

Target maintenance Scenario



LINEAR COLLIDER COLLABORATION

Designing the world's next great particle accelerator

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Target Maintenance Scenario

- Target is one of the most important and difficult to handle device in the particle source.
- Once we had a trouble, it potentially causes a long shutdown.
- The remote handling is effective, but it is not a silver bullet.
- Storage areas for new and used targets, capacity, transportation, has to be considered.



Annual operation period

- Annual operation should be done without any scheduled and accidental maintenance of the target with a reasonably high probability.
- As our working assumption, let us assume 5% failure probability for annual operation. It can be achieved if the system is designed carefully, e.g. select radiation hard material, etc.
- 5% failure probability is, however, not enough, because several 5% failure sources causes a significant loss of the availability.
- To suppress the availability loss, a backup target system should be replaced shortly.



Availability loss with a backup

- Assuming one backup, the probability causing a long shutdown (more than 1 failure) is suppressed much.
- By assuming two days (48 hours) to replace the target, the availability loss is similar with 10% case. 20% is too large, 5% is desirable.

Failure probability	P(0)	P(1)	P(2)
0.05	0.951	0.0476	0.0012 (10h)
0.1	0.905	0.090	0.0045 (36h)
0.2	0.818	0.164	0.016 (128h)



Life cycle

- The current ILC plan assume 8-10 years operation before the major upgrade followed by another 8-10 years operation.
- For 10 years operation, expected probability of accidental maintenance is

Annual Failure probability	P(0)	P(1)	P(2)	P(3)
0.05	0.60	0.30	0.0758	0.0126

- It defines additional number of targets. For 10 years operation, 12 targets could be enough?



Life cycle

- Assuming that the used targets can be removed from the storage area to outside (or other place) and the new targets are installed to the storage area, the capacity of the storage area should be 12 or more.
- Assuming no exchange during the major upgrade, i.e. targets for the whole life should be stored in the storage area, the capacity should be twice or more.



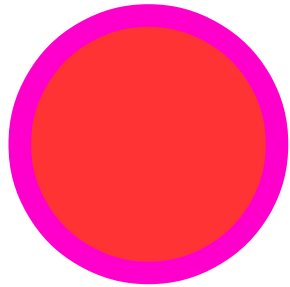
Cooling

- The used target right after the operation should be very hot. It is difficult to handle.
- The exchange of the used target to the new one should be done with a remote handling system.
- The used target should be stored in a hot cell until the target is cooled down. A half year?
- The hot cell should be in near of the target.
- The new one can be stored in the hot cell and swapped to the used one once we have a trouble. We need two hot cells.
- We need a working space.



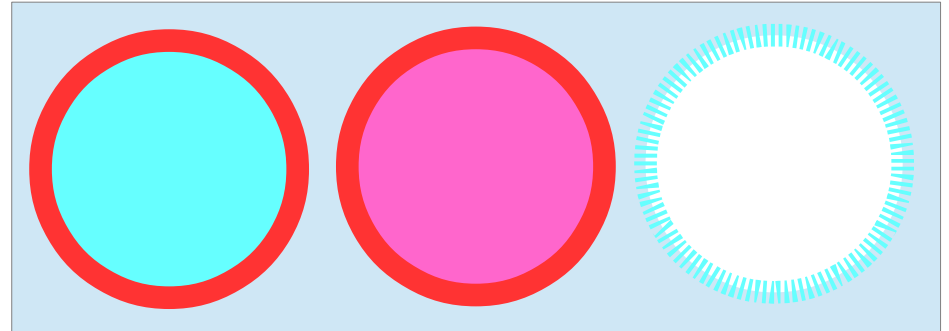
Arrangements

Active Target

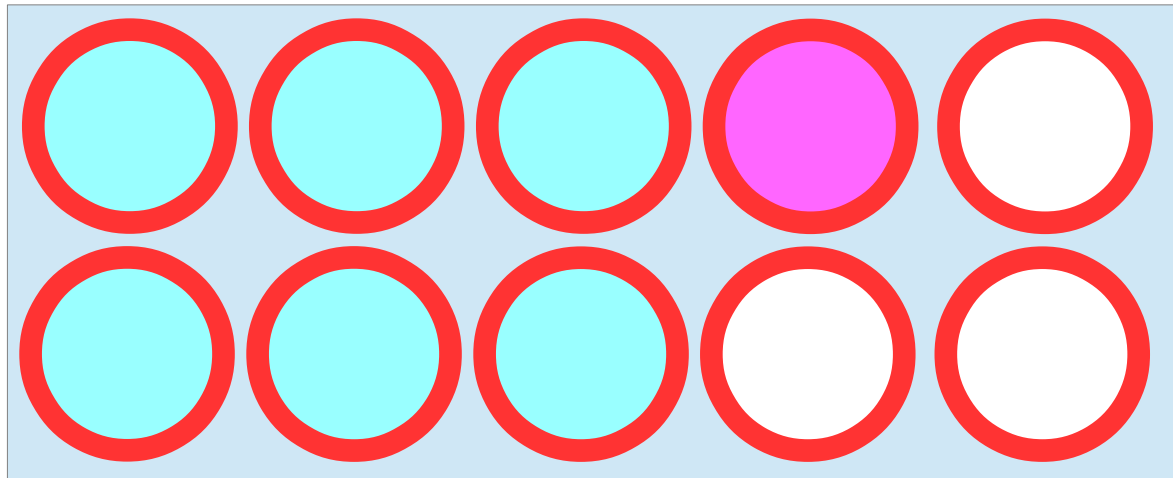


Remote handling

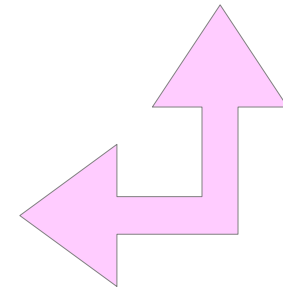
Near Target Storage



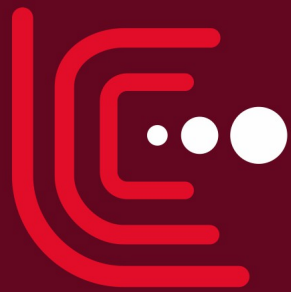
Far Target Storage



Two hot cells + one working area



Manual Transport



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Source is the source of Physics