Latest News on High Average Power Operation at PITZ.

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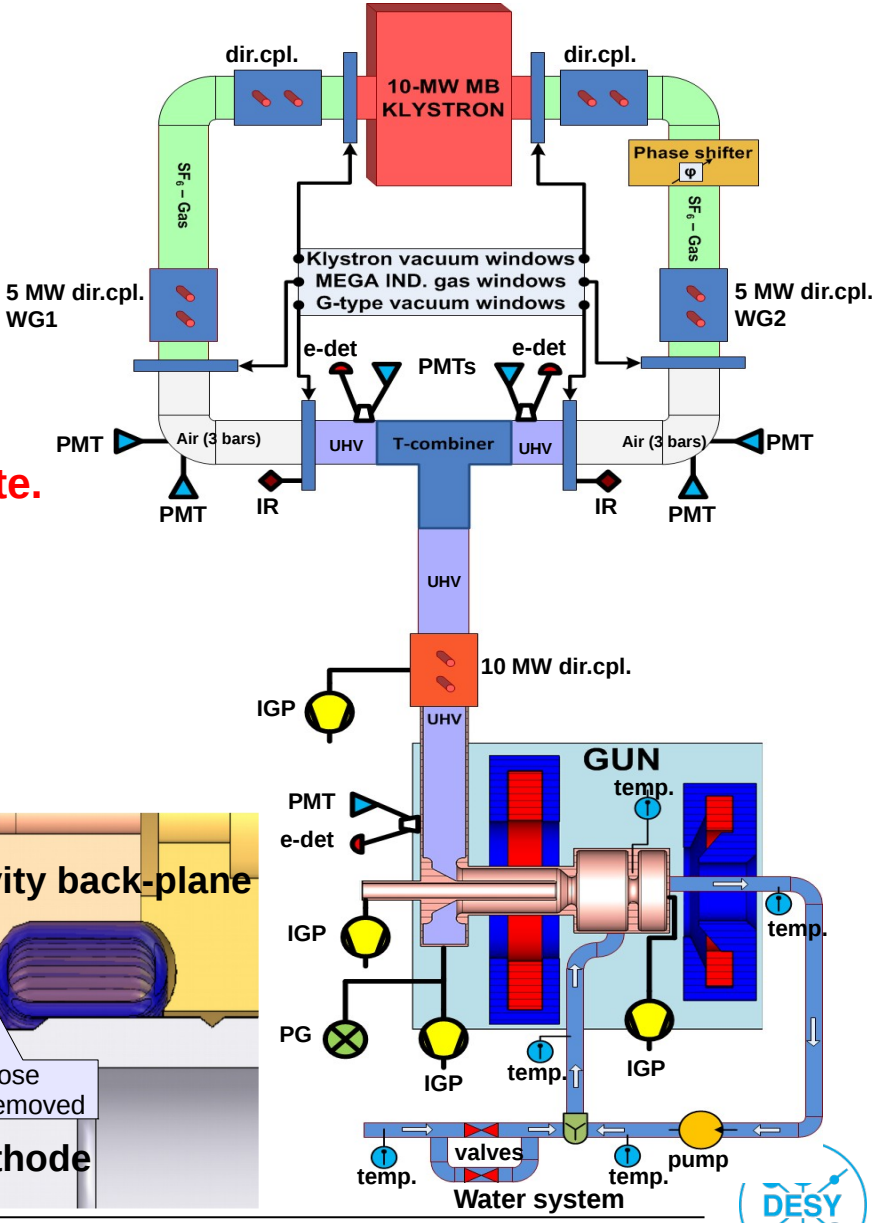
> Motivation:

- Develop, test and characterize e- sources for FLASH and the European XFEL.
- Long bunch train (SC linac) and high cathode field.
- Stable and reliable operation at 42kW average power:

  6.5 MW, 650 us RF pulse length, 10Hz rep. rate.

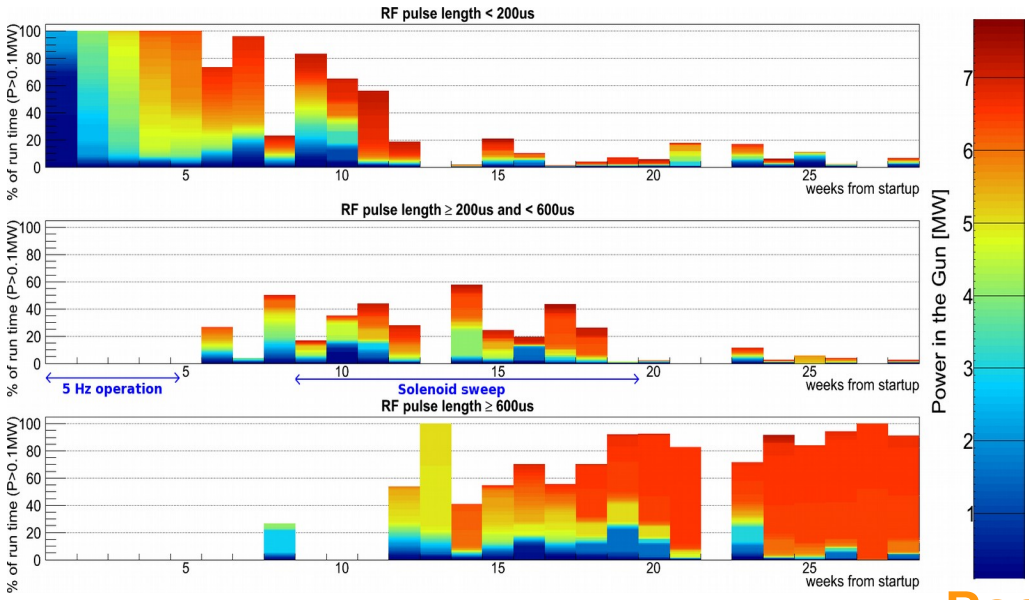


> Features of the gun 4.6 setup:

- Normal conducting L-band gun.
- New design of cathode spring holder.
- Two pre-conditioned DESY-type RF windows.
- Optimized vacuum window position.
- Sensitive settings for ILs during conditioning phase.
- Fast IL system (few us).
- only vacuum is a slow IL system.

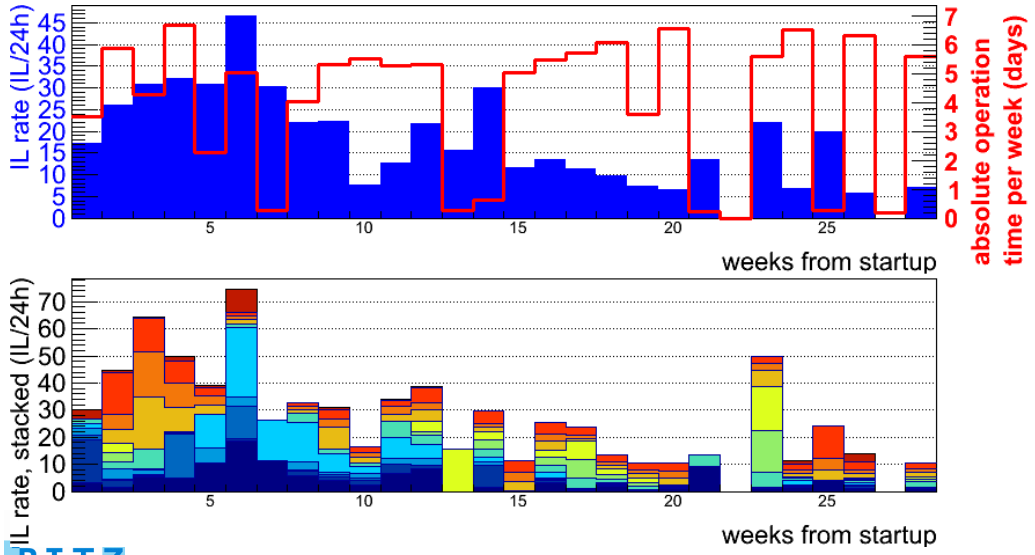
Power, Pulse Length and ILs History.

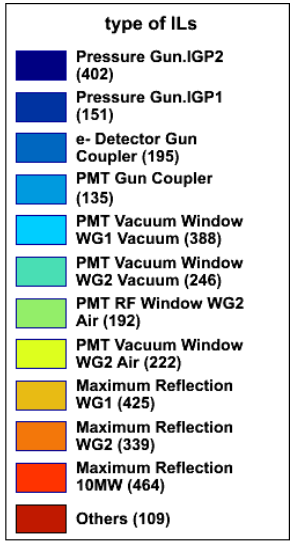
(all data with >0.1MW peak power in the gun are taken into account)



- Conditioning started on 7.3.2016.
- No signature of cathode springs failure. New cathode spring design works.
- 16 weeks to reach 6.5 MW @ 650 us (XFEL nominal parameters).
- More than 80% of operation above 6 MW and above 600 us in the last month (goal >99%), still increasing.

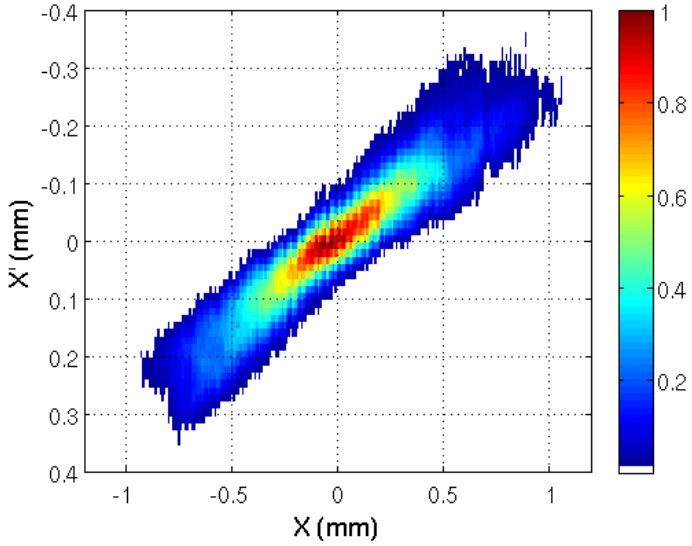
Poster MOPRC002, today 16h - 16h30

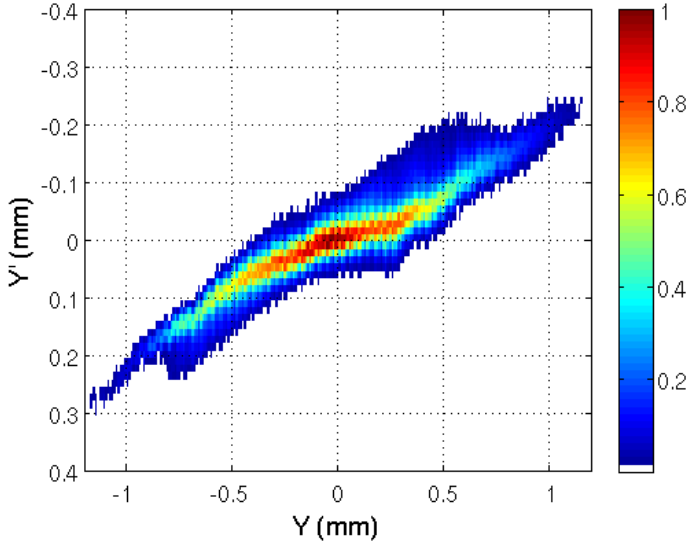


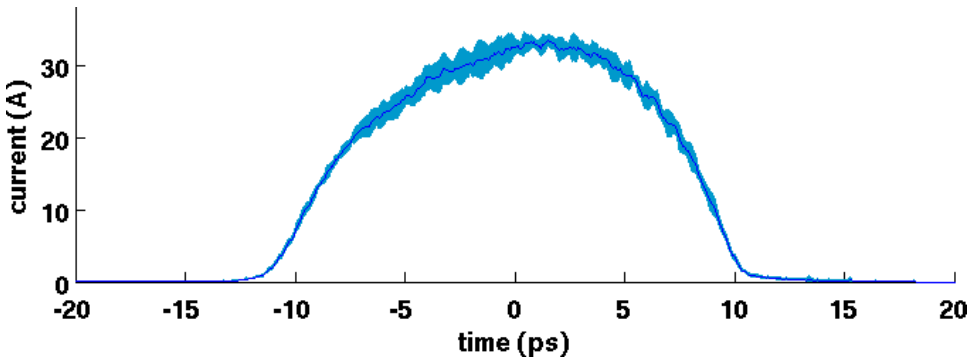


- The IL rate decreases.
- Different type of ILs, changing with time.
- Significant amount of ILs are due to the RF transmission line.

Electron Beam Characterization (E_{cath}=60 MV/m, 0.5 nC charge, 11 ps Gaussian)







- After optimization (solenoid, laser spot size):
  - Projected transverse emittance: 0.80±0.04 mm.mrad
  - Bunch length: 16.3±0.4 ps FWHM (32 A peak current)
  - Brightness ($\frac{2I_{peak}}{\varepsilon_x \varepsilon_y}$): 100 A.mm^{-2}.mrad^{-2}
- Better than specifications for the European XFEL initial phase.
- With improved laser shaping, we will go far beyond nominal specifications.

About electron beam imperfection studies: **Poster MOPLR013, today 16h30 - 17h**