

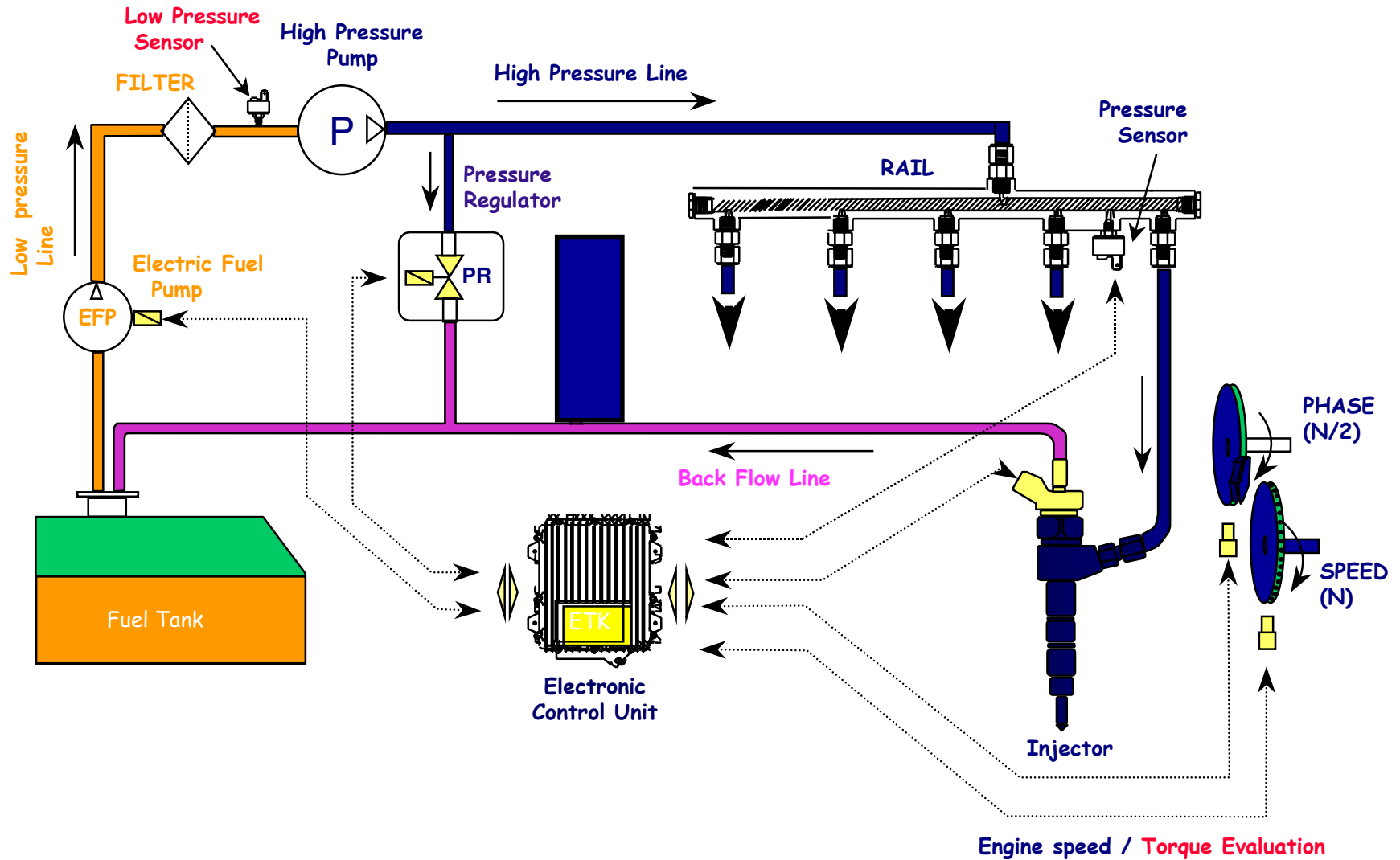
Fiat/Unito: Generation of Diagnostic Trees for On-board Diagnosis

Goals for on-board diagnosis:

- **(Quick) selection of the correct recovery action** in order to:
 - Guarantee passenger safety
 - Avoid damage
 - Avoid vehicle stop if possible
- Example: stop engine
 - if “injector blocked open” is suspected
 - but try to rule out this hypothesis
 - to avoid unnecessarily restrictive action
- Provide good starting point for off-board diagnosis



The Common Rail System

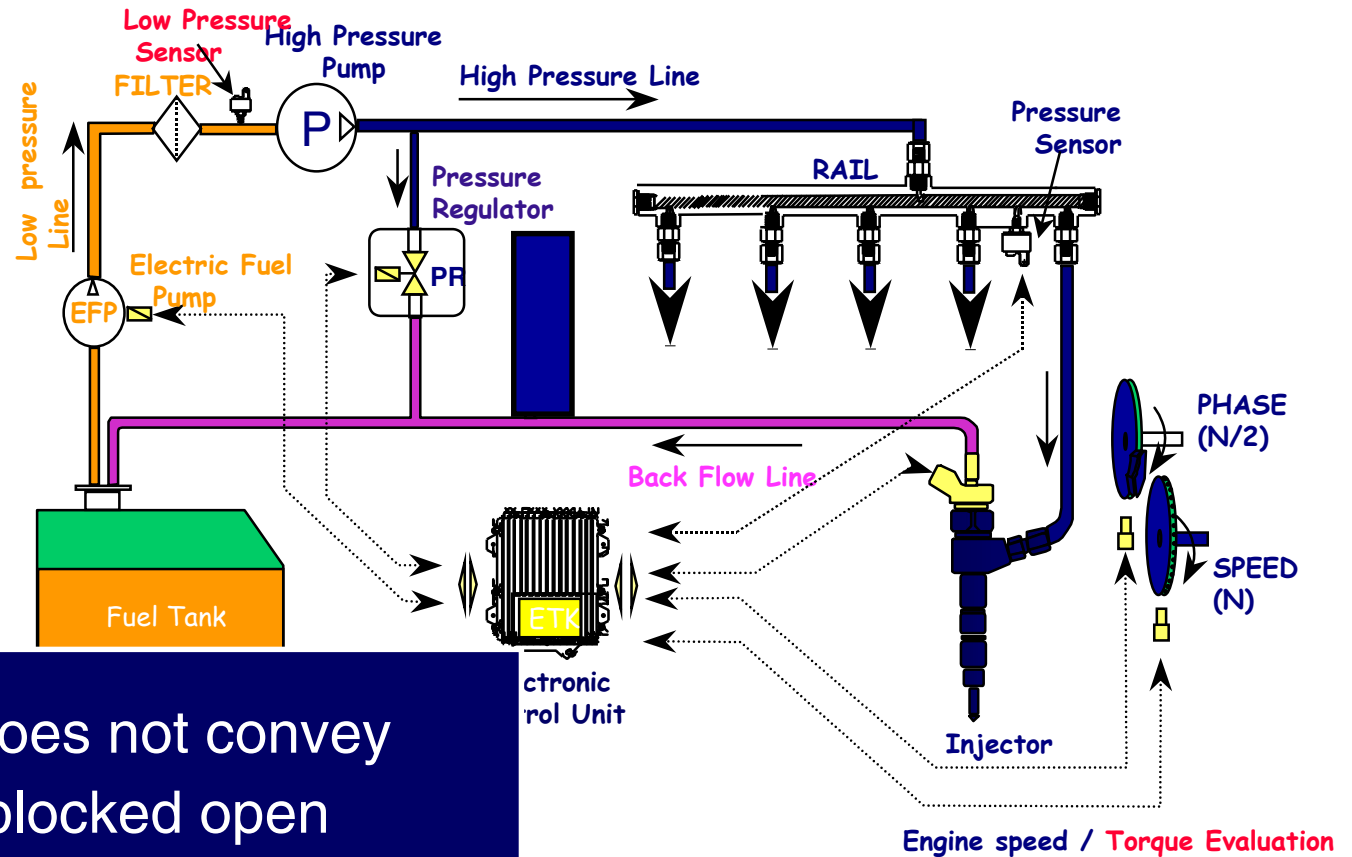


Faults and Recovery Actions

| Component | Fault Mode | Recovery action |
|------------------------------|----------------|------------------------|
| Low Pressure Circuit | Insufficient | Performance limitation |
| Pressure regulator | blocked open | Performance limitation |
| | blocked closed | Stop |
| High Pressure pipes and Rail | Leakage | Limp home |
| High pressure Pump | Blocked | Performance limitation |
| | insufficient | Performance limitation |
| Pressure Sensor | Low | Open loop |
| | Sensor blocked | Open loop |
| | Blocked | Open loop |
| Injectors | Recycle high | Performance limitation |
| | Blocked open | Stop |
| | Blocked closed | Go |
| | Sensor low | Open loop |
| | Recycle low | Go |



Fault Scenarios

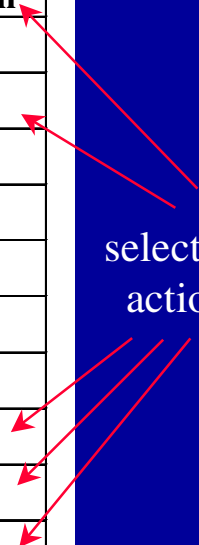


- Electric fuel pump does not convey
- Pressure regulator blocked open
- No injection at one cylinder
- Injector blocked open
(permanently injection in one cylinder)

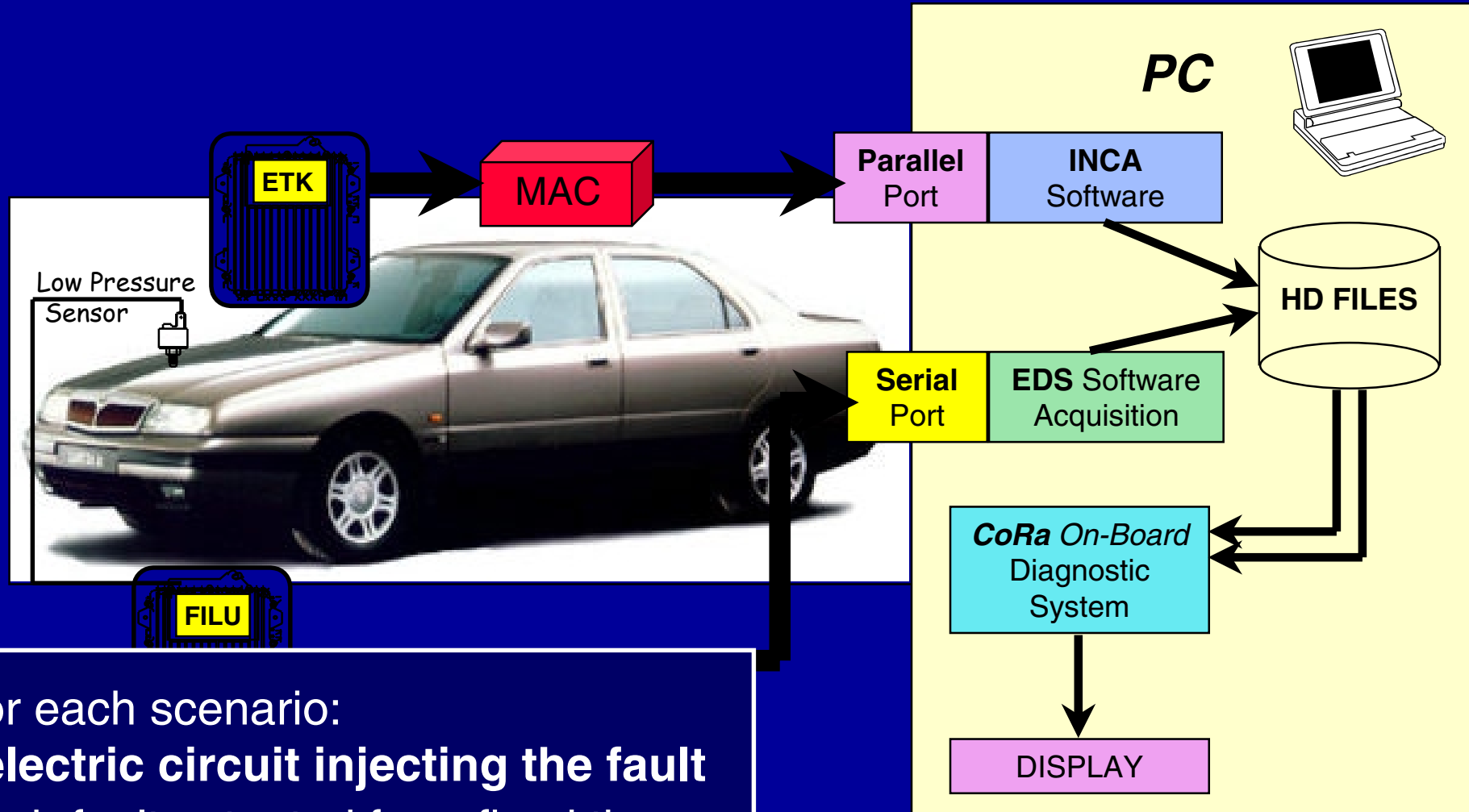
Diagnosis Results

| Observations | | | Diagnoses | Actions |
|-------------------|----------------|-------------|-----------------------------------|-------------------------------|
| Δ lowp_obs | Δ p_obs | Δ tm | | |
| - | - | 0 | lp_system insuff | Performance limitation |
| 0 | - | 0 | Pressure_regulator blocked_open | Performance limitation |
| | | | Hp_pipes_and_rail leak | Limp home |
| | | | Hp_pump blocked | Performance limitation |
| | | | Hp_pump insuff | Performance limitation |
| | | | Sensor low | Open loop |
| | | | Sensor blocked | Open loop |
| | | | Injectors recycle_high | Performance limitation |
| 0 | - | + | Injectors blocked_open | Stop |
| 0 | 0 | - | Injectors blocked_closed | Go |
| 0 | + | 0 | Pressure_regulator blocked_closed | Stop |
| | | | Sensor high | Open loop |
| | | | Sensor blocked | Open loop |
| | | | Injectors recycle_low | Go |

selected action



The Demonstrator Architecture



- For each scenario:
 - **electric circuit injecting the fault**
- Each fault actuated for a fixed time (for safety reasons)



Applying the Diagnostic Trees for Recovery Selection

