

Bound-free pair production at the FCC

Rainer Schicker

Phys. Inst., Heidelberg

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Secondary ion beams at the FCC

The physics interest in secondary ion beams

A trigger on electromagnetic processes

A detector concept for a trigger detector

Secondary ion beams at collider

particle transport according to magnetic rigidity $B\rho = \frac{Z}{A} \frac{p}{q}$

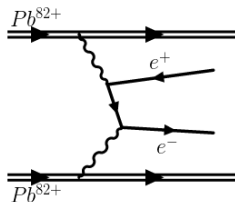
for secondary Pb-beams $\frac{Z}{A} \neq \frac{82}{208}$

- $\frac{Z}{A} = \frac{82}{207}, \frac{82}{206}$: GDR 1n, 2n decay
- $\frac{Z}{A} = \frac{81}{208}, \frac{80}{208}$: single and double bound-free pair production
 - ▶ bound-free pair production is an electromagnetic process
 - ▶ possibility of trigger on purely electromagnetic processes
 - ▶ the physics of strong electromagnetic fields
- search for hybrids Pb_{207}^{80+} (2 b.-free, 1 n), Pb_{206}^{81+} (1 b.-free, 2 n)

measure position (magn. rigidity) and a signal $\propto Z$ (multiple reaction of same kind in one bunch crossing)

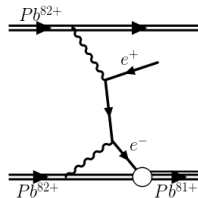
Single and multiple pair production

single pair production: free e^+e^-



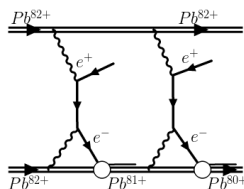
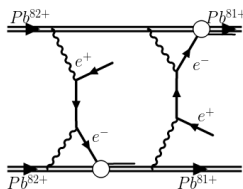
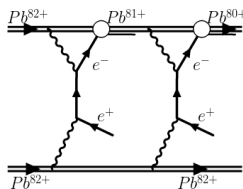
$$\sigma_{\text{Born}}(e^+e^-, \text{PbPb, LHC}) \sim 200 \text{ kb}$$

bound-free e^+e^-



$$\sigma_{\text{BFPP}}(\text{PbPb, LHC}) \sim 270 \text{ b per beam}$$

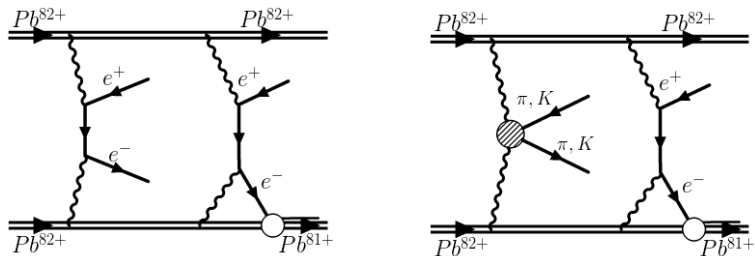
double bound-free pair production



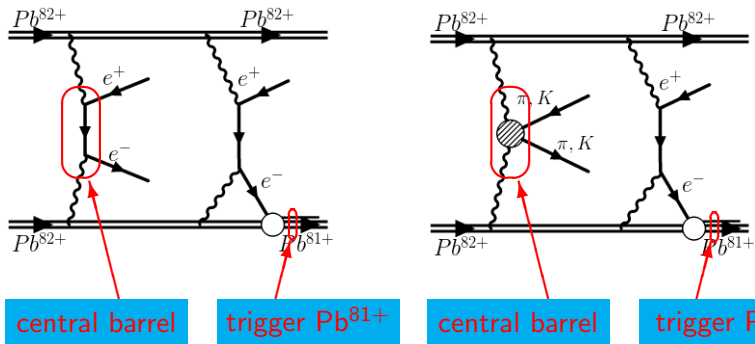
$$\sigma_{2 \times \text{BFPP}}(\text{PbPb, LHC}) > 6 \text{ mb (priv. comm. V.Serbo)}$$

Multiple pair production

production of bound-free pair with a free pair



Trigger on electromagnetic processes



Forward trigger on Pb^{81+} with measurement in central barrel

- free e^+e^- -pairs
- $\pi^+-\pi^-$ and K^+-K^- -pairs
- pure electromagnetic processes

Physics topics in tagging secondary lead beams

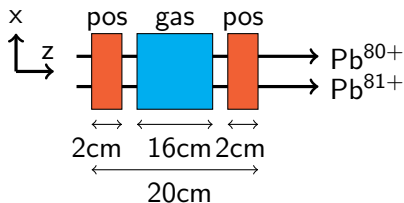
- Giant dipole neutron decays, bound-free pair production, hybrids
- The physics of strong electromagnetic fields
 - ▶ QED in a strong coupling regime: $Z\alpha \sim 0.6$
 - ▶ Coulomb and unitarity corrections to Born level diagrams of double bound-free pairs
 - ▶ Multiple lepton pair production
 - ▶ Pion/Kaon pair photoproduction
 - ▶ $\gamma\gamma \rightarrow$ low mass resonances
 - ▶ Total $\gamma\gamma$ -hadronic cross section
 - ▶ Chiral magnetic effect in pure electromagnetic interactions ?
 - reaction plane not known, charged particle dipole pattern at midrapidity ?
 - comparison to peripheral hadronic reactions (flow)

Concept of a gas detector at dispersion collimator location

concept of a detector, NOT a technical drawing !

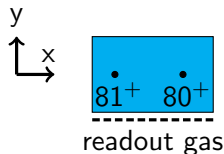
pos: 2-d position and time-of-flight (assoc. bunch crossing)

gas detector volume, segmented readout in z and x



clearance 1 cm at front and end
0.5 cm between elements

total length z-dir. $\sim 20-26$ cm



x-direction dispersive
y-direction vertical
z-direction beam