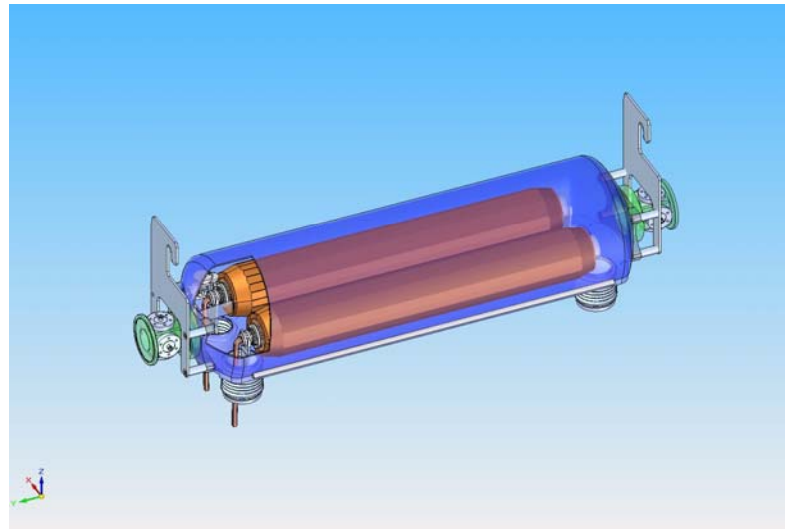


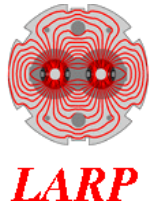
DRAFT

LARP Phase II Secondary Collimator RC-1

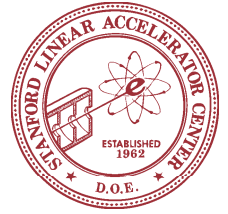
Collimator Development Status and Outlook

Revised 09/21/09

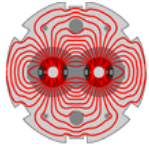




Outline

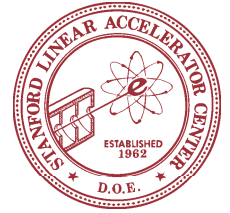


- Strategy for Prototype Tests
- Overview of SLAC design
- Fabrication update
- Outlook



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Strategy for Prototype Tests



Original Plan

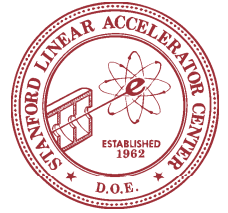
- Full mechanical prototype “robustness tested” in TT60
- Final version prototype incorporating “lessons learned” in LHC

Current plan

- Full mechanical prototype with BPMs tested in SPS
 - After off-beamline mechanical, RF & vacuum tests at SLAC & CERN
- A robustness test, either in
 - TT60
 - An “ad-hoc” site to-be-determined if TT60 availability too late relative to a future decision on the desired timeline for technology choices, fabrication and installation
 - of either:
 - The RC-SPS device
 - An “ad-hoc” device: details yet to be determined
- No LHC prototype test although a 3rd generation RC may be constructed



Mechanical Engineering Decisions Based on Desired Strategy

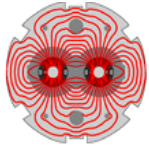


If TT60 Test first:

- Vacuum tank
 - cylinder with domed ends attached with conflat flanges for easy access for later examination of beam-induced damage
 - ports for laser micrometers, cameras and TBD instrumentation
 - high vacuum not important
- Use RC0 jaw & RC1 jaw as quickest, most economical path forward
 - New jaws, new tank for an LHC prototype

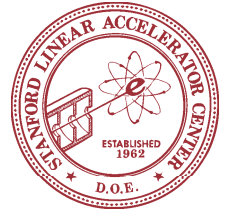
For SPS Test first

- Shorter domes welded to main tank transitioning to 2-axis BPM assemblies
 - Flange-to-flange length same as for LHC
 - BPM strategy being discussed with experts in a separate loop
- Main tank diameter sized for SPS 60mm jaw opening
- BPM flanges currently seen as ROUND with 60mm ID
- Orientation of jaws and aperture requirements needed now to proceed
 - 60mm x 80mm has been mentioned as a possible requirement



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Consequences



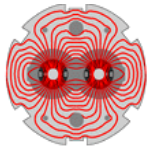
If SPS device used for TT60-like test

- need to be able to handle device after exposure to SPS beam
- tests need to be sequential
- must build in enough diagnostic capability to SPS device now
- must buy in to grinding off tank from base plate to gain access to jaws for eventual examination after TT60 cooldown

If a separate TT60 device is called for

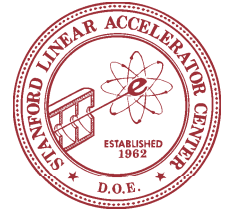
- Is this a simple “burn copper” test or are final-design jaws and supports required?
- If final-design jaws required need to know asap to begin fabrication of two more jaws
 - would still make sense to use RC0 as the “witness” jaw to that being hit by the TT60 beam and build a second “RC1” style jaw for the SPS test device

Ideally would like to reserve “spare materials” for a final lessons-learned third generation design that might include a simplified (non-molybdenum) support scheme

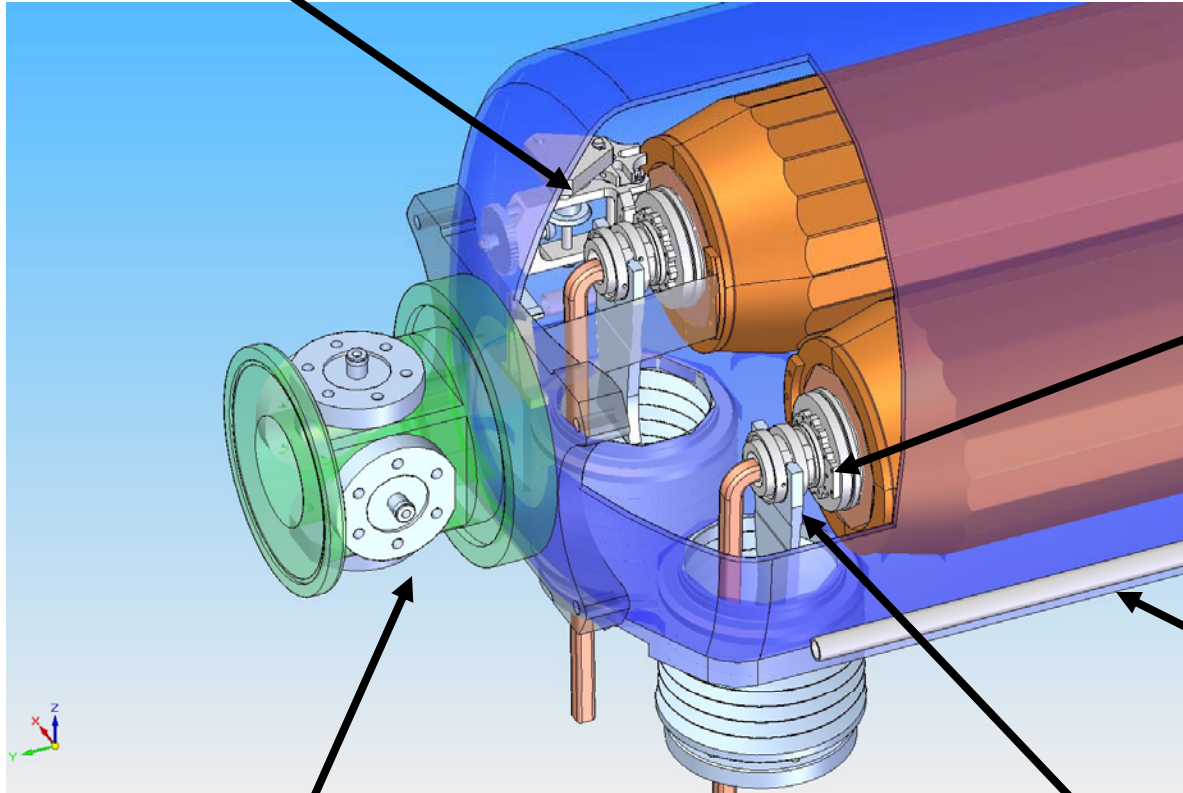


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SLAC design details



Ratchet Gear Drive



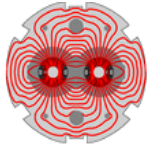
Ratchet Drive
mounts here as well

External Cooling
circuits

End Support

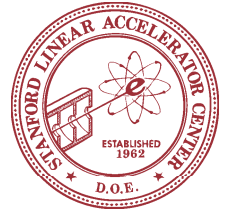
BPM assemblies at each end
are fiducialized to Collimator
2 or 4 buttons of LHC IR7 Style

Tank geometry allows a 60mm
facet-to-facet gap in fully retracted
Jaw position



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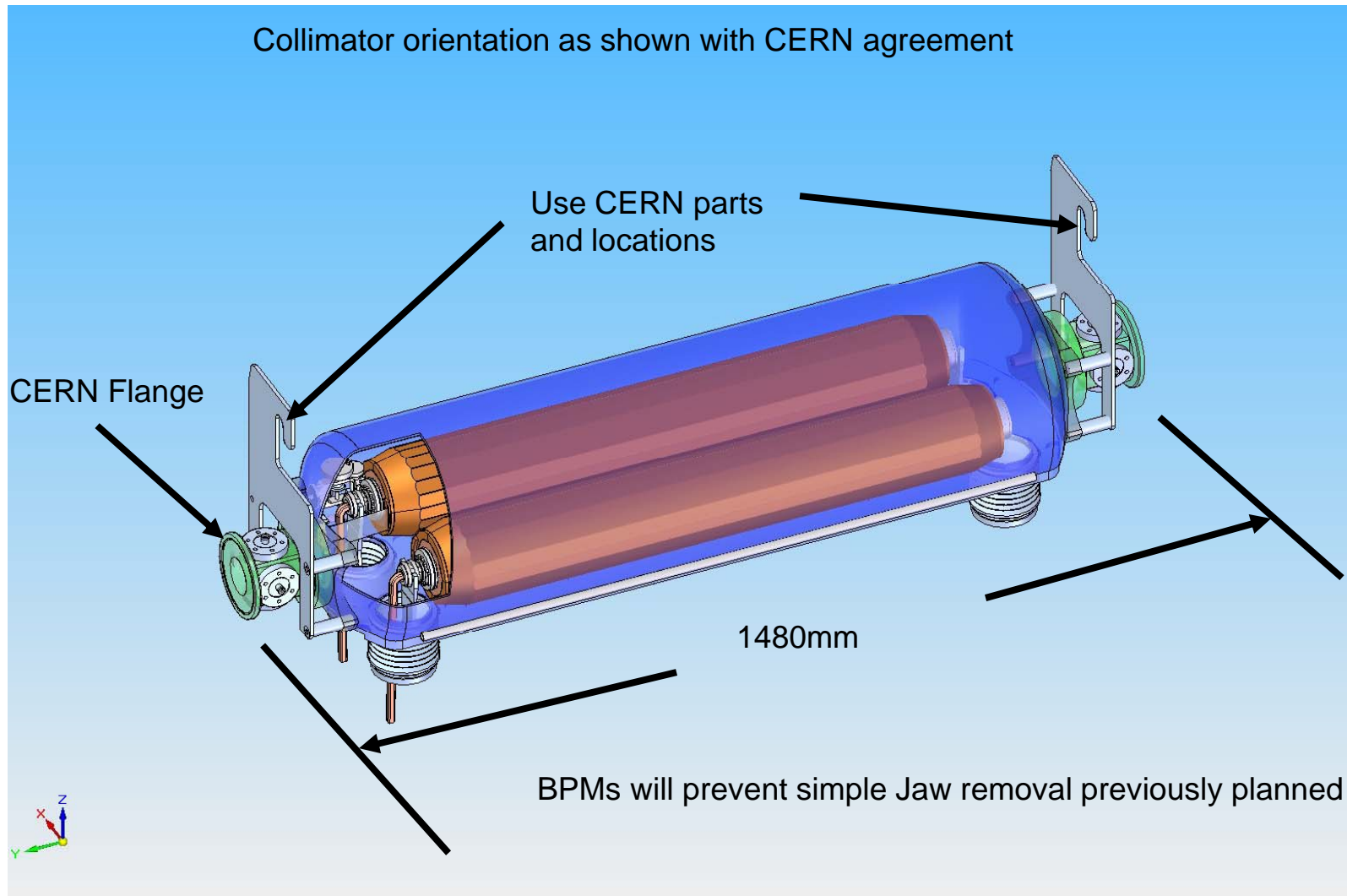
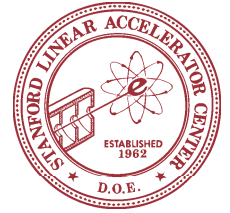
Design Details

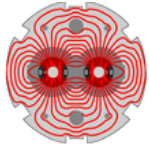


- BPMs planned for each end of Tank
 - CERN Button Feedthroughs (LHCBPM_F0023) could be used and standard LHC BPM processing electronics can be used.
 - Fiducialization with jaw surfaces should not be a problem
 - Aperture could limit test/establish Jaw orientation.
 - If needed we could provide ~84mm x 60.5 aperture
 - But.. need to know soon.
- Two jaws: The original Heater Test Jaw and a new Prototype Jaw (now under construction)
- Maximum Jaw separation increased to 60mm
- Ferrites for HOM damping
 - Simulations in progress to define ferrite details, previous studies suggest HOM damping will be needed
 - Verify with bench testing @SLAC
 - Ferrites could be added on base plate under Jaw then a re-test done



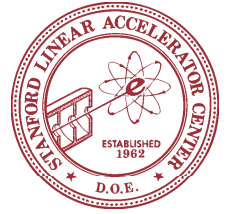
SPS (not TT60) Test config.



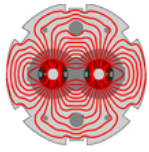


LARP

Materials and Parts Already In-House (or nearly so)

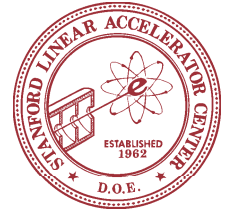


- “RC-0” jaw used for EPAC’08 thermal tests with resistive heater
 - Two Moly half-shafts and half-hubs
 - modifications required at ends to mount to current stainless jaw supports
 - OFE copper jaw material, with 20 facets
 - Groove cut in one facet for heater blocks
 - brazed from 16 ¼-round blocks
 - Facet surface finish and flatness “good”, but expect better in next iterations
- “RC-1” jaw in fabrication (see later slides and photos)
 - One piece shaft assembly
 - Jaws from 5 fully-round Glidcop cylinders
- Two more grooved OFE Copper mandrels identical to that used in RC-1
- Enough raw Glidcop material to make two more full length jaws



LARP

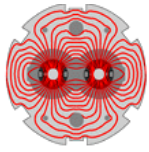
Mandrel Machining and Winding completed



Wound 1 Mandrel

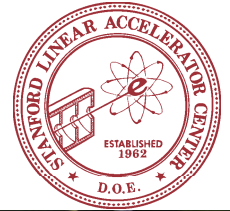
Machined 3 Mandrels





LARP

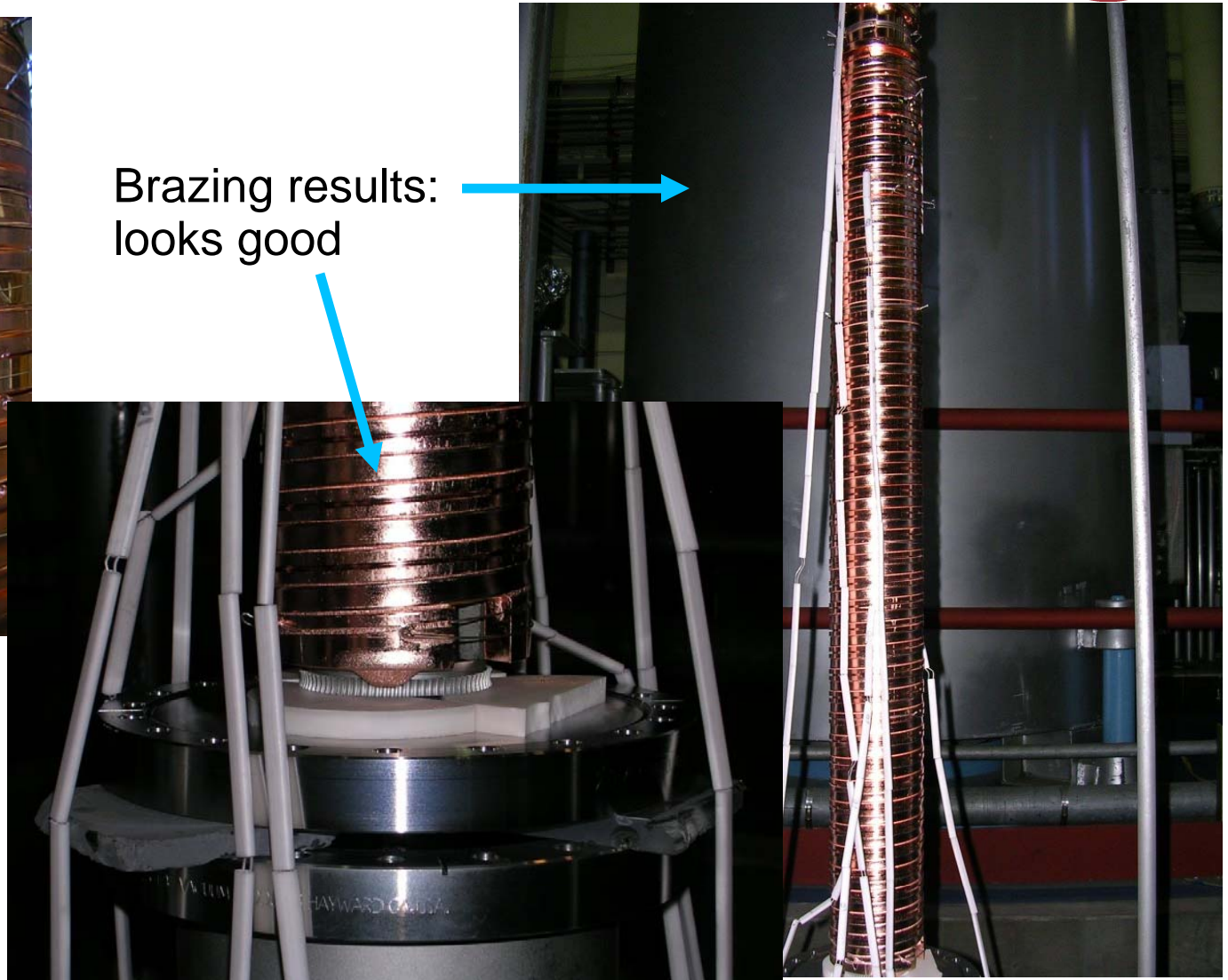
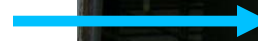
Cooling tube to Mandrel braze completed

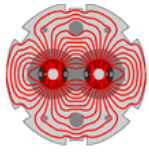


Braze prep.



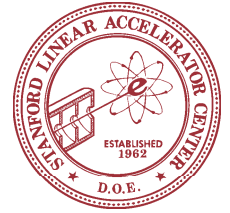
Brazing results:
looks good





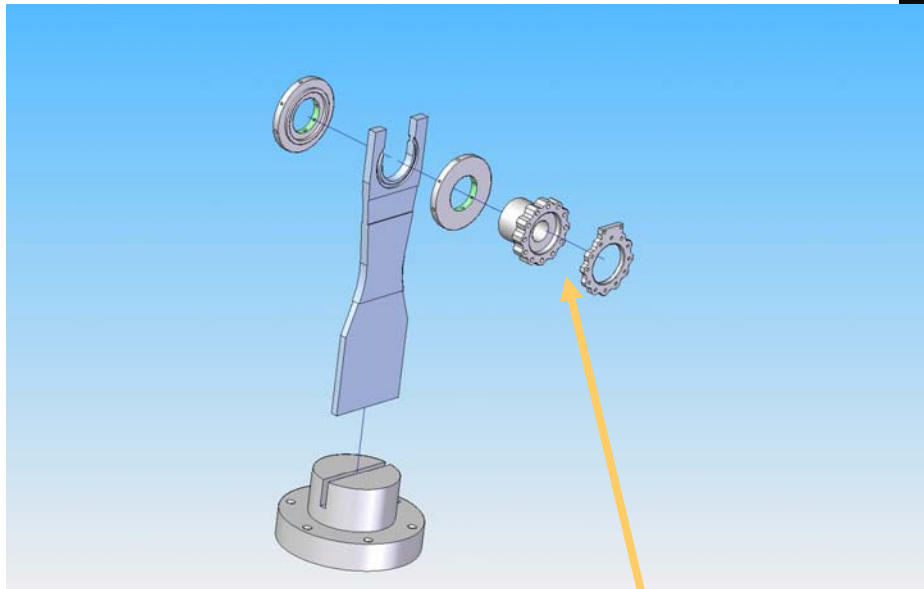
LARP

End Supports/hardware completed



A-286 SST Supports for 2 Jaws

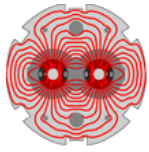
Concept view of “appropriately” flexible Support shown with Shaft mounting hardware



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

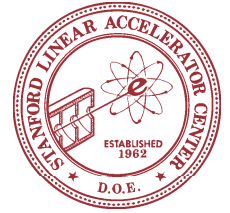


Cooling tube exits here

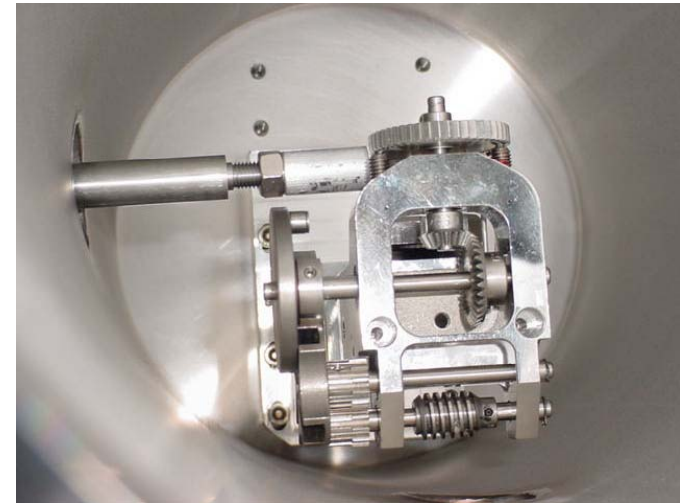


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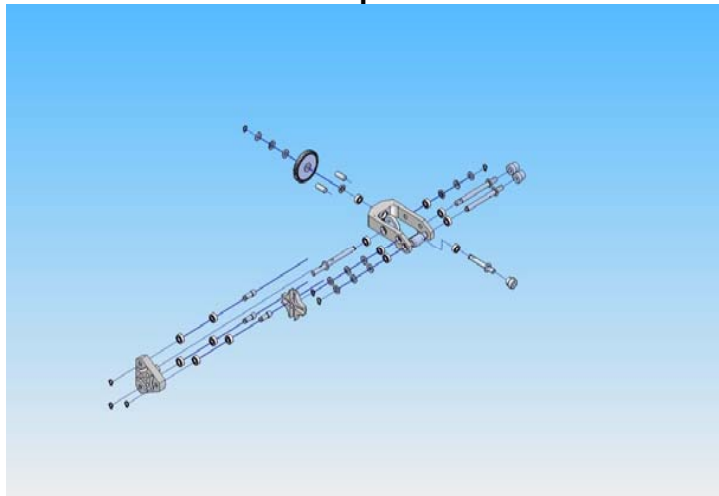
More Parts are real!



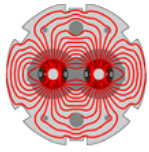
Actual Rotator parts now exist



Rotator life cycle test to begin soon

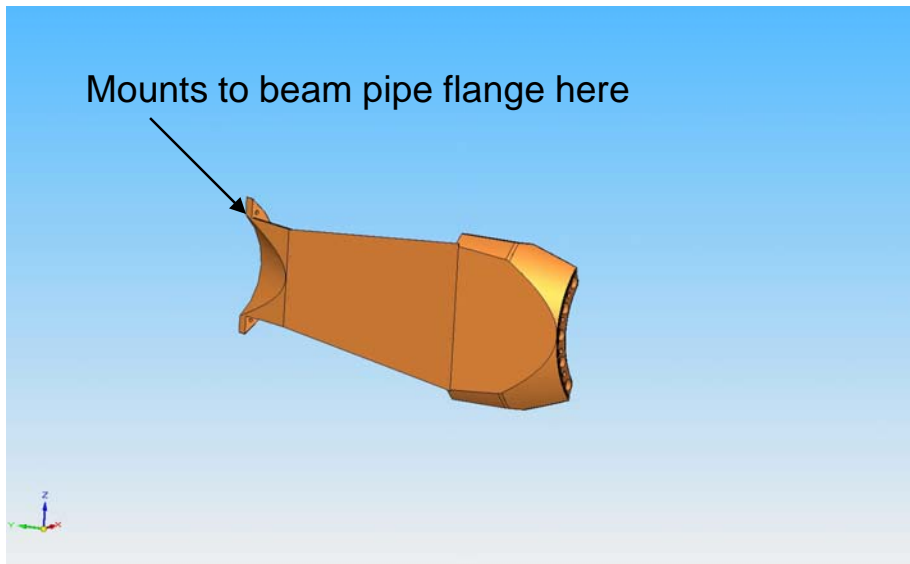
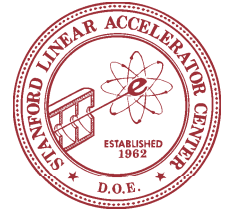


5 Jaw Cylinders are rougher out



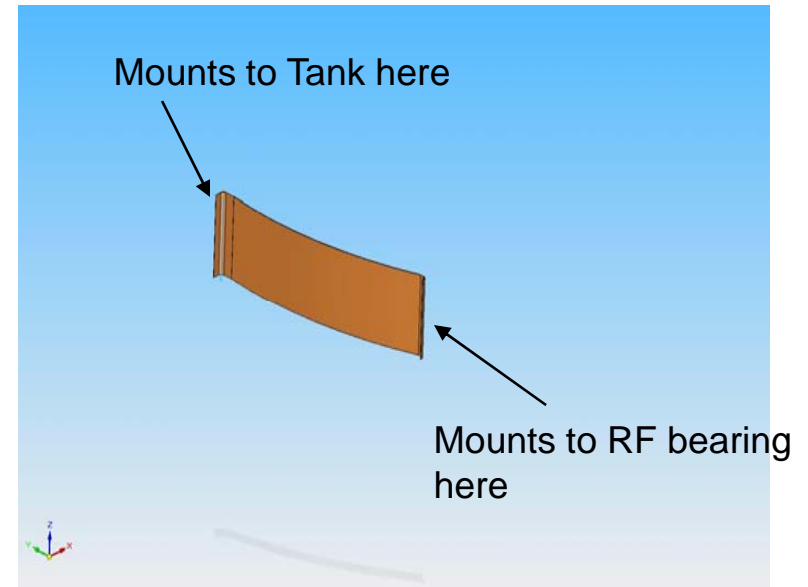
LARP

Image Current Foil Assembly simplified



Cone extended the foil to beam pipe flange

**Height needed to shadow the Gear Drive
on top of Jaw End Support**



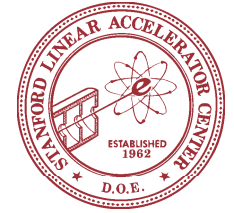
**Cone deleted (foil deemed far
enough from beam to show
little effect)**

**Moved Rotator from top of Support
so foil height could be minimized**

No Brazing Required!



Current housing concept for BPMs

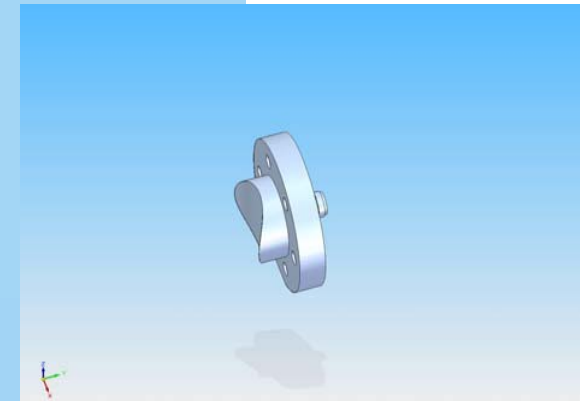
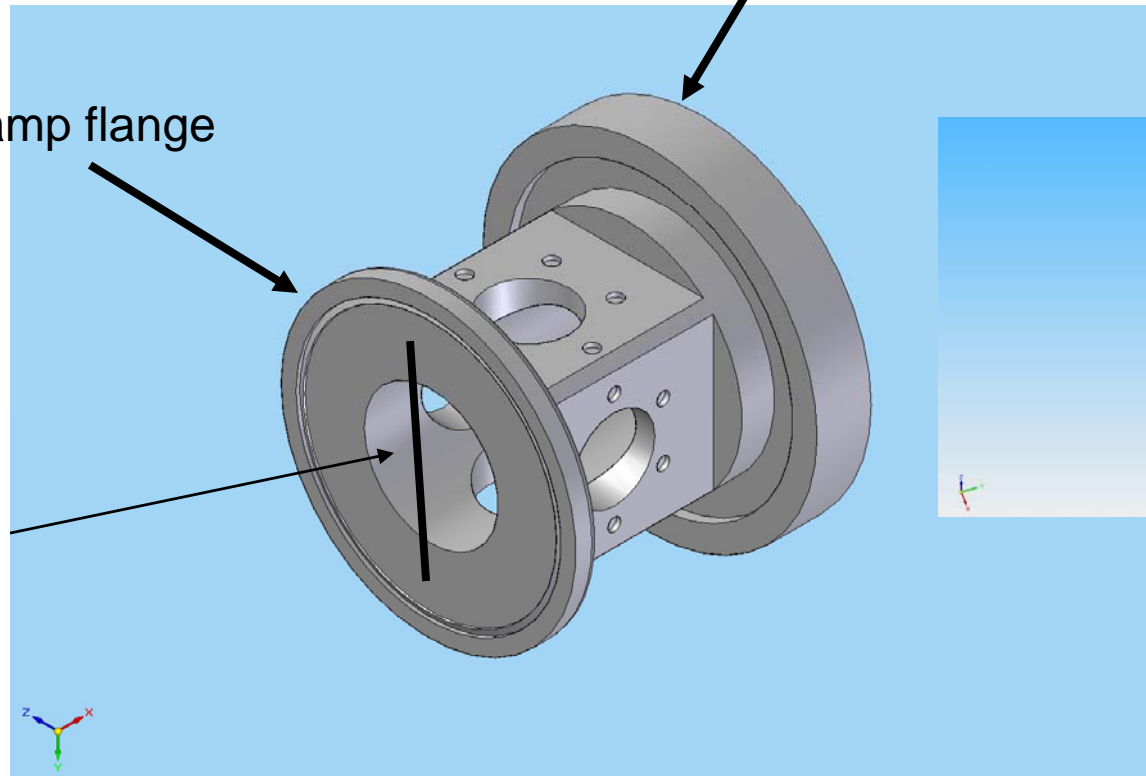


BPM target resolution is 25 microns with Jaw to BPM fiducialization on the order of a few microns

DN 150 Rotatable CF flange allows for BPM alignment with Jaw

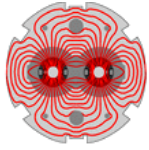
DN 100 Chain clamp flange

Increase this dim. if needed and eliminate 2 BPM buttons



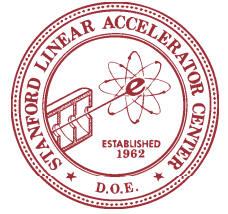
LHC IR7 Button

Current plans are for 60.5mm diameter geometry for saddle-cut BPM buttons
Could reconfigure housing for 2 rather than 4 buttons to increase inside dimension shown



LARP

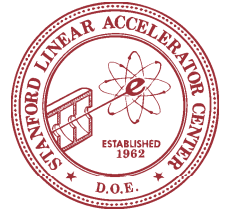
SPS Test Plan Goals



- 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.
 - Similar to phase I graphite SPS tests



Outlook



- Project Milestones are being established to guide completion of Prototype Collimator for late 2010 SPS Installation
 - Collimator set is planned for preliminary SLAC testing starting January 2010
 - Shipment to CERN by August 2010
- Key steps requiring careful coordination to complete first MS are:
 - Machining of Brazed Mandrel (started last week)
 - Brazing on the Glidcop Jaws (due back at SLAC mid October)
 - Final Facet machining (at same vendor, later)