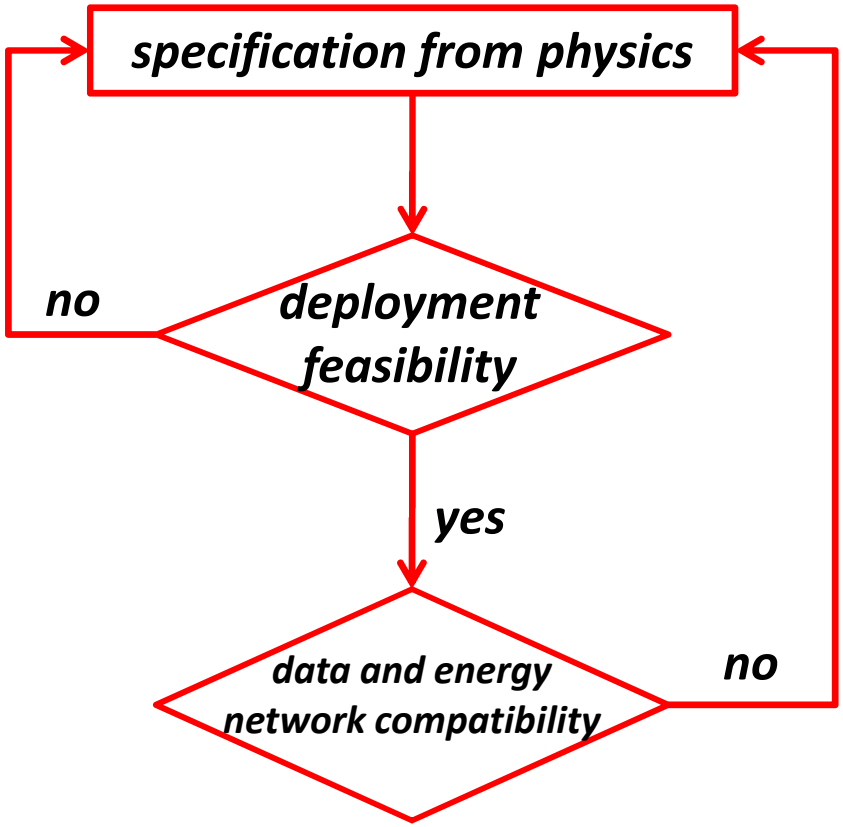
talk outline

- sea bed network deployment issues;
- energy distribution seabed network issues;
- data transmission seabed network;

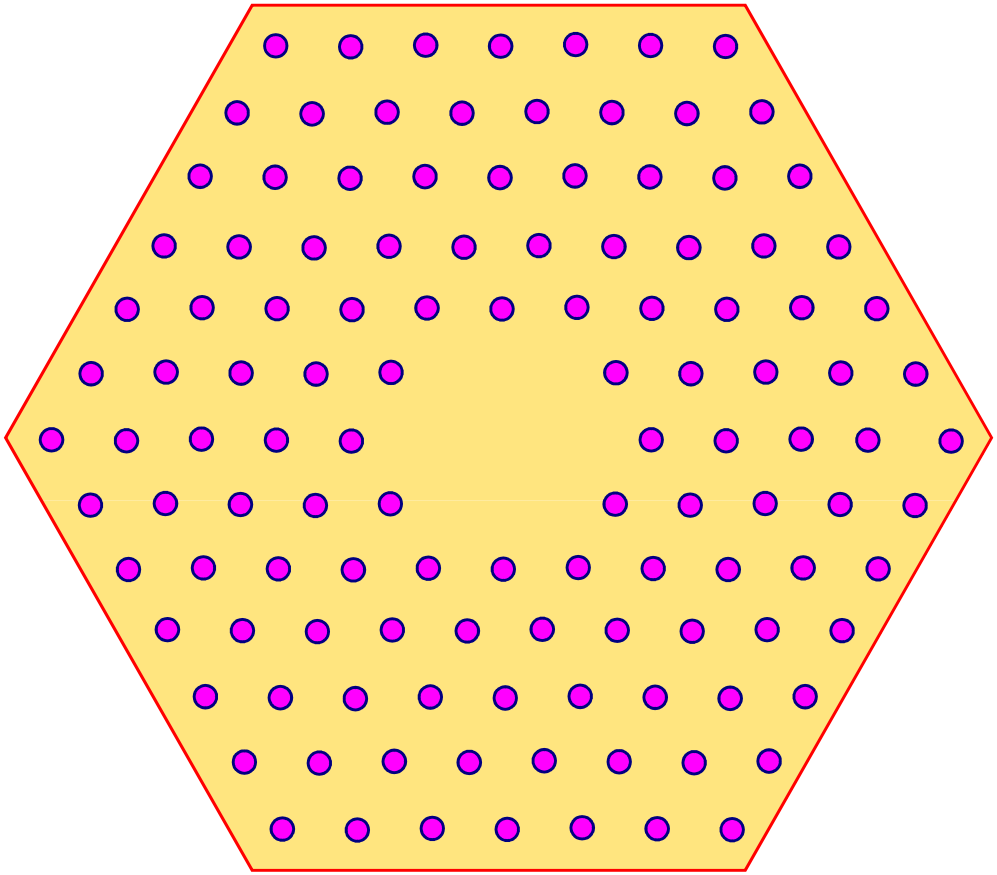
seabed network decisional process

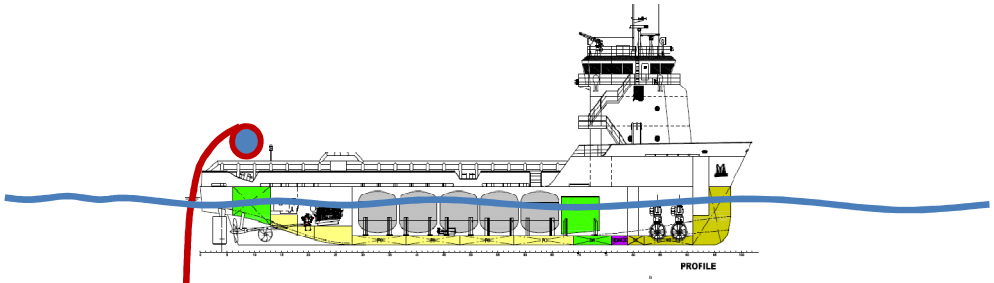


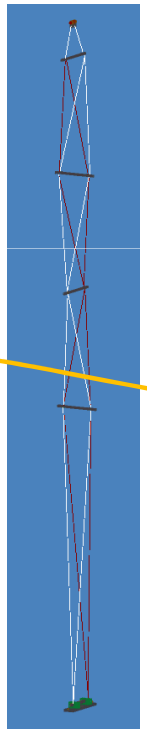
deployment strategy

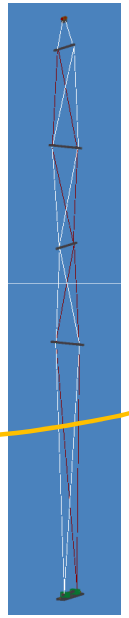
the question is: what to deploy in advance?

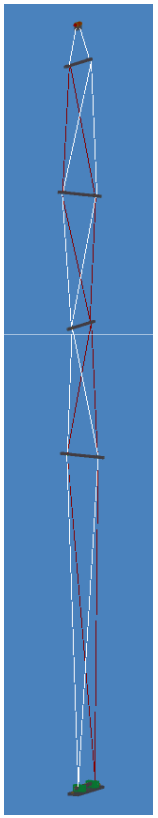
the detection units or the seabed network?



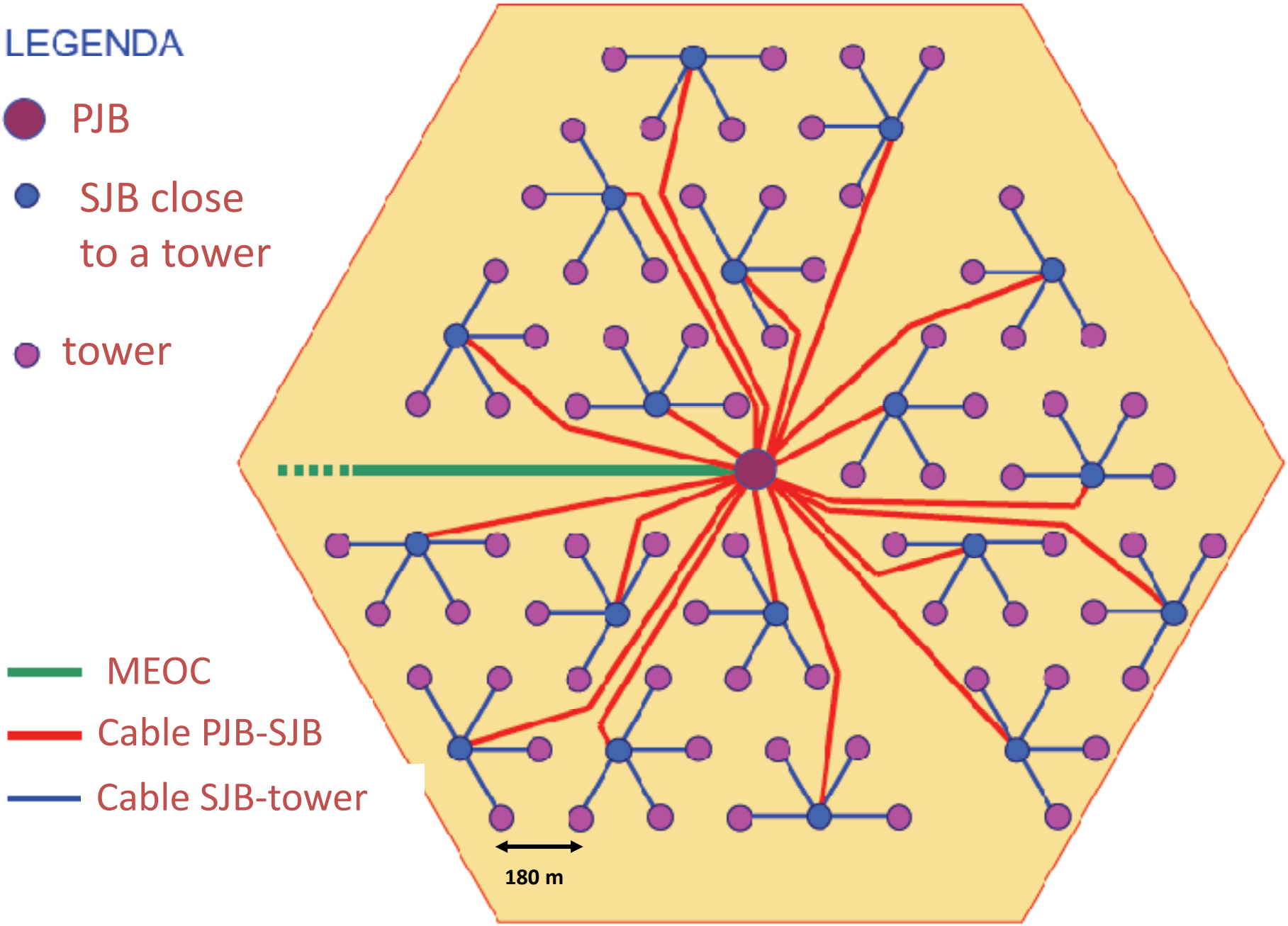

PROFILE







Example of SEABED NETWORK



ELECTRICAL POWER SYSTEM Proposal

This proposal is based on the learned lesson and the current market availability. It strongly takes in account the deployment issues.

The proposal aims to demonstrate the feasibility of the system.

DESIGN INPUTS & CONSTRAINTS:

- a10kV wet mateable connector is not still tested and ready on the market

  for this reason a MV Power distribution network has not been taken in account at the moment ;
- a 375V DC distribution network has been evaluated

  (375 V DC is the ALCATEL MVC output voltage);
- low voltage (375V DC) distribution network cannot accept huge cable (both in cross section and length) due to deployment issues;
- number of detection unit considered: 90 (expandable to 130);
- detection unit electrical load less than 300W;
- total power consumption: 27kW;

ELECTRICAL POWER SYSTEM Proposal

ELECTRICAL SUBSYSTEMS:

On-shore :

- A 50 kW **Power Feed Equipment** with:

  - Input Voltage: 400 V AC 3 phase

  - Output Voltage: 10 kV DC

Off-shore :

- A 10kV DC **Power Transmission system** with sea return using :

  - a single conductor cable

  - earth terminations

- A **Power Distribution network** that includes:

  - Power conversion from 10 kV to 375V using the 10 kW Alcatel Medium voltage Converters;

POWER DISTRIBUTION NETWORK

Primary Junction Box:

the PJB will hosts:

- Cable end and sea electrode terminations;
- the MVCs;
- a monitoring and control system;
- Input: 10 kV feedthrough;
- Output: 400 V wet mateable connectors.

LV Distribution network - Evaluation process:

1. a **LV ring distribution network** containing a certain number of SJB;

   pro:

   - It Is *one line fault* tolerant: if there is a fault in one LV line it can be isolated, and all the SJBs can be fed without anydetector loss;

   vs:

   - a second line fault can cause, in the worst case, the loss of all the detector;
   - each SJB (connectors, switches, etc.) and the ring cable has to be designed for the total detector power, 30kW/375V=80 A. As a consequence the cable cross section must be big to contain voltage drops and joule losses;
   - the SJB cannot be passive;

POWER DISTRIBUTION NETWORK

Low Voltage Distribution Network - Evaluation Process:

2. a **LV star distribution network** containing a certain number of SJBs;

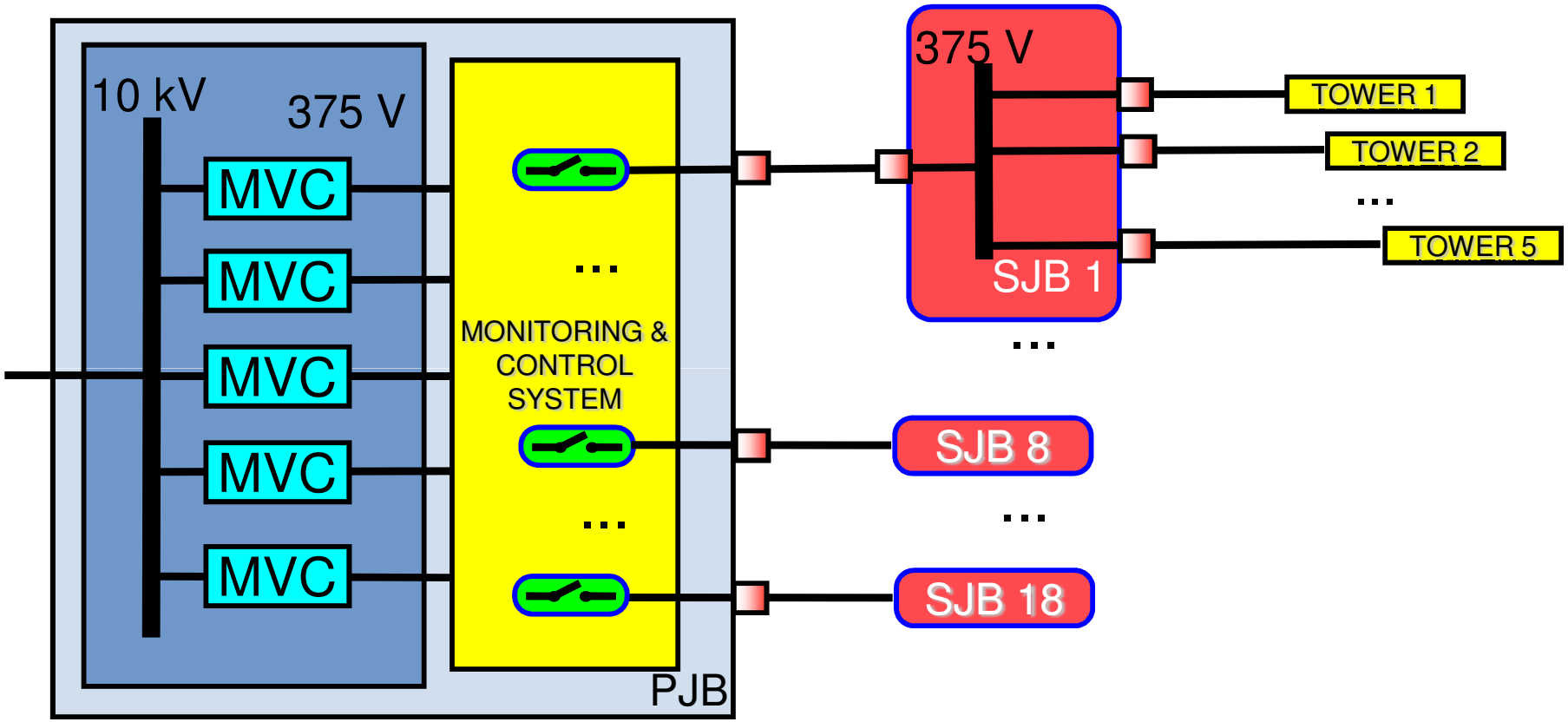
pro:

- The SJB are passive
- The SJB and the PJB-SJB cables have to be designed for a portion of the total power. It depends on the number of SJbs for ex. with 18 SJBs (each SJB feeds 5 DU) we have 30kW/18/375V=4.4A instead of 80 A;

vs:

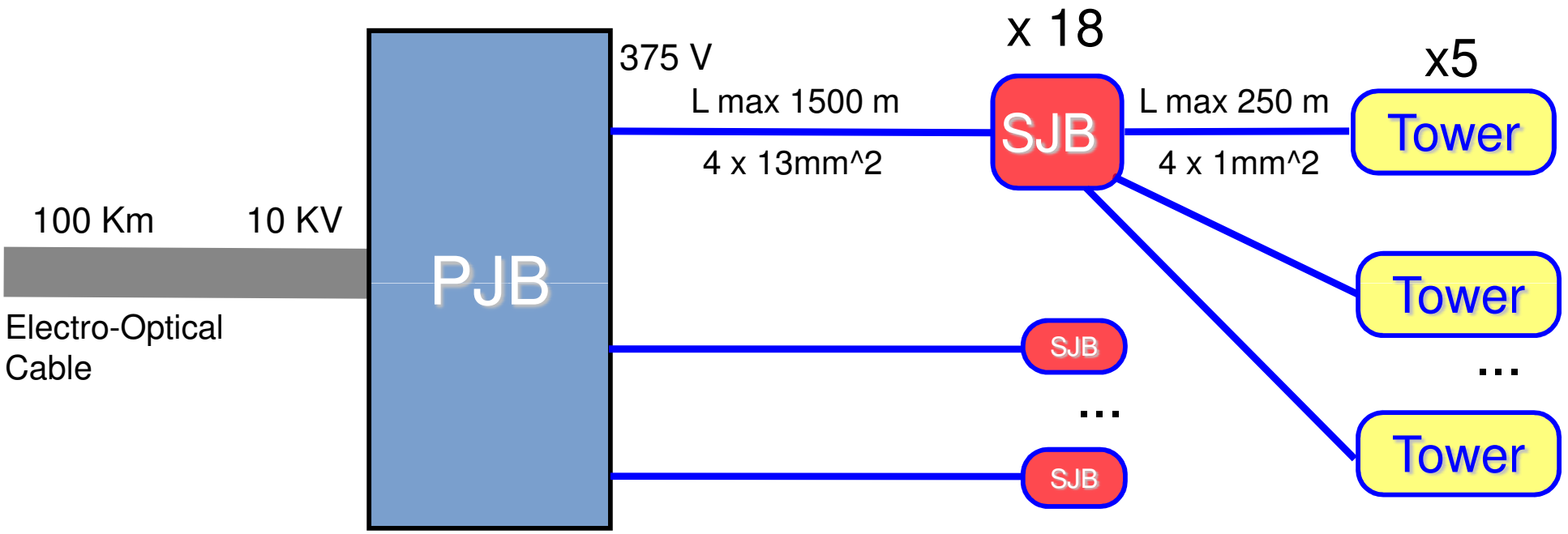
- In case of a PJB-SJB *line fault* a portion of detector is lost (5 DU);

POWER DISTRIBUTION NETWORK



- The PJB will host:
  - a **MVC Box** with 5 MVC both for redundancy and for future grown of the detector (25 years life from Alcatel),
  - a **switch Box** with a monitoring and control system that can be recovered with an automatic recovery system independently from the MVCs box,
  - output 400 V wet mateable connectors including spare connectors.
- The **SJB** is **passive** and will hosts: input and output wet mateable connectors including spare connectors, fuses.

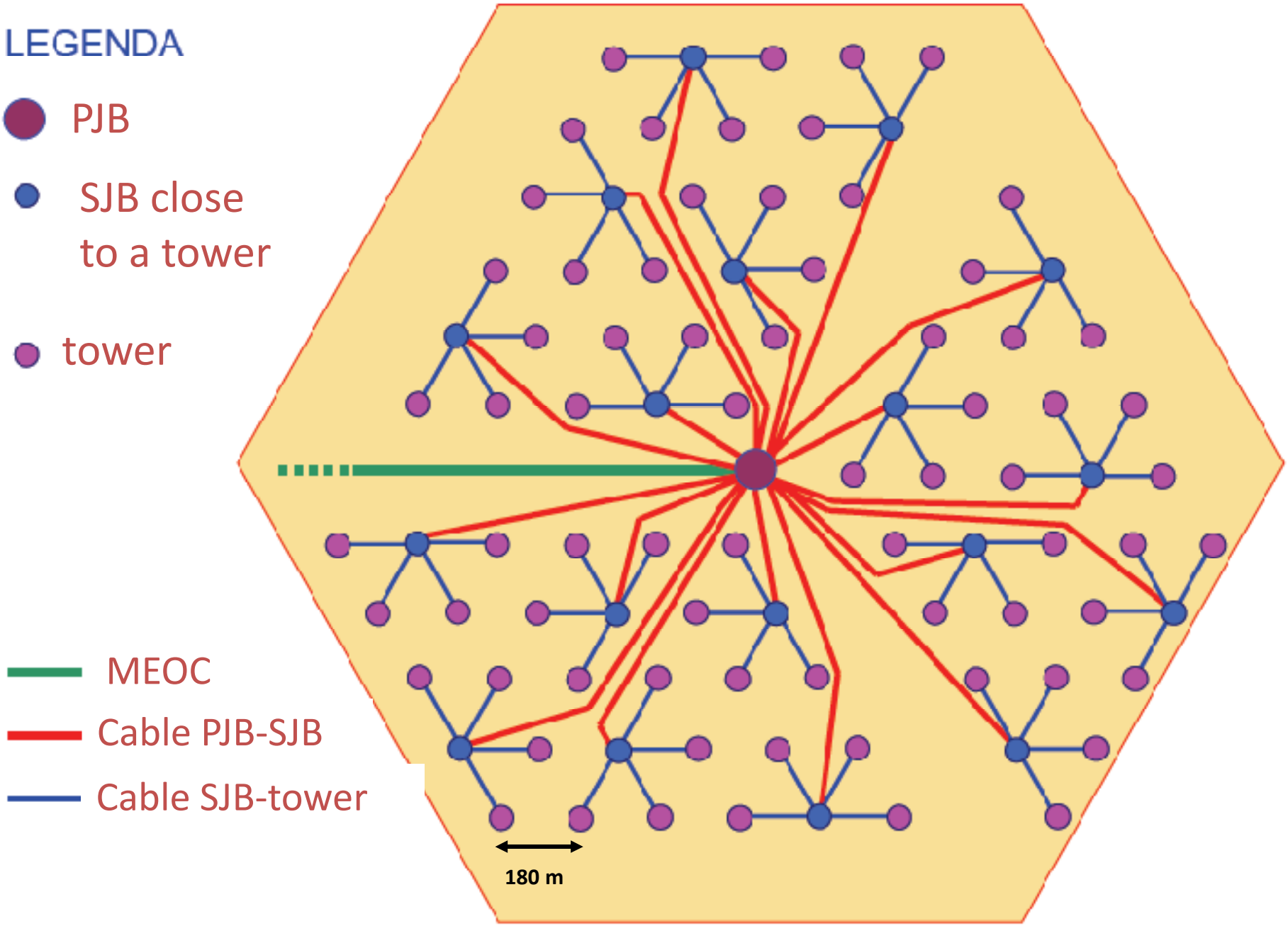
POWER DISTRIBUTION NETWORK



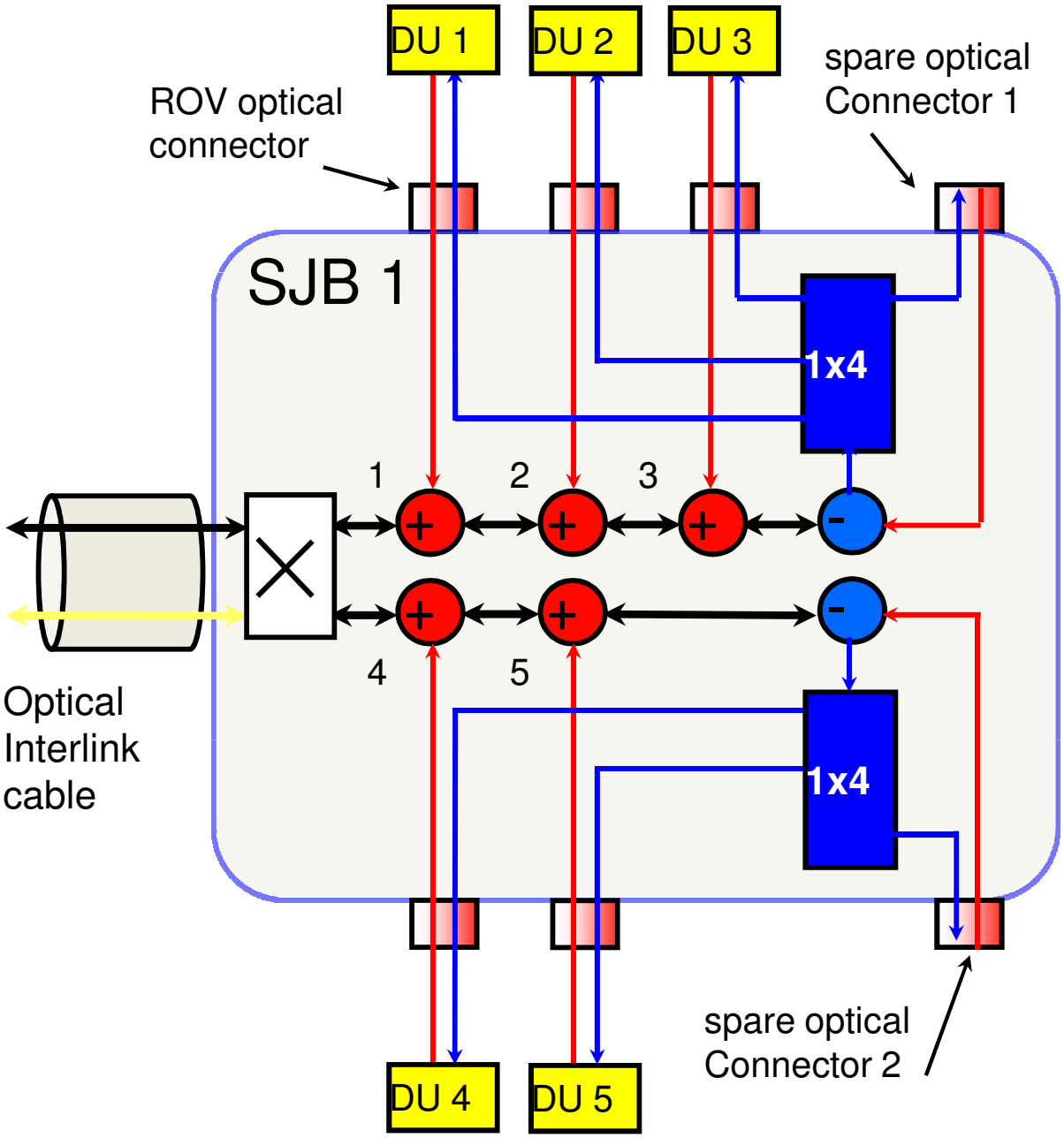
- 1 Primary Junction Box (PJB)
- 18 Secondary Junction Boxes (SJB)
- 5 Tower per SJB
- PJB-SJB: radial distribution
- SJB-tower: radial distribution
- Max distance PJB-SJB: 1500m
- Max distance SJB-tower: 300m

Power per Tower	300 W
90 Towers total power	27 kW
Cable Loss	1 kW
Cable Loss %	< 4%
Cable voltage drop%	< 4%
Total Power	28 kW

Example of SEABED NETWORK

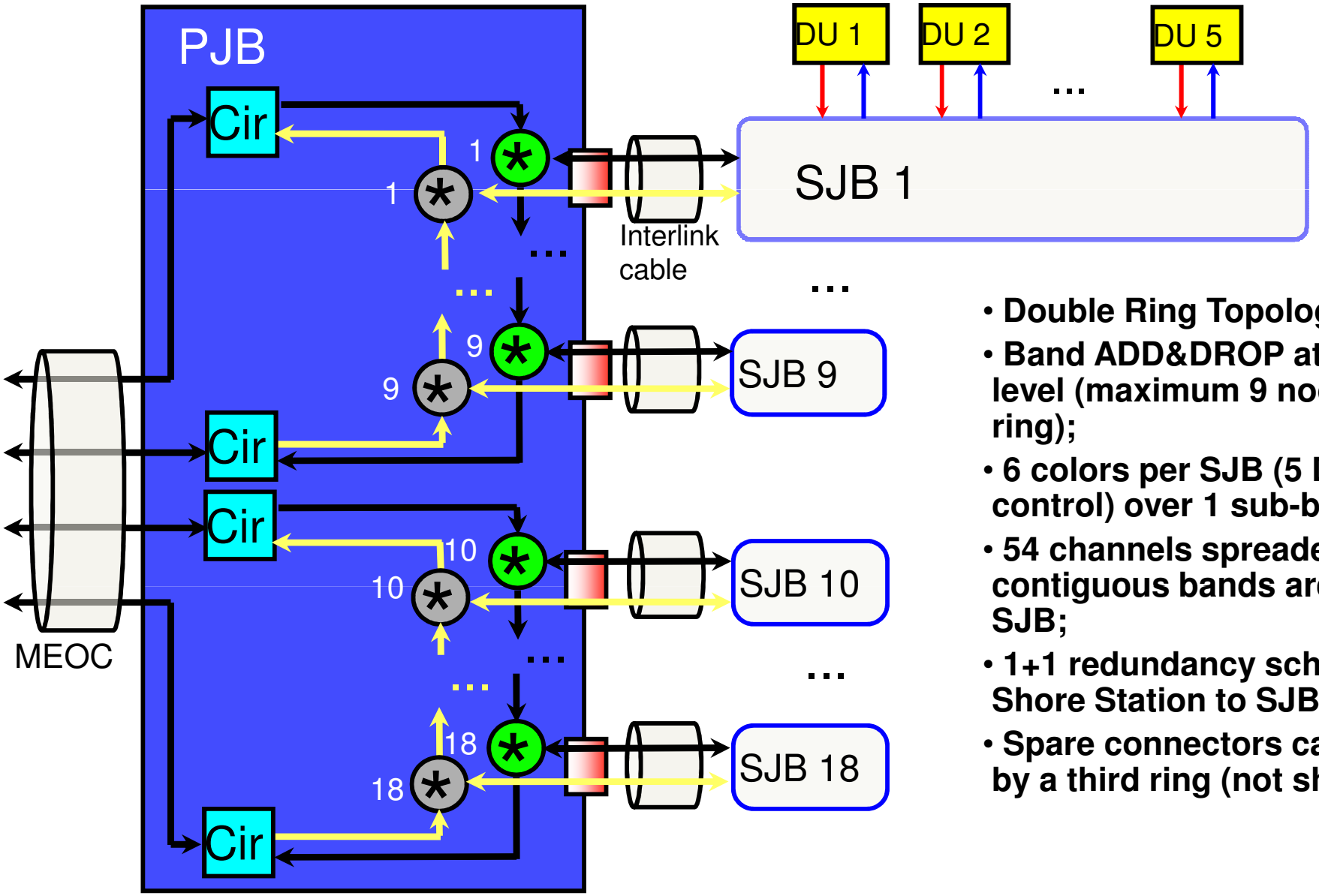


νOne - Optical Network Proposal (1/3): SJBs



- **Double Bus topology;**
- **1 colour per DU @ 2.5 Gb/s (optionally 2 colours @ 2.5 Gb/s);**
- **ADD for the colours from the DUs;**
- **1 colour for slow control from shore**
- **DROP and BROADCAST for the slow control colour @ 2.5 Gb/s;**
- **5 Main optical connectors;**
- **Spare wide bandwidth port is available on each Bus after the Drop node;**
- **2 Spare "colorless" connectors available;**

νOne - Optical Network Proposal (2/3): PJB



- **Double Ring Topology;**
- **Band ADD&DROP at ring node level (maximum 9 nodes per ring);**
- **6 colors per SJB (5 DUs + control) over 1 sub-band;**
- **54 channels spreaded over contiguous bands are used by 9 SJB;**
- **1+1 redundancy scheme from Shore Station to SJB;**
- **Spare connectors can be served by a third ring (not showed)**

νOne - Optical Network Proposal (3/3)

- **Ring topology based on circulators: doubled offshore and onshore to achieve 100% redundancy;**
- **1 ring can support as many DUs as fiber bandwidth allows;**
- **Standard 100 GHz ITU grid accommodates up to ~60 colors: 2 rings are needed to transport 90 DUs;**
- **4 fibers of the Main Electro Optical Cable are used to setup the 2 rings;**