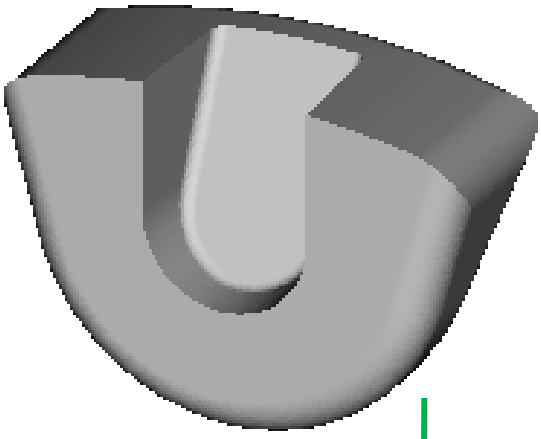
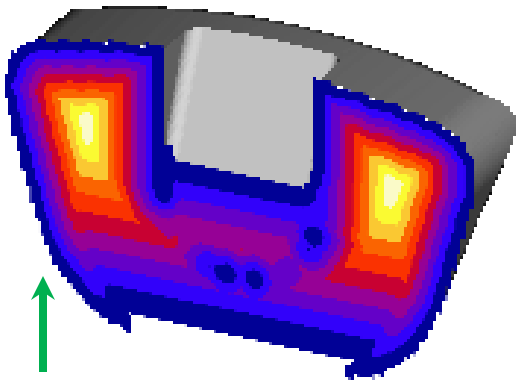
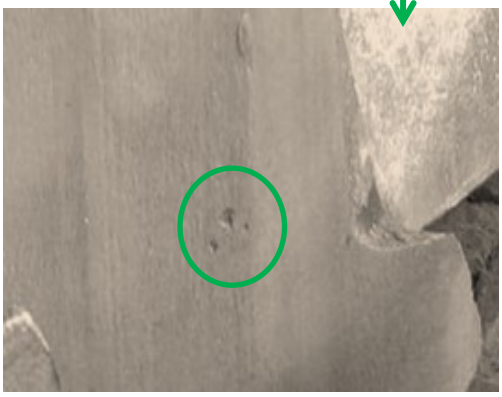
Lug Casting

Aluminum Alloy, G.D.C.

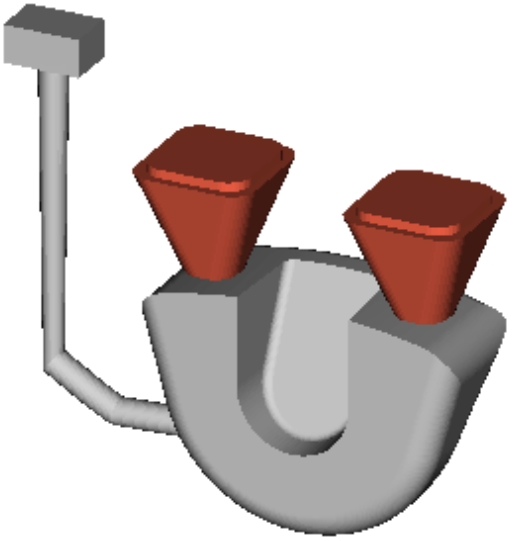
***Case*: The aluminum lug casting of overall size 183 mm x 76 mm x 135 mm weighing 3 kg is produced in a non-ferrous foundry. After fettling and machining the top faces, it exhibited a small shrinkage cavity just below the feeder.**



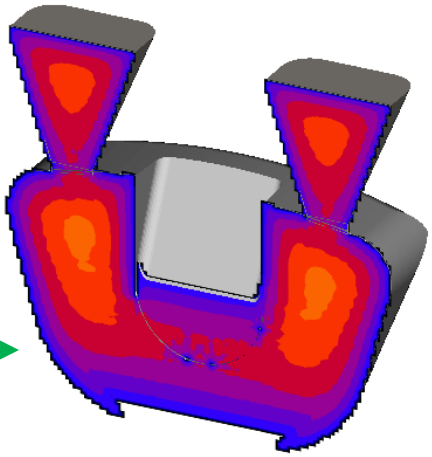




Thickness analysis shows mass concentration in the top portion, corresponding to an inscribed sphere diameter of 59 mm.

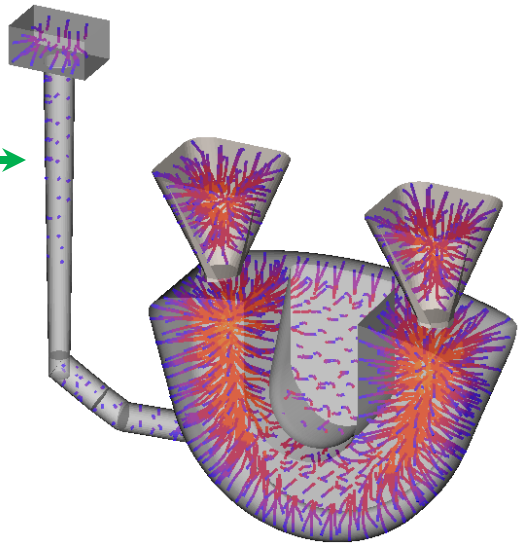


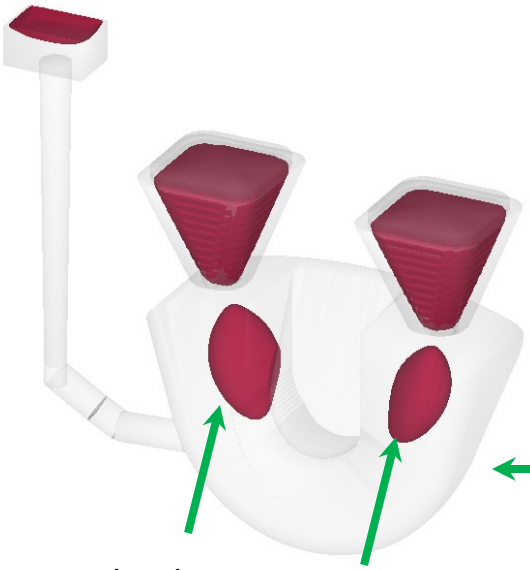
The current methoding of the casting includes two square-shaped feeders of top cross-section 60 x 60 mm and bottom cross-section 20 x 20 mm with height of 60 mm. These feeders are covered with exothermic sleeves of 5 mm thickness.



Simulation of current methoding clearly indicates that feeders are slightly undersized and an isolated hot spot is observed just below the connection. This exactly matches the shrinkage defect found in actual casting.

Feed path analysis shows high temperature feed lines present in the casting. This indicates poor directional solidification.

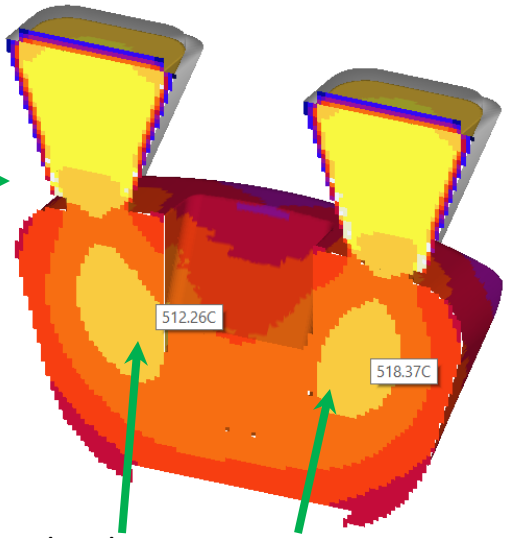




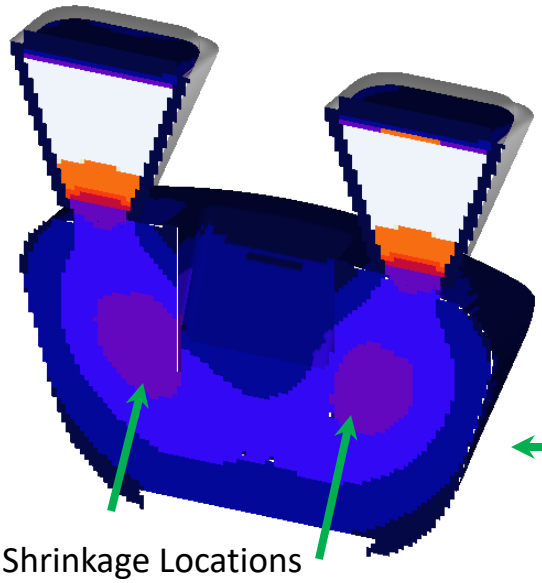
Shrinkage Locations

Liquid fraction analysis displays liquid metal remains inside the casting till the end of solidification. This locations can lead to shrinkage porosity.

Solidification temperature analysis gives locations where metal has highest temperature. This location matches with the defect location inside the part.



Shrinkage Locations



Shrinkage Locations

Solidification time analysis gives locations where metal solidifies last. This location matches with the defect location inside the part.

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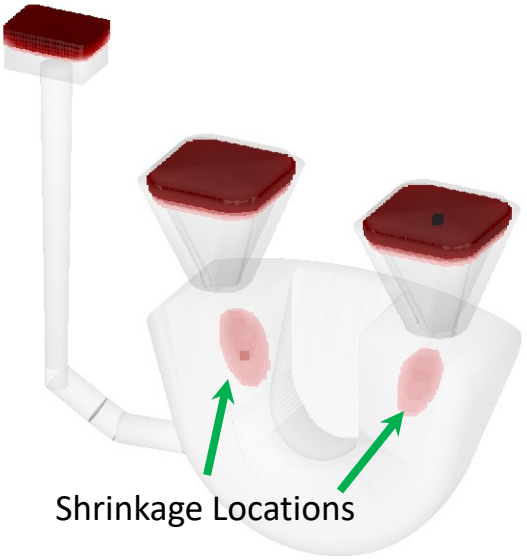
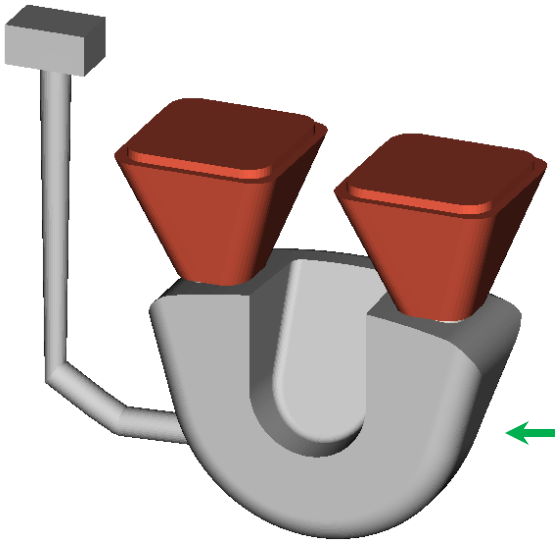
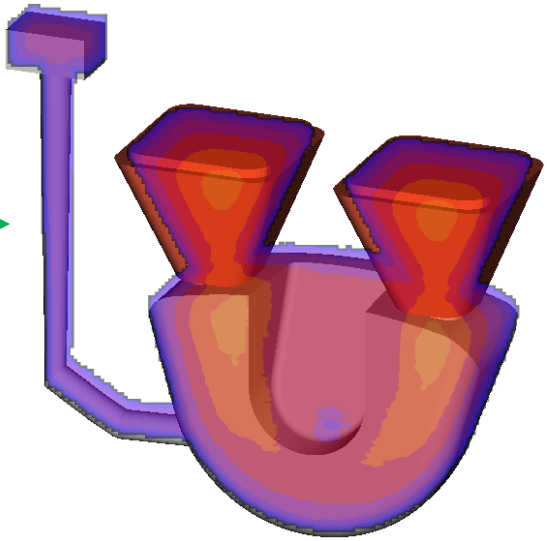
Shrinkage porosity analysis predicts possible shrinkage locations in the casting. It is matched with the exact locations observed at shop floor.

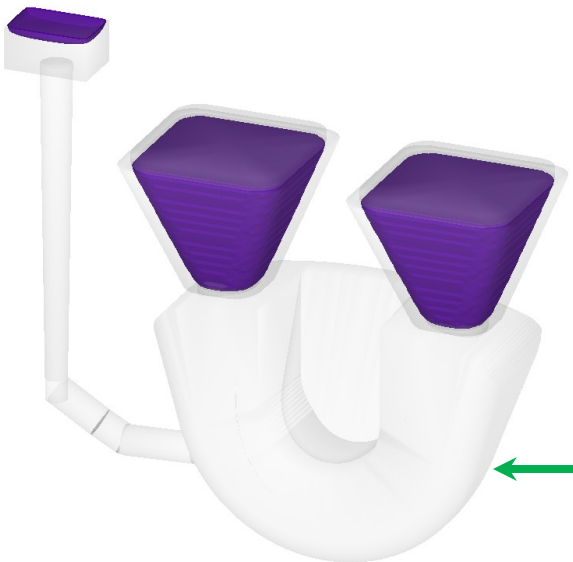




To eliminate the defect, the methoding was revised by increasing the feeder dimensions. The modified dimensions of feeders are at top 80 X 80 mm, bottom 30 X 30 mm with height 70 mm.

Solidification simulation shows concentrated hot spot inside the feeder, with improved solidification at the thick sections by feeder attachments .





Liquid fraction analysis displays liquid metal remains inside the feeders till the end of solidification. So casting is free from possible shrinkage defects.

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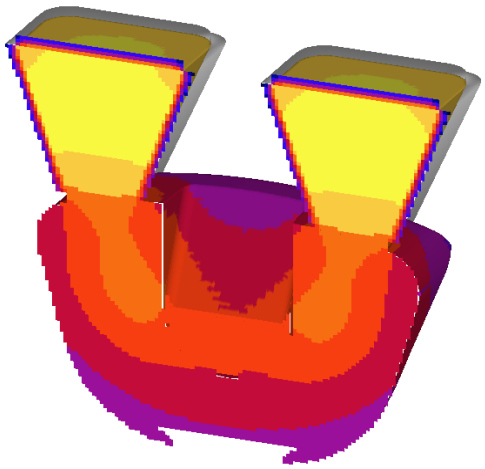
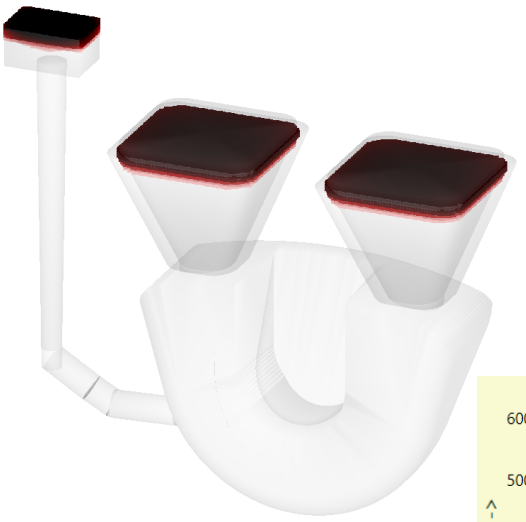
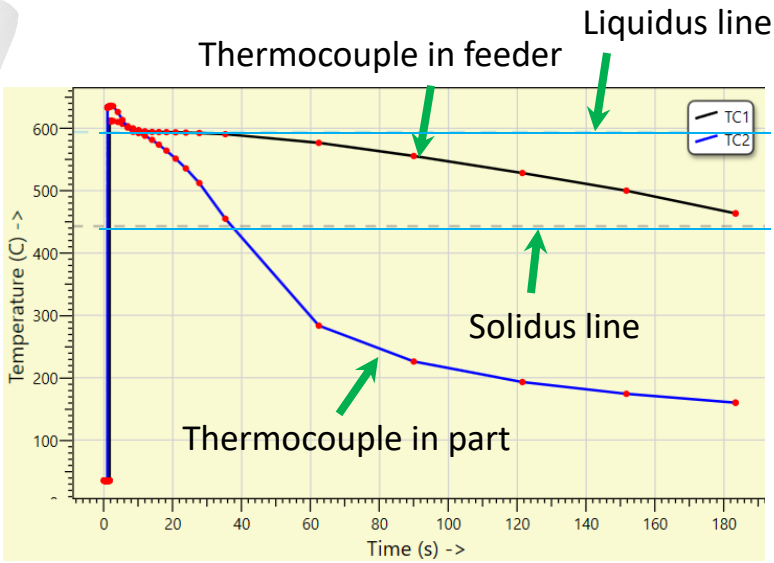


Solidification temperature analysis shows directional solidification with hottest region in the feeder and thick section is at lower temperature connected to feeder . No temperature isolations are observed in the casting

Solidification time shows last solidifying region in the feeder that resulted in elimination of shrinkage defect from the castings.



Shrinkage porosity results shows castings are free from shrinkage defects. Macro porosity is observed in the feeders shown by dark colour.



Thermocouple analysis reveals that thermocouple in part region crosses solidus temperature earlier and thermocouple at feeder crosses solidus afterwards thus feeder solidifies last

Summary: **The simulation of the revised methods with two feeders of modified dimensions shows improved solidification behavior and defect free castings.**