AMBER

Apparatus for Meson and Baryon Experimental Research

PAW'24 introductory slides

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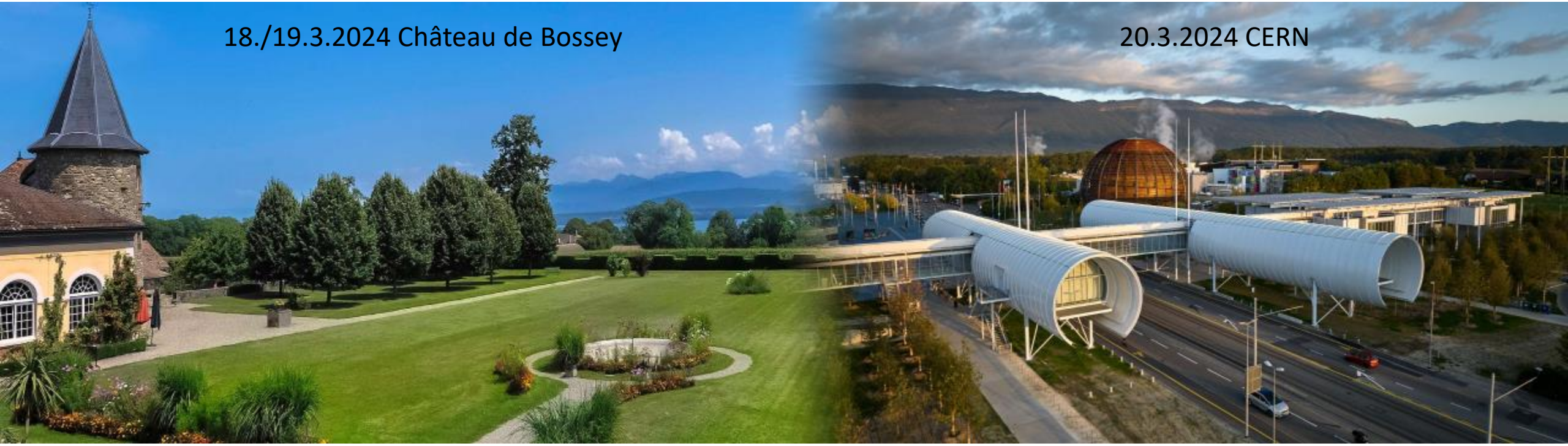
Welcome to the inaugural

Physics at AMBER international Workshop '24



How AMBER was born…

~2009 early ideas of future high-intensity hadron beams for COMPASS are discussed

March 2016 Workshop “COMPASS beyond 2020”

September 2016: Physics Beyond Colliders initiative of CERN

June 2018 Workshop “New QCD Facility at the M2 SPS beamline”

August 2018 Letter of Intent: COMPASS++/AMBER

April 19, 2019 Towards a new collaboration: COMPASS++/AMBER Kick-off meeting

May 2021 First Collaboration Meeting (zoom)

Program	Physics Goals	Beam Energy [GeV]	Beam Intensity [s^{-1}]	Trigger Rate [kHz]	Beam Type	Target	Earliest start time, duration	Hardware Additions
μp elastic scattering	Precision proton-radius measurement	100	$4 \cdot 10^6$	100	$\mu^\pm$	high-pr. H2	2022 1 year	active TPC SciFi trigger silicon veto
Hard exclusive reactions	GPD E	160	10^7	10	$\mu^\pm$	$NH_3^\uparrow$	2022 2 years	recoil silicon, modified PT magnet
Input for DMS	$\overline{p}$ production cross-section	20-280	$5 \cdot 10^5$	25	p	LH2, LHe	2022 1 month	LHe target
$\overline{p}$-induced Spectroscopy	Heavy quark exotics	12, 20	$5 \cdot 10^7$	25	$\overline{p}$	LH2	2022 2 years	target spectr.: tracking, calorimetry
Drell-Yan	Pion PDFs	190	$7 \cdot 10^7$	25	$\pi^\pm$	C/W	2022 1-2 years	
Drell-Yan (RF)	Kaon PDFs Nucleon TMDs	~100	10^8	25-50	$K^\pm, \overline{p}$	$NH_3^\dagger$, C/W	2026 2-3 years	"active absorber", vertex det.
Primakoff (RF)	Kaon polarizi-bility & pion life time	~100	$5 \cdot 10^6$	> 10	K^-	Ni	n/e 2026 1 year	
Prompt Photons (RF)	Meson gluon PDFs	≥ 100	$5 \cdot 10^6$	10-100	$K^\pm$ $\pi^\pm$	LH2, Ni	n/e 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	

Table 5: Requirements for future programs at the M2 beam line after 2021. Standard muon beams are in blue, standard hadron beams in green, and RF-separated hadron beams in red.

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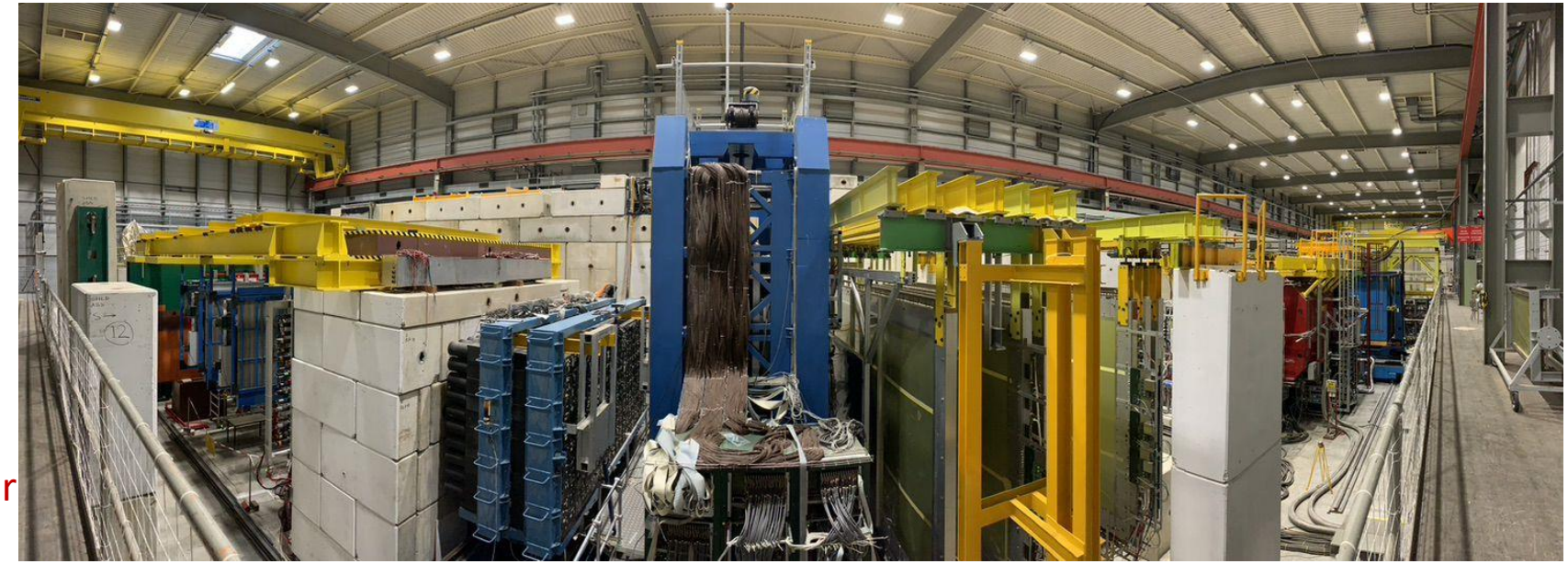
- AMBER has been approved as NA66 experiment in December 2020
- the Collaboration consists of ~200 physicists from 34 institutes
- at the M2 beamline at SPS: muon and hadron beams 60 – 250 GeV
- AMBER inherited, extended and modernized the 2-stage spectrometer of the COMPASS collaboration



- **Approved Phase-1** physics:
  - $\bar{p}$ production cross-sections
  - proton radius
  - pion/kaon structure functions
- Intended **Phase-2** physics (>Long Shutdown 4):
  - strange-meson spectroscopy
  - kaon polarizability
  - prompt-photon production

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AMBER 2023 setup

preparations for AMBER 2025

setting up for AMBER 2024

PAW'24 Programme

3 days with 5 double-session blocks:

Monday morning:	Antiproton production cross-sections (APX)	
Monday afternoon:	Proton radius measurement (PRM)	*19:00 Social Dinner*
Tuesday morning:	Meson structure in Drell-Yan reactions (DY)	
Tuesday afternoon:	Ideas for a follow-up proposal (AMBER Phase-2)	
Wednesday morning:	Beams for AMBER (BE)	*on the CERN site*

we thank our supporters:

…and Martin Zemko, Anne Lissajoux and the whole Local Organizing Committee!