

Historically, fluoroscopic imaging has been utilized to visualize dynamic processes as a means to identify and diagnose diseases of the gastrointestinal tract, musculoskeletal joints, or cardiovascular system. The x-ray detector was a CsI based image intensifier and the diagnostic examination was conducted during real time fluoroscopic visualization of the patient. The record of the diagnostic findings consisted of projection images, either optically captured from the output of the image intensifier (serial photospot camera or cinefluorographic camera), or via a film-screen based image receptor (cassette or automated film changer). The fluoroscopic image consisted of analog video created by a vidicon type pickup tube, processed through a video amplifier and displayed on a Cathode Ray Tube (CRT). An automatic brightness control system sampled the light output of the image intensifier, compared the signal value with a pre-set operating point and produced a feedback signal to the generator. The x-ray generator used the feedback signal to adjust the x-ray technique factors (kV, mA, pulse width) in order to maintain output brightness as the patient thickness varied with position or angulation of the x-ray beam, or to compensate for a change in the image Field Of View (FOV). Image quality was limited by detector blur, spatial distortion, dynamic range, contrast degradation (veiling glare), and noise. Improvement in image quality usually meant a concomitant increase in patient dose.

Today, there is only a cursory resemblance in both the utilization and design of state-of-the art fluoroscopic imaging equipment, as compared with the historical model described above. Equipment design is progressively evolving as demands for better image quality are driven by the increased utilization of interventional techniques to treat visceral, cardiac and vascular disease without surgical intervention. This course will describe the individual components, functions and design parameters associated with modern fluoroscopic imaging systems utilized for diagnosis and interventional treatment of disease. Emphasis will be placed on the current utilization of fluoroscopy for interventional procedures, and how improvements in the design of fluoroscopic imaging systems have contributed to an improvement in both functional performance and image quality.

State-of-the-art image acquisition methods, including pulsed fluoroscopy, last image hold, fluoroscopy store, reference image capture, roadmap, landmarking, digital acquisition, digital subtraction, pixel shift, digital cine, bolus chase/stepping, rotational angiography, and 3D reconstruction techniques will be described. An introduction to the common user selectable post-processing image enhancement features provided with these systems will be included.

Educational Objectives:

1. To provide a basic understanding of the fluoroscopic imaging system design and function.
2. To identify and describe equipment features associated with x-ray production, image capture, image processing, image display, and image storage.
3. To show how equipment design changes have impacted the way fluoroscopic systems are utilized for diagnostic and interventional procedures.