

Simulation Programs

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- 1.) input for simulations
- 2.) formulas and codes
- 3.) a typical simulation
- 4.) LISE demonstration
- 5.) overview on computer codes

Input for Simulation of the FRS

nuclear physics:

reaction kinematics
production cross sections
nuclear absorption

production
target



Detectors

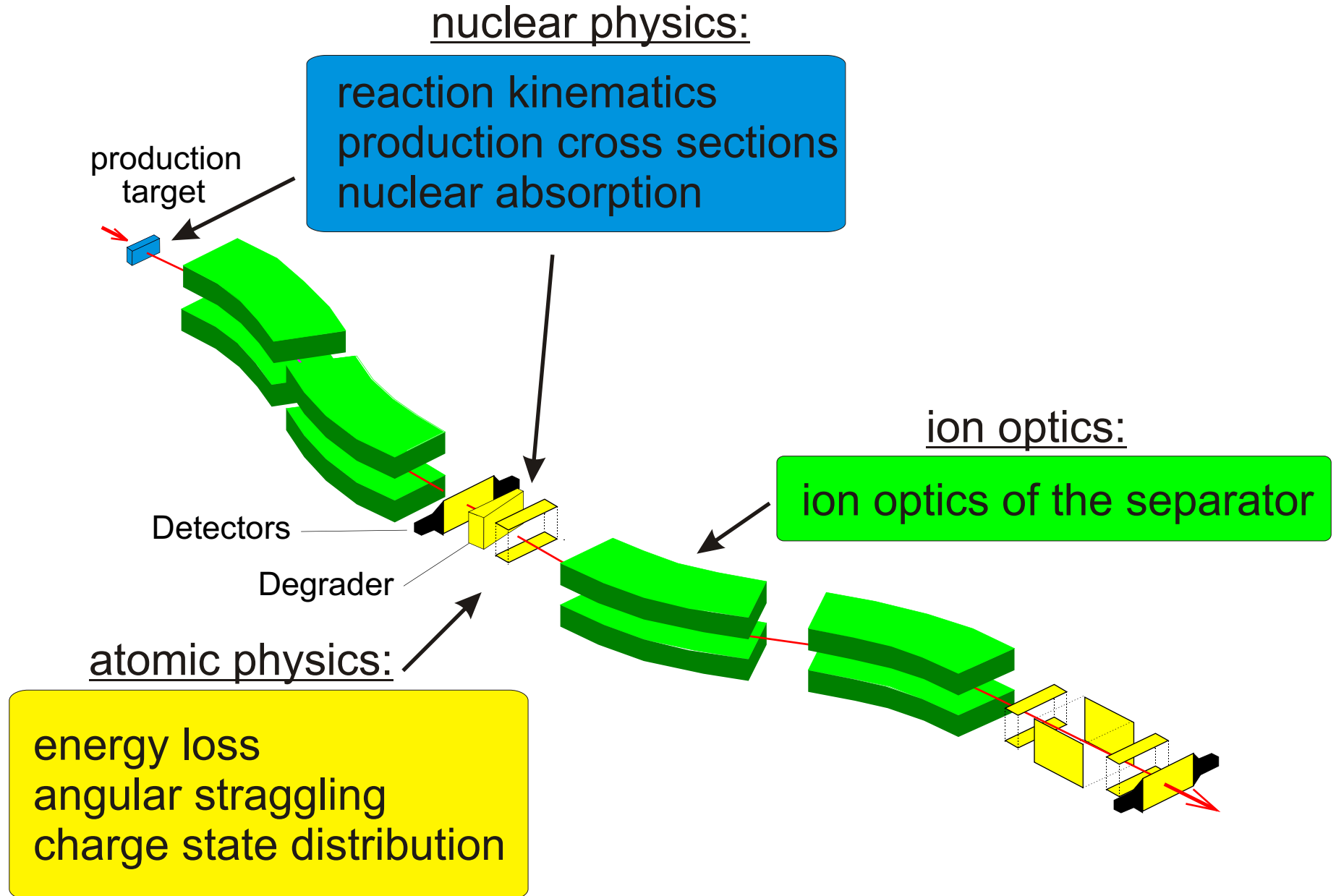
Degrader

atomic physics:

energy loss
angular straggling
charge state distribution

ion optics:

ion optics of the separator



Formulas / Computer Codes Used

prod. cross sections
nuclear absorption
reaction kinematics

EPAX 2

Kox total cross section
Goldhaber and Co.
or fission kinematics

energy loss
energy loss stragg.
angular straggling

ATIMA

dE/dx theory by
Lindhard and Sørensen

(old AMADEUS)

ion optics

GICO

TRANSPORT, GIOS,
COSY, MIRKO

transfer matrices describing
optical properties

LISE LIESCHEN

analytical convolution of many
distributions describing all ions
of one fragment species

MOCADI

combination of many effects
in a Monte Carlo code,
simulate each individual ion

+

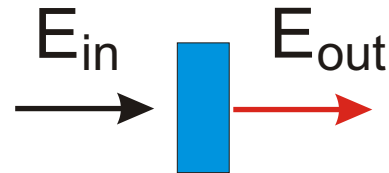
**CHARGE
GLOBAL**

calculate atomic charge-
changing cross sections for
ionization, REC and NRC

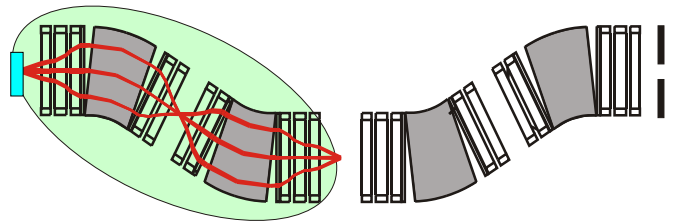
A typical MOCADI simulation

1.) Get standard input file for beamline

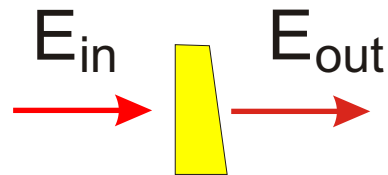
2.) Choose target, primary beam, initial energy



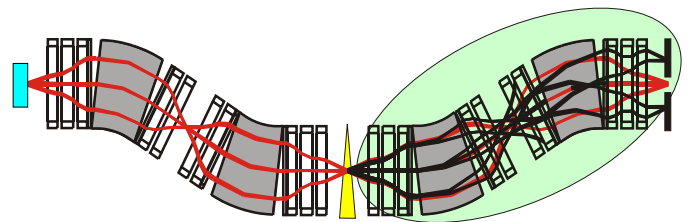
3.) "Scale" magnets of 1st half of FRS



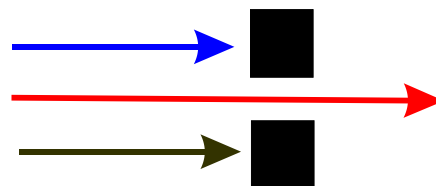
4.) insert degrader
adjust wedge angle



5.) "Scale" magnets of 2nd half of FRS



6.) close slits and
look for separation



7.) final nice output, plots, documentation



Projectile $^{86}\text{Kr}^{36+}$
800 MeV/u 1e+9 pps

Fragment $^{70}\text{Ni}^{28+}$

T Target Be
4000 mg/cm²

Str Stripper

D1 **Brho**
11.1029 Tm

S1_slits
-100 H +100

D2 **Brho**
11.1029 Tm

W S2_wedge **Al**
2000 mg/cm²

S2_slits
-100 H +100
-100 V +100

D3 **Brho**
10.6438 Tm

S Drift 3
-100 H +100

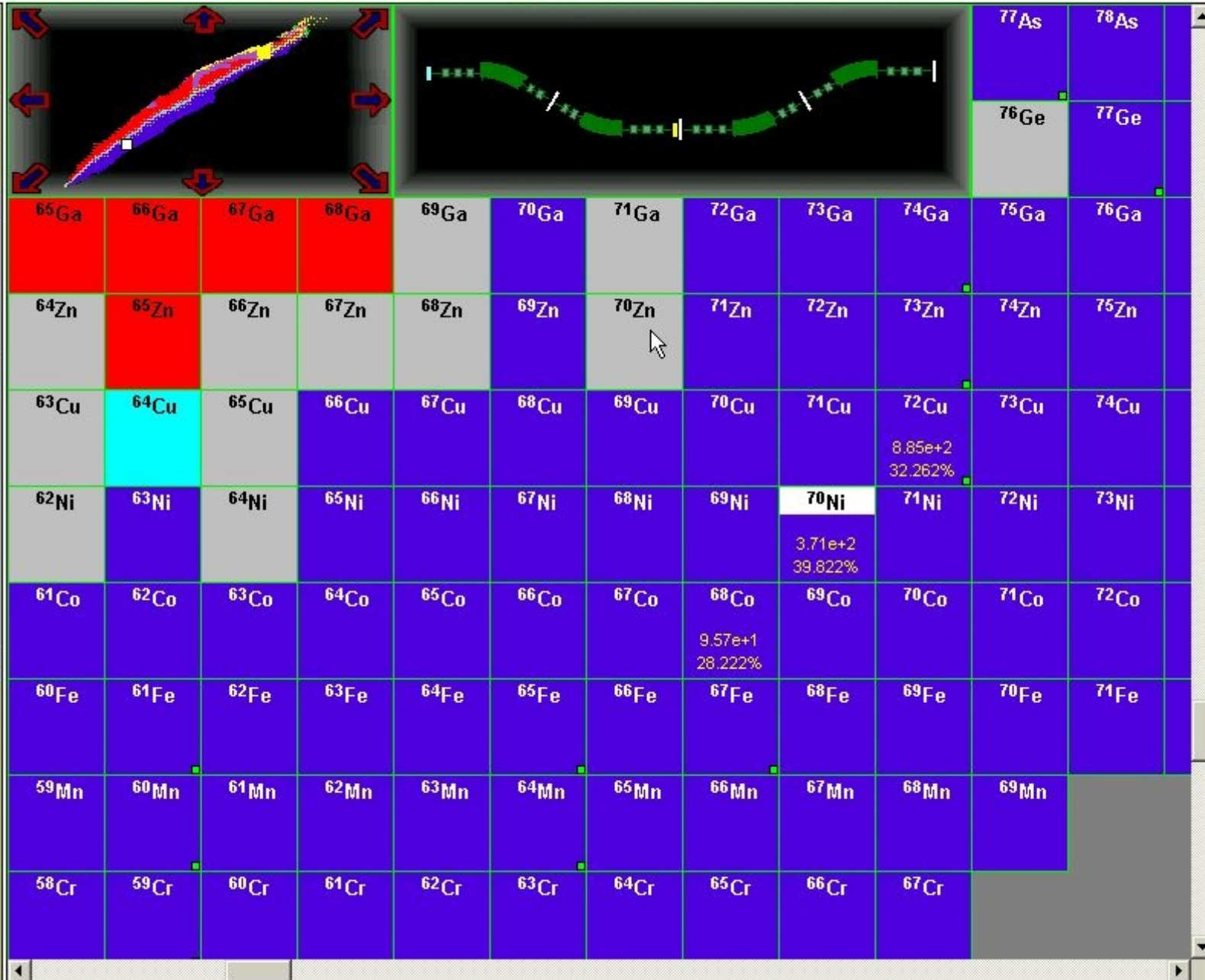
D4 **Brho**
10.6438 Tm

S4_slits
-100 H +100

config: FRS - new standard dp/p
option: default 3.09%
version: 6.1.10

GSI

Fragmentation



Overview of Codes

LISE WINDOWS

download: www.nscl.msu.edu/lise

O. Tarasov, D. Bazin

- + Fast calculation
- + rather easy to use
- better charge state prediction will come soon
- no fission yet

MOCADI LINUX

use it at GSI or install on your PC
get a CD from FRS group

- Slower calculation
- + More precise
- + with fission kinematics
- charge states from extra program

ATIMA LINUX

use at GSI or install on your PC

Included into
MOCADI + LISE

CHARGE LINUX, (Windows)

use at GSI or install on your PC

Still extra programme,
will be part of LISE

GLOBAL AIX, WINDOWS

use at GSI or install on your PC

extra programme for many
atomic charge states