

Carbon elastics for SHMS commissioning at 1 pass

December 6, 2017

1 Introduction

The first excited state of carbon elastics will be used to test the HMS optics. Important to following the SHMS cycling procedure. The running conditions are given in table 1. Rates are listed in table 2 assuming a 1uA beam current. The inelastic events are plotted for various kinematic quantities in Fig. 1 and for different combinations of focal plane quantities in Fig. 2. The elastic 4.4 MeV events are plotted for different combinations of focal plane quantities in Fig. 3. The elastic events are in a narrow part of the of xfp and Fig. 4 shows a comparison of the inelastic and elastic events rates. The elastic events dominate.

beam energy:	2218 MeV
SHMS momentum	-2201.54 MeV
SHMS angle	13.5 deg
SHMS collimator	Centered Sieve
beam current:	3 μ A
fast raster:	off
target:	0.5% carbon

Table 1: Kinematics

Inelastic	340 Hz
4.4 elastic state	490 Hz
ground state	1 Hz

Table 2: Rates assuming 1uA beam current

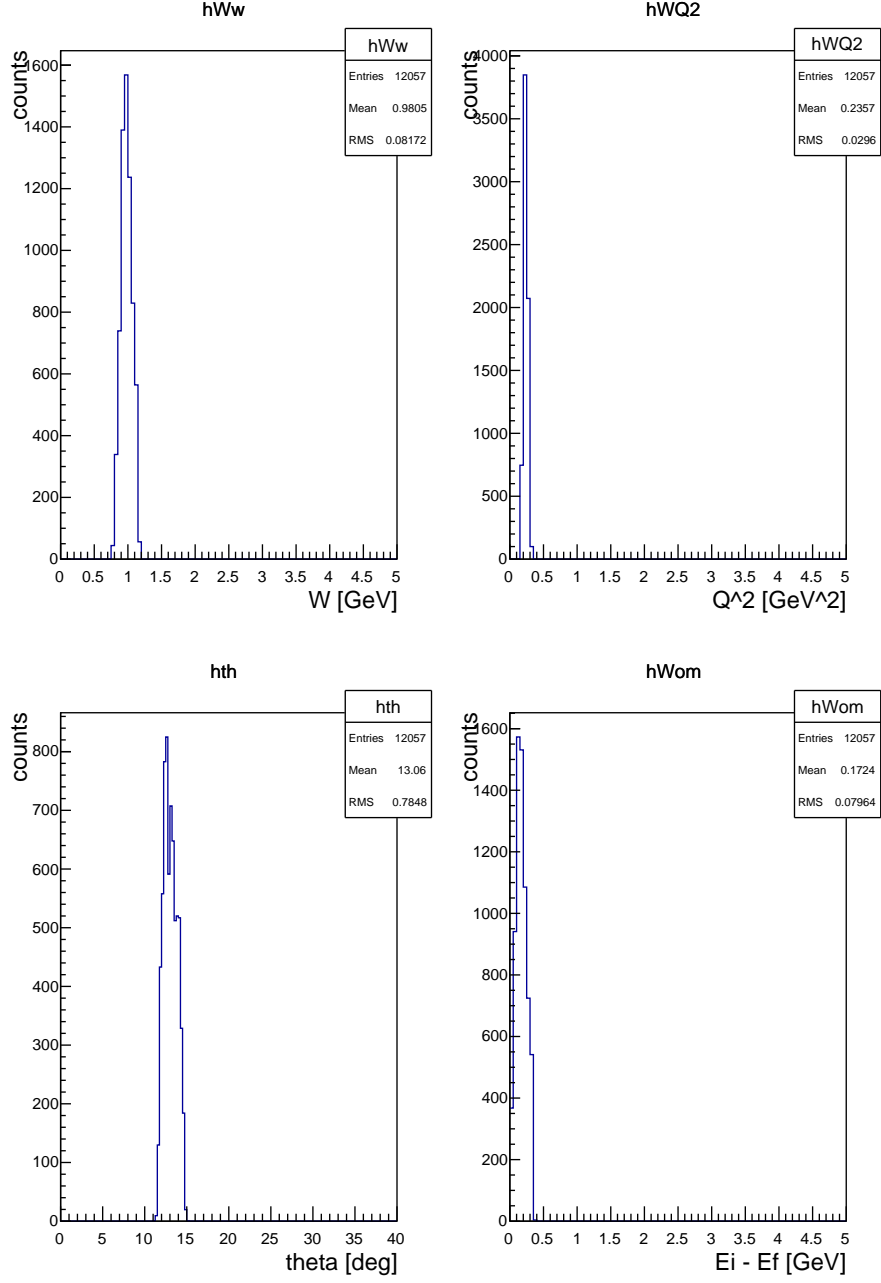


Figure 1: Plots of Inelastic events versus kinematic quantities. Y-axis is rate for 20uA.

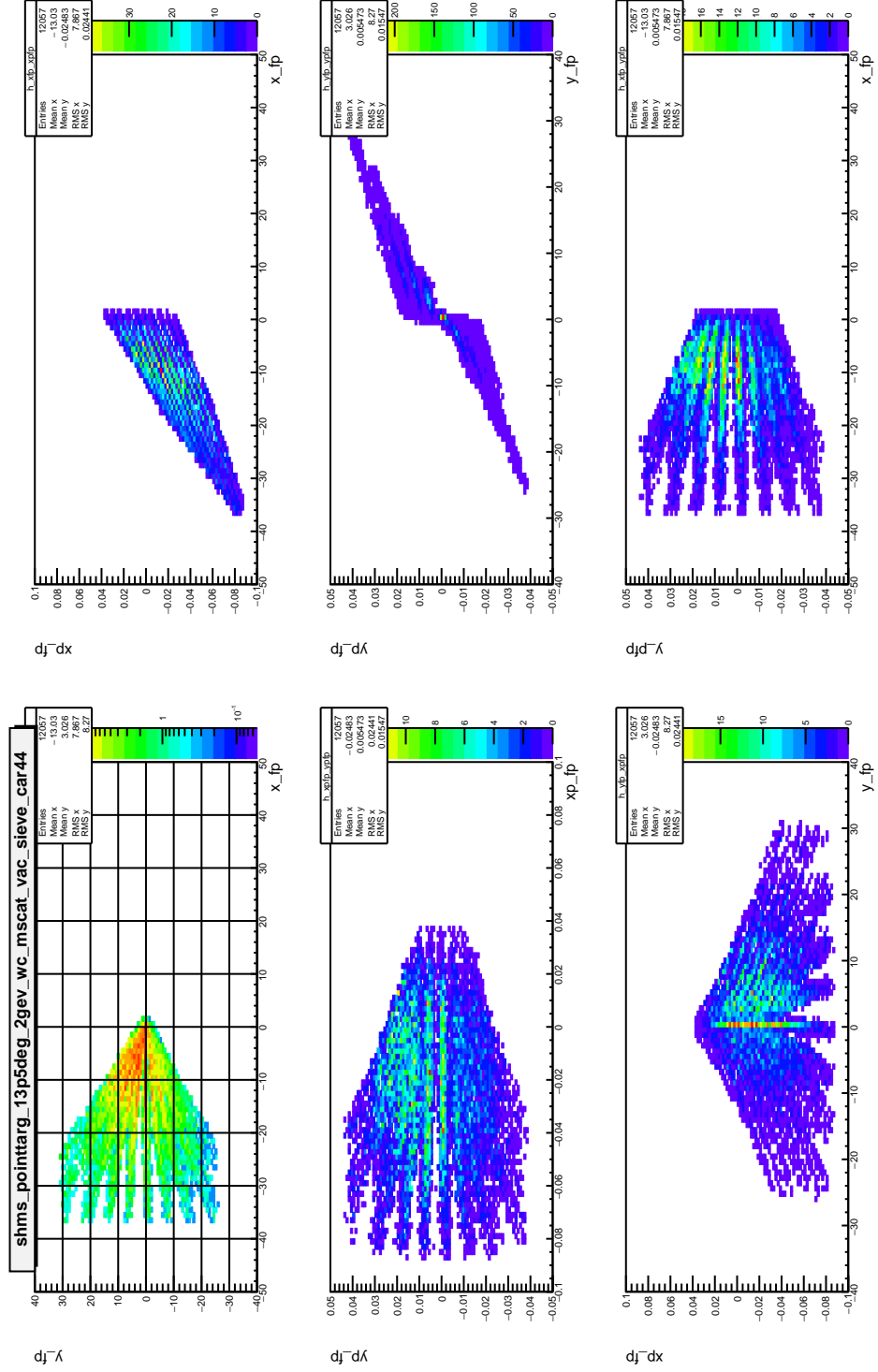


Figure 2: Inelastic events in focal plane for different combinations of quantities. Xfp and Yfp are in cm.

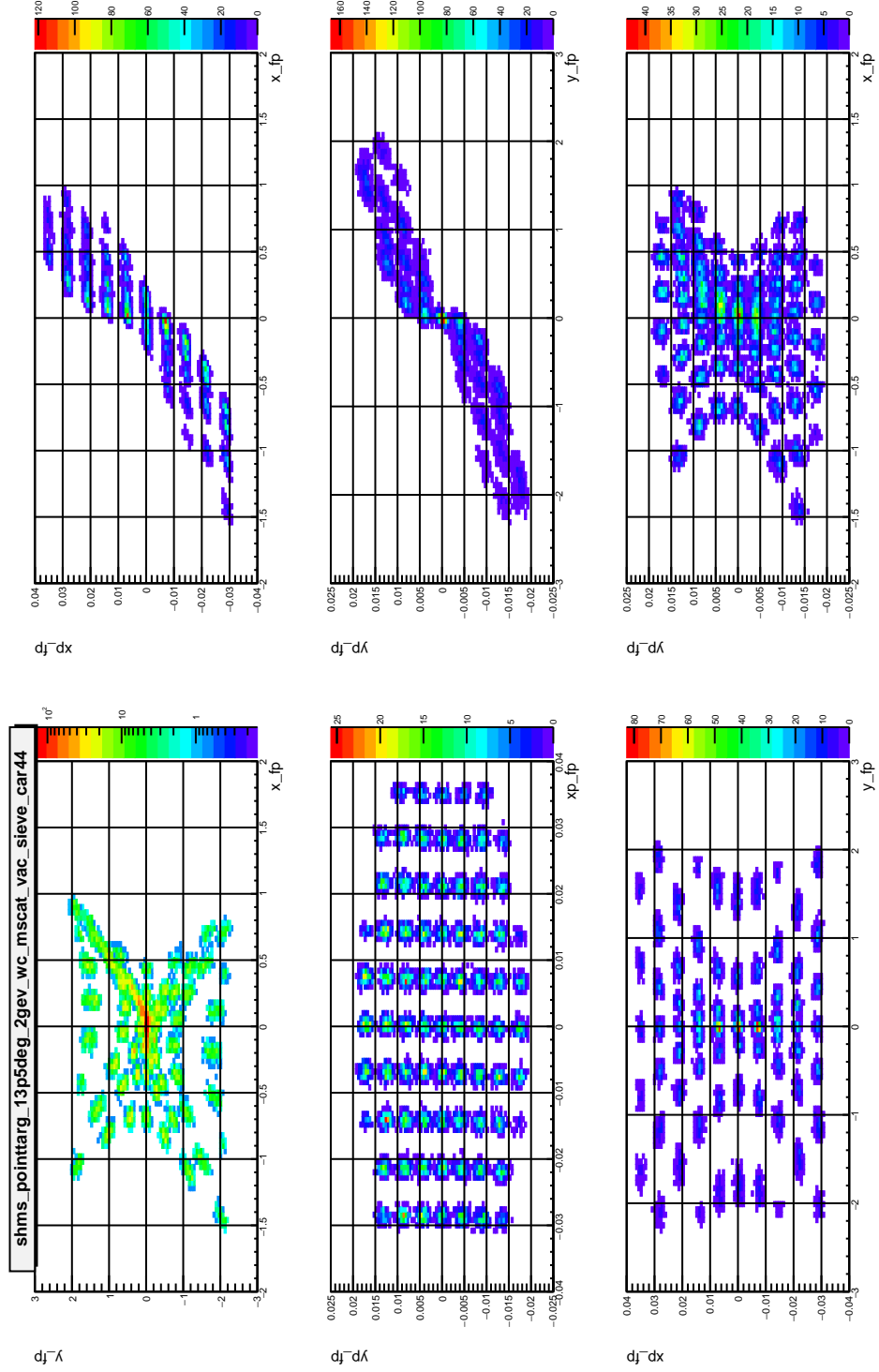


Figure 3: Elastic carbon 4.4 state events in focal plane for different combinations of quantities. X_{fp} and Y_{fp} are in cm.

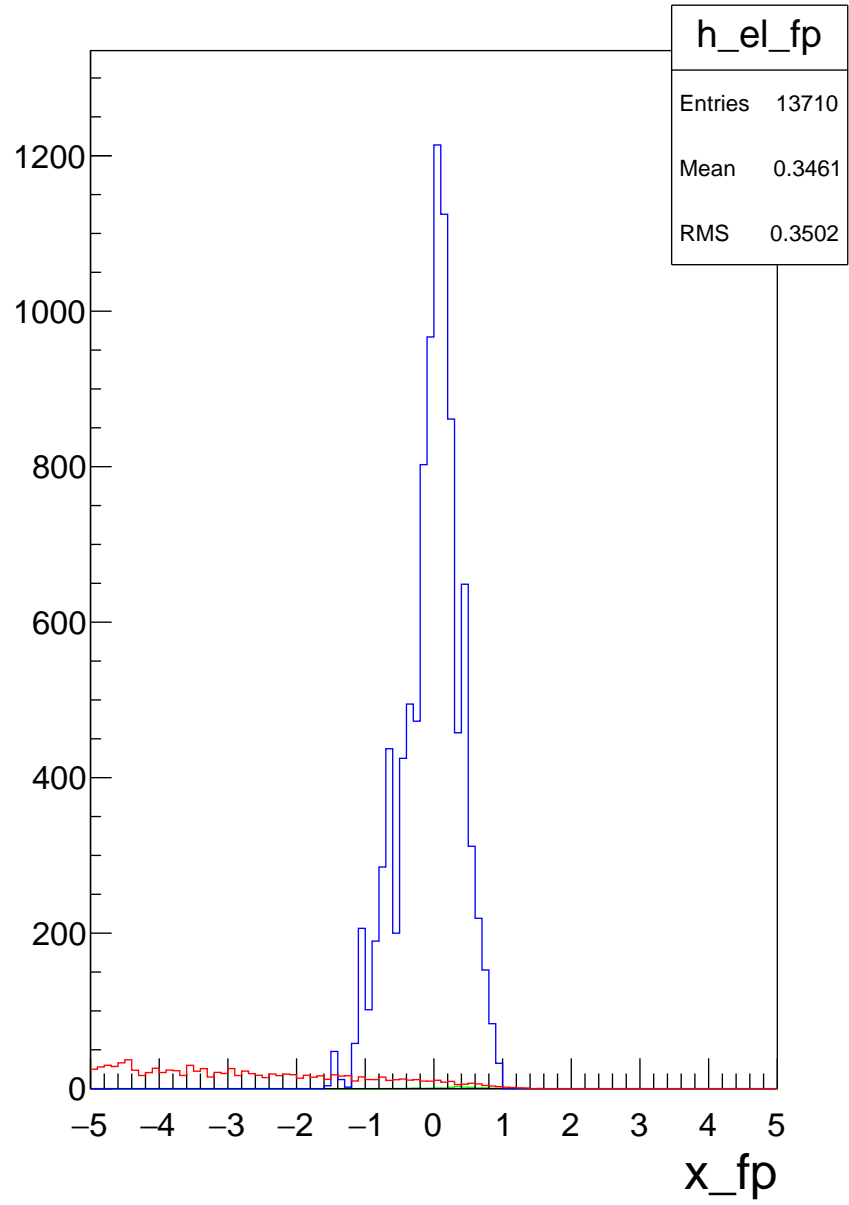


Figure 4: Comparison between distribution of inelastic events (red) and elastic 4.4 MeV events (black) in narrow part of x_{fp} . Y-axis is rate for 20uA.

2 Surveys

The surveys for the SHMS are given in the Table. Pointing is given in the spectrometer coordinate system with +X downwards and +Y towards smaller angles.

Survey	Angle	Horizontal point (Y_{spec})	Vertical point (X_{spec})
C1796R	20.32	-0.57	-0.27
C1806R	15.02	-0.38	-1.16
C1808R	24.99	-0.43	-1.28
C1810R	39.94	-0.43	-1.25
C1812	15.01	-0.74	-1.34

Table 3: Surveys of the SHMS

3 First order optics

SHMS first order forward optics:

$$x_{fp}(mm) = -1.38 * x_{tar}(mm) - 0.004 * x_{ptar}(mr) + 16.5 * delta \quad (1)$$

$$x_{pfp}(mr) = -.602 * x_{tar}(mm) - .72 * x_{ptar}(mr) - 0.3 * delta \quad (2)$$

$$y_{fp}(mm) = -1.6 * y_{tar}(mr) - 0.003 * y_{ptar}(mr) - 1.5 * delta \quad (3)$$

$$y_{pfp}(mr) = -2.68 * y_{tar}(mm) - 0.61 * y_{ptar}(mr) + 0.0074 * delta \quad (4)$$

SHMS first order reconstruction optics.

$$x_{ptar}(mr) = 0.26x_{fp}(mm) - 1.38x_{pfp}(mr) \quad (5)$$

$$delta = 0.06x_{fp}(mm) - 0.0012x_{pfp}(mr) \quad (6)$$

$$y_{tar}(mm) = -.61y_{fp}(mm) - 0.04y_{pfp}(mr) \quad (7)$$

$$y_{ptar}(mr) = 0.27y_{fp}(mm) - 1.6y_{pfp}(mr) \quad (8)$$