

# Dark current measurements with Gun3.1 at PITZ



# Gun history at PITZ

**Gun2:** prepared at PITZ in 2001-2003

→ used at FLASH since 2004

**Gun1:** used at PITZ in 2004/2005

→ high power tests up to 7 MW (57 MV/m)

**Gun3.1:** spare gun for FLASH

→ conditioning up to the full FLASH specifications:

- 10 Hz repetition rate

- 900 ns pulse length

- 3.5 MW peak power

- 31.5 kW average power (maximum ever reached)

**Gun3.2:** installation at PITZ by end 2006

→ run with gradients up to 60 MV/m

# Dark current measurements with Gun3.1

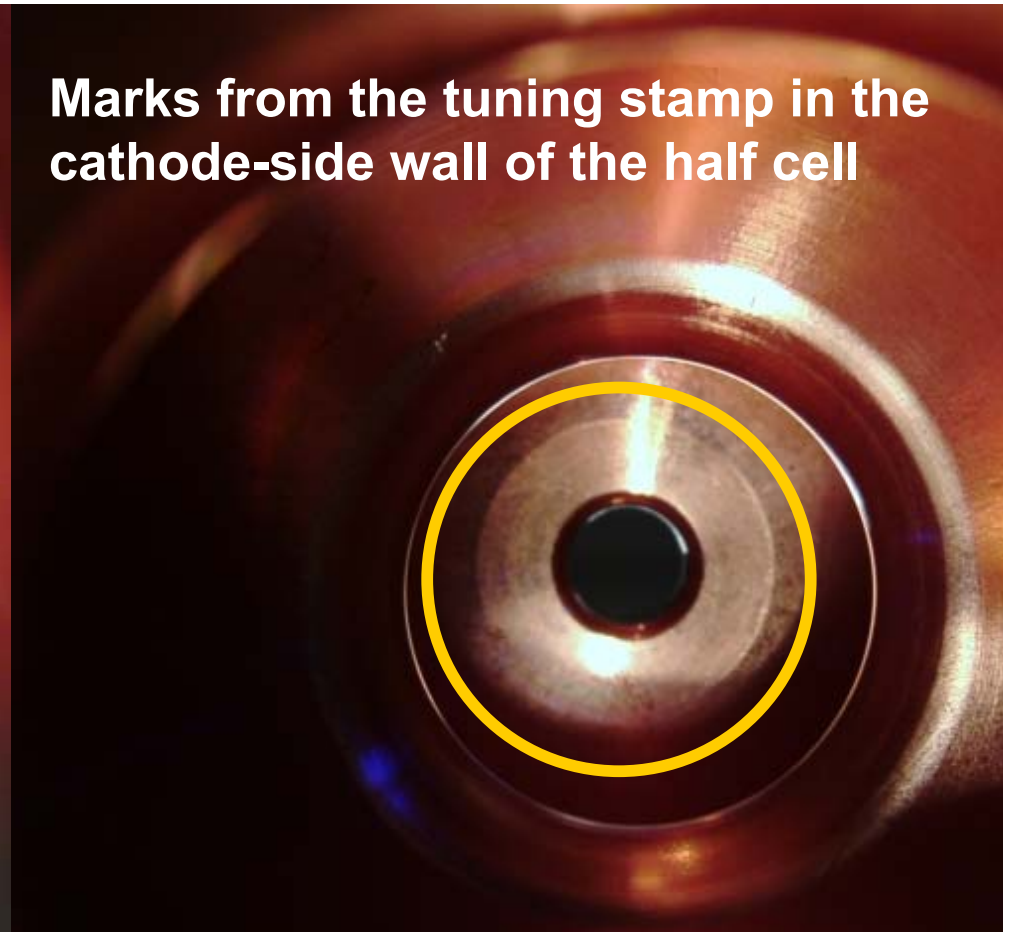
Special question for **Gun3.1**:

Do the tuning marks produce higher dark current level ?

Marks from the tuning clamp in the coupler-side wall of the full cell



Marks from the tuning stamp in the cathode-side wall of the half cell

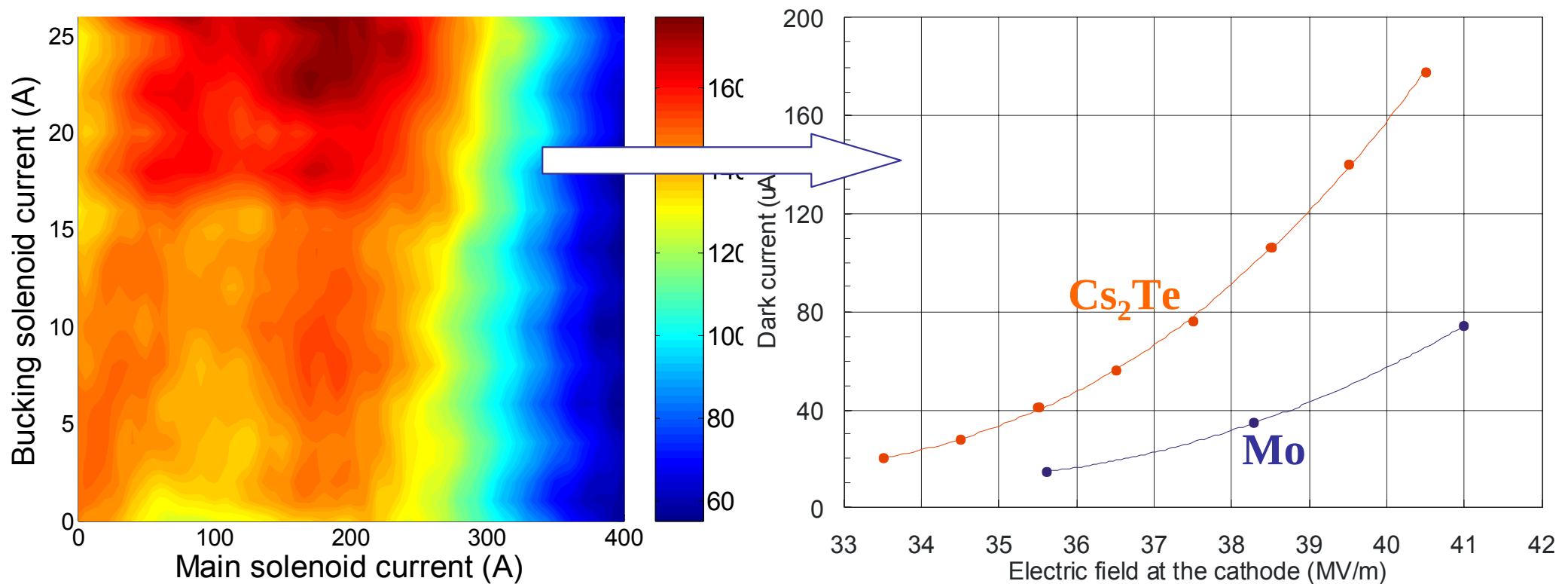


# Dark current measurements

... in dependence on the accelerating gradient at the cathode for different cathodes (Mo / Cs<sub>2</sub>Te) and solenoid currents:

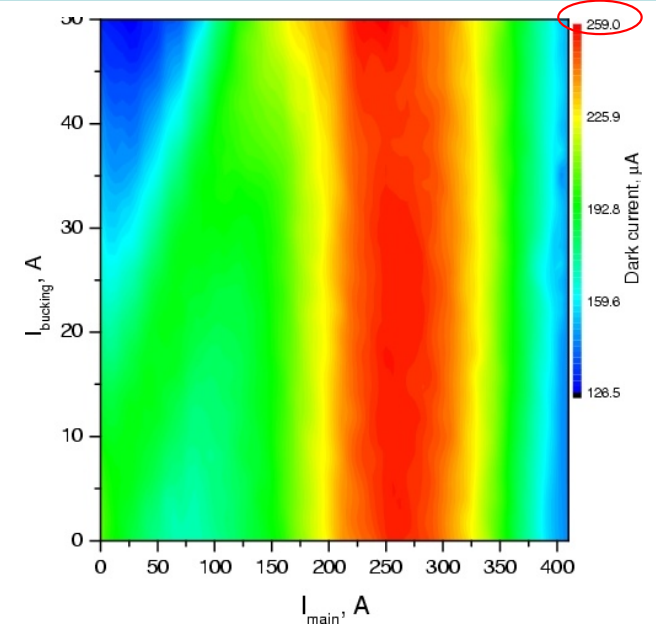
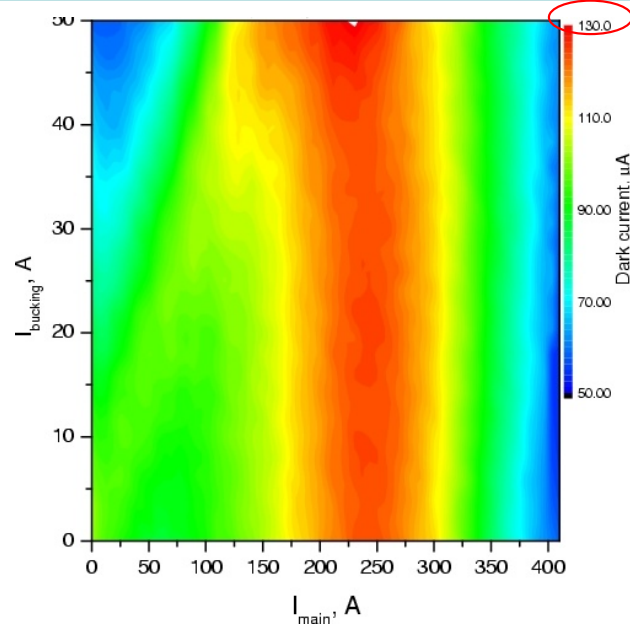
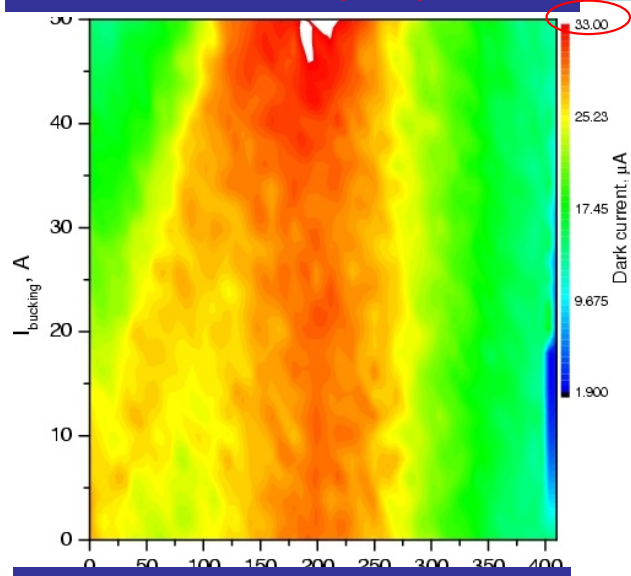
- 2D scans (main vs. bucking solenoid current)
- 1D scans (compensating bucking current)
- both solenoids off

+ comparison with formerly recorded data, e.g. Gun2 (2002):



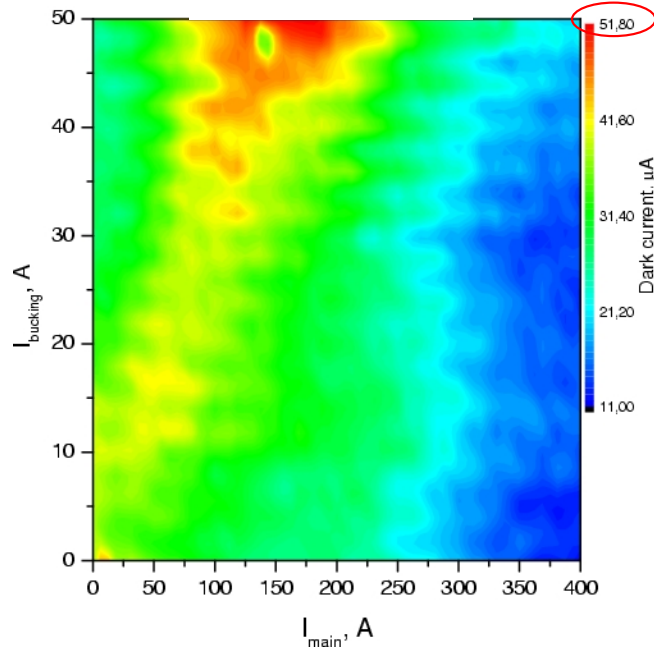
# 2D dark current measurements

Cathode 75.1 (Mo)

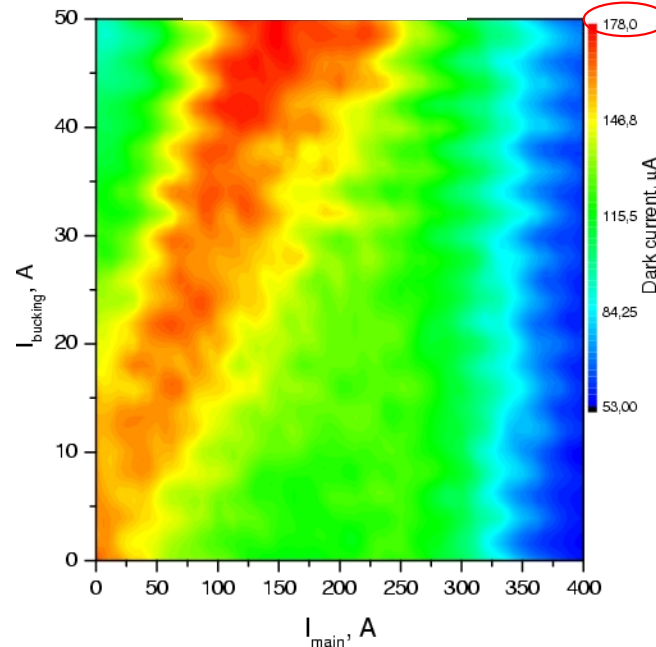


Cathode 58.1 ( $\text{Cs}_2\text{Te}$ )

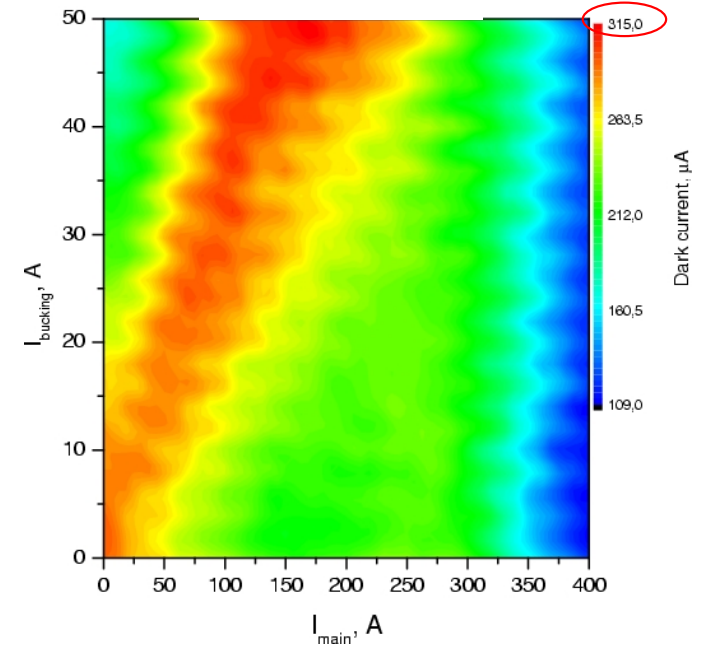
35 MV/m



40 MV/m

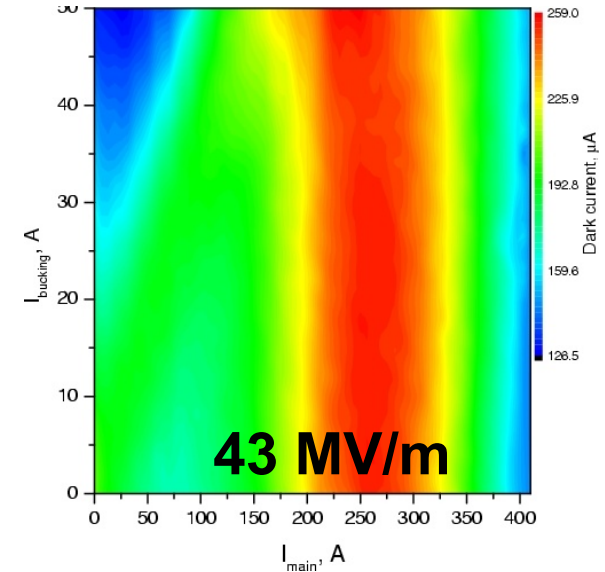
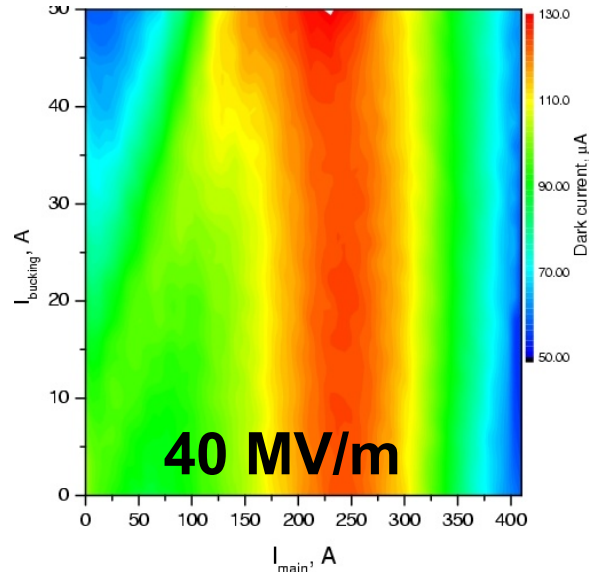
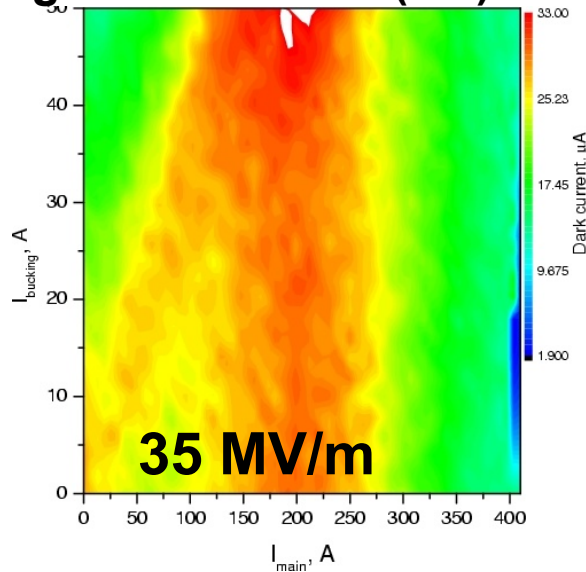


43 MV/m



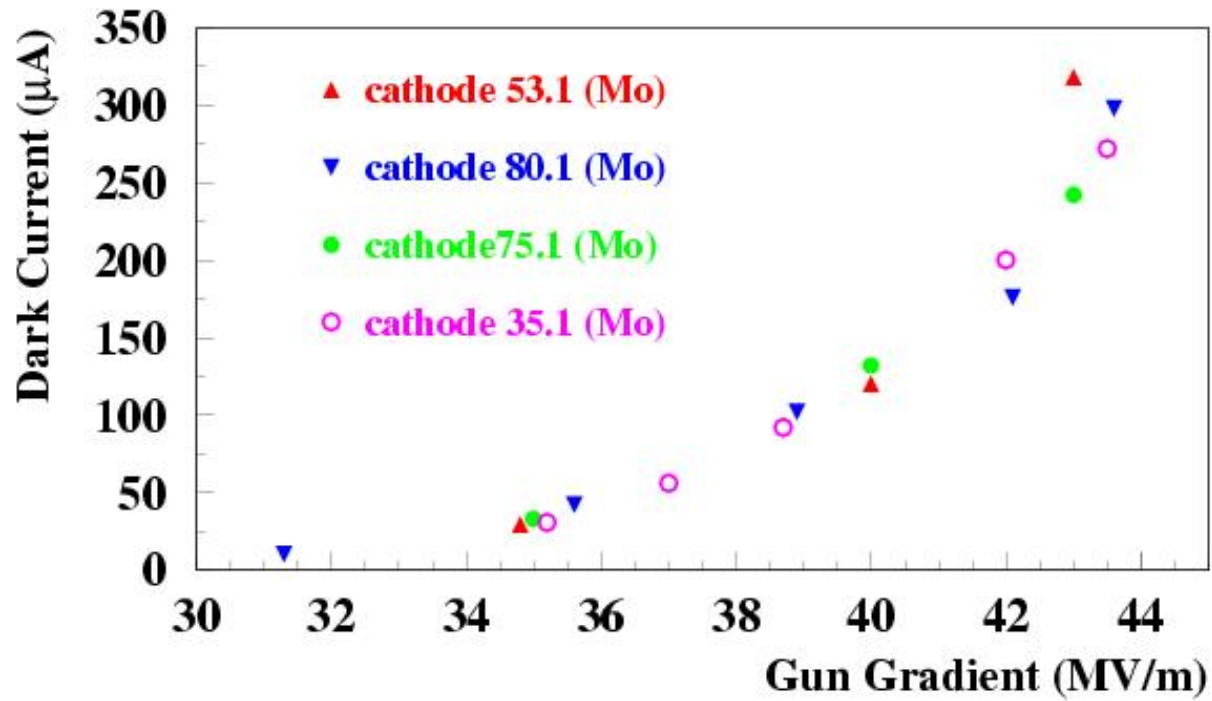
# 2D dark current measurements

e.g. Cathode 75.1 (Mo)



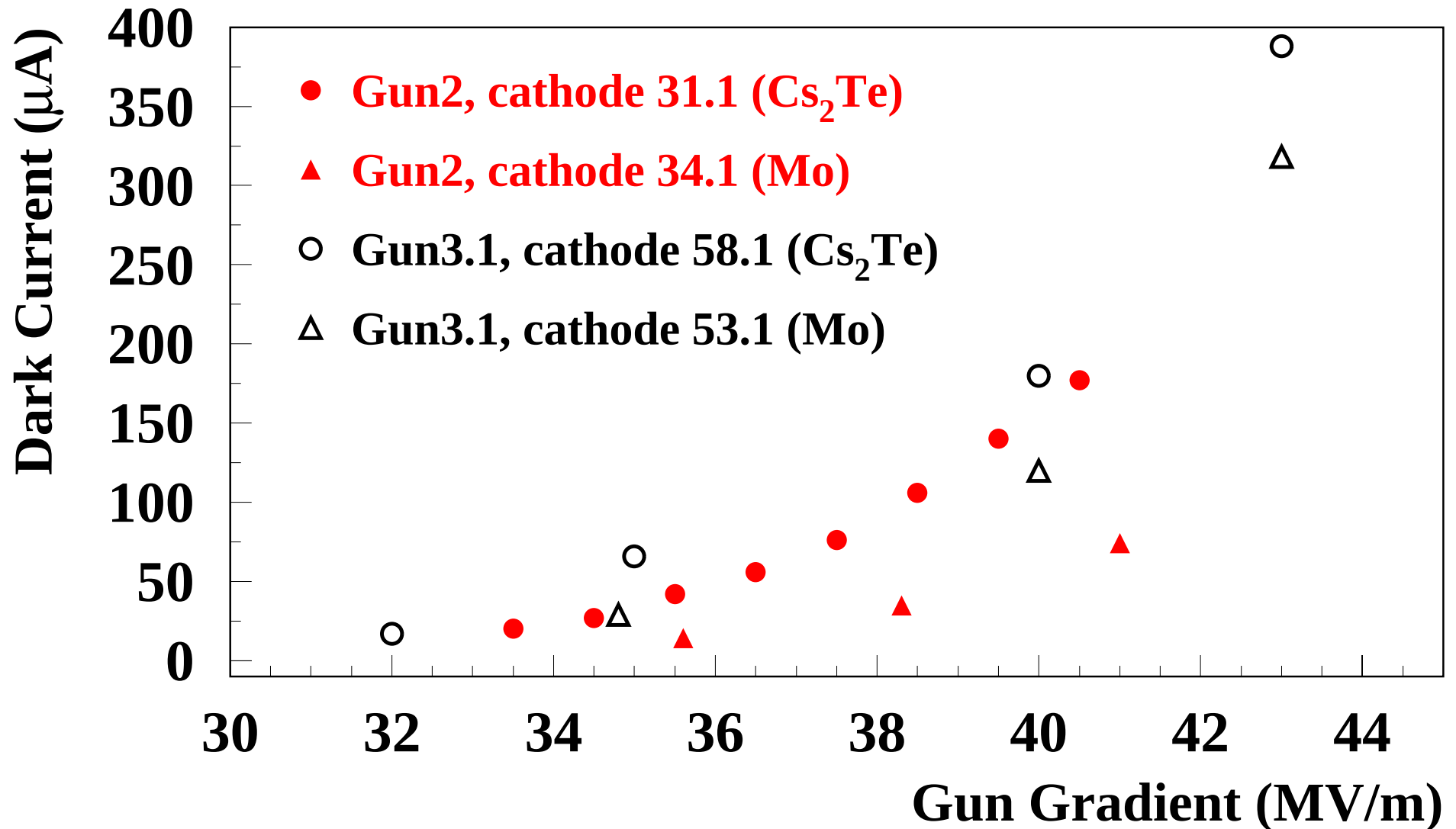
→ max. dark current level:

(only Mo cathodes)



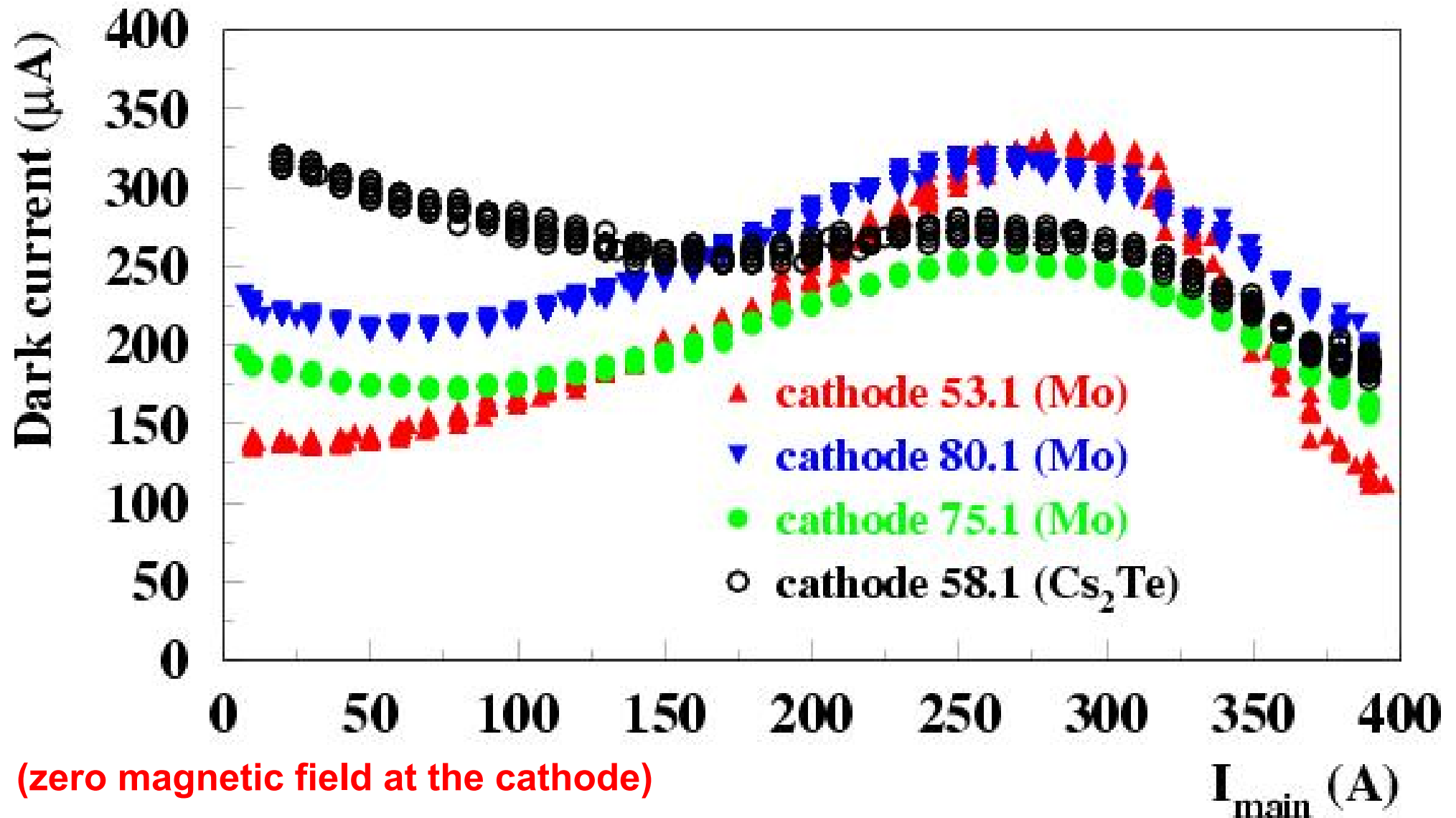
# Comparison Gun2 vs. Gun3.1

maximum dark current level:

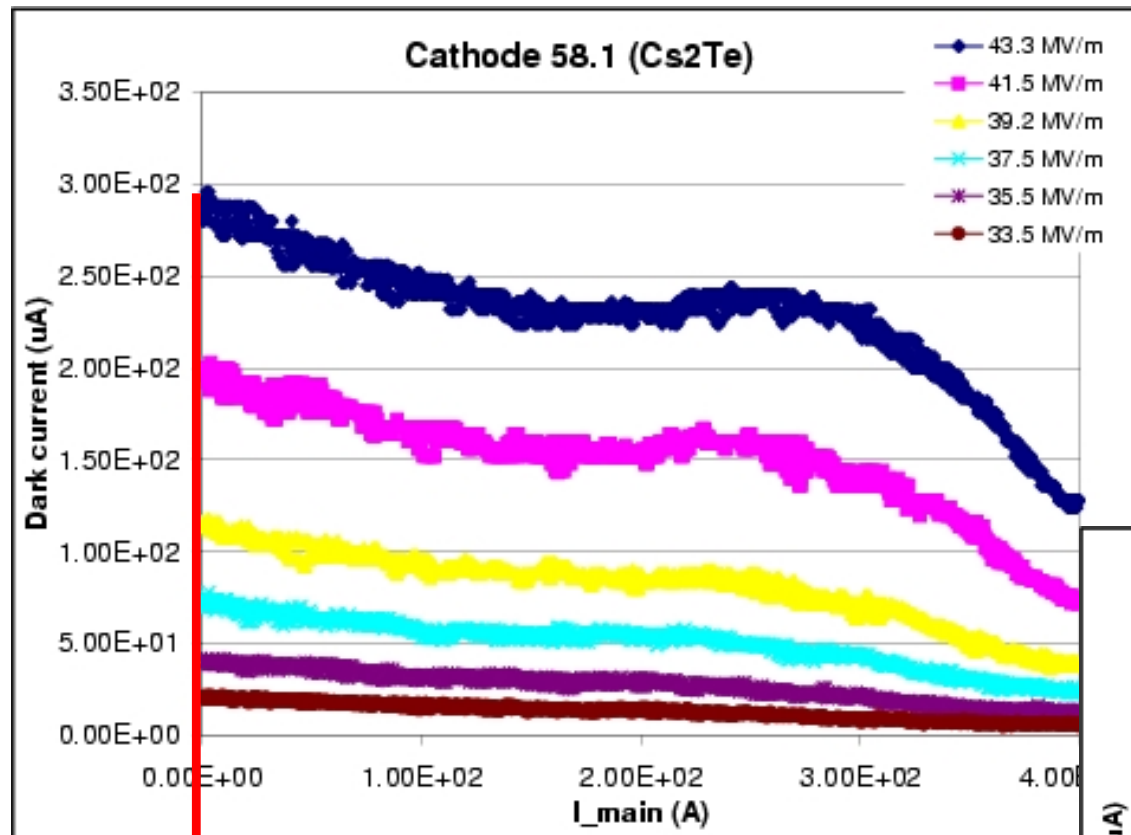


# 1D dark current measurements

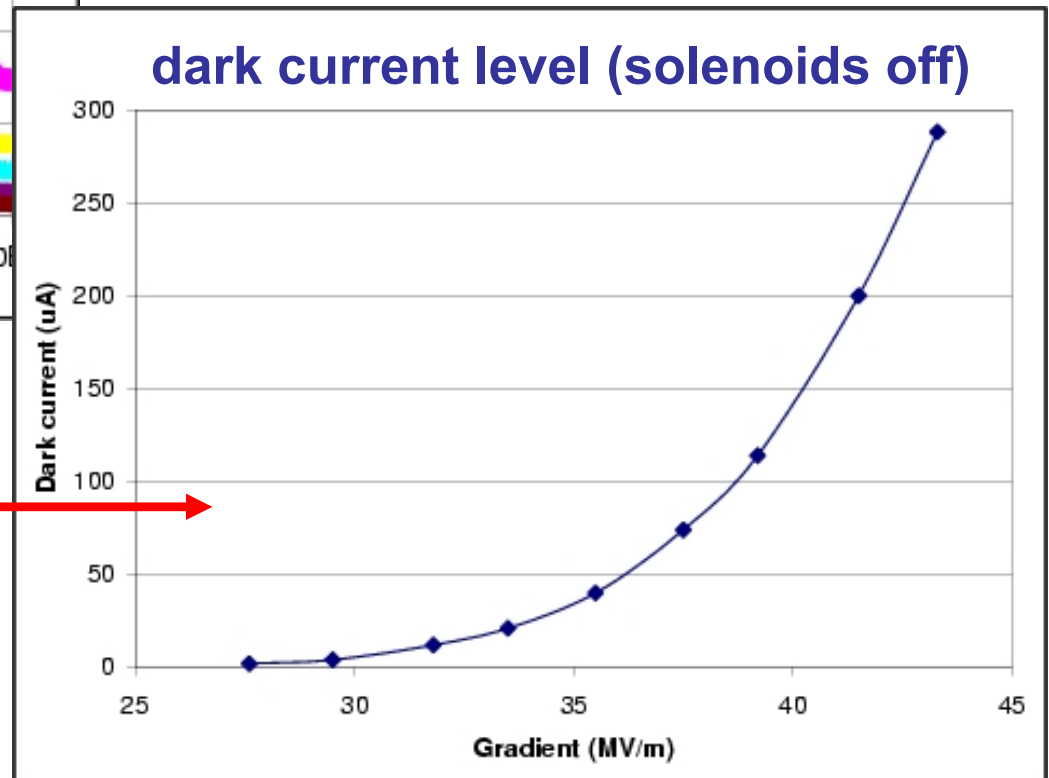
... for different cathodes at 43 MV/m



# 1D dark current measurements

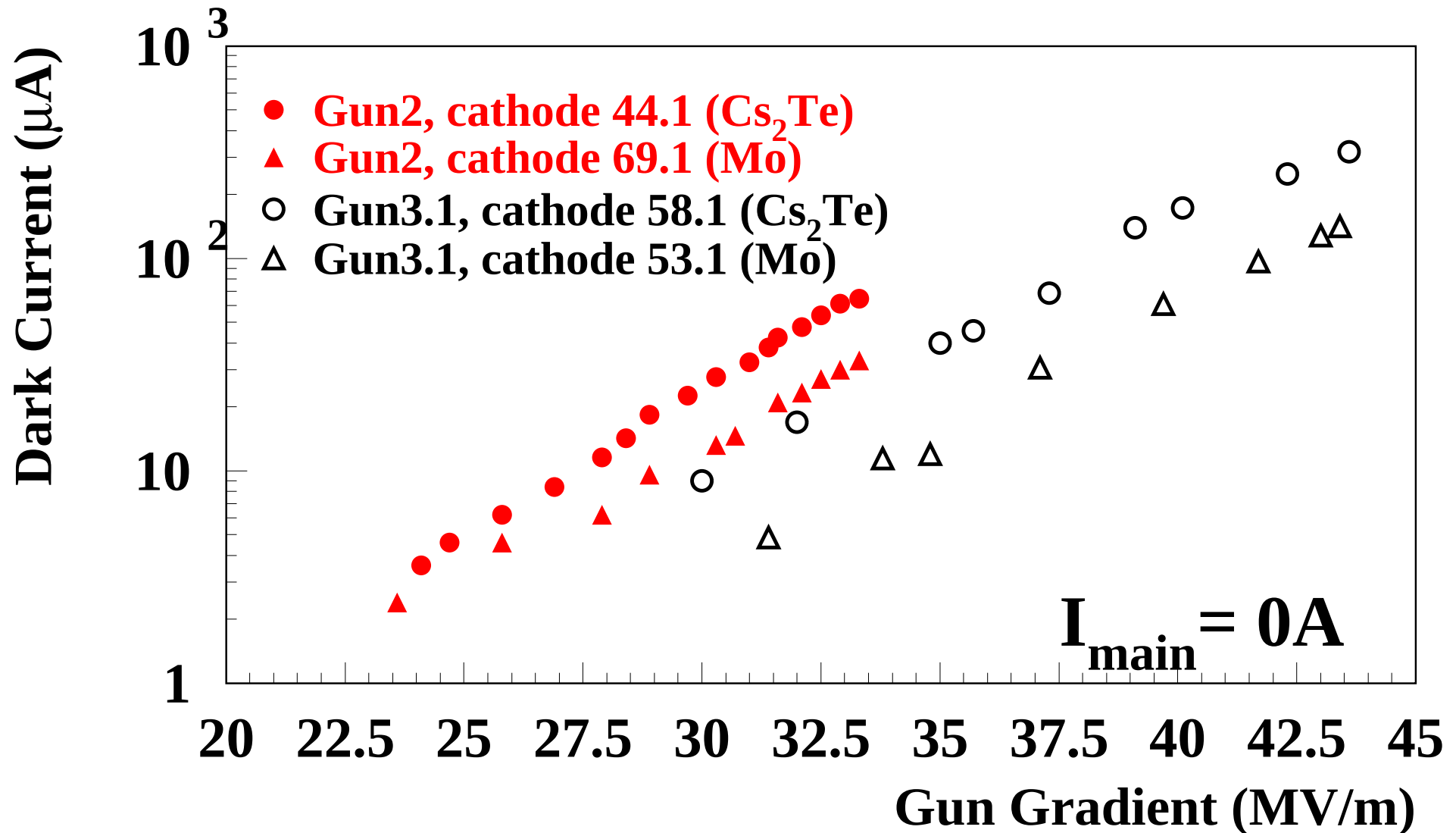


**Cathode 58.1 (Cs<sub>2</sub>Te)**

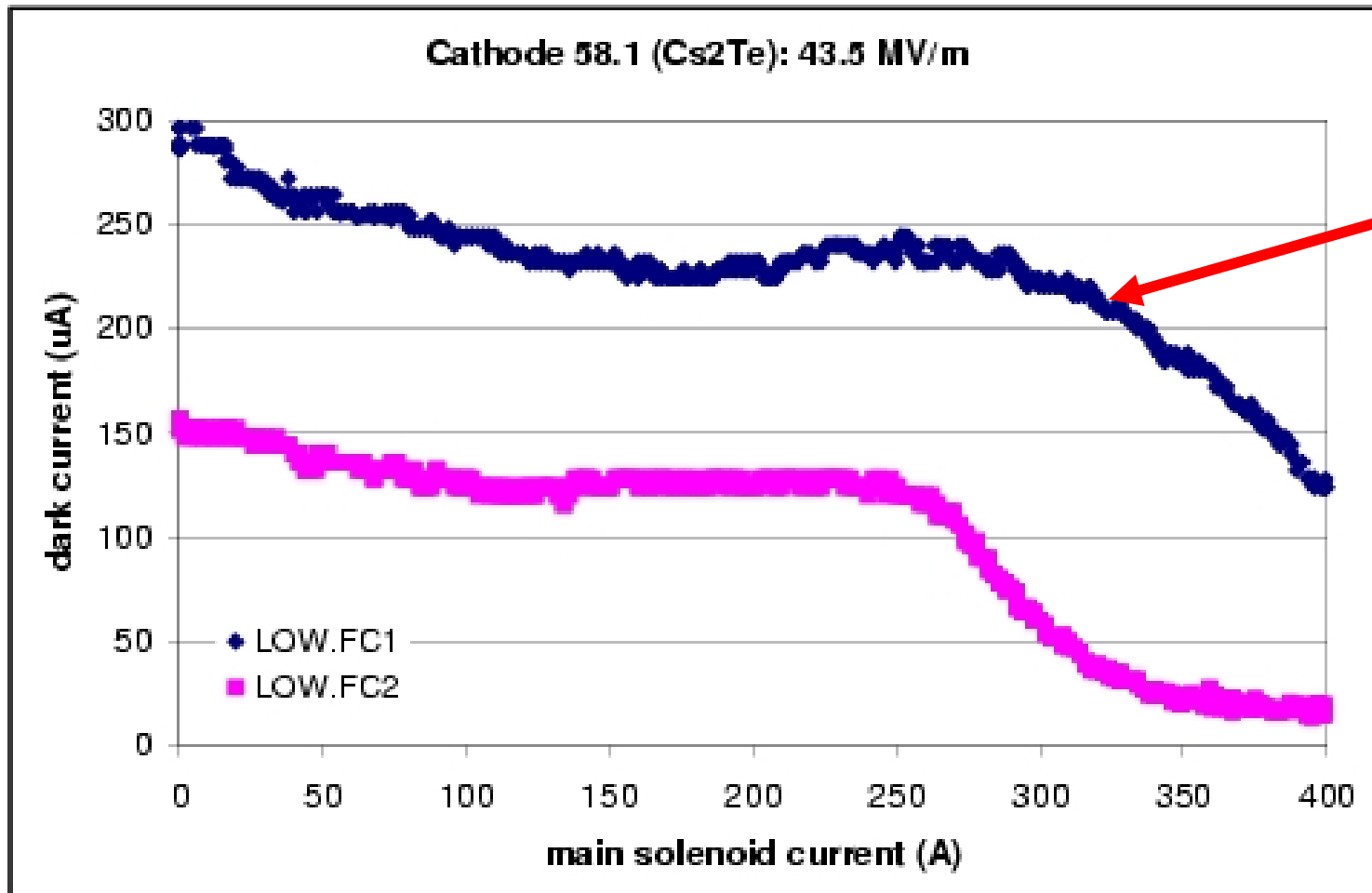


# Comparison Gun2 vs. Gun3.1

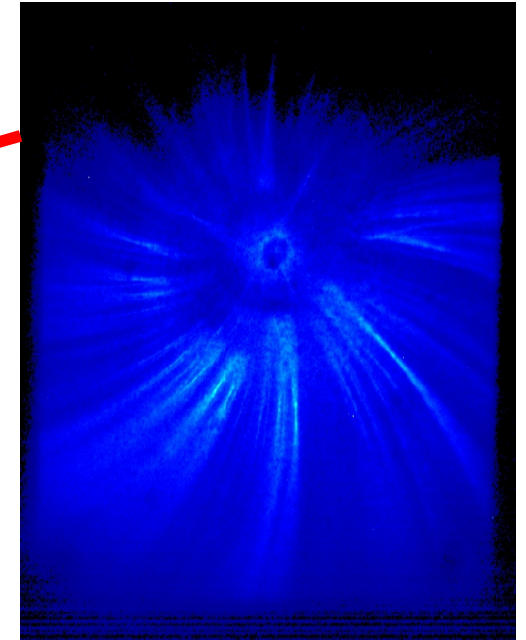
dark current without solenoids:



# Dark current transport in the PITZ beamline



Cathode 58.1 (Cs<sub>2</sub>Te)

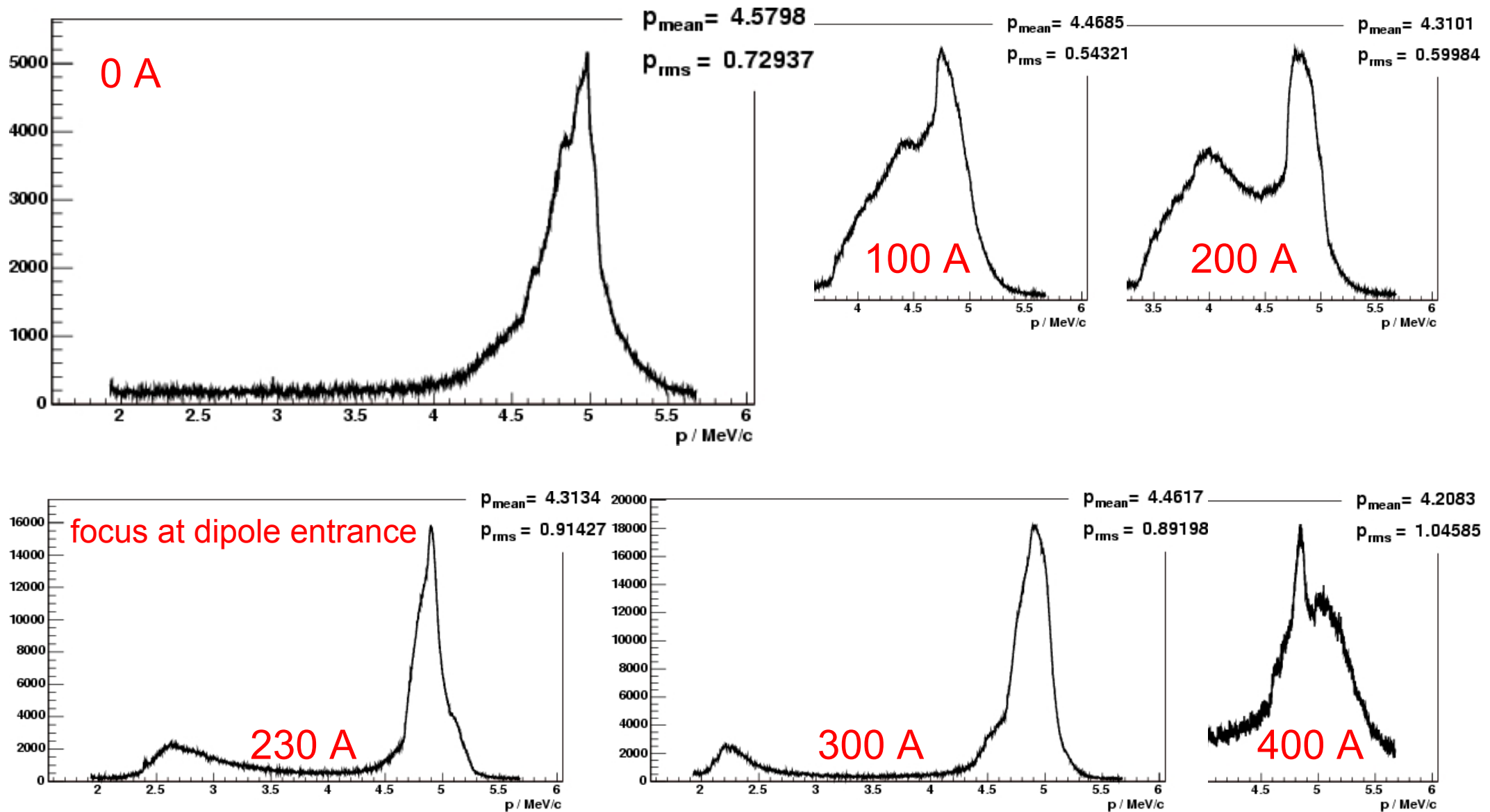


LOW.FC1: 0.776 m from the cathode

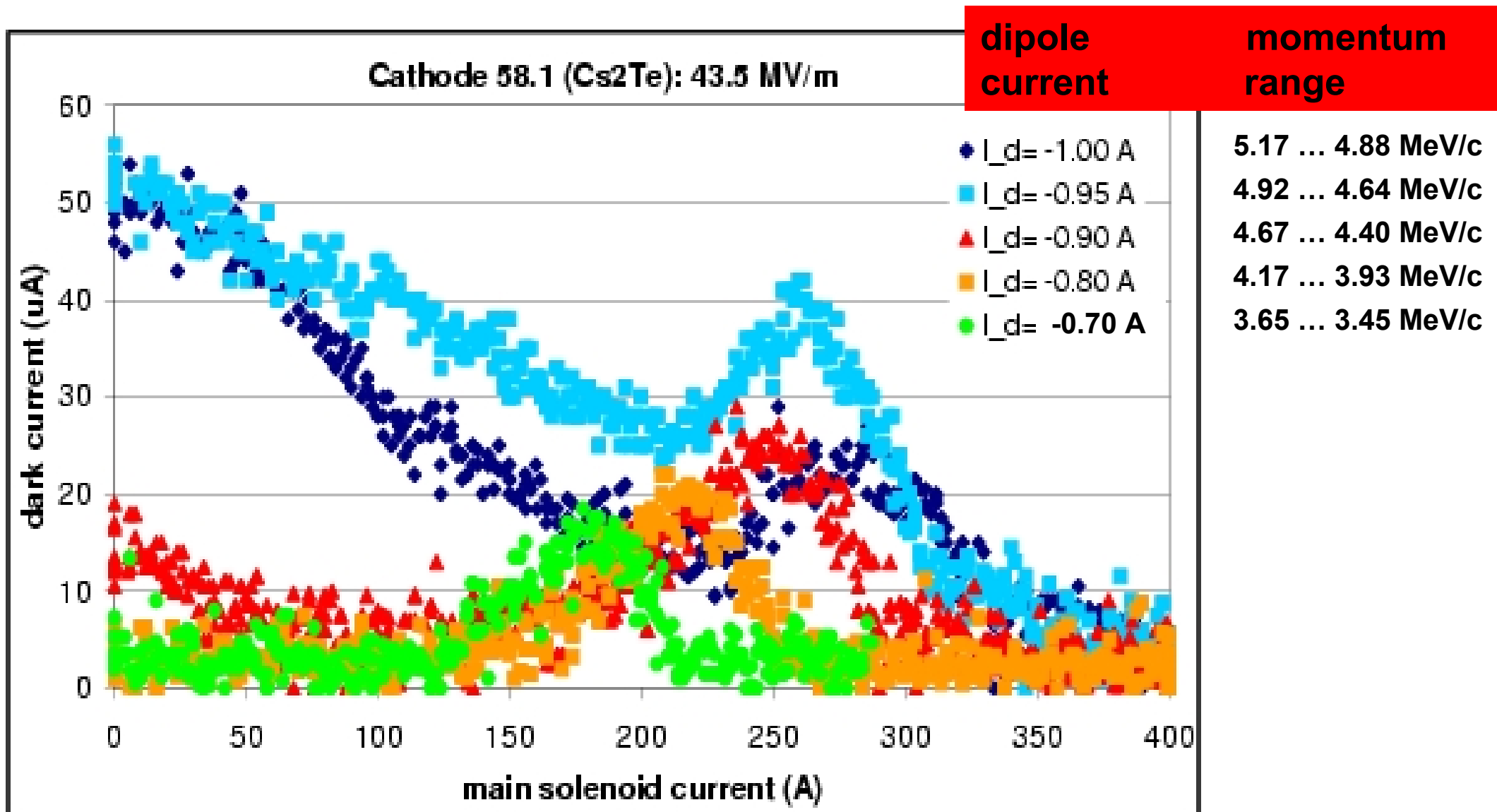
LOW.FC2: 1.379 m from the cathode → ~50% transmission

# Dark current momentum studies with cathode 58.1 ( $\text{Cs}_2\text{Te}$ )

... for different currents  $I(\text{main})$



# 1D dark current scans in the dispersive section



# Summary / Conclusions

- extensive dark current measurements have been done with Gun3.1 between May and Sept 2006
- emitted dark current from different cathodes is comparable but 'spectrum' is different
- Gun3.1 emits similar dark current level as Gun2
- tuning marks seem not to be dark current emitters

# The tuning device

Tuning stamp



Tuning clamp

