CLAIMS

1. A gas target holder system (100) comprising:

- a body (110), which comprises:

- a cavity (120) configured to contain a target gas to irradiate with a particle beam (F) emitted by a particle accelerator, the cavity (120) comprising at least one portion (121) of frusto-conical shape, a back (122) closing a wide base of the portion of frusto-conical shape and an opening (112), opposite the back relative to the portion of frusto-conical shape, forming an entry in order for at least part of the particle beam to enter the cavity;

- a window (150), positioned facing the entry of the cavity to close the cavity, permeable to protons to enable introduction into the cavity of protons of the particle beam (F) emitted by the particle accelerator, the window comprising a sheet (151) permeable to at least part of the particle beam emitted by the particle accelerator and a support grid (152) configured to withstand pressure differences between an inside of the cavity and an outside of the target holder system, the sheet (151) being positioned between the support grid (152) and the cavity (120);

- a support flange (160) which holds the window (150) and is hermetically secured on the body (110), and which comprises a mechanical fastening interface at an exit from a particle accelerator (170); the support flange (160) being furthermore configured to hermetically close the cavity (120) and to at least provide sealing between air outside the target holder system and a cooling

fluid flowing in the cooling circuit (130), in addition to providing sealing between a vacuum formed in a beam line of the particle accelerator and a target gas under pressure contained in the cavity (120); and

- a cooling circuit comprising

a duct comprising an inlet and an outlet, and

a groove in a front surface of the body which faces the support flange, the groove at least partly surrounding the entry of the cavity,

wherein the duct further comprises a helical portion formed in a wall of the body surrounding the cavity that extends from the inlet to the back of the cavity and extends from the back of the cavity to the outlet,

wherein coolant circulates from the inlet, into the groove, then the helical portion and returns to the outlet through the groove.

2. A system (100) according to claim 1, wherein the support grid (152) has an open/filled area ratio comprised between approximately 70% and approximately 90%.

3. A system (100) according to claim 1, wherein the support grid (152) is of tungsten or of aluminum nitride.

4. A system (100) according to claim 1, wherein the support grid (152) is of thickness comprised between approximately 1 mm and approximately 3 mm.

5. A system (100) according to claim 1, wherein the sheet (151) is of thickness equal to or less than 100 µm.

6. A system (100) according to claim 1, wherein the sheet (151) is of tungsten or of synthetic diamond.

7. A system (100) according to claim 1, wherein the front surface (181) forms a bearing surface for at least part of the sheet (151) of the window (150).

8. A system (100) according to claim 1, wherein the window (150) is inserted between the body (110) and the support flange (160).

9. A system (100) according to claim 1, wherein the back (122) of the cavity comprises a concave surface.

10. A system (100) according to claim 1, wherein the body is formed of AS7G6 aluminum alloy and/or by an additive manufacturing process.

11. A system (100) according to claim 1, wherein the sheet (151) is of thickness equal to or less than 80 µm.

12. A system (100) according to claim 1, wherein the sheet (151) is of thickness equal to or less than 30 µm.

13. A system (100) according to claim 1, wherein the sheet (151) is of thickness equal to or less than 20 μm.

14. A system (100) according to claim 7, wherein both the inlet (141) and outlet (142) of the duct (140) emerge into the front surface (181) of the body (110).

15. A system (100) according to claim 1, wherein the cooling circuit (130) comprises a cooling fluid ingress (187), which is configured to introduce the cooling fluid to the cooling circuit.

16. A gas target holder system (100) comprising:

- a body (110), which comprises:
- a cavity (120) configured to contain a target gas to irradiate with a particle beam (F) emitted by a particle accelerator, the cavity (120) comprising at least one portion (121) of frusto-conical shape, a back (122) closing a wide base of the portion of frusto-conical shape and an opening (112), opposite the back relative to the portion of frusto-conical shape, forming an entry in order for at least part of the particle beam to enter the cavity;
- a cooling circuit (130) comprising at least one duct (140) which comprises an inlet (141) and an outlet (142) and surrounds at least part of the cavity (120);
- a window (150), positioned facing the entry of the cavity to close the cavity, permeable to protons to enable introduction into the cavity of protons of the particle beam (F) emitted by the particle accelerator, the window

comprising a sheet (151) permeable to at least part of the particle beam emitted by the particle accelerator and a support grid (152) configured to withstand pressure differences between an inside of the cavity and an outside of the target holder system, the sheet (151) being positioned between the support grid (152) and the cavity (120); and

- a support flange (160) which holds the window (150) and is hermetically secured on the body (110), and which comprises a mechanical fastening interface at an exit from a particle accelerator (170); the support flange (160) being furthermore configured to hermetically close the cavity (120) and to at least provide sealing between air outside the target holder system and a cooling fluid flowing in the cooling circuit (130), in addition to providing sealing between a vacuum formed in a beam line of the particle accelerator and a target gas under pressure contained in the cavity (120),

wherein the body (110) comprises a front surface (181) which forms a bearing surface for at least part of the sheet (151) of the window (150), and

wherein the body (110) comprises a groove (182), set into the front surface (181), surrounding at least partly the entry of the cavity, the groove (182) forming part of the cooling circuit (130).

17. A system (100) according to claim 16, wherein the cooling circuit duct (140) is formed in a body wall (111).

18. A system (100) according to claim 17, wherein the cooling circuit duct (140) comprises at least one helical portion which surrounds at least part of the cavity (120).

19. A system (100) according to claim 17, wherein the support grid (152) has an open/filled area ratio comprised between approximately 70% and approximately 90%.