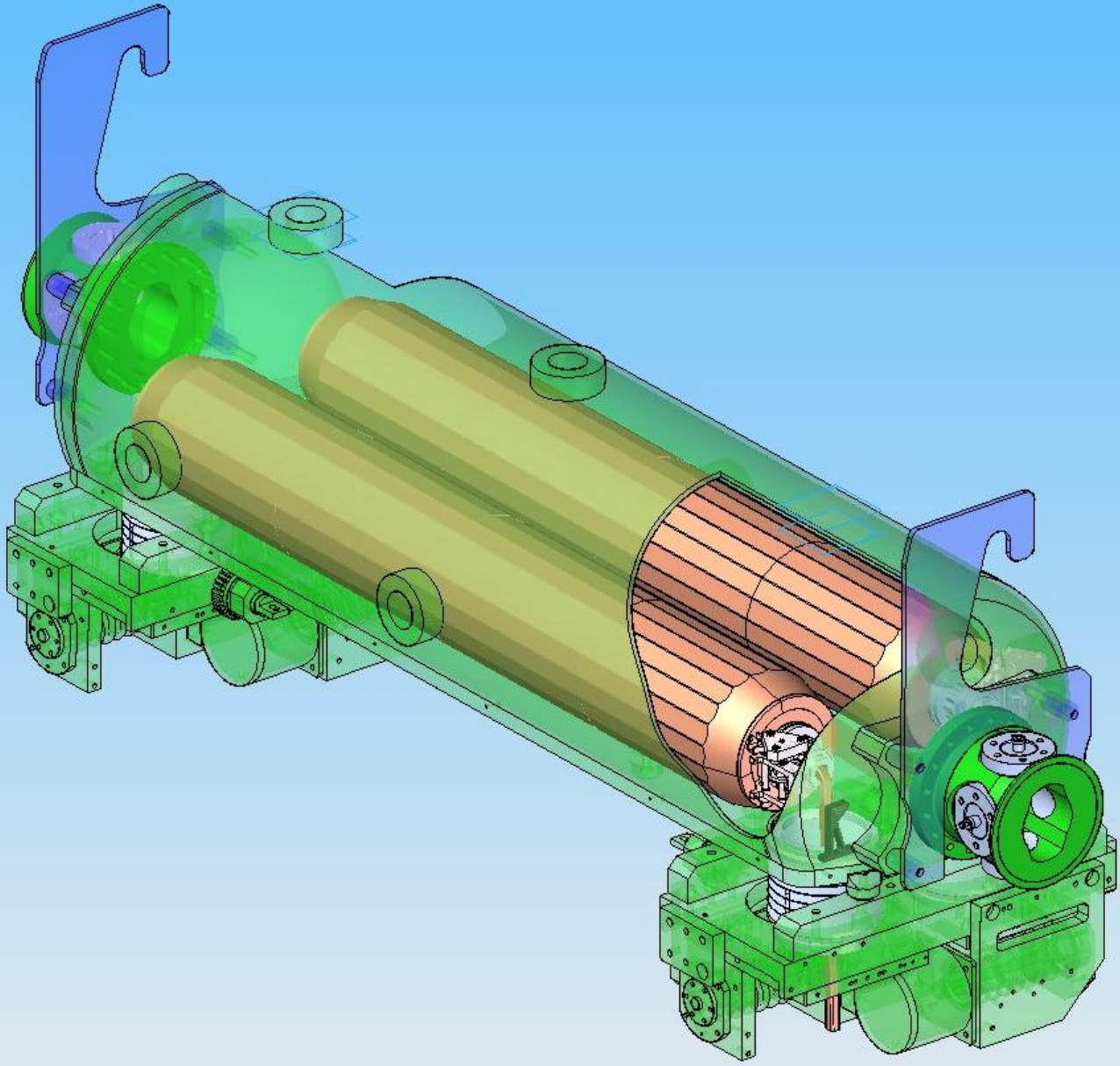


LARP

US LHC Accelerator Research Program

BNL - FNAL - LBNL - SLAC



LARP Rotatable Collimator Status

09 November 2009

Jeffrey C. Smith/SLAC

with

John Amann, Gene

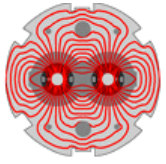
Anzalone,

Lew Keller, Steve

Lundgren,

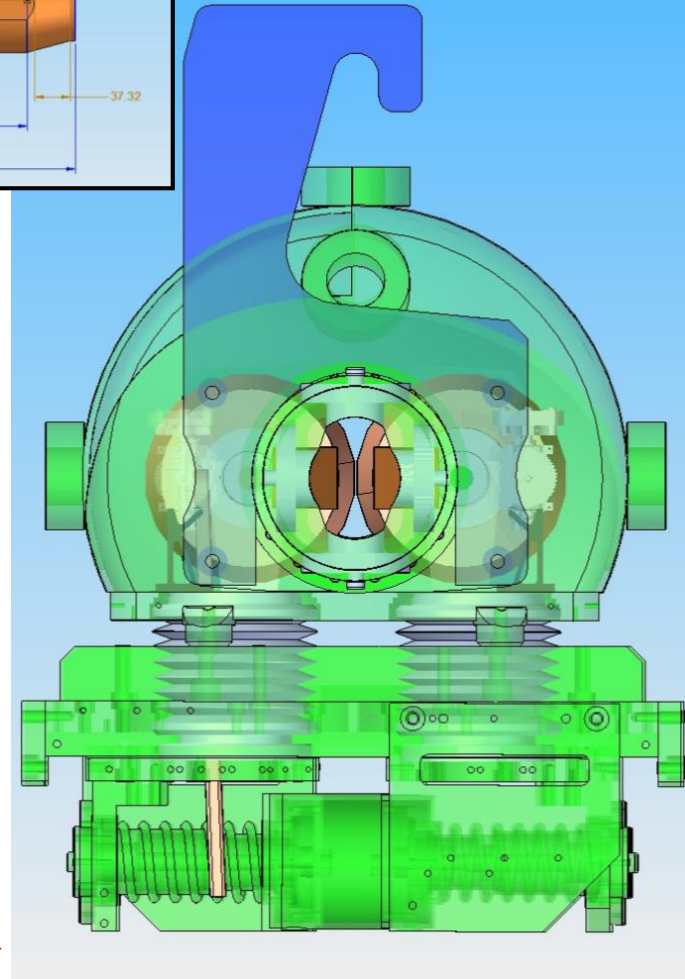
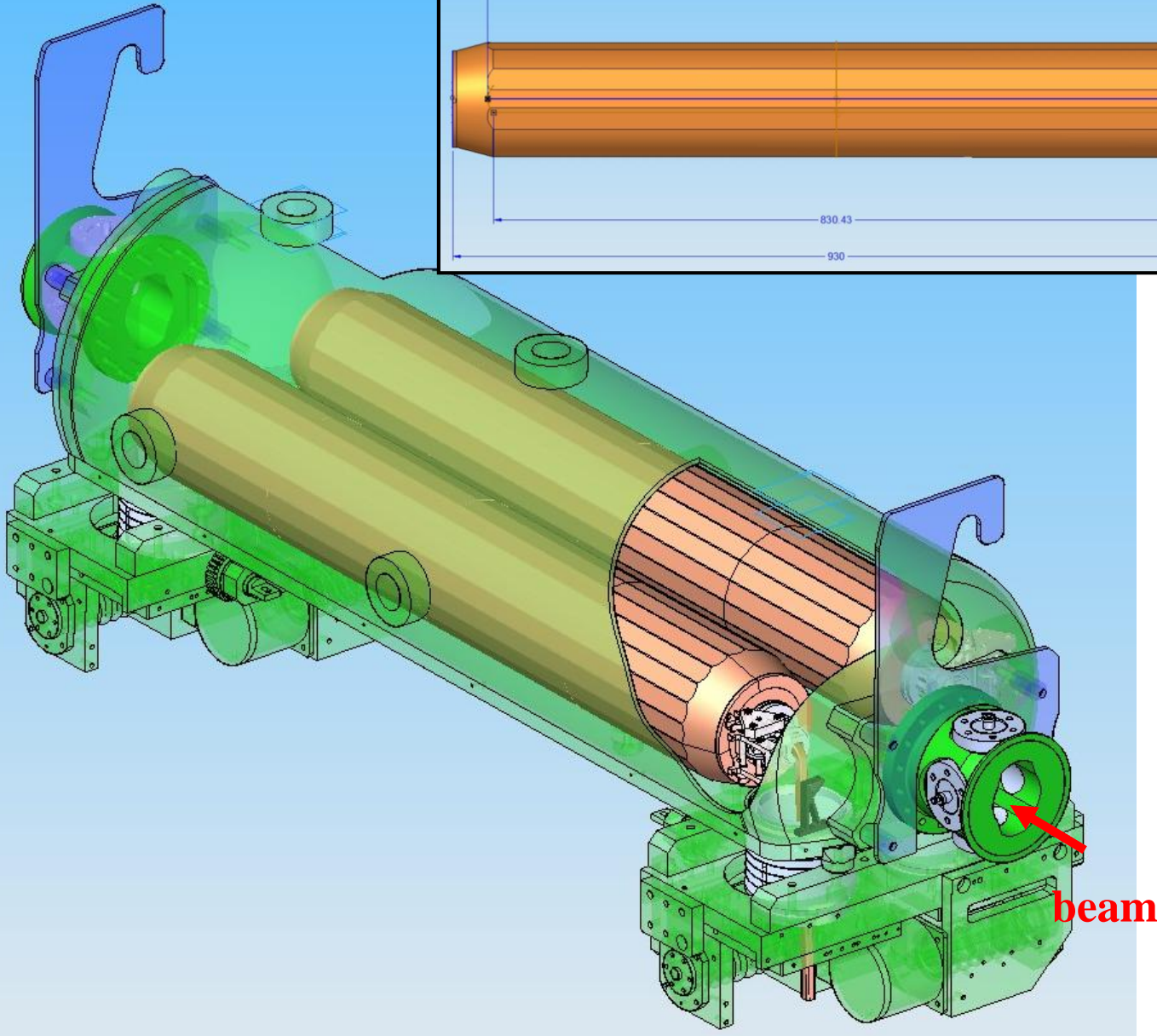
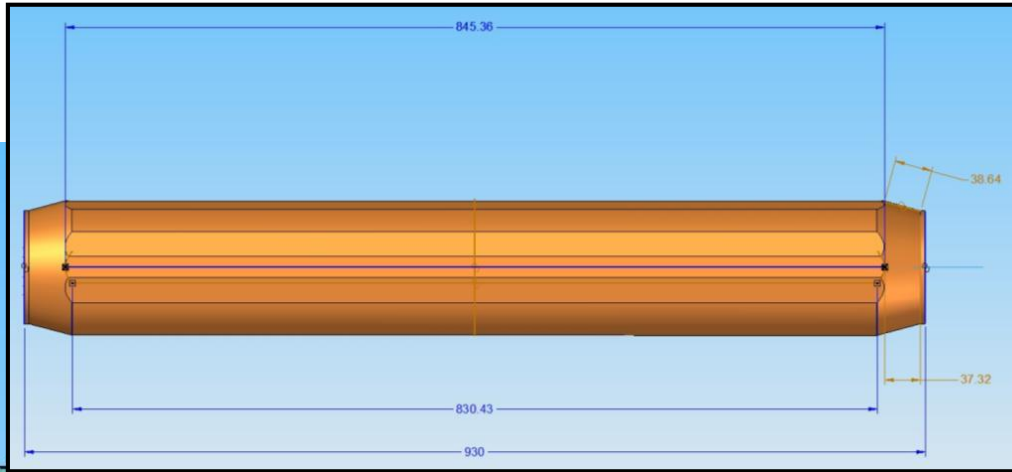
Tom Markiewicz, Reggie

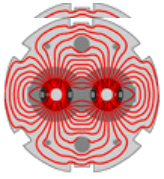
Rogers, Liling Xiao /SLAC



LARP

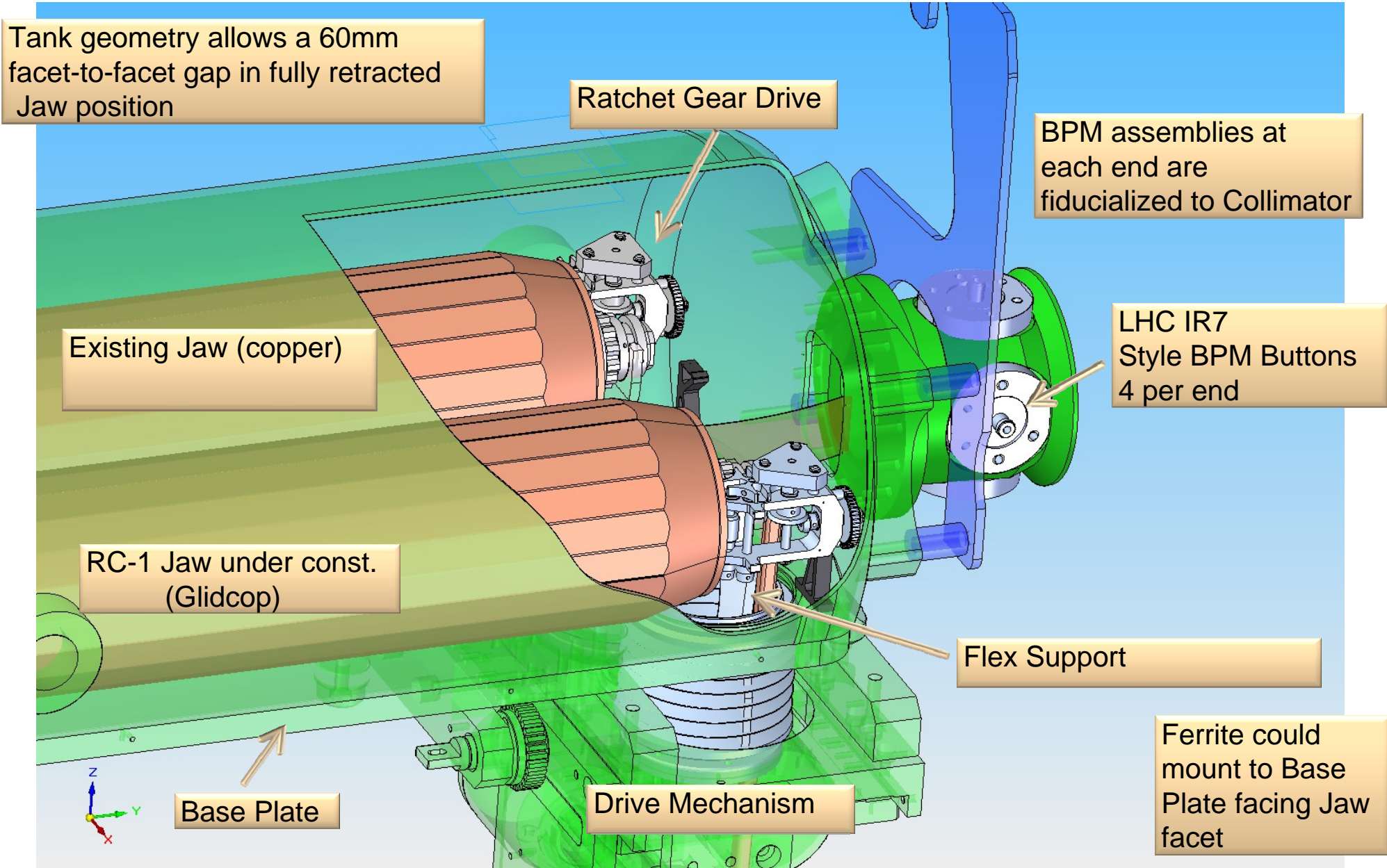
RC Prototype Design (for SPS)

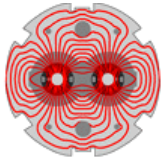




LARP

SLAC design details



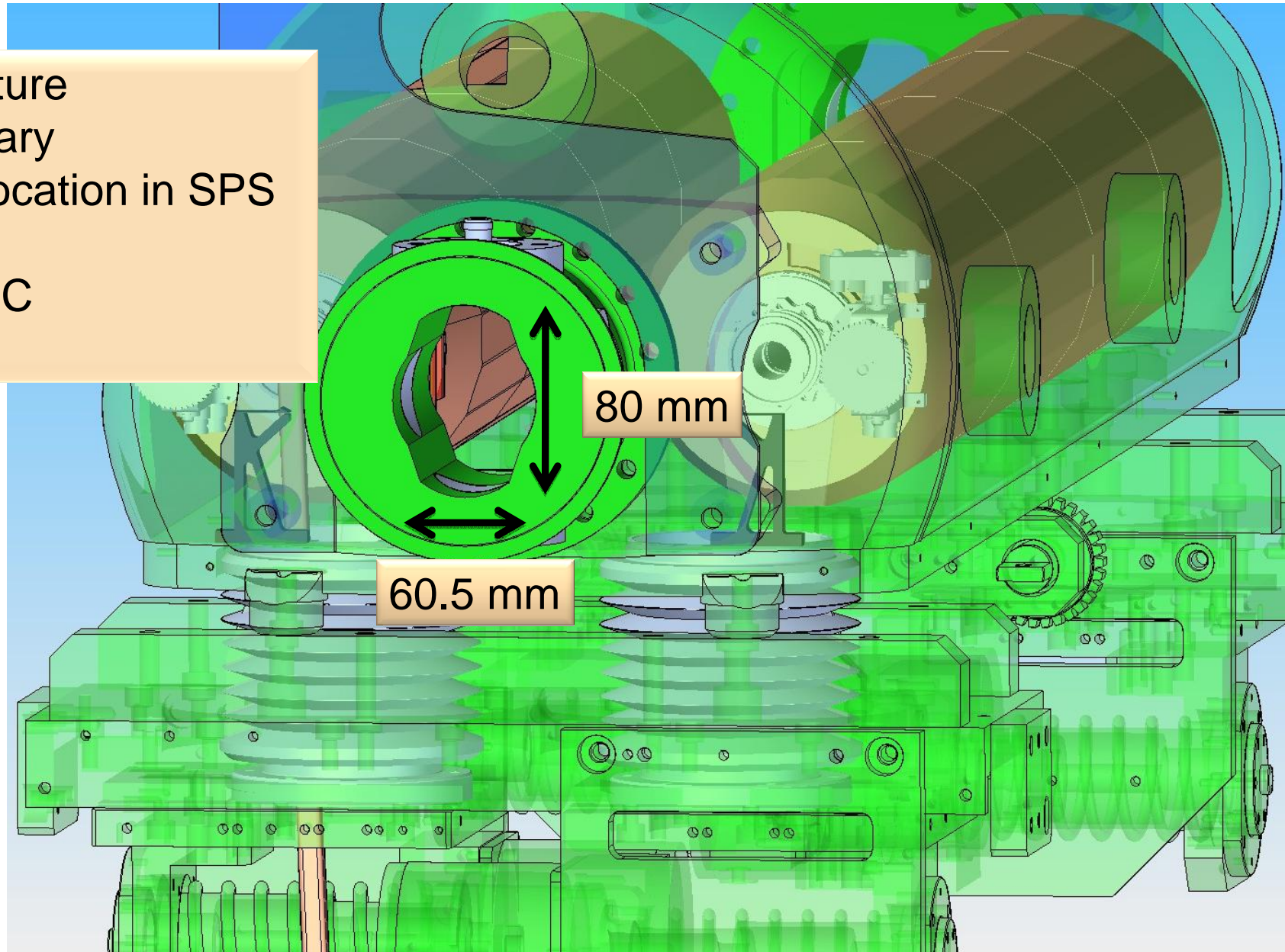


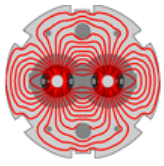
LARP

Proposed Collimator/BPM Aperture Dimensions



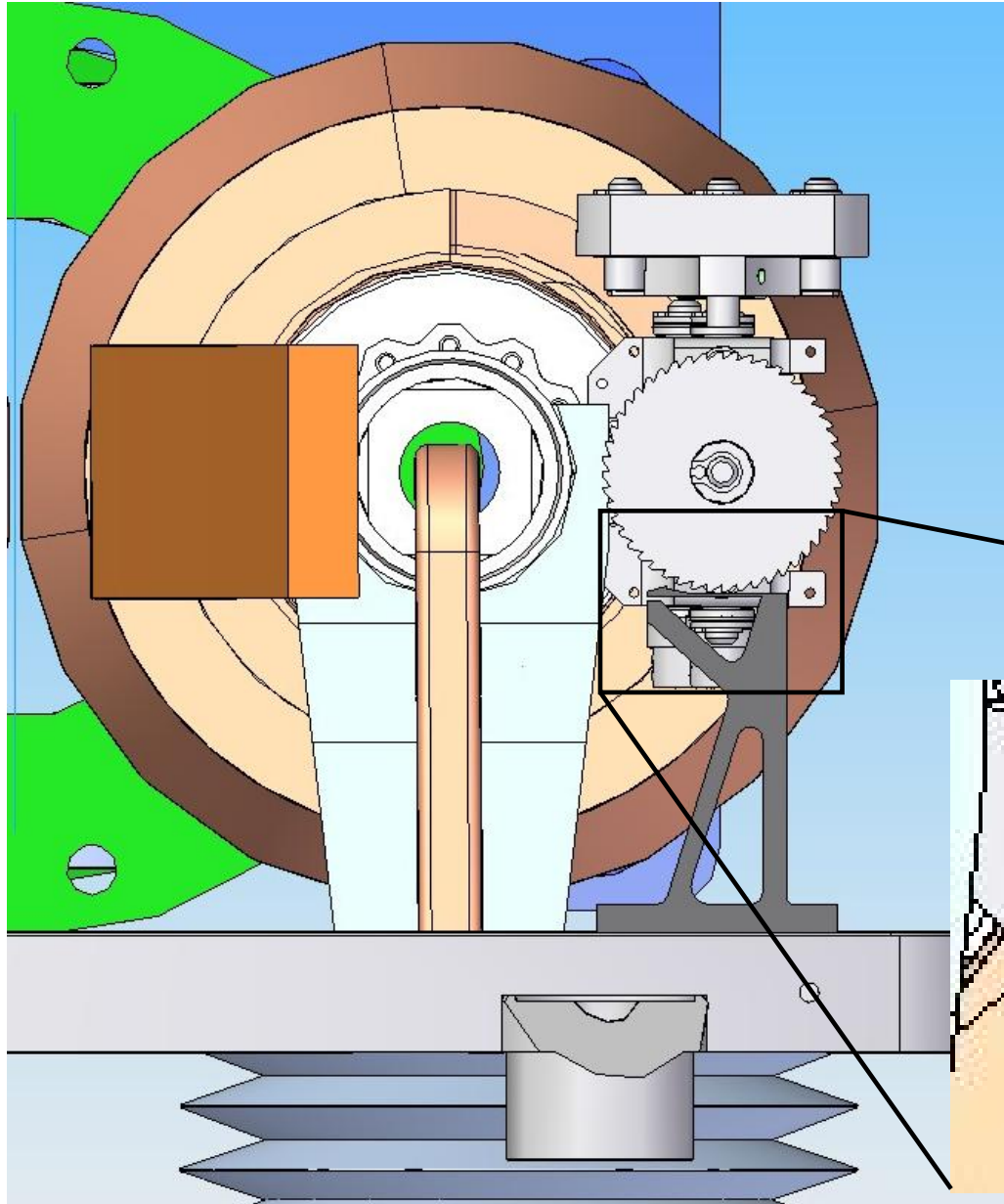
- Odd BPM aperture may be necessary depending on location in SPS
- 60.5 mm round aperture in LHC



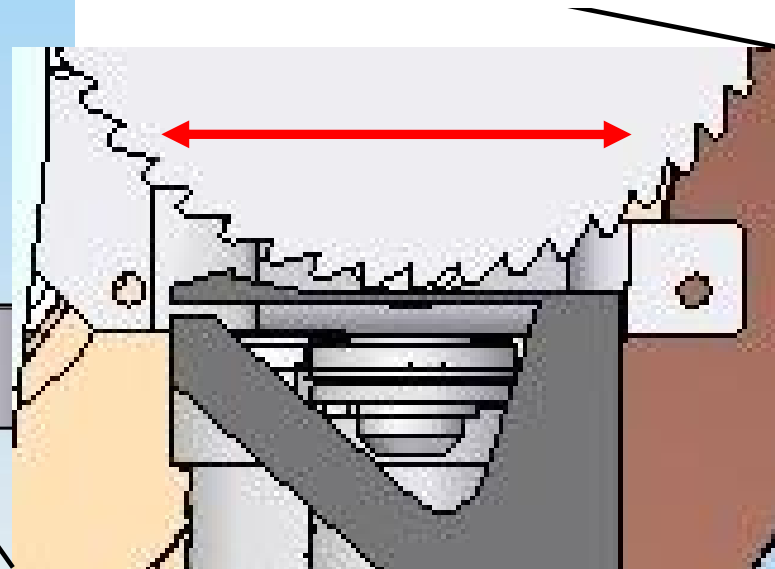


LARP

Jaw Rotation



- Jaw rotation after accident will be performed with a ratcheting mechanism with Geneva gear for precision rotation
 - 512 ratchets per facet rotation
 - Ratcheting performed by over-retracting the jaw so that ratchet hits actuator.
 - No extra motor or linear actuators required, simply use motors for moving jaws in and out

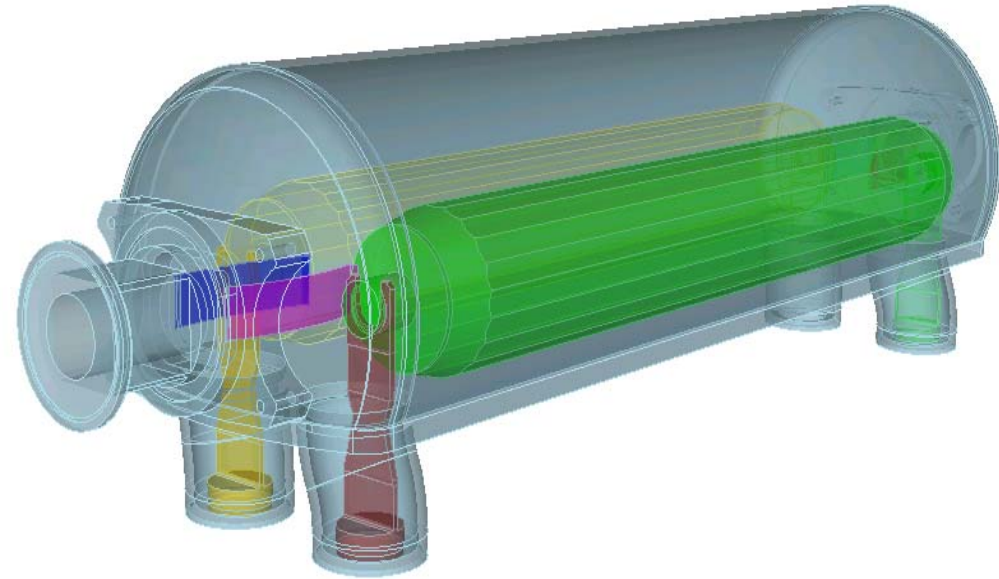




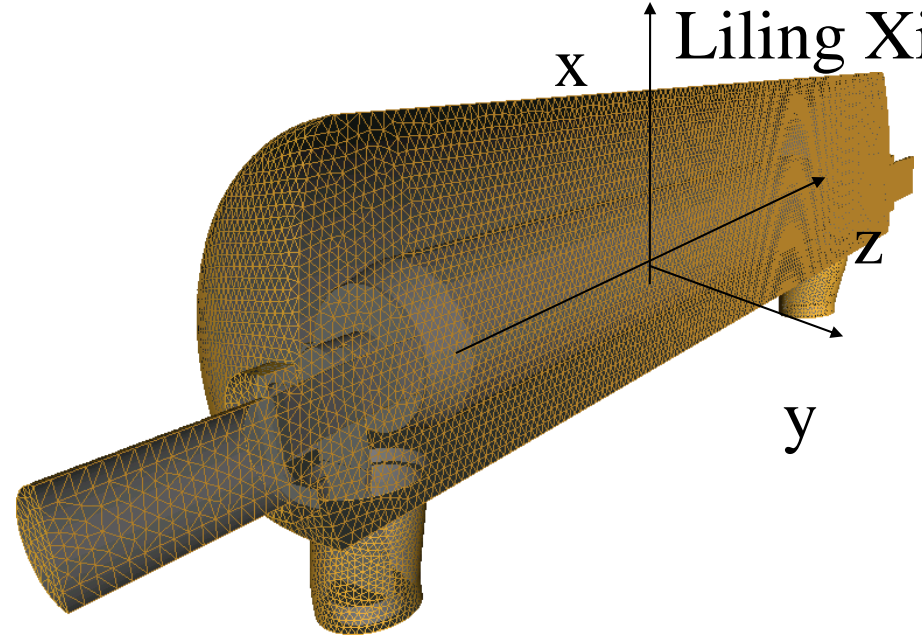
Trapped Modes in Omega3P



Liling Xiao

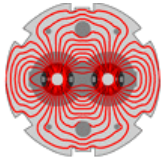


Engineering model



Meshed 1/2 Simulation Model

- Studies have begun with new updated and more accurate mesh model of collimator
- Can only use 1 plane of symmetry so simulations will take some time...
- Calculate the longitudinal modes' heating effect at the worst case for jaw gap=60mm
- Calculate the transverse modes' kick at the worst case for jaws with gap=2mm.

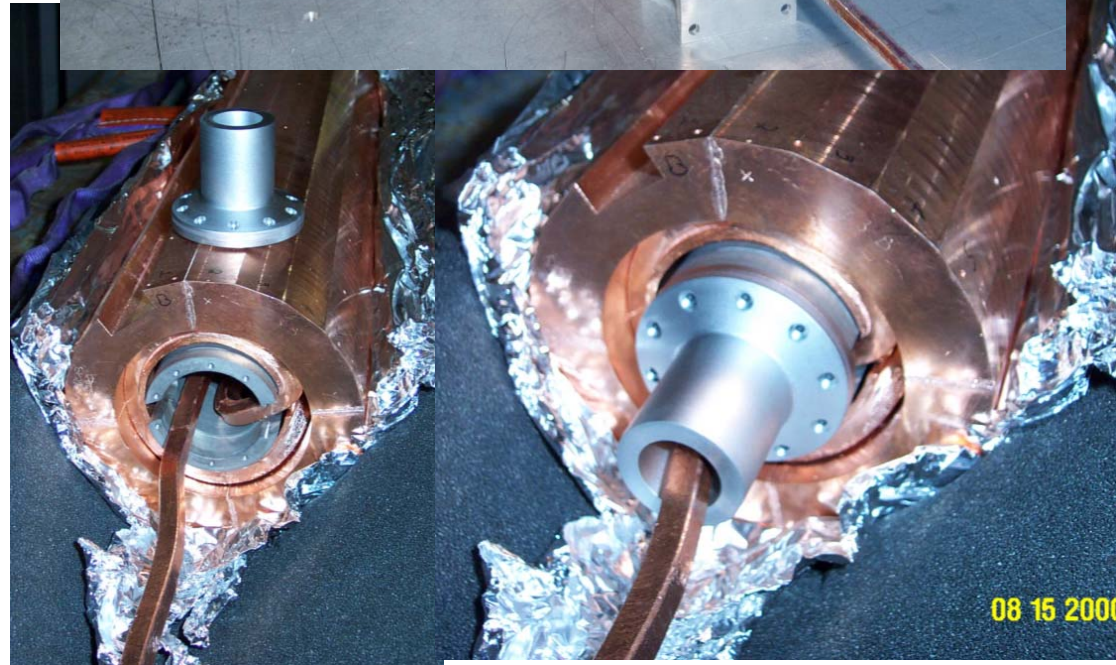
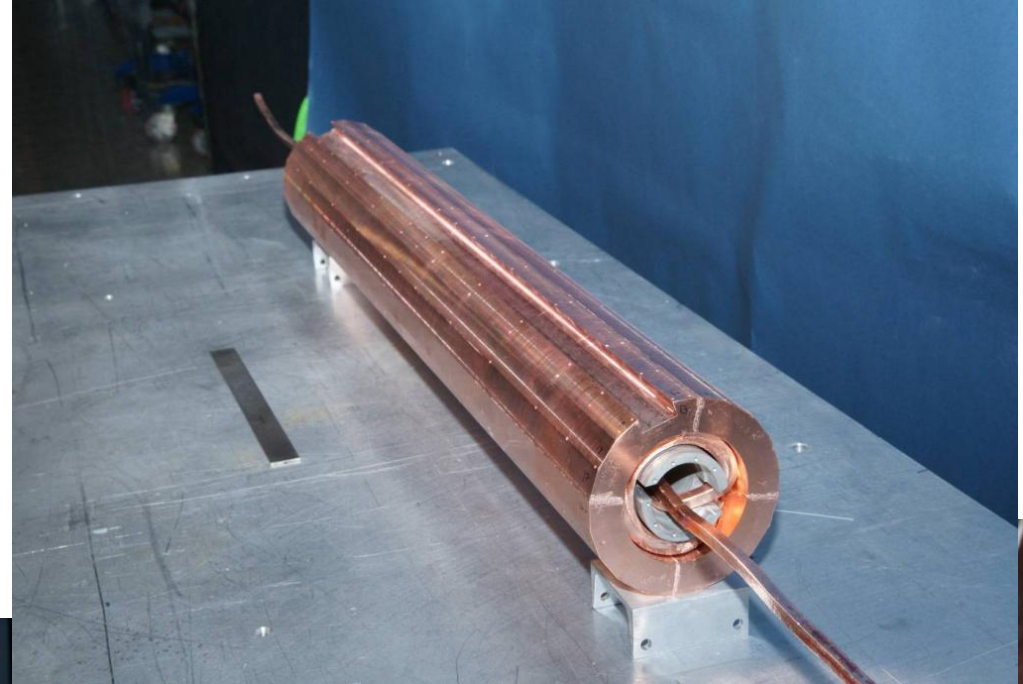


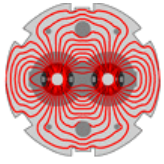
LARP

First Jaw (RC0) Preparation

First prototype jaw from thermal tests last year is being modified for installation in SPS Prototype.

- Two Moly half-shafts and half-hubs
 - modifications required at ends to mount to current stainless jaw supports
- OFE copper jaw material, with 20 facets
 - Groove cut in one facet for heater blocks
 - brazed from 16 ¼-round blocks
 - Facet surface finish and flatness “good” < 25 microns, but expect even better in next iterations



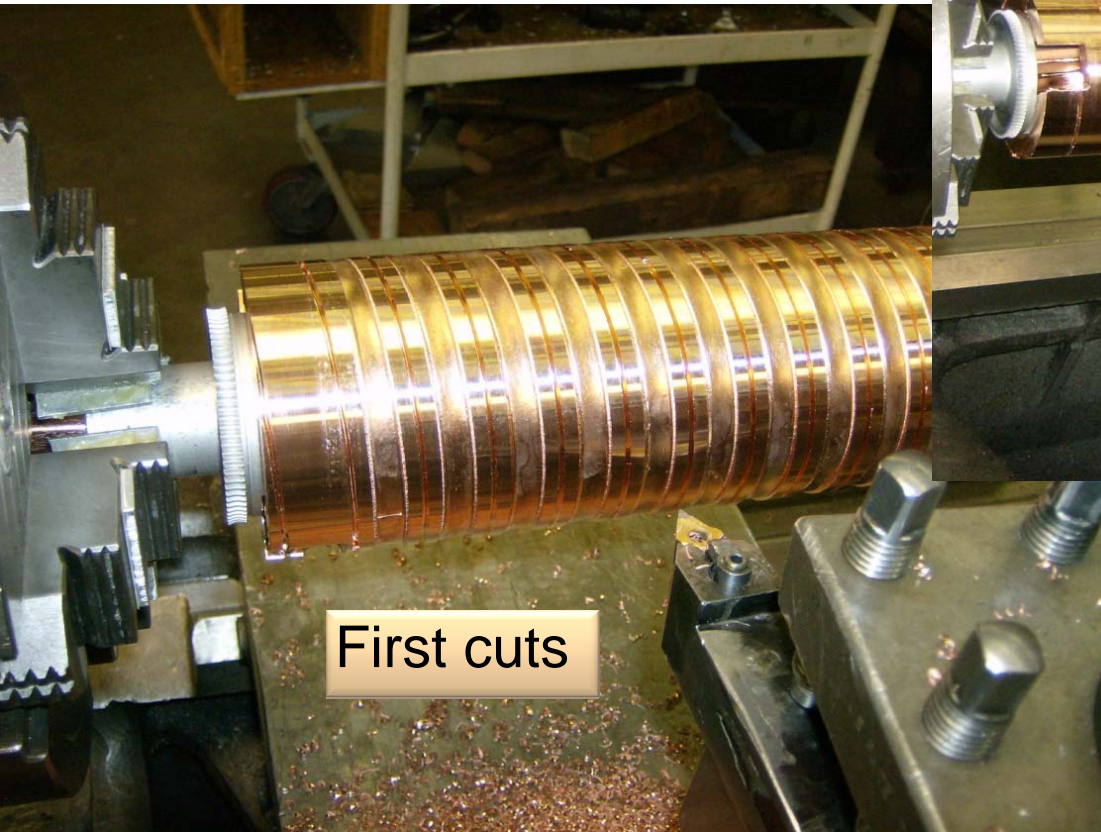
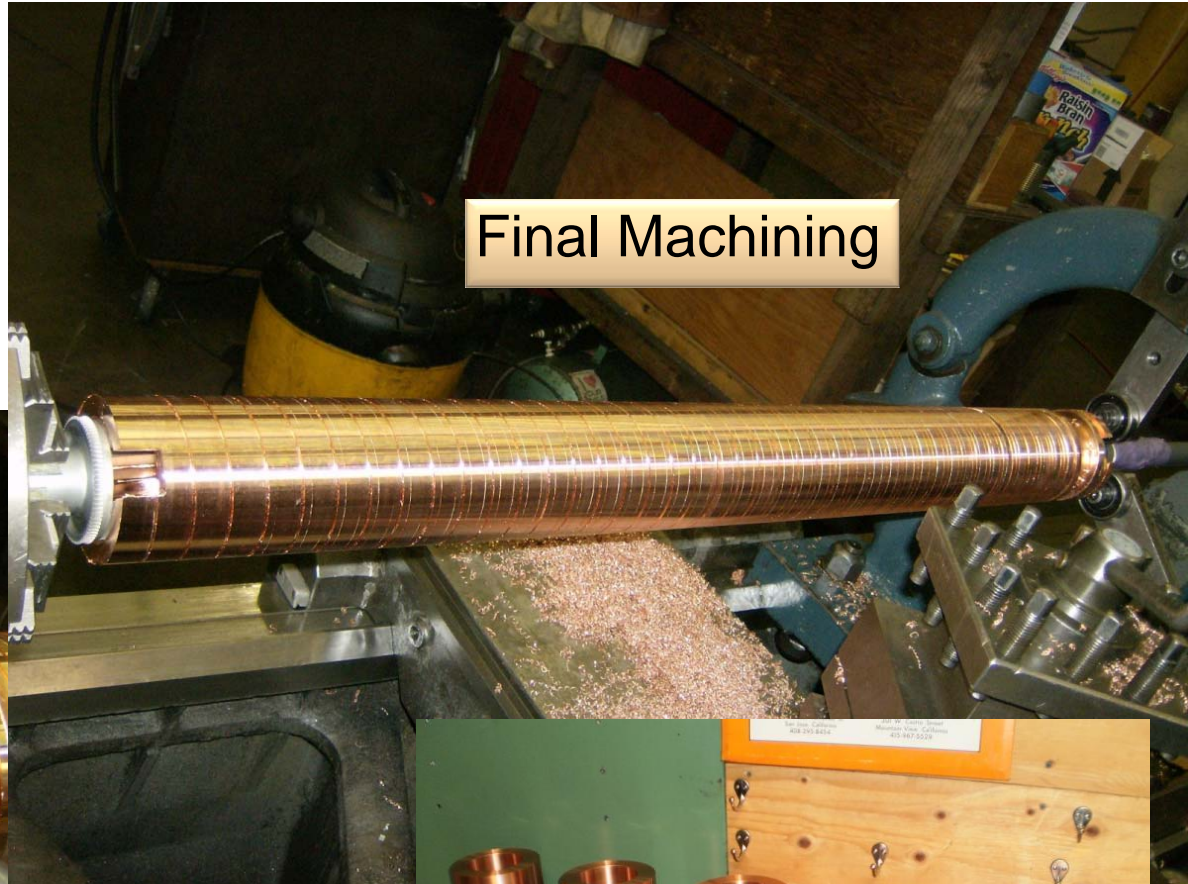


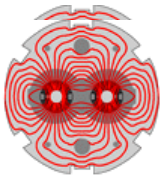
LARP

Final Mandrel Machining



Mandrel ready for jaw surface cylinders for final brazing which will happen very soon





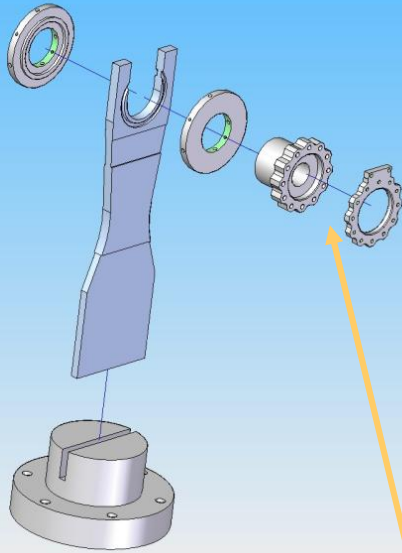
LARP

End Supports/hardware completed



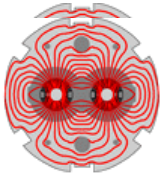
A-286 SST Supports for 2 Jaws

Concept view of “appropriately” flexible Support shown with Shaft mounting hardware



Ceramic bearings roll in “V” groove created by the 2 45 degree chamfers on these parts

Cooling tube exits here

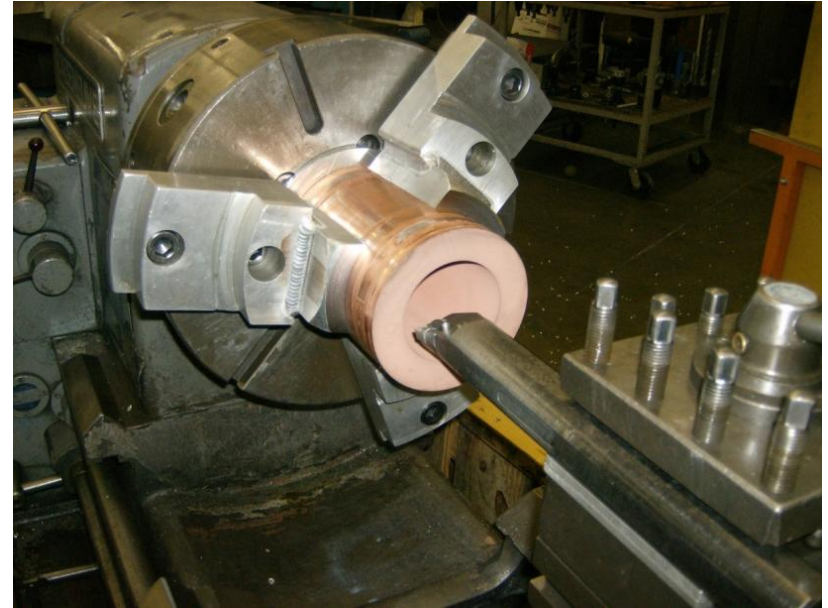


LARP

More Parts are real!



Rotator parts and shaft hardware



5 Jaw Cylinders final machining

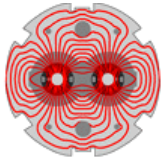




Other Recent Progress



- Vacuum chamber and base plate drawings finished and parts out for fabrication and/or ordered
- First Jaw (RC-0) undergoing final machining to be ready for insertion in full device
- Second Jaw (RC-1) mandrel finished, Jaw cylinders being plated and prepared for brazing
- Documentation:
 - Traveler Documents to be delivered with collimator are being assembled, will describe in details all aspects of device
 - Acceptance Sheet draft created
 - QC and tests to be performed by SLAC and CERN
 - Interface Document draft created
 - Specifies what will be provided by SLAC and CERN for installation in SPS

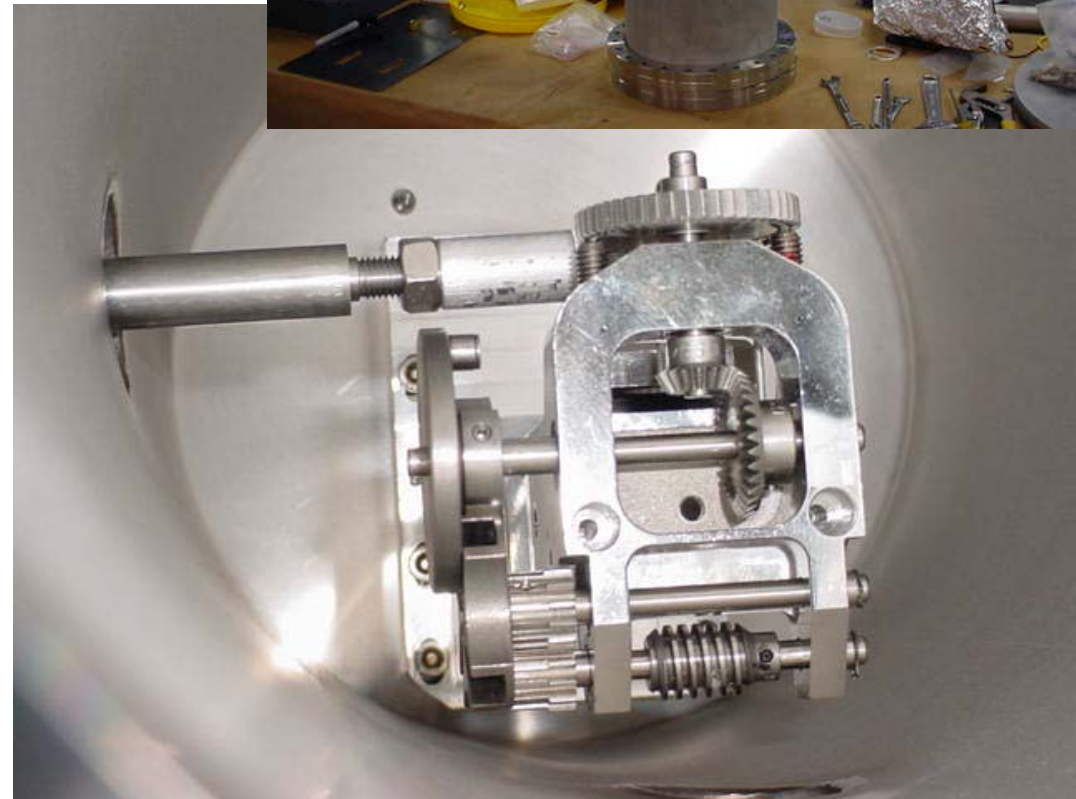


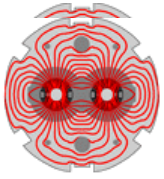
LARP

Long term durability of Rotation Mechanism



- Test Rotation Mechanism in vacuum and bake-out
- Will anything lock up after heat cycle?
- Run for long time, 20,000 cycles to confirm mechanism performs in vacuum





LARP

Strategy for Prototype Tests



- Current plan:
 - Full mechanical prototype with BPMs tested in SPS
 - After off-beamline mechanical, RF & vacuum tests at SLAC & CERN
 - Goals of SPS test:
 - Demonstrate mechanical operation of device in an active machine environment.
 - Demonstrate ability to align jaws with BPMs
 - Measure impedance characteristics of full device, both broad-band and trapped modes.
 - A robustness test to study damage due to direct beam hit
 - TT60 – a beam irradiation facility on an SPS extraction line
 - of:
 - A simple copper block
 - The RC-SPS device
 - No LHC prototype test although a 3rd generation RC may be constructed



TT60 Installation Schedule and Beyond...



- TT60 HiRadMat test facility installation expected Q3 2011
 - Current intention is to use the same prototype as in SPS
 - Plan is to begin with a simple copper block test
 - Hit a copper block ~ 1m long and see what happens
 - Adjust RC prototype tests accordingly
- No LHC Prototype test planned
 - It is assumed SPS and TT60 tests will fully demonstrate RC performance
- Technology choice for Phase II collimation some time after TT60 tests