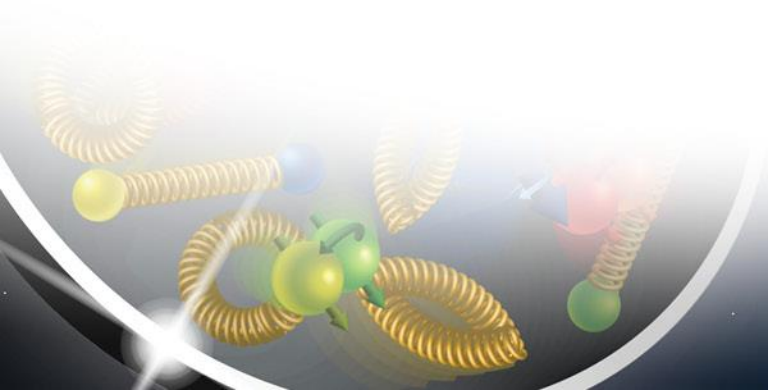


# WBS Example : EIC

Joe Grames

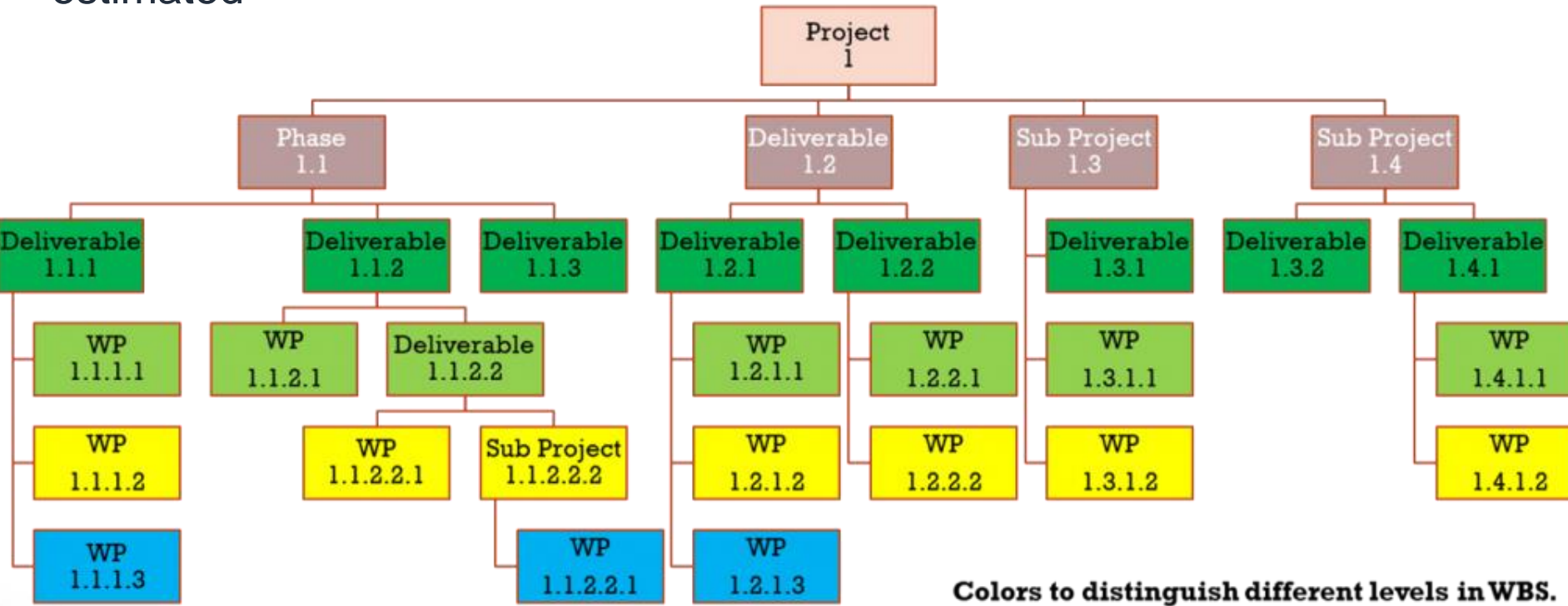
(EIC Electron Injector Level 2 Deputy Manager)

ILC WG2 Meeting, 6/7/21



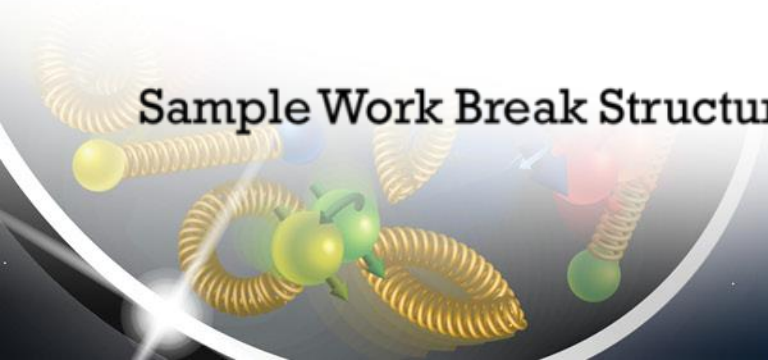
# Work Breakdown Structure

- Breaks down 100% of the work into a structure
- Provides a graphical representation or outline of the project scope
- Larger tasks are broken into manageable parts, that can be supervised & estimated



Colors to distinguish different levels in WBS.

Sample Work Break Structure with Branches Decomposed at WP levels.



# Example: EIC

Management

R&D

Electron injector

Electron storage ring

Hadron Ring

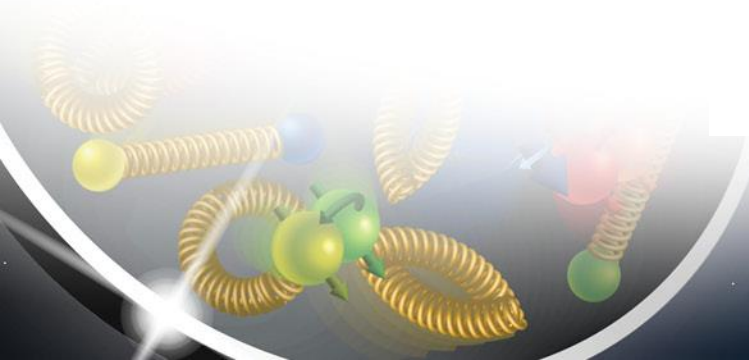
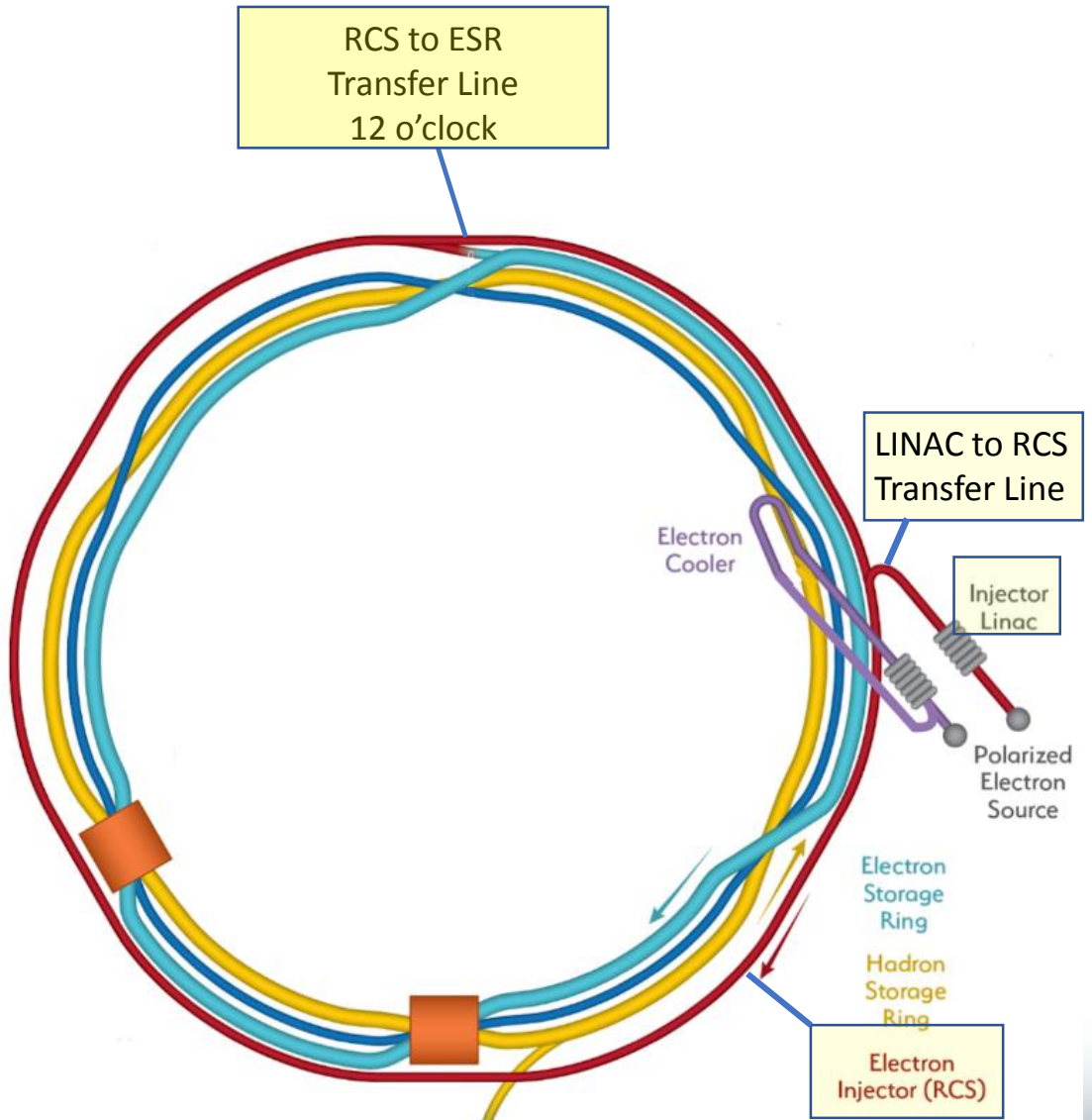
Interaction Regions

Support Systems

Infrastructure

Pre-Operations

Detectors



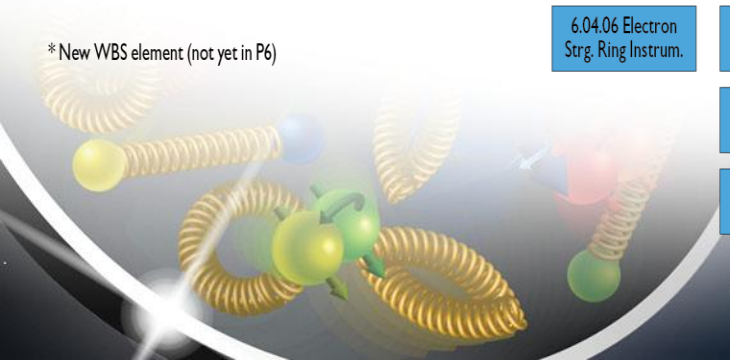
# Example: EIC Work Breakdown Structure

- Breaks down 100% of the work into a structure
- Provides a graphical representation or outline of the project scope
- Larger tasks are broken into manageable parts, that can be supervised & estimated

## 6.0 Electron-Ion Collider

6.01 Project Management	6.02 Accelerator Development & R&D	6.03 Electron Injector	6.04 Electron Storage Ring	6.05 Hadron Ring	6.06 Interaction Regions & Detector Interface	6.07 Accelerator Support Systems	6.08 Infrastructure	6.09 Pre-Ops	6.10 Detectors	
6.01.01 Project Management	6.02.01 Accel. Devel. & R&D Mgmt.	6.03.01 Electron Injector Mgmt.	6.04.01 Electron Storage Ring Mgmt.	6.05.01 Hadron Ring Management	6.06.01 IR & Detect. Interface Mgmt.	6.07.01 Accel. Supp. Syst. Mgmt. & Infra.	6.08.01 Infrastr. Mgmt. & Engrng.	6.09.01 Operations Transition Planning	6.10.01 Detector Management	6.10.08 Electronics
6.01.02 ESH&Q	6.02.02 Accel. Physics & Design	6.03.02 Rapid Cycling Synch. (RCS)	6.04.02 Electron Strg. Ring Magnets	6.05.02 Hadron Ring Strght. Sect. Modif.	6.06.02 Interaction Regions	6.07.02 Cryogenics	6.08.02 Civil Construction	6.09.02 Systems Commissioning	6.10.02 Detect. R&D & Physics Design	6.10.09 DAQ / Computing
6.01.03 Project Support	6.02.03 Accel. Systems R&D	6.03.03 Transf. Lines & Inj./Extr. Elements	6.04.03 Electron Strg. Ring Pwr. Sup.	6.05.03 Hadron Ring RF Systems	6.06.03 Detector Interface	6.07.03 Control System	6.08.03 Electrical Power Systems	6.09.03 Beam Commissioning	6.10.03 Tracking	6.10.10 Detector Infrastructure
6.01.04 Quality Assurance	6.02.04 Accelerator Integrated RF Design	6.03.04 Electron Pre-Injector	6.04.04 Electron Strg. Ring Vacuum	6.05.04 Injection System Upgrade	6.06.04 IR#2 Development*	6.07.04 RHIC Hadron Systems Removal	6.08.04 Cooling Systems	6.09.04 Spares	6.10.04 Particle Identification	6.10.11 IR Integration & Ancillary Detectors
			6.04.05 Electron Strg. Ring RF Syst.	6.05.05 HR SC Magn. Beam Pipe Upgrade		6.07.05 Accel. Strg. Ring Systems Install.		6.09.05 ESH	6.10.05 Electromagn. Calorimetry	6.10.12 Detector Pre-Ops & Commiss.
			6.04.06 Electron Strg. Ring Instrum.	6.05.06 Beam Instrum. Upgrade		6.07.06 SRF Fabrication*		6.09.06 Quality Assurance	6.10.06 Hadronic Calorimetry	6.10.13 Detector #2 Development
				6.05.07 Additional Snakes				6.09.07 IRR-ARR Preparation	6.10.07 Magnets	
				6.05.08 Strong Hadron Cooling						

\* New WBS element (not yet in P6)



# Scope

## 6.03 Electron Injector

6.03.01 Electron  
Injector Mngmt.

6.03.02 Rapid  
Cycling Synch. (RCS)

6.03.03 Transf. Lines  
& Inj./Extr. Elements

6.03.04 Electron  
Pre-Injector

- 6.03 Electron Injector

Design, procure and assemble the electron injector chain, which generates and accelerates polarized electron beam up to 5, 10 and 18 GeV. It will deliver 2 electron bunches of up to 28 nC with polarization of up to 85% at a rate of 1 Hz to the Electron Storage Ring.

- 6.03.01 Level 2 manager responsibility.

## 6.03.02 - Rapid Cycling Synchrotron

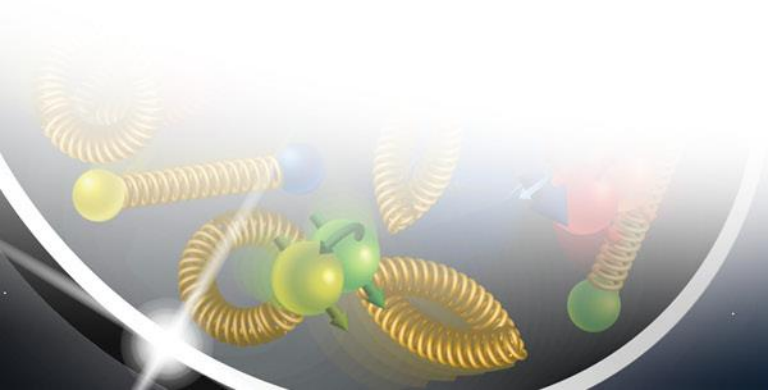
Design, procure and assemble the Rapid Cycling Synchrotron, which accelerates polarized electron beam injected from a 400 MeV injector for subsequent extraction at 5, 10 and 18 GeV to an extraction line. It will accelerate two polarized electrons bunches of up to 28 nC with polarization losses less than 5% over a 100 msec with a repetition rate of 1 second.

- 6.03.02.01 RCS Magnets
- 6.03.02.02 RCS Power Supplies
- 6.03.02.03 RCS Vacuum
- 6.03.02.04 RCS RF Systems
- 6.03.02.05 RCS Instrumentation

## 6.03.03 - Transfer Lines and Injection/Extraction

Design, procure and assemble the transfer beam lines from the 400 MeV electron LINAC to the RCS and the RCS to the electron Storage Ring for 5, 10 and 18 GeV operation

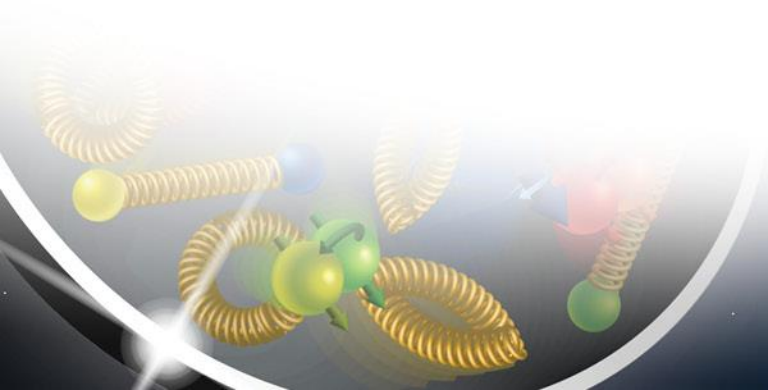
- 6.03.03.01 Transfer Lines Magnets
- 6.03.03.02 Transfer Lines Power Supplies
- 6.03.03.03 Transfer Lines Vacuum
- 6.03.03.04 Transfer Lines Instrumentation
- 6.03.03.05 Pulsed Devices



## 6.03.04 Electron Pre-Injector

Design, procure and assemble the EIC pre-injector system, which generates and accelerates an electron beam for subsequent injection into the RCS ring. The injection system includes polarized electron gun, a 400 MeV linear accelerator (the linac).

- 6.03.04.01 400 MeV Injector
- 6.03.04.02 Polarized Electron Source





# Input to WBS planning

- WBS Level 2 Summary
  - Requirements
  - Scope
  - Assumptions
  - Cost
  - Schedule
  - Environment, Healthy, Safety Concerns
  - Highest Risk Areas

WBS is 100% - must be defined by Level 1 Management

