The nodule provides bunch identification signals via NIM level logic, and adjusted in phase as a function of region. Identification signals are generated in a manner that allows observers in all interaction regions to agree on an unambiguous bunch identity.

The module provides bunch identification signals via NIM level logic, upon CAMAC command, and through LED indicators. A front panel "region select" switch allows the same module to be used in all regions.

The module has two modes of operation: a bunch identification mode and a calibration mode. In the identification mode, signals indicate which of the three bunches of electrons and positrons are interacting and timing information about beam crossing is provided. The calibration mode is provided to assist experimenters making time of flight measurements. In the calibration mode, three distinct gating signals are generated in a manner that allows observers in all interaction regions to agree on an unambiguous bunch identity.

The front panel includes three adjustable potentiometers. The "0 Adjust" control provides approximately 204 ns of phase adjustment in the leading edge of the electron flavor outputs. The "X30" and "X3W" controls adjust the phase and pulse width of the X3 revolution signal.

The "X3" output is a NIM level signal at three times the revolution frequency. The phase and width of this signal are independently adjustable via front panel potentiometers, with the phase continuously adjustable from 0 to 120°, and the width adjustable from 50 ns to 24 µs. It is expected that both adjustments will have associated jitter in the signal of ±1%. This signal is not affected by the calibration mode of operation.

The bunch identification outputs are NIM level, and there are two outputs per flavor of electron. Associated with each electron flavor signal output are four LED's. In the normal mode of operation, the NIM level flavor outputs indicate the colliding electron bunch, and one of the three LED's will light, indicating the flavor of the colliding position bunch. The fourth LED, a rate indicator, flashes if the strobe input is activated.

Table 1 lists the CAMAC commands accepted by the module. The calibration mode is selected by an F(26) A(x) command, where x is the encoded number of a particular electron bunch. Each passing of this bunch will be indicated by all of the flavor outputs, while the unselected bunches will not be indicated by any flavor output. Please examine the timing diagram, Figure #2, for clarification.

During the calibration mode, the positron flavor LED's will not light. An F(26) A(3) command has the effect of shutting off the flavor outputs. Executing an F(24) A(0) command returns the module to the identification mode.

The timing of the identification signals is shown in Figure #2. Please note the 204 ns phase adjustment (±1% jitter) possible in the leading edge of the identification signals. These signals are intended for use as gating signals, or crude timing signals. Individuals with a need for more precise timing information or CAMAC programmable timing signals should examine the PEP digital delay units (#20H-500).

**DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
### TABLE 1

<table>
<thead>
<tr>
<th>CAMAC COMMANDS</th>
<th>Q</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>F(0) A(0)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(9) A(0)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(24) A(0)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(26) A(0)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(26) A(1)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(26) A(2)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>F(26) A(3)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Data format for the F(0) A(0) READ are as follows:

```
R8  R7  R6  R5  R4  R3  R2  R1
Rg3 Rg2 Rg1 Rg0  e+1  e+0  e-1  e-0
```

- e-0, e-1: encoded electron bunch
- chocolate = 0, vanilla = 1, strawberry = 2
- e+0, e+1: encoded positron bunch
- Rg0-Rg3: encoded region number

The module responds to unaddressed Z or 0 operations with a
RESET [F(9) A(0)] sequence.

All other CAMAC commands are ignored, and X=0, Q=0 is returned.
FIGURE CAPTIONS

Fig. 1. Block diagram of the bunch identification module.

Fig. 2. Timing diagram.
Actual bunch crossing is nominally 80 ns from the leading edge, and is adjustable (ϕ-adjust) by 200 ns with respect to leading edge. All flavors adjust phase together.

Calibration Mode—Typical Sequence
F(26) Δ(1) Selected—Vanilla Bunch Timing Standard