Agenda

Introduzione V. Verzi
CT R. Caruso
GSGC F. Salamida
LE L. Perrone
MI L. Caccianiga ← nuovo RL in sostituzione di L. Miramonti
NA L. Valore
RM2 V. Verzi
TO A. Castellina

(Max 15+5 min ciascuno)

17:00 end

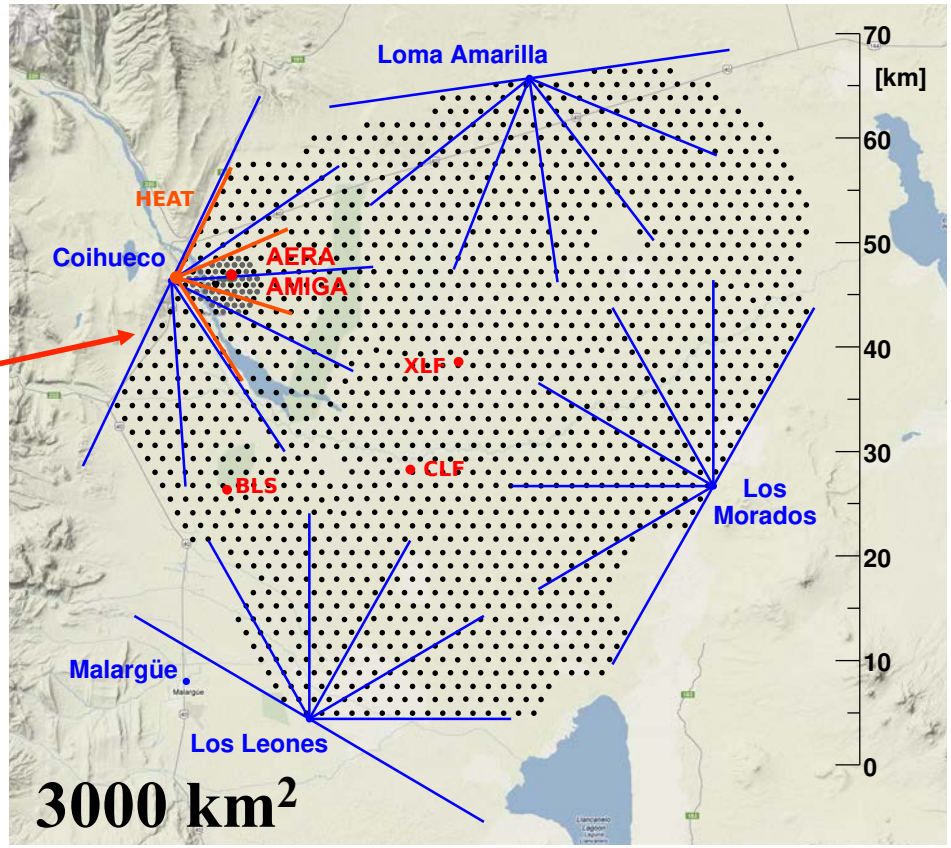
The Pierre Auger Observatory

V.Verzi on behalf of Auger Italia

Pierre Auger Observatory

400 members from 98 institutes and 17 countries

Malargüe - Argentina
35^0 S latitude ≈1400 m height ≈875 g/cm^2



750 m array with 63 detectors – 23.4 km^2

3 high elevation telescopes

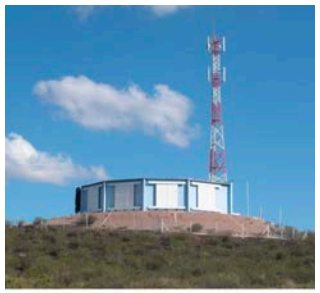
Underground Muon Detector

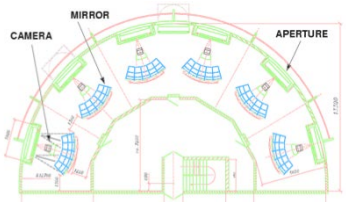
Radio Antenna Array

atmospheric monitoring

Surface Detector: 1600 water-Cherenkov tanks 1.5 km triangular grid

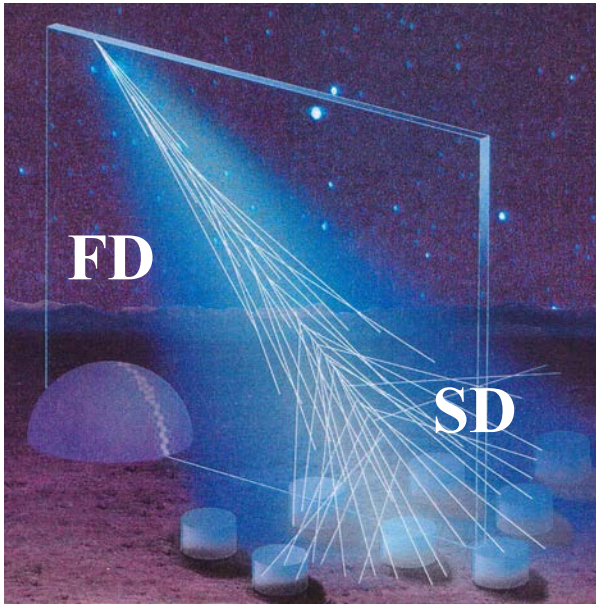
Fluorescence Detector: 24 telescopes in 4 buildings elevation up to 30^0



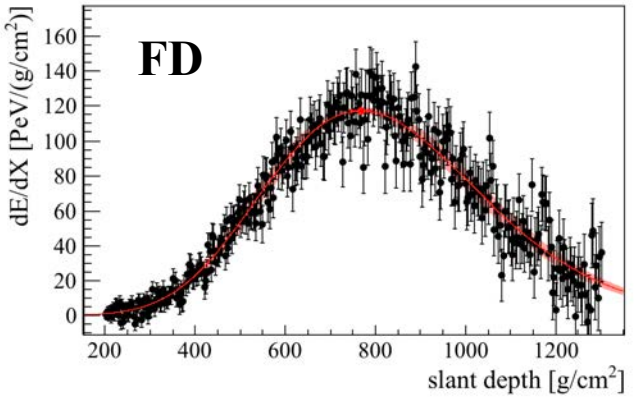


Hybrid Observatory

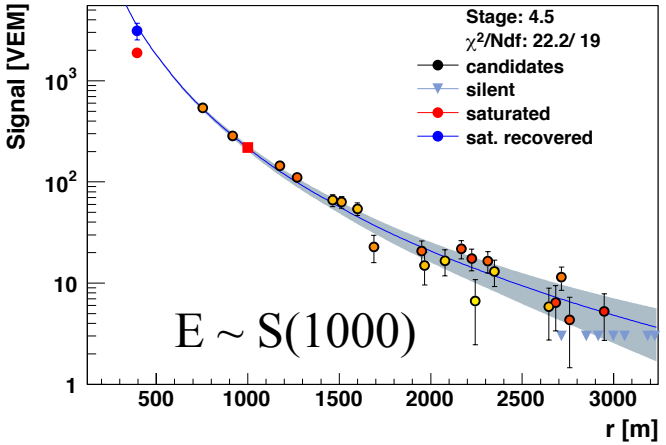
15% duty cycle



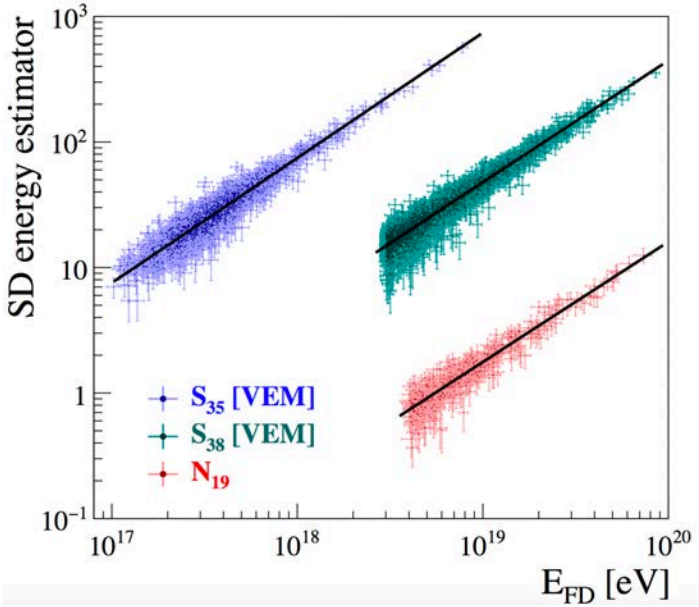
100% duty cycle

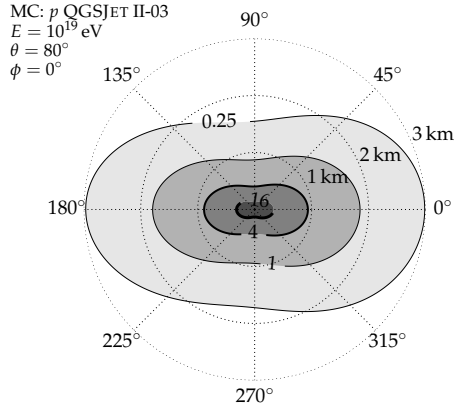


cal. energy X_{max} (mass sensitive)



vertical $\theta < 60^0$





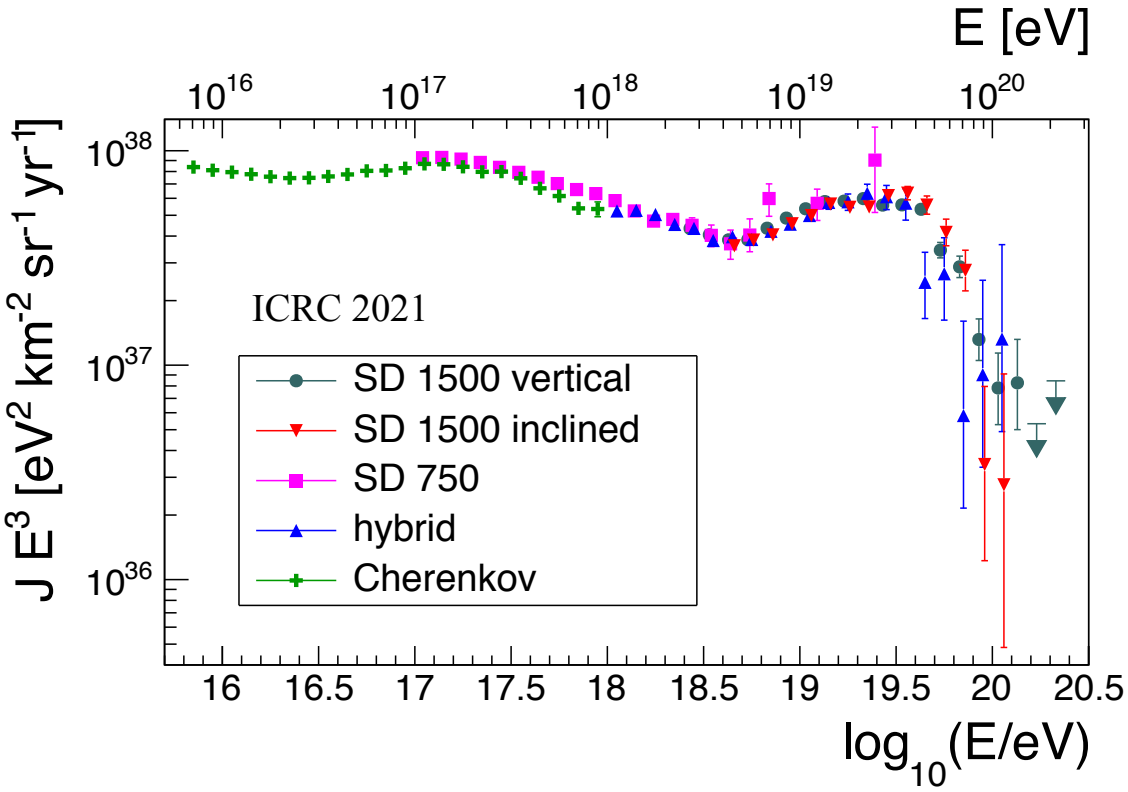
horizontal $\theta > 60^0$

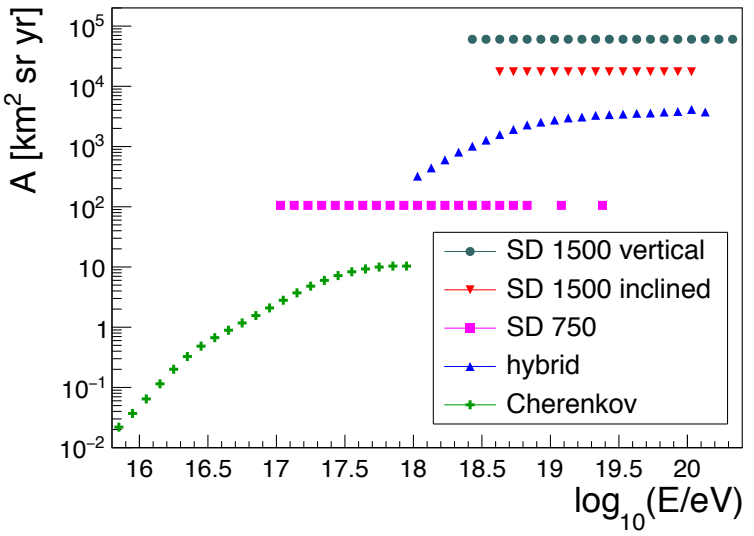
$$\rho_\mu = N_{19}\ \rho_{\mu,19}(r,\theta,\phi)$$

$$E \sim N_{19}$$

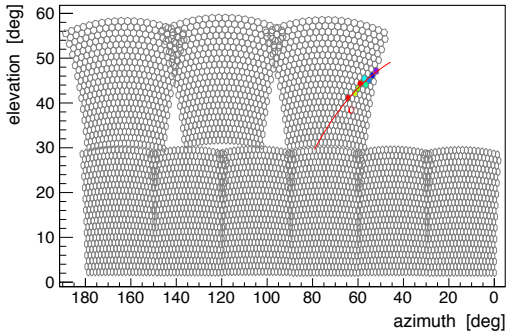
note: "$\theta < 60^0 + \theta > 60^0$" → 85% of sky coverage

Measurements of the energy spectrum

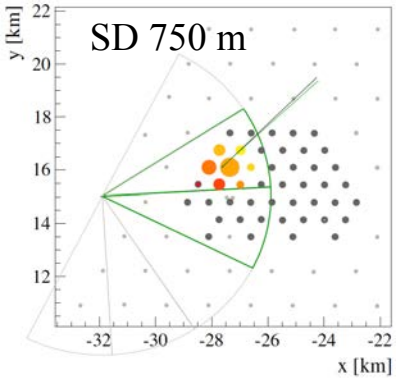


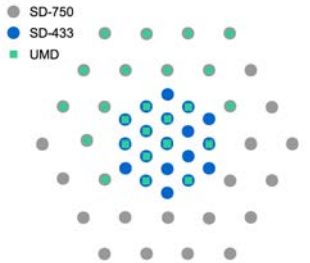


Cherenkov



- **exposure > 80,000 km^2 sr yr**
- **measurements in more than 4 decades in energy**





near future: SD below 10^{17} eV using the 433 m array

Upgrade of the Pierre Auger Observatory: AugerPrime

Detector upgrade

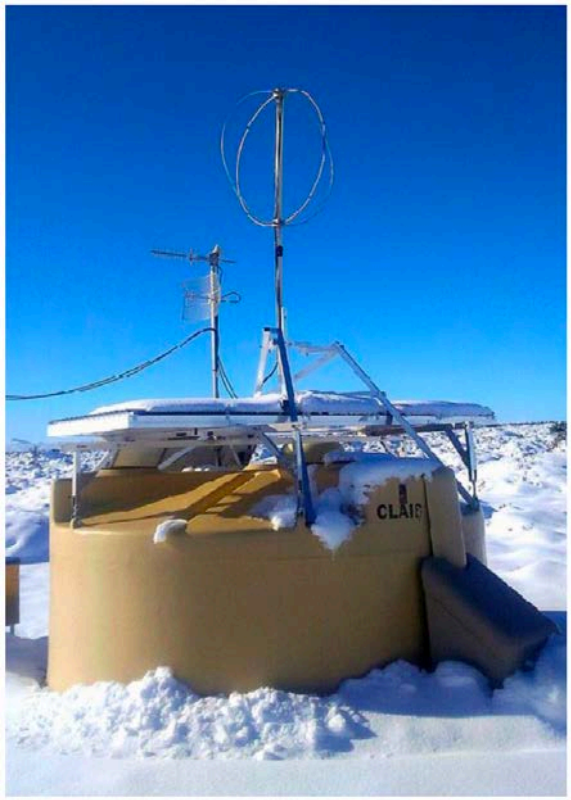
- **3.8 m^2 scintillator detector (SSD) above WCD**
  -> measure the mass composition

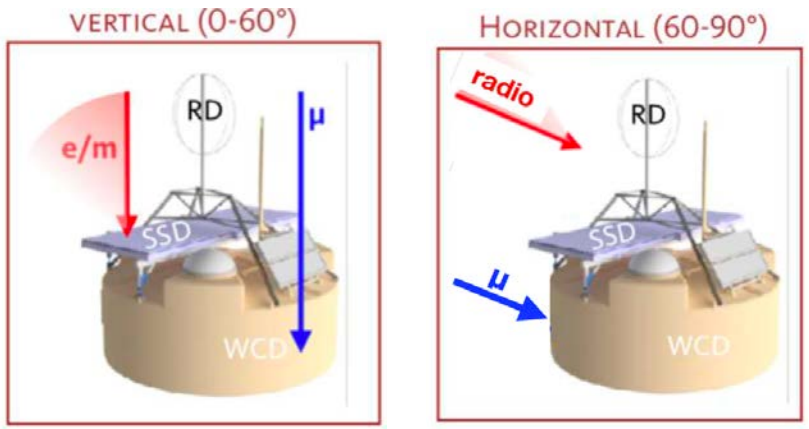
- **small PMT (sPMT)**
  -> increase the dynamic range

- **new electronics (UUB)**
  -> read the new detectors
  -> better performance (40 MHz → 120 MHz)

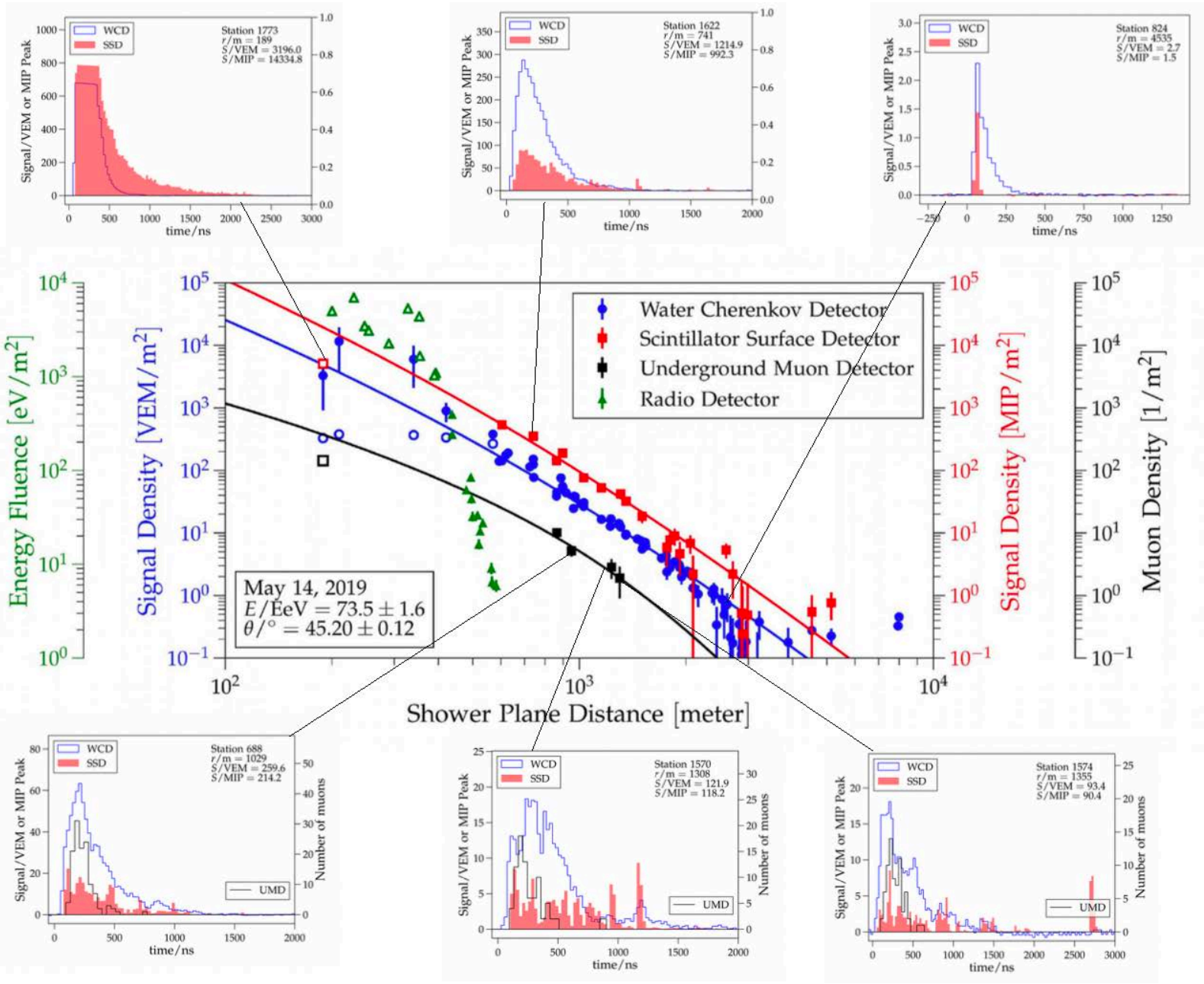
- **underground muon detector (UMD)**
  in the denser array
  -> direct muon measurement and cross-check the SSD-WCD combined analysis

- **radio antennas (RD)**
  -> e.m. component of horizontal showers





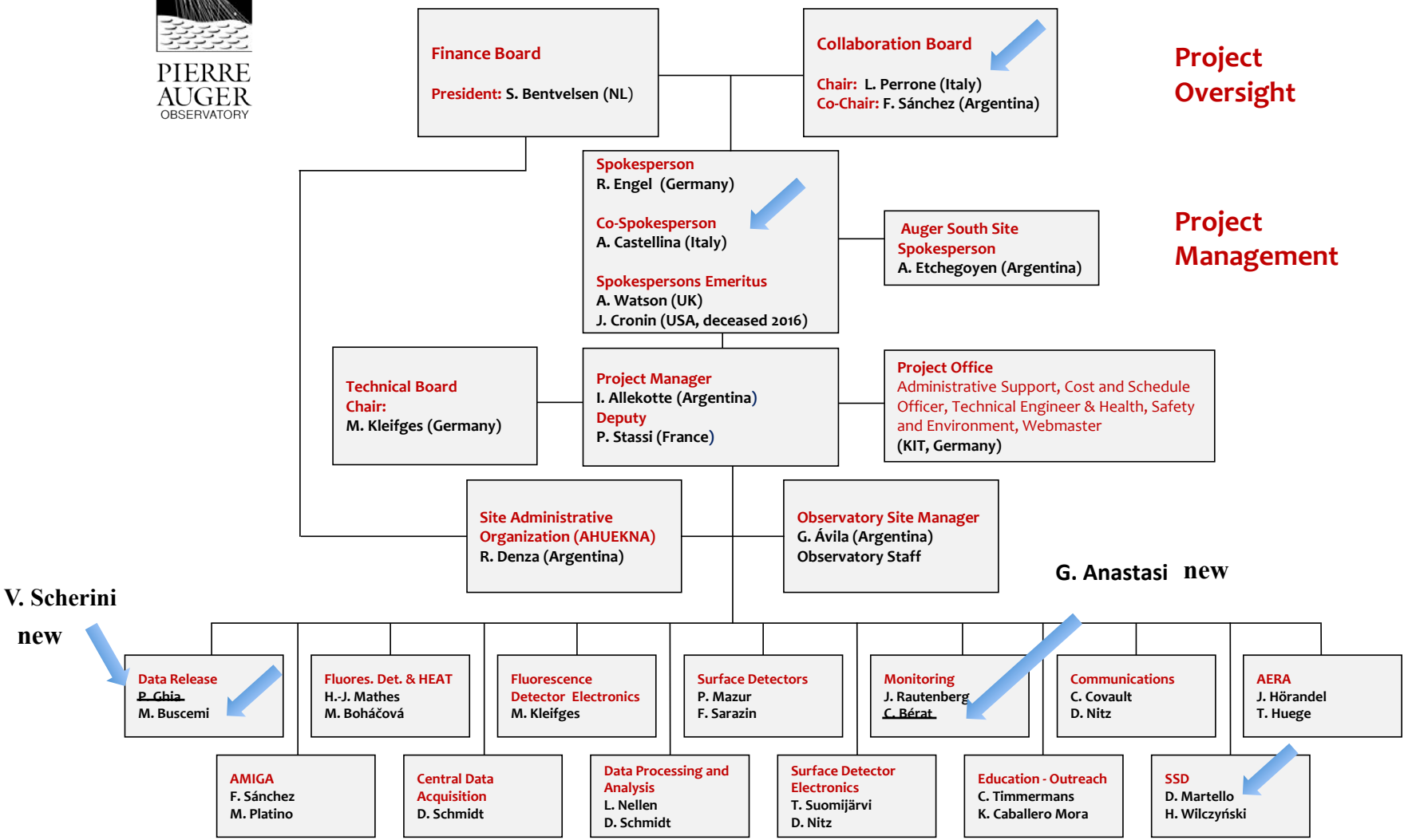
Super-Hybrid Observatory



+FD

AUGER Organization

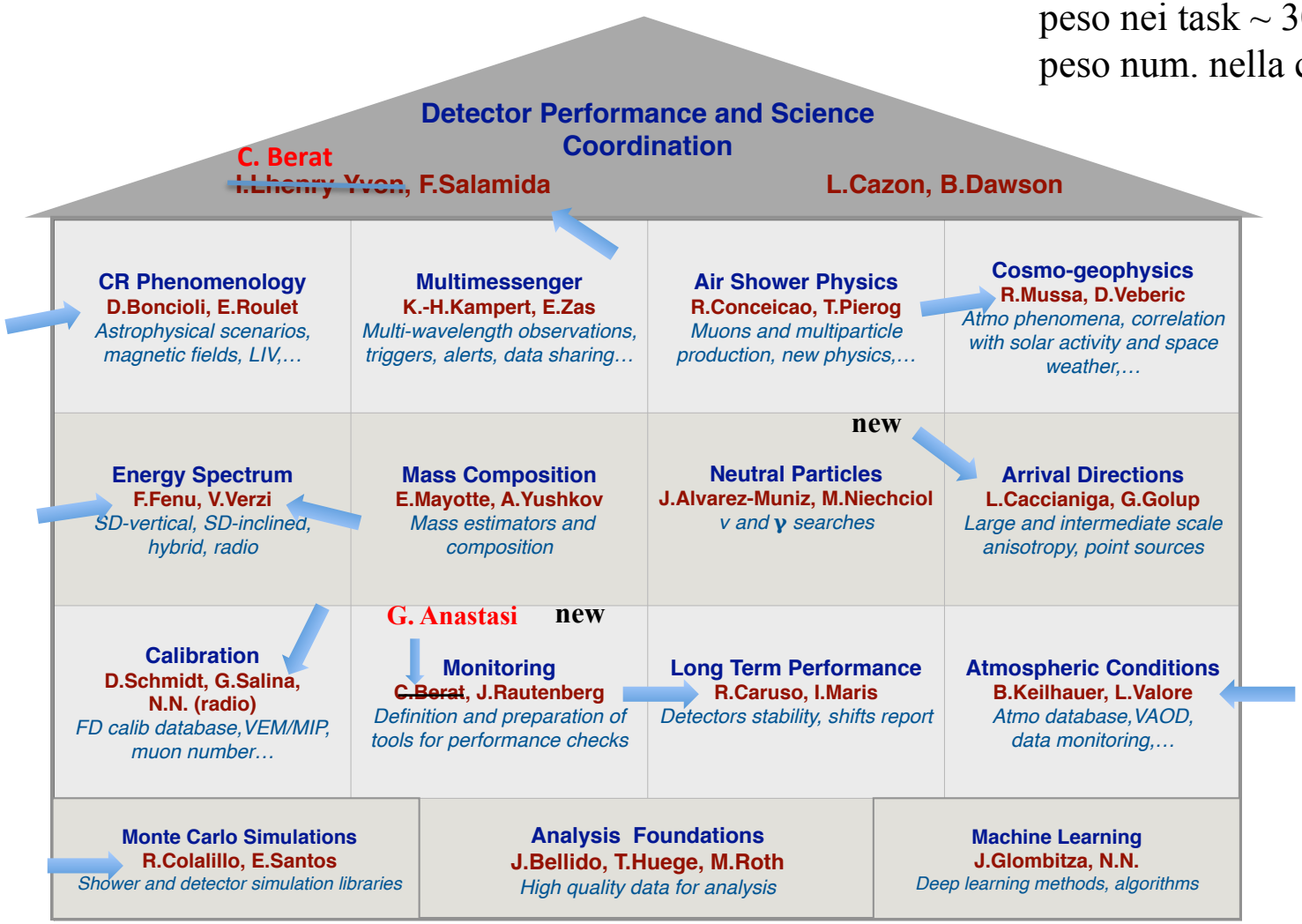
(updated 2021-04-13)



- new Financial Board (FB) chair (replaced N. Ferroni)
- INFN FB member: M. Pallavicini replaced A. Masiero
- R. Engel and A. Castellina confirmed for another mandate

} Nov. 2020

peso nei task ~ 30%
peso num. nella collab. ~ 13%



(2021-02-10)

Publication Committee

C. Dobrigkeit (chair)
R. Clay
B. Fick
A. di Matteo
new
L. Perrone
D. Veberic

Conference Committee

C. Timmermans (chair)
S. Andringa
M. Bohacova
C. Bonifazi

Pubblicazioni: 12 nel 2020 & 8 nel 2021

The Pierre Auger Observatory and its Upgrade	Science Reviews - from the end of the world (Argentina) Vol. 1, No. 4, September 2020 / pp. 8-33
Reconstruction of Events Recorded by the Surface Detector of the Pierre Auger Observatory	JINST 15 (2020) P10021
A search for Ultra-High Energy neutrinos from TXS 0506+056 using the Pierre Auger Observatory	The Astrophysical Journal, 902:105, 2020
Erratum: Search for photons with energies above 10^18 eV using the hybrid detector of the Pierre Auger Observatory	JCAP09(2020)E02
Features of the energy spectrum of cosmic rays above 2.5 x 10^18 eV using the Pierre Auger Observatory	Physical Review Letters 125, 121106 (2020) (Editor's Suggestion)
Measurement of the cosmic ray energy spectrum above 2.5 x 10^18 eV using the Pierre Auger Observatory	Physical Review D 102, 062005 (2020) (Editor's Suggestion)
Studies on the response of a water-Cherenkov detector of the Pierre Auger Observatory to atmospheric muons using an RPC hodoscope	JINST 15 (2020) P09002
Direct measurement of the muonic content of extensive air showers between 2x10^17 and 2x10^18 eV at the Pierre Auger Observatory	Eur. Phys. J. C (2020) 80:751
Search for magnetically-induced signatures in the arrival directions of ultra-high-energy cosmic rays measured at the Pierre Auger Observatory	JCAP 06 (2020) 017
Catching Elves in Argentina	Eos 101 Science News by AGU (2020)
Cosmic ray anisotropies in right ascension measured by the Pierre Auger Observatory	Astrophys. J. 891 (2020) 142
A Three Year Sample of Almost 1600 Elves Recorded Above South America by the Pierre Auger Cosmic Ray Observatory	Earth Space Sci. 7 (2020) e2019EA000582

Design and implementation of the AMIGA embedded system for particle detectors	JINST 16 T07008 (2021)
Deep-Learning based Reconstruction of the Shower Maximum Xmax using the Water-Cherenkov Detectors of the Pierre Auger Observatory	JINST 16 P07019 (2021)
Extraction of the Muon Signals Recorded by the Surface Detector of the Pierre Auger Observatory Using Recurrent Neural Networks	JINST 16 P07016 (2021)
The FRAM robotic telescope for atmospheric monitoring at the Pierre Auger Observatory	JINST 16 P06027 (2021)
Measurement of the fluctuations in the number of muons in extensive air showers with the Pierre Auger Observatory	Phys. Rev. Lett. 126, 152002 (2021)
Calibration of the underground muon detector of the Pierre Auger Observatory	JINST 16 P04003 (2021)
Design, upgrade and characterization of the silicon photomultiplier front-end for the AMIGA detector at the Pierre Auger Observatory	JINST 16 P01026 (2021)

Title: **The Energy Spectrum of Cosmic Rays beyond the Turn-Down at 10^17 eV as Measured with the Surface Detector of the Pierre Auger Observatory**
Author List: FAL: The Pierre Auger Collaboration
Citation: Submitted to Eur. Phys. J. C

ICRC 2021

- 36 contributi di cui 4 in collaborazione con altri esperimenti
- 10 relatori italiani
- contributo italiano in moltissimi items sulla fisica e sul rivelatore

prossimi talks

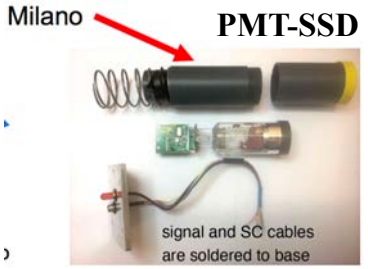
SHORT	Oral/ Post.	PRESENTER	CONTRIBUTION 4
AD1	O	Rogério Menezes	Large-scale and multipolar anisotropies of cosmic rays detected at the Pierre Auger Observatory with energies above 4 EeV
AD2	O	Jonathan Biteau	The ultra-high-energy cosmic-ray sky above 32 EeV viewed from the Pierre Auger Observatory
AD3/ PHENO2	O	Teresa Bister	A combined fit of energy spectrum, shower depth distribution and arrival directions to constrain astrophysical models of UHECR sources
ATM1	O	Andrew Puyleart	Satellite Data for Atmospheric Monitoring
CAL1	O	Christoph Schäfer	The XY Scanner - A Versatile Method of the Absolute End-to-End Calibration of Fluorescence Detectors
CGEO1	P	Roberta Colalillo	Downward Terrestrial Gamma-ray Flashes in Auger?
CGEO2	O	Adriana Vazquez	Study on multi-ELVES in the Pierre Auger Observatory
DPA1	P	Lukas Nellen	Update of the Offline Framework for AugerPrime
DRT1	O	Viviana Scherini	The 2021 Open-Data release by the Pierre Auger Collaboration
EAS1	O	Jakub Vícha	Data-driven Scales of Depth of Shower Maximum and Signals at Ground Level using Hybrid Detection at the Pierre Auger Observatory
EAS2	O	Caterina Trimarelli	Constraining Lorentz Invariance Violation using the muon content of extensive air showers measured at the Pierre Auger Observatory

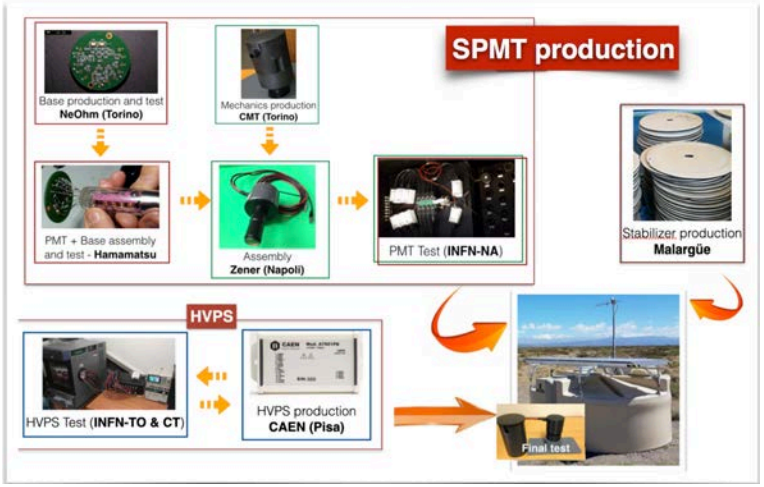
SHORT	Oral/ Post.	PRESENTER	CONTRIBUTION 5
FOUND1	O	Gaia Silli	Performance of the 433 m surface array of the Pierre Auger Observatory
FOUND2	O	David Schmidt	Reconstruction of Events Recorded with the Water-Cherenkov and Scintillator Surface Detectors of the Pierre Auger Observatory
FOUND3	O	Bjarni Pont	The depth of the shower maximum of air showers measured with AERA
LTP1	O	Rossella Caruso	Operations of the Pierre Auger Observatory
MASS1	O	Juan Miguel Carceller	Extraction of the Muon Signals Recorded with the Surface Detector of the Pierre Auger Observatory Using Recurrent Neural Networks
MASS2	O	Jonas Glombitza	Event-by-event reconstruction of the shower maximum Xmax with the Surface Detector of the Pierre Auger Observatory using deep learning
MASS3	O	Eric Mayotte	Indication of a mass-dependent anisotropy above 10^18:7 eV in the hybrid data of the Pierre Auger Observatory
MC1	O	Eva Santos	Monte Carlo simulations for the Pierre Auger Observatory using the VO Auger grid resources
MM1	P	Michael Schimp	Combined Search for UHE Neutrinos from Binary Black Hole Mergers with the Pierre Auger Observatory
MM2	P	Philip Ruehl	Follow-up Search for UHE Photons from Gravitational Wave Sources with the Pierre Auger Observatory
MM3	O	Massimo Mastrodicasa	Search for upward-going showers with the fluorescence detectors of the Pierre Auger Observatory
MM4	P	Ioana Caracas	A tau scenario application to a search for upward-going showers with the Fluorescence Detector of the Pierre Auger Observatory
NEUT1	O	Pierpaolo Savina	A search for ultra-high-energy photons at the Pierre Auger Observatory exploiting air-shower universality

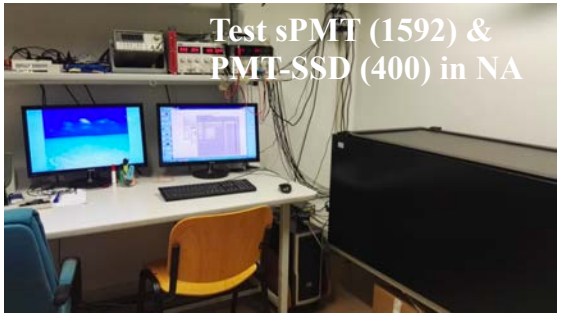
SHORT	Oral/ Post.	PRESENTER	CONTRIBUTION 6
OUT1	P	Karen Mora	Outreach activities at the Pierre Auger Observatory
PHENO1	O	Eleonora Guido	Combined fit of the energy spectrum and mass composition across the ankle with the data measured at Pierre Auger Observatory
PRIME1	O	Gabriella Cataldi	The upgrade of the Pierre Auger Observatory with the Scintillator Surface Detector
PRIME2	P	Giovanni Marsella	AugerPrime Upgraded Unified Board: The New Front-End Electronics
PRIME3	O	Tomas Fodran	First results from the AugerPrime Radio Detector
PRIME4	O	Felix Schlüter	Expected performance of the AugerPrime Radio Detector
PRIME5	O	Ana Botti	Status and performance of the underground muon detector of the Pierre Auger Observatory
SPEC1	O	Vladimír Novotný	Energy spectrum of cosmic rays measured using the Pierre Auger Observatory
WG1	O	Yoshiki Tsunesada (TA)	Joint analysis of the energy spectrum of ultra-high-energy cosmic rays as measured at the Pierre Auger Observatory and the Telescope Array
WG2	O	Armando di Matteo	UHECR arrival directions in the latest data from the original Auger and TA surface detectors and nearby galaxies
WG3	O	Peter Tinyakov (TA)	The UHECR dipole and quadrupole in the latest data from the original Auger and TA surface detectors
WG4	O	Dennis Soldin (IC)	Update on the Combined Analysis of Muon Measurements from Nine Air Shower Experiments

Contributo INFN ad AugerPrime

- SSD – 240/1518 realizzati in LE
- sPMT & HVPS (~1500 comprati dall'INFN)
  – leadership italiana TO-NA-CT
- PMT-SSD NA-CT-MI
- FADC (UUB)
  LE (e ora anche CT)







Expenditures incurred for AugerPrime and comparison with the extimates presented to the CTS

	2016	2017	2018	2019	2020	2016-2020	CTS	Diff
SSD production	22	164	57	107		350	348	2
sPMT	24,5	101	51,5	188	58	423	279	144
PMT-SSD	14,5	55,5	44,5	30		144,5	190	-45,5
HV-CAEN	22	122	0	80	38	262	345	-83
FADC	0	75	75	150		300	265	35
Trasporti		59	30	71		160	170	-10
Totali	83	576,5	258	626	96	1639,5	1597	42,5

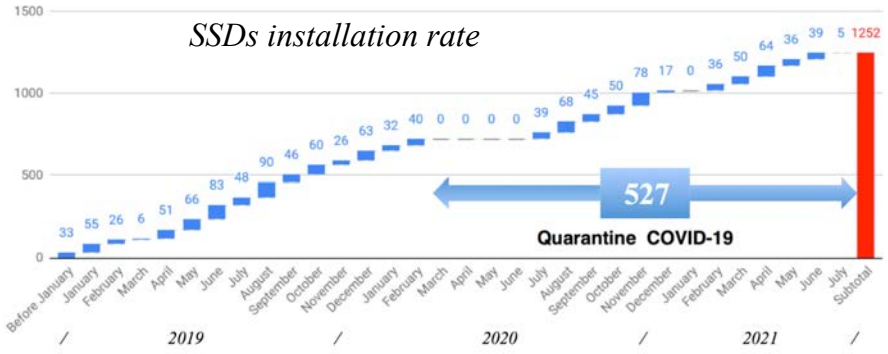
Consuntivo AugerPrime

credits to D.Martello

Stato costruzione e installazione AugerPrime

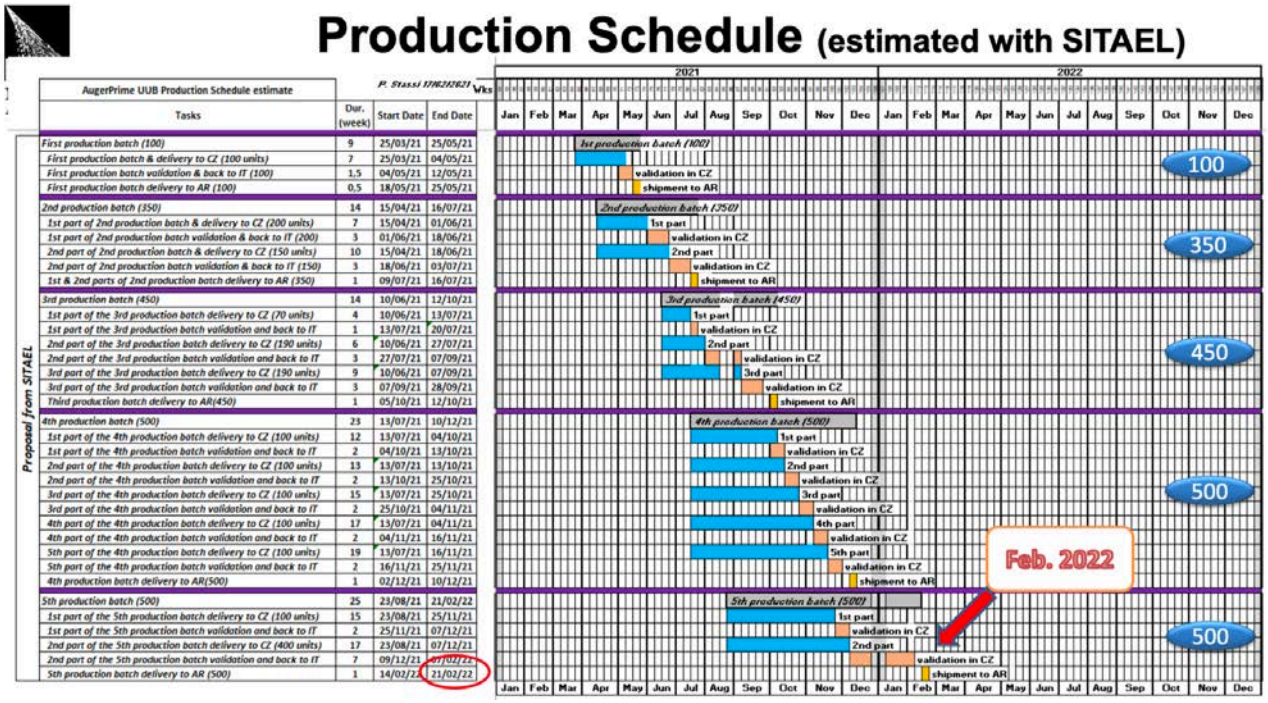
- la costruzione di 1518 SSDs terminata (1293 installati) (pre-production: 77 con vecchia elettronica)

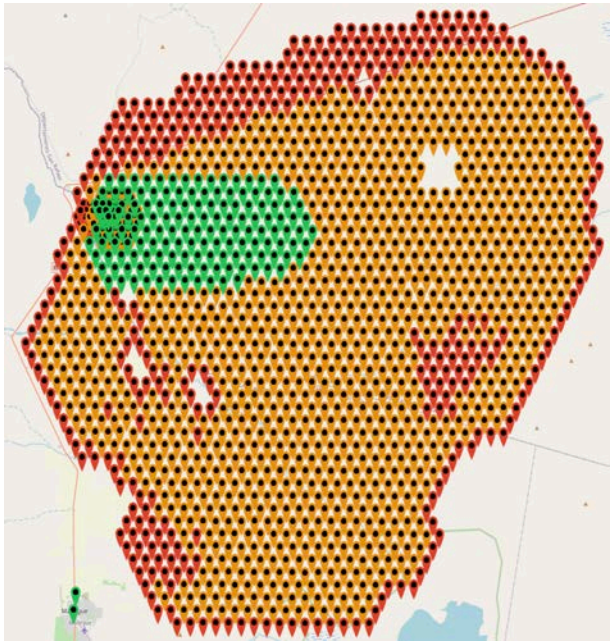
  → **installazione SSD terminerà quest'anno**

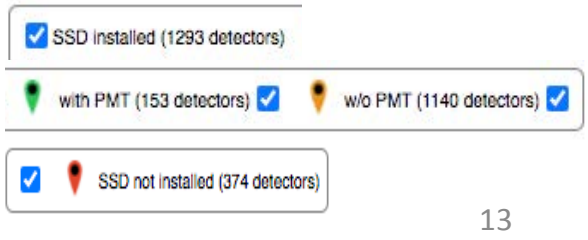


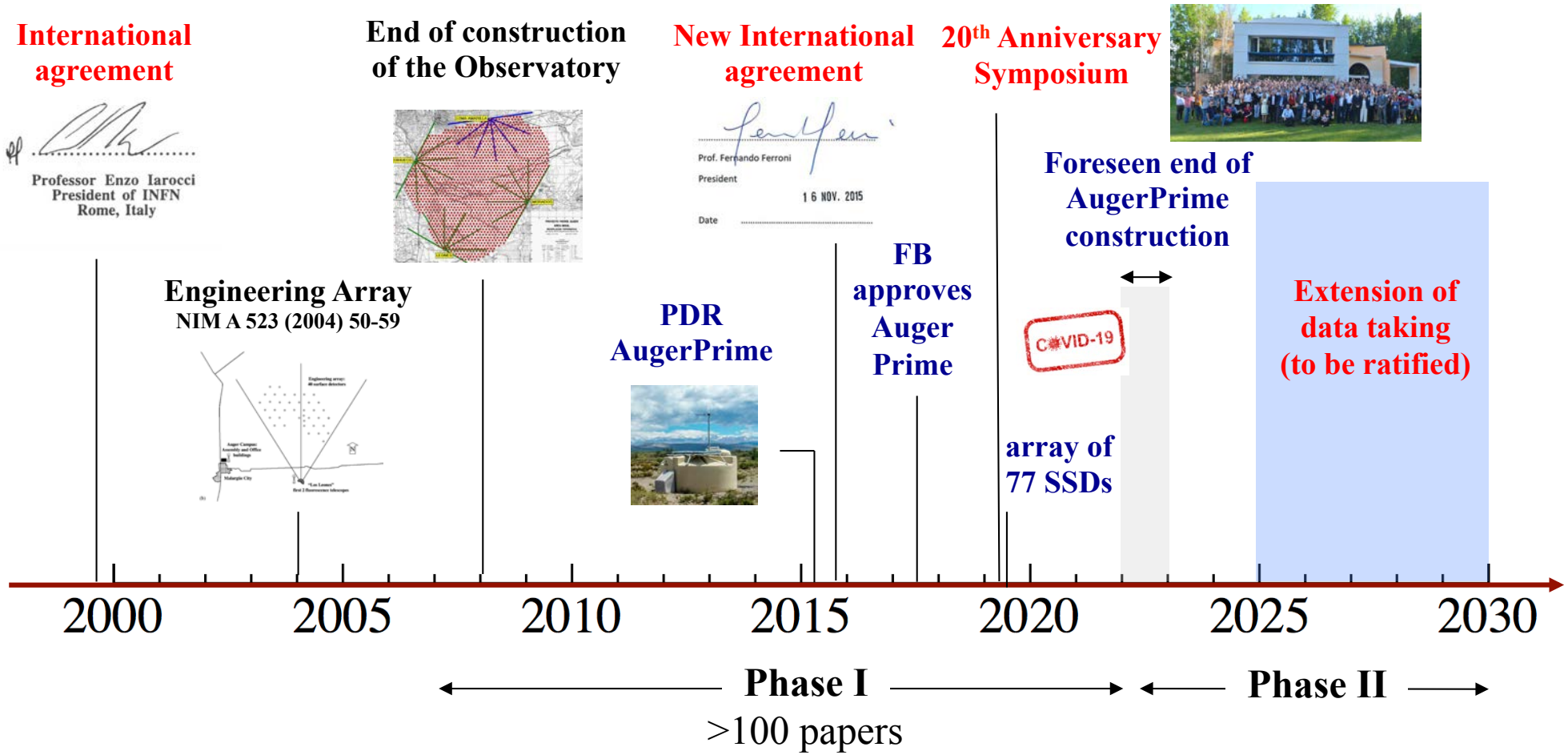
- produzione UUBs ritardata dalla pandemia
  - 74 stazioni equipaggiate con nuova UUB
  - 84 UUBs in Malargüe e 3x84 a breve spedite
- test PMT-SSD e sPMT completati (ultimi 400 sPMT a breve spediti da NA). Saranno installati insieme alle UUBs.

  → **installazione UUBs & PMTs terminerà a fine 2022 (covid permettendo)**









Transition from Phase I to Phase II

- continue analysis of Phase I data
- summary of Phase I results in Rev. of Mod. Phys.
- increase the data release
- installation and commissioning of AugerPrime (+papers)
- operation of the Observatory

https://opendata.auger.org

press release Feb 2021

RICHIESTE FINANZIARIE 2022

	Miss.	Cons.	Trasp.	Manut.	Invent.	App.	Spservizi	**Totale**
CT	50,5	3,5	10	5	7			**76**
GSGC	42	3	5		6			**56**
LE	72,5	5	12,5					**90**
MI	45		2		3			**50**
NA	32	6	2		2			**42**
RM2	21		3		2		253	**279**
TO	75,5	13	10		15	14		**127,5**
Totale	**338,5**	**30,5**	**44,5**	**5**	**35**	**14**	**253**	**720,5**
Tot. 2021	406	33,5	55	5	24	9	282	814,5

<u>Missioni</u>

meeting a Malargüe 138 k€
installazione upgrade 52 k€
maintenance 'non upgrade' 27 k€
turni di presa dati FD 40 k€
altro 53,5 k€ → meeting 'istituzionali' & di analisi 'ristretti'
conferenza (UHECR+...) 28 k€

nota: SJ=0 come concordato nella riunione di Luglio

<u>Trasporti</u> principalmente per le missioni a Malargüe

<u>Altre richieste non CF</u>: 53,5 k€ maintenance, 11 k€ upgrade, 20 k€ materiale informatico

RICHIESTE FINANZIARIE 2022

Si è cercato di motivarle nel modo più dettagliato possibile.

Siamo consapevoli dell'indicazione del management di contenere le missioni per i meeting ma vogliamo sottolineare alcuni punti importanti che riguardano i **meeting a Malargüe**:

- **la Collaborazione si riunisce solo 2 (+1) volte l'anno a Malargüe** (+meeting di analisi in Europa)

- **i meeting online rappresentano una forte limitazione per via del fuso orario** (poche ore disponibili al giorno per tenere conto del fuso in Europa, Australia, Sud e Nord America)

- a Malargüe si trova il sito sperimentale e i meetings vengono sfruttati per svolgere attività sul sito, interagire con lo **staff dell'Osservatorio**, … **È impensabile fare un'esperimento senza mai andare nel sito sperimentale**

- le richieste sono ben calibrate con l'impegno che abbiamo nella Collaborazione. **È impensabile ricoprire ruoli di responsabilità senza recarsi ai meeting**

COMMON FOUND

FB Nov. 2020: **8.677,25 $/persona**

OCL pagato per tutti i senior associati all'INFN

dove per senior si intende: FTE > 50% contratto di lavoro> PhD

nota:

- PhD (n.6) e pensionati (n.4 con FTE=0%) firmano comunque gli articoli di Collaborazione
- le persone con contratto INAF (n.5) sono in carico all'INAF

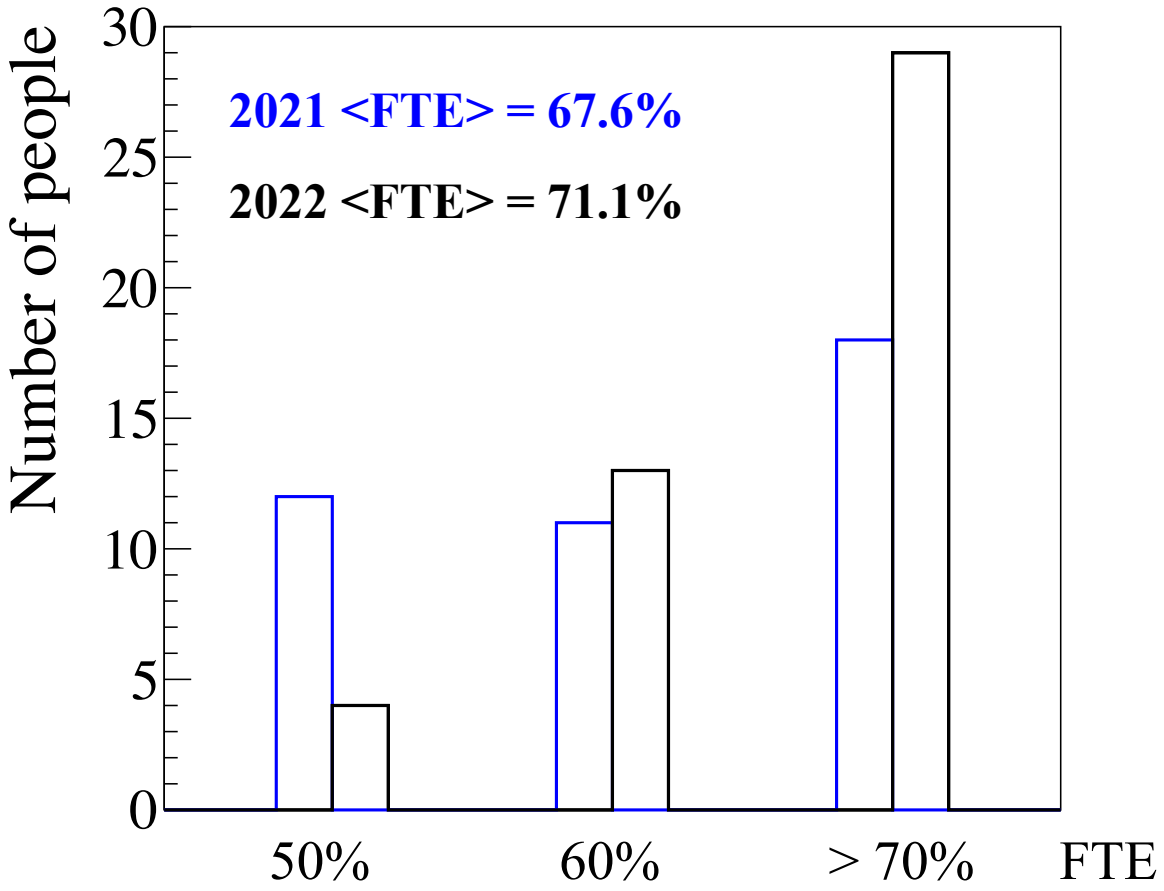
Numero senior in quota all'INFN: 35
Cambio euro dollaro (media nel 2021): 1,20

$$\mathbf{CF = 8.677{,}25 \times 35 / 1{,}20 \approx 253{,}1\ k€}$$

$N_{tot} = 53$ $FTE_{tot} = 34.9$

Numero di persone che firmano gli articoli (di cui 4 pensionati) = 50

Considerando solo le persone per cui sono dovuti i CFs (=35+5):



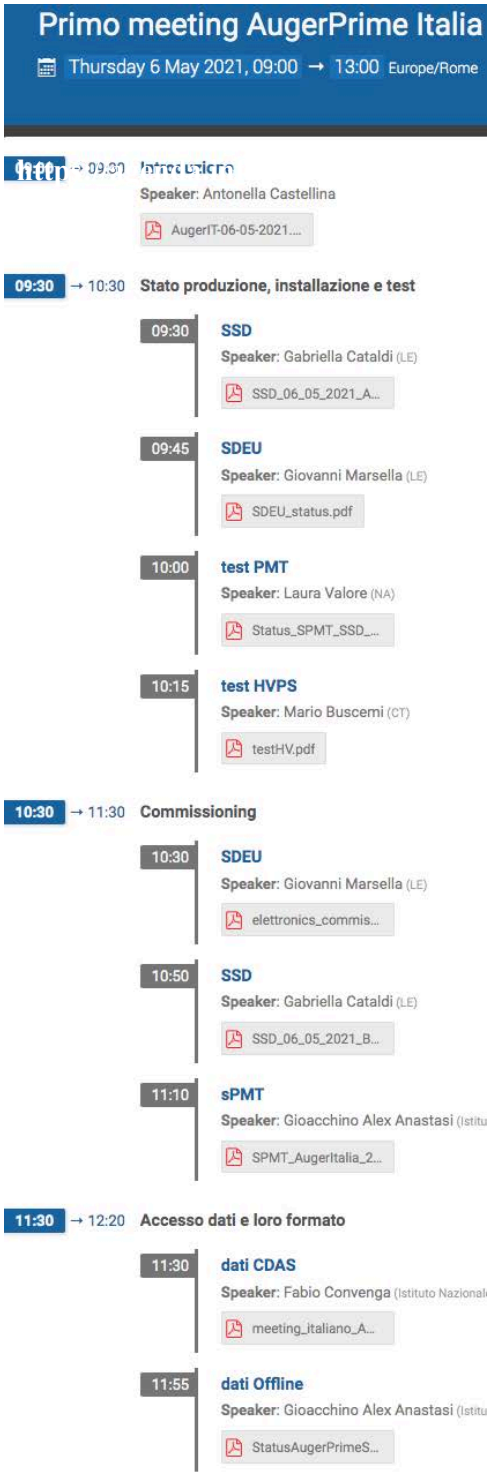
Stato missioni 2021

nemmeno quest'anno è stato possibile recarsi a Malargüe

Spese di missioni per riunioni in Italia/ Europa, shift remoti in altre sedi e per un meeting Auger Italia che faremo in autunno

Si restituiscono 16,5 k€ di missioni assegnate (su un totale di 59,5 k€) più tutti gli 80 k€ di SJ
→ totale restituzioni 96,5 k€
(in via di definizione)

nota: cifra inferiore a quella restituita nel 2020 (235,5 k€) in quanto le assegnazioni 2021 sono state significativamente inferiori (covid?)



END

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

Storia dei finanziamenti per sPMT

CTS:

- erano previsti 400 SSD (no fibre) + 800 SPMT + 1700 HVPS
- costo sPMT 279k, cioè 0.35k€/unit, costo HVPS 345k cioè 0.2 k€/unit = 279+345 = **624k**

2018 Piano B: 75% dell'upgrade coperto
1250 SSD + sPMT&HVPS, 1600 UUB (850k€ per SPMT) - costi invariati ma cambio migliore

- solo 225 SSD invece di 400, ma fibre in piu' per i 225 moduli, prima non previste. Totale invariato, avanzano 15 k€ che vengono assegnati a sPMT (erano 10 ma per effetto cambio li porta a 15)
- sui 1250 SPMT previsti, dovevano essere 800 coperti da INFN e 450 coperti da BR/Campinas. A seguito dell'indisponibilità BR in tempo utile, abbiamo preso in carico l'intera produzione dei 1250
- sPMT 1250 invece di 800, HVPS 1250 invece di 1700:
  - erano 800*0.35 = 280k, 1700*0.2=340k —> tot 620 k
  - pianoB : 1250*0.35=437.5k che diventano 400 per effetto del cambio favorevole, 1250*0.2=250k —> tot 650k di cui 15 coperti dl risparmio sugli SSD : a pagare restano **635k**
  - —> **TOT CTS 624k€, tot da coprire 635k€** quindi totale circa invariato

2019 Piano B++: 95% dell'upgrade coperto
1550 SSD + sPMT&HVPS, 1600 UUB (850k€ per SPMT) - costi ridotti perché ridotte /azzerate le contingenze.

- 225 SSD+15, no costi aggiuntivi (parti mancanti inviate da altre sedi).
- servono 300 sPMT+HVPS = 105k+60k
- (2020) parte dei 150k per l'elettronica (LE) viene coperta da altri paesi membri, si assegna il rimanente alla copertura delle spese per ulteriori 200 sPMT+ 200 HVPS +300 (meccaniche+cavi+assemblaggio)
- (2020) i restanti 100 SPMT + 100 HVPS vengono comprati dal KIT (Germania)
- (2021) finanziate da INFN ulteriori 50 HVPS spare

(*) cifre arrotondate. Il sistema sPMT costa 238,28€/unit (149,5 il solo PMT), le HVPS costano 175€/unit

PROFILO TEMPORALE DELLE RICHIESTE ECONOMICHE

Financial requests for 2022 and estimates for 2023-2027 expressed in k€

Anno	Missioni	Consumo	Trasporti	Manutenz.	Inventario	Apparati	Spservizi (*****)	Totale
2022	338,5	30,5	44,5	5	35	14	253	720,5
2023	350	40	40		30	30	250	740
2024	350	40	40		30	30	250	740
2025	350	40	40		30	30	250	740
2026	350	40	40		30	30	250	740
2027	350	40	40		30	30	250	740
Totale	2088,5	230,5	244,5	5	185	164	1503	4420,5

- estensione data-taking oltre il 2025
- importo CF pari a quello del 2022
- azzeramento dei costi di installazione di AugerPrime compensato da quelli che ci saranno per il maintenance dei nuovi rivelatori

Piano qualità - CSN2-AUGER-QA-321 : progress report

1 Introduzione

2 Rapporto tecnico-scientifico

2.1 Risultati tecnico-scientifici raggiunti
Recenti risultati scientifici, installazione e commissioning upgrade

2.2 Problemi tecnico-scientifici riscontrati
Pandemia: ritardi nell'installazione UUB, problemi nel commissioning/maintenance, difficoltà nel fare i meeting di Collaborazione online

3 Rapporto gestionale

3.1 Stato sulle risorse
Assegnazioni 2021 e deviazioni di bilancio (restituzioni), consuntivo bilancio 2020, risorse umane e contratti cofinanziati

3.2 Stato della pianificazione temporale
Profilo temporale di spesa 2022-2027 (estrapolato dai preventivi 2022); n. di persone per cui l'INFN paga il CF)

3.3 Grafico EVM

4 Principali future milestones
Milestones db

5 Stato dei rischi del progetto

5.1 Stato dei rischi di tipo tecnico
Possibili implicazioni del perpetuarsi della pandemia su installazione/commissioning upgrade e maintenance.
Approvvigionamento LPMT (SD)

5.2 Stato dei rischi di tipo gestionale
Missioni a Malargüe limitate dalla pandemia.
Common Fund

Piano qualità - CSN2-AUGER-QA-240-UPG

cornice entro cui è definito l'esperimento

Data CD: 30/07/2021

Commissione Scientifica Nazionale II

Nome Sigla/Linea Attiva: AUGER

Proponenti: Valerio Verzi, INFN Roma Tor Vergata

Documenti di Riferimento:

1) Consiglio Tecnico Scientifico – Application Form for AUGER - 2015

2) International Agreement for the organization, management and funding for the operation of the Pierre Auger Observatory – 2015

allegati

Descrizione

definizione Osservatorio

The Pierre Auger Observatory is an international scientific project with the aim of studying cosmic rays (CRs) at the very high energies (>10^{18} eV). The Observatory is located in Argentina, close to the town of Malargüe in the province of Mendoza. It is based on an hybrid design, with a surface detector (SD) and a fluorescence detector (FD) that overlooks the atmosphere above the array. In its baseline design, the SD consists of 1600 water-Cherenkov detectors (WCDs) spanning on a total area of 3000 km^2 while the FD consists of 24 fluorescence telescopes. The construction of the Observatory began in 2001 and was completed in 2008. The baseline configuration has been enhanced with the installation of a smaller and denser array of WCDs and of three additional telescopes with high elevation pointing directions, both aiming at lowering the energy threshold of the measurements.

upgrade dell' Osservatorio

In 2015, the Auger Collaboration agreed to build an upgrade of the Observatory dubbed AugerPrime, mainly to improve the mass composition sensitivity at the highest energies. The upgrade consists on installing a plastic Surface Scintillator Detector (SSD) above each WCD, a faster and more performant electronics (Upgraded Unified Board - UUB), a small photomultiplier tube ("small PMT" - sPMT) to increase of the dynamic range of the measurements, an antenna at each station for radio detection of cosmic ray showers (RD) and an Underground Muon Detector (UMD) in a inner region of the array. The construction of AugerPrime is almost completed: the installation of SSD will be concluded in 2021 and the one of the

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UUB (together with the PMTs) is planned to be concluded by the end of next year. The RD and UMD are also expected to be completed in 2022.

Collaborazione

The Auger Collaboration is formed by about 400 scientists from 17 countries. The project is supported by an International Agreement that was signed in November 2015 and replaced a previous one signed in 1999. The new Agreement is valid until 2025. In order to collect a statistics of events sufficient to achieve the scientific objectives set with the upgraded detector, the Collaboration plans to extend the data taking until 2030. This plan will require an extension of the existing Agreement, following the suggestion put forward by the Financial Board in November 2020.

International Agreement

The Sezioni INFN involved in the Auger project are Catania, Gruppo collegato Gran Sasso, Lecce, Milano, Napoli, Roma II and Torino. INFN has contributed to the construction of AugerPrime, in particular the SSD, sPMT and UUB allocating a total amount of about 1600k€, well inline with the expense estimates presented in the application submitted to the INFN Comitato Scientifico Nazionale (CTS) in 2015.

Sezioni coinvolte e costo upgrade

Expenditures incurred for AugerPrime and comparison with the extimates presented to the CTS

	2016	2017	2018	2019	2020	2016-2020	CTS	Diff
SSD production	22	164	57	107		350	348	2
sPMT	24,5	101	51,5	188	58	423	279	144
PMT-SSD	14,5	55,5	44,5	30		144,5	190	-45,5
HV-CAEN	22	122	0	80	38	262	345	-83
FADC	0	75	75	150		300	265	35
Trasporti		59	30	71		160	170	-10
Totali	83	576,5	258	626	96	1639,5	1597	42,5

Futuro: data-taking ed analisi

The upgrade is now fully funded and the next years will be dedicated to the data-taking and analysis. The expense estimates for the next years cover the costs for missions mainly for travels to Malargüe, consumable and equipments for the maintenance of the existing detectors and Common Fund, for a total of about 740k€/year (see CSN2-AUGER-QA-321-1.0).