Your True Partner for CAE&CFD

ICSC2014

IDAJ CAE Solution Conference

EnSight介绍及其自动化后处理

IDAJ-China 技术部

概要

- Ensight介绍
- 自动化后处理

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- Ensight介绍
- 自动化后处理

定位

仿真计算通用后处理工具

接口（部分列表）

CFD
Acusolve
ADINA
Airpak
ANSYS Flotran
AVL FIRE
CFD++
CFD-ACE+
CFD-FASTRAN
CFdesign
CFX
CGNS
Converge CFD
FloEFD
Flow-3D
Fluent
Icepak

CFD
Numeca FINE/Open
Numeca FINE/Hexa
OpenFOAM
Overflow
Phoenics
Plot3D
Polyflow
PowerFLOW
PumpLinx
RADIOSS-CFD
SC/TETRA
Star-CD
Star-CCM+
Tecplot
WIND
XFlow

FEA
ANSYS
AUTODYN
ABAQUS
ADINA
I-DEAS
LS-DYNA
MSC.Dytran
MSC.Nastran
MSC.Marc
MSC.Patran
NX Nastran
PERMAS
RADIOSS

版本

Desktop
Starter package
- Has all basic features
- Recommended for:
  low budget

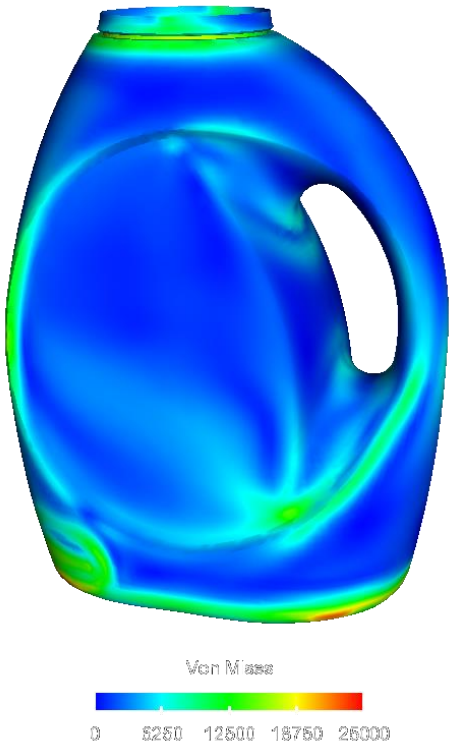
Standard
General purpose
- Has full set of features, except for special cases
- Recommended for:
  most users

HPC/HPC+
SMP & DMP
- More CPU threads (up to 128)
- The main feature is Distributed Memory Parallel. Useful for data with ~100 million cells or more.

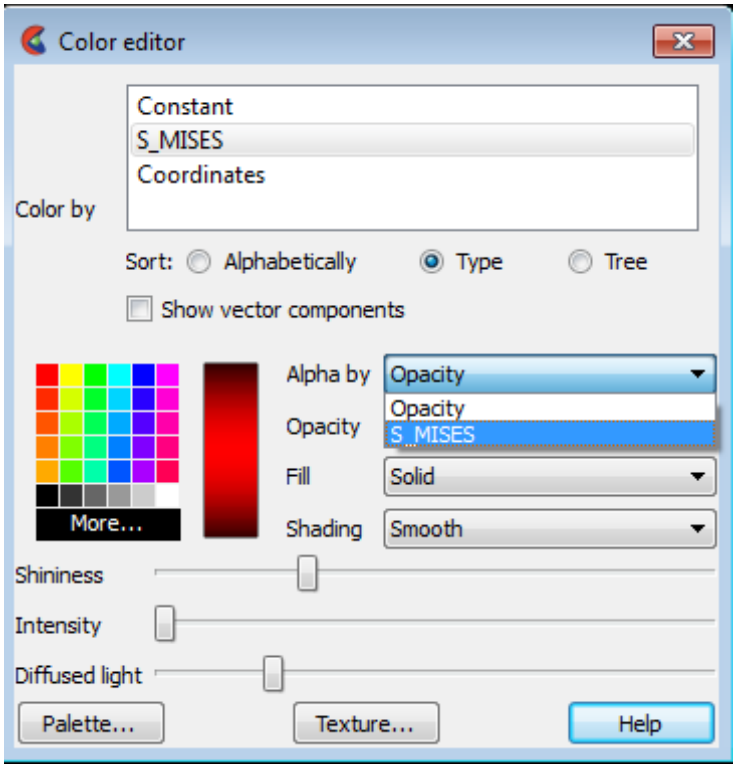
VR
Virtual reality
- Virtual reality – very popular in China
- Single and multiple computer rendering

特点：色彩与透明度

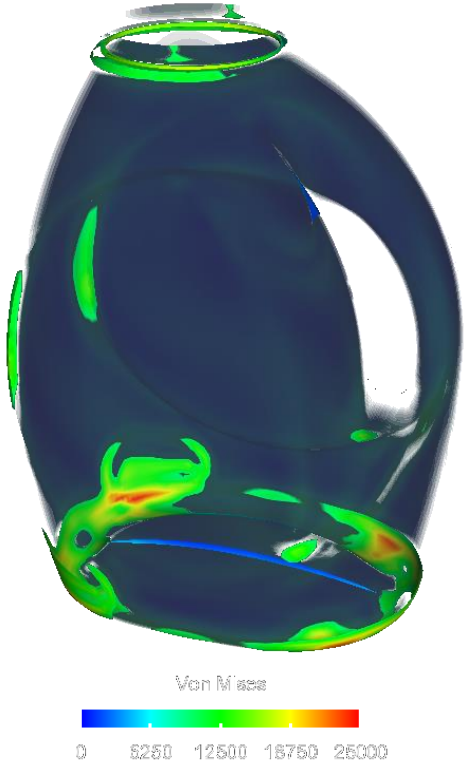
Step 1
Color by a variable



Step 2
Change from single transparency to variable transparency

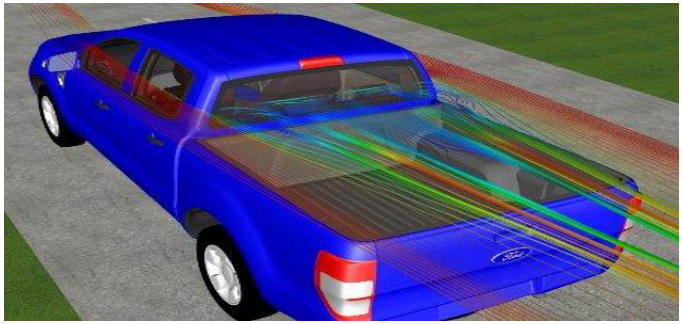


Step 3
Adjust transparency to achieve desired result



特点：纹理映射

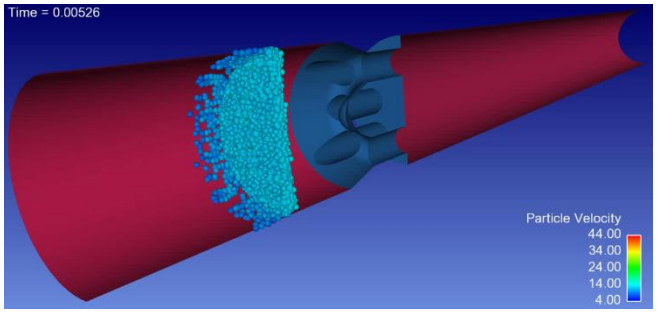
映射logo，细节特征，材料等



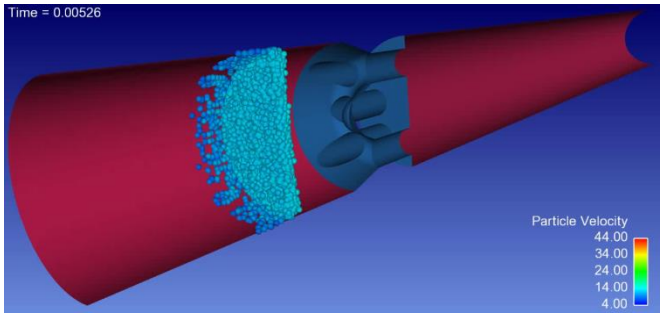
特点：动画

用插值方式使动画更逼真

Normal conditions
No interpolation
Total frames: 32
FPS: 16
Play time: 2.0s

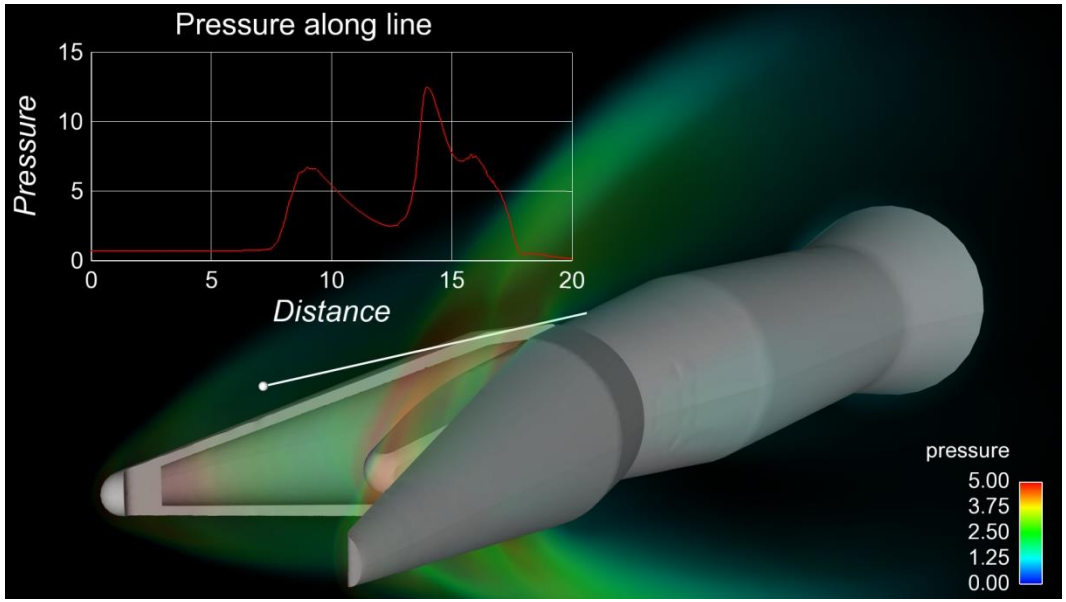


Using Interpolation
Interpolation
Total frames: 125
FPS: 16
Play time: 7.8s



特点：数据抽取

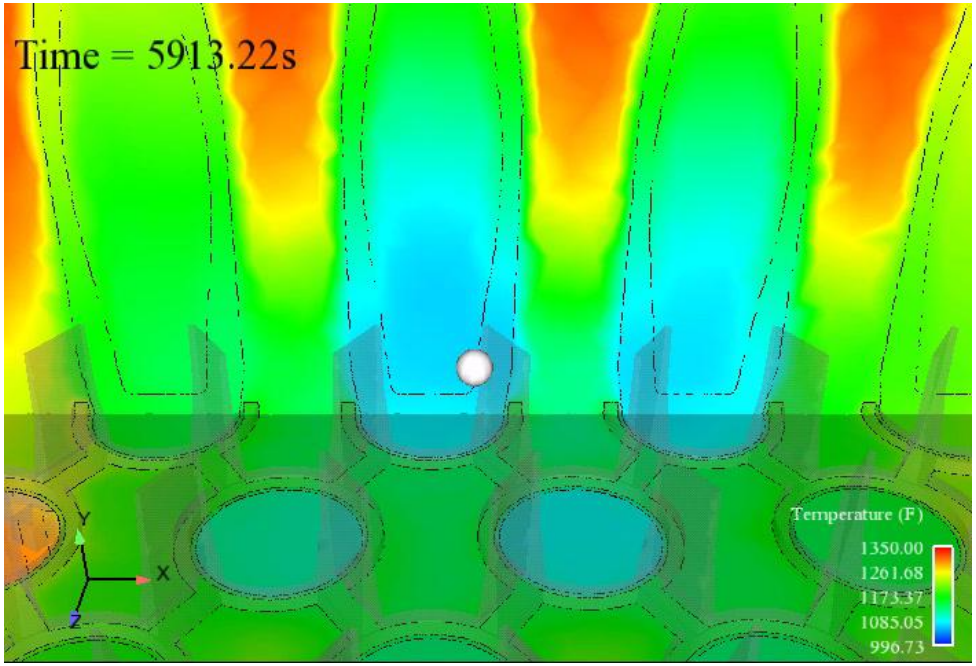
分按距离和按时间两种方式



Example: Rocket opening in space

特点：查询与绘图

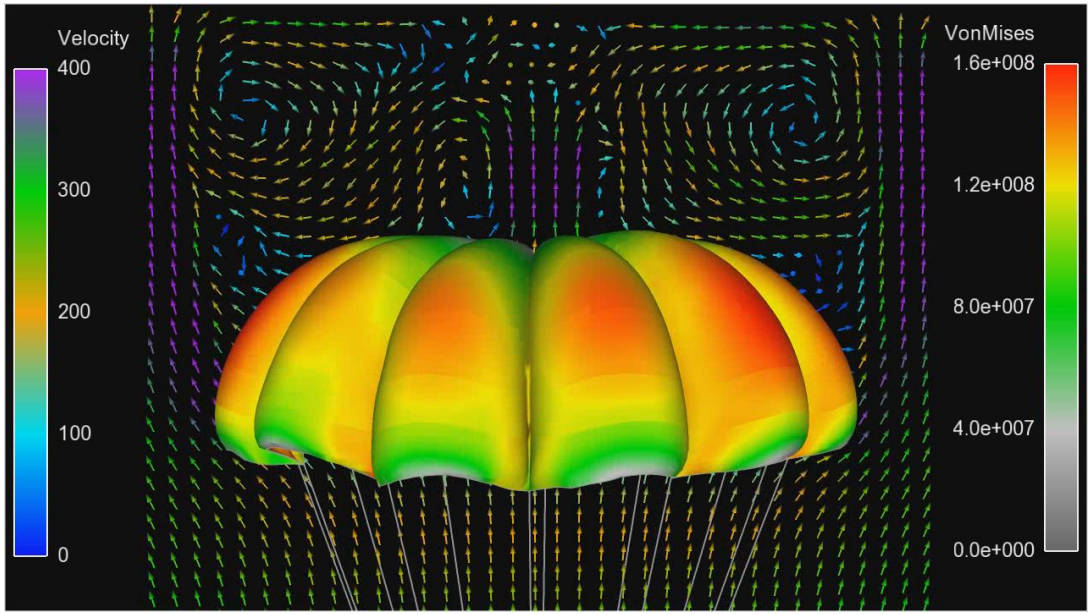
定义query probe，自动更新点和物理量信息



Example: Identify the coldest point over time

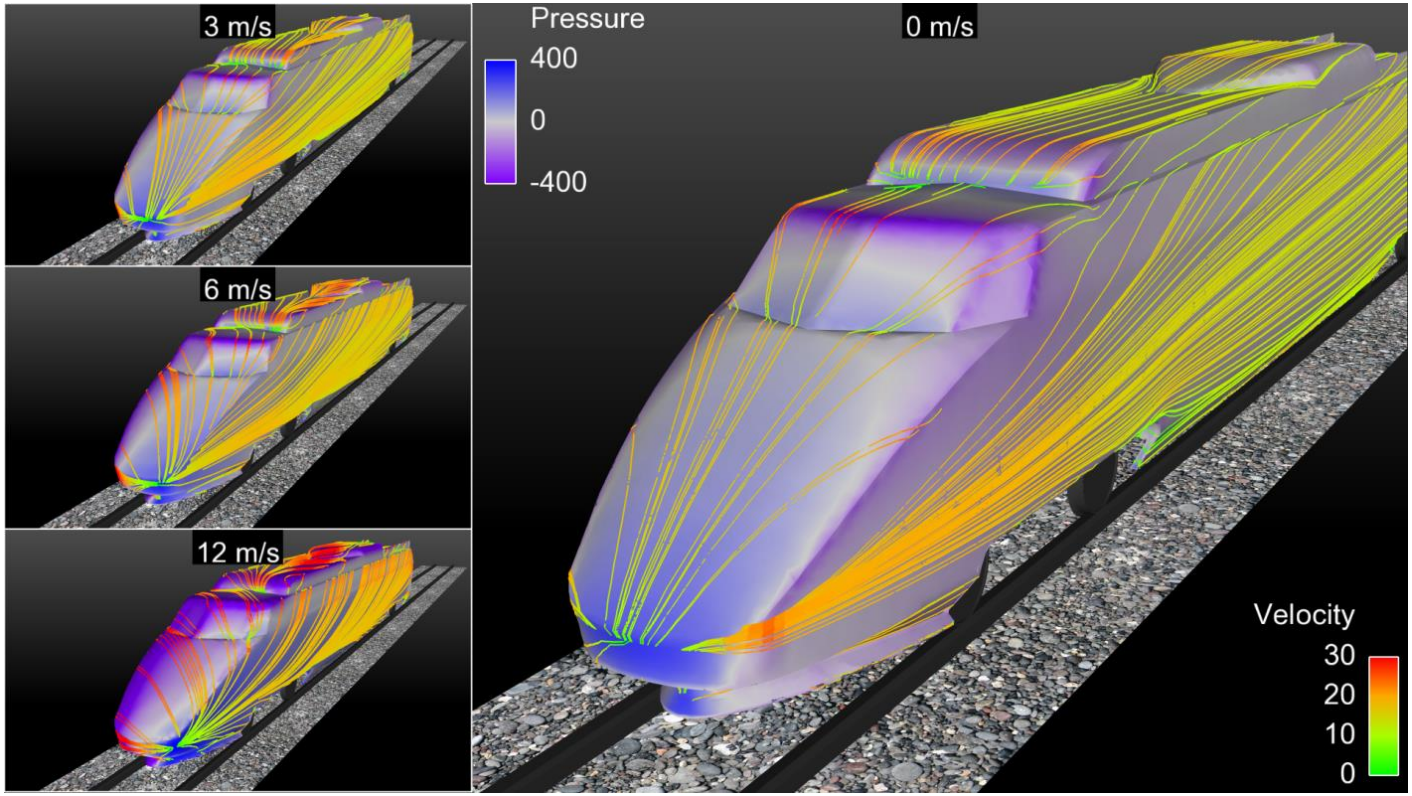
特点：多物理场和多数据集

多物理场：CFD + FEA



特点：多物理场和多数据集(续)

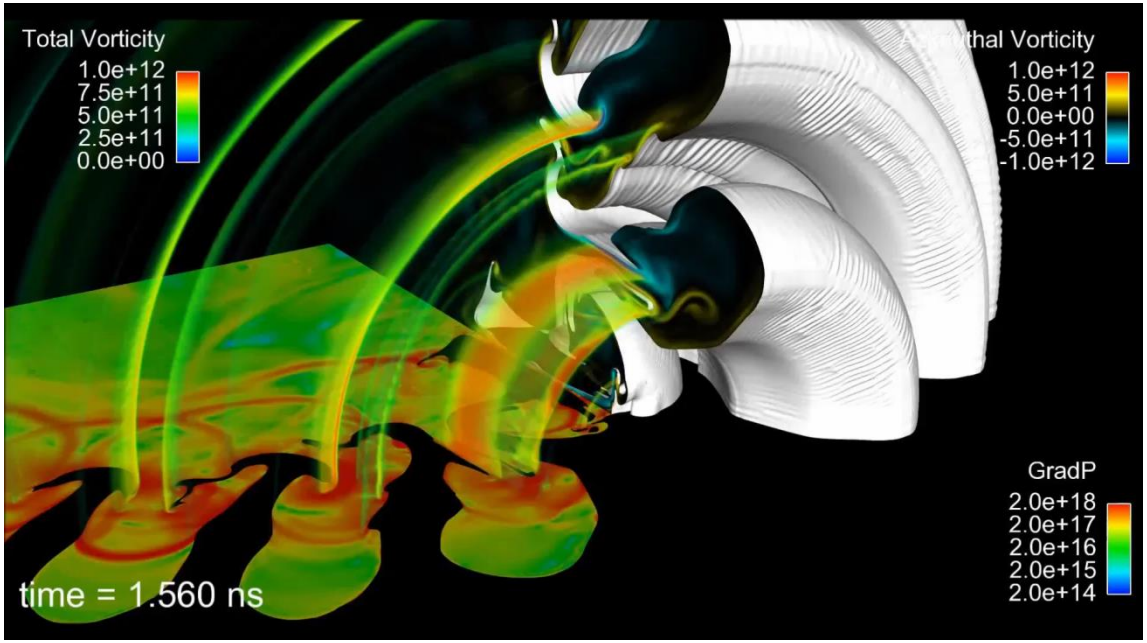
多数据集：导入多case结果进行对比



Example: Train with varying cross-wind Solved with Star-CCM+

特点：大数据

包括网格数量大、计算步数多、零部件多、物理量多等



Example: Inertial confinement fusion ignition
AMR with finest mesh resolution of 50 nm
Mesh ：1,000,000,000 cells in the final time step

概要

- Ensight介绍
- 自动化后处理

特点：

- 节省结果处理时间，把更多时间留给结果分析
- 利用脚本可同时处理多个任务
- 有利于后处理方式的标准化，方便交流
- 与其它CAE软件集成，自动化分析流程

输出图片—用户要求

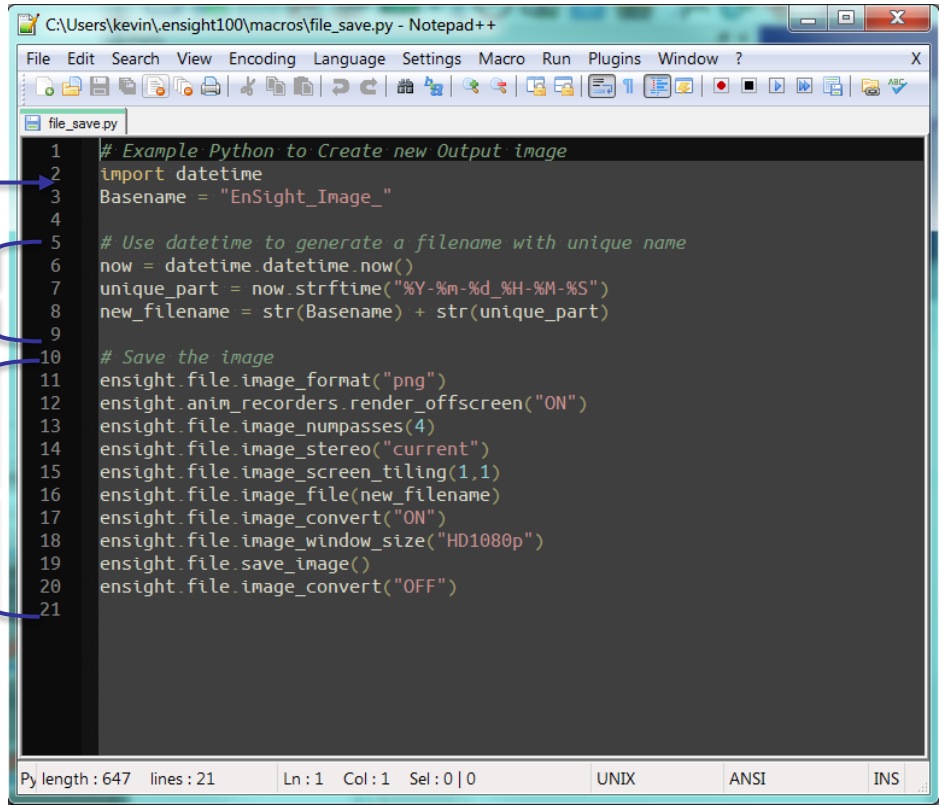
- 格式：PNG
- 大小：300*240
- 文件名：baseName_Time
- 图例：横向，范围，刻度数

输出图片-脚本

引用Python中的datetime模块

定义唯一文件名

定义输出图片格式



输出表格：

使用matplotlib模块生成表格

Drag Force Table [lbf]

	Press Drag	Shear Drag	Total	Cd	% Total
Body	1101.0	913.8	2014.8	0.0262	18.64
Vert	4.6	96.7	101.2	0.0013	0.94
axle_brace	254.4	58.1	312.5	0.0041	2.89
canard	14.2	16.0	30.2	0.0004	0.28
exh_duct	204.2	73.4	277.6	0.0036	2.57
mid_support	3137.1	-1.8	3135.3	0.0408	29.00
mid_wheel	402.6	5.0	407.6	0.0053	3.77
parachute_can	78.0	4.3	82.3	0.0011	0.76
rear_axle	2489.7	39.4	2529.1	0.0329	23.40
rear_wheel	1885.9	33.7	1919.6	0.0249	17.76
Total	9571.4	1238.8	10810.2	0.1405	100.00

输出表格（续）：

利用python脚本和截面定义工具生成表格

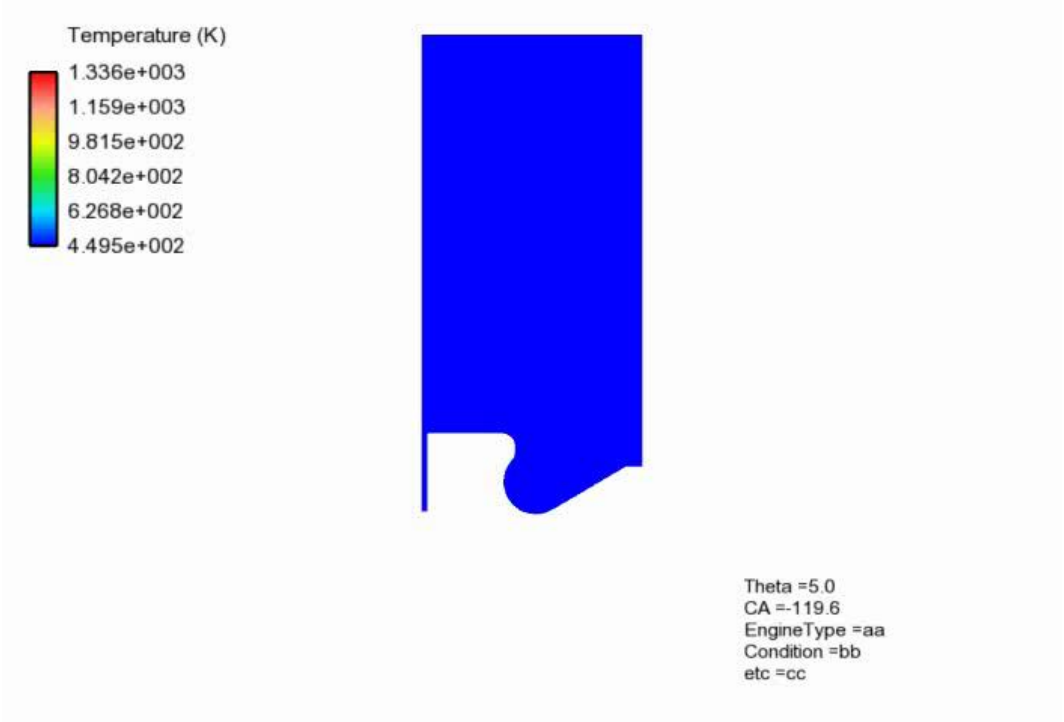
0.60	0.90	0.95	0.65
1.14	1.27	1.23	1.00
1.32	1.27	1.20	1.08
1.54	1.49	1.43	1.43

输出动画：

- 改变视角
- 移动或旋转part
- 改变part透明度
- 与其他动画合并

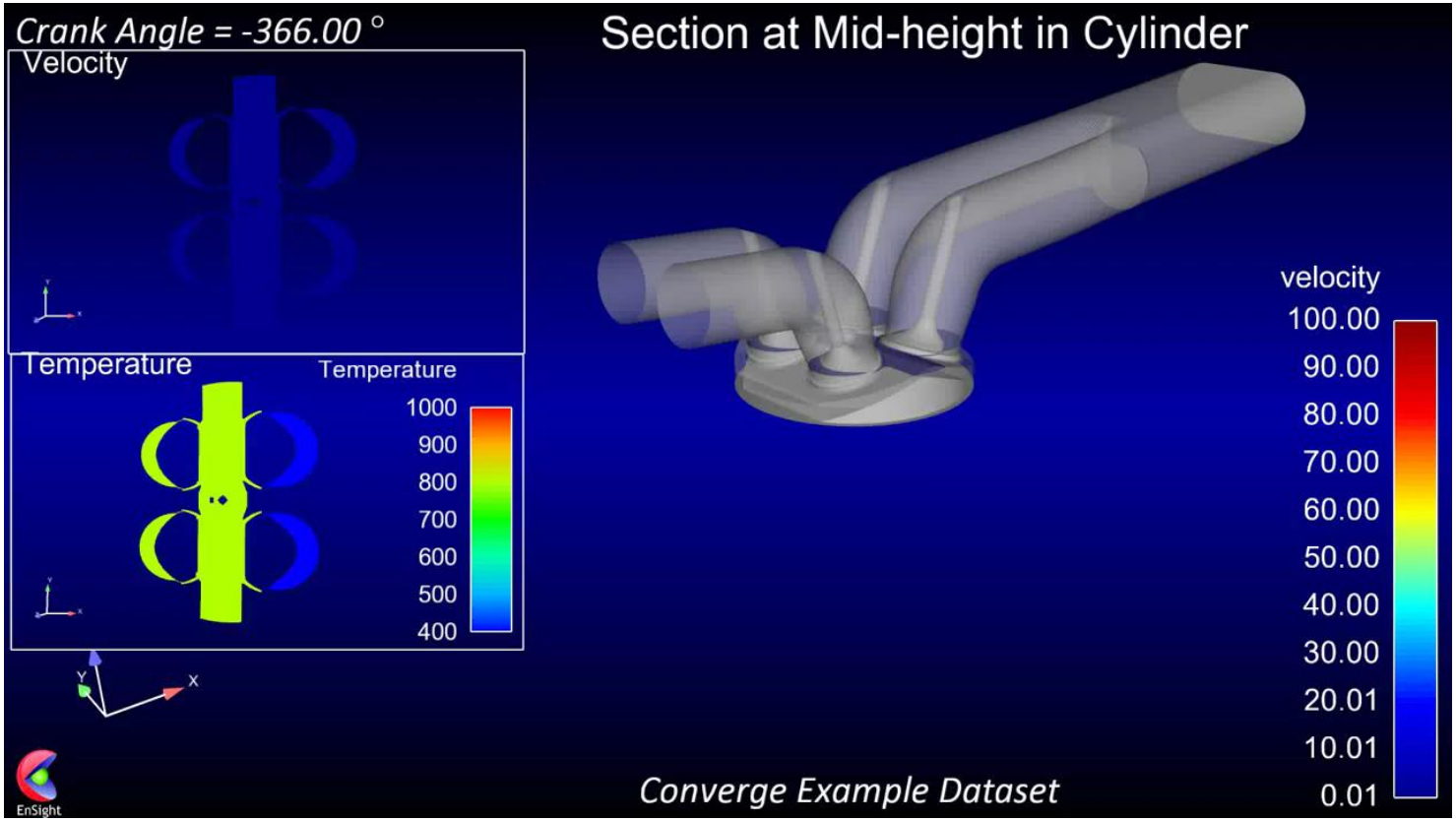
输出动画（续）：

- 自动调整视图
- 自动更新曲轴转角



输出动画（续）：

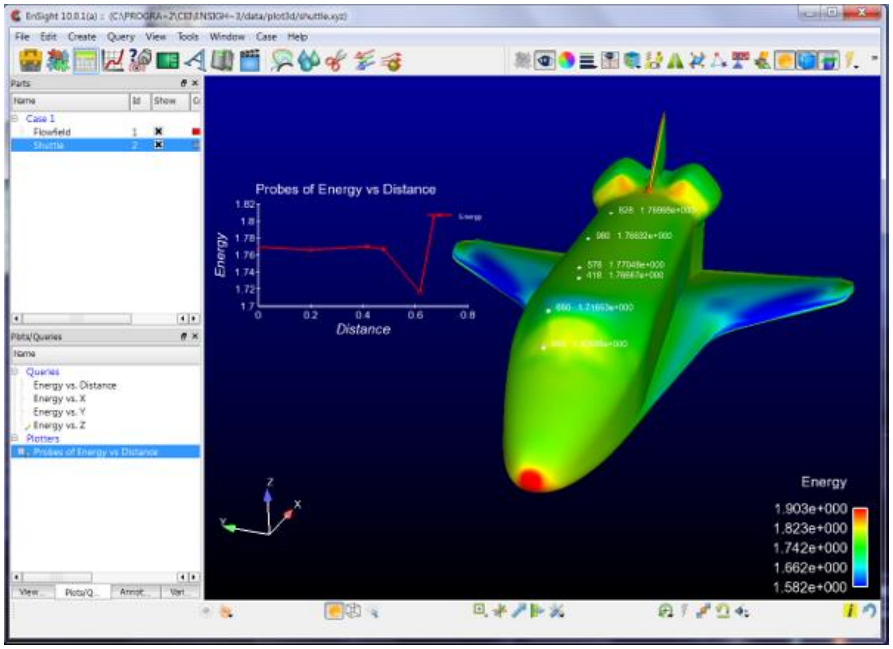
- 多视图



输出曲线：

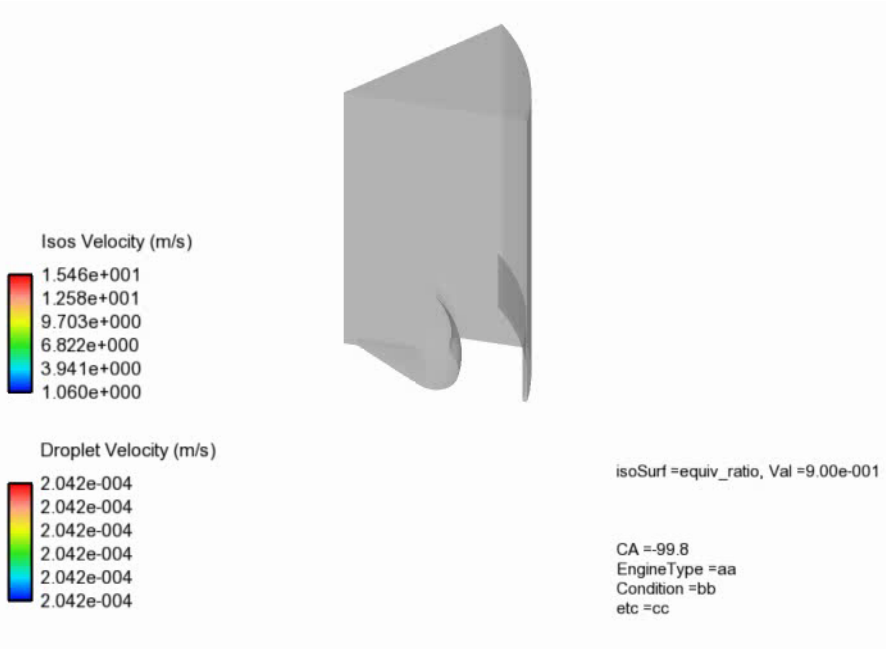
- 使用Interactive Probe工具输出曲线
- 结合Python脚本，自动输出并保存曲线

```
a = ensight.query(ensight.QUERY_PROBE_DATA)
```



输出自定义变量：

由公式定义自定义变量



输出自定义变量：

自定义变量输出文件

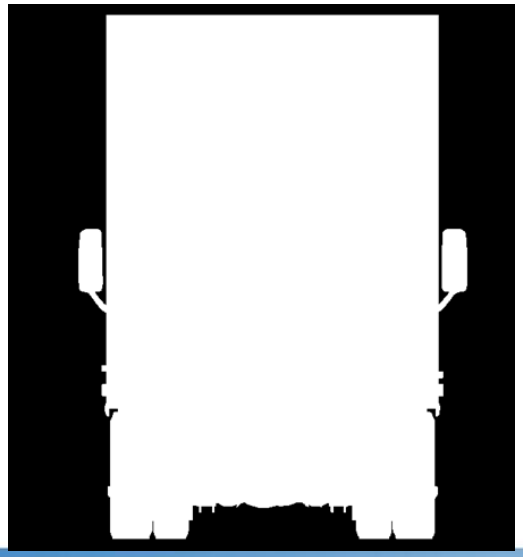
```
part: select_byname_begin
 "(CASE:Case 1)sect"
part: select_byname_end

variables: evaluate FlowRate = FlowRate(plist,U)
variables: evaluate absMassFlowRate = ABS(rho*FlowRate)
variables: evaluate fluxSum = IntegralSurface(plist,absMassFlowRate,[])

variables: evaluate fluxT = T*absMassFlowRate
variables: evaluate fluxTSum = IntegralSurface(plist,fluxT,[])
variables: evaluate aveT = fluxTSum/fluxSum

variables: evaluate relaT = aveT-273.15


variables: select_byname_begin
relaT
variables: select_byname_end
variables: save_constants C:\Users\Desktop\EnSight\tempData01_0
```

输出relaT变量到文件

输出自定义变量：

利用外部计算输出自定义变量

- Use Python to call out to EnVe, to approximate the frontal or projected area.
- Utilize a reference geometry and image size (generated by Python script).
- Extrapolates frontal area of geometry.

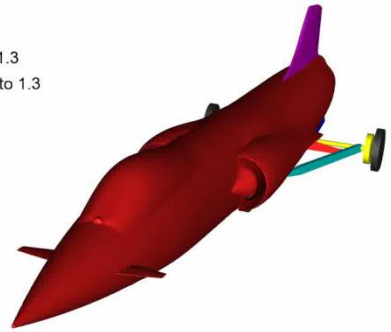


多任务自动化：

多输出自动化

EnSight Scripting routine for Auto Posting

Title is ... NAE 600 mph basline_0canard_600mph dataset
Use Reference Pressure of 1696.0 psif
Velocity Reference is 880.0 ft/s, and Density Reference is 0.0019871 slugs/ft^3
Surface Cp Plot ON, Range -1.5 to 1.5
Surface Restricted Streamlines ON
Surface Drag Plot ON
Section Clip of Velocity Magnitude Plot ON, Range -0.1 to 1.3
Section Clip of Velocity X-component Plot ON, Range -0.1 to 1.3
Section Clip of Cp Plot ON, Range -0.25 to 0.25
X Section Clips from -1.0 to 56.0 with 51 pages
Y Section Clips from 0.01 to 6.0 with 15 pages
Z Section Clips from 0.05 to 10.0 with 21 pages
Accumulated Drag Graph ON
Force Summary ON
Isosurface Plot ON



Using autopost.in input control file
Script run from /home/kevin/work/NAE_Car/NAE_basline_0canard_600mph
Script started on Thu Jun 7 15:06:21 2012

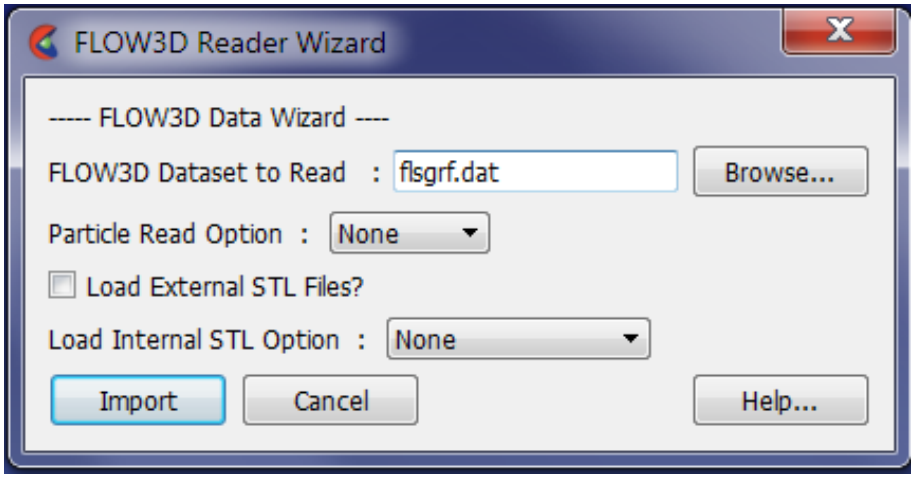
定制后处理界面：

- 支持输出不同位置，不同方位的同类型动画
- 支持不同变量类型的动画
- 支持标尺，动画输出属性等参数的设置

Parameters	Case_1	Case_2	Case_3
	Active	Active	Active
	1 Cp From	1 Cp From	2 Cp From
Spray 3D Animation			
Output Active	Active	Active	Active
View Direction	-Y	-Y	-Y
Offset Angle (deg)	(30,10,0)	(30,10,0)	(30,10,0)
PISTON	1:Piston	1:Piston	1:Piston
LINER	2:Liner	2:Liner	2:Liner
HEAD	3:Head	3:Head	3:Head
Legend Min Value	0	0	0
Legend Max Value	30	30	30
Frame Rate	3	3	3
Output Name	spray3d	spray3d	spray3d
Velocity Contour 2D Plot			
Output Active	Active	Active	Active
Slice Normal	-Y	-Y	-Y
Slice Position	0	0	0
Legend Min Value	0	0	0
Legend Max Value	30	30	30
Arrow Density	0.2	0.2	0.2
Frame Rate	3	3	3
Output Name	velocity2d	velocity2d	velocity2d
AF Contour 2D Plot			

定制后处理界面：

- 使用CeiQtGenericDialog模块定制gui
- 支持对输入输出的控制
- 支持对part、variable、text等对象的访问



总结

- 具有丰富的工具，用户使用方便
- 具有丰富的接口，导入FEA和CFD的计算结果
- 输出形式多样化，满足不同的输出要求
- 具有良好的开放性，可以实现GUI定制、输出自动化以及与其他软件的集成

谢谢大家！