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## PTC Product Focus

### Pro/Engineer Mechanism Design Solutions

#### Integrated Mechanism Design and Simulation

In today's competitive environment, companies involved in the design and development of mechanisms face increasing pressure to produce better products in less time.

To meet this challenge, companies need specific tools and functionality to accelerate the definition, simulation, and documentation of mechanism designs. By introducing more computer-aided (CAD) simulation into the design process, companies can avoid the time-consuming problems associated with testing of multiple prototype iterations.

By checking the operation and function of a mechanism during the early design phase using the native CAD data, designers can gain early insight into the performance of the design. This gives the designer more freedom to explore new ideas or alternatives with greater confidence that the design will perform as expected resulting in fewer changes during prototype testing and real world use.

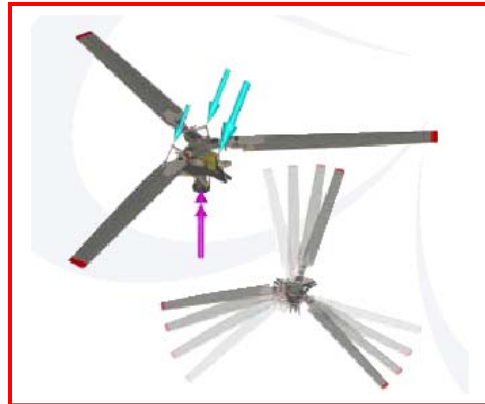
But to make simulation an integrated part of the design process, the simulation tools need to be fast and easy to use. The only way to really achieve this is by completely integrating a comprehensive set of mechanism design and simulation tools within the CAD software used every day by the design engineer.

Pro/ENGINEER Mechanism Design Solutions extend the native Pro/ENGINEER environment, using the same user interface, workflow, and productivity tools that the design engineer is already familiar with.

Pro/ENGINEER Mechanism Design Solutions operate directly on the Pro/ENGINEER geometry and database, so there are no geometry translation or interface problems, and the full power of the proven parametric modeling capability of Pro/ENGINEER can be exploited.

By providing an environment specifically tailored to the design and simulation of mechanisms, Pro/ENGINEER® Mechanism Design Solutions allow engineers to build and test virtual mechanisms early in the design process resulting in fewer prototypes and better products in less time.

"PTC's Mechanism Design Solutions allow us to virtually simulate and optimize our products without leaving the designer's desktop environment."  
— Jean-Christophe Dejean,  
CAD/CAM/CAE Manager, Schneider Electric



PTC's Mechanism Design Solutions provide users with the ability to easily simulate and improve mechanism performance, allowing multiple design iterations to be evaluated quickly.

## Quality Assured Mechanisms

Pro/ENGINEER Mechanism Design Solutions use proprietary technology and algorithms developed at PTC to give users the fastest and most accurate mechanism simulation possible. PTC has developed this technology in conjunction with major customers around the world whose business is based on the design and manufacture of complex, high-speed mechanisms.

PTC provides built-in technology which takes the pain out of virtual prototyping of complex mechanisms by checking the validity of each step in the design process automatically, every time.

By partnering with customers who lead the world in this field, PTC has developed the most comprehensive and functional mechanism development environment available in any CAD system.

## Comprehensive Functionality

Pro/ENGINEER Mechanism Design Solutions have been developed in partnership with, and are used by some of the world's largest engineering companies, including the aerospace, automotive, electronic, and heavy industrial market segments. The extensive list of functionality includes:

- Mechanism assembly tools
- Hierarchical mechanism design
- Interactive mechanism operation
- Space claim envelope generation
- CAM design synthesis
- Automatic interference detection
- Kinematic motion simulation

- Automatic drawing configuration views
- Connections, motors, cams, and slots
- Forces, friction, contacts, and impacts
- Springs and dampers
- Dynamic motion simulation
- Assembly and disassembly sequences
- Animation and high quality movie export

Additionally, Pro/ENGINEER Mechanism Design Solutions work with all your favorite Pro/ENGINEER productivity tools like family tables, simplified reps, and interchange groups – and all mechanism data is stored in the Pro/ENGINEER files for transparent data management.

## **Multi-Disciplinary Design Studies**

Pro/ENGINEER Mechanism Design Solutions work seamlessly with Behavioral Modeling so users can run multi-disciplinary design studies to drive mechanism performance and efficiency in combination with many other design goals and objectives to deliver the optimum design without the need for multiple prototypes or exhaustive build and test experimentation.

## **Scalable Simulation**

Pro/ENGINEER Mechanism Design Solutions are comprised of three optional modules:

- Mechanism Design Extension (MDX) - lets users build, move, and animate the kinematic movement of a mechanism as a natural part of the Pro/ENGINEER design process and workflow. MDX also provides interference detection and space claim envelope generation. MDX provides easy-to-use tools for the capture and manipulation of multiple mechanism configuration states and provides access to these configurations during drawing creation.
- Mechanism Dynamics Option (MDO) - allows users to include the dynamic effects involved in the operation of a mechanism such as friction, inertia, and contact forces, as well as the inclusion of springs and dampers.
- Design Animation Option (DAO) - lets users create powerful movies by automatic interpolation between key frame sequences to produce animations of product assembly and disassembly as well as maintenance procedures or movies for marketing purposes. Because MDX, MDO, and DAO share a common user interface and use a single simulation model and database, models and data are inherited automatically — design intent is captured and re-used by all members of the design team, ranging from the concept designer through the dynamics specialist to the documentation specialist.

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## **PTC Product Focus**

### **Windchill ProjectLink**

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## Tips of the Week

### Pro/Engineer Mechanisms

Using Mechanism for manikin studies. This will also show users how to create limits on ball joints (you can't define limits for a ball joint)

First off we will not be creating any ball joints – we will use 3 pin joints instead and put limits on each pin joint.

This basic exercise will show how a human head can look right and left, tilt forward and backward, and finally tilt from side to side.

Applying these techniques, users can simulate elbow joints, shoulders, wrist, ankles, ....

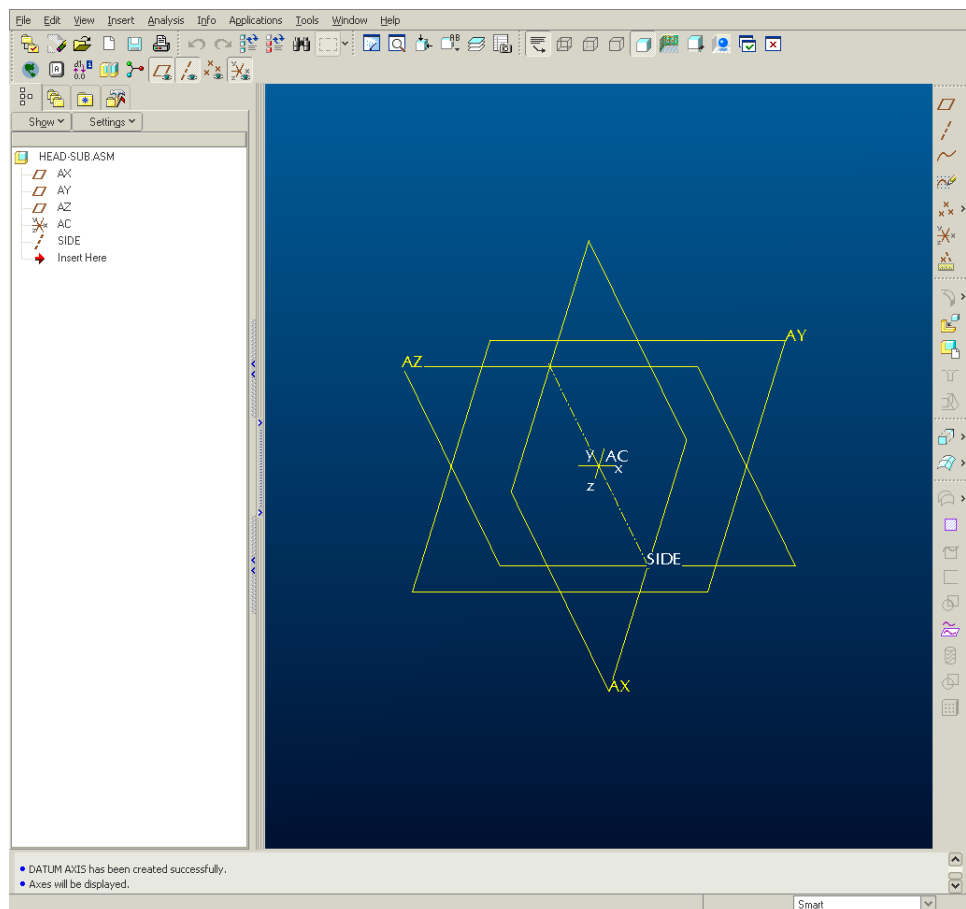
This documentation is for Pro/Engineer Wildfire.

The functionality is included in our basic package.

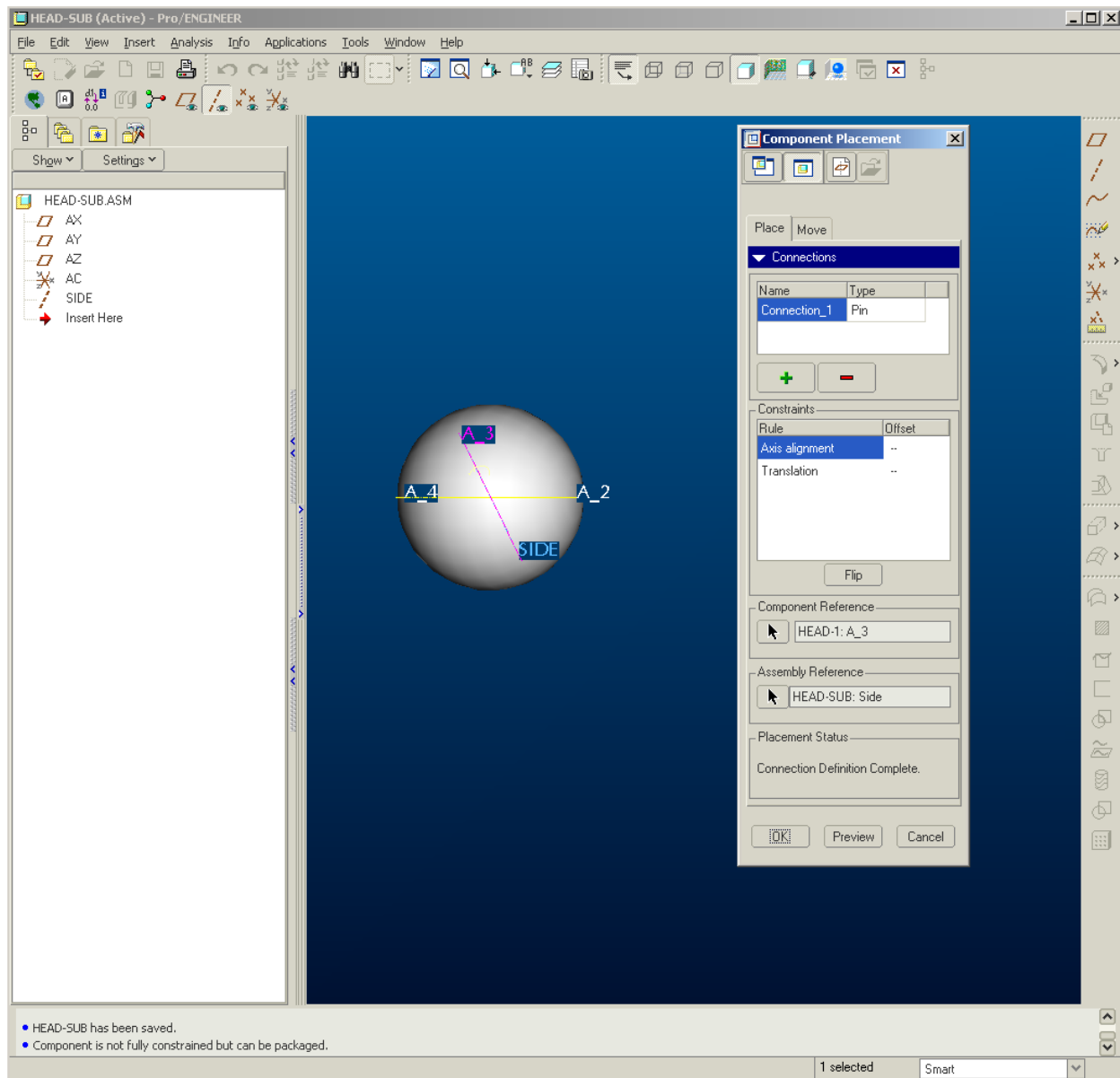
The Solution:

Create an assembly for the head; start with a std. Assembly; create a dtm axis 2 planes

It is always good practice to name your datum planes and coord system to something other than the default. In the image below the planes are named AX, AY, AZ respective to the assembly coordinate system AC. Also the axis is named SIDE. This will be the axis that will allow us to move to turn the head from right to left; just like someone would turn their head to look at something.




Next step is to assembly the part named “HEAD-1.PRT” we will use a pin connection for this part. To access mechanism type connections just select the blue bar that says connections. By default the type of connection is a pin. A pin connection requires 2 references; an axis and a plane. Select the “SIDE” axis in the assy and the “A-3” axis on the part. For the plane reference select “AY” on the assy and “Y” on the part. If you have done this correctly in the Placement Status it will say “Connection Definition Complete” Just remember the plane has to be normal to the axis. See image below:

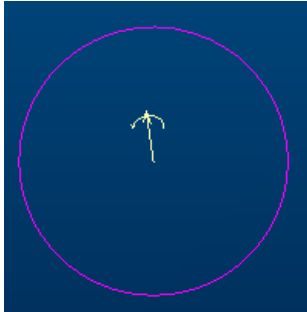


We will now set limits on this pin connection.

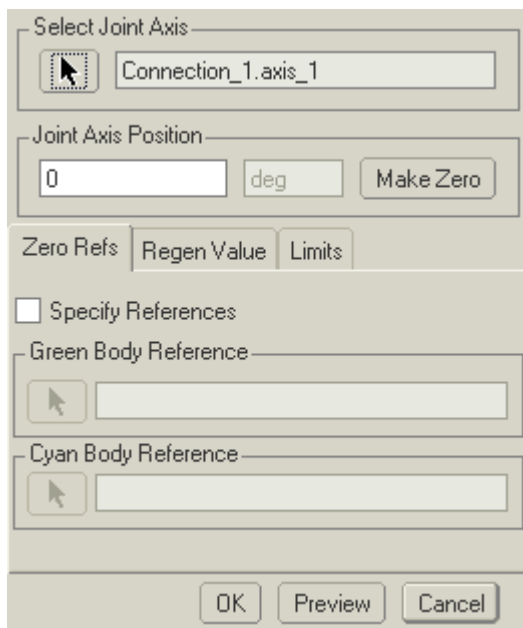
Let's go into our mechanism application by selecting Applications from the toolbar and then Mechanism.

Select this icon  or select Mechanism from the toolbar and then Jt Axis Settings

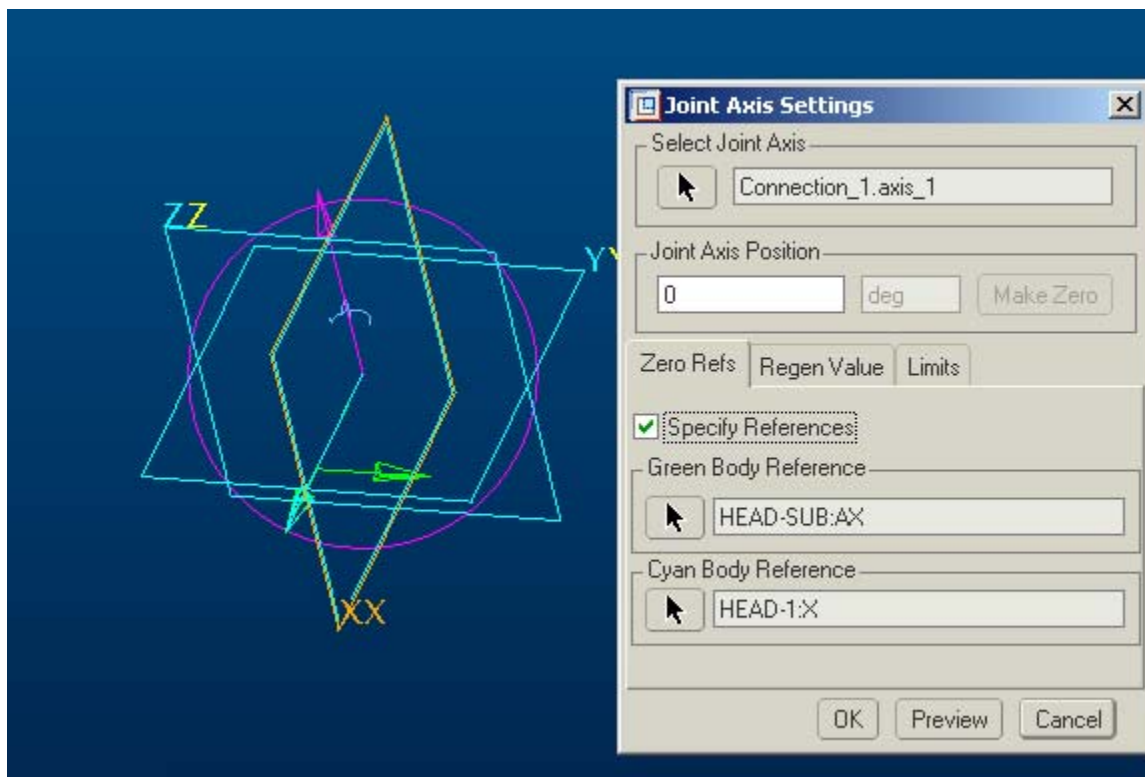
Select the pin joint as shown in this image



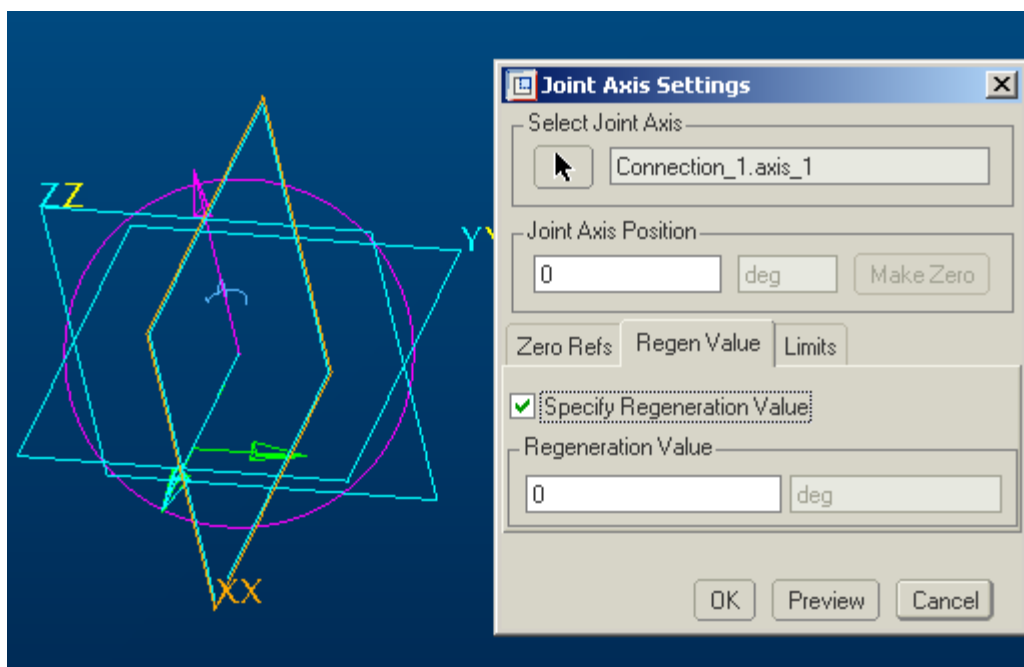
We will be defining information on all 3 tabs in this dialogue



First Specify References – check box Specify References  
Select HEAD-1:X dtm plane; then select AX from the assy  
See image below:  
Note these planes should be on top of each other.

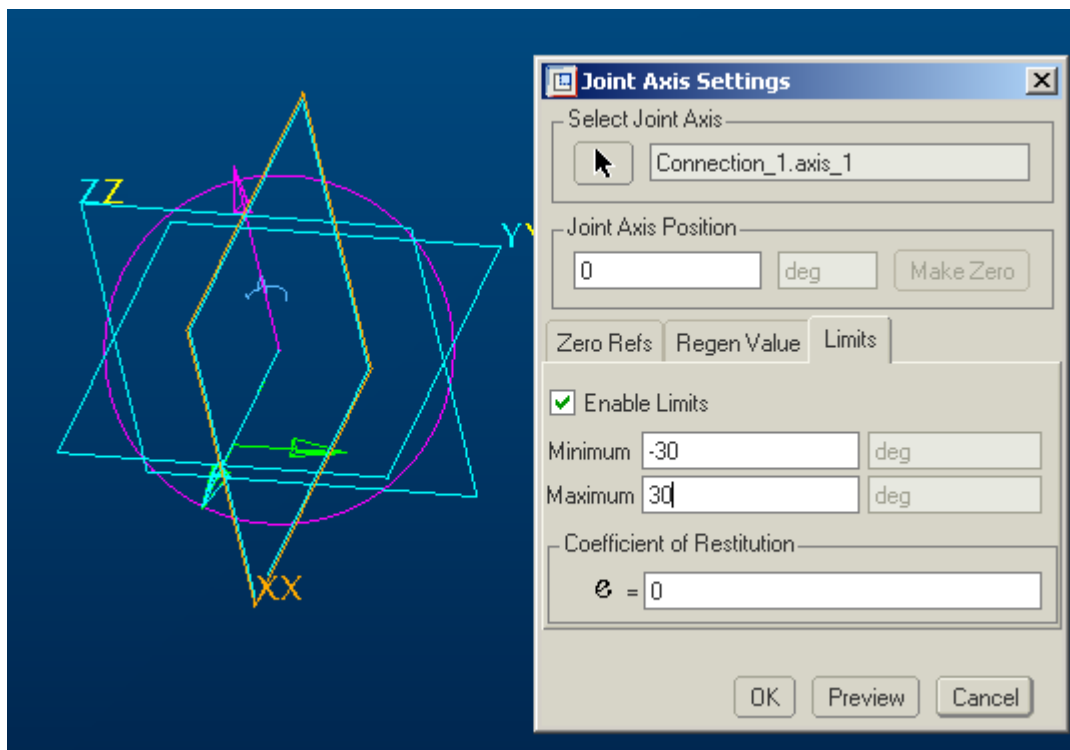


Next select the Regen Value tab; check box Specify Regeneration Value and leave the value 0



Next select the Limits tab. Here is where we will specify the amount of rotation our head is allowed to look right or left; check box Enable Limits and put -30 in for the minimum and 30 for the maximum, don't worry about coefficient of restitution unless you want your head to bounce off of something like in a crash dummy.





We only have 2 more joints to define!

Next joint: This joint will allow the head to tilt forward looking at the ground or backward to look up at the sky.

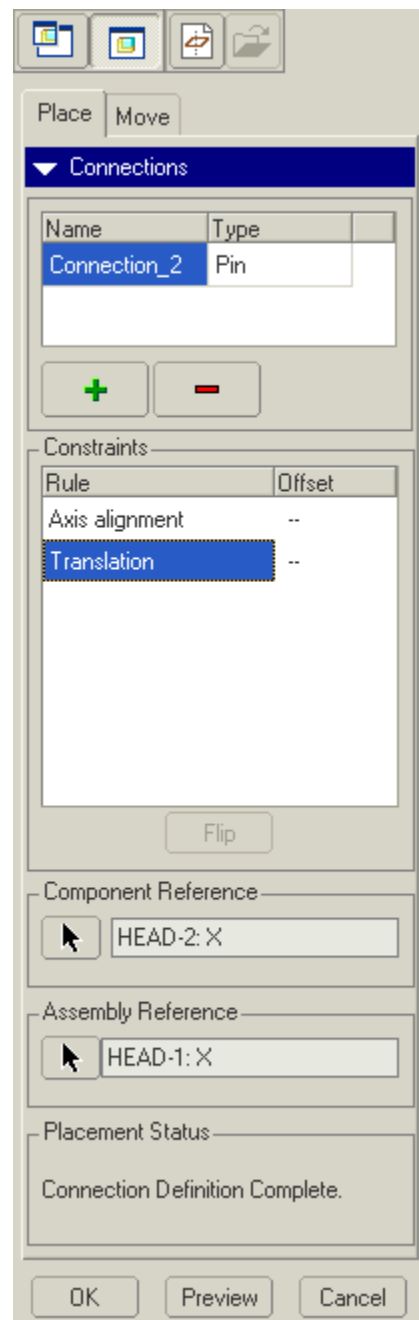
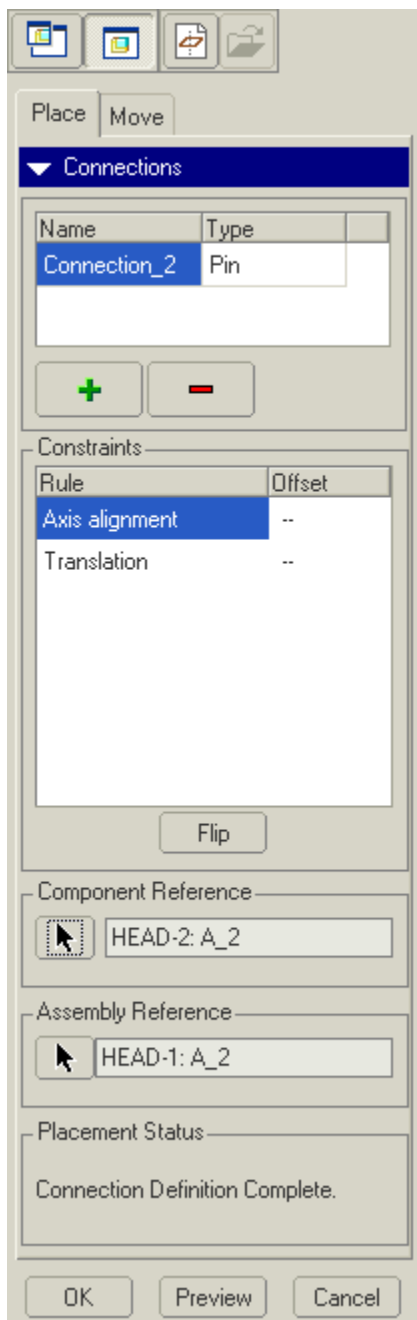
Switch back to Applications, Standard

Assemble the next part.

Assemble “HEAD-2.PRT” use a pin connection as in the earlier instructions.  
This time we will only use an axis and a plane from “HEAD-1.PRT” for the references.

Note it is important to only use references from “HEAD-1.PRT” and not any of the assembly references or else the assembly will not move properly.

Use the axis and plane as shown in the next 2 images for the proper assy references



Next we will set the limits on this pin joint.  
Switch applications to mechanism.

Select Jt. Axis Settings icon

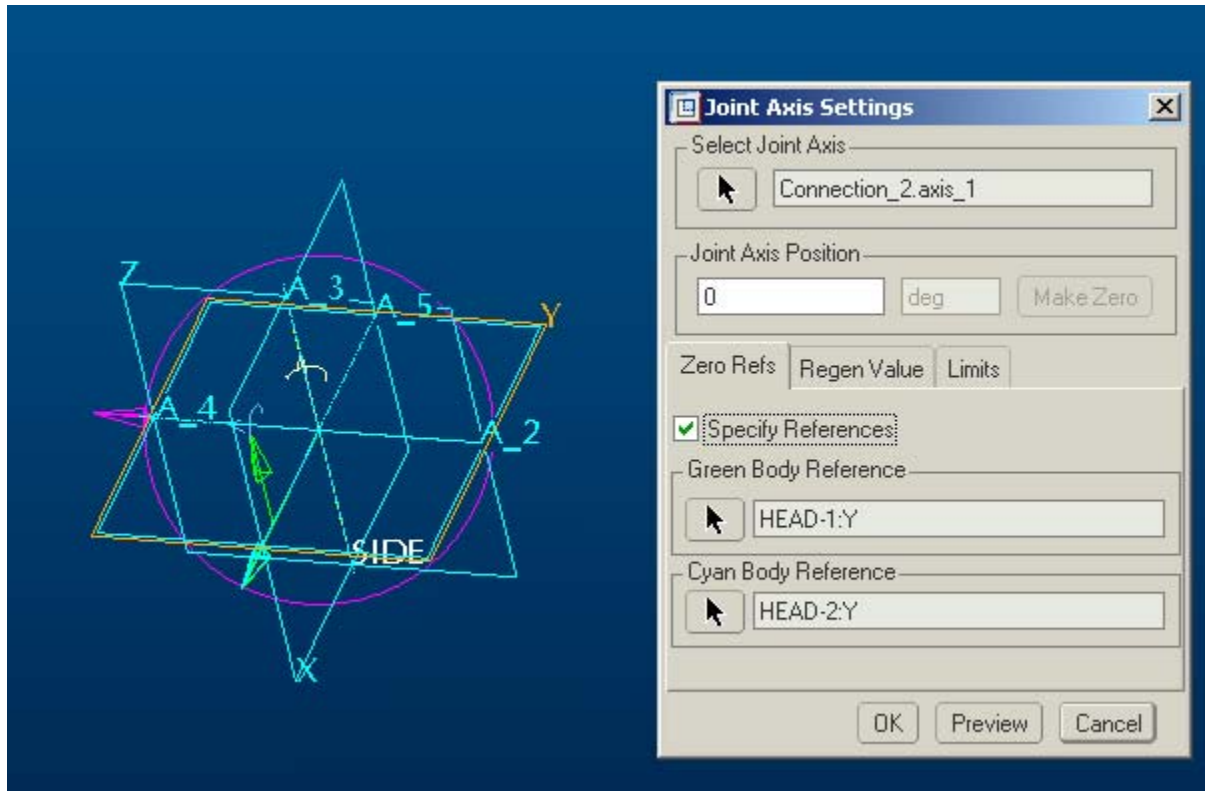


Select the joint we just created; it should be labeled Connection\_2.axis\_1

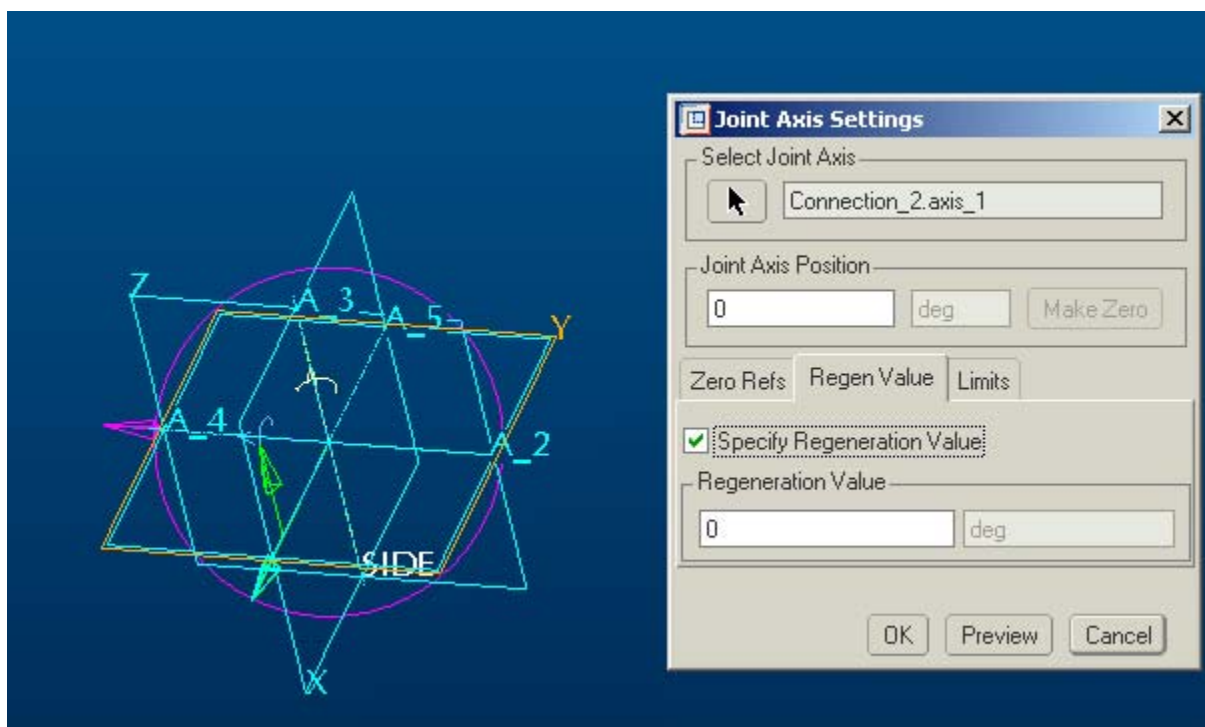
We need to specify references as before, regen value, and limits

See images for this information

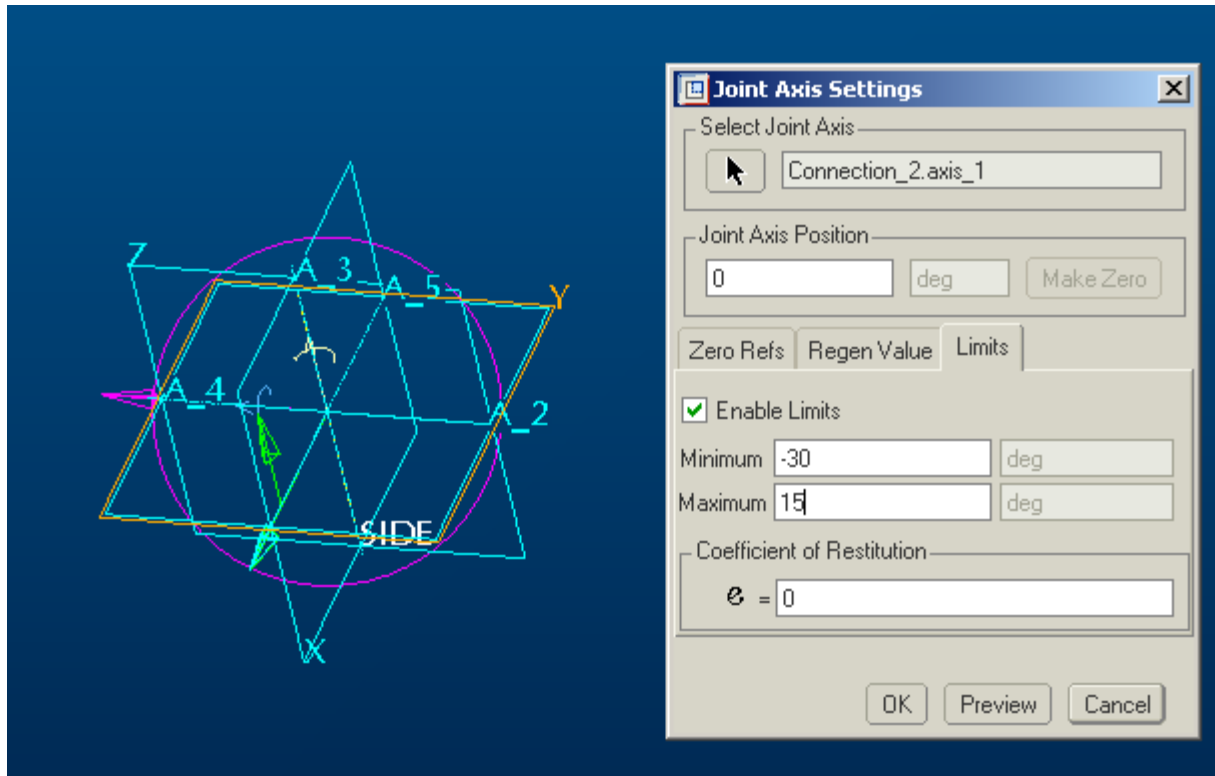
References:



Regen Value:



Limits: -30 to 15 will allow us to only tilt our head back 15 degrees and look down at the floor – 30 degrees; adjust these values as necessary.

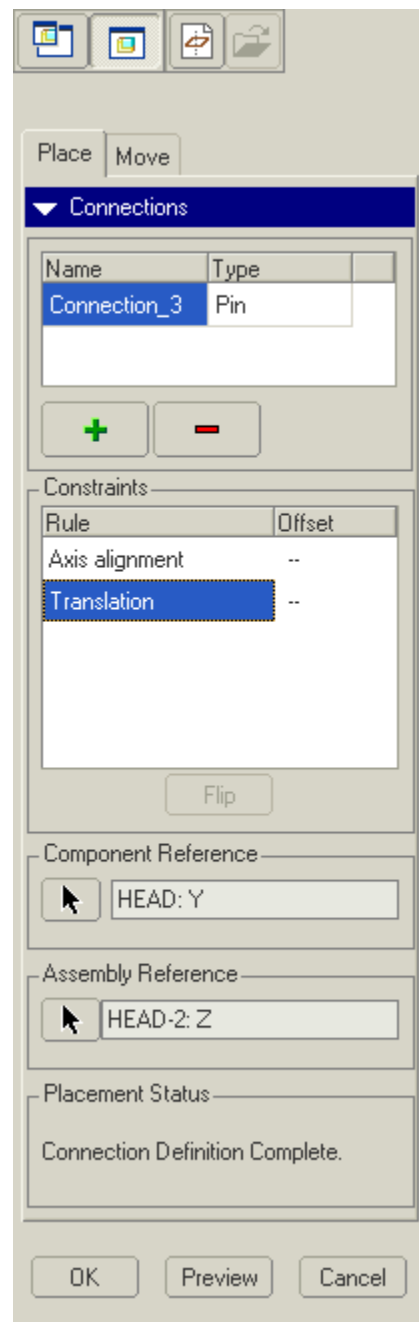
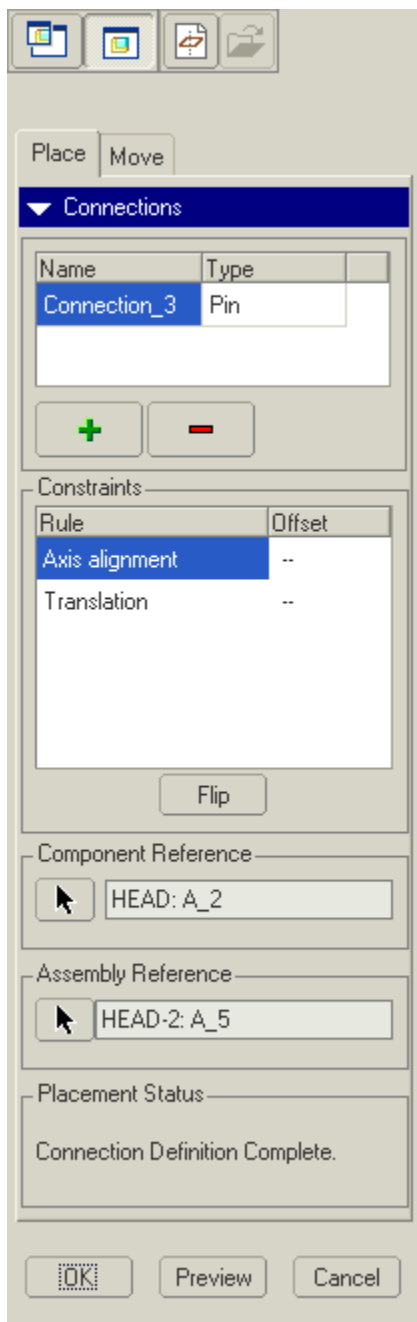


Last joint!

Switch back to Applications, Standard  
Assemble "HEAD.PRT"

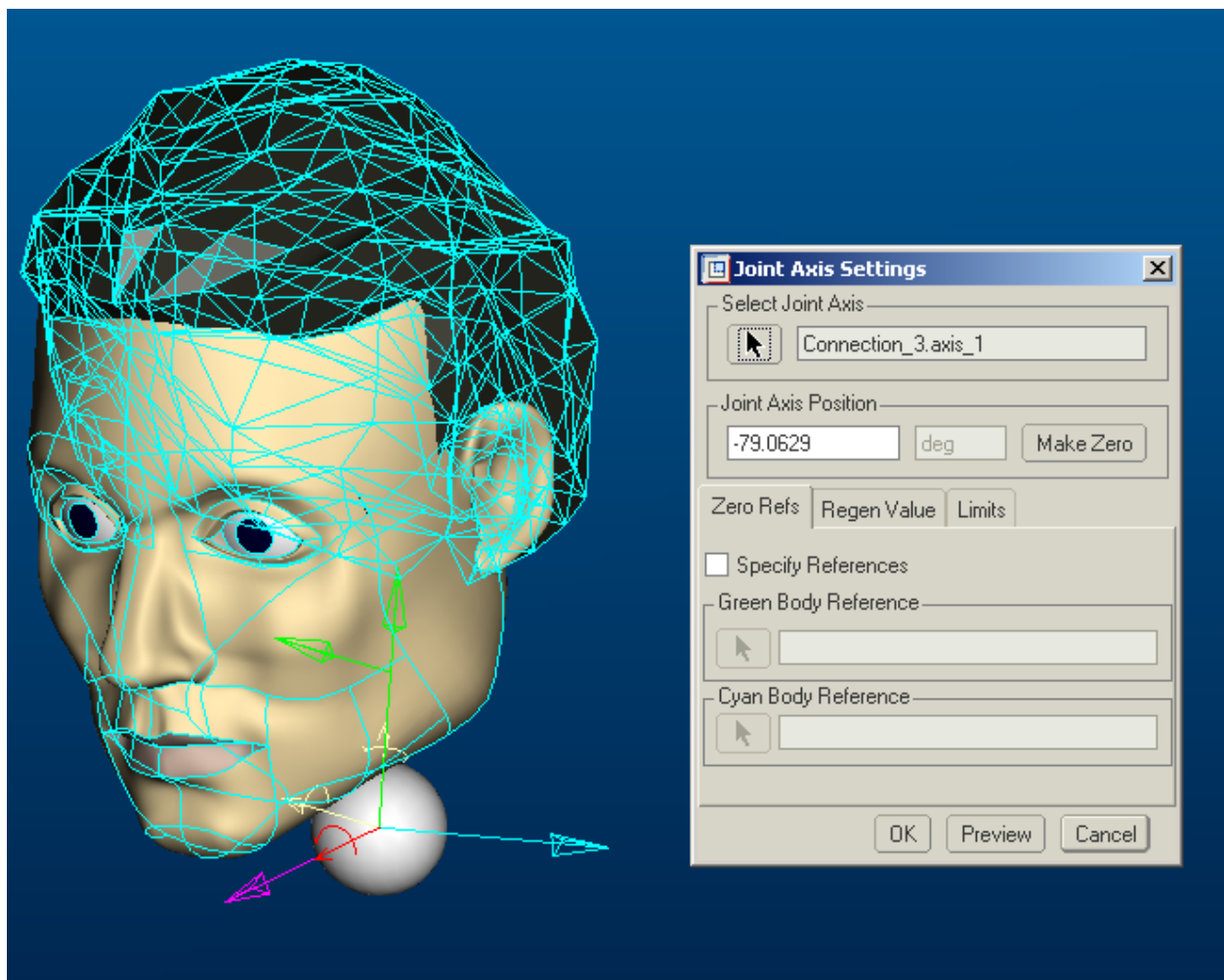
Select pin connection using the following references:

Note: All assembly references are to be made to "HEAD-2.PRT"!



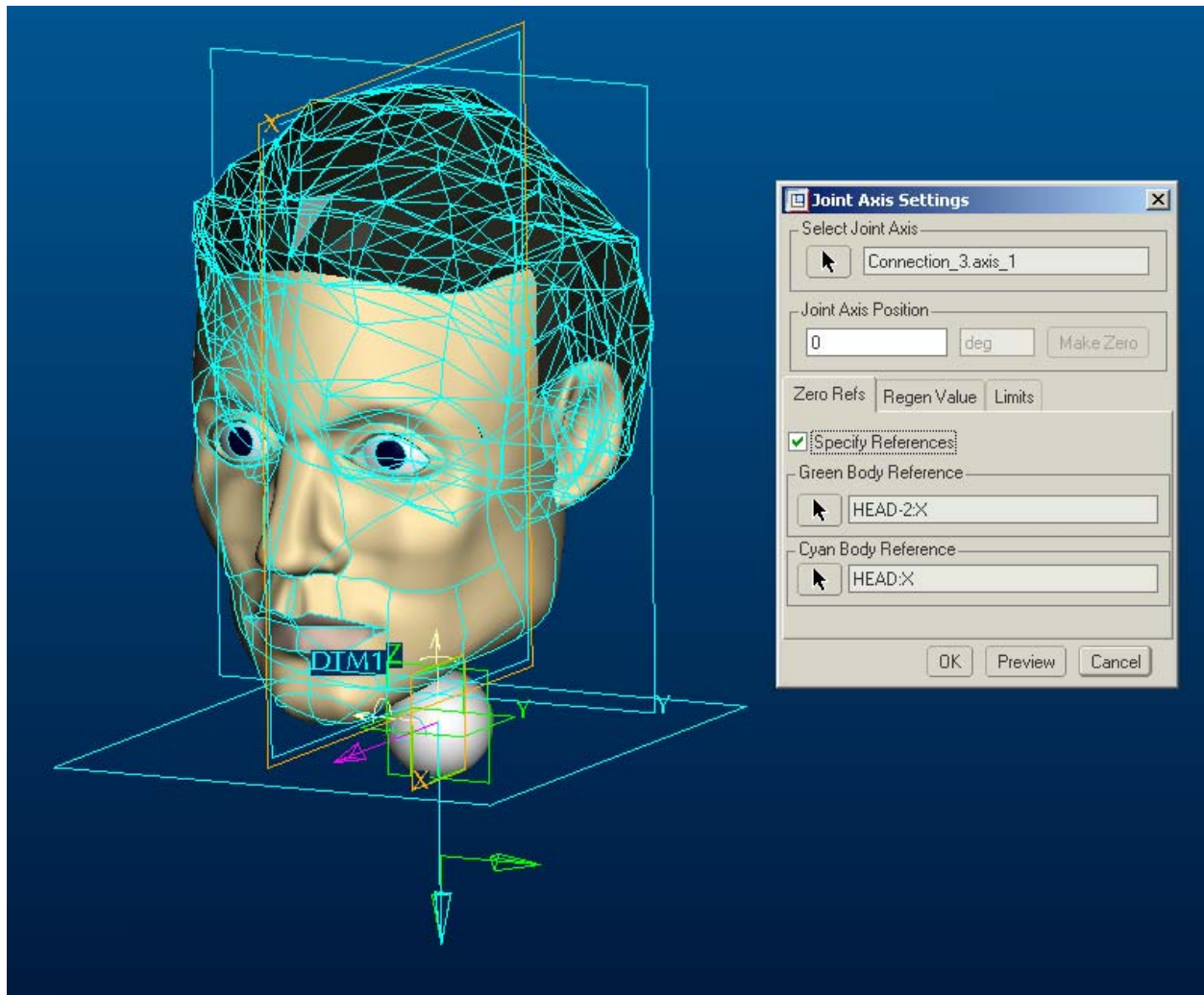
Finally set the limits on this pin connection.

Applications, Mechanism, select Jt Axis Settings icon:

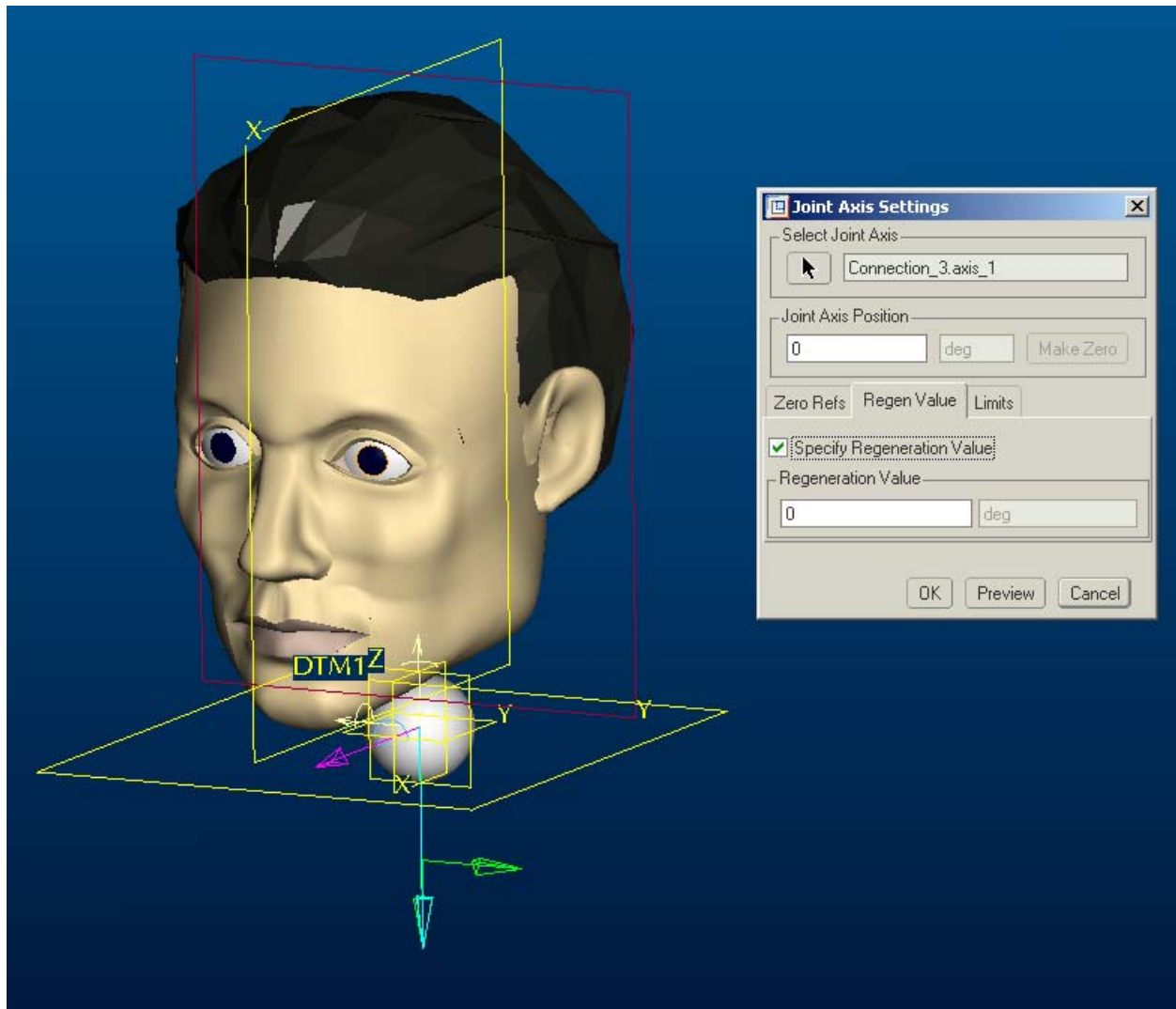


This time we will have to type in  $-90$  in the Joint Axis Position box and then click on Make Zero button. This will reset our zero for us.

Specify references:



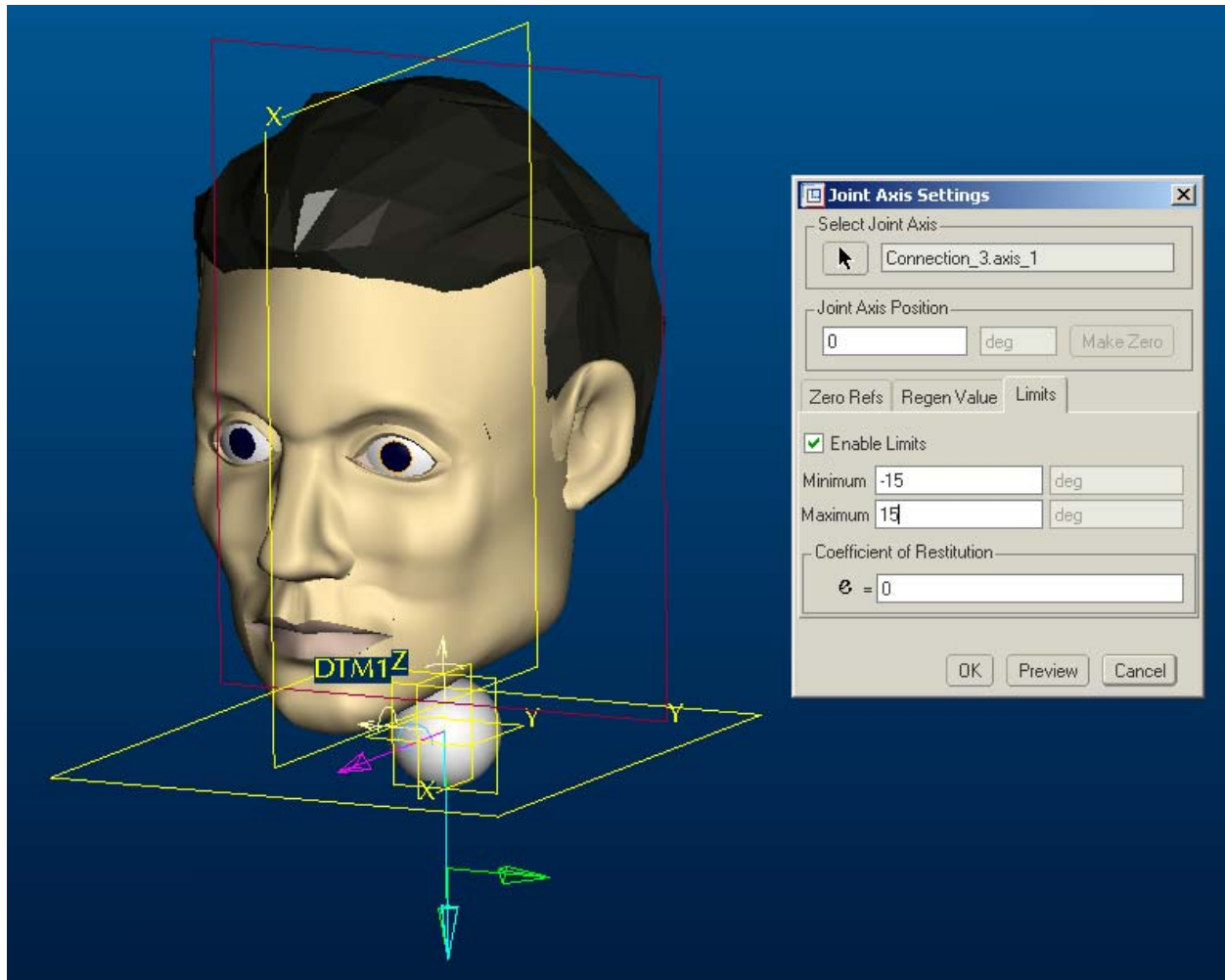
Regen Value:





Limits:

Note: Our limits are symmetrical; this is the amount to tilt our head from shoulder to shoulder

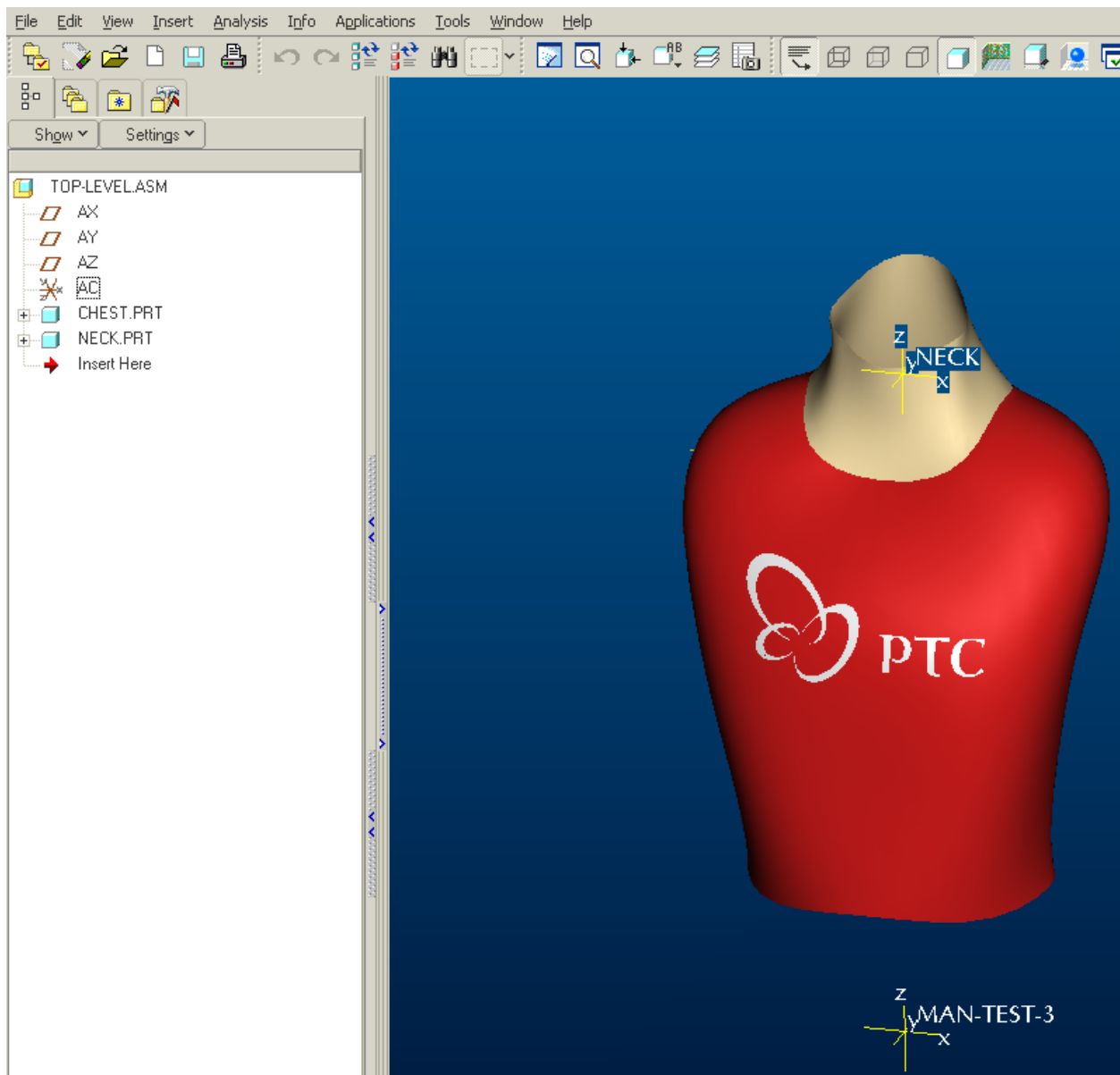


Now create a new assy called “TOP-LEVEL”

Assemble “CHEST.PRT” just use default assy constraint

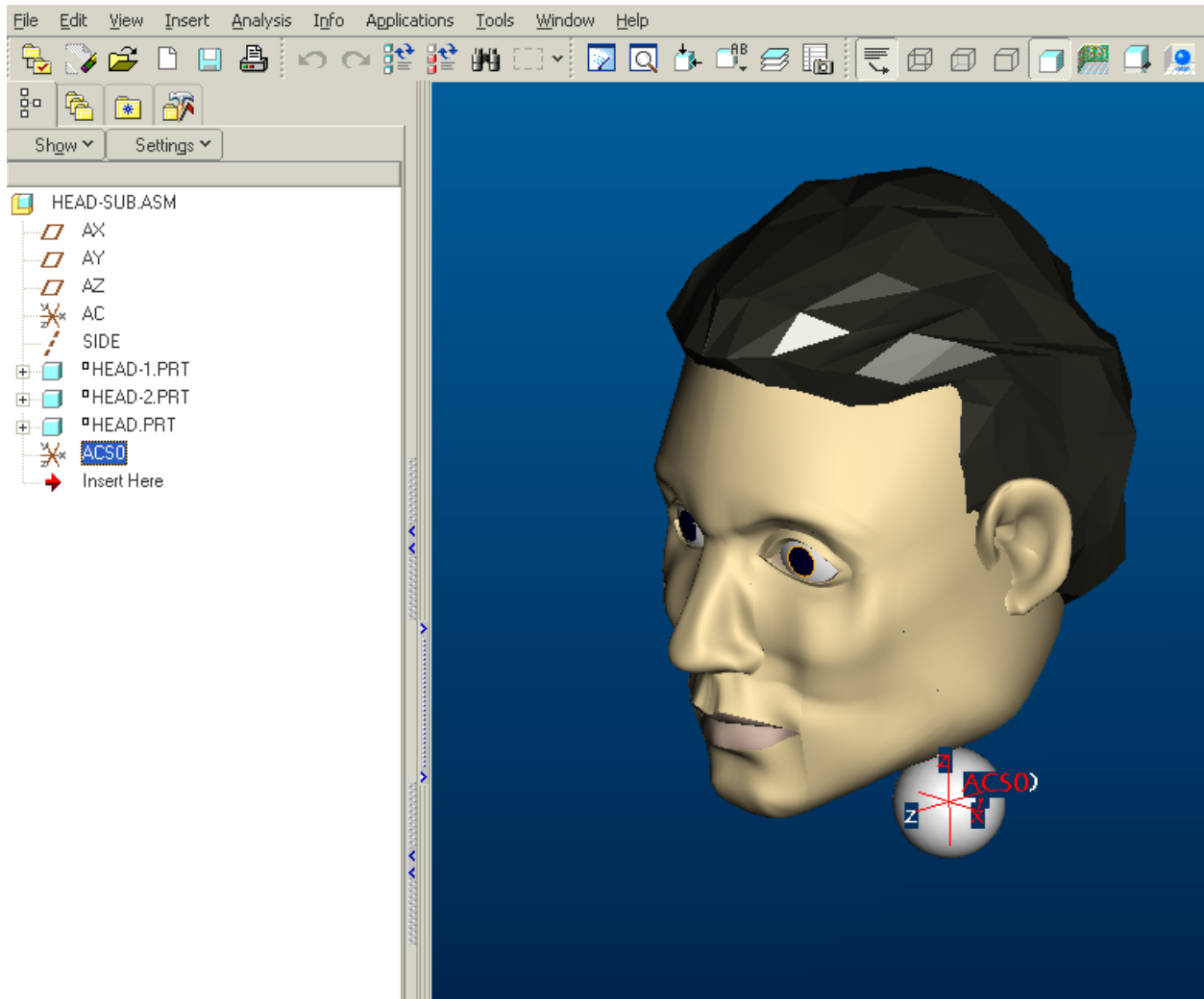
Assemble “NECK.PRT” also just use default assy constraint

Assembly should look like this:



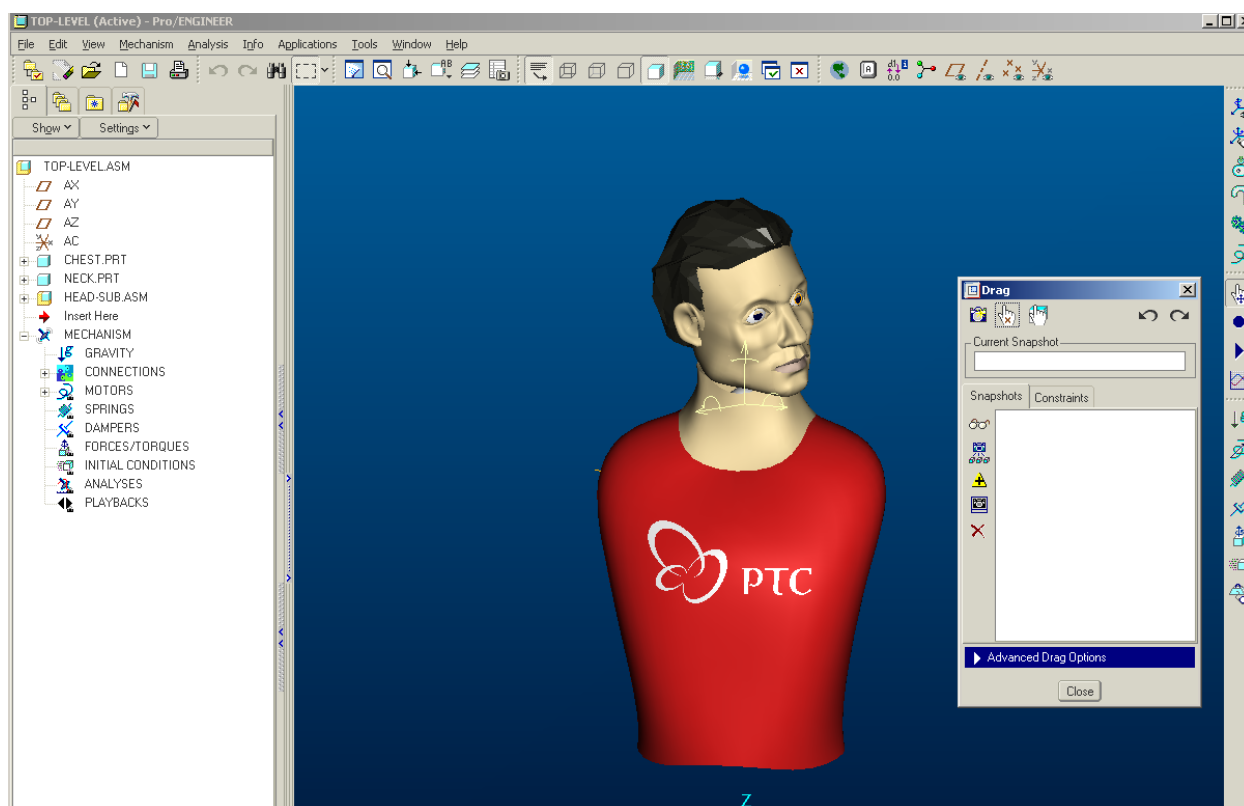
Now assemble the head sub assembly you have been working on

**\*\* First create a coordinate system in this assembly in the same orientation as the neck above. Now use this coordinate system to assemble the head to the “NECK” coordinate system.**



Now go into Mechanism and drag the head around. Notice that it will behave just like a real head with the proper limits.

Go ahead and set snapshots of the head in different positions add arms, legs, ...



Have fun!

And if you would like the files to download and try it out, feel free to click [here](#).

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## **Tips of the Week**

**Best Practice On How To Check A Document In/Out of Windchill ProjectLink**

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## **Announcements**

**Special Hardware offers for customers updating to Pro/ENGINEER Wildfire**

[http://www.ptc.com/partners/hardware/current/wildfire\\_tlo.htm](http://www.ptc.com/partners/hardware/current/wildfire_tlo.htm)

<http://www.3dlabs.com/PTC/>

## PTC Sponsored Events

Click below to see PTC sponsored events:

<http://www.ptc.com/company/news/events/index.htm>

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Thinking About Pro/ENGINEER Wildfire? Check this out.



<http://www.ptc.com/go/engineering/index.htm>

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## **E-PROFILES IS HERE!!**

We have been eagerly anticipating the debut of the new electronic version of Profiles Magazine and now it is here! This new web site will supplement the print edition of the magazine and will provide new useful features not feasible with paper media. e-Profiles will provide you with 24x7, worldwide access to key information previously available exclusively in the print version. "Tips & Tricks," a popular feature pioneered by Pro/USER, has also moved to the web and will be expanded as the site matures. Future plans include several foreign-language editions of Profiles for our many international readers. Currently, Profiles is printed in English and Japanese.

Please take a few minutes to check out this new web site. We don't think you will be disappointed.

<http://profilesmagazine.com/>

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## Upcoming Events & Training Class Schedules

Upcoming, 2003

Your local Pro/Engineer User Groups

<http://www.prouser.org/rugs/>

June 13 - 16, 2004

Nashville, TN

Pro/USER International Conference

<http://www.prouser.org/>

Please visit the [PTC Education Services](#) website for the latest training information including course descriptions, schedules, locations, and pricing.

- Attend a course at any PTC Center and receive a **free** copy of Pro/E 2001 Student Edition!

<http://www.ptc.com/services/edserv/index.htm>

PTC

Note: This PTC E-Newsletter will continue to be used for the following:

- 1) Inform you on events related to PTC products (user groups, conferences, training schedules, etc.)
- 2) Educate you on products that are available at PTC
- 3) Tips & Techniques using PTC Products

Note: These messages are compiled in the local PTC office and will be distributed via e-mail.

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