rupture position of corner rod H (550 mm)
relocated to -475 mm during the rod withdrawn
(videoscope observation through the guide tube of the corner rod H)

increased oxidation above 250 mm
Outlet gas behaviour during air ingress of QUENCH-18: starvation phenomena

consumed oxygen: 100 g; consumed nitrogen: 120 g; consumed steam: 450 g; released hydrogen: 45 g

t ≈ 10600 s: oxygen starvation, \( H_2 \) increase steam and nitrogen consumption
Gas release during the quench stage of QUENCH-18

released hydrogen: 238 g
released nitrogen: >54 g
QUENCH-18:
Zry-4 corner rods withdrawn before air ingress (rod D) and after temperature escalation (rod H)

rod D (550 mm):
pre-oxidation of Zry cladding in steam at 900 °C to ZrO$_2$ and $\alpha$-Zr(O) thicknesses of 5 µm

rod H (520 mm):
strong oxidation during transient 900...1900 °C in steam + air was followed by degradation of ZrO$_2$ layer and formation of ZrN under steam/oxygen starvation

strongly brittle bundle broken in two parts during disassembly

- thin ZrO$_2$
- partially melted $\alpha$-Zr(O)
- thick ZrO$_2$
- porous ZrN
Analysis of cladding segment spalled at 1350 mm from rod #20
(QUENCH-18 bundle)