

Dark current measurement at PITZ

PITZ setup

Gun dark current measurements

Booster dark current measurements

Summary

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Unwanted Beam Workshop 2012

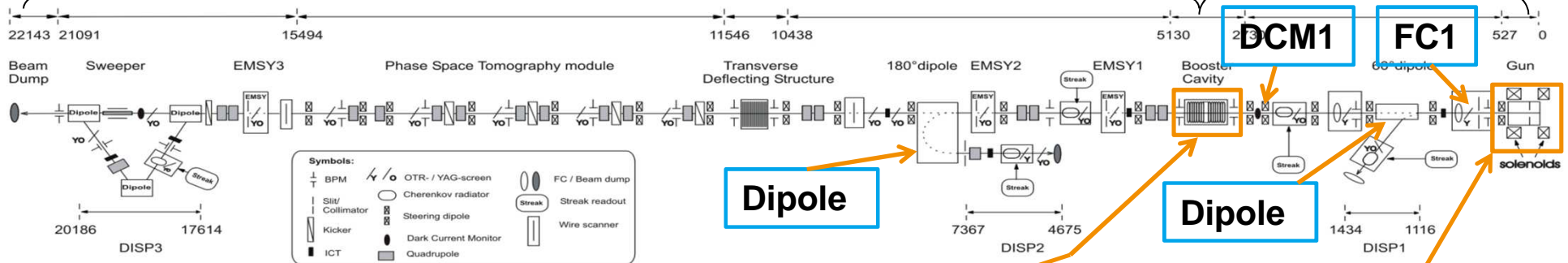
Humboldt-University Berlin,

17-18.12.2012

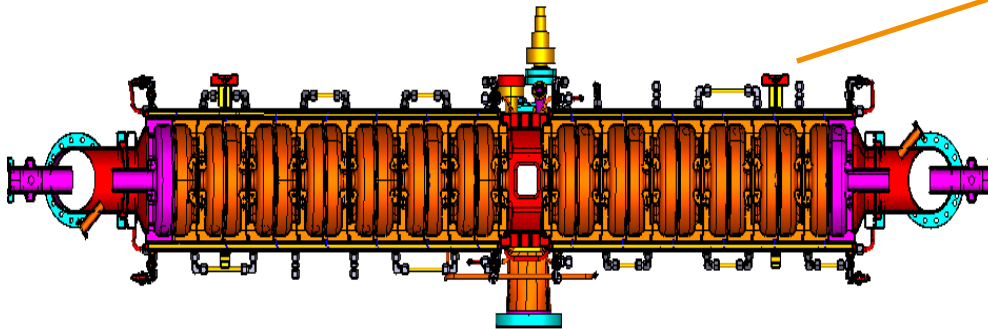
PITZ Setup

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

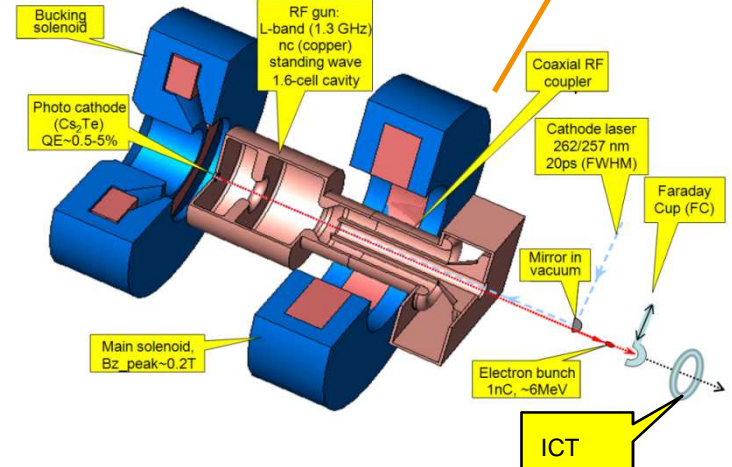
Low energy part (up to ~6.7 MeV/c)



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.

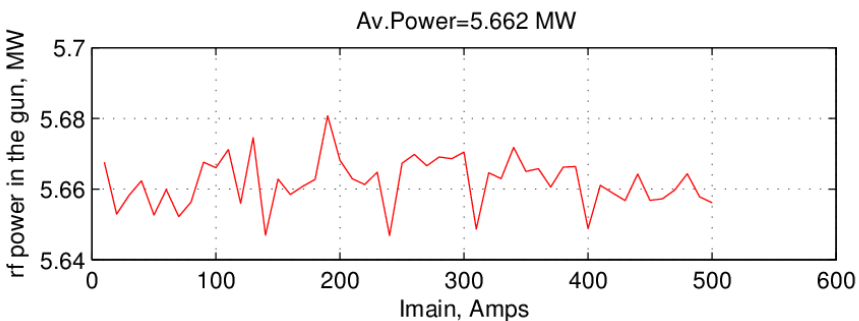
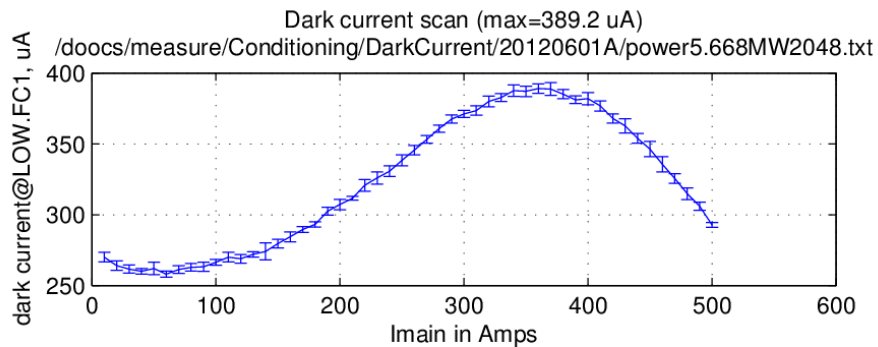
1.6-cell L-band, normal conducting copper photocathode RF cavity
 Max. RF power → 7 MW
 Max. gradient → 60 MV/m
 Max. momentum gain → 6.7 MeV/c
 Max. pulse length → 700 μs
 Repetition rate → 10 Hz
 Cathode material → Cs₂Te.
 Operating temperature 78 °C

Gun 4.1 dark current measurements at PITZ

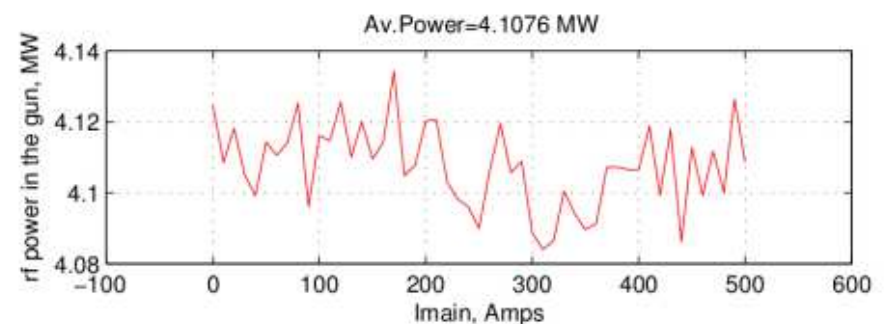
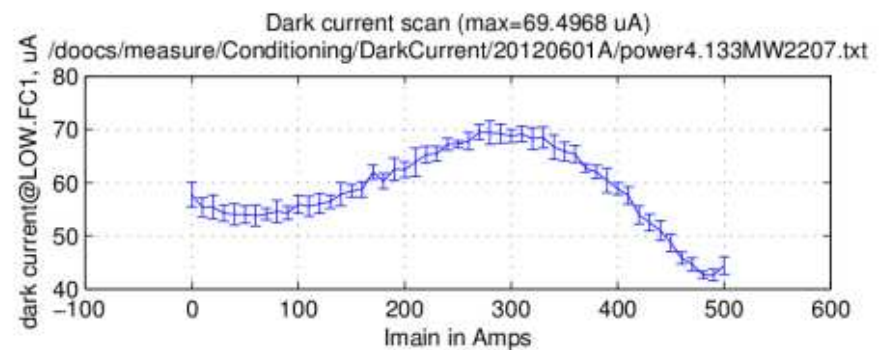
01.06.2012

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.

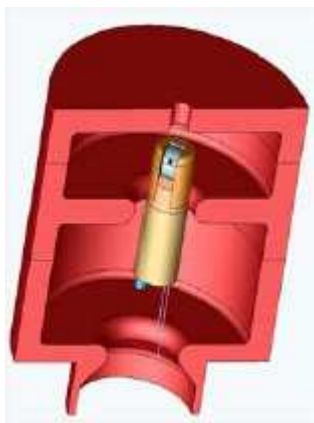


Gun dark current measurements

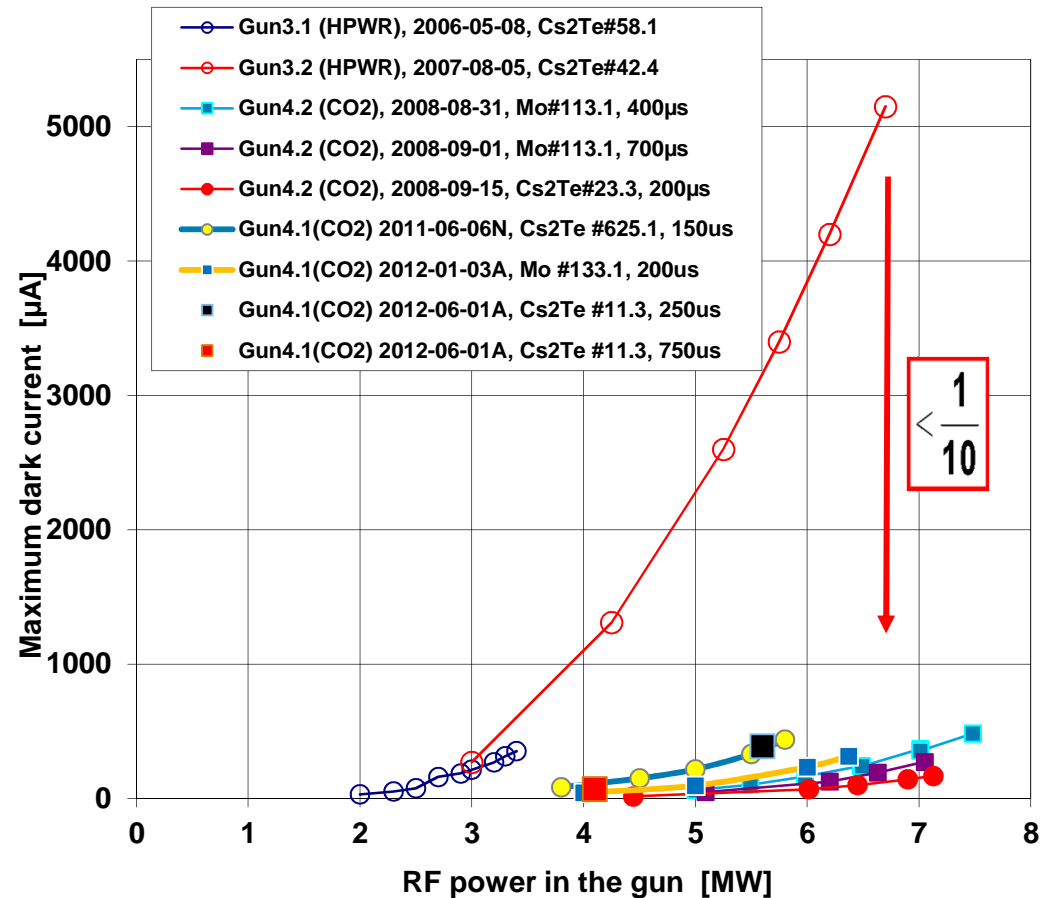
Dry-ice sublimation-impulse cleaning
 → **significant dark current reduction**



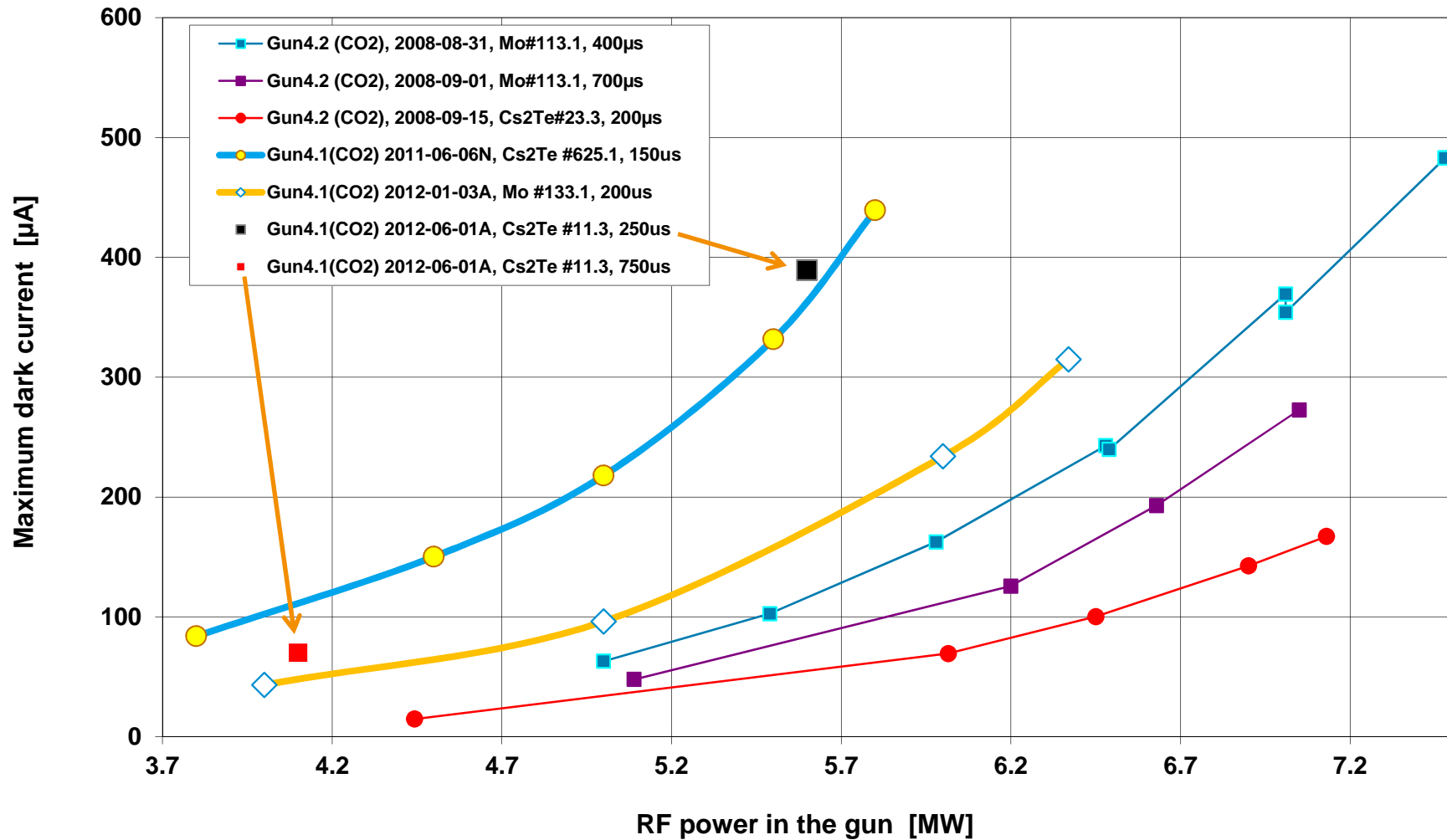
Vertical cleaning setup with 110° rotating nozzle.



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

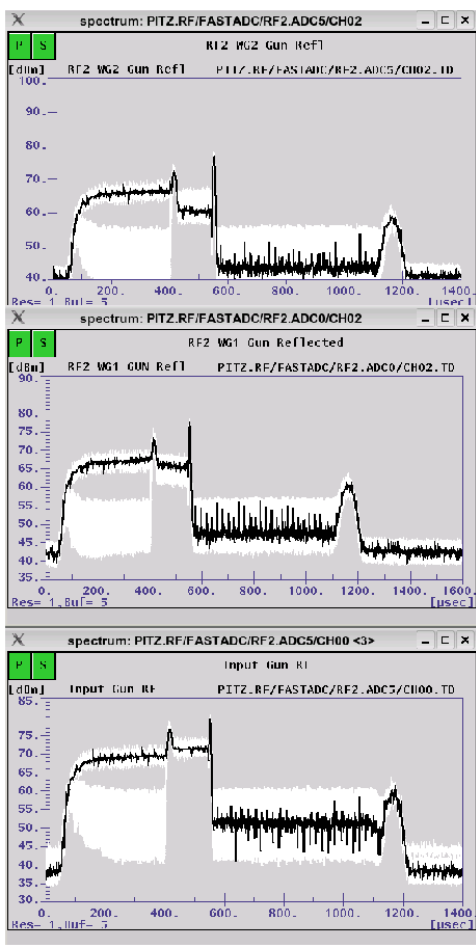


Detailed gun dark current measurements

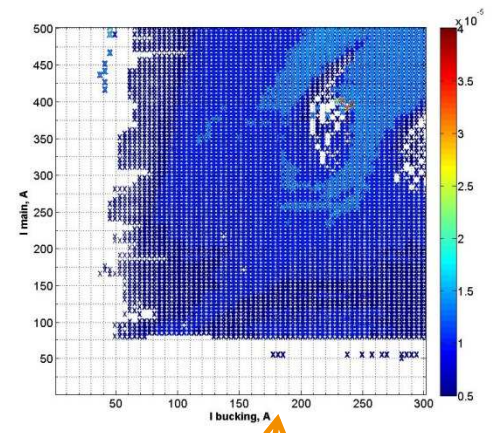
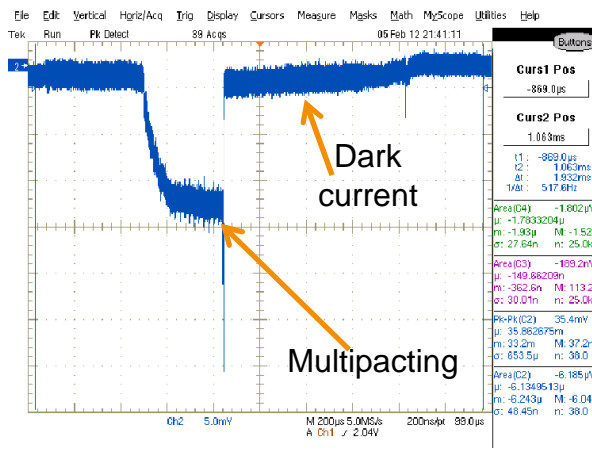


Gun 4.1 multipacting measurements

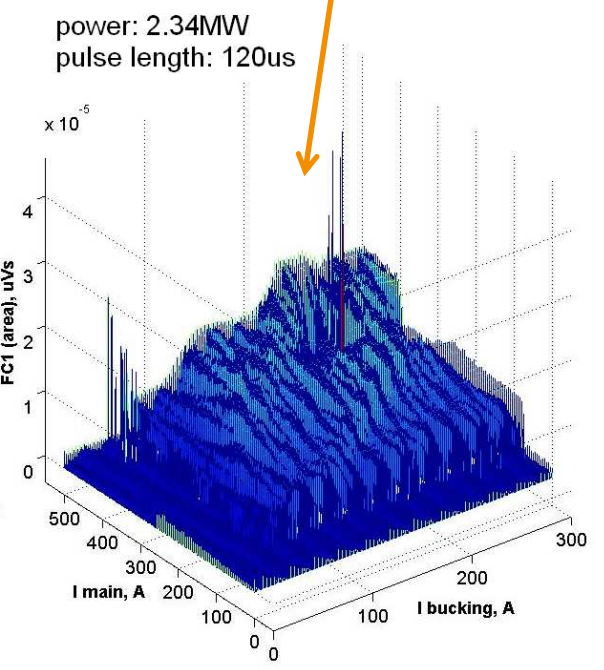
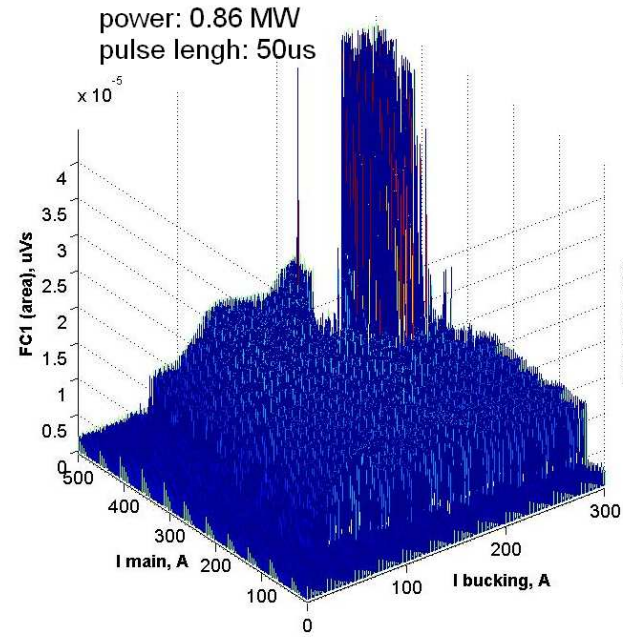
RF reflected power signals



FC signal



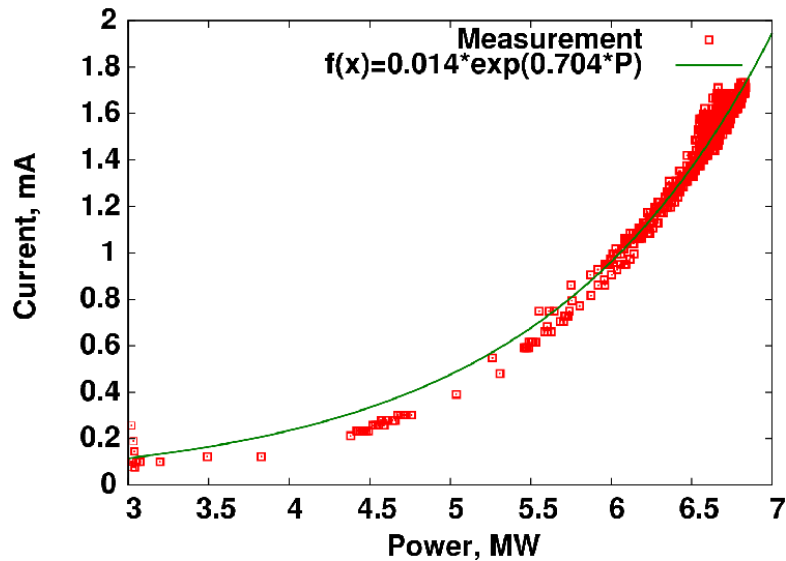
Solenoid scan maps for multipacting measurements



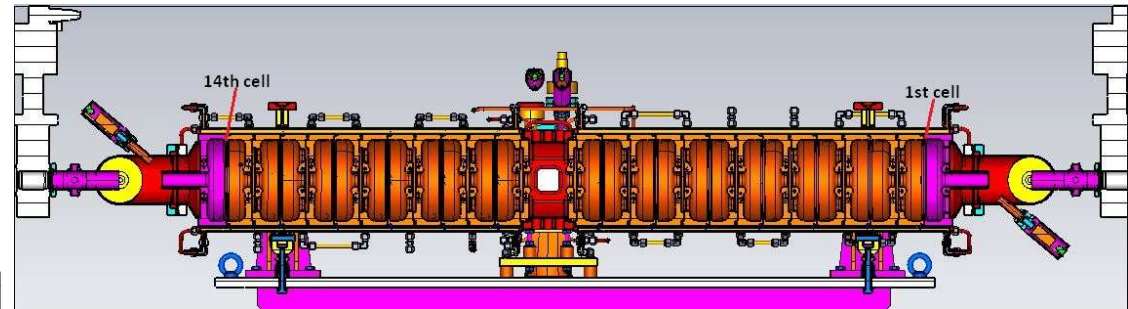
Booster dark current measurements

Current measurements

- Measurement was done using Dark Current Monitor (DCM)
- Measured DC @ FC1 is ~10 times lower



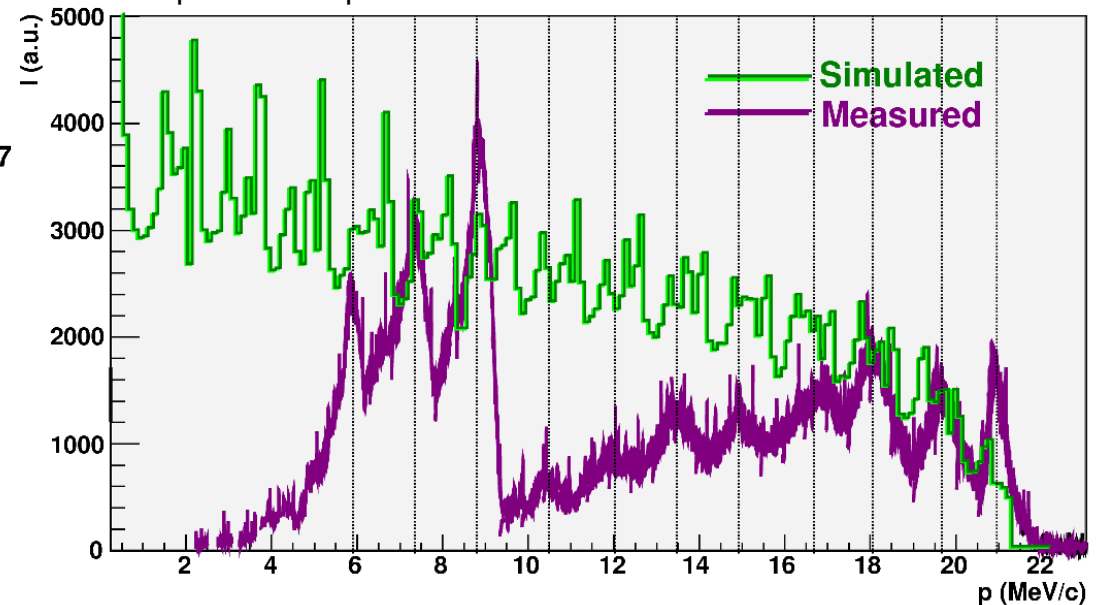
Booster geometry



DC spectrum measurements

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 about 400 μA for the ~ 5.5 MW power with 250 μs pulse duration and 70 μA for the 4 MW power with 750 μs pulse duration
- Solenoid scan maps are performed for multipacting measurements
- 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 spectra measurement showed periodic structure 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