Introduction

- The Vacuum Vessel with End Plates On
  - The Tracks Which Enable a Variable

- The Vacuum Vessel with End Plates Off
  - 5.00% - 7.00%

Physics to Be Studied on CNT

- Fundamentals of Plasma Physics:
  - CNT is one of only two known experiments designed to study nonneutral plasmas on magnetic surfaces.
  - The Prototype Ring Trap (Proto-RT) runs pure toroidal confinement supplemented by an internal, toroidal current conducting ring to produce magnetic surfaces [1].
  - CNT is a relatively simple, small, and elegant configuration.
  - CNT will be the first dedicated study to run nonneutral plasmas.
  - CNT may be an excellent confinement device for exotic antimatter plasmas.
- Physics Relevant to Fusion:
  - Such plasmas are of great interest to both fusion science and astrophysics.
  - Unlike Penning traps, CNT will be able to store particles of opposite charge.
  - CNT may produce the first experimentally studied positron-electron plasmas. Because electrons and positrons have the same mass, a study of such plasmas could test the expected behavior of plasmas with opposite charge and like mass.

Present Design Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tilt Angle</th>
<th>30°</th>
<th>31.5°</th>
<th>33°</th>
<th>45°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Current</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Magnetic</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Magnetic</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Rotor coils</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Rotor coils</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Electromagnetic force</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
</tbody>
</table>
• Langmuir probes will be used to measure the density and temperature of the plasma.
• Current-voltage characteristics of Langmuir probes in pure electron plasmas can be determined [1].
• An array of such probes will be inserted radially into the plasma at various toroidal and poloidal locations.
• Large external sector probes will be used to measure mode of fluctuations in the density and location of the plasma.
• These fluctuations in plasma density and position result in the charge on the sector probe, the resulting fluctuations of the potential on the sector probe directly correspond (fluctuations in local plasma potential).
• 15-20 of these probes will be distributed flexibly and radially outside the plasma edge.
• These sector probes can also be biased so they can be used to move the plasma, instead of having to move the Langmuir probes or measure a different location in the plasma.
• These fluctuations in plasma density and position result in fluctuations in the image charge on the sector probe; the resulting fluctuations of the potential on the sector probe directly correspond (fluctuations in local plasma potential).


• Finalize the design of CNT (2002).
• Recently, much work has been done confirming the quality of the magnetic surfaces under perturbation in the position of the field coils.
• Optimization of the design will be finished shortly.
• The final design of the vacuum vessel will be directed by the CNT group.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.
• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• At these pressures, effects due to neutral interactions will be negligible.
• The vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.

Vacuum System

• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• Vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.


• Finalize the design of CNT (2002).
• Recently, much work has been done confirming the quality of the magnetic surfaces under perturbation in the position of the field coils.
• Optimization of the design will be finished shortly.
• The final design of the vacuum vessel will be directed by the CNT group.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.
• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• At these pressures, effects due to neutral interactions will be negligible.
• The vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.

Vacuum System

• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• Vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.


• Finalize the design of CNT (2002).
• Recently, much work has been done confirming the quality of the magnetic surfaces under perturbation in the position of the field coils.
• Optimization of the design will be finished shortly.
• The final design of the vacuum vessel will be directed by the CNT group.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.
• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• At these pressures, effects due to neutral interactions will be negligible.
• The vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.

Summary

• CNT is a unique, small, and dispensable ultrahigh vacuum chamber which will be used to study nonneutral plasmas on magnetic surfaces.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.
• The interlocking coils may be built by the NCSX team at PPPL.
• A contractor will be hired to build the vessel.
• The device is planned for assembly in the spring of 2003.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.


• Finalize the design of CNT (2002).
• Recently, much work has been done confirming the quality of the magnetic surfaces under perturbation in the position of the field coils.
• Optimization of the design will be finished shortly.
• The final design of the vacuum vessel will be directed by the CNT group.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.
• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• At these pressures, effects due to neutral interactions will be negligible.
• The vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.

Vacuum System

• CNT will need to be an ultrahigh vacuum device (10^-9 Torr).
• At these pressures, effects due to neutral interactions will be negligible.
• The vacuum vessel will be constructed of stainless steel.
• The vacuum vessel will have large amounts of free internal volume and will have numerous large ports.
• The extra internal volume can be used for titanium getters or cryogenic pumps.
• The large ports will have excellent conductance therefore maintaining the efficiency of our pumps.


• Finalize the design of CNT (2002).
• Recently, much work has been done confirming the quality of the magnetic surfaces under perturbation in the position of the field coils.
• Optimization of the design will be finished shortly.
• The final design of the vacuum vessel will be directed by the CNT group.
• The study of such plasmas will be relevant to the fields of nonneutral plasma physics, antimatter research, fusion science and astrophysics.