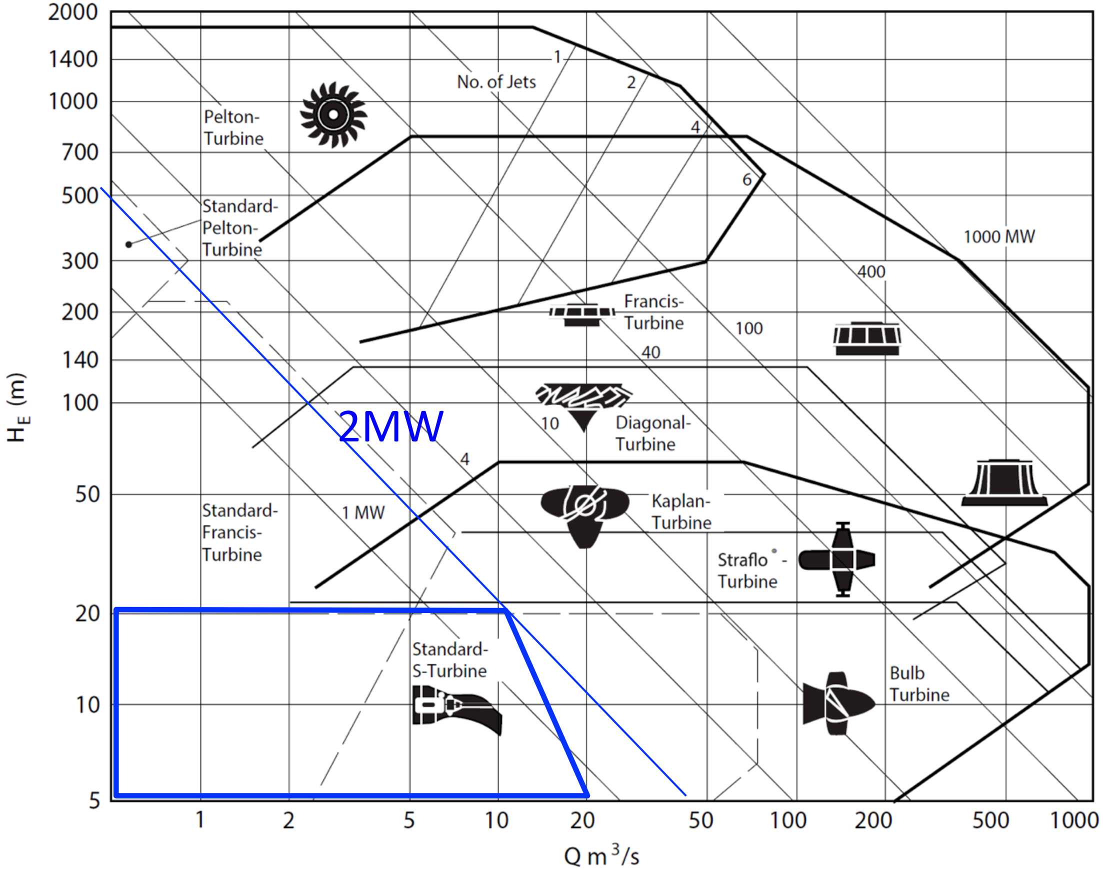
Metodi Zlatinov

Senior Mechanical Engineer
Natel Energy

02/2017 – present
Senior Mech. Engineer, Natel Energy



Natel's Design Space



Natel Design Space

Irrigation Canal

Non-Powered Dam

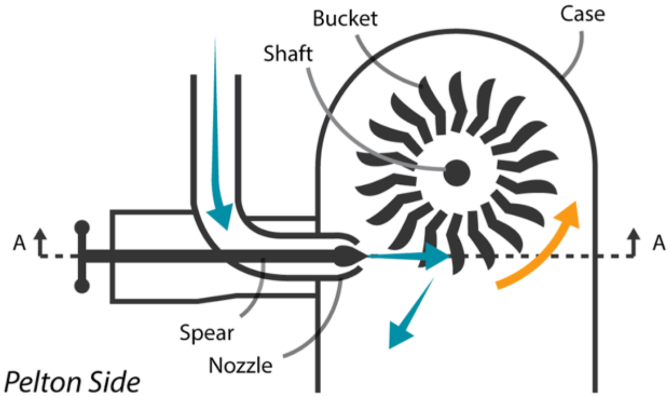
New Stream Reach

Unlocking the potential of low head hydro

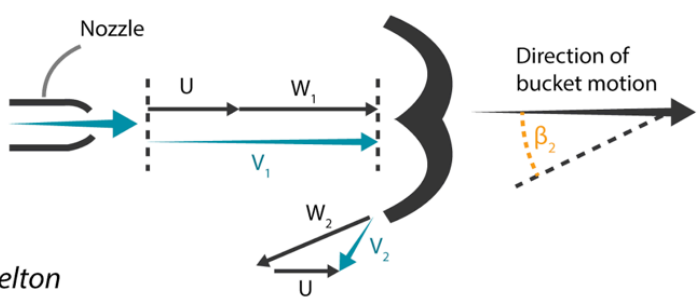
Power Density Problem: Low Head / High Flow → Big equipment, high cost

Natel’s Turbine

Conventional Pelton

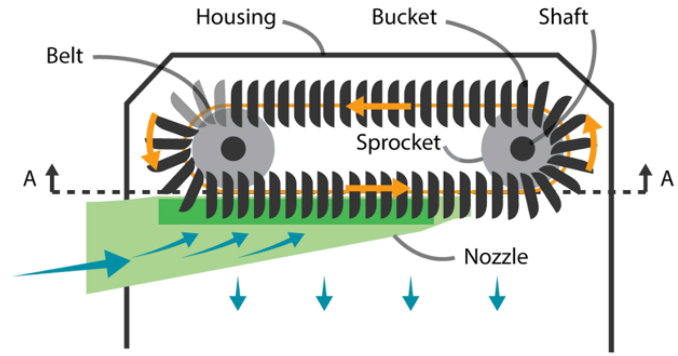


Pelton Side View

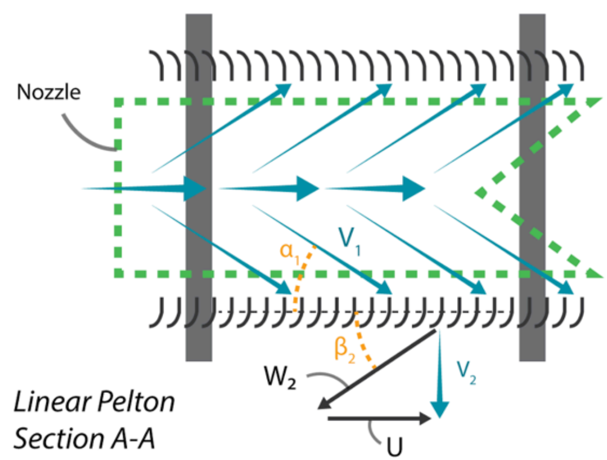


Pelton Section A-A

Natel’s Linear Pelton (LP)



Linear Pelton Side View



Linear Pelton Section A-A

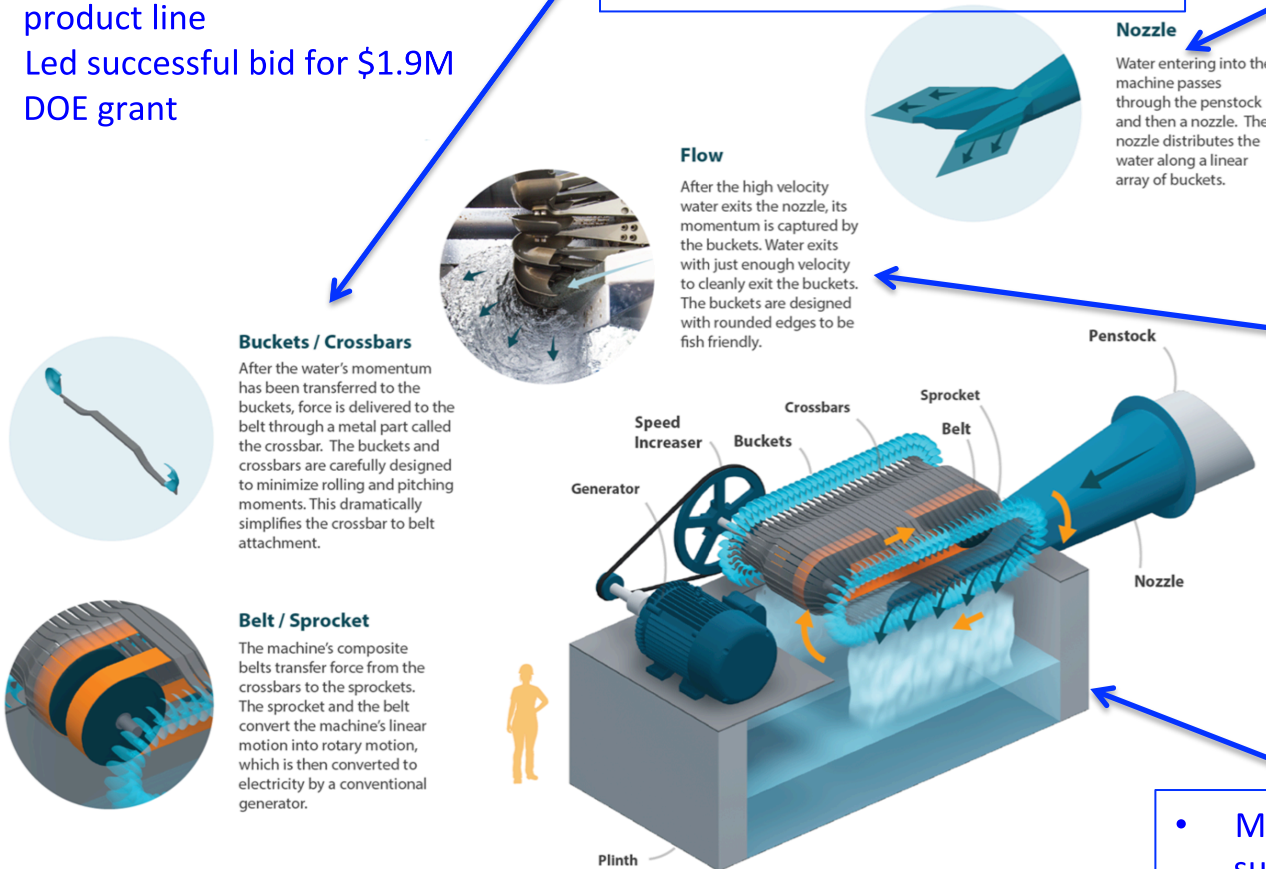
Personal Contributions

- Developed database of technical requirements
- Managed technical spec for the product line
- Led successful bid for $1.9M DOE grant

- Fluid and mechanical design of fish fish-friendly turbine bucket; collaborated on DFM.

- Fluid design of nozzle; collaborated on mechanical and DFM
- Fluid and mechanical design of slide gate
- Improved part-flow efficiency by 4 %-pt

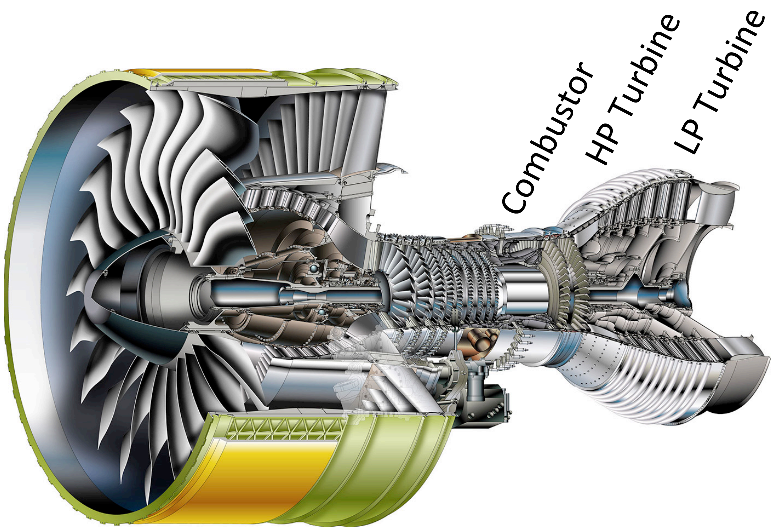
- Sized components for hydraulic testing facility
- Conducted hydraulic testing to identify and address efficiency problems



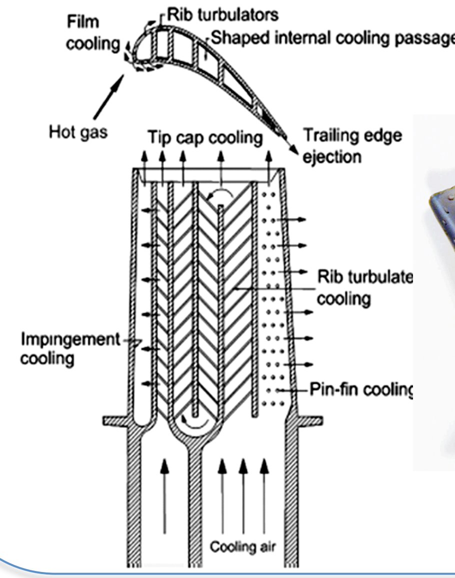
- Managed a team of subcontractors and collaborators to innovate on balance of plant

08/2013 - 02/2017
Lead Engineer, GE Aviation

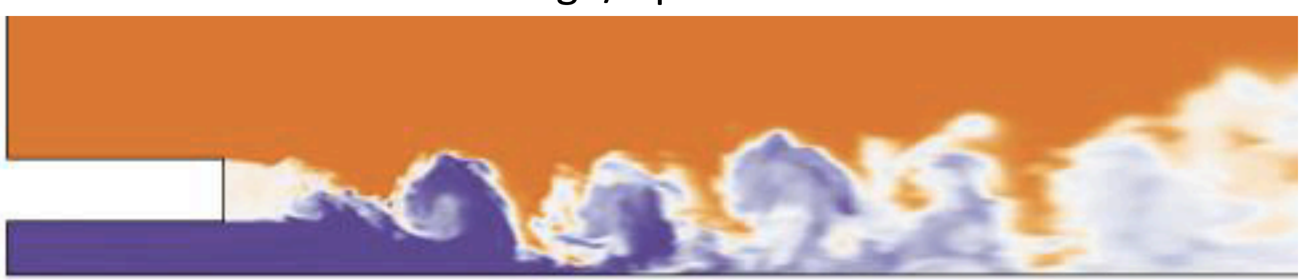
Aviation Turbofan



Cooled turbine blade



Aero-Thermal Design/Optimization with Hi-Fi CFD



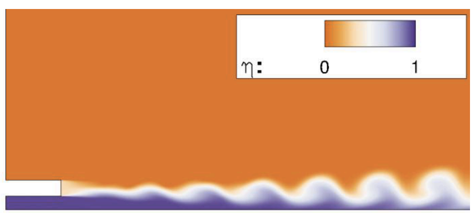
Hi-Fi CFD for Aero-Thermal Design

- Aerodynamics, Heat Transfer and Performance are interconnected
- Testing is expensive, CFD is getting more powerful
- CFD for Analysis → CFD for Design/Optimization
- Hi-Fi CFD (e.g. LES) much more computationally expensive… but necessary for some types of problems

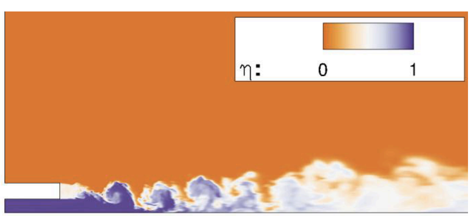
Example: Simplified TE cooling slot
RANS → URANS → DES → LES → DNS
Fewer assumptions/empirical models… but higher cost

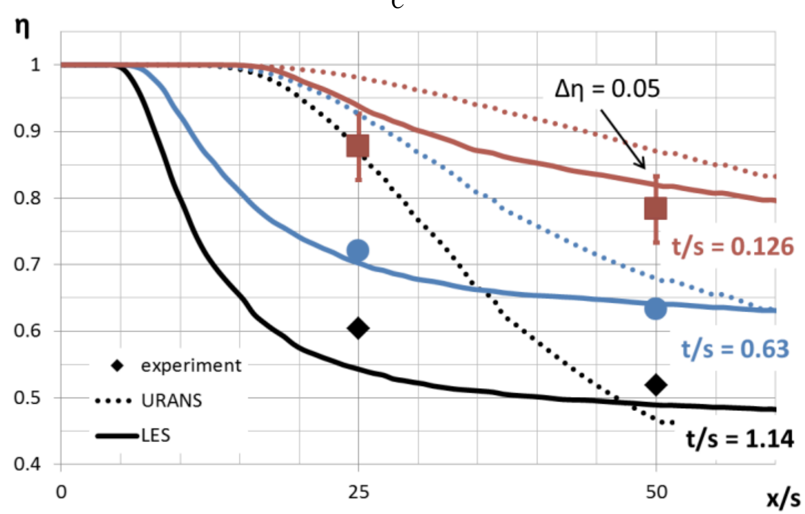
$$\eta = \frac{T - T_H}{T - T_C}$$

URANS



LES (k-eq)



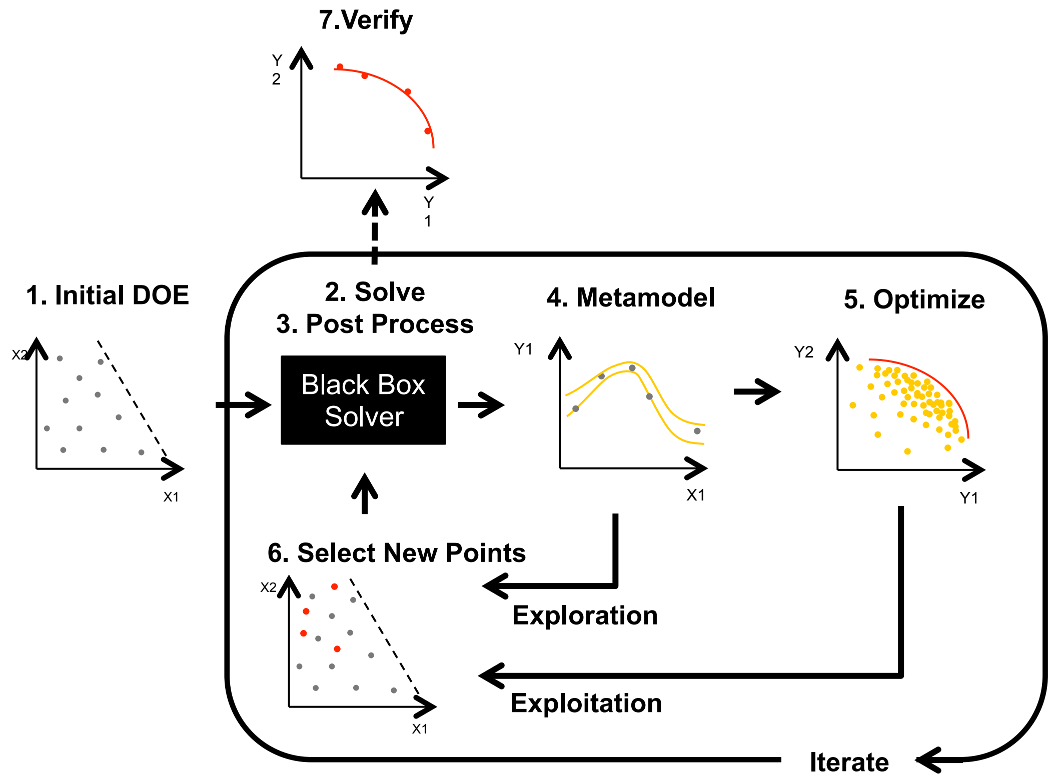


Ivanova and Laskowski, “LES and Hybrid RANS/LES of a Fundamental Trailing Edge Slot”, ASME Turbo Expo 2014, Paper No. GT2014-25906

Metamodel-assisted Optimization

Developed in-house tool for CFD-based optimization:

- Interpolate between expensive black-box solver solutions (e.g. CFD)
- Intelligent and efficient iterative sampling
- Automated process (CAD, Mesh, CFD, Post process, Optimize, Iterate)



Allow “expensive” CFD to be used as a design tool

Example:
Optimization of Turbulated Cooling Passage

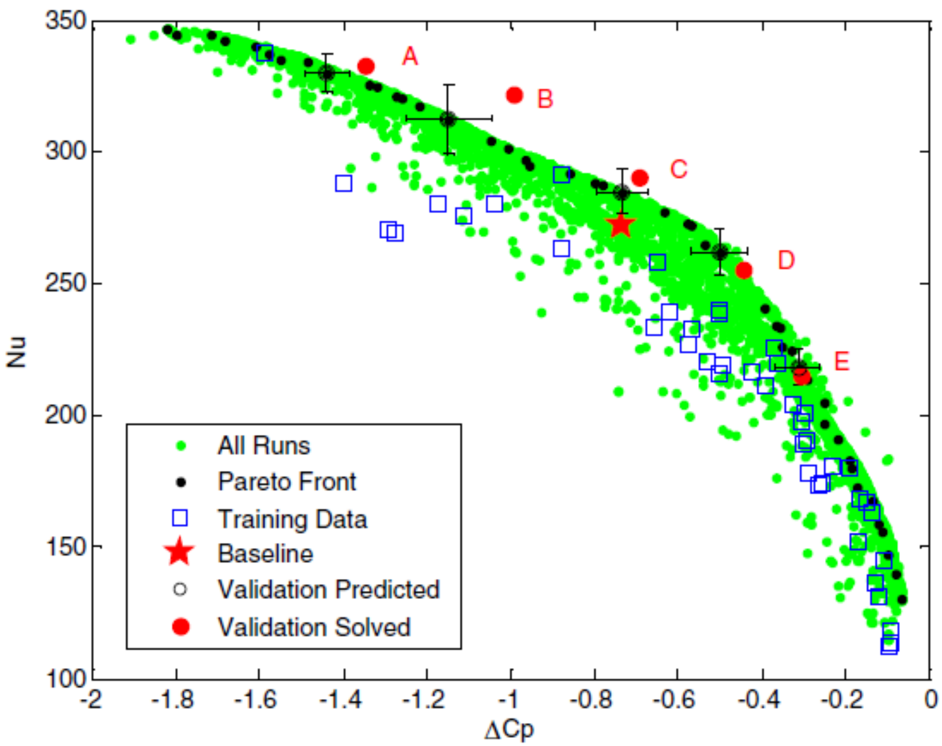


Fig. 8 Pareto front from metamodel assisted optimization, with validation points.

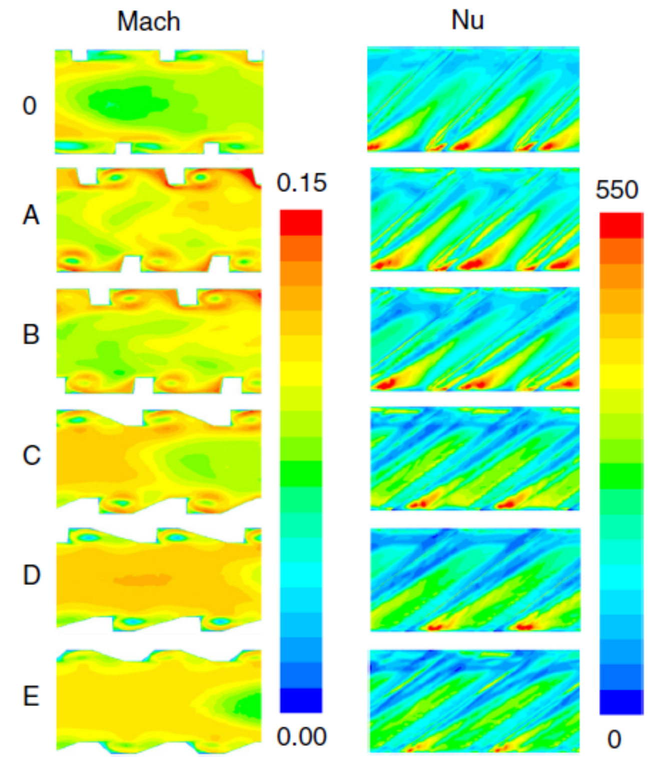
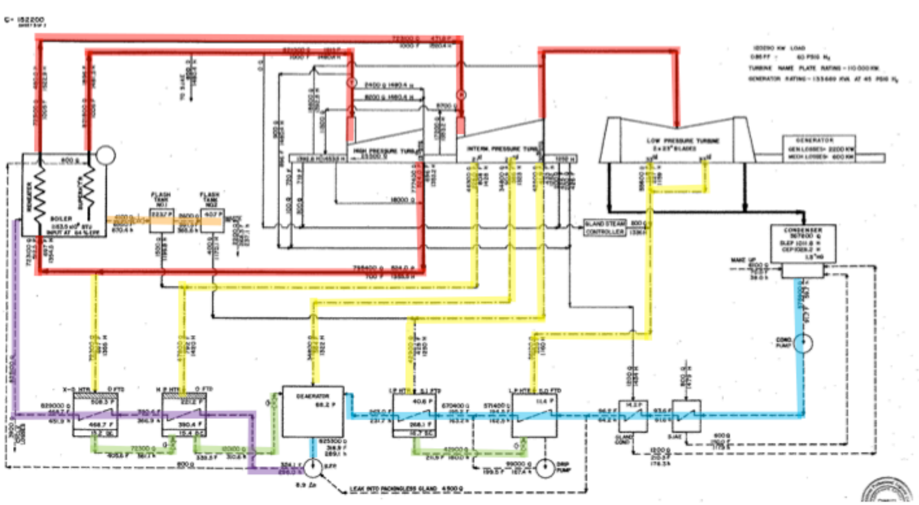


Fig. 10 Comparison of baseline case (0) and selected designs from Pareto front (see Fig. 8 for numbering). Flow direction is from left to right.

- Pareto front in Y-space shows optimal engineering tradeoffs
- Pareto front in X-space (not shown) provide insight into why

06/2011 – 07/2013
Mechanical Engineer, Altran

Structural analysis of power plant piping and pressure vessels, in accordance with the ASME codes, field inspections and failure analysis

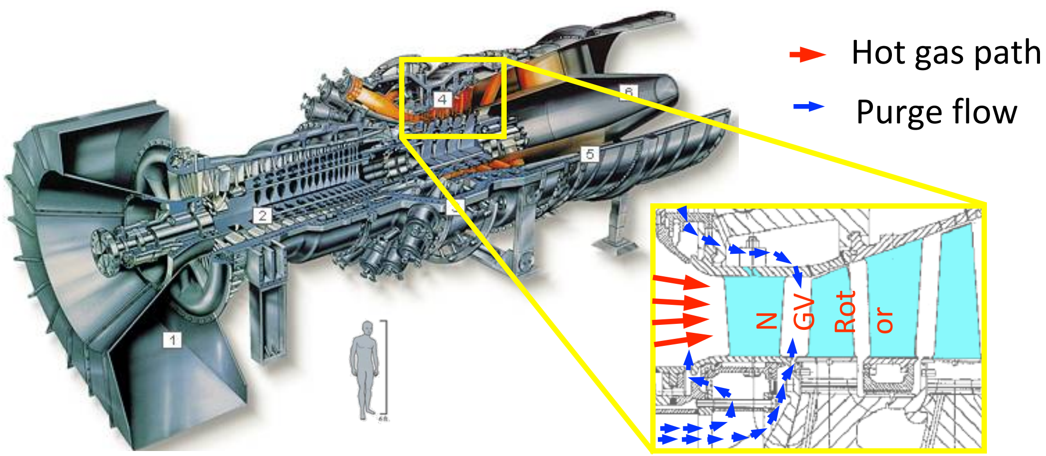


Major Systems:

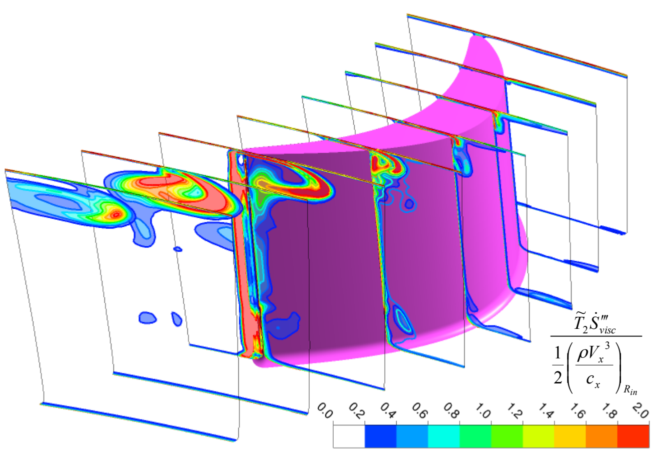
- **Condensate**
- **Feedwater**
- **Main Steam**
- **Extraction Steam**
- **Heater Drains**
- **Blowdown**

09/2009 – 06/2011
MIT Gas Turbine Lab

- CFD-based research into the loss mechanisms associated with purge flow
- 2012 paper awarded Best Paper Awarded at largest ASME conference (IGTI Turbo Expo)

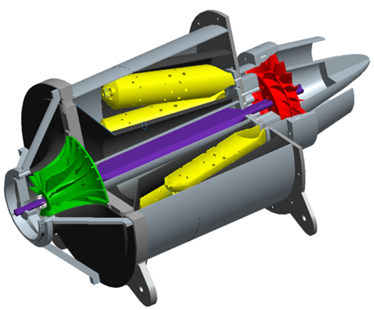


Local rate of entropy generation

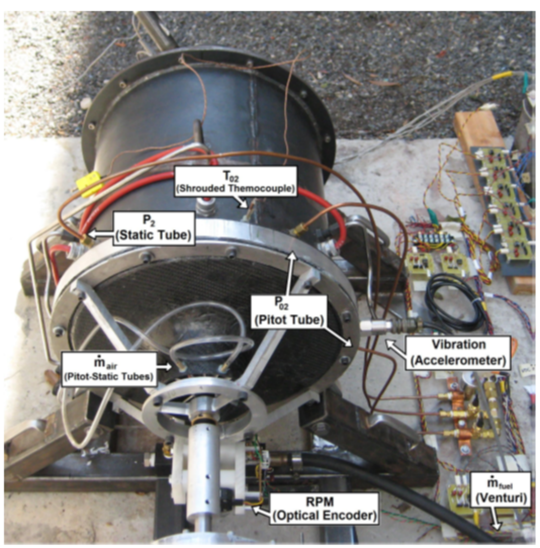


09/2005 - 06/2009
Princeton University

Senior Thesis: Collaborated on design, building and testing of 100 kW gas turbine



$$\omega = 40{,}750\,RPM$$
$$\pi_c = 3.29$$
$$T_3 = 1000K$$
$$\dot{m} = 2\,kg/s$$
$$\dot{W} = 100kW$$



Class project: Design of an autonomous robot for shelving cans