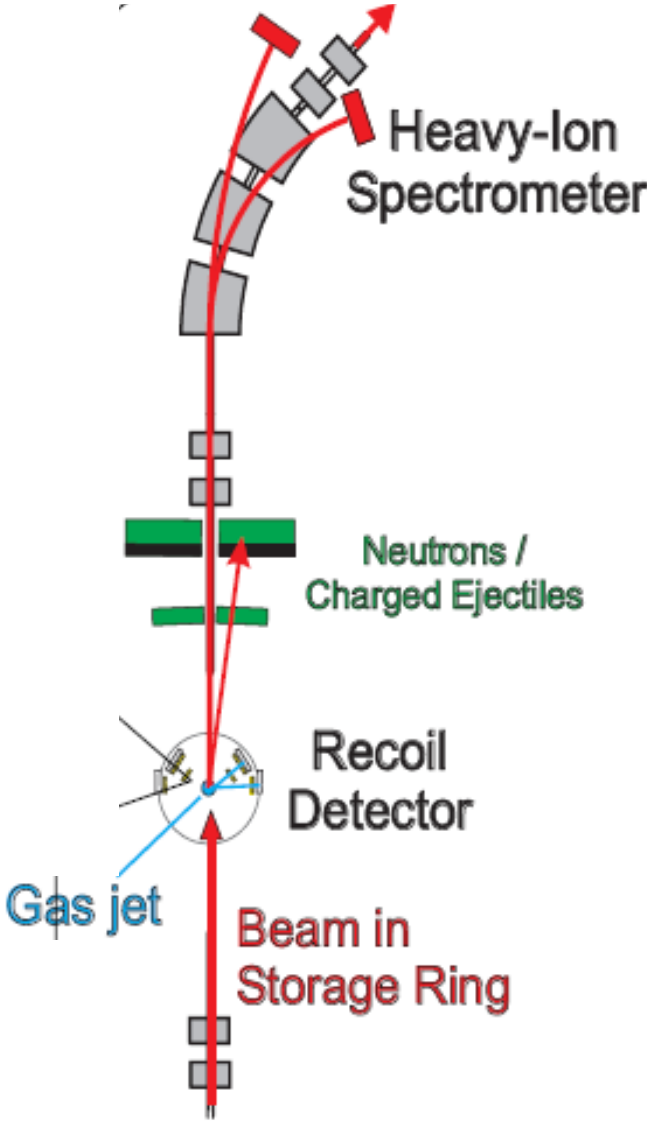
planned ESR tests

T. Faestermann T U München 15 Oct. 2008



EXL Heavy Ion Spectrometer

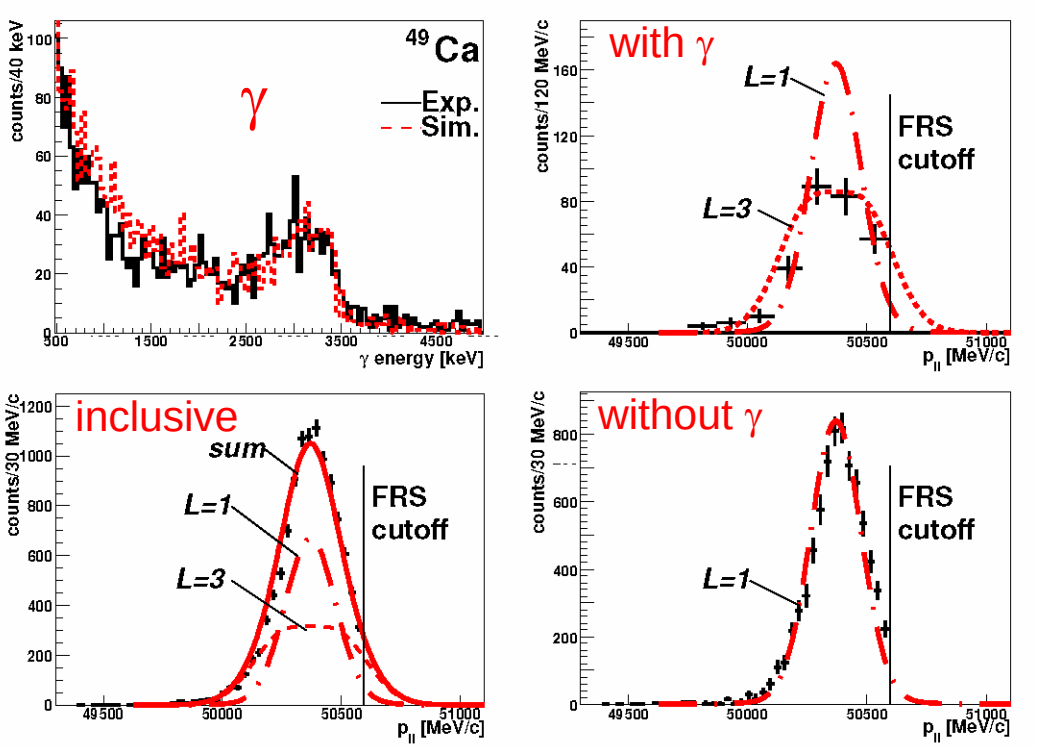
similar for ILIMA, ELISe, AIC

what can be learned at ESR?

on the basis of old proposal
for the ESR

Knockout Reactions - example

450·A MeV ^{50}Ca on ^{9}Be => ^{49}Ca
@FRS - R^{3}B type experiment



Maierbeck et al., PLB nearly submitted

huge cross sections
100 mb

from $d\sigma/dP_{//}$
=> L-value of
knocked-out nucleon

from σ to a specific state
⇒ $C^2S(j,n)$

needs:
- shell model calculation
- eikonal reaction theory

to be measured

particle identification, residual nucleus

$\delta Z < 1 \quad \delta A < 1$

longitudinal momentum

$\delta P_{//} \sim 20$ MeV/c

gamma coincidence

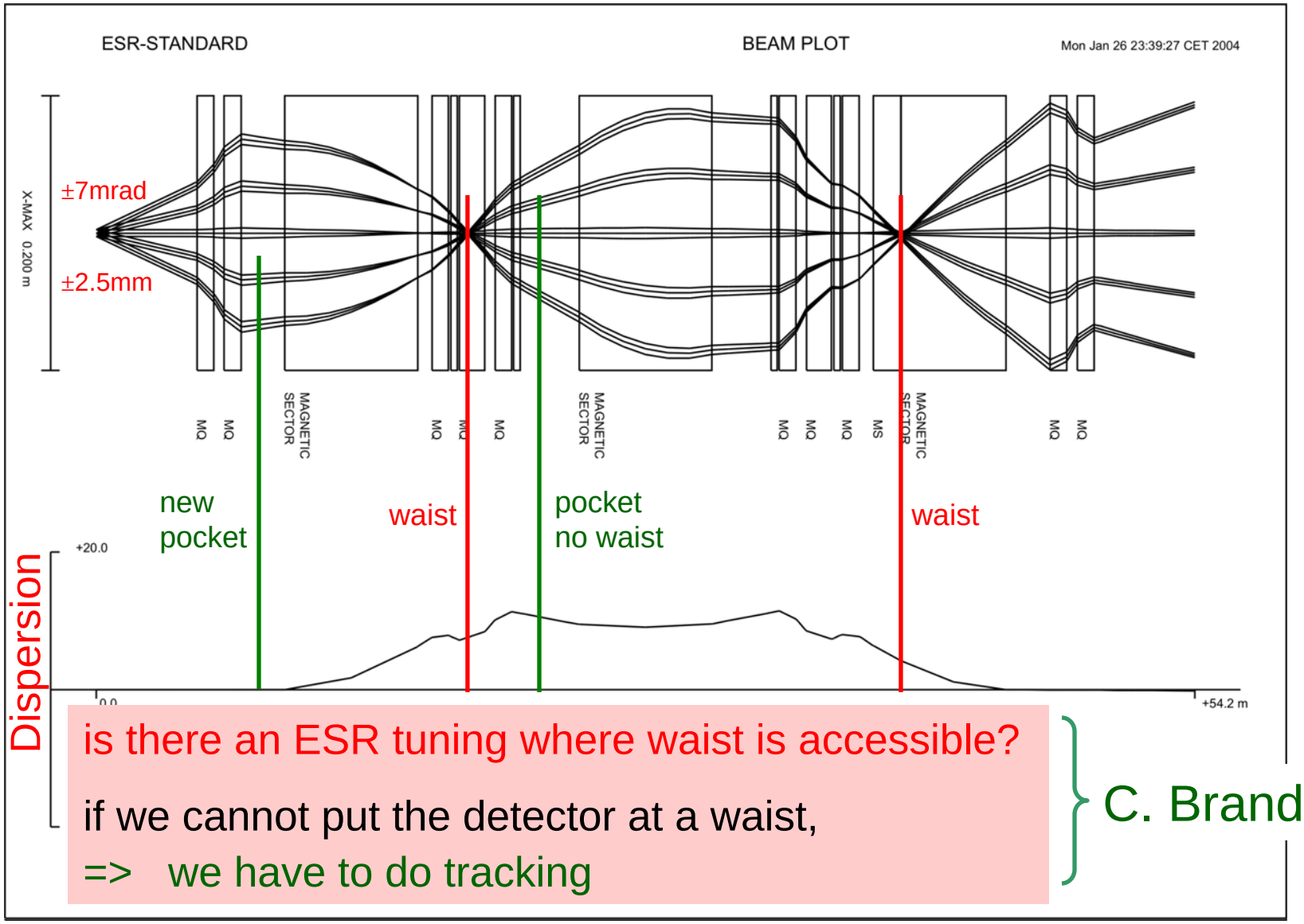
$\varepsilon > 10\%$

 calorimeter

old Proposal

from H. Weick

Where is a waist?

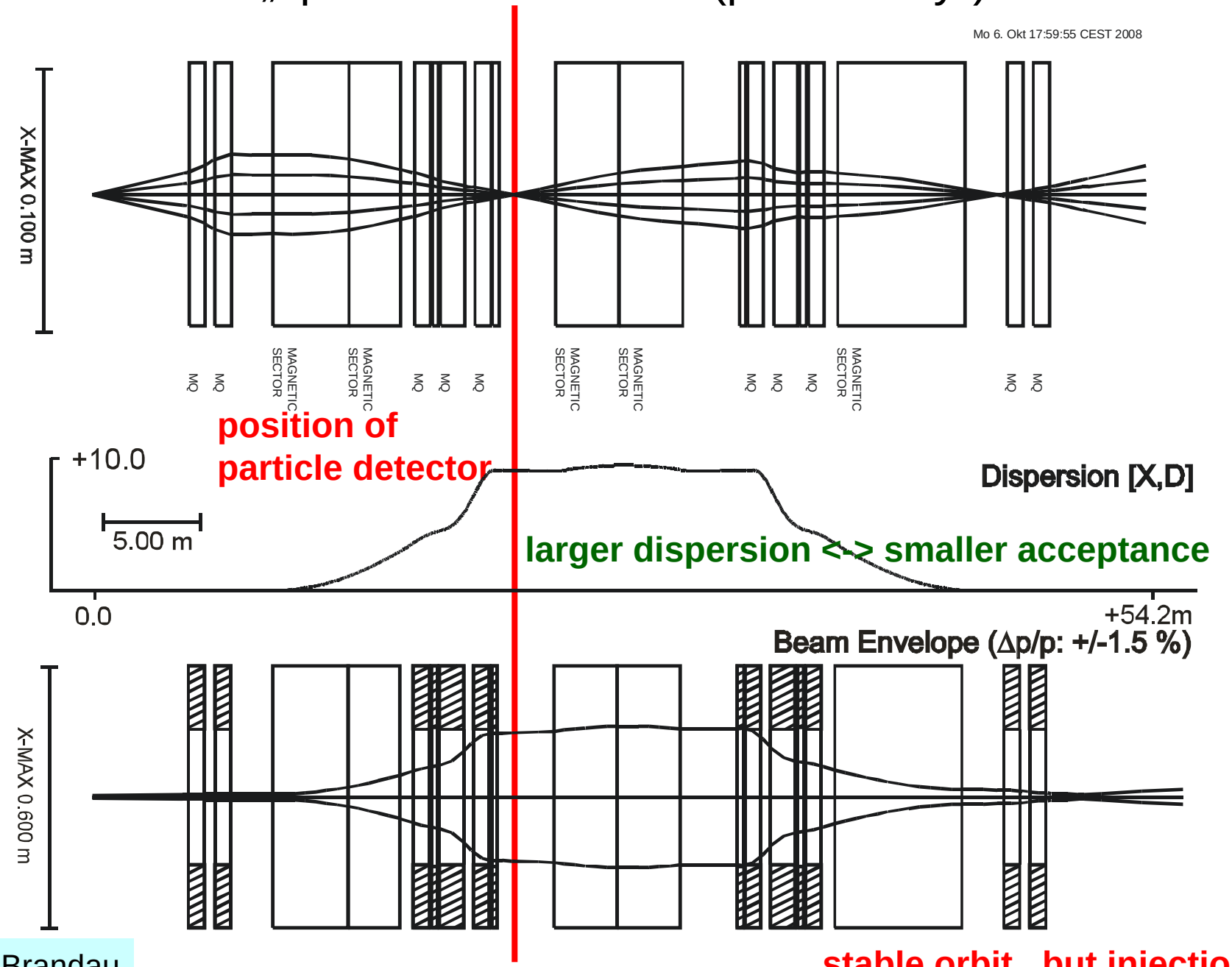


is there an ESR tuning where waist is accessible?

if we cannot put the detector at a waist,
=> we have to do tracking

C. Brandau

ESR „spectrometer mode“ (preliminary“)

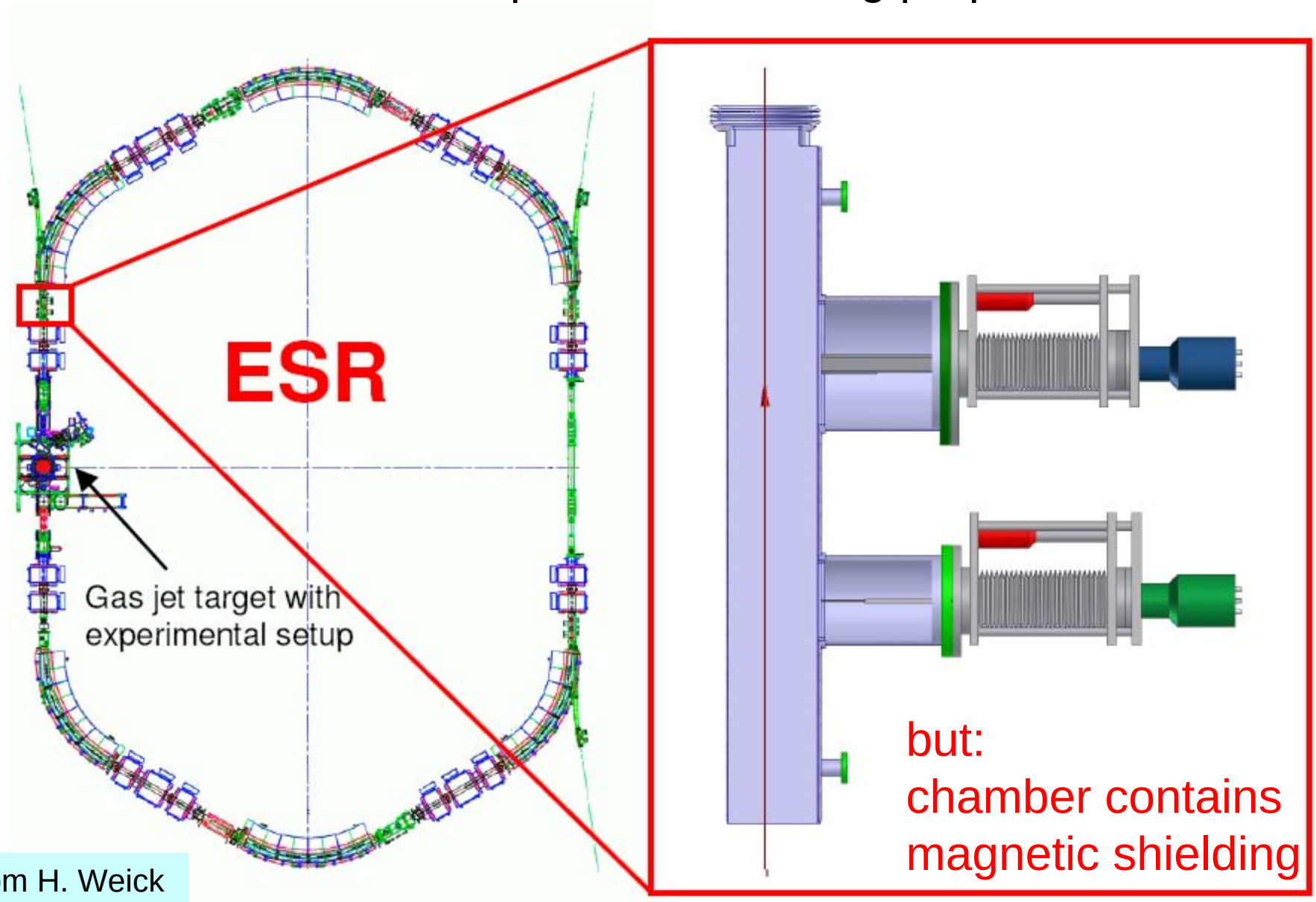


from C. Brandau

stable orbit, but injection?

Tracking Detector in ESR

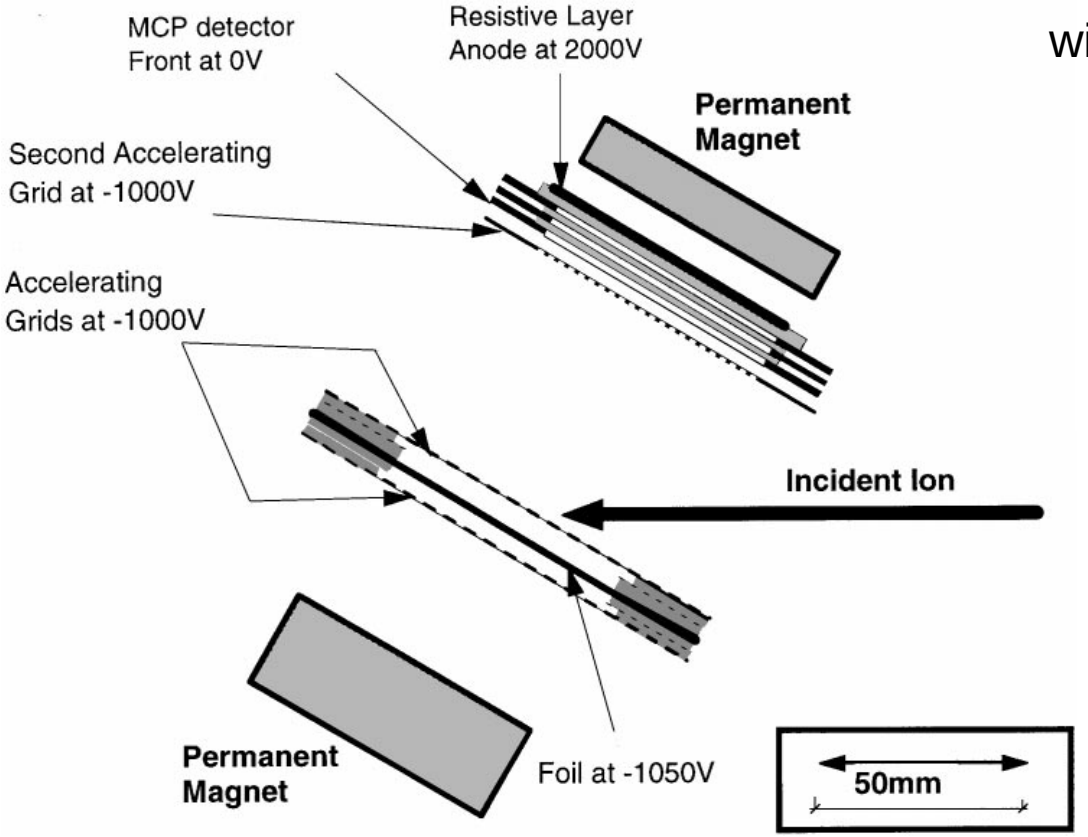
drives and vacuum pockets are being prepared at KVI



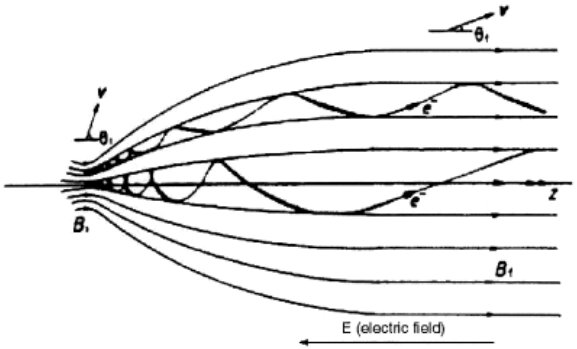
from H. Weick

Foil Detector

B-field parallel to E-field:
Shapira et al., NIM A 454 (2000) 409



with additional field gradient



for our application an external field preferred, i.e. Helmholtz etc.)

from C. Brandau

Restrictions

E < 150 ·A MeV because of limited number of detectors?
no problem if dE measurement at end of range sufficient

A > 90 because of momentum acceptance?
limited acceptance in high-dispersion mode => e.g ^{112}Sn

Only n-knockout?
no, if outside detector could be used

No gamma coincidences?
not high efficiency in ESR, but calorimeter in NESR

Outlook

Annihilation of antiprotons on nuclear surface in NESR-collider

Example

Dispersion: 9m

Acceptance: $\Delta p / p = \pm 1.5 \cdot 10^{-2}$

400 A MeV ^{112}Sn	=>	p = 107 GeV/c
^{111}Sn shift	=>	$1/112 \cdot 9$ m = 80 mm
$\Delta p = \pm 300$MeV/c	=>	$\Delta p / p = \pm 2.8\ 10^{-3}$ => $\Delta x = \pm 25$ mm
		$\alpha = 2.8$ mrad
1mm image	=>	$\delta p / p = 1\text{mm} / 9\text{m} = 1.1 \cdot 10^{-4}$
		$\delta p = 12$ MeV/c

What can be tested?

Detector: Z identification
A identification (dE near Bragg peak)
passive absorber?

Momentum resolution:
spectrometer mode of ESR

Tracking: detector in front of 1st dipole
could a foil detector serve for tracking?

1) stable beam => 2) abundant fragment

Simultaneous test experiment close to gas target

Only parasitic beam is needed

What would we ask for?

- development time for modified ESR mode
  some time in 2009

- develop tracking detector for UHV and
  build ID-telescope in pocket

- real experiment with medium heavy beam
  together with another EXL test
  early in 2010