Electrostatic Storage Devices @ MPI-K

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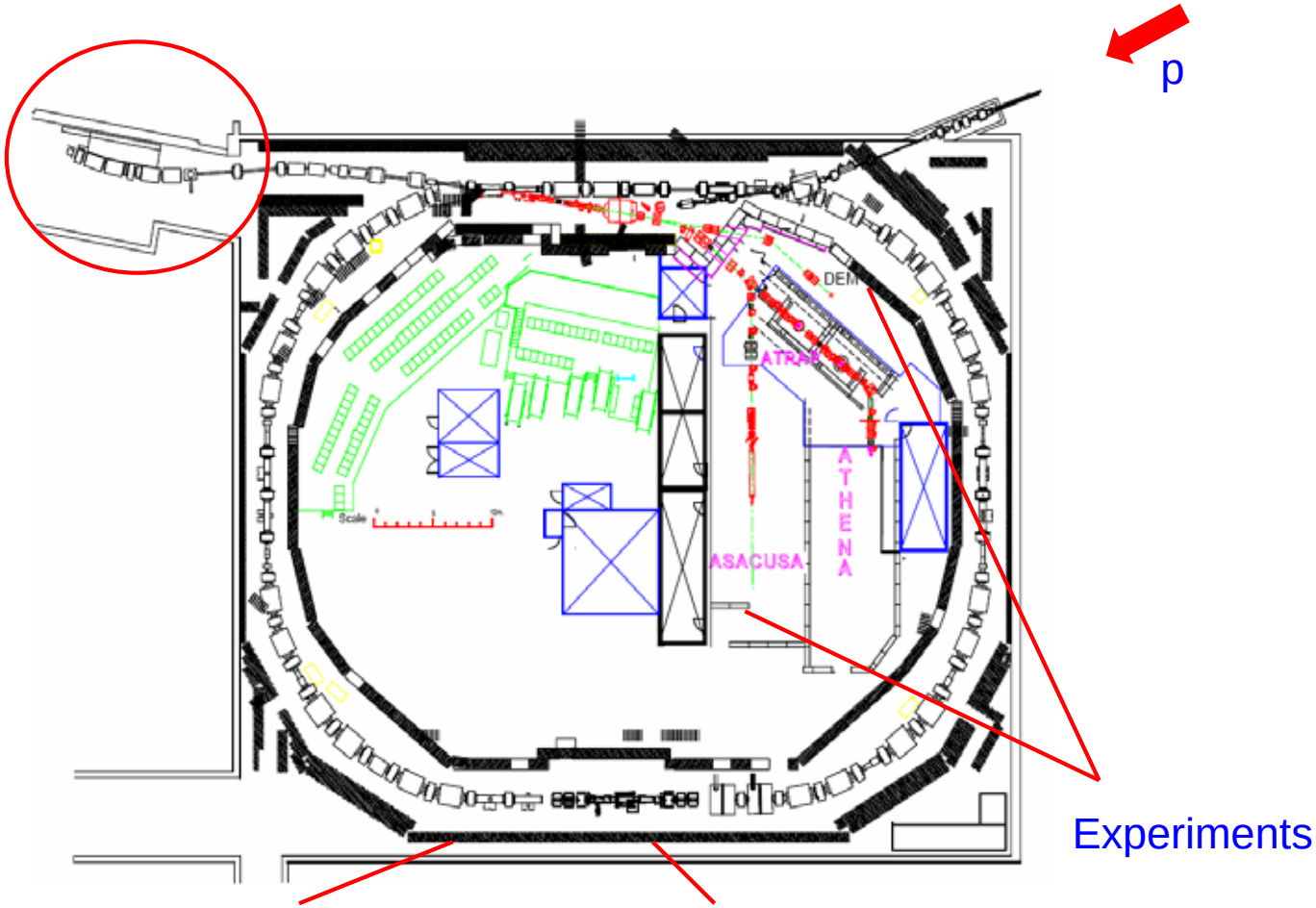
Present Situation: AD @ ... here !

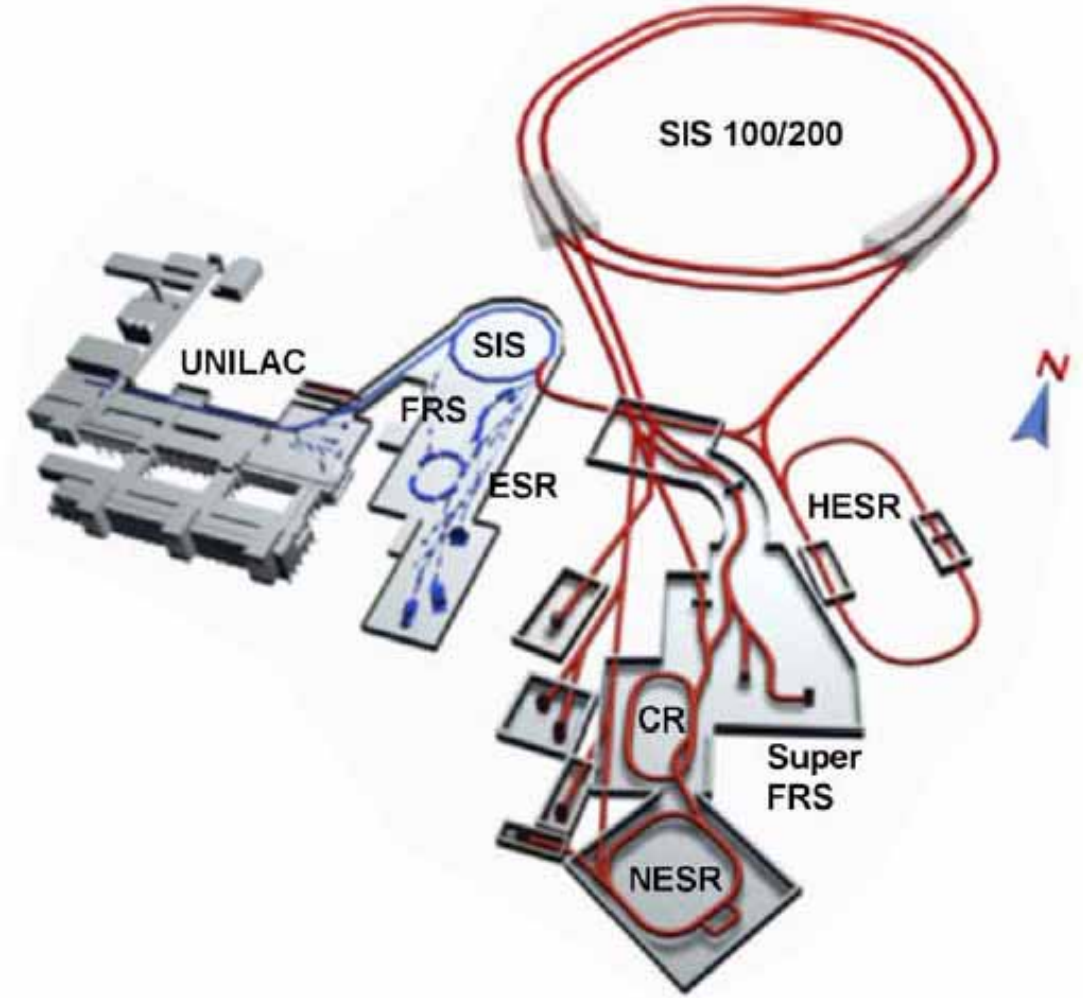
Target Area

26 GeV/c p
➡ 3.57 GeV/c p

Yield: $4 \cdot 10^{-6}$

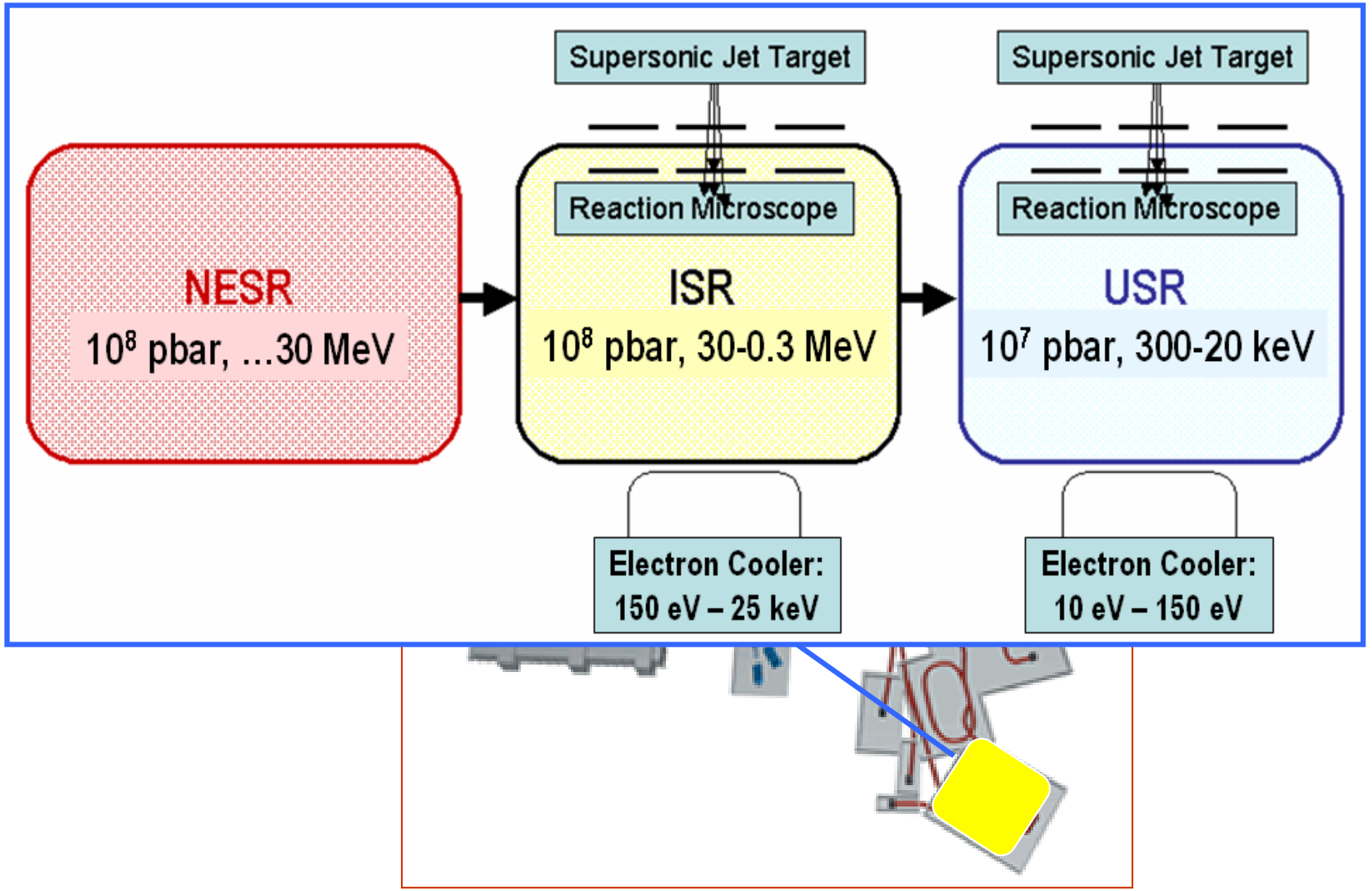


Future: FAIR



10^{11} cooled antiprotons at 30 GeV

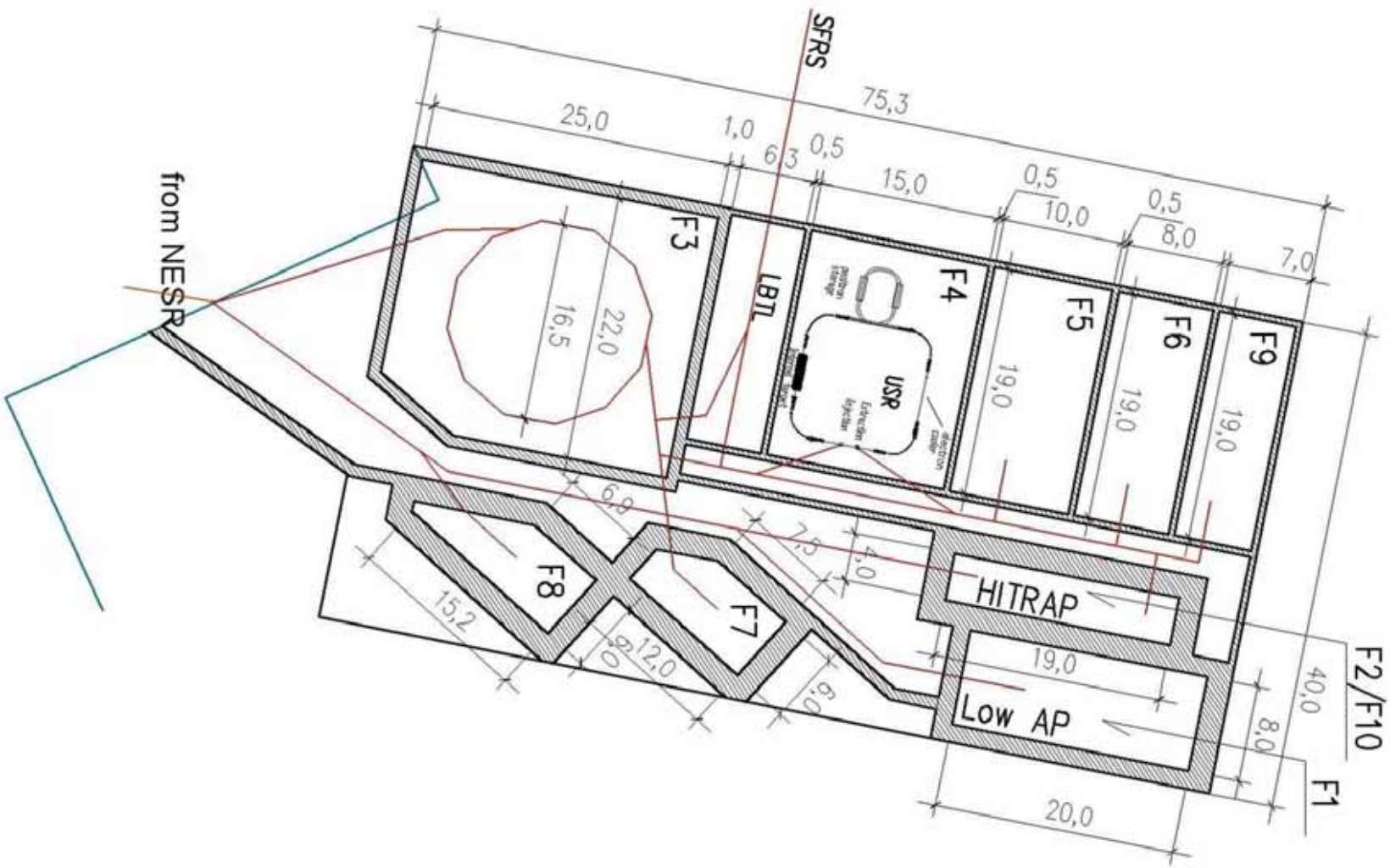
LoI + TR: FLAIR


Supersonic Jet Target
Supersonic Jet Target
Reaction Microscope
Reaction Microscope
NESR
10^8 pbar, ...30 MeV
ISR
10^8 pbar, 30-0.3 MeV
USR
10^7 pbar, 300-20 keV
Electron Cooler:
150 eV – 25 keV
Electron Cooler:
10 eV – 150 eV

Motivations

- Spectroscopy as test of QED and CPT
- Gravitation of antimatter
- Correlated dynamics in collisions
- Antiprotons as hadronic probes
- Medical applications: cancer therapy
- …

Facility Layout

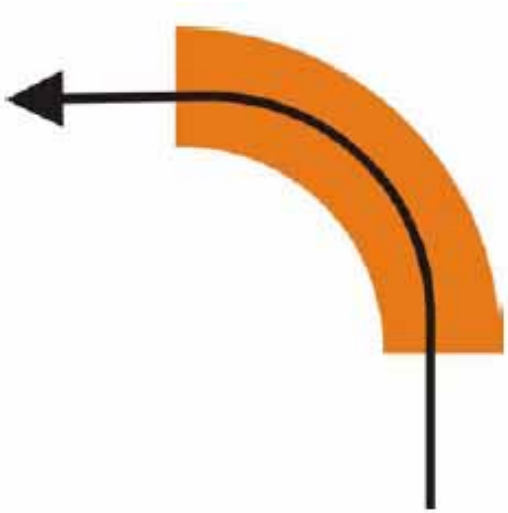


LSR: Cryring ?!

- Energy range meets requirements
- Fast ramping already active
- Excellent vacuum
- Electron cooling integrated
- Space for internal targets
- Injector can be used for test & training

➡ Needs „only“ to be transported to GSI.

Magnetic <-> Electrostatic



$$\frac{mv^2}{R} = q \cdot v \cdot B$$

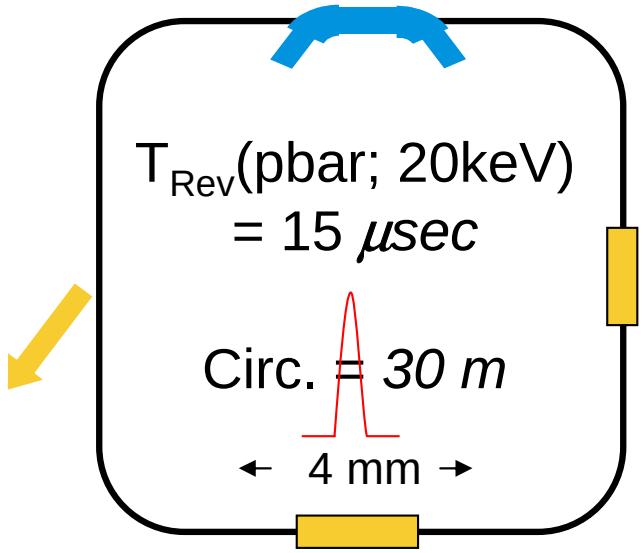
$$R \cdot B = \frac{1}{q} \cdot \sqrt{2 \cdot m \cdot E_{Kin}}$$

$$\frac{mv^2}{R} = q \cdot E$$

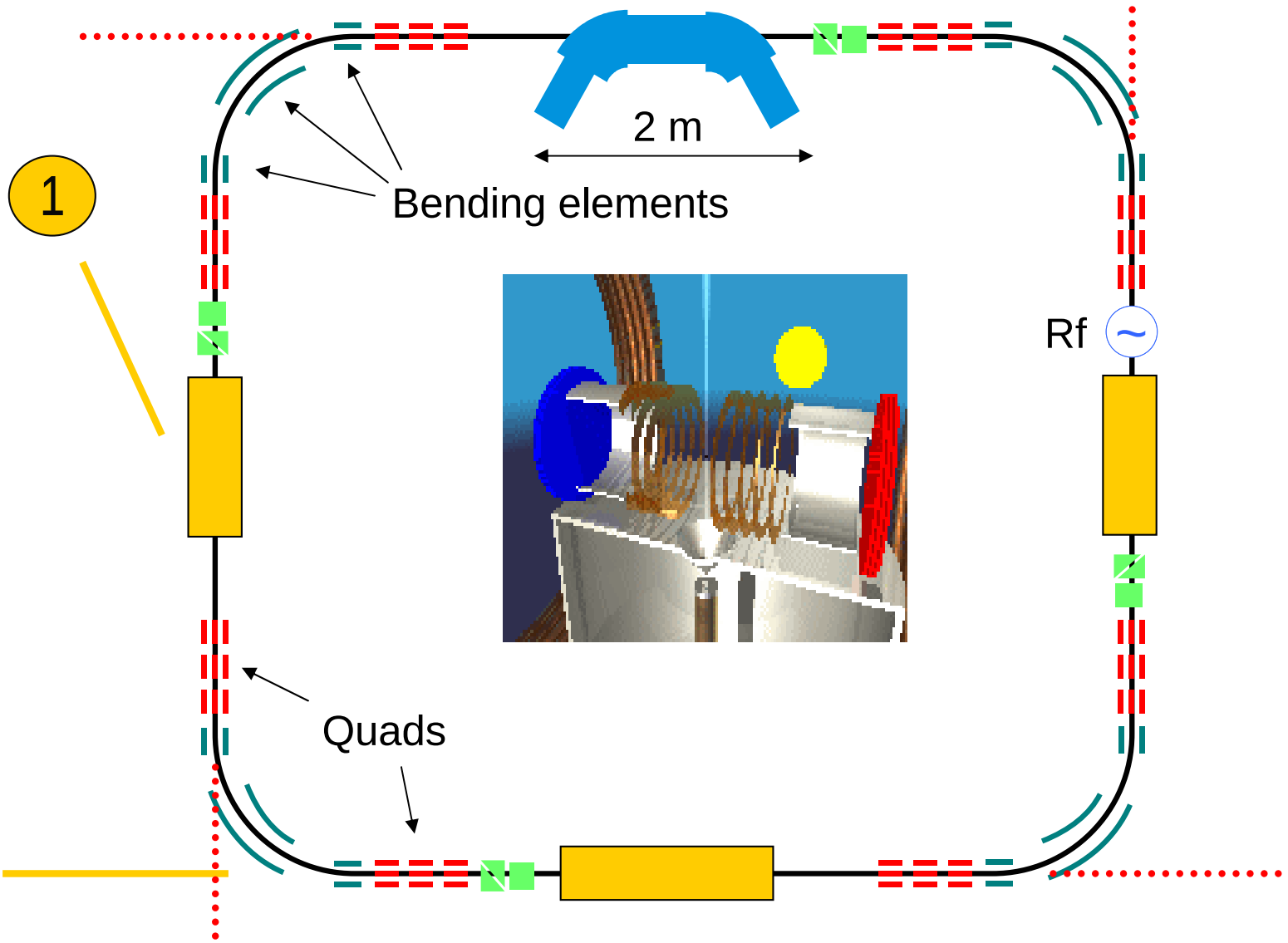
$$R \cdot E = \frac{2 \cdot E_{Kin}}{q}$$

Main Goals

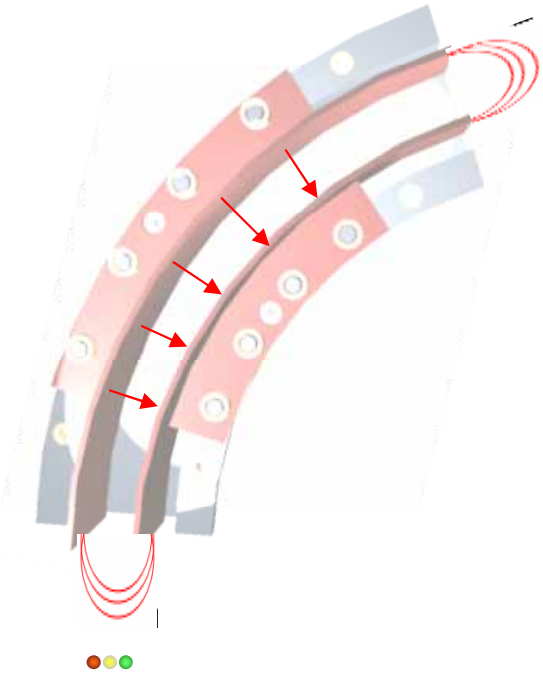
- Variable down to very low energies
  - 300 keV ~ 20 keV
- High luminosity for in-ring experiments
- Well defined extracted beams:
  - small emittance
  - small momentum spread
- Multi-User operation:
  - 2 straight lines for in-ring experiments
  - 1 extraction port
  - additional beam lines possible
- Central requirements
  - Δt ~ 500 nsec for injection into trap
  - Δt ~ 2 nsec / 10^4 ions for collision experiments

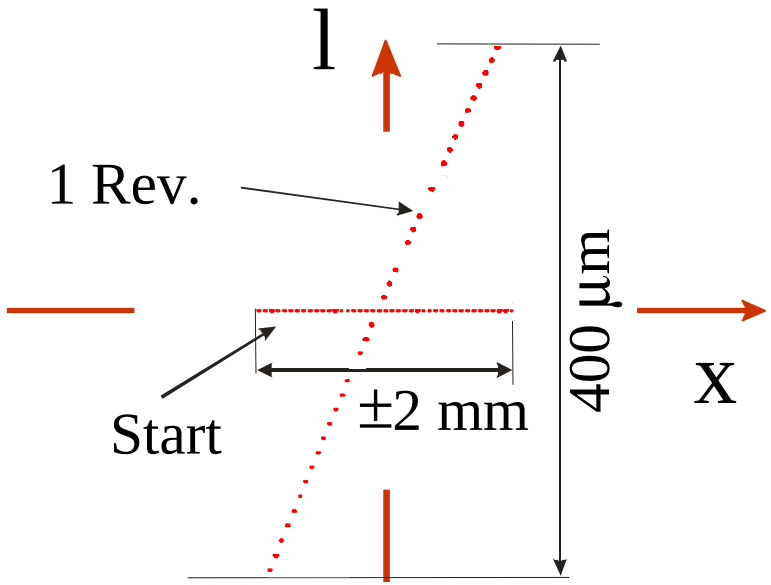


At a Glance



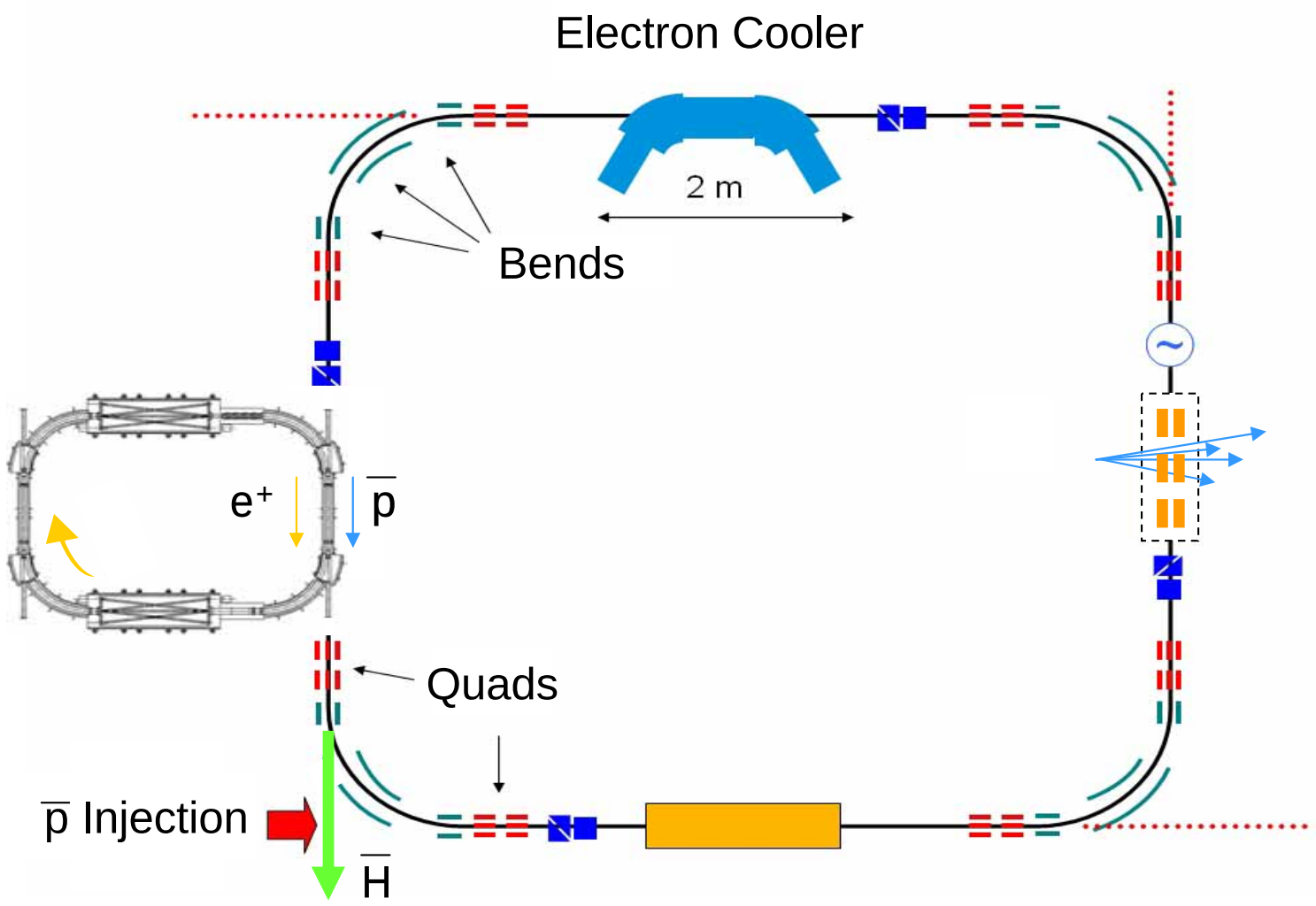
Coupling !





Energy	Time Structure
300 keV	Δt = 50 ps
20 keV	Δt = 200 ps

Merged Positron Beam



Challenges

- Electron cooling at lowest energies
- Energy variability
- Ultra-short bunches
- In-ring Reaction Microscope

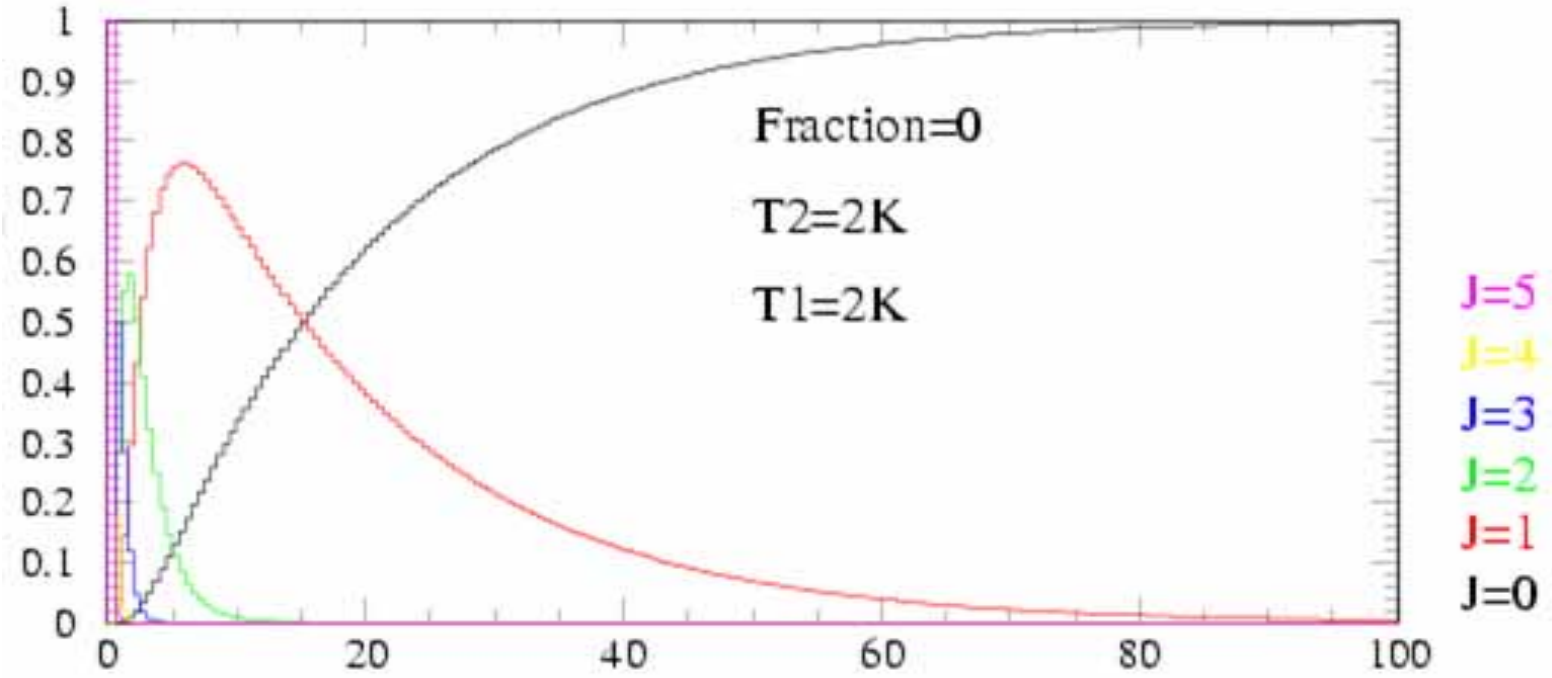
.....never realized in electrostatic ring !

! Cryogenic system required for HCI !

CSR

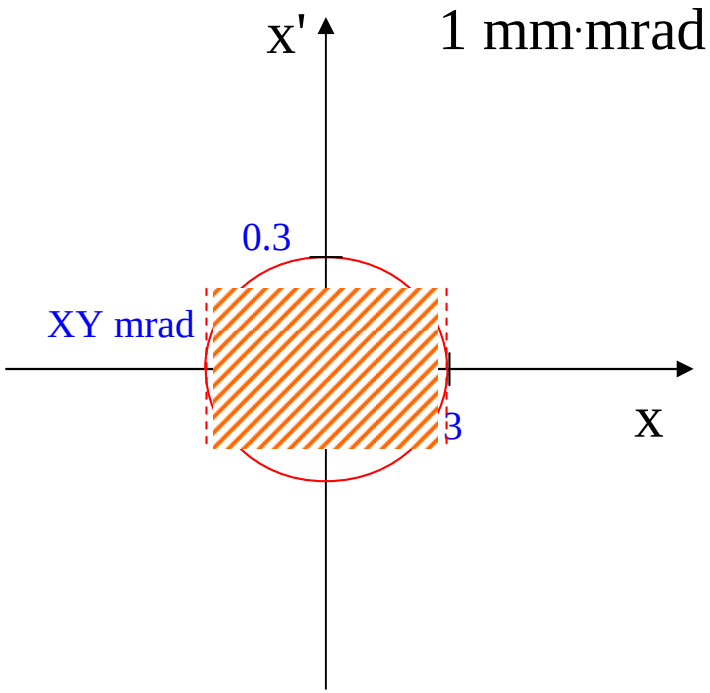
Motivation

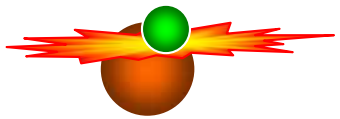
HeH^+



→ $p < 10^{-13}$ mbar, T=2K !

Include Center-of-mass energy





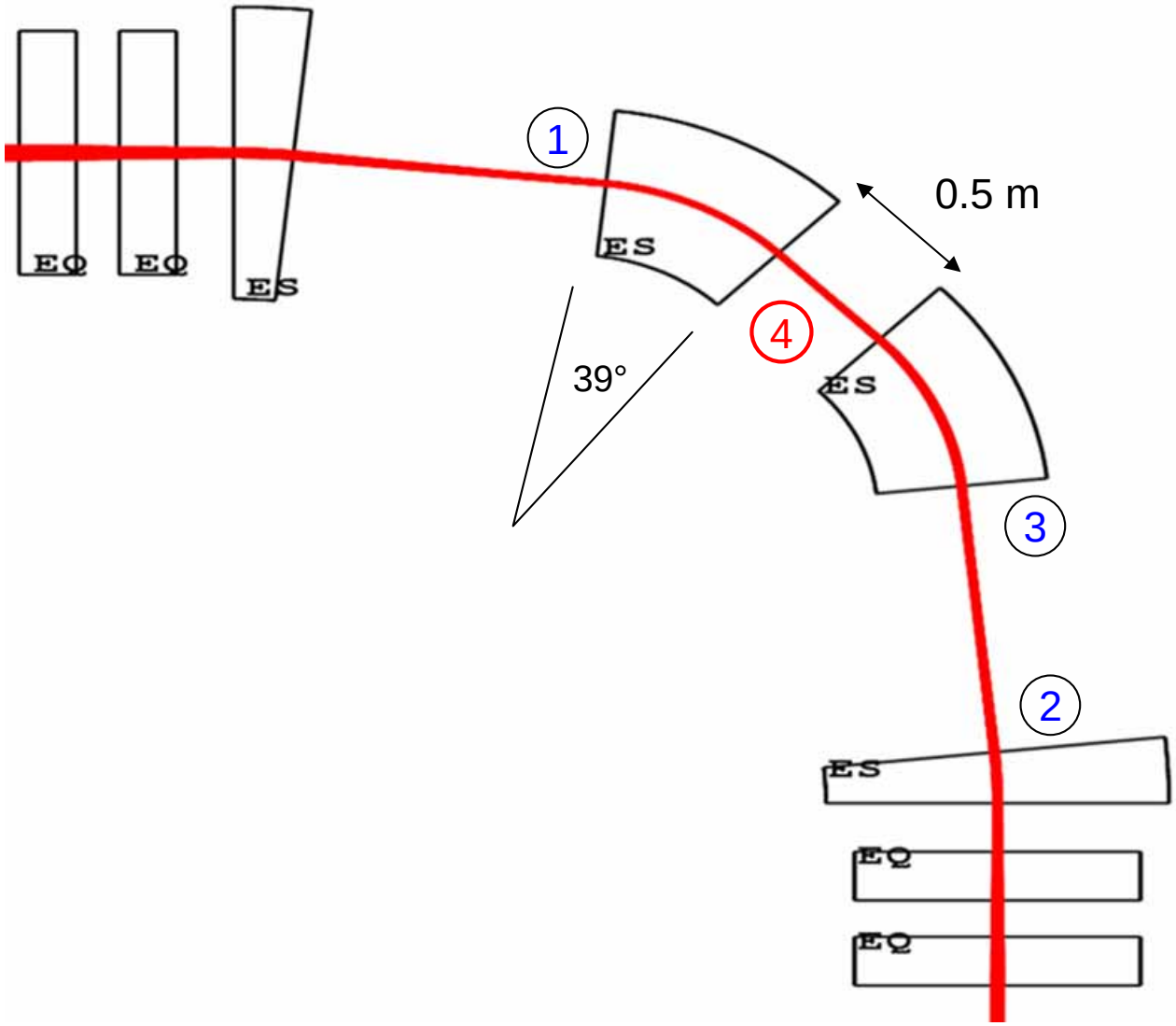
10 eV

Experiments:

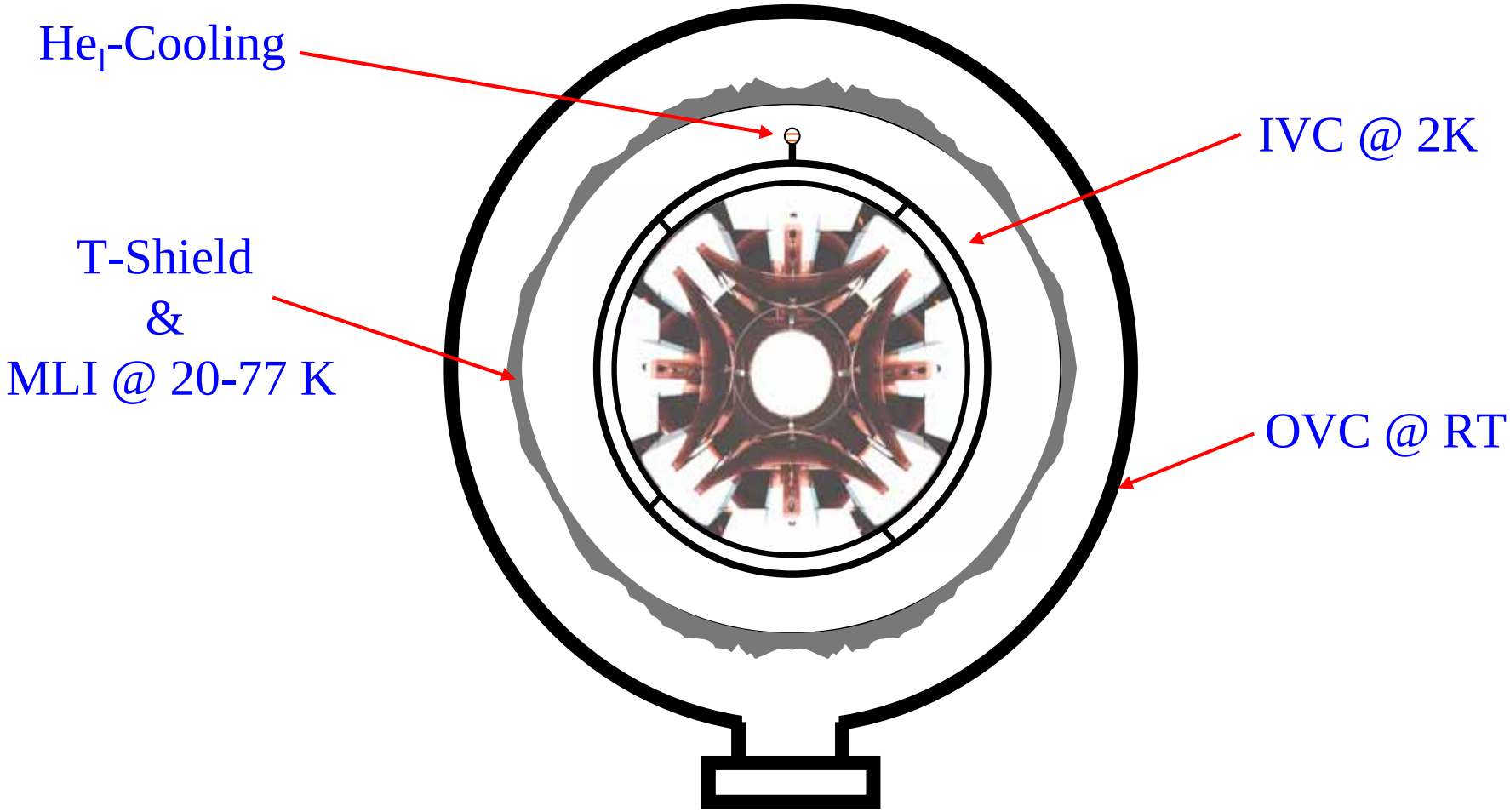
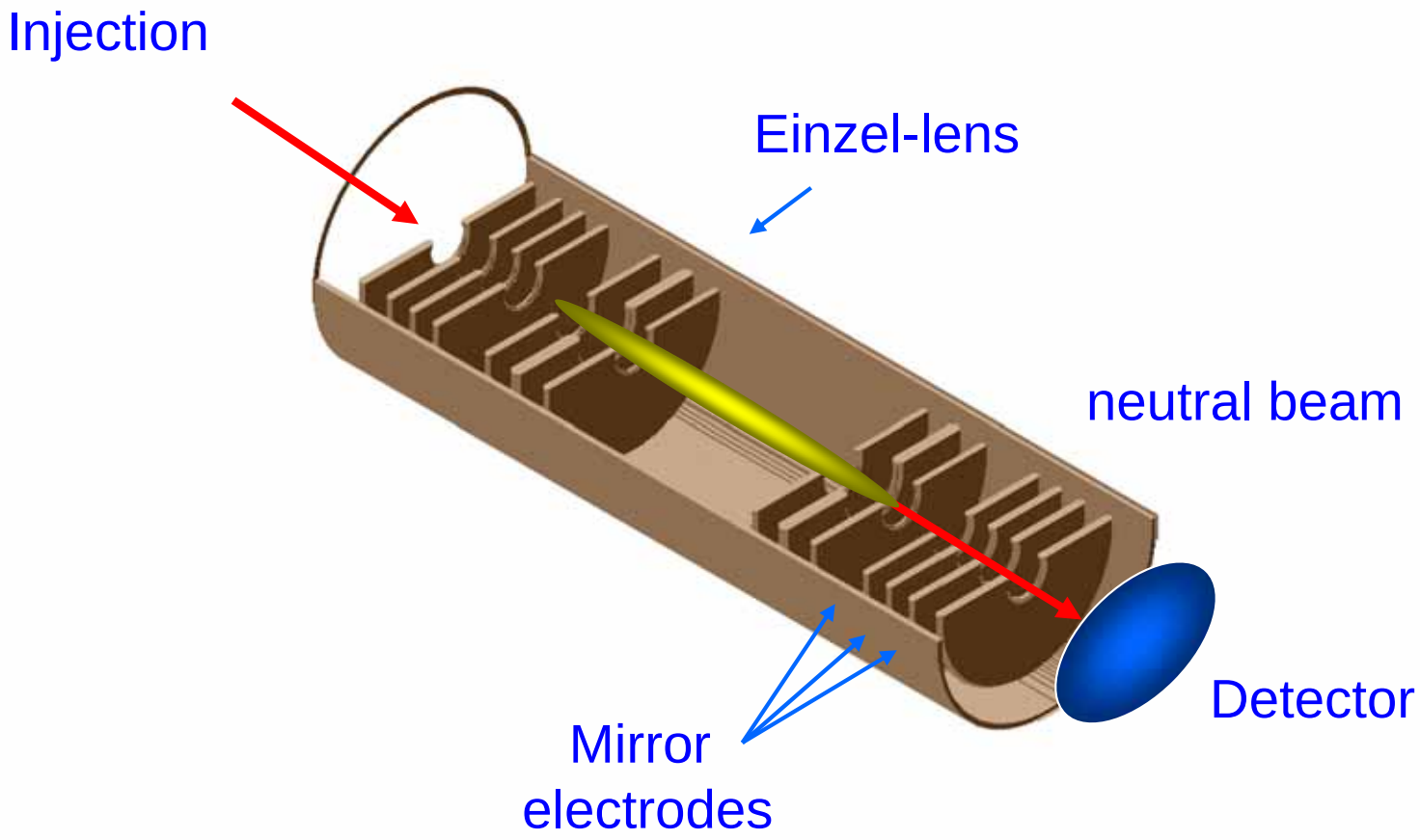
- CH^+, OH^+ and HCO^+
- distance e^-cooler / deflector: *4 m*

+/- 15 mm cone of fragments in corner section !

Close-up View



Cross section



Prototype - Cryogenic Trap