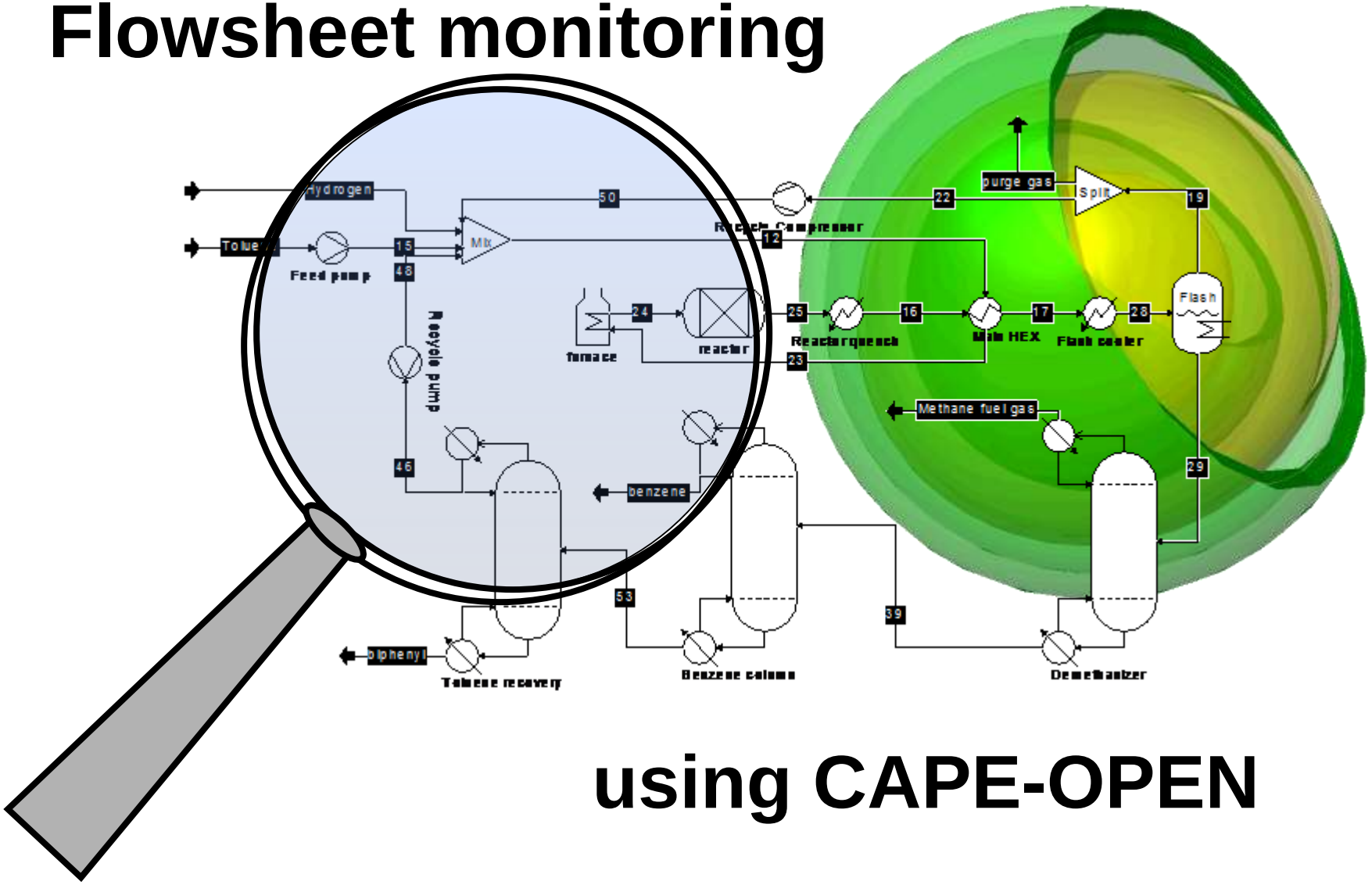
Flowsheet monitoring



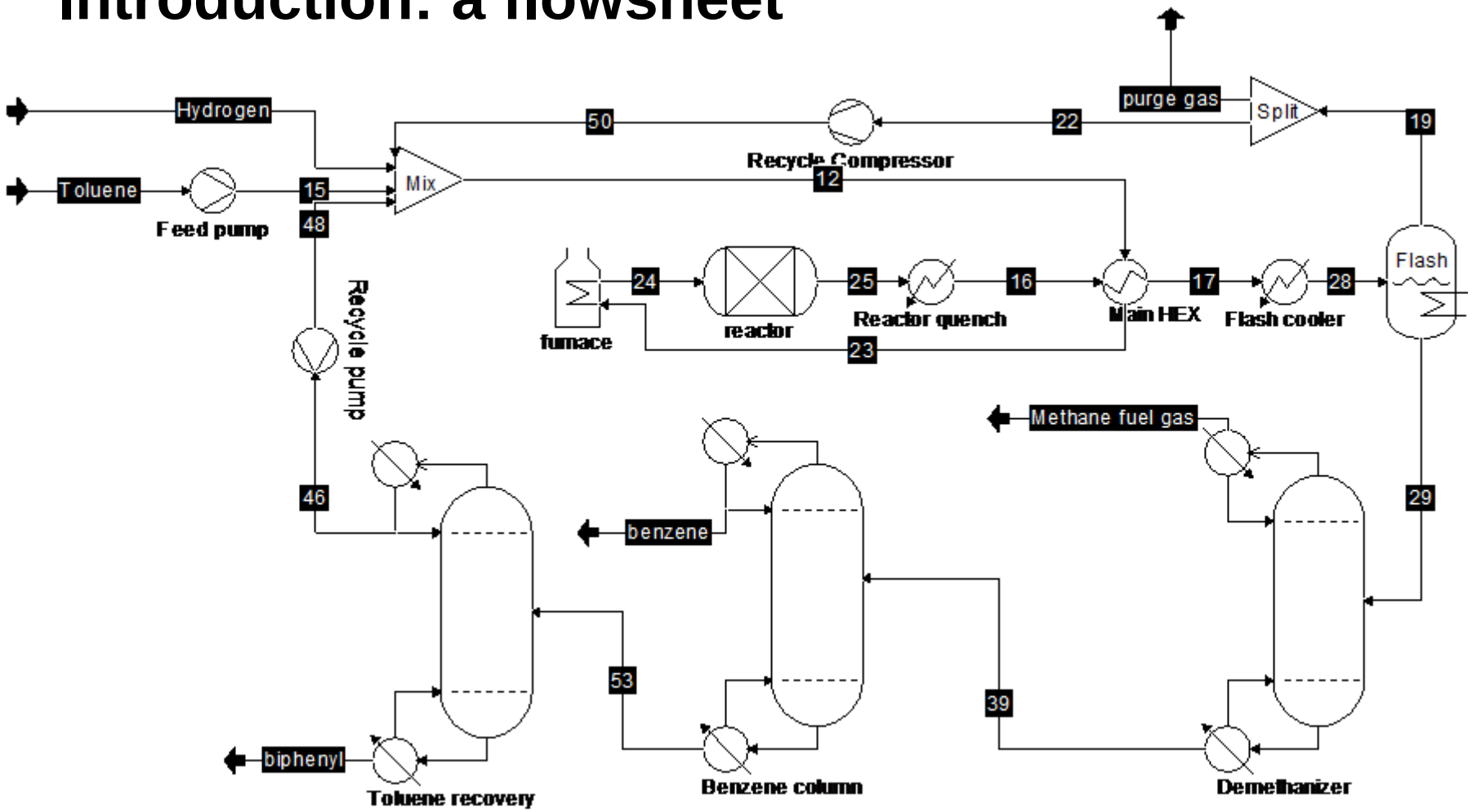
using CAPE-OPEN

Jasper van Baten, AmsterCHEM

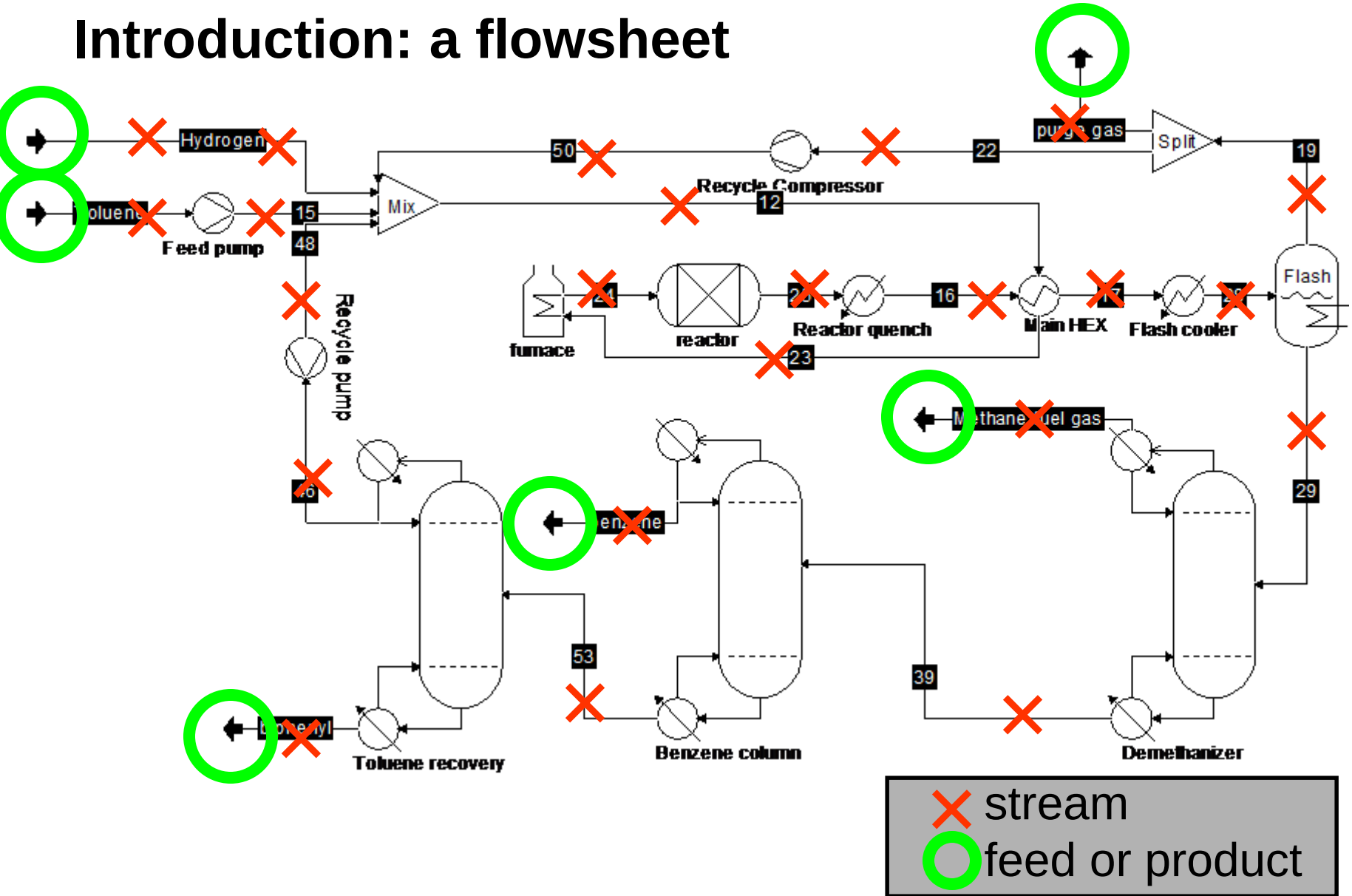
Presentation outline

- Introduction: a flowsheet and its elements
- What is flowsheet monitoring?
- Flowsheet monitoring applications
- Flowsheet monitoring and CAPE-OPEN
- Requirements on PME
- Current status

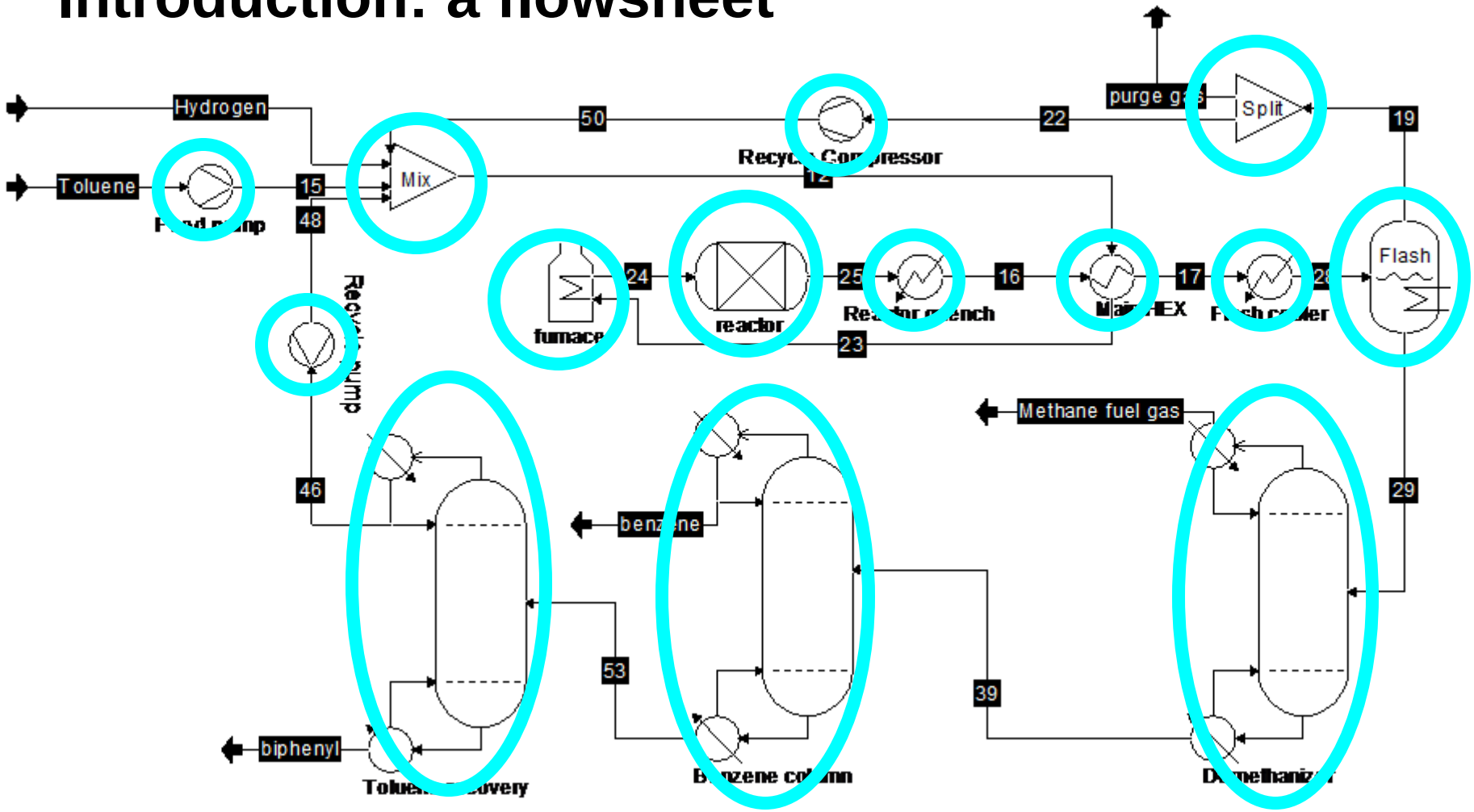
Introduction: a flowsheet



Introduction: a flowsheet



Introduction: a flowsheet

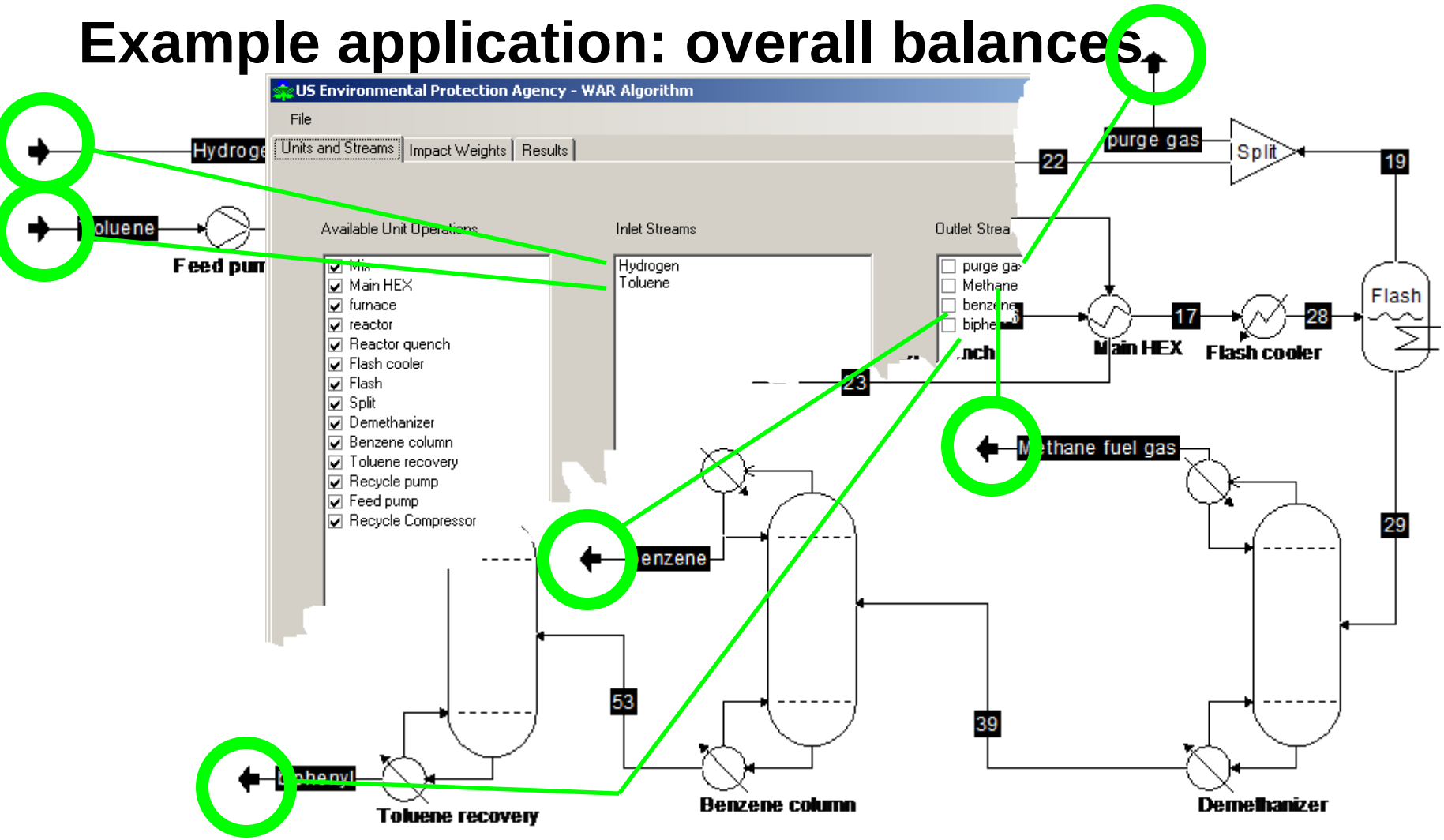


Flowsheet monitoring

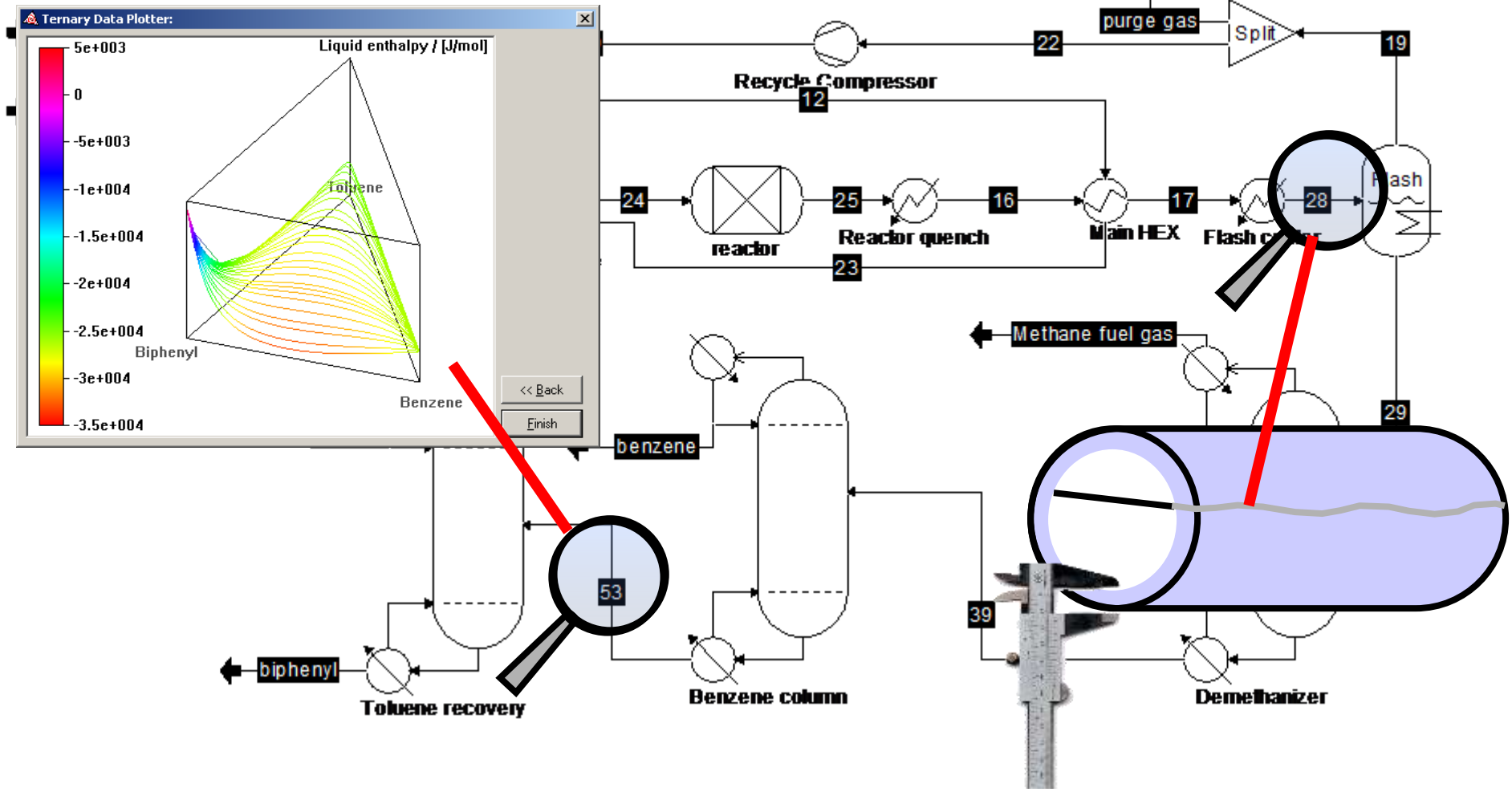
Allow for an additional type of flowsheet component that

- has access to the underlying thermodynamic engine
- has access to all streams and stream data
- has access to all unit operations and -data
- has the ability to determine which streams are connected to which unit operations
- has the ability to perform event driven calculations

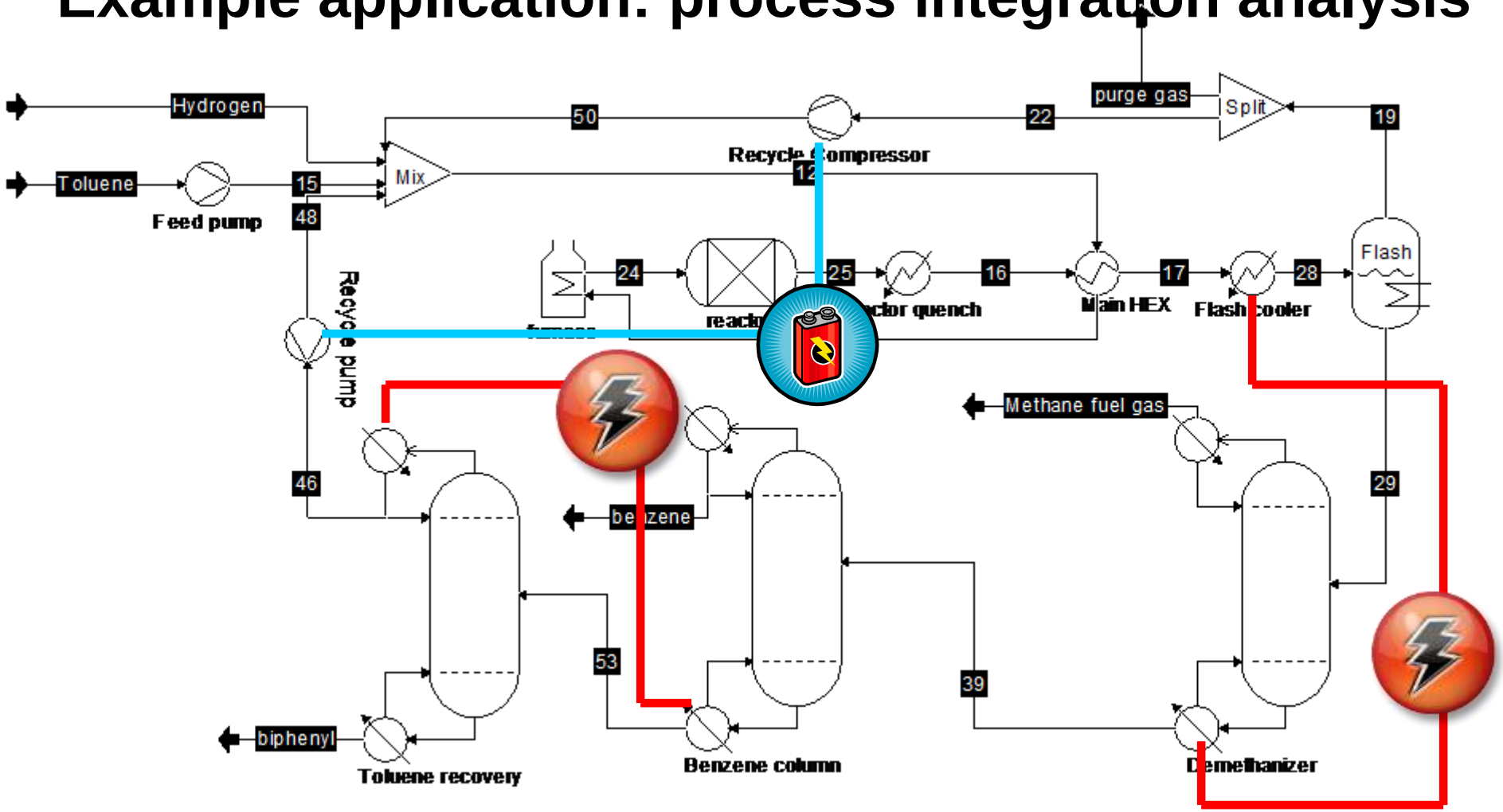
Example application: overall balances



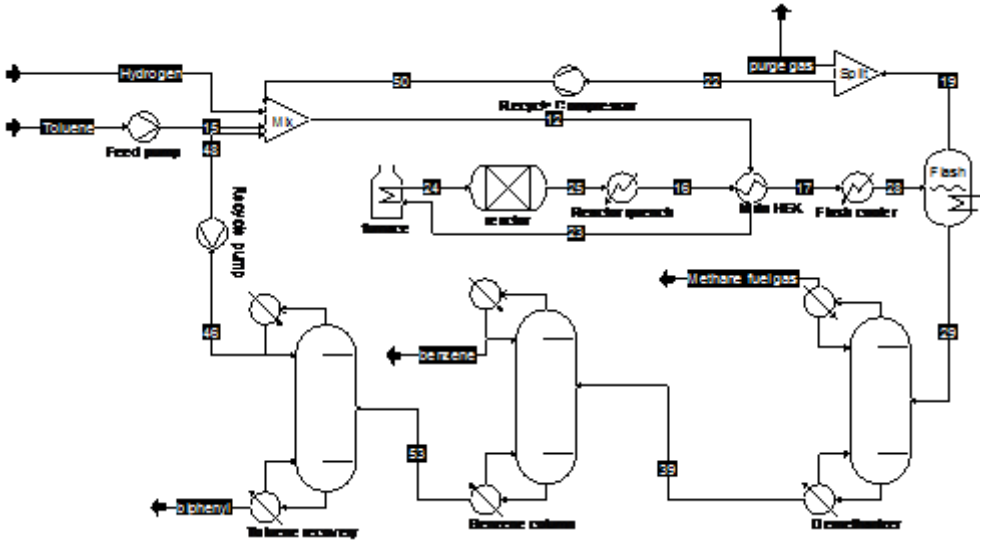
Example application: thermodynamic calculations



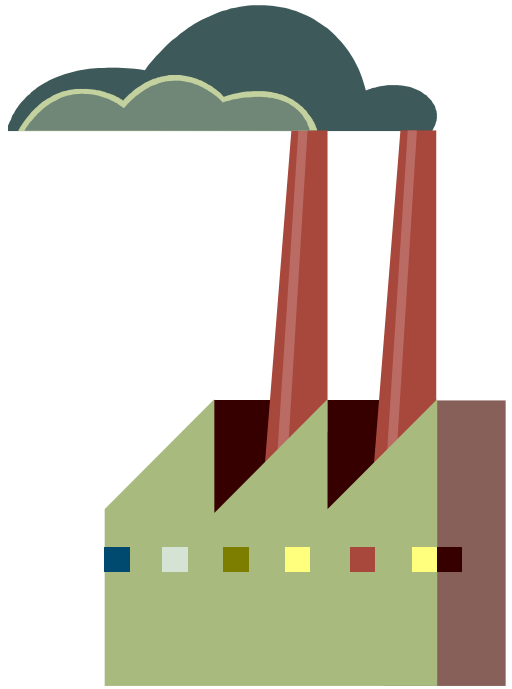
Example application: process integration analysis



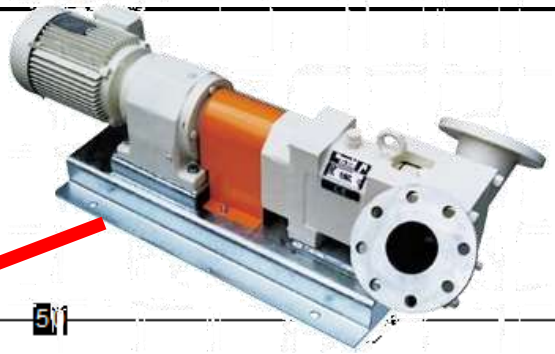
Example application: real-time optimization

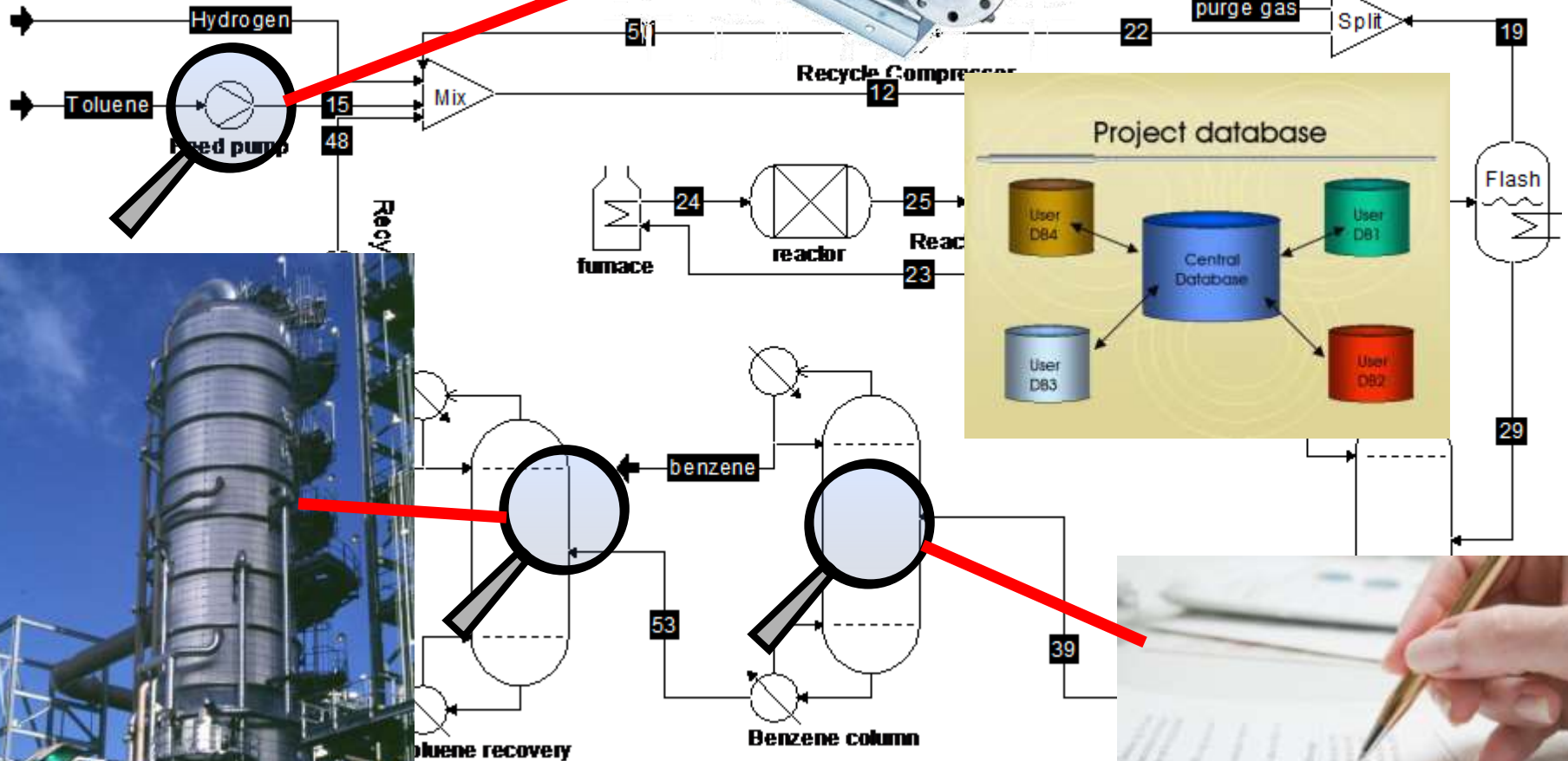


CONTROLLER



More examples…





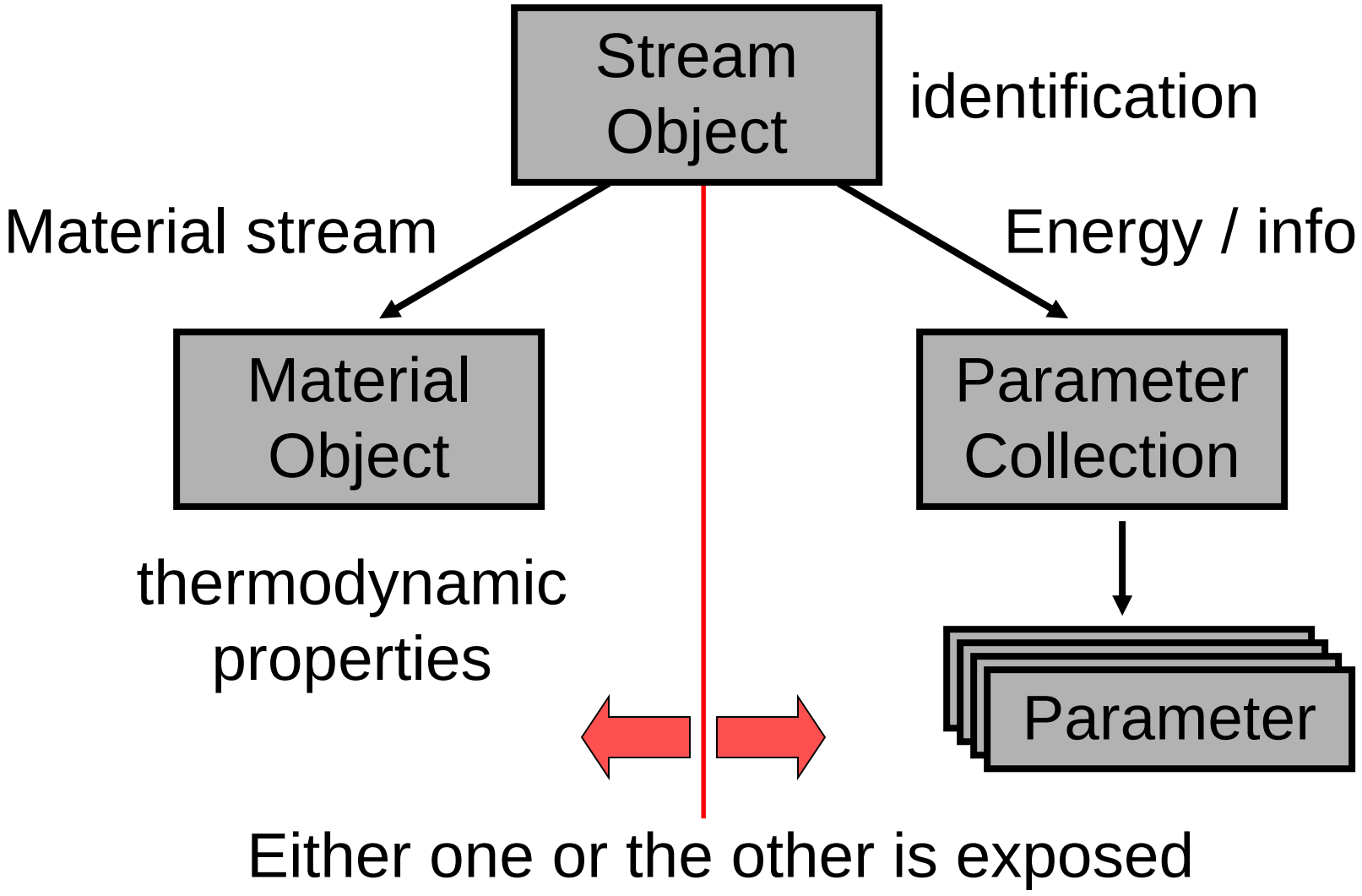
The architecture: CAPE-OPEN

CAPE-OPEN provides us with:

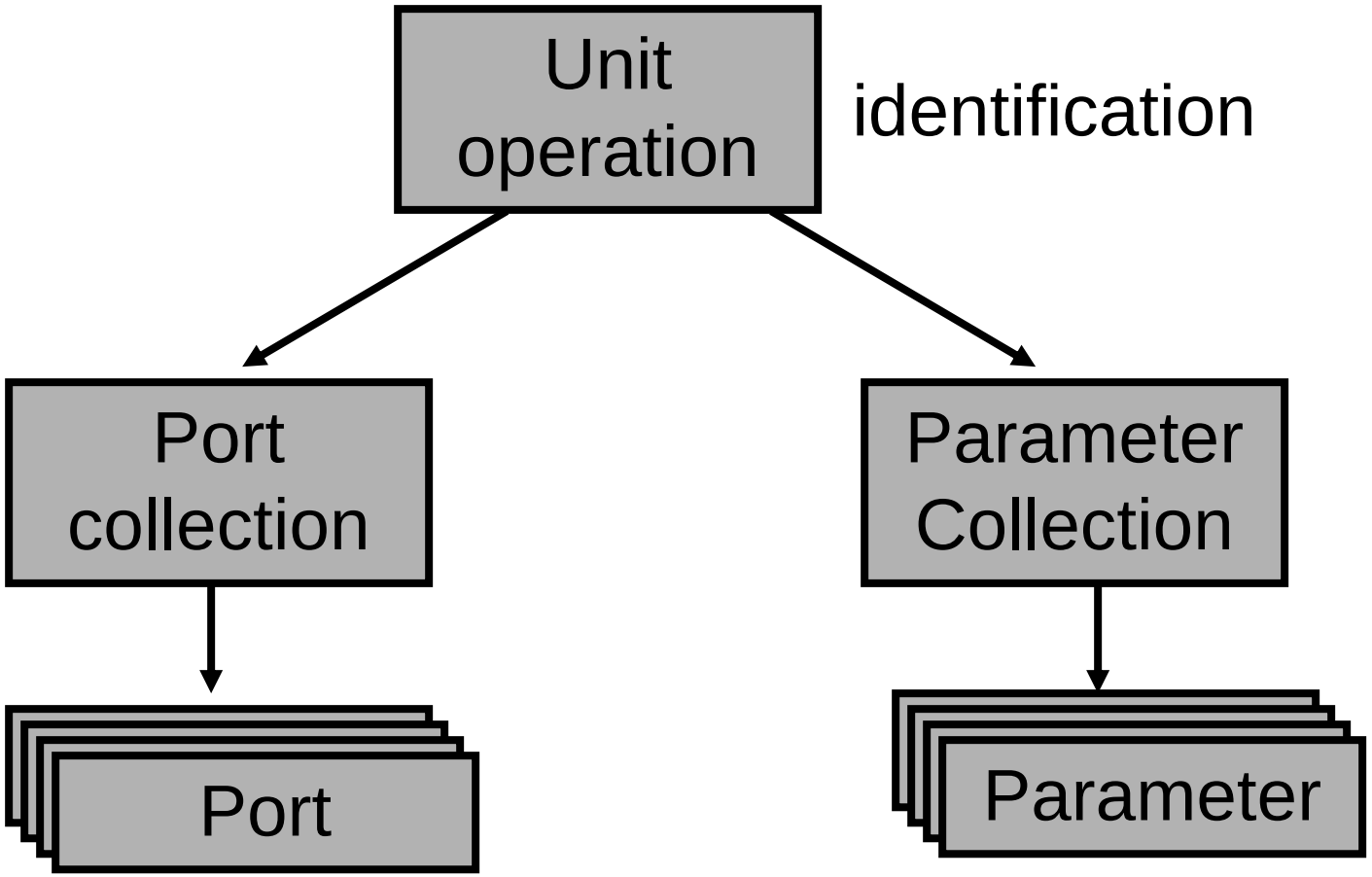
- definitions of a thermodynamic system
- definitions of streams
- definitions of unit operations
- common interfaces: utilities, collections, identification, errors, persistence

CAPE-OPEN available in all major simulation platforms

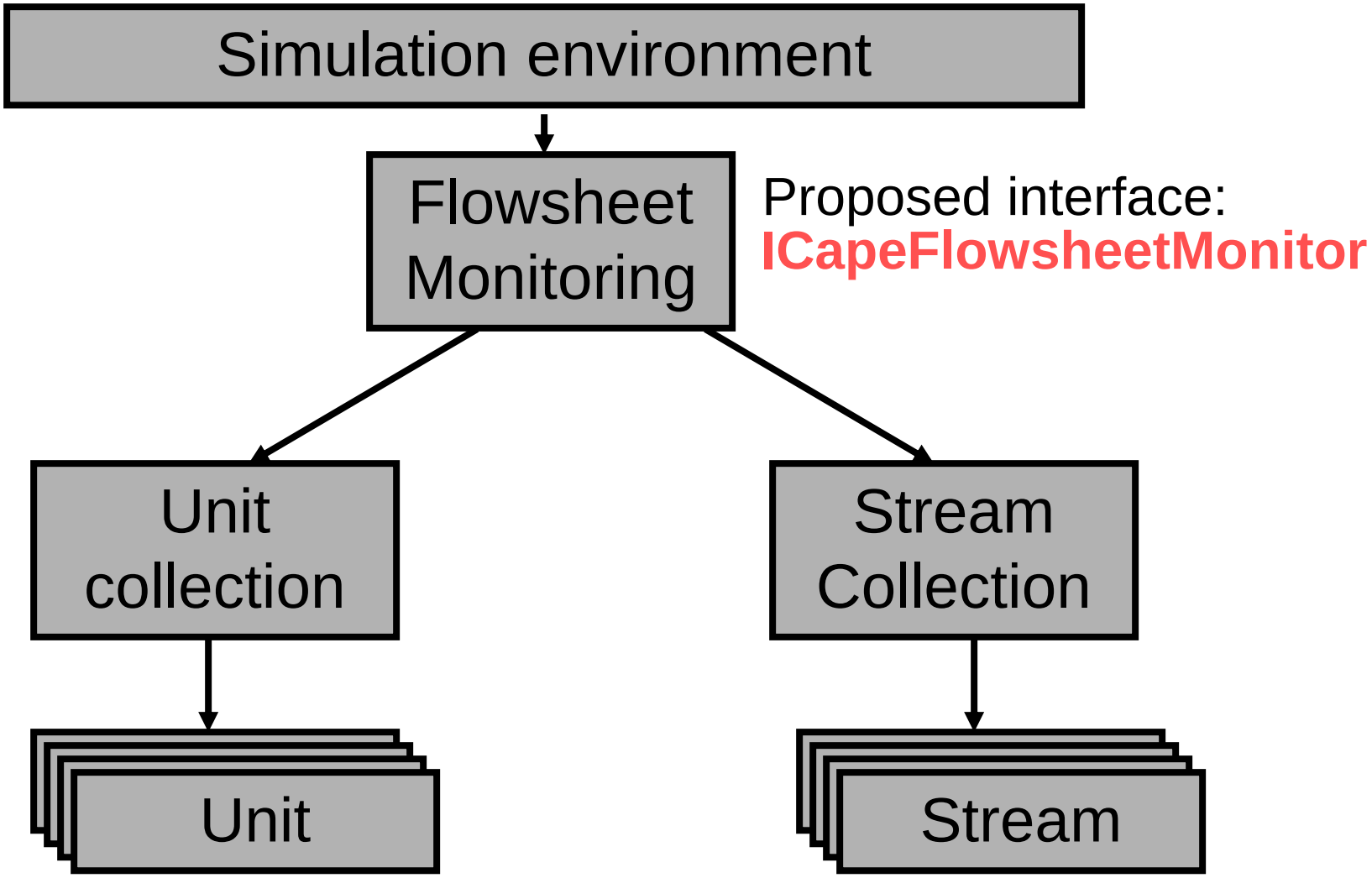
Exposing streams



Exposing unit operations

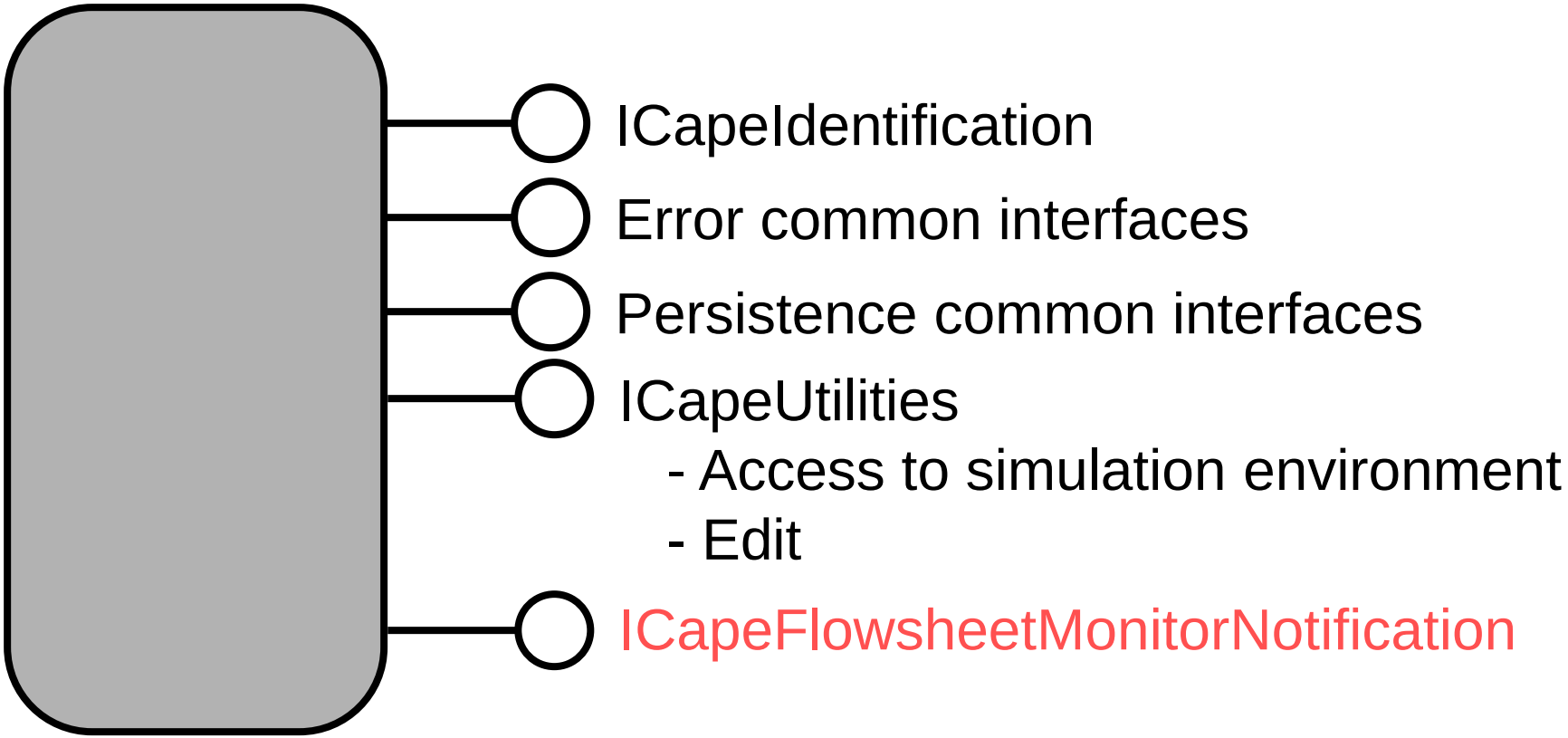


Putting it together



Flowsheet Monitoring Object

PMC software component: expose CAT-ID



Proposed interface:

ICapeFlowsheetMonitorNotification

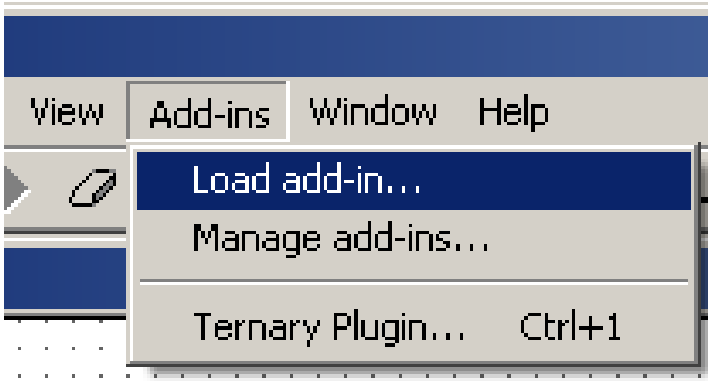
Only required for event driven monitoring objects

(not required for manually invoked monitoring objects)

Methods:

- Unit operation added / removed / modified / renamed
- Stream added / removed / modified / renamed
- Flowsheet solved
- Next time step (dynamic simulations only)

Requirements on the PME



- Implement Flowsheet Monitor interface: little impact
- Ability to load and use monitoring objects
- Expose all streams as CAPE-OPEN MO: little impact
- Expose all unit operations as CAPE-OPEN: medium impact
- Notifications: considerable impact

Current status:

- Proposal has been made
- IDL available (except for notifications)
- Implementation in COFE (COCO)
- Two client implementations: TERNYP (COCO) / WAR (EPA)
- Implementations have been tested
- More interested parties in writing client applications

Request to simulation vendors: support in PME!

- Download COCO: http://www.cocosimulator.org/ (or ask for a copy during the workshop)
- Forum: http://capeopen.19.forumer.com/viewforum.php?f=15
- Contact amsterCHEM for CAPE-OPEN consulting and implementation
- Interoperability testing program: http://www.cocosimulator.org/index_compliancy.html

Acknowledgements:

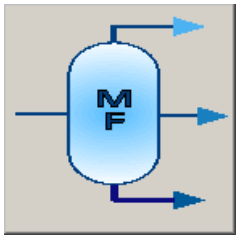
- Richard Baur
- ChemSep: Ross Taylor, Harry Kooijman
- Cosmo*THERM*: Frank Eckert
- Michel Pons
- William Barrett

AixCAPE
Props 1.0

HTRI Xchanger Suite 5.0

Simsci-Esscor Pro/II 8.2

ChemSep 6.24



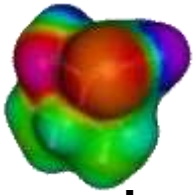
Infochem Multiflash 3.8

SolidSim
Adding solids to the flowsheet
SolidSim 1.1


COMSOL Multiphysics 3.5

gPROMS
PSE
PSE gPROMS 3.1.3

ppds
nel
technology for life
TUV-NEL PPDS v4.1.0.0


CosmoLogic
CosmoTherm C21

ProSim
ProSimPlus 2.1 / Simulis 1.3

VMGThermo
VMG Thermo 5.0