

Power & Cooling Design



PRESENTED BY:

David J. Martinez

Sandia National Laboratories

Infrastructure Computing Systems, Org. 9324

PO Box 5800 MS0823

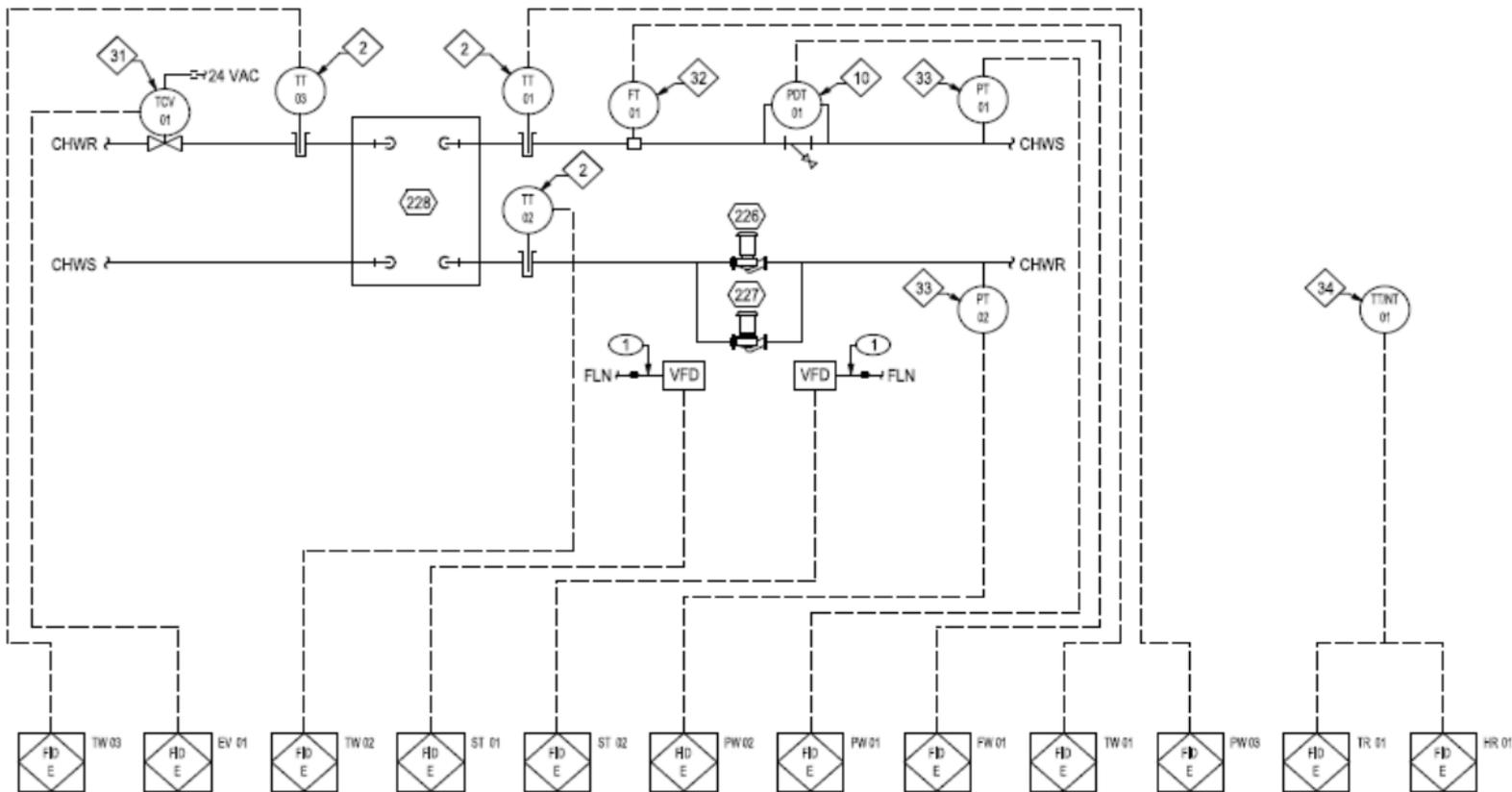
Albuquerque, NM 87185-0823

505.844.6531 voicemail

davmart@sandia.gov email

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Cooling Sequence

PROCESS CHILLED WATER SYSTEM CH09

GENERAL

THE PRIMARY PROCESS CHILLED WATER SYSTEM SHALL CONSIST OF A FLAT PLATE HEAT EXCHANGER AND TWO PROCESS DISTRIBUTION PUMPS WITH VFC'S. THE PROCESS CHILLED WATER SYSTEM SHALL OPERATE CONTINUOUSLY.

CHILLED WATER LOOP PUMP CONTROL

THE PUMPS SHALL OPERATE IN A LEAD/STANDBY CONFIGURATION, THE LEAD PUMP SHALL OPERATE ANYTIME THE SYSTEM IS ENABLED, THE FCS SHALL MODULATE THE SPEED OF THE PUMP TO MAINTAIN THE SYSTEM DIFFERENTIAL PRESSURE AT SETPOINT. THE FCS SHALL MONITOR THE STATUS OF EACH PUMP THROUGH A SET OF CONTACTS IN THE VFC AS WELL AS THROUGH THE FLN NETWORK CONNECTION, IF A FAILURE IS DETECTED IN THE LEAD PUMP, THE STANDBY PUMP SHALL AUTOMATICALLY START AND AN ALARM SHALL BE INITIATED BY THE FCS, THE PUMPS SHALL BE ROTATED MONTHLY, THE DIFFERENTIAL PRESSURE SETPOINTS SHALL BE SET BY THE TEST AND BALANCE CONTRACTOR.

HEAT EXCHANGER TEMPERATURE CONTROL

THE FCS SHALL MODULATE THE HEAT EXCHANGER VALVE TO MAINTAIN THE PROCESS CHILLED WATER SUPPLY TEMPERATURE AT A SETPOINT OF 60 DEGREES F (ADJUSTABLE), THE FCS SHALL MONITOR THE DEWPOINT TEMPERATURE OF THE SPACE. THE FCS SHALL RESET THE PROCESS CHILLED WATER SUPPLY TEMPERATURE AT 2 DEGREES F ABOVE DEWPOINT IF THE DEWPOINT TEMPERATURE RISES ABOVE 60 DEGREES F. THE FCS SHALL INITIATE AN ALARM IF THE PROCESS CHILLED WATER SUPPLY TEMPERATURE EXCEEDS 5 DEGREES F (ADJUSTABLE) ABOVE SETPOINT.

STRAINER DIFFERENTIAL PRESSURE

THE FCS SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE STRAINER, IF THE STRAINER DIFFERENTIAL PRESSURE EXCEEDS THE ALARM SETPOINT, THE FCS SHALL INITIATE AN ALARM.

CHILLED WATER SYSTEM CH09 CONTROL DIAGRAM

SCALE: NONE



Sky Bridge



Process Loop
Supply and
Return
piping

Sky Bridge



Balancing valve between supply and return on the process loop



Sky Bridge

Heat exchanger Chilled
Water/Tower Water 55 F to
60 F to Process Cooling Loop
60 F to 70 F depending on
calculated dew point



Sky Bridge



StarLine Buss system 480 volt 600 amp main 60 amp per cabinet



Sky Bridge

- The power is 480V 60 AMP
- StarLine track buss system
- 65% liquid cooled right to the chip
- Liquid temperature range 60F to 90F
- Controls off differential pressure



What is RackCDU?

Direct-to-Chip, Hot Water Liquid Cooling for Servers

Three Key Elements in the System:

- Outdoor Dry Cooler / Cooling Tower
- Rack Extension containing CDU and L2L HEXs
- Server Cooler

Server Cooler is a drop in replacement for CPU & GPU air coolers

- Air cools components that are not liquid cooled

RackCDU Separates Facilities Liquid and Server Cooling Liquid at the Rack.

- The two liquids never mix.

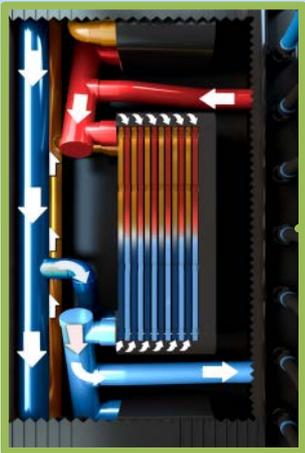
Facilities Liquid Cooled with "Free" Ambient Outdoor Air, No Chilling Required

- Dry Coolers, Cooling Towers, or Waste Heat Recycling used to take heat from facilities liquid



How RackCDU Works

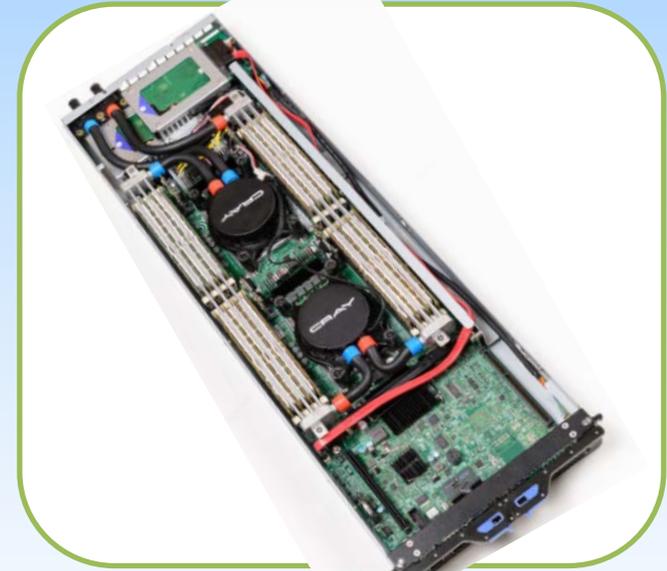
Hot water from Facilities dry cooler or cooling tower enters RackCDU, hotter water returns.



Liquid-to-liquid HEXs exchange heat between facilities liquid loop and server liquid loops. Facilities and server liquids are kept separate and never mix.



Tubes move cooling liquid to and from RackCDU to servers.



Pump/cold plate units atop CPUs (or GPUs) circulate liquid through blades and RackCDU, collecting heat and returning to RackCDU for exchange with facilities liquid.

Sky Bridge

- CAPEX cost for water cooled system install ~35% lower vs air cooled system
- OPEX ~ cost for water cooled system ~ 50% lower vs air cooled system
- Total footprint for install inside the white space for water cooled / system ~30 sq.ft. vs air cooled system ~ 400 sq.ft.



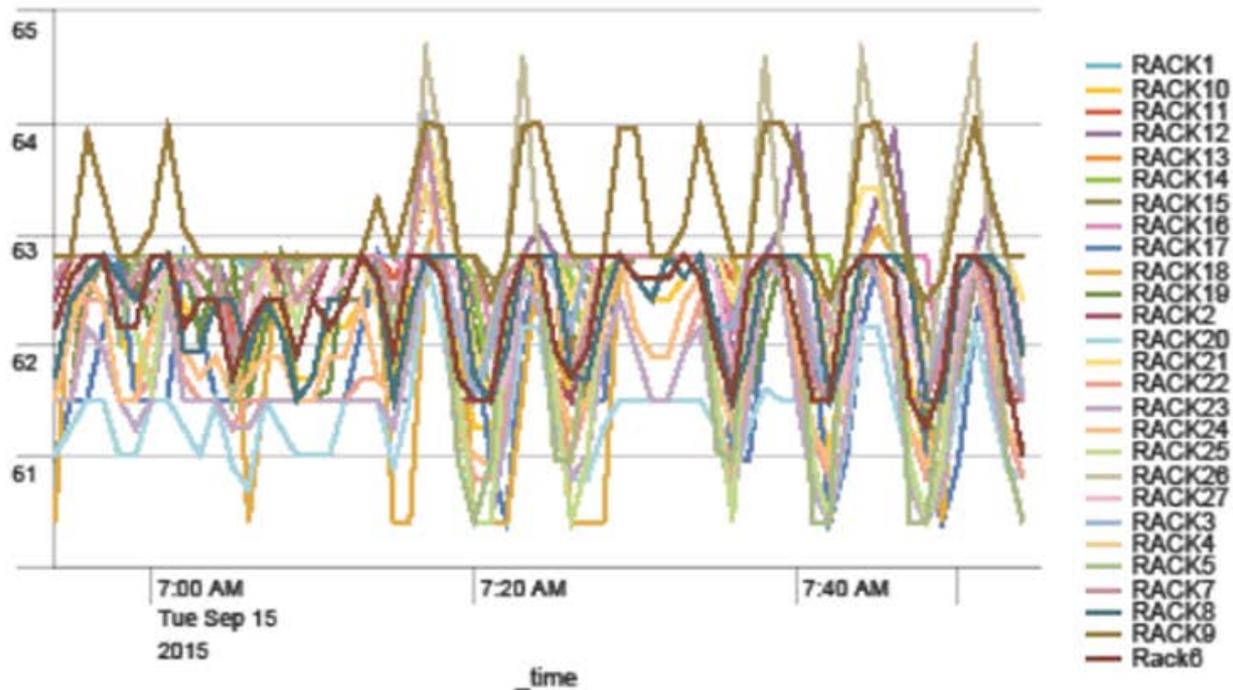
Present

- Tracking both facilities & compute systems
- Looking at jobs in the que
- Gathering data
- Validating information
- Understanding risk and impact



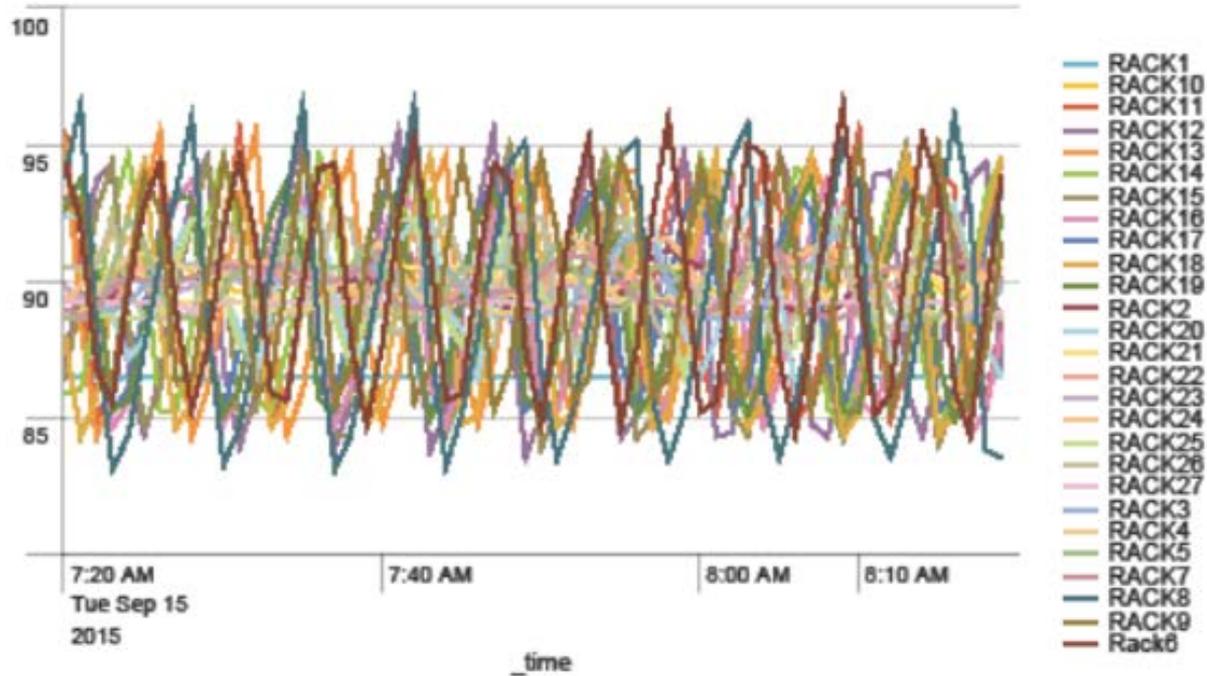
Sky Bridge – H2O Supply Temperatures

Facility Water Supply Temperatures



Sky Bridge – H2O Return Temperatures

Facility Water Return Temperatures



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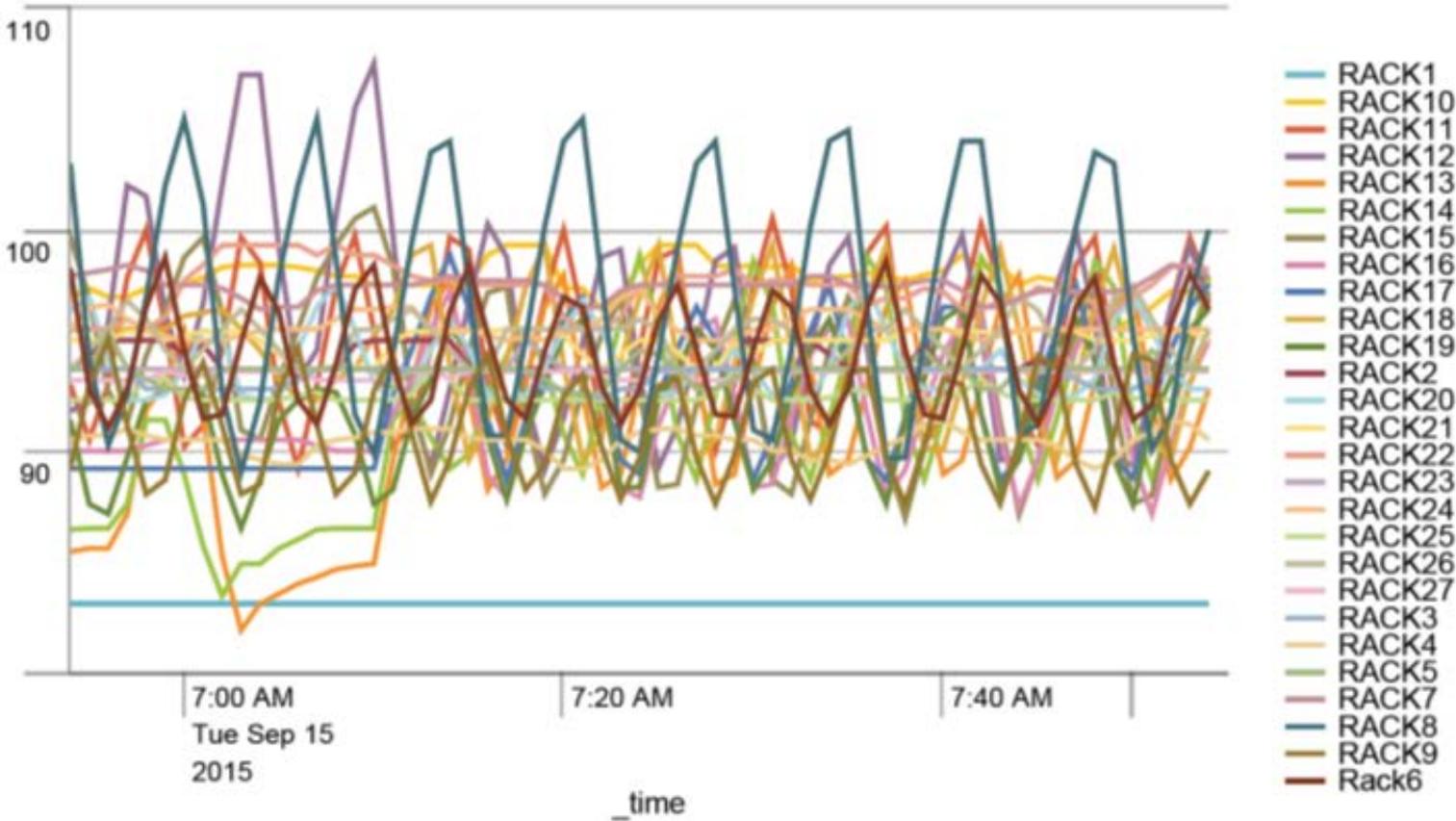
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Page 1



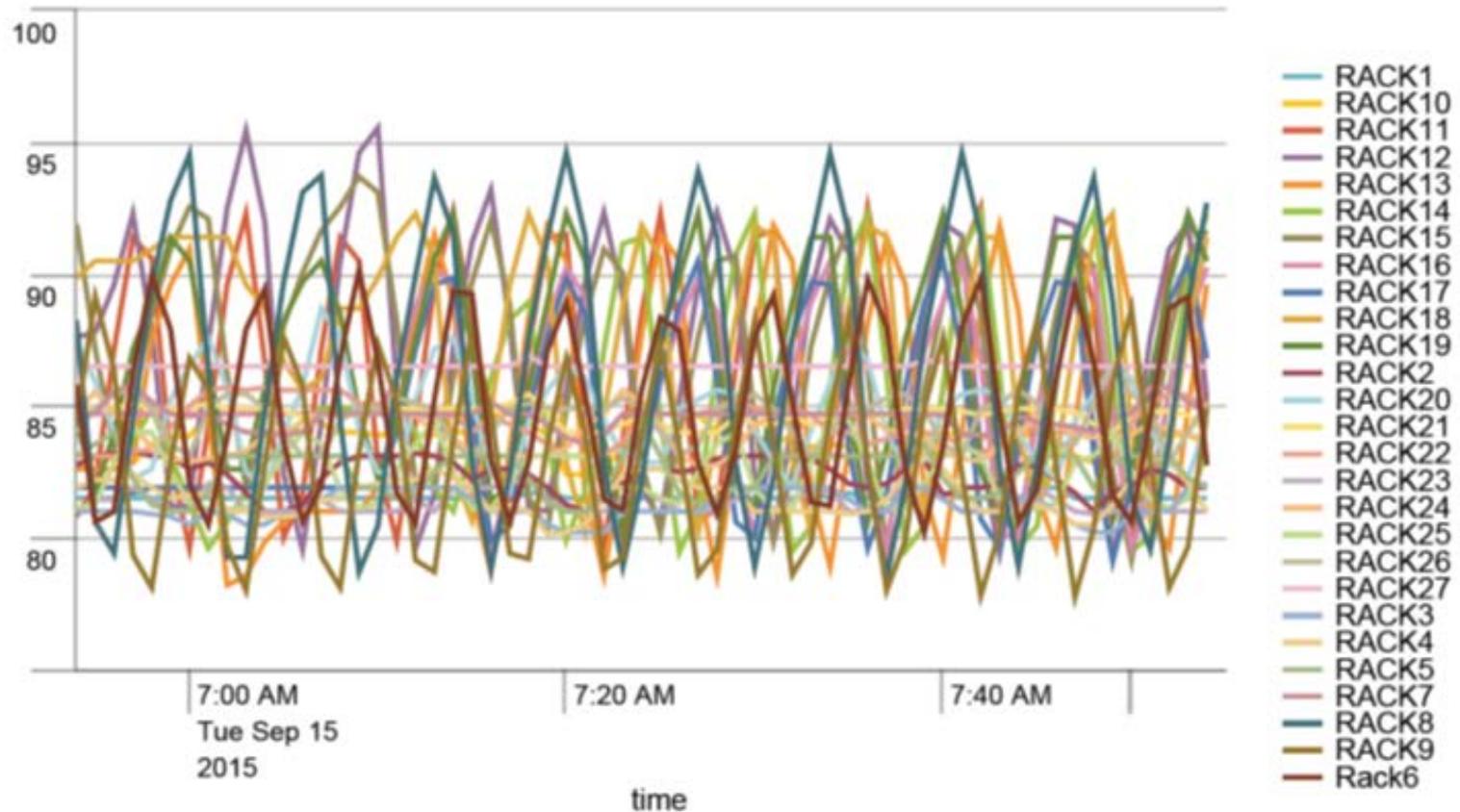
Sky Bridge – Server H2O Return

Server Water Return



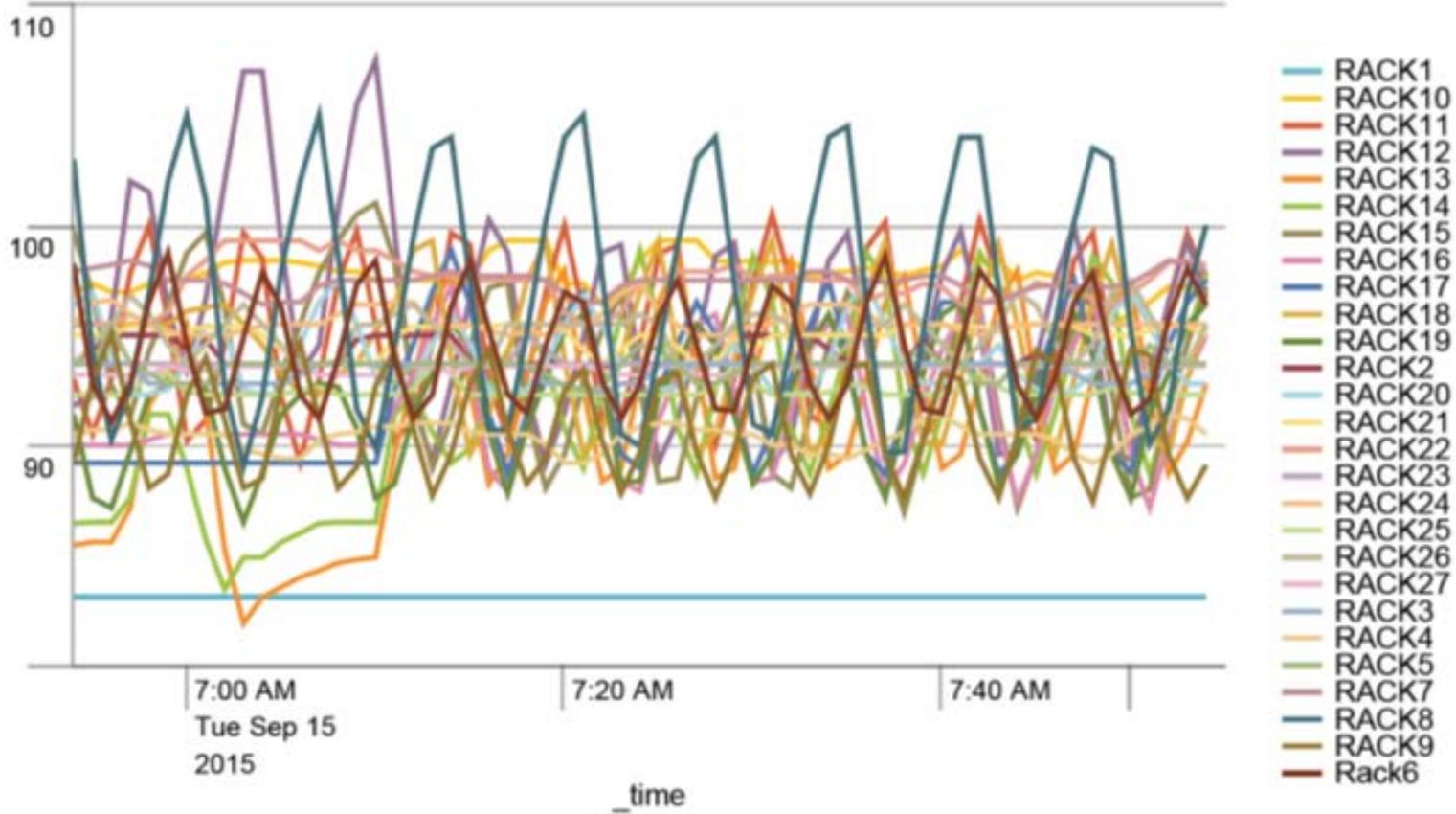
Sky Bridge – Server H2O Supply

Server Water Supply



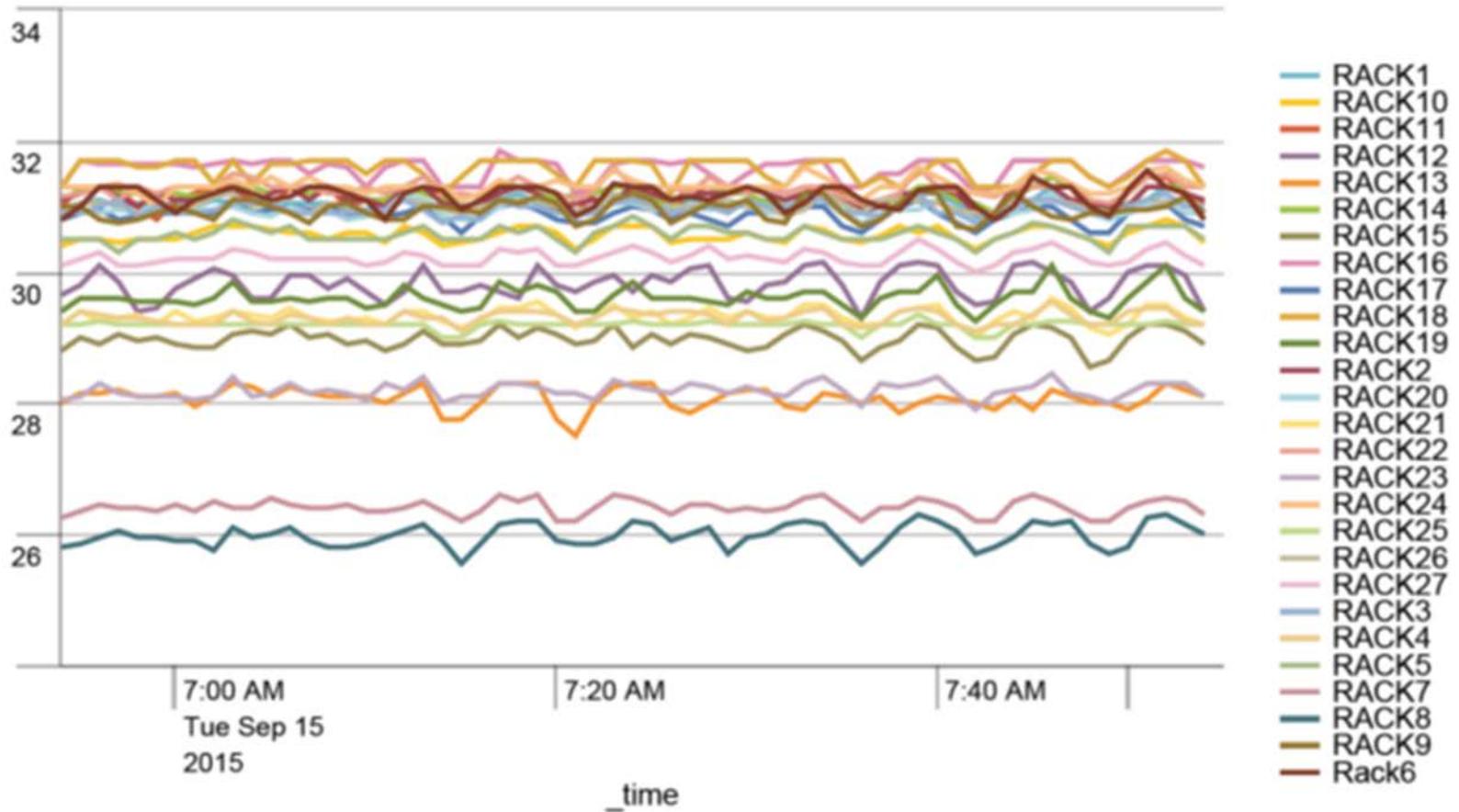
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Server Water Return



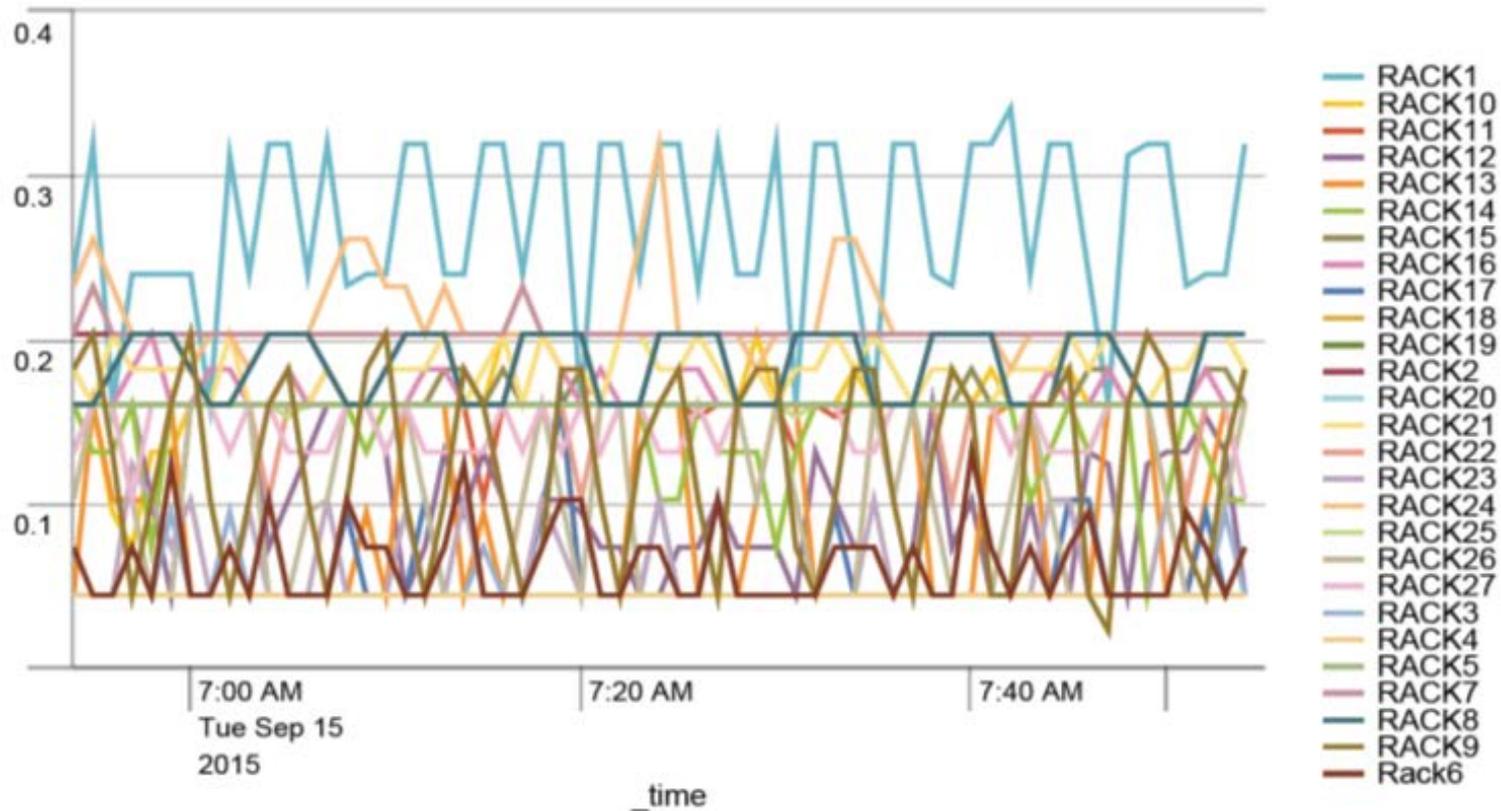
Sky Bridge – Facilities H2O Pressure

Facilities Water Pressure



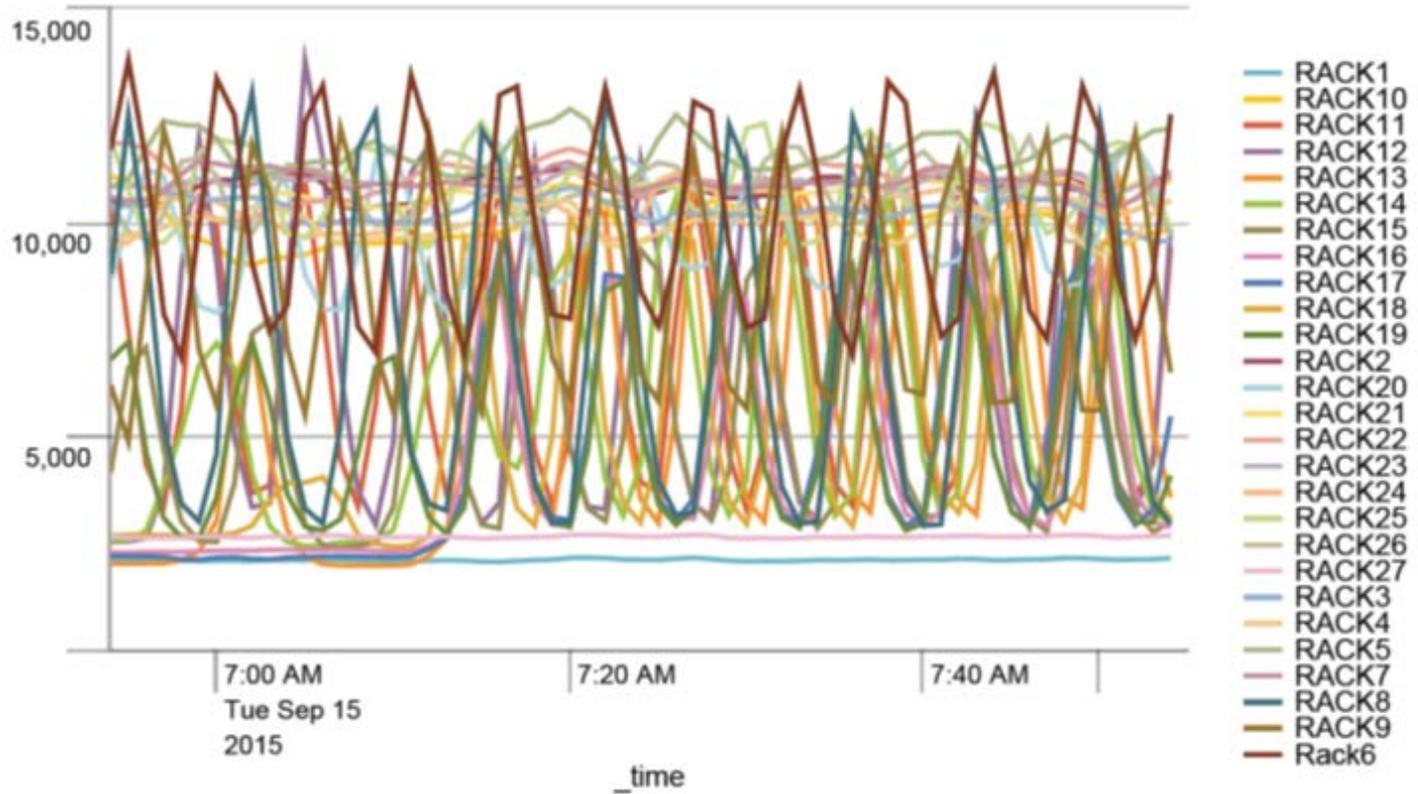
Sky Bridge – Server H2O Pressure

Server Water Pressure



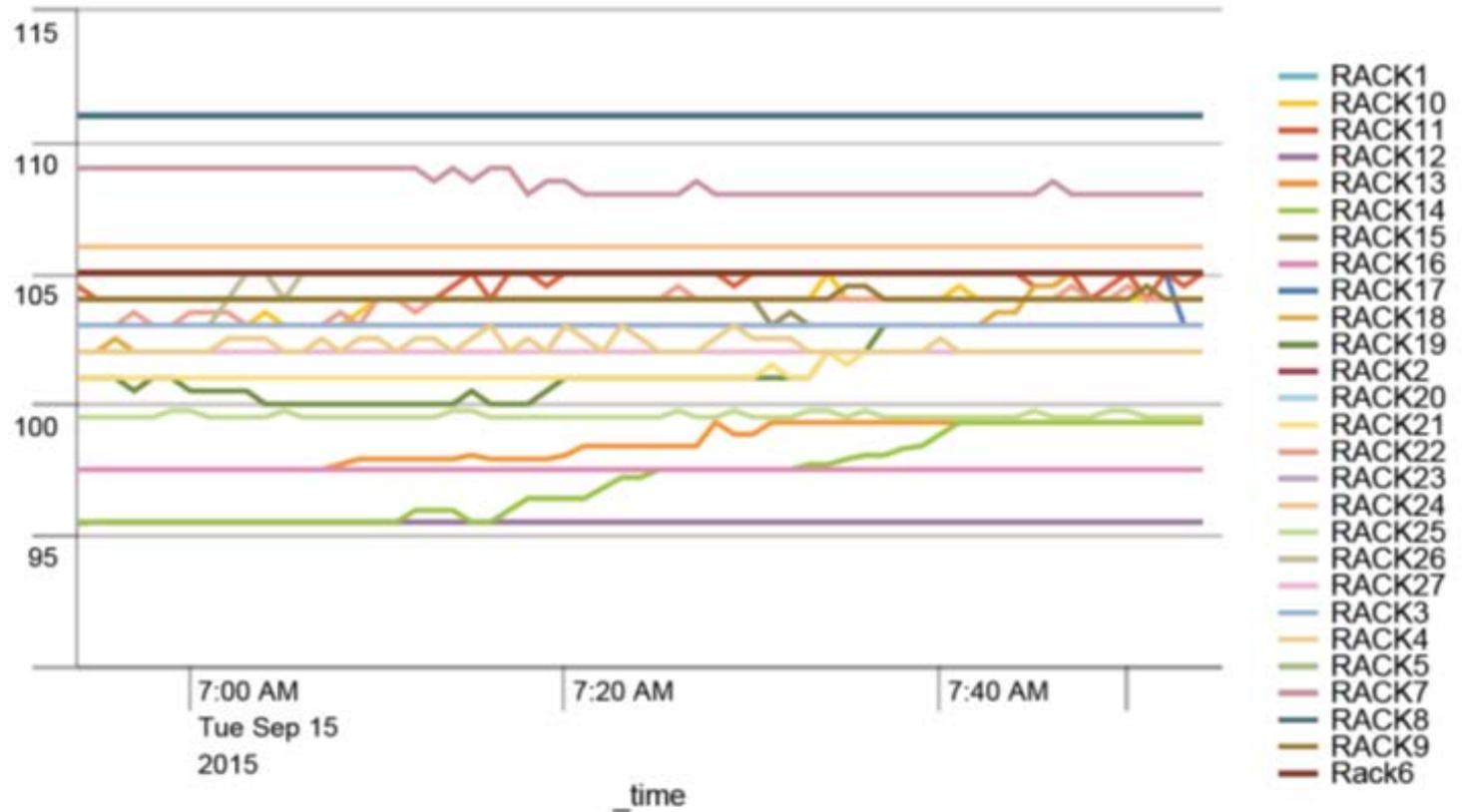
Sky Bridge – Heat Load

Heat Load



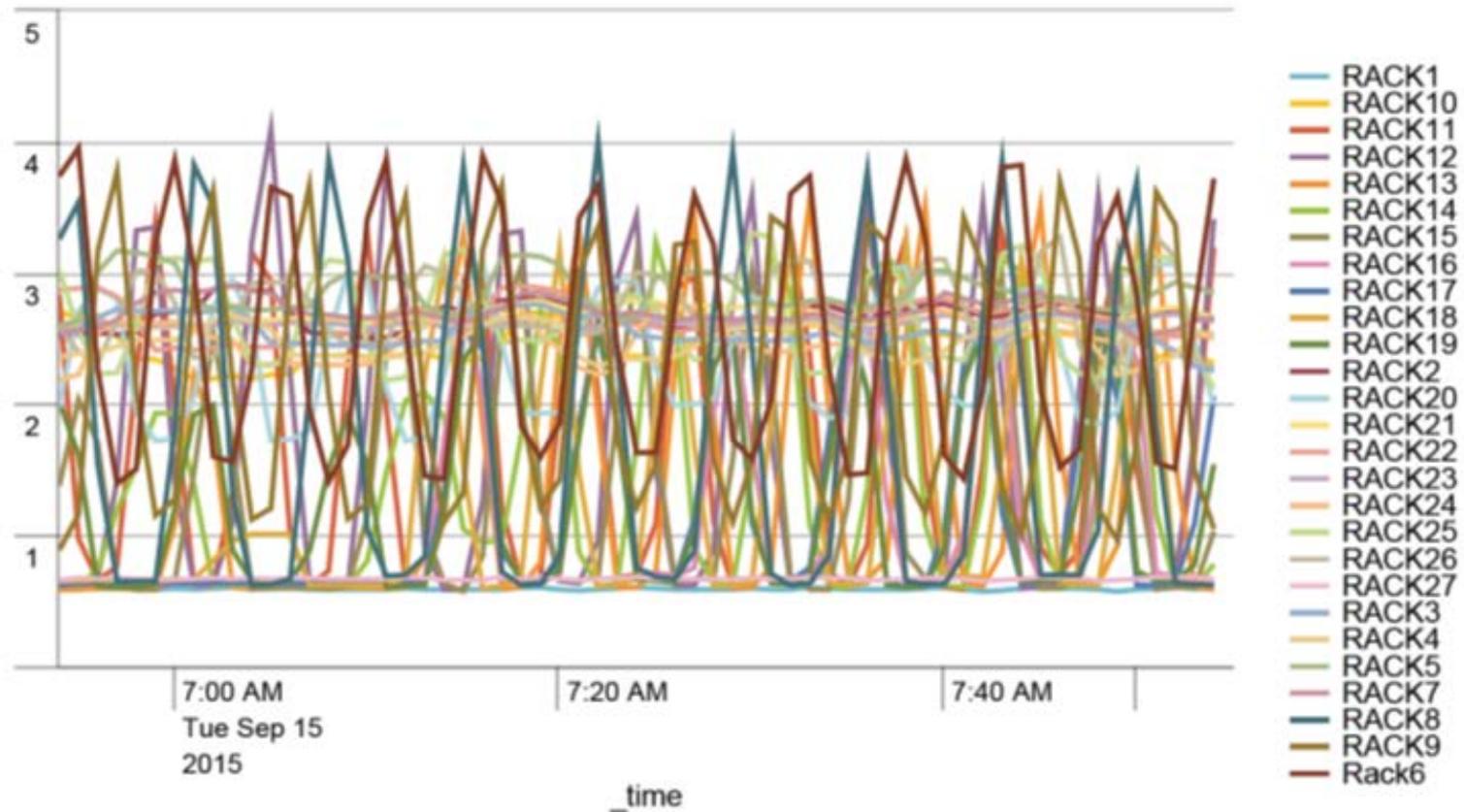
Sky Bridge – CDU Temps

CDU Temperatures

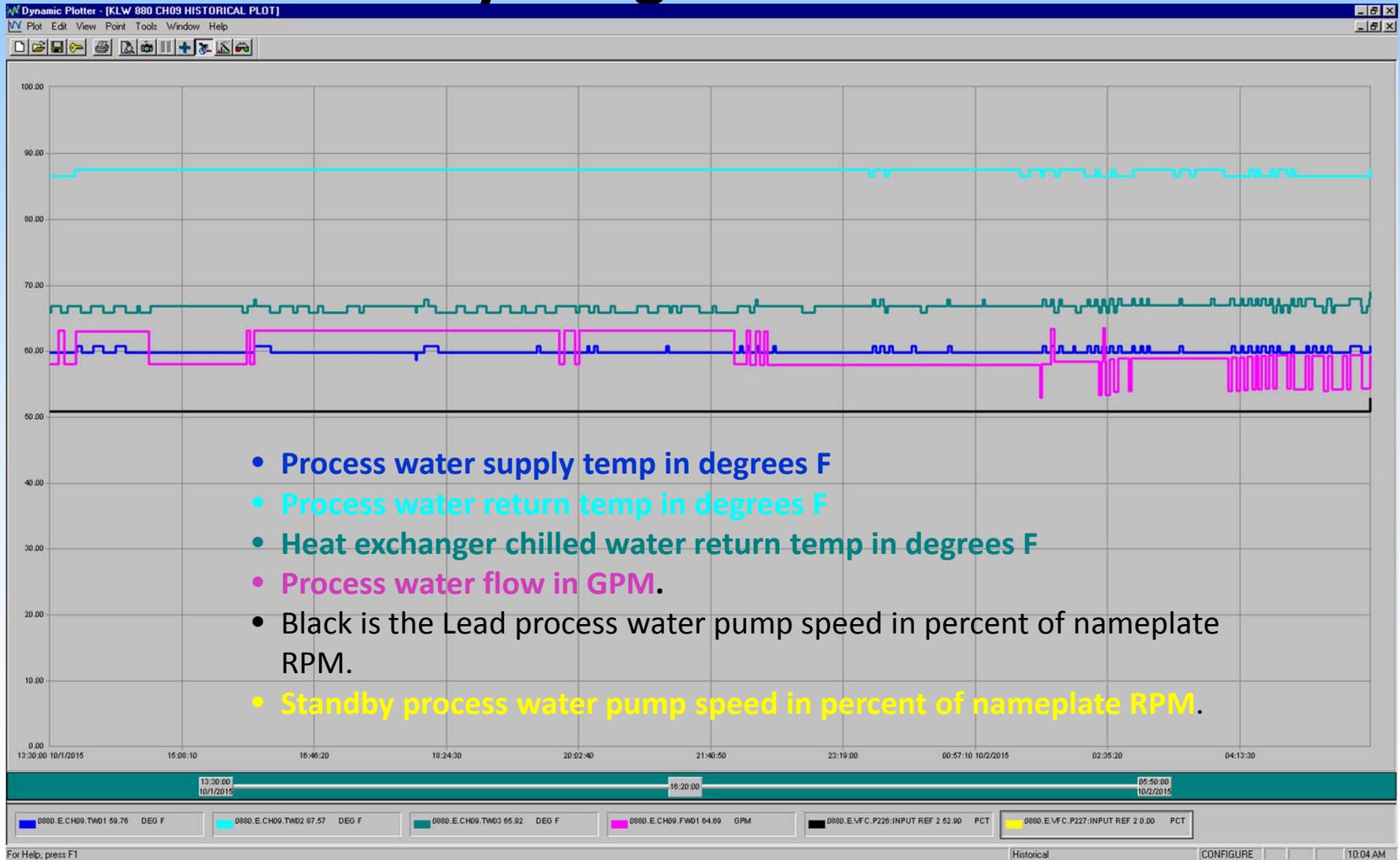


Sky Bridge – Rack Water Flow

Rack Water Flow



Sky Bridge – Chiller Plant



Future

- Increase usage of Plate Frame HX year round
- Trend points with both systems
- Integrated Controls systems
- Trend points with both systems
- Predictive solutions

