FEMTOSCOPY OF STOPPED PROTONS

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1. **STOPPED PROTONS: NET BARYON NUMBER**
2. **VOLUME IN CONFIGURATION SPACE**
3. **TWO LIMITING PICTURES**
4. **FEMTOSCOPY: A NECESSITY**
5. **PROTON-PROTON HBT CORRELATION FUNCTION IN THE LUND MODEL**
6. **COMMENTS**

STOPPED PROTONS: NET BARYON DENSITY AT $Y \approx 0$

TO INVESTIGATE QUARK-GLUON PLASMA AT NONVANISHING NET BARYON DENSITY, ONE NEEDS TO STOP BARYONS AT $Y \approx 0$ IN A SMALL REGION OF SPACE.

TO ESTIMATE THE NET BARYON DENSITY WE NEED BOTH THE NUMBER OF STOPPED BARYONS AND THE VOLUME THEY OCCUPY.

CRUCIAL QUESTIONS:
WHERE ARE THE STOPPED BARYONS IN THE CONFIGURATION SPACE?
DO THEY INDEED STOP IMMEDIATELY AFTER COLLISION, CLOSE TO THE COLLISION POINT?

FEMTOSCOPY IS THE NATURAL TOOL TO ANSWER THESE QUESTIONS.

ENERGY LOSS

TWO LIMITING PICTURES:

(i) THE COLLIDING NUCLEONS STOP IMMEDIATELY AFTER COLLISION AND THUS REMAIN IN THE VICINITY OF THE COLLISION POINT;

(ii) AFTER COLLISION THE NUCLEON LOOSES ENERGY AT A CONSTANT RATE (CALLED "STRING TENSION") AND THUS IT ENDS UP AT THE DISTANCE $\Delta z = \Delta E/\sigma$ WHERE σ IS THE STRING TENSION.

VERY LIKELY THE REALITY IS SOMEWHERE IN-BETWEEN.

FOR NUCLEUS-NUCLEUS COLLISIONS THE PICTURE GETS MORE COMPLICATED BECAUSE OF MULTIPLE COLLISIONS.

THE MESSAGE

IT IS BY NO MEANS OBVIOUS THAT THE STOPPED NUCLEONS ARE SITTING IN A SMALL VOLUME AROUND THE COLLISION POINT.

MEASUREMENT OF THE HBT CORRELATION SEEMS AT THE ORDER OF THE DAY.

WE HAVE WORKED OUT THE PREDICTIONS FOR THE P-P HBT CORRELATION FUNCTION USING LUND/BREMSTRAHLUNG PICTURE. THE RESULTS SHOW CHARACTERISTIC FEATURES WHICH CAN BE USED TO FIGURE OUT WHAT ACTUALLY HAPPENS AFTER COLLISION.

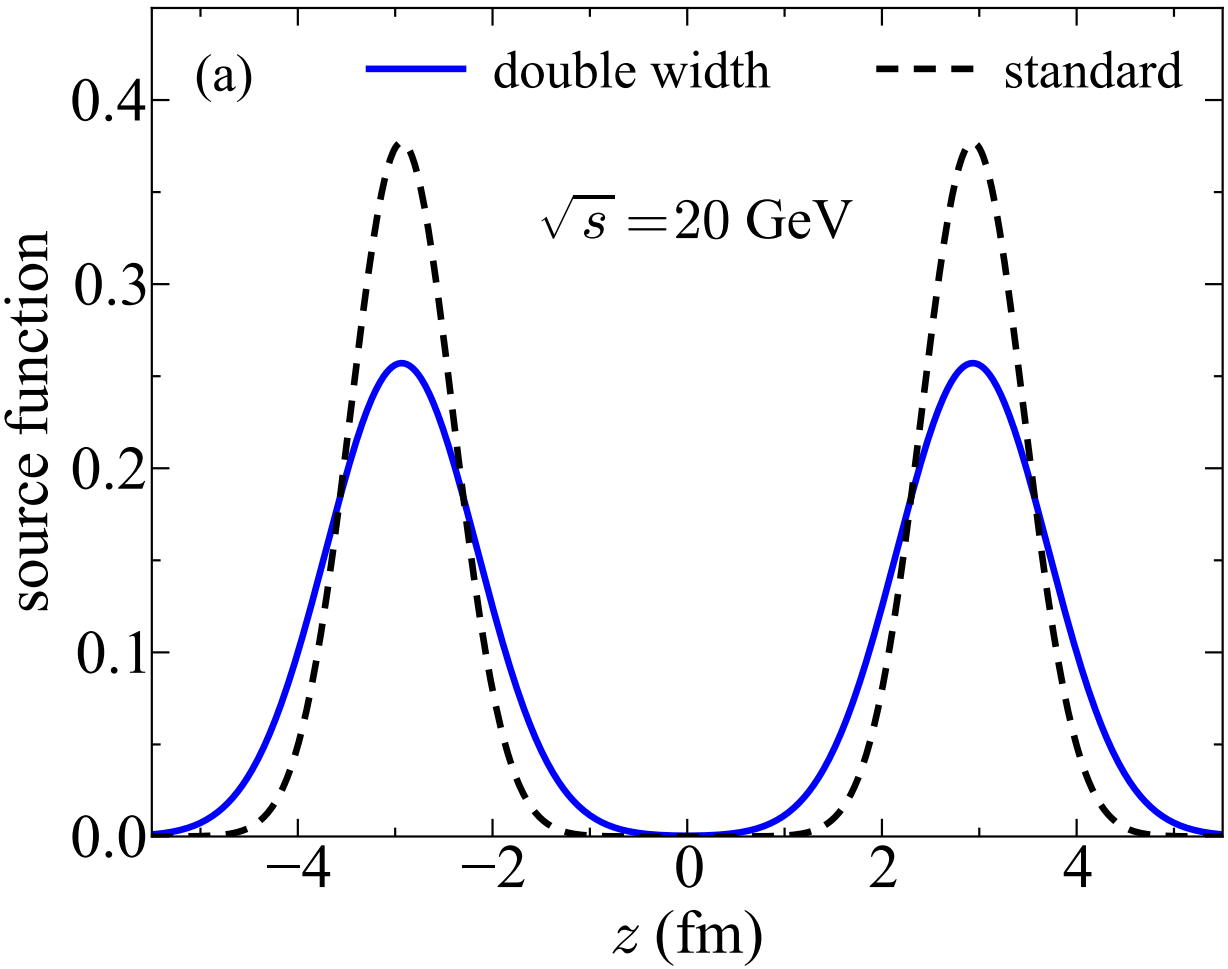
BREMSTRAHLUNG AND LUND MODELS

BOTH MODELS ARE RATHER SUCCESFULL IN DESCRIBING PARTICLE PRODUCTION AT HIGH ENERGIES.

THE PICTURE: IN A "SOFT" COLLISION AT LOW $p_\perp$, THE COLLIDING NUCLEONS EXCHANGE COLOUR, WHILE THEIR ENERGIES ARE PRACTICALLY UNAFFECTED.
CONSEQUENTLY, THEY CONTINUE AFTER COLLISION AS EXCITED COLOURED OBJECTS, EMITTING QUARKS AND GLUONS, THUS LOOSING ENERGY.
FINALLY, THEY SHOW UP AS OBSERVED BARYONS.
NOTE: FOR NUCLEONS AT $y = 0$ THE ENERGY LOSS EQUALS TO $\frac{1}{2}\sqrt{s}$.

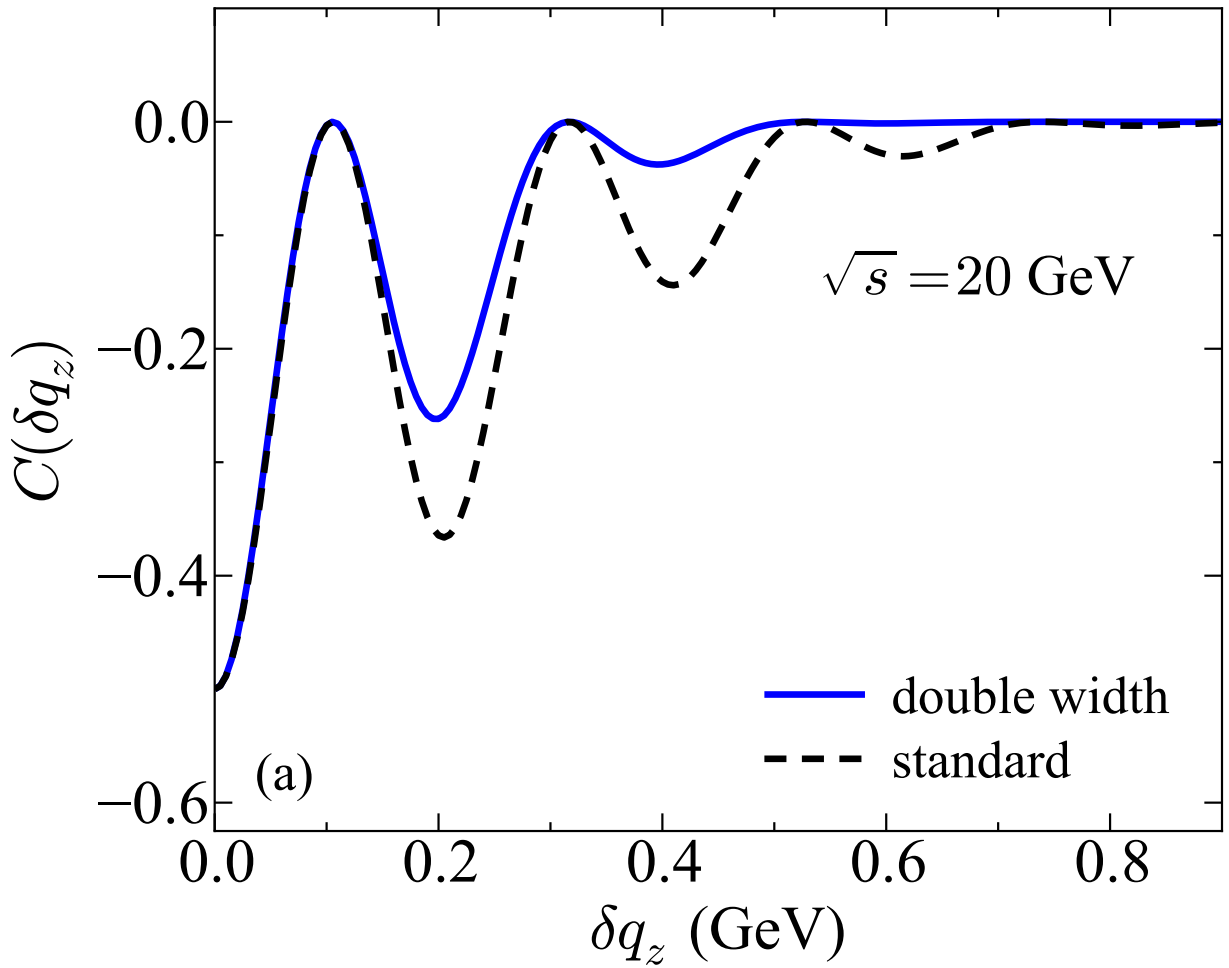
RESULTS: PROTON Z-DISTRIBUTION AT 20 GeV

NOTE THE DOUBLE-PEAK STRUCTURE FROM LEFT- AND RIGHT-MOVERS



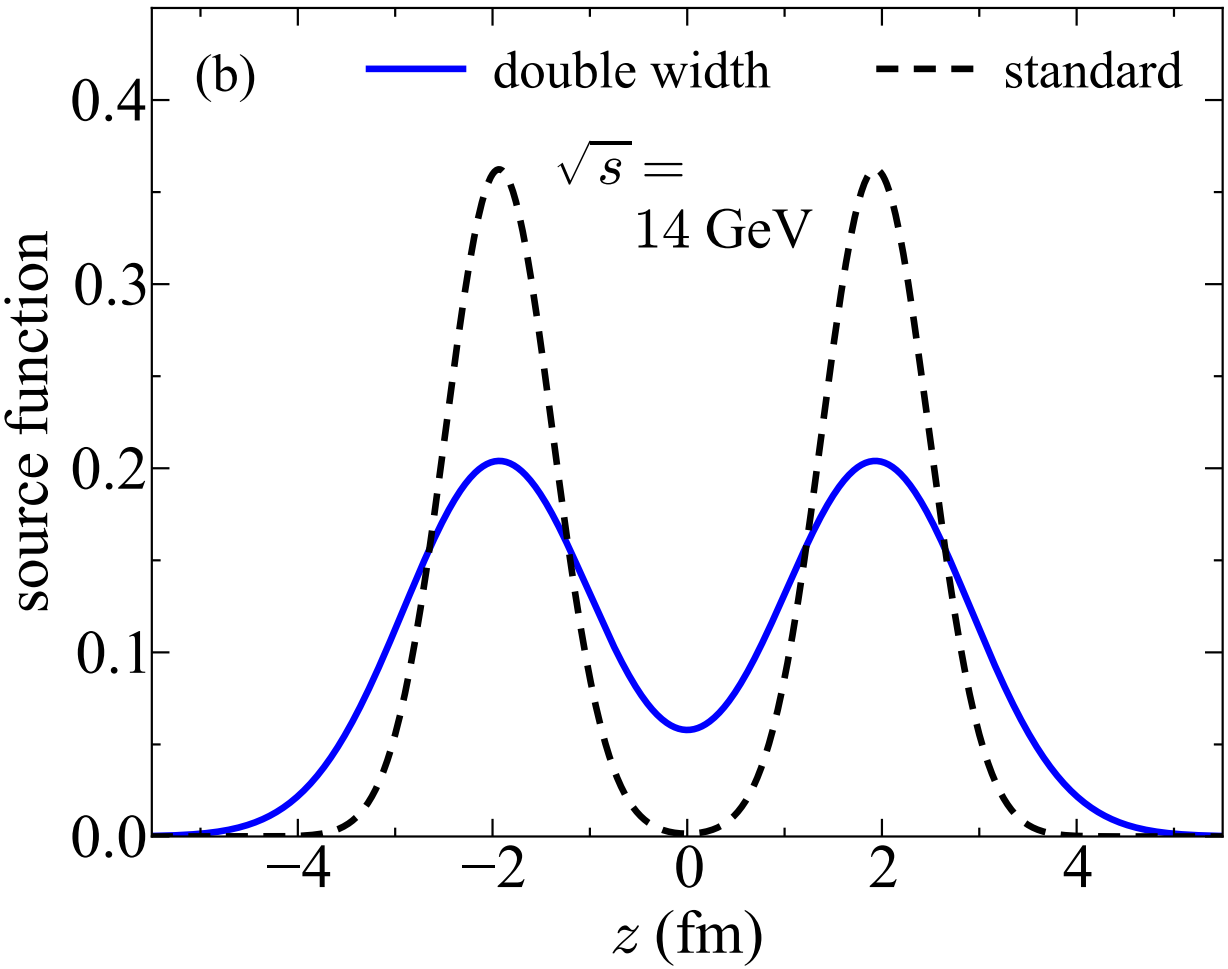
RESULTS: P-P CORRELATION at 20 GeV

PLOTTED VS DIFFERENCE OF LONGITUDINAL MOMENTA OF PROTONS.
NOTE THE CHARACTERISTIC MINIMA



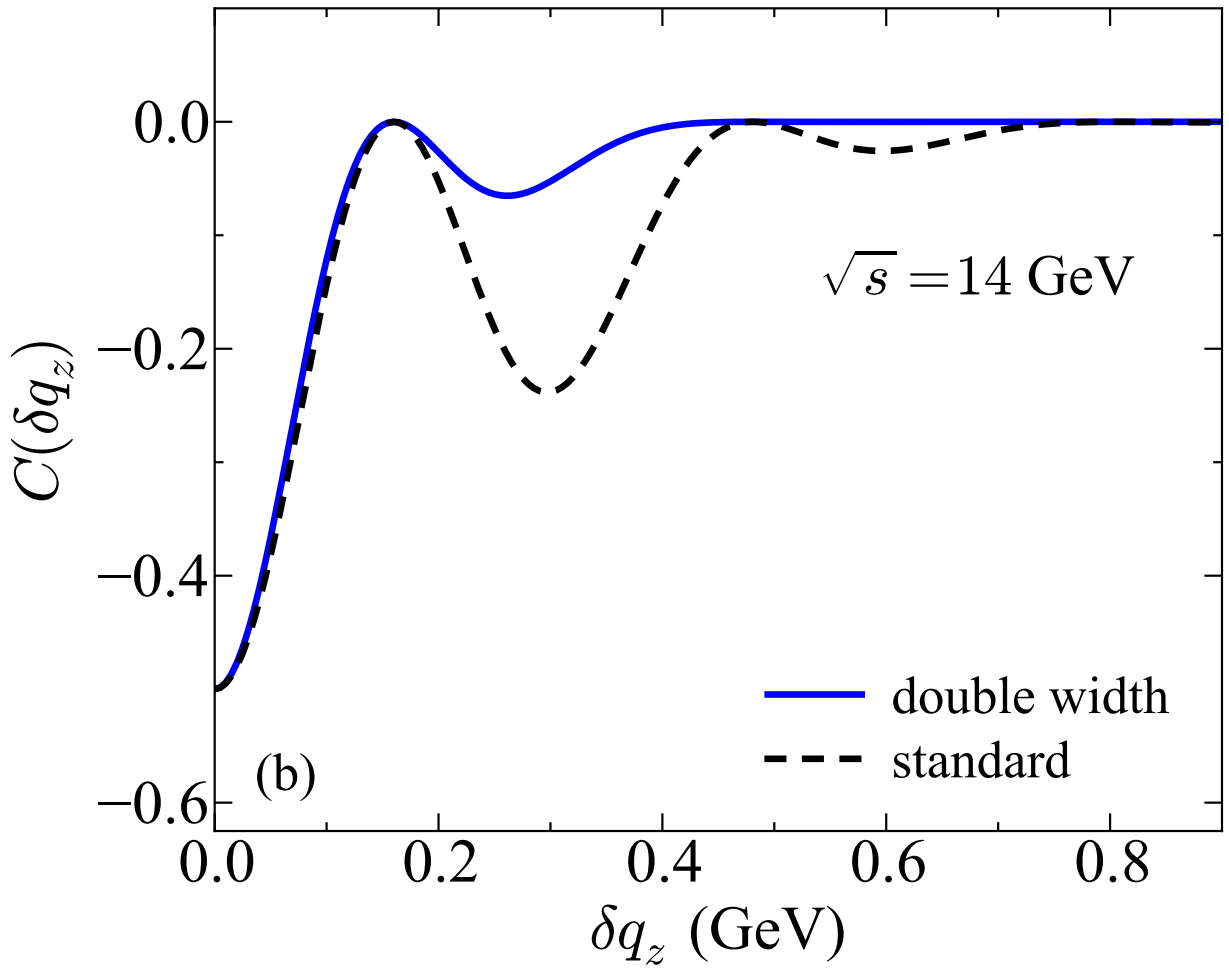
RESULTS: PROTON Z-DISTRIBUTION AT 14 GeV

NOTE THE DOUBLE-PEAK STRUCTURE FROM LEFT- AND RIGHT-MOVERS



RESULTS: P-P CORRELATION at 14 GeV

PLOTTED VS DIFFERENCE OF LONGITUDINAL MOMENTA OF PROTONS.
NOTE THE CHARACTERISTIC MINIMUM



COMMENTS

1. FEMTOSCOPY OF THE STOPPED PROTONS ALLOWS TO DETERMINE THE DISTANCE THEY NEED TO LOOSE THE INITIAL MOMENTUM

2. SUCH MEASUREMENT IS THUS NECESSARY TO ESTIMATE THE NET BARYON DENSITY.

3. OUR CALCULATION SHOWS THAT THE RELEVANT VARIABLE IS Δq_z, THE DIFFERENCE BETWEEN THE LONGITUDINAL MOMENTA OF THE TWO PROTONS.

4. CORRECTIONS DUE TO STRONG INTERACTIONS MUST STILL BE INCLUDED, AS THEY MAY INFLUENCE RESULTS AT SMALL Δq_z.