

# COMPASS++/AMBER PHYSICS PROGRAM



Program	Physics Goals	Beam Energy [GeV]	Beam Intensity [ $s^{-1}$ ]	Trigger Rate [kHz]	Beam Type	Target	Earliest start time, duration	Hardware additions
muon-proton elastic scattering	Precision proton-radius measurement	100	$4 \cdot 10^6$	100	$\mu^\pm$	high-pressure H2	2022 1 year	active TPC, SciFi trigger, silicon veto,
Hard exclusive reactions	GPD $E$	160	$2 \cdot 10^7$	10	$\mu^\pm$	$NH_3^\dagger$	2022 2 years	recoil silicon, modified polarised target magnet
Input for Dark Matter Search	$\bar{p}$ production cross section	20-280	$5 \cdot 10^5$	25	$p$	LH2, LHe	2022 1 month	liquid helium target
$\bar{p}$ -induced spectroscopy	Heavy quark exotics	12, 20	$5 \cdot 10^7$	25	$\bar{p}$	LH2	2022 2 years	target spectrometer: tracking, calorimetry
Drell-Yan charmonium	Pion PDFs	190	$7 \cdot 10^7$	25	$\pi^\pm$	C/W	2022 1-2 years	
charmonium Drell-Yan (RF)	Kaon PDFs & Nucleon TMDs	$\sim 100$	$10^8$	25-50	$K^\pm, \bar{p}$	$NH_3^\dagger$ , C/W	2026 2-3 years	"active absorber", vertex detector
Primakoff (RF)	Kaon polarisability & pion life time	$\sim 100$	$5 \cdot 10^6$	$> 10$	$K^-$	Ni	non-exclusive 2026 1 year	
Prompt Photons (RF)	Meson gluon PDFs	$\geq 100$	$5 \cdot 10^6$	10-100	$K^\pm, \pi^\pm$	LH2, Ni	non-exclusive 2026 1-2 years	hodoscope
$K$ -induced Spectroscopy (RF)	High-precision strange-meson spectrum	50-100	$5 \cdot 10^6$	25	$K^-$	LH2	2026 1 year	recoil TOF, forward PID
Vector mesons (RF)	Spin Density Matrix Elements	50-100	$5 \cdot 10^6$	10-100	$K^\pm, \pi^\pm$	from H to Pb	2026 1 year	

*Phase-1  
conventional muon  
and hadron beams*

*LS3*

*Phase-2  
conventional and RF-  
separated hadron  
beams*