

The Advantages of Using Electronic Controls in CO₂ Booster Systems



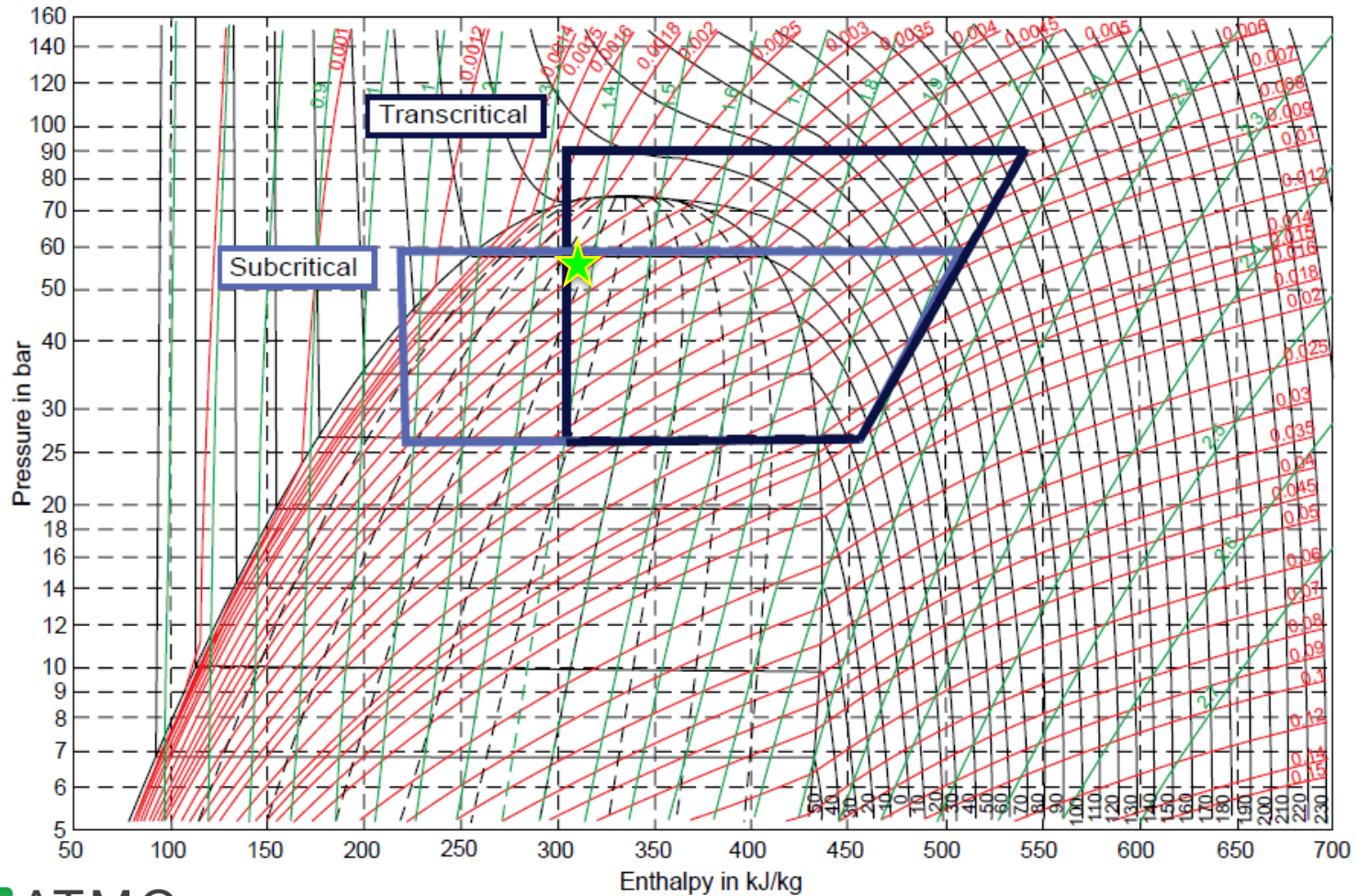
25-26 June 2015 — Atlanta, Georgia



Agenda

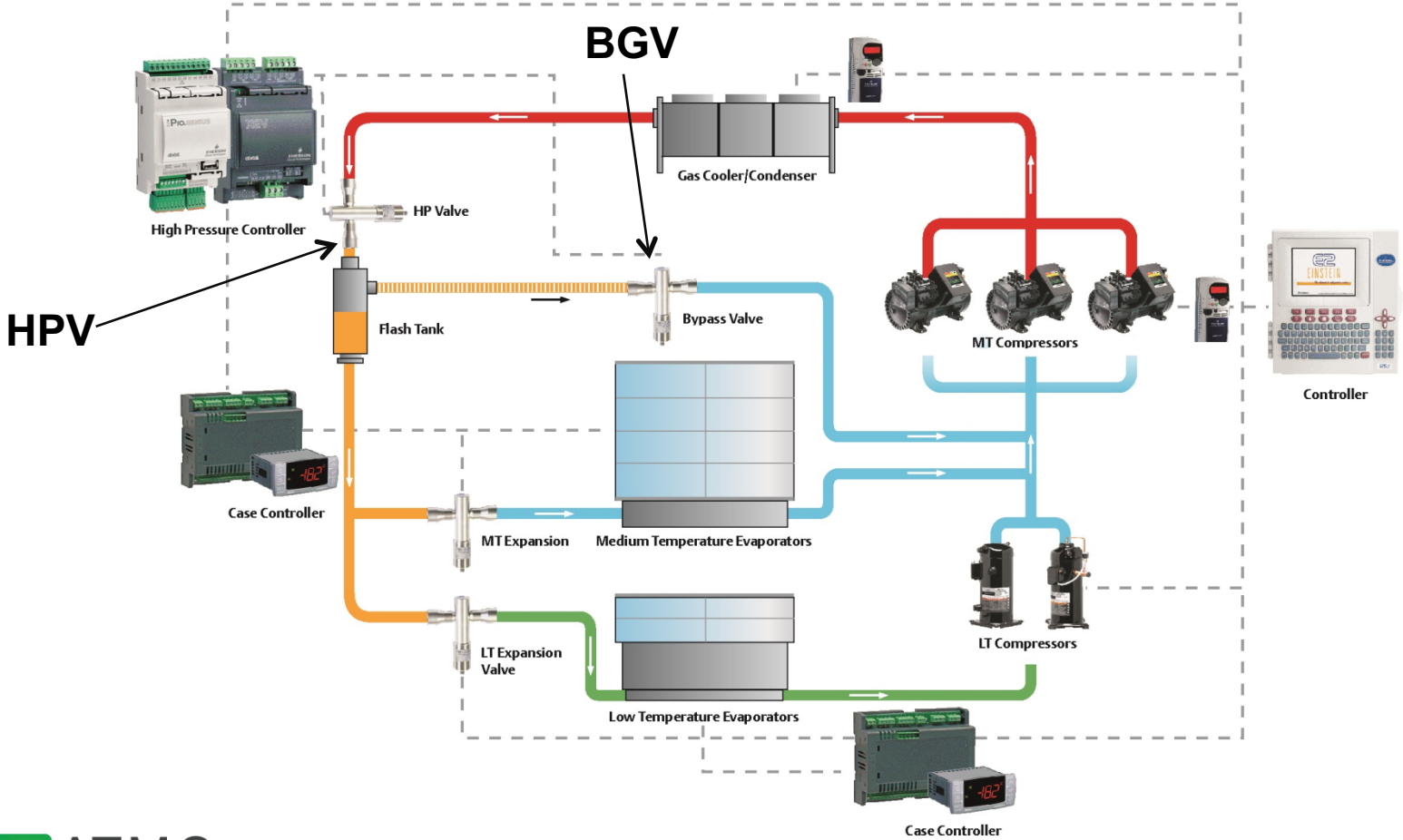
- **Brief Transcritical CO₂ Booster System Introduction**
- **Why Mechanical Controls Are Not Suited for Transcritical Systems**
- **Why Electronic Controls Make Transcritical CO₂ Booster System Possible**
- **Examine Atlanta Store Transcritical CO₂ Booster System**

Using CO₂ as a Refrigerant



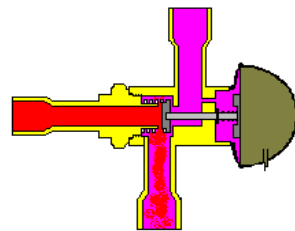
Zero Ozone Depletion Potential & Global Warming Potential of One

Transcritical CO₂ Booster System



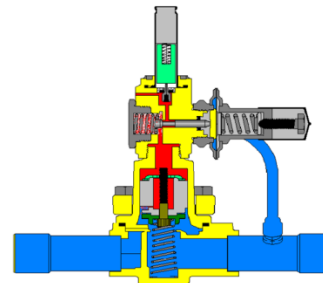
Why Mechanical Controls Are Not Well Suited for Transcritical CO₂ Booster Systems

- **Control design dependent on worse case operating conditions**
 - Atlanta average temperature
 - January - High 52; Low 38
 - July – High 89; Low 71
- **Mechanical control system based on multiple differential valves**
 - Controlled by gas cooler outlet temperature
 - Compromised system performance
- **Difficult to properly adjust Superheat using TXV due to large differences in liquid line pressure**
- **Tough to optimize evaporator coils due to fast frequent changes in Superheat and slow reacting TXV**
- **Leak potential higher with mechanical controls**

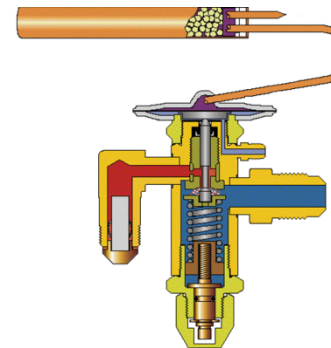


Head Pressure Valve

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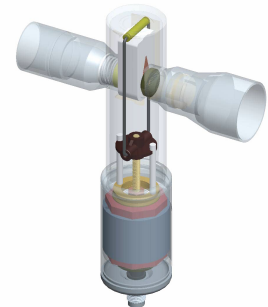
EPR Valve



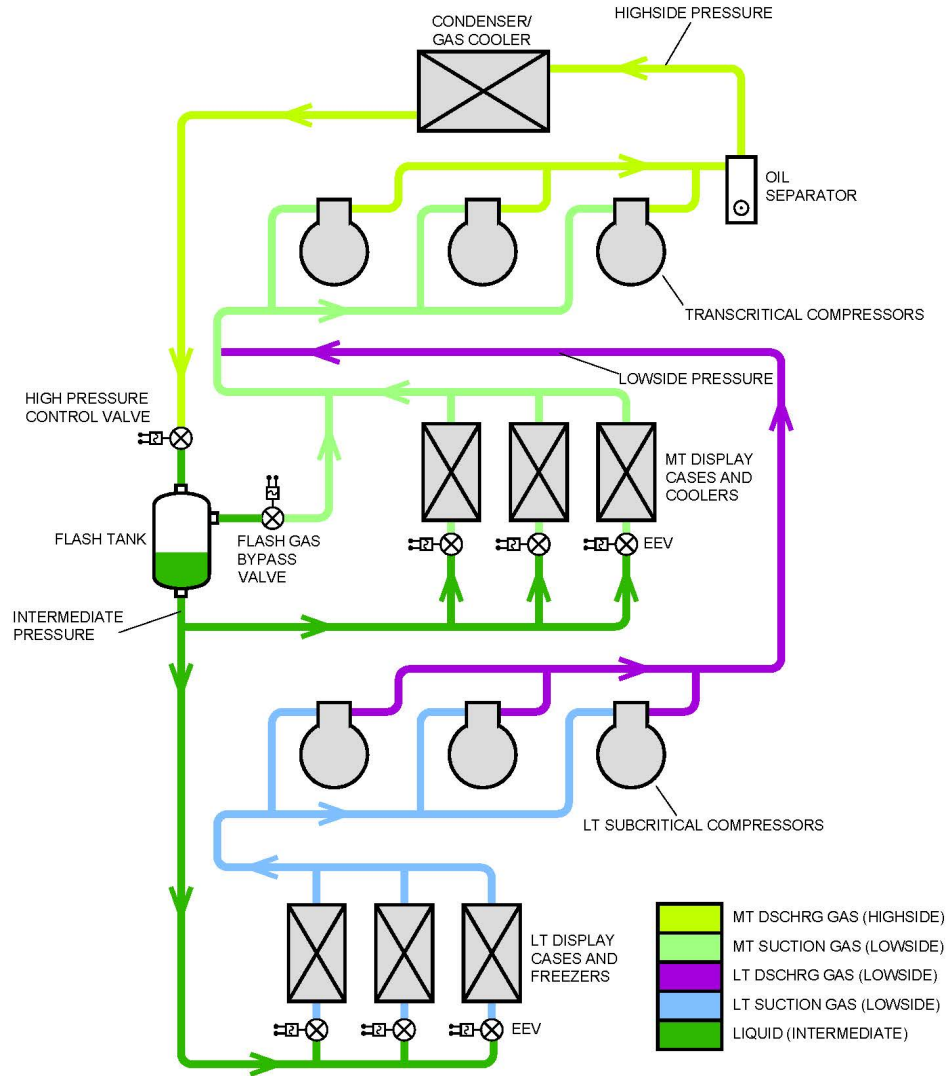
Expansion Valve

Why Electronic Controls Are Well Suited for Transcritical CO₂ Booster Systems

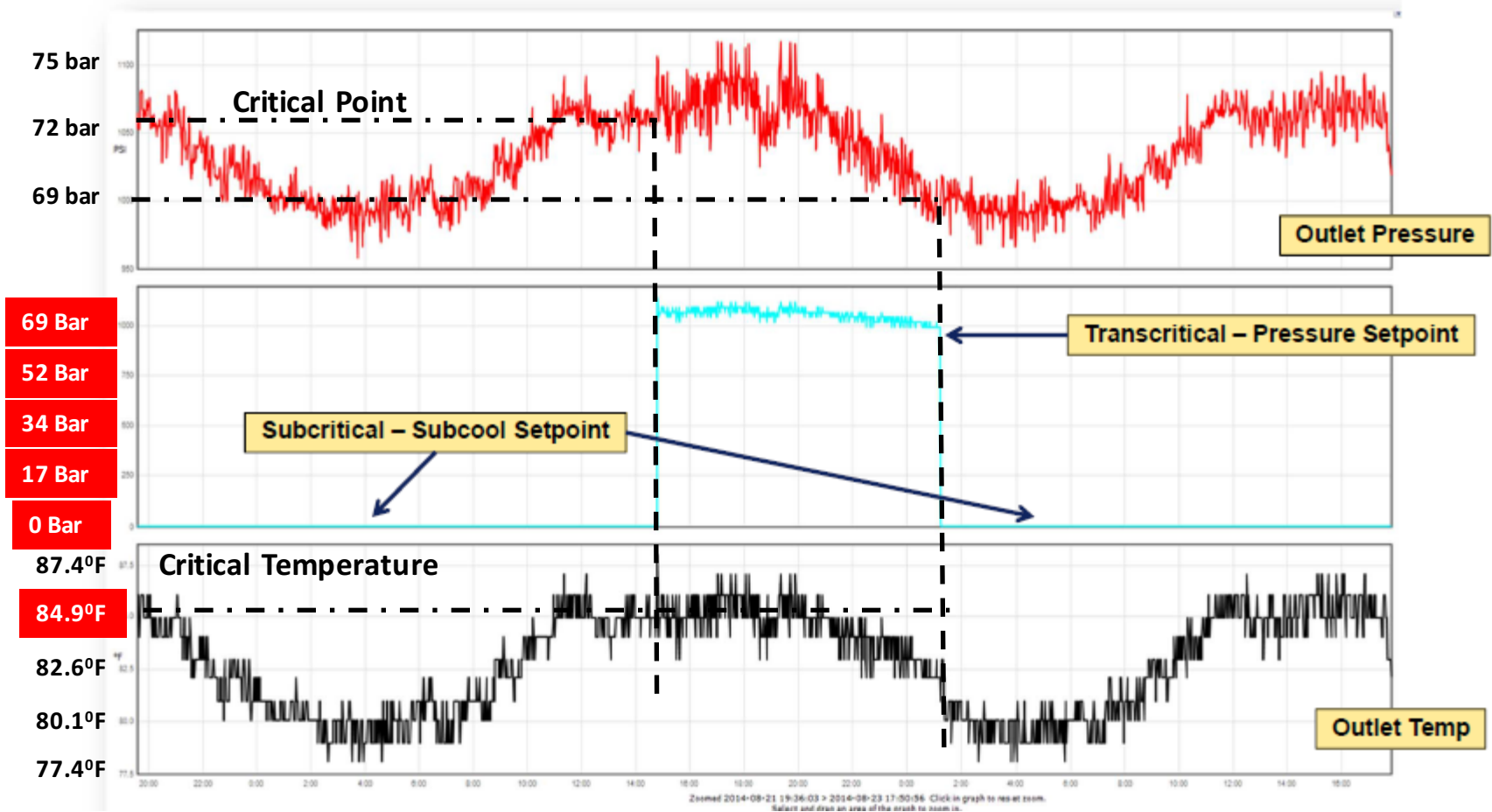
- **Control can adjust to various operating conditions**
 - Atlanta average temperature
 - January - High 52; Low 38
 - July – High 89; Low 71
- **Electronic controls allow the use of algorithms that can optimize the system based on changing environmental conditions**
 - Easily manage transition from subcritical to transcritical operation
 - Manage Flash Tank pressure to optimize system performance
 - Optimize COP
- **Optimize Superheat using electronic expansion valve**
- **System flexibility with remote supervision and control**



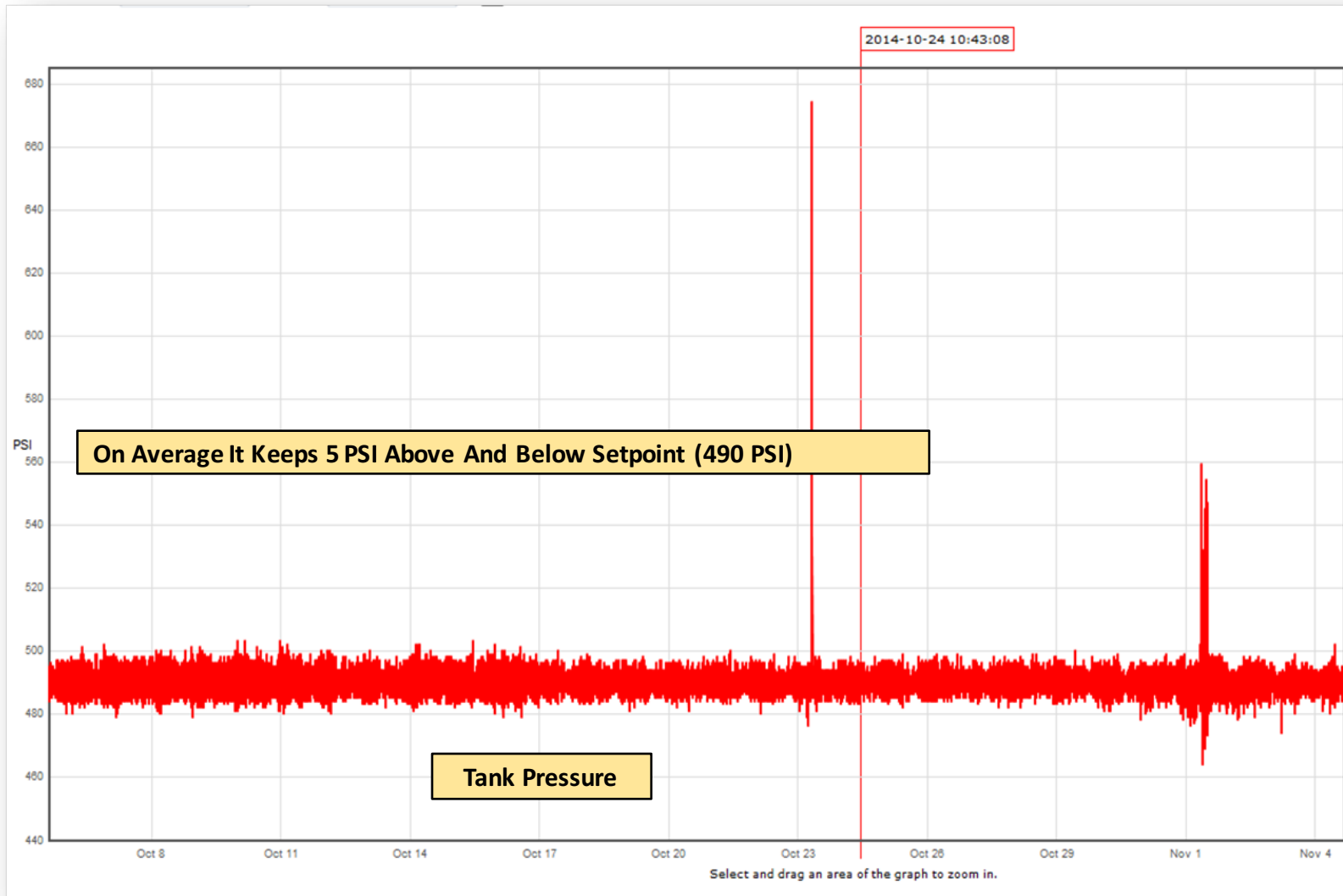
Sprouts Transcritical CO₂ Booster System Diagram – Courtesy of Hillphoenix



Electronic Controls Manage Gas Cooler Transition Between Subcritical & Transcritical



Flash Tank Pressure Maintained



Summary

- **Electronic Controls are easier to adjust to various operating conditions vs. mechanical controls**
- **Electronic controls allow the use of algorithms that can optimize the system based on changing environmental conditions**
 - Easily manage transition from subcritical to transcritical operation
 - Manage Flash Tank pressure to optimize system performance
 - Optimize COP
- **Optimize Superheat using electronic expansion valve**
- **System flexibility with remote supervision and control**
- **Lower leak potential**

**Special Thanks to
Sprouts & Hillphoenix**