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## POLARISATION WORK PACKAGE DESCRIPTION

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## 1. INTRODUCTION

We are making polarization infrastructure and technical components for the instruments.

## 2. TIMELINE SUMMARY

### Equipment development: WBS 1 – 20

#### WBS 1

Management (staff: 1 scientist, 1 engineer, 1 design lead, 1 technician)

Labour	1 132 119 €
Non-Labor	0 €

#### WBS 2

3He gas

50 L

Labour	0 €
Non-Labor	105 000 €

#### WBS 3

SEOP station

1 unit

Labour	28 880 €
Non-labour	19 000 €

Laser interlock

Specification	Fri 23 Jan '26
PDR	Fri 10 Apr '26
CDR	Fri 12 Jun '26
Procurement	Fri 24 Jul '26

Oven

Specification	Fri 27 Mar '26
PDR	Fri 15 May '26
CDR	Fri 17 Jul '26
Procurement	Fri 28 Aug '26

Assemble

Assemble, test	Fri 20 Nov '26
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Details in section 4.3.6.2. SEOP station in [1] and [2].

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#### **WBS 4**

Field Mapper

1 unit

Labour	11 280 €
Non-labour	15 000 €
Specification	Fri 23 Jan '26
PDR	Tue 31 Mar '26
CDR	Tue 2 Jun '26
Procurement	Tue 14 Jul '26
Assemble, test	Tue 6 Oct '26

Details in section 4.3.5.4. Field mapper in [1] and [2].

#### **WBS 5**

Cell making and pressure test setup

1 unit

Labour	112 640 €
Non-labour	102 400 €
Cell processing and pressure test station	
Specification	Fri 3 Apr '26
PDR	Fri 19 Jun '26
CDR	Fri 18 Sep '26
Procurement	Fri 27 Nov '26
Assemble	Fri 5 Mar '27

Cell washing station

Specification	Fri 13 Feb '26
PDR	Fri 8 May '26
CDR	Fri 17 Jul '26
Procurement	Fri 25 Sep '26
Assemble, test	Fri 1 Jan '27

Details in section 4.3.3. Cell making and pressure test setup in [1] and 4.3.3 Cell making in [2].

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## WBS 6

Wide-angle analyser 1

1 unit

Labour	130 960 €		
Non-labour	107 400 €		
	Specification	Fri 24 Apr '26	
	PDR	Fri 21 Aug '26	
	CDR	Fri 18 Dec '26	
	Procurement	Fri 26 Feb '27	
	Assemble, test	Fri 11 Jun '27	

Details in section 4.3.5.3. Magnetic field coils in [1] and 4.3.5.3 WAA in [2].

## WBS 7

Polarisation mobile controller 1

1 unit

Labour	0 €		
Non-labour	33 000 €		
	Specification	Fri 20 Mar '26	
	Review	Fri 8 May '26	
	Procurement	Fri 19 Jun '26	

Details in section 4.8. Equipment controller in [1] and 4.8 Equip Ctrl in [2].

## WBS 8

FID - 3He polarisation measurement

10 units

Labour	0 €		
Non-labour	5 000 €		
	Delivery	Fri 24 Apr '26	

Details in section 4.3.5.1. AFP, FID, EPR-shift in [1] and 4.3.5.1 FID in [2].

## WBS 9

In-Situ SEOP station

1 unit

Labour	60 560 €		
Non-labour	114 800 €		
	Specification	Fri 13 Mar '26	
	PDR	Fri 12 Jun '26	
	CDR	Mon 28 Sep '26	
	Procurement	Mon 23 Nov '26	
	Assemble, test	Mon 1 Mar '27	

Details in section 4.3.6.3. In-situ SEOP setup in [1] and 4.3.6.3 Instr – in situ SEOP in [2].

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## WBS 10

Protective case

4 units

Labour	25 600 €	
Non-labour	20 000 €	
Specification		Fri 1 May '26
PDR		Fri 19 Jun '26
CDR		Fri 21 Aug '26
Procurement		Fri 2 Oct '26
Assemble, test		Fri 20 Nov '26

Details in section 4.3.4. Protective case for cell in ex-situ operation in [1] and 4.3.4 Protective case in [2].

## WBS 11

Cylindrical SEOP cell

4 units

Labour	15 200 €	
Non-labour	15 200 €	
PDR		Fri 11 Sep '26
CDR		Fri 16 Oct '26
Procurement		Fri 8 Jan '27
Build cell 1		Fri 23 Apr '27
Build cell 2		Fri 11 Jun '27
Build cell 3		Fri 30 Jul '27
Build cell 4		Fri 17 Sep '27

Details in section 4.3.1.2. Cylindrical SEOP cell in [1] and 4.3.1.2 SEOP cell Cyl in [2].

## WBS 12

Polarisation mobile controller 2

1 unit

Labour	0 €	
Non-labour	33 000 €	
Delivery		Fri 14 Aug '26

Details in section 4.8. Equipment controller in [1] and 4.8 Equip Ctrl in [2].

### WBS 13

3He gas transporter 1

1 unit

Labour	78 080 €		
Non-labour	41 120 €		
	Specification		Fri 28 Aug '26
	PDR		Fri 30 Oct '26
	CDR		Fri 29 Jan '27
	Procurement		Fri 26 Mar '27
	Assemble, test		Fri 2 Jul '27

Details in section 4.3.7.2. Transporter in [1] and 4.3.7.2 Gas trpt in [2].

### WBS 14

3He gas exchanger 1

1 unit

Labour	7 680 €		
Non-labour	60 000 €		
	Specification		Fri 30 Oct '26
	PDR		Fri 29 Jan '27
	CDR		Fri 14 May '27
	Procurement		Fri 9 Jul '27
	Assemble, test		Fri 1 Oct '27

Details in section 4.3.7.3. Gas exchanger in [1] and 4.3.7.3 Gas Excg in [2].

### WBS 15

MEOP wide-angle cell

2 cells

Labour	14 000 €		
Non-labour	30 080 €		
	PDR		Fri 30 Oct '26
	CDR		Fri 4 Dec '26
	Procurement		Fri 26 Feb '27
	Build cell 1		Fri 23 Apr '27
	Build cell 2		Fri 11 Jun '27

Details in section 4.3.2.1. Wide-angle MEOP cell in [1] and 4.3.2.1 MEOP cell WA in [2].

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## WBS 16

Wide-angle analyser 2

1 unit

Labour	16 560 €	
Non-labour	117 640 €	
	Procurement	Fri 5 Mar '27
	Assemble	Fri 9 Jul '27

Details in section 4.3.5.3. Magnetic field coils in [1] and 4.3.5.3 Instr - WAA in [2].

## WBS 17

MEOP cylindrical cell

2 cells

Labour	14 000 €	
Non-labour	24 080 €	
	PDR	Fri 5 Mar '27
	CDR	Fri 9 Apr '27
	Procurement	Fri 2 Jul '27
	Build cell 1	Fri 20 Aug '27
	Build cell 2	Fri 8 Oct '27

Details in section 4.3.1.1. Cylindrical MEOP cell in [1] and 4.3.1.1 MEOP cell Cyl in [2].

## WBS 18

MEOP polarised <sup>3</sup>He transport cell

2 cells

Labour	14 000 €	
Non-labour	30 480 €	
	PDR	Fri 30 Apr '27
	CDR	Fri 4 Jun '27
	Procurement	Fri 27 Aug '27
	Build cell 1	Fri 15 Oct '27
	Build cell 2	Fri 3 Dec '27

Details in section 4.3.7.1. Polarised <sup>3</sup>He transport cell in [1] and 4.3.7.1 Gas trpt cell in [2].

## WBS 19

<sup>3</sup>He gas transporter 2

1 unit

Labour	1 920 €	
Non-labour	33 000 €	
	Procurement	Fri 2 Jul '27
	Assemble, test	Fri 17 Sep '27

Details in section 4.3.7.2. Transporter in [1] and 4.3.7.2 Gas trpt in [2].

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## WBS 20

3He gas exchanger 2

1 unit

Labour	7 680 €
Non-labour	60 000 €
Procurement	Fri 17 Sep '27
Assemble, test	Fri 10 Dec '27

Details in section 4.3.7.3. Gas exchanger in [1] and 4.3.7.3 Gas Excg in [2].

## Instrument development: WBS 21 – 25

### WBS 21

BIFROST - Polariser, incident beam spin flipper

1 unit

Labour	0 €
Non-labour	32 000 €
Supermirror polariser	
Specification	Tue 18 Nov '25
Tender	Mon 2 Mar '26
Kick off	Mon 9 Mar '26
PDR	Tue 7 Apr '26
CDR	Wed 27 May '26
FAT	Wed 7 Oct '26
SAT	Sat 31 Oct '26

Static & r.f. field for polariser & spin-flipper

Specification	Mon 11 May '26
CDR	Mon 10 Aug '26
Procurement	Mon 5 Oct '26

Assemble supermirror polariser, static & r.f. field

Assemble	Fri 13 Nov '26
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Details in section 5.3.3 BIFROST in [1] and [2].

### WBS 22

DREAM - Analyser interface to wide-angle analyser

1 unit

Labour	37 320 €
Non-labour	20 000 €
Specification	Fri 8 May '26
PDR	Fri 21 Aug '26
CDR	Fri 8 Jan '27
Procurement	Fri 15 Jan '27
Assemble, install	Fri 24 Sep '27

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Details in section 5.3.2 DREAM in [1] and [2].

### WBS 23

SKADI - Analyser positioner, interface to in-situ SEOP station

1 unit

Labour	85 920 €
Non-labour	33 840 €
Specification	Fri 10 Apr '26
PDR	Fri 12 Jun '26
CDR	Fri 9 Oct '26
Procurement	Fri 20 Nov '26
Assemble, install	Mon 19 Apr '27

Details in section 5.3.4 SKADI in [1] and [2].

### WBS 24

CSPEC - Polariser (supermirror not included)

1 unit

Labour	29 120 €
Non-labour	40 000 €
Whole system design	
Specification	Fri 12 Feb '27
PDR	Fri 30 Apr '27
Static & r.f. field for polariser & spin-flipper	
CDR	Fri 30 Jul '27
Procurement	Fri 24 Sep '27
Assemble	Fri 12 Nov '27
Guide fields	
CDR	Fri 10 Sep '27
Procurement	Fri 22 Oct '27
Assemble	Fri 17 Dec '27

Details in section 5.3.7 CSPEC in [1] and [2].

### WBS 25

MIRACLES - polarisation setup (supermirror not included)

1 unit

Labour	207 280 €
Non-labour	264 120 €
Whole system design	
Specification	Fri 15 May '26
PDR	Fri 31 Jul '26
Static & r.f. field for polariser & spin-flipper	
CDR	Fri 2 Apr '27

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Procurement	Fri 28 May '27
Assemble supermirror polariser, static & r.f. field	
Assemble	Fri 25 Jun '27
Optics exchanger	
CDR	Fri 23 Apr '27
Procurement	Fri 4 Jun '27
Assemble	Fri 30 Jul '27
Install prior to supermirror available	
Install	Tue 2 Nov '27
Guide fields	
CDR	Fri 18 Dec '26
Procurement	Fri 29 Jan '27
Assemble, install	Fri 26 Mar '27
Analyser in sample vessel (design, procurement)	
CDR	Tue 14 Sep '27
Procurement	Tue 26 Oct '27
Analyser coil phase 1	
Prototype	Tue 21 Oct '25
CDR	Tue 16 Dec '25
Procurement	Thu 30 Apr '26
Assemble, install	Thu 18 Jun '26
Analyser coil phase 2	
CDR	Fri 8 May '26
Procurement	Fri 19 Jun '26
Assemble, install	Fri 16 Oct '26

Details in section 5.3.8 MIRACLES in [1] and [2].

**MEOP station: WBS 26**

**WBS 26**

MEOP station

1 unit

Labour 35 360 €

Non-labour 2 698 763 €

MEOP station

PDR / Specification	Fri 21 Mar '26
CDR / Final design	Tue 20 Apr '26
Procurement	Thu 31 Dec '26
Construction	Fri 31 Dec '27
FAT	Fri 21 Jan '28
Disassemble and transport	Fri 12 May '28
Assemble at ESS	Fri 7 Jul '28

SAT Fri 21 Jul '28

Hosting platform & infrastructure

1 unit

Labour	0 €
Non-labour	130 000 €
MEOP station	
Specification	Fri 24 Oct '25
PDR	Fri 23 Jan '26
Procurement	Fri 12 Jun '26
Assemble, install	Fri 2 Oct '26

Details in section 4.3.6.1 MEOP station in [1] and [2]. Platform cost includes installation.

### 3. SUMMARY

Polarisation team staff hours and costs are listed in WBS 1. Labour hours and costs in WBS 2 – 26 exclude Polarisation team staff hours and costs.

WBS element	Labor Hours	Labor EUR	Non-Labor EUR
#1	15818	1 132 119 €	0 €
#2	0	0 €	105 000 €
#3	400	28 880 €	19 000 €
#4	260	11 280 €	15 000 €
#5	1616	112 640 €	102 400 €
#6	1900	130 960 €	107 400 €
#7	0	0 €	33 000 €
#8	0	0 €	5 000 €
#9	1036	60 560 €	114 800 €
#10	320	25 600 €	20 000 €
#11	160	15 200 €	15 200 €
#12	0	0 €	33 000 €
#13	1024	78 080 €	41 120 €
#14	160	7 680 €	60 000 €
#15	256	14 000 €	30 080 €
#16	548	16 560 €	117 640 €
#17	160	14 000 €	24 080 €
#18	336	14 000 €	30 480 €
#19	40	1 920 €	33 000 €
#20	160	7 680 €	60 000 €
#21	0	0 €	32 000 €
#22	710	37 320 €	20 000 €
#23	1368	85 920 €	33 840 €

#24	636	29 120 €	40 000 €
#25	3220	207 280 €	264 120 €
#26	320	35 360 €	2 828 763 €
Totals	30448	2 066 159 €	4 184 923 €

## 4. GLOSSARY

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Term	Definition
PDR	Preliminary Design Review
CDR	Critical Design Review
FAT	Factory Acceptance Test
SAT	Site Acceptance Test

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## 5. REFERENCES

- [1] ESS-5972816 Polarisation Work Package Technical Description.
- [2] ESS-5972818 Polarisation Work Package Supplementary Schedule, Budget, Resource.

## DOCUMENT REVISION HISTORY

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Revision	Reason for and description of change	Author	Date
1	First issue	Wai Tung Lee	2026-03-08

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