ADVANCED PROCESS MODELLING FORUM

TOWARDS A "WATER NEUTRAL" IMF FACTORY USING DYNAMIC MODELLING

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Nutricia Research
February 28th, 2017

DANONE NUTRICIA
Early Life Nutrition

PSE

NUTRICIA RESEARCH

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CONTENTS

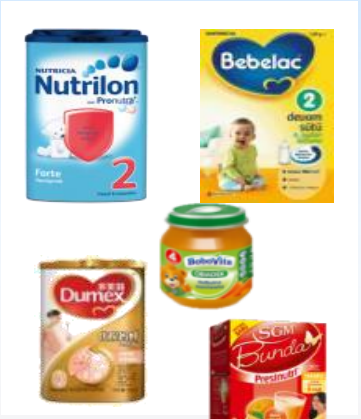
- Company background
- New fermentation line in Ireland
- How we use gPROMS in Nutricia
- Outline of an IMF process
- How to enable users to model a dynamic process

4 DANONE DIVISIONS

Fresh Dairy

Water

Early Life Nutrition



Medical Nutrition

A PORTFOLIO OF PRODUCTS FOR LIFE LONG HEALTH

Growth/ Building Health | **Maintaining Health** | **Ageing Well/ Problem solving**

THE FIRST 1,000 DAYS OF LIFE ARE CRUCIAL ……

-9 to 0 m

Pregnancy

0 to 6 m

Lactation

6 to 12 m

Solid food introduction

> 12 m

Young child development

…….. to build the child's best health foundations

120 YEARS OF RESEARCH AND DEVELOPMENT

1896

Martinus and Jan van der Hagen produced the first infant milk formula, based on research by Prof. Backhaus in Germany

1905

First Medical Nutrition for diabetic patients

1923

First Nutritional guidelines for infants and patients

1946

First Research Centre for Baby and Medical Nutrition in Zoetermeer

1997

Expansion and relocation to Wageningen

2013

Innovation centre moves from Wageningen to Utrecht Science Park

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INTRODUCTION

Previous APMF

- Design of fermentation line
- Roll-out of gPROMS within Nutricia

Goal of today's presentation

- Share how Nutricia models non-continuous processes
- Illustrate how Nutricia is addressing the challenge of rolling out custom gPROMS models to a wider audience (engineering, operations etc.)

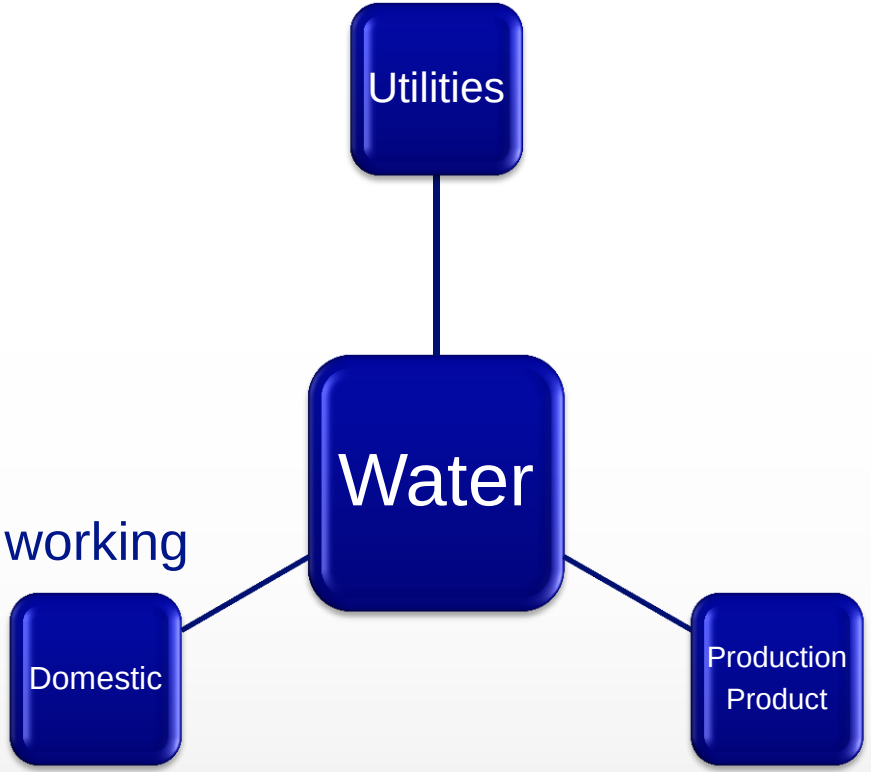
TOWARDS A WATER “NEUTRAL” FACTORY

Why move towards water neutral?

- Factories located in “dry” areas
- Nature targets of Danone

Challenges on the road:

- Each factory is unique
- Getting accustomed to new way of working



100%
COMPLIANCE IN ALL WATER DIVISION SITES BY 2020 (DANONE "CLEAN WATER STANDARDS" FOR WASTE WATER)

60%
REDUCTION OF WATER CONSUMPTION IN FACTORIES BY 2020

100%
COVERAGE IN WATER DIVISION BY 2020 FOR WATER FOOTPRINT MEASUREMENT

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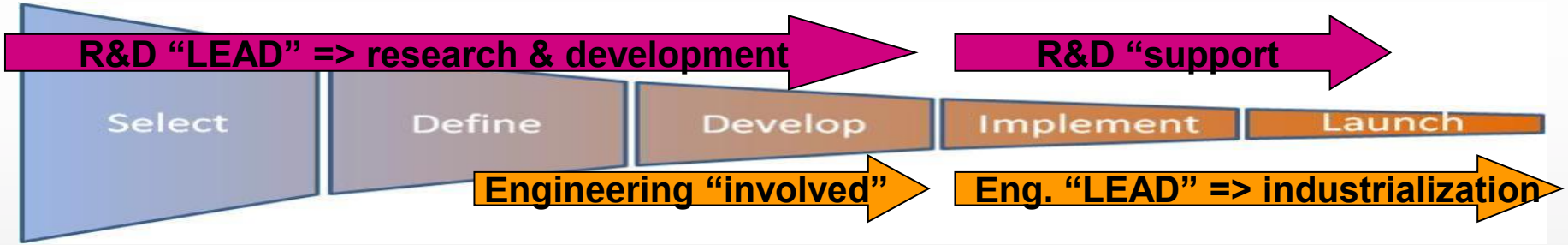
TOWARDS A WATER “NEUTRAL” FACTORY

Role of the R&D team:

- Identifying “optimal” process settings
- Defining process improvement scenarios
- Developing model library to support & drive initiatives



INTRODUCTION

WHO CAN USE gPROMS?

Level 1 user: R&D, Engineering - process development

- Custom model development

Level 2: R&D, Engineering – Process design

- Flowsheeting with existing models

Level 3: Engineering / Factories – Process optimisation

- Use pre-defined flowsheets

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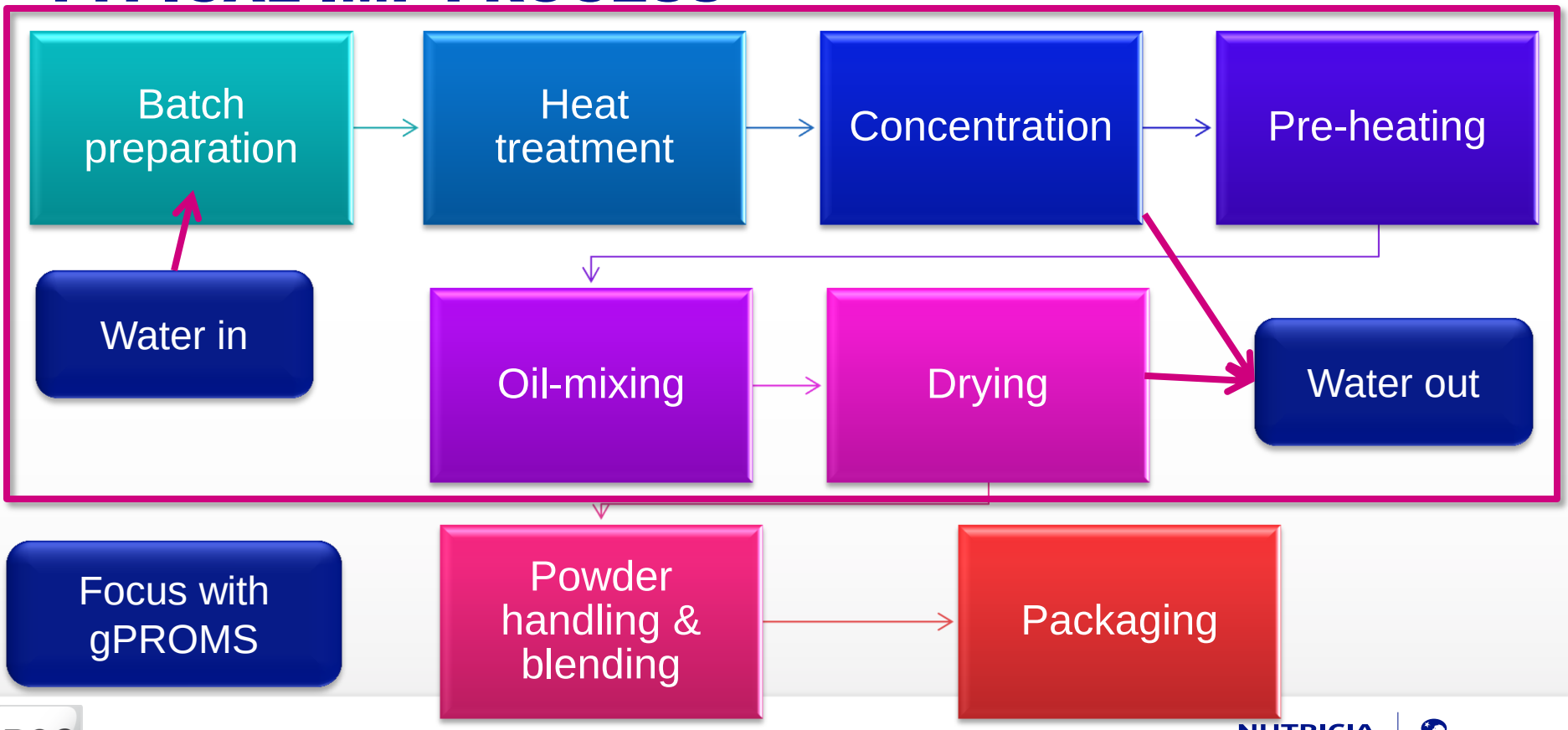
TYPICAL IMF PROCESS



HOW CAN WE LOWER THE FRESH WATER CONSUMPTION?

Strategies to lower water consumption:

- Water reuse (e.g. rinse water)
- Lowering flush time
- Reduce stand-by time on water

Dynamic simulation helps to capture process network

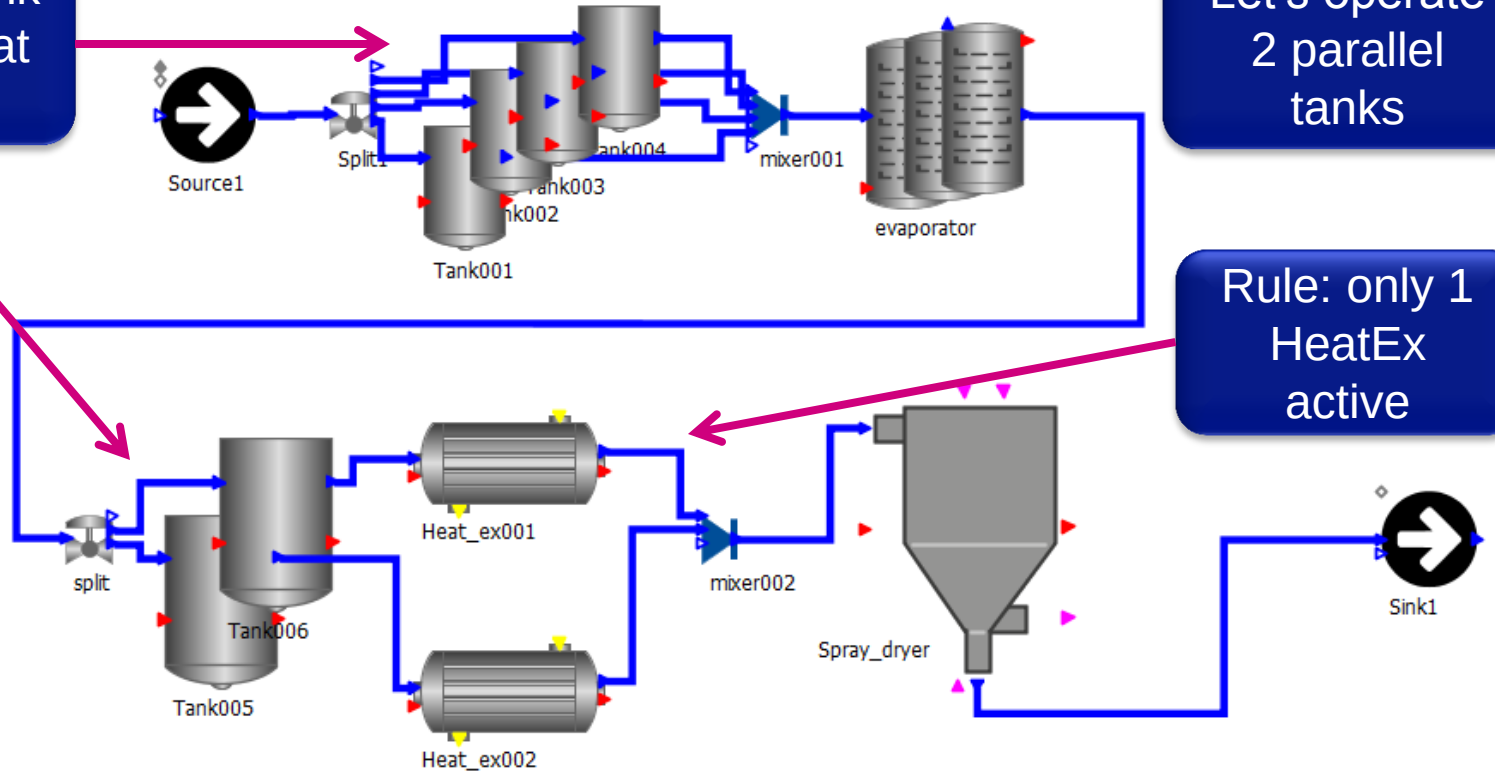
HOW TO HANDLE THE INCREASING AMOUNT OF DYNAMIC OPERATION

Rule: only 1 tank filled/emptied at a time

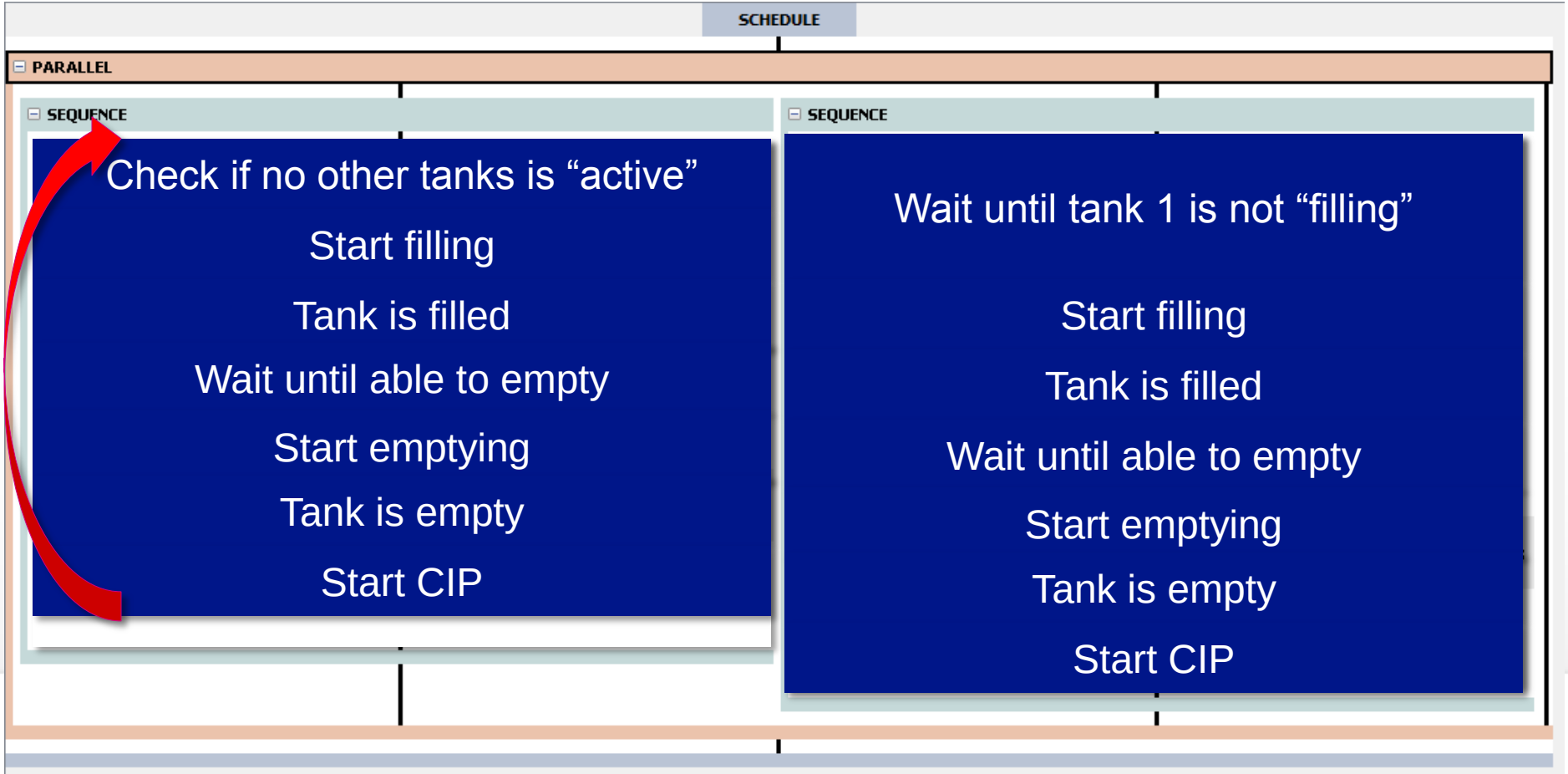
Let's operate 2 parallel tanks

Main rule: never stop the SD

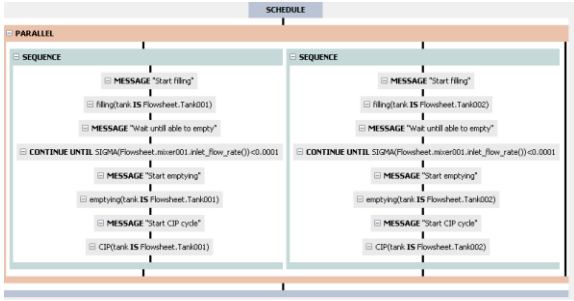
Rule: only 1 HeatEx active



SCHEDULING PROCES OPERATIONS OF 2 TANKS



IMPROVING THE SCHEDULING

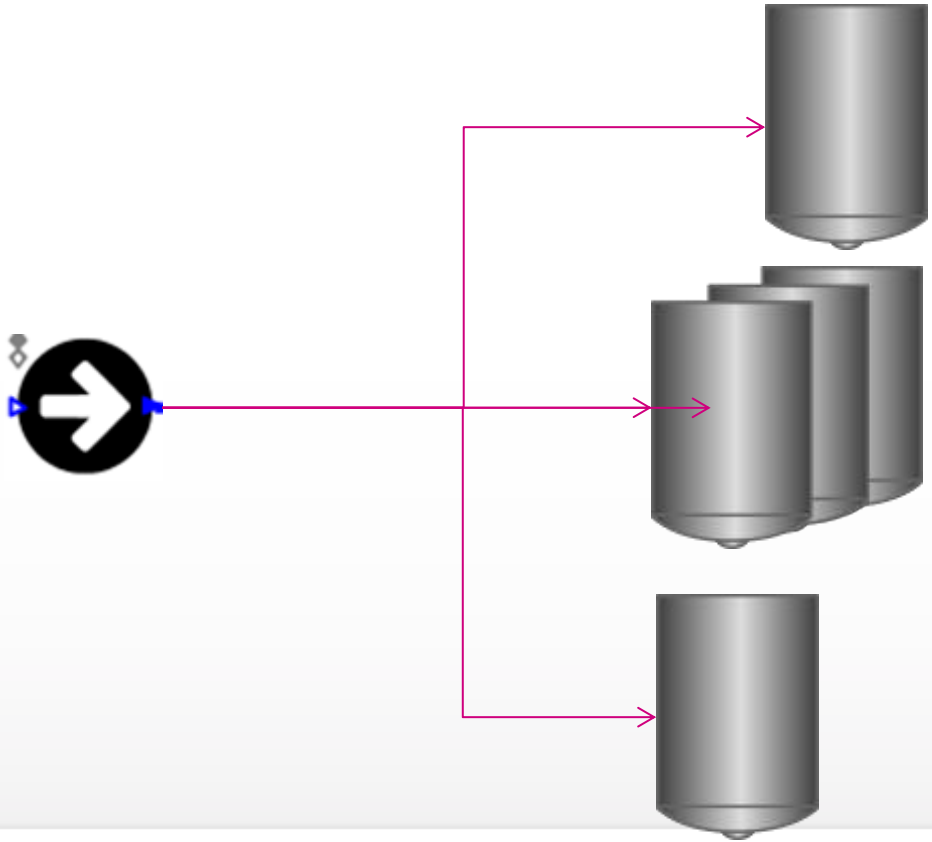


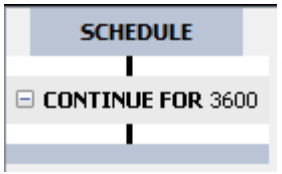
How can we simplify scheduling for model-users?

- What does a user want?
- How comfortable is the user with the software?
- How much effort does he like to put in?
- Solution: incorporate intrinsic tasks/case selectors

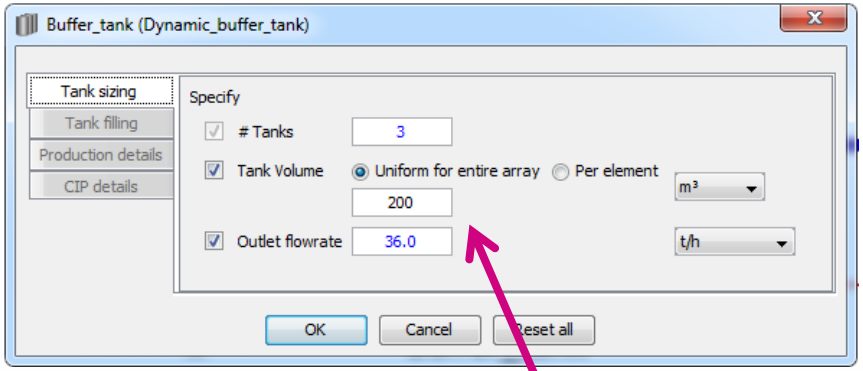
INTERACTING UNITS

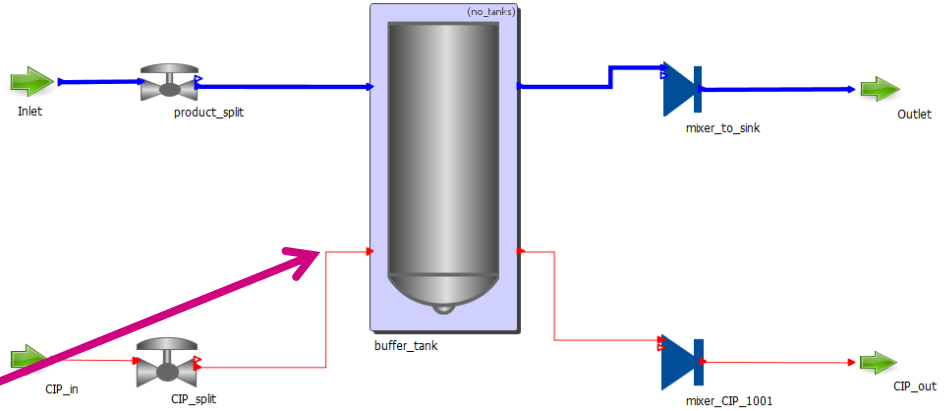
Merged unit with case selectors now has a simple scheduling window

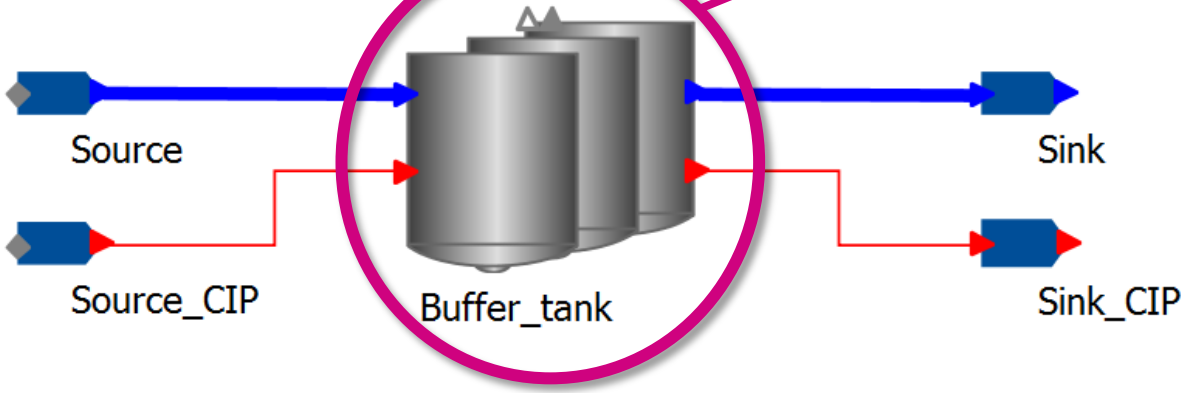




IMPROVING DYNAMIC OPERATION







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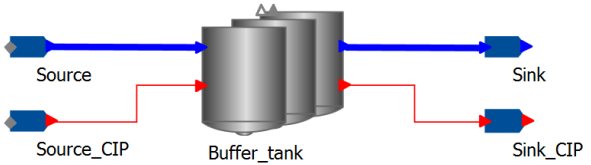
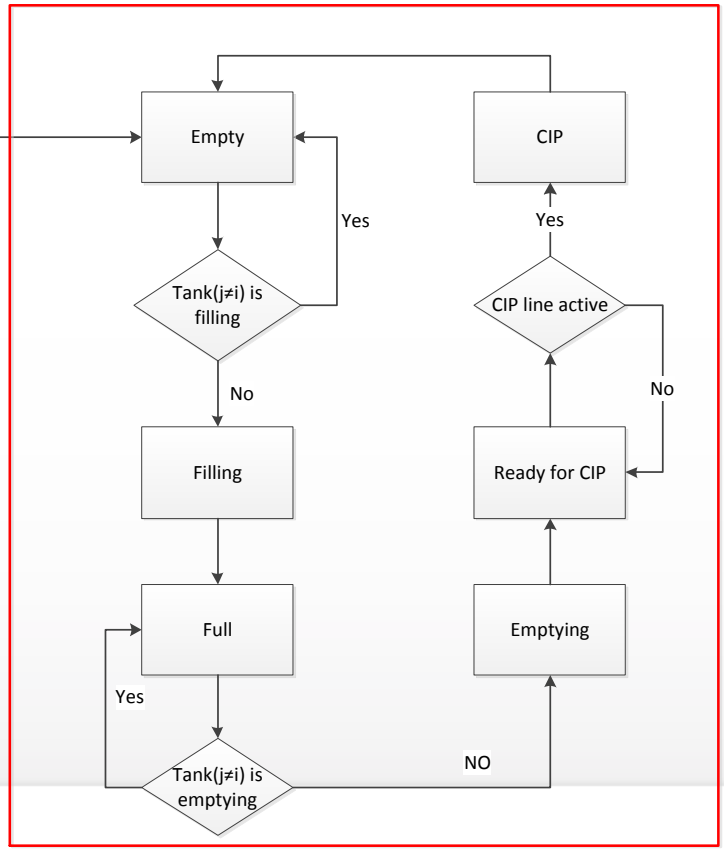
IMPROVING DYNAMIC OPERATION





$$i = 1 \cdots N_{tanks}$$

HOW DID WE IMPROVE ACCEPTANCE OF GPROMS?

Short answer:

- Our model development and deployment activities remain a work in progress
- Models are yet to be distributed to a wider audience

Why is this?

- Similar simplification of other units' model dialogues is still required
- Exporting simulation data

As our capabilities increases our user-group increases

- Drive to continuously simplify model interfaces to improve usability is needed

CONCLUSION AND OUTLOOK

First step(s) made into making dynamic simulations more accessible

Enthusiasm is growing

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