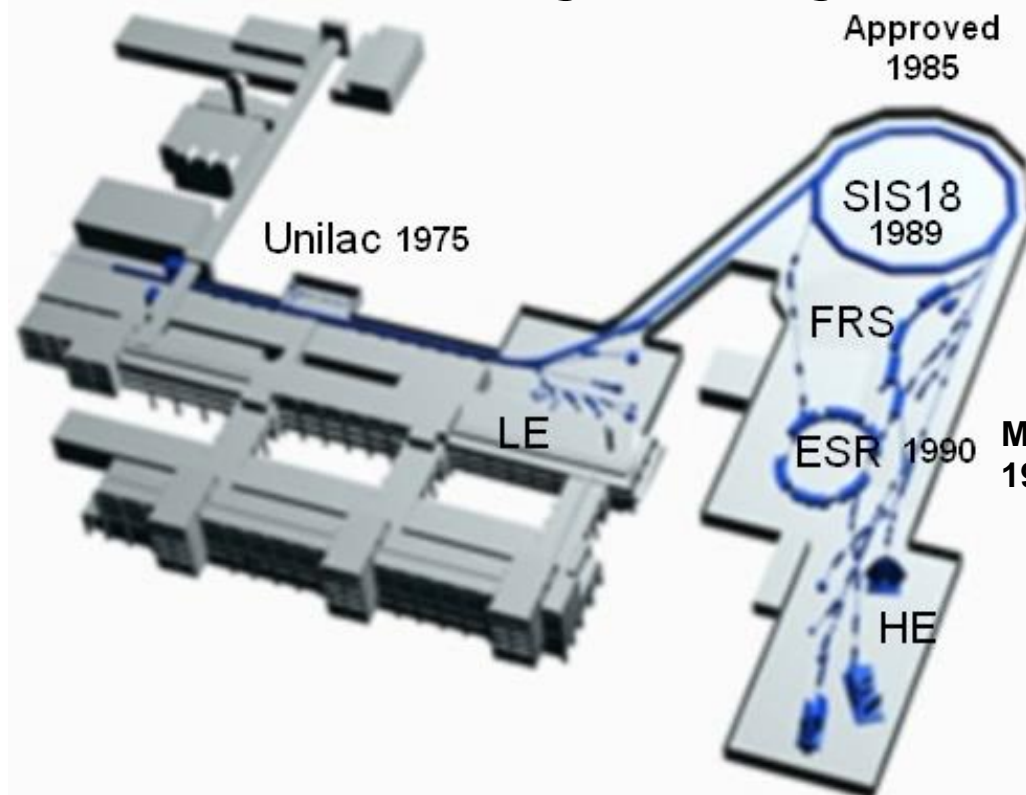1980–82 HEACC at CERN: LEAR–Proposal (LEAR project by Lefèvre, Möhl & Plass); Dieter explains proudly ICE to K. Blasche & B. Franzke; Article: Phase–space Cooling of Ion Beams by Dieter & K.Kilian stimulating the design of SIS18/ESR
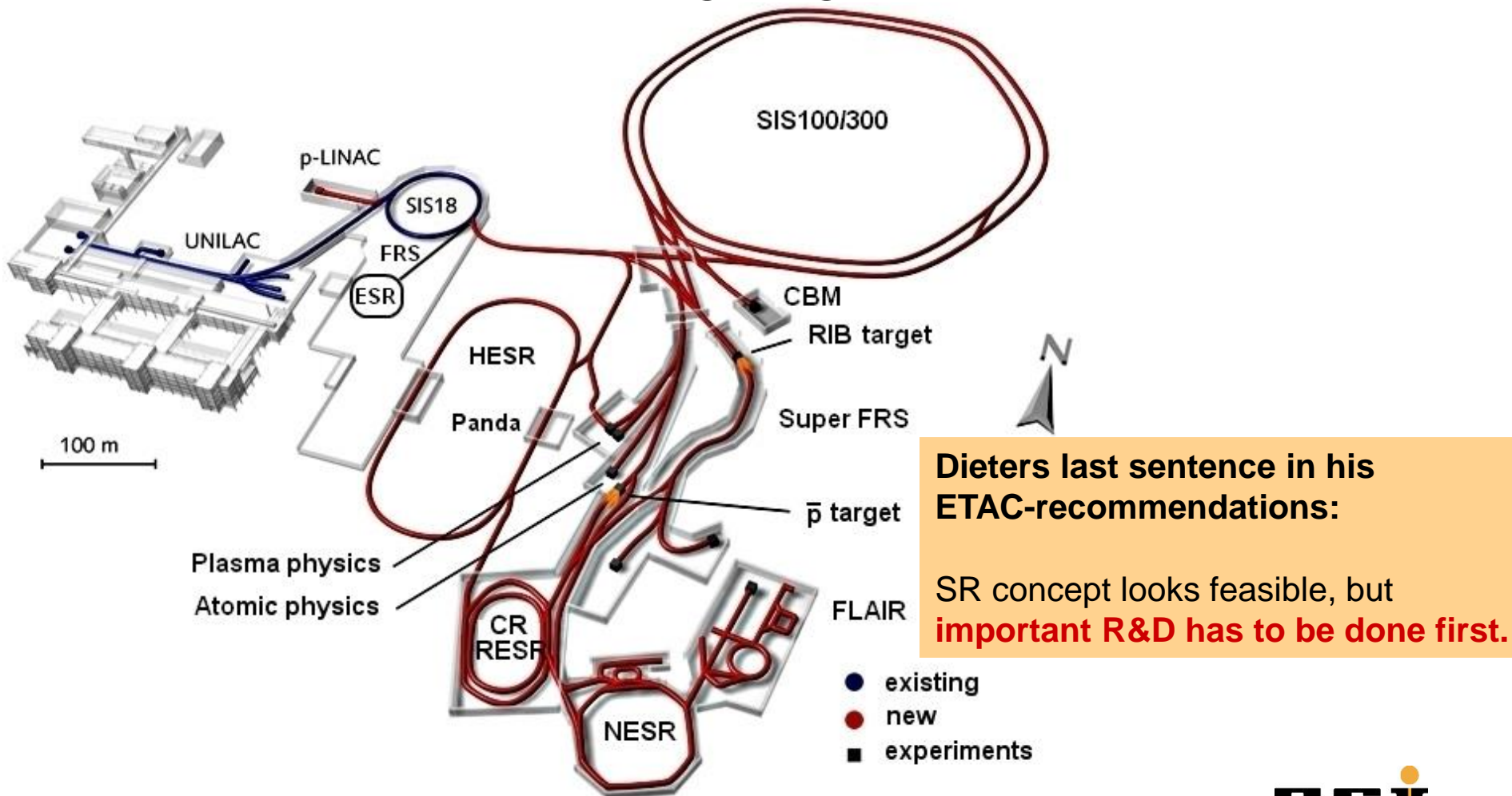

Approved 1985

Unilac 1975

SIS18 1989

FRS

LE

ESR 1990

HE

May 1990 Electron cooling
1997 Stochastic pre-cooling
after strong support by
CERN
(Caspers&Thorndahl)

1993–99 Dieter interested in cooling results at ESR (ordering etc.)

2001 Dieter in Advisory Committee ETAC for the conceptual design of new accelerator/storage ring facilities at GSI (later FAIR)

Dieters last sentence in his ETAC-recommendations:

SR concept looks feasible, but **important R&D has to be done first.**

2002   Invited talk on "Cooling and Accumulation of secondary beams at CERN" and chairman at Hirschegg Workshop on RIB physics at storage rings

Milestones: Dieter Möhl & GSI/FAIR

2003   Mini Workshop of FAIR storage ring-group with Dieter on stochastic cooling (SC) of pbar and HI beams at CR

2004-11 Various meetings (up to 3 times per year):
Concept & design of fast pre-cooling of pbar and HI beams at CR and stochastic pbar accumulation at RESR

Faltin structure for 2-4 GHz momentum cooling in the CR

inventor L. Thorndahl, public relations D. Möhl
April 2011

The CR cooling system has vertical-longitudinal and horizontal-longitudinal PU systems. Each tank contains 8 moving beams. One could equip 2 of the 8 beams with 2-4 GHz Faltin structures (and leave the other 6 for the 1-2 GHz systems). - Instead of 2-4 GHz 2-3 GHz may be considered.

2-4   1-2   1-2   1-2 GHz

Milestones: Dieter Möhl & GSI/FAIR

**DRAFT: Summary of Discussions on Stochastic Stacking
in the RESR, 12.3.2008**
D. Möhl

  T. Katayama and D. Möhl presented preliminary results of stacking, simulated by use of the Fokker-Planck equation . Two codes are available, one developed by **Takeshi Katayama** and one by **Lars Thorndahl.** These programmes include the feedback via the beam and intra-beam scattering. The codes have been tested against each other and by applying them to the case of the CERN AA as modified for the ACO L project in 1983. For this case detailed simulation results by S. van der Meer (handwritten notes) exist. After a lot of checks the agreement can now be regarded as very satisfactory.
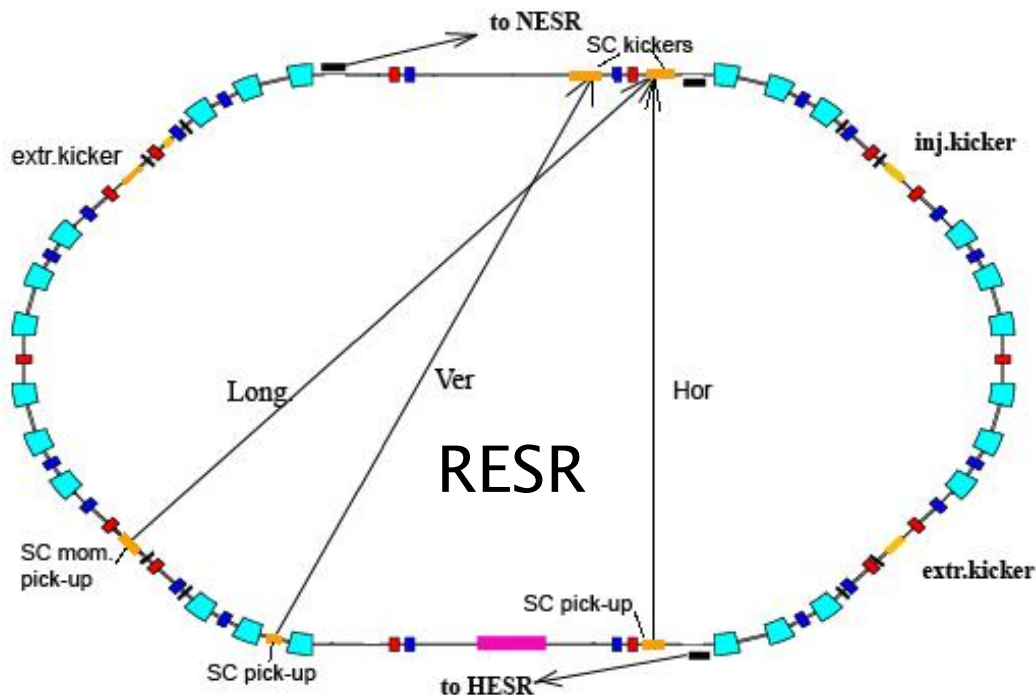
Proceedings of COOL'11
**SIMULATIONS OF STOCHASTIC COOLING
OF ANTIPROTONS
IN THE COLLECTOR RING CR**
C. Dimopoulou, A. Dolinskii, T. Katayama,
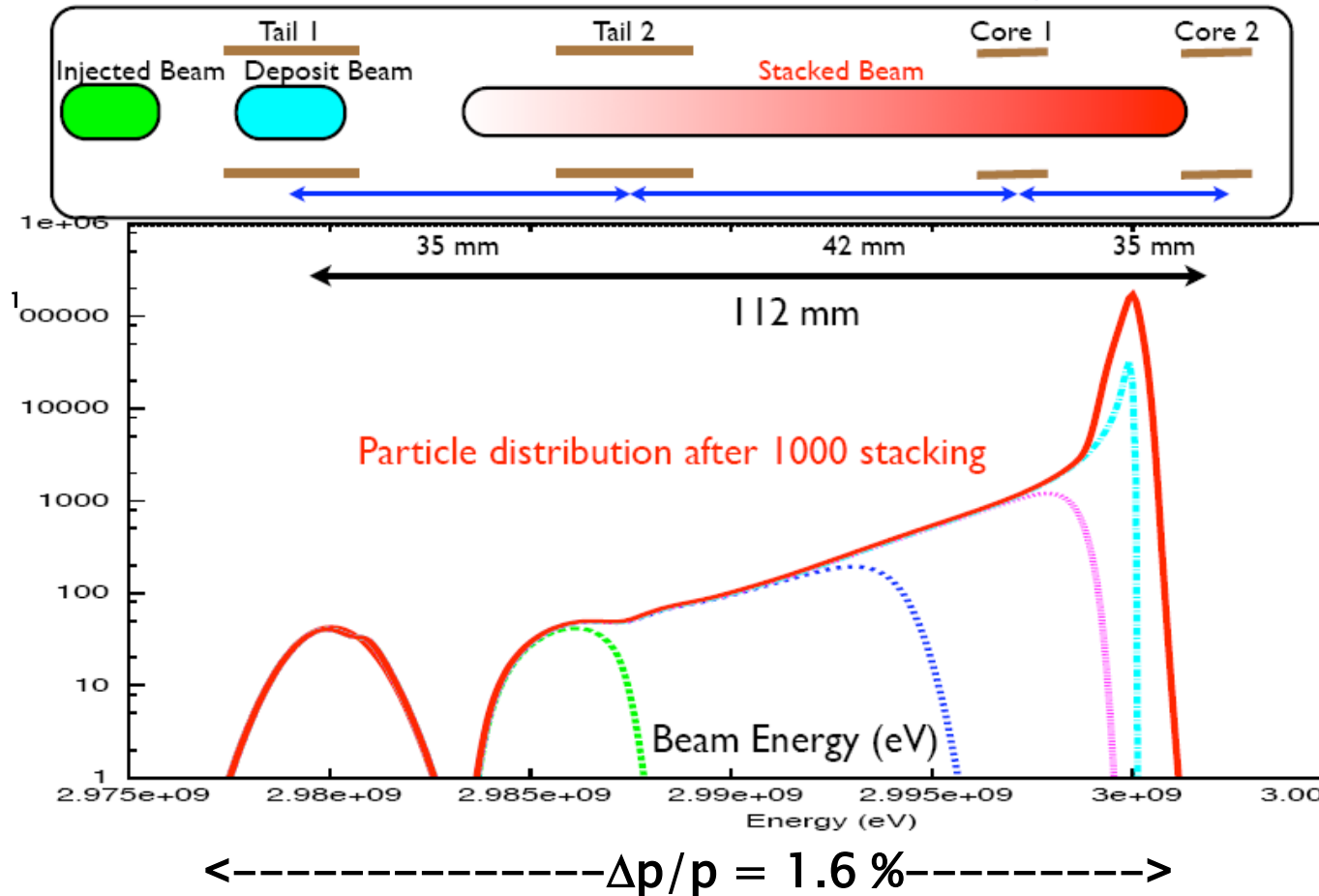F. Nolden, C. Peschke, M. Steck,
GSI-Darmstadt
D. Möhl, L. Thorndahl, CERN

Milestones: Dieter Möhl & GSI/FAIR

10^8 pbars every 5s   **longitudinal tail cooling 1–2 GHz**   **longitudinal & transversal core cooling 2–4 GHz**

Simulation of Pbar accumulation at the RESR

with loop couplers or Faltin–type electrodes

Layout and simulations in collaboration with

D. Möhl
L. Thorndahl
T. Katayama

<------------------$\Delta p/p$ = 1.6 %---------->

up to 10^{11} pbar may be captured from core and transferred to the HESR

Milestones: Dieter Möhl & GSI/FAIR

2006–11 Theoretical and experimental studies of various methods of longitudinal beam accumulation supported by EC or SC:

1) Injection into gap of fixed or moving barrier buckets (BB)

2) Dieters proposal: Injection onto unstable fix point of h=1 rf bucket (obviously much less complicated!)

> 1. draft 20.3.06, present draft 21.6 .06 WORD file "RFstacking_NESR",
> EXCEL "RFstacking"_
> **A stacking scheme for the NESR using the h=1 RF**
> (Draft 21.6.06)
> **Dieter Möhl**

Milestones: Dieter Möhl & GSI/FAIR

2007   Successful beam accumulation at the ESR by means of
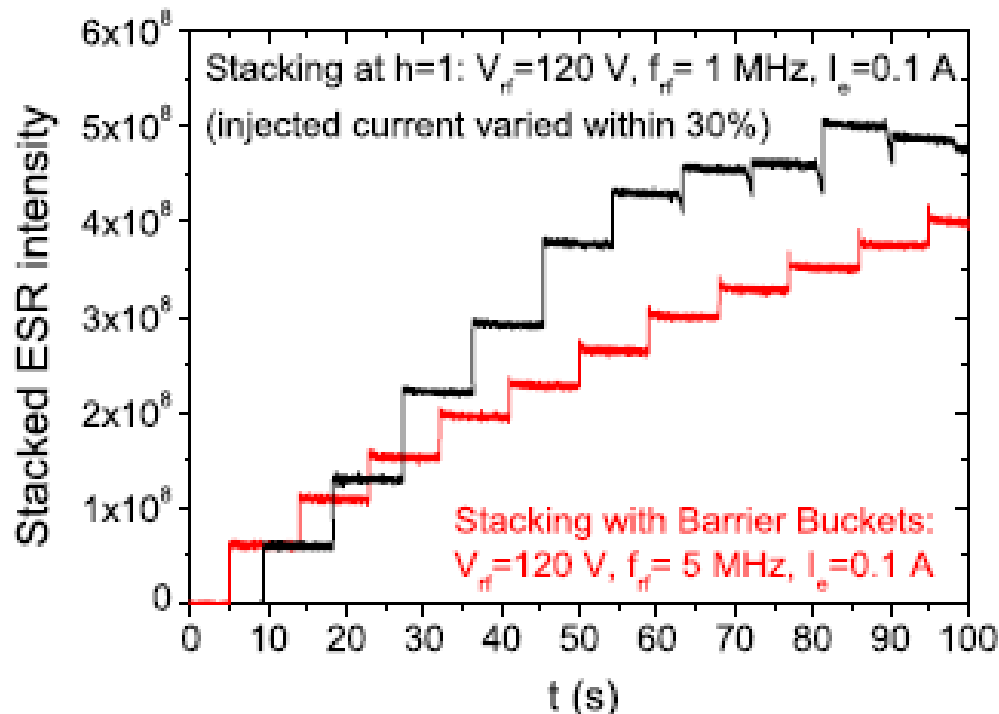   BB or h=1 rf bucket, both with simultaneous EC

Stacking with moving BB and EC
Beam $^{40}Ar^{18+}$ at 65.3 MeV/u
Stacking cycle: 9 s

Milestones: Dieter Möhl & GSI/FAIR

2010   Successful demonstration of BB and h=1 accumulation at ESR with SC (Proof of Principle, POP-Experiment)

TUPS20   Proceedings of COOL'11, Alushta, Ukraine

**DEMONSTRATION OF LONGITUDINAL STACKING IN THE ESR
WITH BARRIER BUCKETS AND STOCHASTIC COOLING**

M. Steck, C. Dimopoulou, B. Franzke, O. Gorda, T. Katayama, F. Nolden, G. Schreiber, GSI Darmstadt, Germany
D. Möhl, CERN, Geneva, Switzerland
R. Stassen, H. Stockhorst FZJ, Jülich, Germany
I. N. Meshkov, A. O. Sidorin, G. Trubnikov, JINR, Dubna, Russia
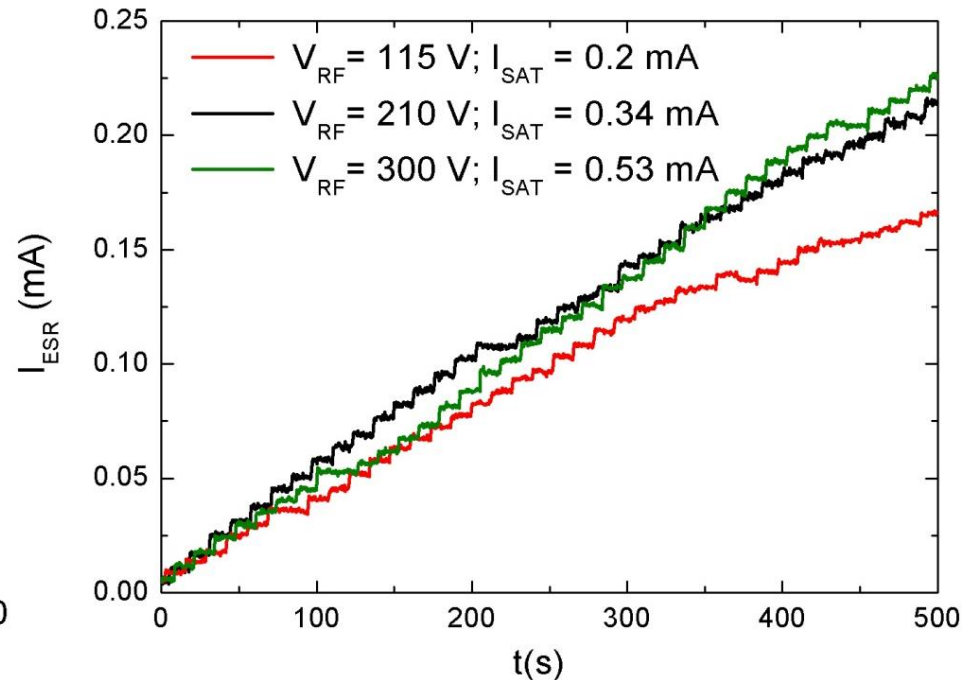
Proof–of–Principle (POP) Experiment in the ESR

single Ar^{18+} bunch
at 400 MeV/u
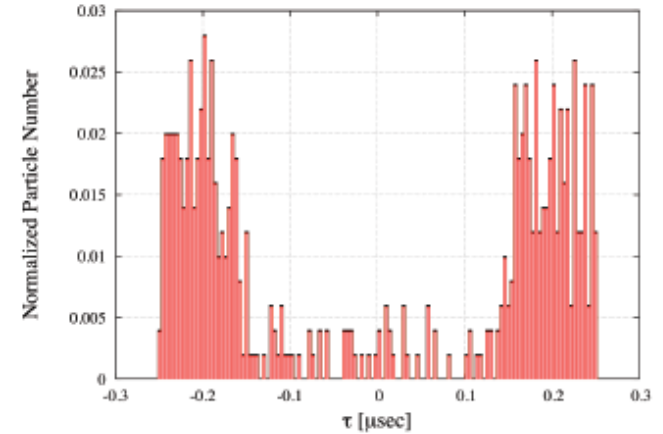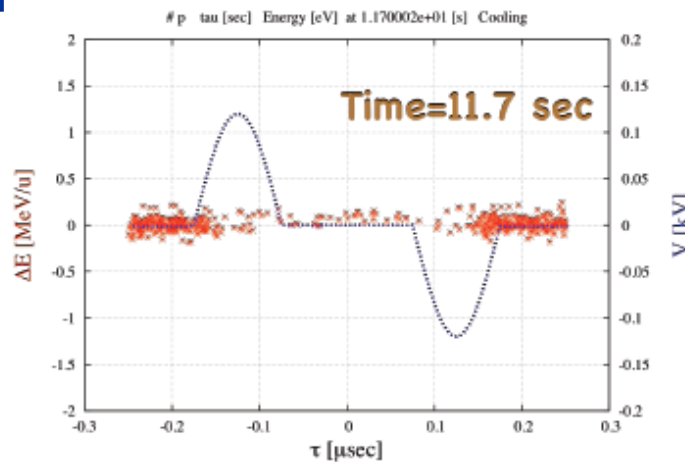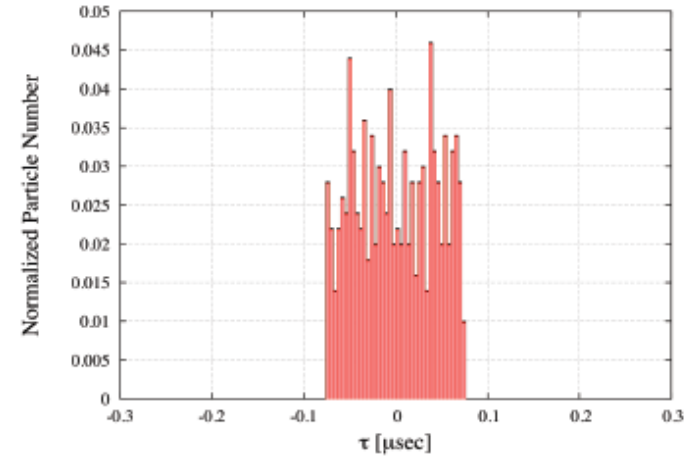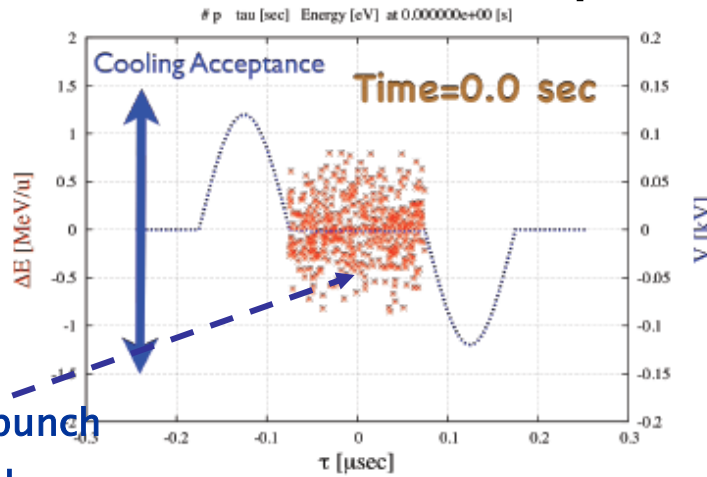
mainly to demonstrate the method and benchmark codes, limited by ESR hardware

Stacking by combination of rf and stochastic cooling
with good efficiency and reliability
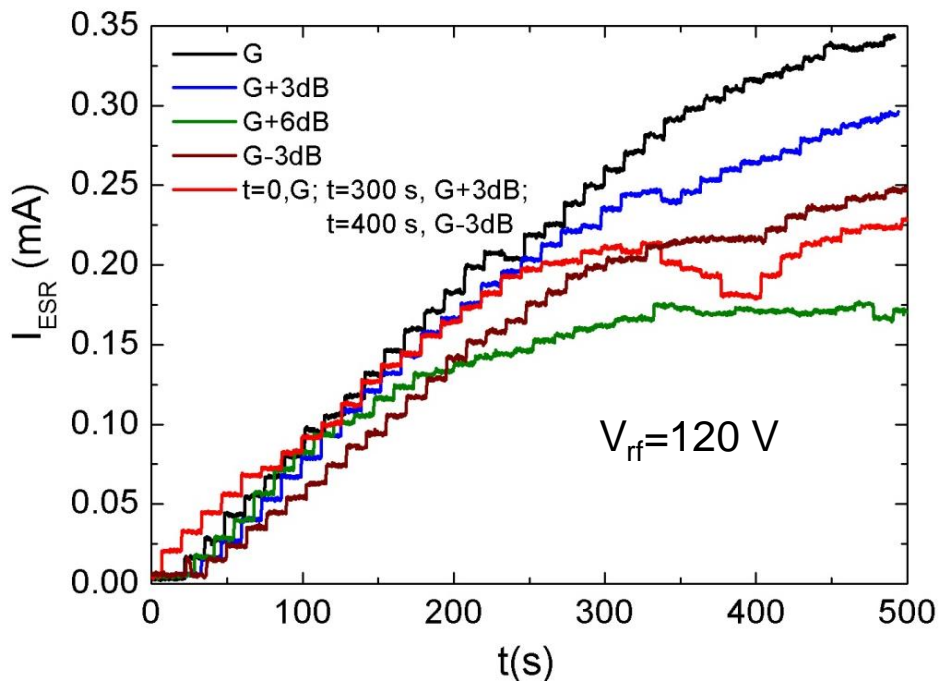
stacking with fixed barriers

stacking on unstable fixed point of h=1 rf−bucket

Milestones: Dieter Möhl & GSI/FAIR

Celebration of Success of POP Experiment
2010 September 9th, at ESR Control Room
GSI, FZJ, JINR & CERN Collaboration

Dieter

We sadly miss you!

We are glad having met you!

We gratefully remember you and your excellent work!