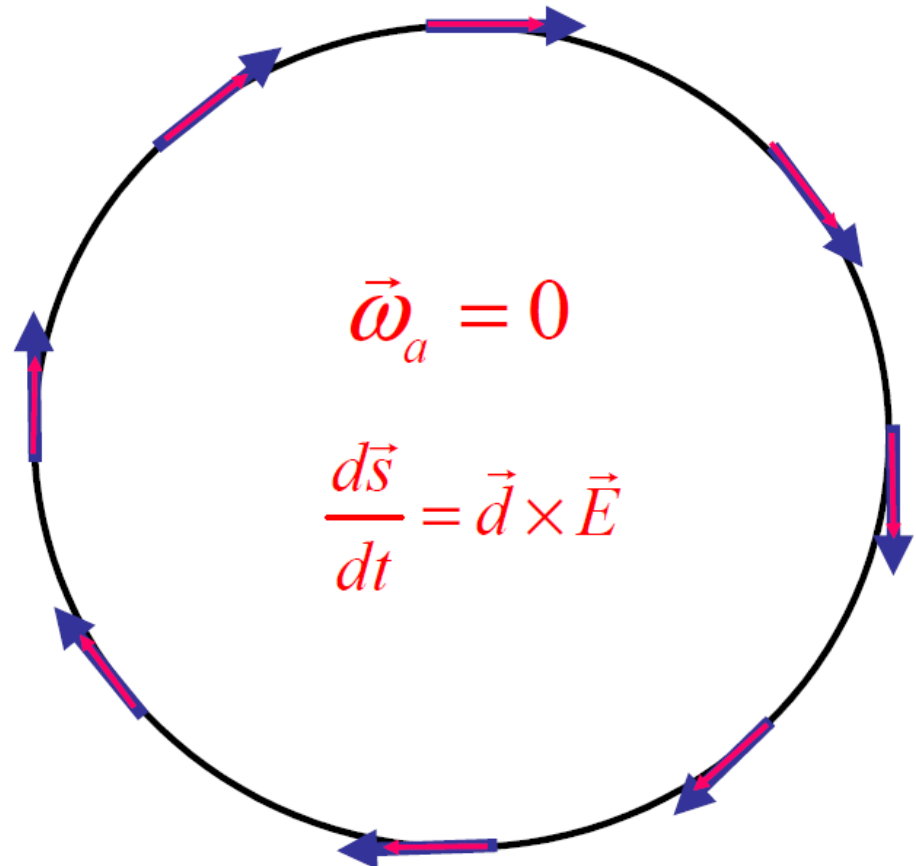


Concluding remarks on the R&D for a Magic Proton Ring for 10^{-29} e·cm.

Yannis K. Semertzidis, BNL

- The bottom line
- Funding request
- Possible action



Need support to develop (fully loaded costs) Total: ~\$4M

- SCT COSY-INF.: \$1M, UAL+SPINK: \$0.5M
- BPMs \$0.45M + hardware: ~\$1M (likely)
- Polarimeter \$1M
- E-field gradient: \$0.6M

Possible Immediate Action Plan

- SCT COSY-INFINITY: \$1M. Need a post doc and a graduate student. Collaboration with COSY/Juelich?
UAL+SPINK: \$0.5M C-AD based, part of RHIC spin effort?
- BPMs: \$0.45M + hardware (need to establish team with experts including a team-leader)
- Polarimeter: \$1M (IUCF based effort?)
- E-field: \$0.6M. BNL Physics dept. based effort.
- \$0.5M for would be needed to keep the momentum in FY10

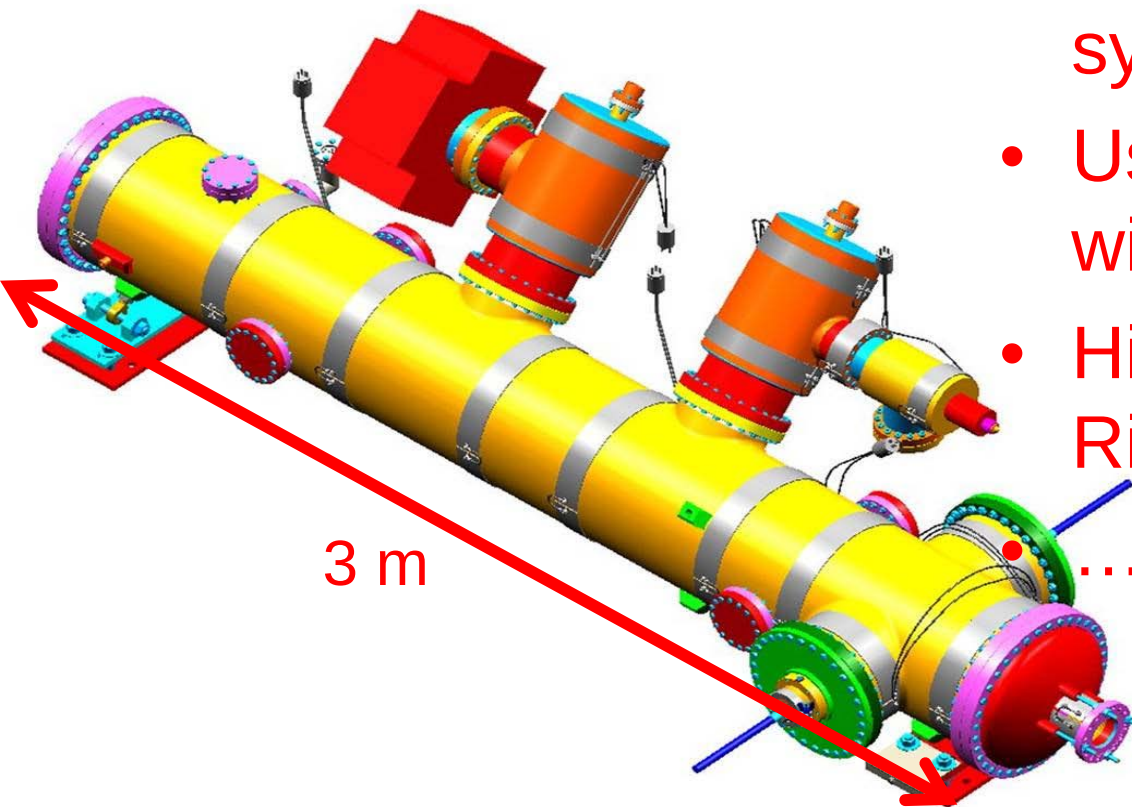
From Frank Rathmann's talk at the collaboration meeting (fully backed by H. Stroeher)



Conclusion

1. In the long-term perspective, more than one EDM machine is required.
2. Jülich would like to play a larger/major role in the search for EDMs:
 - provide more support with R&D
 - On what?
3. Start discussion with BNL and Jülich management the option to have one of the EDM rings (p, d, ^3He) set up in Jülich.

Establish an agreement with FNAL: They can help with E-field & we'll help with muon g-2



- 26 Electrostatic separators with support systems (we need 64)
- Use testing chambers with New Plates
- High Pressure Water Rinsing

BPM Prior work (ATF of KEK/Japan)

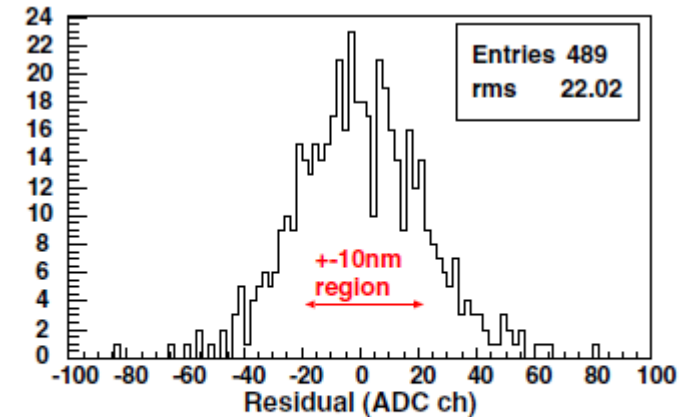
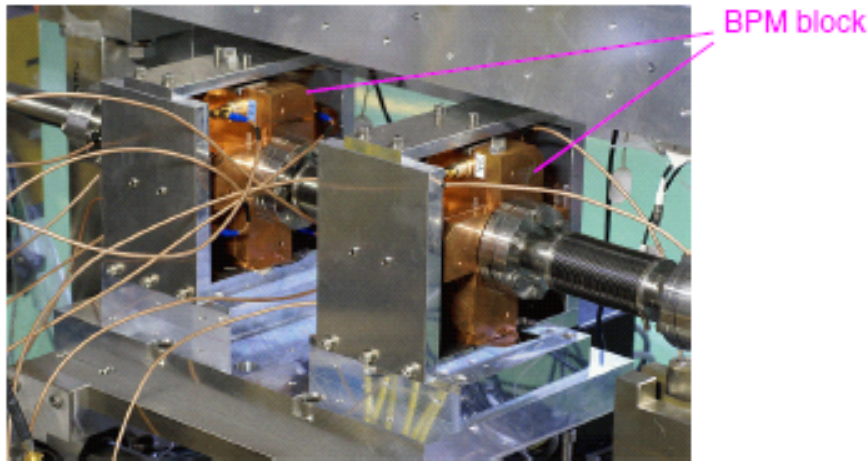


FIG. 17. (Color) Resolution measurement data. The top figure shows a scatter plot of the prediction and measurement. The bottom figure is the distribution of the residual of the prediction.

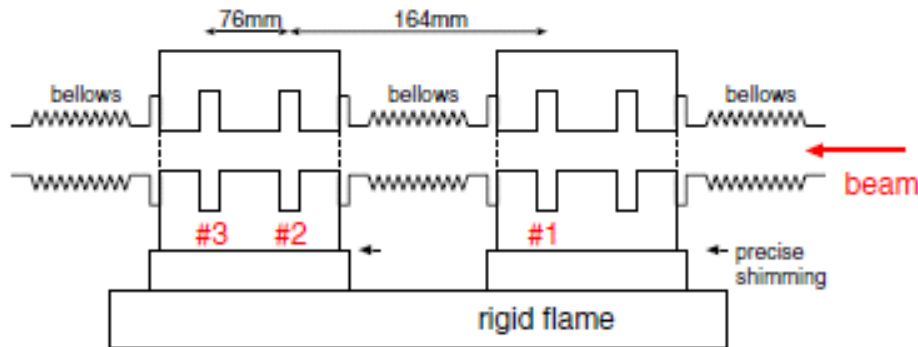


FIG. 6. (Color) BPM support system installed in the beam line. Two blocks were rigidly mounted in the system. The three cavities named 1, 2, and 3 were used in this test. Distances between cavities were 164 and 76 mm. They determine the geometrical factor that appears in the resolution analysis to be 0.799.

PRST , Accel & Beams, 11, 062801 (2008).

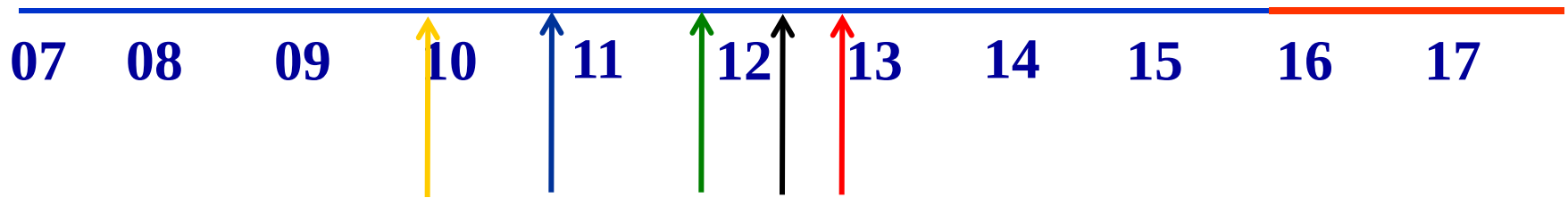
Achieved res. ~ 8 nm per $\sim 10^{10}$ electrons/bunch

Not exactly the same application... NSLS II work (@ BNL) may be more applicable

More work preparing for DOE reviews:

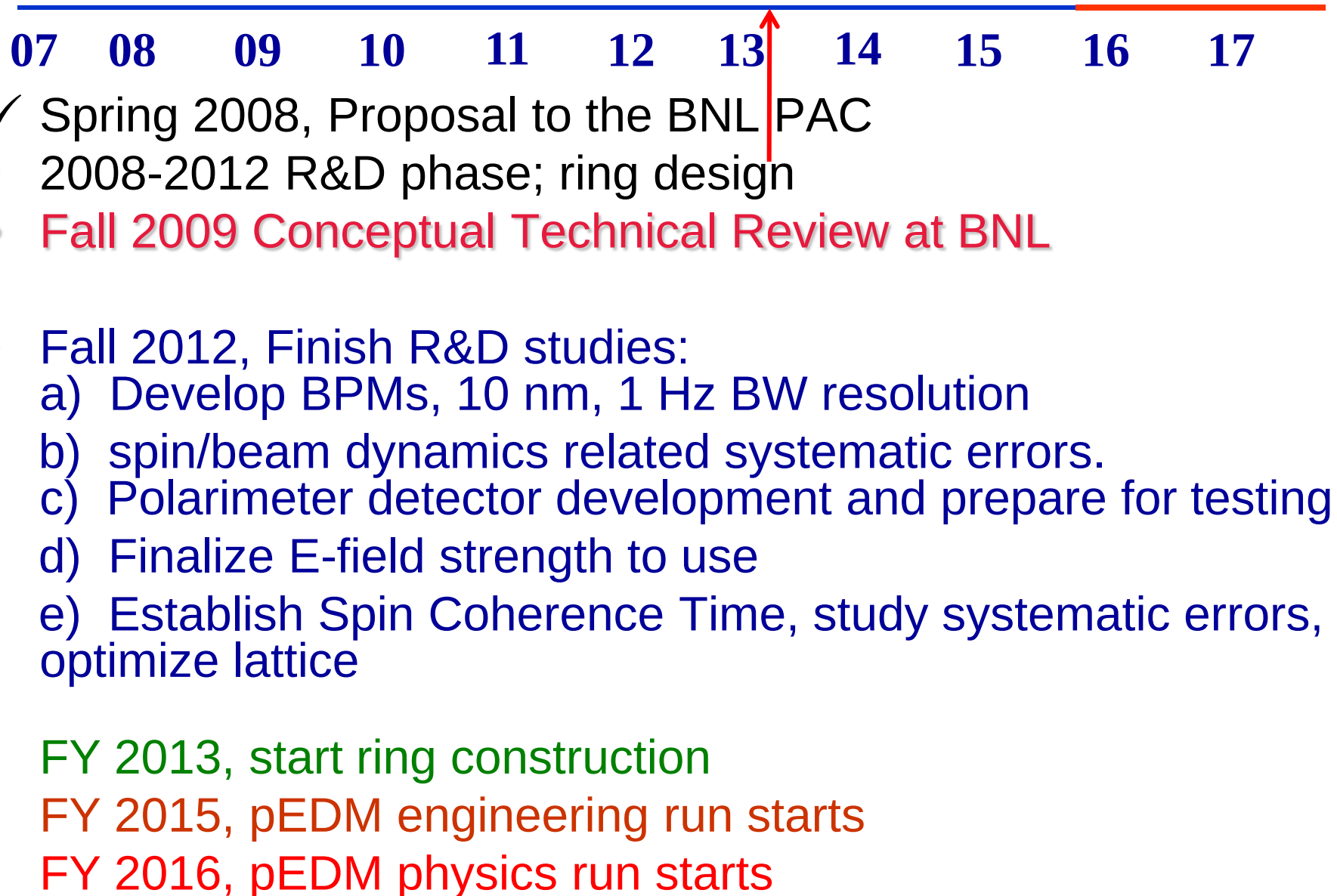
- Source-beam preparation, Beamline, Injection (C-AD)
- Bunch capture with RF (develop RF) (C-AD)
- Vertical to horizontal spin precession (RF-solenoid) (COSY)
- Detailed studies of IBS, beam-beam interactions, optimize phase space (C-AD)
- Slow extraction onto an internal target for polarization monitoring (stripline kickers) (COSY)
- Use feedback to RF from polarimeter to keep spin longitudinal (IUCF/C-AD)
- Costing of experiment (plus building) (C-AD)

Technically driven Milestones

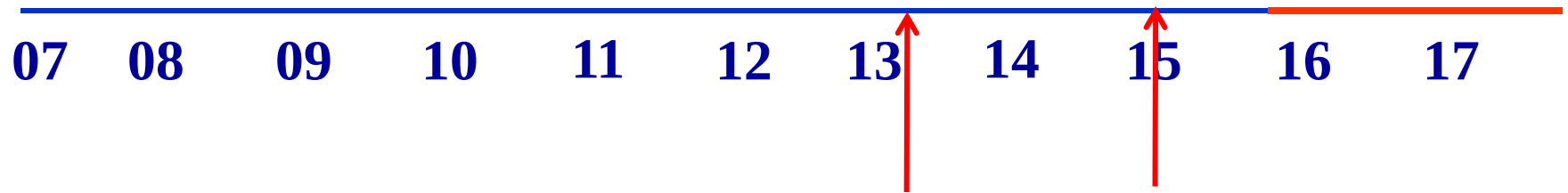


- ✓ Spring 2008, Proposal to the BNL PAC
- 2010-2013 R&D phase; ring design
- Fall 2010: E vs. gap studies; simulation and design of polarimeter; 1st phase of SCT studies; design of BPM cavity
- Fall 2011: Polarimeter construction; SCT including placement errors & fringe fields; BPM cavity construction and electronics development, test in lab.
- Spring 2012: Finish first full scale E-field module test
- Fall 2012: Finish commissioning and calibration of polarimeter detector at COSY; Full scale tracking simulation package for EDM ring in place; Test cavity BPMs at a collision point using stored beams

Technically driven pEDM Timeline



Technically driven pEDM Timeline

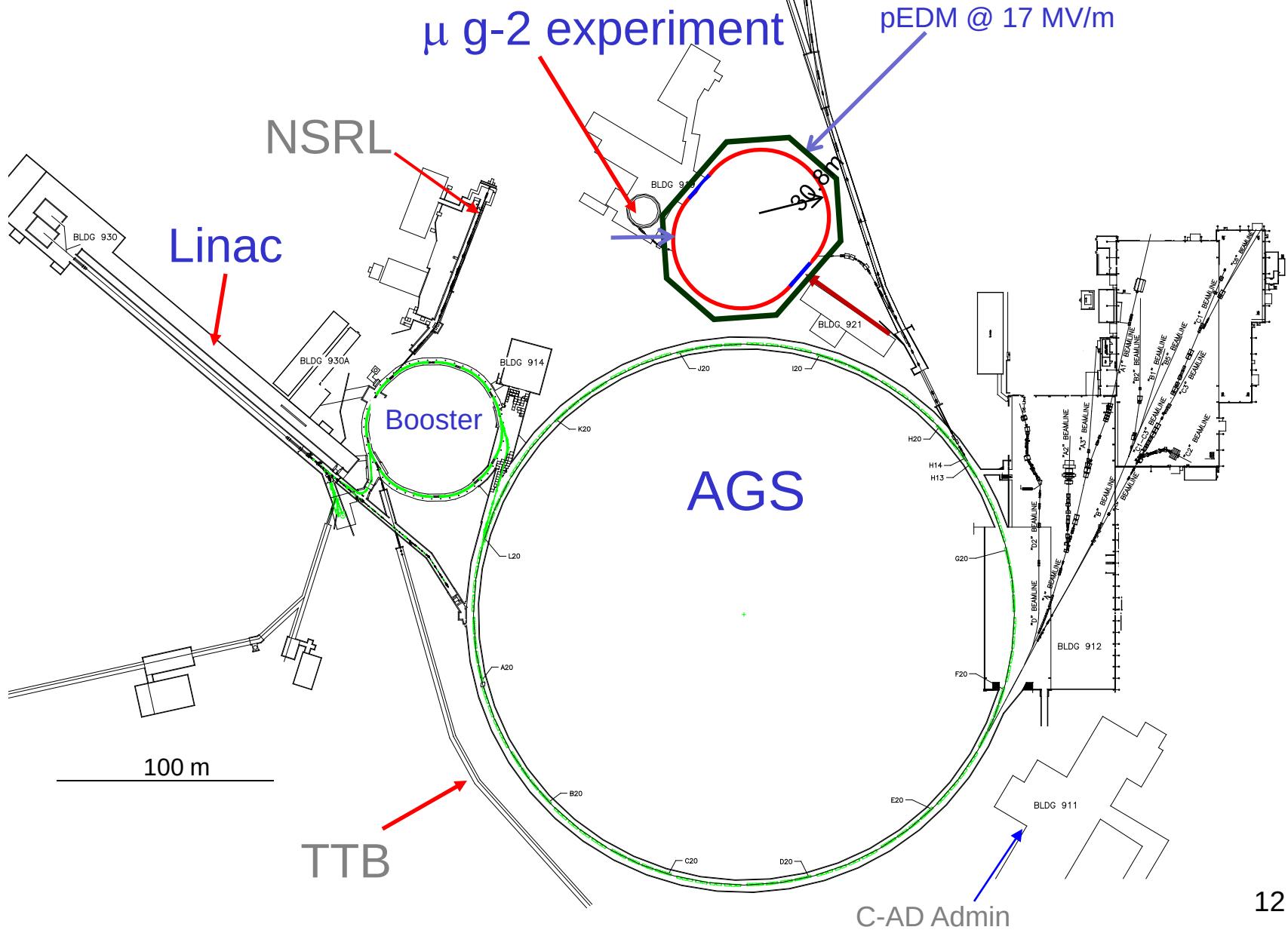


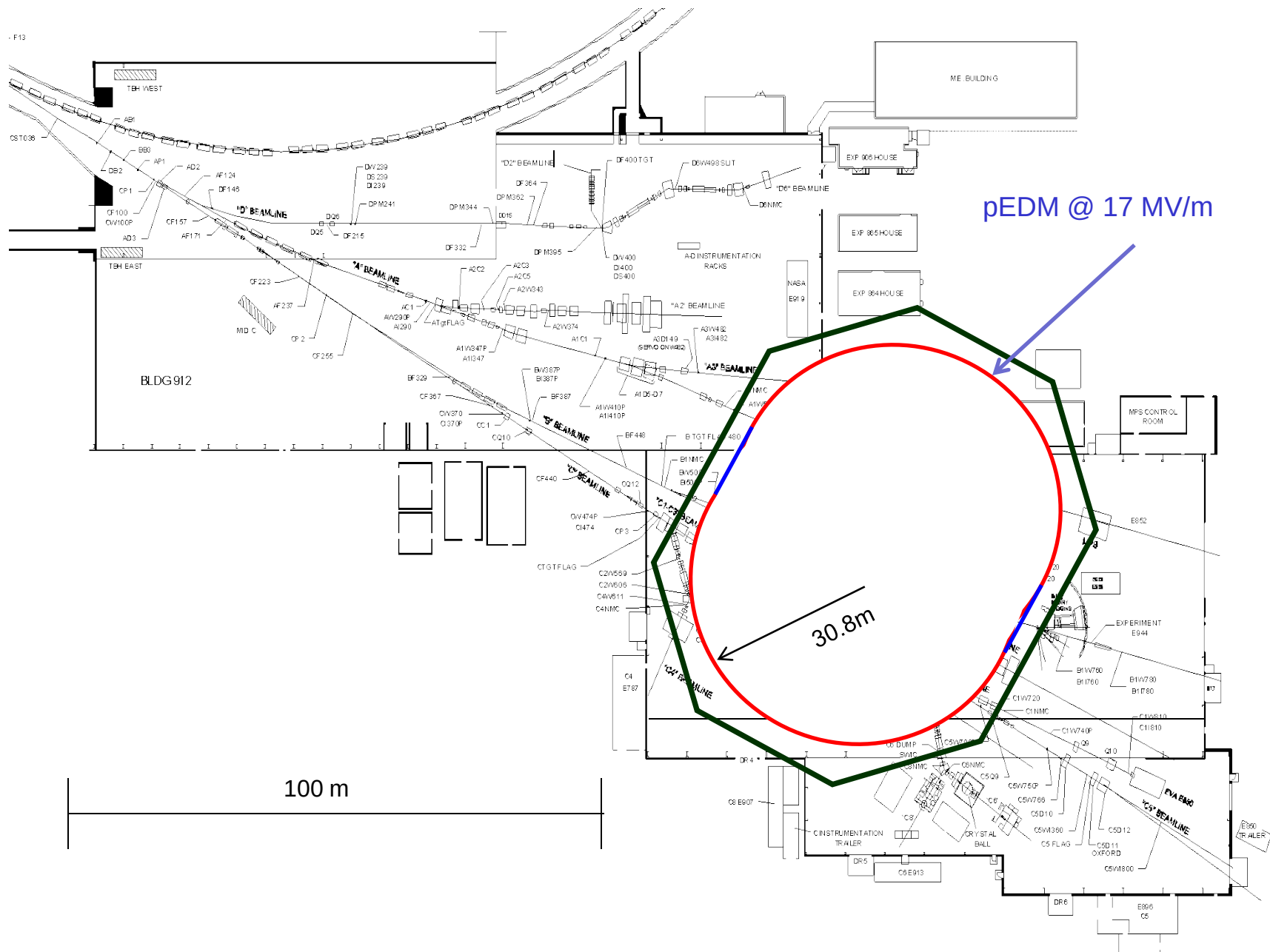
- June 2010 CD-0
 - June 2011 CD-1
 - Fall 2012 CD-2/3
 - Fall 2015 CD-4
-
- Start of 2012, finish pEDM detailed ring design
 - FY 2013, start ring construction
 - FY 2015, pEDM engineering run starts
 - FY 2016, pEDM physics run starts

Summary: Total R&D \$4M, 3 years

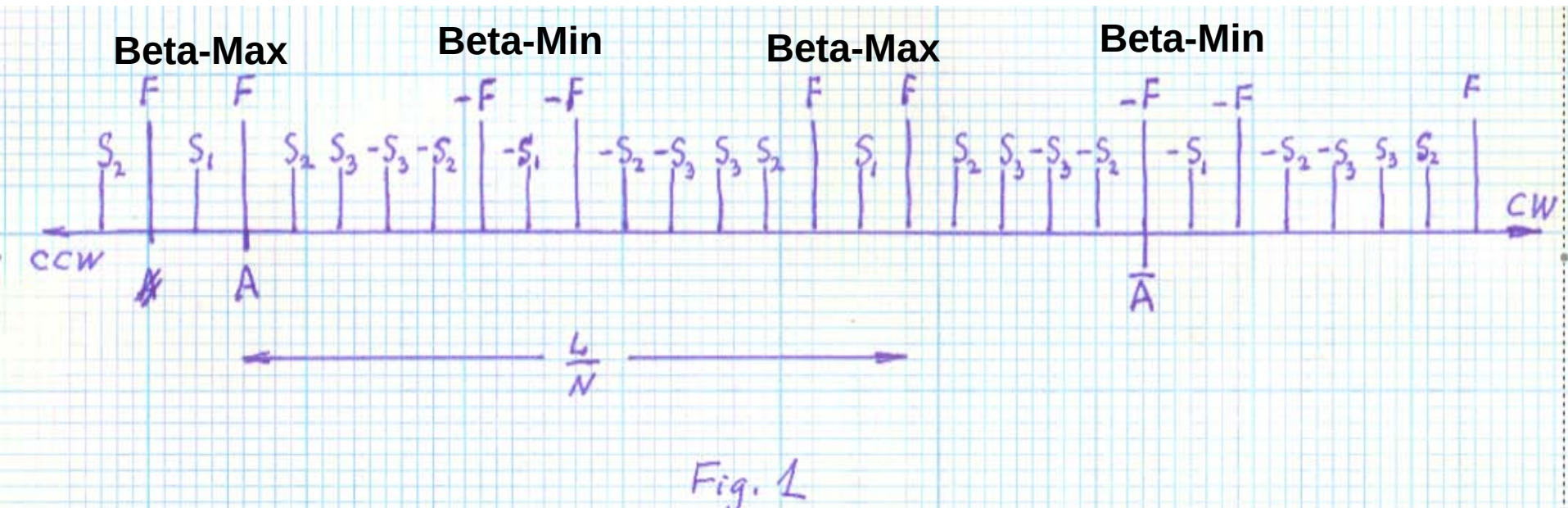
- We need a very strong endorsement to move forward.
- \$0.5M/FY10 not to lose a year
- Need to establish a Beam Position Monitoring team and to support the Spin & Beam Dynamics team. Sufficiently support the E-field and Polarimeter teams.
- Facilitate collaboration with experts around the world (NSLS II, ILC-based BPM work like ATF-KEK, etc.).
- Help with travel expenses until funding materializes to collaborating institutions
- Collaborating with COSY/Juelich and FNAL would be mutually beneficial.

AGS Complex



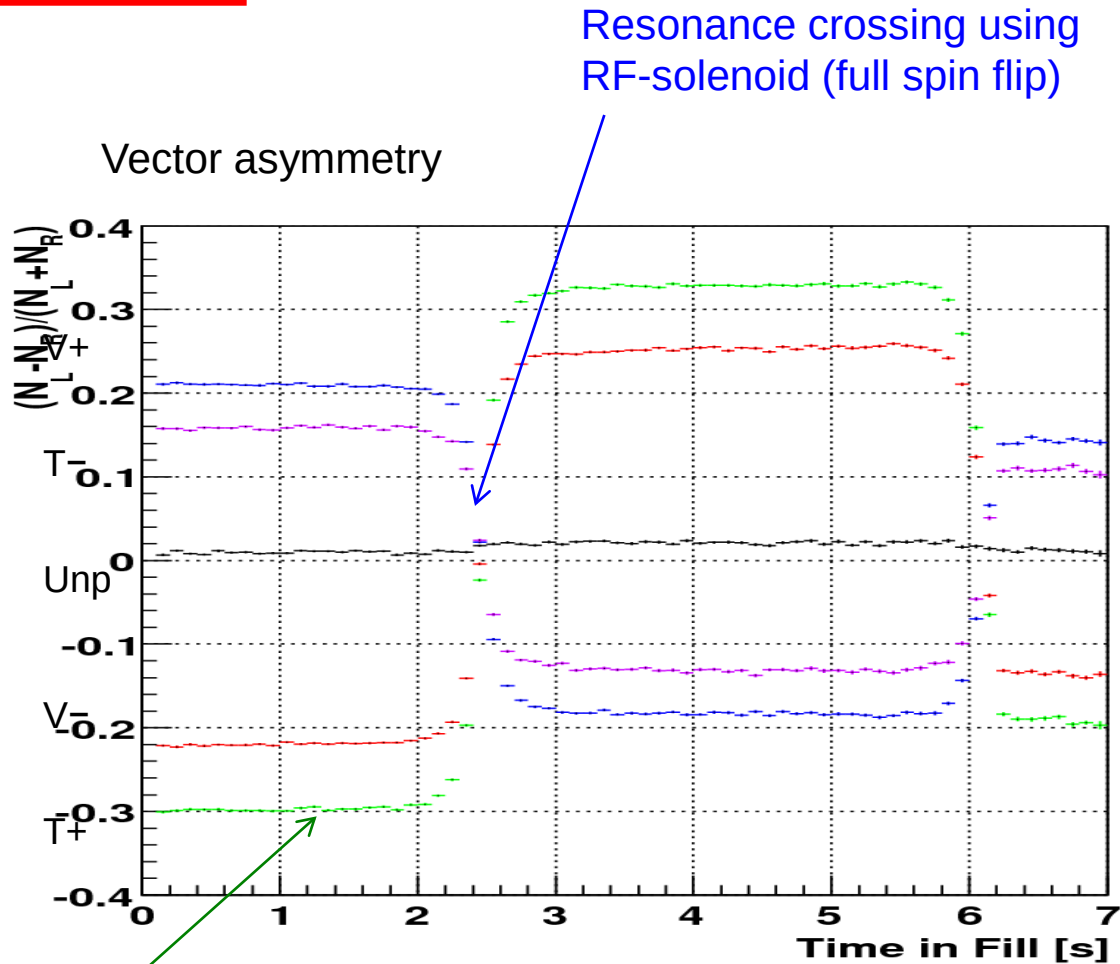


A possible solution for simultaneous CW and CCW beams (Yuri Orlov)



From the September 2008 run at COSY

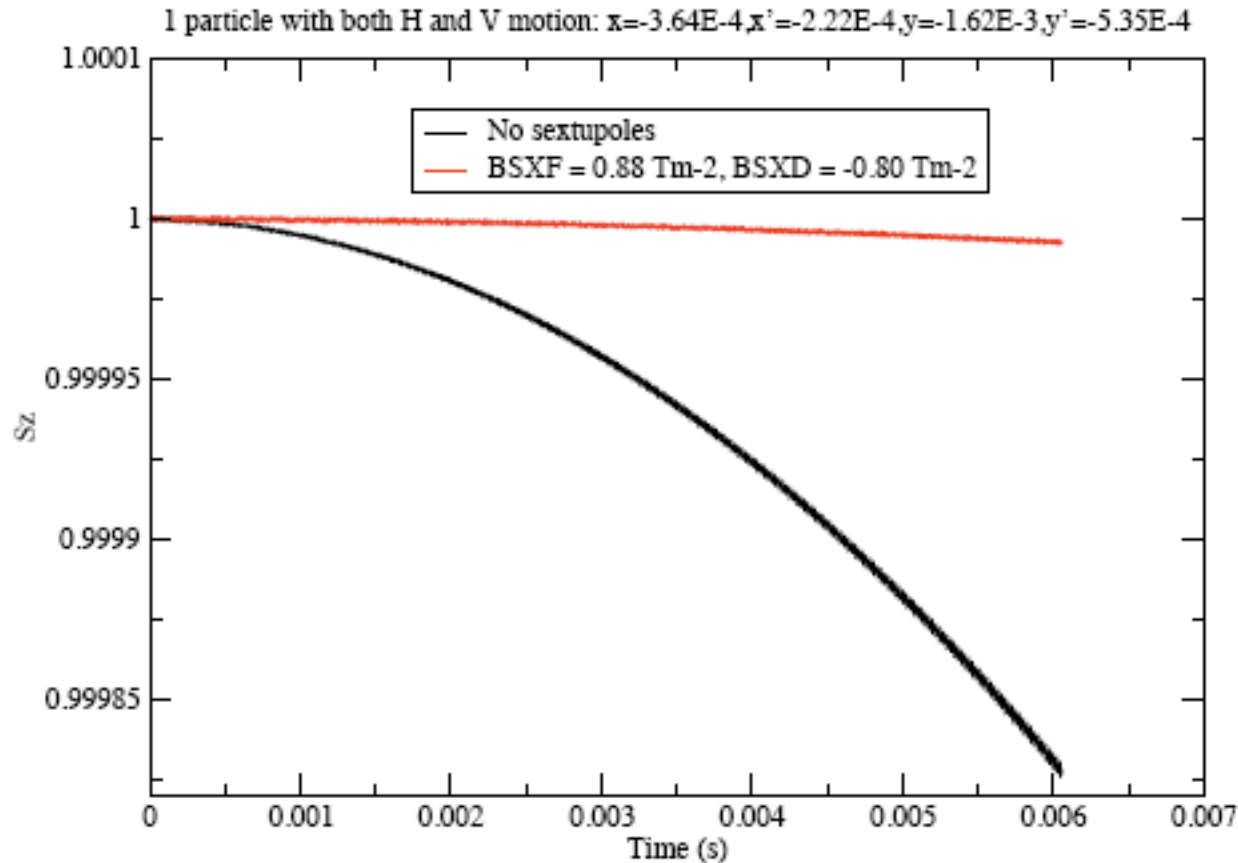
Polarimeter team



Slowly extracting the beam while monitoring
its polarization as a function of time

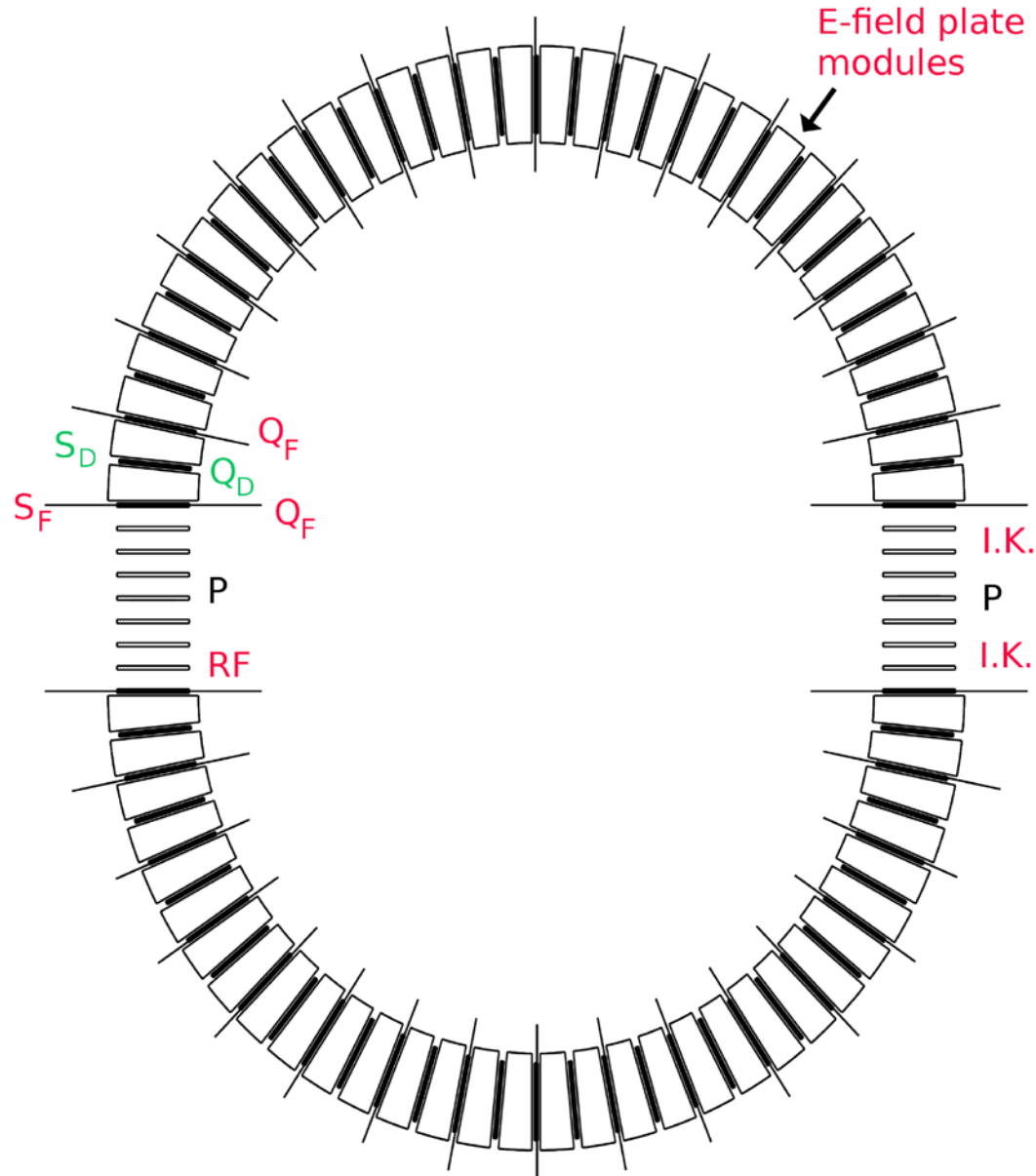
Searching for optimum sextupoles (Preliminary res.)

SCT team, F. Lin et al.



**Two sets of sextupoles are next to focusing and defocusing quads.
Both horizontal and vertical motions are included.**

A possible magic proton ring lattice: ~240m circumference.



Proton Statistical Error (230MeV):

$$\sigma_{d_p} \approx \frac{3\hbar}{E_R A P \sqrt{N_c f T_{Tot} \tau_p}}$$

- τ_p : 10^3 s Polarization Lifetime (**S**pin **C**oherence **T**ime)
 A : 0.6 Left/right asymmetry observed by the polarimeter
 P : 0.8 Beam polarization
 N_c : 2×10^{10} p/cycle Total number of stored particles per cycle
 T_{Tot} : 10^7 s Total running time per year
 f : 0.5% Useful event rate fraction (efficiency for EDM)
 E_R : 17 MV/m Radial electric field strength (65% azim. cov.)

$$\sigma_{d_p} \approx 2.5 \times 10^{-29} \text{ e} \cdot \text{cm/year}$$