Common Opportunities in EBCx

Presentation Outline

- Discuss some of the most common opportunities found during EBCx
  - Scheduling
  - Simultaneous heating/cooling
  - Sensor, actuator, and setpoint improvements (“Dis-a-points”)
  - Testing, Adjusting, and Balancing (TAB) Opportunities

The #1 Rule! Scheduling

- The #1 rule in conserving energy is to shut equipment off!
- Equipment schedules are in synch with the building occupancy?
  - Occupancy schedules are a part of Owner's Project Requirements (OPR)

Scheduling

- What happens when the building goes into unoccupied mode?
- Look for changes in:
  - Equipment status
  - Temperature setpoint
  - Ventilation air quantity

Scheduling

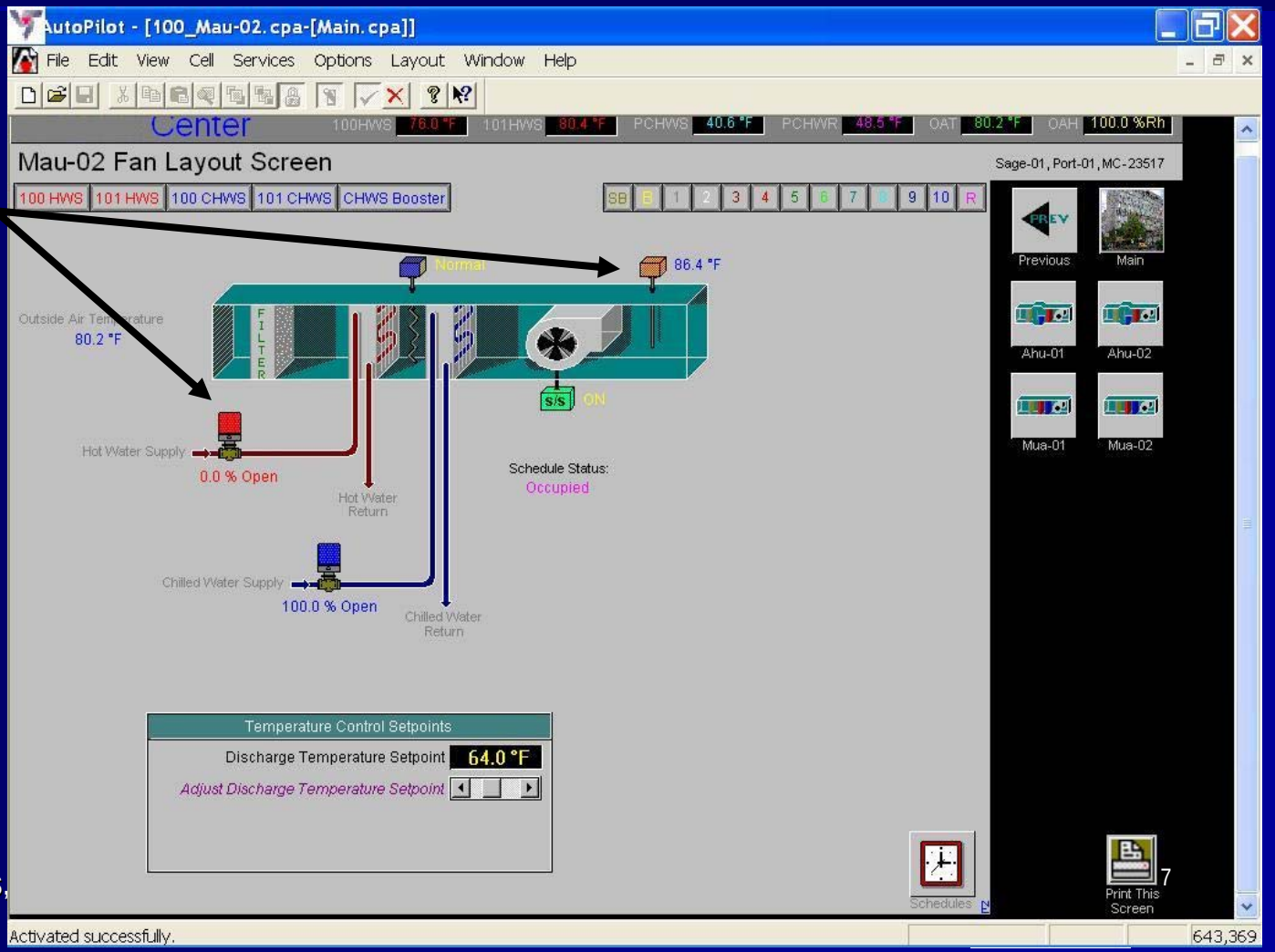
- See if an hour can be trimmed at the start or end of the occupied schedule, these hours add up
- Look for exhaust fans which run unnecessarily during unoccupied hours
- Make sure outside air dampers are closed during unoccupied
- Make sure unoccupied setpoints are different than occupied

Simultaneous Heating & Cooling Valve Leakby

- Heating and cooling valves “leak by”
  - Look for rise across coils when valves are closed (esp. Steam valves)
  - Can also be identified by warm discharge air during economizer
  - Solution: Repair valves

Example: Heating Valve Leak-by on MAU

Makeup air unit shows a 6 degree temperature rise even though the hot water valve appears closed



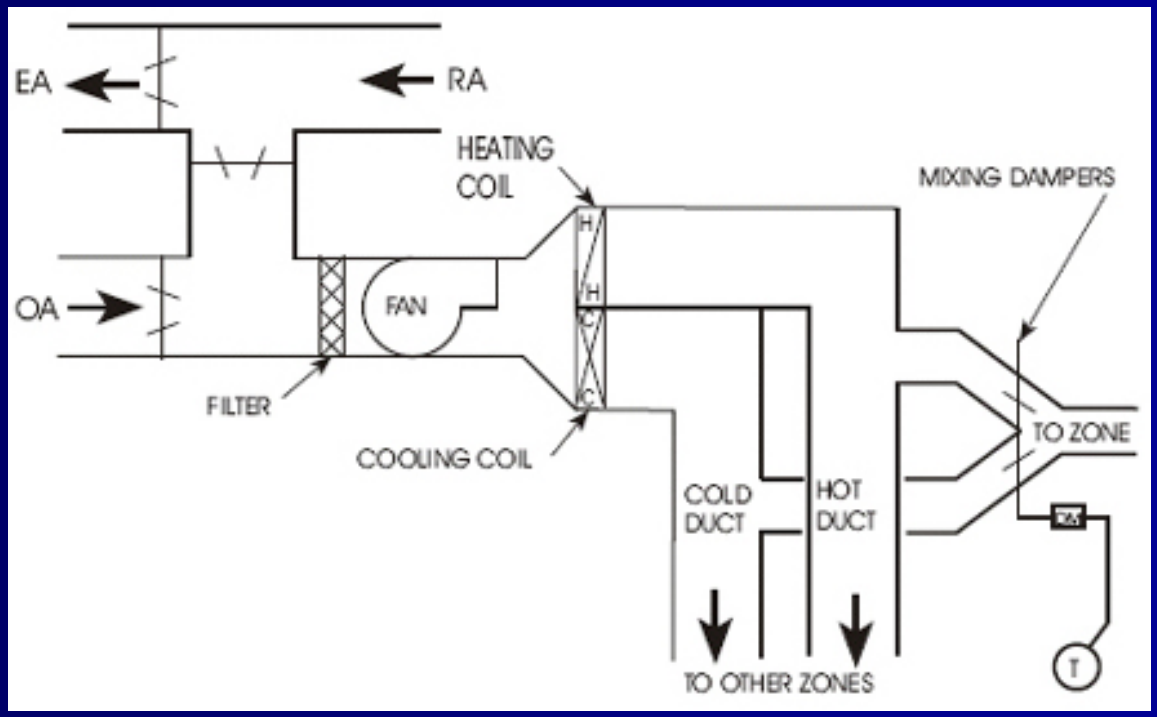
Simultaneous Heating & Cooling
Hot Deck / Cold Deck Units

- No reset of hot deck/cold deck at AHU. Therefore unnecessary reheat is occurring at the zone level of control.

  -Look for use of heat when cooling is present

  -Solution: reset the cooling DAT based upon zone feedback for single path systems, reset hot deck for dual path

Hot Deck / Cold Deck System Schematic



http://www.achrnews.com/articles/variable-air-volume-systems

Simultaneous Heating & Cooling Sensor Placement

- Poor selection/placement of temperature sensors
  - Make sure zone temp sensors are placed within the zone and are not being adversely affected locally by source of heat;
  - Look for single point sensors in large AHU's
  - Temperatures which are not what would be expected, like mat which is too low based upon the ratio of oat/rat
- Solution:
  - placement of space temperature sensors needs to be checked;
  - use averaging sensors for mixed air;
  - make sure sensors are not placed too close to preheat or cooling coil

Example: Sensor Placement

Temperature sensors placed directly below diffusers

Views of open office spaces, perimeter, and columns with thermostats. Note the ceiling where VAV boxes for perimeter and corridor are located. Note that the air distribution for the interior corridor affects the thermostats on these columns.

Simultaneous Heating & Cooling No Deadband

- Heat/cool ranges are too narrow with no deadband, or they may even overlap.
  - Look for simultaneous H/C and/or no difference between summer/winter setpoints
- Solution:
  - Program separate heating and cooling setpoints which are surrounded by deadband

Simultaneous Heating and Cooling Baseboard vs. VAV Box

- Automatic control of the heating baseboard which is fighting w/ the cooling system.
  - Look for baseboard operating when airside is in cooling
  - Solution: tie controls together so they operate in series without overlap, and/or lock out heating when air side is in cooling

Sensor Failure/Calibration Error

- Sensor readings “drift” over time and often “fail” (stop communicating)
  - Look for relative calibration air temperature sensors will be +/- 2°F, water temperature sensors +/- 1°F. CO_2 sensors need to be calibrated every two years. Pay attention to global sensors
  - Solution: calibrate or replace sensors

Failed Actuators

- End devices or linkages which have failed
  - Look for dampers, VAV boxes, valves, temperatures which never vary and find out why?
  - Mixed air dampers (return) often leak by reducing the economizer effectiveness
  - Solution: repair or replace end device

Temperature Reset Schedules

- Discharge Air Temperature Reset
  - AHU discharge air temperature typically doesn't need to be below 55 or above 95, can be reset when not a design day
- Chilled Water/Hot Water Temperature Reset
  - Chilled water supply temp can be reset *up* / Hot water supply temp can be reset *down* when not a design day
- Condenser Water Reset
  - Condenser water temperature typically can be reset *down* to 60°F when not a design day

Economizer Setpoint Optimization

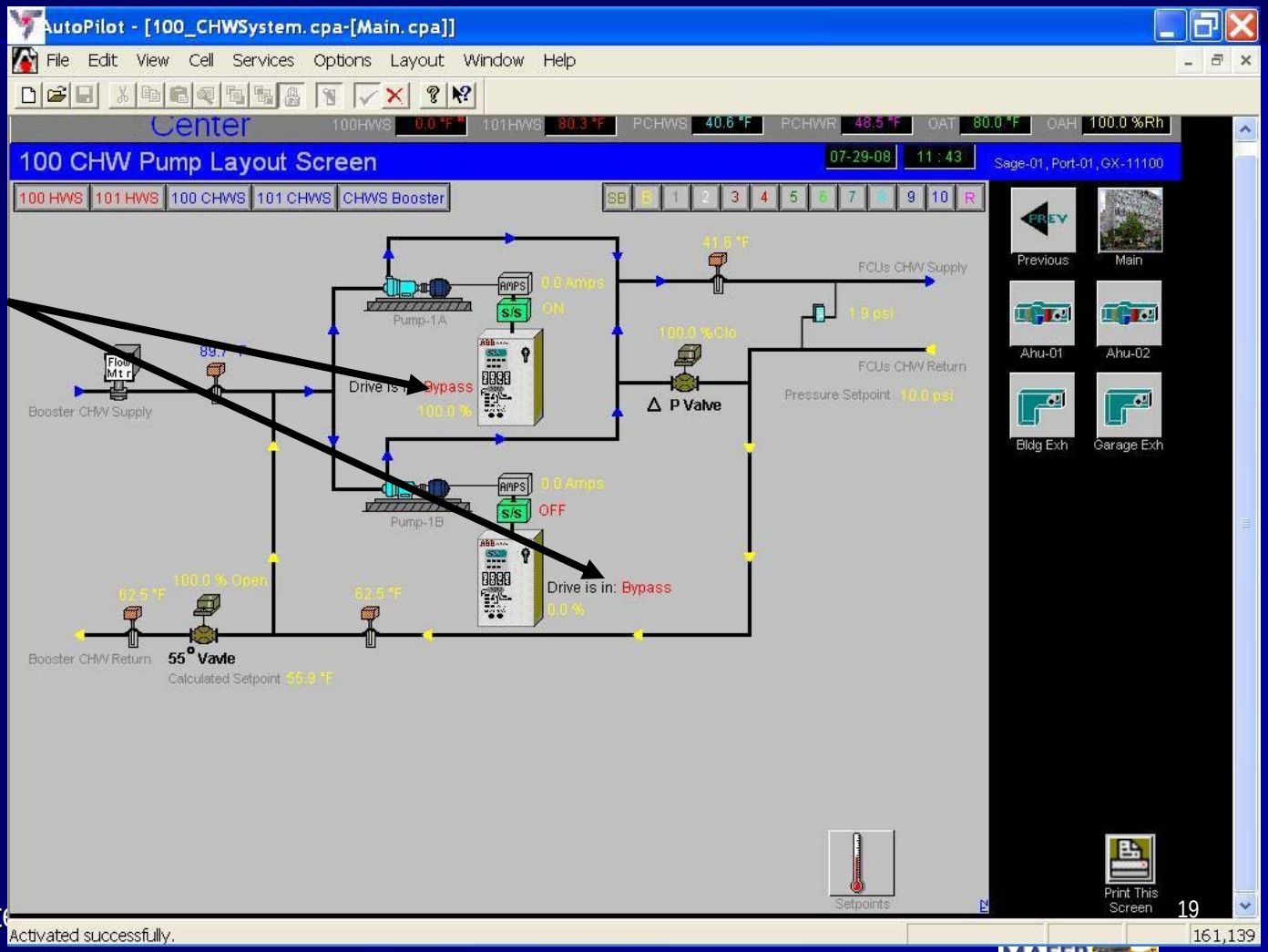
- Look for:
  - More than minimum OA being introduced outside of economizer range;
  - Economizer locked out below 65°F OAT and/or below 55°F;
  - Temperature-only based economizers.
- Solution: Adjust lockout setpoints and/or add relative humidity sensors to implement dual-enthalpy economizer.

Variable Flow Systems in Bypass

- VFDs in “Bypass”/ “ Hand” rather than “Auto”
  - Look for constant flow rates
  - Solution: determine why system is in bypass and correct or may need differential pressure station installed

Example: System in Bypass

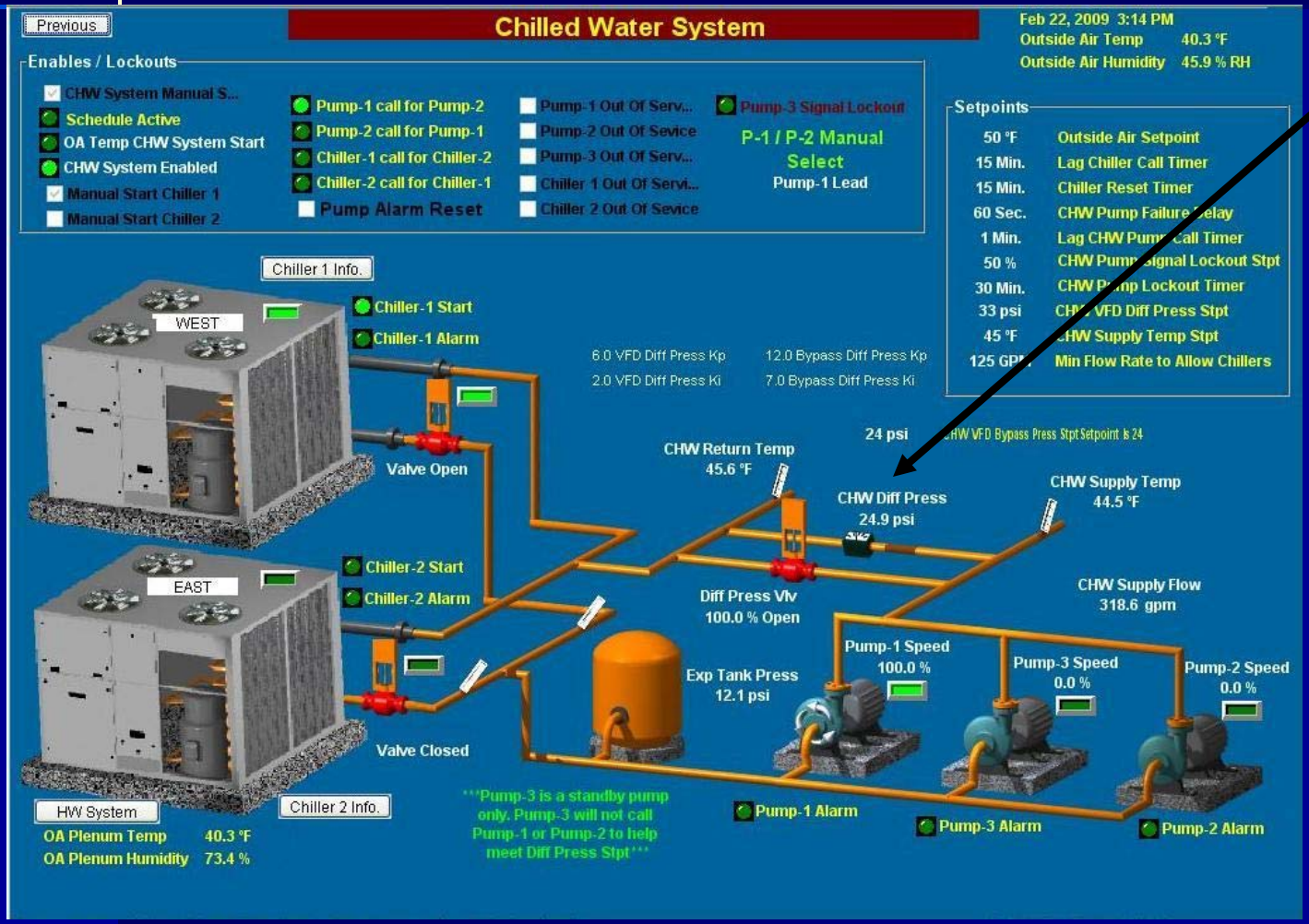
Both pumps have VFDs, but both are in bypass



Pump Differential Pressure Reset

- Variable flow systems with only one DP setpoint:
  - Differential pressure is set at time of installation based upon worst case zone with majority of valves forced open. However, when not worst case scenario, many valves are closed and the pressure setpont is easily maintained. Without reset, drive will not go any lower.
  - Look for drives which never vary lower than 50%
  - Solution: reset differential pressure when worst case zone is satisfied based on valve position

Example: Differential Pressure Reset



No dP reset on a variable flow system resulting in 100% pump speed and a low delta-T.

Low Delta T Syndrome

- Secondary/Tertiary loop over-pumping
  - Look for secondary loop temperatures which are only 2-4 degrees for many hours of the year, and/or deny valves which are frequently recirculating water
  - Solution: adjust pump control algorithm to look at differential temperature as well as differential pressure to prevent over-pumping

Excessive Fan Energy

- Minimum fan speed too high
  - Look for fans which never vary below 50%, check what minimum speed setpoint in drive or control sequence.
  - Solution: lower minimum VFD speed (typically minimum speed for HVAC motor is 30%)
- VAV duct static pressure pressure too high
  - Look for duct static pressure setpoint greater than 1.25 inches
  - Solution: check worst case zone pressure requirements and lower the setpoint.

TAB Opportunity
Unnecessary Pumps

- Look for situations where primary pump has adequate pressure to serve the load
  - Common in hospital and college campuses
- Solution: Eliminate use of pump

TAB Opportunity
Excess Minimum Ventilation Air

- Outside air quantities are too high because they have been based upon theoretical occupancy rates which exceed the buildings true occupancy
  - Look for building ventilation rates in excess of 10%
  - Solution: obtain accurate head count and calculate new ventilation quantity. Adjust flow setpoint/minimum OAD position or re-sheave supply fan.

Example: Excessive Ventilation

- The Make-up Air unit for this facility was continuously supplying 17,000 CFM when only 5,700 CFM was needed at peak.

TAB Opportunity
Excess Primary Air

- Series FP Box with too much primary air:
  - Look for box air flow into the plenum (reverse flow through the return)
  - Solution: Rebalance box to design flow conditions (adjust damper range)

Too Much Primary Air in a Series Fan-Powered Box

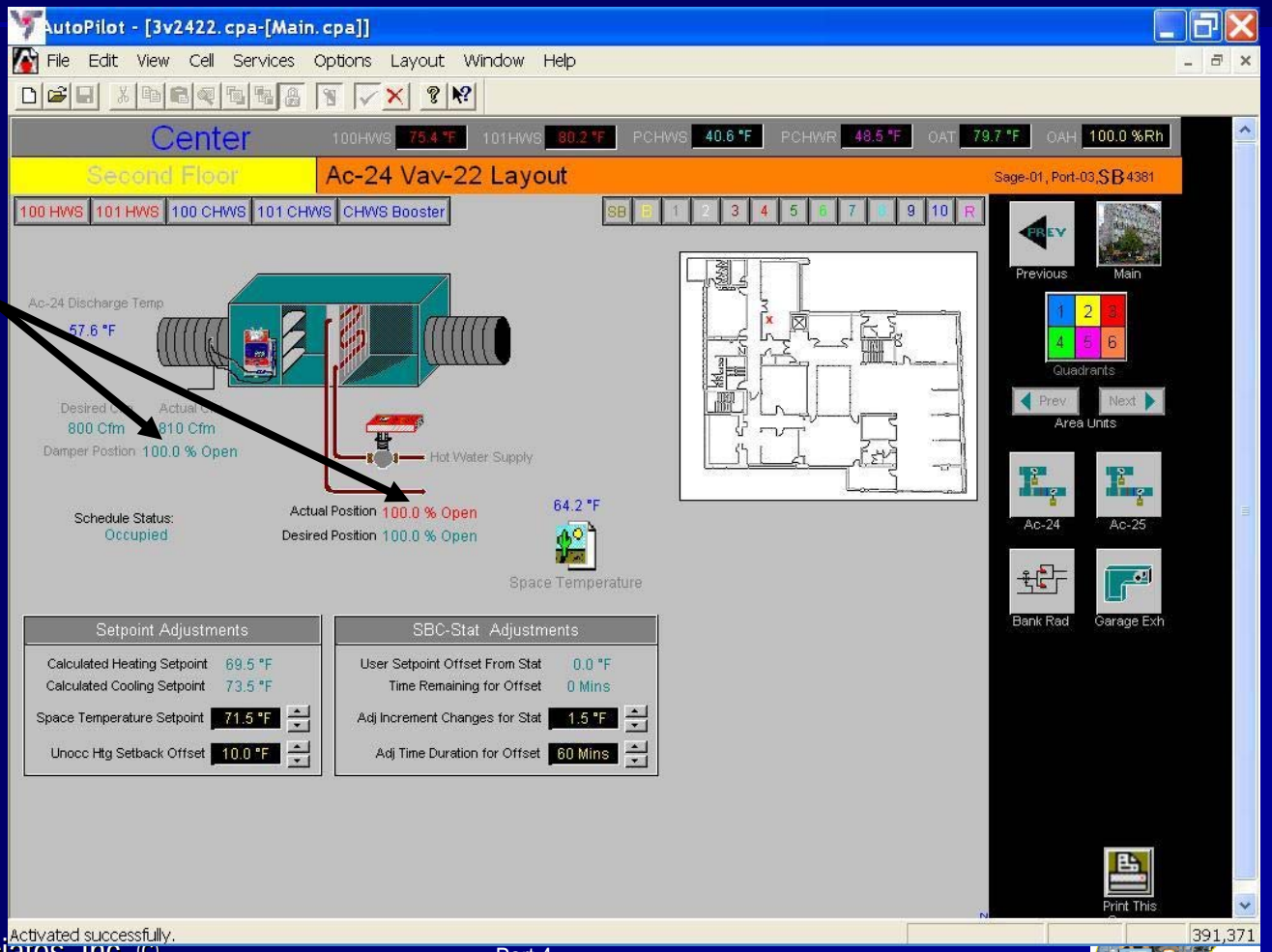
TAB Opportunity
VAV Minimum Flow Too High

- VAV box flow is too high at minimum setting causing excessive reheat
- Can also be classified as simultaneous heating & cooling since primary air is cooled
  - Look for dampers not at minimum when reheating
  - Solution: rebalance and/or reprogram box

Example: VAV Min Set Too High

Damper 100% open with heating valve 100% open, resulting in simultaneous heating and cooling.

OAT is 73˚F



TAB Opportunity
Calibration and Balancing

- VAV box air volume flow measurement stations that need to be recalibrated.
  - Look for min or max setpoints that are never reached or are exceeded
  - Measure zone diffusers with calibrated device and calibrate box
- System air rebalancing (spaces with too much air volume or not enough)
  - Look for box damper positions which never vary off minimum or maximum and/or spaces which are always too cold or too hot on design days
  - Rebalance zone or take zone off system

TAB Opportunity
Pump Balancing

- Excessive pressure drop at pumps
  - Look for balancing valves which are closed more than 25% on VFD-controlled pumps
  - Solution: trim pump impeller and/or open valves on the VFD-controlled systems