CLAIMS

What is claimed is:

1. A negative ion-based beam injector comprises

an ion source configured to produce a negative ion beam,

an accelerator spaced apart from the ion source, and

a transition zone interposing the ion source and the accelerator, the transition zone comprises a low energy beam transport line, wherein the low energy beam transport line includes bending magnets that deflect the beam orthogonally to the beam's direction of motion and focus the beam onto the axis of the accelerator.

2. The injector of claim 1, wherein the ion source includes a plasma container and plasma drivers.

3. The injector of claim 2, wherein internal walls of the plasma container are configured to maintain elevated temperatures of 150-200°C.

4. The injector of claim 1, wherein the ion source includes a pre-accelerator.

5. The injector of claim 4, wherein the pre-accelerator comprises an electrostatic grid having a plurality of electrodes, wherein each of the plurality of electrodes having a plurality of apertures.

6. The injector of claim 5, further comprising a distributing manifold for directly supplying cesium on the electrostatic grid of the pre-accelerator.

7. The injector of claim 5, further comprising a pumping system to pump gas out from a pre-acceleration gap.

8. The injector of claim 5, wherein at least one of the plurality of electrodes is positively biased to pre-accelerate negative ions in the negative ion beam.

9. The injector of claim 5, wherein the plurality of apertures are configured for focusing and passing negative ions to form the negative ion beam.

10. The injector of claim 4, wherein the pre-accelerator includes external magnets to deflect co-extracted electrons in an ion extraction and pre-acceleration region.

11. The injector of claim 4, further comprising a pumping system to pump gas out from a pre-acceleration gap.

12. The injector of claim 1, further comprising a neutralizer interconnected to the accelerator.

13. A negative ion-based beam injector comprises

an ion source configured to produce a negative ion beam, the ion source including a pre-accelerator having an electrostatic grid,

an accelerator spaced apart from the pre-accelerator, and

a distributing manifold for directly supplying cesium on the electrostatic grid of the pre-accelerator.

14. The injector of claim 13, further comprising a transition zone interposing the ion source and the accelerator.

15. The injector of claim 14, wherein the transition zone comprises a low energy beam transport line.

16. The injector of claim 15, wherein the low energy beam transport line includes cesium traps.

17. The injector of claim 15, wherein the low energy beam transport line includes bending magnets that deflect the beam orthogonally to the beam's direction of motion and focus the beam onto the axis of the accelerator.

18. The injector of claim 14, wherein the ion source includes a plasma container and plasma drivers.

19. The injector of claim 18, wherein internal walls of the plasma container are configured to maintain elevated temperatures of 150-200°C.

20. The injector of claim 13, wherein the pre-accelerator includes external magnets to deflect co-extracted electrons in an ion extraction and pre-acceleration region.

21. The injector of claim 13, further comprising a neutralizer interconnected to the accelerator.

22. A negative ion-based beam injector comprises

an ion source configured to produce a negative ion beam, the ion source including a pre-accelerator having external magnets to deflect co-extracted electrons in an ion extraction and pre-acceleration region, and

an accelerator spaced apart from the pre-accelerator.

23. The injector of claim 22, further comprising a neutralizer interconnected to the accelerator.