

SoLID HGC Optimization Update

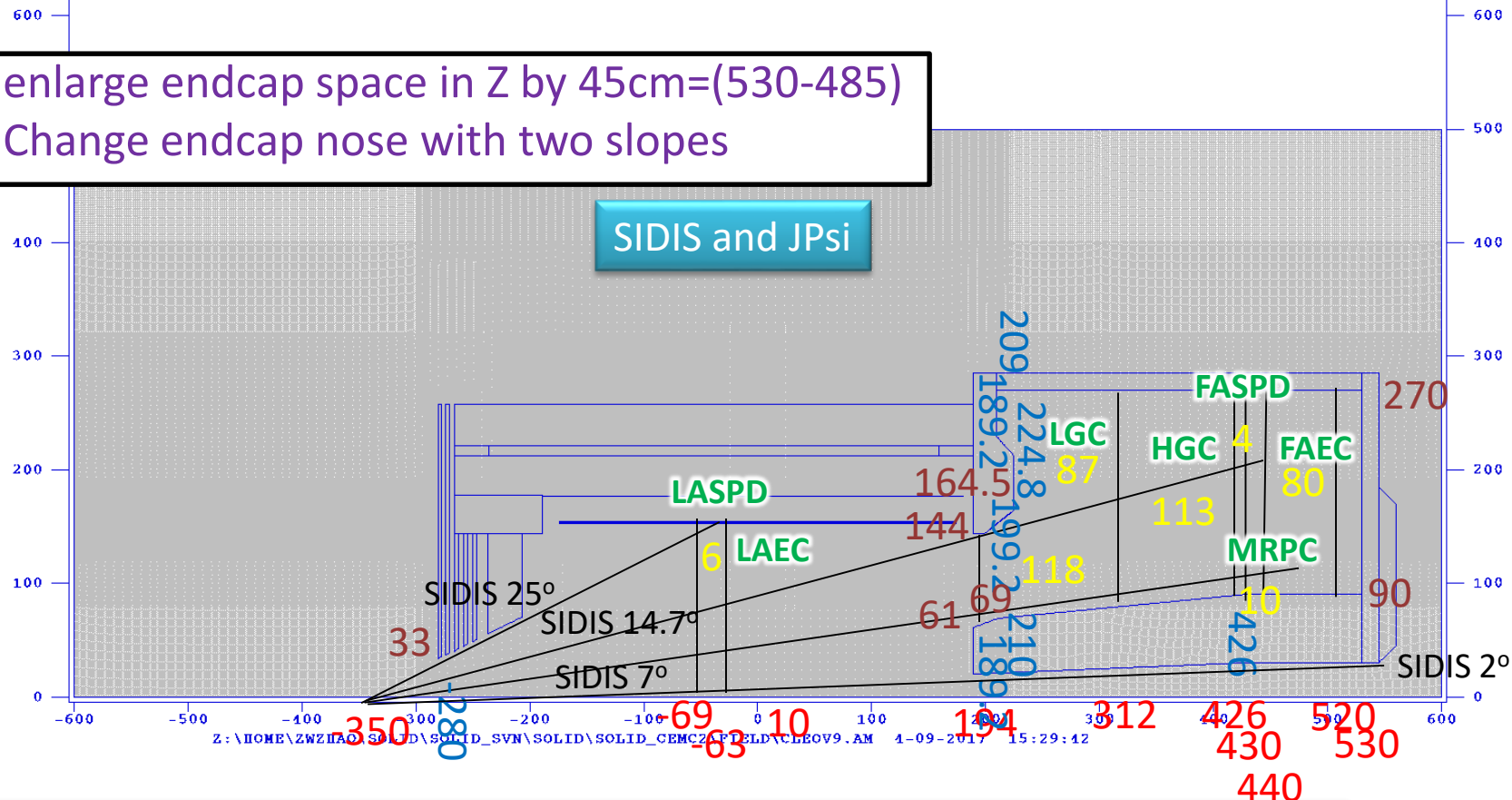
Bo Yu, Zhiwen Zhao

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Proposed Layout and Magnet

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enlarge endcap space in Z by 45cm=(530-485)
Change endcap nose with two slopes



HGC change:

move 20cm downstream, boundary Z=312-426cm
particle angle cover more forward, 7-15 deg from
He3 target center at Z=-350cm

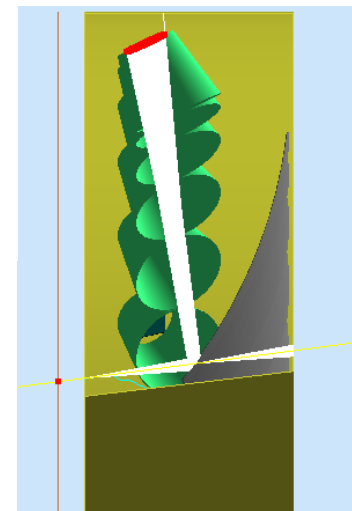
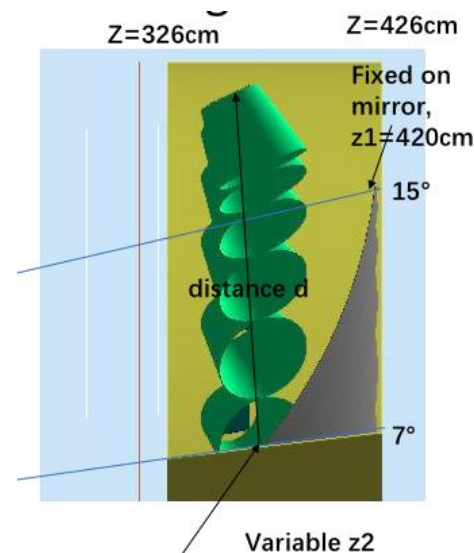
HGC optical system optimization

Elements

- Spherical mirror: determined by z_1 , z_2 and radius r
- PMT: determined by tilt angle and distance d from PMT center to z_2
- Reflective/shielding cone: shape, length, opening

Approach

- $z_1=420\text{cm}$ is determined by boundary
- Try the radius r and variable z_2 to set the mirror
- Then adjust the position of PMT and parameters of cones to collect photons effectively
- Very small region found when given r and z_2 because we hope to collect all the photons
- Approximate feasible region of r and z_2 :
 - $z_2=390\text{cm}$ $r=210$ to 250cm
 - $z_2=380\text{cm}$ $r=240$ to 280cm
 - $z_2=370\text{cm}$ $r=280$ to 300cm
 outside which we can't find a position for PMT to collect all the light



- Make light emitted by 7 degrees pions directly reflected to the center of PMT
- Large z_2 and smaller r will give more gas length and more photons

Mirror

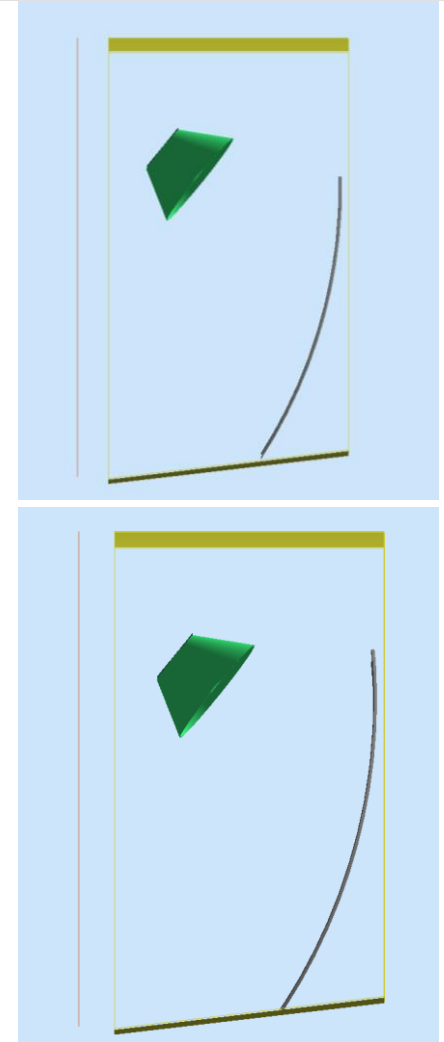
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- 1. Cover more on small and large angles

Change: cut by 7 and 15 degrees -->
cut by 6.8 and 16 degrees

- 2. Adjust the position and radius to lengthen path distance for small angles

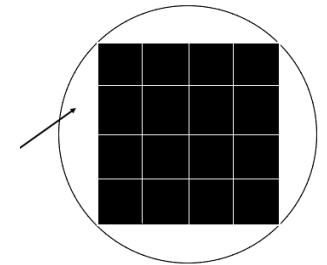
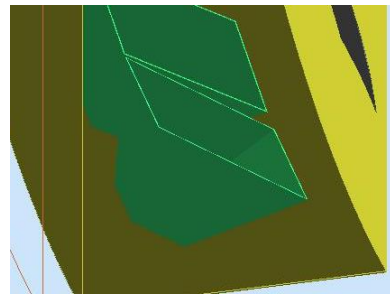
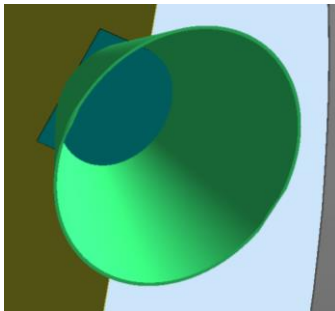
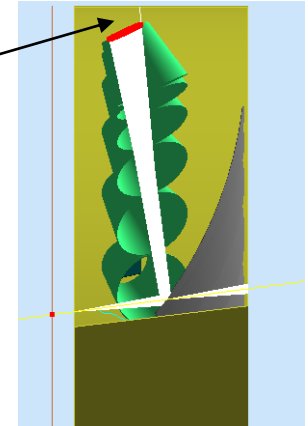
Change: Make r smaller and z_2 greater, currently $r=210\text{cm}$, $z_2=390\text{cm}$



Reflective cone and shielding

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- 1. No shielding behind PMT
Change: leave enough room behind
- 2. Light loss at the gap between PMT and cone
Change: Use smaller-end cone or pyramid-like cone
We used the latter one when testing
TBD by the test on the shielding effect



1st sector at $\phi=0$ deg

- Mirror: radius $r=210\text{cm}$, $z=390\text{cm}$
center: $x=199.23\text{cm}$, $y=0\text{cm}$, $z=210.12\text{cm}$
- PMT: distance $d=135\text{cm}$, tilt angle=39 degrees
center: $x=215.48\text{cm}$, $y=0\text{cm}$, $z=343.74\text{cm}$
width: 21.3cm
four corners: $x=223.76\text{cm}$ $y=\pm 10.65\text{cm}$ $z=350.44\text{cm}$
 $x=207.20\text{cm}$ $y=\pm 10.65\text{cm}$ $z=337.04\text{cm}$
- Cone: length=16.18cm, end $32\text{cm} \times 44.82\text{cm}$
 $x=222.71\text{cm}$ $y=\pm 16.00\text{cm}$ $z=370.41\text{cm}$
 $x=187.88\text{cm}$ $y=\pm 16.00\text{cm}$ $z=342.22\text{cm}$