Survey analysis

of the Career prospects and Diversity in Physics Programme WGs

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Survey results

Main survey targeting ECRs:

- ~ 180 questions on different aspects of work and life
- distributed among ECRs in October 2022
- ~ 680 replies
- currently undergoing analysis

Simplified survey targeting RECFA representatives:

- ~ 26 replies
- no analysis yet

Survey data will be archived for further purposes.

Main objectives

Diversity in Physics programme:

- What are the issues that small collaborations face in comparison with the big collaborations?
- Which are the main differences between the career prospects of ECRs working in bigger and in smaller/new collaborations/experiments?
- How to increase interests in smaller and new experiments/collaborations in the ECR community?

Career aspects:

- Assess current career situation
- What can Career prospects WG provide to ECRs? → e.g ideas for events
- Are ECRs aware of career training opportunities?
- Are ECRs aware of what is needed to get grants (national funds or ERC)?
- What do ECRs think is needed for a successful career versus what is actually needed for a successful career?

Outline of analyzed aspects

- Participant profile:
  - Origin (MK)
  - Country of Employment vs Nationality (MK)
  - Personal info (MK)
  - Position and affiliation (MK)
  - Research (MK)

- Career prospects:
  - Aspects of successful career (OL)
  - Work-life balance (OL)
  - Mobility (OL)
  - Funding opportunities (MK)

- Diversity in Physics Programme
  - Work and life aspects of ECRs based on collaboration size (KJ)
  - Work and life aspects of ECRs in WG vs Collaborations (KJ + OL)

Participant profile

- ○ Origin: Europe. Mostly Italy, Germany and Spain; 61 countries in total.
- ○ Country of employment: Europe. ⅔ in Germany, Switzerland, Italy and Netherlands; 39 in total
- ○ Country of residence: Europe. ⅔ in Germany, Italy, France and Switzerland; 36 in total
- ○ Affiliation: Mostly University (~60%) and National Laboratory (~27%) with no overlap
- ○ Position: Mostly PhD (~40%) students and PostDocs / Research fellows (~38%)
    Mostly fixed-term contracts (90%)
- ○ Research: Various fields of research
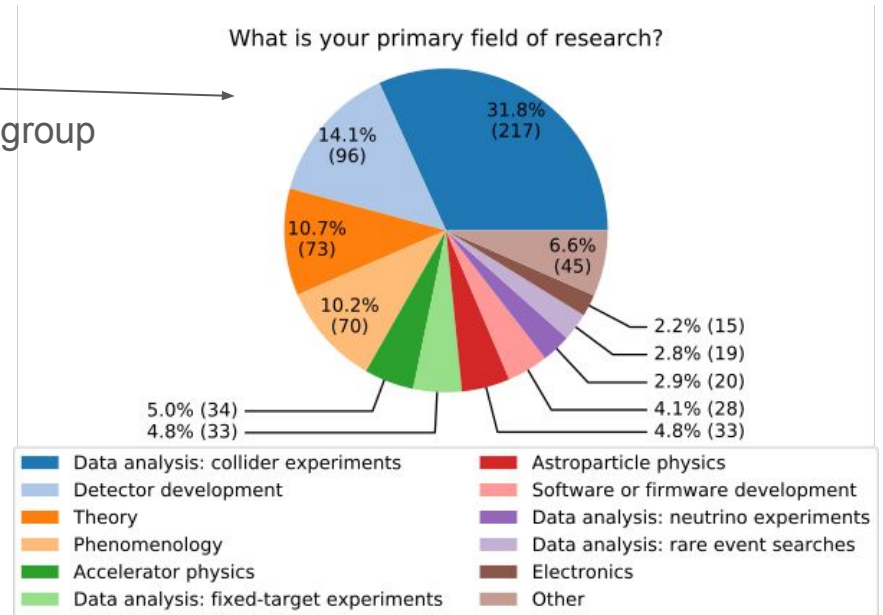   Within collaboration and research group
- ○ Personal info:
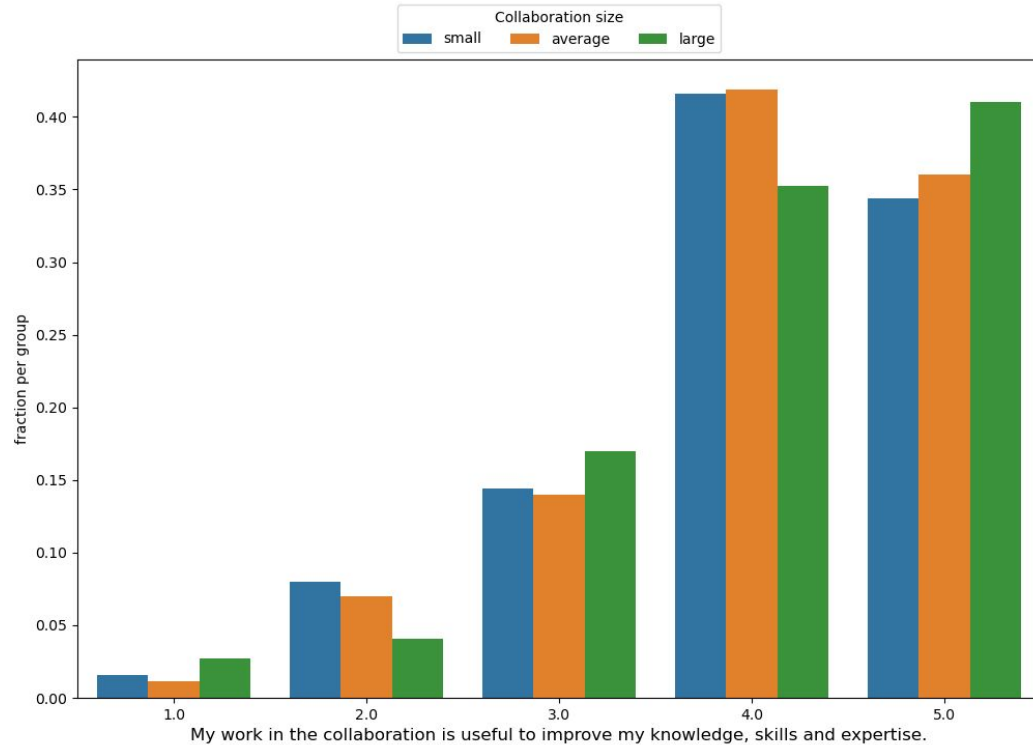   Age: 20-35 years (85%)
    Male (~62%), female (~32%) and others
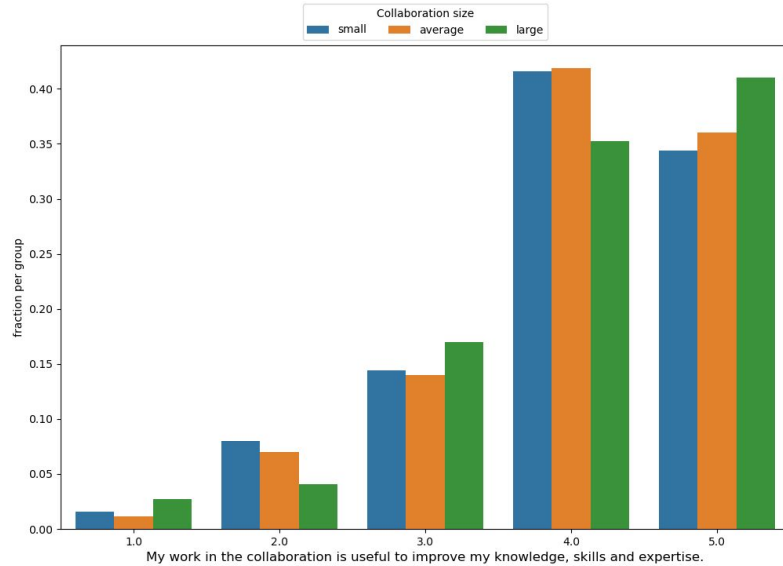   Being under-represented ~27%
    Being discriminated and/or abused ~22%

What is your primary field of research?

- Data analysis: collider experiments — 31.8% (217)
- Detector development — 14.1% (96)
- Theory — 10.7% (73)
- Phenomenology — 10.2% (70)
- Accelerator physics — 5.0% (34)
- Data analysis: fixed-target experiments — 4.8% (33)
- Astroparticle physics — 4.8% (33)
- Software or firmware development — 4.1% (28)
- Data analysis: neutrino experiments — 2.9% (20)
- Data analysis: rare event searches — 2.8% (19)
- Electronics — 2.2% (15)
- Other — 6.6% (45)

Proposed statistical analysis

Proposed statistical analysis

Mean and median values:

	mean	median
small	3.90	4.00
average	4.05	4.00
large	4.06	4.00

Proposed statistical analysis
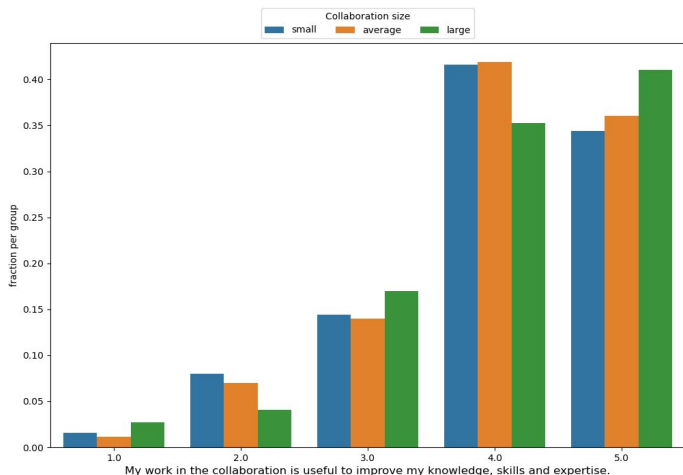
Are data sampled from distributions of the same shape?

- H_0: the distribution of ordinal scale values are identical for two collaboration size categories
- H_A: the distribution of ordinal scale values are not equal for two collaboration size categories

Two tests:

- Chi-square test ("conservative")
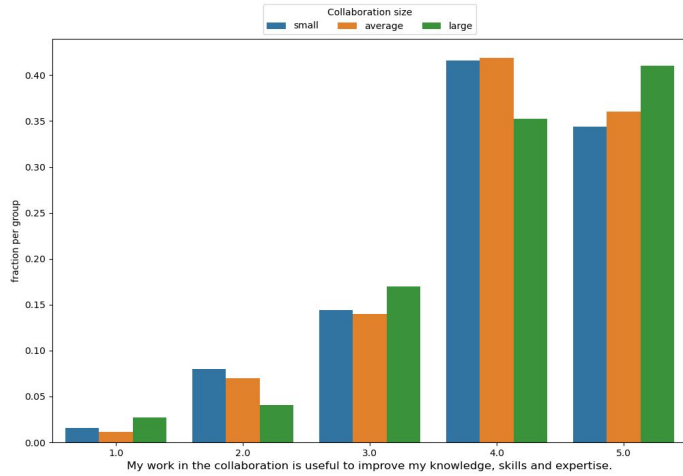- Kolmogorov-Smirnov test (emphasises peak)

Chi-square test	small	average	large
small	1.00	1.00	1.00
average	1.00	1.00	1.00
large	1.00	1.00	1.00

Kolmogorov-Smirnov test	small	average	large
small	1.00	1.00	0.81
average	1.00	1.00	0.99
large	0.81	0.99	1.00

Proposed statistical analysis

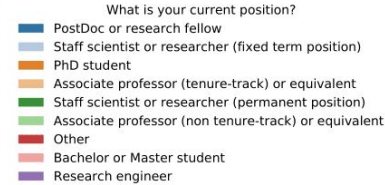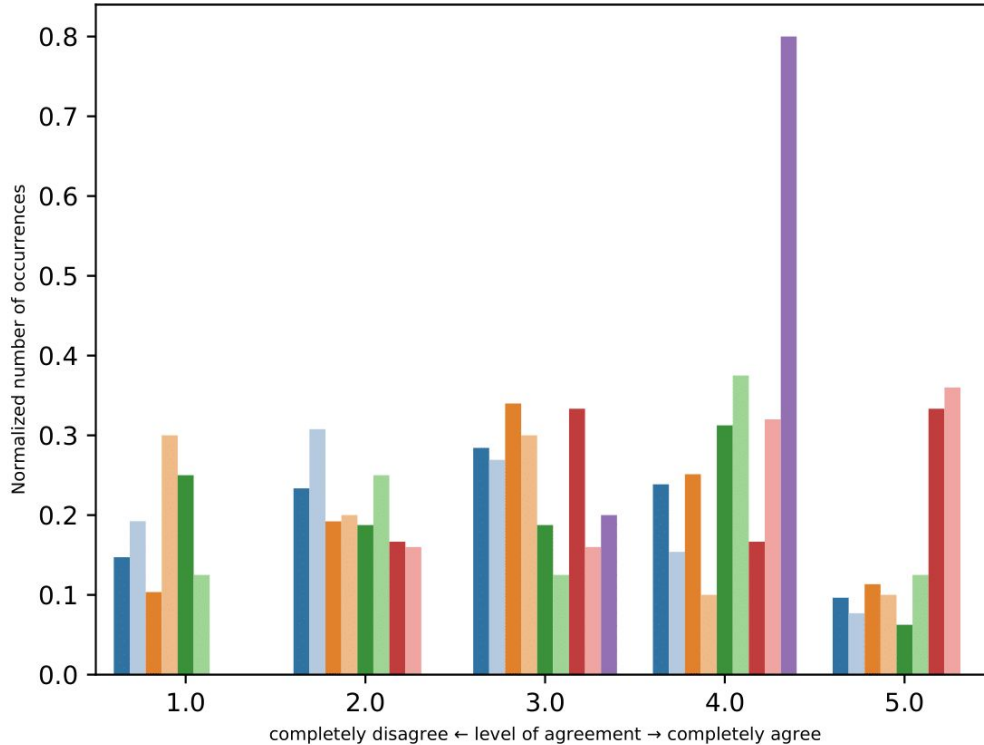If data are sampled from the same-shape distribution, do they have equal medians?

Use Mann-Whitney U test with

- H_0: the distribution of ordinal scale values are identical
- H_A: the medians of the two distributions of ordinal scale values are not equal

Issues with proposed statistical analysis

My work in the collaboration allows me to keep a healthy work-life balance.

What is your current position?
- PostDoc or research fellow
- Staff scientist or researcher (fixed term position)
- PhD student
- Associate professor (tenure-track) or equivalent
- Staff scientist or researcher (permanent position)
- Associate professor (non tenure-track) or equivalent
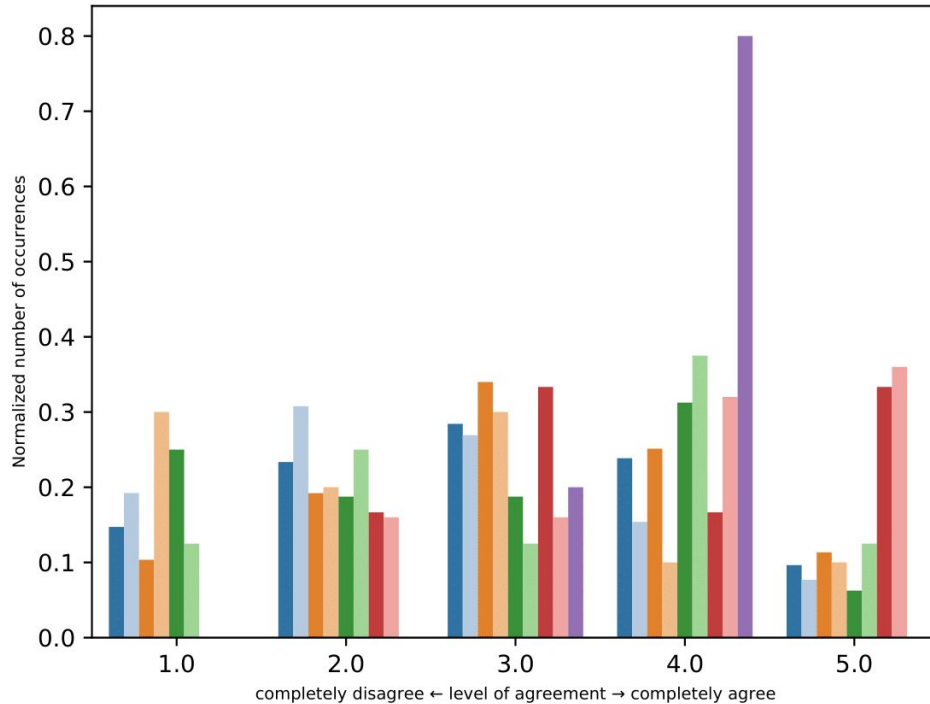- Other
- Bachelor or Master student
- Research engineer

By eye:
- situation of people at different career stages seems to differ
- Example: associate prof (non tenure) seems to have different distribution than e.g. PhD students
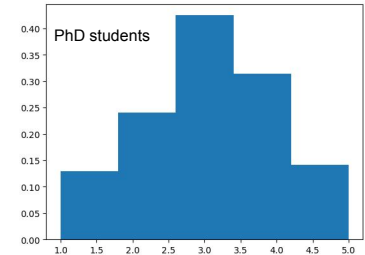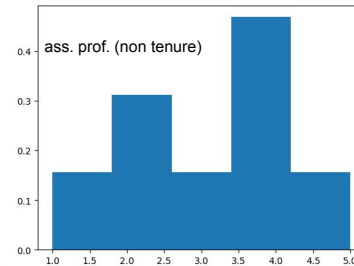
Can I perform statistical tests which confirm my "by eye" observations?

My work in the collaboration allows me to keep a healthy work-life balance.

What is your current position?
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- Associate professor (tenure-track) or equivalent
- Staff scientist or researcher (permanent position)
- Associate professor (non tenure-track) or equivalent
- Other
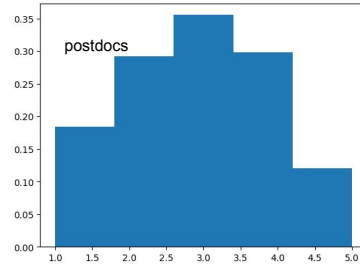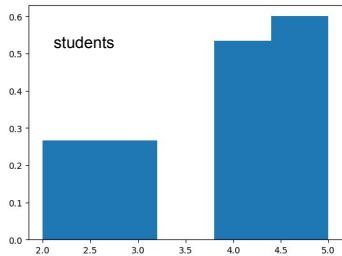- Bachelor or Master student
- Research engineer

	mean	median
bachelor or master student	3.88	4
PhD student	3.08	3
PostDoc or research fellow	2.9	3
staff scientist or researcher (fixed term)	2.62	2.5
staff scientist or researcher (permanent)	2.75	3
associate professor (non tenure track) or equivalent	3.13	3.5
associate professor (tenure track) or equivalent	2.5	2.5
research engineer	3.8	4
Other	3.67	3.5

Chi2 test to see if there is a correlation between:
- What is your current position?
- My work in the collaboration allows me to keep a healthy work-life balance.

Result: p-value: 0.053 ≈ 0.05

if p-value that is less than or equal to significance level:
between the categorical variables a relationship exists

	mean	median
bachelor or master student	3.88	4.0
post doc or research fellow	2.9	3.0

- K-S test
  p-value <0.05 allows to reject the null hypothesis that the two obtained distributions were generated from the same underlying distribution
  p-value=0.7 → I cannot reject the null hypothesis

Comparison of mean and median:
- Shapiro-Wilk test: check if the distributions follow the normal distribution*
  p-value <0.05 means that data are not normally distributed
  students: p-value=0.0009
  postdocs: p-value = 2.7e-09   → both data not normally distributed

- two sided Mann-Whitney U :
  used to test whether or not the medians of two distributions are equal
  p-value = 0.00025→ I can conclude that the medians of the two distributions significantly differ from each other

- one sided Mann-Whitney U :
 p-value= 0.00012 → I can conclude that the median of the students is significantly greater than postdocs

- two sample t-test
  used to test whether or not the means of two distributions are equal
  p-value= 0.00015→ I can reject the hypothesis that the means of the distributions are equal

  * in some sources the requirement of not following normal distribution is mentioned for Mann-Whitney U test
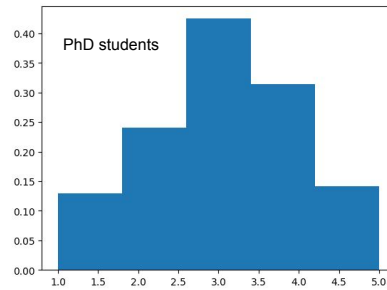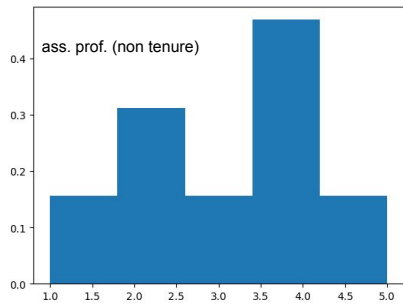
	mean	median
PhD student	3.08	3.0
associate prof (non tenure) or equiv.	3.13	3.5

- **K-S test**
  p-value <0.05 allows to reject the null hypothesis that the two obtained distributions were generated from the same underlying distribution
  p-value=0.7 → I cannot reject the null hypothesis

Comparison of mean and median:
- **Shapiro-Wilk test: check if the distributions follow the normal distribution***
  p-value <0.05 means that data are not normally distributed
  pdh: p-value= 2.3e-09
  ass profs: p-value = 0.51   → PhD students not normally distributed

- **two sided Mann-Whitney U :**
  used to test whether or not the medians of two distributions are equal
  p-value =0.86 → I cannot conclude that the medians of the two distributions significantly differ from each other

- **one sided Mann-Whitney U :**
  p-value=0.43 →I cannot conclude that the median of the ass profs is significantly greater than PhDs

- **two sample t-test**
  used to test whether or not the means of two distributions are equal
  p-value=0.91 → I cannot reject the hypothesis that the means of the distributions are equal

* in some sources the requirement of not following normal distribution is mentioned for Mann-Whitney U test

Still many subjects to be investigated

- Appreciation, recognition and visibility
- Career opportunities and motivation inside the academia
- Career opportunities and motivation outside the academia
- Training opportunities
- Bibliometry
- …

Link to the list of questions

Please, help us and join us :)