Power fluctuations - bulb

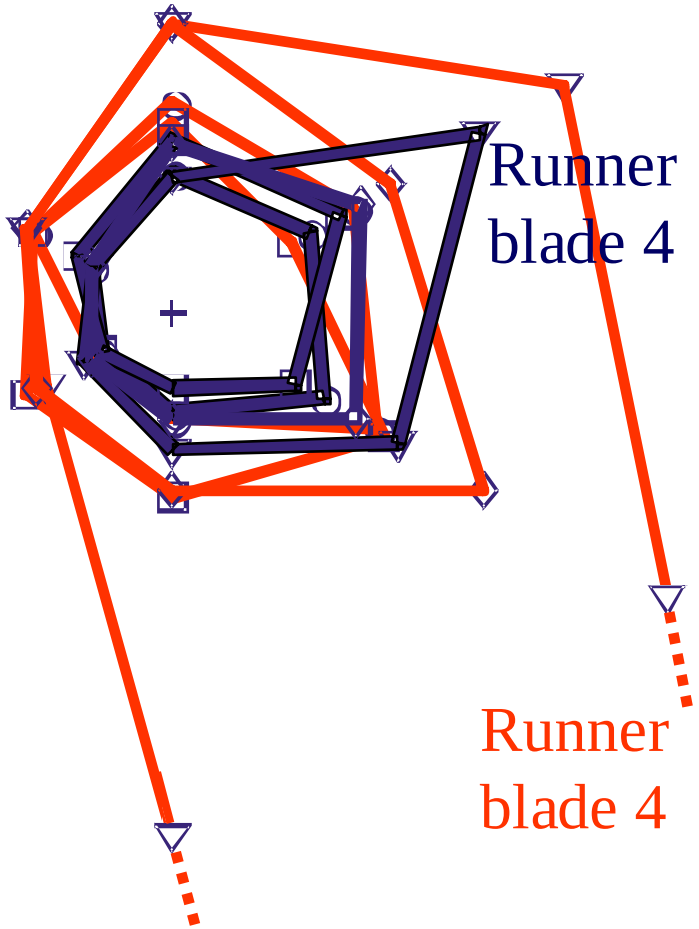
Strong once-per-revolution power fluctuations were recorded on a 40 MW bulb unit.

The multidimensional cavitation diagnosis revealed the cause. Some of the steps are illustrated in the following.

The cause is the cavitation on one faulty runner blade which develops within one part of a revolution and which is especially strong when trash gets caught on an upper guide vane and disturbs the flow.

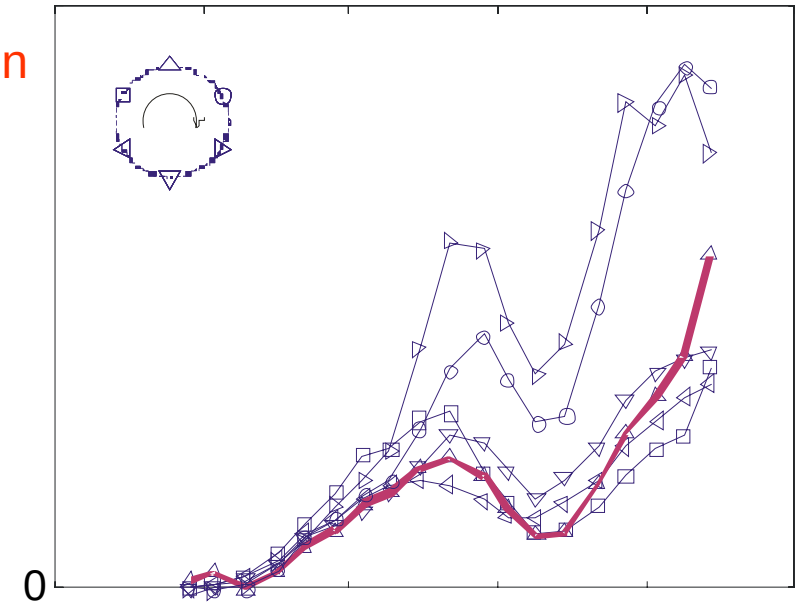
Fluctuations

Cavitation on 4 runner blades (4 symbols) in various angular segments within a turbine does not differ much if the power fluctuations are weak (blue). If the fluctuations are strong, (red), blade 4 cavitates strongly within one part of a revolution.

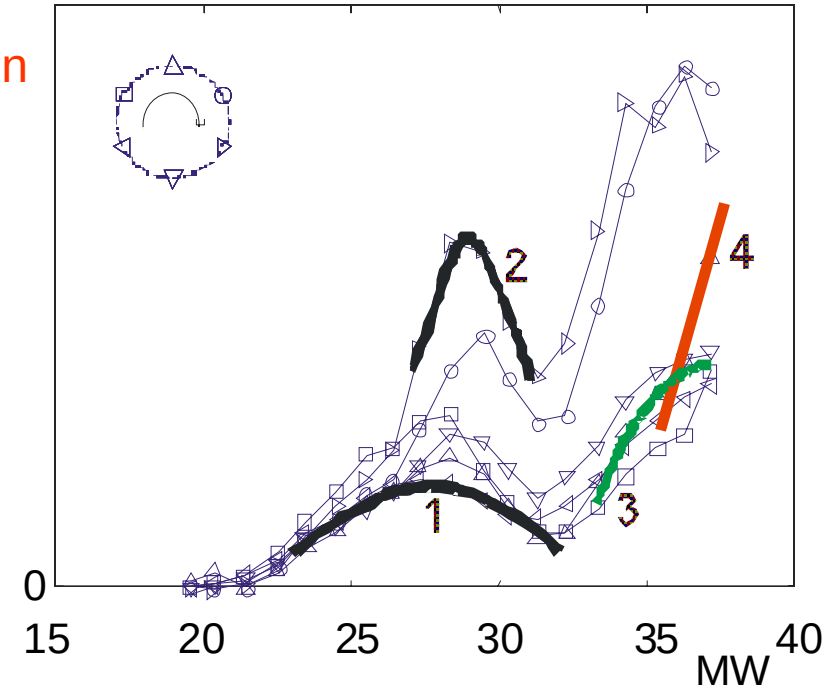


Fluctuations

Note the characteristic form of the cavitation intensity´s power-dependence.



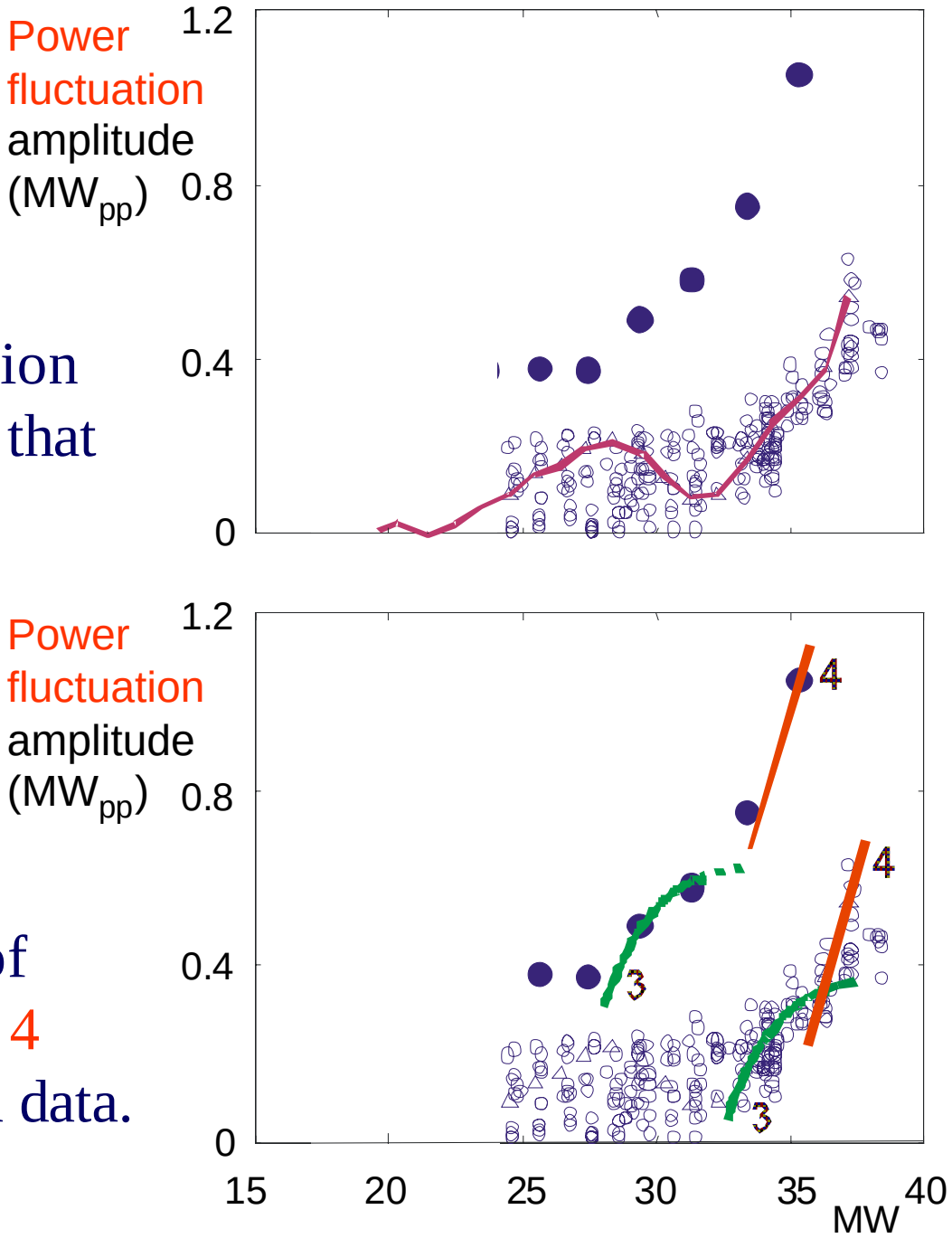
Note the four cavitation mechanisms and especially 4 and 3.



Fluctuations

The form of the cavitation power-dependence fits that of the fluctuations.

There are clear traces of cavitation mechanisms 4 and 3 in the fluctuation data.



Fluctuations

Therefore:

Explosive cavitation within one part of a revolution accompanies strong power fluctuations.

Dependence on operation parameters of cavitation and power fluctuations coincide.

Detailed modelling of the process revealed the cause: At one poorly functioning runner blade, strong cavitation develops, which causes a strong temporary drop in the blade’s efficiency.