

Streamlining the Production of Highly Viscous Fluids using a purpose-built Centrifugal Pump Stage as part of a Conventional ESP Installation

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Schlumberger

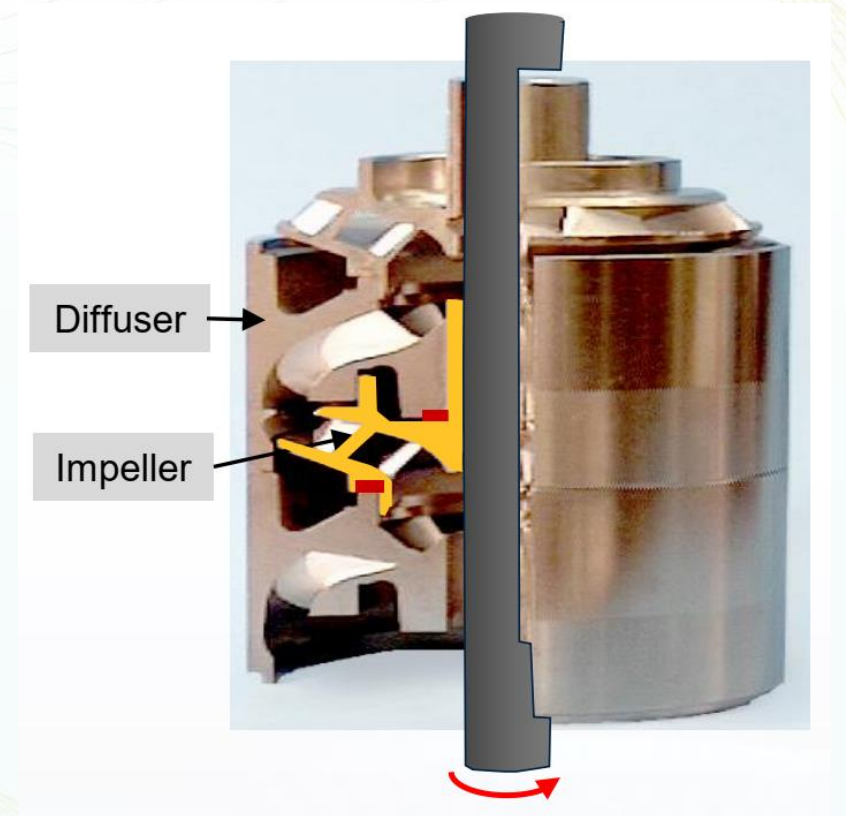
Background

Low viscosity

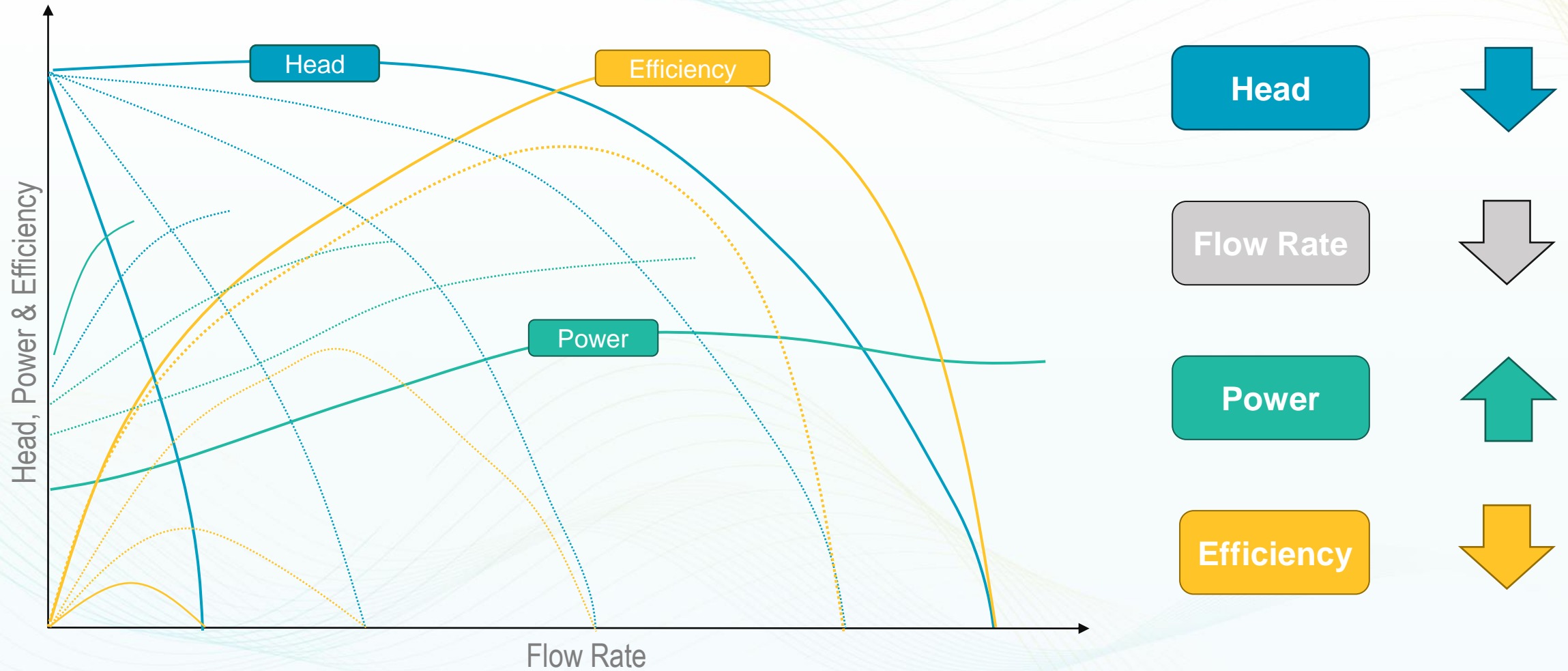
- Flow is **turbulent** with thin, high energy boundary layers
- Vaned passage wall **friction losses are small**
- Disc friction losses are small

High viscosity

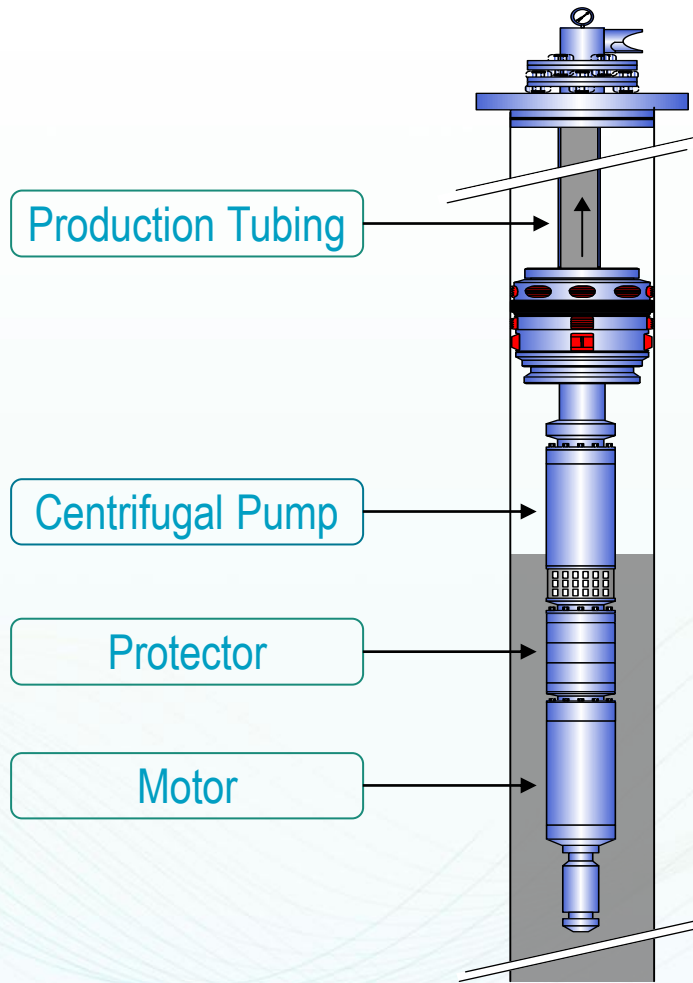
- Flow is **laminar** with thick, low-energy boundary layers
- Vaned passage wall **friction losses are large**
- Disk and journal friction losses are large



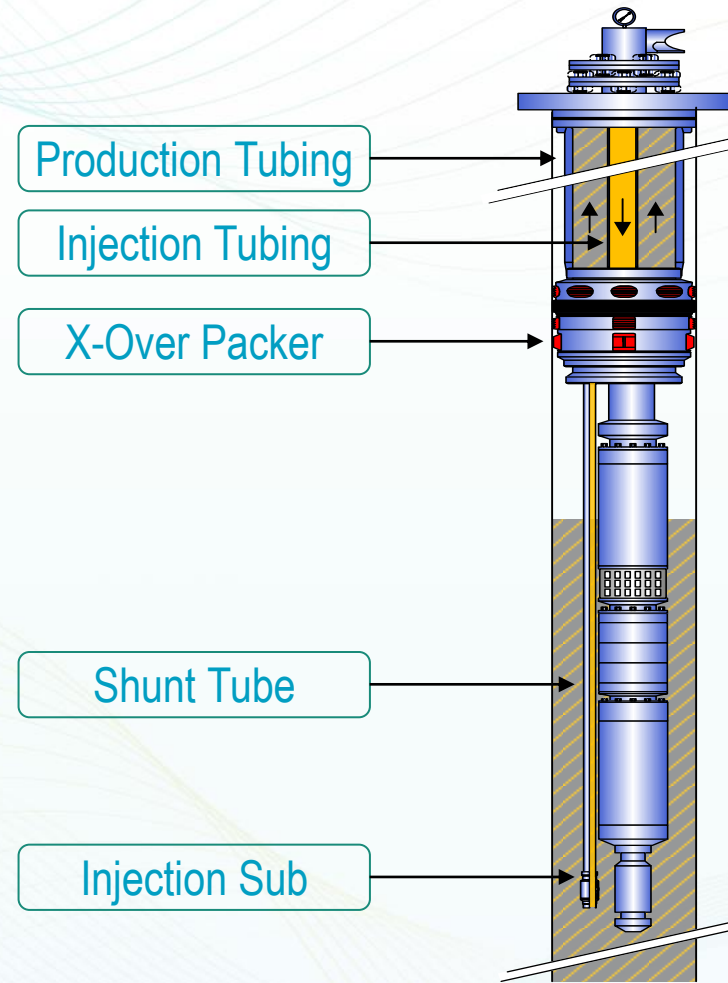
Centrifugal Pump Performance in Viscous Fluids



Competing Concepts



Conventional ESP Completion



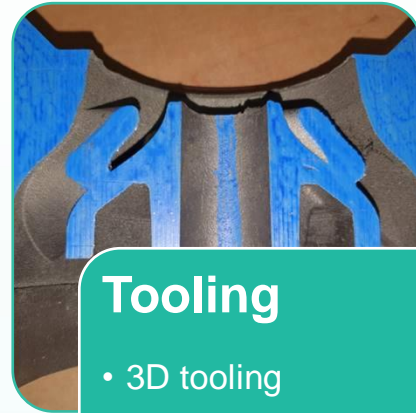
High-Rate Diluent Injection

Development Process



Design

- CAD & CAE modelling
- CFD design
- Rapid prototyping
- Air test



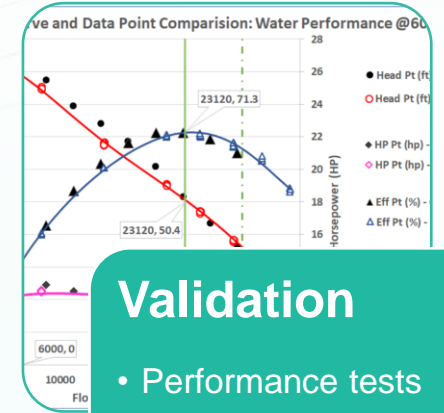
Tooling

- 3D tooling development
- Design for manufacturability



Manufacturing

- Casting simulations
- Prototype
- Operator training



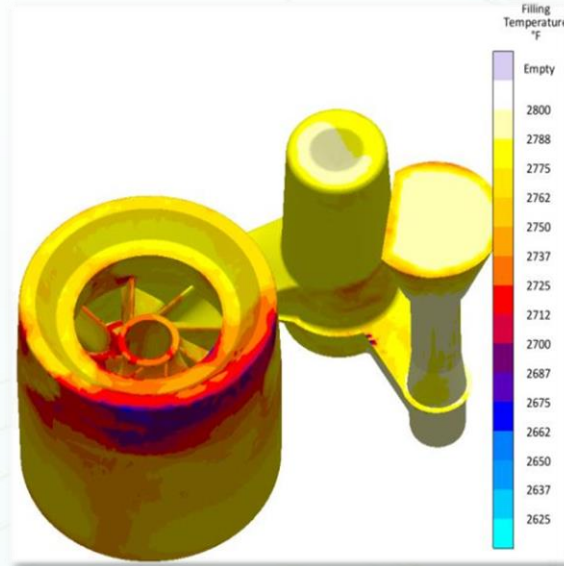
Validation

- Performance tests
- Data evaluation

Rapid Prototyping & Tooling



3D Printing

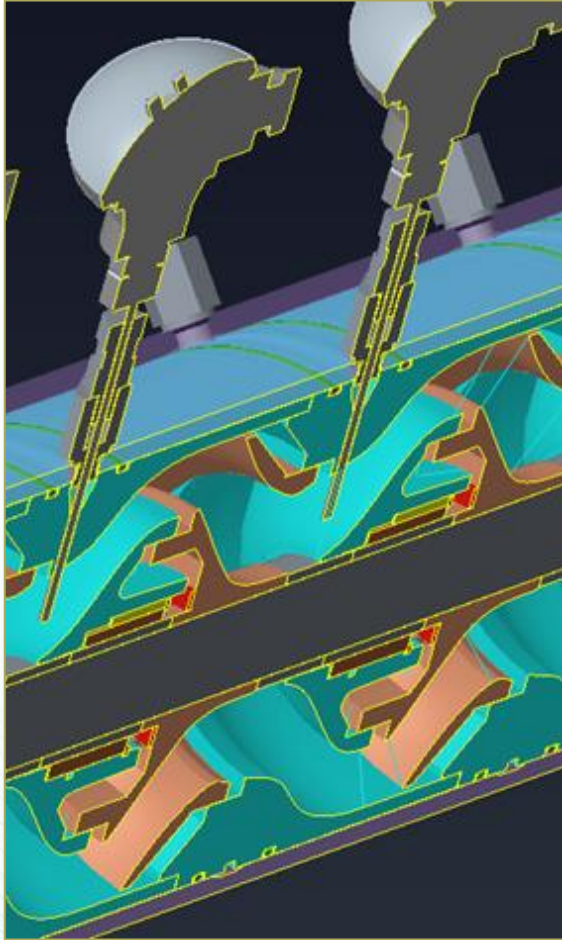


Casting Simulations



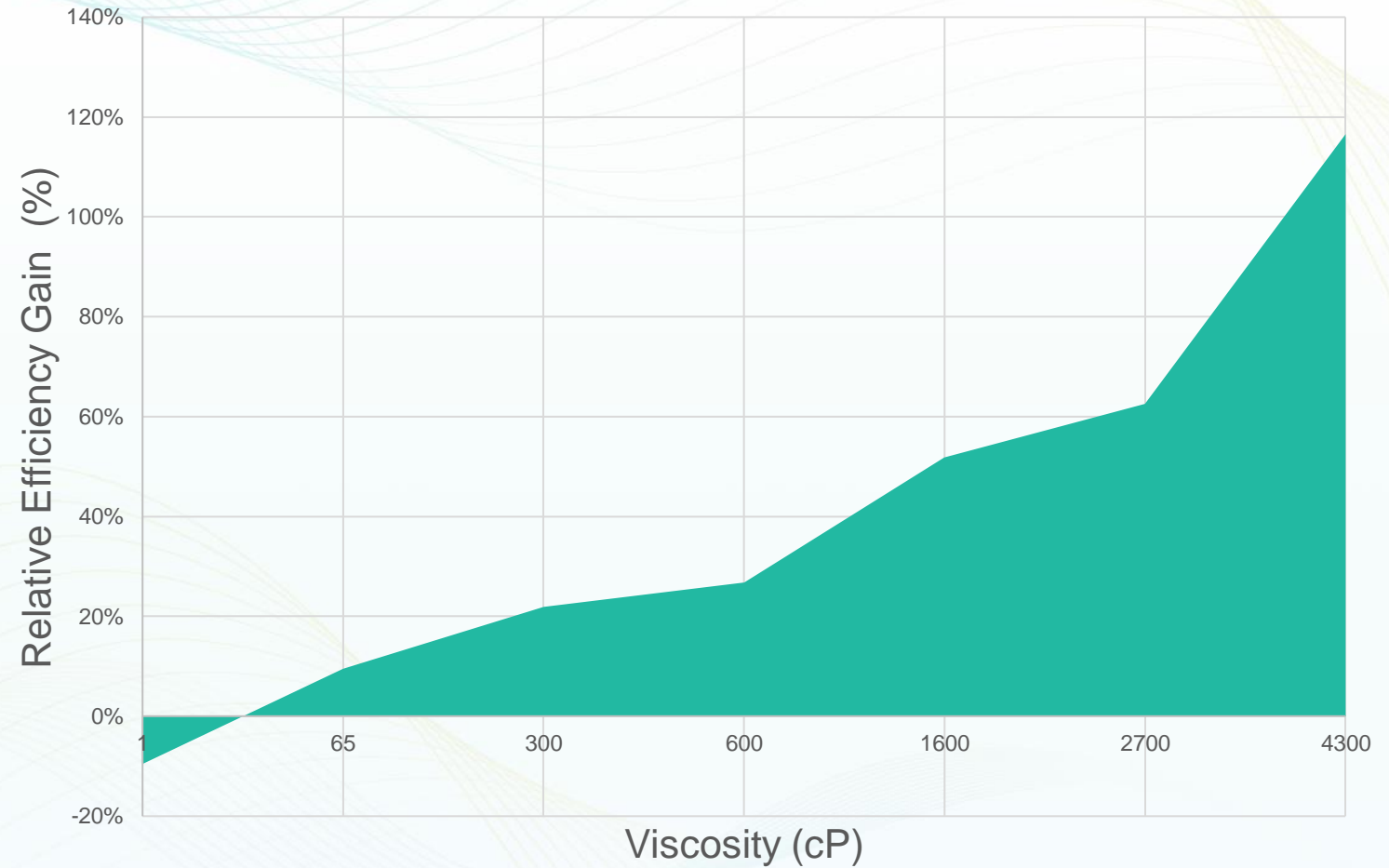
Zero Defects

Testing & Validation



Results

- Significant power reduction
- Lower carbon footprint
- Reduced deferred production
- Savings of ~3 rig days per completion
- Equipment standardisation
- Simpler, safer and more efficient completion and workover design



Q & A

Looking forward to your questions!

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