Hall C Future Experiments

Cynthia Keppel
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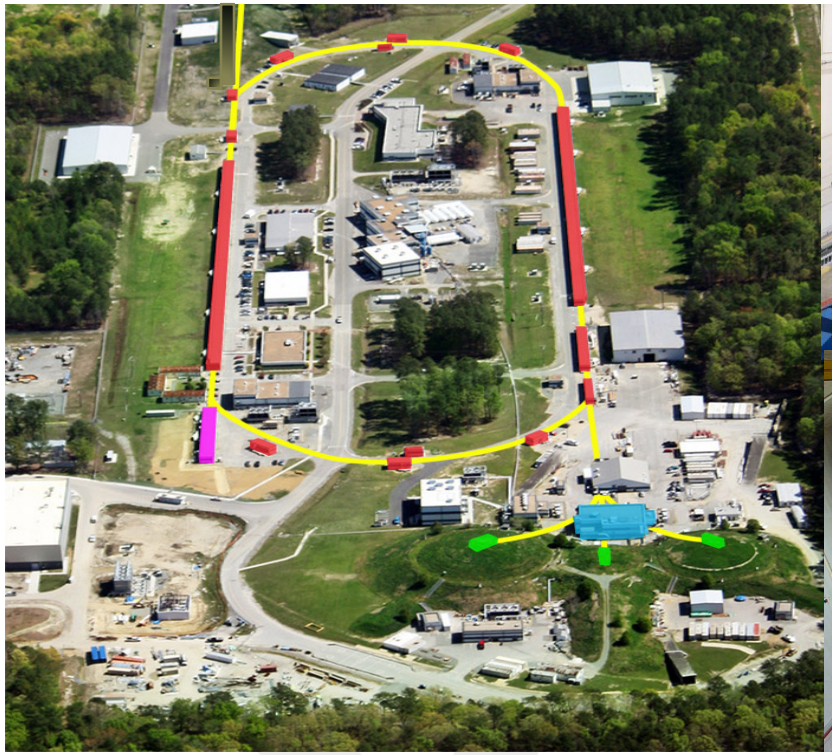
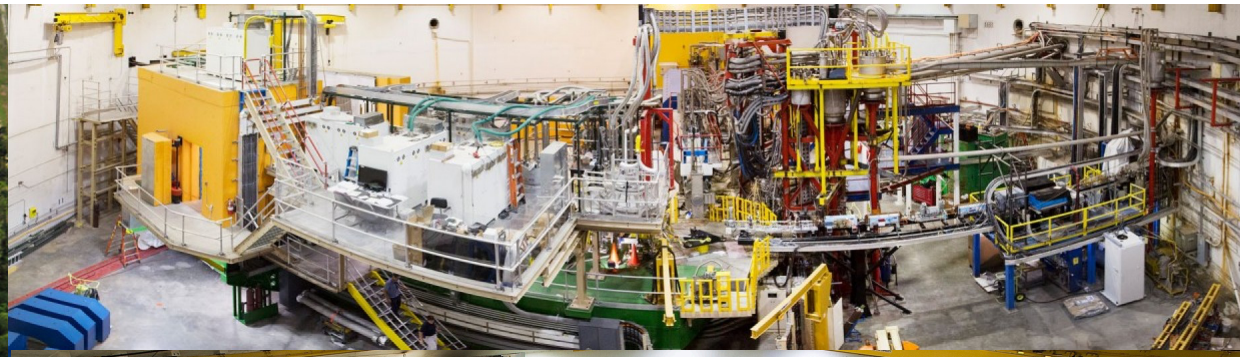
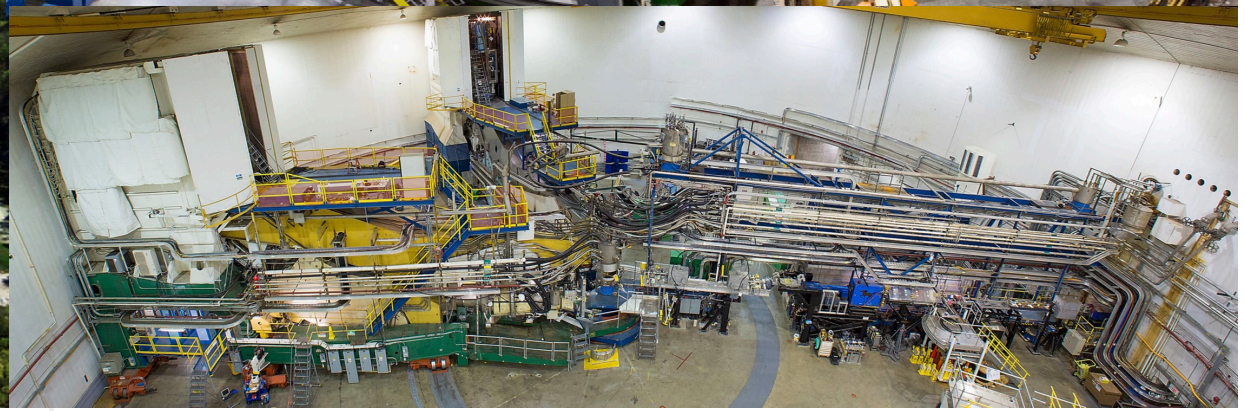






Hall C Collaboration Meeting
January 28,29 2021

Jefferson Lab

U.S. DEPARTMENT OF ENERGY | Office of Science

JSA

Hall C: High Precision at the Luminosity Frontier

- **Anticipate NP community Long Range Planning exercise**
- **What are the unique Hall C capabilities in the EIC-ish era?**

- Optimized facility for *precision* measurements of *small* cross sections:

- Unique equipment in SHMS, HMS, NPS, CPS
- High power and polarized targets
- High precision polarimetry
- Designed for high luminosity running

- Space for new equipment, or can install SBS equipment (BigBite, HCal,...) and/or hypernuclear and/or…

- The only flexible-configuration high power electron hall in the world

Hall C Futures Task Force

- Thia Keppel, Steve Wood
- Eric Christy
- Dipangkar Dutta
- David Hamilton
- Or Hen
- Tanja Horn
- Garth Huber
- Ed Kinney
- Wenliang Li
- Dave Mack
- Carlos Munoz Camacho
- Arun Tadepalli
- Bogdan Wojtsekhowski

- Prepare white paper for laboratory, LRP
- Have not yet started meeting
- Feel free to join/help!

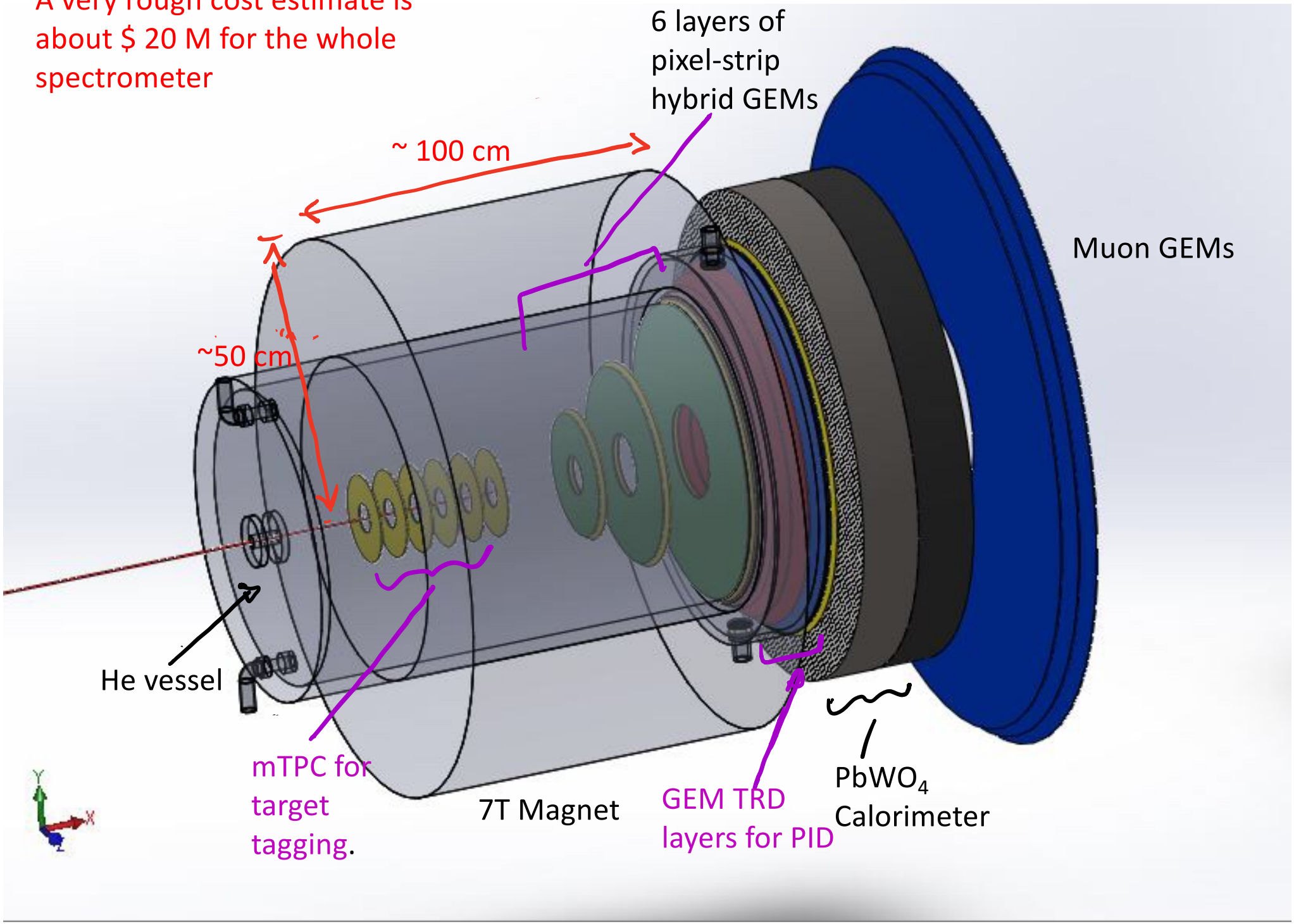
One new idea, from N. Liyanage and collaborators

A high luminosity spectrometer based on a compact 7T Solenoid magnet for DVCS, DVMP, TDIS and more

Nilanga Liyanage, Paul Souder, Weizhi Xiong

- A high field compact Solenoid (~ 7 T field, bore diameter and length ~100 cm) has a $\int b \cdot dl$ similar to a large solenoid like SoLID, but has some important advantages:
  - Costs much less (estimate from manufacturer ~ $ 3.8 M for the magnet)
  - Much easier to install, instrument and run
  - The area needed to be covered by the detectors is much smaller: this allows for state of the art detectors such as $PbWO_4$ calorimeters, pixel GEMs etc. with high granularity.
  - The path length from target to detectors is very short: much less multiple scattering – better resolution- clean missing mass identification
  - We propose to fill the bore with Helium – reduce multiple scattering even further.
- Given the short distance to detectors the background rates will be high: but can handle with pixel GEMs and fast electronics etc: rate estimations already done.
- Early simulations show that this setup can handle luminosities up to 10^{38}
- Will allow comprehensive measurements of DVCS and DVMP covering the entire valance quark region
- Adding several layers of muon GEMs will allow DDVCS.
- The multi-TPC for target tagging fits in nicely within this solenoid – measure TDIS, pion and Kaon structure functions, tagged neutron DVCS, DVMP and more
  - mTPC and the GEMs sitting in the He atmosphere with no windows; ideal conditions for detecting very low momentum spectators.

A very rough cost estimate is about $ 20 M for the whole spectrometer



More ideas, from B. Wojtsekhowski…

- We could add a positron beam:
  - The CPS with a small addition allows us to make a positron beam
  - Could have parameters suitable for e+/e- experiments on two photon exchange in elastic e-p scattering
  - Could also do an A' search as a resonance in e+e- elastic scattering

…and Dave Mack

- Parity violating structure functions accessible only with polarized targets

Any more new ideas?

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