TOWER PHOTONICS

STATUS UPDATE

KM3 COLLABORATION MEETING – LNS – CATANIA- 7/12/2012

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A. D'Amico

SUMMARY

- Optical Transport Requirements: **update**
- Multiplexing Strategy: **All-optical**
- Photonics at Tower base: **Multiplexer and optical interfaces**
- Photonics in the Junction box: **Band coupler and optical interfaces**
- Infrastructure **Capacity**
- Conclusions

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OPTICAL TRANSPORT REQUIREMENTS: UPDATE

- Electro optical conversion at floor level with a signal rate of 800 Mb/s
- 15 bidirectional optical channels per tower (14 floors + 1 base floor)
- 1 bidirectional optical channel per junction box
- Each optical are closely spaced in the spectrum with 50 GHz spacing (standard telecom Dense Wavelength Multiplexing)
- Optical amplifiers will be used and placed at the Shore station in Capo Passero

50GHz

Optical transceivers:
- Power consumption: < 1W
- Optical attenuation budget: 37 dB

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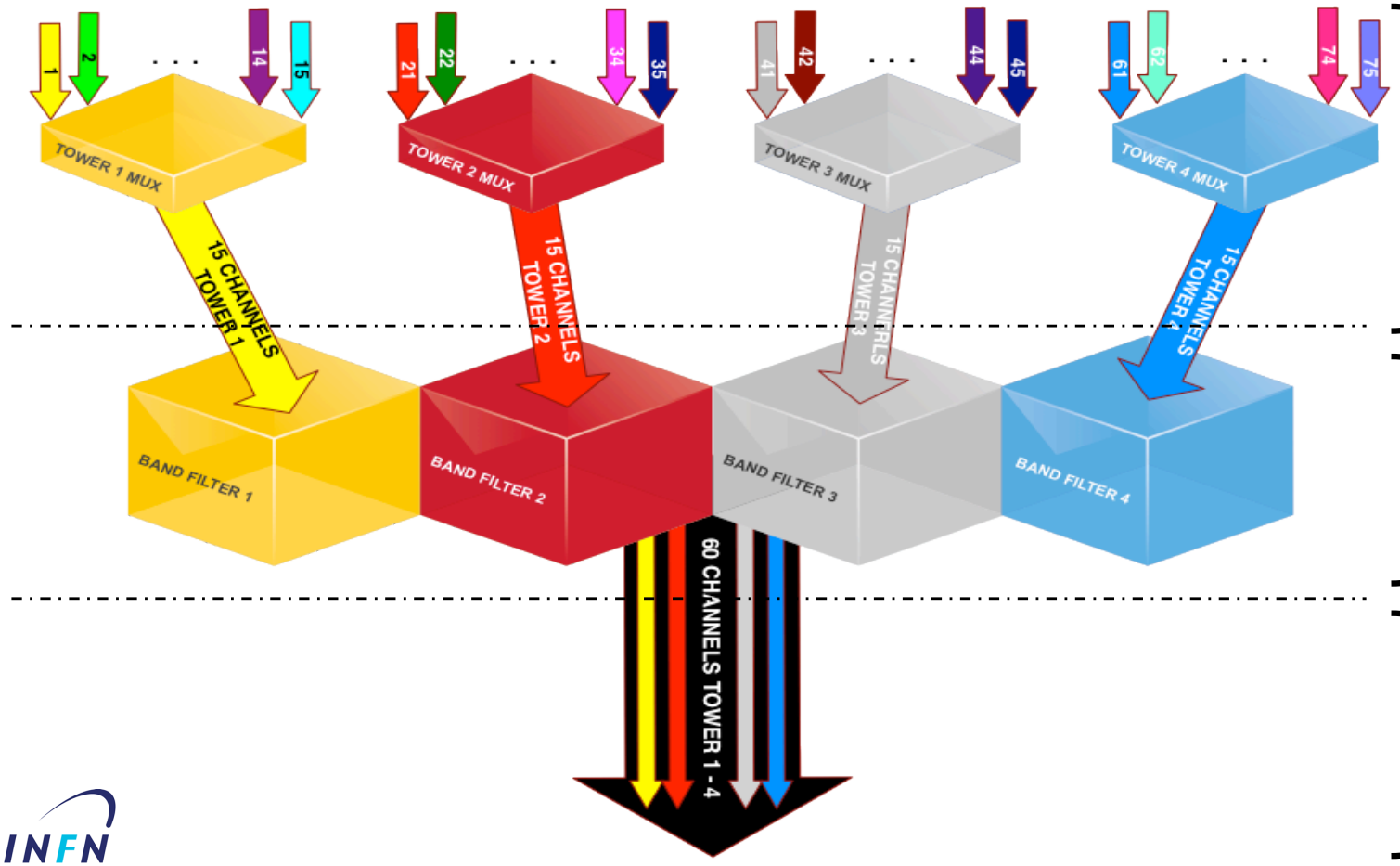
MULTIPLEXING STRATEGIES: ALL-OPTICAL



Tower optical MUX
15 colours TX
+
15 colours RX
50 GHz grid

Junction Box
optical MUX
15 colours
each sub-band

Submarine Cable
4 towers over 2 fibres
(1 TX fibre + 1 RX fibre)
60 colours per fibre

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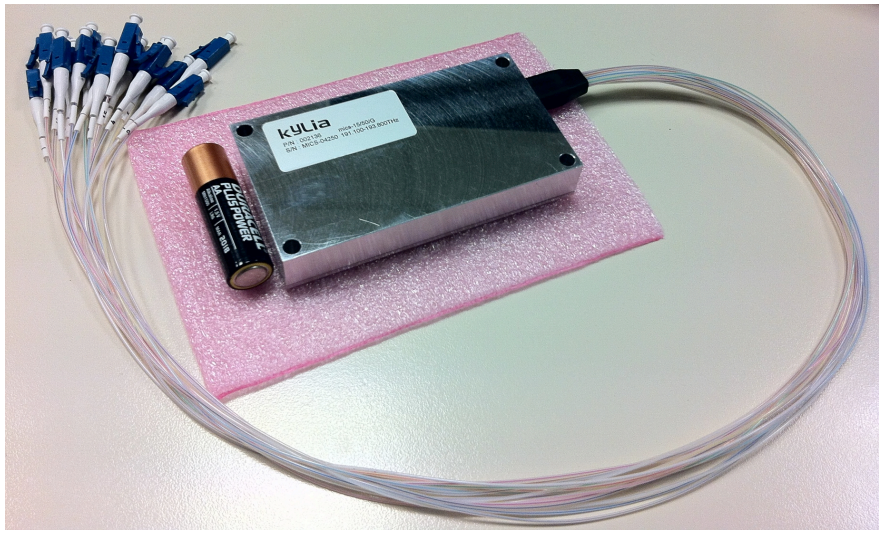
TOWER BASE: MULTIPLEXER

Multiplexer Figures:

- 2 units - 15 channels per unit
- C-Band
- Frequency spacing: 50 GHz
- passively athermal
- small footprint
- low insertion loss: 4 dB
- Telcordia GR-1209 and GR-1221 compliant



Item Status:

- First 2 units have been already delivered to LNS for testing

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TOWER BASE: OPTICAL INTERFACES

Multiplexer/Demultiplexer IN/OUT:

- **28 fibres** towards Tower **Backbone Interface**
  - **(2 fibres per floor FCM: TX + RX)**
- **2 fibres** towards local transceiver (FCM)
- **2 fibres** towards Seabed Network **Junction Box**

Cabling type inside Tower Base Vessel:

- **Fibre ribbon towards Backbone Interface: to be evaluated**
- **Standard buffered fibre towards Junction Box Interface**

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JUNCTION BOX: BAND COUPLER

Coupler Figures:

- 16 units - 15 channels each
- Frequency spacing: 50 GHz
- passively athermal
- low insertion loss: 4.0 dB
- Telcordia GR-1209 and GR-1221 compliant

Item Status:

- Device defined
- Manufacturer found
- To be ordered in the next weeks

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JUNCTION: OPTICAL INTERFACES

Band couplers IN/OUT:

- **16 fibres** towards Tower
  - **(2 fibres per Tower: TX + RX)**
- **2 fibres** towards local transceiver (FCM)
- **2 fibres** towards Seabed Network **main manifold**

Cabling type inside junction box optical vessel:

- **Standard buffered fibre** towards all interfaces

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INFRASTRUCTURE CAPACITY/COSTS

CAPACITY:
16 towers can be transported over 8 fibres of the main cable

@ 800 Mb/s DWDM on 50 GHz spectral density

COSTS:

30 DWDM transceivers per tower (15 onshore + 15 offshore)
4 DWDM transceivers per Junction box (2 offshore +2 onshore)
€ 27200 for DWDM transceivers per tower (€ 800 each)

Passive optics:
€ 6000 per tower (2 mux/dmux offshore + 2 mux/demux onshore)
€ 8000 per junction box (offshore + onshore devices)

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CONCLUSIONS

Project Status:

- **Tower:**
  - multiplexer/demultiplexer has been already delivered
  - SFP laser should be ordered (same kind used in NEMO phase-2)
- **Junction box:**
  - band coupler has been defined and should be ordered soon
    1. The market survey has shown that maximum 4 band couplers can be used to work on the same fibre in the DWDM spectral region (C-BAND)
    2. Each coupler can mux/demux maximum 15 channels @ 50 GHz spacing
    3. 1 and 2 imply → **60 channels per fibre**
- **On-shore optical amplifier have already been successfully operated for NEMO phase-2:**
  - 2 amplifiers more have been ordered and are expected to be delivered by late January 2013

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