SEDIMENT EROSION IN HYDRAULIC TURBINES

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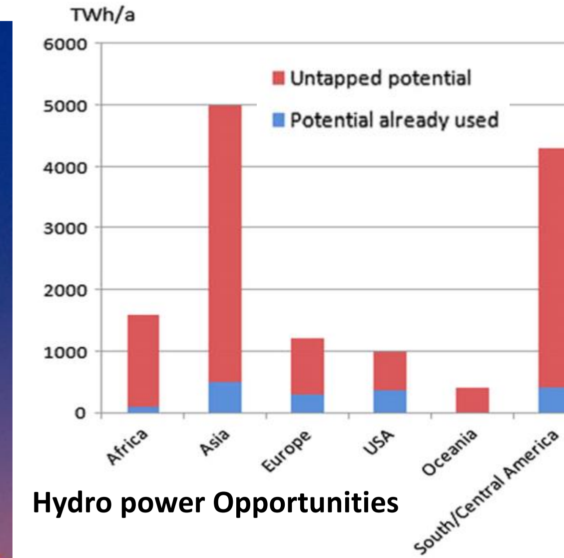
Beauty Comes With Hidden Price!

23 MW*2 Francis runner at Chawa Power plant, Chile



Hydro power Opportunities

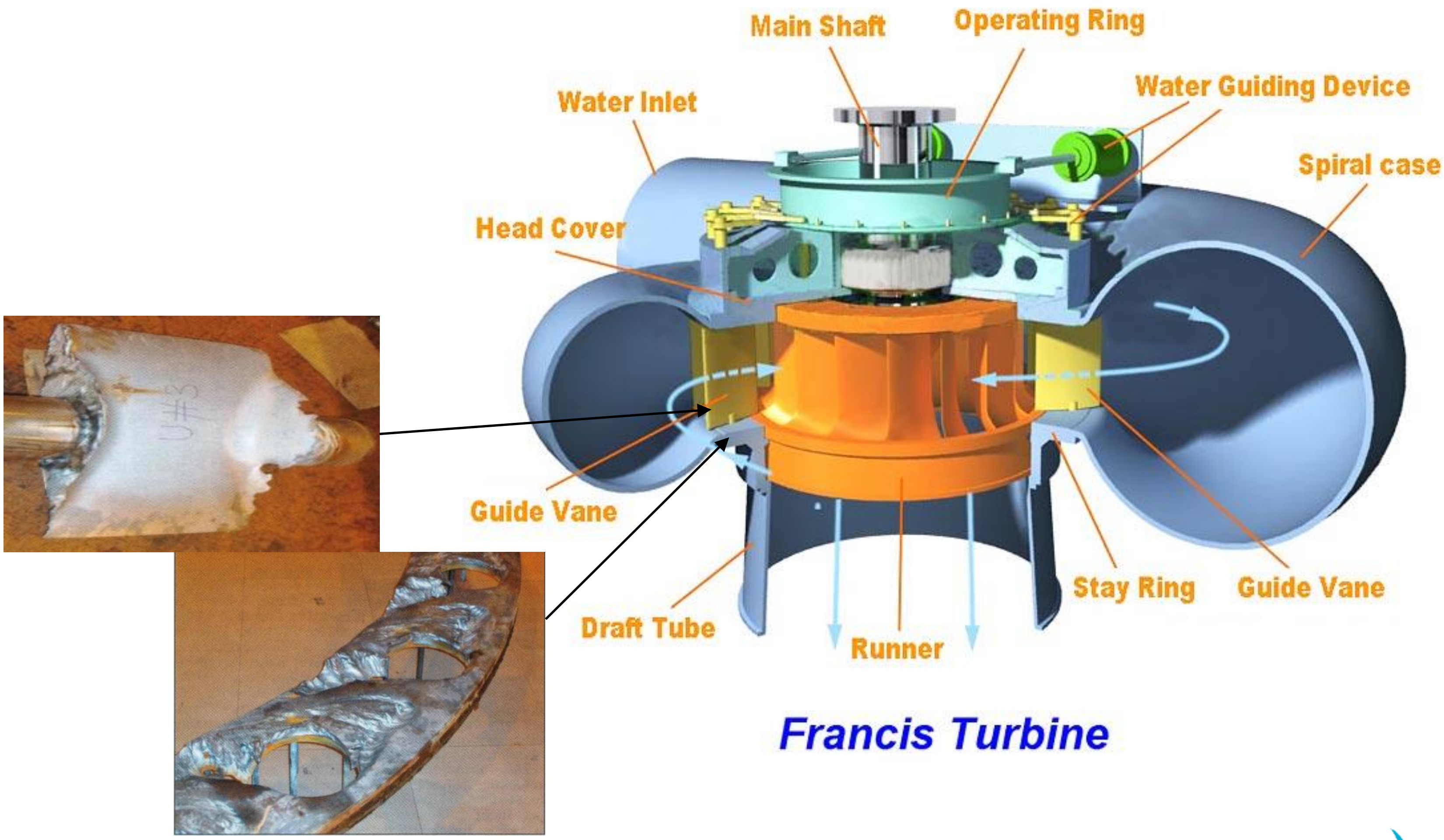
48 MW*3 Francis runner at Kaligandaki Power plant, Nepal

Sediment erosion damage in guide vanes and facing plates

250 MW*6 Francis runner at Nathpa Jhakri Power plant, India

A view of November evening in Nepal

Research Problem



Sediment erosion damage in guide vanes and facing plates

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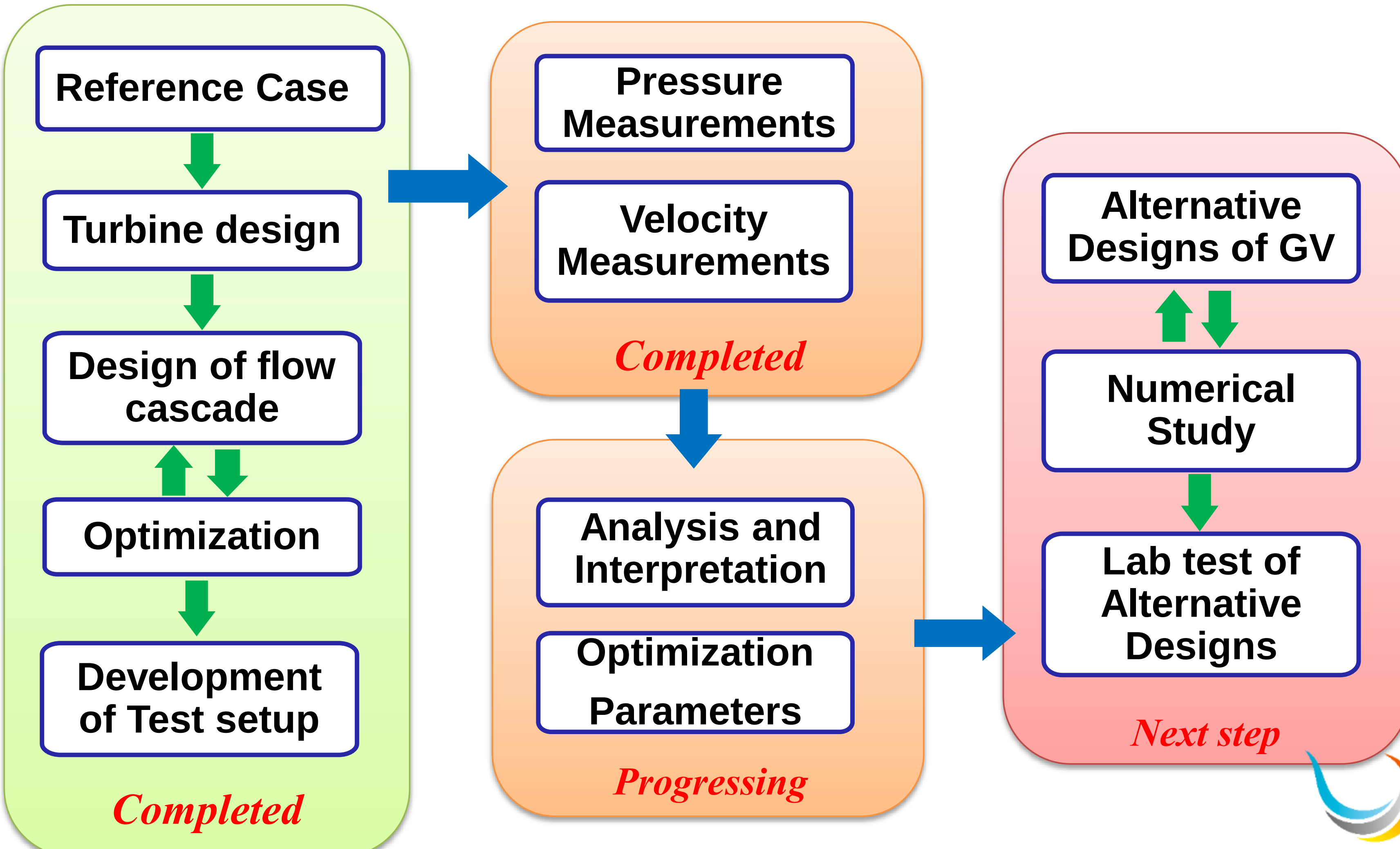
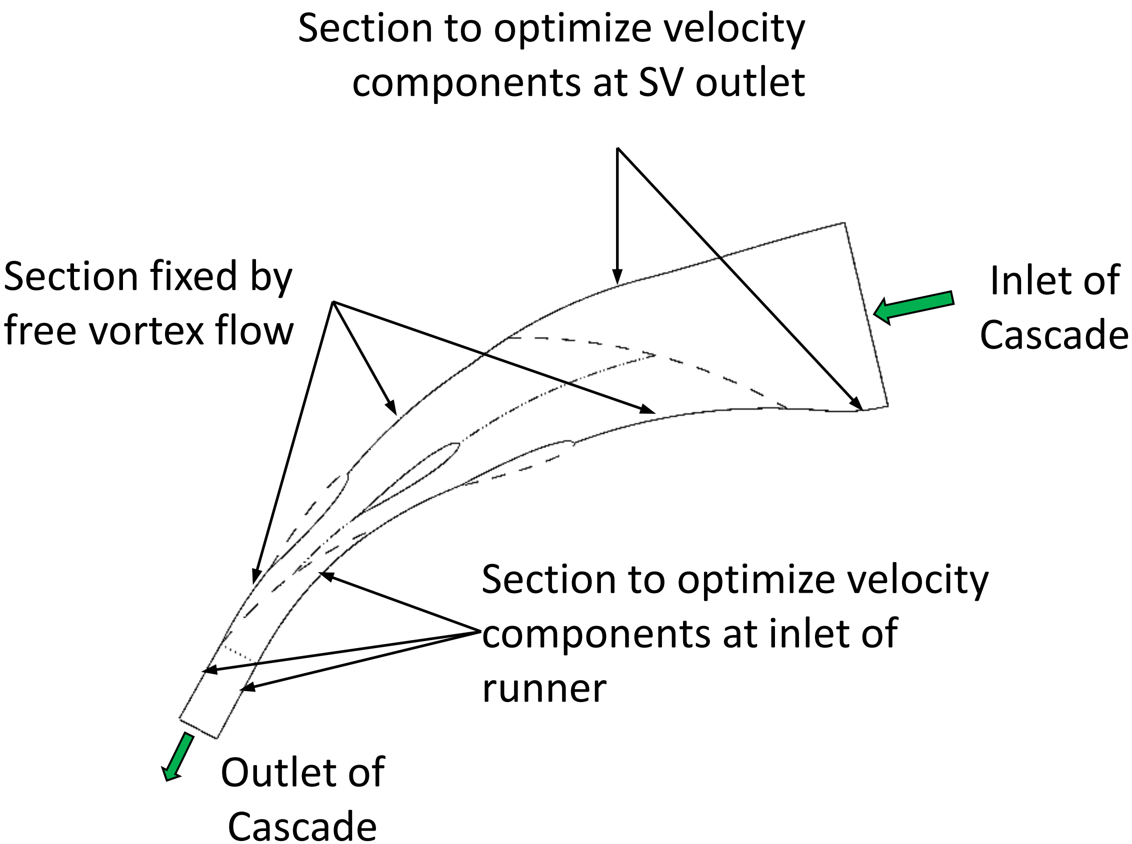
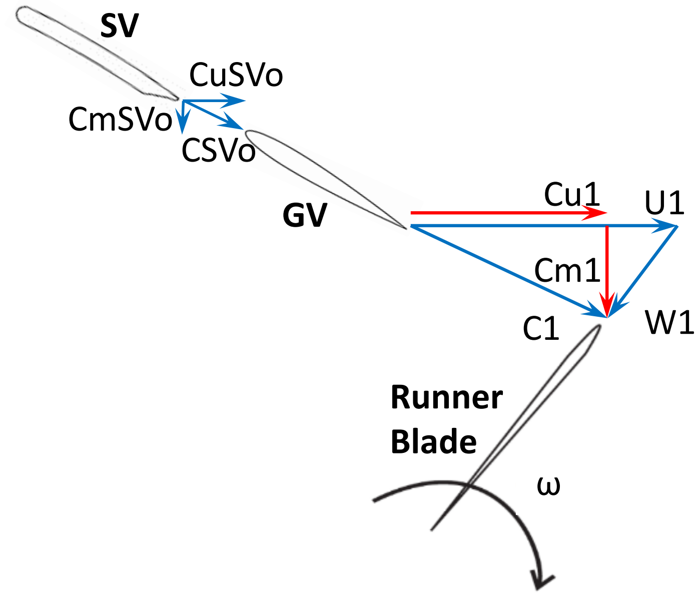
Research Methods



Design of Flow Cascade





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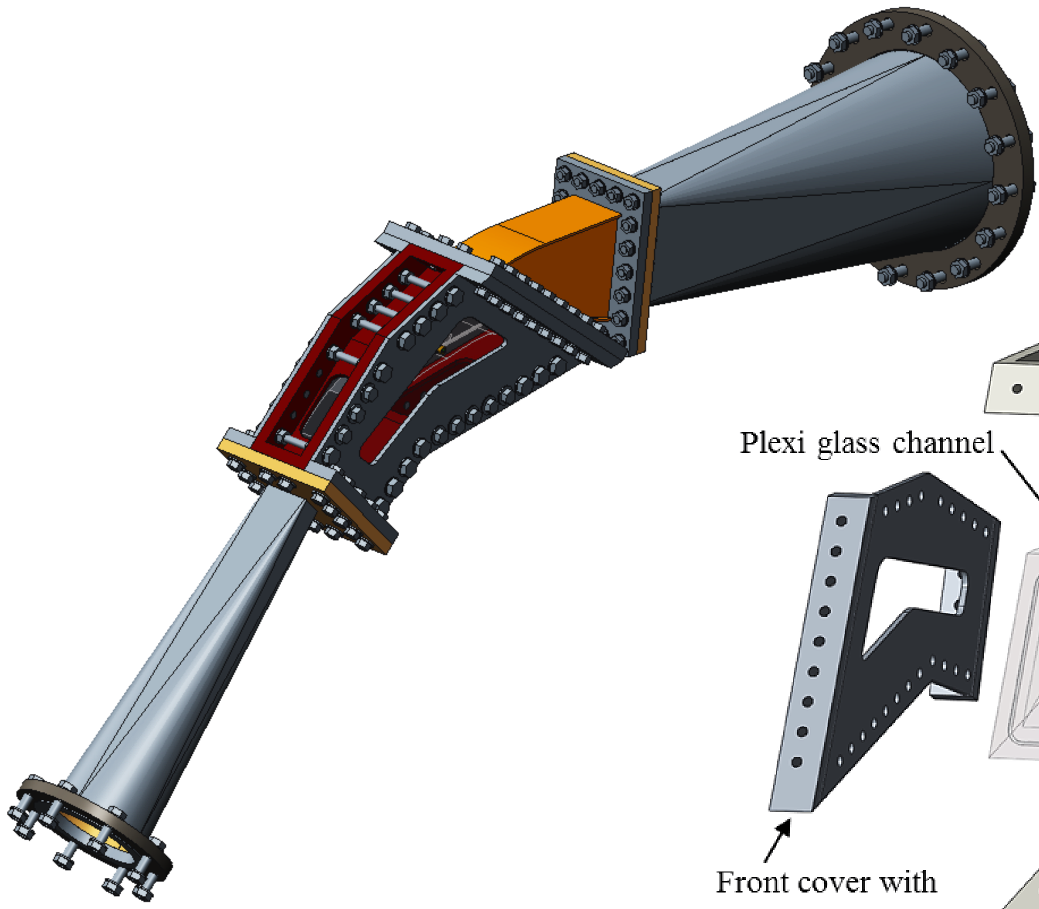
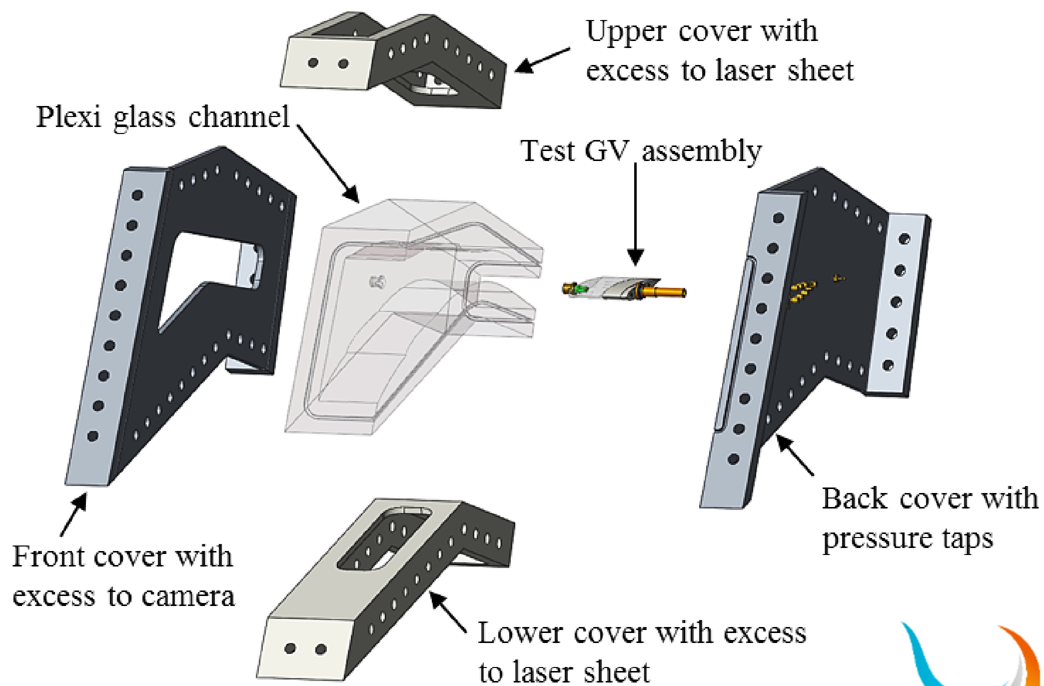
Test Setup





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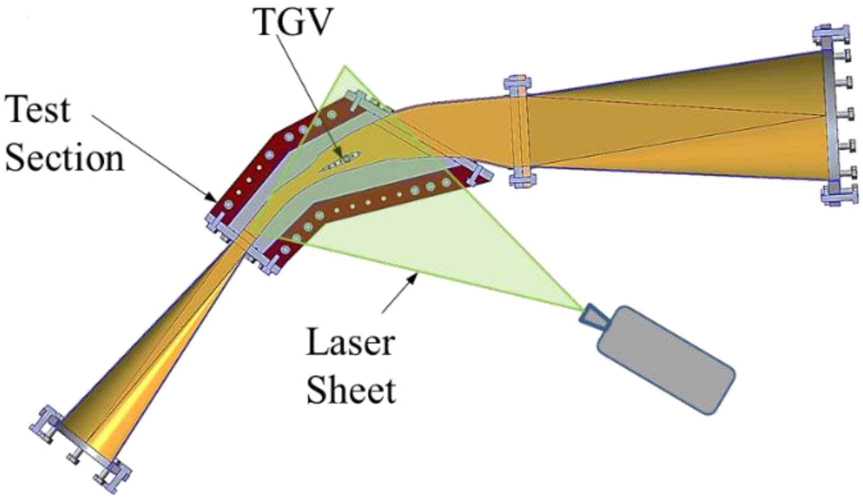
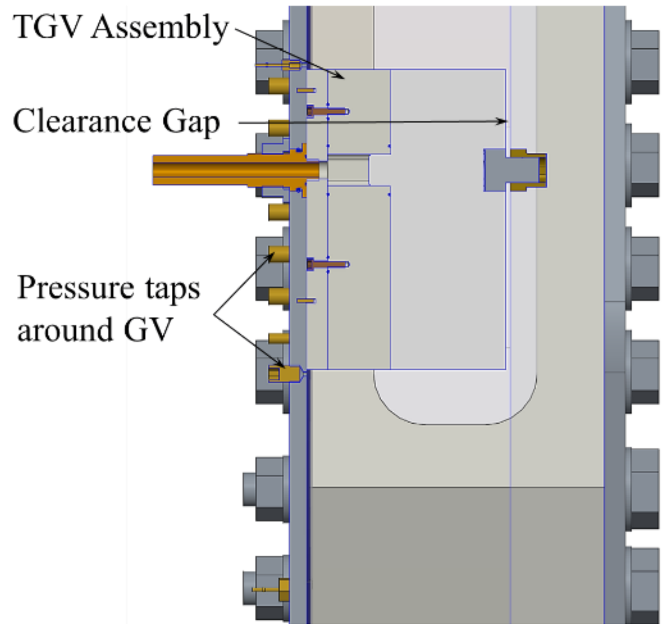
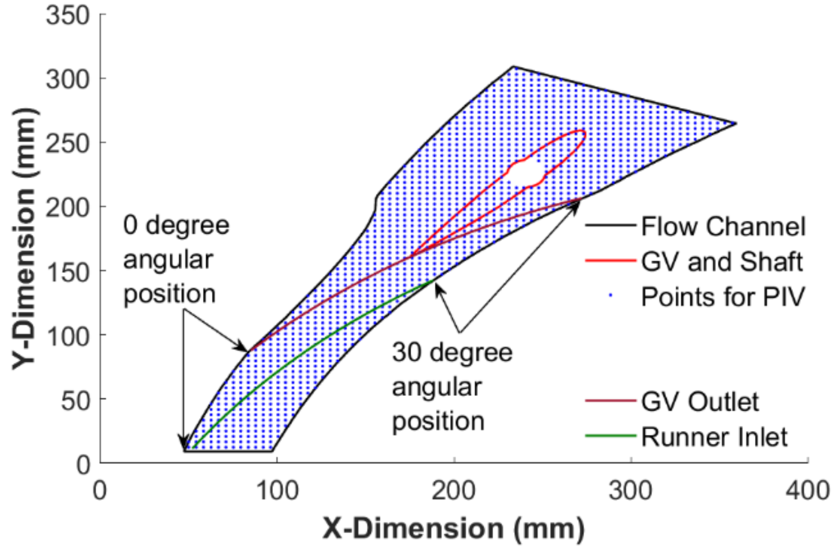
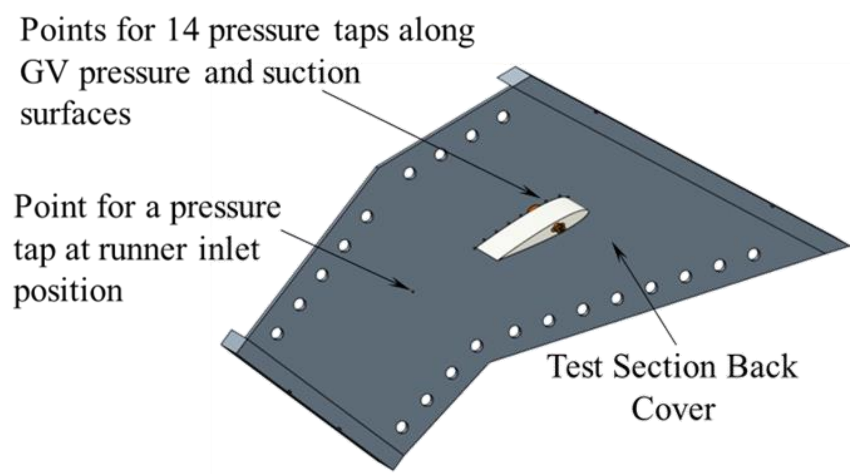
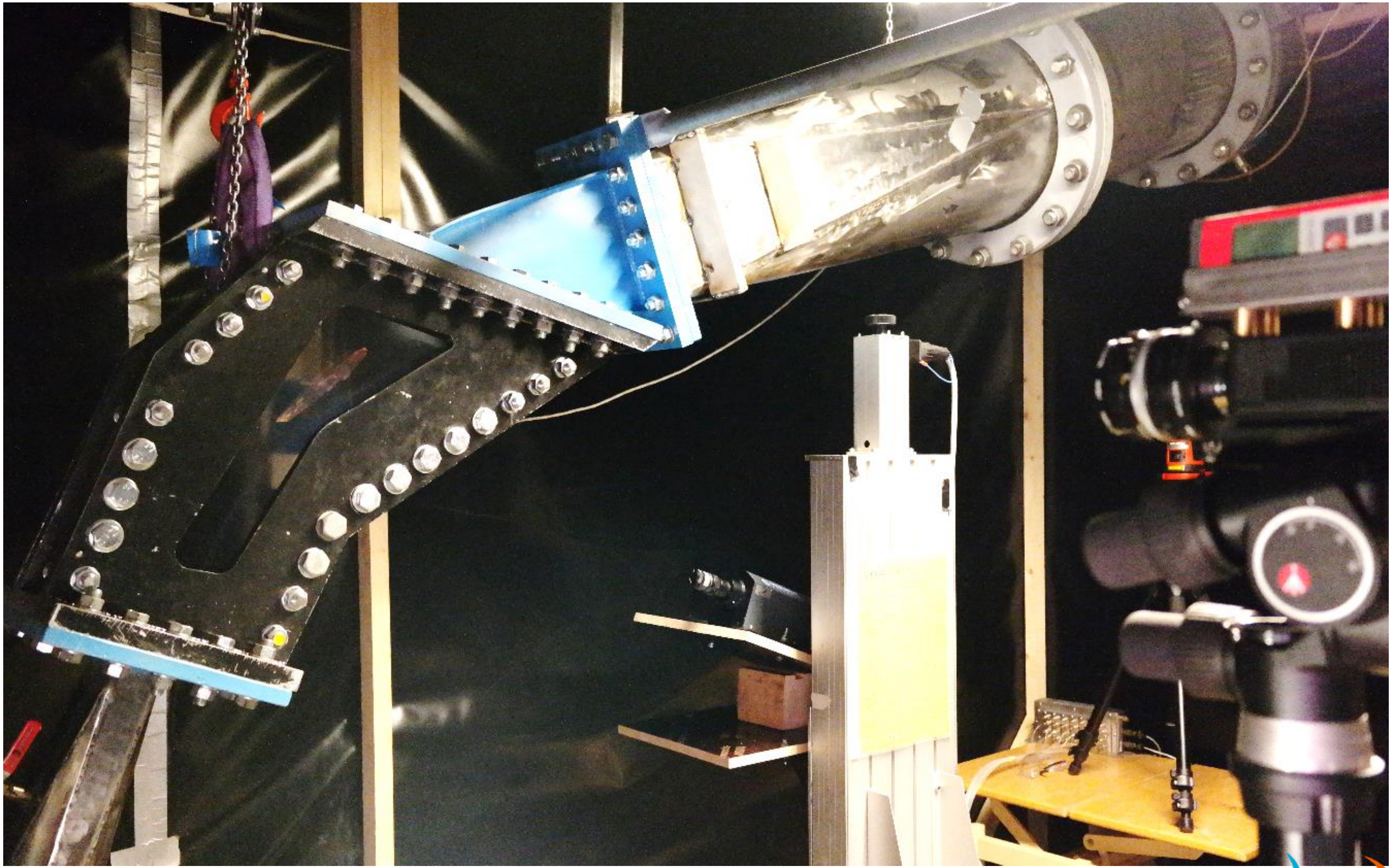
Measurement Sections











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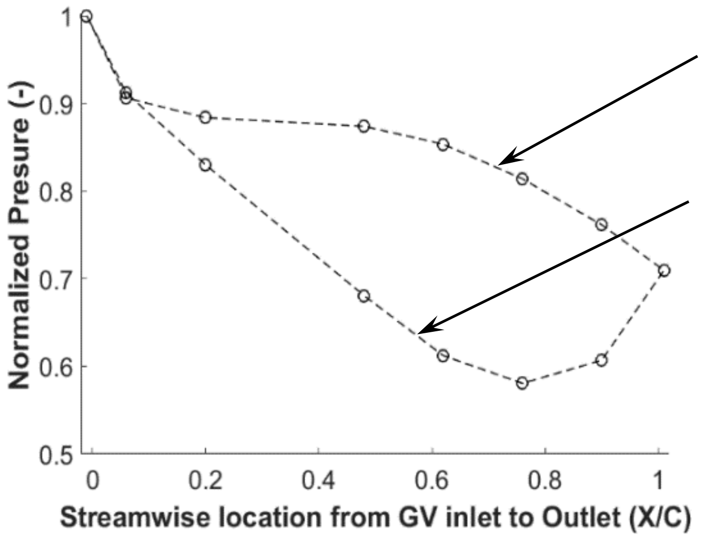
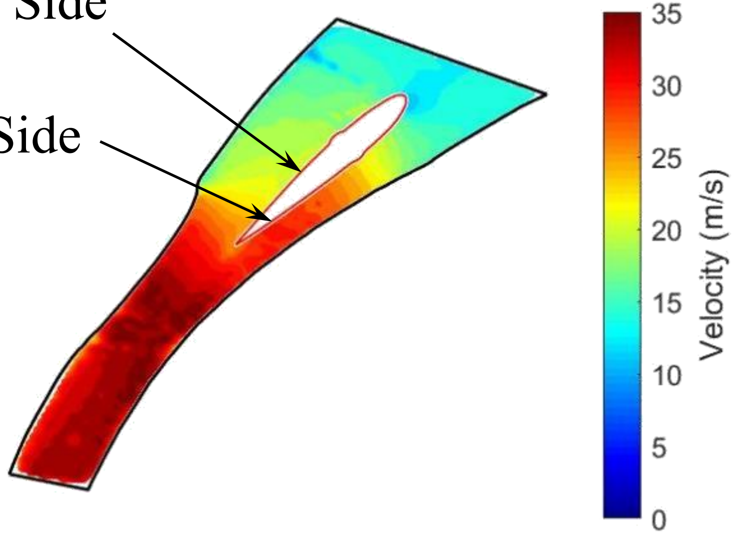
Measurement Along GV Mid Span





Pressure along GV surface

Contour plot of velocity (PIV)

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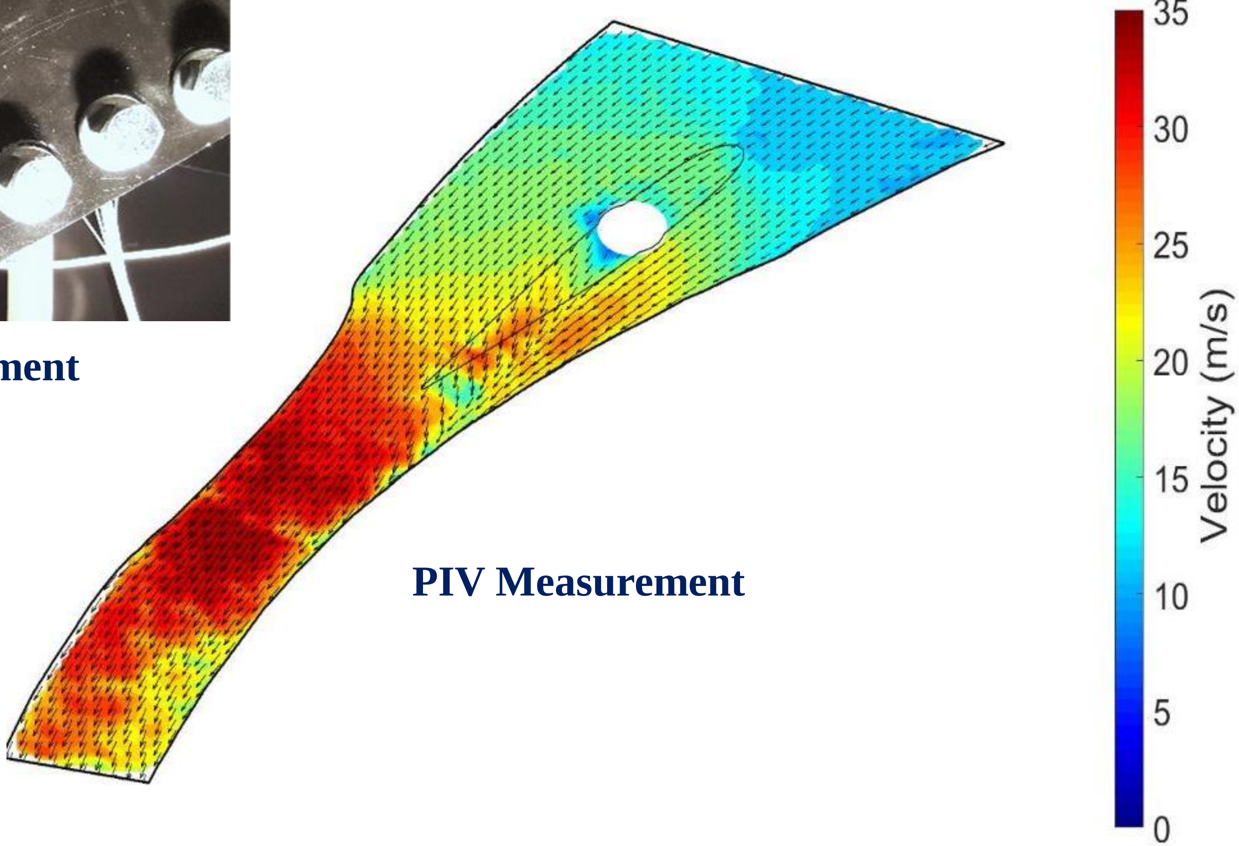
Flow Along Clearance Gap

Observation of vortex filament



PIV Measurement

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Correlating with Observations

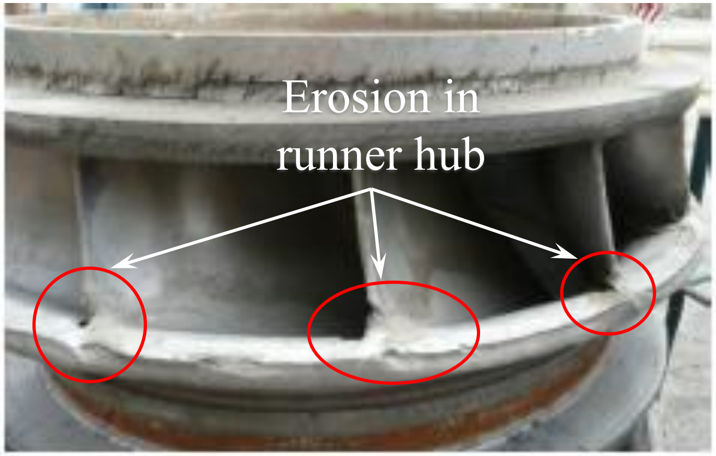

Photo Source: *Ole G. Dahlhaug*

- ***NACA 0012 Profile used for guide vanes***
- ***High Pressure difference towards trailing edge***
- ***More erosion in trailing edge walls due to high velocities and secondary flows***
- ***Formation of clearance gap, inducing strong crossflow***
- ***Increases relative velocity and reduces radial velocity at runner inlet towards hub and shroud***
- ***Thus higher erosion in runner hub and shroud at inlet and lowered runner efficiency***

Other factors as RSI, Blade leaning design and operational parameters are equally important

Thank You!!!

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