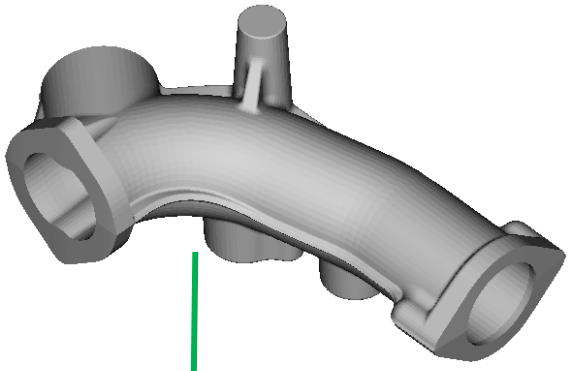
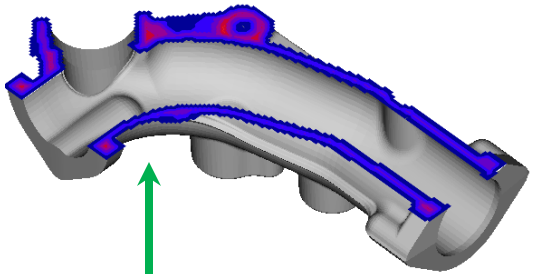
Coolant Pipe

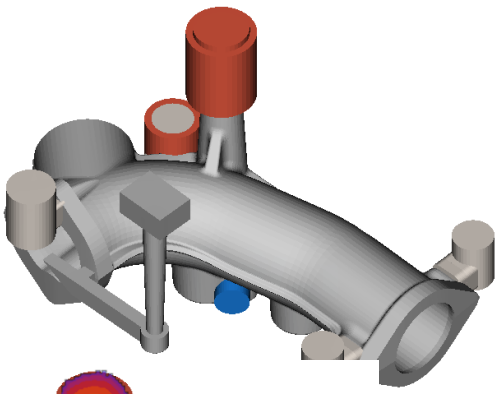
Aluminum Alloy, G.D.C.

***Case*: The aluminum coolant pipe casting of overall size 305 mm x 198 mm x 140 mm weighing 2 kg was produced by gravity die casting. After fettling and machining the bottom faces, it exhibited micro shrinkage porosity in two of the bosses.**

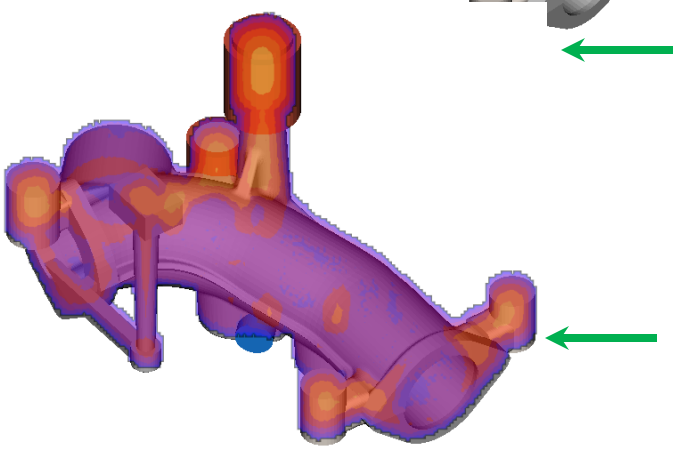




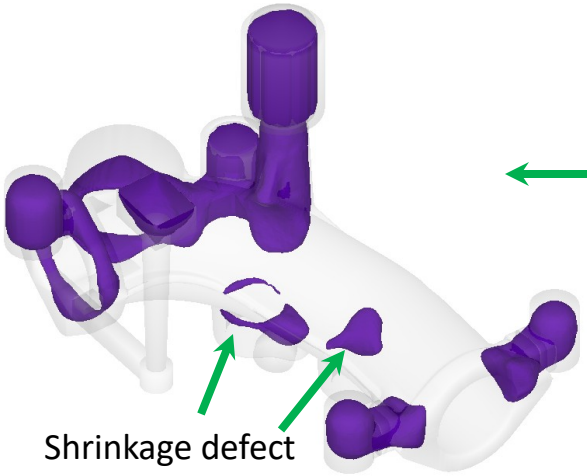
There are several thick regions in the casting at boss sections. Thickness analysis shows mass concentration in the bottom portion, corresponding to an inscribed sphere diameter of 33 mm.



The current methoding of the casting included two top feeders and three side feeders connected at bosses. Also three chills are placed at bottom thick sections.

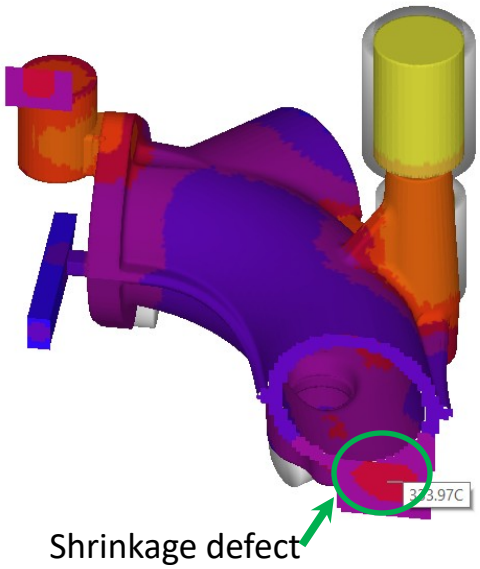


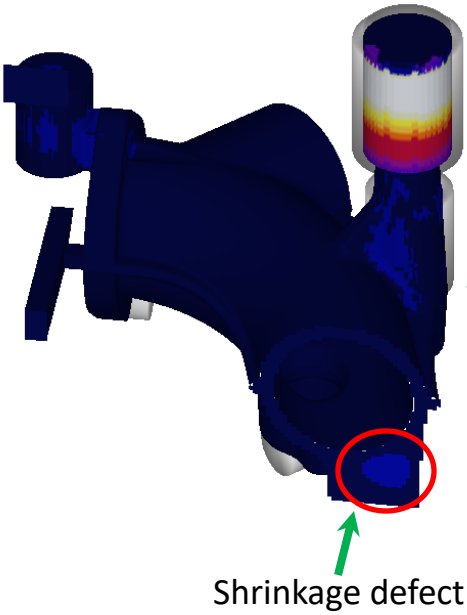
Simulation of current methoding and analysis of solidification contour clearly indicates an isolated hot spot region at bottom bosses of the casting which exactly matches the shrinkage defect found in actual casting.



Liquid fraction shows metal solidifying last in the thick ring section of the casting which leads to porosity . Two isolations are observed at bosses in bottom portion of the casting.

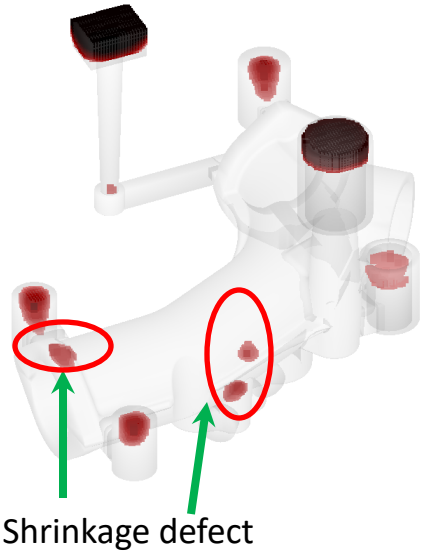
Solidification temperature analysis shows isolated temperature region at boss in bottom side, which leads to shrinkage at the same location of shop floor defect.





Solidification time analysis shows last solidifying region is at boss in bottom side, which matches with hotspot and solidification temperature analysis along with shop floor defect

Shrinkage porosity analysis gives the same locations for the shrinkage at bottom side of the casting where defects observed in shop floor .



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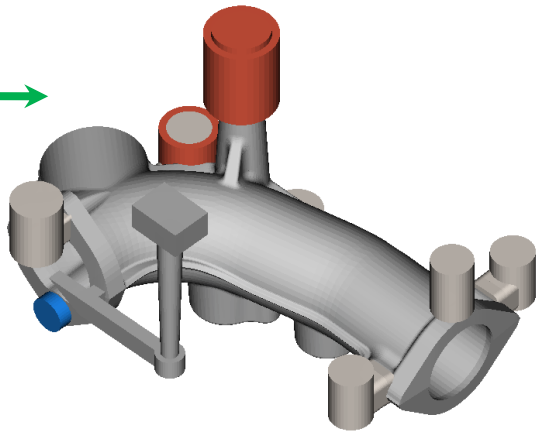
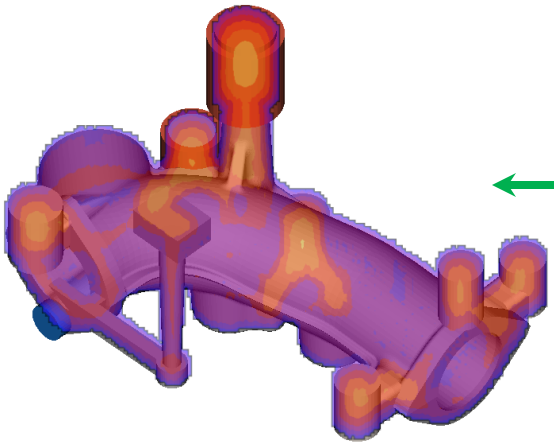
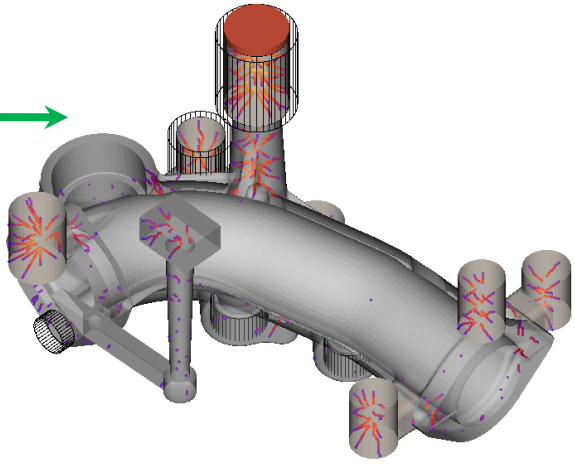
The methoding of the casting was revised by providing additional top feeder to flange of the casting, also one side feeder is shared by two bosses and only one chill is placed at bottom side of other flange.

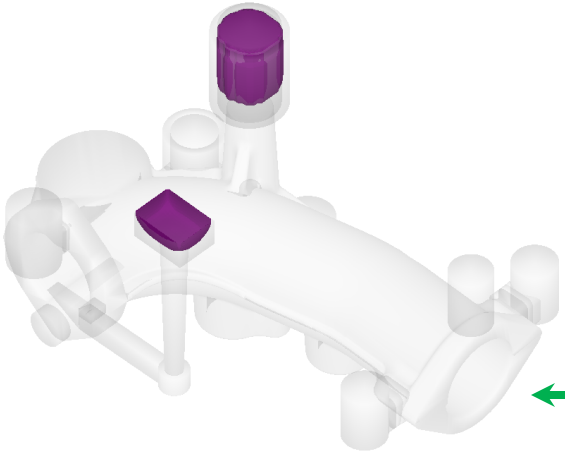




Simulation now shows better directional solidification, with hotspot shifting entirely to feeder, and leading to a defect-free casting.

Feed path analysis at the critical section analysis shows improved temperature and gradient contours, thereby improving metal flow through the feeder to the casting.





Liquid fraction shows liquid region which solidifies last. Figure shows improved results of Liquid fraction and feeder will be solidify at last.

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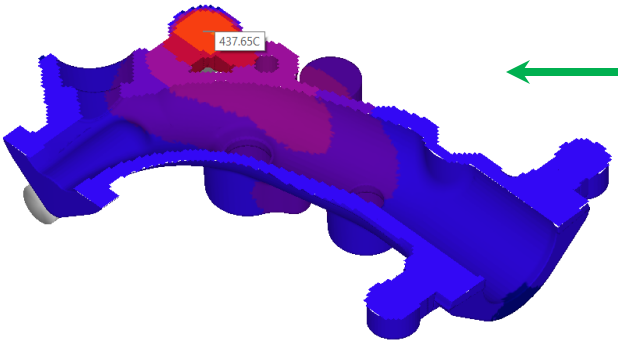
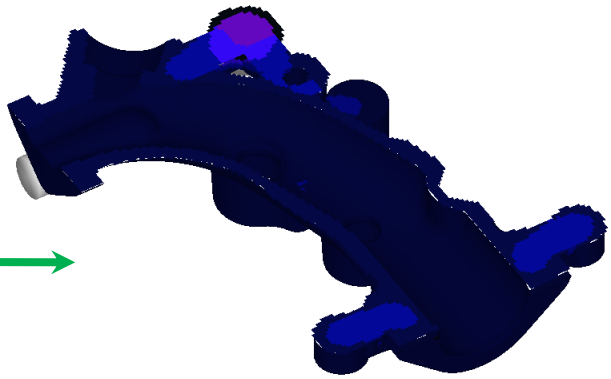
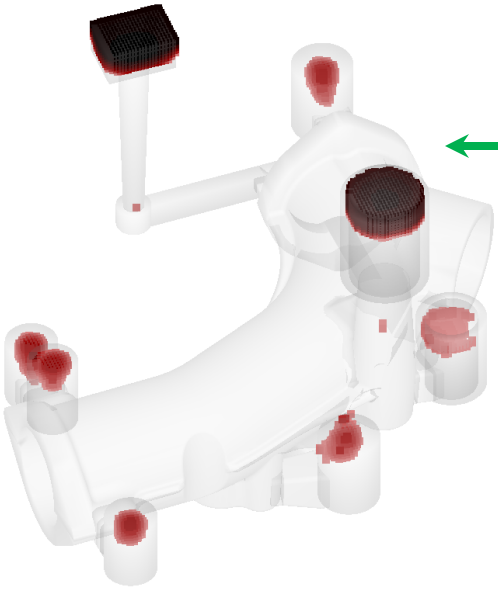


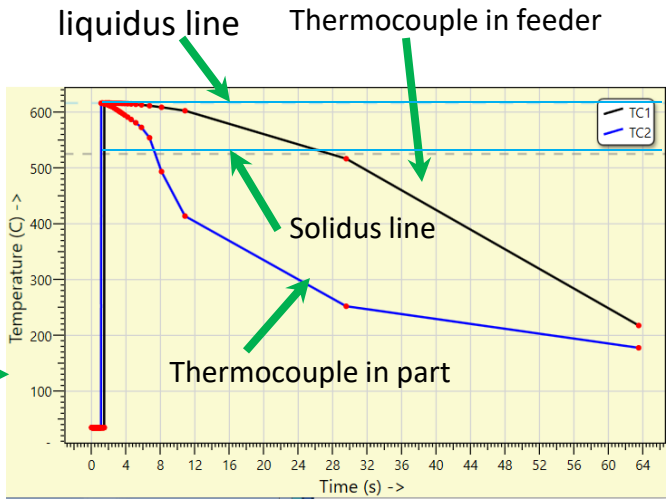
Solidification temperature analysis shows isolated temperature region inside the feeder. So casting is free from shrinkage defect.



Solidification time analysis shows better solidification results and the last solidifying region is inside the feeder and casting will solidify before the feeder. So it is resulted in shrinkage free casting.



Shrinkage porosity results also shows that it is observed in the feeders only. Shrinkage porosity from casting is completely eliminated.



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 revised methoding with additional feeders resulted in directional solidification and eliminates the shrinkage defect completely and improves casting quality.**