Scintillator barrel of 16 scintillators readout by WLSF coupled to 16 photomultipliers.

- **Scintillator:** Kuraray (SCSN-81), 8 mm thickness
- **WLSF:** Kuraray Y-11(200) M
- **PM:** Hamamatsu fine mesh R5946

<table>
<thead>
<tr>
<th>Scintillator</th>
<th>Thickness</th>
<th>Scintillator</th>
<th>Absorption</th>
<th>WLSF</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC-414</td>
<td>10 mm</td>
<td>BC-414</td>
<td>350-470 nm</td>
<td>476 mm</td>
<td>1 m</td>
</tr>
<tr>
<td>SCSN-81</td>
<td>8 mm</td>
<td>Kuraray SCSN-81</td>
<td>350-470 nm</td>
<td>476 mm</td>
<td>1 m</td>
</tr>
<tr>
<td>BC-414</td>
<td>10 mm</td>
<td>SCSN-81</td>
<td>350-470 nm</td>
<td>476 mm</td>
<td>1 m</td>
</tr>
<tr>
<td>SCSN-81</td>
<td>8 mm</td>
<td>SCSN-81</td>
<td>350-470 nm</td>
<td>476 mm</td>
<td>1 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WLSF</th>
<th>吸收率</th>
<th>脱色时间</th>
<th>透光长度</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuraray Y-11(200) M</td>
<td>350-470 nm</td>
<td>476 mm</td>
<td>&gt;3.5 m</td>
</tr>
<tr>
<td>Clear Fiber</td>
<td>—</td>
<td>—</td>
<td>&gt;3 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PM</th>
<th>Spectral response (QE&gt;10%)</th>
<th>Type</th>
<th>Dynodes</th>
<th>Gain @ 0 Tesla, 0 deg</th>
<th>Gain @ 0.3 Tesla, 0 deg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamamatsu R5900</td>
<td>300-500 nm, 420 nm Max</td>
<td>“Metal channel Dynode”</td>
<td>10</td>
<td>$2 \times 10^7 @ 900V$</td>
<td>$1 \times 10^6 @ 2000V$</td>
</tr>
<tr>
<td>Hamamatsu R5946</td>
<td>320-520 nm, 420 nm</td>
<td>Fine mesh</td>
<td>16</td>
<td>$1 \times 10^6 @ 2000V$</td>
<td>Useless above 0.3T</td>
</tr>
</tbody>
</table>
ACC typical signal

- Fine mesh tube operated at 2000 V (gain~5×10^6)

- Pulse shows average of 100 perpendicular singly charged MIPs
Methods to calculate PM gain

- Ideal PM:
  
  \[ N_\sigma = N_{pe} \cdot G \]
  
  \[ N_{pe} \text{ is poisson distributed} \]
  
  \[ \Rightarrow G = \frac{\sigma^2}{N_\sigma} \]
  
  \[ \Rightarrow \sigma_x = \sqrt{N_{pe} \cdot G} \]

- Width can be the Landau width (overestimates G) or LED width at MOP

- Gain can be calculated from a single electron entering the dynode chain

PM R5946 figures

- 13 PMs (out of 21 tested up to now), have nominal gain at 2000 V above \(5 \times 10^6\)

- Only 1 PM (at 2100 V) could not overcome 30 mV threshold, using cosmics
Signal budget

- Small amplifier AD8055 (input ×3) at the input of the SFEA (5 mA on ±5V)
  - 75% signal to the discriminator
  - 20% signal to history channel
  - 5% signal to the ADC

Light coupling performance

- Clear Fibers used to reach PMs on the 0.2 T region.
- Two prototypes built and tested. Good geometrical matching between fibers achieved by using precision pins
- Preliminary results show 15% loss/connector
  Namely:
  - 10% reflectivity loss
  - 5% coupling inefficiency
**Space Qualification Tests**

**Mechanical Vibration Setup @Aachen**

**Sine Vibration**
(10 ~ 2000 Hz, with const acceleration 0.5 g)

**Random Vibration**
(Peak vibration level of 0.04 g²/Hz from 80 ~ 500 Hz, 90s)

\[ g_{RMS} = 6.8 \text{ g} \]

**Test Series**
Sine - Random - Sine in 3-D orientations

**AMS TIM, March 31 - April 5, 2003 @CERN**

**Space Qualification Tests**

**Mechanical Vibration Mode**

**Sine Acceleration Mode**
Distinct resonance occurs at a frequency close to a natural frequency of ~ 1000Hz

**Random Acceleration Mode**
\[ g_{RMS} = 6.8 \text{ g} \]
Peak vibration level of 0.05 g²/Hz from 40 ~ 500 Hz with test durations of 90 s

**AMS TIM, March 31 - April 5, 2003 @CERN**
R5946 PM performance after vibration

XY vibration

XY&Z vibration