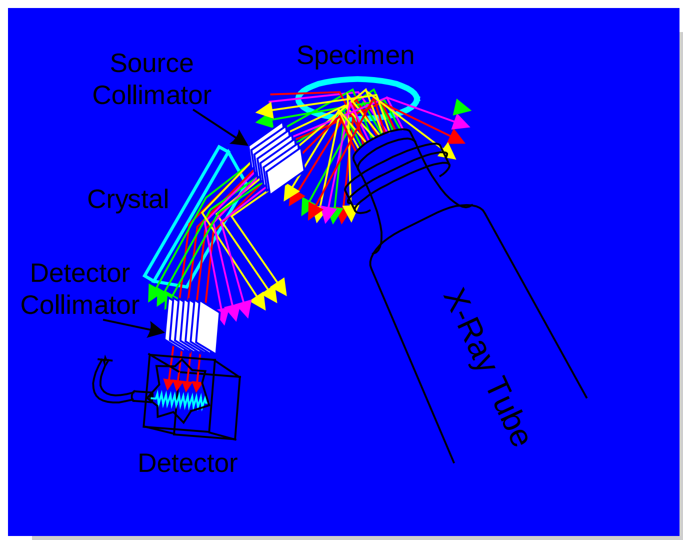
PRINCIPLE OF OPERATION

The x-ray tube directs a beam of primary radiation onto a sample of the material under analysis. The primary radiation causes the sample to emit a secondary fluorescence radiation that contains a characteristic wavelength of each element present in the sample. The characteristic line of each element represents a wavelength, which varies in a regular fashion from one element to another. The characteristic wavelengths decrease as the atomic number of the element increases.

The characteristic radiation from all of the elements present in the sample is directed through the source or divergent collimator onto a large, single crystal. The collimator, for the most part, eliminates divergence of the radiation so that a parallel beam of radiation arrives at the crystal and detector. The crystal acts as a diffraction grating, which separates the various wavelengths emitted by the elements in the sample. This reflected radiation passes through a receiving or detector collimator located in front of a gas-filled, sealed proportional detector.

The detector converts x-ray photons into electrical pulses, which are then amplified, sent to the scaler and digital display. The emitted long wavelength radiation, such as that emitted from Ti, V and Cr, are dispersed at high goniometer angles and short wavelength radiation, such as that emitted from Mo, Nb and Zr, are dispersed at lower goniometer angles.



Radiation Path
Image 4-1

By scanning through the entire angular range with the detector, the presence of each element in the sample can be detected by determining the presence of radiation at their corresponding angular position.

The intensity of each wavelength is, with suitable corrections, proportional to the amount of the corresponding element in the sample. Therefore, the intensity of radiation at each element setting, gives an indication of: 1.) Whether or not the element appears in the sample; 2.) How much of the element is present in the sample.