AutB

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Keyword

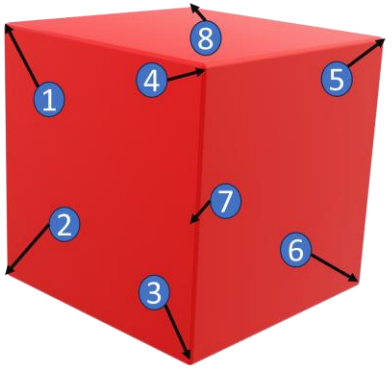
PackML

PLCopen for Motion

Use Case

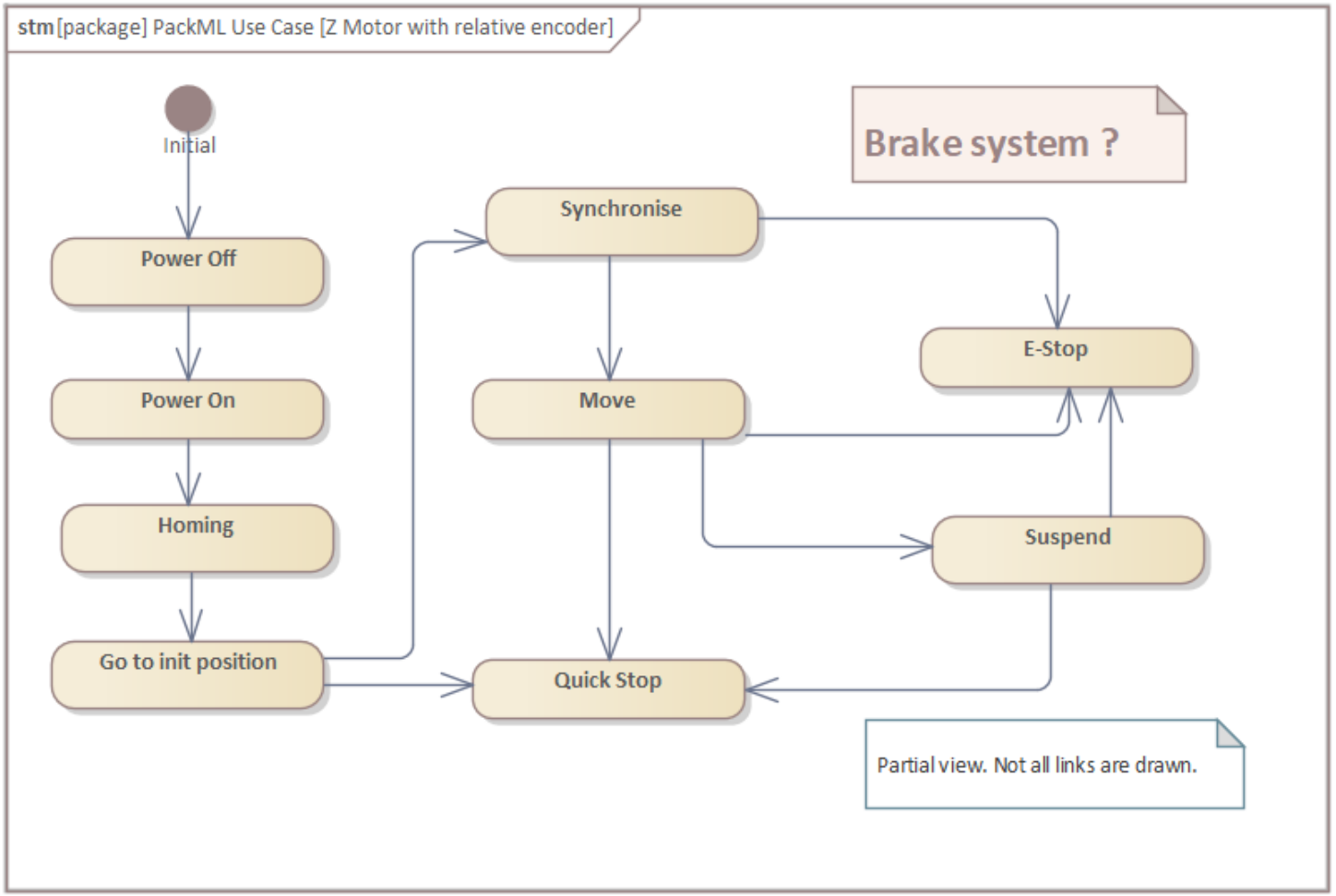
Robot

Movements to do

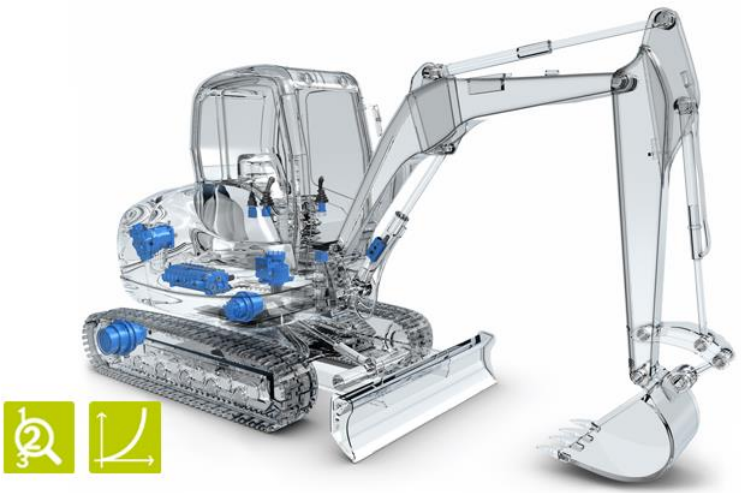


Use Case: State Machine of vertical axis

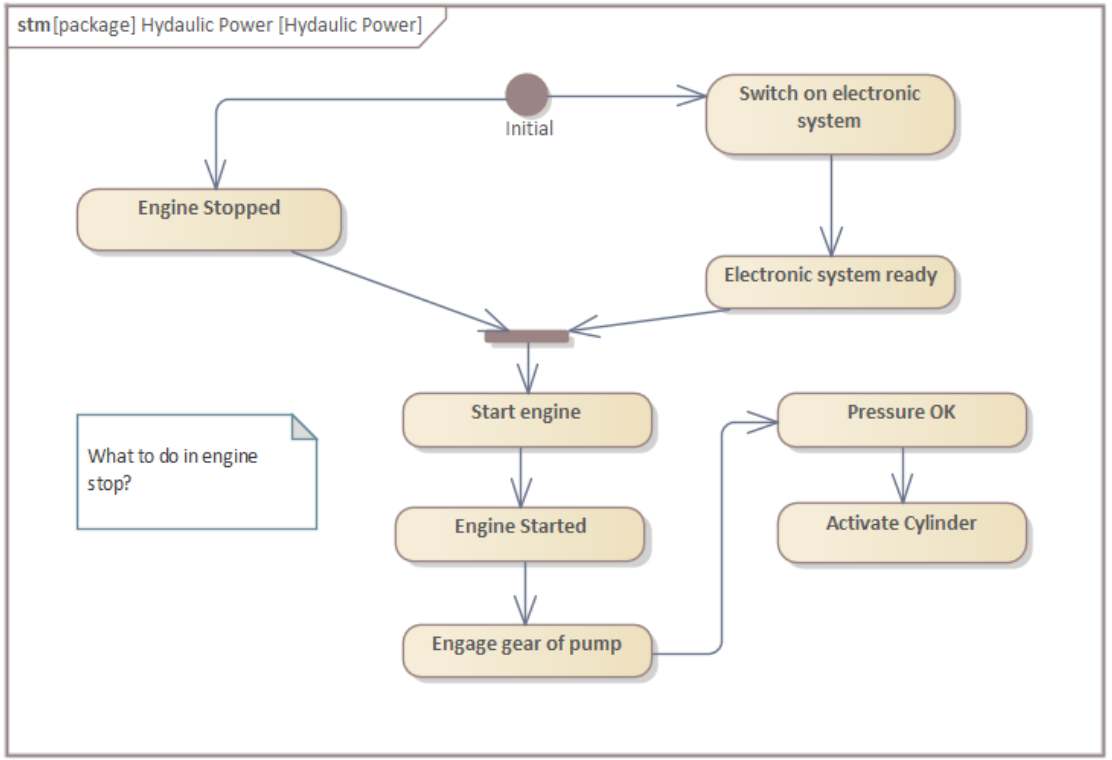
Source: www.jennyscience.ch



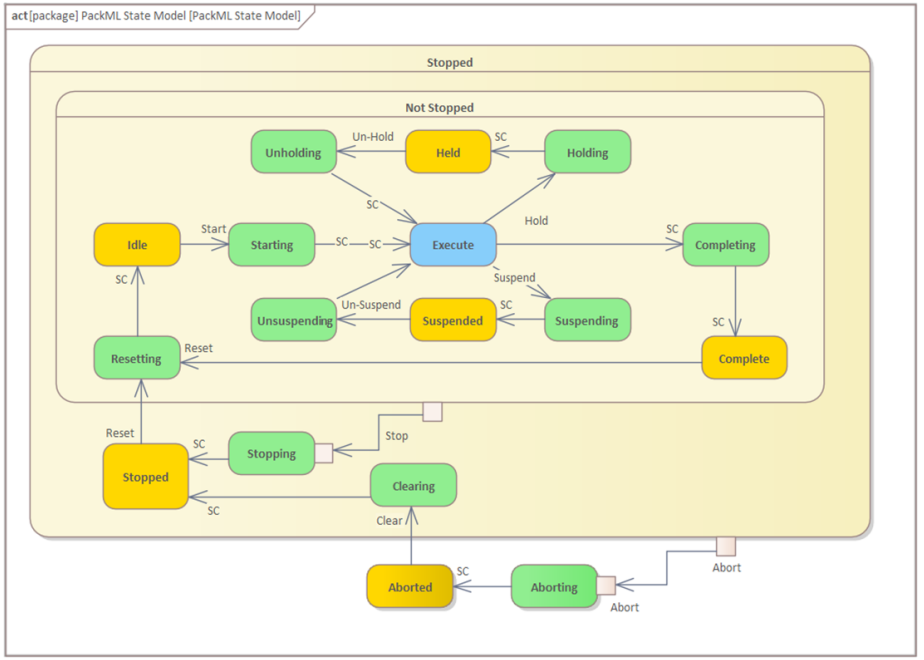
Use case State Machine for Mobile Hydraulic



Source: www.boschrexroth.com

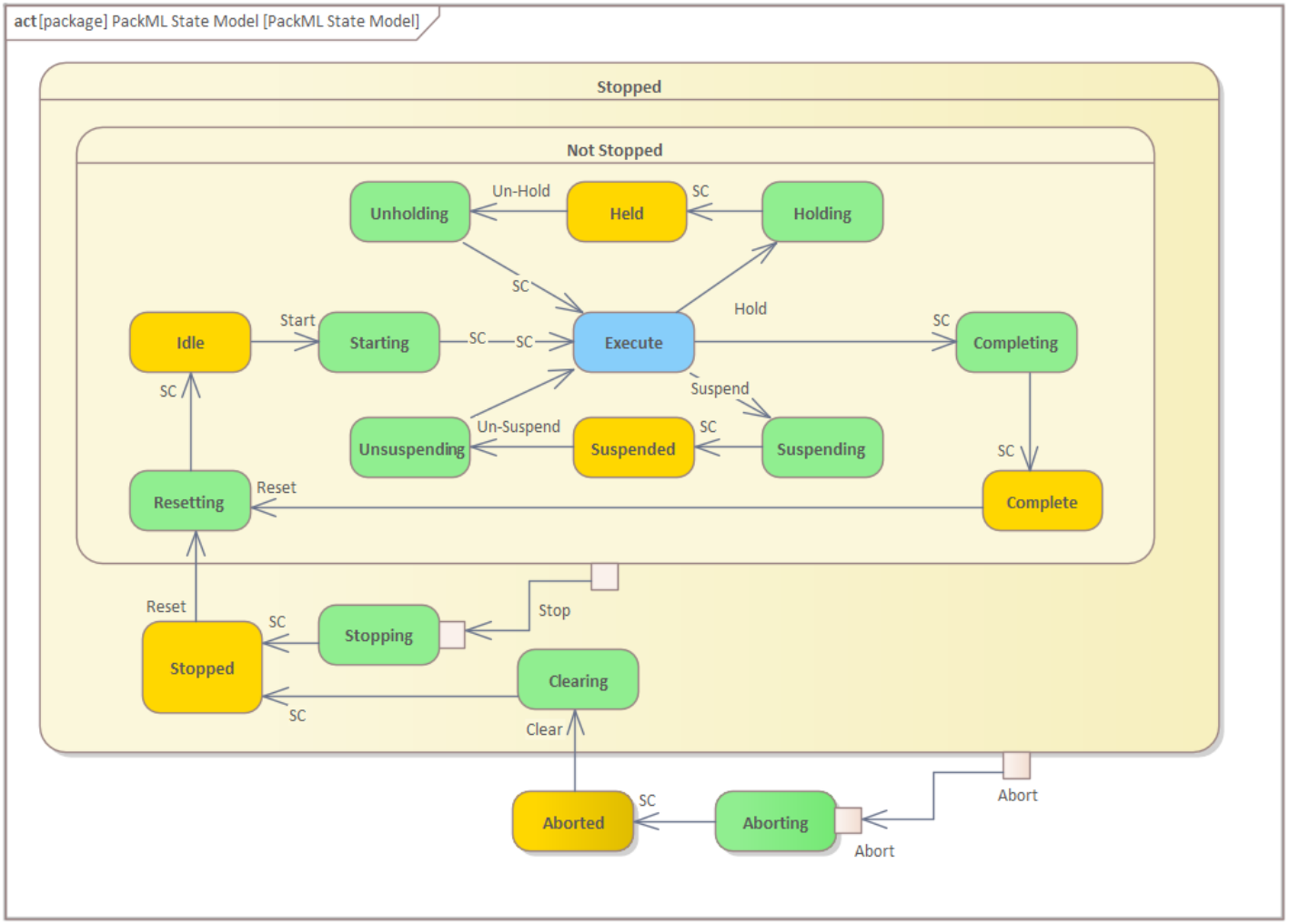


Use case State Machine for a 3D robot



Problem:
Power On, when ?
Position when starting ?
What to do for E-Stop ?
What is a Stop ?
When to start dispensing?
We have no dispenser for Off/On, we have a gripper with Open/Close

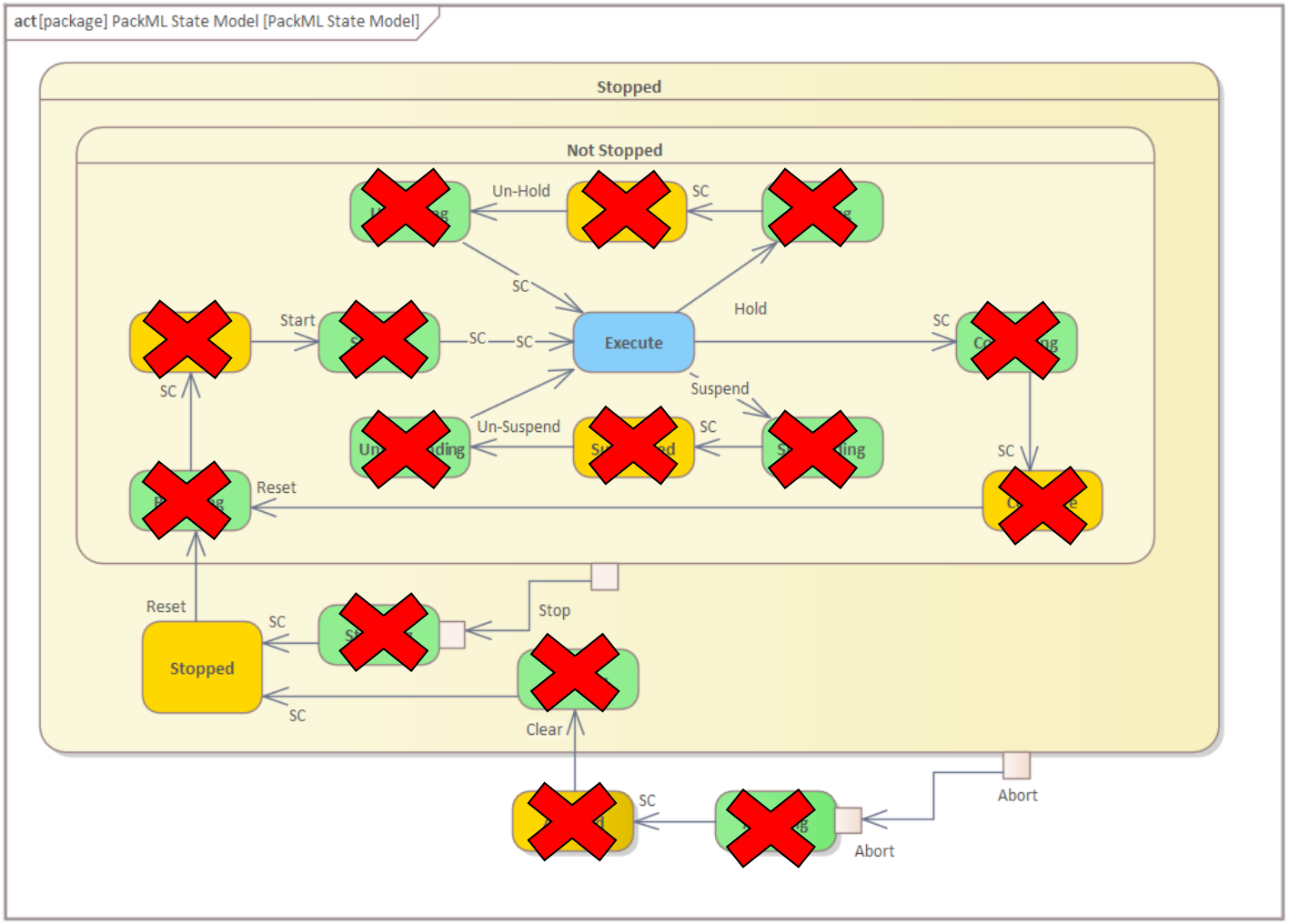
The PackML State Machine



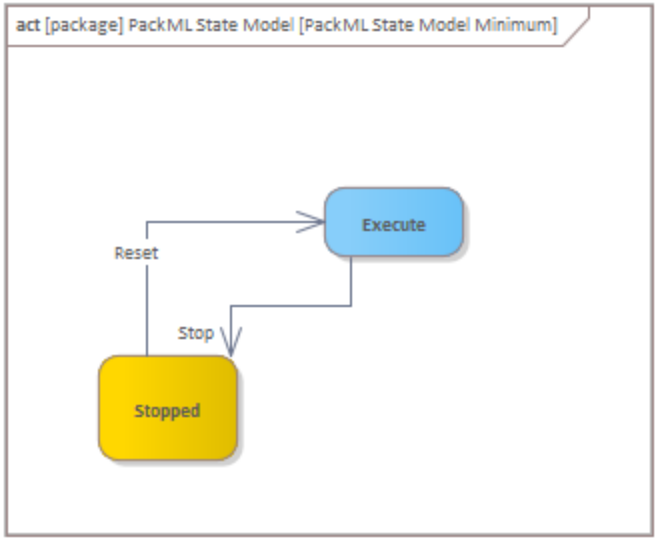
Suppression d'états

- Selon les implémentations, il est possible de désactiver certains états, parmi lesquels Complete, Completing, Suspending, Suspended, Unsuspending, Holding, Held et Unholding, notamment en mode manuel.
- Certaines implémentations, comme Siemens, permettent de configurer les états actifs.
- Dans le plus simple cas, uniquement les états Stopped et Execute sont implémentés.
- De manière générale, tous les états Acting peuvent être supprimés.

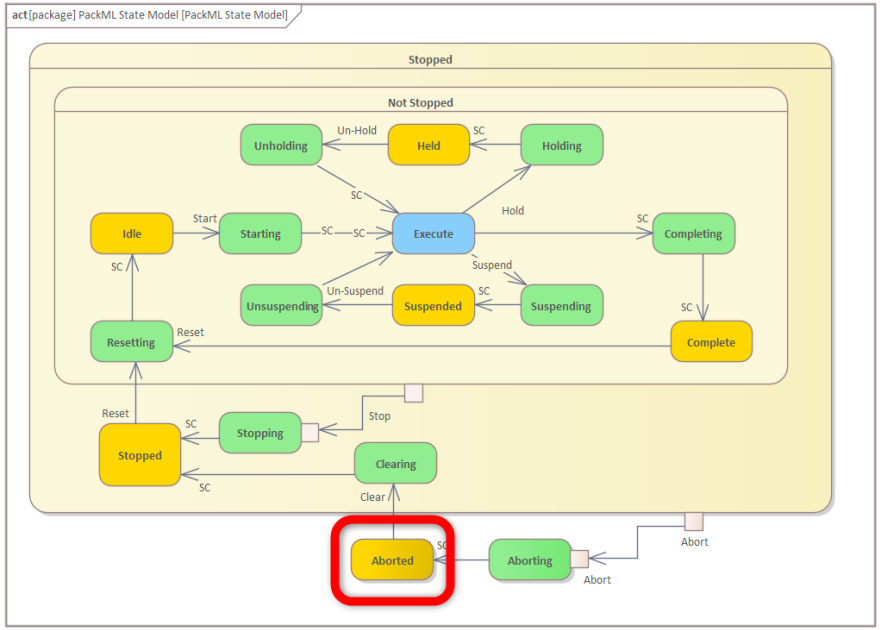
The Minimum State Machine



The Minimum State Machine



Aborted



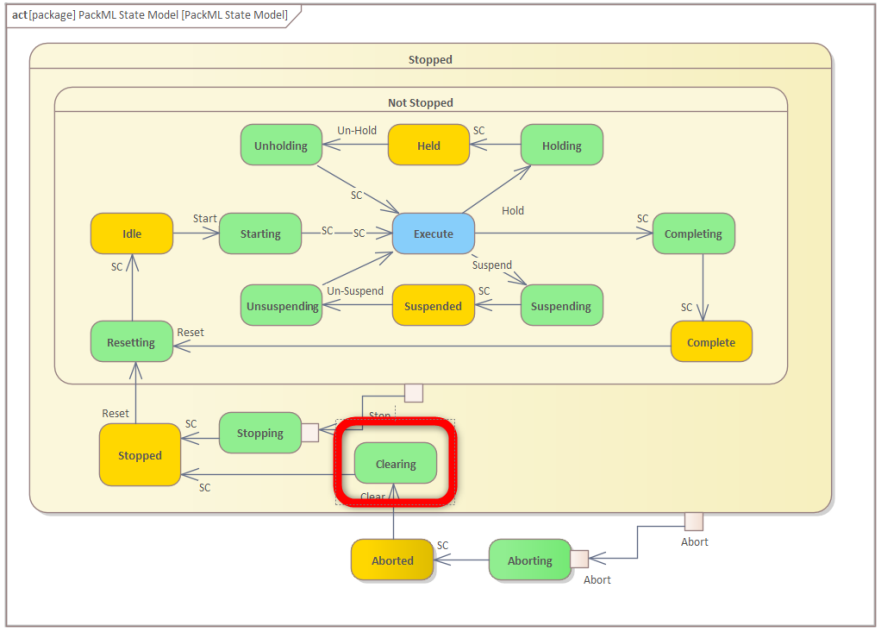
State Type: Wait

Use case:

Etat initial de la machine.

Les «énergies» ne sont pas actives, idéalement pas de pression sur les cylindres, pas de courant dans les moteurs.

Clearing



State Type: Acting

Use case:

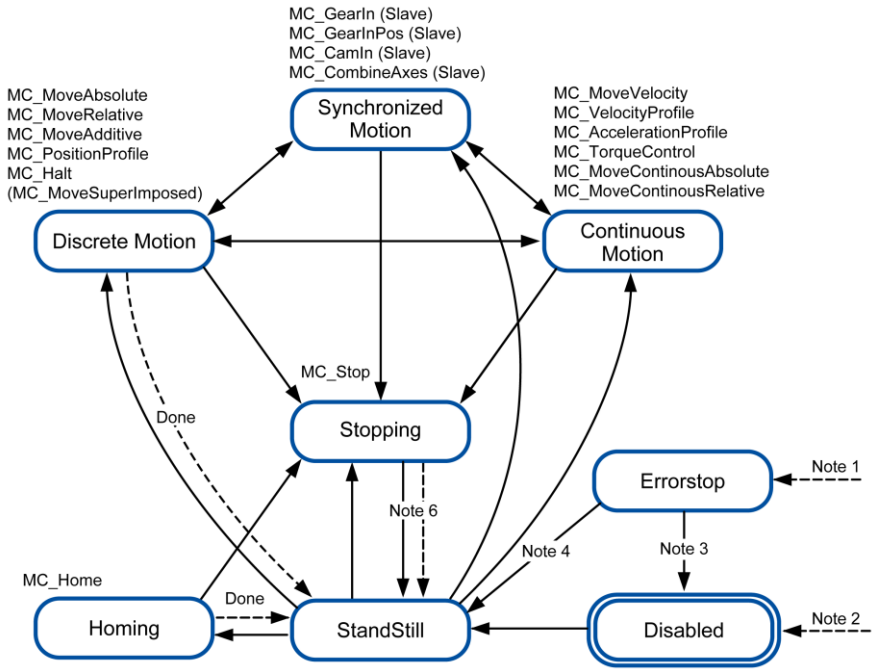
On active les énergies

Dans NOTRE cas: on met les moteurs sous couple. Nous avons un FB **MC_Power.**

Nous pouvons connaitre les états des axes grâce à un FB **MC_ReadStatus**.

Attention, ne pas confondre!

PLCopen Motion State Machine



FB_ReadStatus

Nos axes seront dans un des états suivants:

Disabled : Need a *MC_Power* → Standstill

Standstill: Torque on motor, no motion.

Stopping: during a *MC_Stop*

Discrete Motion : during a *MC_MoveAbsolute*.

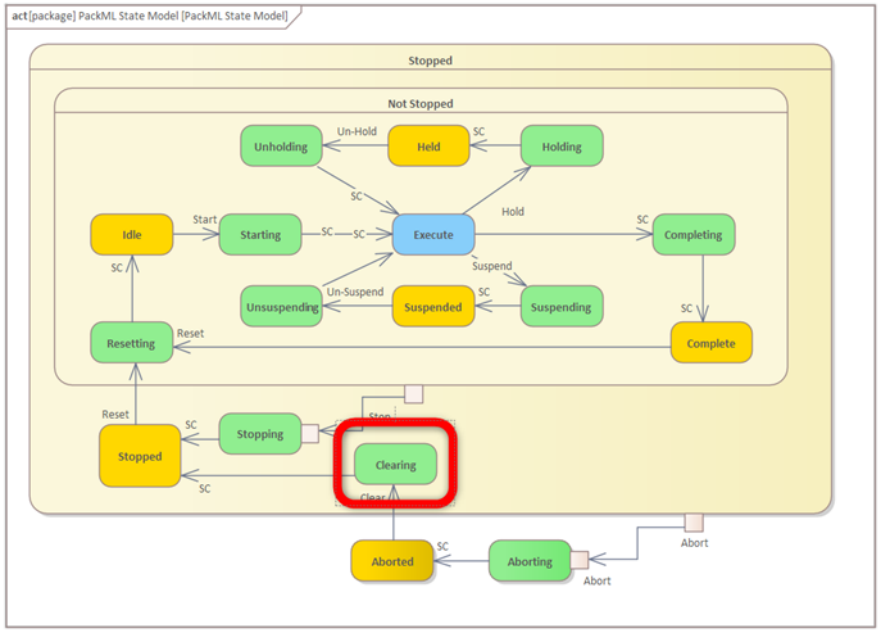
Errorstop : *Need a MC_Reset*

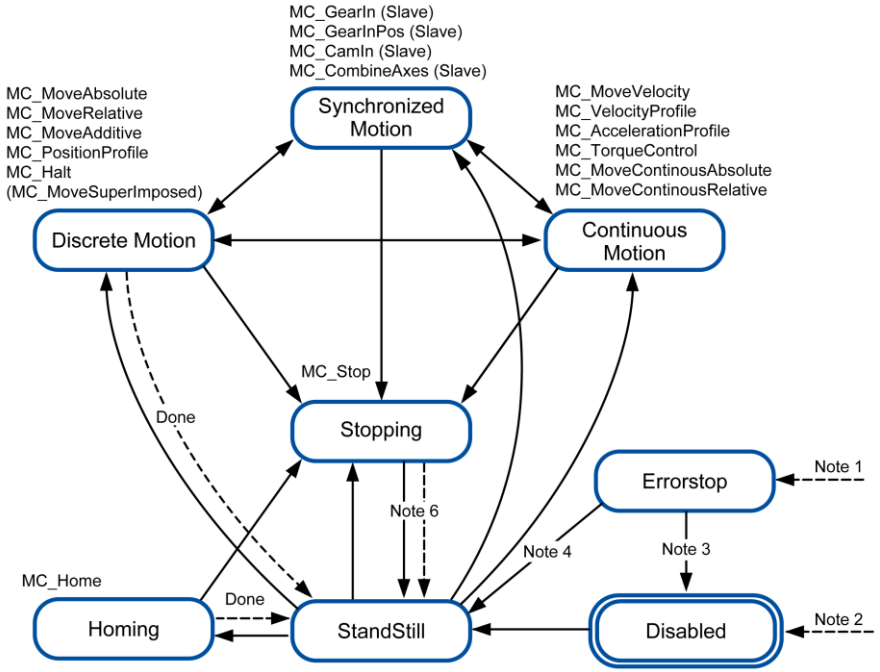
Example

Pendant le clearing on active le FB_Power

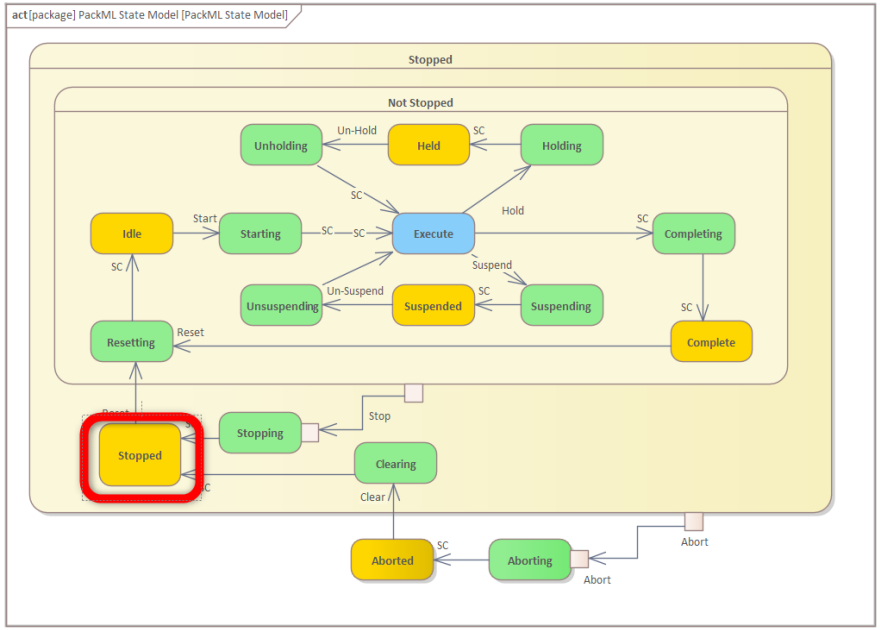
Le MC_Power fait passer l'axe de Disabled à Standstill.

La passage à Standstill provoque un SC State Complete





Stopped



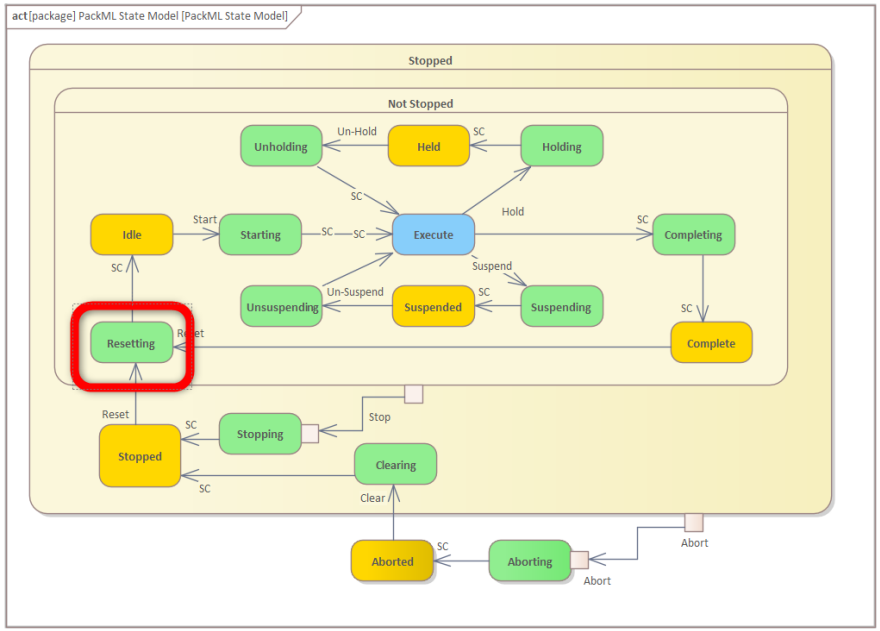
State Type: Wait

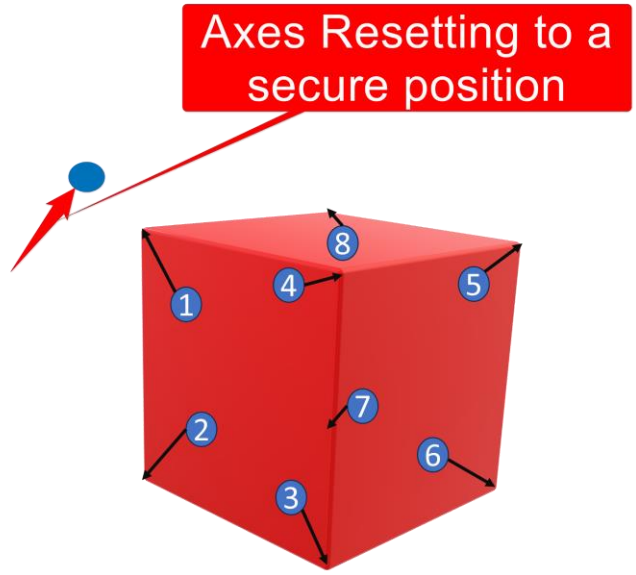
Use case:

Tous les axes devraient être en Standstill.

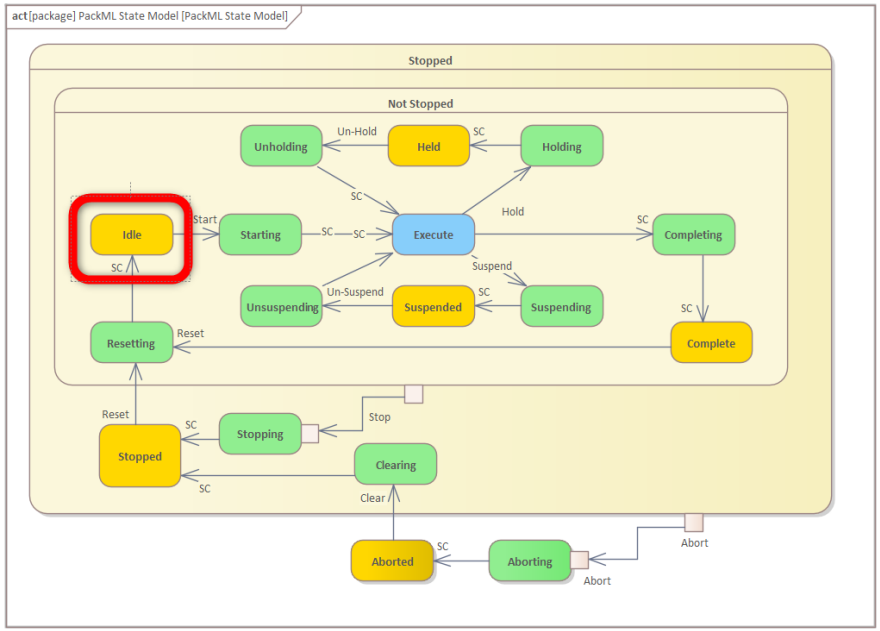
Resetting

On place tous les éléments mobiles en position initiale.





Idle

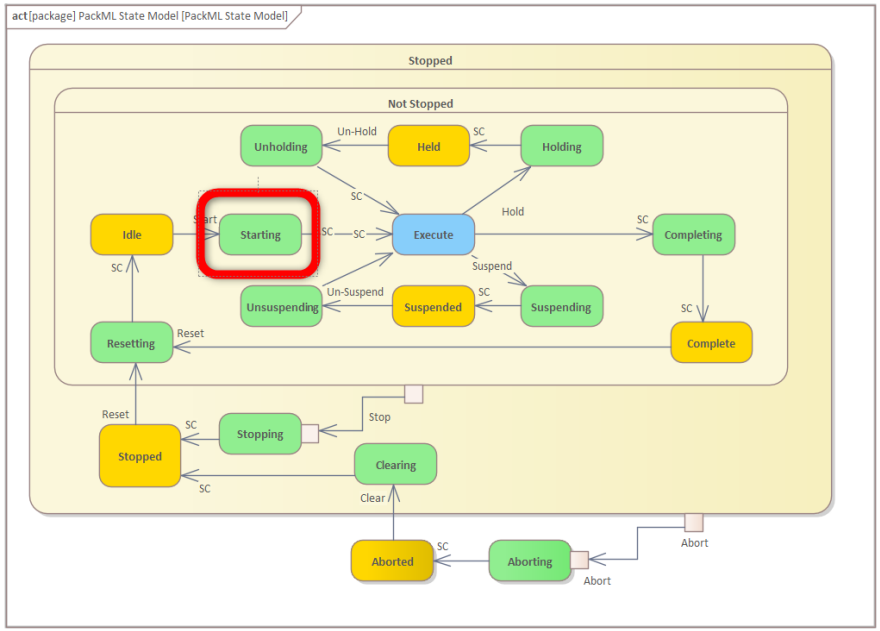


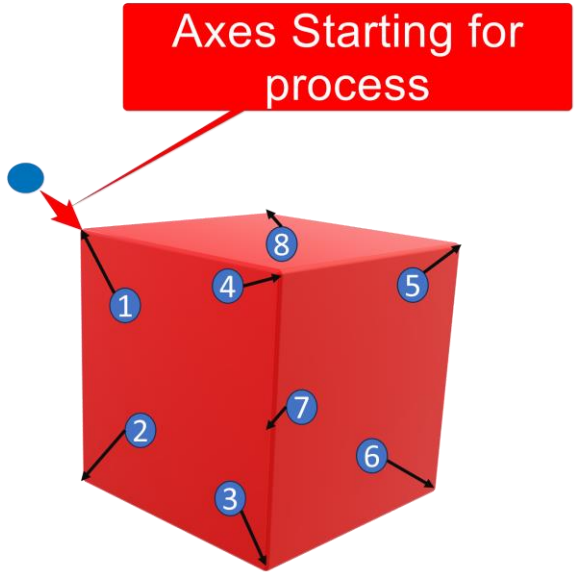
State Type: Wait
Use case:

La machine est prête au démarrage.

Starting

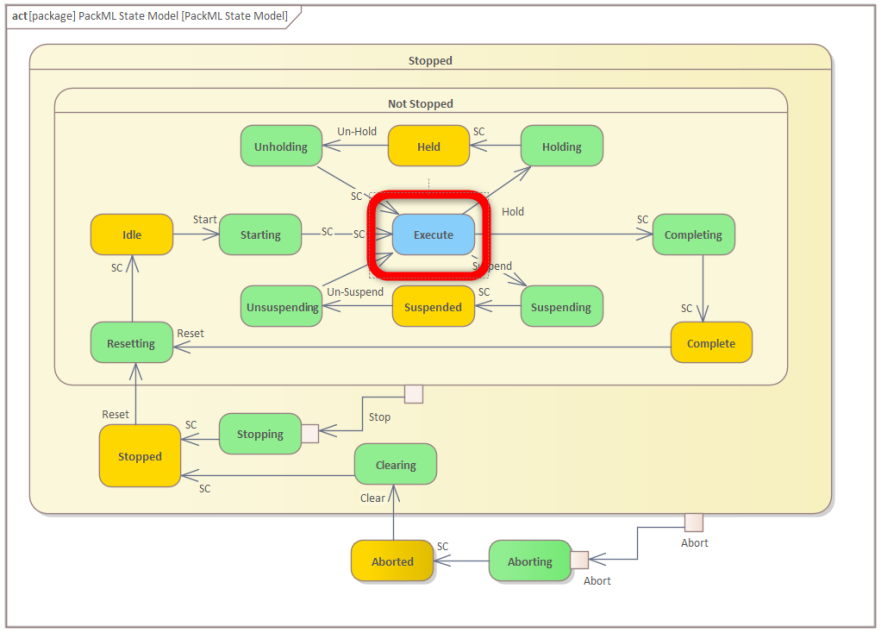
On prépare la machine pour démarrer notre processus

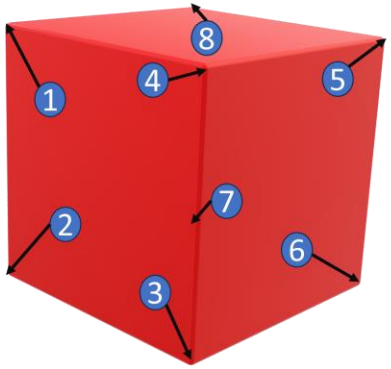




Execute

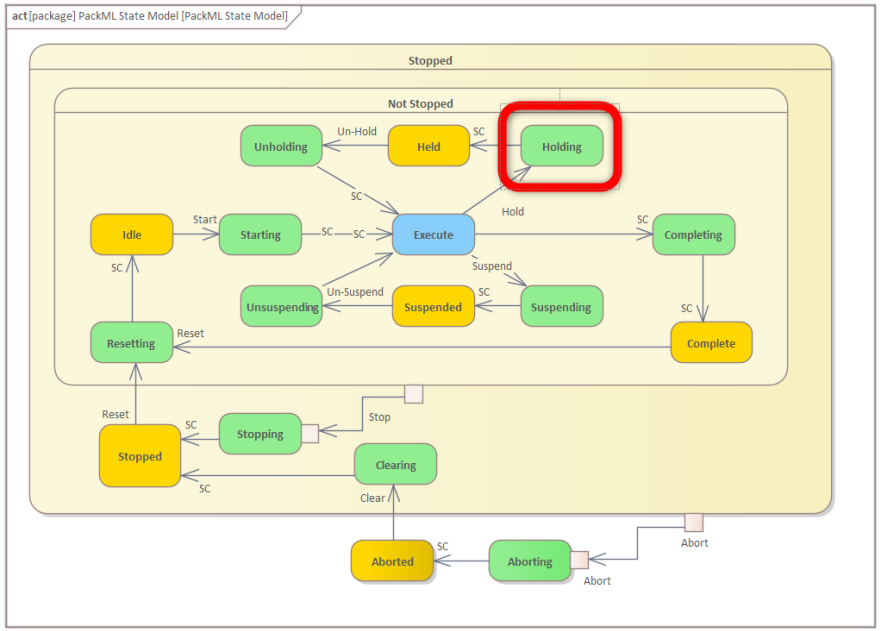
Motion sequence is coded in state Execute.





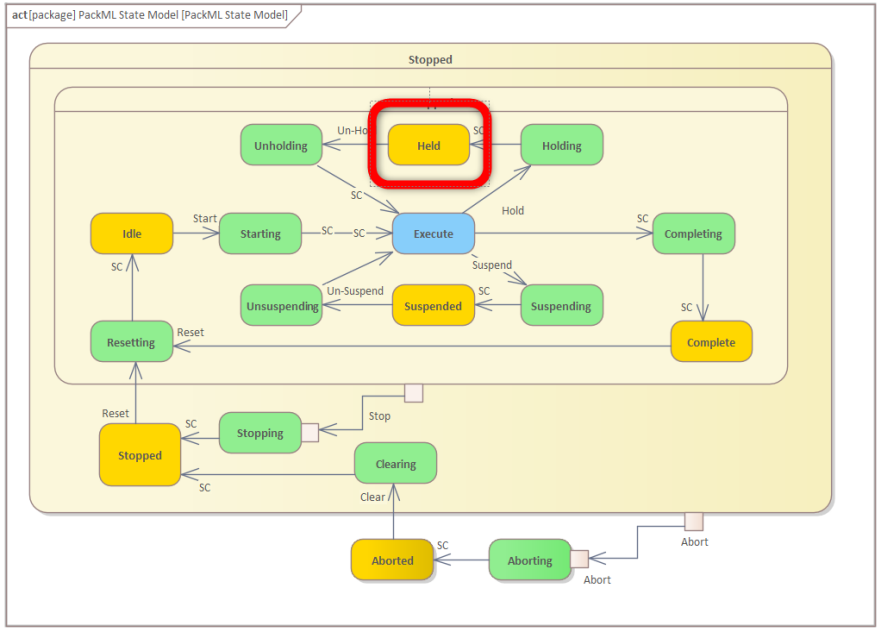
Holding

What to do with the dispenser in this state ?

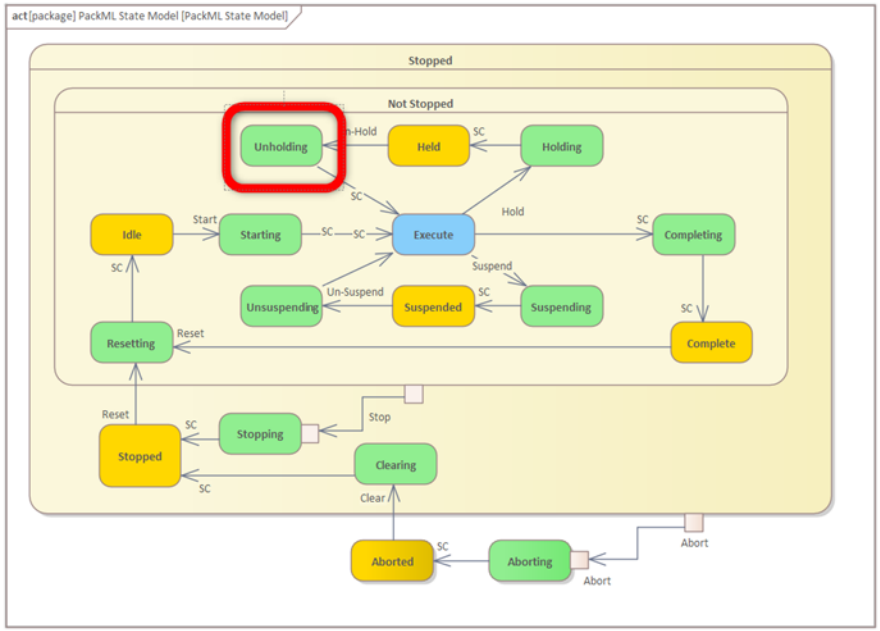


Held

Wait for a Unholding



Unholding

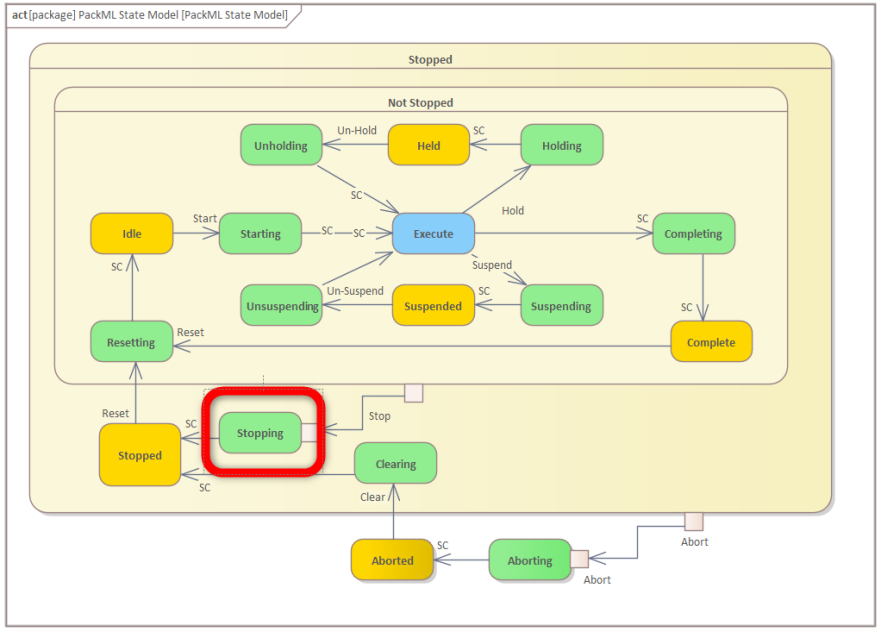


State Type: Acting

Use case:

Redémarrage de la machine grâce à une commande «Unhold» de l'opérateur.

Stopping



State Type: Acting

Use case:

In this case, we need to stop the axes, but the power is still active.

Example: axes are moving in a *DiscreteMotion* and they should go in *Standstill*.

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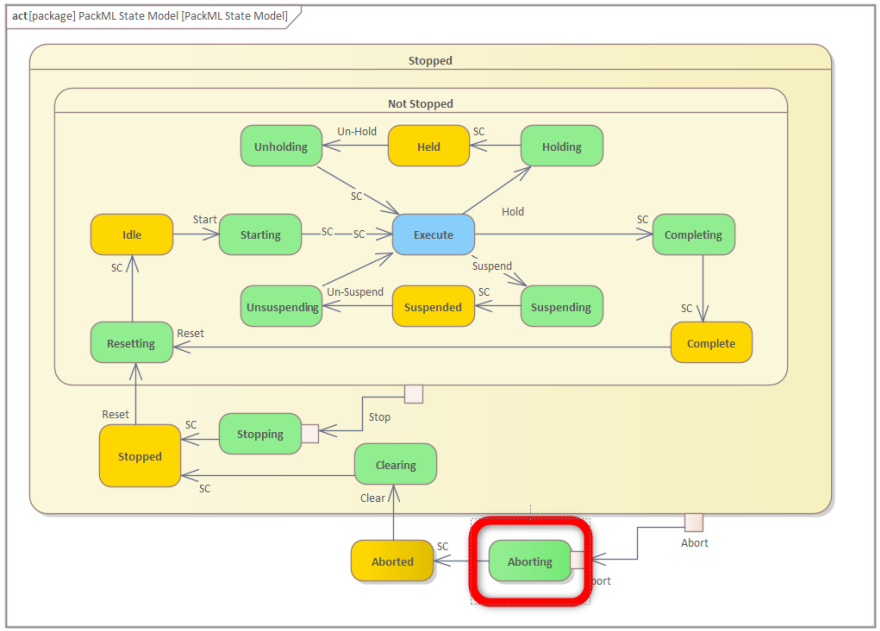
Aborting

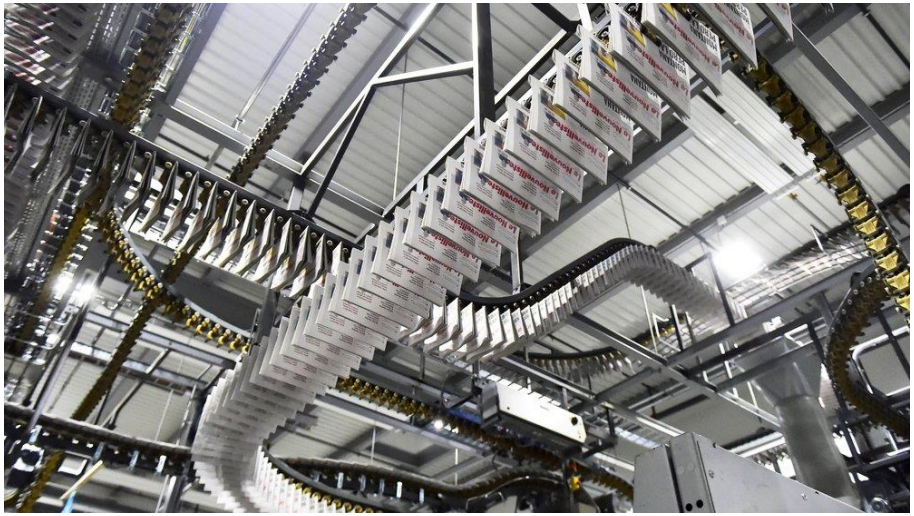
State Type: Acting



Use case:

Arrêt d'urgence. Selon la spécification de la sécurité, la machine a «un certain temps» pour immobiliser tous les éléments avant que le relais de sécurité ne déconnecte l'alimentation en air comprimé et l'alimentation électrique des moteurs.

L'état «aborting» est sans doute l'état le plus critique à gérer !



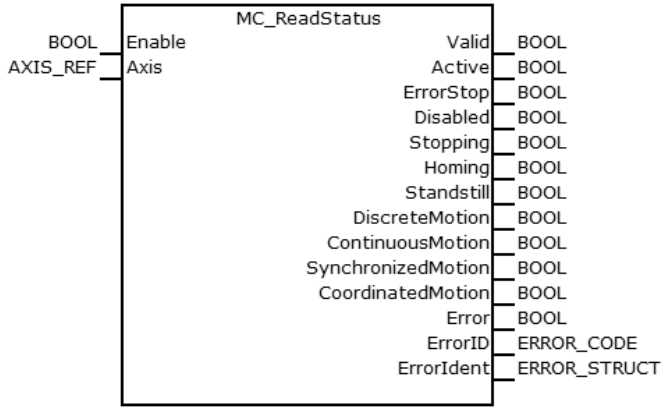
Source: www.lenouvelliste.ch

MC_ReadStatus

Brief description

The function block MC_ReadStatus reads the axis state.

Type: **Enable**

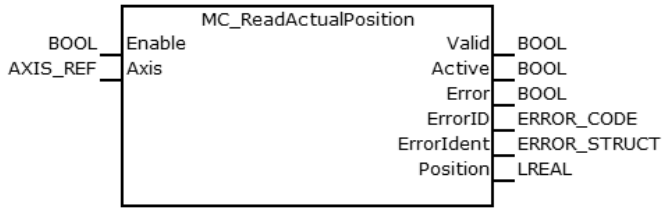


MC_ReadActualPosition

Brief description

The function block MC_ReadActualPosition reads the axis position.

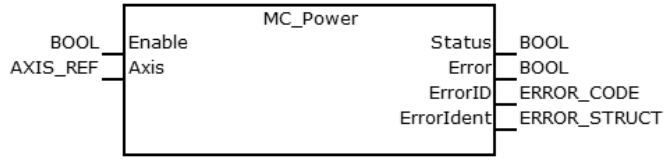
Type: **Enable**



MC_Power

Brief description

The function block MC_Power enables the axis power.



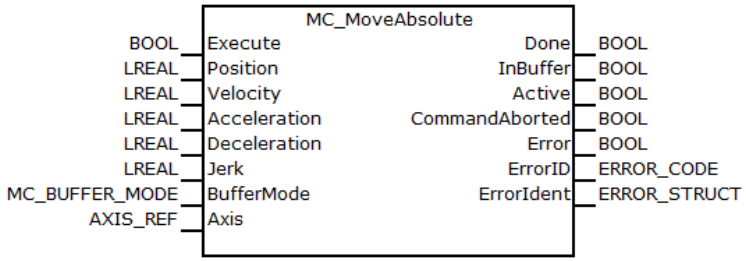
Type: **Enable**

MC_MoveAbsolute

Brief description

The function block MC_MoveAbsolute traverses the axis to a certain position.

Type: **Execute**

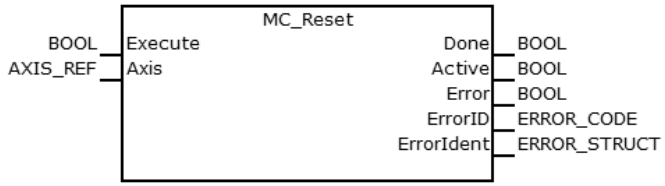


MC_Reset

Brief description

The function block MC_Reset clears a pending axis error.

Type: **Execute**

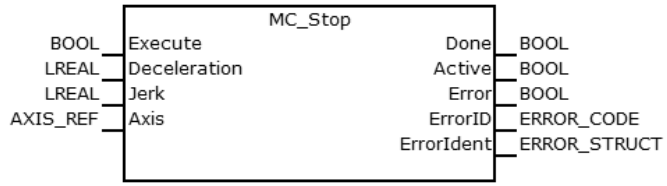


MC_Stop

Brief description

The function block MC_Stop decelerates an axis within the specified limits up to the standstill.

Type: Execute



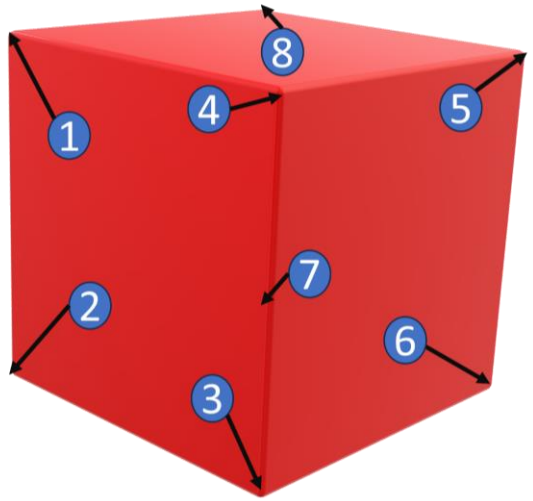
Problème

Comment coder proprement un système qui permette de réaliser les mouvements de 1 à 8.

Comment garantir que la machine puisse démarrer et redémarrer dans tous les cas de figure avec 3 boutons + E-Stop:

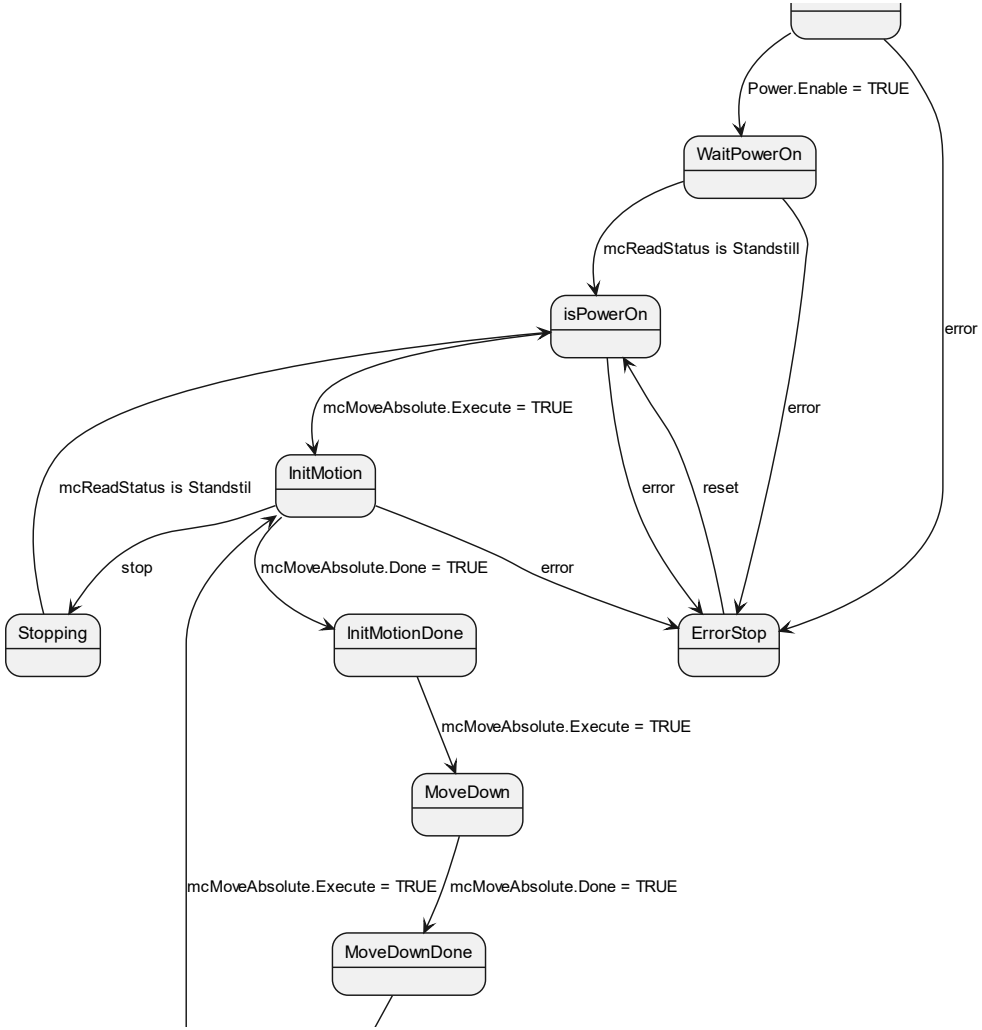
Reset / Start / Stop

Comment coder un système qui nous permette ensuite de modifier facilement la séquence de travail et modifier les positions ?



1ère approche

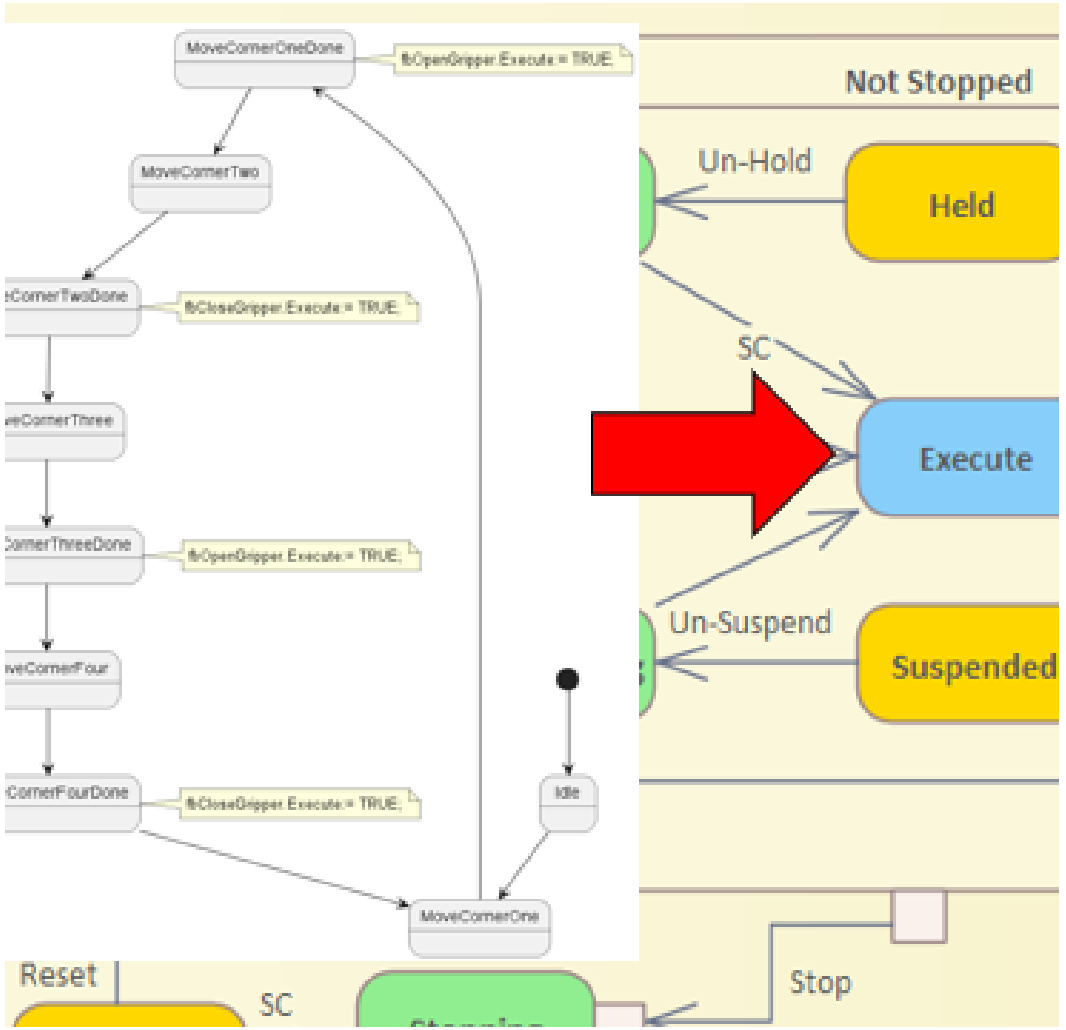
Sans PackML, la machine d'état ressemblerait à ceci.



2ème approche

Avec PackML

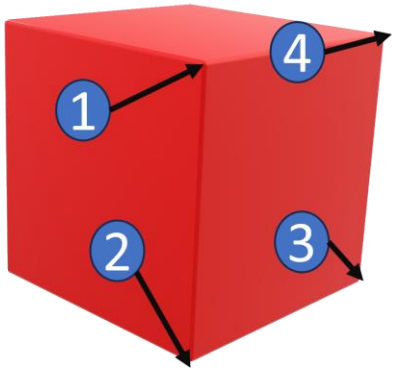
Code sequence in State

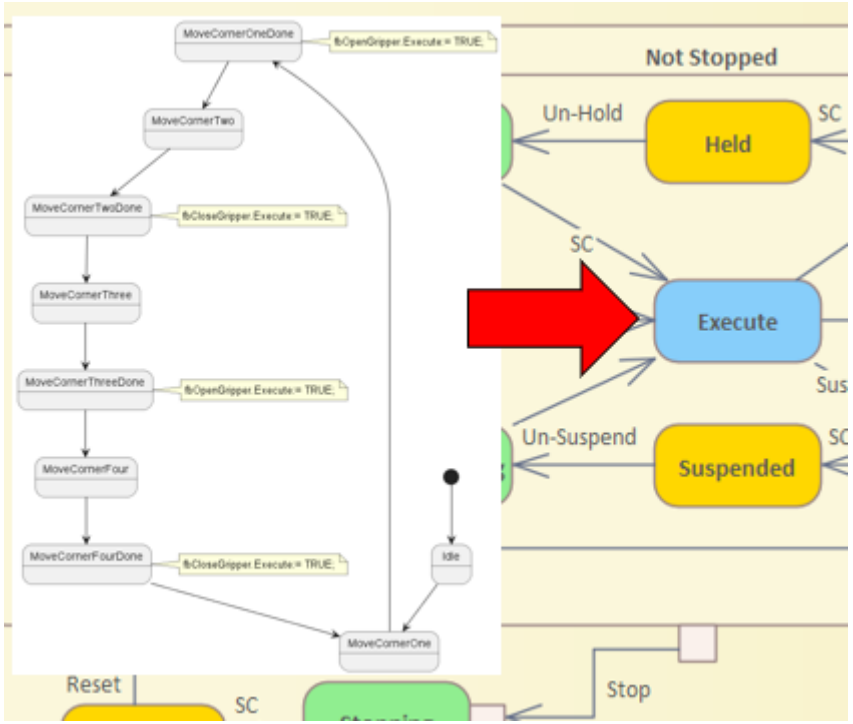


2ème approche (suite)

Avec PackML

Code sequence in State

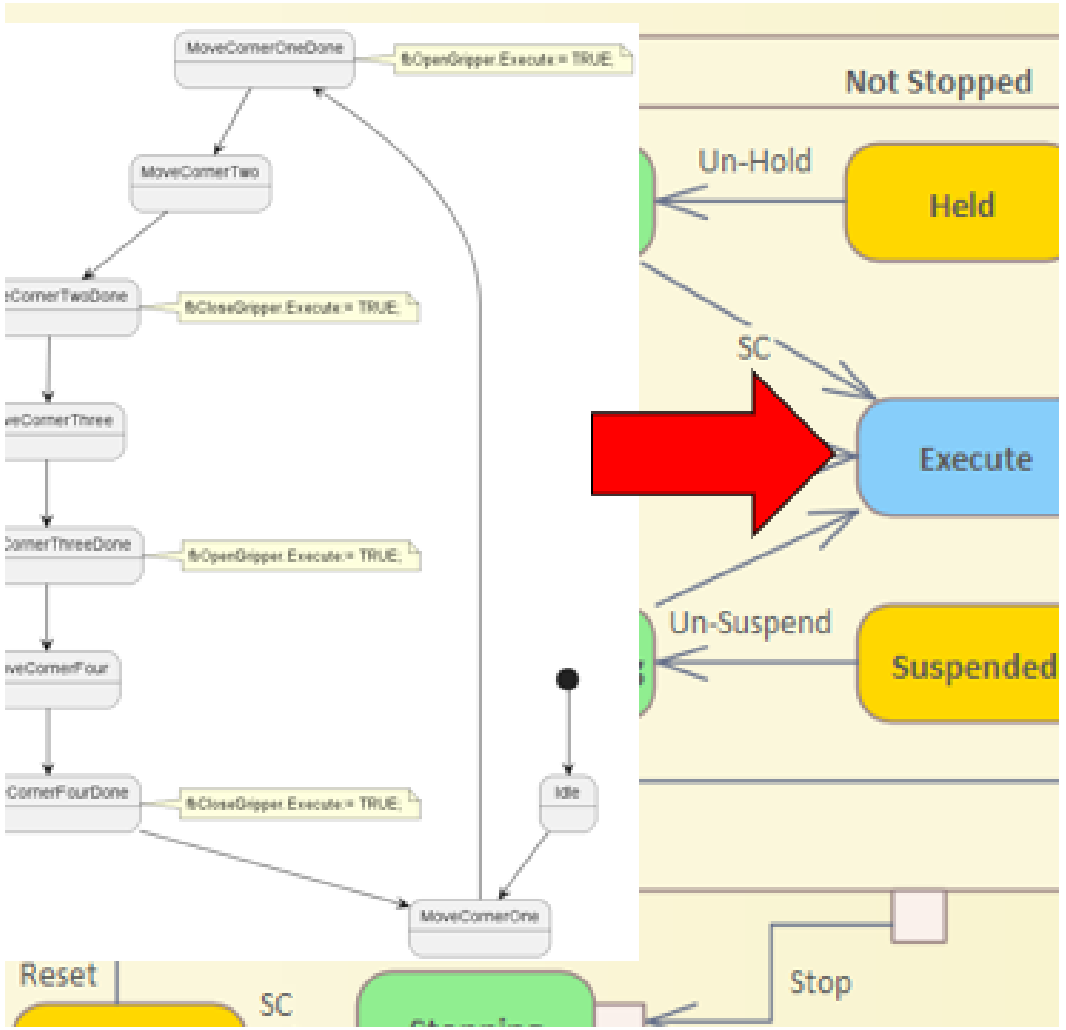




3ème approche

Avec PackML

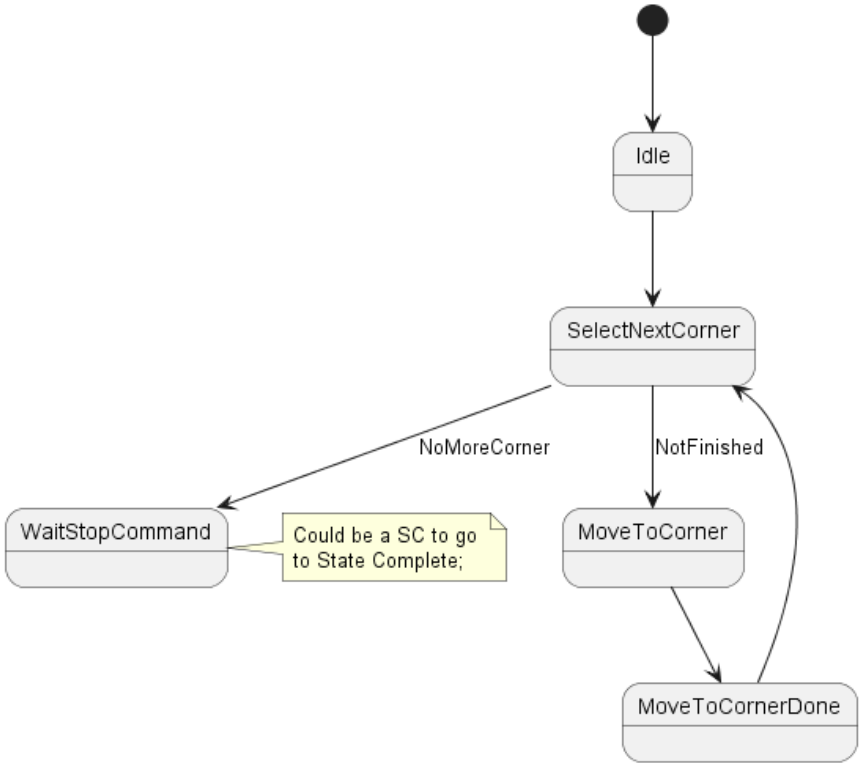
Code a sequence as an array.



3ème approche Your Job

Avec PackML

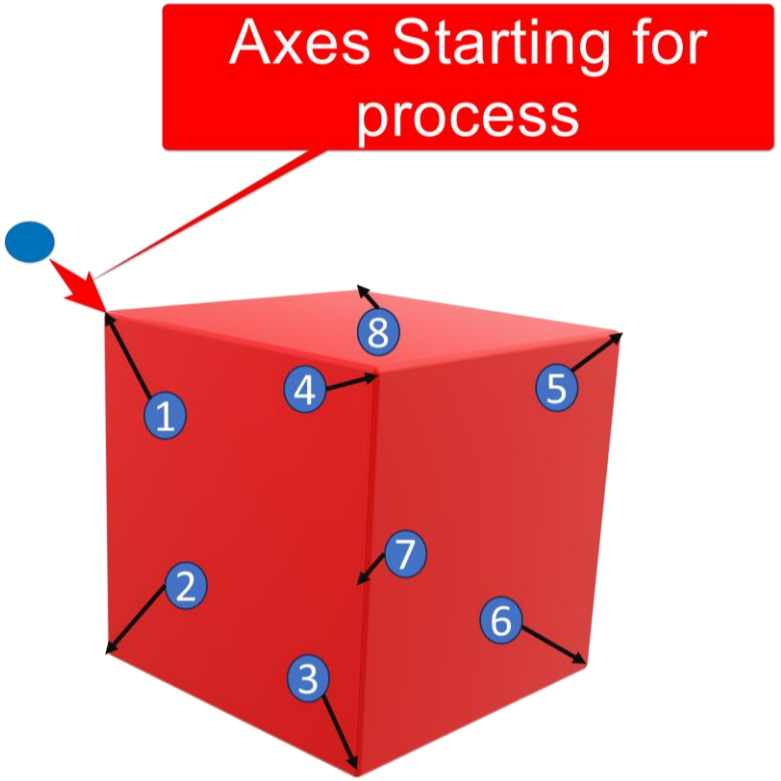
Code sequence in State



List of parameters

Id	Move To Position X	M.T.P Y	M.T.P Z	Action	Delay [ms]	Next Id
1	0	???	50	eOpen	500	2
2	0	???	0	eClose	0	3
3	50	???	0	eOpen	0	4
4	50	???	50	eClose	0	1
1	0	???	50	eOpen	500	2

Add Y Axis



Merci de votre attention