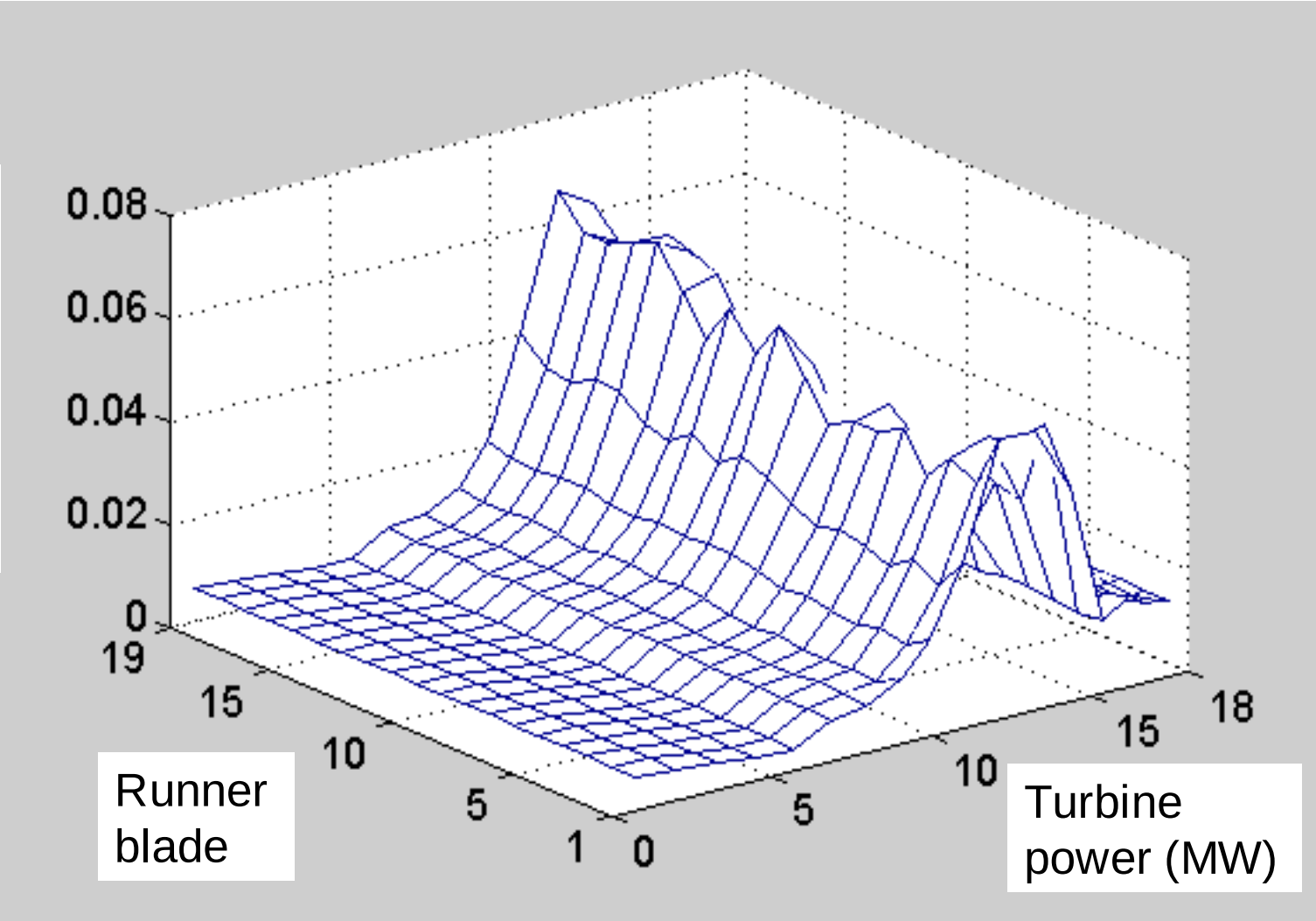
Cavitation quality of turbine parts - Francis

A 17 MW horizontal-axis Francis turbine has been tested in order to assess the cavitation quality of its crucial parts. Rather moderate differences among runner blades and very high differences among guide vanes have been found. The possible improvement through repair of especially poor guide vanes has been estimated.

Quality

Runner cavitation characteristics: The cavitation quality of the runner blades is assessed.

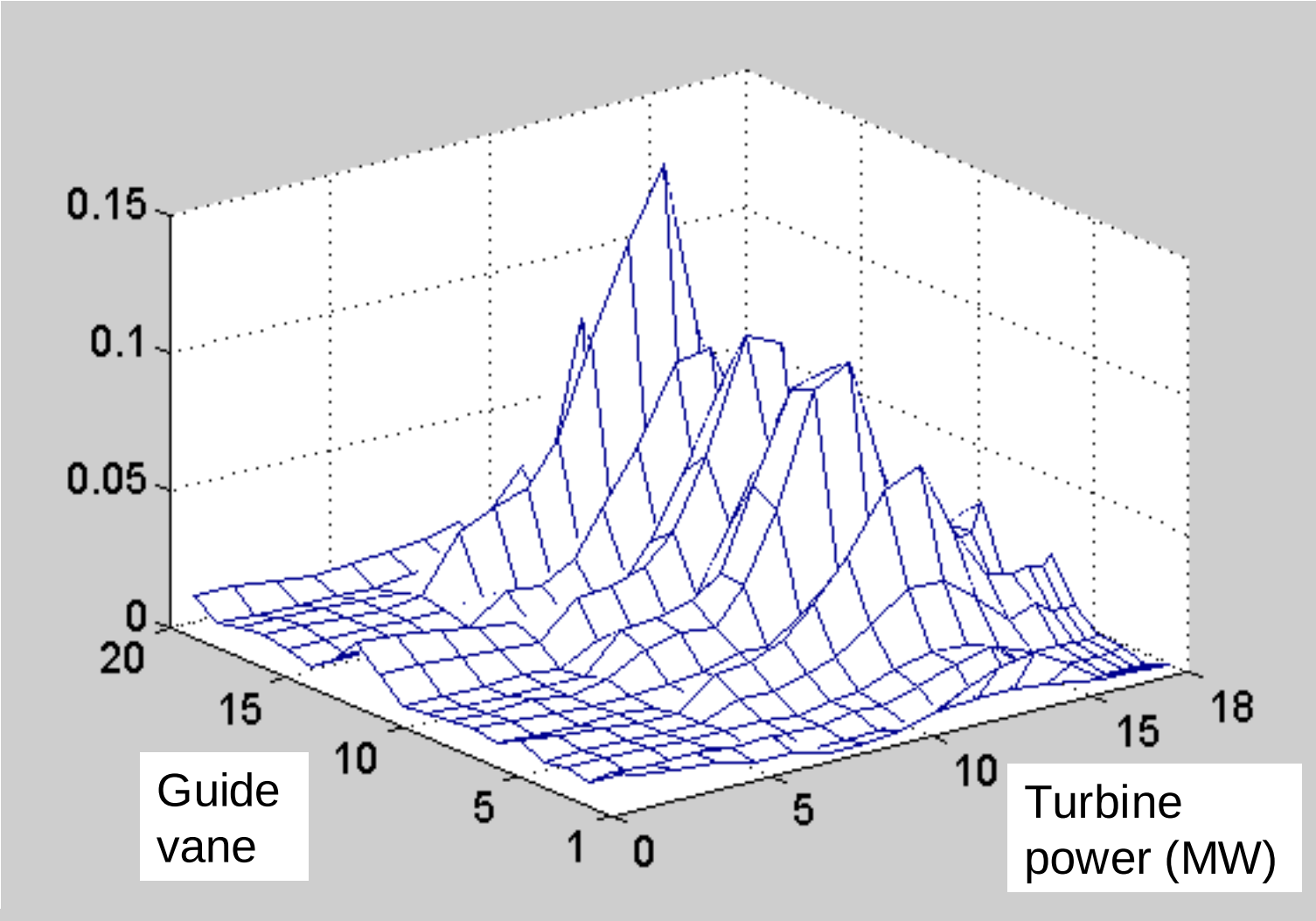
Normalised cavitation intensity - Mean value close to a runner blade



Quality

Wicket gate cavitation characteristics:
The influence that the guide vanes have on cavitation close to the runner is assessed.

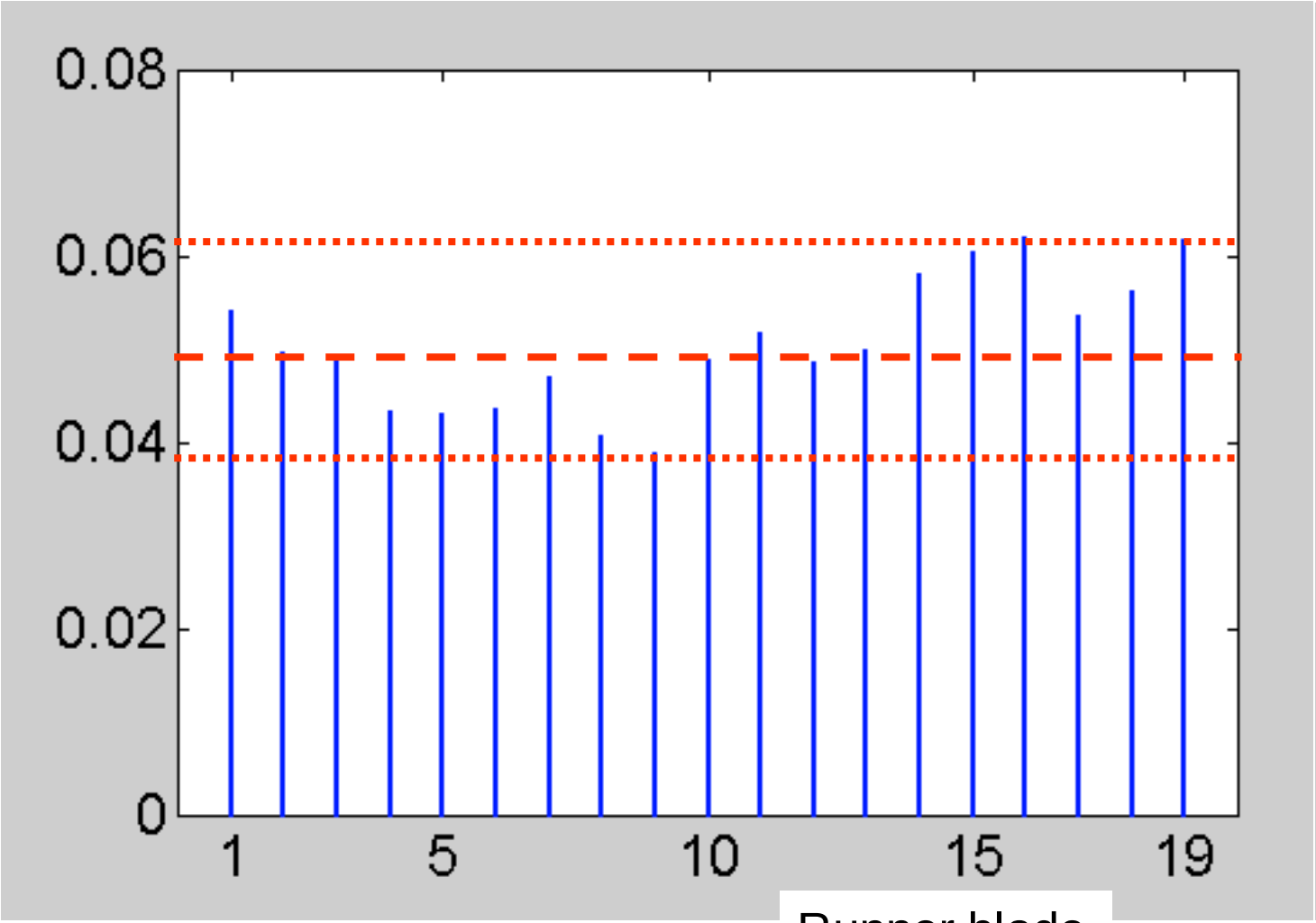
Normalised cavitation intensity - Mean value of that component of cavitation close to the runner blades, which is influenced by a particular guide vane



Quality

Cross-section of the runner cavitation characteristics at the maximum of the total cavitation intensity

Normalised cavitation intensity at 13.3 MW

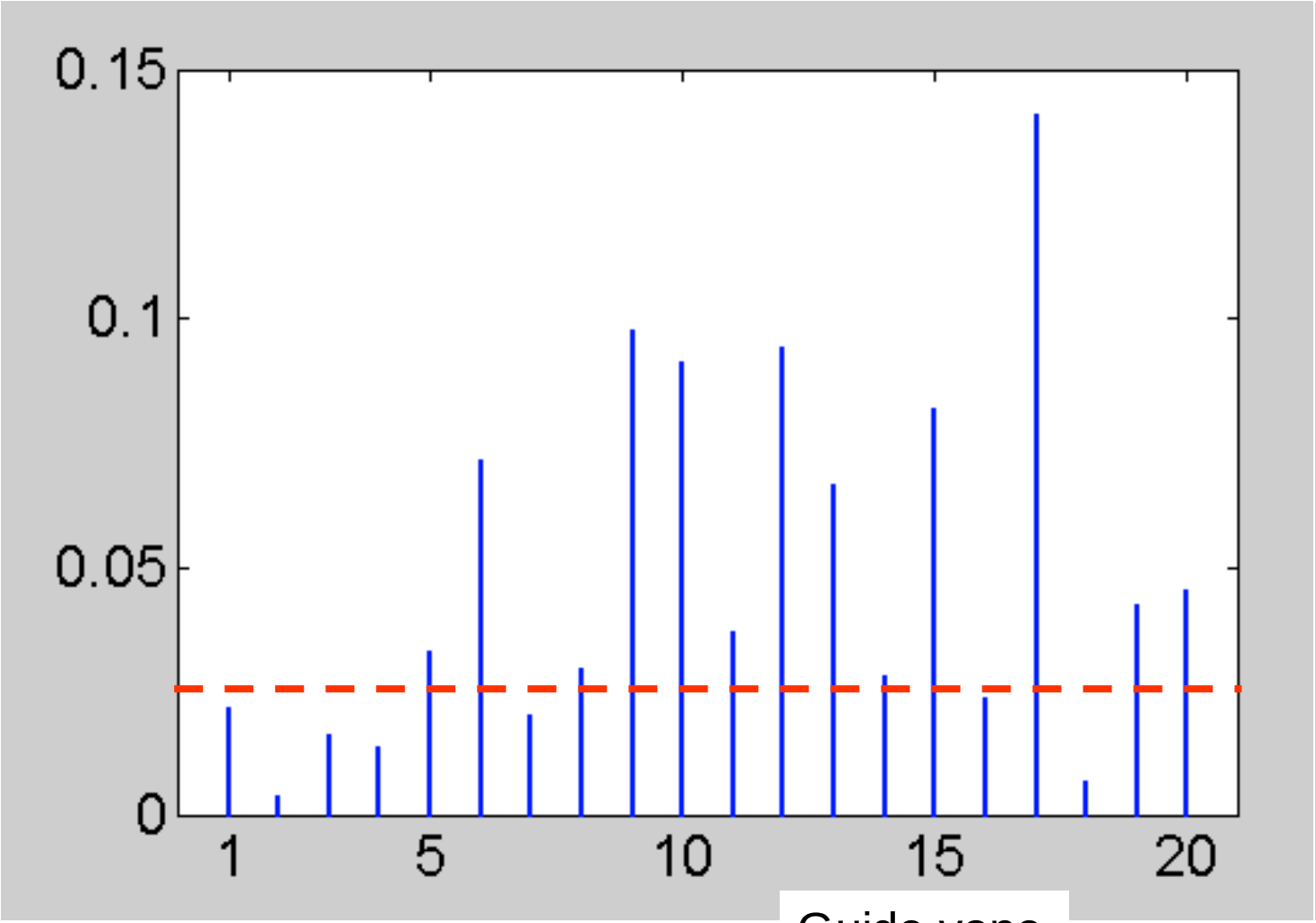


Note:
The quality of the blades varies ±20 %.

Quality

Cross-section of the wicket gate cavitation characteristics at the maximum of the total cavitation intensity

Normalised cavitation intensity at 13.3 MW



Note: Some of the guide vanes cause especially strong cavitation.

Quality

If there is any systematic trend in the cavitation quality of the guide vanes, be it related to the differences in the flow in different positions in the spiral or to the differences in the pressure in this horizontal-axis turbine, that trend cannot explain high differences between neighbouring vanes. Here, the cause of the differences has to be looked for in the details of the shape or in the setting differences of each vane.

Quality

Thus, a repair may be possible. If the guide vanes were to be repaired and their influence reduced to that which is denoted by the thick lines, a 40 % reduction of the total cavitation intensity would be achieved.

Normalised cavitation intensity at 13.3 MW