A Novel MT-style Optical Package

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Introduction

- optical fibers now replacing copper wires in HEP detectors:
  - eliminate electromagnetic interference
  - eliminate ground loops

- commercial VCSEL/PIN packages too bulky for vertex detectors
  - custom design optical packages
  - convert MT fiber connector into an optical package
  - MT-style optical package allows easy mounting/removal of fiber bundle during testing and detector assembly
Design

- good coupled optical power requires good VCSEL alignment:
  - 50 µm in z (along fibre)
  - 25 µm in x and y (transverse to fibre)

- alignment for PIN is not stringent

- machine a pocket on MT connector for placement of base:
  - use alumina as base substrate:
    - ground alumina sheet to proper thickness
    - cut alumina sheet into strips
    - deposit 3D gold traces on strips for wire bondings, VCSEL/PIN placements
    - cut alumina strips into bases
    - 3D traces have good connectivity (~ 94%)
VCSEL Opto-pack Design

- VCSEL
- gold trace
- alumina base
- machined MT connector
- MT connector
- fiber
- guide pin
VCSEL Opto-pack

machined MT connector

wire bond

gold trace

VCSEL
all VCSELs have good coupled power
all VCSELs have good power coupling efficiency
Coupled Power After VCSEL Replacement

- VCSEL can be replaced without damaging adjacent channels
VCSEL opto-pack has fast rise and fall times
MT-style Opto-pack Issues/Limitations

- opto-pack limited to 6 channels due to physical limitations:
  - spacing between fibers is 250 μm for 12-fibers MT connector
  - VCSEL is 250 μm wide

- 8 or 12 channel opto-pack can be fabricated using:
  - 8 or 12-channel VCSEL/PIN array
  - fabricated MT connector with wider fiber spacing
Summary on MT-style Opto-pack

- MT-style opto-pack has good coupled power/efficiency
- MT-style opto-pack is repairable
  - principle of MT-style opto-pack demonstrated