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The development of new concept for CADS spallation target

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For Chinese-ADS project, the aim is to burn MA. The tens of MW spallation targets for CADS is necessary to provide enough neutron to drive the blanket of MA, which is not an easy task.The first issue of high power target is how to remove the heat by the proton beam of the high current density. For solid targets to be used widely, the heat removal will be limited by the heat conduction of the target material and convection-cooling. If the heat deposited could be moved from the interaction zone between the proton beam and the target to other place, where the heat be removed in an easily handle device, thus the target will be cold in off-line. The heat removal of the target will beyond the limit of the solid targets. Based on the concept, the heavy metal liquid target with a beam window have been designed and operated, for example, in the operation spallation targets, the SNS's total heat power is 1.4MW. Here, the beam window will be a limit for increase the power of the proton beam.Thus, the heavy metal liquid target without a beam window (windowless HML target) becomes a candidate for the higher power target. However, for heavy metal liquid, the hydrodynamic effects will be a limit for increase the power, such as, the shock wave, hydrodynamic instability, Cavitations and Splashing.

We propose the concept of the gravity-driven Dense Granular Target, where the heavy metal grains are chose to produce enough neutrons and the temperature of the grains could be thousand degrees. The heat of the high power proton beam deposited in the heavy metal grains will be deal with off-line. Another important aspect is source availability and cost of operation, which is affected by radiation effects, other damages and the radio-toxicity. The gravity-driven Dense Granular Target have a potential to easy deal with these problems. So the gravity-driven Dense Granular Target would be a new concept for tens of MW spallation target.

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