CLAIMS:

1. A system for detecting and identifying at least one predetermined foreign element in a substance, the system comprising:

a measurement device comprising: a radiation source assembly comprising at least one source of X-ray radiation or Gamma-ray radiation, each source of the at least one source being configured to generate X-ray radiation or Gamma-ray radiation having predetermined properties and a predetermined solid angle of radiation emission to excite a portion of the substance located in a region within ~~said~~the predetermined solid angle of radiation emission to cause an X-ray response of ~~said~~the portion of the substance; a radiation detection assembly comprising at least one detector having a solid angle of radiation detection overlapping with ~~said~~the predetermined solid angle of radiation emission, each detector of the at least one detector being configured and operable to detect an X-ray radiation propagating within a solid angle of radiation detection and generate measured data indicative of the ~~detected~~ X-ray response~~;~~ of the ~~measurement device being configured and operable such that~~ portion of the ~~X-ray radiation being detected during~~substance, including a relative displacement between the substance and at least one of the radiation source assembly and the radiation detection assembly along a movement path; the measurement device being configured and operable such that the measured data is indicative of a time variation of the X-ray response of the portion of the substance; ~~and~~

a flow line arrangement comprising a translation assembly configured and operable for translating at least one of the radiation source assembly and the radiation detection assembly with respect to the movement path; and

a control unit configured and operable for a data communication with ~~said~~the radiation detection assembly to receive and analyze the ~~detection~~measured data, the control unit comprising a signal processor configured and operable to identify in ~~said~~the measured data a pattern of a signal variation over time indicative of a location of at least one foreign element carrying an X-ray responsive marker in ~~said~~the substance.

2. The system according to claim 1, wherein ~~said~~the movement path passes through a vicinity of an overlap region between the solid angle of radiation detection and the predetermined solid angle of radiation emission.

3. The system according to claim 1 ~~or 2, comprising a~~, wherein the flow line arrangement ~~comprising~~further comprises a support platform for supporting the substance and moving the

substance with respect to the at least one of the radiation source assembly and the radiation detection assembly.

~~**4.** The system according to any one of claims 1 to 3, comprising a flow lines arrangement comprising a translation assembly configured and operable for translating at least one of the radiation source assembly and radiation detection assembly with respect to said movement path.~~

~~**5.**~~**4.** The system according to claim ~~4~~1, wherein the translation assembly is configured and operable for translating both the radiation source assembly and the radiation detection assembly with respect to the movement path.

~~**6.**~~**5.** The system according to claim ~~5~~4, wherein the translation assembly is configured and operable for simultaneously translating the radiation source assembly and the radiation detection assembly such that ~~their~~the predetermined solid angle~~s~~ of radiation emission and the solid angle of radiation detection are oriented towards two opposite lateral sides of the movement path.

~~**7.**~~**6.** The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein ~~said~~the radiation source assembly and the radiation detection assembly are oriented with respect to the movement path such that ~~said~~the predetermined solid angle~~s~~ of radiation emission and the solid angle of radiation detection oppose a direction of a movement of the substance along ~~said~~the movement path, such that when the substance moves through ~~the~~an overlap region a distance between the substance and each of the radiation source assembly and ~~detector~~ the radiation detection assembly is being reduced.

~~**8.**~~**7.** The system according to claim ~~7~~6, wherein ~~said~~the pattern of the signal variation over time indicative of the location of the at least one foreign element carrying the X-ray responsive marker in the substance is characterized by a non-symmetric characteristic signal peak indicative of ~~said~~the location of the at least one foreign element ~~and~~ carrying the X-ray responsive marker in the substance, the non-symmetric characteristic signal peak having a moderate ~~rise of the~~ signal intensity rise when ~~said~~the distance between the substance and each of the radiation source assembly and the radiation detection assembly is being reduced, and a~~n~~ sharp signal intensity fall when ~~said~~the location of ~~said~~the at least one foreign element carrying the X-ray responsive marker in the substance exits ~~said~~the overlap region, thereby enabling to accurately identify the location of ~~said~~the at least one foreign element carrying the X-ray responsive marker in the substance along at least one dimension.

~~**9.**~~**8.** The system according to claim ~~8~~7, wherein the signal processor is configured and operable to integrate the measured data indicative of the X-ray response of the portion of the

substance being detected over time, while ~~said~~the at least one foreign element is being moved through the overlap region, thereby emphasizing the non-symmetric characteristic ~~of the~~ signal peak.

~~10.~~9. The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein ~~said~~the movement path is a substantially linear path.

~~11.~~10. The system according to ~~any one of~~ claim~~s~~ 1~~ to 9~~, wherein ~~said~~the movement path has a curvilinear path having at least one curved portion aligned with a boundary of ~~said~~an overlap region.

~~12.~~11. The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein ~~said~~the radiation source assembly and ~~said~~the radiation detection assembly are accommodated at opposite lateral sides of ~~said~~the movement path, thereby yielding a reduced variation in a detected signal intensity of the X-ray response of ~~a responding foreign element~~the portion of the substance, irrespective of a lateral location of the ~~responding~~at least one foreign element carrying the X-ray responsive marker in ~~a bulk of said~~ the substance while in ~~said~~an overlap region.

~~13.~~12. The system according to claim ~~12~~11, wherein the ~~accommodation is~~radiation source assembly and the radiation detection assembly are accommodated at opposite lateral sides of the movement path such that the ~~exciting~~ X-ray radiation or Gamma-ray radiation and the X-ray response of the portion of the substance being detected vary with a distance from the radiation source assembly and the radiation ~~detector~~ detection assembly.

~~14.~~13. The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein the signal processor is configured and operable to identify ~~said~~the at least one foreign element carrying the X-ray responsive marker in the substance by analyzing the ~~detected~~ X-ray response ~~signal~~of the portion of the substance over a database storing X-ray signatures corresponding to multiple known X-ray responsive markers.

~~15.~~14. The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein ~~said~~the at least one foreign element carrying the X-ray responsive marker in the substance to be identified comprises one or more plastic elements carrying one or more X-ray responsive markers.

~~16.~~15. The system according to claim ~~15~~14, wherein the signal processor is configured and operable to process ~~said~~the measured data and generate data indicative of a quantity of the one or more plastic elements within at least a portion of the substance.

~~**17.**~~**16.** The system according to ~~any one of the preceding~~ claim~~s~~ 1, wherein ~~said~~the at least one source of X-ray radiation ~~source assembly~~ or Gamma-ray radiation comprises at least two sources of ~~the~~ X-ray radiation or Gamma-ray radiation, each of ~~said~~the at least two sources having the predetermined solid angle of radiation emission oriented with respect to the movement path to irradiate a different side surface of the substance, and ~~said~~the solid angle of radiation detection ~~assembly comprises~~ of the at least one ~~X-ray~~ detector ~~with the solid angle of detection~~ oriented to detect the X-ray ~~response signals~~ radiation propagating from a top surface of the substance.

~~**18.**~~**17.** The system according to ~~any one of~~ claim~~s~~ 1 ~~to 16~~, wherein the ~~detection assembly~~ at least one detector comprises at least two detectors ~~whose~~having solid angles of radiation detection are oriented with respect to the movement path to ~~receive~~detect the X-ray ~~response signals~~ radiation propagating from two opposite side surfaces of the substance, and the predetermined solid angle of radiation emission of ~~said~~the at least one source of ~~the~~ X-ray radiation or Gamma-ray radiation is oriented to irradiate a top surface of the substance.

~~**19.**~~**18.** The system ~~of any one of the previous~~ according to claim~~s~~ 1, wherein the radiation source assembly and the radiation detection assembly are accommodated with respect to the movement path such that the predetermined solid angle~~s~~ of radiation emission and the solid angle of radiation detection are oriented towards two different surfaces of the substance.

~~**20.** The system of any one of claims 11 to 19, wherein said curvilinear movement path is located inside a pipe band.~~

~~**21.** A method for inspecting a substance to detect and identify at least one predetermined foreign element in the substance, the method comprising:~~

~~providing a relative displacement between a substance being inspected and an inspection zone, defined by an overlap region between a solid angle of emission of a source of X-ray or Gamma-ray radiation and a solid angle of detection of X-ray radiation detector, along a predetermined movement path, such that during the substance movement along said movement path, the detected X-ray radiation includes X-ray response signals from successive portions of the substance propagating towards, through, and out of said overlap region; and~~

~~receiving and analyzing the X-ray response signals to identify, in said detected X-ray radiation, a pattern of a signal variation over time indicative of a location of at least one foreign element carrying an X-ray responsive marker in said substance.~~

22. The method according to claim 21, wherein said substance is located on a support platform moving the substance with respect to the at least one of the solid angle of emission and solid angle of detection.

23. The method according to claim 21 to 22, wherein at least one of a radiation source assembly and radiation detection assembly, providing said solid angle of emission and solid angle of detection, respectively, are translated with respect to said movement path.

24. The method of claim 23, wherein both the radiation source assembly and the detection assembly are translated with respect to the movement path.

25. The method according to claim 25, wherein the radiation source assembly and the detection assembly are simultaneously translated, such that the solid angles of emission and detection are oriented towards two opposite lateral sides of the substance located on the movement path.

26. The method according to any one of claims 21 to 25, wherein said solid angles of radiation emission and detection are oriented to oppose a direction of movement of the substance along said movement path, such that when the substance moves through the overlap region a distance between the substance and a radiation source assembly and radiation detection assembly, providing said solid angle of emission and solid angle of detection, respectively, is being reduced.

27. The method according to claim 26, wherein said pattern of the signal variation over time is characterized by a non-symmetric characteristic signal peak indicative of said location of the at least one foreign element and having a moderate rise of the signal intensity when said distance is being reduced and an sharp intensity fall when said location of said at least one foreign element exits said overlap region, thereby enabling to accurately identify the location of said at least one foreign element along at least one dimension.

28. The method according to claim 27, wherein said analyzing of the X-ray response signals comprises integrating the X-ray response being detected over time while said location of the foreign element is being moved through the overlap region, thereby emphasizing the non-symmetric characteristic of the signal peak.

29. The method according to any one of claims 21 to 28, wherein said movement path is a substantially linear path.

30. The method according to any one of claims 21 to 28, wherein said movement path has a curvilinear path having at least one curved portion aligned with a boundary of said overlap region.

31. The method according to any one of claims 21 to 30, wherein said solid angles of radiation emission and detection are oriented towards opposite lateral sides of said substance, thereby yielding reduced variation in detected signal intensity of the X-ray response of a responding foreign element, irrespective of a lateral location of the responding foreign element in a bulk of said substance while in said overlap region.

32. The method according to claim 31, wherein the orientation is such that the exciting radiation and the X-ray response being detected vary with a distance from radiation source assembly and radiation detection assembly, providing said solid angle of emission and solid angle of detection, respectively.

33. The method according to any one of claims 21 to 32, wherein said analyzing of the X-ray response signals comprises to identify said at least one foreign element comprises utilizing prestored X-ray signatures corresponding to multiple known X-ray responsive markers.

34. The method according to any one of claims 21 to 33, wherein said at least one foreign element to be identified comprises one or more plastic elements carrying one or more X-ray responsive markers.

35. The method according to claim 34, wherein said analyzing of the X-ray response signals comprises determining data indicative of quantity of plastic elements within at least a portion of the substance.

36. The method according to claim 34 or 35, wherein said substance is a bale or package of crop.

37. The method according to any one of claims 21 to 36, wherein the substance moves along a pipe-band defining a curvilinear movement path thereinside.