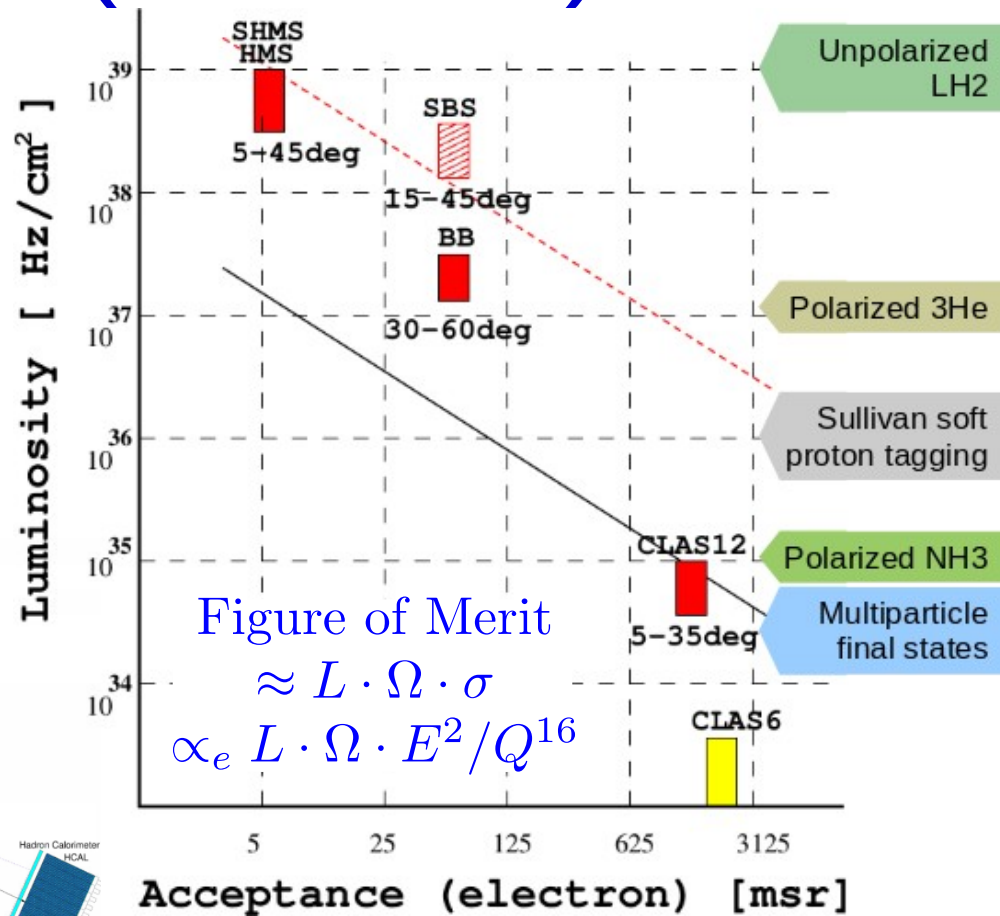
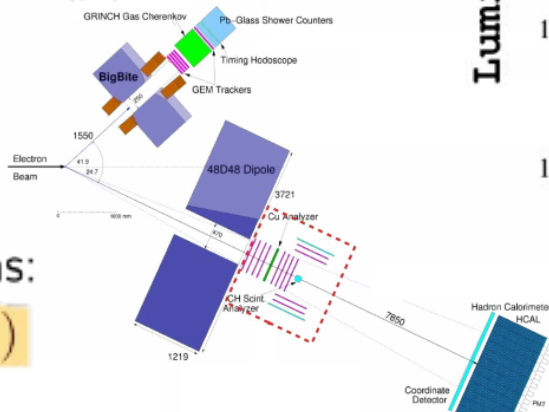
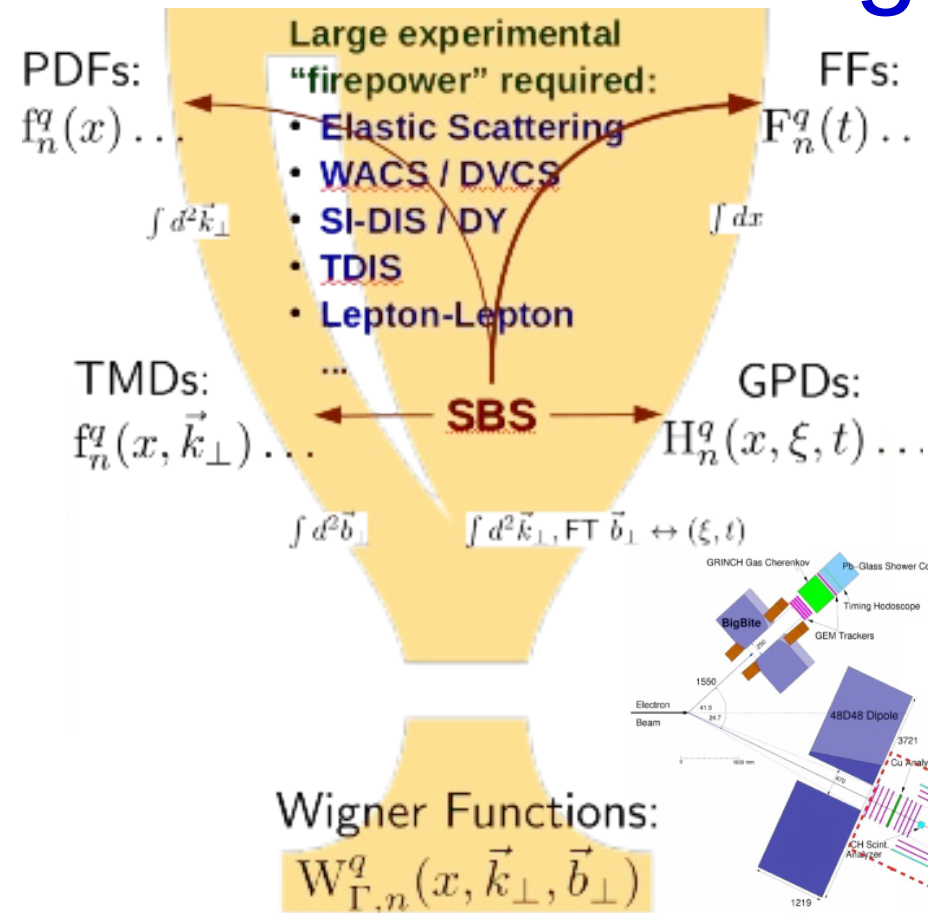


Stato programma sperimentale SBS

E. Cisbani

collaborazione con BA, CT, GE, RM1

SBS Program (~2008 →)

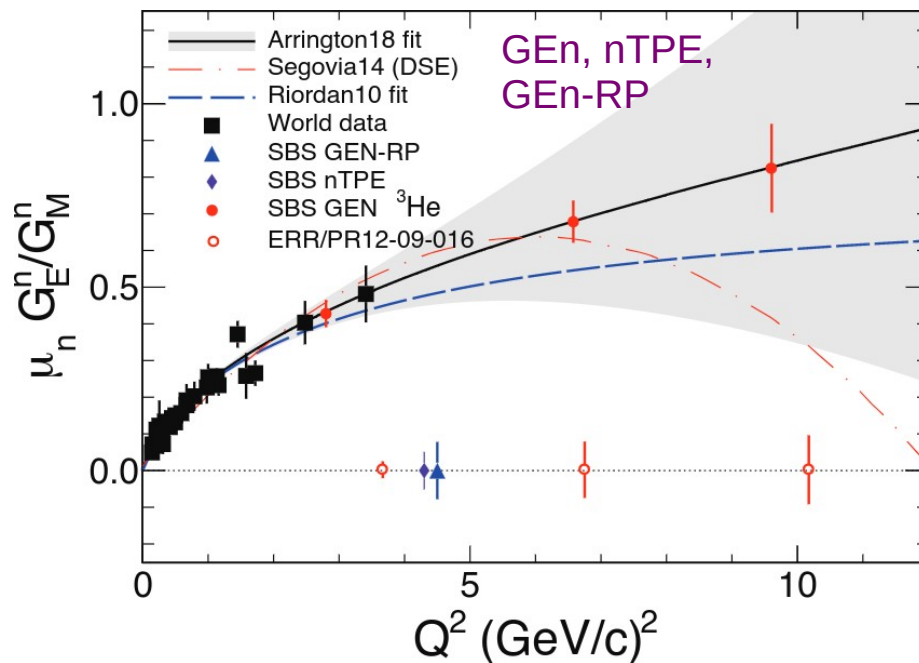
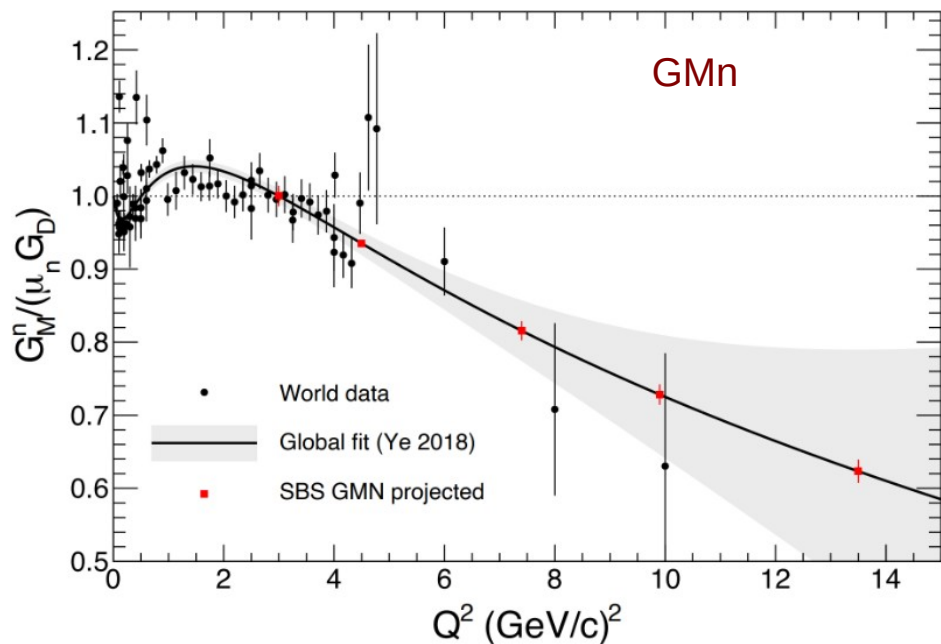


Largely reconfigurable spectrometers → experiment specific optimization

SBS Experimental Program Status

FF	GMN (E12-09-019)	Neutron magnetic form factor GMn up to 13.5 GeV ²	Measure D(e,e'n) and D(e,e'p) cross sections ratio and from it the related elastic cross sections ratio	done, 2021
	nTPE (E12-20-010)	Rosenbluth slope in e+n scattering at Q ² =4.5 GeV ² , with high accuracy; study two photon exchange	Same apparatus of GMN; measure $\sigma(e,n)/\sigma(e,p)$ on deuterium	done, 2021
	GEN-II (E12-09-016)	GEN/GMn up to 10 GeV ²	Beam-target double spin asymmetry on polarized ³ He	done, 2023
	GEN-RP (E12-17-004)	GEN/GMn at 4.5 GeV ²	Charge-exchange recoil polarimetry (first time!), on deuterium	done, May/24
	GEP-V (E12-07-109)	GEP/GMp to 12 GeV ²	Polarization Transfer (the most demanding SBS experiment)	Jun/24 → Install → Feb/25 → Run → Aug/25
	(E12-23-004)	Strange Quark Form-Factor of p	Parity Violating Polarized Electron Scattering on H ²	Hall C > 2025
GPD	WAPP (E12-20-008, E12-21-005)	A _{LL} / K _{LL} from $\gamma^* n \rightarrow \pi^- p^+$	Pioneering measurements; same apparatus of GEN*, on ³ He and LD ₂ target; Cu radiator for γ production	A _{LL} cancelled; K _{LL} done, May/24
	(p)WACS (E12-17-008)	A _{LL,LS} / K _{LL,LS} in $\gamma^* p^+ \rightarrow \gamma p$	Compact Photon Source + Neutral Particle Spect. + BB/SBS + GEM Tracker + HCal	Hall C > 2025
TMD	SIDIS (E12-09-018)	Extract Sivers, Collins and Pretzelosity neutron asymmetries on π and K with high statistics in high x valence region	Transversely Polarized ³ He Target, 3D binning on the relevant variables: x, P _{perp} and z, for both hadrons; 2 Q ² values	Hall C > 2025 ?
PDF	TDIS (C12-15-006A/B)	Measure π/K F ₂ in valence regime	Exploit Sullivan process $e+N \rightarrow e'(\gamma\pi)N' \rightarrow e'XN'$ tagging the spectator N'	Hall C > 2025

SBS+BB @ JLab 12 GeV – Analyses in progress



Statistical expectation largely achieved

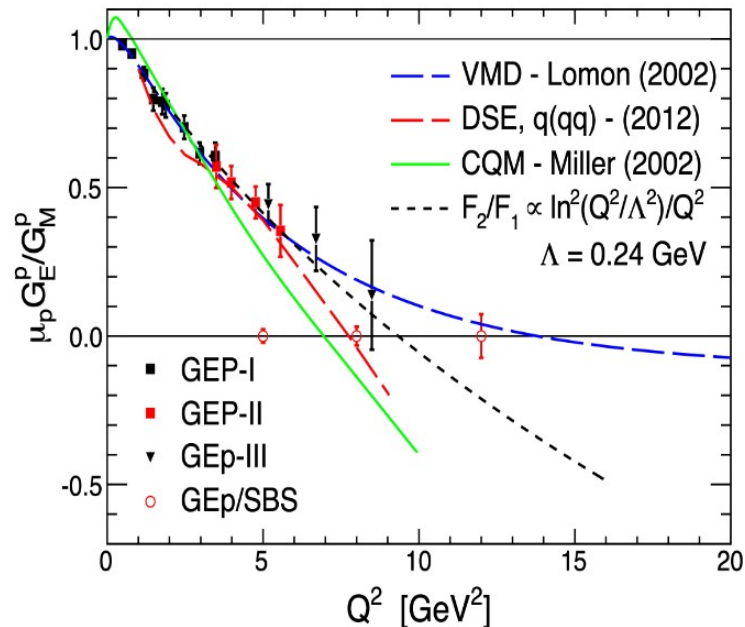
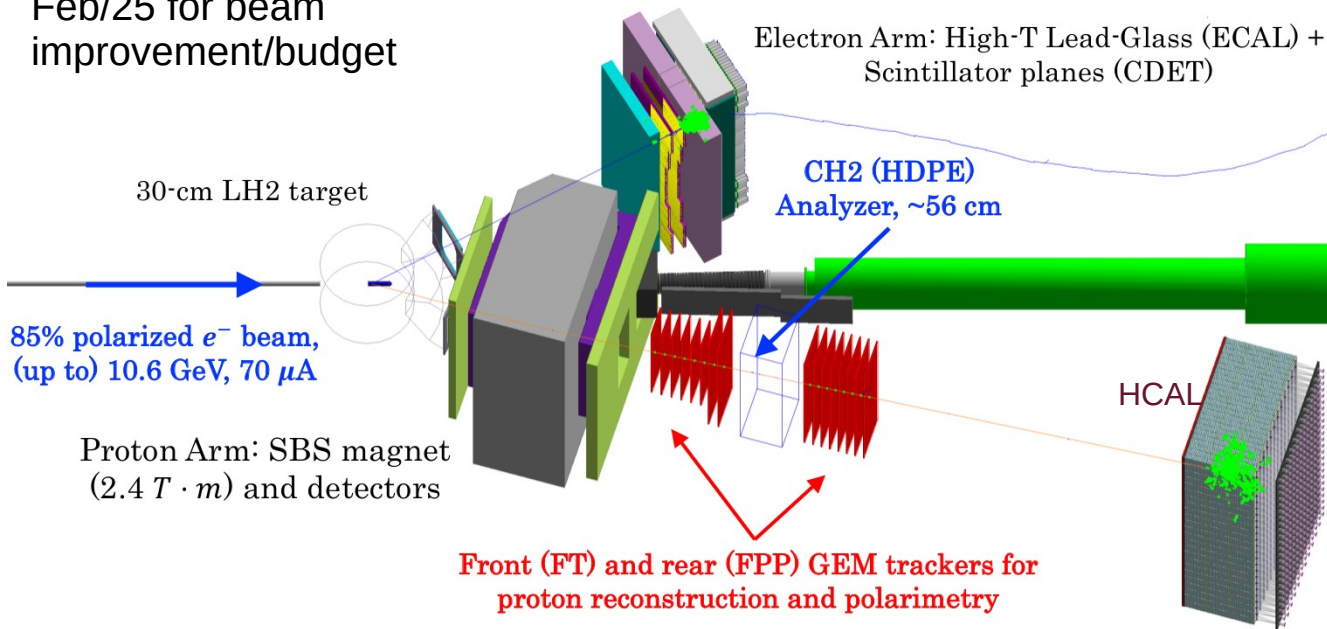
~3 years of exp.reconfiguration, commissioning and data taking →

continuous improvement of understanding and control of the new and refurbished components (pol. ^3He , GEM trackers, E/H calorimeters, GRINCH ...)

Forthcoming GEp – Highest Lumi

Run start postponed to Feb/25 for beam improvement/budget

Beam polarization transfer + nucleon polarimetry

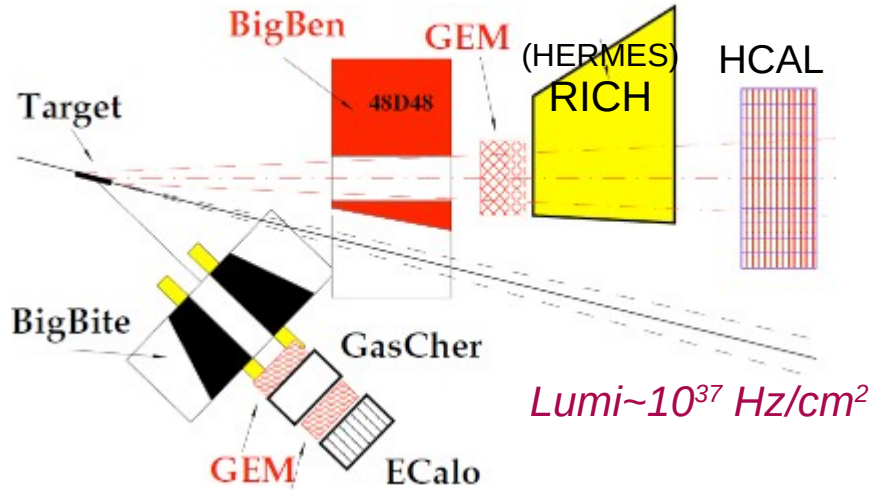


Most demanding SBS experiment (very high Q^2) triggered the SBS project Italian Co-spokespersonship

Funding (~25 keuro BA+CT+RM1) for: participation to data taking and contribution to the coordination, technical support (dis)installation of electron arm: Coordinate Detector + ECAL and reconfiguration of hadron arm: GEMs, CH₂ analyzer and HCAL

Next (?) SIDIS–TMDs on Neutron

$${}^3\text{He}^\uparrow(e, e'h^{\pm,0})X \rightarrow A_{UT} \equiv \frac{d\sigma^\uparrow - d\sigma^\downarrow}{d\sigma^\uparrow + d\sigma^\downarrow}$$

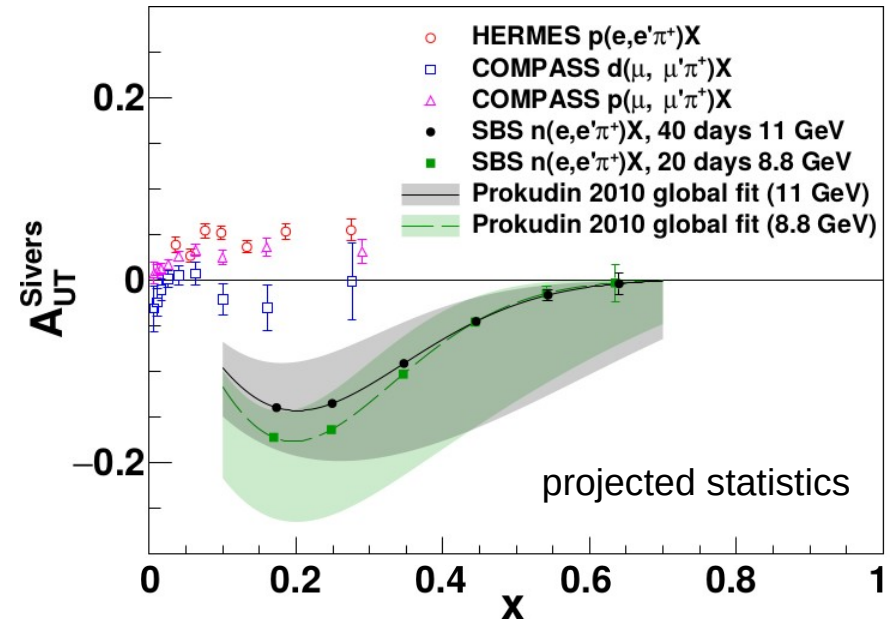


→ **Transversity:** “Clean” probe of relativistic effects; chiral-odd Distribution and Fragmentation Functions

→ **Sivers:** Link to quark Orbital Angular Momentum and QCD FSI mechanism; used to test DF universality

d-quark Sivers/Transversity are poorly constrained by existing data

- Proton data dominated by u-quarks
- d-quarks TMD limited precision
- Scarcity of deuteron (COMPASS) and neutron (${}^3\text{He}$ /Hall A) data to constraint d-quark TMDs
 - expected new polarized deuteron data from COMPASS

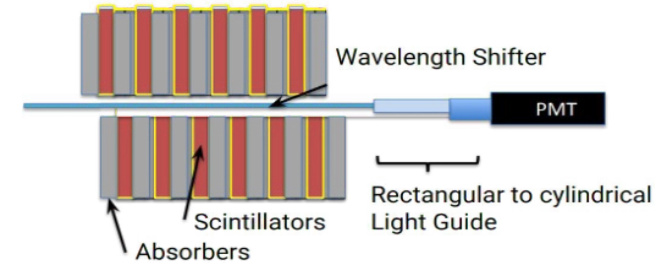


Add on: possibility to measure FSI in ${}^3\text{He}$ distorted spectral function

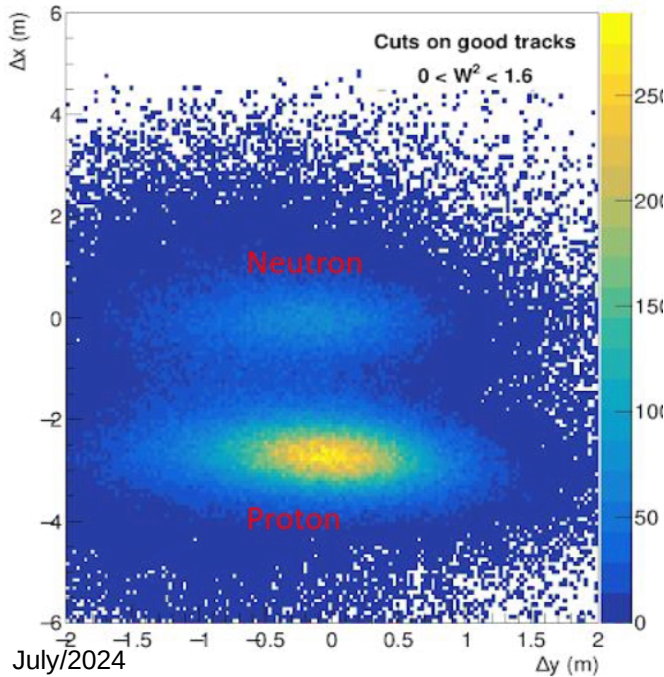
HCAL Status

From Jiwan Poudel - Jan/2024

- Proton/Neutron Calorimeter Detector
- $12 \times 24 = 288$ blocks
- Each block: $15 \times 15 \times 100$ cm³, 40 layers of Fe/Organic Scintillator + wavelength shifter

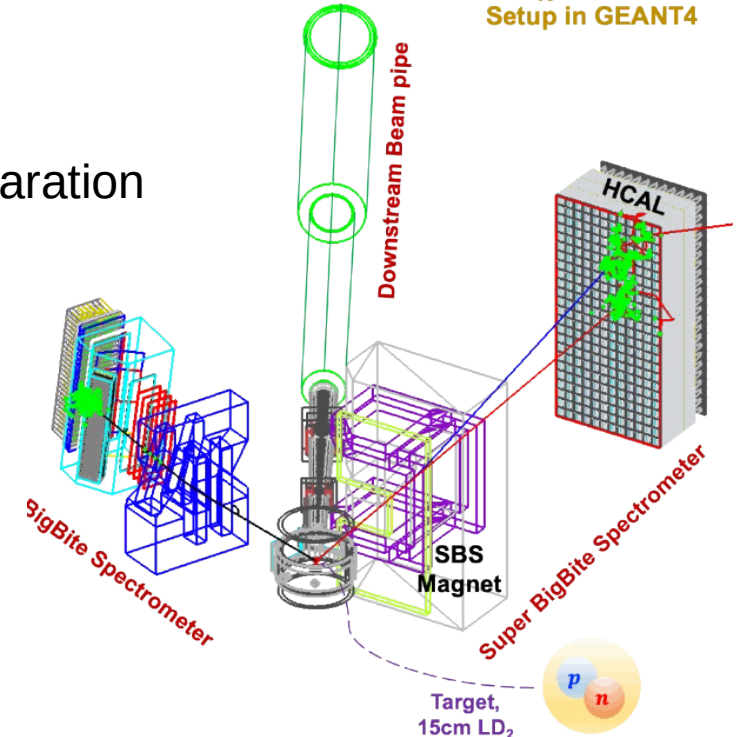


SBS- G_M^n Experimental Setup in GEANT4



Excellent neutron/proton separation (He3 target, elastic events)

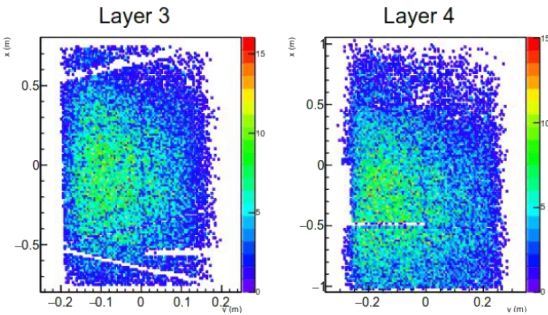
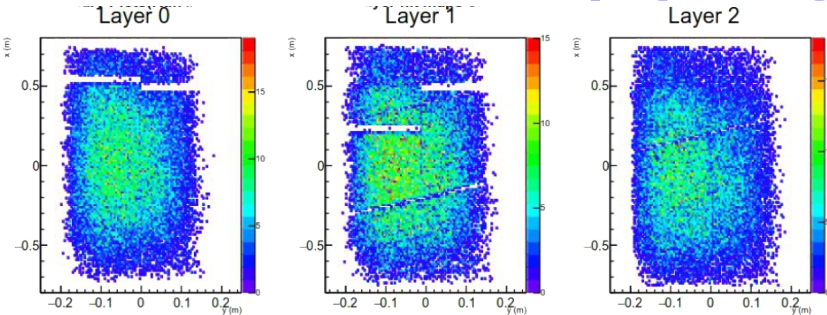
All HCAL modules working fine except few noisy channels



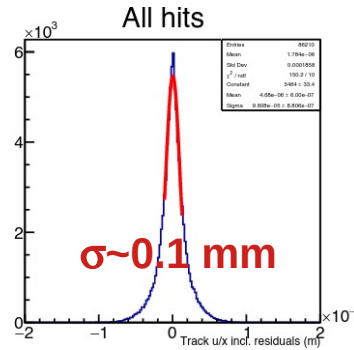
BB/SBS GEM trackers

Efficiency drop in high lumi cured by individual channels (7) HV CAEN power supplies

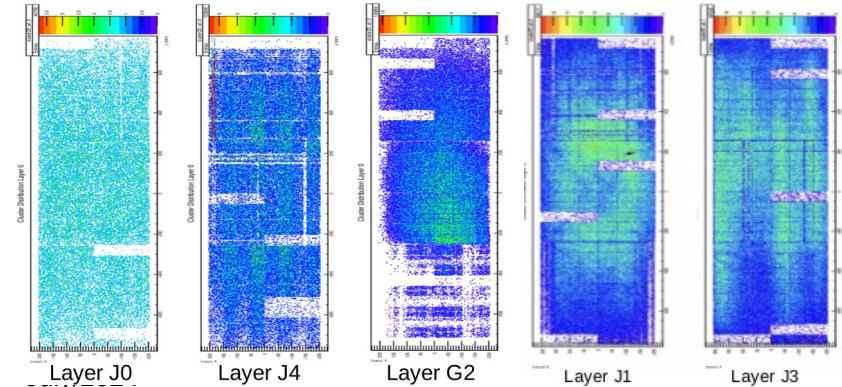
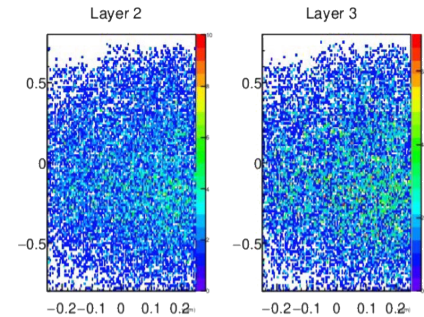
GEMs need continuous presence at JLab (we cannot guarantee)



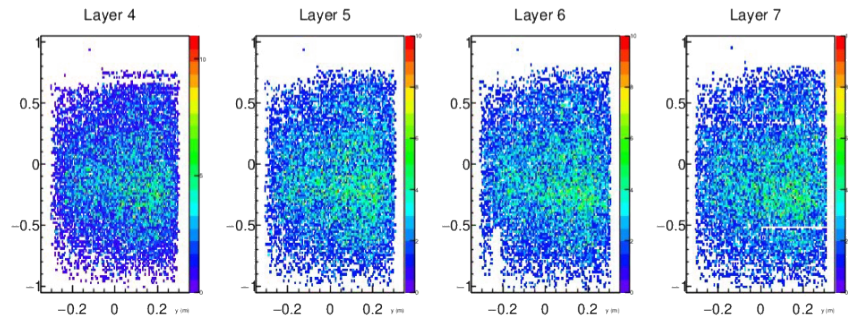
BigBite
GEMs



(Some)
SuperBigBite
GEMs



Our
spare
GEMs
(bottom
G2 needs
minor fix)



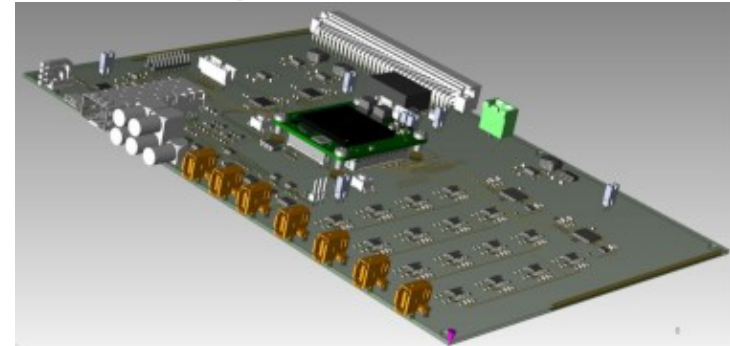
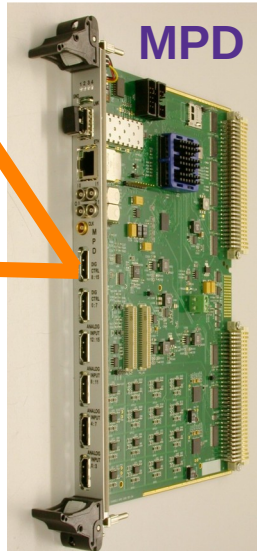
SBS Status

GEM related

Continue collaboration and support in configuration, maintenance, performance analysis

INFN/GE working on MPD upgrade

- new FPGA with extended functionalities
- possibility to change cabling format
 - immediate, but not exclusive application, in upcoming Möller experiment



Funding for acquisition of one board (~3keuro) which will be tested on real detectors and likely used for SiD noise further mitigation (larger number of time samples)

SiD (μ Strip Silicon Detector)

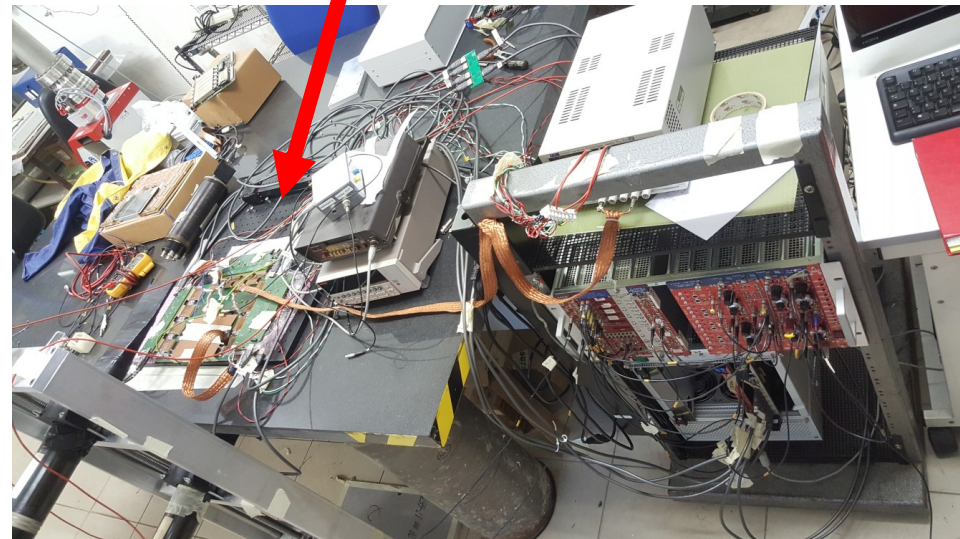
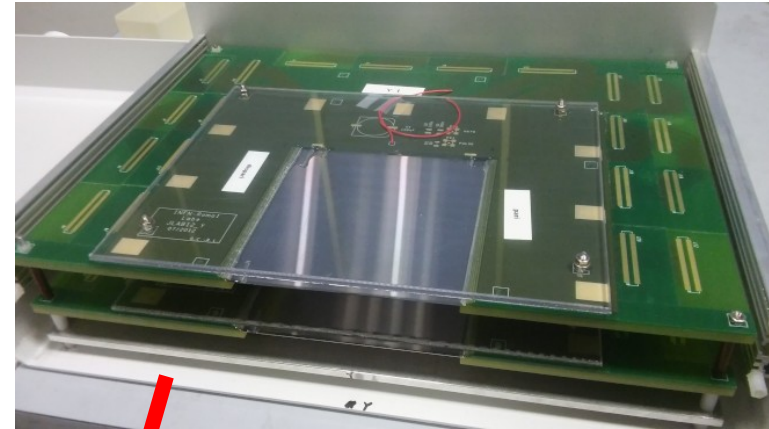
4 planes $\sim 10 \times 10$ cm²: 2x and 2y strips, 50 μ m pitch

Cosmic test ongoing on latest (INFN/BA) bonded sensors

Proposed as active sieve slits in spectrometer calibration in HallC for hypernuclei experiments improving current setup restrictions introduced by the magnetic septa (Particle Charge Separators);
potential application also in CLAS experiment

Finalization: noise filtering, mechanical enclosure and adjustable mechanical support (with adequate tolerance)

Funding for consumable ~ 2.5 keuro used for the finalization of the detectors



SBS Plan Jul/2024 → Dec/2025

Jul/24 → Feb/25 Support GEp installation and experimental planning

Feb/25 → Aug/25 Contribute to data taking and related activities

Aug/25 → Dec/25 Support GEp disinstallation
Support next SBS experiments (in HallC)

- Continue test and characterization of the SiD sensors, then implement other components
- Support MPD upgrade (testing on real detectors... and likely use in SiD noise improvement)

Impact on
Hypernuclei, Moller,
SIDIS experiments
and possibly more