

CSN1

LNF, 07/07/2020

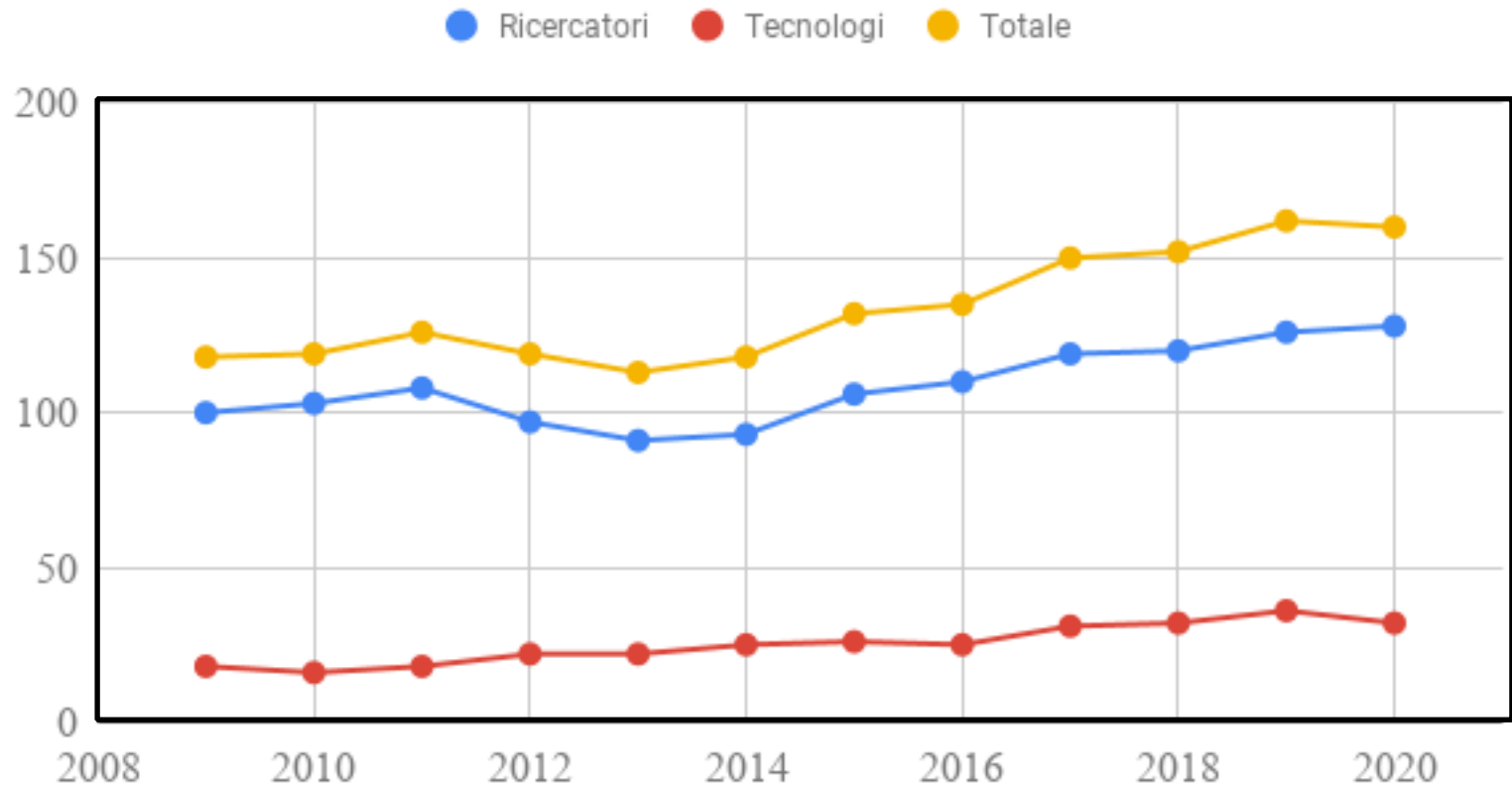
Consiglio di Laboratorio preventivi 2021

G. Finocchiaro

INFN - Laboratori Nazionali di Frascati

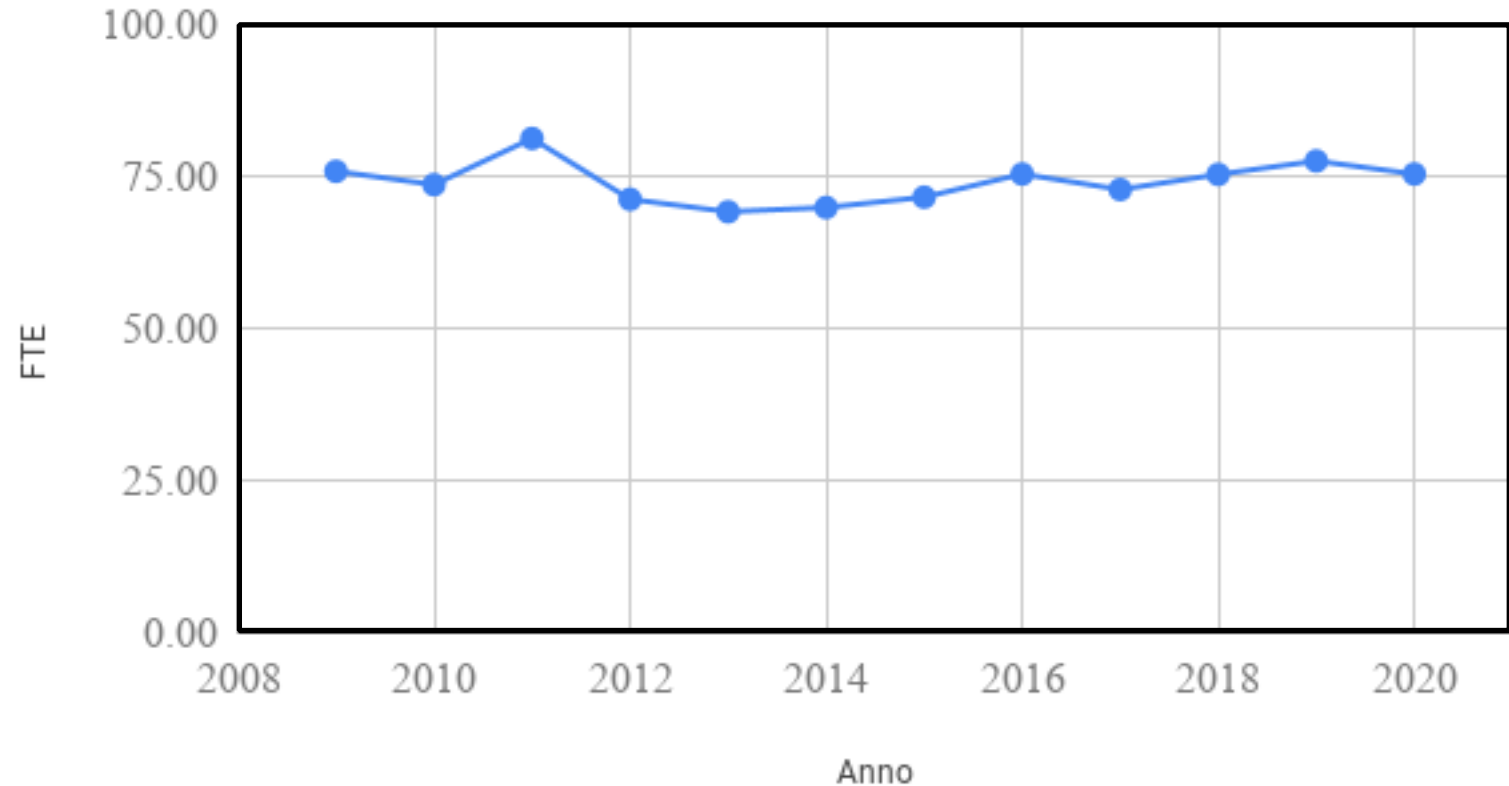
Un po' di sociologia - quanti siamo

CSN1: numero di scienziati



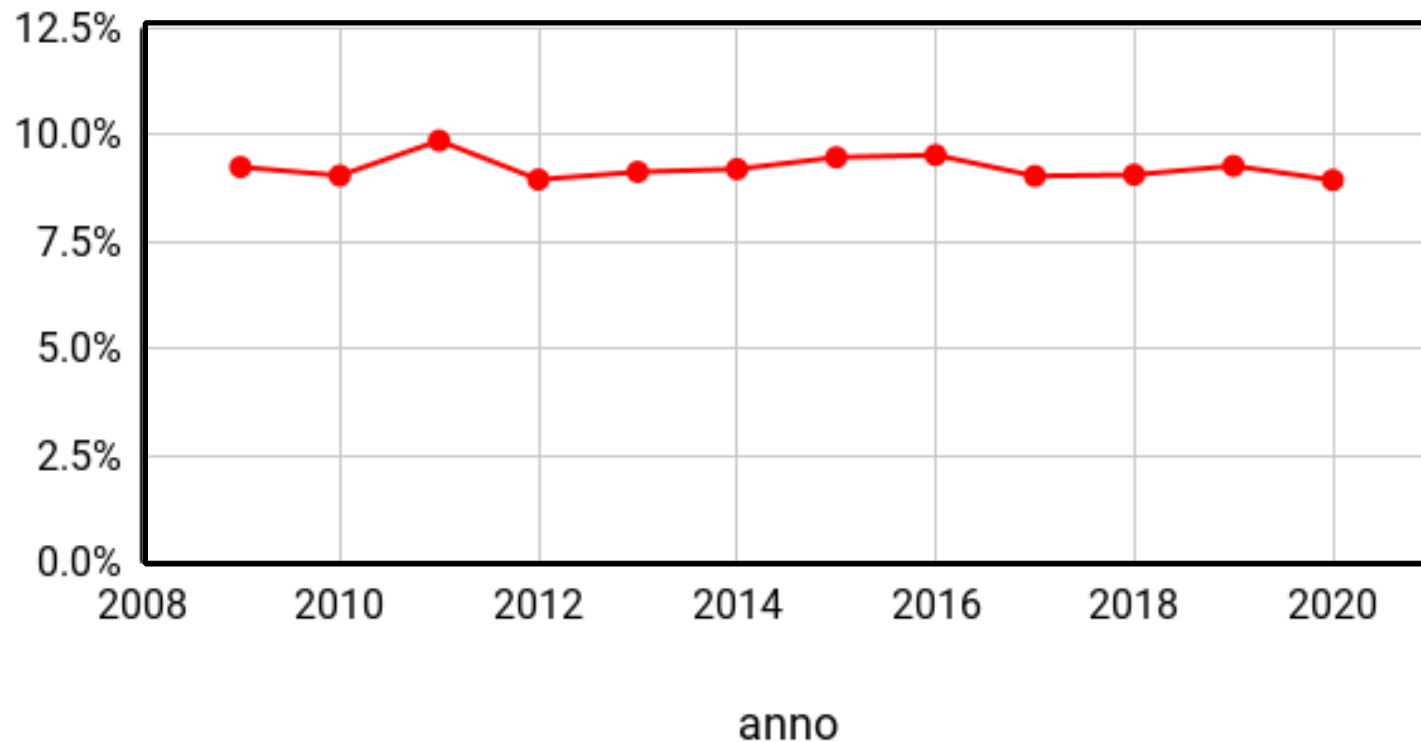
Quanti FTE

FTE vs. Anno



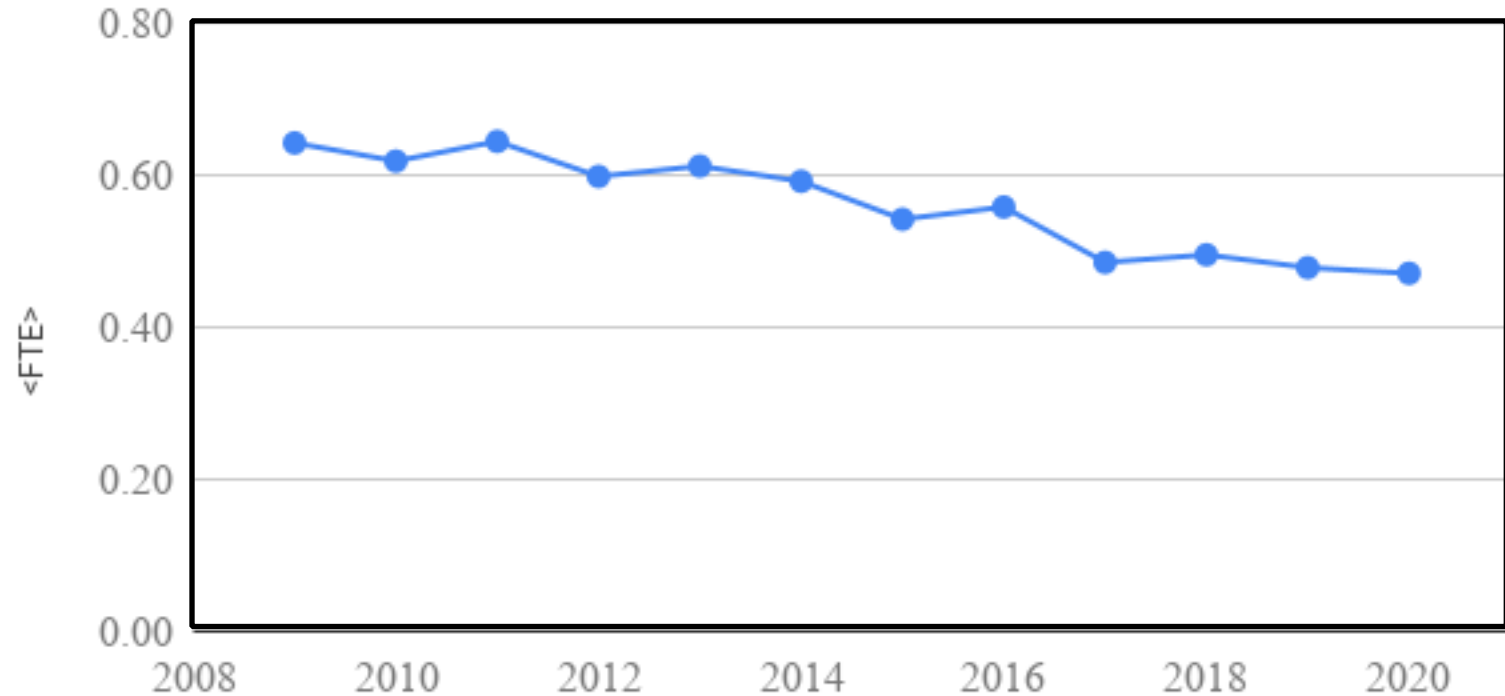
<FTE> LNF/INFN in CSN1

FTE LNF/INFN vs. anno



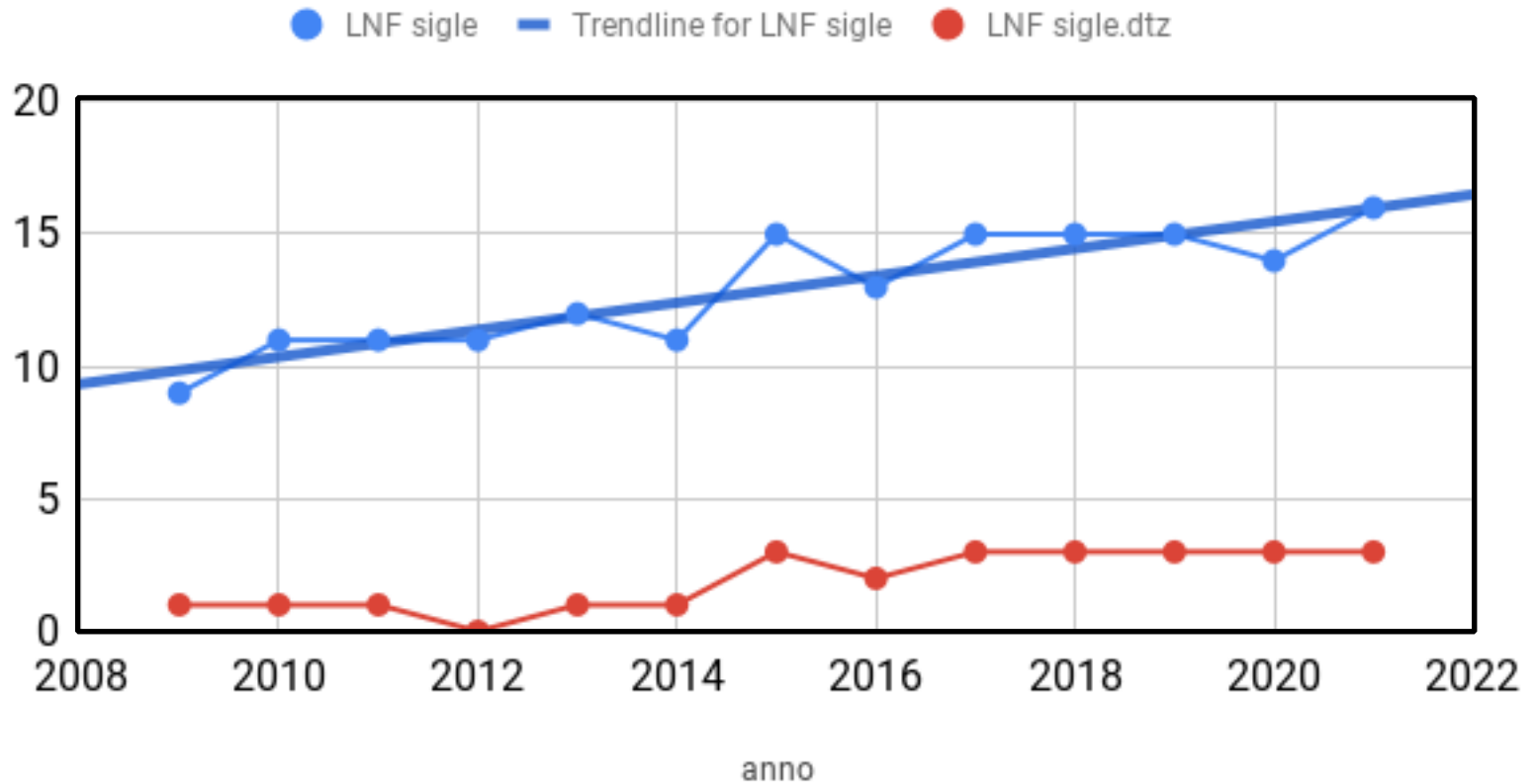
FTE medio LNF in CSN1

<FTE> vs. anno



Sigle di CSN1 @ LNF

LNf sigle and LNf sigle.dtz (*)



(*) FASE2_ATLAS e FASE2_CMS (e prima FASE2_RD) conteggiate come sigle separate

CSN1 - ci sono varie novità

- Pubblicato il “Deliberation document on the 2020 update of the European strategy for Particle Physics”
 - ✓ ha rotto la simmetria.
 - ✓ discussione nella prossima riunione di CSN1 il 10/7
- Suddivisione della sigla RD_FA nelle sigle **RD_MUCOL** (M. Boscolo) e **RD_FCC** (M. Poli Lener) ==> presentazione dedicata
- LHCb ha scoperto un altro tetraquark (a 4 charm)!
- SuperKEKB batte il record mondiale di luminosità!

Rassegna di attività di CSN1

- RD_MUCOL/RD_FCC e NA62/KLEVER sono discussi in presentazioni dedicate
- Le richieste di servizi, già presentate, discusse e approvate dal CIF, sono mostrate in appendice.

ISTITUTO NAZIONALE DI FISICA NUCLEARE Preventivo per l'anno 2021	
Sigla	
ATLAS	
BELLE2	
BESIII	
CMS	
FASE2_ATLAS	
FASE2_CMS	
GMINUS2.DTZ	
KLOE	
LHC-b	
NA62	
PADME	
PMU2E	
P_SHIP.DTZ	
RD_FCC	
RD_MUCOL	
UA9.DTZ	

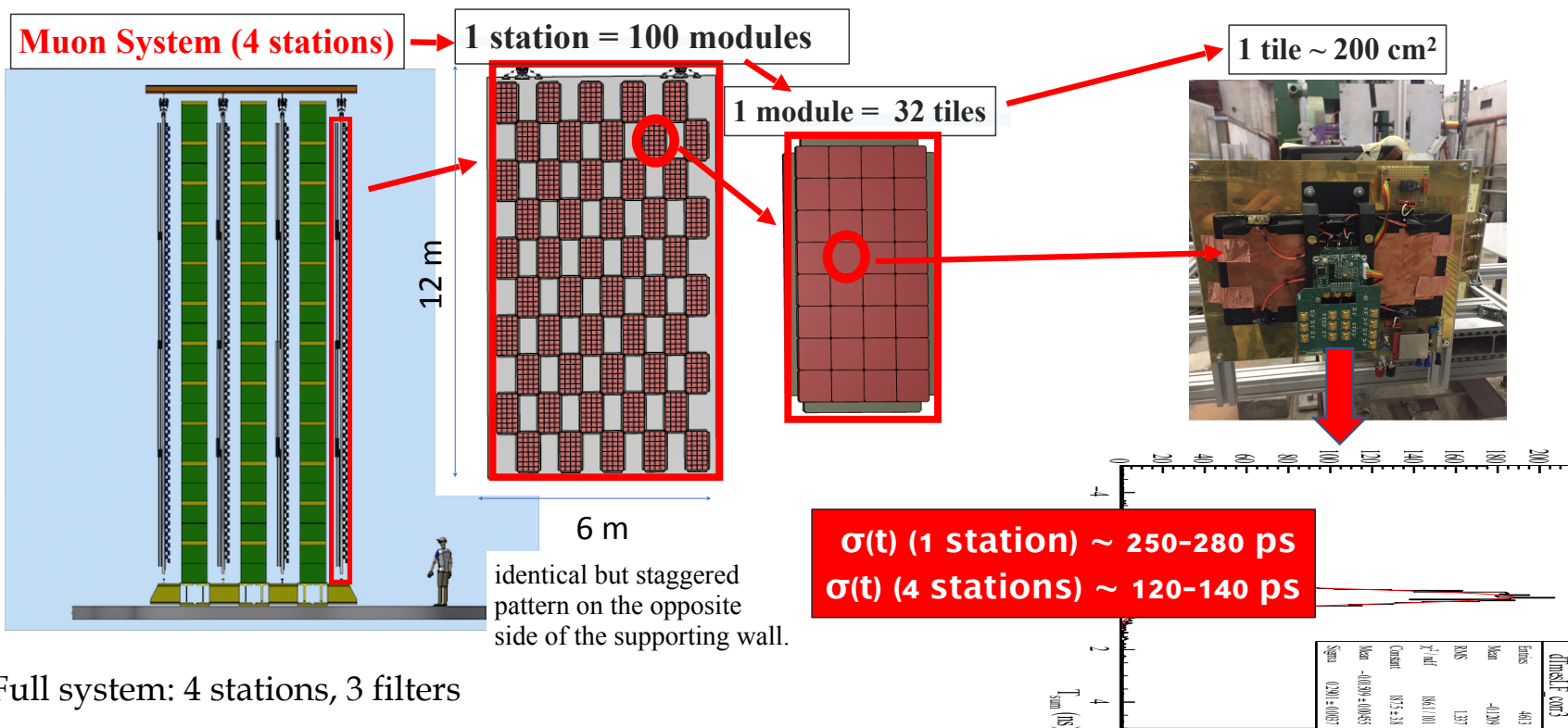
SHiP: il Gruppo e l'attività sul Sistema a Muoni

LNF group: G. Bencivenni, M. Bertani, A. Calcaterra, P. Ciambrone, G. Felici, G. Lanfranchi,

+ aiuto esterno di Alessandro Paoloni per i test beams.

E il (preziosissimo) contributo di: F. Angeloni, A. Balla, G. Papalino, A. Saputi

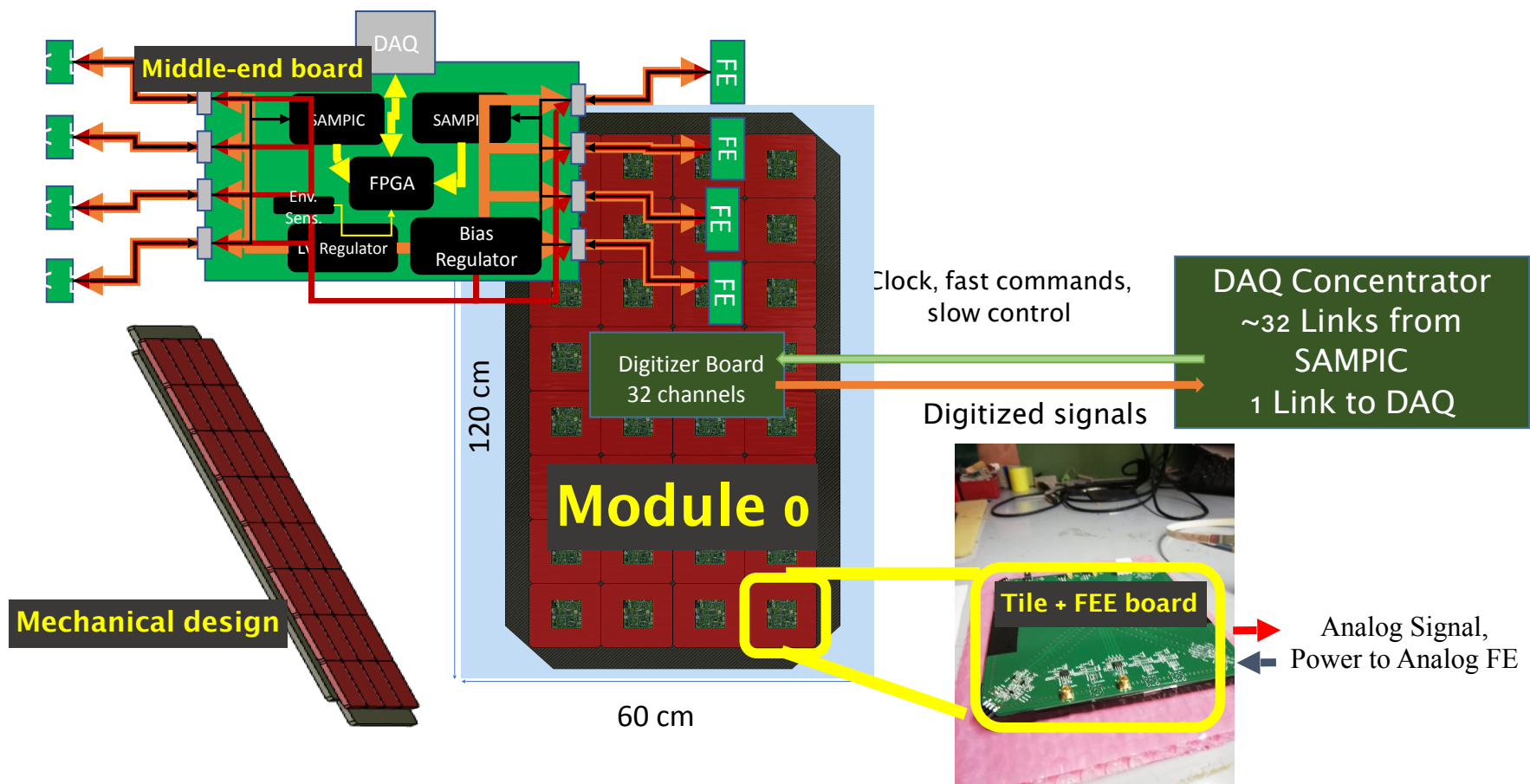
Un grazie particolare ai servizi: SEA (Paolo Ciambrone) e SPCM (Tommaso Napolitano)



Full system: 4 stations, 3 filters

Goal of activity

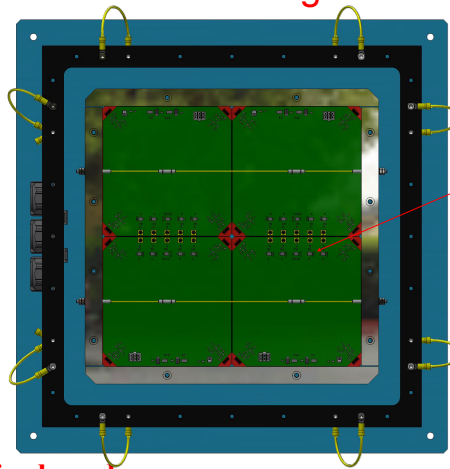
Build, equip, and test a “module 0” for Muon System by 2023



Activity 2020

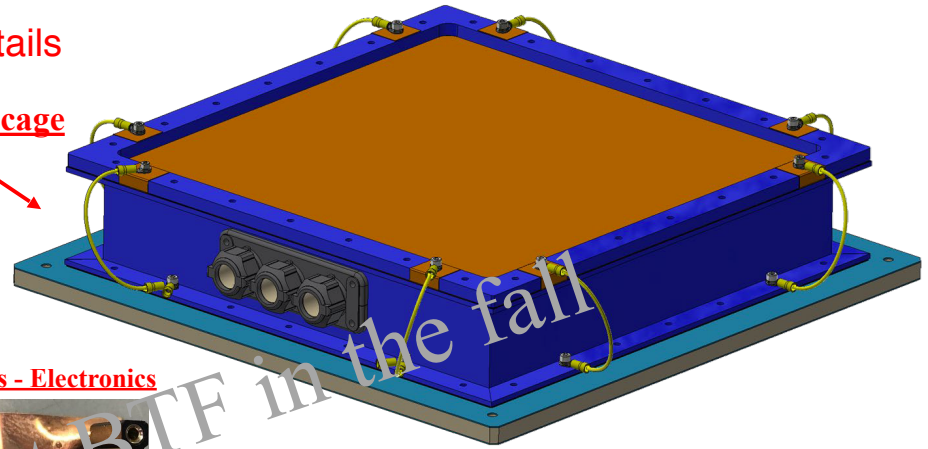
Intermediate step towards the module 0:
mini-module (4 tiles) fully equipped with new electronics

Design of the minimodule in all details



4 tiles

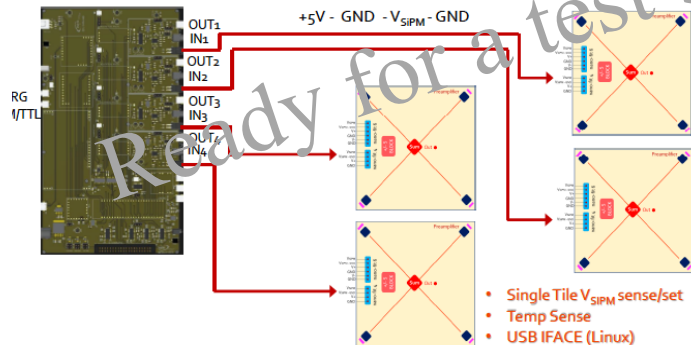
Faraday cage



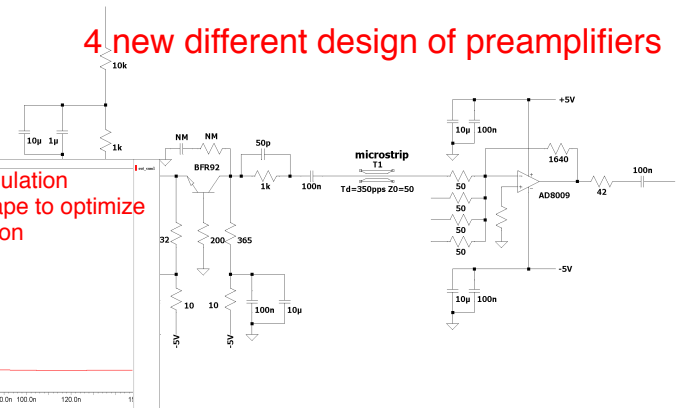
Kapton connections SiPMs - Electronics



Service board



4 new different design of preamplifiers



Outcome of the ESPP Strategy (CERN-ESU-014)

4. Other essential scientific activities for particle physics

a) The quest for dark matter and the exploration of flavour and fundamental symmetries are crucial components of the search for new physics. This search can be done in many ways, for example through precision measurements of flavour physics and electric or magnetic dipole moments, and searches for axions, dark sector candidates and feebly interacting particles. There are many options to address such physics topics including energy-frontier colliders, accelerator and non-accelerator experiments. A diverse programme that is complementary to the energy frontier is an essential part of the European particle physics Strategy. *Experiments in such diverse areas that offer potential high-impact particle physics programmes at laboratories in Europe should be supported, as well as participation in such experiments in other regions of the world.*

A dedicated Physics Beyond Colliders study group was set up at CERN to explore the opportunities offered by the CERN accelerator complex and infrastructure to gain new insights into some of the outstanding questions in particle physics through projects complementary to high-energy colliders and other initiatives in the world. This generated a lot of interest and became the *de facto* focal point for new research initiatives centred not only on the potential of the CERN facilities but also other facilities available throughout Europe in the National Laboratories and research institutes. Many of the proposals for new experiments at CERN are on a scale such that they could be considered for approval in the usual manner by the scientific committees and the Research Board. Among the proposals for larger-scale new facilities investigated within the Physics Beyond Colliders study, the Beam Dump Facility at the SPS emerged as one of the frontrunners. However, such a project would be difficult to resource within the CERN budget, considering the other recommendations of this Strategy.

i. **Strong endorsement** of a “diversity programme” (beyond colliders) at CERN and National Laboratories.

ii. **Strong endorsement** of the Physics Beyond Colliders (PBC) activity: (“focal point for new research initiatives” at CERN and beyond).

iii. **Cut** of the main project of PBC: *The Beam Dump Facility*.

In these conditions SHiP @ LNF is discontinued.

The LNF group will complete the ongoing R&D in 2020 – mid 2021 with the Test beam at BTF. No new activity is foreseen in 2021. P-SHiP will exist for another year to complete the ongoing activity (Gaia will stay at 10%, perhaps someone else, tbc)

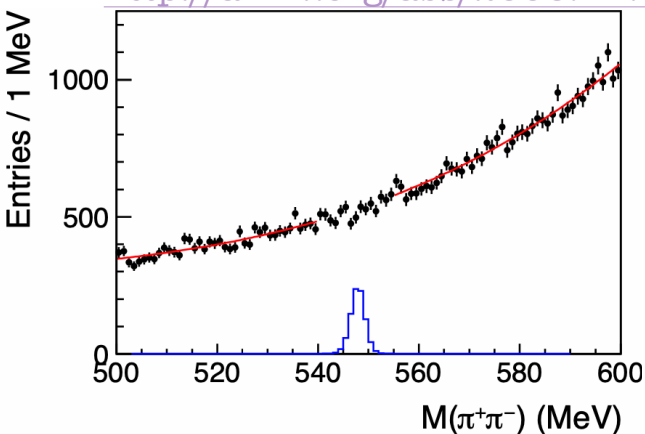
KLOE-2 Achievements 2020 (I)

D. Babusci, C. Bloise, F. Bossi, G. Capon, F. Curciarello, P. Ciambrone, E. De Lucia (Resp. Loc.), A. De Santis, P. De Simone, A. Di Ciccio, D. Domenici, S. Giovannella, X. Kang, M. Martini, S. Miscetti, D. Moricciani, P. Santangelo and F. Fortugno, F. Sborzacchi

- 2nd round of Data Reconstruction DBV-40 started March 2020 – more than 1 fb⁻¹ already reconstructed
- 1st MC massive production completed and getting ready for 2nd with DBV-40
- Root Output for Data Preservation
- Main physics results:

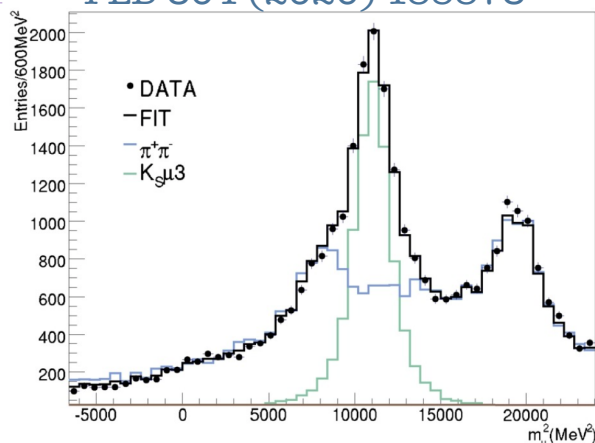
$\eta \rightarrow \pi^+\pi^-$

<http://arxiv.org/abs/2006.147>



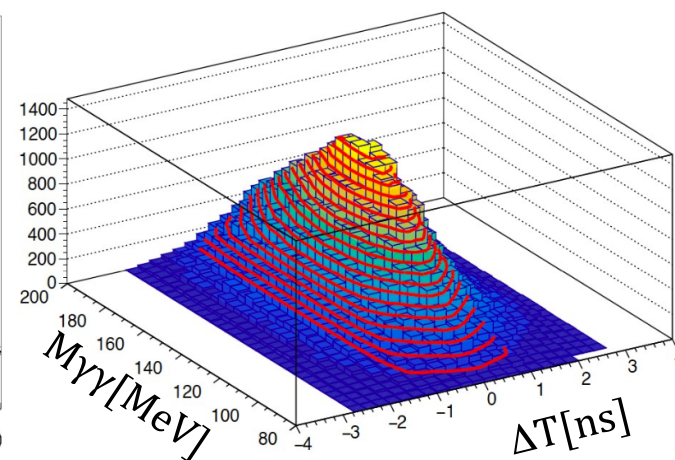
$K_S \rightarrow \pi\mu\nu$

PLB 804 (2020) 135378



$e^+e^- \rightarrow e^+e^- \gamma^* \gamma^* \rightarrow e^+e^- \pi^0$

JINST 15 (2020) INSTR2020



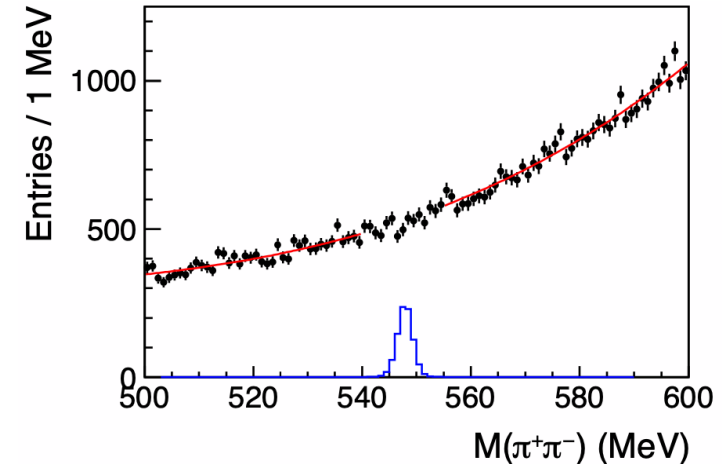
KLOE-2 Achievements 2020 (II)

CP violation source in strong interaction :
upper limit on $\eta \rightarrow \pi^+\pi^-$

Submitted to JHEP

<http://arxiv.org/abs/2006.14710>

- 1) Best UL set by KLOE with 350 pb-1
 $\text{BR}(\eta \rightarrow \pi^+\pi^-) < 1.3 \times 10^{-5}$ @ 90% CL
[PLB 606 (2005) 276]
- ⊕ Recent limit from LHCb with 3.3 fb-1
 $\text{BR}(\eta \rightarrow \pi^+\pi^-) < 1.6 \times 10^{-5}$ @ 90% CL
[PLB 764 (2017) 233]
- 2) Updated with full statistics $L = 1.6 \text{ fb-1}$
 $\text{BR}(\eta \rightarrow \pi^+\pi^-) < 4.9 \times 10^{-6}$ @ 90% CL



Combining 1) with 2) a factor of 3 smaller $\text{BR}(\eta \rightarrow \pi^+\pi^-) < 4.4 \times 10^{-6}$ @ 90% CL

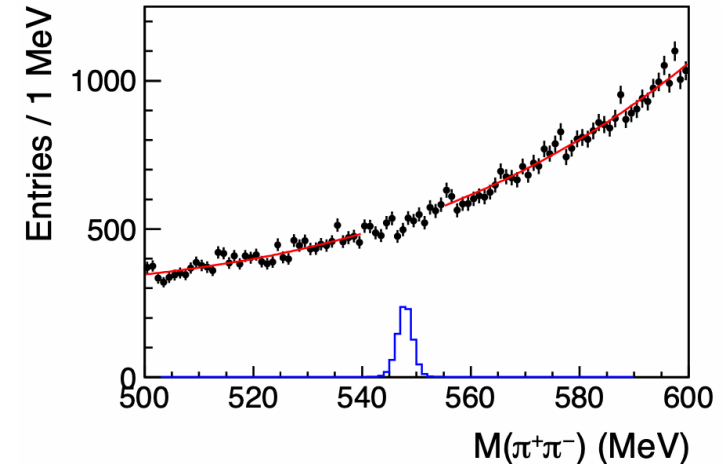
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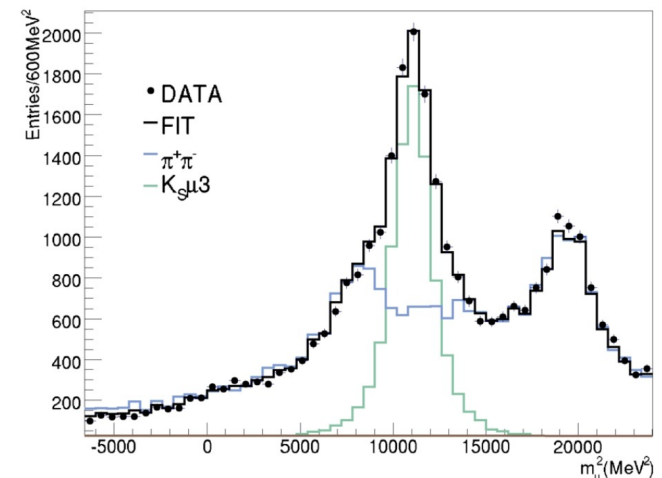


Combining 1) with 2) a factor of 3 smaller $\text{BR}(\eta \rightarrow \pi^+\pi^-) < 4.4 \times 10^{-6}$ @ 90% CL

$\text{BR}(\text{K}_S \rightarrow \pi\mu\nu)$ V_{us} ,
Lepton Univ.

PLB 804 (2020) 135378

- ⊕ **First measurement ever**
- ⊕ **V_{us} & Lepton Universality test w KSe3**
- ⊕ $\text{BR}(\text{K}_S \rightarrow \pi\mu\nu) = (4.56 \pm 0.11_{\text{stat}} \pm 0.17_{\text{syst}}) \times 10^{-4}$



Gruppo 1 LNF, **richieste** nel 2021

Preventivi di spesa preliminari (Keuro) (possibili aggiustamenti al ~10%):

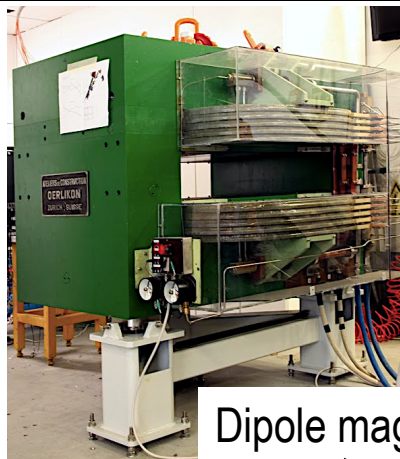
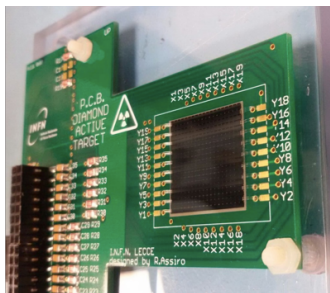
Sigla	Ric	Tec	FTE	<FTE>	MISS	CON	APP	ALTRO	CAP
KLOE-2	13	1	4.7	0.3	16.	17.	5	26	MAN

D. Babusci (30%), C. Bloise (30%), F. Bossi (30%), G. Capon, F. Curciarello (100%), E. De Lucia (30%), A. De Santis (30%), P. De Simone (10%), D. Domenici (10%), S. Giovannella (30%), M. Martini (20%), S. Miscetti (20%), D. Moricciani (50%), P. Santangelo (80%) and F. Fortugno (100%), F. Sborzacchi (50%)

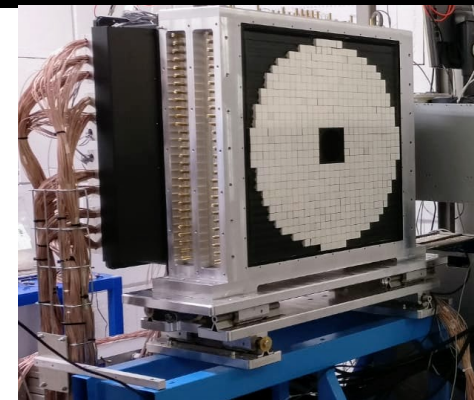
Personale tecnico		
	Computing (Fortugno 100% - Sborzacchi 50%)	

PADME detector in a nutshell

Active target
Lecce & University Salento



C-fiber window

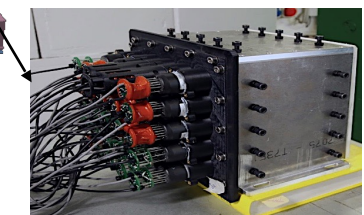
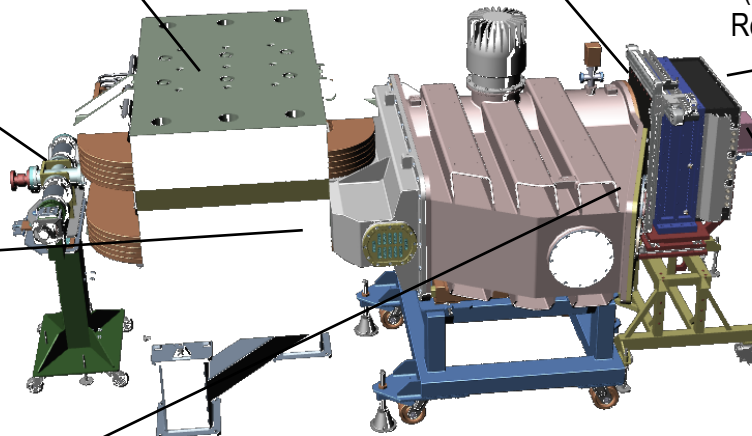


BGO calorimeter
(616 L3 endcap crystals:
Roma, Cornell U., LNF, LE)

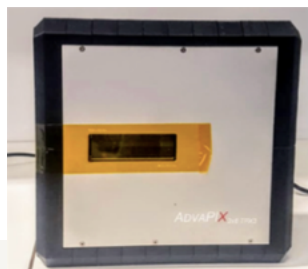
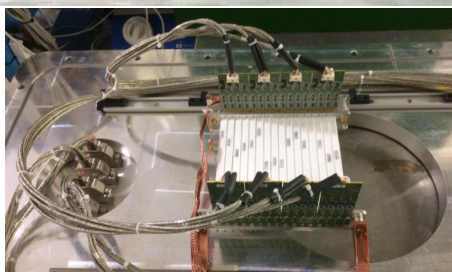
Veto scintillators
(University of Sofia, Roma)



Dipole magnet
(CERN TE/NSC-MNC)



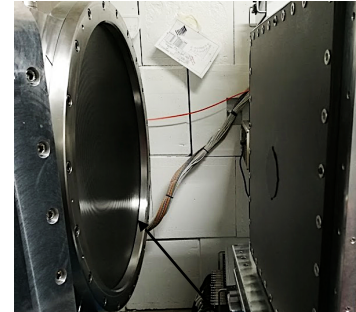
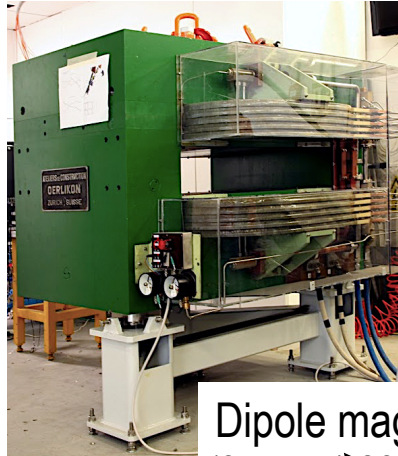
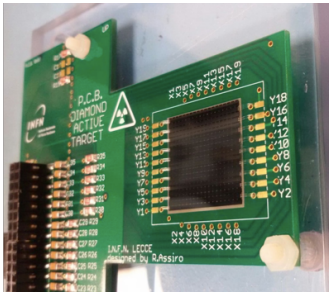
PbF₂ calorimeter
(MTA Atomki, Cornell U., LNF)



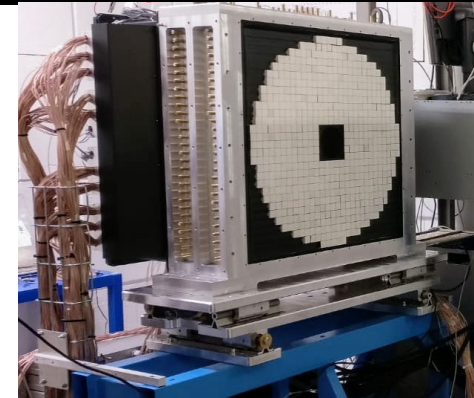
TimePIX3 array
(ADVACAM, LNF)

PADME detector in a nutshell

Active target
Lecce & University Salento



C-fiber window



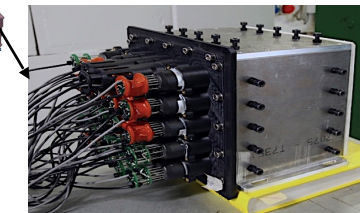
BGO calorimeter
(616 L3 endcap crystals:
Roma, Cornell U., LNF, LE)

Veto scintillators
(University of Sofia, Roma)

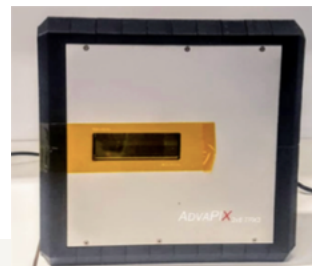
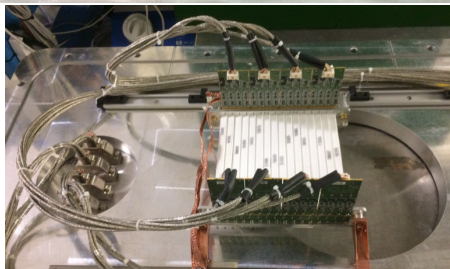


Tutto è pronto per la presa dati

Dipole magnet
(CERN TE/NSC-MNC)



PbF₂ calorimeter
(MTA Atomki, Cornell U., LNF)



TimePIX3 array
(ADVACAM, LNF)

2021 PADME run plan

- Allo stato attuale il LINAC di LNF nel 2021 sarà utilizzato come iniettore di DAFNE per il run di Siddharta (e per la test-facility) \Rightarrow impulso < 13 ns
 - ◆ PADME prenderà dati in modalità dedicata (impulso 150-200 ns) **nell'estate ed inizio autunno 2020**
 - ◆ PADME non può invece prendere dati ad alta intensità in parallelo alle iniezioni per DAFNE nel 2021

- Esistono però canali di fisica che potrebbero essere esplorati ad intensità più basse (1/10 1/20) di quella nominale
 - ◆ sezioni d'urto $e^+e^- \rightarrow \gamma\gamma(\gamma)$: non esiste nessuna misura sotto il GeV
 - ◆ $e^+e^- \rightarrow e^+e^- e^+e^-$ ed $e^+e^- \rightarrow e^+e^- e^+e^- e^+e^-$: non esiste nessuna misura sotto il GeV

- Questo tipo di misure potrebbero essere effettuate nel corso del 2021 in maniera opportunistica, cioè in parallelo al run di DAFNE
 - ◆ La collaborazione PADME vorrebbe esplorare questa possibilità con dei run parassitici durante il 2021.
 - ◆ Ordine 4-6 settimane di run

Richieste PADME per il 2021

- ▣ Metabolismo di missioni e consumi
 - ◆ Sostanzialmente uguale al 2020
 - ◆ Prevediamo l'ingresso di un gruppo di Torino in via di definizione richieste
- ▣ Manutenzione dell'apparato PADME
 - ◆ 10K ad LNF su consumi
- ▣ Run parassitici all'attività di Siddharta
 - ◆ ~10K missioni a Lecce e 2.5K a Roma1 ?? a Torino.
- ▣ In assenza di run di fisica non ci sono richieste aggiuntive di computing
 - ◆ I run parassitici potranno essere allocati all'interno delle attuali risorse.

Anagrafica

Nome	Percentuale	Afferenza
Bossi Fabio	30	1
De Sangro Riccardo	10	1
Domenici Danilo	60	1
Finocchiaro Giuseppe	10	1
Garattini Marco	20	5
Giacchino Federica	50	4
Gianotti Paola	30	3
Kozhuharov Venelin	50	1
Martini Matteo	20	1
Sarra Ivano	10	1
Sciascia Barbara	10	1
Spadaro Tommaso	20	1
Spiriti Eleuterio	10	3
Taruggi Clara	100	1
Vilucchi Elisabetta	10	1
Buonomo Bruno	20	5
Di Giulio Claudio	20	5
Foggetta Luca	20	5
Ghigo Andrea	10	5

Totale

5.1 FTE

ATLAS

Antonelli Mario	albicocco Pietro
Chiarella Vitaliano	Beretta Matteo Mario
Curatolo Maria	Martini Agnese
Esposito Bellisario	Vilucchi Elisabetta
arcangeletti chiara	tomassini sandro
Laurelli Paolo Felice	dane emiliano
Mancini Giada	ligi carlo
Sansoni Andrea	
Testa Marianna	
	9.6 FTE

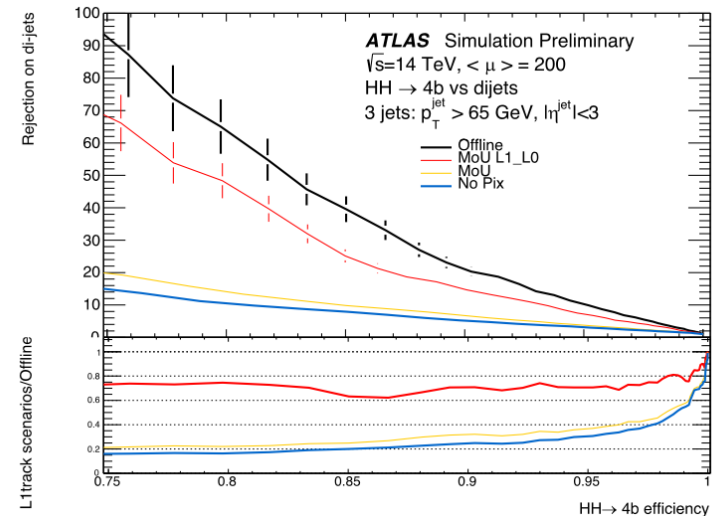
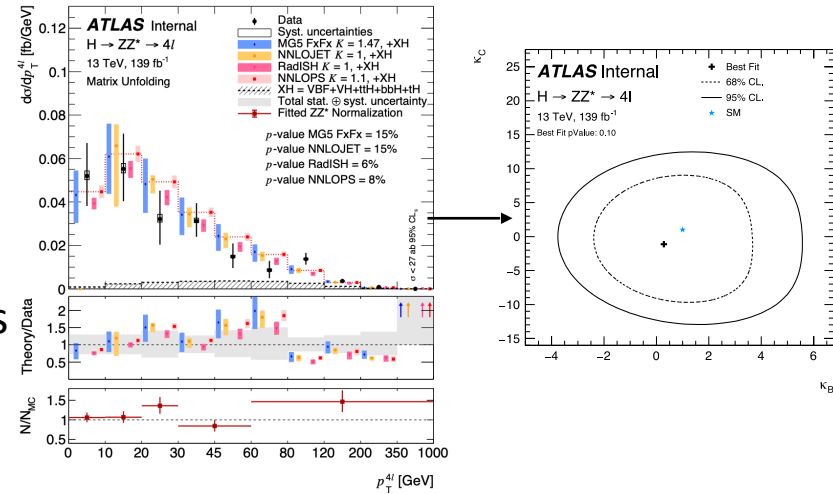
E. Capitolo
S. Cerioni
D. Orecchini
B. Ortenzi
G. Pileggi
B. Ponzio
F. Rosatelli
T. Vassilieva

E. Tskhadadze
V. Russo
M. Paris
S. Lauciani
F. Putino

Analysis

Differential cross section measurement access to the Higgs boson properties in the $H \rightarrow ZZ^* \rightarrow 4l$

- Interpretation of the differential cross sections measurements in $H \rightarrow ZZ^* \rightarrow 4l$: Pseudo – Observables and constraint Light Yukawa couplings
- Paper on arxiv: <https://arxiv.org/pdf/2004.03969.pdf> (submitted to EPJC together with the coupling paper)
- Work on going on CP–odd measurements: Measurement of angular asymmetries in the four lepton decay and study of the Optimal Observable to put constraint on CP – odd couplings for VBF production
- Performance of multi-jet L1 track at HL-LHC with several coverages of pixel ITk
- Critical inputs from LNF for pixel-ITk regional readout decision



Phase2 Activity: ITK

Assembly tools design S. Tomassini

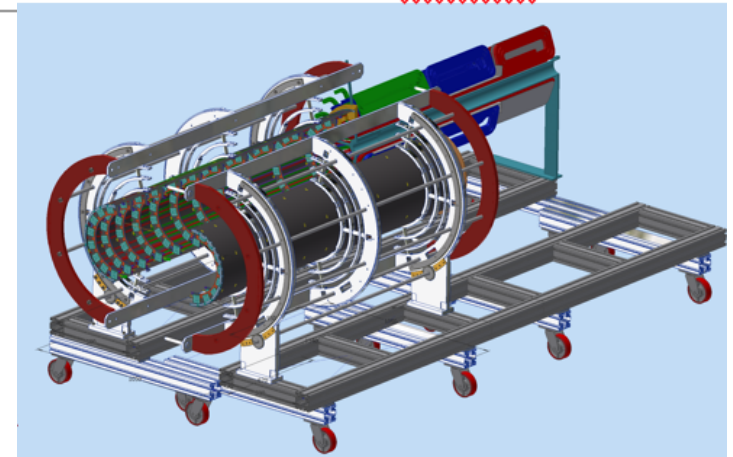
LNF responsibilities:

- Assembly of one pixel outer endcap of ITk (Inner Tracker)
 - assembly tools design and prototyping
 - testing and commission
- Patch Panel 1
 - mechanical design
 - cabling design
 - Prototyping
 - construction
- Caratterizzazione *Xilinx* high bandwidth memory FPGAs per eventuale utilizzo in schede Felix fase2 - P. Albicocco

Critical inputs for services review in fall 2020

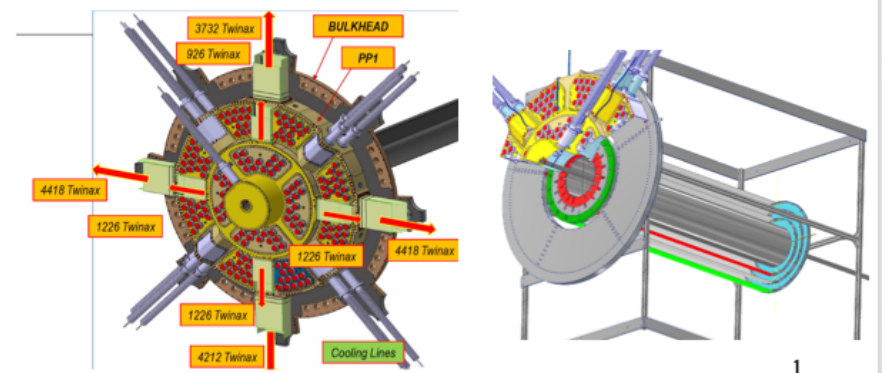
μ spectrometer

- M Beretta responsibility of the new HV and LV system



Design of PP1 and cabling
S. Tomassini, D.Orecchini,
E. Dane', F. Rosatelli

Endcap and PP1 mockup



1

nSW Activity

E. Capitolo, S Cerioni, G. Pileggi, B. Ponzio, T. Vassilieva

SM1 module assembling phase

- 27/32 MM chambers built at LNF (most advanced)
- LNF Responsibility of the entire MM productions
- 4 sites: INFN, SACLAY, DUBNA, Germany
 - 5 chambers built for SACLAY+ Germany
 - Production procedure exported to all sites
 - New assembly station built in record time at SACLAY*
- Thanks to the technicians *dream team* (name given by collaboration)
- Big effort required for 2021:
 - Finish production for other sites SACLAY and DUBNA(at CERN) chambers
 - Integration and commissioning (responsibility for cosmic validation)
 - New HV distribution LNF electronic service
- *S. Lauciani also in the team

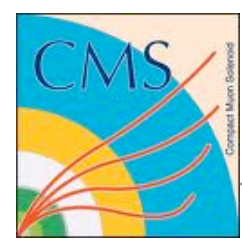


Calcolo Scientifico ai LNF: attività del Tier2

- ▶ Esperimenti con risorse pledged:
 - ▶ **ATLAS, PADME, Gr I**
 - ▶ 2020: ~ 2,7PB raw disco, ~42 kHS06, ~4500 core,
 - ▶ ~20 disk server, ~20 macchine per servizi
 - ▶ Connessione a LHCONE a 20Gbps
 - ▶ Richieste 2021 ATLAS: **204k€**
 - ▶ **Disco 126k€, CPU 65k€, overhead 13k€**
 - ▶ PADME non fa richieste per 2021
- ▶ Altri esperimenti:
 - ▶ risorse opportunistiche del Tier2 e/o User Interface per accesso alla Grid e per uso interattivo:
 - ▶ Belle-II, LHCb, Km3.net , Muon Collider,
- ▶ Altri progetti:
 - ▶ **IDDLS: Italian Distributed Data Lake for Science, Gr V**
 - ▶ Partecipanti: GARR, INFN (CNAF, Bari, LNL, Napoli, Roma I, Pisa, Perugia)
 - ▶ Piccole richieste per missioni

Calcolo Scientifico ai LNF: i PON del Tier2

- ▶ **PON IBiSCo: Infrastruttura per Blg data e Scientific Computing**
- ▶ 6/2019-2/2022: esperimento **CTA, GR II**
 - ▶ ~ 1,2 PB disco raw, ~ 24 nodi di calcolo (~1300 core, ~20kHS06)
 - ▶ 10 macchine per servizi,
 - ▶ Upgrade dell'infrastruttura di rete del Tier 2 con core-switch con connessioni fino a 100Gbps
 - ▶ Partecipanti: INFN (Napoli, Bari, Catania), Università (Bari, Napoli), CNR, INAF, INGV
 - ▶ Gare 2019/20/21, costo **553 k€** (IVA inclusa), oltre a piccoli importi per missioni
- ▶ Proposta di partecipazione **PON Personale IBISCO**, se approvato porterà 4 AR da 3 anni:
 - ▶ 1 AR senior da 3 anni, 3 AR junior da 3 anni
 - ▶ Costo **390 k€** (incluso 20% di spese)
 - ▶ Attività e collaborazioni: ATLAS, Centro Calcolo, INAF/CTA, Gruppo lavoro INFN OpenAccess, IDDLs



ANAGRAFICA CMS 2021

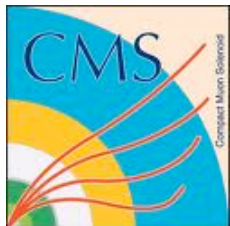
NOME COGNOME	status	CMS	FASE2_CMS	
Luigi Benussi	staff	0.20	0.70	ricercatore
Stefano Bianco	staff	0.80	0.00	ricercatore
Davide Piccolo	staff	0.30	0.40	ricercatore
Guido Raffone	Staff	0.00	0.50	tecnologo
Michele Caponero	staff	0.60	0.20	ricercatore
Giovanna Saviano	staff	0.00	0.80	ricercatore
Gabriella santonicola	staff	0.00	1.00	tecnologo
Marco Parvis	staff	0.00	0.30	ricercatore
Totale CMS		1.90	3.90	5.8

RESPONSABILITA' CMS 2021

Nome	Livello	Progetto	
Benussi	L2	MU-GEM	GEM hardware coordinator
Bianco	L3	MU-RPC	RPC Gas Gain Monitor coordinator
Piccolo	L3	MU-RPC	RPC Eco gas coordinator

Tecnici

NOMI	Frazione CMS
L. Passamonti	0.5
D. Pierluigi	0.5
A. Russo	0.5
Totale	1.5



GEM: ATTIVITA'



Attività 2021

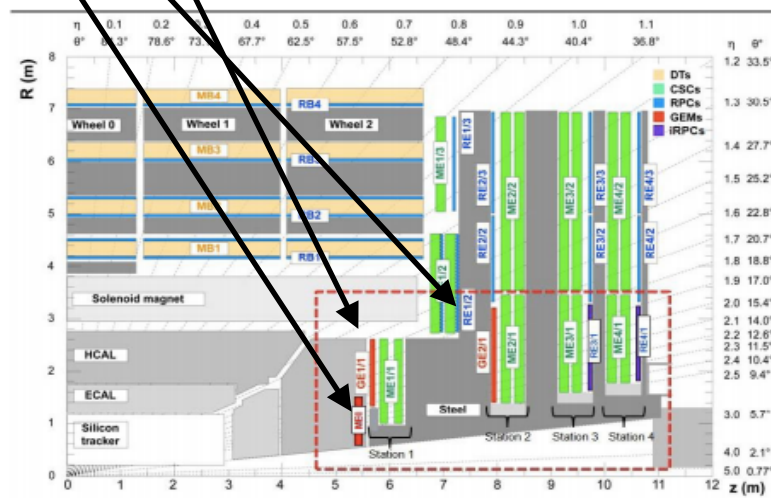
Attività 2020

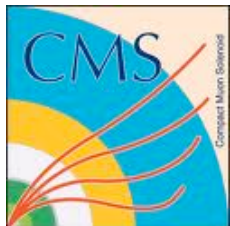
- Iniziato Assemblaggio SuperCamere GE1/1 (ongoing @CERN)
- Frascati e' Sito di produzione per GE2/1 e ME0 (inizio produzione GE2/1 era prevista per la prima metà 2020 - ritardata per COVID)
- L'Installazione GE1/1 in CMS iniziata in autunno 2019 e sta riprendendo ora.

- Costruzione SuperCamere al CERN - 4 mesi uomo personale tecnico
- Installazione SC GE1/1 in P5 - 3 mesi uomo personale tecnico
- Installazione dei sensori FOSxTemp nelle super-chamber - 3 mesi uomo di personale tecnico
- Pre-produzione GE2/1 - Camera pulita ed. 27 e strutture attualmente utilizzate per produzione GE1/1 per caratterizzazione prototipo, 6 mesi uomo personale tecnico di supporto

LIST OF PAPERS SIGNED IN 2019 (CMS COLLABORATION EXCLUDED)

1. G. Ramirez-Sanchez *et al.*, "Search for Heavy Stable Charged Particles in the CMS Experiment using the RPC Phase II upgraded detectors," JINST **14**, no. 11, C11011 (2019). doi:10.1088/1748-0221/14/11/C11011
2. J. Goh *et al.*, "CMS RPC efficiency measurement using the tag-and-probe method," JINST **14**, no. 10, C10020 (2019). doi:10.1088/1748-0221/14/10/C10020
3. R. Reyes-Almanza *et al.*, "High voltage calibration method for the CMS RPC detector," JINST **14**, no. 09, C09046 (2019). doi:10.1088/1748-0221/14/09/C09046
4. E. Voevodina *et al.* [CMS Collaboration], "RE3/1 and RE4/1 RPC chambers integration in the inner region of the forward muon spectrometer in the CMS experiment," JINST **14**, no. 10, C10027 (2019) doi:10.1088/1748-0221/14/10/C10027 [arXiv:1905.07814 [physics.ins-det]].
5. A. Gelmi *et al.*, "Longevity studies on the CMS-RPC system," JINST **14**, no. 05, C05012 (2019). doi:10.1088/1748-0221/14/05/C05012
6. D. Abbaneo *et al.* [CMS Muon Collaboration], "Performance of GE1/1 Chambers for the CMS Muon Endcap Upgrade," arXiv:1903.02186 [physics.ins-det].
7. D. Abbaneo *et al.* [CMS Muon Collaboration], "Layout and Assembly Technique of the GEM Chambers for the Upgrade of the CMS First Muon Endcap Station," Nucl. Instrum. Meth. A **918**, 67 (2019) doi:10.1016/j.nima.2018.11.061 [arXiv:1812.00411 [physics.ins-det]].
8. M. A. Shah *et al.* [CMS Collaboration], "The CMS RPC Detector Performance and Stability during LHC RUN-2," JINST **14**, no. 11, C11012 (2019) doi:10.1088/1748-0221/14/11/C11012 [arXiv:1808.10488 [physics.ins-det]].





RPC GAS: ATTIVITA'



• RPC Gas Gain Monitor

Frascati has proposed, designed, built and operated over the past 10 years the Gas Gain Monitoring system of the CMS RPC muon detector.

o The system provides online monitoring for changes in the RPC gains due to variations in gas mixture.

o **A major rewriting of the GGM DAQ and monitoring code is currently in progress**, in collaboration with S.Colafranceschi (formerly dottorando LNF, now at E.M.Univ., Harrisonburg, Virginia USA)

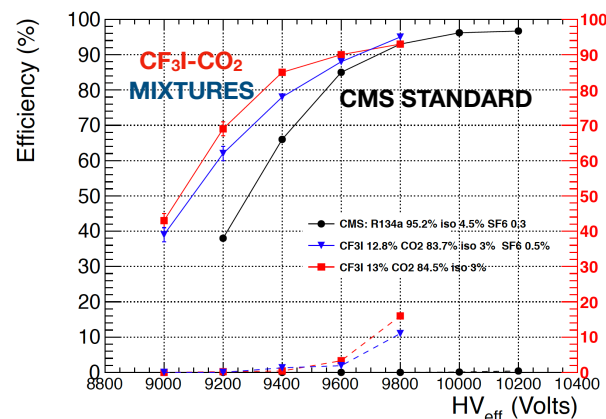
References

- L. Benussi *et al.* [CMS], "Performance of the gas gain monitoring system of the CMS RPC muon detector," JINST **10** (2015) no.01 [arXiv:1412.8039 [physics.ins-det]].
- S. Colafranceschi, *et al.* "Performance of the Gas Gain Monitoring system of the CMS RPC muon detector and effective working point fine tuning," PoS **RPC2012** (2012), 046
- S. Bianco, *et al.* "Operational experience of the gas gain monitoring system of the CMS RPC muon detectors, Nucl. Instrum. Meth. A **617** (2010), 146-147 doi:10.1016/j.nima.2009.06.095
- L. Benussi, *et al.* "The CMS RPC gas gain monitoring system: An Overview and preliminary results," doi:10.1016/j.nima.2008.12.175 [arXiv:0812.1108 [physics.ins-det]].
- L. Benussi, *et al.* "Sensitivity and environmental response of the CMS RPC gas gain monitoring system," doi:10.1088/1748-0221/4/08/P08006 [arXiv:0812.1710 [physics.ins-det]].

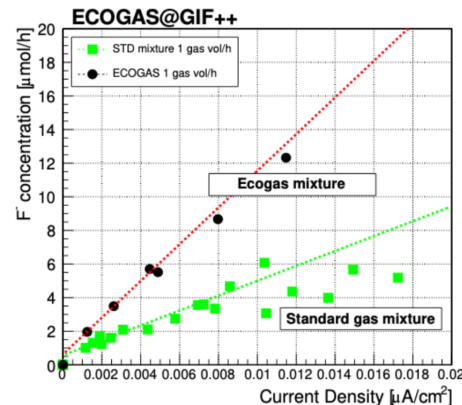
• RPC Eco Gas Studies

Effort to find an ecological replacement for $C_2H_2F_4$ and SF_6 for RPC operations

o Laboratory activities: $C_2H_2F_4$ and CF_3I



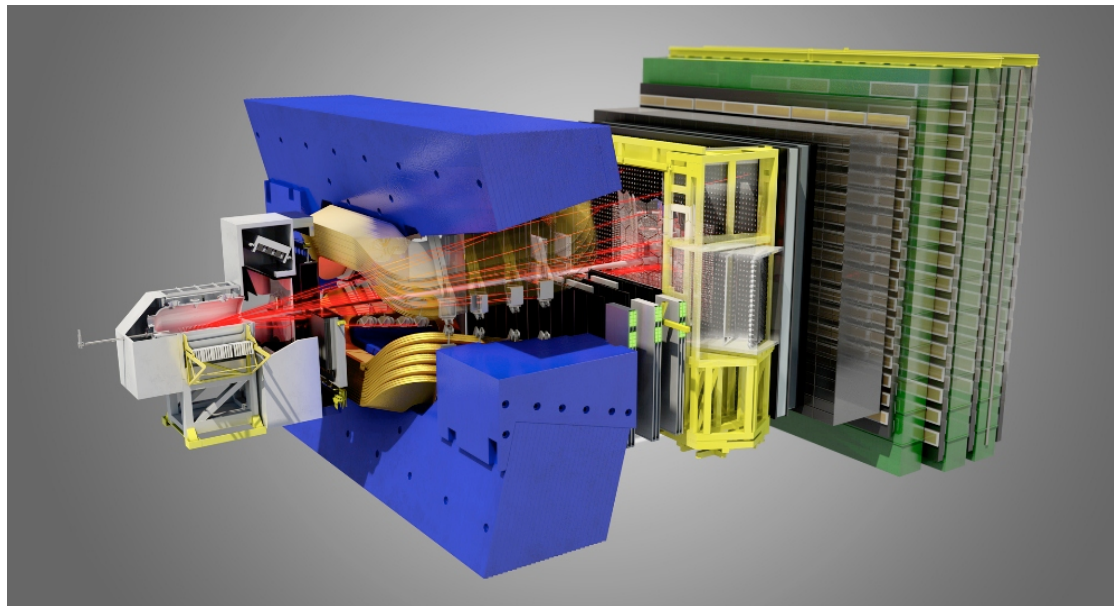
o Test under irradiations at GIF++ (ECOGAS@GIF++ Collaboration: Common effort CMS, ATLAS, ALICE, CERN)



o EcoGas activities at GIF++ Task submitted To AIDAInnova

LHCb - Frascati

Gianni Bencivenni, Stefano Calì, Pierluigi Campana, Paolo Ciambrone, Erika de Lucia, Patrizia de Simone, Pasquale di Nezza, Matteo Giovannetti, Giulietto Felici, Nikita Kazeev, Gaia Lanfranchi, Simonetta Liuti, Gianfranco Morello, Matteo Palutan, Marco Poli Lener, Patrick Robbe, Marcello Rotondo, Marco Santimaria, Paolo Santangelo, Barbara Sciascia, and Adalberto Sciubba



UT and Muon



Michael and Arvind on the CO2 system

preparing some of the PEPI electronics on the slice test setup



Michael and Jerome cleaning the Lukasz plant

Online – Installation of EB server.



Oleg installing muon electronics boards



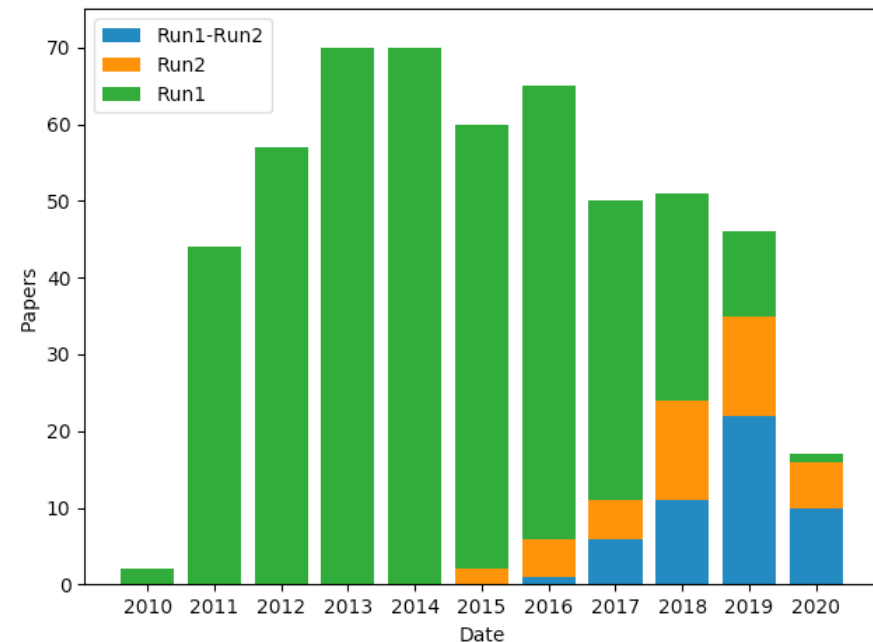
LHCb status

Upgrade I installation and commissioning resumed after CoViD19 lockdown.

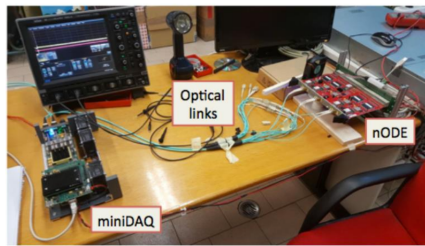
LHC plans:

- 2020 commissioning
- 2021 collisions for physics

[http://lhcbproject.web.cern.ch/lhcbproject/Publications/LHCbProjectPublic/Summary_all.html]

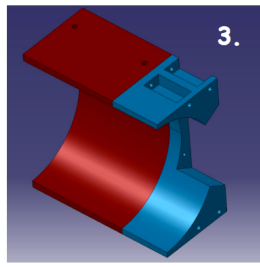


- **More than 500 papers published.** Last [1st July 2020]: Observation of a 4-c-quark tetraquark
- Most of the results from Run 1 data only, with **increasing full Run 1 + 2 data results.**
- Working hard to update to the full Run 1 + Run 2 data set all the results that showed hints of physics beyond SM.



Muon system:

- new FEE, new ECS: test and installation at CERN ongoing, then full commissioning
- 3 new beam plugs to shield chambers: installation ongoing



Real Time Analysis project [full software trigger; HLT1 on GPUs]: muon decoding and online monitoring

Data analyses: $B \rightarrow D$ form factors [published on March 2020],

$$B_{(s)}\mu\mu \text{ full Run 1 + Run 2, } R(D_s) = B_s \rightarrow D_s\mu\nu / B_s \rightarrow D_s\tau\nu,$$

$$R_{\Lambda_b} = \Lambda_b \rightarrow \Lambda_0 ee / \Lambda_b \rightarrow \Lambda_0 \mu\mu, \text{ search for } \Lambda_b \rightarrow \Lambda_0 e\mu,$$



System for Measuring the Overlap with Gas (SMOG) 2: allows to run LHCb in fixed-target mode. Ready to be installed

Development for future detectors (beyond Run 4)

High rate μ Rwell; working on technology transfer to industries. See also RD_FA activities

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN)
 CERN EP/2018/026
 LHCb-PAPER/2018/046
 March 20, 2020

arXiv:2003.08453v2 [hep-ex] 20 Mar 2020

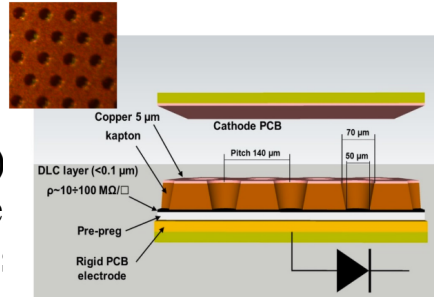
Measurement of the shape of the $B_s^0 \rightarrow D_s^{*+} \mu^+ \nu_\mu$ differential decay rate

LHCb collaboration¹

Abstract

The shape of the $B_s^0 \rightarrow D_s^{*+} \mu^+ \nu_\mu$ differential decay rate is obtained as a function of the hadron recoil using proton-proton collision data at a centre-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 3.76 fb⁻¹ collected by the LHCb detector. The $B_s^0 \rightarrow D_s^{*+} \mu^+ \nu_\mu$ decay is reconstructed through the decay $D_s^{*+} \rightarrow D_s^+ \mu^+$ and $D_s^+ \rightarrow A^+ K^0$. The differential decay rate is fitted with the Chiral Lagrangian (CLN) and hadronization Label (HCL) parametrisations of the form factors, and the former quantities for both are extracted.

Submitted to JHEP



Ricercatori [12.55 FTE]:

- 1) Gianni Bencivenni: 40 % 1 Ric. [+30% in RDA_FA(*)]
- 2) Stefano Cali: 100 % PhD (Tor Vergata)
- 3) Pierluigi Campana: 50 % Dir. Ric.
- 4) Erika de Lucia: 50 % 1 Ric. [+20% in RDA_FA(*)]
- 5) Patrizia de Simone: 90 % 1 Ric.
- 6) Pasquale di Nezza: 85 % 1 Ric.
- 7) Matteo Giovannetti: 100 % PhD (Tor Vergata)
- 8) Nikita Kazeev: 100 % PhD (Sapienza)
- 9) Gaia Lanfranchi: 70 % 1 Ric.
- 10) Simonetta Liuti: 50 % Ric. Straniero Associato (VA University, US)
- 11) Gianfranco Morello: 40% Ric. TD [+30% in RDA_FA(*)]
- 12) Matteo Palutan: 100 % 1 Ric.
- 13) Patrick Robbe: 100% Collaboratore Art. 7
- 13) Marcello Rotondo: 80 % Ric.
- 15) Marco Santimaria: 100 % AdR
- 16) Barbara Sciascia: 90 % Ric
- 16) Adalberto Sciubba: 10 % Prof. Associato (Sapienza)

Tecnologi [1.5 FTE]:

- 1) Paolo Ciambrone: 70 % 1 Tecn.
- 2) Giulietto Felici: 20 % Dir Tecn.
- 3) Marco Poli Lener: 40 % Tecn. [+30% in RDA_FA(*)]
- 5) Paolo Santangelo: 20 % 1 Tecn.

(*) RD_FA activity is synergic to LHCb future upgrades

Ruoli di coordinamento in LHCb attivi nel 2021:

- P. de Simone: Muon Software Coordinator [01/2017 - 12/2021]
- P. Di Nezza: Luminosity Coordinator [01/2019 - 03/2021]
- P. Di Nezza: SMOG2 Project Leader [04/2019 - 03/2021]
- M. Palutan: Deputy Spokesperson [07/2020 - 06/2023]
- M. Rotondo: Convener of Semileptonic Decays WG [01/2020 - 03/2022]
- M. Santimaria: Convener of Very Rare Decays subWG [06/2019 - 06/2021]
- B. Sciascia: Muon Project Leader [01/2021 - 12/2022]

Sigla	Ric	Tec	FTE	<FTE>	MISS	CON	ALTRO
LHCb	16	4	14.05	0.70	192.0	27.0	79.0

Missioni: **tot 192.02 kE**

Estere: $FTE * 2MU * 3.7kE = 103.97kE$

Interne: $FTE * 1kE = 14.05 kE$

Tecnici: 1MU [SMOG2, Gas Feed System (GFS) calibration, GFS installation at pit] = **3.7 kE**

Responsabilità: $3MU * 3.7kE$ [SMOG2 PL] + $4 * 1MU * 3.7kE$ [SL + VRD + Muon soft. + Lumi] + $6MU * 3.7kE$ [deputy SP] + $6MU * 3.7kE$ [MUON PL] = $19MU * 3.7kE = 70.3 kE$

Consumo: **27.075 kE**

Metabolismo: $FTE * 1.5 kE = 21.075 kE$

SMOG2, sistema lettura termocoppie: $\sim 7 kE$ (+2kE a Fe) **TBC**

Altri servizi diversi:

MoF-B LHCb MUON (70% of 120 kCHF, 1.075 CHF/EUR) **79 kE**

PRELIMINARY

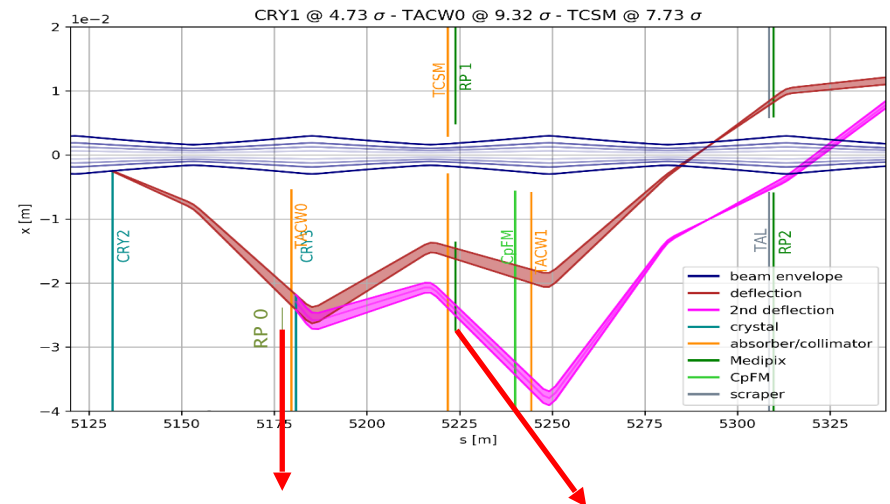
UA9 achievements and contributions

Double channeling was achieved for the first time in 2017 and repeated in 2018 also with Fixed Target

Observables:

- Beam splitting efficiency
- Multi crystal deflection efficiency
- Background
- Background induced by the targets

Low TOTEM background with LHC Crystal Collimation



Last Publications:

- Eur. Phys. J. C (2020) 80:27 <https://doi.org/10.1140/epjc/s10052-019-7590-x>
- Physics Letters B 804 (2020) 135396
- NIMB 467 (2020) 118-122 <https://doi.org/10.1016/j.nimb.2020.01.011>
- NIMA 975 (2020) 16417 <https://doi.org/10.1016/j.nima.2020.164175>
- Eur. Phys. J. C (2019) 79:993 <https://doi.org/10.1140/epjc/s10052-019-7515-8>
- Phys Rev Accel Beams 22,093502 (2019)
- NIM, A 946 (2019) 162513 <https://doi.org/10.1016/j.nima.2019.162513>
- NIM B 438 (2019) 38-41 <https://doi.org/10.1016/j.nimb.2018.10.035>
- Eur. Phys. J. C (2019) 79:933 <https://doi.org/10.1140/epjc/s10052-019-7448-2>

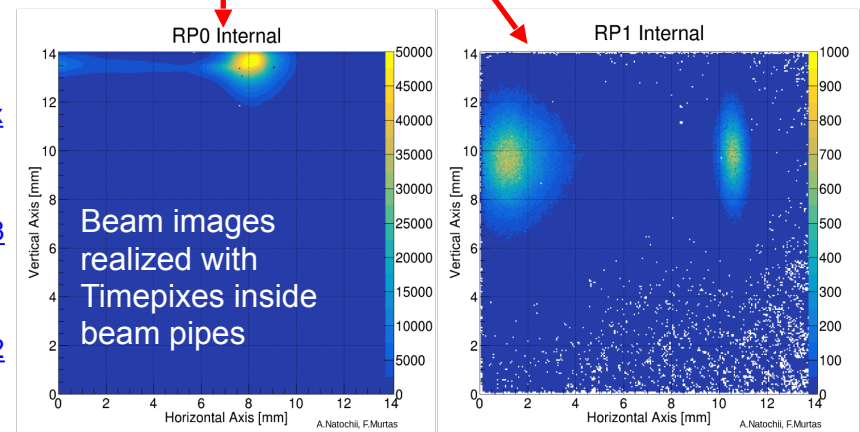
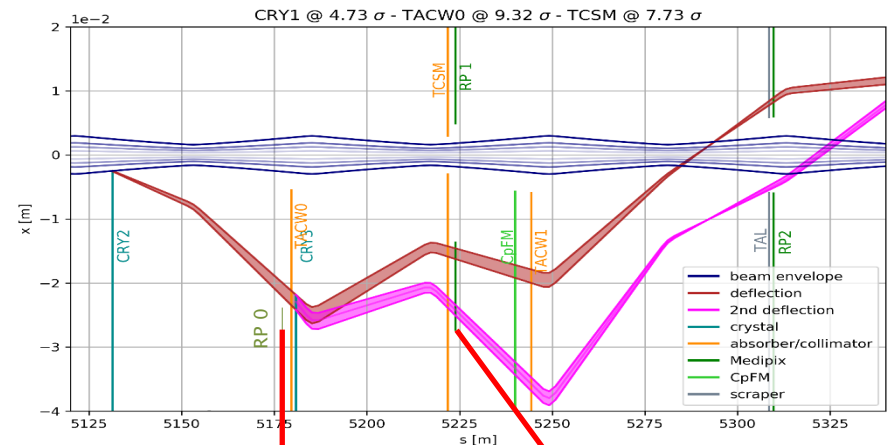
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- NIMA 975 (2020) 16417 <https://doi.org/10.1016/j.nima.2020.164175>
- Eur. Phys. J. C (2019) 79:993 <https://doi.org/10.1140/epjc/s10052-019-7515-8>
- Phys Rev Accel Beams 22,093502 (2019)
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- Eur. Phys. J. C (2019) 79:933 <https://doi.org/10.1140/epjc/s10052-019-7448-2>

UA9 - new MoU under approval

- The MoU is defined and **under approval**
- The human and the financial resources have been defined.
- The upgrade of the setup in the SPS (*updated detectors and layout*) and in the North Area (*new telescope and goniometer*) will be completed **during LS2**.
- In LSS5 (**UA9 site**) **two experiments can be performed**
 - ❖ the double crystal experiment for short living baryons investigation
 - ❖ the beam splitting and the production of fixed target interactions in the SPS vacuum pipe to prepare FT in ALICE (in synergy with the non-resonant extraction studies)
- Plans for LSS4 (**extraction area**) exist, implying:
 - ❖ Study of a system for the non-local non-resonant extraction in pulsed mode appropriate for TT20
 - ❖ Installation of a system for the distant shadowing of the ZS in LSS2
- New activities
 - ❖ Multi-injection assisted by bent crystal in a muon collider (**test beam in H8**)
 - ❖ Preparatory studies on slow extraction in DAPHNE

INFN Contributions

Three INFN sections participating to the UA9 MoU :

➤ **Laboratori Nazionali di Frascati (F.Murtas)**

6 researchers : Timepix3-light Telescope, beam diagnostics & data analysis

➤ **Roma 1 (A.Variola)**

5 researchers : extraction studies and CPFM readout

➤ **Napoli (F.Galluccio)**

1 researcher : SPS optics, coordination

Two Agreements INFN-CERN: KE4450/EN (**Roman Pots**) & KE4350/EN/HL-LHC (**Crystals**)

Institute	CERN	IHEP	INFN	JINR	PNPI	UK	IEAP	TOTAL
Share	29 %	9 %	24 %	2 %	9 %	16 %	11 %	100 %

Richieste finanziarie in 5 anni

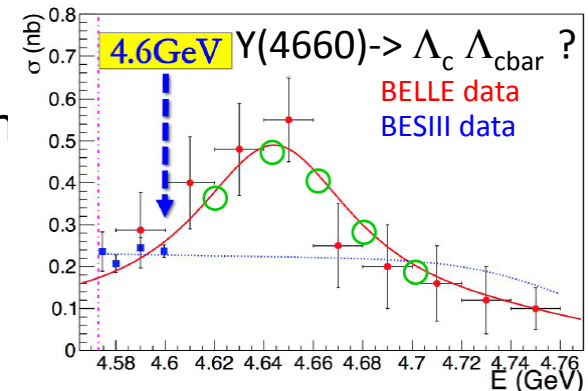
ITEM	Goniometer for SPS	Absorbers	Scintillating counters	Cerenkov counters	Trigger for silicon strip	Scintillation counters for the SPS	Labor	CF contribution	TOTAL
Keuro	20	10	10	25	10	10	5	25x5	225

Upgrade di BEPCII nel 2019:

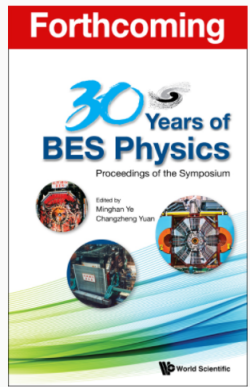
- **top-up** luminosity (incremento 30%), record di luminosità raggiunto: **$4.3 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$**
- aumento di valore massimo di energia E_{cm} : 4.6 \rightarrow 4.7 GeV

Presi dati dic. 2019-giugno 2020 alle energie di $\Upsilon(4660)$ & $\Lambda_c \Lambda_c$:

- 500 pb^{-1} per punto a $E_{\text{cm}}=4.62, 4.64, 4.66, 4.68$ e 4.70 GeV, 100 pb^{-1} a $E_{\text{cm}}=4.61$ GeV & 1.03 fb^{-1} a 4.68 GeV
- shift coperti tutti da IHEP staff causa Covid19
- Ricerca di nuovi stati XYZ e dei loro decadimenti in open charm e charmonio, studio di $\Upsilon(4660)/\Upsilon(4630)$
- Capire la discrepanza di $\sigma(e^+e^- \rightarrow \Lambda_c \bar{\Lambda}_c)$ in **BESIII** e **BELLE**
- Fattori di forma della Λ_c
- Importante contributo LNF nella proposta di presa dati



Highlights e contributi del gruppo italiano

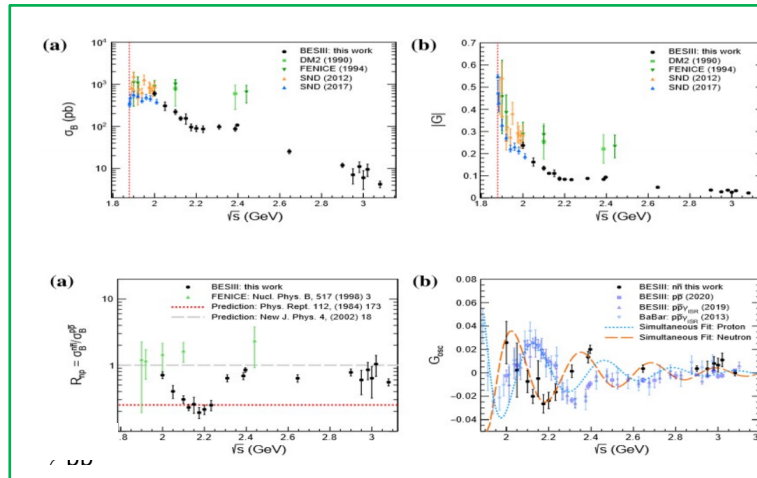


Publicato il **BESIII White Paper** in Chin.Phys. C **CPC 44, 04001 (2020)** con il programma di fisica per i prossimi 10 anni:

- Contributo italiano nella fisica Barione-Antibarione, misure di polarizzazione

September 2019:

Symposium on 30 years of BES physics



New features in the electromagnetic structure of the Neutron, in via di sottomissione a Nature Physics

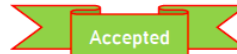
❖ Σ^+ and Σ^- polarization in the J/ψ and $\psi(3686)$ decays, ArXiv: 2004.07701

(sottomesso a PRL)

Prepared to be submitted to Chinese Physics C

A possible simultaneous fit to the available $e^+e^- \rightarrow \Lambda_c^+ \bar{\Lambda}_c^-$ cross section data nearby $\psi(4660)$ by means of a strong correction to the Coulomb enhancement factor

PREPARED FOR SUBMISSION TO JINST



Time performance of a triple-GEM detector at high rate

PREPARED FOR SUBMISSION TO JINST

PARSIFAL: a toolkit for triple-GEM parametrized simulation

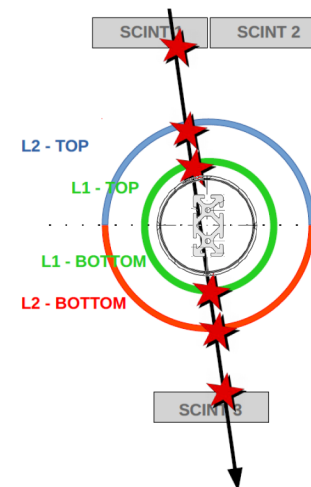
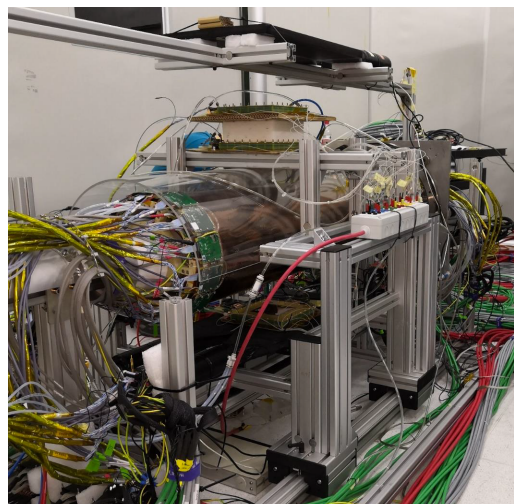
Costruzione @LNF:

- L3 in fase di completamento (ritardato dall'emergenza COVID19) a LNF:
 - ✓ GEM1 , GEM2 e Catodo pronti
 - ✓ GEM3: in fase di completamento nelle prossime settimane, Jing Dong non potrà venire → E.Paoletti incollerà i fogli GEM
 - ✓ Anodo da completare tra LNF e ditta LOSON (MI) [possibilmente entro luglio] (S.Cerioni e M.Melchiorri)
 - ✓ Inserimento dei 5 cilindri con VIM (Vertical Insertion Machine in camera pulita → settembre
- Spedizione L3 in Cina entro il 2020 se possibile viaggiare in sicurezza

Causa ritardi dovuti al COVID19, specialmente per quanto riguarda i viaggi, l'installazione a IHEP è (al 90% CL) rimandata da estate 2021 a estate 2022

Commissioning in corso ad IHEP:

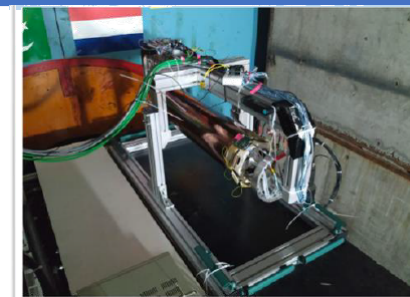
L1+L2 a IHEP da dicembre '19 in presa dati (da remoto) cosmici con struttura di supporto inserita (Multiple Coulomb scattering)



Noise test /induced bkg

Vecchio L1 all'IP accanto all'apparato BESIII per test di rumore:

- **NON** si notano forti correlazioni con MDC accesa/beam current/beam energy



Gruppo 1 LNF, richieste (k€), 2021

Sigla	Ric	Tec	FTE	<FTE>	MISS	CON	APP	ALTRO	CAP
BESIII	3	1	2.9	0.75	70	6	0	0	INV

missioni a IHEP coperte
al 40% dal RISE

Composizione del gruppo BESIII LNF:

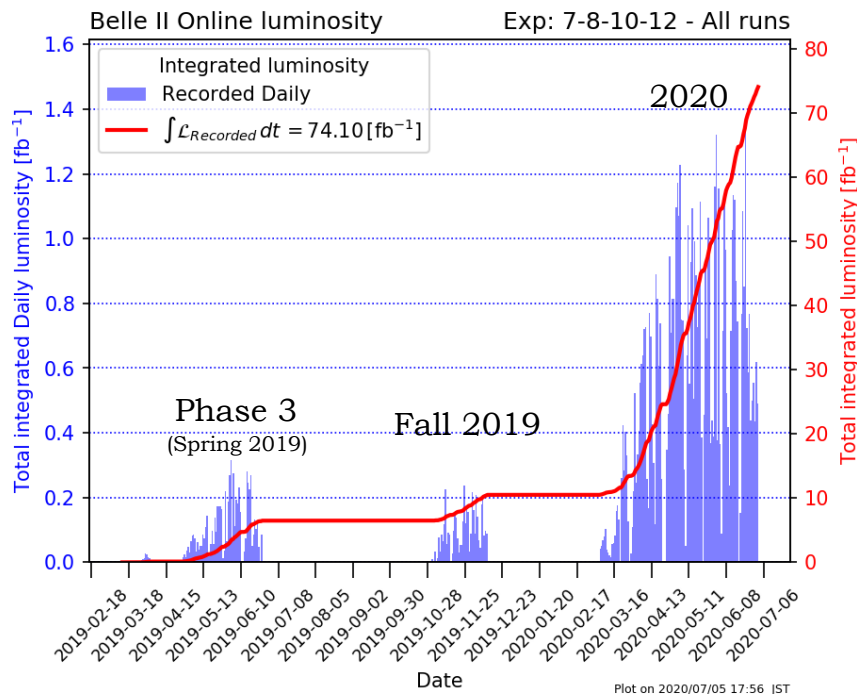
R. Baldini Ferroli (ass.senior)	0%
M. Bertani	90%
A. Calcaterra	100%
G. Felici	30%
P. Patteri	70%
A. Zallo (ospite senior)	0%

supporto tecnico BESIII secondo semestre 2019

S. Cerioni	30%
E. Paoletti	20%
A. Orlandi	10%

Belle II – Operations

- Belle II ha iniziato la presa dati di fisica con la cosiddetta «Fase 3» l'11 Marzo 2019, la presa dati è continuata poi in autunno 2019 e primavera 2020
- In Febbraio 2020 implementato lo schema “crab-waist” di P. Raimondi, già testato con successo a DAFNE, che ha notevolmente stabilizzato i fasci consentendo di aumentare le correnti e la luminosità
- Il 15 Giugno 2020 SuperKEKB ha raggiunto **luminosità di picco di $2.2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$** (con apparato in presa dati), battendo il precedente **record mondiale** di $2.14 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ precedentemente stabilito da LHC!



Luminosità integrata totale: **$\sim 74 \text{ fb}^{-1}$**

Parametri Macchina [design]

$$\beta_y^* = 1 \text{ mm [0.3mm]}$$

$$I_{\text{beam}} (\text{LER/HER}) = 0.72/0.61 \text{ A [2.6/3.6 A]}$$

$$\# \text{ bunches} = 978 [2364]$$

$$L_{\text{peak}} = \mathbf{2.4 \times 10^{34}} [8.0 \times 10^{35}]$$

Belle II – Attività 2020 in corso

- **Hardware e Operations**

- Turni CR Remoti
- Turni sotto-rivelatore KLM
- Manutenzione schede front end lettura degli RPC

- **Software**

- Implementazione e ottimizzazione dell'identificazione di KL
- Studio delle prestazioni del KLM come rivelatore di KL (efficienza, risoluzione angolare, KL-ID ecc.) utilizzando eventi ($e^+e^- \rightarrow \Phi(\mathbf{K}_S\mathbf{K}_L) \gamma$) nei dati, confronto dati/MC

- **Analisi Dati**

- Studio del canale di decadimento $B \rightarrow J/\psi K_L$

- **Pubblicazioni**

1. "Search for an Invisibly Decaying Z' Boson at Belle II in $e^+e^- \rightarrow \mu^+\mu^-(e^\pm\mu^\mp) \text{ Plus Missing Energy Final States}$ ", *Phys.Rev.Lett.* 124 (2020) 14, 141801
2. "Measurement of the integrated luminosity of the Phase 2 data of the Belle II experiment", *Chin.Phys.C* 44 (2020) 2, 021001
3. "Belle II Physics Book", *PTEP* 2019 (2019) 12, 123C01, *PTEP* 2020 (2020) 2, 029201 (erratum)

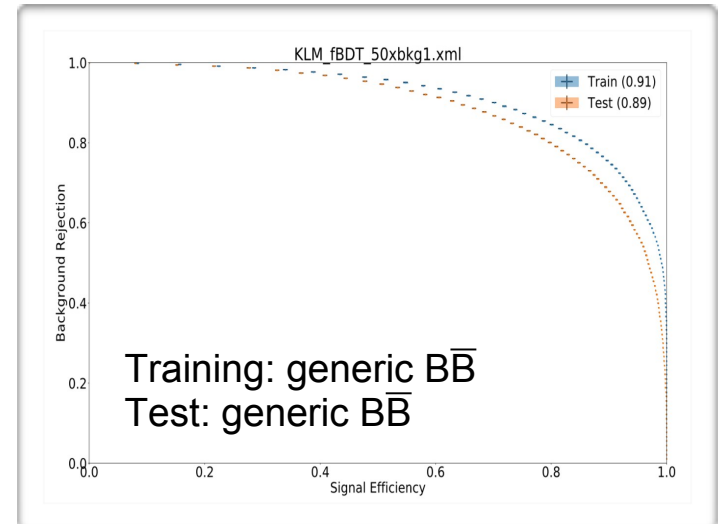
Belle II – Attività 2020 in corso

● Software

● K_L Identification

- BDT based on 18 KLM & ECL variables

BDT ROC Plot



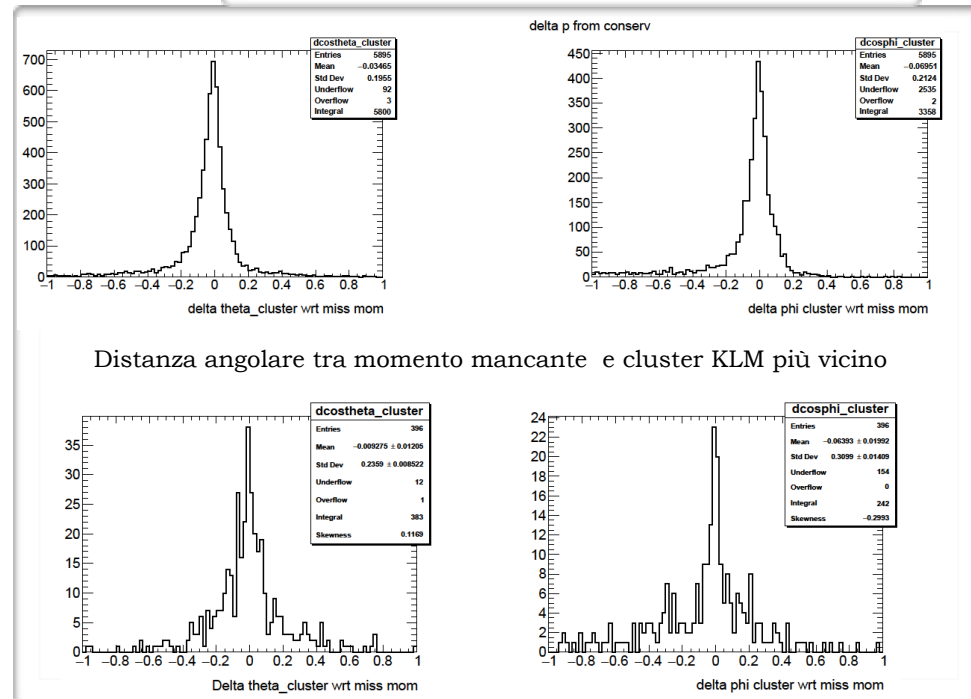
● $e^+e^- \rightarrow \Phi(K_S K_L)\gamma$

- Study resolution and KL-ID efficiency

MC

Risoluzione angolare in eventi $e^+e^- \rightarrow \Phi(K_S K_L)\gamma$

Data



Belle II – Attività 2020 in corso

● Analisi Dati

● $B \rightarrow J/\psi K_L$

Dati analizzati (Phase 3) $\sim 5 \text{ fb}^{-1}$

Sample	$\int \mathcal{L} dt$ (good runs) pb^{-1}	$\int \mathcal{L} dt$ (all runs) pb^{-1}
exp-7 4S	550.8 ± 0.3	642.8
exp-8 4S	4626.3 ± 0.9	4958.94
exp 7+8 4S	5177.1 ± 0.9	5601.74
exp-8 Scan	38.97 ± 0.08	39.02
exp-8 Continuum	828.2 ± 0.4	827.0

BELLE2-NOTE-PH-2020-011

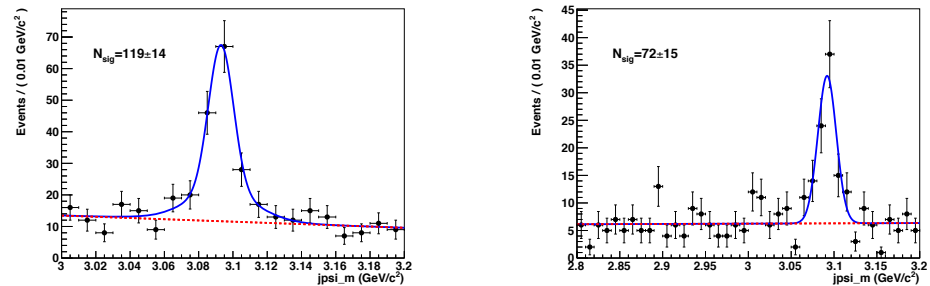
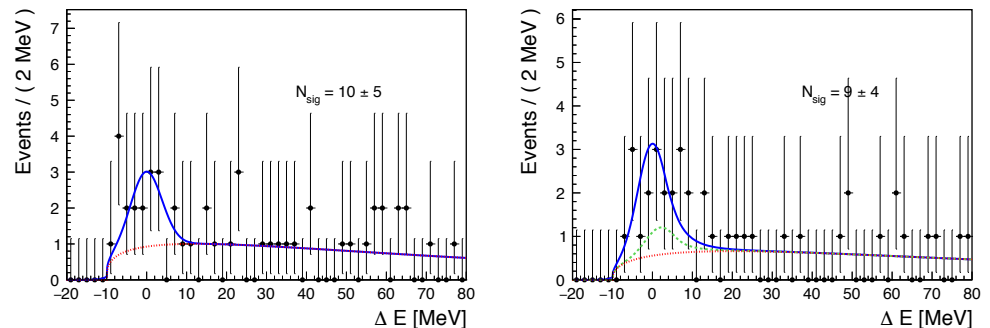
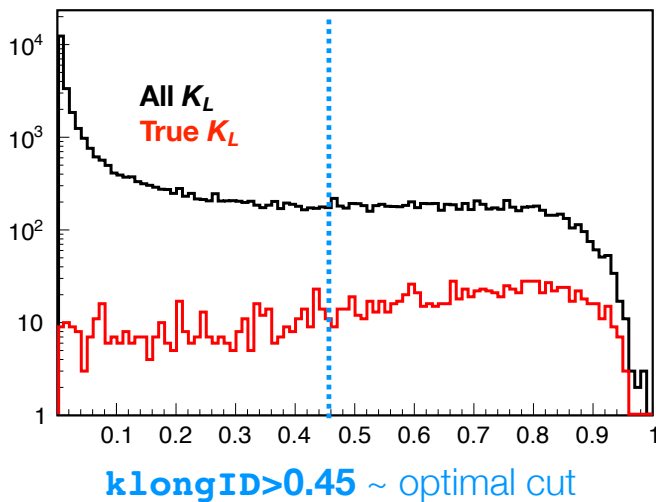


FIG. 4. J/ψ mass spectra for $J/\psi \rightarrow \mu\mu$ (left) and $J/\psi \rightarrow ee$ (right) for data in $B \rightarrow J/\psi K_L$.



Sample	$\mu^+ \mu^-$	$e^- e^-$
MC13b	2.9 ± 0.8	2.2 ± 0.8
proc10	1.9 ± 1.0	1.7 ± 1.0

Belle II – Attività Previste 2021

- Hardware
 - Manutenzione (sostituzione e riparazione) schede di front end
 - Manutenzione Apparato RPC
 - Studio caratteristiche e prestazioni di scintillatori letti da MPPC per upgrade KLM, possibile nel long shutdown di SuperKEKB del 2026
- Software
 - Ottimizzazione, Mantenimento e Controllo di qualità dell'identificazione dei KL
- Analisi Dati
 - Studio efficienza e risoluzione angolare KL nel KLM utilizzando eventi ($e^+e^- \rightarrow \Phi(KS KL) \gamma$) nei dati
 - Analisi dati “Phase 3” e Run 2019-2020
 - Misura del parametro CPV $\sin(\phi_1)$ nel decadimento $B \rightarrow J/\Psi K_L$

Belle 2 LNF, richieste 2021 e composizione

Sigla	Ric	Tec	FTE	<FTE>	MISS	CON	ALTRO CAP
Belle II	5	1	2.2	0.47	35.5	3.5	

Componenti del gruppo 2021

M. Beretta (0.1)
 R. de Sangro (Resp.) (0.9)
 G. Finocchiaro (0.9)
 P. Patteri (0.3)
 I. Peruzzi
 M. Piccolo

Responsabilità

R. de Sangro: Coord. KLM Italia; Belle II Shift Manager
 G. Finocchiaro: Resp. KL-ID
 I. Peruzzi: Speakers Committee Chair

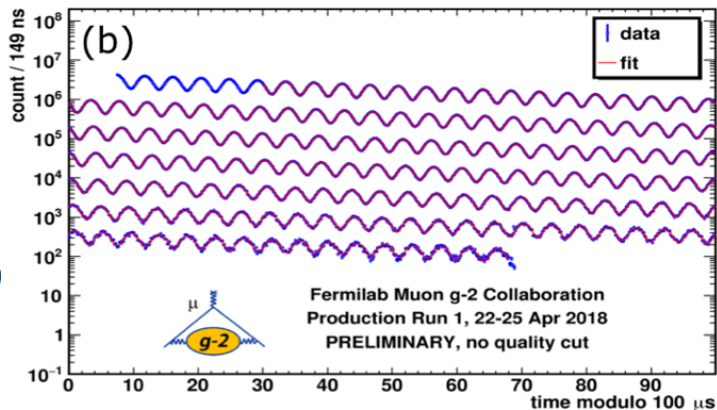
Richieste 2020		I Semestre	II Semestre
SPAS	Tecnico gruppo esperti di elettronica	2 mu	2 mu
Serv. Elettronica	Supporto attività di laboratorio (elettronica lettura MPPC)	1mu	1mu



Attività' esperimento g-2

- risultato sulla analisi del run1 entro l'anno con errore $\sim 1 \cdot \text{BNL}$ (E821)
- il Run3, interrotto a marzo 2020, ha raccolto una statistica limitata
- previsto un Run4 (2021) ed un Run5 (primi mesi 2022, prima di mu2e) necessari per raggiungere la statistica di progetto per misurare g-2 con un errore $\sim 0.3 \cdot \text{BNL}$
- errore teorico (giugno/2020) $\sim 0.7 \cdot \text{BNL}$

$$\Delta a_\mu := a_\mu^{\text{exp}} - a_\mu^{\text{SM}} = 279(76) \times 10^{-11},$$



■ Attività 2021:

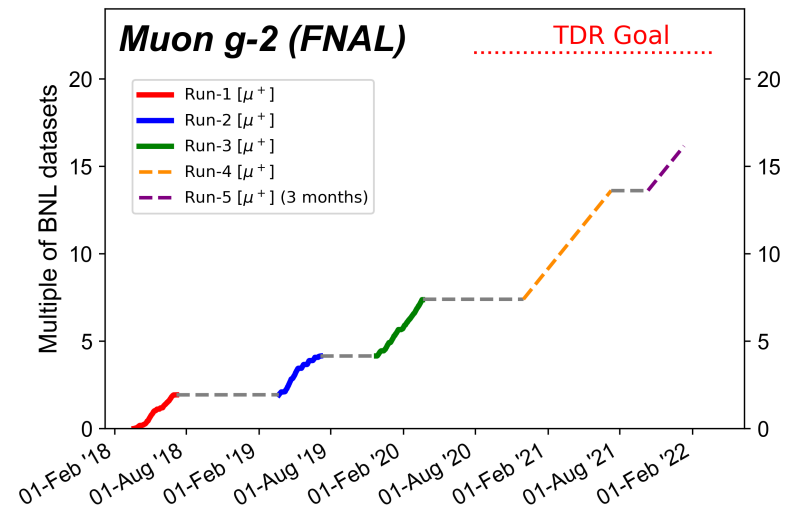
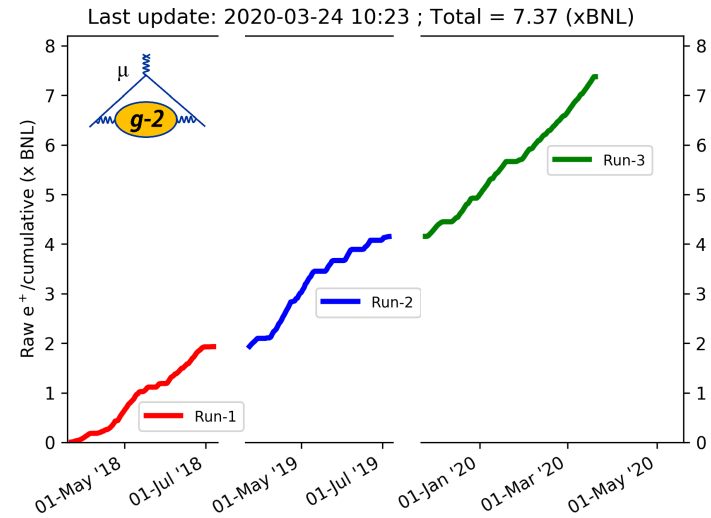
- RUN4 (Novembre 2020-Maggio 2021)
→raddoppiare la statistica sinora acquisita (RUN1-3~7xBNL)→RUN1-4~14xBNL
- Analisi del RUN2+3 (5xBNL) (assumendo che il RUN1 venga pubblicato questo anno). Errore totale atteso RUN2-3~ O(300)ppb.

■ Piano di lavoro e richieste finanziare INFN 2021:

- Mantenimento dell'apparato e presa dati
- Richieste di 30 kE per consumo, 50kE per metabolismo e manutenzione apparato e 300 kE per missioni FNAL

■ Rise (in sinergia con Mu2e) :

- MUSE: 2019;NEWS 2020+2021



G-2 @ LNF: attività & personale & richieste

@ Attività:

- Raccolta dati presso Fermilab;
- GEANT4 simulazioni per un calorimetro di g-2

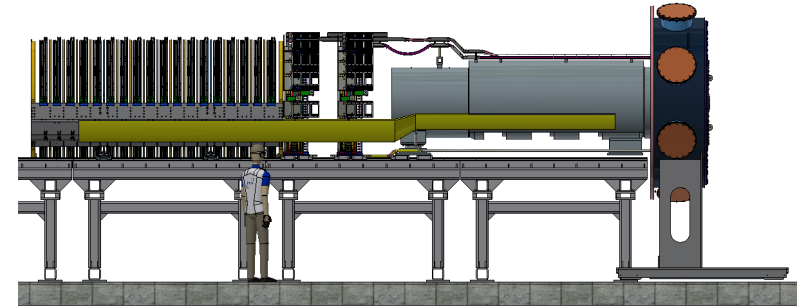
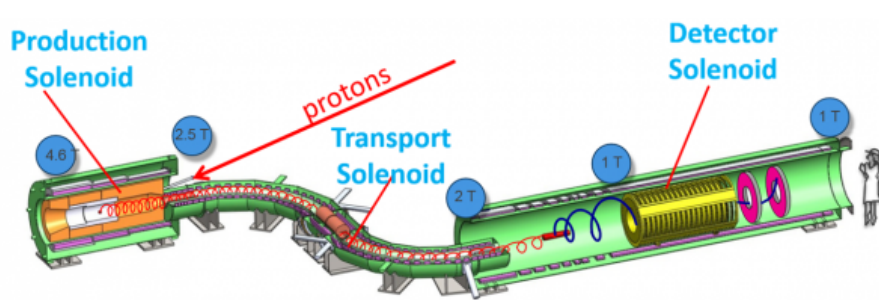
@ Personale FTE 1.2

- S. Dabagov – 50%
- D. Hampai – 40%
- V. Guglielmotti – 30%

@ Richieste

- Missioni – $4 \times 4 \text{ k€} = 16 \text{ k€}$
- Consumabili – 7 k€

MU2E



Composizione MU2E nel 2021

Ricercatori/Tecnologi LNF (6,5/9)

S. Bini (0,5) Ric
C. Bloise (0,7) Dir. Ric
F. Colao (Ass. Enea) (0,5)
M. Cordelli (Ass. senior) (1)
F. Fontana (0,5) (Ass. Marconi),
S. Giovannella (0,7) I Ric,
F. Happacher (0,8) Ric, Res.Locale
M. Martini (0,3) (Ass.Marconi),
S. Miscetti (0,8) Dir. Ric. (Res.Nazionale)
D. Rinaldi (Ass. Ancona) (1,0)
I. Sarra (0,7) Art. 36

Non strutturati (5,7 FTE/6)

M. Ricci (1,0) Dott
R. Donghia (1,0) AR
E. Diociaiuti (1,0) AR
F. Fabiano (1,0) Laur. La Sapienza
L. Montalto (Ass. Ancona) (1,0)
D.Paesani (1,0) Laur. Politecnico di Torino

Tot FTE (Ric+Tecnologi+PHD)

=> 10.7/16 = 0,7

DR: G.Pileggi(0,2), A.Saputi(0,3), A.Mengucci(0,5), M.Ventura(0,5), E.Capitolo (0,2)

SEA (6 MU) G.Corradi (0,5), S.Ceravolo(0,5), B.Ponzio(0,2)

SPCM: 6 MU

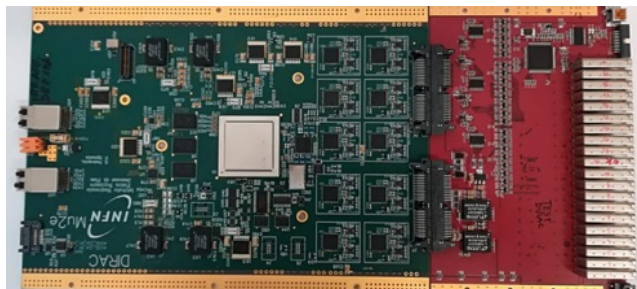
MU2E status

- ❖ CLFV: conversione di un muone in e- su targhetta di Al @ BR $\sim 6 \times 10^{-17}$
- ❖ CD3 June 2016 , costo DOE 274 M\$
- ❖ Costruzione magneti DS, PS e TS in corso. TS @ ASG (Genova)
- ❖ Envelope finanziario Calorimetro at CSN1 (2.9 Meuro)
- ◆ Produzione e test cristalli iniziata Feb 2018 → 1300/1450 shipped and tested
- ◆ Produzione e test SiPM Hamamatsu completata
- ◆ CRR meccanica Maggio 2019, CRR FEE Novembre 2019
- ◆ Complete Gare costruzione componenti meccanici e FEE
- ◆ Module-0 completato e testato con elettroni e sotto vuoto
- ◆ **Mockup and prototypes at LNF, costruzione al FNAL**

- ☐ LNF responsabilita' costruzione calorimetro elettromagnetico – S. Miscetti, L2 Manager → L3 Cristalli - S. Giovannella; L3 fotosensori - I. Sarra; L3 Meccanica - F. Happacher ed A. Saputi; L3 FEE - G. Corradi
- ☐ EB member: S.Miscetti, IB member : F.Happacher, PUB board: S.Giovannella

Attività 2020 in pictures

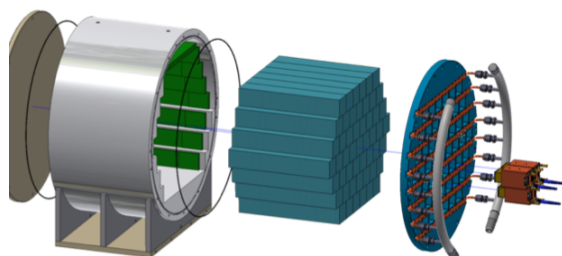
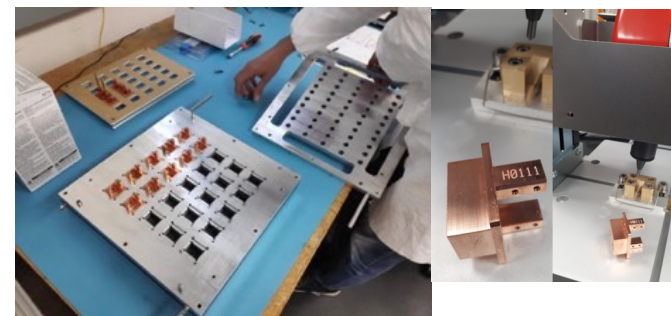
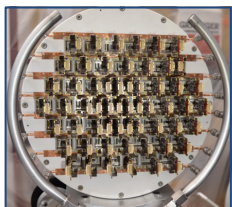
FEE+MB



Module-0 tests in cryostat

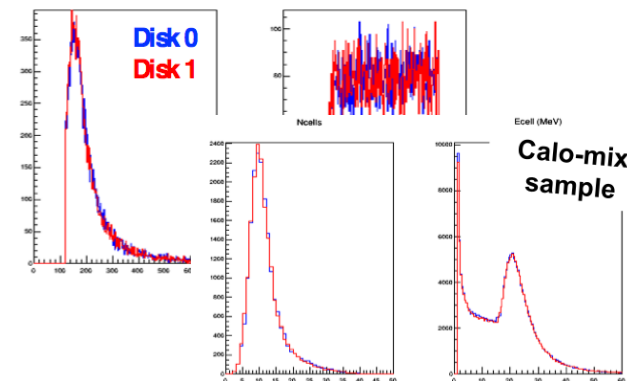
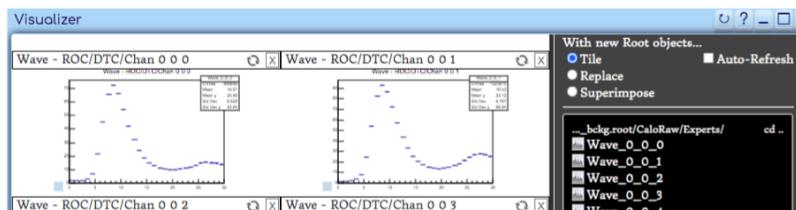
Aluminum rings completed, @INFN

SiPM Gluing on copper holders



Visualizer: Experts

Input: fragments produced from Noprimary-mix MC sample



DQM

PMU2E: Richieste 2021

MI	Metabolismo	7,5 KE	
	Gettone RN	3 KE	17 KE
	Missioni Marconi-LNF	6,5	
ME	Responsabilita` Project Leader+5 L3	71,5 KE	160 KE+ 33 KE (sj)
	QA + Assembly	40 KE	
	Missioni per personale tecnico (SJ)	33 KE	
	Supporto addizionale assemblaggio e installazione In sala (F. Hppacher – A. Saputi –I. Sarra)	33 KE	
Trasporti	Trasporto	5 KE	
Consumi	Metabolismi	16 KE	21 KE
C.A	Cooling Station (SJ)	100	
	Feet manufacturing	10	
	Cables Trays	10	196 KE
	Disks displacement mechanism	5	
	Pipes feedthroughs	10	
	Laser head	12	
	Lyso crystals for beam monitoring	16	
	Outgassing system	15	
R&D	Cristalli LABR 7 + BaF2 9	16	26KE
	SiPMs + FEE 5+5	10	

Conclusioni

- Si conferma una grande vivacità e varietà nelle attività di gruppo 1
- Esperimenti in costruzione, in presa dati, in fase di analisi, in via di concepimento.
- E poi gli upgrades, e -purtroppo- esperimenti in chiusura.
- Mai così tante sigle inserite nei preventivi
 - Tuttavia, rimaniamo incisivi e manteniamo gli impegni su tutti i fronti
 - Si dovrà necessariamente raggiungere un punto di equilibrio

Backup slides



Riepilogo delle richieste e assegnazioni di servizi

Assegnazione risorse servizi 2020/II

SEM

Nome	Richieste II semestre 2020			Percentuali Assegnate CIF	Assegnazioni II semestre 2020	
	Exp.	MU	%	%	MU	Tagli %
Capitolo Emilio	PADME (Gianotti)	0.50	10.0%	10.0%	0.50	0%
	ATLAS NSW (M. Antonelli)	3.00	60.0%	55.0%	2.75	8%
	MUZe (Happacher)	2.00	40.0%	35.0%	1.75	13%
		5.5	110.0%	100.0%	5.0	
Capoccia Cesidio	SIDDHARTA II (Catalina)	2.50	50.0%	30.0%	1.50	40%
	SICURA (Cat. Bed.)	0.50	10.0%	0.0%	0.00	100%
	VIP II (Catalina)	0.50	10.0%	0.0%	0.00	100%
	MEGANTE (INFN-FI Rosi)	2.50	50.0%	40.0%	2.00	20%
	CYGN0/INITIUM (Mazzitelli)	3.00	60.0%	30.0%	1.50	50%
		9	180.0%	100.0%	5.00	
Cerioni Stefano	BESIII (Bertani)	2.00	40.0%	20.0%	1.00	50%
	RWELL (Bencivenni)	4.50	90.0%	30.0%	1.50	67%
	ATLAS NSW (M. Antonelli)	3.00	60.0%	50.0%	2.50	17%
		9.5	190.0%	100.0%	5.00	
Orecchini Dario	ATLAS ITK (M. Antonelli)	2.50	50.0%	50.0%	2.50	0%
	JLAB12 (Mirazita)	3.00	60.0%	50.0%	2.50	17%
		5.5	110.0%	100.0%	5.00	
Oriandi Aldo	JLAB12 (Mirazita)	1.00	20.0%	20.0%	1.00	0%
	BESIII (Bertani)	1.00	20.0%	20.0%	1.00	0%
	ALICE/PAPRICA (Ronchetti)	1.50	30.0%	30.0%	1.50	0%
	DAPHNE LIGHT	0.75	15.0%	15.0%	0.75	0%
	Contingency	0.75	15.0%	15.0%	0.75	0%
		5.00	100.0%	100.0%	5.00	
Ortenzi Bruno	ATLAS ITK (M. Antonelli)	2.50	50.0%	50.0%	2.50	0%
	FOOT (Spiriti)	2.50	50.0%	50.0%	2.50	0%
		5	100.0%	100.0%	5.00	
Pileggi Giuseppe	ATLAS NSW (M. Antonelli)	3.00	60.0%	60.0%	3.00	0%
	MUZe (Happacher)	2.00	40.0%	40.0%	2.00	0%
		5	100.0%	100.0%	5	
Rosatelli Filippo	ATLAS ITK (M. Antonelli)	3.50	70.0%	70.0%	3.50	0%
	CYGN0/INITIUM (Mazzitelli)	1.50	30.0%	30.0%	1.50	0%
	5	100.0%	100.0%	5.00		

SEA

	Prog. Elettronica	CAD	Automazione	Staff	Contingenza	PRIORITA' CIF
ESPERIMENTO						
ALICE - Paprika			0,5		0,5	A1
ATLAS		3,0	3,5	3,0	1,5	A1
Belle 2		0,5			0,5	A2
BESIII			0,5		1,0	A1
CREMLIN-plus	1,5				0,5	A2
FOOT	0,5				3,0	A1
JUNO			0,5		0,5	A1
KAONNIS/SIDDHARTA-2					1,5	A3
Laboratorio COLD (QUAX, SIMP)			0,5		0,5	A1
LHCb	0,5			8,0	3,5	A1
LIMADOU	3,0				1,0	A2
NA62		1,5			1,0	A2
PADME	0,5				0,0	A1
PMU2E	7,5	1,0			2,0	A1
RD-FA	0,5	0,5			1,0	A3
SCF LAB		1,0	0,5		0,5	A2
Servizio FISMEL					2,0	A1
Servizio SIDS	1,0				1,0	A3
SHIP		1,5	0,5		0,5	A1
STRONG2020 - TIIMM		2,0			0,5	A3
VIP2					0,5	A3
Attività LNF	1,0	2,5	2,0		1,5	A2
Varie SEA	3,5	3,0	2,0	2,0	7,0	
contingenza	0,0	2,5	2,0	0,0	0,0	
Tot	19,5	19,0	12,5	13,0	31,5	

Assegnazione risorse servizi 2020/II

SPCM

SCHEDA TECNICI

LNF, 19-06-2020 PROGRAMMAZIONE SPCM LUG-DIC 2020 MESI: 6

PREVISIONE CONSUNTIVO

Priorità	PROGETTAZIONE	M.U.	mesi = 6	personale = 1	M.U. disponibili* = 5,0	M.U.
-	GESTIONE UFF. TEC.	1				0
4	ANET	0,75	progetto e stampa 3D "collimatore-1000-carburo di boro" + "stampo multi-stick"			0
2	ATLAS PP1 (ITK)	0,5	stampa 3D comb passante data cable per prototipo PP1 (ITK)			0
2	BESIII	0,25	progetto e stampa 3D connettori HV e particolari vari (spare)			0
3	CUPID	0,25	stampa 3D particolari per prototipo frame torre			0
1	CYGNO (LIME)	0,25	stampa 3D particolari per prototipo LIME e pezzi spare			0
1	ENTER_BNCT	0,25	progetto e stampa 3D componenti per spettrometro BNCT			0
3	JLAB12	1	stampa 3D coperchi, diffusori azoto, supporti fibre ottiche, supporti aerogel			0
1	SCF_LAB	0,5	stampa 3D componenti vari			0
4	SHiP	0,5	stampa 3D componenti per setup test beam			0
4	SICURA	0,25	stampa 3D componenti per prototipo			0
	PICCOLI LAVORI		piccole richieste di disegni/progetti/prototipaz. non programmati (<15 ore-uomo)			0
	totale M.U. =	5,50	impegno prog. = 110 %			impegno eff. = 0 %

Priorità	MECCANICA	M.U.	mesi = 6	personale = 4	M.U. disponibili* = 20,0	M.U.
-	GESTIONE OFF.	1				0
4	ALICE/PAPRICA	0,5	lavorazioni tool di piccolo taglio per supporti meccanici			0
4	ANET	0,5	costruzione "collimatore-1000-carburo di boro" + "stampo multi-stick"			0
2	ATLAS NSW	3	attrezzature (test stand cosmici e trolley di trasporto) NSW + taglio profilati			0
2	ATLAS PP1 (ITK)	1,5	componenti prototipo feedthrough + bulkhead prototipo endcap + taglio profilati			0
3	ATTRACT-URANIA	1	piani per sist. tens. GEMMESH + flangia clessidra assembl. prototipo CRWELL			0
2	BESIII	0,5	supporti per spedizioni CGEM_IT e/o tools per il debug			0
1	CYGNO (LIME)	1	costruzione particolari per prototipo LIME secondo box			0
1	ENTER_BNCT	1,5	realizzazione struttura meccanica spettrometro BNCT			0
3	JLAB12	1	realizzazione attachi degli specchi specchi piani			0
3	MU2E	3	4 zampe con regolazione X-Y integrata simili ai prototipi 2016			0
1	SCF_LAB	4,5	calotte CORA-micro/n4/p7 + interfacce e lavorazioni varie			0
4	SHiP	0,5	realizzazione componenti per setup test beam			0
4	SICURA	0,25	realizzazione componenti per prototipo			0
4	SIDDARHA-2	6	supporti/frame meccanici per shielding e luminometro			0
4	VIP2	1	piccoli aggiustamenti setup (Veto e Shielding)			0
	PICCOLI LAVORI		piccole richieste di lavorazioni meccaniche non programmate (<15 ore-uomo)			0
	totale M.U. =	26,75	impegno prog. = 134 %			impegno eff. = 0 %

* Ferie: 1,5/12 M.U. Malattia/Permessi: 0,25/12 M.U. Aggiornamento/Manutenzione: 0,25/12 M.U.
Totale indisponibilità annuale: 2/12 M.U. fattore di disponibilità: 1 - (2/12) = 0,83

	Nome	Competenza	Richieste II semestre 2020	Assegnazioni II semestre 2020
1	Fortugno Fabio	Informatico	100% KLOE	100% KLOE
2	Mengucci Alessandro	Rivelatori e meccanico	50% SIDDHARTA-VIP 30% JUNO 30% Mu2e 10% CYGNO	30% SIDDHARTA-VIP 30% JUNO 30% Mu2e 10% CYGNO
3	Paoletti Emiliano	Rivelatori	50% BESIII -RWELL 50% CYGNO 30% ALICE/PAPRICA	30% BESIII -RWELL 50% CYGNO 20% ALICE/PAPRICA
4	Pasquali Luigi	Rivelatori	Malattia	
5	Passamonti Luciano	Rivelatori	30% ALICE/PAPRICA 20% CYGNO 50% CMS	30% ALICE/PAPRICA 20% CYGNO 50% CMS
6	Pierluigi Daniele	Rivelatori	30% ALICE/PAPRICA 20% CYGNO 50% CMS	30% ALICE/PAPRICA 20% CYGNO 50% CMS
7	Russo Alessandro	Rivelatori	30% ALICE/PAPRICA 20% CYGNO 50% CMS	30% ALICE/PAPRICA 20% CYGNO 50% CMS
8	Saputi Alessandro	Progettista meccanico	30% LHCb 10% PADME 50% Mu2e 20% SHiP 10% ALICE	30% LHCb/ALICE 10% PADME 40% Mu2e 20% SHiP
9	Sborzacchi Francesco	Informatico	50% KLOE 50% LHCb	50% KLOE 50% LHCb
10	Tesauro Roberto	Rivelatori	100% CYGNO	100% CYGNO
11	Tibuzzi Mattia	Rivelatori	100% MOONLIGHT	100% MOONLIGHT
12	Vassileva Tatiana	Rivelatori	100% ATLAS	100% ATLAS
13	Ventura Maurizio	Rivelatori	50% SIDDHARTA-VIP 30% JUNO	50% SIDDHARTA-VIP 30% JUNO

Calorimetro: Descrizione, attivita' 2020 + piani 2021

Attivita' 2020

- + **Caratterizzazione cristalli e fotosensori**
- + **caratterizzazione ultimo batch di cristalli SICCAS**
- + **Test cristalli, cavi e fibre (Outgassing) e test meccanici (SPCM)**
- + **costruzione e test tool incollaggio SiPM su holder**
- + **progettazione Tagger raggi cosmici per commissioning of calorimeter disks**
- + **Irraggiamento componenti con dose a Calliope**
- + **produzione board FEE rad-hard**
- + **produzione Mezzanine rad-hard**
- + **studio routing cavi definitive FEE-MB**
- + **Integrazione Disegno nel Detector Solenoid**
- + **sviluppo software for Calorimeter DQM**
- + **produzione component:i**
 - **Dischi di Al + SiPM+FEE holders**
 - **vessel per outgassing component**
 - **Cavi FEE, Bundle fibre per LASER**
 - **Sistema calibrazione laser**

Physics items:

- **PHD thesis on mu- → e+ process**
- **Study of Normalization with LYSO crystals**
- **Photon spectra of RMC events**

PIANI 2021

- **QC of FEE e SIPM+FEE**
- **Assemblaggio e commissioning dischi**
- **Allineamenti cristalli durante pile up**
- **Inserimento Disk assemblati in the pit**
- **Inizio commissioning with TDAQ**
- **Preparazione LYSO crystals x muon capture monitoring**
- **Preparazione DQM per commissioning**
- **Studi di fisica per commissioning e prima presa dati**
- **R&D for Mu2e Phase-II**
 - **BaF2+Solar Blind SIPMs, Labr**
 - **tracker or CRV with micro-Rwell ?**

Ruolo LNF : Management, Meccanica, Cristalli, Sensori, FEE, Laser system Commissioning

- ◇ **Piani:** **Assemblaggio dischi**
 - ◇ **Obiettivi:** **commissioning**
- Con cosmici e Installazione in sala**

ATLAS - richieste 2021

Servizi

Servizio elettronica 2.2 FTE
Servizio progettazione 2.75 FTE
Tecnici divisione 1 FTE
Officina meccanica 0.5 FTE

Finanziarie

130 KEuro Missioni
45 Keuro Consumo/inventariabile
204 Keuro Apparati



CMS - richieste 2021



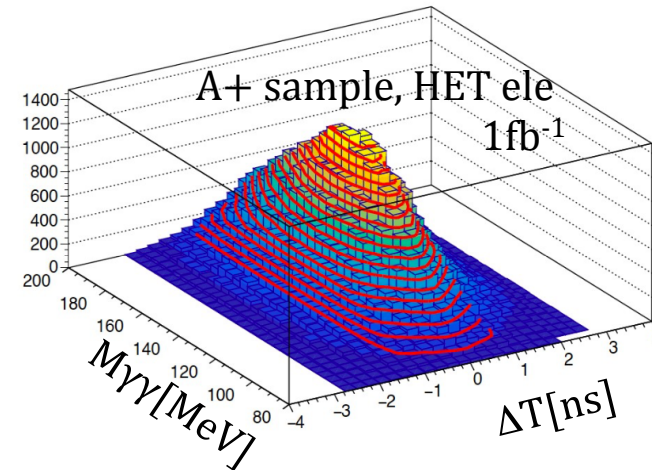
CMS		ANAGRAFICA		MISSIONI					
Sede	(FTE)	Metabolismo ME (1 m.u./FTE)	Missioni. Responsabilita`	Metabolismo MI	Services (1 m.u./FTE)	ME Commissioning and installation	ME test Fase 2	TOTALE Missioni (KEuro)	
LNF	5,80	21,46	11,1	6	21,46	18,5	16,65	95,17	
CONSUMI			TOTALE Consumi	SP SERVIZI					
Metabolismo	Camere pulite	Consumi Fase 2		MOF B GEM					
8,7	4,0	6,0	18,7	72,9					

KLOE-2 Achievements 2020 (III)

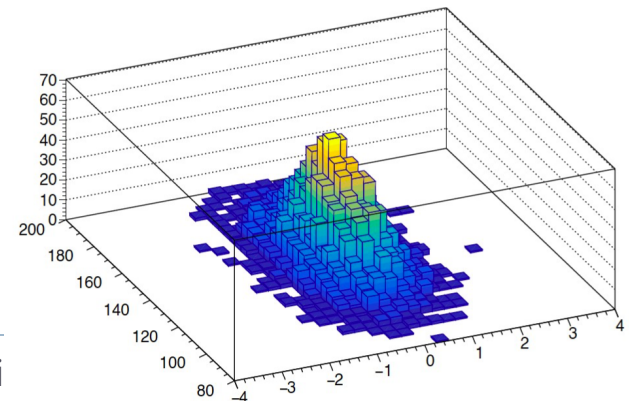
$e+e- \rightarrow e+e- \gamma^* \gamma^* \rightarrow e+e- \pi^0$ and π^0 search with HET

JINST 15 (2020)

- ⊕ Precision measurement of $\Gamma(\pi^0 \rightarrow \gamma\gamma)$ and First measurement transition form factor $F_{\pi\gamma\gamma^*}(q^2, 0)$ at space-like q^2 ($|q^2| < 0.1 \text{ GeV}^2$), impact on value and precision of $a_{\mu}^{\text{LbL};\pi^0}$
- ⊕ Hits in one HET station and 2 clusters in KLOE originating from the same bunch crossing
- ⊕ HET & KLOE data are acquired asynchronously
Accidental-pure sample (A) and HET-KLOE coincidence sample (A+)
- ⊕ 1.5 fb^{-1} reprocessed with optimized calibration constants to improve T and E resolutions
- ⊕ Comparison of A/A+ samples for 1 fb^{-1} sample shows $3.5(0.7)\text{k}$ tagged events in $M_{\gamma\gamma}$ vs $\Delta T_{\gamma\gamma}$ region where π^0 's from fusion are expected
- ⊕ Fit A+ $M_{\gamma\gamma}$ vs $\Delta T_{\gamma\gamma}$ using A sample as background model provides coherent, stable results
- ⊕ Working on further background reduction and improving modelling of expected signal

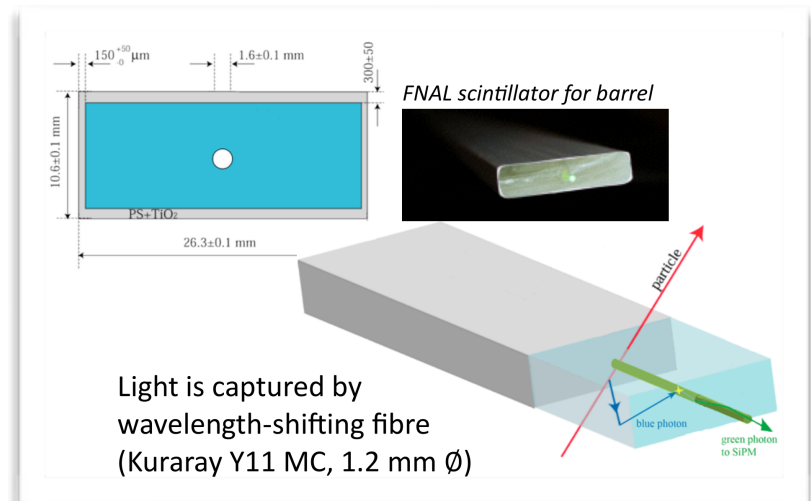
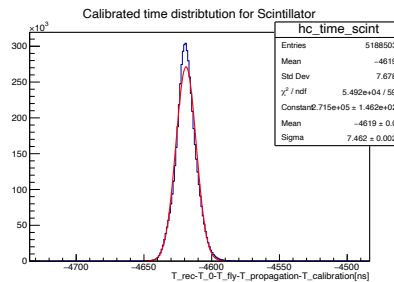
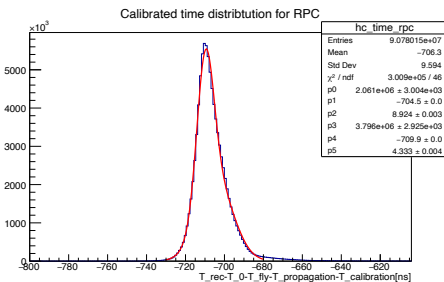


Amount of EKHARA signal events estimated with the fit for $\sigma_T = 500 \text{ ps}$



KLM Upgrade

- Gli RPC del barrel hanno (>24 anni), a causa dell'alta resistività degli elettrodi di vetro possono sostenere un rate limitato
 - Il fondo di SuperKEKB è maggiore di quanto aspettato, il rate di neutroni negli RPC aumenterà ancora con l'ulteriore aumento della luminosità, portando a un intollerabile deterioramento dell'efficienza
- “Long Shutdown” per upgrade di SuperKEKB (QCS) previsto nel 2026, che Belle II potrà sfruttare a sua volta implementare degli upgrade
- **KLM: Sostituzione degli RPC del barrel con barre di scintillatori con fibre WLS lette da MPPC con nuova elettronica di front end**
 - 13 layer per 8 settori FWB + 8 settori BWD



- Possibile un ulteriore significativo aumento della risoluzione temporale
 - Misura dell'impulso dei K_L

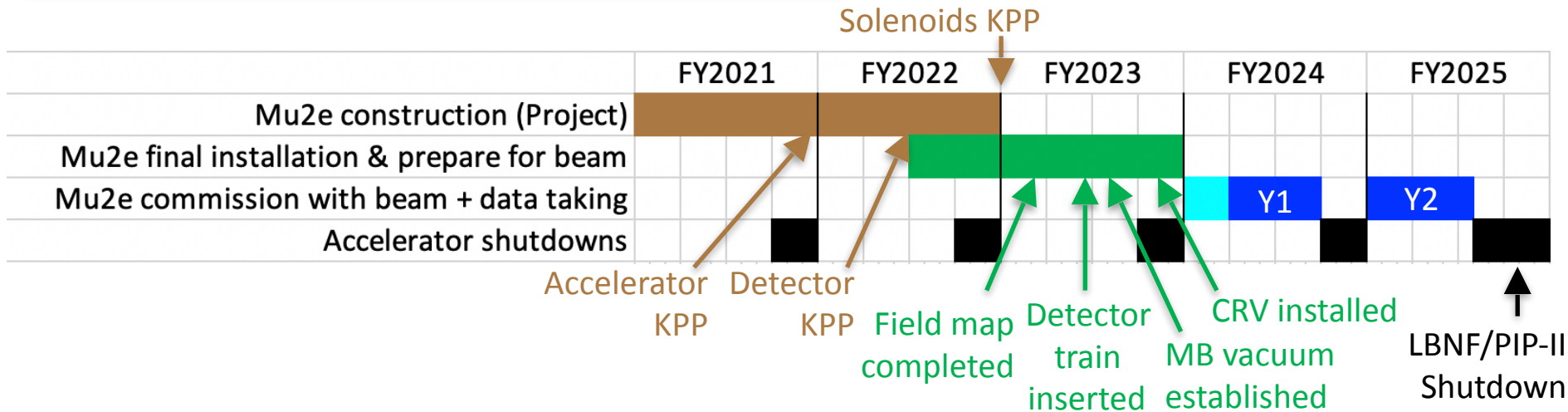
$$\delta p = \frac{t \cdot p^3}{m^2 L^2} \times \delta t$$

if $\delta t = 100 \text{ ps/ch}$ achieved: $\frac{\delta p}{p} = 12.6\%$.

Schedule for commissioning & operations

Key:

- Light blue = Commission with Beam
- Brown = Project
- Dark blue = Physics Data Taking
- Green = Prepare for beam
- Black = Summer shutdown



- Review DOE per pianificazione operations & commissioning effettuata con successo a Maggio 2020. S.Gioannella membro operation-team per operations calorimetro
- Physics Running per CY 2024-2025
- 2 anni di run addizionali (2027-2028) previsti dopo LBNF-PIP-2 shutdown
- Planning per Mu2e-II upgrade in corso
- R&D for Mu2e-II inizia 2020 con simulazioni e small prototyping in 2021 in vista di SnowMass 2021 e Next P5