# Funded Activities

- parts and manufacturing of custom components for sensor measurements, such as custom holders, light box end caps, HV divider, etc.

- MCP-PMT gain measurements; funding covered

    - LHe to cool superconducting magnet

    - travel cost of USC personnel to Jefferson Lab to prepare and conduct the test measurements

    - undergraduate internship of a USC student at Jefferson Lab

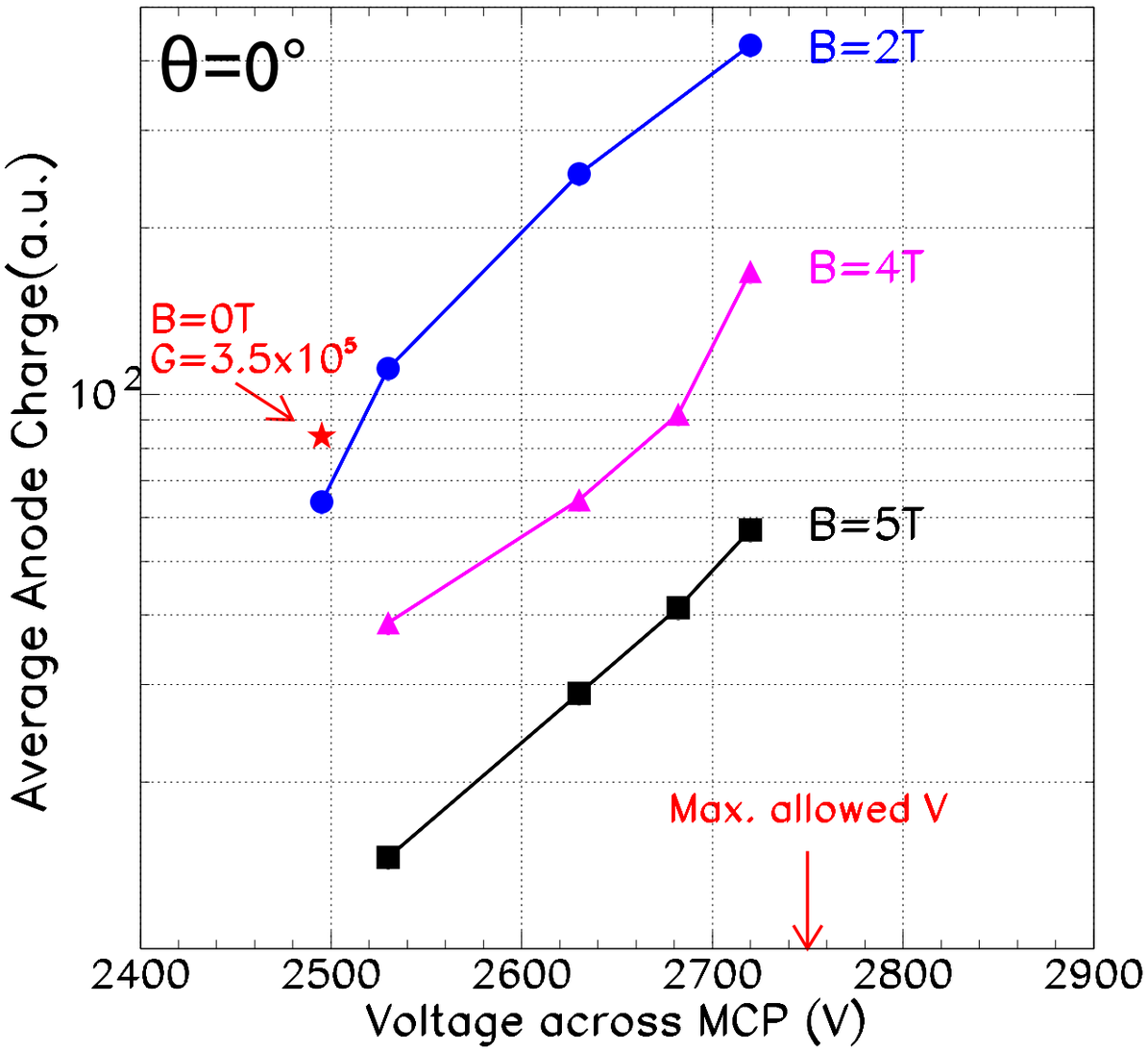
# Progress

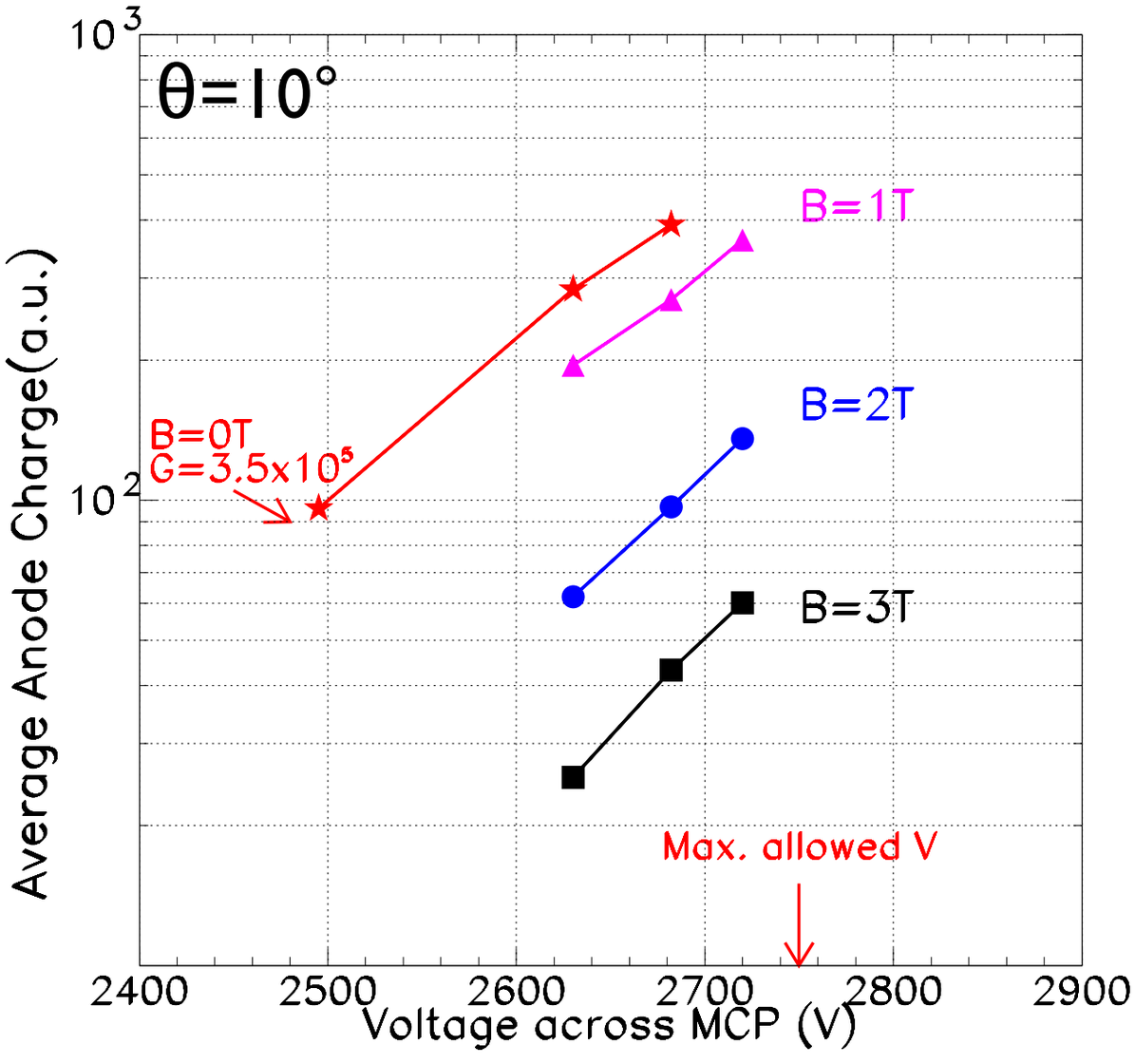
- improvement to the setup and measuring procedure

- measurement of gain performance of Photek single-anode 3-µm PMT as a function of field, orientation, and independently varied high voltages across the MCP-PMT three stages: photocathode – MCP, MCP–MCP, and MCP–Anode

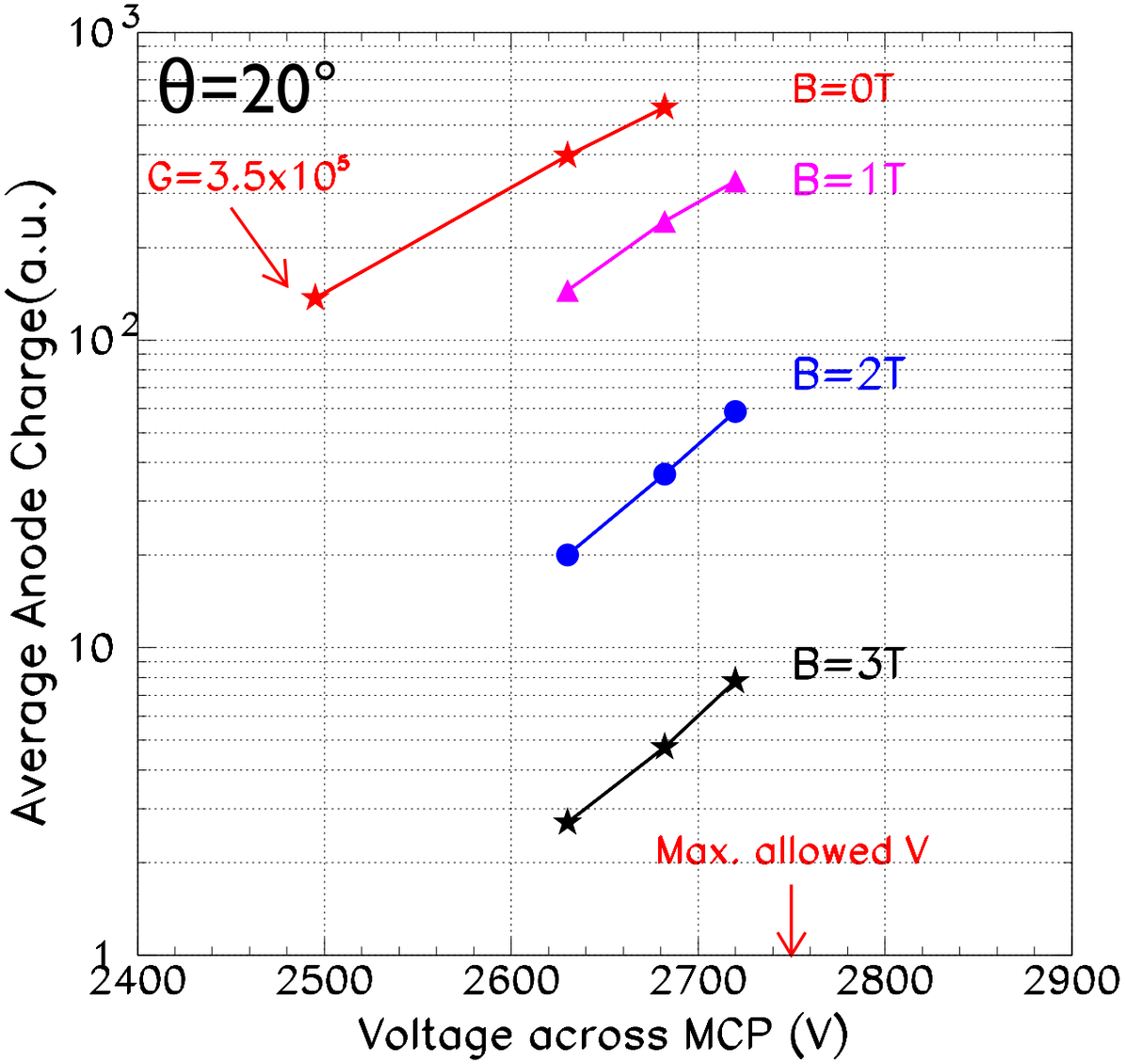
- design of a universal HV divider allowing to control the voltages across the three MCP-PMT stages independently

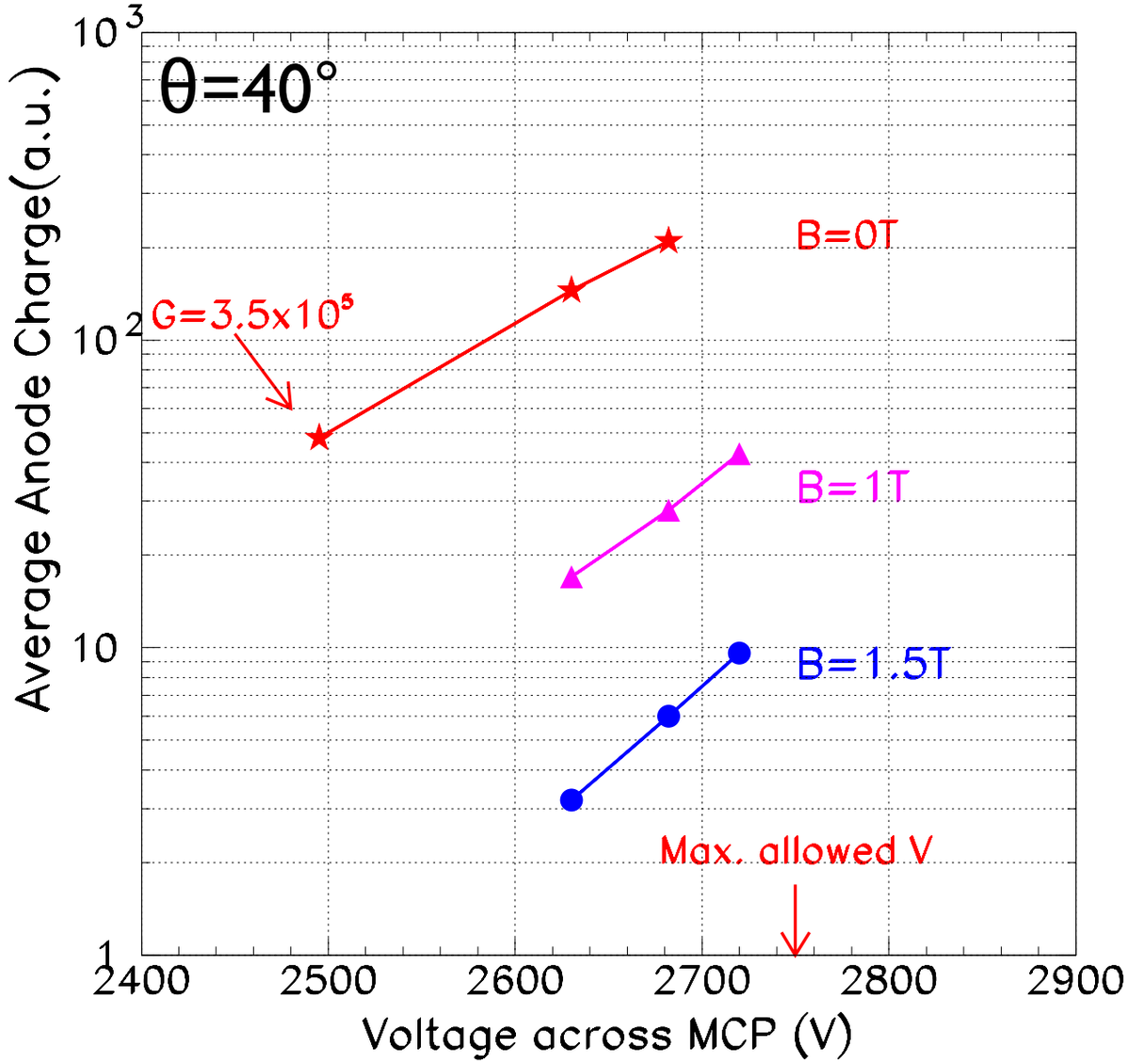
# Gain Performance of PMT210 as a Function of $V_{MCP-MCP}$



# Gain Performance of PMT210 as a Function of $V_{MCP-MCP}$



# Summary of findings

- Increasing the potential difference across the channel plates is a powerful means to recover the loss in gain due to the effect of the magnetic field.

- Gain recovery is strongly correlated with the angle between the MCP and field axes: the larger the angle, the more limited is the range of fields where the sensor can be operated at the same gate.

  - At 0 deg, the gain is recoverable up to 5 T.

  - At 10 deg, the gain is fully recoverable below 3 T.

  - At 20 deg, the gain is fully recoverable below 2 T.

  - At 40 deg, the gain is fully recoverable below 1 T.

- Increasing $V_{cathode-MCP}$ and $V_{MCP-anode}$ above their nominal values do not seem to affect the gain performance.

- Additional optimizations for gain recovery need to be implemented if the orientation of the sensor relative to the field varies significantly.

# Future Activities

- Goal: to achieve an MCP-PMT design and operational parameters that are optimized for successful application in DIRC in the high magnetic field of the central detector at EIC.

- Effort:

  - High-B gain measurements of a variety of commercially available single- and multi-anode MCP-PMTs as a function of various operational parameters

  - Development and implementation of a GEANT4 simulation of an MCP-PMT in the design process

  - Timing studies in high magnetic fields of various commercially available single- and multi-anode MCP_PMTs.