

Capture Data and Knowledge in Models for Remote Monitoring

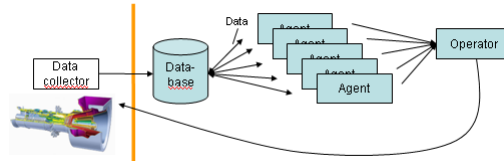
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Outline



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- Background
- Purpose, Goal
- Problem domain
- Specialists
- Models
- Examples
- Aspects on models
- Conclusions

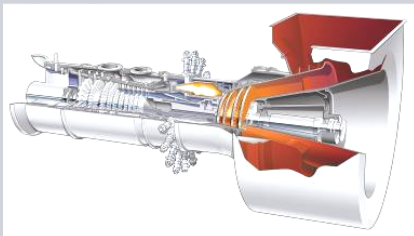
Background

Gas turbine trends

Reliability ↑

Life-time ↑

Performance ↑



Background

Gas turbine trends

These trends drive e.g.:

Reliability ↑



Remote monitoring

Life-time ↑

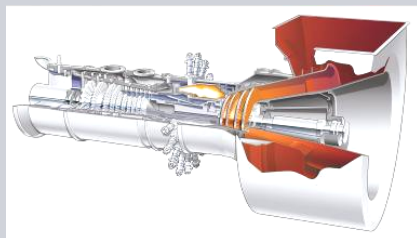


Materials, cooling

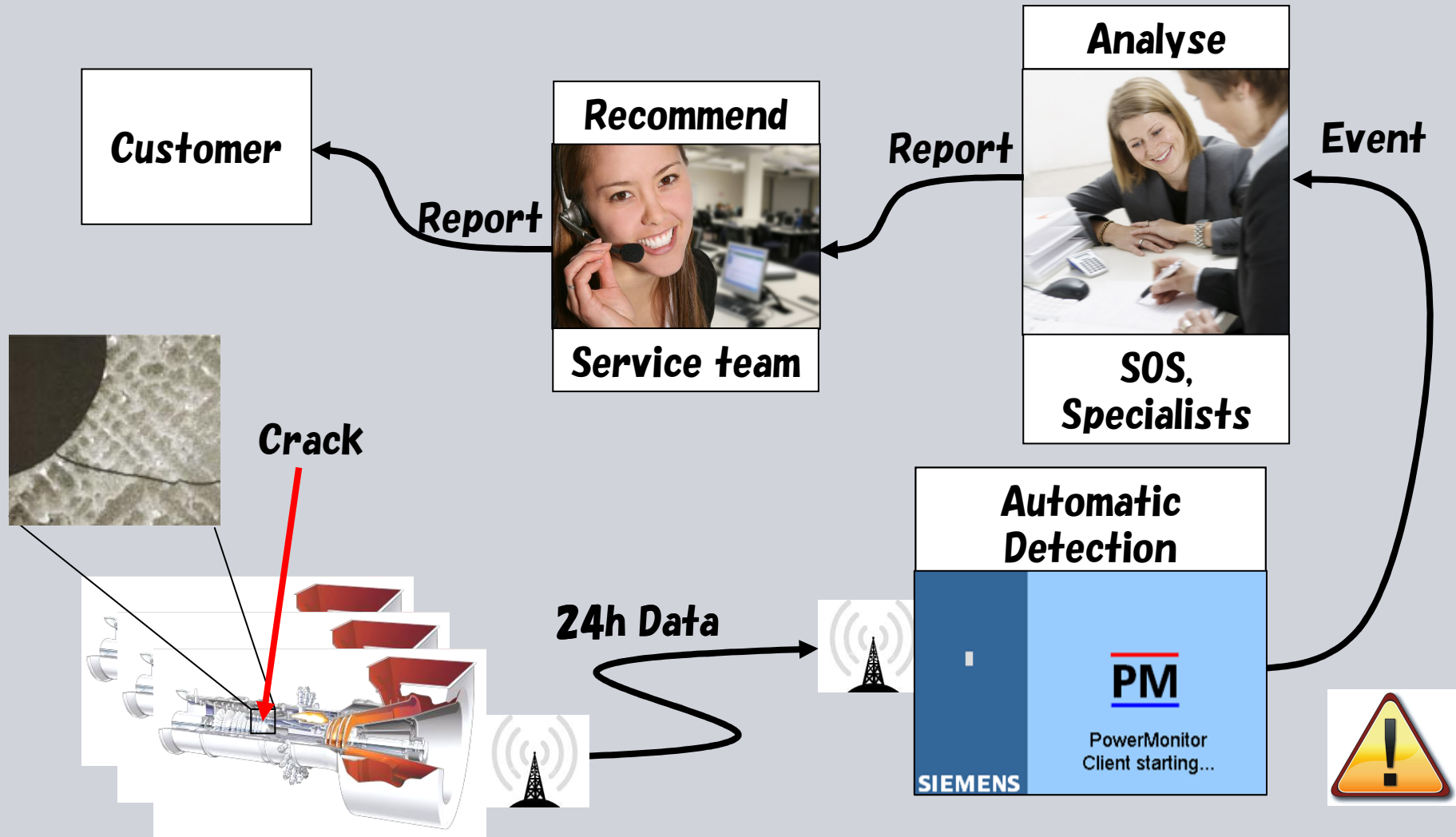
Performance ↑



Complex design



Remote Analysis



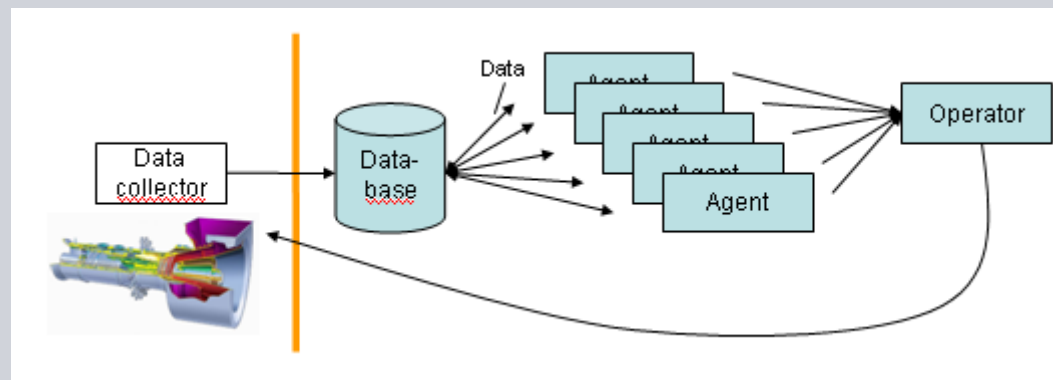
Problem domain

Complex process

Deteriorates over time

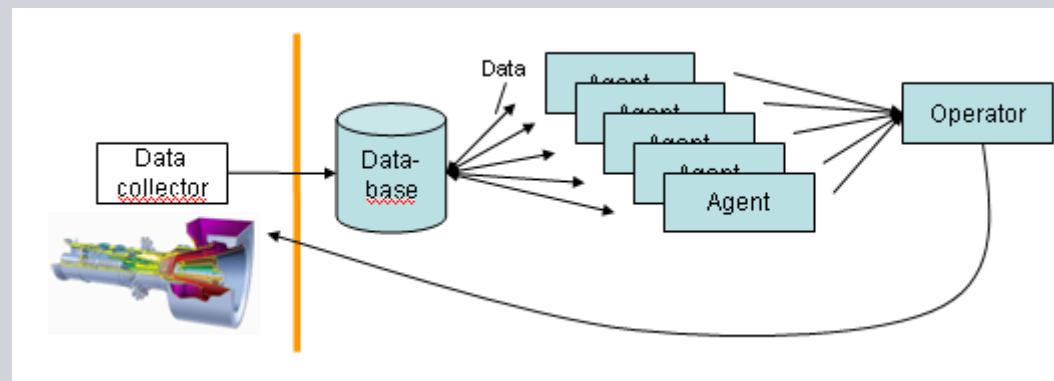
Fast/Slow mechanisms

Require high reliability



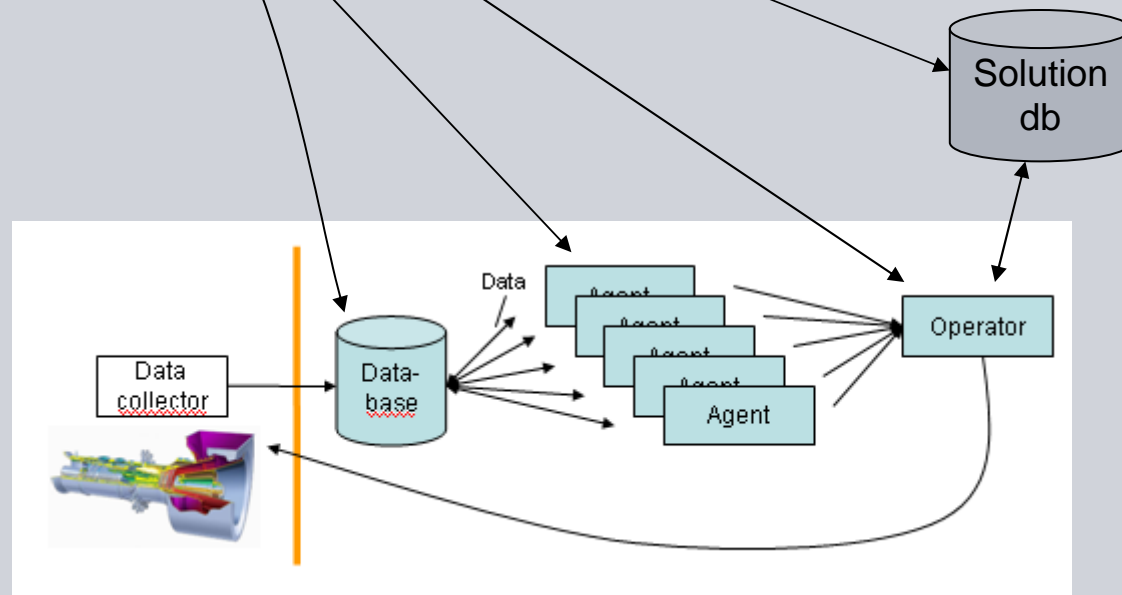
Sources of information

- Specialist knowledge
- Tests
- Operation
- Simulation



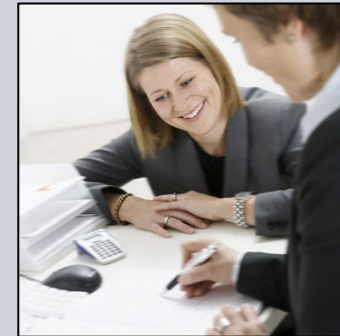
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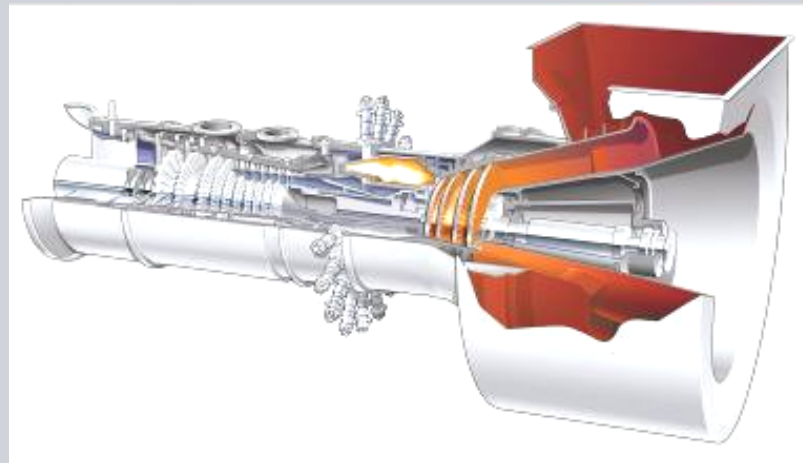
Experiences - specialist

- Reproduce specialist method – is that possible?
- Nothing is obvious – define constraints
- The real challenge - interpret specialist

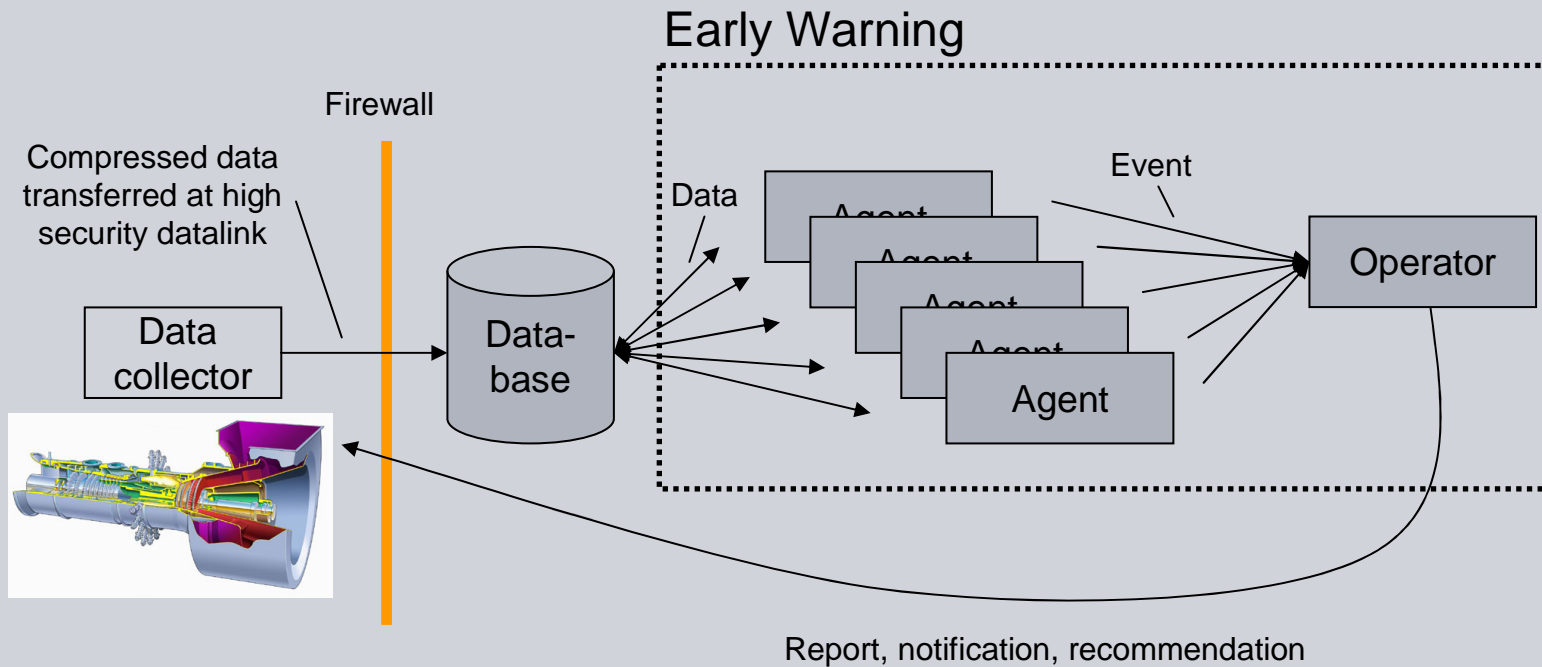


Experiences - models

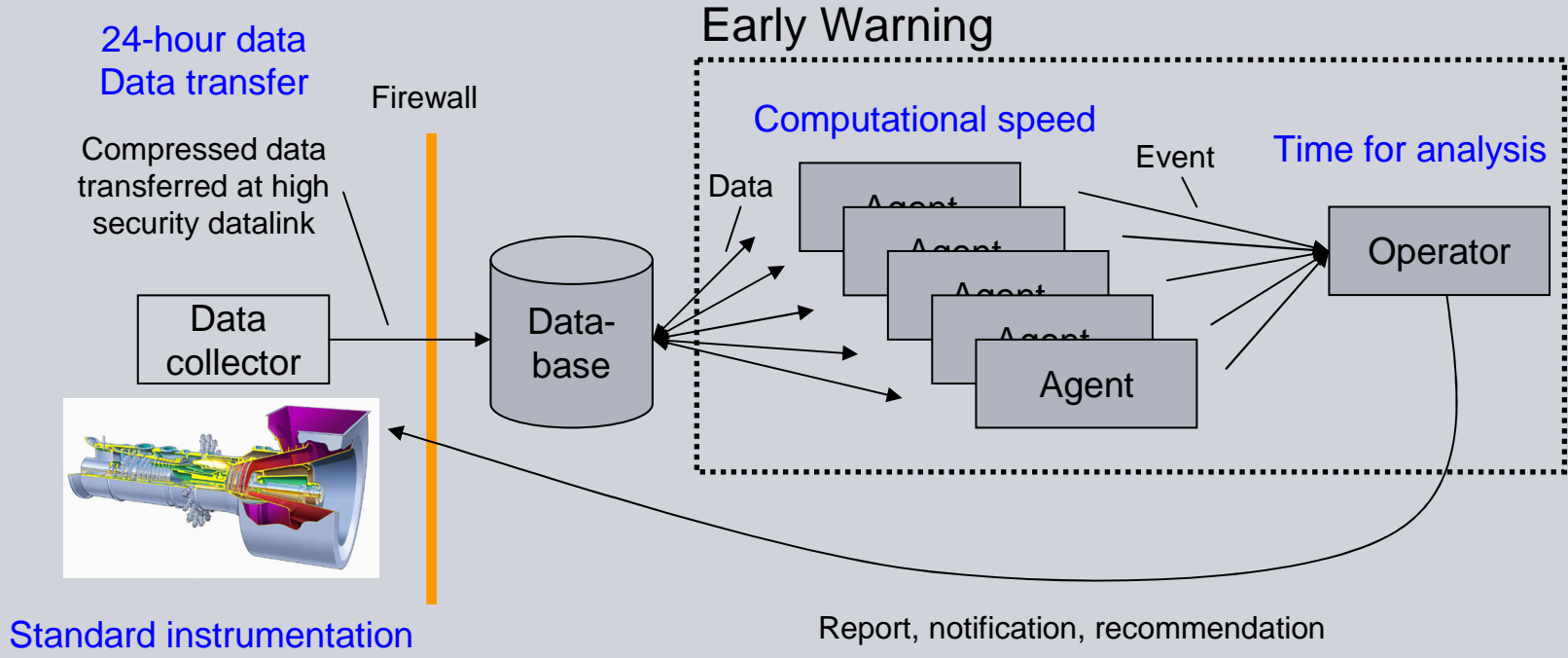
- One type of model to solve it all?
- Hybrid models – the best from two worlds?
- Special algorithms/models – the tailor-made solution
- Constraints – telling what to not model



Early Warning System



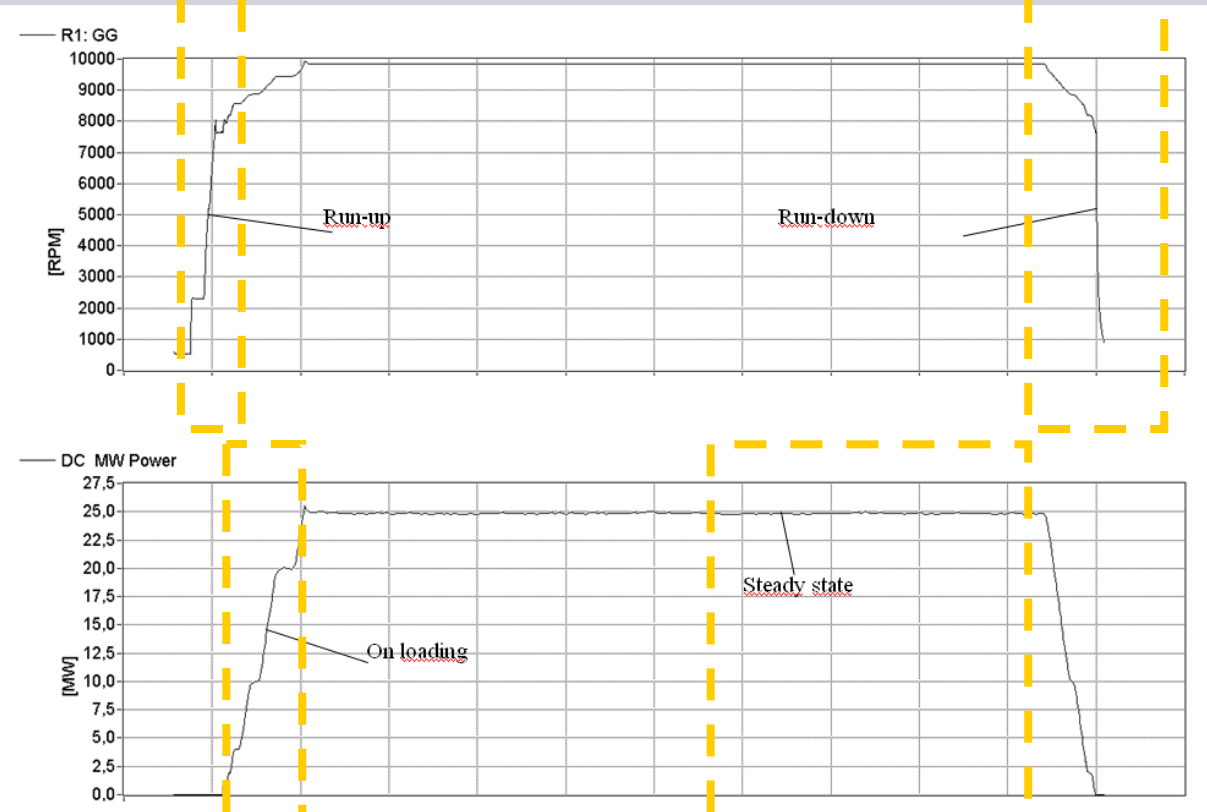
System constraints



Vibration

Run-up (warm, cold)

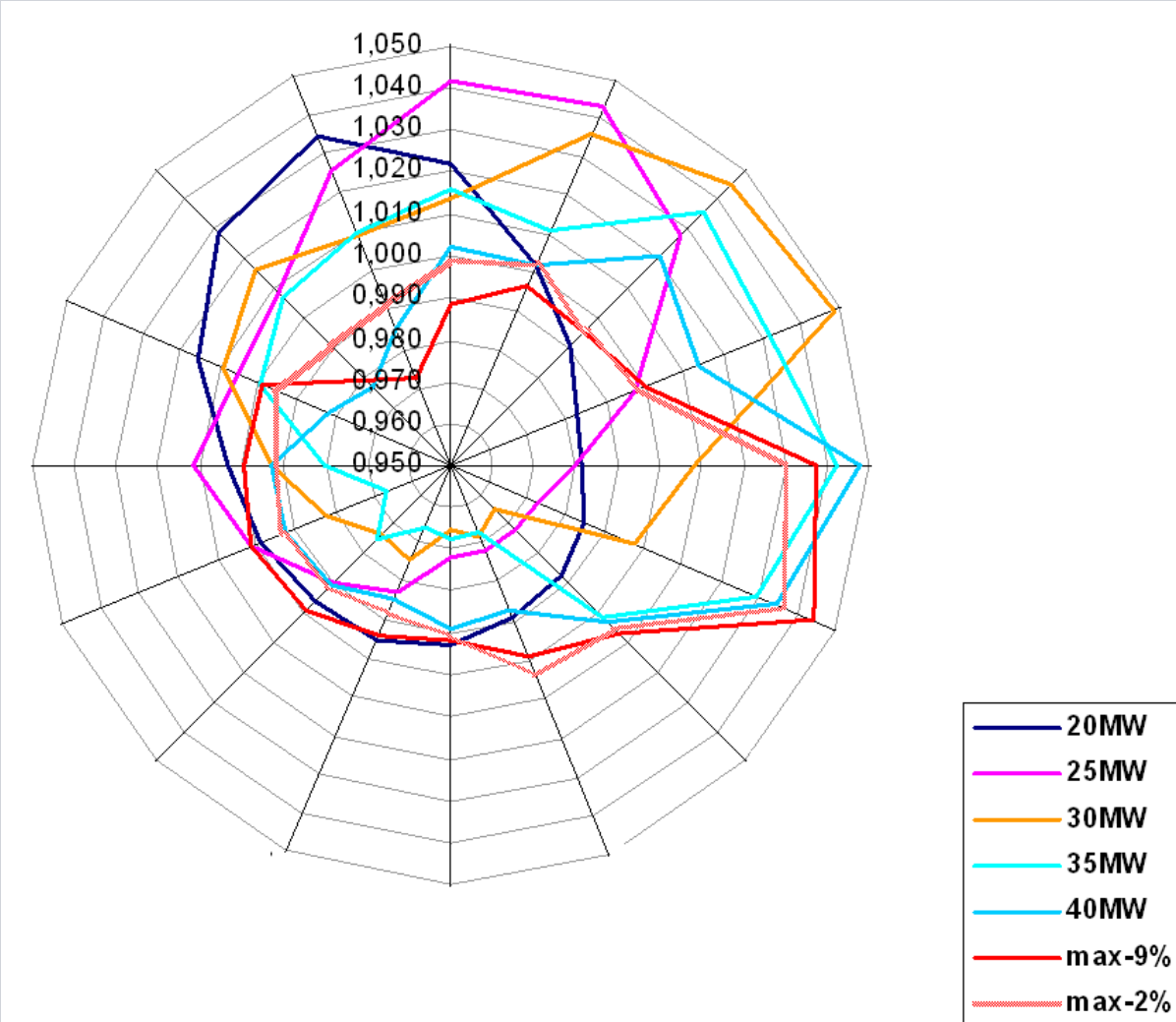
Run-down



On-loading

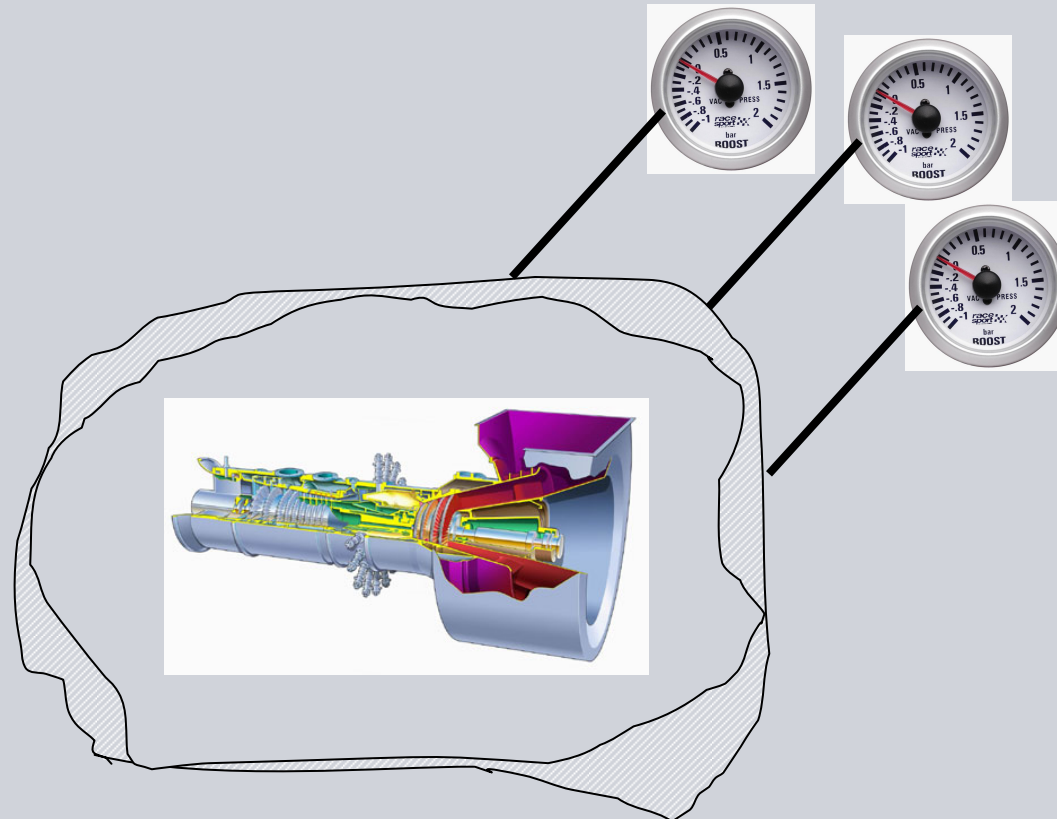
Steady-state

Combustion

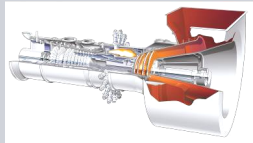


Performance

Rules
Thresholds



Some aspects on models used

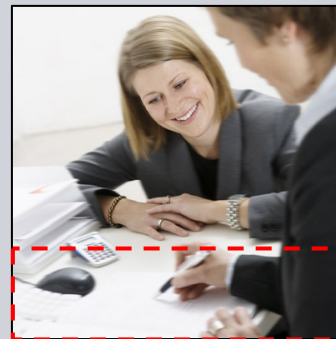


	Data-driven models	First principles models	Hybrid models
Knowledge needed	Overall (in-out)	Detailed	Detailed
Data for construction	Many operating points	Few operating points	Few operating points
Transparency	No	Yes	Yes to some degree
Computation speed	Real-time	On-line	On-line
Time between tuning	Short	Long	Medium

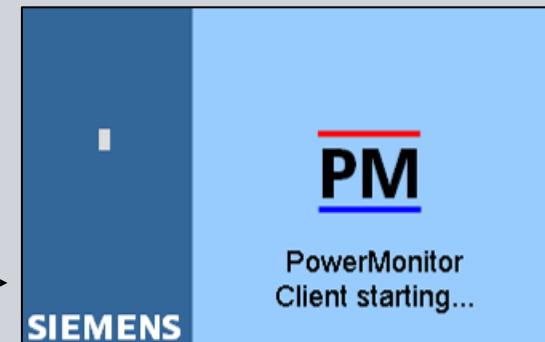
Conclusions

- Domain knowledge and reliable data
- Specialist knowledge transfer to system
- Data-driven, first principles, hybrids
- Deterioration
- Adaptation
- Specialist On-line!

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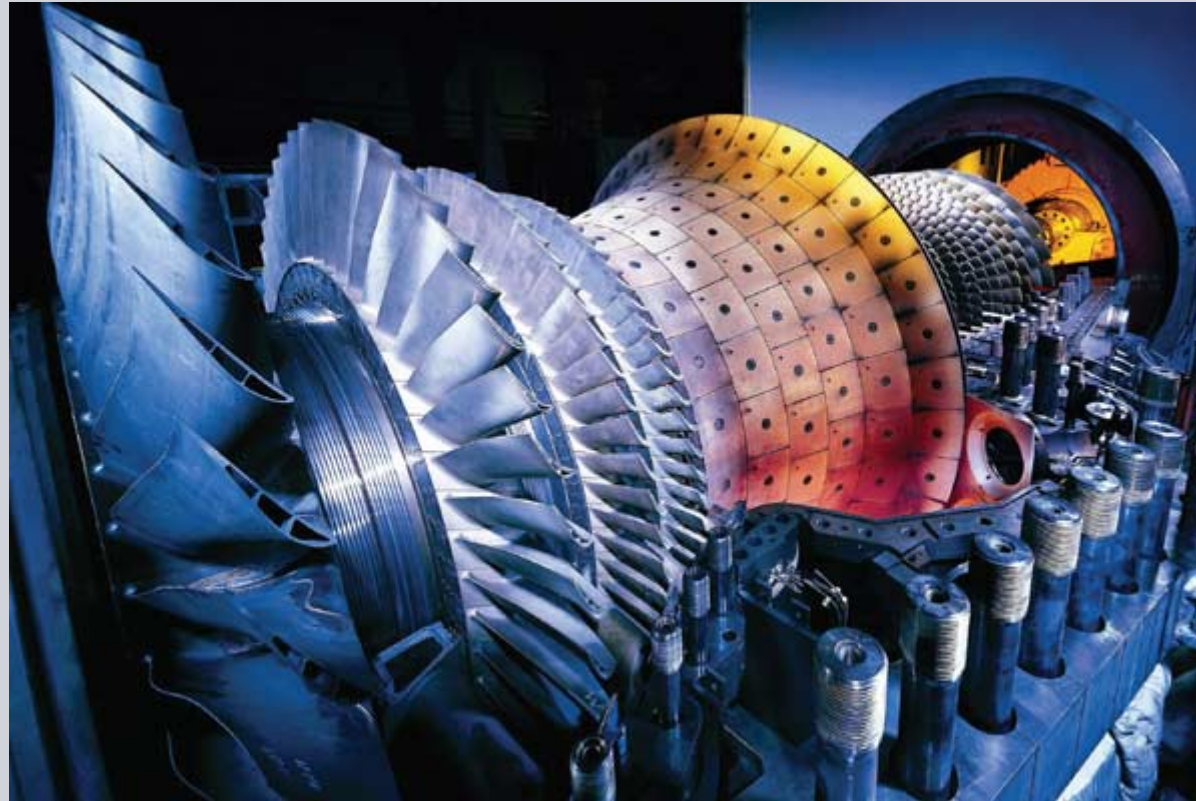


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