

ICSC 2019

Core Competence Enhanced by MBD



IDAJ CAE Solution Conference

基于CONVERGE的柴油机米勒循环流动与换气过程仿真研究

中国北方发动机研究所
工作过程研究室

王子玉

提纲



- 1 研究背景
- 2 计算模型的建立与校核
- 3 计算结果分析
- 4 结论

提纲



- 1 研究背景
- 2 计算模型的建立与校核
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- 4 结论

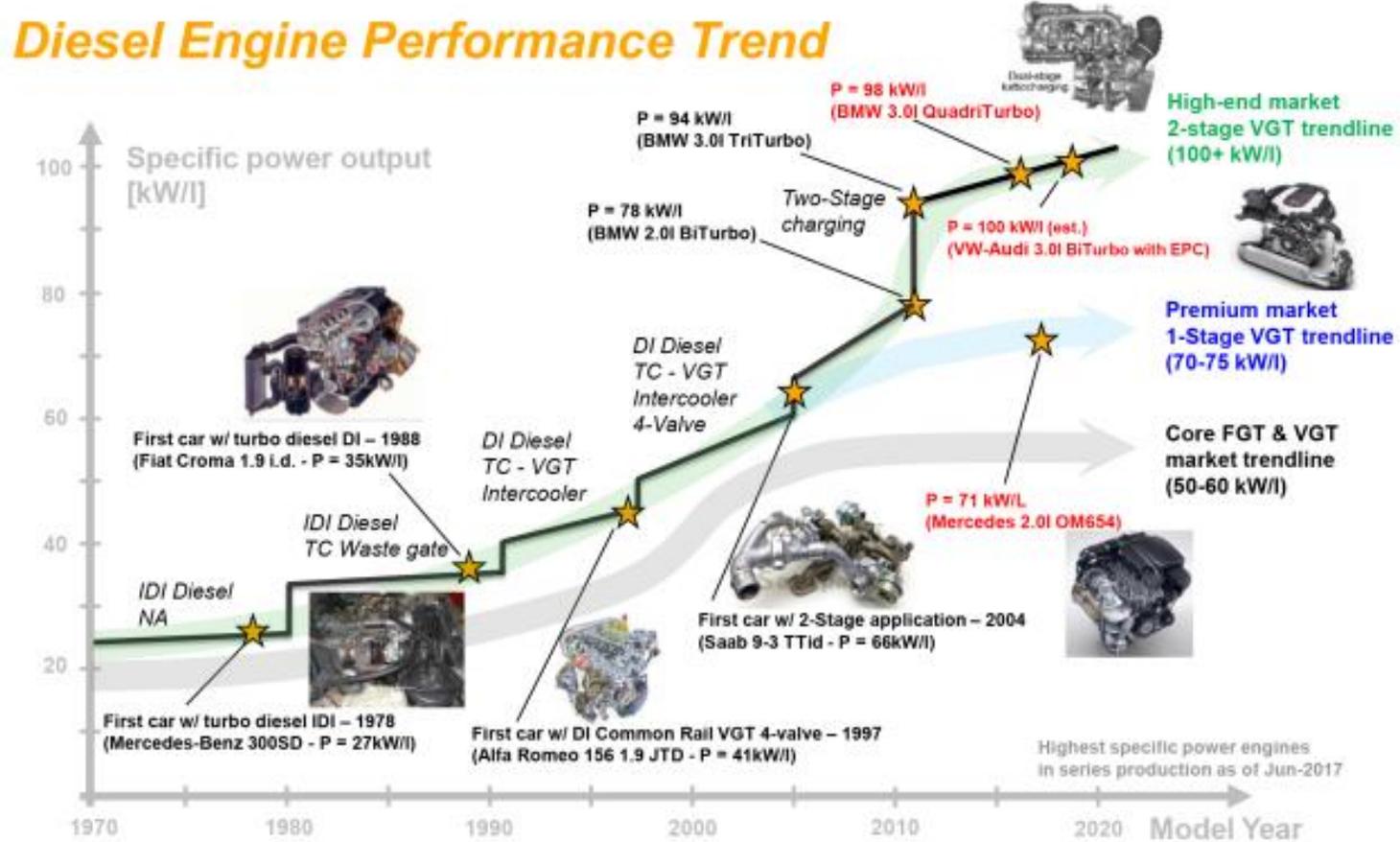
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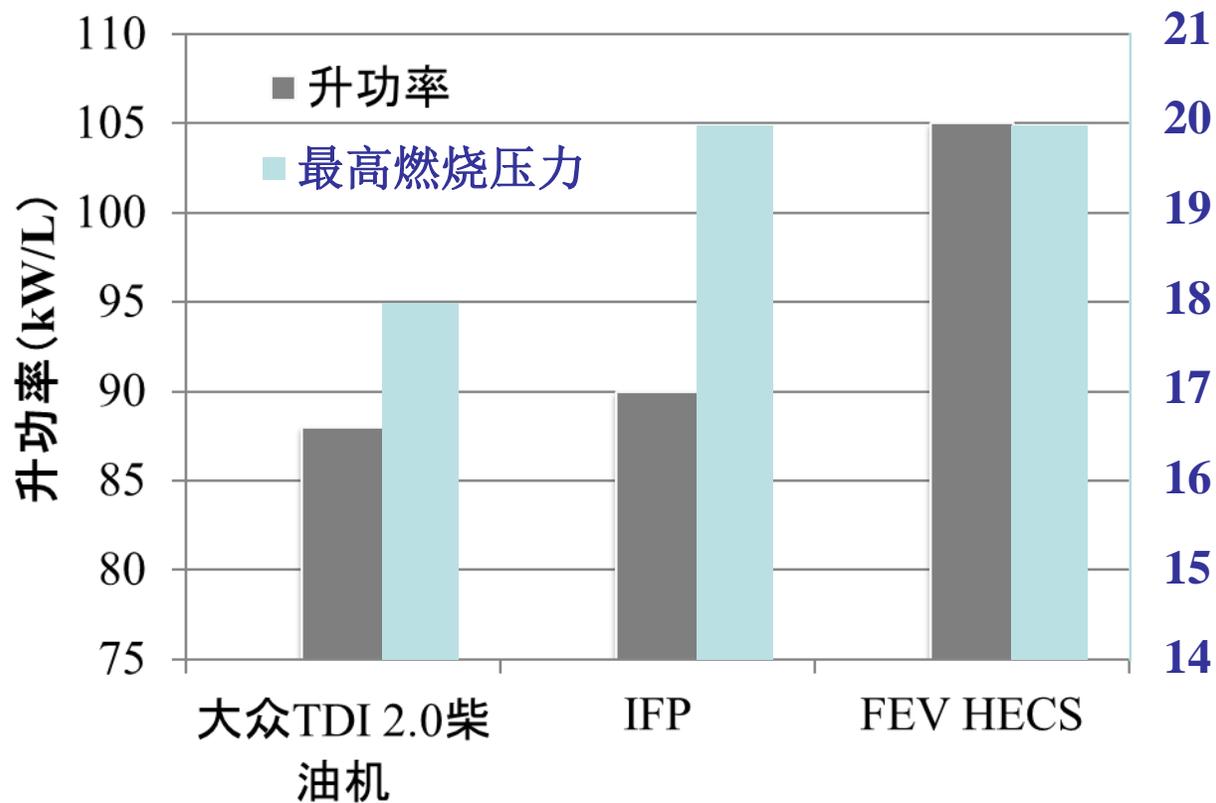
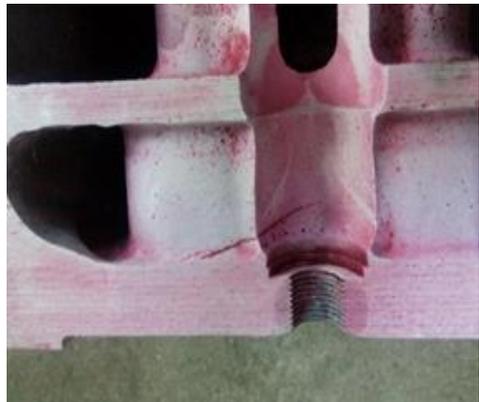
01 Part

研究背景

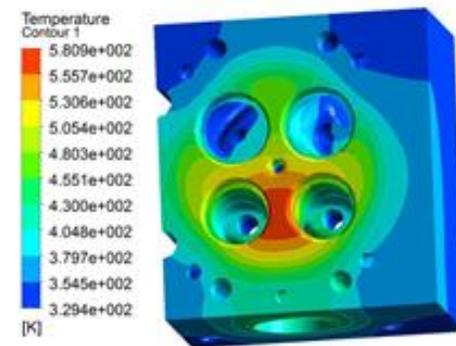
研究背景



研究背景

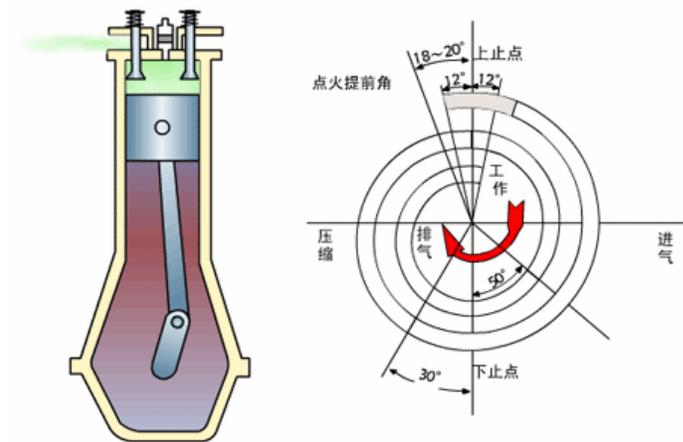


最高燃烧压力(MPa)

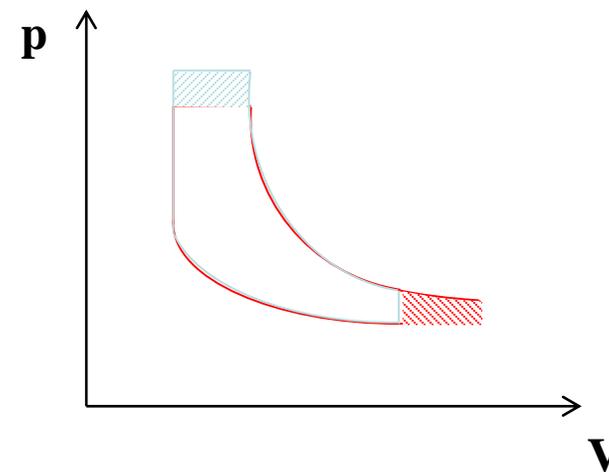
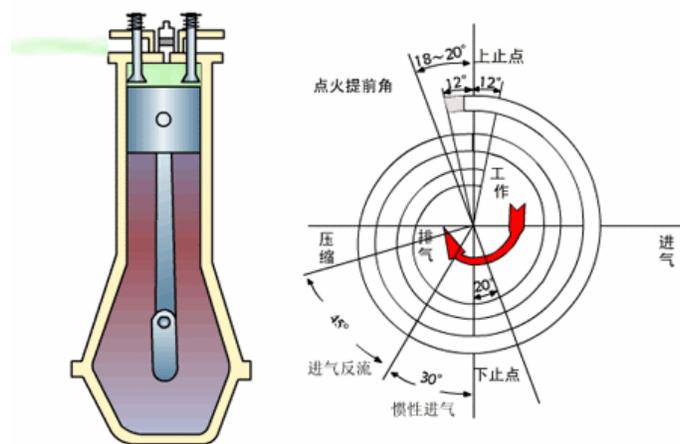


研究背景

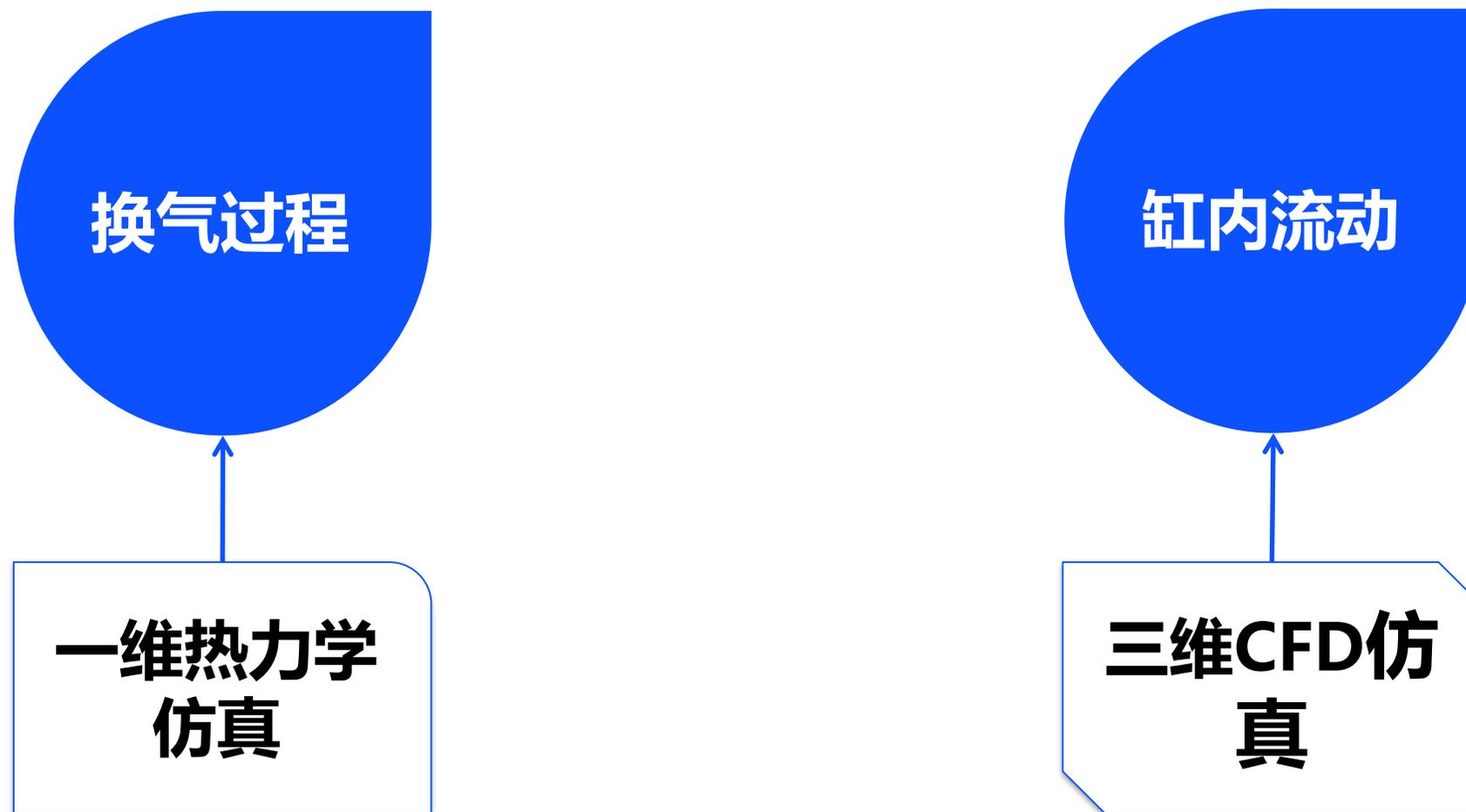
常规发动机配气图解



米勒循环发动机配气图解



研究背景



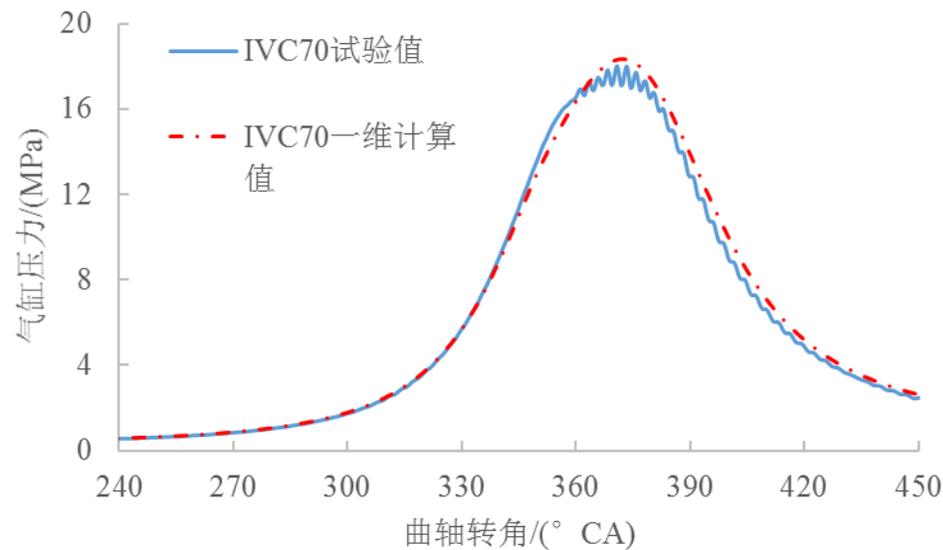
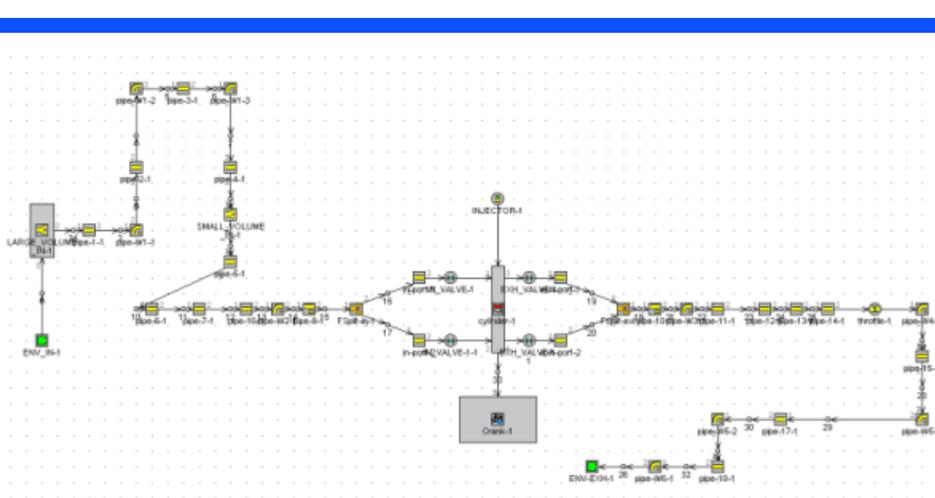
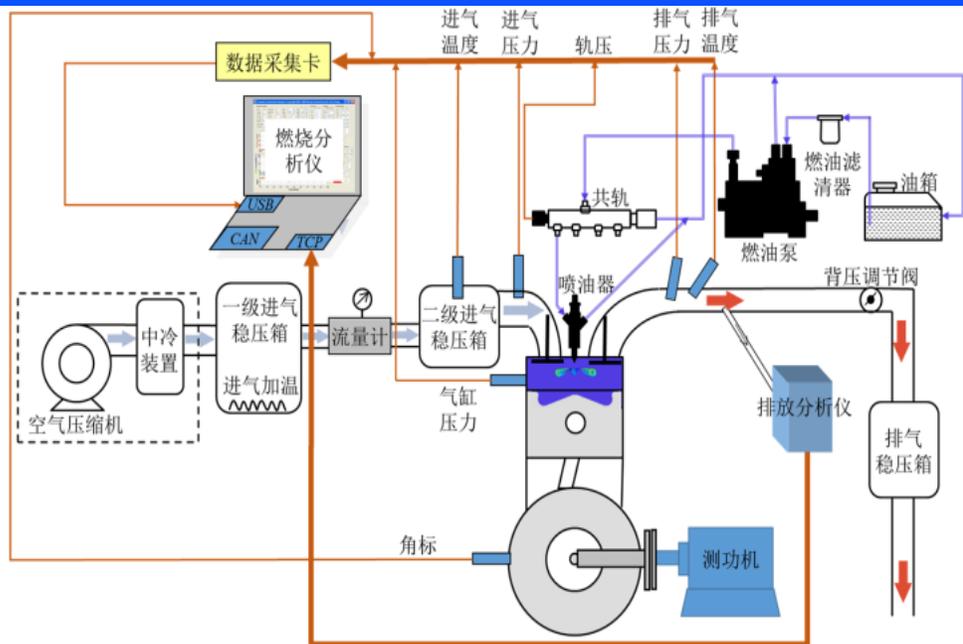
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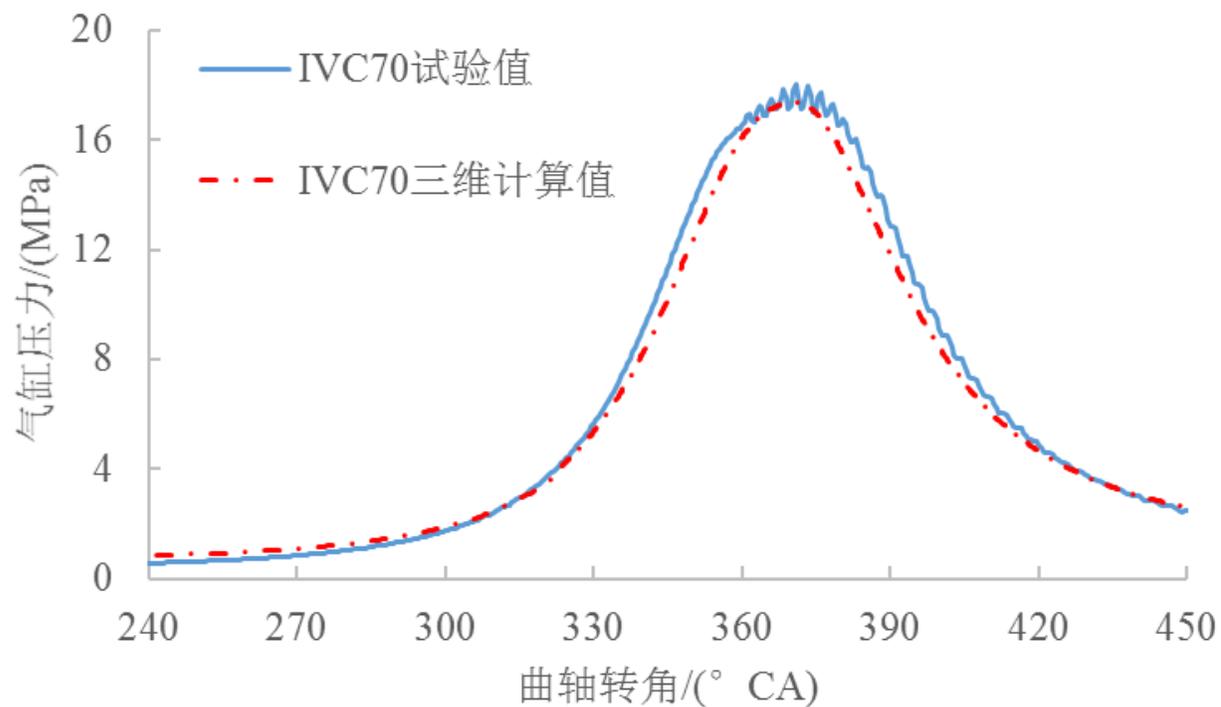
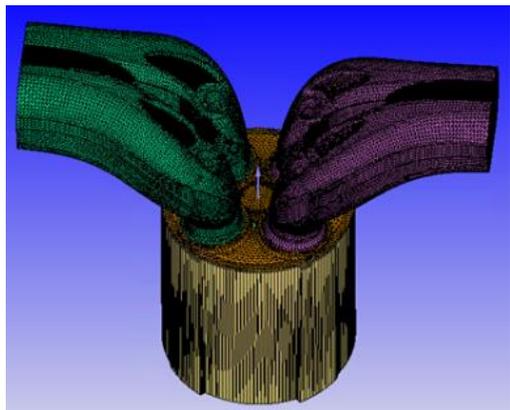
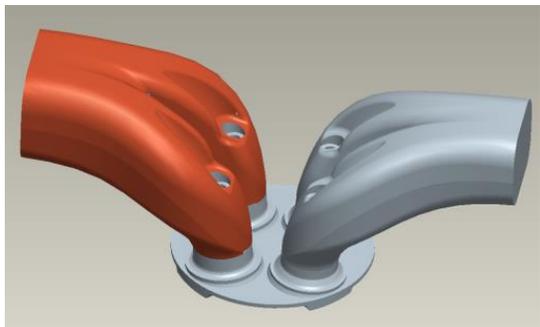
02 Part

计算模型的建立与校核

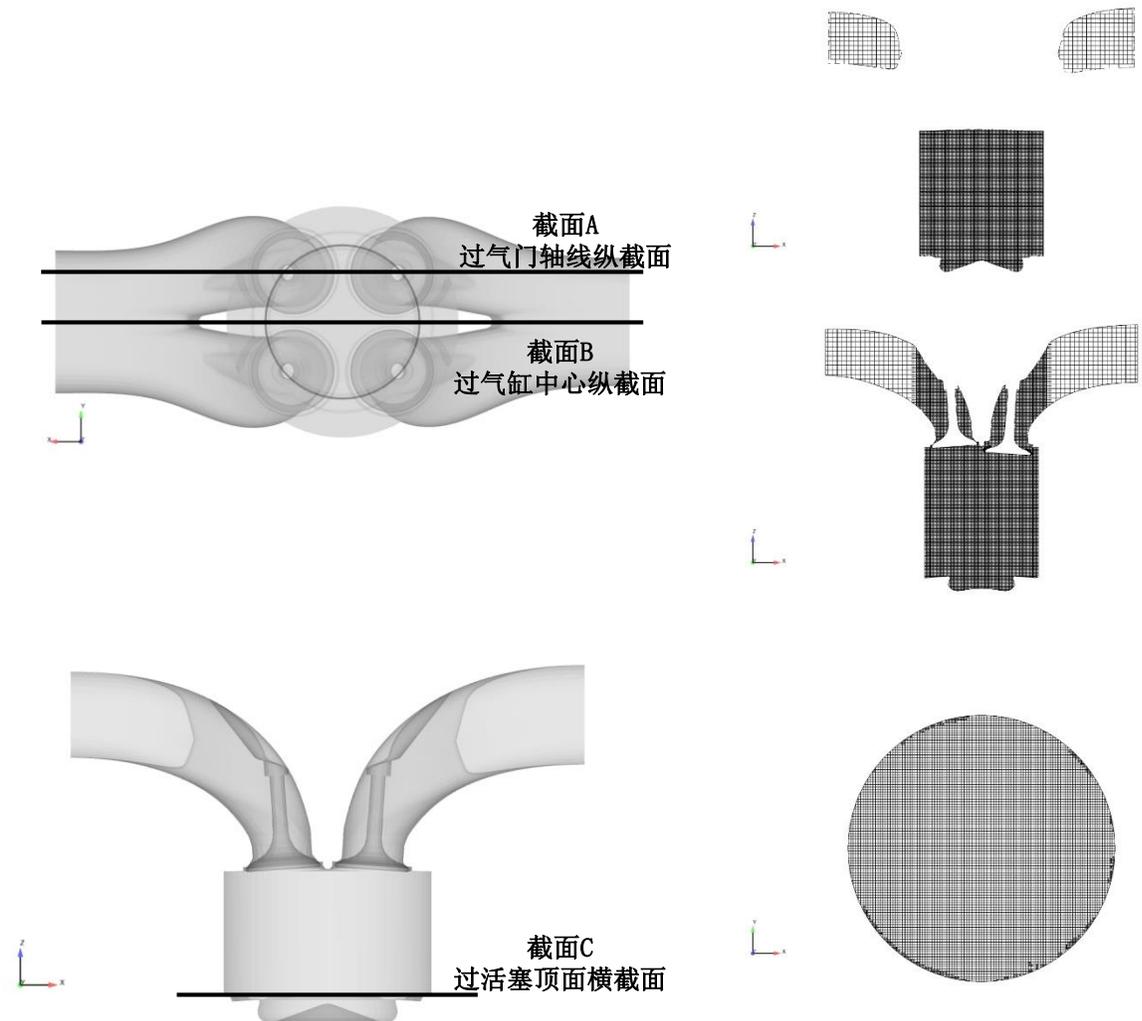
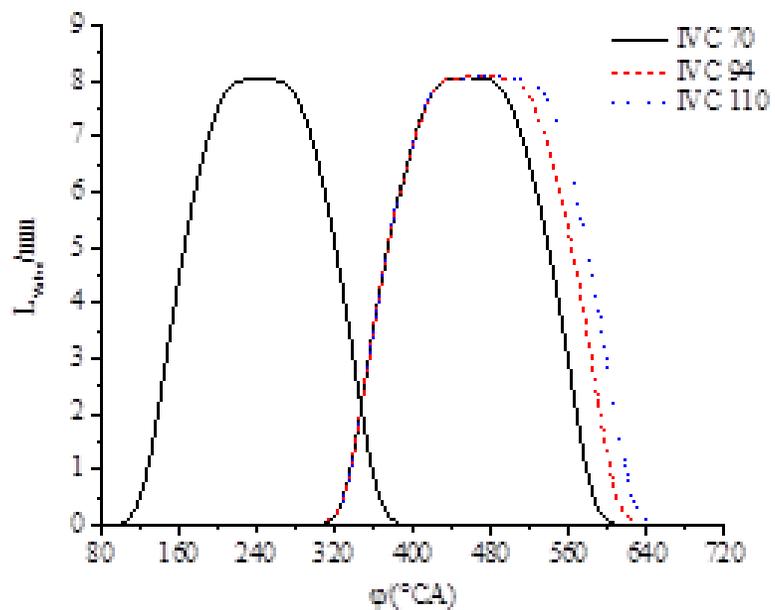
计算模型的建立与校核



计算模型的建立与校核



计算模型的建立与校核



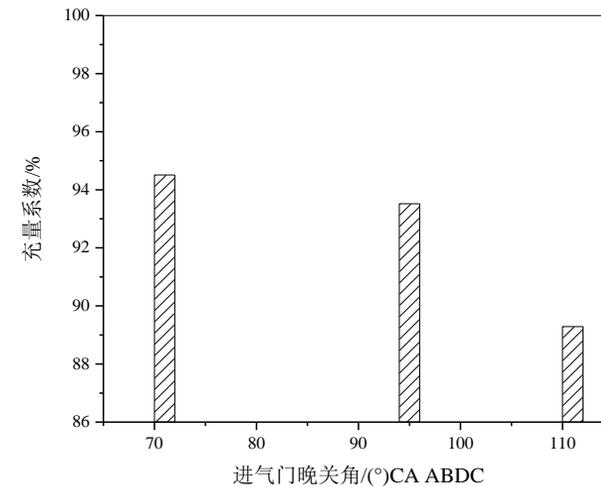
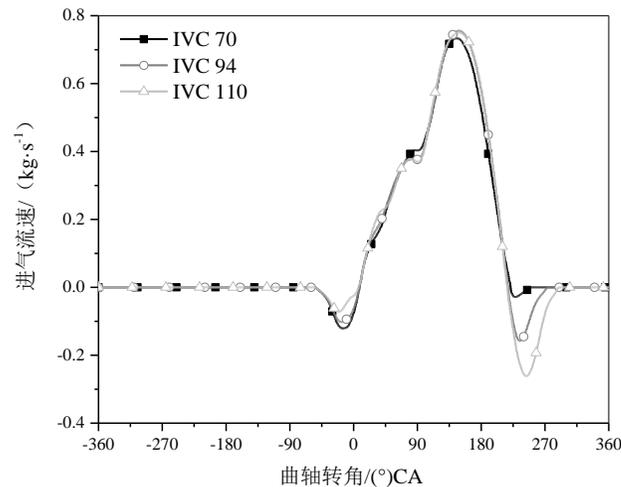
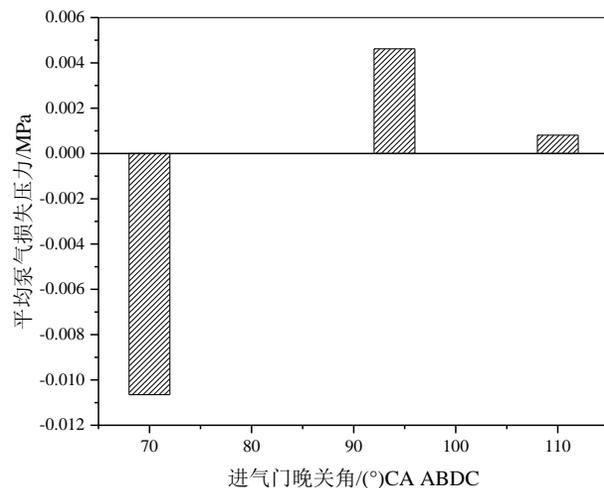
提纲



03 Part

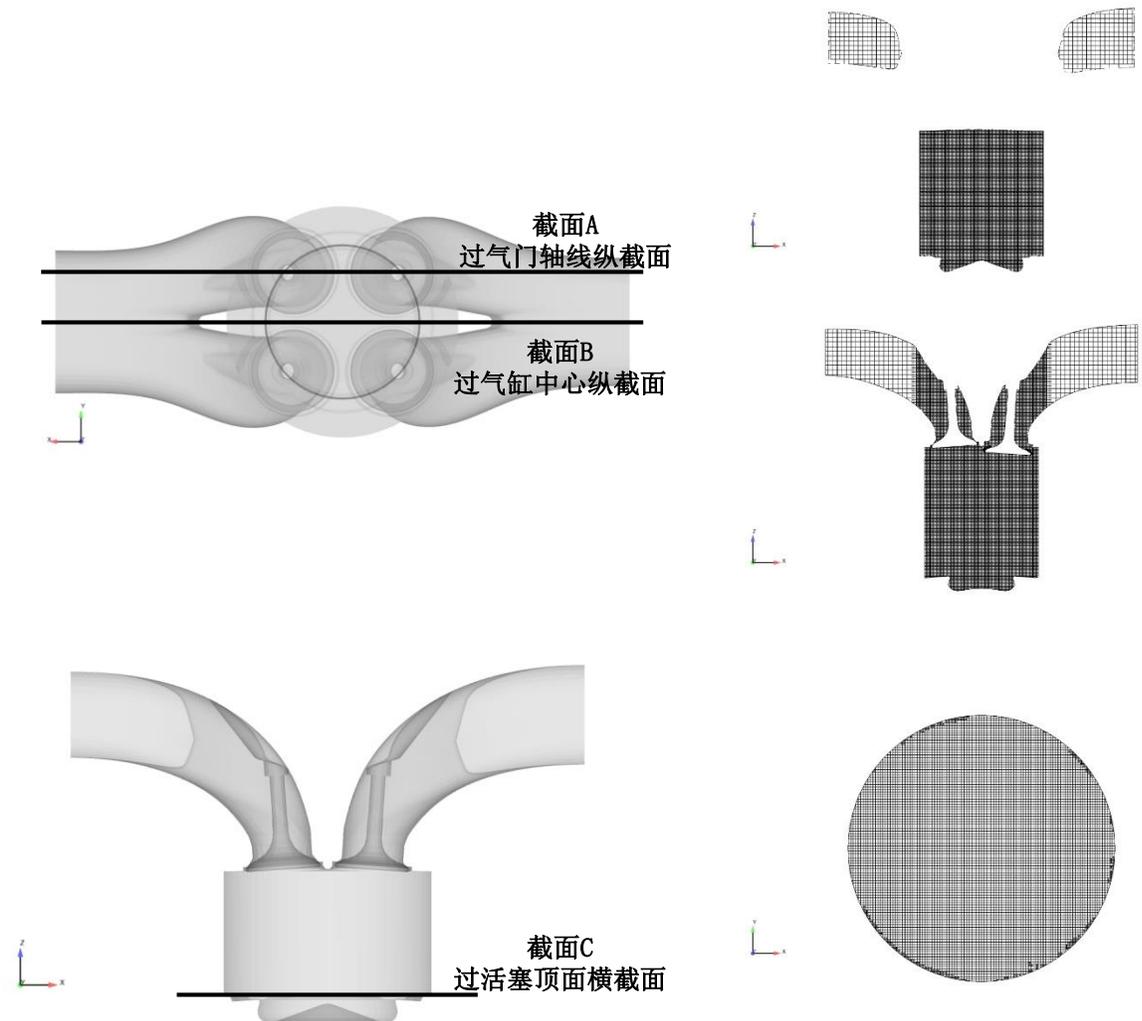
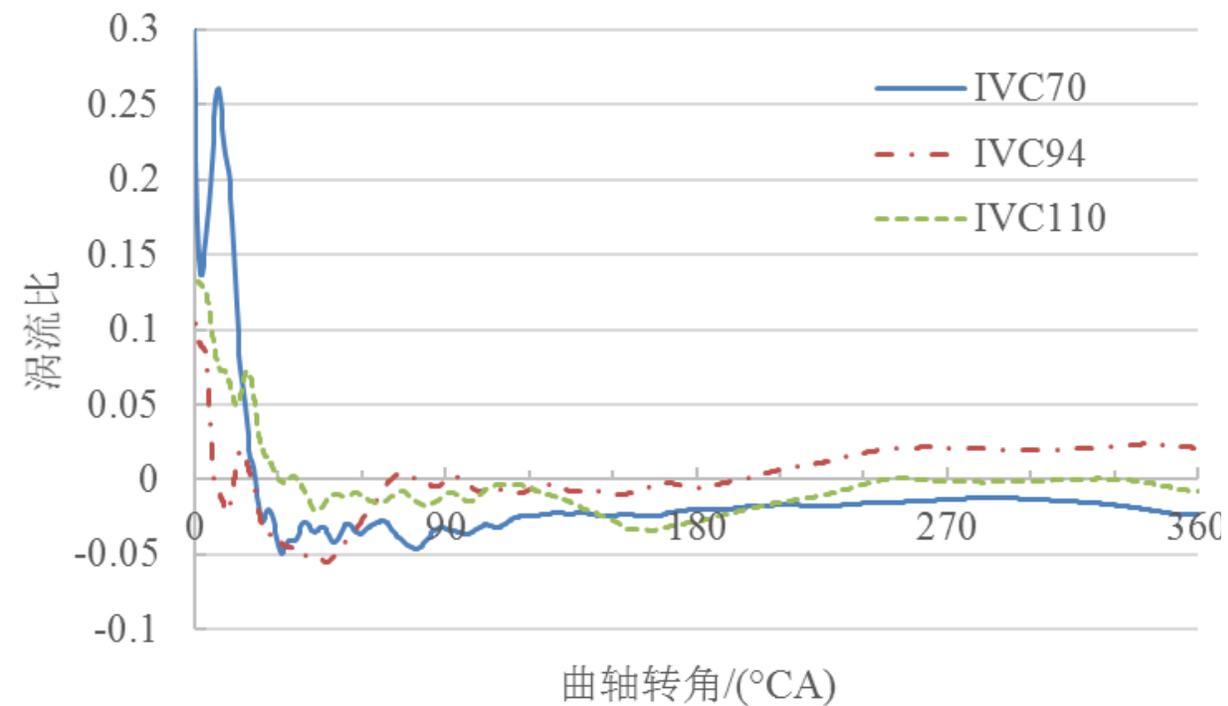
计算结果分析

计算结果分析

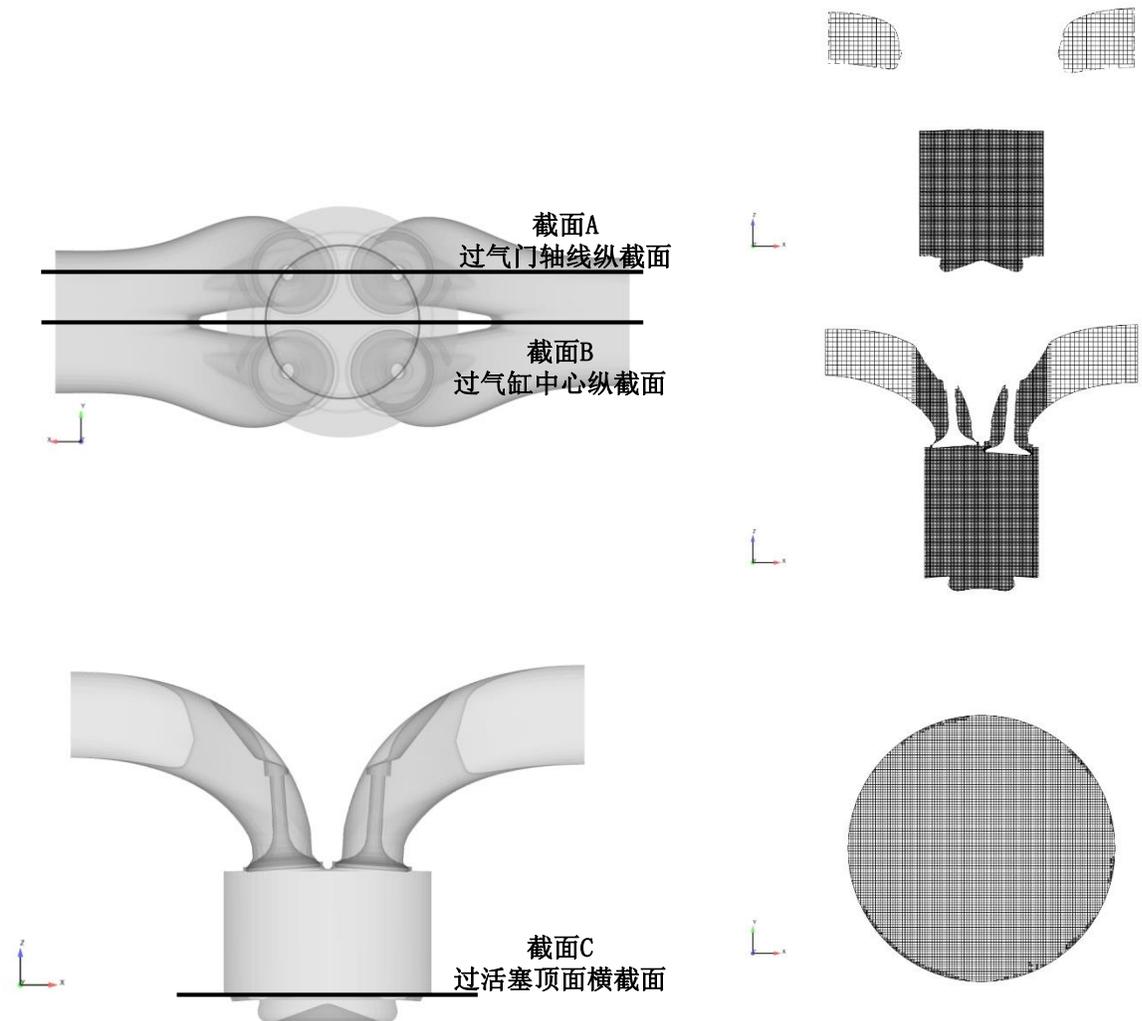
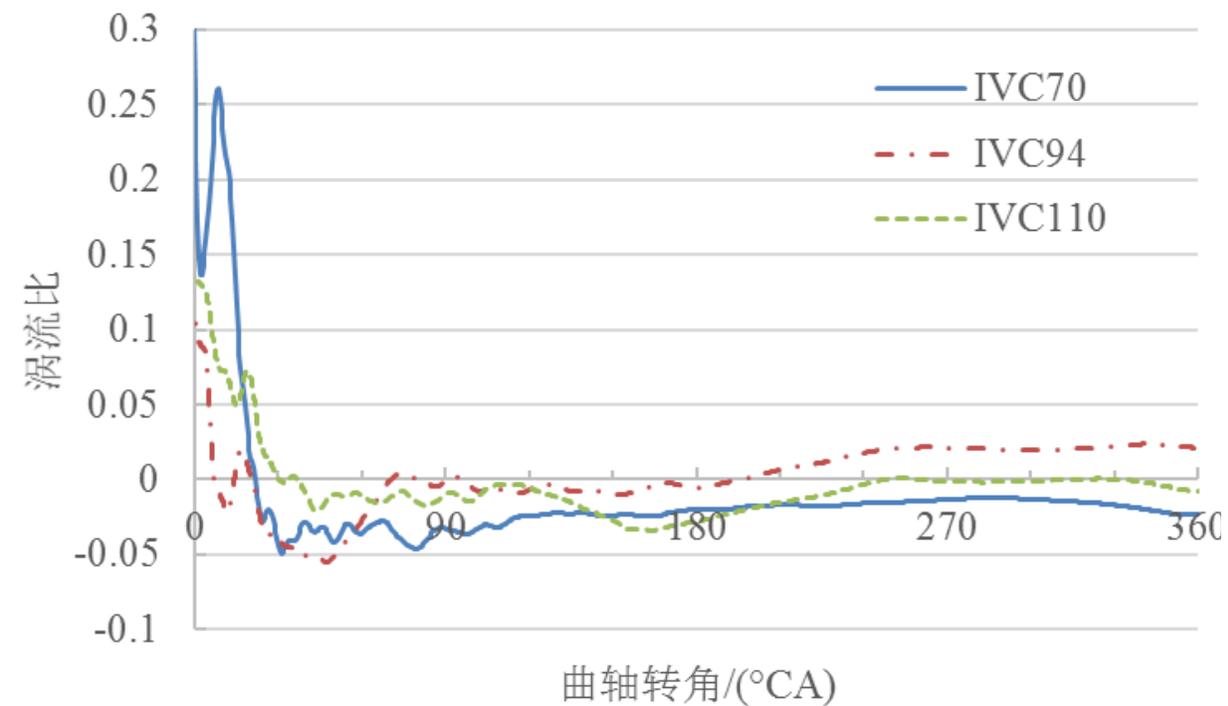


- ◆ 原机相位下泵气损失较大，泵气功为负。随着进气门晚关角的推迟、进气压力提高，平均泵气压力增加。
- ◆ 随着进气门晚关角推迟，进气回流量增加。
- ◆ 随着进气门晚关角的推迟，充量系数降低。

计算结果分析

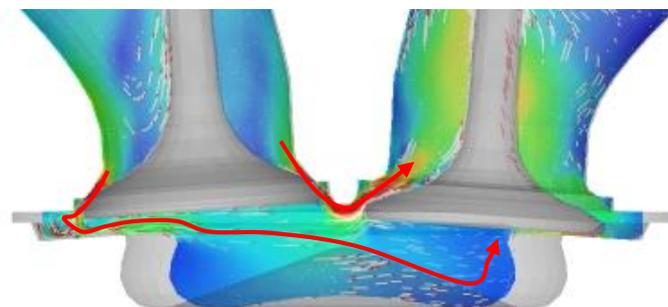


计算结果分析

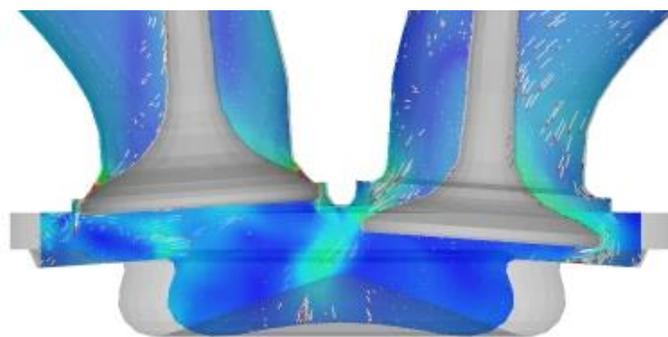


计算结果分析

TDC



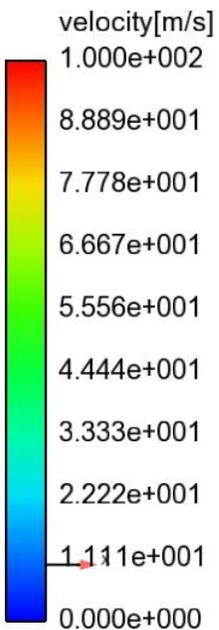
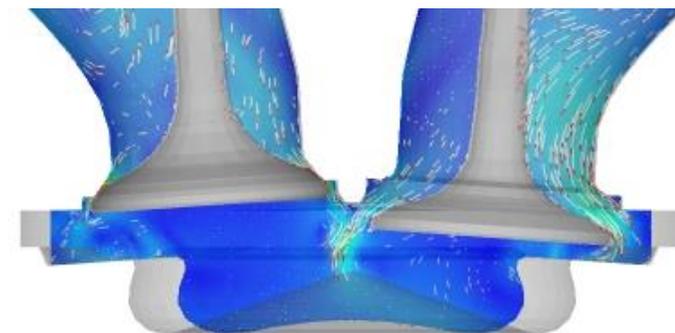
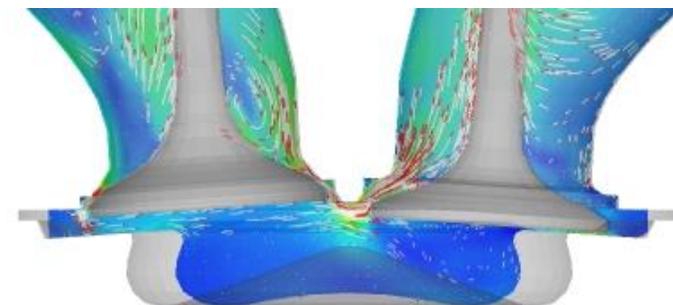
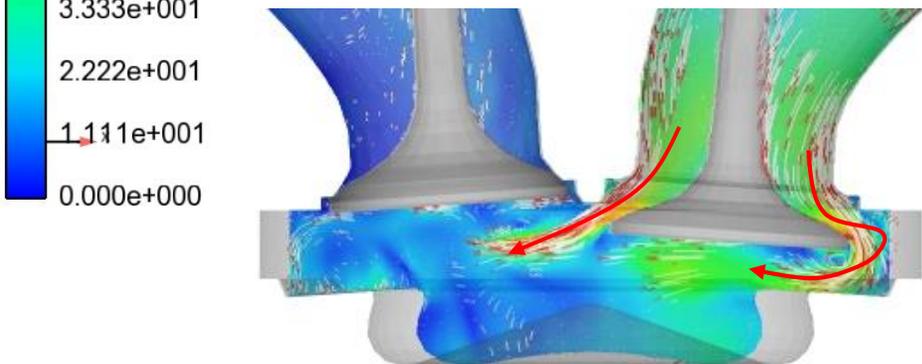
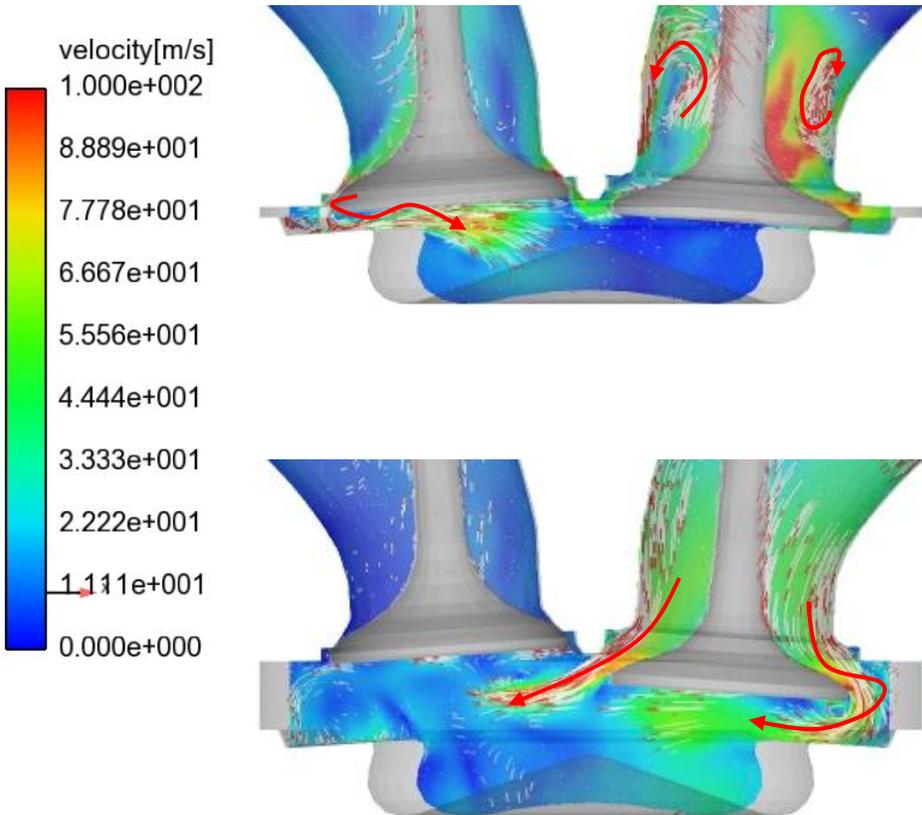
20° CA ATDC



原机

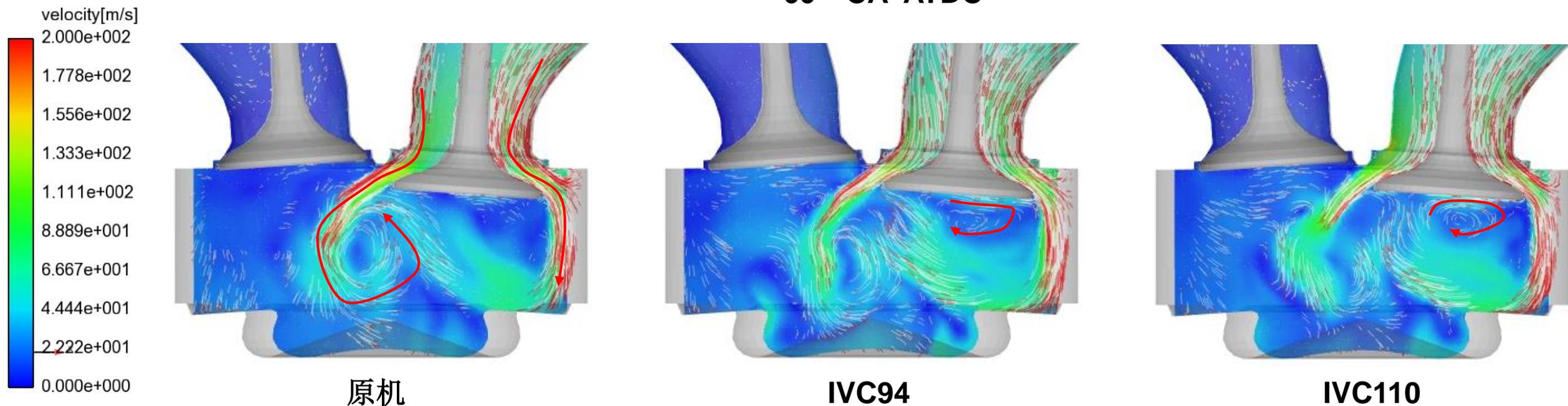
IVC94

IVC110



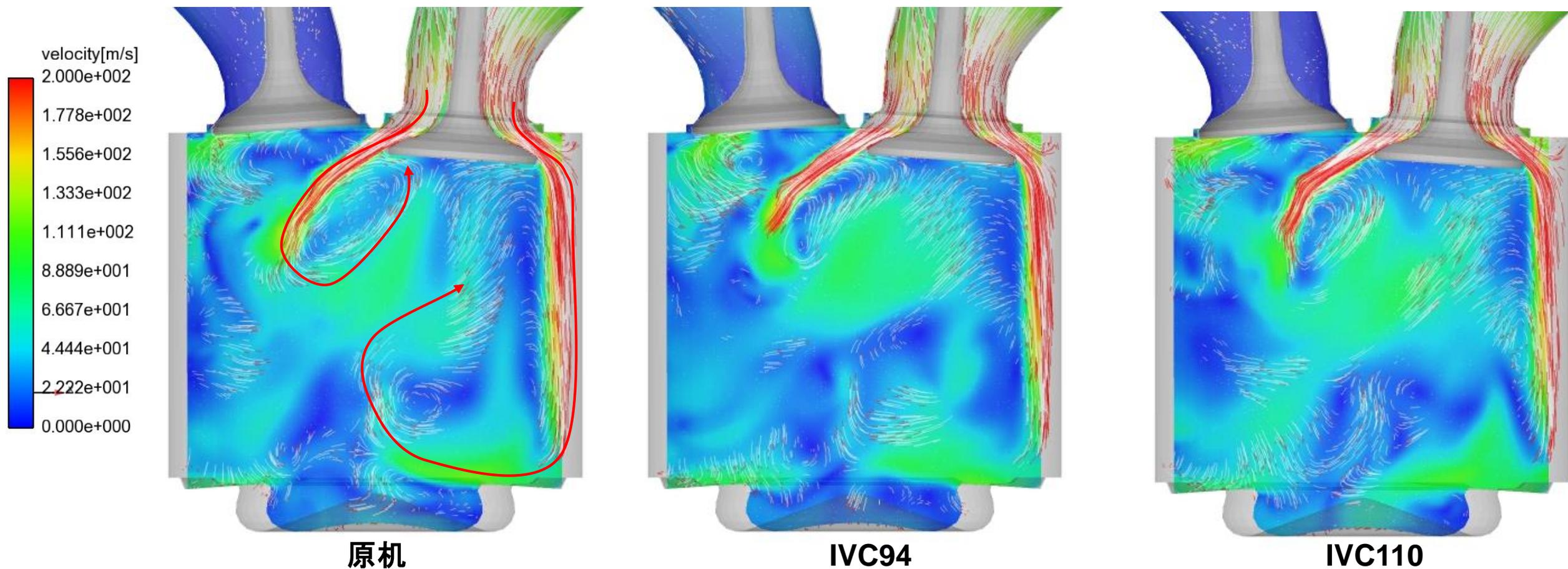
计算结果分析

60° CA ATDC



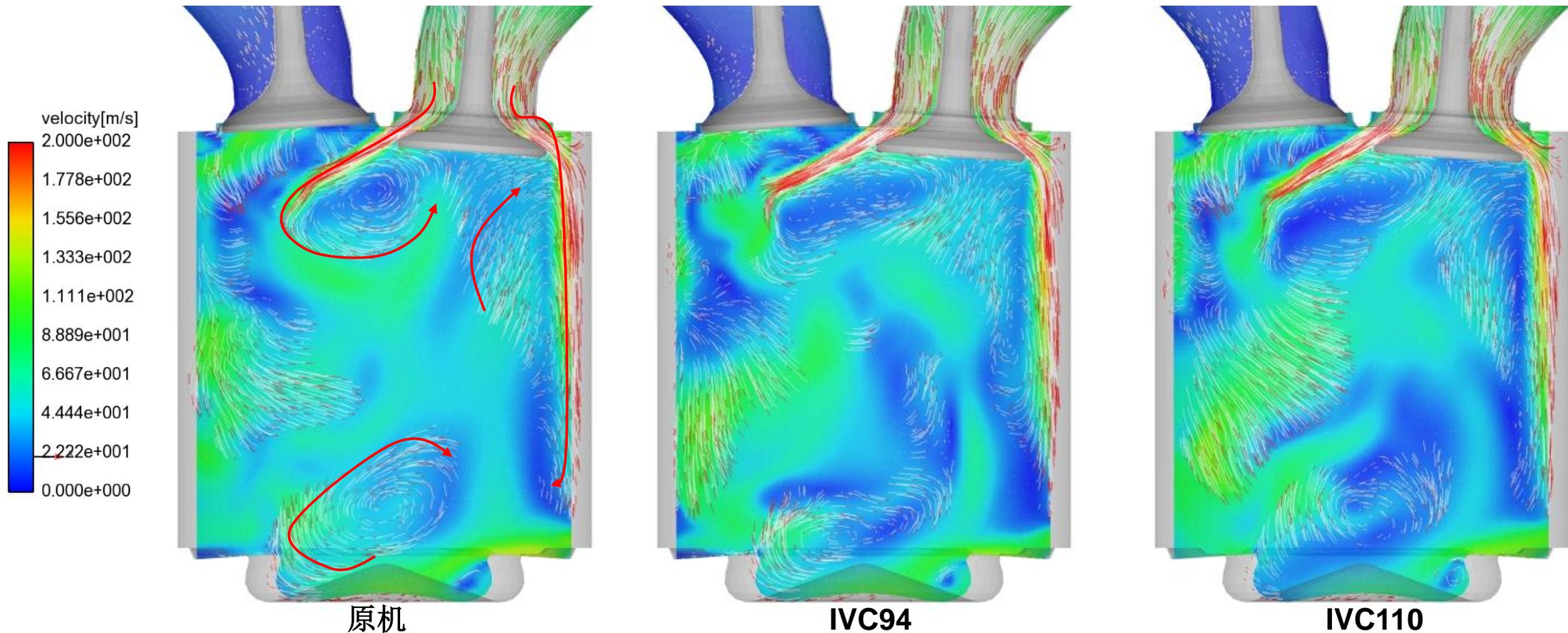
计算结果分析

120° CA ATDC (最大气门升程处)



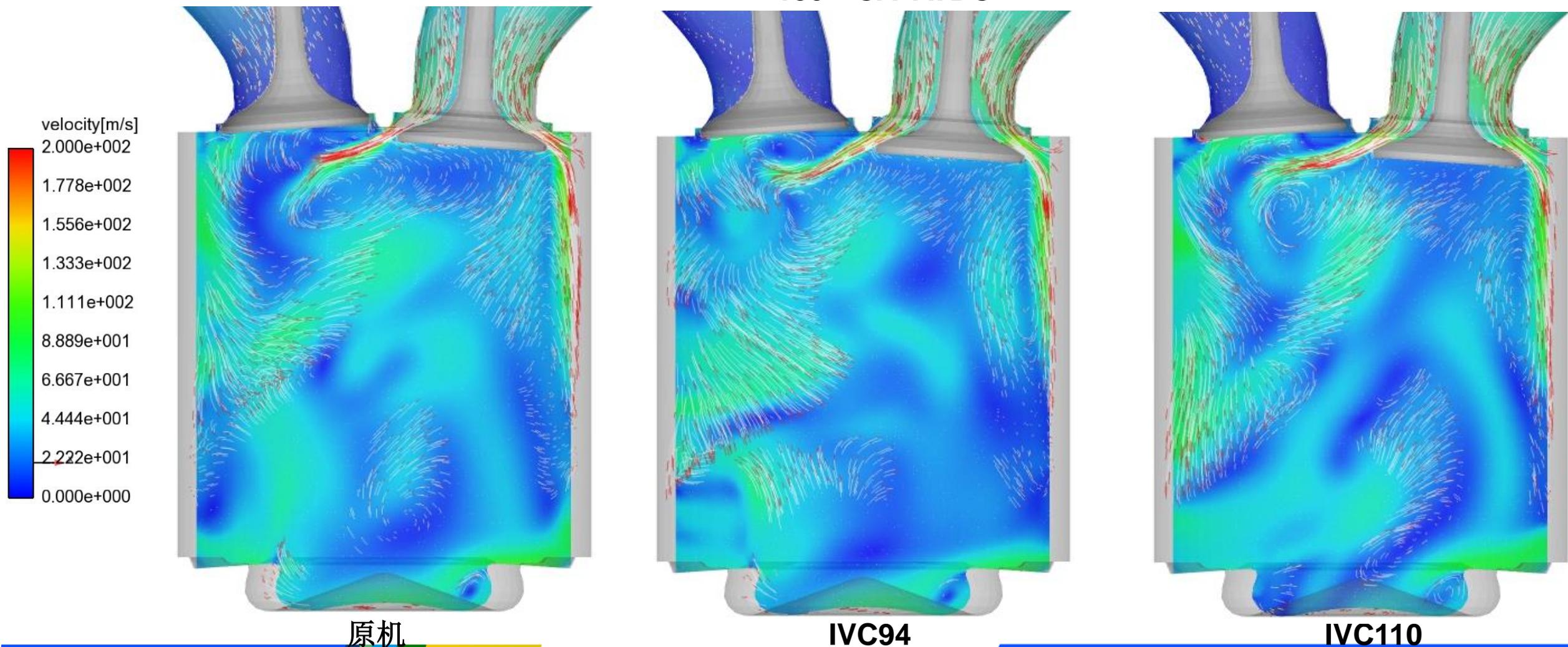
计算结果分析

160° CA ATDC (最大湍动能处)



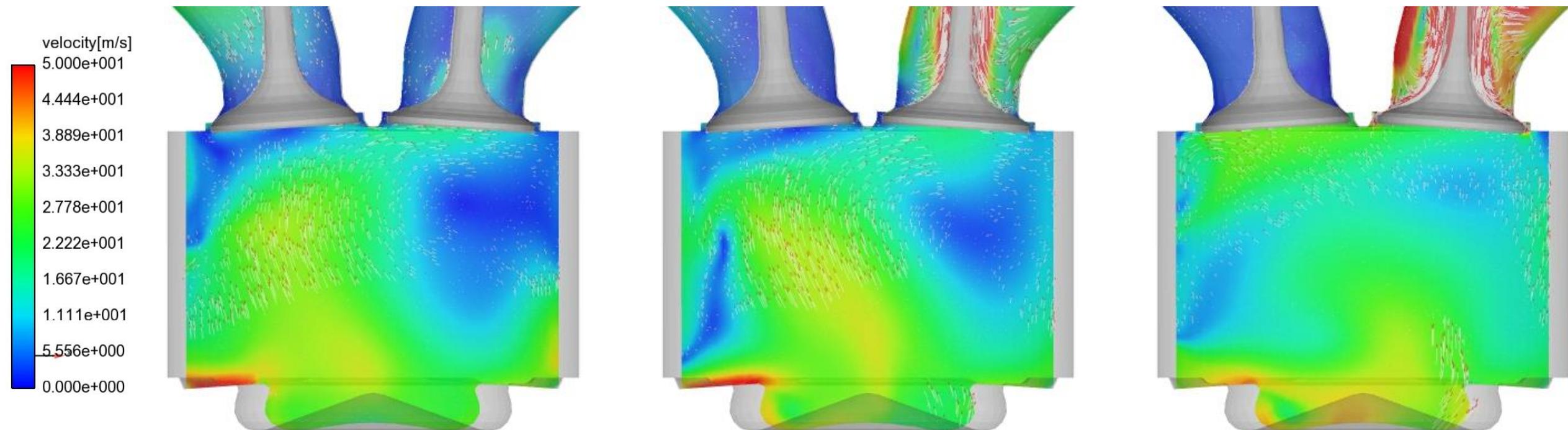
计算结果分析

180° CA ATDC



计算结果分析

270° CA ATDC



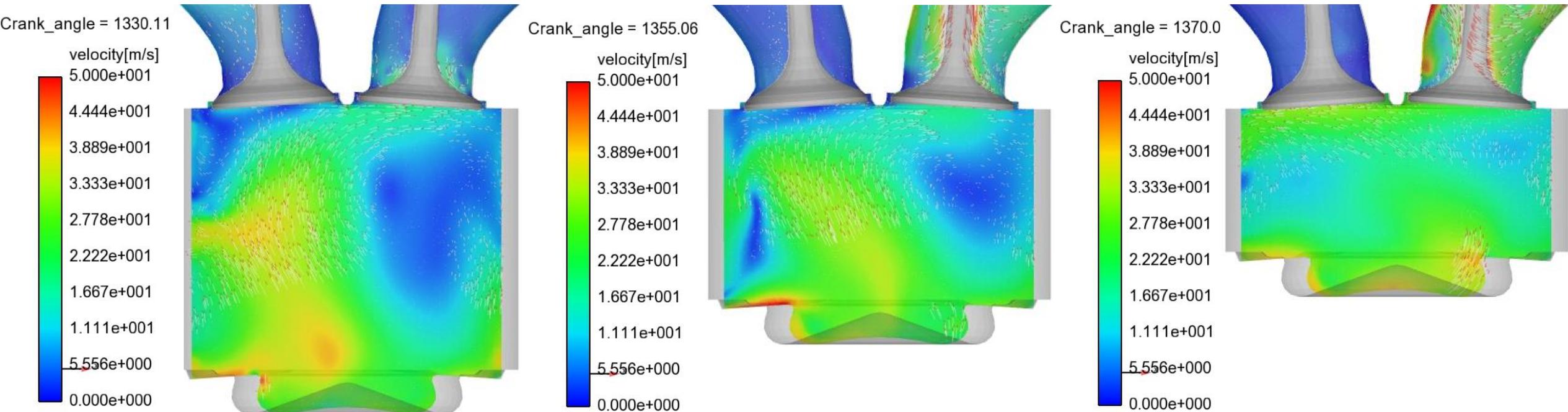
原机

IVC94

IVC110

计算结果分析

进气门关闭时刻

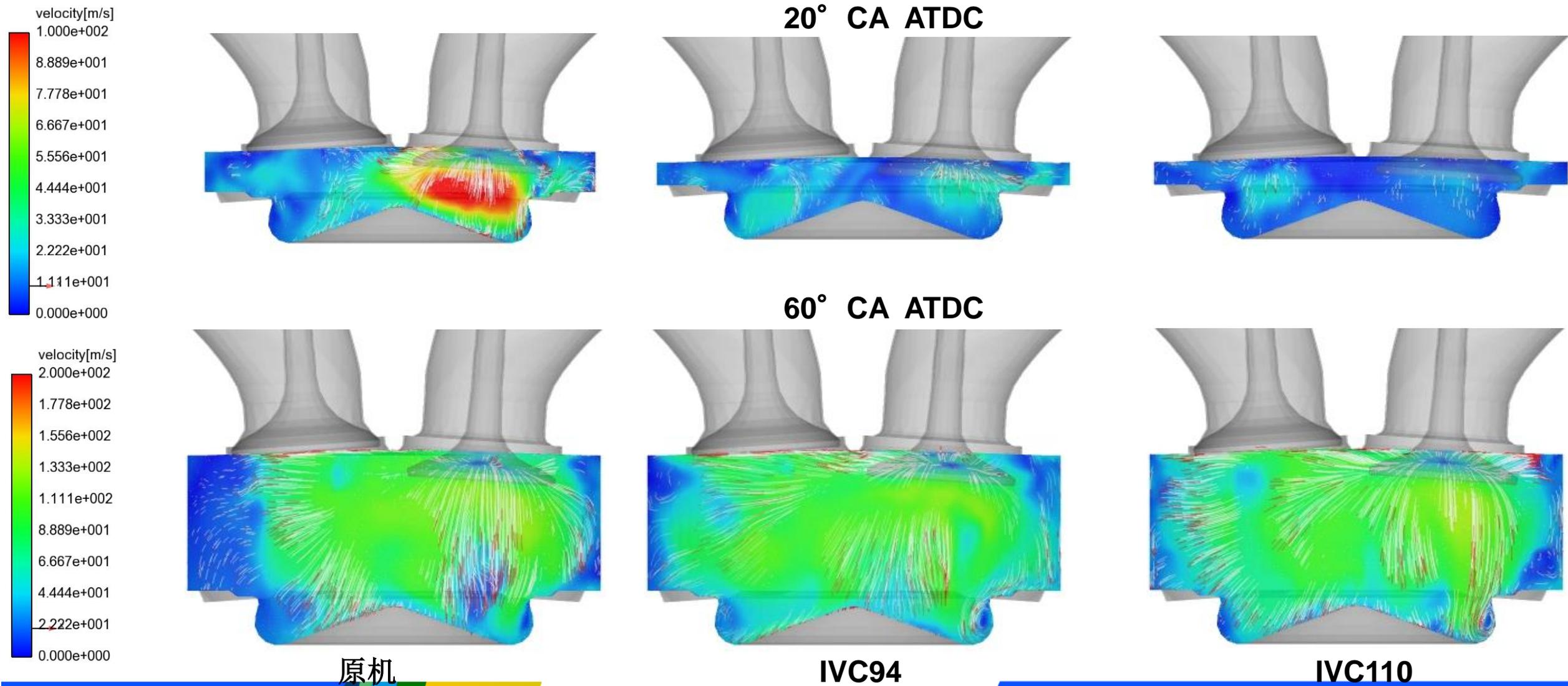


原机

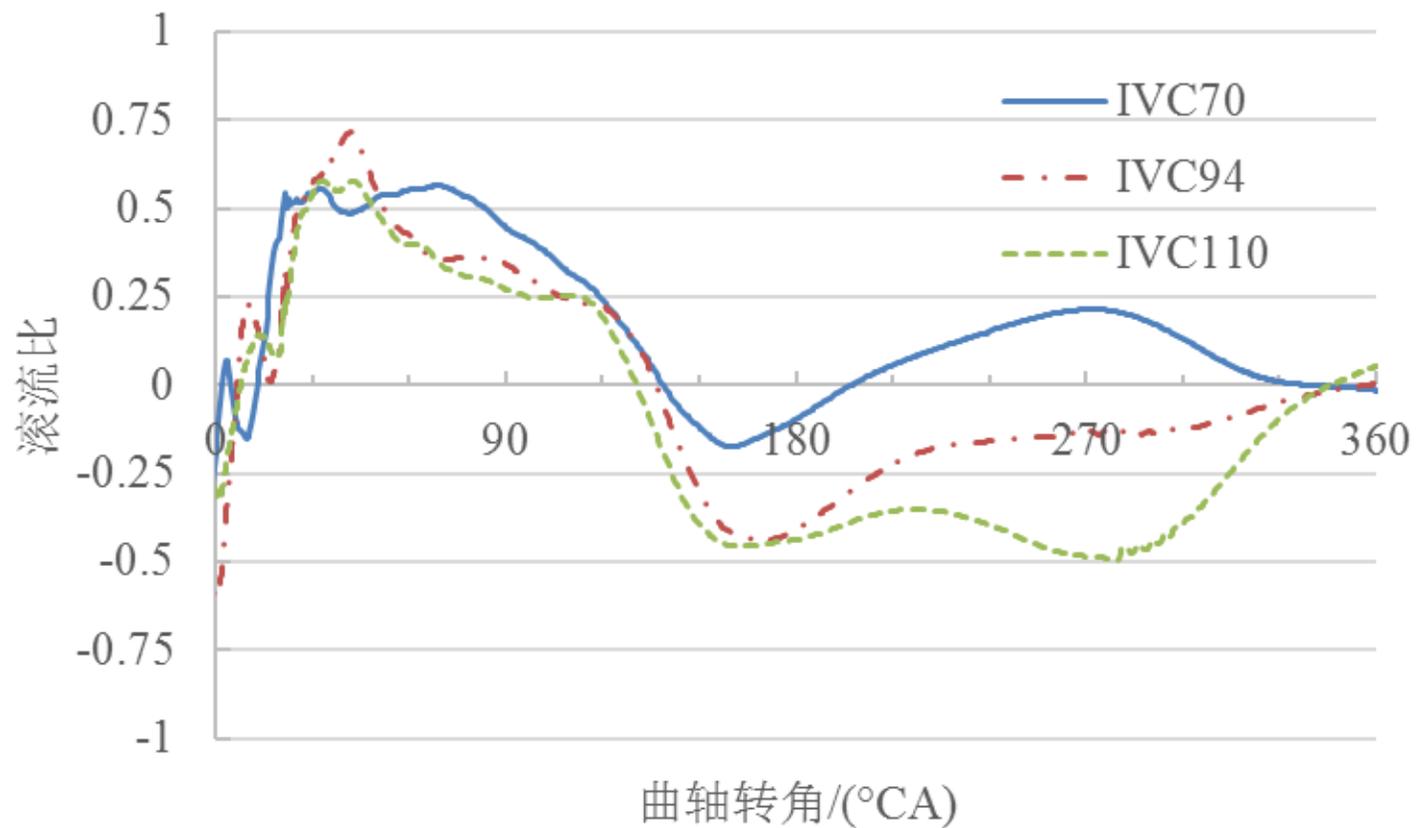
IVC94

IVC110

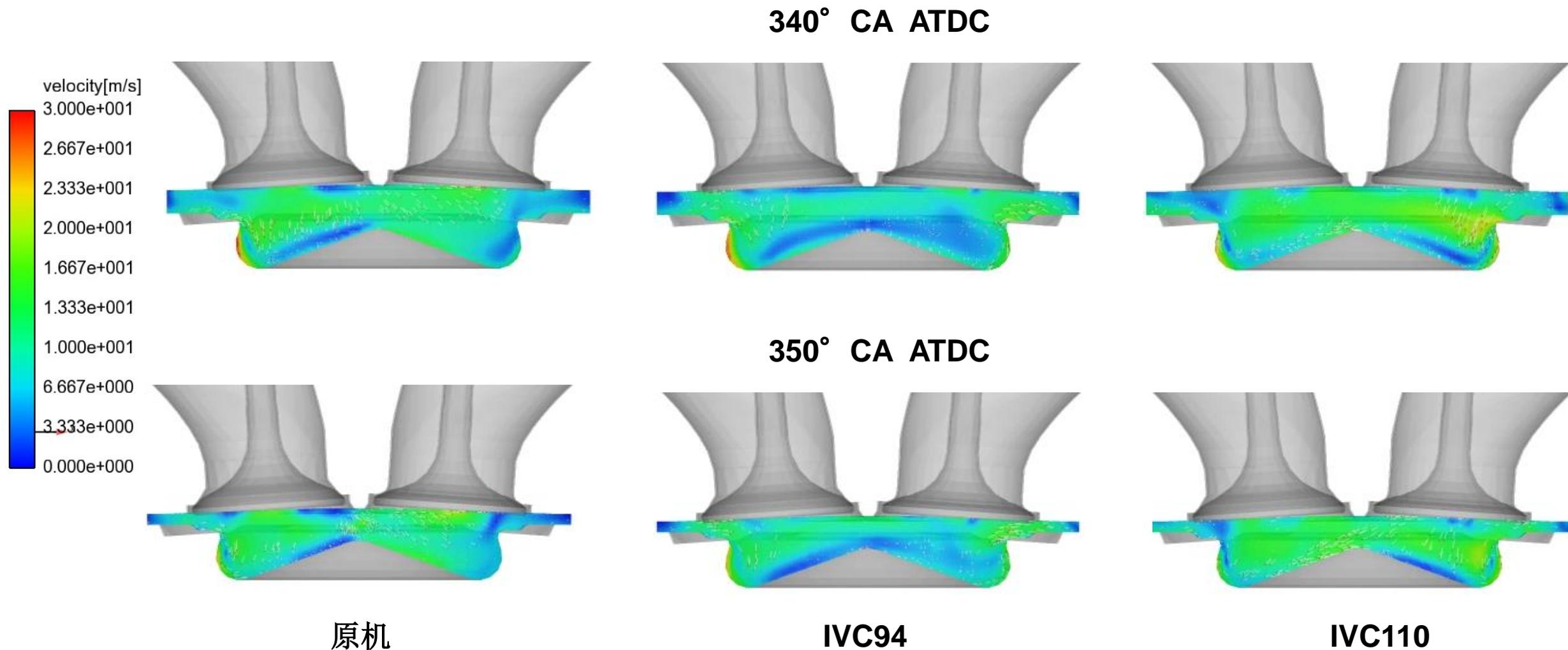
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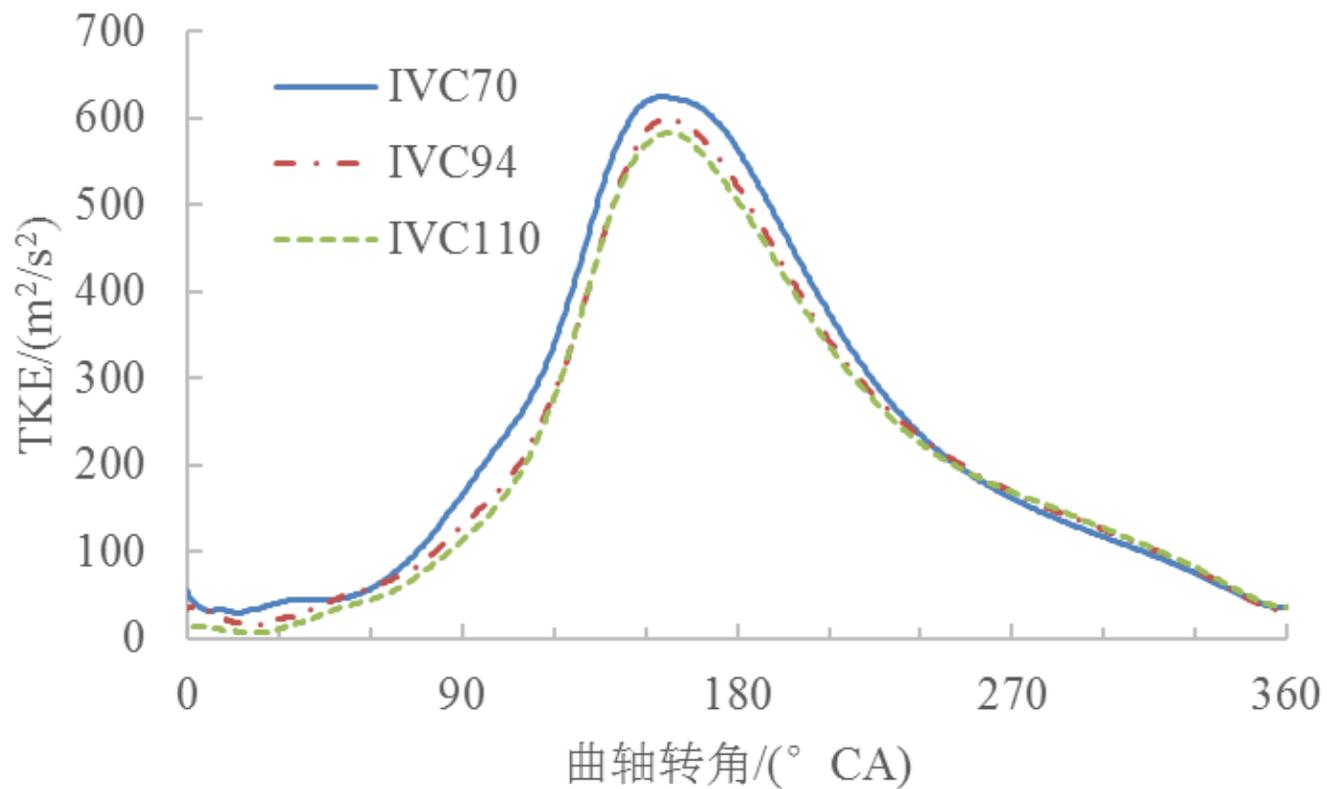
计算结果分析



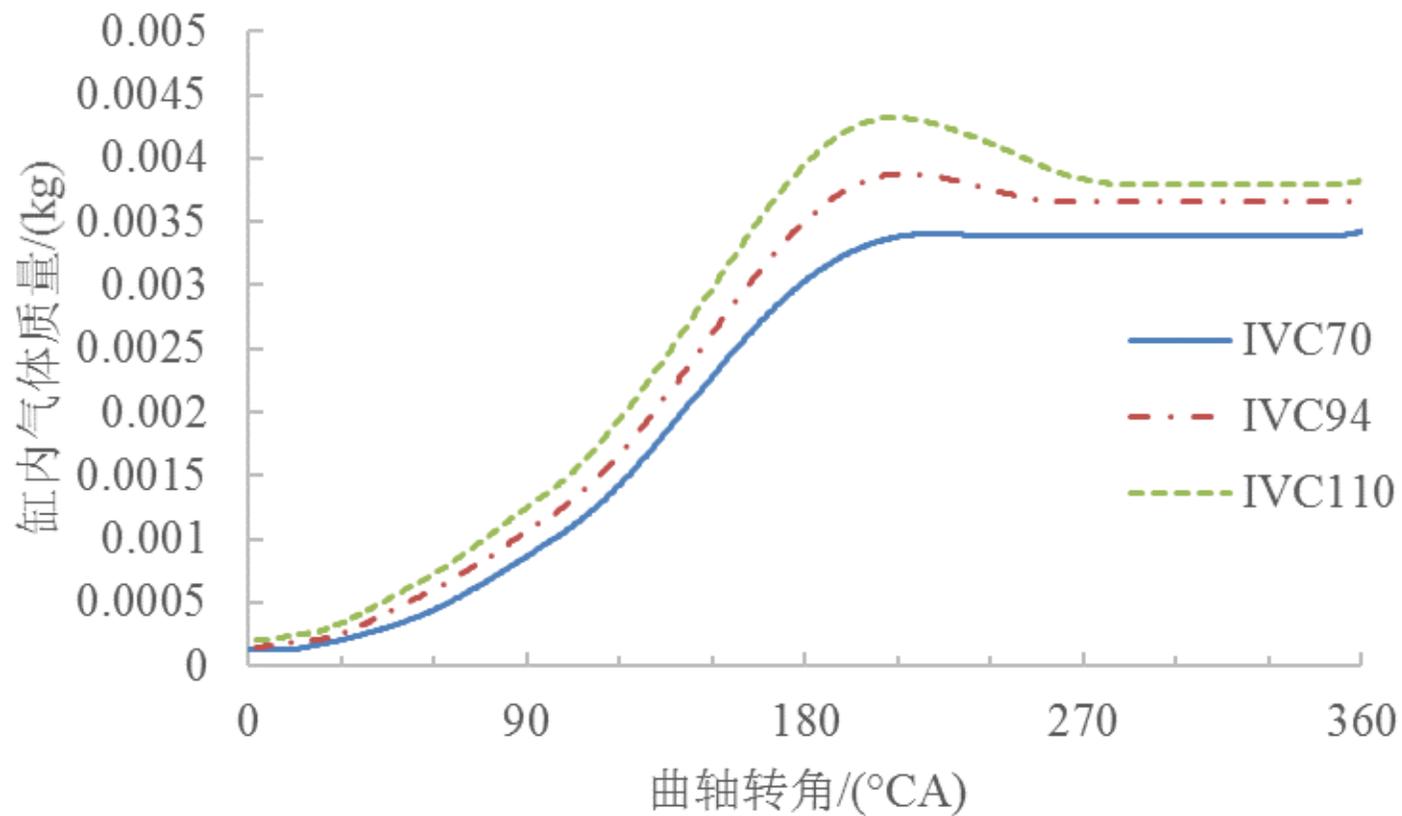
计算结果分析



计算结果分析



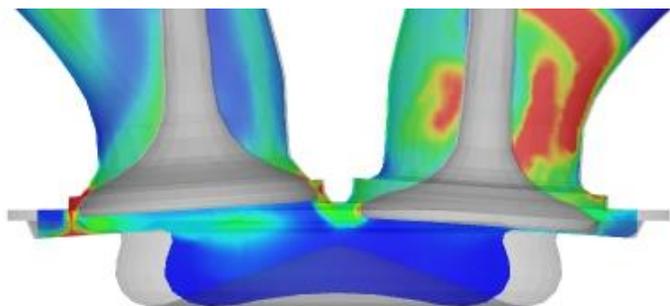
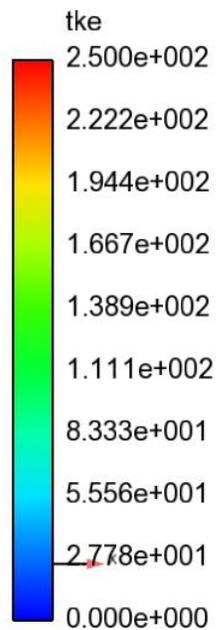
计算结果分析



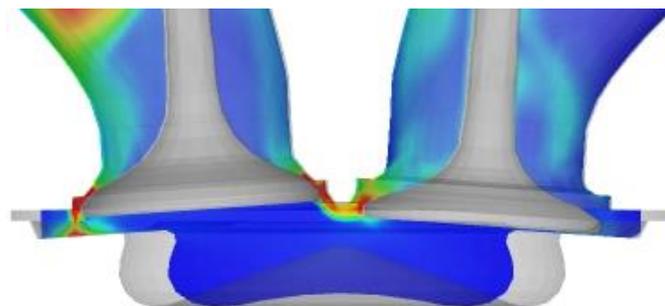
计算结果分析

TDC

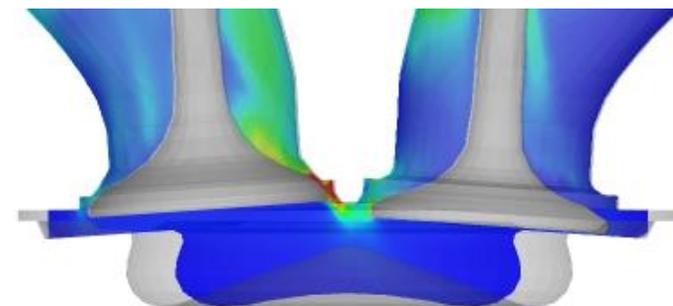
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原机



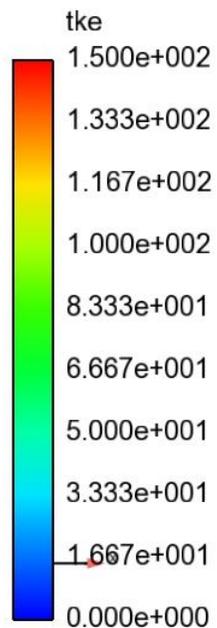
IVC94



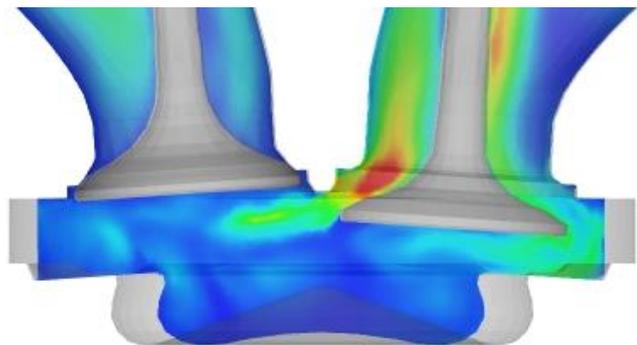
IVC110

计算结果分析

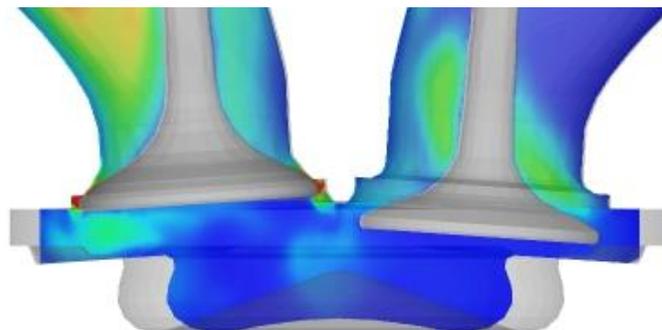
Crank_angle = 1110.06



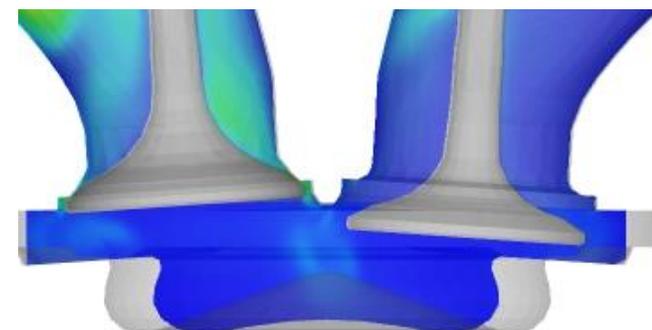
20° CA ATDC



原机



IVC94

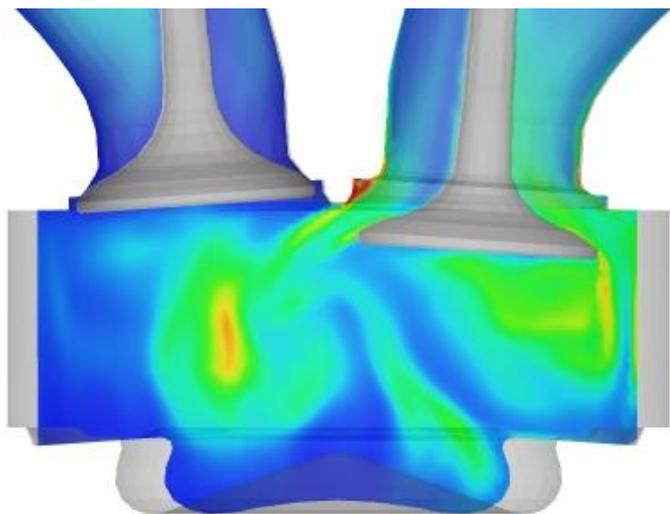
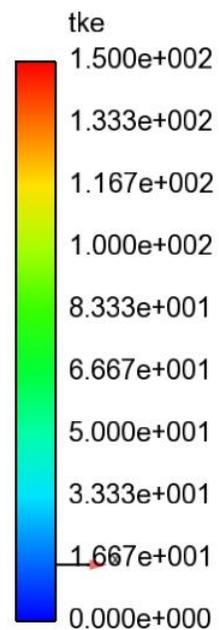


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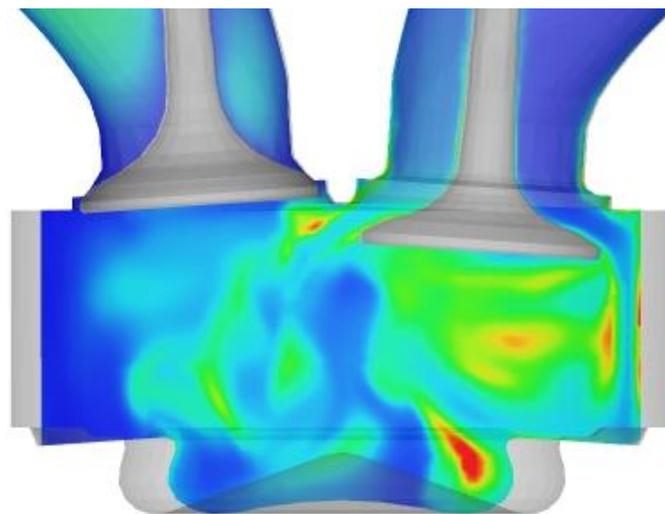
计算结果分析

60° CA ATDC

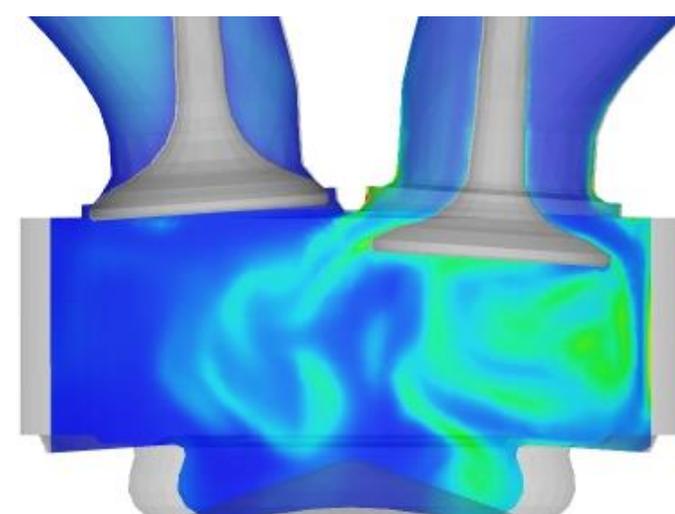
Crank_angle = 1140.02



原机



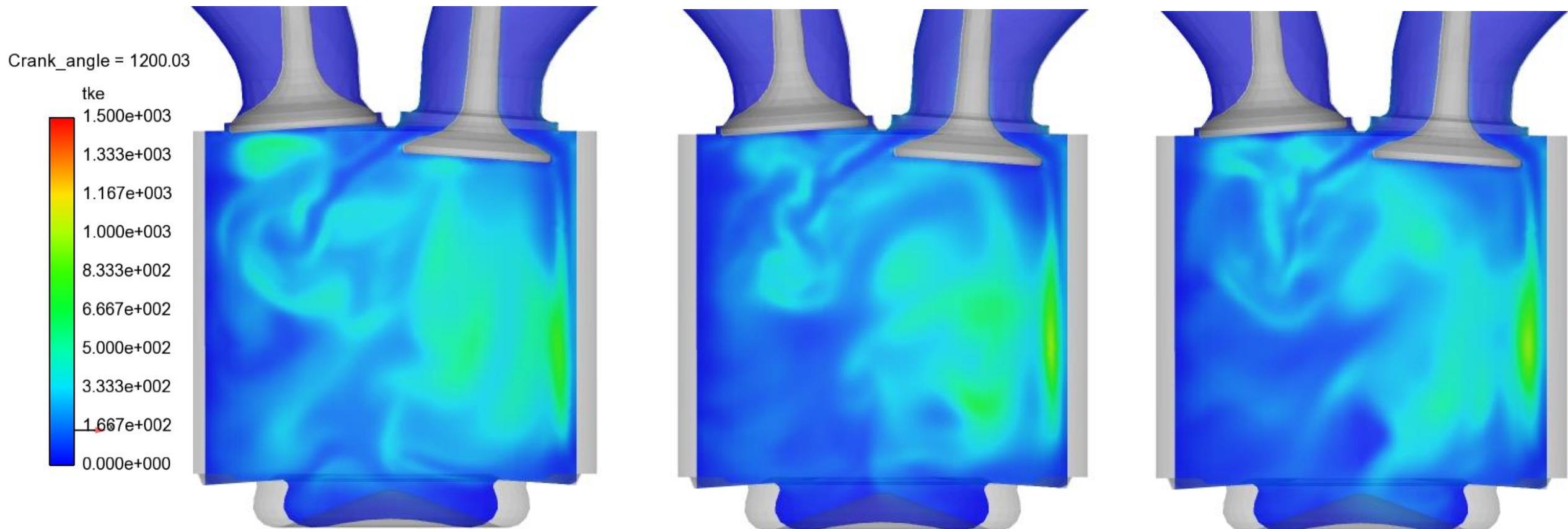
IVC94



IVC110

计算结果分析

120° CA ATDC



原机

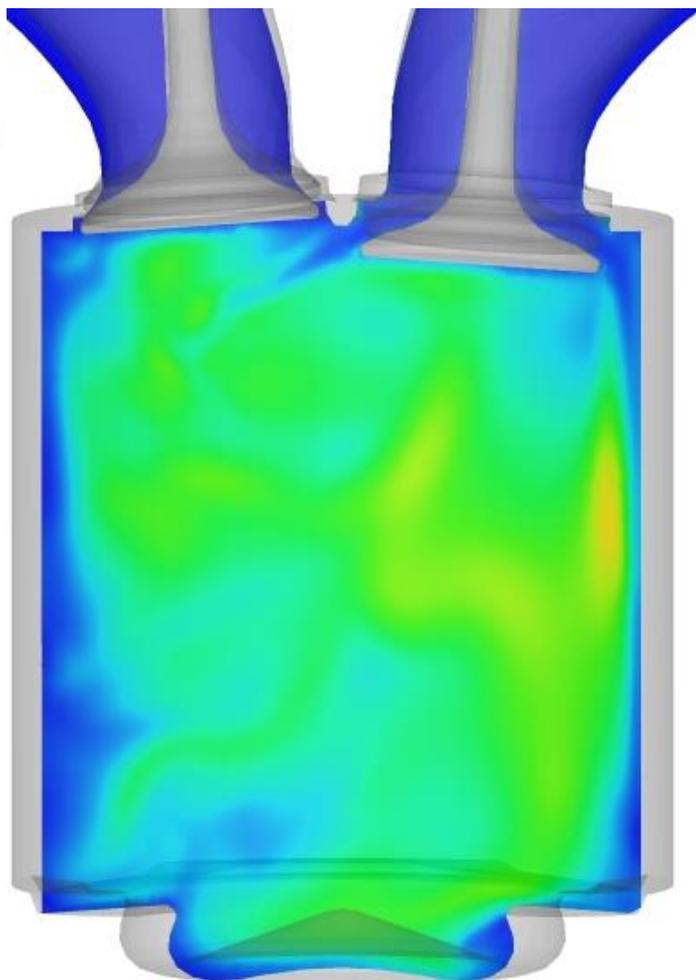
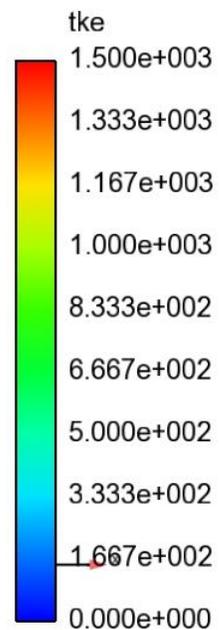
IVC94

IVC110

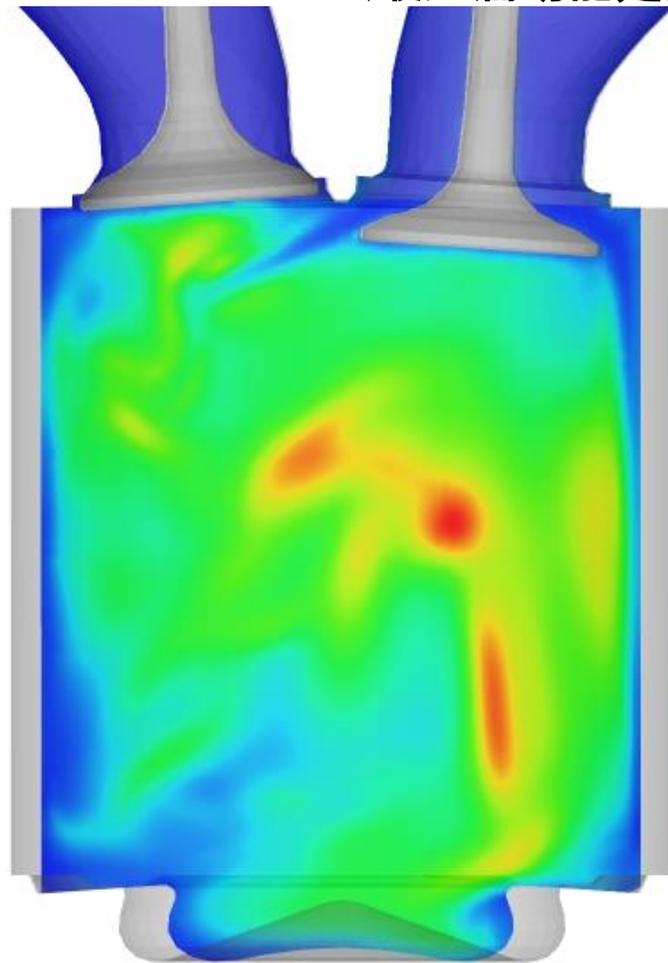
计算结果分析

160° CA ATDC (最大湍动能处)

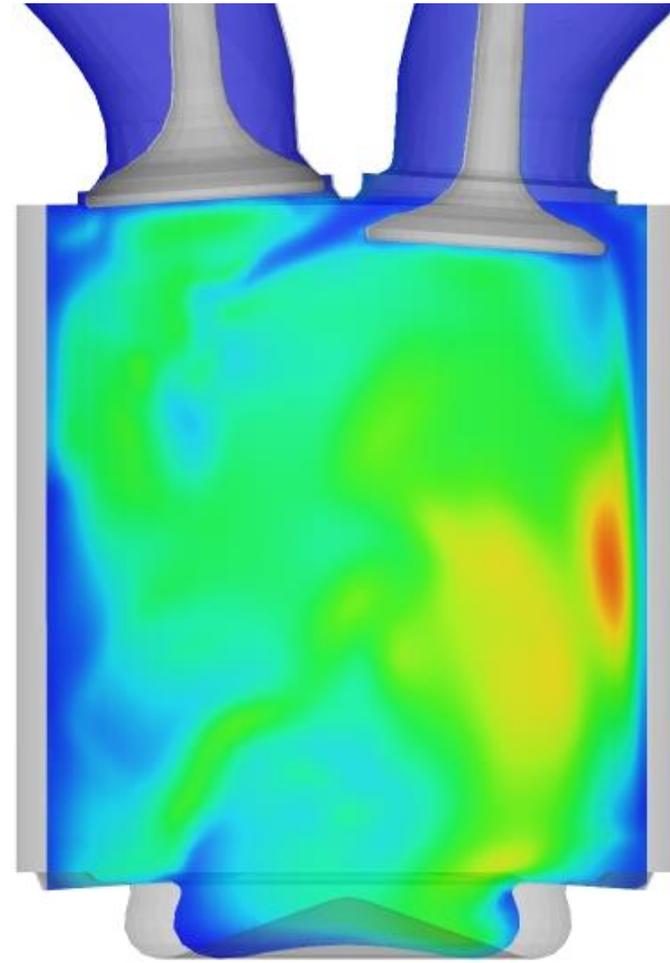
Crank_angle = 1240.01



原机



IVC94

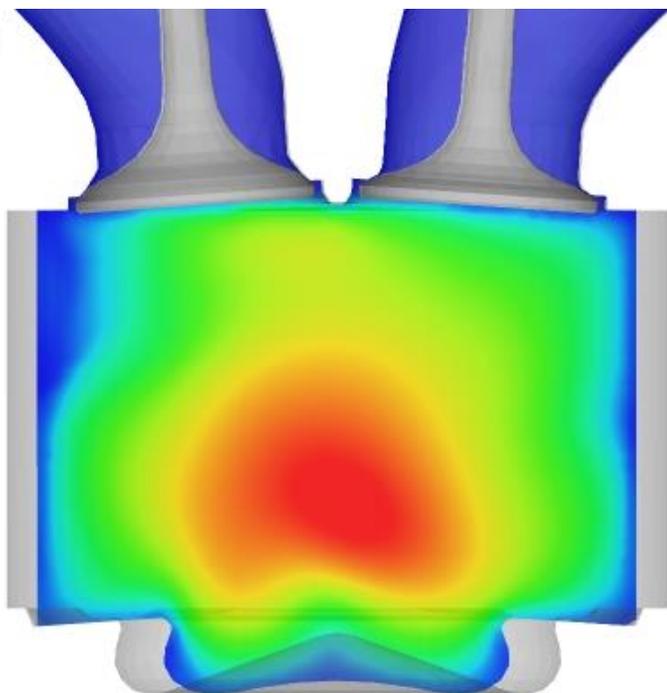
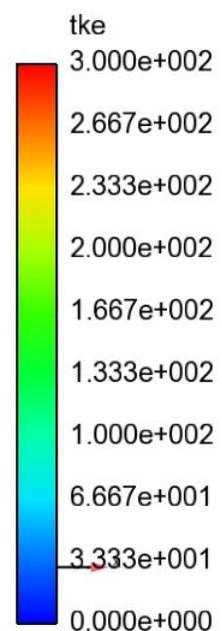


IVC110

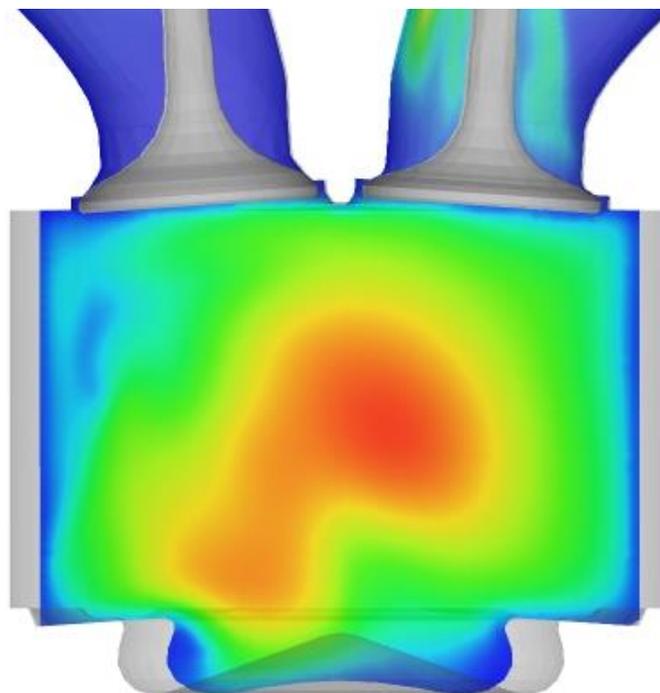
计算结果分析

270° CA ATDC

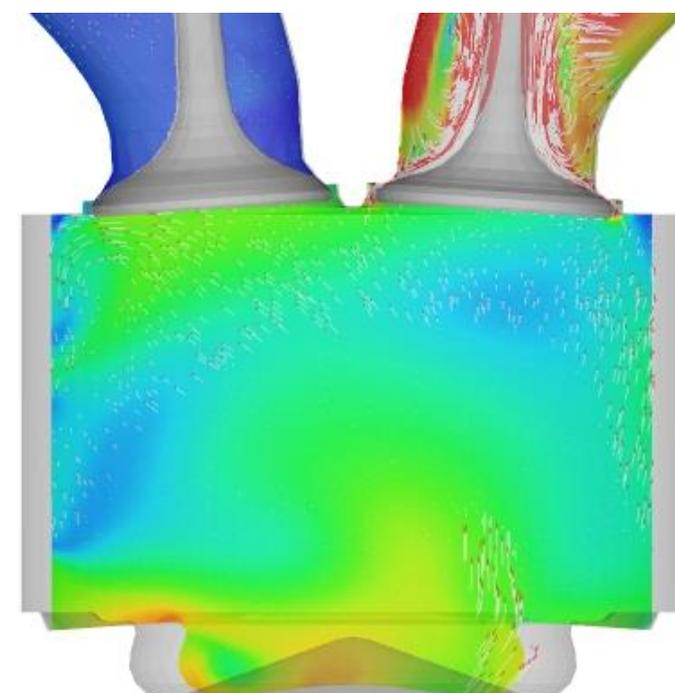
Crank_angle = 1350.03



原机



IVC94

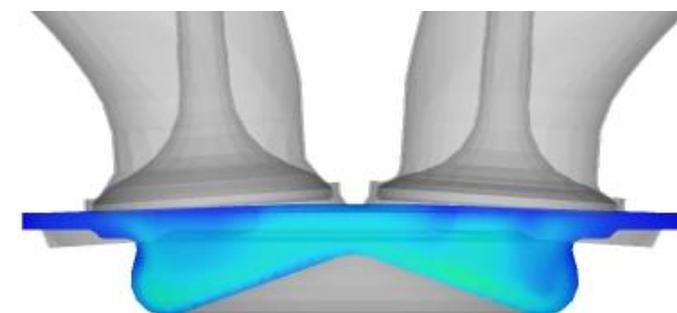
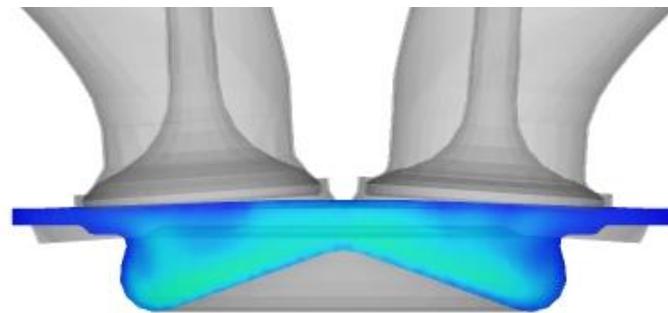
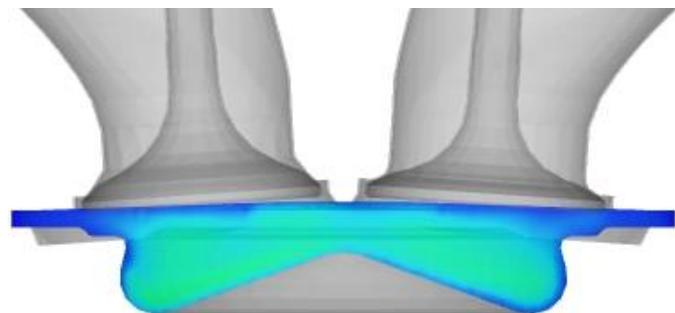
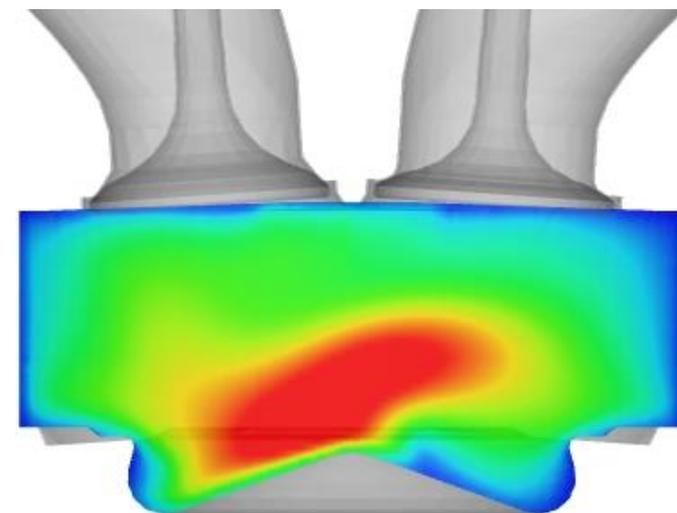
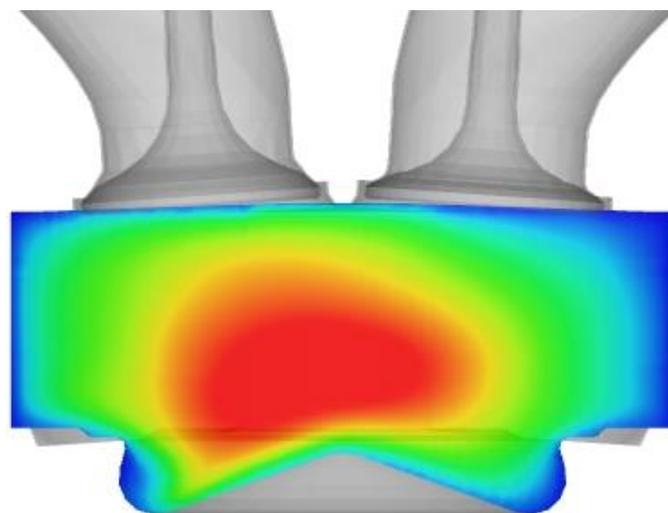
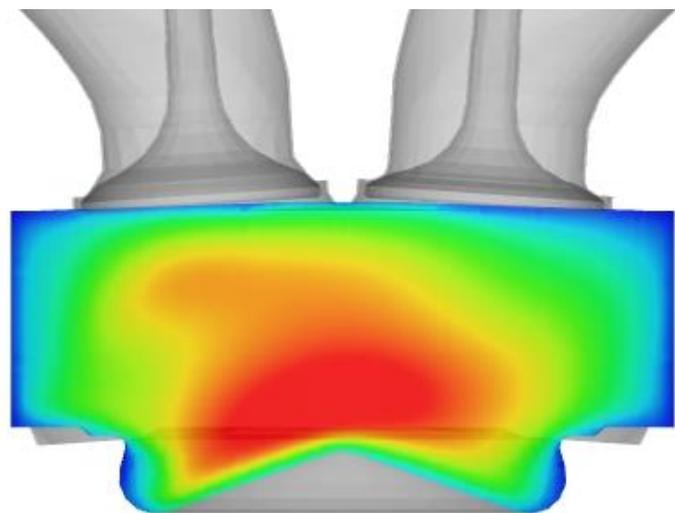
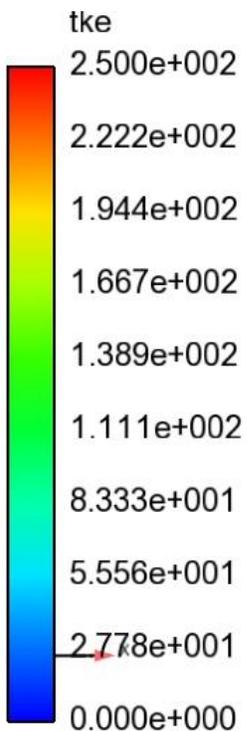


IVC110

计算结果分析

300° CA ATDC

350° CA ATDC



原机

IVC94

IVC110

提纲



04
Part

结论

结论

- ◆ 随着IVC的推迟，压缩过程中进气回流率增加，充气效率、泵气损失下降。
- ◆ 在排气上止点处，由于排气道气体压力较高，导致废气从排气道经由排气门回流到气缸内，而进气无法进入气缸，在进气道形成了涡旋。在米勒循环进气相位下，由于进气压力有所增加，排气倒流的流速有所缓解，但仍存在回流现象。
- ◆ 随着进气门逐渐打开，缸内的滚流比逐渐减弱，而且减弱的程度会随着米勒程度的增大而增大。
- ◆ 在整个进气-压缩过程中，米勒循环的缸内平均湍流强度都比原机小。但随着缸内气体被压缩后，到了压缩后期，不同工况之间的差异变得很微弱。

感谢您的聆听！