What is claimed is:

1. A pulse illumination imaging system comprising:

an image sensor having a plurality of light sensitive pixel elements that are activatable for a designated exposure time to capture one or more images of a field of view of the image sensor;

a light source; and

a controller configured to:

determine an activation time to activate the image sensor based on motion of a target element relative to the image sensor;

activate the image sensor at the activation time; and

activate the light source during the designated exposure time of the image sensor to produce a pulse having a preconfigured time duration that is less than the designated exposure time of the image sensor.

2. The system of claim 1, wherein the activation time includes a repeating frame rate for activating the image sensor, and where the controller is configured to periodically pulse the light source in sync relative to the frame rate and the motion of the target element.

3. The system of claim 1, wherein the controller is further configured to synchronize the activation of the light source with a vertical blanking time of the image sensor so as to capture the target element entirely within a single one of the one or more images.

4. The system of claim 1, wherein the preconfigured time duration is determined as a function of a static resolution of a camera that includes the image sensor and a known maximum speed of the motion of the target element relative to the image sensor.

5. The system of claim 1, wherein the designated exposure time is in a range of between 4 milliseconds and 64 milliseconds and the preconfigured time duration is in a range of between 0.1 milliseconds and 4 milliseconds.

6. The system of claim 1, further comprising a sensor configured to transmit a detection signal to the controller when the sensor detects movement within a sensing region of the sensor.

7. The system of claim 6, wherein the movement the controller is configured to use to determine the activation time includes a known revolutions per minute of the target element, and wherein the controller is configured to determine a time delay from receipt of the detection signal based on the known revolutions per minute associated with the target element and activate the light source following the time delay.

8. The system of claim 6, wherein the target element includes one or more airfoils within multiple stages of an engine, and wherein the sensor is configured to detect movement relative to a single common reference point for each of the multiple stages.

9. The system of claim 1, wherein the motion the controller is configured to use to determine the activation time includes a known frequency and duration of a repeating and periodic movement of the target element relative to the image sensor, wherein the controller is configured to activate the light source based on a time delay as measured relative to activation of the image sensor and initiation of the repeating and periodic movement of the target element.

10. A method for inspecting a target element, the method comprising:

determining an activation time to activate an image sensor based on motion of a target element relative to the image sensor;

activating, at the activation time, a plurality of light sensitive pixel elements of the image sensor for a designated exposure time to capture one or more images of a field of view of the image sensor; and

activating a light source during the designated exposure time of the image sensor to produce a pulse having a preconfigured time duration that is less than the designated exposure time of the image sensor.

11. The method of claim 10, further comprising synchronizing the activation of the light source with a vertical blanking time of the image sensor so as to capture the target element entirely within a single one of the one or more images.

12. The method of claim 10, further comprising determining the preconfigured time duration as a function of a static resolution of a camera that includes the image sensor and a known maximum speed of the motion of the target element relative to the image sensor.

13. The method of claim 10, further comprising:

detecting motion within a sensing region of a sensor;

receiving a detection signal from the sensor responsive to the detecting; and

activating the light source after a time delay following receipt of the detection signal.

14. The method of claim 10, further comprising:

receiving a known frequency and duration of a repeating and periodic movement of the target element;

determining the activation time from the known frequency and duration of the repeating and periodic movement;

determining a time delay for activating the light source as measured relative to activation of the image sensor and initiation of the repeating and periodic movement of the target element; and

activating the light source after the time delay.

15. The method of claim 10, further comprising combining adjacent ones of the one or more images to generate a single composite image of the target element.