Storage Rings Status

Helmut Weick, GSI

EXL / R3B collaboration meeting

Milano, 4. Oct 2006

- Status of Beams
- NESR Building
- Ongoing Work

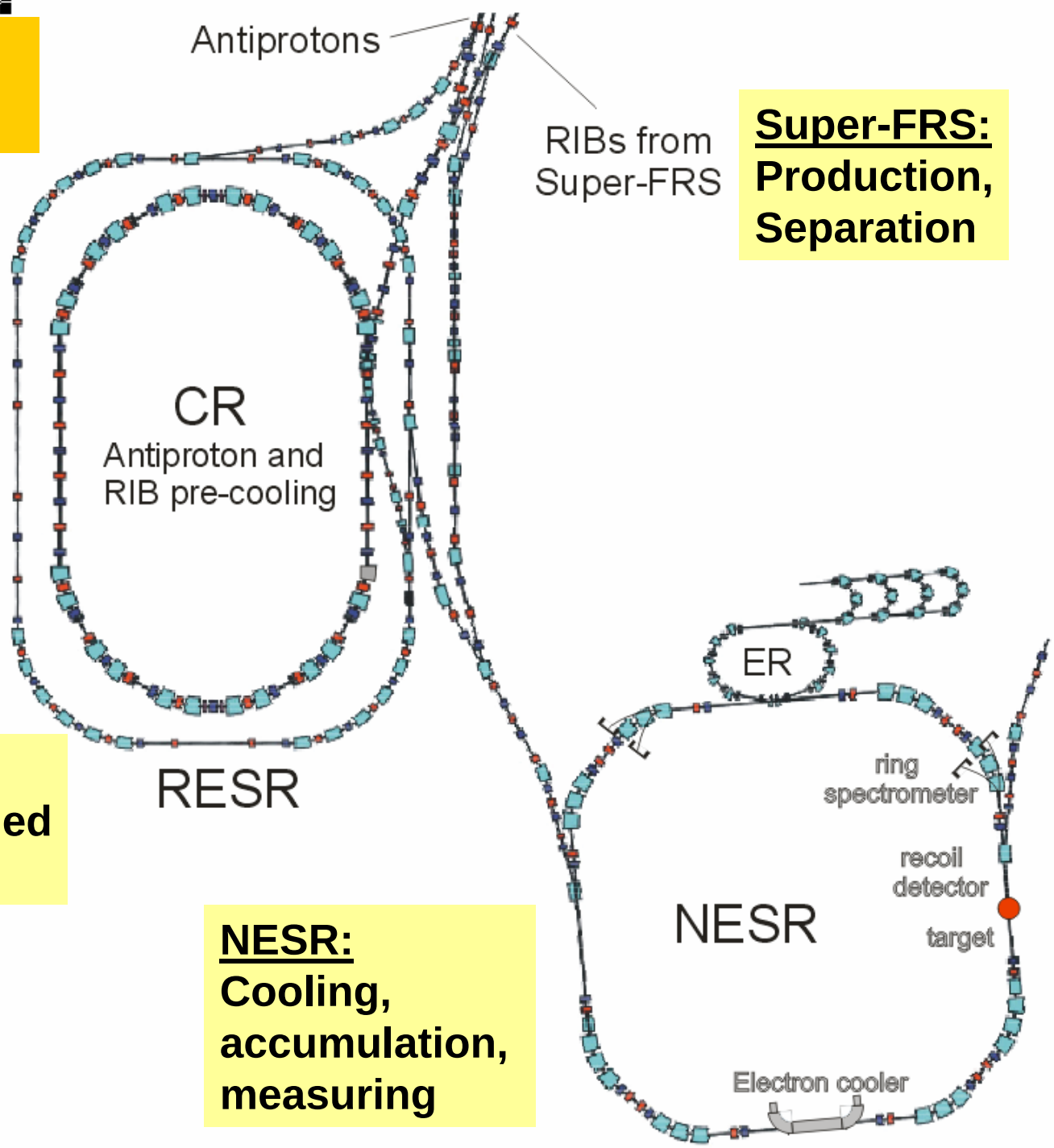
Ring Layout

CR:
Bunch rotation
Stochastic cooling
at 740 MeV/u
also for separation

RESR:
Deceleration if needed
down to 100 MeV/u

NESR:
Cooling,
accumulation,
measuring

Super-FRS:
Production,
Separation



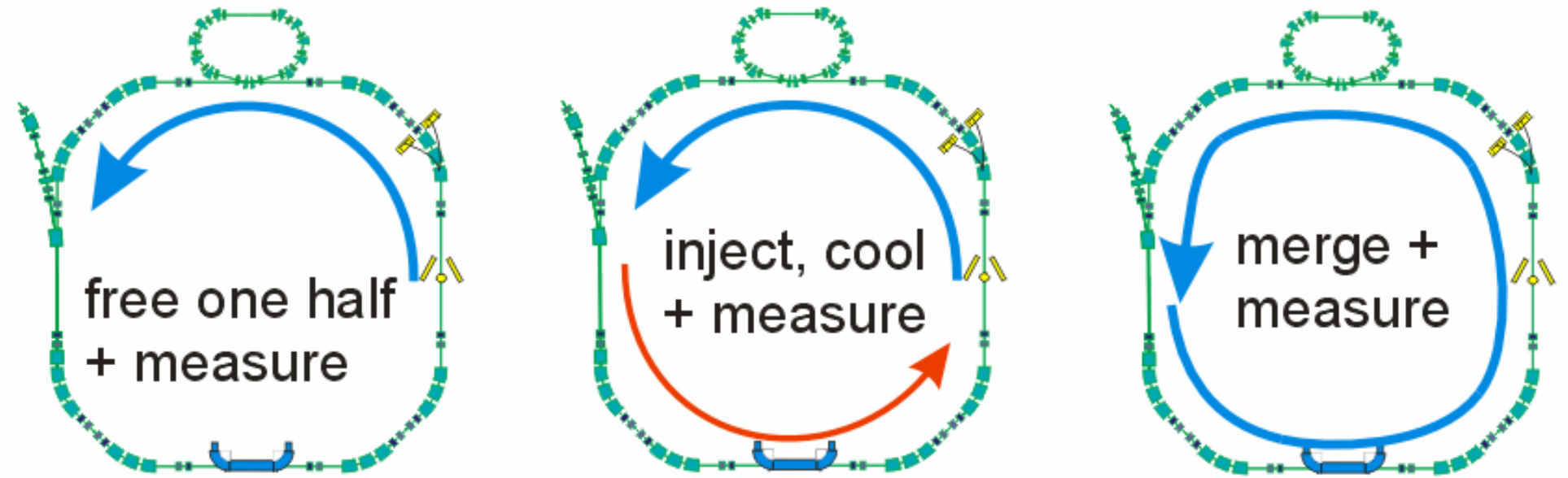
Accelerator as in technical report
partly forced by the need of cost reduction

- **SIS-100: Intensity: 6 *10^{11}/puls, period 1.54s for $^{238}U^{28+}$ at 1500 MeV/u (before 1*10^{12}/s)**

- **CR: Bandwidth and HF-voltage in CR Larger $\Delta p/p=10^{-3}$ cooling time *2 -> ~1.5 sec, acceptance $\Delta p/p$ =±1.0% (before ±1.75%)**

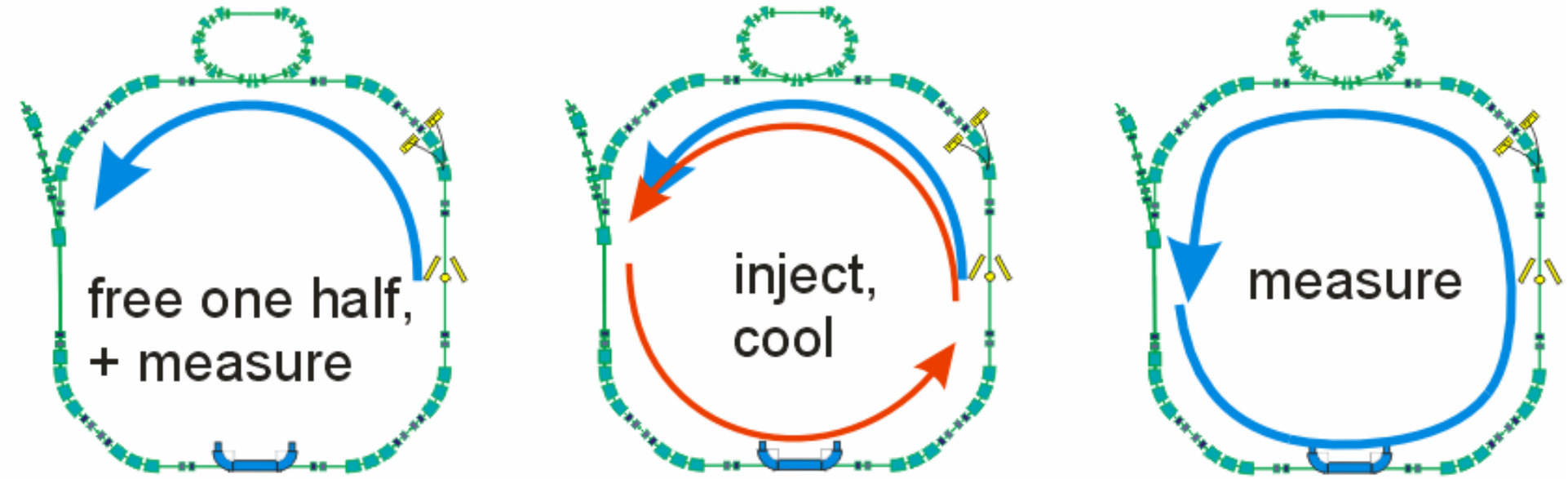
- **NESR: Barrier bucket HF injection system cannot reach high enough voltage. -> No cooled beam ($\Delta p/p=10^{-4}$) measurement and injection simultaneously.**

Continuous Measurement and Longitudinal Accumulation



Problem: HF power is too low
Cooled and uncooled beam will mix.

Longitudinal accumulation and measurement only afterwards

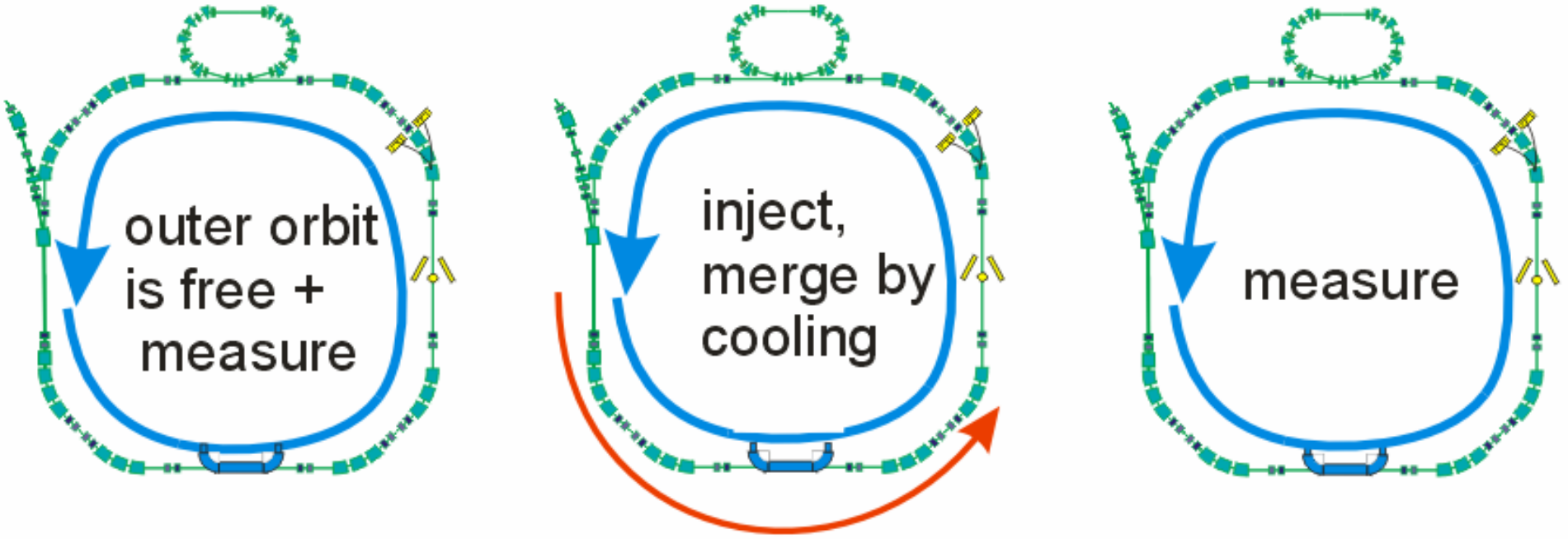


Wait until all beam is cooled -> loss in luminosity.

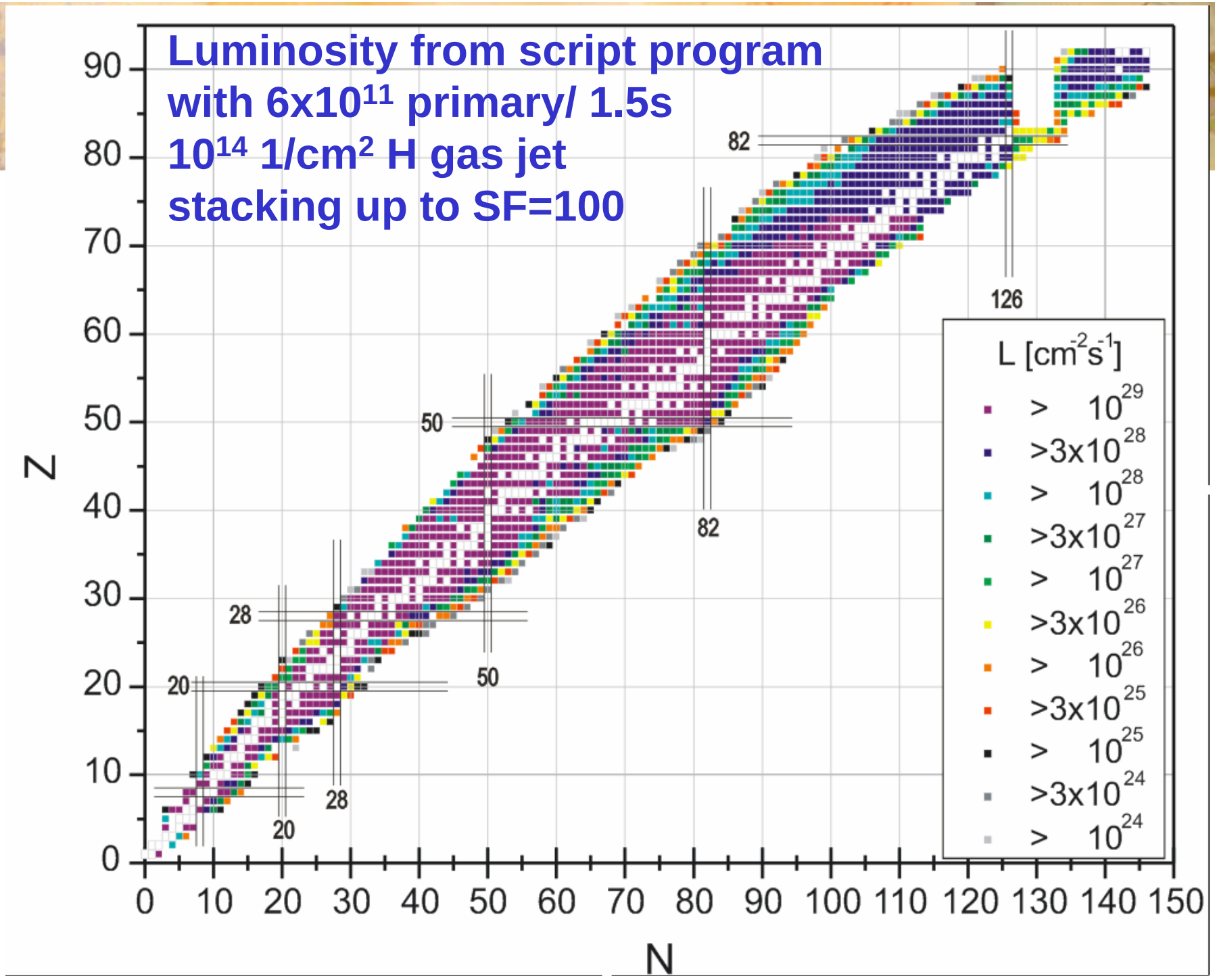
Would provide freedom of bunch structure

may be for reacceleration after thick target.

Transversal Accumulation



No HF barrier bucket system required,
But wide beam at target
-> no narrow apertures for diff.pumping.

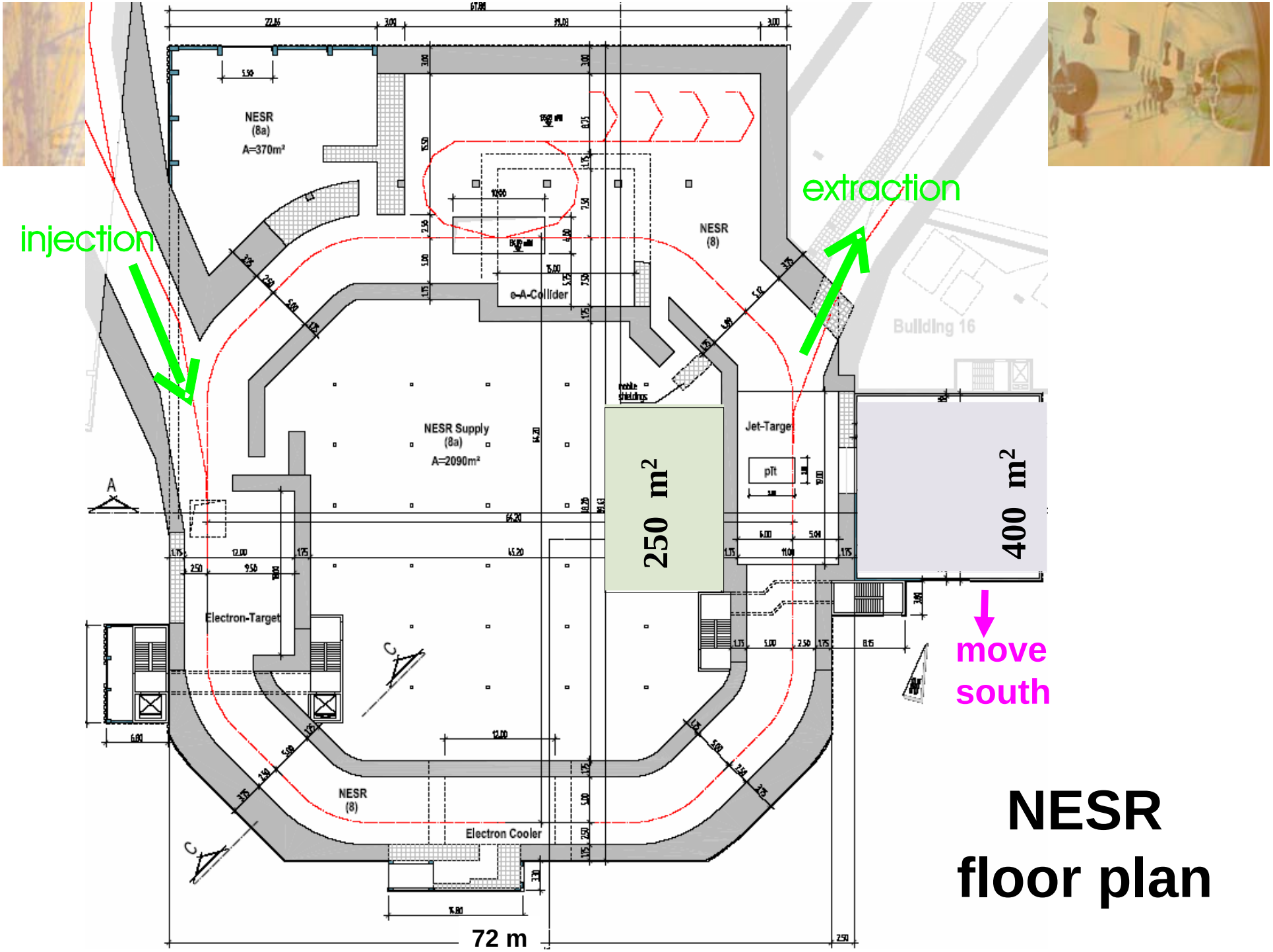

Luminosity from script program
with 6x10^11 primary/ 1.5s
10^14 1/cm^2 H gas jet
stacking up to SF=100
Z
N
0
10
20
30
40
50
60
70
80
90
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
20
28
50
82
126
L [cm^-2 s^-1]
> 10^29
>3x10^28
> 10^28
>3x10^27
> 10^27
>3x10^26
> 10^26
>3x10^25
> 10^25
>3x10^24
> 10^24

Ongoing Work

- **Simulation of cooling times (stochastic + electron cooling)**
- **Magnet Design, by Spanish Consortium, includes vac. chambers**
- **Layout of HF-system for bunching and deceleration**

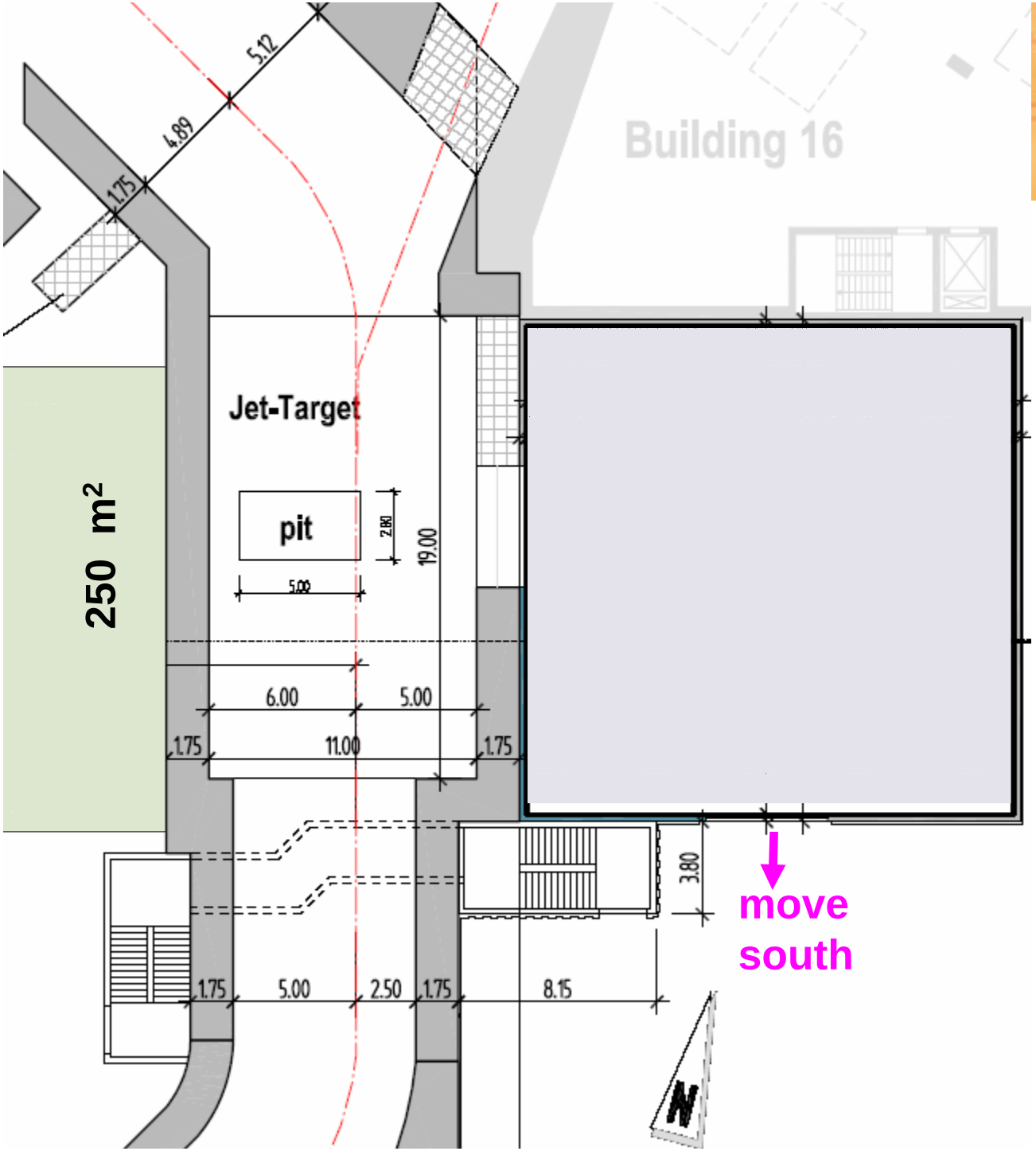
  simulations (Katayama), GSI HF-group
- **Building / Room Layout, civil engineers +**

  M. Steck, Th. Stöhlker, H. Weick
- **Transfer Beam lines to CR / NESR**

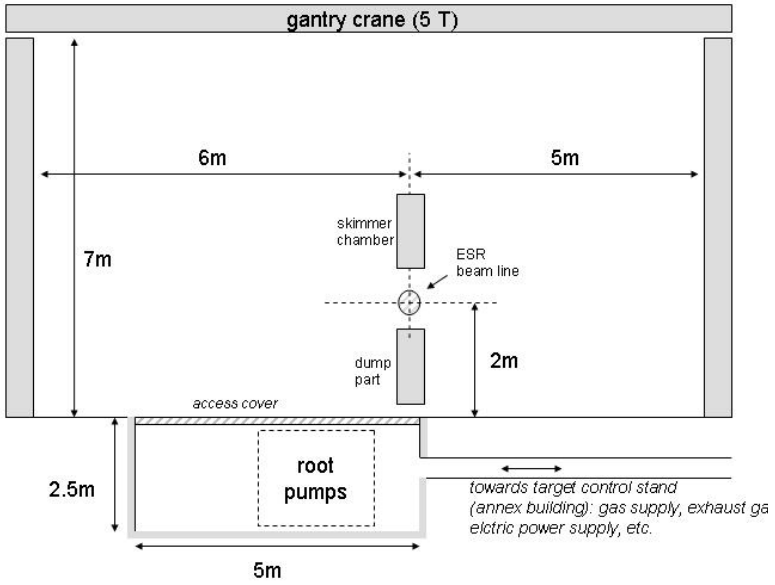


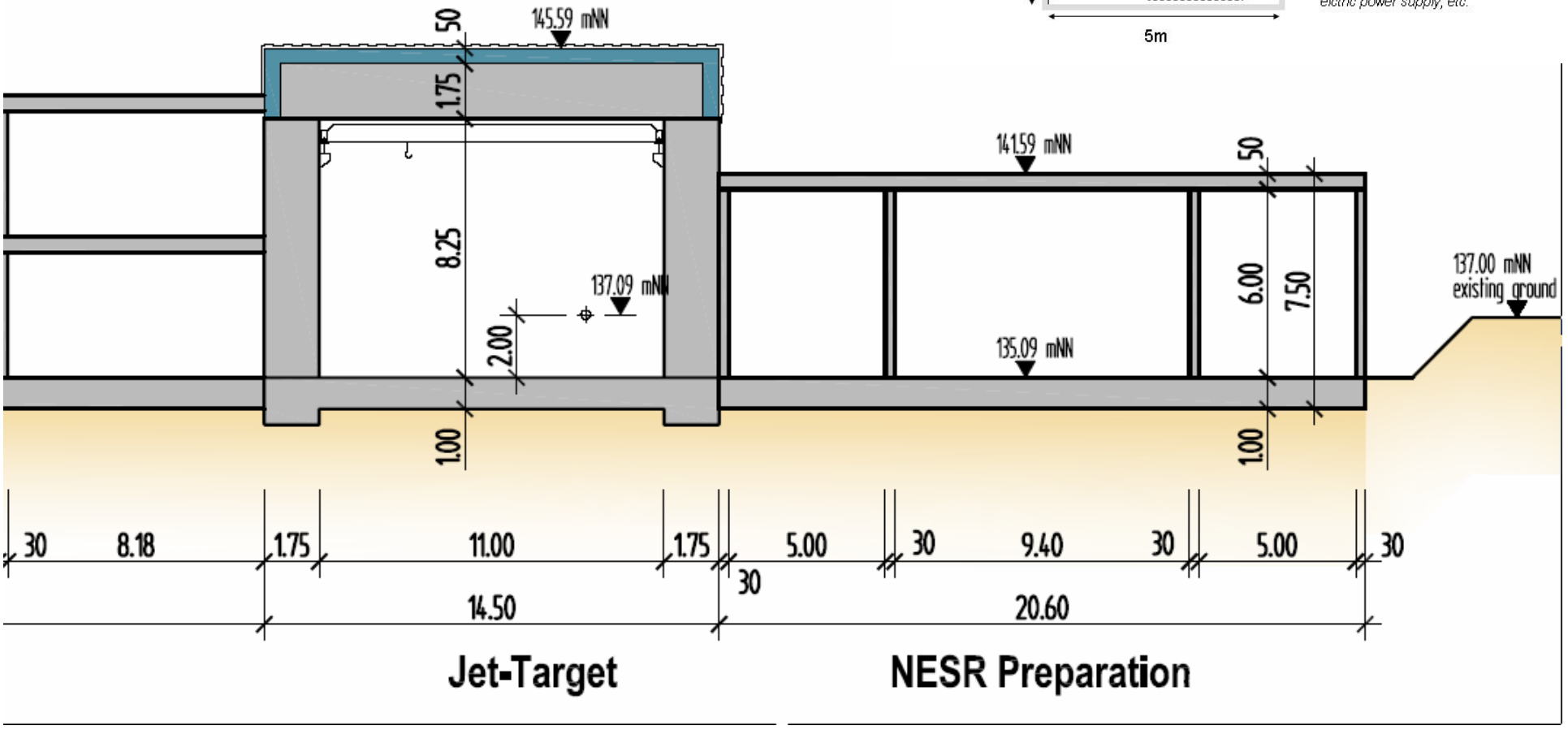
NESR floor plan

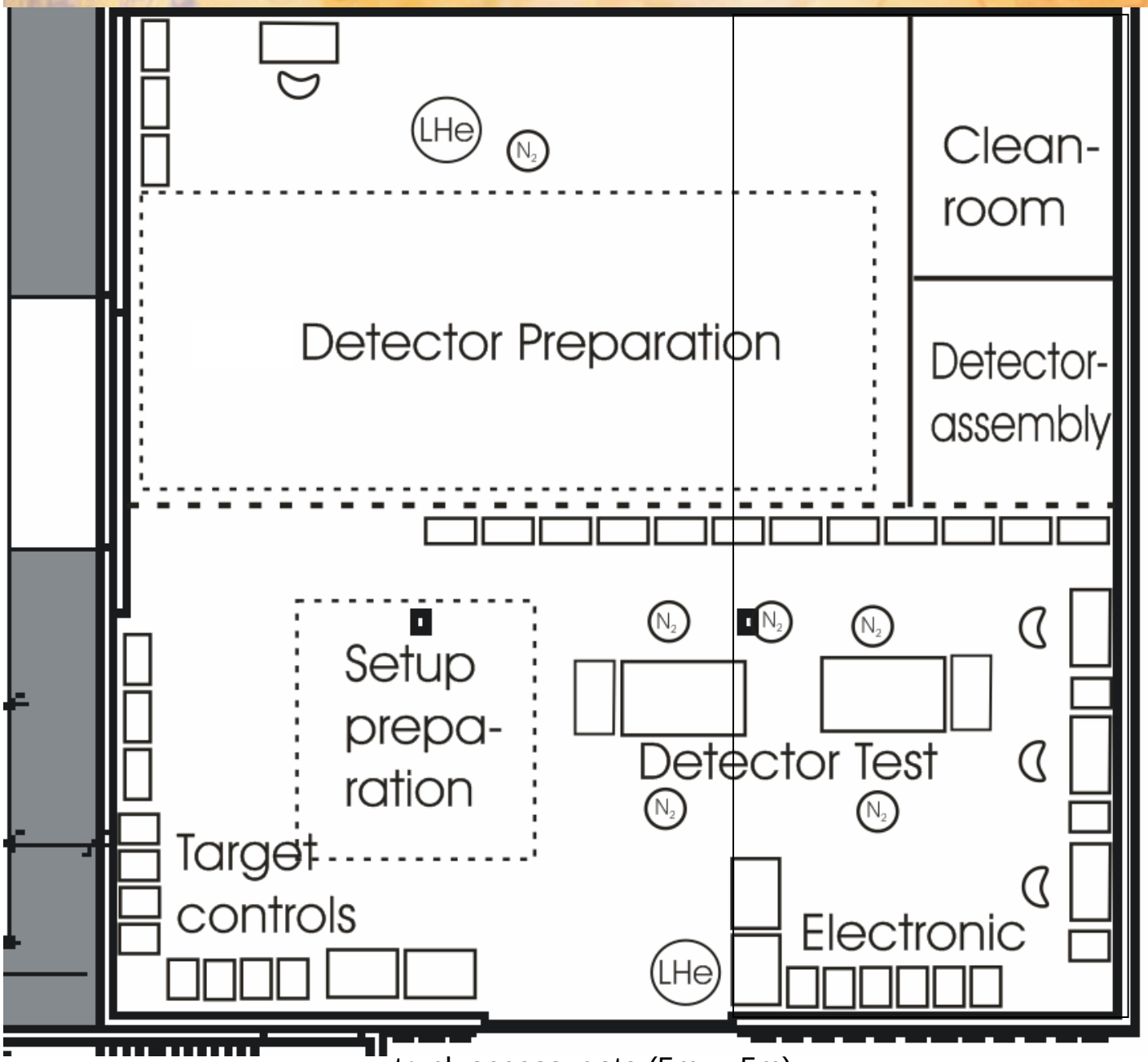
NESR floor plan



NESR building







truck access: gate (5m x 5m)
or big elevator

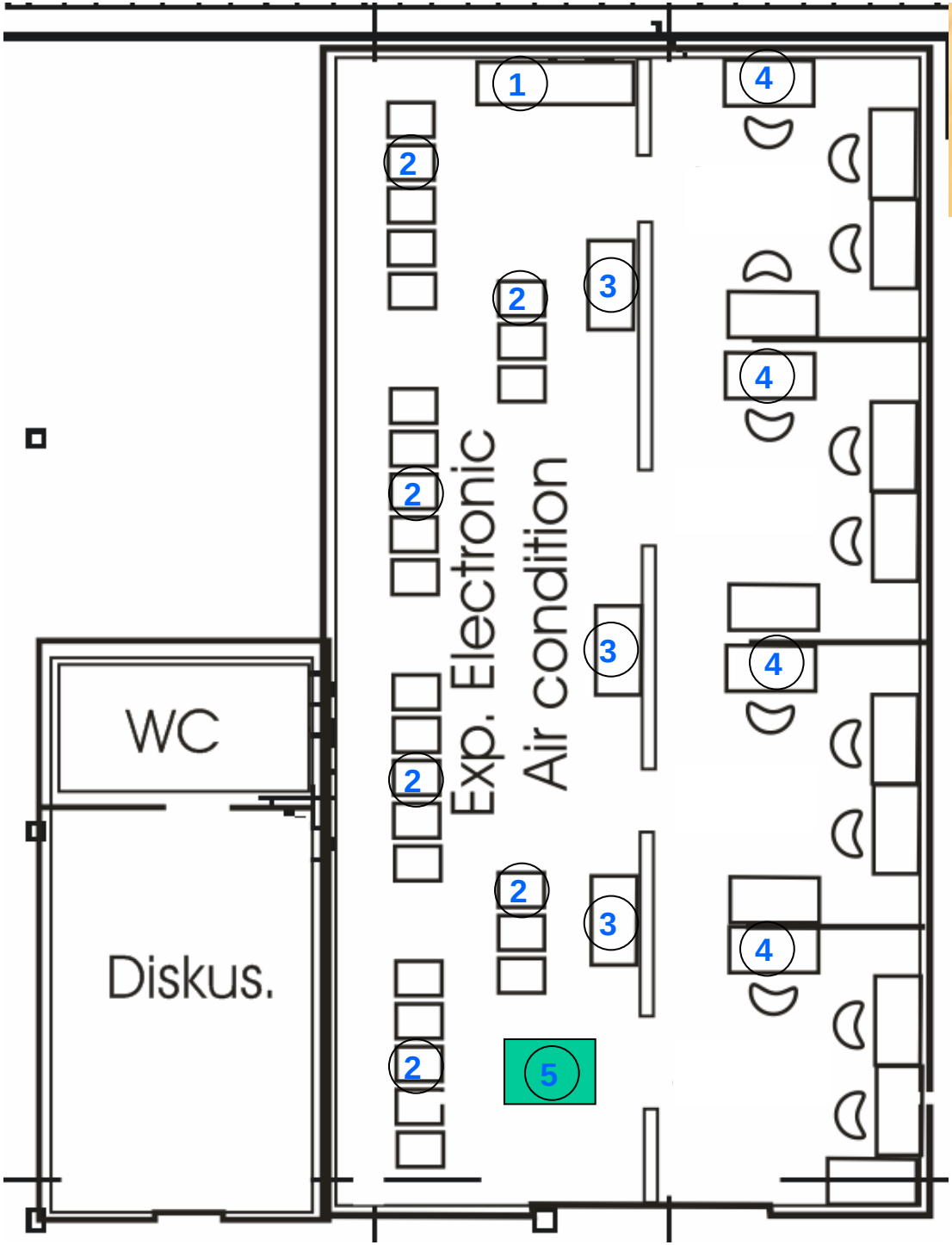
Annex Building
NESR 8b

Total area 400 m^2

height: 7 m

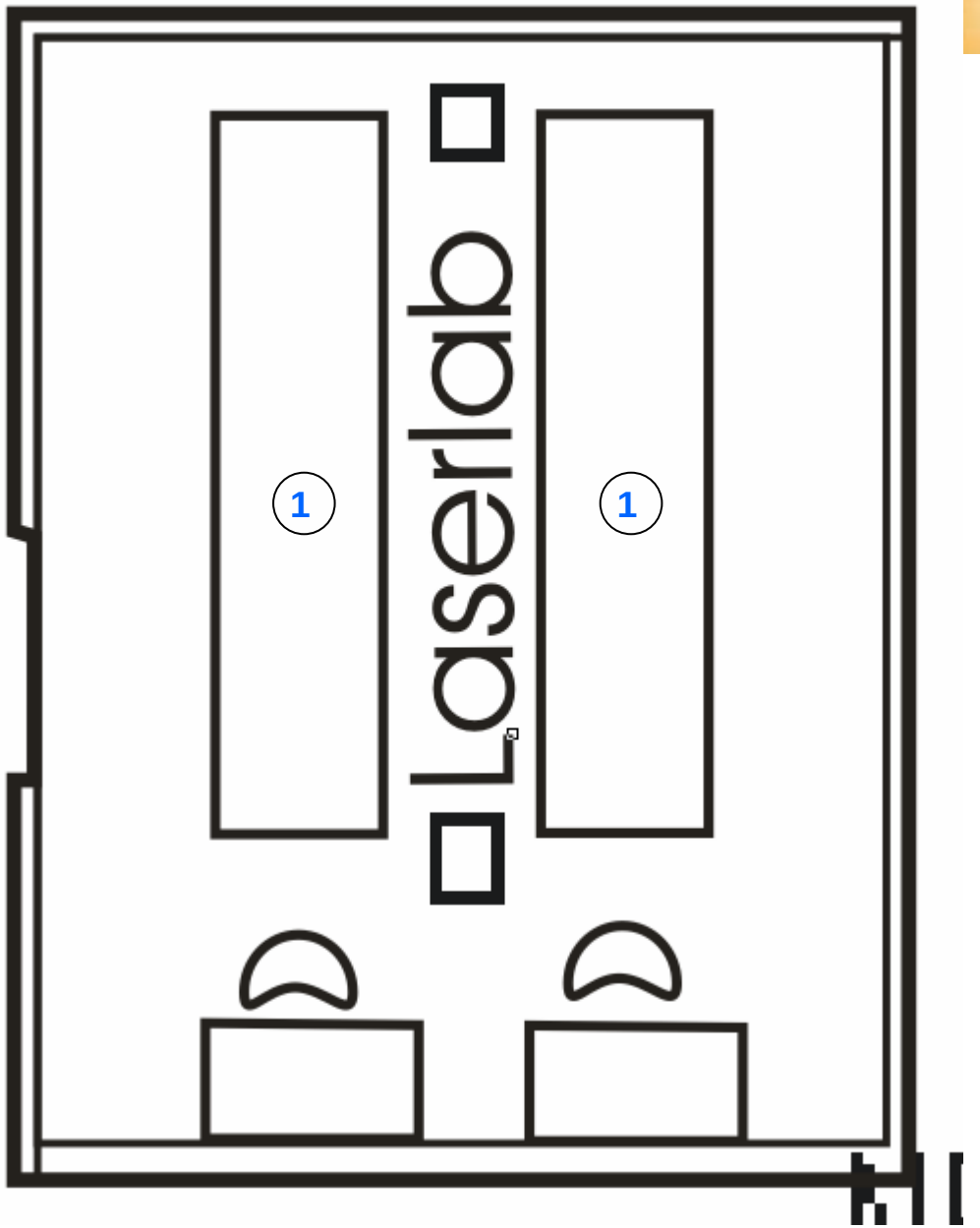
shaded area should
have a second floor

A



1 Workstations
2 Electronic racks
/ cable terminals
3 Terminal desks
4 Work places
5 Accelerator control
(interface)

B



Laser room / clean room 70 m^2 (NESR)

1 Laser desks

C

Load List

Electrical power of each system with cooling water and room temperature.

EXL part:

Bezeichnung						ET			real power		apparent power					
building							el. Work									
Nr.	name	contact	machine	system	system / object	no.	single [kVAh]	total [kVAh]	single [kW]	total [kW]	single kVA	total kVA	multan. factor	net	Power tot. [kW]	max. temp [°C]
8	NESR	M. Steck / T. Stöhlker / H. Weick														
8	NESR	H. Weick	Experiment	others	EXL ring spectrometer detectors	7			0.3	2.10			1	Messnetz	2.10	22
8	NESR	H. Weick	Experiment	others	EXL recoil det. detectors, front end per chan.	560000			1.00E-06	0.56			1	Messnetz	0.56	22
8	NESR	H. Weick	Experiment	others	EXL recoil det. detectors, HV per chan.	560000	C.A.E.N values -> Haik			0.00			1	Messnetz	0.00	22
8	NESR	H. Weick	Experiment	others	EXL recoil det. detectors, front end outside	17500			1.00E-03	17.50			1	Messnetz	17.50	22
8	NESR	H. Weick	Experiment	others	EXL recoil det. detectors, NIM modules+crate	560			0.05	28.00	teilweise		1	Messnetz	28.00	22
8	NESR	H. Weick	Experiment	others	EXL recoil det. detectors, VME crates	4			2.00	8.00			1	Messnetz	8.00	22
8	NESR	H. Weick	Experiment	others	EXL neutron wall, HV per channel	400			0.005	2.00			1	Messnetz	2.00	22
8	NESR	H. Weick	Experiment	others	EXL neutron wall, read out electronics	25			0.06	1.50			1	Messnetz	1.50	22
8	NESR	H. Weick	Experiment	others	EXL luminosity monitor	1			2	2.00			1	Messnetz	2.00	22
8	NESR	H. Weick	Experiment	others	EXL forward detector	1			2	2.00			1	Messnetz	2.00	22
8	NESR	H. Weick	Experiment	others	EXL DAQ	1			2	2.00			1	Messnetz	2.00	22
8a	NESR sup	H. Weick	Experiment	Sonstige	EXL recoil det. detectors sum of in NESR (8)					56.16			1	Messnetz		
8a	NESR sup	H. Weick	Experiment	Sonstige	EXL recoil det. , test stand pumps								1	Messnetz		

target -> Th. Stöhlker, SPARC

-> next step, assign this to single rooms

EXL In-Ring Spectrometer Status

Helmut Weick
for the GSI, KVI, TU München, Uni Teheran, Uni Uppsala WG
EXL / R3B collaboration meeting
Milano, 4. Oct 2006

- Positions of Detectors
- Detector in front of dipole
- Gain in Information
- Ongoing Work

Why a Ring Spectrometer ?

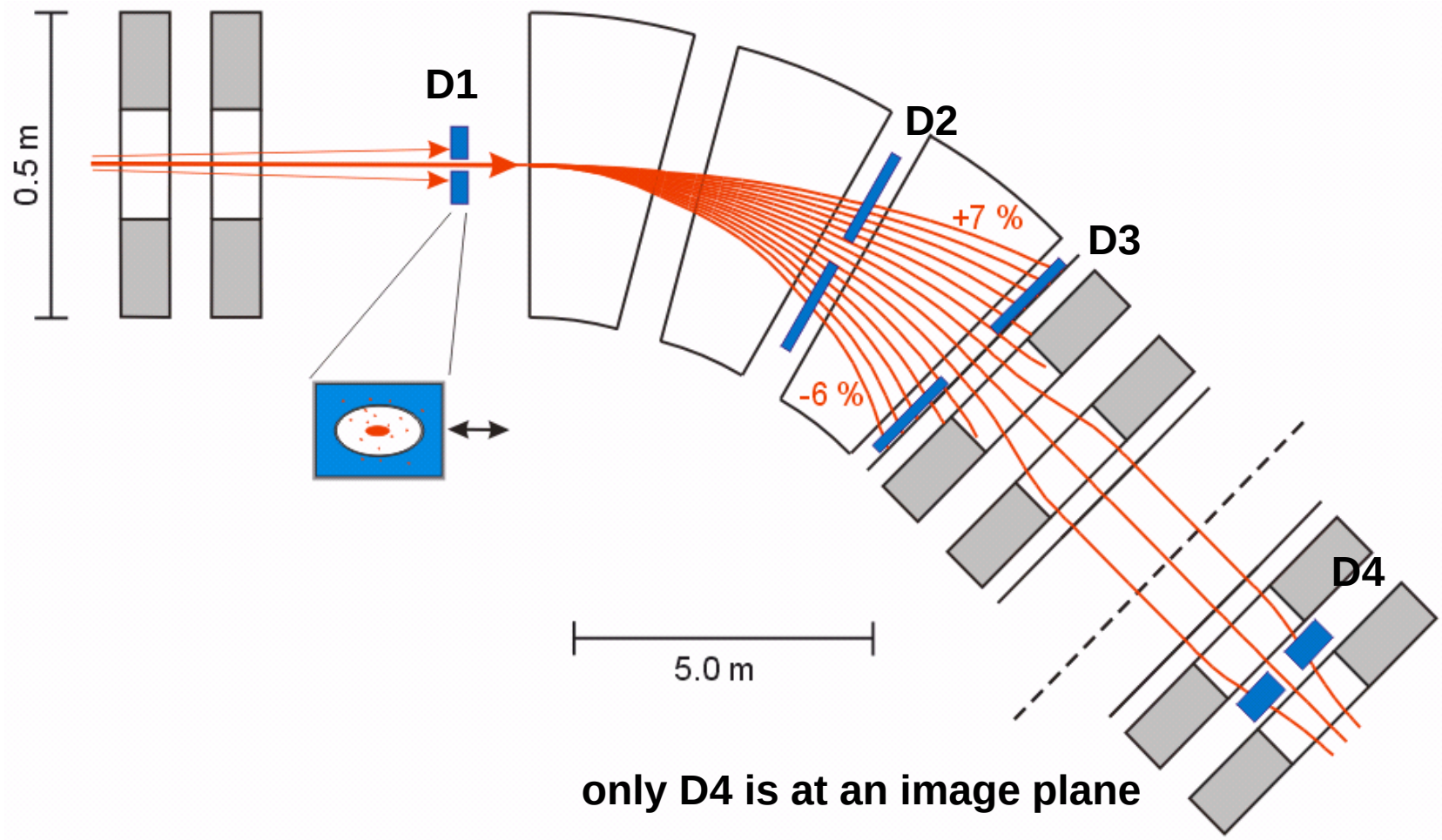
- **Coincidence of heavy ion with light recoil is needed to clean up light recoil distribution useful.**

- **To provide start time for ToF measurement**

- **For identification**
  - **Excitation with subsequent decay (giant resonances)**
  - **Charge-exchange, transfer, quasi-free scattering**
  - **Atomic charge-exchange**

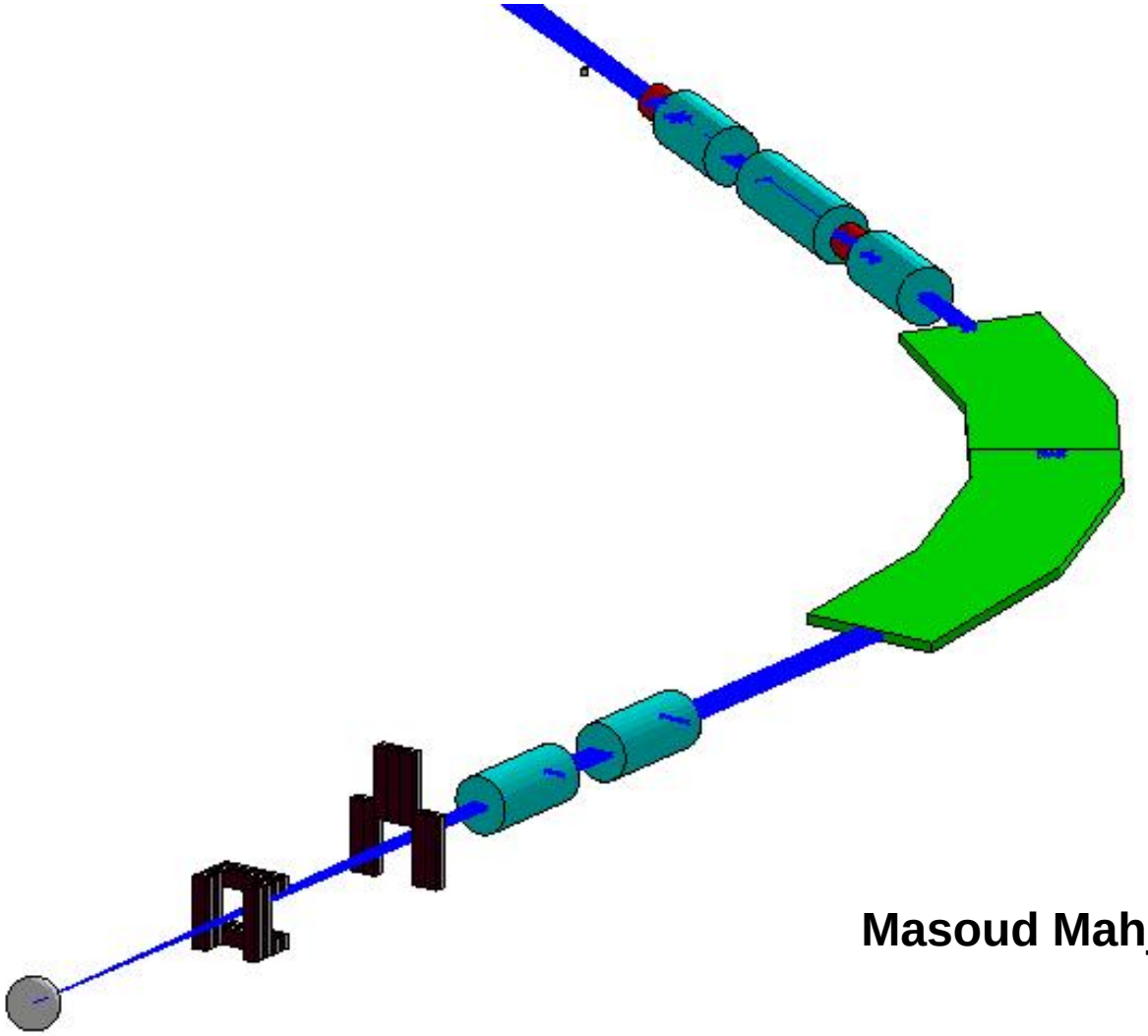
Detector Positions

Beams with significant deviation in magnetic rigidity in the ring behind the gas target.



only D4 is at an image plane

Simulations
for ESR



Setup for ESR

Masoud Mahjour-Shafiei, GEANT4

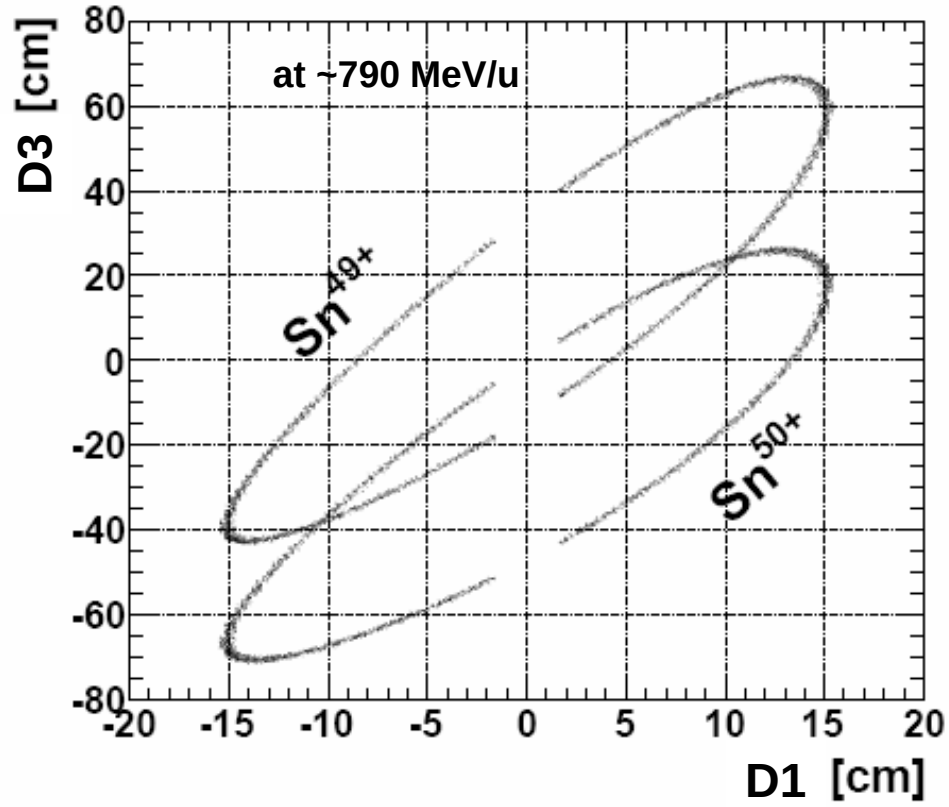
Simulations
for NESR

Examples of elastic scattering:

^{24}F has low transmission through dipole gap
→ need for detector in front of dipole

^{132}Sn is transmitted, but can be detected only for larger scattering angle
-> movable detectors close to beam

or change in m, q



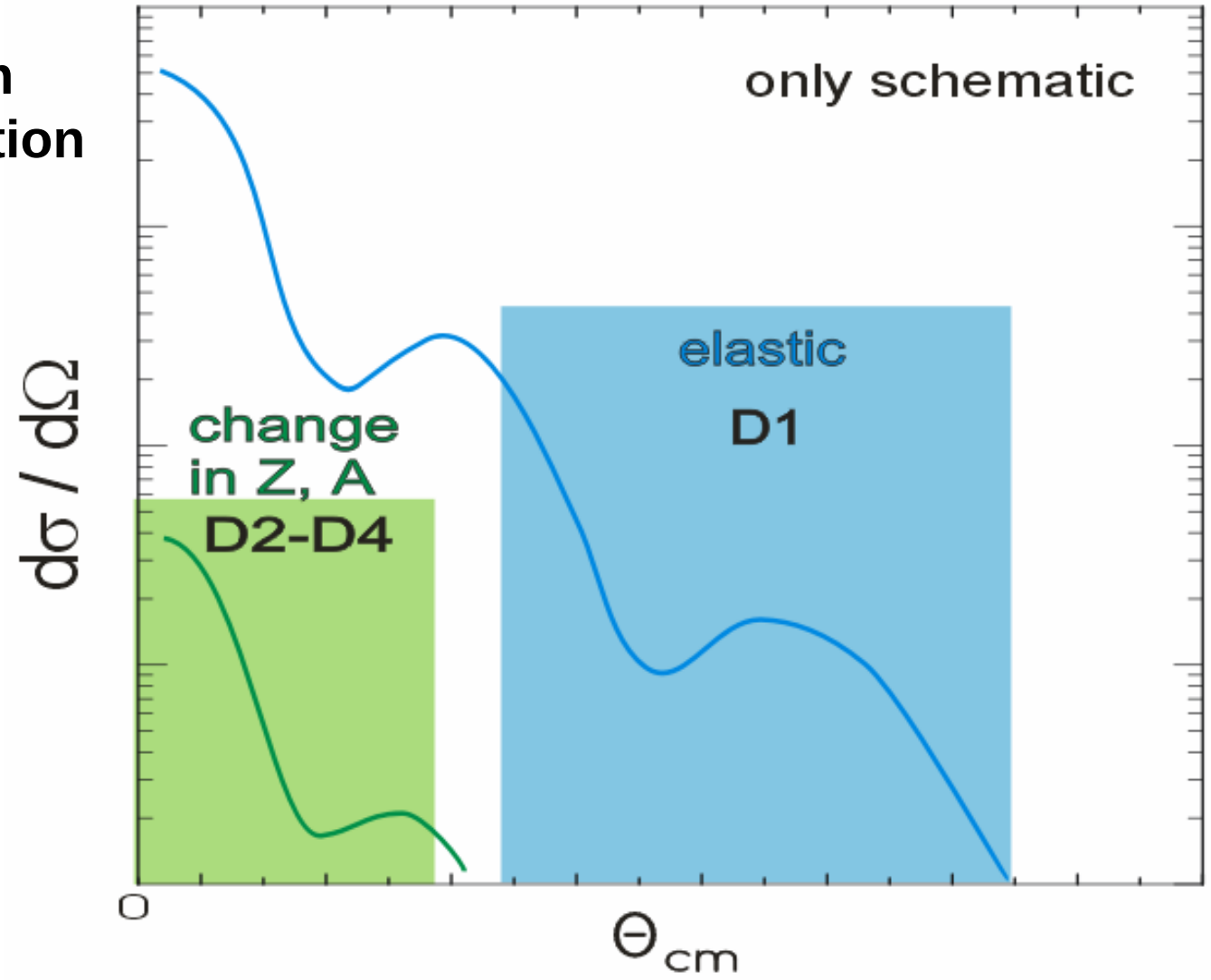
Masoud Mahjour-Shafiei, GEANT4 with GENBOD event generator, from GSI ann. rep. 2005.

Information Gained

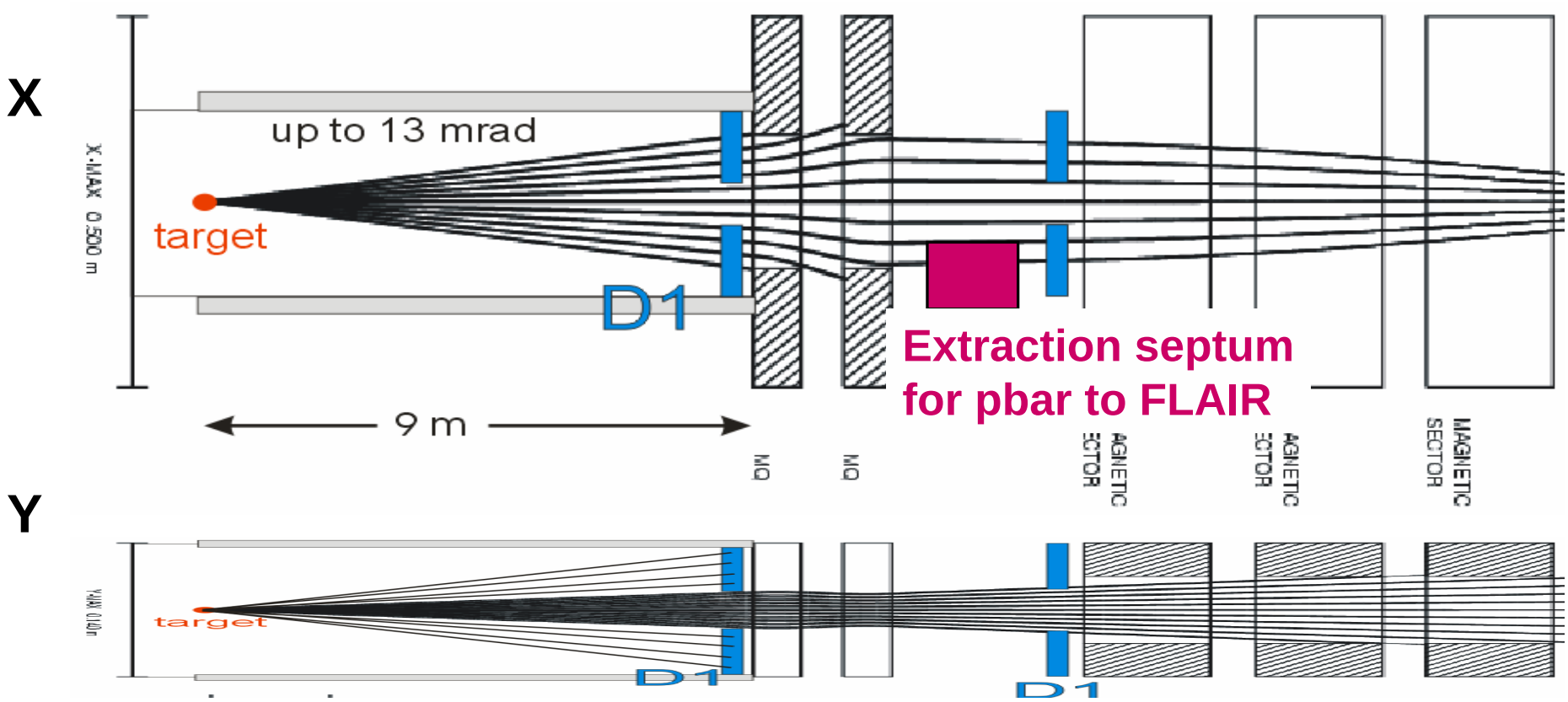
Information from heavy ion detection for light recoils

Coincidence

Facilitate identification
ΔE,
x+y -> angle
ΔE + Bρ



Position of D1
two variants

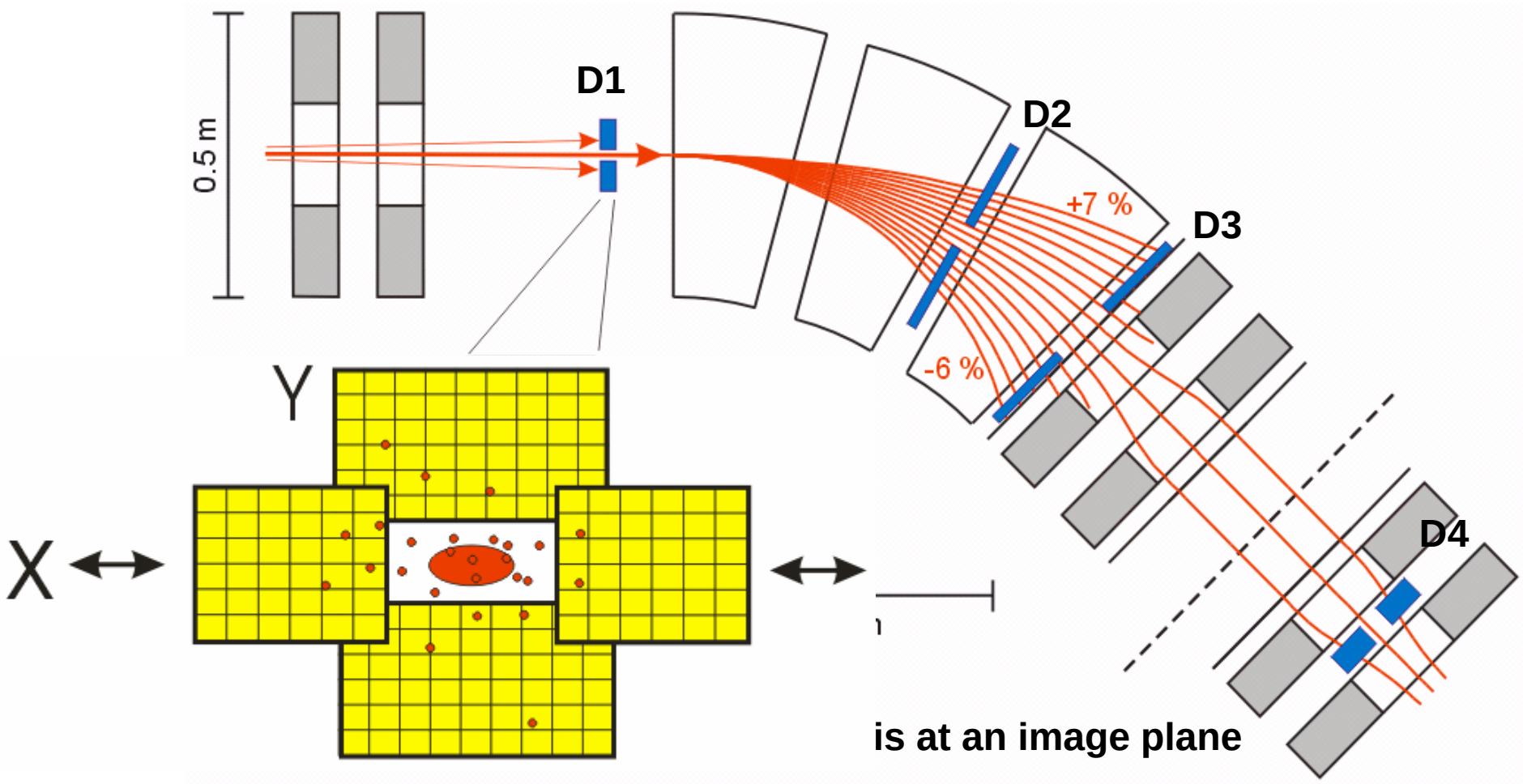


Measure x,y, ΔE

no dead region -> inside UHV

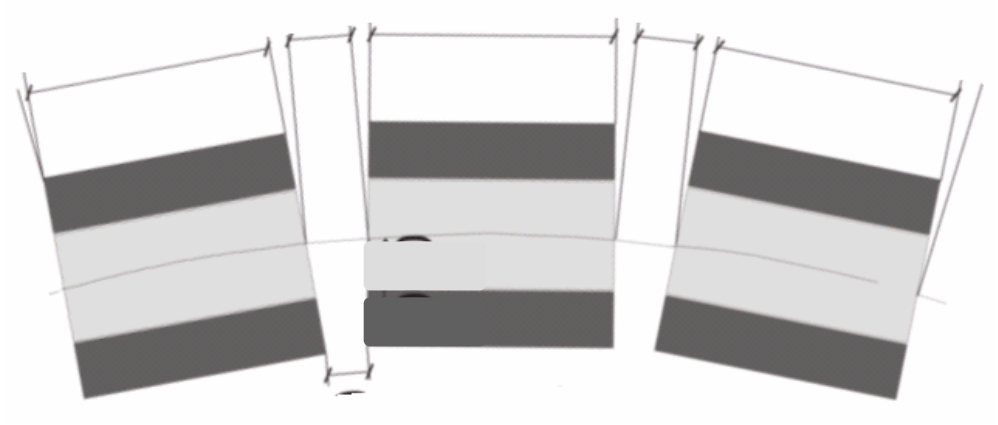
Detector Positions

Beams with significant deviation in magnetic rigidity in the ring behind the gas target.

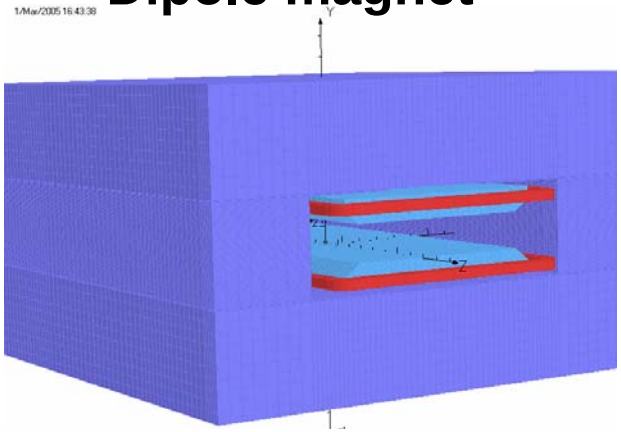


is at an image plane

Implementation



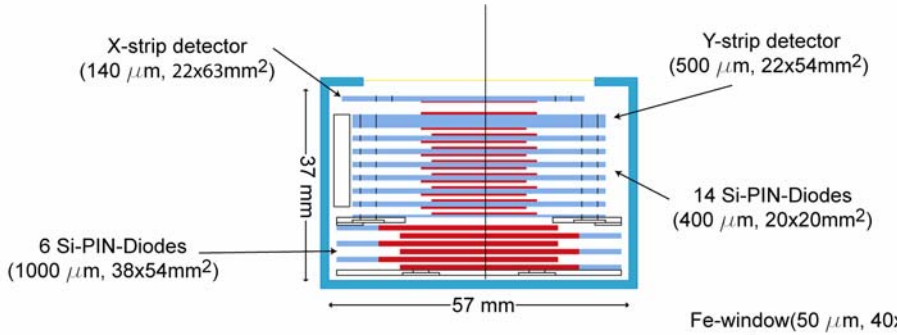
Dipole magnet

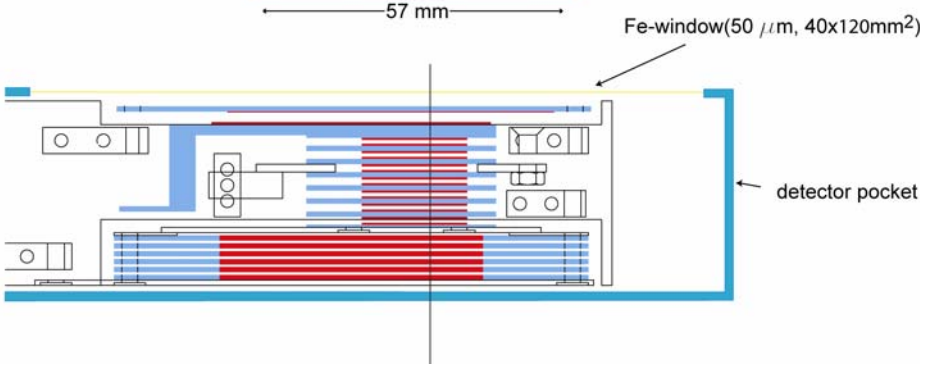


UHV:
Detectors in movable Pockets

Investigate possibility to have one detector in vacuum

Joint effort with other Experim.





Which Detectors ?

Segmented Si detectors as described in TP / wire chambers.

High efficiency for coincidence needed.
-> At least one detector very close to circulating beam (a few mm), diamond?

At some positions high count rates from atomic charge exchange (up to 10^6-10^7/s)
-> Setup has to be flexible for different reactions.

But detector positions have to be fixed, pockets and vacuum sluices have to be installed.

Who? **KVI, TUM, (GSI)** **also for ELISe, AIC, ILIMA, SPARC**

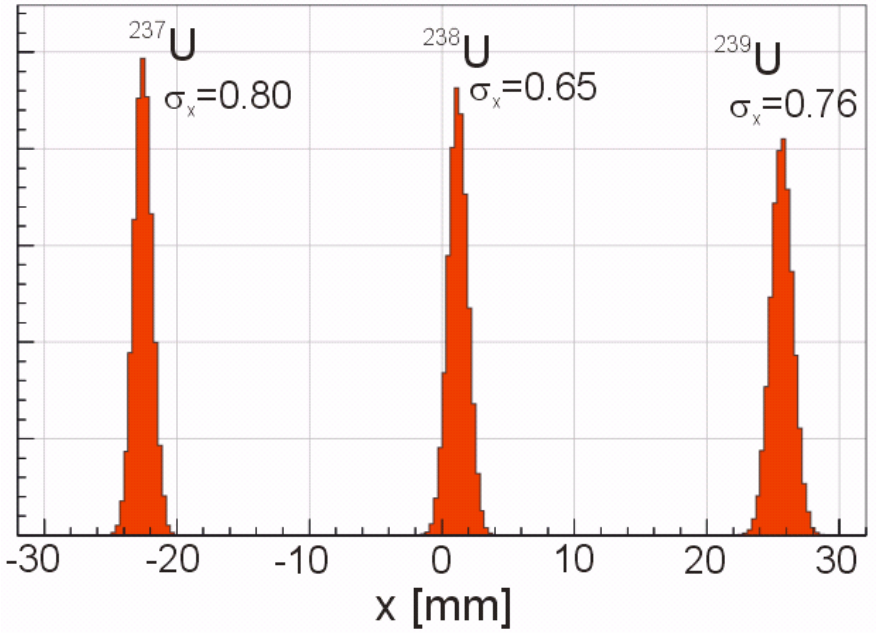
for Discussion

1. More simulation !
2. Better list of tasks: KVI 2.2 FTEs, TU Munich ?
3. ...
4. ...

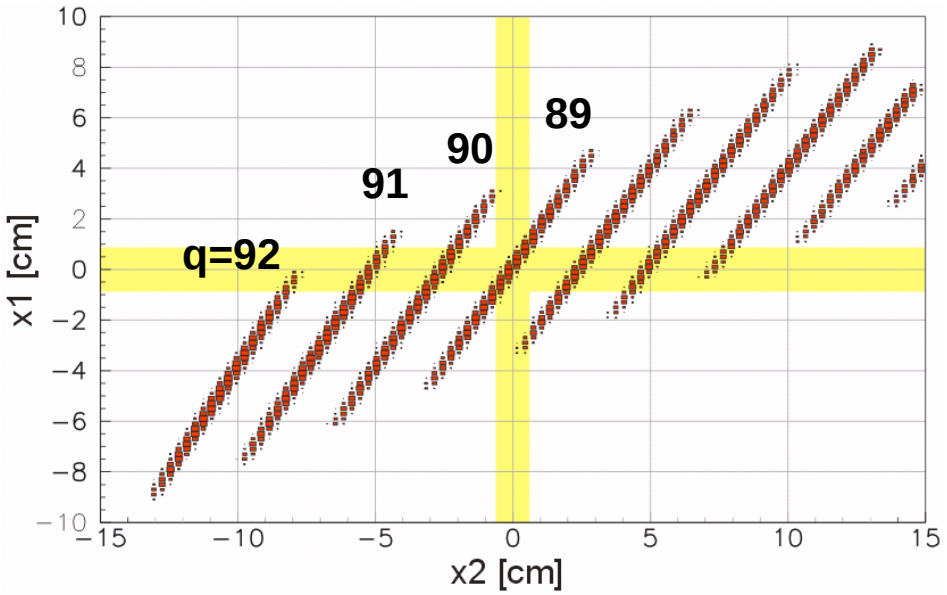
Resolution of Detectors

1st Goal: Identify charge and/or mass
but transmission is not always up to D4.

Best resolution in image plane (D4).



else tracking of ions (D2+D3)



Yellow bars must be free aperture for stored beam