

Istituto Nazionale di Fisica Nucleare

CH4rLiE (PRIN PNRR 2022 - P2022FTF7L) General status of the project





EP-DT Detector Technologies Ilaria Vai^{1,2} ¹ Dipartimento di Fisica, Università di Pavia ² INFN Sezione di Pavia



Funded by the European Union NextGenerationEU

CH4rLiE

CH4 Livestock Emission

Goal of the project: The CH4rLiE project aims at developing a prototype for methane emissions capture in a barn environment. ... CH4rLiE ... proposes to act on the methane already produced and diffused in the air, using a specially developed recovery system. The idea arose from the expertise acquired in the Large Hadron Collider experiments at CERN, where "gas recuperation systems" are being developed to extract CF4 and other components from gaseous detectors exhausted gas mixture. ... (project abstract)

Involved units

Università degli Studi di Pavia, Dipartimenti di Fisica e Chimica TL and PI: Ilaria Vai

Istituto Nazionale di Fisica Nucleare TL and vicePI: Linda Finco

Università degli Studi di Torino, Dipartimento di Scienze Agrarie, Forestali e Alimentari TL: Elio Dinuccio

With collaboration from CERN EP-DT group

Project organization

The project is organized in four Working Packages (WPs):

- WP1: Simulation of gas diffusions
- WP2: Monitoring stations preparation and research on adsorption material
- WP3: Preparation, testing and deployment of a prototype for CH4 capture
- WP4: Evaluation of the impact of the project

Funding

Titolo del progetto: CH4 Livestock Emission (CH4rLiE)

Codice del progetto: P2022FTF7L

Settore ERC: PE2

Principal Investigator: Ilaria VAI

Ente di afferenza: Università degli Studi di PAVIA

Contributo MUR / costo totale: 224.787,00 €

Suddivisione dei costi delle Unità

La suddivisione fondi è stata trasmessa il 30/07/2023

N°	Sede dell'Unità	Responsabile Scientifico	Contributo MUR / costo Totale
1	Università degli Studi di PAVIA	Ilaria VAI	125.687,00€
2	Istituto Nazionale di Fisica Nucleare	Linda FINCO	64.563,00€
3	Università degli Studi di TORINO	Elio DINUCCIO	34.537,00 €
Totale			224.787,00€

Timeline proposed ...

<u>Link</u>

54		Year					Fir	st Ye	аг				-				5	Seco	nd Ye	ar			
		Quarter	BIN	W1	BIM	12	BIM3	BIN	14	В	IM5	BI	M 6	BIN	11	BIM2	BI	M3	BI	M4	BIM	5	BIM6
Activity WP1	Description	Month	1	2	3	4	5 6	7	8	9	10	11	12	1	2	3 4	5	6	7	8	9	10	11 12
S1	Implementation of geometry and setup diffusion	environment for one gas																101					
S2	Simulation of diffusion in different atmospheric c	onditions																					
\$3	Combination of diffusion data for CH4, CO2, NO	2									D1-M1												
S4	Evaluation of cattle emissions in different barn v	entilation conditions												-					_	_			
Activity WP2																							
\$5	Preparation, testing and calibration of monitoring	stations. with known gasses							D2														
\$6	Preparation of data-acquisition system																						
\$7	Installation of monitoring stations in the barn					_																	
S8	Monitoring and analysis of data from sensors sta	tions													M2								
\$9	Absorption test on commercially available molec gas group	olar sieves in sinergy with CERN EP-DT																					
S10	Research of new materials for methane absorpti	on and pollutant rejection							_				M 3	2									_
Activity WP3																							
S11	Optimization and production of filters														D3								
S12	Design and implementation of methane capture	prototype																					
S13	Absorption tests in laboratory of methane captur	e prototype																	h	14-D4			
S14	Installation in the barn																						
S15	Monitoring and analysis of data from methane c	apture prototype																					M
Activity WP4																							
S16	Evaluation of the ecological impact due to the pr of methane capture	oduction of waste materials in the phase																					
S17	Evaluation of the impact of the installed equipme	ent on the barn infrastructure																					
S18	Evaluation of the economical aspects for the ma	nagement of the farm																					
S19	Evaluation of the potential reduction of greenhou	ise gases (CH4)																					M

Timeline proposed and revised

Link

				Year					Fir	rst '	<i>lear</i>								Se	con	d Year				
				Quarter	B	IM1	BI	M2	BIM	3	BIM4	L	BIM5	BIN	6	BIM1	1	BIM2	BI	M3	BIM	4	BIM:	BI	M 6
Activity WP1	Description			Month	1	2	3	4	5	6	7 8	3	9 10	11	12	2		3 4	5	6	7	8	9 1	0 11	12
S1	Implementation of geometry	and setup diffusion	environment for one	e gas																					
S2	Simulation of diffusion in diffe	erent atmospheric c	onditions																						
\$3	Combination of diffusion data	a for CH4, CO2, NO	02													D1-N	1								
S4	Evaluation of cattle emission	is in different barn v	entilation conditions	3																					
Activity WP2																									
\$5	Preparation, testing and calil	bration of monitoring	g stations. with know	wn gasses											02										
S 6	Preparation of data-acquisition	on system																							
\$7	Installation of monitoring stat	tions in the barn																							
S 8	Monitoring and analysis of da	ata from sensors sta	ations																	M2					
\$9	Absorption test on commerci gas group	ially available molec	colar sieves in siner	gy with CERN EP-DT																					
S10	Research of new materials for	or methane absorpt	ion and pollutant rej	ection													M	13							
Activity WP3																									
S11	Optimization and production	of filters																	D3						
S12	Design and implementation	of methane capture	prototype																						
S13	Absorption tests in laborator	y of methane captur	re prototype																		M4	-D4			
S14	Installation in the barn																								
\$1 5	Monitoring and analysis of d	ata from methane c	apture prototype										_												M5
Activity WP4																									
S16	Evaluation of the ecological i of methane capture	impact due to the pr	roduction of waste n	naterials in the phase																					
\$17	Evaluation of the impact of the	he installed equipme	ent on the barn infra	structure																					
S18	Evaluation of the economica	I aspects for the ma	nagement of the far	rm																					
\$19	Evaluation of the potential re	duction of greenhou	use gases (CH4)																						M6

Status of the WPs in a nutshell

- WP1:
 - Simulation in progress, behind schedule due to COMSOL learning curve and computational time → see Francesco's talk
 - Evaluation of cattle emissions from direct measurements completed → see Elio's talk
- WP2:
 - Monitoring stations being assembled, software ready → see
 Alessandro's talk
 - Research on new materials ongoing → see Nitish's talk
- WP3:
 - Test at CERN with prototype ongoing \rightarrow see Francesco's talk
- WP4:
 - Not yet started

Results dissemination

- <u>Talk</u> at DRD1 Meeting, 18th July 2024, F. Angiulli et al
- <u>Talk</u> at Congresso SIF 2024, 10th September 2024, F. Angiulli et al
- <u>Abstract</u> submitted to ASPA 2025 Congress, E. Dinuccio et al
- <u>Review</u> on methane capture strategies prepared, Vadivel, Kameswaran, Dondi

Dedicated talk this afternoon!

Scientific reports

<u>Scientific report are due every four months</u>: they are submitted to a Comitato Tecnico Scientifico (CTS) nominated by Università di Pavia. After CTS evaluation, the reports should be forwarded to the Ministry of Research (details on the procedure still to be clarified).

Three scientific reports have been submitted so far:

- 1) <u>Dec.2023-Mar. 2024</u>:
 - a) Positive evaluation from CTS
- 2) <u>Apr.2024-Jul.2024</u>:
 - a) Positive evaluation from CTS, with suggestion for monitoring of the timeline of the project
- 3) <u>Aug.2024-Nov.2024</u>:
 - a) Submitted but not yet evaluated

Next report due in April 2025

CH4rLiE in detail: today's agenda

https://agenda.infn.it/event/44941/

3 -10:20 Updates on COMSOL simulations (m) 4 -10:20 Updates on comothoring stations (m) 5 -11:20 Updates on barn measurements (m) 6 -11:20 Updates on prototype testing (m) 7 -11:20 Updates on prototype testing (m) 8 -11:21 Updates on theraptic (m) (m) 9 -11:20 Updates on theraptic (m) (m) 10 -11:21 Updates on prototype testing (m) 11 Updates on prototype testing (m) (m) 12 Updates on prototype testing (m)		y 28 Jan 2025, 09:00 → 18:00 Europe/Rome	
https://cem.soon.us/j8124626501/pwd/Yk9HMDZeL2Z/ZW/42HcBRTV/ZWj62609 Meeting ID: 12 462 650 P: -09.50 Introduction - General istatus of the project G: -1020 Updates on COMSOL simulations G: -1020 Updates on COMSOL simulations G: -1030 Updates on COMSOL simulations G: -1130 Updates on COMSOL simulations G: -1130 Updates on controling stations G: -1130 Updates on protocype testing G: -1130 Updates on protocype testing G: -1124 Updates on protocype testing G: -1125 Updates on protocype testing G: -1126 Updates on protocype testing G: -11260 Updates on protocype testing	Descript	inn Zoom link-	
Passeder: 701428 Ordustion - General status of the project Speakers: Barla Val (prints harowas of Plata huosana), Enda Finoso (prints harowas of Plata huosana)	Dearchip		
Speekers: Ratia Val (ottots hazonas di Rata hazonas) Faca hazonas di Rata hazona di Rata hazonas di Rata hazonas di Rata hazonas di Ra			
Speakers: Barla Val (patte Inscread & Radia Notaeu), Linda Fince (patter Inscread & Radia Notaeu) (m) 10.20 Updates on COMSOL simulations (m) 10.20 Updates on Combining stations (m) 10.20 Updates on Dern measurements (m) 11.20 Updates on period (p) (m) Speakers: Beatrice Mandelli (CDM), Fancesco Alessando Anglulii (p) (m) Results of tests at CERN (m) (m) Results of tests at CERN (m) (m) Speakers: Beatrice Mandelli (CDM), Fancesco Alessando Anglulii (p) (m) Speakers: Restrice Mandelli (CDM), Fancesco Alessando Anglulii (p) (m)	-+ 09:50	Introduction - General status of the project	© 20m
Bpeskers: Prancesco Alessandro Angluili (sittuo Nationau di Placa Nacionau), Enfa Val (sittuo Nationau di Placa Nacionau), Peri Peolo Vitulo (m) 10.50 Updates on monitoring stations (m) 11.30 Updates on measurements (m) 11.30 Coffe break (m) 11.30 Updates on protochype testing (m) 11.30 Coffe break (m) 11.31 Updates on protochype testing (m) (m) Speakers: Bestrice Mandelli (CRM), Francesco Alessandro Angluili (utitud Nacionau di Placa Nacionau) Place Nacionau) (m) Speakers: Bestrice Mandelli (CRM), Francesco Alessandro Angluili (utitud Nacionau) Place Nacionau) (m) Speakers: Restrice Mandelli (CRM), Francesco Alessandro Angluili (utitud Nacionau) Place Nacionau) (m) Speakers: Peolo Vitulo (M) (m) (m) Speaker: Peolo Vitulo (M) (m) (m) Speaker: Peolo Vitulo (M) (m) <t< td=""><td></td><td>Speekere: Ilaria Val (istituto Nazionale di Pisica Nucleare), Linda Finco (istituto Nazionale di Pisica Nucleare)</td><td></td></t<>		Speekere: Ilaria Val (istituto Nazionale di Pisica Nucleare), Linda Finco (istituto Nazionale di Pisica Nucleare)	
Speakers: Prancesco Alessandro Angluili (uttato Nationau d Plata Nationau), Ilaria Val (uttato Nationau d Plata Nationau), Peolo Vitulo (m) 1.050 Update on monitoring stations (m) 1.120 Update on measurements (m) 1.120 Coffe break (m) 1.120 Update on prototype testing (m) 1.120 Coffe break (m) 1.120 Update on prototype testing (m) 1.120 Coffe break (m) 1.120 Update on prototype testing (m) Speakers: Restrice Mandelli (CBN), Francesco Alessandro Angluili (uttato Nationau d Plata Nationau) Plata Nationau) Prototype testing (m) (m) Speakers: Bestrice Mandelli (CBN), Francesco Alessandro Angluili (uttato Nationau d Plata Nationau) Plata Nationau) Paesitice Mandelli (CBN), Francesco Alessandro Angluili (uttato Nationau d Plata Nationau) Plata Nationau) Speakers: Bestrice Mandelli (CBN), Francesco Alessandro Angluili (uttato Nationau d Plata Nationau) Plata Nationau) Paesitice Mandelli (CBN), Francesco Alessandro Angluili (uttato Nationau d Plata Nationau) Plata Nationau) Speaker: Pari Paelo Vitulo (PV) (m) Speake	-+ 10:20	Updates on COMSOL simulations	© 30m
Byeskers: Alessandro Bregheri (batto haboux di Palos Nubara), Mattee Brunoldi (batto haboux), Pede Vitulo (briventy di Internau) Internau) This contribution and the previous on should contain also discussion on installation of monitoring stations Speakers: Davide Biagini (batto haboux) di Palos Nubara), Bio Dinuccio (batto haboux) di Palos Nubara) (ministrational di Palos Nubara) International di Palos Nubara), Bio Dinuccio (batto haboux), Bio Dinuccio (batto haboux), Bio Dinuccio (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Matteo Brunoldi (batto haboux), Matteo Brunoldi (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Bio Dinuccio (batto haboux), Matteo Brunoldi (batto haboux), Bio Beaker, Beatrice Mandelli (CBN), Francesco Alessandro Anguili (batto haboux) di Palos Nubara), Matteo Brunoldi (batto haboux), Matteo Brunoldi (batto haboux), di		Speakers: Francesco Alessandro Angiulli (lattuto Nationale di Fisica Nucleare), Ilaría Vai (lattuto Nationale di Fisica Nucleare), Prof. Paolo Vitul	
Initia Decision	-+ 10:50	Updates on monitoring stations	() 30m
This contribution and the previous one should contain also discussion on installation of monitoring stations Speekere: Devide Blagini (untub National di Ross Naciava), Dio Dinuccio (untub National di Ross Naciava) 11:20 Coffe break 12:15 Updates on prototype teeting Speekere: Bearloc Mandelli (CBR), Francesco Alexandro Anglulli (untub Naciava), Mateo Brundéli (untub Naciava), Roberto Guida (CBR), Simone Calcaferi (untub Naciava), Brice Naciava), Mateo Brundéli (untub Naciava), Roberto Guida (CBR), Simone Calcaferi (untub Naciava), Roberto Buildo (Untub Naciava), Roberto Guida (CBR), Simone Calcaferi (untub Naciava), Roberto Buildo (CBR), Simone Calcaferi (untub Naciava), Roberto Buildo (Untub Naciava), Roberto Guida (CBR), Simone Calcaferi (untub Naciava), Roberto Buildo (Untub Naciava), Roberto Buildo (CBR), Simone Calcaferi (untub Naciava), Roberto Buildo (Untub Naciava), Roberto Guida (CBR), Simone Calcaferi (Untub Naciava), Roberto Buildo (Untub Nac			sity of Pavla 8
Bpeakers: Devide Blagini (status Hadowak di Pasa Huskaw), Bilo Dinuccio (status Huskaw) Image: https://www.fig.doi.org/fig.fig.fig.fig.fig.fig.fig.fig.fig.fig.	-+11:20	Updates on barn measurements	@ 30m
		This contribution and the previous one should contain also discussion on installation of monitoring stations	
-12:15 Updates on prototype testing Speaker: Brainice Mandelli (SDN), Francesco Alessandro Angiulii (status hatonaus d'Hora hatonaus), Matteo Brunoldi (status hatonaus), Matteo Brunoldi (status hatonaus), Beeker: Daniel Dondi (status hatonaus d'Hora hatonaus), Matteo Brunoldi (status hatonaus), Matteo Brunoldi (status hatonaus), Beeker: Daniel Dondi (status hatonaus), Brunolaus, Lombardy, Matteo Brunoldi, Previnez, alexanard, Bereker, Daniel Dondi (status hatonaus), Lembardy, Matteo Brunoldi, Previnez, alexanard, Bereker, Bereker, Bereker, Bereker, Bereker, Bereker, Bereker, Bereker, Bereker, Hatonaus, d'Hora hatonaus), Bereker, Bereker, Bereker, Berek		Speakers: Davide Blagini (Isthuto Nationale at Fisica Hudeare), Elio Dinuccio (Isthuto Nationale at Fisica Nucleare)	
Speakers, Bestrice Mandelli (2011), Prancesco Alessandro Angiulii (shtub tiacoval di Pilos Huckan), Matteo Brunoldi (shtub tiacoval di Pilos Huckan), Roberto Guide (2014), Simone Calsaferri (simto Huchan), Simone Calsaferri (simto Huchan), Simone Calsaferri (simto Huchan), Simone Calsaferri (simto Huchan), Simone Calsaferri (Simone Calsaferri (Simone Huchan), Simone Calsaferri (Simone Calsa	-+ 11:30	Coffe break	
Speaker: Bestice Mandelli (EBN), Farecesco Alessandro Arguilli (Initia Interview), Mattee Brunoldi (Initia Interview), Roberto Guida (IDN), Simore Calzaferi (Initia Interview) () Results of tests at CEBN () Speaker: Bestice Mandelli (IDN), Farecesco Alessandro Arguilli (Initia Interview) () Speaker: Bestice Mandelli (IDN), Farecesco Alessandro Arguilli (Initia Interview) () Speaker: Bestice Mandelli (IDN), Farecesco Alessandro Arguilli (Initia Interview) () Speaker: Bestice Mandelli (IDN), Farecesco Alessandro Arguilli (Initia Interview) () Absorption model () Speaker: Denice Dould (Initia Interview) () Speaker: Denice Dould (IDN), Simore Calzaferi (Initia Nationae di Rusa Nationae) () Speaker: Denice Dould (Initia Interview) ()	-+ 12:15	Updates on prototype testing	@ 45m
Results of tests at CERN (c) Speakers: Beartice Mandelli (CERN, Francesco Alessandro Angulli (ontuo Nacionard, Matteo Brunoldi (ontuo Nacionard, Brush N		Speakers: Beatrice Mandelli (CERH), Francesco Alessandro Angiulli (Istituto Nazionale di Fisica Nucleare), Matteo Brunoldi (Istituto Nazionale	
Speaker: Besicie Mandelli (2011), Francesco Alessandro Angulii (antuo lucolaus di Ruis lucolaus), Mateo Brunoldi (antuo lucolaus di Ruis lucolaus), Mateo Brunoldi, Beseker, Daniele Dondi (antuo lucolaus), Brunola Vicolaus), Mateo Brunoldi, Brunola Vicolaus), Mateo Brunola di Ruis lucolaus), Brunola Vicolaus, Brunolaus,			
Hussandi, Roberto Guida (DEM), Simone Calcaderri (ustuto Hussonia di Pisca Hussand) Absorption model () Speaker: Prof. Paolo Vitulo (PV) () () () Speaker: Daniele Dondi (ustuto Hustonia di Pisca Hustand) () () () Speaker: Daniele Dondi (ustuto Hustonia di Pisca Hustonia) () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () () Speaker: Daniele Dondi (ustuto Hustonia) () () () () () Speaker: Taria Vai (ustuto Hustonia) () () (Results of tests at CERN	() 30m
Byeeker: Prof: Prof: Value (r/r)			zie di Fisica
Byeeker: Prof: Prof: Value (r/r)		Absorption model	@ 15n
Speaker: Daniele Dondi (tatuto Nacionali di Raco Nacional) - 15:00 Lunch https://www.tripadrisoni/Restaurant_Review-g2357810-d2228583-Reviews-L_Ustaria_DL_Glogaton- Travace_Slocomaria_Province_of_Pavia_Lombardy.html 0 - 15:20 Plana for resulta dissemination Talks and papers Speaker: Ilaria Vai (unita Nacionali di Raco Nucione) 0			010
Speaker: Daniele Dondi (tatuto Nacionali di Raco Nacional) - 15:00 Lunch https://www.tripadrisoni/Restaurant_Review-g2357810-d2228583-Reviews-L_Ustaria_DL_Glogaton- Travace_Slocomaria_Province_of_Pavia_Lombardy.html 0 - 15:20 Plana for resulta dissemination Talks and papers Speaker: Ilaria Vai (unita Nacionali di Raco Nucione) 0		Undeten an materials testion	
https://www.txipadrison.iv/Restaurant_Reviews2357810-d2328533-Reviews-LUktaria_DLGlugaton- Travace_Slocomaria_Province_of_Pavia_Lombardy.html 1 5:20 Plans for results dissemination (Talks and papers Speaker: Ilaria Vai (untub Nationale d Places Nucleure)	-+ 12:45		() 30m
Travaco, Siccomario, Province, of Pavia, Lombardy, html - 15.20 Plans for results dissemination Talks and papers Speaker: Rafa Val (initia Hadowie of Pacia Huckero)	-+ 15:00	Lunch	G
Tails and papers Speeker: Taria Vai (uttato Nationale of Pace Nacional)			
Speeker: Itaria Vai (uttuto Nationale di Paloa Nucleare)	-+ 15:30	Plans for results dissemination	() 30m
Speeker: Itaria Vai (uttuto Nationale di Paloa Nucleare)		Talks and papers	
		Speaker: Ilaria Vai (stituto Nationala di Fisica Nucleare)	
17:00 Visits at the laboratories	17:00	Viete at the laboratories	() 1h 30m

Vote for CH4rLiE Logo!

Please go to: <u>https://forms.gle/QT8BuUT6RDsFZLE98</u> and vote by 4 PM today!



Thanks to Matteo for the graphics!