Sample Transfer & Manipulator Terminology

MANIPULATOR (X,Y,Z)
A manipulator is a 3-axis (X,Y,Z) positioning device. For most applications, the instrument hardware is mounted outside the vacuum chamber, with a welded bellows providing a flexible vacuum curtain. The X axis passes in front of the vertical, mechanical structure, or “backframe,” with the Y axis moving to and away from the backframe. The Z axis is perpendicular to the X and Y axes and moves up and down directly against the vacuum pressure differential. The polar axis is the same as the Z axis. The limit of X and Y travel is normally a circular pattern. The range is indicated as a vector sum. This means a ± .50 inch range of X and Y allows the polar axis to be moved anywhere inside a 1.00 inch diameter circle. The sum of the X and Y vectors is limited to .50 inch. Square pattern XY stages are available as options on some models.

TRANSLATOR (Z)
A translator is a single axis positioning device, utilizing a bellows as a vacuum seal. They are also referred to as a “Z only” stage. This axis is normally perpendicular to the chamber. This causes the Z axis to work directly against the force from the pressure differential.

XY STAGE
The XY stage provides the X and Y axes only. No Z motion is available.

POLAR ROTATION
The polar axis is the same as the Z axis. Rotation about the polar axis is commonly achieved by mounting a rotary feedthrough at the center of the traveling flange of a manipulator or translator. This degree of freedom can also be achieved with a differentially pumped rotary seal.

AZIMUTHAL AXIS
The azimuthal axis is perpendicular to the polar axis. Sample azimuthal rotation refers to rotation of the sample about an axis normal to the sample face and perpendicular to the polar axis.

FLIP MOTION
Flip motion is the changing of an axis normal to the sample face from parallel (or coaxial) to the polar axis to coaxial with the azimuthal axis. The range of this change of axis may be 90°, 180° or full 360°.

TILT MOTION
Tilt refers to changing the polar axis with respect to the X, Y and Z axes. This is usually done at the traveling flange of a 3-axis manipulator or other exterior mounting stage. Tilt range is often limited by the bellows ID and the OD of the probe passing through the bellows. The maximum angle practical is about ±7°. When used in this manner, translation in X, Y and (slightly) Z will occur with adjustment of the tilt angle. Tilt stages are available in single or dual axis units.