

# ***Model Predictive Control for small applications***

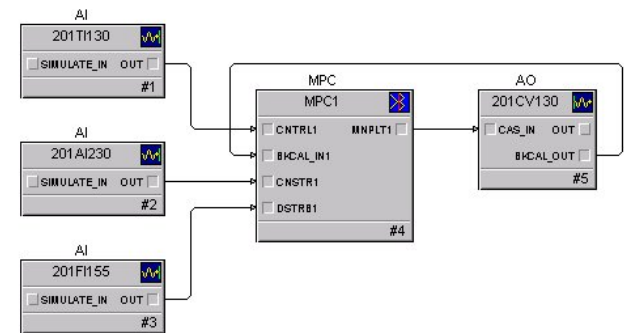
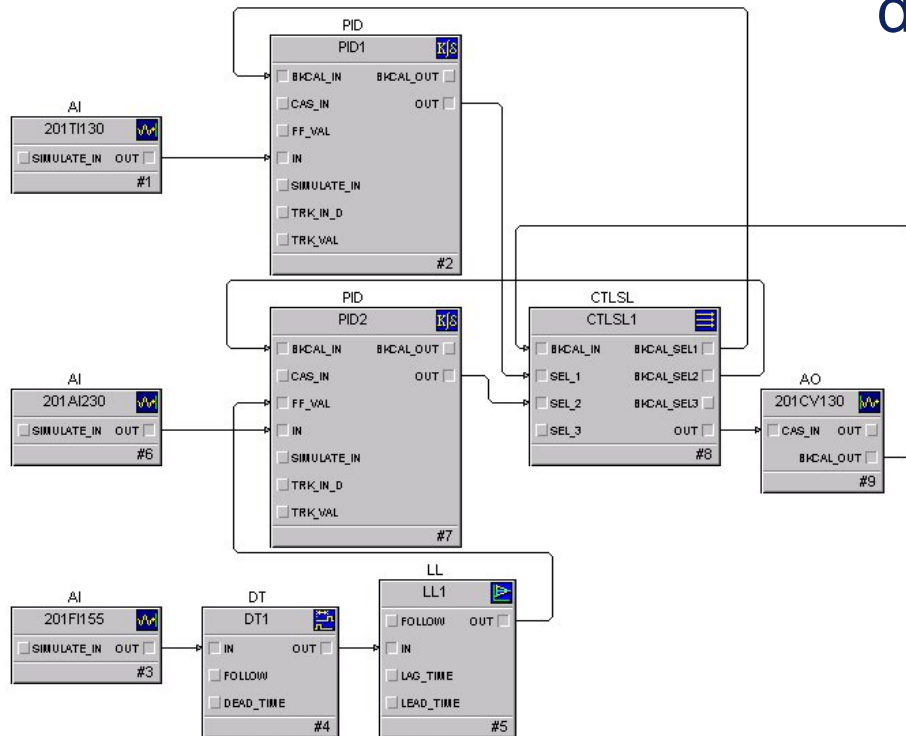
# ***Advantages of Model Predictive Control***

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- Automatically compensate for process interaction, measurable load disturbances and constraints using MPC function block.
- Difficult process dynamics may be effectively addressed e.g. deadtime dominant
- Allow production to be increased by automatically adjusting throughput to maintain a process at its input operating constraint.

# Multi-variable Control Made Easy

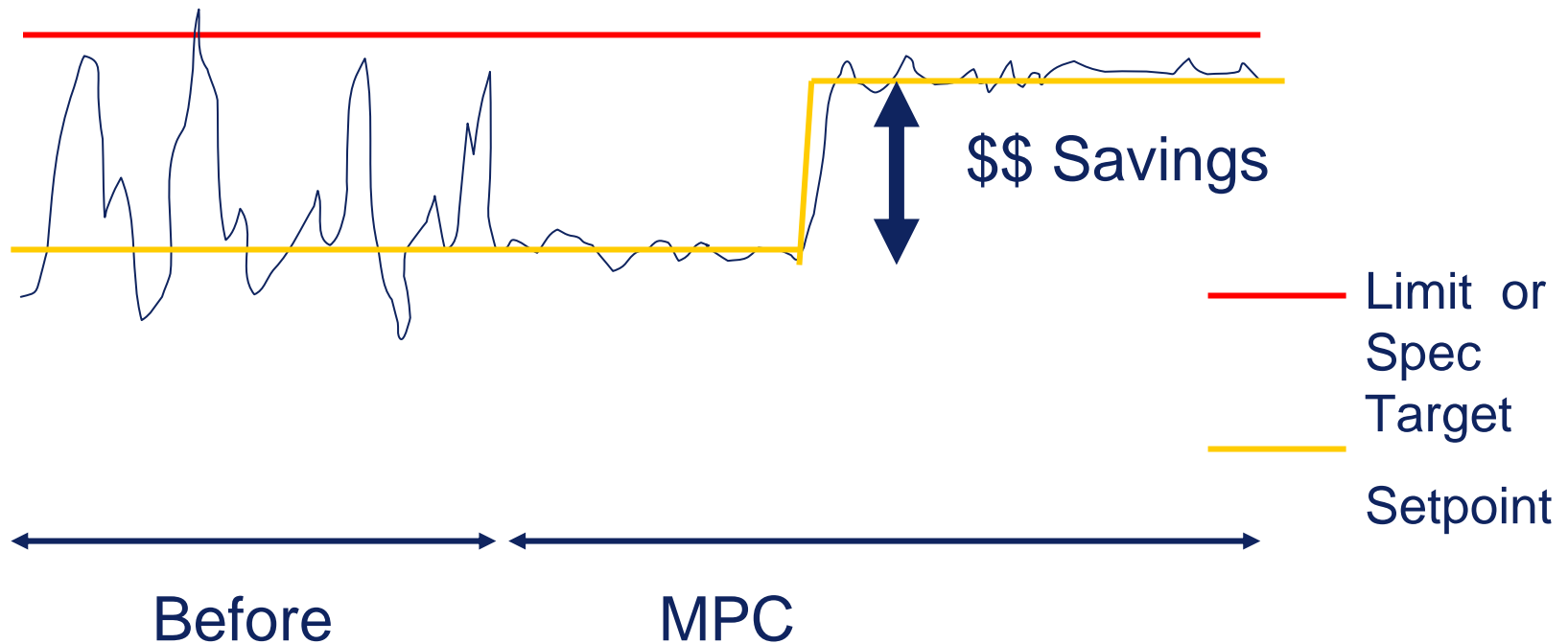
Example: Control loop with one disturbance and one constraint



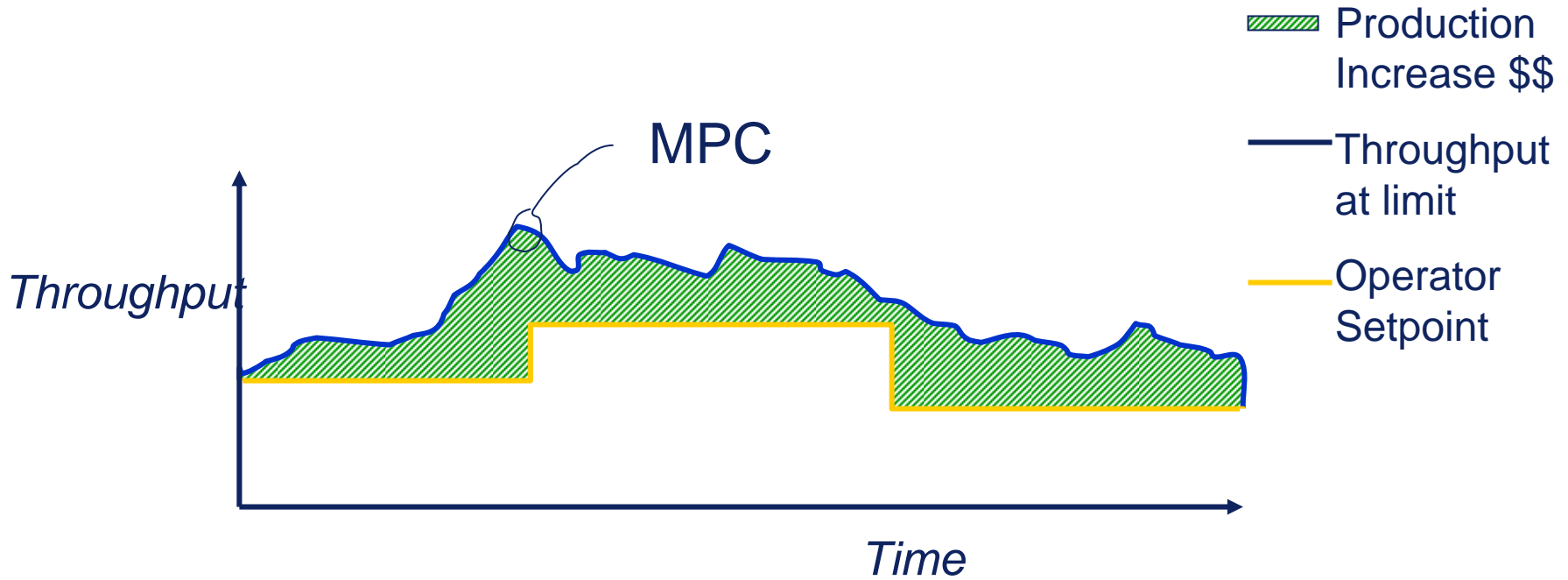
MPC

Traditional Approach

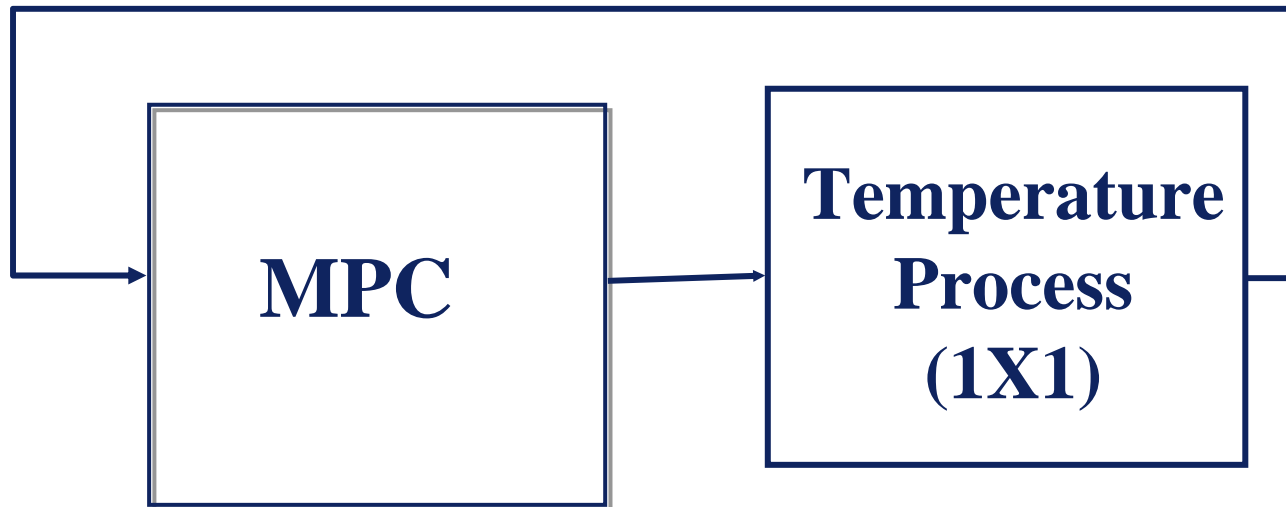
# ***Saving by Operating Closer to Product Specification or Operating Limit***



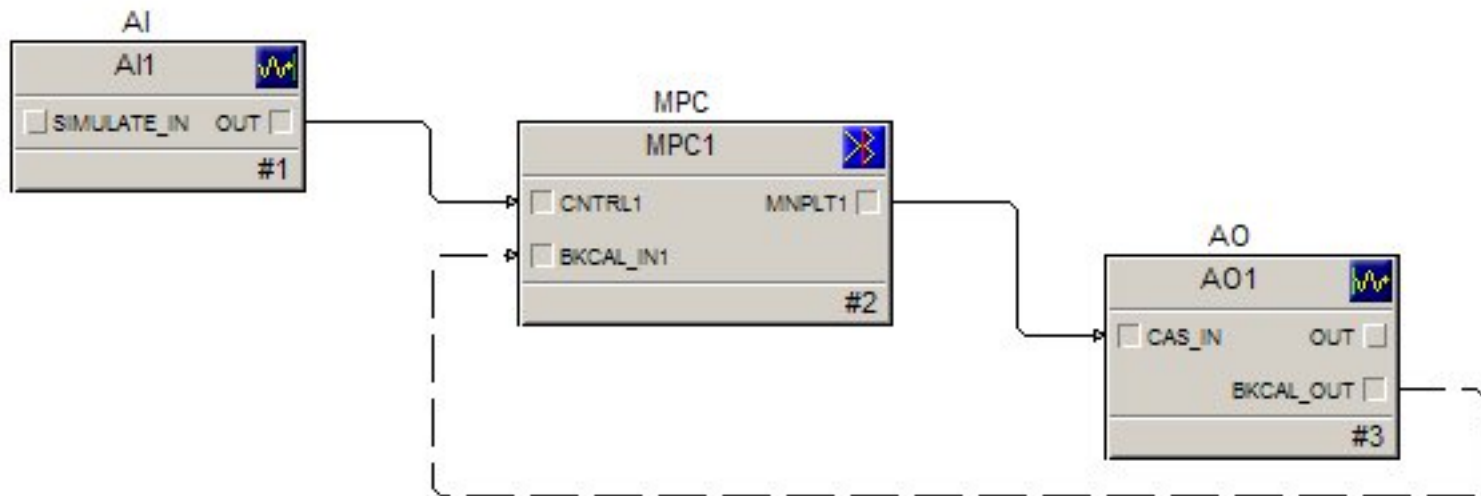
# Throughput May be Operating at Process Input Limit or Operating Constraint



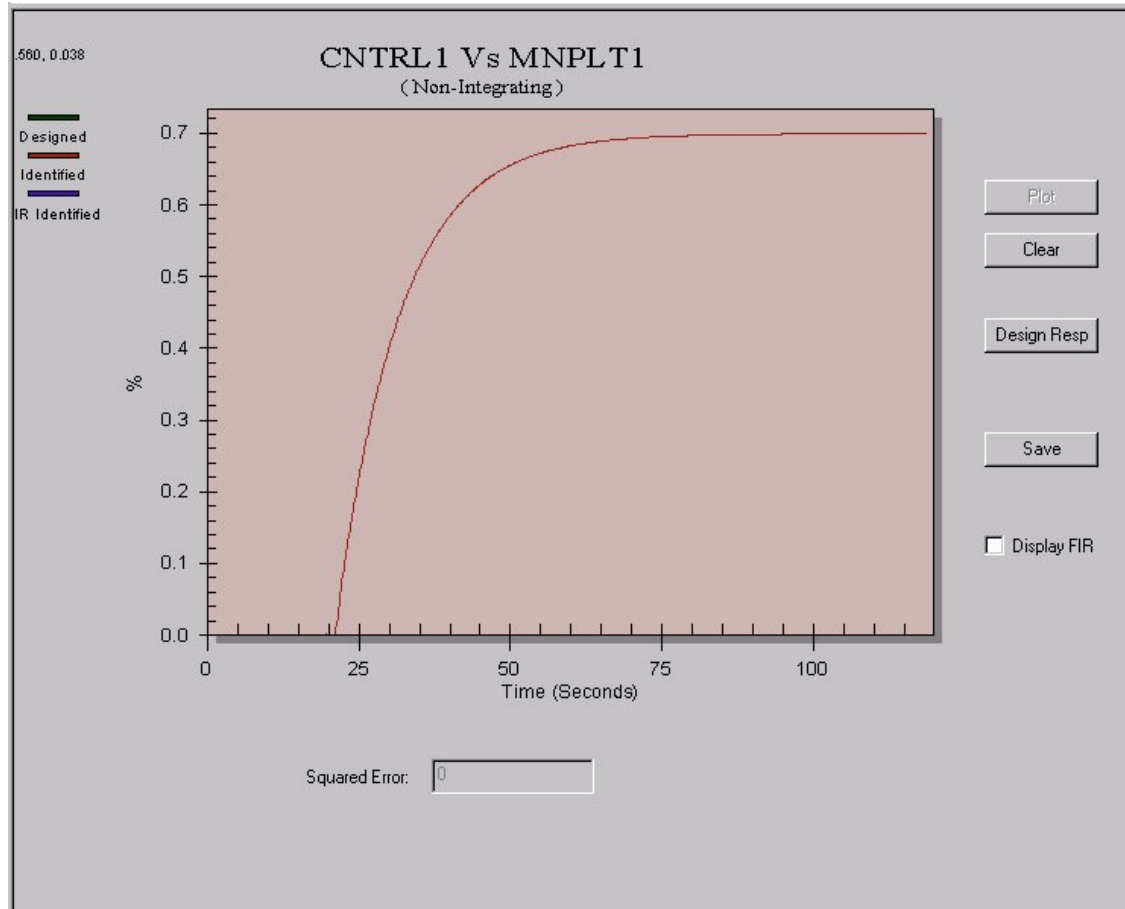
# ***MPC - Addressing Difficult Dynamics***



# MPC -Addressing Difficult Dynamics

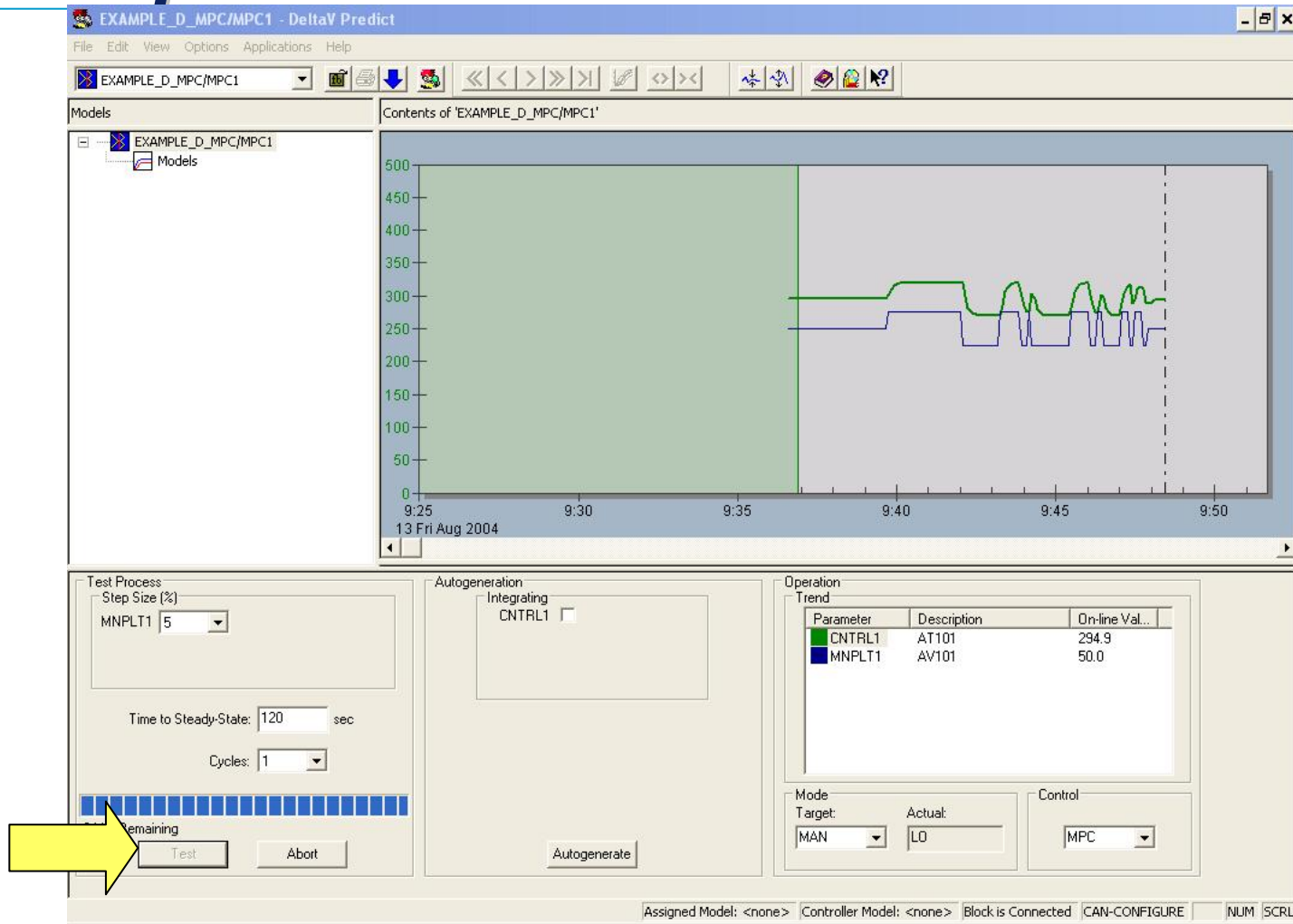


# MPC -Addressing Difficult Dynamics

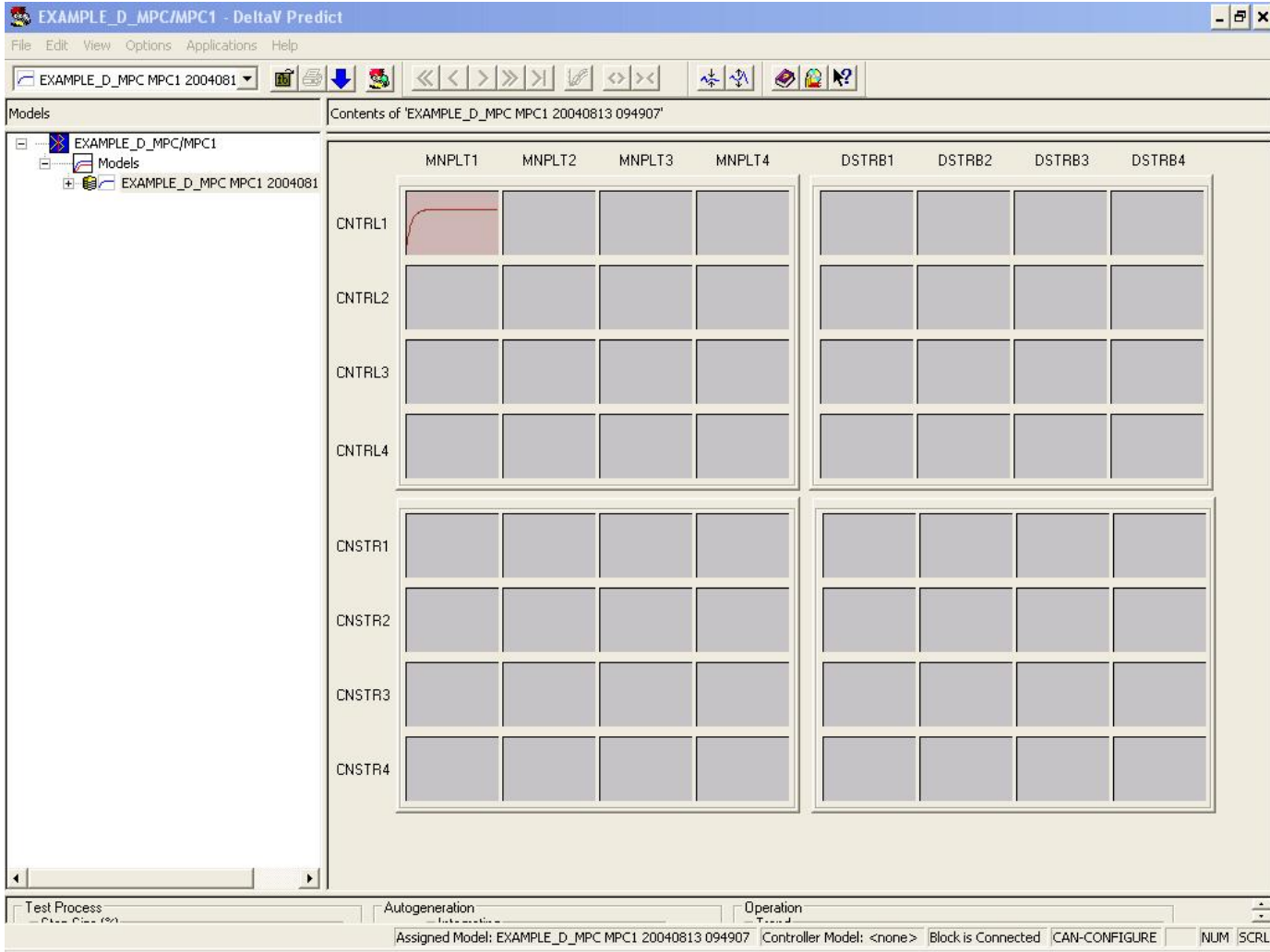




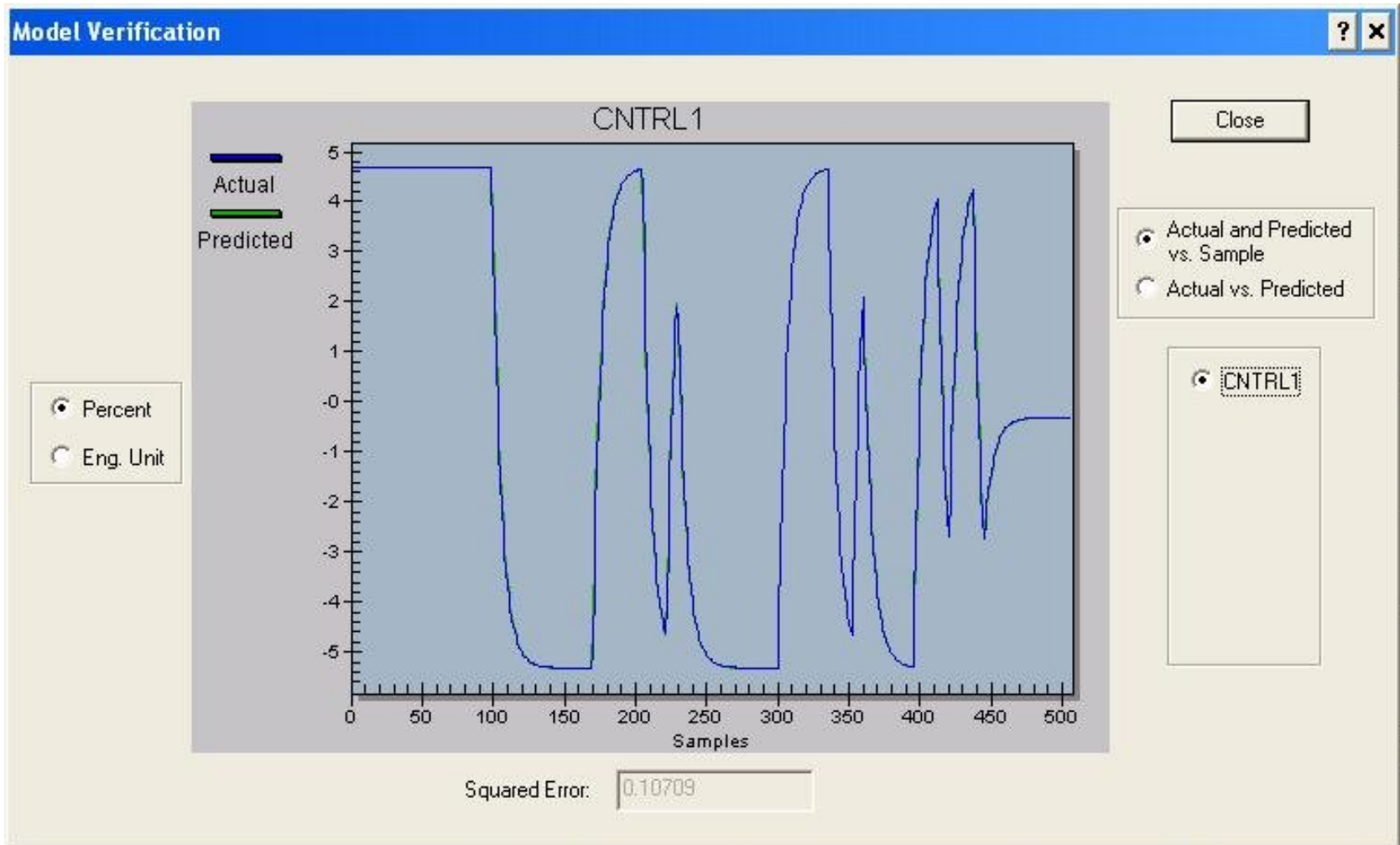
# Automated process testing to identify the process model



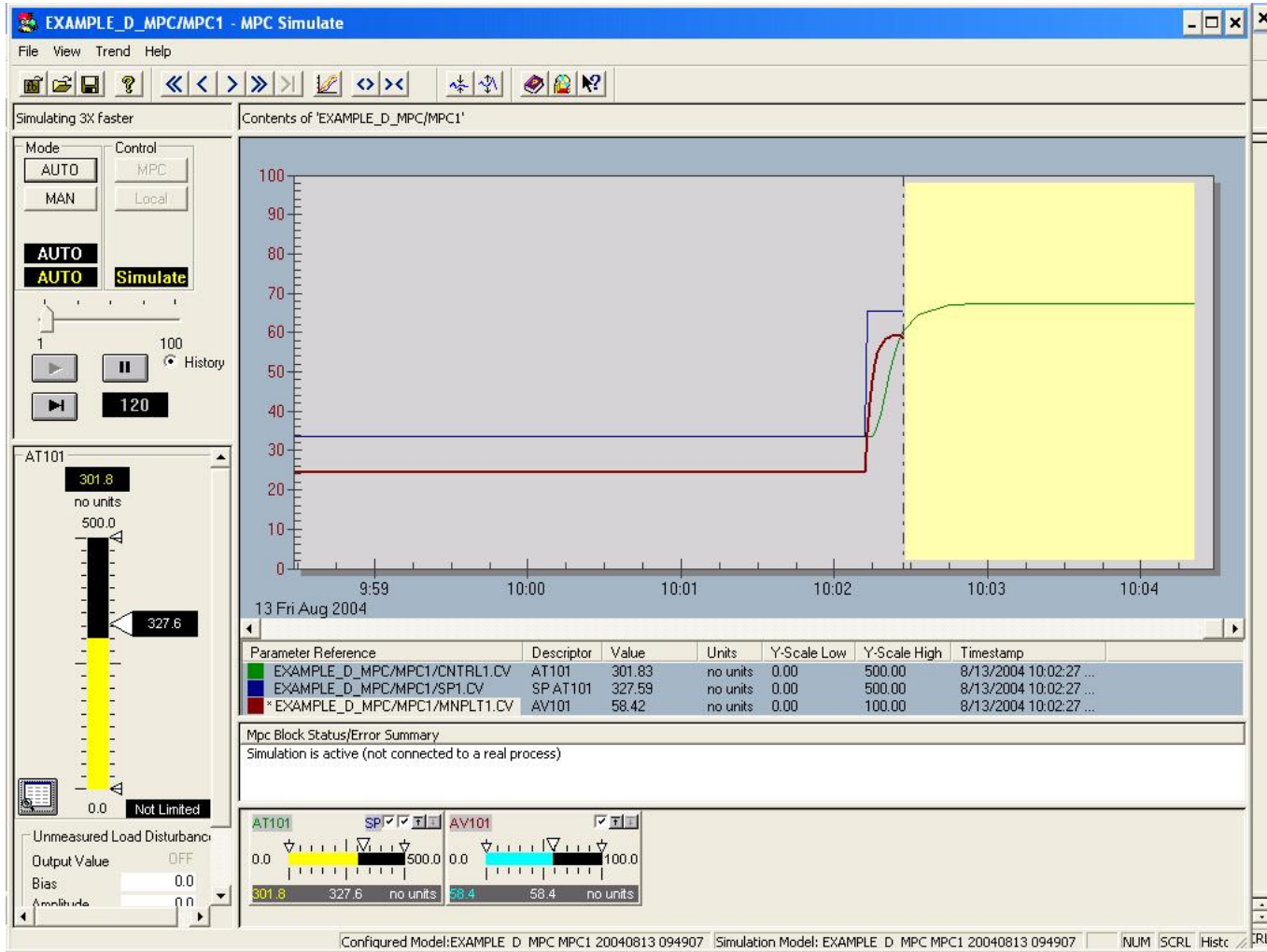
# Step Response Model



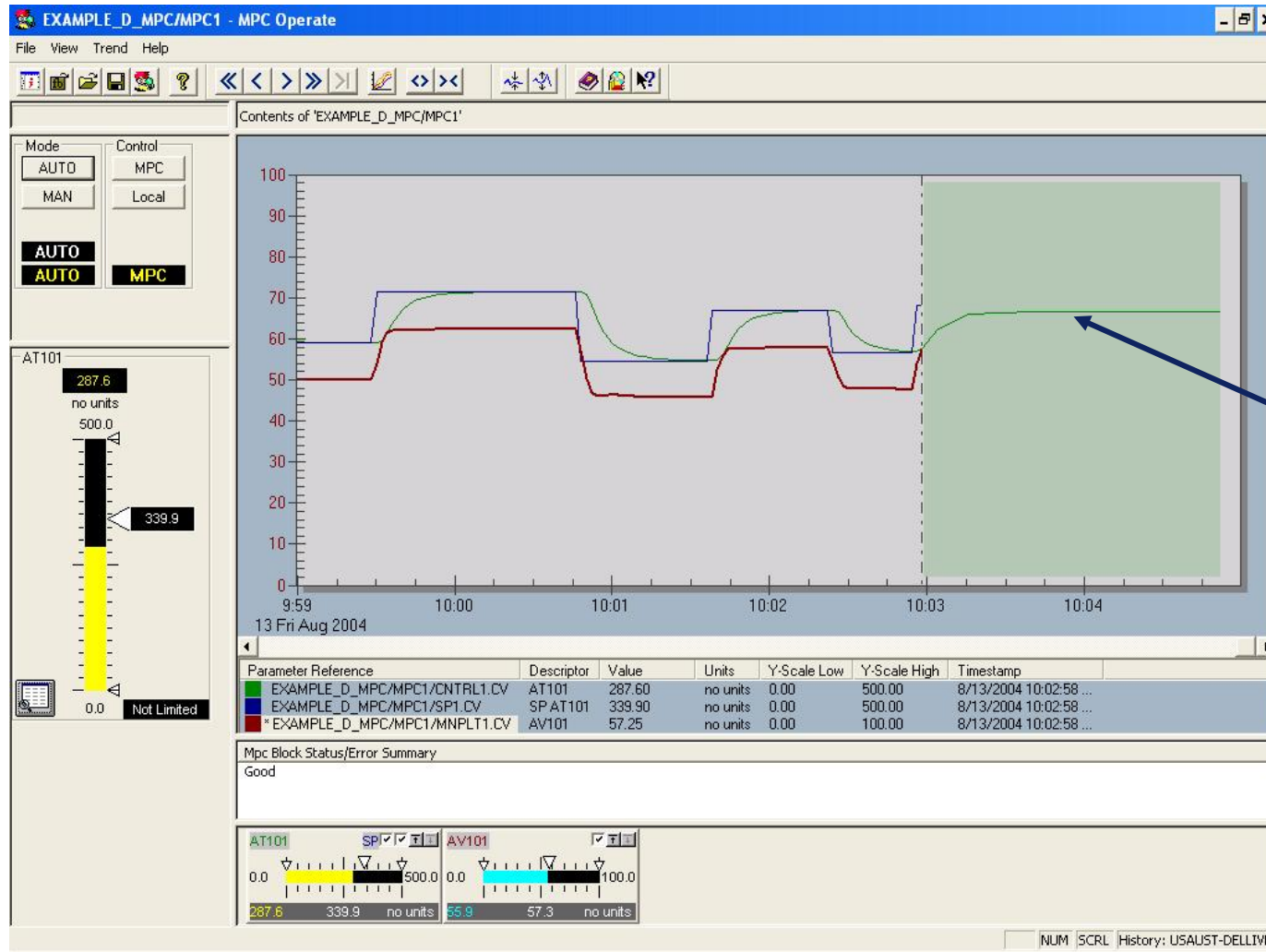
# Verification of identified model



# Testing of control using simulated environment

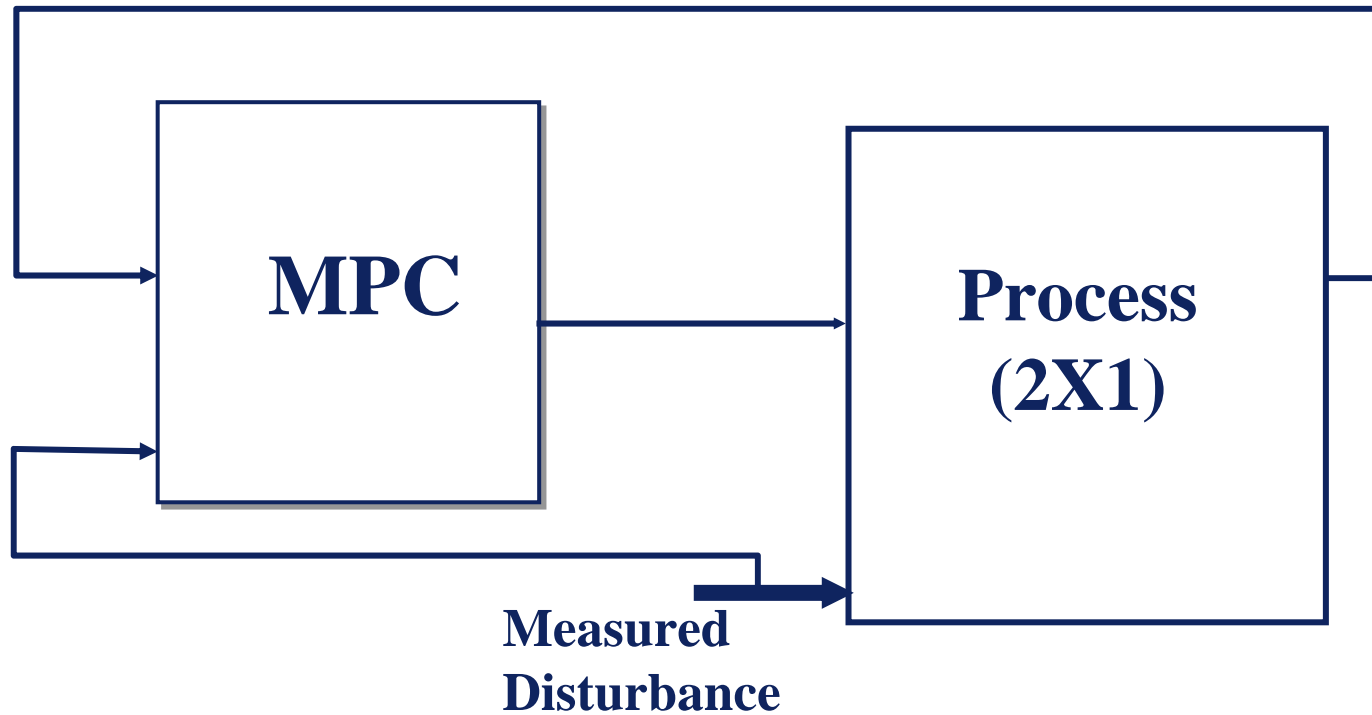


# Example Operator interface to MPC

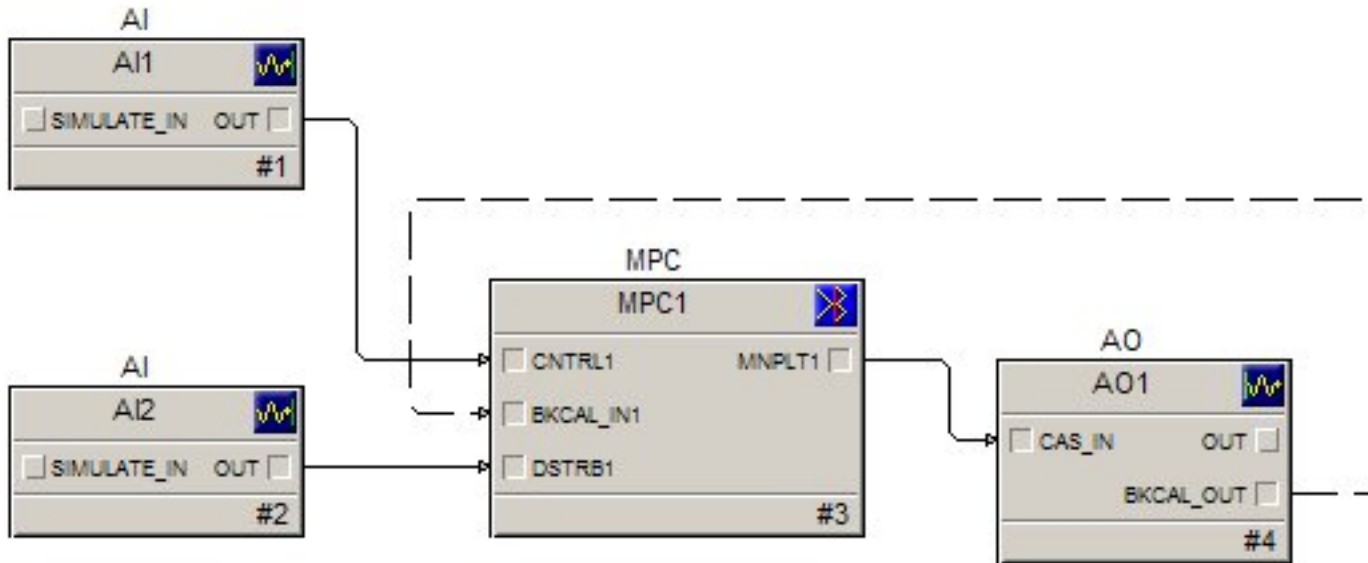


Future Values of control

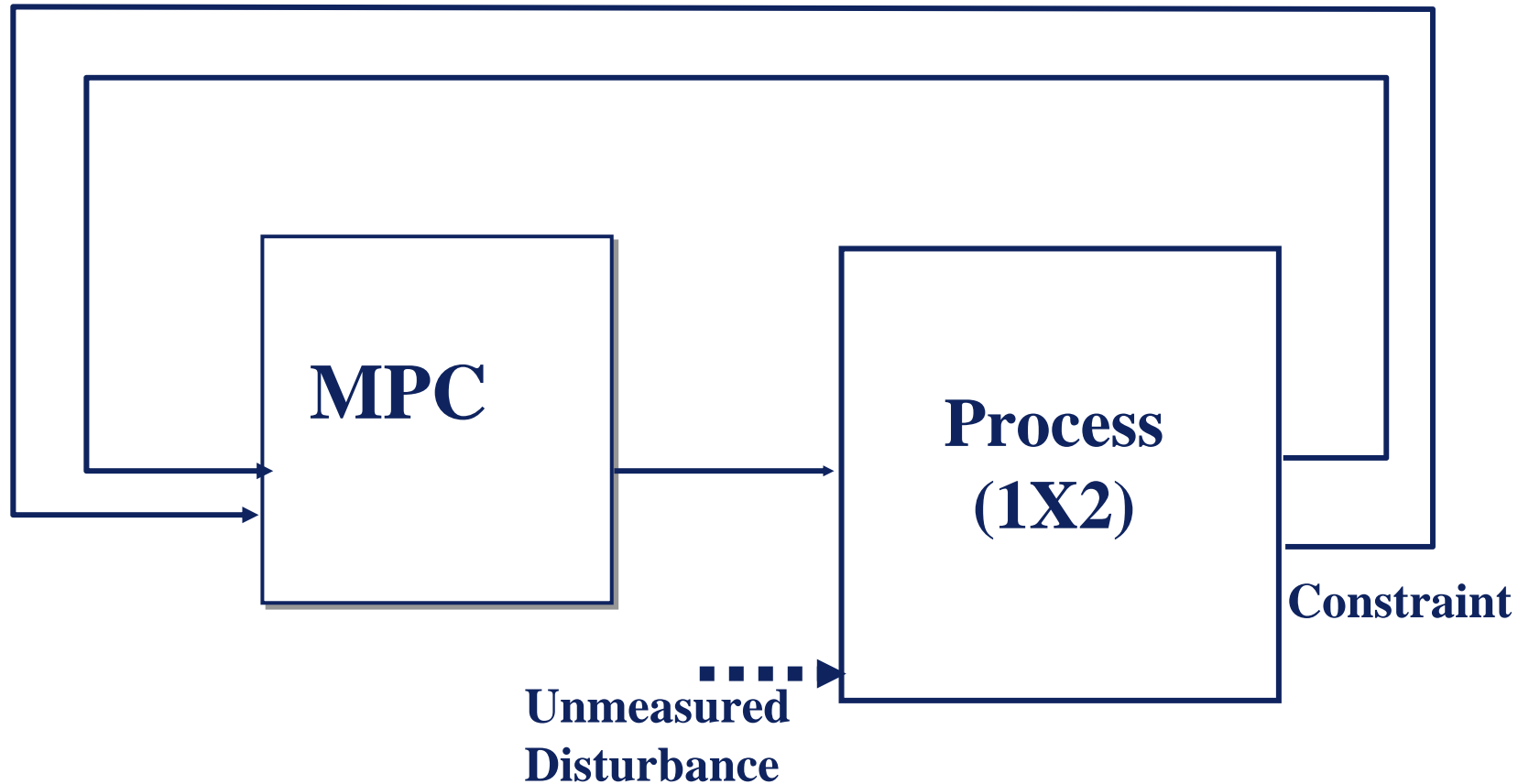
# ***MPC Replacement for PID with Feedforward***



# MPC Replacement for PID with Feedforward

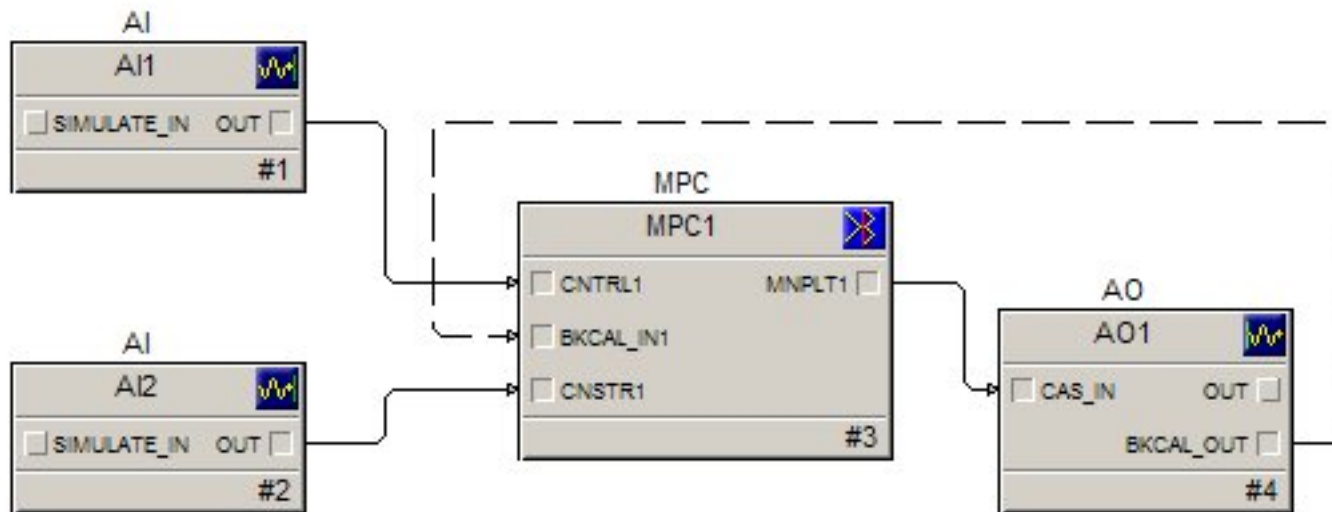


# ***MPC Replacement for PID Override***

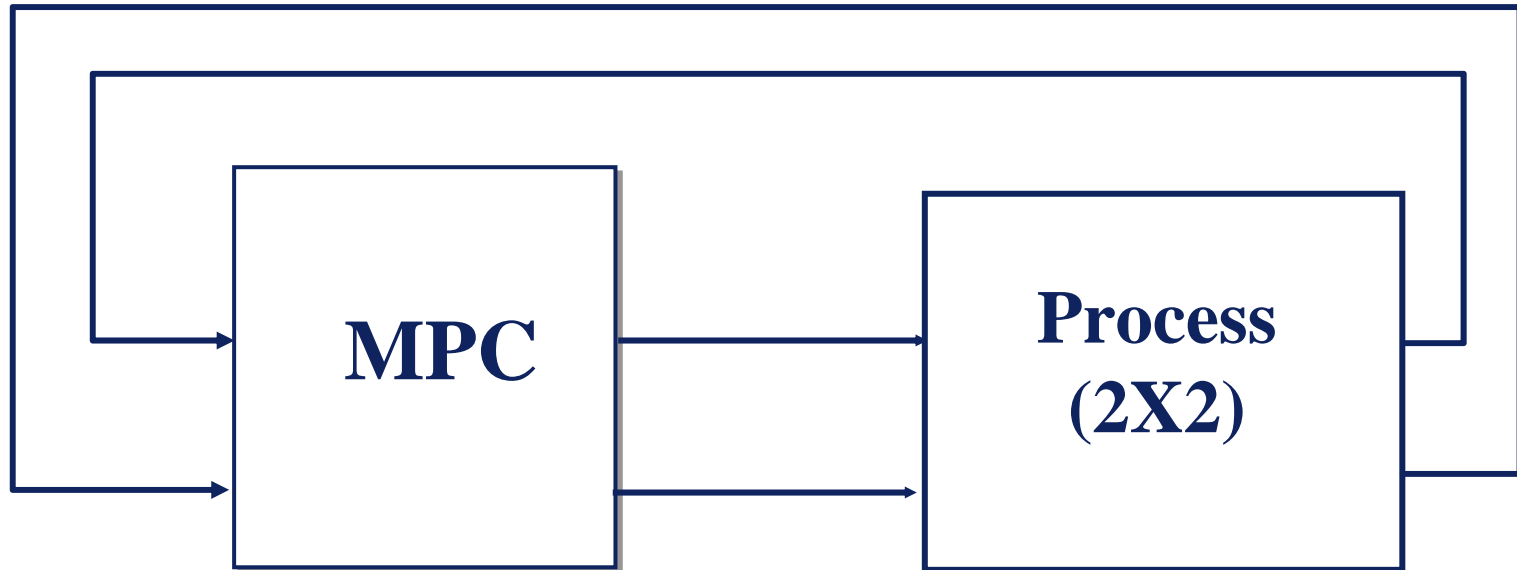




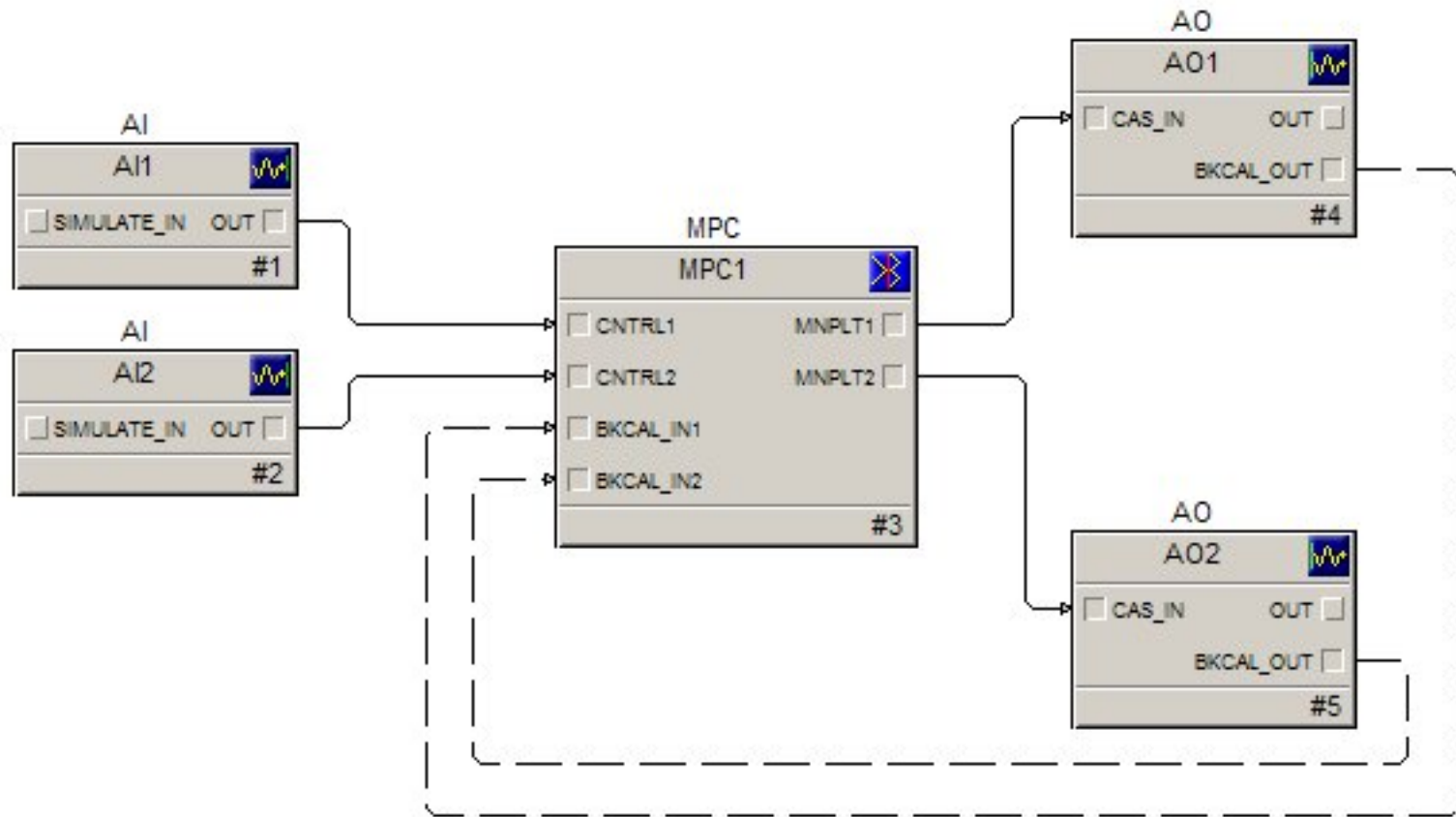
# MPC Replacement for PID Override



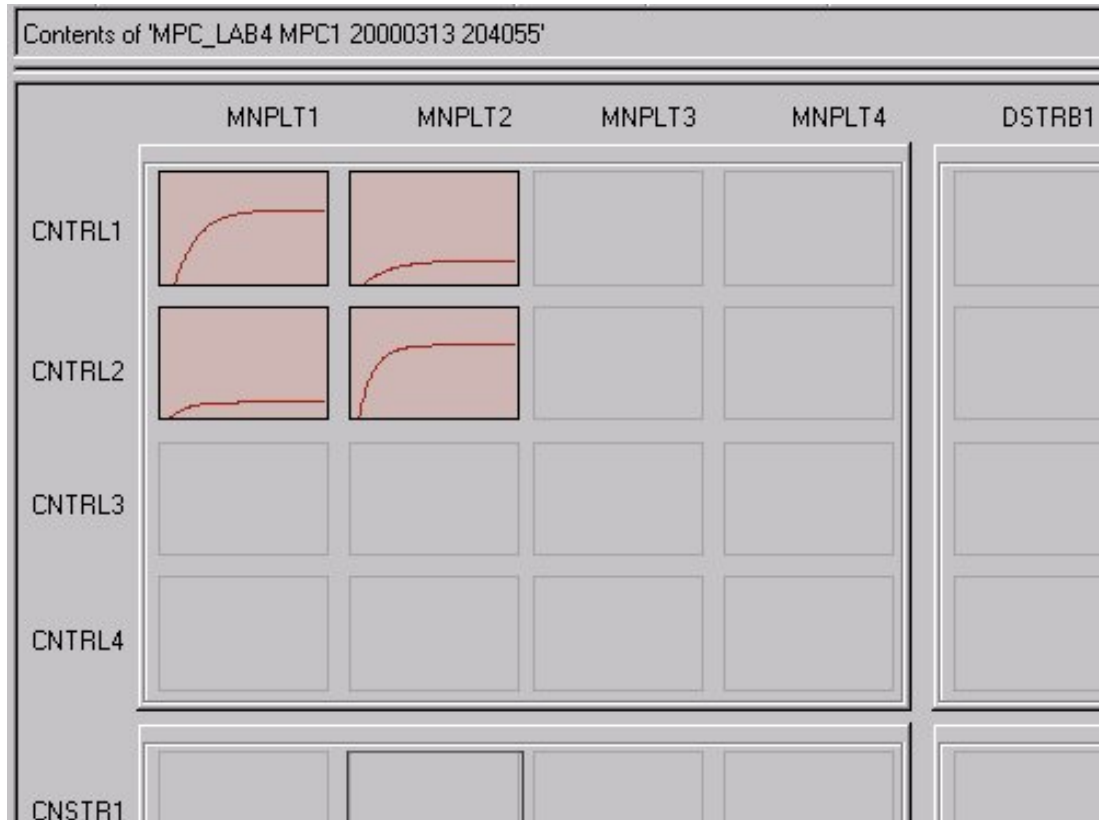
# Addressing Process Interaction



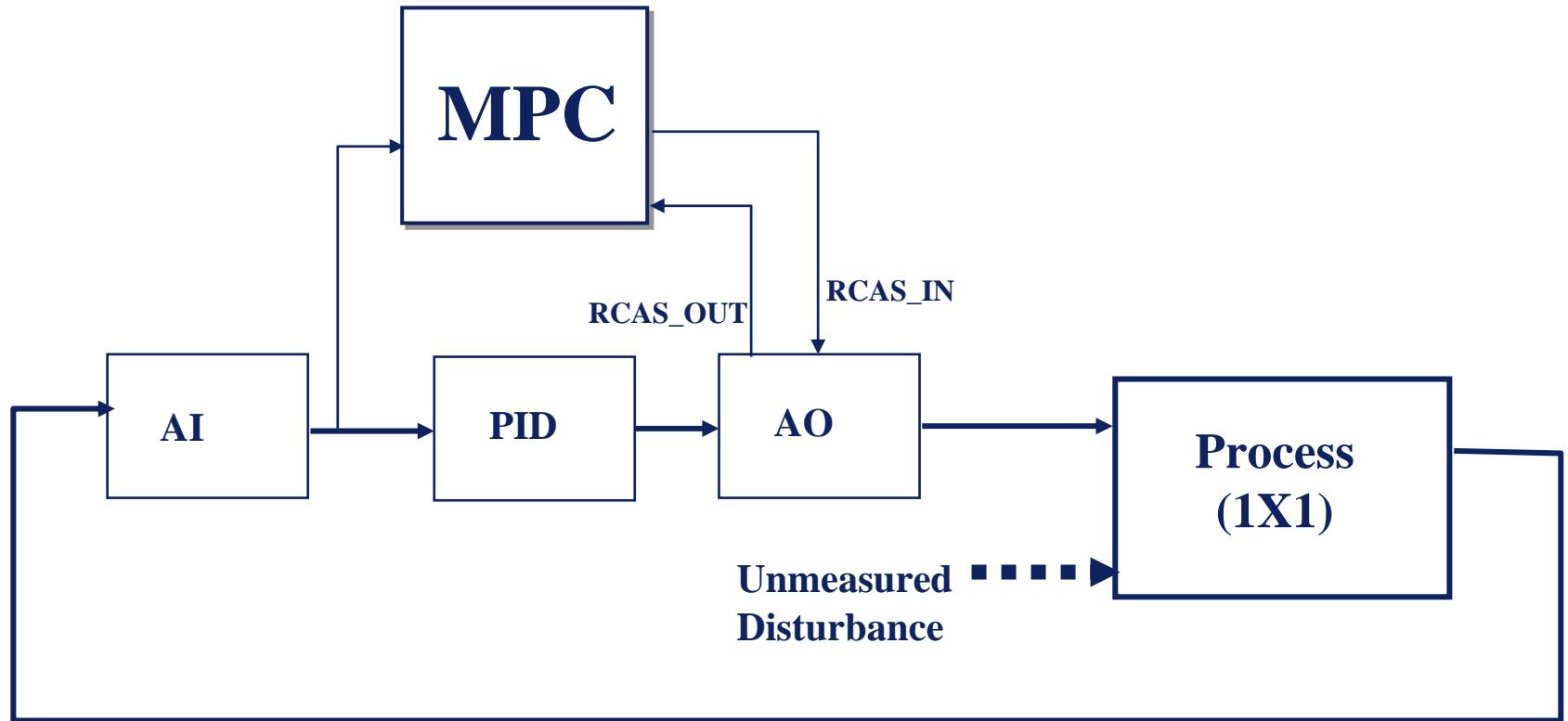
# Addressing Process Interaction



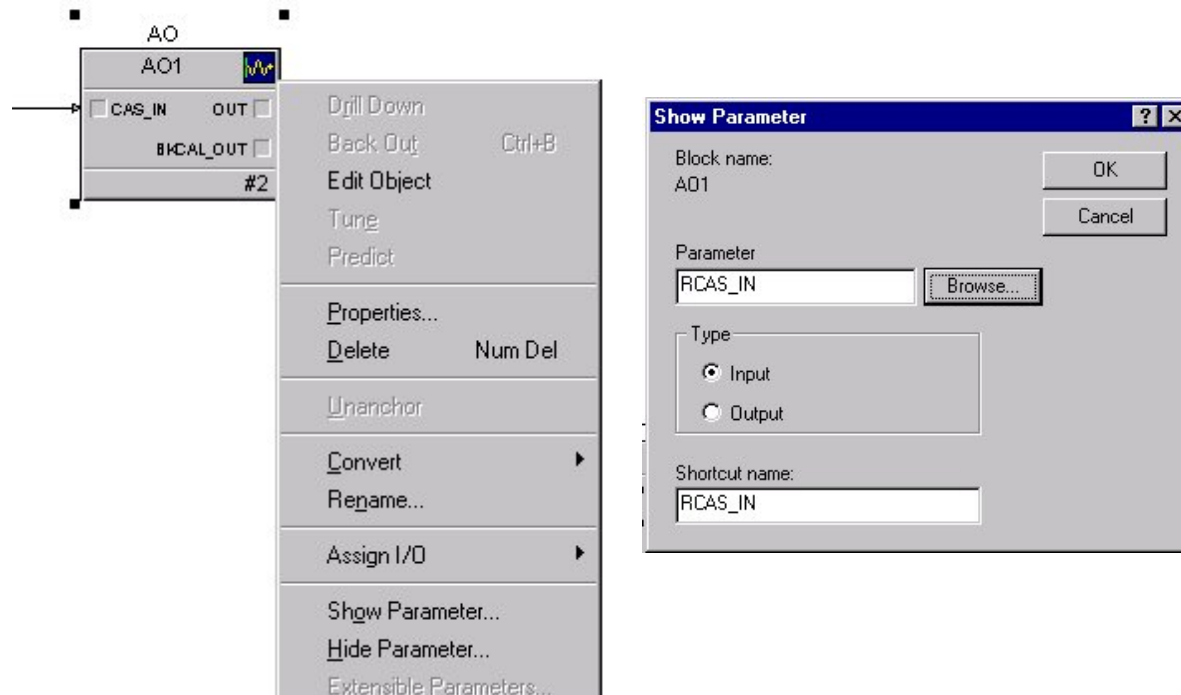
# Addressing Process Interaction



# Layering MPC on Existing Strategy

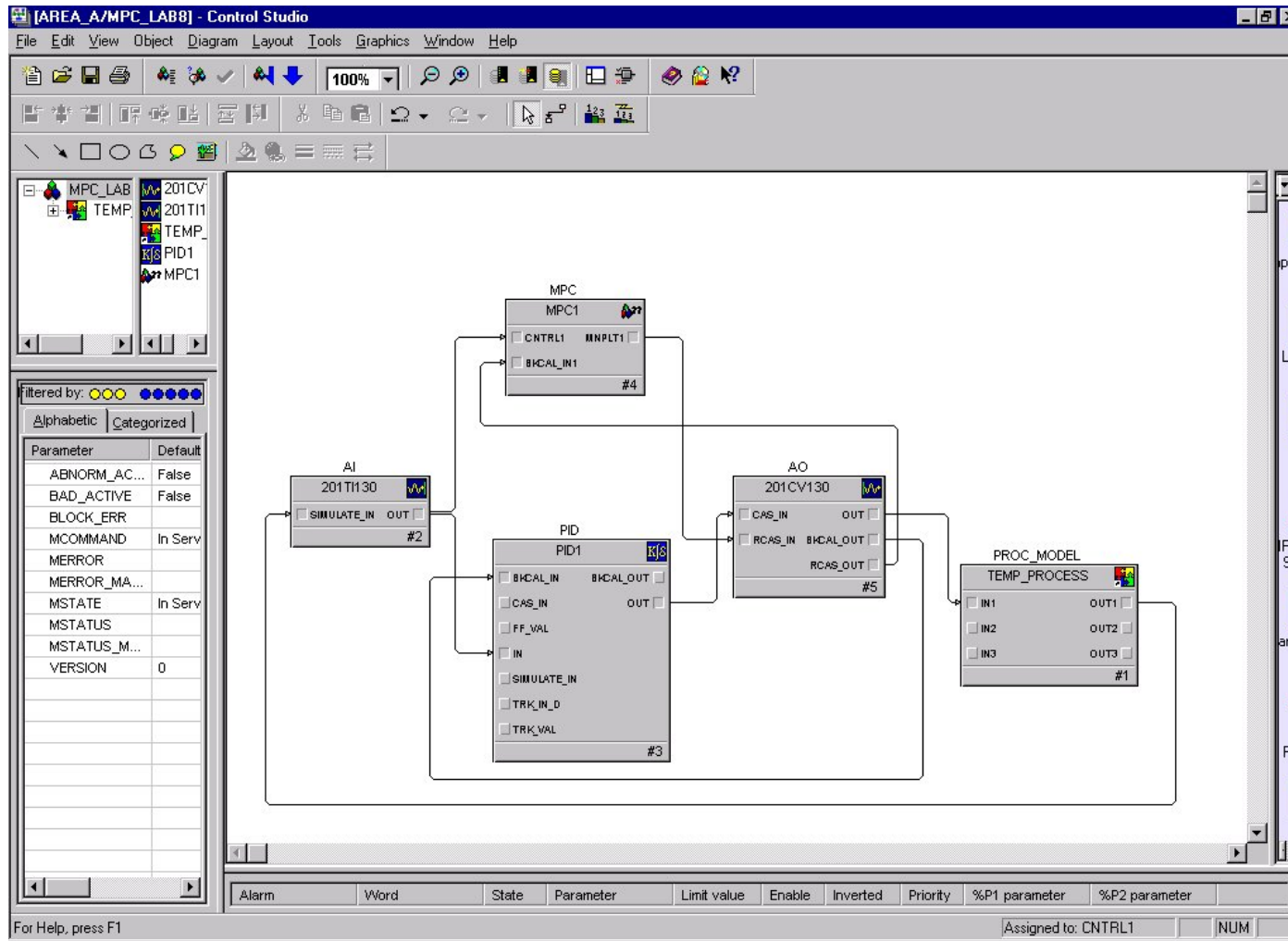


# Exposing RCAS\_IN & RCAS\_OUT



Right click on the control or AO block to expose the RCAS\_IN as an Input parameter and RCAS\_OUT as an Output parameter.

# Layering MPC on an Existing Strategy



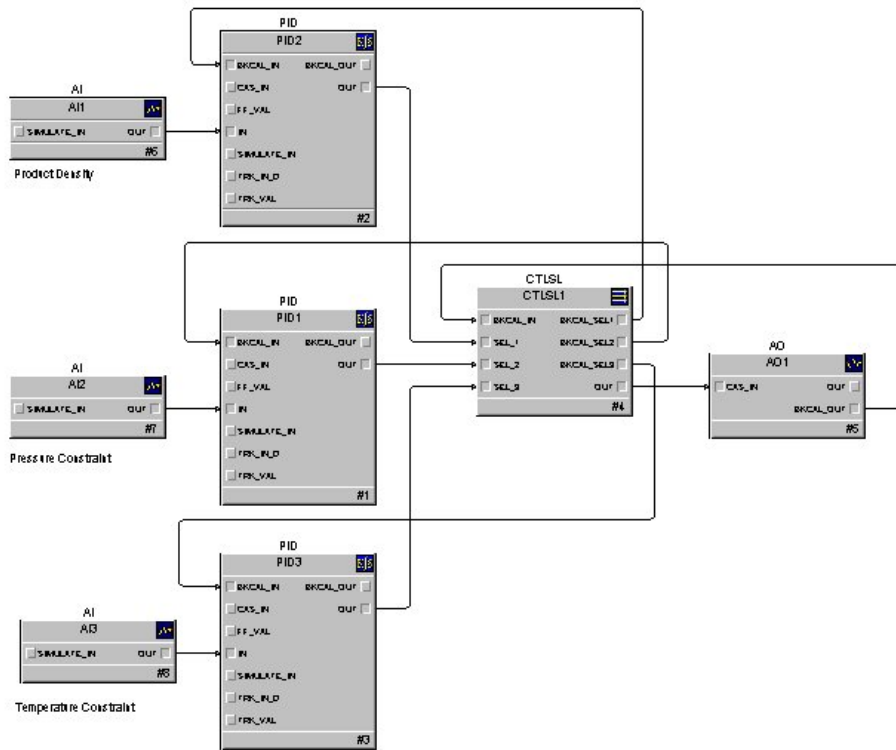
# ***Example - Long-tube Rising Film Evaporator***



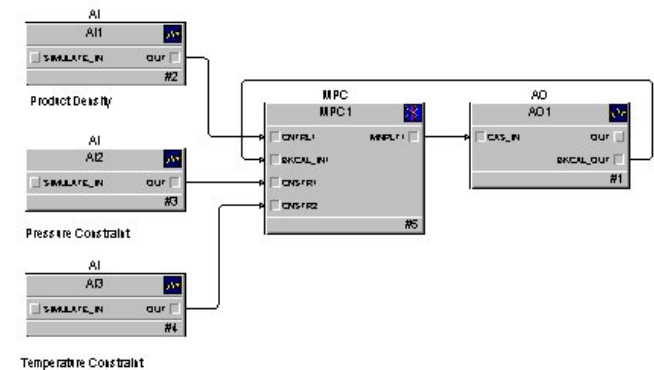
- Feed enters the bottom of the heating tubes and as it heats, steam begins to form.
- Usually there must be a rather high temperature difference between the heating and boiling sides
- Extensively used for food, pharmaceutical, and many industrial applications.



# Evaporator Products Solids Control With Temperature and pressure Constraints



Traditional Strategy - 3 PID's and Control Selector Blocks



Predict Strategy - 1 MPC Block

# *Installation Experience*

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- 5 Evaporator units commissioned to-date using DeltaV Predict
- Much faster to config! Much easier to Tune. No de-coupling of loops, *13 minutes* and your done!
- MPC is easier to manipulate from startup SFC's. This is a no-brainer, manipulating the mode of one block would always be easier than four.
- Simple and easy to use!!!!!!!!!!!! No grey matter needed!

# *Installation Experience*

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- Operators love the MPC Operator Display. Evaporator Graphics are less cluttered with one MPC, than 3 PID dynamo's
- MPC operator interface is much more simple and easier to use. On the older plants with override control the operators never know which of the 3 loops is controlling the final control element. They never know if they are constraining the plant via temp or heater pressure and therefore sometimes run the process at lower throughput rates than they need to **\$\$\$\$\$\$\$**.