? Exercise 3: Spin Precession Along CEBAF; P^2 Matrix

Write a program or a simple spreadsheet to calculate the spin precession along the CEBAF machine for various passes and energies.

Using Sand's formula, the loss per arc can be approximated to

$$\Delta E = 0.08846 E^4 \frac{\pi n_d}{2 l_d}$$

with n_d the number of dipoles in an arc and l_d the length of the trajectory in a dipole. Calculate the P^2 matrix and Wien filter settings required for each hall. For scheduling purposes, it is acceptable if the P^2 in a given hall is above 0.8. Besides Hall B, which other combinations of halls and passes are acceptable when we are maximizing the polarization for Hall B at pass 5 ?

Solution:

The spreadsheet, spinprecessionCEBAFRLA [9], implements the calculation as described above. The gains for the North and South linacs are entered in E2 and F2. The injector gain is automatically calculated in D2. Precession is calculated around the machine using the simplified expression of the Thomas BMT equation 8.3 and the resulting P^2 matrix available in cells C23 thru G28. The table labeled *wien required* give the necessary Wien angle to maximize the longitudinal polarization for a particular pass and hall. Finally, the cell C7 provides a mean to turn on (1) or off (0) the synchrotron radiation.