Dark current measurement at PITZ

PITZ setup

Gun dark current measurements

Booster dark current measurements

Summary

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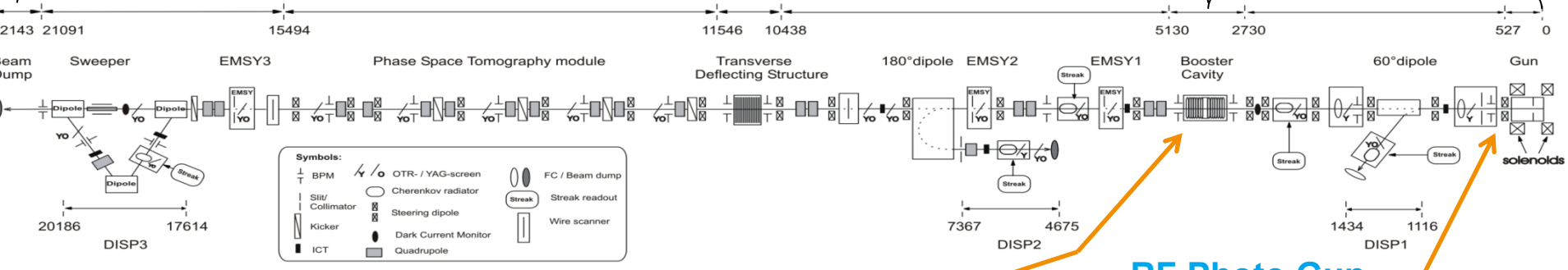
HELMHOLTZ GEMEINSCHAFT

DESY

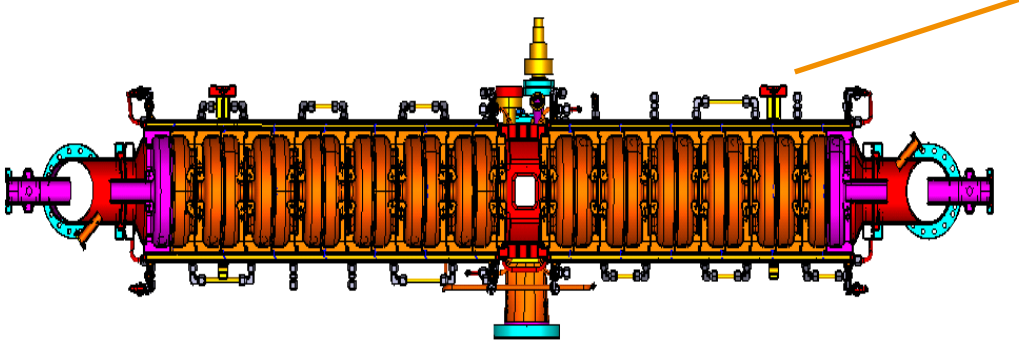
PITZ Setup

High energy part (up to ~25 MeV/c)

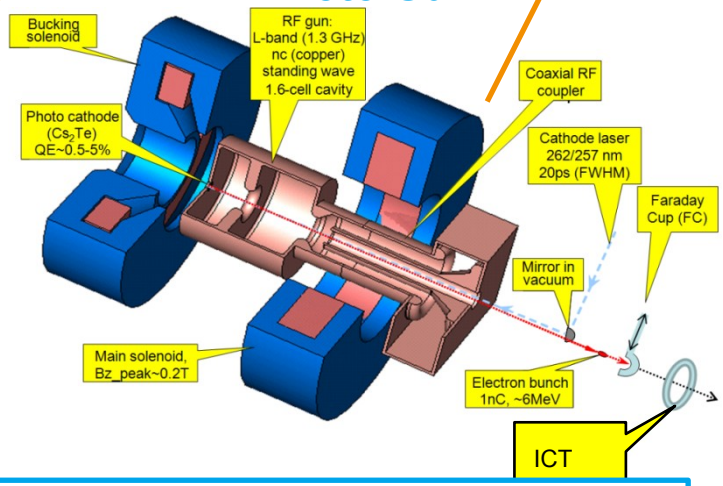
Low energy part (up to ~6.7 MeV/c)



CDS Booster



RF Photo Gun



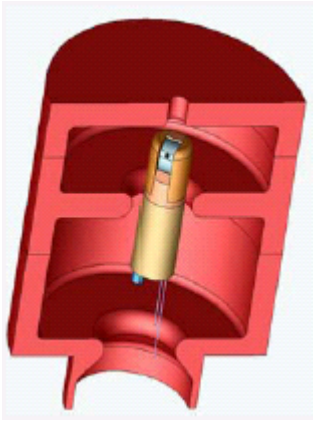
14-cell, L-band, normal-conducting copper Cut Disc Structure (CDS)
Max. RF power → 8.6 MW
Max. gradient 14 MV/m.
Max. momentum gain 25 MeV/c.
Max. pulse length 900 μs.
Repetition rate 10 Hz
Operating temperature 44 °C.

1.6-cell L-band, normal conducting copper photocathode RF cavity
Max. RF power → 7 MW
Max. gradient →60 MV/m
Max. momentum gain→6.7 MeV/c
Max. pulse length →700 μs
Repetition rate →10 Hz
Cathode material → Cs_2Te.
Operating temperature 78 °C

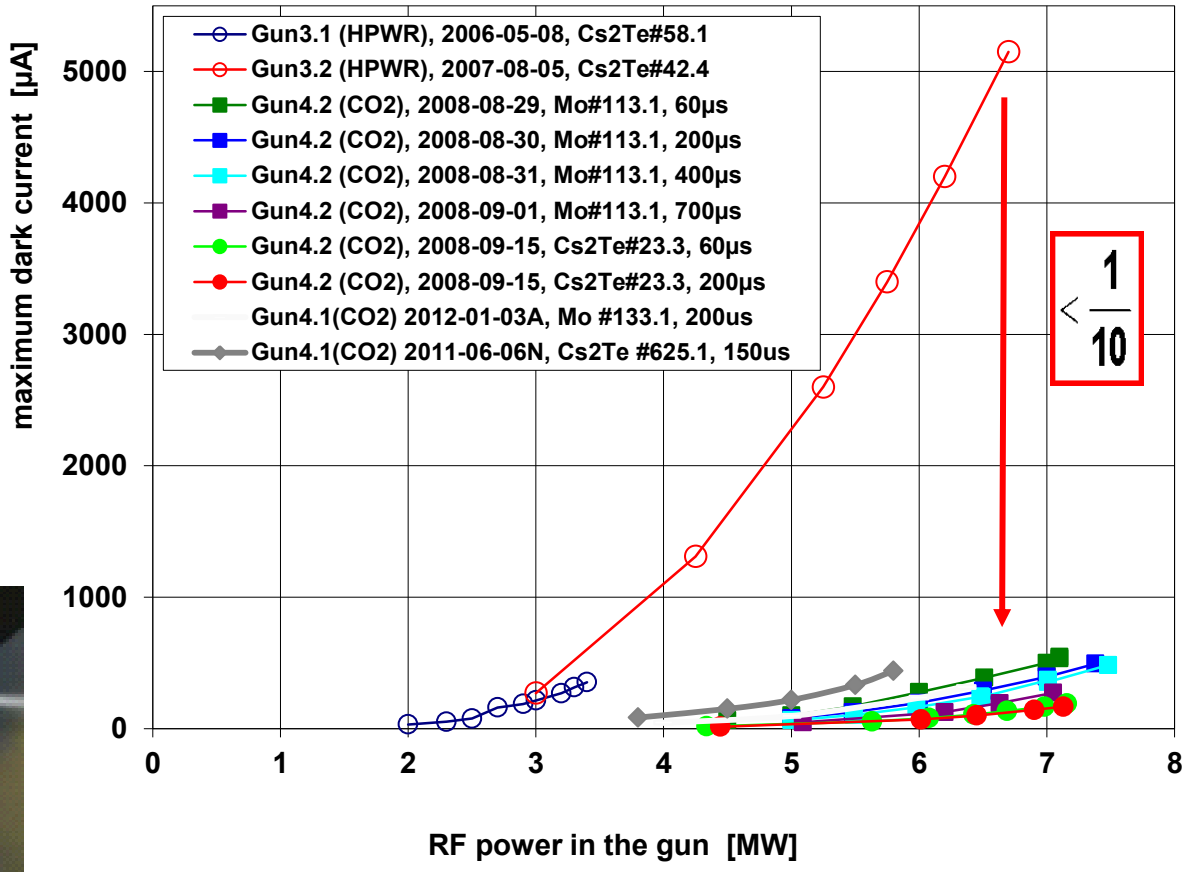
Gun dark current measurements

Dry-ice sublimation-impulse cleaning
→ **significant dark current reduction**

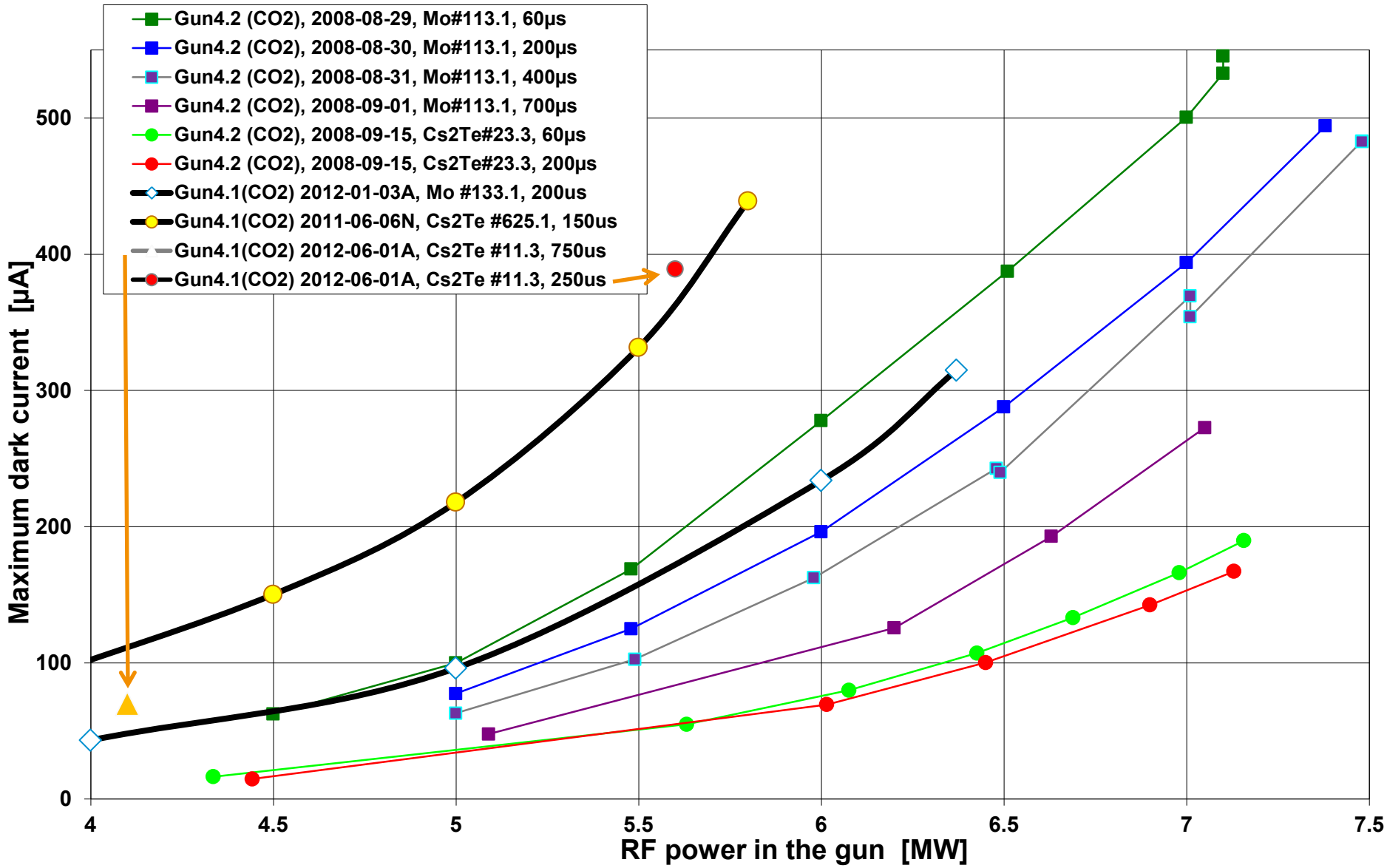
Vertical cleaning setup with 110° rotating nozzle.



Dark current in Faraday cup versus RF power for different Guns and cathodes



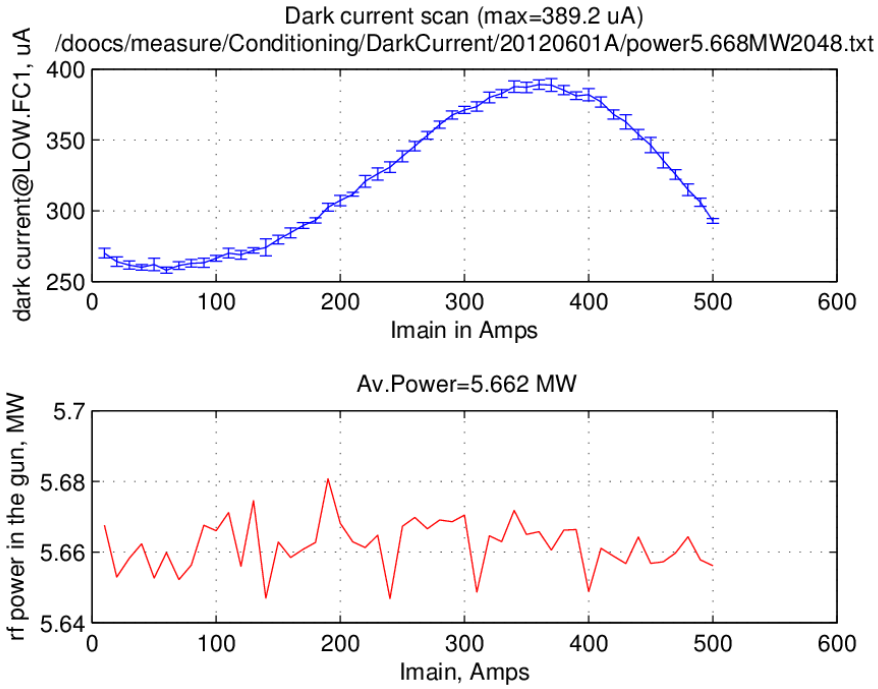
Detailed gun dark current measurements



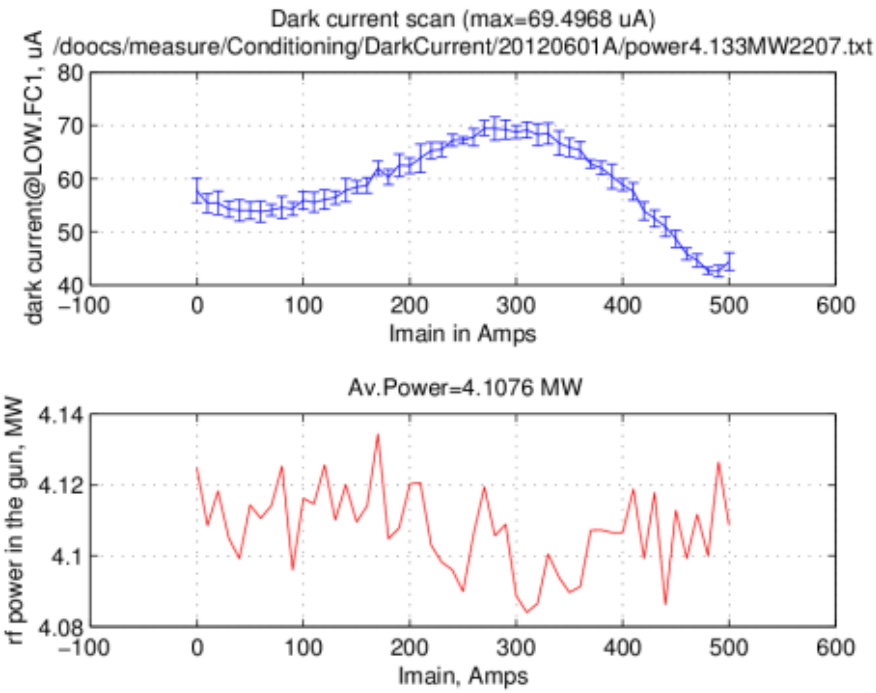
Latest Gun 4.1 dark current measurements at PITZ 01.06.2012

Dark current as a function of main solenoid current

5.6 MW power in the gun
250 us RF pulse duration

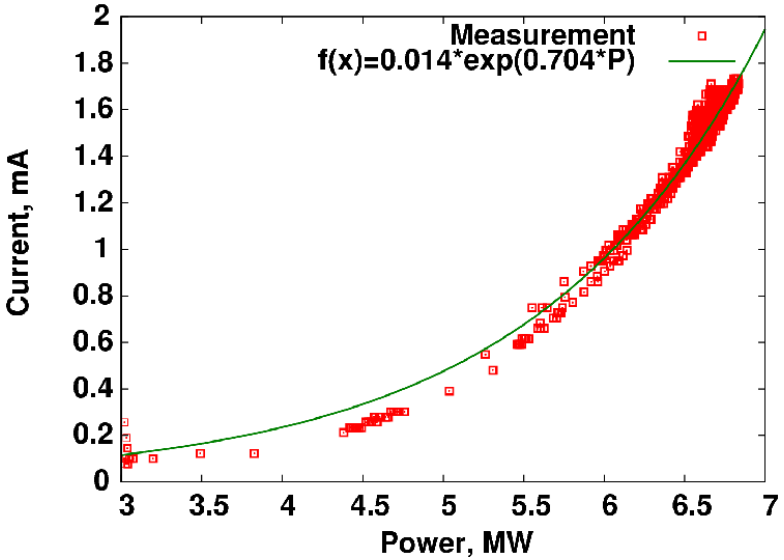


4.1 MW power in the gun
750 us RF pulse duration.

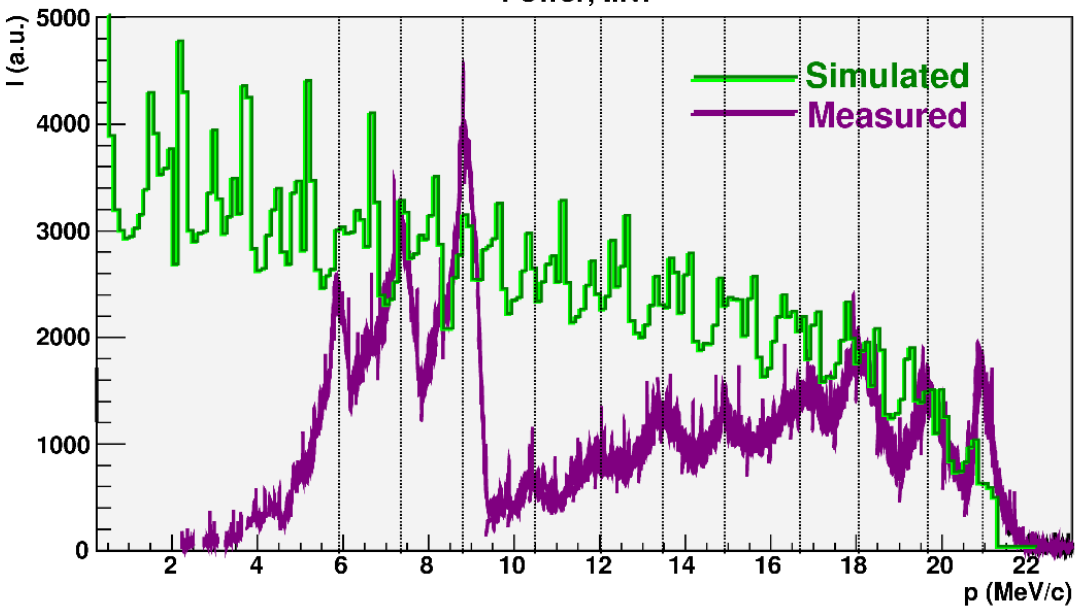


Booster dark current measurements

Measurement was done using Dark Current Monitor (DCM)



Measurement was done downstream in High Energy dispersive arm



- Well pronounced bumps
- Three cells have the most contribution
- Three bumps are missing in low energy part of the spectrum

Summary

- Significant dark current reductions can be obtained by the dry-ice sublimation-impulse cleaning procedure.
- The latest measured dark current from the gun is 389 µA for the 5.6 MW power with 250 µs pulse duration and 70 µA for the 4.1 MW power with 750 µs pulse duration
- Booster dark current of up to 1.8 mA was measured with the DCM

upstream the cavity at full power of 6.6 MW

- The measurement showed striped spectra similar to the simulations, with more distinct bumps and different relative intensity
  - Three lowest energy bumps are missing, next three deliver the highest dark current