Enhanced inner structure for an improved lithium transport during heat pipe operation

- During operation of first lithium plasma cell accumulations of solid lithium balls were observed
- Balls grew over time until beam tube was blocked
- Mesh was used for lithium transport by capillary forces
- Blockage was most probably caused by an insufficient heat transfer from the chamber walls to the inlayed mesh (complicated geometry) together with insufficient lithium transport due to too big mesh pores
- For next generation plasma cell 0.3 mm wide grooves are foreseen
- Grooves are machined directly into the beam tube by wire eroding
- Generate a strong capillary force for improved lithium flow
- As grooves are part of the chamber body a good heat transfer is guaranteed
- First tests on simplified beam tube show promising results → no solid lithium deposition with increased lithium vapour density
- New plasma cell is manufactured and will be tested in summer 2016

Interlock system

- For intended wake field experiments a lithium plasma density of $10^{15}$ cm$^{-3}$ is required
- Density is achieved by evaporating lithium at 750 °C in an argon atmosphere of 0.8 mbar
- Polymer foils are used as electron windows to separate plasma from ultra high vacuum (UHV) beam line
- Foils have to be as thin as possible (less than 2 µm to avoid strong scattering of electron beam) → potential risk to be destroyed by radiation and/or electron beam
- Interlock system is developed to protect beamline components

Residual gas analyser (RGA)
- RGA measures via by-pass gas components on both sides of the plasma cell
- Mass 7(Li), 28(N$_2$), 32(O$_2$) and 40(Ar) are constantly monitored and transformed into analogue signal

Vacuum gauges
- One cold cathode gauge is installed on UHV side of each window
- One Pirani gauge measures the pressure inside the plasma cell

Any change of an interlock signal will close the vacuum valves to prevent the distribution of lithium vapour inside the PITZ beamline