This document describes the calculations necessary to transform a point of interest P between coordinate systems, when moving specimens between instruments. The described method is a Helmert Transformation, in two dimensions. Depending on the situation, this transformation could be used between the FB 2100 and S 4800 or vice versa, or even between different setups on the same machine, at different times.

This method requires two reference points to be created on the specimen, A and B. These could be Sharpie dots, FIB fabricated marks, or the like.

The typical use of the transformation would be:

1. Create two reference marks A and B on the specimen.
2. Use the FIB stage to move the specimen and determine the [x y] coordinates of A and B.
3. Move to your specified location(s) and fabricate the structures, recording the [x y] coordinates of each fabrication point P.
4. Move the specimen to the SEM (or to the FIB, at a later date).
5. Find the reference marks A and B, and record their [x y] coordinates.
6. Use this information along with the function described below to determine the [x y] coordinates of P, in the new system.
7. Translate the stage to the new position, and the fabrication point will be close by.

Initial coordinate system:

$[A_x\ A_y]$, $[B_x\ B_y]$, $[P_x\ P_y]$

Coordinate system to be transformed into:

$[a_x\ a_y]$, $[b_x\ b_y]$, $[p_x\ p_y]$

where $[p_x\ p_y]$ are the computed coordinates of P in the new system.

The steps in the calculation are as follows:

1. Move P such that A is at the origin:

2. Use points A and B in the two systems to determine the rotation of the systems.   is the angle between A and B in the initial system and   is the angle between A and B in the new system.

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In this construction, point