Improvement of Functional Safety by using Partial Stroke Valve solution

APS Forum 2010

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Remote automated safety valve testing

On-line diagnostics are used to detect failures and annunciate the failure for repair or automatic shut down

On-line dignostic testing

- Partial Valve Stroking Test
- Run at a frequency at least ten time faster than the manual proof test frequency

Manual proof testing

- Reveale failures undetected by on-line diagnostic testing
- Generally perform during shut down

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Remote automat[illegible]ing

When implemented, on-line diagnostics can significantly improve the reliability of the safety instrumented function (SIF)

On-line dignostic testing

- Partial Valve Stroking Test
- Run at a frequency at least ten time faster than the manual proof test frequency

Manual proof testing

- Reveale failures undetected by on-line diagnostic testing

Generally speaking, when more often proof testing of equipment is implemented, a higher SIL can be acheived

Remote automated safety valve testing

ability to detect as much as possible dangerous failure of the remote automated safety valve

\+ capability to document the results

\+ ease of use and automatisation

= Performance of the testing method

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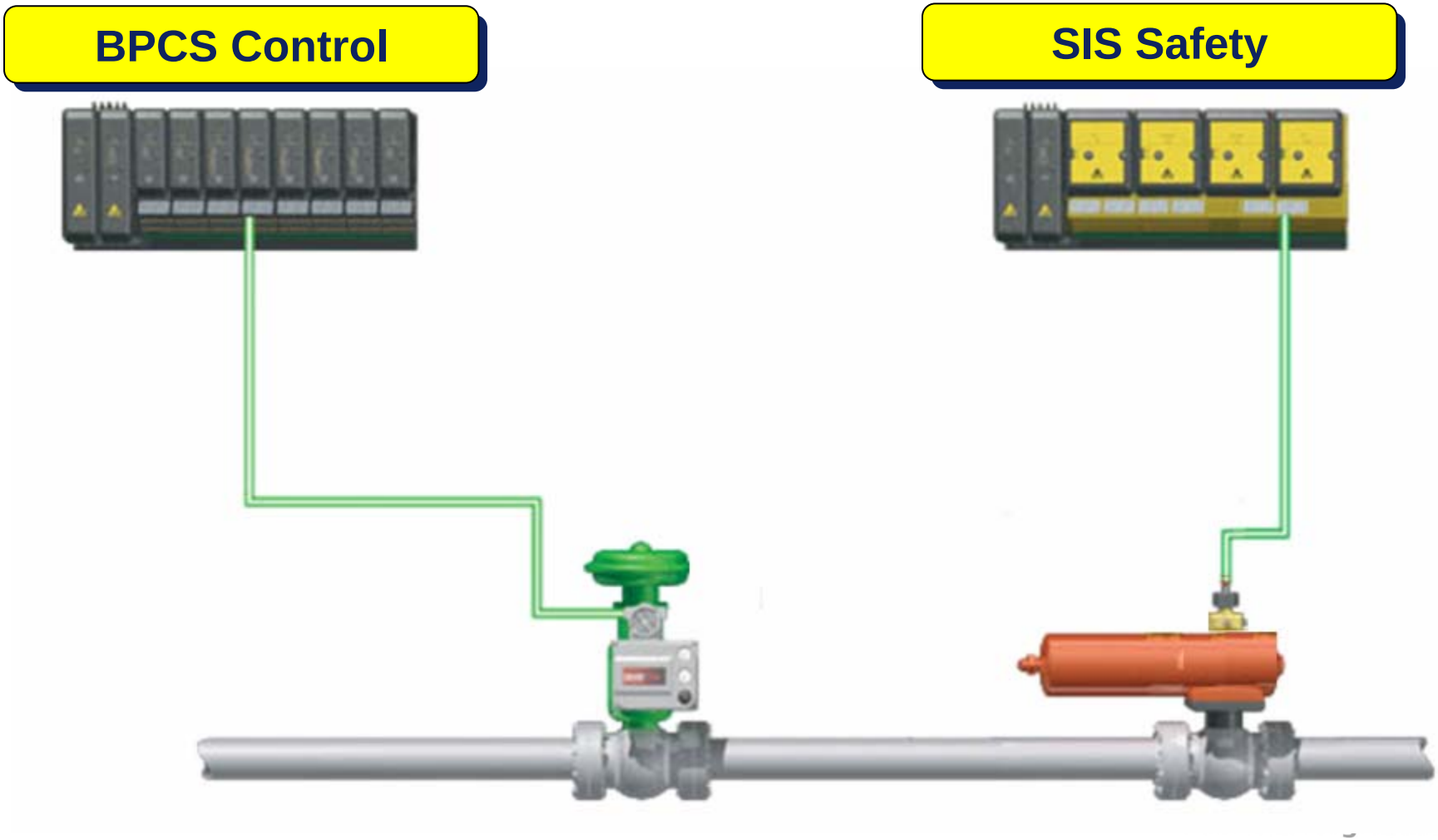
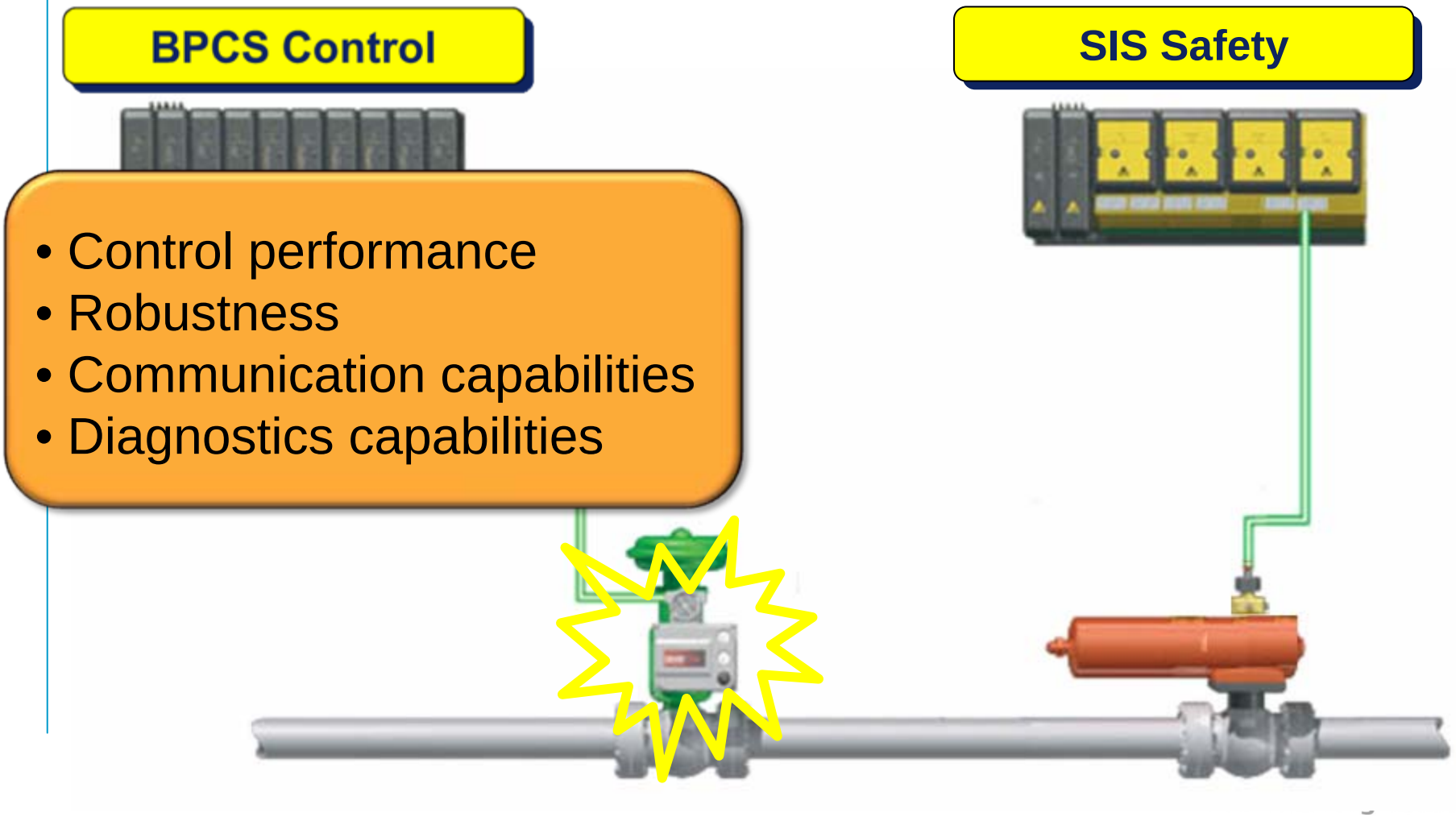
Remote automated safety valve testing with smart valve positionner



Remote automated safety valve testing with smart valve positionner



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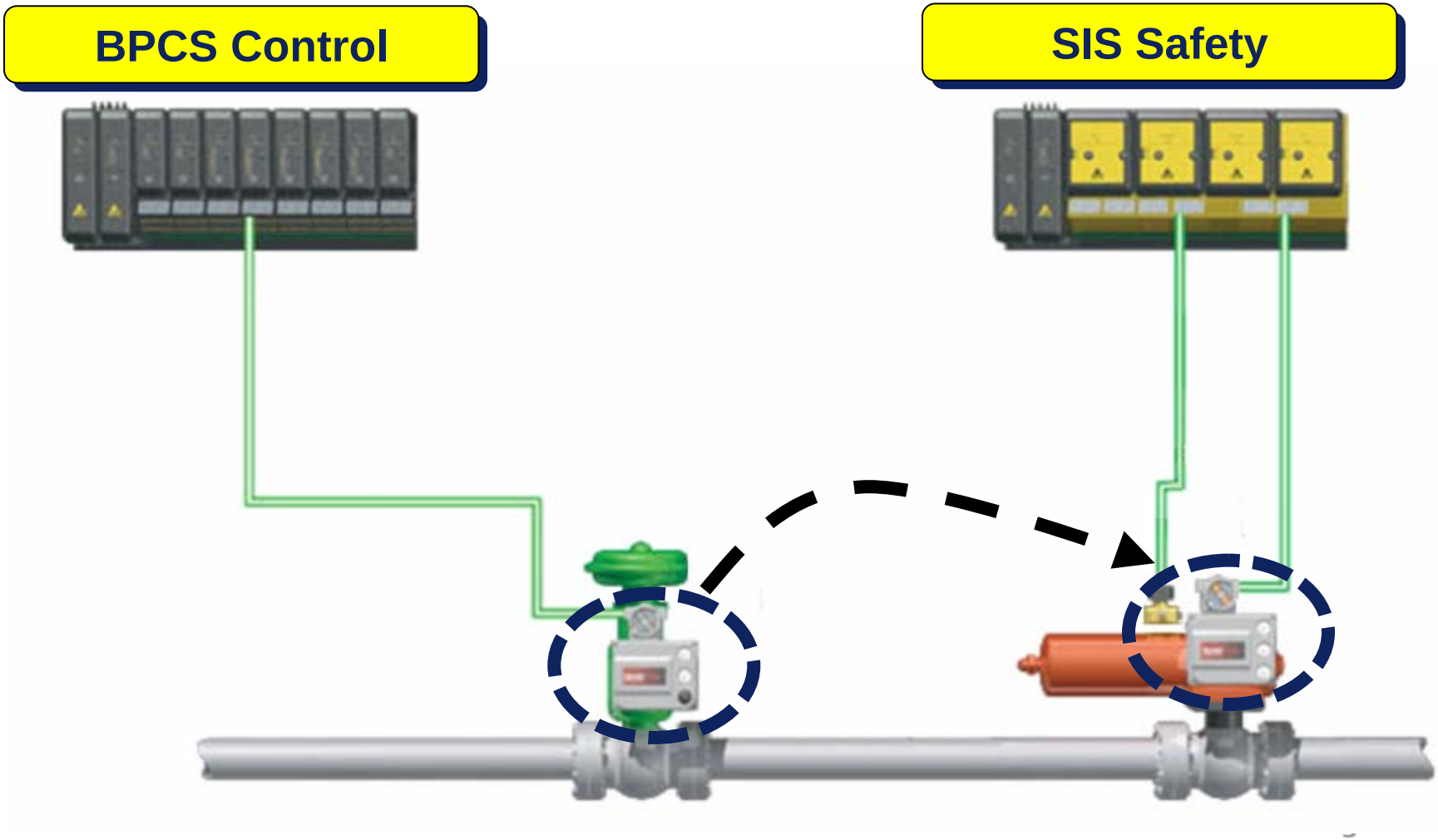
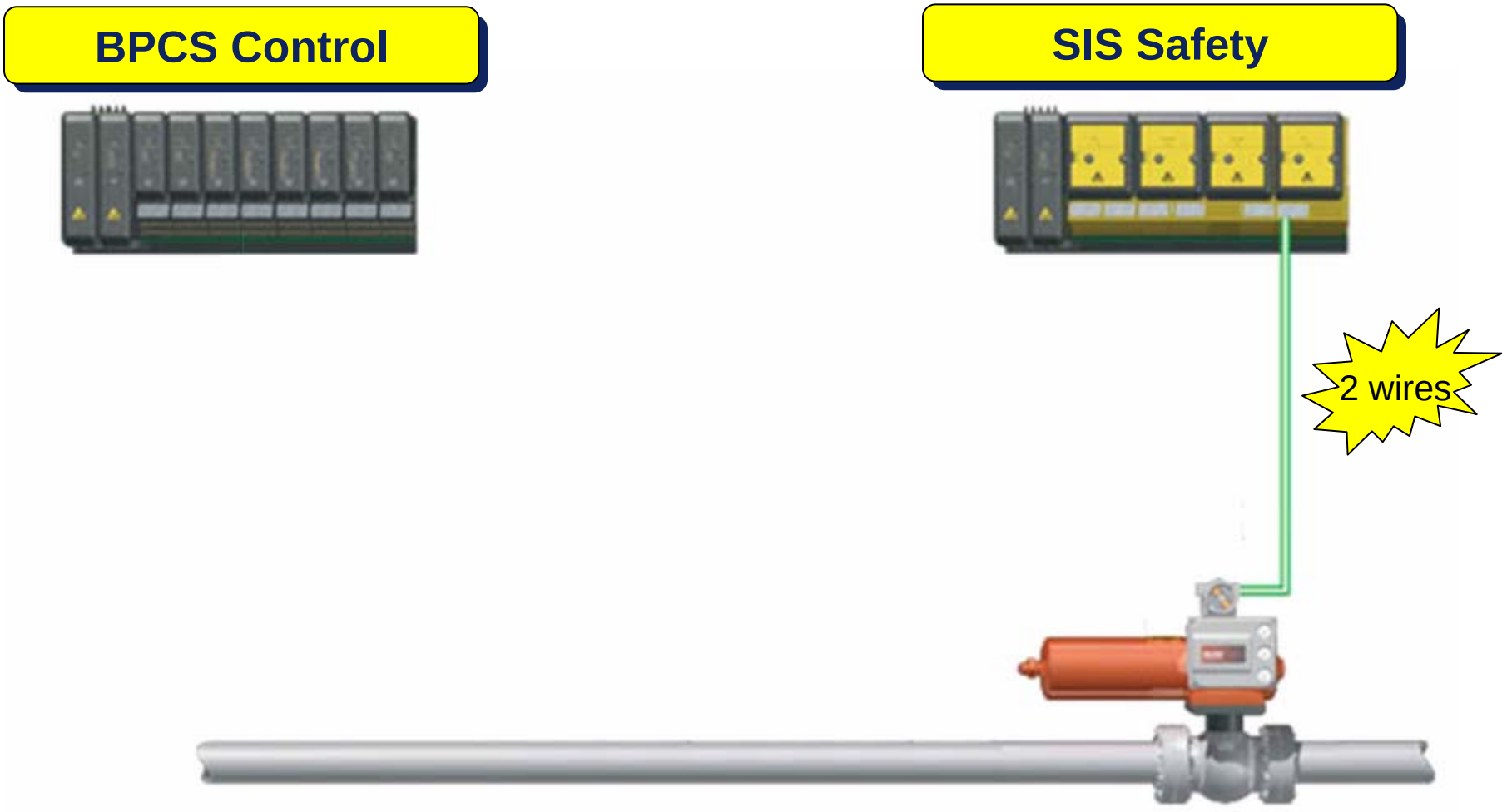
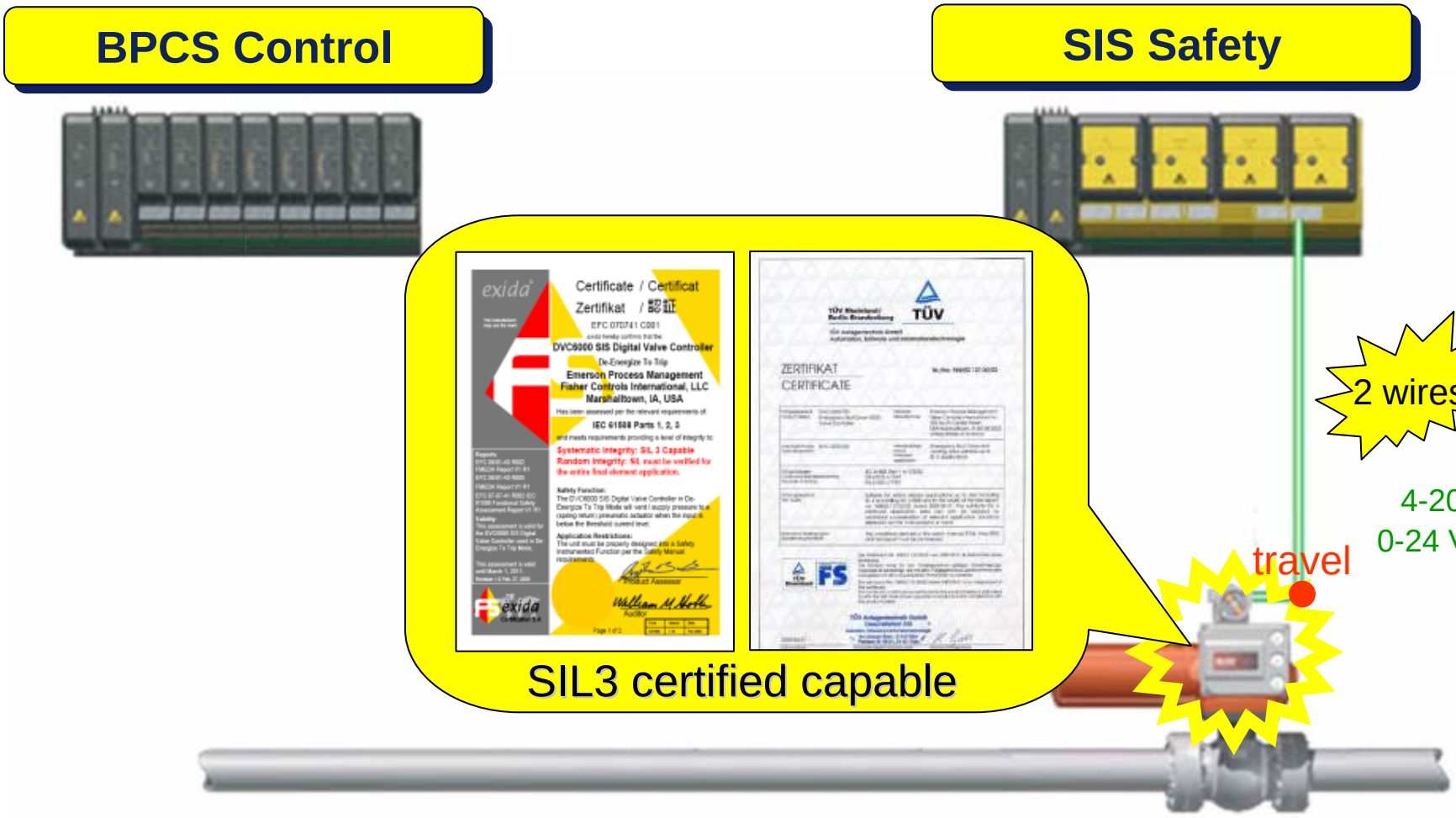


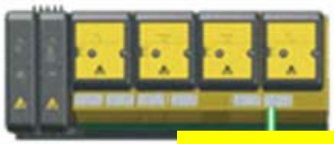
Remote automated safety valve testing with smart valve positionner



Remote automated safety valve testing with smart valve positionner



Proof Test & Full Valve Stoke Test (FVST)



- Full Valve Stroke Test (FVST)

ValveLink Custom Report

XV1011

DVC6000 SIS

Master Spec Sheet [XV1011]

Instrument Configuration [XV1011]

07 May 2004 14:34:34 Initial Set Up 30 % Partial Stroke

ValveLink Custom Report

Total Scan [XV1011]

07 May 2004 14:27:21

PASS

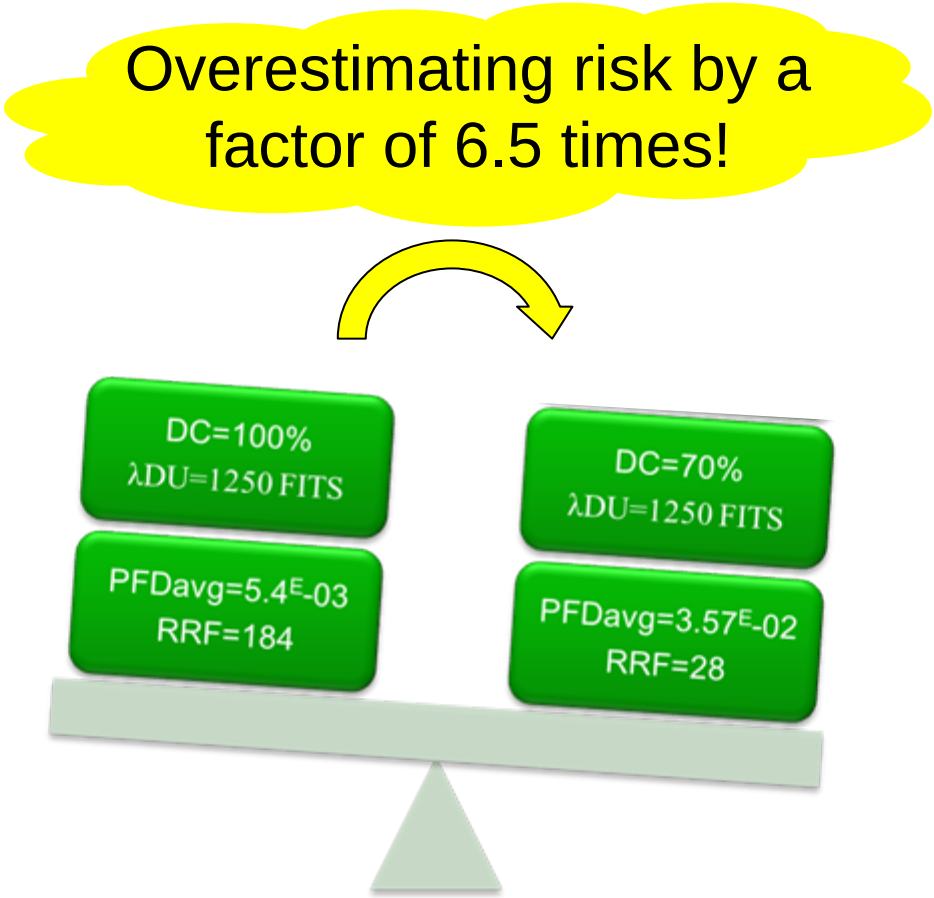
efits:

ual

Proof Test – Full Stoke Test (FST)

- It is important that proof test coverage is just not assume 100% because this will lead to designs without enough safety integrity

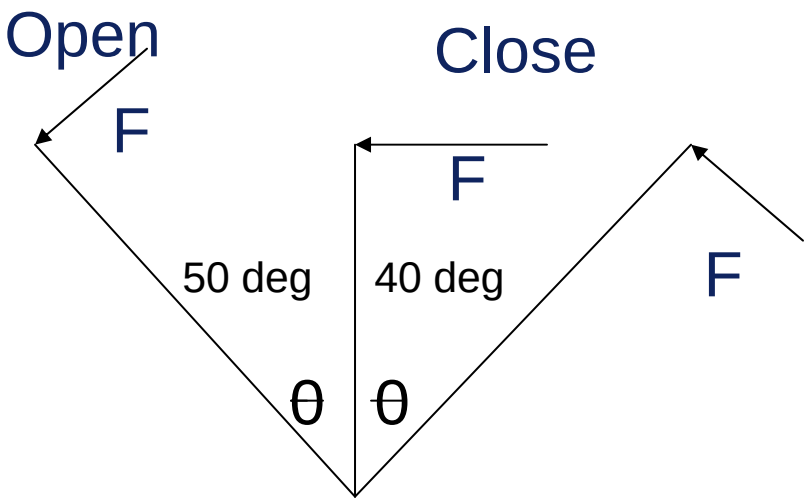
Example of a safety valve proof tested every 12 month on a 20 years mission time

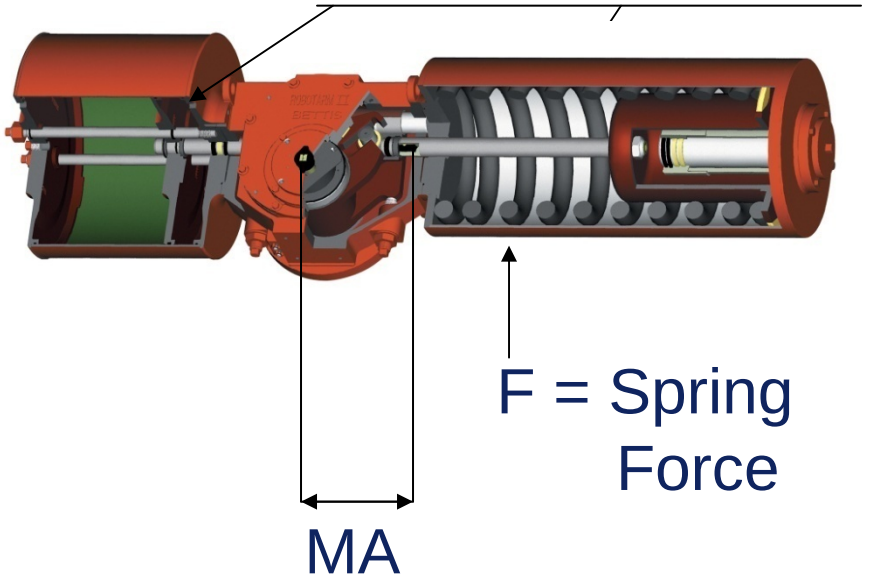


Advantages of using Control Valve Diagnostics in the field of ON/OFF valve operation

- Because Digital Valve positionner includes pressure sensors along with travel sensors they can monitor and analyse forces and torque during the FVST & PVST

$$\text{Torque} = \frac{E \times MA \times F}{(\cos \theta) \times (\cos \theta)}$$



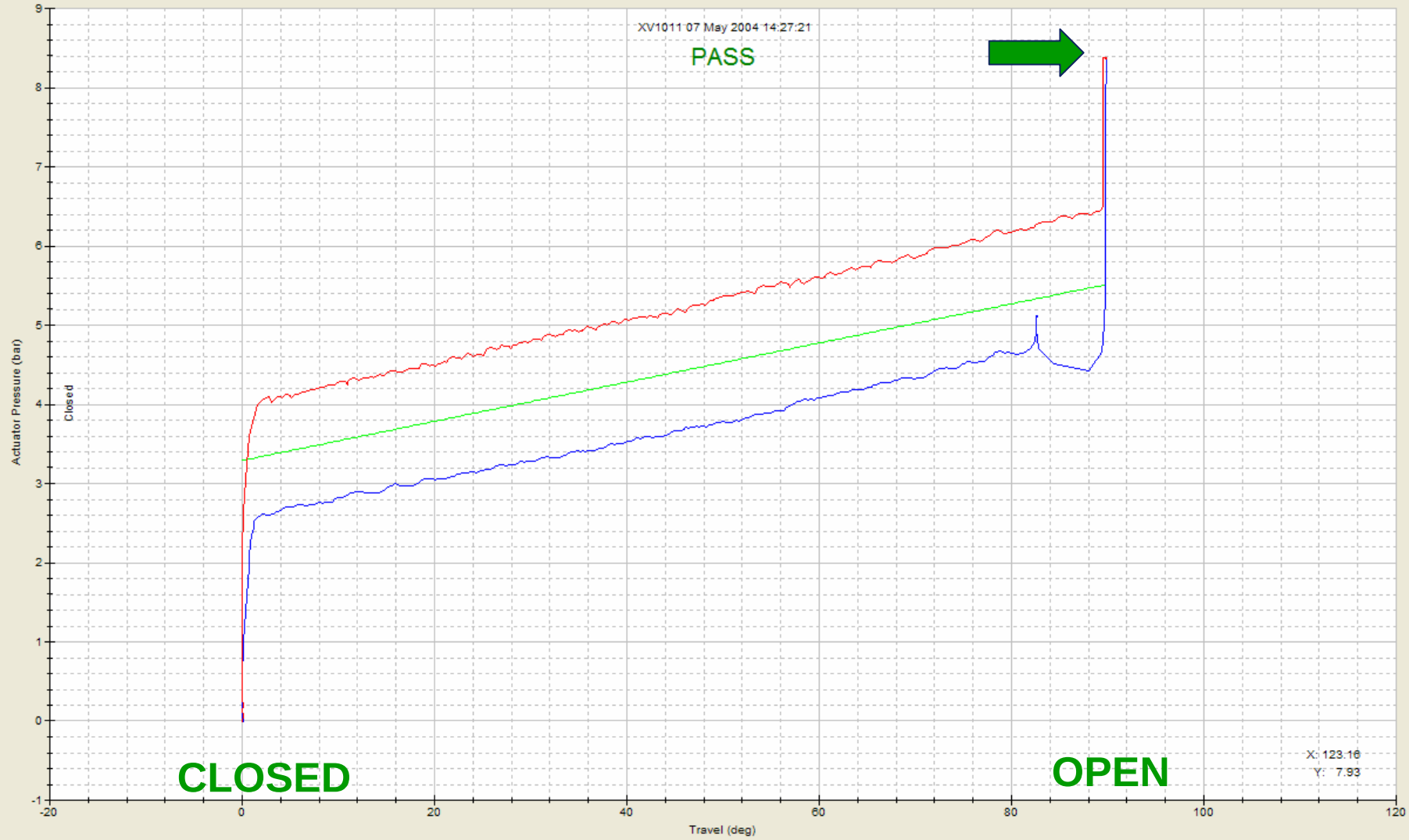


E = Efficiency
MA = Effective Moment Arm

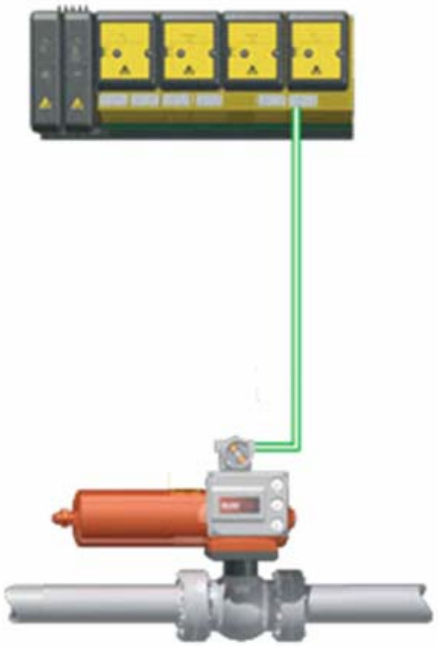
Advantages of using Control Valve Diagnostics in the field of ON/OFF valve operation

- Digital Positionners can automatically detect failures that could not have been detected by traditional mechanical methods, such as:
  - Shaft Broken
  - Torque degradation
  - Stick Slip phenomena
  - Friction degradation
  - Pneumatic path leakages

FVST Mechanical Signature

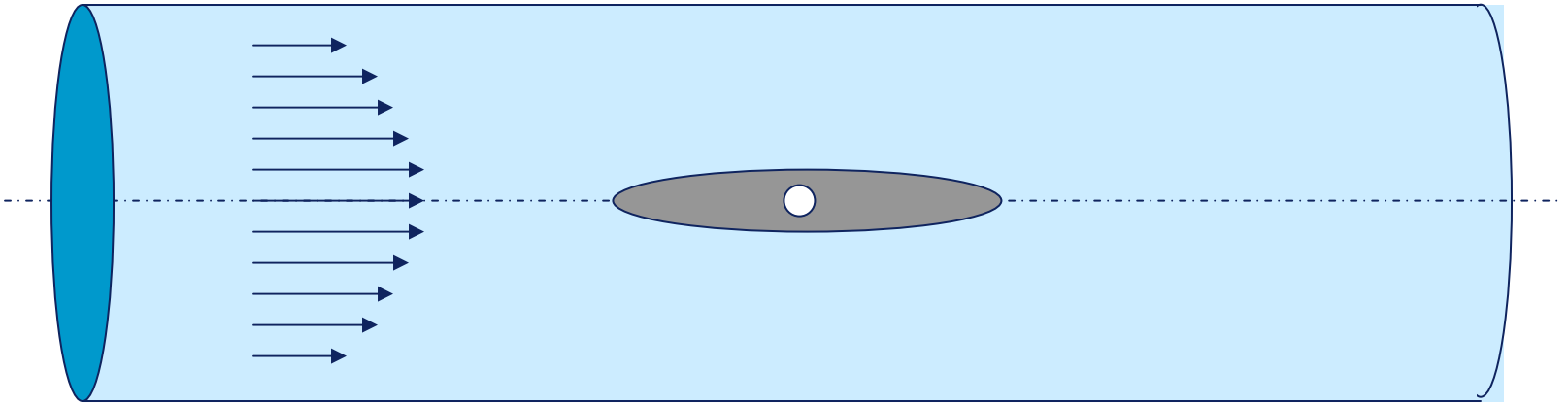


Partial Valve Stroke Test (PVST)



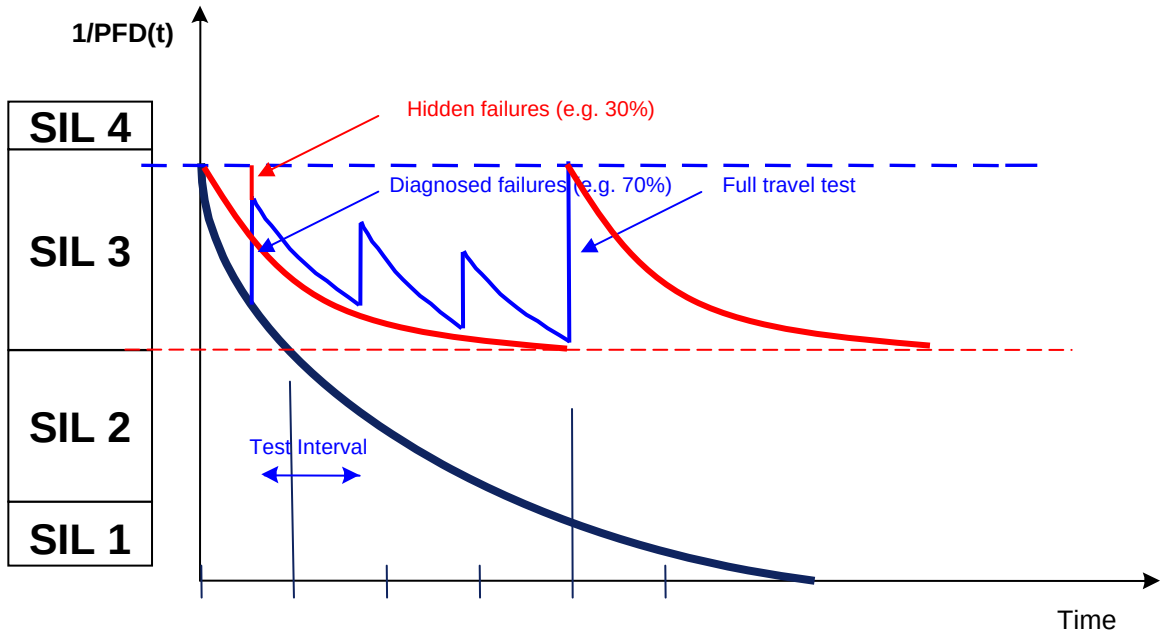
- Partial Valve Stroke Test (PVST)
- PSVT uncover dangerous failures while safety loop in operation

➡ Lower safety valve PFD to enable longer proof test interval



Partial Valve Stroke Test (PVST)

- SAFELY EXTENDS TIME BETWEEN SCHEDULED PLANT SHUTDOWNS
- Partial Stroking allows SIL rating to be maintained for longer continuos operating periods



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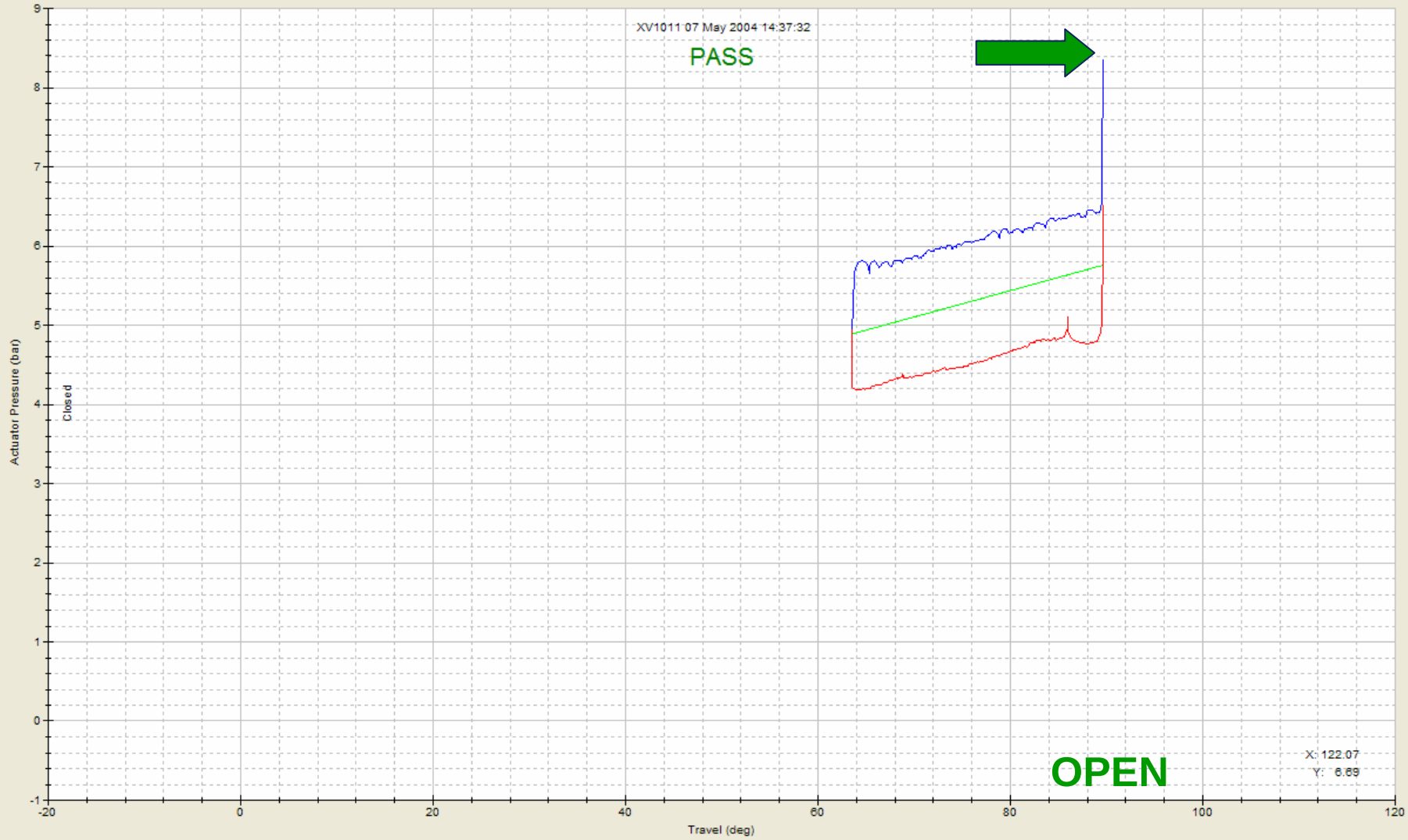
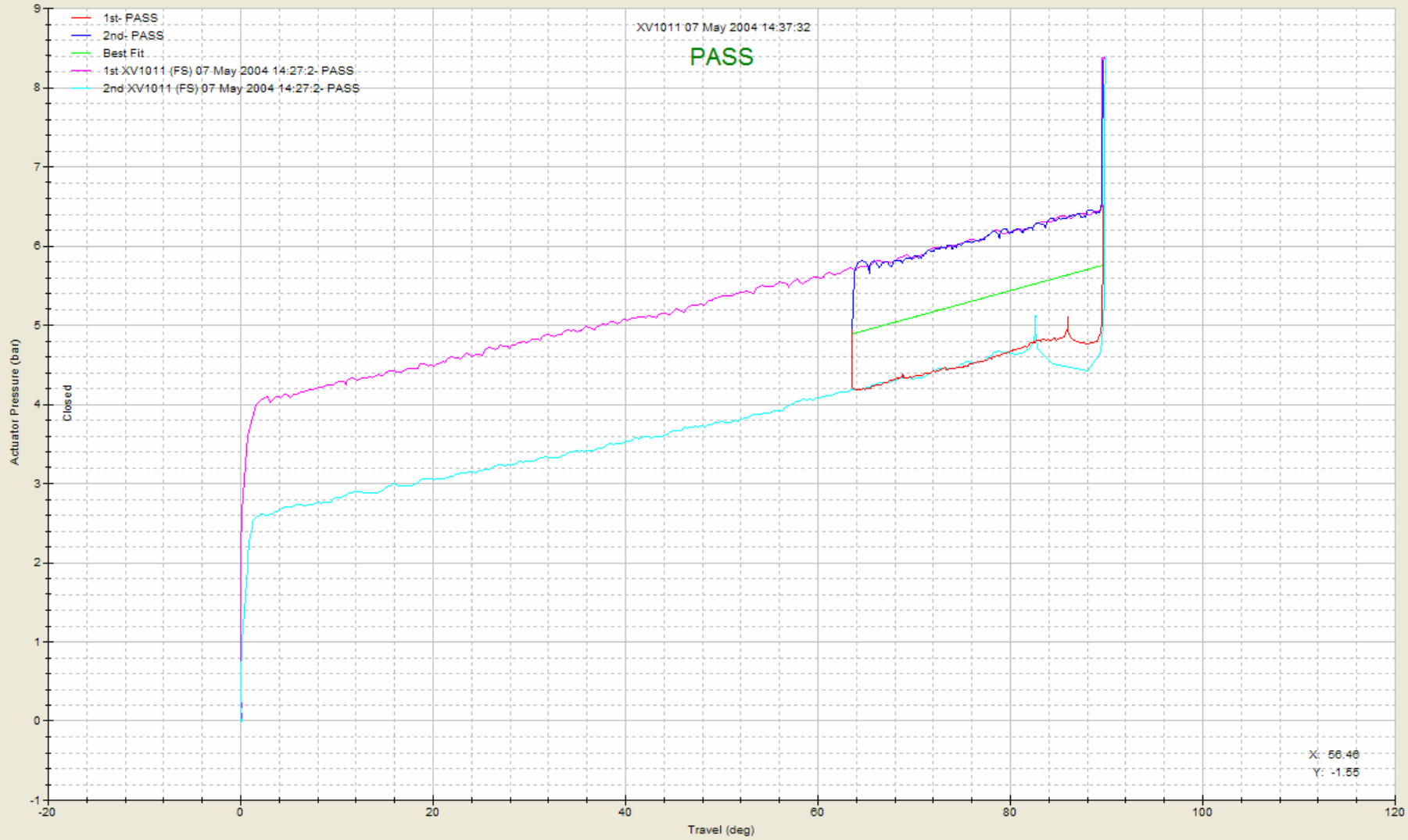
PVST Mechanical Signature

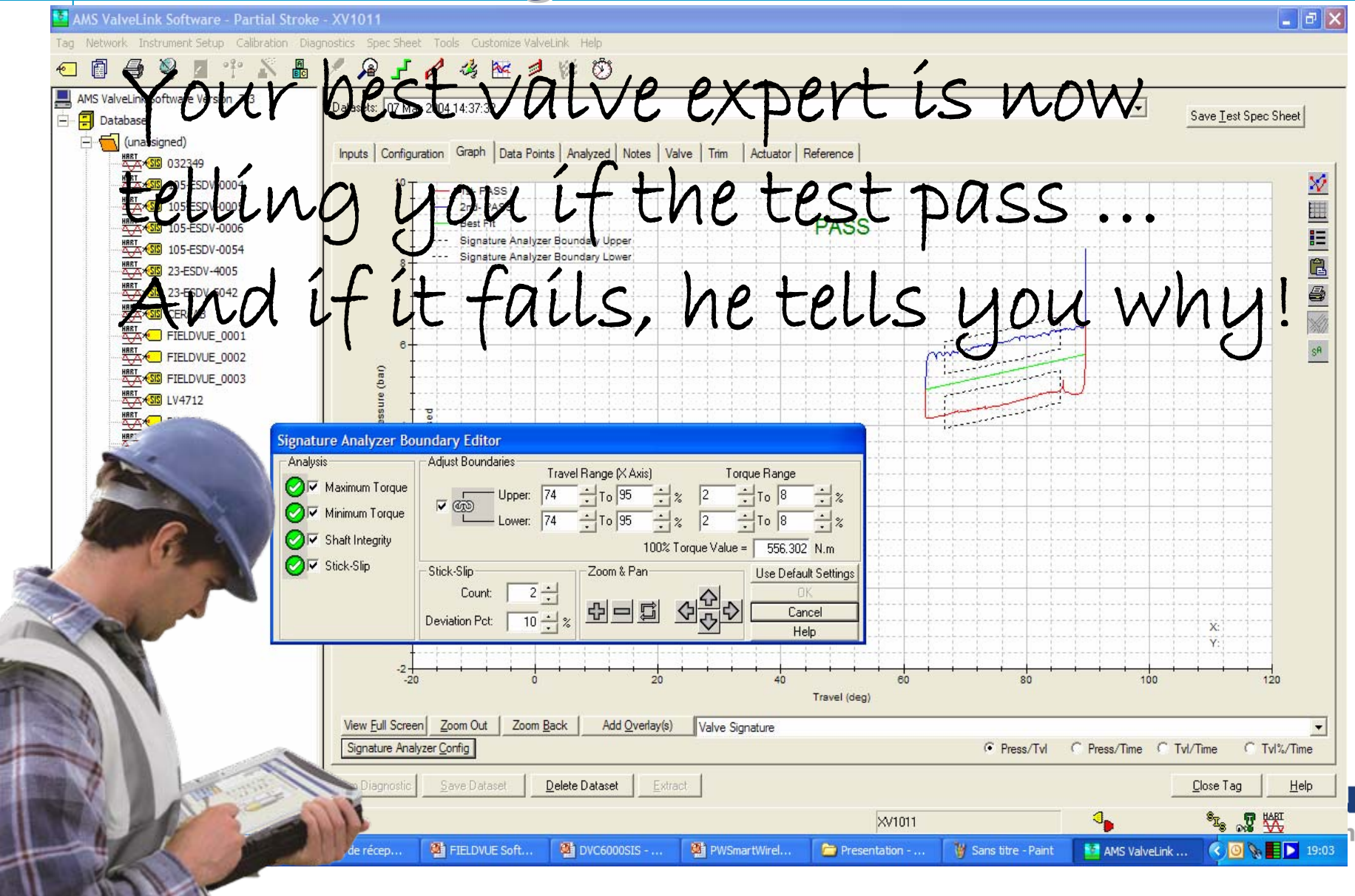


Return to Test View | Zoom Out | Zoom Back

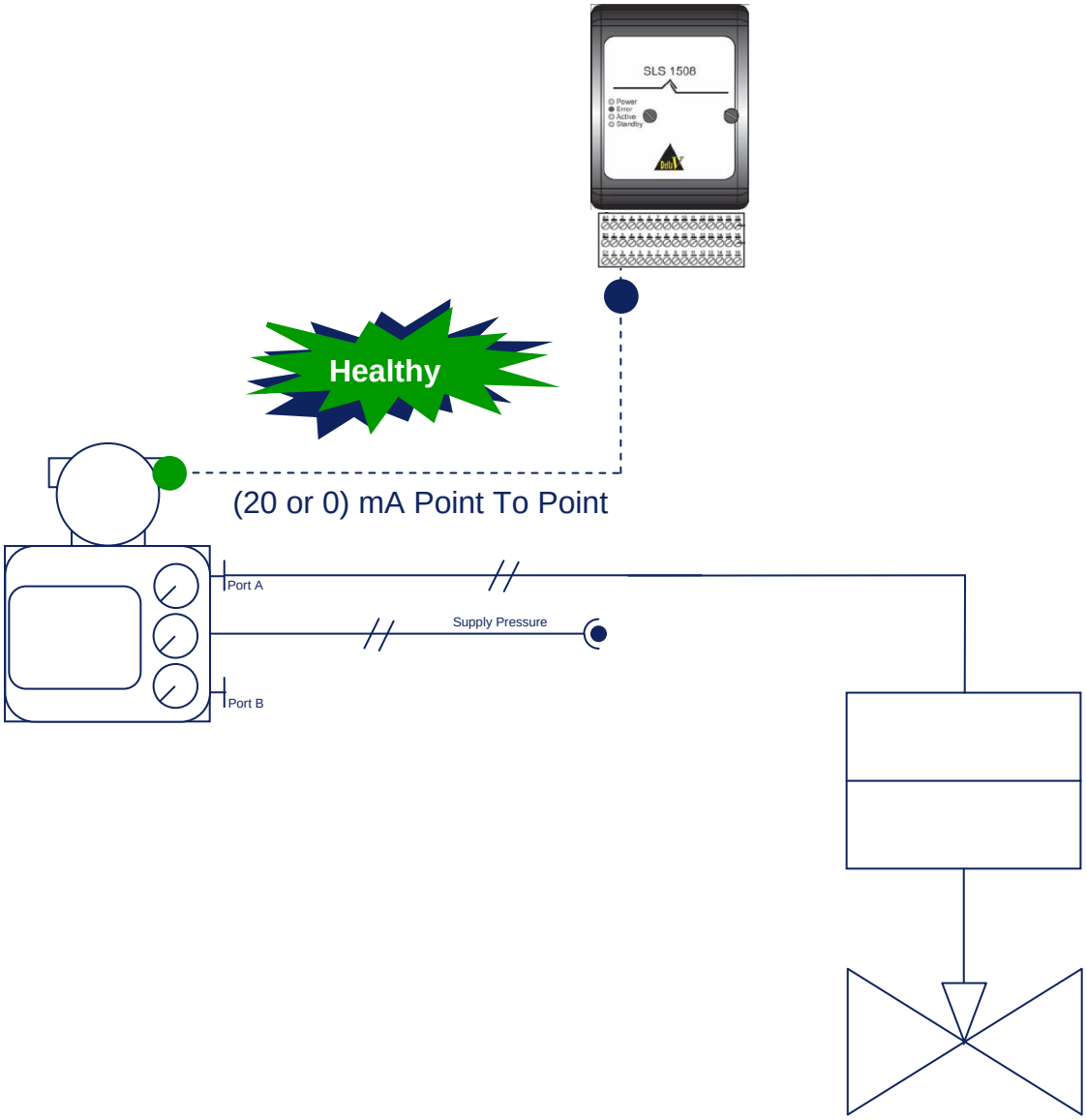
Overlay of the FSVT and PVST Mechanical Signature



Mechanical Signature



Managing test regime



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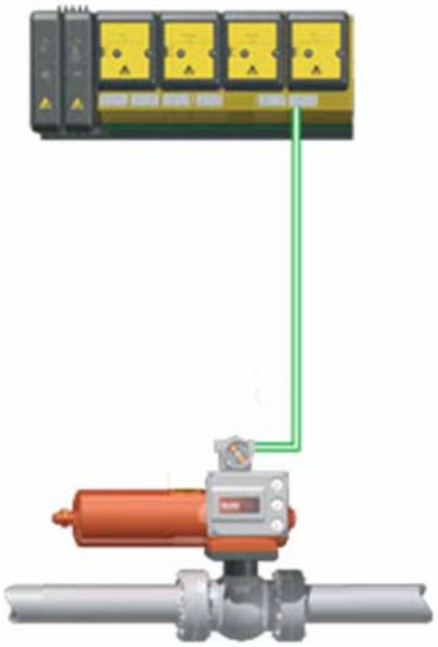
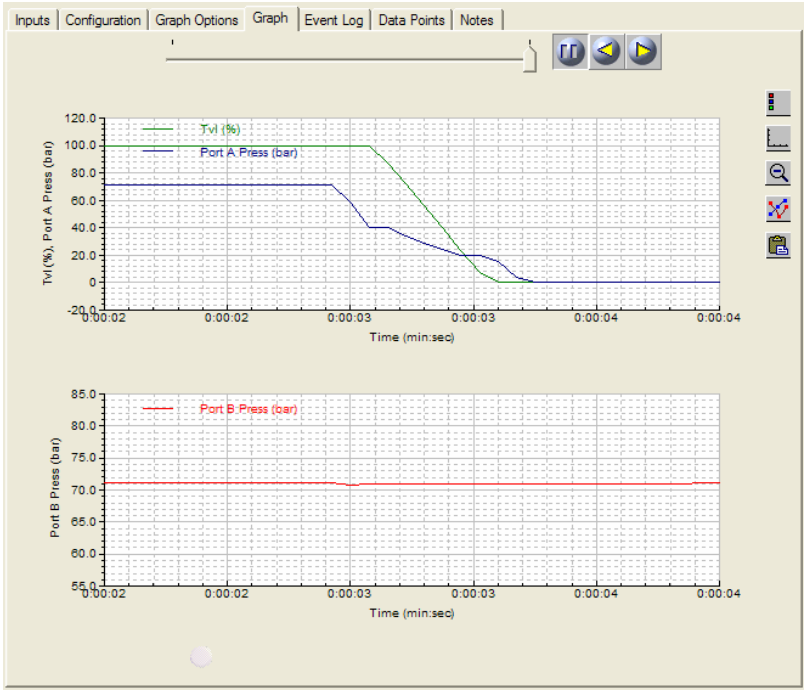
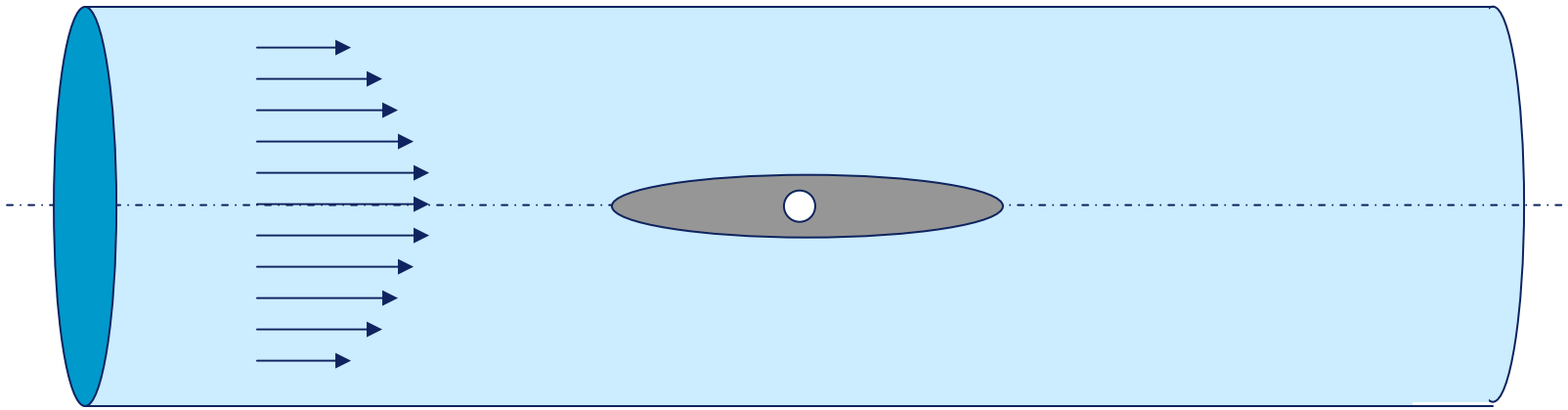
Record & time stamp valve closure signature during Safety & Spurious trip

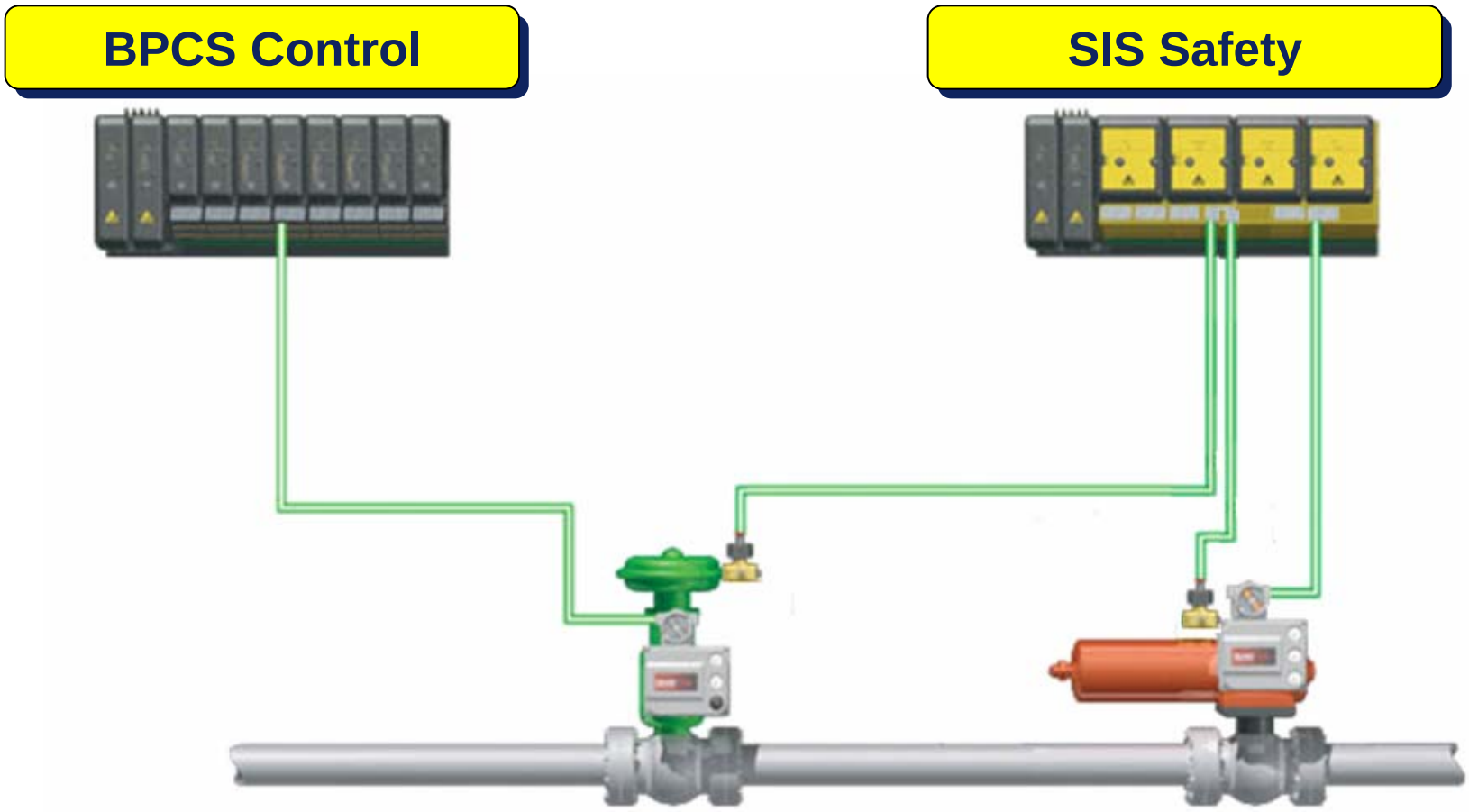




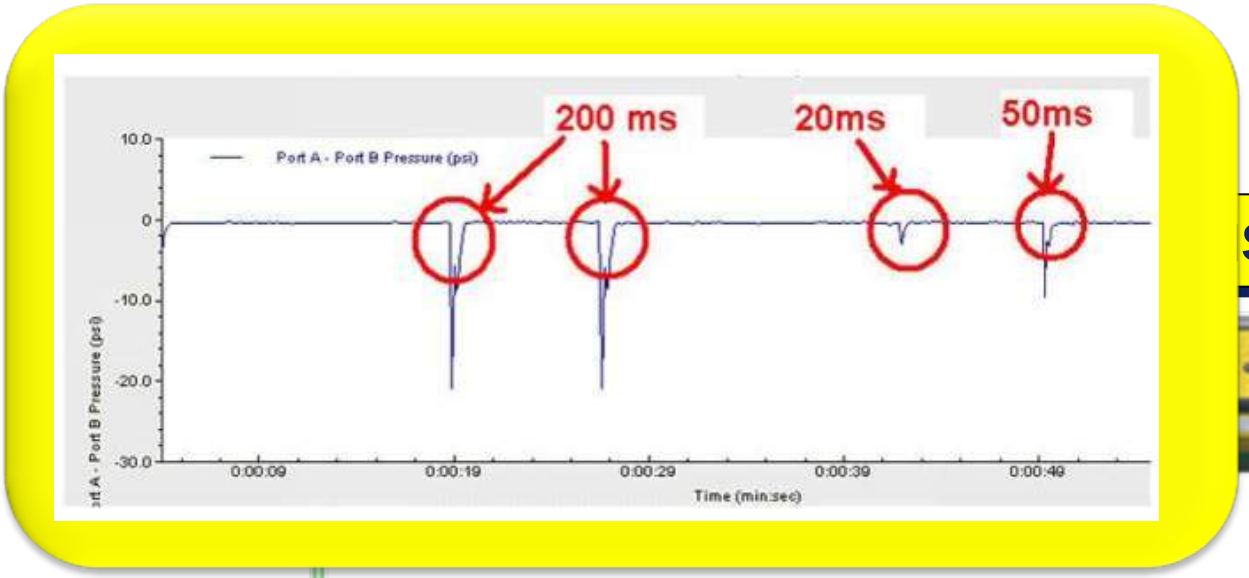


Test external SOV when in operation

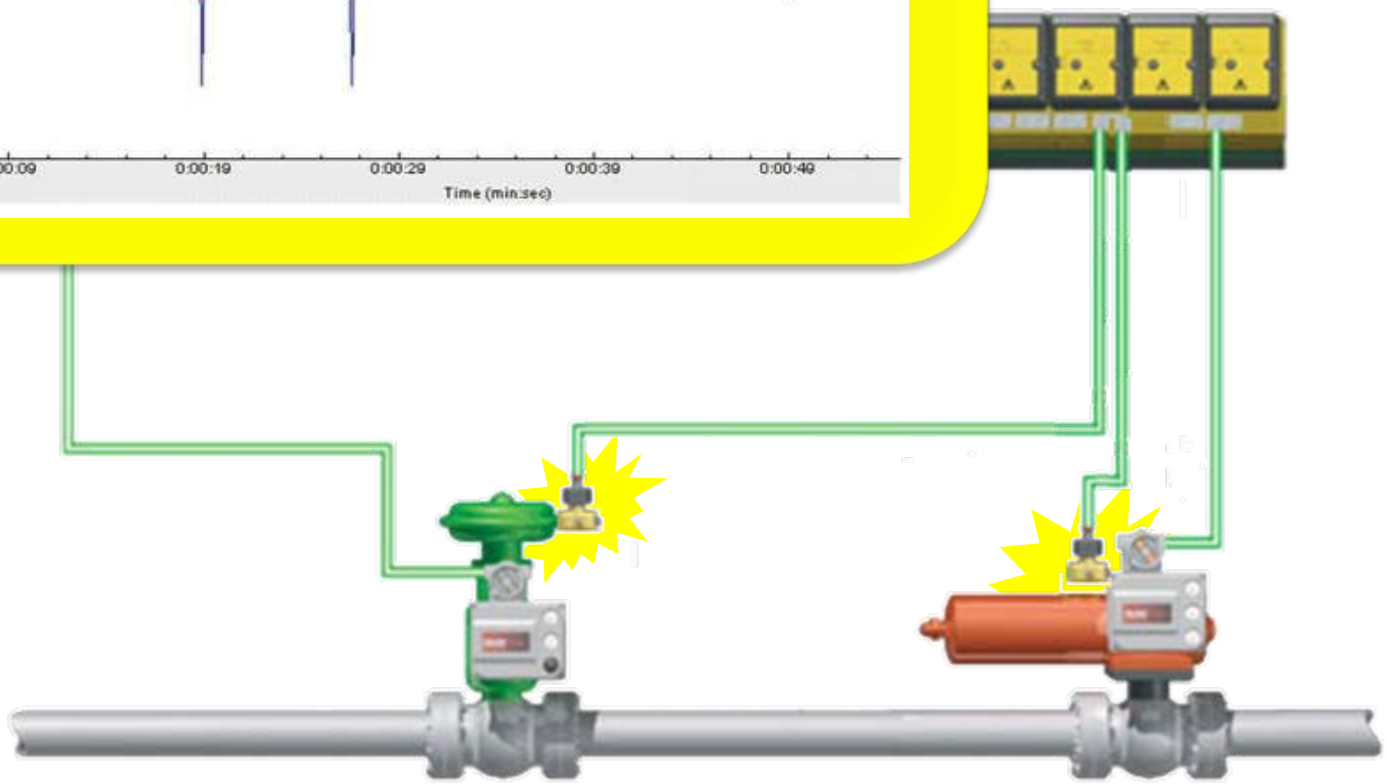
- Pulse test on the external SOV of a:
  - Dual purpose control valve
  - Remote operated safety valve



Test external SOV when in operation



S Safety



Conclusion

- Techniques and procedures initially introduced into the process control industry are now capable of being utilised in remote automated safety valves.

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