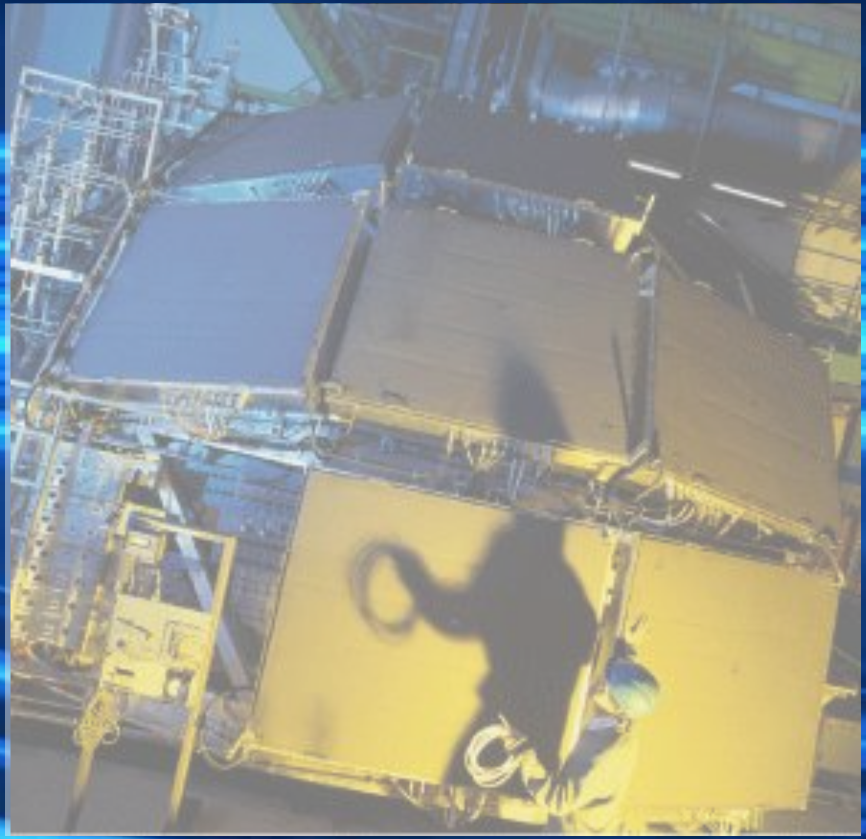
ALICE-HMPID in Run3 and LS2 planning



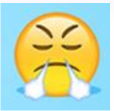
The HMPID in the ALICE upgrade LoI 2012

- Since the preparation of the LoI on the ALICE upgrading (Sept 2012), the HMPID was in the list of the detectors to take data during the period 2021-2023 (Run-3);

- short description of the physics tasks was given: “Its excellent PID capabilities can be exploited for physics and to constrain the charged hadron identification by the dE/dx measurement of the TPC in the overlapping momentum range”.

- As from 2012 HMPID has attended all the upgrading forum adapting the detector to the new trigger schema and data format compliant with O^2 environment;

- Nevertheless during the first half of 2018, HMPID has been asked to provide a physics program justifying the data taking in Run-3  ??!??

Preparing the scrutiny of HMPID 

- Two meetings were fixed:
  - the first with the Physics Board (Nov. the 1st 2018)
  - the second with the Management Board (Nov. the 15th 2018)
- A very intense work to prepare the document with physics program, was launched;
- The fantastic collaboration of several colleagues external to the HMPID team has been fundamental for succeeding!
- A second technical document with the detector status, the operation costs and the participating institutions was also prepared.

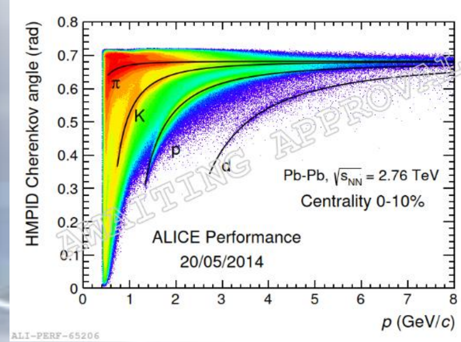
The physics program

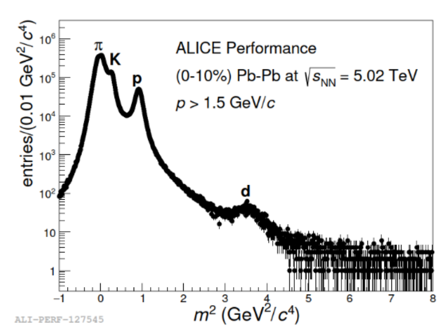
- Light nuclei identification
  - Deuteron in pp collisions up to the momentum bin 8 GeV/c
  - Deuteron in Pb-Pb collision up to the momentum bin 8-10 GeV/c, not only in central collisions, and identification of triton and helium up to 7 GeV/c;
  - Measurement of anti-nuclei absorption cross section;
- PID cross-calibration of HMPID-TOF-TPC
- Identified particle correlation study :
  - p/p ratio in the bulk and in the jets;
- reduction of combinatorial background in topological identification:
- $(e.g.: \Lambda_c^+ \to p + K^- + \pi^+$ and/or $\rho \to e^+e^-$);
- Pions, kaons and protons PID in lighter nuclei collisions (O or Ar);
- Experiment alignment.

Light nuclei identification

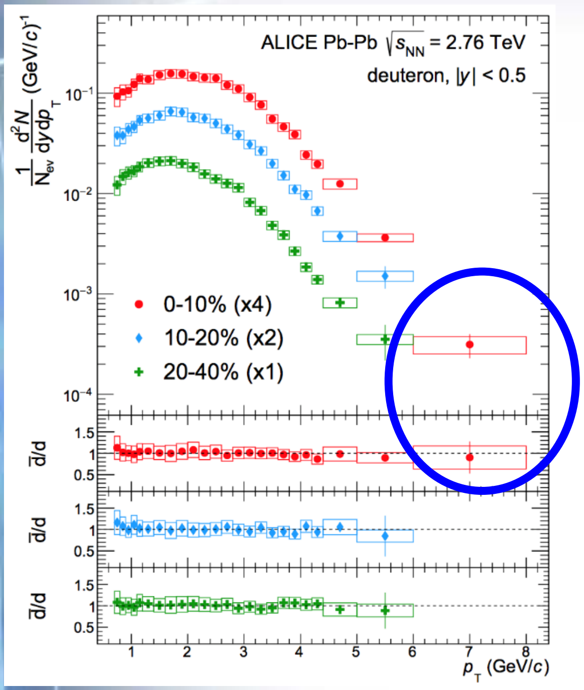
- **In pp,**
- in Run-3, with 2.4 10^{10} events in HMPID, the **10 GeV/c** momentum bin for the **deuteron** can be filled in.This spectrum extension is of interest t in the quest of establishing the composition of the X(3872) particle.

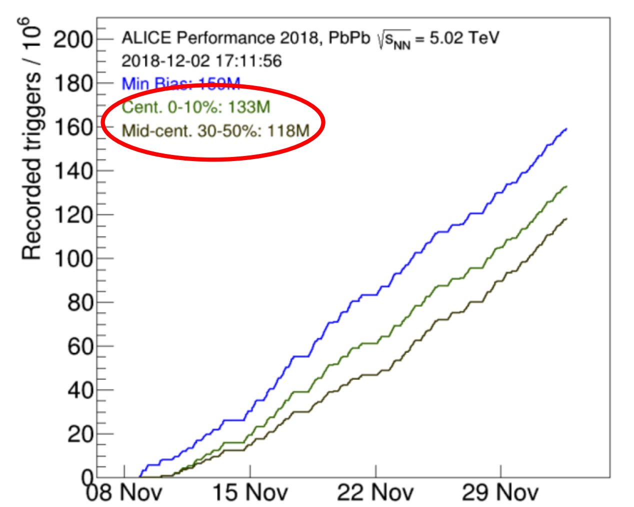
- **In Pb-Pb,**
- In Run-1, HMPID filled in the 8 GeV/c momentum bin for deuteron in 0-10% centrality interval;
- In 2018 , with 150 M events (0-10% centrality), the deuteron momentum bin at **10 GeV/c** can be filled in.
- In 2022, with B=0.2 T and ~300 M central events in HMPID, also the **12 GeV/c** bin (with 2 sigma separation) can be filled in. Contribution in other centalities, possible;
- Triton and ^{3}He spectra up to 7 GeV/c using central collisions can also be measured. Cross-check with TPC-TOF mesurement to be done.





Deuteron detection in Pb-Pb



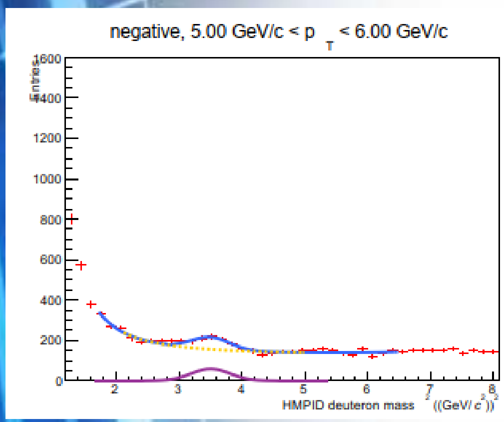


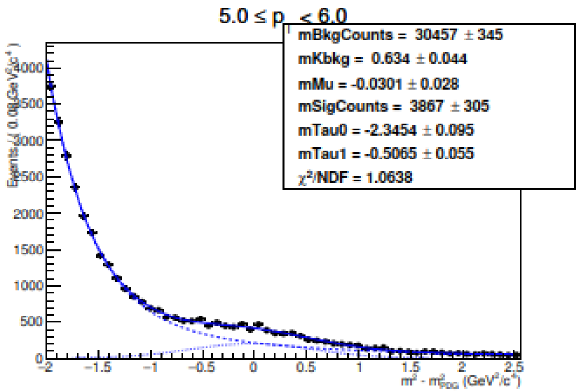
With 2018 Pb-Pb events the HMPID will be able to fill the 8-10 GeV/c p_T bin in two central classes.

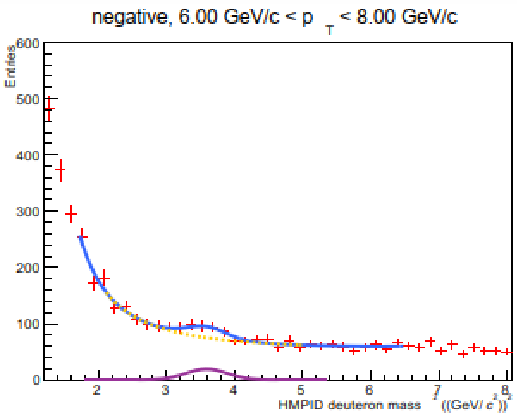
HMPID contribution with 11 ML central class events (0-10%) from 2011 Pb-Pb data (EPJ C(2017) 77:658)

Whereas with the expected Run-3 Pb-Pb statistics the HMPID will also fill the 7 GeV/c bin for the Tritium

PID performance of HMPID vs TOF







Left panel. Examples of the fitting procedure to extract the yields for the anti-deuteron in Pb-Pb collisions using the HMPID detector in the centrality bin 0-10%. Right panel. Fits to the anti-deuteron TOF mass squared shifted by the squared nominal mass of deuteron in the centrality bin 0 – 10%.

Superior separation is shown in the HMPID

Examples of the fitting procedure to extract the yields for the anti-deuteron in Pb–Pb collisions in the transverse momentum bin of using the HMPID detector.

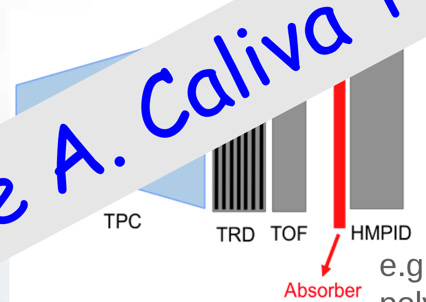
No corresponding figure exists for TOF in the same momentum bin.

Absorption cross section for anti-protons and light anti-nucl…i

- Interesting for multi-baryon states prod…
- To reduce the systematic uncertai… …ti-)deuteron (and anti-^{3}He) yield measurement;

$N = N_0 \times e^{-\frac{\Delta x}{\lambda_i}}$ wi…

See A. Caliva' Presentation !



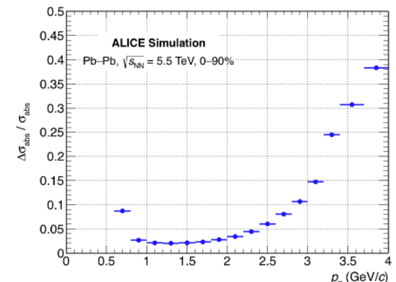
e.g.: 25 cm thick polyethylene slab (1/3 λ_i)

$N_A^{HMPID} = (N_{A,actual}^{TPC} \times\ 0.05\ \times f)\ \times \epsilon\ \times 10$

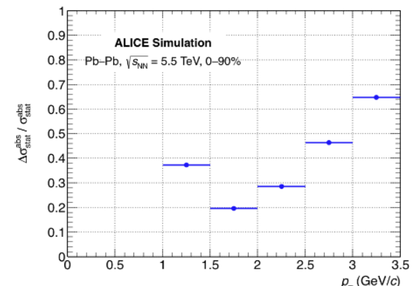
f = fraction of HMPID modules

ϵ=matching efficiency

10 = new Read Out Rate factor



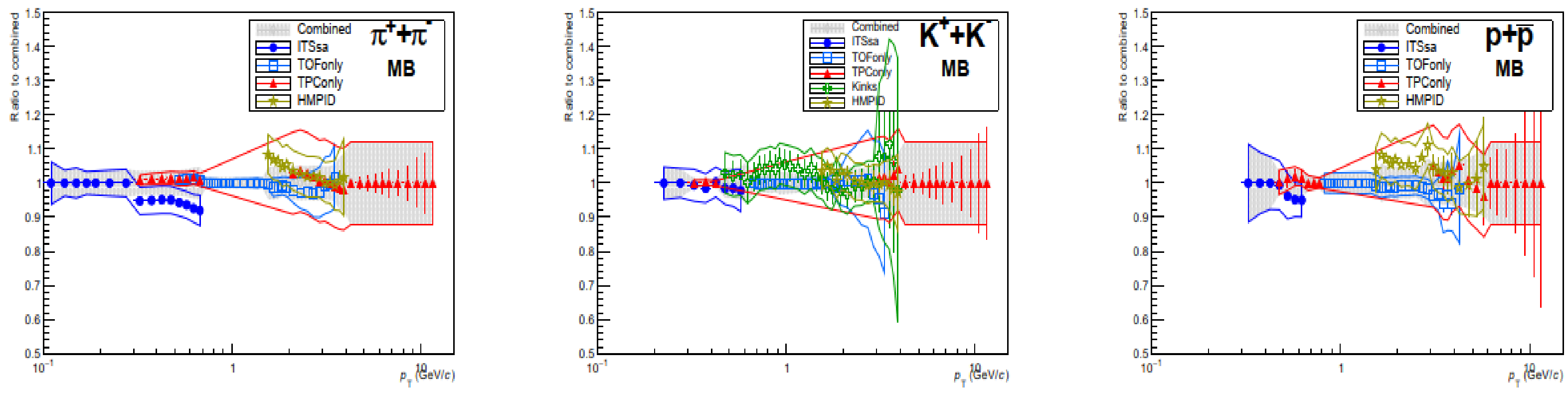
Expected statistical precision for anti-deuteron



For anti-^{3}He

PID cross-calibration of HMPID-TOF-TPC

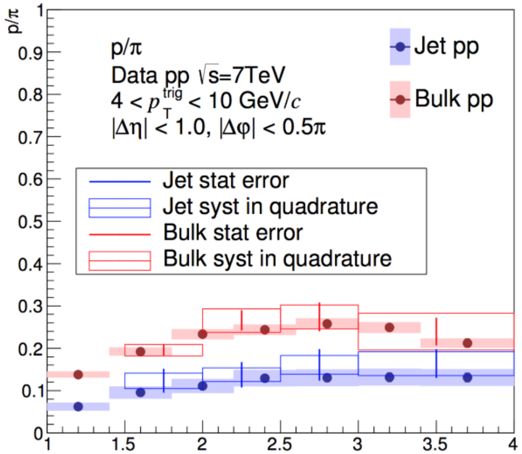
- collision energies in Run-3 different from Run-2, no published spectrum that can be used for precise benchmarking;
- HMPID can select with 3 sigma separation samples of π, K and p in the range 1-5 GeV/c;
- HMPID overlaps TPC and TOF, with uncertainties smaller than the TPC and also of the highest-pT TOF points in the ratio of individual spectrum to combined



(a) $\pi^{+}+\pi^{-}$: Ratio to combined (b) $\pi^{+}+\pi^{-}$: Ratio to combined (c) $\pi^{+}+\pi^{-}$: Ratio to combined

Identified particles correlation study

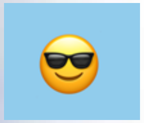
- in pp collisions at 7 TeV, an internal note on one trigger particle in the full TPC acceptance with one identified in the HMPID acceptance was prepared;
- In Run-3 this study can be completed crosschecking with a ten times higher event statistics in the HMPID;



Proton-over-pion *p/π* ratio as measured with the HMPID detector. Empty rectangles (combined sys. and stat. errors) represent the points measured with the HMPID. The ratio is measured in jet and bulk and in the figure, it is compared with correlation analysis using TOF templates [1] not yet published. The results agree within statistical and systematic errors

HMPID in Run-3 !!

- On Nov. the 1st The Physics Board has approved the HMPID scientific program for Run-3;
- And on Nov. the 14th the Management Board has given the green light for the HMPID in Run-3;
- Details in the documents at:
  - https://twiki.cern.ch/twiki/pub/ALICE/ResonsForHMPIDinRUN3/Reasons_x_HMPID_in_Run3_v3.pdf;
  - https://twiki.cern.ch/twiki/pub/ALICE/HMPIDPhysicsinRUN3/Physics_for_the_HMPID_in_Run3_v3.7.pdf



Credits to G. Volpe and to: M. Van Leeuwen, F. Barile, F. Bellini, S. Bufalino, A. Caliva, M. Colocci, A. Dainese, A. P. Kalweit and M. Weber.

Activity in LS2

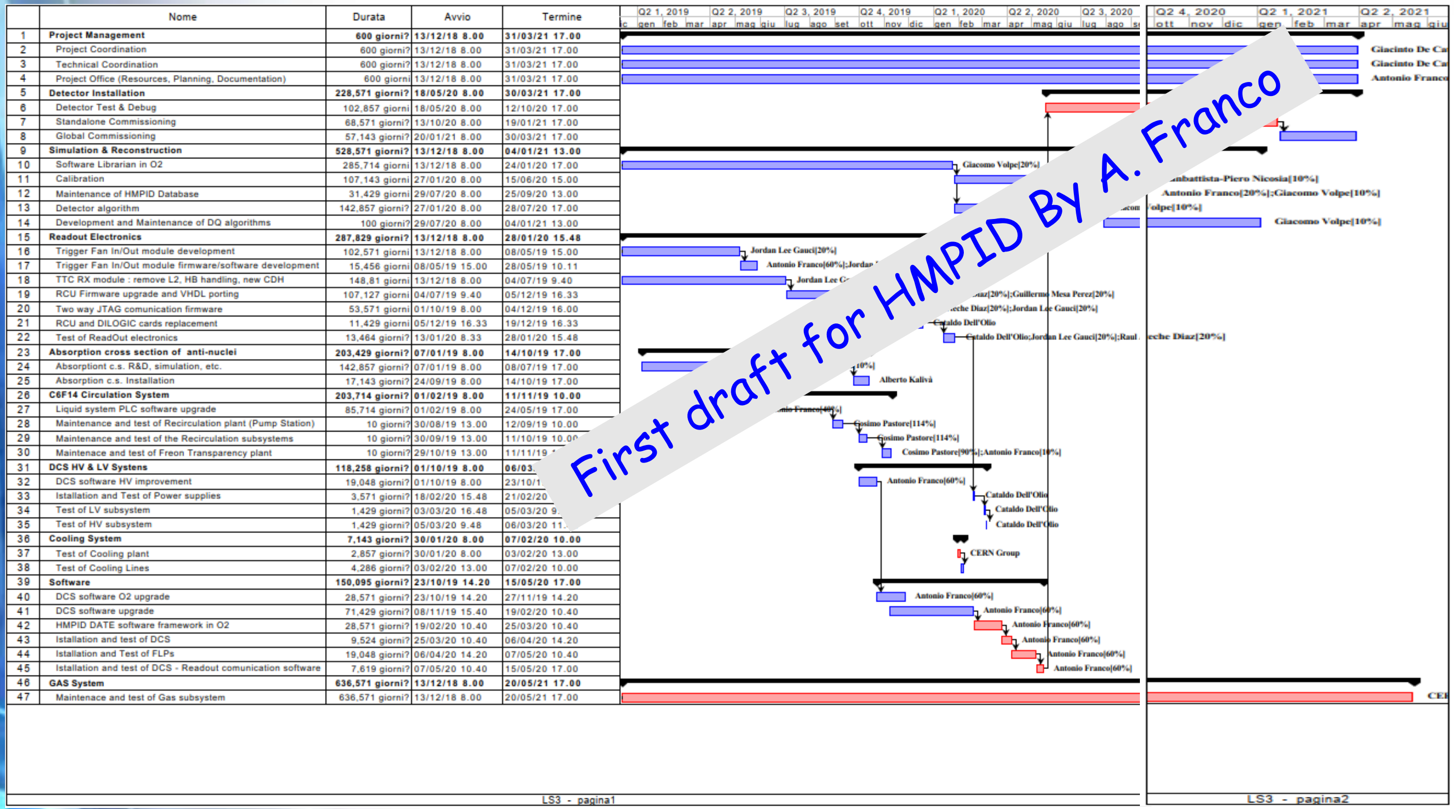
- HMPID will not be removed from L3;
- First draft of Service Work, Planning of Activities and Resources for LS2, prepared;
- Porting in O^2 under way for Simulation-reconstruction-calibration software (see presentation of G. Volpe);
- Check feasibility of the target installation for the measurement of the absorption cross section of light (anti)-nuclei;
- Development/procurement of new software components (RO firmware, DCS…) and external HV-LV and trigger modules;
- New Lab. set-up at bld. 581 for HMPID under preparation: FLP computer and C-RORC already available, new CTP-LTU delivered by end Jan 2019.

First draft Service Work for HMPID
By A. Franco

System	Activity	Class	Task Id	Task	Location	Expertise	2019		2020				2021				Units
					CERN / Institute /	PH/ME/MT/EE/ET	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Units
HMP	Project Management	3	10000	Project Leader	CERN	PH	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	FTE
HMP	Project Management	3	10001	Deputy Project Leader	Remote	PH	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	FTE
HMP	Project Management	3	10002	Technical Coordinator	CERN	PH/EE/ME	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	FTE
HMP	Project Management	3	10003	Project Office (Resources, Planning,	Remote	PH/EE/ME	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	FTE
HMP	Detector Operation	3	10004	System Run Coordinator	CERN	PH	0	0	0	0	0	0.2	0.2	0.2	0.2	0.2	FTE
HMP	Detector Operation	3	10005	Deputy System Run Coordinator	CERN	PH	0	0	0	0	0	0.2	0.2	0.2	0.2	0.2	FTE
HMP	Detector Operation	2	10006	**On-call Expert (24h - I)**	CERN	PH	0	0	0	0	0	0	0.3	0.3	0.3	0.3	FTE
HMP	Detector Operation	2	10007	**On-call Expert (24h - II)**	CERN	PH	0	0	0	0	0	0	0.3	0.3	0.3	0.3	FTE
HMP	Detector Operation	2	10008	**On-call Expert (24h - III)**	CERN	PH	0	0	0	0	0	0	0.3	0.3	0.3	0.3	FTE
HMP	Detector Operation	3	10009	Readout Experts (front-end)	Remote	PH or EE	0.2	0.2	0.2	0.2	0	0	0	0.1	0.1	0.1	FTE
HMP	Detector Operation	3	10010	Readout Experts (back-end)	Remote	PH or EE	0	0	0	0.2	0.2	0.2	0	0.1	0.1	0.1	FTE
HMP	Detector Operation	3	10011	Power System Expert	Remote	PH or EE	0	0	0	0	0.5	0	0	0.1	0.1	0.1	FTE
HMP	Detector Operation	3	10012	Cooling Expert	Remote	PH or ME	0	0	[illegible]	0.5	0	0	0	0.05	0.05	0.05	FTE
HMP	Detector Operation	3	10013	DCS/DSS Expert	Remote	PH	0.2	[illegible]	[illegible]	[illegible]	0	0	0	0.5	0.25	0.25	FTE
HMP	Detector Operation	3	10014	Online Software	Remote	PH	0	[illegible]	[illegible]	[illegible]	0	0	0	0.3	0.3	0.05	FTE
HMP	Detector Operation	3	10015	Reference System	CERN	PH	0	[illegible]	[illegible]	[illegible]	0	0	0.1	0.1	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10020	Simulation and Reconstruction Coordinator	Remote	PH	[illegible]	[illegible]	[illegible]	[illegible]	0.1	0.1	0.1	0.1	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10021	Software Librarian in O2	Remote	PH	[illegible]	[illegible]	[illegible]	[illegible]	0.1	0.1	0.1	0.1	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10022	Calibration	Remote	[illegible]	[illegible]	[illegible]	[illegible]	0	0.3	0.3	0.3	0.3	0.5	0.5	FTE
HMP	Simulation and Reconstruction	3	10023	Maintenance of HMPID Database	Remote	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0.2	0.2	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10024	Coordination of DQ Activities	Remote	[illegible]	[illegible]	[illegible]	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10025	Development and Maintenance of DQ algorithms	Remote	[illegible]	[illegible]	[illegible]	0	0.2	0.4	0.4	0.2	0.1	0.1	0.1	FTE
HMP	Simulation and Reconstruction	3	10026	Data Quality Team	Rem[illegible]	[illegible]	[illegible]	0	0	0	0	0	0	1	1	1	FTE
HMP	Assembly & Commissioning on	3	10030	Trigger Fan In/Out module development	[illegible]	[illegible]E/ET	0.5	0.2	0	0	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10031	Trigger Fan In/Out module firmware/s[illegible]	[illegible]	[illegible]MT/EE/ET	0	0	0.2	0	0	0	0	0	0	0	
HMP	Assembly & Commissioning on	3	10032	TTC RX module : remove L2, HB han[illegible]	[illegible]	[illegible]/ME/MT/EE/ET	0	0.3	0.1	0.3	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10033	RCO Firmware upgrade and VH[illegible]	[illegible]	PH/ME/MT/EE/ET	0.5	0.5	0.4	0.4	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10034	Two way JTAG comunicati[illegible]	[illegible]	PH/ME/MT/EE/ET	0	0	0.5	0.3	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10035	HMPID DATE software [illegible]	[illegible]	PH/ME/MT/EE/ET	0	0	0	0.25	0.25	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10036	Absorption cross [illegible]	[illegible]	PH/ME/MT/EE/ET	0	0	0.5	0.5	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10037	Liquid syste[illegible]	[illegible]	PH/ME/MT/EE/ET	0.125	0.125	0.125	0.125	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10038	DCS soft[illegible]	Remote	PH/ME/MT/EE/ET	0.125	0.125	0.125	0.125	0	0	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10039	DCS [illegible]	Remote	PH/ME/MT/EE/ET	0	0	0	0	0.125	0.125	0	0	0	0	FTE
HMP	Assembly & Commissioning on	3	10040	[illegible]	CERN	PH/ME/MT/EE/ET	0	0	0	0	1	1	0	0	0	0	FTE
HMP	Detector Installation	3	[illegible]	[illegible]	CERN	ME/MT	0	0	0	0.5	0	0	0	0	0	0	FTE
HMP	Detector Installation	3	10[illegible]	[illegible]	CERN	ME/MT	0	0	0	0.5	0	0	0	0	0	0	FTE
HMP	Detector Installation	3	100[illegible]	[illegible]r Power supplies	CERN	EE/ET	0	0	0	0	0.5	0	0	0	0	0	FTE
HMP	Detector Installation	3	1005[illegible]	[illegible]tem	CERN	EE/ET	0	0	0	0	0.25	0	0	0	0	0	FTE
HMP	Detector Installation	3	10054	[illegible]osystem	CERN	EE/ET	0	0	0	0	0.25	0	0	0	0	0	FTE
HMP	Detector Installation	3	10055	[illegible]ance and test of Recirculation plant	CERN	ME/MT	0	0	0	0	0	0	0.25	0	0	0	FTE
HMP	Detector Installation	3	10056	M[illegible]ntenance and test of the Recirculation	CERN	ME/MT	0	0	0	0	0	0	0	0	0	0	FTE
HMP	Detector Installation	3	10057	Maintenace and test of Freon Transparency plant	CERN	ME/MT	0	0	0	0	0	0	0	0	0	0	FTE
HMP	Detector Installation	3	10058	Maintenace and test of Gas subsystem	CERN	ME/MT	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.05	0.05	0.05	
HMP	Detector Installation	3	10058	RCO and DILOGIC cards replacement	CERN	EE/ET	0	1	0	0	0	0	0	0	0	0	
HMP	Detector Installation	3	10059	Test of ReadOut electronics	CERN	EE/ET	0	0	0	0.33	1	0	0	0	0	0	FTE
HMP	Detector Installation	3	10060	Absorption cross section of anti-nuclei	CERN	ME/MT	0	0	0.66	0	0	0	0	0	0	0	
HMP	Detector Installation	3	10061	Istallation and test of DCS	CERN	PH/ME/MT/EE/ET	0	0	0	0	0.5	0.5	0.33	0	0	0	FTE
HMP	Detector Installation	3	10062	Istallation and Test of FLPs	CERN	PH/ME/MT/EE/ET	0	0	0	0	0.33	1	0.33	0	0	0	FTE
HMP	Detector Installation	3	10063	Istallation and test of DCS - Readout comunication	CERN	PH/ME/MT/EE/ET	0	0	0	0	0	0	0.33	0	0	0	FTE
HMP	Detector Commissioning	3	10070	Standalone Commissioning	CERN	PH/ME/MT/EE/ET	0	0	0	0	0	0.3	1	0	0	0	FTE
HMP	Detector Commissioning	3	10071	Global Commissioning	CERN	PH/ME/MT/EE/ET	0	0	0	0	0	0	1	0.3	0	0	FTE
				Total Class-2			0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	
				Total Class-3			3.70	4.70	5.06	6.28	6.96	5.58	5.99	5.00	4.45	4.20	
							3.70	**4.70**	**5.06**	**6.28**	**6.96**	**5.58**	**6.99**	**6.00**	**5.45**	**5.20**	FTE
						Total 2019 (only Q3-Q4)		**8.40**		**Total 2020**		**23.87**		**Total 2021**		**23.64**	FTE
					conversion to FTE.mont	**Total 2019 (only Q3-Q4)**		**25.20**		**Total 2020**		**71.61**		**Total 2021**		**70.92**	
					conversion to FTE.year	**Total 2019 (only Q3-Q4)**		**2.10**		**Total 2020**		**5.97**		**Total 2021**		**5.91**	

Table 1

Planning of LS2 activities



	Nome	Durata	Avvio	Termine
1	**Project Management**	**600 giorni?**	**13/12/18 8.00**	**31/03/21 17.00**
2	Project Coordination	600 giorni?	13/12/18 8.00	31/03/21 17.00
3	Technical Coordination	600 giorni?	13/12/18 8.00	31/03/21 17.00
4	Project Office (Resources, Planning, Documentation)	600 giorni	13/12/18 8.00	31/03/21 17.00
5	**Detector Installation**	**228,571 giorni?**	**18/05/20 8.00**	**30/03/21 17.00**
6	Detector Test & Debug	102,857 giorni	18/05/20 8.00	12/10/20 17.00
7	Standalone Commissioning	68,571 giorni?	13/10/20 8.00	19/01/21 17.00
8	Global Commissioning	57,143 giorni?	20/01/21 8.00	30/03/21 17.00
9	**Simulation & Reconstruction**	**528,571 giorni?**	**13/12/18 8.00**	**04/01/21 13.00**
10	Software Librarian in O2	285,714 giorni	13/12/18 8.00	24/01/20 17.00
11	Calibration	107,143 giorni	27/01/20 8.00	15/06/20 15.00
12	Maintenance of HMPID Database	31,429 giorni	29/07/20 8.00	25/09/20 13.00
13	Detector algorithm	142,857 giorni?	27/01/20 8.00	28/07/20 17.00
14	Development and Maintenance of DQ algorithms	100 giorni?	29/07/20 8.00	04/01/21 13.00
15	**Readout Electronics**	**287,829 giorni?**	**13/12/18 8.00**	**28/01/20 15.48**
16	Trigger Fan In/Out module development	102,571 giorni	13/12/18 8.00	08/05/19 15.00
17	Trigger Fan In/Out module firmware/software development	15,456 giorni	08/05/19 15.00	28/05/19 10.11
18	TTC RX module : remove L2, HB handling, new CDH	148,81 giorni	13/12/18 8.00	04/07/19 9.40
19	RCU Firmware upgrade and VHDL porting	107,127 giorni	04/07/19 9.40	05/12/19 16.33
20	Two way JTAG comunication firmware	53,571 giorni	01/10/19 8.00	04/12/19 16.00
21	RCU and DILOGIC cards replacement	11,429 giorni	05/12/19 16.33	19/12/19 16.33
22	Test of ReadOut electronics	13,464 giorni?	13/01/20 8.33	28/01/20 15.48
23	**Absorption cross section of anti-nuclei**	**203,429 giorni?**	**07/01/19 8.00**	**14/10/19 17.00**
24	Absorptiont c.s. R&D, simulation, etc.	142,857 giorni?	07/01/19 8.00	08/07/19 17.00
25	Absorption c.s. Installation	17,143 giorni?	24/09/19 8.00	14/10/19 17.00
26	**C6F14 Circulation System**	**203,714 giorni?**	**01/02/19 8.00**	**11/11/19 10.00**
27	Liquid system PLC software upgrade	85,714 giorni?	01/02/19 8.00	24/05/19 17.00
28	Maintenance and test of Recirculation plant (Pump Station)	10 giorni?	30/08/19 13.00	12/09/19 10.00
29	Maintenance and test of the Recirculation subsystems	10 giorni?	30/09/19 13.00	11/10/19 10.0[illegible]
30	Maintenace and test of Freon Transparency plant	10 giorni?	29/10/19 13.00	11/11/19 [illegible]
31	**DCS HV & LV Systens**	**118,258 giorni?**	**01/10/19 8.00**	**06/03[illegible]**
32	DCS software HV improvement	19,048 giorni?	01/10/19 8.00	23/10/1[illegible]
33	Istallation and Test of Power supplies	3,571 giorni?	18/02/20 15.48	21/02/20 [illegible]
34	Test of LV subsystem	1,429 giorni?	03/03/20 16.48	05/03/20 9[illegible]
35	Test of HV subsystem	1,429 giorni?	05/03/20 9.48	06/03/20 11[illegible]
36	**Cooling System**	**7,143 giorni?**	**30/01/20 8.00**	**07/02/20 10.00**
37	Test of Cooling plant	2,857 giorni?	30/01/20 8.00	03/02/20 13.00
38	Test of Cooling Lines	4,286 giorni?	03/02/20 13.00	07/02/20 10.00
39	**Software**	**150,095 giorni?**	**23/10/19 14.20**	**15/05/20 17.00**
40	DCS software O2 upgrade	28,571 giorni?	23/10/19 14.20	27/11/19 14.20
41	DCS software upgrade	71,429 giorni?	08/11/19 15.40	19/02/20 10.40
42	HMPID DATE software framework in O2	28,571 giorni?	19/02/20 10.40	25/03/20 10.40
43	Istallation and test of DCS	9,524 giorni?	25/03/20 10.40	06/04/20 14.20
44	Istallation and Test of FLPs	19,048 giorni?	06/04/20 14.20	07/05/20 10.40
45	Istallation and test of DCS - Readout comunication software	7,619 giorni?	07/05/20 10.40	15/05/20 17.00
46	**GAS System**	**636,571 giorni?**	**13/12/18 8.00**	**20/05/21 17.00**
47	Maintenace and test of Gas subsystem	636,571 giorni?	13/12/18 8.00	20/05/21 17.00

Resources for LS2 activity

ID	Resource Name	Work	Details
	Unassigned	0 hrs	Work
	Detector Test & Debug	0 hrs	Work
	Standalone Commissioning	0 hrs	Work
	Global Commissioning	0 hrs	Work
	Test of Cooling Lines	0 hrs	Work
1	**Giacinto De Cataldo**	**2,451.28 hrs**	Work
	Project Coordination	1,225.64 hrs	Work
	Technical Coordination	1,225.64 hrs	Work
2	**Antonio Franco**	**1,699.04 hrs**	Work
	Project Office (Resources, Planning, Documentation)	593.13 hrs	Work
	Maintenance of HMPID Database	22 hrs	Work
	Trigger Fan In/Out module firmware/software development	64.91 hrs	Work
	Liquid system PLC software upgrade	240 hrs	Work
	Maintenace and test of Freon Transparency plant	7 hrs	Work
	DCS software HV improvement	80 hrs	Work
	DCS software O2 upgrade	120 hrs	Work
	DCS software upgrade	300 hrs	Work
	HMPID DATE software framework in O2	120 hrs	Work
	Istallation and test of DCS	40 hrs	Work
	Istallation and Test of FLPs	80 hrs	Work
	Istallation and test of DCS - Readout comunication software	32 hrs	Work
3	**Cosimo Pastore**	**223 hrs**	Work
	Maintenance and test of Recirculation plant (Pump Station)	80 hrs	Work
	Maintenance and test of the Recirculation subsystems	80 hrs	Work
	Maintenace and test of Freon Transparency plant	63 hrs	Work
4	**Cataldo Dell'Olio**	**142.91 hrs**	Work
	RCU and DILOGIC cards replacement	80 hrs	Work
	Test of ReadOut electronics	17.91 hrs	Work
	Istallation and Test of Power supplies	25 hrs	Work
	Test of LV subsystem	10 hrs	Work
	Test of HV subsystem	10 hrs	Work
5	**Jordan Lee Gauci**	**423.25 hrs**	Work
	Trigger Fan In/Out module development	150 hrs	Work
	Trigger Fan In/Out module firmware/software development	10.82 hrs	Work
	TTC RX module : remove L2, HB handling, new CDH	169.52 hrs	Work
	Two way JTAG comunication firmware	75 hrs	Work
	Test of ReadOut electronics	17.91 hrs	Work
6	**Raul Arteche Diaz**	**458.56 hrs**	Work
	TTC RX module : remove L2, HB handling, new CDH	208.33 hrs	Work
	RCU Firmware upgrade and VHDL porting	149.98 hrs	Work
	Two way JTAG comunication firmware	75 hrs	Work
	Test of ReadOut electronics	25.25 hrs	Work
7	Giacomo Volpe	667 hrs	Work
	Software Librarian in O2	400 hrs	Work
	Calibration	75 hrs	Work
	Maintenance of HMPID Database	22 hrs	Work
	Detector algorithm	100 hrs	Work
	Development and Maintenance of DQ algorithms	70 hrs	Work
8	Gianbattista-Piero Nicosia	75 hrs	Work
	Calibration	75 hrs	Work
9	**Alberto Kalivà**	**220 hrs**	Work
	Absorptiont c.s. R&D, simulation, etc.	100 hrs	Work
	Absorption c.s. installation	120 hrs	Work
10	**CERN Group**	**64.56 hrs**	Work
	Test of Cooling plant	20 hrs	Work
	Maintenace and test of Gas subsystem	44.56 hrs	Work
11	**Guillermo Mesa Perez**	**149.98 hrs**	Work
	RCU Firmware upgrade and VHDL porting	149.98 hrs	Work

First draft for HMPID By A. Franco

Institutions and people involved

- INFN Bari, It:
  - G. Volpe, A. Franco, C. Pastore , A. Dell'Olio (electr. Tech.) and GdC;
- CERN team
  - A. Di Mauro (consultancy)
- University of Malta, Malta
  - Dep of Info. & Comm. Tech. Microelectronics and nanoelectr.
    - E. Gatt, O. Casha, J.L Gauci (PhD);
  - Dep of Computer science
    - G. Valentino, J. Briffa;
  - Dep of Physics;
    - C. Sammut, G.P. Nicosia (Master student)
- Hungarian Academy of Sciences
  - Wigner inst. Budapest:
    - G. Barnafoldi, A. Futo and O. B. Visnyei (not full time, master student);

External collaborators

- CEADEN Cuba
  - Raul Arteche Diaz; Guillermo Mesa Perez.

Summary

- The PB approved the HMPID phisics program for Run-3 and the MB has given green light for HMPID in Run-3;
- Upgrading activities successfully under way;
- Service work, Activity planning and Resouces for LS2, are under preparation;

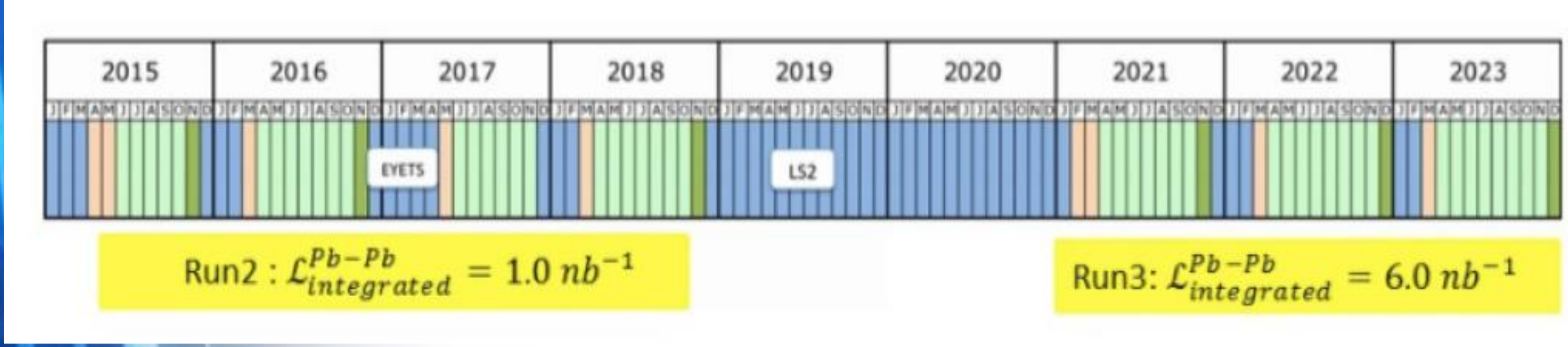
Backup slides

Additional tasks

Details in the posted documents:

- **Pions, kaons and protons PID in lighter nuclei collisions;**
- Experiment alignment;
- **Combinatorial background reduction for the topological identification;**

LHC shedule


2015
2016
2017
2018
2019
2020
2021
2022
2023
EYETS
LS2
Run2 : $\mathcal{L}_{integrated}^{Pb-Pb} = 1.0\ nb^{-1}$
Run3: $\mathcal{L}_{integrated}^{Pb-Pb} = 6.0\ nb^{-1}$

Present baseline lumi requirements and schedule

- ALICE L_{int} requirements (Upgrade LOI):
  - Pb-Pb: 10/nb @0.5T + 3/nb @0.2T
  - pp 5.5 TeV: 6/pb (4e11 events)
  - p-Pb: 50/nb
  - pp 14 TeV: introduced in 2015 (O² TDR)
- ATLAS/CMS:
  - Pb-Pb: 13/nb
  - pp 5.5 TeV: 300/pb (equivalent NN lumi of 10/nb Pb-Pb)
  - p-Pb: no lumi limitations
- LHCb:
  - Committed to participate in all runs, but no specific lumi requests up to now

Year	System	$\sqrt{s_{NN}}$ (TeV)	L_{int} pp: (pb^{-1}) p–Pb: (nb^{-1}) Pb–Pb: (nb^{-1})	$N_{collisions}$
2021	pp	14	0.4	$2.7 \cdot 10^{10}$
	Pb–Pb	5.5	2.85	$2.3 \cdot 10^{10}$
2022	pp	14	0.4	$2.7 \cdot 10^{10}$
	Pb–Pb	5.5	2.85 **0.2T**	$2.3 \cdot 10^{10}$
2023	pp	14	0.4	$2.7 \cdot 10^{10}$
	pp	5.5	6	$4 \cdot 10^{11}$
2027	pp	14	0.4	$2.7 \cdot 10^{10}$
	Pb–Pb	5.5	2.85	$2.3 \cdot 10^{10}$
2028	pp	14	0.4	$2.7 \cdot 10^{10}$
	Pb–Pb	5.5	1.4	$1.1 \cdot 10^{10}$
	p–Pb	8.8	50	10^{11}
2029	pp	14	0.4	$2.7 \cdot 10^{10}$
	Pb–Pb	5.5	2.85	$2.3 \cdot 10^{10}$

Updated (years) from ALICE O² TDR, CERN-LHCC-2015-006

Andrea Dainese

HL-LHC WG5 meeting, 30.10.18 2

Establishing the composition of the X(3872) particle

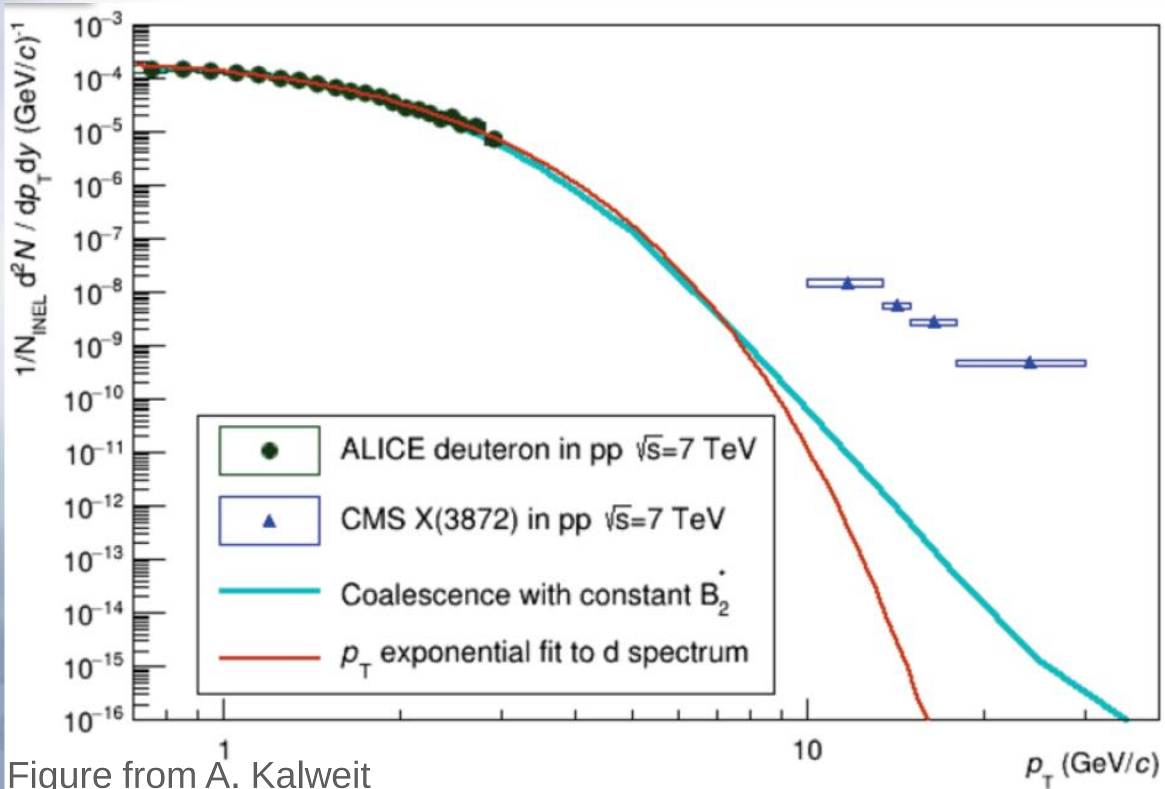


Figure from A. Kalweit

Technical papers and Public Note

Pattern recognition and PID procedure with the ALICE-HMPID

CrossMark

Giacomo Volpe

European Organization for Nuclear Research (CERN), Geneva, Switzerland

On behalf of the ALICE Collaboration

ARTICLE INFO

ABSTRACT

The ALICE–HMPID performance during the LHC run period 2010–2013

CrossMark

Giacinto De Cataldo *

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On behalf of the ALICE c

ARTICLE INFO

Available online 21 August 2014

Keywords:
RICH
C_6F_{14} radiator
CsI photocathode
Accumulated charge dose
PID

RICH2013

ARTICLE IN PRESS

Nuclear Instruments and Methods in Physics Research A (xxxx) xxxx–xxxx

Contents lists available at ScienceDirect

Nuclear Instruments and Methods in Physics Research A

journal homepage: www.elsevier.com/locate/nima

ELSEVIER

The High Momentum Particle IDentification (HMPID) detector PID performance and its contribution to the ALICE physics program☆

Giacomo Volpe[a,b,*], On behalf of the ALICE Collaboration

[a] *Dipartimento Interateneo di Fisica "M. Merlin", Bari, Italy*
[b] *Sezione INFN, Bari, Italy*

Performance of the High Momentum Particle IDentification detector of ALICE during the LHC run period 2015-2016

G. De Cataldo, on behalf of ALICE collaboration

INFN Bari, Via Amendola 4, 70126 Bari Italy

RICH2016

Abstract

In the period June 2015- September 2016 the LHC has delivered pp and Pb-Pb collisions respectively at $\sqrt{s}$ =13 TeV and $\sqrt{s_{NN}}$ = 5.02 TeV for a total integrated luminosity in ALICE of 14 pb^{-1}. The High Momentum Particle IDentification detector (HMPID) is part of the ALICE experiment. It is based on seven Ring Imaging Cherenkov (RICH) modules, 1.3×1.3 m^2 each, with a proximity focusing geometry. The Cherenkov photon detection is achieved by pad segmented photocathodes, coated with 300 nm thick Caesium Iodide layer, installed in multiwire

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

ALICE

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ALICE-INT-2017-xx
24 May 2017

Performance of the ALICE-HMPID detector during the LHC run period 2010-2015 and perspectives

F. Barile[1], G.G. Barnaföldi[4], D. Di Bari[2], J. Briffa[6], M. Davenport[3], G. De Cataldo[1], A. Dell'Olio[2], D. Dell'Olio[2], A. Di Mauro[3], A. Franco[1], P. Martinengo[3], M. L. Minervini[7], E. Nappi[1], L. Oláh[4], G. Paic[5], F. Piuz[3], C. Pastore[1], S. Pochybova[4], I.Sgura[1], M. Tangaro[2], G. Valentino[6], J.S.Van Beelen[3], G. Volpe[2].

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3. European Organization for Nuclear Research (CERN), Geneva, Switzerland;
4. Wigner Research Centre for Physics, Hungarian Academy of Science, Budapest, Hungary;
5. Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Mexico City, Mexico;
6. Information and Communication Technology Department, Malta University, Malta;
7. Moved to private company.

Abstract

In this note the performance of the ALICE High Momentum Particle IDentification (HMPID) detector during the LHC run period 2010-2015, is presented. The HMPID can identify with three sigma separation charged π and K in the momentum range 1-3 GeV/c and protons in the range 1.5-5 GeV/c. It consists of 7 Ring Imaging Cherenkov modules (RICH), 1.3 × 1.3 m^2 each. The detection of Cherenkov UV photons is achieved by multiwire proportional chamber (MWPC) with CsI pad segmented photocathodes, for a total active area of 10.3 m^2. The Cherenkov radiator used is the liquid C_6F_{14} (perfluorohexane) with n=1.2989 at λ=175 nm.

The detector stability with emphasis on the CsI quantum efficiency stability and the Particle Identification performance (PID), by both statistical and track-by-track approaches, are presented.

The contribution of the HMPID to charged hadrons and deuteron identification will be shown.

Finally the perspective of the detector operation during the High Luminosity LHC period (2020-2023) is briefly discussed.

https://aliceinfo.cern.ch/Notes/node/474

HMPID contribution to the physics

http://aliceinfo.cern.ch/ArtSubmission/node/3691 (EPJ)

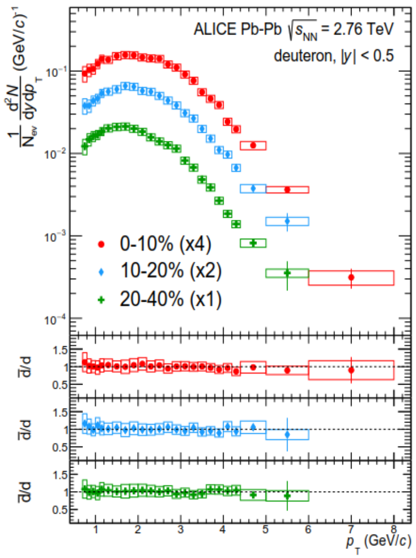

Fig. 3: In the upper panel the deuteron p_T spectra are shown for the three centrality intervals extended to high p_T with the TOF and HMPID analyses. In the lower panels the ratios of anti-deuterons and deuterons are shown for the 0–10%, 10–20% and 20–40% centrality intervals, from top to bottom. The ratios are consistent with unity over the whole p_T range covered by the presented analyses.

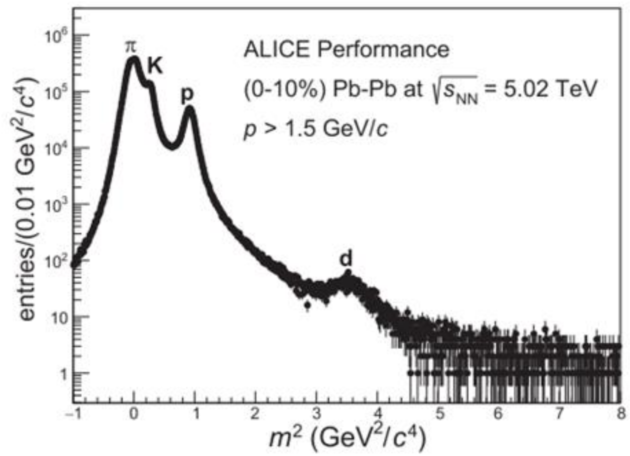

Fig. 8. Particle squared mass distribution obtained from the Cherenkov angle measured in the HMPID combined with the momentum information provided by the ALICE tracking devices, in central (0–10%) Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV.

RICH2016

G. Volpe

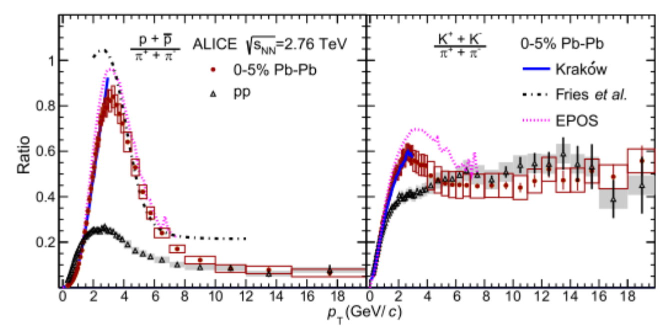

Fig. 7. Kaon to pion and proton to pion ratios as a function of p_T in minimum bias pp collisions and in the most central Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. Statistical and systematic uncertainties are displayed as vertical error bars and boxes, respectively. The theoretical predictions refer to Pb–Pb collisions..