SESAME BM08-XAFS/XRF

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Simulation Setups

Name	Description
Setup 1	Setup with M2 toroidal without KB mirrors.
Setup 2	Setup with M2 plane and with KB mirrors focusing (we simulated this case here, but I don't have the workspace. Perhaps you can fill these slides with those simulation)
Setup 3A	Latif's workspace sent by email with M2 toroidal creating a secondary source for the KB mirrors, but with large working distance and small demagnification factors.
Setup 3B	Same as before, but modifying the KB mirrors position closer to focus, so that the demagnification factor is larger and the beam is focused down to ~20x20 μm^2. In this case, the working distance will be smaller ~ 15 cm. This would make better use of the KB mirrors by increasing spatial resolution and flux density at the sample (better signal-to-noise ratio) simultaneously. This can be optimized even further, depending on the beam size that you desire. Note that the KB mirrors specification will also be tighter as the beam focus is decreased, meaning the mirrors will be more expensive.

Setup 1: M2 toroidal

```
******** SUMMARY OF DISTANCES ********
** DISTANCES FOR ALL O.E. [mm] **
    OE      TYPE       p[mm]       q[mm]      src-oe    src-screen
     1     EMPTY    6895.0000      0.0000    6895.0000    6895.0000
     2     EMPTY     583.0000      0.0000    7478.0000    7478.0000
     3     EMPTY    3862.0000      0.0000   11340.0000   11340.0000
     4    MIRROR    1338.0000      0.0000   12678.0000   12678.0000
     5   CRYSTAL    2500.0000      0.0000   15178.0000   15178.0000
     6   CRYSTAL      23.0000      0.0000   15201.0000   15201.0000
     7     EMPTY    1500.0000      0.0000   16701.0000   16701.0000
     8    MIRROR    1642.0000   9157.0000   18343.0000   27500.0000

** FOCUSING ELEMENTS **
    OE     SHAPE     p_foc     q_foc      1/M
     4  CYLINDER       ?         ?         ?
     8    TOROID       ?         ?         ?

Sum of Alphas [deg]:       180.000000
Sum of Alphas Mod 180 [deg]: 0.000000
Sum of Alphas Mod 360 [deg]: 180.000000
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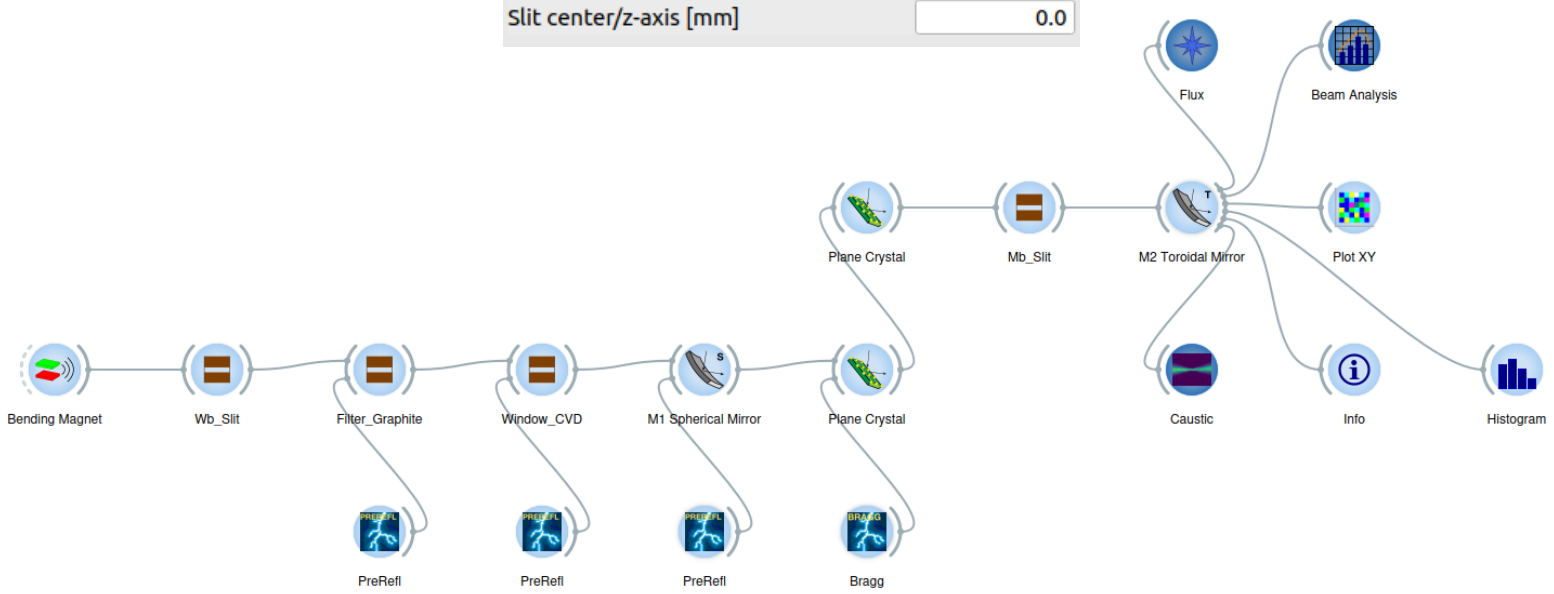
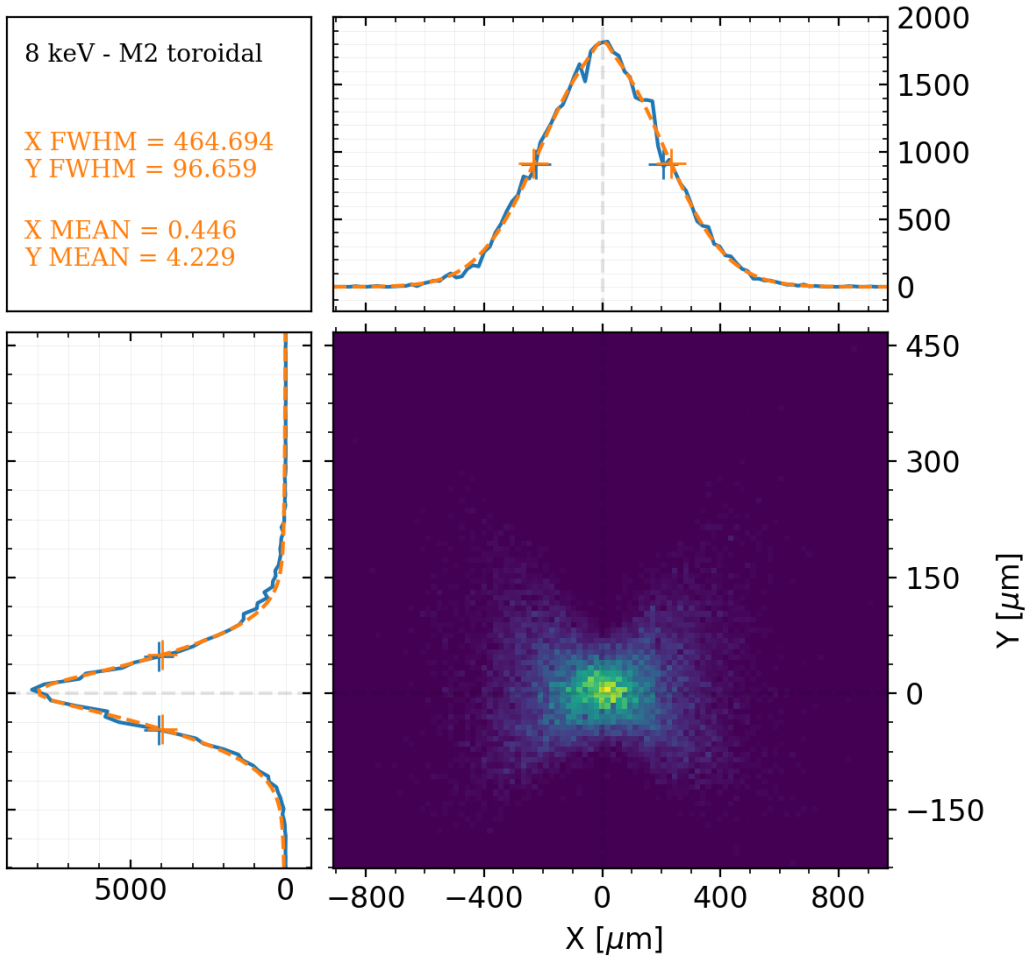
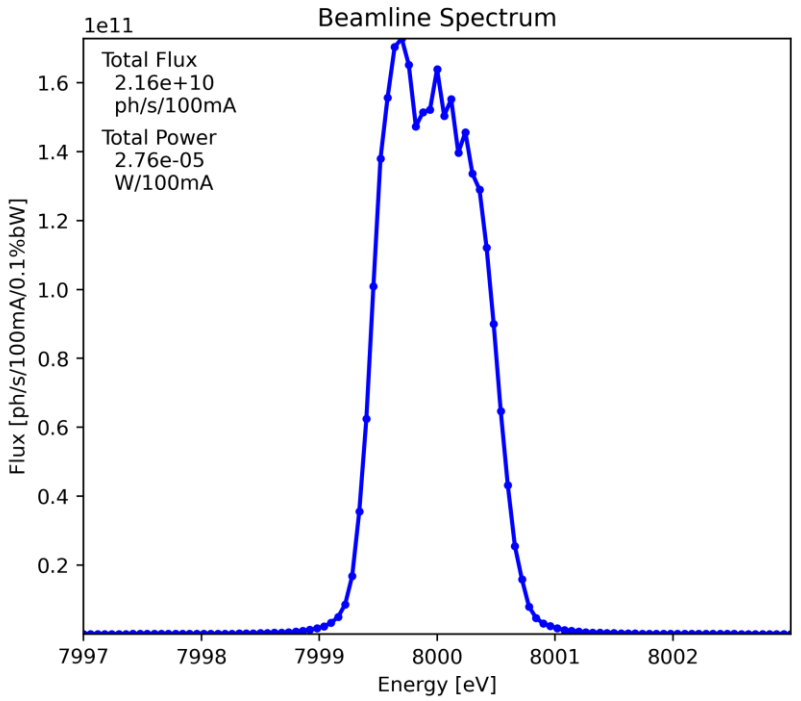
Aperturing	Yes
Open slit/Solid stop	aperture/slit
Aperture shape	Rectangular
Slit width/x-axis [mm]	5.0
Slit height/z-axis [mm]	0.3
Slit center/x-axis [mm]	0.0
Slit center/z-axis [mm]	0.0



Setup 1: M2 toroidal





Setup 2: M2 plane and KB mirrors

```
******** SUMMARY OF DISTANCES ********
** DISTANCES FOR ALL O.E. [mm] **
    OE       TYPE       p[mm]        q[mm]       src-oe     src-screen
     1      EMPTY     6895.0000       0.0000     6895.0000     6895.0000
     2      EMPTY      583.0000       0.0000     7478.0000     7478.0000
     3      EMPTY     3862.0000       0.0000    11340.0000    11340.0000
     4     MIRROR     1338.0000       0.0000    12678.0000    12678.0000
     5    CRYSTAL     2500.0000       0.0000    15178.0000    15178.0000
     6    CRYSTAL       23.0000       0.0000    15201.0000    15201.0000
     7      EMPTY     1500.0000       0.0000    16701.0000    16701.0000
     8     MIRROR     1642.0000       0.0000    18343.0000    18343.0000
     9     MIRROR     6957.0000       0.0000    25300.0000    25300.0000
    10     MIRROR     1200.0000    1000.0000    26500.0000    27500.0000

** FOCUSING ELEMENTS **
    OE     SHAPE     p_foc     q_foc      1/M
     4  CYLINDER         ?         ?        ?
     9  PARABOLA 10000000000.00   2200.00 4545454.55
    10   ELLIPSE  26500.00   1000.00    26.50

Sum of Alphas [deg]:       450.000000
Sum of Alphas Mod 180 [deg]: 90.000000
Sum of Alphas Mod 360 [deg]: 90.000000
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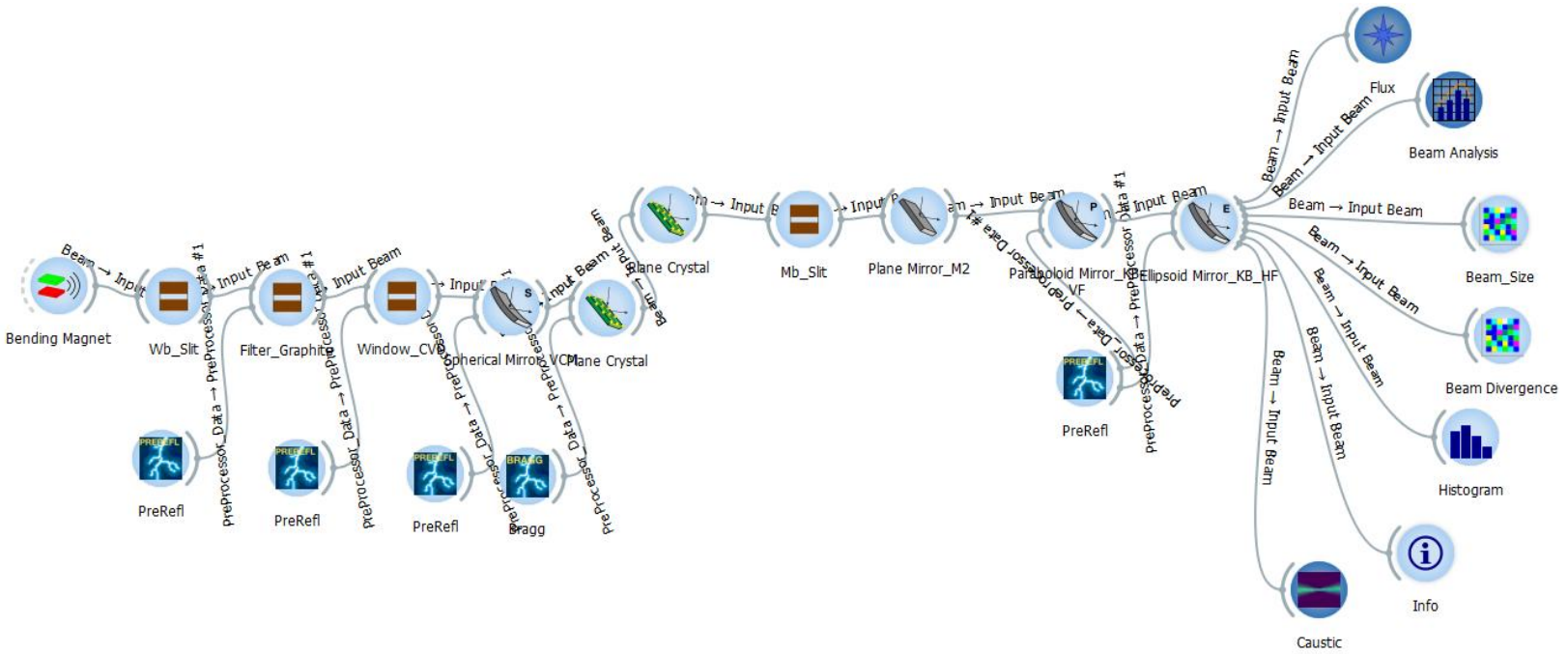
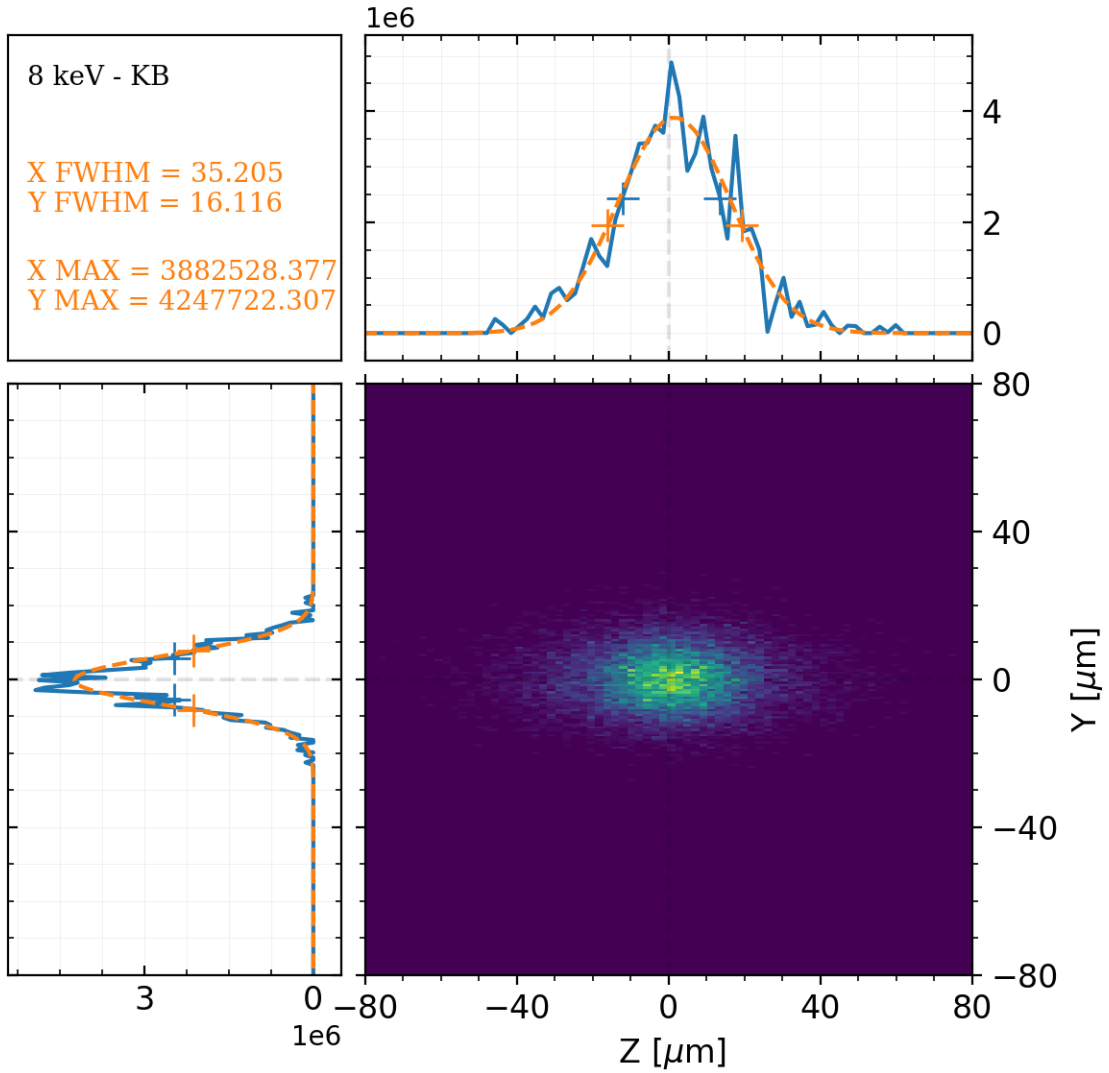
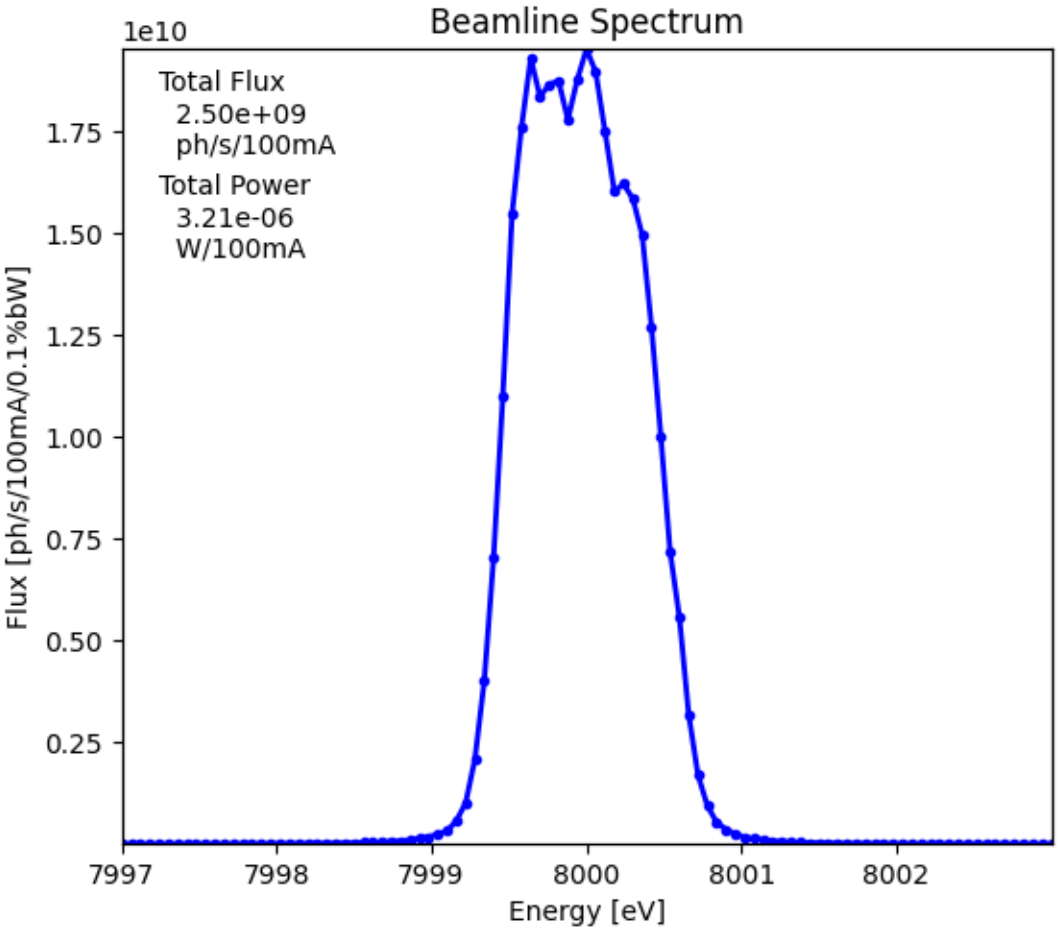


Setup 2: M2 plane and KB mirrors





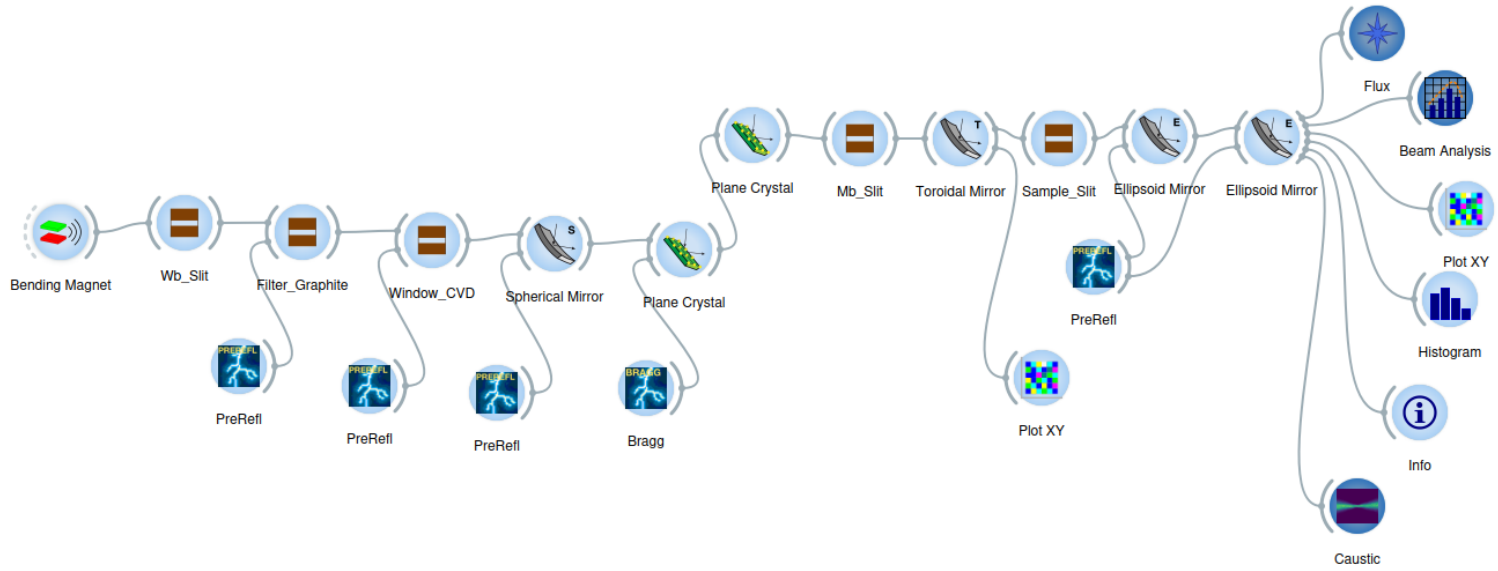
Setup 3A: M2 toroidal + KB mirrors

******** SUMMARY OF DISTANCES ********
** DISTANCES FOR ALL O.E. [mm] **

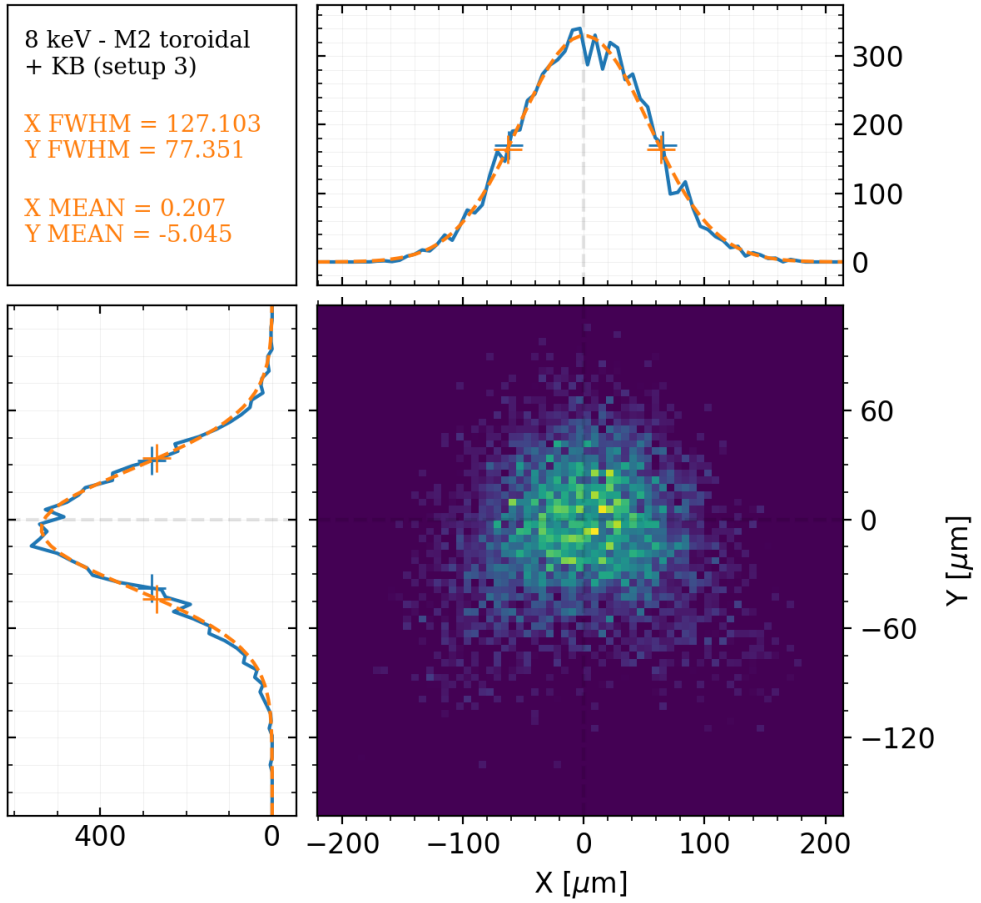
OE	TYPE	p[mm]	q[mm]	src-oe	src-screen
1	EMPTY	6895.0000	0.0000	6895.0000	6895.0000
2	EMPTY	583.0000	0.0000	7478.0000	7478.0000
3	EMPTY	3862.0000	0.0000	11340.0000	11340.0000
4	MIRROR	1338.0000	0.0000	12678.0000	12678.0000
5	CRYSTAL	2500.0000	0.0000	15178.0000	15178.0000
6	CRYSTAL	23.0000	0.0000	15201.0000	15201.0000
7	EMPTY	1500.0000	0.0000	16701.0000	16701.0000
8	MIRROR	1642.0000	9157.0000	18343.0000	27500.0000
9	EMPTY	0.0000	0.0000	27500.0000	27500.0000
10	MIRROR	2000.0000	0.0000	29500.0000	29500.0000
11	MIRROR	1200.0000	1000.0000	30700.0000	31700.0000

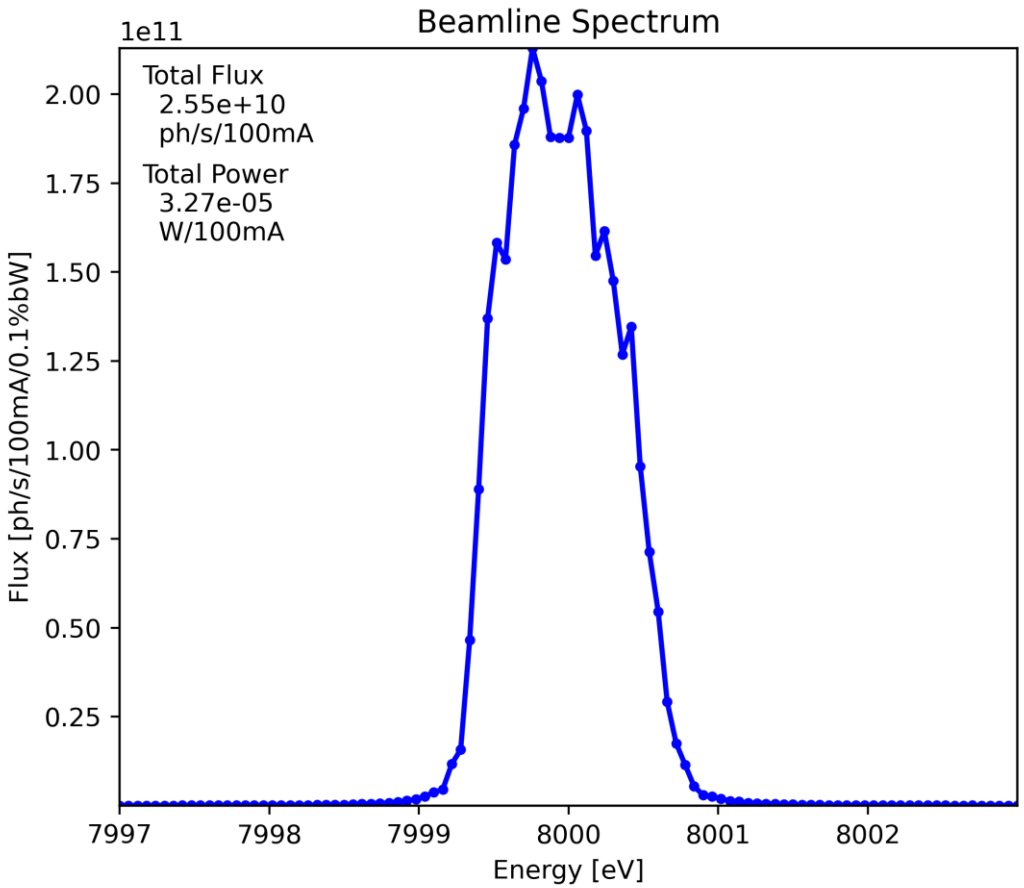
** FOCUSING ELEMENTS **

OE	SHAPE	p_foc	q_foc	1/M
4	CYLINDER	?	?	?
8	TOROID	?	?	?
10	ELLIPSE	2000.00	2200.00	0.91
11	ELLIPSE	3200.00	1000.00	3.20



Setup 3A: M2 toroidal + KB mirrors





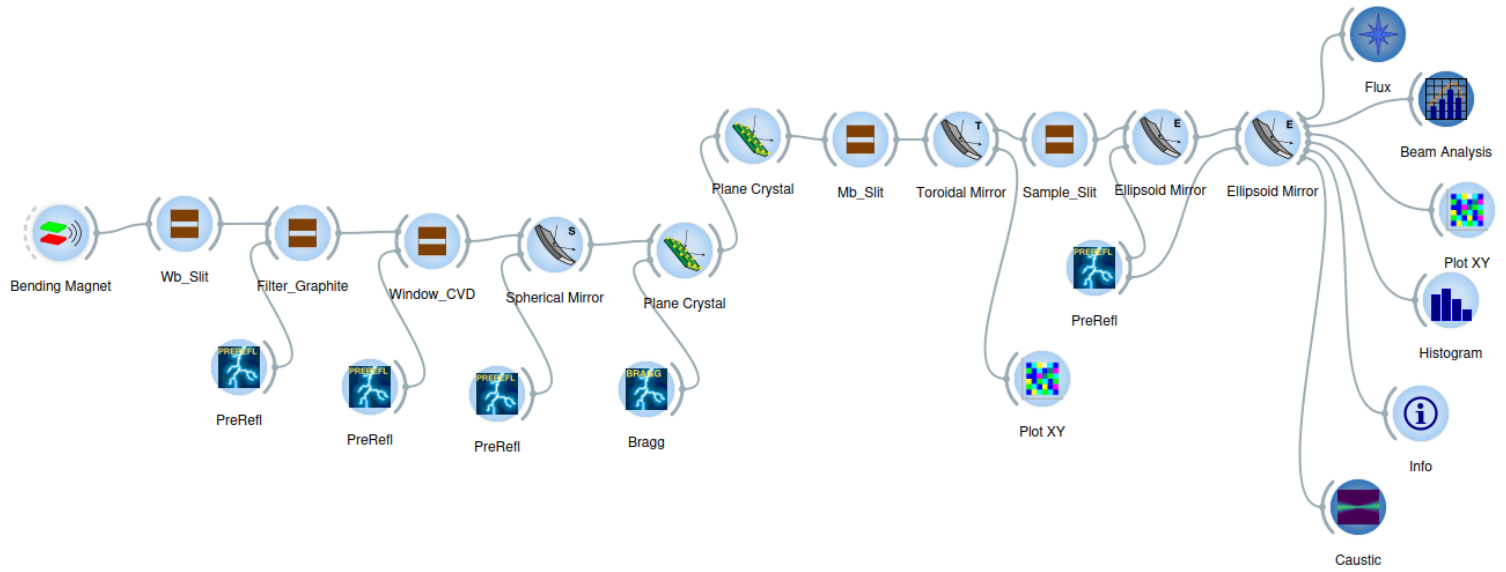
Setup 3B: M2 toroidal + KB mirrors (Stronger focusing – smaller working distance)

******** SUMMARY OF DISTANCES ********
** DISTANCES FOR ALL O.E. [mm] **

OE	TYPE	p[mm]	q[mm]	src-oe	src-screen
1	EMPTY	6895.0000	0.0000	6895.0000	6895.0000
2	EMPTY	583.0000	0.0000	7478.0000	7478.0000
3	EMPTY	3862.0000	0.0000	11340.0000	11340.0000
4	MIRROR	1338.0000	0.0000	12678.0000	12678.0000
5	CRYSTAL	2500.0000	0.0000	15178.0000	15178.0000
6	CRYSTAL	23.0000	0.0000	15201.0000	15201.0000
7	EMPTY	1500.0000	0.0000	16701.0000	16701.0000
8	MIRROR	1642.0000	9157.0000	18343.0000	27500.0000
9	EMPTY	0.0000	0.0000	27500.0000	27500.0000
10	MIRROR	3200.0000	0.0000	30700.0000	30700.0000
11	MIRROR	800.0000	200.0000	31500.0000	31700.0000

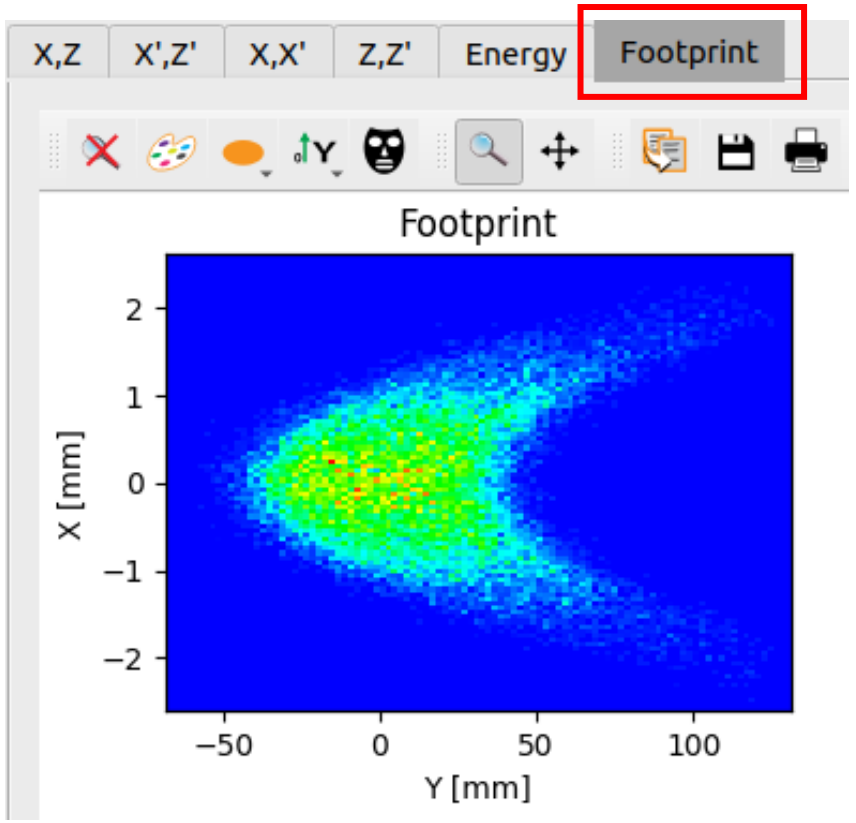
** FOCUSING ELEMENTS **

OE	SHAPE	p_foc	q_foc	1/M
4	CYLINDER	?	?	?
8	TOROID	?	?	?
10	ELLIPSE	3200.00	1000.00	3.20
11	ELLIPSE	4000.00	200.00	20.00

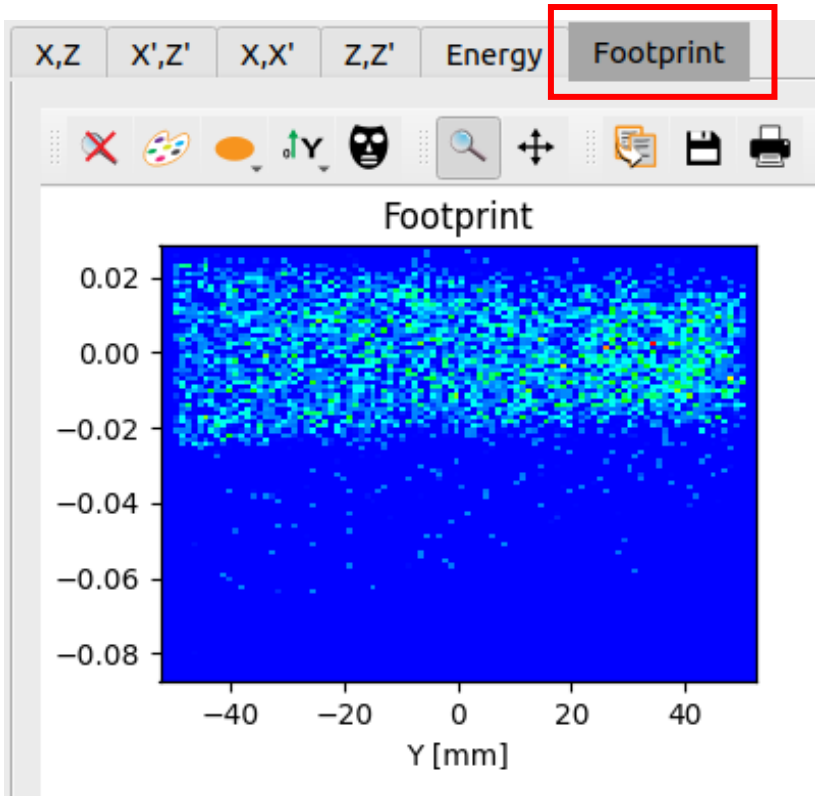


Setup 3B: M2 toroidal + KB mirrors (Stronger focusing – smaller working distance)

KB-VFM

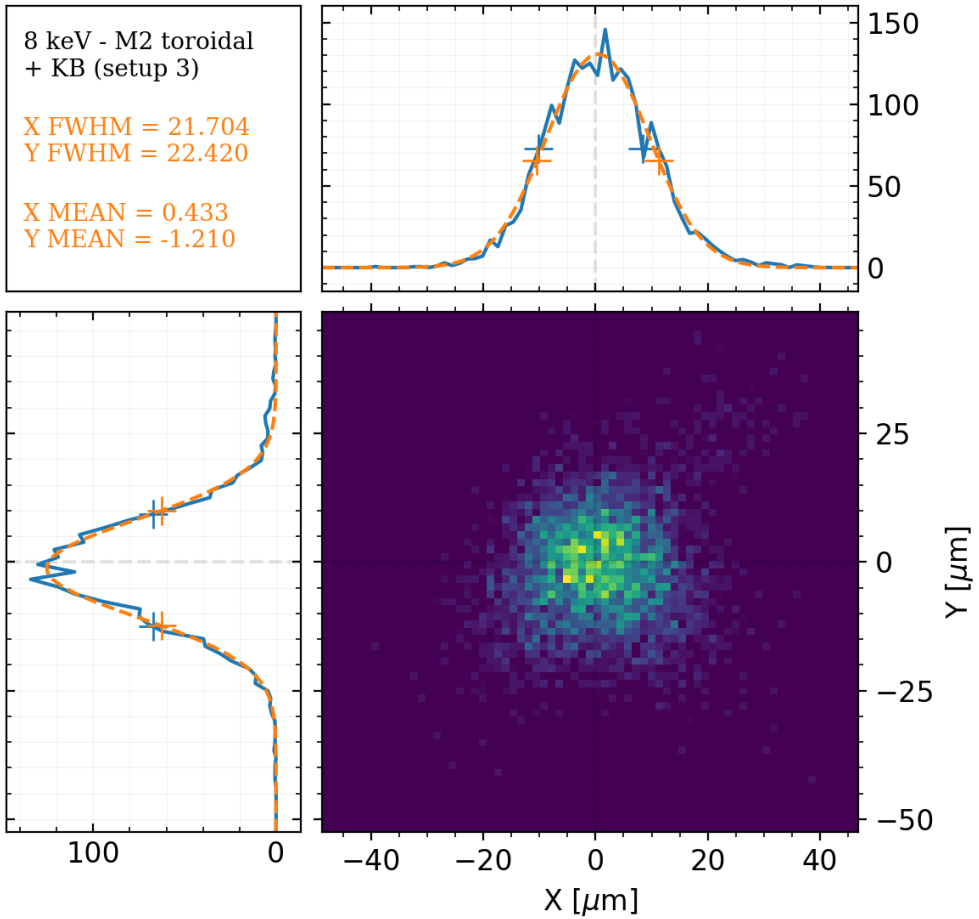


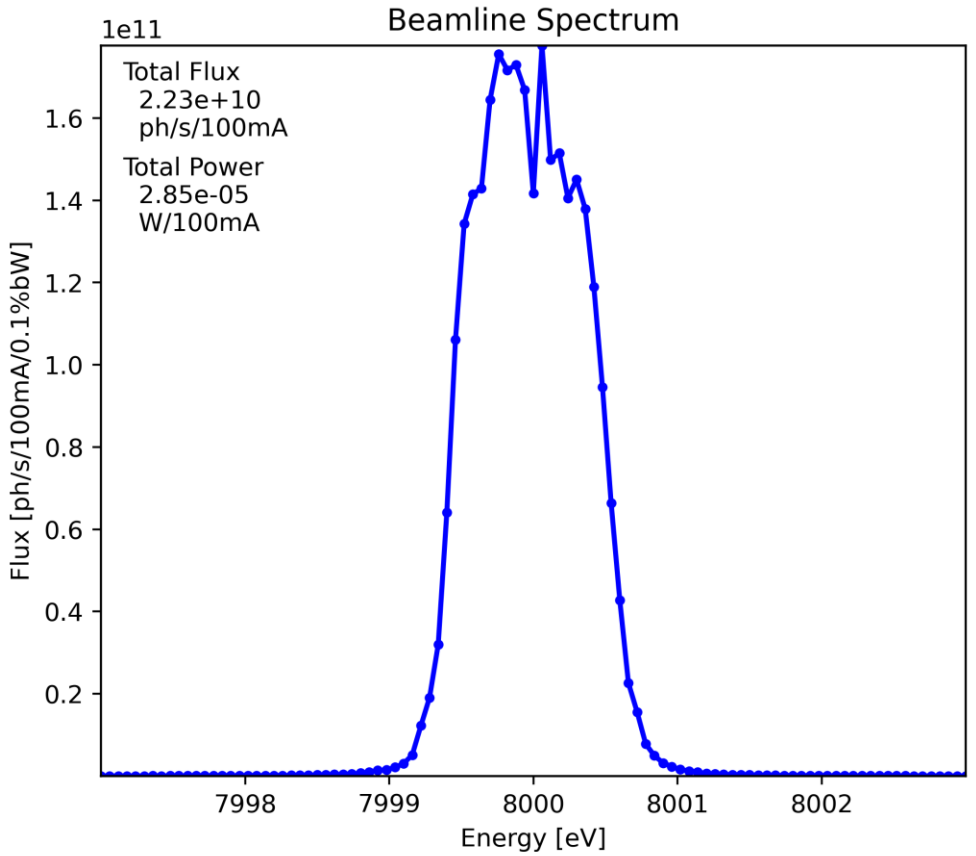
KB-HFM



In each mirror's widget, you can look at the beam footprint on the mirror. This help us choose an adequate mirror dimension. Remember that in Shadow Y is the mirror length (horizontal axis above). The vertical axis is the mirror width. Therefore, VFM can be 100 mm long without loosing much flux. Longer HFM could result in larger flux. It's a compromise.

Setup 3B: M2 toroidal + KB mirrors





Setups Comparison

	Setup 1	Setup 2	Setup 3A	Setup 3B
Focus Size FWHM (H x V) [µm²]	465 x 97	35 x 16	127 x 77	22 x 22
Total Flux [ph/s/100mA]	2.2×10^{10}	2.5×10^{09}	2.5×10^{10}	2.2×10^{10}
Avg. Flux Density [ph/s/µm²/100mA]	**4.9×10^{5}**	**4.2×10^{6}**	**2.5×10^{6}**	**4.5×10^{7}**