PANDA Collaboration Meeting
Sep 12th 2014

JLab/PANDA Collaboration
The JLab point of view

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The JLab parameters

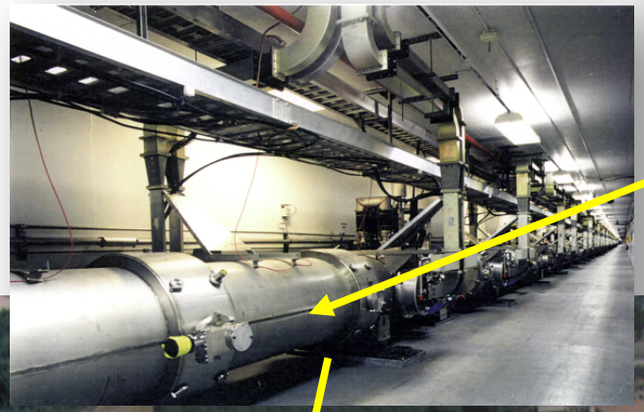
- ✳ Primary Beam: Electrons
- ✳ Beam Energy: from 6 GeV to12 GeV
  - $10 > \lambda > 0.1$ fm
    nucleon → quark transition
    baryon and meson excited states
- ✳100% Duty Factor (cw) Beam
  - coincidence experiments
  - Three (four) Simultaneous Beams with Independently Variable Energy and Intensity
  - complementary, long experiments
- ✳ Polarization (beam and reaction products)
  - spin degrees of freedom
  - weak neutral currents

L > 10^6 x SLAC at the time of the original DIS experiments!
JLab12 luminosity will increase by 10 x

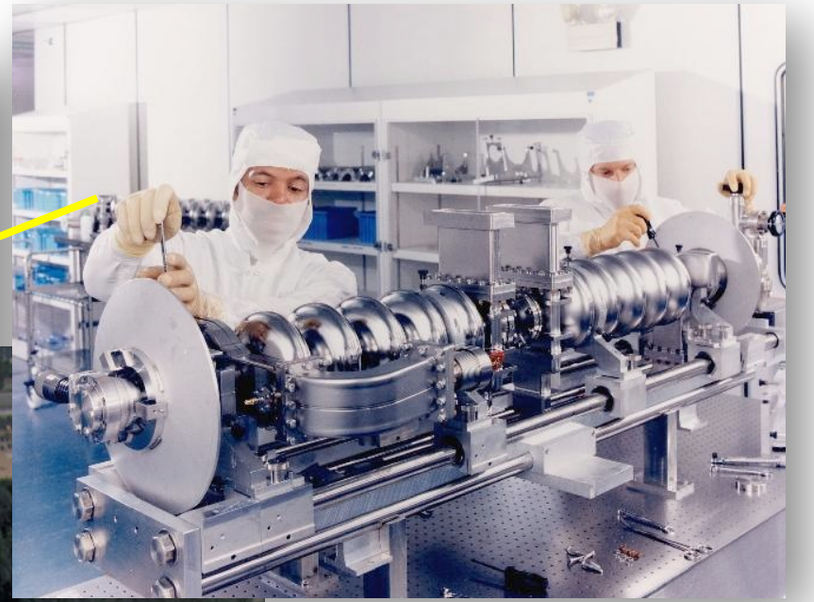
The Jefferson Lab accelerator complex

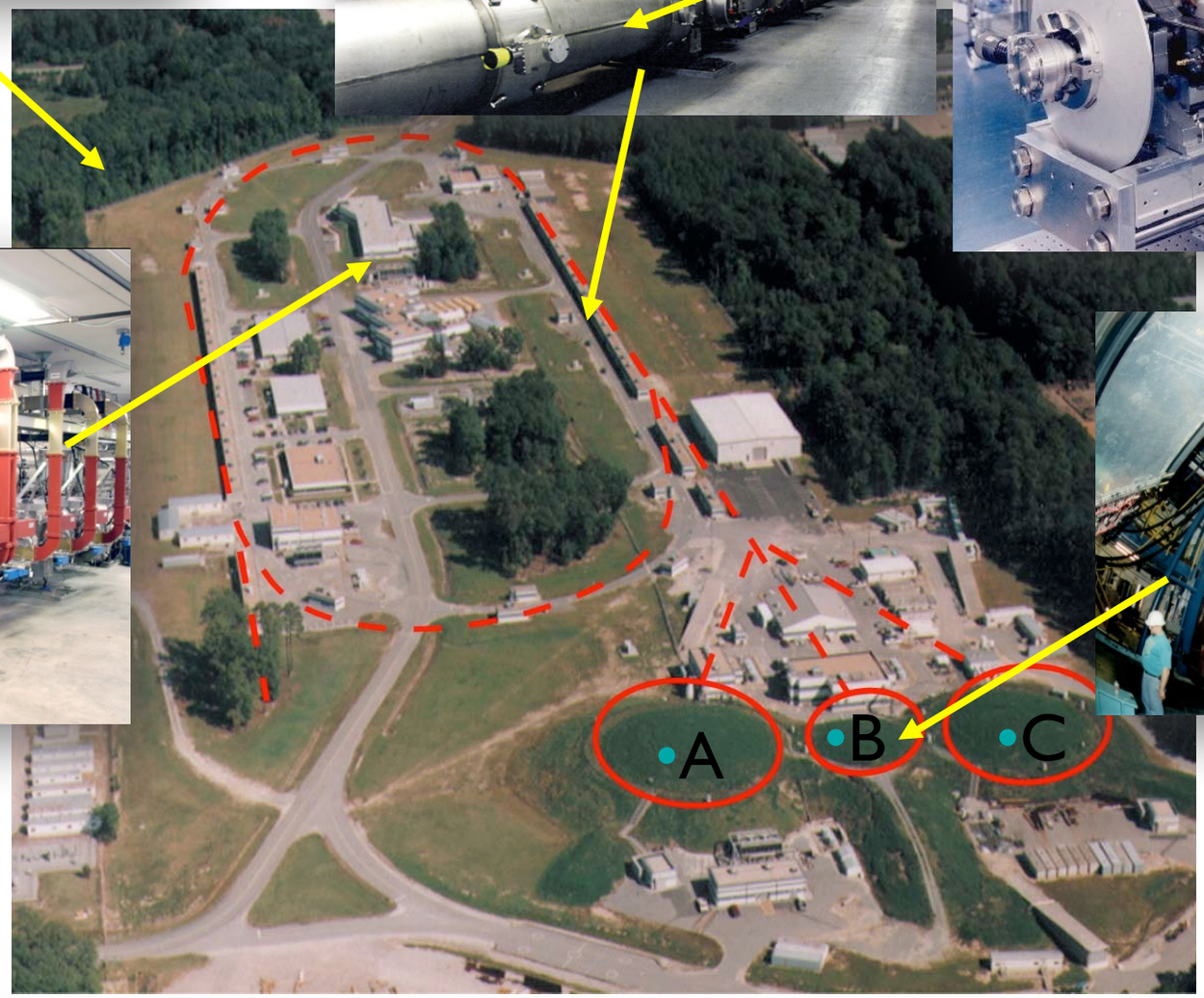
•*Hall D (construction)*

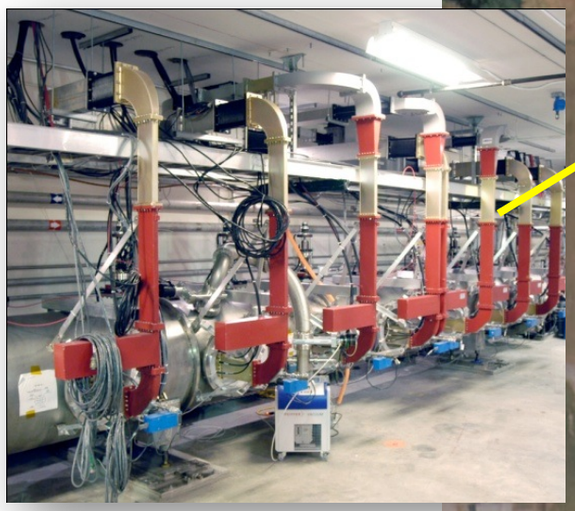
•*Cryomodules in the accelerator tunnel*



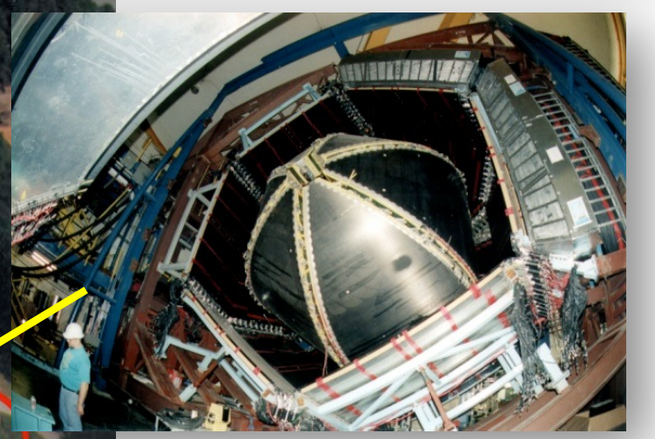
•*Superconducting radiofrequency (SRF) cavities*







•*Free Electron Laser (FEL)*



•*CEBAF Large Acceptance Spectrometer (CLAS) in Hall B*

•*An aerial view of the recirculating linear accelerator and 3 experimental halls.*

The 12 GeV upgrade

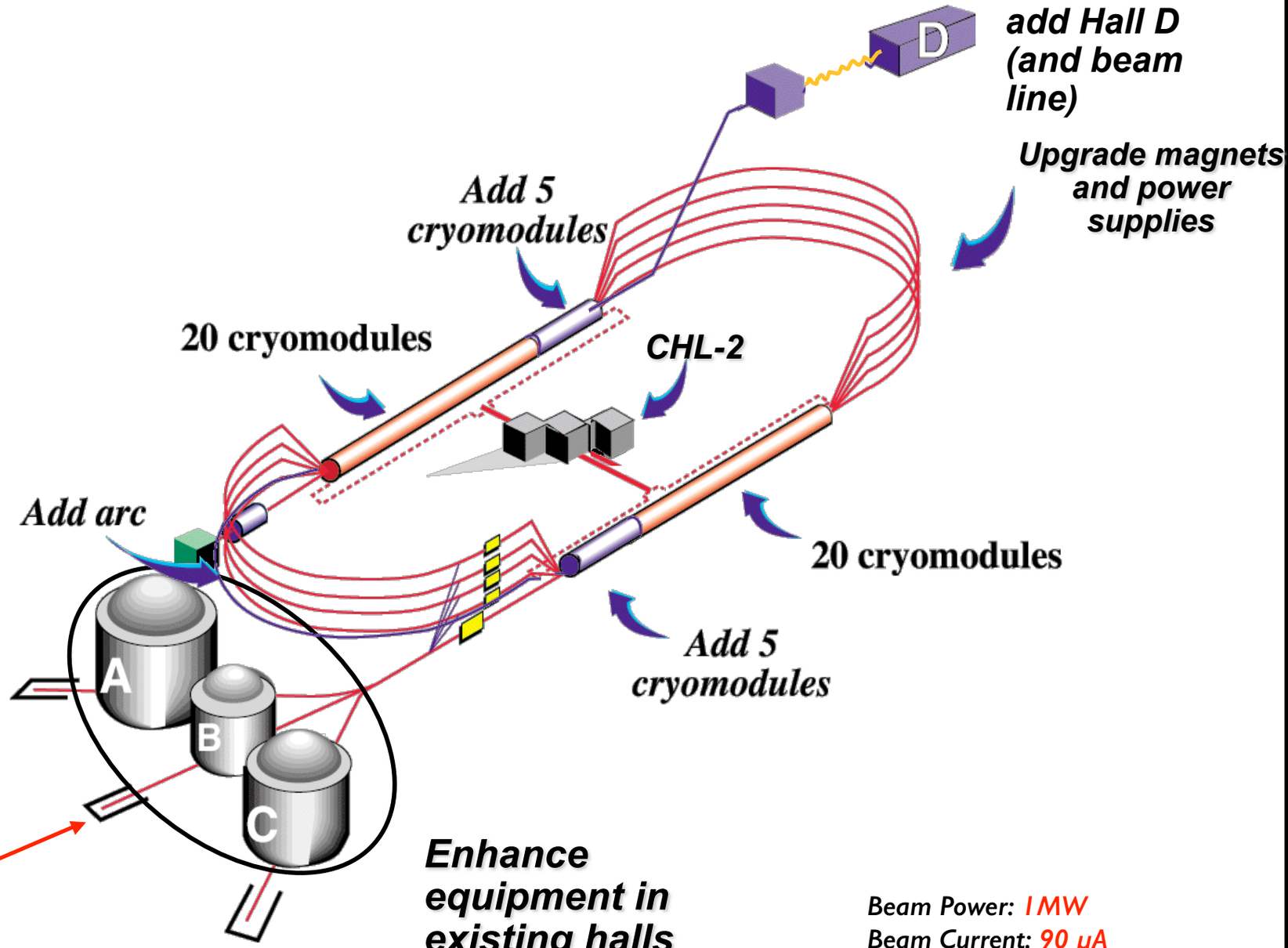
- CEBAF design and performance make easy the energy upgrade
  - CEBAF RF cavities exceeded the designed specification by 50%
  - Maximum beam energy of 6 GeV routinely achieved (4 GeV max nominal energy)
  - ARCS can accommodate an electron beam up to 24 GeV
- Upgrade of the accelerator (6 GeV to 12 GeV)
- Construction of new equipment for Hall A, B and C
- Construction of a new experimental hall (Hall D)

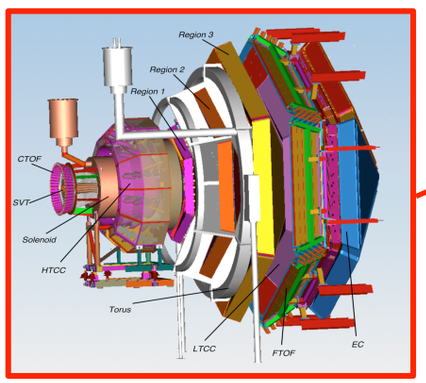
The Upgrade of CEBAF to 12 GeV (the highest priority of the 2007 NSAC Long Range Plan) is now well underway

- Project is "**on cost and on schedule**" and over 3/4 complete as of today
- Initial beam operation to begin in Hall A and D in Oct 2014 and full operation by fall 2015

The 12 GeV Research Program is Evolving Rapidly

Jefferson Lab at 12 GeV





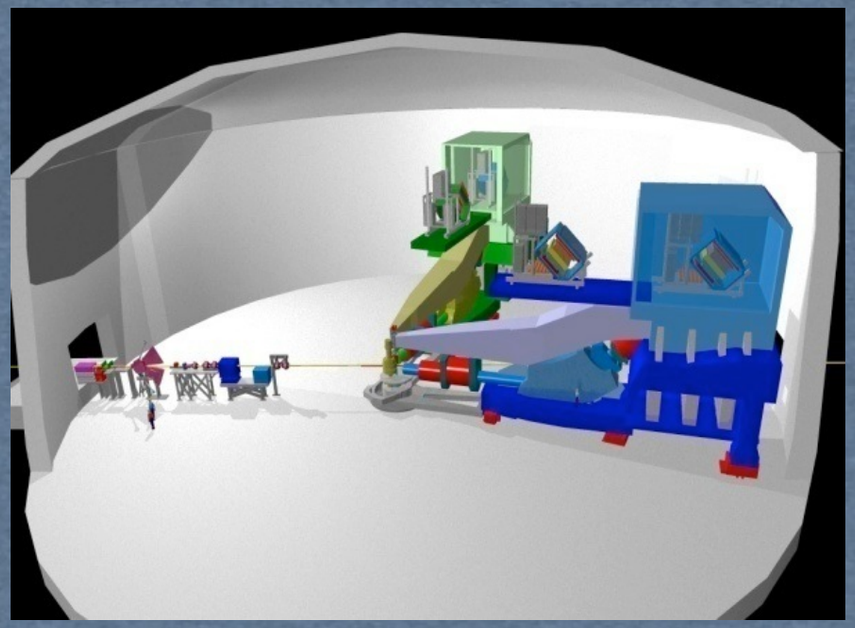
CLAS12

Enhance equipment in existing halls

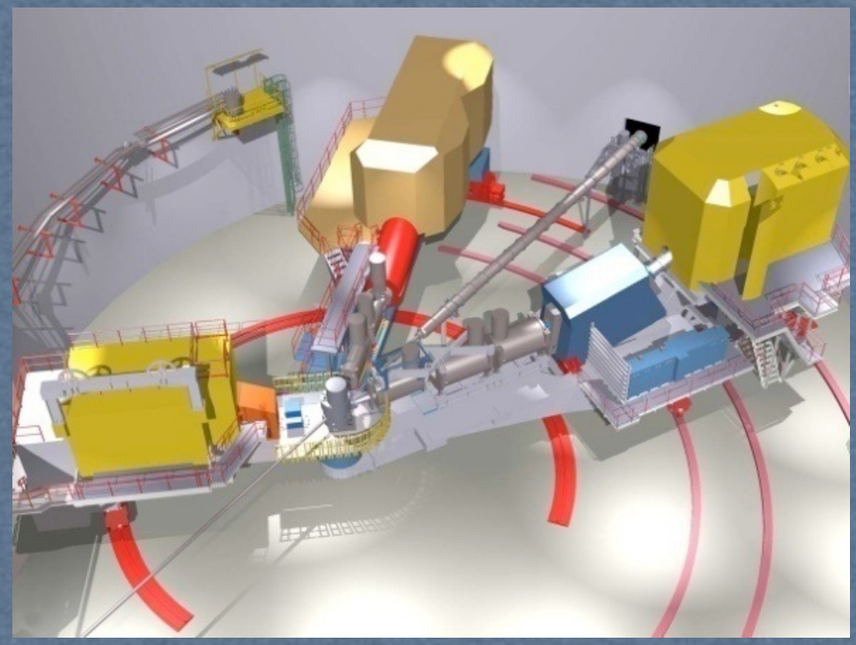
Beam Power: 1MW
Beam Current: 90 μA
Max Pass energy: 2.2 GeV
Max Enery Hall A-C: 10.9 GeV
Max Energy Hall D: 12 GeV

The 12 GeV equipment

Hall A – High Resolution Spectrometers and new multipurpose large acceptance detectors

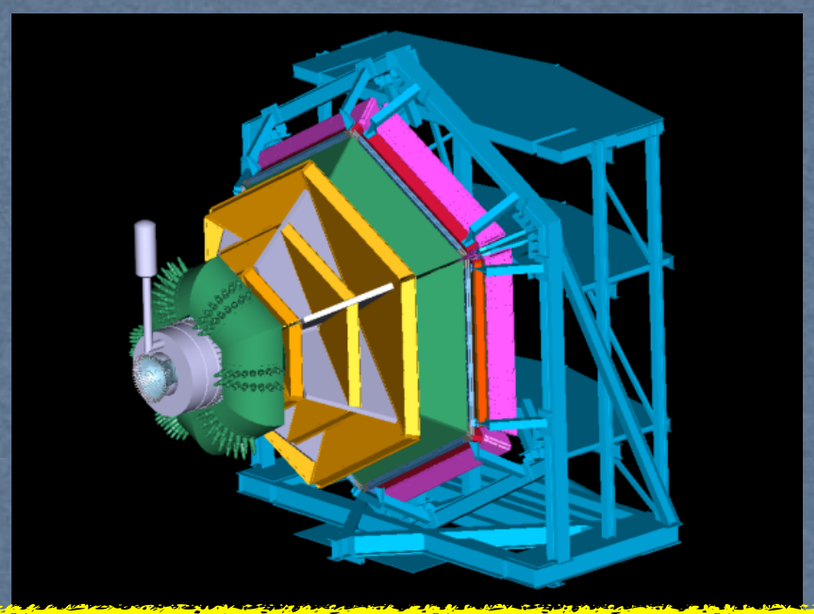


✳ short range correlations, form factors, and future new experiments: SOLID, MOELLER, SBS



Hall C – Super High Momentum Spectrometer (SHMS)

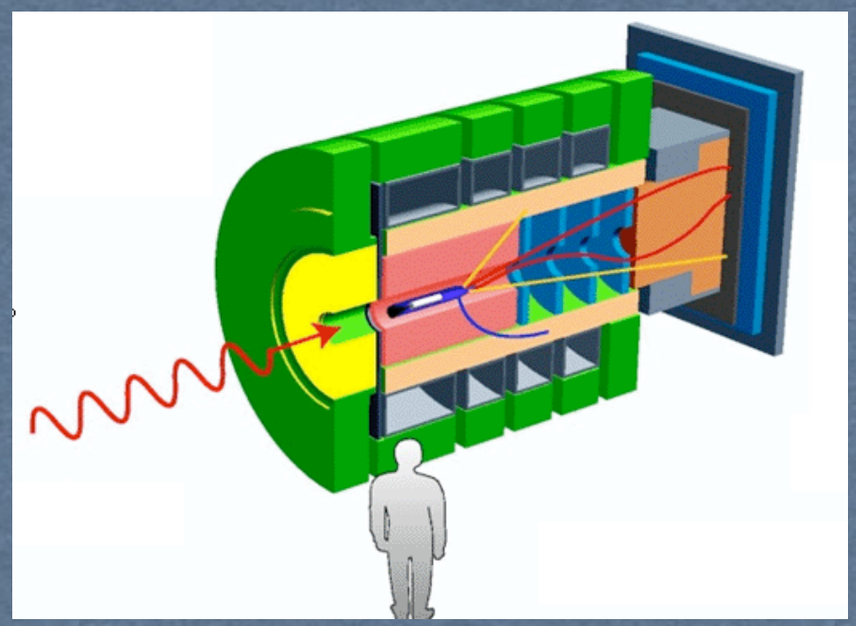
✳ precise determination of valence q properties in nucleons and nuclei



Hall B – Large acceptance detector CLAS12 for high luminosity measurements ($10^{35}cm^{-2}s^{-1}$)

✳ Understanding nucleon structure via GPDs and TMDs and hadron spectroscopy

Hall D – GLUEx detector for photoproduction experiments

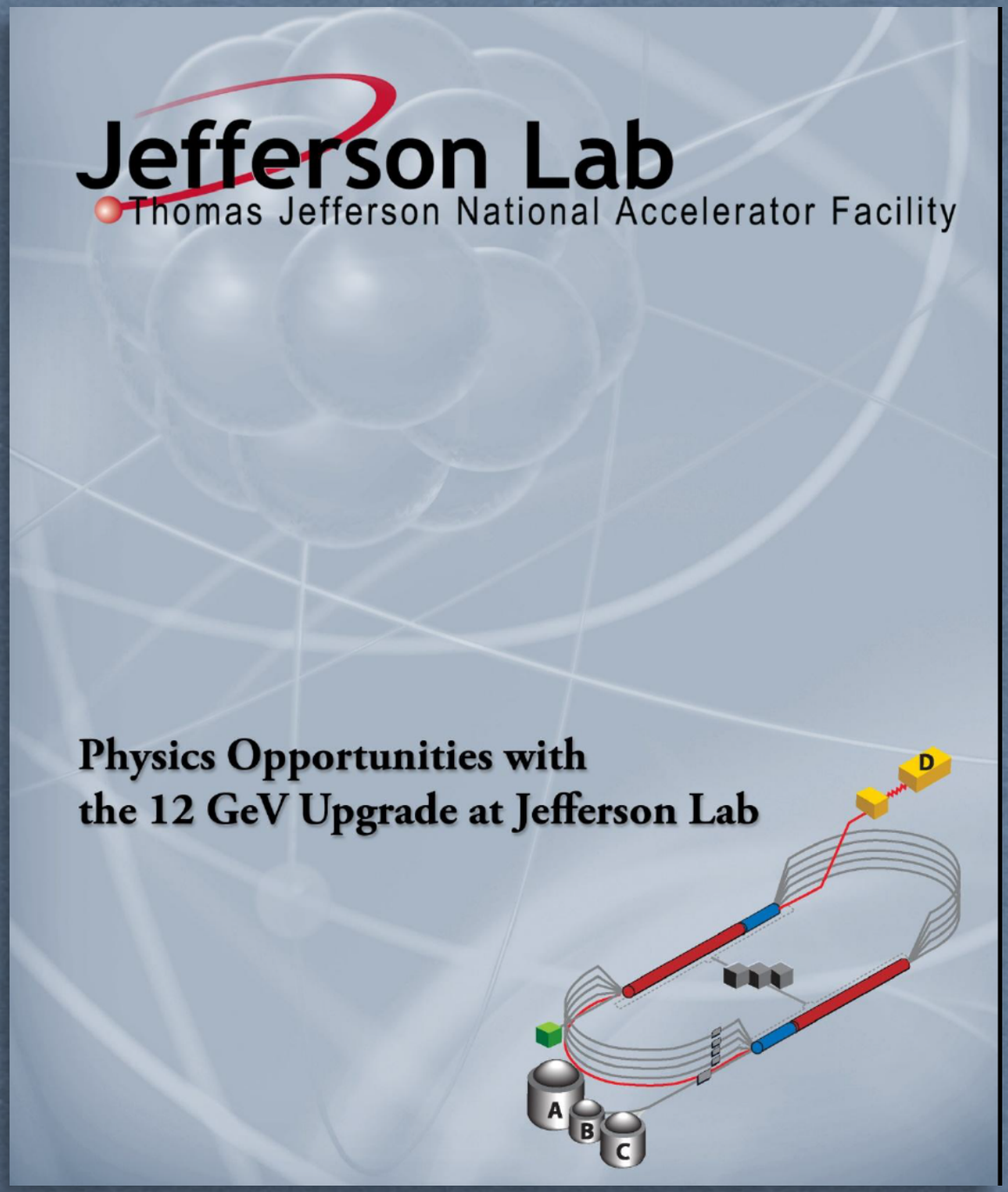


✳ explore origin of confinement by studying hybrid mesons

JLab scientific mission

- Understand how hadrons are constructed from the quarks and gluons of QCD
- Understand the QCD basis for the nucleon-nucleon force
- Explore the limits of our understanding of nuclear structure
  - high precision
  - short distances
  - the transition from the nucleon-meson to the QCD description
- To make progress in these areas we must address critical issues in "strong QCD":
  - What is the mechanism of confinement?
  - Where does the dynamics of the q-q interaction make a transition from the strong (confinement) to the perturbative (QED-like) QCD regime?
- Probe potential new physics through high precision tests of the Standard Model

12 GeV White Paper



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Eur.Phys.J. A48 (2012) 187

JLAB/PANDA Collaboration: motivations

Strengthen the collaboration between
JLab-CLAS and FAIR- PANDA
experiments finding area of overlap

- to promote and defende hadron physics
- to present common programs at funding agencies (NSF, DOE, HPH …)
- to facilitate data/analysis exchanges
- to help PANDA students/post-docs and staff with limited membership

Started from PANDA spokesperson request followed by meetings involving the spokesman of the two collaborations

… presentation at PANDA & CLAS Collaboration Meetings

… plan a common workshop to be held in 2015/16

JLAB/CLAS - FAIR/PANDA Collaboration

Four Working Groups with one or few representatives from each Collaboration

Board: M.Battaglieri (coordinator), S.Schadmand (coordinator)

V.Burkert, D. Ireland, P.Gianotti, J.Ritman

Nucleon structure: Keith Griffioen, Frank Maas, Marco Mirazita, …

Hadron Spectroscopy: Raffaella De Vita, Diego Bettoni, …

Physics Analysis: Adam Szczepaniak, Klaus Goetzen, Frank Nerling, …

Detectors: Latifa Elouadrhiri, Lars Shmitt, …

Dedicated wiki page http://wiki.ge.infn.it/panda-jlab/index.php/Main_Page

Phone meetings and presentations at the Collaboration meetings

JLAB/CLAS - FAIR/PANDA Collaboration examples

Light Meson Decay WG

- Started from MesonNet project (network initiative in HP3 involving Juliech, LNF, GSI, Bonn, Uppsala)
- CLAS involvement via the Light Meson Decay CLAS-CAA
- Interest in theoretical communities (EU and US)
- New students and faculties involved
- Regular meetings and presentations

analysis task force

decay channel	analyzers pd data sets WASA-at-COSY	analyzers pp data sets WASA-at-COSY	analyzers γp data sets CLAS g11/g12 Data Mining	physics
$\pi^0 \to e^+e^-(\gamma)$	PLB 726 (2013) 187)	Carl-Oscar Gullstrom (Uppsala)	Michael Kunkel (Old Dominion)	
$\eta \to \pi^0\pi^+\pi^-$	arXiv:1406.2505 (subm. PRC)	(WASA)	(CLAS)	Dalitz plot analysis
$\eta \to \pi^+\pi\gamma$	PLB707(2012)243	Daniel Lersch (Jülich/Wuppertal)	Georgie Mbianda Niencheu (Old Dominion)	box anomaly
$\eta \to e^+e\gamma$	Malgorzata Hodana (JU Krakow) PhD2012 Krakow	Ankita Goswami (IIT Indore/Jülich)		transition form factor
$\eta \to \pi^+\pi e^+e^-$	Daniel Coderre (Jülich) PHD2012 Bochum	NN		CP violation
$\eta \to e^+e^-e^+e^-$	Patrick Wurm (Jülich) PhD2012 Köln	Akshansh Singh (IIT Kanpur)		branching ratio (double transition form factor)
$\omega \to \pi^0\pi^+\pi^-$	Lena Heijkenskjöld (Uppsala) (+KLOE data?)	Siddhesh Sawant (IIT Bombay)	(CLAS)	Dalitz plot analysis
$\omega \to \pi^0e^+e^-$			NN (Jülich)	transition form factor
$\eta' \to \pi^+\pi\ \pi^0/\eta$			Sudeep Ghosh (IIT Indore)	

HASPECT WG

- HAdron SPEctroscopy CenTer
- JPAC direct involvement
- Theoretical contributions from EU/US groups
- New analysis using CLAS data and contribution from PANDA Collaboration (tools, analysis procedures …)
- Search for CLAS12/PANDA common grounds
- Regular meetings and joint workshops

JLAB/CLAS - FAIR/PANDA Collaboration examples

Horizon 2020 Framework Programme

HadronPhysicsHorizon (HPH)

TEMPLATE

for drafting a Proposal for a

Networking Activity or Joint Research Activity

Activity Descriptive Title:	HadronS: study of the spectrum of hadrons made by light and charm quarks
Activity Acronym:	HS-HPH
Leading Institution:	INFN – Sezione di Genova
Name of spokesperson:	Marco Battaglieri
E-mail:	battaglieri@ge.infn.it
Telephone number:	+390103536736
Fax number:	+390103536458
Mobile:	+393479520041

- Hadron Physics Horizon (H2020) continuation of Hadron Physics 3 (FP7)
- Open to collaboration with non-EU labs
- Mutual benefit presenting EU/US common physics programs
- Priorities of the program: excellence science, industrial leadership, societal challenges
- Strong competition with other proposal: same budget as FP7 but more competitors

EU institutions: INFN, EdiU, GlasgowU, GiessenU, GSI, MainzU, BonnU, TUM

US institutions: JLab, GWU, IU

The HPH proposal has just been submitted

Expected to be effective in 2015-2017

JLAB/CLAS - FAIR/PANDA Collaboration

I) Search for a common ground

- Many area of overlap in NS and HS and complementarity of the two physics programs
- Natural collaborations in PA and Detector technologies

II) Example of effective collaboration

- LMD and HASPECT working groups
- Common strategy for proposals to funding agencies

III) How to strengthen the collaboration?

- Physics program presentation at the Collaboration meeting (PANDA CollMeeting in LNF) to better know each others
- Organize a joint workshop in 2015/16
- Involvement in data analysis of young post-docs
- Establish MOU (eg JLab/Bonn) with reciprocal advantages
- Promoting common projects to share and access data (data mining) by presenting joint proposal to funding agency
- Promoting exchange of personnel (young and senior) by using known funding programs (JSA, Marie Curie, …) and looking for new opportunities