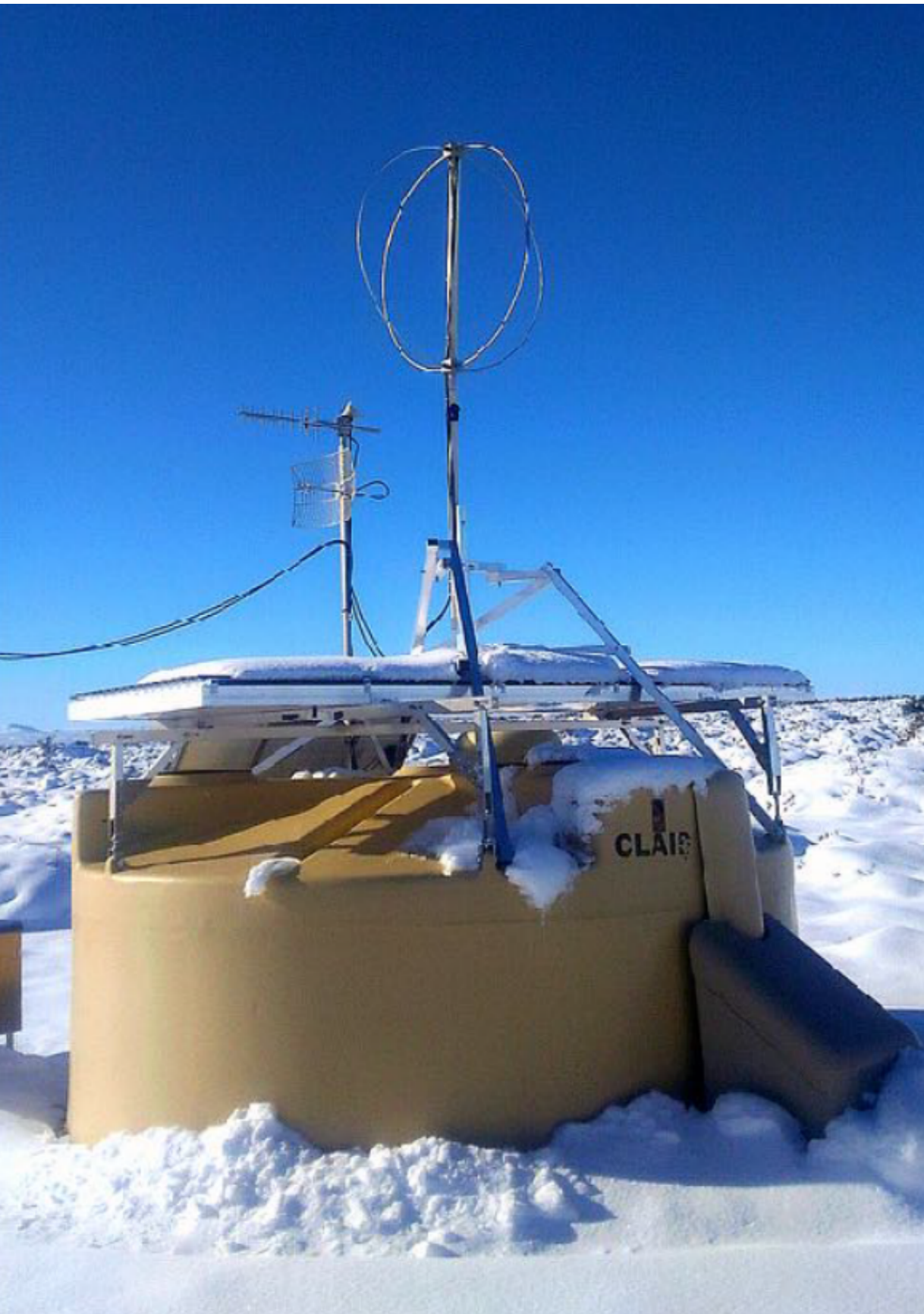


AugerPrime status



- ⦿ General Status

 - SSD

 - UUB+sPMT

 - RD

 - UMD

- ⦿ Manpower

- ⦿ Commissioning

...with some info and news from the Management

1 - AugerPrime - SSD

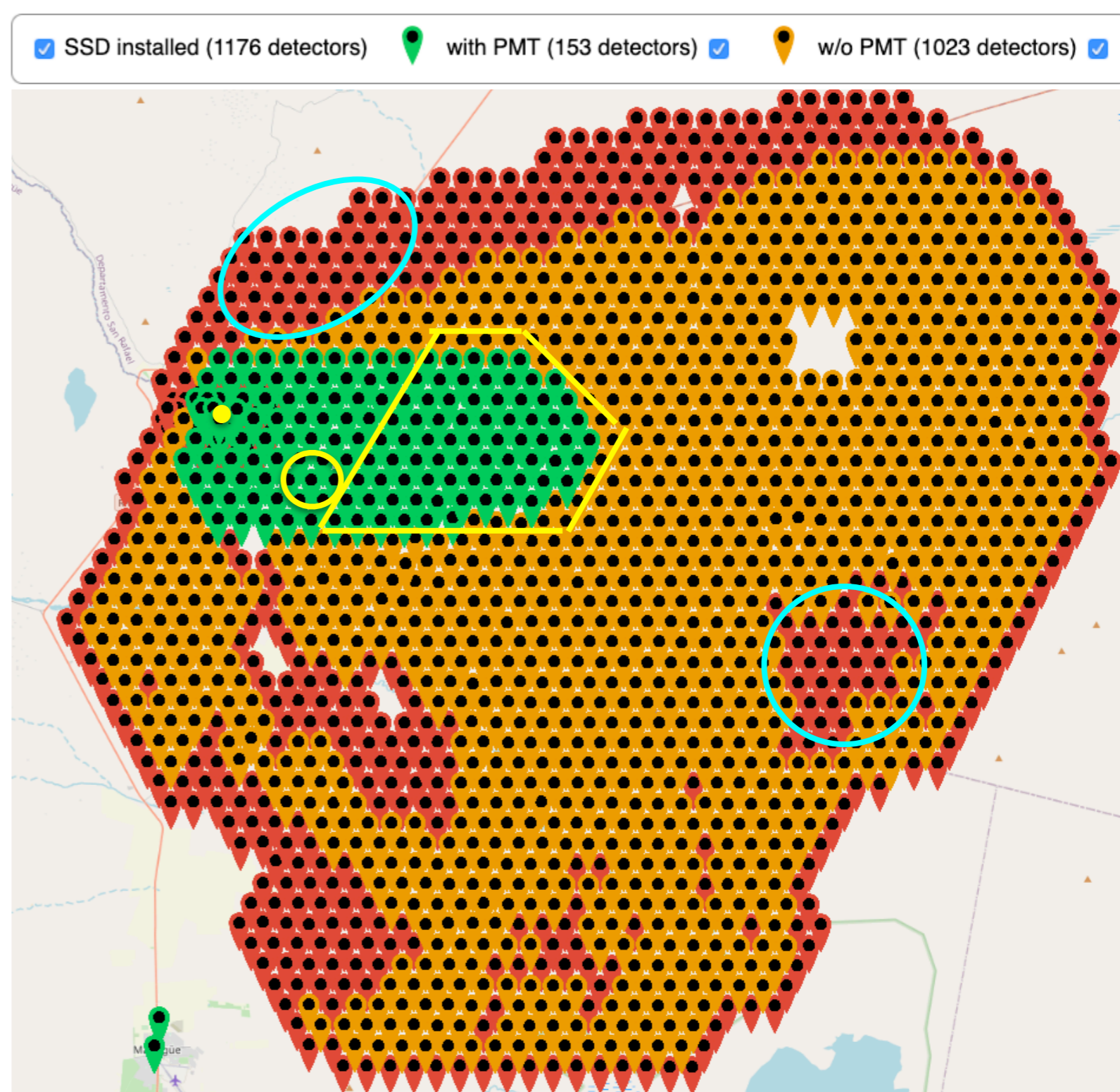
- 1176 SSD installed (May 4th) [~76%]
- 153 with PMT
- in cyan: problems with landowners
- in yellow: UUB installed

SSD PMTs

- 1590 produced by Hamamatsu and delivered to Wuppertal
- bottleneck ISEG mounting of bases (50/week in batches of 200)
- Tests in Napoli and Wuppertal
- ~500 already in Malargüe
- Two waivers in preparation for 200+200 PMTs

Assembly & deployment

- Man-power: 5 SSD staff + 2 Management
- Assembly : 6 modules/day, 2 people
- Deployment: 6 modules/day with 2 people/trip (crane+truck)
- 4 days/week installation + 1 day maintenance of truck/crane/tools

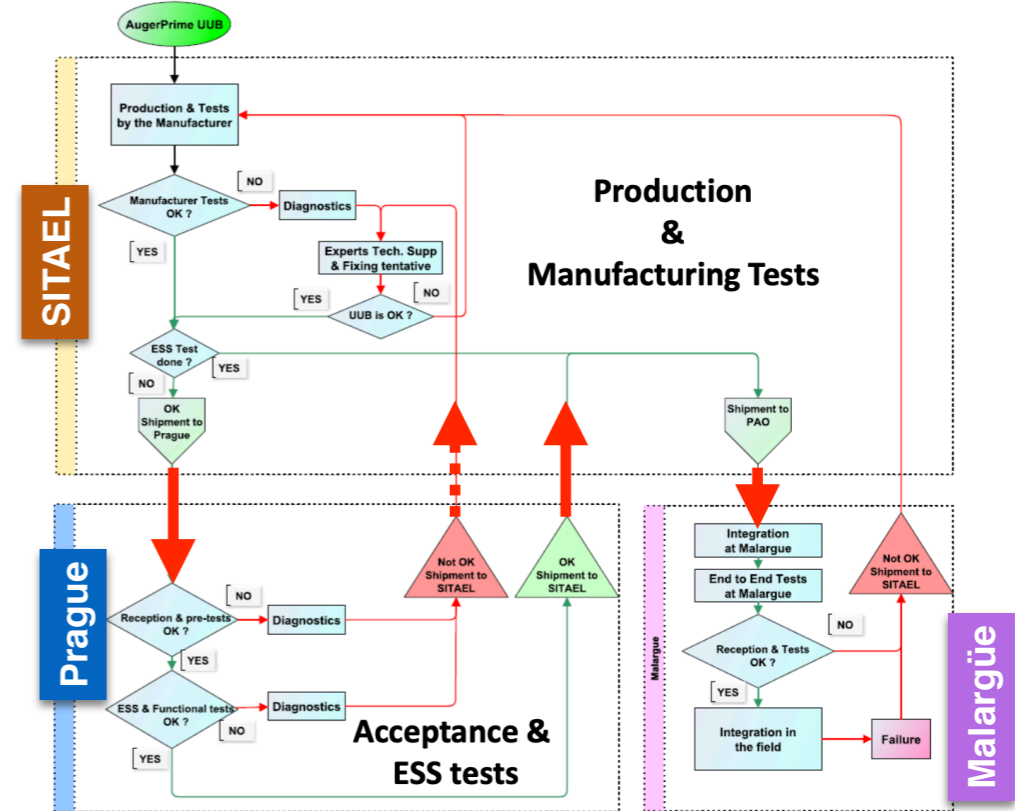


~ 54 days to complete the deployment (~ 4 months)

2 - UUB production

Schedule for 2021 agreed with SITAEEL

- fabrication validation in SITAEEL
- ESS test in Prague
- delivery to Malargue from SITAEEL
- 29+2 (first shipment) installed in December 2020
- 49 (second shipment): 39 in main array, 9 in EA installed in April 2021



Production Schedule (estimated with SITAEEL)

AugerPrime UUB Production Schedule estimate				2021																								2022											
Tasks	Dur. (week)	Start Date	End Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec												
First production batch (100)	9	25/03/21	25/05/21																																				
First production batch & delivery to CZ (100 units)	7	25/03/21	04/05/21																																				
First production batch validation & back to IT (100)	1.5	04/05/21	12/05/21																																				
First production batch delivery to AR (100)	0.5	18/05/21	25/05/21																																				
2nd production batch (350)	14	15/04/21	16/07/21																																				
1st part of 2nd production batch & delivery to CZ (200 units)	7	15/04/21	01/06/21																																				
1st part of 2nd production batch validation & back to IT (200)	3	01/06/21	18/06/21																																				
2nd part of 2nd production batch & delivery to CZ (150 units)	10	15/04/21	18/06/21																																				
2nd part of 2nd production batch validation & back to IT (150)	3	18/06/21	03/07/21																																				
1st & 2nd parts of 2nd production batch delivery to AR (350)	1	09/07/21	16/07/21																																				
3rd production batch (450)	14	10/06/21	12/10/21																																				
1st part of the 3rd production batch delivery to CZ (70 units)	4	10/06/21	13/07/21																																				
1st part of the 3rd production batch validation and back to IT	1	13/07/21	20/07/21																																				
2nd part of the 3rd production batch delivery to CZ (190 units)	6	10/06/21	27/07/21																																				
2nd part of the 3rd production batch validation and back to IT	3	27/07/21	07/09/21																																				
3rd part of the 3rd production batch delivery to CZ (190 units)	9	10/06/21	07/09/21																																				
3rd part of the 3rd production batch validation and back to IT	3	07/09/21	28/09/21																																				
Third production batch delivery to AR(450)	1	05/10/21	12/10/21																																				
4th production batch (500)	23	13/07/21	10/12/21																																				
1st part of the 4th production batch delivery to CZ (100 units)	12	13/07/21	04/10/21																																				
1st part of the 4th production batch validation and back to IT	2	04/10/21	13/10/21																																				
2nd part of the 4th production batch delivery to CZ (100 units)	13	13/07/21	13/10/21																																				
2nd part of the 4th production batch validation and back to IT	2	13/10/21	25/10/21																																				
3rd part of the 4th production batch delivery to CZ (100 units)	15	13/07/21	25/10/21																																				
3rd part of the 4th production batch validation and back to IT	2	25/10/21	04/11/21																																				
4th part of the 4th production batch delivery to CZ (100 units)	17	13/07/21	04/11/21																																				
4th part of the 4th production batch validation and back to IT	2	04/11/21	16/11/21																																				
5th part of the 4th production batch delivery to CZ (100 units)	19	13/07/21	16/11/21																																				
5th part of the 4th production batch validation and back to IT	2	16/11/21	25/11/21																																				
4th production batch delivery to AR(500)	1	02/12/21	10/12/21																																				
5th production batch (500)	25	23/08/21	21/02/22																																				
1st part of the 5th production batch delivery to CZ (100 units)	15	23/08/21	25/11/21																																				
1st part of the 5th production batch validation and back to IT	2	25/11/21	07/12/21																																				
2nd part of the 5th production batch delivery to CZ (400 units)	17	23/08/21	07/12/21																																				
2nd part of the 5th production batch validation and back to IT	7	09/12/21	07/02/22																																				
5th production batch delivery to AR (500)	1	14/02/22	21/02/22																																				

~1300 units
~ end 2021

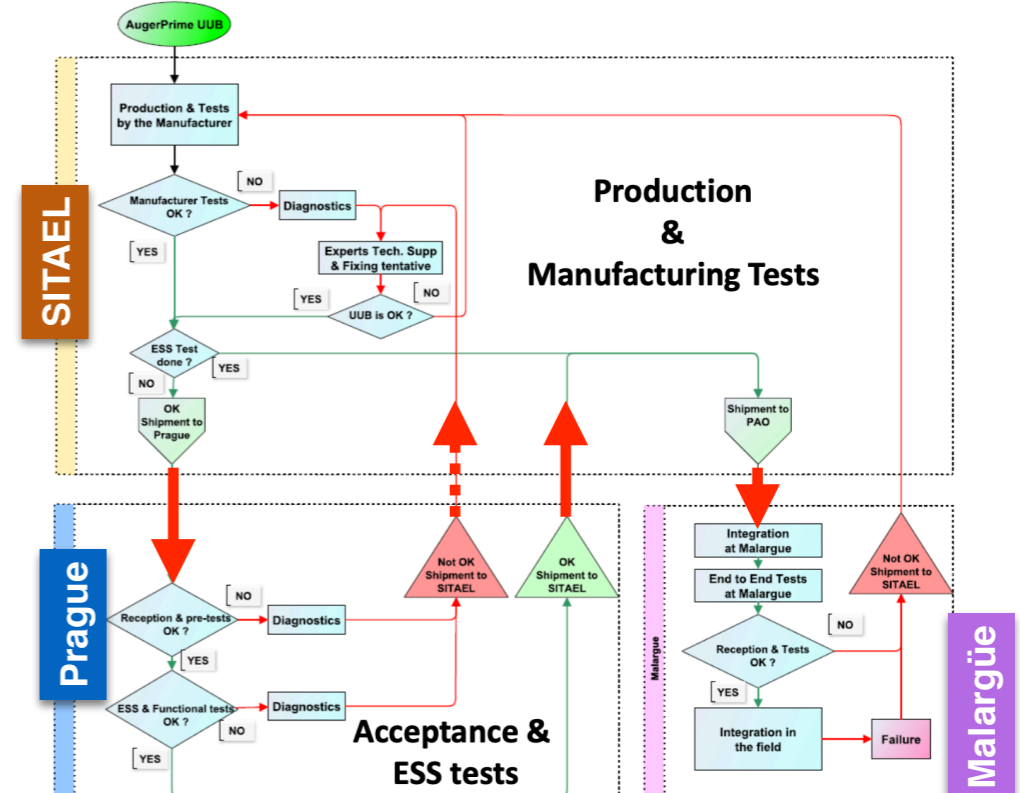
1660
~ mid 2022

Feb. 2022

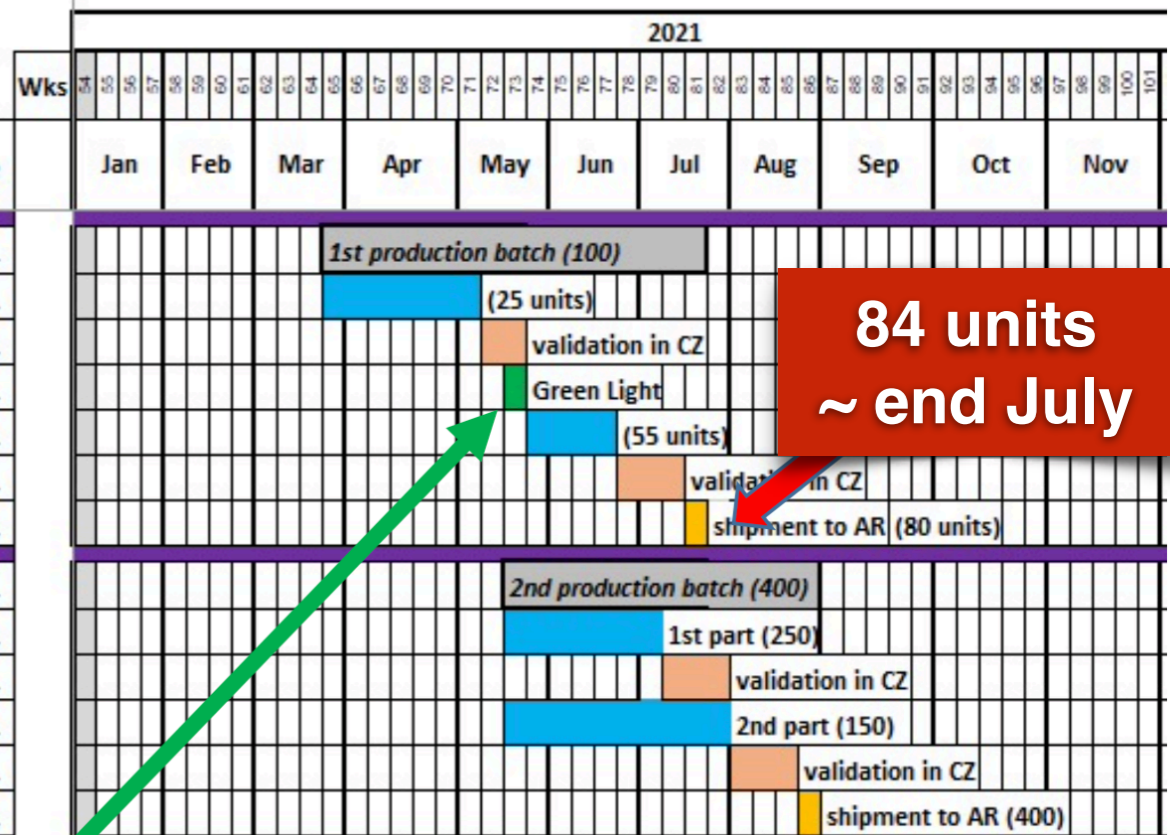
2 - UUB production

Schedule for 2021 agreed with SITAEI

- fabrication validation in SITAEI
- ESS test in Prague
- delivery to Malargue from SITAEI
- 29+2 (first shipment) installed in December 2020
- 49 (second shipment): 39 in main array, 9 in EA installed in April 2021



AugerPrime UUB Production Schedule estimate				P. Stassi 03/05/2021 -v2	
Tasks	Dur. (week)	Start Date	End Date	Wks	
First production batch (100)	18	25/03/21	26/07/21		
1st part of the first production batch delivery to CZ (25 units for val.)	6	25/03/21	07/05/21		
1st part of the First production batch validation (25)	1	07/05/21	16/05/21		
<i>Green light to continue the production of the first batch</i>	ms	16/05/21	16/05/21		
2nd part of the first production batch & delivery to CZ (55 units)	4	16/05/21	19/06/21		
2nd part of the First production batch validation & back to IT (80)	3	19/06/21	16/07/21		
First production batch delivery to AR (80)	1	19/07/21	26/07/21		
2nd production batch (400)	20	15/04/21	27/08/21		
1st part of 2nd production batch & delivery to CZ (250 units)	7	20/05/21	09/07/21		
1st part of 2nd production batch validation (250)	3	09/07/21	29/07/21		
2nd part of 2nd production batch & delivery to CZ (150 units)	10	20/05/21	29/07/21		
2nd part of 2nd production batch validation & back to IT (400)	3	29/07/21	14/08/21		
1st & 2nd parts of 2nd production batch delivery to AR (400)	1	20/08/21	27/08/21		



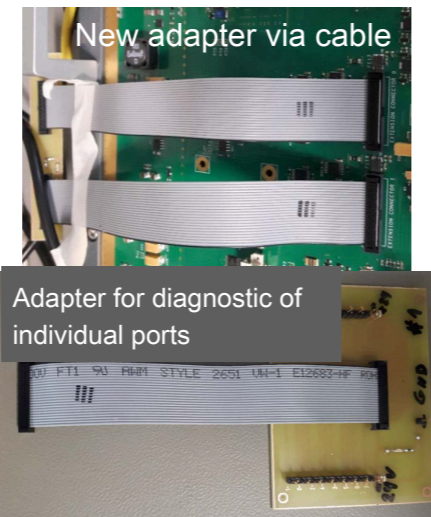
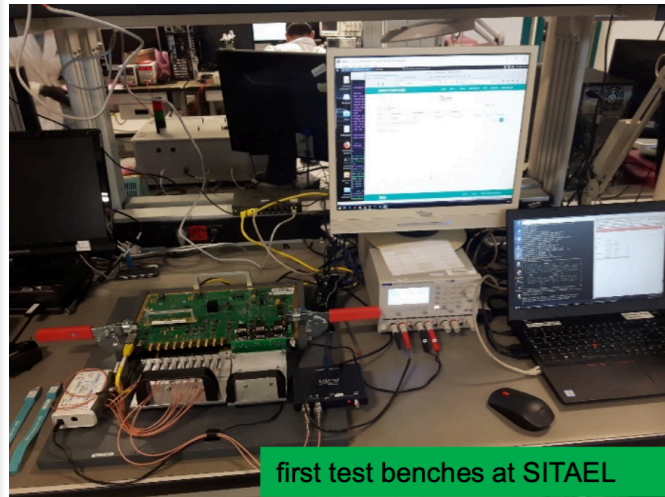
Validation of the last components modification (PRR request)

400 units ~ end August

84 units ~ end July

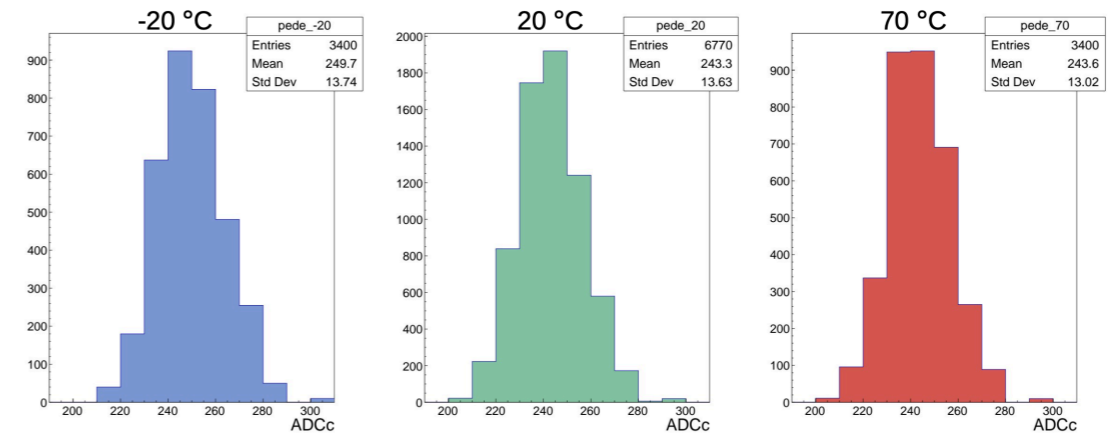
UUB manufacturer test

- 2 test benches installed at SITAEL (despite lockdown!)
- Test of voltages and currents, trigger and ADC system, interface to PMTs, etc.



ESS test FZU

- noise with open connectors, thermal image
- T profiles at -20, +20, +70°C (pedestals, gains, noise, etc.)
- failures: 1 failed, 5 with non critical problems @70°C



SDEco test

Final test of UUB before deployment
a Test Jig simulates slow control external signals

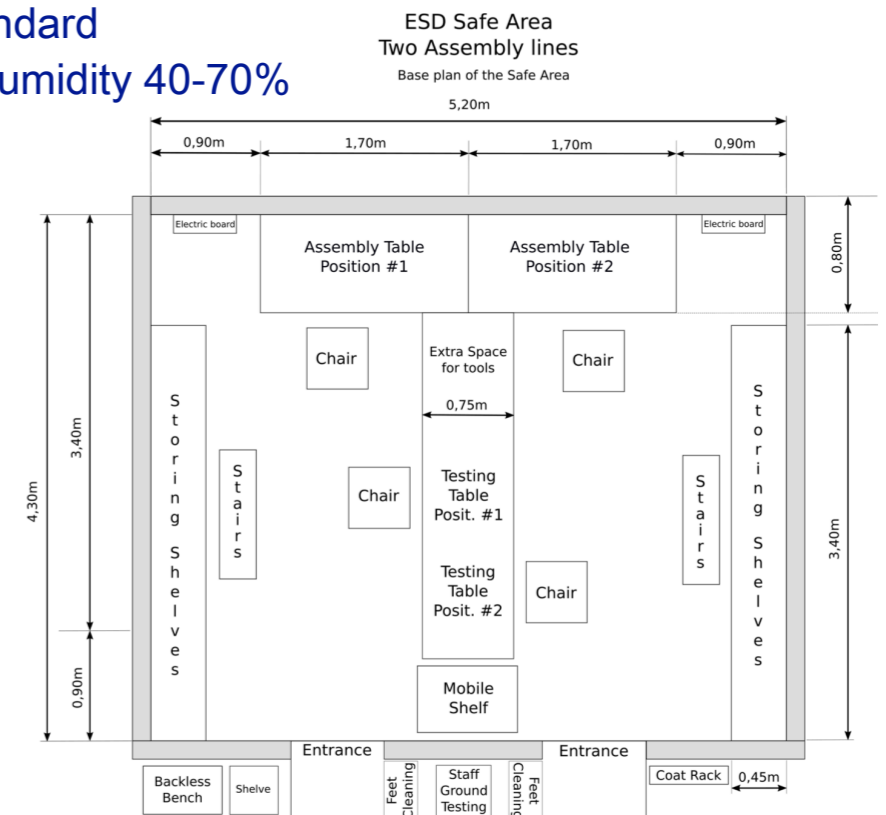
- communications with Radio/GPS
- PMT Vmon, Imon, Temp
- TPCB: voltage and currents for batteries and solar panels



SDEco ESD safe area

- closed electrostatic discharge protected area for visual inspections testing and assembly
- following free JEDEC standard
- controlled environment: humidity 40-70%

Safe table currently used for the pre-production

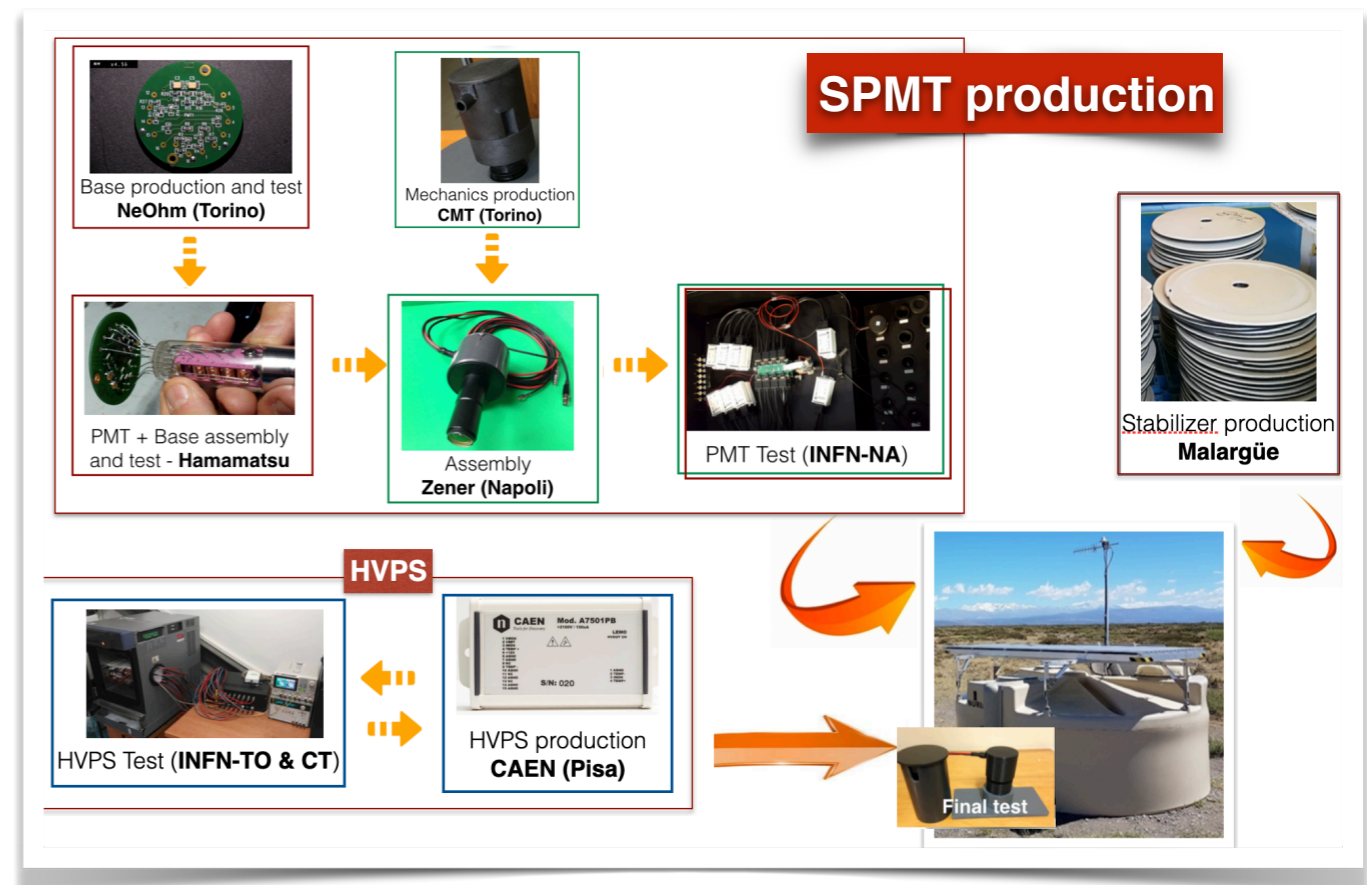


3 - small PMT

1550 units in total

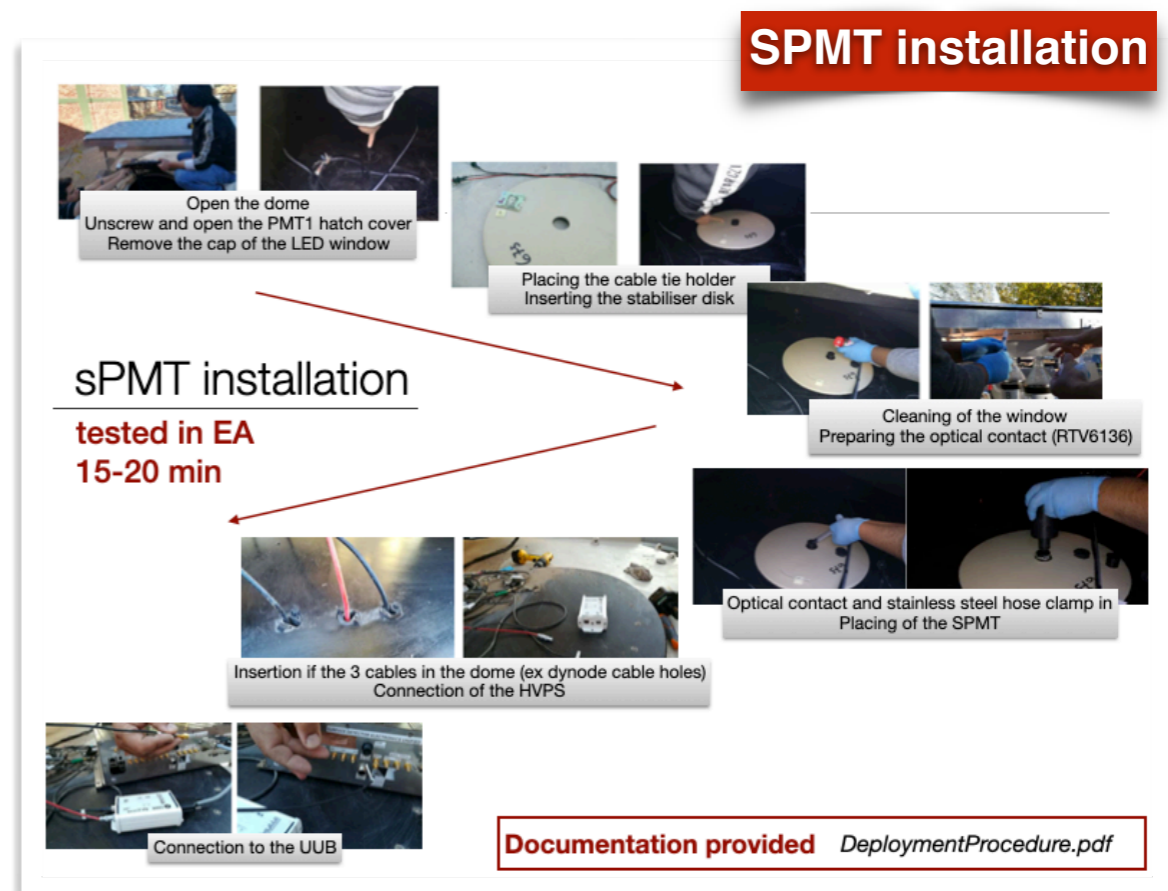
(1 unit = sPMT+mechanics+cables)

- 1290 sPMT units already in Malargüe
- 1306 HVPS already in Malargüe
- funds provided and production started for the remaining 300 units (of which 50 spares)



In the field

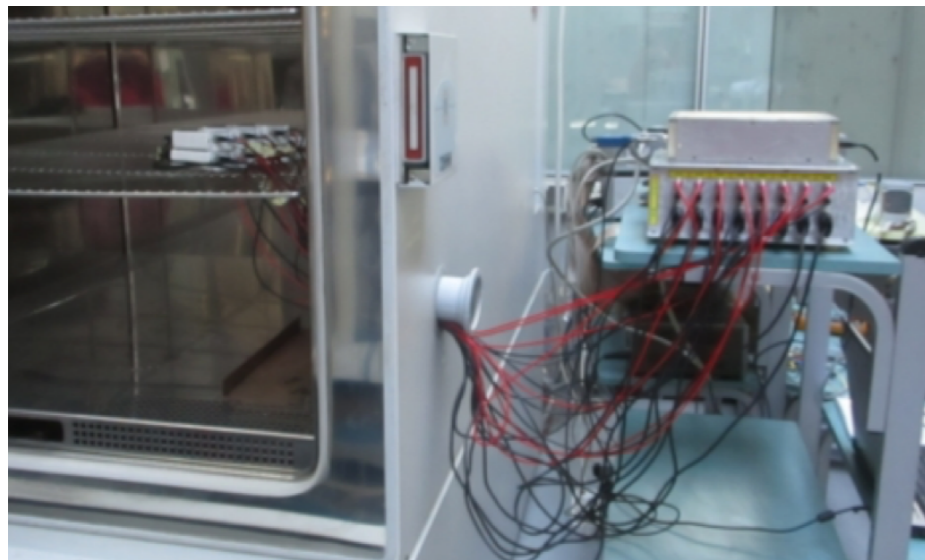
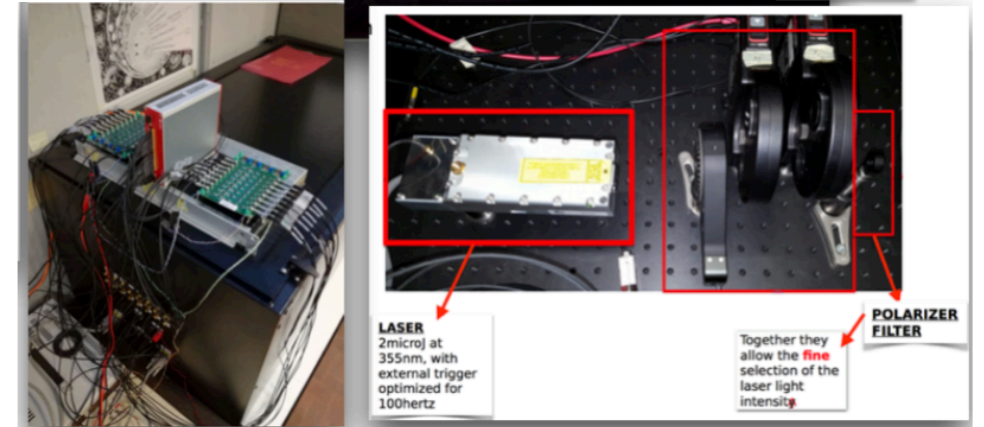
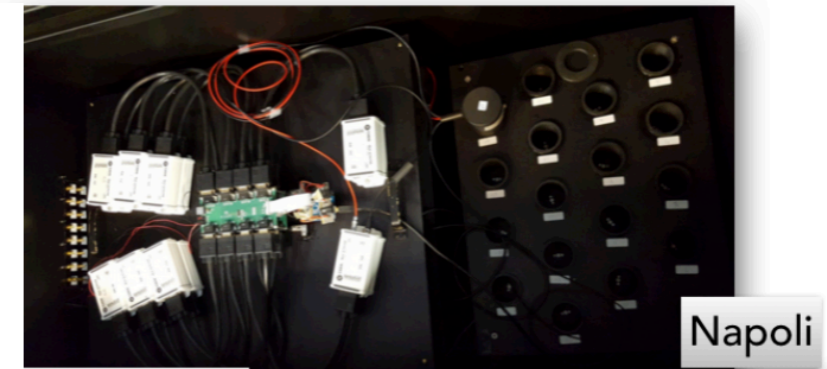
- 79 final units already in Malargüe
 - 29 installed in December 2020 (pre-prod.array)
 - 48 installed in March-April 2021 (pre-prod.array + EA)
 - 2 used for testing in Trak and Clais



sPMT tests

PMT test (INFN-Napoli)

- ◉ 16 sPMT tested in one shot
- ◉ Double dynamics front-end: x12 amplifier for SPE/MIP measurements, /7 attenuator for linearity
- ◉ results in MySQL database

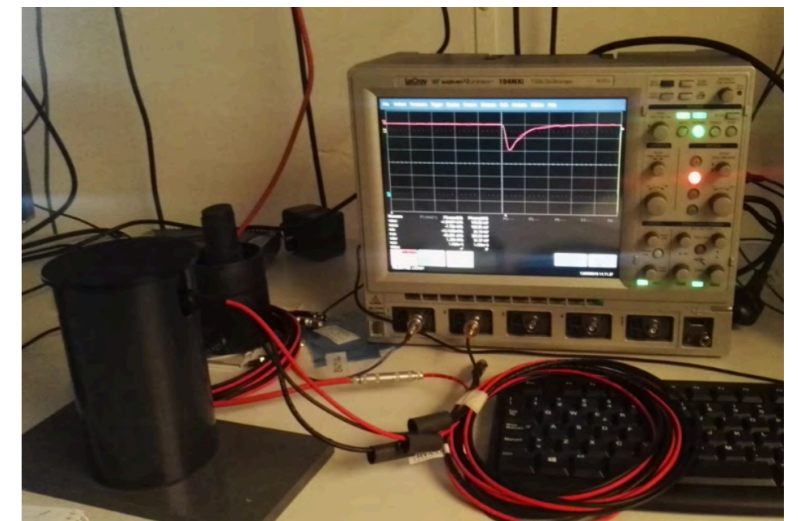


HVPS test (INFN-Torino & Catania)

- ◉ preliminary test of all modules at CAEN
- ◉ two identical test systems
- ◉ results in <https://pandora.infn.it/public/b4022a>

Final test at SDEco (staff)

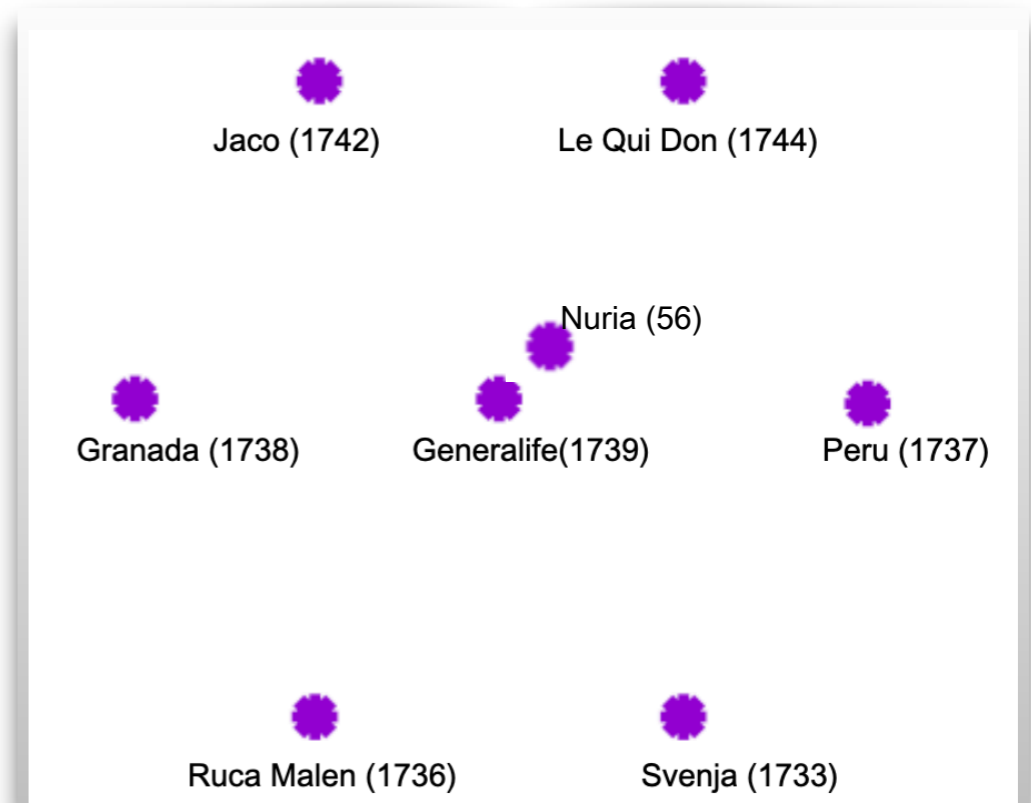
- ◉ fast test with light pulser ^{251}Am -YAPN (identical to that performed in Napoli before delivery)
- ◉ robust technique to monitor the gain at % accuracy



4 - AugerPrime - RD

- ◉ SALLA design: low cost, low maintenance
- ◉ frequency range 30-80 MHz
- ◉ since November 2019, 4 RD in EA with electronics + Trak + Clais
- ◉ in April: EA fully equipped with UUB+SMPT+SSD+RD: only hexagon with fully upgraded stations

- ◉ possible to install 1 EA in 2 days with 4 people
→ full deployment ~ 240 days



Schedule

- ◉ ~Apr 2021 PRR for RD mechanical components
start production of mechanical components - ideally, all 1700 stations are produced in ONE GO (for the mechanics, frames, antenna arms etc)
- ◉ ~ Jun 2021, PRR for RD electronics (after verifying the performance)
start production of electrical components - currently investigating how to produce (in one go or in batches)
- ◉ ~ autumn 2021 start roll out of RD mass production and move to continuous development for ~12 months

5 - AugerPrime - UMD

UMD-750 : central position + 4 crowns

UMD-433 : central position + 2 crowns [7 in common with UMD-750]

UMD 750		UMD 433	
Total Positions	61	Total Positions	12
Total positions deployed	18	Total positions deployed	4
Total positions in acquisition	16	Total positions in acquisition	4
Remaining positions	43	Remaining positions	8

GRAN TOTAL			UMD750+ UMD433	UUB (Trak Jr)
Positions	73			
Deployed	23	32%	22	1
In ACQ	21	29%	20	1

- Fabrication of modules moved to Malargüe due to pandemic: material for 18 modules (6 positions)
- purchase of material ongoing

Phase 1 is defined as :

- 24 position of UMD 750 in acquisition
- 4 positions (Unitary cell) of UMD 433 in acquisition



To connect UMD to WCD:

- LS changed to the appropriate hardware version (Cyclone)
- LS firmware updated to send T1 to UMD

UMD shifts have been implemented

Deployment - Manpower

SSD

ass: 6 modules/day with 2 people, 50 SSD/month
depl: 6mod/day with 3 people+crane
4 days/week work + 1 maintenance
1500-1176= 324 modules to install —> ~ 4 months

UUB

ass: 6 modules/day with 2 people
depl: 3 UUB/day with 2 people —> 2 teams = 4 people
4 days/week work
1660-79 = 1581 UUBs to install —> ~ 1 year

Total installation time ~ 1 hr
(1.5 if LEDs installed too)

RD

deployment: 4 RD/day with 4 people
5 days/week work
1660-9 = 1651 RD to install —> ~ 1.5 year
1 yr foreseen hiring more people

UMD

deployment: 2 positions (6 modules)/month
43 positions UMD-750 —> 2 yrs
8 positions UMD-433 —> 4 months
crew complete (6 people)

Management proposal :

- ➔ people to hire for the deployment (cost for 1 technician ~30,000 USD per year)
 - 5 more technicians
 - 1 engineer for management
 - 1 technician for the RD+solar panel
 - +
- ➔ Maintenance staff (Oscar, Raul, Mauro, Juan Pablo) to train new technicians in the first months. Newly hired technicians to assist in maintenance during training time.
- ➔ SSD crew complete, when finished can help for RD+Solar panels

Commissioning

The fact that a module (PMT) in operation is sending data does not automatically mean that these data can be used for successive analysis. Only a careful commissioning can validate the quality of the data it sent

The commissioning includes UUB, sPMT, SSD, RD, UMD

Current situation: the 4 groups organize and work independently

SSD

- bi-weekly meetings of the SSD task, include discussion on deployment and commissioning
- activity in Lecce and KIT
- Italy: Gabriella+...

UUB + sPMT

- bi-weekly meetings organized by Tiina [https://www.auger.unam.mx/AugerWiki/SDEU_Front_Page#preview]
- Dave (trigger), Corbin (time resolution), Alexander (baselines, calibration)
- Italy: Giovanni+Fabio (test UUB), Gialex+Marco (sPMT calibration)

Italy not involved in

RD

- weekly meetings to discuss RD EA, twins, status of operations
- analyses performed in Nijmegen/Wuppertal

UMD

- analyses performed in Buenos Aires/KIT
- they have meetings, but restricted to the two groups

Commissioning

The fact that a module (PMT) in operation is sending data does not automatically mean that these data can be used for successive analysis. Only a careful commissioning can validate the quality of the data it sent

The commissioning includes UUB, SPMT, SSD, RD, UMD

Management proposal → 2 Commissioning coordinators

The activity in each group continues as currently organised

The Coordinators, together with the groups leaders, will

- ➔ develop a validation plan for monitoring, debugging, overseeing and controlling the functionality and performance of AugerPrime as a whole
- ➔ identify the parameters to be checked and verified (e.g. power consumption, hardware performances, PMT voltages, baselines, thresholds, calibration, trigger rates, noise, stability, event loss rate...)

Their charge includes

- ➔ help in identifying tasks or collaborators needed to this aim
- ➔ coordinate and oversee the commissioning activities
- ➔ report periodically to the Collaboration

Conclusion

⊙ production

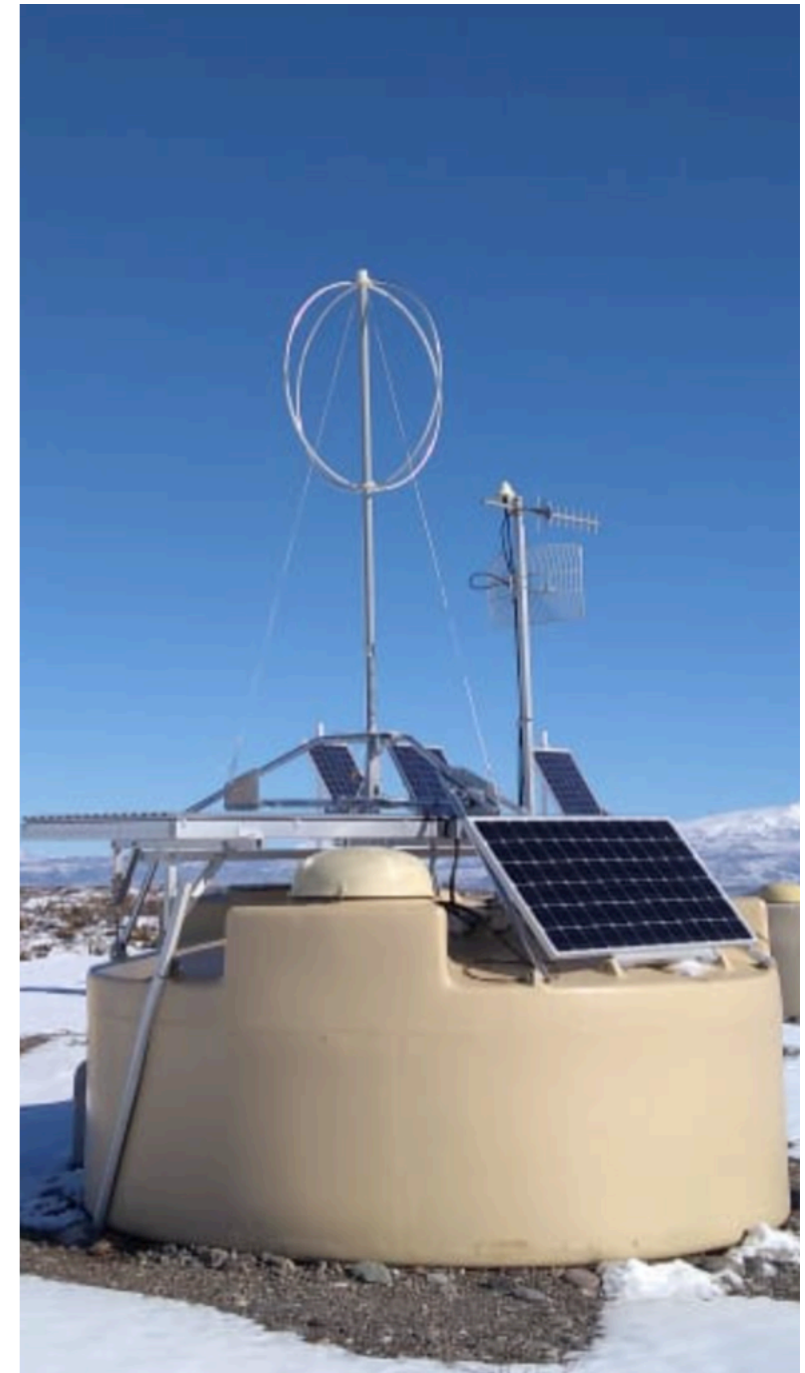
- SSD: completed
- UUB: started (79 pre-production units completed)
- SPMT: 1300 completed, 300 in first months of 2021
- UMD: ongoing
- RD: will start in 2021

⊙ deployment

- SSD: 1176 out of 1500 in place, completed in 2021
- UUB: ~79 out of 1660 in place, completed in 2022
- SPMT: ~79 out of 1500 in place, completed in 2022
- UMD: 16 out of 61 in place, completed in 2022
- RD: 9 out of 1660 in place, completed in 2022

Technical papers in the pipeline for 2021: the beginning of Phase 2 !

- ➔ one for each element of the Upgrade (author list including also engineers and technicians)
- ➔ contributions to ICRC2021 in Berlin & other technical conferences



BACKUP

Version 0,51

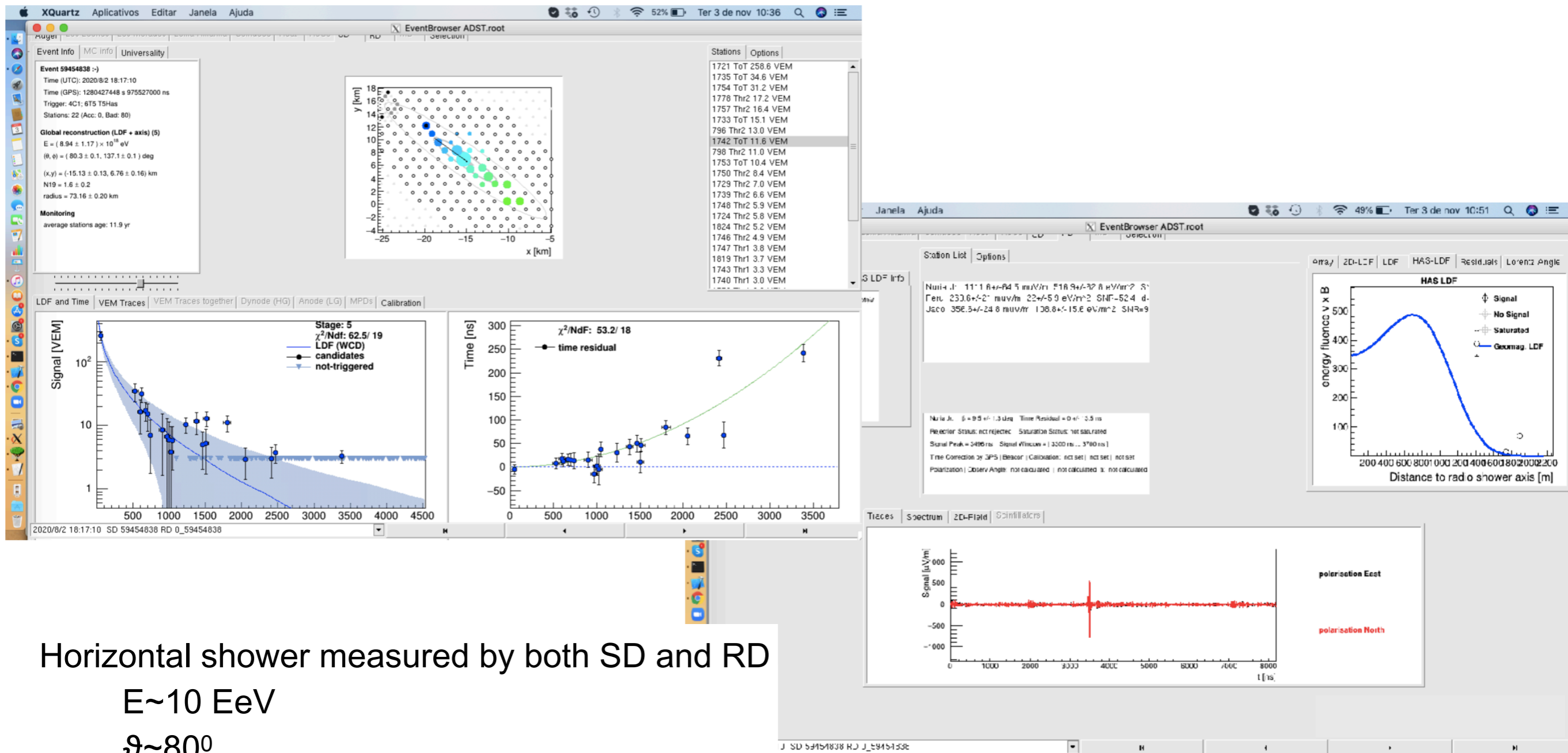
Pierre Auger Observatory Upgrade - Cost Estimate - Preliminary Design																		
Design: Preliminary *3 March 2021																		
WBS	Activity	Quant	Base Unit	Est. Code	Contingency	Spare	Waste	Esc	Work Eff.	Cost / Unit	Total Cost with Cont.	Contingency amount	Cost Type	Infrastructure labor cost	Total cost (with cont.)	Material & Labor cost needed	Infrastructure labor costs (IFL)	
cost drivers			hours	Help	%	%	%	%	%	EUR	EUR	EUR	Help	EUR	EUR	EUR	EUR	
0	Pierre Auger Observatory Upgrade											527.880			3.360.716	3.360.716	0	
4	Radio Detection Upgrade											527.880		Total Cost >	3.360.716	3.360.716	0	
4.1	Antenna											78.805		Total Cost >	1.000.479	1.000.479	0	
4.1.1	Antenna											15.985,71		Help	IFL	250.780,31	250.780,31	0,00
4.1.1.1	antenna design (external contractor) WT	73	days	EE	30%	0%	0%	0%		316,52	30.037,91	6.931,83	EDIA					
4.1.1.2	antenna	1661	each							59,96	99.592,70	9.053,88	M&S					
4.1.1.2.1	Al arms	1661	each	VQ	10%	5%	0%	0%		34,36	66.143,63	6.073,06	M&S					
4.1.1.2.2	mast	1661	each	VQ	10%	2%	0%	0%		17,89	33.449,07	3.040,82	M&S					
4.1.1.3	housings	1661	each							72,94	121.149,70	1.150,00	M&S					
4.1.1.3.1	screws	1661	each	VQ	10%	20%	0%	0%		25,00	54.999,82	4.999,98	M&S					
4.1.1.3.2	packing	1661	each	VQ	10%	20%	0%	0%		5,75	12.649,96	1.150,00	LABOR					
4.1.1.3.3	plastic, included in above	1661	each	VQ	10%	20%	0%	0%		0,00	0,00	0,00	M&S					
4.1.1.3.4	small parts, incl mooserubber	1661	each	EE	30%	20%	0%	0%		10,00	25.999,92	5.999,98	M&S					
4.1.1.3.5	mold	1	each	VQ	10%	0%	0%	0%		25.000,00	27.500,00	2.500,00	M&S					
4.1.2	Antenna electronics (LNA)											39.737,88		Help	IFL	279.686,79	279.686,79	0,00
4.1.2.1	electronics design RJ, ST	250	days	EE	30%	0%	0%	0%		316,52	102.869,57	23.739,13	EDIA					
4.1.2.2	LNA	1661	each							30,74	51.051,70	0,00	M&S					
4.1.2.2.1	PCB	1661	each	VI	20%	20%	0%	0%		21,27	51.051,70	8.508,62	M&S					
4.1.2.2.2	components, included in above	1661	each	VI	20%	20%	0%	0%		0,00	0,00	0,00	M&S					
4.1.2.2.3	assembly (external), included in above	1661	each	VI	20%	20%	0%	0%		0,00	0,00	0,00	LABOR					
4.1.2.3	Bottom load	1661	each							17,92	29.773,01	0,00	M&S					
4.1.2.3.1	PCB	1661	each	VI	20%	20%	0%	0%		12,41	29.773,01	4.962,17	M&S					
4.1.2.3.2	components, included in above	1661	each	VI	20%	20%	0%	0%		0,00	0,00	0,00	M&S					
4.1.2.3.3	assembly (external), included in above	1661	each	VI	20%	20%	0%	0%		0,00	0,00	0,00	LABOR					
4.1.2.4	TNC pigtail	1661	each	VI	20%	20%	0%	0%		40,00	95.992,51	15.998,75	M&S					
4.1.3	Mechanical frame to mount RD on WCD											62.819,55		Help	IFL	470.011,65	470.011,65	0,00
4.1.3.1	Al tubes, custom made, incl packing	1661	each	VQ	10%	2%	0%	0%		69,14	129.299,30	11.754,48	M&S					
4.1.3.2	plates	1661	each	VQ	10%	2%	0%	0%		84,73	158.448,87	14.404,44	M&S					
4.1.3.3	brackets frame, incl shipping crate	1661	each	VQ	10%	2%	0%	0%		5,02	9.383,18	853,02	M&S					
4.1.3.4	brackets mast	1661	each	VQ	10%	2%	0%	0%		0,63	1.178,12	107,10	M&S					
4.1.3.5	small parts	1661	each	EE	30%	2%	0%	0%		50,00	110.502,18	25.500,50	M&S					
4.1.3.6	Onsite shipment - sea container	3	each	VI	20%	0%	0%	0%		17.000,00	61.200,00	10.200,00	M&S					

➔ PDR

➔ PDR

RD-SD event

- fully integrated in SD data stream



Horizontal shower measured by both SD and RD

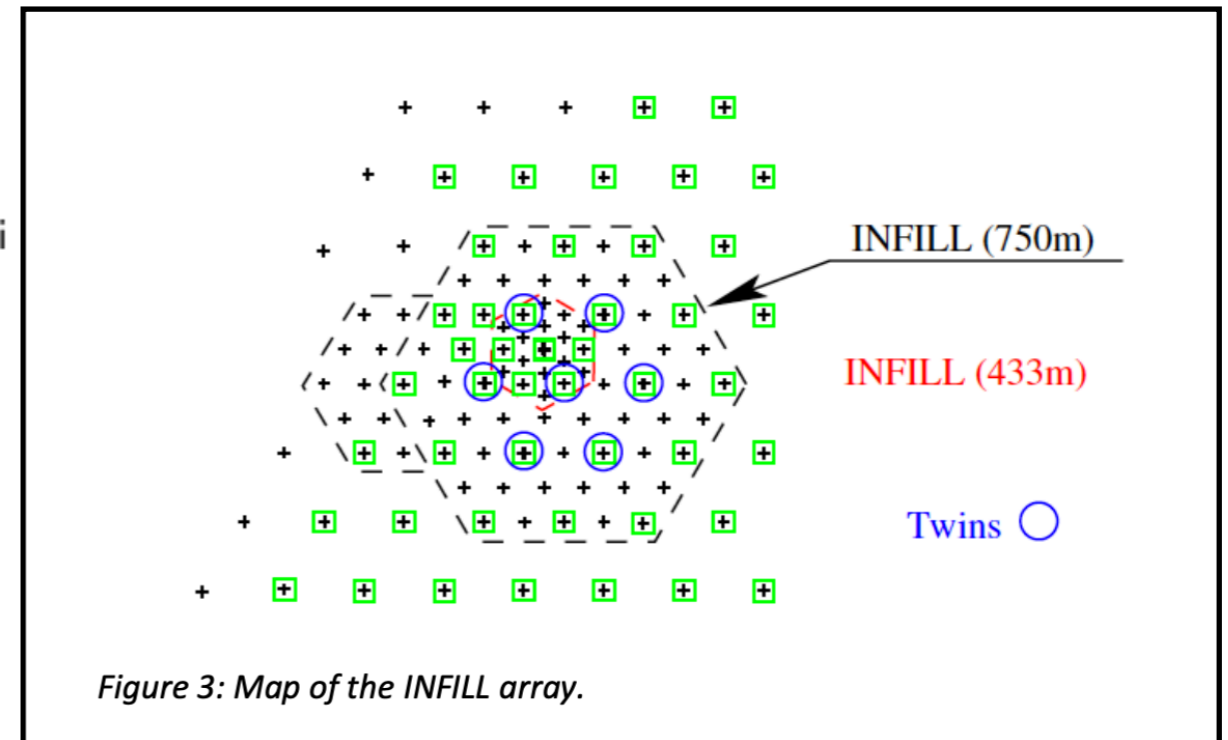
$E \sim 10 \text{ EeV}$

$\theta \sim 80^\circ$

Twins

notation: (number of twins × number of stations);
A-AMIGA, U-Upgrade, R-RD, Si-SiPM, M-Marta, O-Other

- At INFILL:
 - (1×5): Katy Turner(1764)-A, Clais Jr(22)-U.R, Trak Jr(20)-U.R.A, Peteroa Jr(39)-U.R and Pichi-Peni-Hue(41)-U.Si
 - (1×4) + (6×2):
 - Oye(710)*, Corrientes(94)-A, Tierra del Fuego(93)-M and Guapa/Guerrera-O
 - Toune(688)-A and France(72)-M
 - Traudel(819)-A and Alataco(79)
 - Toribio(669)-A.M and Promeri(80)
 - Constanza(734)-A and Santa Fe(89)
 - La Salinilla(651) and Cordoba(90)
 - Borbaran(643) and San Juan(91)
 - (1×2) - Phill Collins(1622)-A and Clairon Jr.(24)-O
- At EA: (1×3): Generalife(1739), Nuria Jr.(56)-U and Cristian Jr(59)-U.Si
- Historical: (1×2): Dia(139) and Noche(189)



- UB/no SSD + UUB/SSD
 - comparison of signals UB and UUB
 - comparison (Infill) of saturated events: recovery/SPMT
- UUB/SSD + UUB/SSD
 - comparison of accuracy and reconstruction with old ones
- UUB/SSD + UUB/no SSD
 - study of the configuration we will have at the border