

SAVE

ANIE
AUTOMAZIONE



Riduzione del time-to-market con il Virtual Commissioning

Davide Conti

SIMATIC Technical Support

SIEMENS

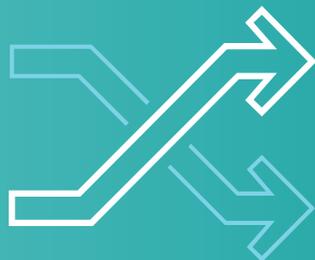
Ingegno per la vita

Requisiti essenziali nell'industria manifatturiera

Velocità



Flessibilità



Qualità



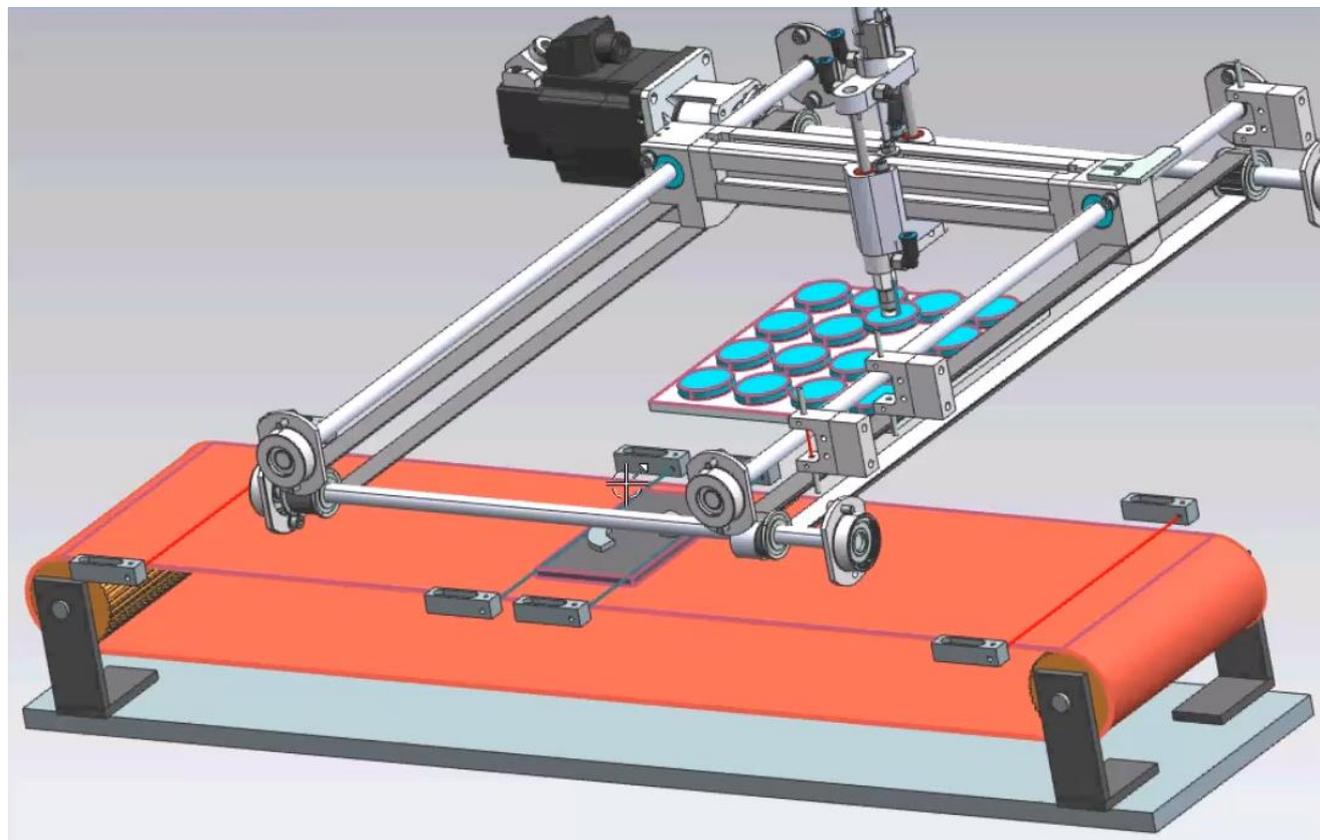
Efficienza



Security



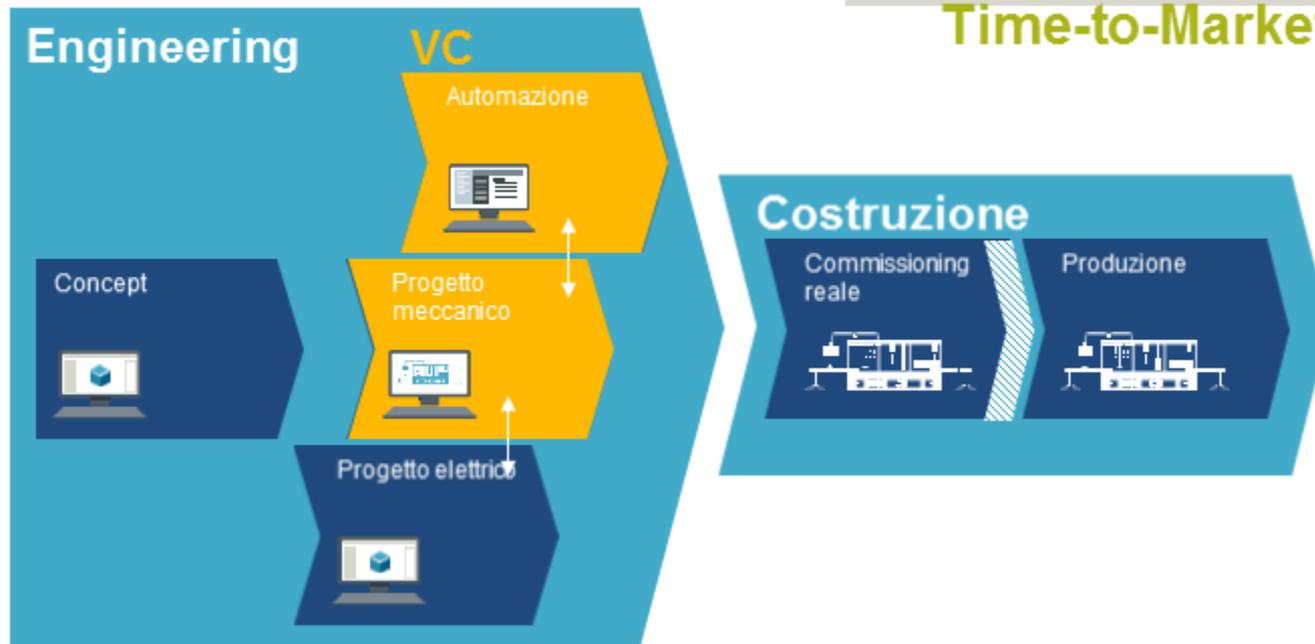
Una macchina di esempio



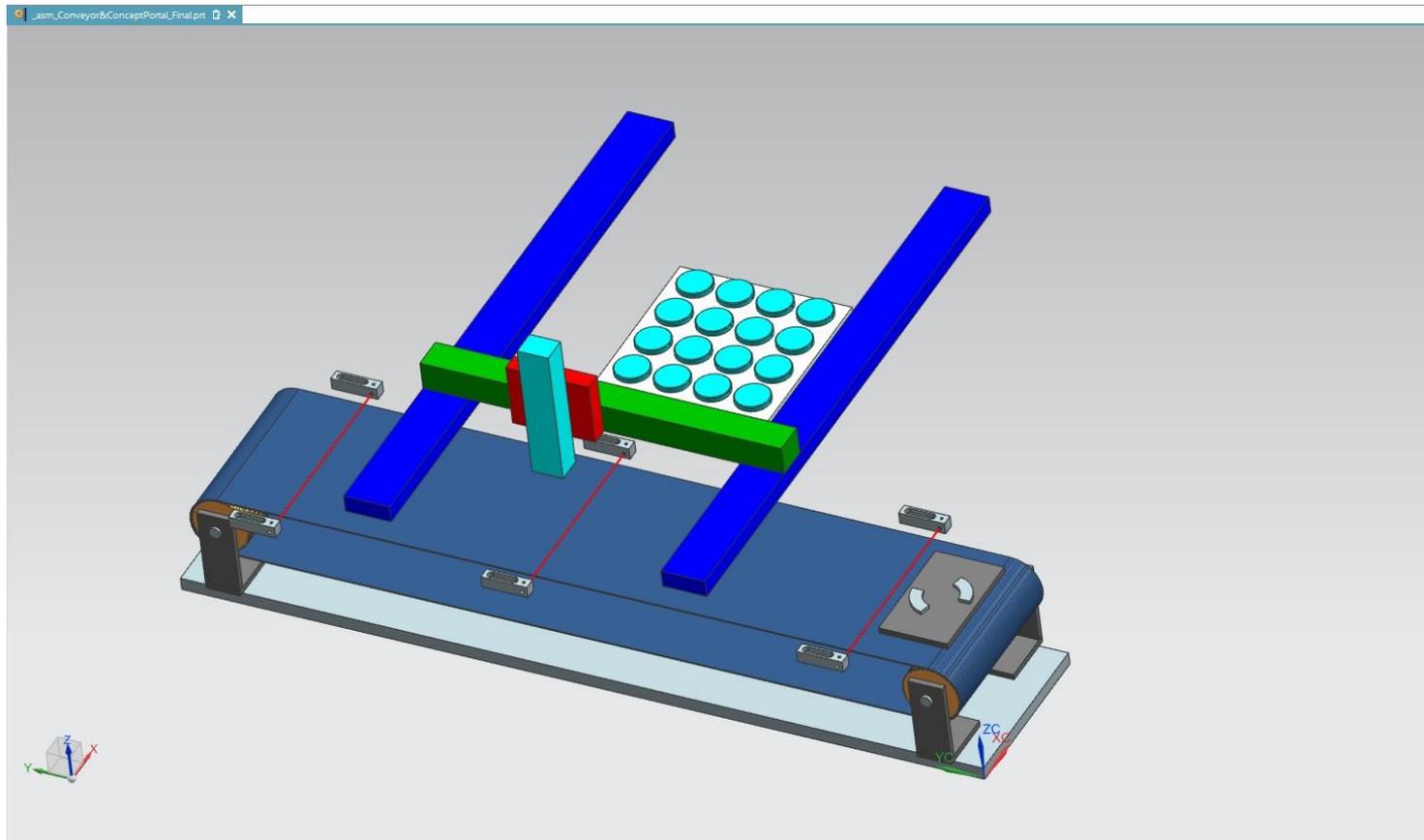
Il Virtual Commissioning abilita il lavoro parallelo... ...e quindi un Time-to-market più breve

Time-to-market

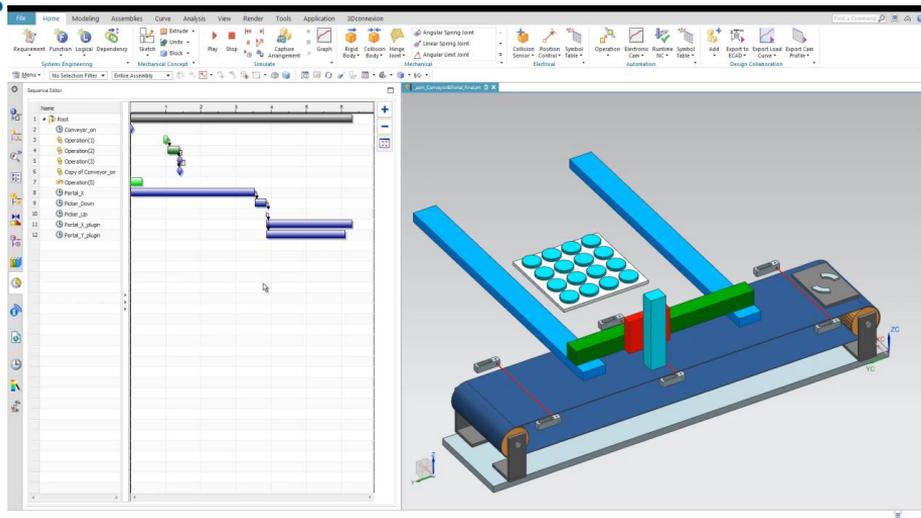
Riduzione
Time-to-Market



Il concept



Dal concept alle sequenze logiche



Sequenza delle operazioni

Condizioni logiche

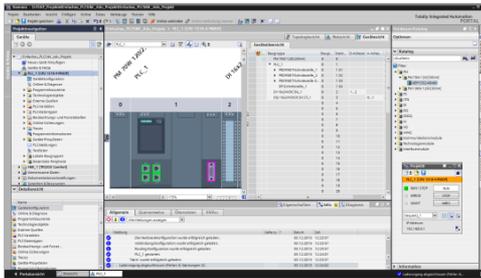
Posizione, velocità, accelerazione dei singoli assi

Posizioni di presa e deposito

Resource name	Ref. Desig	Step	Action	Predecessors	Signal out	Signal in	Time Start	Dur.	Sum
SpeedControl(1)		1	Conveyer_on	(null)	SpeedControl(1).speed = -20.000000*/s				
PositionControl_x_Axis_1		2	Portal_X	(null)	PositionControl_x_Axis_1.speed = 100.000000mm/s; PositionControl_x_Axis_1.acceleration = 163.272000mm/s^2		#####	#####	
PositionControl_x_Axis_1		3	Picker_Down	2	PositionControl_x_Axis_1.position = -10.000000mm		#####	0.3	#####
PositionControl_x_Axis_1		4	Picker_Up	3	PositionControl_x_Axis_1.position = 0.100000mm		#####	0.0	#####
PositionControl_x_Axis_1		5	Portal_X_plugin	4	PositionControl_x_Axis_1.position = 73.100000mm		#####	#####	#####
PositionControl_y_Axis_1		6	Portal_Y_plugin	4	PositionControl_y_Axis_1.position = 67.380000mm		#####	#####	#####
SpeedControl(1)		7	Operation(1)	(null)	SpeedControl(1).speed = 0.000000*/s	CollisionSensor(2).triggered	#####	0.1	#####
PositionControl_x_Axis_1		8	Operation(2)	7	PositionControl_x_Axis_1.position = -10.500000mm	CollisionSensor(2).triggered	#####	0.6	#####
PositionControl_x_Axis_1		9	Operation(3)	8	PositionControl_x_Axis_1.position = 0.000000mm		#####	#####	#####
SpeedControl(1)		10	Copy of Conveyer_on	9	SpeedControl(1).speed = -20.000000*/s		#####	#####	#####

Simulatori PLC a confronto

Simulatore PLC Standard



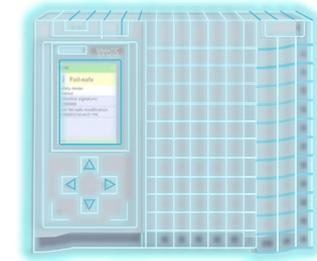
Simulazione integrata nell'ambiente di sviluppo

Utilizzo tipico:

- Test funzionale di un programma PLC e/o HMI

✓ / ✓	Basic Controller / Advanced Controller	✗ / ✓
✗	API	✓
fino a 2	Istanze multiple	fino a 16
✗	Istanze distribuite	✓
✗	OPC UA	✓
✗	Web server	✓
✓	Diagnostica di processo	✓
(✓)	Traces	✓
(✓)	Motion	✓
via softbus	Comunicazione con PLC e HMI	✓
via softbus	Open User communication	✓
(✓)	Blocchi know how protected	✓
✗	Virtual time	✓
✗	Collegamento di PLC e HMI reali	✓
✗	DNS	✓
✗	Supporto di memoria virtuale	✓

Simulatore PLC Advanced

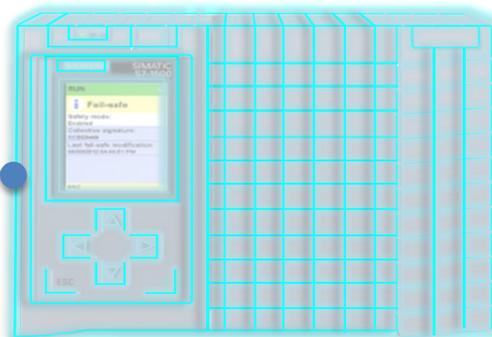
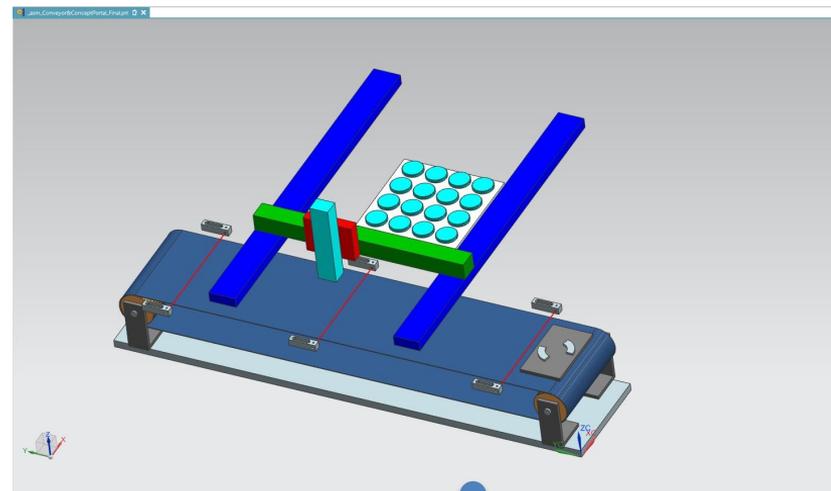
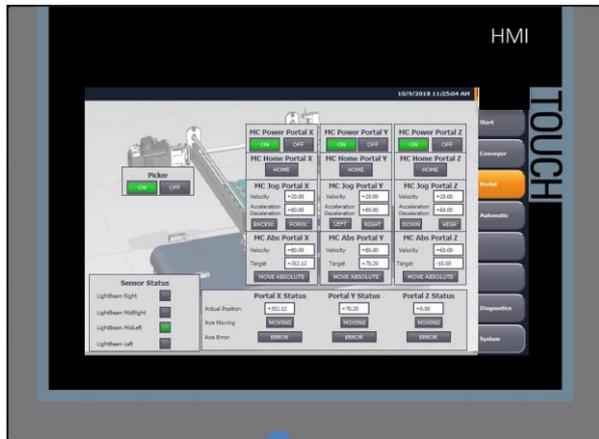


Controllore virtuale

Applicazioni:

- Test funzionale di un programma PLC e/o HMI anche nel contest di macchina e/o impianto
- Addestramento operatori
- Virtual commissioning / Factory Acceptance Test (FAT)

Ambiente di simulazione



Impostazione della co-simulazione

Signal Mapping

External Signal Type

Type: PLCSIM Adv Instances

PLCSIM Adv
PLC_1

Signals

MCD Signals (17)

Name	Adapter Name	IO Type	Data Type	Mapping Count	Owner Component
Angle_speed_n...	Global	Input	double	0	
millimeters	Global	Input	double	0	
Set_Speed_x	SignalAdapter(1)	Input	double	0	
Set_Pos_x	SignalAdapter(1)	Input	double	1	
Set_Speed_y	SignalAdapter(1)	Input	double	0	
Set_Pos_y	SignalAdapter(1)	Input	double	1	
Set_Speed_z	SignalAdapter(1)	Input	double	0	
Set_Pos_z	SignalAdapter(1)	Input	double	1	
Set_Speed_conv	SignalAdapter(1)	Input	double	1	

External Signals (10)

Name	IO Type	Data Type	Mapping Count	Path
LightBeam_Mid...	Input	bool	1	
LightBeam_Mid...	Input	bool	1	
LightBeam_Left	Input	bool	1	
LightBeam_Right	Input	bool	1	
Picker_vakuum	Output	bool	1	
Portal_X_Position	Output	double	1	
Conveyor_Velo...	Output	double	1	
Portal_Y_Position	Output	double	1	
Portal_Z_Position	Output	double	1	

Do Auto Mapping

Mapped Signals

Connection Name	MCD Signal Name	Direction	External Signal Name	Owner Component	Message
PLCSIM Adv.PLC_1					
SignalAdapter(1)_Set_Speed_conv...	Set_Speed_conv	←	Conveyor_Velocity		
SignalAdapter(1)_LB_left_LightBea...	LB_left	→	LightBeam_Left		
SignalAdapter(1)_LB_right_LightB...	LB_right	→	LightBeam_Right		
SignalAdapter(1)_Set_Pos_x_Portal...	Set_Pos_x	←	Portal_X_Position		
SignalAdapter(1)_Set_Pos_y_Portal...	Set_Pos_y	←	Portal_Y_Position		
SignalAdapter(1)_Set_Pos_z_Portal...	Set_Pos_z	←	Portal_Z_Position		
SignalAdapter(1)_LB_middleleft_Li...	LB_middleleft	→	LightBeam_MiddleLeft		
SignalAdapter(1)_LB_middleright...	LB_middleright	→	LightBeam_MiddleRi...		

Check for N->1 Mapping

OK Cancel

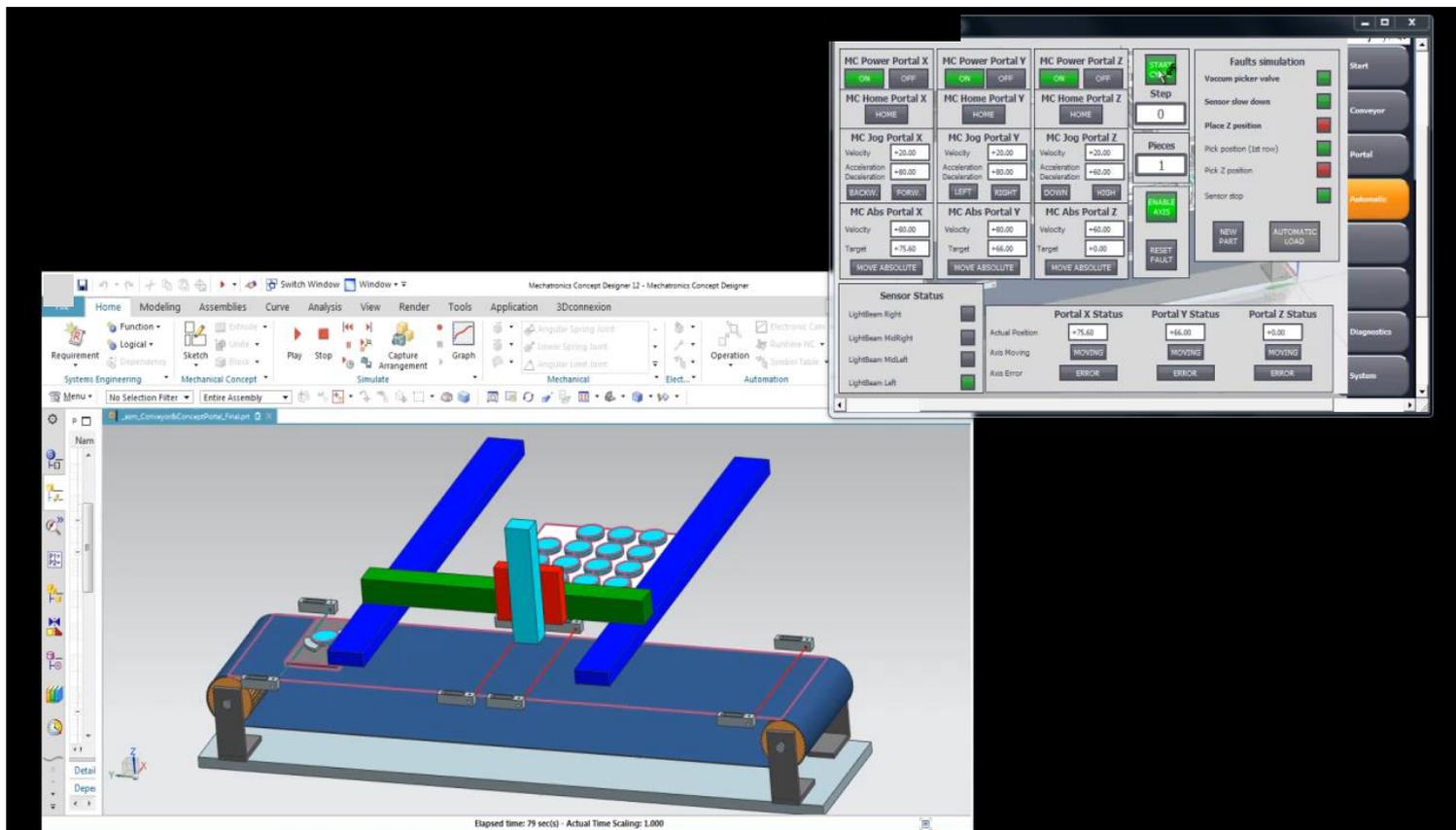
Debug del software in ambiente di co-simulazione

The image displays a software interface for co-simulation, likely between a CAD application and a PLC. The main window shows a 3D model of a conveyor system with a tray of blue cylinders. The interface includes several panels:

- MC Power Portals:** A grid of controls for X, Y, and Z axes, including ON/OFF buttons and HOME positions.
- MC Jog Portals:** Controls for jogging the X, Y, and Z axes, with fields for Velocity, Acceleration, and Deceleration.
- MC Abs Portals:** Controls for absolute movement of the X, Y, and Z axes, with fields for Velocity and Target.
- Start Cycle Step:** A control panel with a 'START CYCLE' button, a 'STEP' counter set to 0, and 'ENABLE AXIS' and 'RESET FAULT' buttons.
- Faults simulation:** A panel for simulating faults, including 'Vacuum picker valve', 'Sensor slow down', 'Place Z position', 'Pick position (1st row)', 'Pick Z position', and 'Sensor stop'.
- Sensor Status:** A panel showing the status of various sensors like LightBeam Right, LightBeam MidRight, etc.
- Control Panel:** A panel for online access to the PLC, showing 'PLC1M' and 'PLC1M Virtual Eth. Adapter'. It includes 'Virtual Time Scaling' (set to 1) and 'Start Virtual S7-1500 PLC' options.
- Active PLC Instance(s):** A list showing one active instance: 'PLC1' at IP address '192.168.0.1'.

At the bottom of the interface, the following information is displayed: Elapsed time: 29 sec(s) - Delay Time: 9 msec(s) - Actual Time Scaling: 1.200

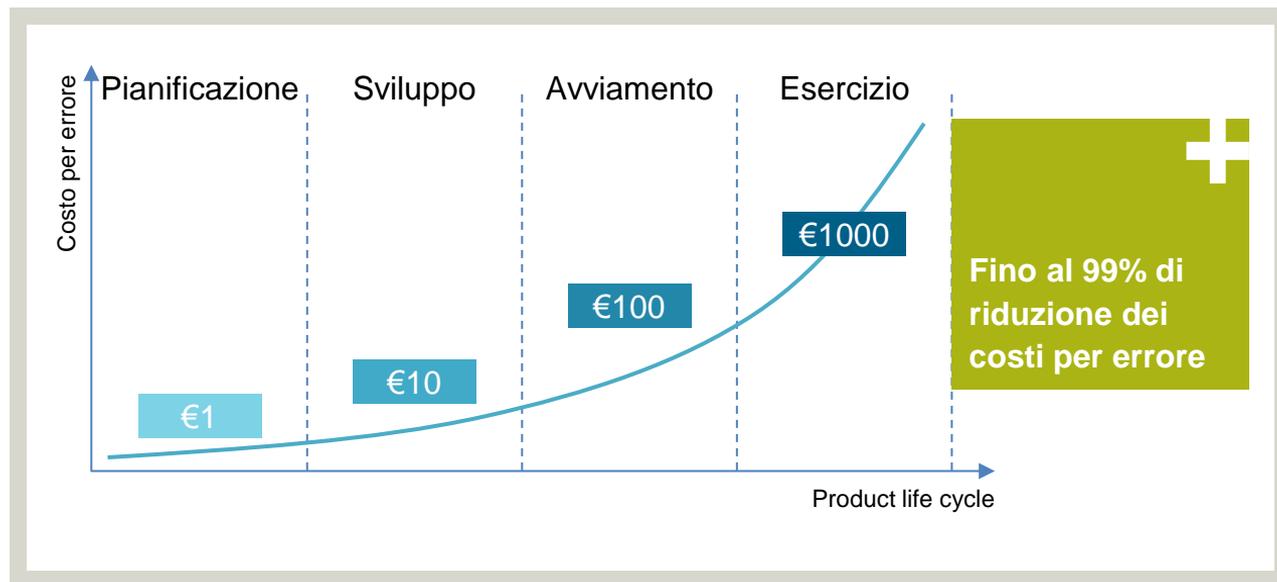
Debug del software in ambiente di co-simulazione



Il costo degli errori nel ciclo di vita dei prodotti

Six Sigma/Quality Rule Rule of tens

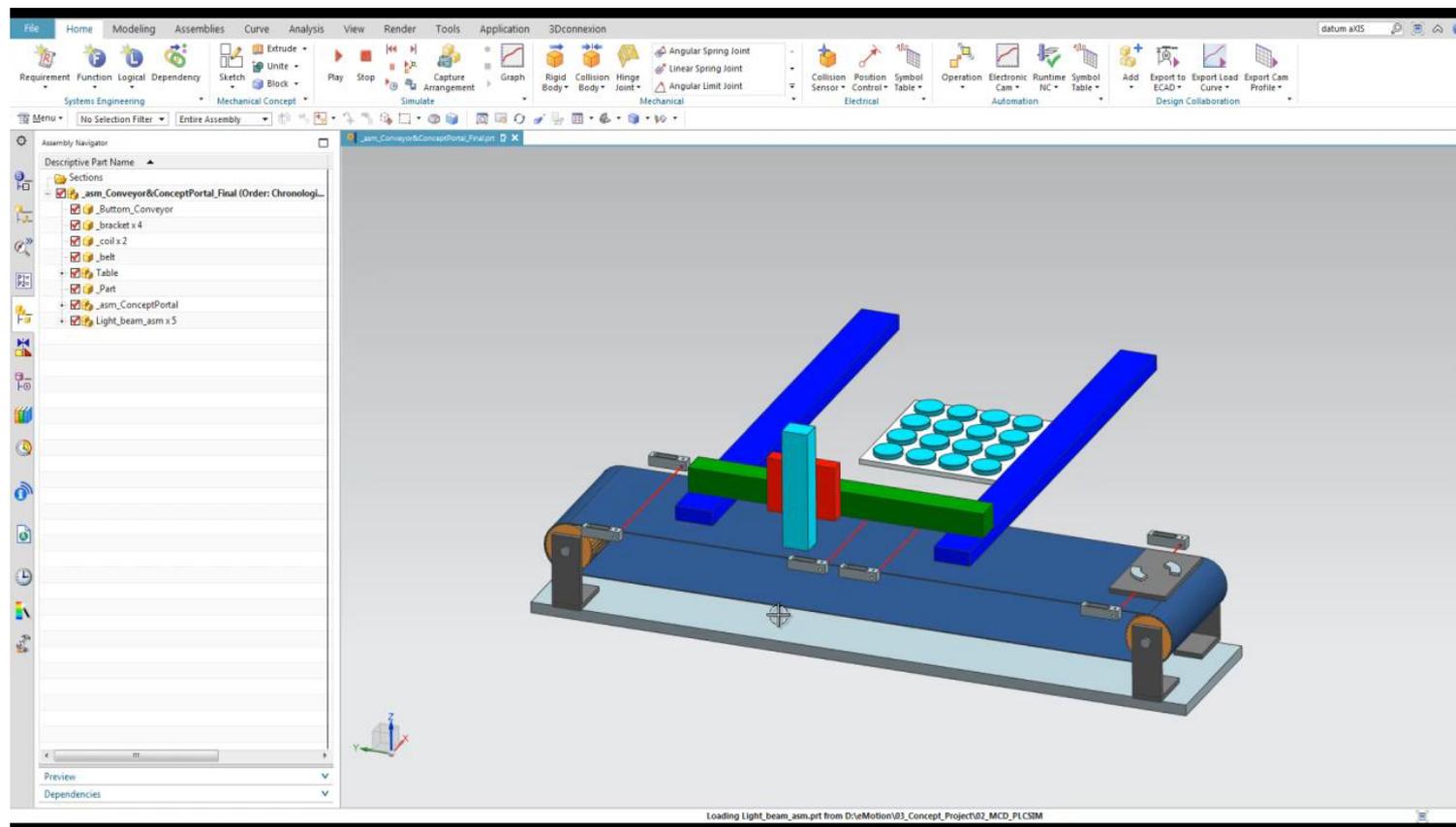
"The rule of tens says that error-related costs for an unidentified error increase by a factor of 10 from one value-added level to the next. The earlier a error is identified and corrected, the cheaper this is for the organization. (...)"



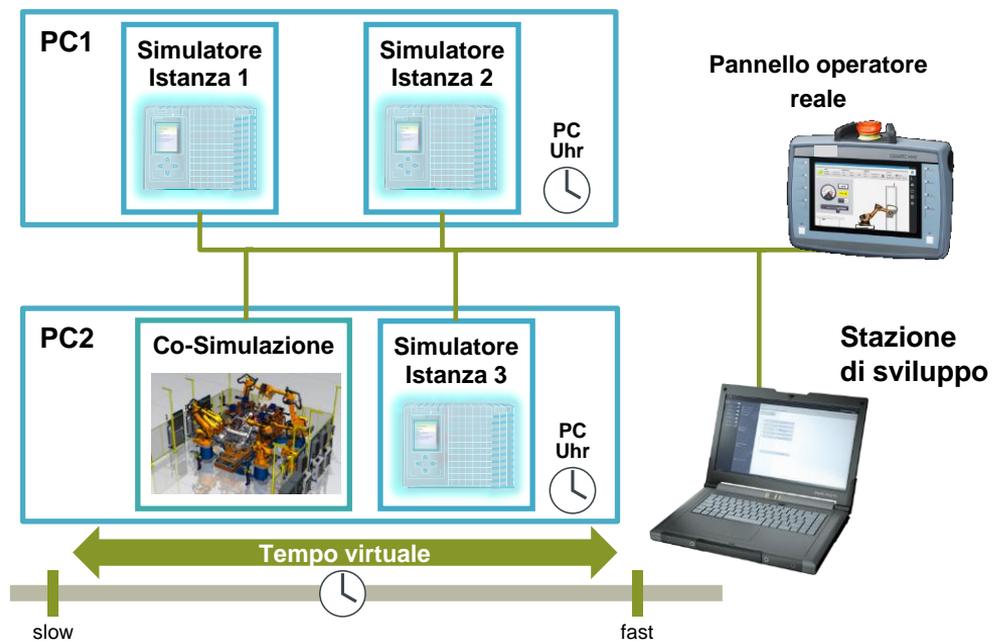
Conclusione

La qualità dello sviluppo deve essere incrementata il prima possibile!

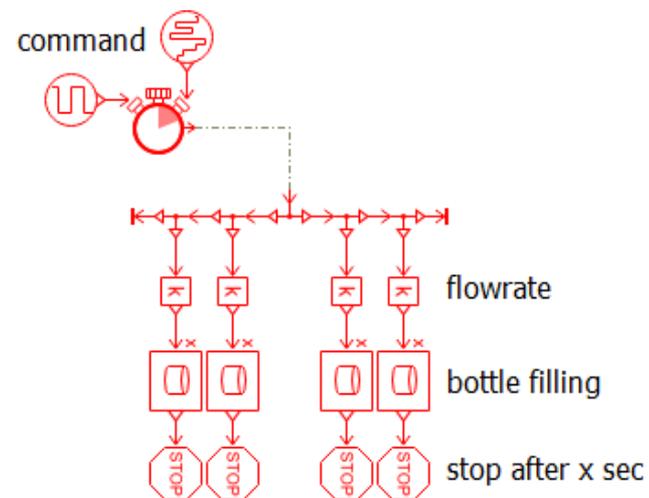
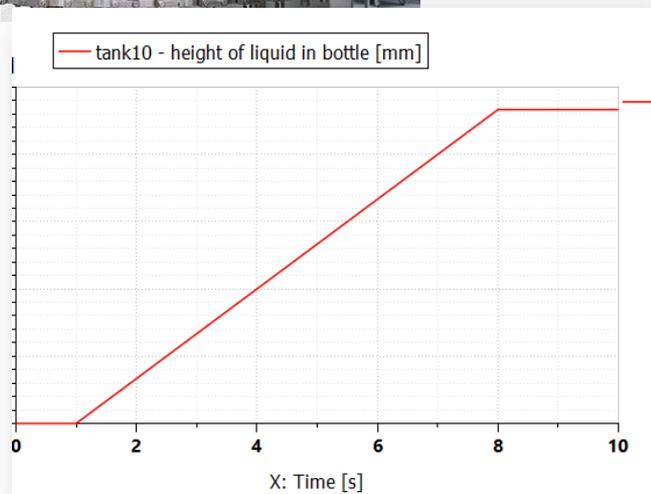
Dal concept al design definitivo



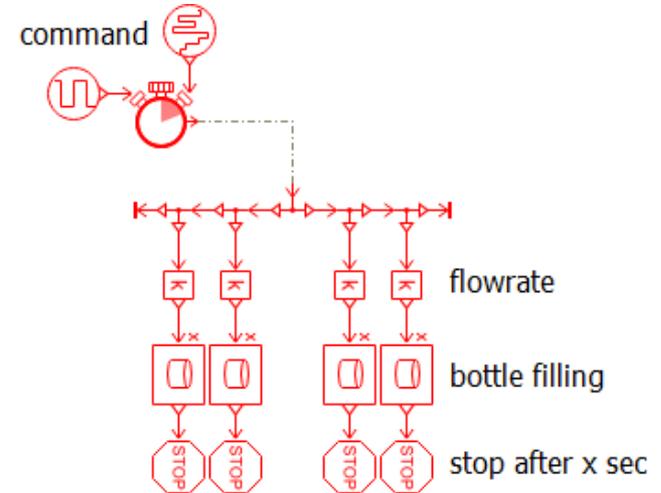
Simulazione distribuita



Co-simulazione con altri tipi di modelli

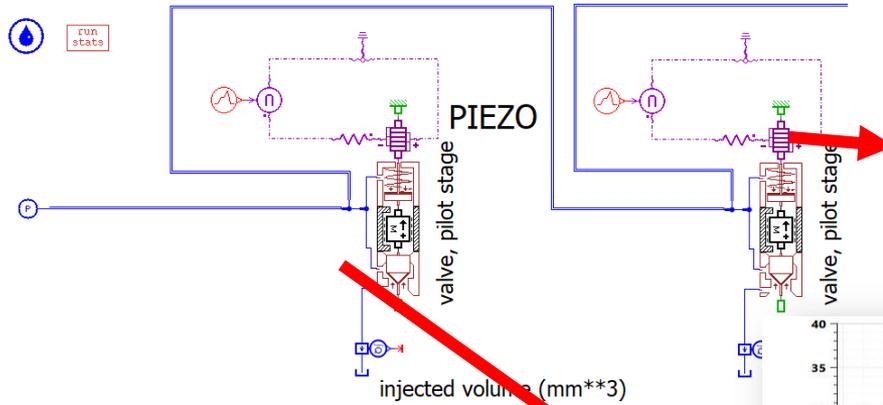


Co-simulazione con altri tipi di modelli

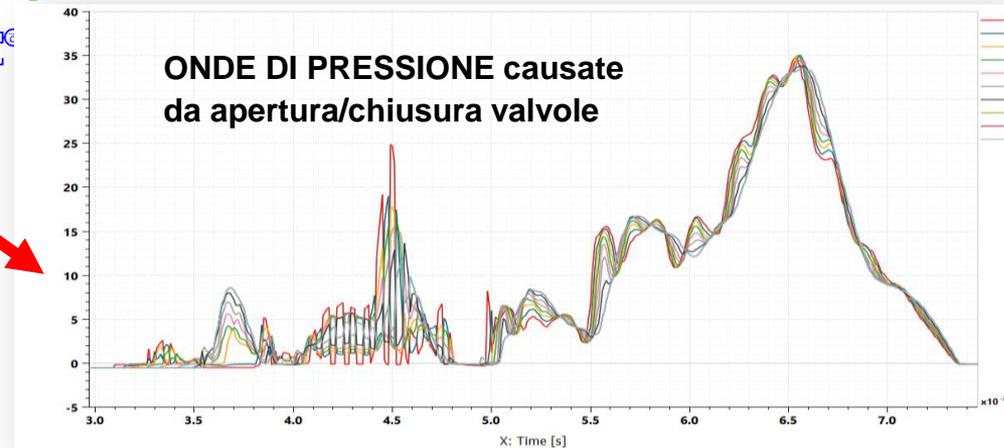


- Siamo sicuri che arrivi la stessa portata ad ogni bottiglia?
- Le valvole non creano delle onde d'urto che impattano sul riempimento?
- Siccome la pressione nel circuito varia, siamo sicuri che le mie valvole rimangano aperte al mio comando?
- Se accelero la macchina, pompe e valvole mi stanno dietro?
- E se il liquido fosse più viscoso come si riempiranno? Ce la faccio in un giro della giostra?
- Come faccio a migliorare l'efficienza energetica del mio impianto?

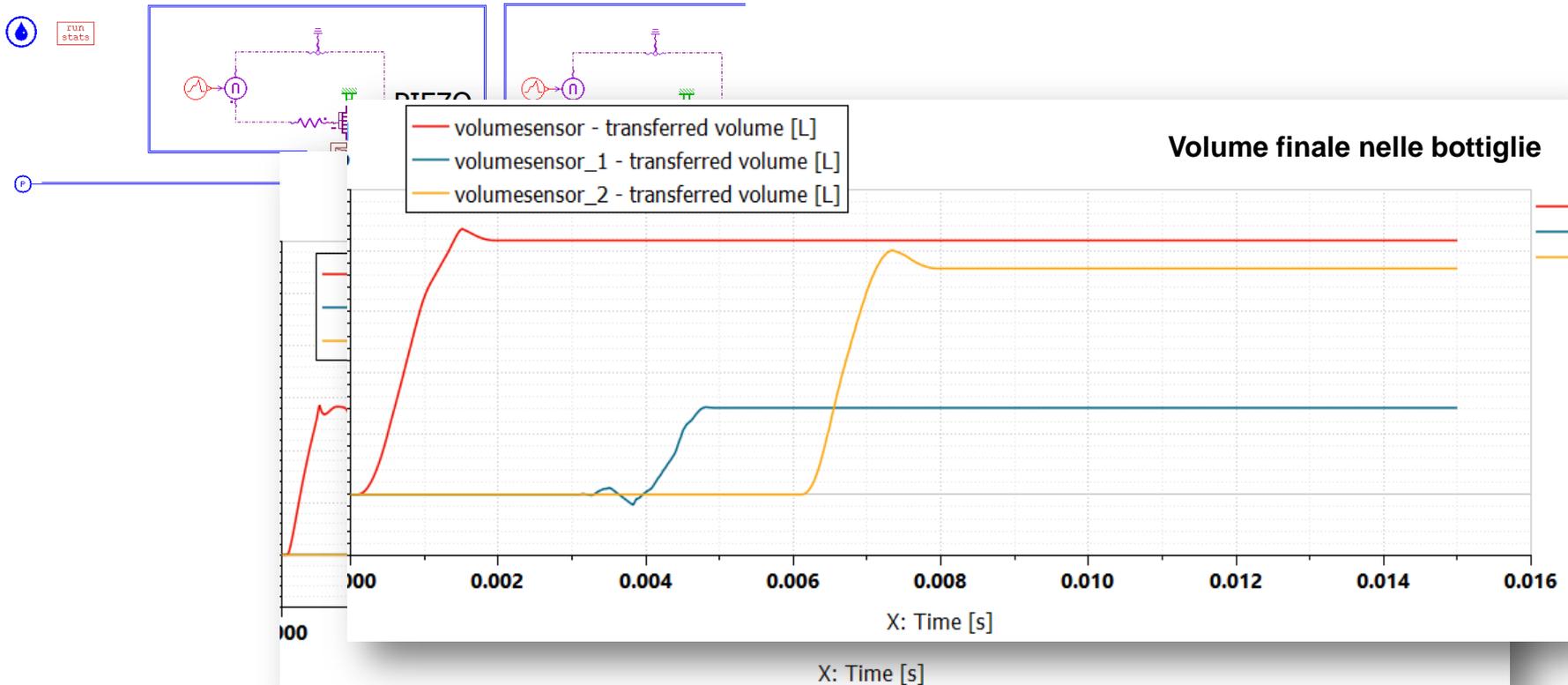
Un esempio di modello multifisico



**ASSORBIMENTO
ENERGIA elettrica**



Un esempio di modello multifisico



Conclusioni



Qualità

- Ottimizzare l'intera macchina in un **ambiente virtuale**



Velocità

- **Ridotti tempi** per la messa in servizio
- **Sovrapporre** le attività di progettazione meccanica ed elettrica



Costi

- Risoluzione anticipata di problemi
- **Riduzione costi di messa in servizio**



Rischi

- Ambiente di test sicuro ed efficiente usando il modello
- **Ridotti rischi durante la reale messa in servizio e in caso di errori**



Flessibilità

- Possibilità di sperimentare migliorie o modifiche
- **Valutazione delle migliorie durante la fase di test**



Grazie per l'attenzione

Davide Conti
SIMATIC Technical Support

SIEMENS

Ingegno per la vita

