2012 USLARP/CERN meeting

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Purpose of this Meeting

- Update CERN management on LARP activities.
- Get feedback about priorities for the future.
- Discuss likely US role in large projects
  - Nb_3Sn quadrupoles
  - Crab Cavities
  - High Bandwidth Feedback in SPS
  - ???

I would like this meeting to be used primarily for discussion, so we'll keep formal presentations to a minimum.

Updates Since Last Meeting

- According to the wishes of both CERN and the DOE, much LARP activity has been integrated into the HL-LHC design study
  - Many LARP activities now mapped to packages and milestones within HL-LHC
  - Two annual LARP meetings have now been replaced with two joint meetings, one in the US and one in Europe
    - First meeting, 11/2011 at CERN
    - Next meeting, 5/2012 at FNAL
    - Following meeting, 11/2012 (at INFN?).

General Vision for US Participation in Upgrades

- I'll avoid discussing specifics of the budget (because no one knows them), but the key features of DOE planning are as follows:
  - The DOE is committed to the US playing a significant role in the detector and accelerator upgrades for LS2 and LS3.
  - To this end, they support the integration of LARP into the HL-LHC design study.
  - The total budget for the accelerator effort will "increase" over the next few years:
    - This will most likely be divided between
      - A substantial part of quadrupole construction project.
      - A reduced LARP which will continue to do accelerator R&D, small projects, and support personnel at CERN.
    - Very important to prioritize!

LARP Magnet Program -> Magnet Project

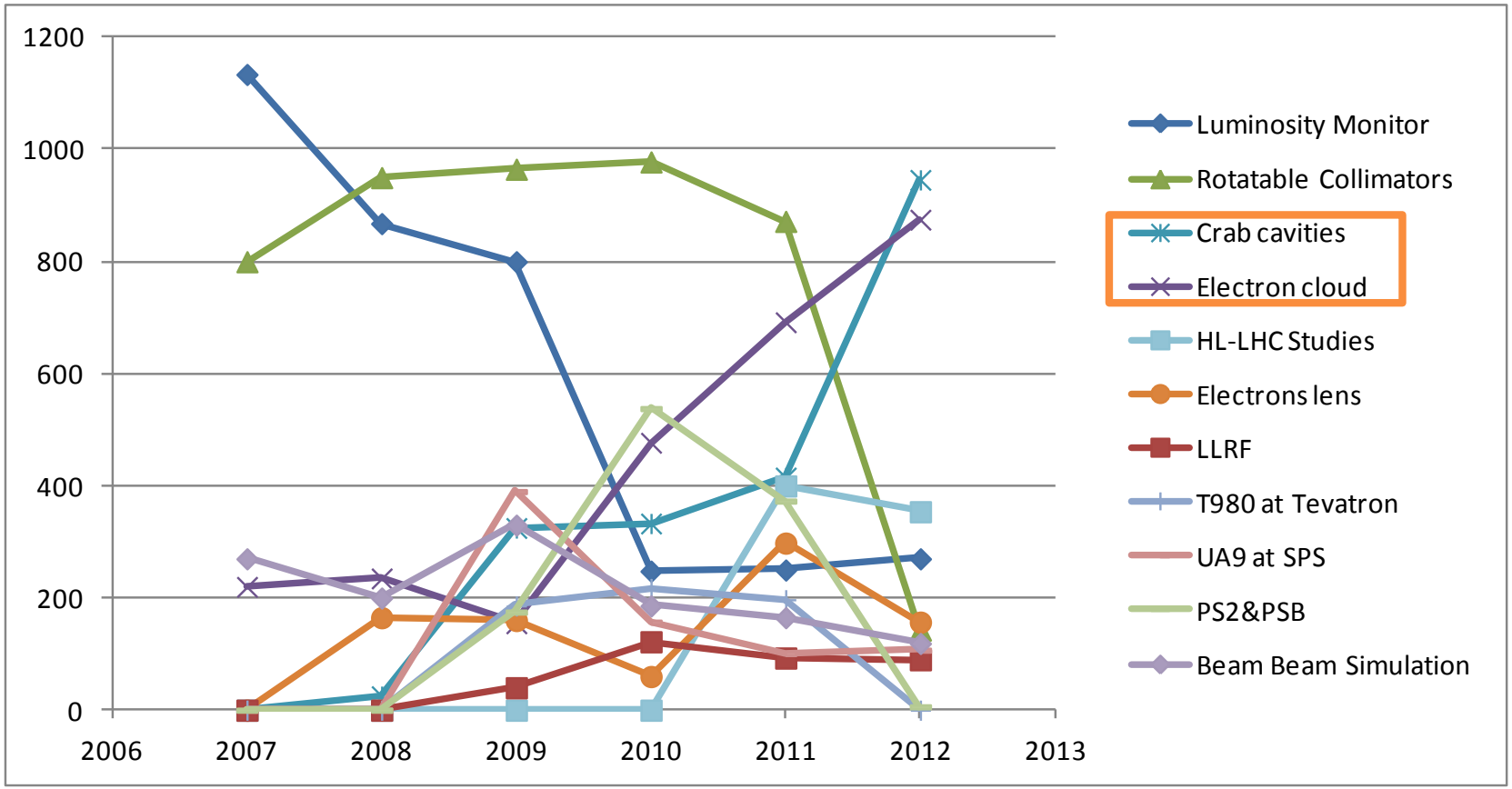
- The LARP magnet program will officially end with “LHQ”
  - 120 mm aperture
  - 4 m long
  - ~2014
- It has been agreed that this will “establish the viability of the technology”
- If 120 mm aperture is chosen for the upgrade
  - We could proceed to a full prototype based on this design
  - The US could build at least a large fraction of the cold masses for the LS3 upgrade
- If a larger aperture is chosen
  - ~two year overall delay
  - The US would likely concentrate on the new round of demonstration magnets which would be required.
  - Participation in the production effort could be limited.

Discussions Regarding Magnet Program

- What is the latest official (earliest) date for the LS3 shutdown?
  - 2021 is starting to look unlikely
  - Can we start saying 2022 at the earliest?
- What is the time line *and process* for making the decision regarding aperture?
  - Learned something about this yesterday.
- What is the model for US/CERN collaboration on the magnet production?

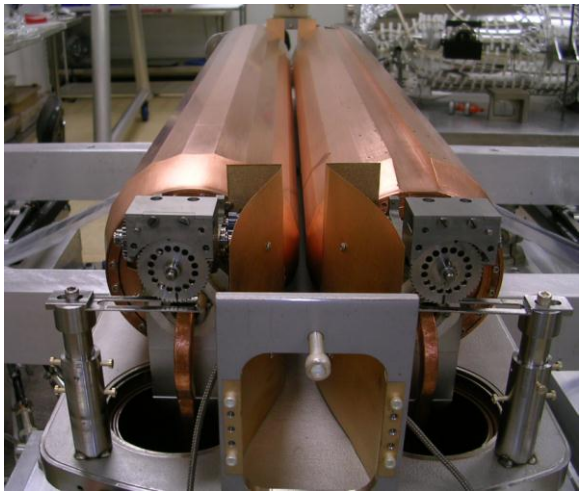
"The Rest": Evolving Priorities in Accelerator Systems

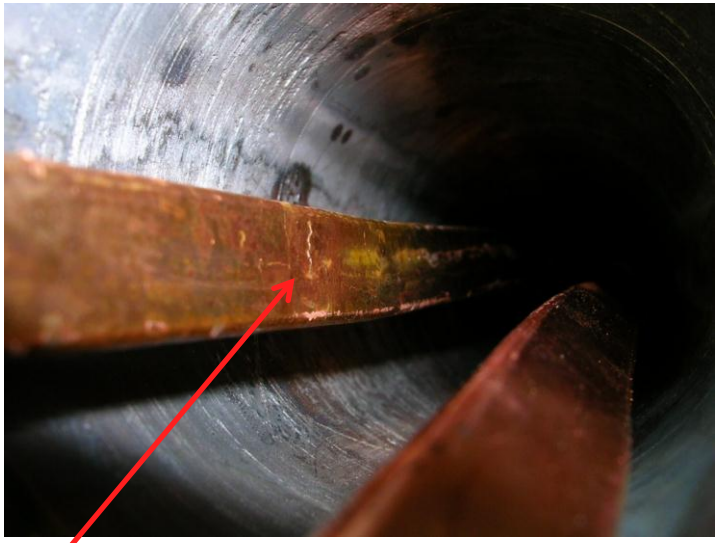
- Top funded in FY12
  - Crab cavities
  - "Ecloud", primarily in support of R&D into SPS feedback



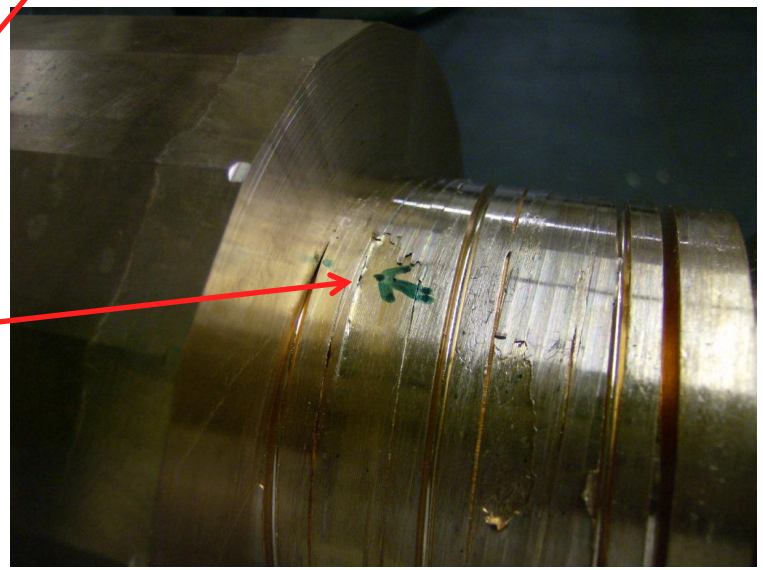
* SUBSTANTIAL un-billed Labor from, especially, Fermilab NOT included

Update on Rotatable Collimators



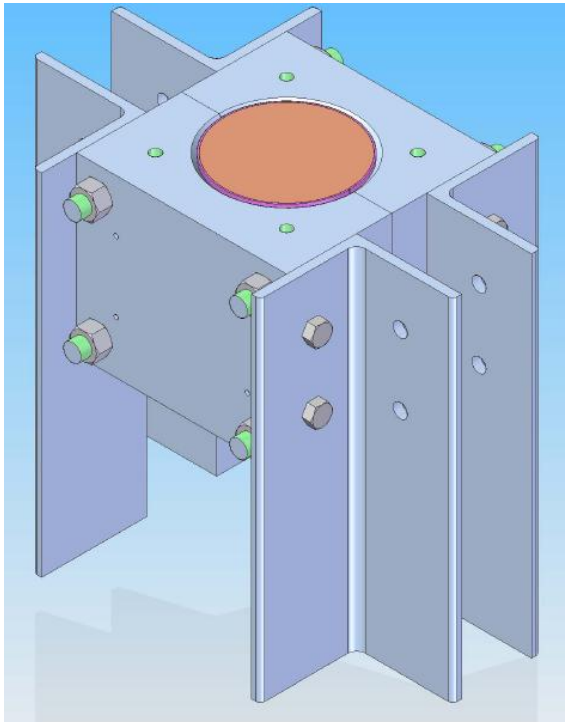


- During the final stages of preparation for the CERN test, it was discovered that the cooling channels in both jaws had catastrophic leaks.
  - One likely due to stress of repeated heating of substandard Copper
  - One due to error in fabrication procedure (thinning)



Remediation

- We discussed whether to cap cooling lines and perform tests at CERN
  - Rejected as not useful by CERN collimation group
- Currently fabricating two new jaws, using new technique to avoid thinning problem
  - Miscellaneous mechanical improvements as well
- Plan to deliver to CERN this summer for beam tests, followed by destructive tests in HiRadMat



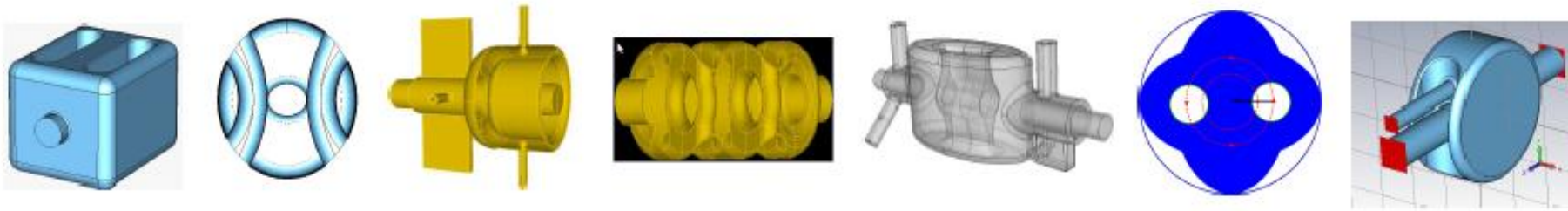
Collimator Discussion

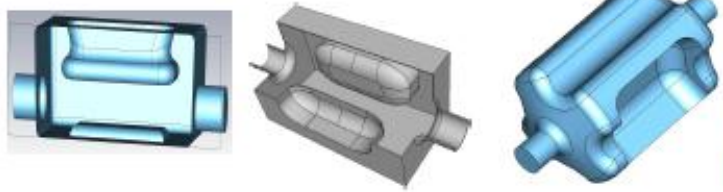
- What is the future of these collimators, assuming they pass the test?

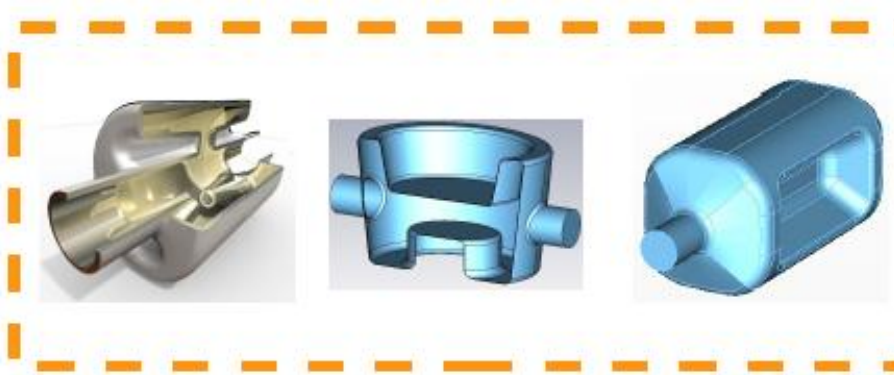
Crab Cavities

- Recall
  - The HL-LHC design study has tentatively endorsed crab cavities as the best way to achieve the highest integrated luminosity in the HiLumi upgrade
    - Base line approach: local crabbing scheme based on “compact” (read “exotic”) 400 MHz cavities.
    - Back up plan: global scheme based on 800 MHz elliptical cavities (IR4?).
- Significant progress has been made in narrowing the range of viable designs

Progress in Crab Cavity Design*







~4yr of design evolution

Exciting development of new concepts
(BNL, CERN, CI-DL-LU, FNAL, KEK, ODU/JLAB, SLAC)

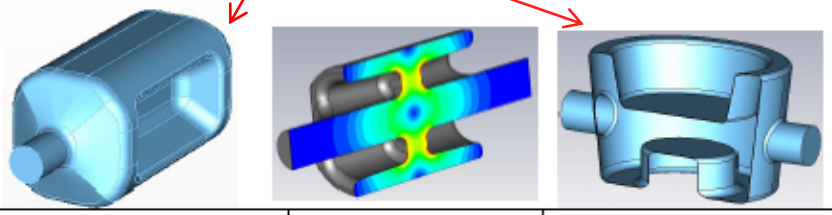
*R. Calaga, Chamonix 2012

Remaining Designs*

Performance Chart

Kick Voltage: 3 MV, 400 MHz

LARP



		Double Ridge (ODU-SLAC)	4-Rod (UK)	¼ Wave (BNL)
Geometrical	Cavity Radius [mm]	**147.5**	**143/118**	**142/122**
	Cavity length [mm]	597	500	380
	Beam Pipe [mm]	84	84	84
RF	Peak E-Field [MV/m]	33	32	47
	Peak B-Field [mT]	56	60.5	71
	R_T/Q [Ω]	287	915	318
	Nearest Mode [MHz]	584	371-378	575

194 mm

B1 B2

< 60 MV/m

< 100 mT

damping more complicated

*R. Calaga, Chamonix 2012

LARP Plans wrt Crab Cavities

- LARP will likely continue support of the crab cavity effort at its current level.
- This should allow us to…
  - Complete simulation and design of the two remain LARP concepts, sufficient to make a down-selection.
  - Fabricate one and run tests in a cryostat
  - Participate in the beam tests in the SPS and/or the LHC.
- Given the projected level of funding, and the prior commitment to the magnet program, it's unlikely that the US will take the lead role in crab cavity production.
  - Of course nothing is impossible.

Discussion Points for Accelerator Systems

- Current priorities
  - Complete rotatable collimator prototype
    - Last “original” activity
  - Support crab cavitity R&D
    - SLAC/ODU design
- There continues to be interest in
  - Studies for an high bandwidth feedback system for the SPS
    - Appears under “E-cloud studies”
  - Crystal collimation
    - LARP activity reduced since Tevatron shut down
  - Hollow electron beams for collimation
- What priority would CERN assign to these activities?

LARP Long Term Visitor Activity

- This year, LARP supported two long term visitors:
  - Chandra Bhatt(FNAL)
    - Long and high intensity bunch studies for LPA option
  - Alexey Burov (FNAL)
    - Studies of various instabilities

LARP Toohig Fellows

- Fellows who left during the year
  - Dariusz Bocian (FNAL)
    - Completed fellowship and took position in Poland
  - Ryoichi Miyamoto (BNL)
    - Completed fellowship and took position at ESS
  - Themis Mastoridis (SLAC)
    - Cut fellowship short to take CERN staff position
- Continuing fellows
  - Simon White (BNL)
    - luminosity measurement, electron lenses
- New fellows
  - Valentina Previtali (FNAL)
    - Hollow electron beams
  - John Cesaratto (SLAC)
    - High bandwidth feedback system
    - IPM?

Discussion: LARP Personnel

- Are LARP visitors at CERN being used effectively?
- Are there more activities were LARP personnel would be useful?

Discussion: Accelerator Physics

- Accelerator physics is one of the areas where LARP can make significant contributions to the LHC
  - This is because much of the scientific effort comes "for free" from the labs (although this is getting a bit tougher)
- Is it CERN's impression that we are using our resources as effectively as we can?
- Are there other areas where we can assist?
  - In particular, can we increase our involvement in support of the optics studies for the upgrade?

Conclusion and Acknowledgements

- We feel that LARP has made and continues to make valuable contributions to the LHC.
- We want to work with CERN to use our (limited) resources as effectively as possible in the future.
- We greatly appreciate the support and recognition that we've gotten from CERN
  - The support letters from CERN to the DOE have been helpful.
  - It doesn't go unnoticed when LARP is mentioned in a CERN talk.
  - As always, we're grateful for the strong support and welcoming environment that CERN provides for our visiting personnel.
- We also want to acknowledge the significant resources that have been provided by the labs outside of direct LARP funding.

ANY OTHER BUSINESS??