

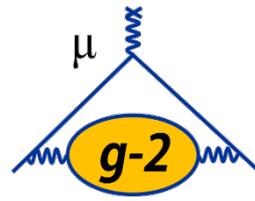
RF matching/RF scraping status and plan

Young-Im Kim

Center for Axion and Precision Physics Research
Institute for Basic Science

November 30, 2016

RF matching concept

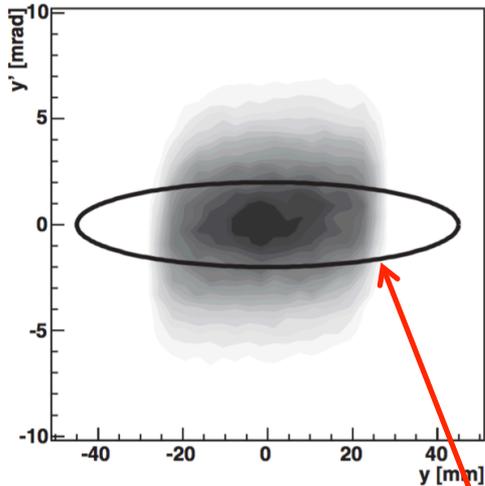


A radio frequency (rf) can be applied to a quad structure:

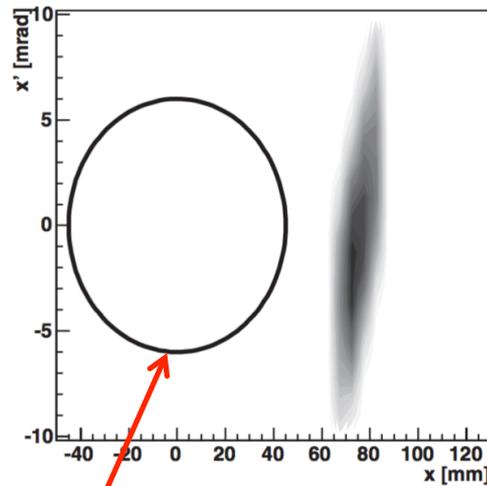
- Match the beam phase space
- Significantly eliminate the double CBO signal
- Create a healthy gap of the beam from the apertures

Inflector exit

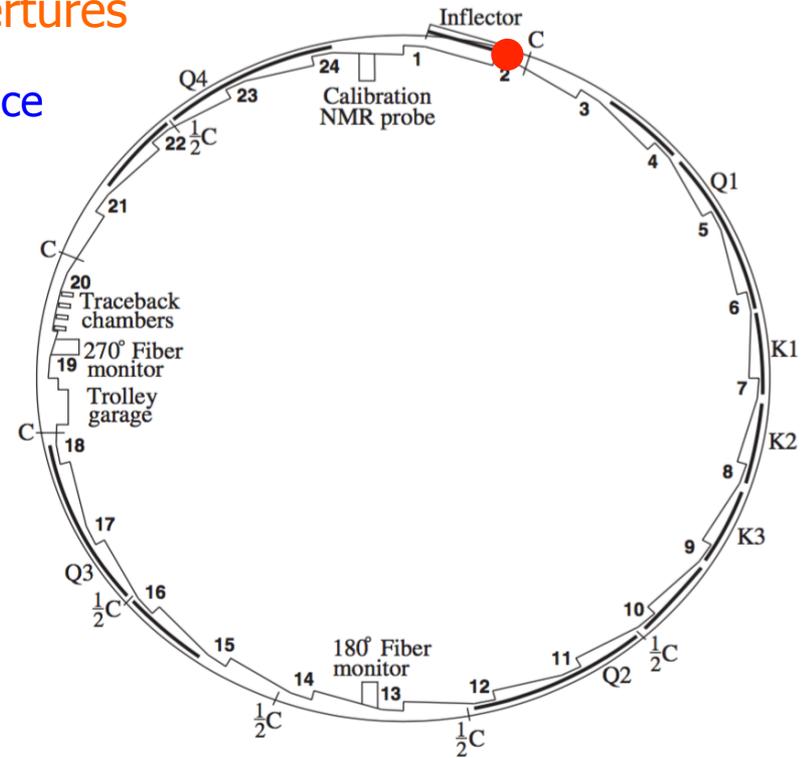
Vertical beam phase space



Horizontal beam phase space

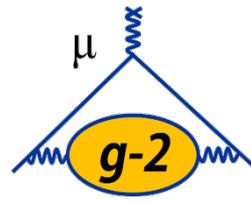


Storage ring acceptance



Physical Review D 73, 072003 (2006)

RF matching concept

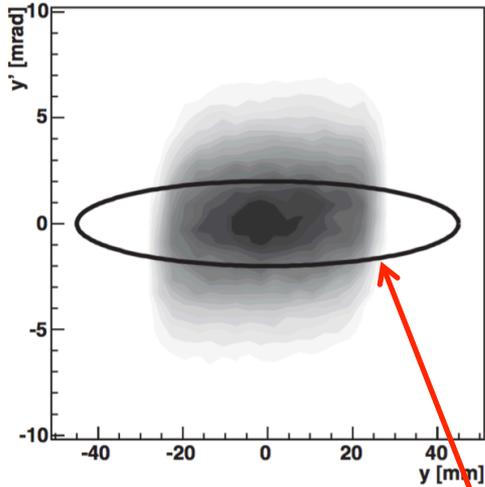


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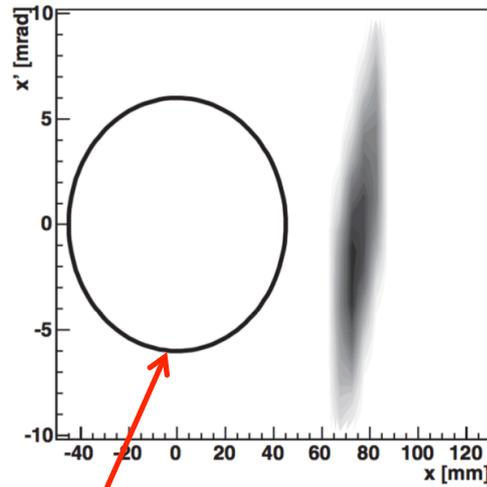
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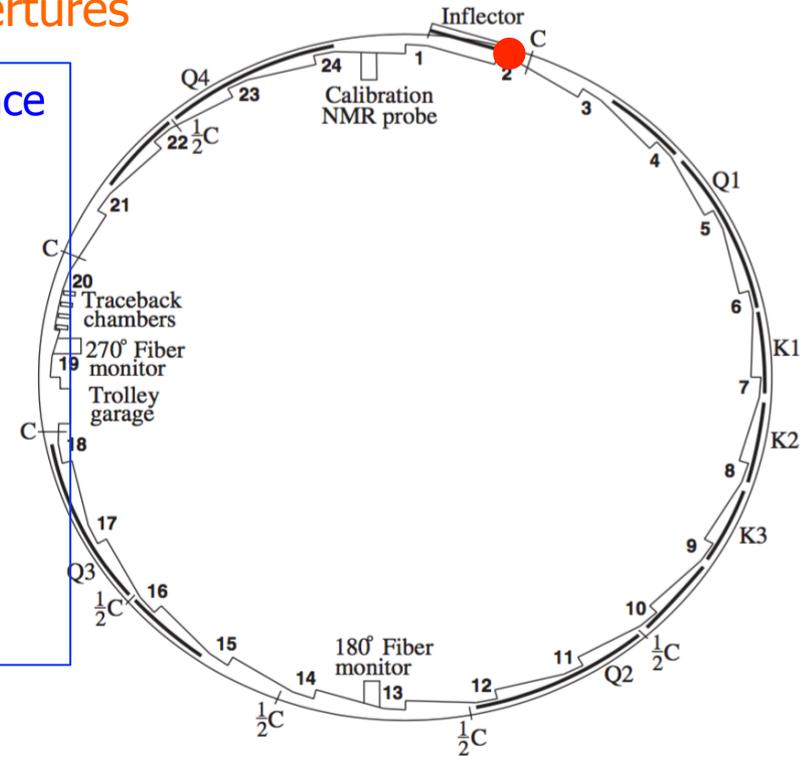
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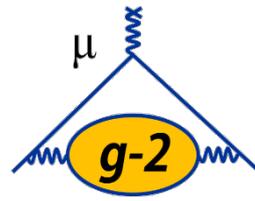


Storage ring acceptance



Physical Review D 73, 072003 (2006)

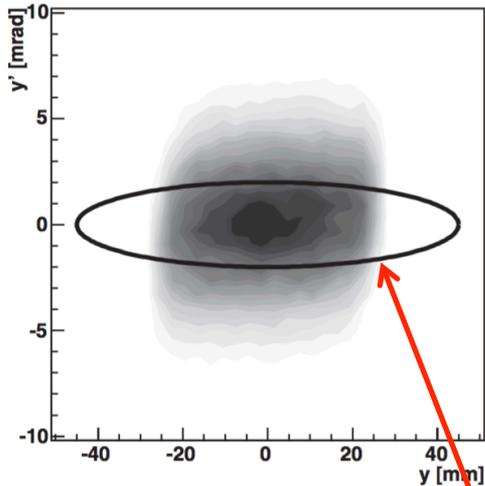
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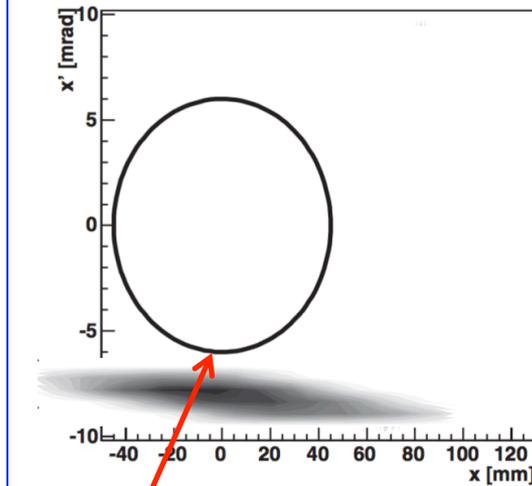
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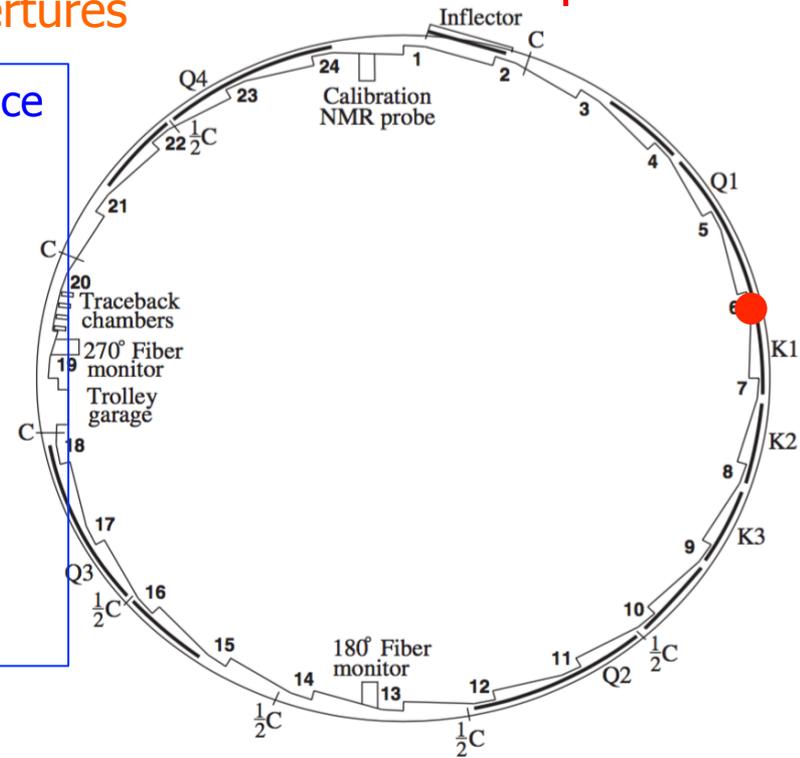


Horizontal beam phase space



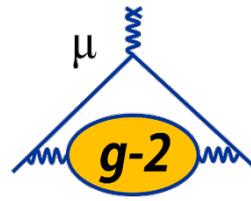
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After one quarter turn



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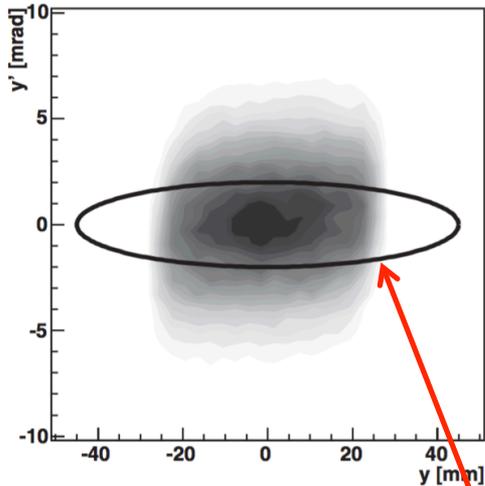
RF matching concept



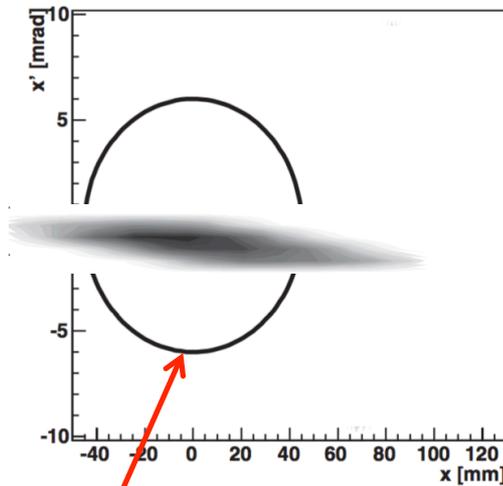
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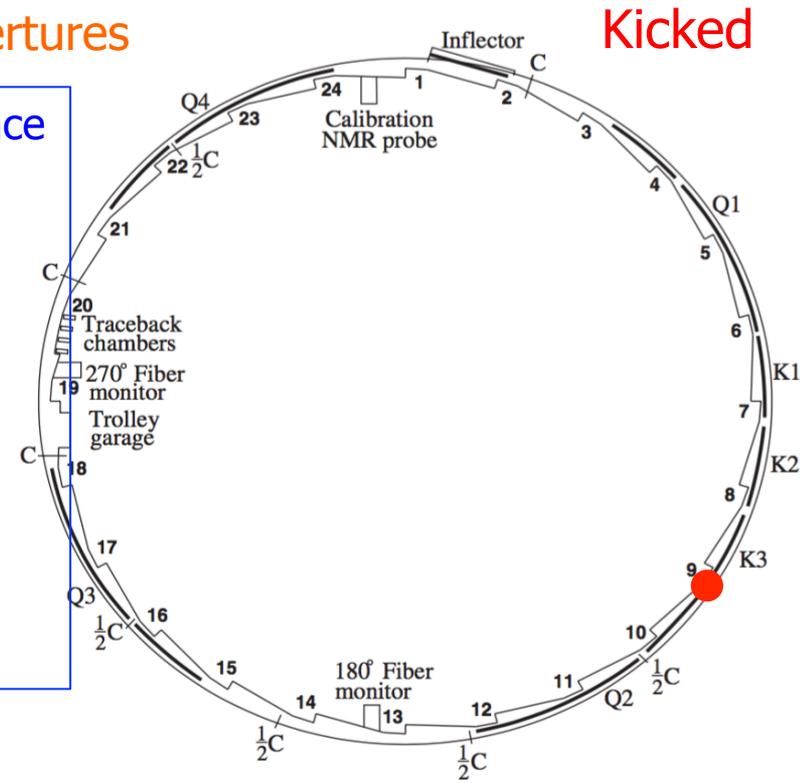
Vertical beam phase space



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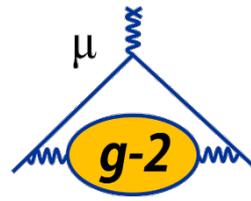
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Kicked

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RF matching concept

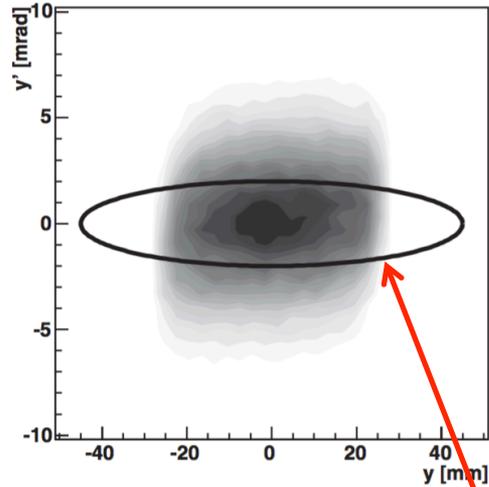


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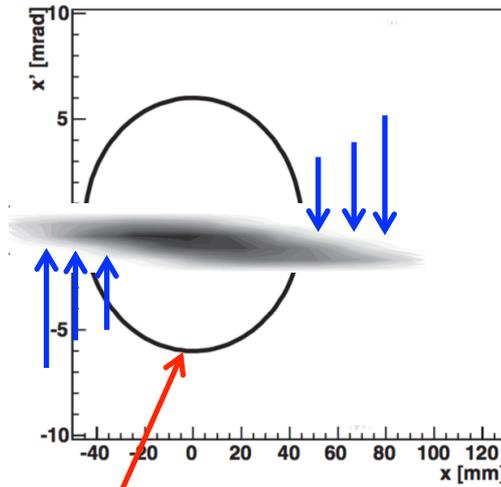
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Apply RF

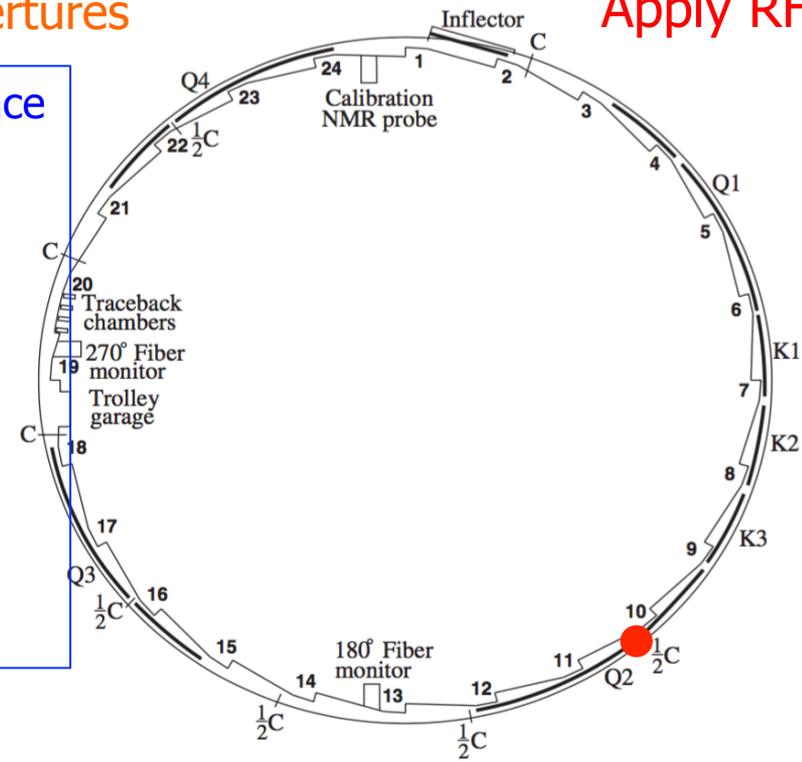
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Horizontal beam phase space

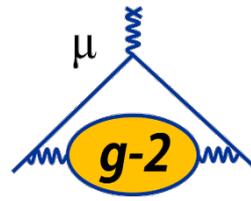


Storage ring acceptance



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RF matching concept

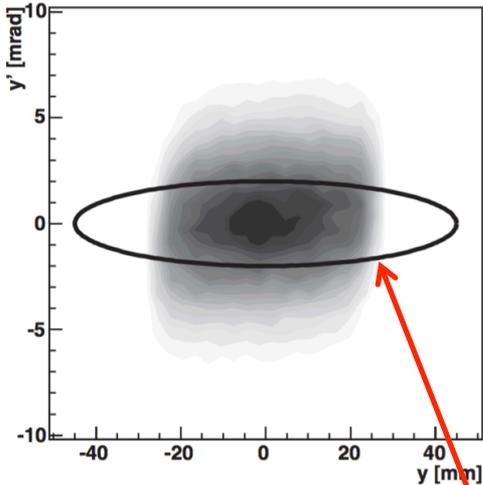


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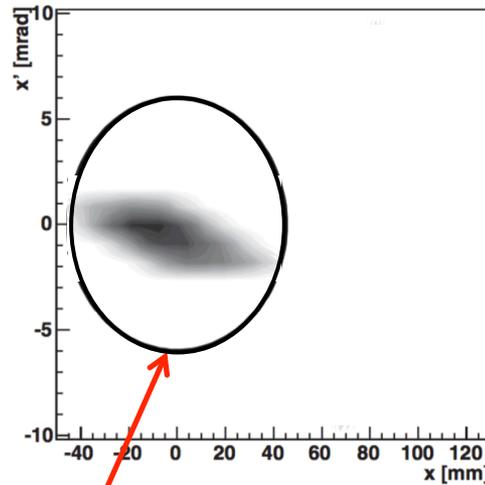
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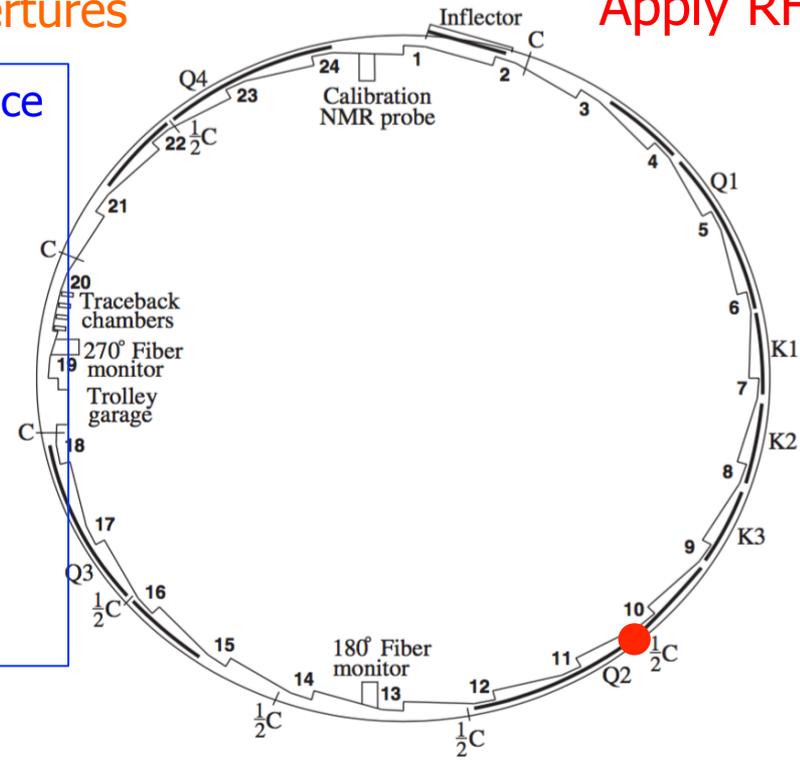
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Storage ring acceptance



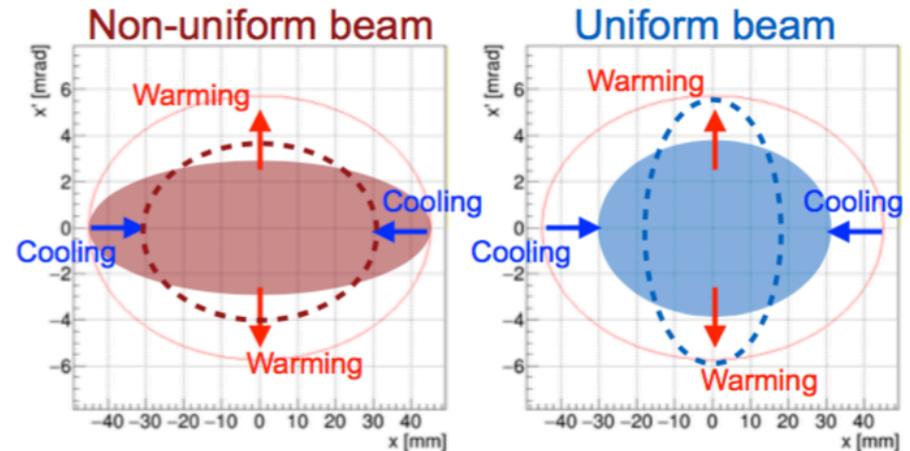
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- The method **works with non-uniform beam** in phase-space (especially for $|x'|$ (or $|y'|$) < 1.5 mrad beam)

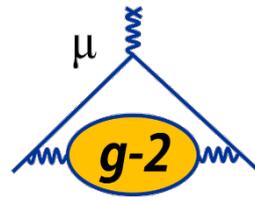
- Confirmed that the method is:

- ▶ **Good** for; E821-like beam
- ▶ **Bad** for; D. Rubin's realistic beam and an uniform beam



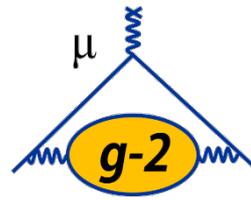
- If the real distribution is closer to David Rubin's, is there nothing we can do for this? **No, we have plan B**
 - ▶ RF scraping by Yuri Orlov and Yannis K. Semertzidis (E821 note #431)

RF scraping



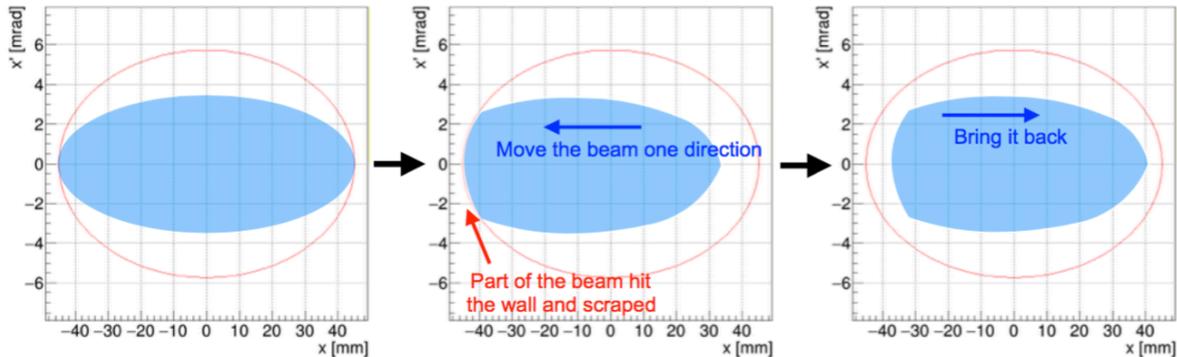
- [g-2 note \(E821\), 431 \(2003\)](#) – Y. Orlov and Y. Semertzidis
- According to Yuri Orlov scraping using lower voltage on some of the quad plates is not perfect since at the end of scraping the voltage needs to go up and resonances are crossed in the process!
- Using RF-HV at the CBO frequency can help: During [scraping](#) amplify the CBO amplitude in both horizontal and vertical directions. At the end of it reverse the phase to [eliminate](#) the CBO amplitude producing large gaps between the beam and the collimators

RF scraping concept

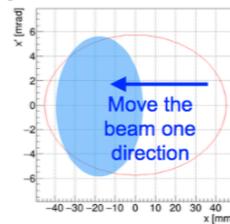


Soohyung Lee, Apr. 2, 2016

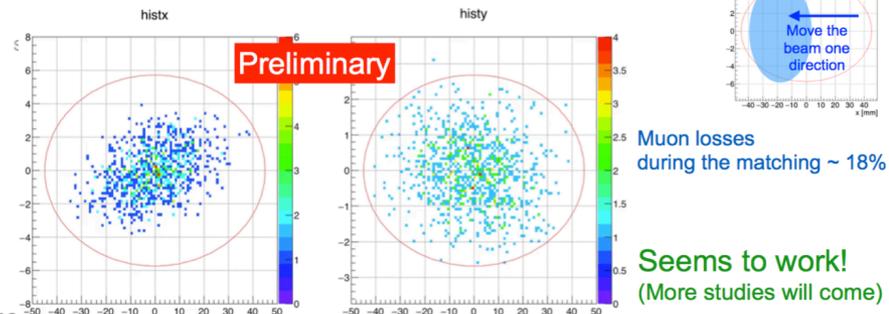
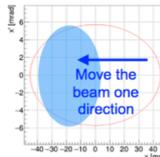
- RF electric field moves the beam to one direction
 - Scrape the beam using the wall, and bring it back with opposite phase electric field



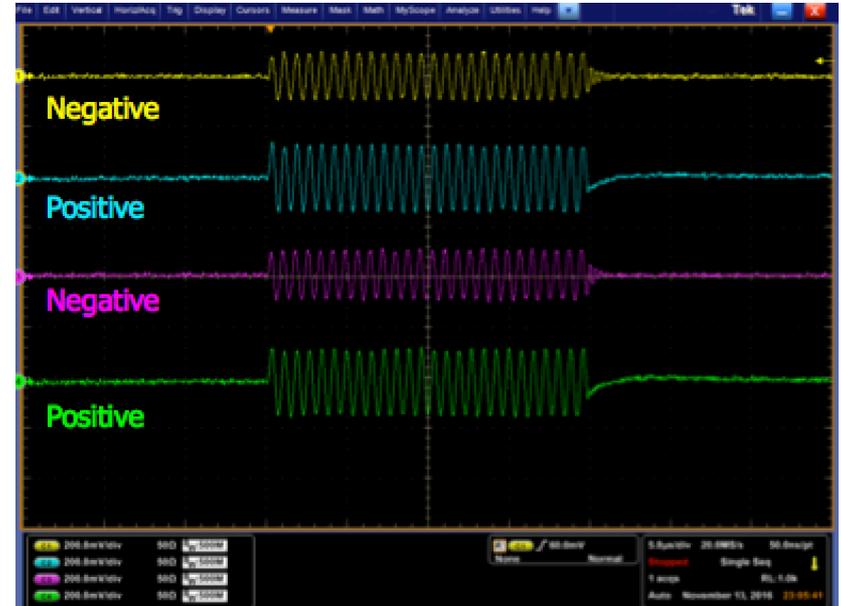
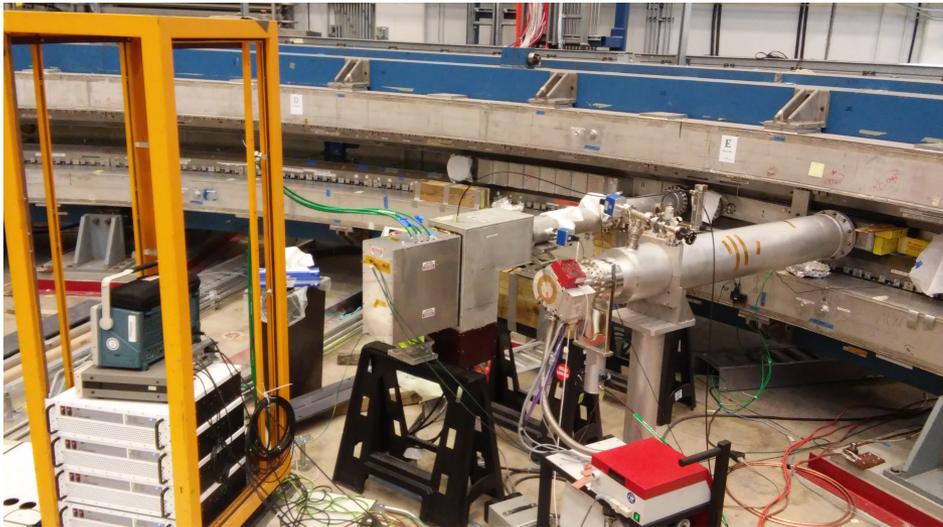
- We want to scrape for both side
 - Shake the beam to both side
 - 90° phase offset



- David Rubin's phase-space distribution + spread-in-time + $\Delta p/p$ with 90° off-phase, $E_{x0}=72$ kV/m for 10 μ s and -72 kV/m for 10 μ s

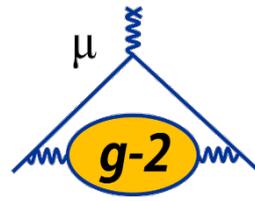


- Hardware test was done – See tomorrow's talk



- Power available for the RF: 4 kW = 4 amplifiers
- Beam dynamics studies with 4 kW – will be presented in early January, 2017

Etc..



- Gate signal for RF system
 - Sync to HV pulser control signals
- RF matching vs. RF scraping
 - How do we know the beam distribution in phase space? Or apply each method for different data set and see the results?