

# Graphical Visualisation

Using Bmotion Studio

# BMotion Studio plug-in (from Duesseldorf)

- Developed by:
  - Lukas Ladenberger,
  - Heinrich Heine University, Duesseldorf
- [http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/Main\\_Page](http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/Main_Page)

N.B. Activate CLP(FD)solver in the ProB settings

- Window -> Preferences -> ProB

## Example – IXL

**Events**

Event	Parameter
route_reservation	
route_freeing	
FRONT_MOVE_1	
FRONT_MOVE_2	I
BACK_MOVE_1	
BACK_MOVE_2	B
point_positionning	
route_formation	

**State**

Name	V
train_ctx0	
fst	{(R1→A), (R2→A)}
lst	{(R1→C), (R2→F)}
nxt	{(R1→(A→B), (B→R1), (A→R1), (A→R2)}
rtbl	{(A→R1), (A→R2)}
train_ctx1	
SIG	{(A→S1), (C→S4)}
train_ctx2	
blpt	
lft	
rht	
train_0	
OCC	{A, B}
resbl	{A, B, E, F, G}
resrt	{R4, R5}
rsrtbl	{(A→R5), (B→R5)}
train_1	
LBT	{B}
TRK	{(B→A), (C→B), (C→R4, R5)}
frm	{R4, R5}
OCC	{A, B}
resbl	{A, B, E, F, G}
resrt	{R4, R5}
rsrtbl	{(A→R5), (B→R5)}
train_2	
rdy	
LBT	{B}
TRK	{(B→A), (C→B), (C→R4, R5)}
frm	{R4, R5}
OCC	{A, B}
resbl	{A, B, E, F, G}
resrt	{R4, R5}
rsrtbl	{(A→R5), (B→R5)}
train_3	
GRN	
LBT	{B}
TRK	{(B→A), (C→B), (C→R4, R5)}
frm	{R4, R5}
OCC	{A, B}

**Reserve routes**

Route	Route
Route 1	Route 5
Route 2	Route 6
Route 3	Route 7
Route 4	Route 8

**Reserved blocks (resbl)**

Block
A
B
E
F
G
I

**Reserved routes (resrt)**

Route
R4
R5

**Reserved tracks (rsrtbl)**

Block	Route (R4, R5)
A	R5
B	R5
E	R4
F	R4
G	R4
I	R4

**Occupied blocks (OCC)**

Block
A
B
I

**Lights**

Light	Status
S1	Red
S2	Red
S3	Green
S4	Green
S5	Green

# Example – mechanical press

The screenshot displays a BMS software interface for a mechanical press. The main workspace features a 3D model of the press, labeled "Mechanical Press". To the left of the model is a "Controller" panel with a table of start/stop commands and their corresponding actuators/sensors. Below this table is an "Information" box and a "Manual" section. To the right of the model are four large, 3D-rendered buttons: "Start Motor" (green), "Stop Motor" (red), "Start Clutch" (green), and "Stop Clutch" (red). The "Outline" panel on the right lists the system components, including the controller, press machine, and various sensors and actuators. The bottom of the interface shows a "Properties" panel and a "BMS Errors" section.

**Controller**

Start/Stop Command	Actuator/Sensor
start motor: %R%	start motor impulse: %R%
stop motor: %R%	stop motor impulse: %R%
start clutch: %R%	start clutch impulse: %R%
stop clutch: %R%	stop clutch impulse: %R%

**Information:**

- Visualization with images
- Creation time: ca. 15 min. + 2 h. for the images

**Manual:**

- You can simultaneously or separately press on each button; it remains pressed down as long as your finger is on it.
- The press is started by turning the motor on and engaging the clutch. It is stopped by disengaging the clutch and turning the motor off.

**Mechanical Press**

Start Motor (green button) Stop Motor (red button)  
Start Clutch (green button) Stop Clutch (red button)

**Outline**

- controller\_overview
- pressmachine
- buttonbar
- txt\_start\_motor\_bt
- txt\_stop\_motor\_bt
- txt\_start\_clutch\_bt
- txt\_stop\_clutch\_bt
- txt\_stop\_motor\_impulse
- txt\_stop\_clutch\_impulse
- txt\_start\_motor\_impulse
- txt\_title\_press
- txt\_title\_controller
- txt\_clutch\_actuator
- txt\_clutch\_sensor
- txt\_door\_actuator
- txt\_door\_sensor

**Properties**

Property	Value

**BMS Errors**

Name	Type

# Waterboiler Tutorial

(taken from BMotion Studio website)

- Download and import the waterboiler example from
  - [http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/User\\_Guide/Examples](http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/User_Guide/Examples)
- The waterboiler has functions to
  - open/close its cap      `cap = open/closed`
  - fill/effuse water      `fill_height = 0..maximum (3)`
  - switch on/off.      `switcher = on/off`

# Waterboiler Tutorial

- Add a new Bmotion studio visualisation
  - R click on Event-B project – new other...
  - (can leave the old one there for reference)
- Add images for kettle bottle and cap
  - Add observer-switch image for cap

Predicate	Image	Expression?
cap = closed & switcher = off	cap_closed.jpg	<input type="checkbox"/>
cap = open & fill_height < maximum	cap_open.jpg	<input type="checkbox"/>
cap = open & fill_height = maximum	cap_full.jpg	<input type="checkbox"/>
cap = closed & switcher = on	cap_on.jpg	<input type="checkbox"/>

# Waterboiler Tutorial

- Add text field for setting fill/pour rate
  - In properties, set id = rate (for ease of reference)
  - Set text = 1
  - Nearby, add a title (text) Rate:
- Add text to display fill\_height
  - set text = Fill: %F%  
(%F% is a placeholder for the value)
  - Add a simple value display observer
    - Expression = fill\_height
    - Replacement String = %F%

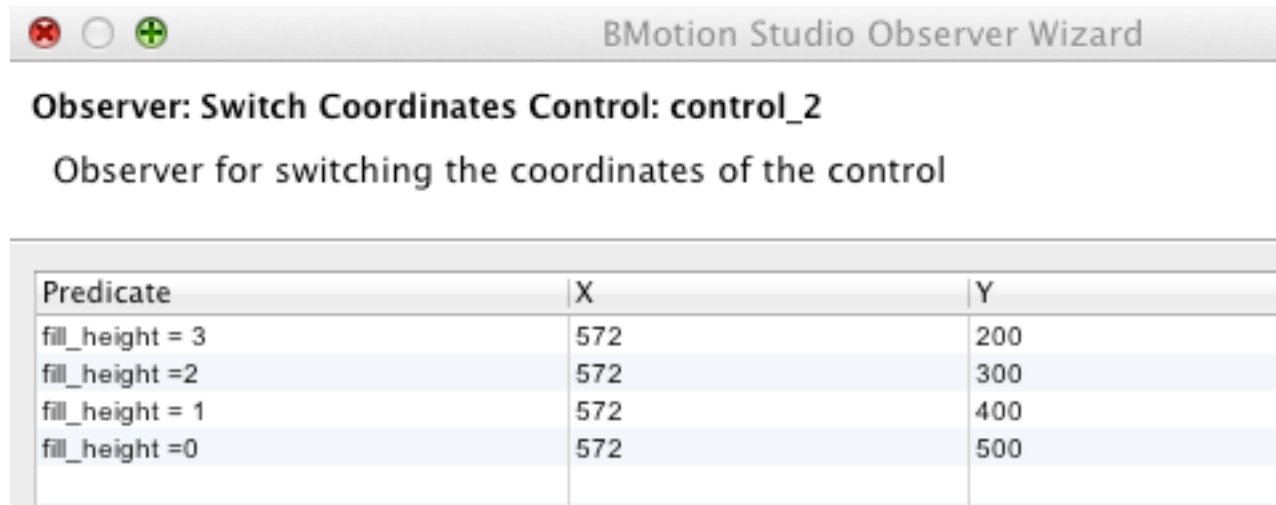
# Waterboiler Tutorial

- Add buttons: open/close, pour/fill, on/off
  - Set suitable button labels
  - Add event-execute operations
    - Select appropriate event for button
    - For pour/fill need to specify predicate for parameter value:  
yy=rate/xx=rate
  - Add listen operation for button enablement
    - Select appropriate event to listen for
    - Select Attribute = Enabled and value = true
    - For pour/fill need to specify predicate for parameter value  
yy=rate/xx=rate
    - in properties, initialise Enabled = false

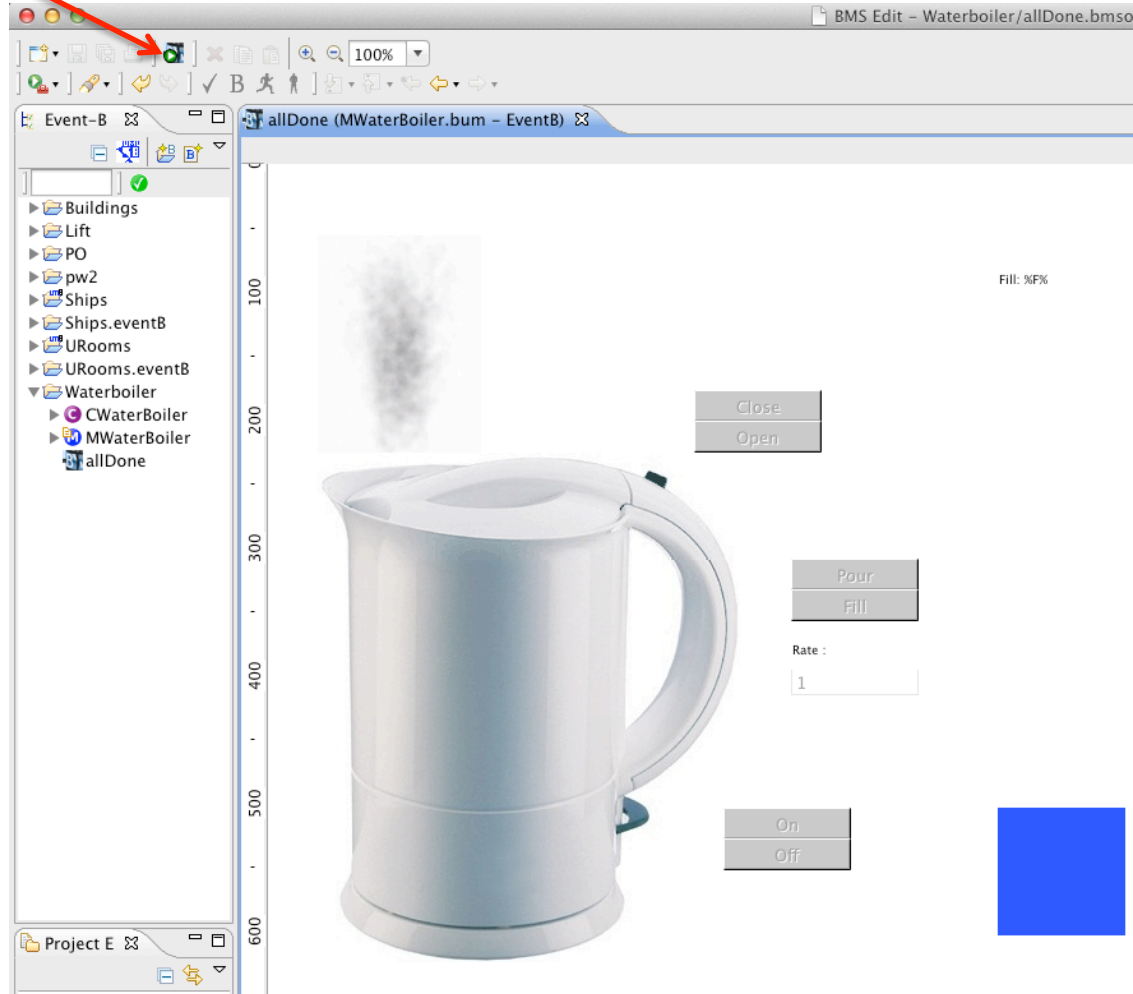


# Waterboiler Tutorial

- Add a moving block to indicate fill height
  - Add observer–switch coordinates
  - Set different Y values against predicates for each possible value of fill\_height:



# Run visualisation



# Exercise - Lift example

Download and import the lift example from

[http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/User\\_Guide/Examples](http://www.stups.uni-duesseldorf.de/bmotionstudio/index.php/User_Guide/Examples)

Run the visualisation to explore how it works.  
In the edit mode, explore how it is constructed.

Note that the green/open door is moved up and down by an observer (switch child coordinates) that belonging to the background image

Attempt to replicate the visualisation

