

# Magnetized Beam on Viewers

Abdullah Mamun

June 26, 2017

# Magnetized Beams on Viewers

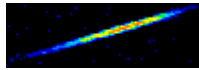
- Magnetic field on the gun solenoid was varied with solenoid current ranging from 0-400 A.
- Two sets of data were collected as:
  - Case 1: beamline lenses were all turned off
  - Case 2: used lens 2 for beam waist immediately prior to viewer 1. All other beamline lenses were turned off.

# Measurement of Rotation Angles

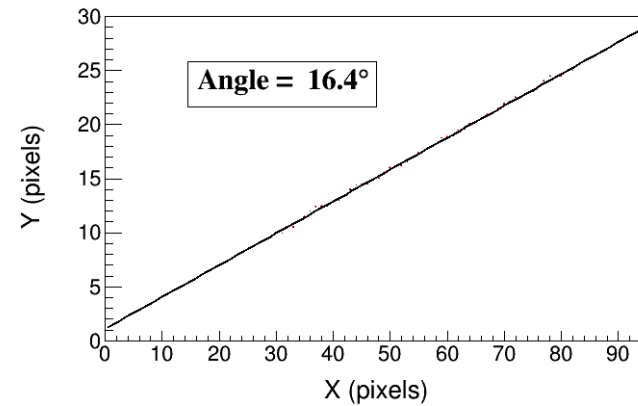
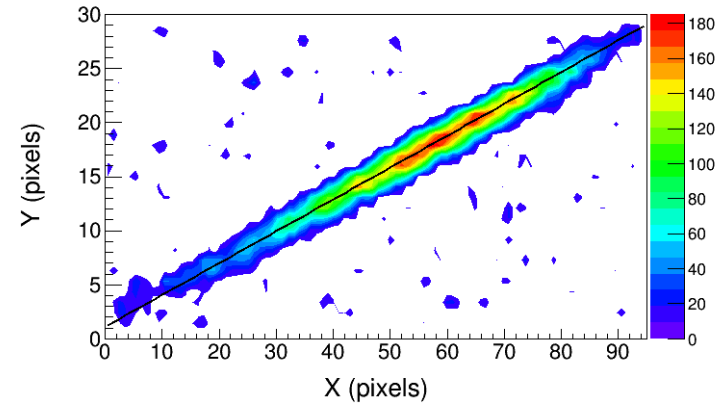
- The slit images on different viewers were analyzed to determine the slope with respect to x (+ve) axis using the linear least square fit method.
- Sign convention used:
  - a clockwise rotation w.r.t. x-axis is +ve angle
  - a counter clockwise w.r.t. x-axis is -ve angle

# Example of Rotation Measurement

Captured Image

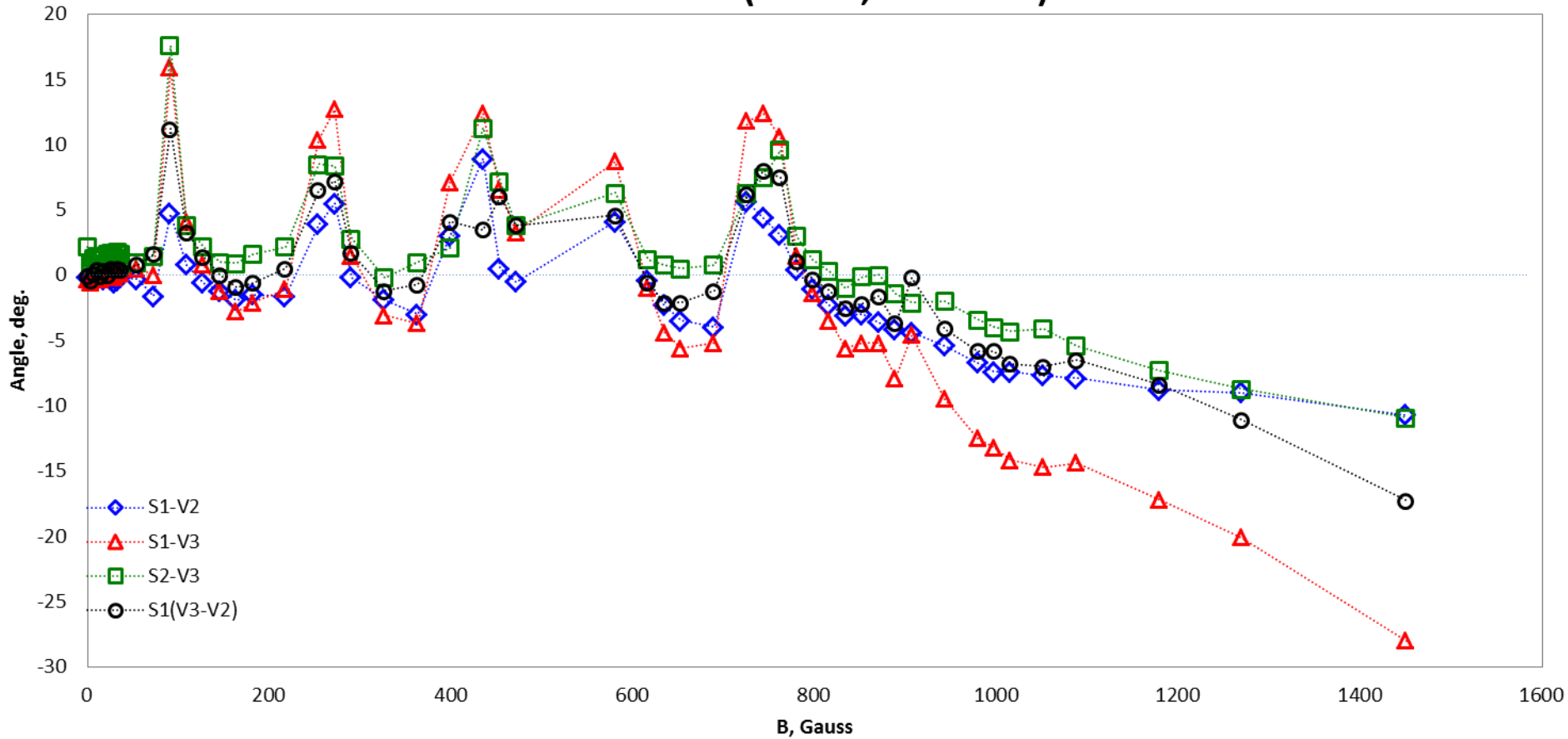


Post-analysis



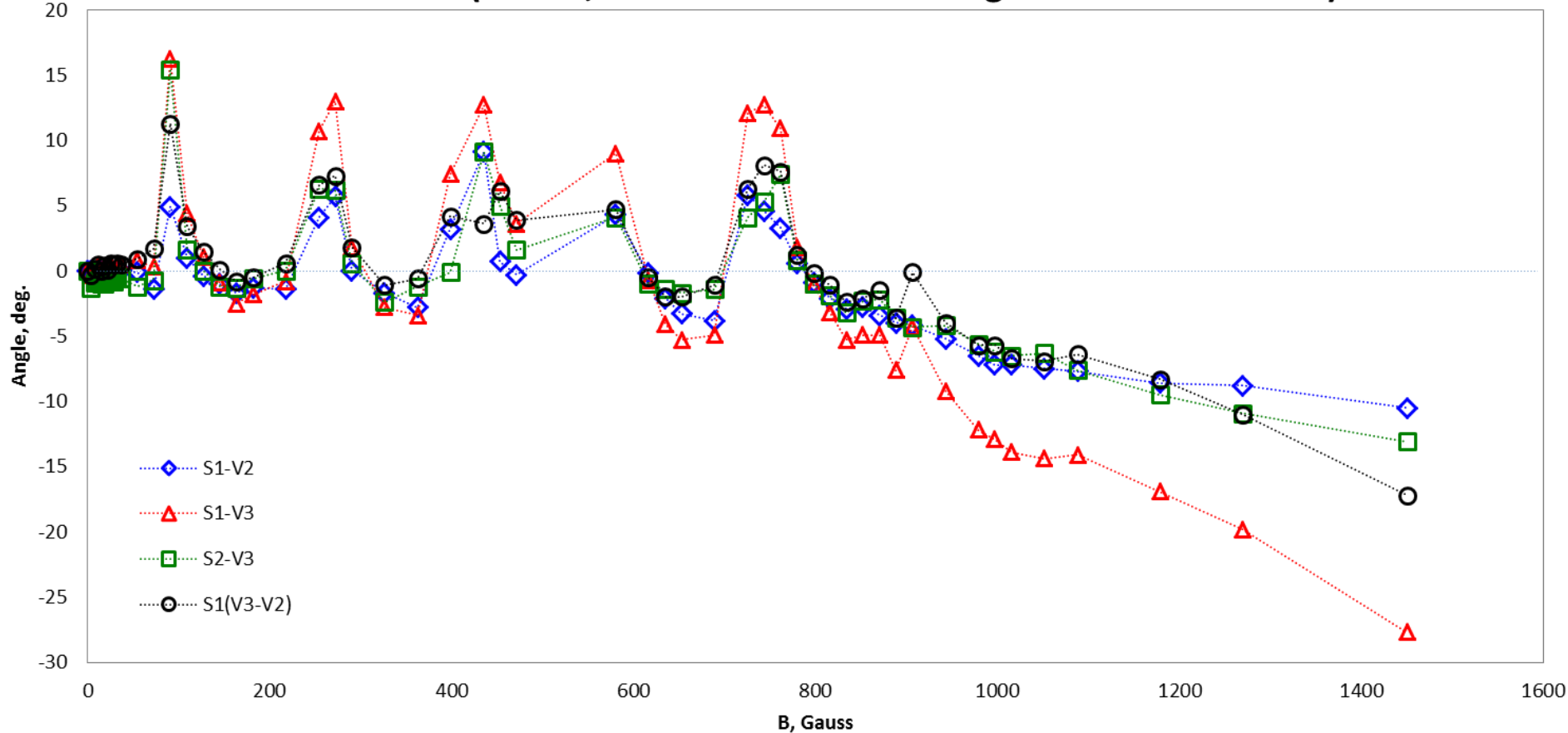
# Rotation from Slit-Viewer Images

Rotation vs. B (Case 1, Raw data)



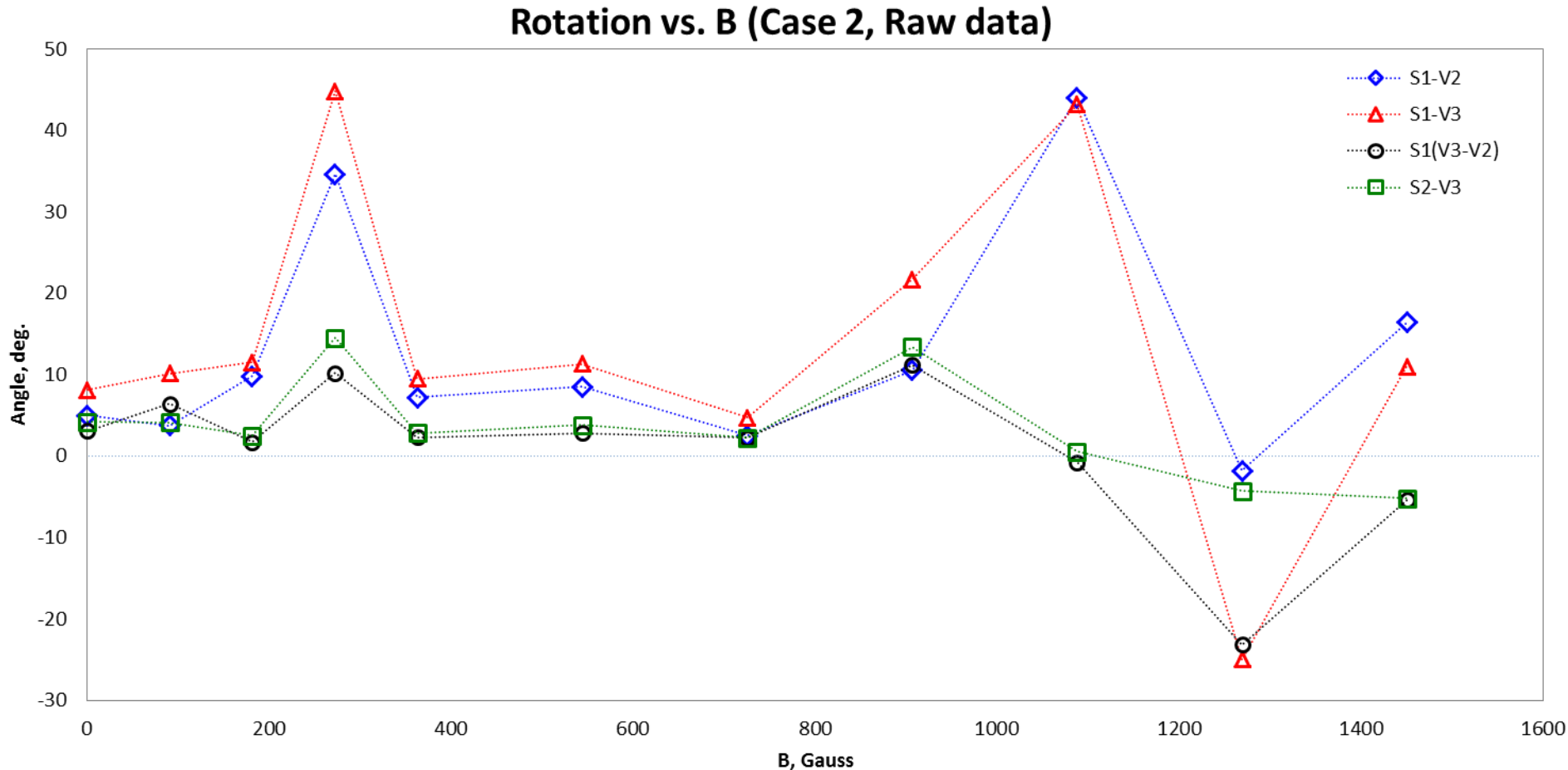
# Rotation from Slit-Viewer Images

Rotation vs. B (Case 1, Rotation zeroed for 0A gun solenoid current)



The modified data after forcing to match the expected zero rotation at 0 A gun solenoid setting.

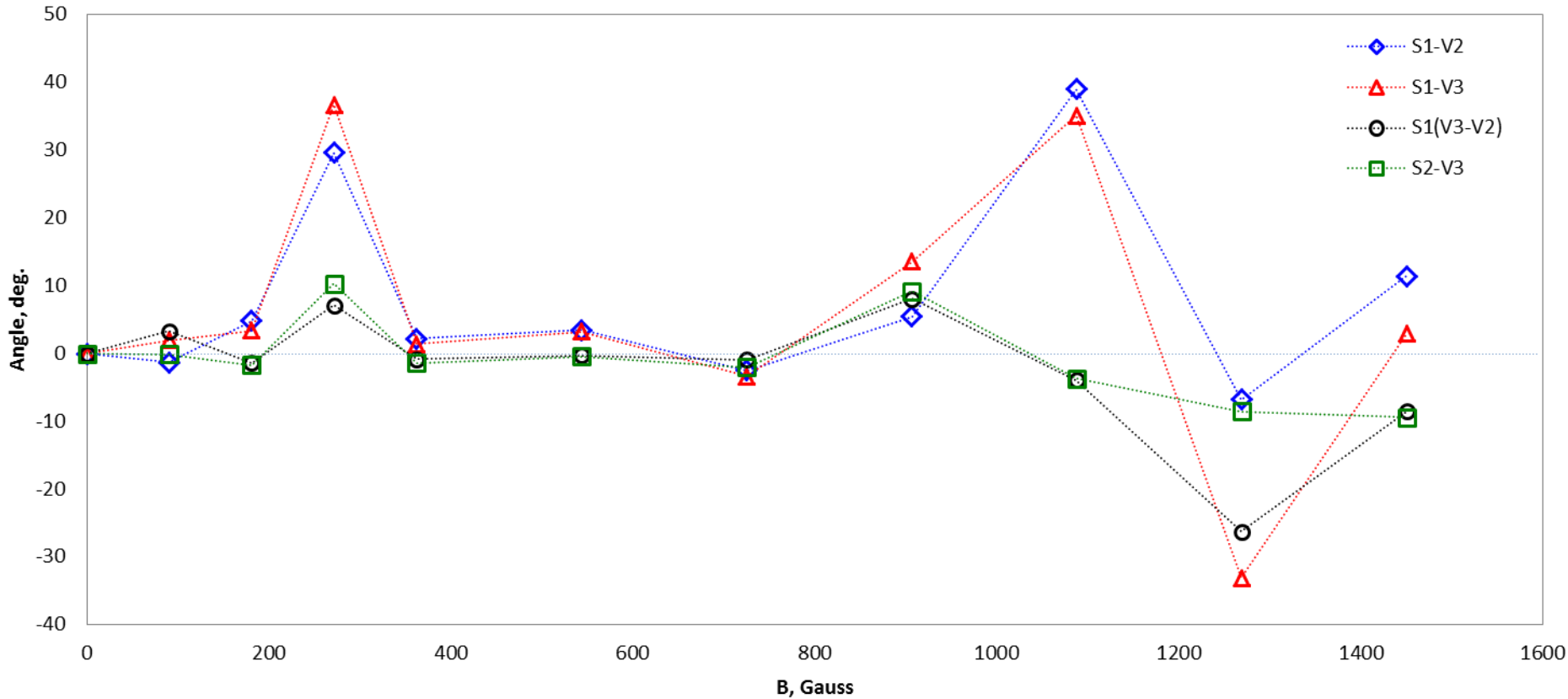
# Rotation Angles from Diverging Beam



Contrary to expectation, the beamlet images on viewers depicted non trivial rotation (4.2° to 8.1°) at 0 A gun solenoid setting. How a focusing lens can impart angular momentum!

# Rotation Angles from Diverging Beam

Rotation vs. B (Case 2, Rotation zeroed for 0A gun solenoid current)



The modified data after forcing to match the expected zero rotation at 0 A gun solenoid setting.



# Summary

- Two sets of beam rotation measurement were performed- (1) without use of any beamline forcing lenses, and (2) with forcing the beam to focus prior to viewer 1 using beamline lens#2
- Case 1 showed oscillatory pattern in rotation
- Case 2 results are ambiguous and not clear why there appeared beamlet rotation by focusing lens for nonmagnetized beam
- The angular momentum will be analyzed later

Experimental Data

# **BEAM AND BEAMLET IMAGES**

# Magnetized Beam on Viewers

(case 1: beamline lenses were all turned off)

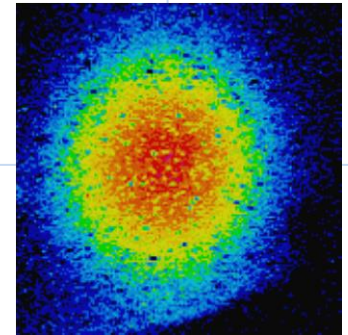
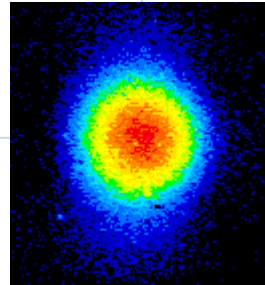
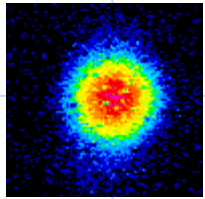
0 A

Viewer 1

Viewer 2

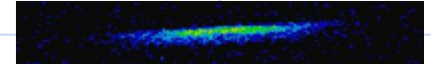
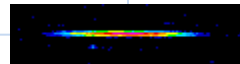
Viewer 3

Beam



Beamlet

Slit 1



Viewer 1

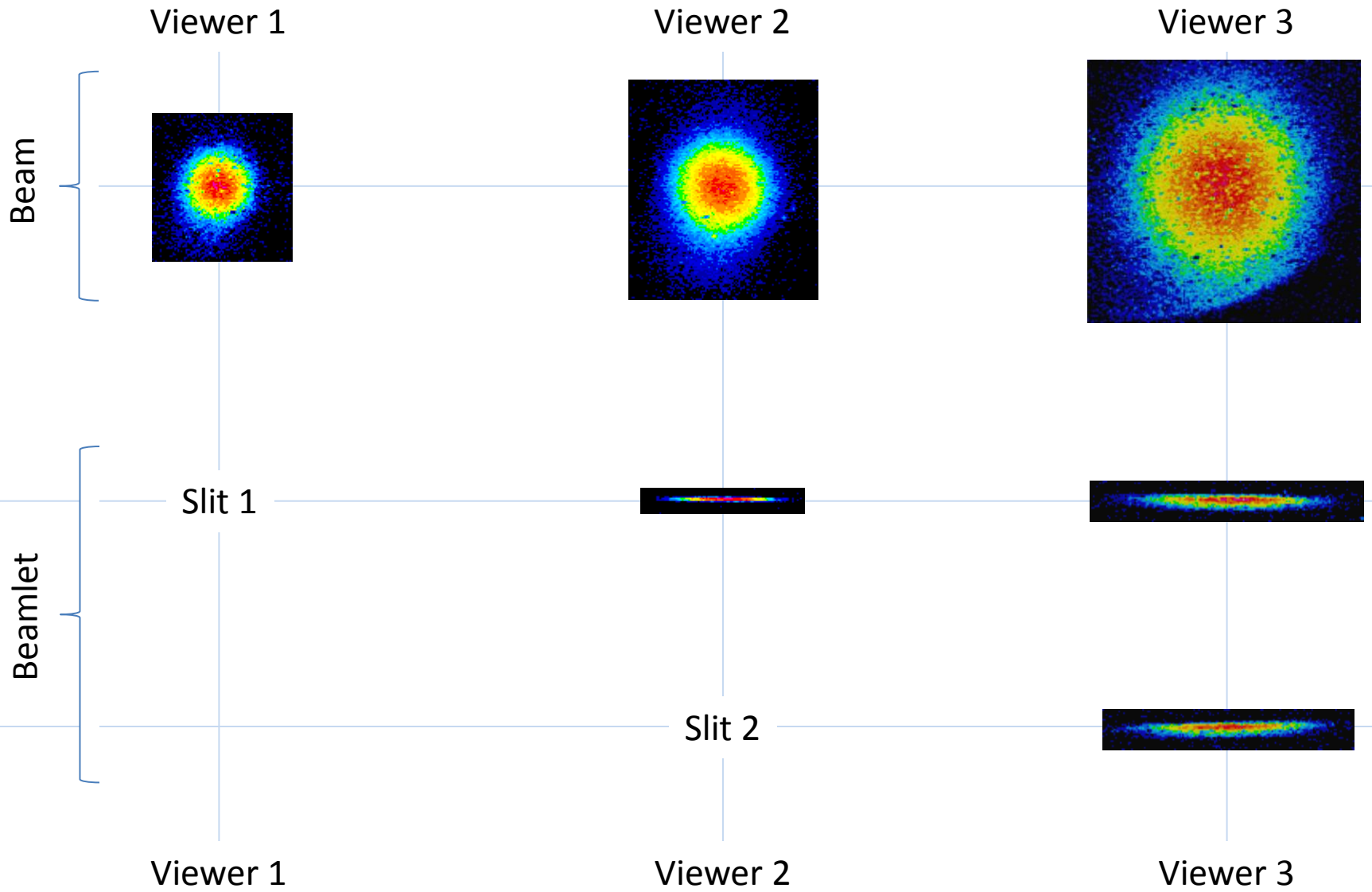
Viewer 2

Viewer 3

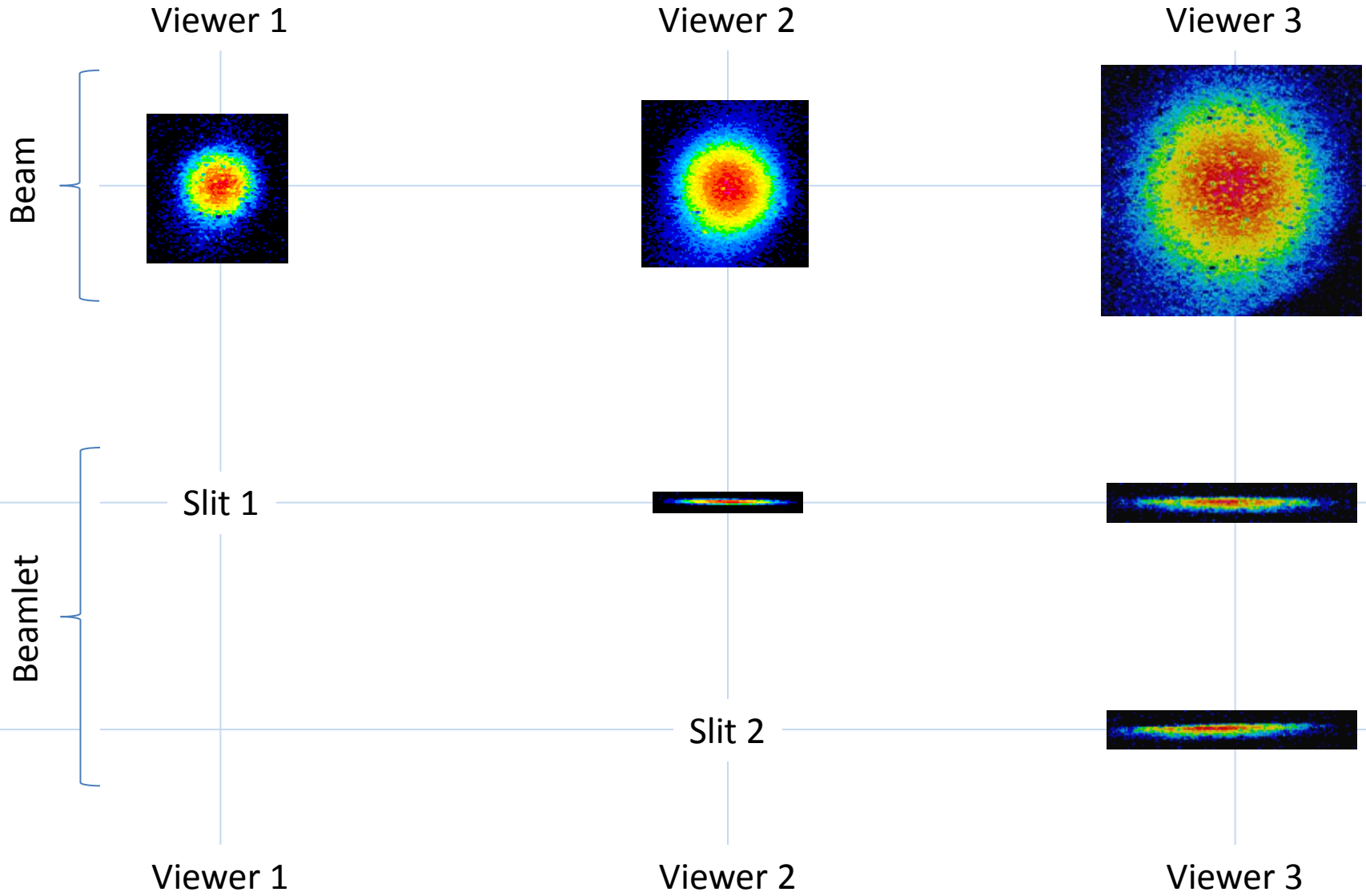
Slit 2



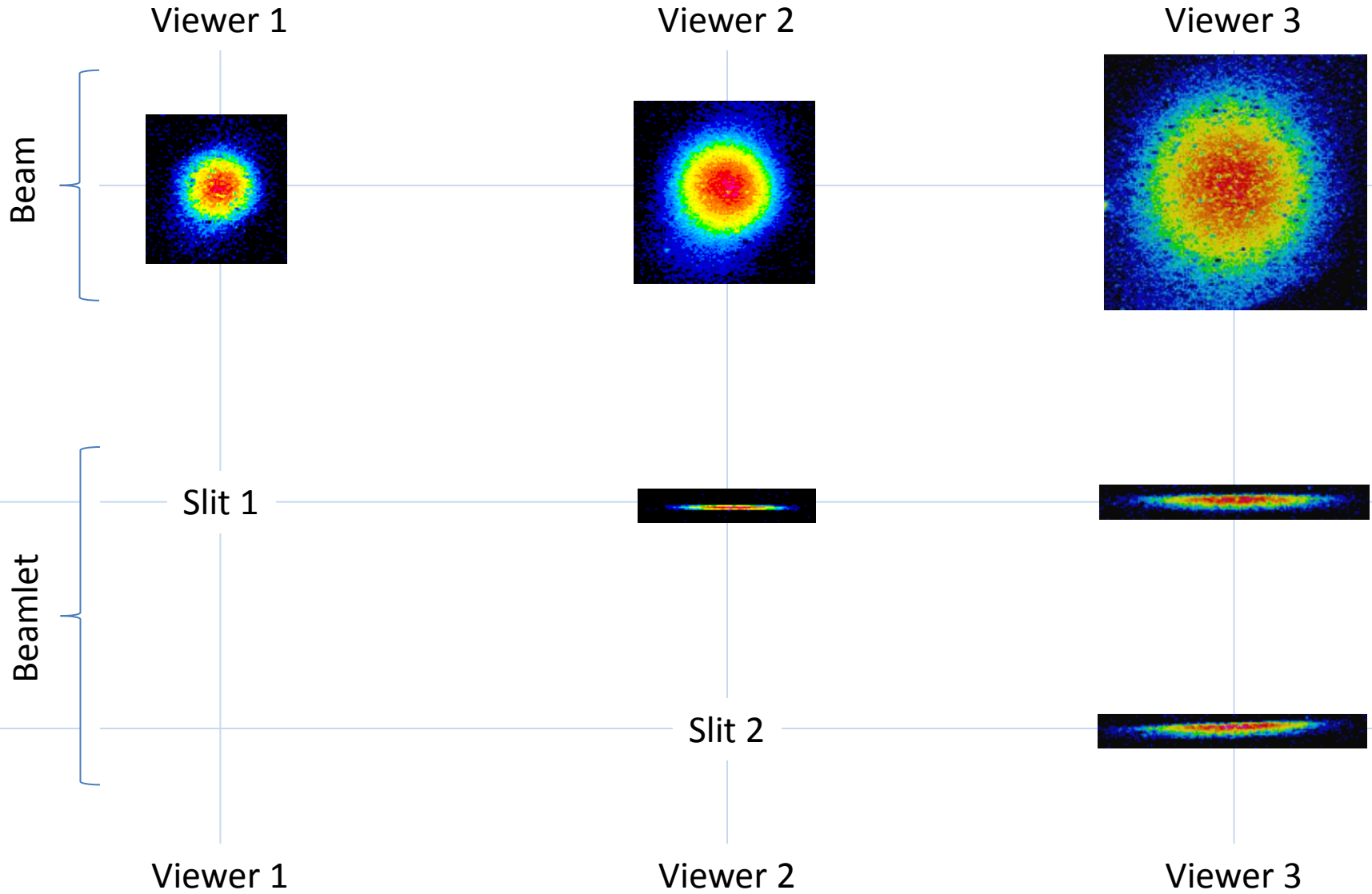
# 1 A



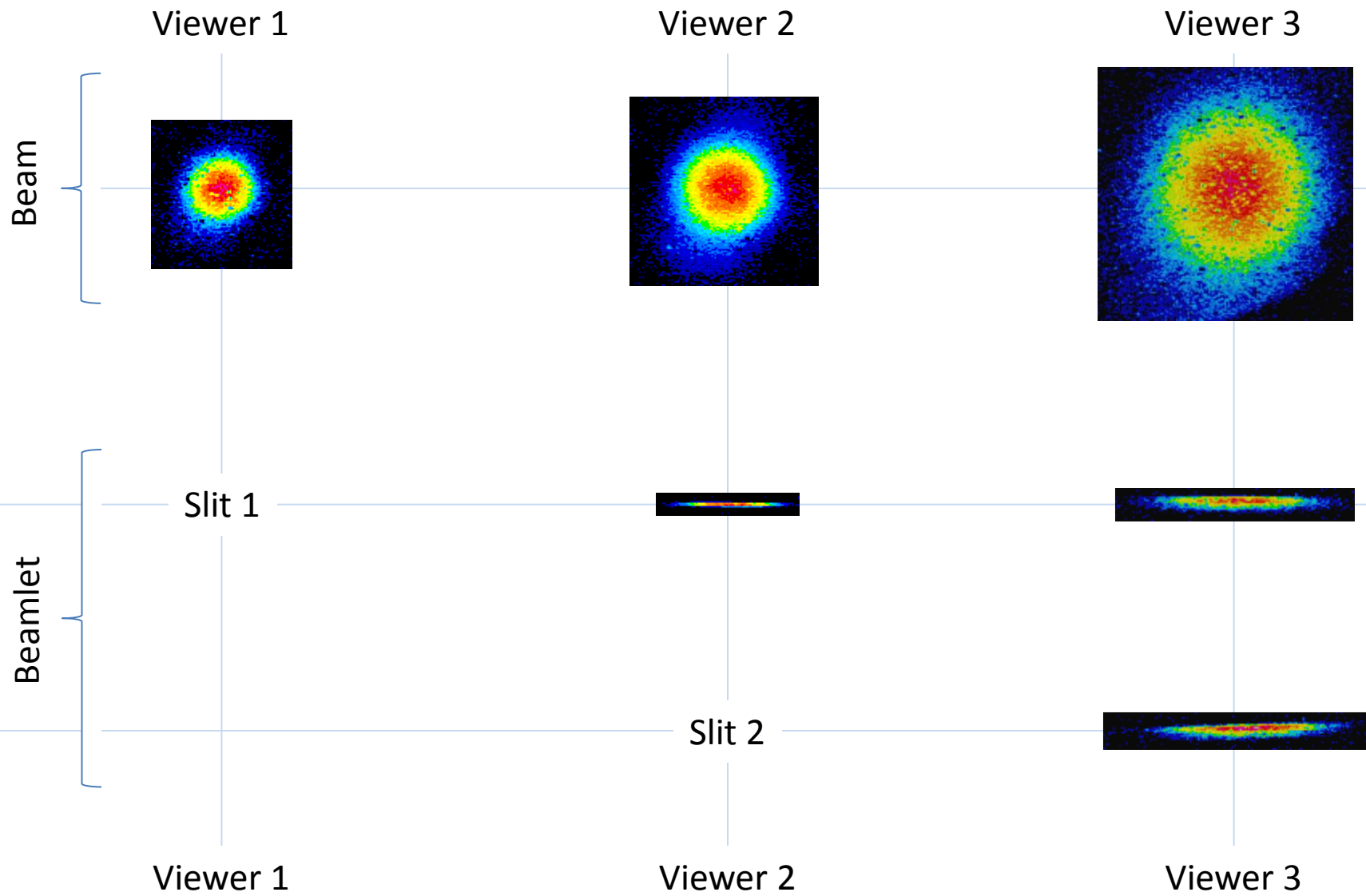
# 2 A



# 3 A

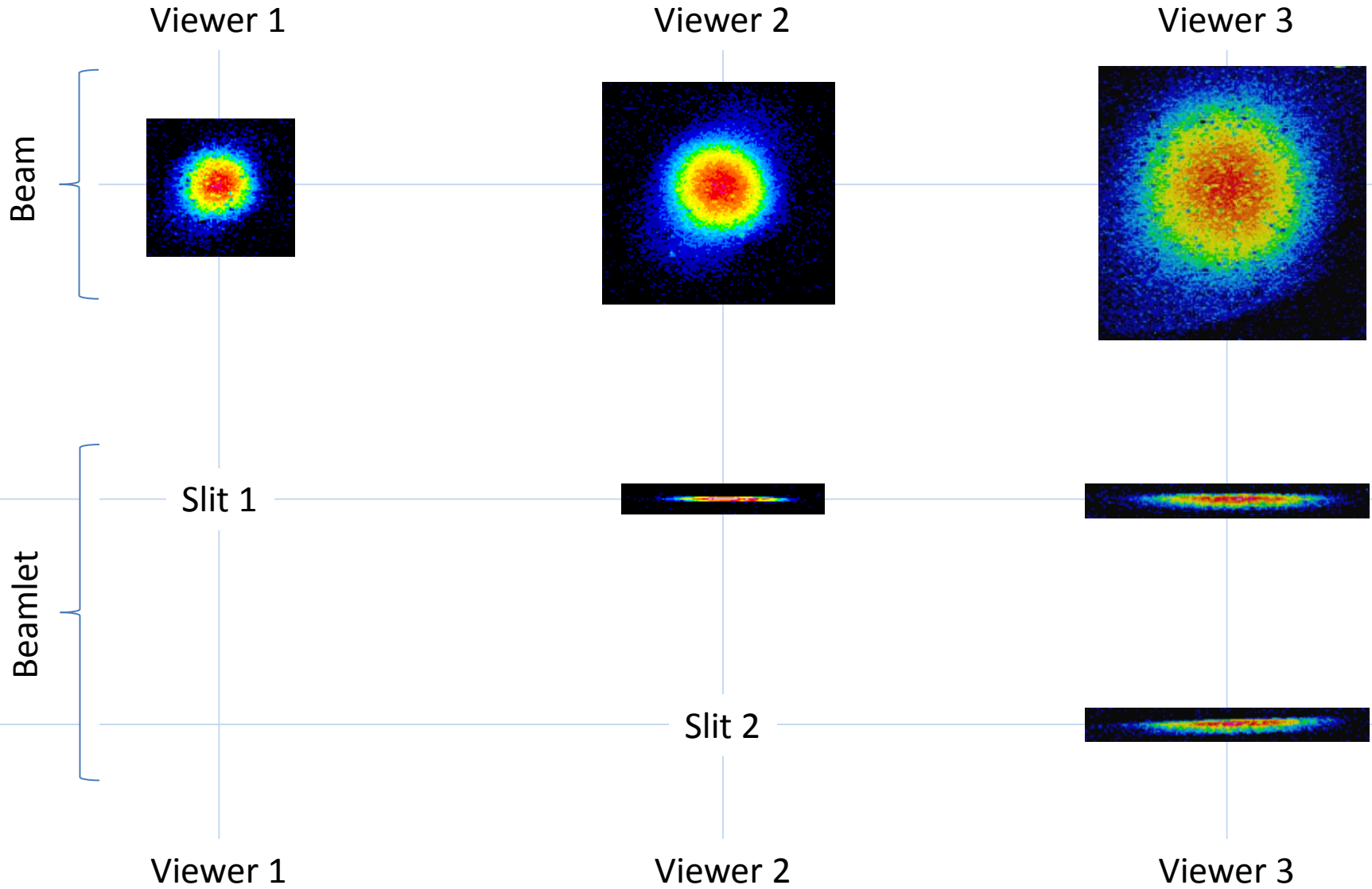


# 4 A

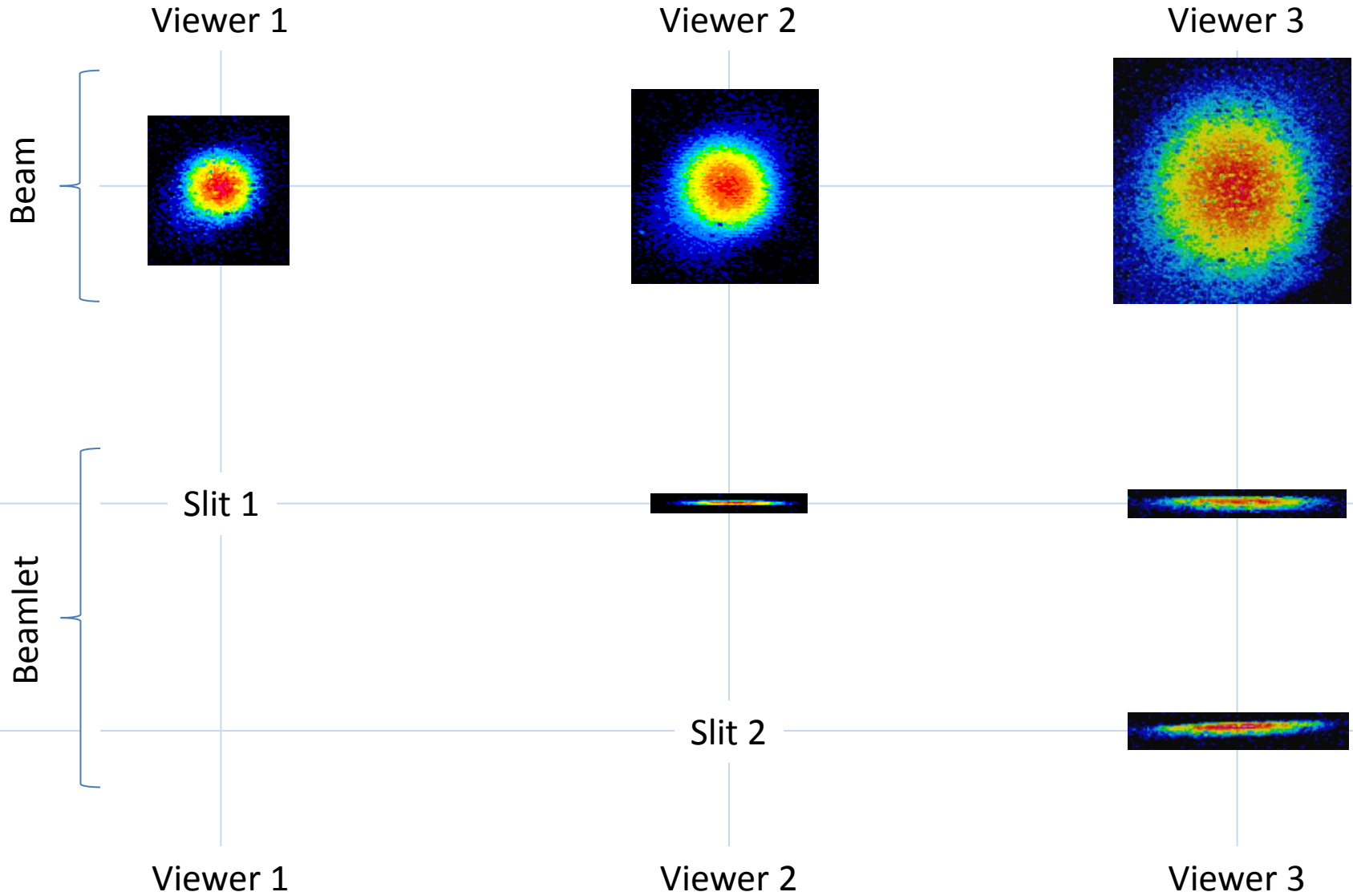




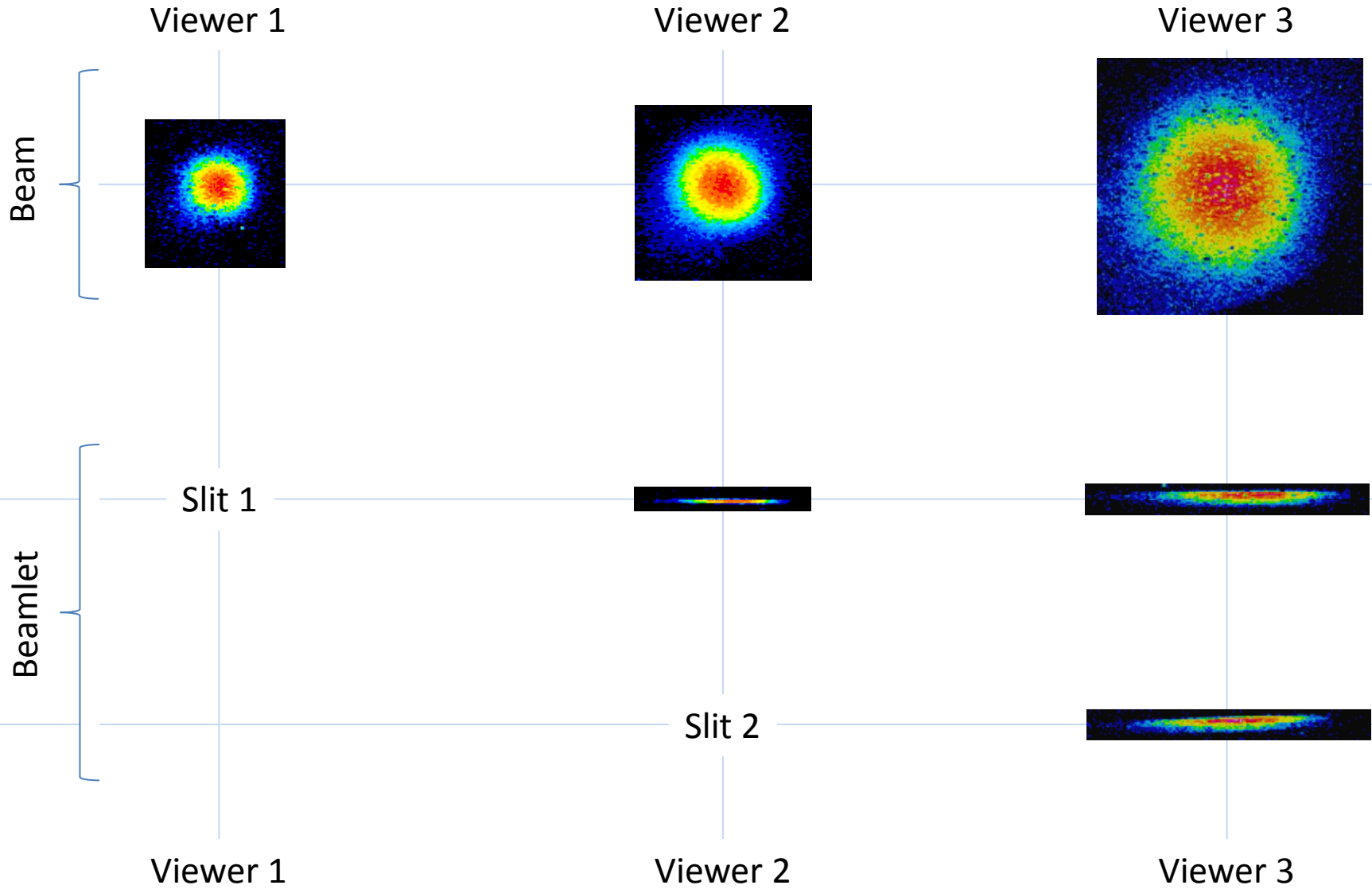
# 5 A



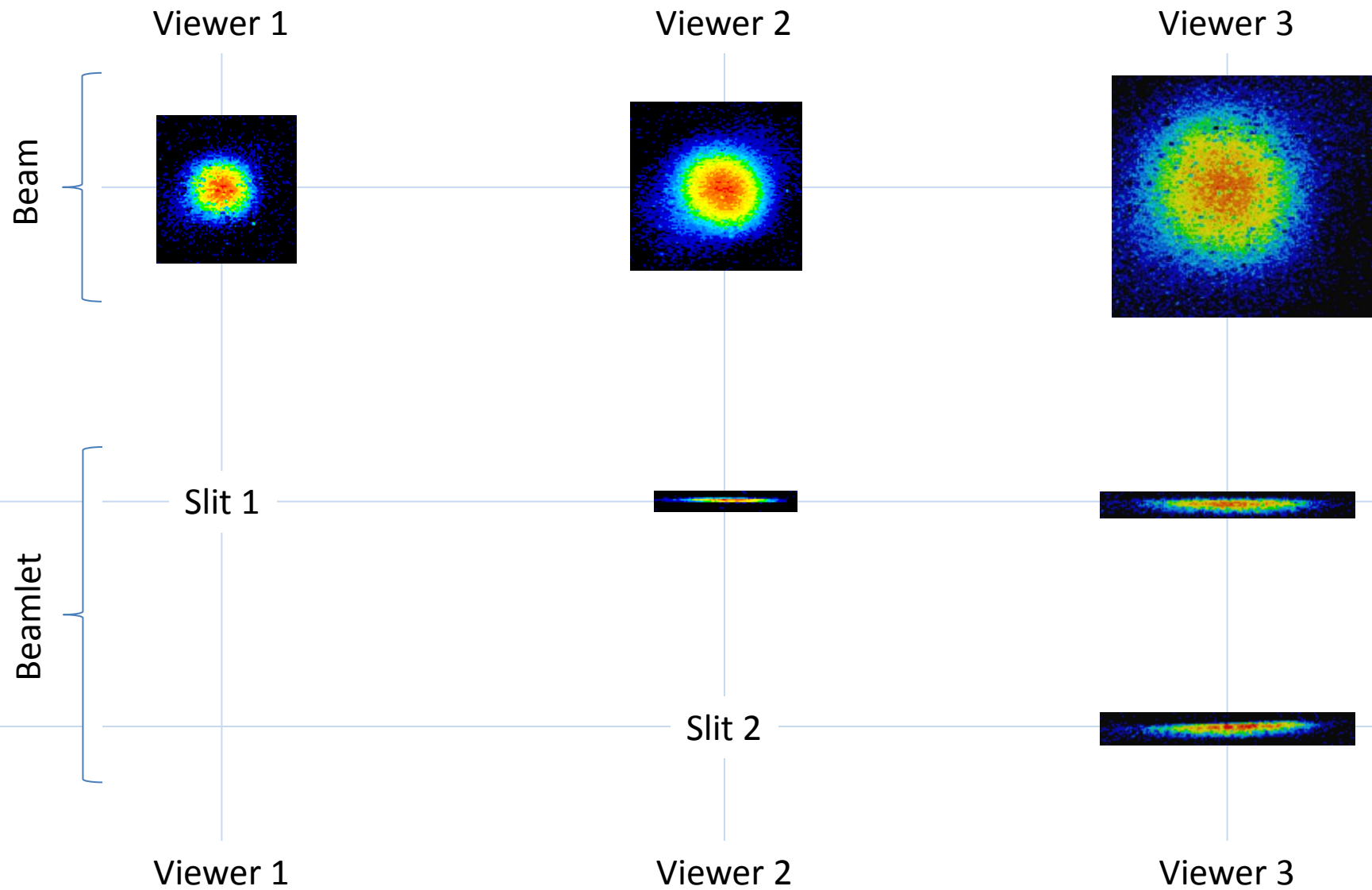
# 6 A



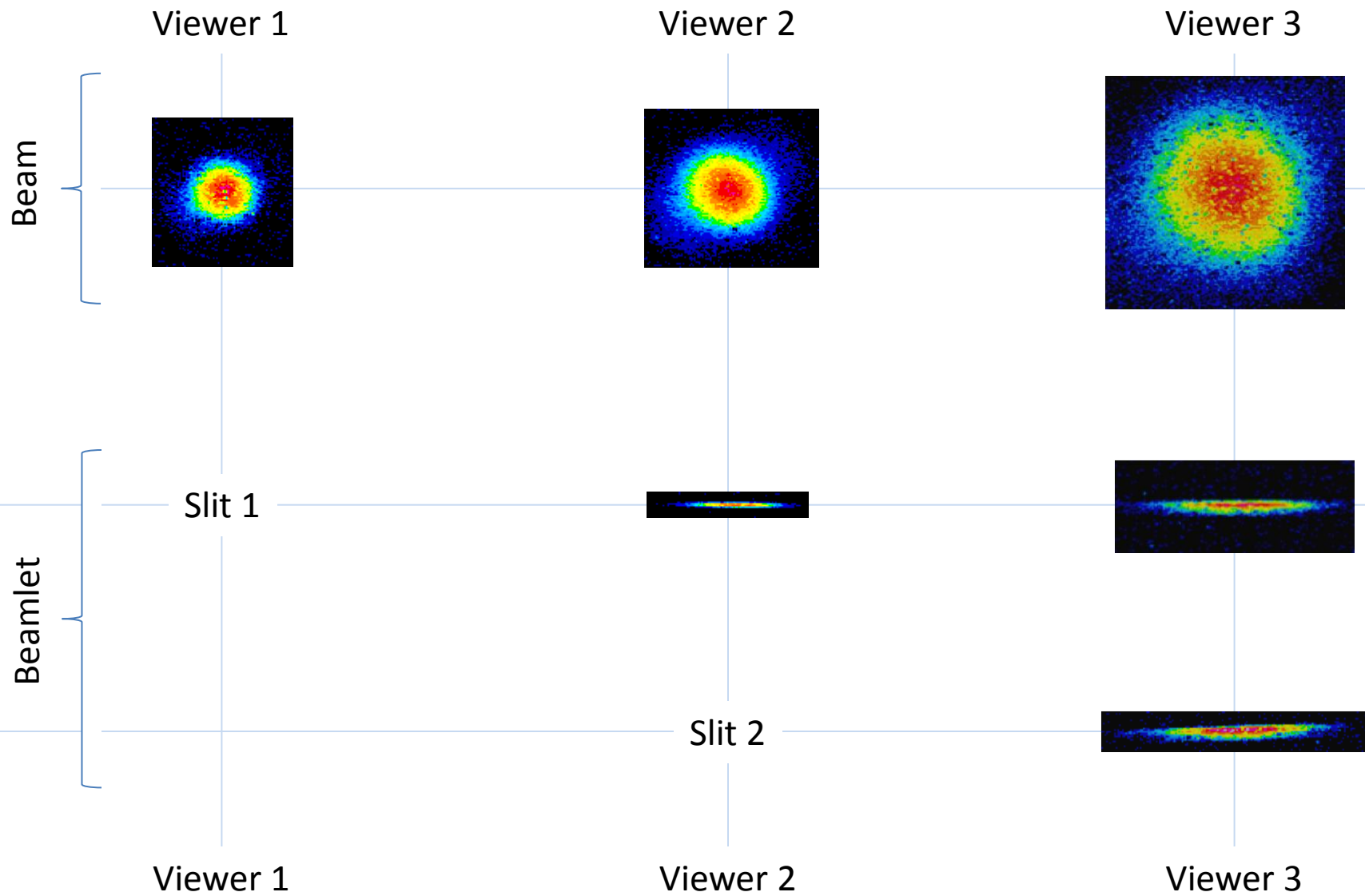
# 7 A



# 8 A



# 9 A



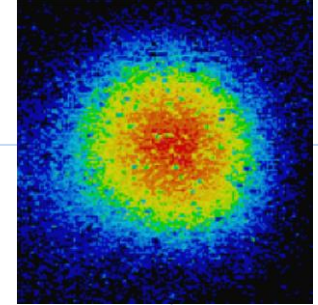
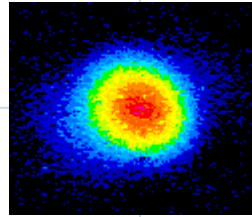
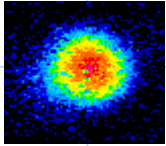
# 10 A

Viewer 1

Viewer 2

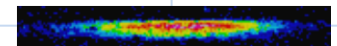
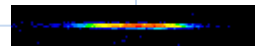
Viewer 3

Beam

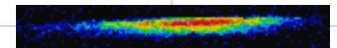


Beamlet

Slit 1



Slit 2

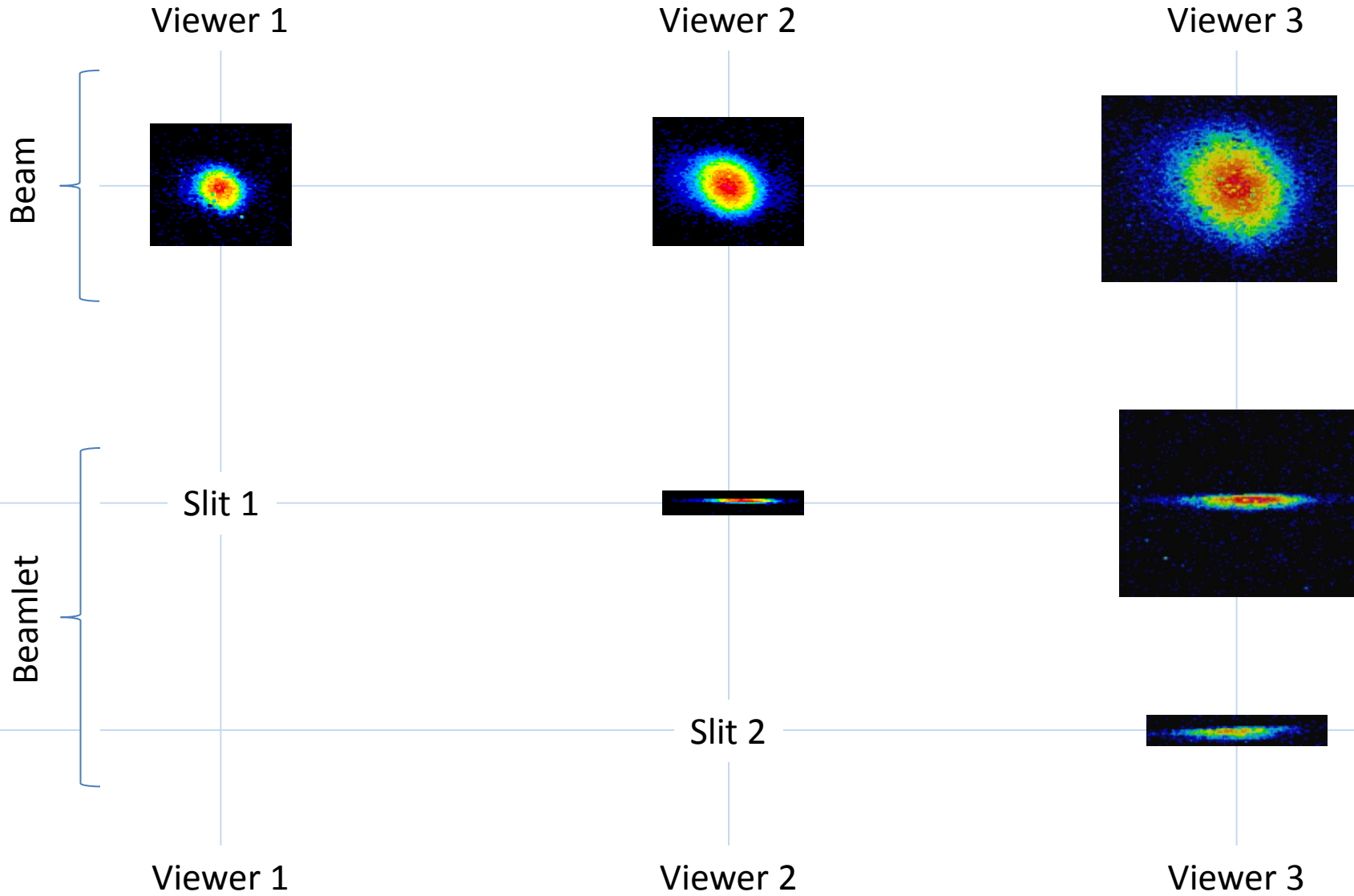


Viewer 1

Viewer 2

Viewer 3

# 15 A



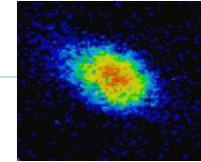
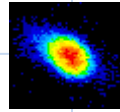
# 20 A

Viewer 1

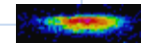
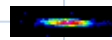
Viewer 2

Viewer 3

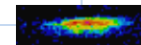
Beam



Slit 1



Slit 2



Viewer 1

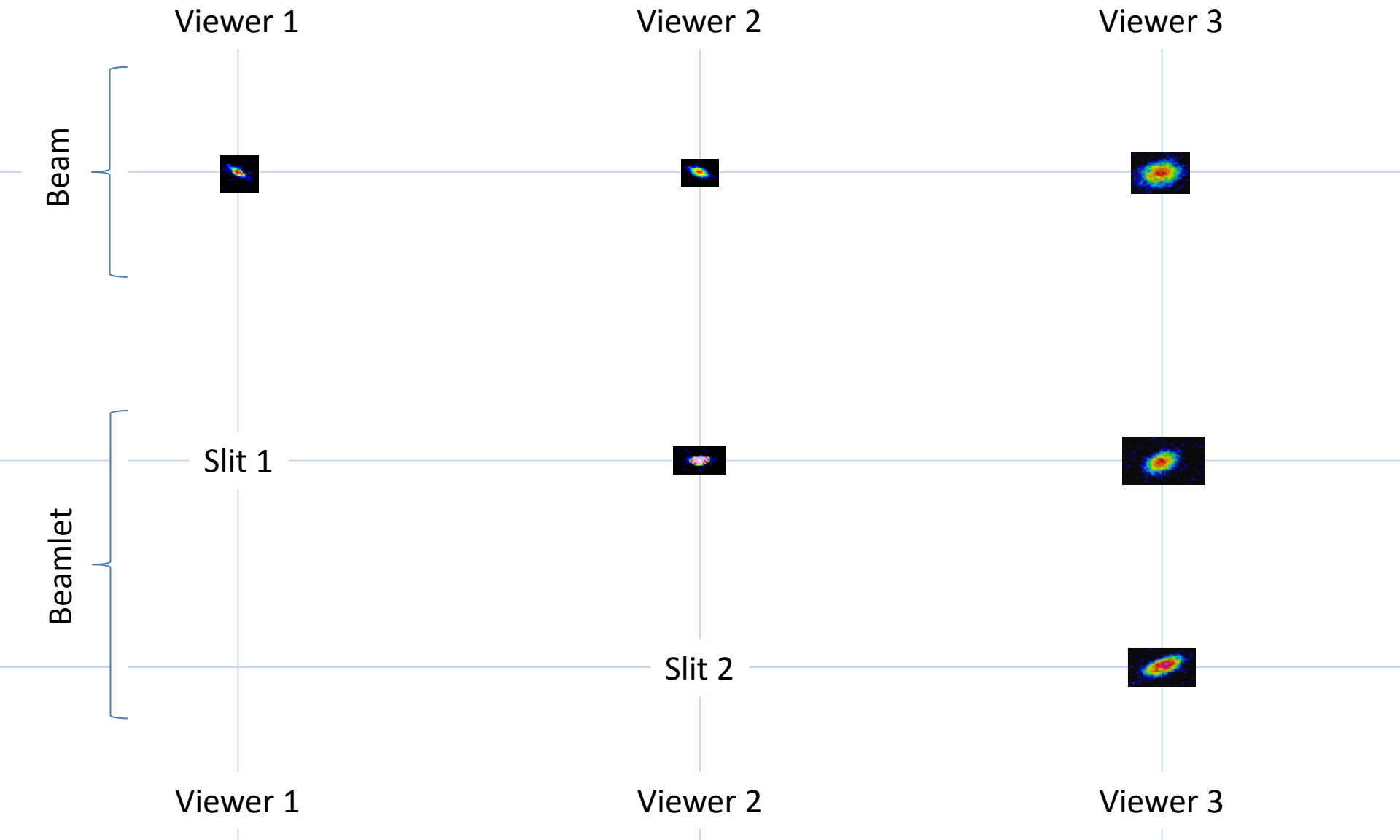
Viewer 2

Viewer 3

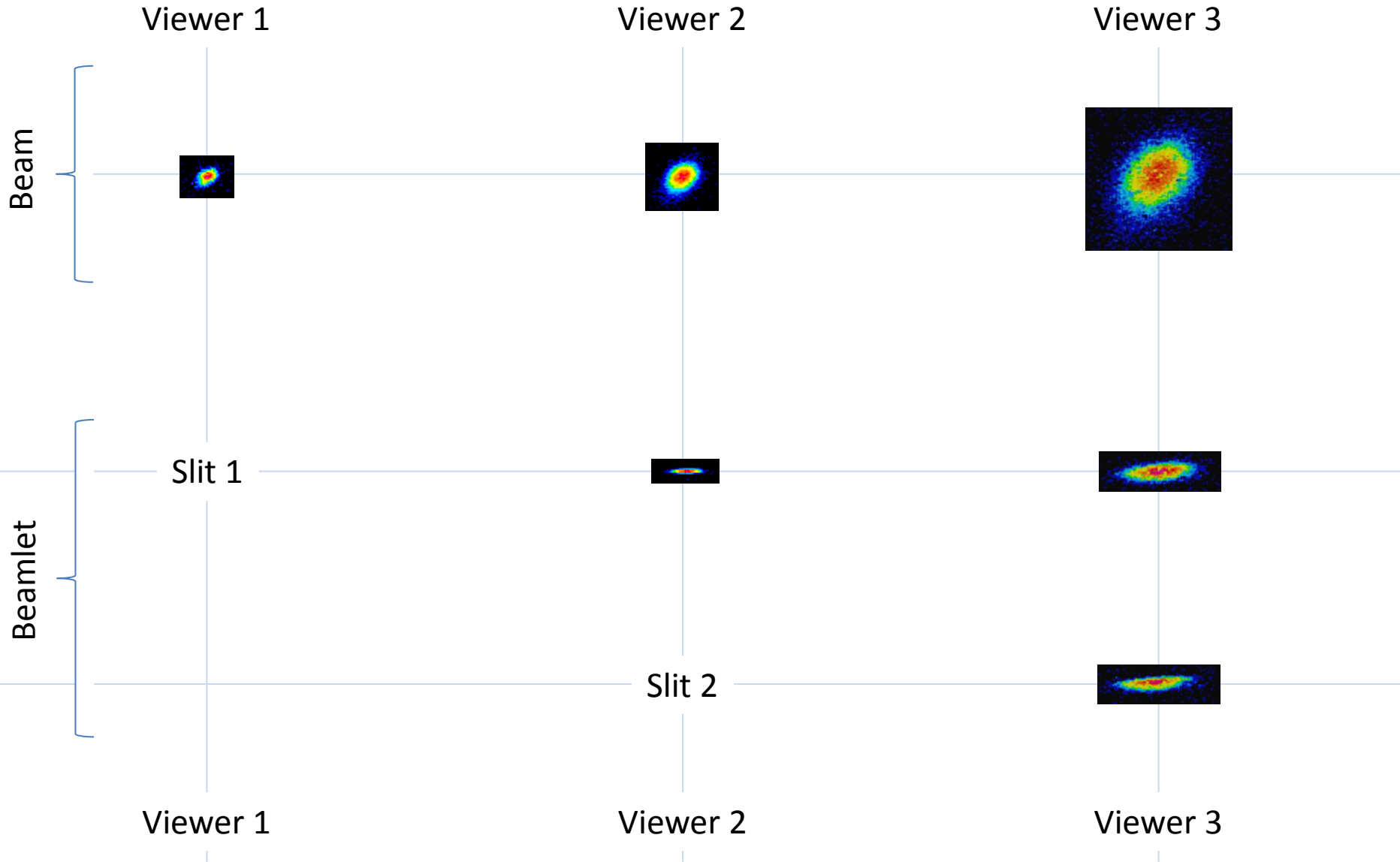
Beamlet



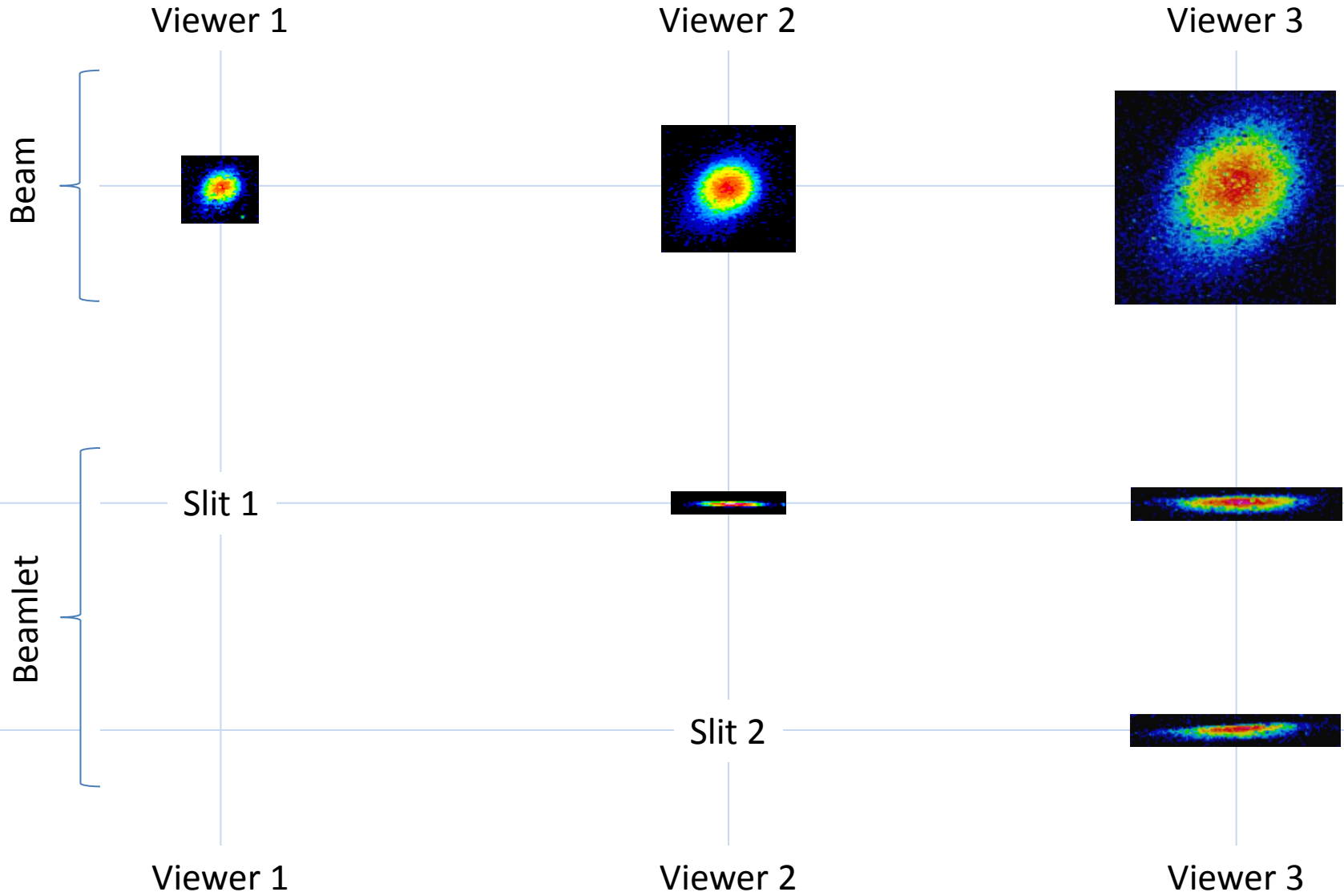
# 25 A



# 30 A



# 35 A



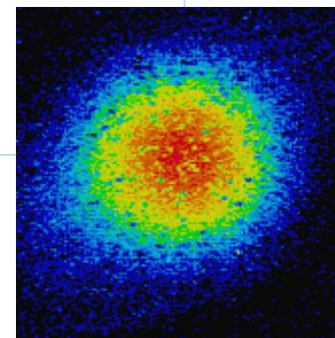
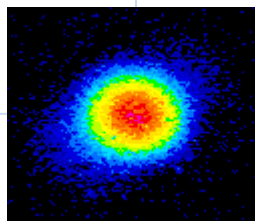
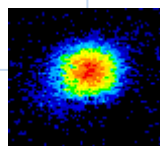
# 40 A

Viewer 1

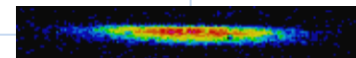
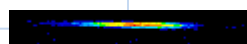
Viewer 2

Viewer 3

Beam

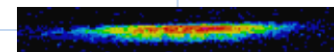


Slit 1



Beamlet

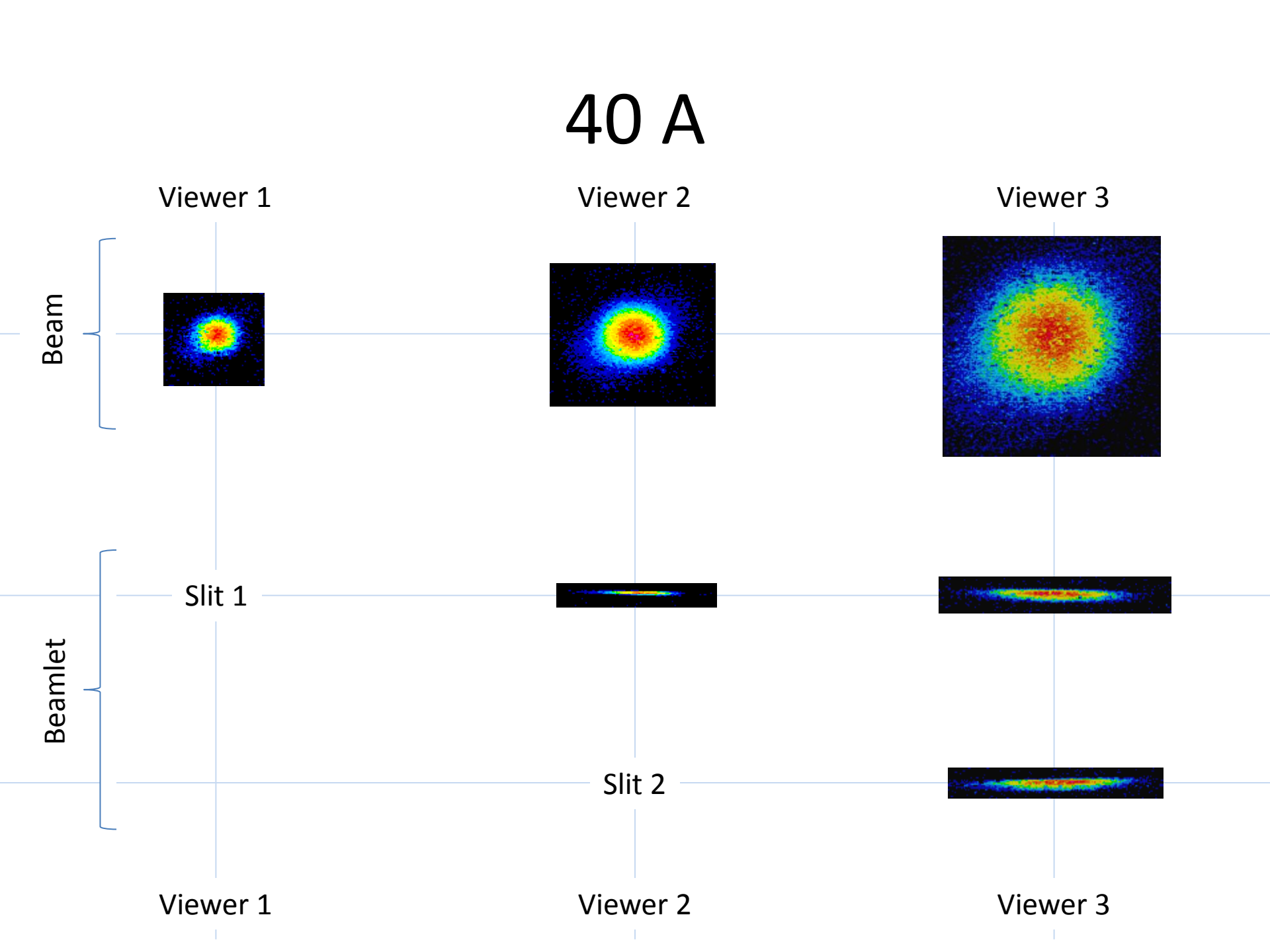
Slit 2



Viewer 1

Viewer 2

Viewer 3



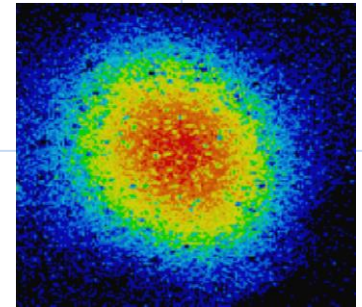
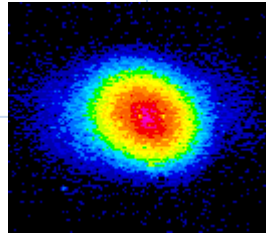
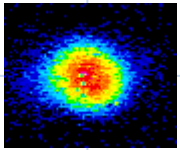
# 45 A

Viewer 1

Viewer 2

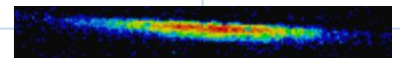
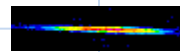
Viewer 3

Beam

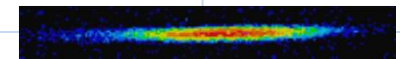


Beamlet

Slit 1



Slit 2



Viewer 1

Viewer 2

Viewer 3

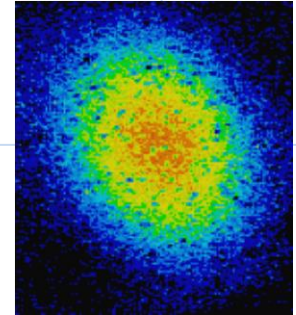
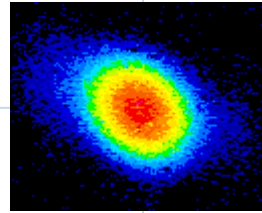
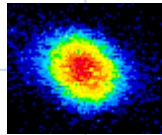
# 50 A

Viewer 1

Viewer 2

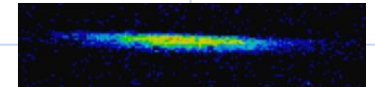
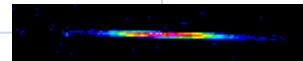
Viewer 3

Beam

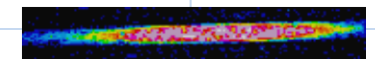


Beamlet

Slit 1



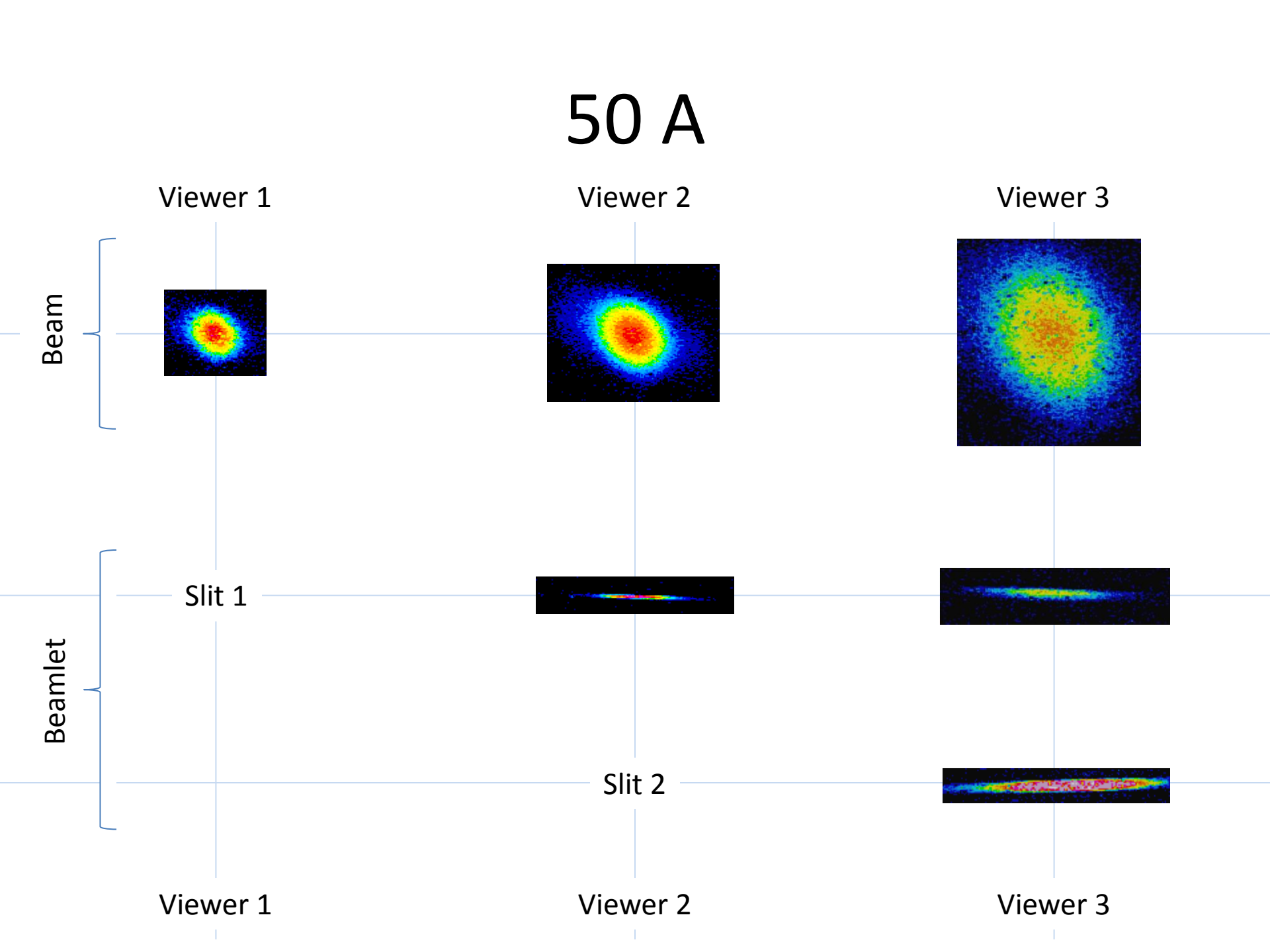
Slit 2



Viewer 1

Viewer 2

Viewer 3



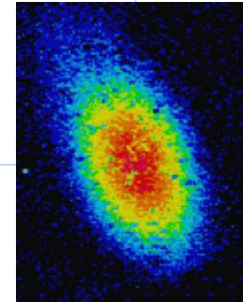
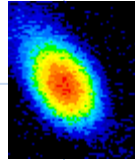
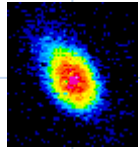
# 60 A

Viewer 1

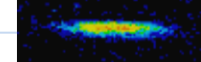
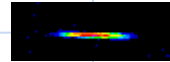
Viewer 2

Viewer 3

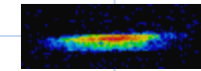
Beam



Slit 1



Slit 2



Viewer 1

Viewer 2

Viewer 3

Beamlet

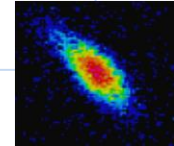
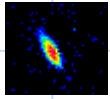
# 70 A

Viewer 1

Viewer 2

Viewer 3

Beam



Slit 1



Slit 2



Viewer 1

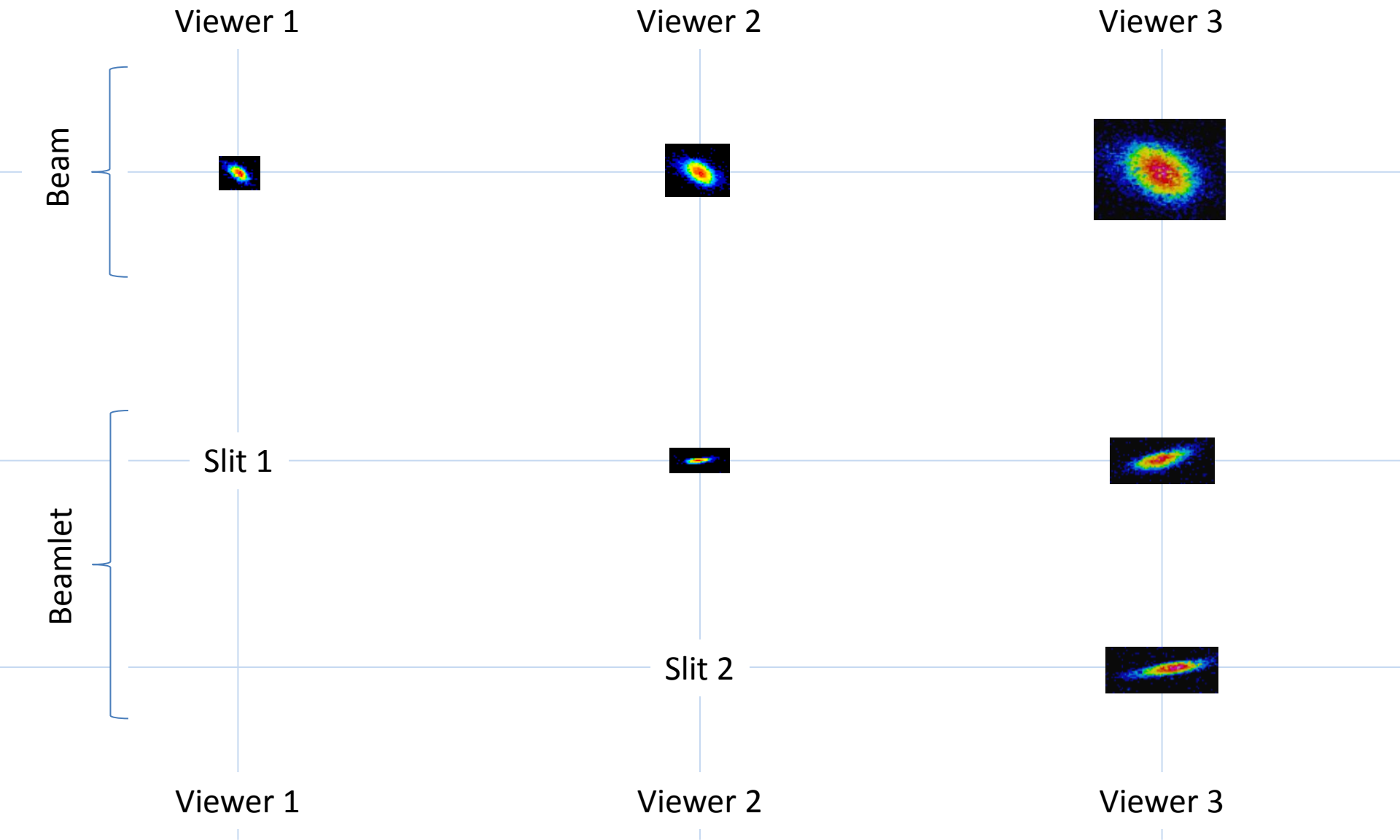
Viewer 2

Viewer 3

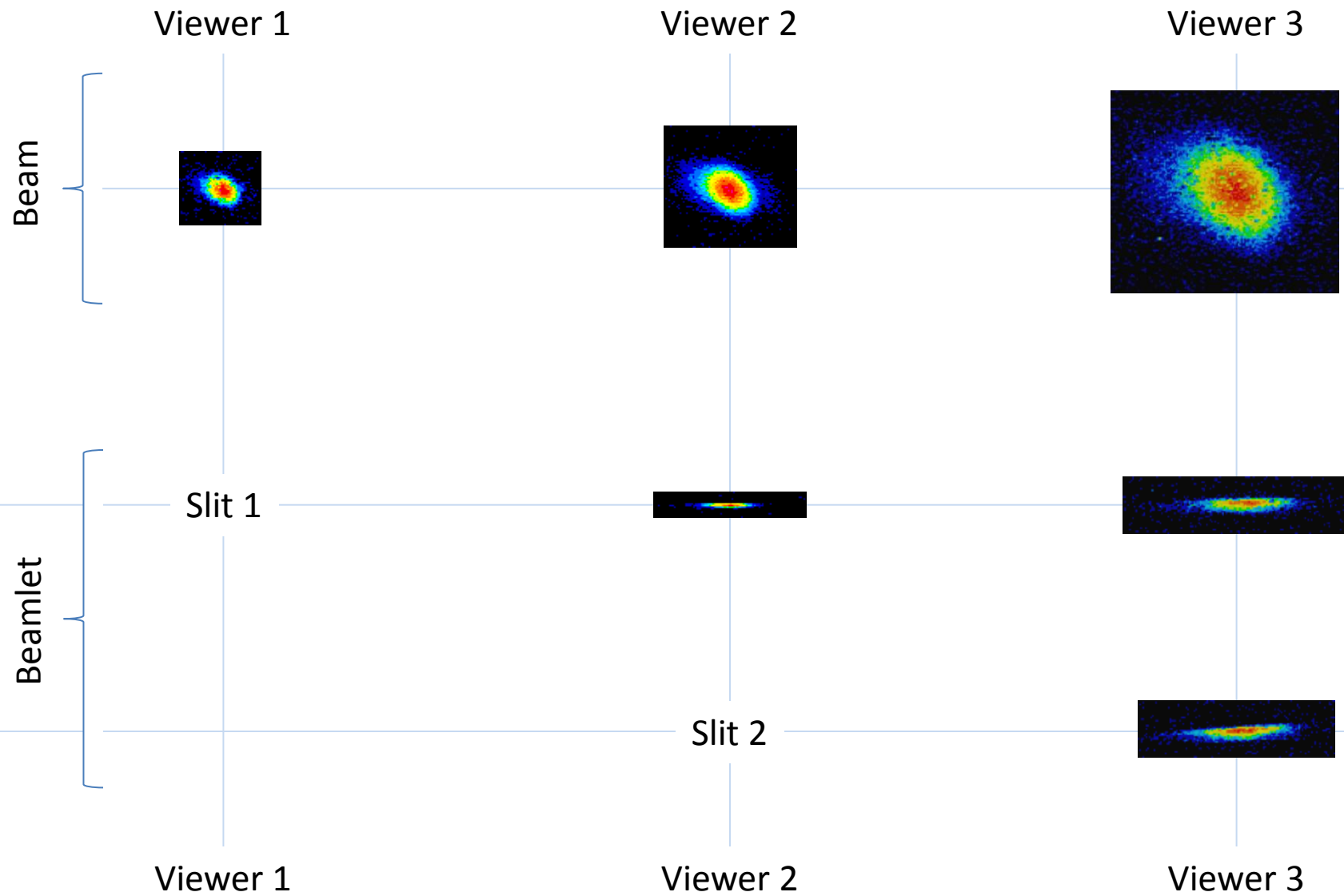
Beamlet



# 75 A



# 80 A



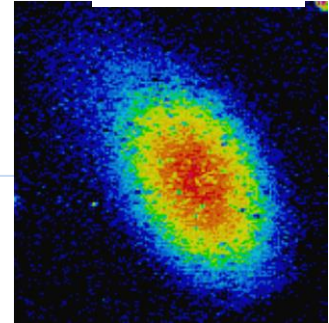
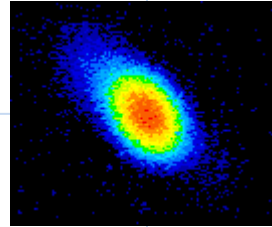
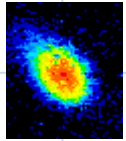
# 90 A

Viewer 1

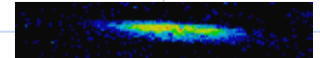
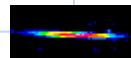
Viewer 2

Viewer 3

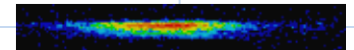
Beam



Slit 1



Slit 2



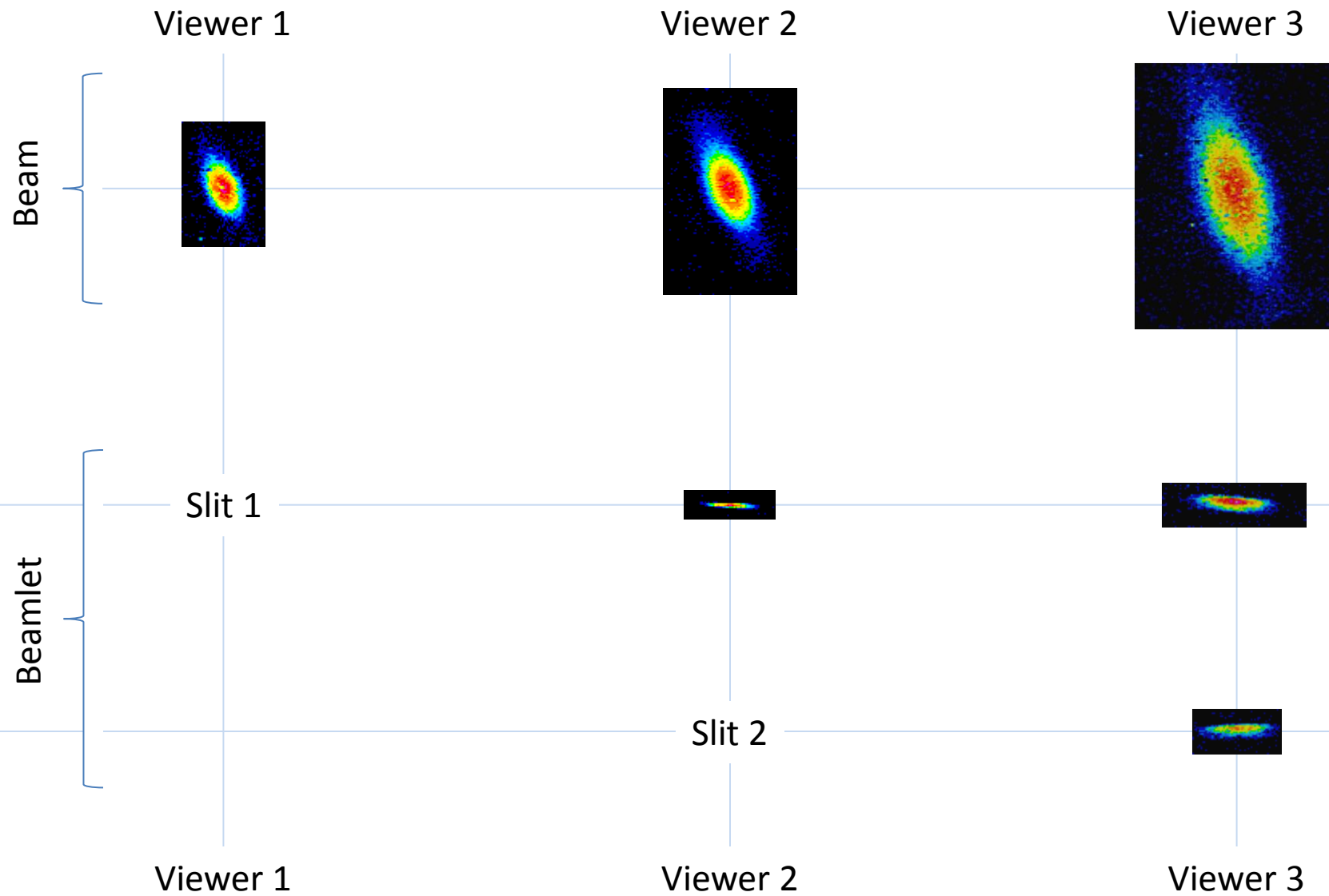
Viewer 1

Viewer 2

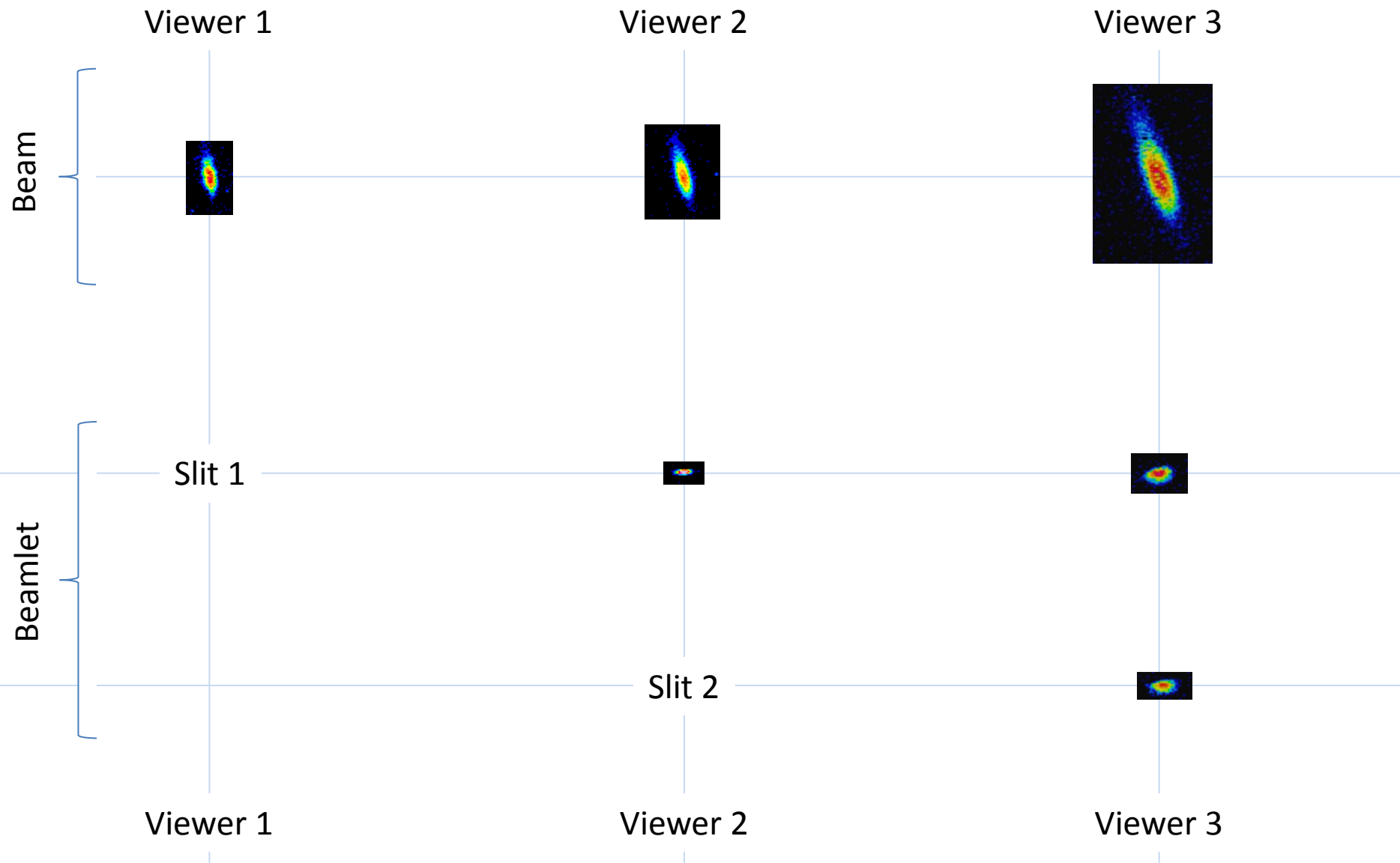
Viewer 3

Beamlet

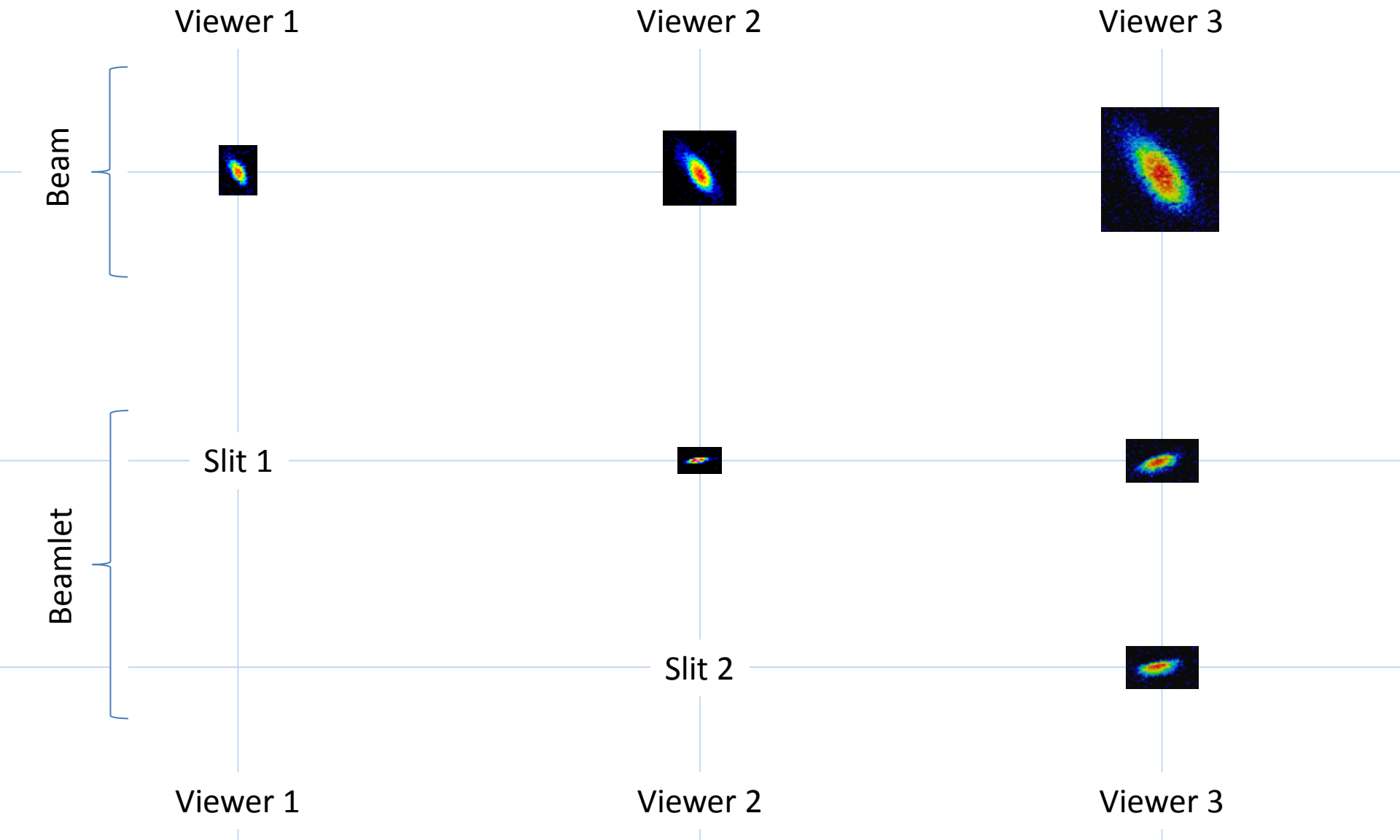
# 100 A



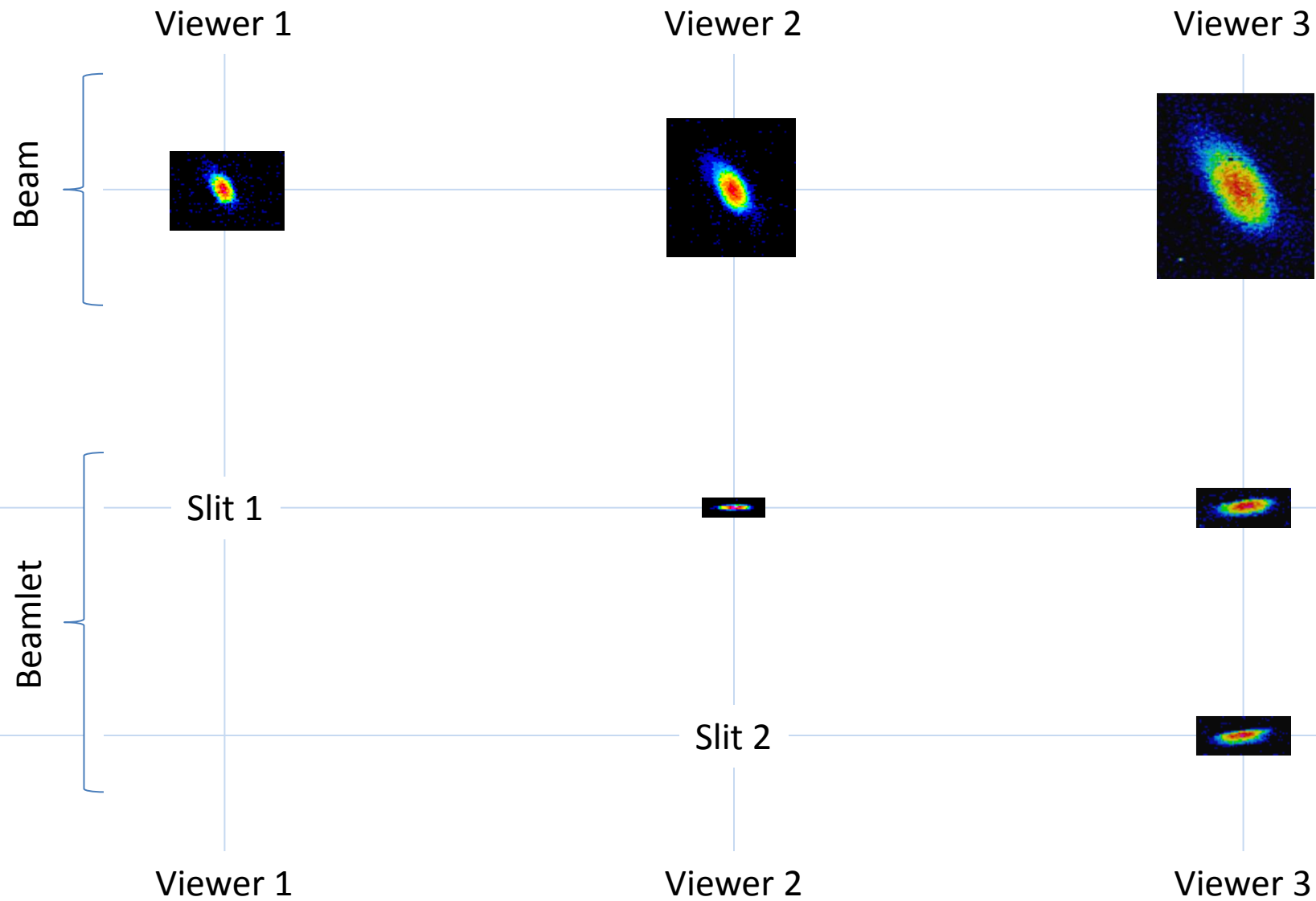
# 110 A



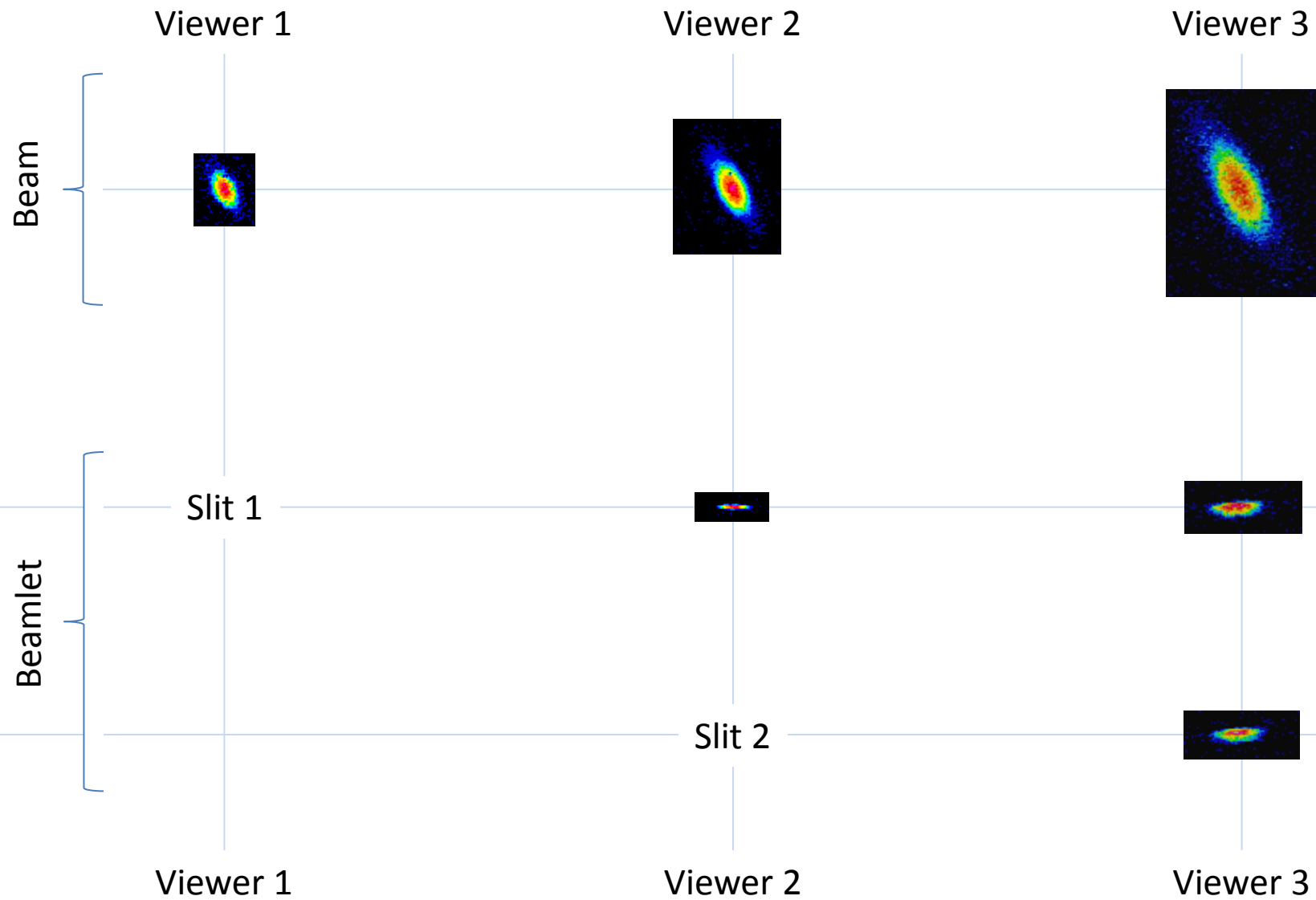
# 120 A



# 125 A

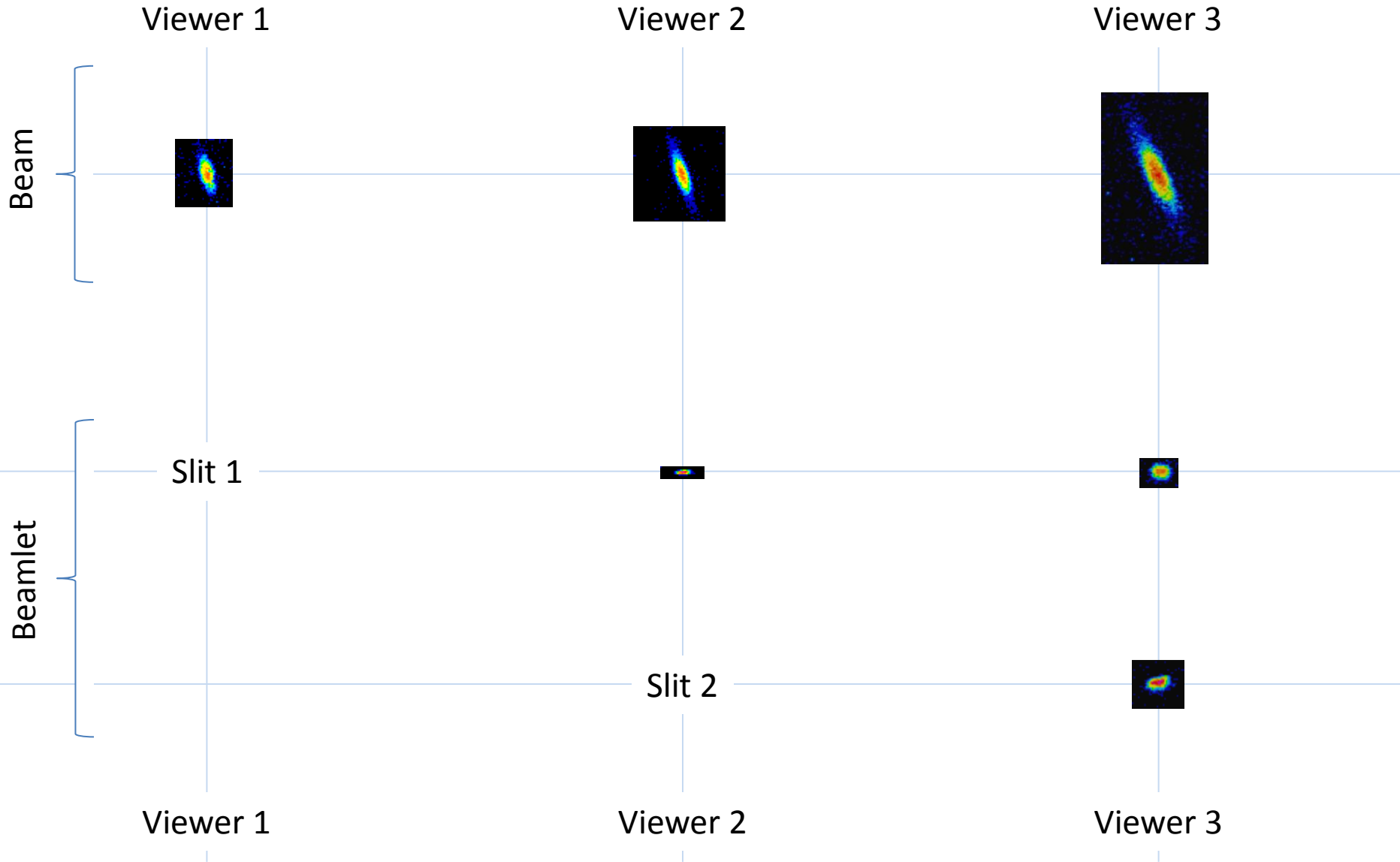


# 130 A

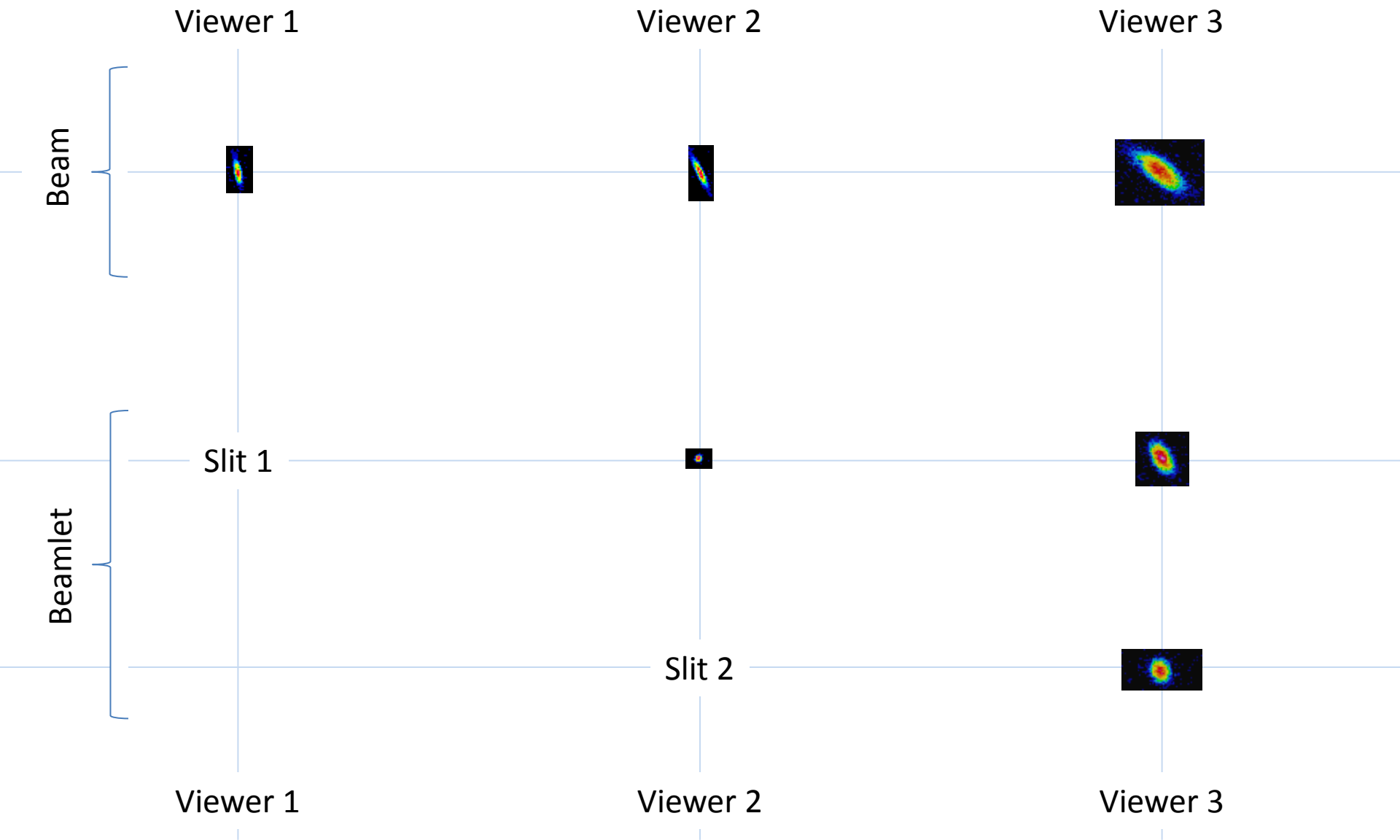




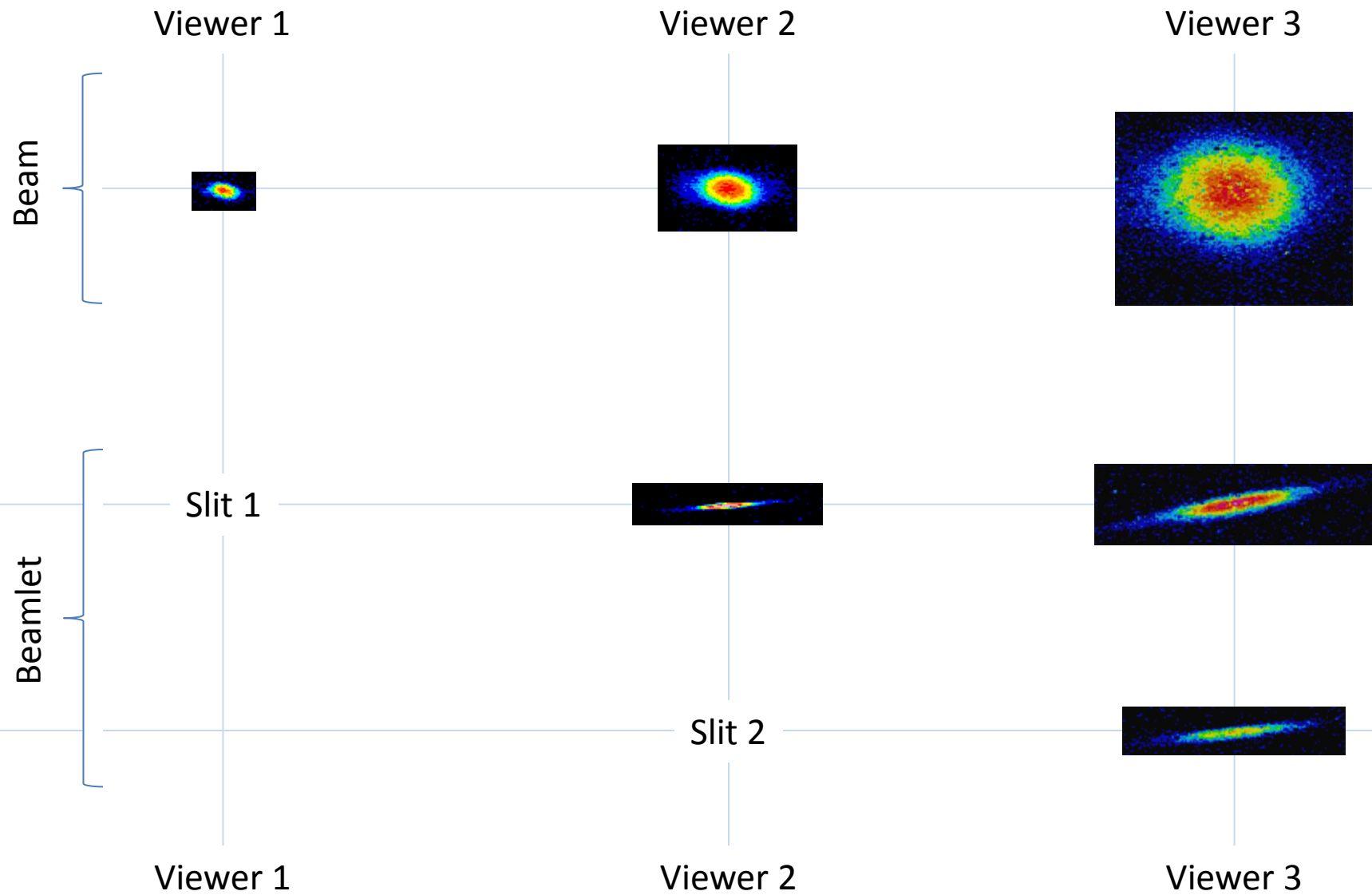
# 140 A



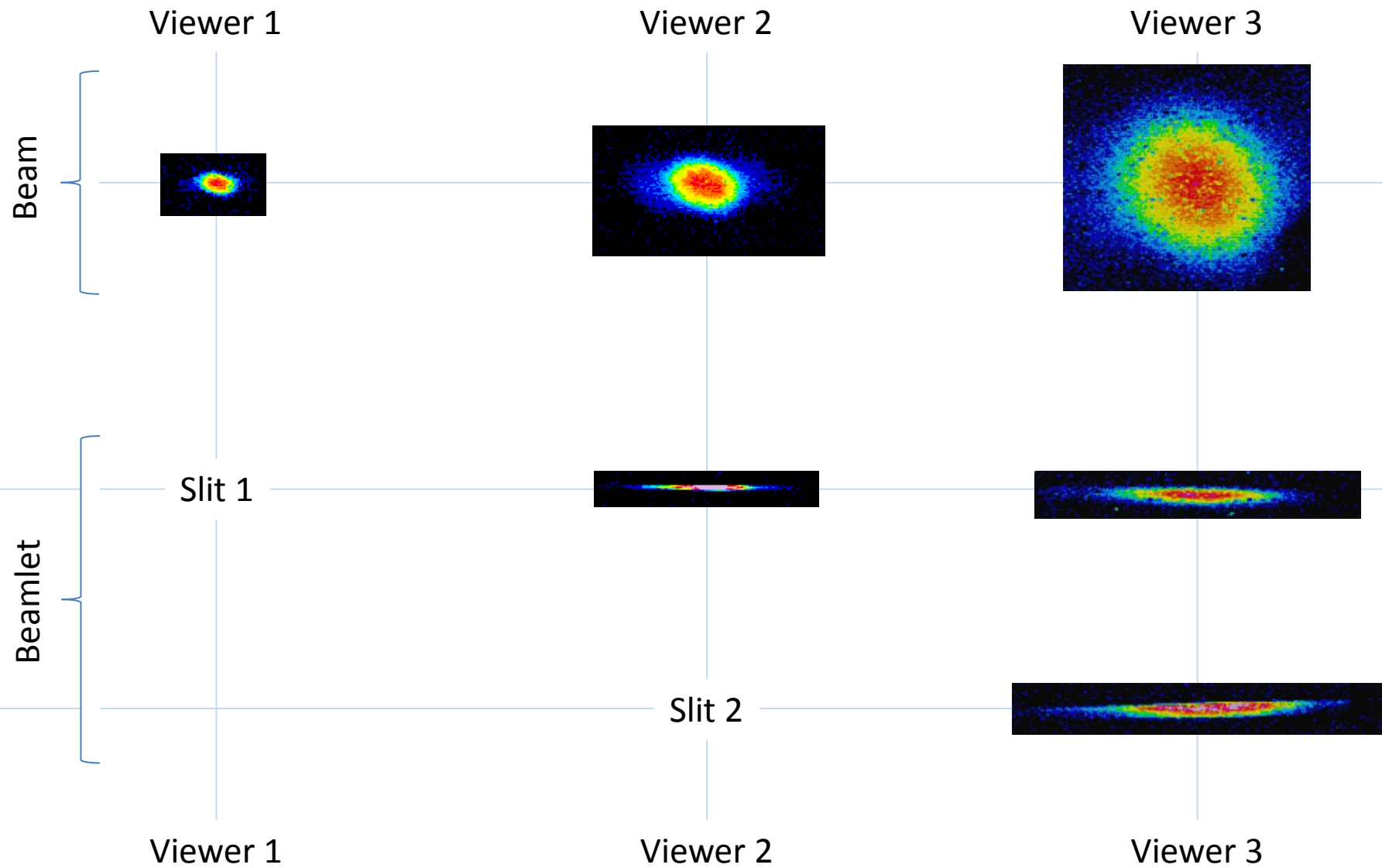
# 150 A



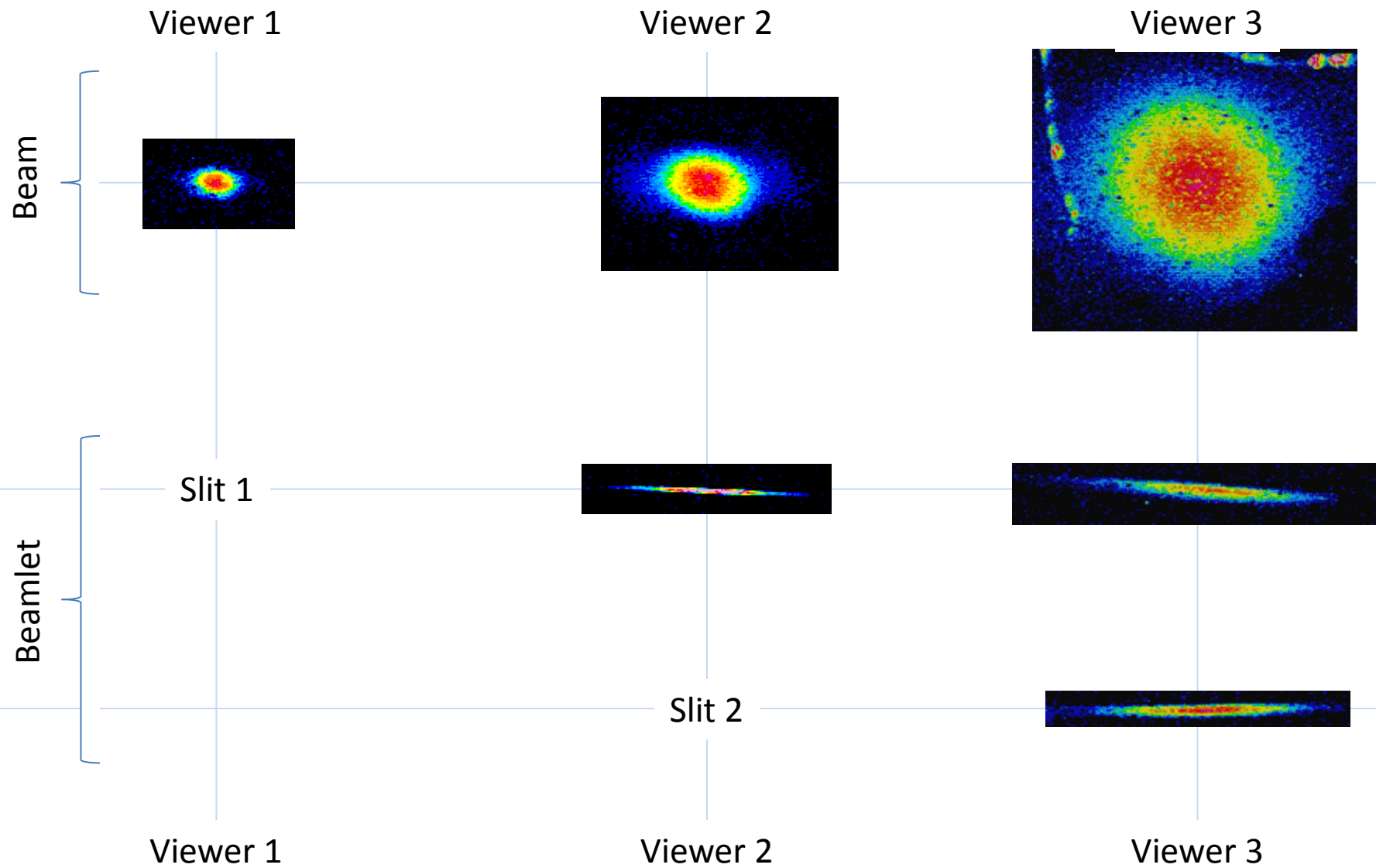
# 160 A



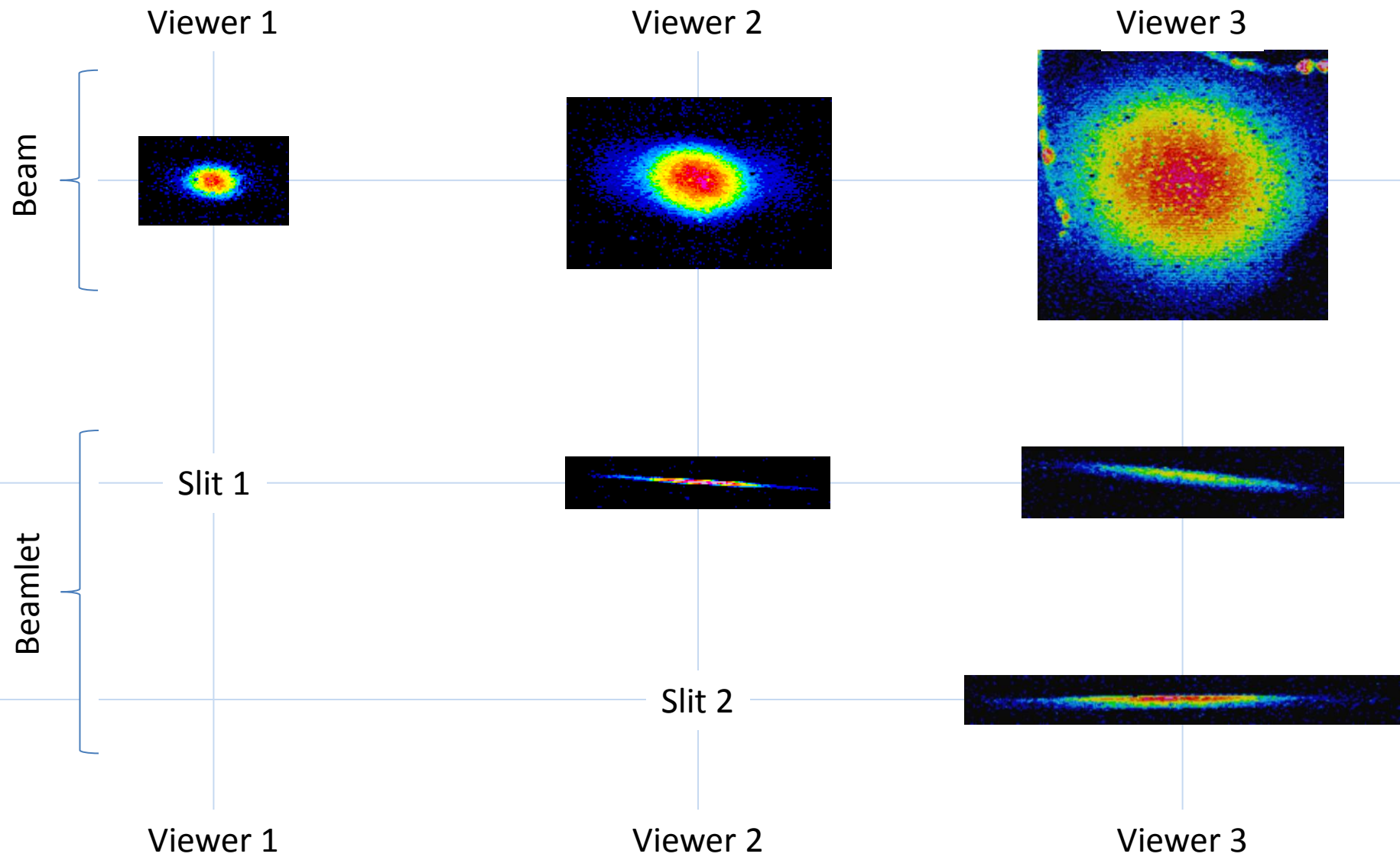
# 170 A



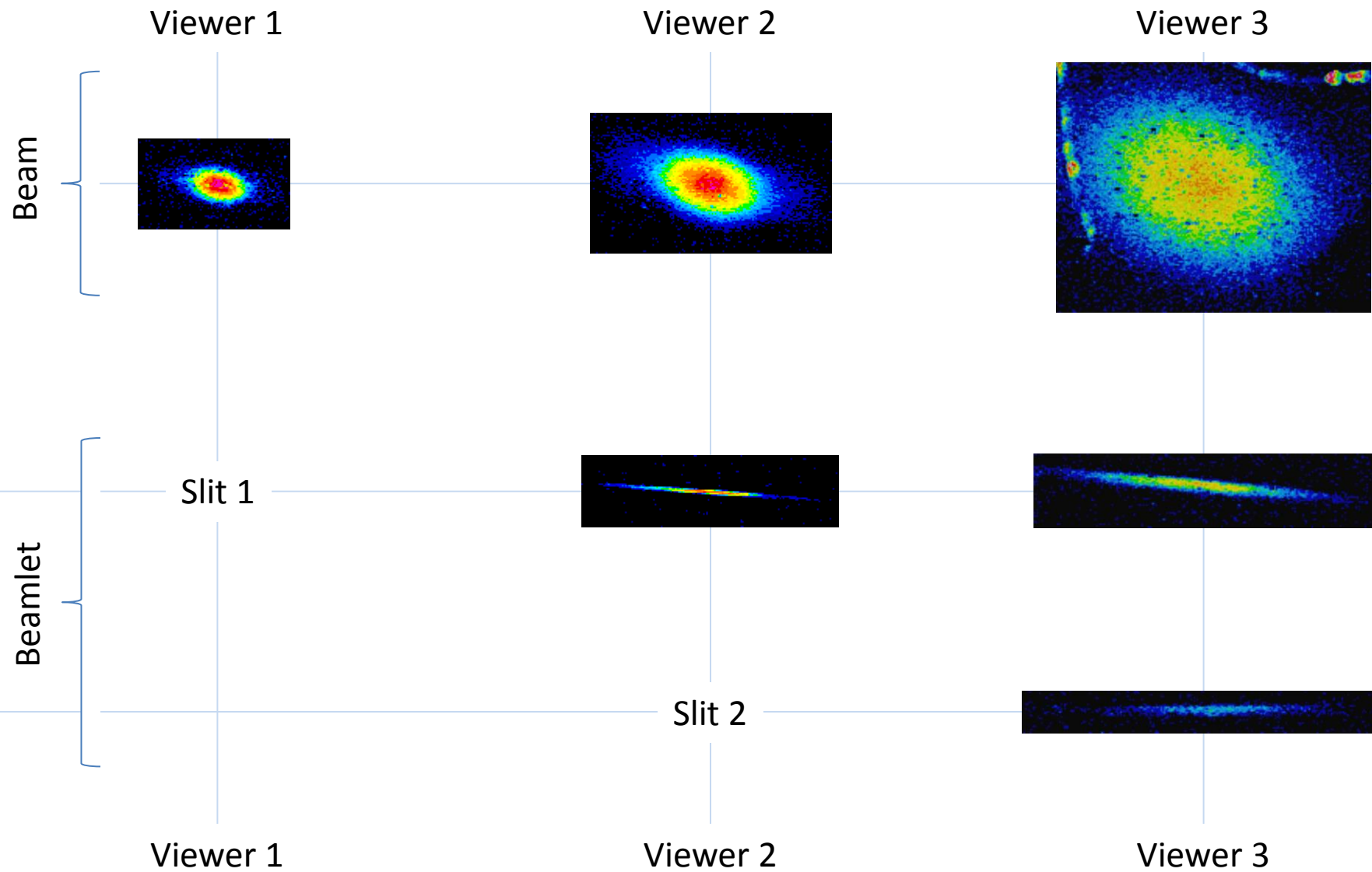
# 175 A



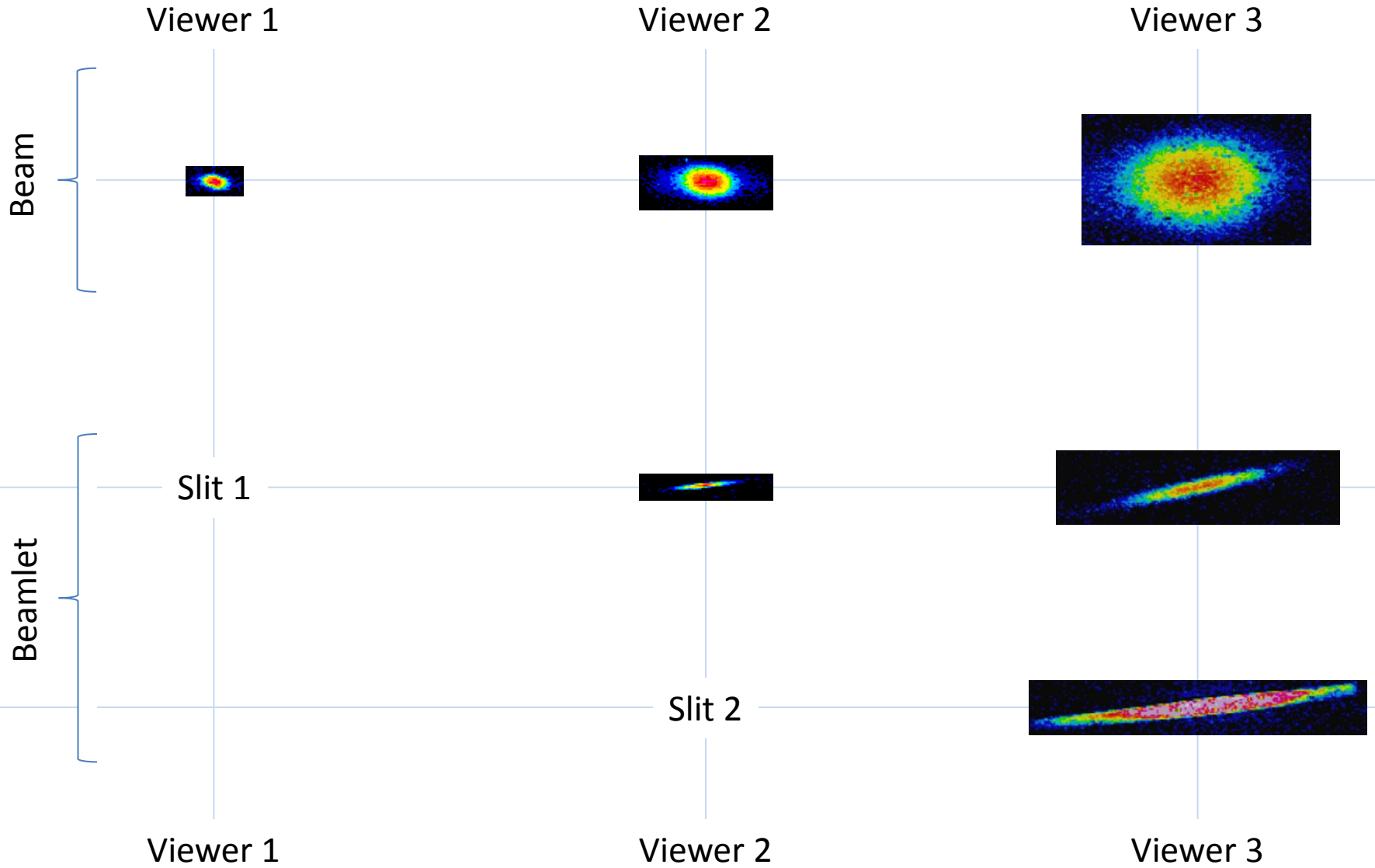
# 180 A



# 190 A

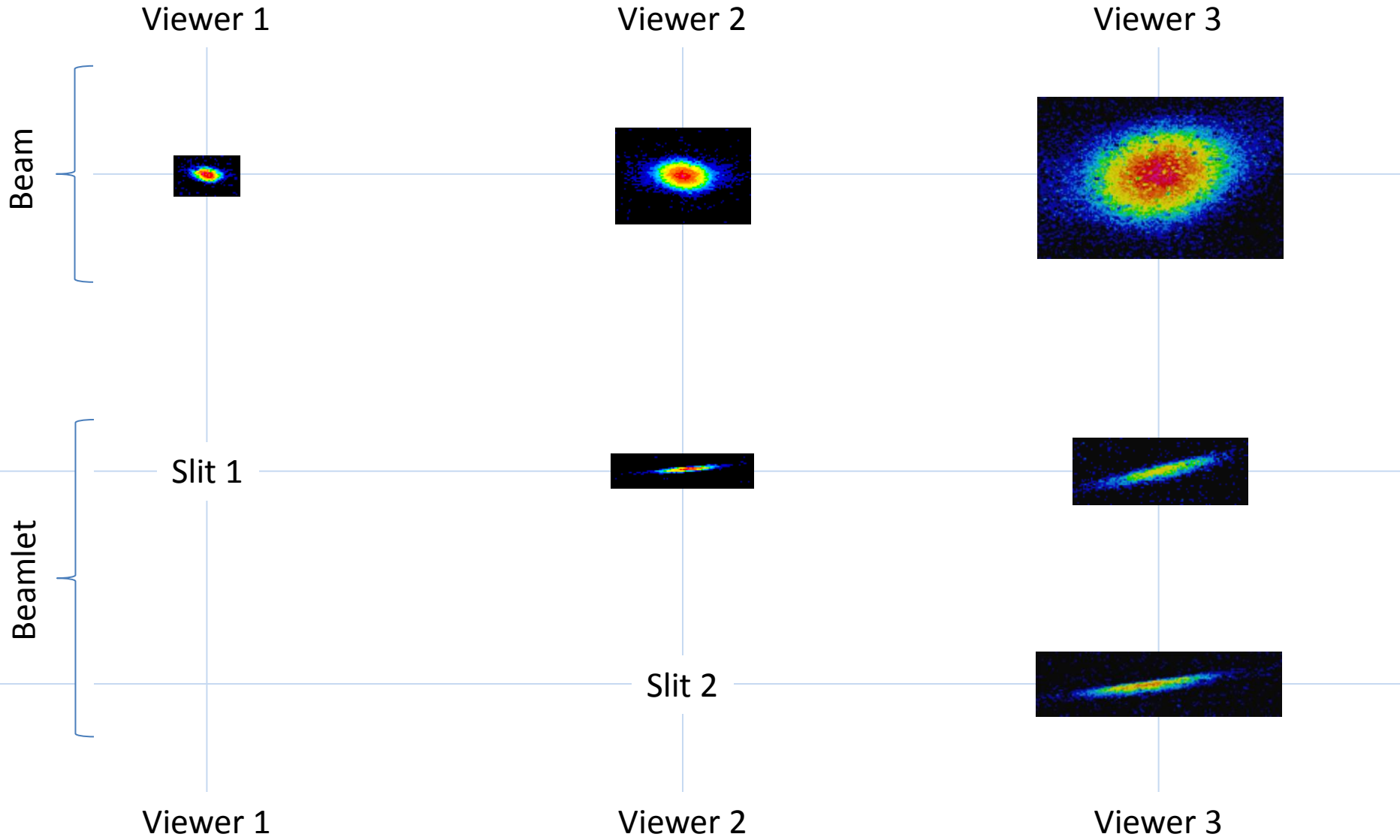


# 200 A

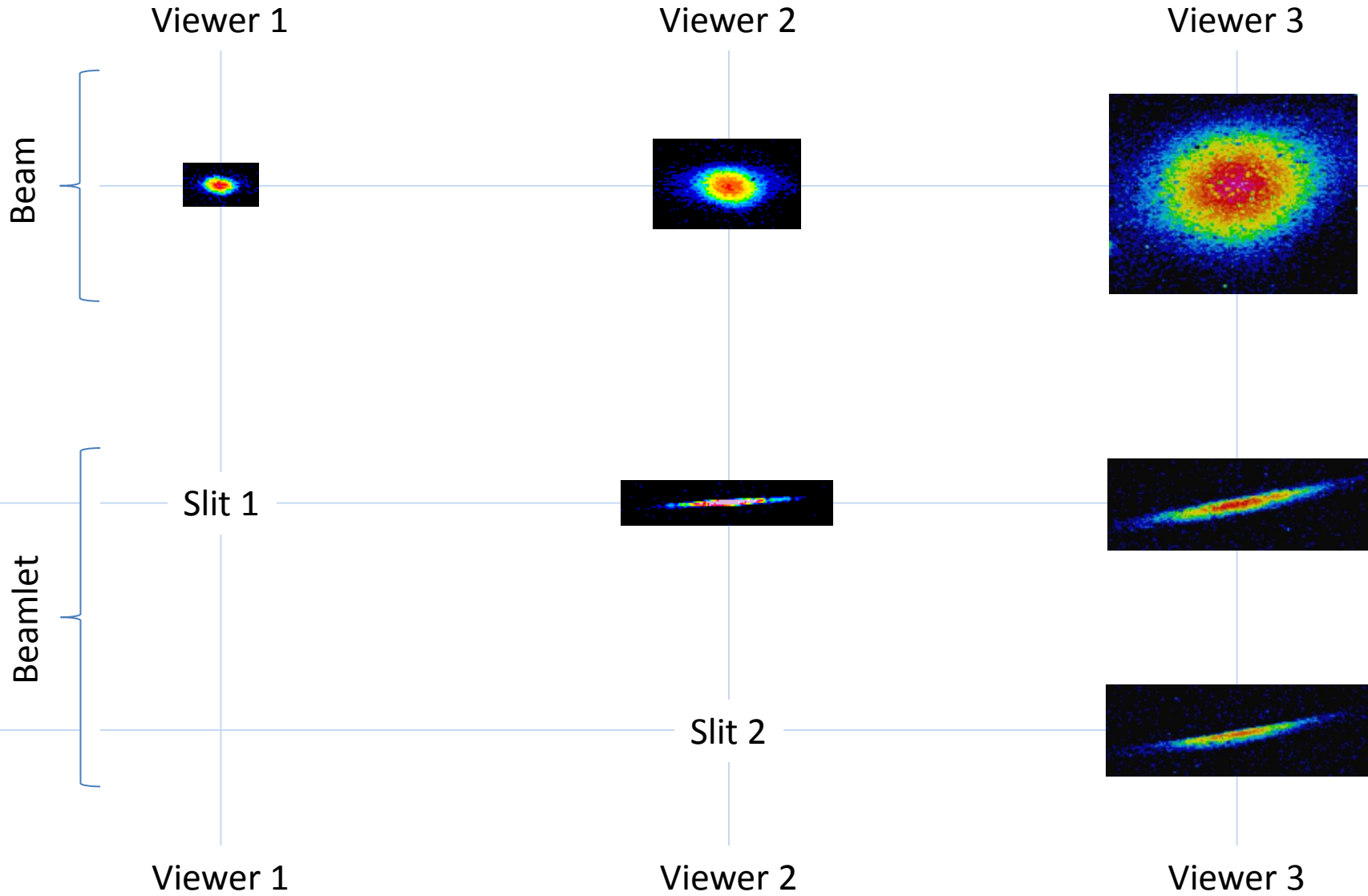




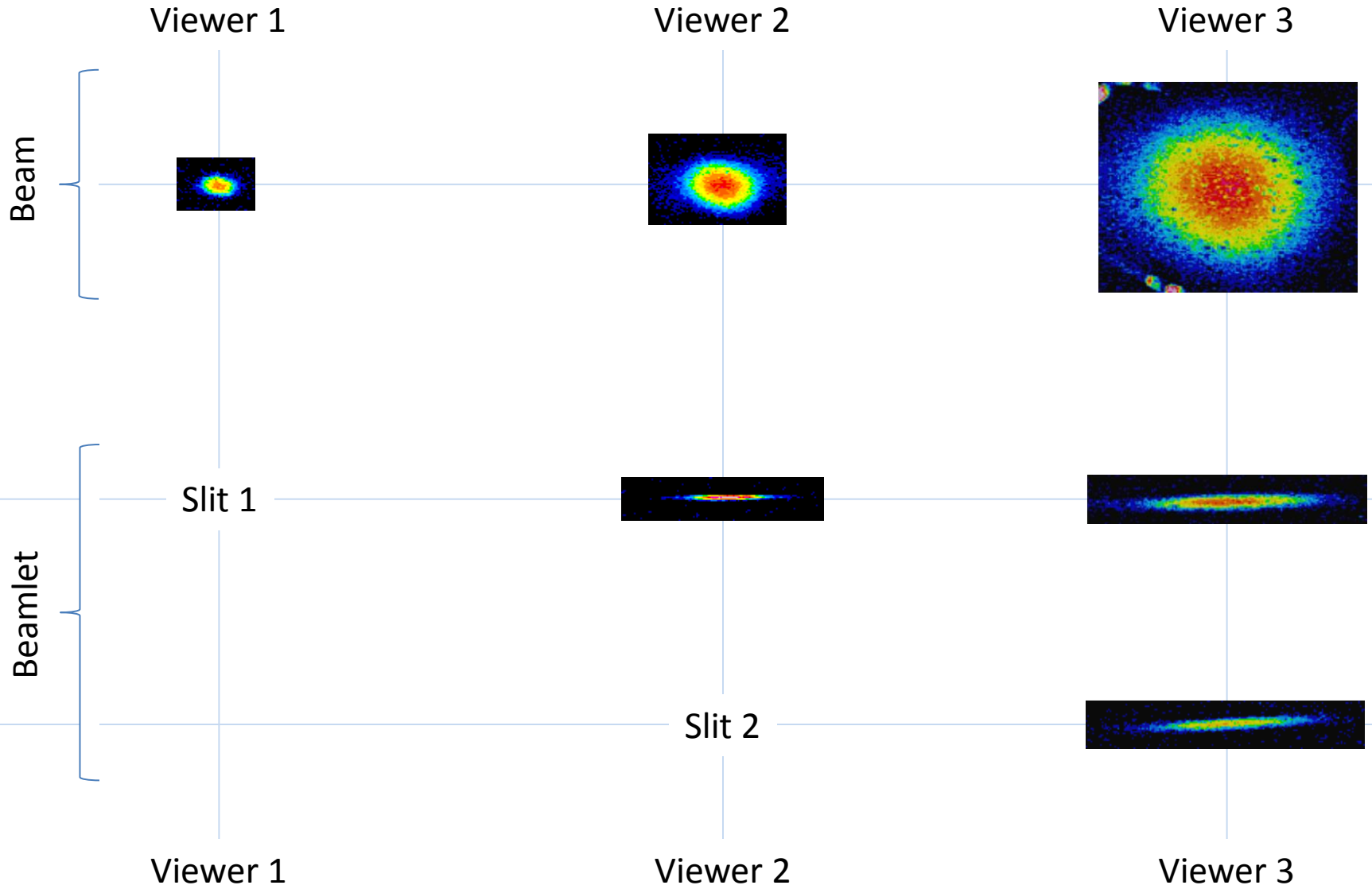
# 205 A



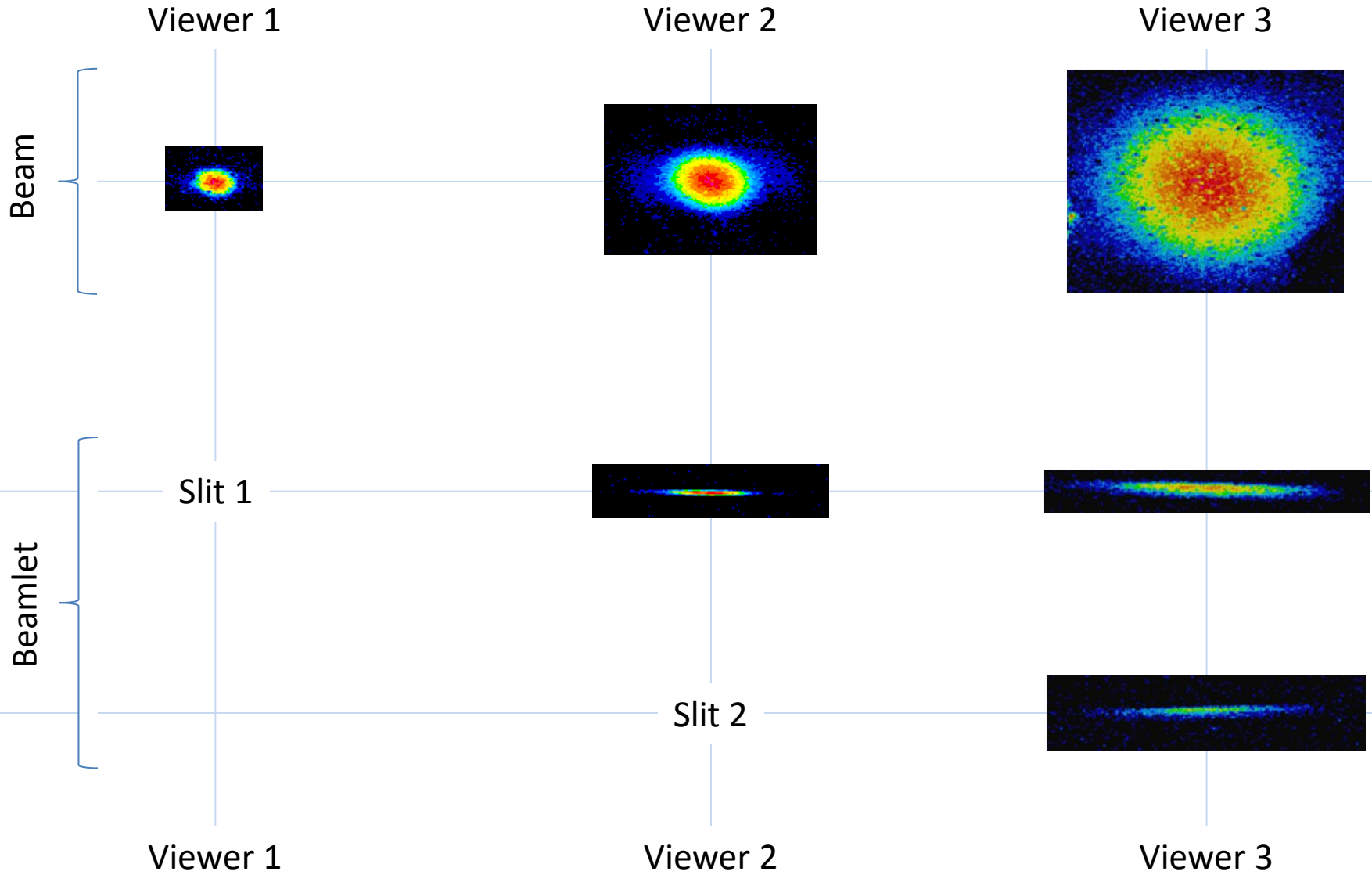
# 210 A



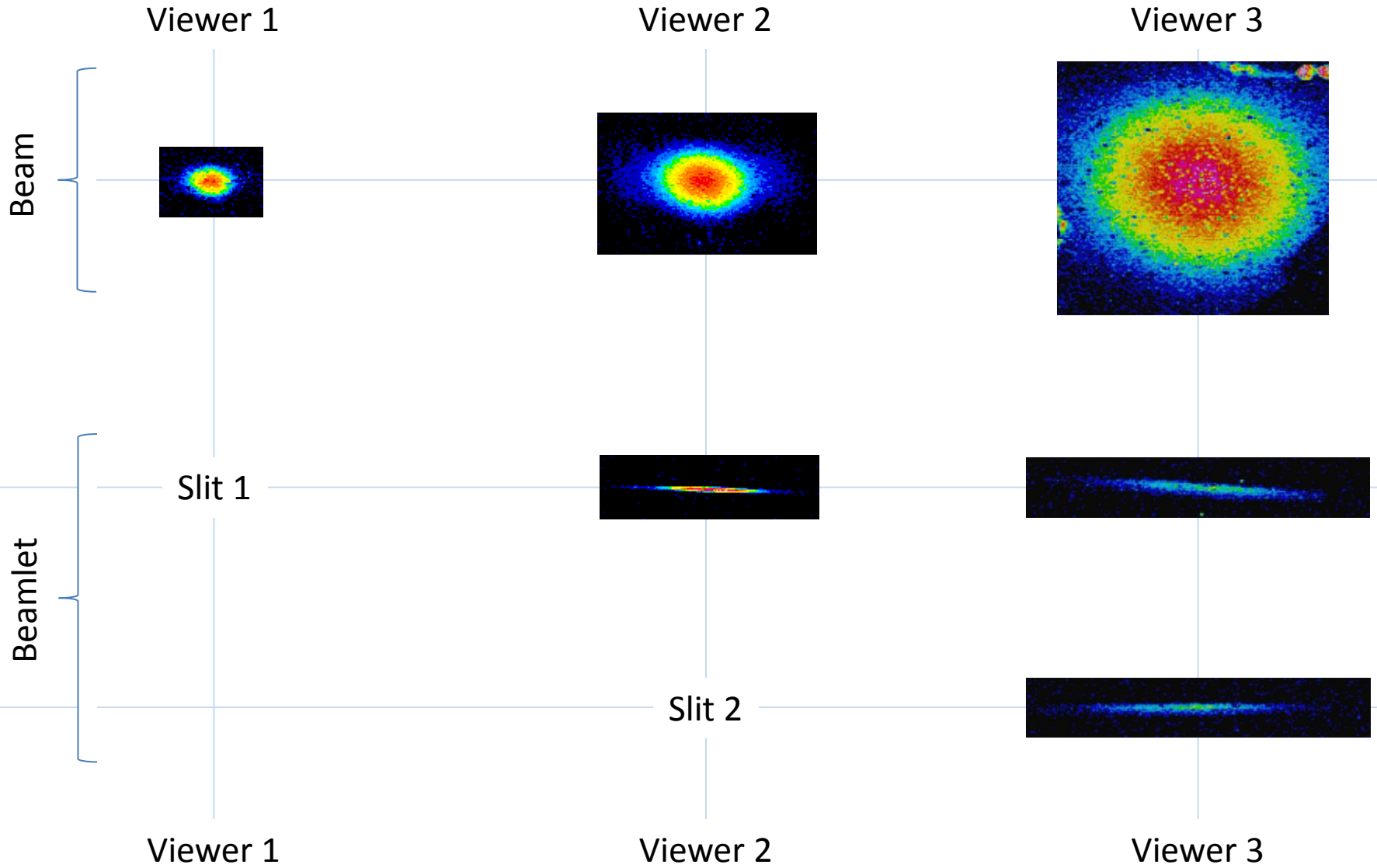
# 215 A



# 220 A



# 225 A



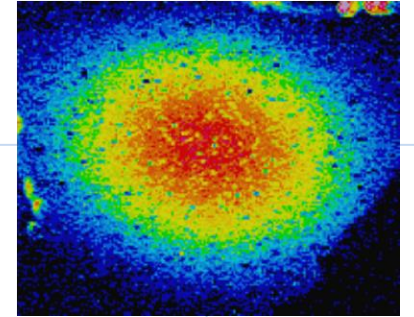
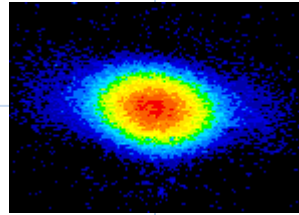
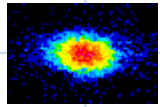
# 230 A

Viewer 1

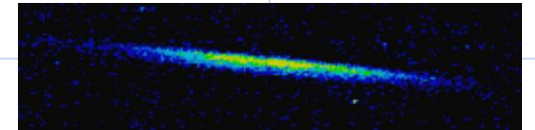
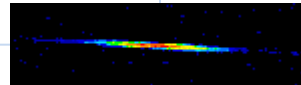
Viewer 2

Viewer 3

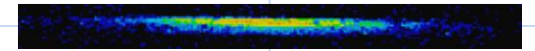
Beam



Slit 1



Slit 2



Viewer 1

Viewer 2

Viewer 3

Beamlet

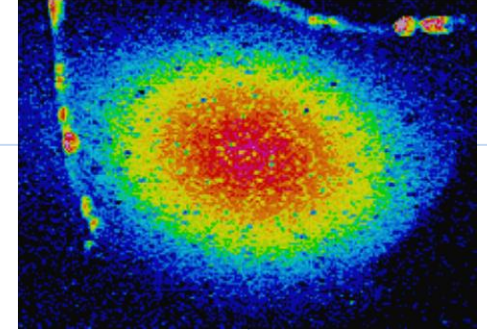
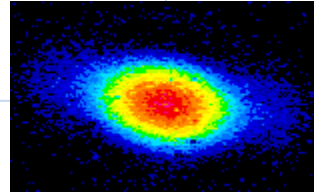
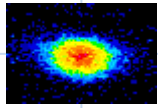
# 235 A

Viewer 1

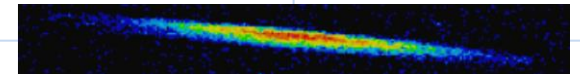
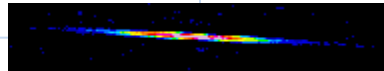
Viewer 2

Viewer 3

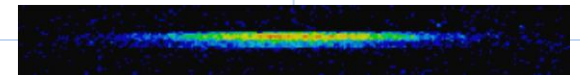
Beam



Slit 1



Slit 2



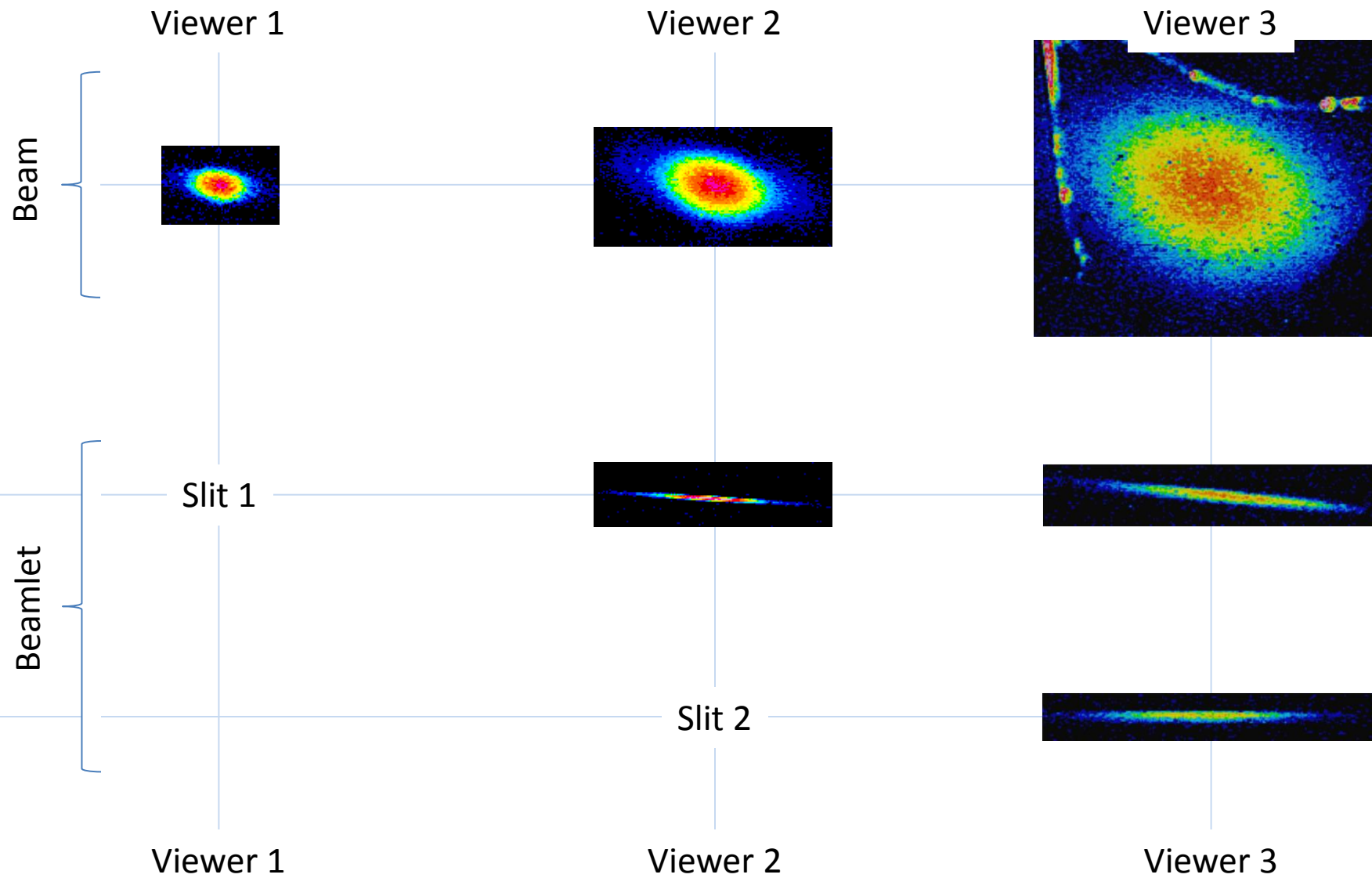
Beamlet

Viewer 1

Viewer 2

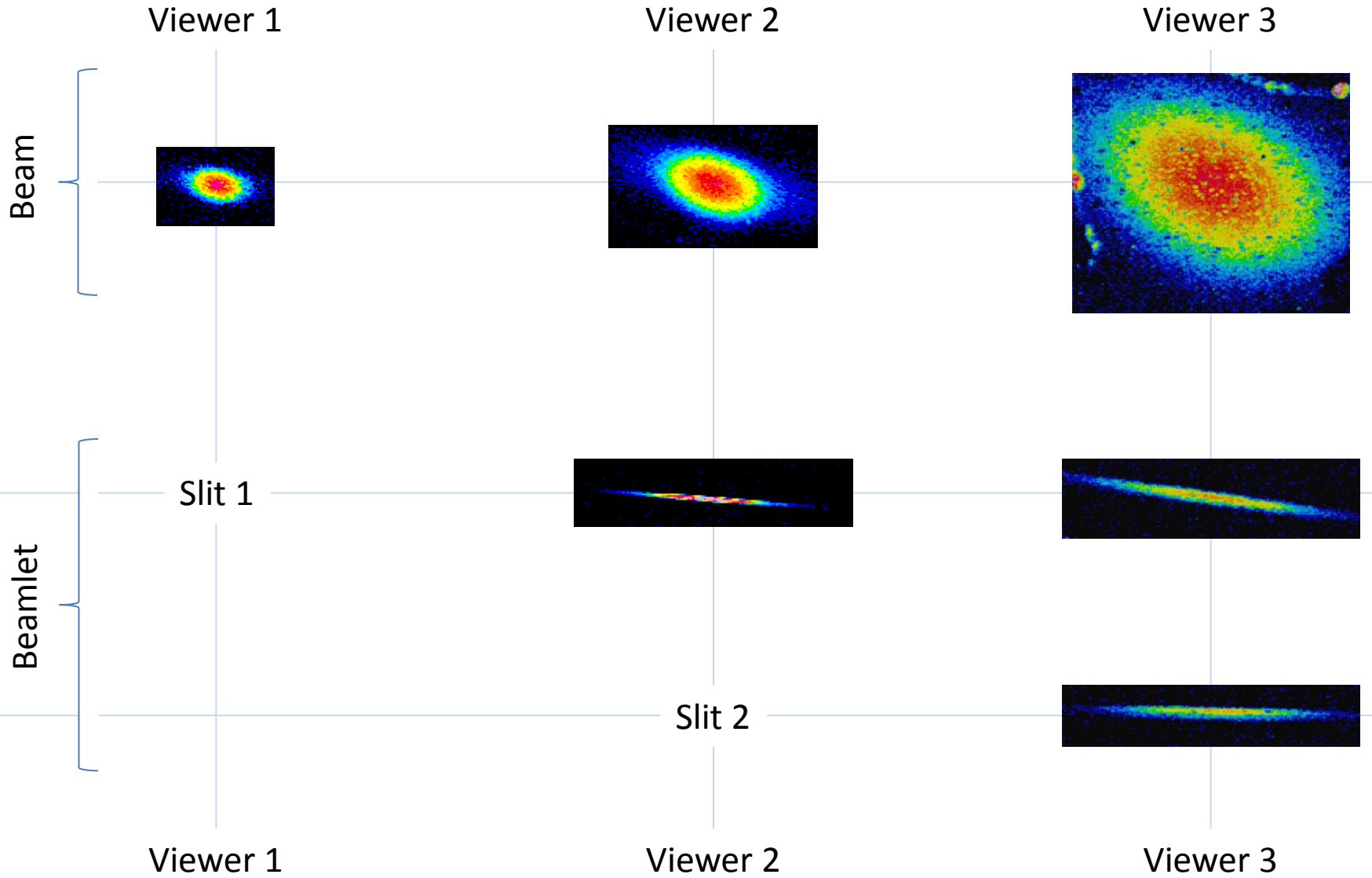
Viewer 3

# 240 A

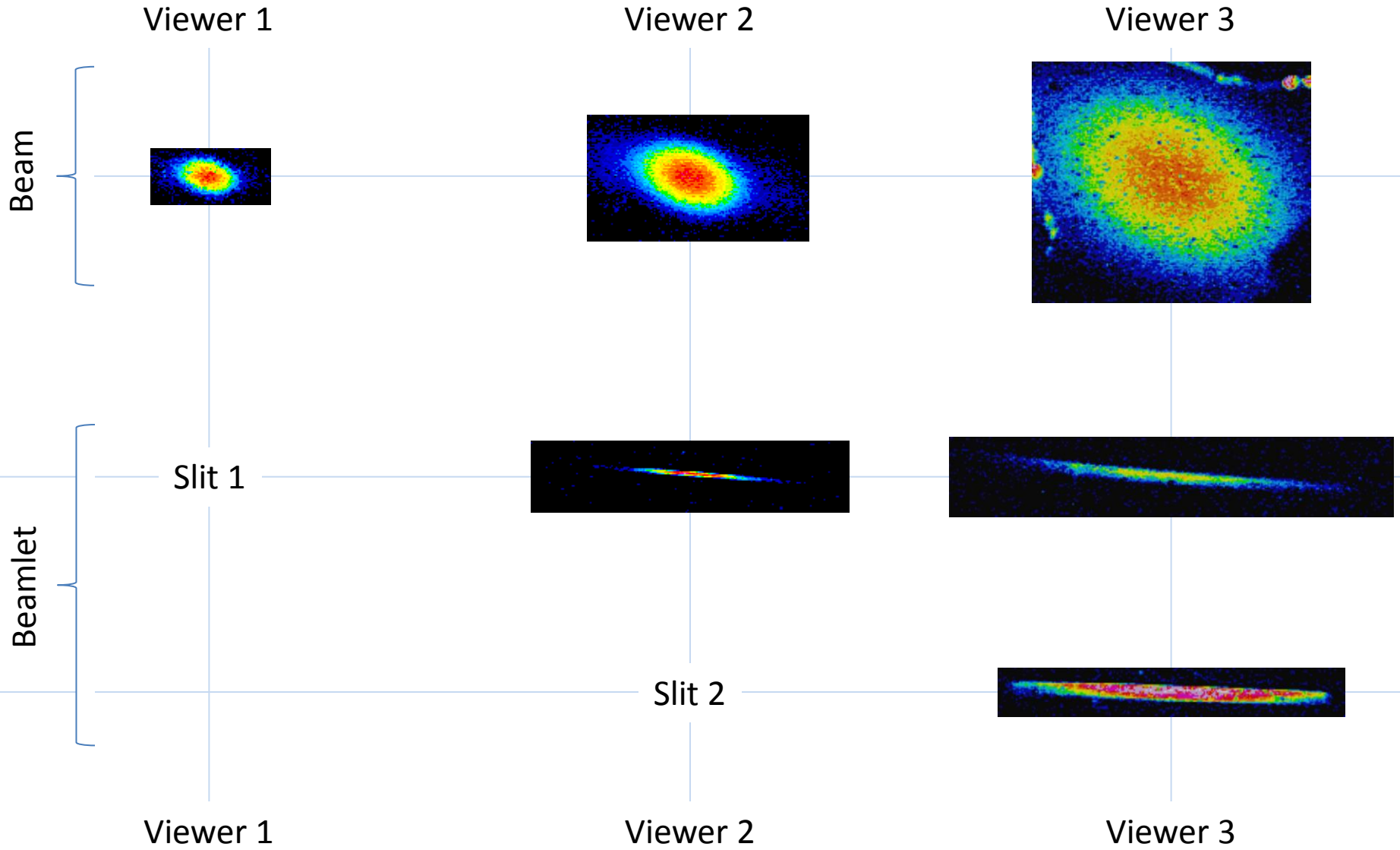




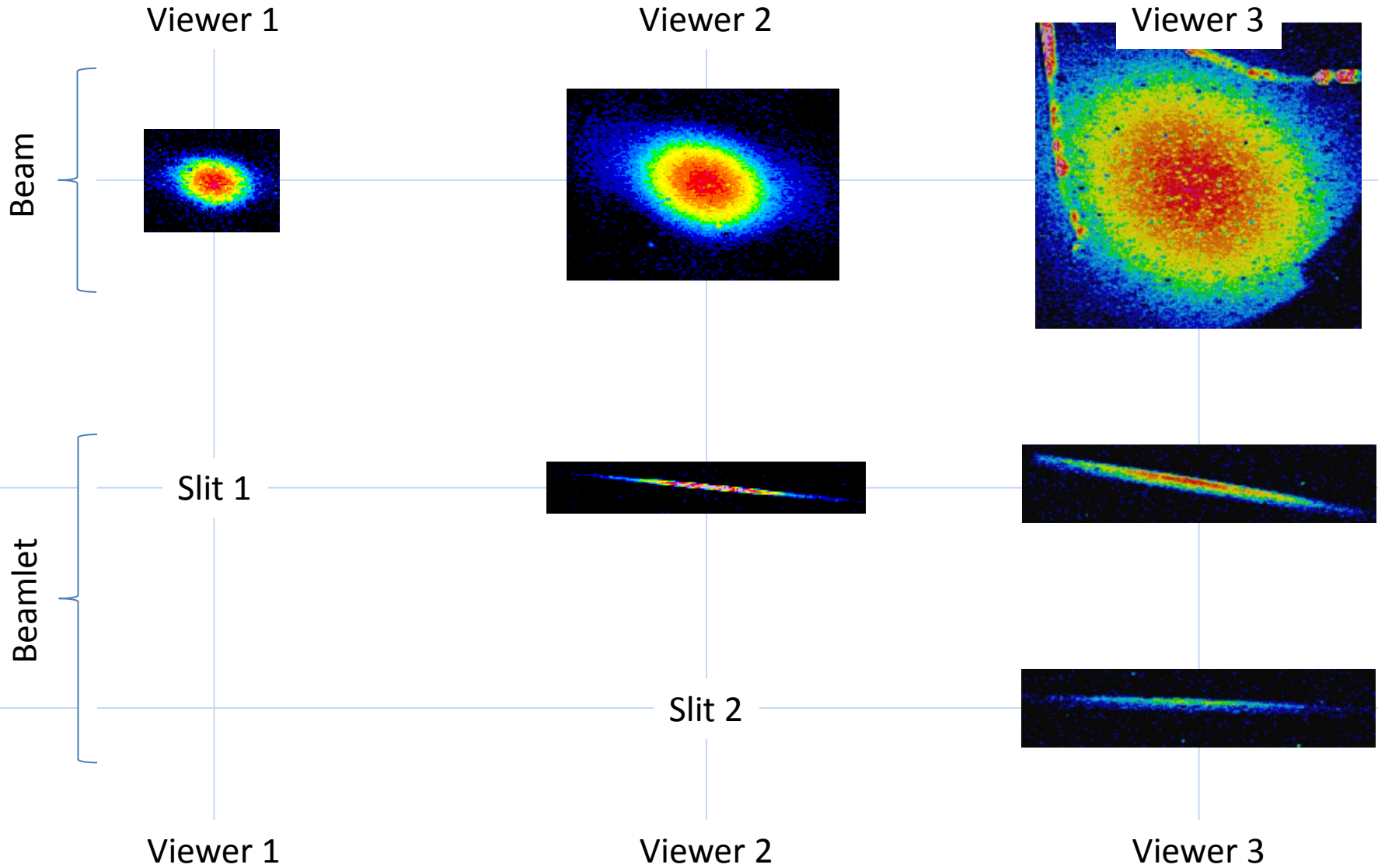
# 245 A



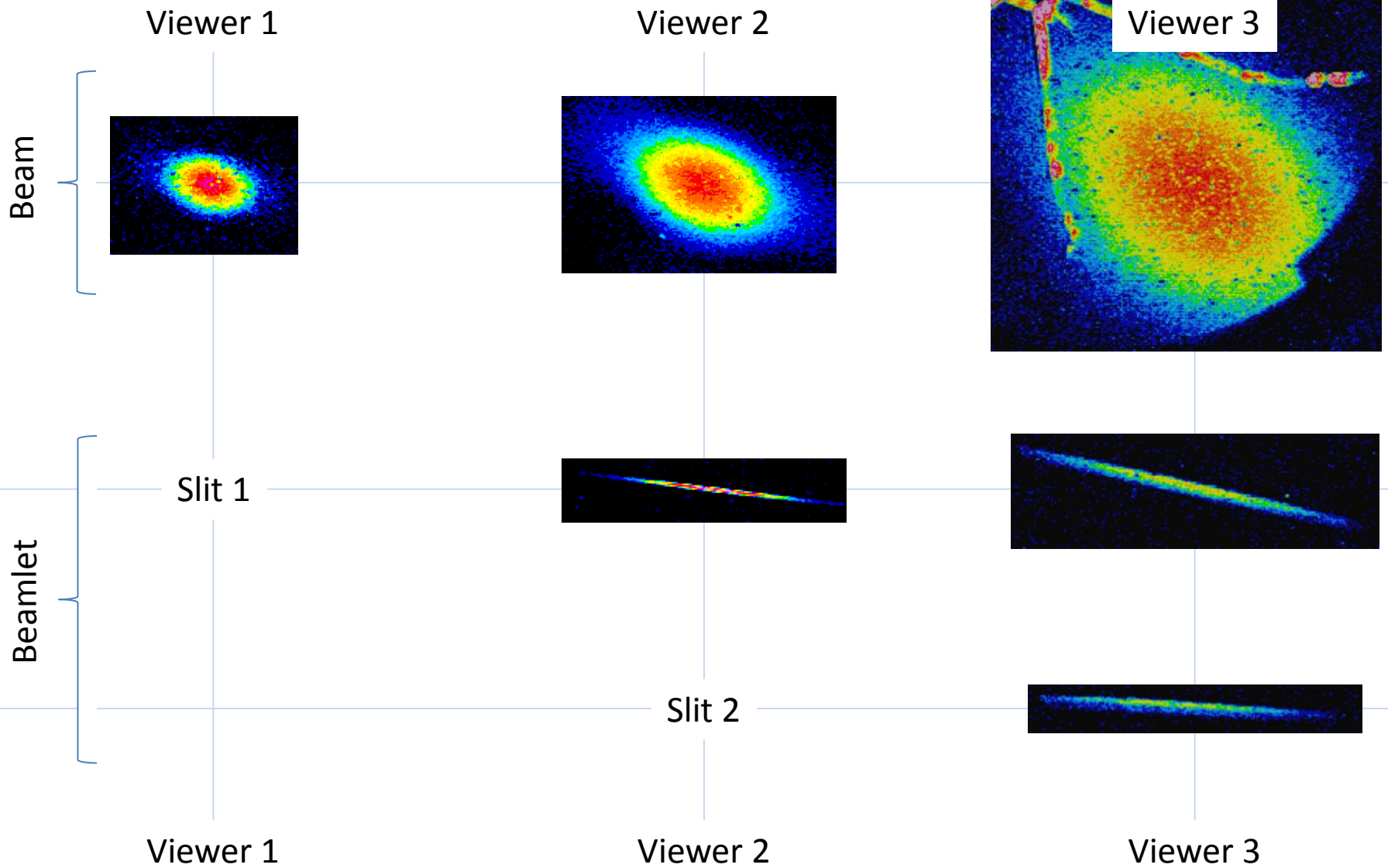
# 250 A



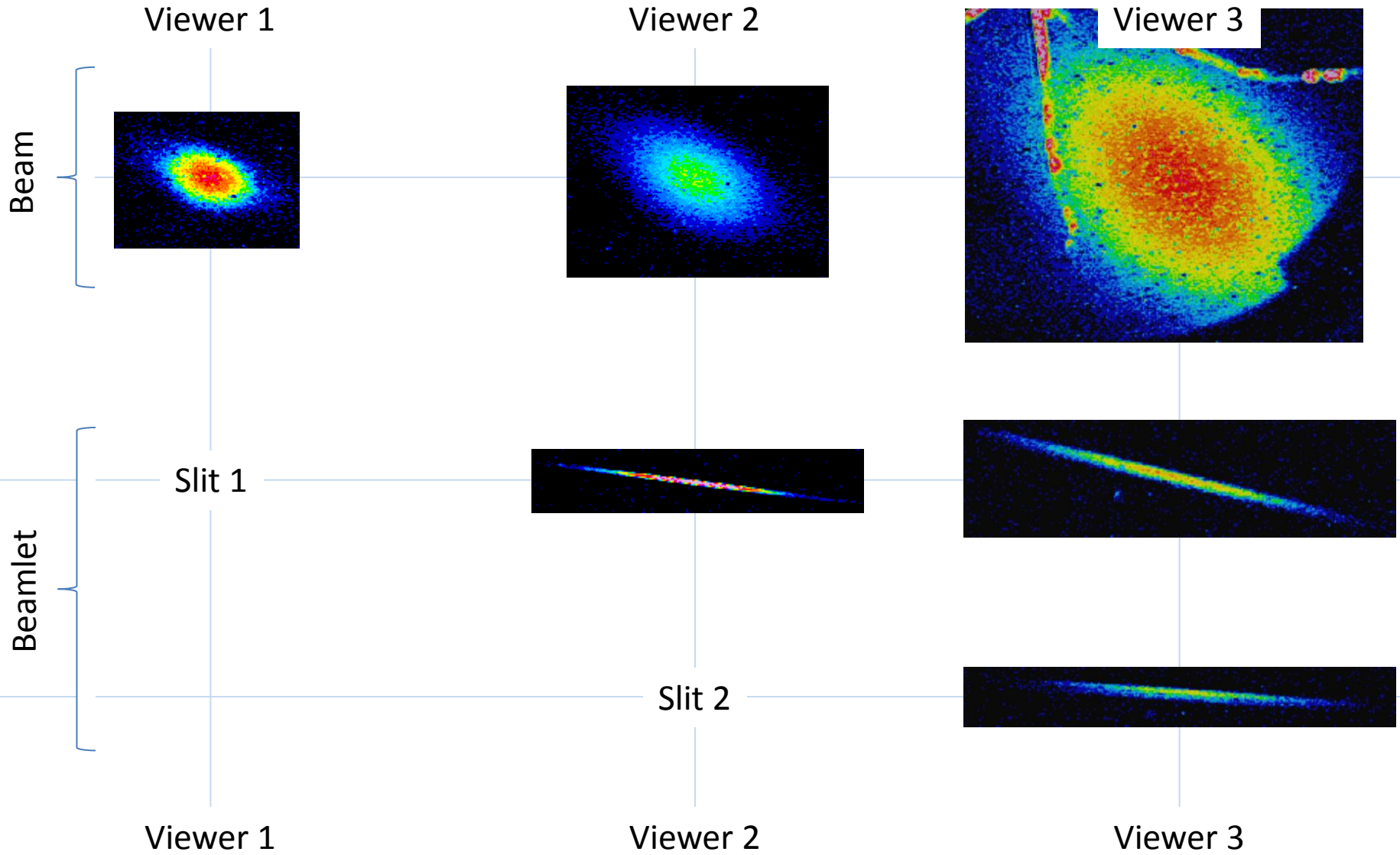
# 260 A



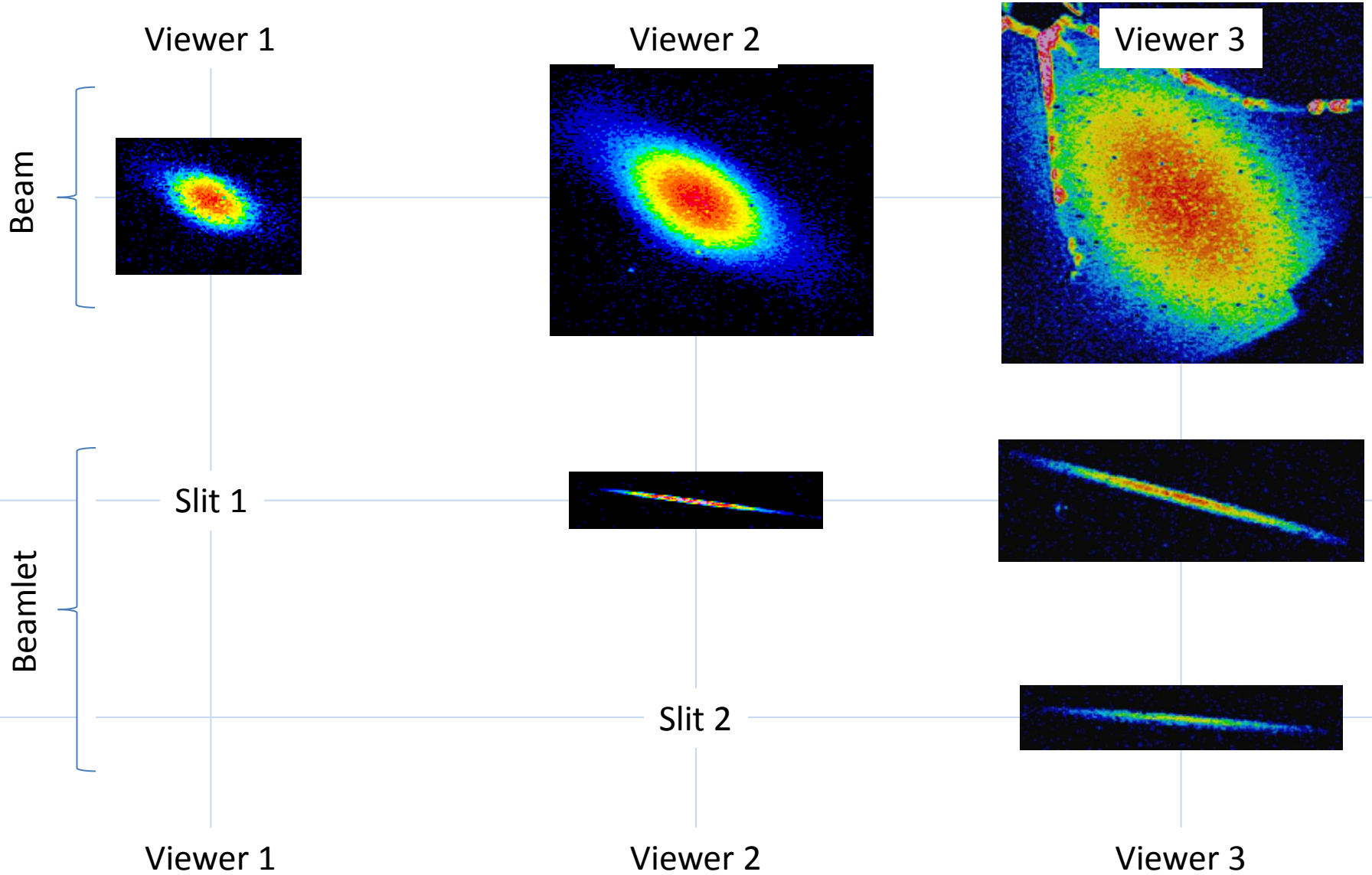
# 270 A



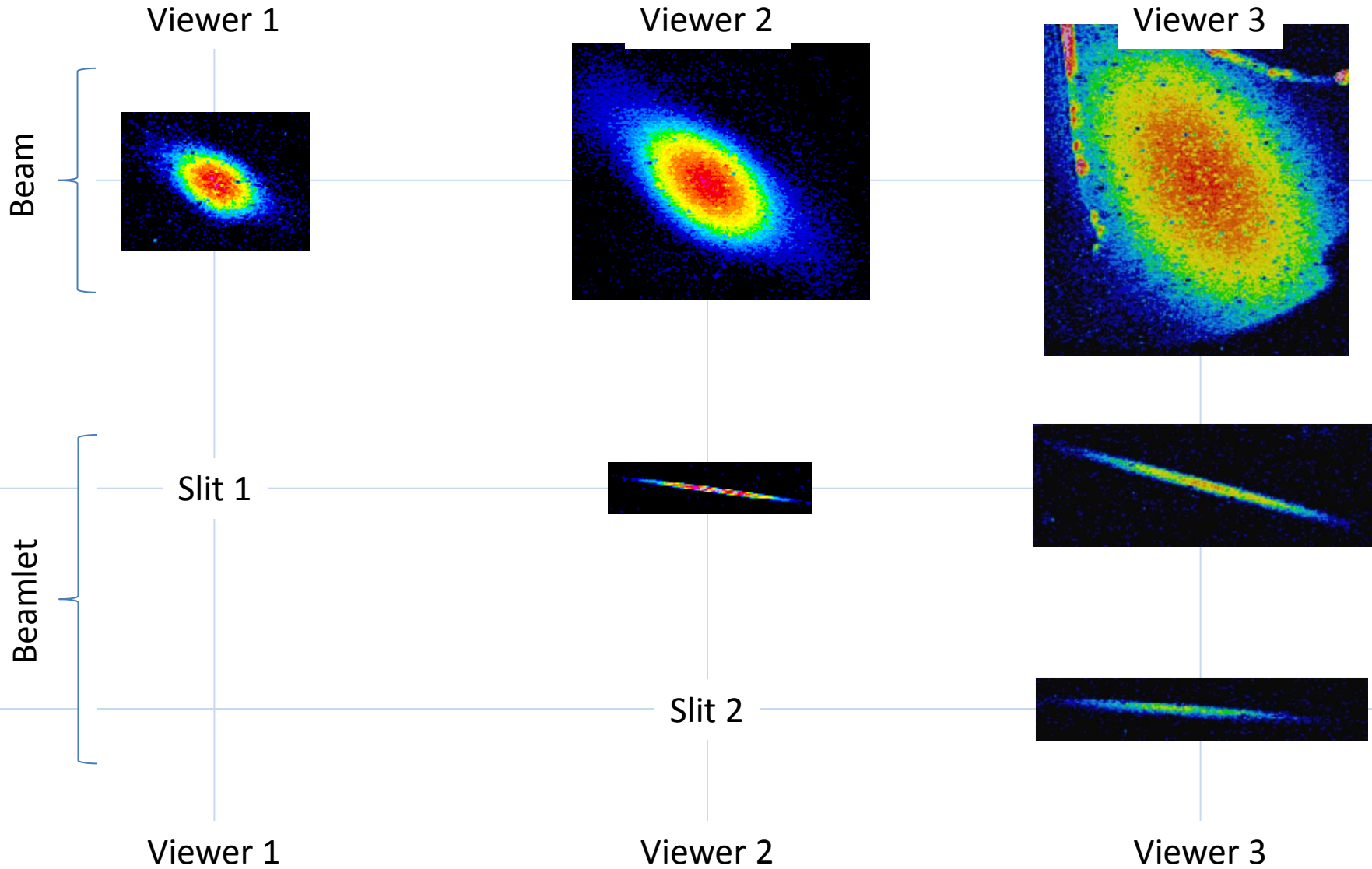
# 275 A



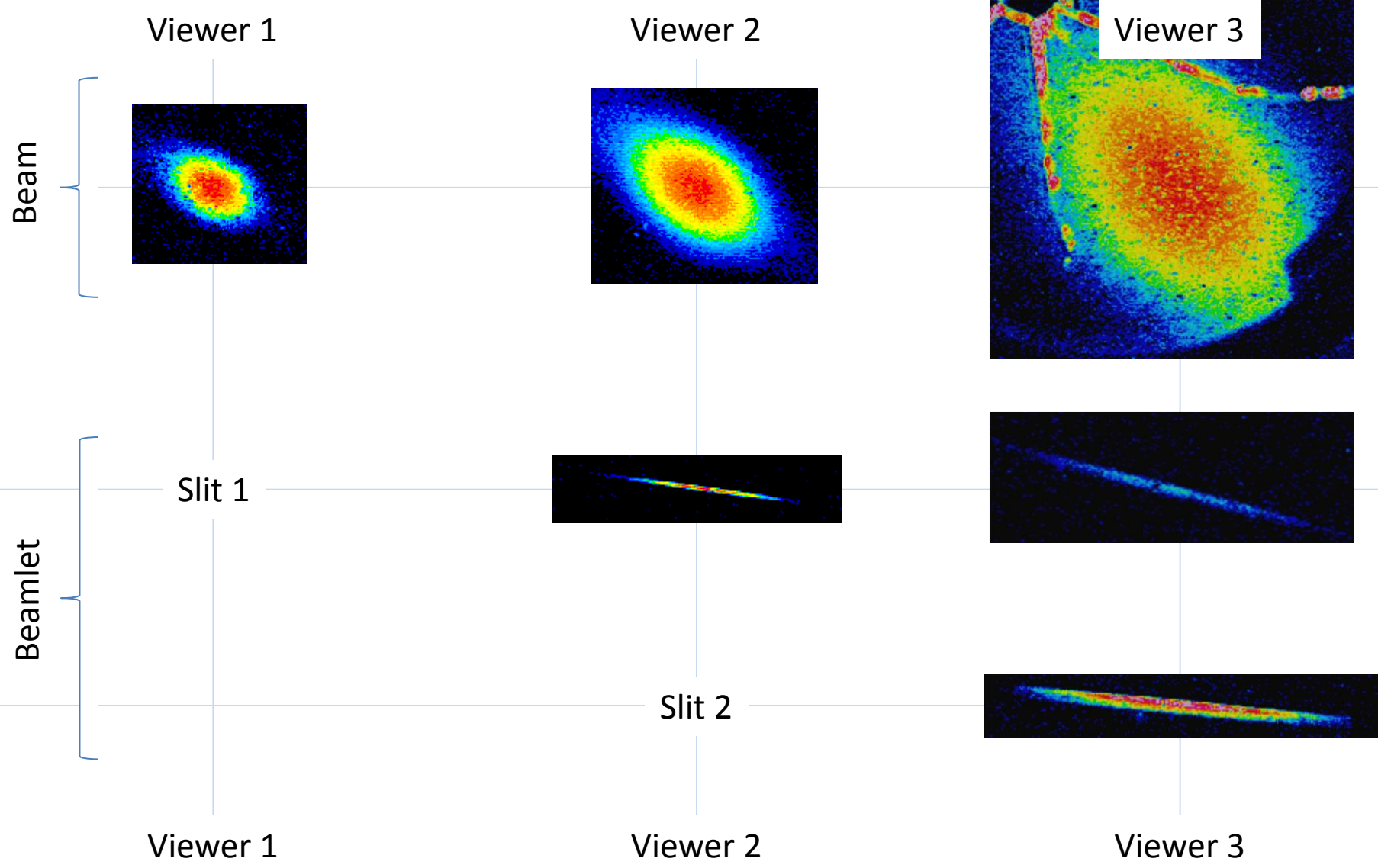
# 280 A



# 290 A

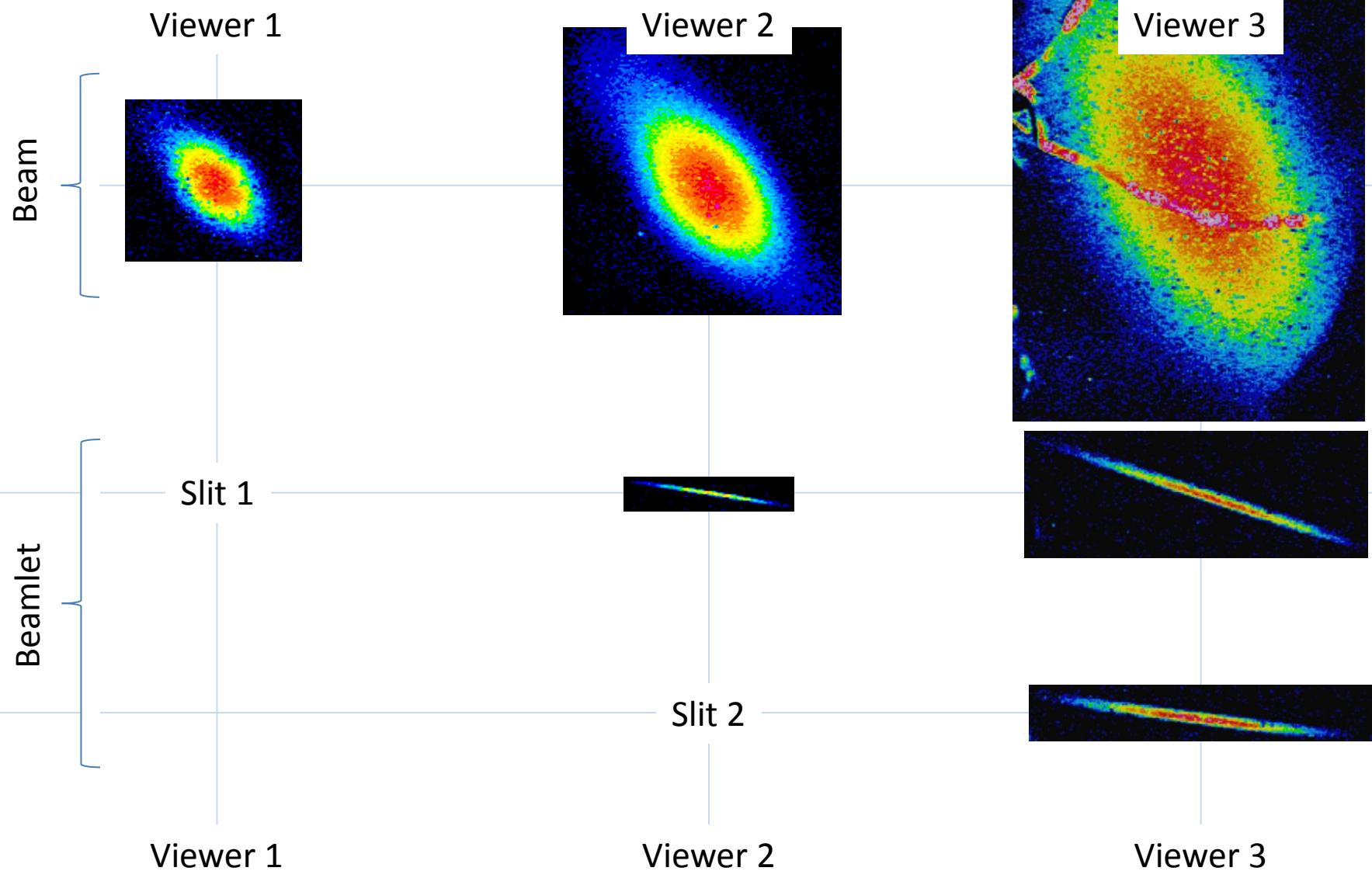


# 300 A

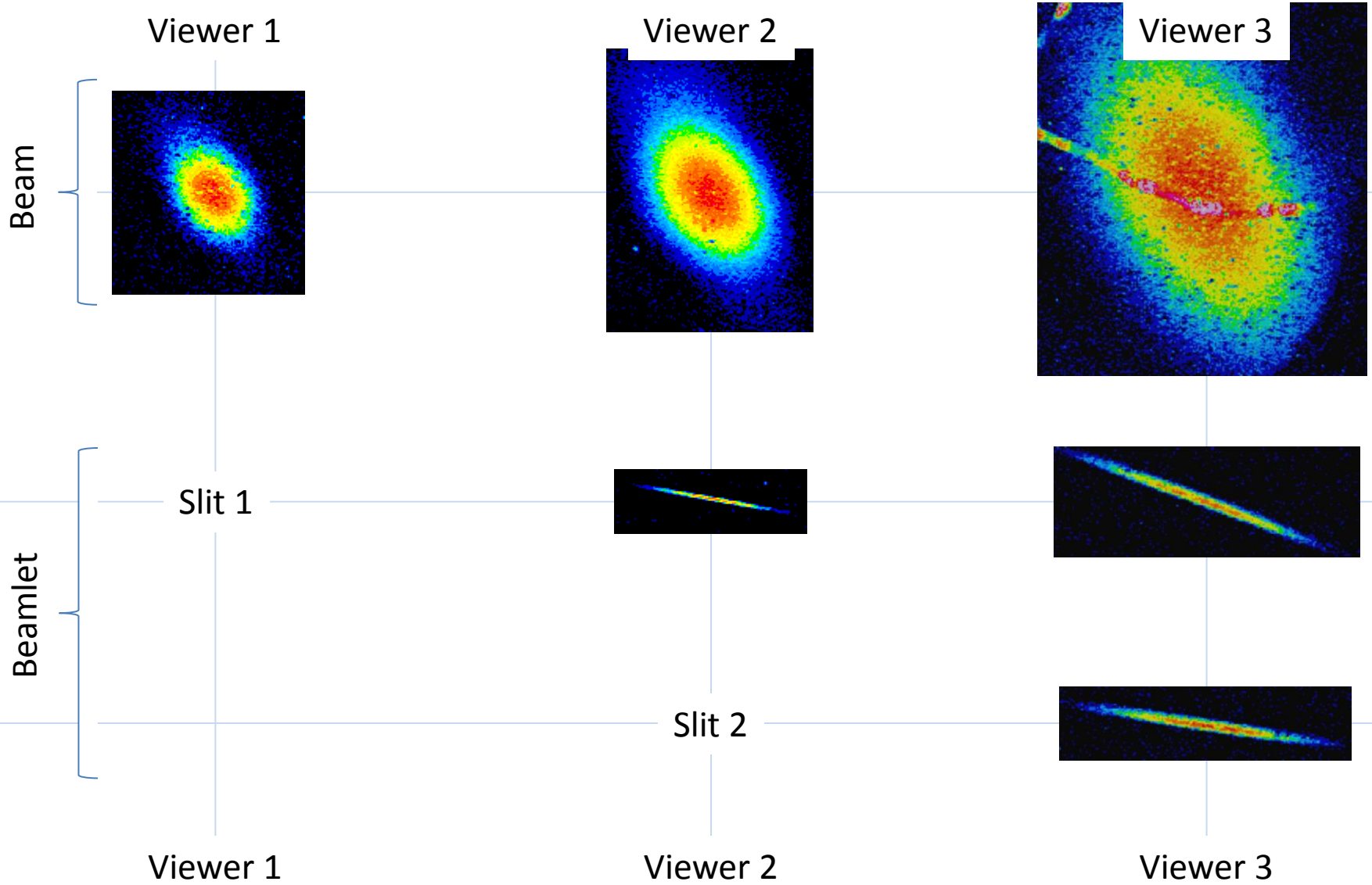




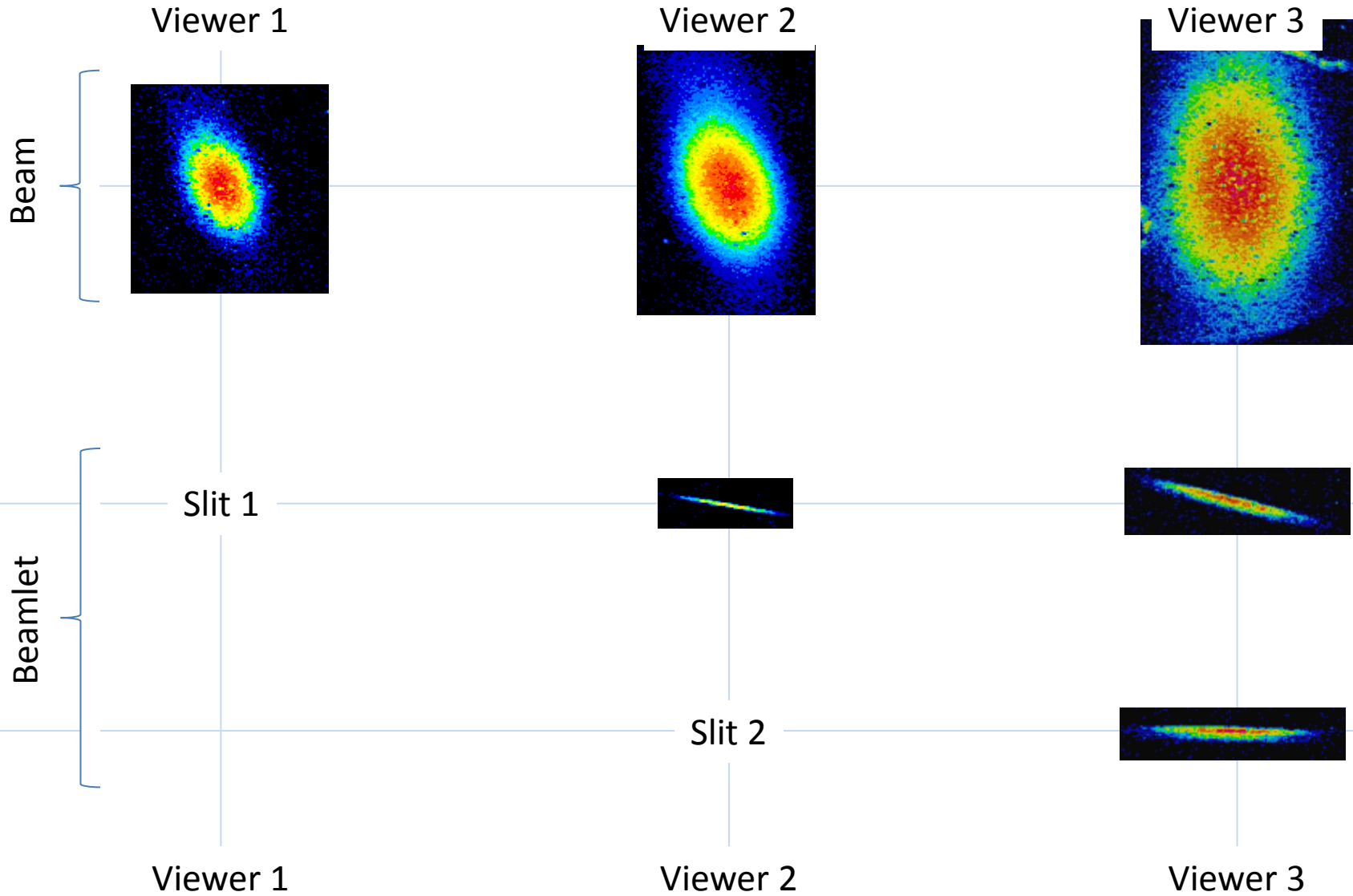
# 325 A



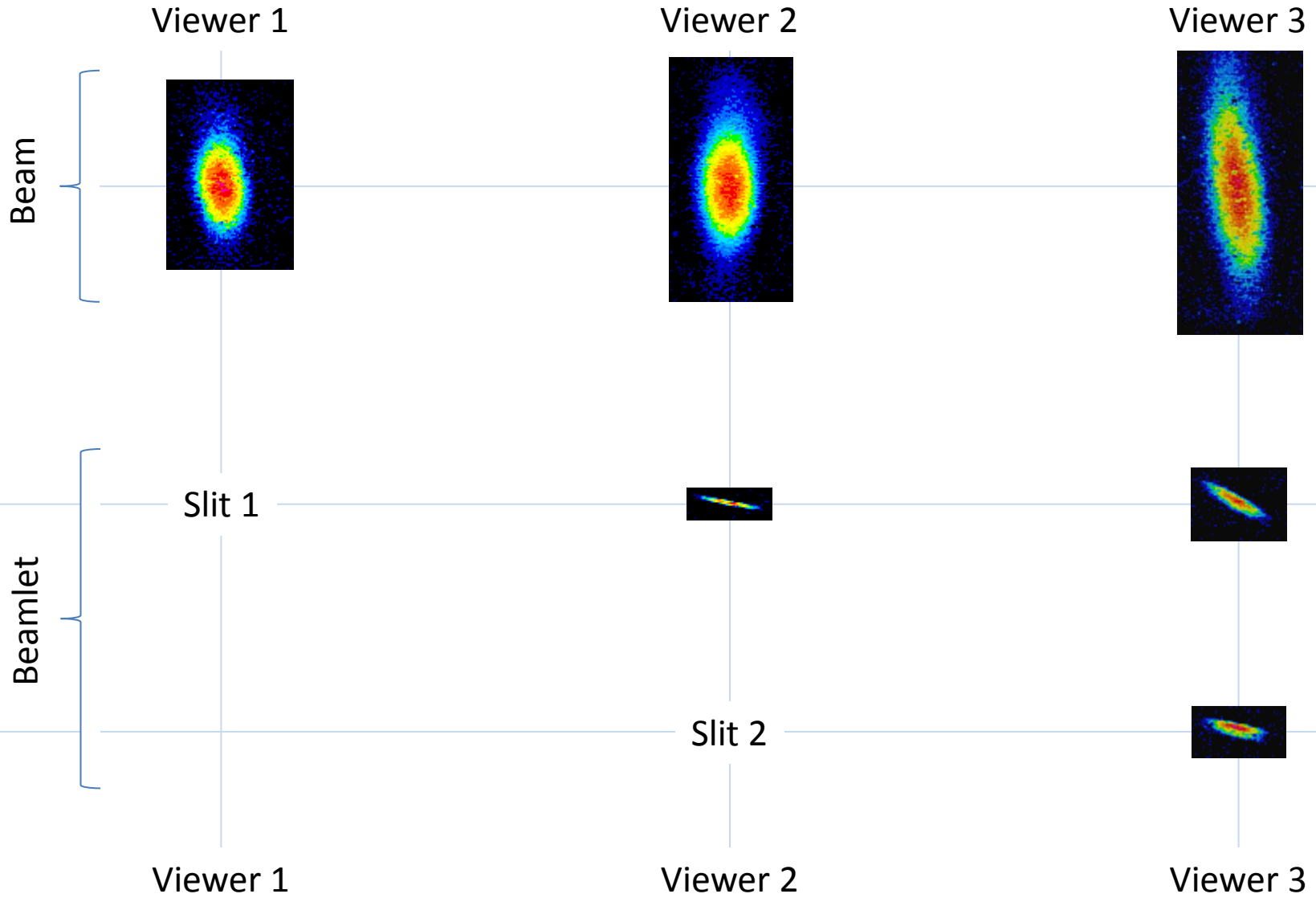
# 350 A



# 375 A



# 400 A



# Magnetized Beam on Viewers

(case 2: used lens 2 for beam waist immediately prior to viewer 1)

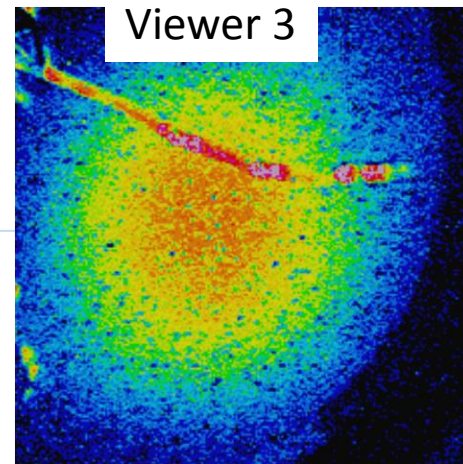
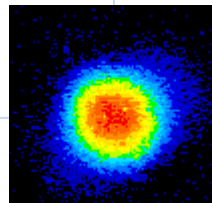
0 A

Viewer 1

Viewer 2

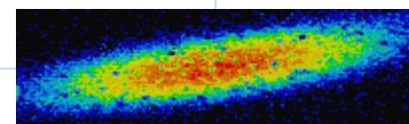
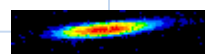
Viewer 3

Beam

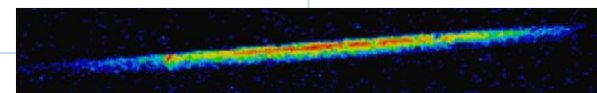


Beamlet

Slit 1



Slit 2

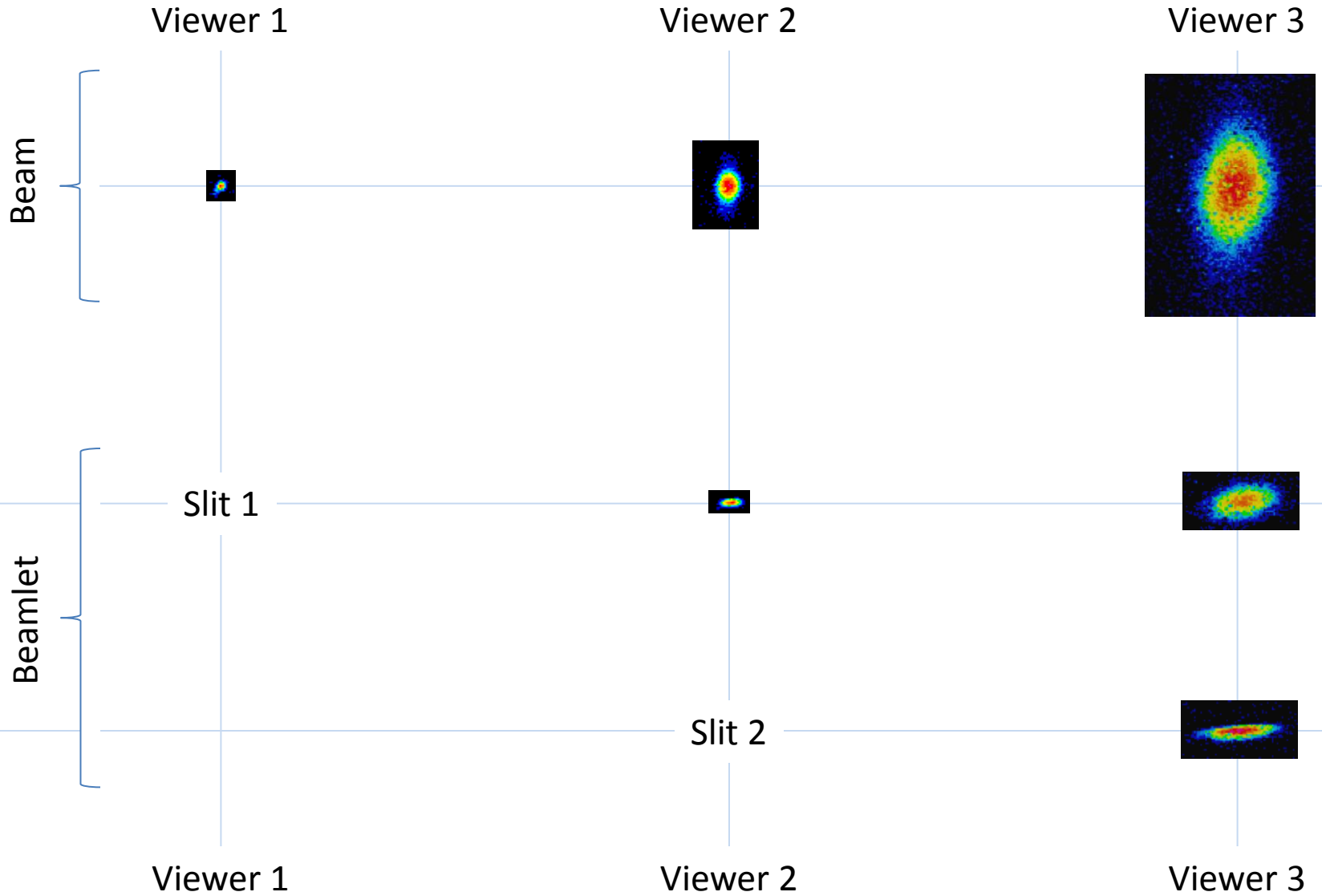


Viewer 1

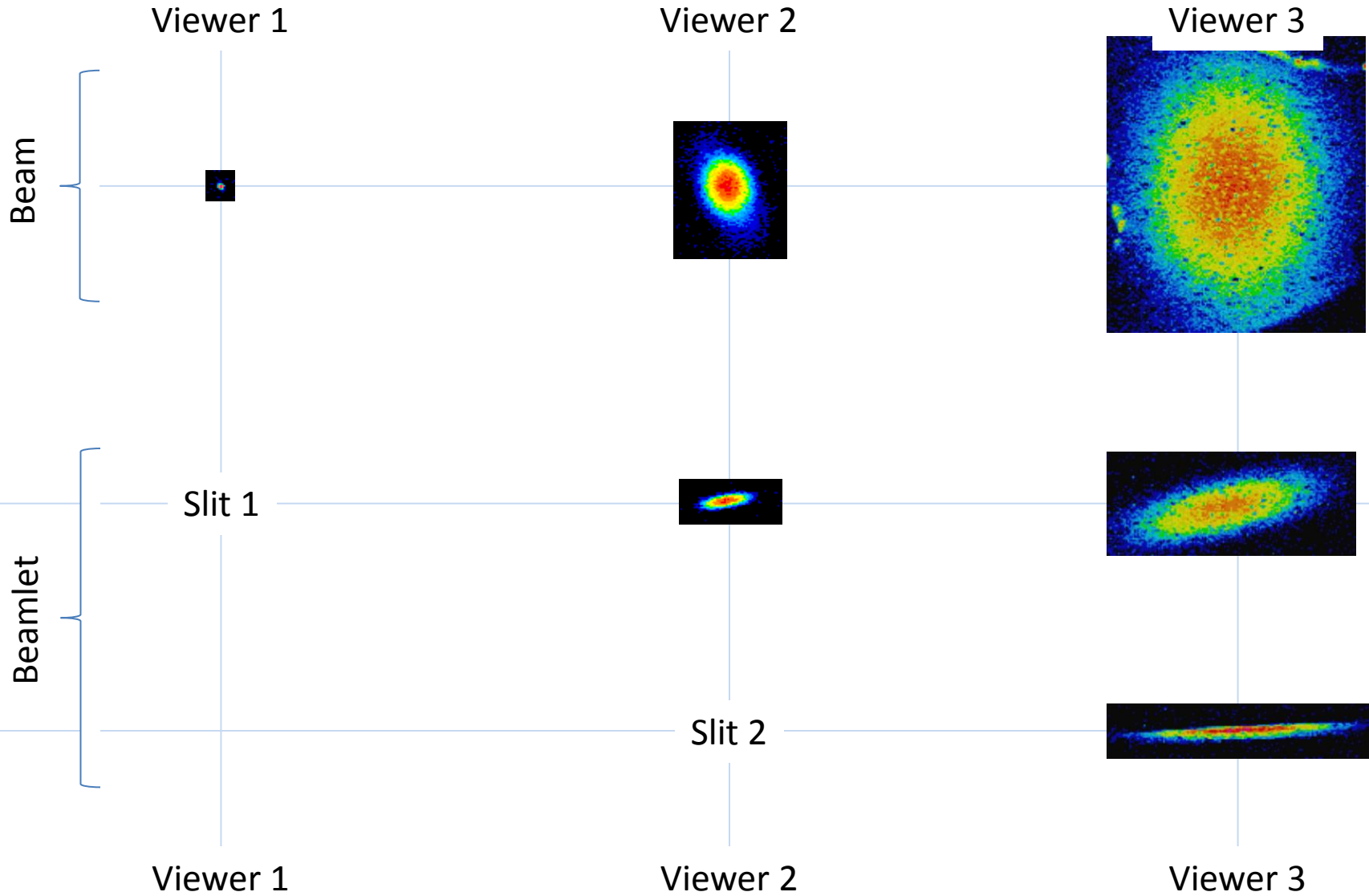
Viewer 2

Viewer 3

# 25 A

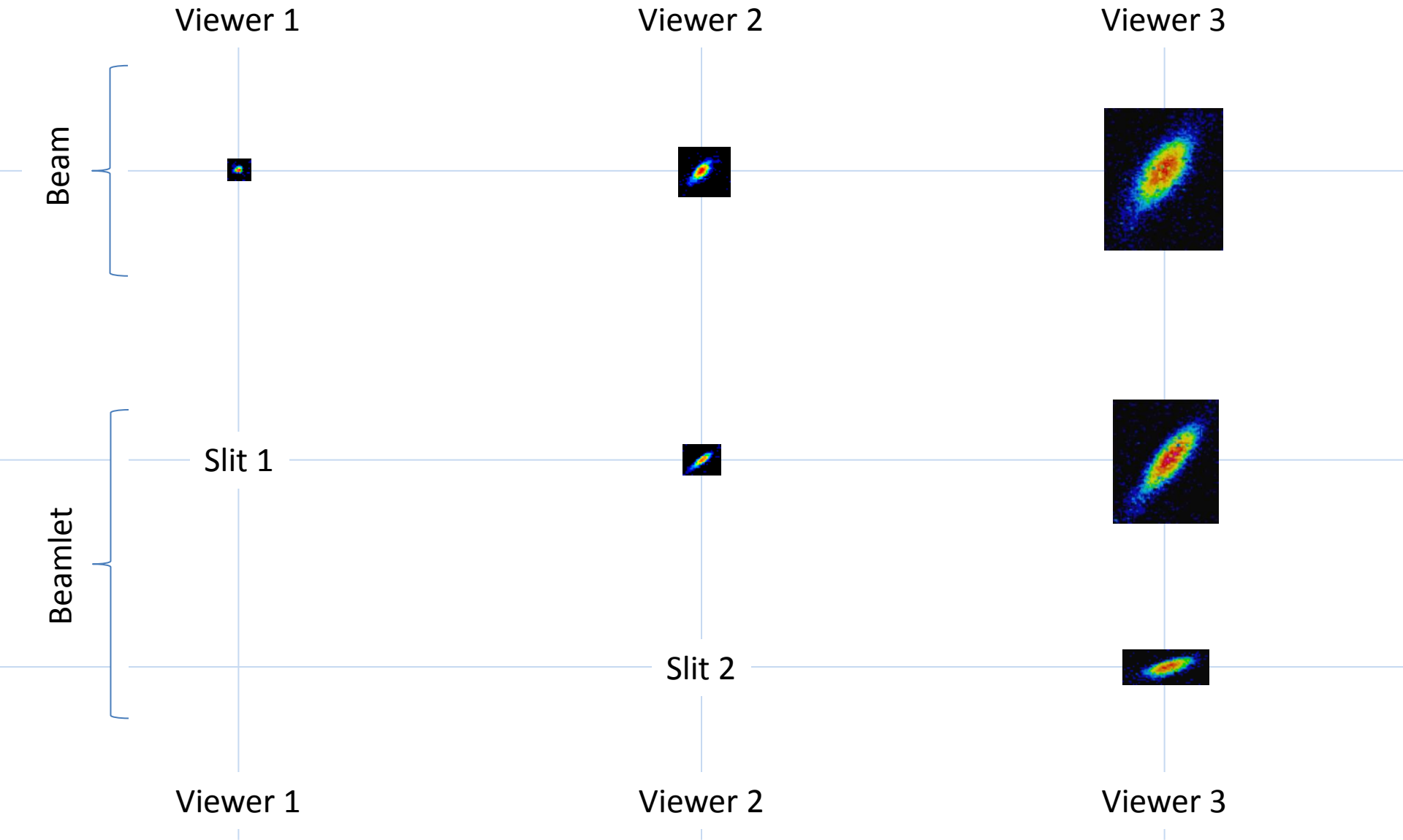


# 50 A

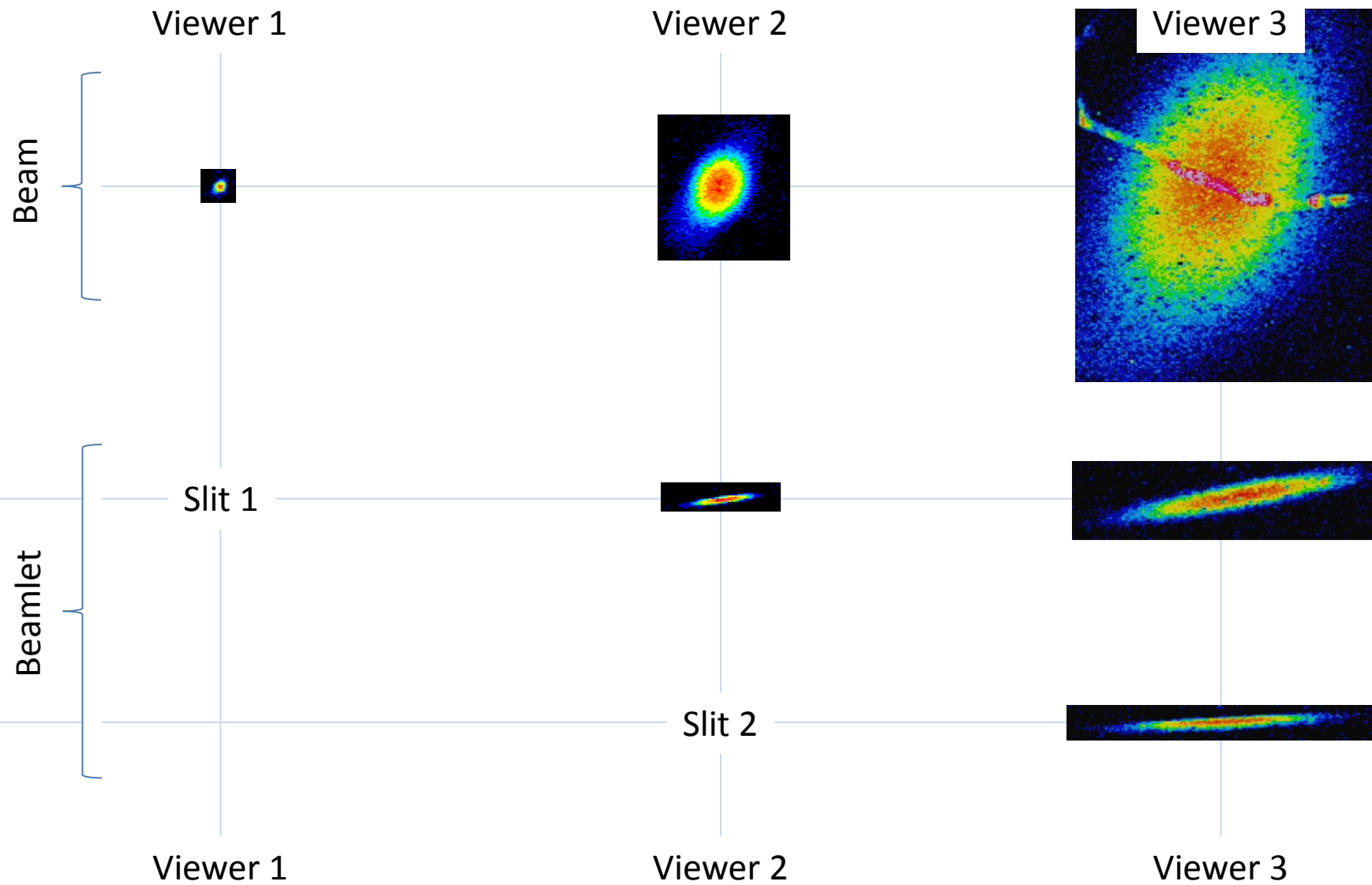




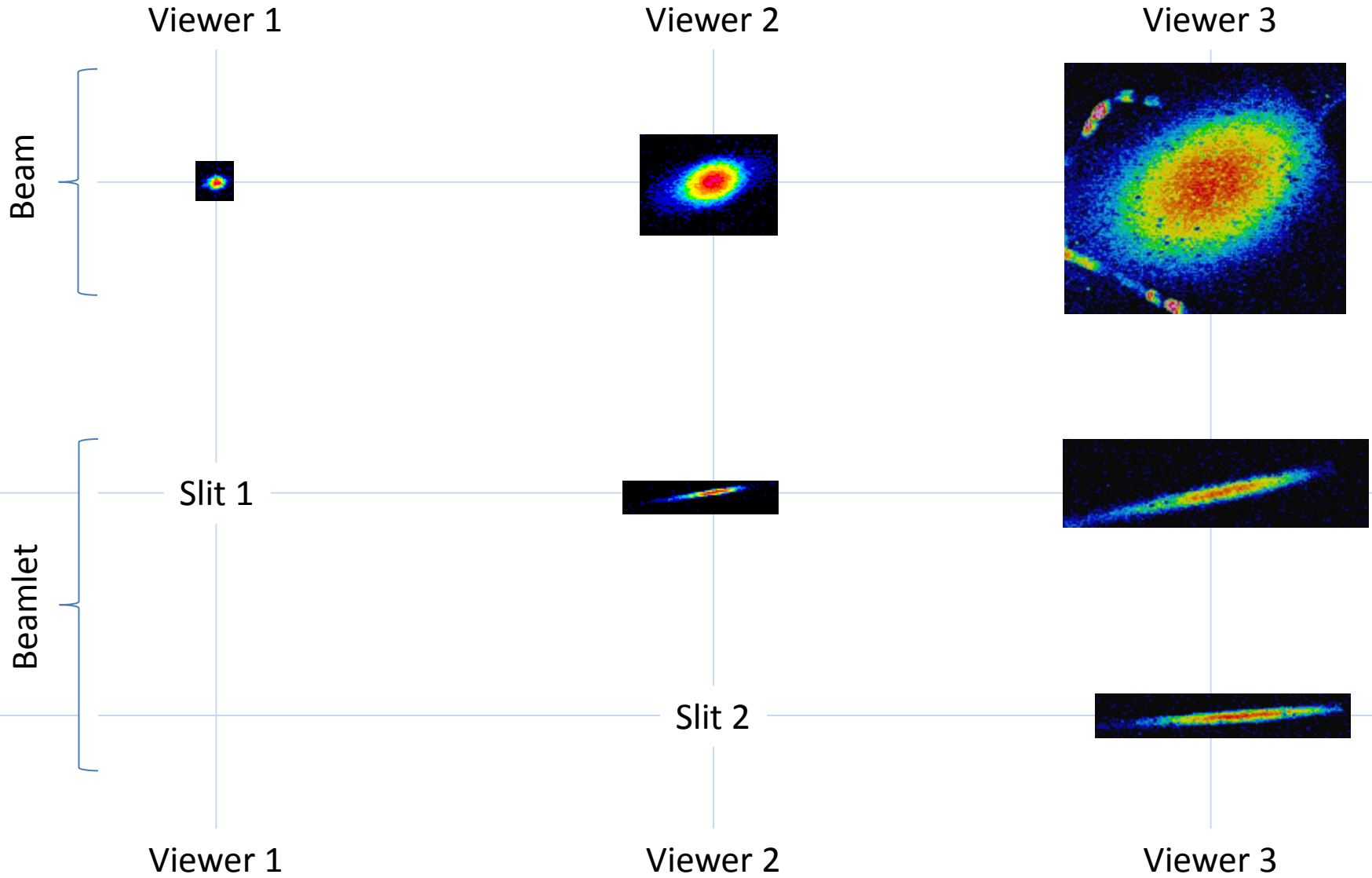
# 75 A



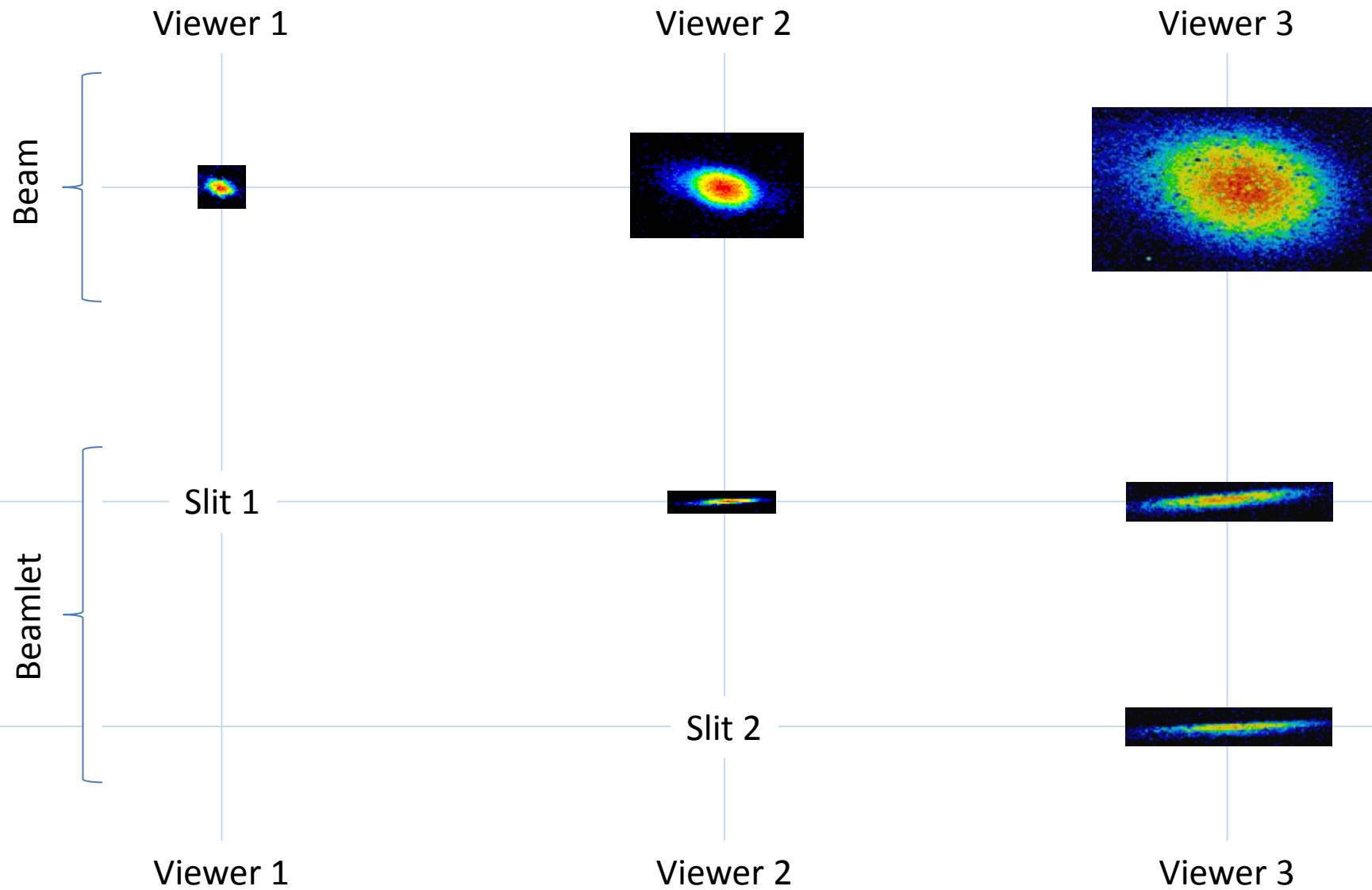
# 100 A



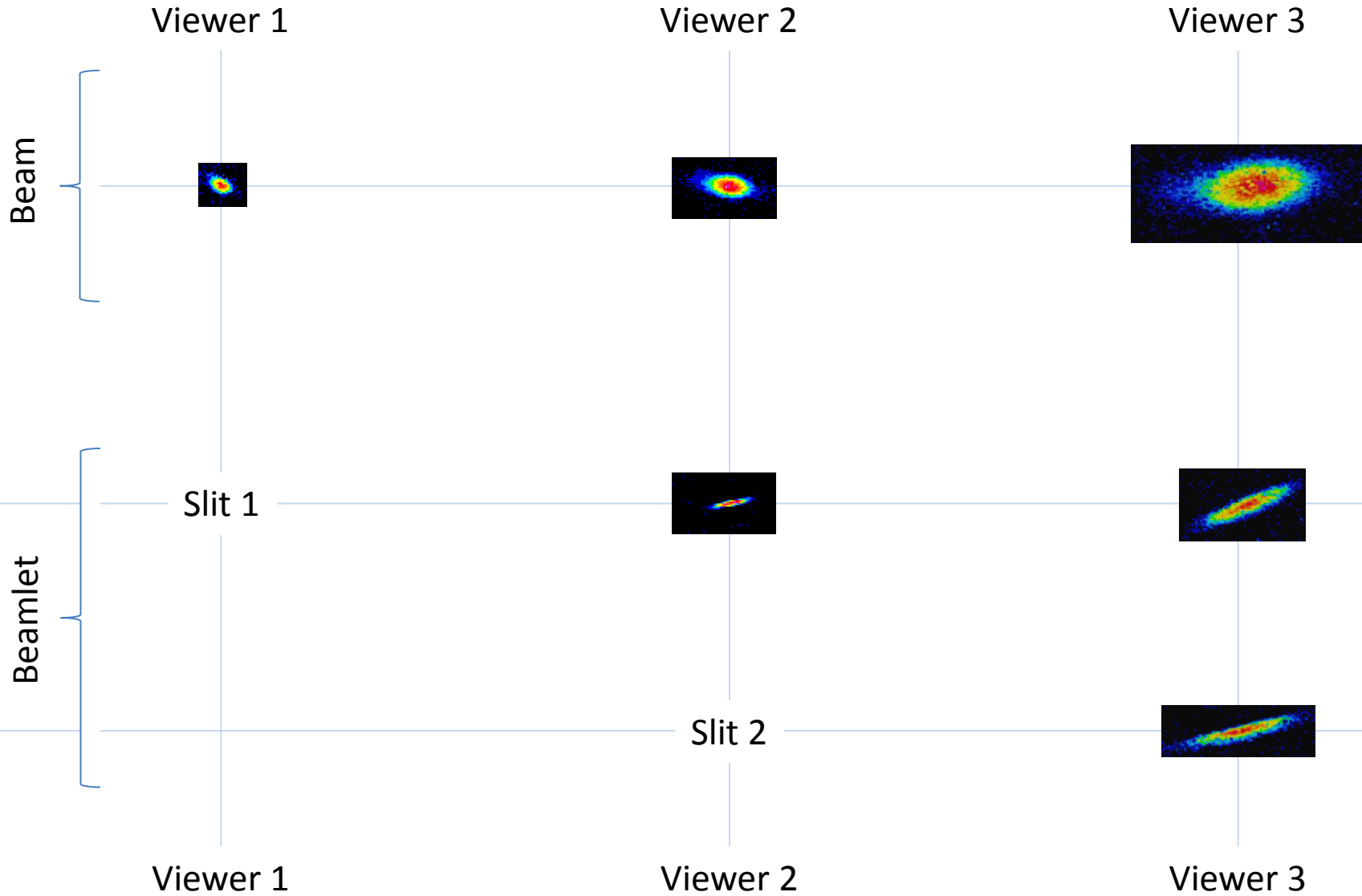
# 150 A



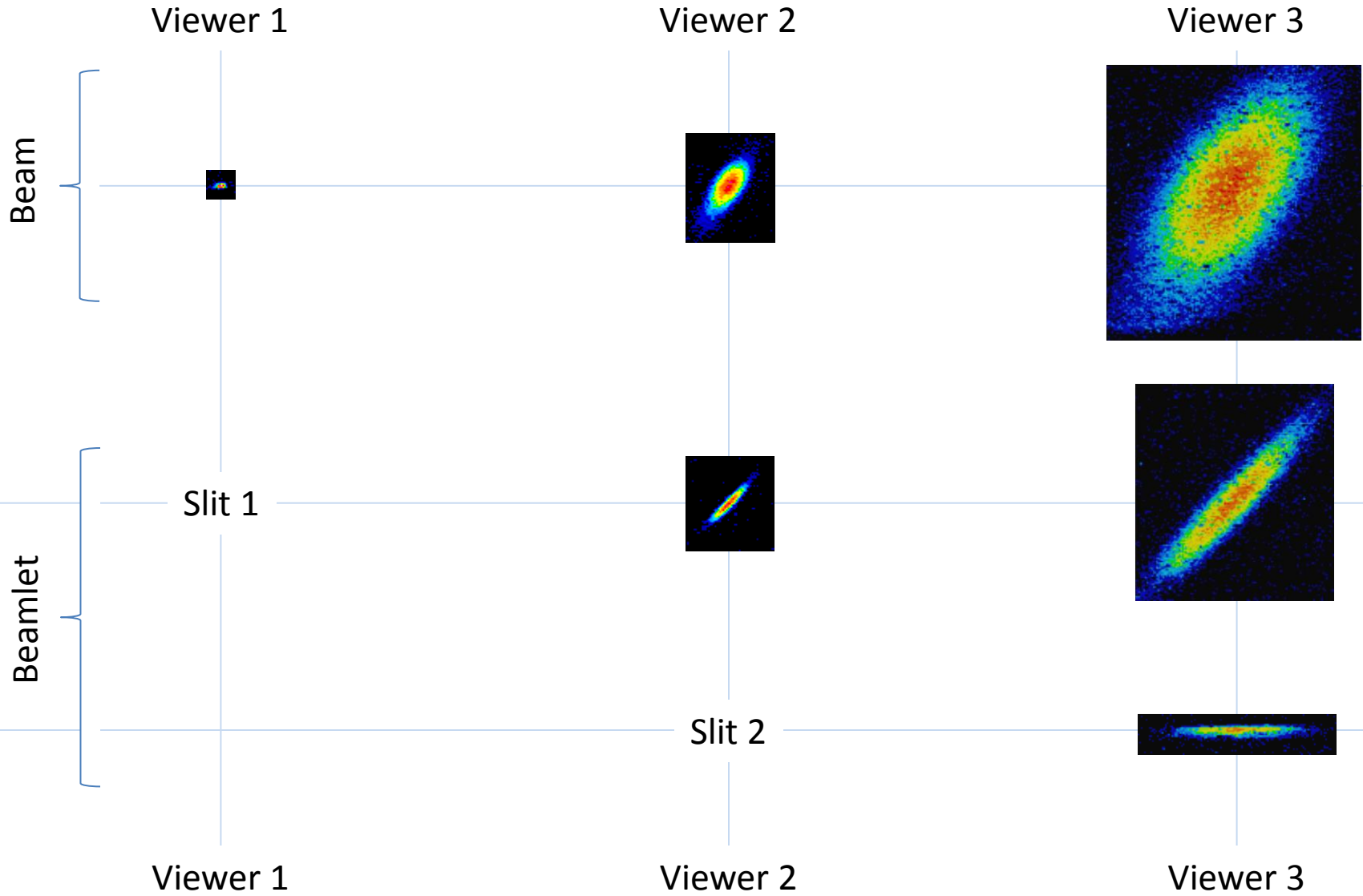
# 200 A



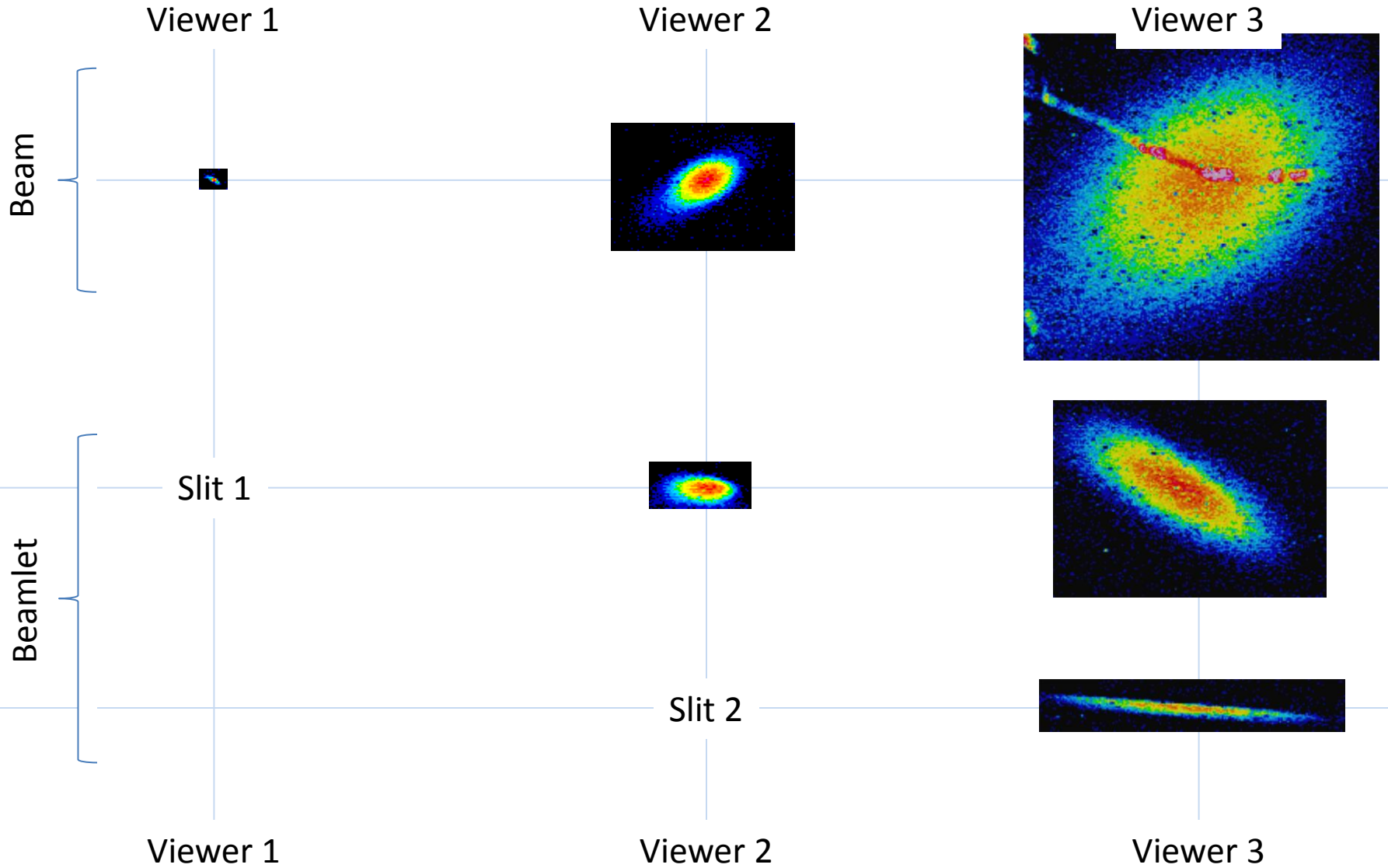
# 250 A



# 300 A



# 350 A



# 400 A

