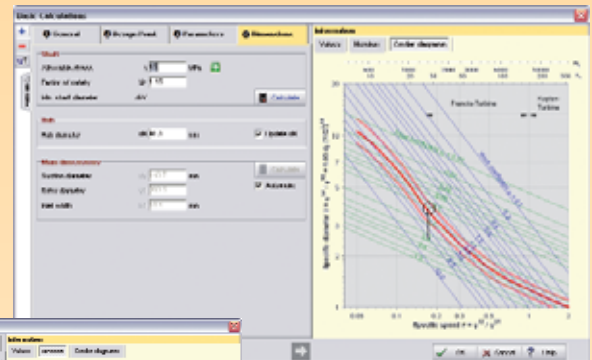
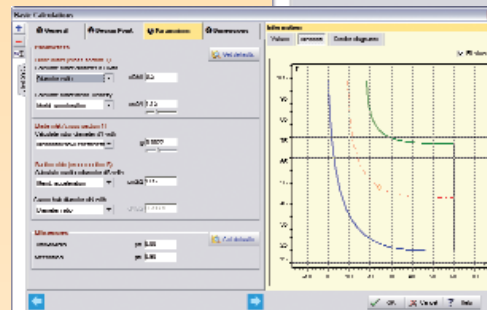


TURBINES – MAJOR DESIGN STEPS

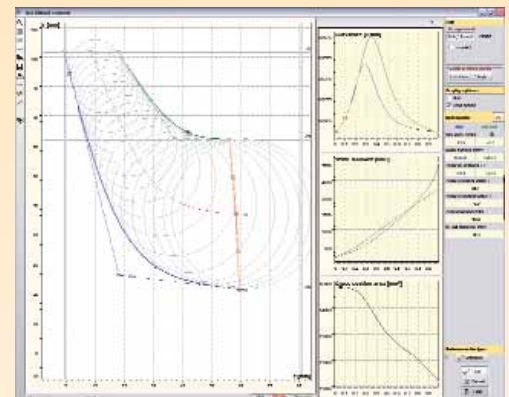
1. Main dimensions

- Computation of turbine rotor main dimensions: hub diameter, rotor diameter, inlet and outlet widths
- Use of built-in or user-defined approximation functions for determination of turbine parameters



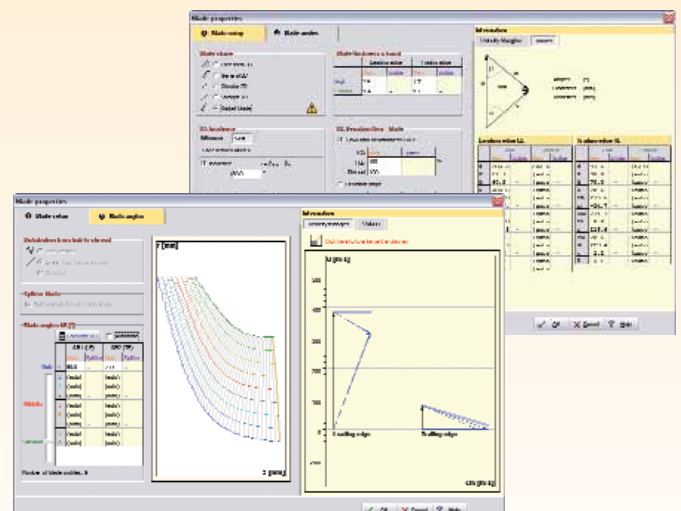
2. Meridional contour

- Design of meridional contours by Bezier-splines, arcs and lines or user-defined poly-lines
- Straight or curved leading and trailing edges
- Radial or mixed-flow turbine shape
- Information about important rotor parameters



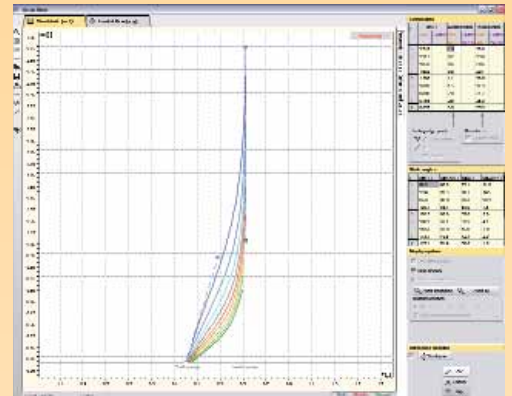
3. Blade angles

- Selecting blade shape: Free form 3D, General 2D, Circular 2D, Straight 2D, Ruled surface blades, Radial element blades
- Blade design on 2 to 11 meridional flow sections
- Computation of optimal blade angles considering flow contraction inside blade channel
- Presentation of velocity triangles and tabular listing of all velocity components as well as flow angles



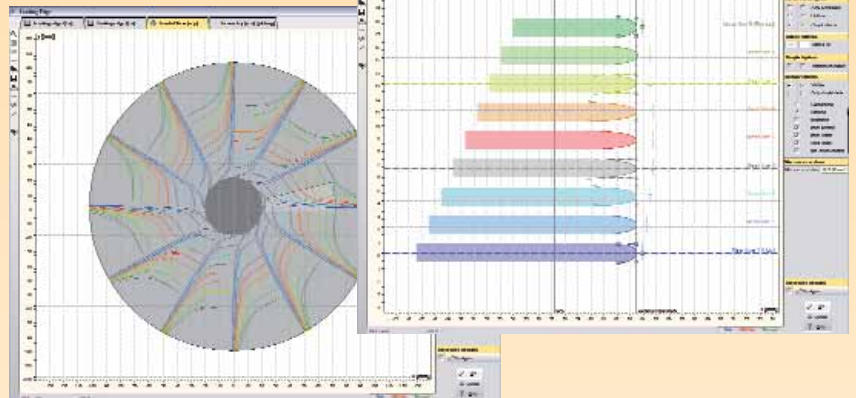
4. Mean lines

- Definition of mean lines by Bezier-splines or user-defined poly-lines
- Coupled or non-coupled manipulation of blade shape
- Free choice to determine the wrap angle
- Presentation of blade angle distributions
- Control of the outlet flow angle by "Sinus-Rule"



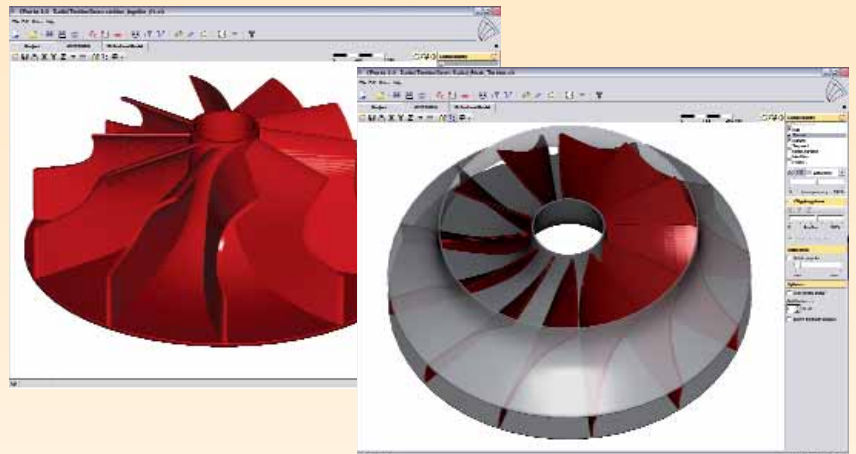
5. Blade profiles, leading edges

- Specification of blade thicknesses on all profile sections
- Rounding of leading edges and trailing edges by Bezier-splines or ellipses
- Frontal view possibility for the designed rotor



6. 3D-views

- Dynamic 3D-representation (rotate, move, zoom)
- Partial views
- Cutting plane
- Assembly view



7. Data export

- Neutral formats like IGES, STEP, DXF
- Export of point, curves and surfaces
- Direct interfaces to major CAD- and CAE/CFD-systems
- Special export formats available on customer request

8. Performance map estimation

- Computation of fundamental losses for rotor and volute by proven empirical relations
- Performance curve display for different speed
- Surge line estimation
- Various possibilities to set-up and to show relevant values on diagram

