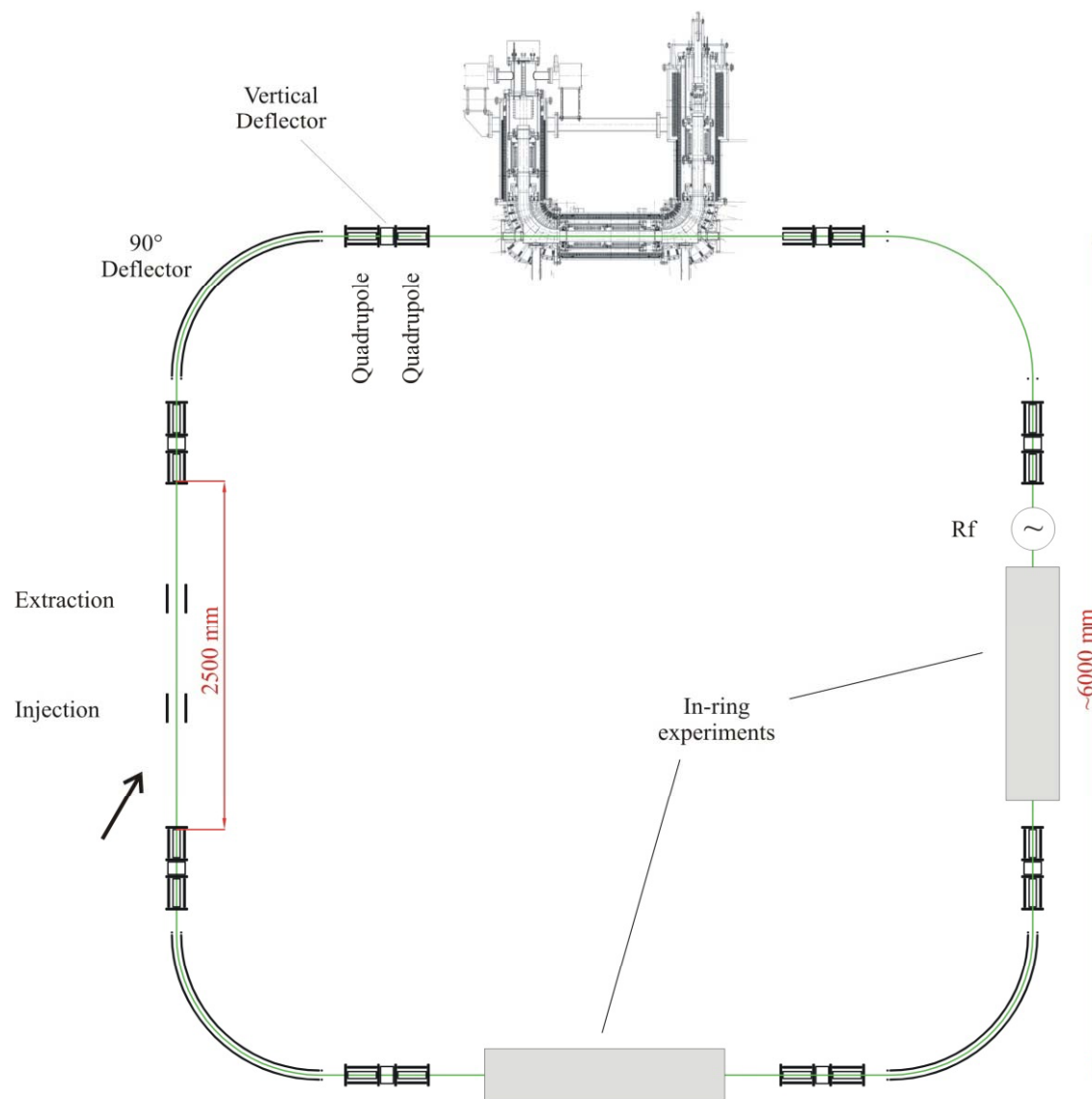


Progress Report on the USR

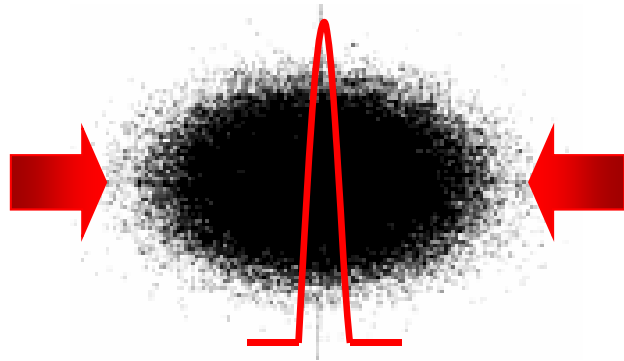
Carsten P. Welsch

USR: First Design in 2005



Welsch, C.P., et al.
Nucl. Instrum. Methods A **546**
405–417 (2005)

USR – Ring Re-Design



ns Bunching

Steps:

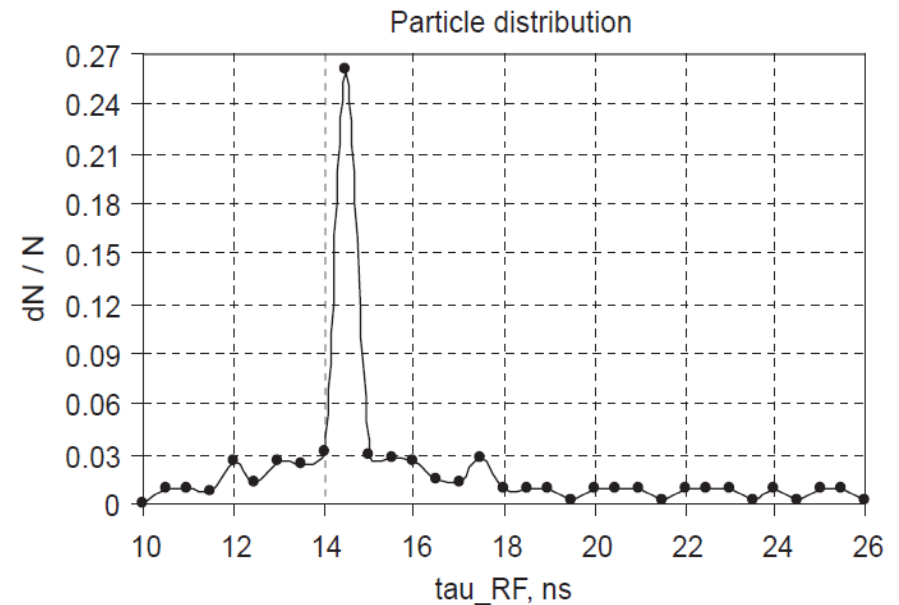
- General feasibility
- 1-D simulation
- Full study



Alexander

How to realize nanosecond bunches ?

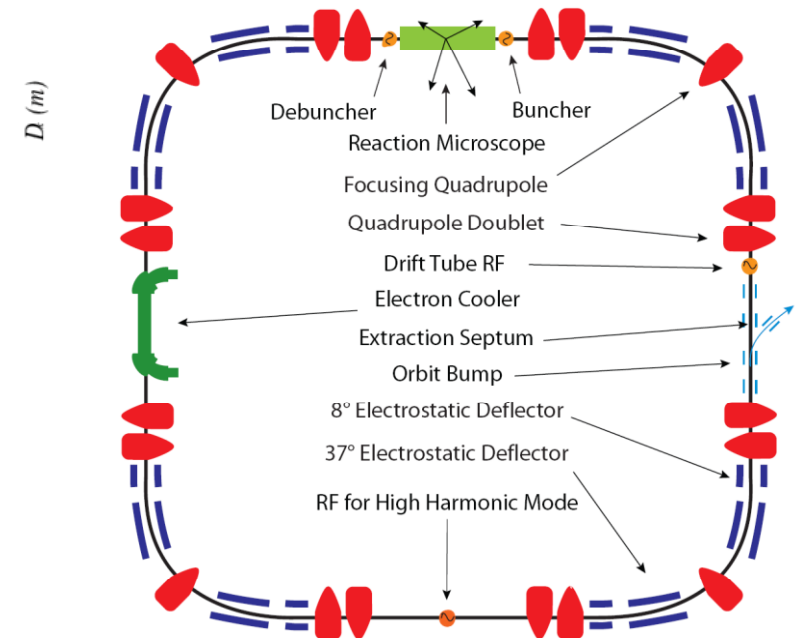
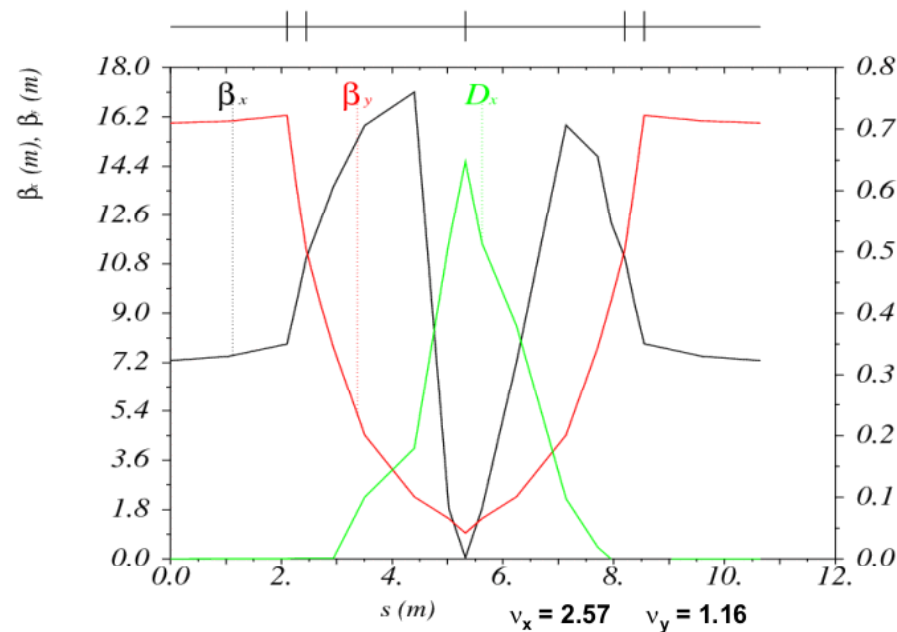
How to extract the beam ?



Part Phys. Nucl. Letters **3** (2009)

Modification to USR Lattice

- "Split-achromat" geometry, new concept



- Achromatic section, $D=D'=0$ in straights
- D never > 0.6 m.

Proc. PAC (2009)

Staged approach

Deceleration of beam to 20 keV

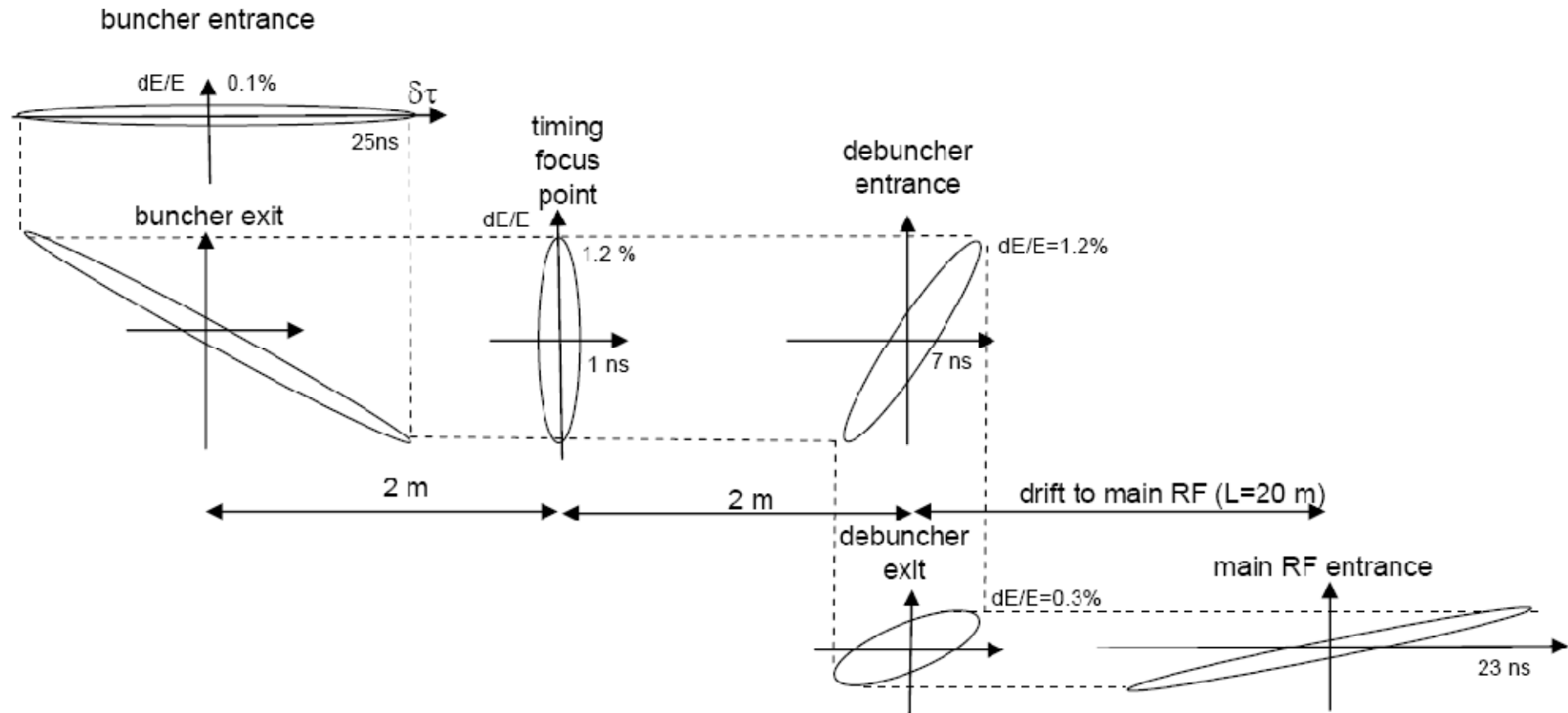
e^- cooling to $\Delta E/E = 5 \cdot 10^{-4}$

Capture beam @ 20 MHz (50 ns)

$3\beta\lambda/2$ buncher / debuncher

Part Phys. Nucl. Letters **3** (2009)

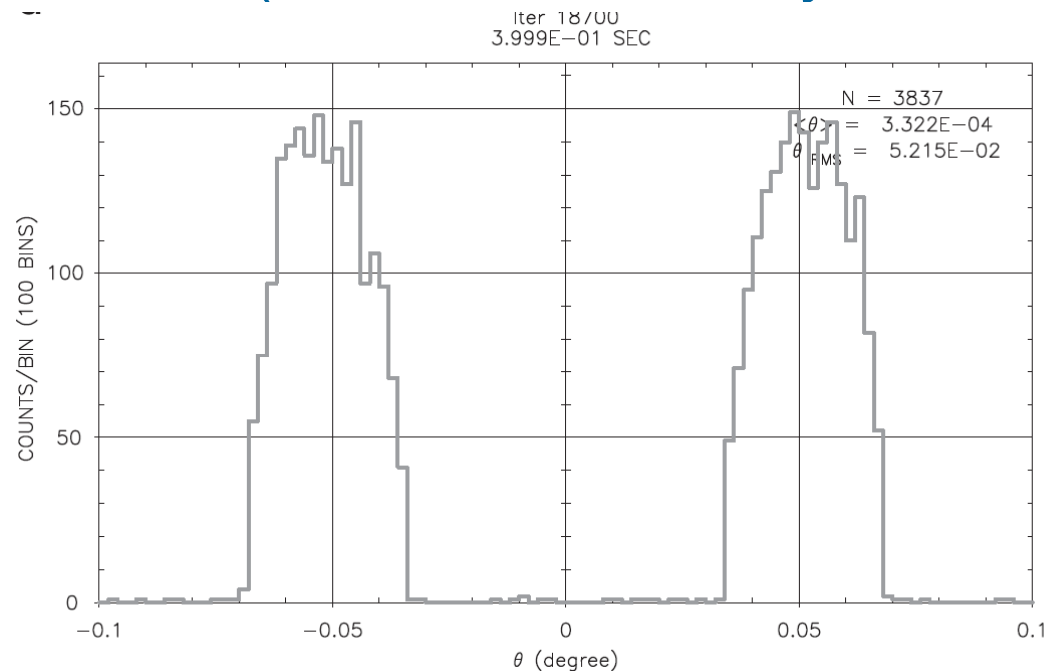
Evolution in Phase Space



Crucial: Dispersion in straight section !

Alternative: Higher harmonic split

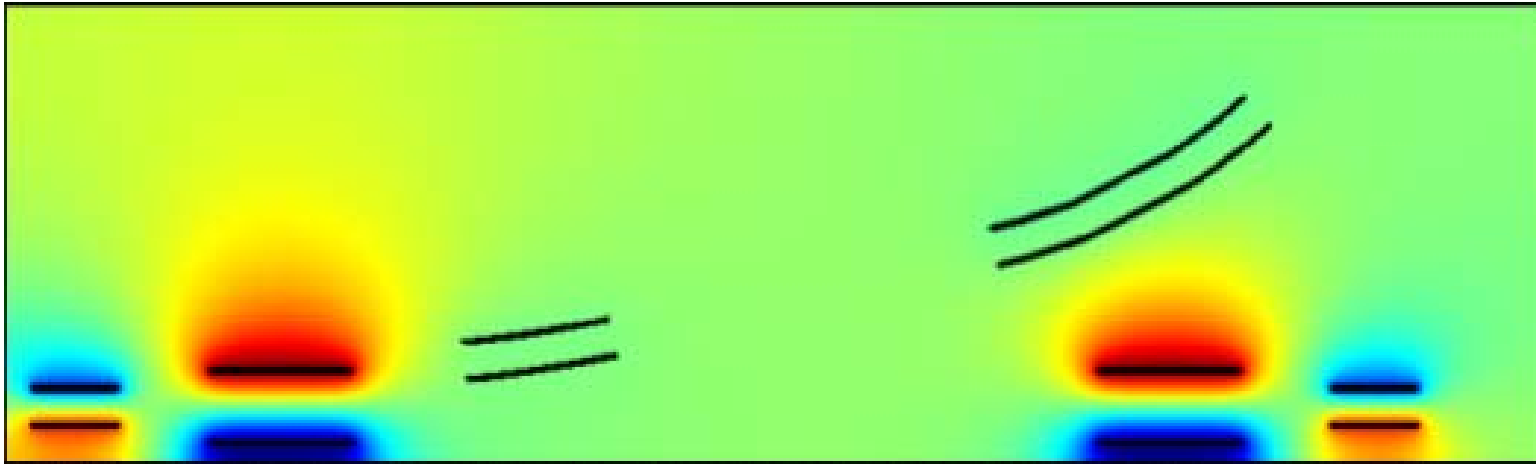
- 20, 40, 80, 160 MHz split into smaller rf buckets
- Minimize losses (overall efficiency is ~30 %)



- Problem: Inter-bunch spacing ! Use chopper.

USR - slow/fast Extraction

Goal: Combined system, providing highly-flexible extraction

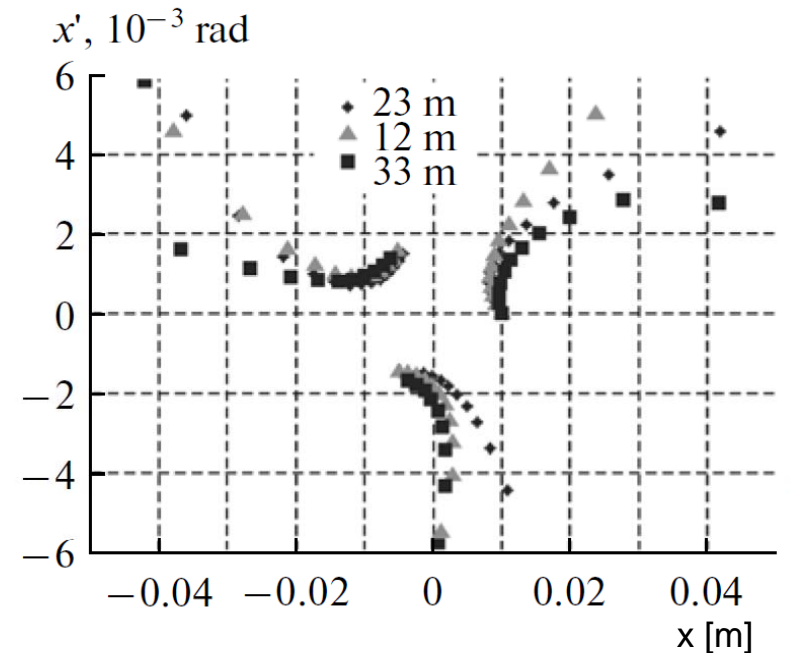
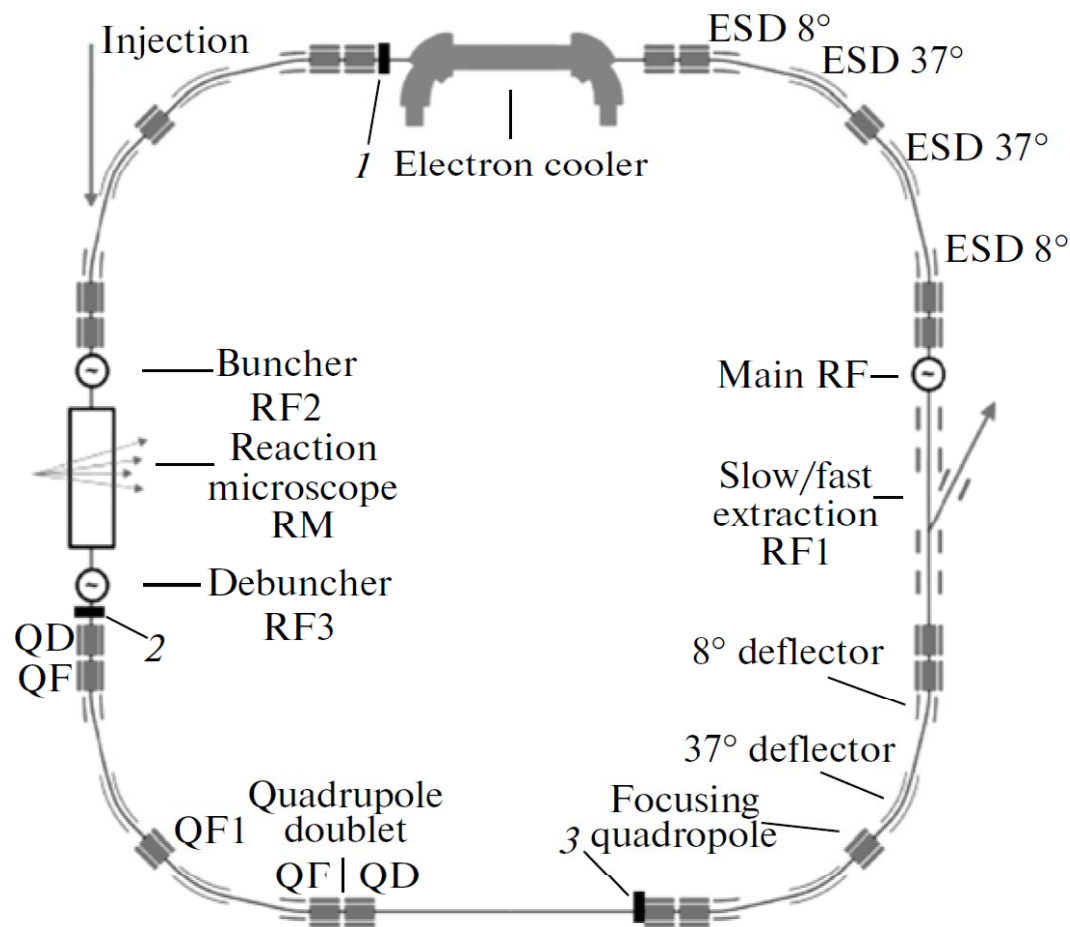


Motivation: Nuclear physics-type experiments.

➡ First time in electrostatic ring !

Part Phys. Nucl. Letters **8** (2011)

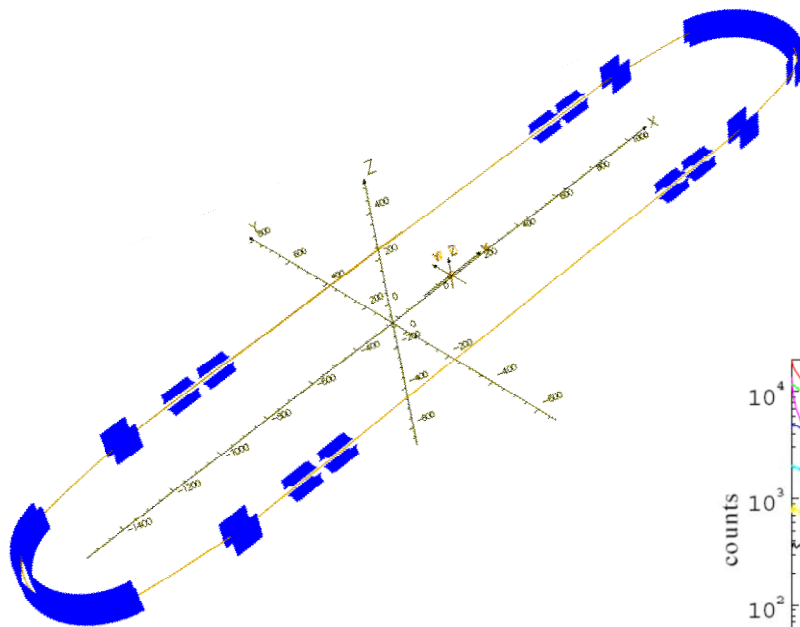
Sextupole Integration



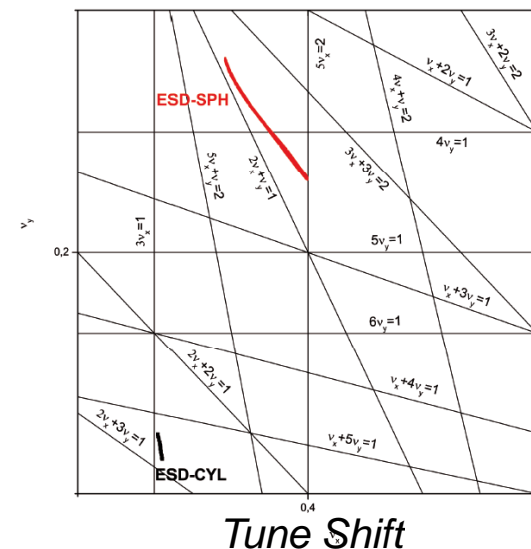
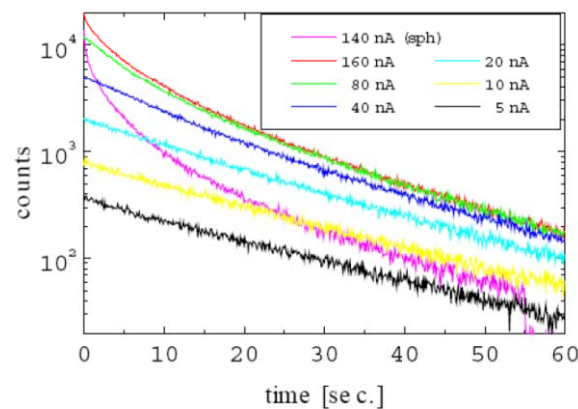
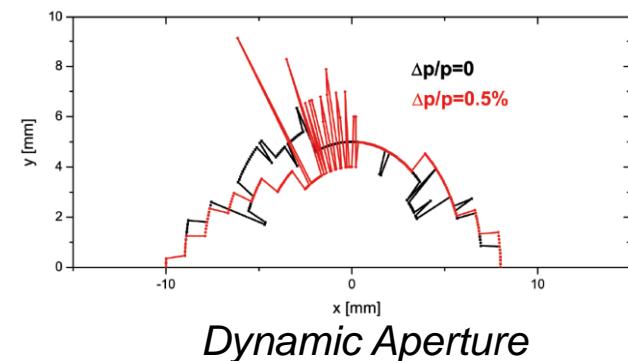
Part Phys. Nucl. Letters **8** (2011)

USR – Advanced Studies

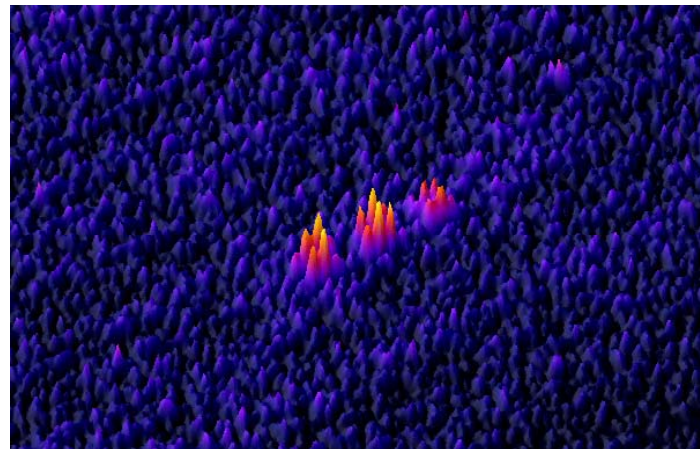
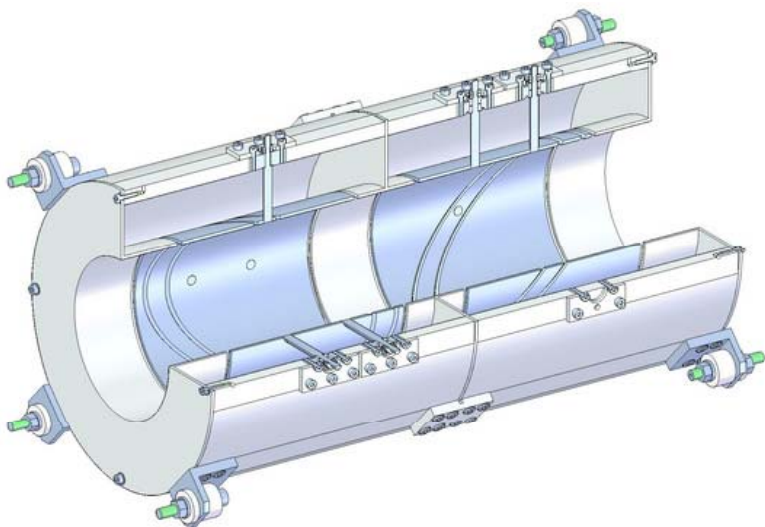
- Full 3D ring model, detailed studies
- Similar approaches are used for most new FAIR rings



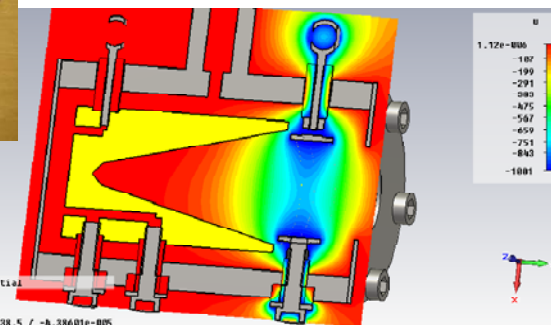
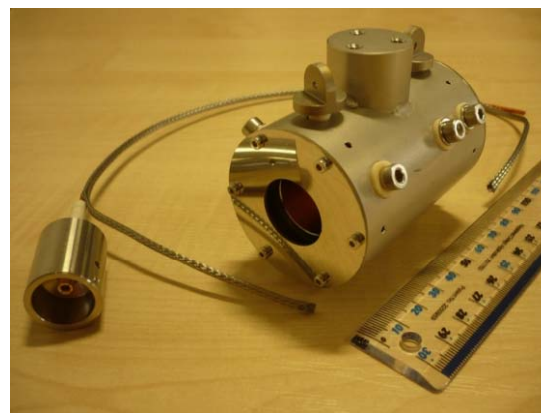
Proc. IPAC (2010)



USR – Diagnostics



Rev. Sci. Instr., (2010)

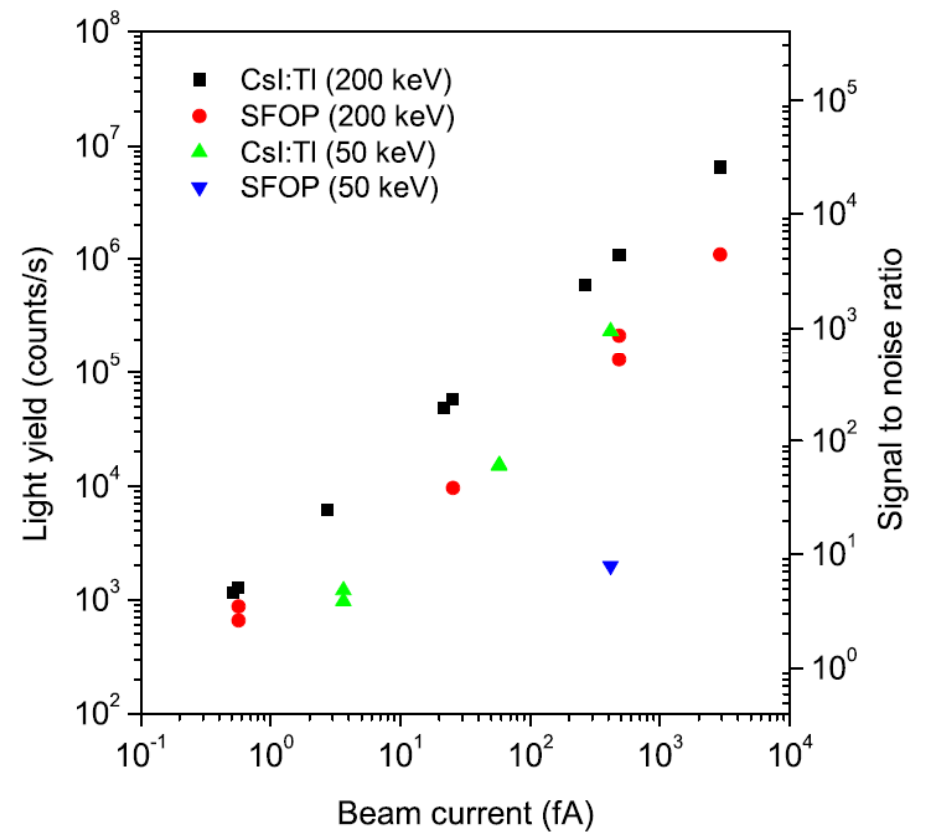
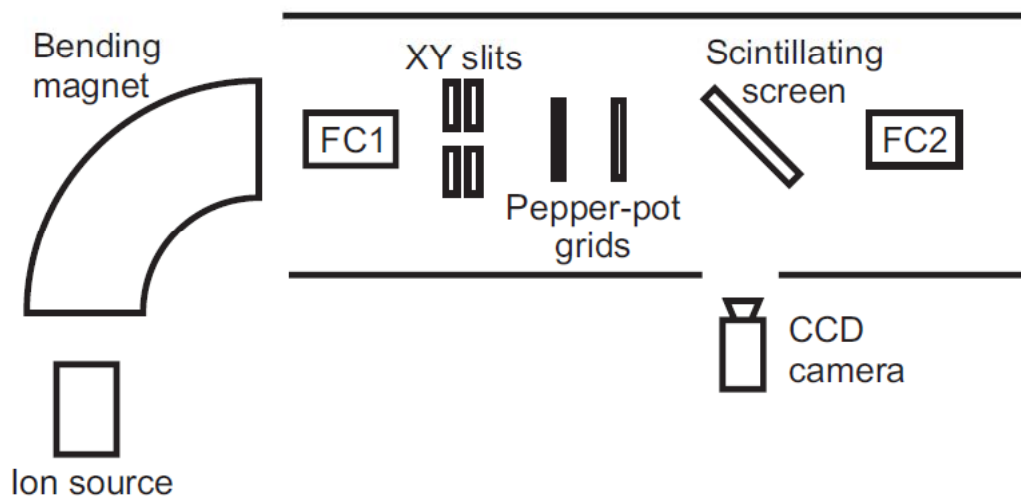


Janusz

- Position
- Profile
- Intensity

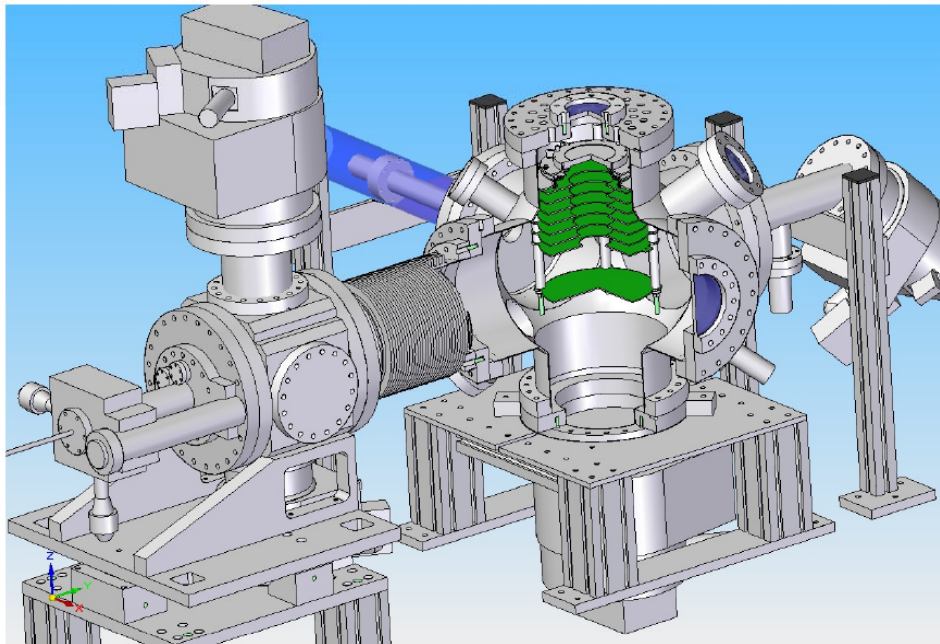
Screen Studies

- Realized in close collaboration with INFN-LNS



USR – Curtain Gas Jet Monitor

Design of the experiment.



Design finished 2009,
Setup in rf lab.

M. Putignano et al., Proc. BIW and IPAC (2010)



Kai-Uwe

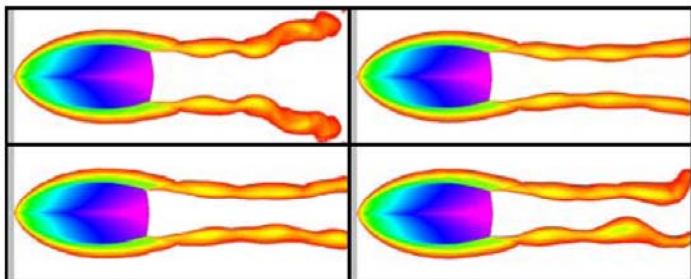


Massimiliano

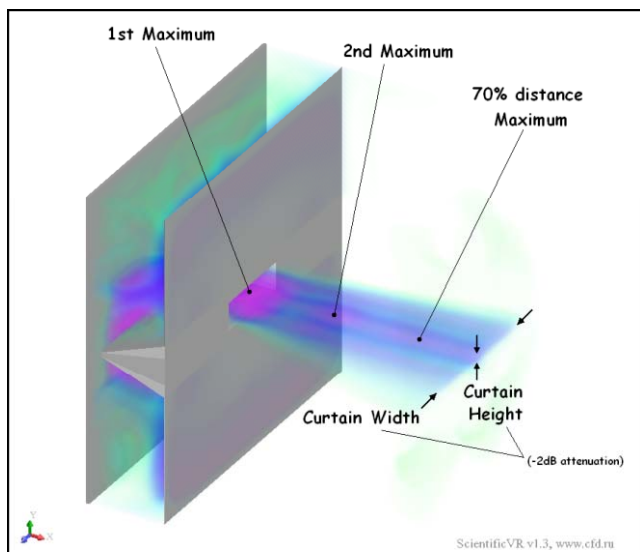

















Michele

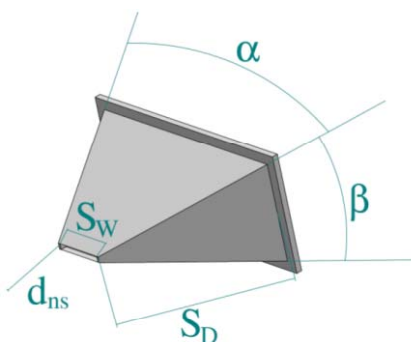
Numerical Investigations with GDT



- System optimization and trends analysis



	Mach N.	D	W
α			
β			
SW			
SD			
Dist			

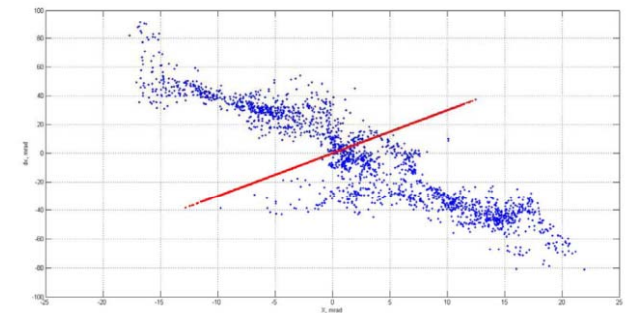
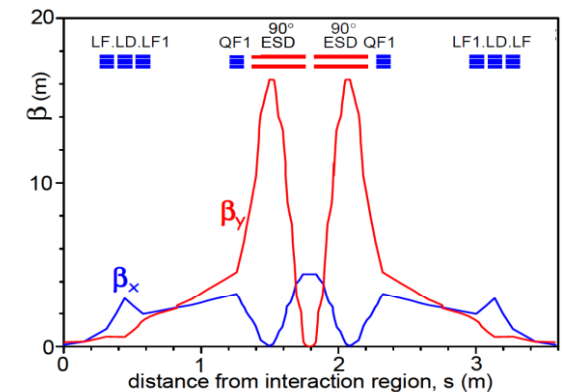


Ongoing: Flexible nozzle/skimmer system for benchmarking GDT.

Proc. DIPAC 2009, BIW 2010

Prototyping: Antiproton *Recycler*

- Proposed behind Musashi or ELENA
- Prototype for USR developments
- Possibility to measure partial differential antiproton cross sections



Alexander, Galina, Michele, Oleg

Summary of Progress

- USR design now fulfils all FLAIR requirements
(what we did not touch: e-cool),
- Understanding of beam dynamics in electrostatic ring advanced, ELISA measurements explained,
- (scaled) mechanical design of components realized
- Diagnostics prototypes built up and tested
- Final measurements this summer @ MSL, INFN and CERN (?)