JAI Student Design Project

HE-LHC Design Tasks

Team	Work on IR4	Work on General Machine

Optics	• Work with RF group to adjust optics depending on how much space is needed for the cavities
	• Adjust separation dipoles depending on findings of RF and Magnet team
	• Work with magnet team to explore the advantages weaker quadrupoles with a large aperture have on the beam stay clear
		• Optimising the arc cell
		  ○ A larger fill factor would relax magnet design goals or could increase the energy
		  ○ Can be achieved by making the arc cells longer
		  ○ Comes at the cost of larger beta functions and dispersion – reducing the beam aperture
		• Improving the dispersion suppressor
		  ○ Geometry dictated by LEP geometry
		  ○ Also contains sextupoles for chromaticity correction
		  ○ Currently not fully compatible with arc cell

RF	• Design the HE-LHC RF cavities
	  ○ Aim to make them as short as possible to help optics design team and fit more instrumentation
	  ○ Aim to minimise the distance between the beams to ease separation
		• Design the crab cavities for main experiments
		  ○ The total voltage needed for full crossing will depend on the crossing angle
		  ○ Space require for crab cavities crucial to know for experimental interaction region design

Magnets	• Design a quadrupole with weaker field and larger aperture
	  ○ This is done in IR4 and IR6 in LHC to increase the beam stay clear
	  ○ Can potentially help the optics team
	• Look into the feasibility of a 10 T dual aperture separation dipole
	  ○ The dual aperture causes very high return fields in the separation between the beams
	  ○ This magnet is used in several areas of the machine
		• Optimising the arc dipole
		  ○ Initially the FCC dipole was used but it is too big for the tunnel (need space for transport)
		  ○ The size was reduced but now there are very large (several 100G) surface fields
		  ○ Could also look into the option of using high temperature superconductors
		  ○ Potentially links with arc optimisation work