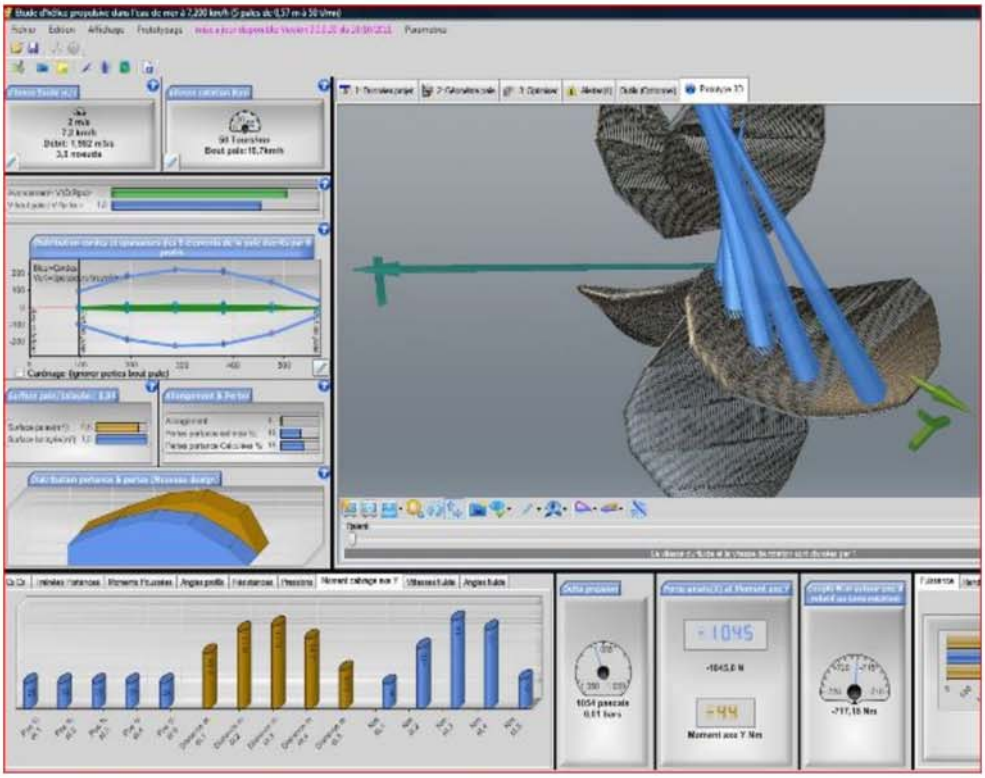
Generator position and pitching moment and plunging wing or rotor blade

Lift and drag forces which apply on a wing or propeller blade , generate a torque about the axis **X** (rotation for a propeller blade or roll to a wing) but also a pivoting torque about the axis **Y** (pitching) .



Here we call the pivoting torque about the axis **Y**, **Pitching torque**. The pitching moment may be plunging or rearing up.

- **rearing up Pitching torque,** tends to lift the front of the blade or wing by increasing the angle of incidence. A wing that tends to pitch up, naturally increases the angle of incidence and can stall, This can make it dangerous. A propeller blade which rears under stress, increases this stress..this can lead to breakage
- **plunging Pitching torque,** tends to plunge forward of the blade, reducing the angle of incidence. Reducing the angle of incidence, can accelerate the wing, while moving away from the point of stall. but for flexible wings, if the incidence goes under the incidence of zero lift, there may be closure risk. Control the evolution of the pitch moment, depending on the angle of incidence, allows you to create self-stable profiles. A wing whose pitch moment is rearing up in low angles of incidence, and plunging to the high incidences, balances naturally.. A propeller whose blades have a moment plunging self-protected against overload. This can be a safety factor.

It is important to control the reactions of our blade or wing by controlling the pitch moment

By positioning the generator profiles from the pivot point (Y axis),and to the point of lift, it is possible to control the character of the blade or wing. Héliciel controls the position of the generator of the blade, at tab "**2:Blade Geometry/advenced Geometry/shape of blade generator**".

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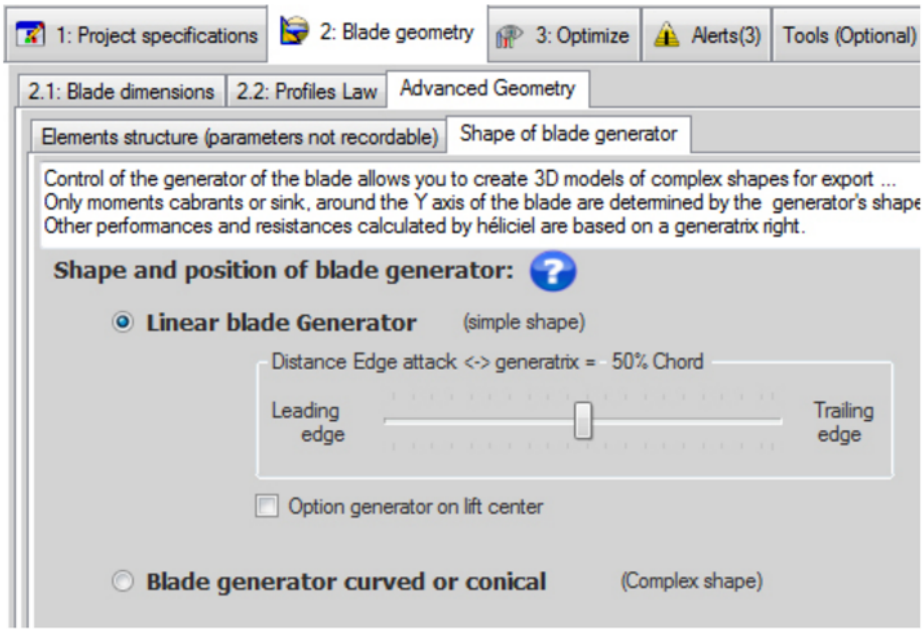
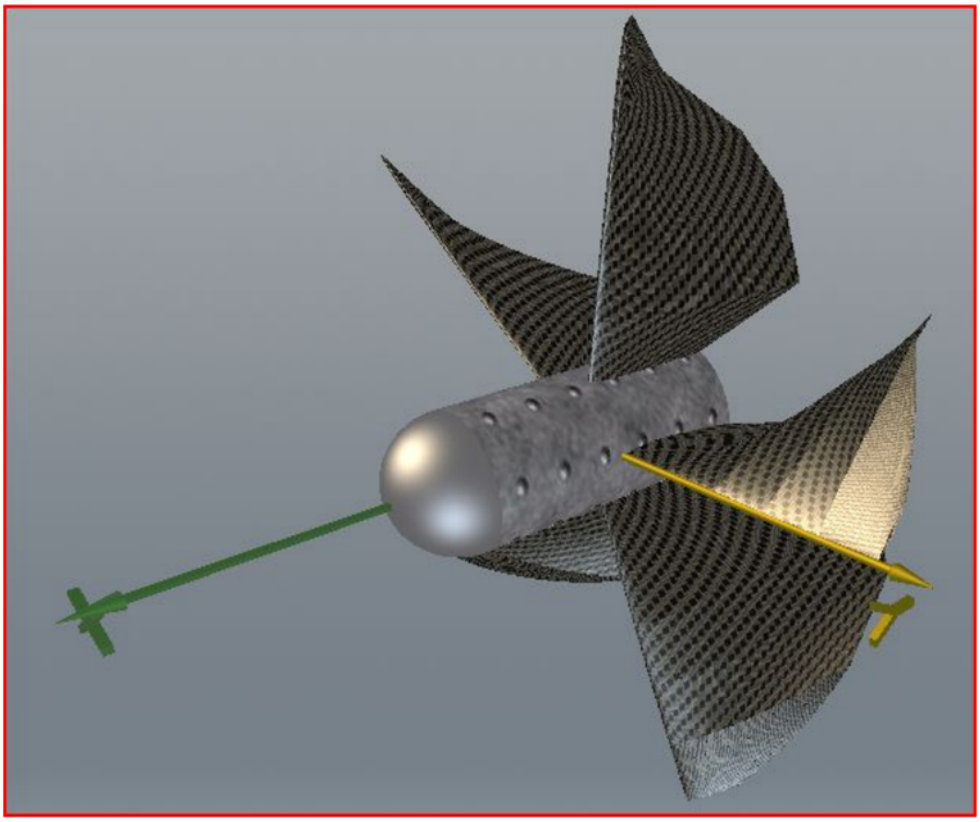
Two modes of parameterization of the shape and position of the generator of the blade are available:

1. **Generator straight blade**: We'll see for example, four types of setting straight position generator:

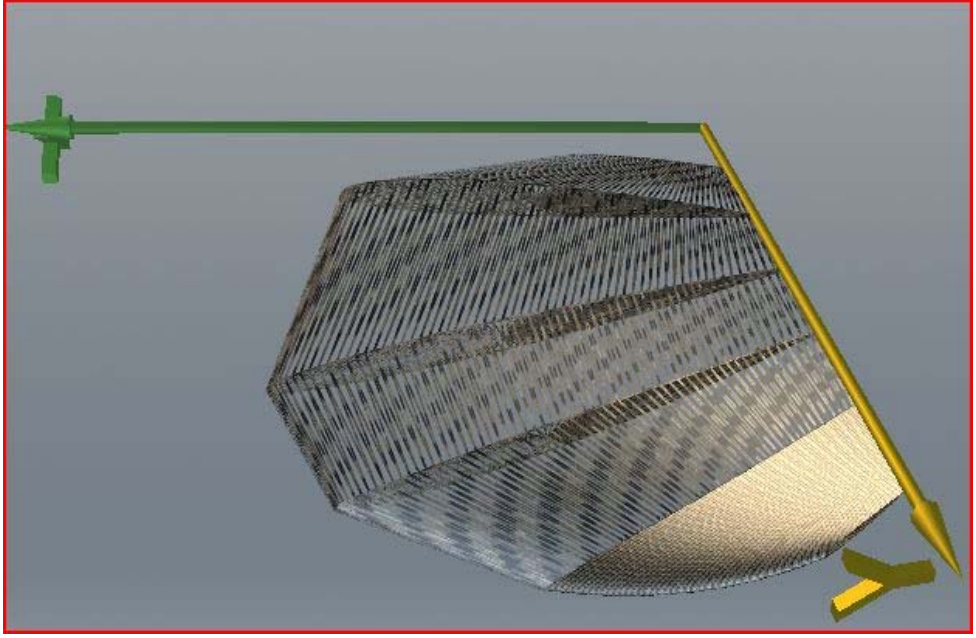
- Examples of settings generator blade straight on the leading edge:



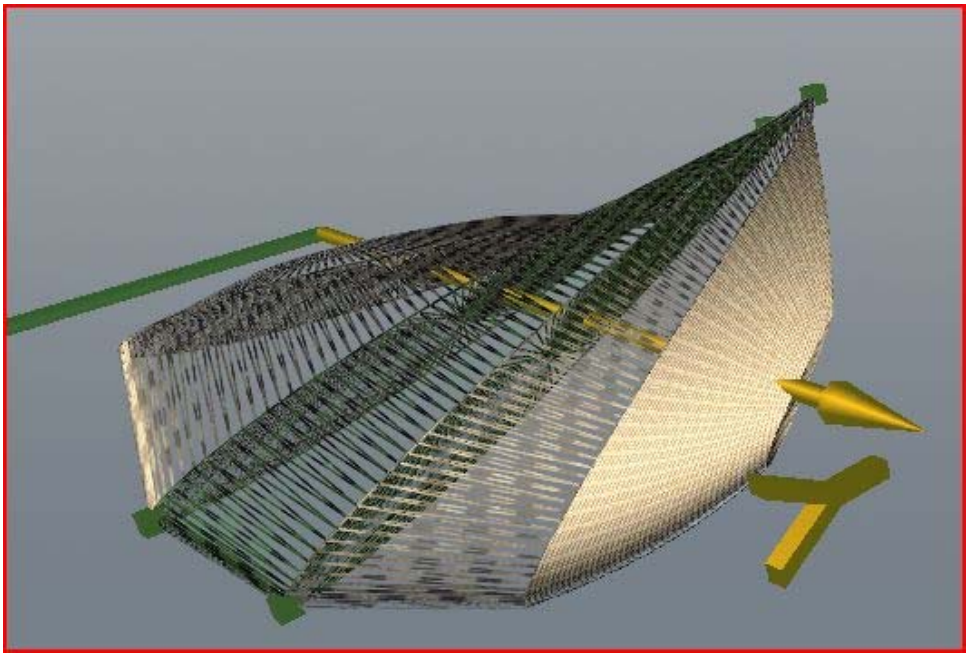
- 3D diagram of the blade with its generator on the leading edge (the pitching moment is plunging):



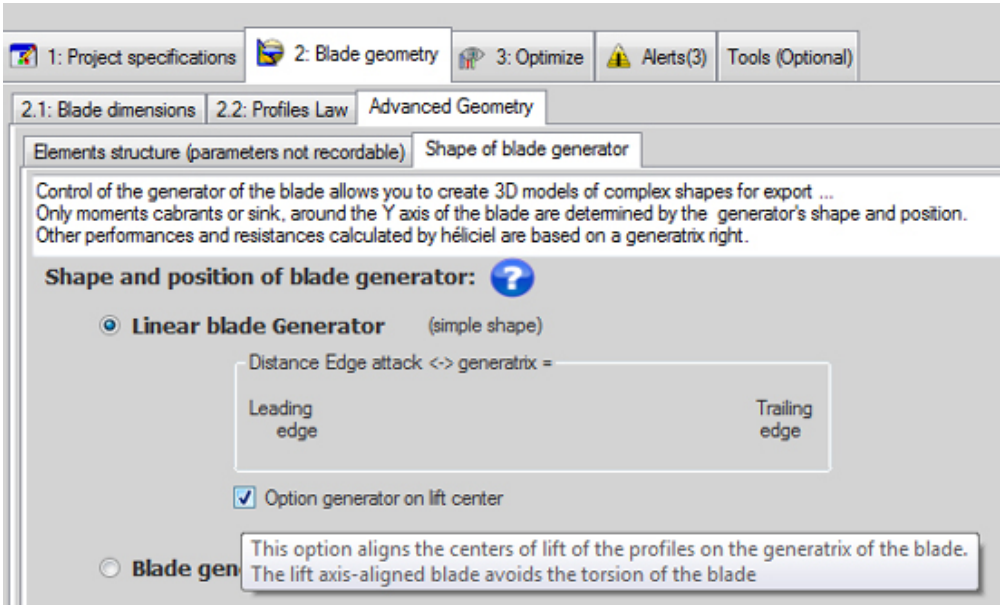
- The same blade with a generator on the trailing edge (the pitching moment will be highly rearing up)



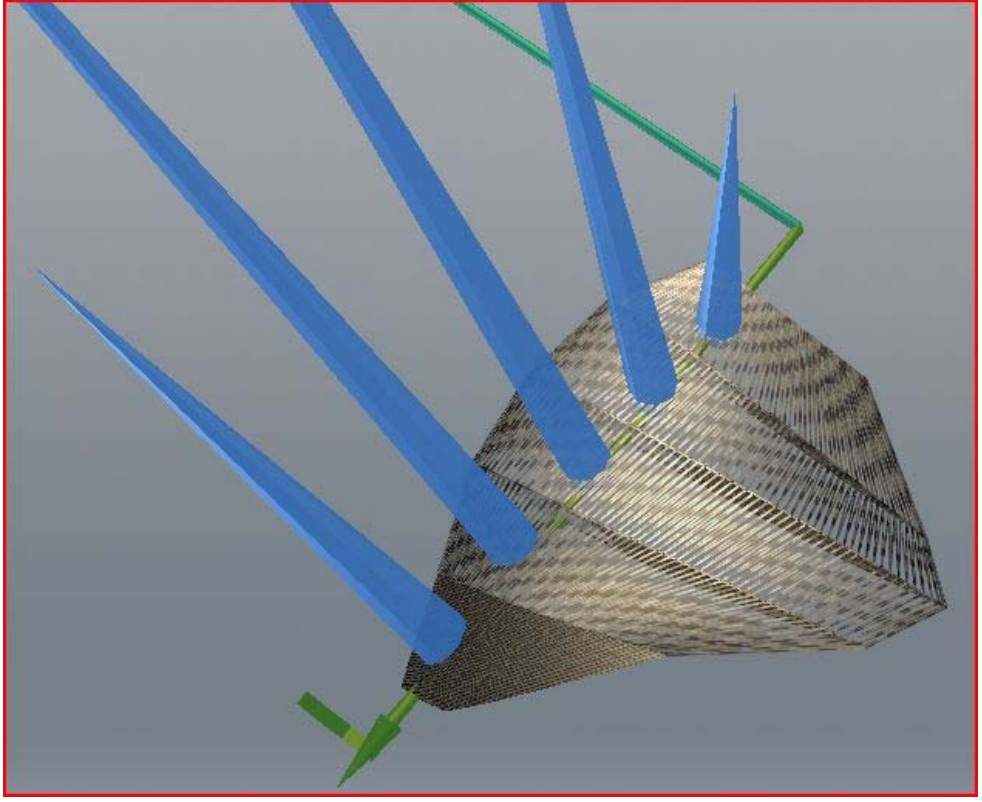
- the same blade with the generator centered at 50% of the cords profiles (pitching moment is rearing up)



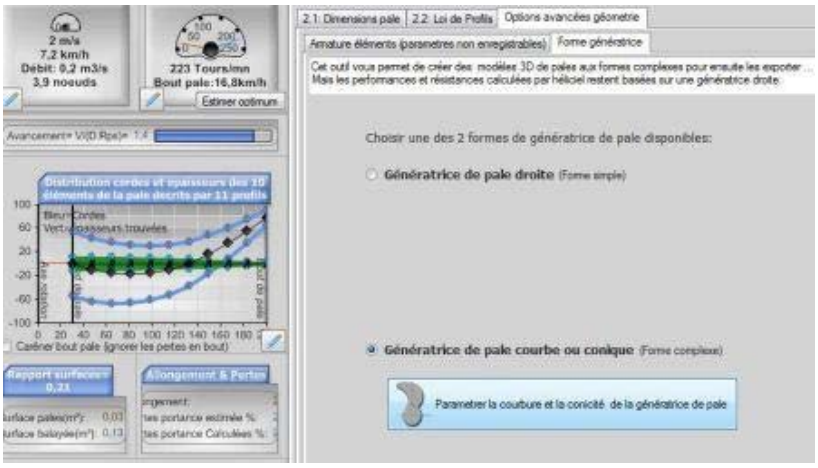
By checking the option of adjusting the generator aligned on the center of lift, pitching moment will be void (or very low)::

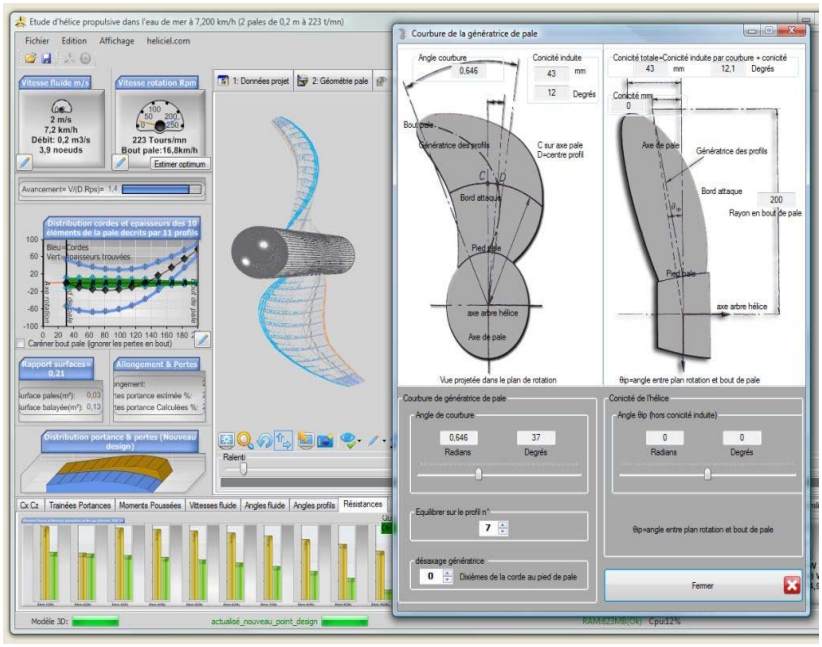


- Diagram of the same blade with center lift on the generator:

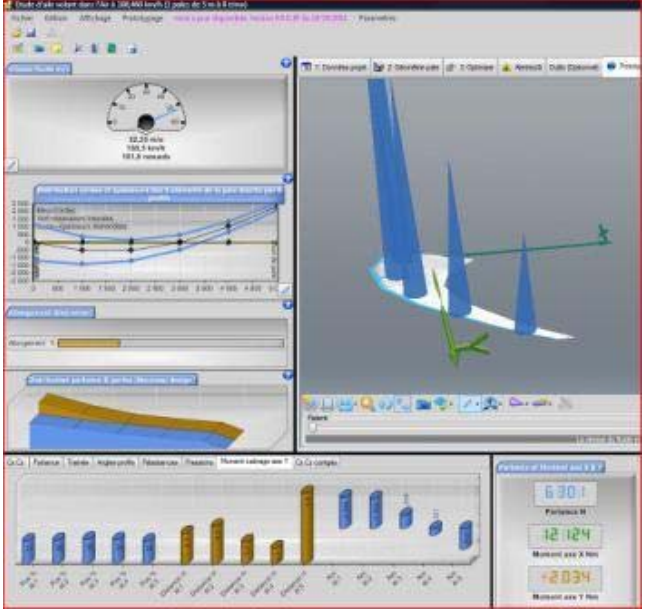


curved Generator blades or wings: By selecting " blade Generator curved or conical", You have access to the interface parameterization of curvature and taper generator::





This tool allows you to create 3D models of blades with complex shapes and then export to igs 3D format... Below is a wing generating curve:



Warning: Only pitching moments are calculated according to the position and shape of the blade generator.

To subsonic regimes, the performance of drag and lift are not affected by the curvature of Generator,performance and resistance calculated by héliciel are therefore based on a Generator straight. In Héliciel, a blade with straight or curved Generator will have the same flexural strength and performance, so this is an estimate, because in reality, the curvature the blade affects these parameters.