

**mid** Moulding  
Innovation  
Day 2023

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**Moldex3D ITALIA**

**Giorgio Nava**

**Digital Twin e Smart Design & Manufacturing**

**Moldex3D**





# Dalla Simulazione a Digital Twin verso Smart Design&Manufacturing

# Moldex3D

Più di 30 anni di esperienza  
nella simulazione di prodotto e  
di processo in ambiente  
iniezione sia per materiale  
termo-plastico sia termo-reattivo

# Moldex3D

Oggi Moldex3D conta 200  
clienti in Italia, oltre 1.500 in  
Europa, oltre 6.000 nel mondo

# Moldex3D

Oggi Moldex3D è riconosciuto  
come best-in-class technology e  
leader del proprio mercato

# Moldex3D

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- La sede è a Hsinchu, Taiwan
- 300+ collaboratori
- 100+ R&D e 100+ per il supporto tecnico



**12**

12 direct offices in US  
Europe and Asia

**60+**

Present in over  
60 countries

**400+**

More than 400  
sales offices

**Moldex3D Italia ha sede in Lecco**

Europe support center from the Netherlands

# Digital Twin for Smart Design& Manufacturing

- Design Digital Twin
- Machine Digital Twin
- Material Digital Twin
- Process Digital Twin



# Moldex3D- Dalla Simulazione a Digital Twin

## Machine Digital Twin

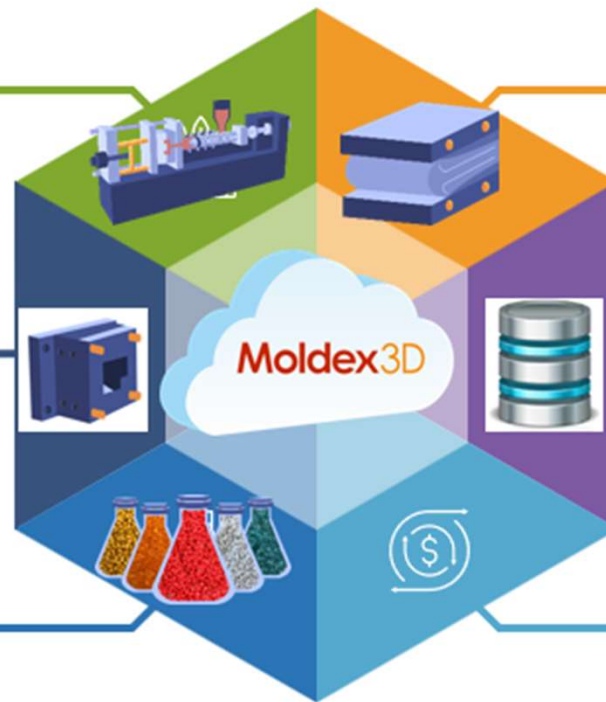
- Machine response
- Screw/Nozzle design
- Molding machine design

## Design Digital Twin

- Design database/wizard
  - DFM
- Design optimization
  - Smart Design

## Material Digital Twin

- Material modeling
- Material characterization
- Measurement instrument development



## Process Digital Twin

- Insights for process dynamics
- Process simulation/optimization
- Molding innovation

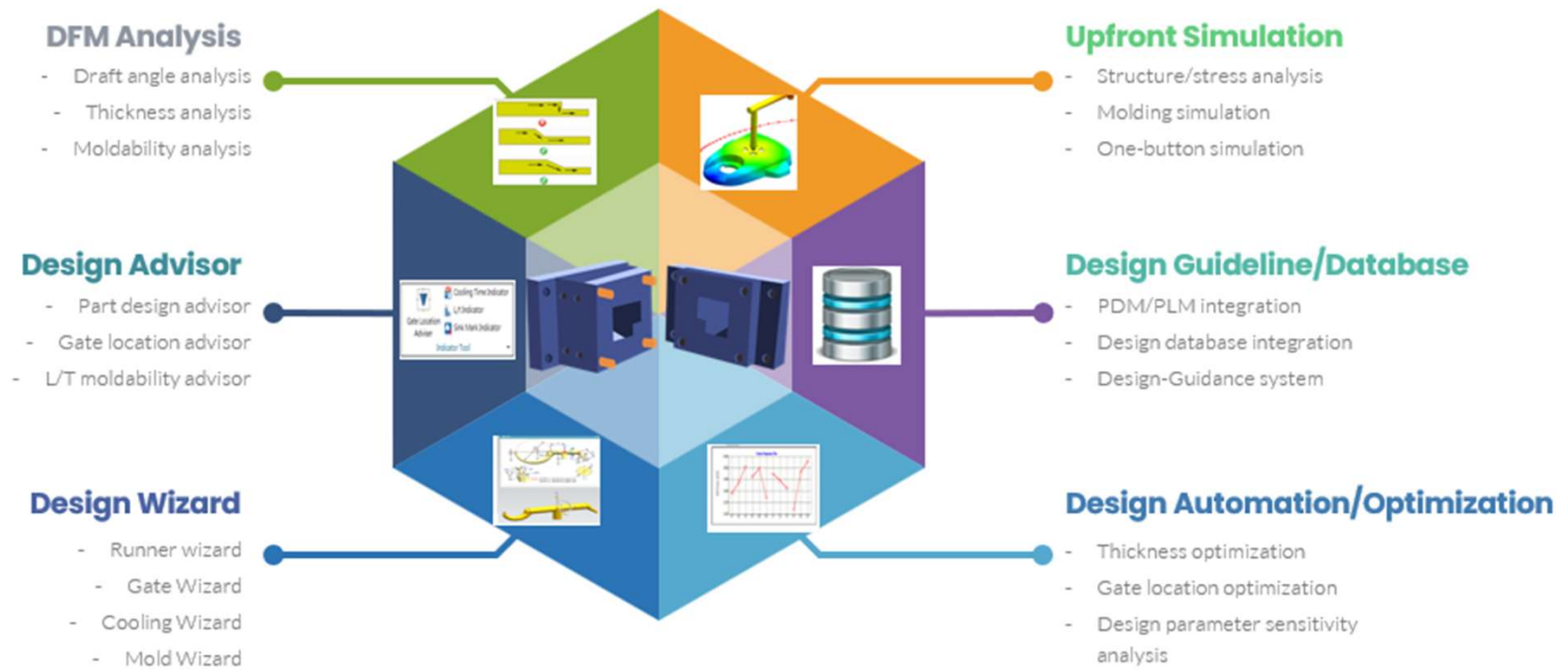
## Industrial Big Data

- Data collection/ clustering
- Modeling and data analytics
- Knowledge discovery

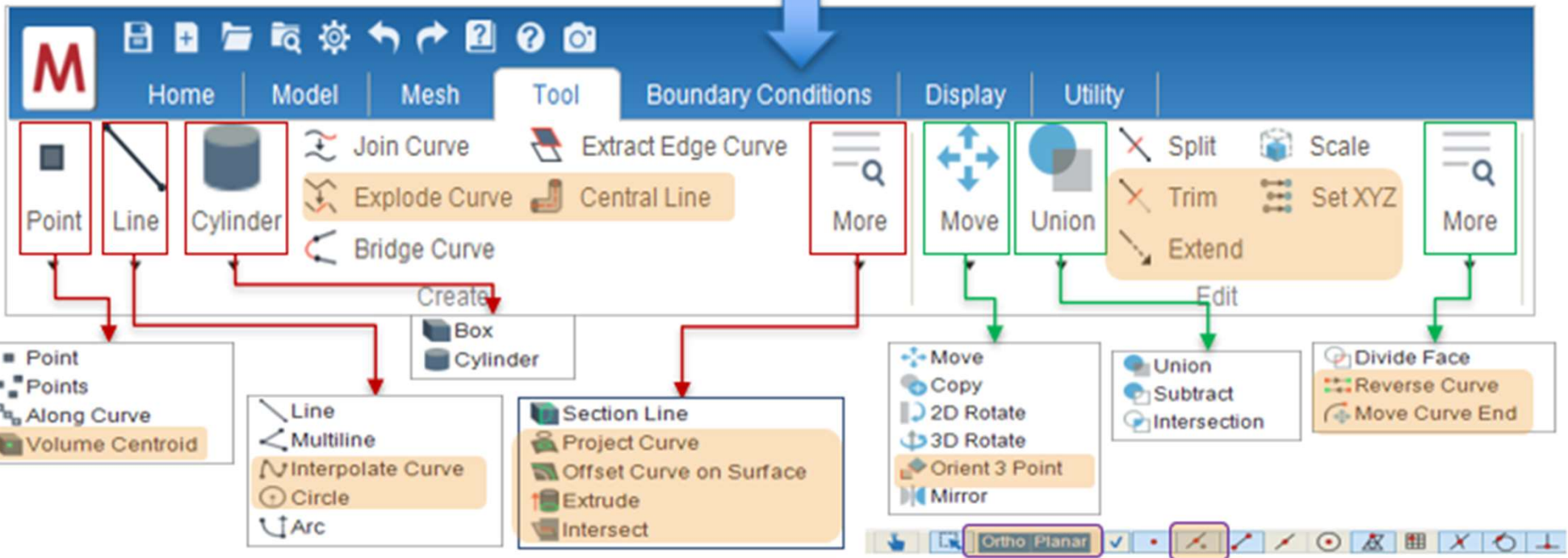
## Cloud Computing/Service

- HPC
- On-Demand simulation
- Cloud-based service

# Design Digital Twin



# Design Digital Twin : Cad Tools e interfaccia utente

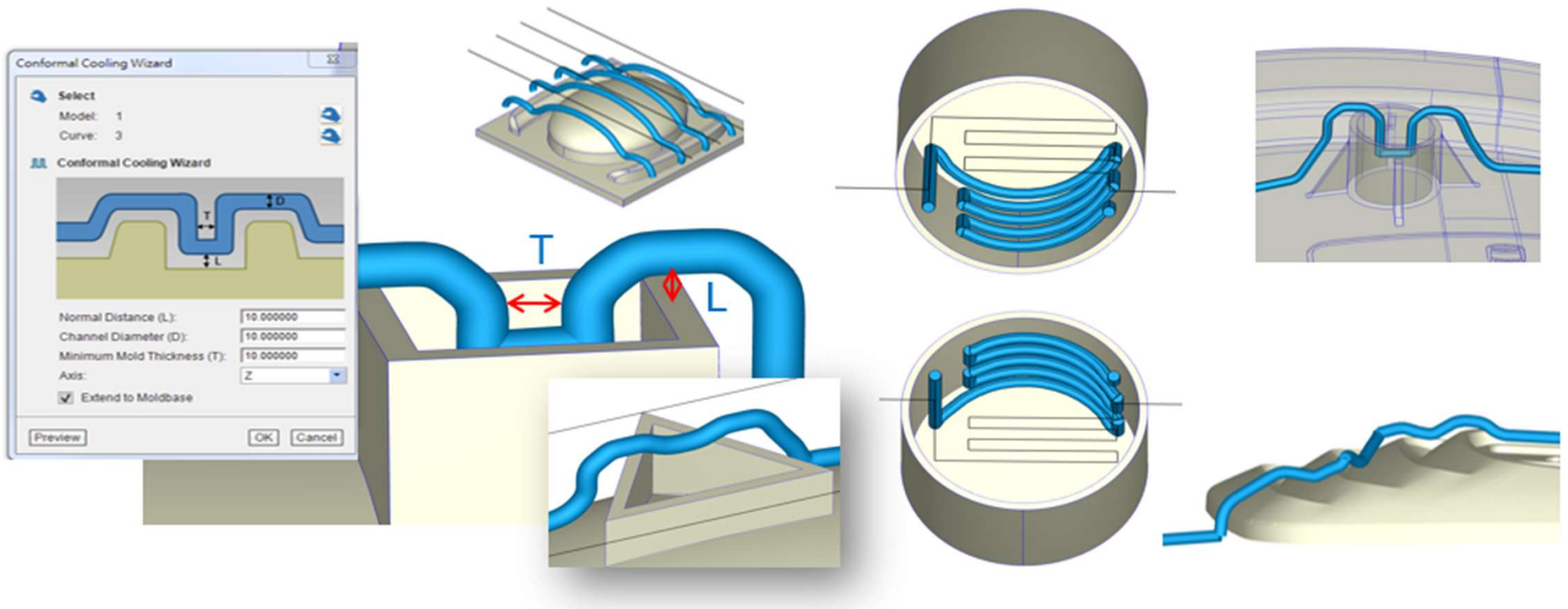


# Design Digital Twin : Cooling Channel Wizard

The image displays a comprehensive set of tools and results for designing cooling channels in a mold. Key elements include:

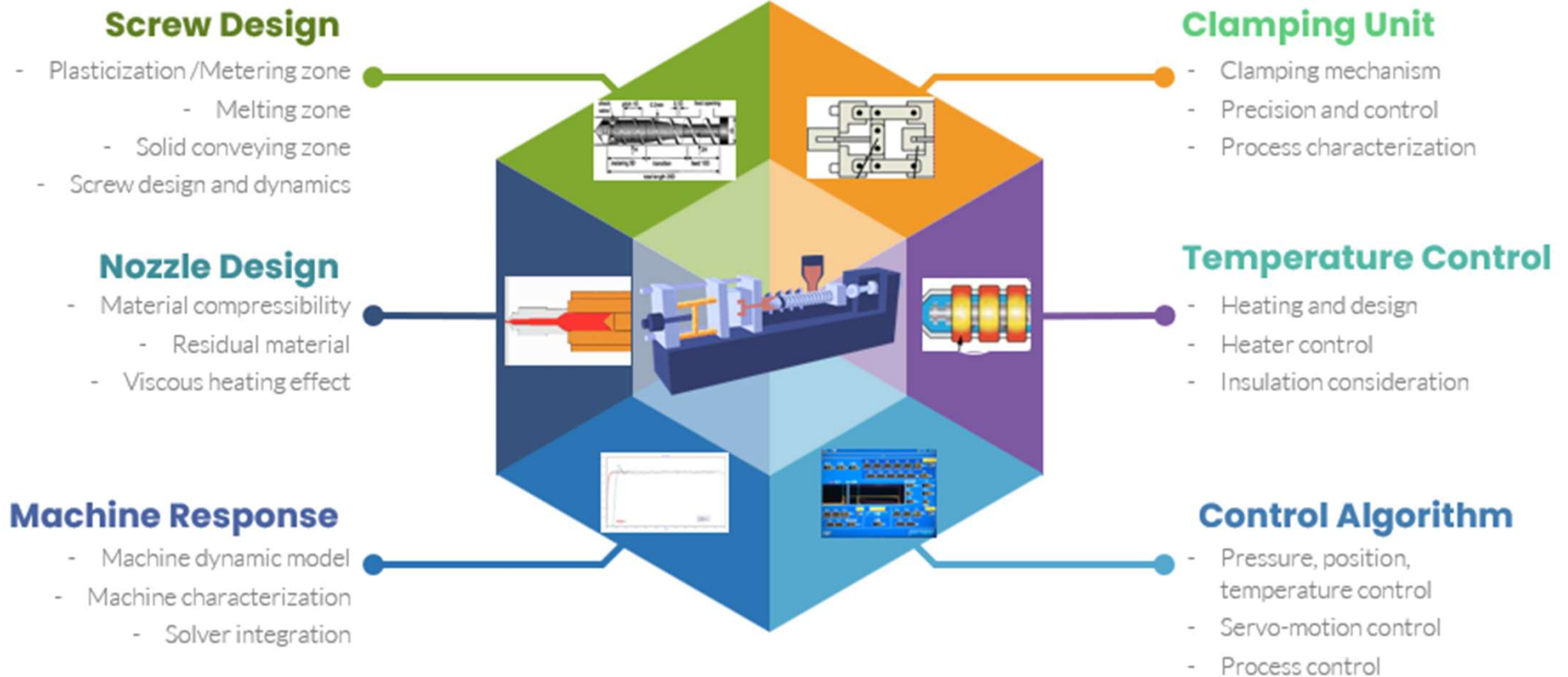
- 3D Models:** Various mold cavity designs with integrated cooling channels, including a complex multi-cavity mold and a cylindrical part with a spiral channel.
- Thermal Simulation:** Heatmaps showing temperature distribution in the mold cavity. The top-left heatmap shows a conventional cooling setup, while the bottom-right heatmap shows a conformal cooling setup, demonstrating more uniform temperature distribution.
- Spiral Cooling Wizard:** A software dialog box for configuring a spiral cooling channel. The settings shown are:
  - Point 1: Target: < Select Base Point >
  - Point 2: Target: < Select Base Point >
  - Radius 1: 5
  - Radius 2: 8
  - Cooling Radius: 1
  - Pitch: 1
  - Turns: 10
  - Outlet Position: Position 1
- Labels and Diagrams:** A diagram labeled '異型水路' (Irregular Waterway) shows a blue spiral channel. Another diagram shows a cross-section of a mold with labels: Core, Cooling channel, Cavity, and Plastic part.

# Design Digital Twin : Cooling Channel Wizard



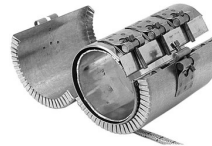
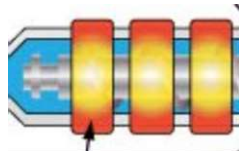


# Machine Digital Twin



# Machine Digital Twin – I Componenti

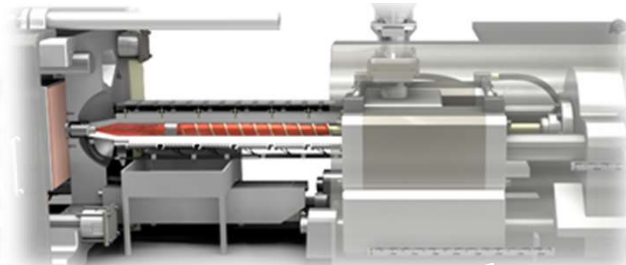
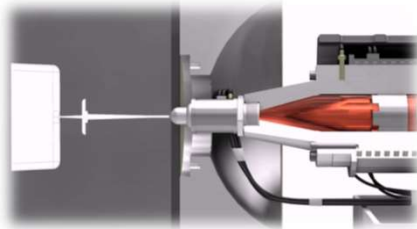
Ugelli



Sistema di riscaldamento



Unità di controllo



Unità di chiusura

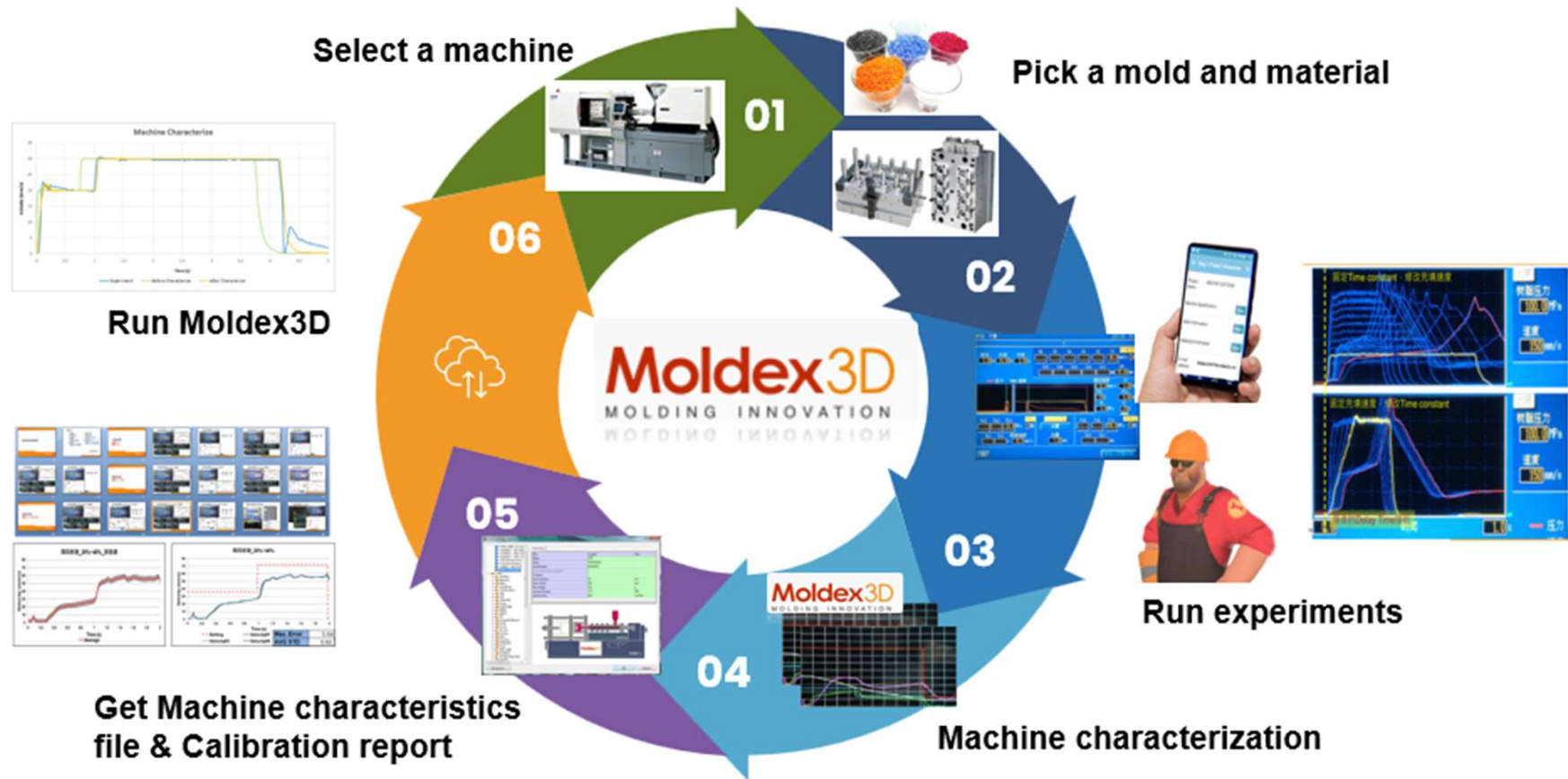


Vite



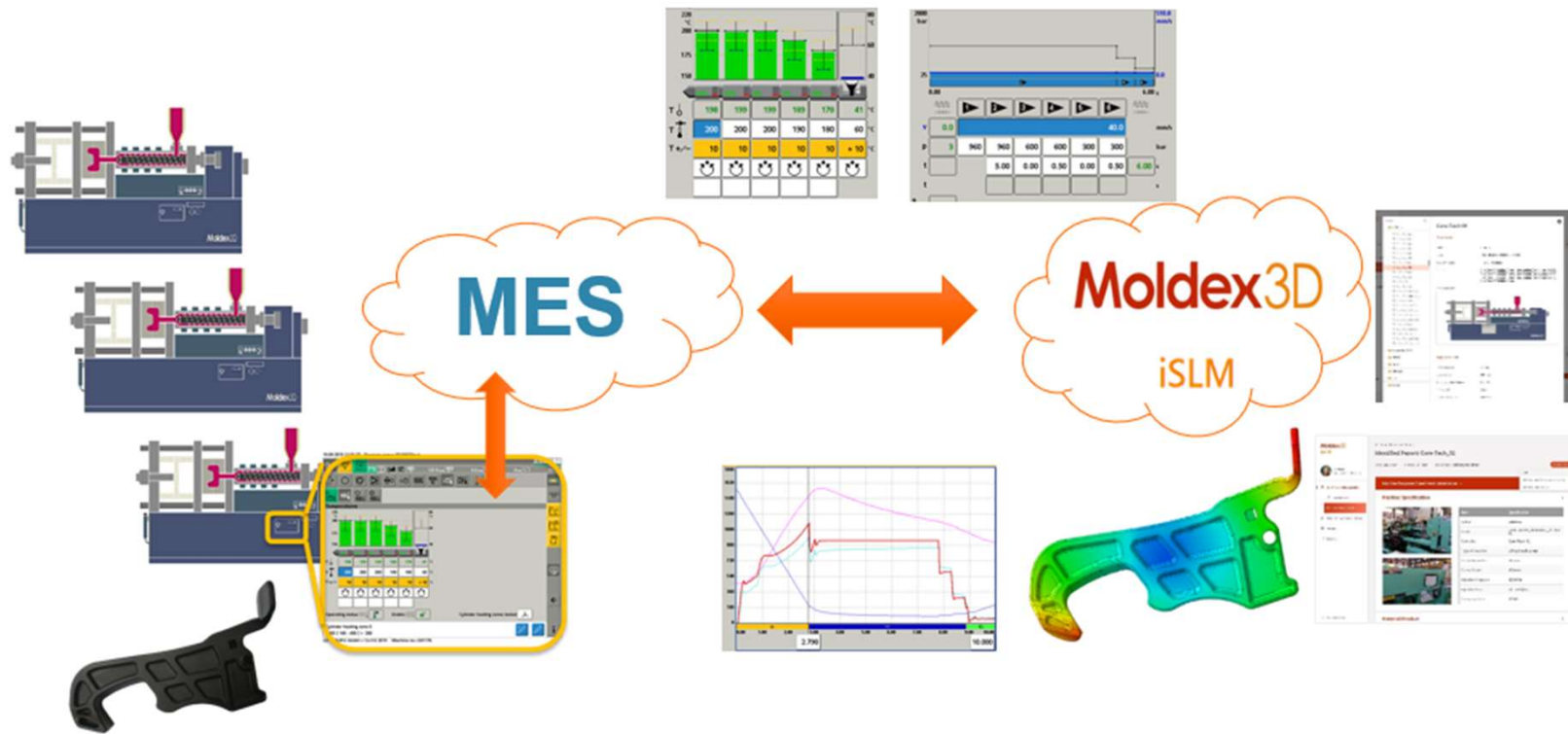
Risposta macchina

# Machine Digital Twin – La Caratterizzazione





# Machine Digital Twin – Manufacturing Data Link



MES: Manufacturing execution system

# Material Digital Twin

## Thermal Properties

- Thermal conductivity
- Heat Capacity
- Heat Transfer Coefficient

## Mechanical Properties

- Young's Modulus
- Poisson ratio
- Stress-Strain Curve
- CLTE

## Volumetric Properties

- $pVT$ ,  $pVTC$
- Density

## Kinetic Properties

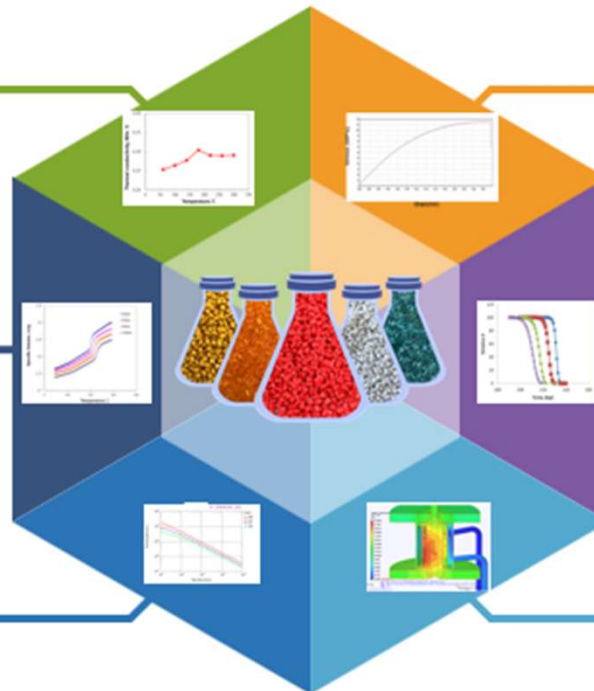
- Crystallization kinetics
- Curing kinetics
- Foaming Kinetics

## Flow/Rheological Properties

- Shear viscosity,
- Elongational Viscosity,
- Storage/Loss moduli
- First/Second Normal Stresses

## New Machine Development

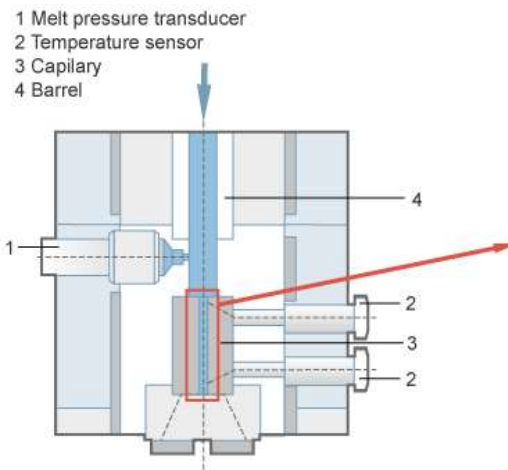
- Digital twin for instrument development
- Digital Twin-Aided Measurement



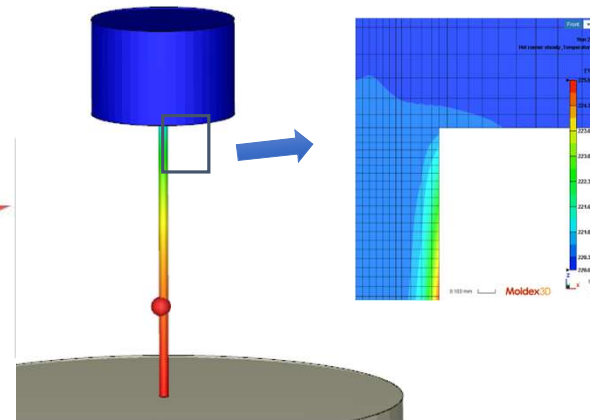
# Material Digital Twin : es. Viscosimetro capillare



Gemello fisico



Gemello digitale

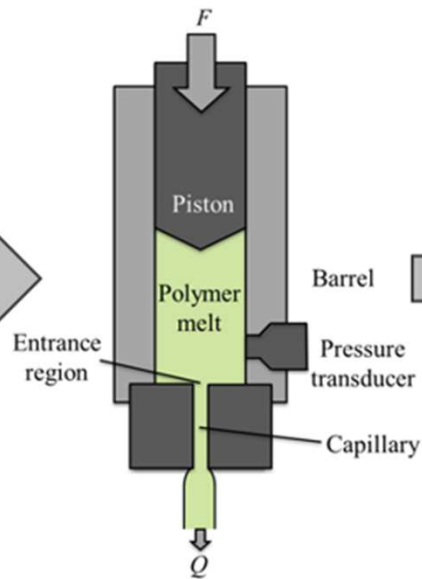


# Material Digital Twin : es. Viscosimetro capillare

(1) Capillary Rheometer (physical twin)



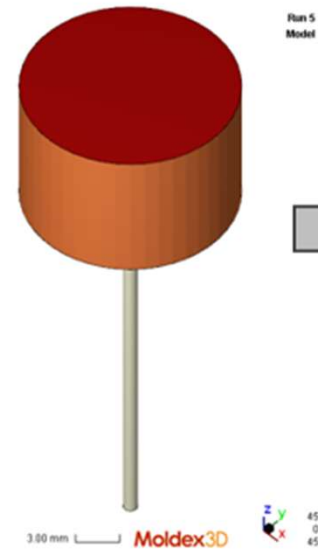
(2) Measurement



(3) Material File (original)



(4) Simulation & Correction (digital twin)

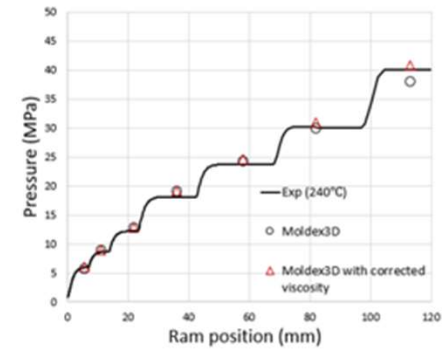
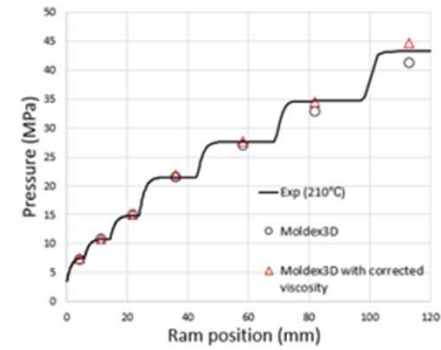
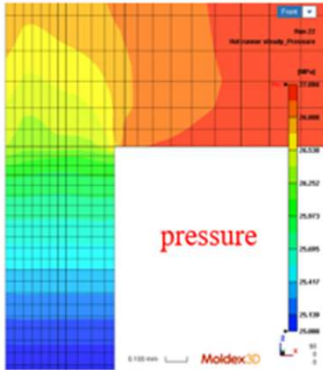
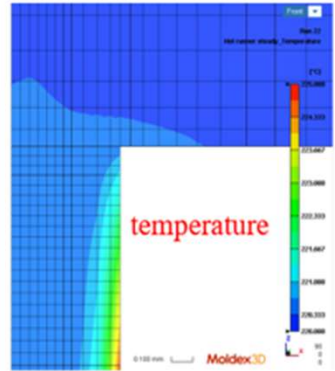
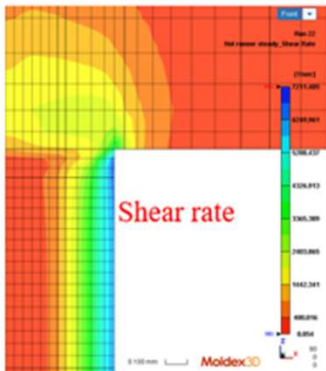
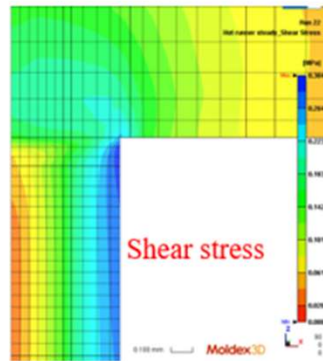
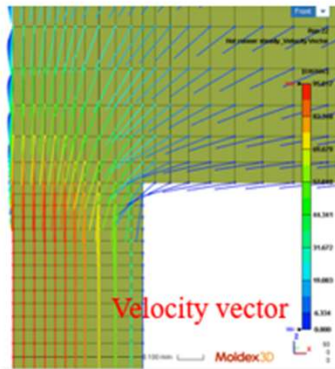
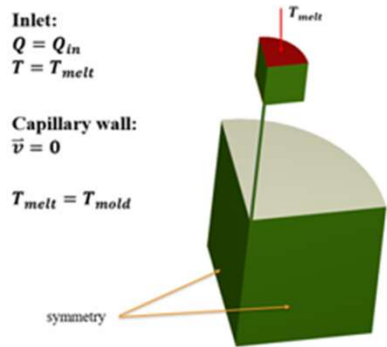


(5) Material File (corrected)

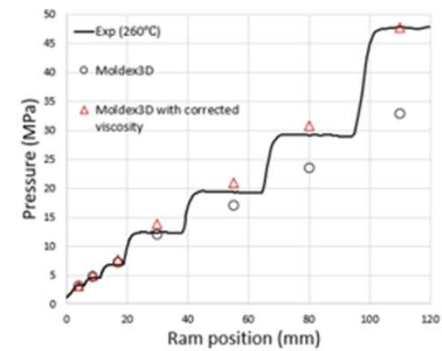
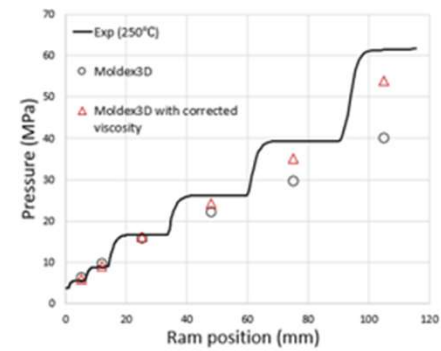


*Accurate flow analysis*

# Material Digital Twin



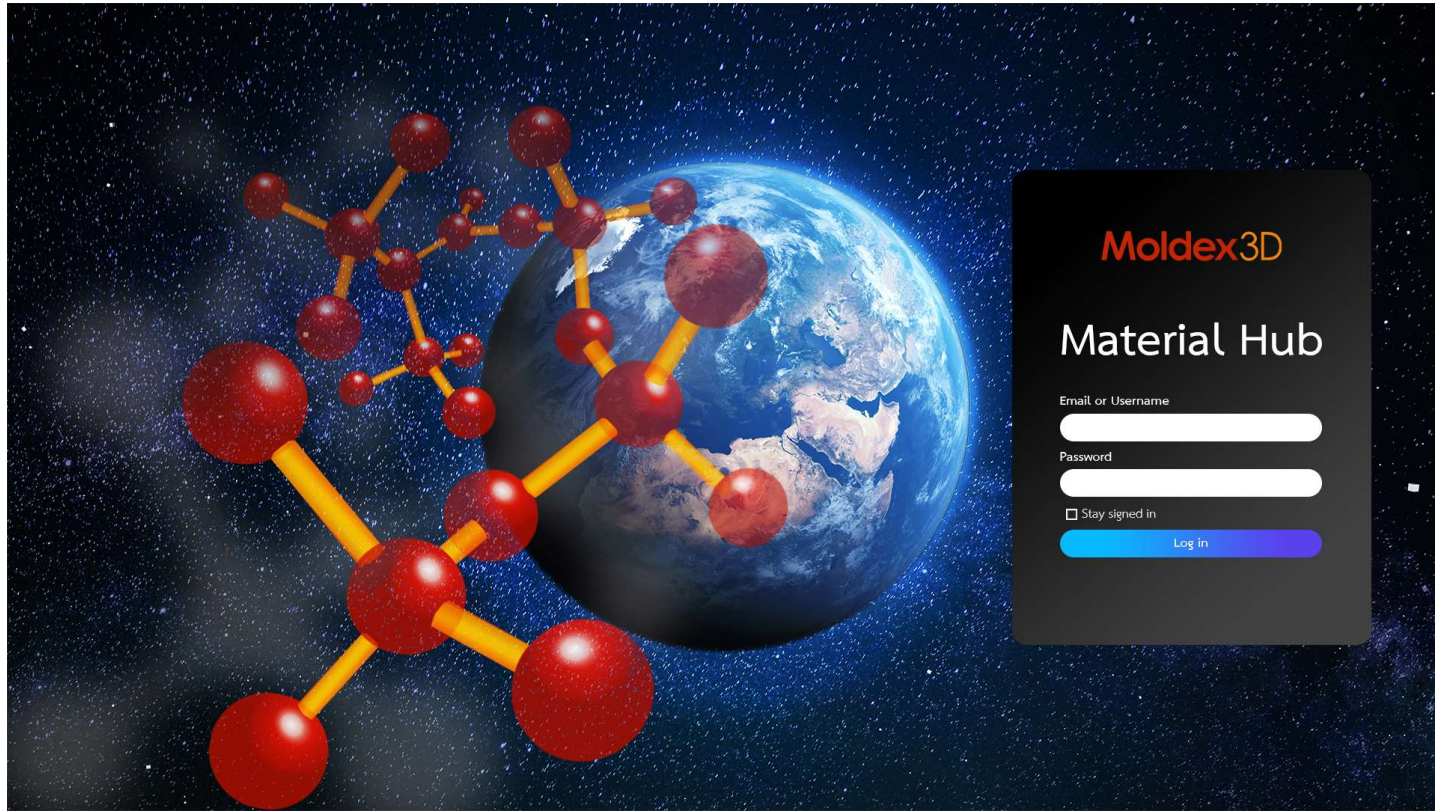
(a) HDPE <sup>±</sup>



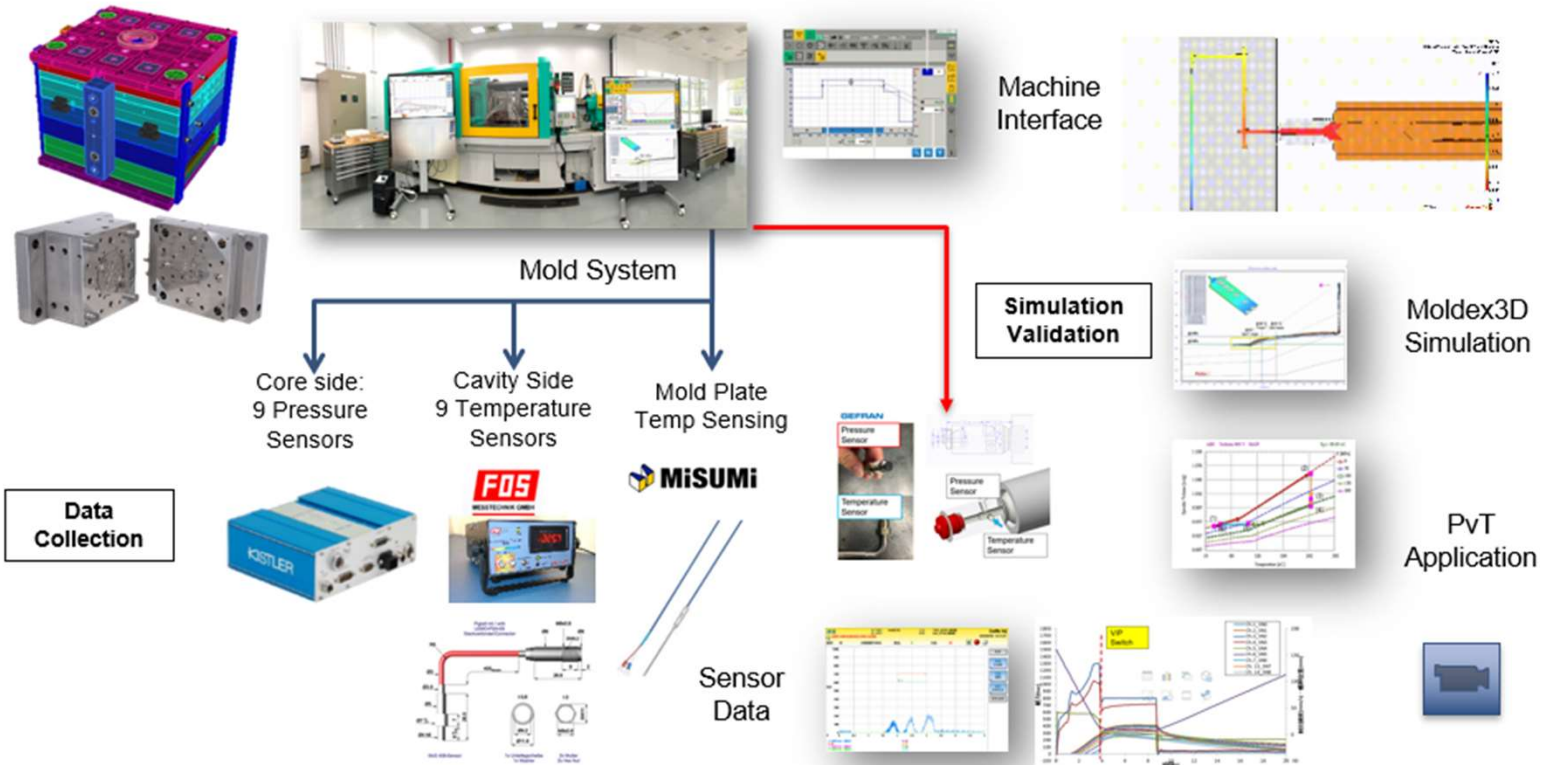
(b) PBT <sup>±</sup>



# Moldex3D Material HUB

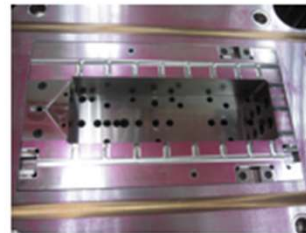
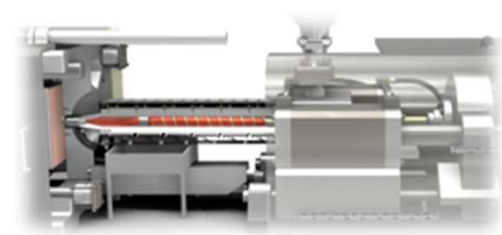
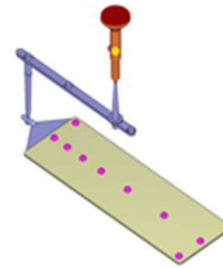
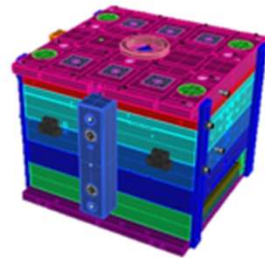
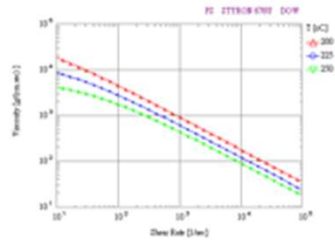


# Process Digital Twin – Validazione e calibrazione



# Process Digital Twin – Validazione e calibrazione

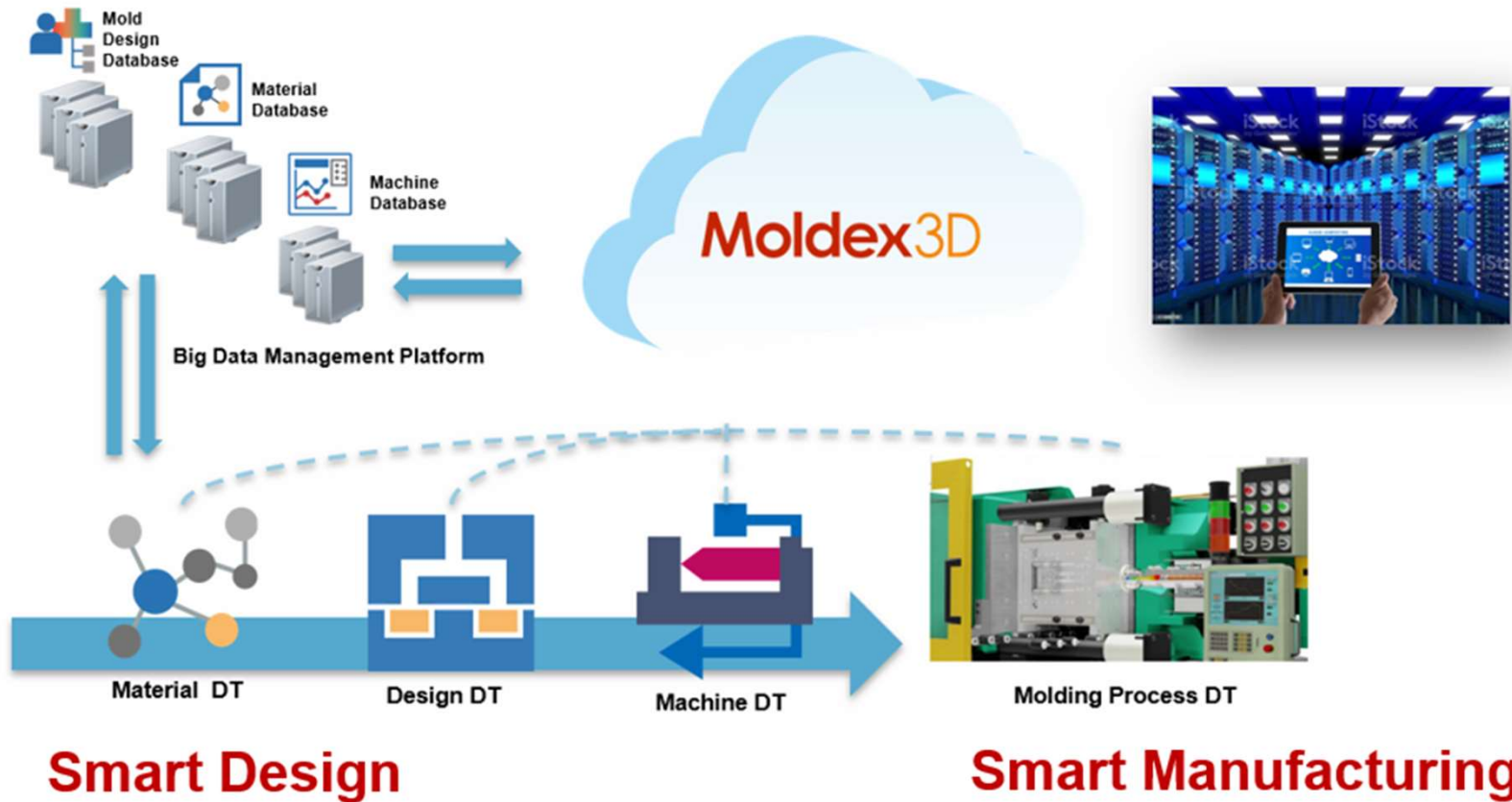
## Cyber/Virtual Space



## Physical/Real Space



# Smart Design and Manufacturing



The background is a complex, abstract composition of overlapping, angular shapes. The color palette is dominated by deep, dark purples and blues, with some lighter teal or cyan highlights. The shapes are layered, creating a sense of depth and movement. The overall effect is a modern, digital aesthetic.

Thank you