To instantiate this safety case pattern for the GPCA system and display it in a hierarchical tree format, let's first replace the placeholders with specific instances, assume operational hazard, and define the scenarios, specifications, and properties. For example, consider the system is a Generic Patient-Controlled Analgesia (GPCA) system, and we want to ensure its operational safety with respect to the scenarios of medication delivery and user interaction.

### Instantiated Safety Case

- \*\*C1\*\*: "Specs for overall functionality and hazard mitigation are well-defined."

- \*\*C2\*\*: "This system operates under the known operational hazards of medication overdose and mechanical failure."

- \*\*C3\*\*: "The scenarios considered are 'medication delivery' and 'parameter settings by healthcare professionals'."

- \*\*C4\*\*: "Specs related to the scenarios include dose limits and system responsiveness."

- \*\*C5\*\*: "Properties include system reliability and accuracy."

- \*\*C6\*\*: "The source of these properties is based on industry standards and clinical trials."

- \*\*Sn1\*\*: "Clinical trial results confirm reliability."

- \*\*Sn2\*\*: "Technical documentation supports property definitions."

### Hierarchical Tree Structure of the Example Safety Case:

```

- Goal (G1, Operational safety is verified in GPCA system)

- Strategy (S1, Argument over the satisfaction of all specs over GPCA system) (\*) [Uninstantiated]

- Goal (G2, All operational hazards are mitigated)

- Strategy (S3, Argument over operational hazards)

- Goal (G3, Medication overdose is mitigated)

- Strategy (S4, Argument over the applied scenarios of medication overdose)

- Goal (G4, Medication overdose is mitigated under parameter settings scenario)

- Strategy (S5, Argument over all specs related to parameter settings scenario)

- Goal (G5, Dose limits are appropriate for parameter settings scenario)

- Strategy (S6, Argument the appropriateness of dose limits over properties)

- Goal (G6, System reliability is appropriate for dose limits)

- Strategy (S7, Argument over the source of the system reliability definition)

- Goal (G7, Source is appropriate and trustworthy for system reliability)

- Solution (Sn1, source) [Clinical trial results confirm reliability]

- Goal (G8, System reliability definition is sufficient)

- Solution (Sn2, property) [Technical documentation supports property definitions]

- Strategy (S2, Argument over reliability in all suitable levels of GPCA system) (\*) [Uninstantiated]

```

Legend:

- (\*) Denotes elements marked as undeveloped.

Contexts are assumed to be part of the information contributing to the structured arguments but not displayed in the simplified tree above. The described hierarchy represents the assurance case at various abstraction levels, with each goal decomposed into strategies and sub-goals, focused from system-wide considerations to specific properties and scenarios. The placeholders have been replaced based on the typical considerations for a GPCA system in a healthcare setting.