Energy and Camera Length

In order to determine the optimum set up for each experiment, a couple of important pieces of information are needed. If you do not understand or know the answers to any of these questions, please contact a member of the beamline team who will be happy to advise you.

- What is the q range of interest for your experiment?
- Which energy will you need to use for your experiment?
- Does your sample has a preferred orientation or alignment? Do you want to maximise the q-range by setting the beamstop at the top, or investigate orientation effects using a central beamstop?
- Do you need to measure WAXS?

Using this information, the table below can help you to work out the set up requirements for each experiment. Please note that there is a time cost associated with all set up changes during an experiment and so we do not recommend more than one camera length, energy or sample environment change during an experiment. Please discuss all set up requirements in advance with your local contact.

Energy and wavelength

The beamline team will often refer to the energy of the beamline, which relates to the wavelength of the light used. I22 is monochromatic, so a single wavelength is used. Energy and wavelength are related by this simple equation:

$$E(keV) = \frac{12.3984}{\lambda(\mathring{A})}$$

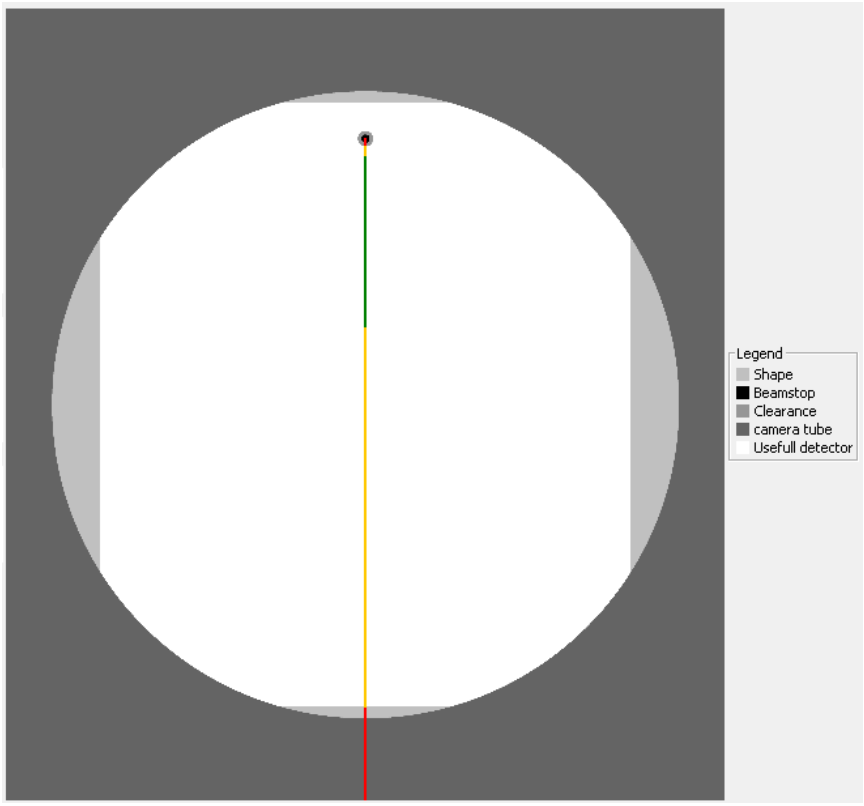
Most laboratory sources and other scattering tools will refer to the wavelength rather than the energy, so it's good to know how to switch between the two. Some popular choices of energy are:

12.4 keV	1 Å
8 keV	1.54 Å (Cu K alpha)
17.5 keV	0.71 Å (Mo K alpha)

Camera length and energy table

SAXS using Pilatus P3-2M (2D detector)

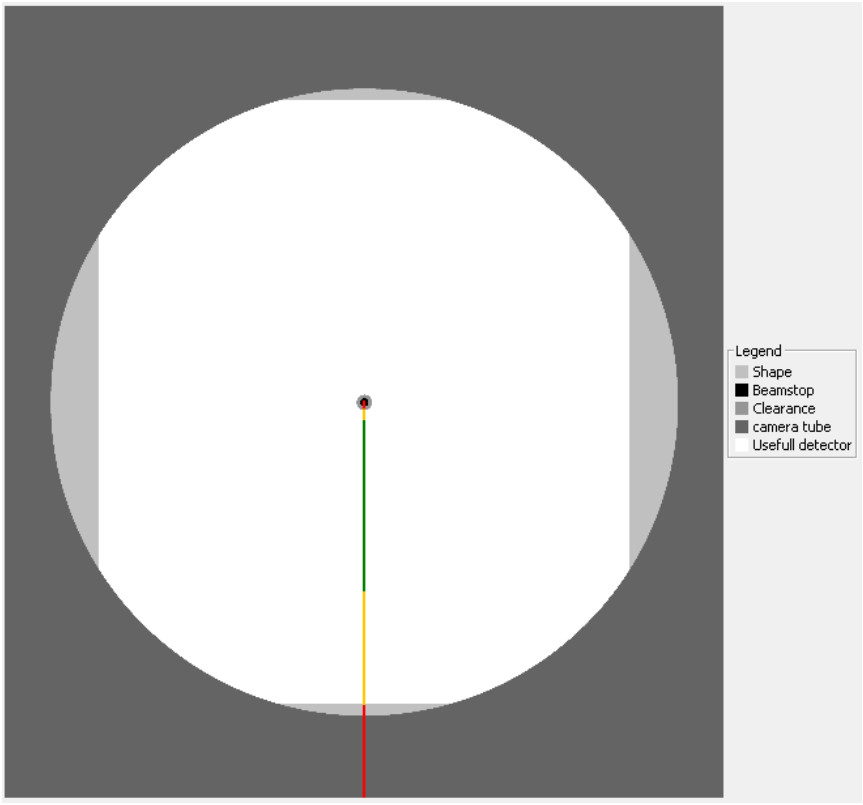
Isotropic SAXS (Beamstop at top)



Sample-Detector Distance / m	Energy / keV	q_{min}	q_{max}	d_{min}	d_{max}
1.9	5	4.90E-03	0.350	17.9	1300
	7	6.80E-03	0.490	12.8	930
	10	9.67E-03	0.700	8.96	650
	12.4	1.20E-02	0.870	7.23	525
	14	1.40E-02	0.980	6.40	465
	17	1.60E-02	1.19	5.27	380
	20	1.90E-02	1.40	4.48	325
3.9	5	2.39E-03	0.174	36.1	2630
	7	3.34E-03	0.244	25.8	1880
	10	4.78E-03	0.348	18.1	1320
	12.4	5.92E-03	0.432	14.6	1060
	14	6.69E-03	0.487	12.9	940
	17	8.12E-03	0.592	10.6	775
	20	9.55E-03	0.696	9.03	660
5.9	5	1.59E-03	0.116	54.3	3960
	7	2.22E-03	0.162	38.8	2830
	10	3.17E-03	0.231	27.2	1980
	12.4	3.93E-03	0.287	21.9	1600
	14	4.44E-03	0.324	19.4	1420
	17	5.39E-03	0.393	15.9	1170
	20	6.34E-03	0.463	13.6	990
7.9	5	1.19E-03	0.087	72.6	5300
	7	1.66E-03	0.121	51.8	3780
	10	2.37E-03	0.173	36.3	2650
	12.4	2.94E-03	0.215	29.2	2140
	14	3.32E-03	0.242	25.9	1890

	17	4.03E-03	0.294	21.3	1560
	20	4.75E-03	0.346	18.1	1320
9.7	5	9.72E-04	0.071	88.5	6460
	7	1.36E-03	0.099	63.2	4620
	10	1.95E-03	0.142	44.3	3230
	12.4	2.41E-03	0.176	35.7	2600
	14	2.72E-03	0.199	31.6	2300
	17	3.31E-03	0.241	26.0	1900
	20	3.89E-03	0.284	22.1	1620

Anisotropic SAXS (Beamstop at centre)



Sample-Detector Distance / m	Energy / keV	q_{min}	q_{max}	d_{min}	d_{max}
1.9	5	4.90E-03	0.187	33.6	1300
	7	6.80E-03	0.262	24	930
	10	9.67E-03	0.375	16.8	650
	12.4	1.20E-02	0.464	13.5	525
	14	1.40E-02	0.524	12.00	465
	17	1.60E-02	0.637	9.87	380
	20	1.90E-02	0.75	8.39	325
3.9	5	2.39E-03	0.093	67.9	2630
	7	3.34E-03	0.13	48.5	1880
	10	4.78E-03	0.185	33.9	1320
	12.4	5.92E-03	0.23	27.4	1060
	14	6.69E-03	0.259	24.2	940
	17	8.12E-03	0.315	20.0	775
	20	9.55E-03	0.37	17	660
5.9	5	1.59E-03	0.061	102.0	3960

	7	2.22E-03	0.086	73	2830
	10	3.17E-03	0.123	51.1	1980
	12.4	3.93E-03	0.152	41.2	1600
	14	4.44E-03	0.172	36.5	1420
	17	5.39E-03	0.209	30.1	1170
	20	6.34E-03	0.246	25.5	990
7.9	5	1.19E-03	0.046	136.5	5300
	7	1.66E-03	0.064	97.5	3780
	10	2.37E-03	0.092	68.2	2650
	12.4	2.94E-03	0.114	55.1	2140
	14	3.32E-03	0.129	48.8	1890
	17	4.03E-03	0.156	40.2	1560
	20	4.75E-03	0.184	34.1	1320
9.7	5	9.72E-04	0.038	167.0	6460
	7	1.36E-03	0.053	119	4620
	10	1.95E-03	0.075	83.3	3230
	12.4	2.41E-03	0.094	67.2	2600
	14	2.72E-03	0.106	59.5	2300
	17	3.31E-03	0.128	49.0	1900
	20	3.89E-03	0.151	41.6	1620

WAXS using Pilatus3-2M-DLS-L

The exact q-ranges available from the WAXS detector are variable due to the large number of possible sample/WAXS Detector/SAXS detector configurations but, as a guide, numbers below are given for sample - WAXS detector distance = 175.4mm and with the pirmary beam passing 2mm from the edge of the WAXS detector chips.

Energy (keV)	q_{min}	q_{max} (Horizontal)	qmax (Vertical)
5	0.029	1.91	1.98
7	0.040	2.67	2.77
10	0.058	3.82	3.95
12.4	0.072	4.73	4.90
14	0.081	5.34	5.54
17	0.098	6.49	6.72
20	0.116	7.63	7.91

NOTE: For a given detector geometry and energy, if q_{min}(WAXS) < q_{max}(SAXS) you will have overlap between data sets.