



Design and Development of a light, compact V6 3.0L Diesel for Passenger Car & SUV Applications

*Nicola Menarini, Giorgio Corno, Gianluca Sabbioni, Mauro
Puglia, Paolo Patroncini / VM Motori S.p.A., Cento*

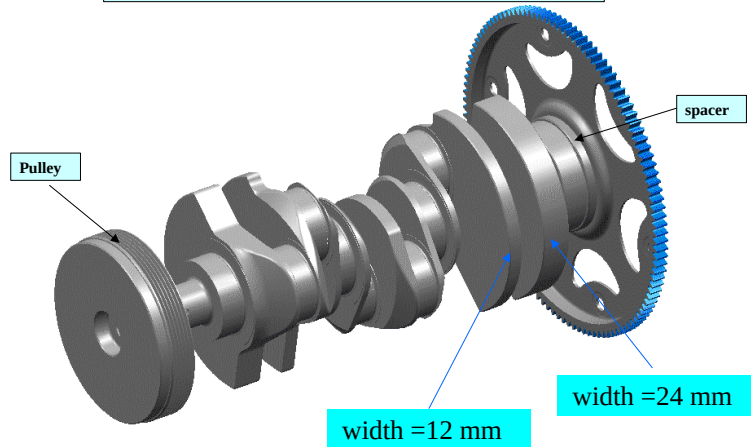
*Rüdiger Beykirch, Hans-Dieter Sonntag / FEV
Motorentechnik GmbH, Aachen*



Bank angle 60° vs 65°: overall length & NVH considerations

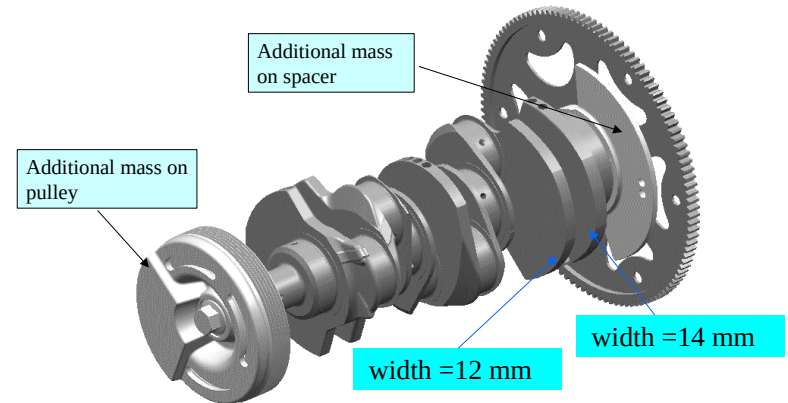
Cranktrain balancing study: **1st method**

Balancing: crankshaft (large counterweight)



Cranktrain balancing study: **2nd method**

Balancing: crankshaft + pulley & balancing spacer



20 mm total length reduction

▪ External crankshaft balancing of 1st order moments vs. internal balancing:

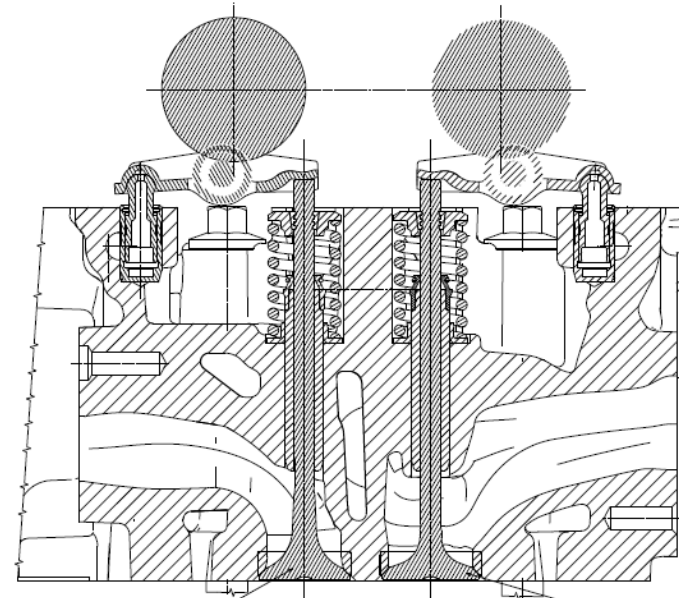
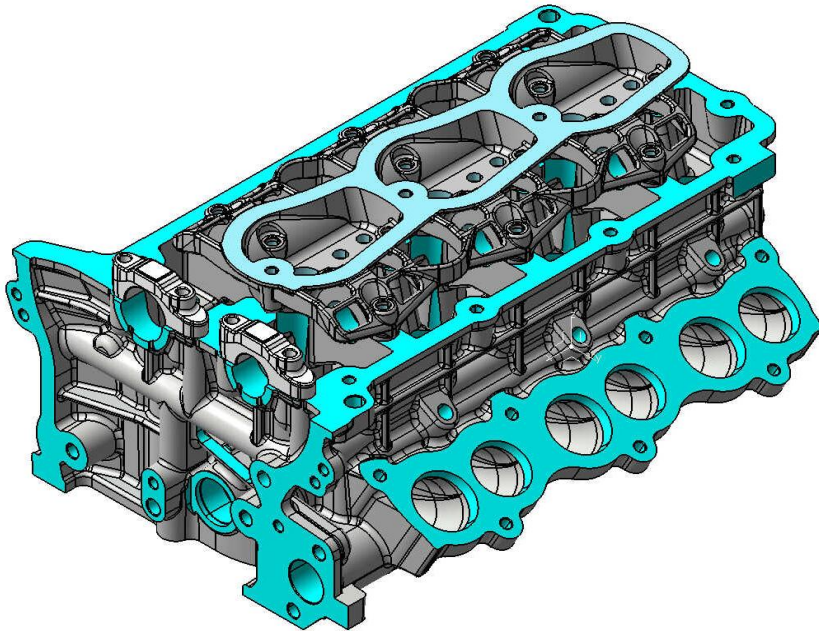
	Direction	V6 - 60°	V6 - 65°
F (centr.) <i>N</i>	Rotating	0	0
F (1° ord.) <i>N</i>	Rotating	0	0
F (1° ord.) <i>N</i>	Counter rotating	0	0
Mcent (1° ord.) <i>N*m</i>	Rotating	Balanc.	Balanc.
Malt (1° ord.) <i>N*m</i>	Rotating	Balanc.	Balanc.
Malt (1° ord.) <i>N*m</i>	Counter rotating	0	85
F (2° ord.) <i>N</i>	Rotating	0	0
F (2° ord.) <i>N</i>	Counter rotating	0	0
M (2° ord.) <i>N*m</i>	Rotating	0	24
M (2° ord.) <i>N*m</i>	Counter rotating	471	482

Note: Balanc. = means that is possible balancing force/moment with opposite
Note: force and moment calculated with RPM = 4500

▪ VM-V6 engine: free forces & moment of inertia



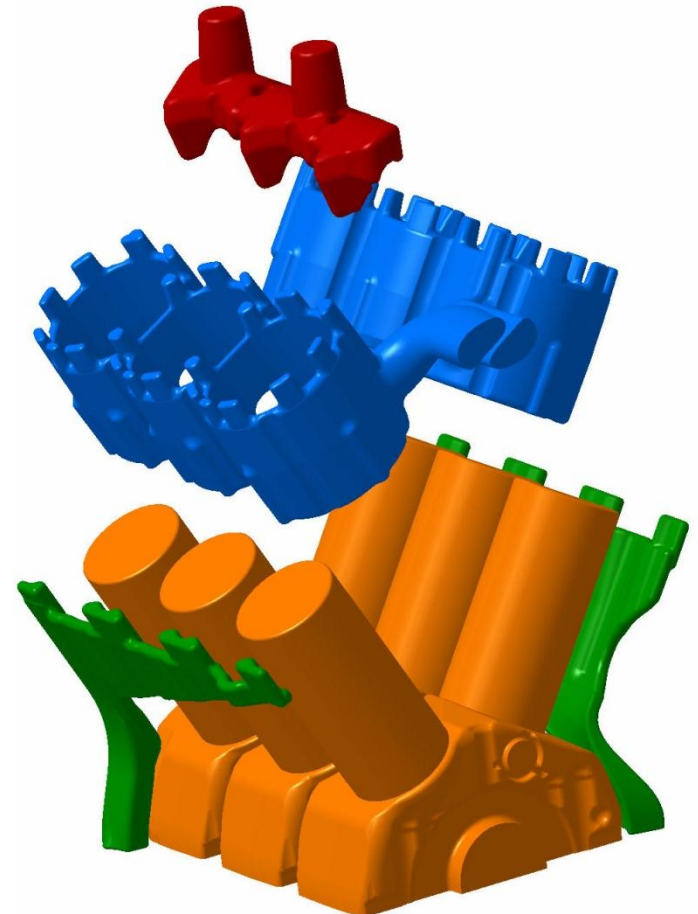
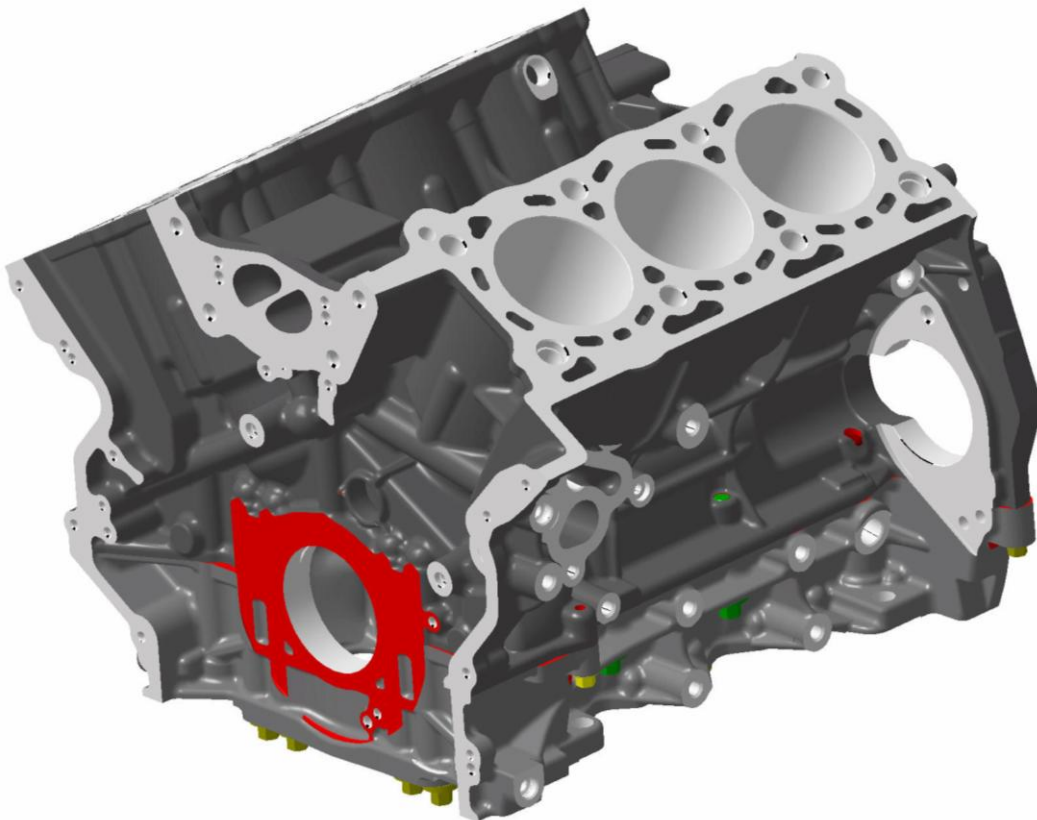
Cylinder head, material GAlSi7 / vertical valves DOHC





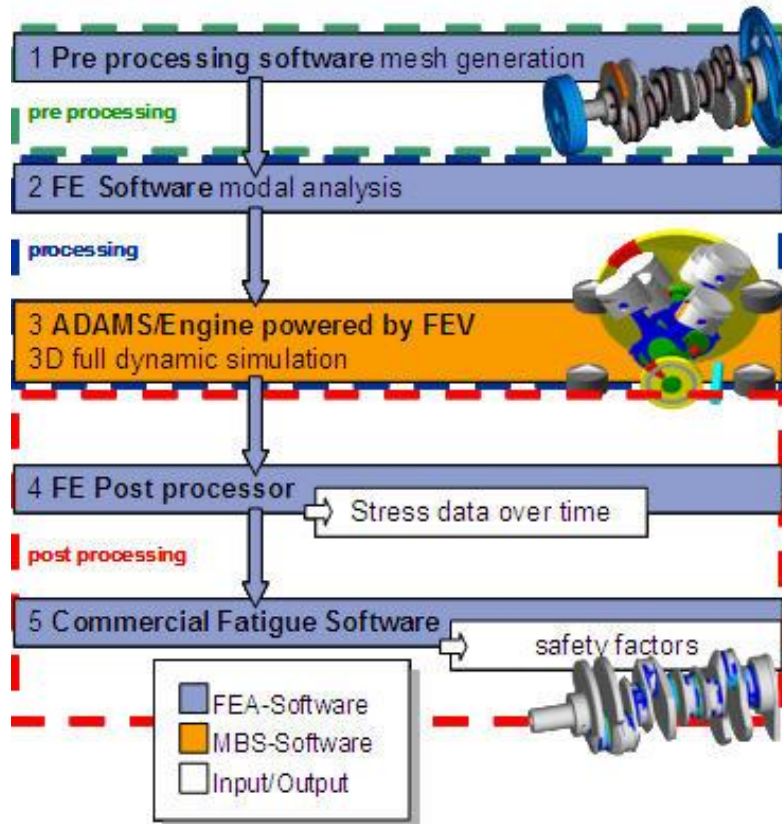
Cylinder Block

- ✓ Bedplate design for “state of the art” stiffness (NVH, future performance increases)
- ✓ CGI 450 material



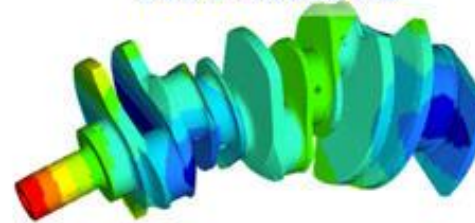
Core package

Description of Stiffness in MBS Model

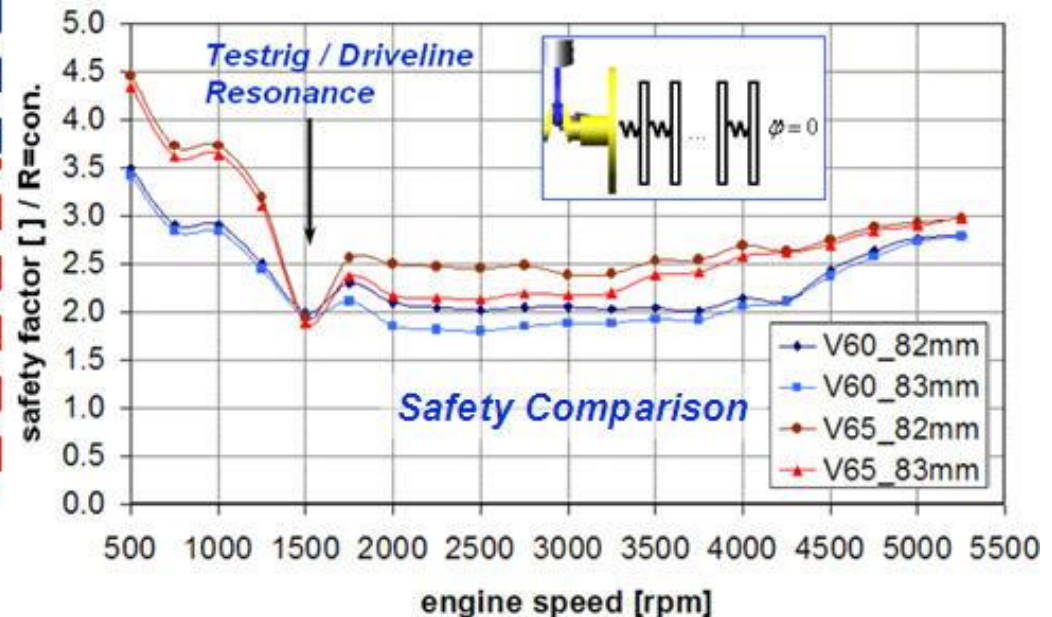
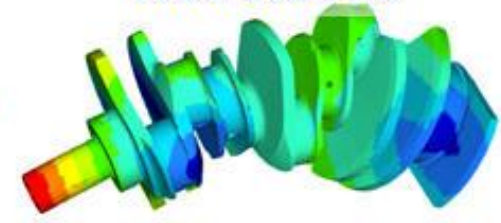


Modal Results

V65 $f=160.5$ Hz



V60 $f=160.2$ Hz



Comparison of surface velocity level for bedplate and ladderframe design

