



Accelerator Instrumentation and Technology for High Energy Physics

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PEP-II Electron Cloud Diagnostics



- Question: How to get a more global view of the low energy electrons in the beam pipe?
- Initial idea: Measure electron induced modulation of first TE waveguide modes transmitted in the beam pipe. (Caspers and Kroyer, 2004)
- The results should be directly related to the averaged electron cloud density.

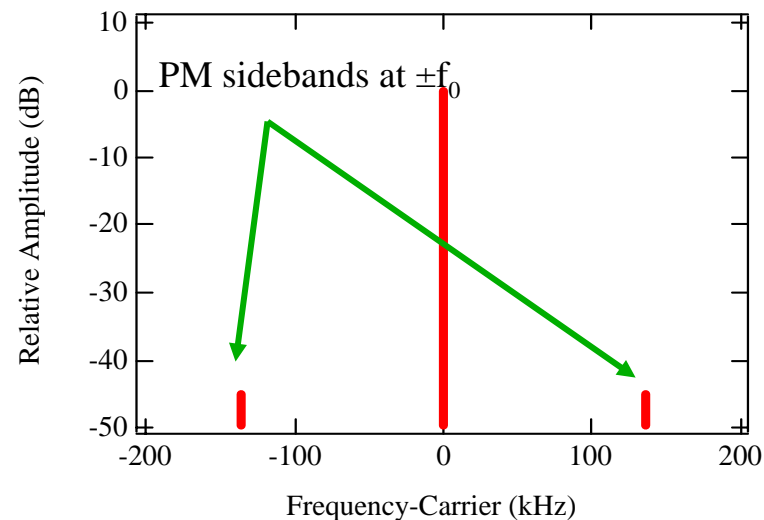
The phase shift for an angular frequency ω is given by

$$\Delta\phi = -\frac{1}{2} \frac{\omega_p^2}{\omega c} L$$

with the plasma frequency

$$\omega_p = \sqrt{4\pi\rho_e r_e c^2}$$

For $\rho_e=10^{12}/\text{m}^3$, $\Delta\phi \sim 1$ degree

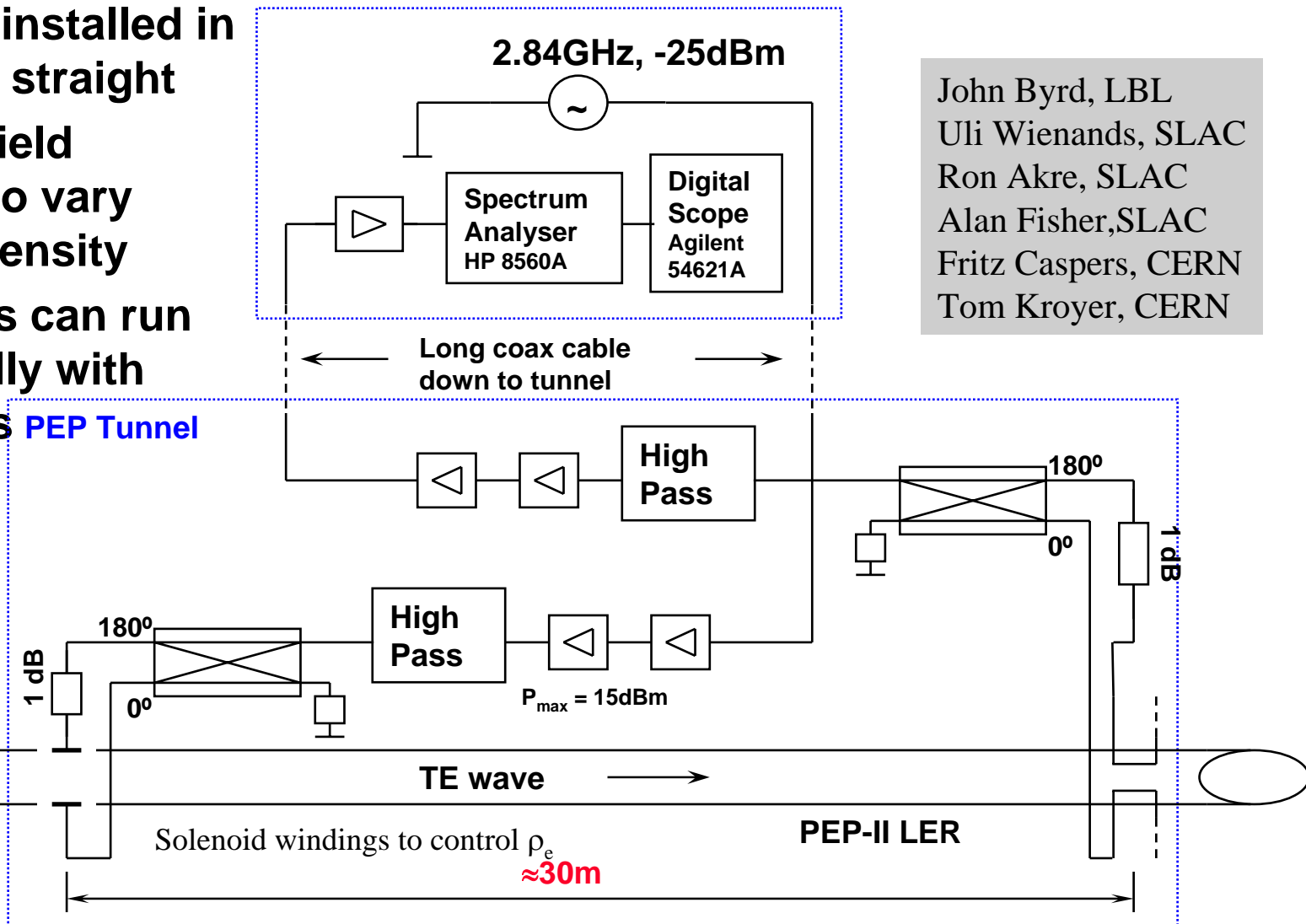


A similar effect can be observed in the ionosphere, limiting the accuracy of GPS.

PEP-II Beam Pipe Transmission Expt

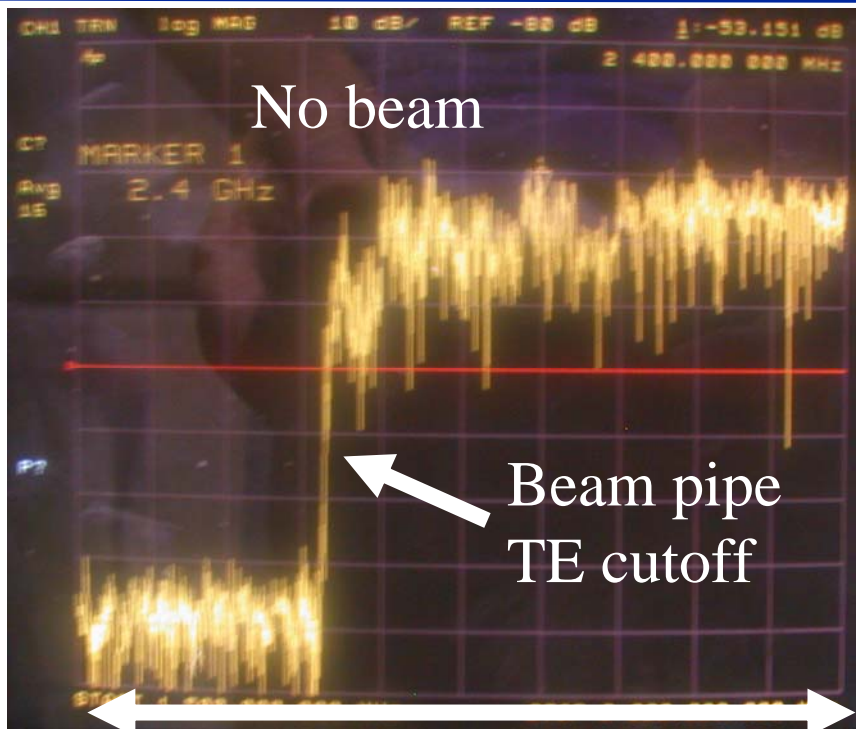


- Hardware installed in Region 12 straight
- solenoid field available to vary electron density
- initial tests can run parasitically with operations

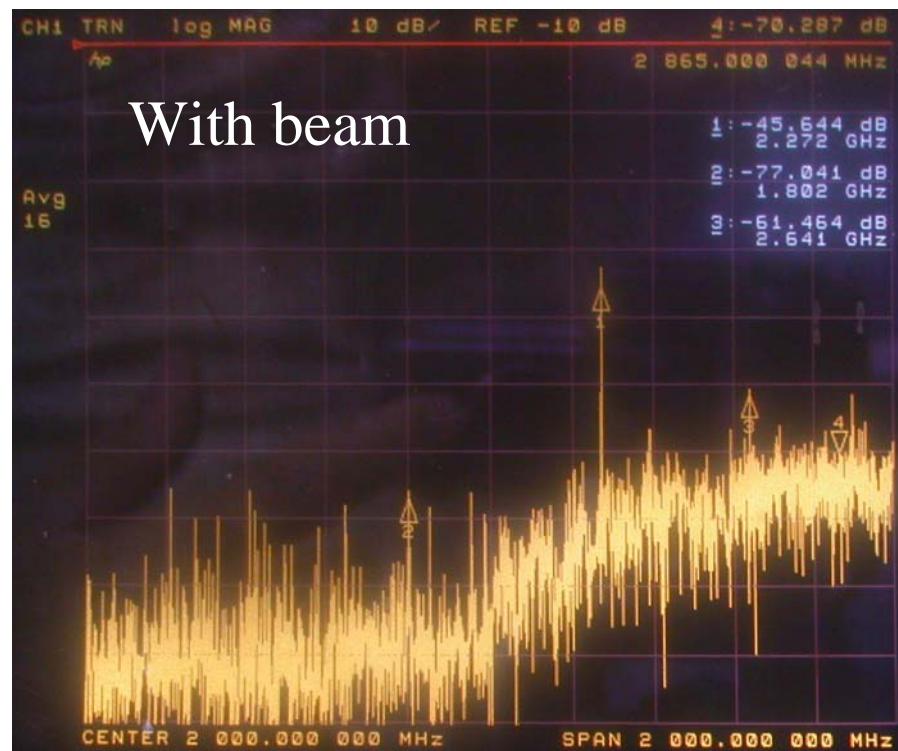


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Initial observations



An initial test shows some effect. Further studies starting now.



2 GHz

4 GHz