

## Introduction

Diesel engines are limited by the turbocharger's ability to provide higher boost levels over a wide range of engine speeds. Turbocharger compressor flow range improvements are required to meet the demand of reduced exhaust gas emissions, particularly where exhaust gas recirculation is employed. The map width enhancement (MWE) is a bleed slot on the shroud surface of impeller casing which improves the flow range.

## Aims

A numerical and experimental investigation of 3 geometrical parameters of the bleed slot (shown by the red circle in Fig. 2) with the aim of understanding the interaction between the impeller passage flow, the flow in the bleed slot and the mixing of the recirculated flow at impeller inlet as flow goes towards surge.

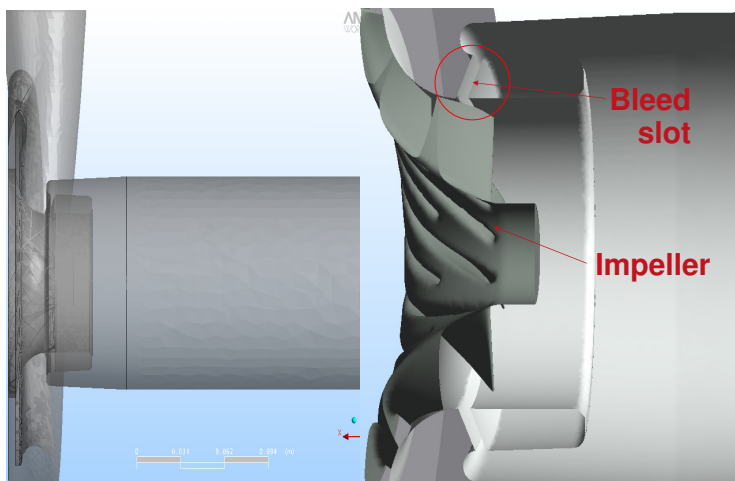


Fig. 1: Compressor mesh

Fig. 2: Cross-section highlighting the bleed slot

## Method

The compressor and bleed slots are meshed using a commercial computational fluid dynamics (CFD) package Ansys ICFM CFD. 6 new bleed slots are to be modelled and then manufactured for testing.

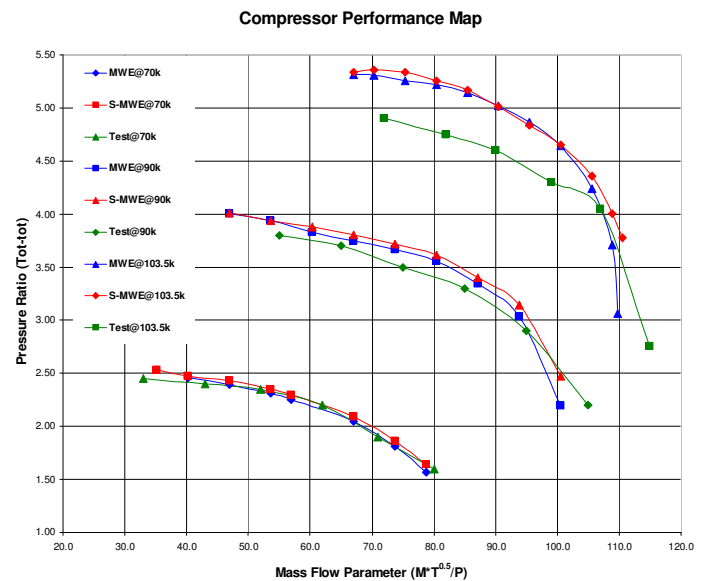


Fig. 3: Compressor map for the base MWE model

## Results

Fig. 4 shows some of the flow passing through the bleed slot which then mixes with the main flow upstream of the impeller. The mixing of these flows produces negative pre-swirl (swirl which rotates in the same direction as the impeller). Fig. 5 shows this pre-swirl

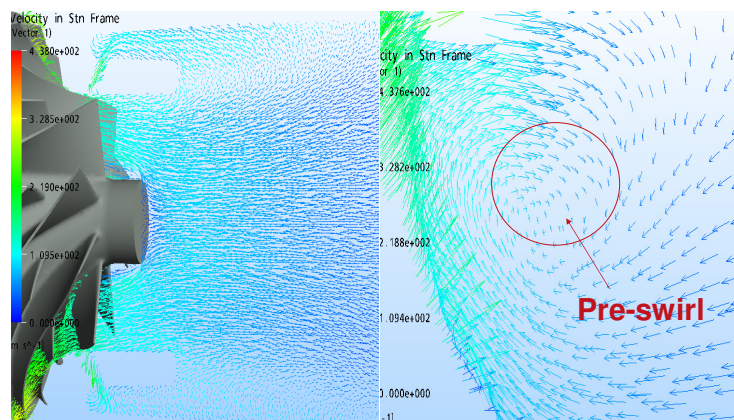


Fig. 4: Velocity vector plot on XY plane

Fig. 5: Pre-swirl in flow upstream of impeller

## Discussion

As the mass flow was decreased from 0.34kg/s down to 0.24kg/s the pressure ratio increased. The effect of this on the bleed flow is that the bleed mass flow rate increases and the pre-swirl occurs further upstream of the impeller