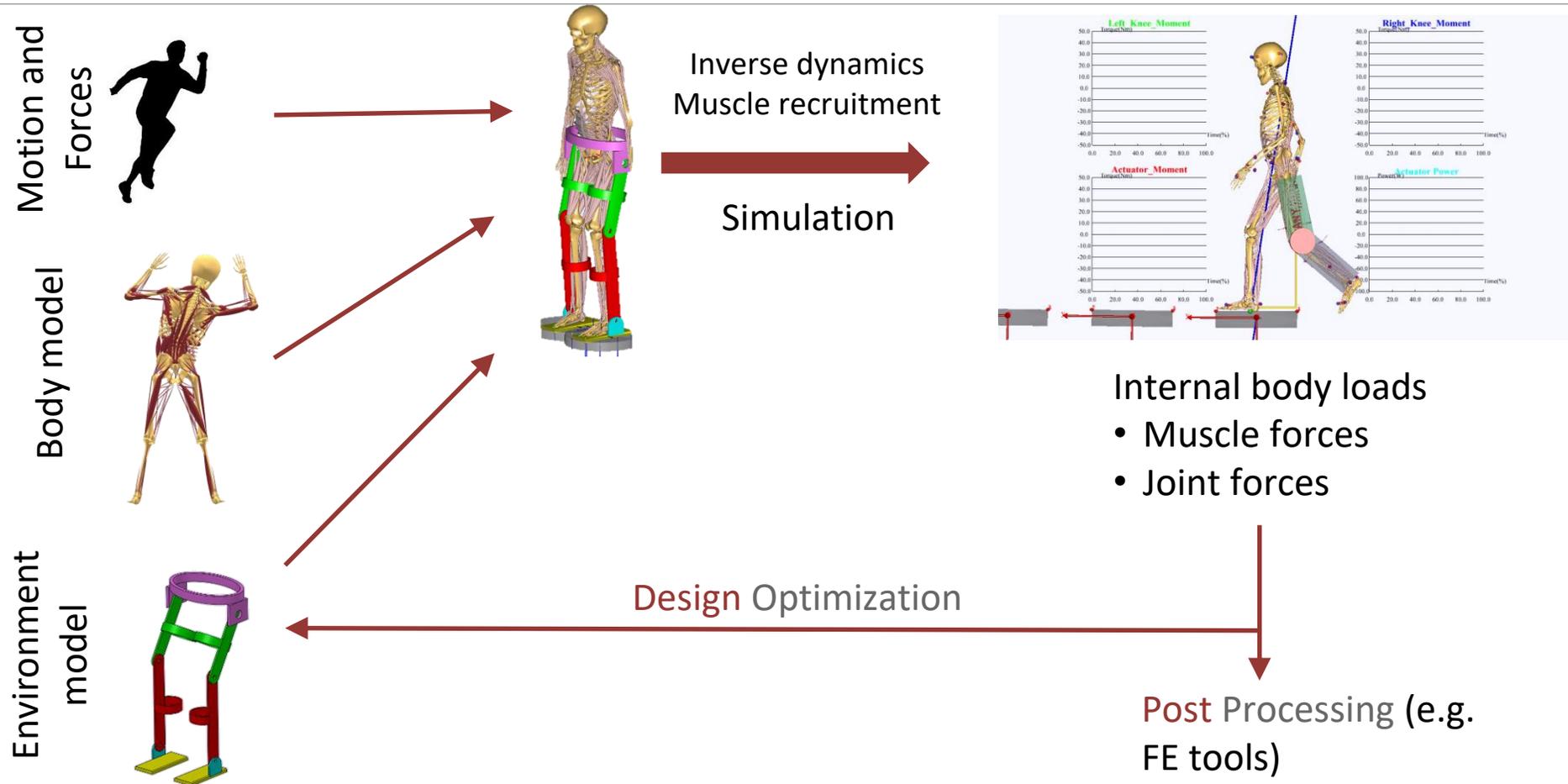


Load Cases for
Finite Element
Analysis

Surgical Planning and
Outcome Evaluation



AnyBody Modelling System



How to batch process

YOUR ANYBODY MODELS

Morten Enemark Lund
R&D Engineer
AnyBody Technology



Why automate your simulations?

- Best argument is *Reproducibility*
- Explore the effect of different inputs
- Batch process many models

16000 simulations



Simulation of Automotive Ergonomics based on Population specific Anthropometrics.

Kasper Pihl Rasmussen,
John Rasmussen
Aalborg University

Model example for this webcast

- A simple model to calculate the moment arms for the hip

```
C:\how-to-batch-process-anybody-models\macro examples\hip.any - Not Loaded

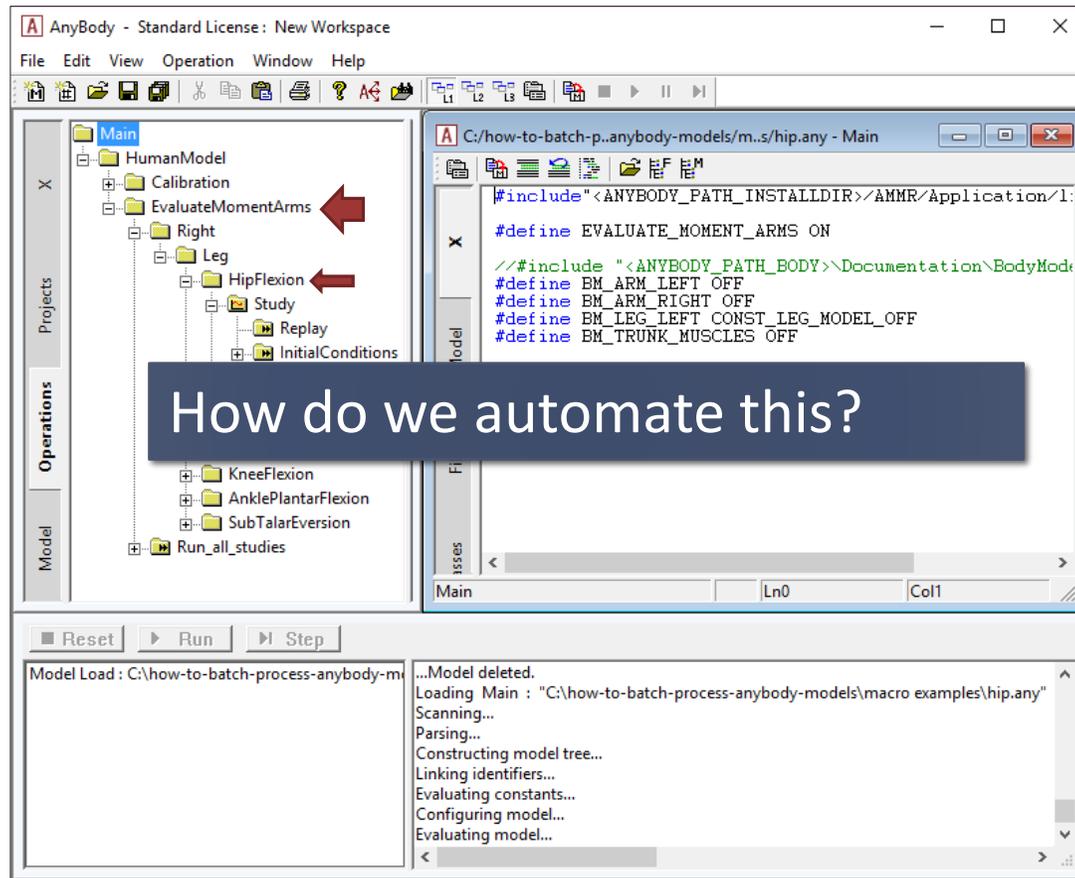
#include "<ANYBODY_PATH_INSTALLDIR>/AMMR/Application/libdef.any"

#define EVALUATE_MOMENT_ARMS ON
#define BM_ARM_LEFT OFF
#define BM_ARM_RIGHT OFF
#define BM_LEG_LEFT CONST_LEG_MODEL_OFF
#define BM_TRUNK_MUSCLES OFF

Main =
{
    #include "<ANYBODY_PATH_BODY>\HumanModel.any"
};
```



Model example for this webcast



The screenshot displays the AnyBody software interface. On the left, a project tree shows a hierarchy starting with 'Main', followed by 'HumanModel', 'Calibration', 'EvaluateMomentArms', 'Right', 'Leg', 'HipFlexion', 'Study', 'Replay', and 'InitialConditions'. Red arrows point to 'EvaluateMomentArms' and 'HipFlexion'. Below this, there are folders for 'KneeFlexion', 'AnklePlantarFlexion', 'SubTalarEversion', and 'Run_all_studies'. The central window shows a code editor with the following content:

```
#include "<ANYBODY_PATH_INSTALLDIR>\AMMR\Application\1:  
#define EVALUATE_MOMENT_ARMS ON  
// #include "<ANYBODY_PATH_BODY>\Documentation\BodyMod  
#define BM_ARM_LEFT OFF  
#define BM_ARM_RIGHT OFF  
#define BM_LEG_LEFT CONST_LEG_MODEL_OFF  
#define BM_TRUNK_MUSCLES OFF
```

At the bottom, a console window shows the following output:

```
Model Load : C:\how-to-batch-process-anybody-m...  
...Model deleted.  
Loading Main : "C:\how-to-batch-process-anybody-models\macro examples\hip.any"  
Scanning...  
Parsing...  
Constructing model tree...  
Linking identifiers...  
Evaluating constants...  
Configuring model...  
Evaluating model...
```

How do we automate this?



The console application

The AnyBody Modeling System without the graphical user interface (GUI)

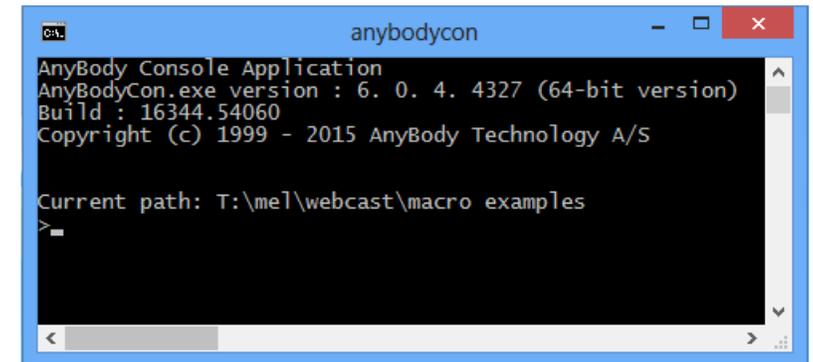
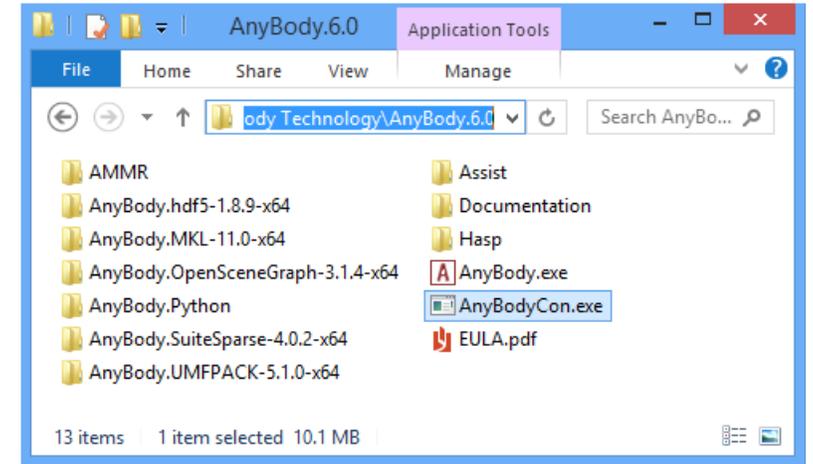
Accepts macro commands:

```
load "filename.any" [arguments]
```

Arguments:

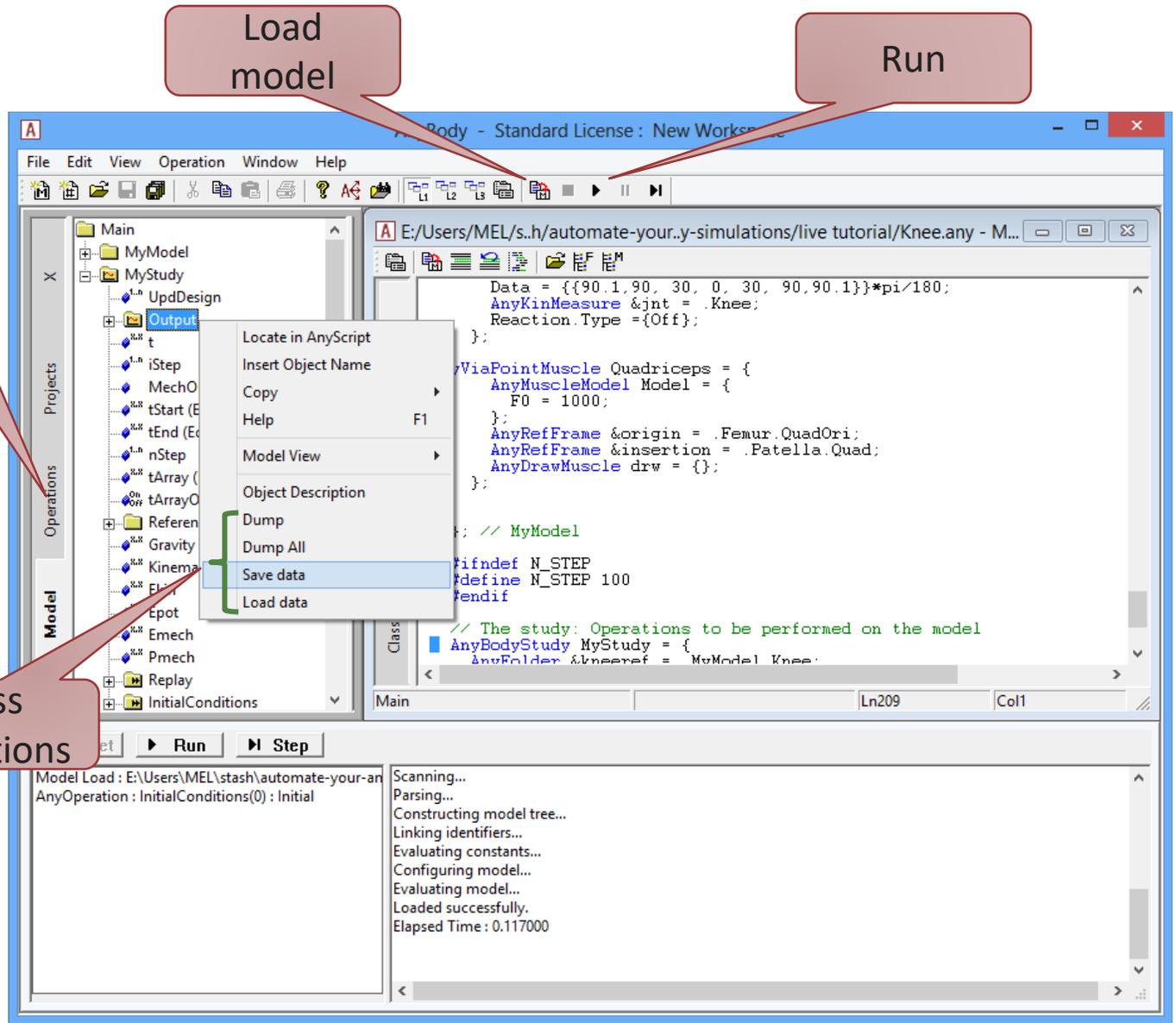
```
-def <identifier>=<value>
```

```
-p <path-identifier>=<dir-path>
```

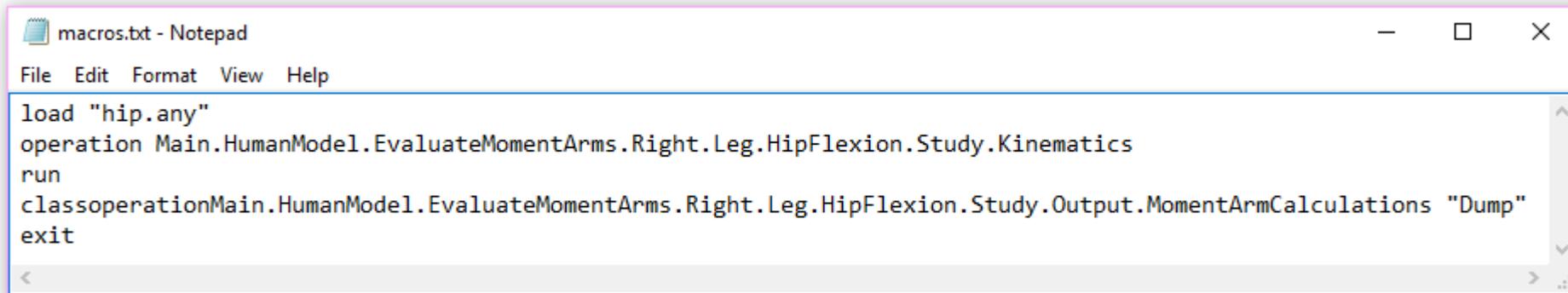


AnyScript Macros

- load <"file name"> [arg]
- operation <opr_name>
- run
- classoperation <obj> <cmd> [arg]
- exit

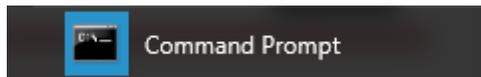


Creating a macro file

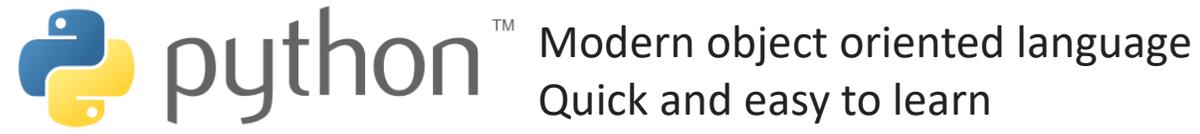


```
macros.txt - Notepad
File Edit Format View Help
load "hip.any"
operation Main.HumanModel.EvaluateMomentArms.Right.Leg.HipFlexion.Study.Kinematics
run
classoperationMain.HumanModel.EvaluateMomentArms.Right.Leg.HipFlexion.Study.Output.MomentArmCalculations "Dump"
exit
```

Launch the AnyBodyCon.exe with the file



Running Anybody from Python



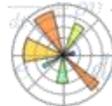
Large ecosystem of libraries for math, science and engineering



NumPy
N-dimensional arrays



SciPy
Library of scientific
functions



Matplotlib
Plotting library

IP[y]

IPython
Interactive computing

Many more...

Next: Live Examples

Basic example with multiple main files

All input data in one folder

Every trial in their own folder

One common base model

Name	Date modified	Type	Size
c3d_files	23-11-2016 11:16	File folder	
Trial01	23-11-2016 11:19	File folder	
Trial02	23-11-2016 11:19	File folder	
Trial03	23-11-2016 11:19	File folder	
Trial04	23-11-2016 11:19	File folder	
Trial05	23-11-2016 11:19	File folder	
Trial06	23-11-2016 11:19	File folder	
Trial07	23-11-2016 11:19	File folder	
base_model.any	23-11-2016 11:18	AnyScript ...	1 KB

Name	Date modified	Type	Size
Trial01.c3d	23-11-2016 10:37	C3D File	109 KB
Trial02.c3d	23-11-2016 10:38	C3D File	109 KB
Trial03.c3d	23-11-2016 10:38	C3D File	109 KB
Trial04.c3d	23-11-2016 10:38	C3D File	109 KB
Trial05.c3d	23-11-2016 10:38	C3D File	109 KB
Trial06.c3d	23-11-2016 10:38	C3D File	109 KB
Trial07.c3d	23-11-2016 10:38	C3D File	109 KB
Trial08.c3d	23-11-2016 10:38	C3D File	109 KB
Trial09.c3d	23-11-2016 10:38	C3D File	109 KB
Trial10.c3d	23-11-2016 10:38	C3D File	109 KB
Trial11.c3d	23-11-2016 10:38	C3D File	109 KB

Basic example with multiple main files

All input data
in one folder

Every trial in their
own folder

One common
base model

The image shows a file explorer window on the left and a code editor window on the right. The file explorer is titled 'BatchProcess' and shows a directory structure with a 'c3d_files' folder and seven 'Trial' subfolders (Trial01 to Trial07). A 'base_model.any' file is also present. The code editor shows the content of 'base_model.any', which includes preprocessor directives for muscle models and a 'Main' block defining an 'AnyInputC3D' object and an 'AnyBodyStudy' object.

```
#path ANYBODY_PATH_OUTPUT "."
#include <ANYBODY_PATH_INSTALLDIR>/AMMR/Application/libdef.any"

#define BM_TRUNK_MUSCLES OFF
#define BM_ARM_MUSCLES_BOTH OFF
#define BM_LEG_MUSCLES_BOTH OFF

Main = {

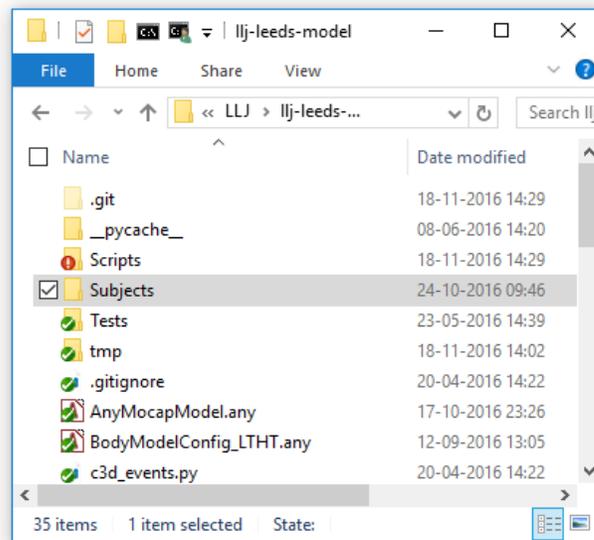
  AnyInputC3D C3D_data =
  {
    FileName = "c3d_files/" + ANYBODY_NAME_MAINFILEDIR + ".c3d";
  };

  #include "<ANYBODY_PATH_BODY>\HumanModel.any"

  AnyBodyStudy Study =
  {
    Gravity = {0, -9.82, 0};
    AnyFolder& BodyModel = .HumanModel.BodyModelWithDefaultDrivers;
    nStep = 1;
  };
};
```

Real life example

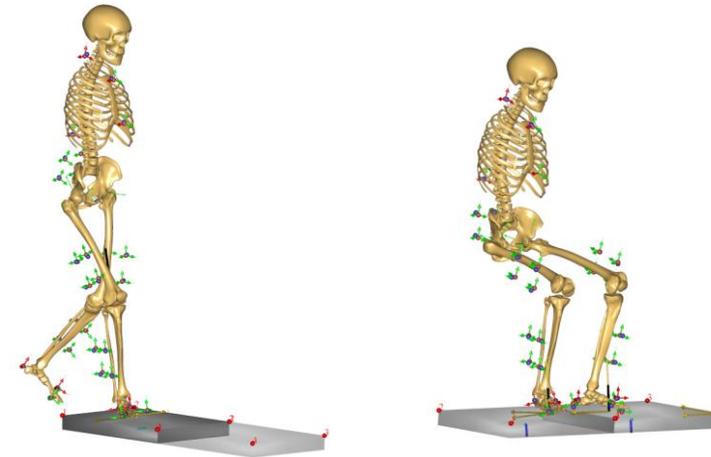
MoCap based model of hip patient.
 Activities of daily living.



DATA SET The Leeds Teaching Hospitals 
 NHS Trust

Collected at 'Leeds Teaching Hospital NHS Trust'

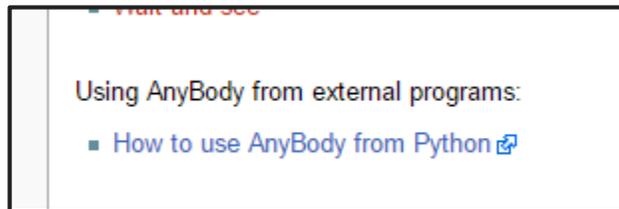
- 152 hip patients
- > 2000 trials



The End

Refer to the AnyPyTools tutorial.

- A HTML version on <http://wiki.anyscript.org>



- Interactive version is installed with AnyPyTools.
(In the windows start menu)

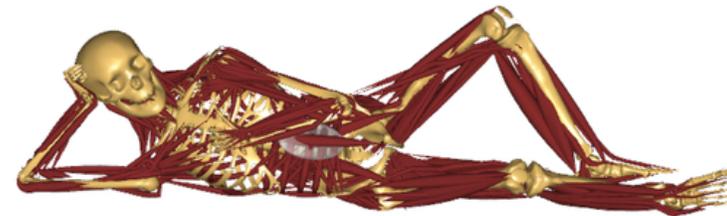
Using AnyBody from Python

The package `anypytools` has utilities and tools to work with the AnyBody Modeling System (AMS).

This tutorial includes the following:

Topics

- [Getting started](#) Running simple AnyBody macros
- [Generating macros](#) Generate and run complex macros
- [Working with AnyBody output](#) Loading AnyOutput files and HDF5 files generated by AMS
- [Batch processing](#) Techniques to batch process many models
- [Advanced studies](#) Build macros for parameter, monte carlo and Latin hypercube studies.
- [Tips&Tricks](#) Technical tricks for using anypytools



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Upcoming Webcasts:

- Musculoskeletal modeling of Dragonflies
 - Sina David (Institute of Biomechanics and Orthopaedics, German Sport University Cologne)
 - Dr. Alexander Blanke (University of Hull, Department of Mechanical Engineering)

Events:

- PhD Course: Predictive Musculoskeletal Modelling
 - At Aalborg University, Denmark
 - 27th to 31st of March 2017
 - Sign-up open from the 28th of November 2016.
 - Find registration link on www.anybodytech.com

www.anybodytech.com

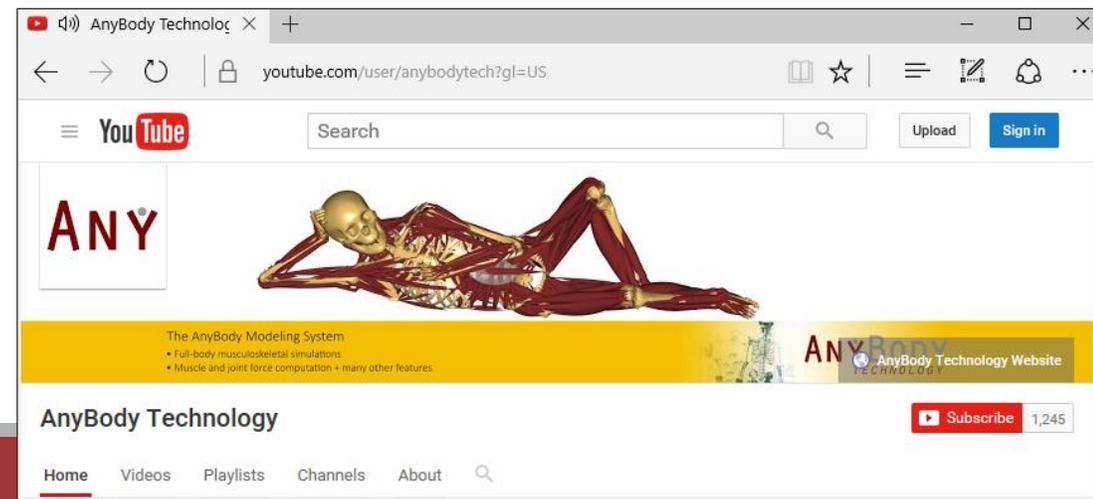
- Events, dates, publication list, ...

www.anyscript.org

- Wiki, Forum



Check previous webcasts on: <http://youtube.com/anybodytech>



Time for questions:

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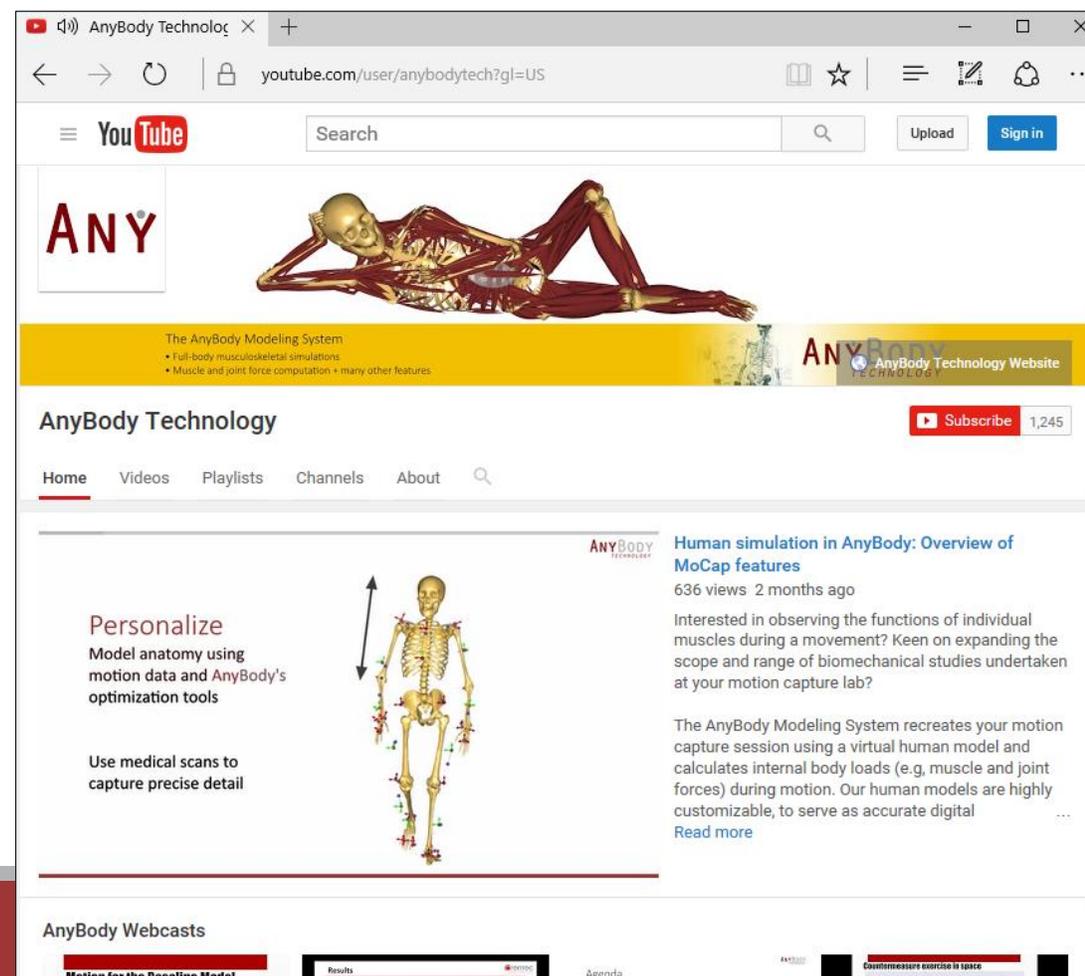
www.anybodytech.com

- Events, dates, publication list, ...

www.anyscript.org

- Wiki, Forum

Check previous webcasts on: <http://youtube.com/anybodytech>



The screenshot shows a YouTube channel page for 'AnyBody Technology'. The channel has 1,245 subscribers. The main content area features a video titled 'Human simulation in AnyBody: Overview of MoCap features' with 636 views, posted 2 months ago. The video description mentions that the AnyBody Modeling System recreates motion capture sessions and calculates internal body loads. A sidebar on the left offers options to 'Personalize' the model anatomy and 'Use medical scans to capture precise detail'. The bottom of the page shows a section for 'AnyBody Webcasts' with several video thumbnails.