











First glimpse on Run4

Giorgio Dho on behalf of CYGNO coll.

Istituto Nazionale di Fisica Nucleare (INFN-LNF), Frascati (RM), Italy



Part of this project has been funded by the European Union's Horizon 2020 research and innovation programme under the ERC Consolidator Grant Agreement No 818744



Established by the European Commission

G. Dho, LNF

Apr 24 2024

RUN4 TIMELINE

- Run3 ended on 16th Nov and the water shielding installation started immediately
- First data taken for Run4 on 1st December
- Decommissioning of the water shielding is happening now





RUN4 DATA TAKING



Key moment: Both humidity and oxygen filters employed in series

RUN4 DATA TAKING



RUN4 DATA TAKING



- Long stretches of data collected in these 5 months
- Duty cycle around 95%
- High reliability of all components

2.8 * 10⁶ pictures collected at a 0.9 Hz

Run3 had 2.7 * 10^6 pictures with 1.3 Hz rate and in one more month

REMOTE SHIFTS AND MONITOR

• The remote control system was improved and extended. Allows to check:

Environmental variables

HV currents and stability

Step motor for dail scan calibration

Trigger rate

		GEM H	gh Voltage	Control Page				
Electric Fields			Readings					
	Input	Set		Demand	Read	Current	¢	
Drift field [kV/cm]	0.900000 0	0.900000000000001	HV0	10.000	9.600	0.002	•	
Fransfer field 1	2.5	2.500	HV1	400.000	400.180	-0.002	٠	•
Rov/cmj			HV2	500.000	500.380	0.004	٠	•
kV/cm]		2.500	HV3	400.000	400.220	0.000	٠	•
VGEM 1 [V]	400	400	HV4	500.000	500.420	0.000	٠	•
VGEM 2 [V] 🗆		400	HV5	400.000	400.100	0.000	٠	•
VGEM 3 [V] 🗆		400	HV6	1080.000	1000.860	0.000	٠	•
Offset [V]	10 🗉	10	HV7	46130.000	-46167.898	-10.490	٠	•
C	IN ALL OF	ALL		• HV0 • HV1 • HV5 •	ettings ○ HV2 ○ HV3 HV6 ○ ALL CAI	O HV4 EN		
			Ramp Up Speed [V/s	5				
DRIFT ON OFF			Ramp Down Speed [V/s] 20				
TRANSFER ON OFF			Trip Current [µA]	10	10			
GAIN ON OFF			Trip Time [s]	10				
				Hot Spot Current [µA]			

• A complementary online monitor based on Grafana server was extended to grant monitoring

Trigger rate: 0.9 Hz

without direct access to DAQ machines



No in person

shifter was

required anymore

(except for gas bottle changes)

GRAFANA IMPROVEMENTS

• The Grafana-based monitor was extended and serves multiple purposes



Check on-line status

LIME pressure



Current Run

HV status

Gas system

GRAFANA IMPROVEMENTS

The Grafana-based monitor was extended and serves multiple purposes

Exploit reconstructed files for small analysis



Alpha rate vs Time

GRAFANA IMPROVEMENTS

• The Grafana-based monitor was extended and serves multiple purposes

Send alarm to our Discord server



Example: the DAQ crashes and no new files are taken and uploaded to the cloud -> Alarm triggered

EXAMPLE: CAMERA TEMPERATURE

• This tool helped us to improve our response to detector issues:

We noticed the total counts of the camera pixels was increasing

The average clusters found by the reconstruction

algorithm increased too \backsim

More noise in the camera

Thus, we found the water cooling of the sCMOS was not properly working and repaired it before it could affect the data



Light yield vs time



COSTANT LIGHT YIELD

• Given what was learnt from past Runs, Run4 was operated with rather constant light yield.



ALPHA RATE DECREASE

We had a preliminary look at the reconstructed data. Density vs length **Run4** periods LIME Run3 re-reco normalised [19909 - 20415] No Source 100 LIME Run4 normalised [45252 - 46635] No Source LIME Run4 normalised [40919 - 42848] No Source 22-25 May 2023 (Run3 no rec.) 4-14 Dec 2024 24 Jan -2 Feb 2024 80 107 Alpha particles Events Events δ ч 10¹ Ц δ δ 20 2500 2000 2500 1500 2000 2500 sc lenath sc length sc_length LIME Run3 re-reco normalised [21049 - 22514] No Source 100 LIME Run4 normalised [43886 - 45213] No Source LIME Run4 normalised [48055 - 50891] No Source 12-19 July 2023 (Run3 rec.) 15-23 Jan 2024 15 Feb -5 Mar 2024 Events δ Events δ Lo1 Lo1 δ 20 1500 2500 2500 500 1000 2000 1500 2000 2500 500 1000 1500 2000 sc length sc_length sc length

G.Dho

11

ROUGH LOOK AT THE SPECTRA

- Only the quality cuts applied to the data (no extremely thin tracks, no borders)
- We can compare the light equivalent spectra (Run3 data set corrected for light yield difference and rate difference)

