CLAIMS:

1. A lithographic apparatus, comprising:

a programmable patterning device, configured to provide a plurality of radiation beams;

a projection system, configured to project the plurality of radiation beams onto a substrate to form respective spots of radiation, the substrate being supported by a substrate table, wherein the target is elongate and comprises a plurality of the measurement targets, distributed along the target in its elongate direction, and ~~wherein~~ the said target is in or on the substrate table; and

a radiation spot measurement system, comprising:

a target, onto which the spots of radiation may be projected for a spot measurement process, the target comprising a reflective measurement target;

a radiation detector mounted to the projection system, configured to detect radiation from one of the spots of radiation that has been projected onto the measurement target; and

a controller, configured to receive information from the radiation detector and, based on the information, to determine at least the position of the spot of radiation relative to an intended position of the spot of radiation on the target in a plane substantially parallel to an upper surface of the target.

2. ~~The lithographic apparatus according to claim 1, wherein the target is elongate and comprises a plurality of the measurement targets, distributed along the target in its elongate direction.~~

2~~3~~. The lithographic apparatus according to ~~any of the preceding~~ claim~~s~~ 1, comprising an actuator system configured to control the position of the radiation detector relative to the target such that, at different respective positions, it can detect radiation that has been projected onto different measurement targets on the target.

4~~3~~. The lithographic apparatus according to claim 2~~3~~, wherein the target further comprises a radiation detector alignment marker; and the lithographic apparatus comprises a radiation detector alignment marker inspection system configured to inspect the radiation detector alignment marker and determine the position of the radiation detector relative to the target based on the inspection of the radiation detector alignment marker.

45. The lithographic apparatus according to any of the preceding claims, wherein the projection system comprises a moveable optical element and is configured such that, for a given position of a substrate or the target relative to the projection system, it can project each spot of radiation onto a plurality of locations on the substrate or target during the formation of an image on the substrate or the performance of a spot measurement process, respectively.

56. The lithographic apparatus according to claim 45, wherein the target, radiation detector and controller are configured to determine for a plurality of the locations, the position of the spot of radiation on the target relative to the corresponding intended position of the spot of radiation.

67. The lithographic apparatus according to any of the preceding claims, wherein the projection system comprises a plurality of units, each to project a plurality of beams of radiation onto a substrate to form respective spots of radiation;

each of the units comprises a moveable optical element and is configured such that, for a given position of a substrate or target relative to the projection system, it can project each spot of radiation onto a plurality of locations on the substrate or target during the formation of an image on the substrate or the performance of a spot measurement process, respectively; and

the lithographic apparatus comprises a respective radiation detector associated with each of the units of the projection system, each configured to detect radiation from a spot of radiation from the corresponding unit that has been projected onto a measurement target.

78. The lithographic apparatus according to any of the preceding claims, wherein the measurement target comprises a window to permit an image of the spot of radiation to be directed to the radiation detector when the spot is projected onto the window;

the radiation detector comprises an image sensor configured to acquire an image that includes an image of the spot of radiation; and

the controller is configured to determine the position of the spot of radiation relative to an intended position of the spot of radiation based on the position of the image of the spot of radiation in the field of view of the image sensor.

89. The lithographic apparatus according to claim 78 when dependent on claim 34, wherein the image acquired by the image sensor includes an image of the radiation detector alignment marker.

910. The lithographic apparatus according to claim 78 or claim 89, wherein the controller is configured to determine the shape of the spot of radiation based on the image of the spot of radiation acquired by the image sensor.

10~~11~~. The lithographic apparatus according to any of claims 1 to 6~~7~~, wherein:

the measurement target comprises first, second and third sections, the first and third sections each comprise a grating and the second section comprises a window configured to permit the spot of radiation to be directed to the radiation detector;

the lithographic apparatus is configured such that the spot of radiation is projected onto the measurement target such that it scans across the first, second and third sections;

the radiation detector comprises a radiation intensity sensor configured to detect the intensity of radiation from the spot directed to the radiation detector from the measurement target; and

the controller is configured to control the programmable patterning device such that the beam of radiation providing the spot of radiation has a substantially constant intensity when it scans across the first and third sections and has a varying intensity at a reference position when the spot of radiation scans across the second section, and to determine the position of the spot of radiation based on the timing and/or phase of first, second and third signals from the radiation detector that correspond to the spot of radiation being projected onto the first, second and third sections respectively.

11~~12~~. The lithographic apparatus according to any of claims 1 to 6~~7~~, wherein:

the measurement target comprises a plurality of sections, each section comprising a respective grating;

the lithographic apparatus is configured such that the spot of radiation is projected onto the measurement target such that it scans across the sections of the measurement target;

the radiation detector comprises a radiation intensity sensor configured to detect the intensity of radiation from the spot directed to the radiation detector from the measurement target;

the controller is configured to control the programmable patterning device such that the beam of radiation providing the spot of radiation has a varying intensity at a substantially constant frequency at the point at which it is projected onto the target; and

the controller is configured to determine the position of the spot of radiation relative to an intended position of the spot of radiation based on respective signals from the radiation detector corresponding to the spot of radiation being projected at the plurality of sections of the measurement target.

12~~13~~. The lithographic apparatus according to any of claims 1 to 6~~7~~, wherein:

the lithographic apparatus is configured such that the spot of radiation is projected onto the measurement target such that it is scanned across the measurement target;

the target comprises a slit configured to select a fraction of the area of the spot of radiation such that the fraction is directed to the radiation detector for each position of the spot of radiation relative to the measurement target; and

the radiation detector comprises a radiation intensity sensor to detect the intensity of radiation from the spot directed to the radiation detector from the measurement target.

13~~14~~. The lithographic apparatus according to claim 12~~13~~, wherein the measurement target comprises at least first and second slits arranged such that, as the spot of radiation scans across the measurement target, it successively scans across each of the slits; and the first and second slits are arranged at respective different oblique angles to the direction of scanning of the spot of radiation across the target.

14~~15~~. A method for measuring a radiation beam spot position in a lithographic apparatus that comprises a programmable patterning device to provide a plurality of radiation beams and a projection system to project the plurality of radiation beams onto a substrate to form respective spots of radiation. The substrate is supported by a substrate table, wherein the target is elongate and comprises a plurality of the measurement targets, distributed along the target in its elongate direction, and ~~wherein~~ the said target is in or on the substrate table, the method comprising:

projecting the spots of radiation onto a target comprising a reflective measurement target;

using a radiation detector mounted to the projection system to detect radiation from one of the spots of radiation that has been projected onto the measurement target; and

determining at least the position of the spot of radiation relative to an intended position of the spot of radiation in a plane substantially parallel to an upper surface of the target based on information from the radiation detector.

15~~16~~. A radiation detector system for a lithographic apparatus that comprises a programmable patterning device to provide a plurality of radiation beams and a projection system to project the plurality of radiation beams onto a substrate to form respective spots of radiation. The substrate is supported by a substrate table, wherein the target is elongate and comprises a plurality of the

measurement targets, distributed along the target in its elongate direction, and the said target is in or on the substrate table, the system, comprising:

a radiation detector mounted to the projection system configured to detect radiation;

a substrate table configured to support a substrate, wherein the radiation detector is in or on the substrate table;

a radiation detector alignment marker spatially fixed in relation to the substrate table or in relation to the radiation detector;

a radiation detector alignment marker inspection system comprises an illumination system configured to illuminate, to inspect the radiation detector alignment marker and determine the position of the radiation detector relative to the substrate table or an object fixed to the substrate table based on the inspection of the radiation detector alignment marker; and

an actuator system configured to control the position of the radiation detector relative to the substrate table or the object fixed to the substrate table, such that the radiation detector can detect radiation at different positions.

16. The radiation detector system according to claim 14 or claim 15, wherein the radiation detector alignment marker inspection system comprises an illumination detector configured to detect radiation coming from the radiation detector alignment marker when illuminated.

17. A lithographic apparatus comprising the radiation detector system according to claim 14 to claim 15.