Super Bigbite Project

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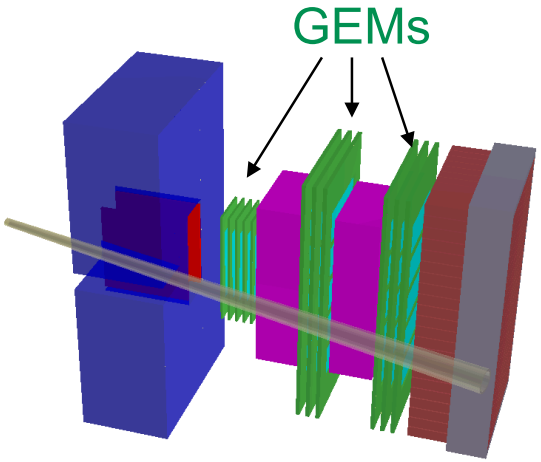
Good news: SBS concept and EMFF proposals got approval, INFN group is doing experimental work with GEM system.

Funding status: SBS is included in JLab budget request for FY2011. Status of the budget is complicated and unclear.

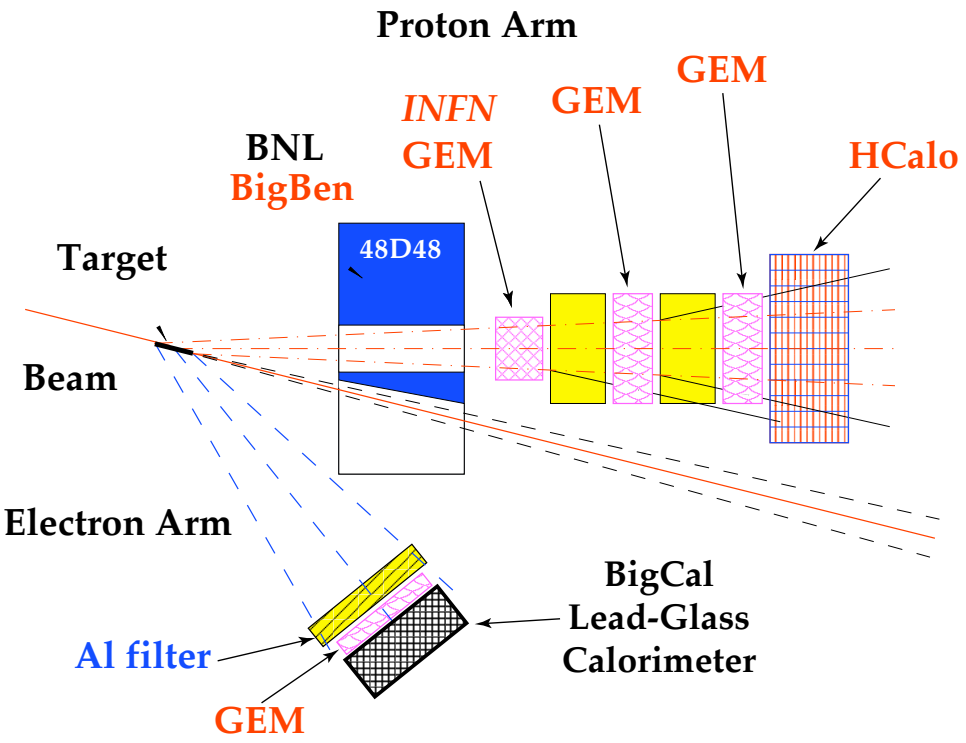
Since March collaboration meeting (3/19/10) our efforts were focused on the SBS development.

Deadline for the reply to the Mecking's review report is midJuly.
Reply will allow to start a mail review: a key step for the project, also the SBS is a part of the u/d proposal to PAC36.
Regular updates are in the newsletter (on the SBS webpage)
Subgroups are formed, several reports will be today.

The SBS: scope, concept, and applications



Proton form factors ratio, GEp(5) (E12-07-109)



The Super Bigbite project:

- SBS magnet
- SBS trackers
- Hadron calorimeter
- Trigger and DAQ

Why SBS?: the cost/physics is an answer.

SBS Concept

- Vertical bending
- Detector located behind the magnetic field
- Cut for the beam line in the “field free” area
- Simple dipole for the large acceptance
- Field integral vs. detector resolution => GEM
- Forward angles vs. solid angle

$\theta_{central}$, degree	Ω, msr	D, meter	Hor. range, degree	Vert. range, degree
3.5	5	9.5	$\pm$ 1.3	$\pm$3.3
5.0	12	5.8	$\pm$ 1.9	$\pm$4.9
7.5	30	3.2	$\pm$ 3	$\pm$8
15	72	1.6	$\pm$ 4.8	$\pm$12.2
30	76	1.5	$\pm$ 4.9	$\pm$12.5

Development

- Need to be done: the advanced physics and engineering design, construction …

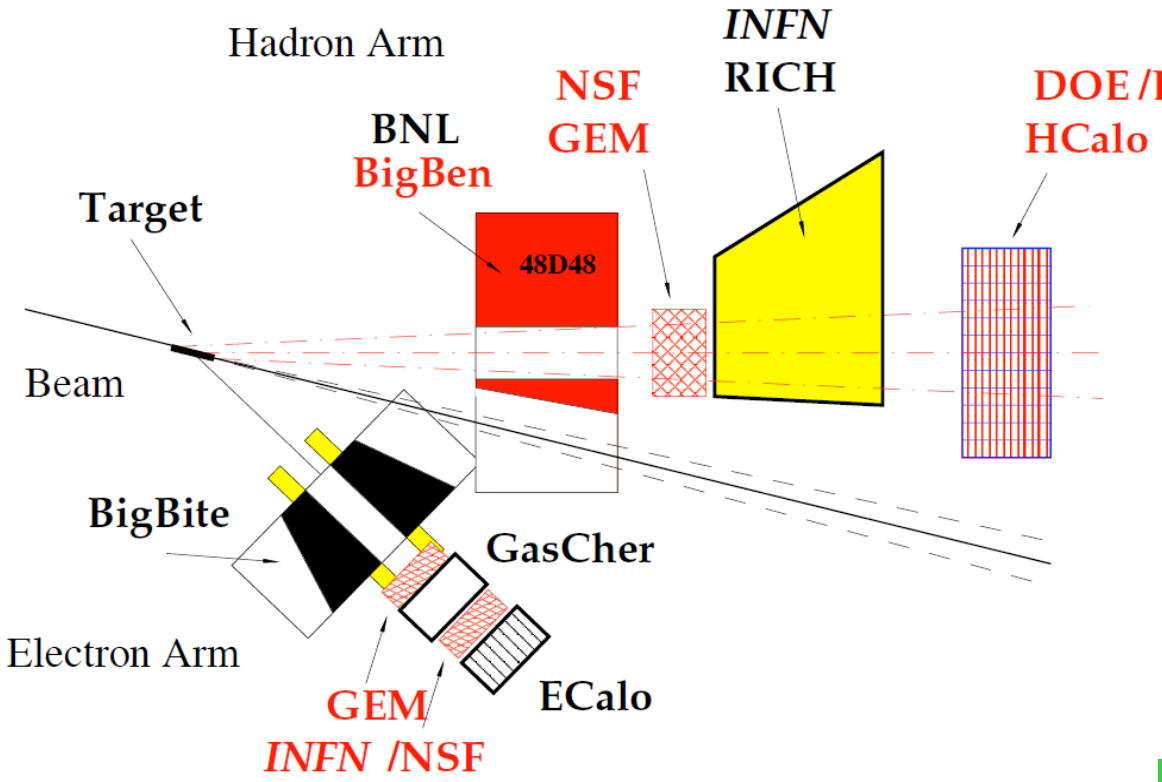
Spokespeople are the drivers and providers of manpower and related resources

- GEp(5) has 8 spokespeople (CNU, NSU, W&M, JLab)
- GEn(2) has 3 (UVA, JLab)
- GMN has 3 (CMU, RU, JLab)
- SIDIS has 4 (INFN, CMU, UVa, JLab)
- A1n has 6 (WM, GU, UVa, JLab)
- Tritium has 4 (KU, JLab, ANL, RU)

Total 22, including one postdoc, four JLab staff, and 17 faculty members of the user community

SIDIS experiment (conditionally approved)

$$e + {}^3He^{\uparrow} \rightarrow e' + \pi(K)^{\pm} + X$$



BB: e-arm at 30°
Ω = 45 msr
GEM Tracker
Gas Cherenkov
Shower
⇐ GMn/PR-09-019

SBS: h-arm at 14°
Ω = 50 msr
GEM tracker
excellent PID / RICH
Hadron CALO

Beam: 50 μA, E=8.8 and 11 GeV (80% long. Pol.)
Target: 65% polarized 3He ⇐ GEn(2)/PR-09-016
⇨ Luminosity: 1.4×10^{37} $cm^{-2}s^{-1}$, 0.05 sr

Event rate: ~10^4×HERMES
60 days of production
expected stat. accuracy:
1/10 of proton HERMES

GEM chambers

In view of the very large production of GEM foils and readout PCBs by the CERN workshop, **the Committee strongly recommends to set up a list of specifications and QA acceptance criteria** (e.g. max. leakage currents, inner/outer hole diameter range, max. mask misalignment, etc.) **before the start of mass production this year.** Strict QA rules and documentation of acceptance tests at the institutes receiving the GEM foils and PCB boards should be set up and followed. Depending on the details of the QA requirements, the level of required contingency should be discussed with the CERN workshop. The quality of GEM foils and PCB components during the mass production process has to be closely monitored, and rapid feedback to the CERN workshop should be ensured.

The Committee recommends investigating the possibility to reduce the number of spacer strips between GEM foils which will result both in a smaller dead area and a smaller amount of material.

The Committee also proposes to investigate the possibility to increase the technical personnel for the construction and system integration aspects of GEM chambers and electronics for ST and TT at the University of Virginia.

The cost estimate for the construction of GEM trackers seems to be adequate. The Committee recommends to make sure that the cost estimates for the GEM foils and readout circuits include the contingency for the final yield, based on the QA procedures, and to review the cost estimate for the gas system which seems to be on the low side.

GEM chambers readout

Recommendations:

Noise performance studies of the chamber with UV strip orientation, and therefore varying strip lengths, and an analysis of its impact on resolution and efficiency are of a great importance before the start of mass production. Special tests to estimate S/B performance should be also foreseen for the ST and TT chambers, where four strips are connected into a single readout channel (longer effective strip length mean higher capacitance, i.e. more noise).

In view of the high background levels (~ 500 kHz/cm^2) in the GEp(5) spectrometer, the Committee recommends that the 3-sample readout method of the APV25 be adopted as the default solution for all trackers (FT, ST, TT). This will increase the bandwidth requirement and data rates from tracking stations to the DAQ which, however, seems to be consistent with the plans for the Hall A DAQ upgrade.

The Committee strongly recommends that the response of a GEM detector to low-energy photons should be measured using a prototype detector and electronics.
The results should be compared to the GEANT modeling to confirm that the background levels in the Monte Carlo simulation are realistic. The expected level of occupancy in the GEM detectors, using an APV time window of 250 ns and an average number of strips in cluster per MIP particle ~ 3.5, seems to be exceedingly high.

SBS components, development #1

- **GEM:**
  - hardware: design of the chambers, electronics
    beam tests in Hall A
    construction of the labs at Uva, NSU
    $$$ contracts, acceptance checks
  - software: MC of the events, data analysis
    track finding, fast logic
  - readout and DAQ:

- **Magnet:**
  - TOSCA, design optimization (e.g. field at GEM)
  - design of the magnet modifications, coils, field clamp
  - power supply system from AC to controls

SBS components, development #2

- **HCal:**

  hardware: study of the fast scintillator&WLS
  test of the modules in Hall A
  design of the HCal detector
  $$ contracts, acceptance checks

  readout, HV, and DAQ: design, construction, tests

- BigBite Gas Cherenkov:

  a report on the existing counter, analysis of data
  MC study of the possible version, novel design

SBS components, development #3

- **RICH** with the aerogel and/or the N2 radiator
  - hardware: MC investigations
    background tests in Hall A
    design of the front-end for PMTs
    $$ contracts, acceptance checks
  - readout and DAQ

- pre/Shower for Bigbite (need in Tritium u/d):
  - MC simulation, rate analysis in A1n
  - design of the front-end, HV, and DAQ

Detector configurations in SBS program

	Front GEM	Polar GEM	Had Calo	Elec Calo	Big Ben	Big Bite	RICH a/gas	BB Calo	preShower (HERMES)
GEP	X	X	X	X	X				
GEN	X(BB)	X(BB)	X		X	X		X	
GMN	X(BB)	X(BB)	X		X	X		X	
A1n+	X (BB)	X	X		X	X	X,gas	X	X
T:u/d	X (BB)	X	X		X	X	X,gas	X	X
SIDIS+	X (BB)	X	X		X	X	X,a	X	
D(e,e'p)	X (BB)	X	X		X	X	*X,a	X	
SRC	X (BB)	X	X		X	X			
e,e'ϕ	X (BB)	X	X		X	X	X,a	X	
A(Q^2)	X (BB)	X	X		X	X	X,gas	X	