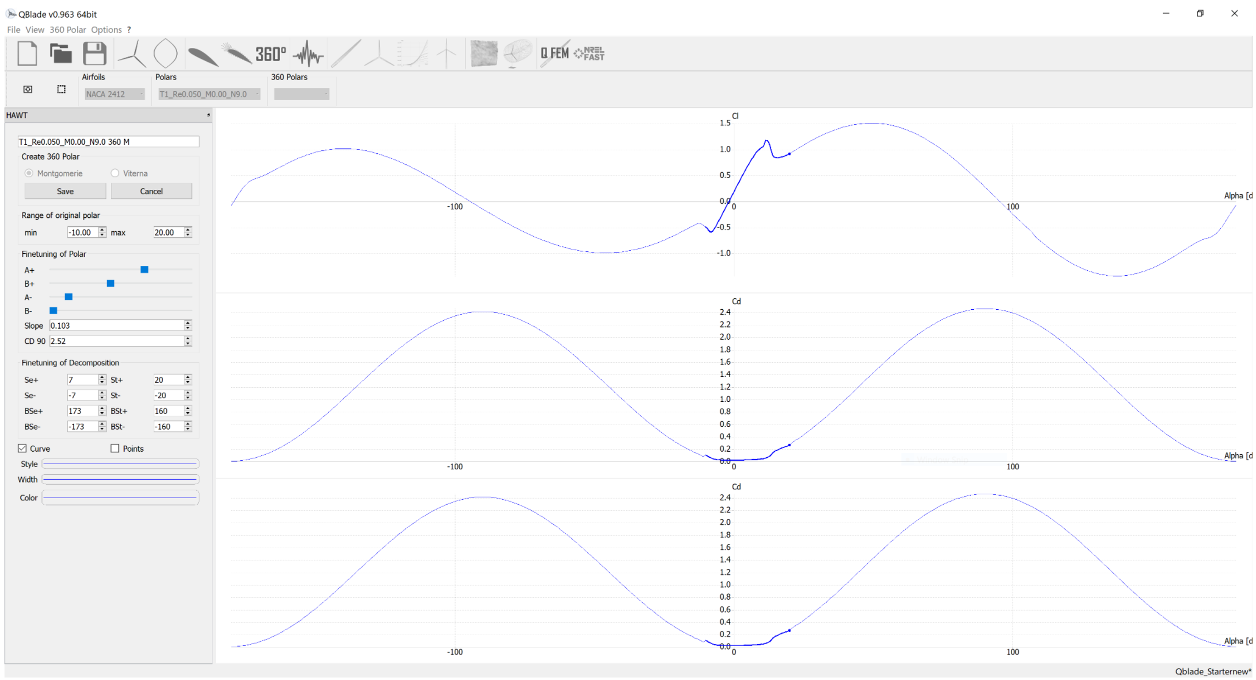
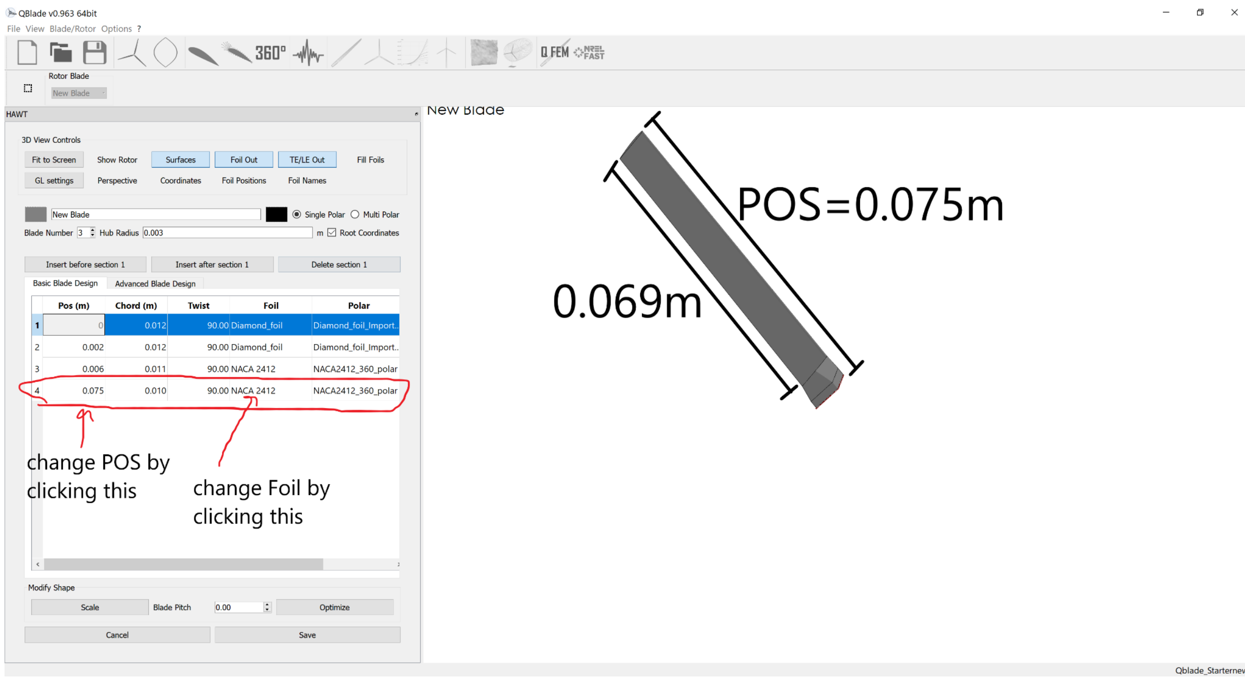
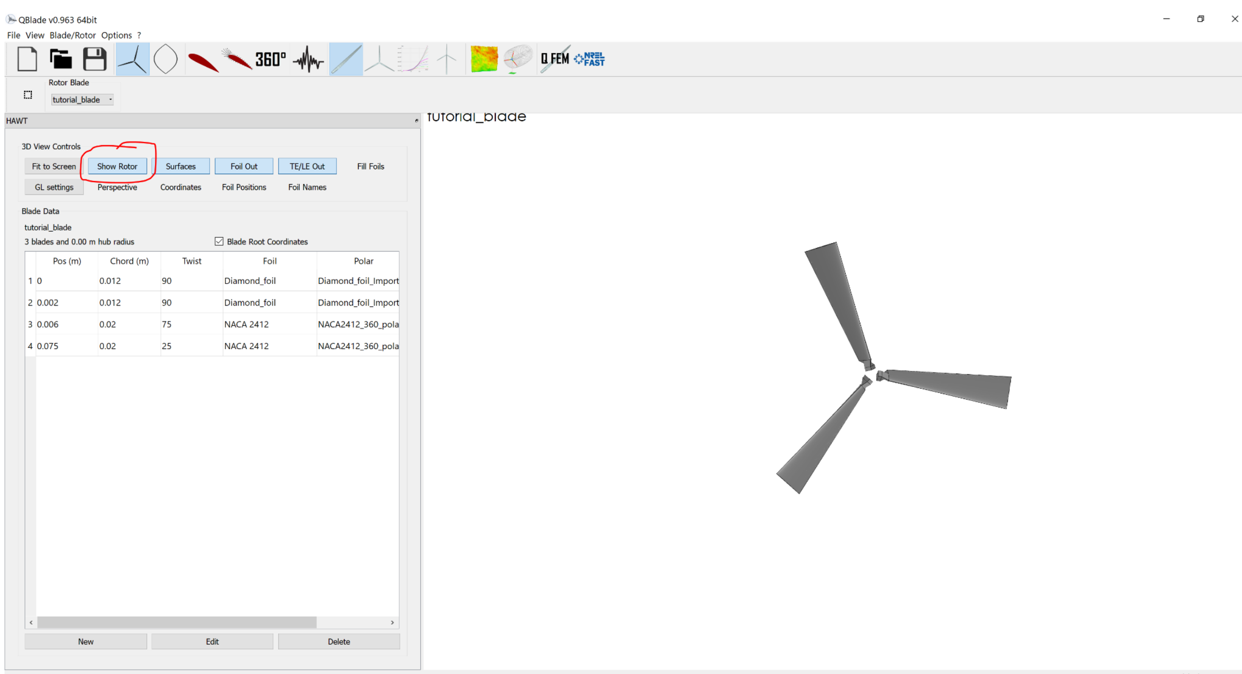
QBLADE 360 degree extrapolation

- CD = drag at 90 degree angle of attack
  - need to increase this a lot in order to reasonably match your extrapolation curve to your simulated data (i.e. to get rid of the sharp cusps at the point where the extrapolation and the simulated data meet)
  - How to pick CD?
    - basically you can choose around the 1.0-2.0 range
    - there is a way to find this but beyond the scope of our course, look at the linked paper if interested:
      - https://www.foi.se/rest-api/report/FOI-R--1305--SE page 17
- Also adjust the A+/-, B+/- sliders
- reasonable agreement looks like this:
- 

QBLADE Rotor Design

- When adding airfoil sections (the part in the tutorial where you click “insert after section 2” etc, BE SURE TO CHANGE THE POS of the newly added section
  - POS is the radial position that the blade section ENDS at (i.e. so in this screenshot, the 4th blade section starts at 0.006m away from the center and extends to 0.075m, so that part of the blade is 0.075m - 0.006m = 0.069m long

- 

- Also be sure to change the FOIL type to NACA2412 (at least for the tutorial, you can change this later to experiment in your design
    - as an aside, to change blade number you do so in the above screen, next to "Blade Number"
- The Show Rotor button is here
- 

QBLADE BEM SIM

- TSR = Tip Speed Ratio

Parameter	Definition	Explanation
$C_P = \frac{Power}{1/2\rho V_0^3 \pi R^2}$	*Power Coefficient*	Power the turbine produces divided by the available power in the incoming wind
$C_T = \frac{Axial\ Thrust\ Force}{1/2\rho V_0^2 \pi R^2}$	*Thrust Coefficient*	Force acting on the turbine hub in the axial direction (same direction as free-stream velocity)
$TSR = \frac{\omega R}{V_0}$	*Tip Speed Ratio*	Ratio of the blade tip velocity to the free-stream velocity
$Re_D = \frac{\rho V_0 2R}{\mu}$	*Reynolds Number Based on diameter*	This value does not change with rotational speed
$Re_c = \frac{\rho c \sqrt{V_0^2 + (\omega r)^2}}{\mu}$	*Reynolds number based on chord and on estimated local velocity*	This value is the "local" Reynolds number, and changes at each radial station, r, which has a chord, c.
$C_{P_{BETZ}} = 0.593$	*Betz Limit Power*	This is the theoretical maximum value of the power coefficient a turbine can produce.

-
- if C_P is negative, it means that the turbine REQUIRES power input in order to turn the blades at that speed (i.e. it is taking in power not generating power!)
    - don't want to operate at that operational point!