



| The European Synchrotron



ESRF-Double Crystal Monochromator Prototype – Control Concept

Maxim Brendike

Co authors: Gilles Berruyer, Hervé Gonzalez, Ludovic Ducotté,
Cyril Guilloud, Manuel Perez, Robert Baker

1. Introduction DCM

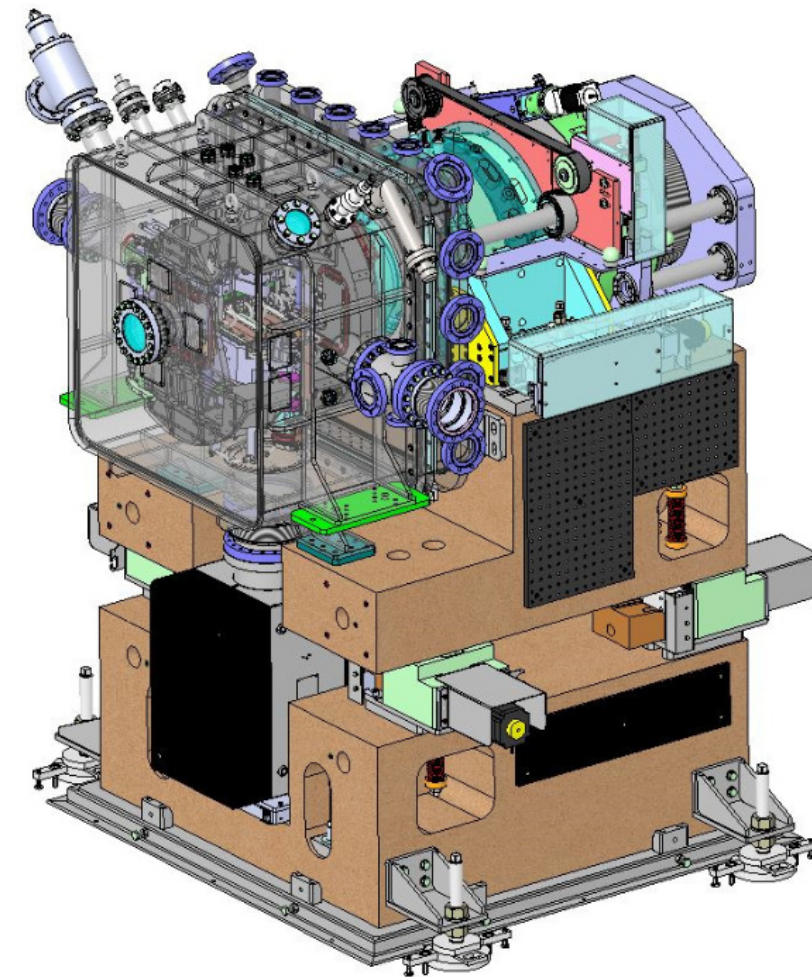
1. What does a Double Crystal Monochromator?
2. The ESRF-DCM prototype

2. The Control Concept

1. Concept of 3 modes
2. Implementation

3. Test setup and results

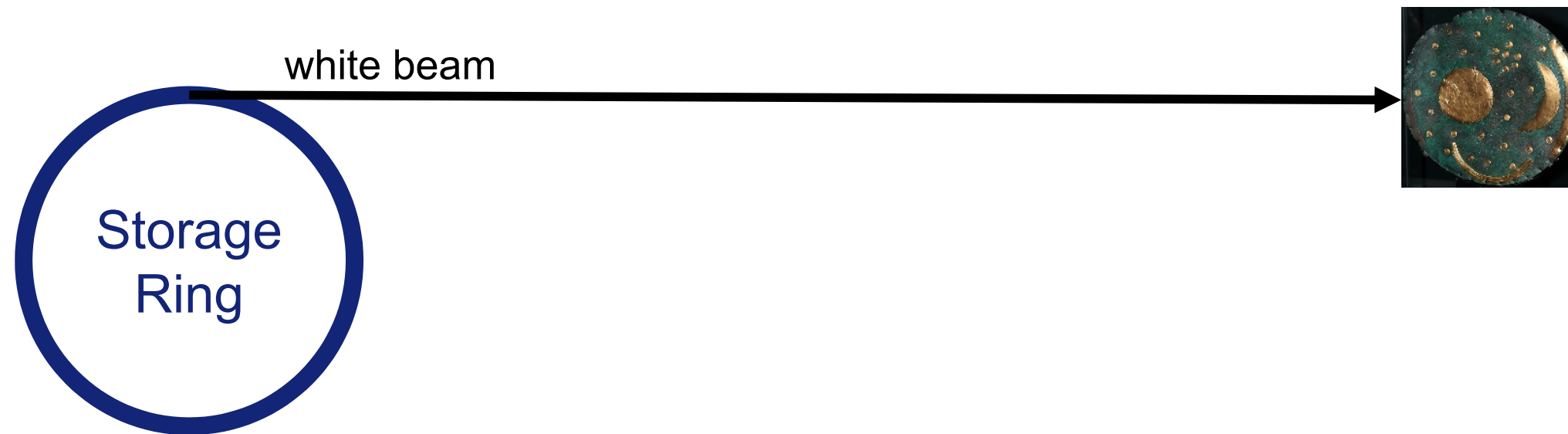
4. Conclusion



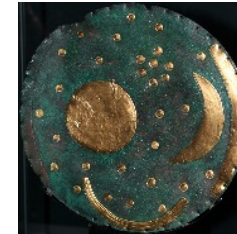
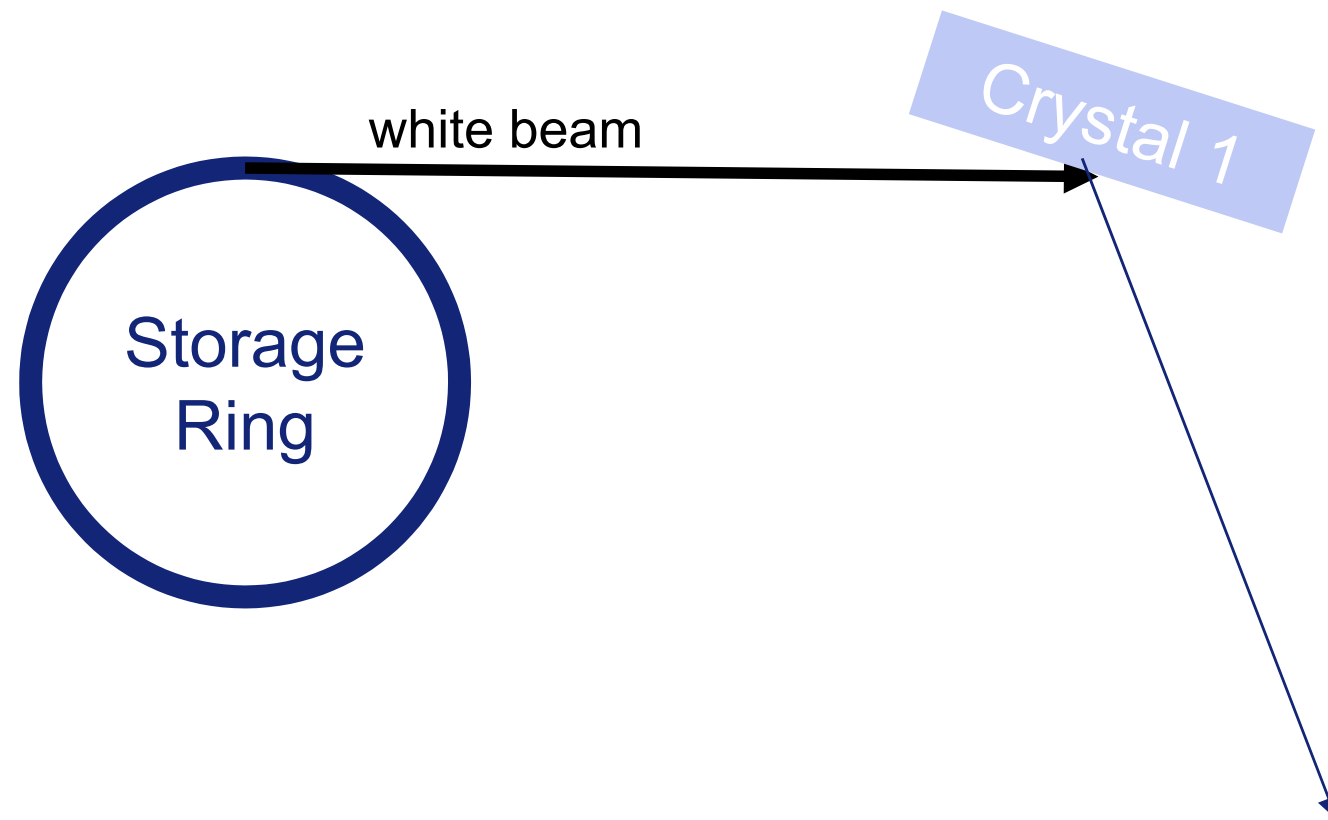
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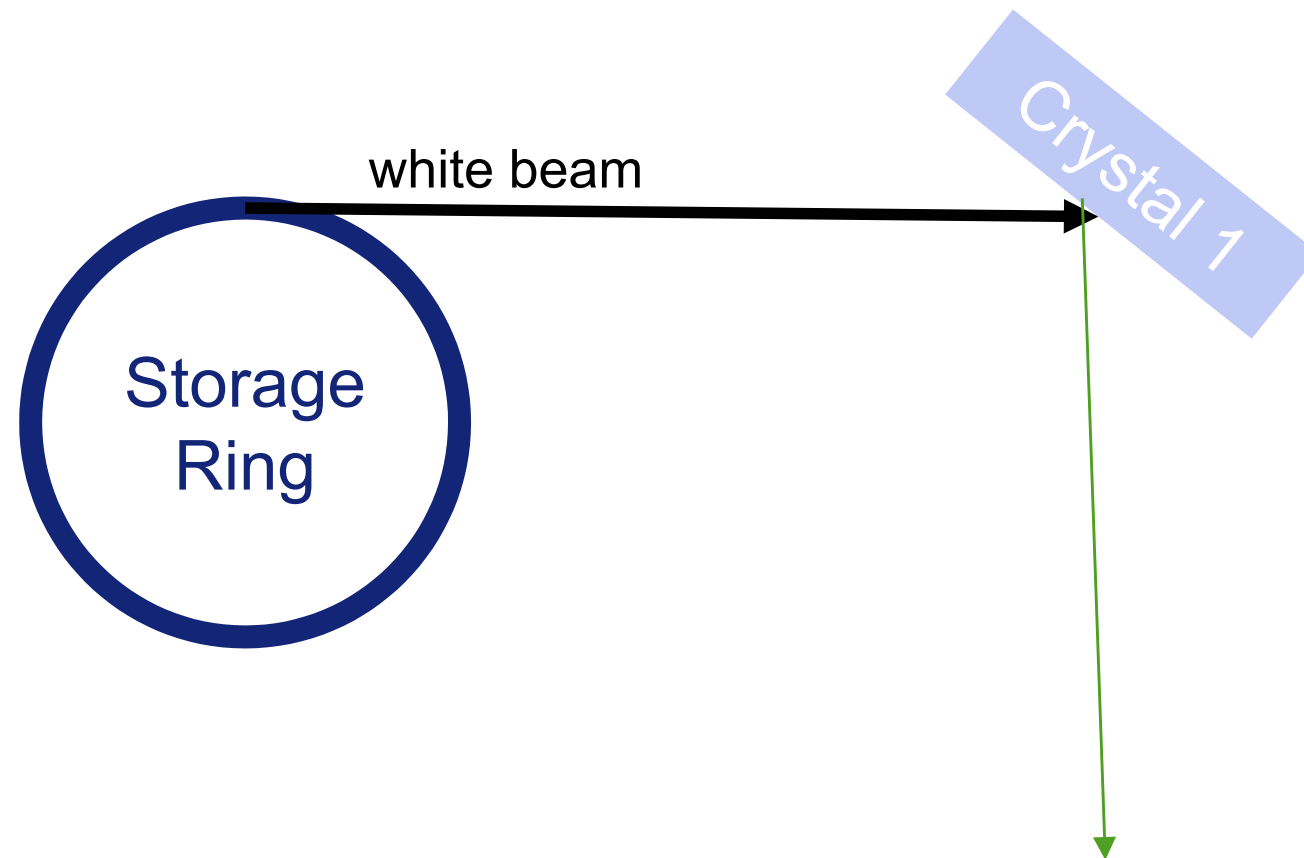
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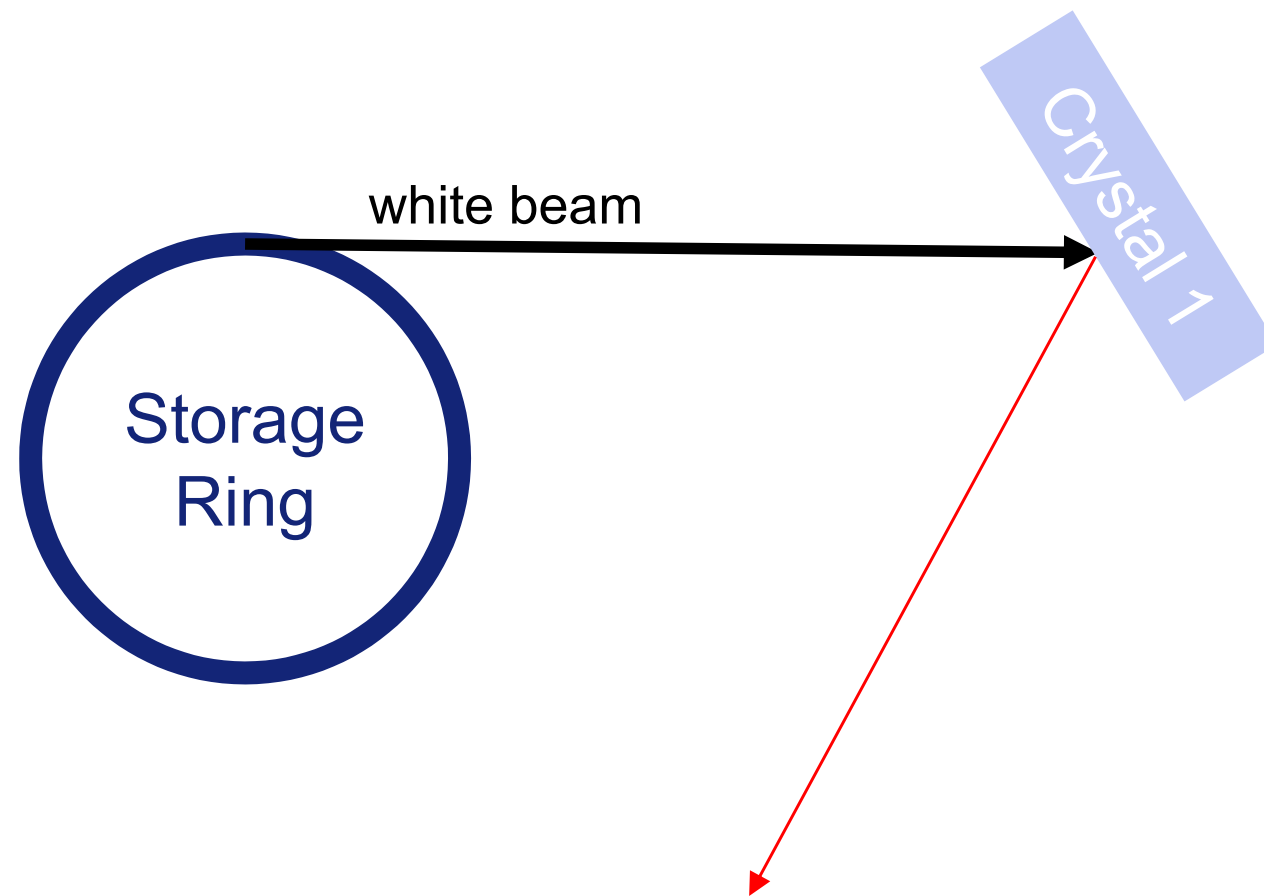
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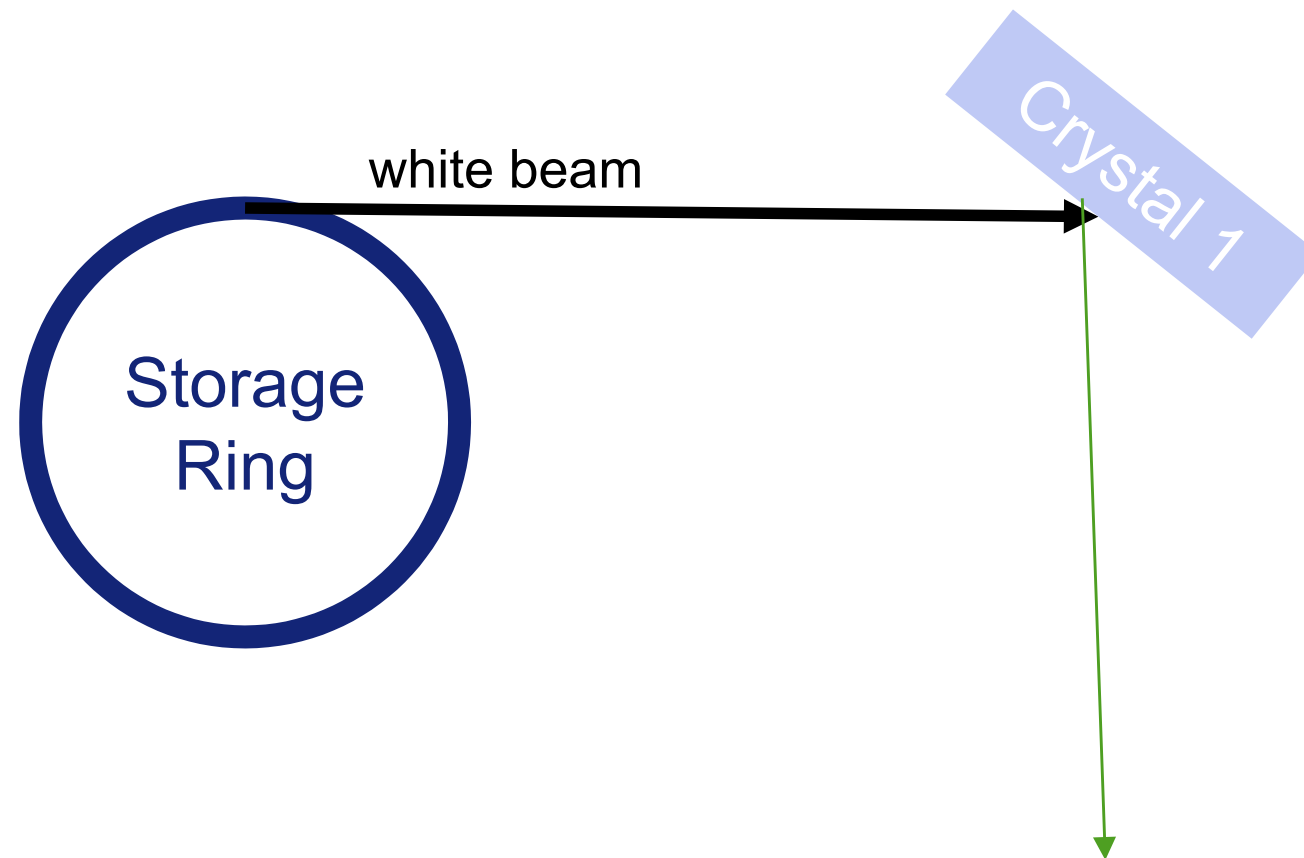
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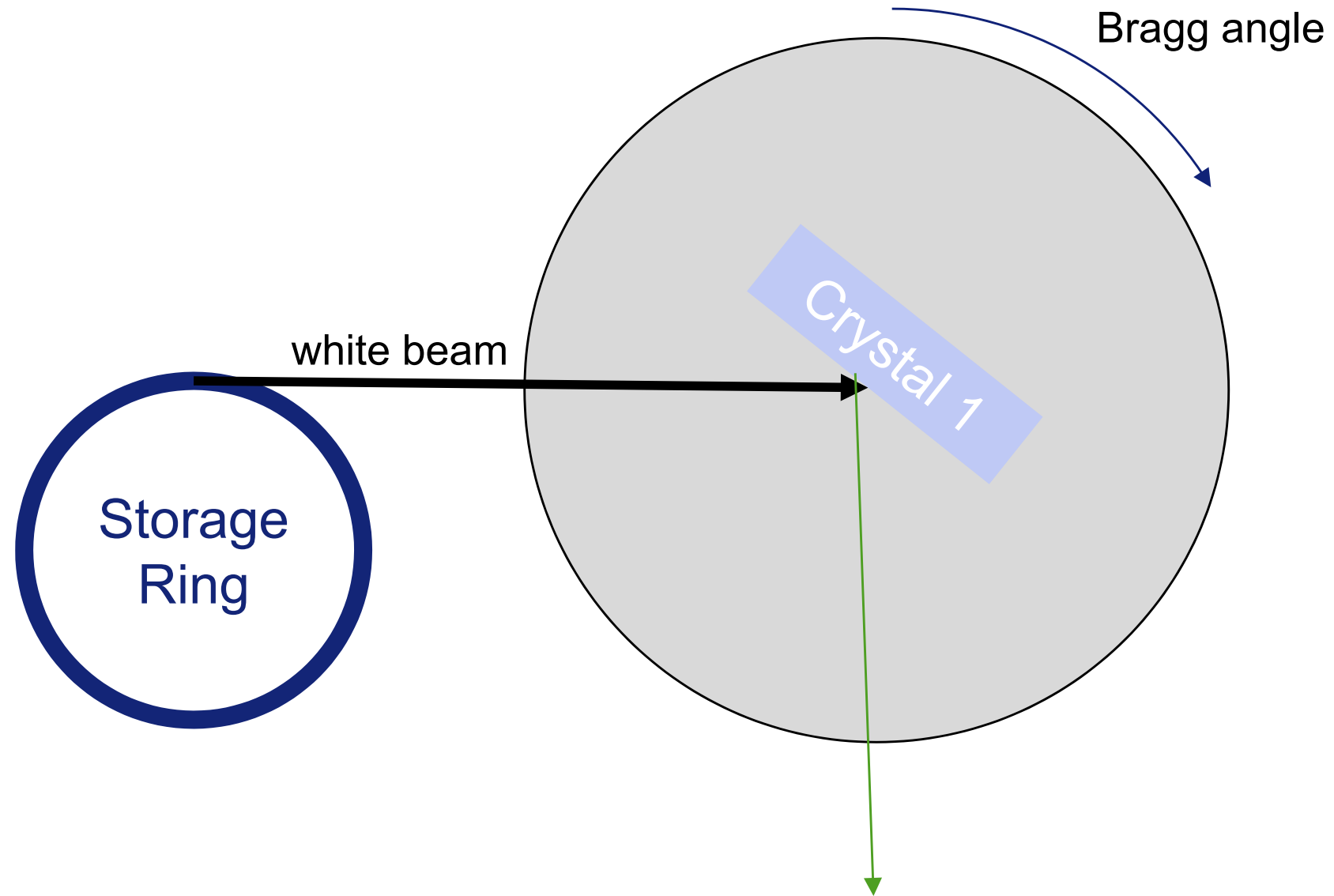
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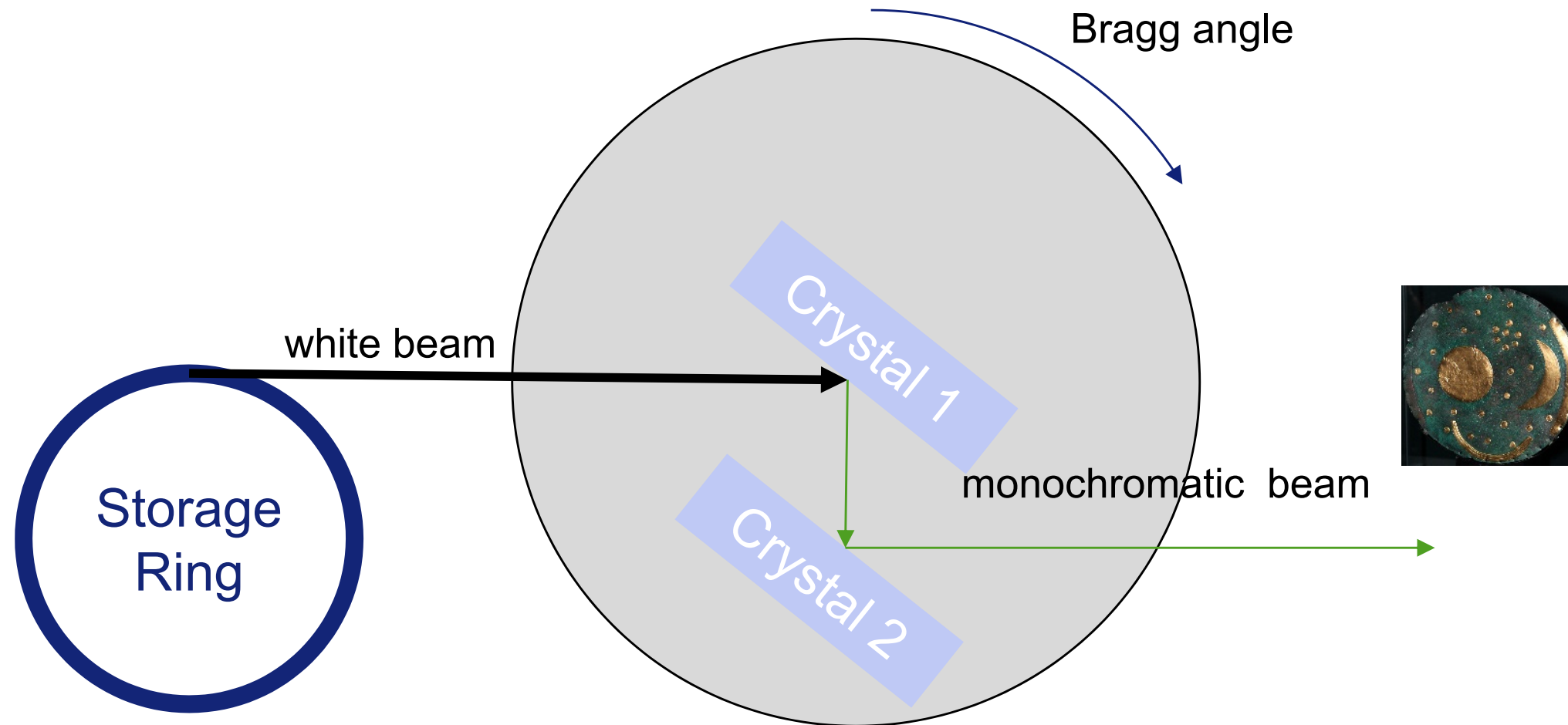
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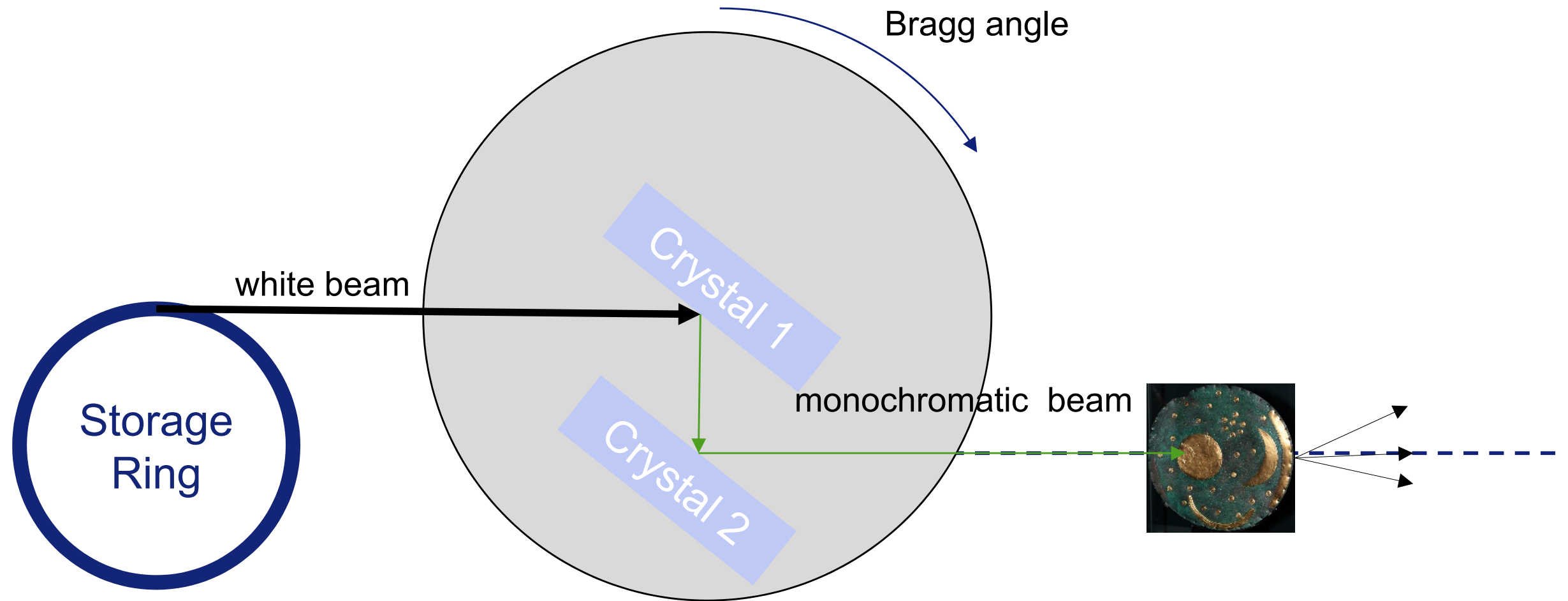
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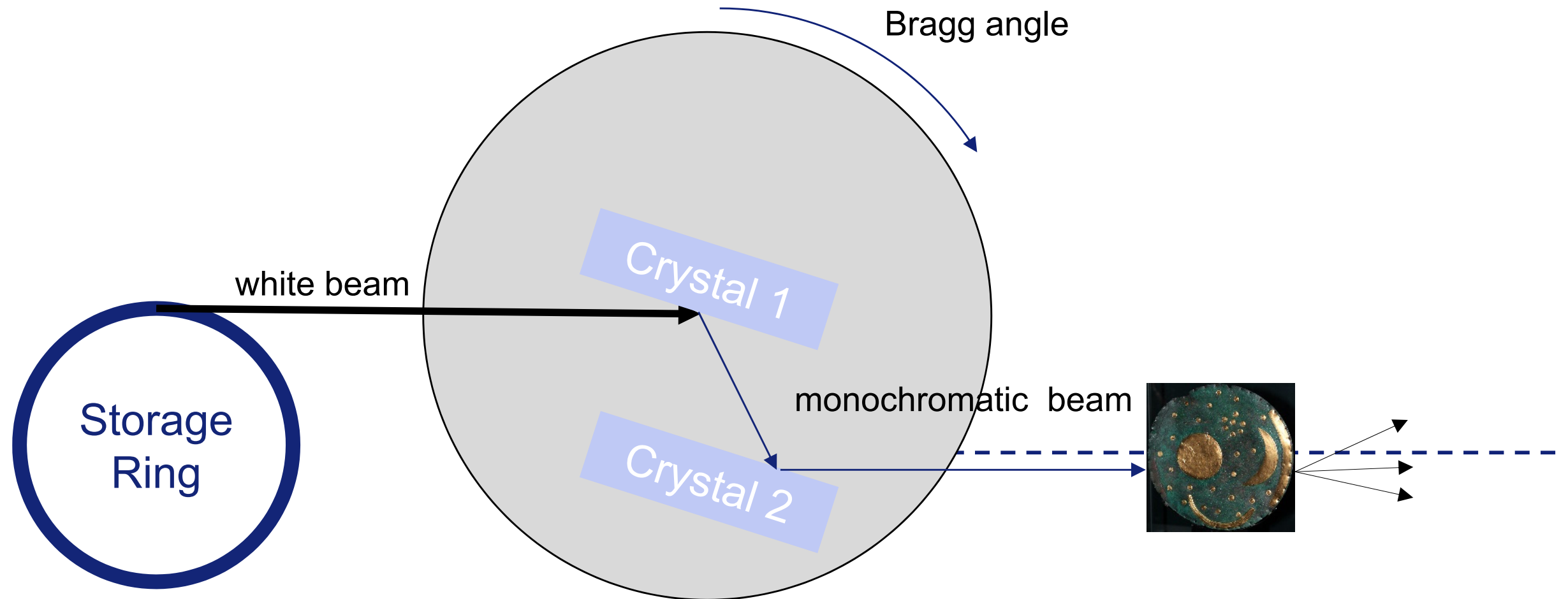
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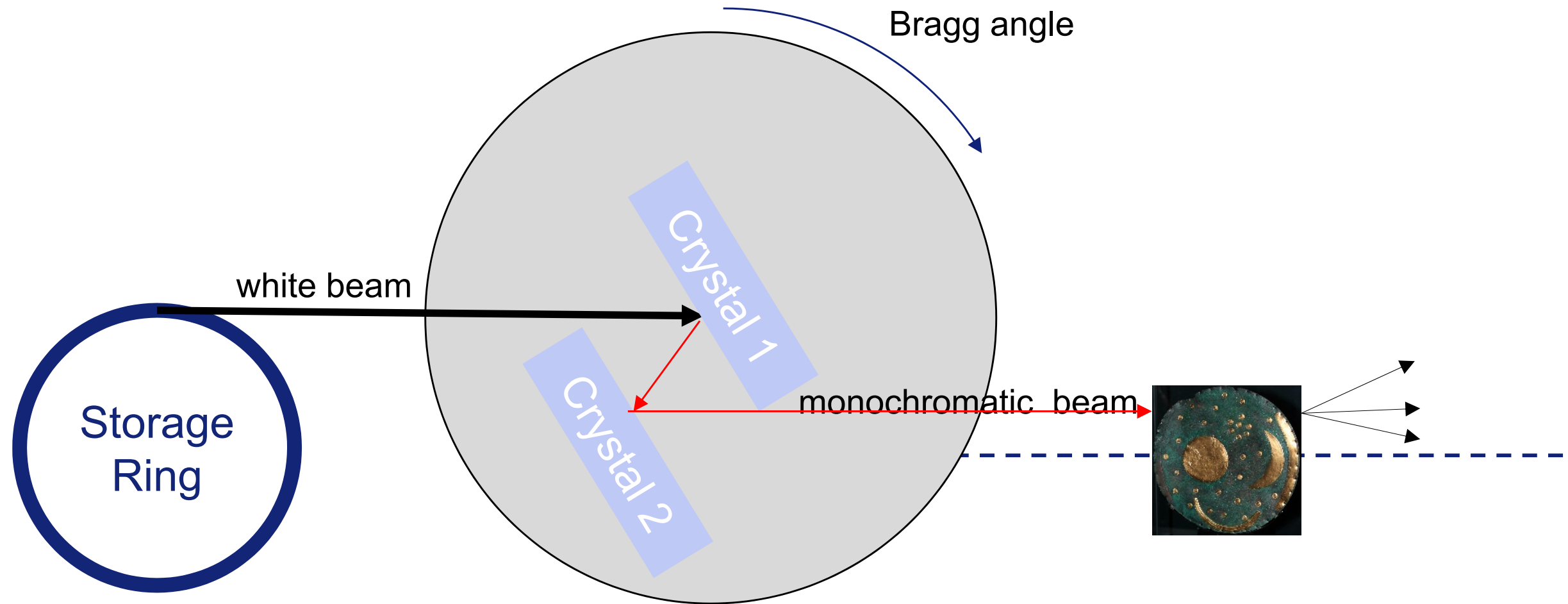
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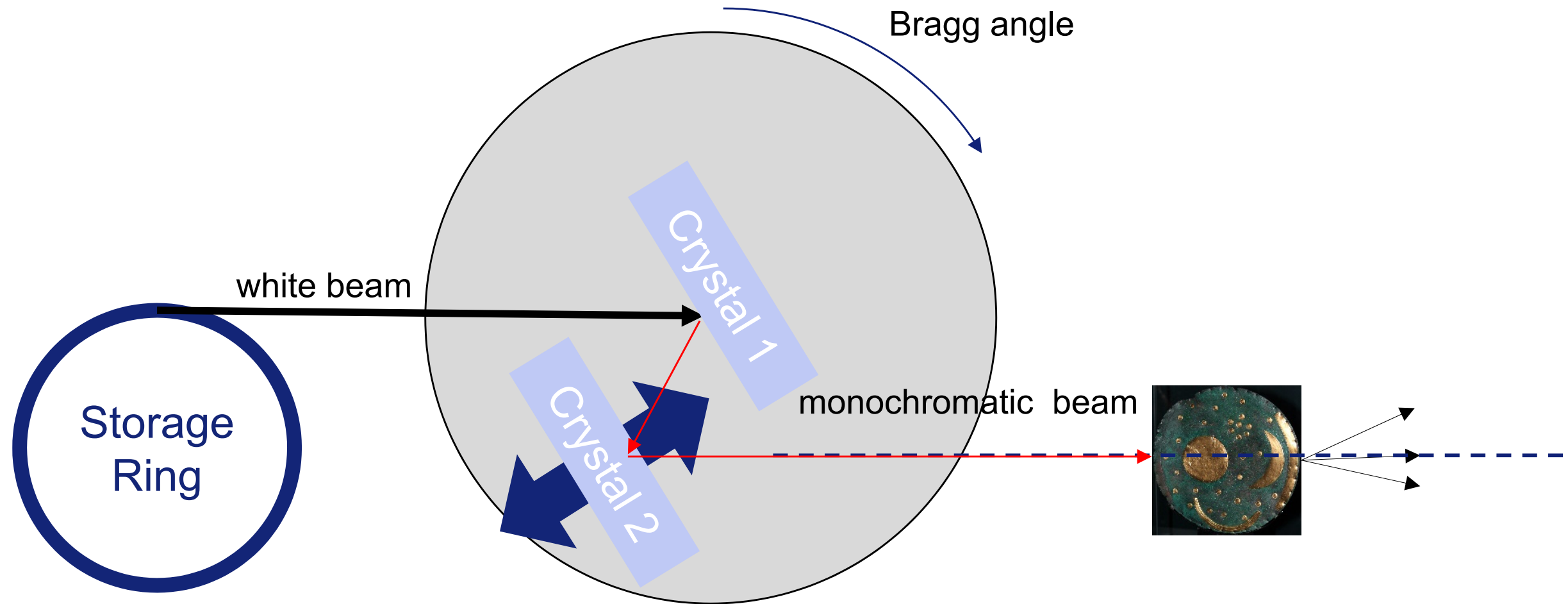
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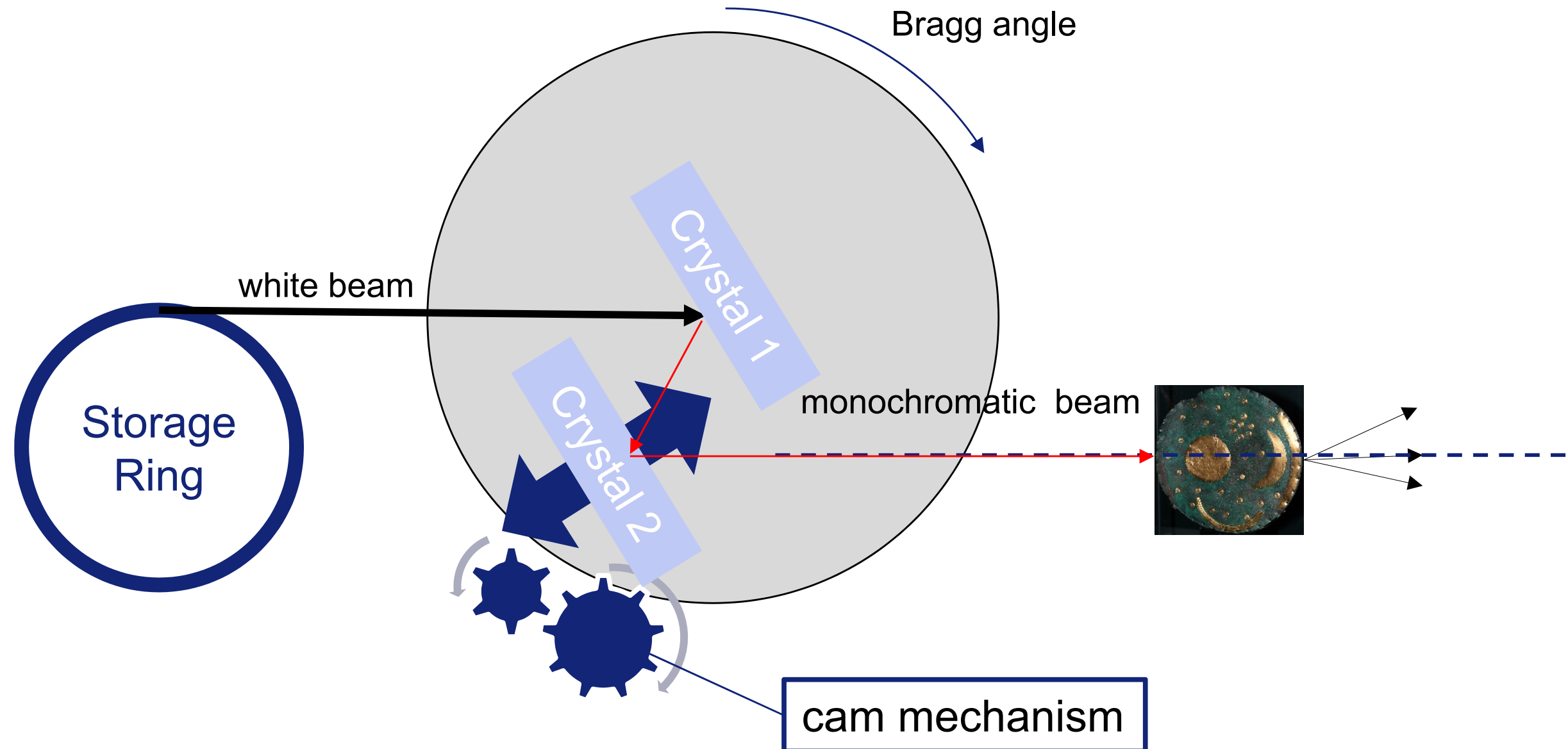
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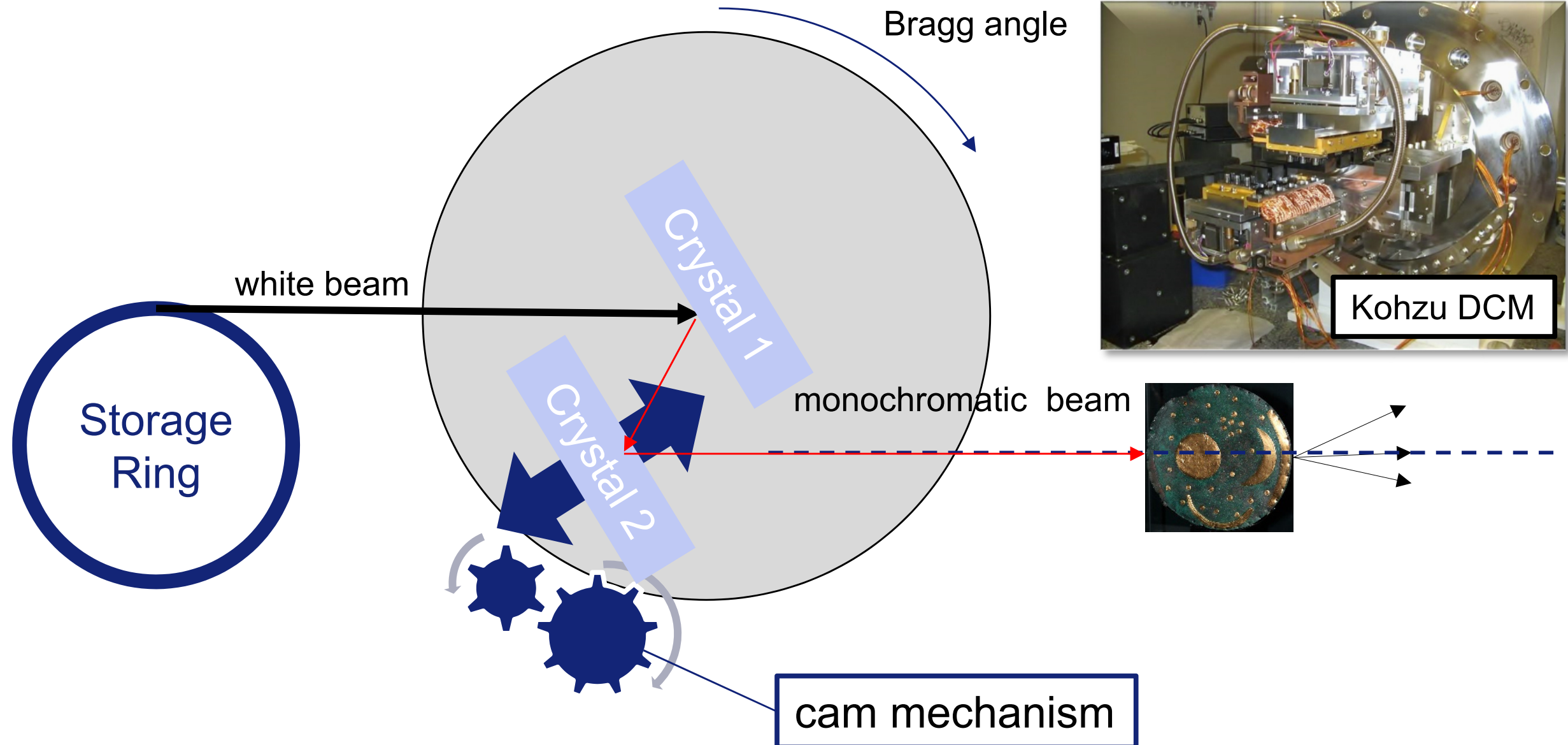
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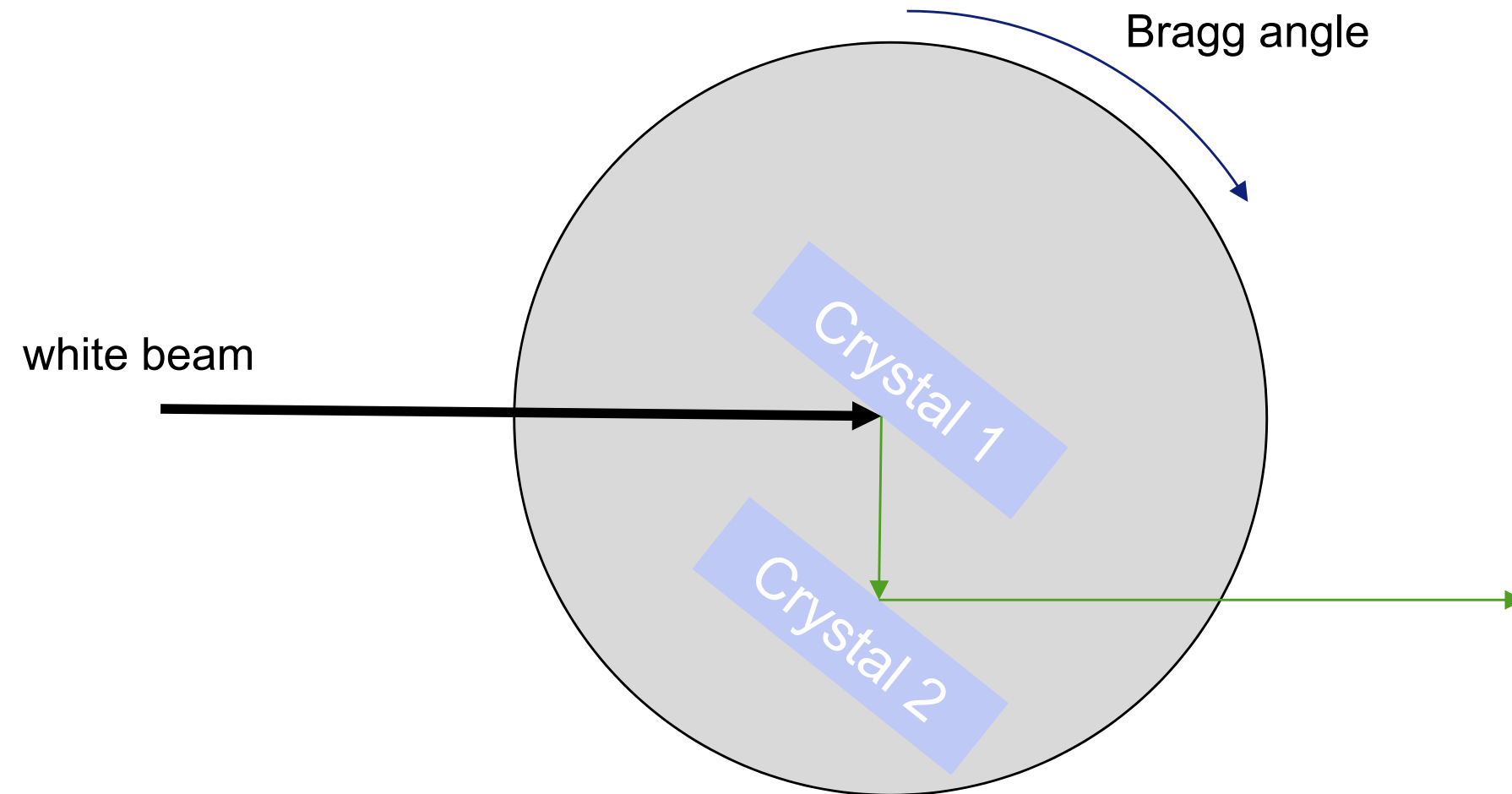
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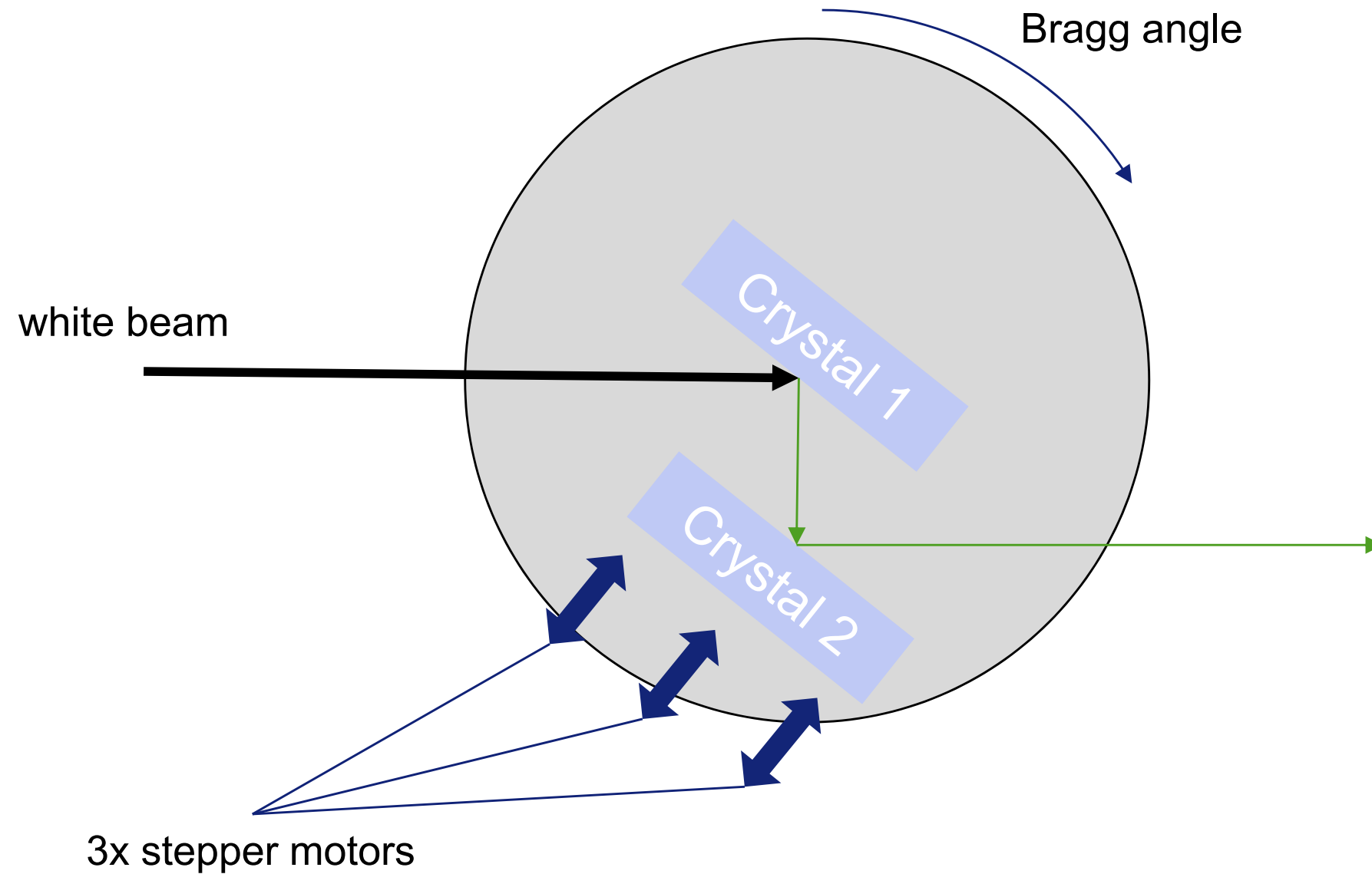
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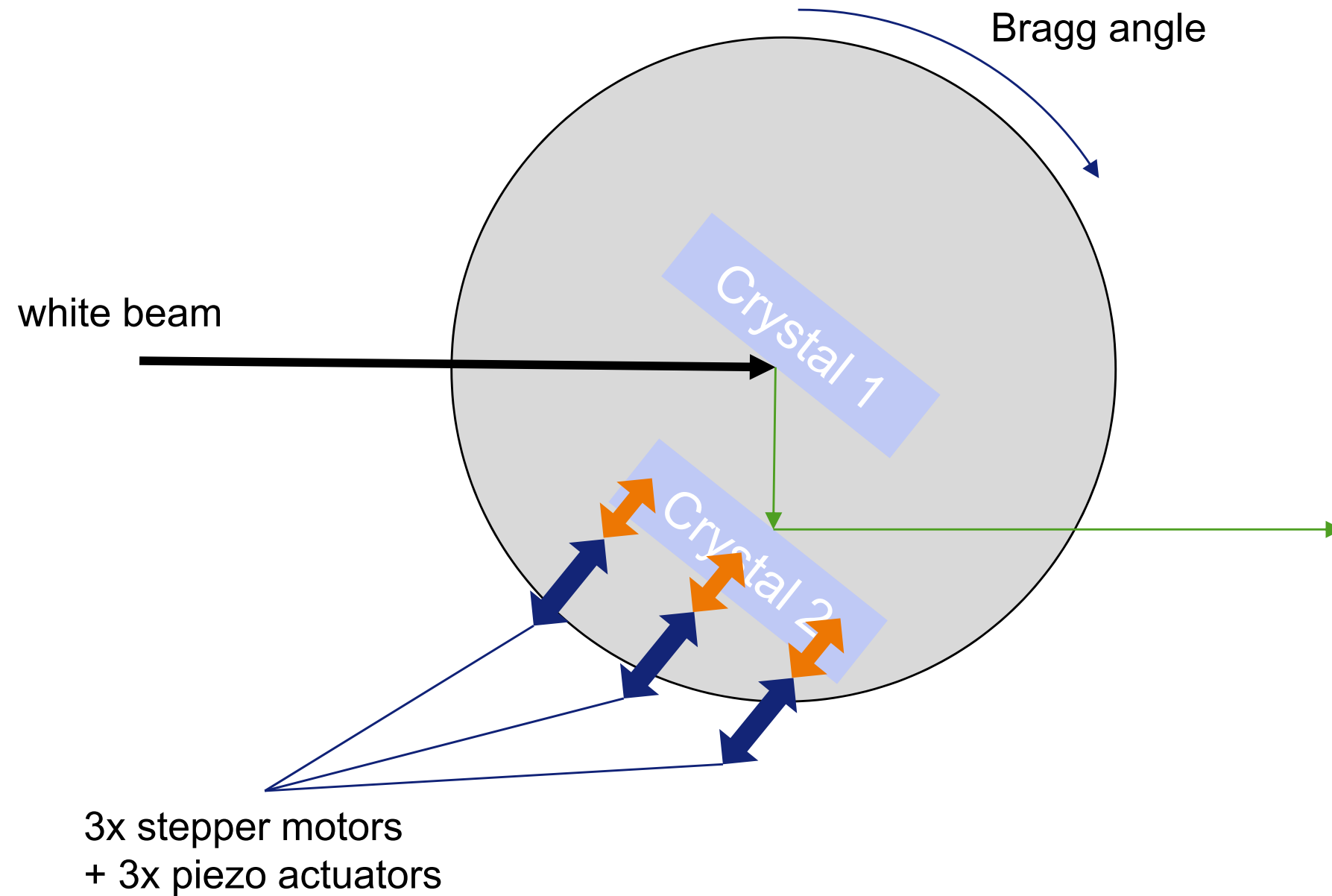
The ESRF-DCM prototype



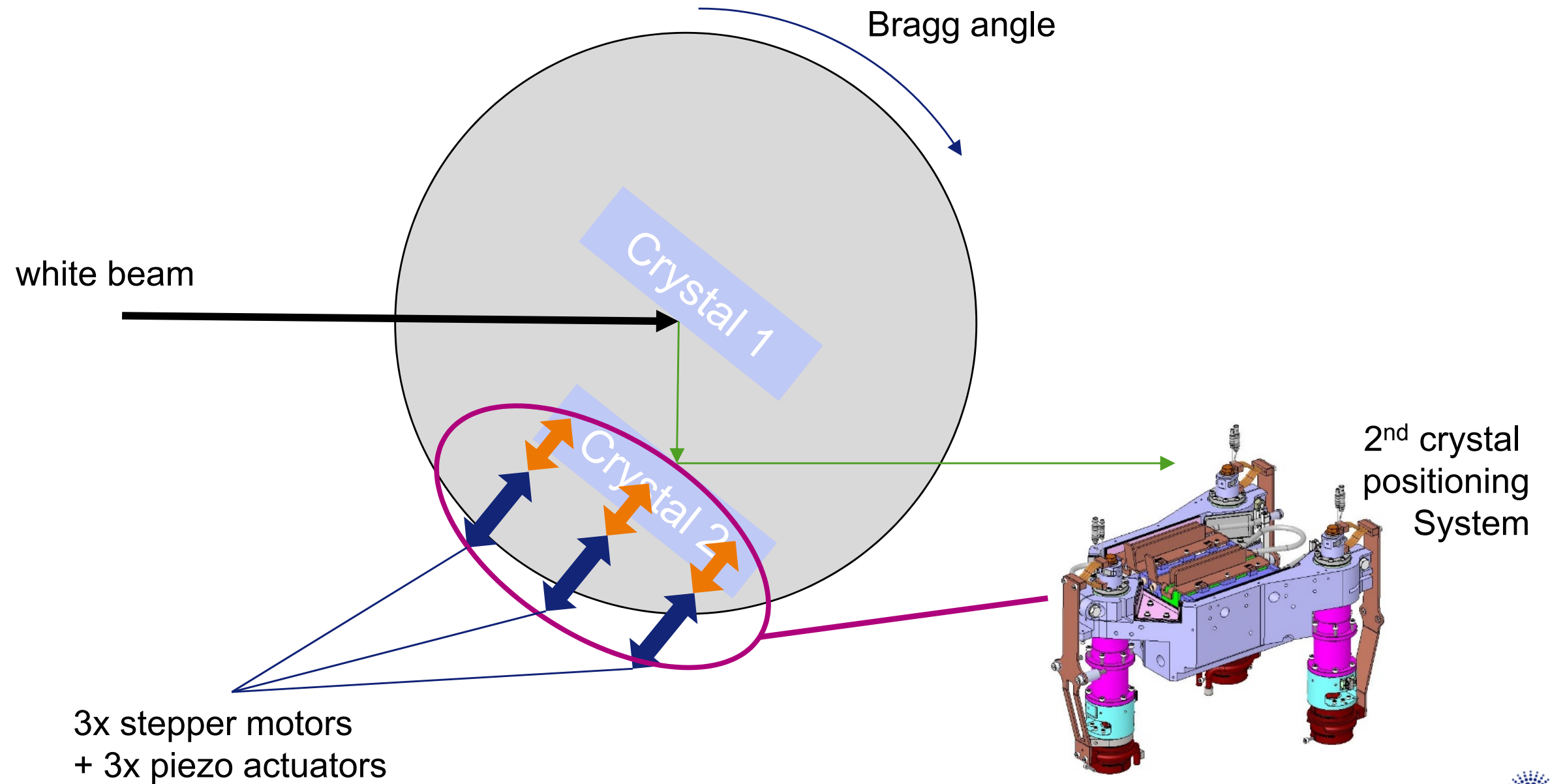
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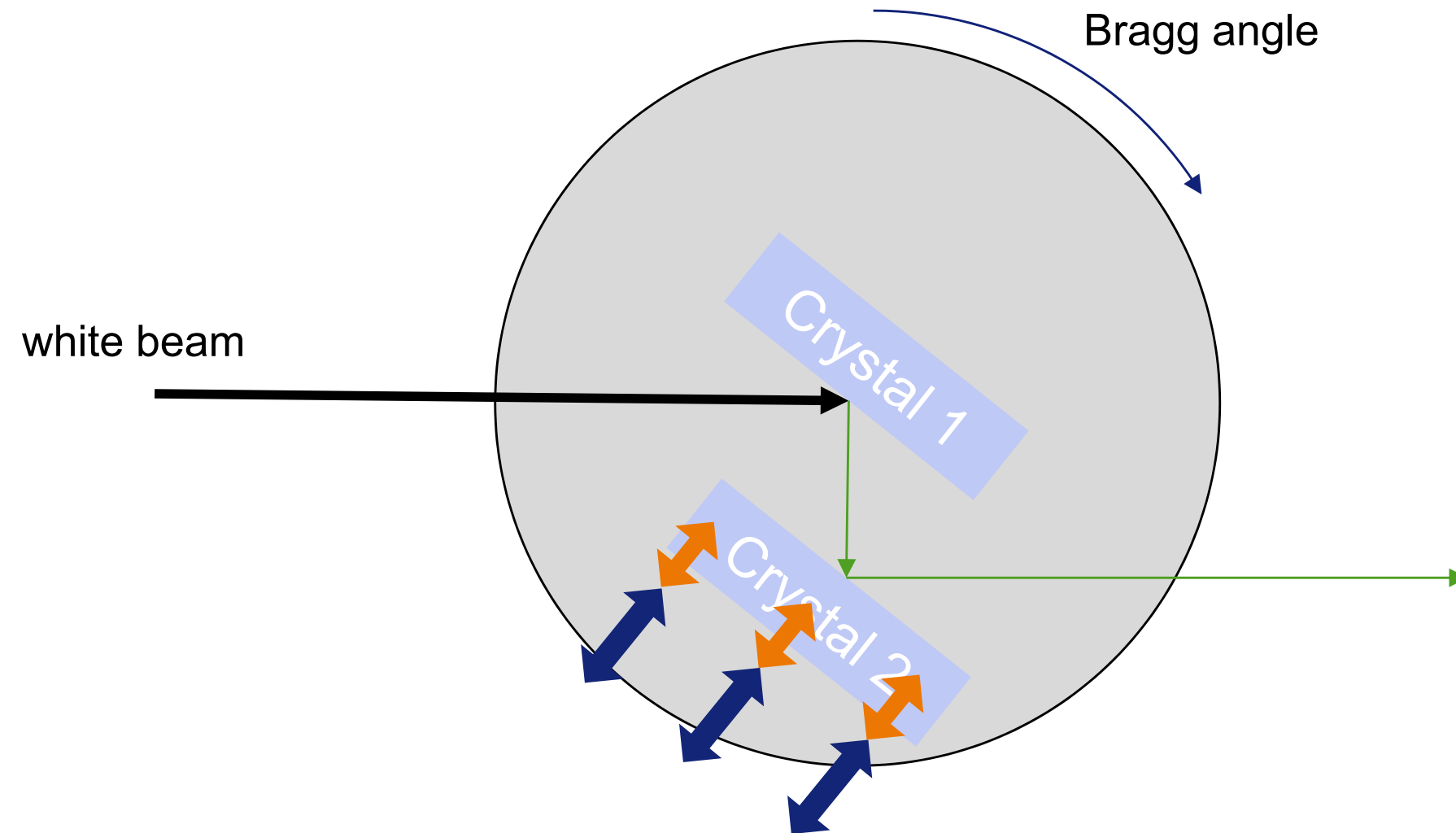
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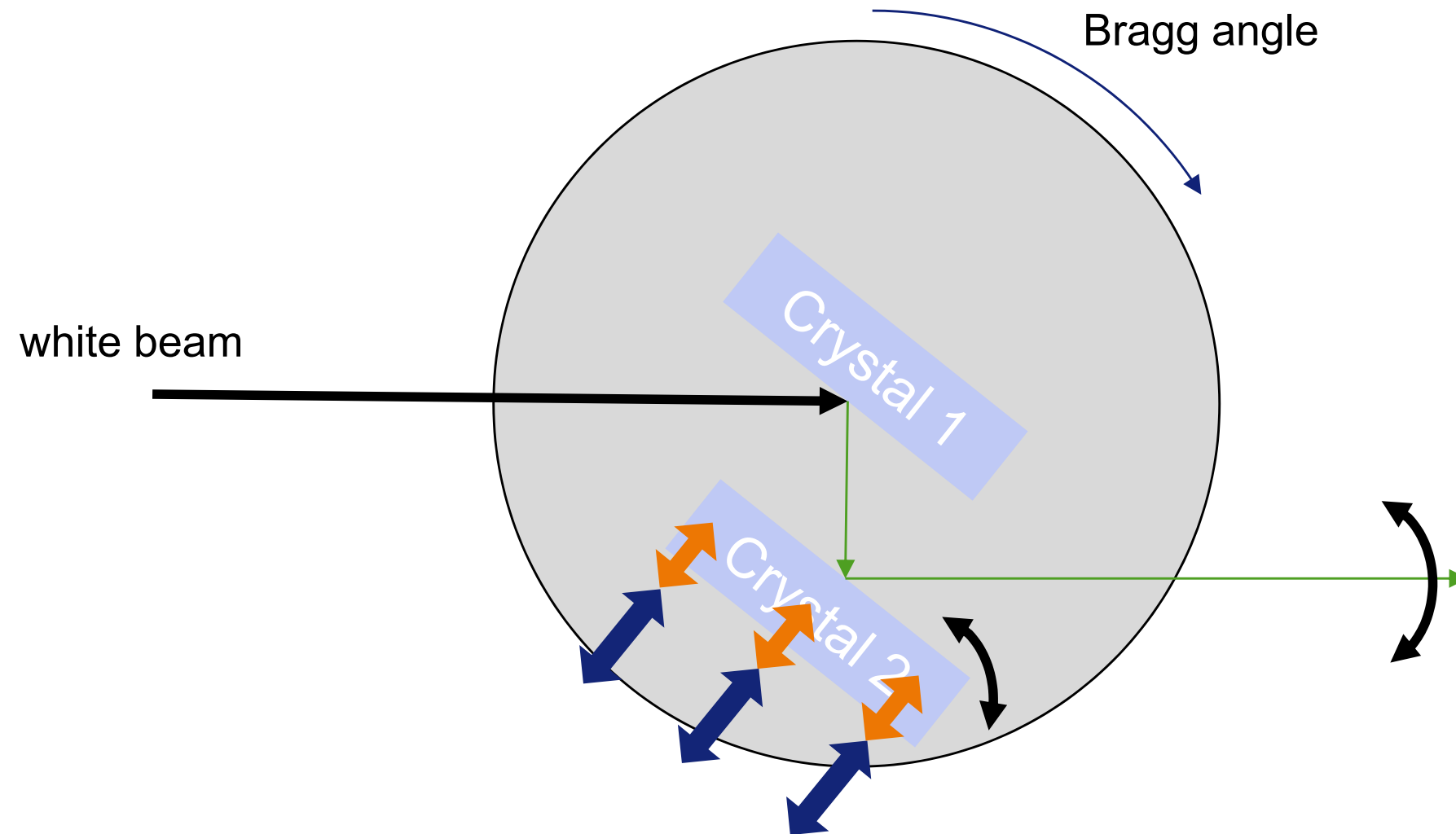
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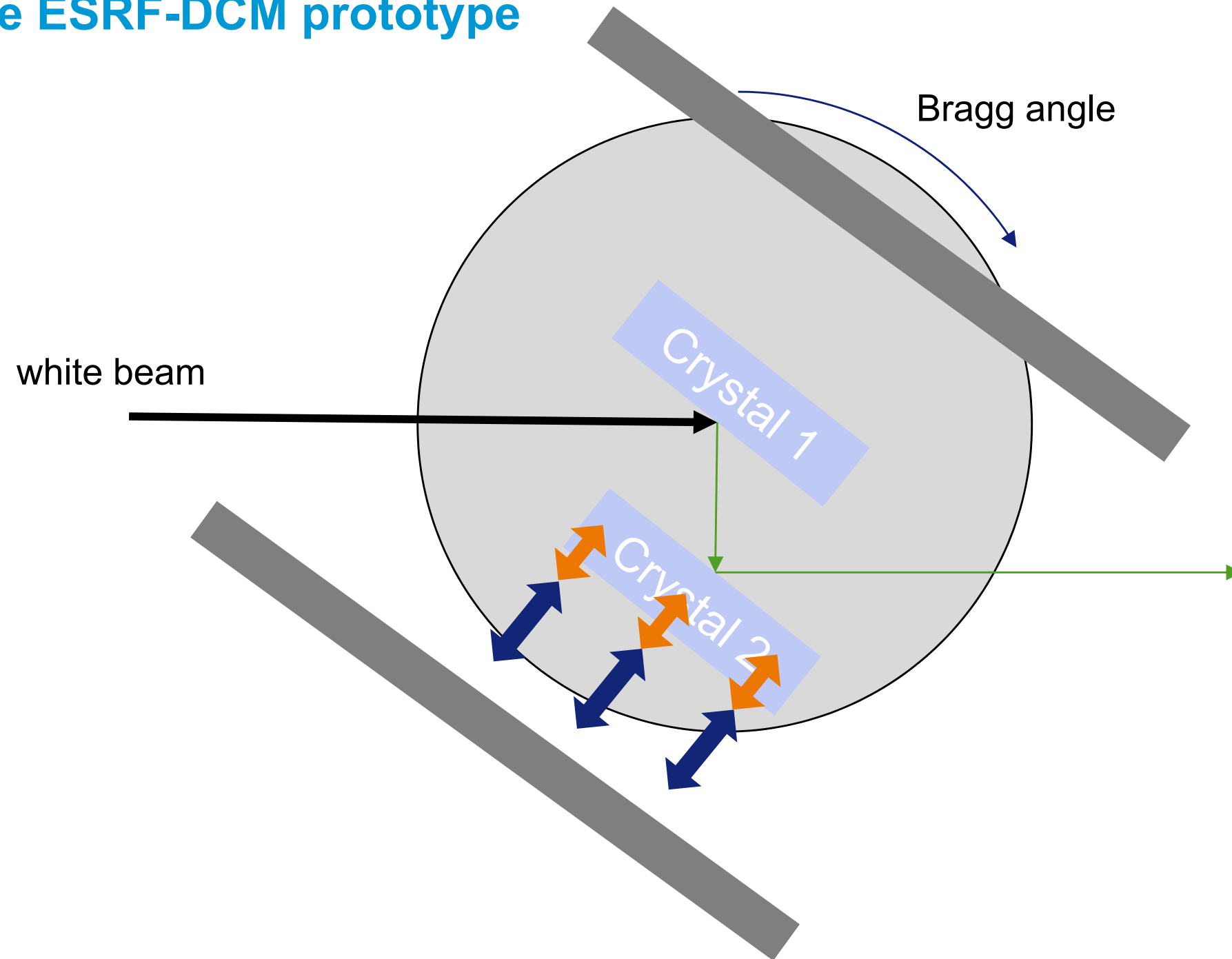
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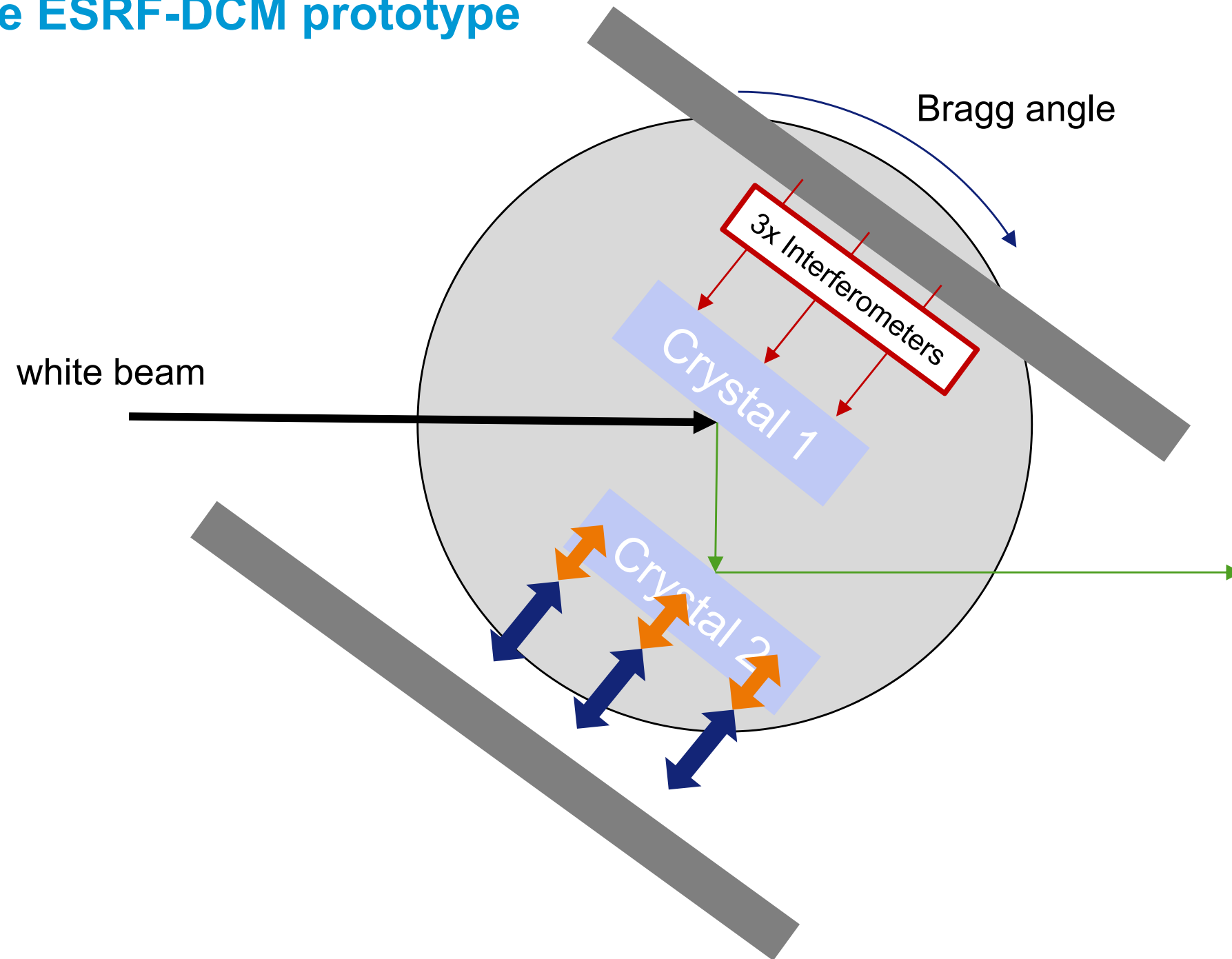
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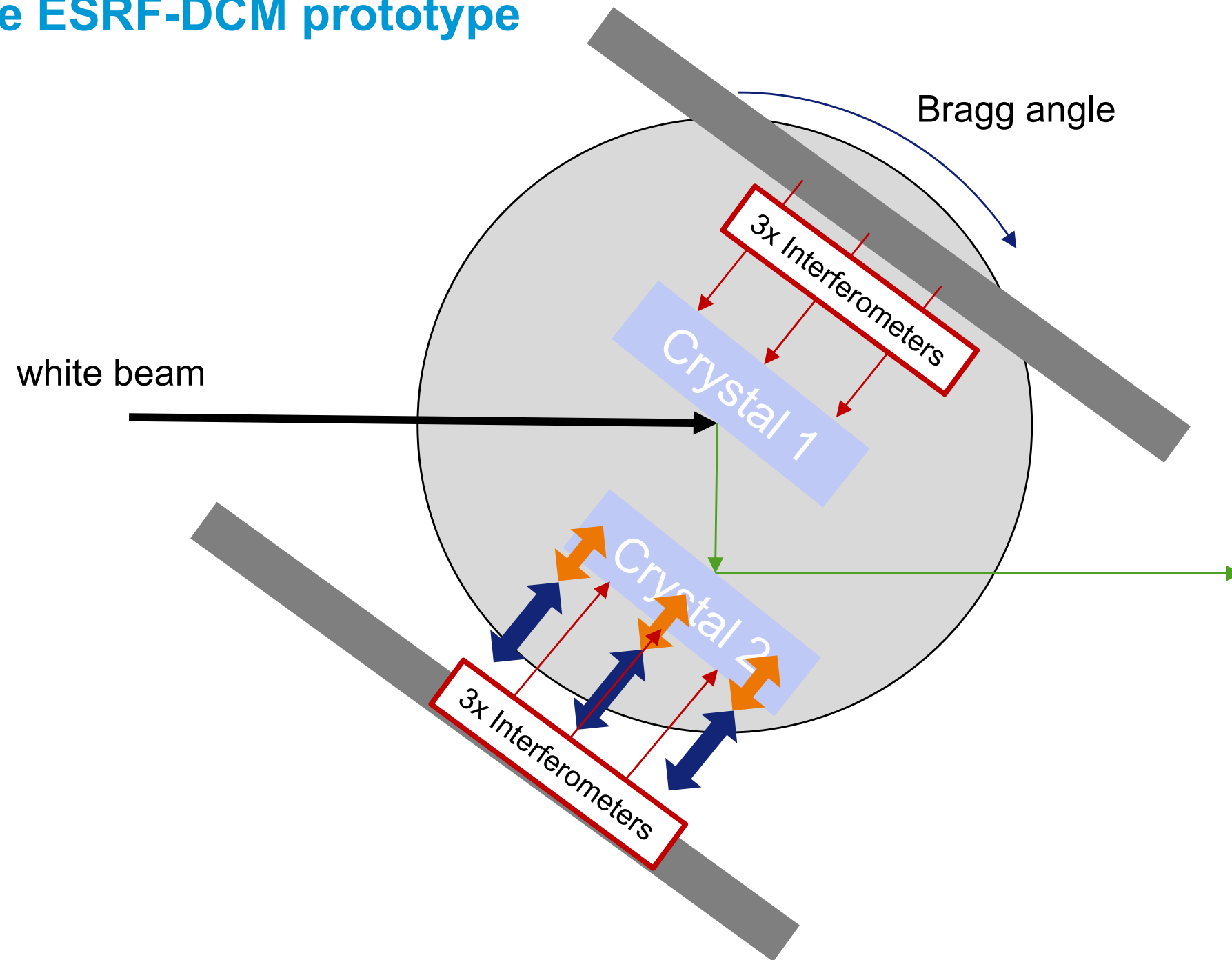
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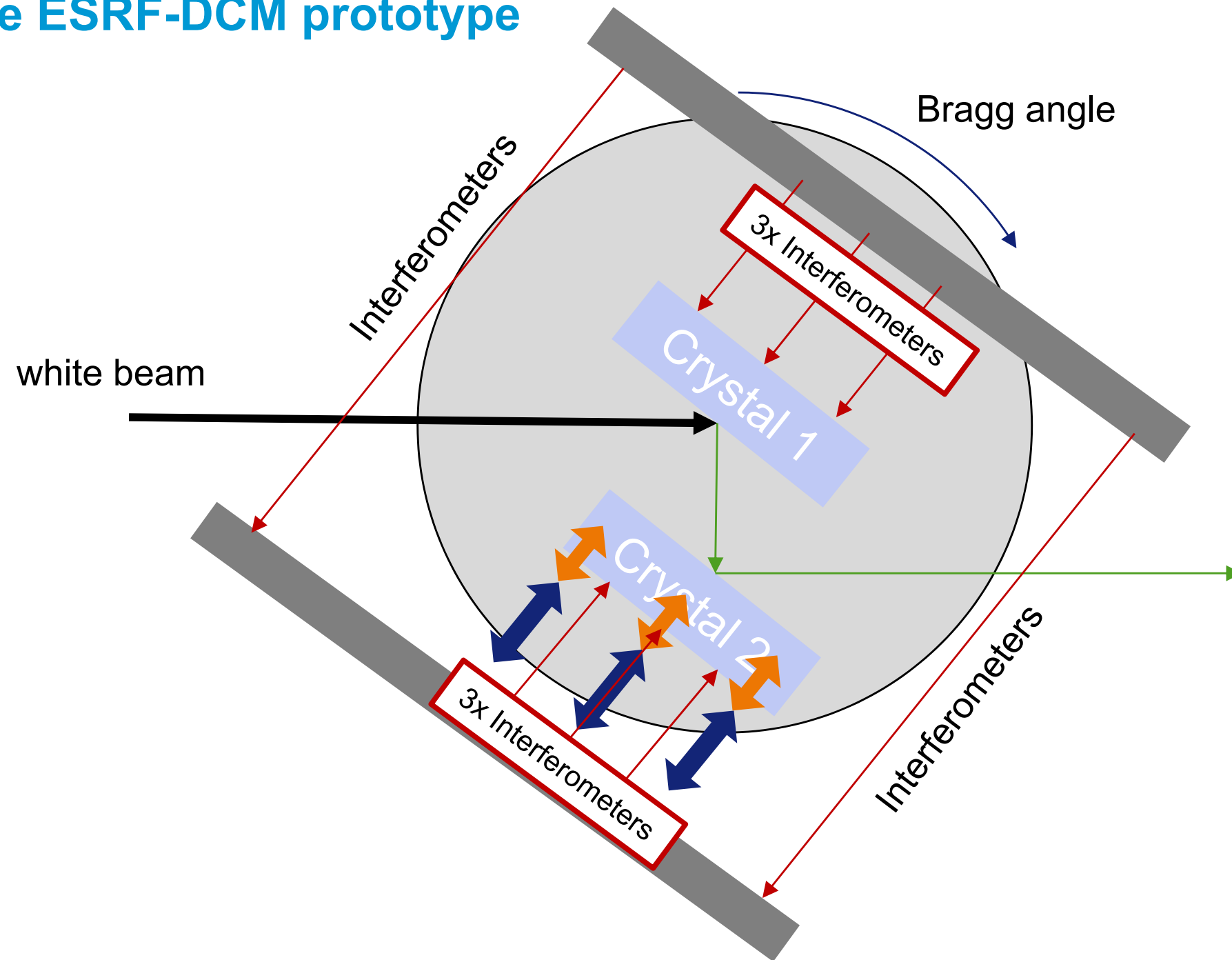
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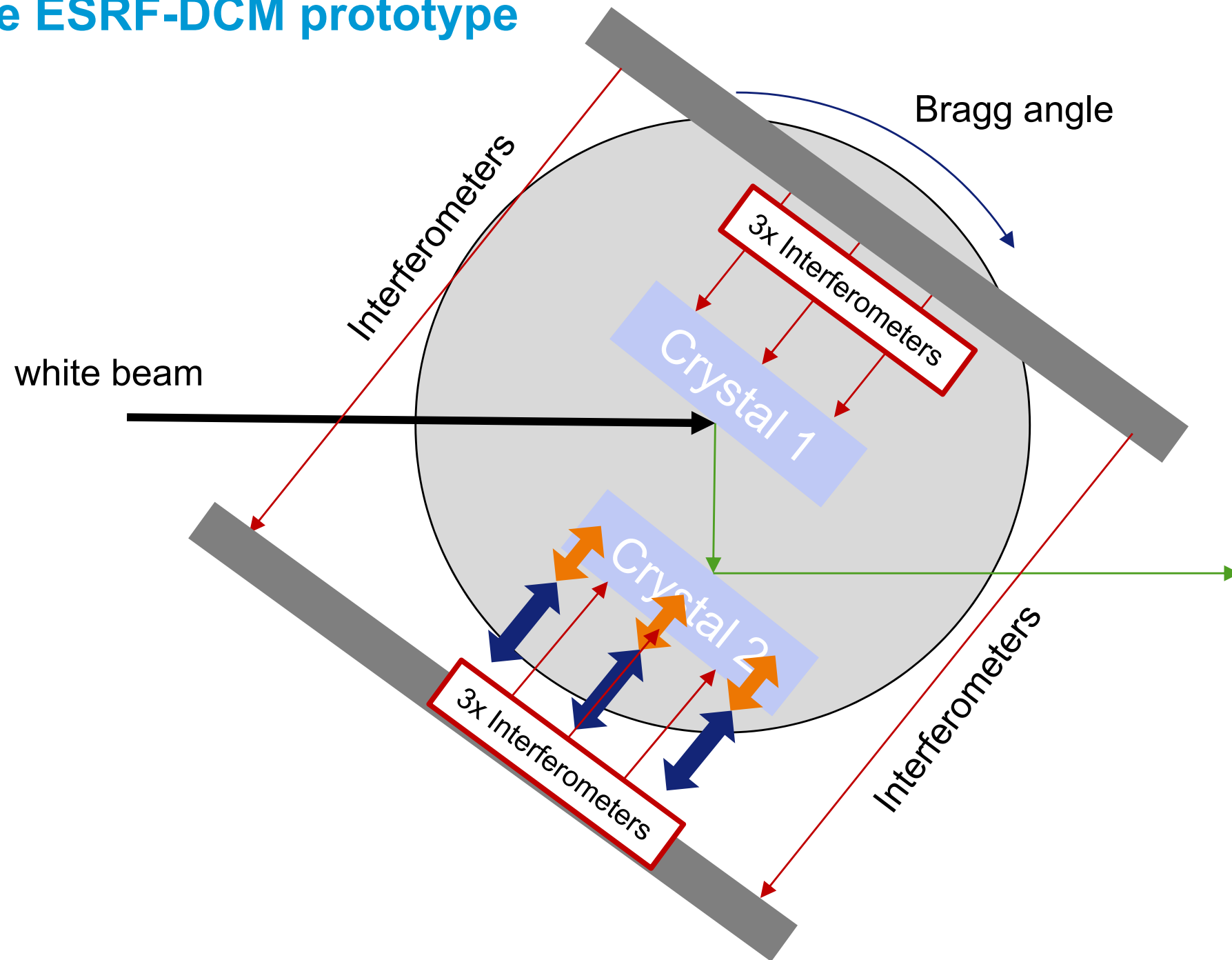
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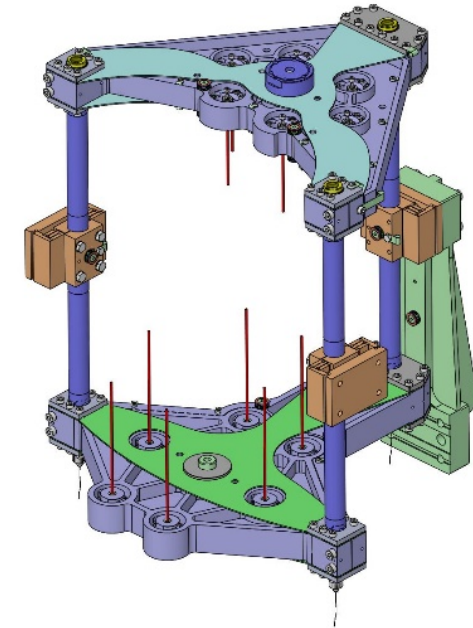
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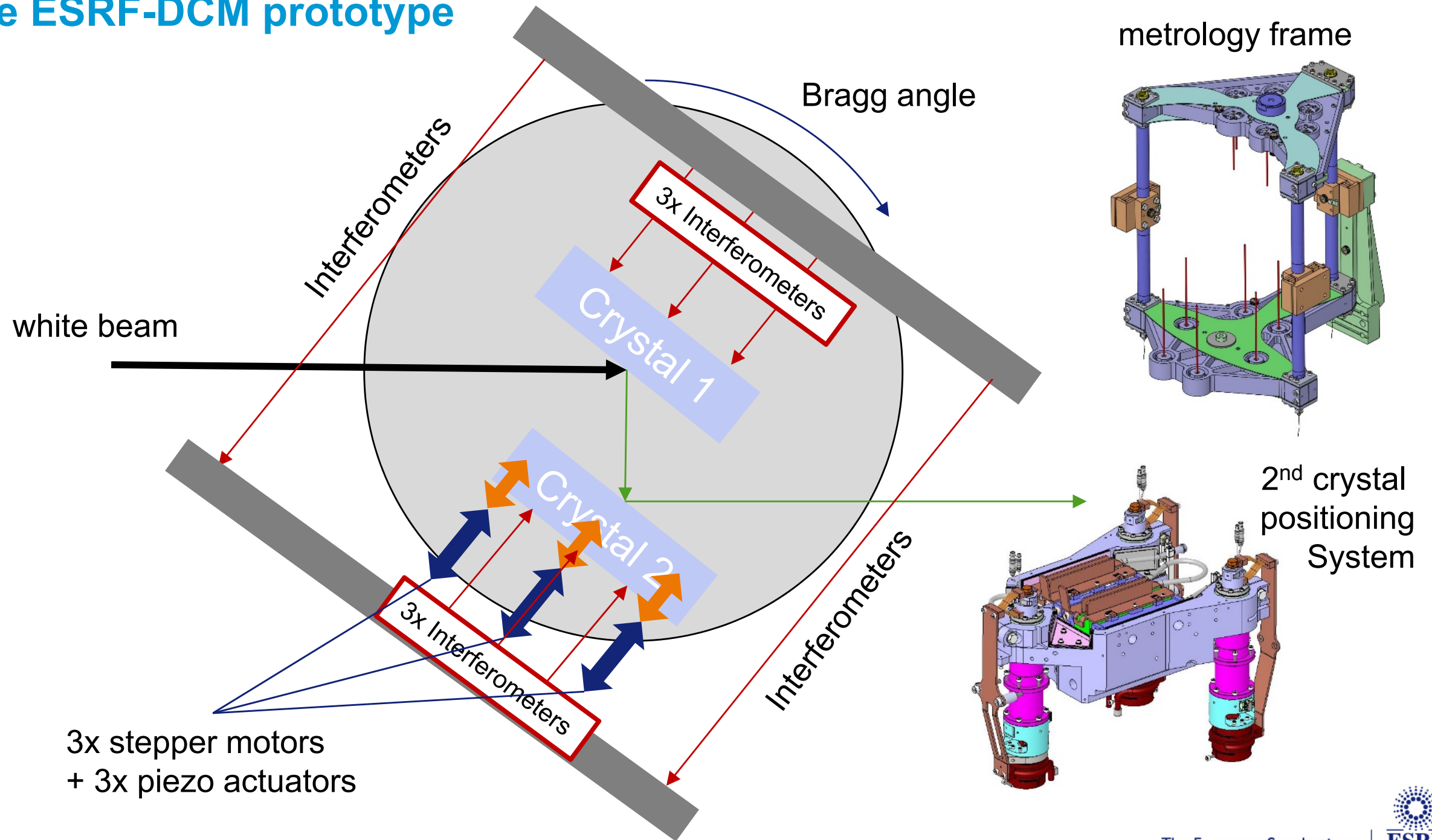


metrology frame



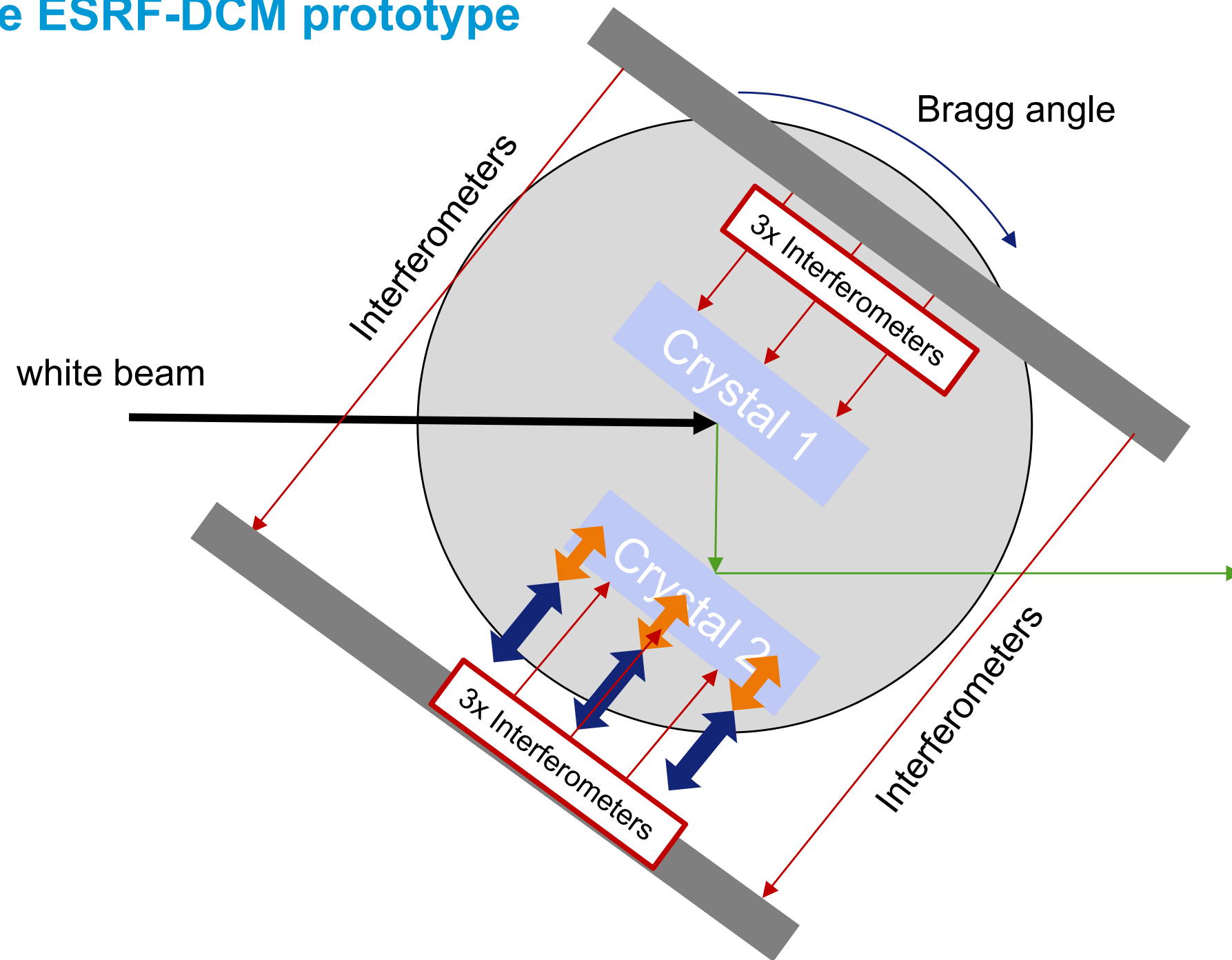
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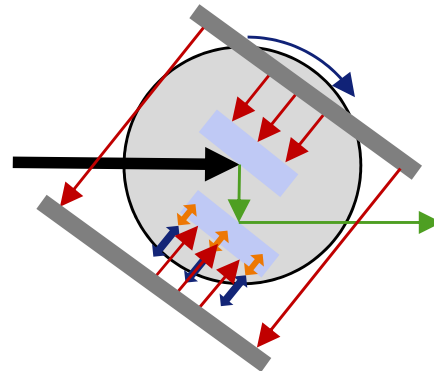


2. THE CONTROL CONCEPT

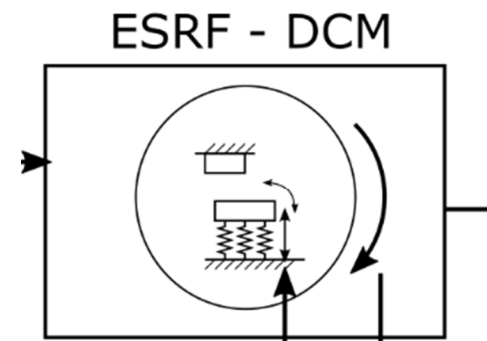
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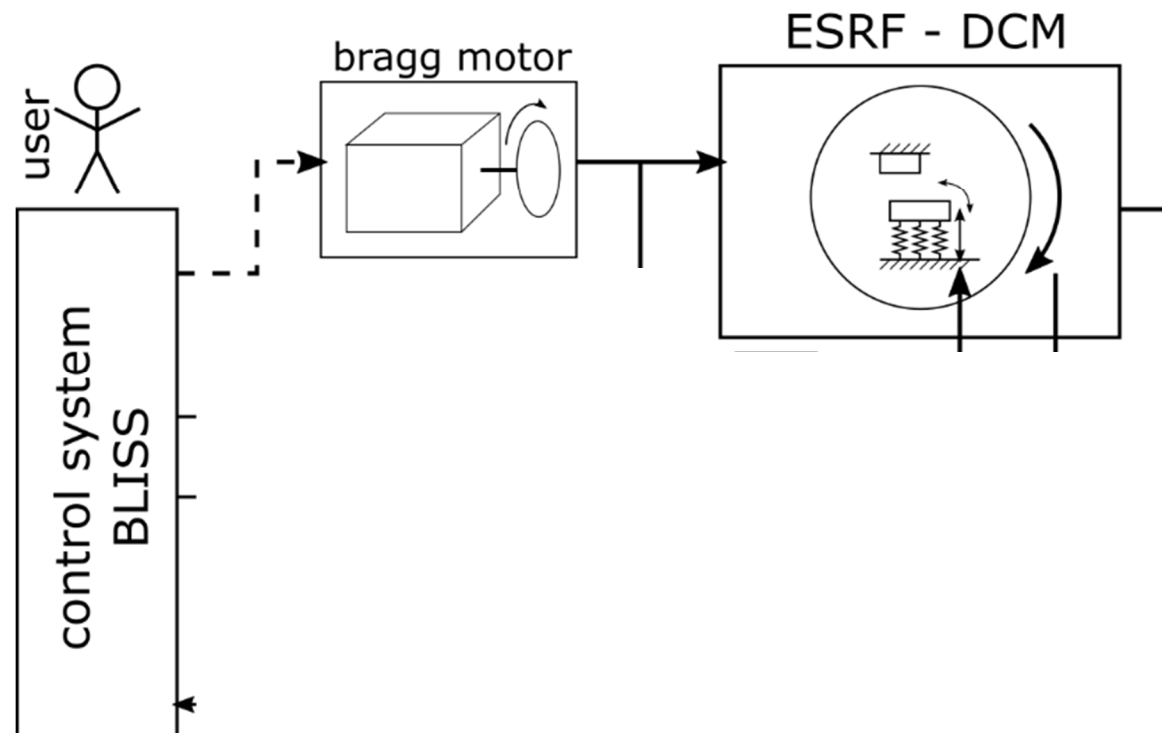
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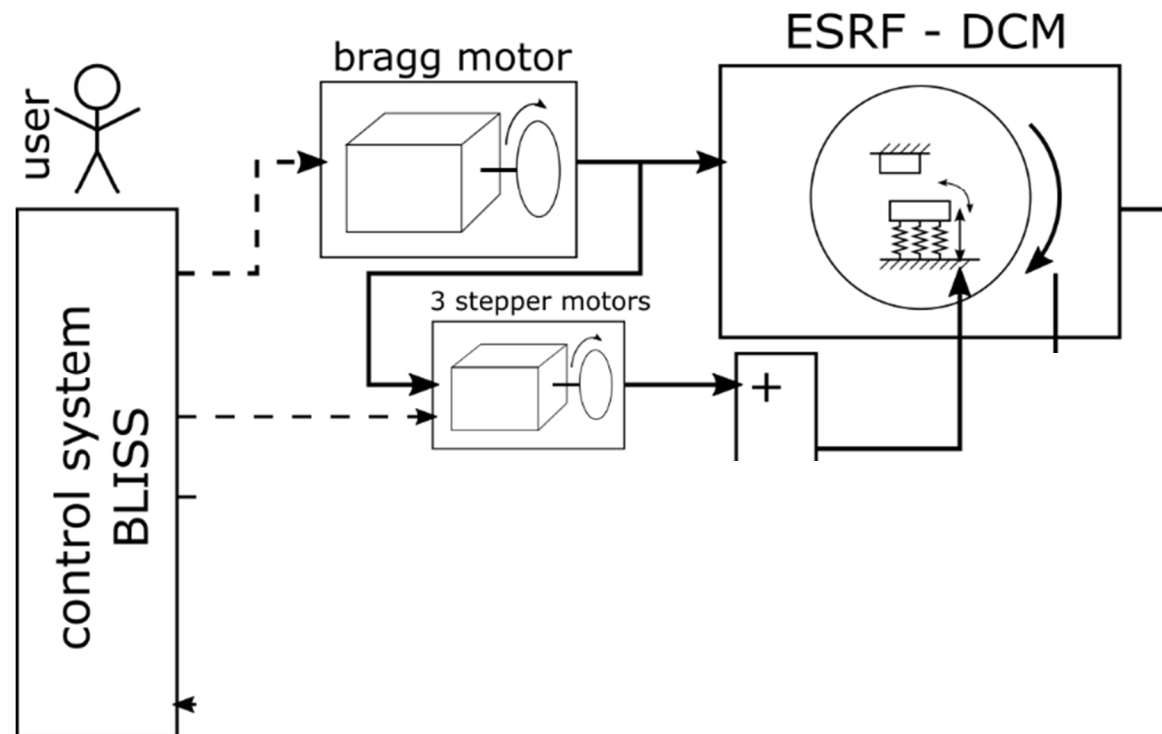
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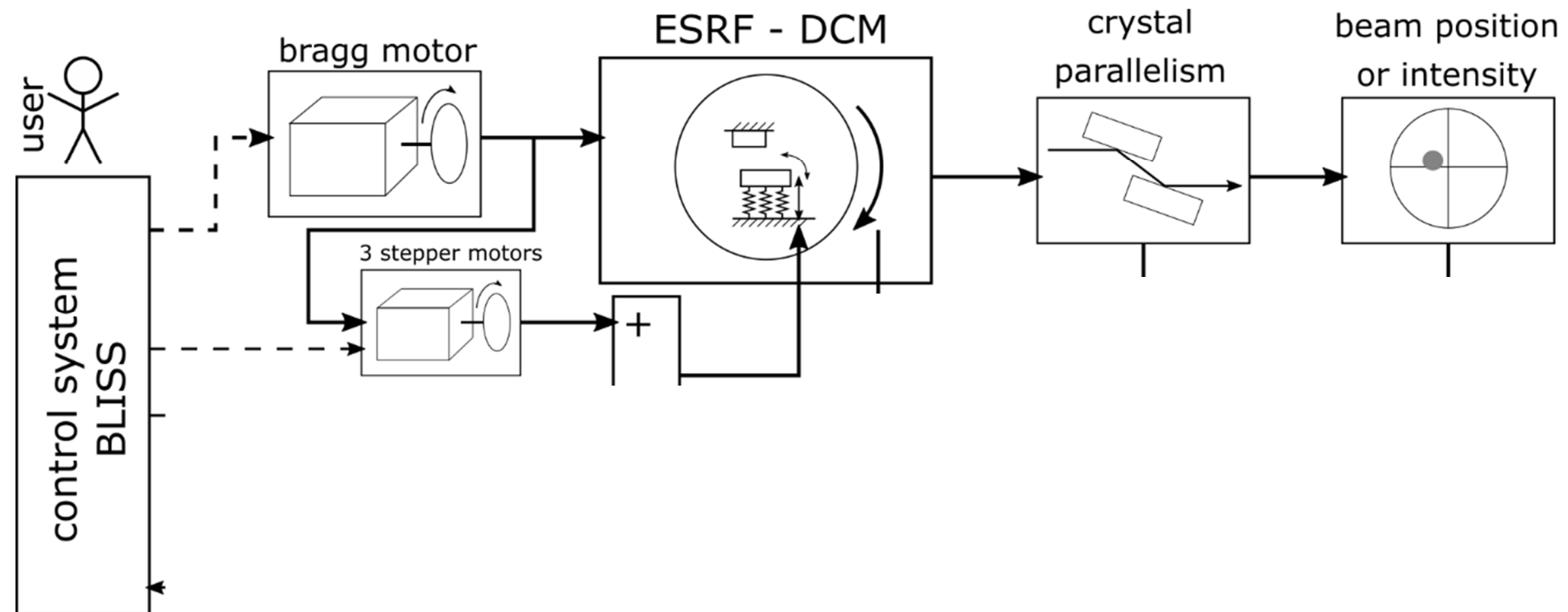
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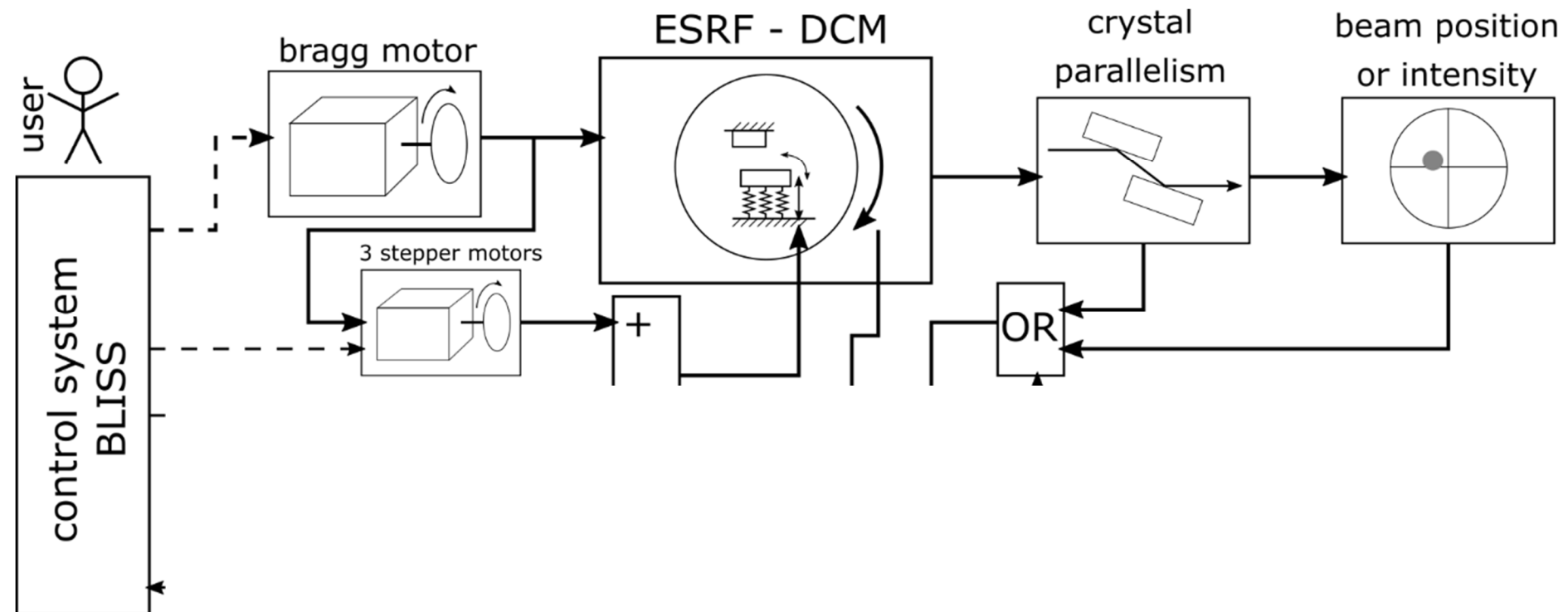
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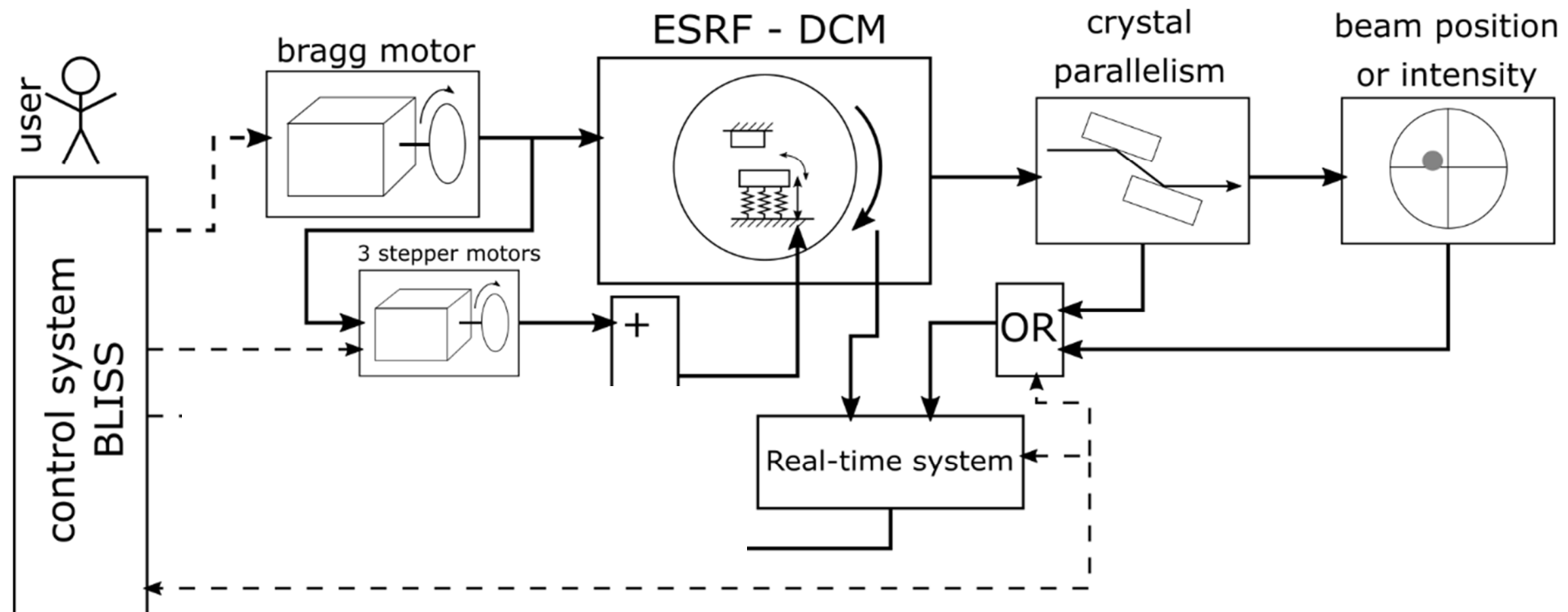
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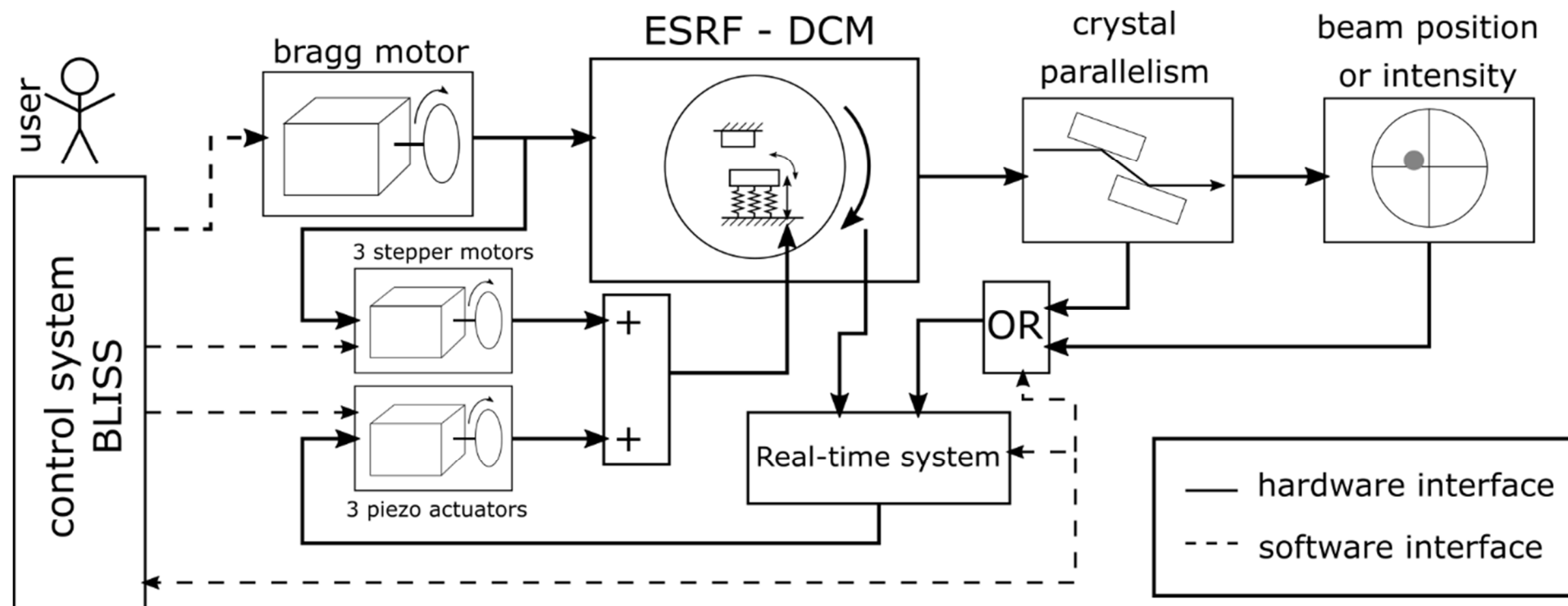
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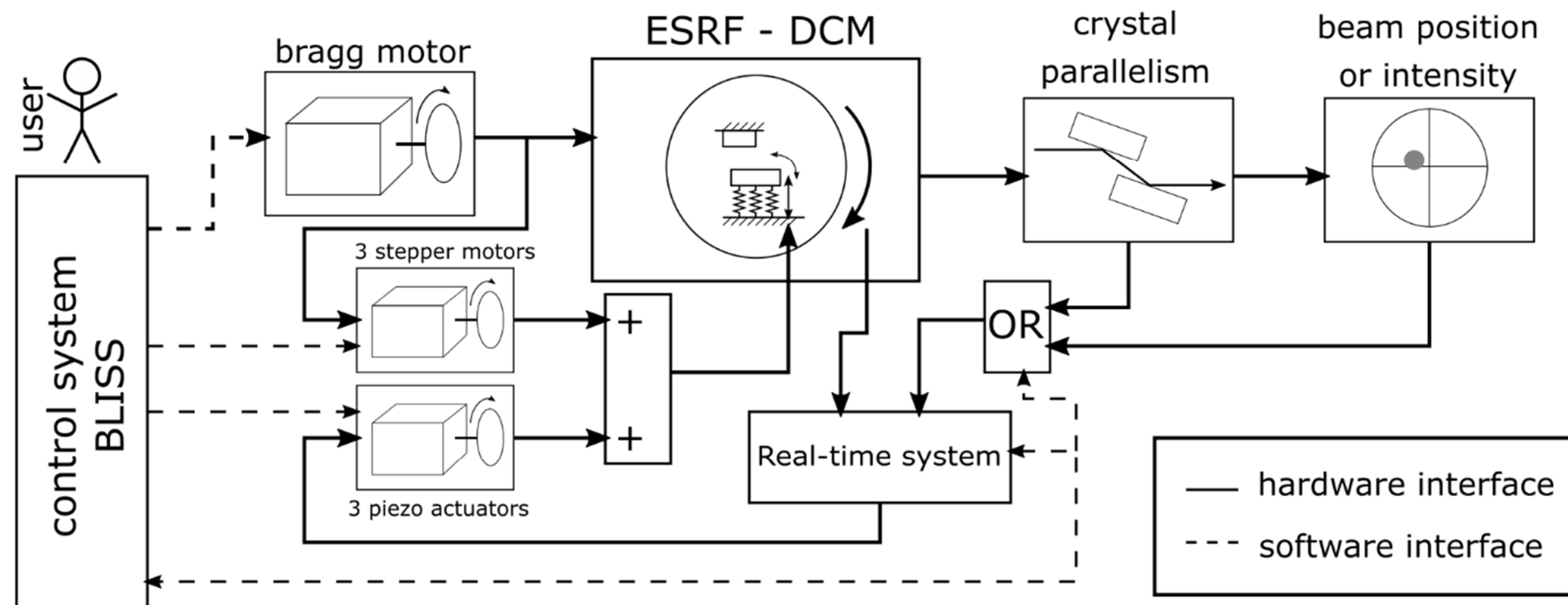
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ESRF-DCM design principle in three modes:

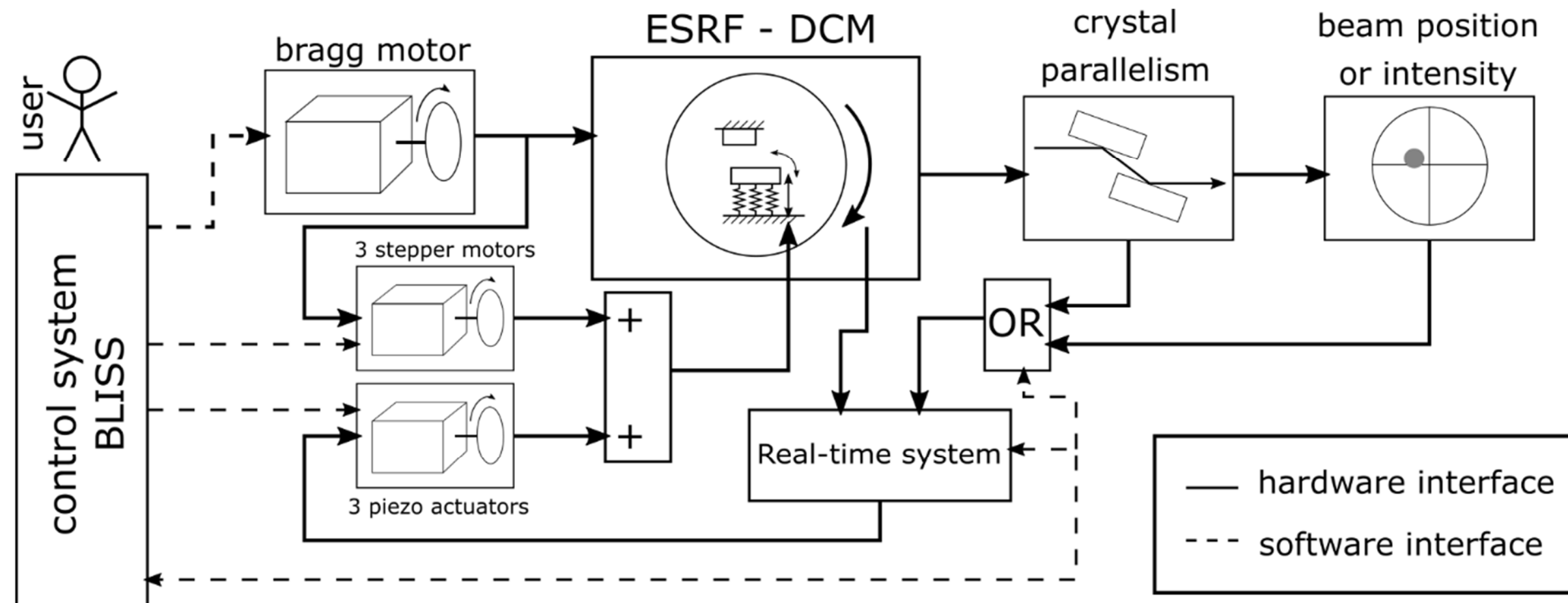
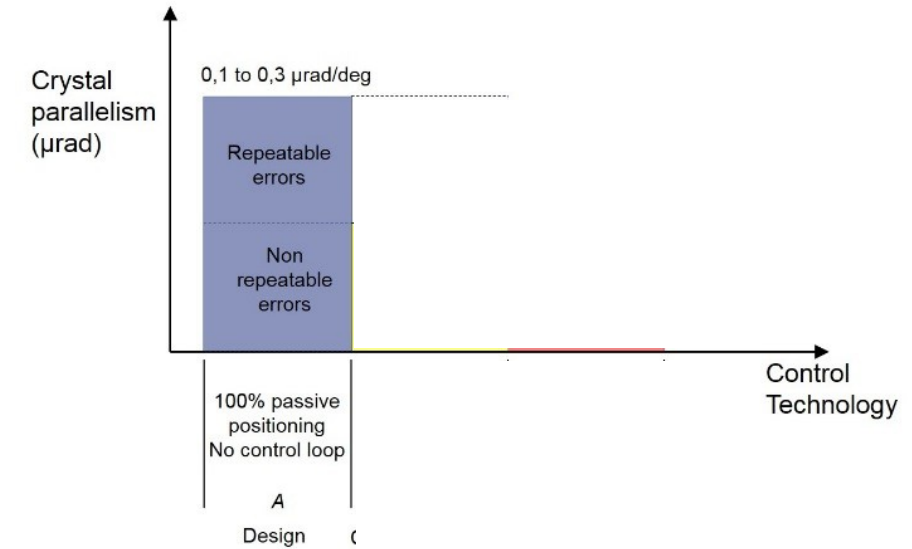
- Mode A
- Mode B
- Mode C



2. THE CONTROL CONCEPT

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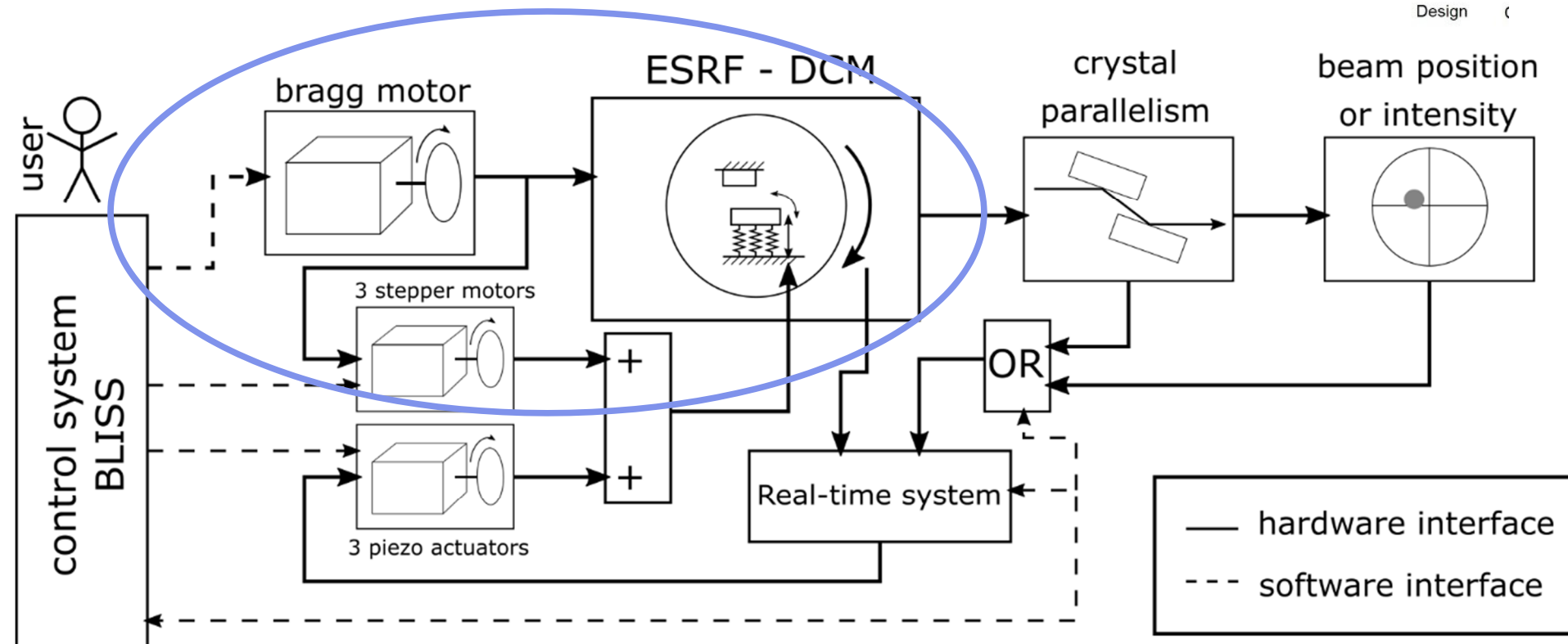
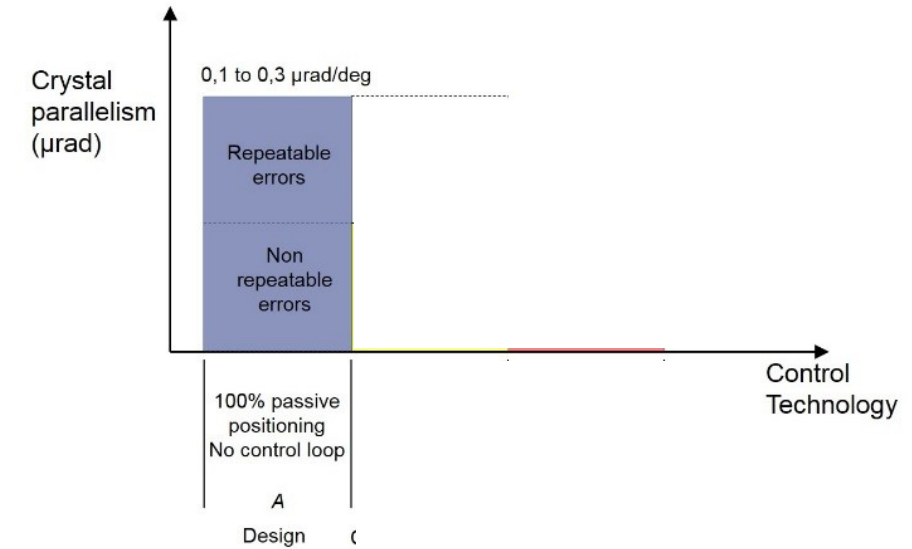
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2. THE CONTROL CONCEPT

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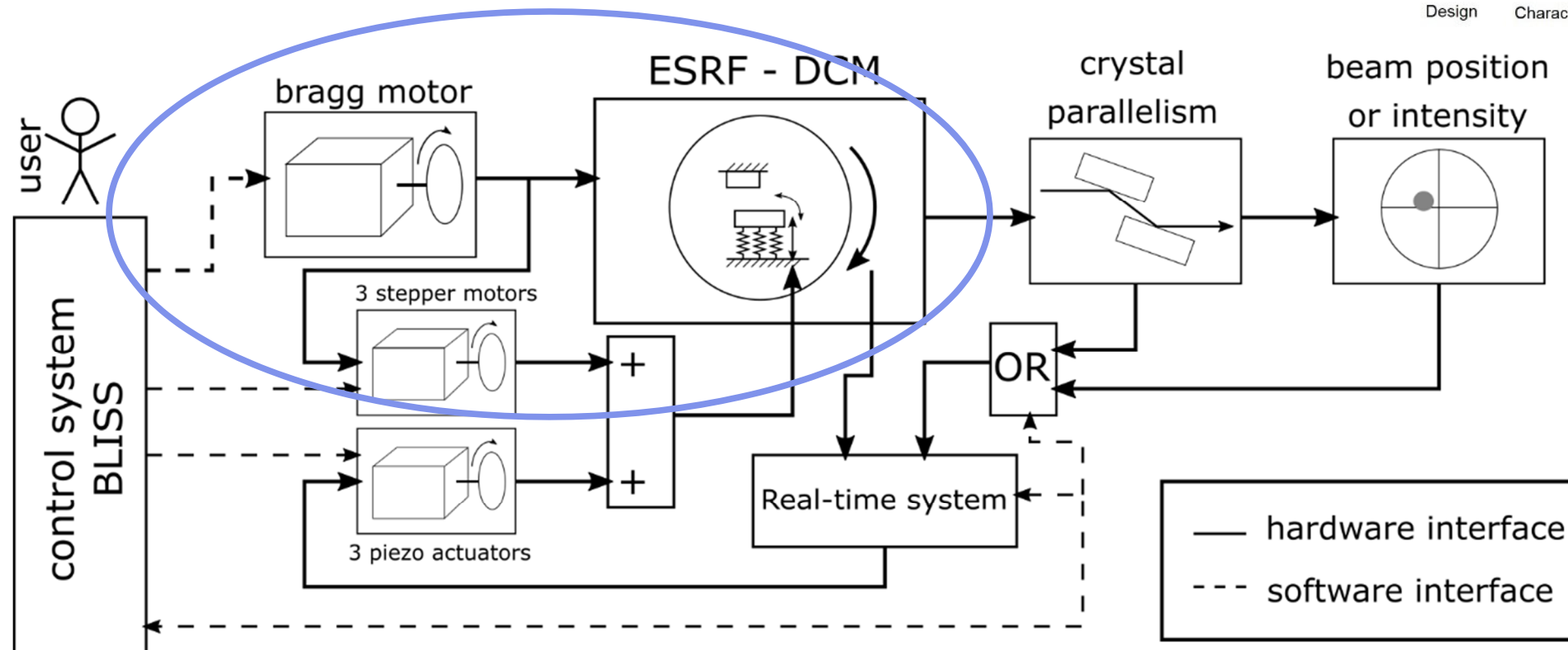
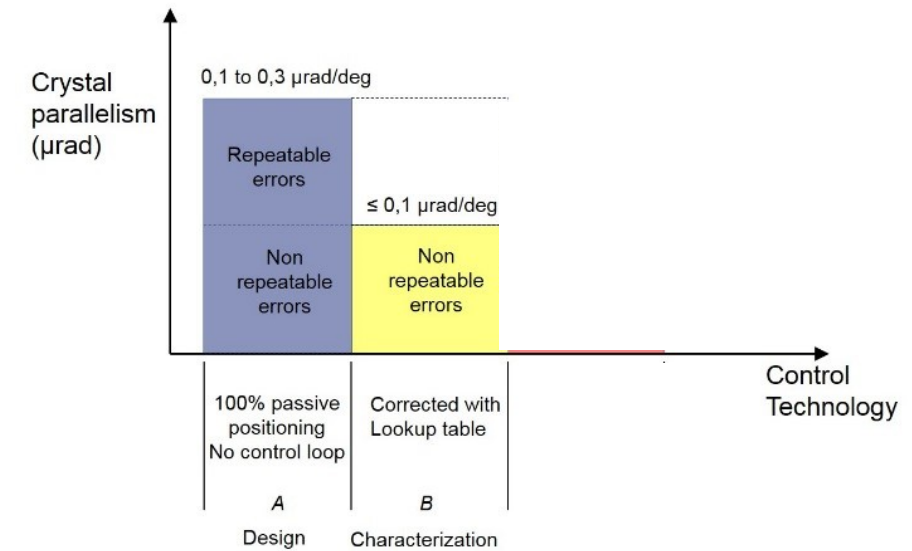
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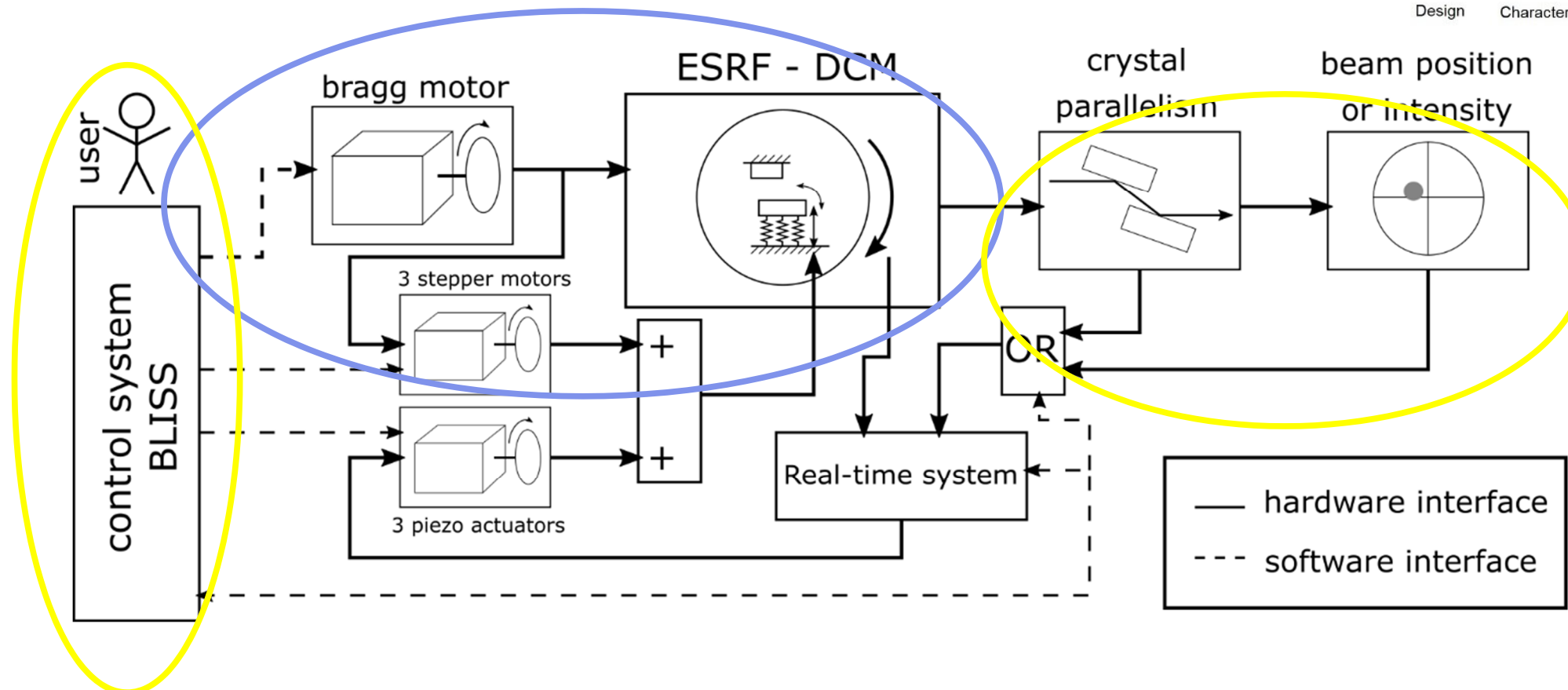
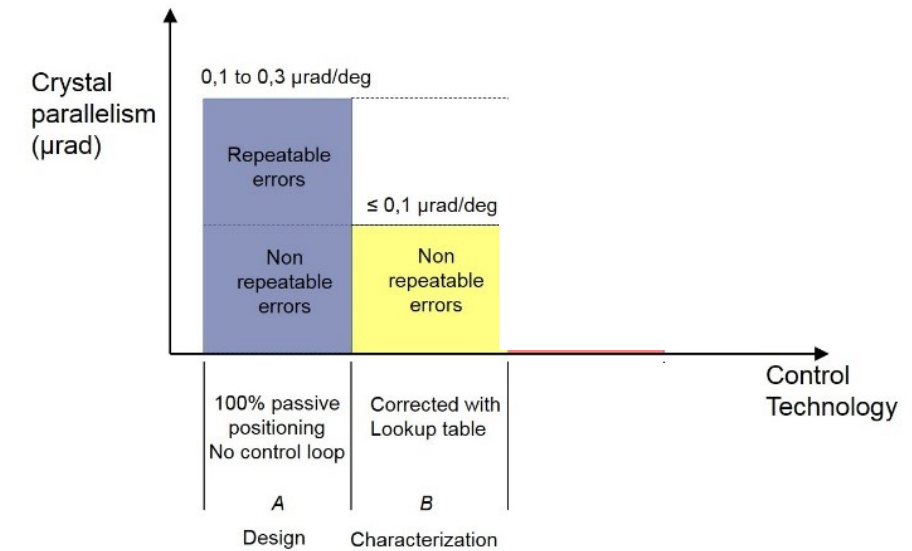
- Mode A: No control loop
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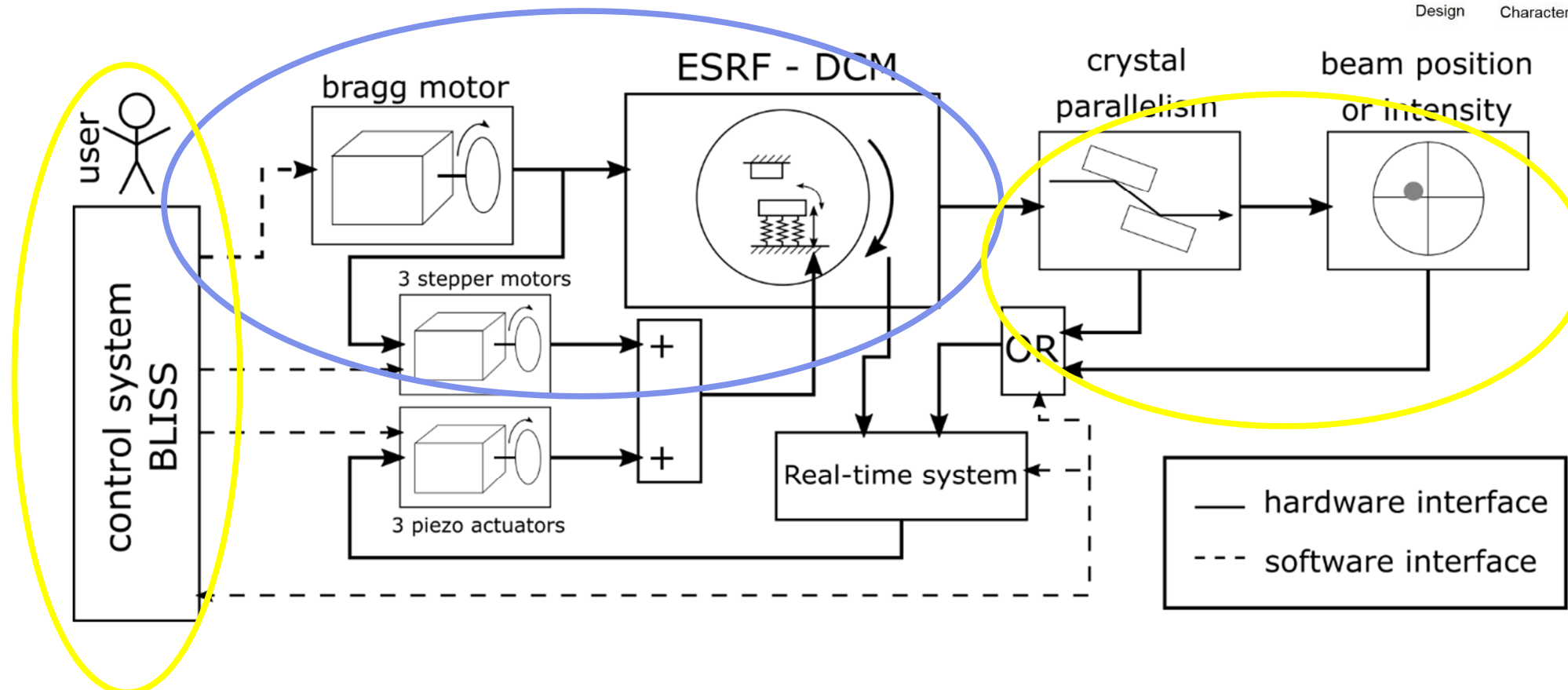
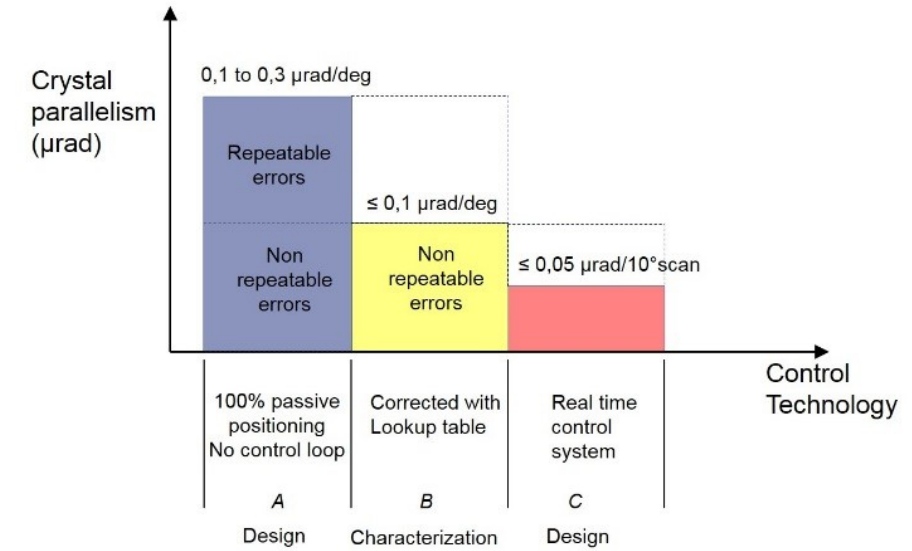
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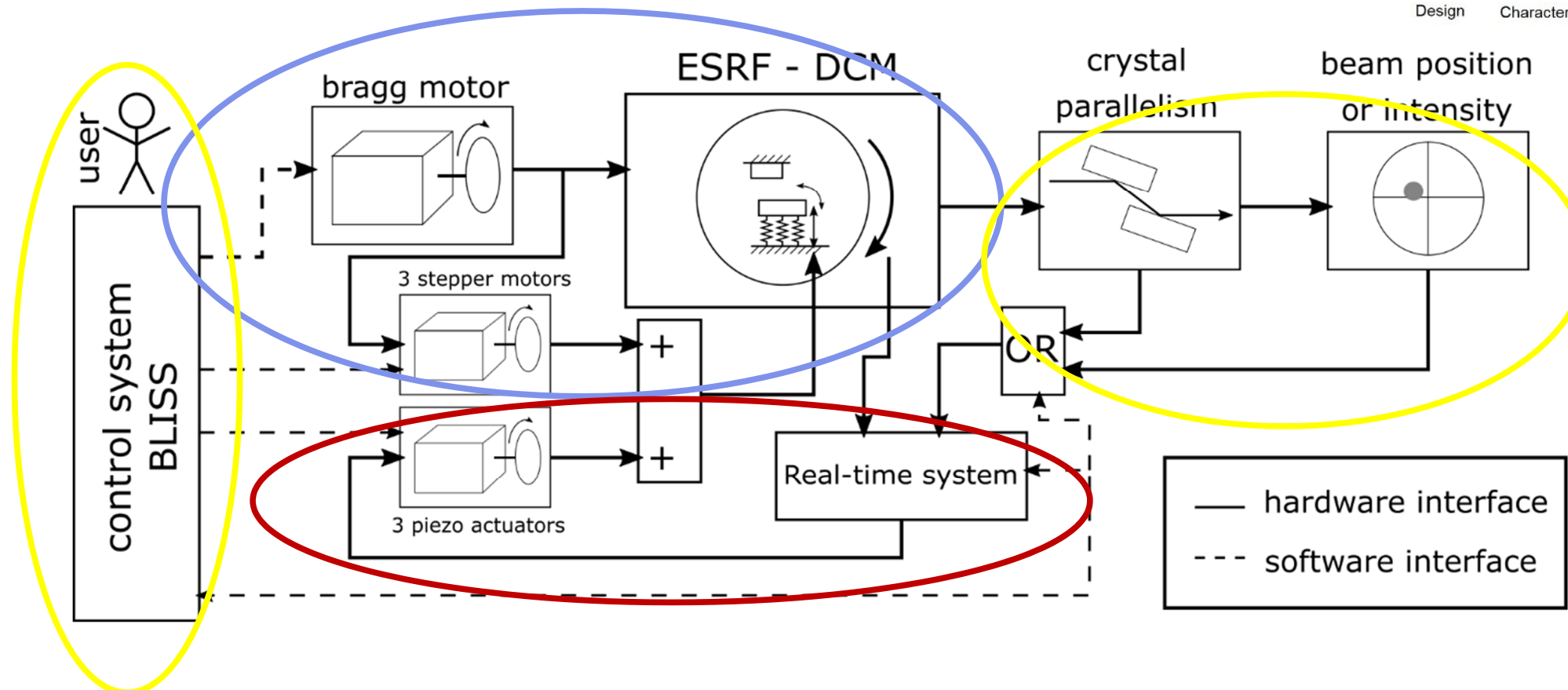
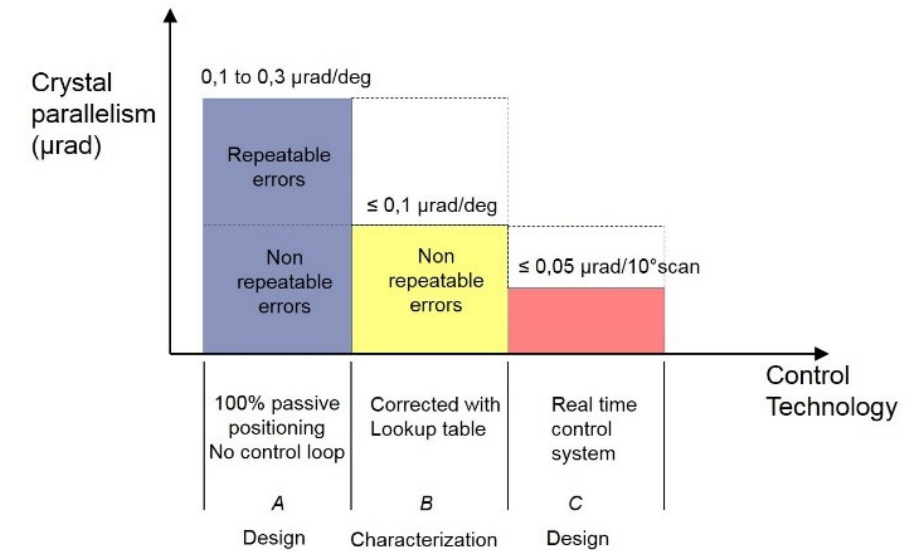
- Mode A: No control loop
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- Mode C: Active real-time control



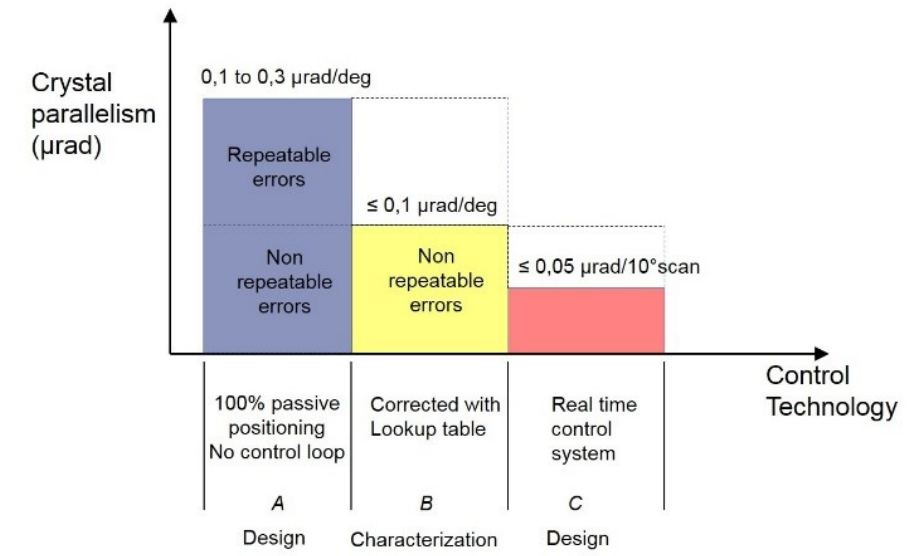
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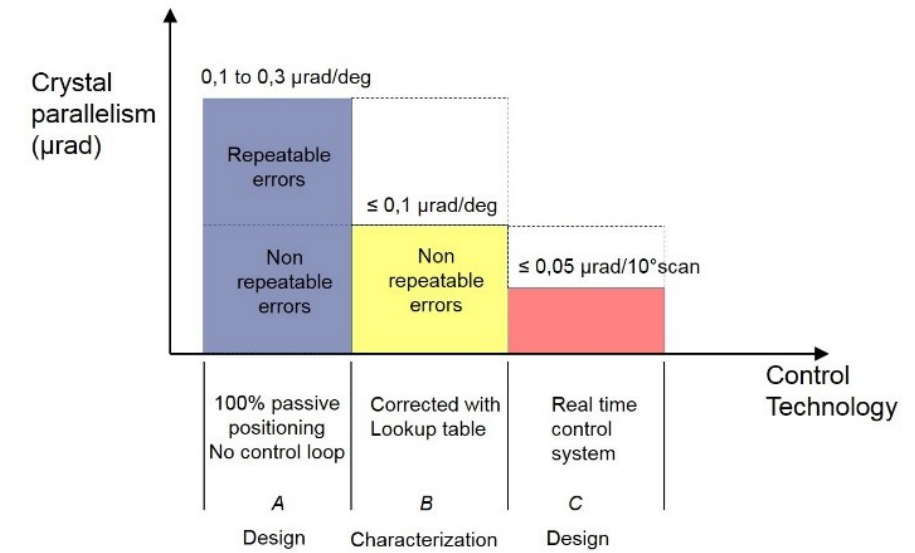
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Resulting block diagram:

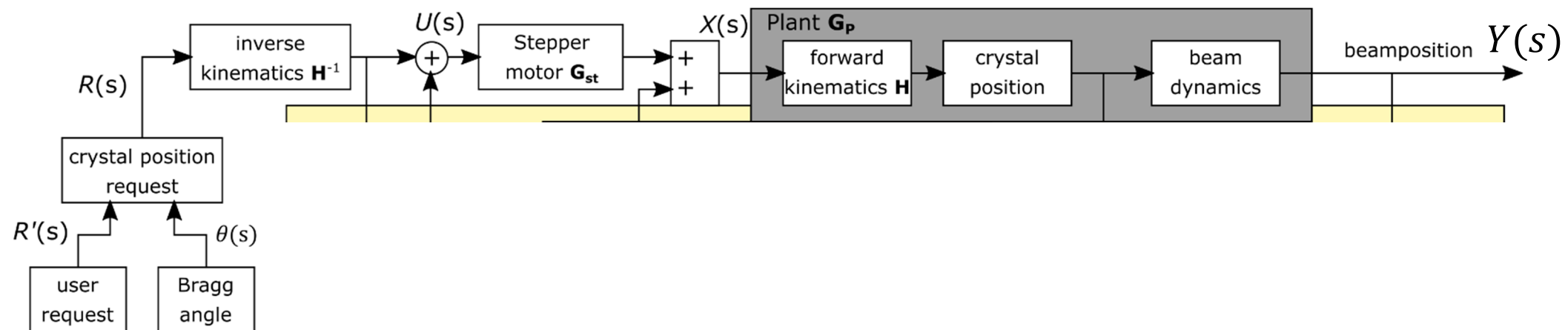
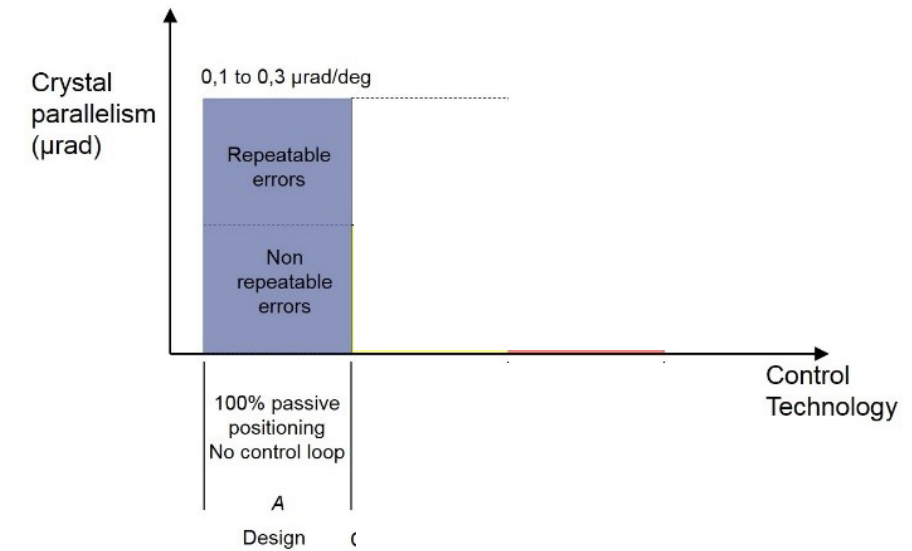
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2. THE CONTROL CONCEPT

Resulting block diagram:

- Mode A:
$$Y(s) = \underbrace{G_P(s) G_{st}(s) H^{-1}}_{G_A(s)} R(s)$$
- Mode B:
- Mode C:



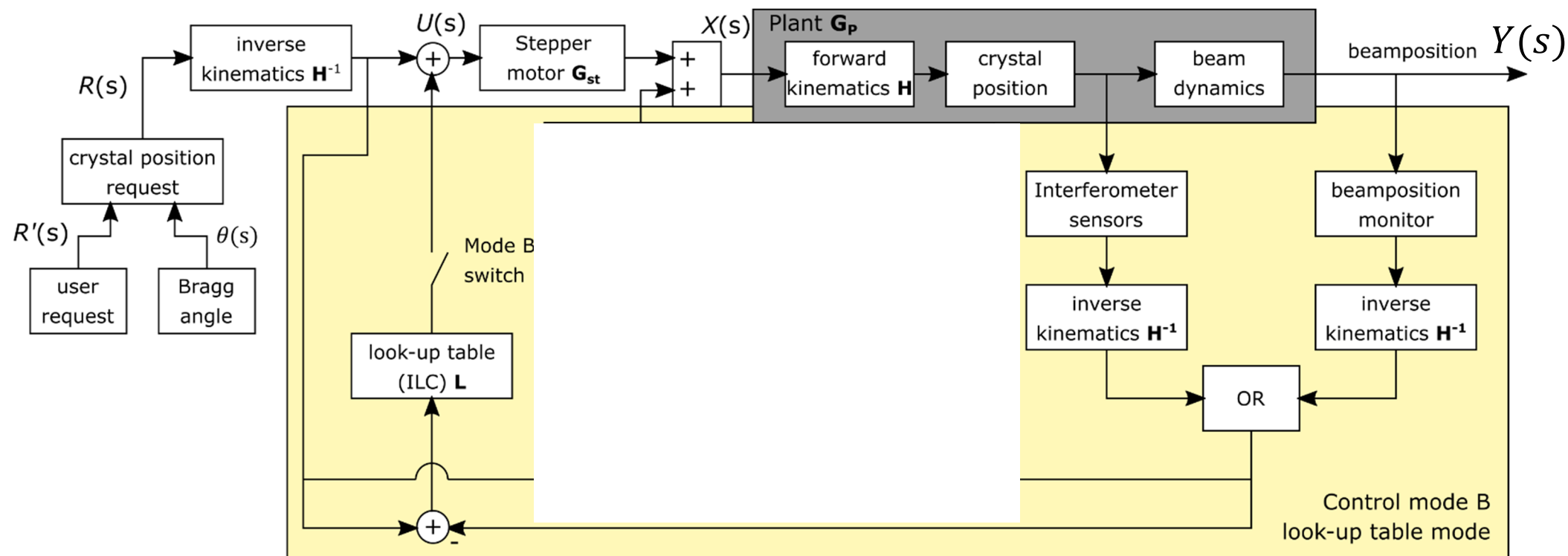
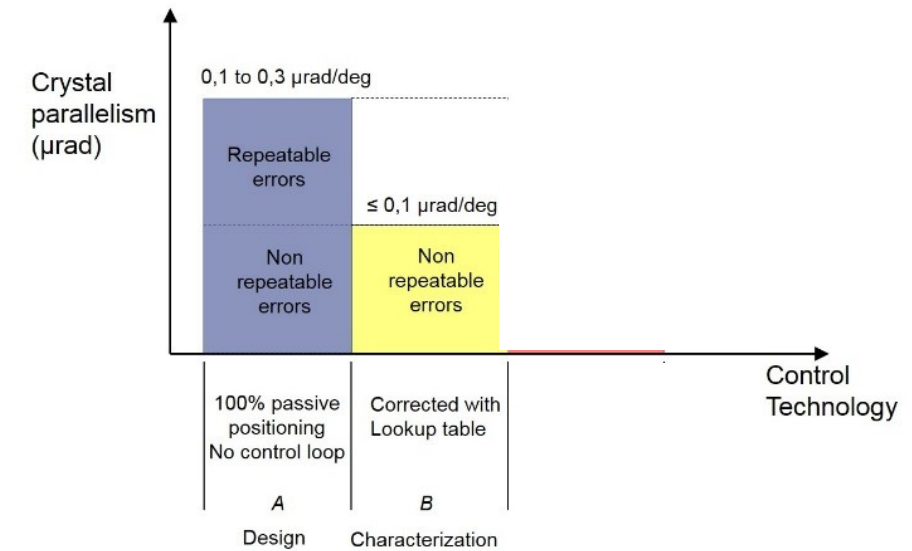
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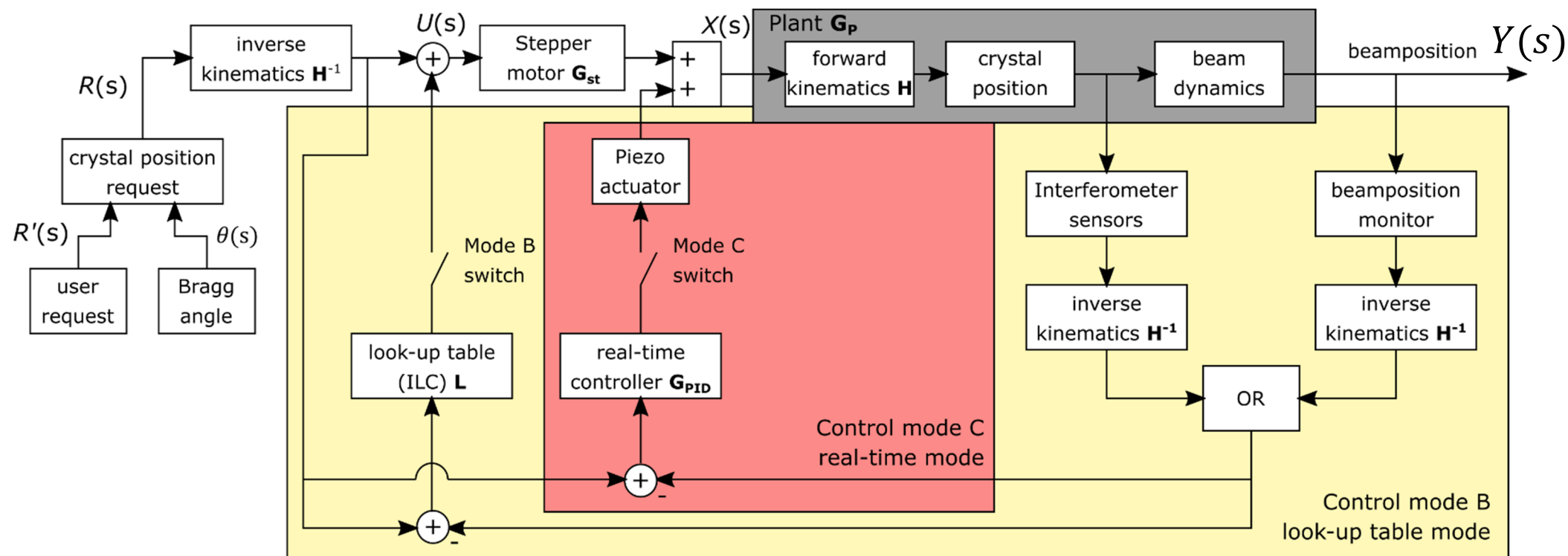
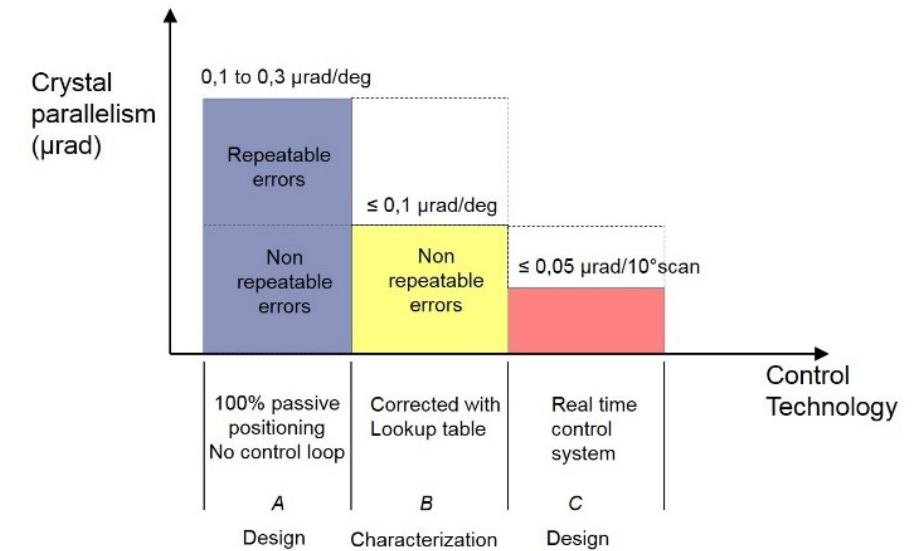
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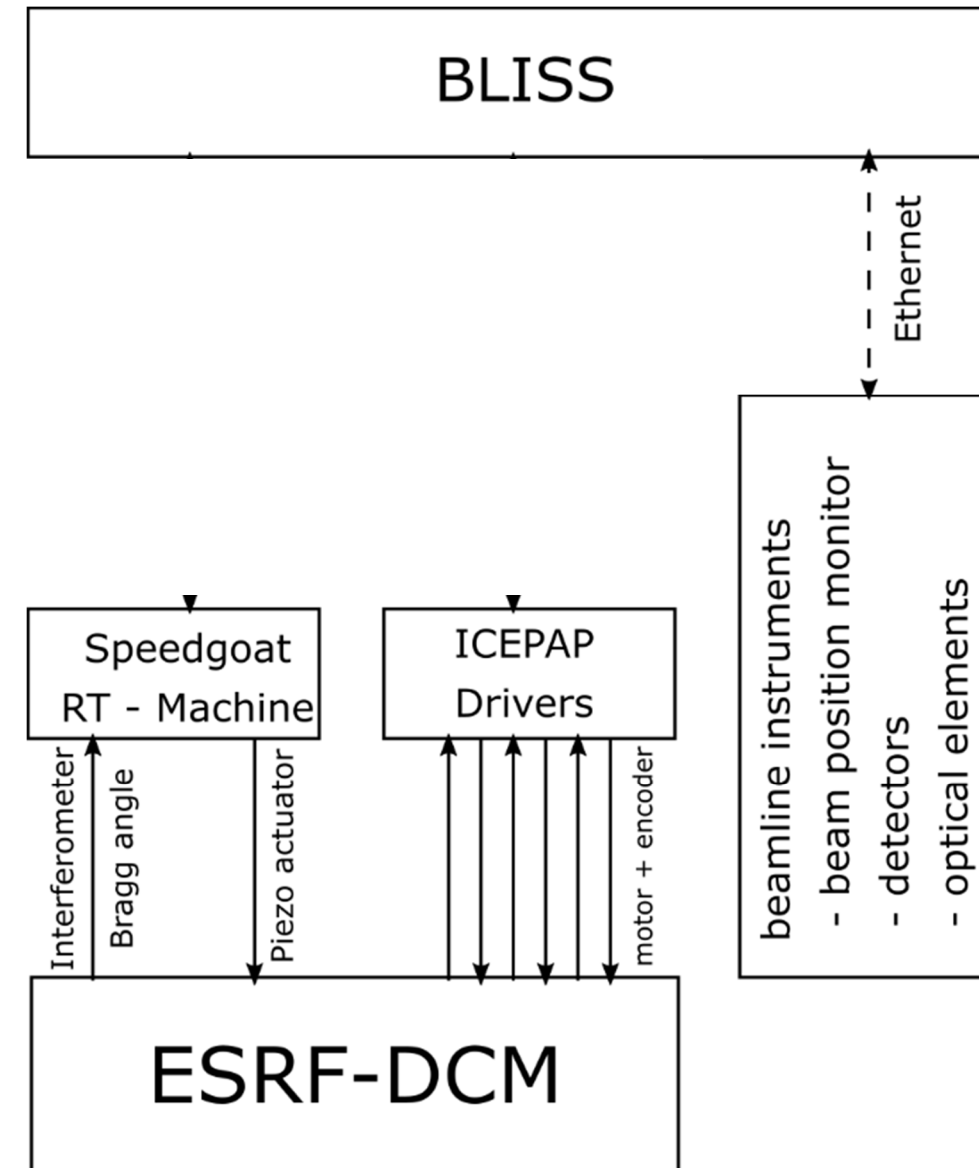
- Mode C:

$$Y(s) = \underbrace{G_{PID} G_P (I_3 + G_{PID} G_P)^{-1} H^{-1}}_{G_C(s)} R(s)$$



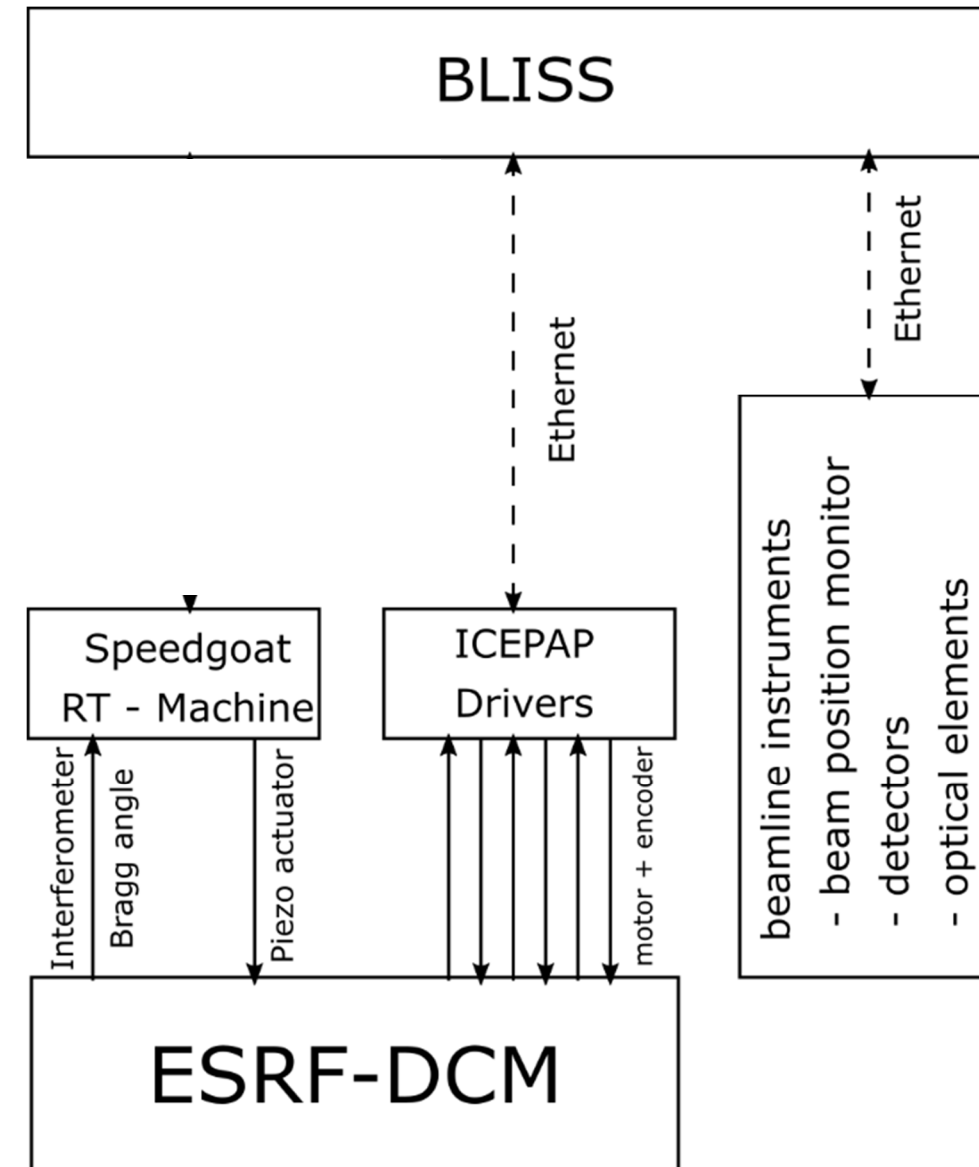
2. THE CONTROL CONCEPT

Integration into BLISS:



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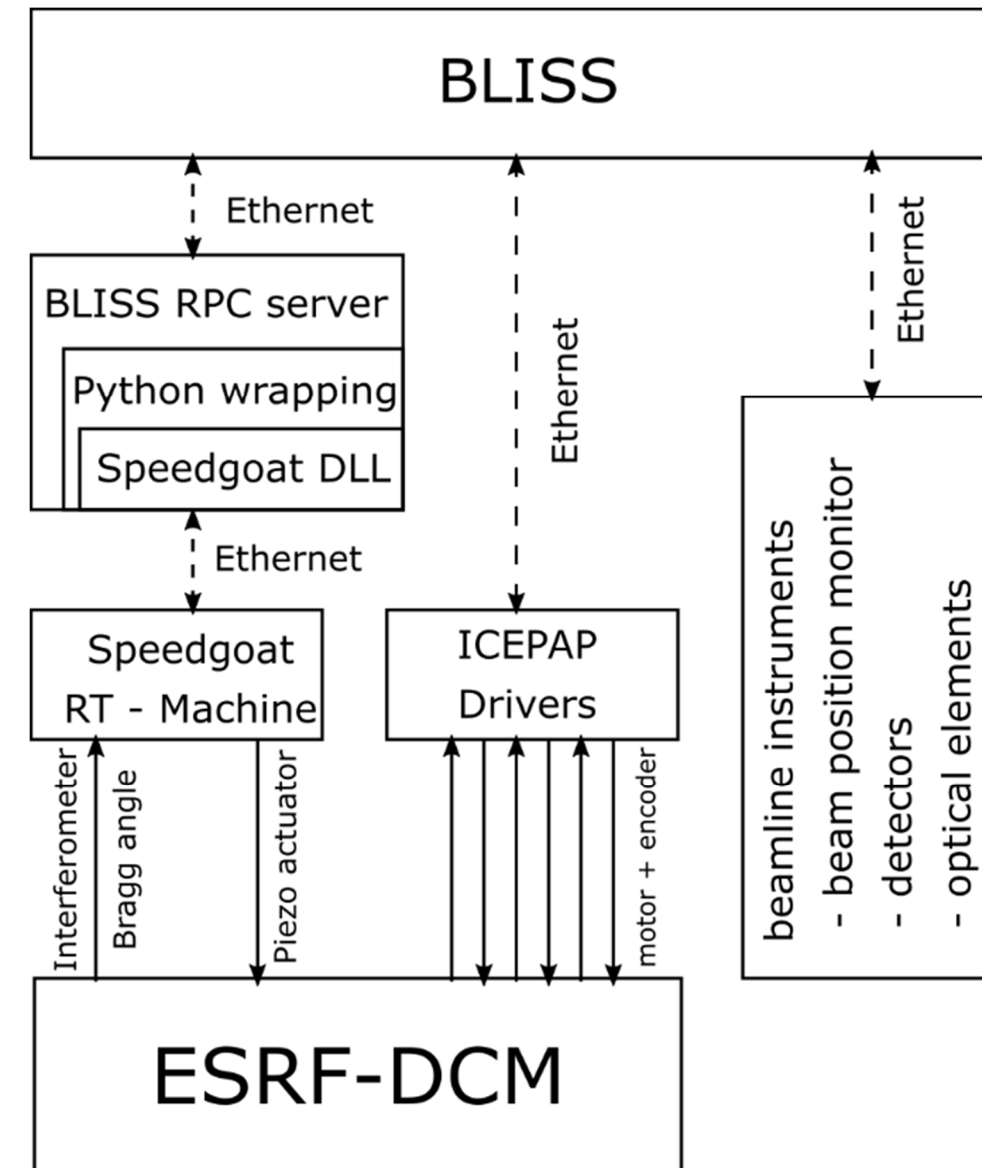
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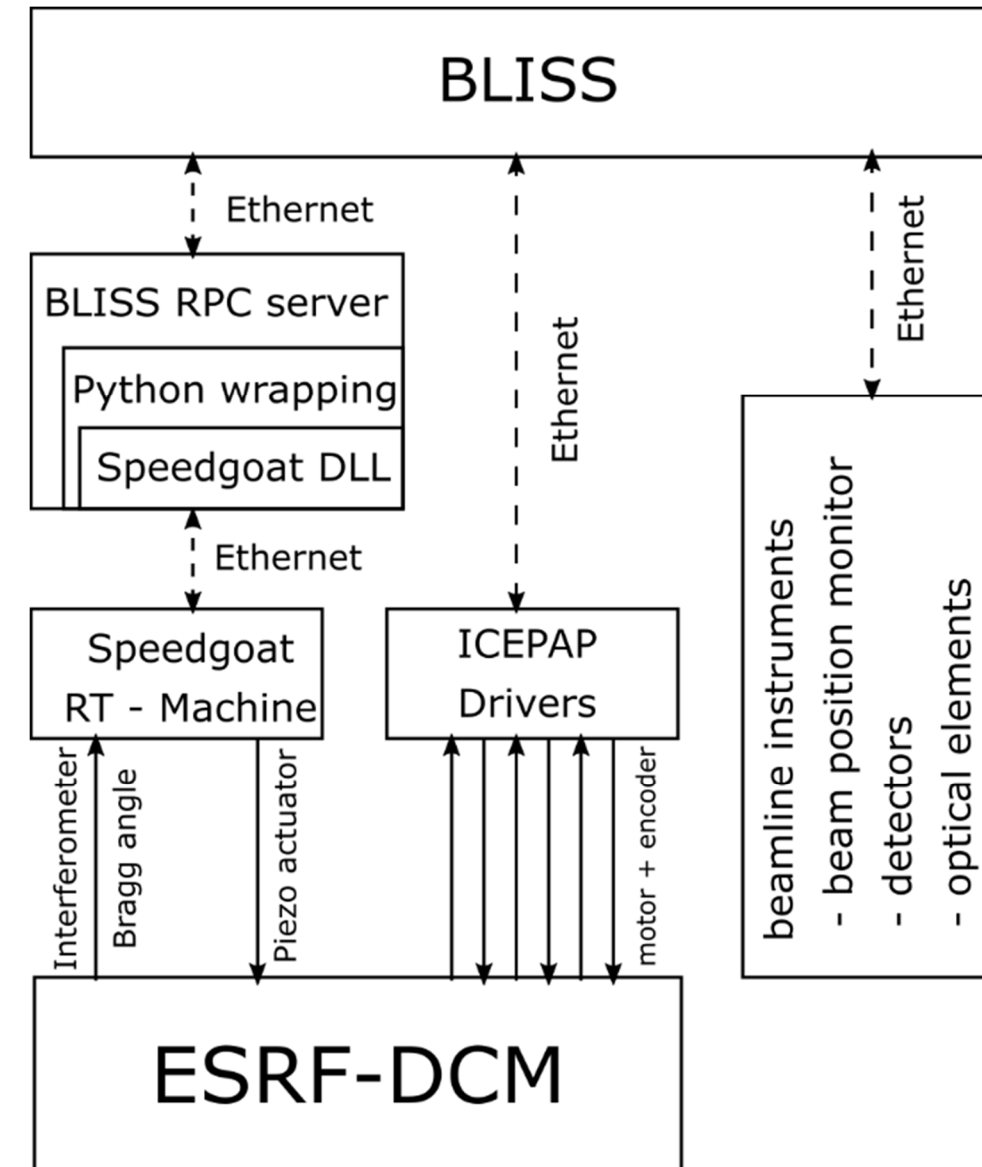
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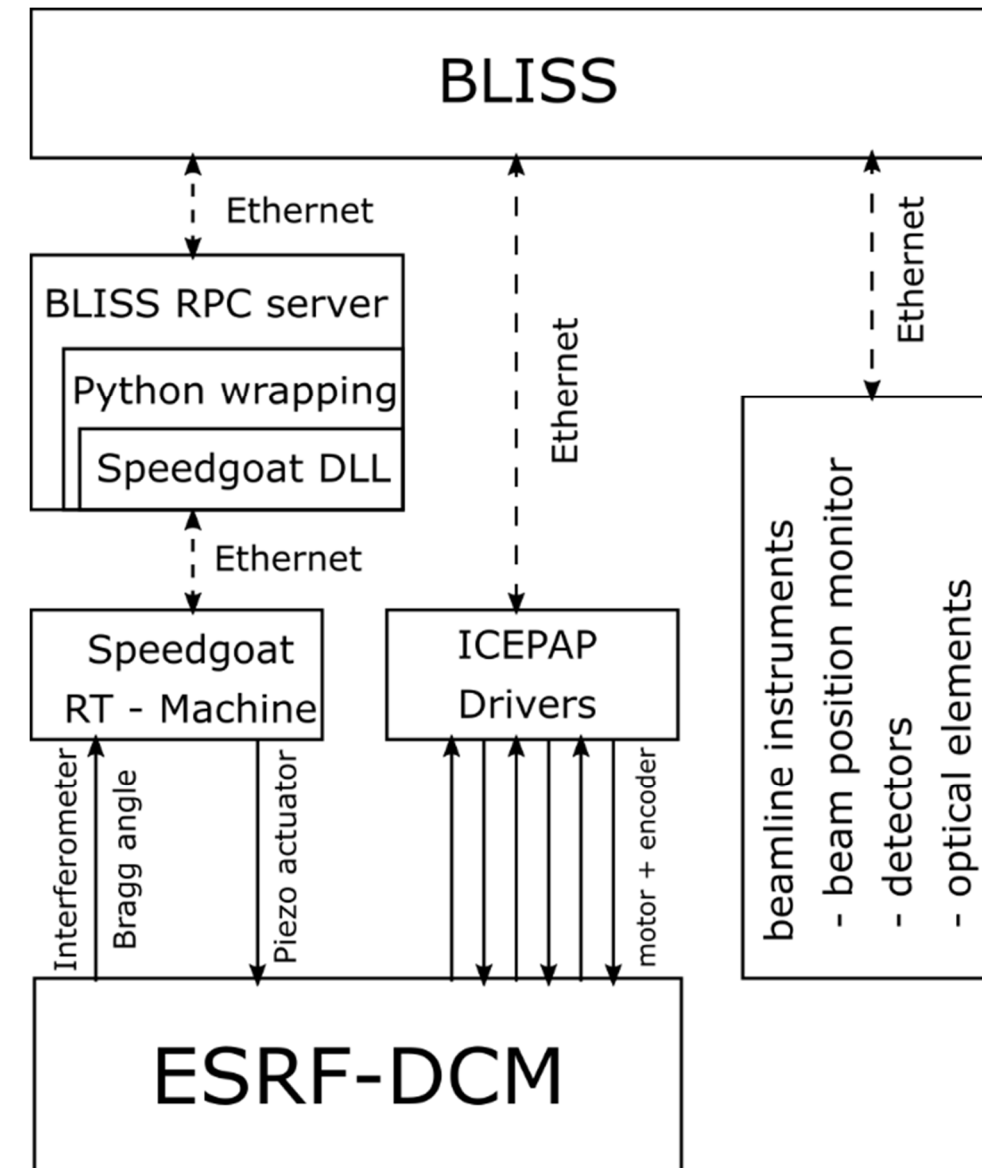
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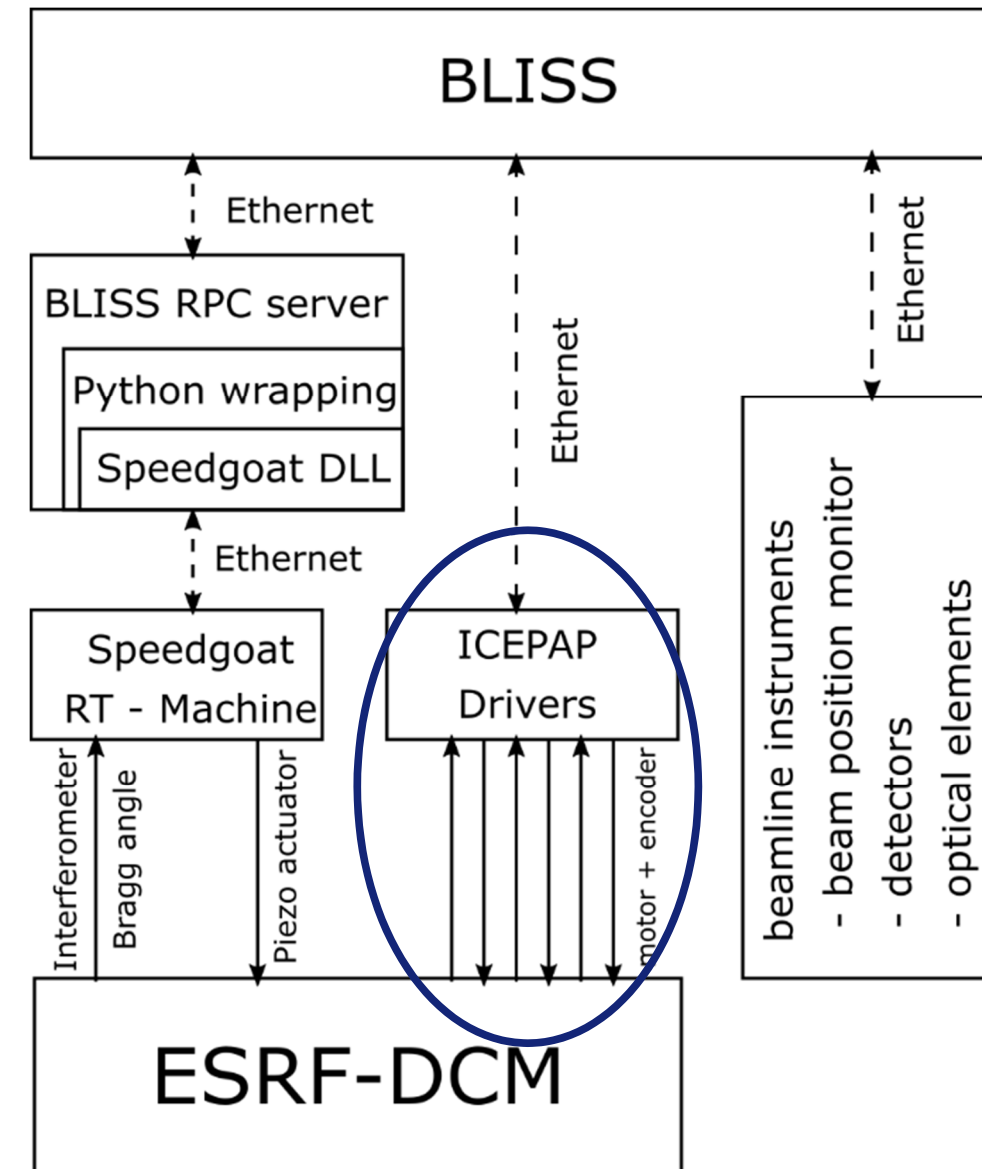
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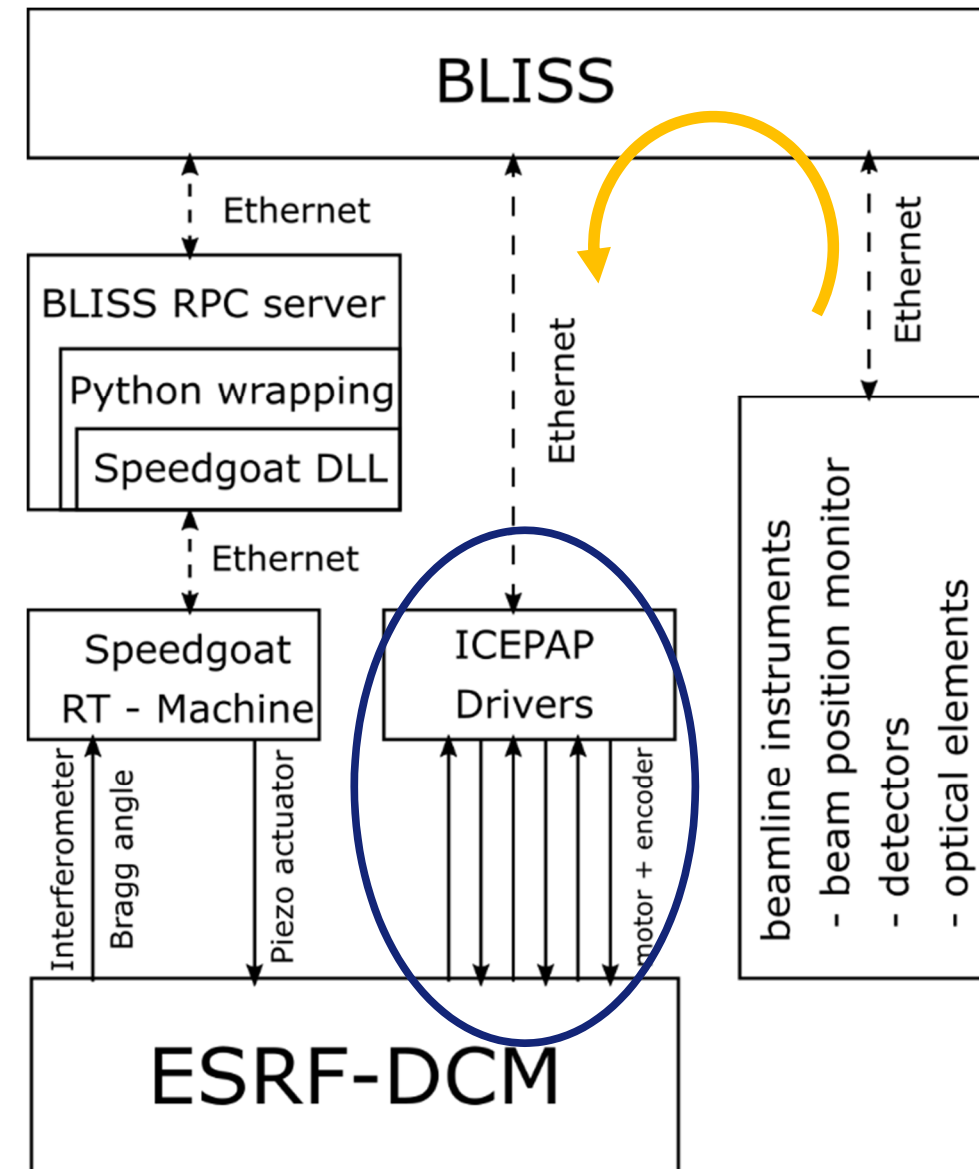
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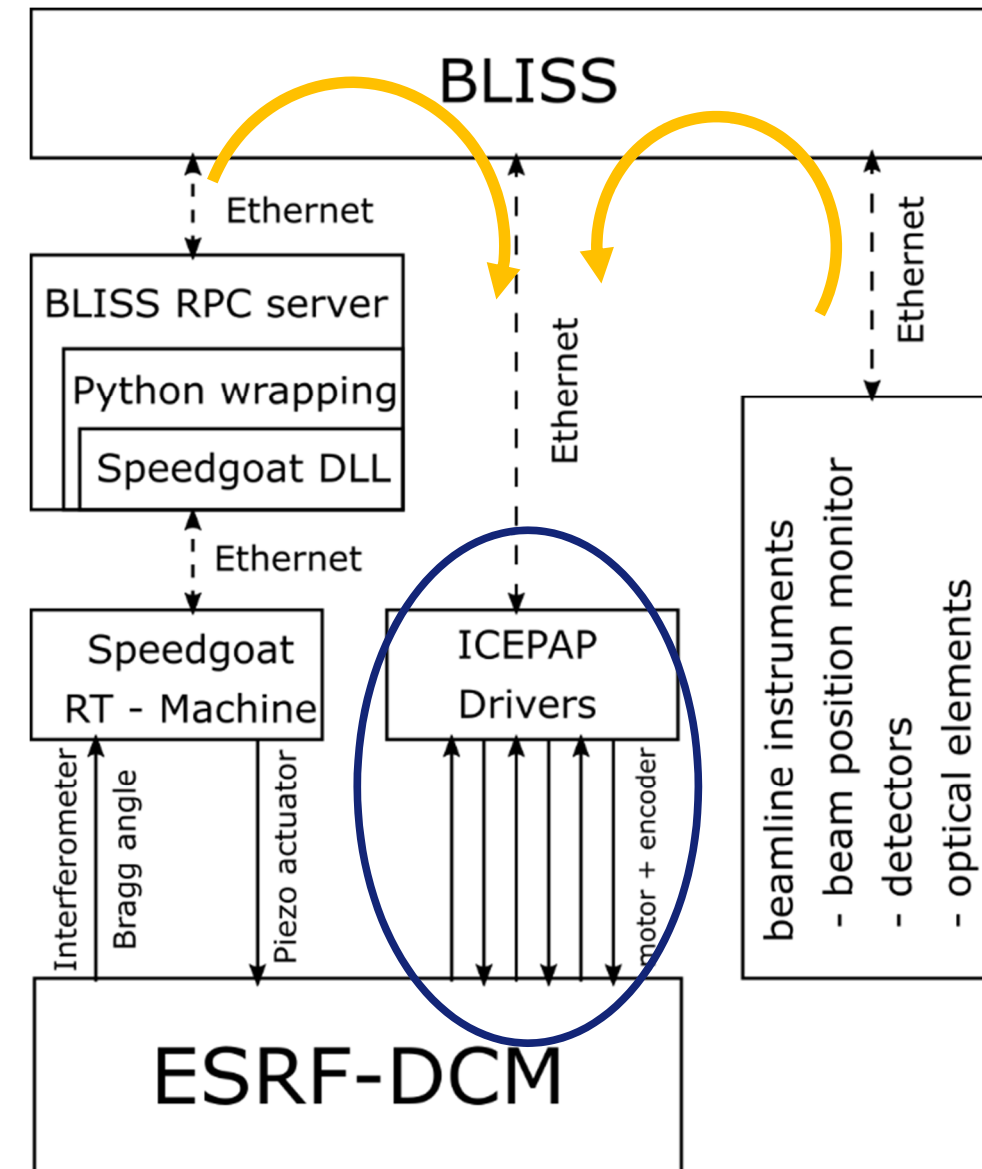
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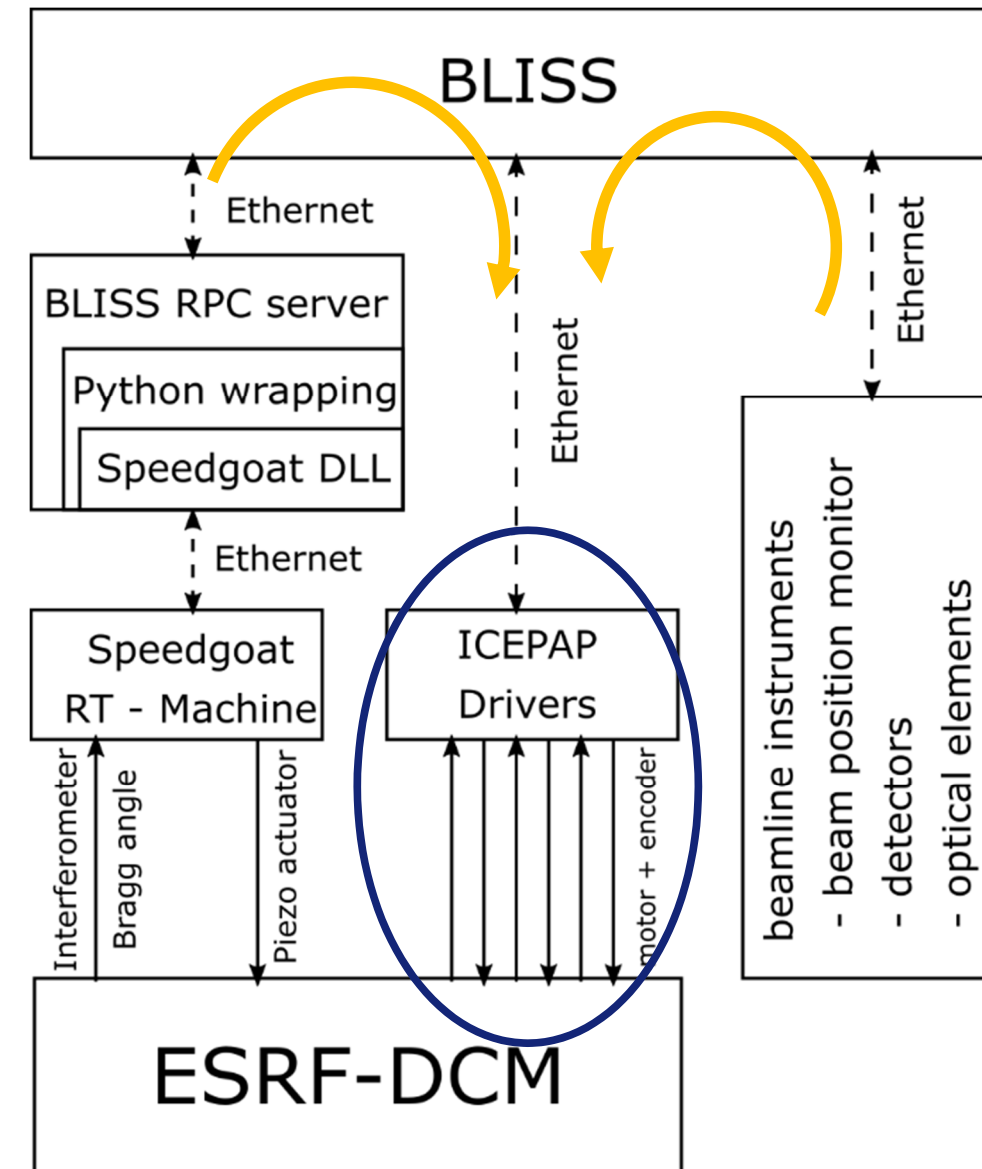
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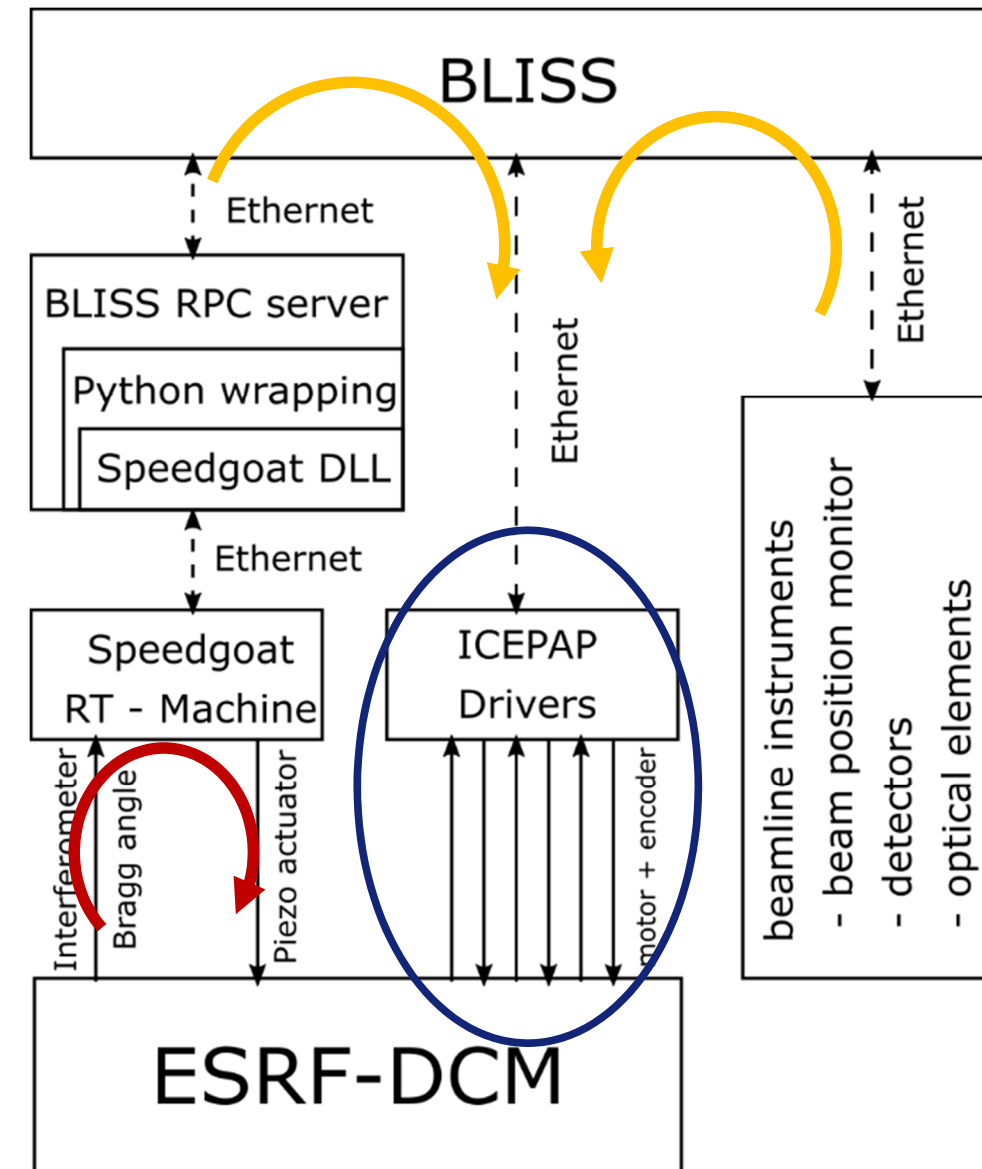
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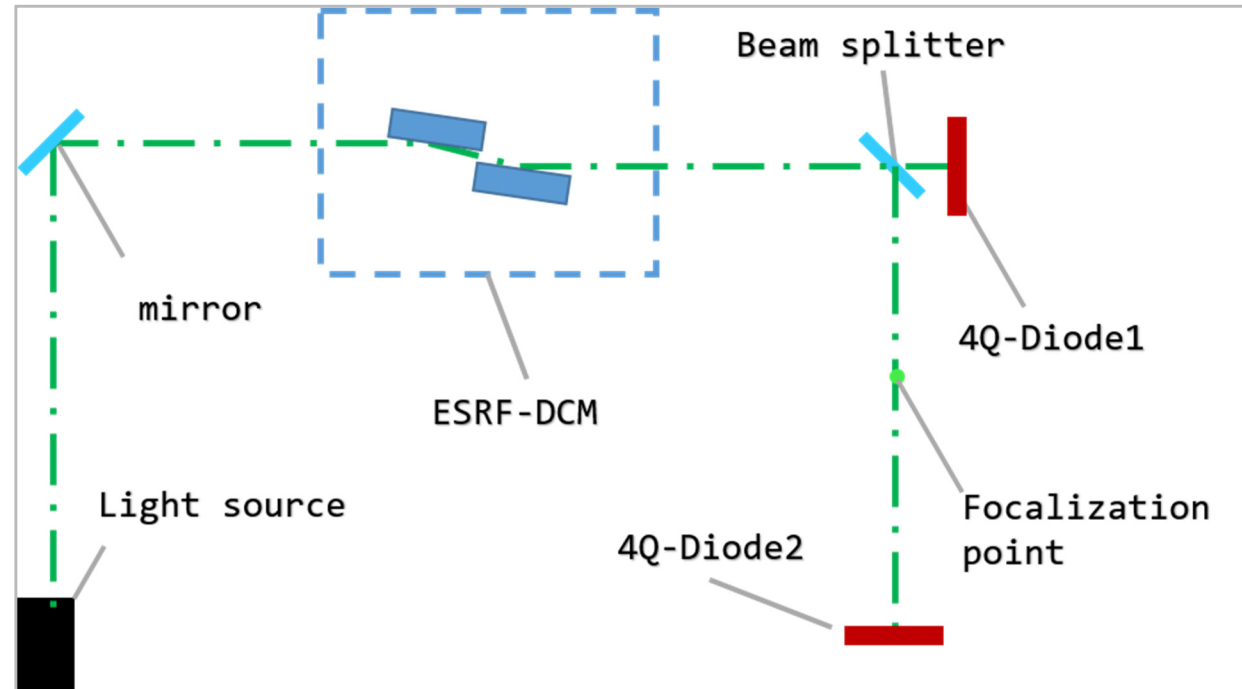
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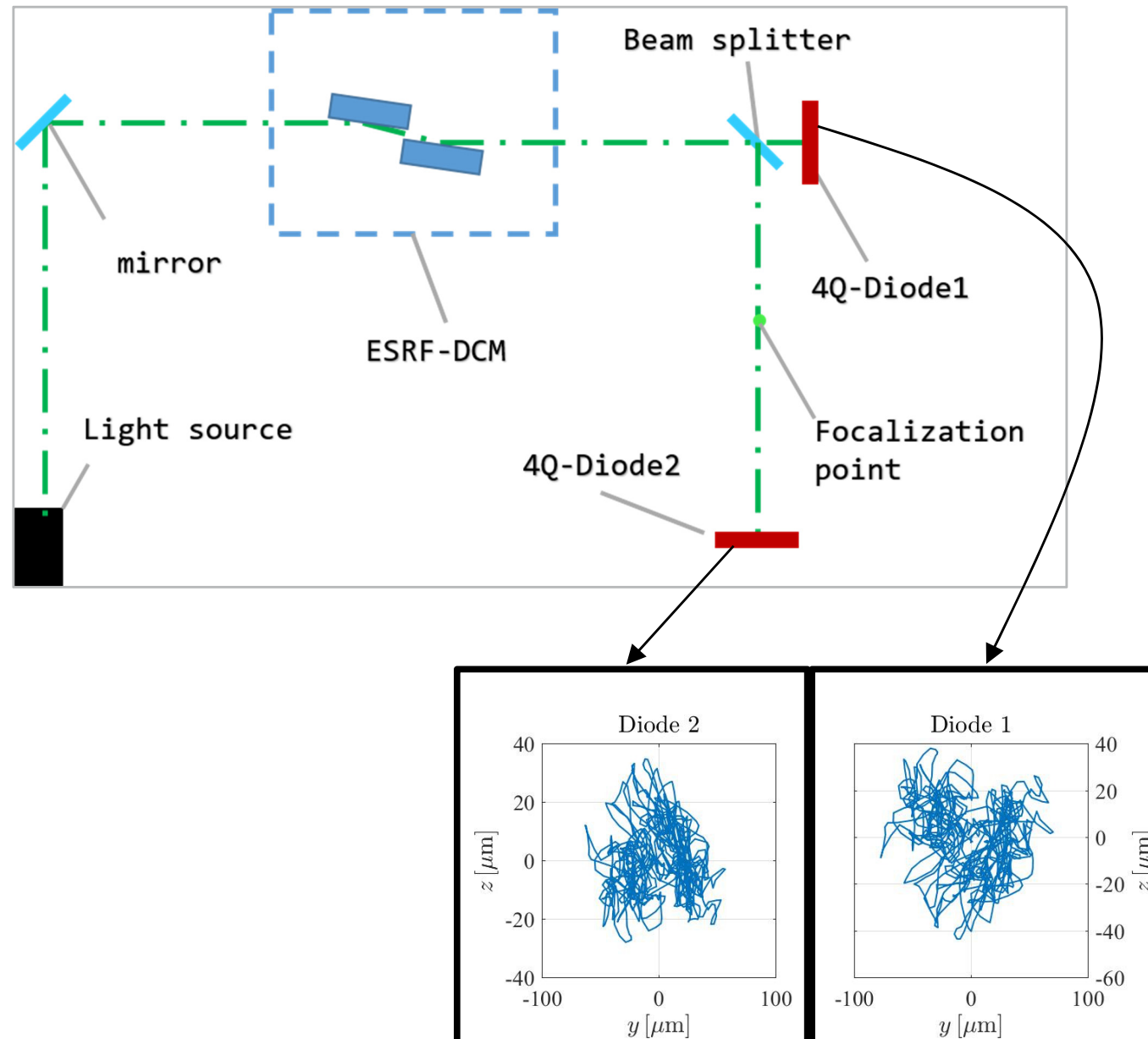
3. TEST SETUP AND RESULTS

Laser setup:



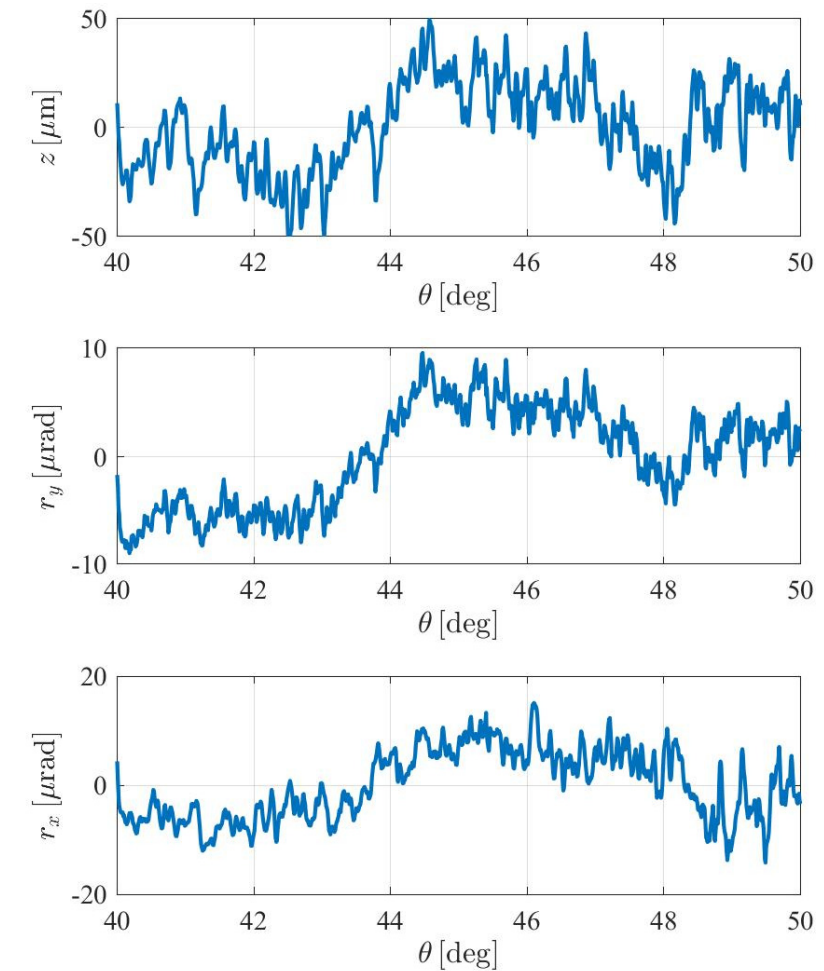
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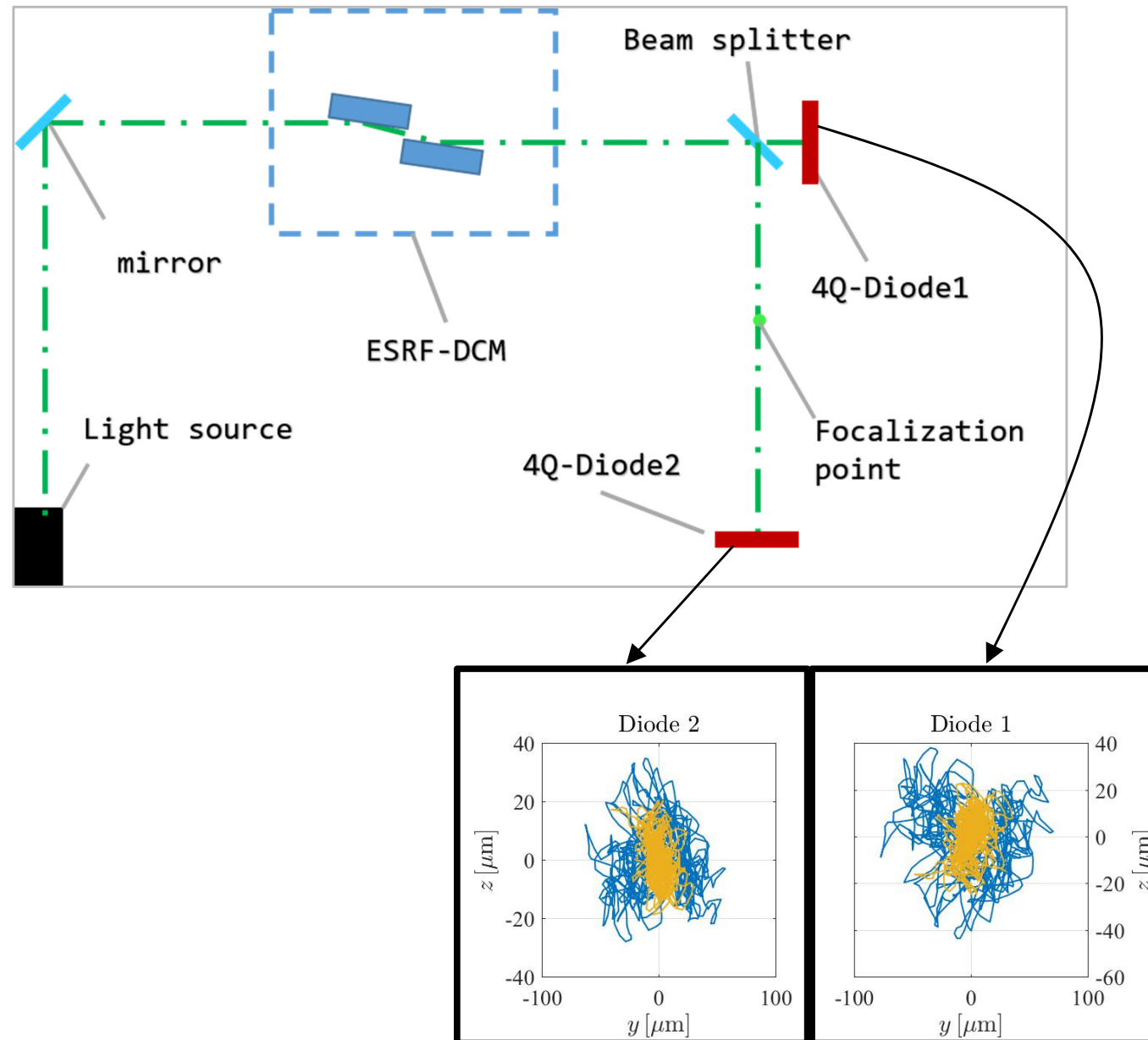
Beam stability at 10 degree scan:

- Mode A (blue)



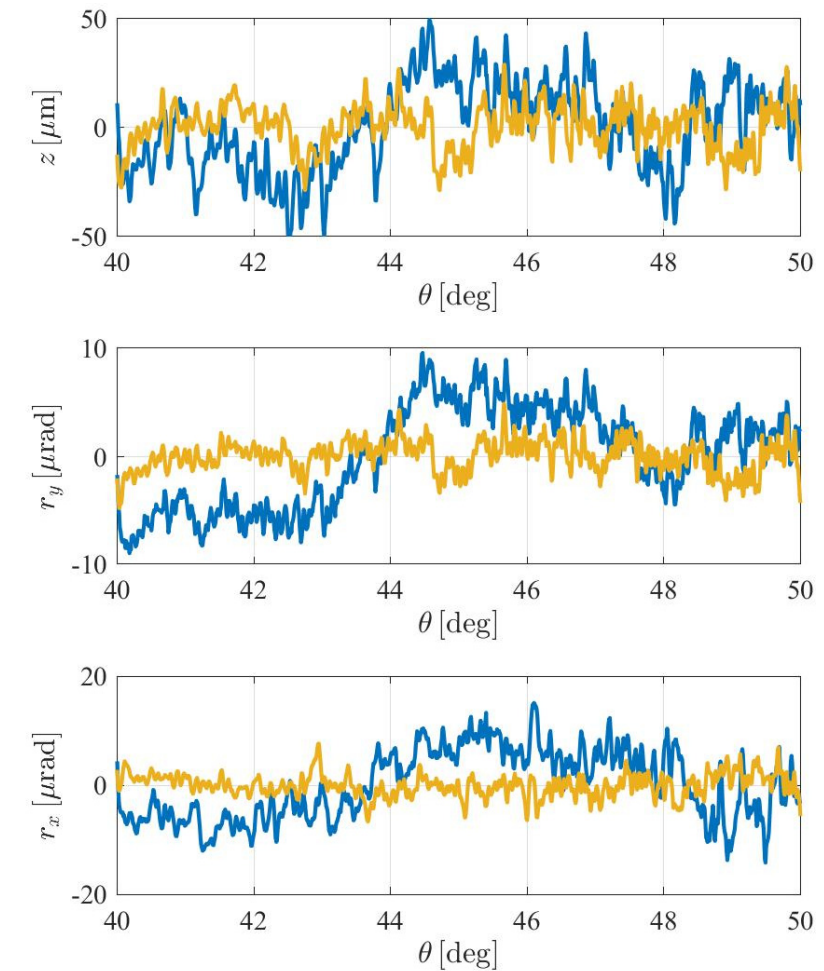
3. TEST SETUP AND RESULTS

Laser setup:



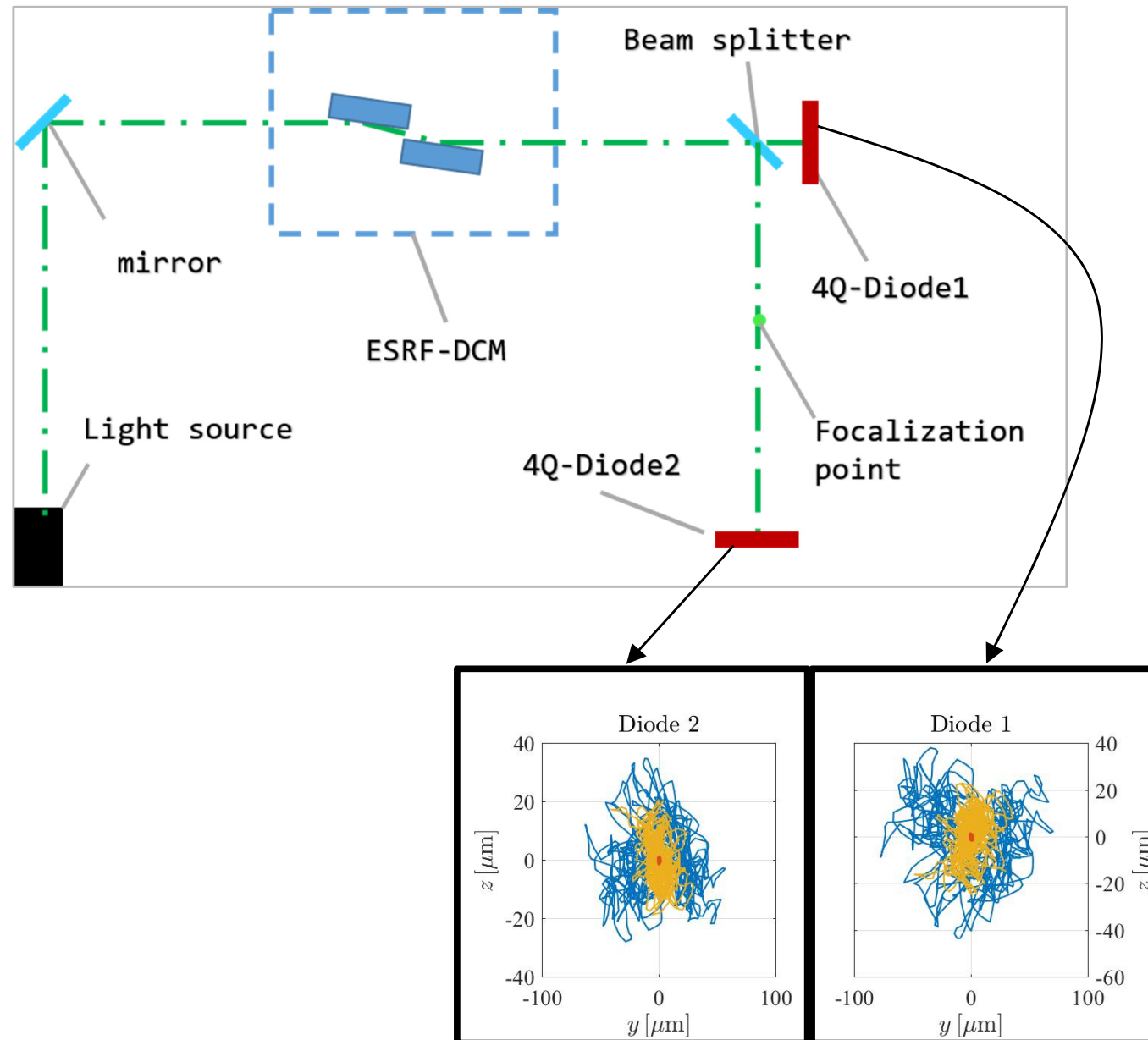
Beam stability at 10 degree scan:

- Mode A (blue)
- Mode B (yellow)



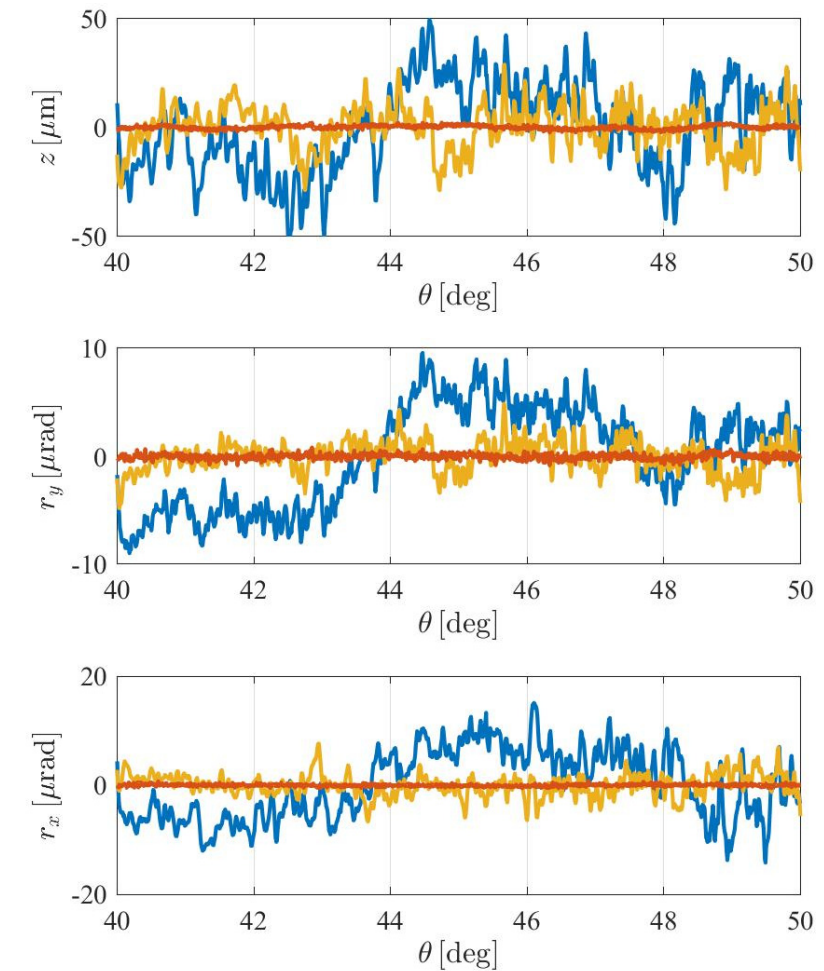
3. TEST SETUP AND RESULTS

Laser setup:



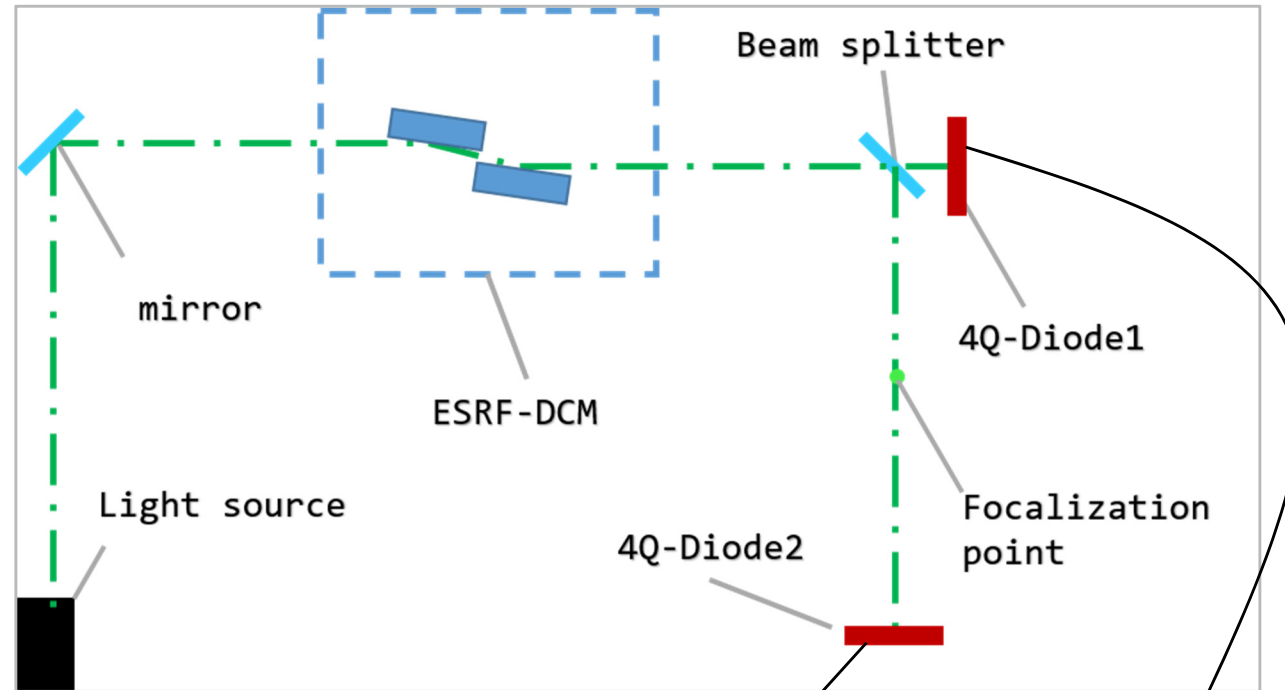
Beam stability at 10 degree scan:

- Mode A (blue)
- Mode B (yellow)
- Mode C (red)



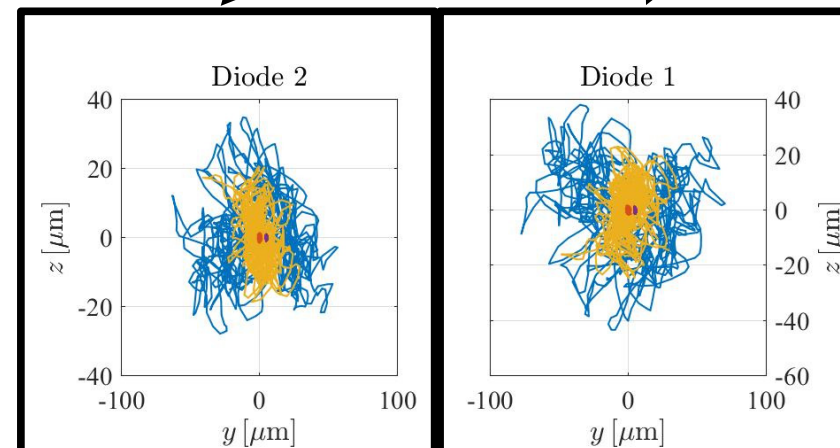
3. TEST SETUP AND RESULTS

Laser setup:



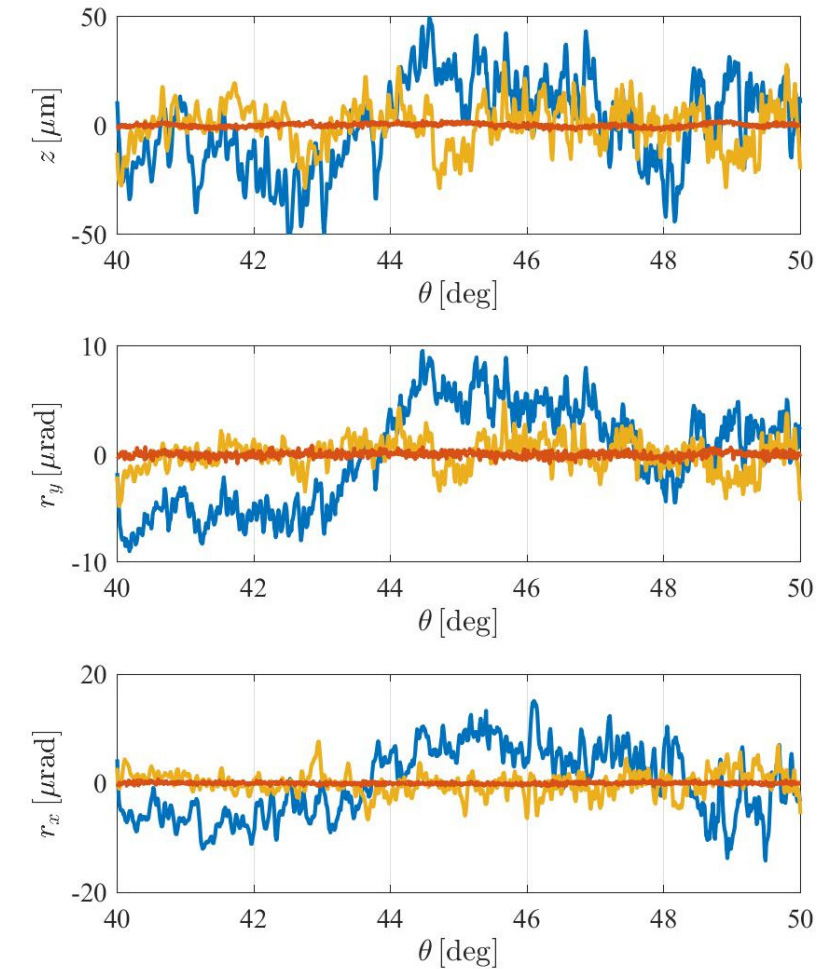
Beam stability on diodes:

- mode C scan (red)
- diode noise (purple)



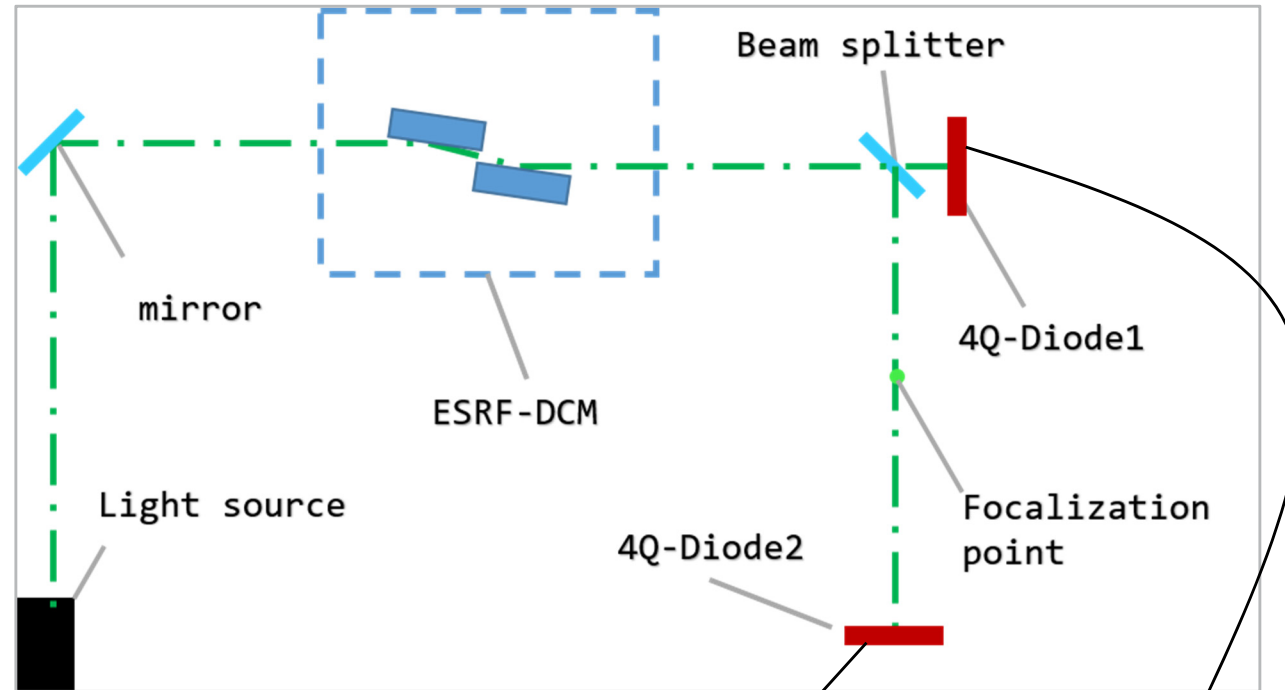
Beam stability at 10 degree scan:

- Mode A (blue)
- Mode B (yellow)
- Mode C (red)



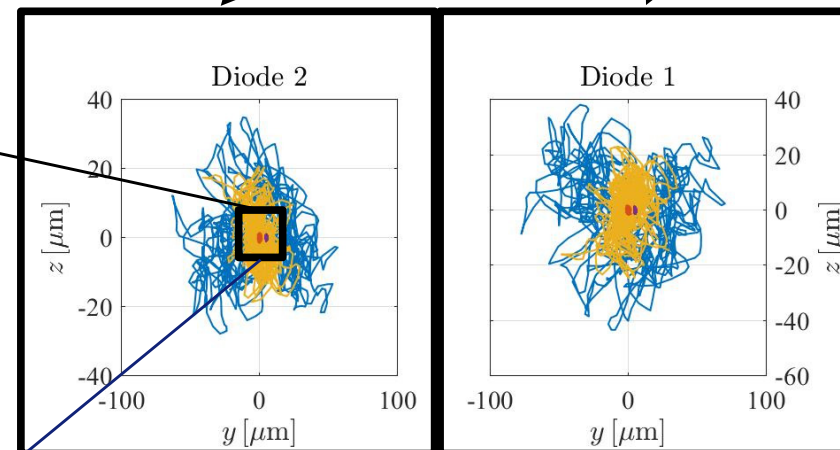
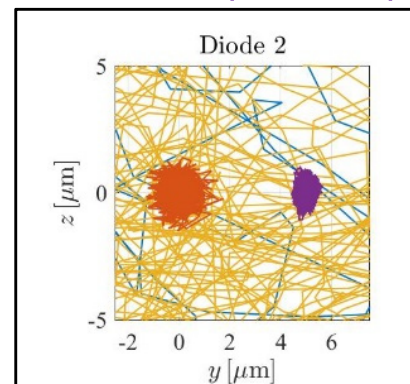
3. TEST SETUP AND RESULTS

Laser setup:



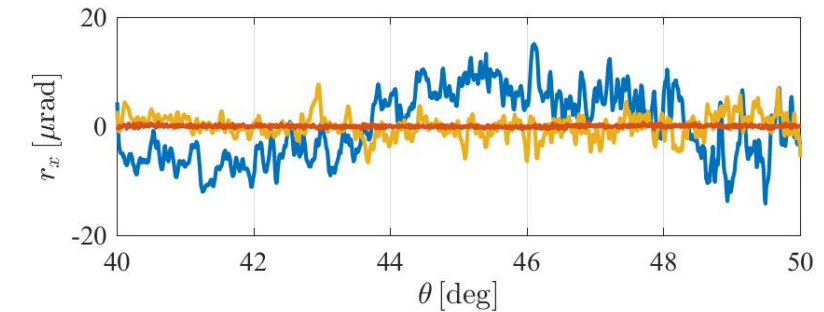
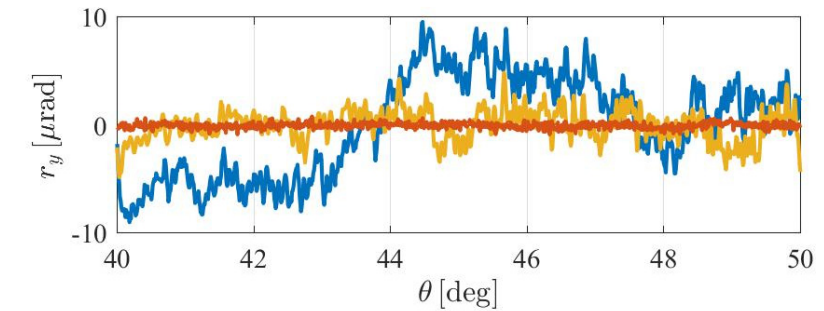
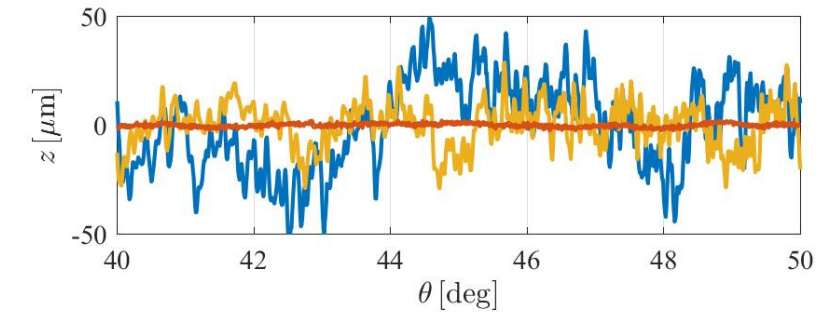
Beam stability on diodes:

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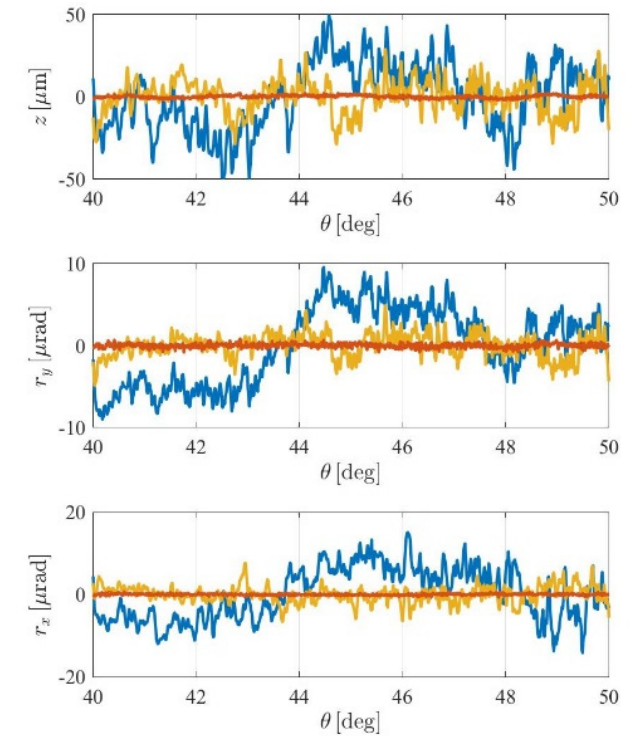
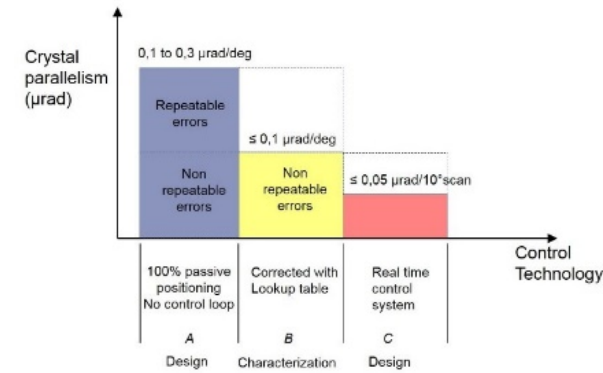
Beam stability at 10 degree scan:

- Mode A (blue)
- Mode B (yellow)
- Mode C (red)



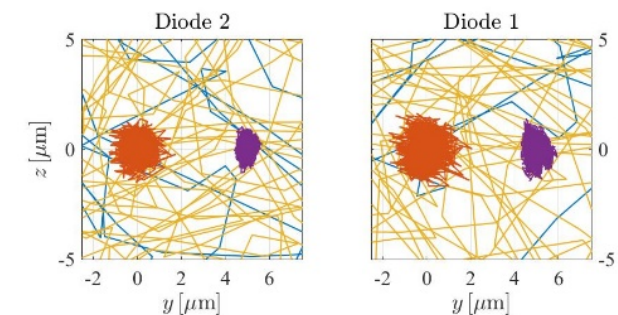
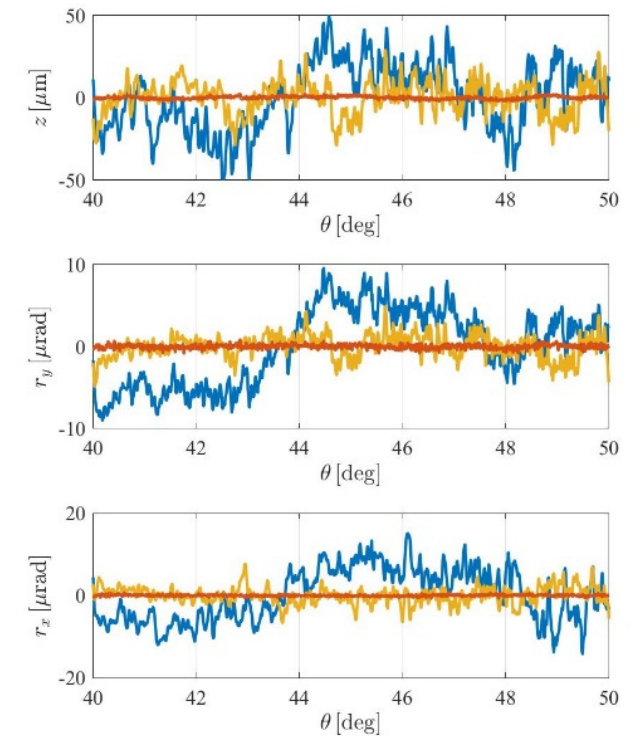
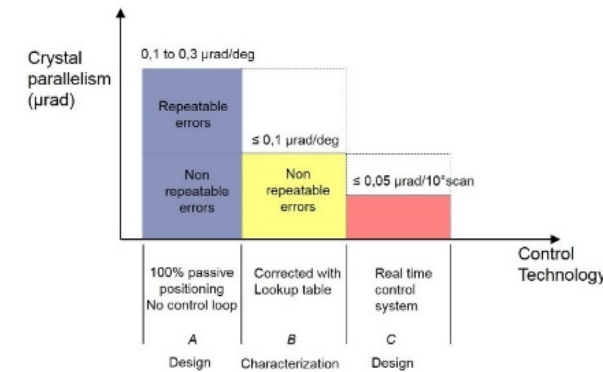
4. CONCLUSION

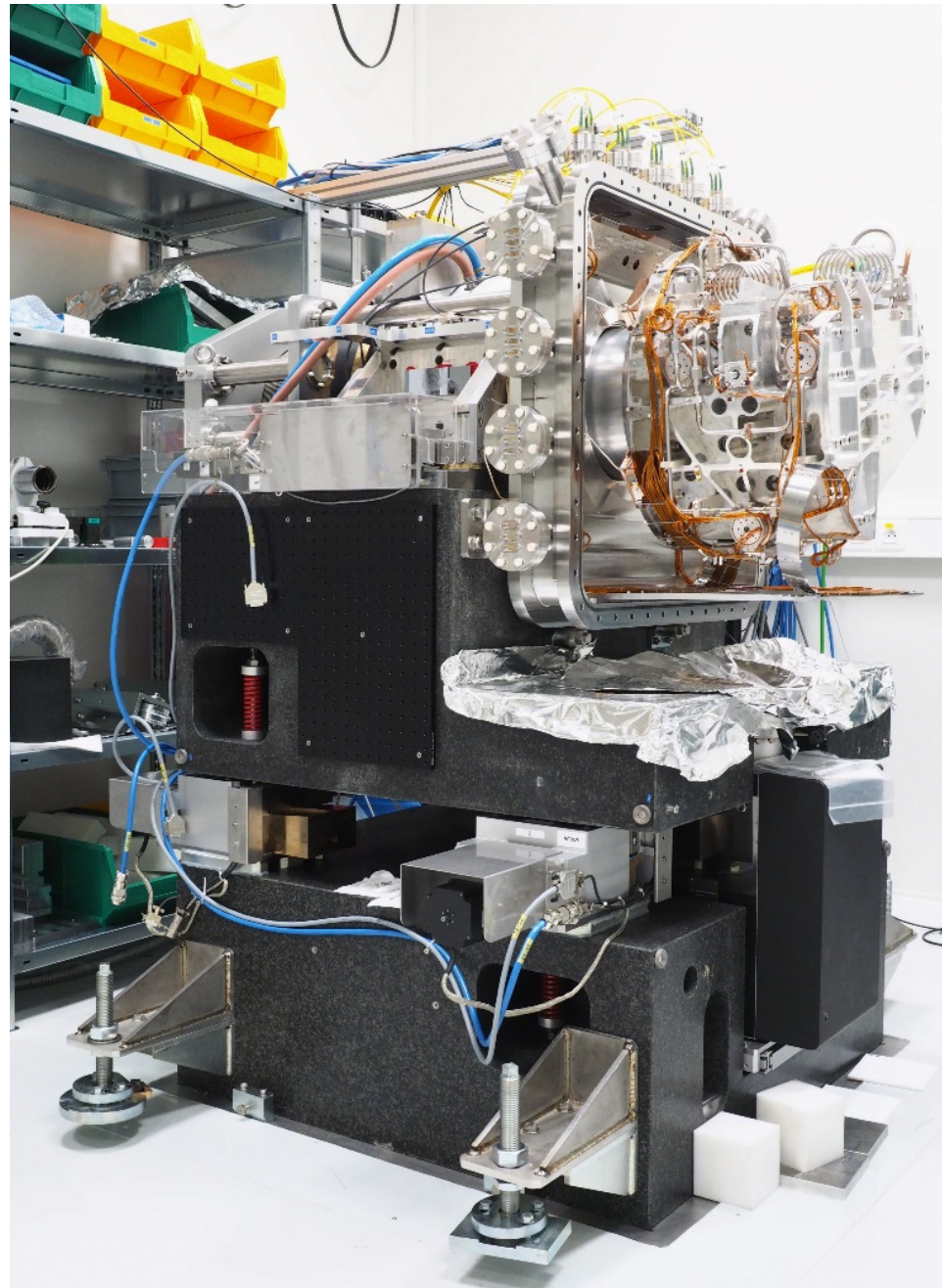
- **The control concept:**
 - follows the design principles
 - improves beam position stability by changing from mode A to B to C
 - works in degraded modes



4. CONCLUSION

- **The control concept:**
 - follows the design principles
 - improves beam position stability by changing from mode A to B to C
 - works in degraded modes
- **Performance and field tests**
 - Final performance characterization still limited by laser setup
 - Dynamic scans not yet implemented and tested
 - No thermal effects detectable with laser set-up





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Julien Bonnefoy
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Remi Tucoulou
ID21 – team
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Thank you for your attention!