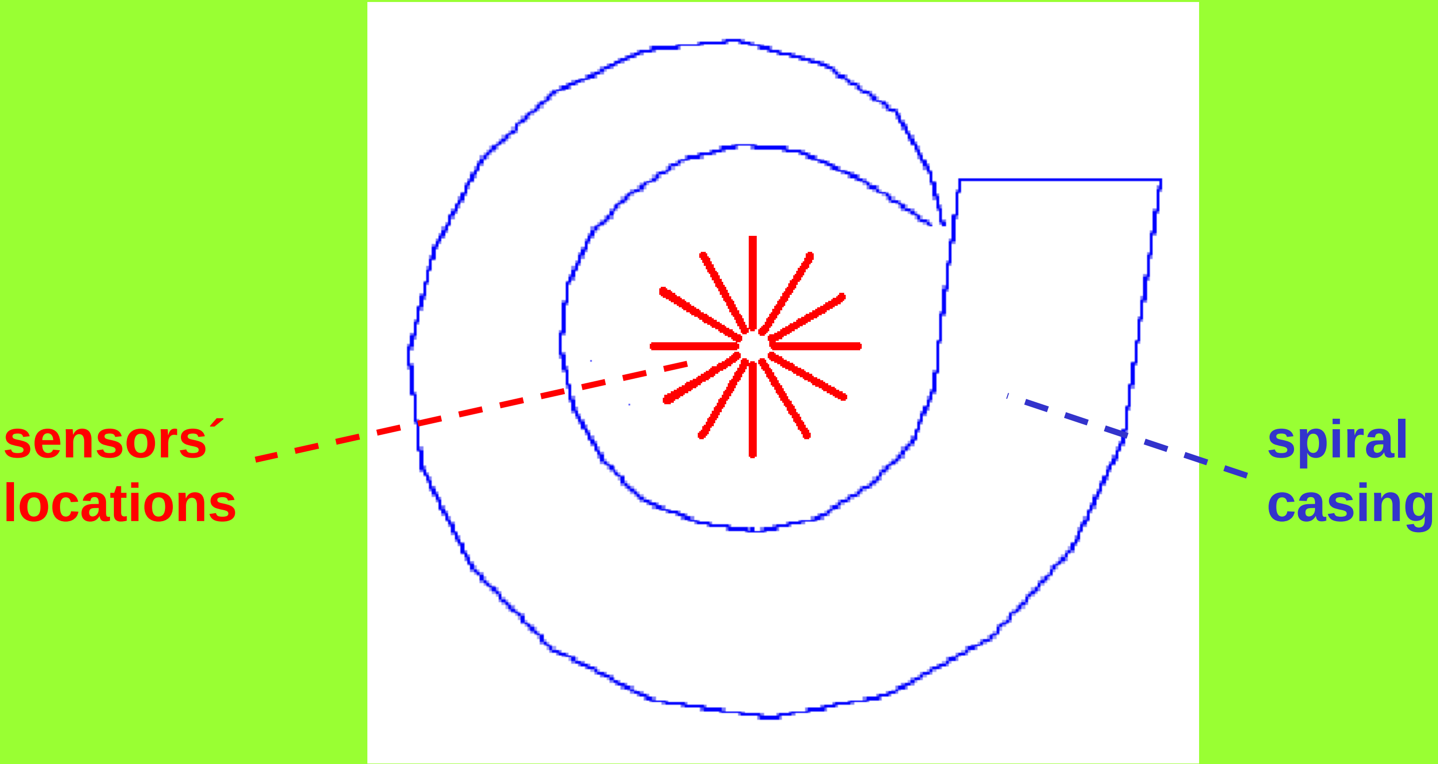
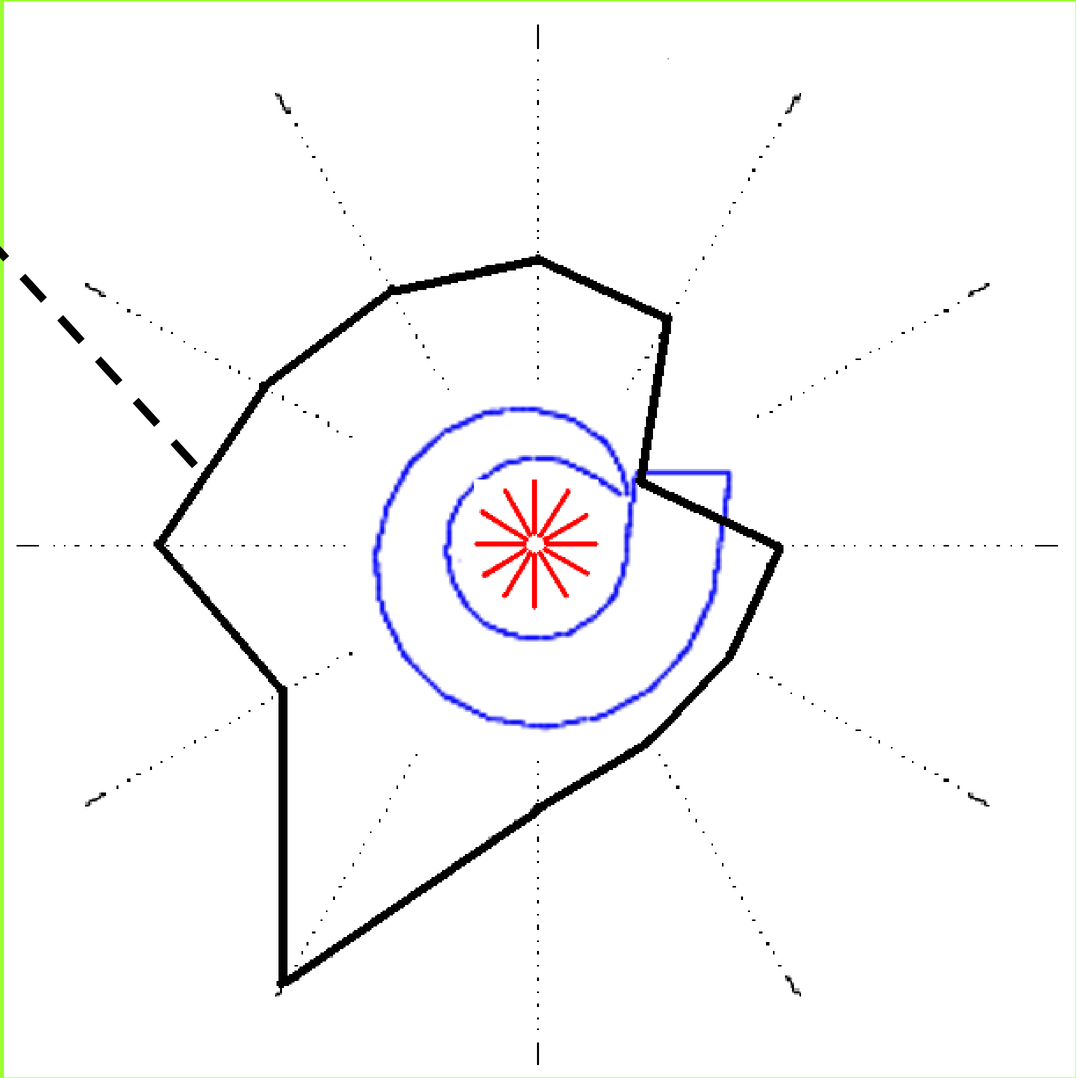
How do the estimates of cavitation depend on the sensors´ location?

How many sensors are needed?

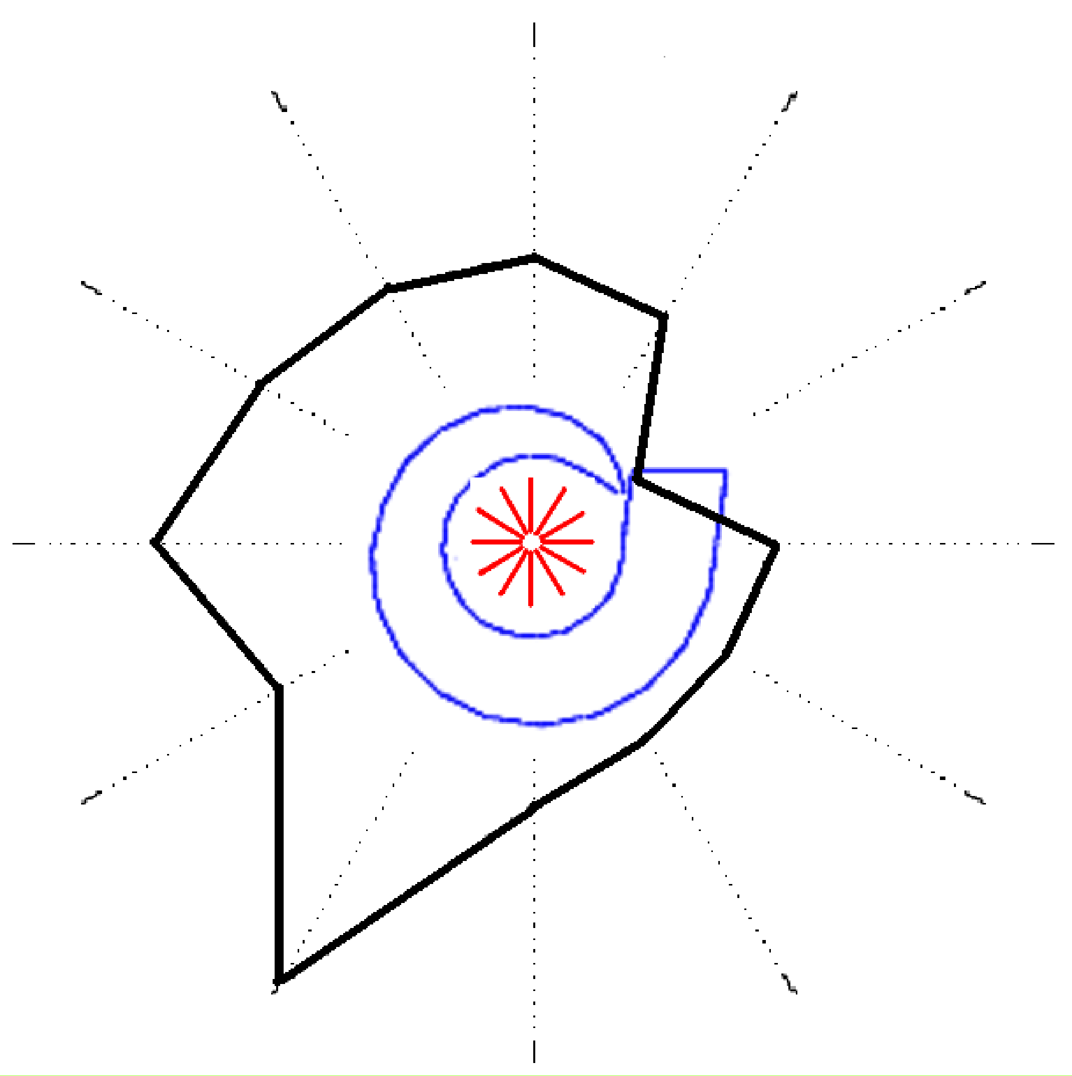
An example of a vertical-shaft turbine: the sensors on the casing, in 12 positions around the runner

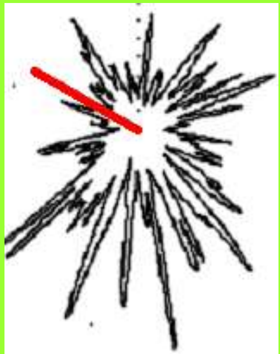
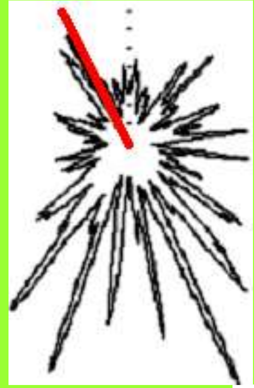
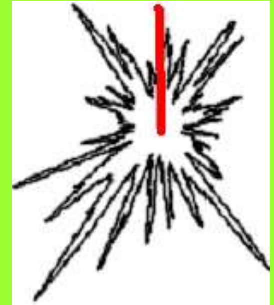


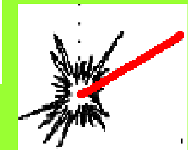
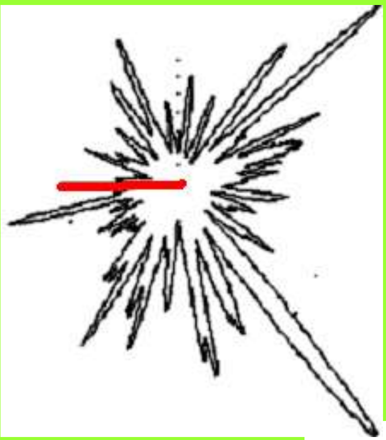
Total cavitation intensity recorded by means of the sensor in a given location, presented in a polar diagram



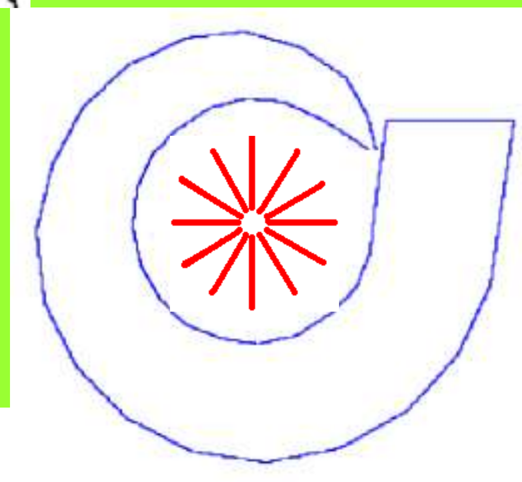
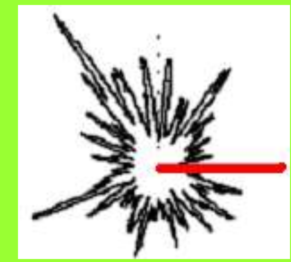
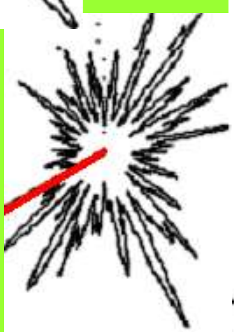
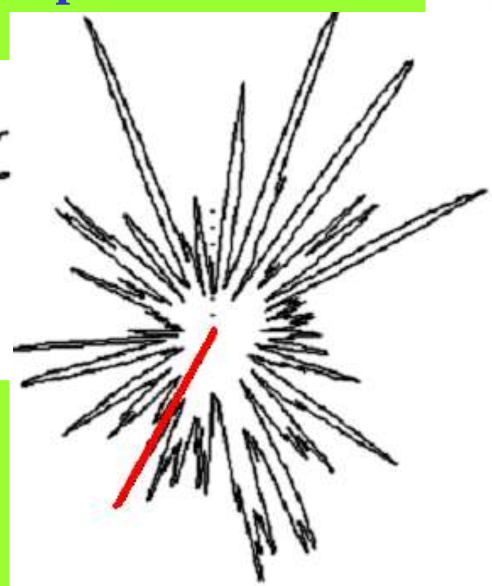
The estimate of the mean total cavitation intensity strongly depends on the position of the sensor with respect to the spiral casing.



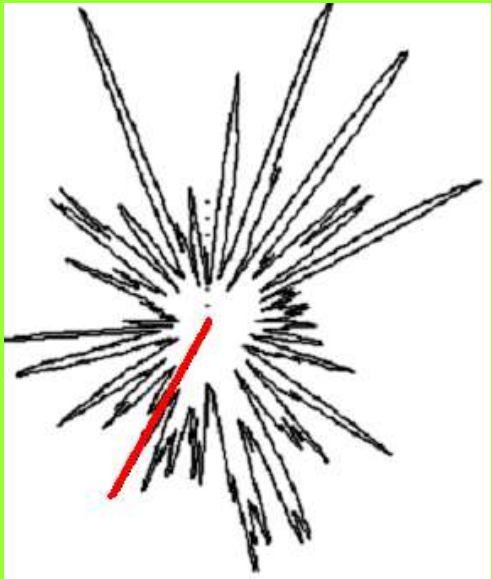




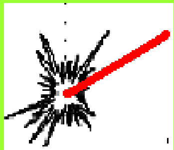
The same is true in respect to the form of the dependence on the instantaneous runner position.


A comparison of the results obtained in two positions,

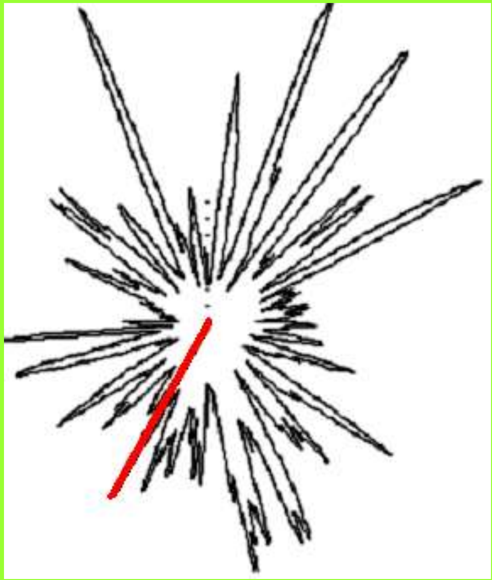


and

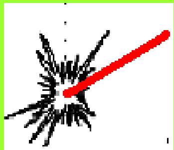


shows how great the differences in the estimates of the mean intensity would be if only one sensor in one or another location were to be used.

A comparison of the results obtained in two positions,

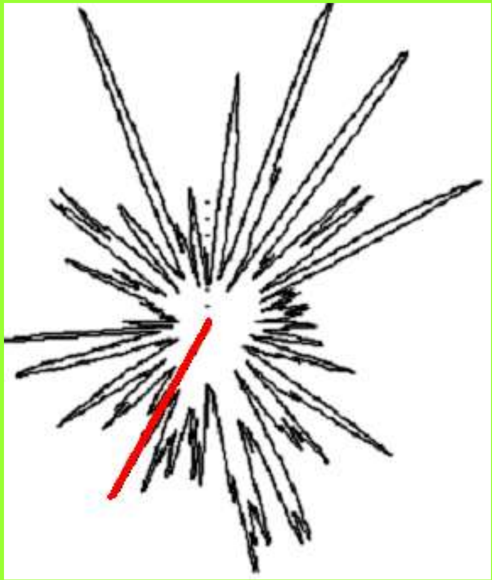


and

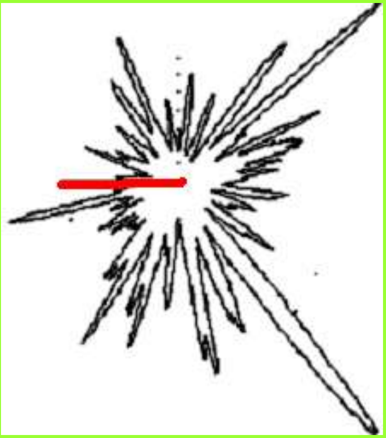


shows how high the differences in the estimates of the mean intensity would be if only one sensor in one or another location would be used,

and a comparison of



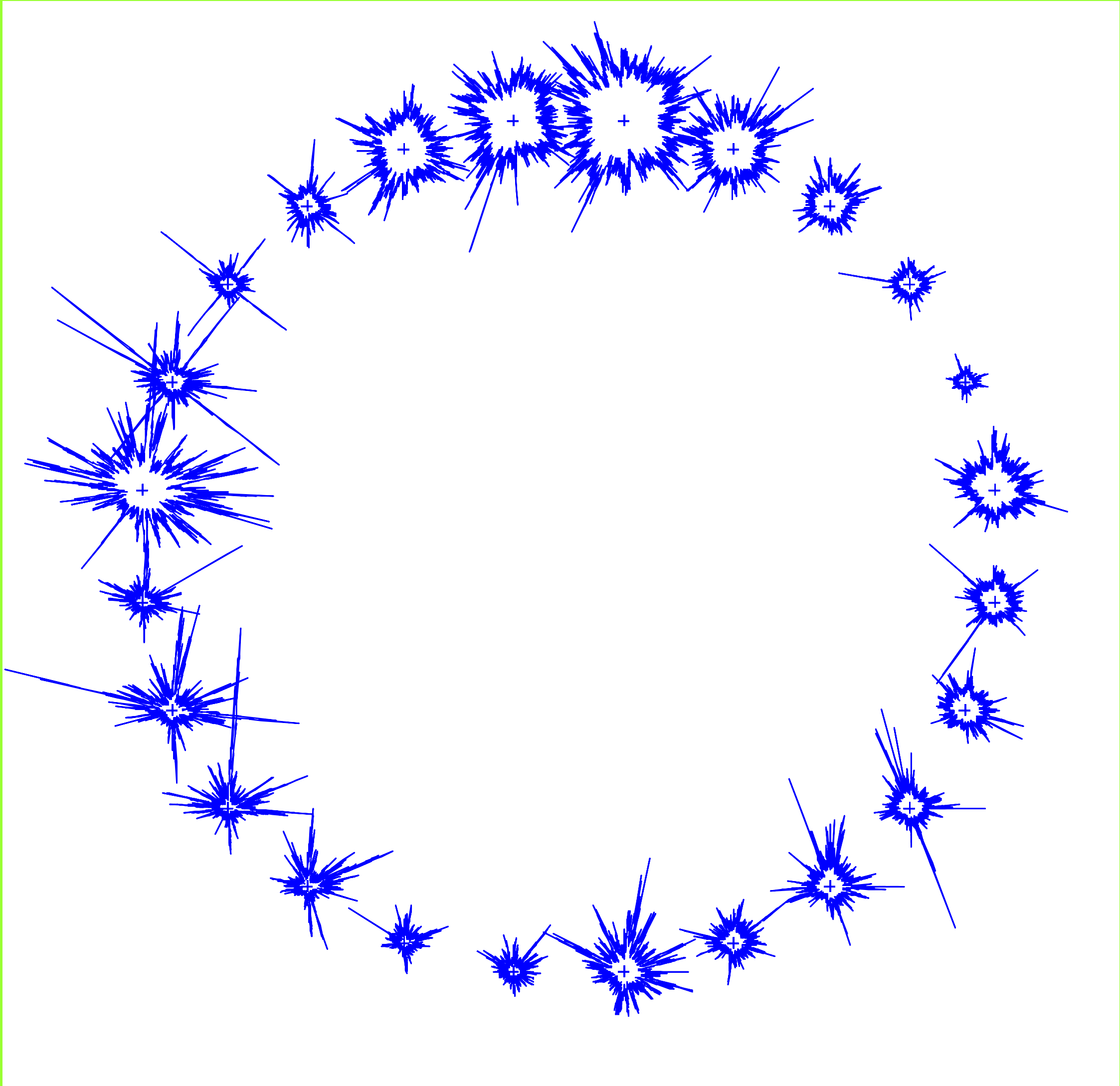
and



shows how different the conclusions on the role of the runner blades and guide vanes would be.

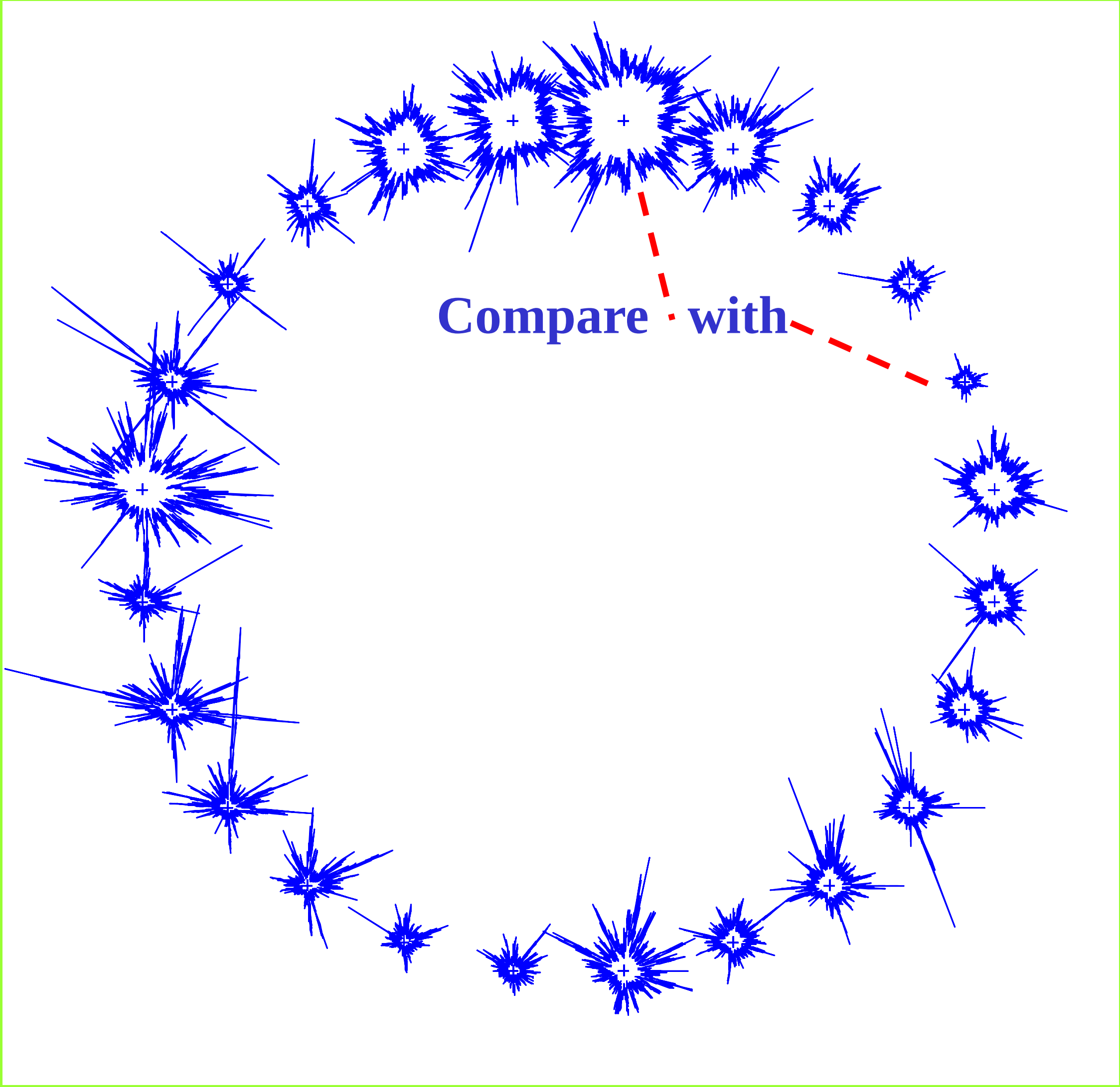
An example of a horizontal-shaft turbine shows the same:

The sensors in 24 circumferential locations; in each, the dependence on the instantaneous runner position was estimated.



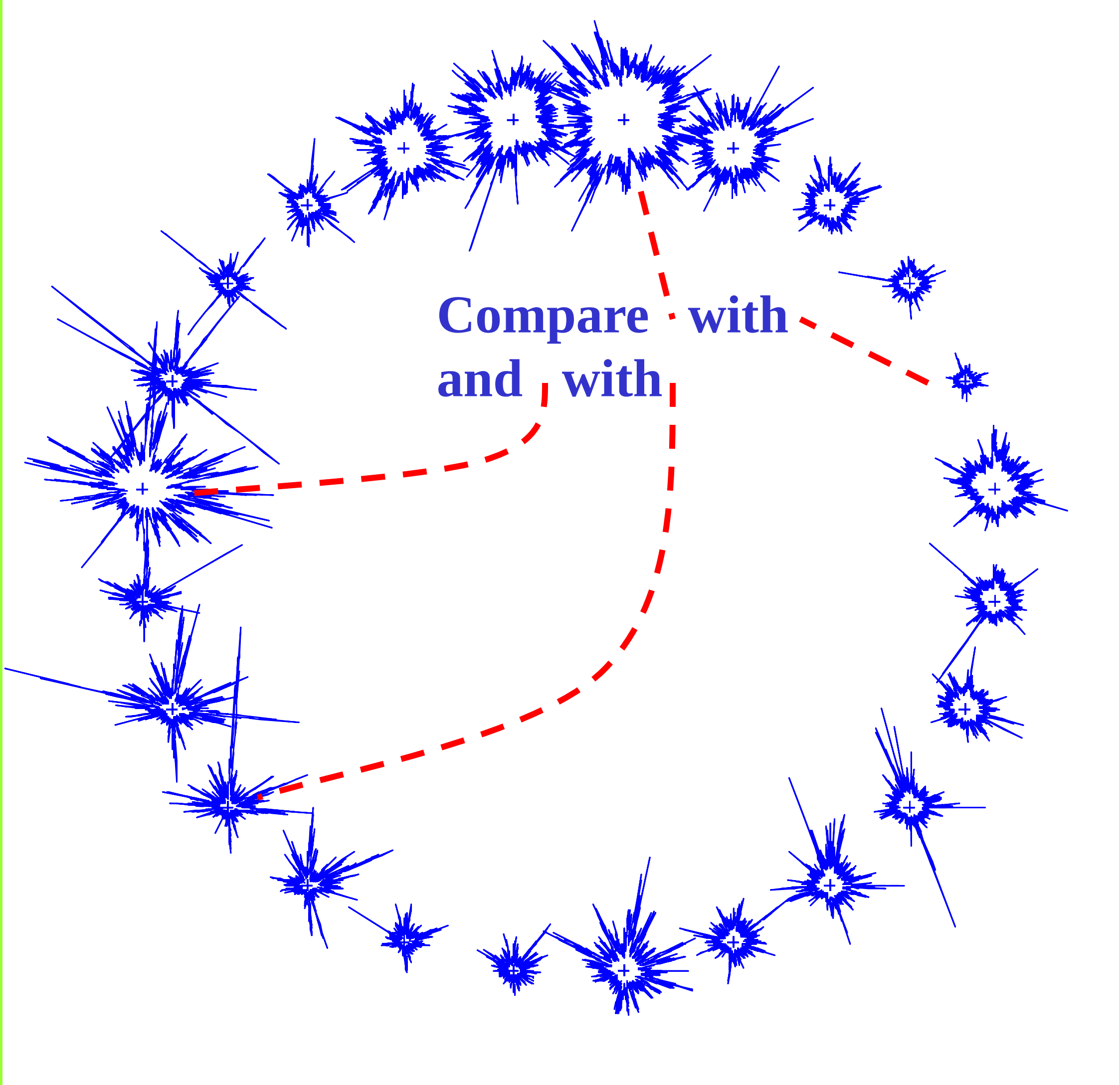
An example of a horizontal-shaft turbine shows the same:

The sensors in 24 circumfer-ential locations; in each, the depend-ence on the instan-taneous runner position was estimated.



An example of a horizontal-shaft turbine shows the same:

The sensors in 24 circumfer-ential locations; in each, the depend-ence on the instant-aneous runner position was estimated.



The diagnosis or monitoring based on only one or only a few sensors can yield

- erroneous estimates of cavitation intensity, and

- false judgments of the role of turbine parts.

In order to ensure a reliable cavitation sampling,

- a rather higher number of sensors suitably distributed over the turbine, and

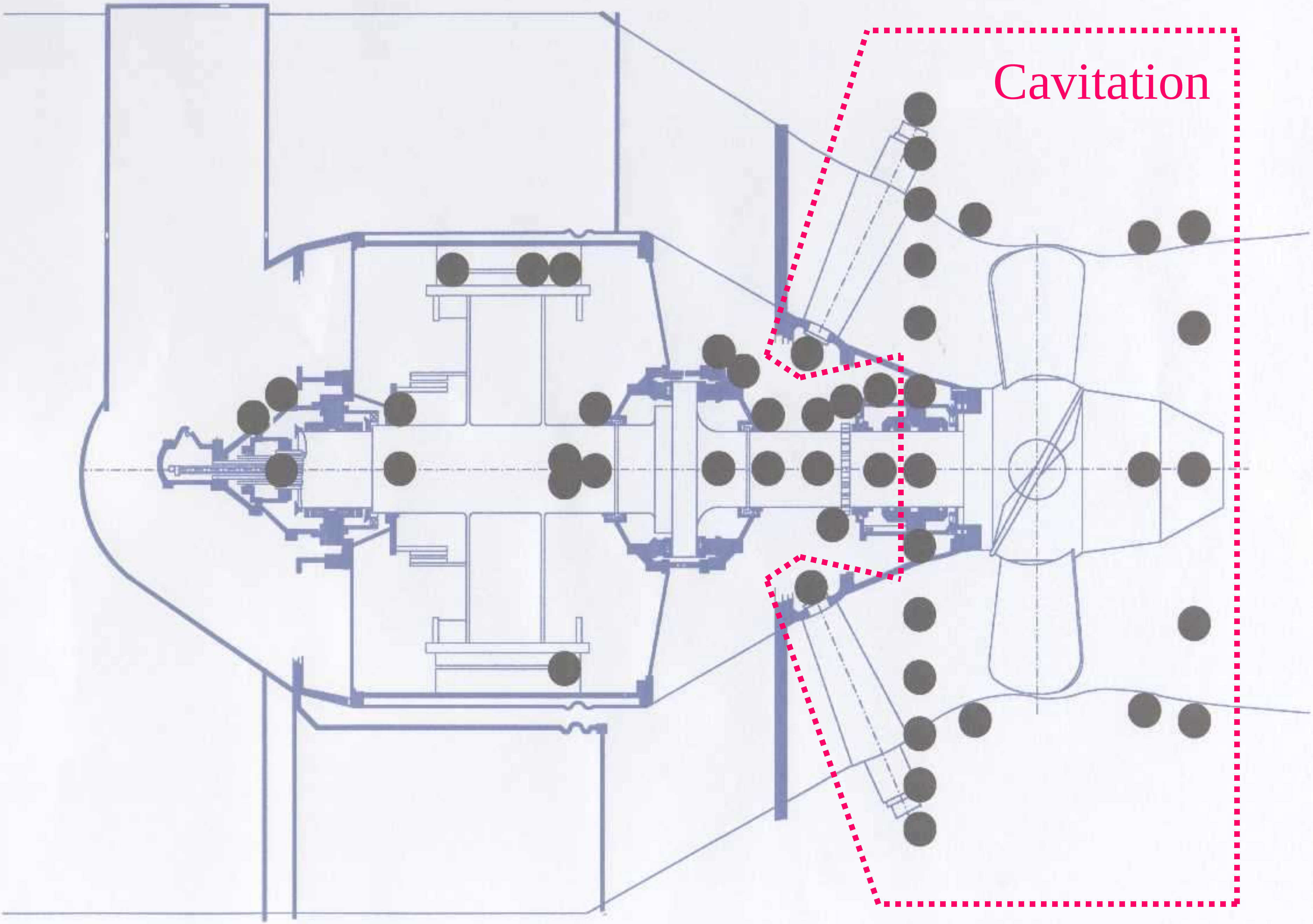
- a suitable multidimensional algorithm for processing the data they deliver,

are necessary.

Our practice:

- **In the diagnostic tests, we use a high number of sensors (possibly as many as 20-30 for cavitation).**
- **For permanent monitoring, we reduce the number to a minimum, based on the test results (typically 8, 6, or 4 for cavitation).**

An example of a sensor set used on a bulb unit, in a general diagnostic test that included cavitation, is presented on the next slide. For permanent cavitation monitoring, 8 were kept mounted.


Cavitation