

**HKS-ENGE Hypernuclear Experiment Engineering**

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## **Overview**

### Major new equipment

- HKS Magnets (Q1,Q2,Dipole)
- HKS Frame
- HKS Vacuum chamber
- HKS Dipole Power Supply
- HKS Detector Assembly

### Existing equipment

- ENGE Spectrometer
- ENGE Support Frame
- Splitter
- Beamline "Bz" magnets
- Power Supplies (ENGE,Splitter,Q1,Q2,"Bz")
- HKS Detector Deck
- Shielding
- Vacuum system
- Sieve Slit controls

### **JLAB engineered components**

Scattering chamber and target

Sieve slit systems for Enge and HKS

Stand for HKS

Detector mounts for HKS and Enge

Beamline

# HKS-ENGE Work Breakdown Structure

13-Sep-02

TU	Tohoku	Acc align	Accelerator Division alignment
HU	Hampton	Acc Mech	Accelerator Division Mechanical
Mits	Mitsubishi	Acc Elec	Accelerator Division Electrical
FIU	Florida International	Acc Inst	Accelerator Division Instrumentation
UofH	Univ. of Houston	Acc ME	Accelerator Division Mechanical Engineering
YER	Yerevan	Acc EE	Accelerator Division Electrical Engineering
tbd	To be determined	HallC	JLAB Hall C
collab	collaboration	n/c	not counted

WBS	Item	Responsible	Source	Fabrication	Installation	
				Unit: k\$	Unit:K\$	
<b>1</b>	<b>HKS</b>			<b>Total</b>	<b>205.0</b>	<b>86.0</b>
1.1	Q1 Quad			Sub. total	13.0	13.5
	magnet	TU	Mits			
	power supply	JLAB	SOS Q	n/c		
	mount	TU	Mits			
	adjustment	TU	Mits			
	Hall probe	JLAB	HallC	3.0		
	Temp Sensor	TU	Mits			
	DC cable	JLAB	ACC Elec			5.0
	LCW	JLAB	ACC Mech			2.5
	control cable	JLAB	HallC			1.0
	vacuum chamber	TU	Mits			
	shipping	TU	Mits			
	installation	JLAB	HallC			5.0
	alignment	JLAB	ACC Align			n/c
	stand	JLAB	HallC	10.0		
	fiducialization	JLAB	ACC Align	n/c		
	magnet map	TU	Mits			
1.2	Q2 Quad			Sub. total	13.0	13.5
	magnet	TU	Mits			
	power supply	JLAB	SOS D1	n/c		
	mount	TU	Mits			
	adjustment	TU	Mits			
	Hall probe	Jlab	HallC	3.0		
	Temp Sensor	TU	Mits			
	DC cable	JLAB	ACC Elec			5.0
	LCW	JLAB	ACC Mech			2.5
	control cable	JLAB	HallC			1.0
	vacuum chamber	TU	Mits			
	shipping	TU	Mits			
	installation	JLAB	HallC			5.0
	alignment	JLAB	ACC Align			n/c
	stand	JLAB	HallC	10.0		
	fiducialization	JLAB	ACC Align	n/c		
	magnet map	TU	Mits			

1.3 Dipole			Sub. total	35.0	25.0
magnet	TU	Mits			
power supply	TU	Mits			
mount	TU	Mits			
adjustment	TU	Mits			
NMR	JLAB	HallC		5.0	
Temp Sensor	TU	Mits			
DC cable	JLAB	ACC Elec			6.0
LCW	JLAB	ACC Mech			3.0
control cable	JLAB	HallC			1.0
vacuum chamber	TU	Mits			
shipping	TU	Mits			
installation	JLAB	HallC			15.0
alignment	JLAB	ACC Align			n/c
stand	JLAB	HallC		30.0	
fiducialization	JLAB	ACC Align		n/c	
magnet map	TU	Mits			
1.4 Sieve Slit System (SSS)			Sub. total	50.0	3.0
Conceptual Design	JLAB	HallC		n/c	
Slit box	JLAB	HallC		10.0	
lift mechanism	JLAB	HallC		20.0	
Densimet	JLAB	HallC		20.0	
controls software	JLAB	HallC		n/c	
control cables	JLAB	HallC			3.0
installation	JLAB	HallC			n/c
Fiducialization	JLAB	Acc Align			n/c
Alignment	JLAB	Acc Align			n/c
1.5 Vacuum System			Sub. total	58.0	4.0
S1-SSS	JLAB	HallC		5.0	
SSS-Q1	TU	Mits			
Q1-Q2	TU	Mits			
Q2-D	TU	Mits			
Vacuum Extension	TU	Mits			
Exit Vacuum Window	HU	HU			
Vacuum Gauges	JLAB	Hall C		5.0	
Vacuum Turbo Pump	JLAB	Hall C		24.0	
Vacuum Rough Pump	JLAB	Hall C		15.0	
Pump Gate Valve	JLAB	Hall C		4.0	
Vacuum Manifold	JLAB	Hall C		5.0	
Installation	JLAB	HallC			n/c
Controls software	JLAB	HallC		n/c	
Control Cabling	JLAB	HallC			3.0
AC Power	JLAB	Acc Elec			1.0

1.6 Detector Support System			Sub, total	28.0	20.0
Detector Mount	JLAB	Hall C		25.0	
Detector Platform	JLAB	HallC		n/c	
Detector Legs(HallC)	JLAB	HallC		n/c	
Access stair	JLAB	HallC		3.0	
Shielding	JLAB	HallC		n/c	
installation	JLAB	HallC			10.0
AC Power	JLAB	Acc Elec			5.0
Lights	JLAB	Acc Elec			2.0
Safety systems	JLAB	HallC			3.0
Alignment	JLAB	Acc Align			n/c
1.7 HKS Detectors			Sub, total	8.0	7.0
Drift Chambers	HU	HU			
Time of Flight	TU	TU			
Aerogel Ceernkov	FIU/TU	FIU/TU			
Lucite Cerenkov	FIU/TU	FIU/TU			
Gas Cerenkov (tbd)	YER	Yerevan			
Detector Cabling	Collab	See electr. table			
Readout electronics	JLAB/Collab	See electr. table			
front end electronics	TU/HU	See electr. table			
AC power	JLAB	Acc Elec			5.0
Installation	JLAB	HallC			n/c
Alignment	JLAB	Acc Align			n/c
Fiducialization	JLAB	Acc Align			n/c
Cabling to Counting House	JLAB	See electr. table			
Detector Gas systems	JLAB	HallC		8.0	2.0

<b>2 ENGE Spectrometer</b>			<b>Total</b>	<b>101.0</b>	<b>43.0</b>
<b>2.1 ENGE systems</b>			<b>Subtotal</b>	<b>51.0</b>	<b>40.0</b>
Magnet	HU	HNSS			
Power supply	JLAB	Enge/Moller		n/c	
DC cables	JLAB	Acc Elec			5.0
LCW-water	JLAB	Acc Elec			3.0
New ENGE Mount	JLAB	HallC		25.0	
support structure	JLAB/HU	HNSS		n/c	
shielding	JLAB	HallC		10.0	
Hodoscope	TU	TU			
Drift Chanber	TU	TU			
Detector Mounts	JLAB	HallC		8.0	
installation	JLAB	HallC			25.0
Alignment	JLAB	Acc Align			n/c
safety systems	JLAB	HallC			5.0
cabling to counting house	JLAB	See electr. table			
electronics	HU/collab	See electr. table			
Detector cabling	Collab	See electr. table			
Detector Gas systems	JLAB	HallC		8.0	2.0
Vacuum Turbo Pump	HU	HNSS		n/c	
Vacuum Rough Pump	HU	HNSS		n/c	
<b>2.2 ENGE Sieve Slit System (ESSS)</b>			<b>Sub. total</b>	<b>50.0</b>	<b>3.0</b>
Conceptual Design	JLAB	HallC		n/c	
Slit box	JLAB	HallC		10.0	
lift mechanism	JLAB	HallC		20.0	
Densimet	JLAB	HallC		20.0	
controls software	JLAB	HallC		n/c	
control cables	JLAB	HallC			3.0
installation	JLAB	HallC			n/c
Fiducialization	JLAB	Acc Align			n/c
Alignment	JLAB	Acc Align			n/c

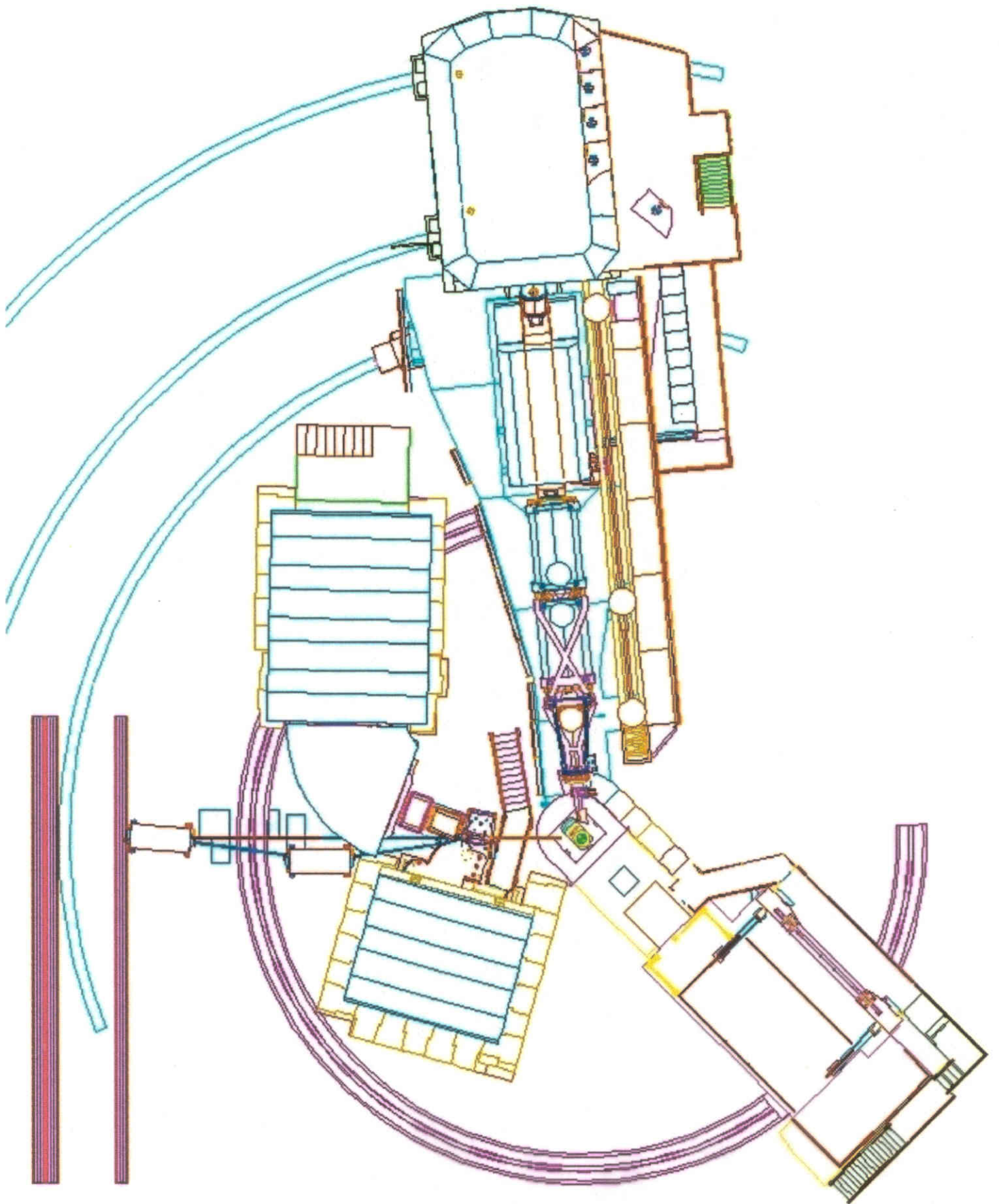
<b>3 Beamline</b>				<b>Total</b>	<b>133.0</b>	<b>29.0</b>
3.1	Splitter Magnet	HU	HNSS	Sub. total	25.0	11.0
	Gap Modification	HU	HU		n/c	
	Splitter Mount	JLAB/HU	Note 2		25.0	
	Power supply	JLAB	Splitter		n/c	
	DC cables	JLAB	Acc Elec			4.0
	LCW-water	JLAB	Acc Mech			2.0
	Installation	JLAB	HallC			5.0
	Alignments	JLAB	Acc Align			n/c
3.2	Splitter chamber			Sub. total	63.0	5.0
	New Chamber	JLAB	HallC		35.0	
	New cooled target ladder	JLAB	HallC		10.0	
	targets	collab	TU			
	controls	HU/JLAB	HallC		n/c	
	exit windows	JLAB	HallC		5.0	
	cabling	JLAB	HallC			5.0
	access platform	JLAB	Hall C		8.0	
	vacuum connections	JLAB	HallC		5.0	
3.3	Electron Dump line		Note 1	Sub. total	45.0	13.0
	Dump Magnets	JLAB	Acc ME		n/c	
	Power supplies	JLAB	Acc EE		n/c	
	stands	JLAB	Hall C		20.0	
	DC cables	JLAB	Acc Elec			5.0
	LCW--water	JLAB	Acc Mech			3.0
	Installation	JLAB	Acc Mech			5.0
	Alignments	JLAB	Acc Align			n/c
	Beam viewers	JLAB	Acc Inst		5.0	
	Vacuum pipes	JLAB	Hall C		20.0	
3.4	New Girder		Note 2	Sub. total	0.0	
	Girder	JLAB	Acc ME			
	super harps	JLAB	Acc INST			
	cabling	JLAB	Acc Elec			
	stands	JLAB	Acc ME			
	vacuum pipes	JLAB	Acc ME			
	installation	JLAB	Acc Mech			
	alignment	JLAB	Acc Align			
	cabling	JLAB	Acc Elec			
	gate valve	JLAB	Acc Mech			

	Fabrication		installation
<b>Total estimated costs for JLAB HKS+HNSS fabrication and installation</b>	<b>439</b>	<b>k\$</b>	<b>158</b>
<b>Contingency (25%)</b>	<b>110</b>	<b>k\$</b>	<b>40</b>
<b>Total costs with contingency</b>	<b>549</b>	<b>k\$</b>	<b>198</b>
<b>Total cost to JLAB including contingency</b>	<b>746</b>	<b>K\$</b>	

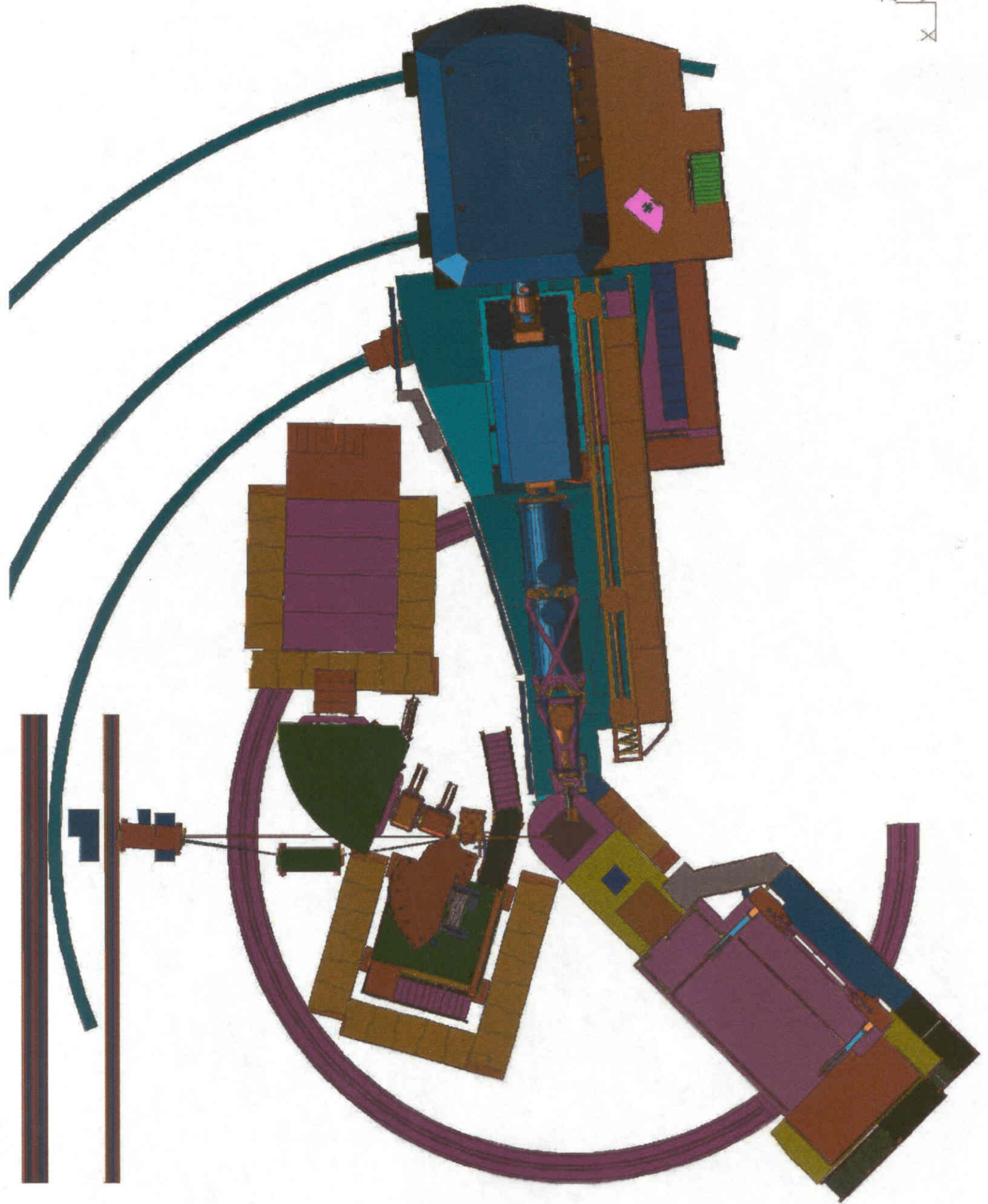
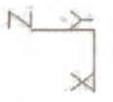
note 1 electrons are steered to the main dump  
other in Hall dumps may be needed for example photons

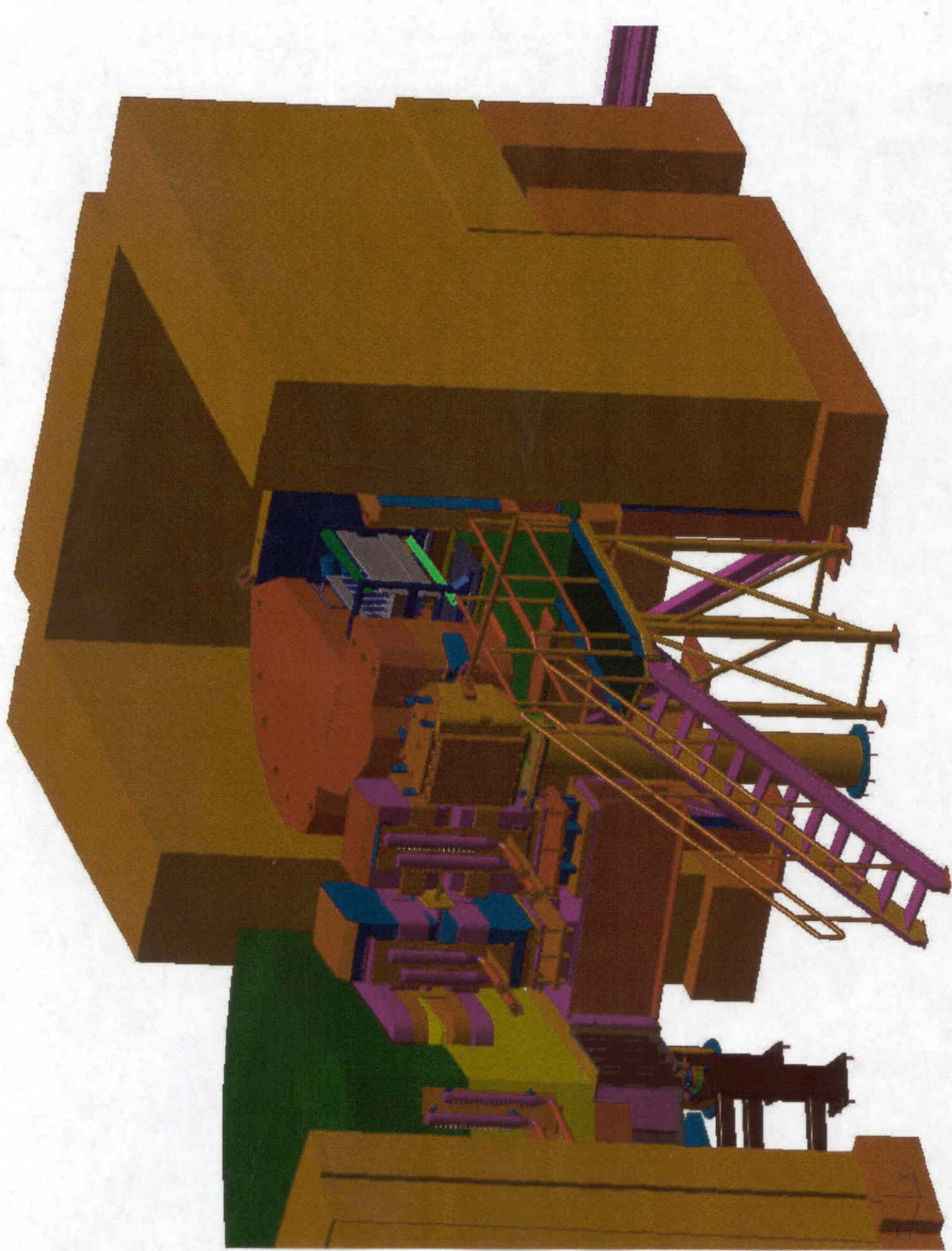
Note 2 New Girder depends on final location of HKS-Enge  
No girder is needed if the target and HKS-HNSS system is sufficiently close to Hall C pivot.











## **Scattering chamber and target**

Chamber accomodates one incoming and 4 outgoing beamlines

All welded Stainless Steel Chamber

Stress levels acceptable

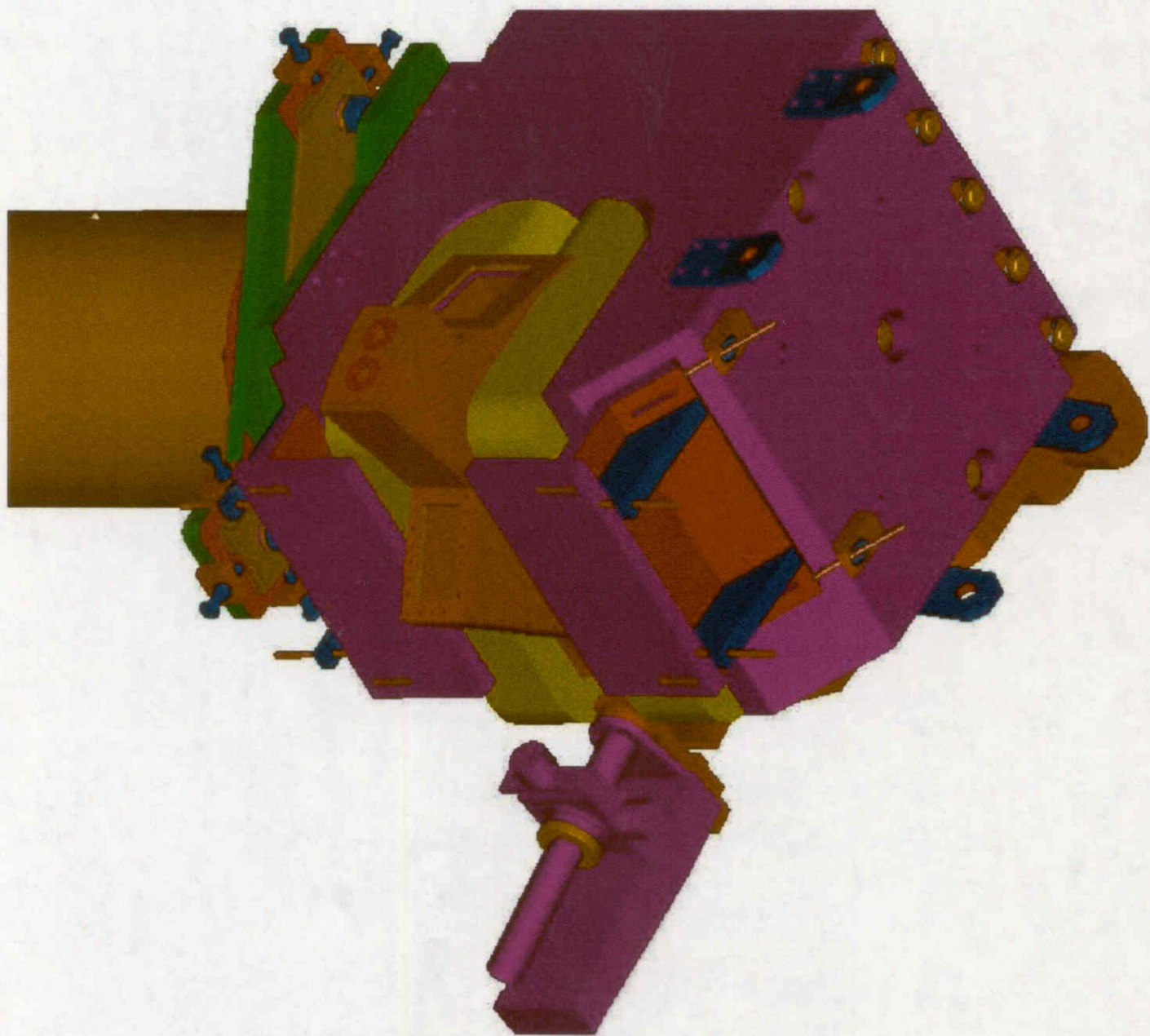
Stress ~ 10 KSI at edges and corners

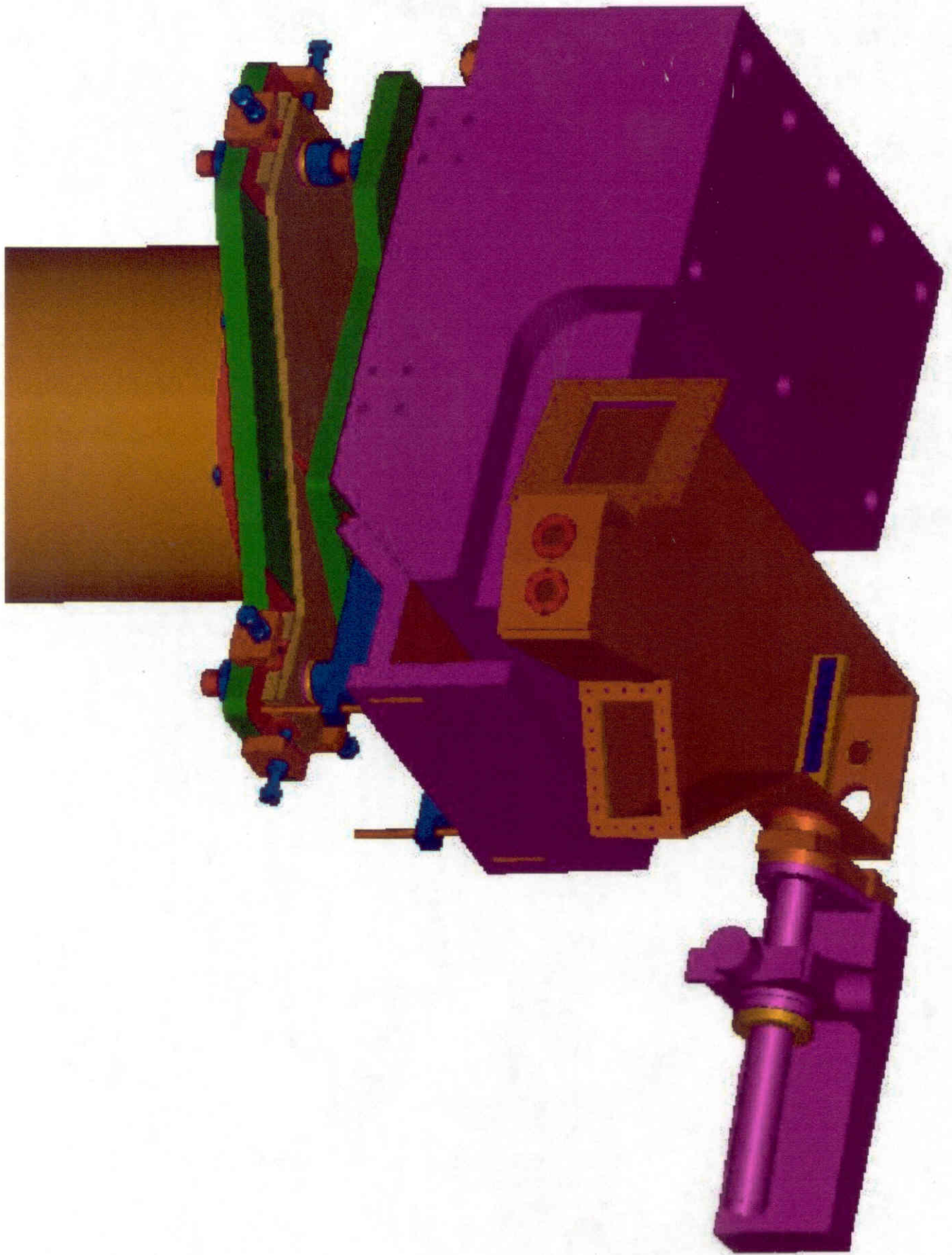
Peak stress at single nodes ~ 17ksi

Target has 5 positions, water cooled

Target Uses commercial actuator and existing controls









## **Sieve slit systems for Enge and HKS**

Systems designed after HMS/SOS existing systems

New sieve slits use existing controls

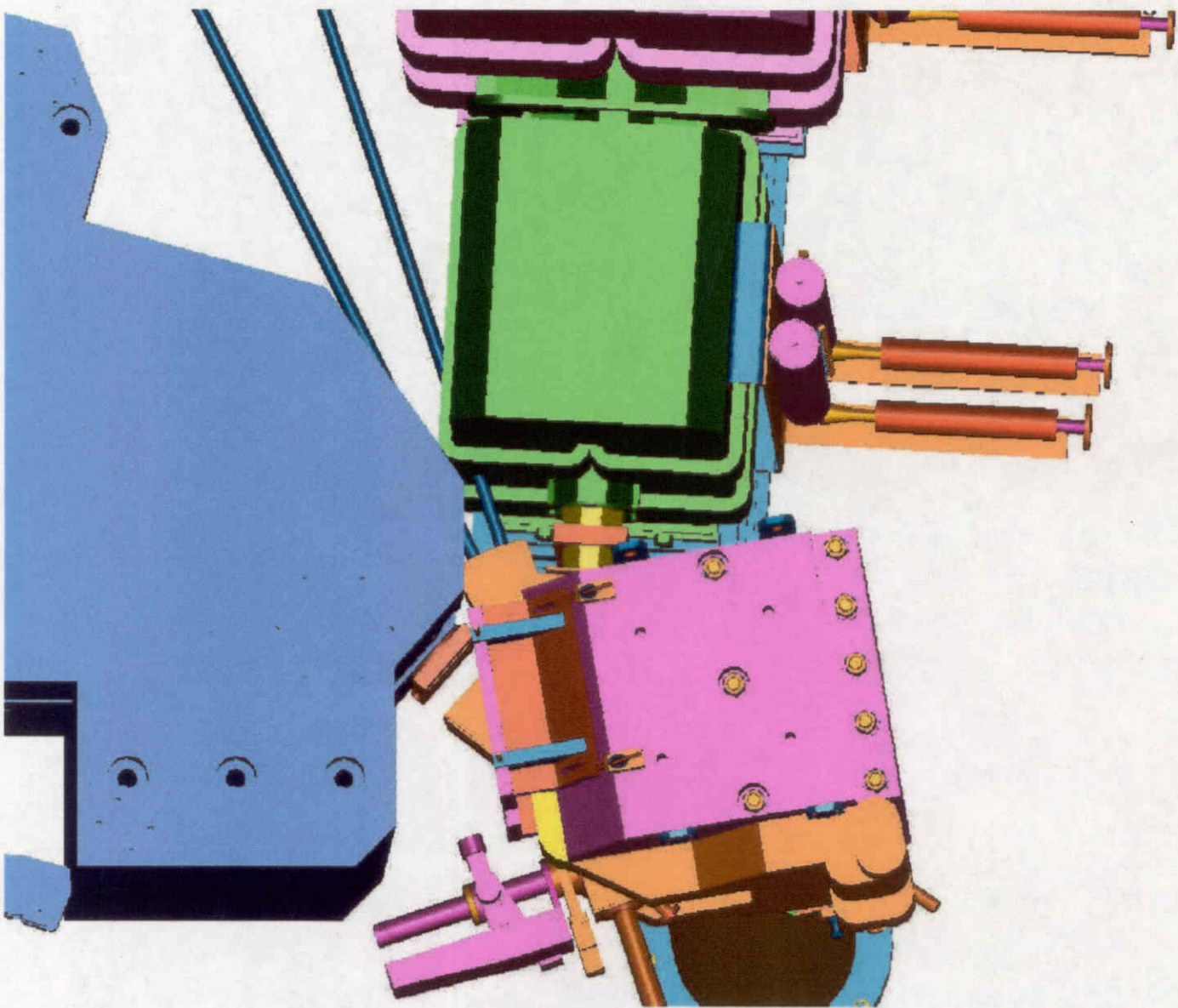
Stainless steel vacuum chamber

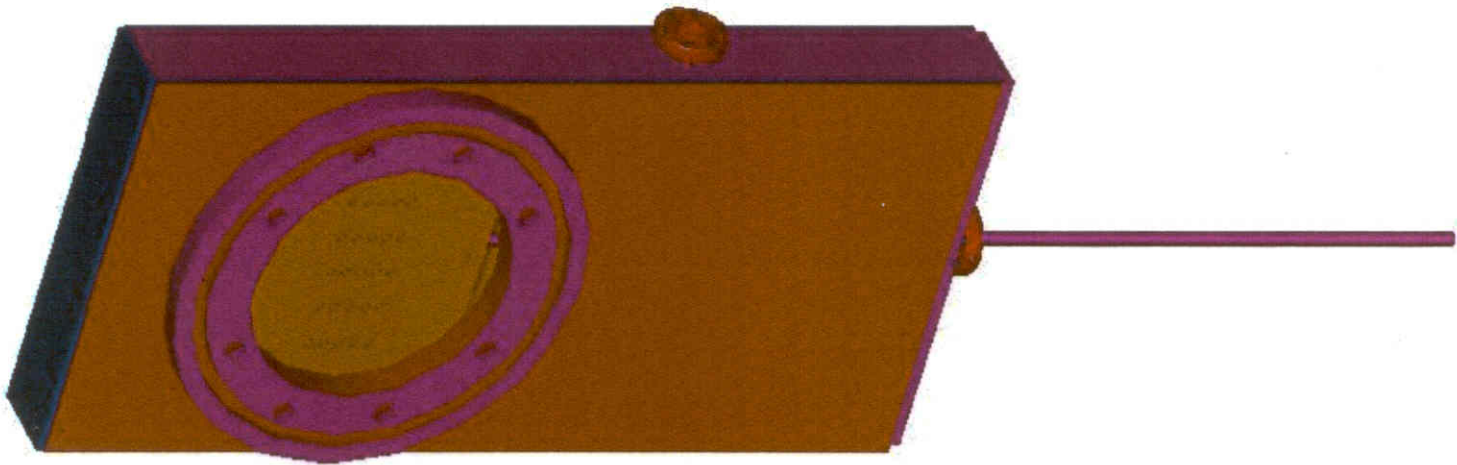
Thompson internal rails

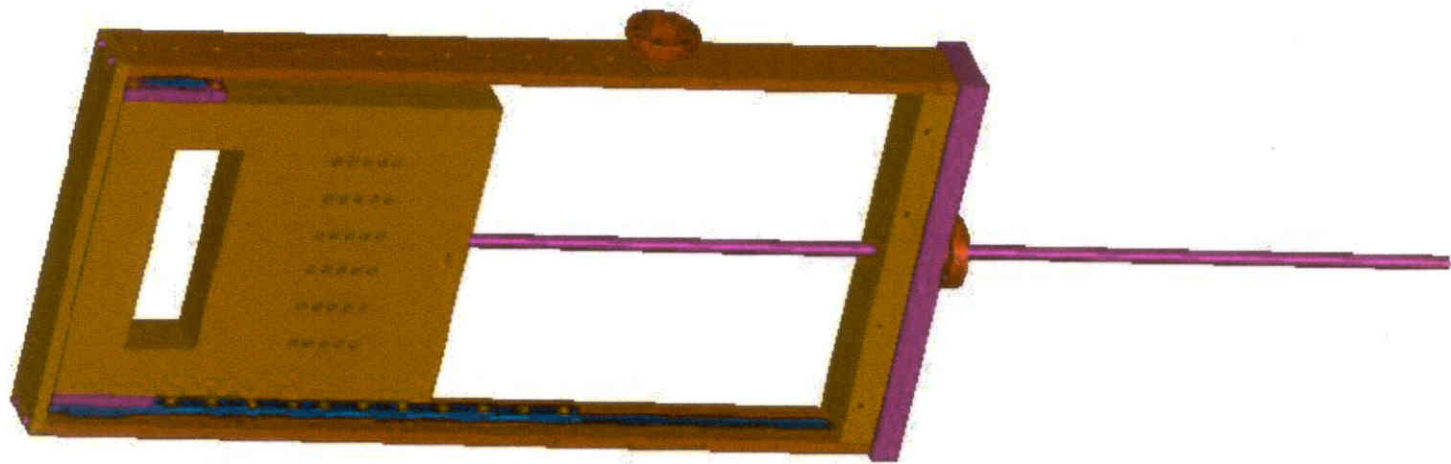
Densimet sieve slit and open

External actuator









## **Stand for HKS**

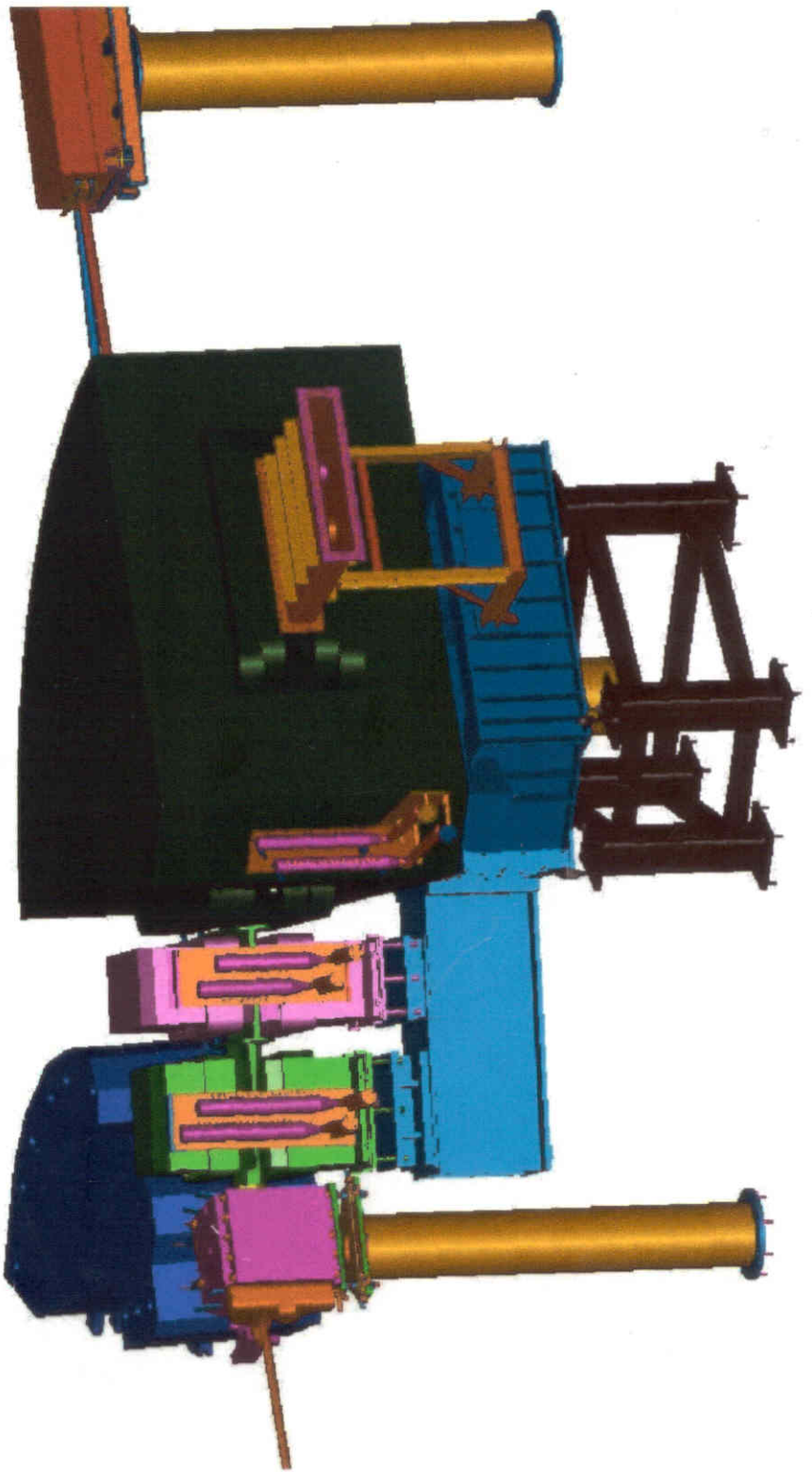
Support HKS magnets at proper height for Hall C beamline (13' CL.)

Total weight ~ 250 Tons

4 leg steel posts with braces

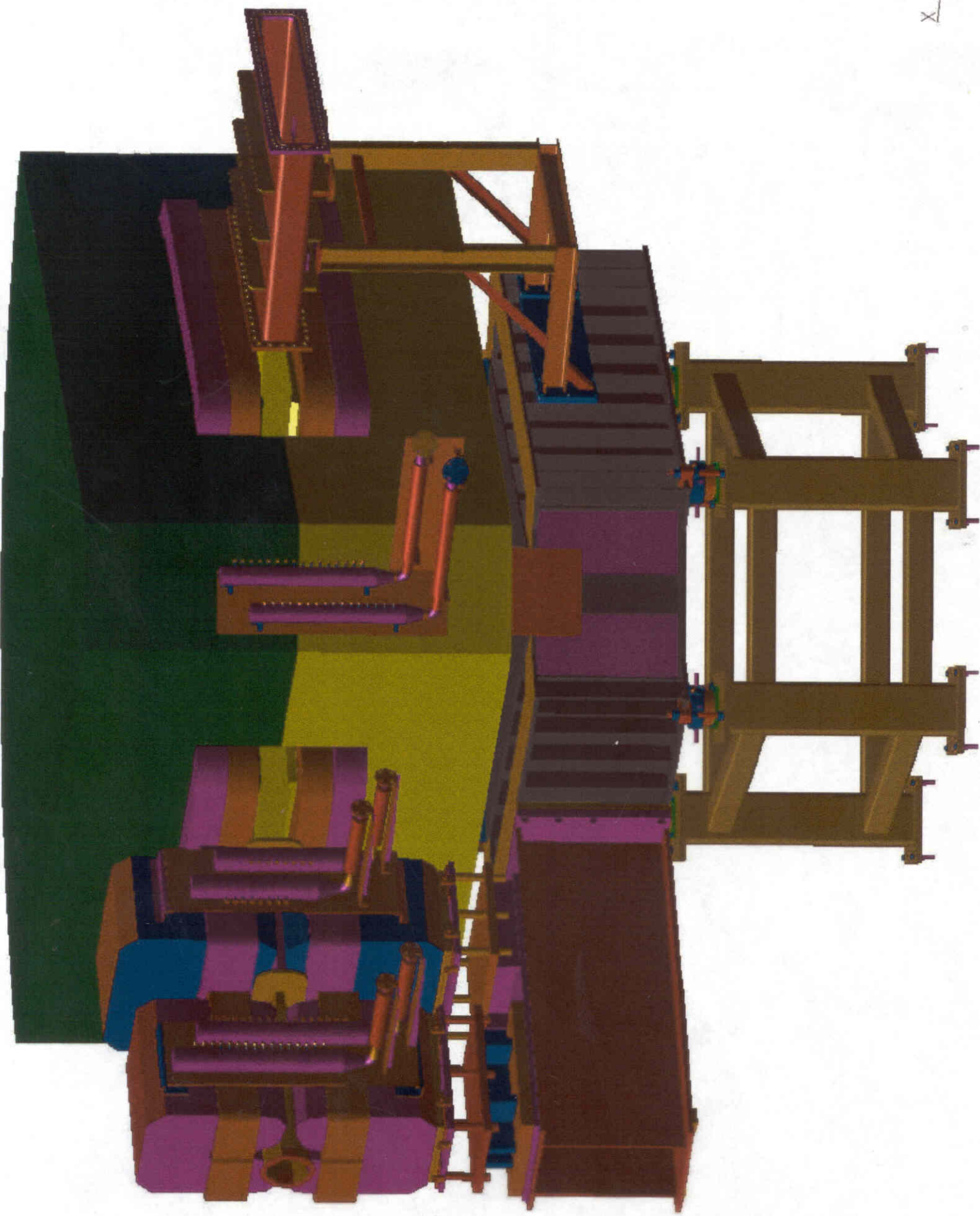
Height adjustment by Hydraulic locking jacks

Transverse adjustment with drive screws

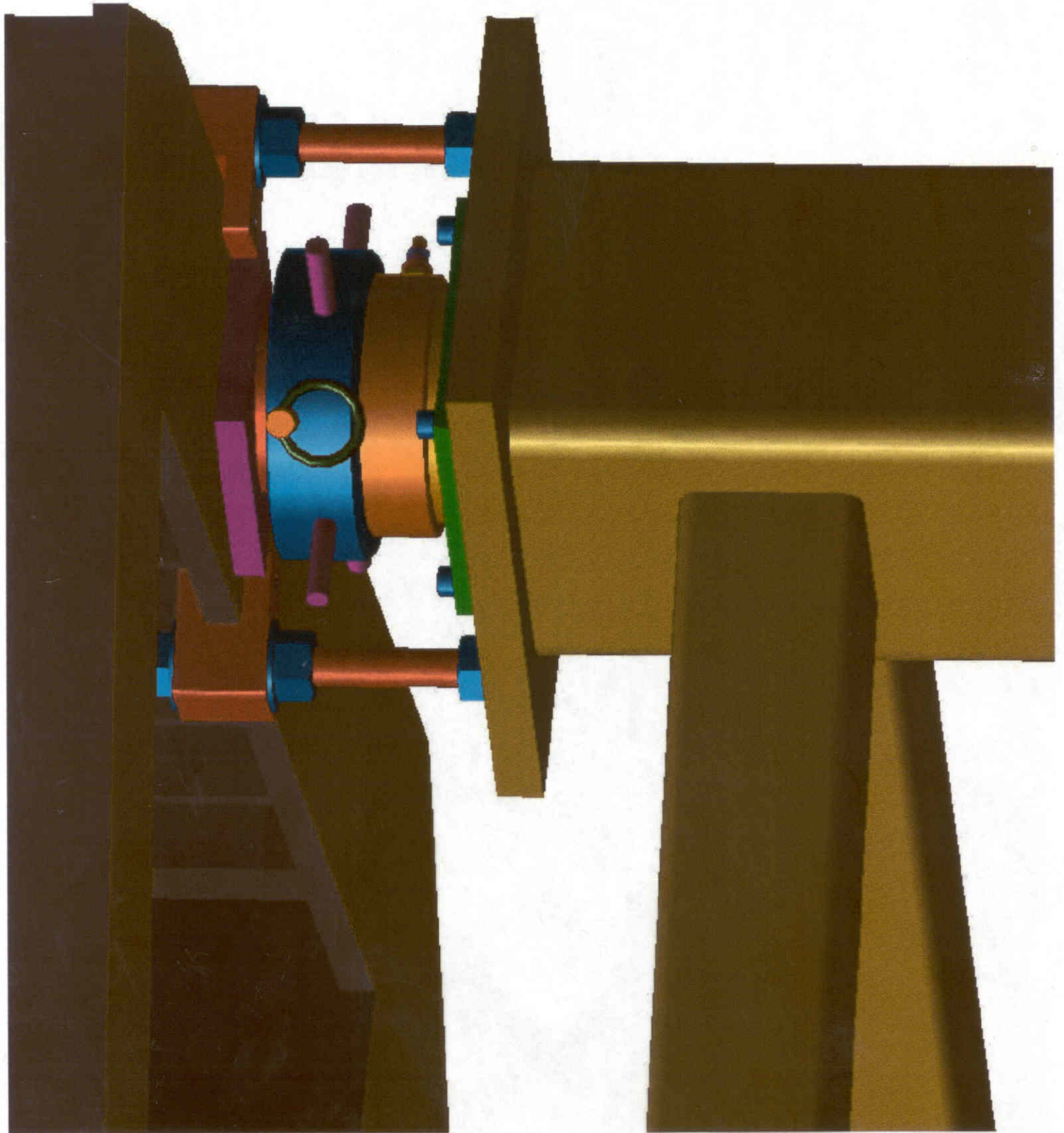




X  
Y  
Z



X  
Y Z





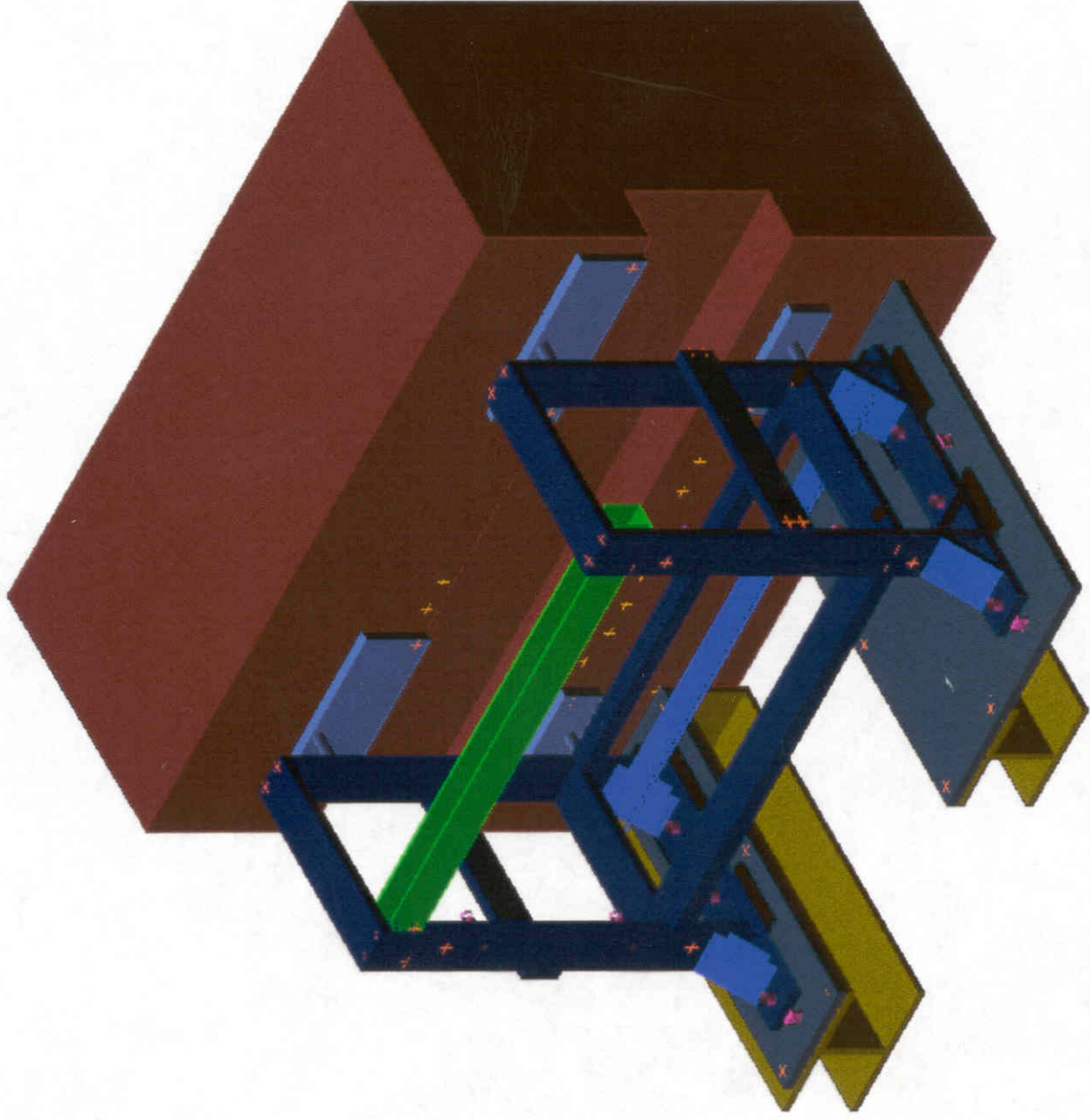
**Detector mounts for HKS and Enge**

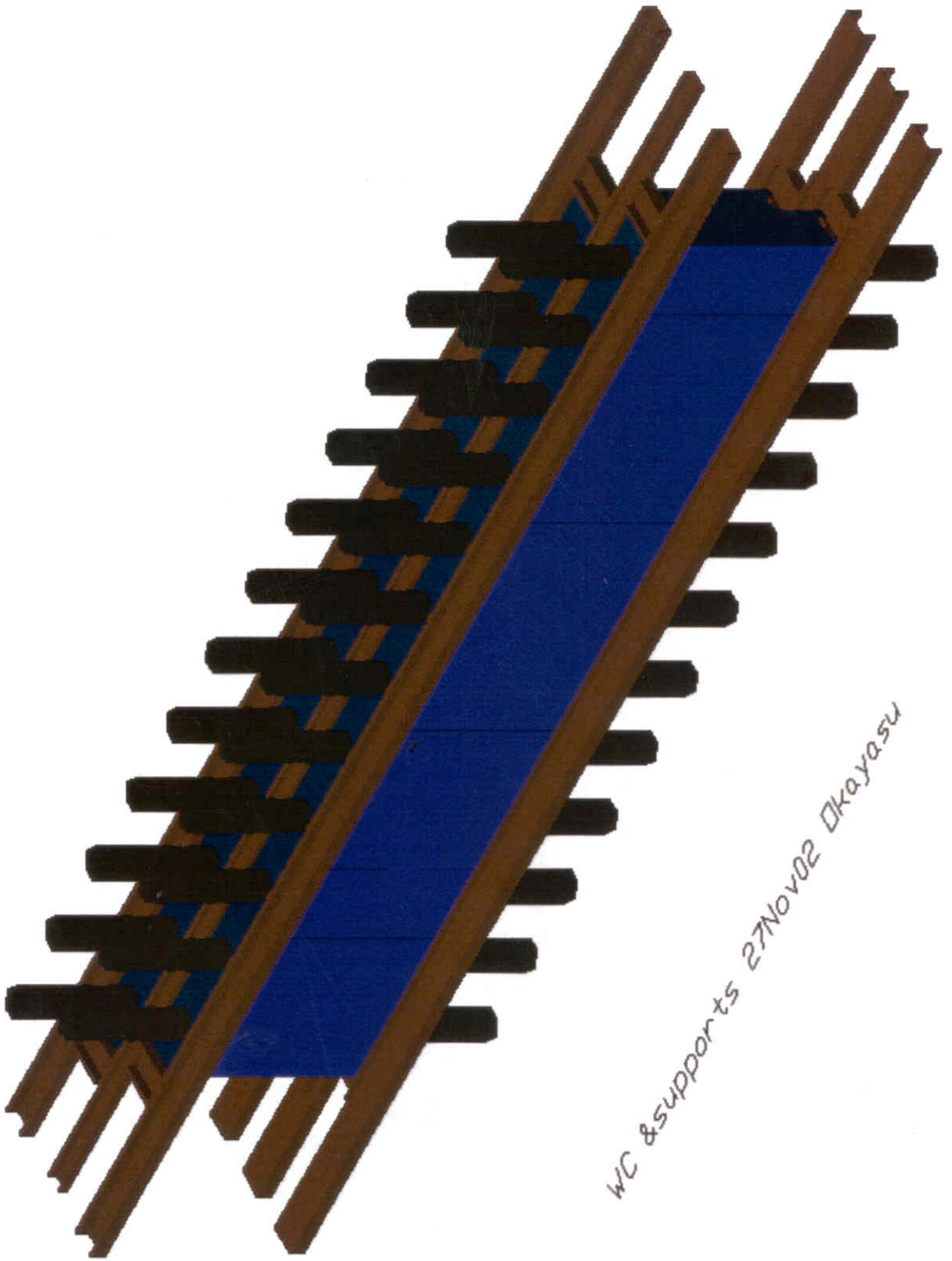
Preliminary designs from Tohuku and Hampton

Engineering and finished drawings from JLAB

Fabrication in Virginia

# Enge DC Support





WC & supports 27Nov02 Dkayasu

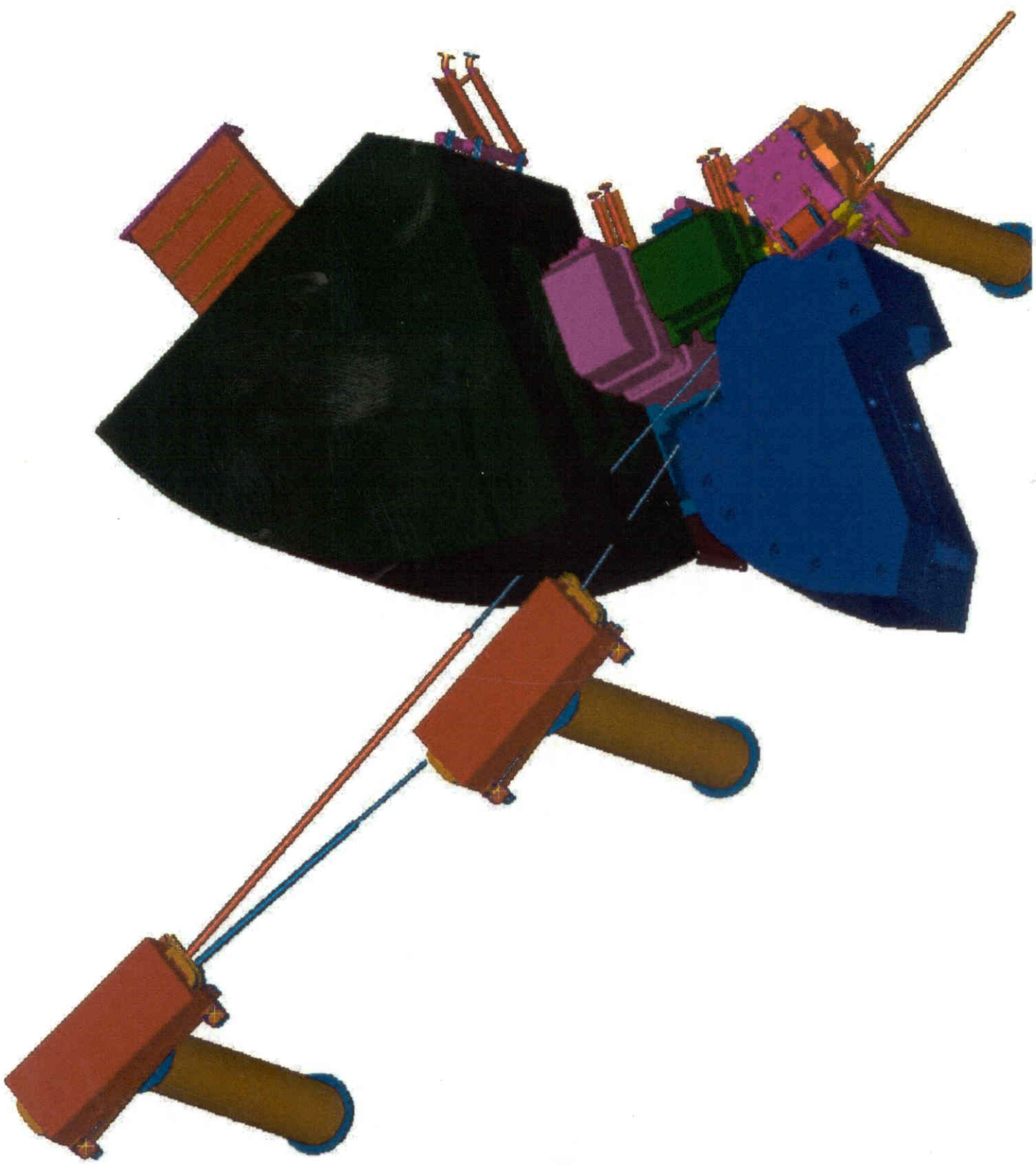
## **Beamline**

Splitter magnet stand

Electron dumpline

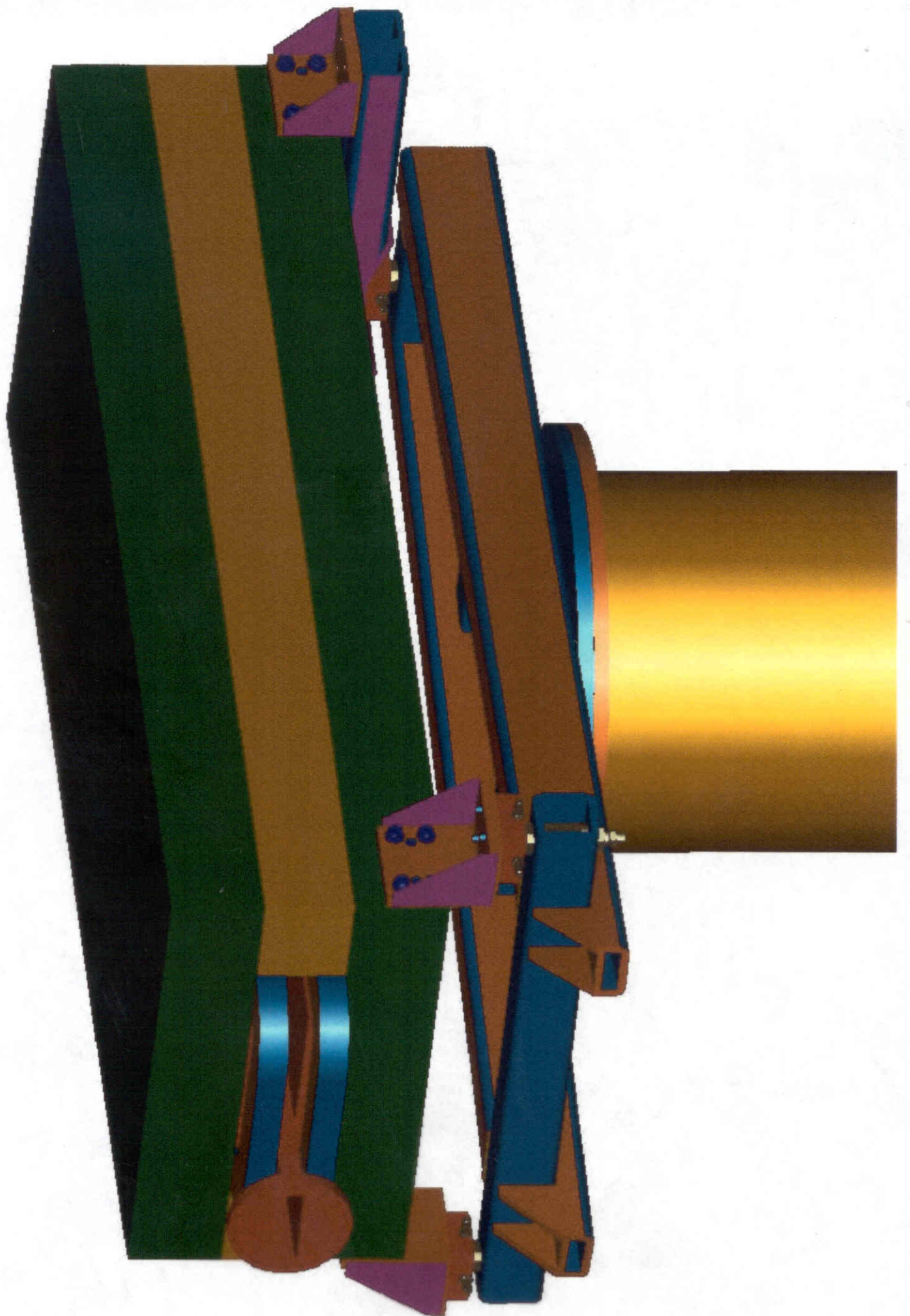
Bz magnets stands

Photon dumpline











JLAB Design and Fabrication		Status	9-Jan-03
	3D Design	Details	Fabrication
HKS-ENGE General Arrangemen complete		complete	N/A
1	HKS General arrangement	complete	N/A
1.1	HKS Stand	complete	TBD FY-04
1.2	HKS Sieve Silt System	complete	in progress FY-03
1.3	Vacuum System	existing	N/A existing
1.4	Detector access deck	existing	N/A existing
1.5	HKS Detector Support	preliminary	TBD FY-03
1.6	Shielding	complete	N/A existing
2	Enge General Arrangement	complete	complete N/A
2.1	Enge Tilt Mount	preliminary	TBD FY-04
2.2	Enge Detector mount	preliminary	TBD FY-03
2.3	Enge Sieve Silt System	complete	in progress FY-03
2.4	Shielding	complete	N/A existing
3	Beamline General Arrangement	complete	complete N/A
3.1	Splitter magnet Stand	complete	TBD Fy-04
3.2	Splitter Chamber and target	complete	complete FY-03
3.3	Dumpline Stands	complete	TBD FY-04
3.4	Dumpline Beamtubes	complete	TBD FY-04

