You need a **6-DOF robot mounted on a 20-meter rail system** with **100kg payload**, **3000mm working radius (from rail)**, and **≤0.5mm repeatability**. Here’s a targeted analysis:

**Key Challenges & Solutions**

1. **20m Rail Requirement**:
   * Most industrial 6-DOF arms aren’t designed for rails this long. Custom integration is needed.
   * **Solution**: Use a **heavy-duty linear rail system** (e.g., Bosch Rexroth, THK) paired with a robot base that maintains rigidity over 20m. Expect added cost (20k–20*k*–100k+ for rail alone).
2. **Payload & Reach**:
   * Few 6-DOF robots hit **100kg payload** while maintaining **3000mm reach**.
   * **Best Match**: **FANUC M-2000iA/2300** (2300kg payload, 3700mm reach) – Overkill but proves heavy payloads require gantry/SCARA designs.
3. **Repeatability**:
   * **0.5mm over 20m is extremely challenging**. Thermal expansion, vibration, and deflection must be mitigated.
   * **Solution**: Use **laser tracking compensation** (e.g., Leica Absolute Tracker) or **reinforced steel rails** with active cooling.

**Viable Robot Candidates**

| **Robot Model** | **Payload** | **Reach** | **Rail-Compatible?** | **Notes** |
| --- | --- | --- | --- | --- |
| **FANUC R-1000iA/100F** | 100kg | 2230mm | Yes | Needs rail extension to 3000mm |
| **ABB IRB 6700-245** | 150kg | 2450mm | Yes | Requires custom rail mounting |
| **KUKA KR 500 FORTEC** | 500kg | 3100mm | Yes | Over-payload, high cost (~$200k) |

**Critical Gap**: No off-the-shelf 6-DOF robot meets **100kg + 3000mm reach** simultaneously.

**Custom Workaround**

1. **Robot + Rail Combo**:
   * Mount a **FANUC R-1000iA/100F** (100kg) on a 20m rail, but its **2230mm reach** falls short. Use **two robots** spaced 10m apart.
2. **Gantry Alternative**:
   * A **3-axis gantry** (e.g., Festo EXCH) with a 6-DOF wrist actuator may better suit 100kg/20m needs.

**Cost Estimate**

| **Component** | **Price Range** |
| --- | --- |
| 6-DOF Robot (100kg) | 80k–150k |
| 20m Rail System | 50k–150k |
| Integration/Controls | 30k–100k |
| **Total** | **160k–400k+** |

**Recommendations**

1. **Contact Integrators**:
   * Reach out to **FANUC, ABB, or KUKA System Partners** for custom quotes (e.g., Motoman, RobotWorx).
2. **Prioritize Rigidity**:
   * Specify **ground-mounted rails** (not overhead) to minimize deflection over 20m.
3. **Test Repeatability**:
   * Demand **on-site validation** of 0.5mm repeatability post-installation.