



ICHEP 2022

XLI

International Conference
on High Energy Physics
Bologna (Italy)

6-13-07 2022

Final Report



ICHEP 2022 Final Report

Overview

The 41st International Conference on High Energy Physics (ICHEP) has been held in Bologna from July 6th to July 13th 2022, hosted by Italy for the first time in its more than seven decades long history.

Since its first edition in Rochester in 1950, ICHEP has been the cornerstone event for the scientific community involved in High Energy Physics (HEP), where the most important recent results and future strategies are presented and discussed bringing together experimentalists and theorists in a vital and productive exchange of views and ideas.

The venue was the Volvo Congress Center in the Bologna's fair district, the only site in Bologna suited to host an event of this scale.

The format of the conference was the usual one with the first three days (Thu-Sat) of parallel sessions and the last three (Mon-Wed) dedicated to plenary sessions. The number of simultaneous parallel sessions was extended to 12 considering the request of the computing community for a larger than usual computing session due to the cancellation of CHEP 2022, the reference conference for this community. A poster session, allowing young people to present their own work, was held on Friday evening and the posters were exhibited for the whole duration of the conference.

The Bologna edition was the first time of ICHEP in full hybrid format, marking the return to the in-person participation after the pandemic emergency but also guaranteeing the possibility of a fruitful remote participation for scientists living in countries still affected by the pandemic or who couldn't attend in-person for whatever other reason.

The setup of a hybrid format was one of the most critical aspects of the organization because of the large number of parallel sessions to manage and the need for a ticketing service to allow online access only to registered people. After examining several possibilities, the chosen platform was ZOOM Events, a new product that worked excellently but required the joint effort of a dedicated team of four expert people for about 6-7 weeks to set-up the platform before the conference and assist participants during the conference.

Another critical aspect that had remarkable impact on the organization was the effect of the pandemic. A reliable in advance estimation of the number of attendants was not possible due to the swinging trend of the pandemic with an unexpected increasing of cases right at the beginning of the conference. The participation at the end was somehow larger than expected with some crowding problems especially during the lunches. Despite this, the number of infections during and soon after the conference was relatively contained, thanks to the diligence of the majority of the participants who carefully observed the strong recommendation to wear a face mask at all times inside the conference venue. The pandemic trend caused several last-minute cancellations: all the people who couldn't come because of Covid-19 positivity were fully reimbursed. People were obliged to extend their stay because of quarantine, also in this case full reimbursement of extra-expenses, if not insured, was guaranteed.

An important aspect, the organizers are keen to emphasize, was the large participations of young people favored by the low-fee policy and the substantial economic support assigned, thanks to the contributions of our institutional sponsors, to students coming from disfavored countries: more than hundred people benefited of fee waiver and about forty of additional € 400 contribution to cover the conference lunches and accommodation expenses.

Participants with family in tow benefited of the free child-care service and could get access to a dedicated family grant of € 300.

As mentioned above the crucial contribution of many worldwide institutions and laboratories allowed to adopt a fee policy favoring the participation of students and to setup a supporting program for scientists coming from disfavored countries. The conference was also largely attractive for technical companies, as evidenced by the many requests for participation in the ICHEP 2022 sponsorship program. The company booths were placed in a highly visibility location, the big foyer just in front of the main Auditorium, allowing easing interactions with the participants especially during the coffee-breaks.

Beside the conference and thanks to the valuable collaboration of the municipality of Bologna and of the Emilia-Romagna region, a rich program of outreach events was also organized.

The program included exhibitions, public debates, a theatrical performance on the role of women in science and a final conference show in the main square of Bologna (Piazza Maggiore) with the participation of CERN's Director General Fabiola Gianotti, the Director of the CERN Theory Division Gian Francesco Giudice, Professor Guido Tonelli (University of Pisa, former spokesperson of CMS, one of the Large Hadron Collider collaborations) and INFN's President Antonio Zoccoli. The show was moderated by Serena Dandini, a well-known Italian TV host and was a great success with the participation of more than 4000 people.

Another relevant related initiative was the competition for the logo and the poster of the conference, organized in collaboration with an Italian association of professional graphic designers (AIAP). The competition was a great success with more than 400 participants. The submitted projects were examined by a committee formed by 4 members of the LOC and one representative of the AIAP and the winner project was adopted as the distinctive brand of the conference. An exhibition of the best projects was also organized during the conference with the possibility for the conference participants to vote for their favorites.

The final part of the report contains the result of a survey distributed to the participants soon after the conference in order to get feedback on various organizational aspects.

More than 500 participants answered, the feedback was positive for everything but the catering at the conference venue that was the only item to be evaluated slightly below average. Bologna Congressi, the company that manages the venue, has been promptly informed of the not quite satisfactory result of the catering provider, that was the only one authorized to operate at the conference venue.

The INFN divisions of Bologna and Ferrara, together with the Universities of the two cities, directly involved in the conference organization, are proud and honored for having hosted such a prestigious event. The organizational machine started to move four years in advance with the preparation of the proposal submitted to the C11 Committee of IUPAP. It was a long and challenging task, further complicated by the pandemic related issues, it involved a Local Organizing Committee (LOC) of more than 70 people who worked hard often behind the scenes. The conference chairs are extremely grateful to all of them for their strong dedication that has been crucial for the success of the event. A special thank goes to the International Advisory Committee (IAC) for their valuable suggestions and their continuous support throughout the whole process of preparation of the scientific program of the conference.

In conclusion the key role played by the staff of our PCO, NOEMA, must be pointed out. They supported the LOC with competence and professionalism in every organizational aspect, always ready to face any critical issue with a constructive and positive attitude. The conference organizers are deeply grateful for their crucial contribution in making the event a success.

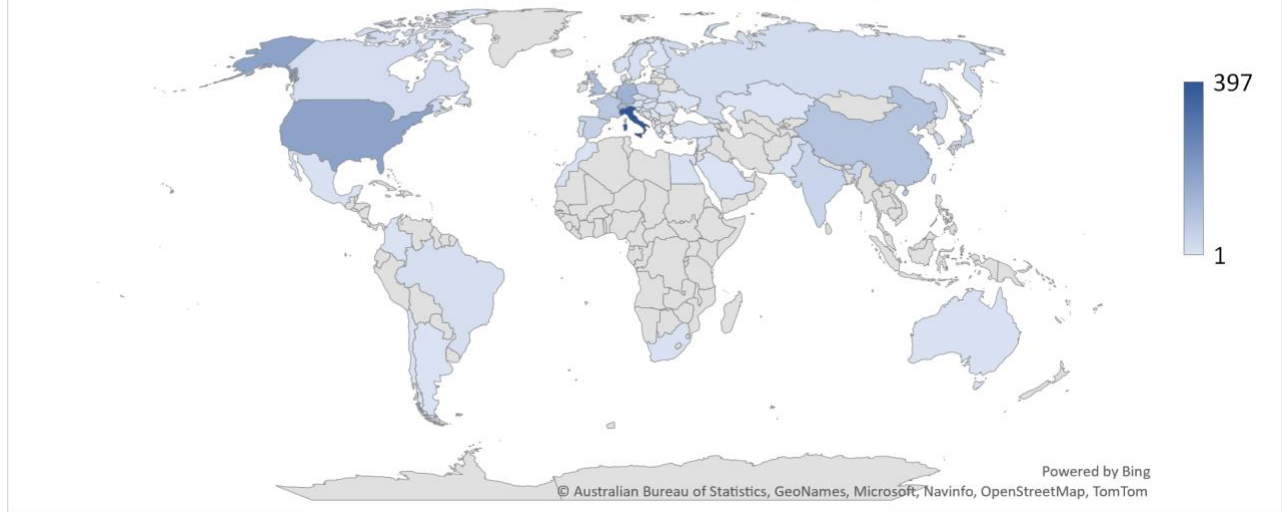
ICHEP 2022 attendance statistics

The total number of participants, including in-person and online participation, was **1469** from **50** countries. The following table shows the breakdown for the different categories.

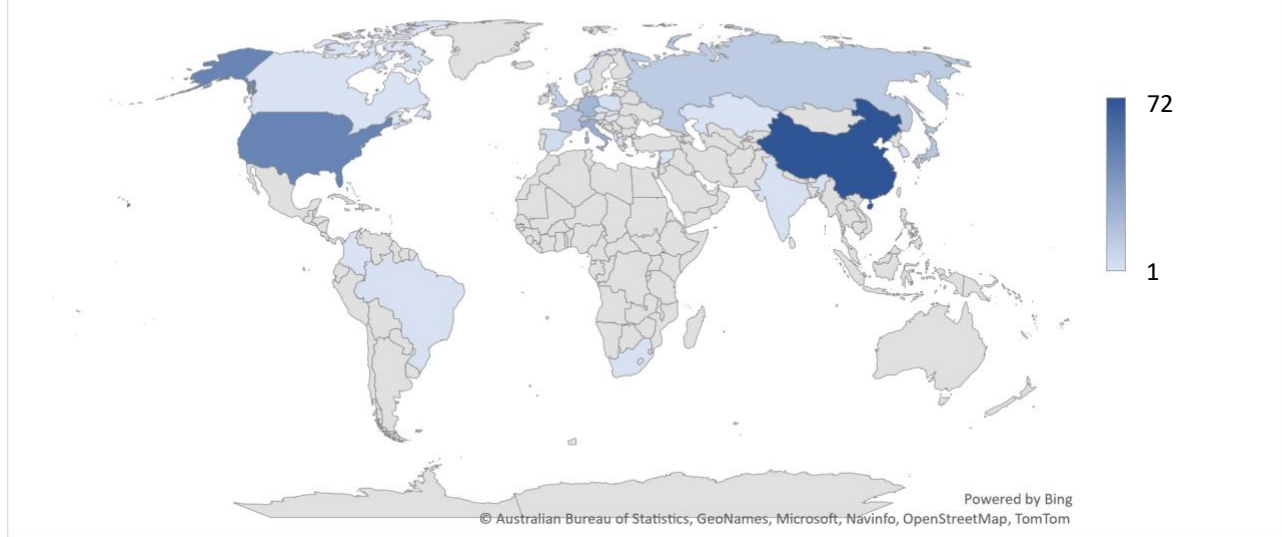
	Staff/PostDocs	PhD Students	Total
In-person	804	344	1148
Online	235	86	321
Total	1039	430	1469

The geographic distributions of the participants is shown in the following maps for the total and online participation. The second map clearly points out the impact of the hybrid conference format on the participation of people from countries still affected by restrictions due to the pandemic.

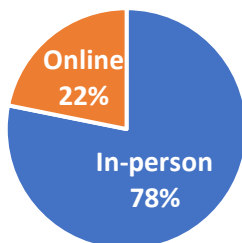
Geographic distribution (total)



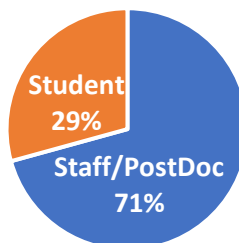
Geographic distribution (online)



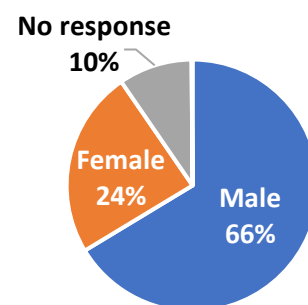
Mode of participation



Fraction of students



Gender



Scientific program

International Advisory Committee

The International Advisory Committee (IAC) played an important role in assisting the LOC to setup the scientific program of the conference and in particular in the selection of the parallel session conveners and the plenary speakers. It was formed by the directors of the main HEP laboratories, the chairs of the previous ICHEP editions and prestigious personalities of the HEP community. The geographical distributions and the gender balance of the IAC members is shown in the following table.

Country	Number
USA	11
CERN	5
Italy	4
Germany	3
UK	2
France	2
Japan	2
Switzerland	2
Czech Rep.	2
Australia	2
China	1
India	1
Spain	1
Russia	1
Canada	1
Netherlands	1
South Korea	1
Israel	1
Total	43
Female fraction	0.30

Parallel Sessions

The first three days of the conference (7-9 July) hosted 17 sessions, with 12 running in parallel at every given time, listed in the following table.

Parallel sessions
1 - Higgs Physics
2 - Neutrino Physics
3 - Beyond the Standard Model
4 - Top quark and EW Physics

5 - Quark and Lepton Flavour Physics
6 - Strong interactions and Hadron Physics
7 - Heavy Ions
8 - Astroparticle Physics and Cosmology
9 - Dark Matter
10 - Formal Theory
11 - Accelerators: Physics, Performance and R&D for future facilities
12 - Operation, Performance and Upgrade (Incl. HL-LHC) of Present Detectors
13 - Detectors for Future Facilities, R&D, novel techniques
14 - Computing and Data handling
15 - Education and Outreach
16 - Equality, Diversity, and Inclusion
17 - Technology and Industrial Applications

The scientific organization was delegated to the session conveners (from 5 to 7 for each session). The following table shows the geographic distribution of the conveners and the gender balance.

Country	Number
Italy	26
USA	12
Germany	12
UK	9
CERN	8
France	6
Japan	4
China	4
Sweden	4
Switzerland	3
Czech Rep.	2
India	2
Spain	2
Brazil	1
Russia	1
Greece	1
Denmark	1
South Korea	1
Israel	1
Belgium	1
Total	101
Female fraction	0.39

One of the conveners for each session acted as liaison with the LOC. The choice of the conveners was done in agreement with the IAC favoring in-person attendance whenever possible. In few

cases, due to last minute defections, the conveners' team was integrated with further LOC members.

The scientific program of the parallel sessions was setup by the conveners based on the submitted contributions. Due to the large number of contributions submitted as parallel talks, a fraction of them was accepted as posters. The following table shows a complete statistic of the abstract submissions and of the contributions accepted as parallel talks or posters.

Submitted contributions	1391
Parallel talks	883
Posters:	
Total	332
On site	231
Online	101

A special talk by Federico Ferrini, Director of the Cherenkov Telescope Array Observatory (CTAO) whose headquarter is located in Bologna, was organized on Saturday evening (9 July) at the end of the parallel sessions.

Plenary session

The Europa Auditorium, the main hall of the venue with a capacity of 1700 seats, hosted the plenary session (11-13 July). These also included a live connection with the IUPAP centenary celebration in Trieste with the talk on neutrino physics by the Nobel Prize winner Takaaki Kajita and a special session on the decennial of the Higgs boson discovery with the participation of the previous and the present CERN Directors General, Rolf Heuer and Fabiola Gianotti. The three days of plenary sessions hosted in total 38 talks, the geographical origin of the speakers and the gender balance are listed in the following table.

Country	Number
Italy	8
USA	6
Germany	4
UK	4
CERN	4
France	3
Japan	2
Switzerland	2
Spain	2
Belgium	1
Netherlands	1
Poland	1
Total	38
Female fraction	0.32

Proceedings

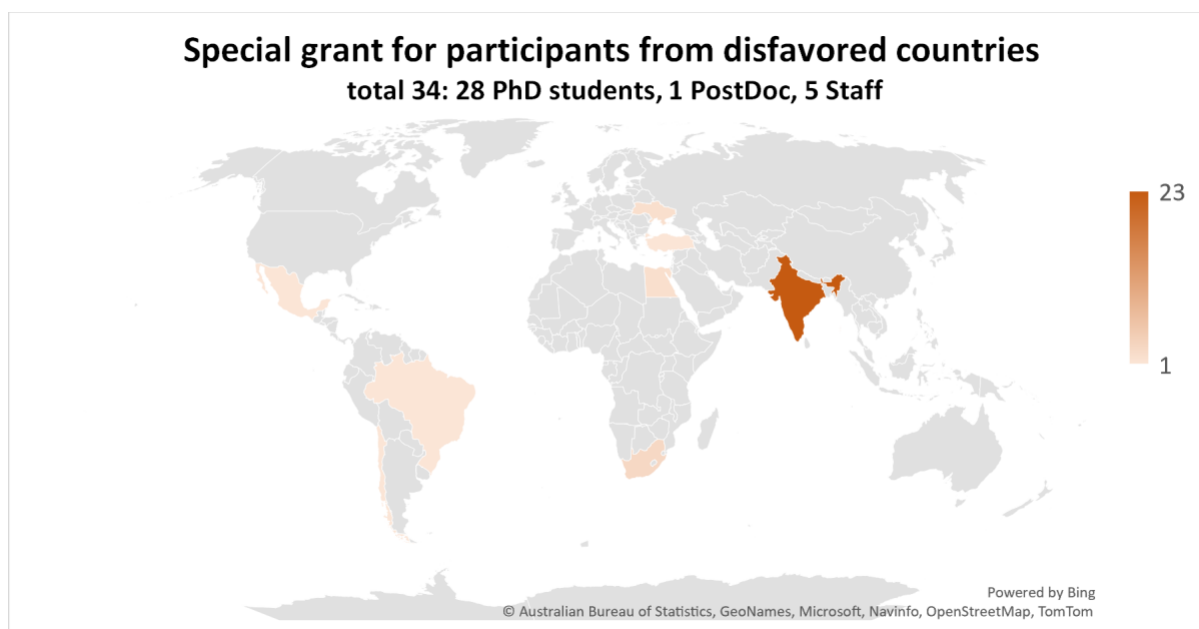
The proceedings of the conference were published online on Proceedings of Science (PoS, <https://pos.sissa.it/414/>). The fraction of submitted contributions was around 55% of the total with a fraction of more than 60% for posters and less than 20% for plenary talks. The following table shows the breakdown for the different sessions. The numbers indicate that a relevant fraction of participants, especially younger people, consider the proceedings useful for documenting their own scientific activity.

Session	Total contributions	Submitted to the proceedings	Fraction
Higgs Physics	51	26	0.51
Neutrino Physics	83	46	0.55
Beyond the Standard Model	74	36	0.49
Top quark and EW Physics	46	30	0.65
Quark and Lepton Flavour Physics	74	41	0.55
Strong interactions and Hadron Physics	83	46	0.55
Heavy Ions	62	29	0.47
Astroparticle Physics and Cosmology	63	41	0.65
Dark Matter	62	18	0.29
Formal Theory	31	20	0.65
Accelerators: Physics, Performance and R&D for future facilities	31	14	0.45
Operation, Performance and Upgrade (Incl. HL-LHC) of Present Detectors	62	30	0.48
Detectors for Future Facilities, R&D, novel techniques	53	34	0.64
Computing and Data handling	49	35	0.71
Education and Outreach	33	20	0.61
Equality, Diversity, and Inclusion	12	3	0.25
Technology and Industrial Applications	14	4	0.29
Total Parallel sessions	883	473	0.54
Plenary sessions	38	6	0.16
Poster session	332	201	0.61
Total	1253	680	0.54

Support to participants

Different kinds of supports were made available with the goal of favoring the participation of people from disfavored countries.

The conference fees were fully waived to **102** participants and halved to **22** participants. In addition, **34** grants of € 400 were assigned, mostly to PhD students coming from disfavored countries and in particular from India, as shown in the following map.



In very few special cases an extra support to cover accommodation and travel expenses was also given. In order to help participants with family in tow a free childcare service was made available for the entire duration of the conference. The service also included the lunches and hosted 24 children in an age range from 11 months to 12 years. An extra family support of € 300 was also assigned to **4** participants with special needs.

The total budget dedicated to the fee waiver and the grants to support the participants was € 53593, the cost of the childcare service, including the lunch for the children, was € 8479, the travel and accommodation expenses for the two winners of the IUPAP prize for young scientists were € 2000, for a total budget devoted to participant support of € 64072 as detailed in the following table.

values in €, VAT not included

Full fee waiver			
Staff-PostDoc	In-person 64	Online 10	27869
PhD students	In-person 28		5738
50% fee discount			
Staff-PostDoc	In-person 12	Online 1	2541

PhD students	In-person 9	922
Disfavor countries grants	34	13800
Family grants	4	1200
Support for winners of the IUPAP young scientists' prize	2	2000
Full support for Ukrainian scientist	1	1523
Childcare	24	8479
Total		64072

Detailed conference budget

The following tables show the total costs and incomes with the full details of the various items.

Total costs (all values in €, VAT not included)	
Conference Venue	
Site	88250.00
Venue equipment (outside and inside boards, signages, panels, staging ...)	26765.00
Technical equipment (audio/visual room equipment)	42544.50
Total	157559.50
Organization and services to participants	
NOEMA PCO (overall organization, administrative and suppliers management)	29000.00
Implementation of registration system	2320.00
Management of cancellations, changes of registrations and reimbursements	3500.00
Management of extra participants above the 1200 foreseen	4304.25
Staff for registration and participants support	12570.00
Congress kit	16825.00
Shuttle service	25576.00
Total	94095.25
Catering	
Catering at the Conference site	184201.00
Social dinner	50276.50
Total	234477.50
Outreach events	
Conference show in Piazza Maggiore	27350.06
Other outreach events	20071.13
Competition for ICHEP 2022 logo	6000.00
Total	53421.19

Support to participants (excluding fee waiver) and awards	
Grants and support for travel and accommodation	15323.00
Support for participants in quarantine due to covid infection	1000.00
Childcare service	8479.00
Awards for posters	5000.00
Total	28802.00
Miscellaneous	
Web site design and maintenance	4000.00
Zoom Events license	5500.00
Social media coordination and management	3800.00
Production, printing and posting of various material and documents	13254.76
Support for HEPCon app	1000.00
Proceedings	4500.00
Equipment and management of electronic badges	5750.00
Professional photographer	2687.50
Credit card commissions	20342.14
Costs related to sponsors research and management	10450.92
Appreciation dinner for the conveners	2400.00
Other expenses (guests travel and accommodation, support for participants in quarantine due to covid infection, secretarial expenses)	10664.38
Total	83349.70
Grand Total	652745.14

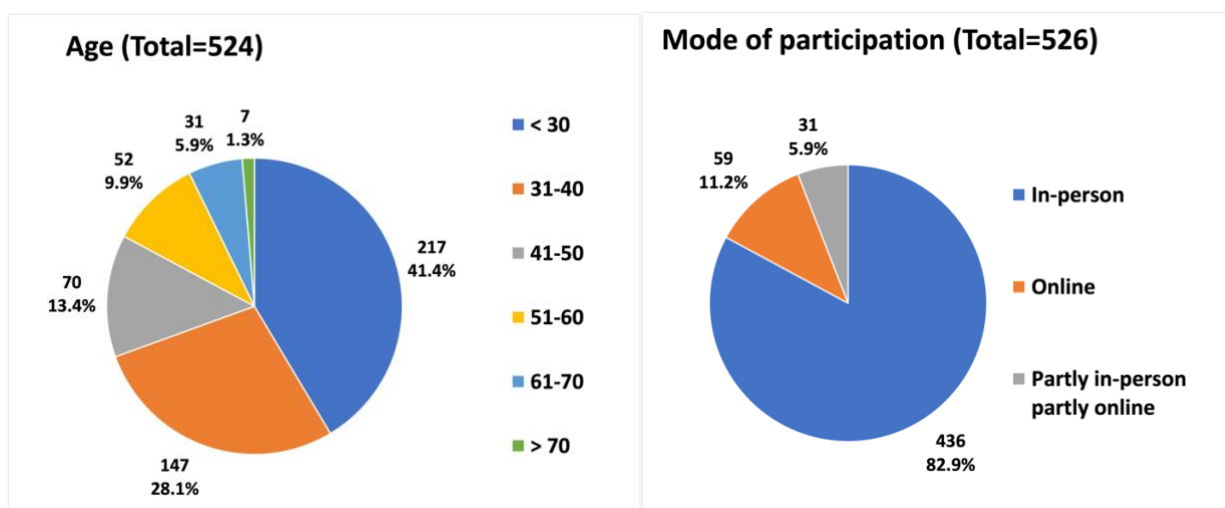
Total income (all values in €, VAT not included)	
Sponsorships	
IUPAP	10000.00
INFN	30000.00
University of Bologna	8135.00
University of Ferrara	2000.00
Regione Emilia Romagna	8000.00
Other institutional sponsors	41509.15
Commercial sponsors	53000.00
Total	152644.15
Fees, lunches and social dinner	
Registration fees	417704.92
Lunch service	46000.00
Conference dinner	37745.90
Total	501450.82
Grand Total	654094.97

Conference result (all values in €, VAT not included)	
Total costs (VAT not included)	652745.14
Total incomes (VAT not included)	654094.97
Difference incomes - costs	1349.83

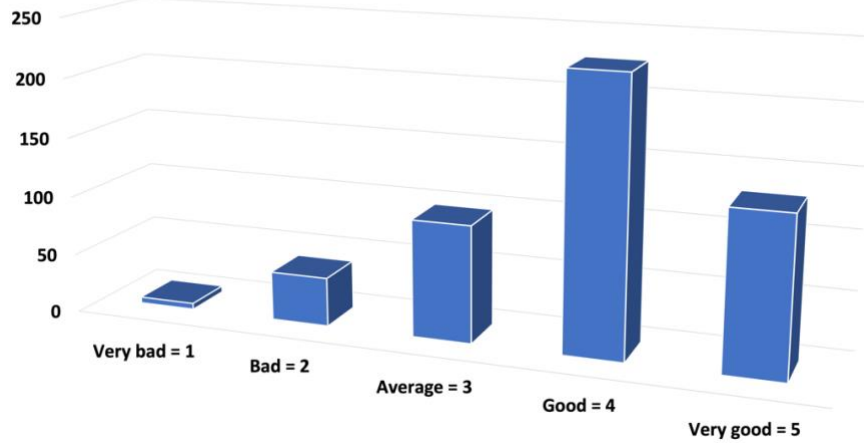
Survey

This section contains the result of a survey distributed to the participants soon after the conference in order to get feedback on various organizational aspects.

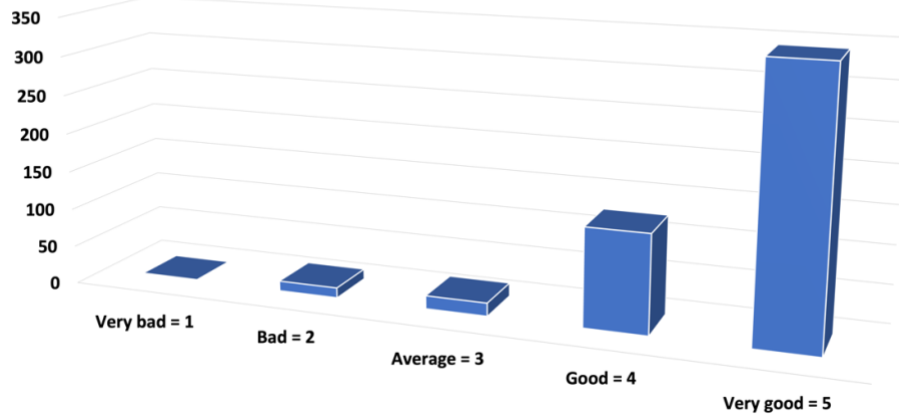
More than 500 attendees participated to the survey, the feedbacks were in general very positive apart from the catering at the conference venue that was the only item to be evaluated slightly below average. The catering provider, that was the only one authorized to operate at the conference venue and the company that manages the venue, were promptly informed of the not quite satisfactory result of the catering service provided.



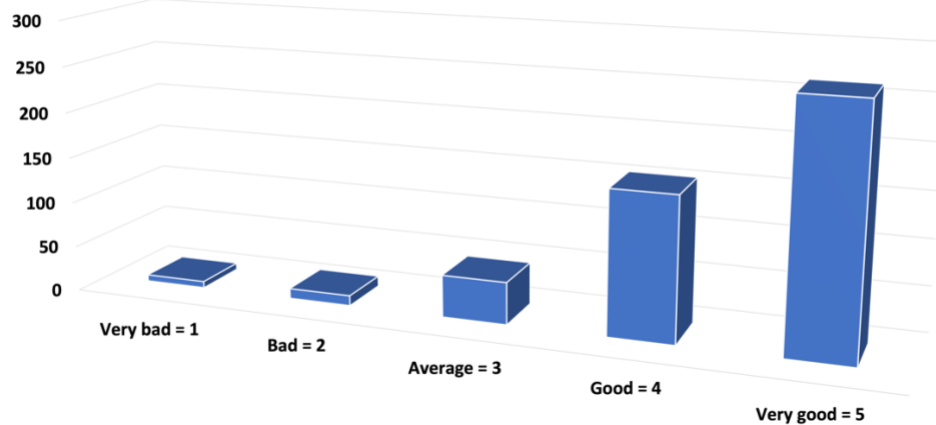
Conference venue: evaluate the venue in terms of technical equipment and rooms comfort (Total=504, Mean=3.88, Sigma=0.92)



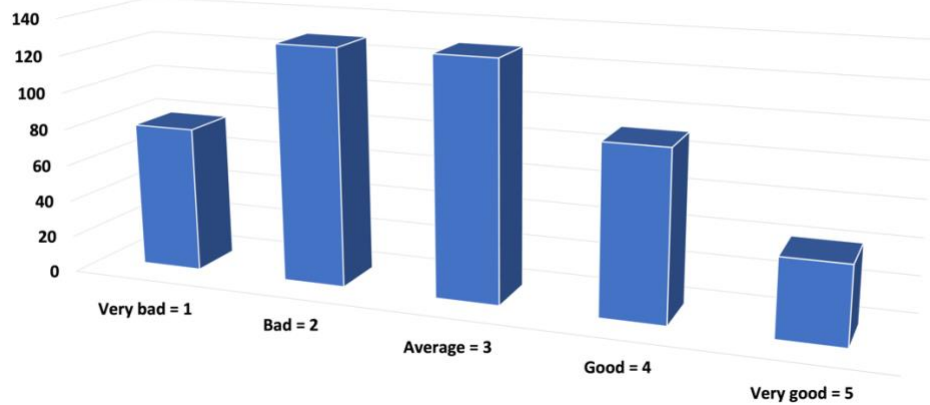
Conference organization: evaluate the efficiency and kindness of the staff of the registration and information desk (Total=501, Mean=4.59, Sigma=0.70)



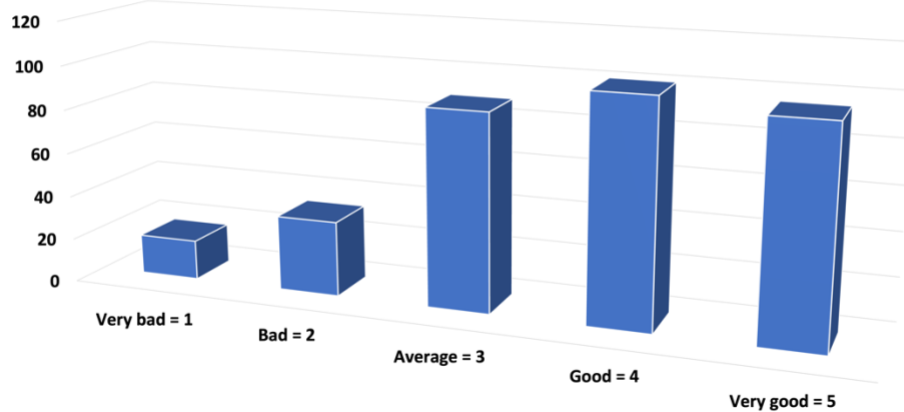
Conference organization: evaluate the efficiency of the organizers in addressing the requests of the participants (Total=484, Mean=4.36, Sigma=0.85)



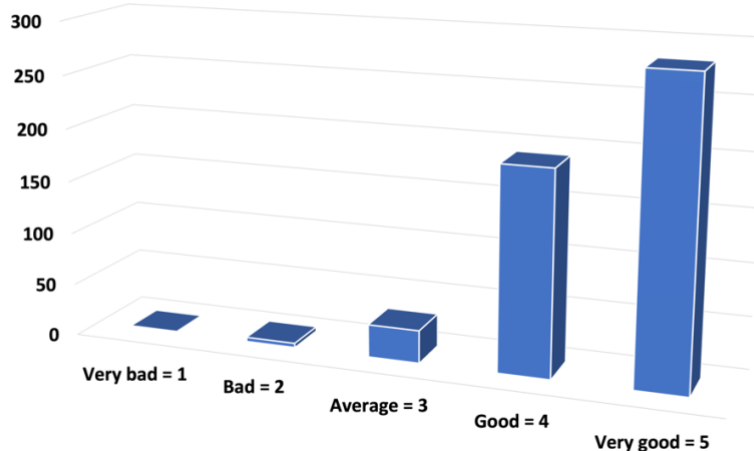
Food and social events: evaluate the quality of the lunches, the coffee breaks and the other social events at the conference venue (Total=470, Mean=2.76, Sigma=1.20)



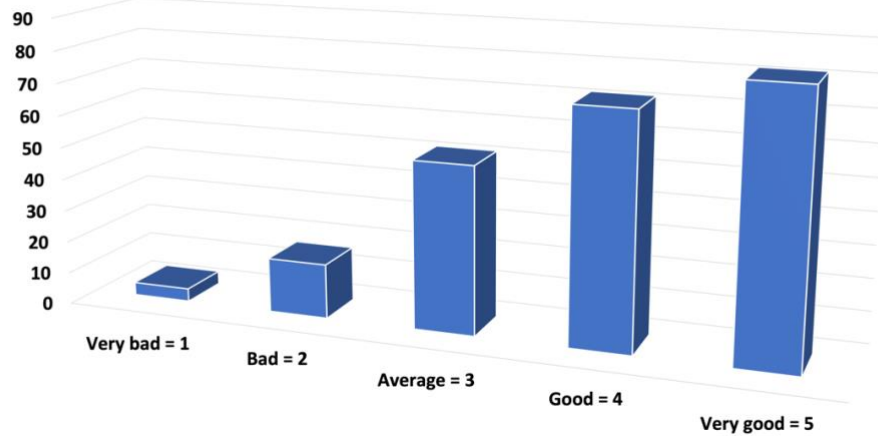
Food and social events: evaluate the Gala dinner at Palazzo Re Enzo both in terms of the location and the food quality (Total=338, Mean=3.66, Sigma=1.15)



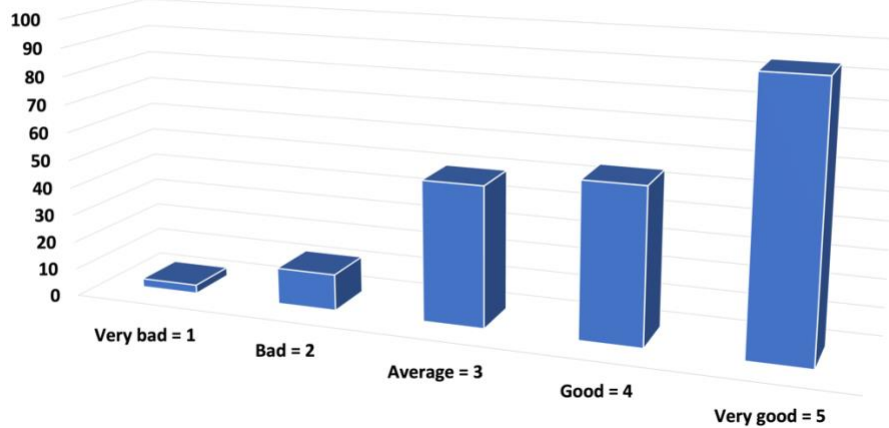
Scientific program: evaluate the overall quality of the scientific program (Total=511, Mean=4.47, Sigma=0.66)



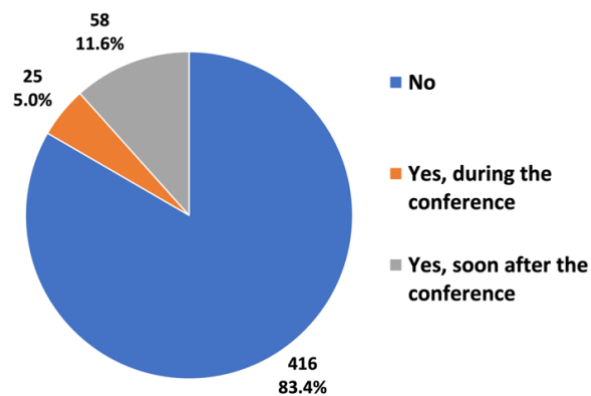
Online participation: evaluate the experience of the remote participation with ZOOM events (Total=227, Mean=3.93, Sigma=1.02)



Online participation: evaluate the support for technical problems related to the ZOOM events platform (Total=215, Mean=4.04, Sigma=1.02)



Did you test Covid-19 positive during the conference or soon after? (Total=499)



Local Organizing Committee

Chairs:

L. Bellagamba, P. Giacomelli

Scientific Secretaries:

F. R. Cavallo, L. Fabbri, I. Garzia, R. Preghenella

Working Groups:

Sponsors:

P. Antonioli, G. Baldazzi, C. Bozzi, G. Bruni, A. D'Orazio, V. Vagnoni, M. Villa

Communications:

L. Bandiera, L. Capriotti, G. Carratta, F.R. Cavallo, A. Cervelli, F. Cuicchio, M. Fiorini, I. Garzia, M. Massicci, F. Mazzotta, S. Perazzini, M. Soldani, A. Varaschin

Logistics:

F.R. Cavallo, E. Franzoso, U. Marconi, L. Patrizii, L. Tomassetti

IT systems:

D. Bortolotti, R. Giacomelli, A. Monducci, L. Rinaldi, M. Vassilev, S. Zani

Proceedings:

G. Abbiendi, C. Bozzi, A. Castro, M. Colocci, L. Dell'Agnello, F. Maltoni, A. Margiotta, A. Oliva, S. Perazzini, A. Perrotta, C. Sbarra, G.P. Vacca

Diversity and Inclusion:

A. Bruni, S. Pascoli, S. Valentinetti

Education and Outreach:

G. Carratta, G. Cibirnetto, L. Fabbri, M. Guarise, A. Margiotta, G. Mezzadri, F. Scianitti, G. Scioli

Treasury and Secretariat:

M. Allegro, E. Amadei, B. Giacobbe, G. Grandi

Travel grants, Visas:

S. Okamura, M. Pozzato, B. Simoni

Poster session:

C. Battilana, R. Farinelli, T. Peraro, M. Scodeggio, M. Tenti, G.P. Vacca

Website:

S. Antonelli, A. Carbone, A. Sidoti

Awards:

F. Bastianelli, F. Bellini, U. Marconi, G. Sirri

Local Scientific Program Committee:

Chair: S. Bertolucci

G. Abbiendi, L. Bandiera, F. Bellini, D. Bonacorsi, C. Bozzi, S. Braibant, A. Bruni, R. Casadio, A. Castro, A. Cervelli, G. Cibirnetto, M. Colocci, F. Ferrari, F. Finelli, D. Fioravanti, I. Garzia, B. Giacobbe, F. Maltoni, A. Margiotta, A. Montanari, M. Negrini, R. Nania, S. Pascoli, L. Patrizii, A. Perrotta, R. Preghenella, C. Sbarra, A. Sidoti, M. Selvi, V. Vagnoni

International Advisory Committee

H. Abramowicz (Israel)
E. Barberio (Australia)
U. Bassler (France)
L. Bellagamba (Italy)
S. Bentvelsen (Netherlands)
T. Behnke (Germany)
F. Bossi (Italy)
F. Canelli (Switzerland)
A. Dabholkar (India)
A. de Gouvea (USA)
D. Denisov (USA)
Z. Dolezal (Czech)
J. Fuster (Spain)
P. Giacomelli (Italy)
F. Gianotti (CERN)
G. Giudice (CERN)
S. Henderson (USA)
J.A. Hewett (USA)
A. Hoecker (CERN)
A. Ichikawa (Japan)
K. Jakobs (Germany)
J. Kim (Korea)

Y.-K. Kim (USA)
R. Leitner (Czech)
L. Malgeri (CERN)
L. Musa (CERN)
J. Nash (Australia)
C. Parkes (UK)
K. Pitts (USA)
G. Rameika (USA)
L. Rivkin (Switzerland)
N. Roe (USA)
N. Smith (Canada)
M. Spiro (France)
I. Taboada (USA)
M. Thomson (UK)
G. Trubnikov
P. Vahle (USA)
Y. Wang (China)
M. Yamauchi (Japan)
G. Zanderighi (Germany)
A. Zoccoli (Italy)
K. Zureck (USA)

Supporting institutions and sponsors

Organized by:



Hosted by:



With the patronage of:



Università
degli Studi
di Ferrara



Supporting institutions



Technical sponsors





ICHEP 2022
BOLOGNA



ICHEP 2022
XLI
International Conference
on High Energy Physics
Bologna (Italy)
6–13 07 2022