Prof. Elisabetta Baracchini
Gran Sasso Science Institute

Recommendations & suggestions for ERC Grant applicants by an ERC recipient

Many thanks to A. D'Orazio, M., Schisani and V. Valsecchi for their help with all my applications (INFN Fondi Esterni)

The discussed project has been funded by the European Union's Horizon 2020 research and innovation programme under the ERC Consolidator Grant Agreement No 818744

CAVEAT

ERC working program is going to change in 2020

While some details of the restriction rules or eligibility conditions might be revisited in the new program, no substantial modifications of the scientific or writing part are expected

Outline

- **ERC program** — Rules & regulations
  - Objectives, actions and definitions
  - Criteria & evaluation process
- **ERC Starting & Consolidator Grant Application** — With examples from my proposal & interview
  - A section by section course on how to write your proposal
  - Tips & recommendation on how to give a successful interview

Disclaimer

The content of this seminar is not necessarily endorsed or supported by the ERC council

The content of this seminar comes from my personal experience with Italian and European grants preparation (>15 written, 3+1 won)

ERC program:
objectives, actions & definitions

European Research Council structure

The European Commission

- **Provides financing** through the EU framework programmes
- **Guarantees autonomy of the ERC**
- **Assures the integrity and accountability of the ERC**
- **Adopts annual work programmes** as established by the Scientific Council

The ERC Scientific Council

- **21 prominent researchers** proposed by an independent identification committee
- **President** appointed following recommendation of an independent committee
- **Appointed by the Commission** (4 years, renewable once)
- **Establishes overall scientific strategy;** annual work programmes (incl. calls for proposals, evaluation criteria); peer review methodology; selection and accreditation of experts
- **Controls quality of operations and management**
- **Ensures communication with the scientific community**

From U. Kainz-Fernandez, ERCEA

The ERC Executive Agency

- **Executes annual work programme** as established by the Scientific Council
- **Implements calls for proposals** and provides information and support to applicants
- **Organises peer review evaluation**
- **Establishes and manages grant agreements**
- **Administers scientific and financial aspects** and follow-up of grant agreements
- **Carries out communications activities** and ensures information dissemination to ERC stakeholders

European Research Council mission in a nutshell

- Long term individual grants
- One researcher , one host institution, one project
- No consortia, no co-financing
- Open to any field of research, no thematic priorities
- Ground-breaking, high-risk/high gain projects
- Host organisations based in an EU Member State, an Associated country, or an InternationalEuropean Interest Organisation
- Sole evaluation criterion: scientific excellence (PI and proposal)
- International peer review evaluation process based on 25 different panels
- Simple procedures that combine flexibility with accountability
- There are restrictions on resubmission: apply only if your project is ready
- Portability (possibile negoziare le migliori condizioni di lavoro con la Host Instit.)
- Principal Investigators from anywhere in the world can apply for an ERC Grant.

From J. P. Bourguignon, ERC President

ERC "flavour"

From V. Valsecchi, INFN Fondi Esterni

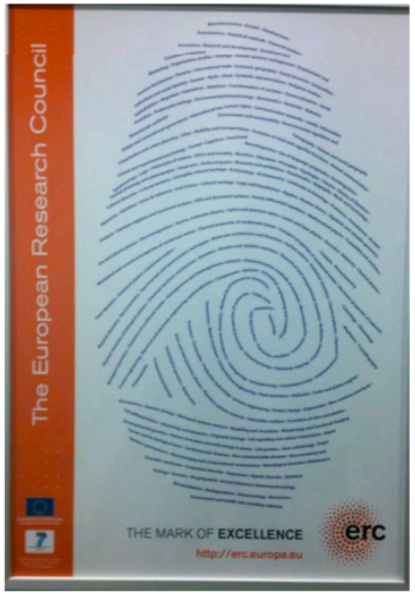
HIGH RISK/HIGH GAIN

UNLOCKING BRILLIANT IDEAS

IDEAS **BEYOND** IMAGINATION

<u>INDEPENDENCE</u> FOR **CREATIVE** MINDS

THE MARK OF **EXCELLENCE**



Un "marchio di qualità" per **attrarre finanziamenti aggiuntivi e riconoscimento**

... Substantial grants and a recognised label of excellence

IL TARGET DI ERC, ricerca dei futuri premi Nobel.

ERC Grant Scheme

STG
Starting Grants
(2-7 years after PhD)

up to €1.5 Million
for 5 years
+ up to €1 Million

COG
Consolidator Grants
(7-12 years after PhD)

up to €2 Million
for 5 years
+ up to €1 Million

ADG
Advanced Grants
10 years' track-record

up to €2.5 Million
for 5 years
+ up to €1 Million

Proof-of-Concept -POC
bridging gap between research – earliest stage of marketable innovation
€150,000 for ERC grantees holders

Synergy Grant - SYG
2-4 Principal Investigators
up to €10 Million for 6 years
+ up to €4 Million

- Reasons for additional funds:
  - start-up costs when moving to Europe
  - access to large facilities
  - major equipment

Need to be very very well motivated

European Commission | Horizon 2020 European Union funding for Research & Innovation

ERC Panels Structure

Each panel:
Panel Chair and 12-16 Panel Members

Life Sciences

- **LS1** Molecular Biology, Biochemistry, Structural Biology and Molecular Biophysics
- **LS2** Genetics, 'Omics', Bioinformatics and Systems Biology
- **LS3** Cellular and Developmental Biology
- **LS4** Physiology, Pathophysiology and Endocrinology
- **LS5** Neuroscience and Neural Disorders
- **LS6** Immunity and Infection
- **LS7** Applied Medical Technologies, Diagnostics, Therapies, and Public Health
- **LS8** Ecology, Evolution and Environmental Biology
- **LS9** Applied Life Sciences, Biotechnology and Molecular and Biosystems Engineering

Social Sciences and Humanities

- **SH1** Individuals, Markets and Organisations
- **SH2** Institutions, Values, Environment and Space
- **SH3** The Social World, Diversity, Population
- **SH4** The Human Mind and Its Complexity
- **SH5** Cultures and Cultural Production
- **SH6** The Study of the Human Past

Physical Sciences & Engineering

- **PE1** Mathematics
- **PE2** Fundamental Constituents of Matter
- **PE3** Condensed Matter Physics
- **PE4** Physical & Analytical Chemical Sciences
- **PE5** Synthetic Chemistry and Materials
- **PE6** Computer Science and Informatics
- **PE7** Systems and Communication Engineering
- **PE8** Products and Processes Engineering
- **PE9** Universe Sciences
- **PE10** Earth System Science

From I. Ruigrok, ERCEA

ERC program:
criteria & evaluation process

Who can apply?

- **Excellent Researchers (PIs)**
  - → Any nationality, age or current place of work
- **In conjunction with a Host Institution (HI)**
  - → Based in the EU or an Associated Country (spend min. 50% (StG / CoG) of total working time

  Individual research team
  - → Researcher has freedom to choose national or trans-national team, if scientific added value proven
- **ERC Grants are portable**

Not happy of your HI choice, or your HI fails in providing you the possibility to carry on your project as from the contract HI signed with ERC? NO PROBLEM!

You can always change your HI at any moment of the project development!

Scientific excellence

the sole criterion of evaluation

Evaluation of *excellence* at two levels:

- **Excellence of the Research Project**
  - ✓ **Ground breaking nature**
  - ✓ **Potential impact**
  - ✓ **Scientific Approach**

- **Excellence of the Principal Investigator**
  - ✓ **Intellectual capacity**
  - ✓ **Creativity**
  - ✓ **Commitment**

From D. Krasa, ERCEA

ERC Starting Grant

PhD awarded >2 & <=7 years prior to 1st January of the year of the call

- **Objective:** support excellent PIs at the stage at which they are **starting** their own independent research team or programme
- **Grant size:** €1.5M (possibility of additional €0.5M)
- **PI Profile:**
  - → Potential for research independence
  - → At least one publication as main author or without PhD supervisor
  - → Invited presentations in conferences
  - → Funding, patents, awards, prizes
  - → 50% of PI's time in the project + 50% in the EU or AC

European Commission | Horizon 2020 European Union funding for Research & Innovation

From U. Kainz-Fernandez, ERCEA

ERC Consolidator Grant

PhD awarded >7 & <=12 years prior to 1st January of the year of the call

- **Objective:** support excellent PIs at the stage at which they **may still be consolidating** their own independent research team or programme
- **Grant size:** €2.0M (possibility of additional €0.75M)
- **PI Profile**
  - → Has achieved a certain degree of research independence
  - → Several publications as main author or without PhD supervisor
  - → Invited presentations in conferences
  - → Funding, patents, awards, prizes, mentoring
  - → 40% of PI's time in the project + 50% in the EU or AC

From U. Kainz-Fernandez, ERCEA

StG and CoG eligibility extensions

Extensions of eligibility window possible for documented cases of:

- Maternity – 18 months per child (before or after PhD)
- Paternity – actual time taken off
- Military service
- Medical speciality training
- Caring for seriously ill family members
- No limit to the total extension

From U. Kainz-Fernandez, ERCEA

Proposal Structure

From V. Valsecchi, INFN Fondi Esterni

Part A (solo online)

1 – General Information: abstract, panel, keywords...
2 – Administrative data of participating organisations (PI e Host Institution)
3 – Budget (total estimated project costs and the requested EU contribution)
4 – Ethics
5 – Call specific questions

Part B, the Research Proposal

B1

1pdf

1 - Cover page: Title, Acronym, Abstract, Interdiscip.
2 - Extended synopsys [Max 5 pages]
3 - CV [Max 2 pages]
4 - Funding ID [no page limit]
5 -Track record [Max 2 pages]

Access to the interview (step 2) depends on this

B2

1pdf

- Scientific proposal [Max 15 pages]
  a State of the art, objectives
  b Methodology
  c Resources (incl. Budget table)

Success depends on both + the interview

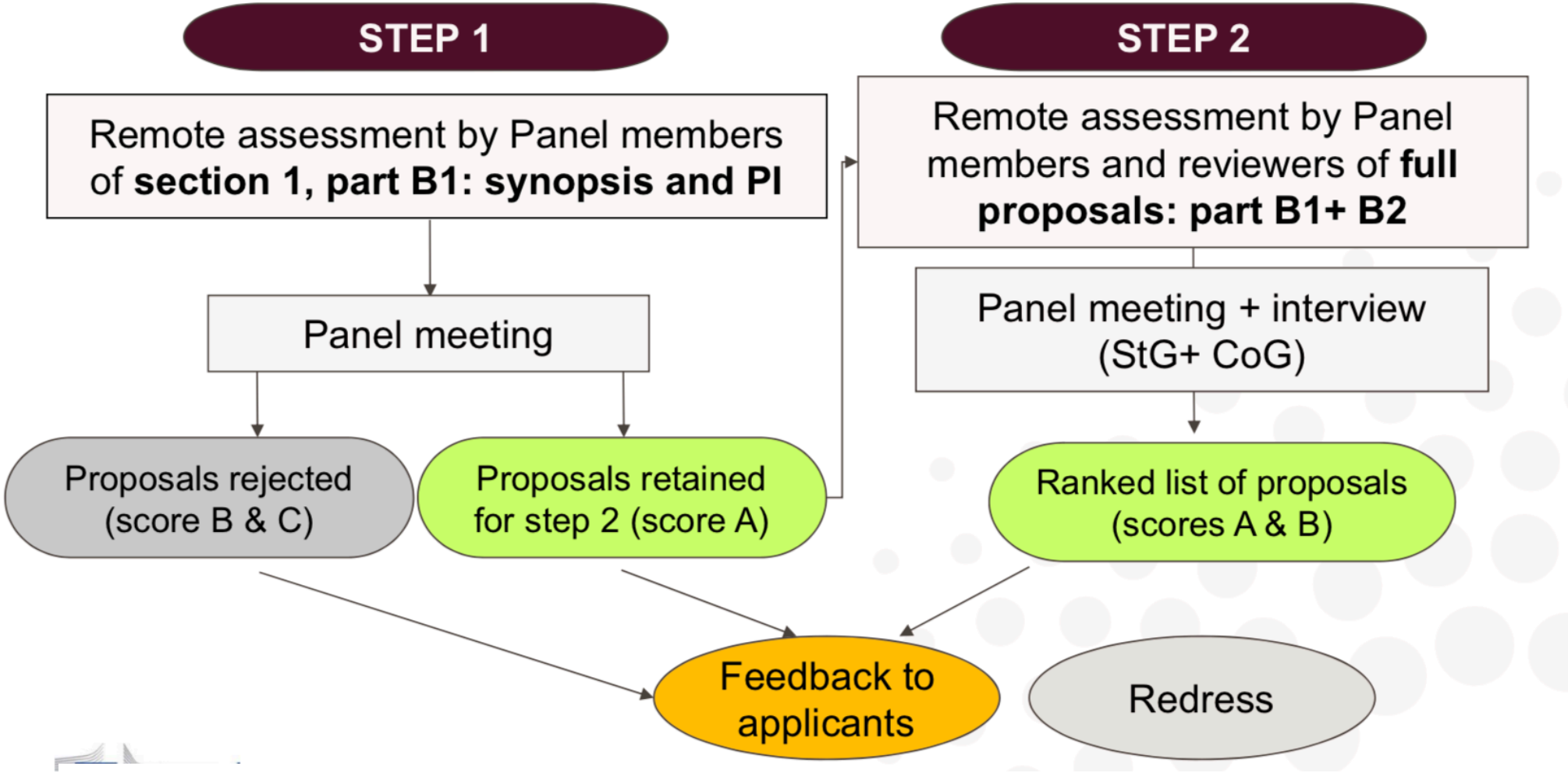
Supporting Documentation (pdf only)

Support statement from the HI: originally signed, stamped and dated by HI's legal represent.
PhD record and supporting documentation for eligibility checking
Ethical issues annex (if applicable)

Evaluation procedure

From D. Krasa, ERCEA

Single submission, 2 steps evaluation

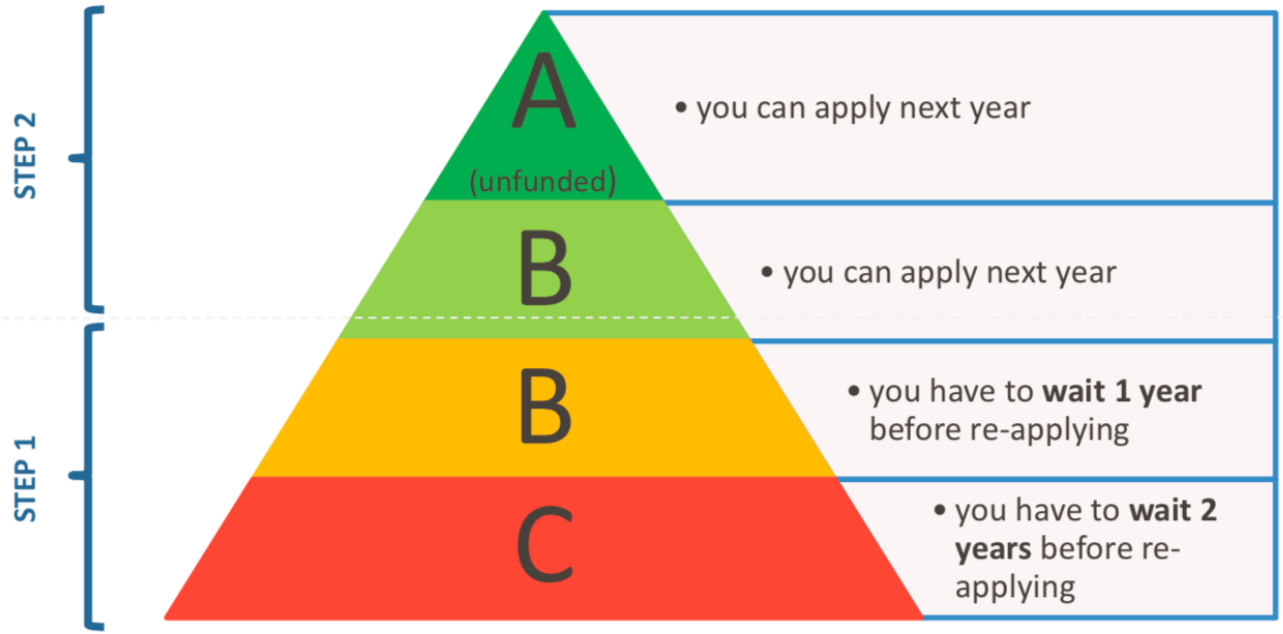


B1 Reviewers from the chosen panel, but not necessarily experts of your field

B1 + B2 reviewed by experts of your field, interview given to the chosen panel

Scoring scheme & resubmission restrictions

- **Score 'A':** Fully meets the ERC excellence criterion and is recommended for funding if sufficient funds are available.
- **Score 'B':** Meets some but not all of the ERC's excellence criterion and will not be funded.
- **Score 'C':** Proposal is not of sufficient quality to pass to Step 2 of the evaluation. The applicant may also be subject to resubmission limitations in the next call.



Typical structure of restrictions, actual one will depend on your year call

Proposal preparation: a step by step how-to with examples from my ERC experience

Questions to ask yourself before deciding to apply

- Am I internationally competitive as a researcher at my career stage and in my discipline?
- Am I able to work independently, and to manage a 5-year project with a substantial budget?
- Why is my proposed project important?
- Does it promise to go substantially beyond the state of the art?
- Why am I the best/only person to carry it out?
- Is it timely? (Why wasn't it done in the past? Is it feasible now?)
- What's the risk? Is it justified by a substantial potential gain? Do I have a plan for managing the risk?

From D. Krasa, ERCEA

Choosing the title and the acronym

Part A (solo online)

1 – General Information: abstract, panel, keywords... *and title!!*

- The title and the acronym are more important that you think
- It is what you will be remember for among the panel and review members
- Choose a significant and meaningful title that with few words summarise to goal of your project
- Make it so that you can build a nice acronym out of it :)
- Very important also for the interview (see later)

Valid for any proposal, not only ERC

NITEC: a Negative Ion Time Expansion Chamber

My MSCA Individual Fellowship (2015-17)

NICE: a Negative Ion Chamber Experiment

My StG (approved "A"+"A", but not funded, 2015-16)

INITIUM: an Innovative Negative Ion Time projection chamber for Underground dark Matter searches

My CoG (2019-24)

Choosing the panel & keywords

- Proposals are submitted to a *Targeted Panel* (of PI's choice)
  - ➔ Can flag one "*Secondary Review Panel*"
- **Applicant chooses his/her panel**, this panel is "responsible" and takes ownership for the evaluation of the particular proposal
- Switching proposals between panels not possible unless clear mistake on part of applicant, or due to the necessary expertise being available in a different panel
- **But**: In case of cross-panel or cross-domain proposals, evaluation by members of other panels possible
  - Descriptors and free keywords may influence:
    - ➔ Evaluation Panel
    - ➔ Panel members
    - ➔ Whether a cross-panel evaluation is necessary

Rumour: some panels are more successful than others

✘ **NOT true**: budget is allocated based on submitted proposals to each panel, so success rate is ~constant across different panels.

Rumour: *The more cross-panel descriptors I indicate, the higher the funding chances, since I emphasize like this the interdisciplinarity of my proposal.*

✘ **NOT true**: even though these are used to allocate proposals to Panel Members, once the proposals are allocated, the Panel Members do not see the keywords and descriptors used.

From U. Kainz-Fernandez, ERCEA

INITIUM example

INITIUM aims at building directional Dark Matter detector: I choose PE2 and these keywords because I wanted to stress the detector development part and therefore believed it was a better fit than PE9 (Universe science)

Primary ERC Review Panel*	PE2 - Fundamental Constituents of Matter	
Secondary ERC Review Panel		(if applicable)

ERC Keyword 1*	*Fundamental interactions and fields*

Please select, if applicable, the ERC keyword(s) that best characterise the subject of your proposal in order of priority.

ERC Keyword 2	*Particle physics*
ERC Keyword 3	*Dark matter, dark energy*
ERC Keyword 4	*Not applicable*
Free keywords	*Directional Dark Matter Searches, Time Projection Chamber, Negative Ion Drift, Gas Electron Multipliers (GEMs), CMOS-based camera*

Part B1 structure

1 - Cover page: Title, Acronym, Abstract, Interdiscip.
2 - Extended synopsys [Max 5 pages]
3 - CV [Max 2 pages]
4 - Funding ID [no page limit]
5 -Track record [Max 2 pages]

Part B1:

communicate the essence to generalists

NOVELTY, AMBITION AND FEASIBILITY:
research challenge; aims, groundbreaking nature vs. state of the art; originality, feasibility, impact, methodology, expertise of PI & team, brief time plan
+ references → also a source for selecting specialist reviewers for step2

→ convince generalist and specialist **panel members**
→ careful choice of panel(s)

Abstract (2000 characters)

[1] Write a strong abstract – The panel chair uses the abstract to decide on which of the panel members should review your short proposal/B1.

The abstract is also the first thing that all the reviewers read and first impressions do matter a great deal.

Part B1: general recommendations

Remember: access to the interview (step 2) depends only this part!

Remember: B1 is reviewed by high level scientist which do not necessarily know your field

- Pay particular attention to the **ground-breaking nature** of the research project – no incremental research. State-of-the-art is not enough. Think big!
- Know your competitors – what is the **state of play** and why is your idea and scientific approach outstanding?
- Part B1: **concise and clear presentation** is crucial (not all evaluators are experts in your field)
- Outline of the **methodological approach is recommended** (feasibility assessment)
- Show your **scientific independence** in your CV (model CV provided in the part B1 template)
- Select the **'right' Panel** – very IMPORTANT!

In 5 pages you need to be able to include all of this in a very clear and convincing form

From U. Kainz-Fernandez, ERCEA

Part B1, first page: abstract

Tip: I put the plot reporting the expected sensitivity of the detector in the B1 abstract (mainly because of limited space…)

- Duration in months: 60

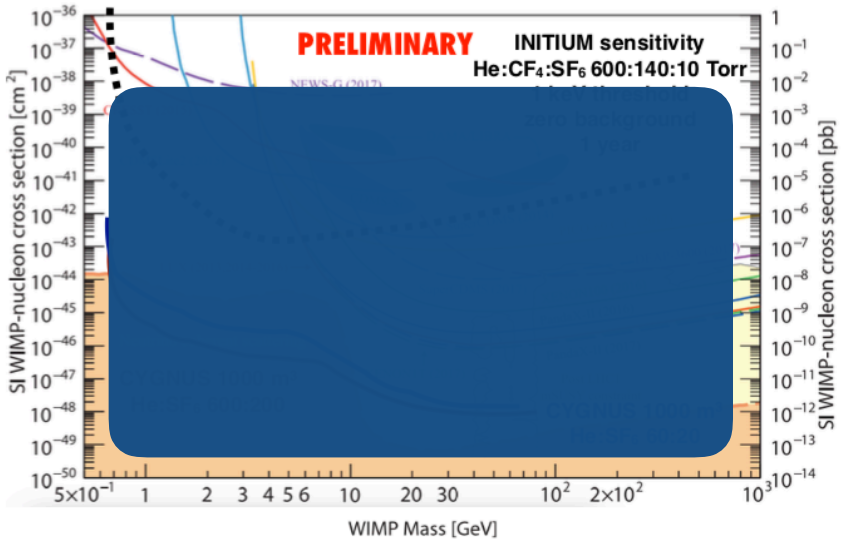


Figure 0: INITIUM expected sensitivity to SD WIMP-nucleon coupling for ~ 1 kg year exposure with 1 keV threshold and zero background.

INITIUM goal is to boost the advancement of gaseous Time Projection Chamber detectors in the Dark Matter (DM) searches field, one of the most compelling issues of todays fundamental physics. I believe this approach to be superior because of its active neutron/electron discrimination, directional and fiducialization capability down to low energies and versatility in terms of target material. Thanks to recent advances in Micro Pattern Gas Detectors amplification and improved readout techniques, TPCs are nowadays mature detectors to aim at developing a ton-scale experiment. INITIUM focuses on the development and operation of the first 1 m^3 Negative Ion TPC with Gas Electron Multipliers amplification and optical readout with CMOS-based cameras and PMTs for directional DM searches at Laboratori Nazionali del Gran Sasso (LNGS). INITIUM will put new significant constraints in a DM WIMP-nucleon scattering parameter space still unexplored to these days, with a remarkable sensitivity down to 10^{-42}-10^{-43} cm^2 for Spin Independent coupling in the 1-10 GeV WIMP mass region. As a by-product, ~~INITIUM will also precisely and simultaneously measure environmental fast and thermal neutron flux at LNGS, supplying crucial information for any present and future experiment in this location.~~ Consequently, I will demonstrate the proof-of-principle and scalability of INITIUM approach towards the development of a ton-scale detector in the context of CYGNUS, an international collaboration (of which I am one of the Spokespersons and PIs) recently gathered together with the aim to establish a Galactic Directional Recoil Observatory, that can test the DM hypothesis beyond the Neutrino Floor and measure the coherent scatter of galactic neutrinos, generating a significant long-term impact on detection techniques for rare events searches.

- **Use it as an outline of the proposal**
- **Needs synthesise with few effective words:**
  - **The goal of the project**
  - **The importance of the subject at study**
  - **The state of the art**
  - **The innovation brought by the project to the state of the art**
  - **The feasibility of the project**
  - **The impact of your project**

Tip: keep repeating some key words/ concepts along the whole proposal

Tip: keep repeating your acronym along the whole proposal

Part B1: Extended Synopsis

Demonstrate in 5 pages your abstract for high level (but not necessary in your field) scientists

- The goal of the project
- Chapter 1: The importance of the subject at study
- The state of the art
- The innovation brought by the project to the state of the art
- The feasibility of the project
- The impact of the project

1. *INITIUM SCIENTIFIC AND EXPERIMENTAL BACKGROUND*

The presence of DM in the Universe is nowadays an established, yet still mysterious, paradigm: deciphering its essence is one of the most compelling tasks for fundamental physics today [1]. Direct DM searches look for very low energy (10-100 keV) nuclear recoils due to the elastic scattering of Weakly Interactive Massive Particles (WIMPs) in the active volume of the detector. The present experimental limits for Spin-Independent

- *What is Dark Matter*
- *How we try to measure it directly*
- *Why the approach I propose is crucial and timeliness*
- *How the detector I propose can realise such approach*

± 1 page

INITIUM Example

The presence of DM in the Universe is nowadays an established, yet still mysterious, paradigm: deciphering its essence is one of the most compelling tasks for fundamental physics today [1]. Direct DM searches look

to Earth's axis orientation with respect to DM wind. The determination of the incoming direction of the WIMP particle can provide a correlation with an astrophysical source that no background whatsoever can mimic and therefore offers an unique key for a positive, unambiguous identification of a DM signal [3]. Such

For all these reasons I believe that the development of INITIUM, a negative ion gaseous TPC with active electron/neutron recoil discrimination, high resolution 3D tracking, easy scalable readout and He-based gas mixture at atmospheric pressure can give a significant contribution to the DM direct search field at O(GeV)

Part B1: Extended Synopsis

Demonstrate in 5 pages your abstract for high level (but not necessary in your field) scientists

- **The goal of the project**
- **The importance of the subject at study**
- **Chapter 1.1: The state of the art**
- **The innovation brought by the project to the state of the art**
- **The feasibility of the project**
- **The impact of the project**

± 1 page w/ table

1.1 Existing directional DM detectors and future prospects

TPCs can potentially provide the best observables and architecture for a DM search experiment. For a comprehensive review of directional readout technologies, we refer the reader to [11], that I helped author.

	Drift	Amplification + Readout	Gas Mixture	Pressure (mbar)	Volume (L)	Energy Threshold (keV)	Active Mass (gr)
DRIFT	i^-, 50 cm	MWPC	73% CS_2 + 25% CF_4 + 2% O_2	55	800	20	33.2
NEWAGE	e^-, 40 cm	mu-PIC	CF_4	100	37	20	11.5
MIMAC	e^-, 25 cm	Micromegas	70% CF_4 28% CHF_3 2% C_4H_{10}	50	5.8	2	1.1
DMTPC (in R&D)	e^-, 27 cm	Meshes + CCD + PMT	CF_4	30-100	1000	20	~50-100
INITIUM	i^-, 75 cm	GEMs + CMOS + PMT	He + CF_4 + SF_6	1000	1000	1	~1000

- ***Here only 5 pages: concentrate on the state of the art closer to your project (i.e. only directional DM detectors, not all DM detectors)***
- ***Contextualise your project within the present and future challenges***
- ***Underline your contribution to the state of the art***
- ***Tip: use table to synthesise concepts and comparisons***

Part B1: Extended Synopsis

Demonstrate in 5 pages your abstract for high level (but not necessary in your field) scientists

- The goal of the project
- The importance of the subject at study
- The state of the art
- Chapter 2: The innovation brought by the project to the state of the art
- The feasibility of the project
- The impact of the project

± 1.5 pages w/ figures

2. *INITIUM INNOVATIONS TO MEET DIRECTIONAL DM EXPERIMENTAL CHALLENGES*

The main experimental challenge of a DM detector aiming at directional sensitivity is to instrument a large volume with high enough granularity to be able to infer recoiling tracks direction down to low energy, while

Notice the captivating title

- *Use bullet points or tables to underline your innovation to the state of the art*
- *Be daring and convinced of what you write ("I firmly believe that INITIUM will..)..*
- *..but properly back up your statement! (feasibility)*
- *Stress your personal contribution to such innovations development in the past*

INITIUM Example

based on optical readout and negative ion drift. Backed by some recent breakthroughs in the field (to which I and my group significantly contributed), INITIUM will bring together and optimise in a mannerly fashion the following innovative features:

mass. With the NITEC detector I developed during my Marie Curie Individual Fellowship, I recently proved for the first time the feasibility of negative ion operation at nearly atmospheric pressure with

consuming than CCDs [30]. Together with the group I gathered around my Marie Curie Individual Fellowship, I recently developed the 7 L sensitive volume prototype LEMOn with 20 cm drift distance,

Part B1: Extended Synopsis

Demonstrate in 5 pages your abstract for high level (but not necessary in your field) scientists

- **Chapter 3: The goal of the project**
- **The importance of the subject at study**
- **The state of the art**
- **The innovation brought by the project to the state of the art**
- **The feasibility of the project**
- **The impact of the project**

± 1 page

3. ***INITIUM DESIGN AND EXPECTED SENSITIVITY***

A sketch of INITIUM detector is shown in the central panel of Fig.1. The CMOS sensors will be located at the TPC anode behind the GEM planes and will detect the scintillation light produced in the amplification

- ***How the innovative features described in Chapter 2 will be realised by the project***
- ***Be daring in your statements, but always keeping in mind the feasibility***
- ***Provide possible back up solution to mitigate risks***
- ***Discuss the expected result and long term impact***

INITIUM Example

Ethic Annex attached). From the results I obtained on gas performances with LEMOn (better light yield with higher He to CF_4 fraction) and NITEC (few % of SF_6 is sufficient to induce the negative ion drift), we can foresee a He:CF_4:SF_6 gas mixture ranging from 600:140:10 Torr to 645:100:5 Torr. A dedicated DAQ system

background contribution to come from the GEMs. Given the expected dimensions, from simulations within the CYGNUS collaboration, we expect about 2.6 x 10^3 gamma/year between 1-10 keV (3.7 x 10^4 gamma/

rate from all the other internal components added together. Given that DRIFT showed 1.98 x 10^{-5} gamma rejection at 20 keV [16] and [34] similar capabilities with 2D optical readout and 100 Torr of CF_4 at 10 keV, I believe INITIUM will be able to control all the gamma induced backgrounds. DRIFT has demonstrated that

Part B1: Extended Synopsis

Demonstrate in 5 pages your abstract for high level (but not necessary in your field) scientists

- The goal of the project
- The importance of the subject at study
- The state of the art
- The innovation brought by the project to the state of the art
- Chapter 4 & 5: The feasibility of the project
- The impact of the project

± 1 page

You need to demonstrate that you can deliver what you promise

4. *IMPLEMENTATION*

The INITIUM project will last for 60 months and will be divided in four Working Packages (WPs), namely Prototype studies (WP I), Detector design optimisation, engineering and construction (WP II), Detector

5. *APPROPRIATENESS OF THE FACILITIES, RESEARCH TEAM AND COSTS*

The Host Institution will be the Gran Sasso Science Institute (GSSI), an international PhD school and research center recently established in l'Aquila, in order to exploit its academic excellence to build a new,

- *Outline the methodological approach that you will discuss in details in part B2 through a brief description of the WPs, deliverables ad milestones*
- *Demonstrate the appropriateness of the HI and facilities*
- *Discuss the expertise of the team*
- *Motivate your capability of being the PI of the described project*
- *Briefly delineate the budget through its categories*

INITIUM Example

The Host Institution will be the Gran Sasso Science Institute (GSSI), an international PhD school and research center recently established in l'Aquila, in order to exploit its academic excellence to build a new, young and motivated research group around the PI. GSSI proximity and strong connections with LNGS, the largest underground laboratory in the world, offer an exclusive opportunity for the success of the INITIUM

subnuclear, nuclear and astroparticle physics. Its partnership is crucial condition for the success of INITIUM, thanks to the outstanding INFN research facilities. LNGS and Laboratori Nazionali di Frascati (LNF) are the

member peculiar skills into the project. INFN collaborators possess a longstanding tradition in tracking detectors, especially with GEMs, and are among the first developers of the optical readout approach with CMOS cameras [37]. This same group, lead by the PI, has been the first to establish negative ion operation at

Institution and partner laboratories, together with the research team, offer an unique combination of the best academic researchers and experimental facilities available in Italy for the success of the INITIUM project and to launch the development of the international CYGNUS effort.

Part B1: Curriculum Vitae

General example: modify it as necessary ad appropriate to your CV

- Education
- Current and previous position(s); tip: + declined offers
- Fellowships
- Supervision of Graduate Students and Postdoctoral Fellows
- Teaching Activities
- Organisation of Scientific Meetings
- Institutional Responsibilities
- Commissions of Trust
- Tip: + Reviewer for Journals
- Tip: + Concluded grants (in addition to extra annex on current grants)
- Memberships of scientific societies
- Major collaborations
- Career breaks

Part B1: Curriculum Vitae

A template is provided as guidance: modify it as necessary ad appropriate to your CV

- 2 pages, synthetic
- Underline mobility
- Underline managing of fundings
- Underline international experiences
- Underline collaborations/network participation
- Underline tutoring and mentorship
- Underline your capability to adapt to new challenges
  - Having changed experiments, field of research, laboratories
- Underline responsibility position
  - PIs, Spokesperson, WPs conveener, conference organisation, run coordination, R&D or analysis responsibilities
- Underline every experience that is propaedeutic to the submitted project
  - Gas detector development (first in HEP, now in DM)
  - Data analysis & simulation (first in HEP, now in DM)
  - New experiments feasibility studies (first in HEP, now in DM)

2 pages

Section b: Curriculum Vitae

ELISABETTA BARACCHINI

ORCID ID 0000-0003-4686-128X

Date of birth: 26th April 1982

Nationality: Italian

- **EDUCATION**

2009 PhD in Particle Physics at Università La Sapienza of Rome, Italy, with grade "Optimum", thesis title "Search for B+→ l+ν at BaBar with l = (e, μ) and Phenomenological Implications".

2005 Master Degree in Particle Physics at Università La Sapienza of Rome, Italy, with grade 110/110 *cum laude*, thesis title "Correzioni radiative ai decadimenti in due corpi del mesone B".

- **CURRENT POSITION**

2018-present Assistant Professor of the Astroparticle Physics Department at the Gran Sasso Science Institute (GSSI), l'Aquila, Italy.

- **PREVIOUS POSITIONS AND INTERNATIONAL MOBILITY**

2017 Researcher of the Istituto Nazionale di Fisica Nucleare (INFN) at Università La Sapienza of Rome, Rome, Italy.

2015-2017 INFN Senior Researcher (within the Marie Słodowska-Curie Individual Fellowship) at the Laboratori Nazionali di Frascati, Frascati, Italy.

2012-2015 Researcher of the International Center for Elementary Particle Physics (ICEPP) at the University of Tokyo, Tokyo, Japan, for the MEG experiment.

2012 Researcher of Université Paris Sud at the Laboratoire de l'Accélérateur Linéaire (LAL), Orsay, France, for the SuperB project.

2011 Researcher of the Institute of Particle and Nuclear Studies (IPNS) at the High Energy Accelerator Research Organization (KEK), Tsukuba, Japan, for the MEG experiment.

2008-2011 Post Doctoral Scholar Employee of the Department of Physics and Astronomy of the University of Irvine, California, USA, for the MEG experiment.

- **FELLOWSHIPS AND AWARDS**

2016 ERC Starting Grant for the project "*NICE: a Negative Ion Chamber Experiment*" in the framework of Horizon 2020, evaluated to fully meet ERC excellence criteria (panels score 'A' and 'A'), not funded due to ranking and limited funds.

2015 Marie Słodowska-Curie Individual Fellowship for the project "NITEC: a Negative Ion Time Expansion Chamber for directional Dark Matter searches" in the framework of Horizon 2020, Supervisor G. Bencivenni.

2011 Research Fellowship at the Université Paris Sud in the framework of the European Project "Research Chairs of Excellence Based University - Universities of Paris" (RBUCE-UP), funded as a part of Marie-Curie Actions under the 7th Framework Programme.

2003 Student Excellence Award "Enrico Persico" from the Accademia Nazionale dei Lincei, Rome, Italy.

- **QUALIFICATIONS**

2014 National scientific qualification as Assistant Professor in the sector "02/A1 -Experimental Physics of Fundamental Interactions".

- **TEACHING ACTIVITIES**

2018 Lecturer of the PhD course "Direct Dark Matter Searches and its Experimental Challenges" at the Gran Sasso Science Institute.

2015 Tutor for the "GEMPix TPC tracker characterization at the BTF" class of the Gaseous Detector Laboratory for the Excellence in Detector and Instrumentation Technology International School 2015 (EDIT 2015) at Laboratori Nazionali di Frascati (INFN).

2006-2007 "Radiation Detector Laboratory" class for the Physics Master Degree at Università la Sapienza of Rome, Italy, as Assistant of Prof. Mattioli.

- **ORGANIZATION OF SCIENTIFIC MEETINGS**

2016 Co-organizer and chair of "*CYGNUS-TPC meeting*" at Shieffield University, Sheffield, United Kingdom.

2016 Organizer and chair of "*CYGNUS-TPC kick-off meeting: a mini-workshop on dark matter*

Part B1: funding ID

Appendix: All on-going and submitted grants and funding of the PI (Funding ID)
Mandatory information (does not count towards page limits)

On-going Grants:

Project Title	*Funding source*	*Amount (Euros)*	*Period*	*Role of the PI*	*Relation to current ERC proposal*[2]
NITEC: a Negative Ion Time Expansion Chamber for directional Dark Matter searches	Marie Sklodowska-Curie Actions, Individual Fellowship	168227	2 years	PI	NITPC with GEMPix readout for directional DM search application (no light detection): preliminary studies for the ERC project

An illustrative example from my second ERC Starting Grant Proposal

Past ERC Grant applications:

Project Title	*Funding source*	*Amount (Euros)*	*Period*	*Role of the PI*	*Relation to current ERC proposal*[2]
NICE: a Negative Ion Chamber Experiment for very rare events searches	ERC Starting Grant 2015 Action (Proposal Number 677290)	1078750	5 years	PI	Some minor differences with respect to current proposal. This 2015 ERC Starting Grant project fully met the evaluation criteria (panel scores 'A' and 'A') but was not funded due to ranking position and limited funds

- **List all on-going grants and funding of the PI**
- ***At that time I was carrying on my MSCA IF, with preliminary studies on the gas mixtures discuseed in the ERC project***
- ***The previous year my ERC StG had scored "A" at both steps, and I was therefore allowed to reapply without restriction***

Part B1: Early track records

Discuss your past ad present research activity & list of major publications

Goal: demonstrate your are the best person to carry on the research project you outlined

2 pages

Start with a strong statement

My research interests focus on fundamental physics, in particular the answer to the questions what the Universe is made of and which are the laws of physics that govern its fundamental constituents. For this

In few lines summarise your entire career

reason, I took part in accelerator-based particle physics experiments (Babar, MEG), aimed to probe

Strong of the experience acquired during my studies and my seven postdocs years, I recently moved my attention to DM and neutrinos, in my opinion the most interesting and fertile fields where to work right now,

Go through your career from today backwards showing intent and direction

Show that you already started doing preliminary works propaedeutic to your project

Explain the significance of your major past works

Demonstrate your capability of independence as a researcher and as a project manager

Conclude summarising your career listing the skill you acquired that make you the best candidate for carry out the project and discussing how getting the ERC would allow you to start (consolidate) your research line

Sell yourself hard, but without sounding cocky

Part B1: Early track records

List of major publications

- 5 for Starting Grant, 10 for Consolidator Grant
- You are required to show at list one (several) publication without your PhD supervisor to demonstrate independence
  - Reviewers are not stupid: what you need to demonstrate is that you did independent work from your supervisor, even if you signed the same papers. Use the discorsive part to explain it
- Choose the publications more related to the proposed project
- Tip: if your publication have an high level >50 citations, write it

5. J. Adam et al. [MEG Collaboration], *"New constraint on the existence of the $\mu^+ \to e^+\gamma$ decay"*, Phys. Rev. Lett. 110 (2013) 201801, **(527 citations)**.
6. A. M. Baldini et al. [MEG Collaboration], *"Search for the lepton flavour violating decay $\mu^+ \to e^+\gamma$ with the full dataset of the MEG experiment"*, Eur. Phys. J. C 76 (2016) no.8, 434, **(165 citations)**.

- Try to show consistency along the time, i.e. one publication per year
- Tip: numerically order the publications, and use these number as references to cite your works in the discorsive part

In the previous years (2008-2015), I worked in the MEG collaboration as the responsible for the simulation, reconstruction and analysis of charged tracks in the drift chambers (DCH) [5,6] and from 2011 in the cylindrical drift chamber of the MEG II upgrade. The MEG experiment searches for the $\mu \to e\gamma$ decay, a

Part B1: what it needs to demonstrate

- Is my project new, **innovative**, bringing in new solutions/theories?
- Does it promise to go **substantially beyond the state of the art**? – no incremental research.
- How can I **prove/support** my case? Is the project **feasible**? Are my goals **realistic**?
- Interdisciplinary proposals are attractive as novelty may stem from the combination of two disciplines. But be careful: expertise in all disciplines should be guaranteed (by PI or team)
- Is there an element of '**high risk high gain**'? Meaning: *scientific* risk is welcome. There is something the world does not know and you will find out, despite a risk that this might not be possible. But there should be *great value* in finding out.

- **Must need to be able to stand on its own as a complete document with all the relevant information, including the feasibility and methodology**
- **Must be written for both non-specialists and specialists as well (step 2 reviews both)**
- **Must not be a cut and paste or simple summary of B2**
- **Suggestion: start from B1 and then from that elaborate B2**

Part B2 structure

B2

- Scientific proposal [Max 15 pages]
  - a State of the art, objectives
  - b Methodology
  - c Resources (incl. Budget table)

Part B2:

convince specialists reviewers as well

In Step 2, both part B1 and B2 are read by panel members and by specialists around the world (external referees).

- Do not repeat the synopsis, but **detail the methodology** and work plan.
- Make sure that the **state of the art is clear, well-written and referenced** - show you did your homework.
- Provide alternative **strategies to mitigate the main risks**.
- **Justify requested resources** – explain the budget properly.

Part B2: outline

14 pages + Resources & Budget section in online submission form (see later)

Part B2: *The scientific proposal* (max. 15 pages, references do not count towards the page limits)

a) State of the art and objectives: provide context, define your aims
objectives clearly specified in context of state of the art; importance, timeliness and anticpated impact of proposed research

b) Methodology: feasibility & coherence with your aims
detailled; novel/ unconventional aspects, work and time plan, key intermediate goals; intermediate stages that may require adjustments to the project planning; risks and contingency plans; required expertise of team members, working arrangements

Section c. Resources (including project costs)

C.4 PI COMMITMENT TO THE PROJECT

Please indicate the duration of the project in months:	
Please indicate the % of working time the PI dedicates to the project over the period of the grant:	%

Part B2: state of the art and objectives

A.1 INITIUM OBJECTIVES ***A short abstract of what will be discussed in B2***

Start with a strong statement that immediately clarify the goal, innovation and the importance of the project

INITIUM goal is to boost the development and advancement of gaseous Time Projection Chamber detectors, in particular in the Dark Matter (DM) searches field. I believe this approach to be superior because of its active electron/nuclear recoil discrimination, directional and fiducialization capability down to low energies and versatility in terms of target (Sec. A.2). Thanks to advances in recent years in Micro Pattern as Detectors

Elaborating on the B1 abstract, use it as a guide of what will be discussed in B2, with proper reference to the sections

and versatility in terms of target (Sec. A.2). Thanks to advances in recent years in Micro Pattern as Detectors (MPGD) for amplification and improved readout techniques (Sec. A.3, A.4), TPCs are nowadays mature

cameras and PMTs at Laboratori Nazionali del Gran Sasso (LNGS). Thanks to the foreseen innovative features discussed in Sec. A.5., INITIUM will be able to put new remarkable constraints in a WIMP-nucleon

State the expected results

features discussed in Sec. A.5., INITIUM will be able to put new remarkable constraints in a WIMP-nucleon scattering parameter space still unexplored to these days, with sensitivity down to ~ 10^{-42}-10^{-43} cm^2 for Spin

Conclude with a strong statement on short and long term impact

measure the coherent scattering of neutrinos from the Sun and Supernovae. I firmly believe that INITIUM can start a new era for NITPC detectors in directional DM search, while giving me the chance to solidly establish my research team and line in Italy and worldwide.

Part B2: state of the art and objectives

The general idea is to follow the B1 structure without repeating it but elaborating on the details and statement that were given there

A.2 DIRECT DARK MATTER SEARCHES: SCIENTIFIC AND EXPERIMENTAL BACKGROUND

Several astrophysical measurements (cosmic microwave background, cluster and galaxy rotations, lensing and Big Bang nucleosynthesis) indicate that the majority of the matter in the Universe is cold and dark (i.e.

A.2.1 Current status of direct DM searches

Figure 1 report the current status of the direct DM search, for SI (on the left) and SD proton (on the right) WIMP-nucleon coupling. Four preeminent features can be observed:

i.e. discuss the project in the context of all DM experiments, not only directional

A.2.2 The case for directional DM searches with gaseous TPCs

The measurements of the rotation curve of our Galaxy suggest the presence of high concentrations of DM at the galactic radius of the Sun, although its exact distribution remains still highly unconstrained. A standard

i.e. elaborate on the importance and features of directional searches

A.3 DIRECTIONAL DARK MATTER EXPERIMENTAL STATE OF THE ART

The principal characteristics of all existing directional gaseous DM detectors are summarised together with INITIUM expected features in Table 1. The main experimental challenges of DM detectors aiming at

i.e. elaborate on other directional detectors with additional details w.r.t B1

A.4 RECENT BREAKTHROUGHS IN TPCs FOR DIRECTIONAL DM SEARCHES

The experience of a decade of DRIFT operations, together with the advances of the experimental efforts described in Sec. A.3 and recent R&Ds progresses, generated several breakthroughs in these past years that

i.e. elaborate on recents breakthroughs that back up your project feasibility

long-term development of new techniques for rare event searches.

A.5 INITIUM DESIGN AND INNOVATION BEYOND THE STATE OF THE ART

For all the reasons discussed above, INITIUM goal is the development of an innovative approach towards large TPCs sensitive to the direction of nuclear recoils down to O(1) keV energy, based on optical readout

i.e. elaborate on the challenging/ unconventional aspects of your project with additional description of your preliminary works

A.5.3 INITIUM expected performances and sensitivities for direct Dark Matter searches

I believe that detector approach described in Sec. A.5, supported by the recent breakthroughs discussed in Sec. A. 4, will make INITIUM one of the most sensitive DM detectors to both SI and SD couplings below 10

i.e. discuss and motivate your expected performances/results with preliminary numbers/studies

Part B2: impact of your project, your vision

In B2 it is important to clarify and motivate the expected impact of your project

The impact should include both your personal vision about what you would do beyond month 60 if you succeed with everything that you hope to achieve and what other researchers could do after you have created new opportunities or opened new windows through the new knowledge that you will publish during this fellowship.

Examples:

If some of our approaches are successful, we can expect within the next few years a **detailed understanding of**…..

The proposed project should provide a rich set of scientific data on X, which will suggest new research experiments in the area of X.

The expected result **will open a new research area**/ …can open up new perspectives for analyzing …

The results are to drastically advance not only the fields of X systems and Y but also the current understanding of Z which is of **great importance far beyond the borders** of…

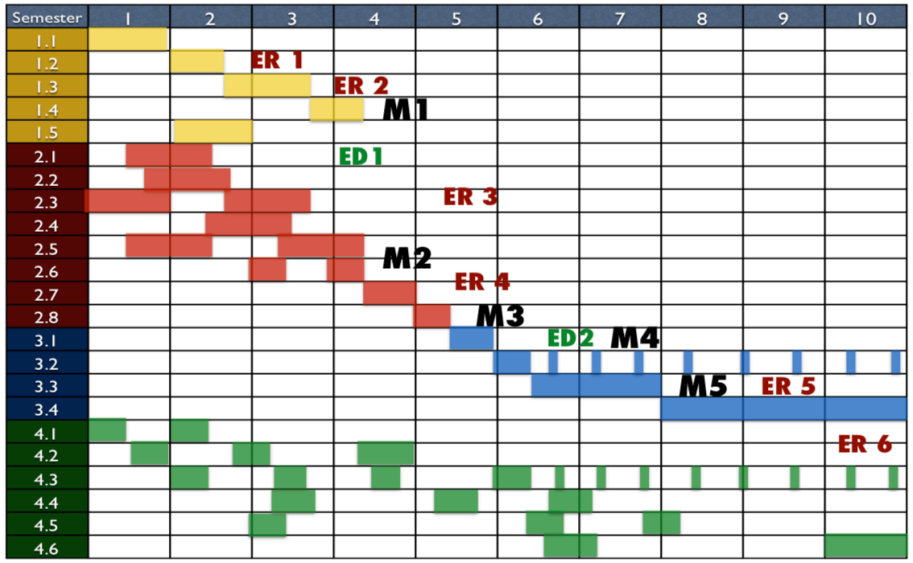
Show that you have a vision of how your project can open new windows of opportunities

Part B2: methodology

SECTION B: METHODOLOGY

B.1 INITIUM PROJECT IMPLEMENTATION

The INITIUM project will last 60 months and will be divided in four Working Packages (WPs), namely Prototype studies (WP I), Detector design optimisation, engineering and construction (WP II), Detector underground commissioning and physics run (WP III) and Data analysis, calibrations and simulation (WP IV). A detailed breakdown of the INITIUM time development is shown in Figure 4. The different expertise



Highly recommended to use Gantt plot with Working Packages, Deliverables and Milestones

Go through each WPs, describing the activities, expected results and propedeuticity to following steps

B.2 RISK ASSESSMENT

I believe that the proposed approach, combined with chosen institutions and research team, can mitigate the expected contingencies. The time devoted to the optical readout design and performances optimisation will allow us to sustain our final detector choices with experimental data in addition to simulations. The

Discuss how you can mitigate the contingencies with back up plans

Elaborate on the feasibility of the project, backing it up with appropriateness of the research team and facilities chosen

Part B2: resources

NEW from 2021

Do NOT include any description of resources or budget table here (Part B2). The Resources section and the detailed budget table are now part of the online submission form (Part A, Section 3 - Budget). This section 3 will be extracted and provided to the peer reviewers.

Only formally new, not conceptually

Part B2: resources

As it was before 2021

SECTION C: RESOURCES (INCLUDING PROJECT COSTS)

C.1 HOST ISTITUTION AND PARTNER FACILITIES

The Host Institution Gran Sasso Science Institute (GSSI) is an research center and international PhD school

Elaborate on the available facilities discussed in B1, linking them to the methodology and WPs discussed in B2 Section B

C.2 RESEARCH TEAM

Being the first proponent of directional DM search with NITPC in Italy, and one of CYGNUS Spokespersons, I will fully manage INITIUM project as PI, with a 80% time commitment. My experience in detector R&D, tracking and data analysis, combined with the know-how in the DM search field and management of Europeans grants, provide me with the all-inclusive scientific perspective needed to integrate

Elaborate on your capability of managing the project as PI and on your skills and know-hows that make you the best candidate for the job, linking it to what discussed in the CV

- General detector design and optimisation (*G. Cavoto, G. Mazzitelli, D. Pinci, F. Renga, S. Tomassini, Postdoc1, Postdoc2, LNF and LNGS TS*)
- Prototype tests and calibrations (*G. Cavoto, G. Mazzitelli, D. Pinci, F. Renga, E. Di Marco, Postdoc1, Postdoc2, PhD1, PhD2, LNF TS*)

Justify the requests for personnel in the budget and demonstrate the adequacy of the manpower, possibly linking them to the WPs discussed in Section B

gaseous tracking detectors development and operation. They are among the first proponents of the optical readout with GEMs amplification and CMOS cameras (*M. Marafini, D. Pinci)* [69] and calibrations and general detector development experts *(G. Mazzitelli, A. Tomassini*). The colleagues from the INFN-Roma group (*G. Cavoto, E. Di Marco, F. Renga, C. Voena*) have developed and worked in several high-precision cutting-edge experiments (BaBar, MEG, CMS), from R&D, to data analysis, calibrations and physics

Elaborate on the research team members expertise, showing how they perfectly fit with the know-hows required to successfully carry out the project

To know: only the persons explicitly listed in the proposal can use fundings from the ERC grant. Still, with proper motivation to your Project Officer and his/her approval, you can add any member you want during the project development.

Budget: general considerations

- Budget analysis carried out in **Step 2** evaluation (meeting)
- Panels have responsibility to ensure that resources requested are reasonable and well justified
- Panels do not 'micro-manage' project finances
- Budget cuts need to be justified on a proposal by proposal basis (no across-the-board cuts)
- But **unexplained costs are often cut!**
- Panels to recommend a final maximum budget based on the resources allocated/ removed
- **Ask for funding for Open Access – this is obligatory in Horizon 2020!**

- Panels do not “micro-manage” project finances
- Awards made on a “take-it-or-leave-it” basis: no negotiations

From U. Kainz-Fernandez, ERCEA

As it was before 2021

Part B2: budget

C.3 PROJECT BUDGET

The total cost of the project is ~2 MEUROS, of which nearly 50% is devoted to personnel, and in particular to establish a new research team at GSSI. It is worth noticing how the total cost to build and operate the experiment is only ~500kEUROs, including several R&Ds for the gas and DAQ systems. A breakdown of the expected expenses, divided by institution, is reported in Tab. 3 and briefly discussed here:

- **Personnel**: ~915 kEUROs will be used to finance new contracts at GSSI: 36 months for the PI (due to the end of her contract by 2020), 60 months for two Postdocs and 36 months for 2 PhD students. INFN will partially cover the expenses for AS and TS, for which ~110 kEUROS and ~100 kEUROS respectively are requested, covering 2 AS and 2 TS years person at 100% commitment for 5 years.
- **Travel**: ~100 kEUROS will be used to pay for travel to LNGS for detector commissioning and installation, to present INITIUM results at workshops and conferences, and for networking with the CYGNUS collaborations (including expenses for the Advisor Committee travels).
- **Equipment**: we expect to spend ~30kEUROs for GEMs and cathode HVs, ~100kEUROs for the gas purification and recirculation development and underground system. About ~50kEUROs are foreseen for the DAQ R&D and final system.
- **Consumables:** we foresee a cost of ~70kEUROs for the vessel (including cathode and field cage) and ~45kEUROs for the neutron shielding and muon veto. Total GEMs costs will amount to ~50kEUROs, and 16 CMOS+PMT modules (an upper limit on the number of the optical devices) ~210 kEUROs. All

Cost Category		
Direct Costs	**Personnel**	PI
		Academic Staff
		Postdocs
		PhDs
		Technical Staff
	i. Total Direct Costs for Personnel (in Euro)	
	Travel	
	Equipment	
	Other goods and services	Consumables
		Publications
		Certificate of Financial Statement
	ii. Total Other Direct Costs (in Euro)	
A – Total Direct Costs (i + ii) (in Euro)		
B – Indirect Costs (overheads) 25% of Direct Costs (in Euro)		
C1 – Subcontracting Costs (no overheads) (in Euro)		
C2 – Other Direct Costs with no overheads (in Euro)		
Total Estimated Eligible Costs (A + B + C) (in Euro)		
Total Requested EU Contribution (in Euro)		
Total Cost of the project (in Euro)		

- **First of all: study in details your chosen HI costs categories rules to properly account them in the budget**
- **Briefly elaborate on them through the different categories and use the provided table template**
- **Tip: use an excel table (not to be put on the proposal) to properly account the costs through categories and calculates overhead (25% of indirect cost as a rule)**

Part B2: commitment

As it was before 2021

> 50 % for Starting Grant, > 40 % for Consolidator Grant required

For the above cost table, please indicate the duration of the project in months:	**60**
For the above cost table, please indicate the % of working time the PI dedicates to the project over the period of the grant:	**80%**

C.4 PI COMMITMENT TO THE PROJECT

I am profoundly convinced of INITIUM potentialities and extremely committed to its success. Since the preliminary studies outlined in my Marie Curie Individual Fellowship proposal, I strove for an independent and leadership role in directional DM searches with innovative detection approaches. In less than two years, I build a Time Projection Chamber (TPC) with triple thin GEMs amplification and pixel readout and operated it with highly original negative ion gas mixtures based on SF_6 never tested before, opening the doors for the feasibility of NITPC at atmospheric pressure with SF_6 [43]. Subsequently, I gather around me a new group of people with different expertise and backgrounds, that helped me to develop an innovative 7 L TPC with optical CMOS+PMT readout [44,45]. My work and my enthusiasm for the field led me to a leadership position in the development of the CYGNUS project [36], where I am one of the four original Spokespersons and founders since January 2016. The positive recommendation and encouragement to continue INITIUM R&Ds and feasibility studies I already obtained from LNGS Scientific Committee testify my commitment to the proposal. I firmly believe that INITIUM can start a new era for NITPC technology in directional DM search, while giving me the chance to solidly establish my research line and team at GSSI.

Tip: no need to put 100% to show motivation, that can otherwise limit you

- **Show that you believe in your vision and your project**
- **Demonstrate your initiative and your commitment to what led to the development of this project in the past years, possibly referencing it to the publications in the bibliography**
- **Show intent and direction of your past work towards the development of this project**

Preliminary timeline for 2021

Starting Grant: deadline for submission 8th April

Timeframe for sending information to applicants (StG 2021)	Social Sciences & Humanities (SH)	Physical Sciences & Engineering (PE)	Life Sciences (LS)
1. Results of eligibility check (applies only to proposals declared ineligible)		End June 2021	
2. Invitations for interviews	Beginning July 2021	Mid July 2021	End July 2021
3. Results of Step 1 for non-retained applicants	End July 2021	End July 2021	Beginning August 2021
4. Step 2 Interviews	Beginning October 2021	Mid October 2021	Mid / End October 2021
5. Results of Step 2		Mid Dec 2021	

Consolidator Grant: deadline for submission 20th April

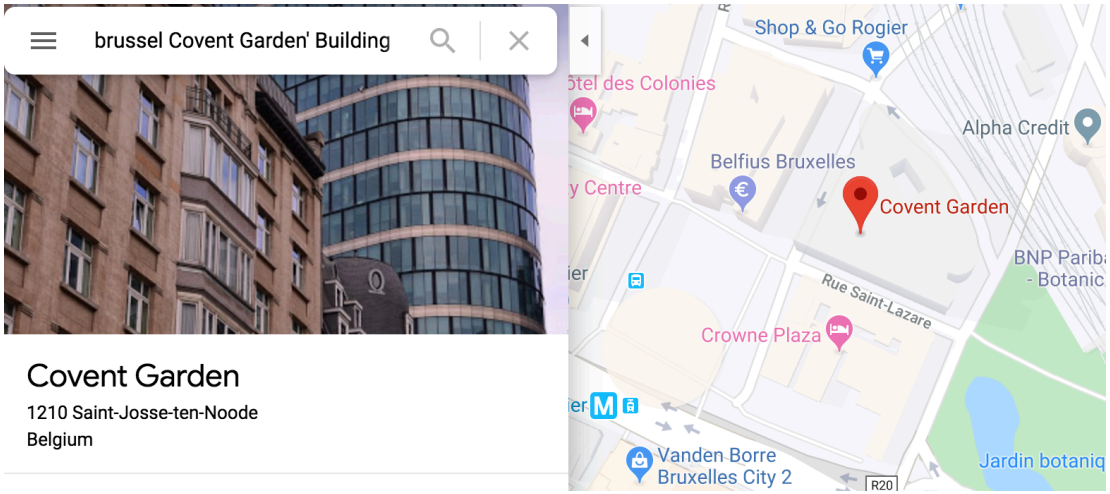
Timeframe for sending information to applicants (CoG2021)	LS Life Sciences	SH Social Sciences & Humanities	PE Physical Sciences & Engineering
1. Results of eligibility check (applies only to proposals declared ineligible)	end August 2021	end August 2021	end August 2021
2. Invitations for interviews	end October 2021	mid October 2021	end October 2021
3. Results of Step 1 for non-retained applicants	end October 2021	mid October 2021	end October 2021
4. Step 2 Interviews	end January 2022	mid January 2022	mid January 2022
5. Results of Step 2	end March 2022	end March 2022	end March 2022

The interview: generalities

Dear Dr. BARACCHINI,

The ERC evaluation panels, composed of independent experts, have carried out their review of the proposals submitted to the ERC-2018-COG.

I am pleased to inform you that your proposal was retained following Step 1 of the evaluation and will now proceed to the second step.



The interviews take place in the ERCEA building in Brussel and your trip expenses will be reimbursed

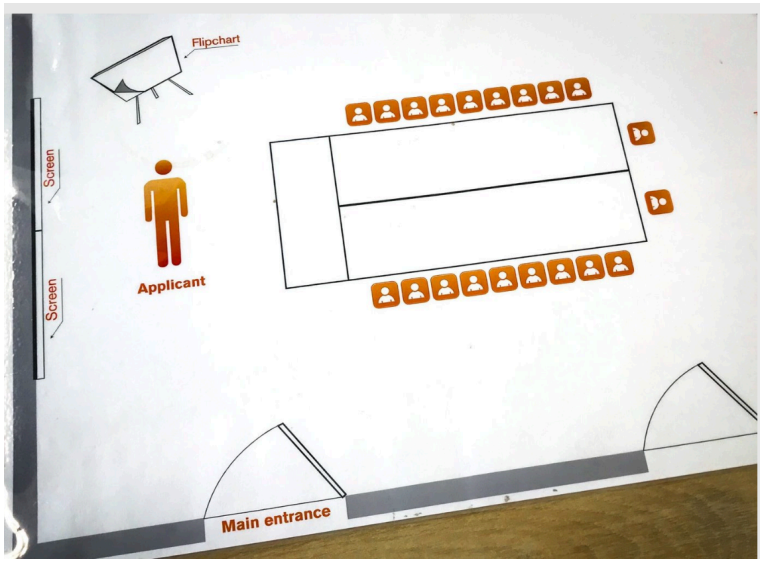
(Obvious) suggestion: arrive in town one day early, take an hotel close by, arrive well on time

- **First: be happy! the success rate of projects selected for step 2 is nearly 50%**
- **Typical time of interview: 12 minutes presentation + 20 minutes questions, *strictly enforced***
- **Prepare yourself well in advance, rehearsing the talk several time possibly in front of faculty members and ask them to do the "devil's advocate" to prepare you to any possible question**

The interview: my 5 cents on the attitude

CAVEAT: everyone has his/her own style and you should in general simply be comfortable and be yourself

- All the projects selected for the interview are of the same very high quality: you need to stand out
- Wear something you feel comfortable in, go with elegant but don't be afraid to dare, the goal is to make people remember you
- Show enthusiasm and confidence, in your project and in your capability to carry it out
- When talking, keep standing towards the audience alternatively looking to each of the panel members
- Typical panel is 12-16 members, with at most 2 in your field: target the talk to not experts
- Distill the concepts and try to intrigue/seduce them
- In the slides use mostly images/photos rather than words

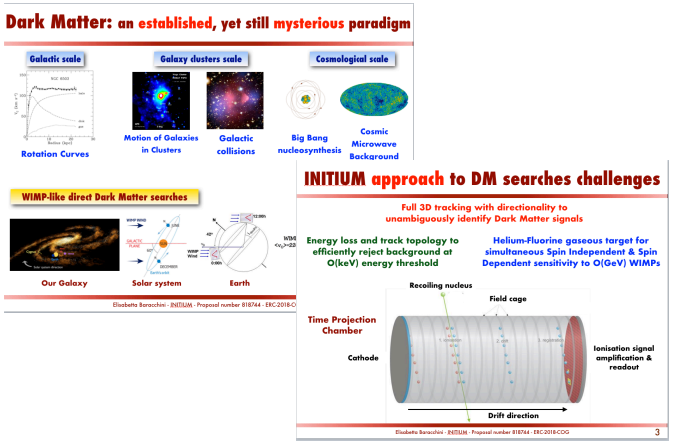


The slides: a possible template outline

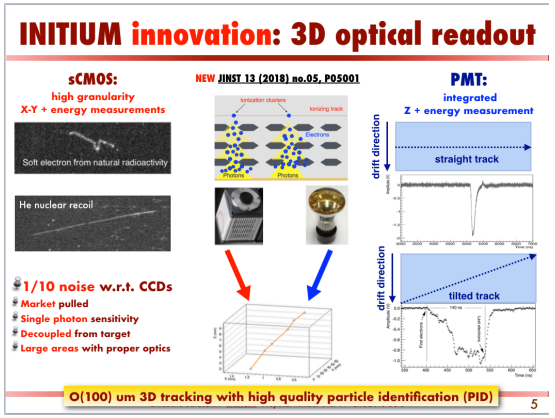
General consideration: try to to keep it simple and minimalistic, but don't deny your usual style
Always remember: you need to feel comfortable

1. Cover

Try to stand out, while keeping it simple and still related to the project

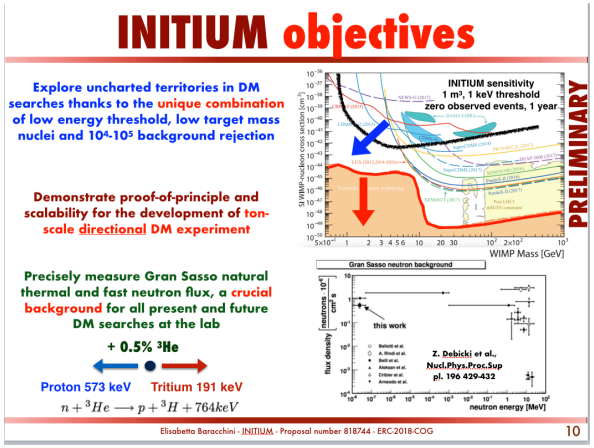


1-2 slides to introduce the subject



1-3 slides to illustrate project innovations & methodology

1-3 slides to illustrate your groundwork on the subject



1-2 slides of objectives and expected results

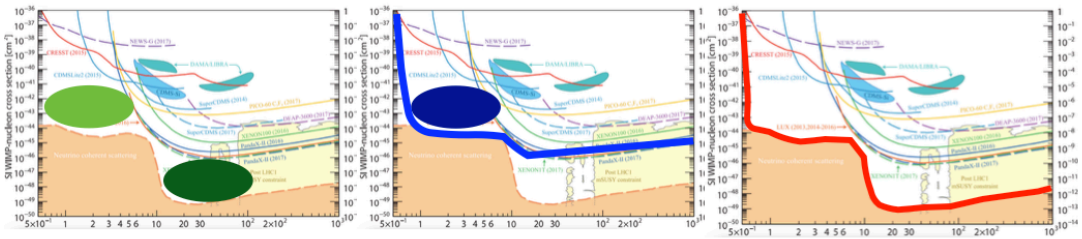
1-2 slides about your CV, the chosen team, HI and budget

The final slides: my personal suggestion

Key point: the final slide is what will stay up on the screen during the questions

Key point: you need to impress them, sell yourself & the project and be daring

Direct DM search future



DM is observed: only a directional experiment can perform DM astronomy

Incompatible results: only a directional experiment can test the galactic origin of the observed signal

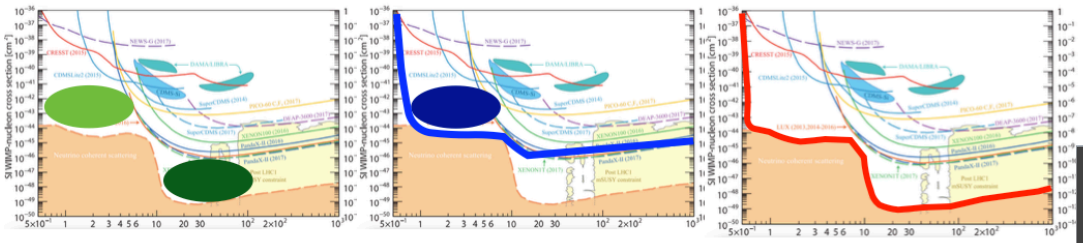
DM is excluded to the Neutrino Floor: only a directional experiment can continue DM searches and study neutrinos

The final slides: my personal suggestion

Key point: the final slide is what will stay up on the screen during the questions

Key point: you need to impress them, sell yourself & the project and be daring

Direct DM search future



DM is observed: only a directional experiment can perform DM astronomy

Incompatible results: only a directional experiment can test the galactic origin of the observed signal

DM is excluded to the Neutrino Floor: only a directional experiment can continue DM searches and study neutrinos

The interview: questions

- General advice: try to answer to the question with 2-3 single sentences that go right to the point. If they want additional details, they will ask.
- Show confidence, with the proper humility. You don't need an answer for everything, but you need to look like you are capable with dealing with anything.
- Expect to get a lot of questions on feasibility
- Expect questions about competitiveness
- Expect questions about your appropriateness as PI

A couple of months after…the results & feedback

EVALUATION CRITERIA

1. Research Project

Ground-breaking nature and potential impact of the research project

To what extent does the proposed research address important challenges?
To what extent are the objectives ambitious and beyond the state of the art (e.g. novel concepts and approaches or development across disciplines)?
To what extent is the proposed research high risk/high gain?

Scientific Approach

To what extent is the outlined scientific approach feasible bearing in mind the extent that the proposed research is high risk/high gain (based on the Extended Synopsis)?
To what extent is the proposed research methodology appropriate to achieve the goals of the project (based on the full Scientific Proposal)?
To what extent does the proposal involve the development of novel methodology (based on the full Scientific Proposal)?
To what extent are the proposed timescales and resources necessary and properly justified (based on the full Scientific Proposal)?

2. Principal Investigator

Intellectual capacity, creativity and commitment:

For each of the statements below, reviewers were asked to choose one of the following four responses: Outstanding / Excellent / Very good / Non-competitive

To what extent has the PI demonstrated the ability to propose and conduct ground-breaking research?
To what extent does the PI provide evidence of creative independent thinking?
To what extent have the achievements of the PI typically gone beyond the state of the art?
To what extent does the PI demonstrate the level of commitment to the project necessary for its execution and the willingness to devote a significant amount of time to the project (min 50% of the total working time on it and min 50% in an EU Member State or Associated Country) (based on the full Scientific Proposal)?

Typical reasons for rejection

From D. Krasa, ERCEA

Research Project

- **Scope**: Too narrow ←→ too broad/unfocussed
- Incremental research
- Collaborative project, **several PIs**
- **Work plan** not detailed enough/unclear
- Insufficient **risk** management

Principle Investigator (PI)

- Insufficient **track-record**
- Insufficient (potential for) **independence**

Before Redressing: see what you could you have done/explained/ presented better before blaming the process!

- Diverting scientific opinion is not a motivation for redress
- An obvious mistake however might result in a re-evaluation

Some encouragement: success rates from re-applicants are typically 1,5 times higher...

My StG-2015: NICE

Call reference	ERC-STG-2015
Activity	ERC-STG
Funding scheme	ERC Starting Grant
Panel name	PE2-Fundamental Constituents of Matter
Title	NICE: a Negative Ion Chamber Experiment for very rare events searches

I got to the interview (step 2) already at my first attempt: a big satisfaction!

PANEL SCORE AND RANKING RANGE

Final panel score :	A (fully meets the ERC's excellence criterion and is recommended for funding if sufficient funds are available)	**Ranking range *:**	54%-56%

I won …but I lost: project fully met ERC criteria, but not funded due to ranking

The panel appreciates the scientific goals and potential impacts of this proposal.

The panel acknowledges that the PI gave a very clear presentation of her research project and its scientific approach. In particular, she described the designing details of the NICE detector for the direct dark matter search and the neutrinoless double-beta decay search in a parallel way, to show their similarities and differences. She answered most of the questions properly, demonstrating her strong ability and good expertise in experimental particle physics.

After very careful evaluation and discussions, the panel's main concerns regarding the feasibility of this project are summarized as follows:

- **Feasibility of the proposed approach**
- **Scalability to large detector volumes**
- **Control of radioactivity**
- **Experience of the PI in DM and low radioactivity detectors**

The panel therefore considers the proposal of high quality and fundable; however it is not in a sufficiently high position in the ranking order to be retained for funding.

From StG-2015 to my StG-2016

Profit from the comments and feedback you receive to improve your project ad your CV!

experienced in the fields of dark matter and double beta decay searches, and in ultra-low background detectors, that have somewhat different requirements. This becomes evident when reading the proposal, since no realistic detector description and requirements (light and charge yields, and correspondingly energy thresholds, gains, low-radioactivity materials, uniform drift field, electrodes etc) are provided. This might however also provide an advantage for the proposed research, as open-minded research experience from a closely related field could be successfully applied to the exciting field of dark matter and double beta searches.

- **Feasibility of the proposed approach**
- **Scalability to large detector volumes**
- **Control of radioactivity**
- **Experience of the PI in DM and low radioactivity detectors**

All true concerns…
remember, this was before I got my MSCA IF

I did my homework

- **I significantly improved the project, providing estimates of expected parameters**
- **I clarified the control of radioactivity**
- **I improved the costs estimate**
- **I significantly improved by CV in terms of activities related to DM:**
  - ***I got the MSCA Individual Fellowship for DM detector development***
  - **New papers**
  - **New collaborations**

My StG-2016: NICE again

Call reference	ERC-2016-STG
Activity	ERC-STG
Funding scheme	ERC-2016-STG
Title	NICE: a Negative Ion Chamber Experiment for very rare events searches

Rememberer: I did not had restrictions because I got "A"

PANEL SCORE AND RANKING RANGE

Final panel score :	B (is of high quality but not sufficient to pass to Step 2 of the evaluation. Please note that you may also be subject to resubmission limitations in the next call.)	Ranking range*: 34%-43%

Same project that got "A" the year before, but better written ad with better CV..

...had significantly different reviews than the previous year..

The proposed project is interesting and timely, but it seems to be mainly a continuation of what the applicant is already doing at the moment. It is unclear to what extent the concepts are really novel and innovative.

The PI is experienced in many areas, but to-date her experience in detector development remains to be demonstrated.

The proposal is well written, but lacks the necessary details to judge the probability of success.

On the other hand, the panel felt that the PI failed to address key technical challenges which will surely impact the proposed workplan. The feasibility of the overall workplan was found difficult to assess given the lack of milestones and schedule.

My CoG 2018: INITIUM

Call reference	ERC-2018-COG
Activity	Consolidator Grant
Funding scheme	ERC Consolidator Grant
Title	an Innovative Negative Ion TIme projection chamber for Underground dark Matter searches

PANEL SCORE AND RANKING RANGE

Final panel score: A (fully meets the ERC's excellence criterion and is recommended for funding if sufficient funds are available)	**Ranking range*:** 1%-34% For your information, only the top 34% of the proposals evaluated in panel PE2 in Step 2 were funded.

The Panel concluded that the project addresses a highly relevant and topical physics issue, to push frontiers in the search for Dark Matter, with an innovative advance in detection technology. It considers that sensitivity to directional Dark Matter detection is an important feature for the future of the field. The proposed advances in instrumentation with a negative ion drift TPC read out with a system combining gas electron multipliers (GEMs) and optical readout components are considered to be promising also for future very large scale detectors. The Panel is confident that the PI is scientifically and managerially competent to execute the project.

- **A different project, but with some similarities to NICE**
- **An improved CV, with contributions with detector development in DM**
- **A small research team of which I was already Scientific Advisor working on R&D on the subject since 2016**

Never give up, never surrender!!

...and if you can't appreciate this quote, watch the movie "Galaxy Quest" :)