The big Picture

1 What is the big picture?

1.1 What do all the suggested planners output?

- All the PRM- and RRT-based planners compute the inverse kinematics, i.e. a path from x_{start} to x_{end} which is valid (i.e. only includes possible robot movements, grasps,...) and collision-free.
- It only regards geometric properties, not yet dynamical aspects (i.e. bounded force/torque at joints or velocity/acceleration limits). No time included yet!
- In what I have done so far, this corresponds to the piecewise linear path through the configuration space, which still requires post-processing.
-

1.2 What are we doing so far?

- no simultaneous manipulation planning, but sequential planning of grasps, placements, inverse kinematics, motions
- hacks which artificially prohibit certain robot movements in order to make it look nicer

1.3 What is planned to be incorporated?

- use idea like Random Manipulation Roadmap-star [Philipp's paper] for manipulation planning
- improve post-processing
- dynamic planning, not only geometric (?)

2 Ideas for internship

Postprocessing of the plans that are generated e.g. by RMR* [Philipp's paper] or PTR (probabilistic tree of roadmaps):

1. smoothing, ShortCutting
2. smooth in linear movement, object grasping
   - now: try to use `alternate_start` by generating time optimal spline. If this fails, don't use it at all.
   - idea: if time optimal spline fails, try another point above `alternate_start`
3. use different contacts within transition regions between $C_{free,\sigma}$ and $C_{free,\sigma'}$
   - Use SAFT-Strategy for mode expansion (i.e. assign priority to each pair (σ, σ') and decrease it if sampling in $\mathcal{F}_{\sigma,\sigma'}$ fails)

- Use utility-based strategy like Hauser (i.e. come up with some utility function/heuristic for contacts)

4. copy planned path in a within-contact roadmap in $C_{free,\sigma}$ into another area $C_{free,\sigma'}$ of the robot's configuration space, corresponding to another contact σ'
   $\rightarrow$ in practice, this corresponds for instance to a slightly different grasp of the object and therefore a only slightly shifted motion

3 Ideas for Master's Thesis

combine:

1. idea of connected within-contact roadmaps, Random Manipulation Roadmap-star [Philipp's paper] (possibly improved like `Incremental-MMPRM`)

2. heuristic (RRT* informed, Nebel/FFRob/Garrett) in order to sample effectively from infinite space of possible actions (and thus build roadmap/random tree effectively)