



May 7, 1990

MEMO TO: Rodger Bossert, John Carson, Rick Dixon, Jim Kerby,
David Orrell, Bill Robotham

FROM: Jim Strait

SUBJECT: 50 mm Dipole Collar Alignment Features

Various features are included in the collars to align them with respect to the yoke and the tooling, as well as for other reasons. Some of these features effect the details of the yoke and therefore the magnetic design. We need to be sure that all of the design requirements are met in an optimal way before releasing the collar and yoke drawings for the 50 mm dipole. In addition, we must design our tooling so that we can also assemble magnets with BNL collars. I attach copies of the BNL collar drawing and a preliminary version of the FNAL collar drawing.

- 1) Horizontal collar-yoke alignment is provided by several mils of interference near the horizontal mid-plane. Vertical alignment is provided by the tab at the horizontal mid-plane. At the moment this tab is quite small to allow the use of the same key placement as on the collars for the 40 mm horizontally split yoke magnet. This tab is rectangular in cross section: 150 mils wide, and 100 mils long. In the short 40 mm magnets it has been found to be difficult to place the collared coil into a pre-stacked yoke because of the difficulty in getting the collar tab to drop into the corresponding slot in the yoke. This problem will presumably be worse for the long magnets. If a modest (approximately 15 degree) taper were put on each side, the alignment needed for insertion would be relaxed from approximately 1 mil to approximately 50 mils. If the present key spacing were maintained then the tab width would be shrunk to 100 mils at the top. Is this a problem? Do we need as much as 50 mils of "slop" for easy insertion into the yoke? How does this effect the magnet design?
- 2) For proper key insertion the collars need to be aligned azimuthally with the tooling to approximately 1 mil on the circumference. In the short magnets this is accomplished with the vertical collar tab. On the long 40 mm magnets the plan is to align the collar using the lifting fixture and then hope that things remain aligned as the lifting fixture is removed and the press is closed. It was proposed to eliminate the vertical tab on the 50 mm magnets because Ramesh Gupta calculated that this would increase the transfer function at 6.6 T by 0.3% (and therefore the margin by 0.1%). David Orrell has calculated, however, that the harmonics are better with the tab present in the yoke.

This feature, particularly if tapered as proposed for the horizontal tab, could be used for collar-tooling alignment. Alternatively the features for the lifting fixture could be used for collar-tooling alignment, or other features specifically for this purpose could be included in the design.

Our collaring tooling must be able to accommodate the collars for BNL's version of the magnet. This means that even if we do not use the vertical tab for collar-tooling alignment, the tooling must include a notch because the BNL collar has such a tab for collar-yoke alignment. We cannot have tooling features, such as those proposed to interlock with our lifting fixture points, that would prevent putting BNL's collars into our tooling. The BNL key spacing is slightly different from what we are proposing. Does this make the BNL collars and our tooling incompatible? Ideally the BNL collars should be designed to be compatible with our collars and tooling as well as the other way around. (For example, could they use a tapered tab at the vertical mid-plane?) I do not know how far BNL is with their collar and yoke die orders and whether they would be willing, at this stage, to make "minor" modifications for compatibility with our tooling and assembly methods.

I think the required actions are:

- 1) Decide on the geometry of the horizontal collar-yoke alignment tabs. (John, Rodger)
- 2) If tapered tabs require using a different key spacing than BNL's we need either to build two sets of pusher bars or negotiate with BNL to change their key spacing. (Jim)
- 3) Decide which feature(s) to use for collar-tooling alignment. (John, Rodger)
- 4) If this is a tapered vertical tab or a collar feature not present in the BNL design, we must negotiate with BNL to modify their collars (and perhaps yoke) design. (Jim)
- 5) Recompute the magnetic field with the modified yoke features that are required by the modified collar features. If the harmonics are unacceptable, we may need to iterate the shape of the features. (David)

Only after all of these have been done can we release the drawings of the collar and collaring tooling laminations for manufacturing.

JS/lc

cc: Gale Pewitt
Jay Jayakumar
Paul Mantsch
Erich Willen