direction. This produces another set of a plurality of scans, displaced from the first set of scans in the x direction.

[0030] Referring to both **FIGS. 4 and 5**, an alignment system **72** facilitates aligning workpiece **22** with respect to tool **24**. Alignment is determined as a function of a circumference of fiducials present on workpiece **22**, which is described in greater detail below with respect to **FIG. 15**. Referring again to both **FIGS. 4 and 5**, two fiducials are shown as **74**. To that end, alignment system **72** includes an optical detector **72***a* and a laser range finder **72***b*. In signal communication with both detector **72***a* and laser range finder **72***b* is processing electronics **76**. Processing electronics **76** receives signals from either detector **72***a* or laser range finder **72***b* and produces signals that may be processed by processor **34**, which is in data communication therewith. With this arrangement, proper alignment between workpiece **22** and tool **24** may be ensured, thereby facilitating precisely registering an image, written by tool **24**, with respect to workpiece **22**.

[0031] Alignment system **72** cooperates with an illumination source, shown by dashed lines **78**, to overcome a problem concerning reflection of electromagnetic radiation. Referring to **FIG. 6, a** problem was found in that light was reflected from fiducials **74** that hinders calculation of an accurate circumference of the same and, therefore, aligning workpiece **22** with tool **24**.

[0032] Before a pattern is imaged on workpiece **22**, a photo-sensitive layer **80** is disposed thereon. Also a layer of mylar **82** may be disposed on workpiece **22** to facilitate patterning of photo-sensitive layer **80**. A portion of photo-sensitive layer **80** and mylar **82** often covers one or more of fiducials **74**, creating what is referred to as a tented fiducial **84**. As a result, electromagnetic radiation impinging thereon creates artifacts that are sensed by detector **72***a*, when employing standard illumination techniques.

[0033] Referring to **FIGS. 5, 6** and **7**, were top-down-dark-field illumination employed, a pattern **84***a* sensed by detector **72***a* includes artifacts **86** that are reflections from the uneven surface of tented fiducial **84**. Artifacts **86***a* are bright regions, with surrounding regions **86***b* of pattern **84***a* being dark. As a result, determining the circumference of fiducial **74** is greatly hindered. Artifacts **86***a* define optical contrasting regions that hinder accurate determination of a fiducial circumference, because the width, w, of each of artifacts **86***a* may define a circumference that may vary ±w. Thus, the circumference may be out of tolerance, resulting in fiducial **84** not being identified.

[0034] Referring to **FIGS. 5 and 8**, an analogous problem exists were top-down-bright-field illumination employed. A pattern **84***b* sensed by detector **72***a* employing top-down-bright-field illumination includes artifacts that are characterized as bright concentric rings **90***a*. Regions **90***b* surrounding rings **90***a* are dark. Determining the accurate circumference of pattern **84***b* is hindered by the difficulty in determining which of the rings define the circumference thereof.

[0035] To overcome this drawback, the present invention employs backlighting of fiducials **74** with sufficient electromagnetic flux impinging upon detector **72***a* to ensure any artifacts present in fiducials **74** are not sensed. As shown in **FIG. 9**, illumination source **78** emits electromagnetic radiation **94** in the form of light that impinges upon fiducials **74**. A sub-portion of radiation **94** passes through fiducials **74**, and emerges therefrom as an emergent flux **96**. Detector **72***a* senses the irradiance (watts/m^2) of emergent flux **96** impinging thereupon and produces signals in response thereto that include information corresponding to one of fiducials **74**. Processor **34** identifies the edge of emergent flux **96** by finding optically contrasting regions sensed by detector **72***a*. A boundary, typically annular in shape, is fitted to the shape of the edge identified by processor **34**.

[0036] Referring to **FIG. 9**, artifacts produced by radiation **94** may be characterized as points **98** of dispersive radiation shown as rays **98***a* and **98***b*. The total power associated with rays **98***a* and **98***b* defines a radiant flux (watts). A sub-portion of the radiant flux, i.e., rays **98***b*, falls within the detection area of detector **72***a*, referred to as dispersive rays, while the remaining portion of the radiant flux, i.e., rays **98***a*, falls outside of the detection area, referred to as scattered rays. Thus, a component of emergent flux **96** includes dispersive rays **98***b* and, therefore, information corresponding to the artifacts. The power per unit area of dispersive rays **98***b* impinging upon detector **72***a* defines an irradiance. The remaining component of emergent flux **96** comprises the undispersed radiation, which includes information corresponding to fiducial **74**. The power per unit area of the undispersed radiation defines an irradiance. However, radiation **94** is provided with sufficient power to ensure that the irradiance associated with the undispersed radiation is greater than the irradiance associated with dispersive rays **98***b*. Specifically, the relative irradiance between the undispersed radiation and dispersive rays **98***b* is such that the total irradiance sensed by detector **72***a* is substantially uniform across the detection area. In this manner, information corresponding to artifacts is attenuated and the irradiance sensed by detector **72***a* corresponds to electromagnetic radiation with substantially all the information contained therein corresponding to fiducial **74**.

[0037] Referring to **FIG. 10**, an additional benefit provided by the present invention is that problems regarding misalignment of the features of fiducial **74** may be overcome. Specifically, as shown, often both sides of workpiece **22** are patterned, i.e., photo-sensitive material **80** and mylar **82** may be disposed on both sides. This requires proper alignment with respect to a common fiducial to ensure that the pattern on one side of the workpiece is registered properly with respect to the pattern on the opposing side. To that end, fiducial **74** is usually formed as a throughway extending between opposing sides of workpiece **22**. The opposed ends of fiducial **74** terminate in an orifice, shown as **74***a* and **74***b*. However, fiducial **74** is formed by drilling or punching through workpiece **22**. The drilling process often does not produce a perfectly cylindrical fiducial. As a result, orifices **74***a* and **74***b* disposed on opposing ends of fiducial **74** may not be centered on a common axis, shown as **100**. Were top-down illumination employed, the circumference of the fiducial sensed by detector **72***a*, which is defined, for example, by orifice **74***a*, would be offset with respect to the circumference of fiducial **74**, defined by orifice **74***b*. This situation hinders properly aligning the pattern on one side of workpiece **22** with respect to a pattern on the opposing side. The magnitude and position of the circumference of fiducial **74** is dependent of the side of workpiece **22** facing detector **72***a*.