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Operational Experience with the Combined Solenoid/Dipole Magnet System of the COMPASS Experiment at CERN

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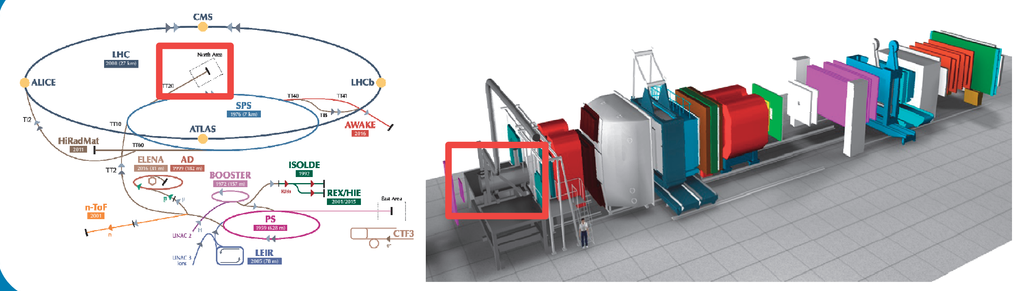
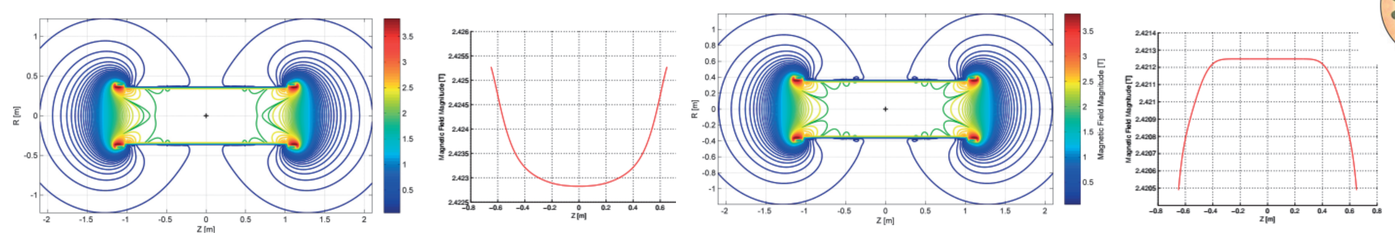
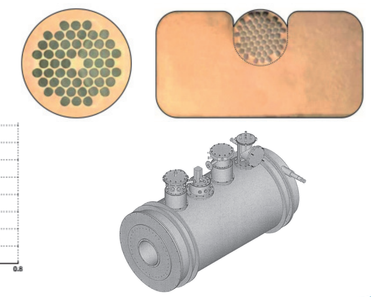
Introduction

The first ever polarized Drell-Yan experiment was performed at the COMPASS spectrometer at CERN in 2015. Longitudinal polarization is obtained by applying Dynamic Nuclear Polarization (DNP) using a 2.5 T longitudinal solenoid field. Transverse polarization is obtained by **rotating** the magnetic field and a 0.63 T transverse dipole magnetic field.

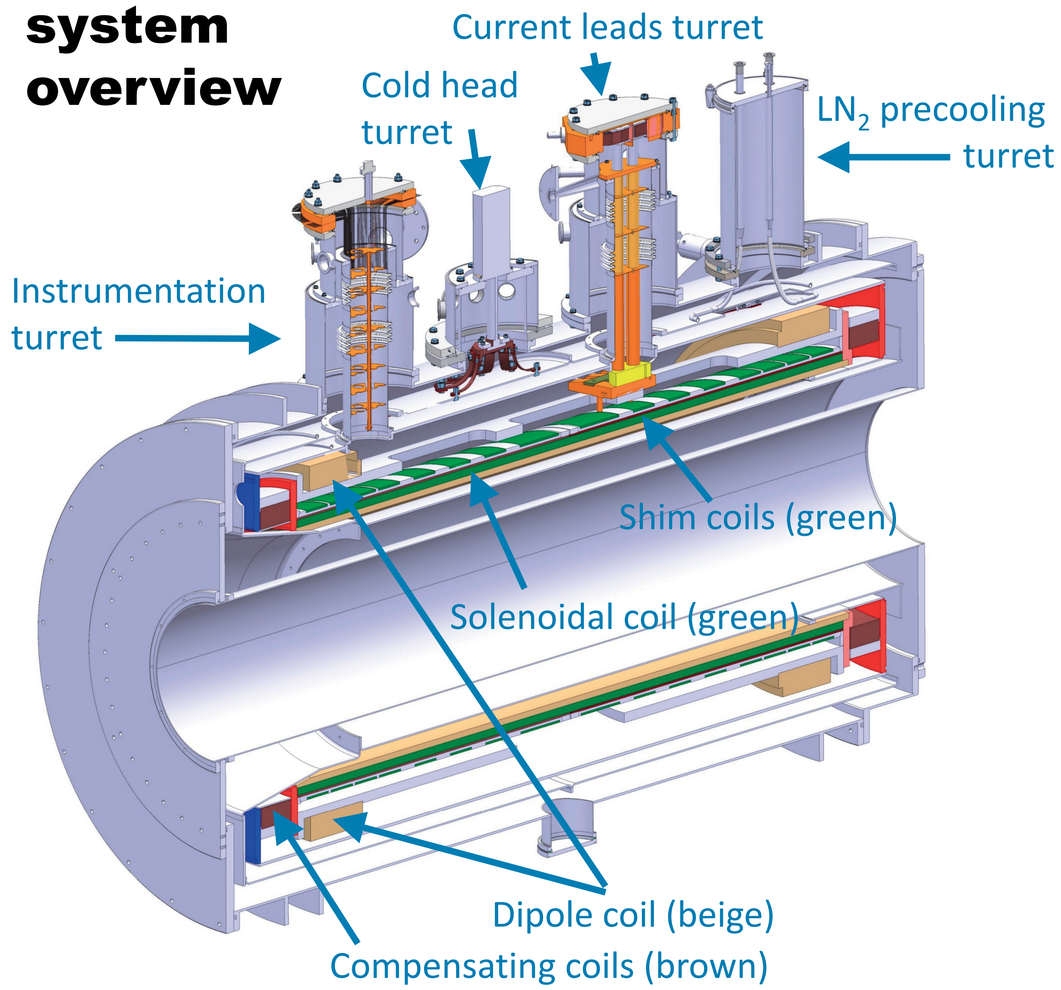
COMPASS spectrometer and target system







Refurbished system overview



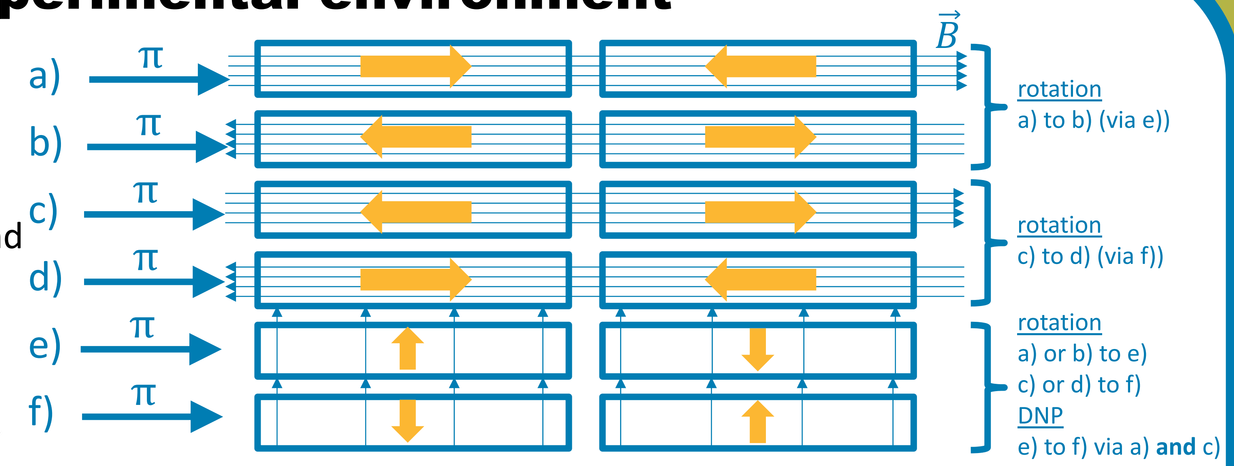
	Solenoid	Dipole
Operational / critical current (A)	650 / 1200	590 / 1000
Inner/outer radius - length (mm)	340/361 - 2020	420/452 - 1840
# layers / # turns	10 / 611	10 /60
Stored energy (MJ) / inductance (H)	2.58 / 12.2	0.468 / 2.69

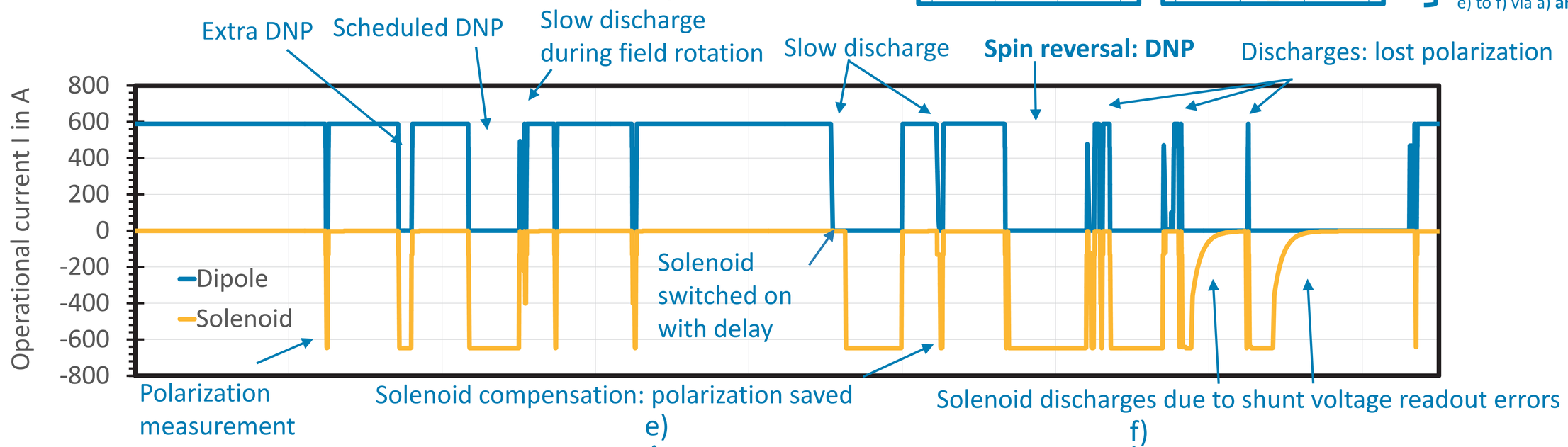
Operation in experimental environment

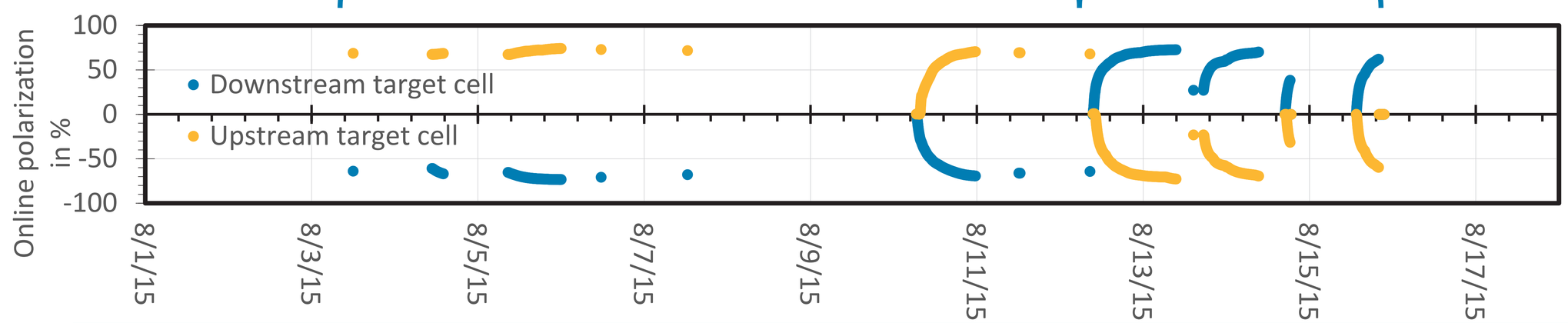
The statistical accuracy of the experiment depends on beam properties (flux) and (NH_3) target properties. The required beam time to achieve a certain accuracy is inversely proportional to the figure of merit F:

$$F = \kappa\rho(fP_T)^2$$

where κ is the packing factor, ρ the mass density, f the dilution factor and P_T the target nucleon polarization. Therefore, a **high magnetic field**, low temperature (<100 mK) and microwaves are required. To reduce the systematic error, the spin reversal is obtained with a **field rotation** for longitudinal studies, while for transverse studies, DNP is always required.







Summary and outlook

The magnet was refurbished, tested and put into operation with success. The magnet control and safety systems were updated accordingly. In 2015 the system performed very well. The system will be used again for the next physics campaign in 2018.

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