

# 5 Stroke Development Review

8<sup>th</sup> January 2008



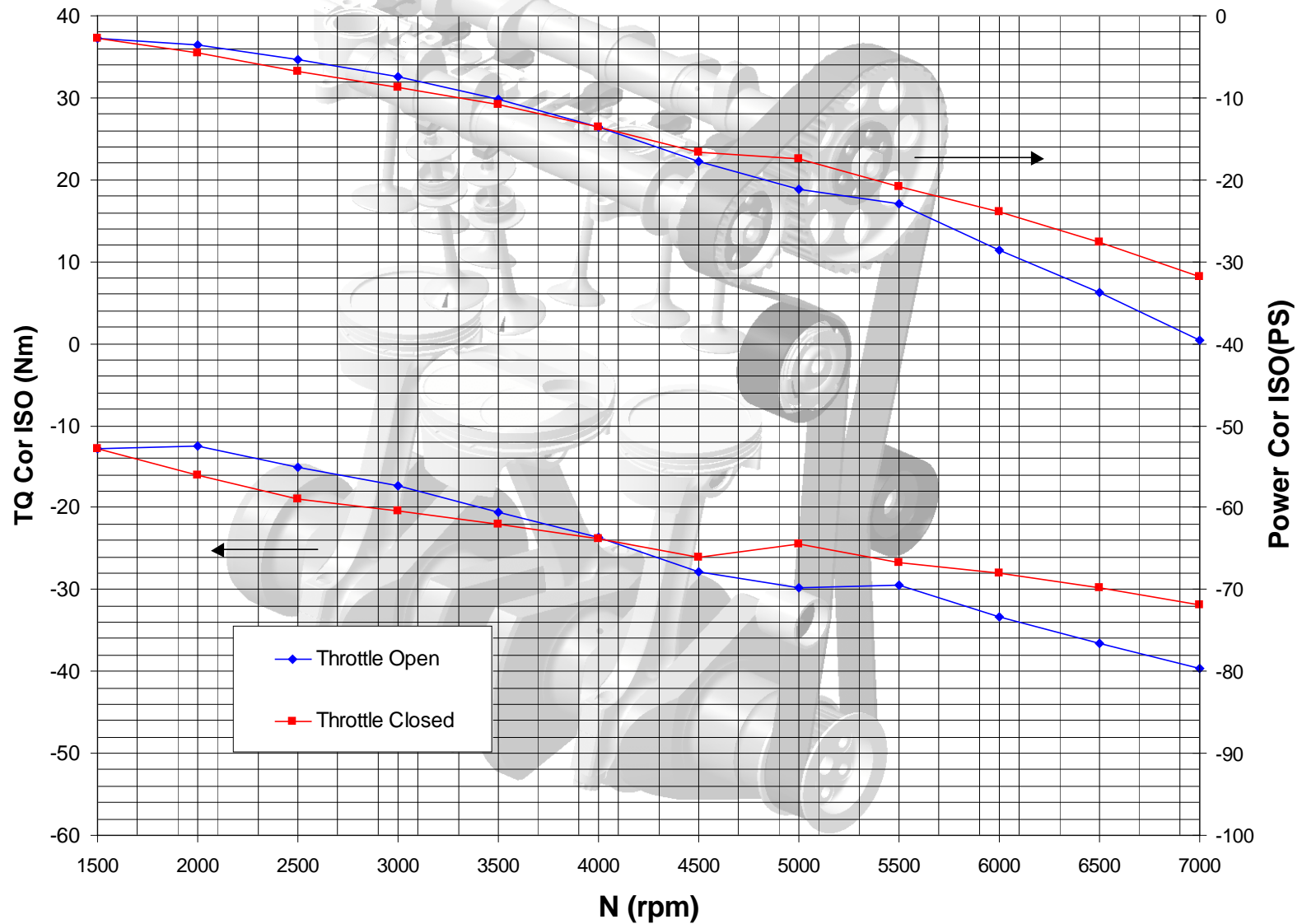
## Sequence 1

- Non Preferred HP camshaft used for initial testing
- Back up Garrett GT25 hybrid turbo fitted
- Insufficient boost achieved
- Issue with measuring low fuel flows
- General dyno control and instrumentation calibration

## Motored Curve (see Chart 1)

- High motored power consumption possibly due to pumping losses between un-fired cylinders
- Future work to evaluate pure frictional losses?

# Chart 1 Motored Curve



## Engine Stripped

- Oil discovered in exhaust
- Heavy scuffing on LP cylinder

## Sequence 2

- Turbo oil feed regulated
- Alternative OCR material used – wear issues resolved
- Production specification HP camshaft fitted

## Sequence 3

- Garrett GT14 variable geometry turbo installed
- Issues with VNT control and exhaust back pressure

## Sequence 4

- Returned to running GT25

## **Spark Sweeps (see Charts 2, 3 & 4)**

- Improvement on BSFC
- Higher performance figures achieved

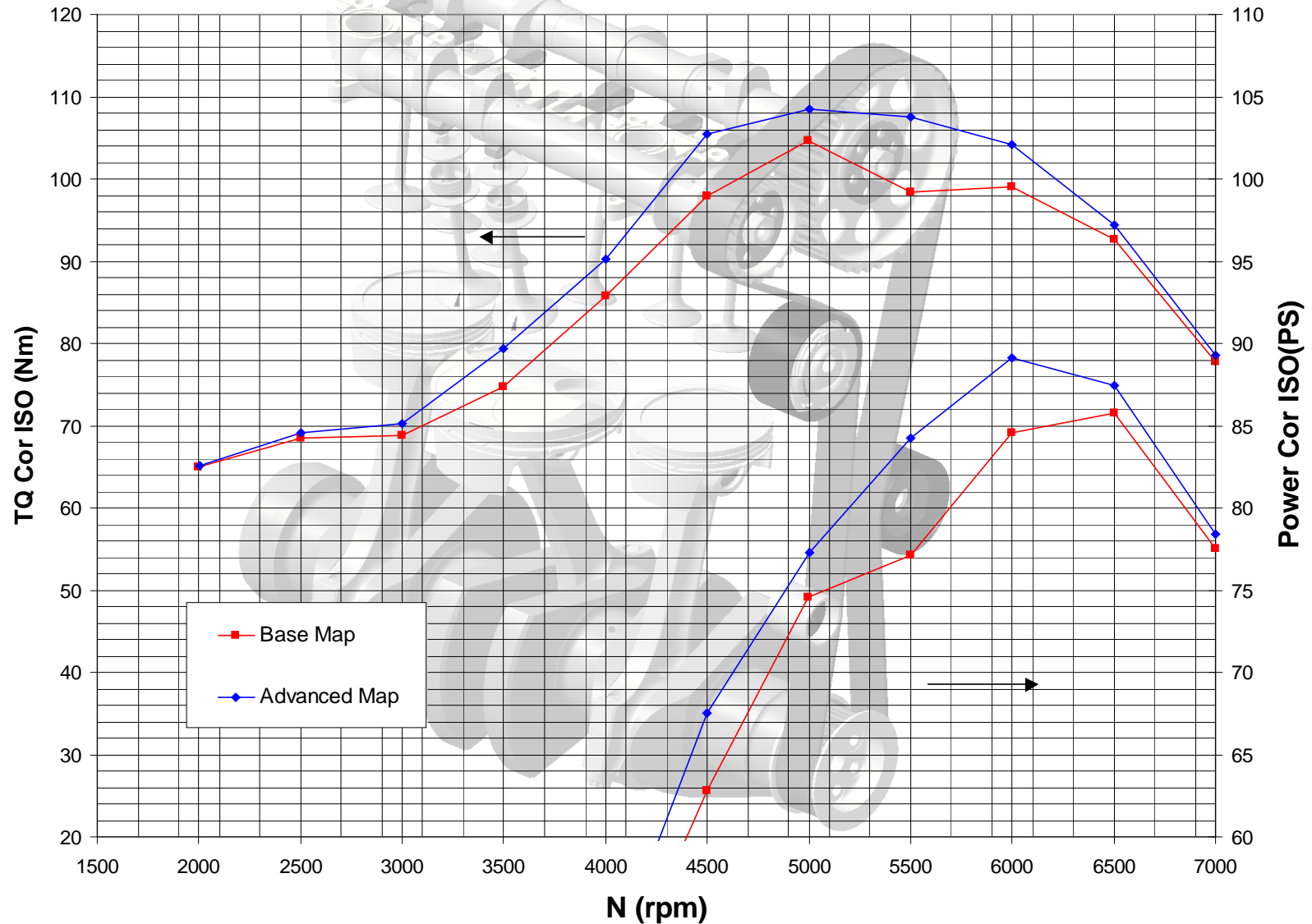
## **Sequence 5 (see Charts 5, 6 & 7)**

- CR increased from 7:1 to 8:1
- BSFC and power improvement

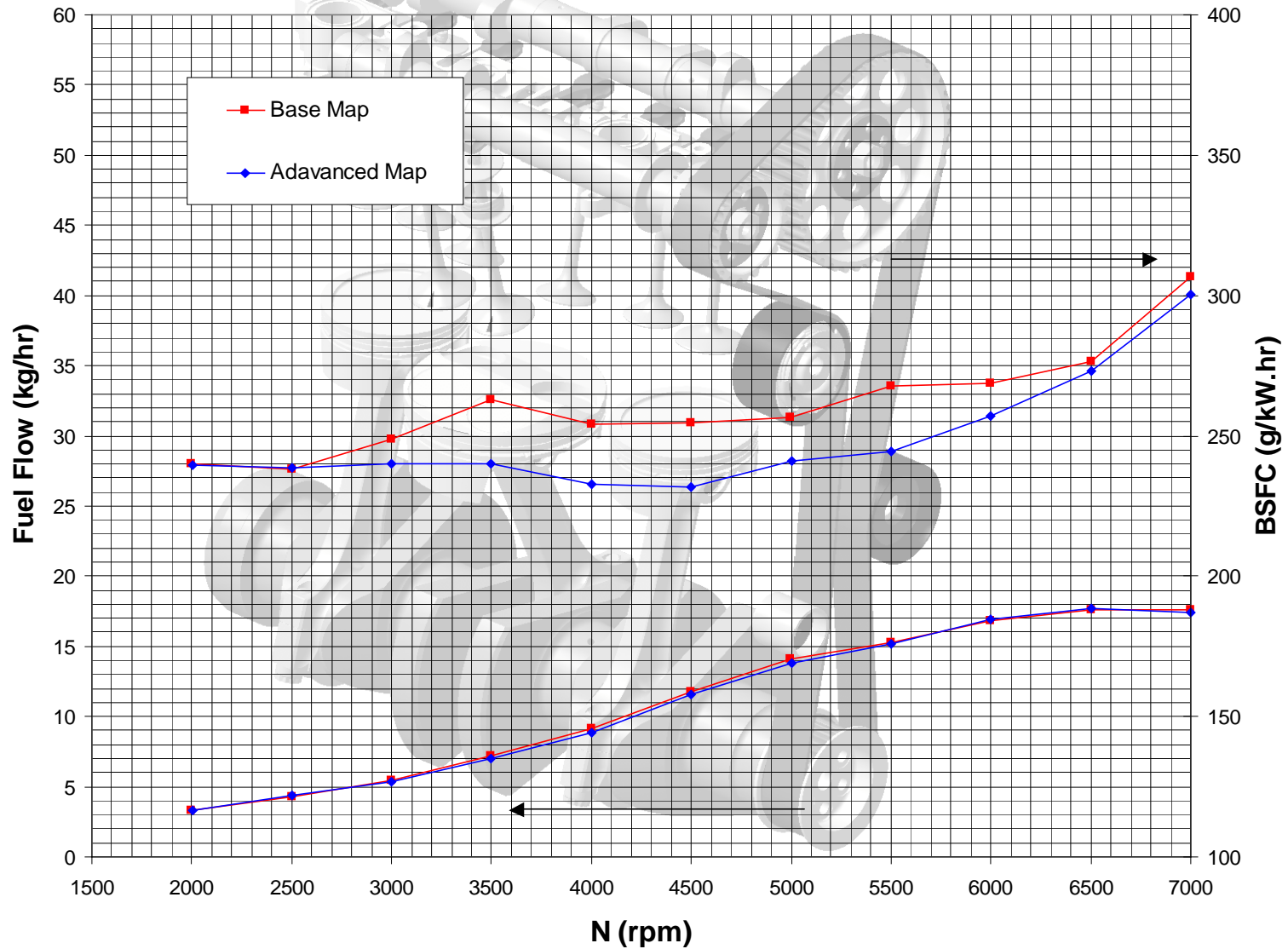
## **Sequence 6 (see Charts 5, 6 & 7)**

- Returned to GT14 with revised VNT control
- 3 bar boost now achievable
- Engine knock limited with high combustion variability
- Performance improvement at expense of BSFC
- Over fuelling required to control exhaust gas temperatures

# Chart 2 Spark Sweeps – Torque and Power

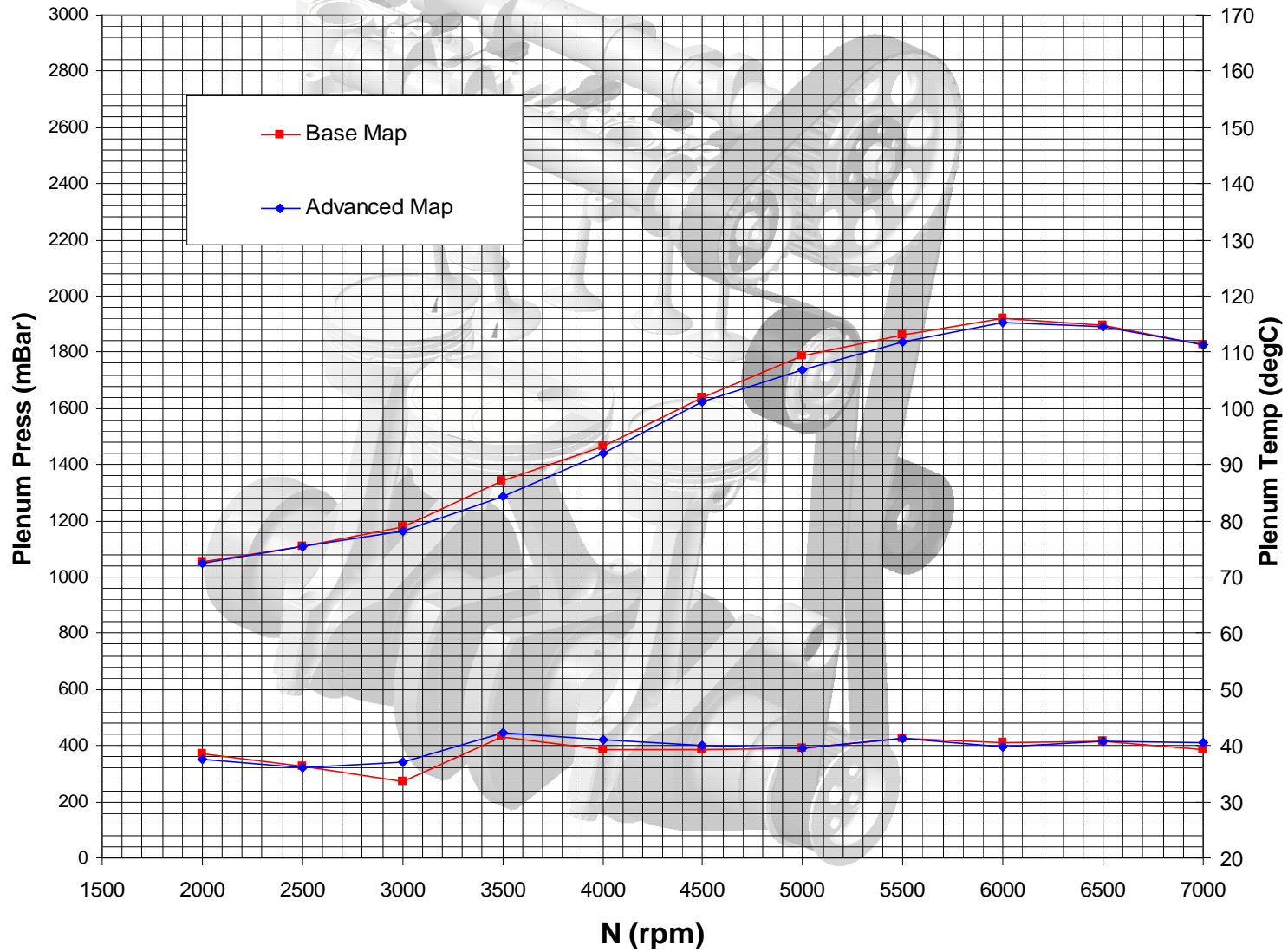


### Chart 3 Spark Sweeps – Fuel Flow and BSFC



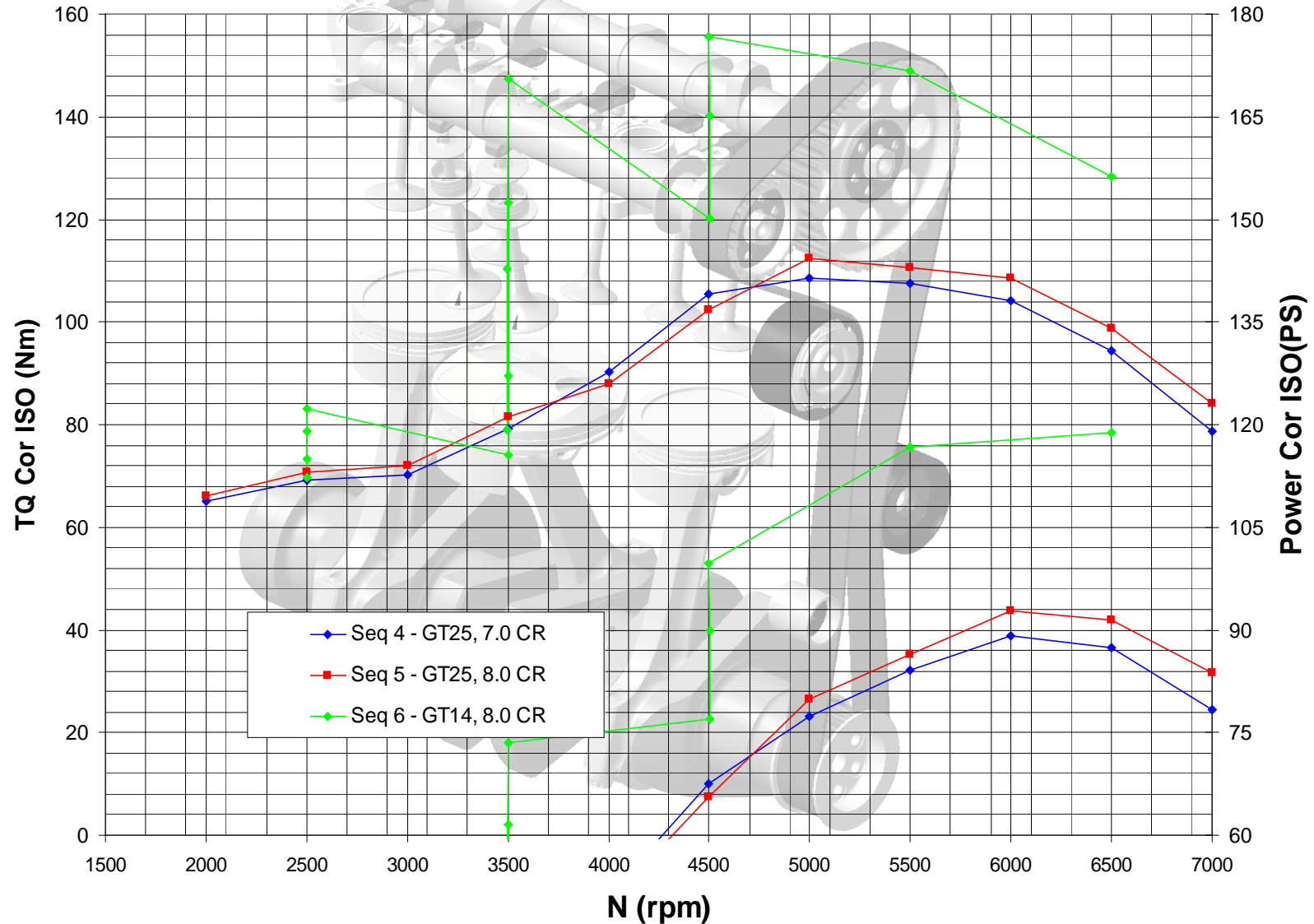


# Chart 4 Spark Sweeps – Plenum Pressure and Temp

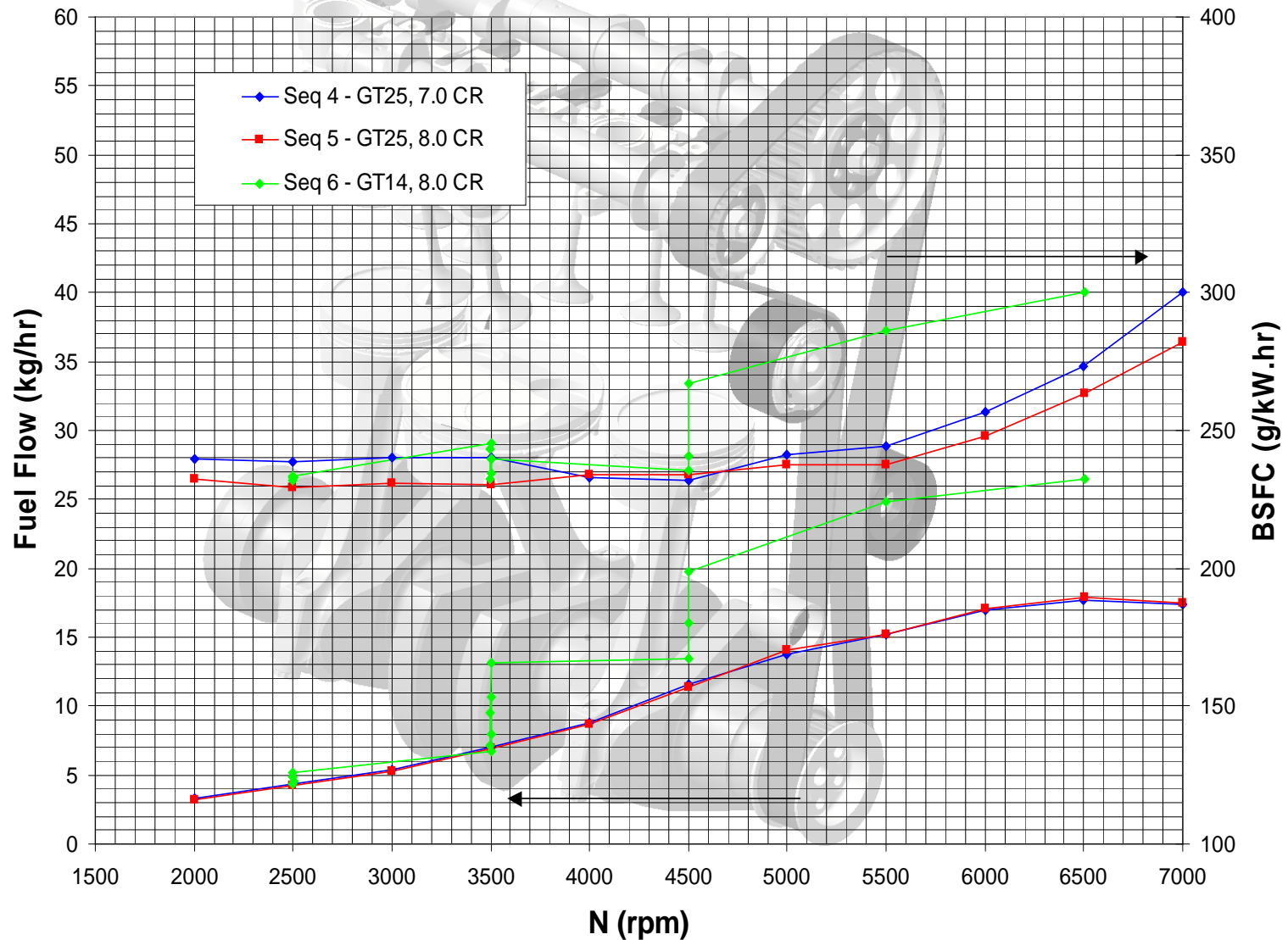




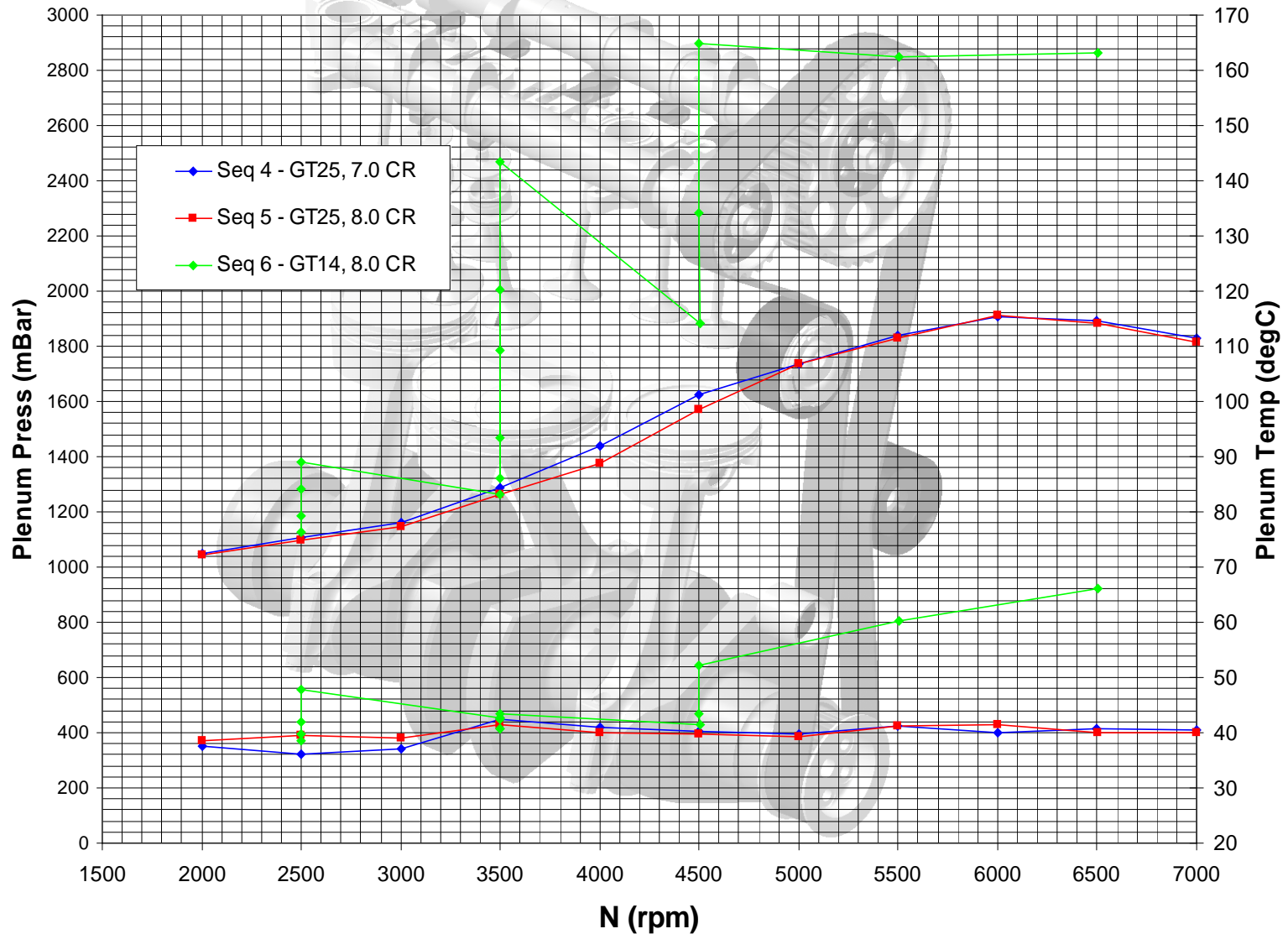
# Chart 5 Sequence 5 & 6 – Torque and Power



# Chart 6 Sequence 5 & 6 – Fuel Flow and BSFC



# Chart 7 Sequence 5 & 6 – Plenum Pressure and Temp



## **Part Load** (see Chart 8)

- Poor part load consumption achieved
- Limited by rate of combustion

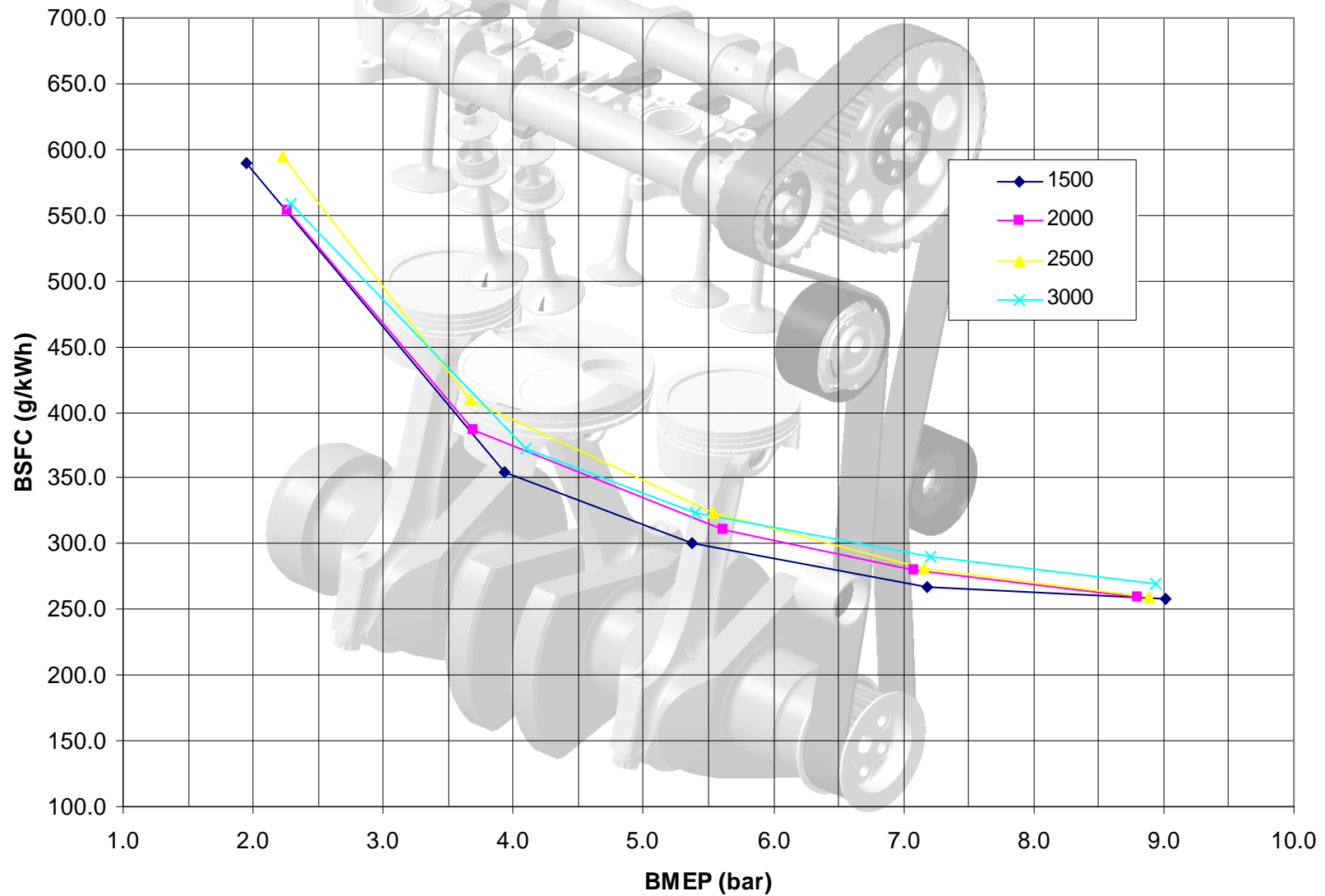
## **Sequence 7** (see Chart 9 & 10)

- Longer exhaust camshaft fitted with same opening point
- Improved performance at top end and small change in BSFC

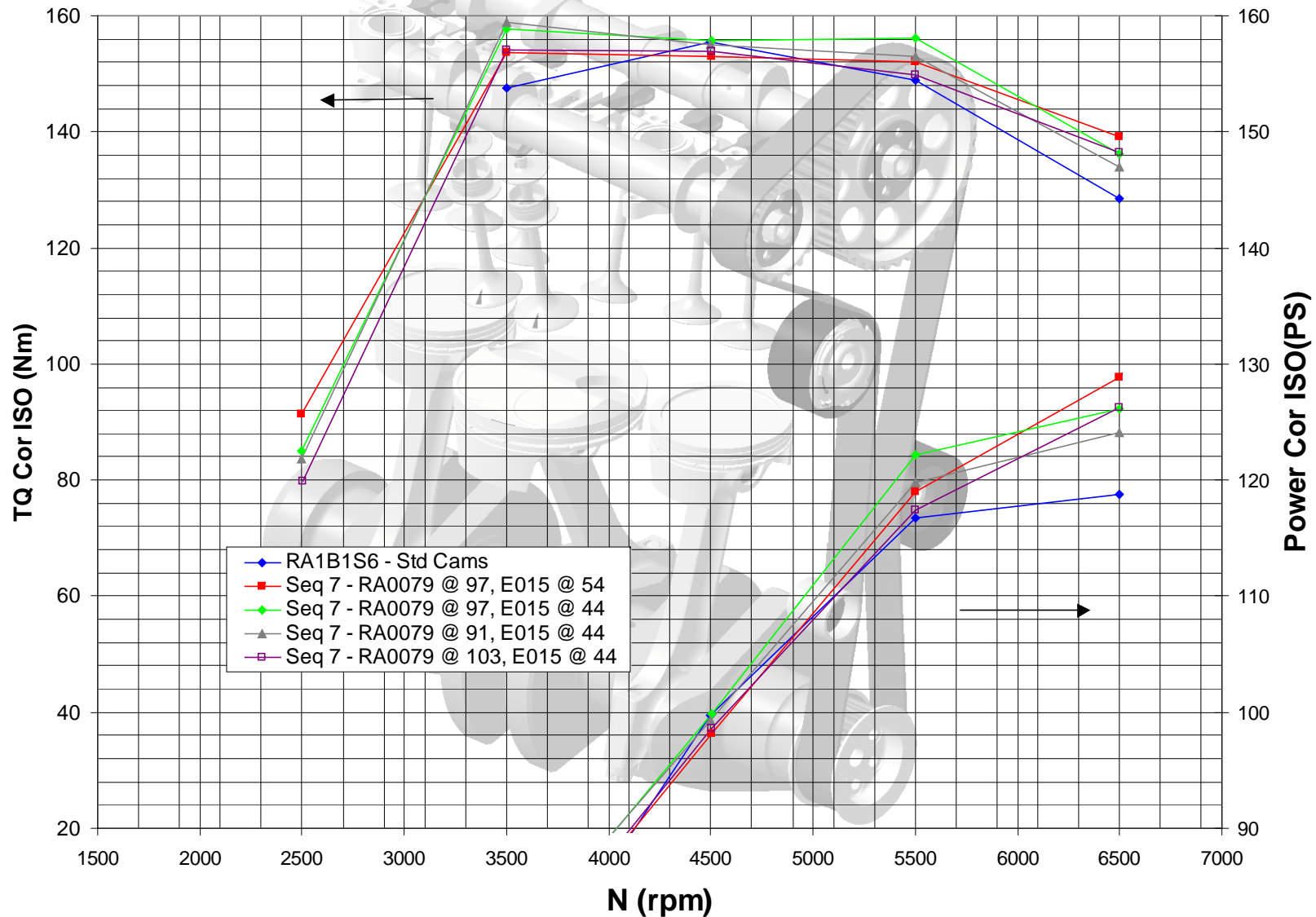
## **Cam Swings** (see Chart 9 & 10)

- Variations on HP and LP cam timings
- No improvements to be made on BSFC

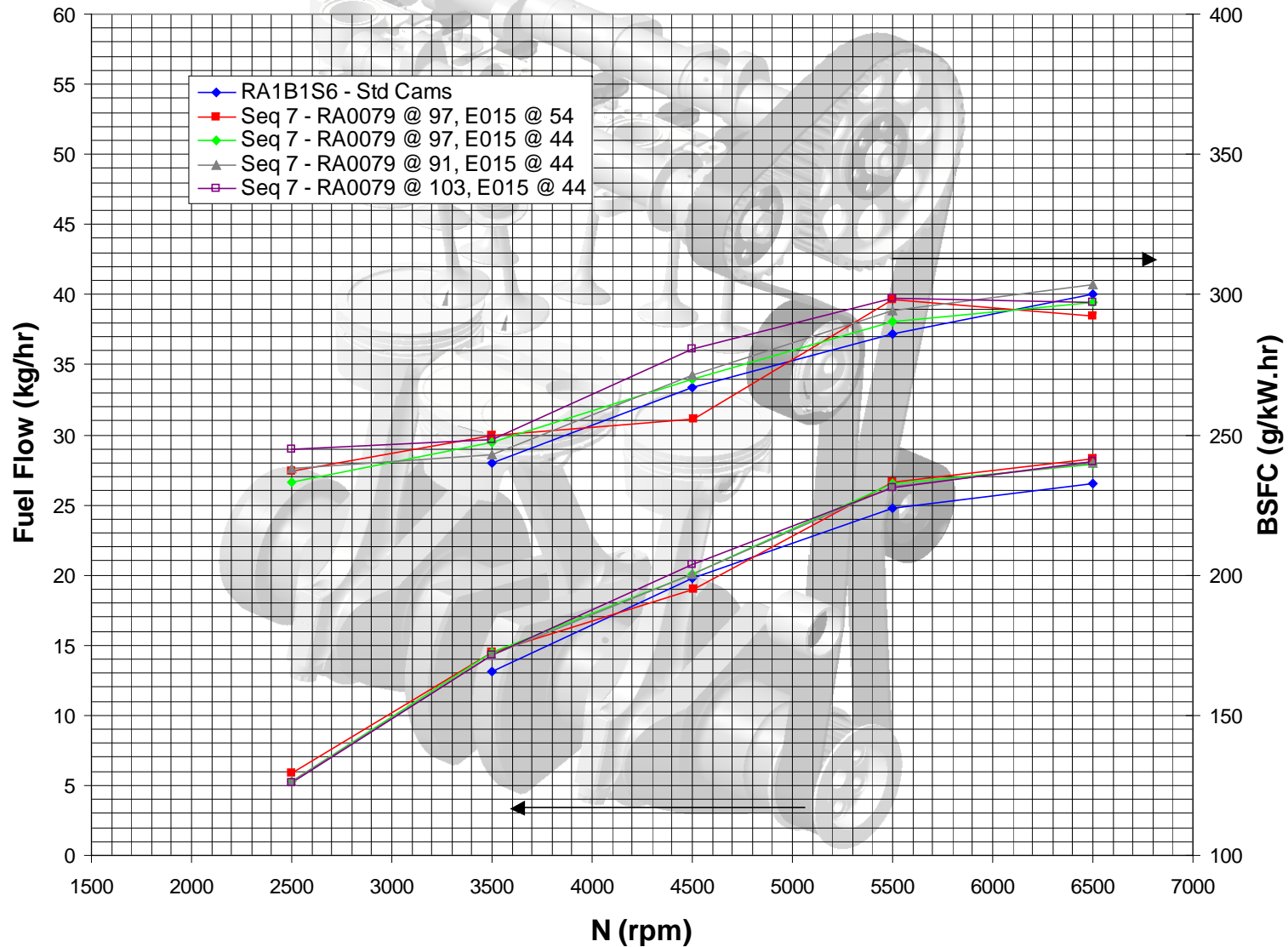
# Chart 8 Part Load Summary



# Chart 9 Sequence 7 – Torque and Power



# Chart 10 Sequence 7 – Fuel Flow and BSFC





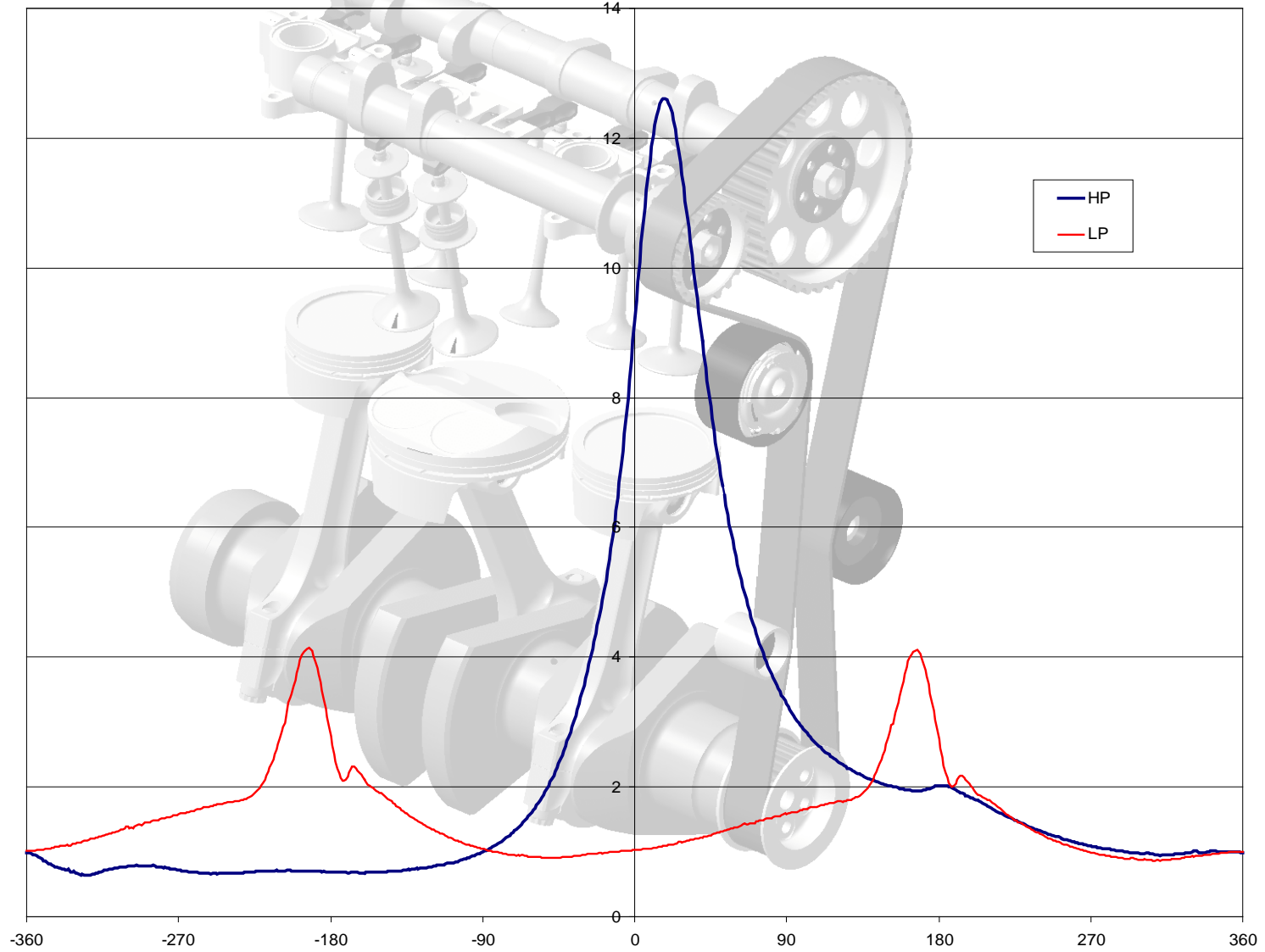
## **Indication Measurements (see Charts 11 & 12)**

- High percentage of negative work present at low load sites
- Reverse flow present in transfer port due to low combustion pressures in HP cylinder
- Negative work not present at full load
- Charts show data for 2500 rpm at full and part load

## **Potential Further Testing**

- Twin spark – improved combustion
- Overhead injector – improved mixture preparation
- Smaller inlet port – increased charge motion
- Disabled LP cylinder – frictional analysis and conventional performance analysis

# Chart 11 Indication Measurements – Part Load



# Chart 12 Indication Measurements – Full Load

