efficient ion accumulation of the IFT with techniques such as multiplexing, traditional limitations of the IMS duty cycle can be effectively circumvented and ion utilization efficiencies of >50% can be realized.

[0046] While exemplary embodiments of the present invention have been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its true scope and broader aspects. The appended claims are therefore intended to cover all such changes and modifications as fall within the spirit and scope of the invention.

SEQUENCE LISTING

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<213> ORGANISM: Homo sapiens

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1 5

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<400> SEQUENCE: 2

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We claim:

1. A system for ion analysis characterized by an ion trap, said ion trap comprises:

an inlet portion defined by electrodes that diverges ions in an ion beam introduced thereto to expand same;

a trapping portion defined by electrodes that are operatively coupled to said inlet portion that traps and accumulates a preselected quantity of said ions received from said inlet portion therein, said trapping portion includes a first grid that controls entry of said ions from said inlet portion and at least one second grid that controls outflow of a preselected ion therefrom; and

an outlet portion defined by electrodes that are operatively coupled to said trapping portion that converges said preselected ions released from said trapping portion.

2. The system of claim **1**, wherein each of said electrodes of said ion trap has an inner geometry that is symmetric in the X plane, the Y plane, and/or the X/Y plane with respect to the Z-axis of said ion trap.

3. The system of claim **1**, wherein each electrode of said ion trap includes an rf-potential that is phase shifted 180 degrees from a subsequent electrode in said ion trap.

4. The system of claim **1**, wherein said electrodes of said inlet portion are a series of axially aligned concentric ring electrodes that define an ion flow path, each of said electrodes in said series has an inner geometry perimeter that is equal to, or greater than, an electrode preceding it in said series.

5. The system of claim **4**, wherein said series of electrodes includes a first electrode that couples said inlet portion to a conductance limit of a preceding ion stage.

6. The system of claim **5**, wherein said preceding ion stage includes an electrodynamic ion funnel.

7. The system of claim **1**, wherein said electrodes of said trapping portion are a series of axially aligned concentric ring electrodes, each of said electrodes in said series has an inner geometry perimeter that is equal to, smaller than, or greater than, an electrode preceding it in said series that provide for accumulation of said preselected quantity of said ions therein.

8. The system of claim **7**, wherein said trapping portion includes one or more trap gradient controls.

9. The system of claim **8**, wherein said one or more trap gradient controls couple to a DC-electrode positioned adjacent to and/or following said first grid, and a DC electrode positioned adjacent to and/or prior to at least one of said at least one second grids, said trap gradient controls provide preselected DC-potentials to said DC-electrodes.

10. The system of claim **1**, wherein said at least one second grids includes two electrostatic grids, a trapping grid that traps ions in said trapping portion for a preselected time for accumulation of said ions; and an exit grid that releases said ions from said trapping portion at a preselected rate.

11. The system of claim **10**, wherein said trapping grid and said exit grid are DC-grids.

12. The system of claim **10**, wherein said trapping grid and said exit grid are comprised of a metal mesh defined by a preselected density of adjacent squares, said trapping grid and said exit grid are disposed a preselected separation distance apart from each other on an exit side of said trapping portion, said separation distance is on the order of spacing between said adjacent squares of said metal mesh.

13. The system of claim **1**, wherein said electrodes of said outlet portion are a series of axially aligned concentric ring electrodes that define an ion flow path, each of said electrodes in said series has an inner geometry perimeter that is equal to,