Opto-Link Redundancy for IBL???

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Outline

- Possible redundancy scheme
- If we had redundancy in present pixel detector…
- System/cost implications

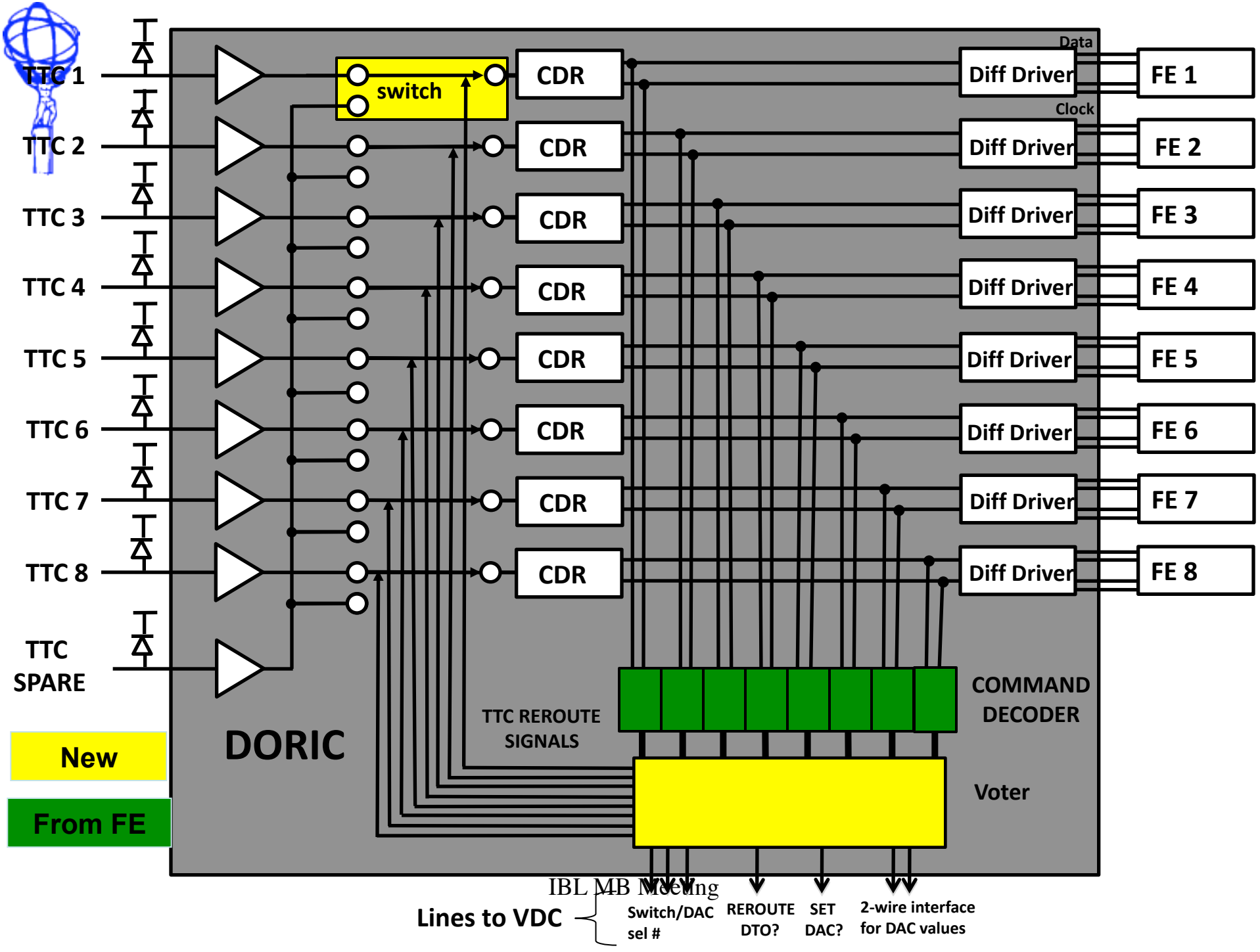
Opto-Links of Present Pixel Detector

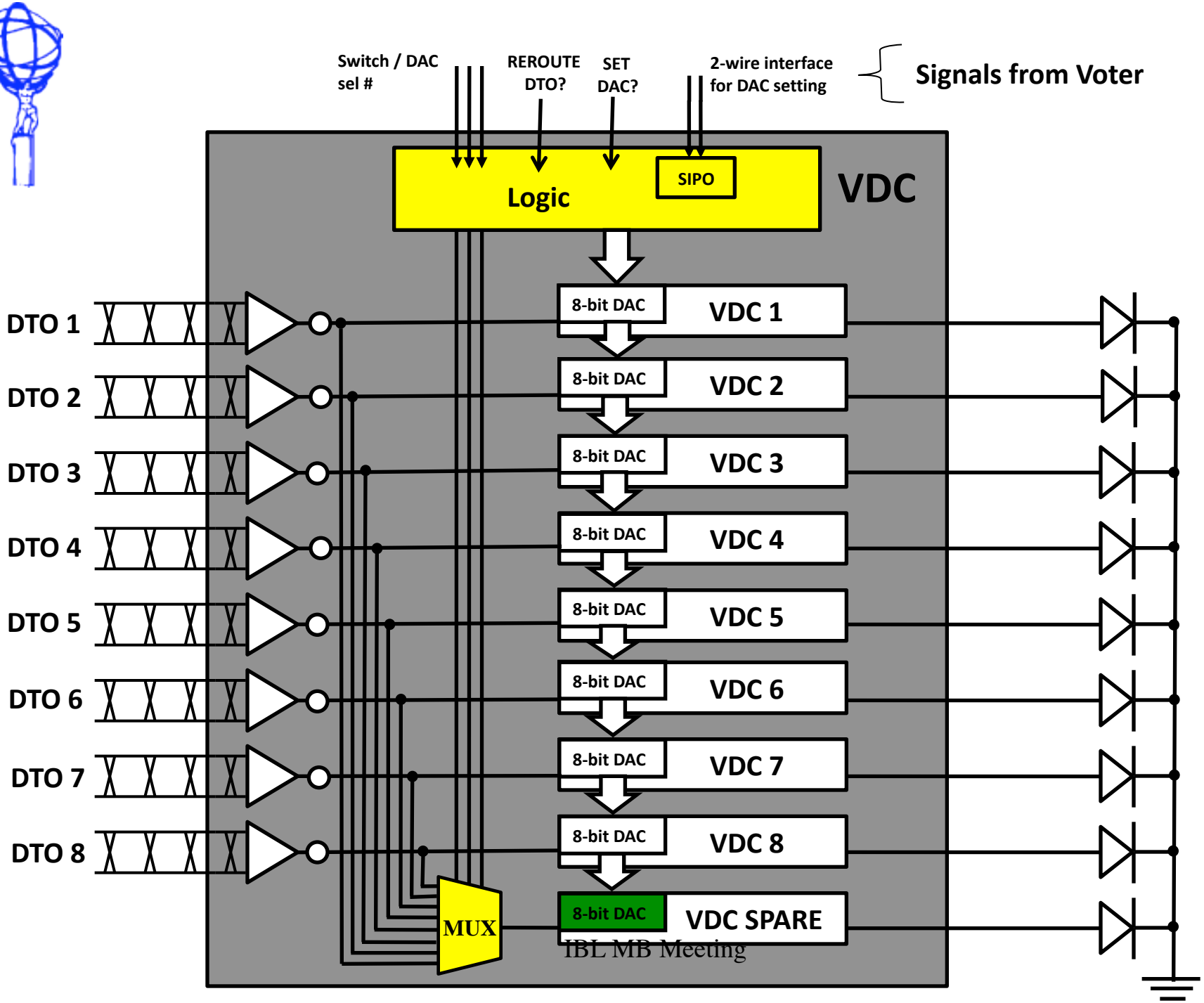
- opto-boards are mounted at PP0 and inaccessible
  - there are 21 broken links in present system (details later)
  - no individual control of optical power in VCSEL array
    - ⇨ difficult to operate some arrays due to power spread

Possible Redundancy Scheme

- IBL opto-boards will be mounted near ID endplates:
  - ID endplates will be activated
  - ~ 2 months to open ID endplates
  - ~ 2 months to close ID endplates
    - ⇨ don't expect access to opto-boards just to fix few broken links

- Current IBL design has 32 FEs on each stave
  - each opto-board serves 8 FEs
  - there is no 8-channel VCSEL/PIN array
    - VCSEL/PIN array contains 12 channels:
      - ⇨ use 4 unused channels to bypass broken channels?
      - ⇨ control of optical power of individual channels to improve the operating margin


TTC 1
TTC 2
TTC 3
TTC 4
TTC 5
TTC 6
TTC 7
TTC 8
TTC SPARE
switch
CDR
CDR
CDR
CDR
CDR
CDR
CDR
CDR
Data
Clock
Diff Driver
Diff Driver
Diff Driver
Diff Driver
Diff Driver
Diff Driver
Diff Driver
Diff Driver
FE 1
FE 2
FE 3
FE 4
FE 5
FE 6
FE 7
FE 8
DORIC
TTC REROUTE SIGNALS
COMMAND DECODER
Voter
New
From FE
Lines to VDC
Switch/DAC sel #
REROUTE DTO?
SET DAC?
2-wire interface for DAC values


Switch / DAC sel #
REROUTE DTO?
SET DAC?
2-wire interface for DAC setting
Signals from Voter
Logic
SIPO
VDC
DTO 1
DTO 2
DTO 3
DTO 4
DTO 5
DTO 6
DTO 7
DTO 8
8-bit DAC
VDC 1
VDC 2
VDC 3
VDC 4
VDC 5
VDC 6
VDC 7
VDC 8
VDC SPARE
MUX

What if we had Redundancy in Present System...

- Impact of redundancy on present broken links:
  - seven single channel failures
    - could likely be fixed with redundancy
  - one 3-channel failure and one 4-channel failure
    - could be fixed if failures are in the opto-links
  - one 7-channel failure
    - 4 channels could be fixed if failures are in the opto-links
  - ⇨ most problems could be fixed if failures are in the opto-links

System/Cost Implications

- fibers:
  - need 12-fiber ribbon instead of 8-fiber ribbon
    - cost increase is minimum since most cost is in polishing
  - no increase in array cost since only 12-channel array is available
  - need new chips: $90k for a production run
  - minimum impact on BOC since FPGA can be programmed to produce 8 output channels from 12 input channels
  - ⇨ add ~100kCHF to a 10MCHF detector
  - implementing redundancy has no impact on IBL schedule as MOSIS offers multiple submissions/year at $10K for 4 mm^2