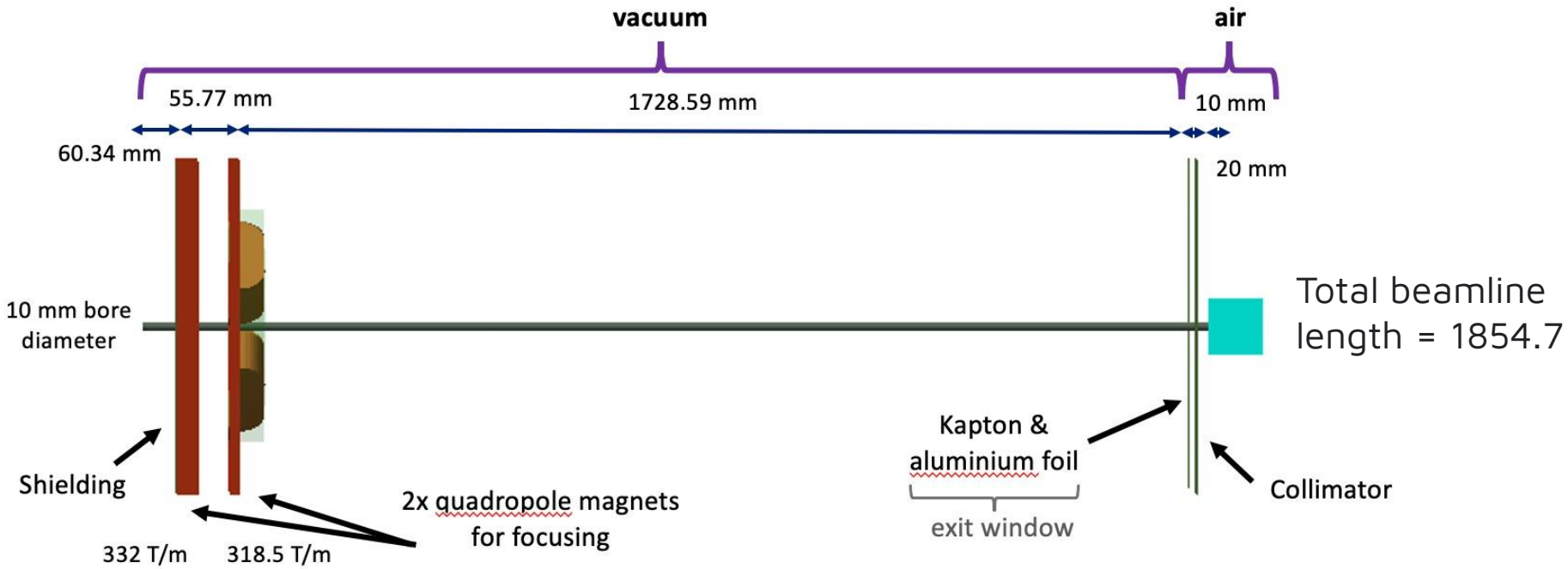
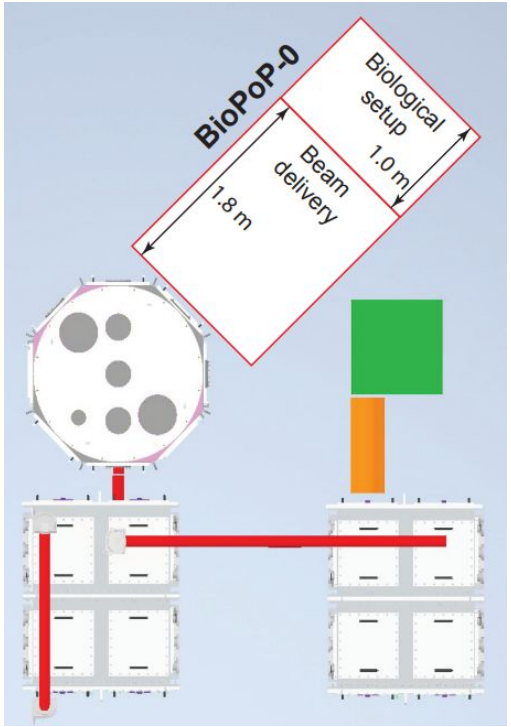
PoPLaR (Proof of Principle LhARA Radiobiology)

WP7- Proof of Principle Biological Experiment (Update 09/04/2024)

LION beamline schematic

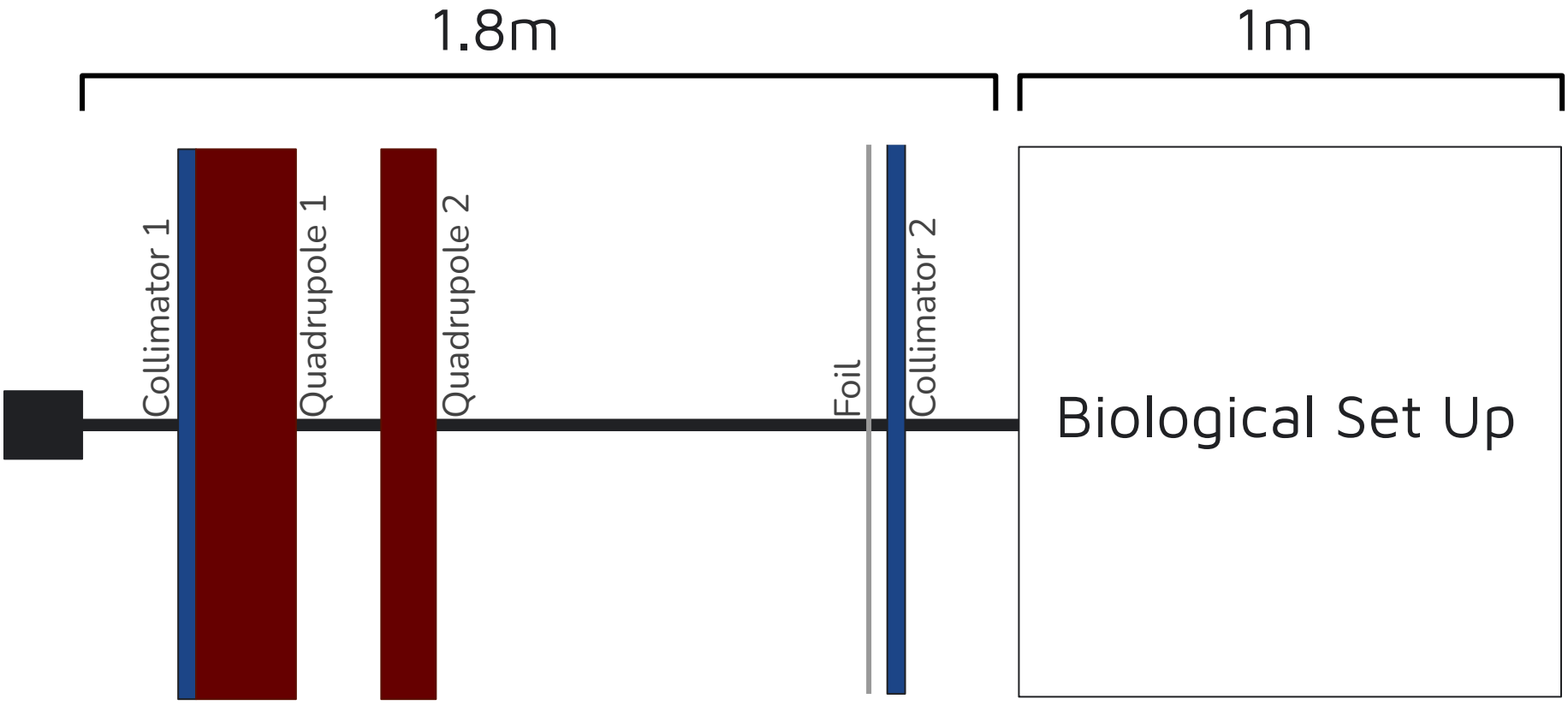


SCAPA schematic

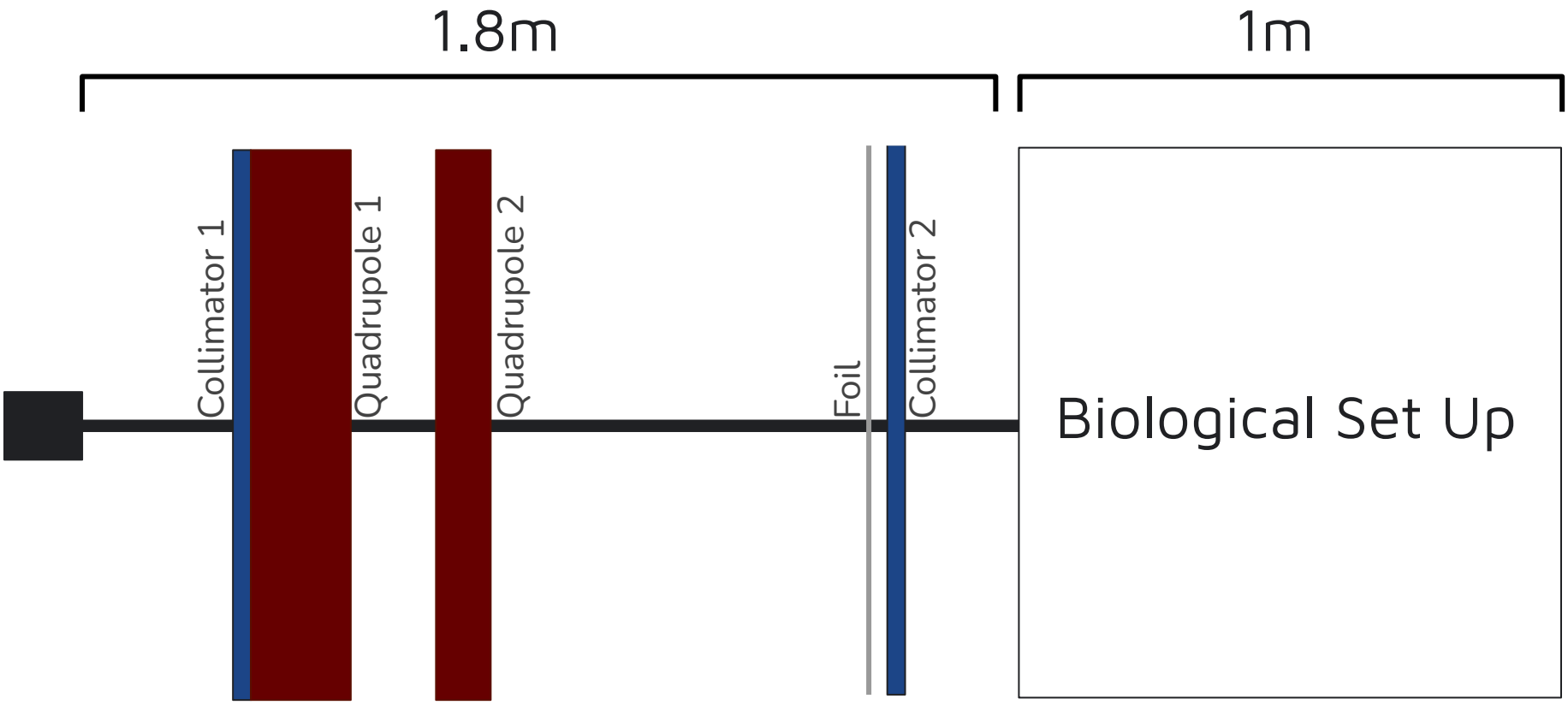


Stage	Section	Element	Type	Parameter	Value	Unit	Comment
0	Facility	Global	Name	Name	LION		
0	Facility	Global	Reference particle	Kinetic energy	10	MeV	
0	Facility	Global	Vacuum chamber	Mother volume radius	0.5	m	
1	Source	Source	Parameterised TN	SourceMode	0		Gaussian kinetic energy
1	Source	Source	Parameterised TN	SigmaX	0.000004	m	Gaussian width, x
1	Source	Source	Parameterised TN	SigmaY	0.000004	m	Gaussian width, y
1	Source	Source	Parameterised TN	Emin	1	MeV	Minimum of energy distribution
1	Source	Source	Parameterised TN	Emax	25	MeV	Maximum of energy distribution
1	Source	Source	Parameterised TN	nPnts	1000		Number of points to sample for integration of PDF
1	Source	Source	Parameterised TN	MinCTheta	0.999691155		Maximum theta for flat cos theta
1	Source	Source	Parameterised TN	Power	2500000000000000	W	Laser power
1	Source	Source	Parameterised TN	Energy	70	J	Laser energy
1	Source	Source	Parameterised TN	Wavelength	0.8	um	Laser wavelength
1	Source	Source	Parameterised TN	Duration	2.8E-14	s	Laser pulse duration
1	Source	Source	Parameterised TN	Thickness	0.0000004	m	Target thickness
1	Source	Source	Parameterised TN	Intensity	4E+020	W/cm2	Laser intensity
1	Source	Source	Parameterised TN	DivAngle	25	degrees	Electron divergence angle
1	Capture	Drift		Length	0.04118	m	Length of first drift
1	Capture	Aperture	Elliptical	RadiusX	0.003	m	Half aperture in x of elliptical colimator
1	Capture	Aperture	Elliptical	RadiusY	0.0015	m	Half aperture in y of ellipse of elliptical colimator
1	Capture	Drift		Length	0	m	Gap between colimator and first quad
1	Capture	Fquad		Length	0.04	m	Length of focusing quad
1	Capture	Fquad		Strength	332	T/m	Strength of focusing quad
1	Capture	Aperture	Circular	Radius	0.005	m	Aperture of quad
1	Capture	Drift		Length	0.036953	m	Gap between colimator first (F)quad and second (D)quad
1	Capture	Dquad		Length	0.02	m	Length of defocusing quad
1	Capture	Dquad		Strength	318.5	T/m	Strength of defocusing quad
1	Capture	Aperture	Circular	Radius	0.005	m	Aperture of quad
1	Delivery	Drift		Length	1.6	m	Main drift from last quad to kapton/aluminium foils
1	Delivery	Drift		Length	0.015	m	Drift from kapton/aluminium foils to collimator
1	Delivery	Aperture	Circular	Radius	0.0015	m	Collimator before "end station"
1	Delivery	Drift		Length	0.02	m	Final drift

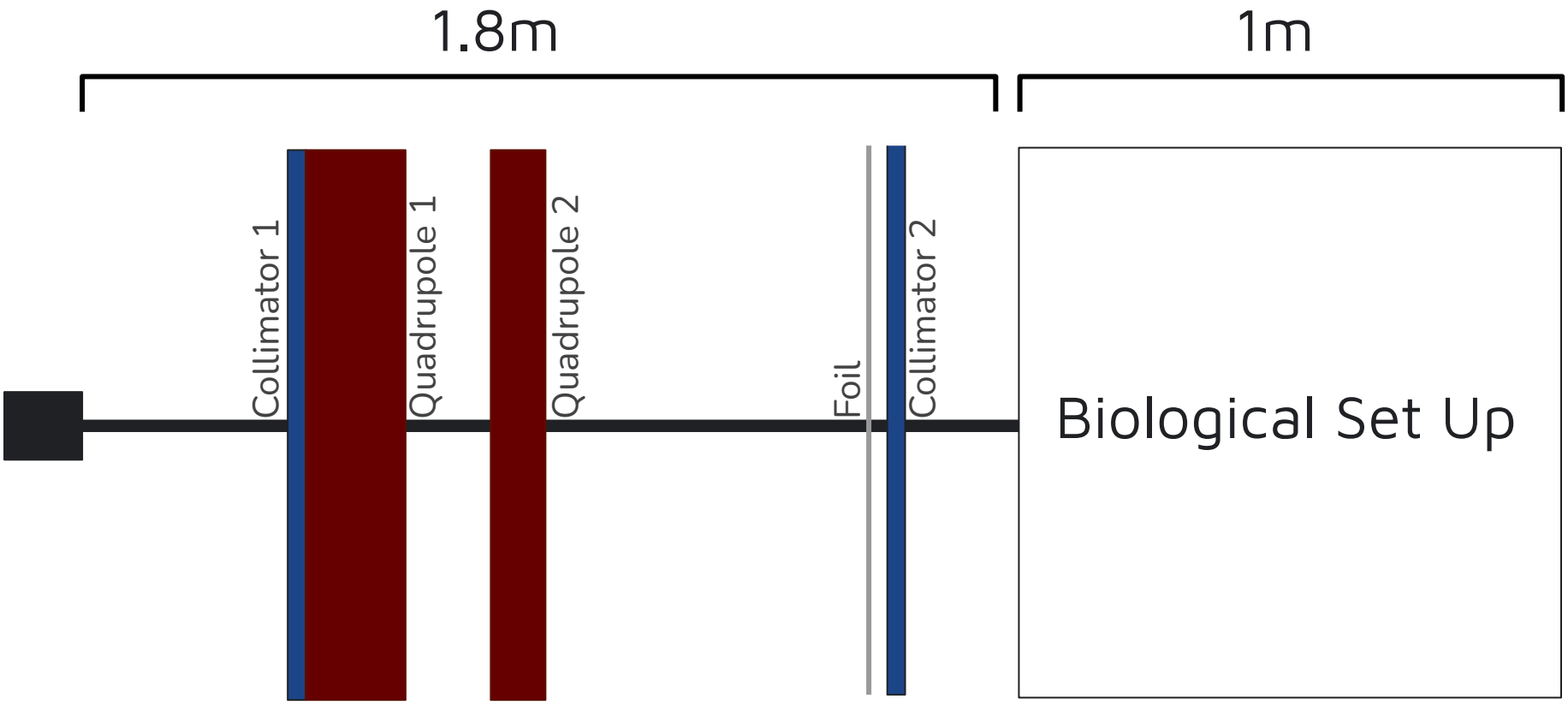
PoPLaR Set-Up



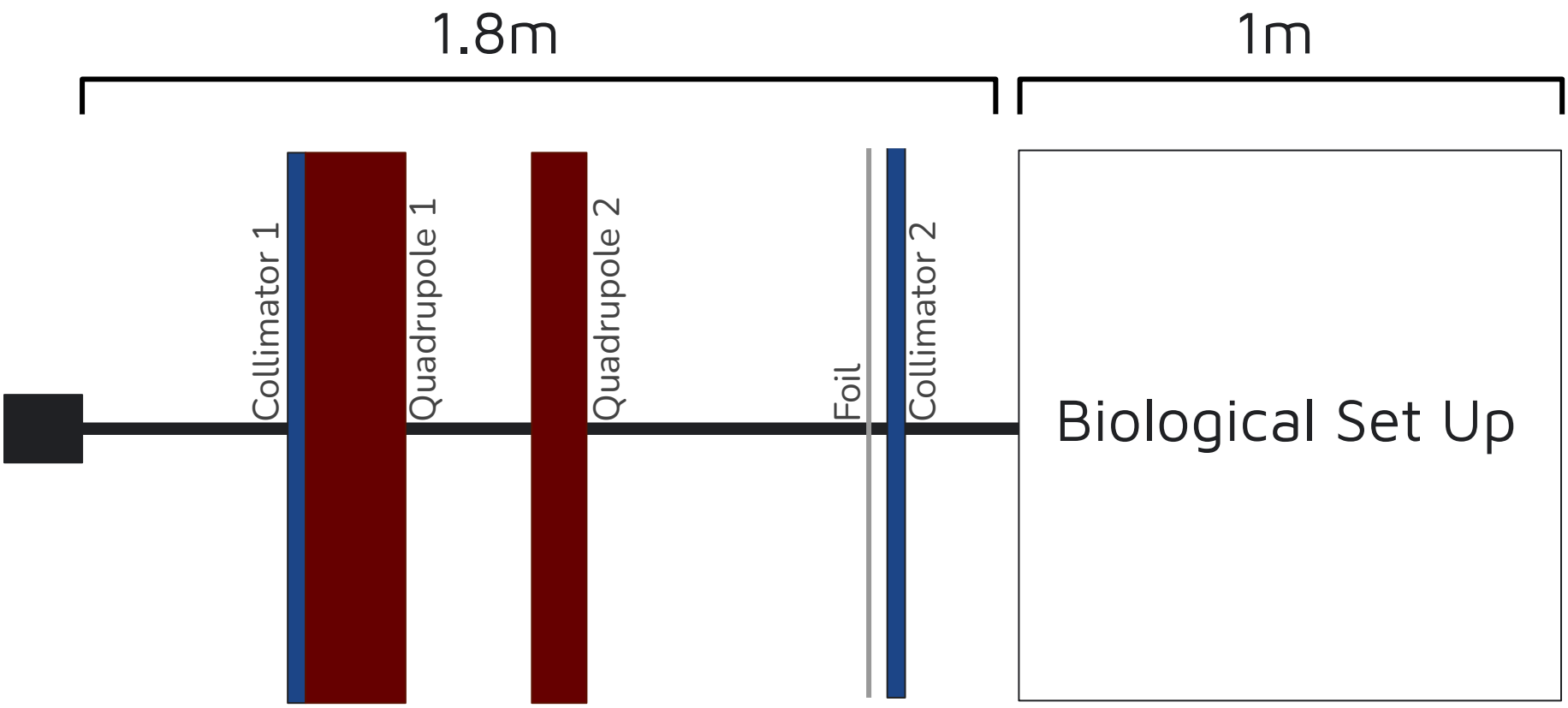
PoPLaR Set-Up



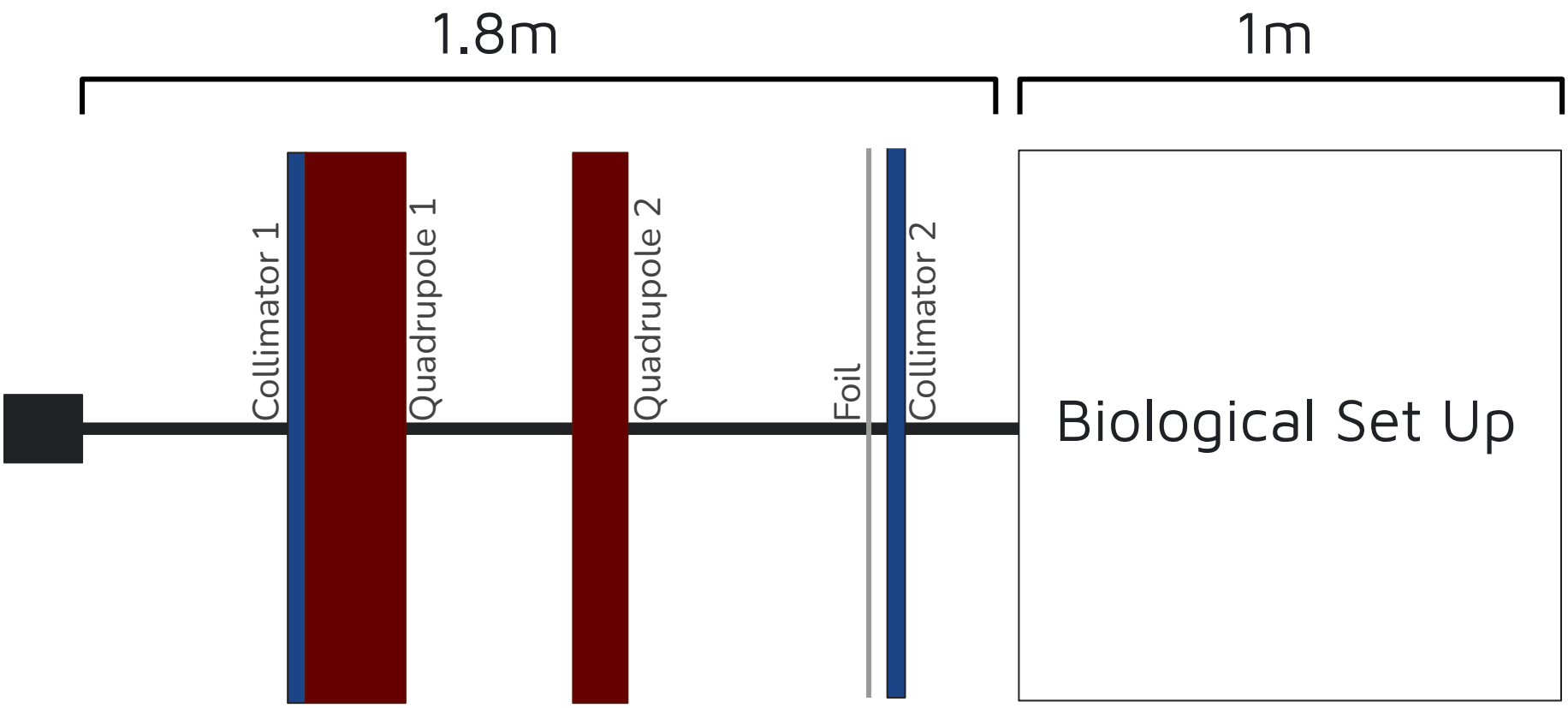
PoPLaR Set-Up



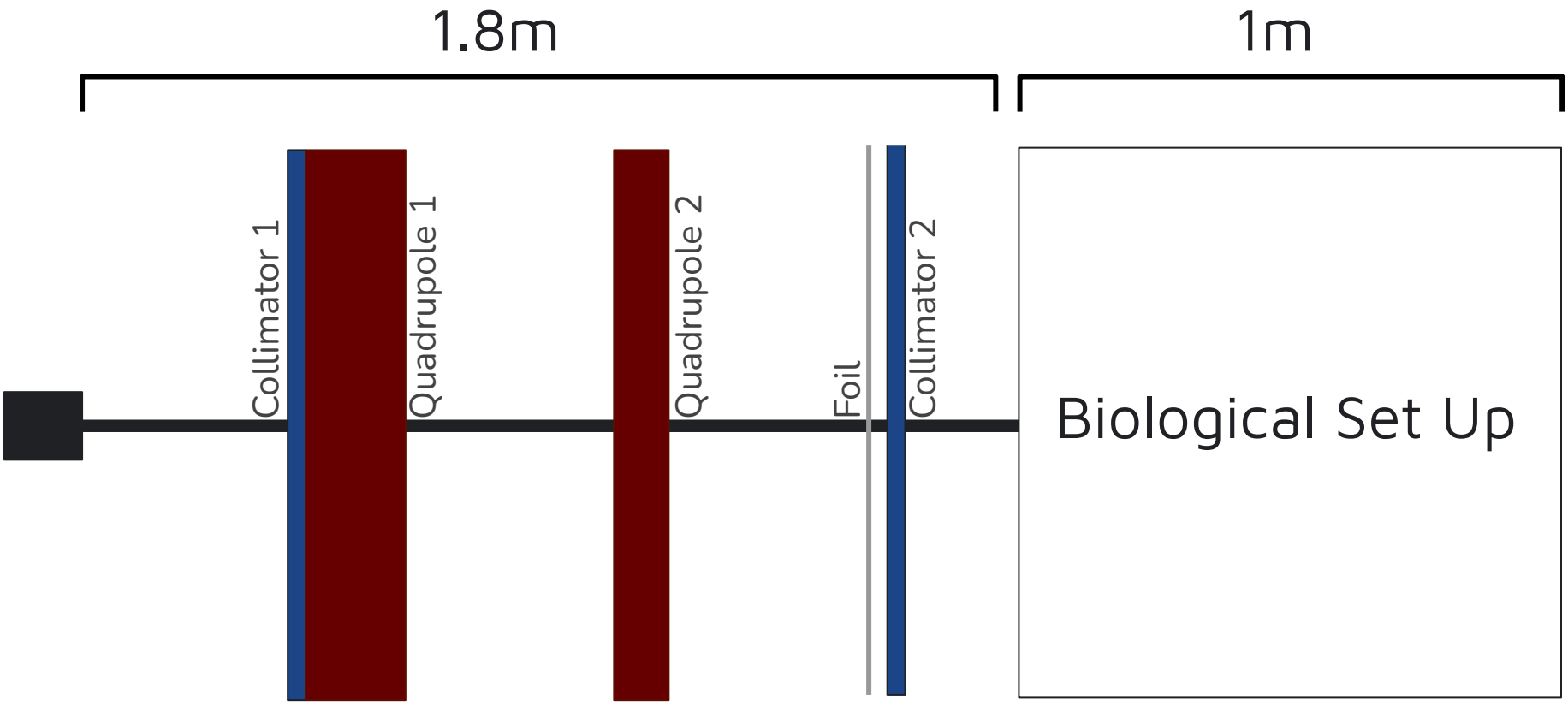
PoPLaR Set-Up



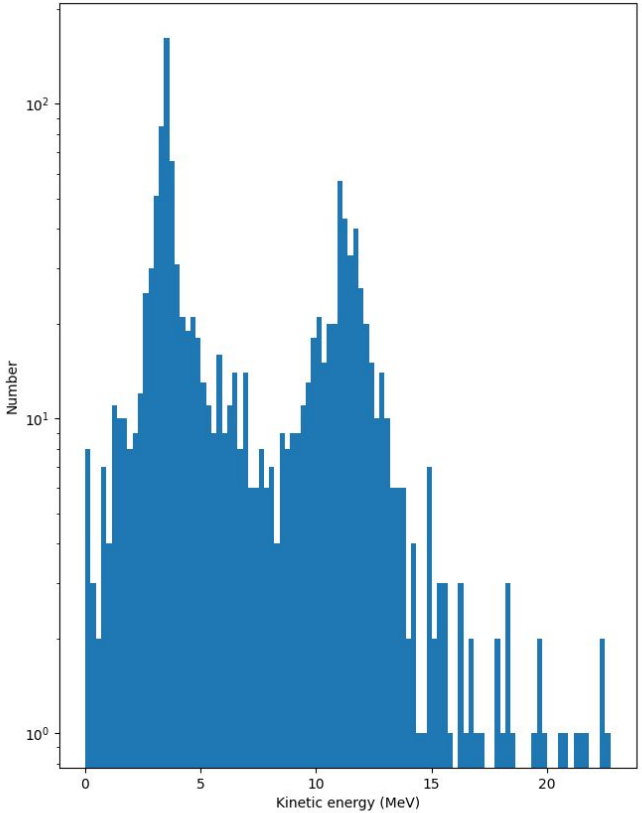
PoPLaR Set-Up



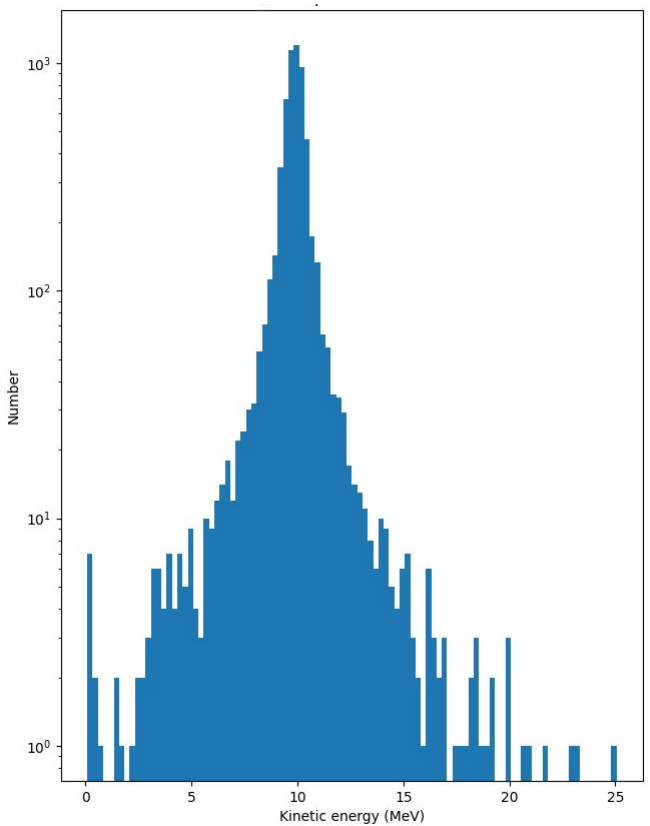
PoPLaR Set-Up



Distributions

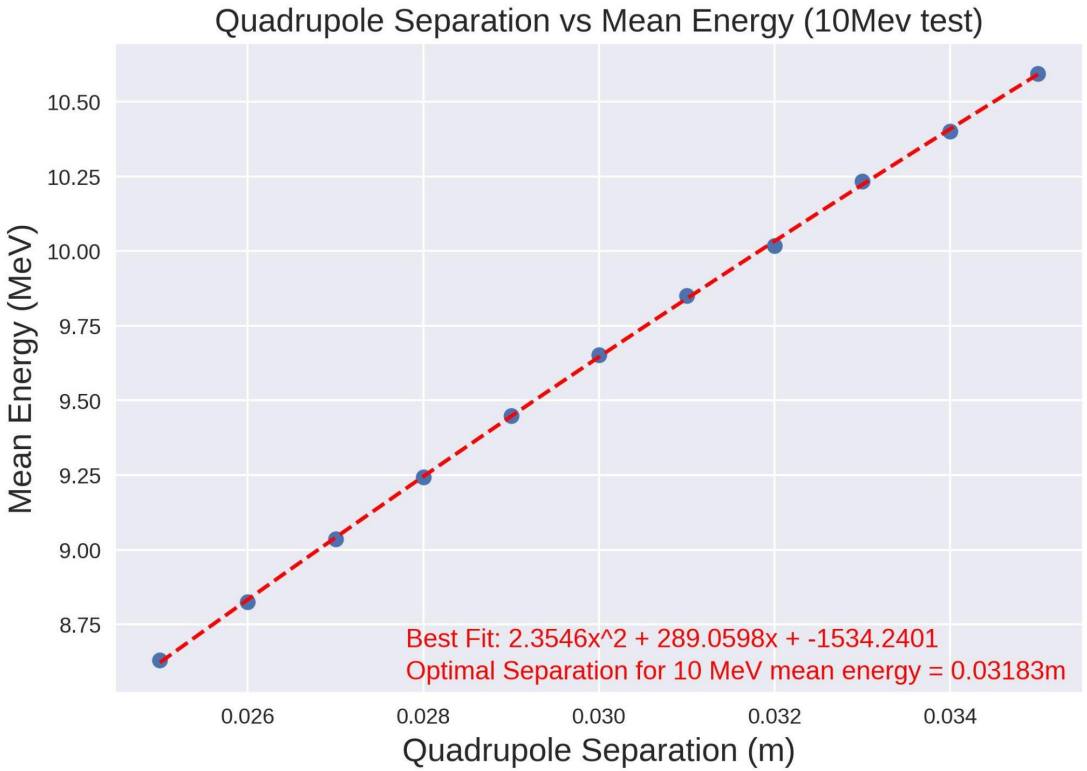


Two peak distributions



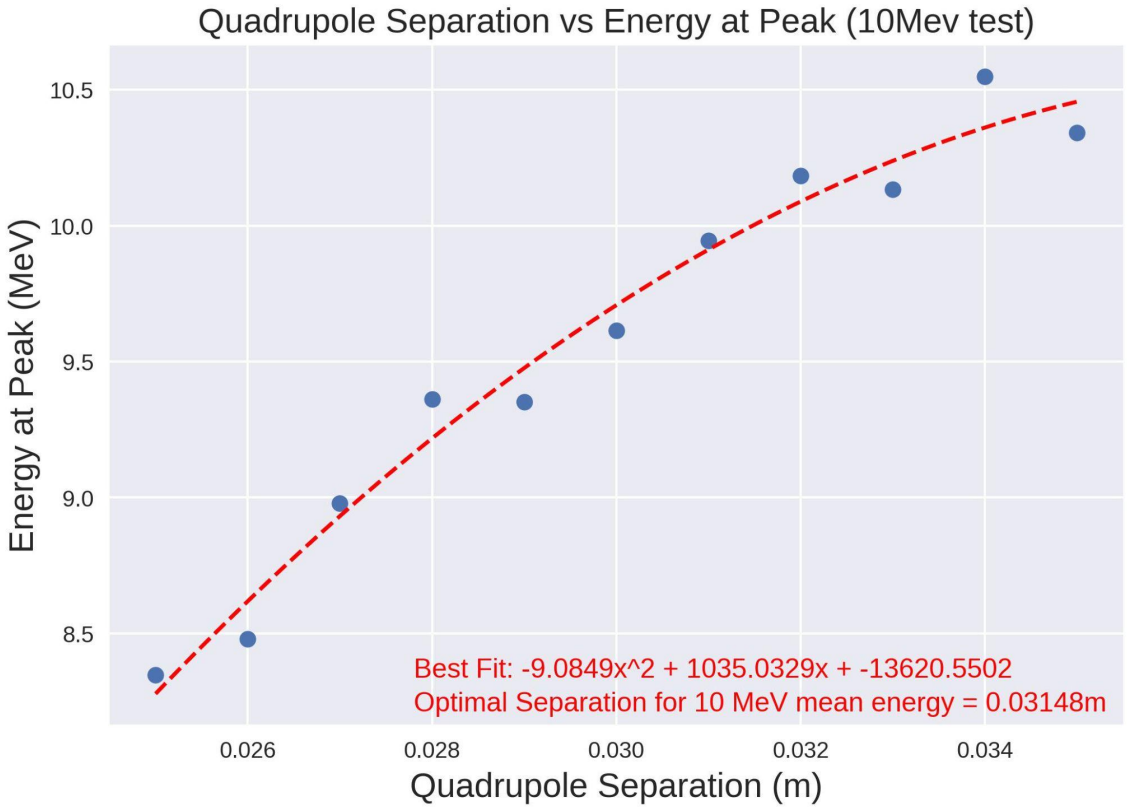
Single peak distribution

Quadrupole Separation for 10MeV (Mean)



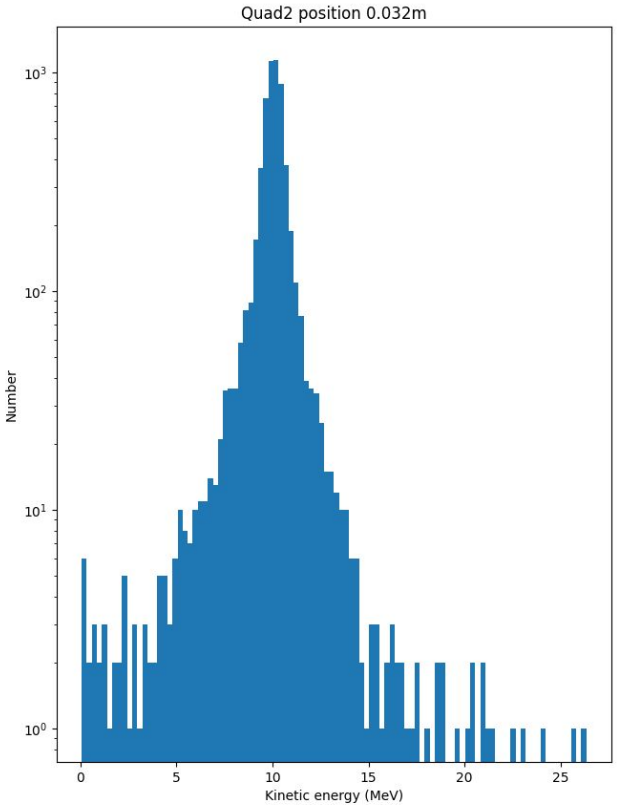
Quadrupole 1 fixed at 0.04m

Quadrupole Separation for 10MeV (Peak)

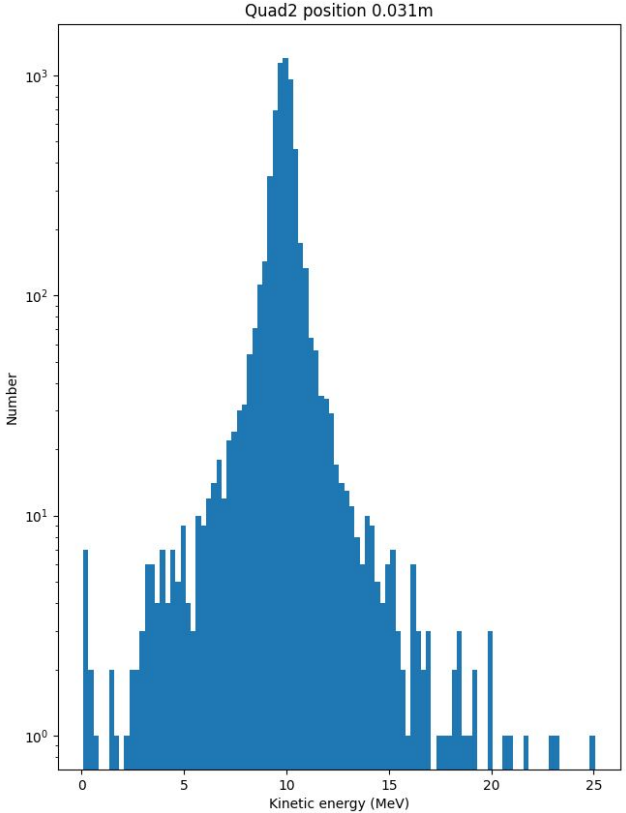


Quadrupole 1 fixed at 0.04m

Distribution for 10MeV



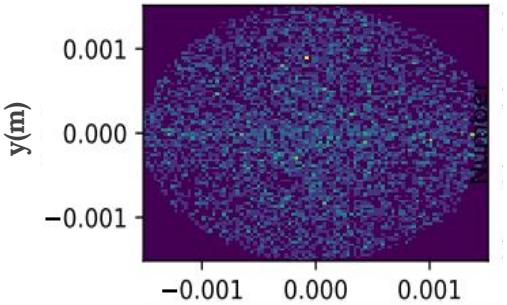
Based on Mean

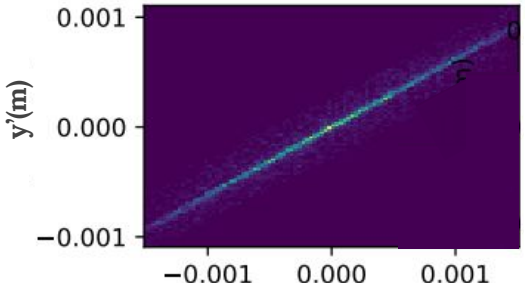


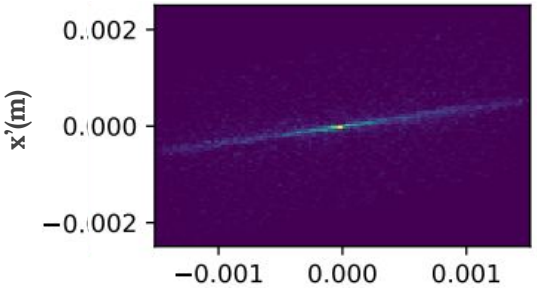
Based on Peak

Beam Properties at the Target

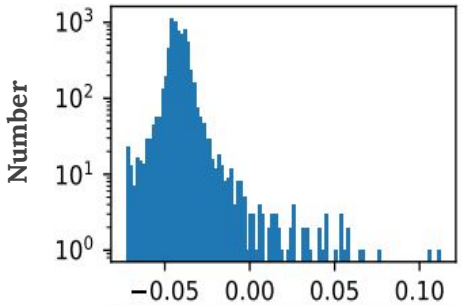
Beam geometrics

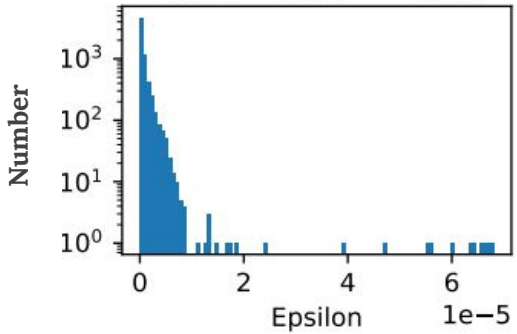


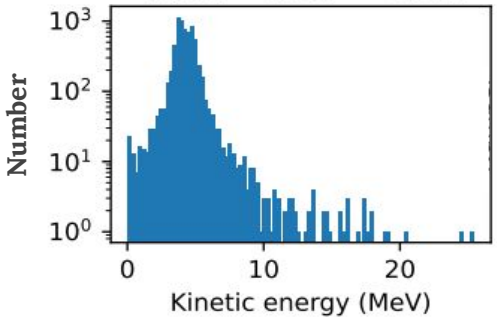




Beam distribution







Plans for PoPLaR

- Test quadrupole separation to find optimal position for different quadrupole options
- Investigate beam shapes for these quadrupoles
- Design biological experiment with these optimised parameter ranges
- Carry it out!!