I. TABLE OF REACTIONS AND THRESHOLDS FOR PANDA PHASE-C (PROTON-PROTON SCATTERING)

Definition of **Threshold kinematics: the final particles are produced at rest.** This means that the reaction knows only one direction, the beam momentum, and the final distributions are isotropic. In other words, the S-state is selected, among the possible initial pp states. The threshold region, where the S state dominates, can be more or less broad, depending on the reaction.

Let us consider the pp reaction producing two or more particles in final state:

$$p(p_1) + p(p_2) \to a(k_a) + b(k_b) + ... \tag{1}$$

where the four-momenta are indicated in parentheses. The total energy squared, s, is conserved and it is a kinematical invariant

$$s = (p_1 + p_2)^2 = (k_a + k_b + ..)^2. \tag{2}$$

Calculated in Lab system and entrance channel we find:

$$s = (p_1 + p_2)^2 = 2M_p^2 + 2E_L M_p, \tag{3}$$

where E_L is the beam energy in Lab system, M_p is the proton mass. In cms systems and in final channel is:

$$S = (\tilde{k}_a + \tilde{k}_2)^2 + .. = (\tilde{E}_a + \tilde{E}_b + ...)^2 - (\vec{\tilde{k}}_a + \vec{\tilde{k}}_2 + ...)^2, \tag{4}$$

that becomes at threshold:

$$s_{Thr} == (M_a + M_b + ...)^2, \tag{5}$$

where E_i and $M_i, i = a, b..$ are the Lab energies and the masses of the final particles. The corresponding Lab beam energy at threshold, E_{Thr}, can be calculated from the equality of Eqs. (3) and (5):

$$2M_p^2 + 2E_{Thr} M_p = (M_a + M_b + ..)^2; \tag{6}$$

Threfore, the total beam energy at threshold is:

$$E_{Thr} = \frac{(M_a + M_b + ..)^2 - 2M_p^2}{2M_p}. \tag{7}$$

and the kinetic beam energy at threshold is:

$$E_{Thr}^{kin} = E_{Thr} - M_p = \frac{(M_a + M_b + ..)^2 - (2M_p)^2}{2M_p}. \quad (8)$$

The corresponding beam momentum is:

$$P_{Thr} = \sqrt{E_{Thr}^2 - M_p^2}. \quad (9)$$

The list of some reactions accessible with PANDA and a proton beam is given in Table I, focussing on three particles prodution in the final state.

Reaction	E_{Th} (GeV)	$\sqrt{s}$ (GeV)	P_{Thr} GeV/c
$p+p \to p+p+J/\Psi$	12.2428	4.97341	3.37082
$p+p \to p+\Sigma_C^+ + D^0$	13.7853	5.25637	3.59235
$p+p \to p+\Sigma_C^{++} + D^-$	13.8077	5.26037	3.59547
$p+p \to p+\Lambda_C^+ + D^0$	12.8554	5.08767	3.4605
$p+p \to p+p+\pi^0$	1.21793	2.01152	0.581016
$p+p \to p+p+a_0$	2.11326	2.39298	1.11036
$p+p \to p+p+f_0$	3.44056	2.86654	1.60006
$p+p \to p+p+\omega$	2.82999	2.65919	1.39629
$p+p \to p+p+\rho$	2.80973	2.65203	1.38902
$p+p \to p+p+\phi$	3.53101	2.89600	1.62808
$p+p \to p+p+\eta$	2.19395	2.42441	1.14612
$p+p \to p+p+\eta'$	3.34268	2.83432	1.56918
$p+p \to p+K^+ + \Lambda$	2.52044	2.54763	1.28066
$p+p \to p+K^+ + \Sigma^0$	2.73255	2.62459	1.36096
$p+p \to p+p+\pi^+ + \pi^-$	1.5266	2.15068	0.803894
$p+n \to d*(2360)+\pi^0+\pi^0$	2.74757	2.62995	1.36646

TABLE I: Summary of reactions and threshold kinematics: E_{Thr} (P_{Thr}) is the total energy (momentum) of the proton beam in Lab system from Eqs. (??), (??): , $\sqrt{s}$ corresponds to the total CMS energy.