Work for the undulator based ILC positron source

The Undulator people used GEANT, to create and track the particles through the magnetic field. FLUKA is more suitable for energy deposition, heating,…Thereafter, for stress and cooling, ANSYS or COMSOL is fine.

Yield optimisation with respect to magnetic field was done here by GEANT, however with a static POISSON field.

The field used so far for the yield calculation and optimization based the “old” QWT design. Taking the idealistic shape (yellow in the figure) one reaches Y > 1e+/e-. However, the real (black) as well as the approximated (magenta) field result in yield below 1 e+/e-



Considering the ILC250 option with the 7mm thick Ti6Al4V target, Andriy found the following connection between field on target, max B field and yield. The distance between Max B field and target exit was 10mm. (see also arXiv:2002.10919)



So, starting with a 1T field on target is fine.

By the way, in Lei Zang’s thesis (<https://livrepository.liverpool.ac.uk/1445/2/ZangLei_Sept2010_1445.pdf> ) one finds more details about the eddy current experiment performed in UK.

I kind of expect that a pure Bz, no Br, but as close as possible to the downstream end of the target increases the yield. As you realised, a “Field Immersed” target may also help. But this requires to lead the Bz from the downstream solenoid back through the target by an upstream booster solenoid.

And then of course appears the question will the fast-rotating wheel, with however high electrical resistivity, suffer from skin effect, braking and power deposition? And, most importantly, will the Bz at this critical location be deformed and “dragged” by the rotating wheel which may degrade the yield? I know that COMSOL can calculate the field.. May be ANSYS as well.

The realistic target design is also an important item but first the eddy currents should be known. Also, the dimension of the capture optics is important since it could influence the cooling efficiency if it occupies a large ‘cooling area’ opposite to the spinning target.

It would be great if this could be an option for ‘later’ contribution.