SBS overview of development

Bogdan Wojtsekhowski, JLab

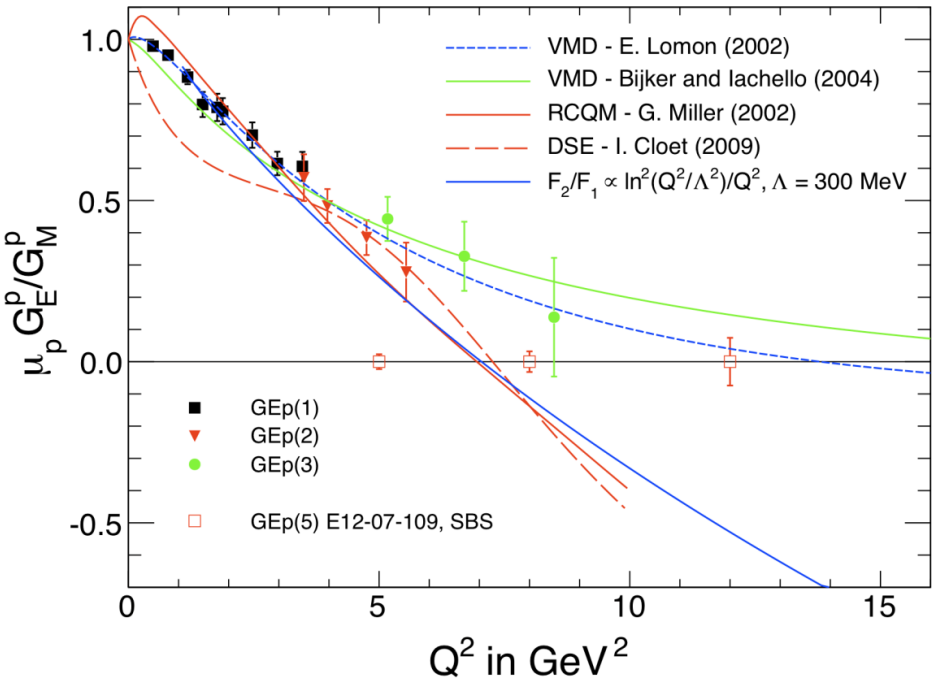
- Concept of the apparatus
- Experimental program
- Layout, Parameters
- Life of the project
- Funding profile(s)
- Schedule (in a perfect case)

The concept ideas

- Vertical bending: use of the beam coordinate
- Detector location behind the magnetic field
- Field integral and tracker resolution
- Small bending angle: large acceptance
- Forward angle: the beam line through the yoke
- Calorimeters for the trigger and analysis
- High-speed & high-resolution tracker

Flagship experiment – GEp(5)

$$H(\vec{e}, e'\vec{p})$$



Beam: 75 μA, 85% polarization
Target: 40 cm liquid H_2
Electron arm at 28°
Proton arm at angle 17°, Ω = 35 msr
Spin precession angle is ~ 75°
Event rate is 15 times higher
than with standard spectrometer
From 58 days of production time
resulting accuracy (for higher Q^2)

$$\Delta(\mu G_E^p / G_M^p) = \pm 0.074$$

Approved group of experiments

- GEp(5) – up to 12 GeV^2 in 60 days; $^{+}/_{-}$ 0.074
- Neutron FFs: GEn to 10 GeV^2; GMn to 14 GeV^2
- Transversity data at high x/Q^2: n(e,e'$\pi^{+/o/-}$/$K^{+/-}$)

The physics program

- A1n – FOM is 300+ higher compared with prev. exps.

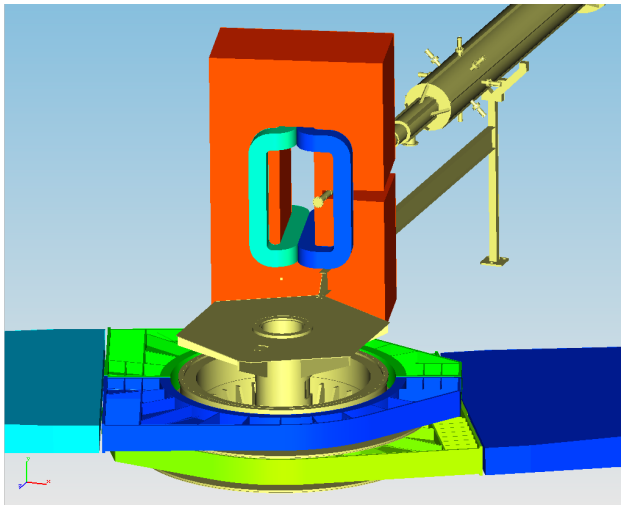
.....

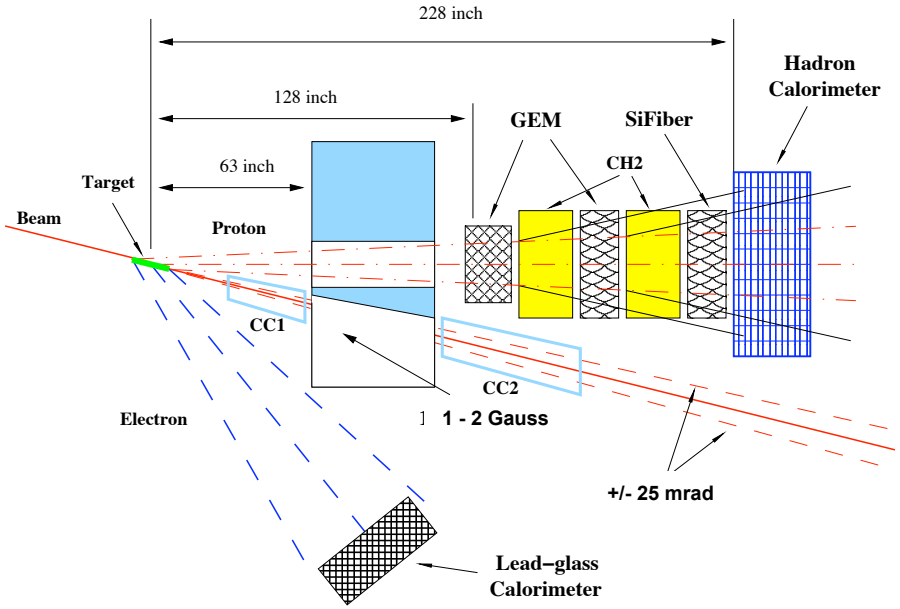
- GEP : reach unique high 12 GeV^2
- GMN: reach absolute max 18 GeV^2
- GEN: reach very important value of 10 GeV^2
- SSA in nSIDIS: very effective and timely

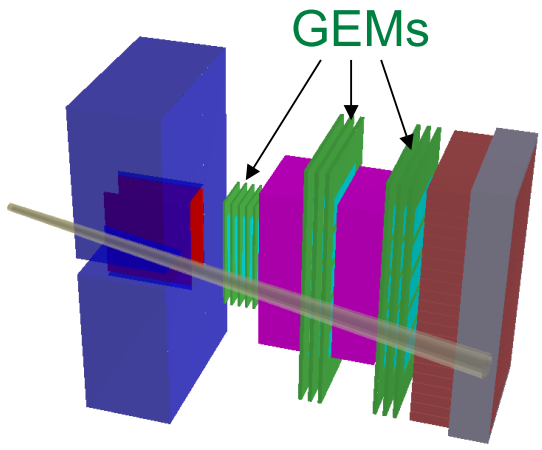
==========

- Polarized target RCS
- SRC: e'(SBS) + p(BB) + p/n(Scin)
- Pion structure function
- PVDIS
- J/Psi production
- p(e,e'ϕ)

Super Bigbite "Poster"







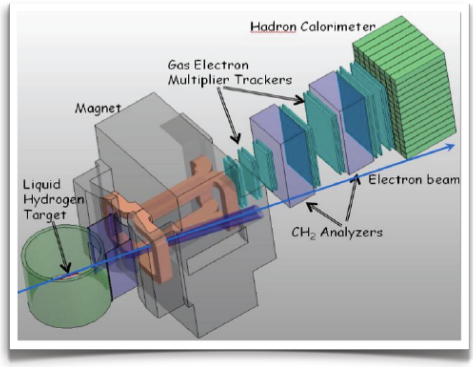
- Magnet: 48D48 - 46 cm gap, 2.5 Tesla*m
- Solid angle is 70 msr at angle 15 deg.
- GEM chambers with 70 μm resolution
- Momentum resolution is 0.5% for 8 GeV
- Angular resolution is 0.3 mrad

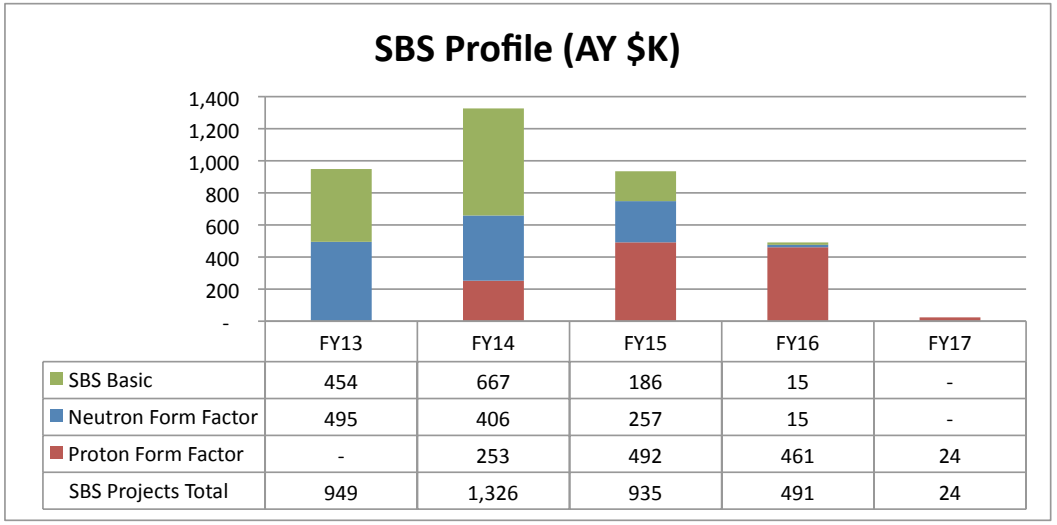
The funding: SBS projects

Super-BigBite-Spectrometer (SBS)

Program Management Plan

J. LeRose etal





	FY13	FY14	FY15	FY16	FY17
SBS Basic	454	667	186	15	-
Neutron Form Factor	495	406	257	15	-
Proton Form Factor	-	253	492	461	24
SBS Projects Total	949	1,326	935	491	24

n.b. No contingency shown (total contingency is $1,042K)

The life of the project

- Web page: http://hallaweb.jlab.org/12GeV/SuperBigBite/

- About 40 weekly SBS meetings:
  http://hallaweb.jlab.org/12GeV/SuperBigBite/SBS-minutes/

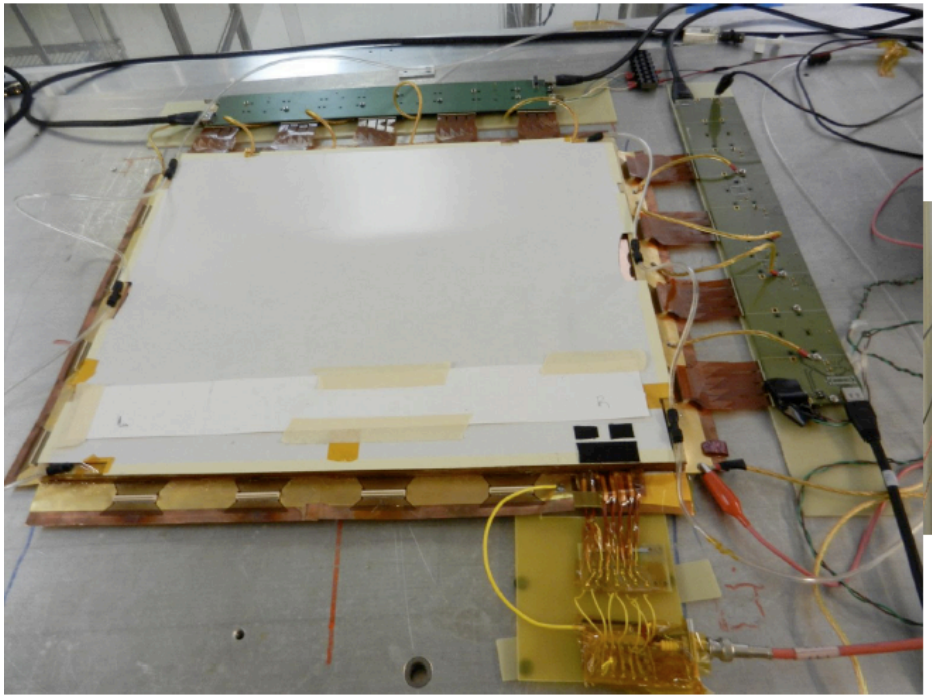
- R&D highlights: GEM, 48D48, HCAL, ECAL, CoorDet, BigBite

- Two monthly reports to DOE

- Collaboration meeting in October:
  http://hallaweb.jlab.org/12GeV/SuperBigBite/meetings/col_18oct12/

GEM chamber construction

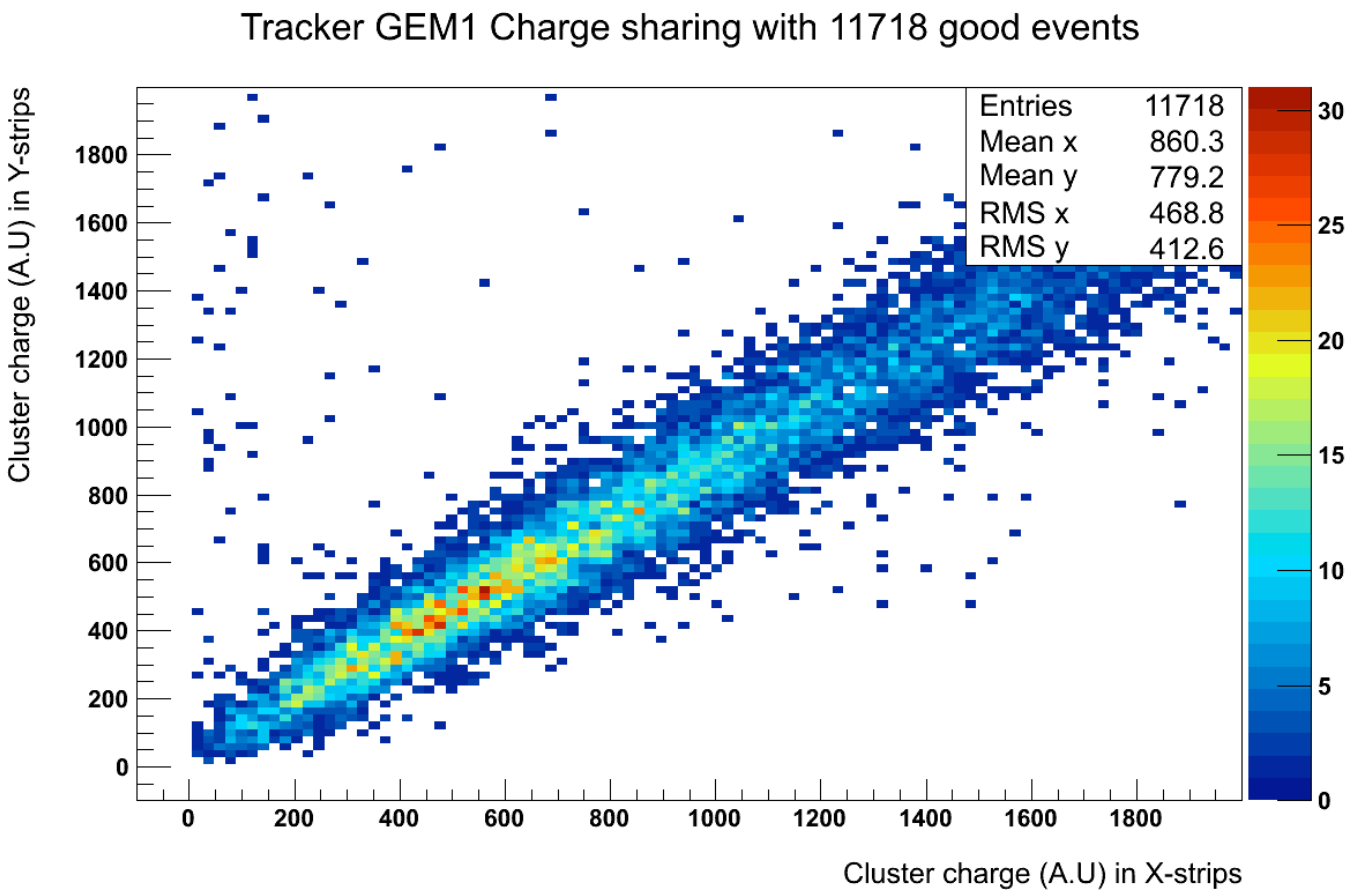
9 APV25 FE (5 on X and 4 on Y) cards on the chamber with the back plane, the Panasonic to ZIF connectors and the FE cards grounded directly to the GEM readout ground



MPD VME64x board with the HDMI cables to communicate with the FE cards

3

GEM chamber construction



University of Virginia

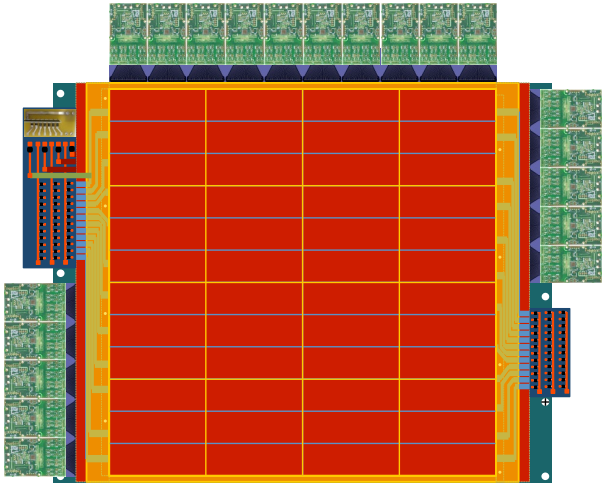
6

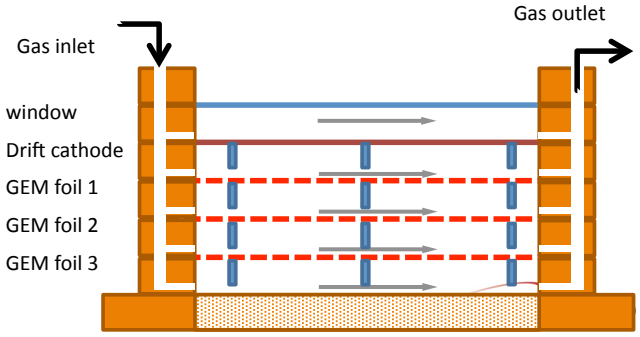
Jefferson Lab

GEM chamber construction

Proposal for a new design for the SBS GEM polarimeter trackers
by Kondo Gnanvo

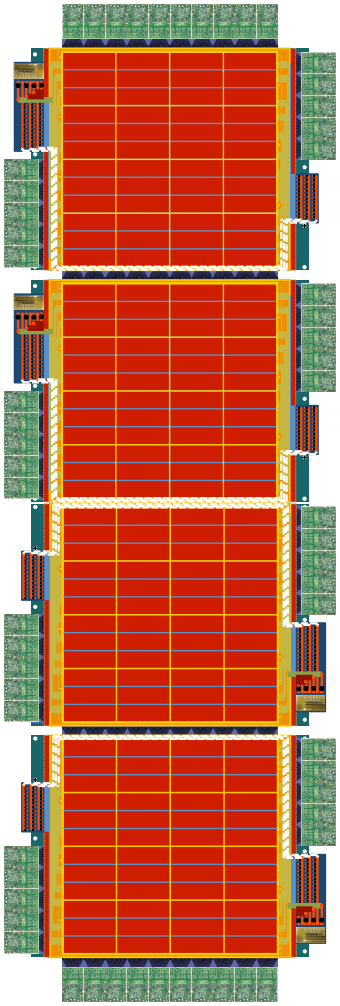
- **Module of 50x50cm^2 to replace the 40x50cm^2**
  - 32 modules to be built instead of 40 for the 8 Polarimeter chambers
- **Wider GEM frames along x-axis**
  - Width of 30 mm instead of 8 mm
  - Better stretching
  - Alignment holes away from active area
- **Wider readout support frame along x-axis (74 mm)**
  - Room for strips connectors and GEM HV sectors electrodes
- **No protective resistors on the GEM foils**
  - External resistor boards
- **Gas system same as in Evaristo's design**





GEM chamber construction

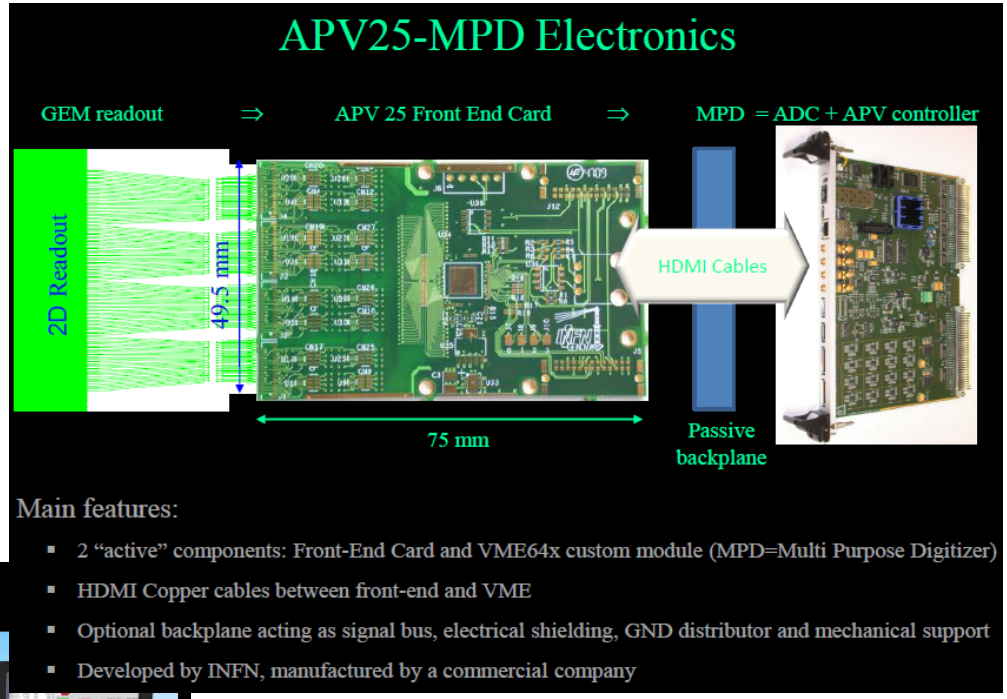
4 SBS GEMs with APV25-FE for each of the 8 Polarimeter chambers

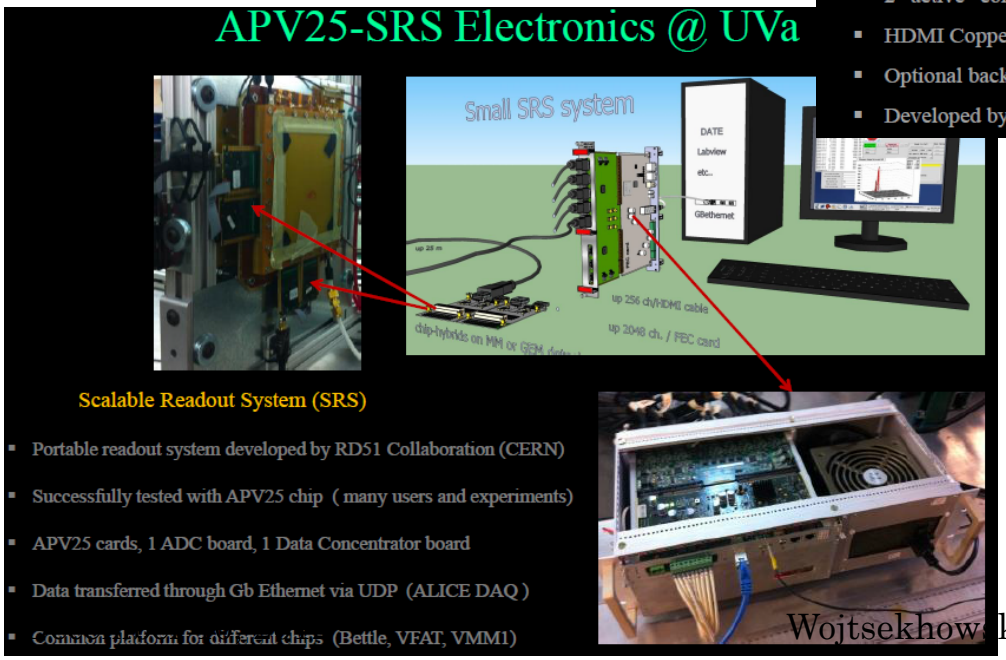


APV25 MPD and SRS system

Multi Purpose Digitizer (MPD)

- P. Musico, INFN Italy
- More than 2.5K Channels at UVa



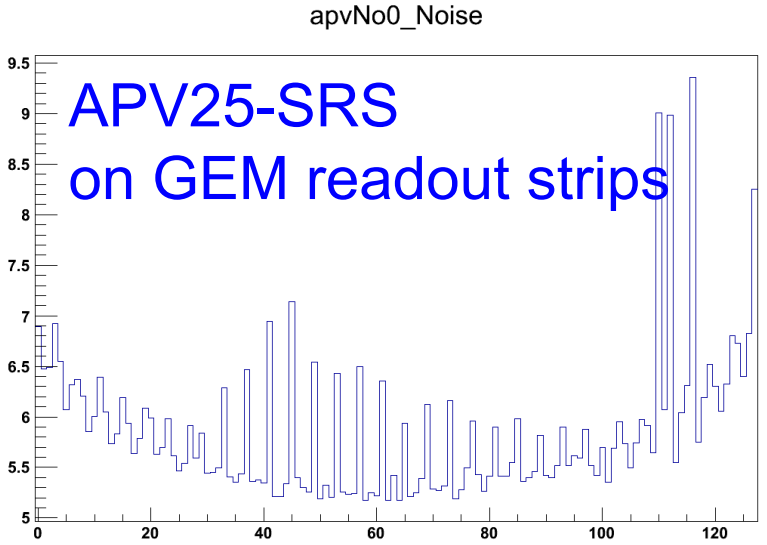


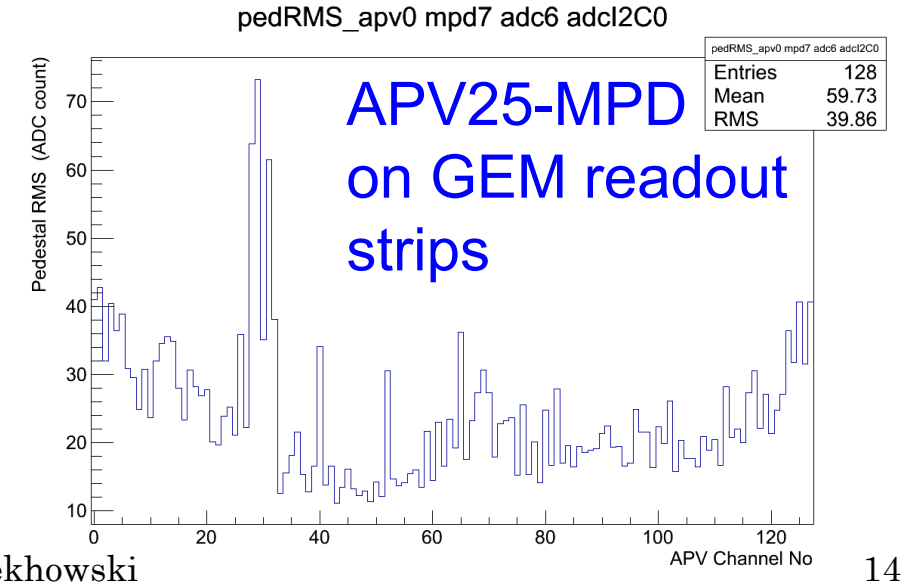
Scalable Readout System (SRS)

- H. Muller, CERN, RD51
- 2048 channels at UVa

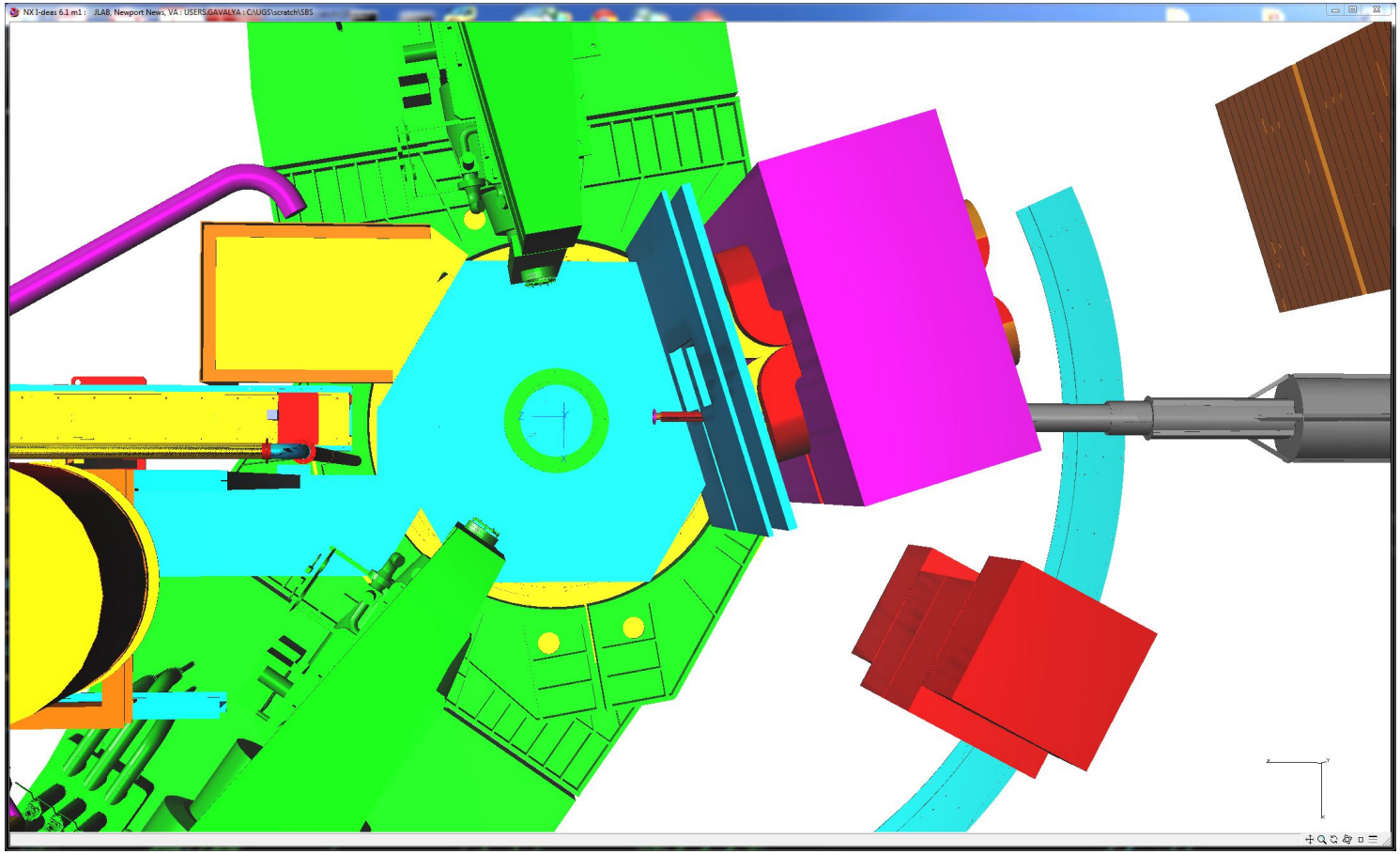
Study of the noise

- Typical rms for each of the 128 channels of a given APV card from a pedestal run and for both MPD and SRS
- This rms is obtained after common mode correction of the baseline
- The common mode correction reduces the rms by
  - a factor of 2 for apv25-MPD (basically from ~ 40 adc counts to ~ 20)
  - A few adc counts for apv25-SRS (from ~8 adc counts to 6.5-7)

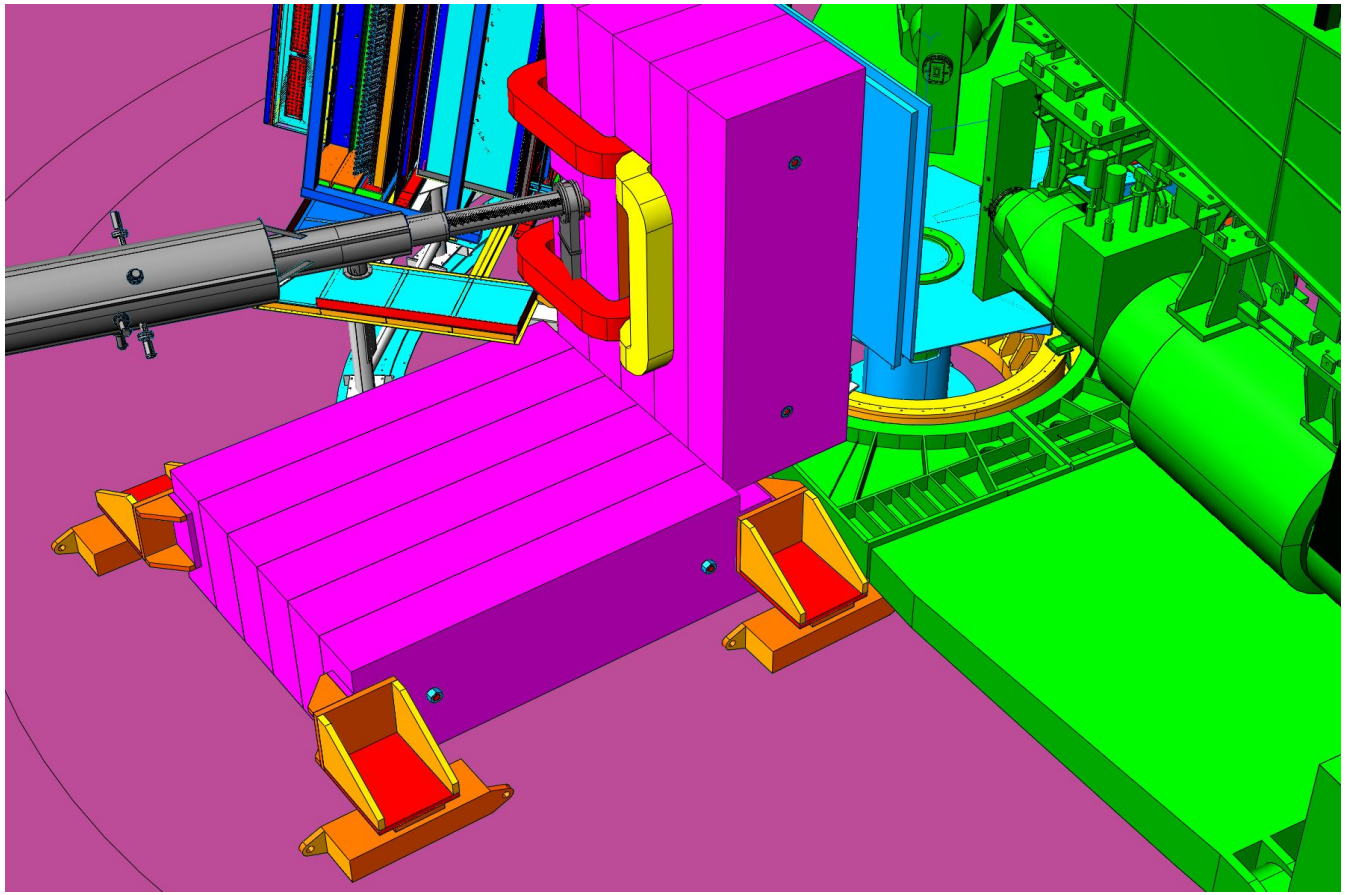




48D48 magnet for the Form Factor experiments



48D48 magnet for the Form Factor experiments



HCAL for the Form Factor experiments

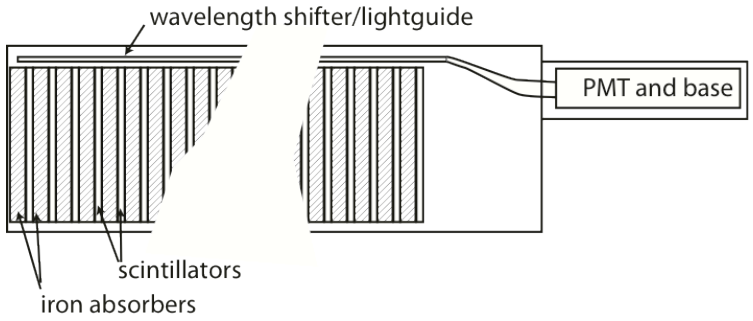
Hadron Calorimeter for Hall A (HCAL-J)

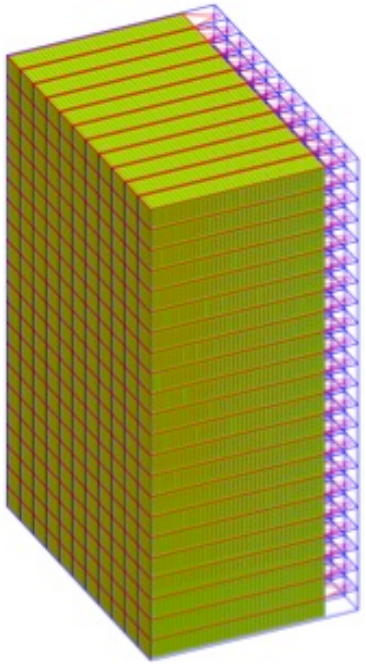
Status report 9/26/12
G.B. Franklin, Carnegie Mellon

JLAB/CMU/JINR/Catania Collaboration

Based on JINR design used at COMPASS

Want faster scintillator and wavelength shifters



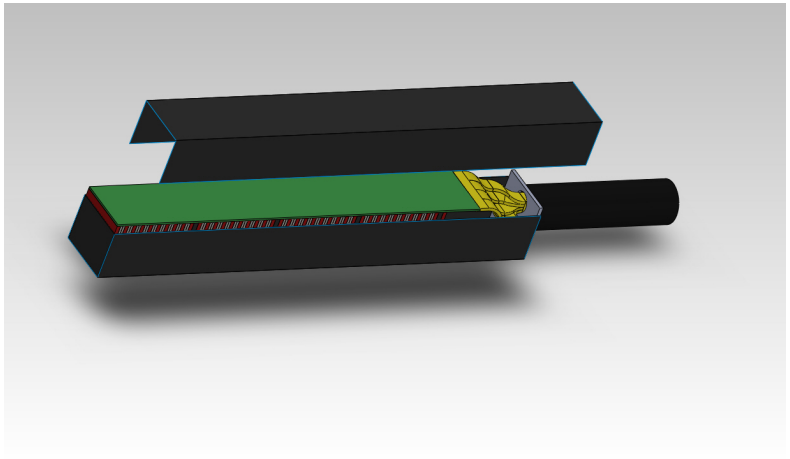


1

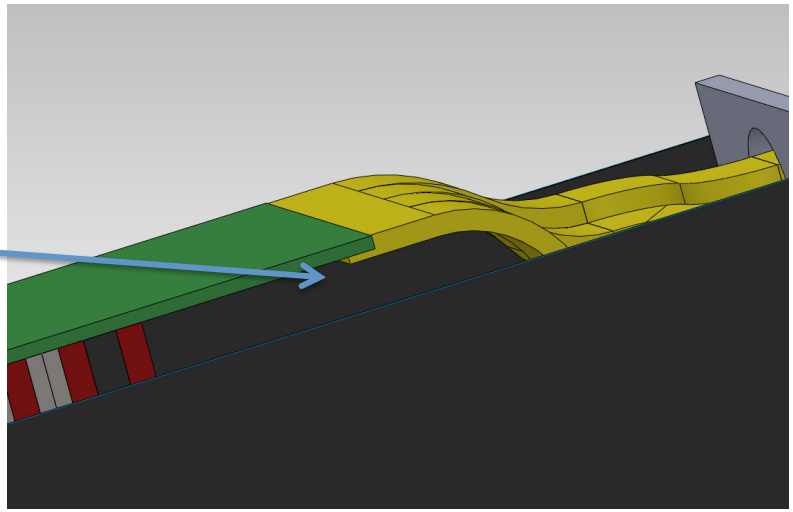
HCAL for the Form Factor experiments

Design Initiated

CMU Mechanical Engineering
Student Glenn Philon



Possible light guide design utilizing over-size guide with lip to facilitate stronger joint



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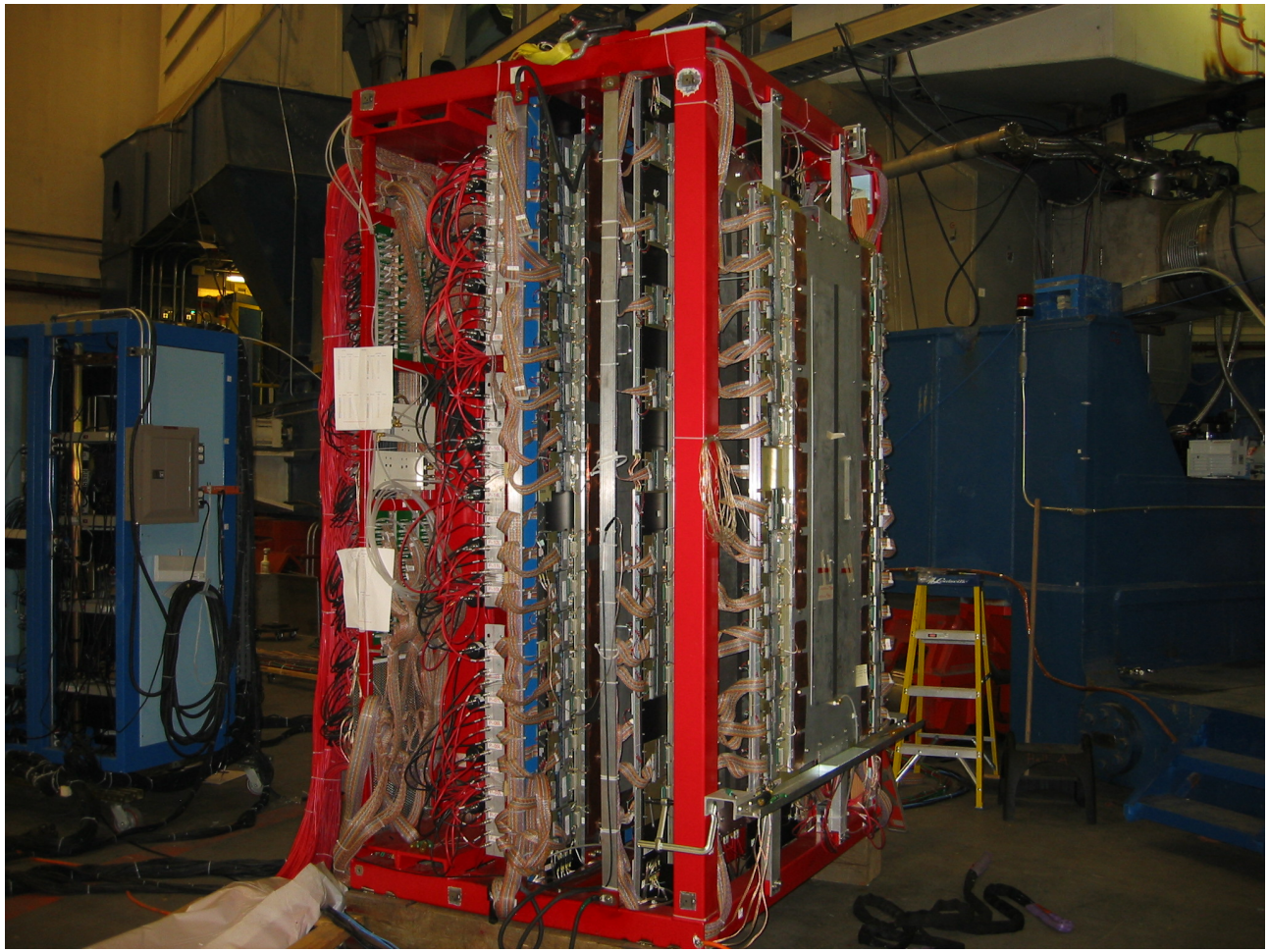
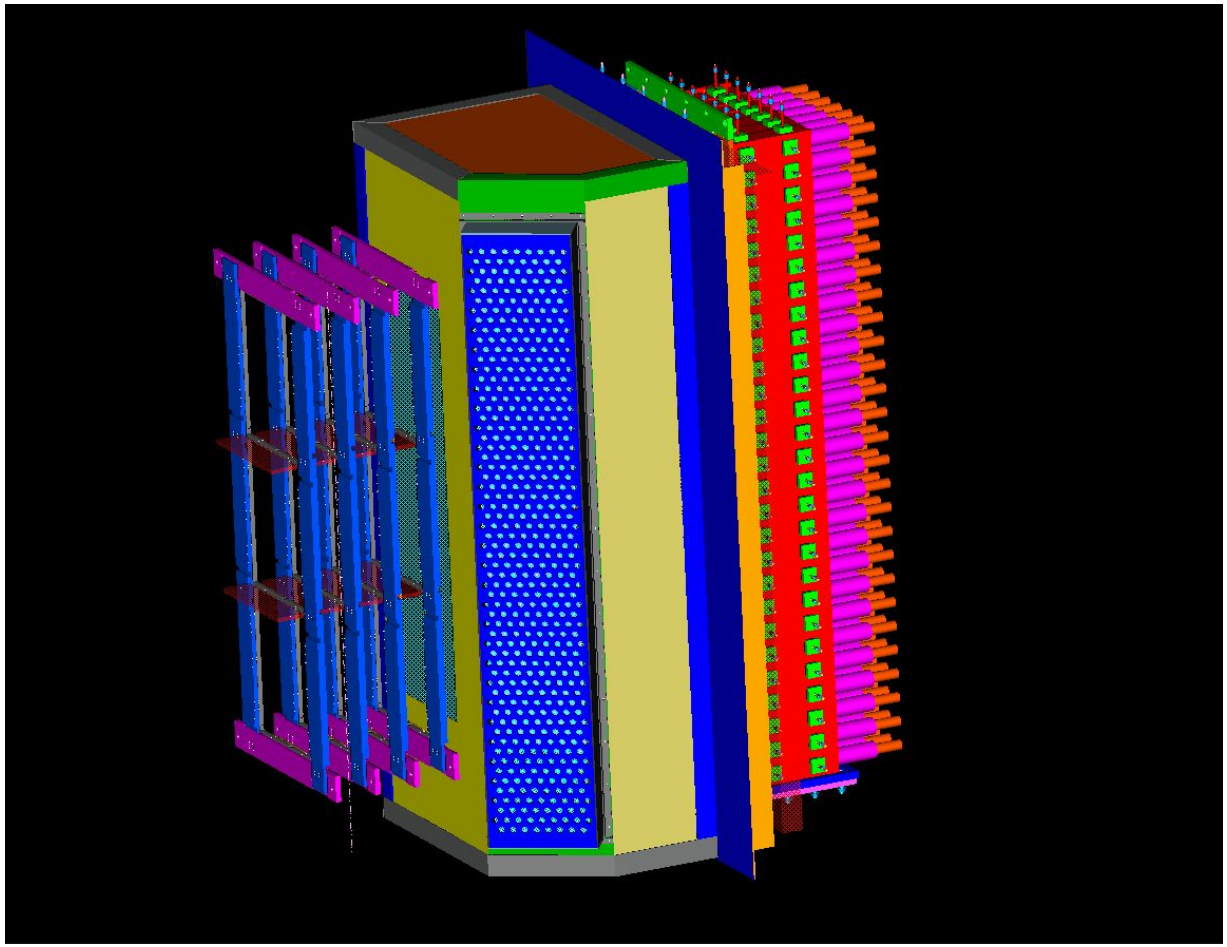
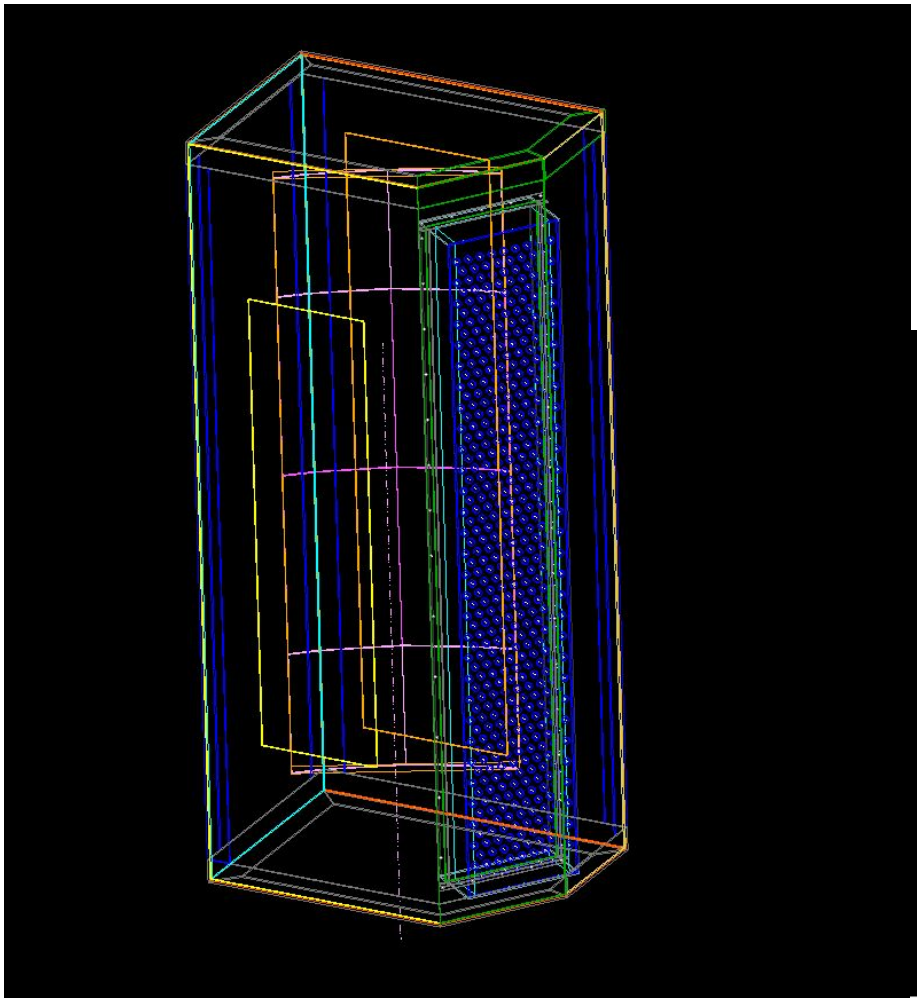
BigBite for the Form Factor experiments



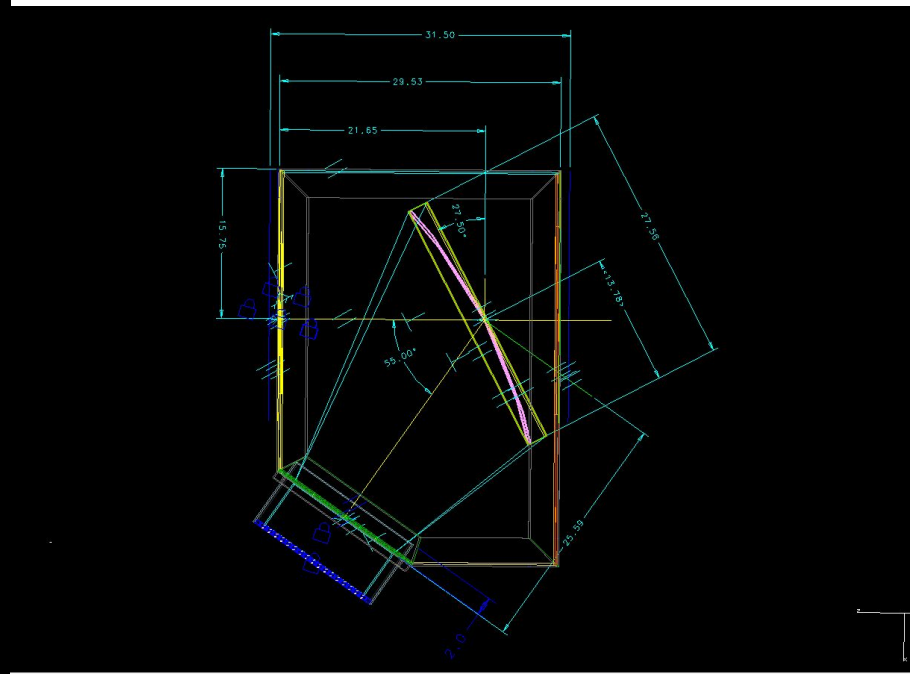
BigBite for the Form Factor experiments



BigBite for the Form Factor experiments



Gas Cherenkov counter



BigBite for the Form Factor experiments

Collaboration behind these efforts:

GEM chambers:	INFN & UVa
Gas Cherenkov:	W&M/ NCAT/ JLab
Timing hodoscope:	GU/CSULA/YerPhI
Design and DAQ:	JLab
Lead-glass calorimeter:	JLab

Time line:

It is driven by the collaboration schedule and preparation for the experiments.
If everything works well, a new detector could be ready by 2015.

Recent Events

- October 1: The “Program” started
  - Project 1: SBS Basic (WBS 1)
  - Project 2: Neutron Form Factor (WBS 2)
- October 15: Sent the 1st Monthly e-mail report to DOE
  - With Modified PMP
    - Personnel shifts
    - Schedule Shifts/Delays

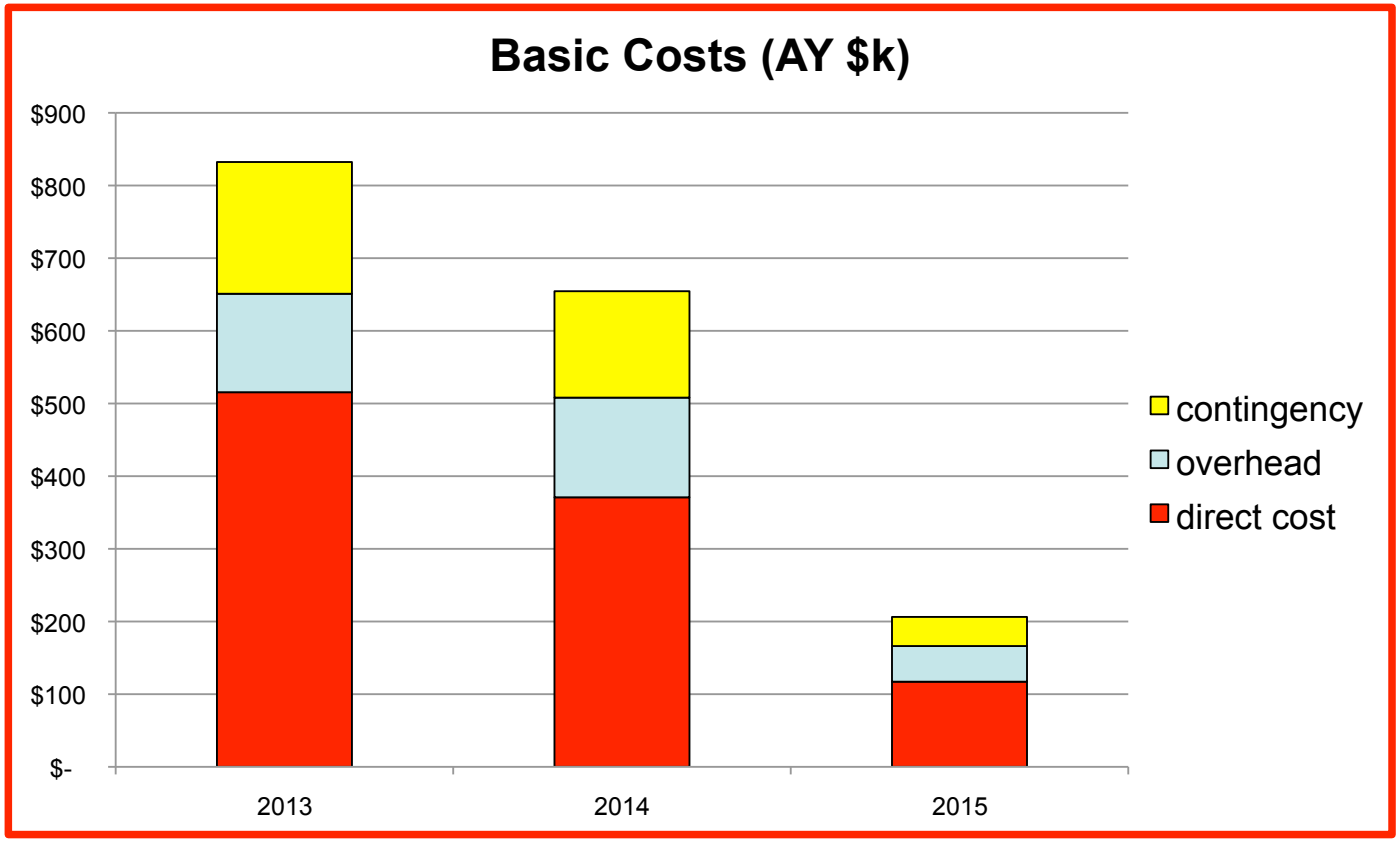
WBS 1 (SBS basic)

- 48D48 Magnet transportation and modifications
- 48D48 Magnet assembly and support platform
- Magnet power supply and its associated infrastructure
- Beam-line vacuum and shielding components
- Beam-line steering magnets

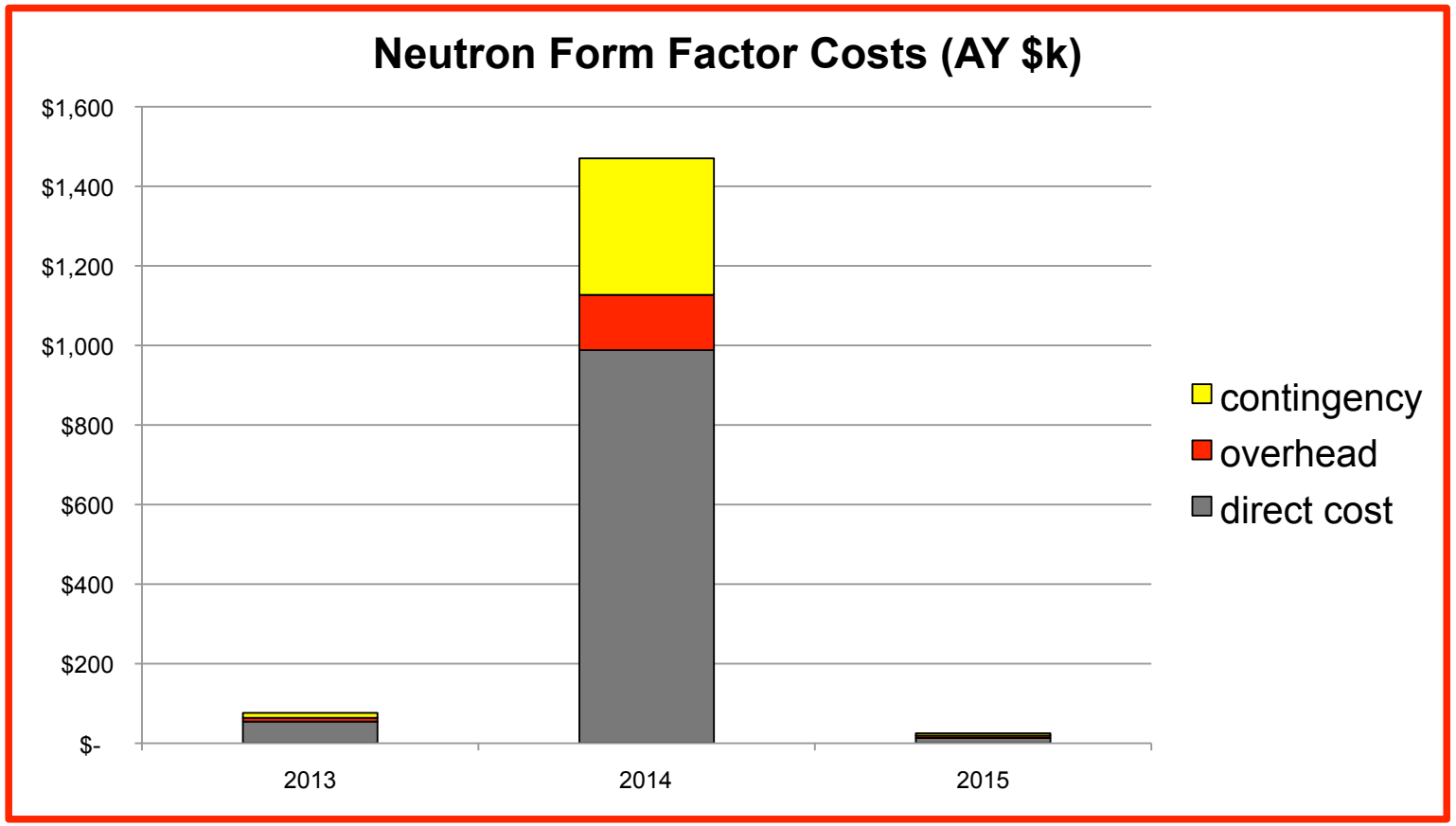
WBS 1 Milestones

ID #	Level	Milestone	Date
1.1-01M	1	Project start	10/1/2012
1.2-01M	2	Magnet delivered to JLab	4/30/2013
1.2-10M	2	Platform parts received	6/27/2014
1.2-20M	2	Magnet assembled on platform	3/19/2015
1.2-30M	2	Beam-line parts received	9/24/2015
1.1-10M	1	Project completion	1/29/2016

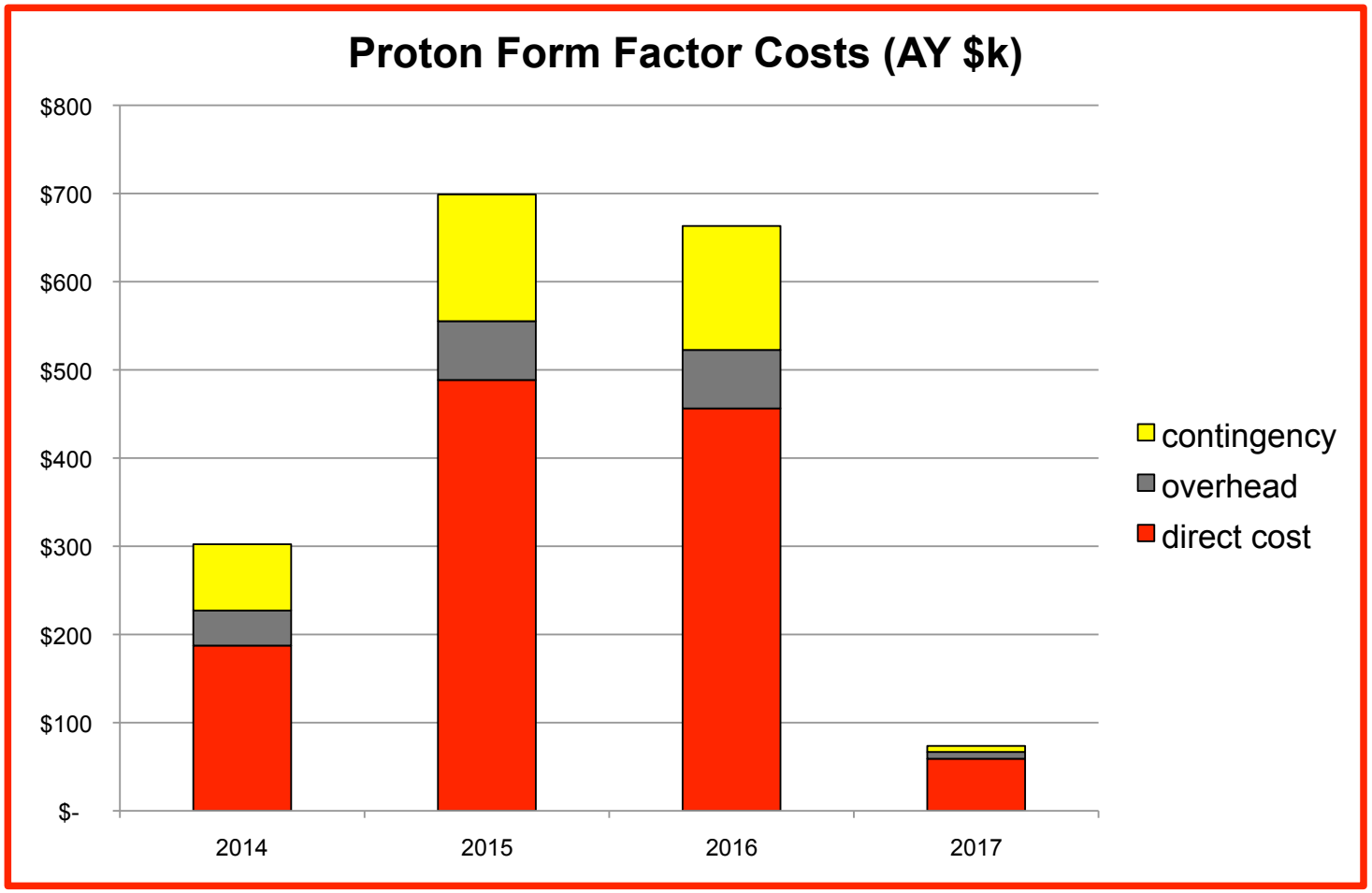
SBS Basic


Basic Costs (AY $k)
$900
$800
$700
$600
$500
$400
$300
$200
$100
$-
2013
2014
2015
contingency
overhead
direct cost

Neutron Form Factor



Proton Form Factor



The Monthly Report

- Executive summary of the “projects”
- Management Highlights
- WBS 1
  - Work breakdown structure
  - Milestones (scheduled, expected, achieved)
  - Project oversight
  - WBS 1.1, 1.2, 1.3 progress problems
  - Costs
- WBS 2 (ditto)
- WBS 3 (ditto) This year no progress, problems, or costs

October 15 report is already 7 pages (nothing really to report except that we started)

Equipment: current time-line

	Front tracker	Polar GEM	Coord Detect	Hadron Calo	Elec Calo	48D48	RICH	Trigger
2008/2	INFN	UVa/	ISU/UVa	CMU	W&M/	JLab	???	JLab/
	Collab.	JLab	SMU	Dubna	JLab			RU
2009/1	R&D	pre-R&D		pre-R&D		pre-R&D		
2011/1	Test	pre-R&D		pre-R&D		pre-R&D		
2012/1	Test	pre-R&D	pre-R&D	R&D	R&D	pre-R&D		
2012/2	Prod'on	pre-R&D	pre-R&D	R&D	R&D	R&D		
2013/1	Prod'on	pre-R&D	R&D	design	Tests	design		
2013/2	**Pro'ced!**	Prod'on	design	Tests		Prod'on		
2014/1	Ready	Prod'on	Prod'on	Prod'on				
2014/2	Ship'nt	Prod'on	Prod'on	Prod'on	R&D			R&D
2015/1	Tests	**Pro'ced!**	Prod'on	Prod'on	R&D	Install		
2015/2	A1n	Tests	Ship'nt	Ship'nt	Tests	Tests		Prod'on
2016/1	ready	**Pro'ced!**	Tests	Tests	Prod'on	ready		Prod'on
2016/2	ready	GMn	GMn	GMn	**Pro'ced!**	GMn		Tests

Equipment: development/collaborations

	Front tracker	Polar GEM	Coord. Detect.	Hadron Calo	Elec Calo	48D48	RICH	Trigger
institute	INFN	JLab/	SMU/UVa	JLab/	W&M/	JLab	???	RU/
		UVa	NSU	CMU	JLab	ready		JLab
2016/1	ready	Pro'ced!	Tests	Tests	Prod'on	ready		Prod'on
2016/2	GMn	GMn	GMn	GMn	**Pro'ced**	GMn		Tests
2017/1					Tests			ready
2017/2		GEp			GEp			GEp
2018/1								
2018/2								
2019/1								
2019/2								
2020/1								

More progress is needed in

MOUs with collaborating groups and universities

GEp-5: DAQ, Electron arm

GEn: He-3 target system

SIDIS: SBS arm PID (RICH)

Summary

SBS is an approved and funded project(s) with a well defined scope and time line of construction (per budget).

Precision measurements of the nucleon FFs are of a great large interest for the nuclear physics.

Technical advances of SBS are very significant.

Production of the components will start in 2013.