moysescott

CAD / CAM Australia & New Zealand

Cranking into the Future of Making Things with CXP Racing - MFG119631

Scott Moyse

Manufacturing & CAM Technical Specialist

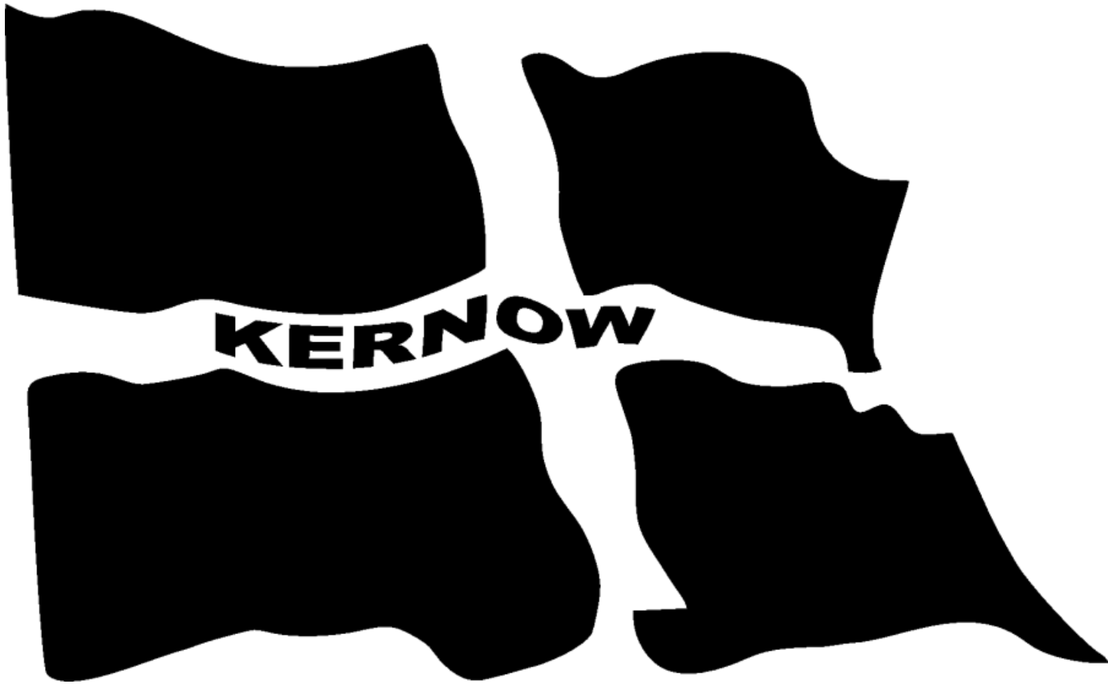
AUTODESK® EXPERT ELITE

CADPRO Systems Ltd

AUTODESK. UNIVERSITY

Who’s this guy?

- Proud Cornishman
- Motorsport Engineering
- New Zealand
- Marine Industry
- 14 Yrs of CAD/CAM/CNC
- CADPRO – 4 years



32
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CADPRO Systems Ltd

INVENTOR

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The Original Dovetailed Quick Change Vice Jaw System

ORANGE VISE COMPANY

MITEE-BITE® PRODUCTS LLC

MARITOOL

History

CXP Racing Story

Pre Fusion 360 & Haas

Pre Fusion 360 & Haas

CXP Racing Story

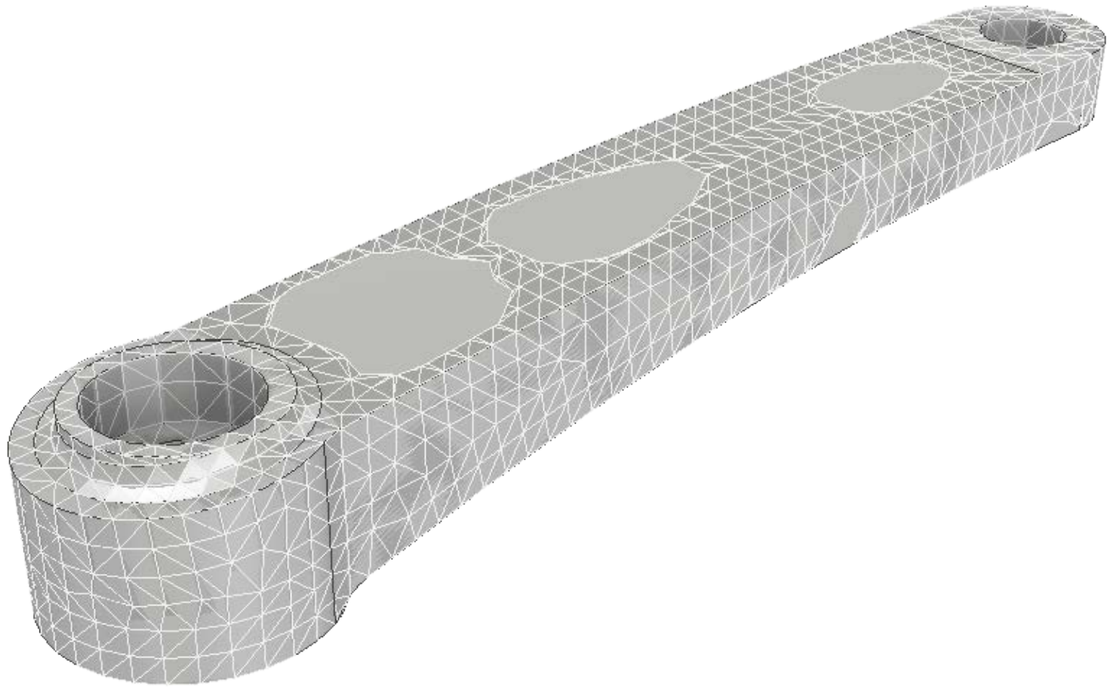
AUTODESK® **FUSION 360**™

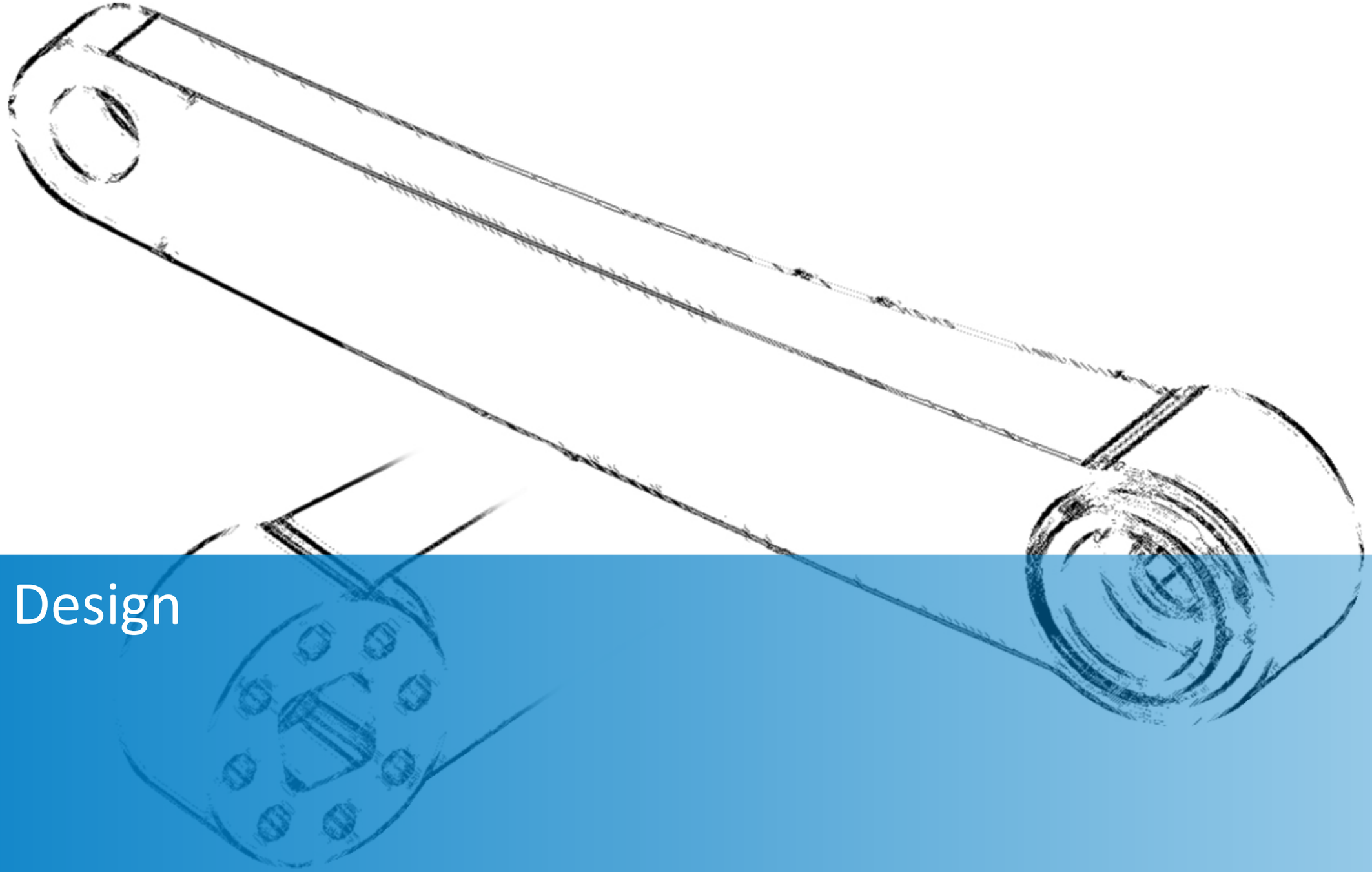
CXP Racing Today

CXPR Video

Crank & Chain Ring Requirements

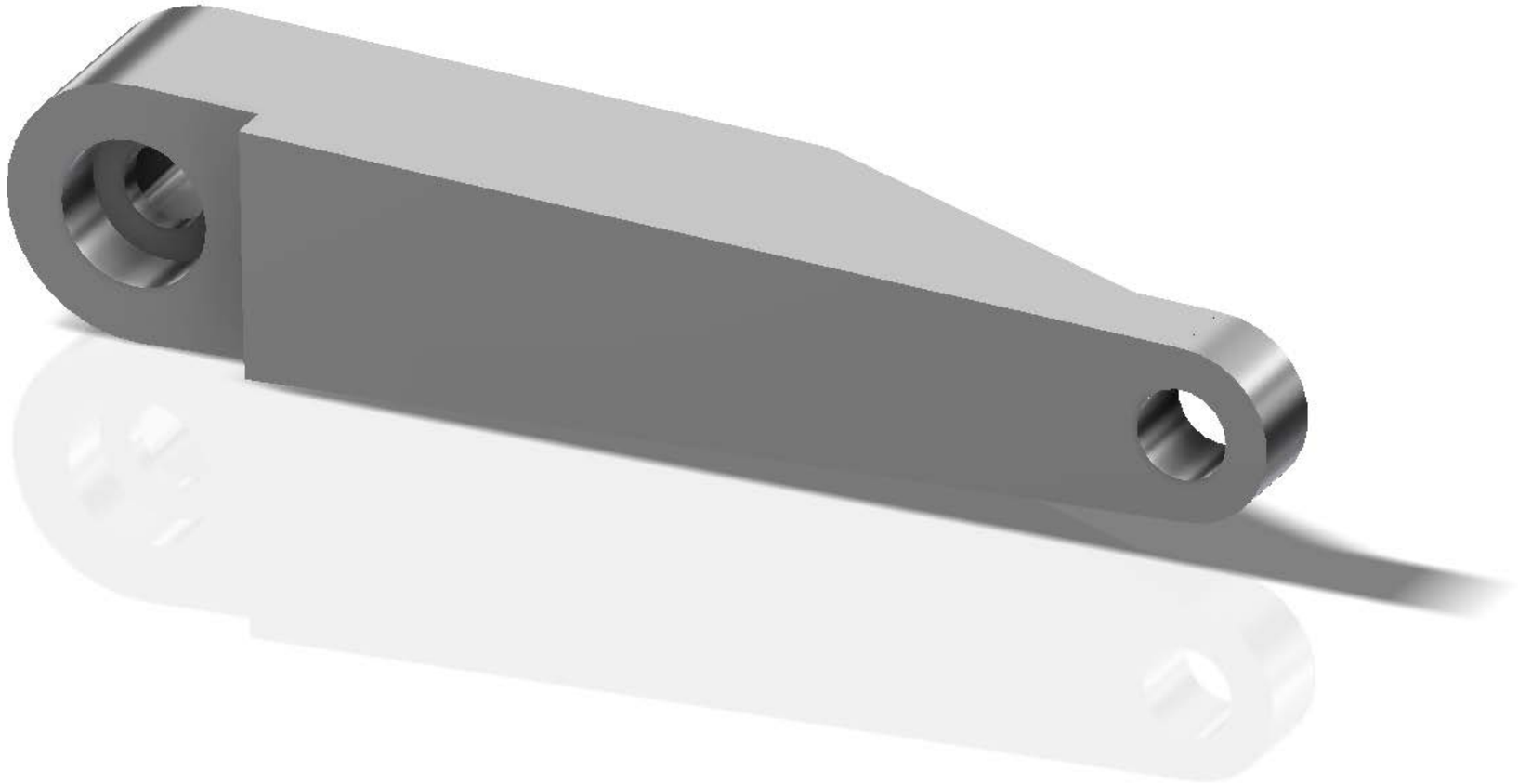
- Lighter than existing components
- Customisable
- Ease of Manufacture
- Aesthetics
- Kids up to 55kg
- 1250N at Pedal
- Shape Generated



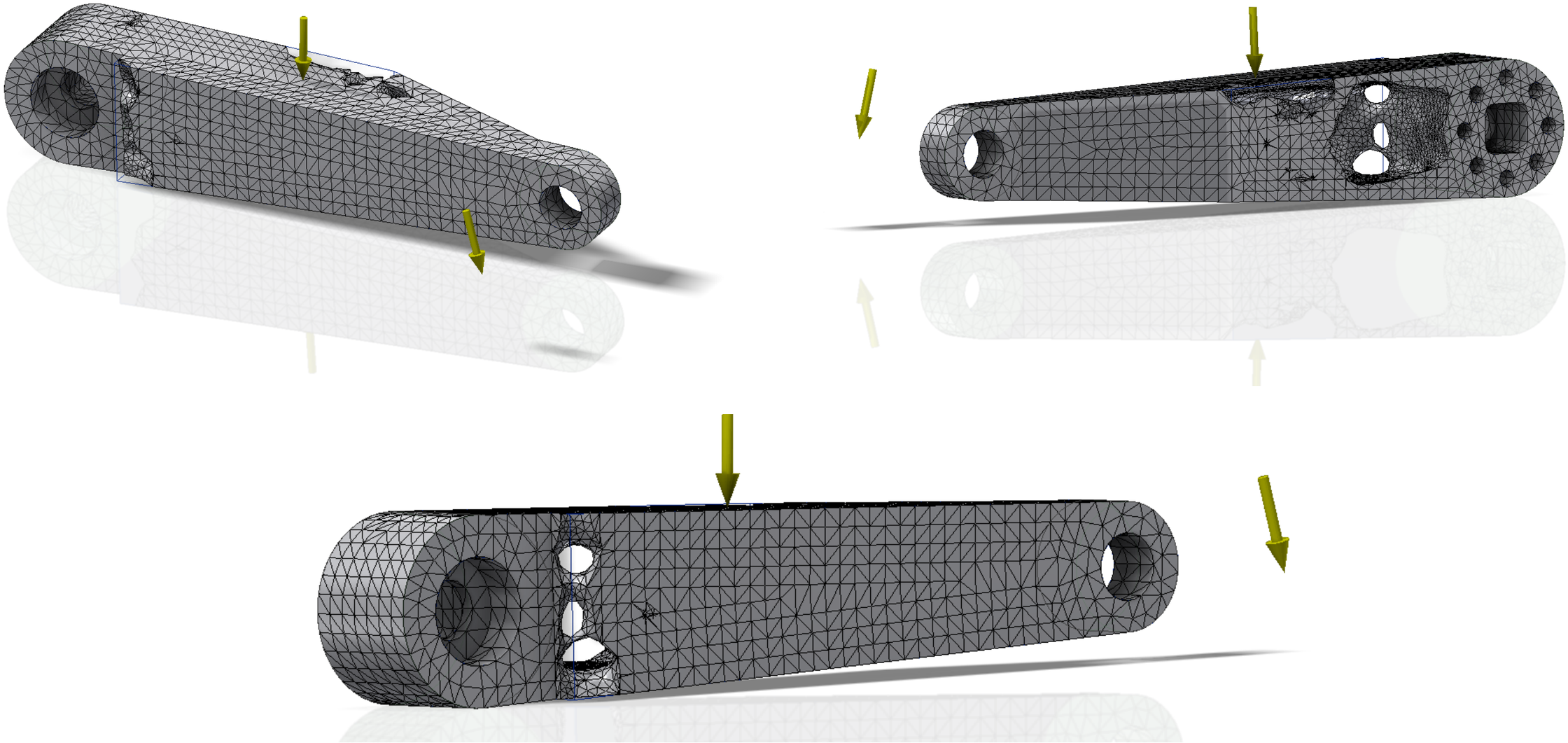


Crank Design

Crank Development V1

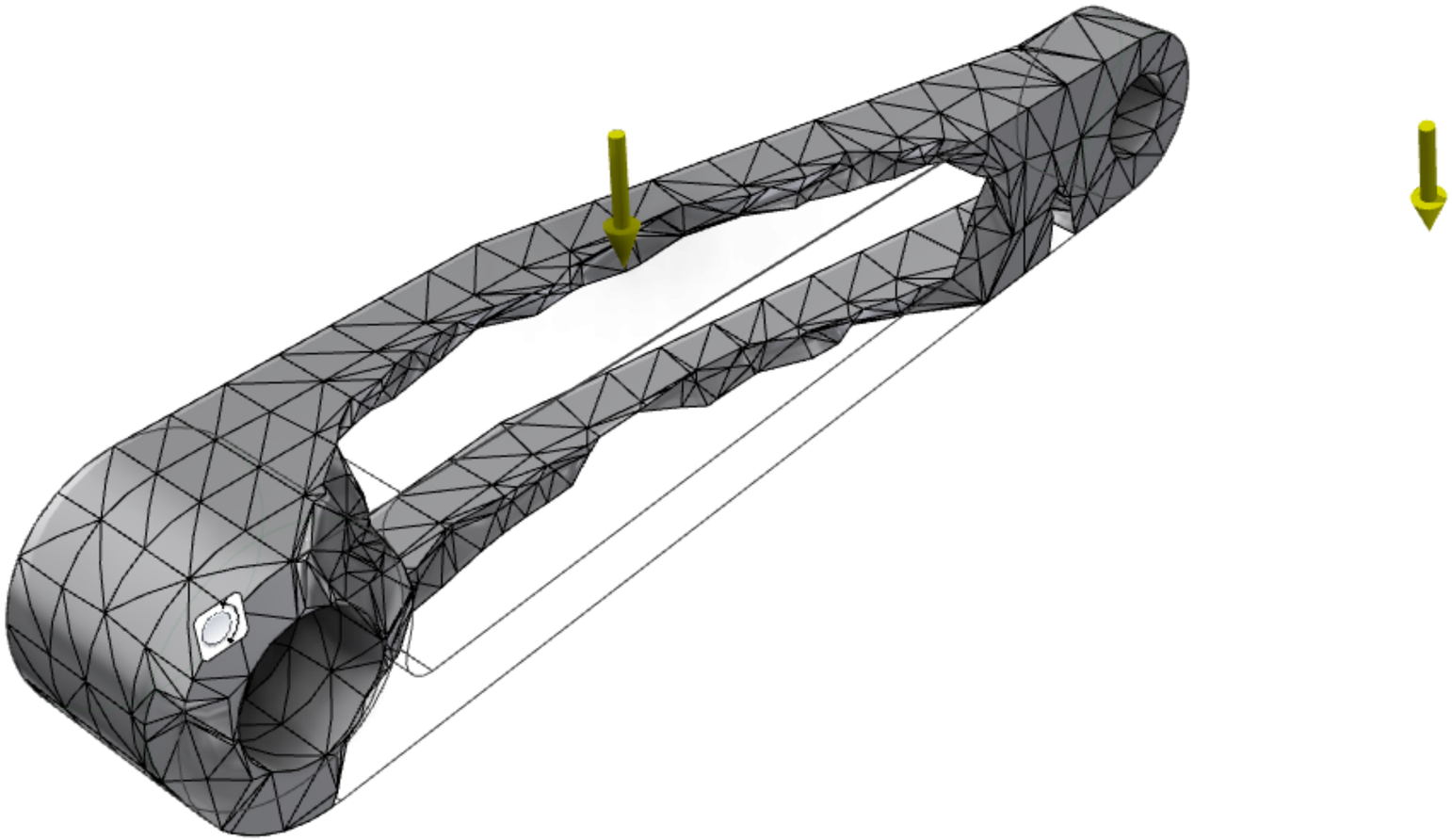


Crank Development V1

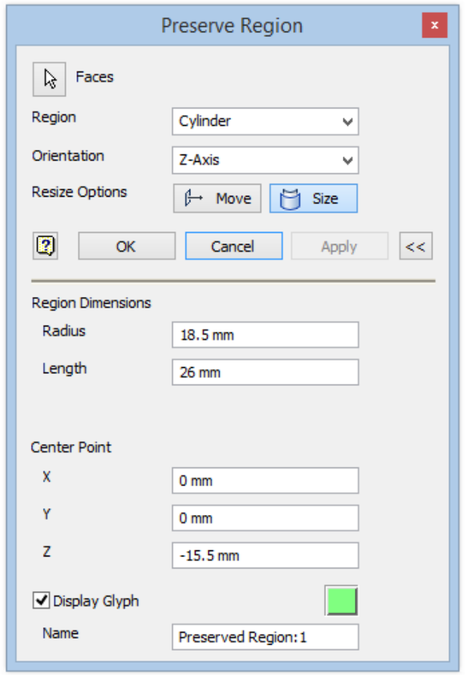


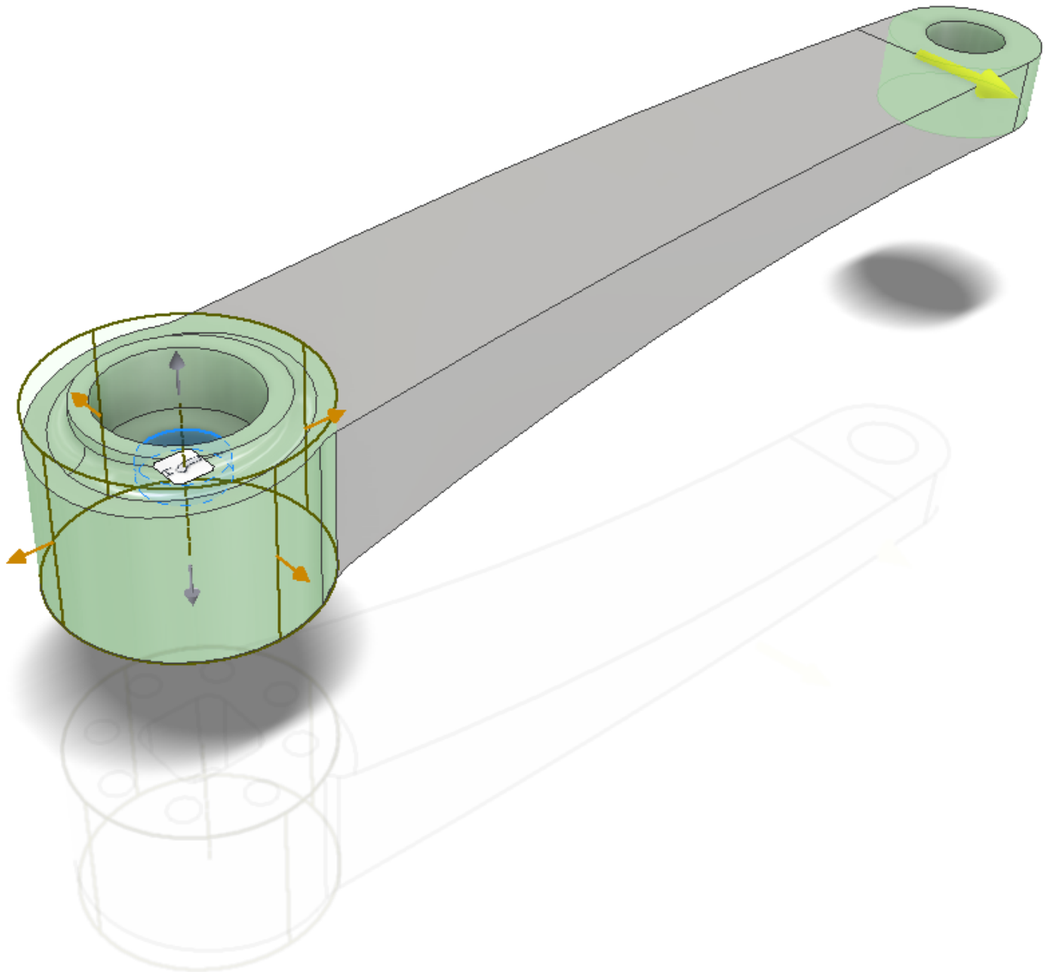
Crank Development V2

Crank Development V2

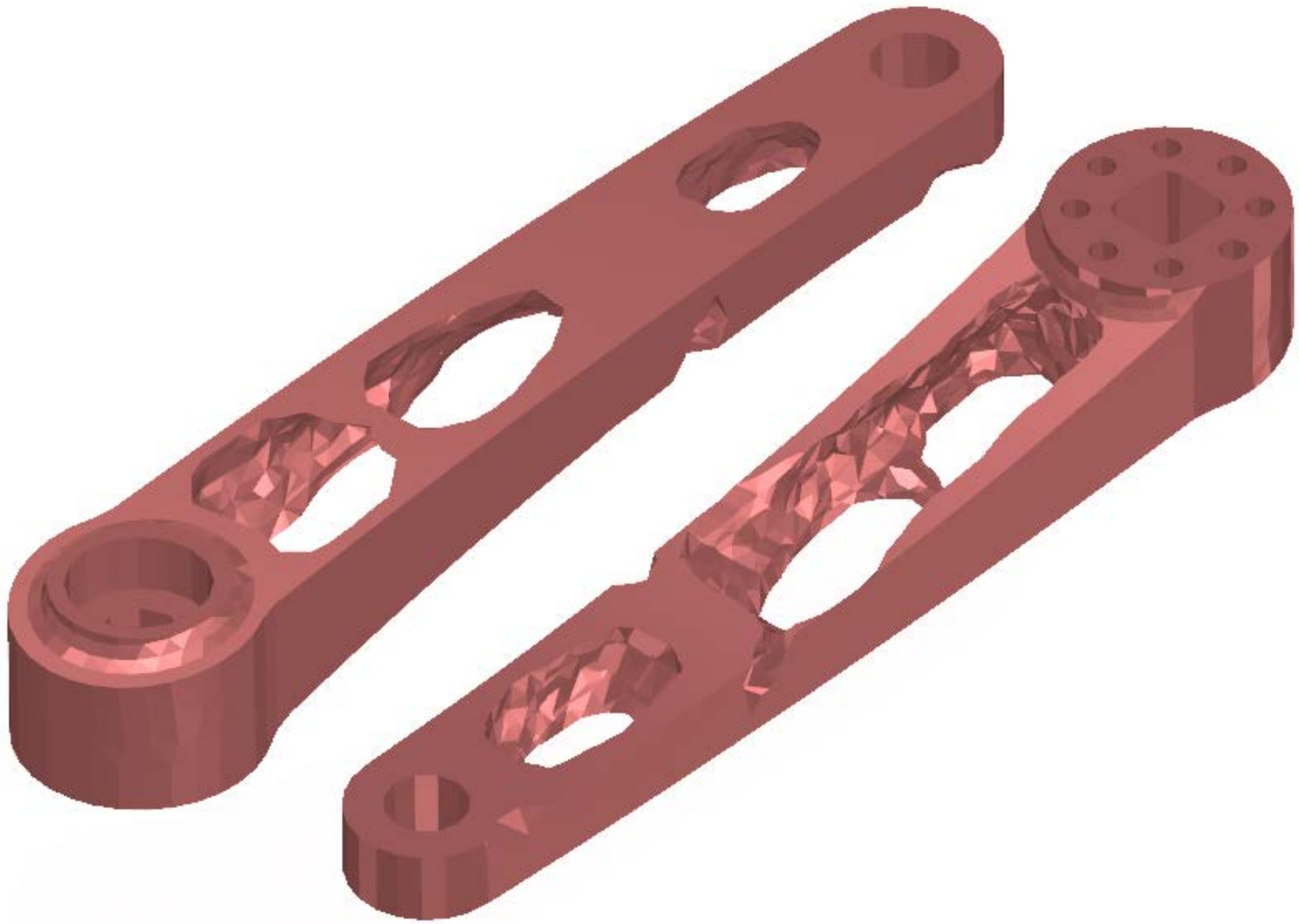


Crank Development V3

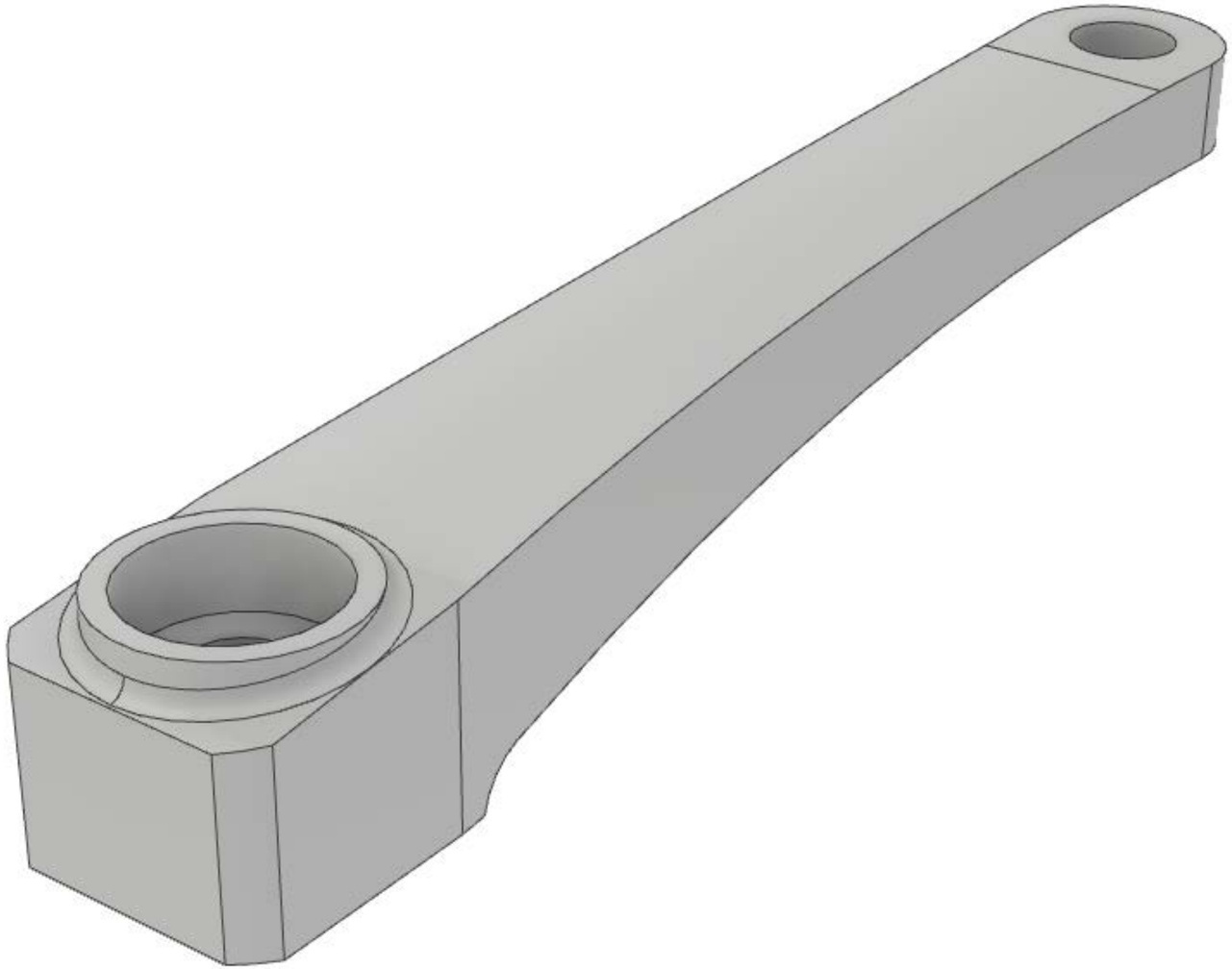




Crank Development V3

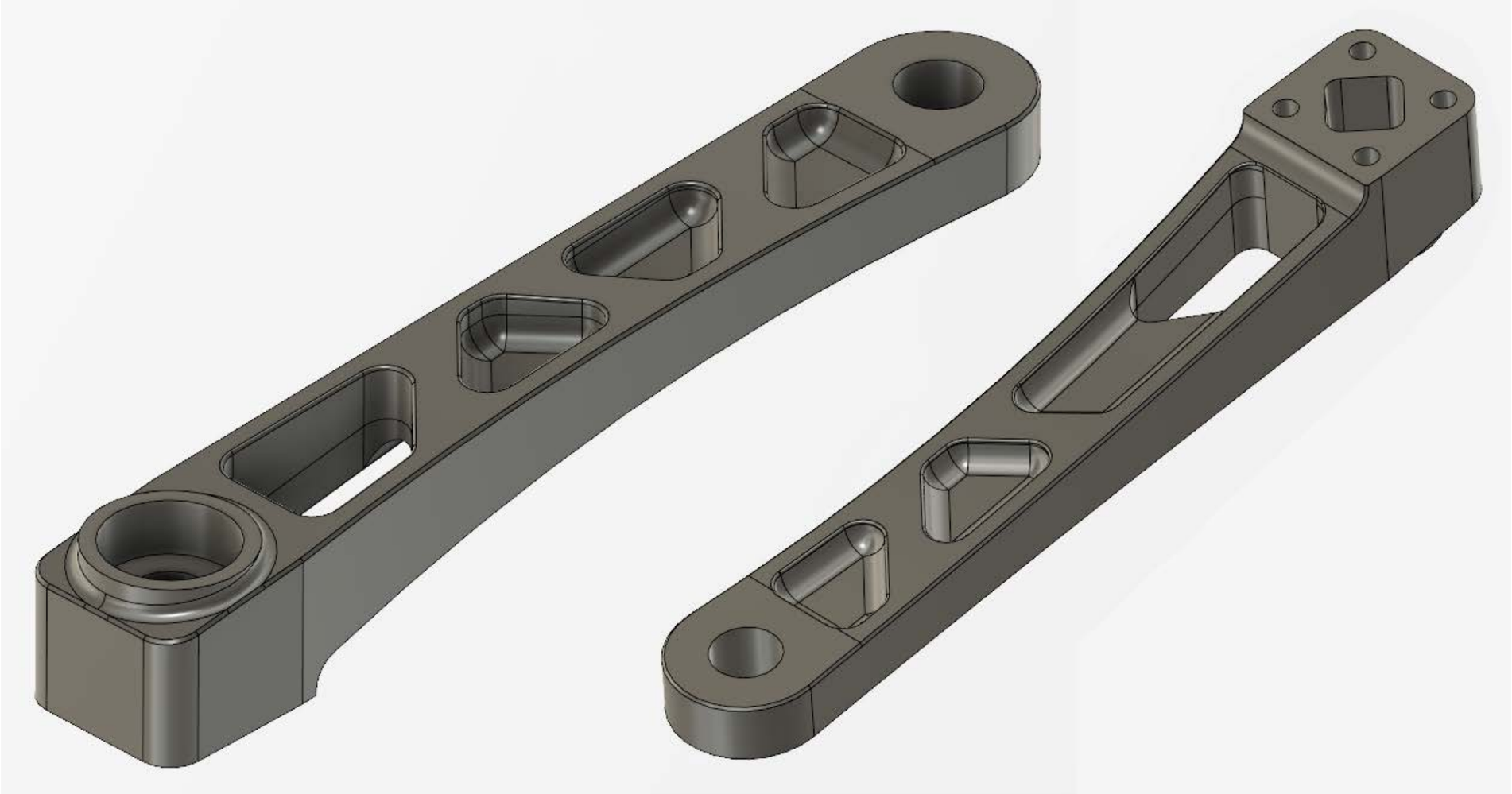


Crank Development V4

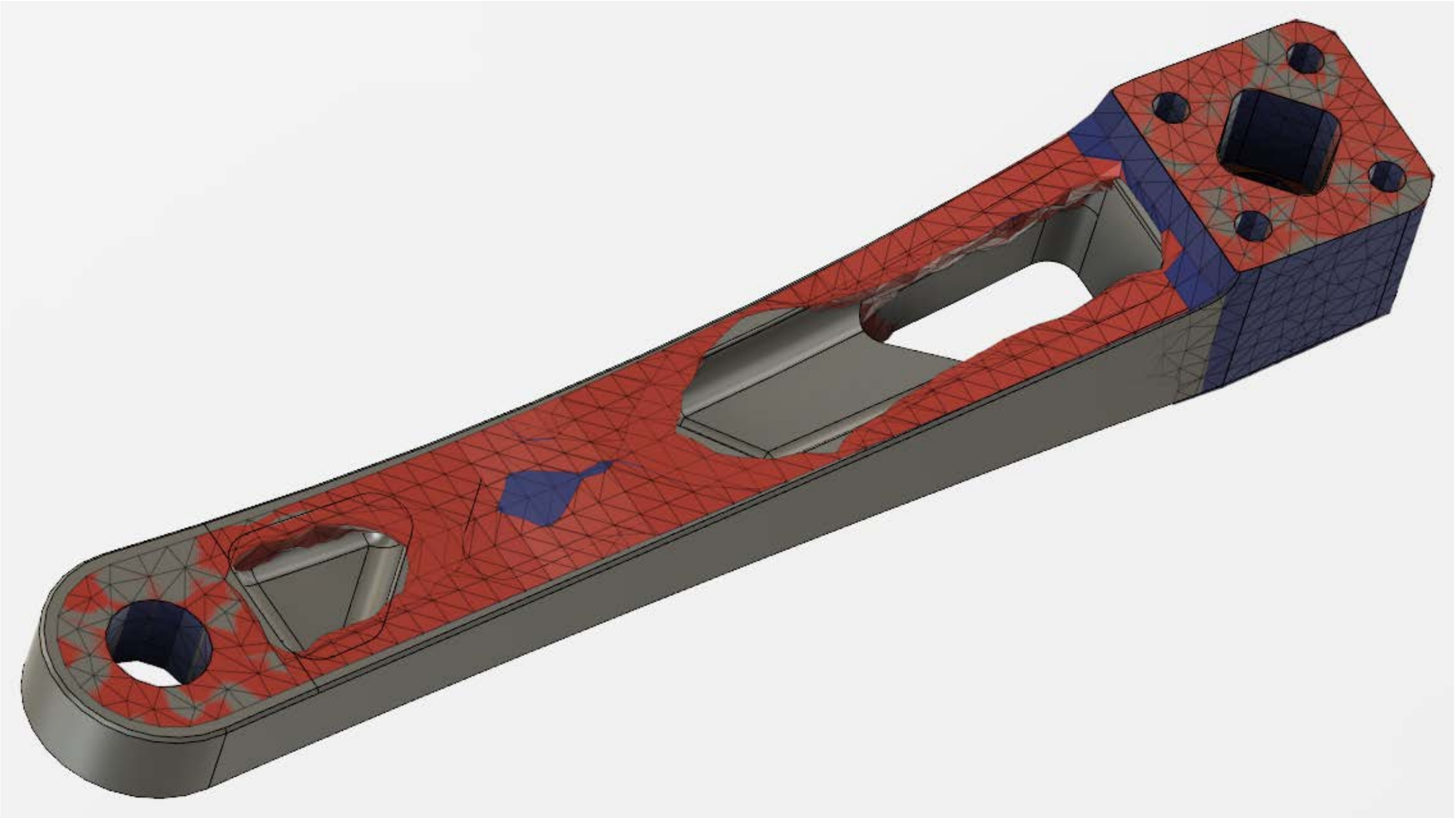


Crank Development V4

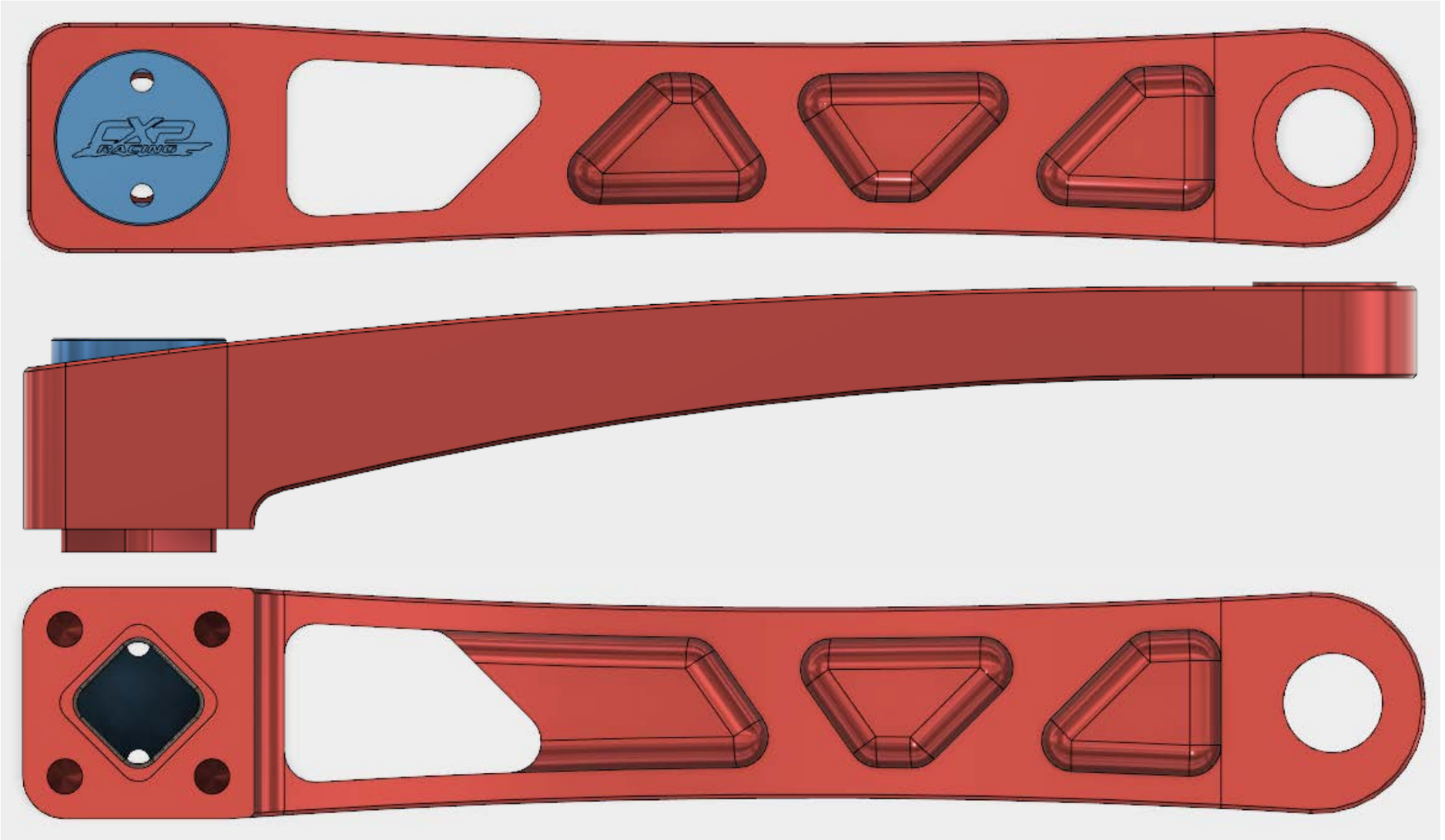
Crank Development V5



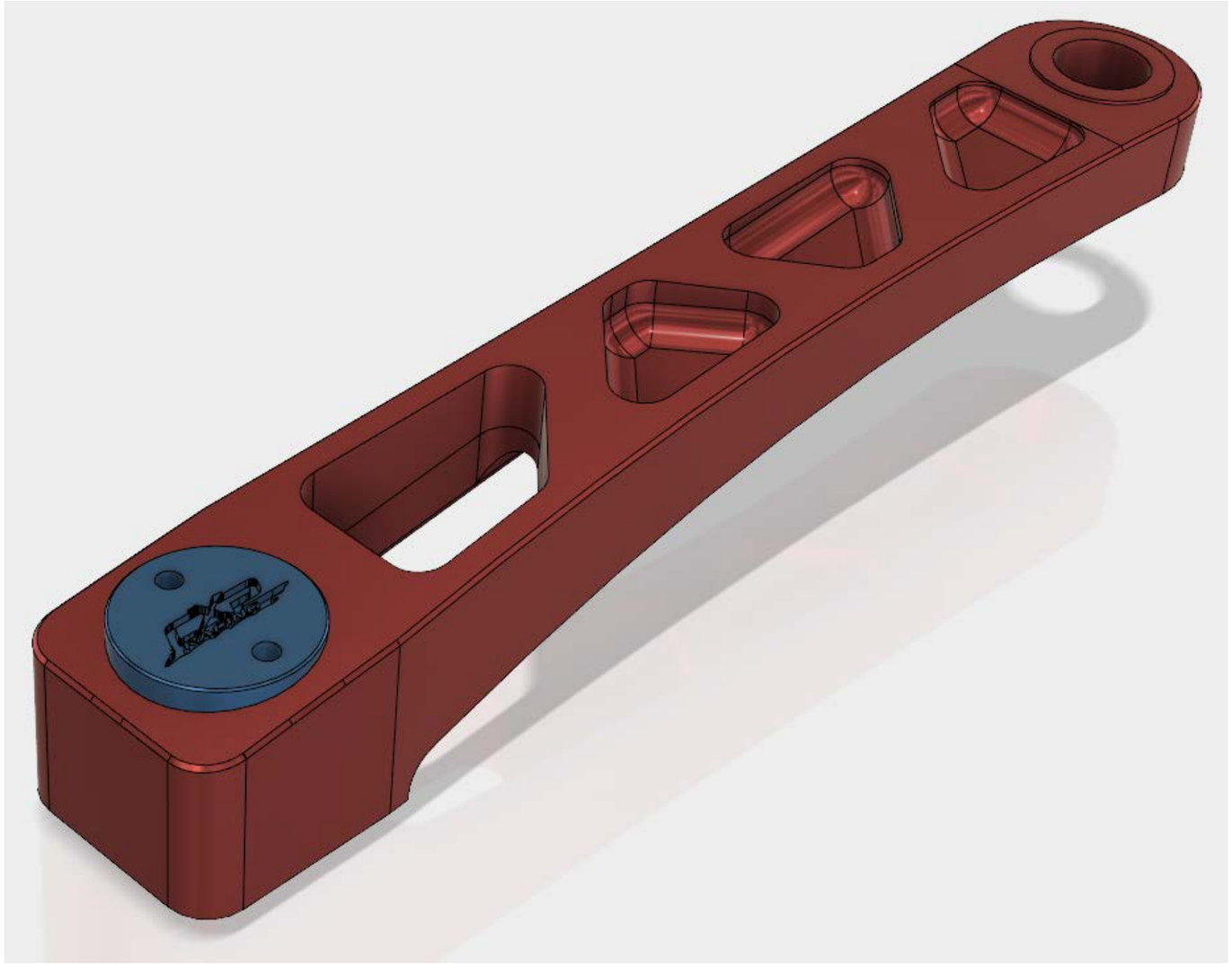
Crank Development V5



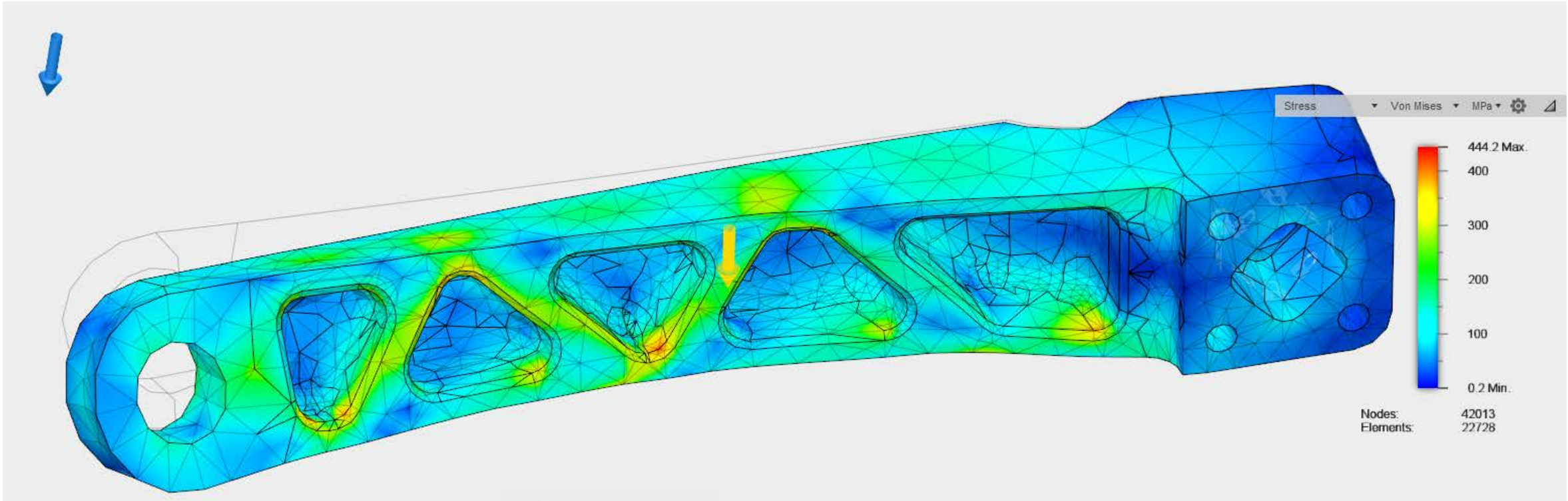
Crank Development V6



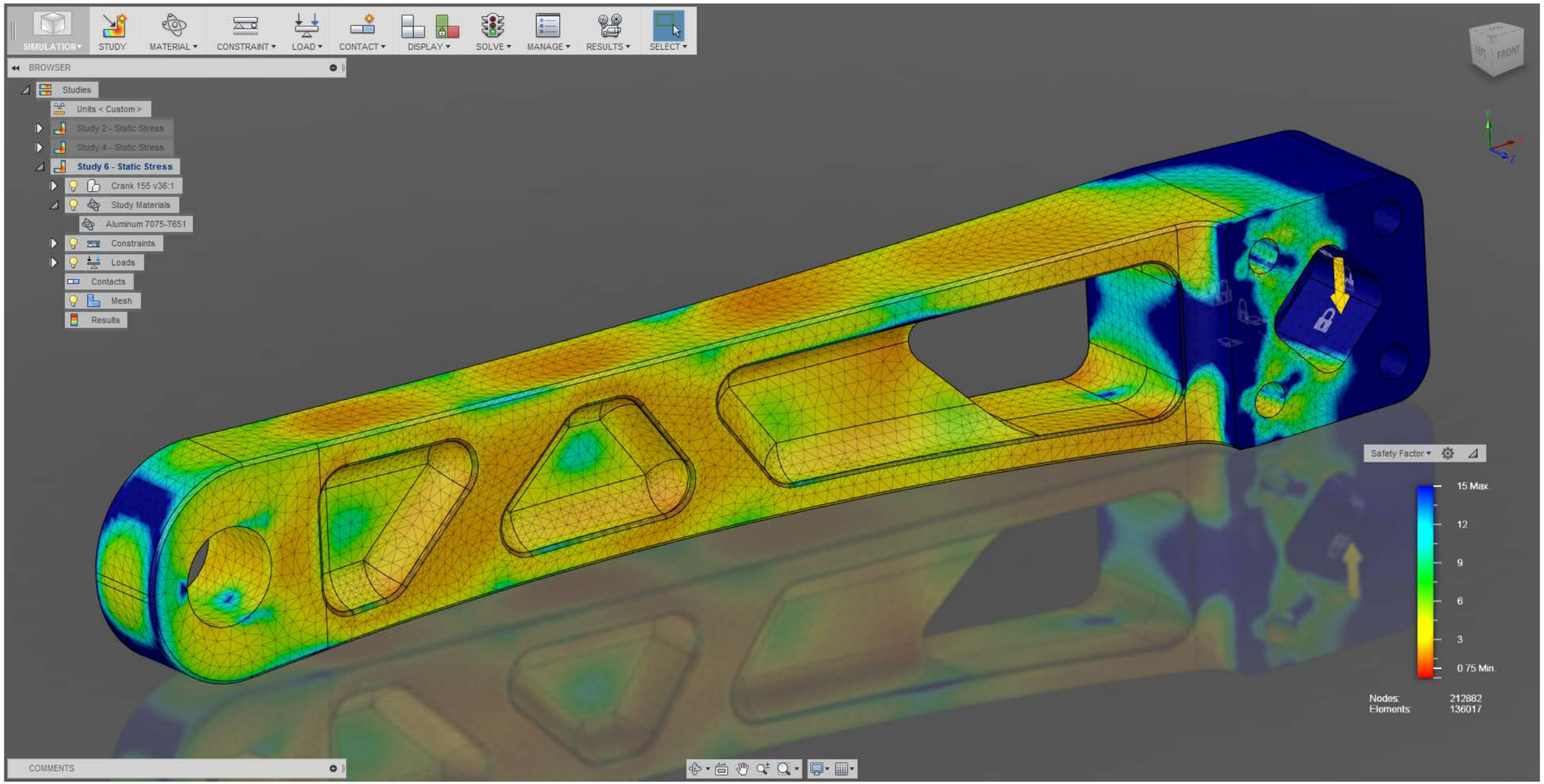
Crank Development V6



Old FEA Solver Results



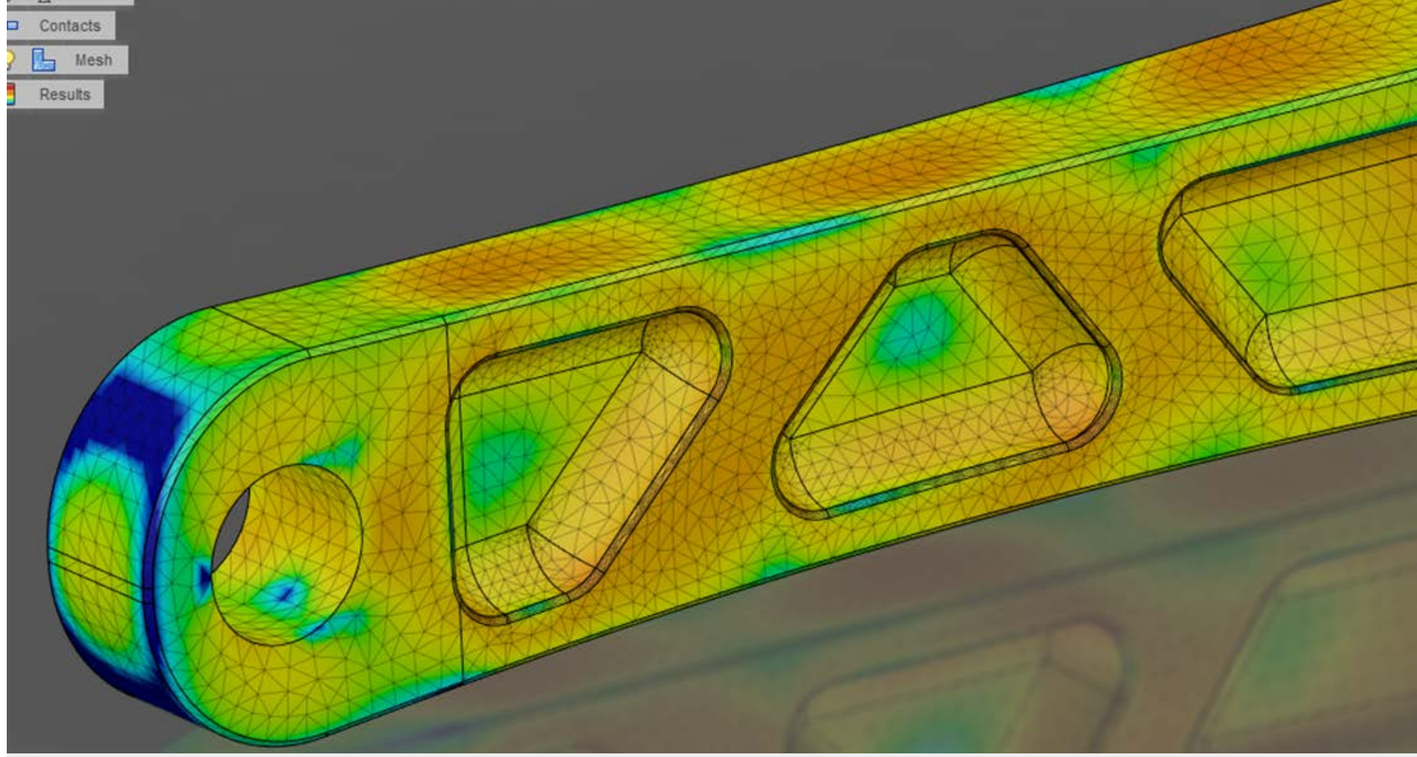
Crank Development V5

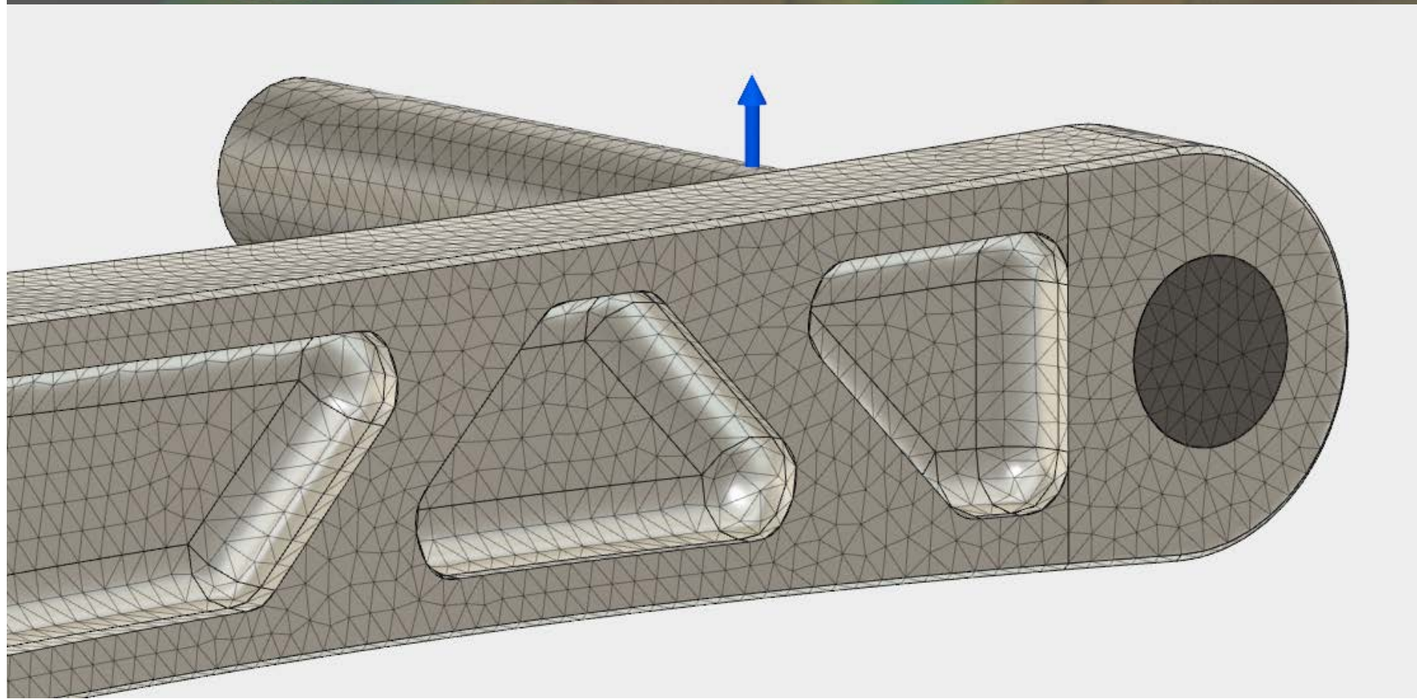


The Real World!!

What went wrong?

- Old mesh tools weren’t as good
- Naïve
- Incorrect assumptions during creation of Load Case
- Remote Load used previously, possibly added to inaccuracy

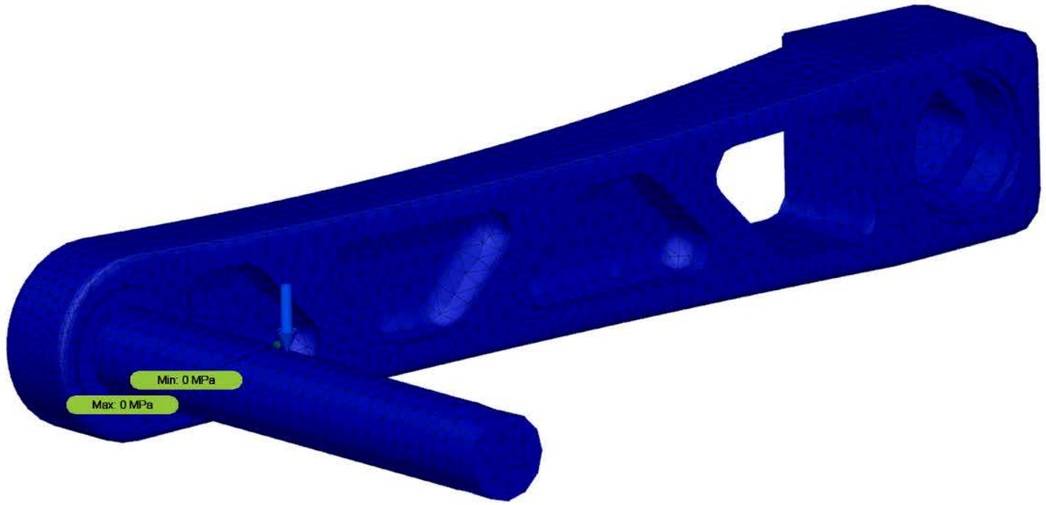


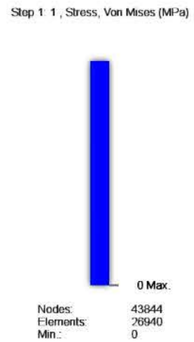


How can it be fixed?

Drop height	1	m
Velocity	4.429446918	m/s
Deceleration distance	50	mm
Deceleration	196.2	m/s/s
Mass	55	kg
Total Force	10,791.00	N
Force On each Pedal	5,395.50	N

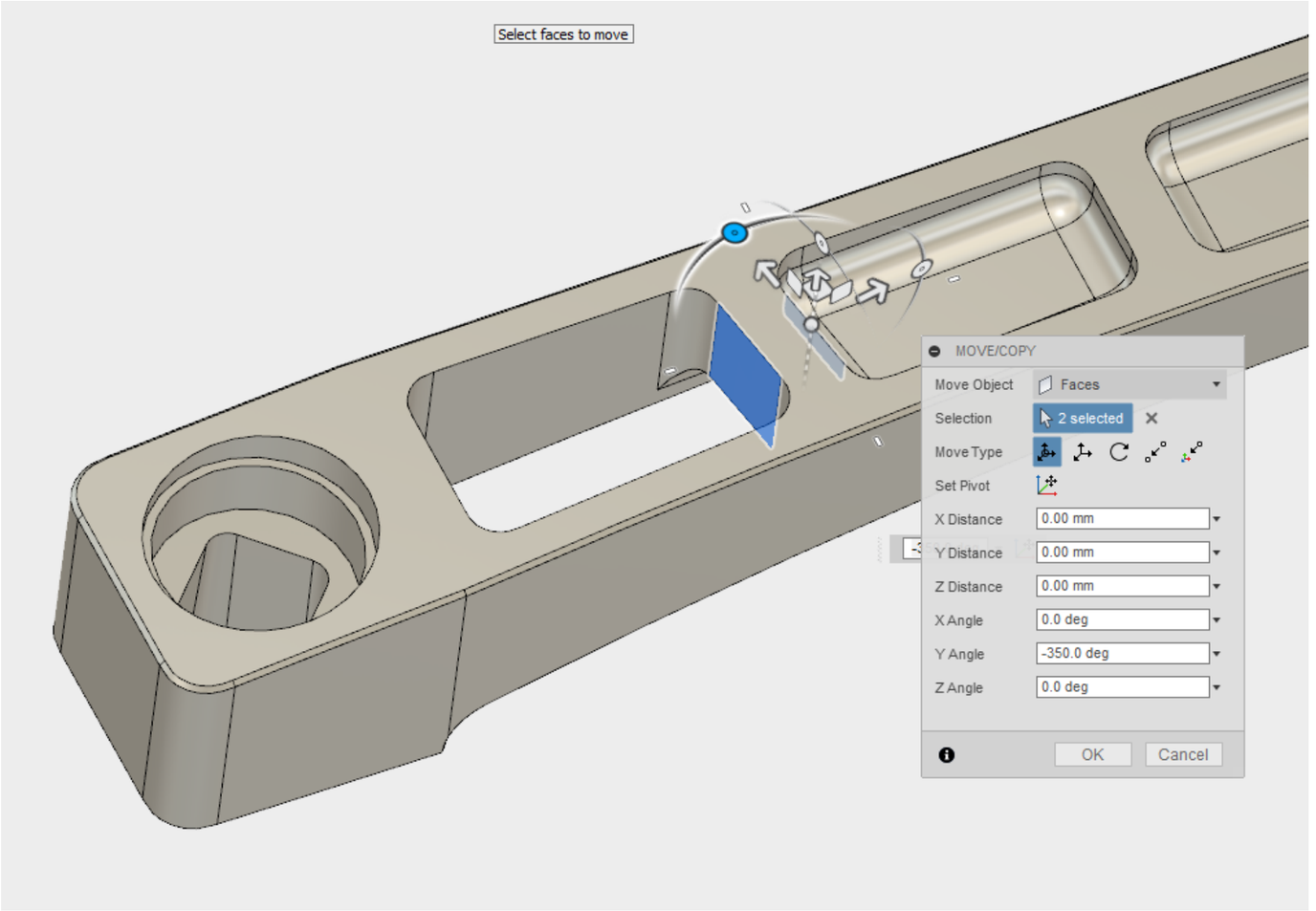
- Use original design parameters
- Apply load to pedal shaft body
- Re-run static study with new solver
- Investigate new nonlinear studies available with the NASTRAN solver
- Replicate Physical failure digitally
- Assume 1m vertical drop & 50mm deceleration distance
- Lets take a look…





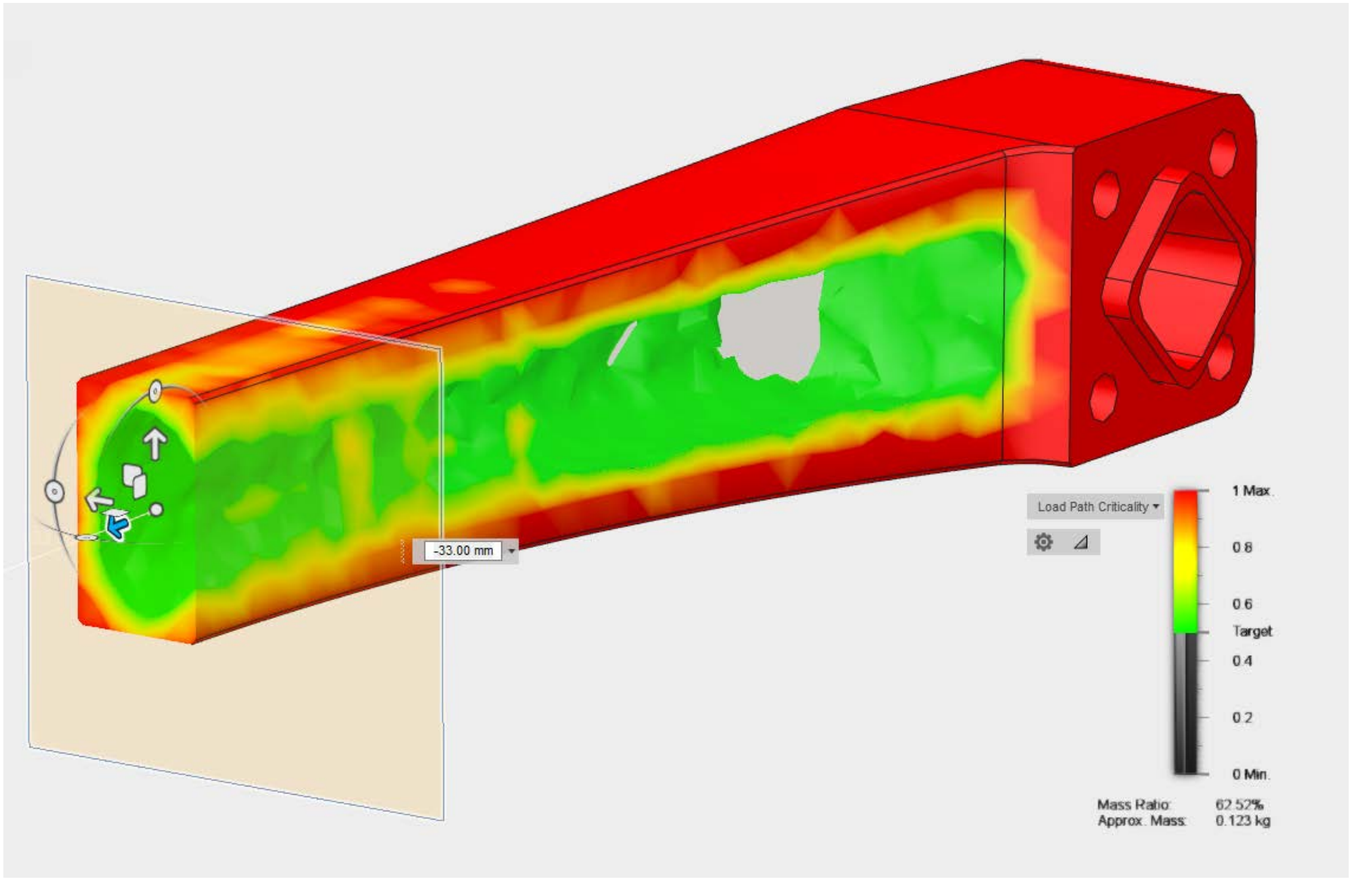
Iterate Design

- Simplify Workspace
- Quickly create multiple designs
- Direct Edit Tools
- Remove & Add features
- Run simulations on each variation



Fusion 360 Shape Generation

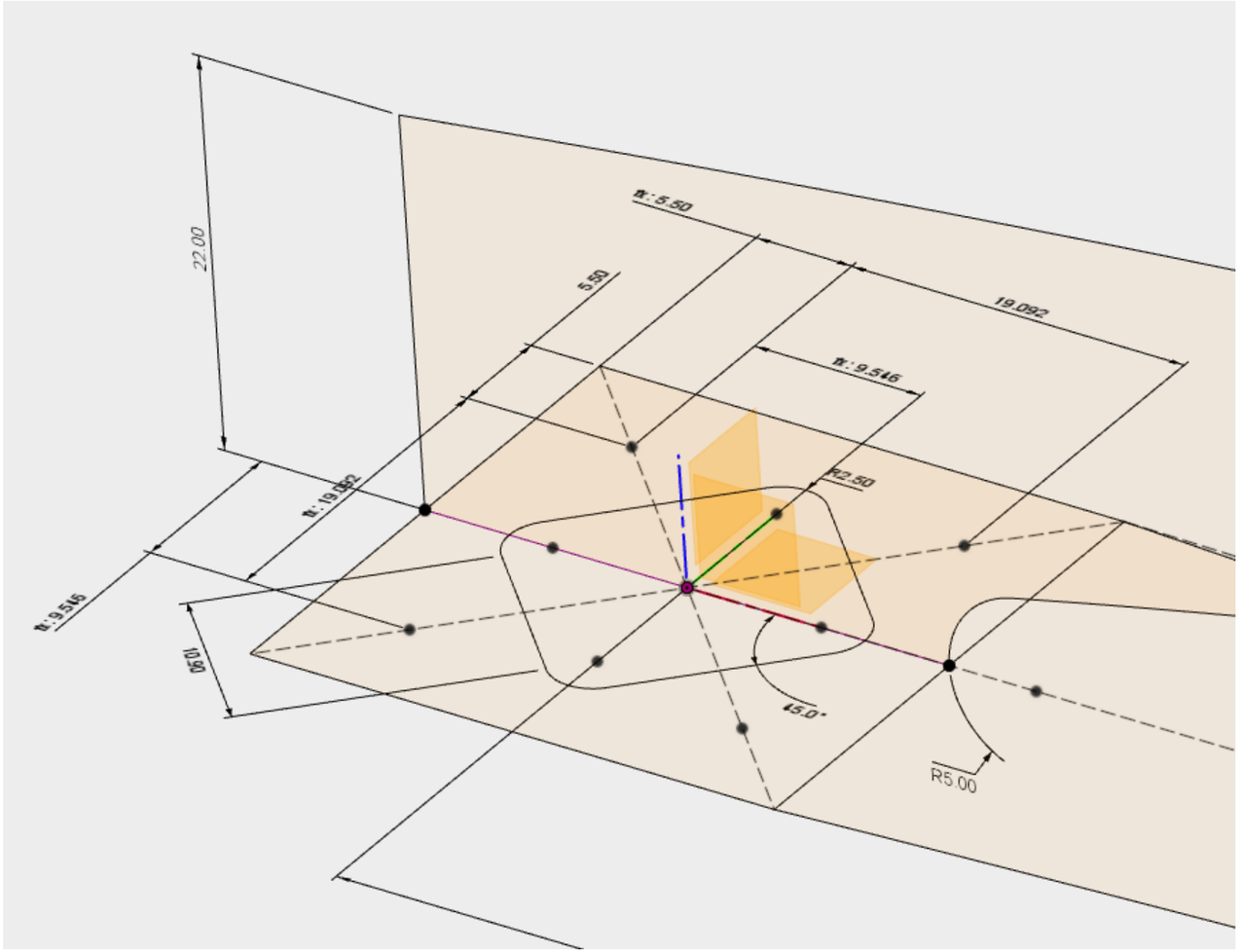
- Cloud Solved with Cloud Credits
- Don’t make mesh size too small
- Promote Mesh Result to Model
- Rationalise result to manufacturing method
- Fusion Shape Gen seems better than Inventor’s



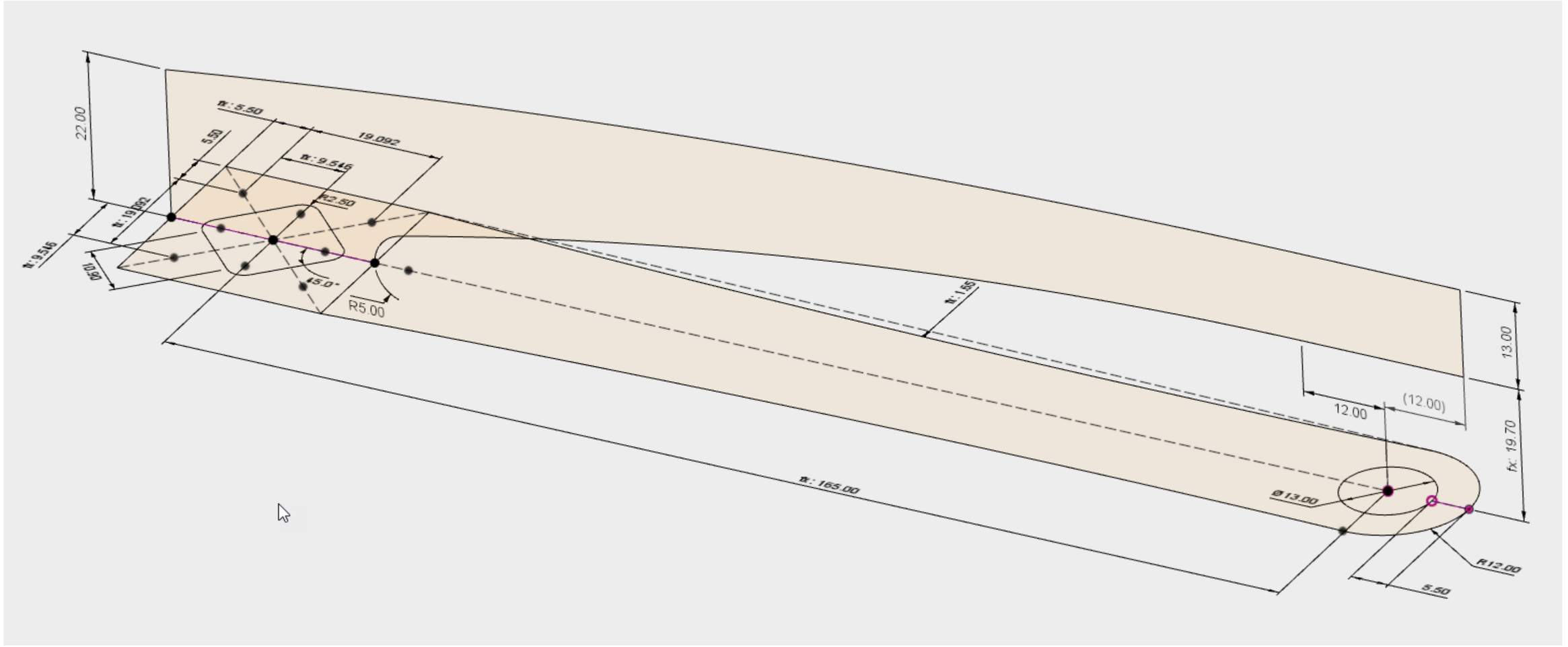
CREATE NEW COMPONENT

Parametric History Based Design

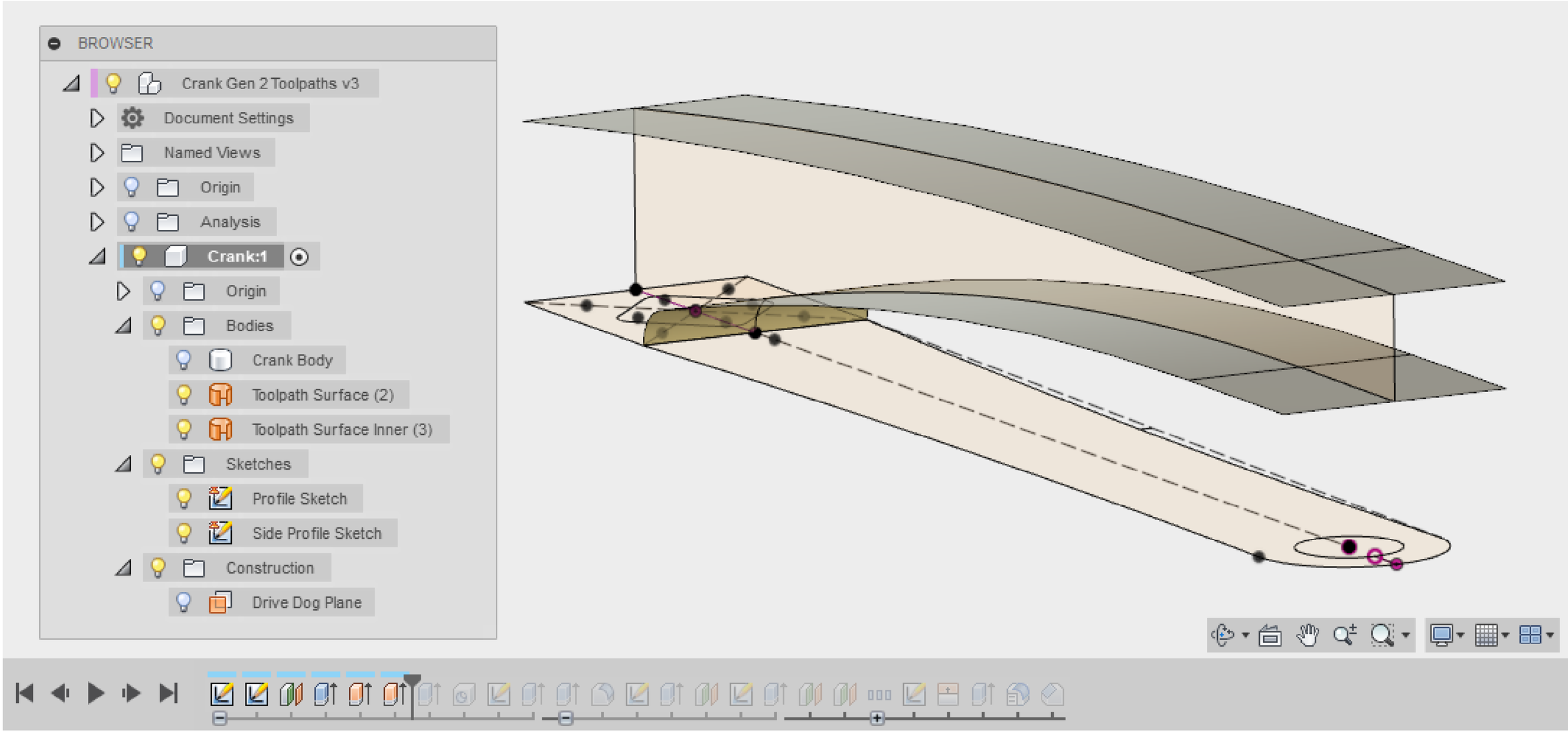
- Establish Design Intent
- Start from Origin
- Simple Sketches
- Simple model features
- Model fillets where possible, don’t sketch them.
- Use Construction features.
- Reuse base sketches



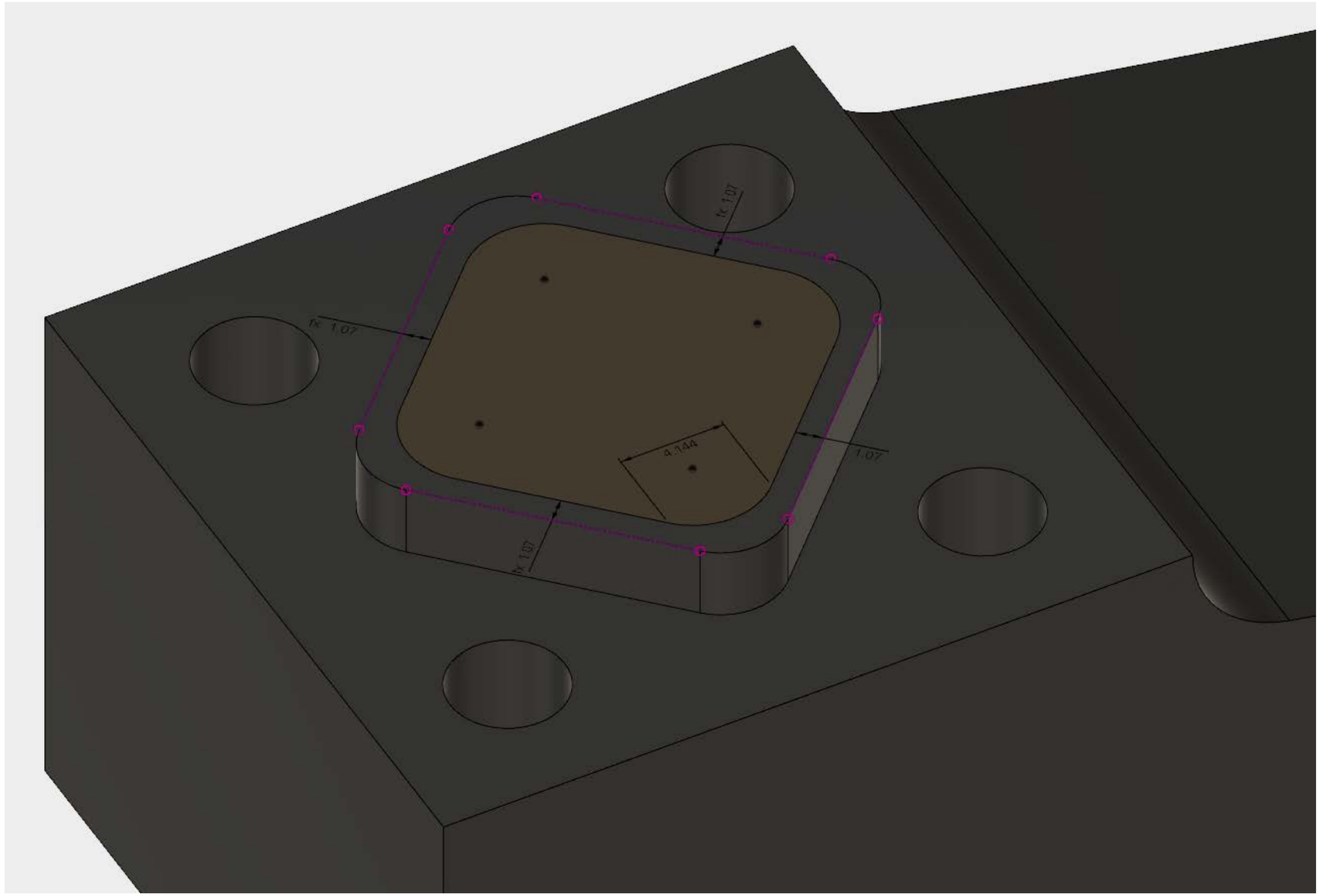
Parametric History Based Design



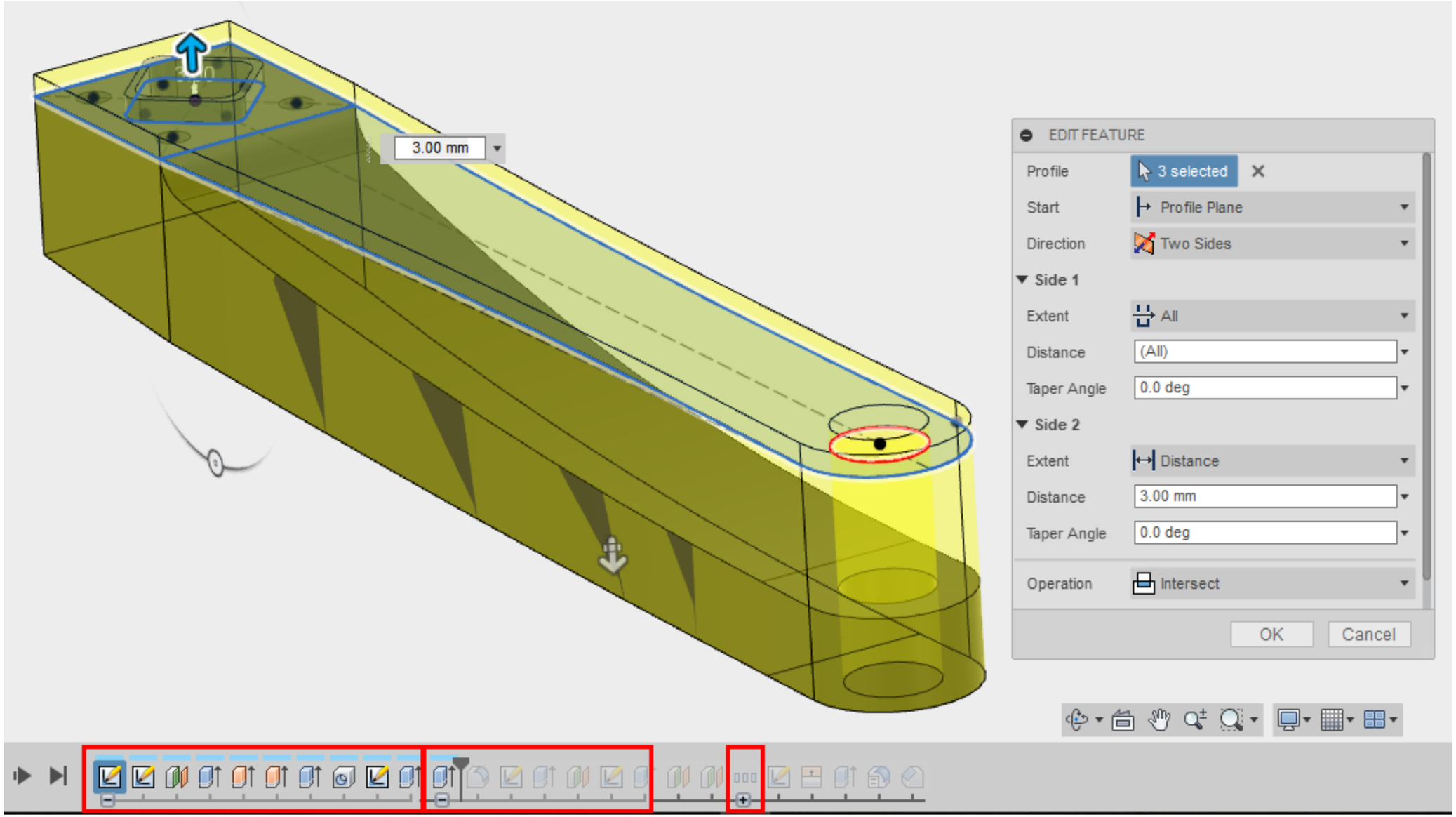
Model for Manufacture



Build relationships between sketches & features

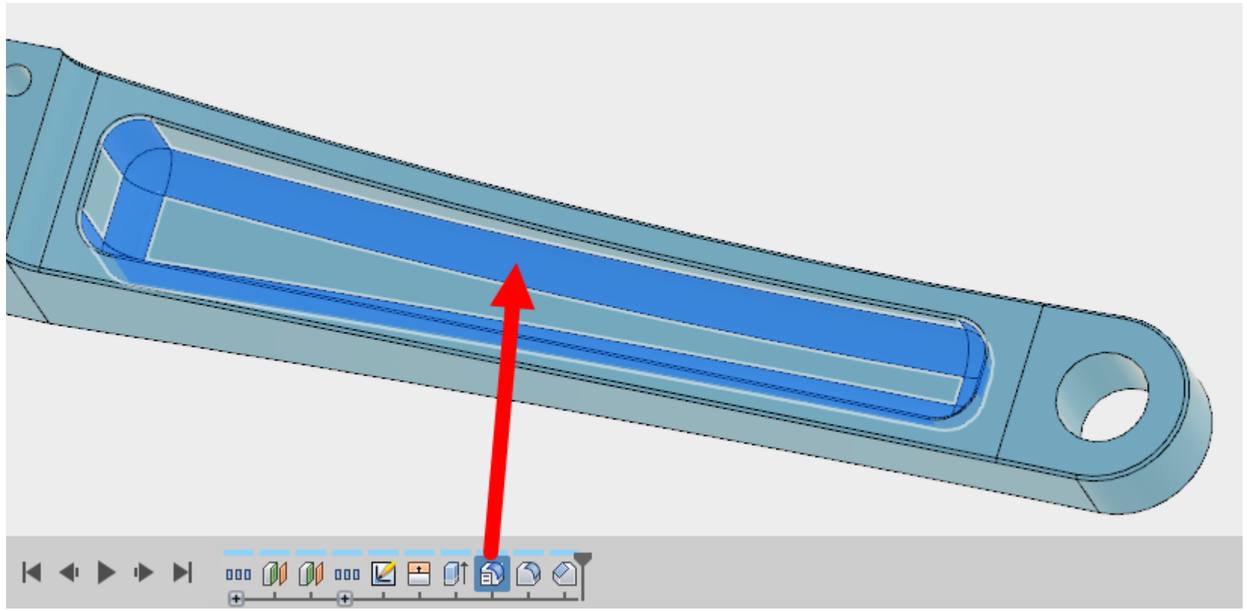


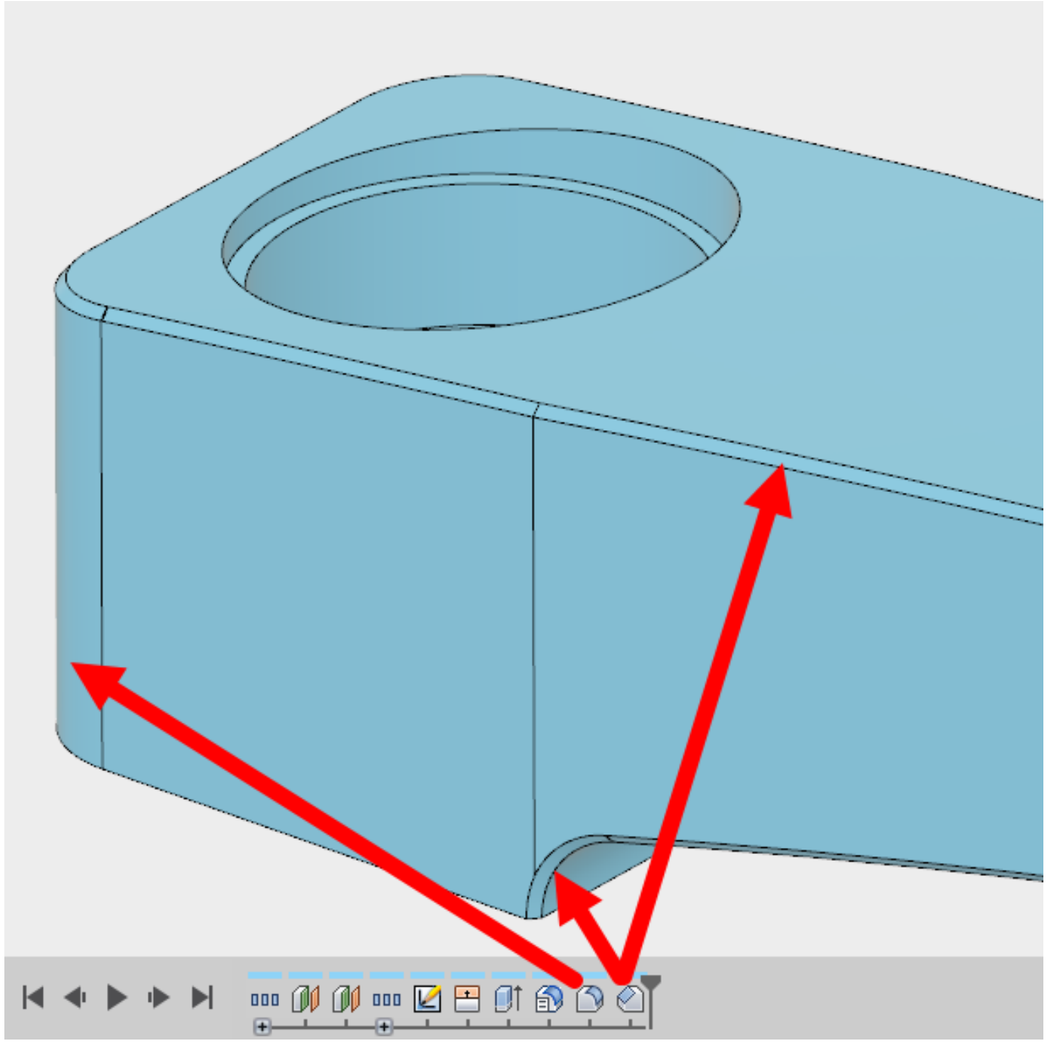
Grouping & ‘different’ methods



Best Practice

- Add fillets & chamfers last
- Rule Fillets are more reliable
- Try not to model chamfers



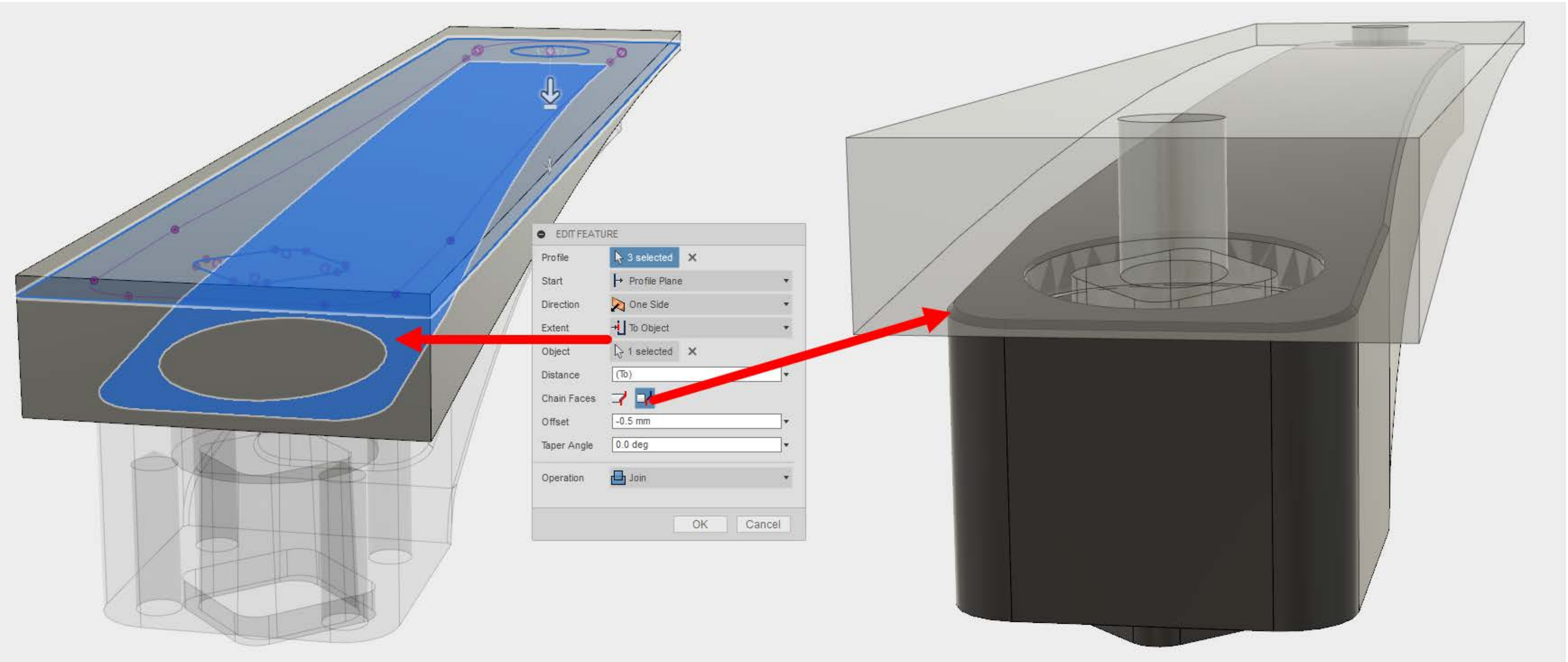


Crank CAD Demo

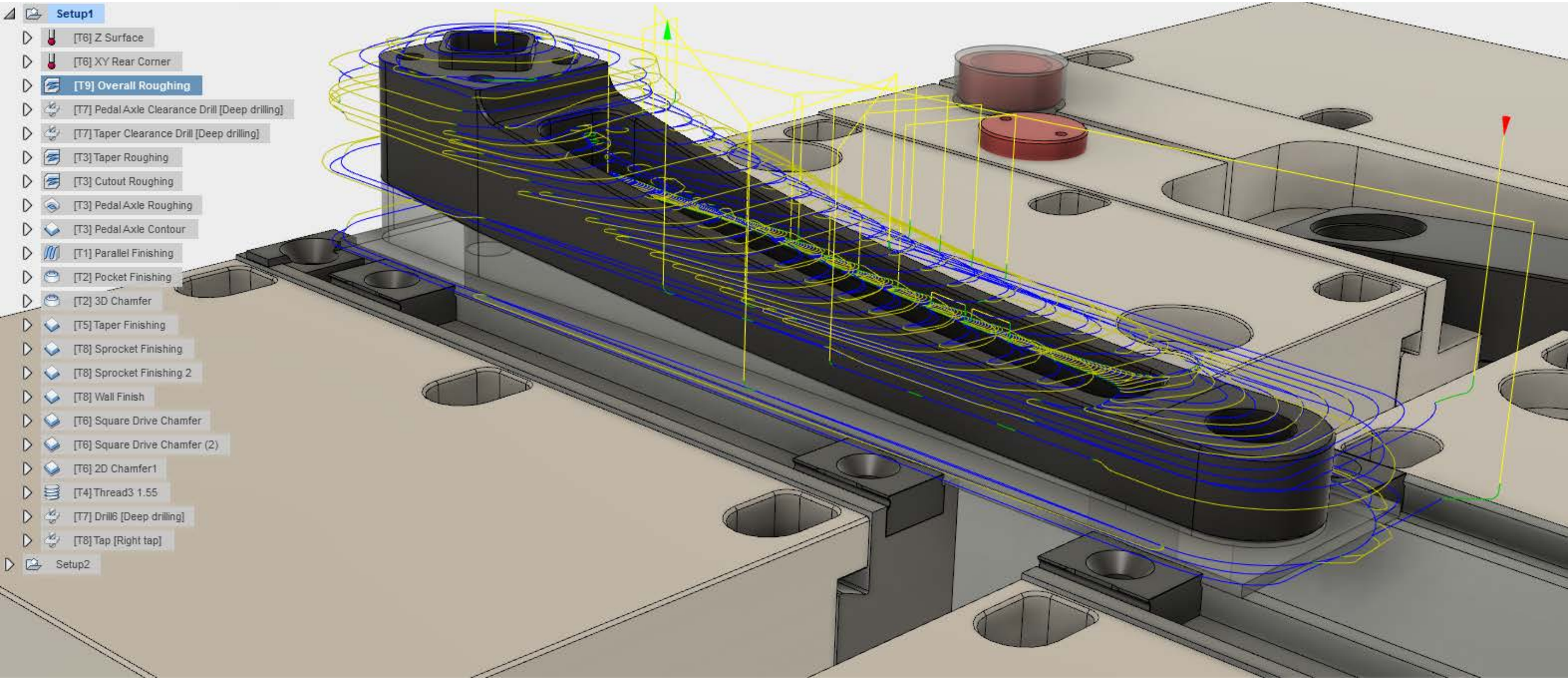
Switch to Fusion 360 for Live CAD Demo

Crank CAM

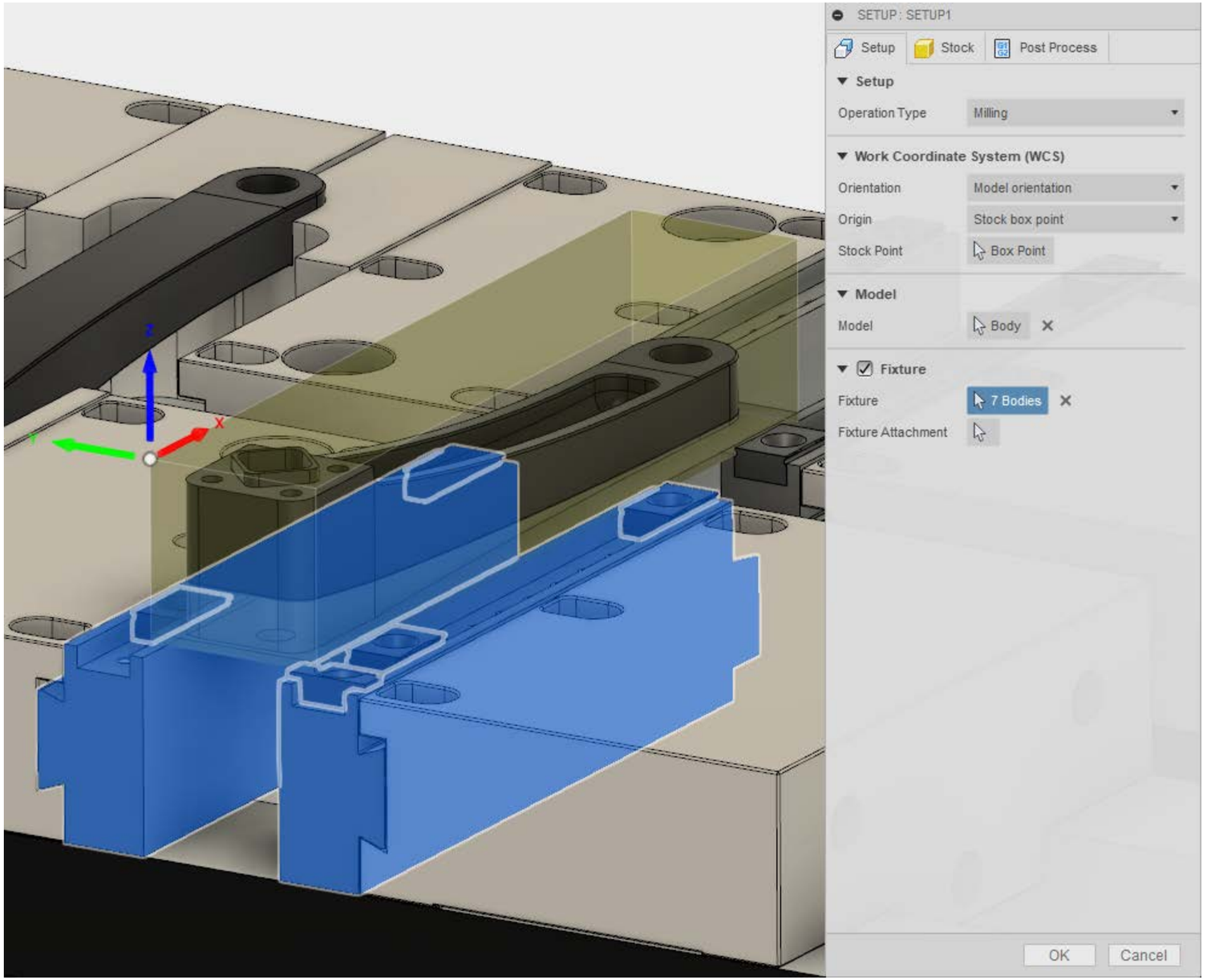
Stock Definition



Setup

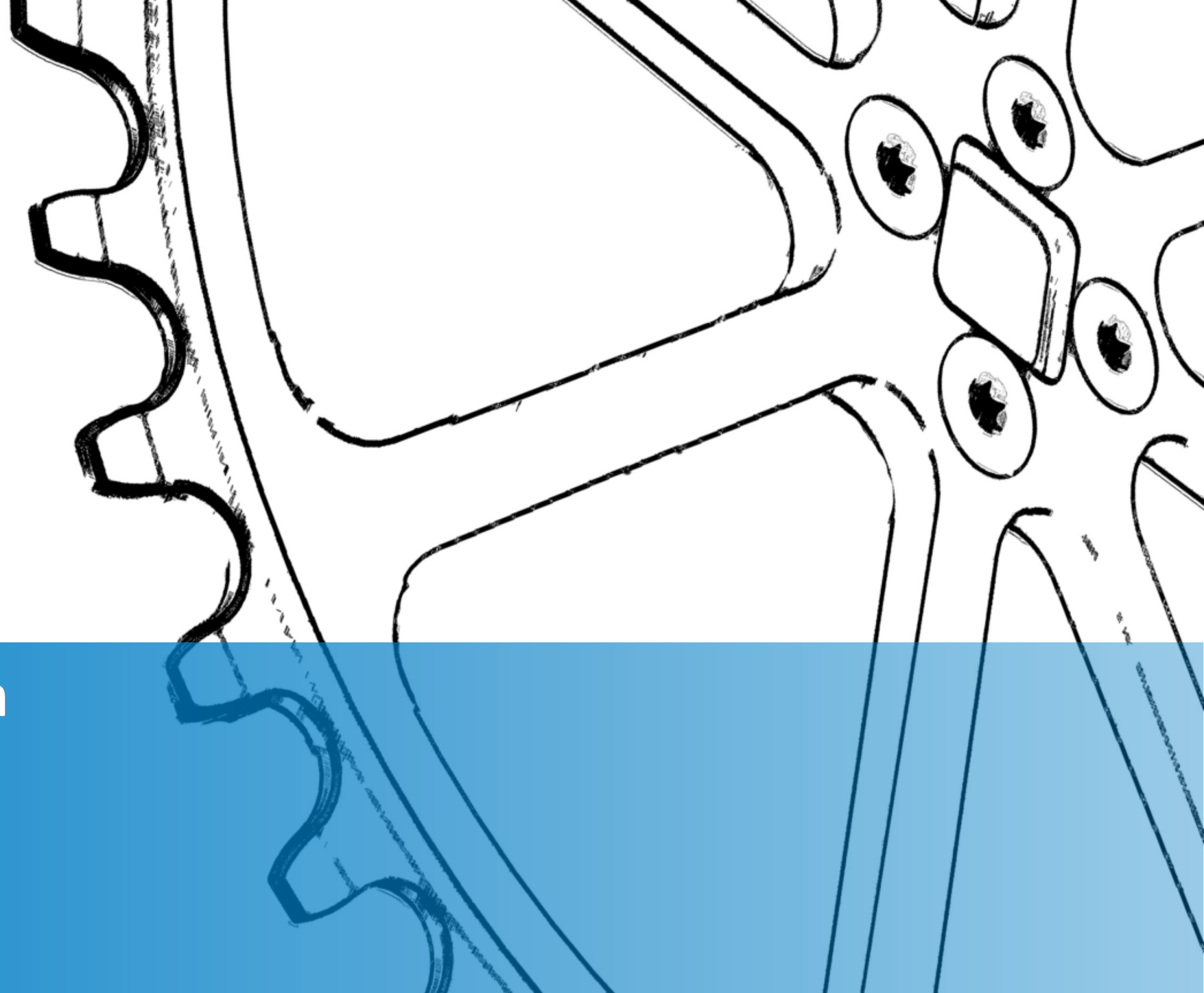

Setup1
[T6] Z Surface
[T6] XY Rear Corner
[T9] Overall Roughing
[T7] Pedal Axle Clearance Drill [Deep drilling]
[T7] Taper Clearance Drill [Deep drilling]
[T3] Taper Roughing
[T3] Cutout Roughing
[T3] Pedal Axle Roughing
[T3] Pedal Axle Contour
[T1] Parallel Finishing
[T2] Pocket Finishing
[T2] 3D Chamfer
[T5] Taper Finishing
[T8] Sprocket Finishing
[T8] Sprocket Finishing 2
[T8] Wall Finish
[T6] Square Drive Chamfer
[T6] Square Drive Chamfer (2)
[T6] 2D Chamfer1
[T4] Thread3 1.55
[T7] Drill6 [Deep drilling]
[T8] Tap [Right tap]
Setup2

Setup


SETUP : SETUP1
Setup
Stock
Post Process
Setup
Operation Type
Milling
Work Coordinate System (WCS)
Orientation
Model orientation
Origin
Stock box point
Stock Point
Box Point
Model
Model
Body
Fixture
Fixture
7 Bodies
Fixture Attachment
OK
Cancel
Z
X
Y

Crank CAM Demo

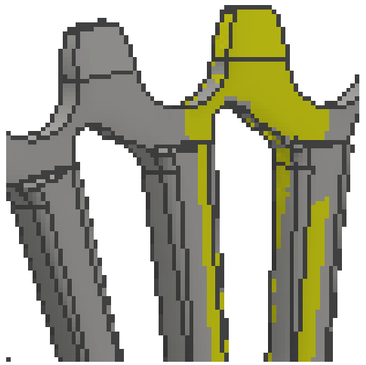
- Switch to Fusion for CAM Demo

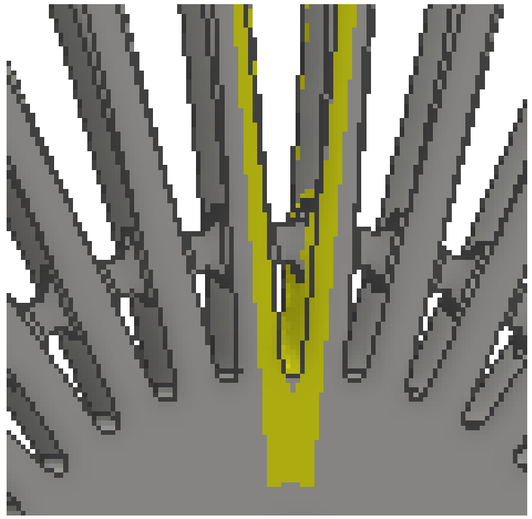


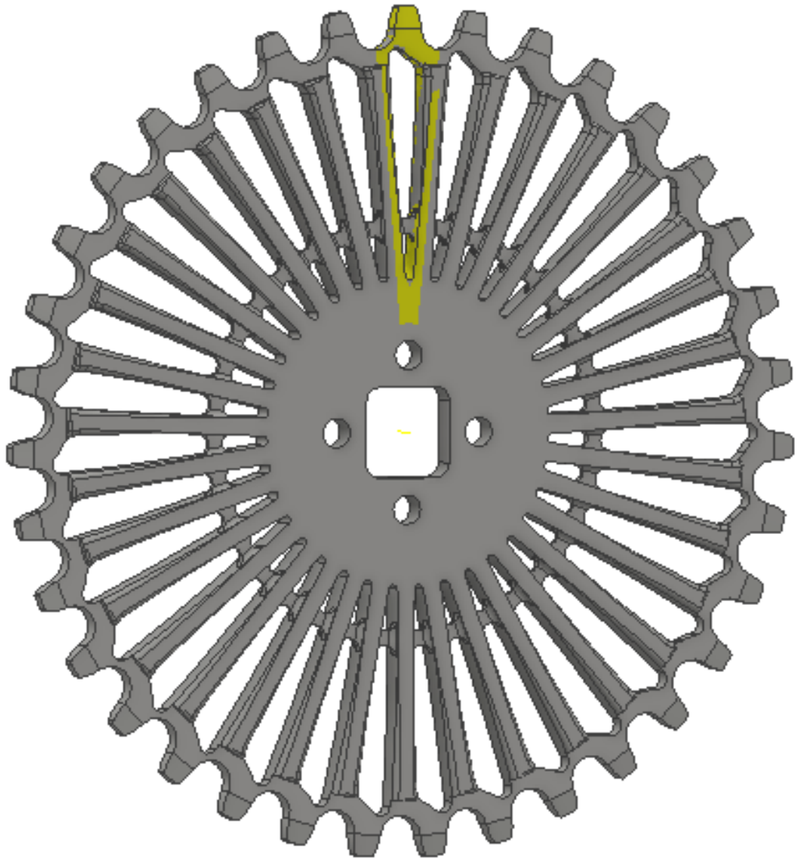
Chain Ring Design

Chain Ring Development V1

- Shape Gen Study
- Single Tooth Load
- Interesting Features
- Too Heavy

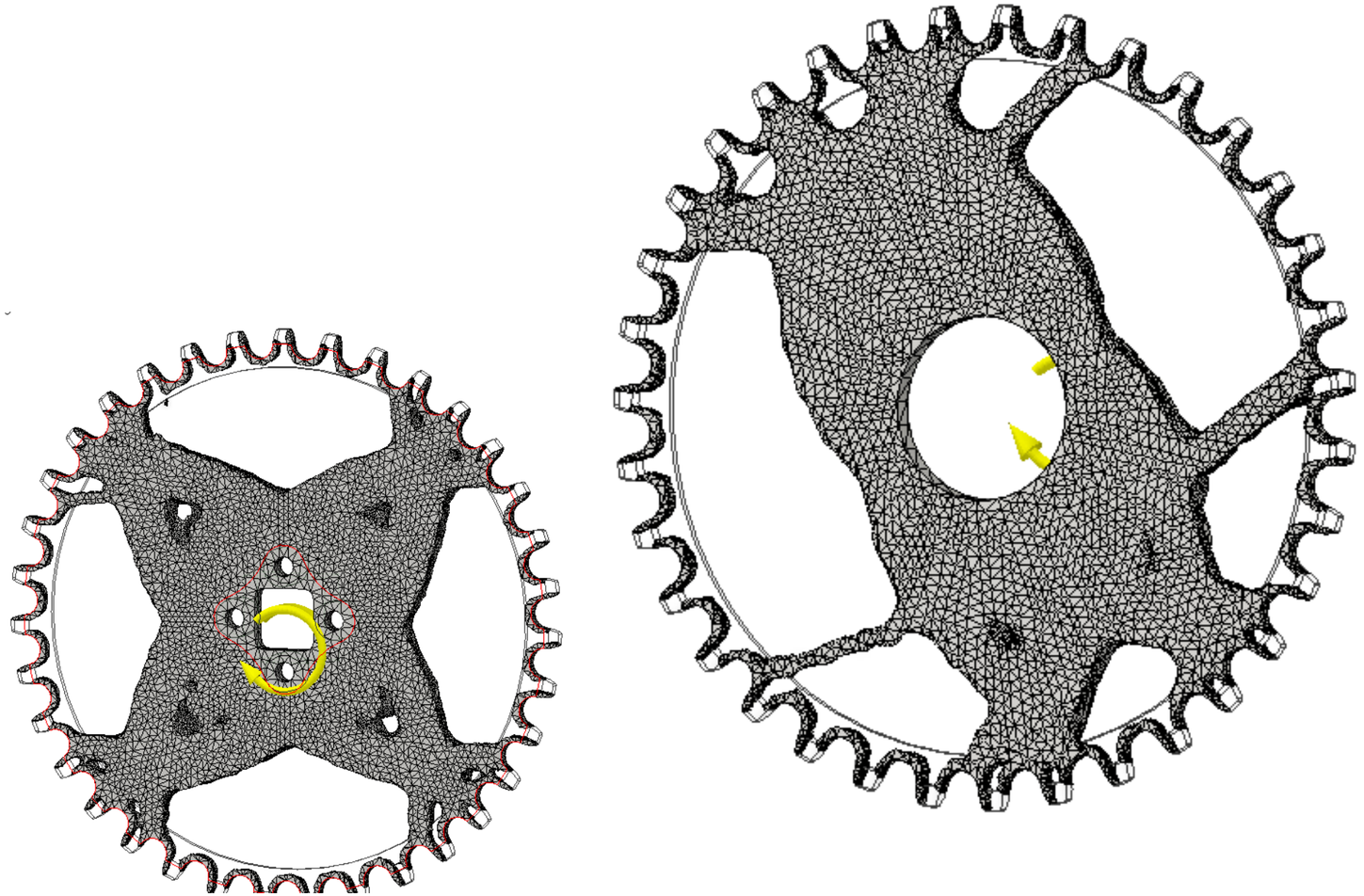






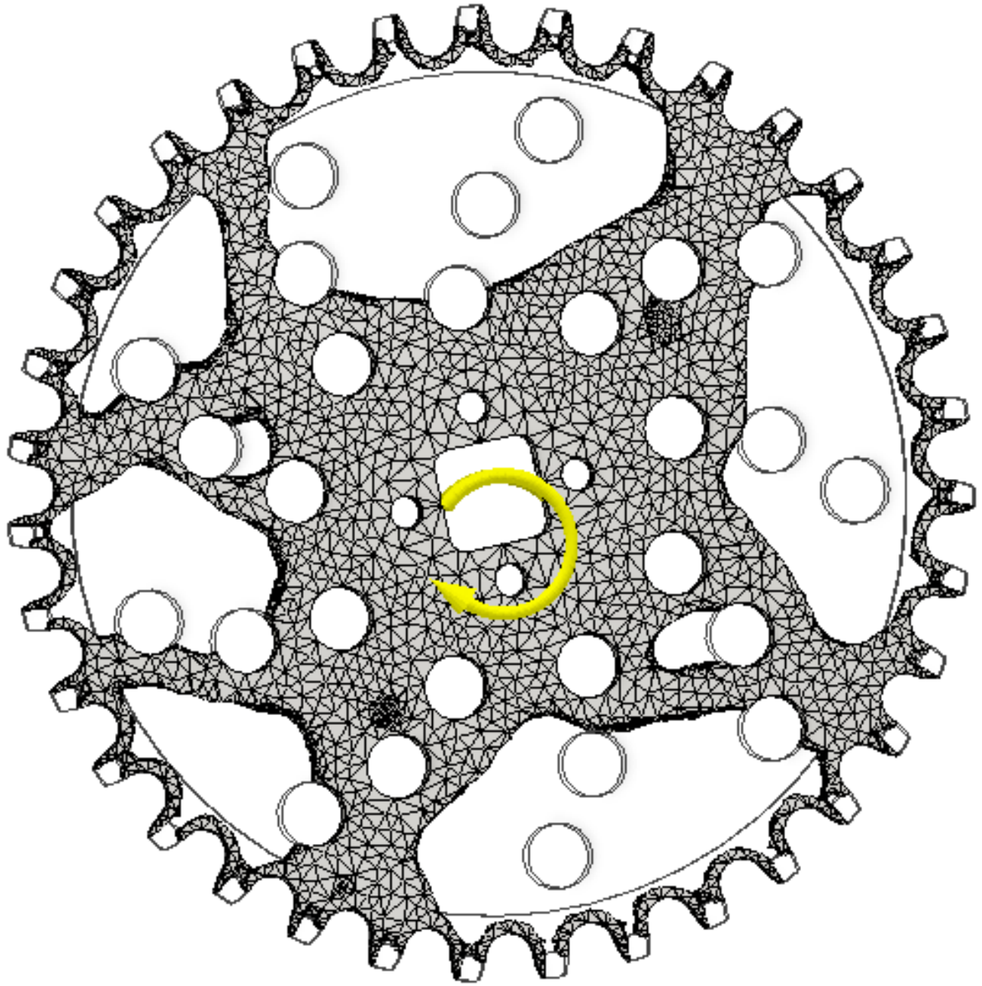
Chain Ring Development V2

- Shape Gen Study
- All Teeth Loaded
- Useless
- Too Heavy
- Dodgy Teeth
- Curious



Chain Ring Development V3

- Shape Gen Study
- All Teeth Loaded
- Guided Modelling
- More Useful
- Too Heavy
- Dodgy Teeth
- More Curious



henderson_eng... FOLLOWING

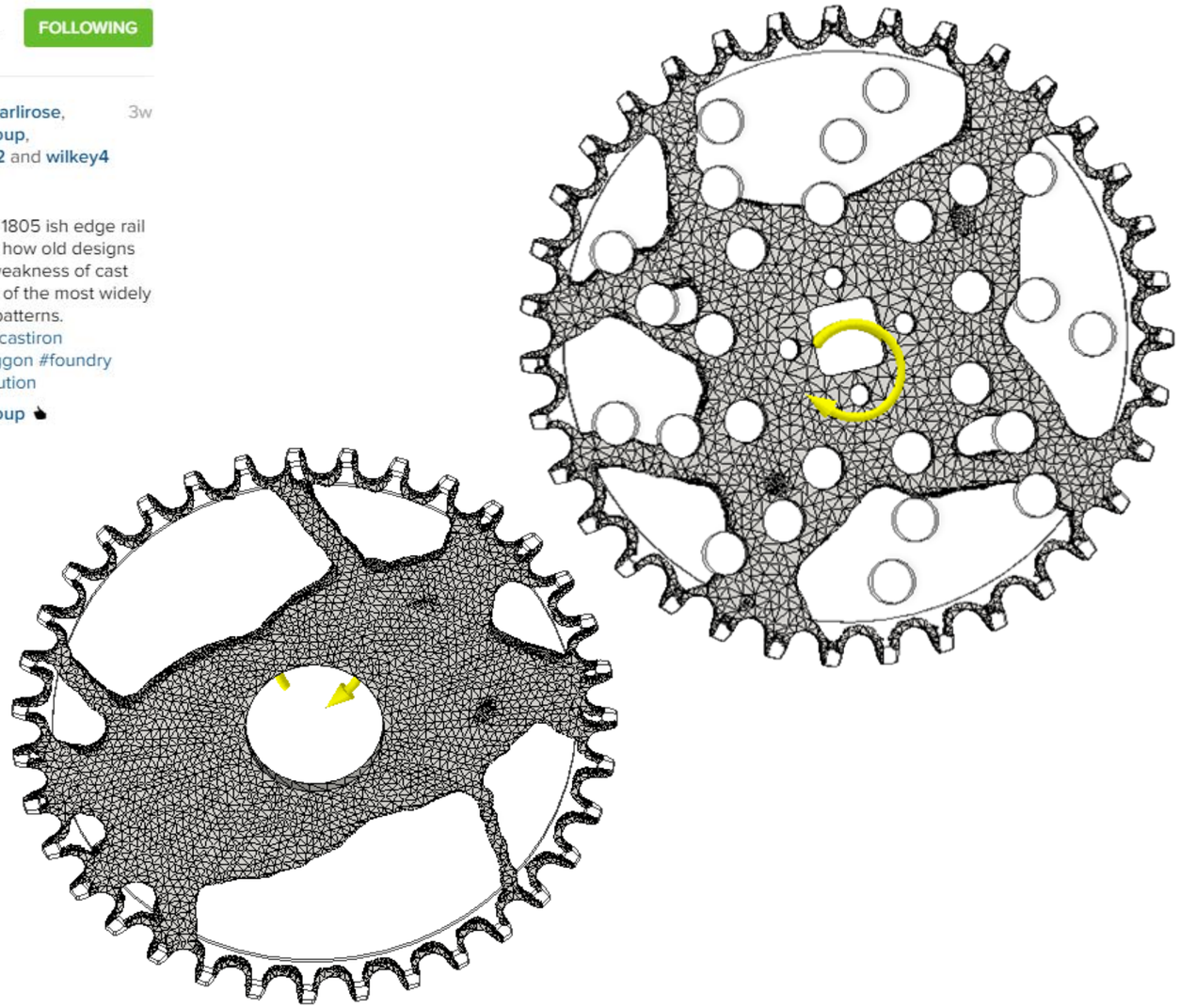
moysescott, natura_._, harlirose, industrialcomponentsgroup, reason_season_lifetime2 and wilkey4 like this 3w

henderson_engineering 1805 ish edge rail waggon wheel...amazing how old designs to counter the inherent weakness of cast iron ended up being one of the most widely used alloy wheel spoke patterns. #blaenafon #penderyn #castiron #oldschool #spoke #waggon #foundry #casting #industrialrevolution

industrialcomponentsgroup

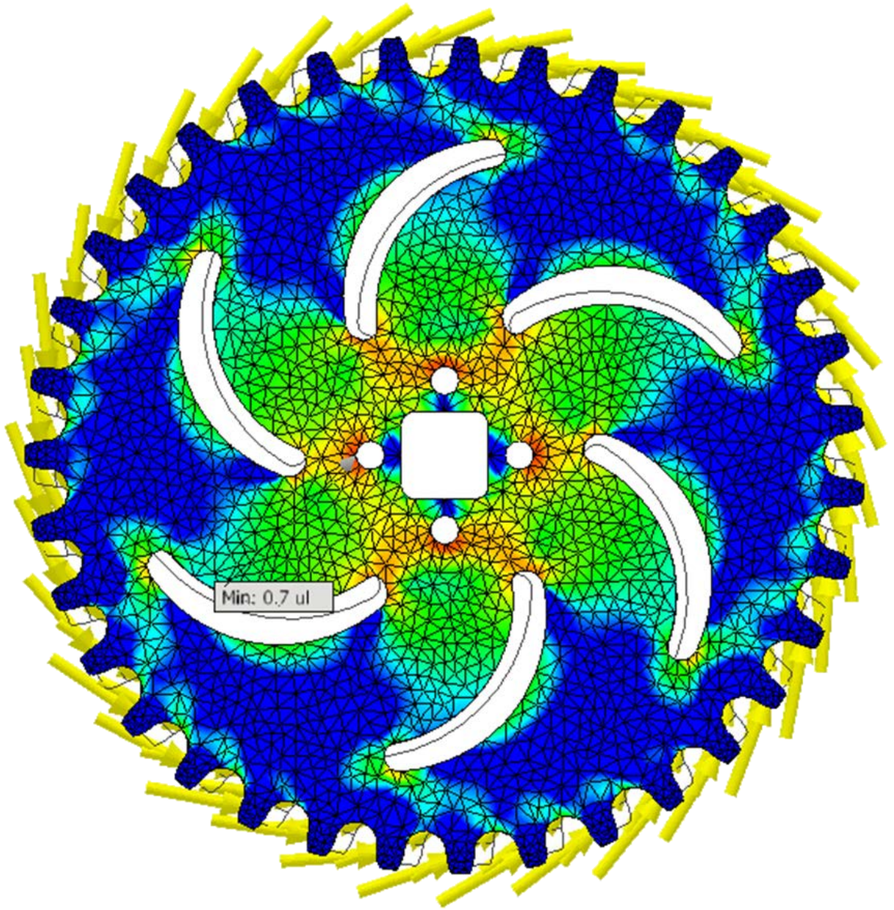
moysescott Ooooh

Add a comment...



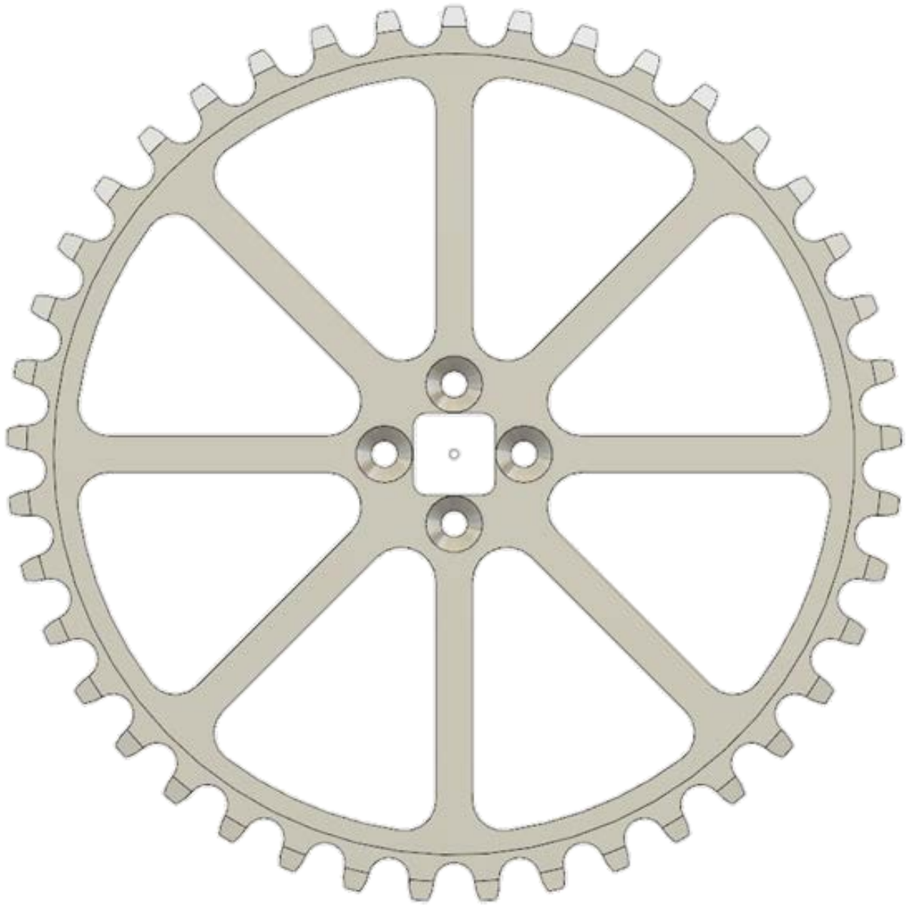
Chain Ring Development V4

- FEA Study
- All Teeth Loaded
- Guided Modelling
- Remove Unstressed Regions?

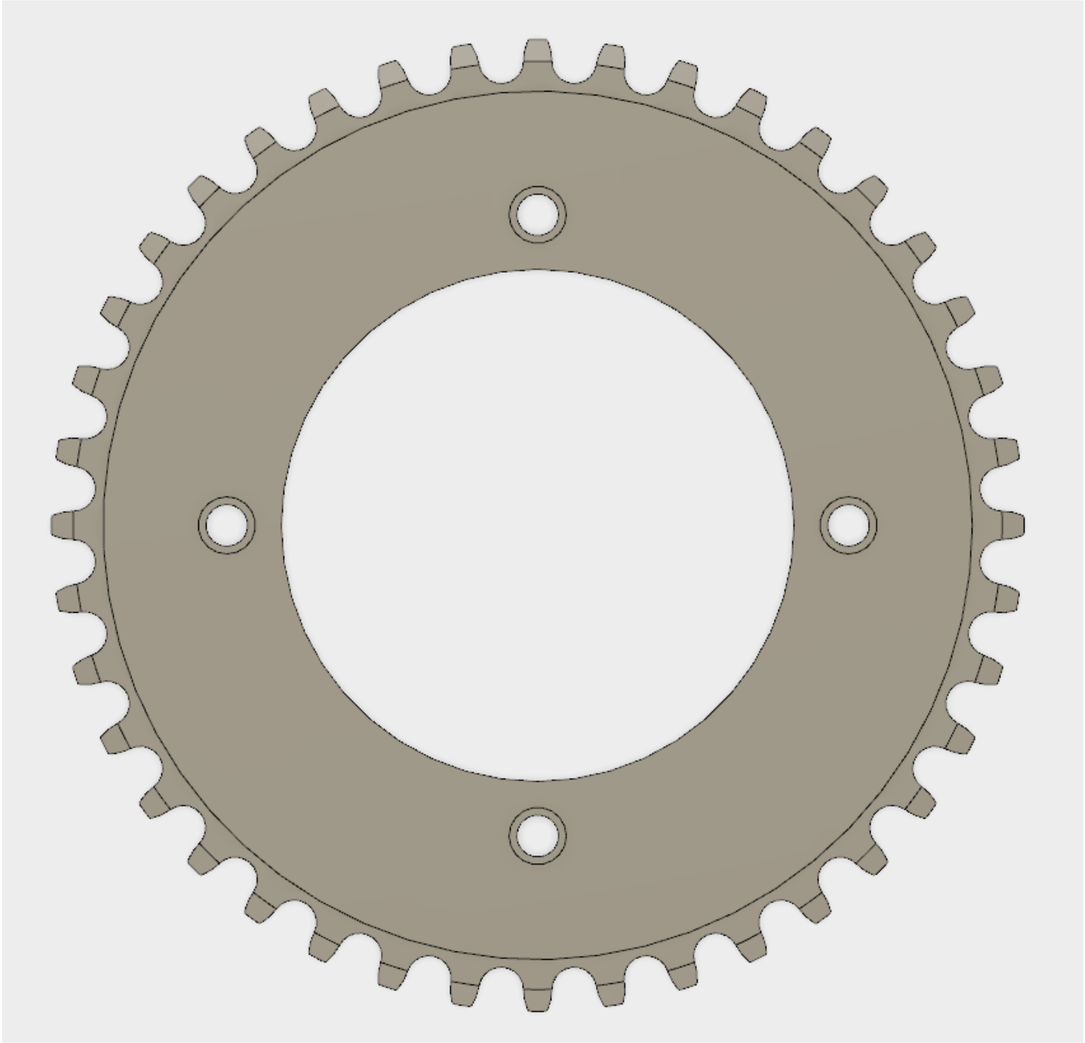


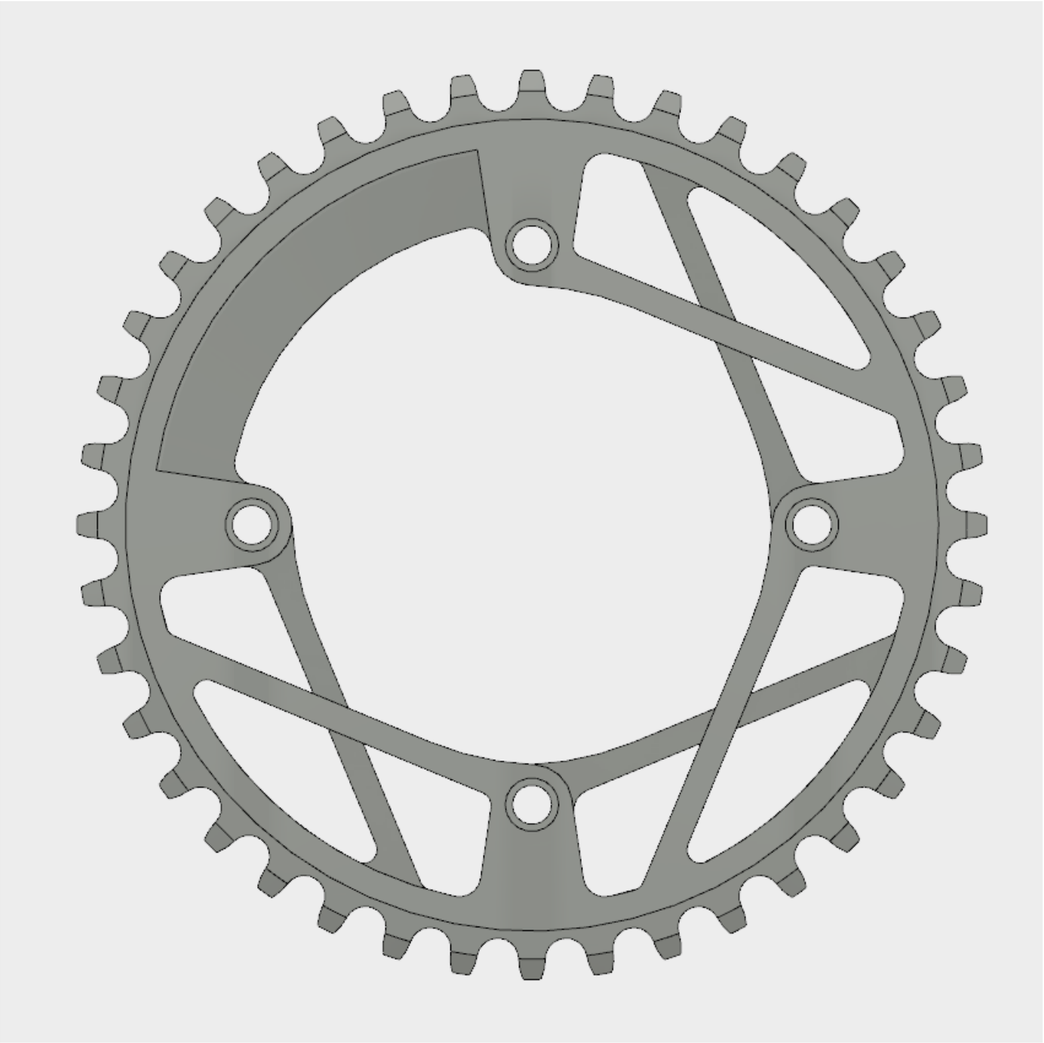
Chain Ring Development V5

- Human Study
- No FEA
- No Shape Gen
- Logic
- Can be confirmed with FEA later

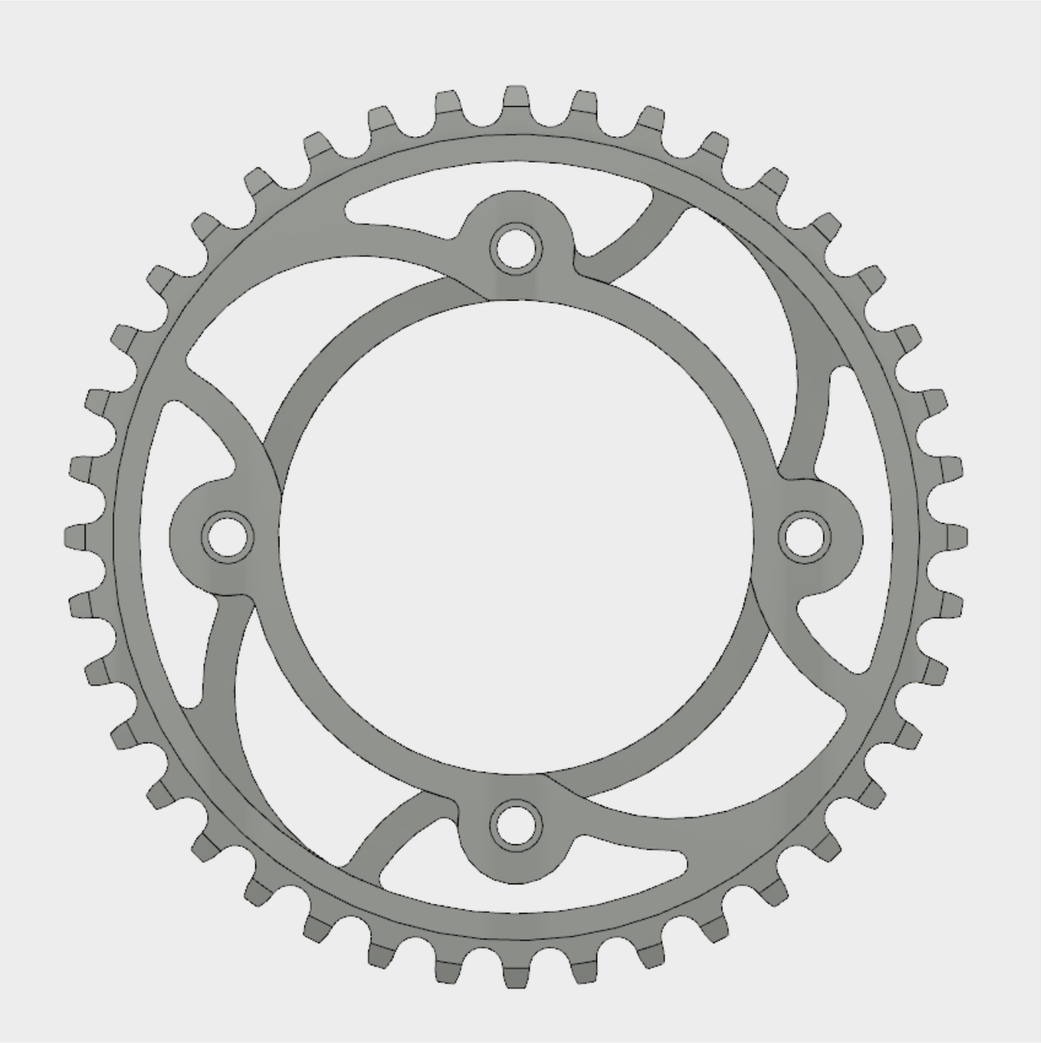


Parametric Chain Rings





Parametric Chain Rings



Chain Ring Manufacture

Final Result

Image courtesy of CXP Racing & CADPRO Systems Limited - New Zealand

This chain ring and crank combination
competed on two different bikes during
the 2016 BMX World Championship held in Columbia

385
385
MANZANA

Meekboys Collaboration

THE WORLD'S BEST DOWNHILL BIKES FOR CHILDREN

Photo Credit

All Beast bikes sport a progressive linkage designed to run a standard adult rear shock at an average of 100 – 150 psi.

Due to the extensive leverage, the bike is able to perform like an adult bike..

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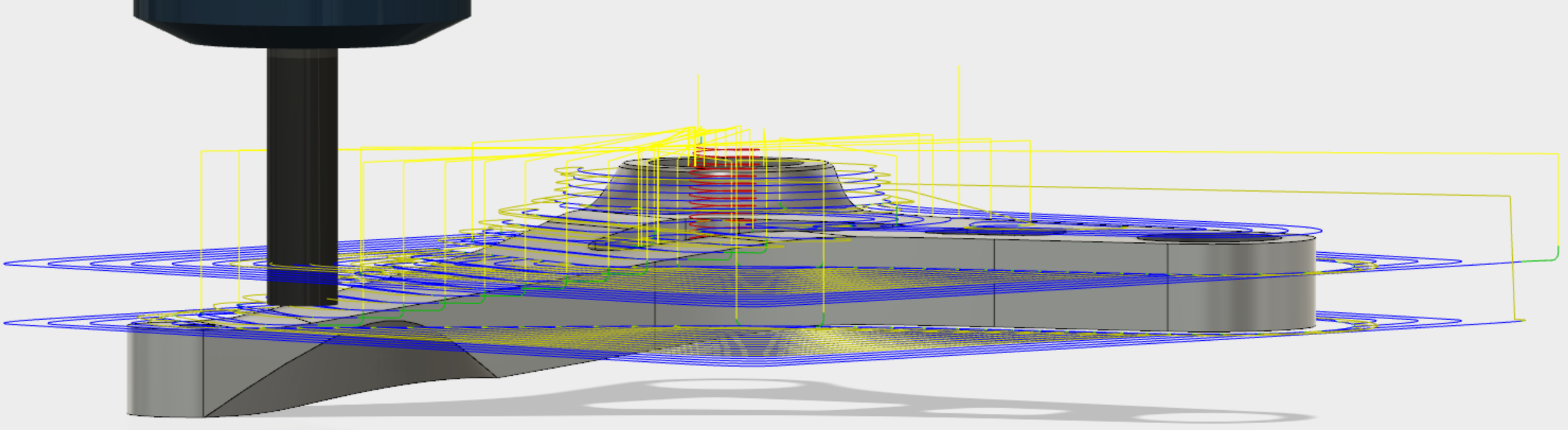

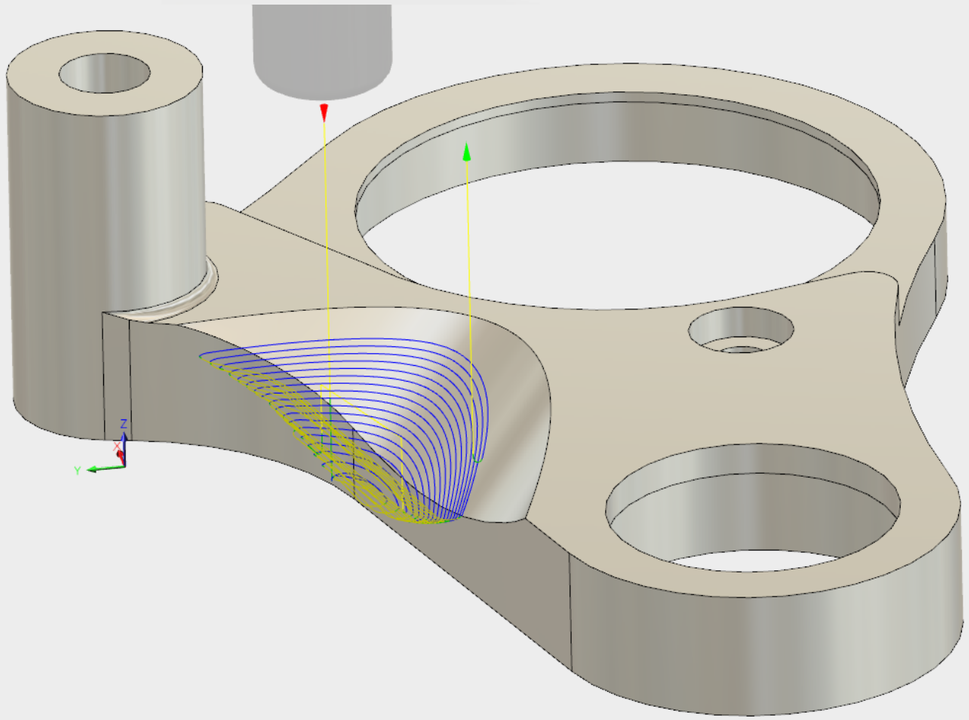

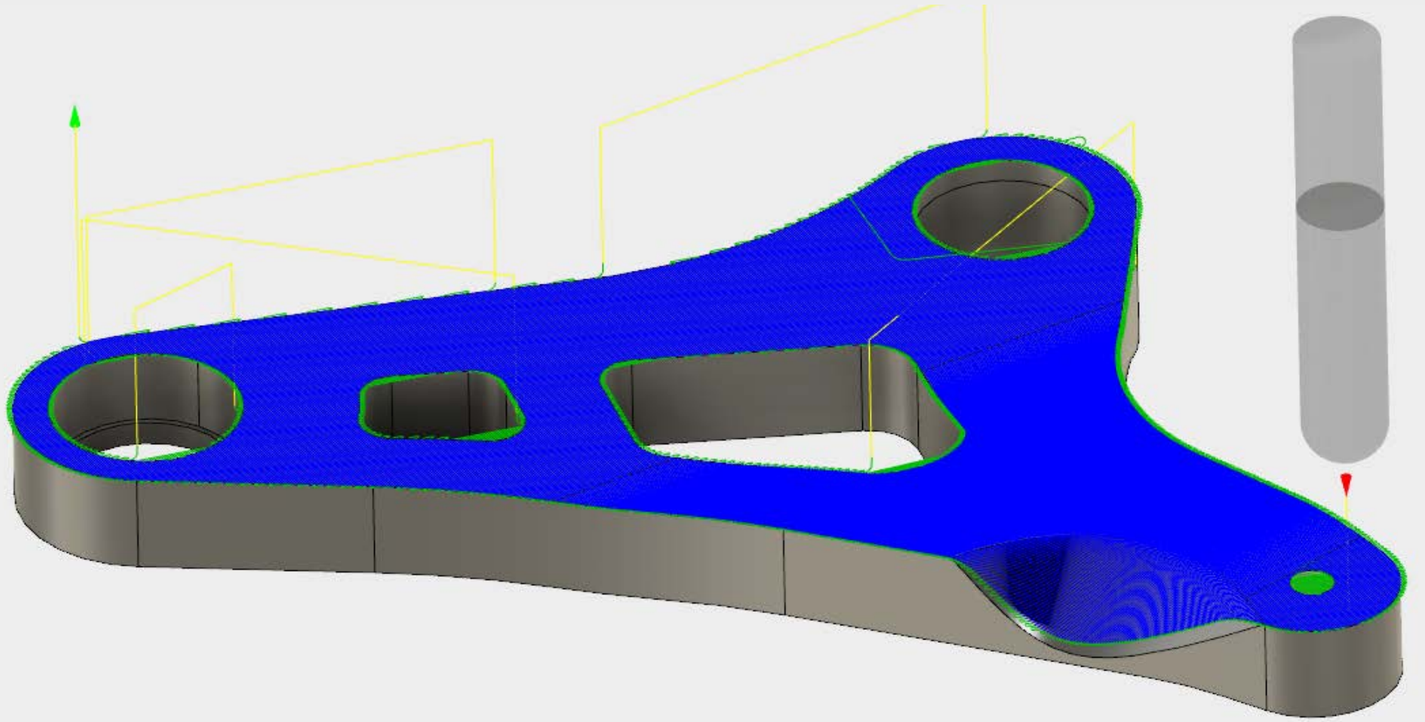

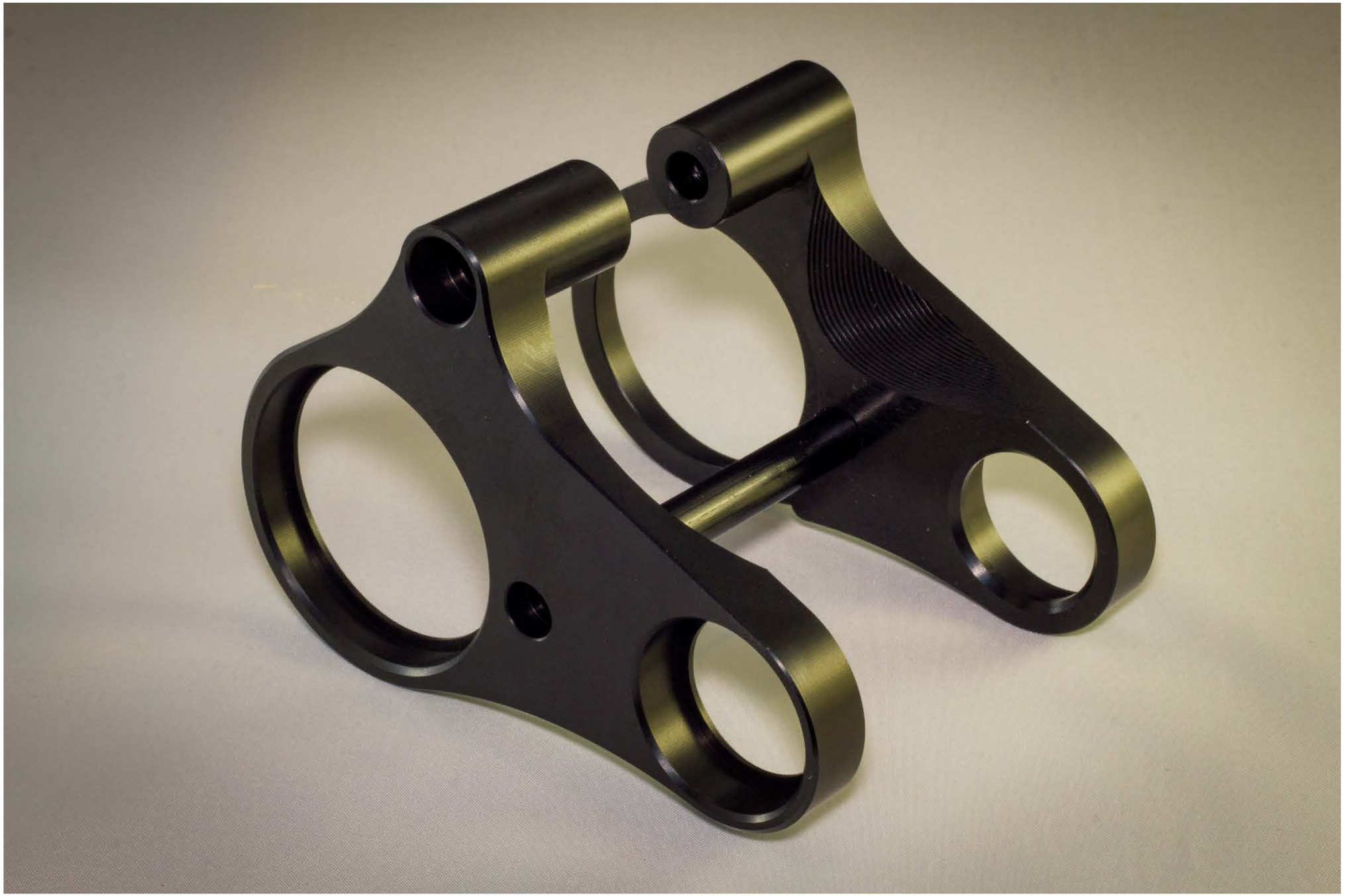

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