

The Particles team

Assessment and recommendations from Tourniquet and HCERES

Giovanni Marchiori
on behalf of the Particles group

Biennale du laboratoire APC
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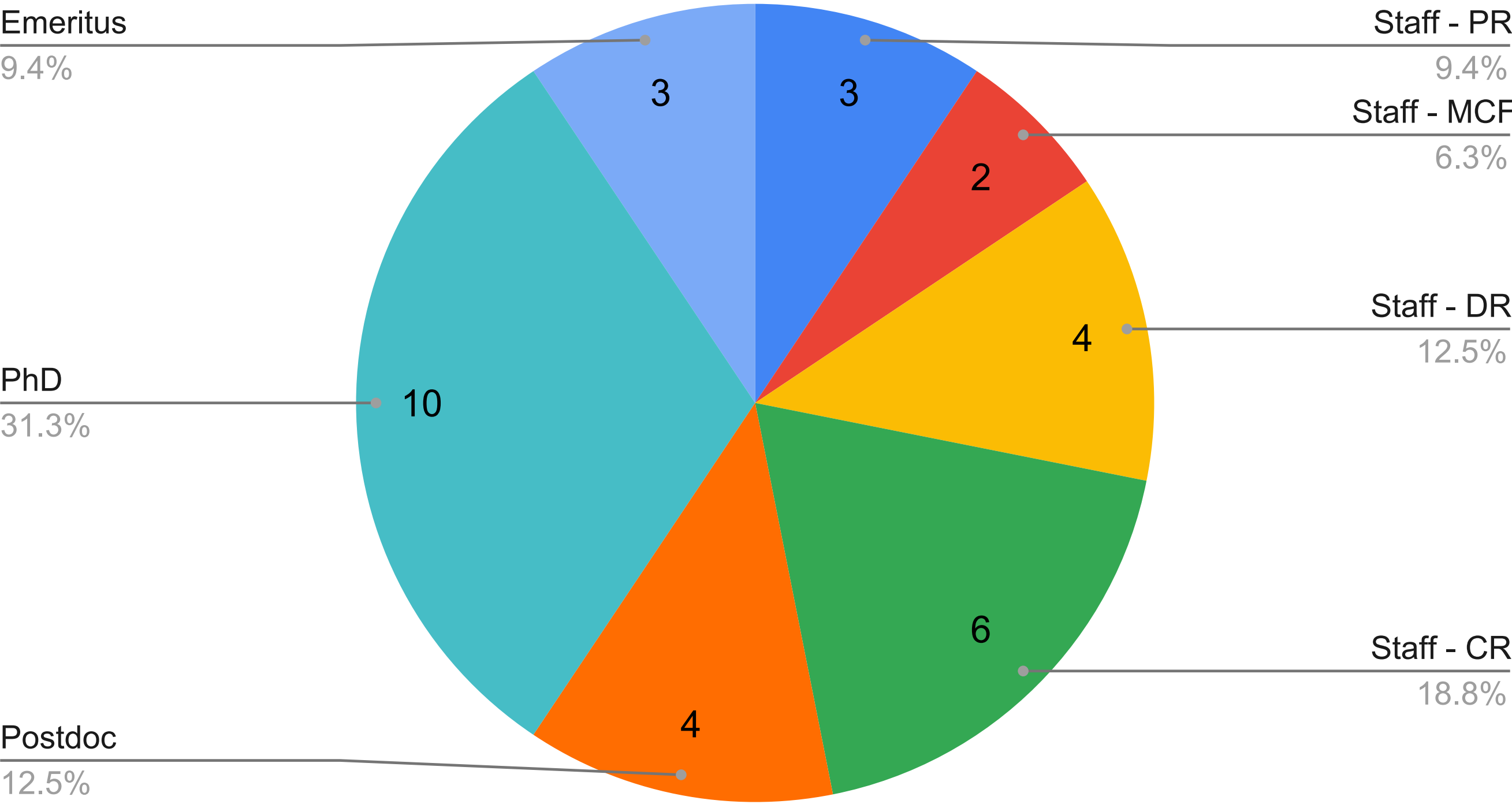
**NUCLÉAIRE
& PARTICULES**

The Particles team - who

Name	Surname	Project	Position
Gregorio	Bernardi	HIGGS	Staff - DR
Marco	Bomben	HIGGS	Staff - MCF
Ariel	Coehn	DUNE	PhD
Joao	Coelho	ORCA	Staff - CR
Michel	Cribier	OTHER	Emeritus
Jaime	Dawson	DUNE	Staff - CR
Sonia	El Hedri	ORCA	Staff - CR
Davide	Franco	DARKSIDE	Staff - DR
Matteo	Galli	DUNE	PhD
Isabel	Goos	ORCA	Postdoc
Pierre	Granger	DUNE	Postdoc
Timothee	Hessel	DARKSIDE	PhD
I Cheong	Hong	DUNE	PhD
Antoine	Kouchner	ORCA	Staff - PR
Thierry	Lasserre	DUNE	Staff - CR
Tong	Li	HIGGS	Postdoc
Alexis	Maloizel	HIGGS	PhD
Giovanni	Marchiori	HIGGS	Staff - CR
Camelia	Mironov	DUNE	Staff - DR
Keerthi	Nakkalil	HIGGS	PhD
Evangelia	Nikoloudaki	DARKSIDE	PhD
Thomas	Patzak	DUNE	Staff - PR
Santiago	Pena Martinez	ORCA	PhD
Sabrina	Sacerdoti	DUNE	Staff - CR
Qiuping	Shen	HIGGS	PhD
Camille	Sironneau	DUNE	PhD
Alessandra	Tonazzo	DUNE	Staff - PR
Benjamin	Trocme	ORCA	Staff - DR
Véronique	Van Elewyck	ORCA	Staff - MCF
Francois	Vannucci	OTHER	Emeritus
Henrique	Vieira De Souza	DUNE	Postdoc
Daniel	Vignaud	OTHER	Emeritus

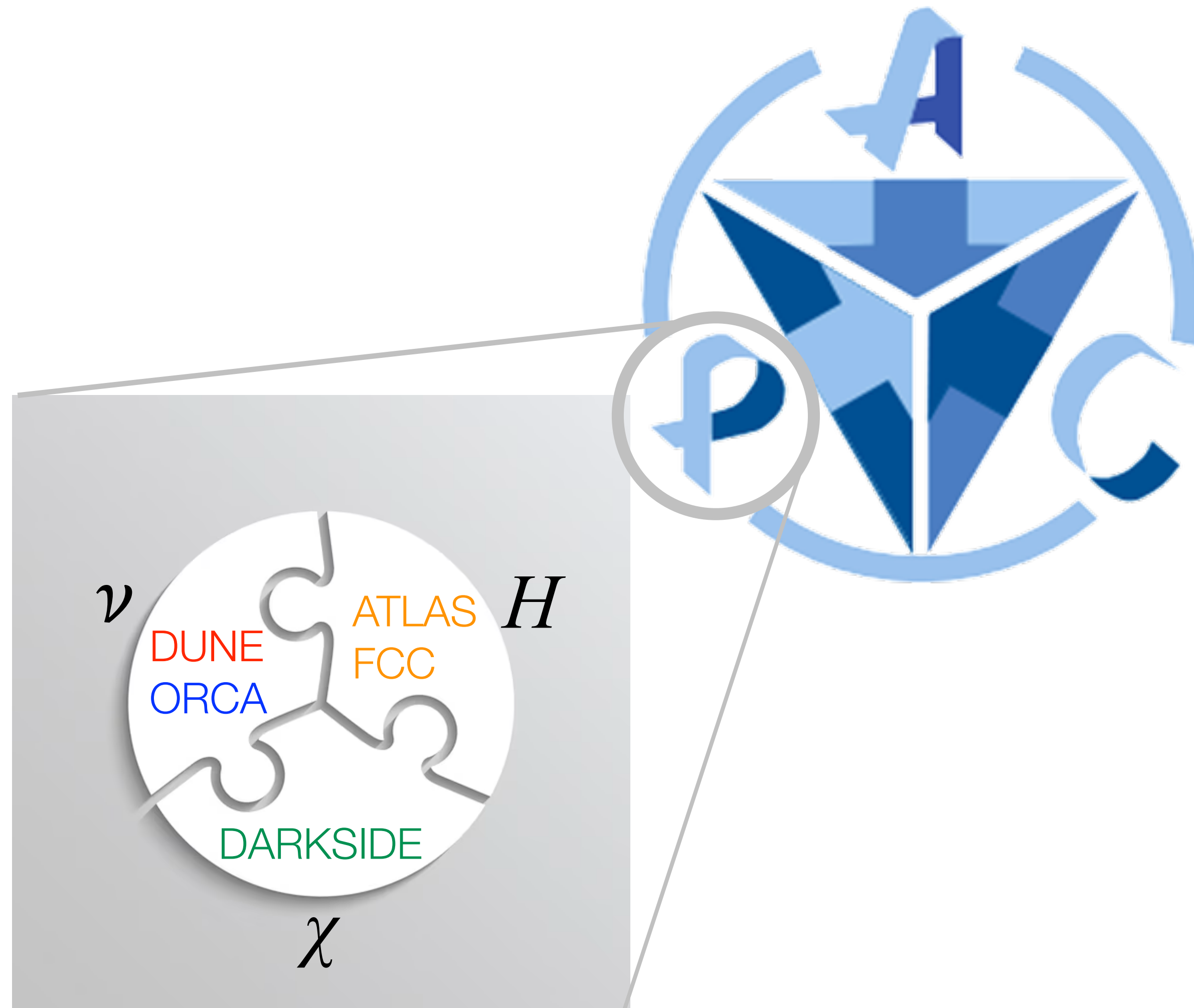
32 members

Position



The Particles team - what

*3 main axes of research at the interface between particle physics and astroparticle physics:
neutrinos, Higgs, and dark matter*



5 international projects/collaborations

Project

OTHER

9.4%

DARKSIDE

9.4%

HIGGS

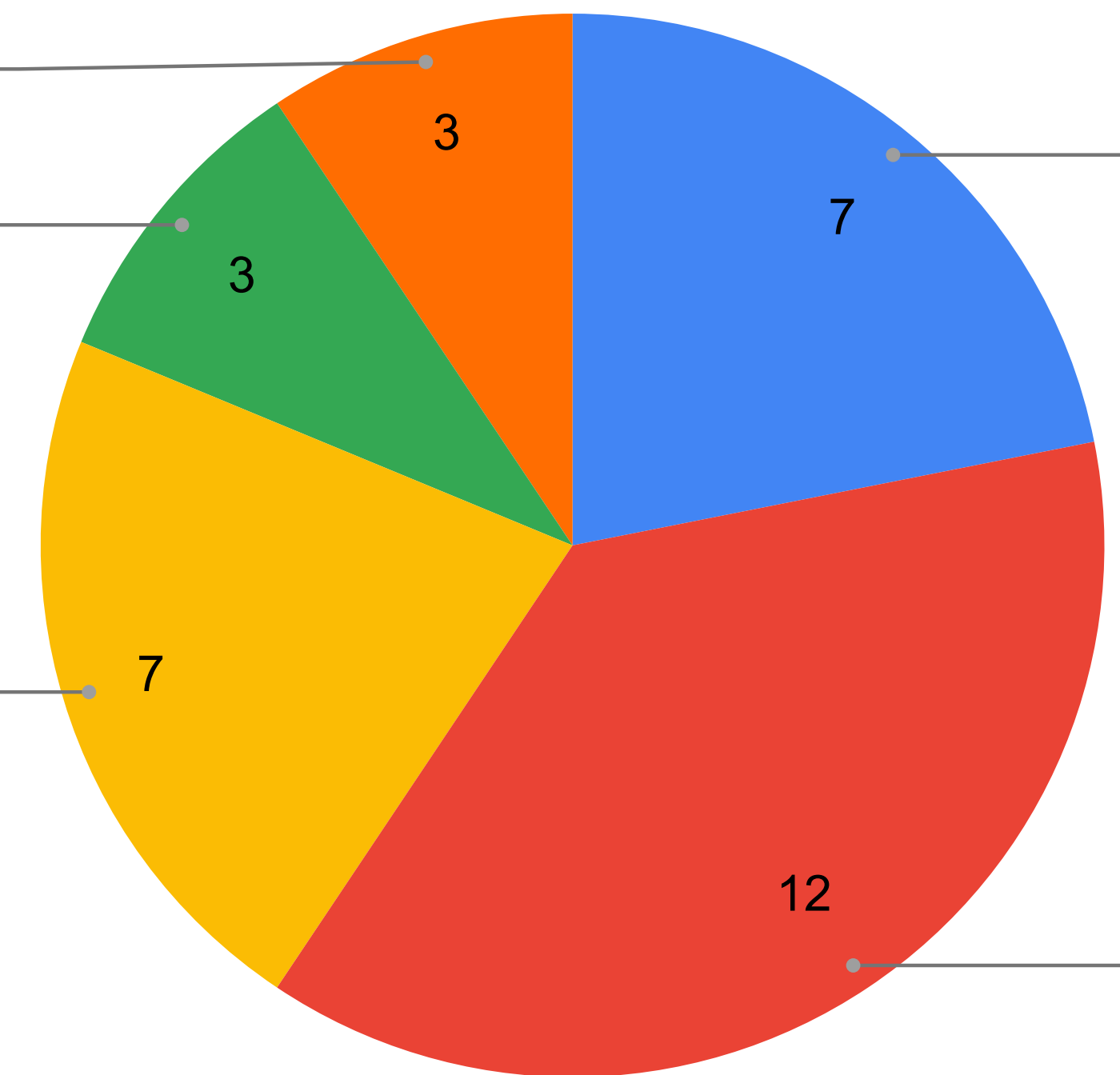
21.9%

ORCA

21.9%

DUNE

37.5%



The Particles team - trajectory

Project	2024	2025	2026	2027	2028	2029	2030
ATLAS	data taking (Run3: 220/fb)		upgrades for HL-LHC		Commissioning	data taking (Run4) HL-LHC target: 3000/fb	
ProtoDUNE-VD	filling	data taking (with beam)					
DARKSIDE	construction			data taking			
ORCA	Construction				data taking		
	Commissioning and data taking						
DUNE	FD-VD construction				FD-VD data taking (w/o beam)		
FCC	Feasibility study, R&D		R&D, TDR preparation, collaboration building, project approval				

Tourniquet and HCERES assessment

- Overall assessments from Tourniquet and HCERES are very positive, with only few recommendations
- Assessment in a nutshell
 - *“Previous recommendations were generally well implemented”*
 - *“The team has a very high visibility because of the quality of the work it does and the responsibilities it takes on in the experiments in which the team members are involved”*
 - *“The team has grown significantly [...] which gives the dynamism needed to successfully complete its projects”*
 - *“The arrival of a new group [...] opens a new research theme [that] may lead to interesting developments”*
- Recommendations:
 - None from Tourniquet
 - 4 (3?) from HCERES

Strengthen the DarkSide team with human resources in line with the quality of the important work carried out by this group.

Ensure scientific coherence and communication between the ATLAS/FCC group and the other projects of the 'Particle' team.

Maintain a high level of activity and expertise in the field of materials. → CRYOMAT?

Create internal links with the theory and cosmology teams.



Tourniquet and HCERES reports - strengths

1. Scientific output and responsibilities



- Tourniquet:
 - “*Previous involvements in neutrino experiments have ended with **important scientific results***”
 - “*All subgroups have been given **significant responsibilities**, [providing] **excellent visibility in world-class projects***”
- HCERES:
 - “*The team has a **very high visibility** because of the **quality of the work** it does and the **responsibilities** it takes on in the experiments in which the team members are involved. [...] All the experiments [...] have very high visibility and international support. [...] The work carried out in these experiments, in terms of hardware or analysis and simulations, is **highly recognised***”
- In terms of scientific responsibilities in the projects, the team continues to be strong - just a few recent highlights here:
 - Pierre has been recently appointed as coordinator of the DUNE analysis on atmospheric neutrinos
 - Alessandra is analysis coordinator for DUNE-France
 - APC DUNE team in charge of coordination, installation, data taking of cold-box tests @CERN of photon detection system
 - Gregorio is chair of FCC International Forum of Nations contacts & coordinator of FCC-France master project
 - Giovanni recently appointed convener of full-simulation working group of FCC-ee detector project “ALLEGRO”
 - Joao is convener of the KM3Net neutrino oscillation working group
 - Davide responsible of DS-20k Offline

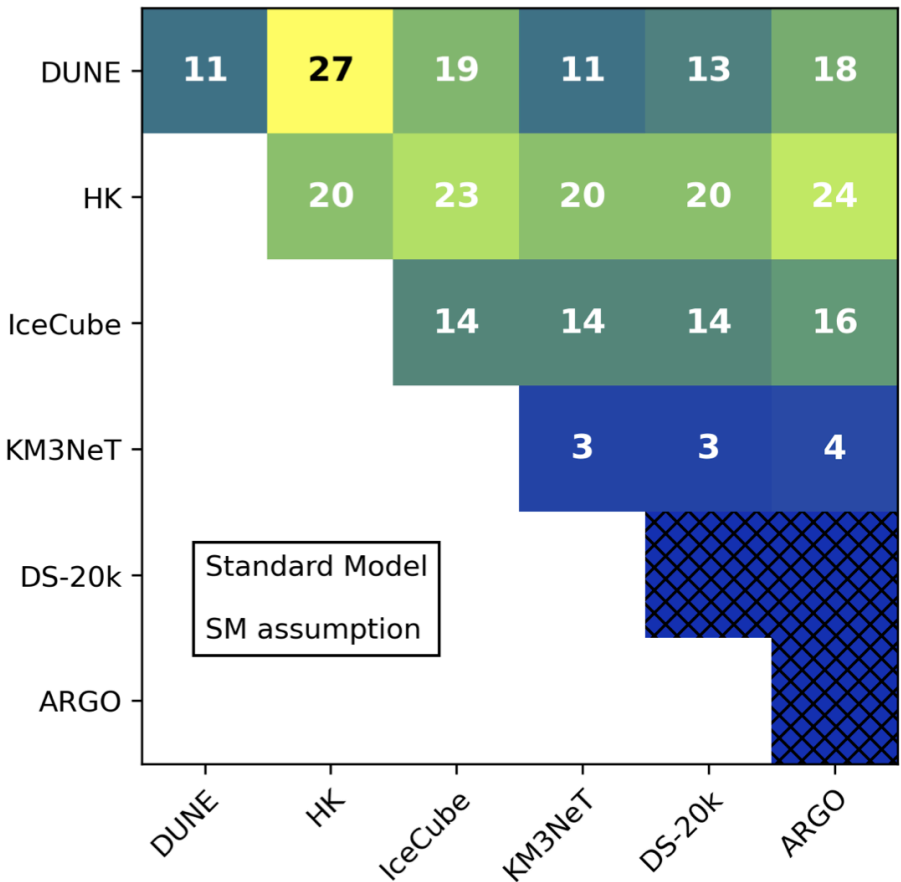
Tourniquet and HCERES reports - strengths

1. Scientific output and responsibilities

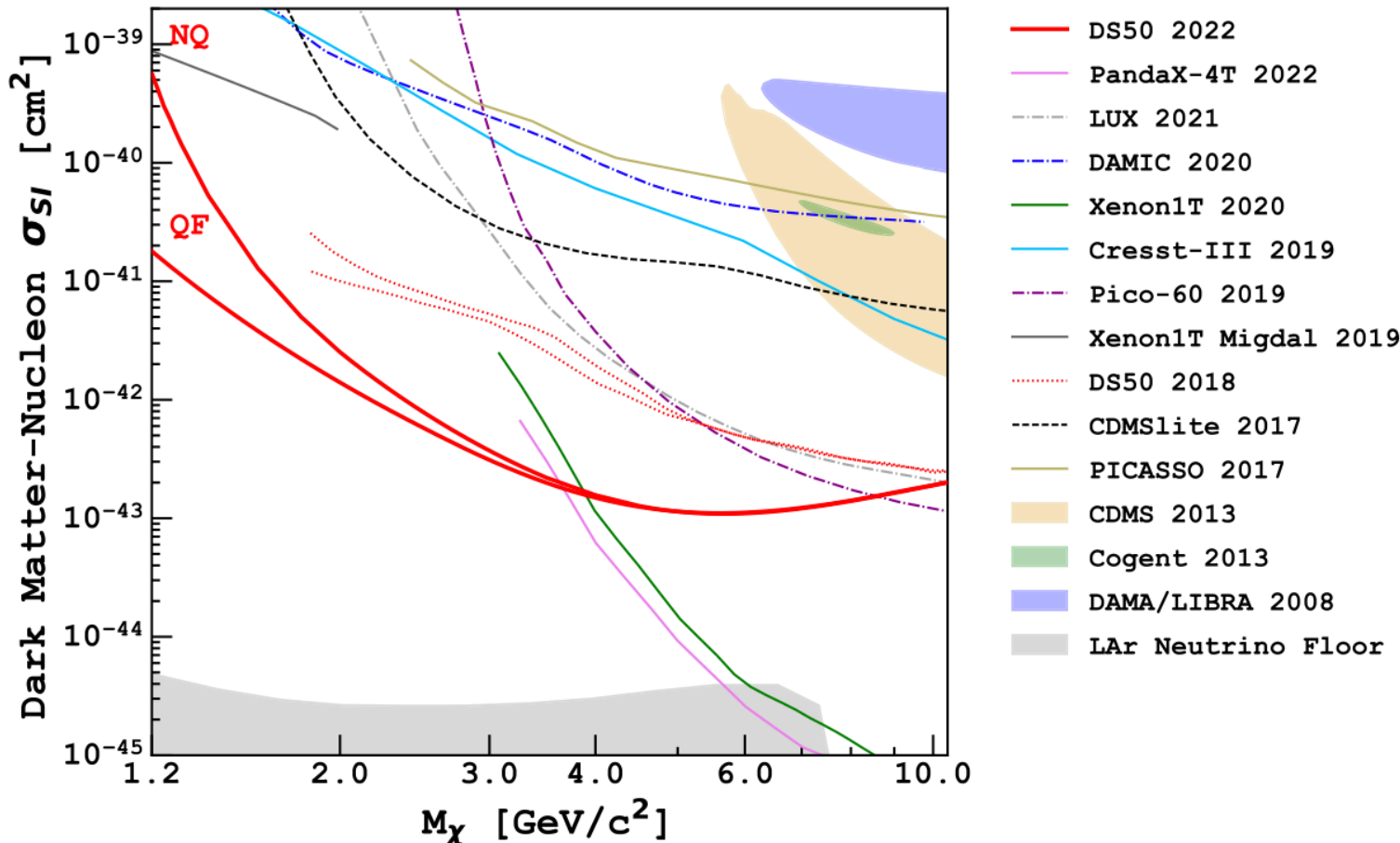
- Tourniquet:
 - “Previous involvements in neutrino experiments have ended with **important scientific results**”
 - “All subgroups have been given **significant responsibilities**, [providing] **excellent visibility in world-class projects**”
- HCERES:
 - “The team has a **very high visibility** because of the **quality of the work** it does and the **responsibilities** it takes on in the experiments in which the team members are involved. [...] All the experiments [...] have very high visibility and international support. [...] The work carried out in these experiments, in terms of hardware or analysis and simulations, is **highly recognised**”
- Scientific output from the team also keeps flowing steadily with high-impact results:



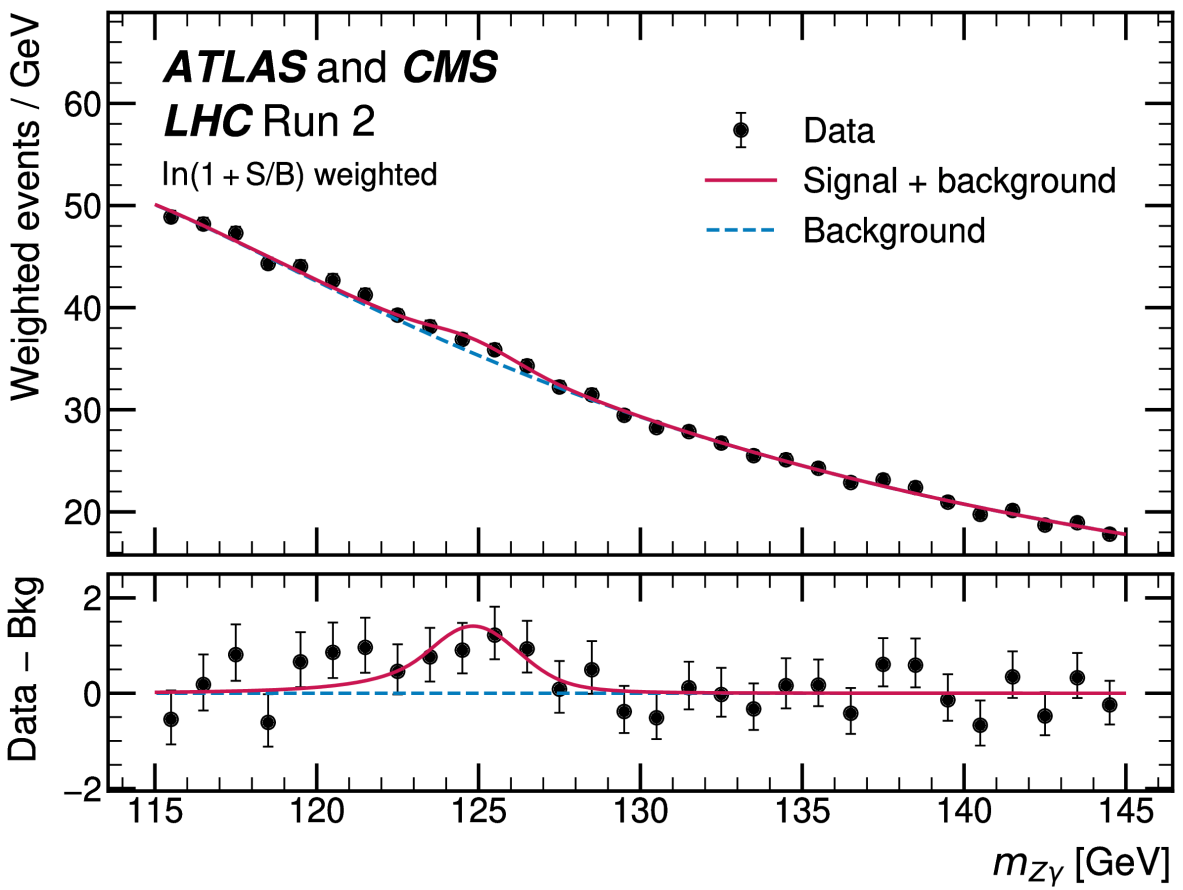
ORCA/DUNE/DS: prospects for real-time characterisation of core-collapse SN and neutrino properties, [JCAP02\(2024\)008](#)



DARKSIDE: world's best limits on low-mass DM - [PRL130, 101002 \(2023\)](#)



ATLAS: 1st evidence of H->Z+gamma - [PRL132, 021803 \(2024\)](#)

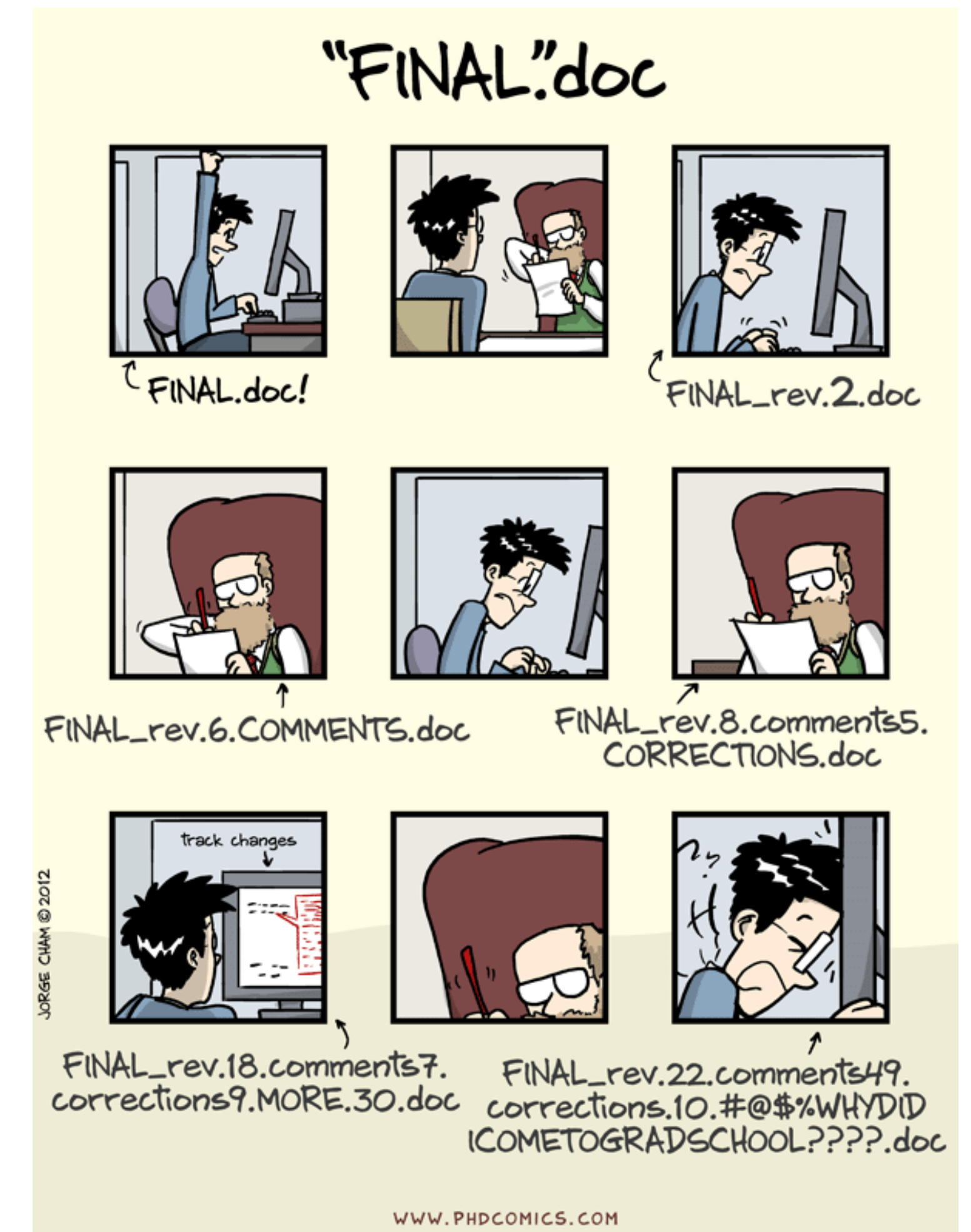


Tourniquet and HCERES reports - strengths

2. PhD thesis supervision



- Tourniquet: *"Doctoral supervision is very active with 13 theses defended since the previous visit"*
- The trend continues:
 - **4** theses defended end of **2023** (Ang, Meriem, Yulei) - beginning of 2024 (Théo)
 - **4** defences expected in fall **2024** (Ariel, Keerthi, Qiuping, Timothée)
 - **2** defences expected in **2025** (Camille, Santiago)
 - **4** defences expected in **2026** (Alexis, Evi, I Cheong, Matteo)
 - + 5 new PhD subjects proposed for fall 2024, 2 already financed (ANR, cotutelle)



Tourniquet and HCERES reports - strengths

3. Organisation of events / management of research / academic roles

- HCERES:
 - *"Several members play an important role in organising events, hold important positions on scientific and advisory committees and are actively involved in management of the university"*
- Once more, the Particles team keeps rocking also on this point, just a few examples:
 - Antoine is Vice-President in charge of International Relations @ U. Paris Cité, deputy chair of APPEC General Assembly
 - Thomas is Vice President in charge of IT @ U. Paris Cité
 - Giovanni co-convener of ongoing ECFA study on future e+e- electroweak/top/Higgs factories, towards next update of the European Strategy on Particle Physics (2025—2026)
 - Higgs team is organising the final workshop of the ECFA study on future factories (Oct. 2024), and will organise the LHC Physics conference (300–400 participants) in 2026
 - ORCA team organised KM3Net international collaboration meeting in Oct. 2023
 - Alessandra is organising École de Gif 2024 on multimessenger astronomy @APC in Sept. 2024



Tourniquet and HCERES reports - weaknesses/recommendations

1. Size of some teams

- Tourniquet (remarks)
 - *“The small size of the [Higgs] subgroup compared to other ATLAS groups in France is a singularity, partially compensated by significant non-permanent support (currently 5 doctoral students, 1 post-doc)”*
 - HCERES:
 - *"Despite the quality of the work the DarkSide team is still very small [..]. To be productive, these groups depend strongly on the possibility of obtaining funding for postdocs"*
 - *Recommendation #1: "Strengthen the DarkSide team with human resources in line with the quality of the important work carried out by this group"*
- ➡ Not all ATLAS groups in France are big flagships - there are also smaller teams (Toulouse, Grenoble, Clermont) that were similar in size to ours, and have been recently reinforced by IN2P3 (CR, chaires) and University chaires
- ➡ The priorities indicated by our group for future recruitments at University and CNRS are indeed for the two smallest teams, Darkside (MCF) and Higgs (CR)
- ➡ While waiting for these requests to be endorsed, we do our best with our own forces + non-permanent staff recruited also via alternative sources of funding — e.g. ANR (X-Art: one post-doc and one PhD student to be recruited later this year)

Tourniquet and HCERES reports - weaknesses/recommendations

2. Access to the lab technical resources

- Tourniquet (remarks)
 - *“Another singularity [of the Higgs group] is the initial agreement that access to the technical services of the laboratory is not a priority, imposing if necessary the use of the technical services of other laboratories such as the LPNHE”*
 - HCERES (weaknesses)
 - *“The [Higgs] group has to be aware that any new technical developments have to fit into a fairly tight technical workload”*
- ➡ the agreement mentioned in the Tourniquet concerns involvement of the lab in big productions. For this reason, after the Tourniquet’s visit, the Higgs group - in agreement with the other ATLAS IN2P3 groups - has stopped contributing to the ITk assembly activity in LPNHE and started focus on ITk software development that can be done in-house without technical resources.
- ➡ for what concerns future projects, the Higgs group is focusing on small R&D on the hardware side (e.g. on CMOS sensors) — for which BTW it has been allocated some technical resources from the lab — and on software aspects (e.g. full simulation of FCC-ee detectors) that can be done by the physicists of the team.
- ➡ For more technical developments the Higgs group — and more broadly the Particles team — is also searching for alternative sources of funding of technical personnel (e.g. ANR calls) as a way to alleviate the need to “fit into a fairly tight technical workload”

Tourniquet and HCERES reports - weaknesses/recommendations

3. Timescale of some projects

- HCERES (weaknesses)
 - *“Some projects such as DUNE, and in particular the highly speculative FCC, are on a very long timescale”*
- ➡ The more sophisticated the questions about Nature we ask ourselves and the problems we have to solve, the more complex are the detector to search for the answers — this is not particularly specific to the Particles team.

These require a long time for planning / design / building / operation. Not embarking on such projects due to their long timescale would be a lack of foresight and would leave future generations without ambitious scientific projects
- ➡ DUNE is already being built, with a significant already been made: the underground laboratories for the Far Detectors have been dug out and are currently being cleaned, and the FD-HD detector components are being built.
- ➡ About the potential impact on students and postdocs working on such long-term projects, a good thing for e.g. FCC is that the students and post-docs in the team can also work in parallel on an ongoing experiment (ATLAS) and thus learn through analysis of real data and operation of a detector already assembled (see also example of LEP and LHC).
- ➡ DUNE and Darkside (but also LHC experiments in the 1st decade of this century) also demonstrate(d) that there's a lot to learn for the young generation (and plenty of publication opportunities) also from preparing a future experiment (beam tests and prototypes also foreseen for FCC)

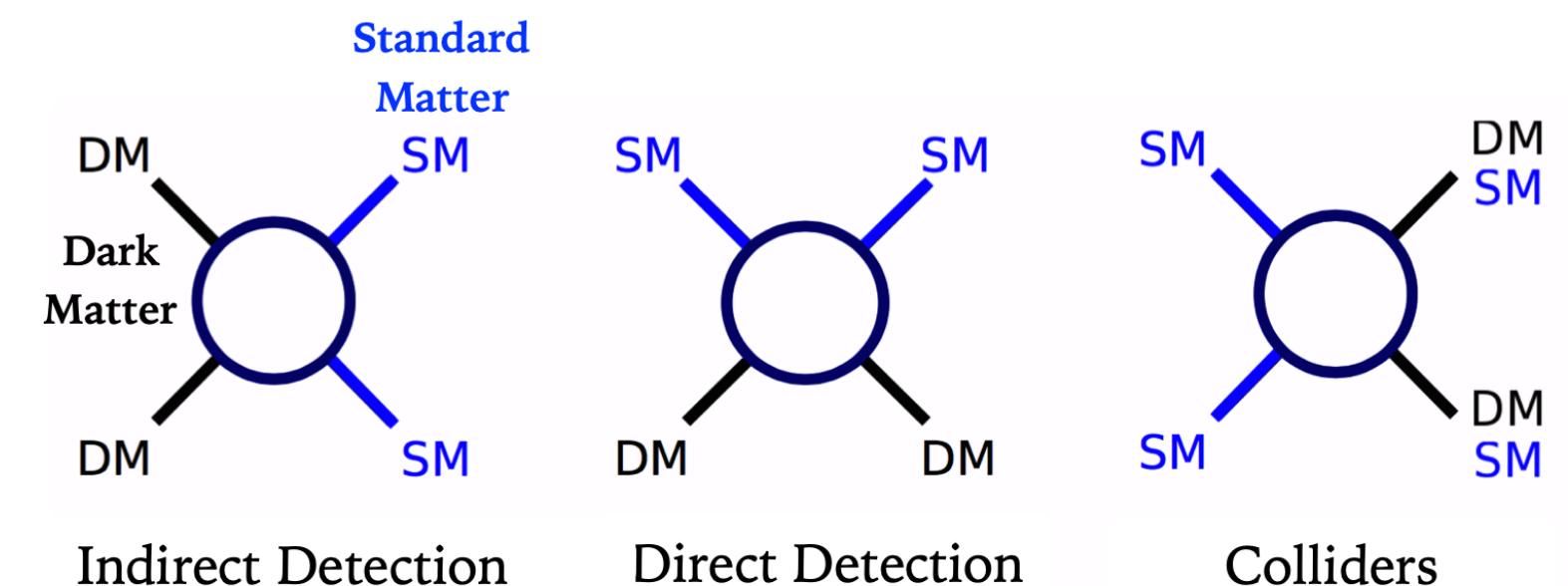
Tourniquet and HCERES reports - weaknesses/recommendations

4. Internal coherence of the team

- HCERES

- *“The entry of the ATLAS/FCC group raises questions about the coherence and possible synergy in the future between the two main axes of the team, accelerator and non-accelerator particle physics”*
- *Recommendation #2: “Ensure scientific coherence and communication between the ATLAS/FCC group and the other projects of the 'Particle' team”*

- ➔ In terms of **communication**, regular & quite frequent group meetings (every 1.5 months) with slides on highlights from each project + more in-depth presentation on a rotation basis goes in the right direction (4 meetings between March and July = the same number as we had in whole 2023, which was already a 2x improvement wrt 2022 and 2021)
- ➔ There are/can be **synergies** to be explored/being explored on **tools** (statistical and ML techniques) / **R&D** (ANR X-art, CMOS) / large **collaboration building&running experience** (open data handling, committees, ..) / joint **organisation of events** (masterclass, outreach, ..)
 - ➔ Can e.g. replace for some of our meetings the talk after the round table of the projects with a “topical” cross-project discussion e.g. on the statistical tools used
- ➔ Possible (obvious) **scientific complementarity**: with more person power the team could also search for dark matter search at colliders (e.g. within the framework of the future InIdEx)



Tourniquet and HCERES reports - weaknesses/recommendations

5. Links with other APC teams

- HCERES

- Recommendation #4: *“Create internal links with the theory and cosmology teams”*

- ➡ There's of course a certain complementarity in terms of big scientific questions that we try to address with those from other APC teams, e.g. on dark matter and neutrinos (direct searches vs constraints from cosmology) as already identified in the past, but also on other directions such as the inflation (does the Higgs, or some other elementary scalar possibly discovered in the future at colliders, play a role in it?) and the electroweak phase transition (whose signatures can be searched for in Higgs self-interactions, but also in primordial gravitational waves)
- ➡ At the same time, experimental techniques are drastically different - and the information we're looking for rather complementary
- ➡ Links with other groups might be established in the form of joint seminars / journal clubs / ... on cross-team topics, potentially with guidance/input from the theory group, and after initial joint brainstorming among different teams

Conclusion

- Overall assessment from Tourniquet and HCERES was very positive; a very limited set of recommendations was provided
 - No recommendation from Tourniquet; 4 recommendations from HCERES, but 1 was probably there by mistake
- We have started to think on how to work on and implement the recommendations from HCERES for next review in ~4 years
 - Some of them are not really under our own control, as the recruitment strategies of the University and CNRS depend on the lab priorities and on those set by the tutelles
 - Some other - eg establishing connections with the Cosmology and Theory groups - require a joint effort with those two groups, and some time to sit together and take stock of the various activities in the different groups, possible intersections and common interests, and how to move forward.
- In my opinion, however, we should not forget that the assessments were very positive due to how well we score in our core business: scientific results in our projects, scientific responsibilities, management of research and academic roles (..)
 - We should thus continue having those criteria as our guiding light and continue delivering as well as we did in the past