

# General Meeting

10 Oct 2024

# News

---



- Collaboration meeting is going to be held in Cagli on the 27-29 November;
- Meeting will start on the 27<sup>th</sup> in the afternoon and closes at noon 29<sup>th</sup>;
- Most of people will move from Roma by car in the morning of the 27<sup>th</sup> (~9AM) and will be back in the evening of the 29<sup>th</sup> (~17PM);
- We arranging to share cars and give a ride to whoever would need;
- Francesco R. is taking care of booking hotel rooms. Please register asap!

# News

---

- The [ELY paper](#) was officially accepted for publication by EPJ C;
- Many thanks to Giorgio for drafting and editing it

## Enhancing the light yield of He:CF<sub>4</sub> based gaseous detector

Fernando Domingues Amaro<sup>1</sup>, Rita Antonietti<sup>2,3</sup>, Elisabetta Baracchini<sup>4,5</sup>, Luigi Benussi<sup>6</sup>, Stefano Bianco<sup>6</sup>, Roberto Campagnola<sup>6</sup>, Cesidio Capocchia<sup>6</sup>, Michele Caponero<sup>6,7</sup>, Danilo Santos Cardoso<sup>8</sup>, Luan Gomes Mattosinhos de Carvalho<sup>9</sup>, Gianluca Cavoto<sup>10,11</sup>, Igor Abritta Costa<sup>6</sup>, Antonio Croce<sup>6</sup>, Emiliano Dané<sup>6</sup>, Giorgio Dho<sup>4,6,a</sup>, Flaminia Di Giambattista<sup>4,5</sup>, Emanuele Di Marco<sup>11</sup>, Melba D'Astolfo<sup>4,5</sup>, Giulia D'Imperio<sup>11</sup>, Davide Fiorina<sup>4,5</sup>, Francesco Iacoangeli<sup>11</sup>, Zahoor ul Islam<sup>4,5</sup>, Herman Pessoa Lima Júnior<sup>4,8</sup>, Ernesto Kemp<sup>4,12</sup>, Giovanni Maccarrone<sup>6</sup>, Rui Daniel Passos Mano<sup>1</sup>, Robert Renz Marcelo Gregorio<sup>13</sup>, David José Gaspar Marques<sup>4,5</sup>, Giovanni Mazzitelli<sup>6</sup>, Alasdair Gregor McLean<sup>13</sup>, Andrea Messina<sup>10,11</sup>, Pietro Meloni<sup>2,3</sup>, Cristina Maria Bernardes Monteiro<sup>1</sup>, Rafael Antunes Nobrega<sup>9</sup>, Igor Fonseca Pains<sup>9</sup>, Emiliano Paoletti<sup>6</sup>, Luciano Passamonti<sup>6</sup>, Fabrizio Petrucci<sup>2,3</sup>, Stefano Piacentini<sup>4,5</sup>, Davide Piccolo<sup>6</sup>, Daniele Pierluigi<sup>6</sup>, Davide Pinci<sup>11</sup>, Atul Prajapati<sup>4,5</sup>, Francesco Renga<sup>11</sup>, Rita Joanna da Cruz Roque<sup>1</sup>, Filippo Rosatelli<sup>6</sup>, Alessandro Russo<sup>6</sup>, Joaquim Marques Ferreira dos Santos<sup>1</sup>, Giovanna Saviano<sup>6,14</sup>, Pedro Alberto Oliveira Costa Silva<sup>1</sup>, Neil John Curwen Spooner<sup>13</sup>, Roberto Tesauero<sup>6</sup>, Sandro Tomassini<sup>6</sup>, Samuele Torelli<sup>4,5</sup>

<sup>1</sup>LIBPhys; Department of Physics; University of Coimbra; 3004-516 Coimbra; Portugal

<sup>2</sup>Dipartimento di Matematica e Fisica; Università Roma TRE; 00146; Roma; Italy

<sup>3</sup>Istituto Nazionale di Fisica Nucleare; Sezione di Roma Tre; 00146; Rome; Italy

<sup>4</sup>Gran Sasso Science Institute; 67100; L'Aquila; Italy

<sup>5</sup>Istituto Nazionale di Fisica Nucleare; Laboratori Nazionali del Gran Sasso; 67100; Assergi; Italy

<sup>6</sup>Istituto Nazionale di Fisica Nucleare; Laboratori Nazionali di Frascati; 00044; Frascati; Italy

<sup>7</sup>ENEA Centro Ricerche Frascati; 00044; Frascati; Italy

<sup>8</sup>Centro Brasileiro de Pesquisas Físicas; Rio de Janeiro 22290-180; RJ; Brazil

<sup>9</sup>Universidade Federal de Juiz de Fora; Faculdade de Engenharia; 36036-900; Juiz de Fora; MG; Brasil

<sup>10</sup>Dipartimento di Fisica; Sapienza Università di Roma; 00185; Roma; Italy

<sup>11</sup>Istituto Nazionale di Fisica Nucleare; Sezione di Roma; 00185; Rome; Italy

<sup>12</sup>Universidade Estadual de Campinas (UNICAMP); Campinas 13083-859; SP; Brazil

<sup>13</sup>Department of Physics and Astronomy; University of Sheffield; Sheffield; S3 7RH; UK

<sup>14</sup>Dipartimento di Ingegneria Chimica; Materiali e Ambiente; Sapienza Università di Roma; 00185; Roma; Italy

Internal v1: 2024-05-13

**Abstract** The CYGNO experiment aims to build a large ( $\mathcal{O}(10) \text{ m}^3$ ) directional detector for rare event searches, such as nuclear recoils (NRs) induced by dark matter (DM), such as weakly interactive massive particles (WIMPs). The detector concept comprises a time projection chamber (TPC), filled with a He:CF<sub>4</sub> 60/40 scintillating gas mixture at room temperature and atmospheric pressure, equipped with an amplification stage made of a stack of three gas electron multipliers (GEMs) which are coupled to an optical readout. The latter consists in scientific CMOS (sCMOS) cameras and photomultiplier tubes (PMTs). The maximisation of the light yield of the amplification stage plays

a major role in the determination of the energy threshold of the experiment. In this paper, we simulate the effect of the addition of a strong electric field below the last GEM plane on the GEM field structure and we experimentally test it by means of a 10×10 cm<sup>2</sup> readout area prototype. The experimental measurements analyse stacks of different GEMs and helium concentrations in the gas mixture combined with this extra electric field, studying their performances in terms of light yield, energy resolution and intrinsic diffusion. It is found that the use of this additional electric field permits large light yield increases without degrading intrinsic characteristics of the amplification stage with respect to the regular use of GEMs.

<sup>a</sup> Corresponding author: giorgio.dho@lnf.infn.it