Demonstration of the LRC Storage Skallen – Sweden

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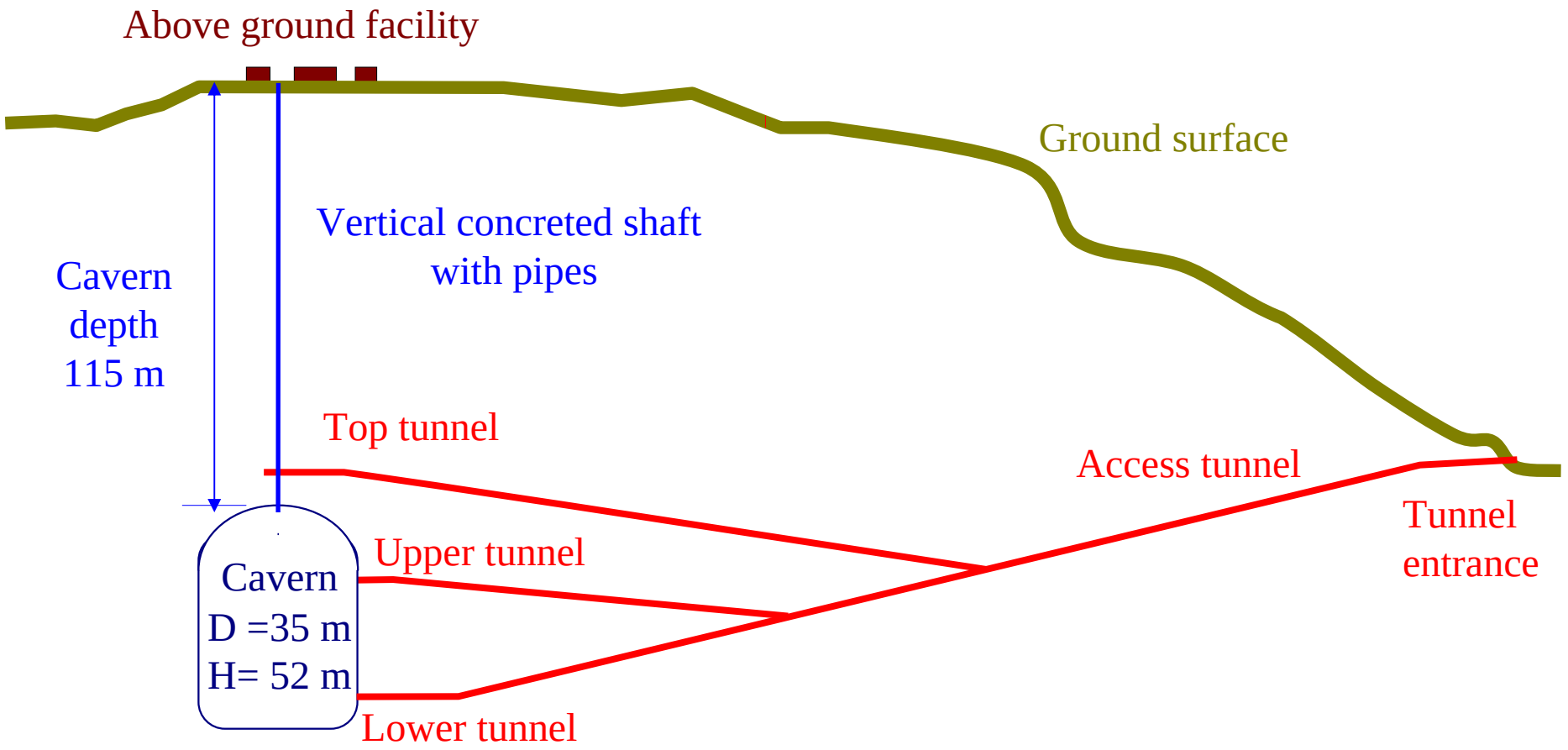
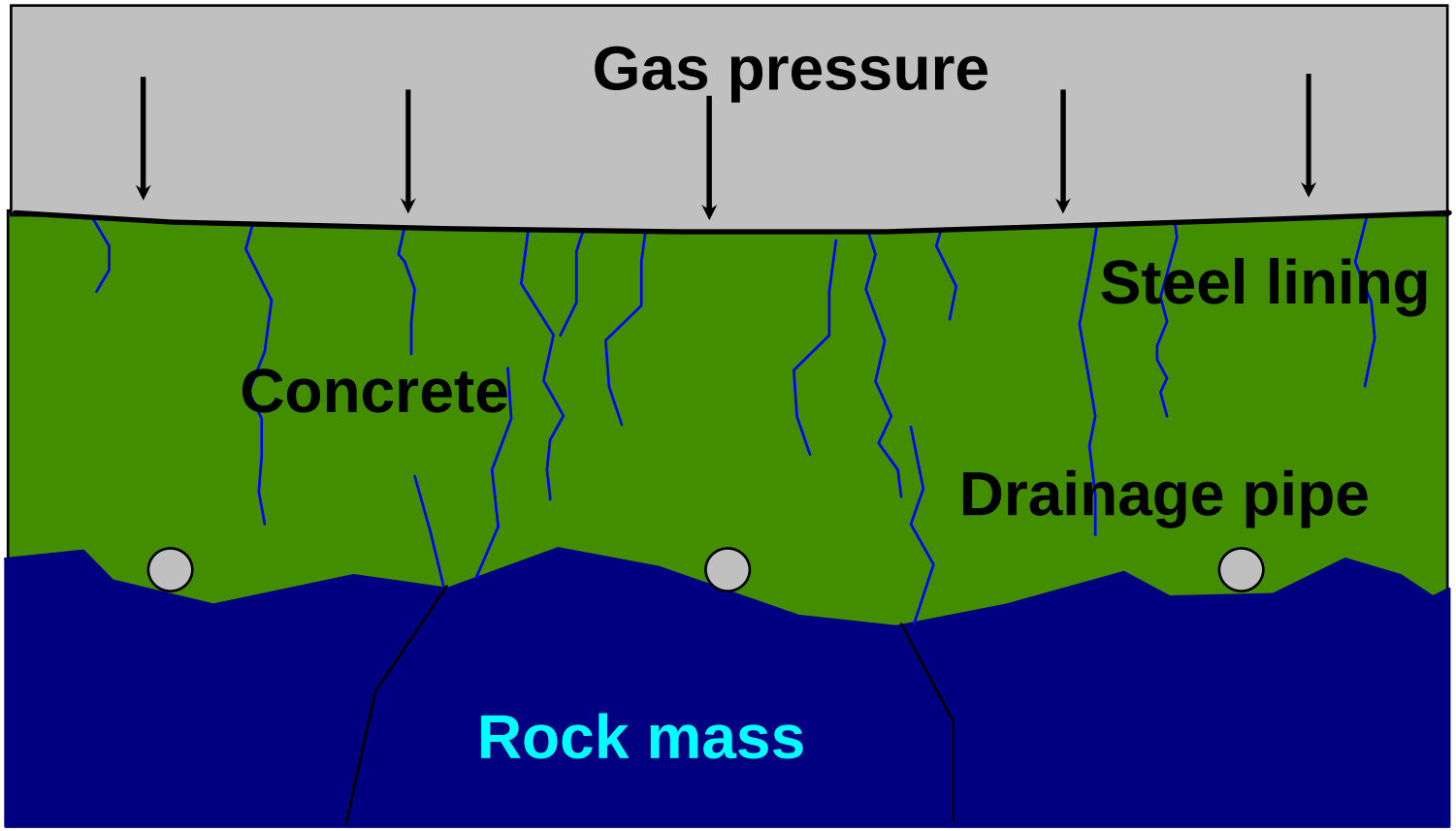
Schematic principle



Storage performance

Gas Pressure	200 bar
Total Gas Volume	$10x10^6$ $m^3(n)$
Working Gas Volume	$8.5x10^6$ $m^3(n)$
Max withdrawal flow	40 000 m3(n)/h
Withdrawal Time	10 days
Max Injection flow	15 000 m3(n)/h
Injection Time	20 days

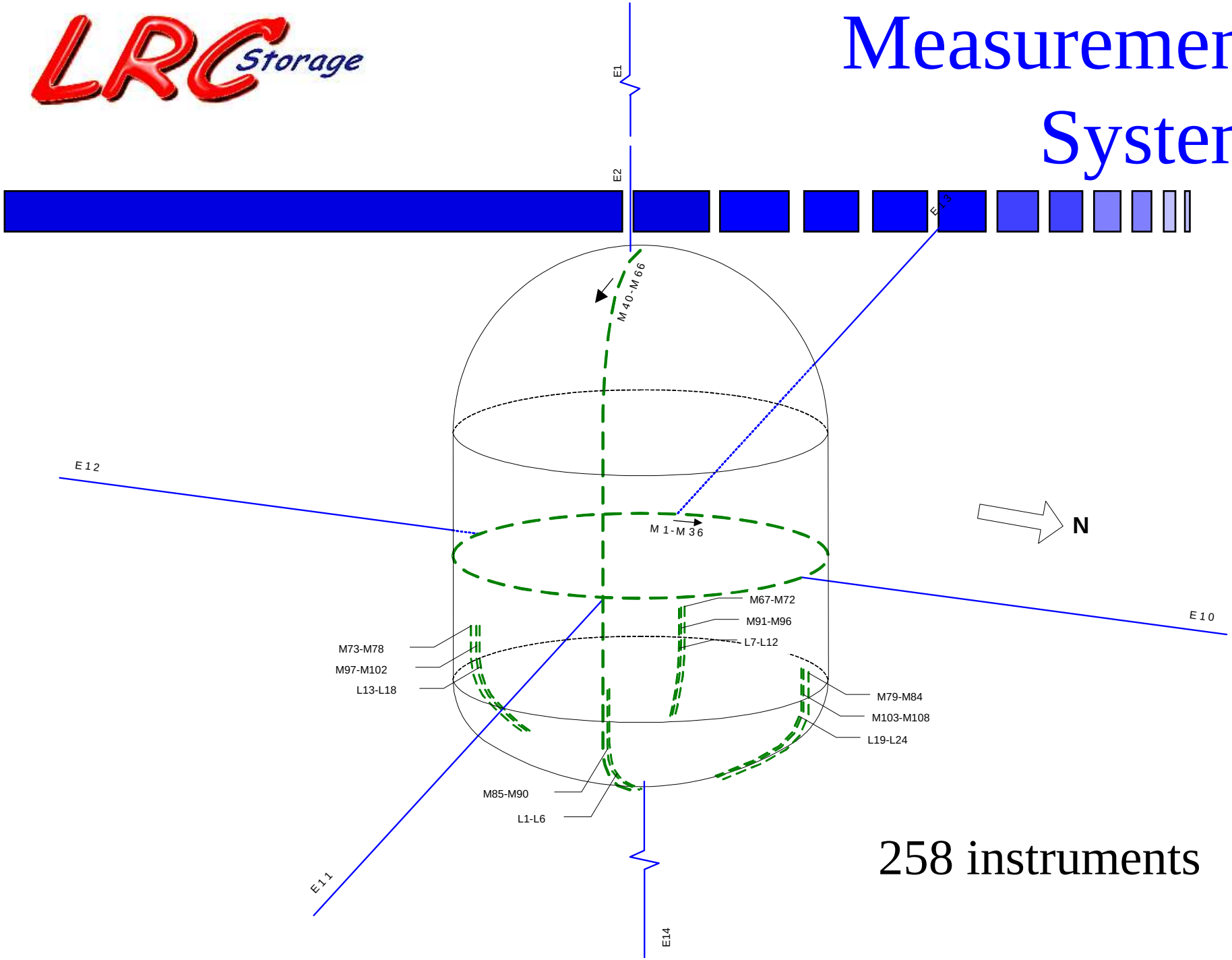
Cavern Wall Design



Demonstration Program

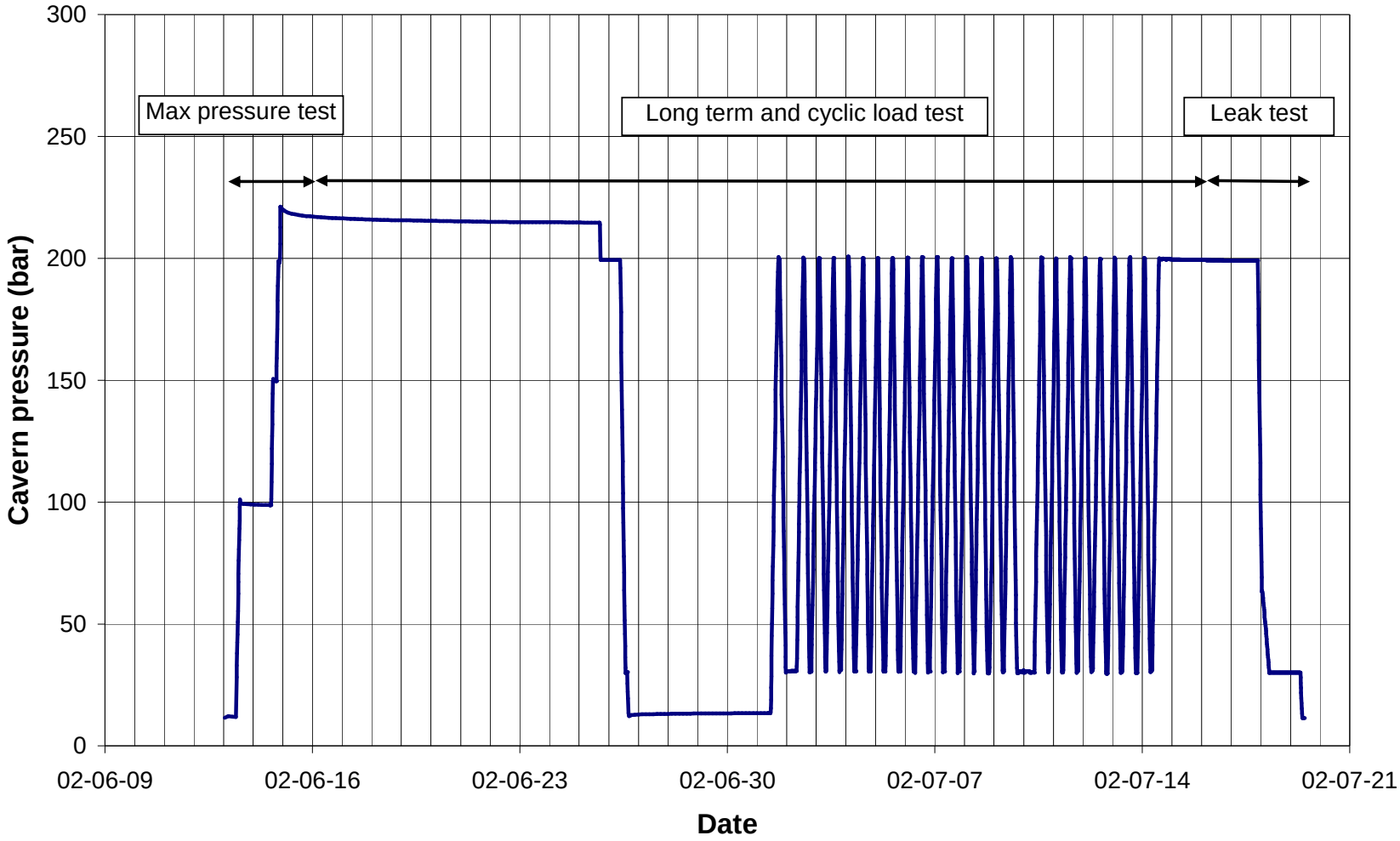
- Hydraulic pressure tests
  - Mechanical integrity test of the cavern at 220 bar
  - Mechanical behaviour test under cyclic loads (25 cycles 30-200 bar)
  - Constant pressure test after cyclic test (at 200 bar)
  - Gas leakage test
- Preparation for gas operation
  - Dewatering procedure (replacing water with gas)
  - Gas drying procedure
- Gas cycle tests

Measurement System

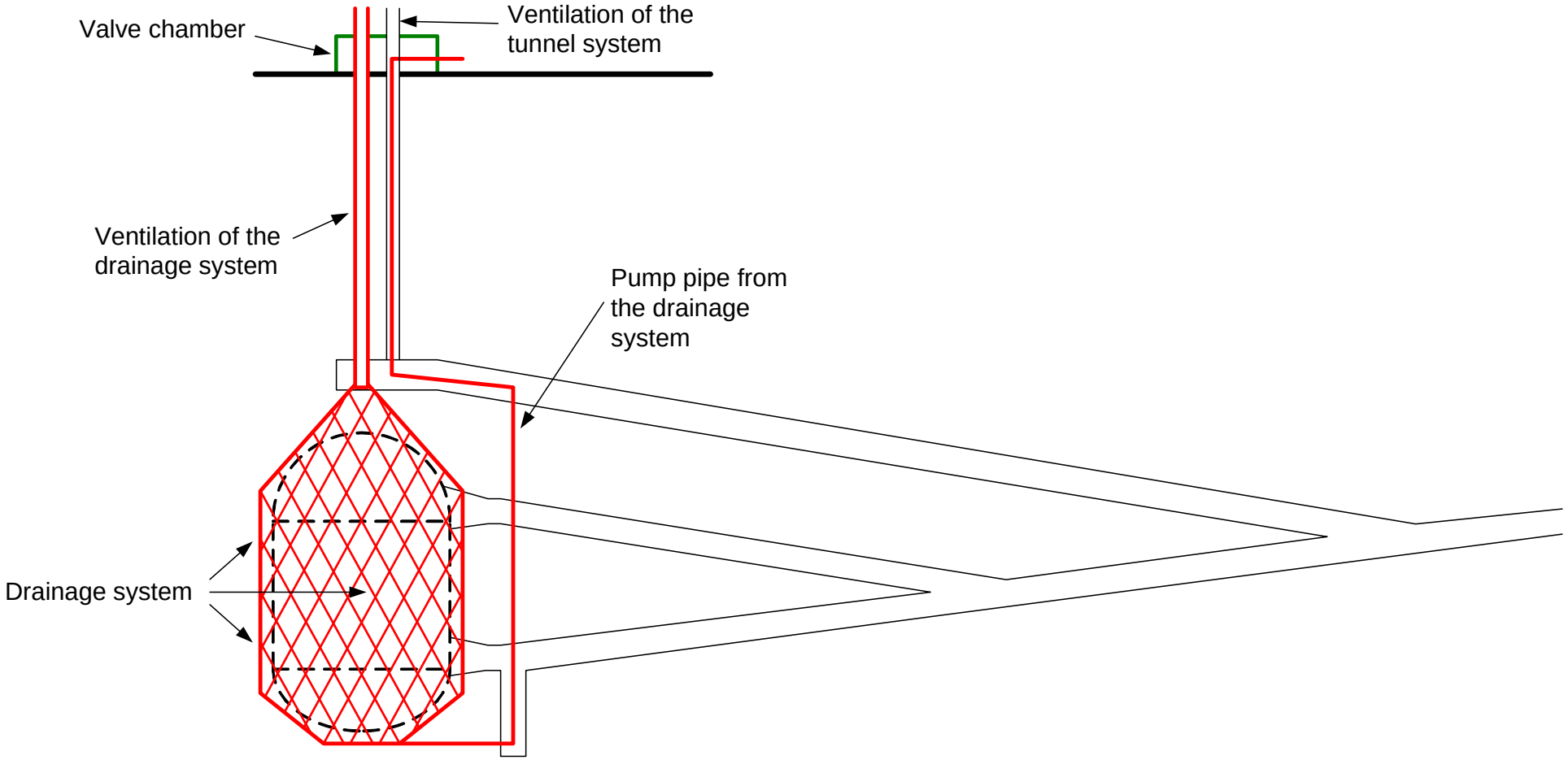


258 instruments

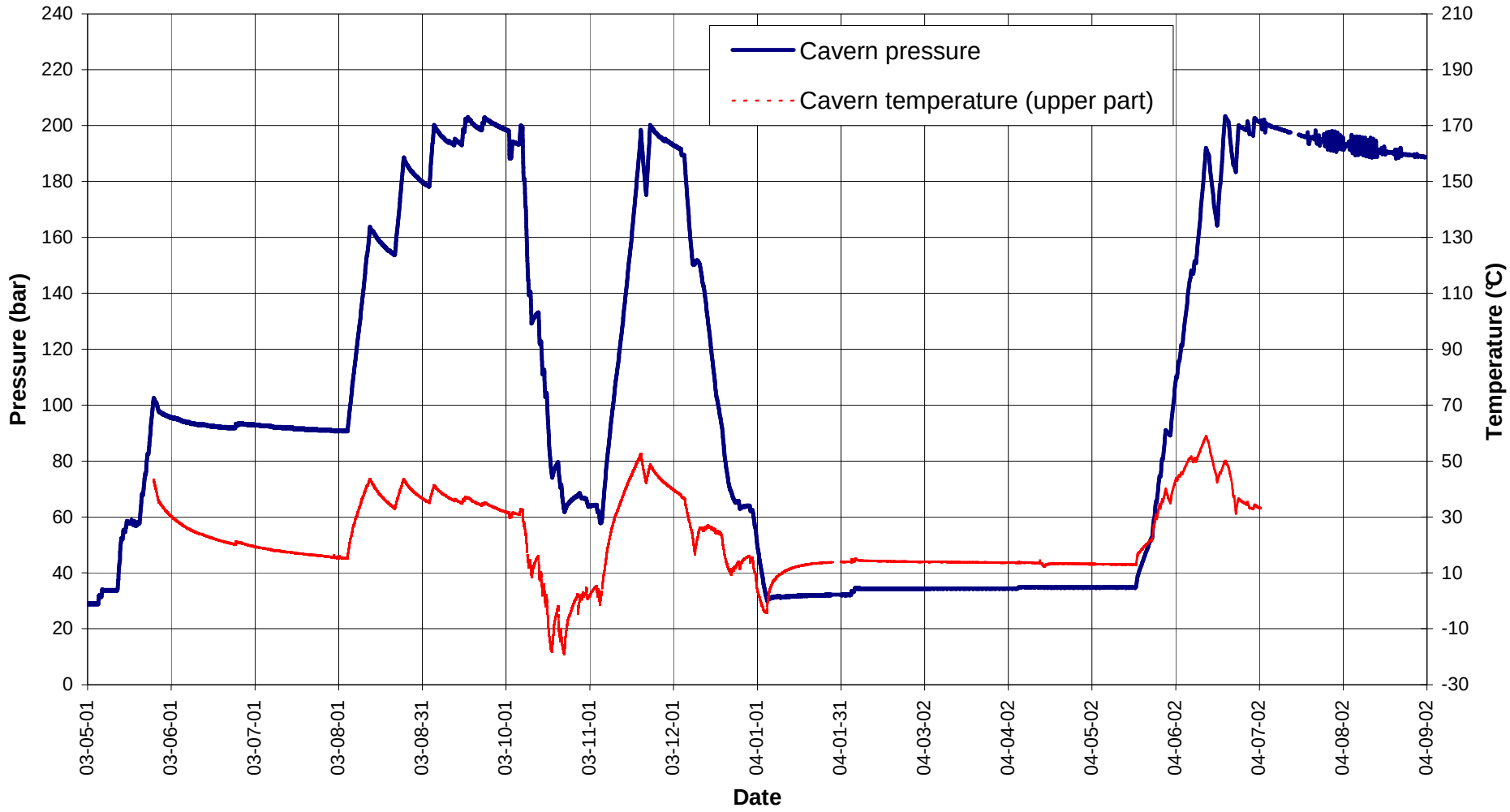
Hydraulic pressure test



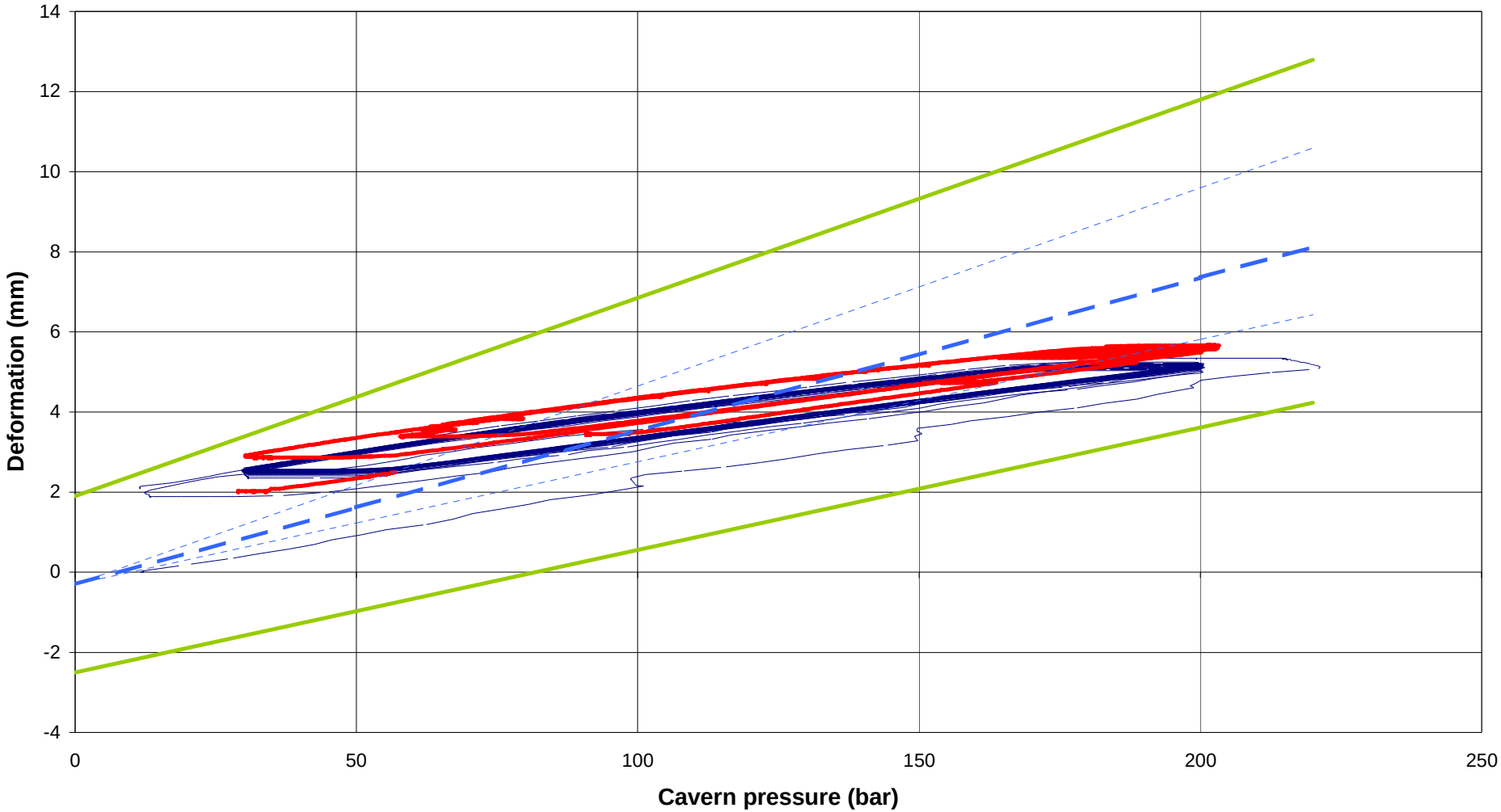
Gas leakage test



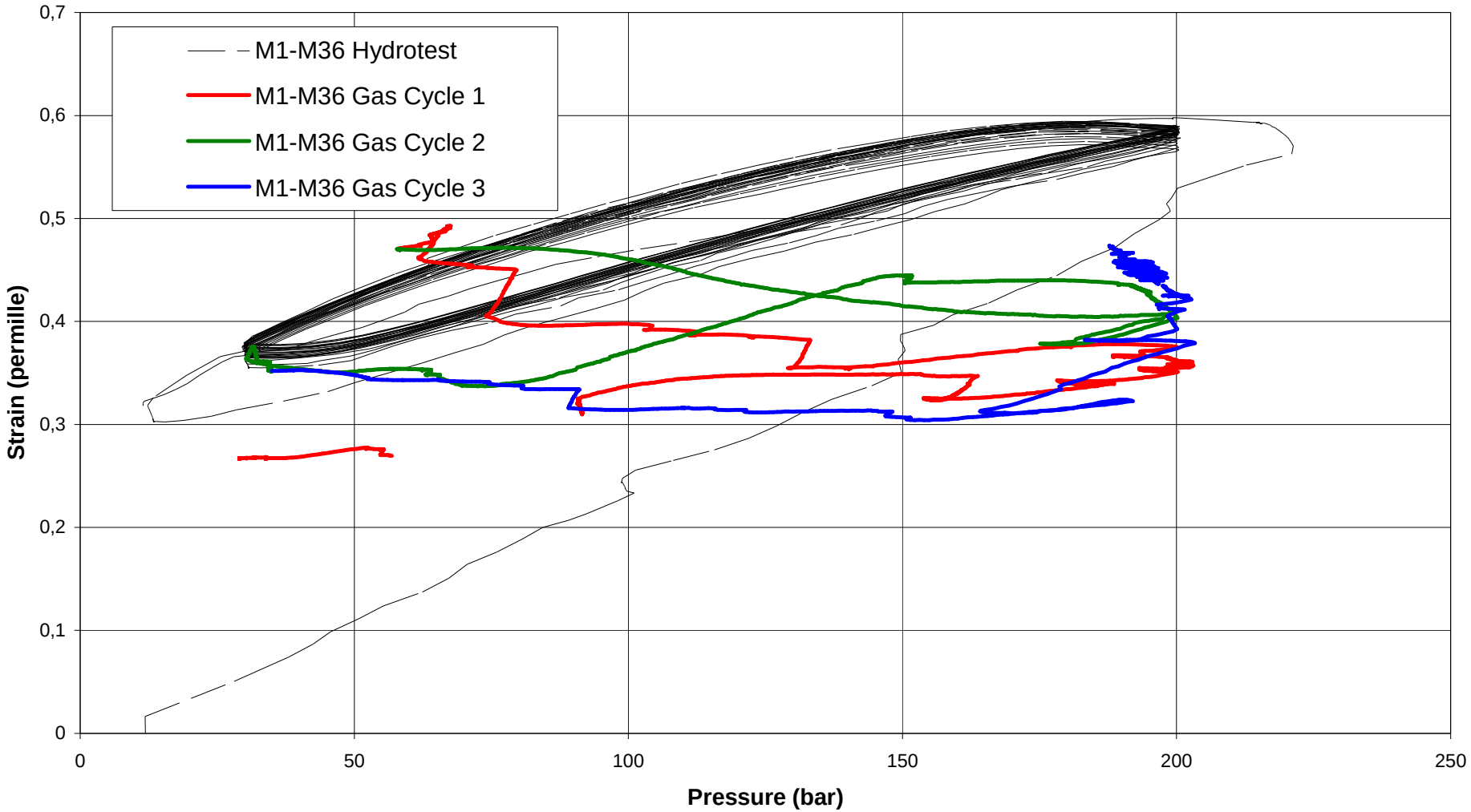
Gas cycle tests



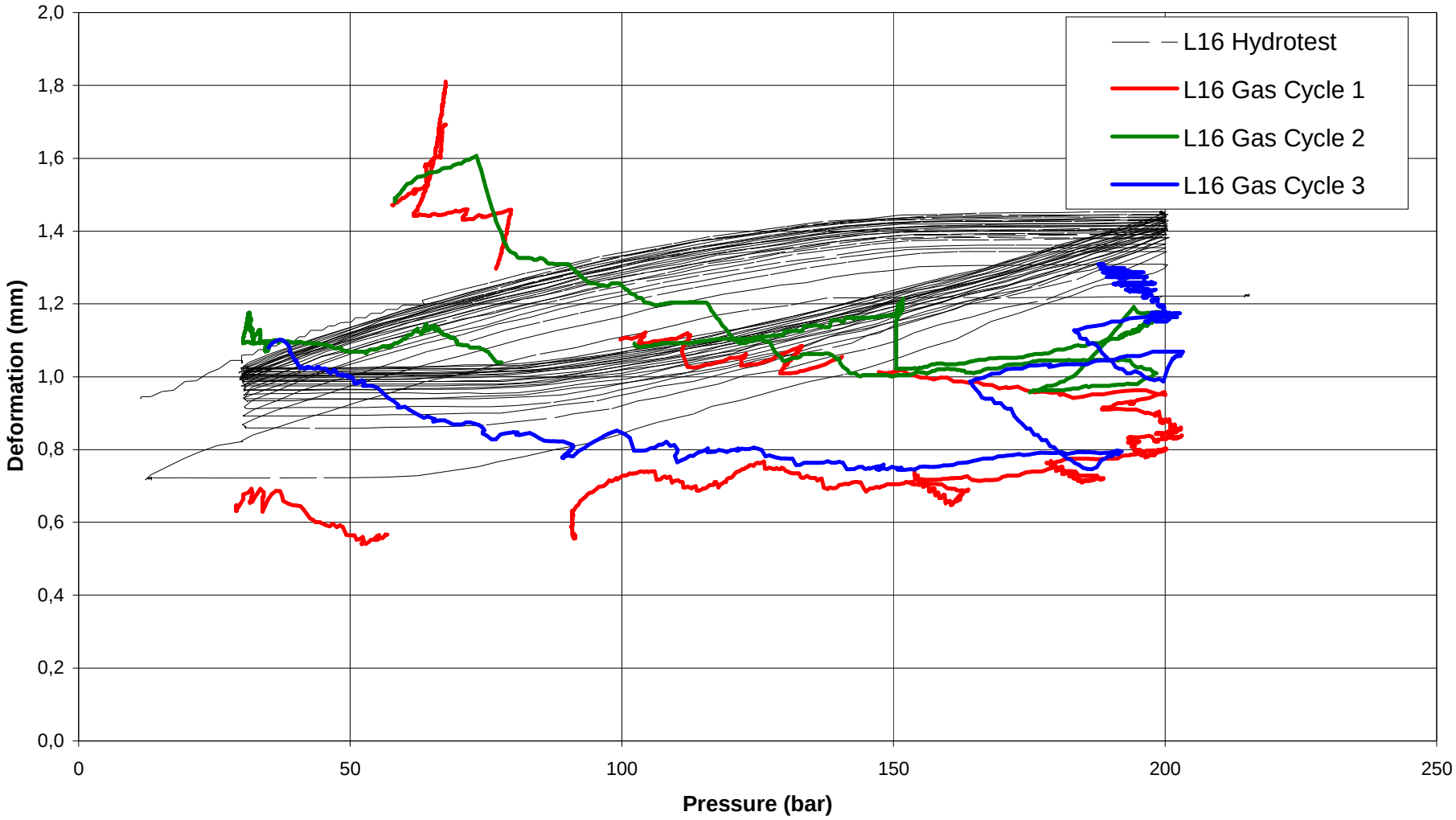
Rock mass deformation



Tangential strain



Strain in steel lining



Conclusions

- Behaviour of rock mass and cavern wall are as expected:
  - the deformation level is lower than expected,
  - the strain level is well below the design values,
  - the design assumptions have been confirmed with a margin.
  - the temperature variation in the cavern during gas operation has, as expected, a large influence on the deformation pattern.
- Steel lining is absolutely gas tight. Gas leak tests proved that the leak monitoring system is capable of detecting a small gas leak from the cavern in a very short time.
- The gas cycles demonstrated that the Demo Plant can fulfil the requirements regarding storage capacity and deliverability.
- It has been shown that the gas cooling/heating circulation system can control the temperature in the cavern, thereby increase the storage deliverability with several cycles possible per year