Moldex3D

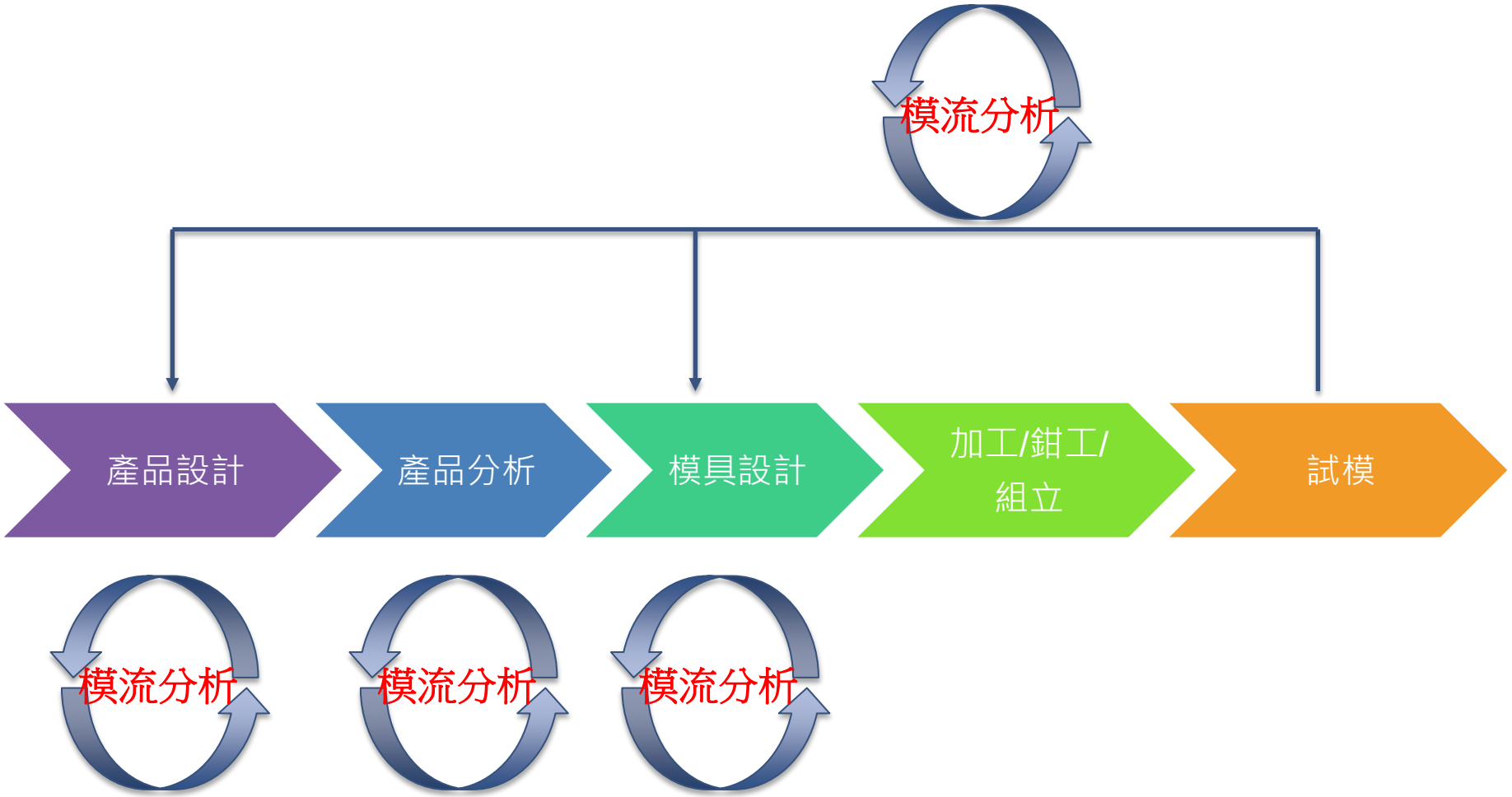
# 模流分析趨勢-標準化與自動化


CoreTech System Co., Ltd.
www.moldex3d.com

# 大綱

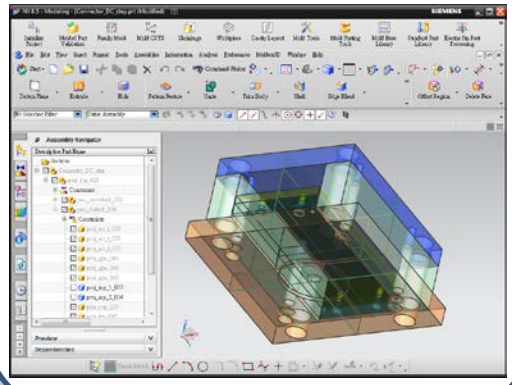
- 一般模流分析的使用者現況
- 未來模流分析的趨勢 – 標準化及自動化
- 案例分享

# 模具開發流程

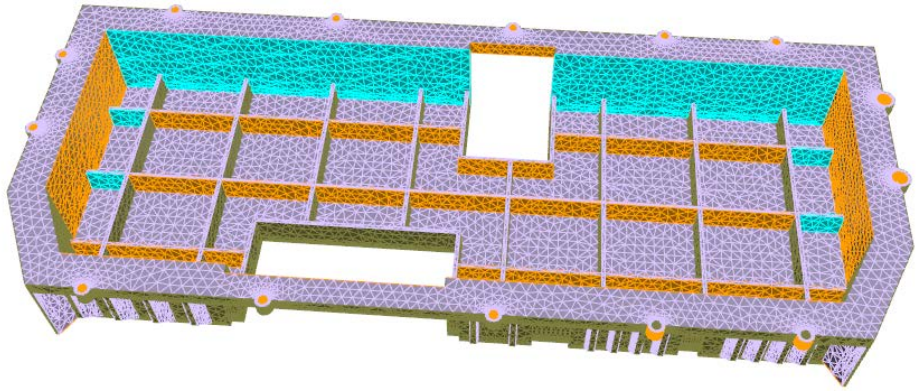


# 一般模流分析的使用者現況 – 分析流程

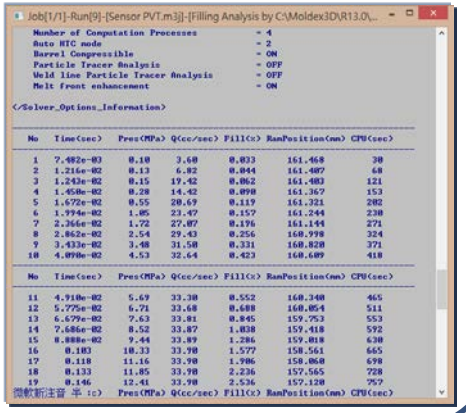
## Geometry Model



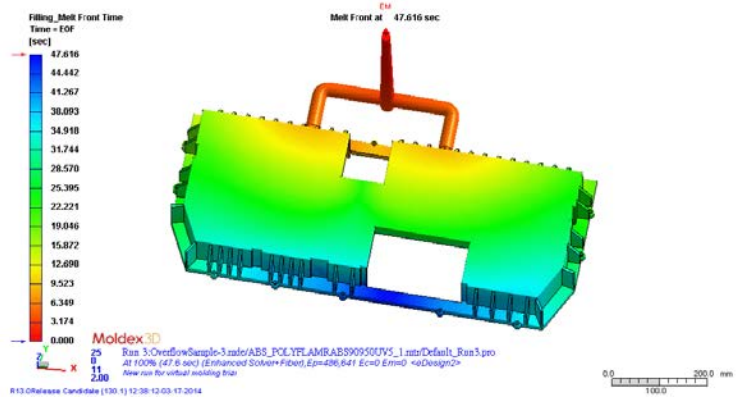
## CAE Mesh Generation



## CAE Simulation



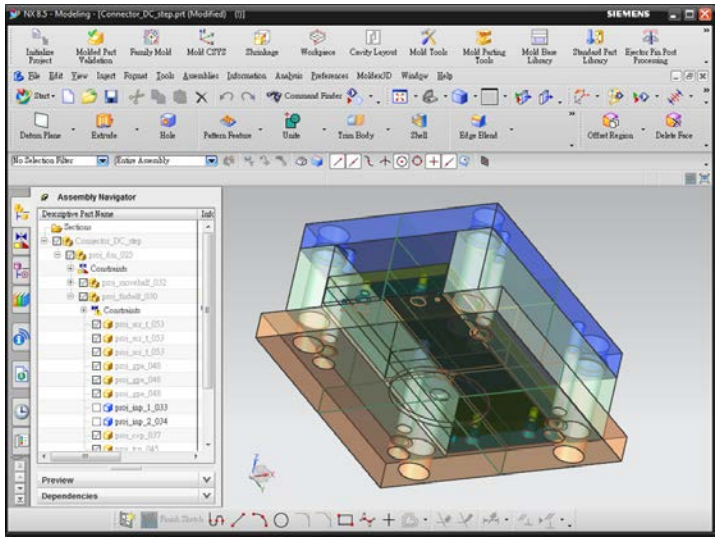

## CAE Result Interpretation



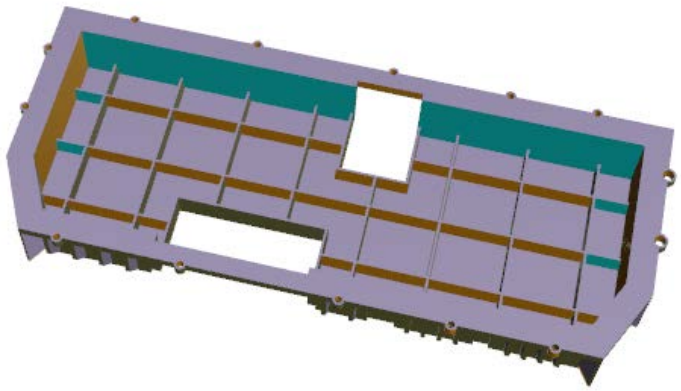
# CAD File Convert Issues

- Model geometry **data may loss** when file convert between different software.
- Have to redefine the model attribute (part, hot/cold runner, insert, cooling channel,…) at different software and that may lead to unexpected errors

Geometry Model in CAD

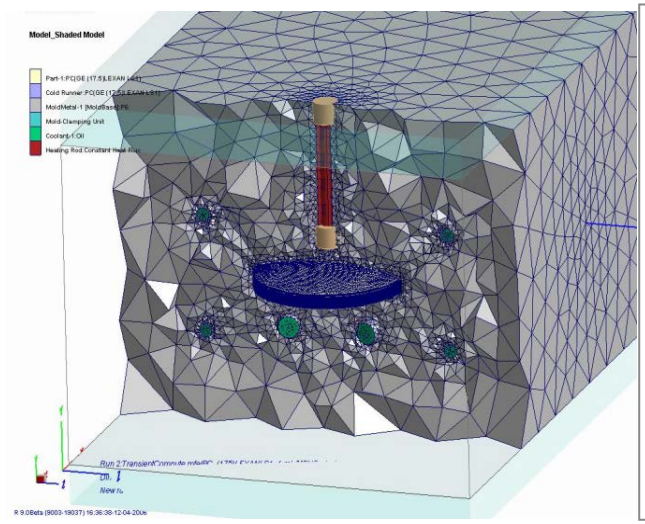


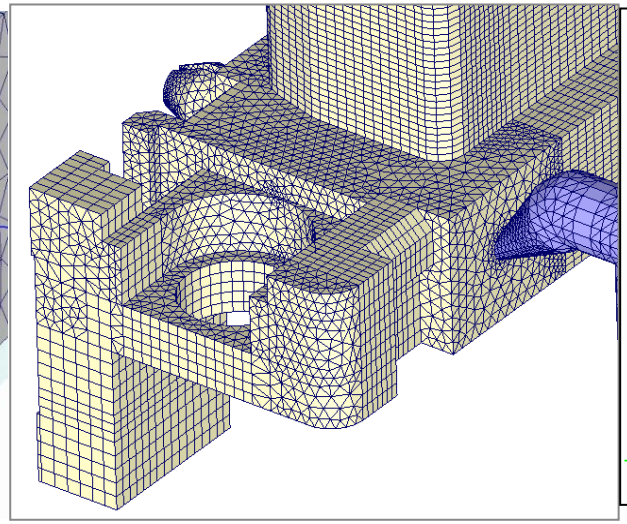
CAE Software

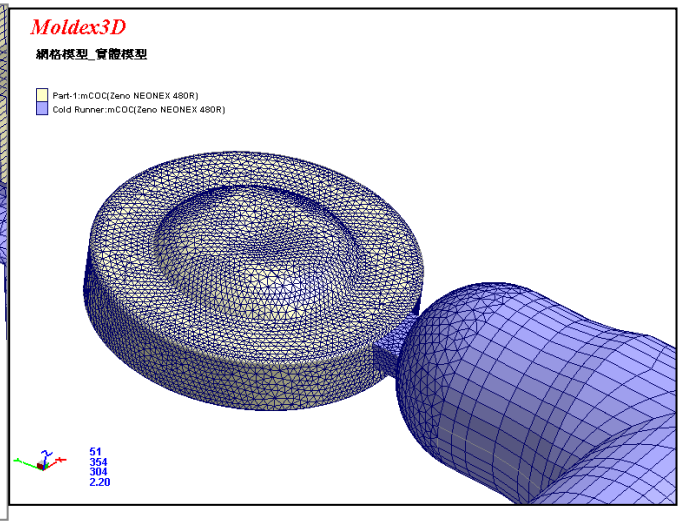


# CAE Mesh Generation Efforts

- Mesh generation is an important step and that can not be reduced running a CAE analysis
- Generally, the mesh generation step spent the most **human resources** in the CAE analysis workflow
- Mesh quality will affect the CAE analysis result directly; that is to say, the CAE analysis result credibility depend on user's experience.





# CAE Simulation Take Lots of Time

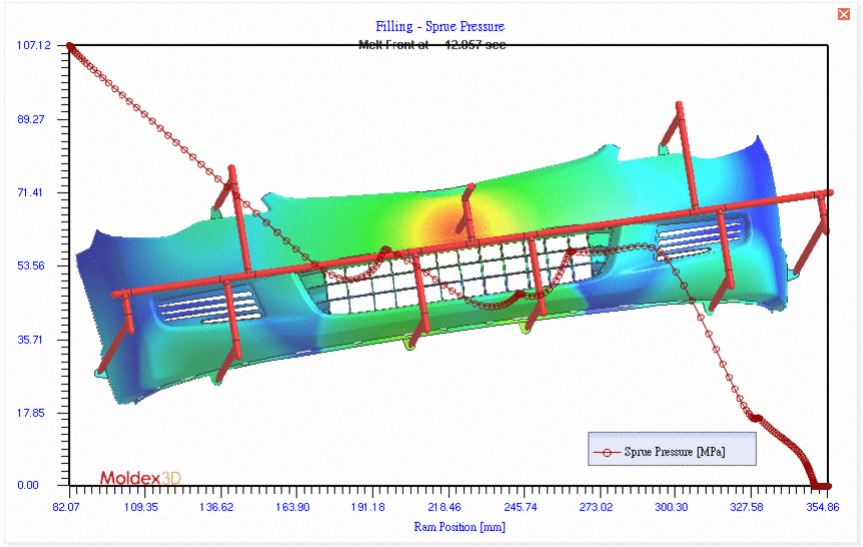
- Generally, you need to use more elements to increase the model resolution for CAE simulation, and that will also spend more times to run a simulation.
- You may need huge elements to describe detailed model features for complicated model and that will also take more simulation time
- It becomes inefficiency if CAE simulation is not fast enough

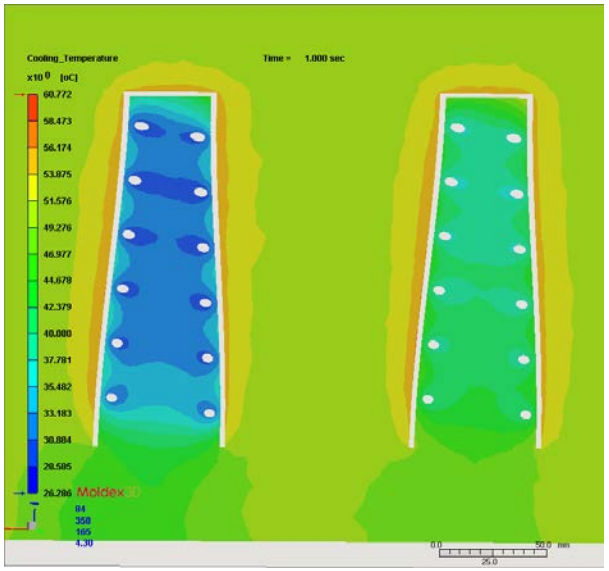
Job[1/1]-Run[9]-[Sensor PVT.m3j]-[Filling Analysis by C:\Moldex3D\R13.0\...

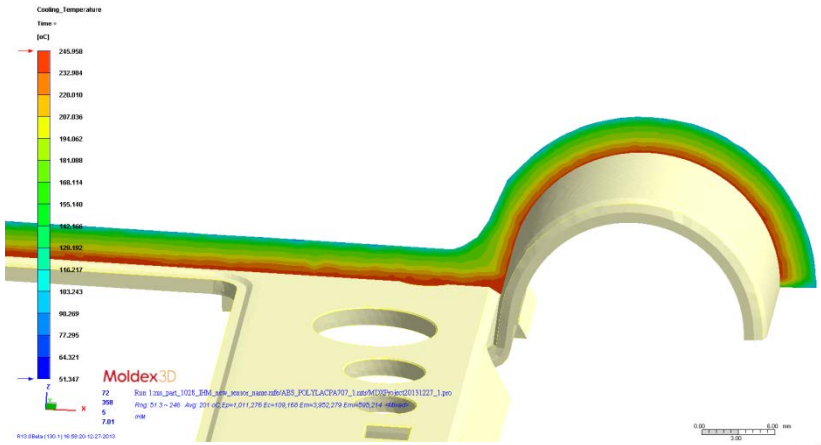
```
   Number of Computation Processes          = 4
   Auto HTC mode                            = 2
   Barrel Compressible                      = ON
   Particle Tracer Analysis                 = OFF
   Weld line Particle Tracer Analysis       = OFF
   Melt front enhancement                   = ON

</Solver_Options_Information>

-------------------------------------------------------------------------------
  No   Time(sec)   Pres(MPa) Q(cc/sec) Fill(%) RamPosition(mm) CPU(sec)
-------------------------------------------------------------------------------
   1  7.482e-03      0.10      3.60      0.033      161.468         30
   2  1.216e-02      0.13      6.82      0.044      161.407         68
   3  1.243e-02      0.15     19.42      0.062      161.403        121
   4  1.450e-02      0.28     14.42      0.090      161.367        153
   5  1.672e-02      0.55     20.69      0.119      161.321        202
   6  1.994e-02      1.05     23.47      0.157      161.244        230
   7  2.366e-02      1.72     27.07      0.196      161.144        271
   8  2.862e-02      2.54     29.43      0.256      160.998        324
   9  3.433e-02      3.48     31.50      0.331      160.820        371
  10  4.090e-02      4.53     32.64      0.423      160.609        418
-------------------------------------------------------------------------------
  No   Time(sec)   Pres(MPa) Q(cc/sec) Fill(%) RamPosition(mm) CPU(sec)
-------------------------------------------------------------------------------
  11  4.910e-02      5.69     33.30      0.552      160.340        465
  12  5.775e-02      6.71     33.68      0.688      160.054        511
  13  6.679e-02      7.63     33.81      0.845      159.753        553
  14  7.686e-02      8.52     33.87      1.038      159.418        592
  15  8.888e-02      9.44     33.89      1.286      159.018        630
  16      0.103     10.33     33.90      1.577      158.561        665
  17      0.118     11.16     33.90      1.906      158.060        698
  18      0.133     11.85     33.90      2.236      157.565        728
  19      0.146     12.41     33.90      2.536      157.120        757
微軟新注音 半 :c)   Pres(MPa) Q(cc/sec) Fill(%) RamPosition(mm) CPU(sec)
```

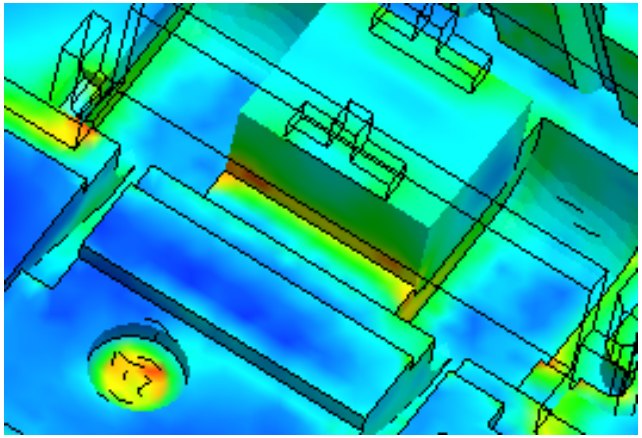
# CAE Result Interpretation

> Too many result items in CAE analysis, and users may not well know about all the meanings of each result item.



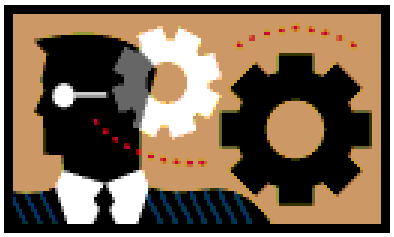



# 模流分析者的角色位置

Product & Part Design

**Design Engineers**

Esthetics, functions, mechanism..



Process Optimization

**Process Engineers**

Moldability, process window, efficiency, quality…

Moldex3D

MOLDING INNOVATION

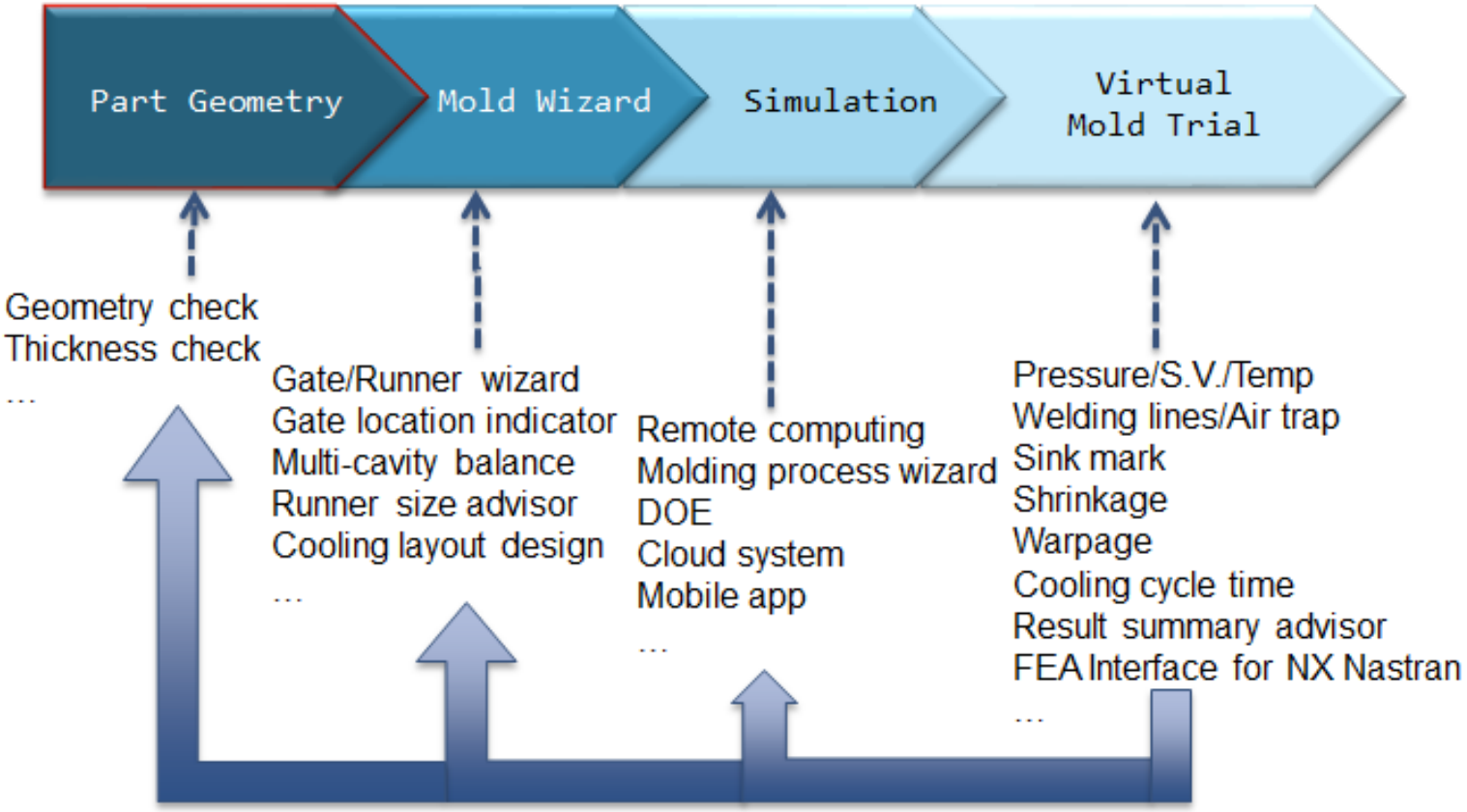
Mold Design & Tooling

**Mold Engineers**

Ease of processes, least scrap…

# 模流分析管理上的困難點

- 不同的模具開發階段,需要進行的分析任務不完全相同
- 模具幾何資料,成型數據...等完整資料蒐集不易
- 模流分析人員經驗缺乏，經驗養成耗費時間長

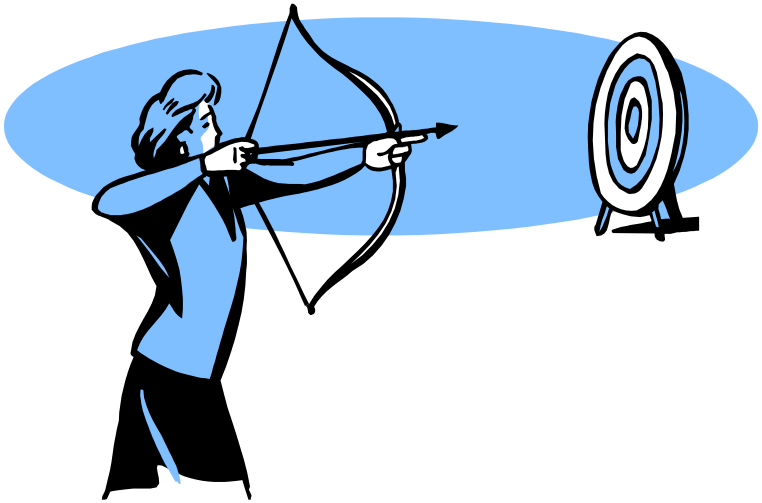


# 軟體上(Moldex3D)提供的解決方案

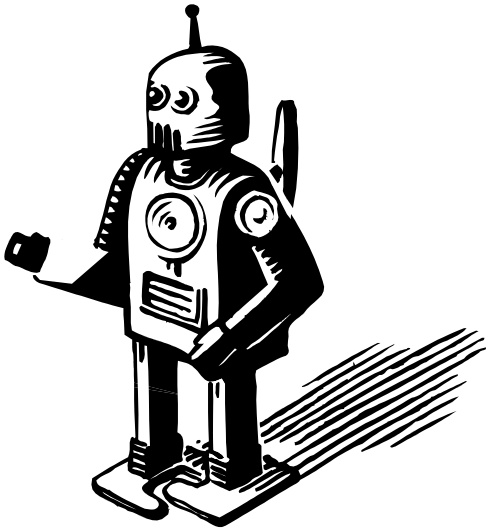
1. CAD File Convert Issues
   - **Integration** with CAD/ECAD software
     - Support import CAD native files into Moldex3D directly
     - The model attributes will be defined automatically
2. CAE Mesh Generation Efforts
   - **eDesign Meshing** Technology
     - CAE users do not have to mesh the model manually any more
3. CAE Simulation Take Lots of Time
   - **Parallel Computing** Technology
     - Speedup the calculation efficiency by 10 times

# 模流分析管理上可進行的解決方案

> 標準化

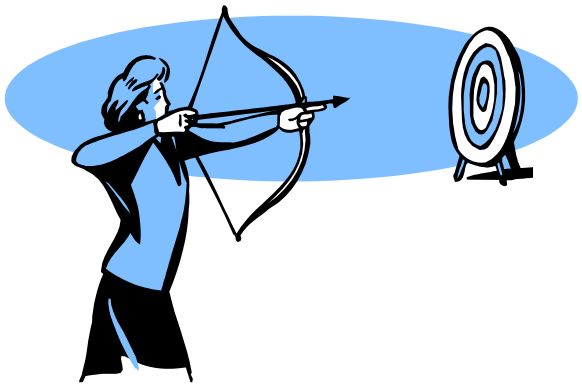


> 自動化



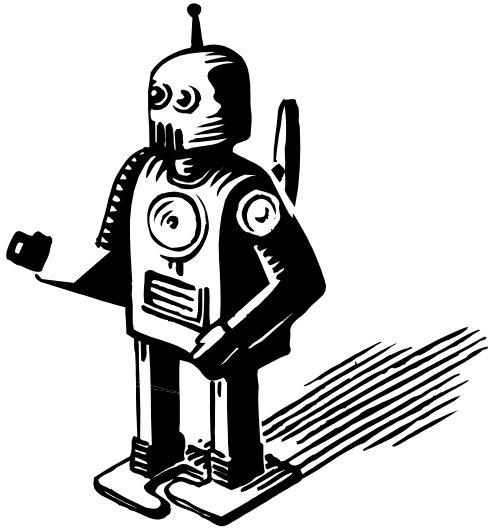
# 未來模流分析的趨勢 - 標準化

- 分析目標標準化
  - 明確的定義出模流分析想要了解的問題
- 分析結果標準化
  - 明確的定義出模流分析後需要檢視的結果項目
- 分析流程標準化
  - 明確的定義出模流分析需要進行哪些項目
- 分析報告標準化
  - 明確的定義出需要提供的報告內容

# 未來模流分析的趨勢 - 自動化

- 分析流程自動化執行
  - 減少人為操作的錯誤
- 分析結果自動化篩選
  - 降低人為判斷的錯誤及差異
- 分析報告自動化產生
  - 一致性報告內容及格式,方便人員了解

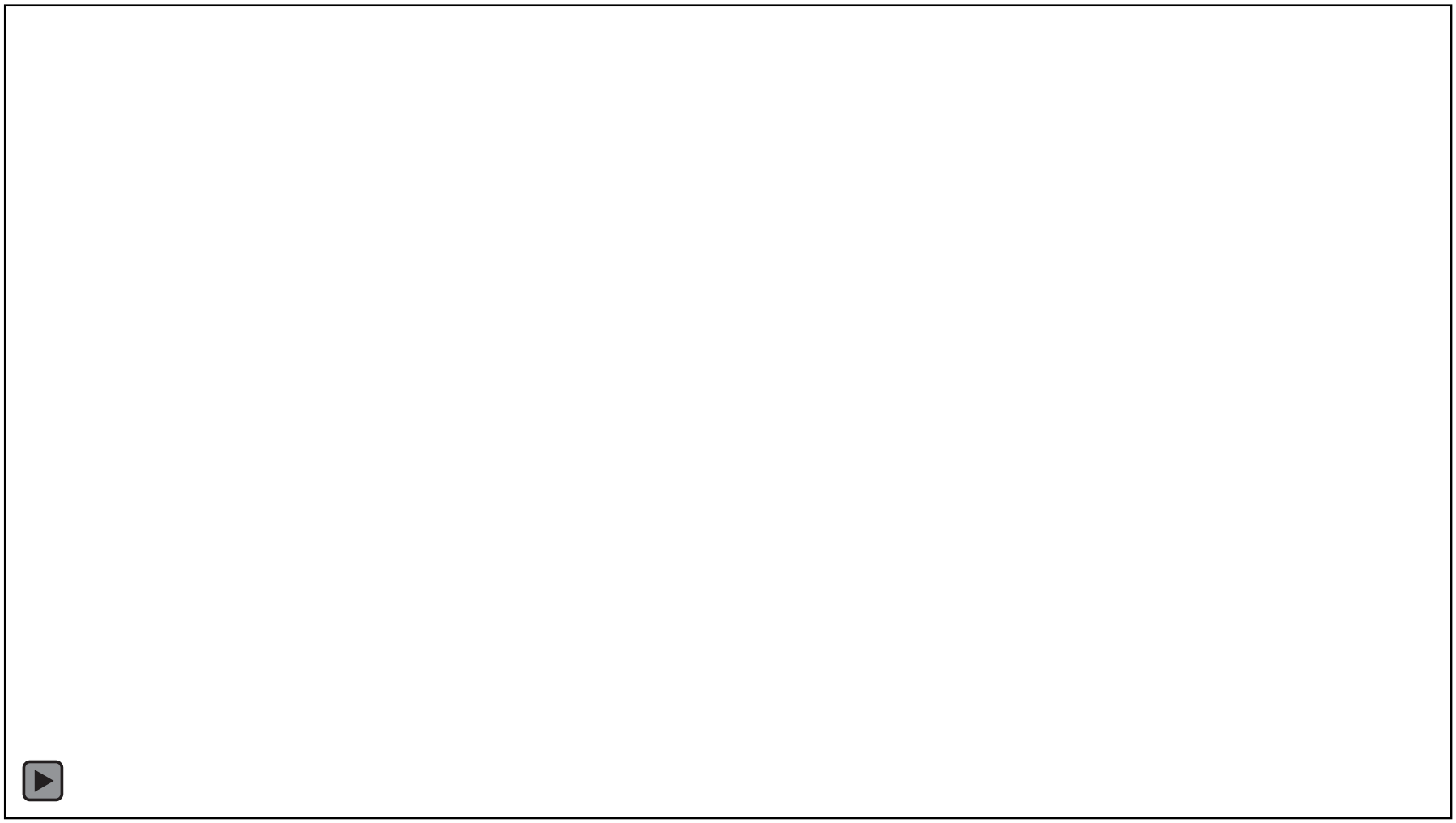


# 案例分享1 – CAD與Moldex3D Workflow Integration

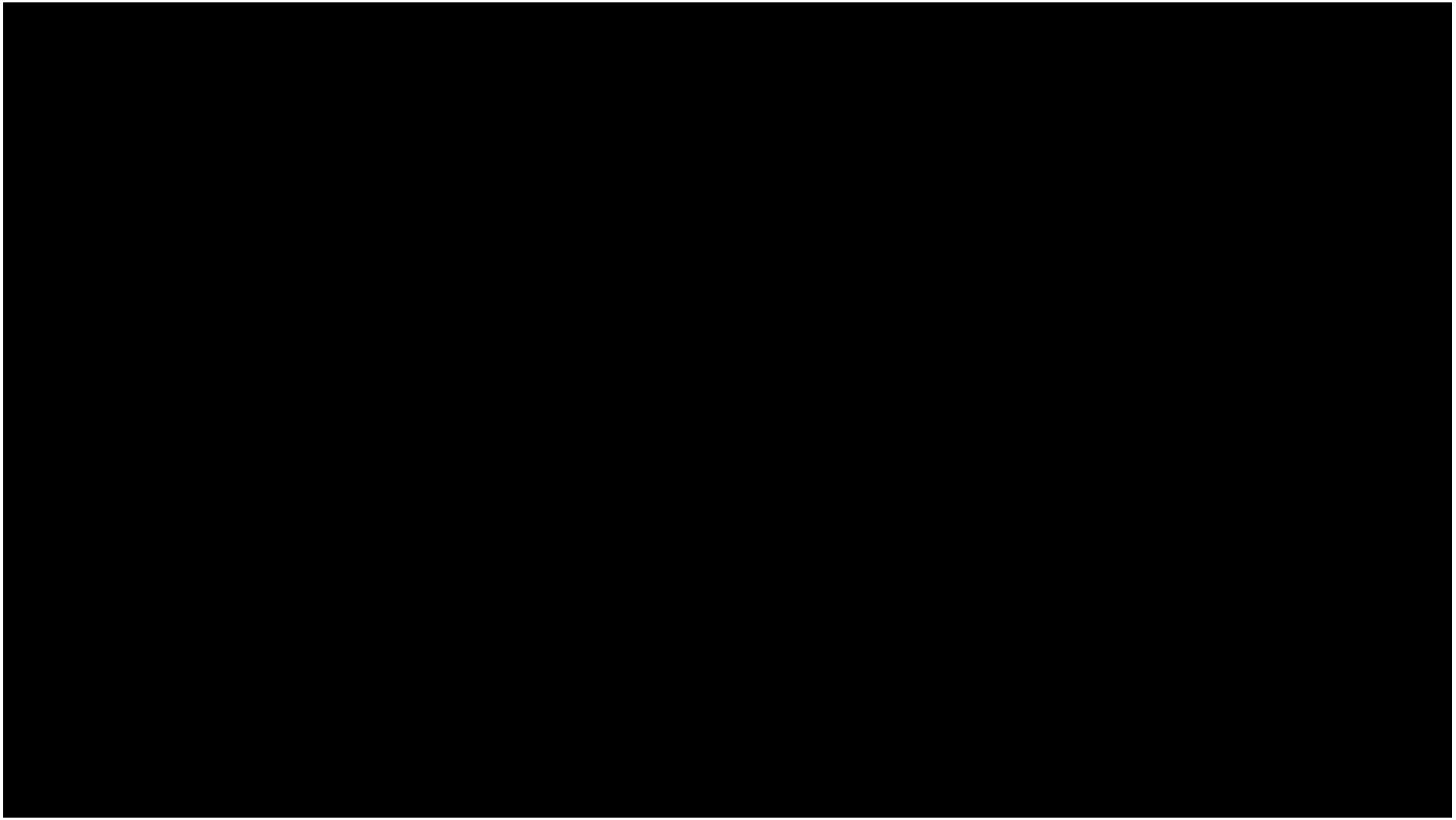
1. CAD File Convert Issues
   - Integration with CAD/ECAD software
     - Support import CAD native files into Moldex3D directly
     - The model attributes will be defined automatically
2. CAE Mesh Generation Efforts
   - eDesign Meshing Technology
     - CAE users do not have to mesh the model manually any more

> Target: 減少轉檔產生的問題及人為操作造成的錯誤

# Moldex3D Integrate With NX/Creo/SW

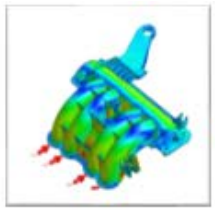


# Moldex3D Integrate With ECAD



# 案例分享2 – CAE Software Integration

> Target: True Material Properties Structure Analysis



Flow analysis

Moldex3D MOLDING INNOVATION

Orientation information

+

Material parameters

| Polymer \| Grade Name \| Producer | PA6 \| Ultramid B3WG7 \| BASF |
|---|---|
| Mechanical Properties | Fiber-filled polymer - Experimental prope |
| Poisson's ratio v12 | 0.37 (-) |
| Poisson's ratio v23 | 0.54 (-) |
| Modulus E1 (fiber direction) | 1.28e+011 (dyne/cm^2) |
| Modulus E2 (transverse direction) | 4.49e+010 (dyne/cm^2) |
| Shear Modulus G | 1.53e+010 (dyne/cm^2) |
| CLTE a1 (fiber direction) | 2e-005 (1/K) |
| CLTE a2 (transverse direction) | 5.65e-005 (1/K) |
| Fiber Length/Diameter (L/D) | 20 (-) |
| Interaction coefficient | 0.01 (-) |
| Fiber weight percentage | 35 (%) |

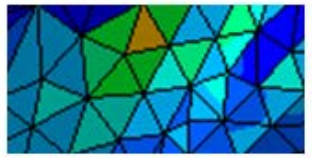
Altair ANSYS

Abaqus Solution Partner | SIMULIA

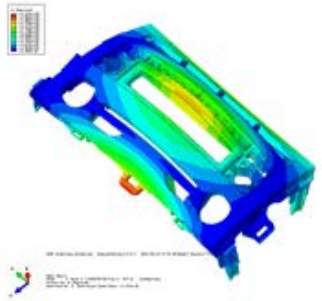
LSTC Livermore Software Technology Corp.

MSC SOFTWARE SIMULATING REALITY

Element properties



Structural simulation software



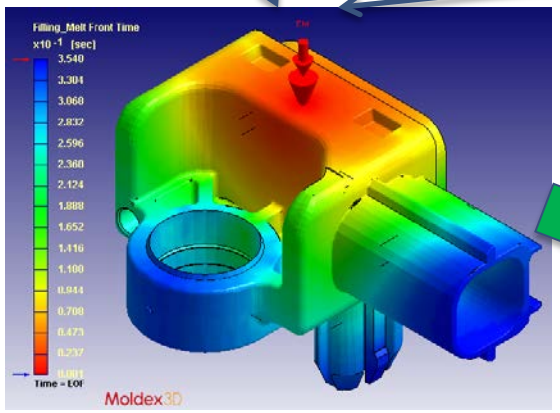
# Product Quality Driven Simulation Workflow

> **Replace metal by plastics**

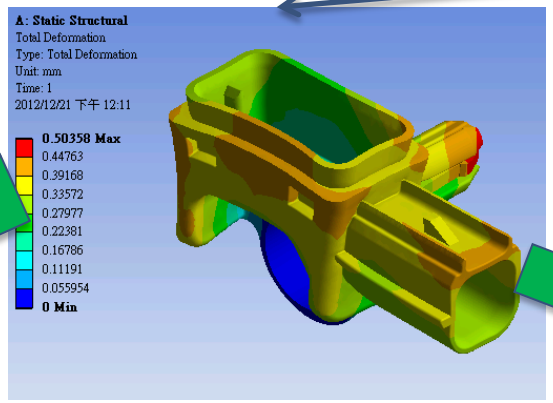
Material Properties

Molding Conditions

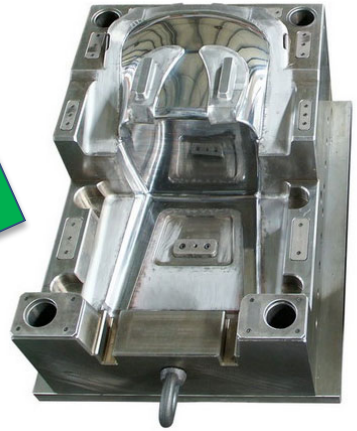
Apply Simulation Condition




Molding Analysis
- Molding effects
- Fiber effects
- …



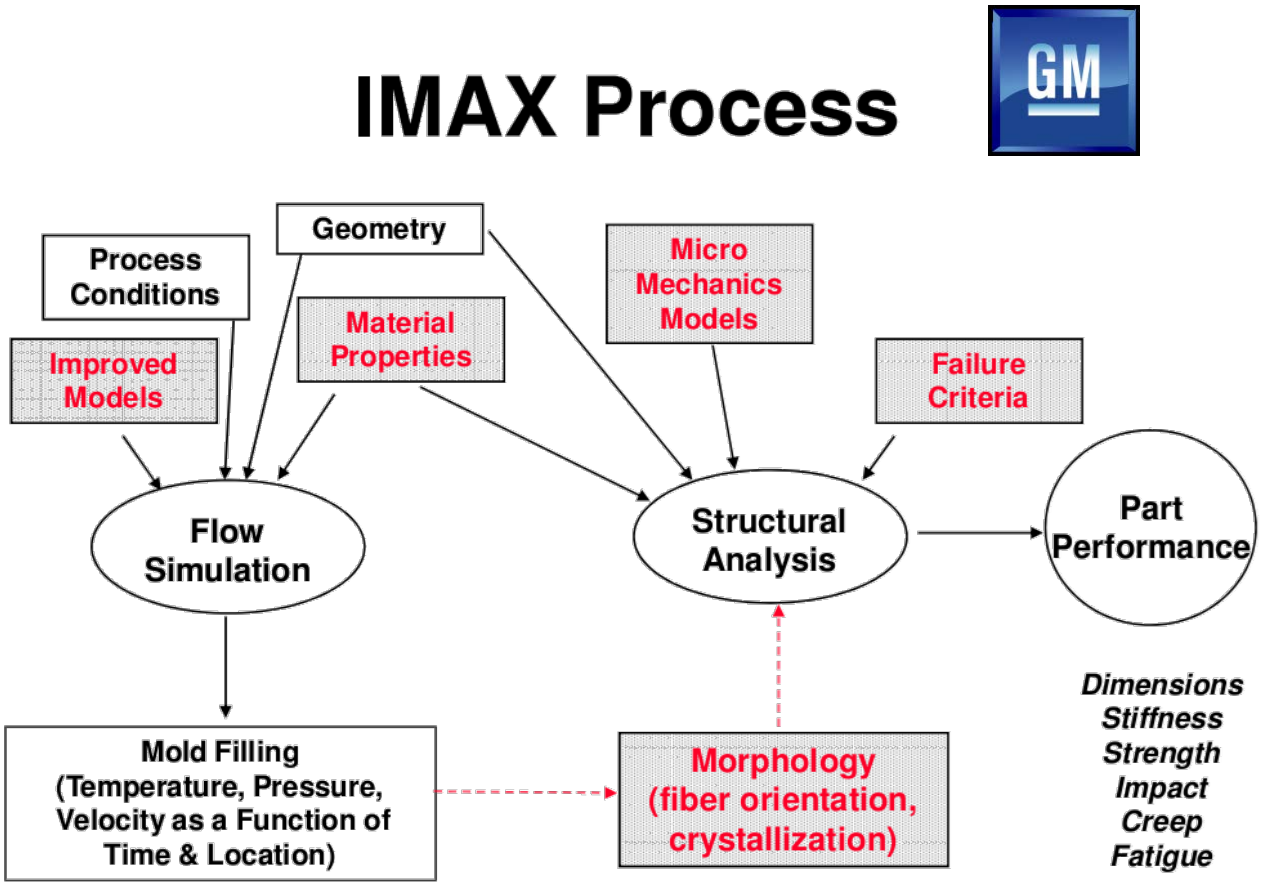

Structure Analysis
- Impact
- Creep
- Fatigue…



Mold Manufacture

Failure Criteria

# CAE IMAX Process (GM RD)



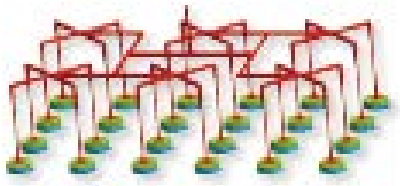

Source: Pete Foss, GM RD, SPE ACCE

# 案例分享3 – Pressure Drop Prediction

12穴平衡

16穴平衡

24穴平衡



http://www.hotrunner.com.tw/2/2-3/04-1.htm

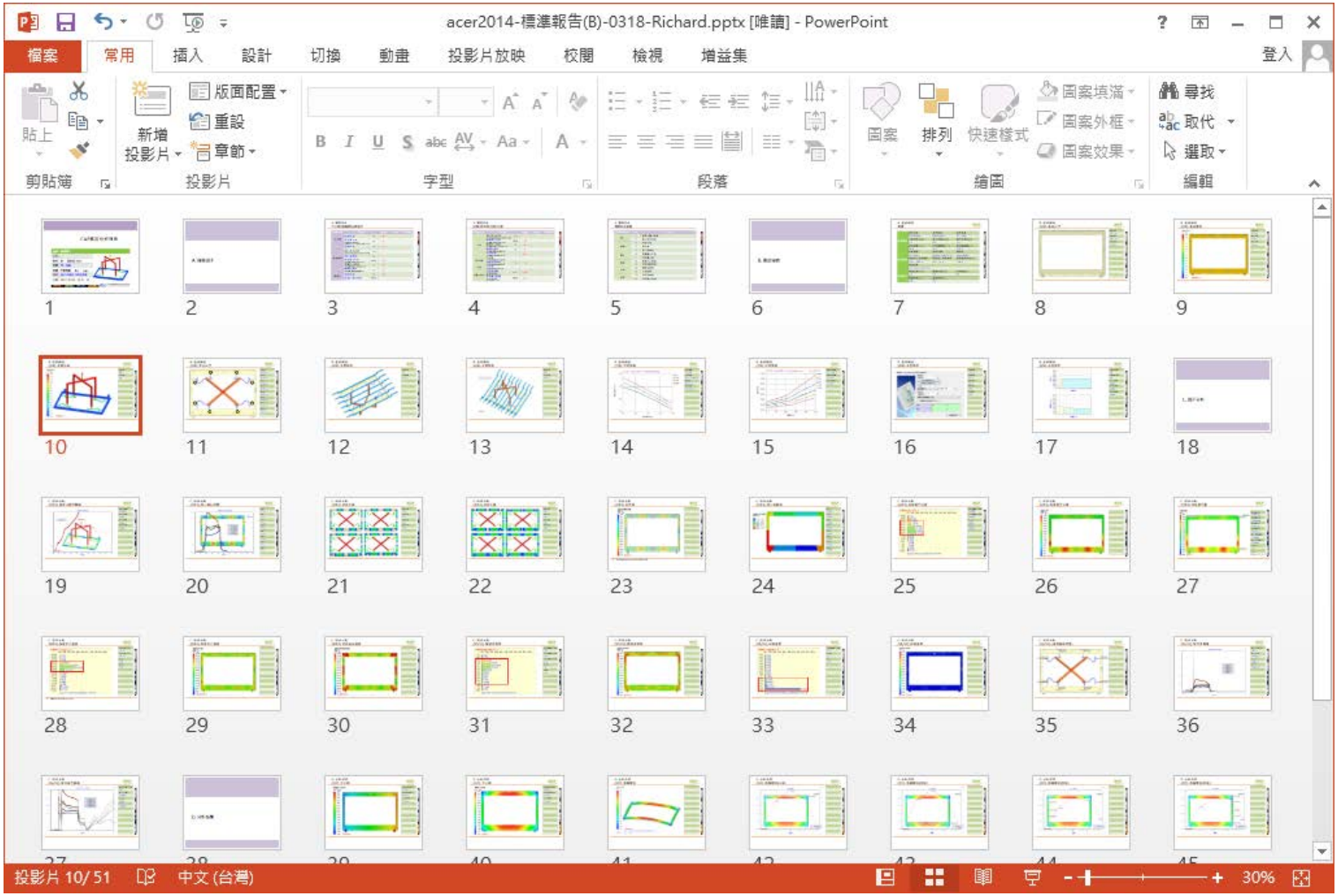
simulate the optimized hot runner layout

| Position | Value | Difference |
|---|---|---|
| 0 | 94.874 | |
| | | 7.254 |
| 1 | 87.62 | |
| | | 16.57 |
| 2 | 71.05 | |
| | | 7.99 |
| 3 | 63.06 | |
| | | 7.43 |
| 4 | 55.63 | |
| | | 46.823 |
| 5 | 8.807 | |
| Pressure drop in HRS | | 86.067 |

http://www.fujiseiki.com/cn/mold_productivity/

# 案例分享4 – 分析報告自動化

> **Target:** 自動將有效的數據以固定的報告格式輸出



# 結論

- 透過自動化可以有效率的**整合**不同功能的軟體
- 透過自動化才能**有系統**的進行模流分析
- 透過自動化可以將分析結果**完整的保存**
- 透過自動化才能將模流分析變成**知識管理系統**
- 自動化可以更有效率的執行模流分析並取得有效的分析結果
- 模流分析的標準化及自動化在目前已經是**進行式**
- 未來模流分析的趨勢: **標準化 及 自動化**

# Thank you for your attention!