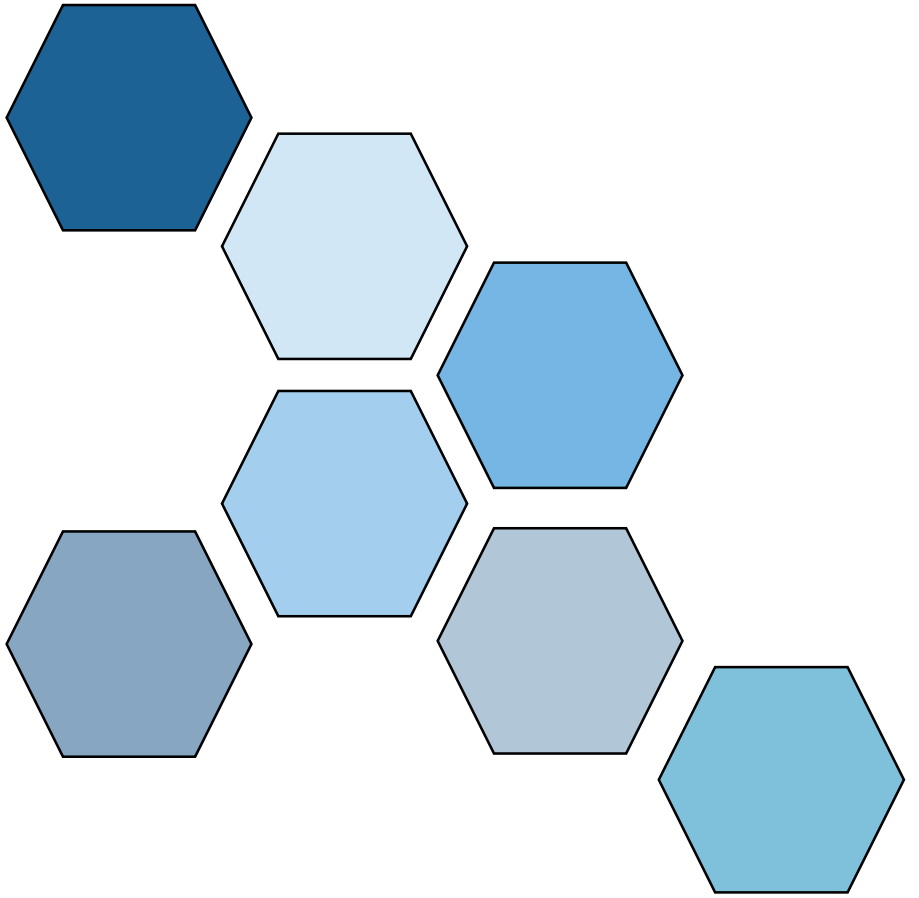
P-ONE Virtual Meeting

P-ONE - cable outreach & mooring concept



M. Böhmer, C. Fink, C. Fruck, R. Gernhäuser, A. Gärtner, C. Haack, F. Henningsen, K. Holzapfel, Na. Khera, Ni. Khera, K. Leismüller, L. Papp, I.C. Rea, E. Resconi, C. Spannfellner, M. Traxler, J. Michel, L. Winter, L. Ruohan, C. Bellenghi, D. Vivolo

TUM – Experimental Physics with Cosmic Particles

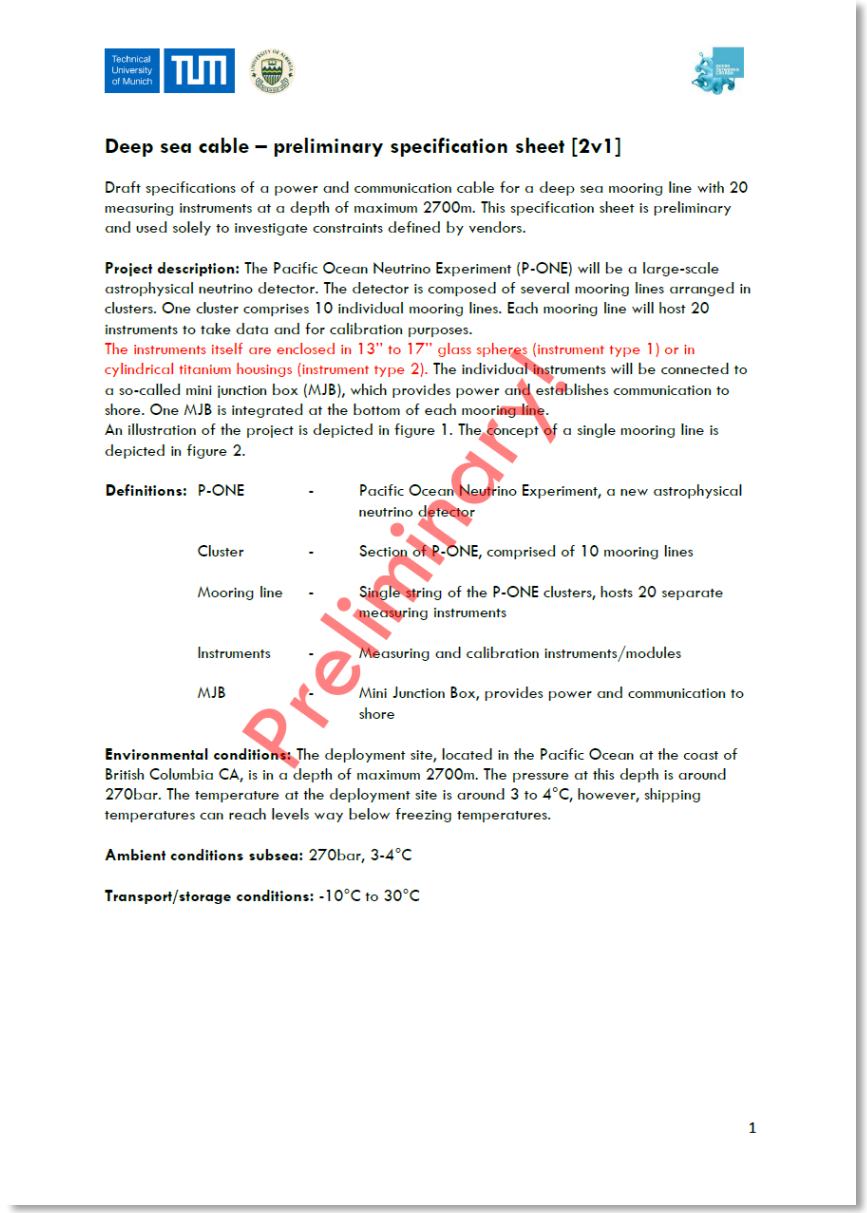
Cable vendor outreach – background

- **Goal:** Market research – find the best solution for P-ONE mooring
  1) Ask for tentative offers in Europe, Canada, US,..
  2) Get input on possible solutions by vendors
  3) Decide for one concept (requirements) and perform offical procurement

- **Idea:** Come up with a draft specification sheet (send to vendors)

- **But #1:** Many open questions regarding specs
  1) Power budget, number of fibers
  2) Instruments (amount, housing, etc.)
  3) Mooring length
  4) Bundling, strain members (estimated load)
  5) Lifetime of P-ONE

➡ Dedicated P-ONE call after Christmas break?



Deep sea cable – preliminary specification sheet [2v1]

Draft specifications of a power and communication cable for a deep sea mooring line with 20 measuring instruments at a depth of maximum 2700m. This specification sheet is preliminary and used solely to investigate constraints defined by vendors.

Project description: The Pacific Ocean Neutrino Experiment (P-ONE) will be a large-scale astrophysical neutrino detector. The detector is composed of several mooring lines arranged in clusters. One cluster comprises 10 individual mooring lines. Each mooring line will host 20 instruments to take data and for calibration purposes.
The instruments itself are enclosed in 13" to 17" glass spheres (instrument type 1) or in cylindrical titanium housings (instrument type 2). The individual instruments will be connected to a so-called mini junction box (MJB), which provides power and establishes communication to shore. One MJB is integrated at the bottom of each mooring line.
An illustration of the project is depicted in figure 1. The concept of a single mooring line is depicted in figure 2.

Definitions:

P-ONE	-	Pacific Ocean Neutrino Experiment, a new astrophysical neutrino detector
Cluster	-	Section of P-ONE, comprised of 10 mooring lines
Mooring line	-	Single string of the P-ONE clusters, hosts 20 separate measuring instruments
Instruments	-	Measuring and calibration instruments/modules
MJB	-	Mini Junction Box, provides power and communication to shore

Environmental conditions: The deployment site, located in the Pacific Ocean at the coast of British Columbia CA, is in a depth of maximum 2700m. The pressure at this depth is around 270bar. The temperature at the deployment site is around 3 to 4°C, however, shipping temperatures can reach levels way below freezing temperatures.

Ambient conditions subsea: 270bar, 3-4°C

Transport/storage conditions: -10°C to 30°C

Preliminary

1

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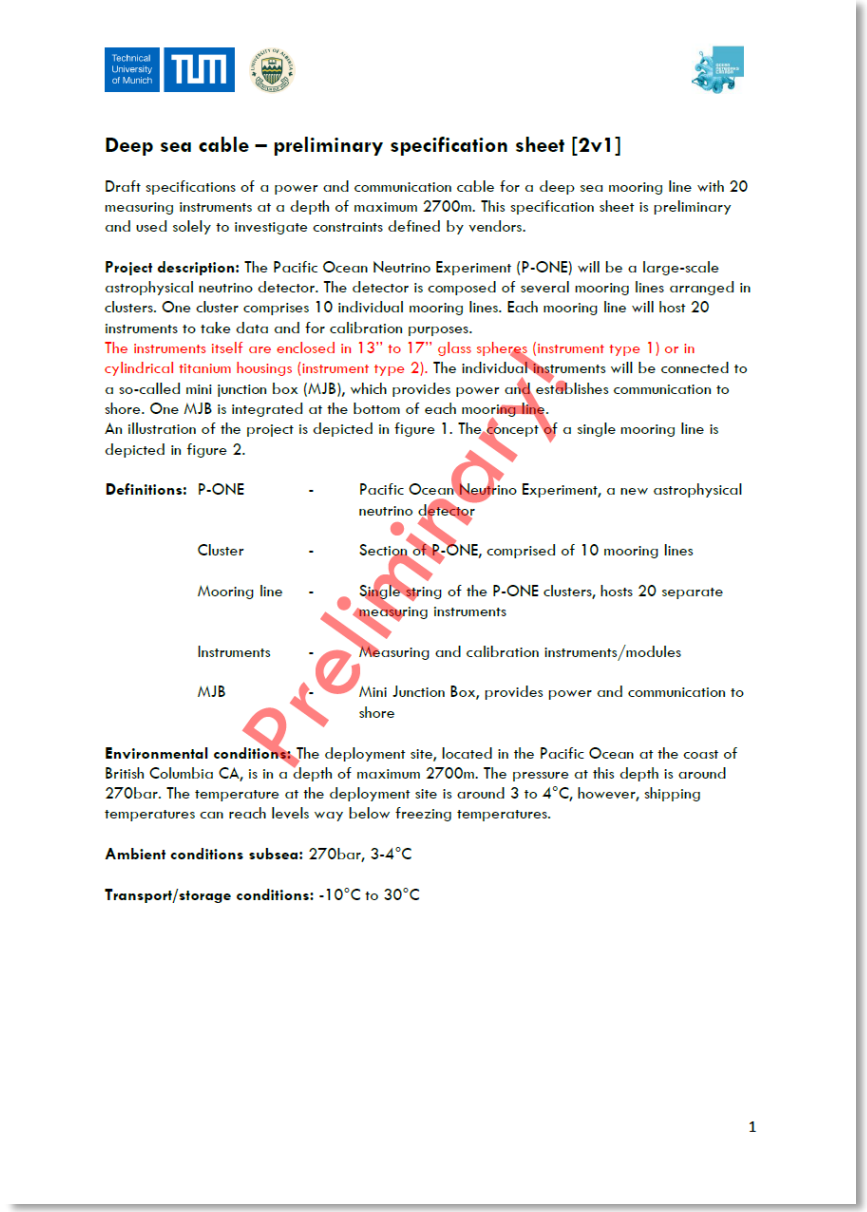

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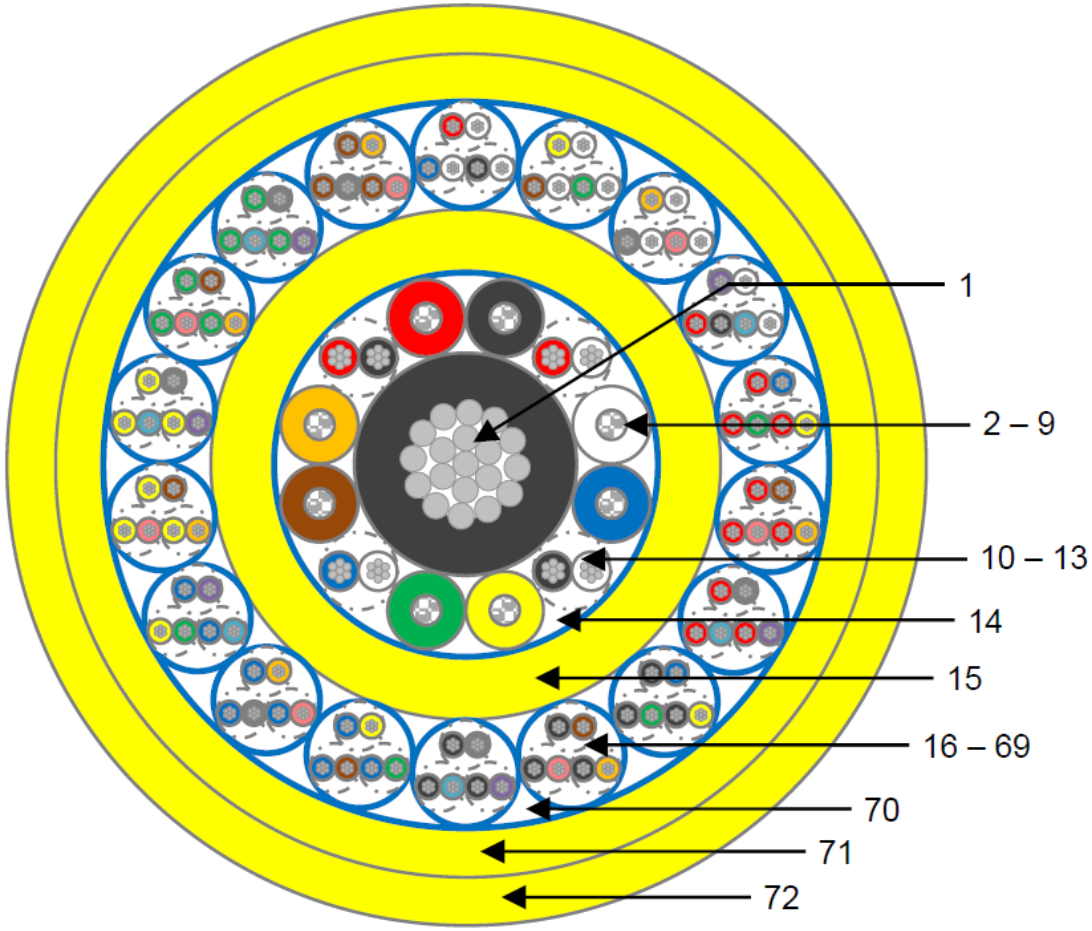
- **But #2:** Preliminary outreach has been performed already (due to STRAW-b)

  ➡ P-ONE mooring concept based on that

Disclaimer: The concept is very preliminary and summarizes only a few lose thoughts. Consider this as a talk during the coffee break of an in-person meeting.

P-ONE mooring concept – cable

- Concept based on cable with strength members
  - Several different applications available (e. g. deepsea, mining, cargo lifts)
  - Different techniques:
    - Wire rope as core (proposed by ConceptCables)
    - Fibers as strength members
    - Cable shield (similar to coaxial cable)
- Advantages
  - Significantly less slack managment
  - No merging of components necessary – reduced hands-on time during deployment
  - Integrated design of mooring line



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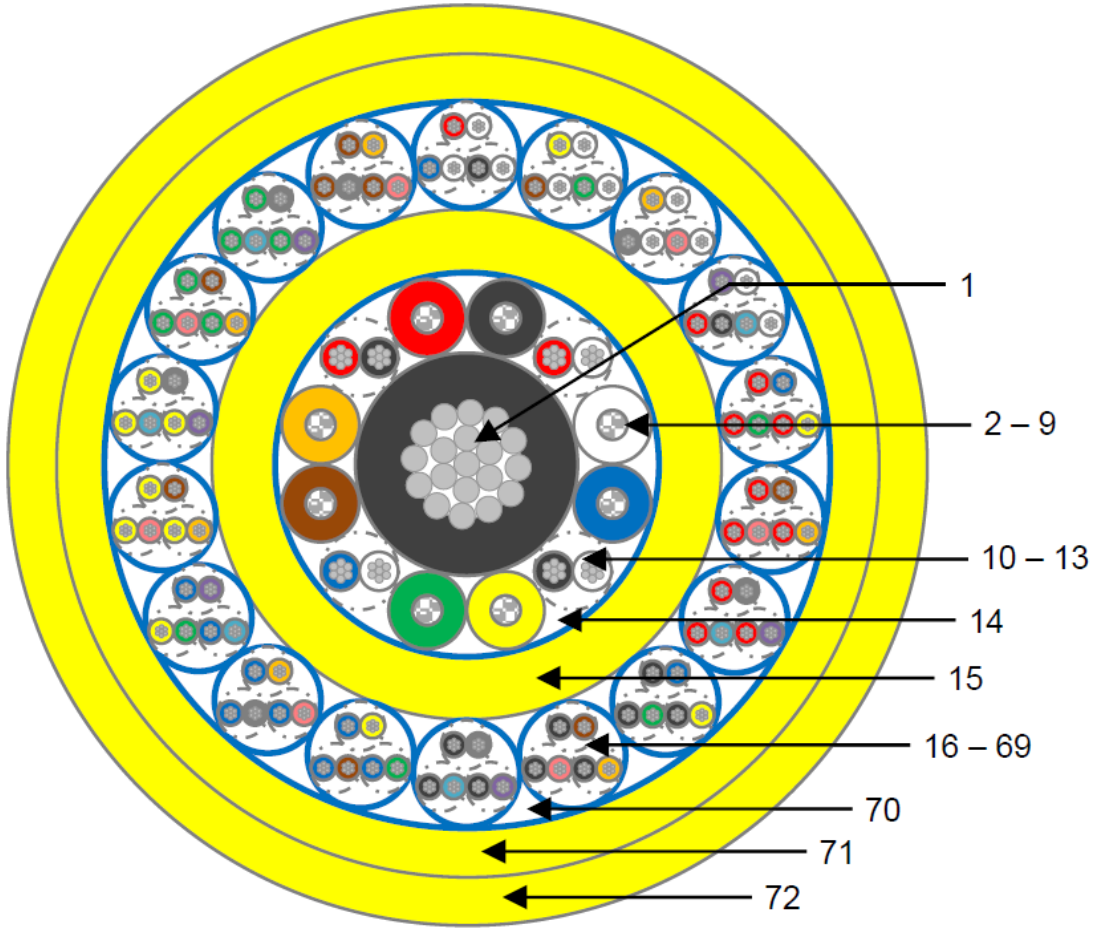
  - Integrated design of mooring line may be possible (similar to bottom-up)



P-ONE mooring concept – structure

- Concept idea similar to IceCube
  - Single cable with breakouts at instrument positions
  - Cable redirected around module (load transfer required)
- Instrument types
  - P-DOR (P-ONE Digital Optical Receiver)
  - P-CAL (P-ONE Calibration Module)
- Intermediate floats (between instruments)

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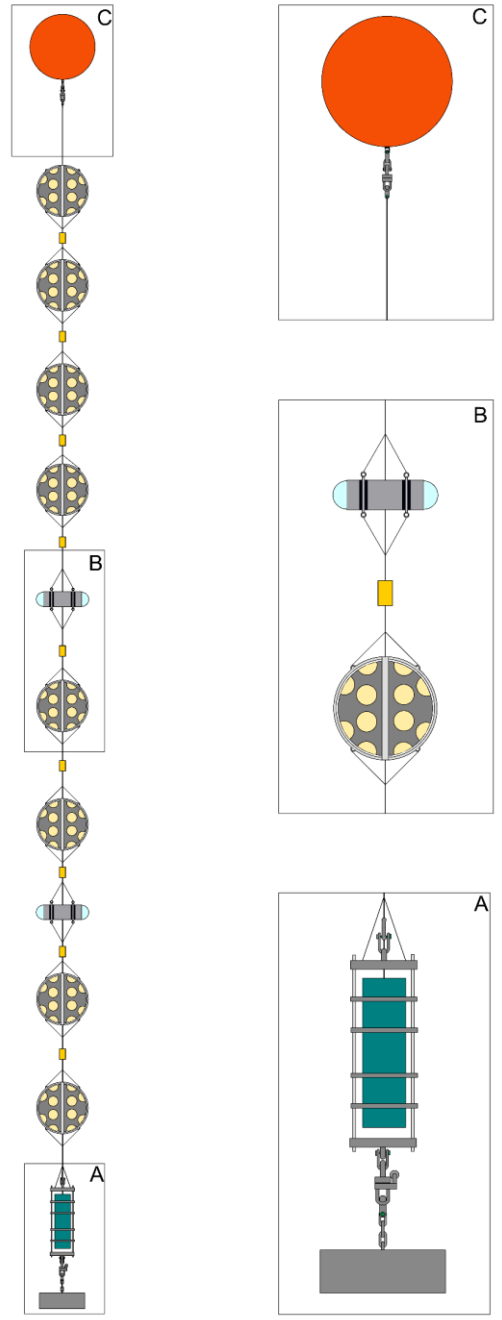
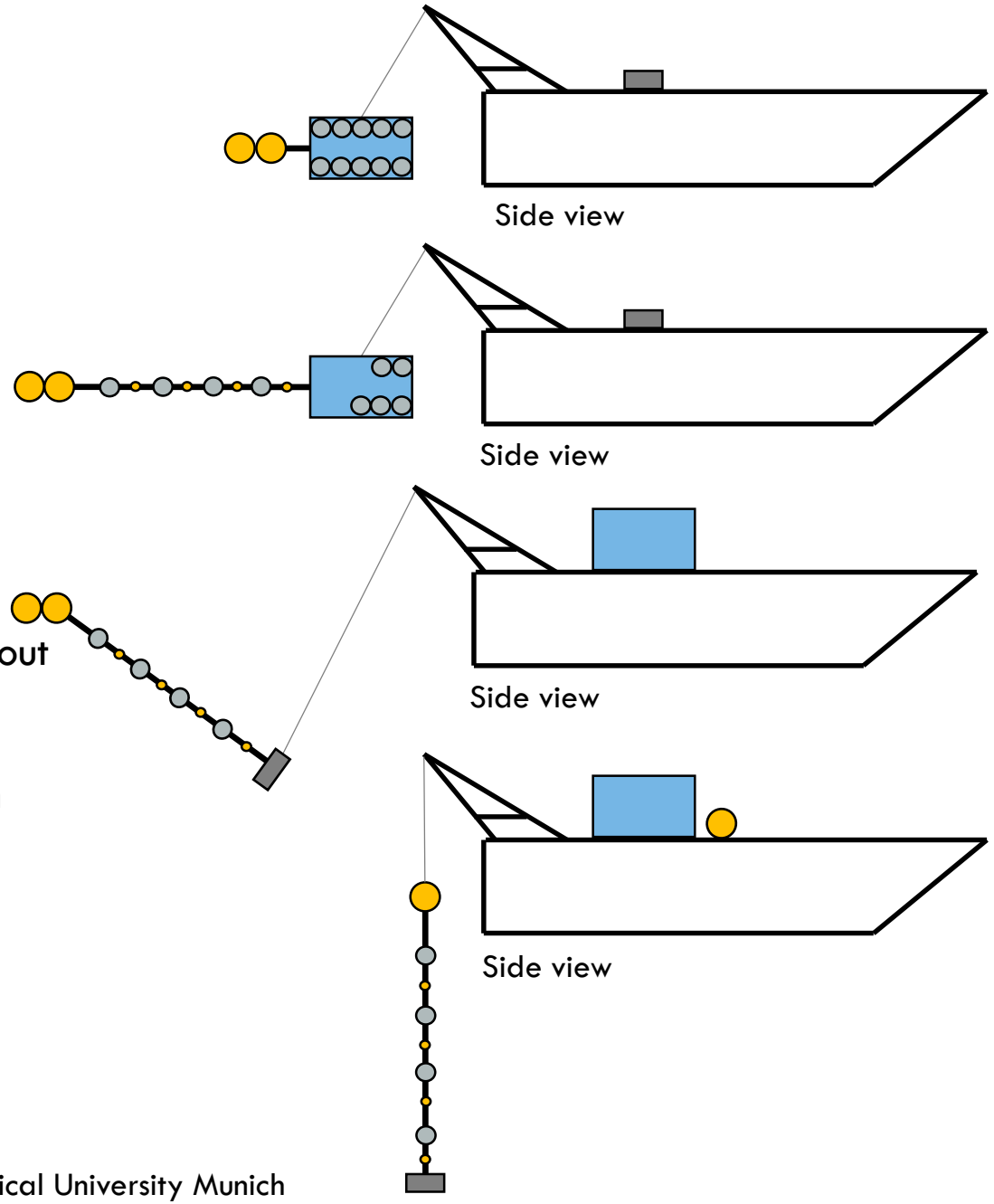
  - Single cable with breakouts at instrument positions
  - Cable redirected around module (load transfer required)
- Instrument types
  - P-DOR (P-ONE Digital Optical Receiver)
  - P-CAL (P-ONE Calibration Module) – cylindrical housing
- Intermediate floats (between instruments)



P-ONE mooring concept – deployment

1) „Rail/battery tray" lowered to sea surface via A-frame
2) Drag draws mooring out bit-by-bit
3) Load transfer to anchor on back deck once mooring is stretched-out
4) Anchor lowered via HLL until mooring is in nearly upright position
5) Controlled lowering of mooring to seabed



➡ „Bottom-up just top-down“ – combine best of both worlds

Technical University of Munich

P-ONE

Thank you for the attention!

Technical University of Munich

P-ONE

Backup

Technical University of Munich

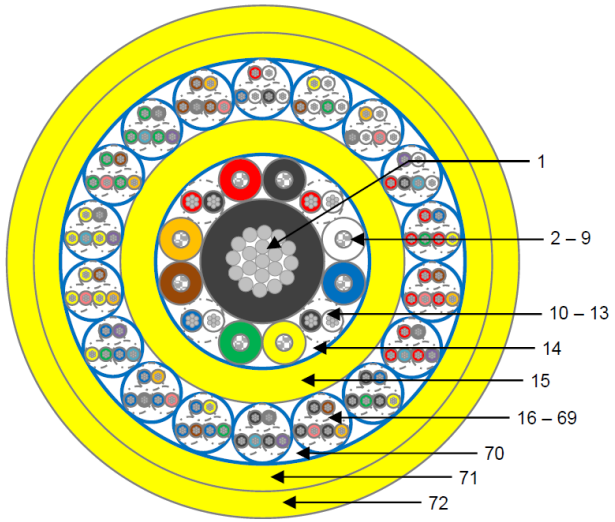
P-ONE

Part No: 200512-017

RoHS COMPLIANT 2011/65/EC

Customer Ref:

Quotation Drawing No:



No	Description	Colr	Dia mm
1	**1 Position Central Strain Member** 4.00mm Galvanised Steel Wire Rope HDPE Jacketed 1.45mm nom RTI	BK	6.90
2 3 4 5 6 7 8 9	**8 Position Conductors** 0.50mm² (16/0.20mm) Tinned Copper Polyolefin Insulated 0.74mm nom RTI	RD BK WH BU YW GN BN OR	2.40
10 11 12 13	**4 Position Twisted Pairs** 0.34mm² (7/0.25mm) Tinned Copper Polyolefin Insulated to 1.20mm 2 no twisted together.	RD/WH BK/WH BU/WH RD/BK	2.40
14	**Primary Lay Up** Items 2 – 13 cabled around item 1 with overall Helical PET binding tape, minimum overlap 30%	N/A	11.90
15	**Bedding** Polyether Polyurethane 85 Shore A UL94 V-2 Flame Retardant Halogen Free 1.95mm nom RTI	YW	15.80

No	Description	Colr	Dia mm
16 - 69	**54 Position Twisted Pairs** 0.14mm² (7/0.16mm) Tinned Copper Polyolefin Insulated to 0.90mm 2 no twisted together. Arranged as 18 off Triads each with overall PET binding tape, minimum overlap 30% Colour Coded as follows: RD/WH, BK/WH, BU/WH YW/WH, GN/WH, BN/WH OR/WH, PK/WH, GY/WH VT/WH, TQ/WH, RD/BK RD/BU, RD/YW, RD/GN RD/BN, RD/OR, RD/PK RD/GY, RD/VT, RD/TQ BK/BU, BK/YW, BK/GN BK/BN, BK/OR, BK/PK BK/GY, BK/VT, BK/TQ BU/YW, BU/GN, BU/BN BU/OR, BU/PK, BU/GY BU/VT, BU/TQ, YW/GN YW/BN, YW/OR, YW/PK YW/GY, YW/VT, YW/TQ GN/BN, GN/OR, GN/PK GN/GY, GN/VT, GN/TQ BN/OR, BN/PK, BN/GY		3.30
70	**Secondary Lay Up** Items 16 – 69 cabled around item 15 with overall Helical PET binding tape, minimum overlap 30%	N/A	22.50
71	**Primary Jacket** Polyether Polyurethane 85 Shore A UL94 V-2 Flame Retardant Halogen Free 1.50mm nom RTI	YW	25.50
72	**Secondary Jacket** Polyether Polyurethane 85 Shore A UL94 V-2 Flame Retardant Halogen Free 1.50mm nom RTI	YW	28.50 +/- 1.50

ISSUE	DESCRIPTION	DRWN	DATE	APPD	DATE
01	Issue Part Numbers	SMO	14/06/17	ND	14/06/17
00	Quotation	SMO	13/06/17		

Conceptcables FROM CONCEPT TO CABLE

TITLE: 124C-58UTP-S-PU-PU 28.50 YW

DESCRIPTION:

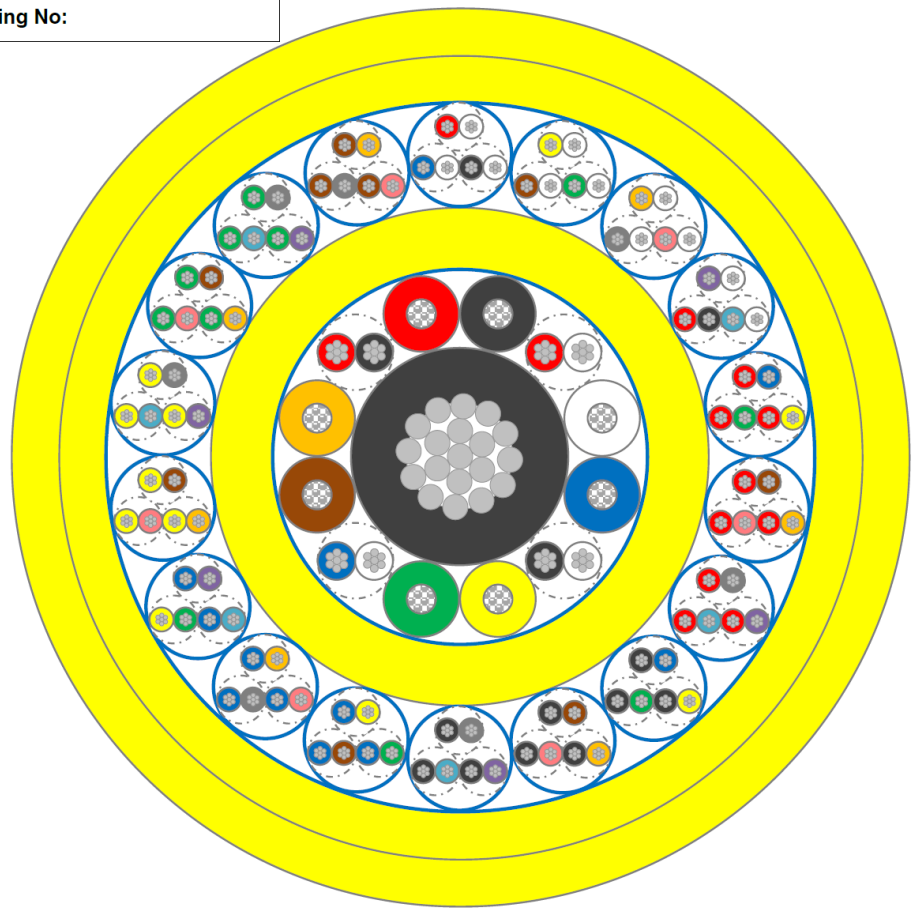
CUSTOMER:

Technical University of Munich

P-ONE

Part No:	**200512-017**
Customer Ref:	
Quotation Drawing No:	

RoHS COMPLIANT 2011/65/EC



Notes	
Electrical Characteristics	
0.50mm² Conductors	
Nominal Conductor Resistance	40.50 Ω/KM @ 20°C
Max Recommended Voltage	600 V
Max Recommended Current / Conductor	3 A
0.34mm² Twisted Pairs	
Nominal Conductor Resistance	59.30 Ω/KM @ 20°C
Max Recommended Voltage	300 V
0.14mm² Twisted Pairs	
Nominal Conductor Resistance	144.70 Ω/KM @ 20°C
Max Recommended Voltage	200 V
General	
Minimum Insulation Resistance	>900 MΩ/KM @ 1000V
Mechanical Characteristics	
Maximum Operating Temp	
Static	+90°C
Dynamic	+80°C
Cold Flex Temp	-40°C
Minimum Break Load	1,600 KGF
Recommended Safe Work Load	530 KGF
Min Recommended Bend Radius	
Static	200 mm
Dynamic	340 mm
Nominal Weight	
In Air	791 KG/KM
In Sea Water @ SG 1.025	137 KG/KM

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