

WHAT IS CLAIMED IS:

1. A system for detecting a status of a pocket of a tray, the system comprising:
 - a tray comprising a plurality of pockets, each of the plurality of pockets being configured to hold an integrated circuit device;
 - a vision mechanism configured to image the tray along a first optical axis;
 - a light line generator configured to emit a light line along a second optical axis;
 - a reflective device configured to reflect the light line onto the tray along a third optical axis, the third optical axis having a different angle relative to the first optical axis than an angle between the first optical axis and the second optical axis; and
 - a controller configured to:
 - receive an image of the tray from the vision mechanism;
 - detect the light line reflected onto the tray along the third optical axis; and
 - determine a status of a pocket based on the detected light line along the third optical axis.
2. The system of claim 1, wherein the plurality of pockets is arranged in a plurality of rows and a plurality of columns and the light line along the third optical axis is reflected along a row of the plurality of rows.
3. The system of claim 2, wherein the tray further comprises a first outer protrusion provided at a first end of the plurality of rows and a second outer protrusion provided at a second end of the plurality of rows, the first and second outer protrusions being formed along a length of the plurality of columns.
4. The system of claim 3, wherein the controller is further configured to:
 - detect the light line along the third optical axis reflected onto the first outer protrusion and the second outer protrusion;
 - detect the light line along the third optical axis reflected onto a surface of the pocket;
 - calculate an offset between the detected light line on the first outer protrusion and the second outer protrusion and the detected light line on the surface of the pocket; and
 - determine the status of the pocket based on the calculated offset.

5. The system of claim 4, wherein the controller is further configured to:
 - set an upper limit position of the light line along the third optical axis reflected on the surface of the pocket;
 - set a lower limit position of the light line along the third optical axis reflected on the surface of the pocket; and
 - detect a shift of the light line along the third optical axis, the status of the pocket being determined based on the detected shift.
6. The system of claim 3,
 - wherein the first outer protrusion and the second outer protrusion are provided with at least one notch such that at least one row of the plurality of rows comprises the at least one notch at an end of the at least one row, and
 - wherein the controller is further configured to:
 - interpolate a position of the light line along the third optical axis reflected onto the at least one notch based on one or more positions of the detected light line along the third optical axis reflected onto the first outer protrusion or the second outer protrusion of one or more rows adjacent to the at least one row.
7. The system of claim 6, wherein the controller is configured to interpolate the position of the light line along the third optical axis reflected onto the at least one notch based on an average of a first position of the detected light line along the third optical axis reflected onto the first outer protrusion or the second outer protrusion of a first adjacent row and a second position of the detected light line along the third optical axis reflected onto the first outer protrusion or the second outer protrusion of a second adjacent row.
8. The system of claim 1, wherein the status of the pocket is one of an integrated device properly placed in the pocket, a stack of two or more integrated devices placed in the pocket, an integrated device partially placed in the pocket, or an empty pocket.
9. The system of claim 1, wherein the light line generator is a laser.
10. The system of claim 1, wherein the second optical axis is substantially parallel to the first optical axis.

11. The system of claim 10, wherein the first optical axis and the second optical axis are substantially orthogonal to an upper surface of the tray.
12. The system of claim 11, wherein the third optical axis is offset from the first optical axis by an angle of about 35 degrees to about 55 degrees.
13. The system of claim 11, wherein the third optical axis is offset from the first optical axis by an angle of 45 degrees.
14. The system of claim 9, wherein the laser is mounted to the vision mechanism.
15. The system of claim 8, wherein the laser is mounted to a pick-and-place device configured to place a plurality of integrated circuit devices into the plurality of pockets of the tray, and wherein the reflective device is configured to reflect the light line onto the tray along the third optical axis such that the space required to mount the laser to the pick-and-place device is reduced.
16. The system of claim 1, wherein the tray is a JEDEC tray.
17. A method for detecting a status of a pocket of a tray comprising:
 - providing a tray comprising a plurality of pockets, each of the plurality of pockets being configured to hold an integrated circuit device;
 - providing a vision mechanism configured to image the tray along a first optical axis;
 - emitting a light line along a second optical axis;
 - reflecting the light line onto the tray along a third optical axis, the third optical axis having a different angle relative to the first optical axis than an angle between the first optical axis and the second optical axis;
 - receiving at a controller an image of the tray from the vision mechanism;
 - detecting the light line reflected onto the tray along the third optical axis; and
 - determining a status of a pocket based on the detected light line along the third optical axis.
18. The method of claim 17, further comprising:

setting an upper limit position of the light line reflected along the third optical axis projected onto the pocket; and

setting a lower limit position of the light line reflected along the third optical axis projected onto the pocket;

wherein the step of determining a status of a pocket comprises detecting a shift of the light line reflected along the third optical axis.

19. The method of claim 17, wherein the third optical axis is offset from the second optical axis by an angle of about 35 degrees to about 55 degrees.

20. The method of claim 17, wherein the second optical axis is substantially orthogonal to an upper surface of the tray.

21. The method of claim 17, wherein the tray comprises a plurality of rows and a plurality of columns, and the light line having the third optical axis is reflected along a row of the plurality of rows.

22. The method of claim 21,

wherein the step of reflecting the light line onto the tray along a third optical axis comprises reflecting a light line having the third optical axis along a first row of the plurality of rows,

wherein the step of detecting the light line reflected onto the tray along the third optical axis comprises detecting the light line having the third optical axis along the first row,

wherein the step of determining a status of a pocket comprises determining a status of each of the plurality of pockets in the first row based on the detected light line reflected along the first row, and

wherein the steps of reflecting the light line, detecting the light line, and determining a status of a pocket are repeated for each row of the plurality of rows.

23. The method of claim 21, wherein the tray further comprises a first outer protrusion disposed at a first end of the plurality of rows and a second outer protrusion disposed at a second end of the plurality of rows, the first and second outer protrusions extending along a length of the plurality of columns.

24. The method of claim 23,
wherein the step of detecting the light line reflected onto the tray comprises detecting the light line reflected along the third optical axis projected onto the first outer protrusion and the second outer protrusion; and
wherein the step of determining a status of a pocket comprises calculating an offset between the detected light line on the first outer protrusion and the second outer protrusion and the detected light line on the pocket.