# Chicane current setting

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## 1) HPS chicane

Heavy Photon Search (HPS) experiment will use three magnet chicane. All three magnets are H-type dipoles. The first and the last magnets are so called Hall-B ”frascati” magnets (FM), the middle magnet, which plays a role of the HPS spectrometer [analyzing] magnet (AM), is the Hall-B pair spectrometer magnet, 18D36 dipole. The ”frascati” magnet length is 50 cm, analyzing magnet is 91.44 cm, and the distance between physical centers of the magnets is 218.1 cm. The two ”frascati” dipoles will be powered from a single power supply, the spectrometer dipole will be fed from a separate power supply.

The chicane will be setup in a way that the first and the last dipoles will bent electron beam to left, the middle magnet will bent beam to right. The net field along the beam direction will be zero, so the electron beam will have the same direction before and after the chicane. The analyzing magnet (the Hall-B pair spectrometer dipole) will be set according to the relation $B_0 = A \cdot E$ where E is the beam energy in GeV, $B_0$ is the field value at the center of the magnet in Tesla, and A = 0.22727 Tesla/GeV ( This value correspond to 0.5T field for 2.2 GeV). At the HPS target, which is located at the physical edge of the analyzing dipole pole, the beam direction will be ~30.5 mrad relative to the original direction. At the exit of the analyzing magnet vacuum chamber (at the entrance to the ECal vacuum chamber) the beam direction should be ~36 mrad.

## 2 Analyzing magnet current

The current on the analyzing magnet (the Hall-B pair spectrometer dipole) will be set to have 0.22727 T central field per GeV beam energy. The current for given central value is defined by using fit to the measured excitation curve of the magnet (see Fig.1):

$$I(A) = 0.22727(T) \cdot P(GeV) \cdot 0.1537 \cdot 10^4 + 0.6657$$

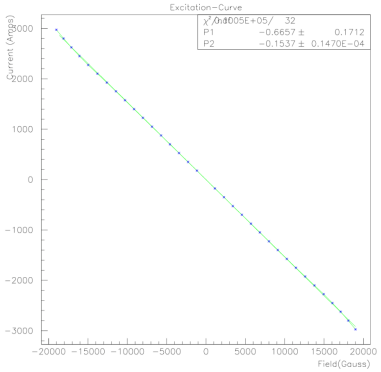


Figure 1: Analyzing magnet (the Hall-B pair spectrometer) excitation curve.

Based on this, for beam energy of E = 2.3 GeV (present machine, February 2016) the central field value should be $B_0 = 2.3 \cdot 0.22727 = 0.523$ T and the current on the power supply should be set at I = 804.1 A.

## 3 ”frascati” dipole current

From the relation between analyzing magnet and ”frasacati” current settings from the December, 2014, run:

R = I/i = 0.52 (1)

where I is the analyzing magnet current and i is the ”frascati” power supply current, the ”rfascati current for p = 2.3 GeV will be i = 1546.4A. On March 16, 2015, when first beam was sent to Faraday cup, it was determined that the field (current) on FDs must be lowered by 2.4 A, or 0.17%, in order to retain the position of the beam on the downstream viewer before chicane was energized. So the found current on the ”frascati” dipoles would be 1543.8 A.

## 4 Current settings for horizontal target scan

In order to find target frame sides, horizontal sweep with the beam can be done using the proper chicane settings. For the sweep, 4 μm W-target should be inserted. In Table 1 values of analyzing magnet (AD) and ”frascati” magnets (FD) currents are given for 1 mm steps at the target for ±1 cm move. The negative values are beam right, the positives are beam left. FD current values labeled ”as found” must be used. The halo counter rates must be recorded for every magnet settings. When rates will start to go up it means that beam start scraping the frame.

Table1 Settings for magnets

| x at the target(cm) | AM Current (A) | FD Current (A) calculated | FD Current (A) as found | AM Field (G) | FD field (G) |
|---|---|---|---|---|---|
| -1 | 937.7 | 1803.4 | 1800.3 | 6096.8 | 7017.5 |
| -0.9 | 924.3 | 1777.6 | 1774.5 | 6009.6 | 6918.4 |
| -0.8 | 911.0 | 1751.9 | 1748.9 | 5922.7 | 6820.4 |
| -0.7 | 897.6 | 1726.3 | 1723.3 | 5836.0 | 6723.5 |
| -0.6 | 884.3 | 1700.7 | 1697.8 | 5749.4 | 6627.5 |
| -0.5 | 871.0 | 1675.1 | 1672.2 | 5662.9 | 6532.2 |
| -0.4 | 857.7 | 1649.5 | 1646.7 | 5576.3 | 6437.6 |
| -0.3 | 844.4 | 1623.9 | 1621.1 | 5489.5 | 6343.6 |
| -0.2 | 831.0 | 1598.1 | 1595.4 | 5402.5 | 6249.9 |
| -0.1 | 817.6 | 1572.3 | 1569.6 | 5315.2 | 6156.5 |
| 0 | 804.1 | 1546.4 | 1543.8 | 5227.4 | 6063.3 |
| 0.1 | 790.5 | 1520.3 | 1517.7 | 5139.1 | 5970.1 |
| 0.2 | 776.9 | 1494.0 | 1491.5 | 5050.2 | 5876.7 |
| 0.3 | 763.1 | 1467.5 | 1465.0 | 4960.6 | 5783.2 |
| 0.4 | 749.2 | 1440.8 | 1438.3 | 4870.1 | 5689.2 |
| 0.5 | 735.1 | 1413.8 | 1411.3 | 4778.7 | 5594.9 |
| 0.6 | 720.9 | 1386.5 | 1384.1 | 4686.3 | 5499.9 |
| 0.7 | 706.6 | 1358.8 | 1356.5 | 4592.9 | 5404.1 |
| 0.8 | 692.0 | 1330.8 | 1328.6 | 4498.2 | 5307.6 |
| 0.9 | 677.3 | 1302.5 | 1300.3 | 4402.2 | 5210.0 |
| 1 | 662.3 | 1273.7 | 1271.5 | 4304.9 | 5111.3 |